PRICE $15.00

SERVICE BULLETIN 8804-7
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SQUARE D®

omegapak®
Adjustable Frequency Controller

Variable Torque
PUMP & FAN

60 - 125 HORSEPOWER VARIABLE TORQUE

CONTENTS

NOTE: This service bulletin covers the installation, start-up and servicing of standard controllers and controllers with pre-engineered options. Controllers having variations or special options will be furnished with a set of record drawings which must be consulted to properly and safely install, start-up or service the controller.

1.0 GENERAL

1.1 PRECAUTIONS

The following list of "PRECAUTIONS" must be studied and followed during the installation, operation, and servicing of the equipment.

1. Read this service bulletin prior to installing or operating the equipment.
2. Service work should be performed only after becoming familiar with all listed danger and caution statements.
3. If OMEGAPAK controllers are to be stored prior to installation, they must be protected from the weather and kept free of condensation and dust.
4. Use extreme care when moving or positioning controllers (even if crated) as they contain devices and mechanisms which may be damaged by rough handling.
5. Only authorized personnel should be permitted to operate or service the controller.
6. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.
7. Do not make any modifications to this controller other than those described in this manual. Doing so may damage or degrade the apparatus.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT 5 MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THAT THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

The dc bus capacitors are discharged slowly when input power is removed from the OMEGAPAK controller. To ensure the capacitors are fully discharged, always test with a dc voltmeter (1000vdc scale) before doing any wiring, troubleshooting or work inside the controller enclosure. If no reading is shown on the voltmeter, reduce scale and test again.

If the capacitors are not fully discharged in 5 minutes, contact Square D — *Do not operate the controller.*

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

MANY PARTS, INCLUDING ELECTRONIC PRINTED WIRING BOARDS, IN THIS CONTROLLER OPERATE AT LINE VOLTAGE. DO NOT TOUCH. USE ONLY ELECTRICAL INSULATED TOOLS WHILE MAKING ADJUSTMENTS.

CAUTION
DO NOT CHANGE THE POSITION OF ANY PRINTED WIRING BOARD SWITCH OR REMOVE ANY PRINTED WIRING BOARD WITH THE DRIVE RUNNING. TO DO SO MAY CAUSE AN EQUIPMENT MALFUNCTION.

1.2 PRELIMINARY INSPECTION

Inspect for shipping damage upon receiving the OMEGAPAK controller. If any shipping damage is found, immediately notify the freight carrier and your Square D representative. Open the door on the controller and check inside for any visual damage. DO NOT ATTEMPT TO OPERATE THE CONTROLLER IF ANY VISUAL DAMAGE IS NOTED. All printed wiring boards should be in place and secure. Check all connectors to be sure they are locked and securely in place.

1.3 STORAGE

After the preliminary inspection repack and store the OMEGAPAK controller in a clean dry location. DO NOT store this equipment in any area where the ambient temperature will rise above 60 °C (140 °F) or go below — 17 °C (0 °F). DO NOT store this equipment in high condensation or corrosive atmospheres. Proper storage is required to prevent equipment damage.

1.4 CONTROLLER IDENTIFICATION

The 60-125 HP OMEGAPAK adjustable frequency controller is a combination (with molded case switch and current limiting fuses) controller. The controller can be supplied in a wall mounted

enclosure (OMEGAPAK 1500) or a floor mounted enclosure (OMEGAPAK 3500).

The OMEGAPAK 3500 controller enclosure provides space for one or two OMEGAPAK 1500 open controllers depending upon options selected. Optional power and standard ground bus enables the OMEGAPAK 3500 controller to become an integral part of a Square D motor control center line-up.

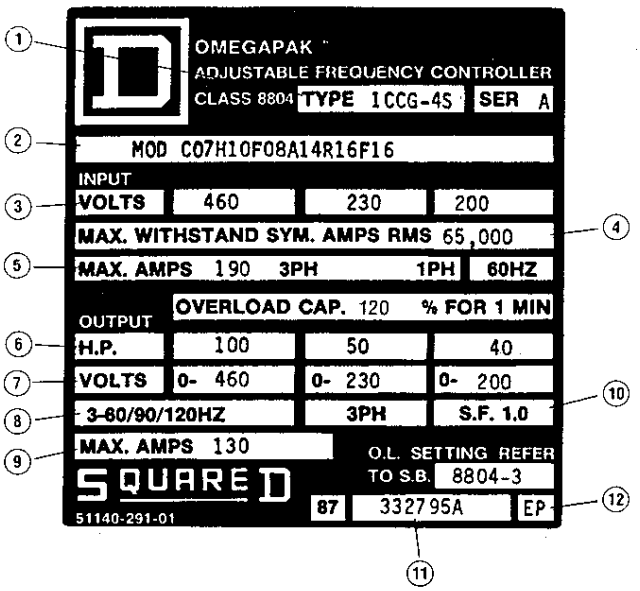
The nameplate for the OMEGAPAK 1500 open controller is located on the inside surface of the electronics door. This nameplate is described in Figure 1.1 and carries the 1500 controller class, type and MOD (options) listing. When identifying 1500 controllers use the data from this nameplate.

The main nameplate for the 3500 controller is located on the outside of the controller enclosure. This nameplate is described in Figure 1.2 and carries the 3500 controller class, type and MOD (options) listing in addition to the factory order number and bus rating if optional power bus is furnished. When identifying 3500 controllers use the data from this nameplate.

To aid in identifying the controller, refer to Figure 1.3 & 1.4 for nameplate identification codes. When the controller has been defined, refer to the appropriate section of this service bulletin.

FIGURE 1.1

1500 CONTROLLER NAMEPLATE



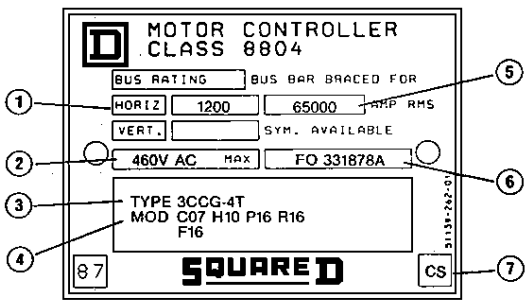
1500 CONTROLLER NAMEPLATE (LOCATED INSIDE THE DOOR)

1. CONTROLLER TYPE CODE*
2. MODIFICATION (MOD) CODE**
3. PERMISSIBLE INPUT VOLTAGES
4. MAX. WITHSTAND SYM. AMPS. RMS
5. MAX. INPUT RATED CURRENT***
6. HORSEPOWER RATINGS AT INPUT VOLTAGES
7. OUTPUT VOLTAGES
8. OUTPUT FREQUENCY
9. MAX. OUTPUT RATED CURRENT***
10. SERVICE FACTOR OF CONTROLLER
11. FACTORY ORDER NUMBER
12. DATE CODE

* SEE FIGURE 1.3.
** SEE FIGURE 1.4.
***SEE SECTION 2.0, FIGURE 2.1

FIGURE 1.2

3500 CONTROLLER NAMEPLATE



3500 CONTROLLER NAMEPLATE (LOCATED OUTSIDE THE ENCLOSURE)

1. HORIZONTAL BUS RATING
2. PERMISSIBLE MAXIMUM INPUT VOLTAGE
3. CONTROLLER TYPE CODE*
4. MODIFICATION (MOD) CODE**
5. HORIZONTAL BUS BAR SHORT CIRCUIT RATING
6. FACTORY ORDER NUMBER
7. DATE CODE

* SEE FIGURE 1.3.
** SEE FIGURE 1.4.

FIGURE 1.3

IDENTIFICATION CODE

CLASS 8804, TYPE					-4
STYLE CONTROLLER					
1500	1				
3500	3				
HORSEPOWER RANGE					
60-125 @ 460V		C			
CONTROLLER SYSTEM					
VARIABLE TORQUE RATED			F		
TYPE ENCLOSURE					
OPEN TYPE				O	
NEMA 1				G	
RATING OF CONTROLLER @ 460V					
60 HP					Q
75 HP					R
100 HP					S
125 HP					T

1.5 KITS FOR FIELD INSTALLATION

Controller modifications are available in kit form. Each kit contains necessary hardware and installation instructions.

Description	Kit Number	Kit Installation Instructions
Speed Meter (Analog)①	Class 8804, Type AM-1	50006-020-01
Voltmeter (Analog)①	Class 8804, Type AM-2	50006-020-01
Ammeter (Analog)①	Class 8804, Type AM-3	50006-020-01
Speed Meter, Voltmeter or Ammeter (Digital)①	Class 8804, Type DM-1	50006-020-01
Control Cable Assembly②	Class 8804, Type CK-16	50006-018-01

① Open type. For remote mounting or as replacement device in 1500/3500 controllers.

② Twelve conductor cable for wiring controller mounted pilot devices.

FIGURE 1.4

IDENTIFICATION CODE

MOD						
GENERAL PURPOSE PILOT DEVICES						
START-STOP, MANUAL SPEED POTENTIOMETERS	S10					
HAND-OFF-AUTO, MANUAL SPEED POTENTIOMETER	H10					
HAND-AUTO, START-STOP, MANUAL SPEED POTENTIOMETER	A10					
POWER BUS						
600A BUS (1/4X2 AL/SN)		A12				
600A BUS (1/4X2 CU/SN)		B12				
600A BUS (1/4X2 CU/AG)		C12				
800A BUS (1/4X3 AL/SN)		D12				
1000A BUS (1/4X3 CU/SN)		E12				
1000A BUS (1/4X3 CU/AG)		F12				
1000A BUS (1/4X4 AL/SN)		G12				
1000A BUS (2-1/4X2 AL/SN)		H12				
1200A BUS (2-1/4X2 CU/SN)		J12				
1200A BUS (2-1/4X2 CU/AG)		K12				
1200A BUS (1/4X4 CU/SN)		L12				
1200A BUS (1/4X4 CU/AG)		M12				
1200A BUS (2-1/4X3 AL/SN)		P12				
1400A BUS (2-1/4X4 AL/SN)		Q12				
1600A BUS (2-1/4X3 CU/SN)		R12				
1600A BUS (2-1/4X3 CU/AG)		S12				
1800A BUS (2-1/4X4 CU/SN)		T12				
1800A BUS (2-1/4X4 CU/AG)		U12				
CONTACTORS						
OUTPUT ISOLATION			C13①			
BY-PASS AND ISOLATION WITH CIRCUIT BREAKER STARTER			B13①			
BY-PASS AND ISOLATION WITH FUSIBLE SWITCH STARTER			D13①			
METERING, SPEED-FREQUENCY						
ANALOG SPEED INDICATOR				A14		
DIGITAL SPEED/FREQUENCY INDICATOR				D14		
ADDITIONAL METERING						
ELAPSED TIME METER					T15	
ANALOG VOLT-METER					V15	
ANALOG AMMETER					A15	
ANALOG AMMETER & VOLT-METER					B15	
ANALOG VOLT-METER & ELAPSED TIME METER					C15	
ANALOG AMMETER & ELAPSED TIME METER					D15	
ANALOG AMMETER, VOLT-METER & ELAPSED TIME METER					E15	
DIGITAL VOLT-METER					F15	
DIGITAL AMMETER					G15	
DIGITAL AMMETER & VOLT-METER					H15	
DIGITAL VOLT-METER & ELAPSED TIME METER					J15	
DIGITAL AMMETER & ELAPSED TIME METER					K15	
DIGITAL AMMETER, VOLT-METER & ELAPSED TIME METER					L15	
PILOT LIGHTS						
POWER ON LIGHT						P16
RUN LIGHT						R16
DRIVE FAIL LIGHT						F16

① Available for OMEGAPAK 3500 controllers only.

2.0 INSTALLATION

2.1 MECHANICAL INSTALLATION

The OMEGAPAK controller is mounted in a general purpose NEMA 1 enclosure. It is suitable for use in normal industrial environments:

Temperature range of 0°C to 40°C (32°-104°F)

Humidity range of 0% to 95% maximum non-condensing

Altitude to 3300 ft. above sea level

Do not mount the OMEGAPAK controller in direct sunlight or on hot surfaces. The controller must be mounted vertically to allow for proper ventilation. When drilling for conduit entry, care must be exercised to prevent metal chips from falling on parts and electronic printed wiring boards. Mounting dimensions, conduit entry areas and controller weights are located in Section 11.0 of this service bulletin.

Wall mounted controllers must be securely attached to the mounting surface. The mounting arrangement and surface must be capable of supporting a weight of approximately 350-400 pounds.

Floor mounted controllers should be located on a concrete pad or equivalent and secured firmly in place using mounting holes provided in bottom channels of the enclosure. Adequate clearance must be provided to permit the door(s) to be fully opened for easy access.

LIFTING INSTRUCTIONS — FLOOR MOUNTED CONTROLLERS

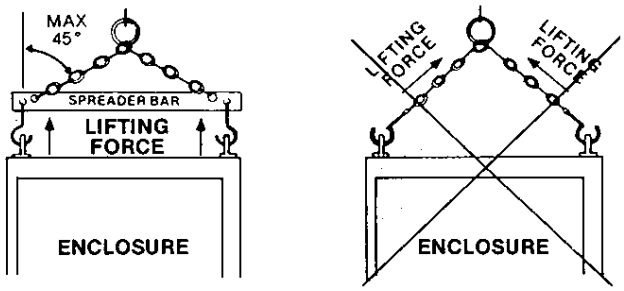
The following instructions are provided to assist in the avoidance of personal injury and equipment damage during movement of the controller.

1. Use extra caution and very sound safety practice while moving the controller.
2. Exercise extreme care when lifting or lowering the controller using a fork lift truck or equivalent. Prevention of damage or injury due to dropping or jolting this equipment should be strictly observed.
3. When lifting enclosures, use an I beam sling or spreader bar as shown in illustration to prevent distortion of the cabinet.

CAUTION

DO NOT PASS ROPES OR CABLES THRU LIFT HOLES; USE SLINGS WITH SAFETY HOOKS OR SHACKLES.

ATTACH SPREADER BAR KEEP LIFTING FORCE VERTICAL (SEE ILLUSTRATION)



RIGHT WAY **WRONG WAY**

2.2 ELECTRICAL INSTALLATION

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
TURN OFF POWER (MAIN AND REMOTE) PRIOR TO INSTALLING THIS EQUIPMENT

2.2.1 INPUT POWER

The OMEGAPAK controller operates from three phase 460/230/200vac, +10% −5%, 60/50 Hertz, connected to the input disconnect switch. Current limiting fuses are installed in the controller input. These fuses are coordinated with the controller power circuit for a fault withstand capability of 65,000 RMS symmetrical amperes maximum.

The controller is factory set for 460vac, 60 Hertz input power. If the controller is connected to operate from 230vac, 200vac or 50 Hertz power, refer to the initial start-up procedure (Section 5.0) described in this service bulletin.

2.2.2.A INPUT WIRING

The ampacity of power conductors feeding the OMEGAPAK controller should be sized for the maximum input currents listed in Figure 2.1, the National Electrical Code and applicable local electrical codes. Refer to Figure 2.5 for lug data and maximum wire size.

FIGURE 2.1

MAXIMUM CONTROLLER INPUT AND OUTPUT RATED CURRENTS

MAXIMUM HORSEPOWER 200V	230V	460V	INPUT AMPERES①	MAXIMUM CONTINUOUS RATED OUTPUT AMPERES②
25	30	60	116	80
30	40	75	142	104
40	50	100	190	130
50	60	125	230	156

① Input currents are maximum values expected. Actual current values could be less depending on the power input source impedance.
② Motor nameplate load current must not exceed the maximum continuous output current rating of the controller. For multiple motor applications, the total of the connected motor nameplate load currents must not exceed the controller rated output current.

For safe operation, the controller must be grounded. A ground lug is provided in wall mounted controllers and ground bus is provided in floor mounted controllers. See Section 2.2.2.C for ground bus splicing instructions.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
CONTROLLER PANEL MUST BE PROPERLY GROUNDED BEFORE APPLYING POWER.

Input wiring for wall mounted controllers or floor mounted controllers without power bus should be connected to lugs on the bottom of the controller disconnect switch. Lugs provided on the switch will accept one #4 AWG-300 MCM Copper or aluminum wire per phase. Wire binding screws should be tightened to 250 lb.-in. Two-high controllers or controllers with the bypass and isolation contactor option will have main power terminals located in the power bus area at the top of the enclosure. Use of normal flexibility stranded conductors is recommended. High flexibility conductors with many fine strands should be avoided due to the increased possibility of a poor termination. Some floor mounted controllers may be equipped with horizontal power bus. In controllers so equipped, wiring from the disconnect switch to the horizontal bus will have been factory installed. It will be necessary to connect the controller power bus to the power bus in other equipment using splice bars furnished. Follow the procedure detailed in Section 2.2.2.B.

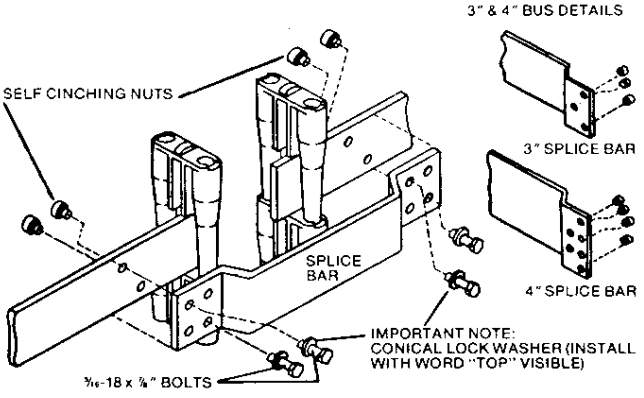
2.2.2.B POWER BUS INSTALLATION
(OMEGAPAK 3500 controllers only)

To gain access to the power bus, open the power bus compartment door (Refer to Section 4.0 Controller Photos). Install splice bars per Figure 2.2A for single bus bars per phase or Figure 2.2B for dual bus bars per phase. Install the bus barrier plate and close and secure bus compartment door.

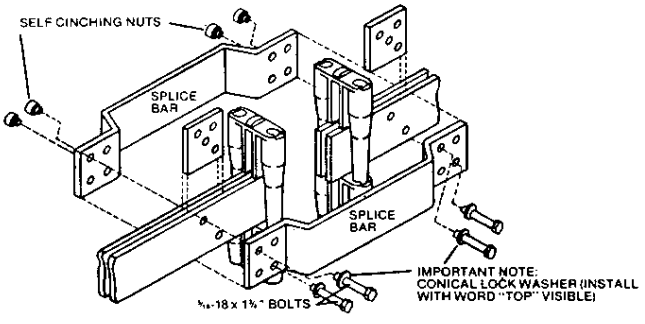
DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN
BEFORE SPLICING TO EXISTING APPARATUS, DISCONNECT ALL POWER TO BUS OF EXISTING EQUIPMENT. DO NOT ATTEMPT TO WORK WHILE EXISTING EQUIPMENT IS ENERGIZED.

FIGURE 2.2
POWER BUS — SPLICE BAR INSTALLATION

A
SINGLE BUS PER PHASE (2" BUS SHOWN)



B
DOUBLE BUS PER PHASE (2" BUS SHOWN)



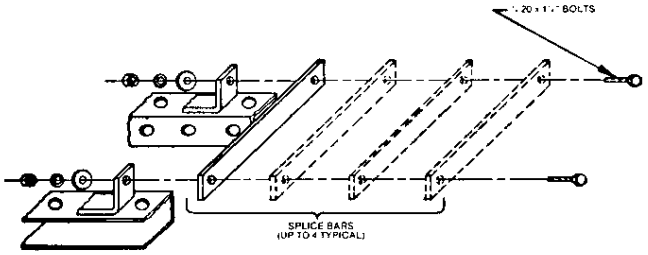
2.2.2.C GROUND BUS INSTALLATION

(OMEGAPAK 3500 controllers only)
If an adjustable frequency controller is not installed in the bottom compartment of the OMEGAPAK 3500 cabinet, follow Step 2 only.

1. Remove the four mounting screws at the bottom of the heat sink fans. Slide the fans out far enough to access the power connector. Unplug the power cords and remove the fans. (See section 4, controller photos)

   Remove the screws holding the bottom fan mounting bracket in place and remove the bracket to gain access to the ground bus.
2. Install the ground bus splice bar(s) provided (See Figure 2.3).
3. Reverse the procedure in Step A to reassemble the controller.

FIGURE 2.3
GROUND BUS — SPLICE BAR INSTALLATION



2.2.3 OUTPUT POWER

The output voltage is proportional to the output frequency to provide a constant Volts/Hertz ratio in the 20 to 60 Hertz operating range. Below 20 Hertz the Volts/Hertz ratio will vary depending on the setting of the voltage boost potentiometer.

The ampacity of motor power conductors should be sized according to the motor full load current, National Electrical Code and applicable local electrical codes.

Connect motor conductors to the lugs provided. Refer to Section 4 controller photos for lug location. Refer to Figure 2.5 for data on lugs and maximum wire size.

Do not connect the output terminals of the controller (T1, T2, or T3) to the L1, L2, or L3 controller terminals or to any other source of voltage. To do so will cause controller damage. Should it become necessary to bypass a controller not equipped with an iso-bypass option, the customer connections to the controller T1, T2, and T3 terminals must be disconnected to prevent back feeding the controller.

If a customer supplied isolating device is installed between the controller output and the motor (e.g. isolation contactor), the isolating device must not be switched to the open position and then back to the closed position, unless sufficient time is allowed for the motor open-circuit voltage to decay to less than 10% of the motor nameplate rated voltage. Re-connecting the motor to the operating controller without allowing the motor terminal voltage to decay may cause controller damage. When multiple motors are operated from one controller, several critical requirements must be met to assure proper controller and motor operation.

1. Individual motor overload protection must be provided in accordance with the National Electrical Code or applicable local codes.

2. The total of the connected motor nameplate load currents, as seen by the controller, must not exceed the controller rated output current.

3. If one or more of the motors are to be connected or disconnected from the controller while the controller is operating, the following conditions *must be met.*

   A) The motor isolating device must not allow reconnection of the motor to the controller without first allowing the motor open-circuit voltage to decay to less than 10% of the motor nameplate rated voltage.

   B) The summation of the running currents of the connected motors and the locked rotor current of the motor(s) being reconnected to the controller must be less than 110% of controller rated output current.

2.2.4 CONTROL WIRING

If the OMEGAPAK controller does not have pilot devices mounted in the door cover, refer to Section 11.5 for wiring of remote control operators station. Refer to Figure 2.5 for data on maximum wire size.

NOTE: All remote Manual Speed potentiometers must be wired with insulated shielded cable. One end of the shield must be grounded at the controller per the wiring diagram. The other end must be insulated from ground and **unconnected**.

When wiring external control devices to the controller's sequencing circuitry the following guidelines should be considered:

Pilot Devices (push buttons, selector switches, relay contacts, etc.) — The maximum distance from the controller to an external pilot device is limited by the dc resistance of the wiring plus the remote device contact resistance and the leakage capacitance between the conductors. Wire size must be selected such that the maximum circuit resistance (wire plus remote contact) does not exceed 10.5 ohms. Higher resistance may result in failure to deliver sufficient voltage to pick up the controller sequencing relays. Maximum leakage capacitance of installed wire must not exceed 1.4 microfarads. Higher leakage capacitance may prevent the controller sequencing relays from dropping out.

Solid State Contacts — Many solid state control devices, such as programmable controllers, use solid state switches (Triacs) in the output stages. In addition to criteria stated above for resistance and leakage capacitance, the off state resistance must limit leakage current (with 24v applied) to not more than .5 ma.

OMEGAPAK Controller Relays — Some relays in the controller have extra contacts available for controlling the remote devices. These contacts are rated as described in Figure 2.4.

FIGURE 2.4

MAXIMUM ELECTRICAL RELAY CONTACT RATINGS

Relay Designation	Contact Arrangement	Contact Current Rating	Contact Type	Maximum Initial Contact Resistance
DFR	DPDT	2A, at 28VDC, .5A, at 120VAC, resistive	Gold over Silver	100 million
RCR	DPDT	2A, at 28VDC .5A, at 120VAC, resistive	Gold over Silver	100 million
DRR	DPDT	4A, at 30 VDC 4A, at 250 VAC resistive	Silver Cadmium Oxide	50 million

NOTE: To avoid electrical noise problems and nuisance tripping of the adjustable frequency controller, all remote controlled inductive loads (relay coils, contactor coils, solenoids, etc.) must be transient suppressed.

2.2.5 WIRING PRACTICE

Good wiring practice requires that control circuit wiring be separated from all power (line) wiring and all load wiring to the motor have the maximum possible separation from this power (line) wiring (whether from the same controller or other controllers). This minimizes the possibility of electrical transients being electrostatically or electromagnetically coupled from the power (line and load) circuits into the control circuits or from the load circuits onto the power (line) circuits.

The following general wiring practice is recommended in addition to that already prescribed in National Electrical Code and applicable local electrical codes.

Controllers are intended to be wired using conduit. Metallic conduit is preferred. Control and power wiring should never be run in the same conduit. Metallic conduits carrying power wiring and metallic conduits carrying low level control wiring should be separated by at least three inches. Non-metallic conduits or cable trays carrying power wiring and non-metallic conduits or cable trays carrying low level control wiring should be separated by at least twelve inches. If it is necessary to cross power and control wiring, the above spacing recommendations should be observed and conduits or trays should cross at right angles.

Refer to Section 11, Controller Drawings for outline drawings which show recommended conduit entry areas.

All low level control wiring (start-stop circuits, manual speed potentiometer, etc.) may be run in the same conduit or tray. Remote mounted manual speed potentiometers must be wired using shielded cable. The shielded cable must be jacketed and the shield terminated only where shown on the connection diagram. Refer to Section 11, Controller Drawings for connection diagrams of remote pilot devices.

FIGURE 2.5
LUG & MAXIMUM WIRE SIZE TABLE

Application	Number Conductors	Wire Size	Tightening Torque
		Min. Max.	
Incoming Power①	1	4AWG 300MCM	250 lb-in
Output Power (Motor)	2	8AWG 2/0AWG	140 lb-in
Control Circuit (Main Control Board)	1	N/A 12AWG	7 lb-in
	or 1	N/A 14AWG	
	or 2	N/A 16AWG	
	or 3	N/A 18AWG	
	or 5	N/A 20AWG	
GROUND 1500 Controller	1	8AWG 2AWG	90 lb-in
3500 Controller	Ground Bus		
Isolation or Bypass & Isolation Contactor	1	60-100 HP 00AWG 250MCM 125 HP 00AWG 350MCM	200 lb-in
Incoming② Power	2	4AWG 350MCM	275 lb-in

① Used for 1500 controllers and single 3500 controllers without bypass and isolation.
② Used for dual 3500 controllers or single 3500 controllers with bypass and isolation

3.0 APPLICATION DATA

3.1 BASIC CONTROLLER

3.1.1 INPUT

Voltage	200/230/460vac +10%, −5%
Frequency	50/60 Hertz
Maximum Continuous Input Current - See Section 2.0, Figure 2.1	
Three Phase Only	Phase Rotation Insensitive
Displacement Power Factor	.95 lagging @ rated load
Control Power	24vac and 24vdc
Pilot Lights	24vac (Full Voltage Only)

3.1.2 OUTPUT

Frequency	3 to 60 Hertz
Voltage	0 to 200vac, 0 to 230vac, 0 to 460vac, three phase
Waveform	Sine coded PWM (Pulse Width Modulated)
Maximum Continuous Output Rated Current - See Section 2.0, Figure 2.1	
Short Time Overload	120% of maximum continuous output rated current for 60 seconds.

OUTPUT SIGNALS

Current	0 to 5vdc proportional to output current, 5vdc equals 150% of maximum continuous output current.
Voltage	0 to 5vdc proportional to the fundamental output voltage, 4vdc equals 460 output voltage.
Frequency	0 to 5vdc proportional to output frequency/motor speed, 2.5vdc equals selected Hertz/motor base (rated) speed.
Run Command Relay (RCR)	One normally open contact rated 2.0 amps @ 28vdc or 0.5 amps @ 120 vac resistive.
Drive Run Relay (DRR)	One Form C contact rated 4.0 amps @ 30vdc or 250 vac resistive.
Drive Fail Relay (DFR)	One Form C contact rated 2.0 amps @ 28vdc or 0.5 amps @120vac resistive.

3.1.3 PERFORMANCE

Controller Linearity (Percent of F_{Base})

F_{Base} = 60 Hz
Auto or Hand Input ± .25 Typ.
Frequency Stability At 25°C Ambient ± .55 Hz Max.
Frequency Shift With Ambient Temperatures:
Hand Input ± .01 Hz/°C Typ., ± .015 Hz/°C max.

Current Limit	Adjustable 75% to 120% of maximum continuous output rated current.

3.1.4 ENVIRONMENTAL CONDITIONS

Storage Temperature	−17°C to 60°C (0°F to 140°F)
Operating (Ambient) Temperature	Enclosed 0° to 40°C (32°F to 104°F) Open 0°C to 40°C (32°F to 104°F)
Altitude	To 1,000 meters (3,300 feet) w/o derating
Relative Humidity	To 95% maximum noncondensing

3.1.5 ADJUSTMENTS

Current Limit	Adjustable 75-120% of maximum continuous output rated current.
Voltage Boost	Adjustable 100% to 400% of nominal Volts/Hz ratio in constant Volts/Hz range. This boost is fully effective at 3 Hz and tapers to zero boost at 20 Hertz. (60% to 200% for variable Volts/Hertz range)
Output Frequency Range	Maximum 60 Hertz output
Maximum Frequency	Adjustable 40 Hertz to 60 Hertz (33 Hertz to 50 Hertz in 50 Hertz range)

Minimum Frequency	Adjustable 3 Hertz to 54 Hertz (3 Hertz to 45 Hertz in 50 Hertz range).
Acceleration/ Deceleration Time Range	Range selection from 6 seconds to 75 seconds for 60 Hertz maximum operating frequency.
Acceleration Time	Adjustable over selected range.
Deceleration Time	Adjustable over selected range.
Overload Threshold	Adjustable 0% to 115% of maximum continuous output rated current.
Input Voltage	200vac, 230vac or 460vac operation.
Input Frequency	The controller is factory set to operate from 60 Hertz power. Adjustable for operation from a 50 Hertz power source.
One or Two Fault Lockout	For OV faults only, the controller is factory set for lock-out (manual reset) after first protective circuit trip. Selectable automatic reset after first trip and lockout after second trip within 28 seconds of the first.

3.1.6 PROTECTION

Instantaneous Overcurrent Trip	Non-adjustable trip setting of 130% of peak maximum continuous output rated current.
Ground Fault	Non-adjustable trip setting of 27 amperes peak. Trips in 6 microseconds when current settings are exceeded.
Full Time Current Limit	Adjustable 75% to 120% of maximum continuous output rated current.
Over-temperature	Thermostat mounted on heatsink.
Overload	Adjustable 0% to 100% of maximum continuous output rated current.
Overfrequency	Non-adjustable clamp limits output frequency to not more than 75 Hertz.
Overvoltage	Protects the controller against excessive dc bus voltage. Trips at 900vdc for 460vac systems or 450vdc for 200/230vac systems.
Undervoltage	Trips at 87.5% of rated input voltage. Automatically resets at 95% of rated input voltage.
Shoot-Through	Protects the controller against dc bus short circuits caused by mis-sequencing of the inverter GTO switches. Trips at 100vdc for 460vac systems or 50vdc for 200/230vac systems.
Input Fuses	Three current limiting fuses provide coordinated protection of the controller power circuit for fault withstand capability of 65,000 RMS symmetrical amperes.
Bus Undervoltage	Protects the controller against dc bus undervoltage due to loss of a phase. Trips at 400vdc for 460 vac systems or 200 vdc for 200/230vac systems.

3.1.7 DIAGNOSTIC AND STATUS INDICATORS

Light Emitting Diodes (LEDs) and a neon light are provided for the following:

Bus Undervoltage (BUV)
Undervoltage (UV)
Overvoltage (OV)
Ground Fault (GF)
Instantaneous Overcurrent (IOC)
Shoot Through (ST)
Overtemperature (OT)
Overload (OLD)
Overload Timer (OLT)
Motor Current Limit (MCL)
Power Up Delay (PUD)
Drive Enabled (DE)
Power (PWR)

NOTE: A detailed description of the diagnostic and status indicators is located in Section 7.0

3.2 OPTIONS

There are a number of factory and/or field installed options for the Class 8804 OMEGAPAK controller. To determine which options (if any) were factory installed, refer to the controller nameplate for the MOD alphanumeric listing.

3.2.1 CONTROLLER MOUNTED PILOT DEVICES①

MOD A10

Hand-Auto-Selector Switch	Class 9001, Type KS11B-H2 Class 9001, Type KN 340 Legend Plate
Start Push Button	Class 9001, Type KR1B-H13 Class 9001, Type KN301 Legend Plate
Stop Push Button	Class 9001, Type KR1R-H13 Class 9001, Type KN302 Legend Plate
Manual Speed Potentiometer	Class 9001, Type K2107

MOD H10

Hand-Off-Auto Selector Switch	Class 9001, Type KS43B-H2 Class 9001, Type KN-360 Legend PLate
Manual Speed Potentiometer	Class 9001, Type K2107

MOD S10

Start Push Button	Class 9001, Type KR1B-H13
Stop Push Button	Class 9001, Type KR1R-H13 Class 9001, Type KN-302 Legend Plate
Manual Speed Potentiometer	Class 9001, Type K2107

MOD F16

Drive Fail Pilot Light	Class 9001, Type KT35 Class 9001, Type KN399 (DRIVE FAIL)

MOD P16

Power On Pilot Light	Class 9001, Type KP35 Class 9001 KN338 Legend Plate

MOD R16

Run Pilot Light	Class 9001, Type KT35 Class 9001, Type KN324 Legend Plate

① Refer to wiring diagram section of this service bulletin for terminal connections.

3.2.2 OUTPUT ISOLATION CONTACTOR

MOD C13

Square D Class 8502 Type S Contactor properly sized for controller maximum continuous output current. Includes a 200/230/460 – 120 volt control power transformer with 2 primary and one secondary fuse. Available with OMEGAPAK 3500 controllers only.

3.2.3 ISOLATION & BYPASS CONTACTORS

MOD B13 & D13

Includes isolation contactor mechanically and electrically interlocked with a full voltage combination starter to provide emergency full speed operation in the event the controller is out of service, a transfer delay timer and an AFC-Bypass Selector Switch. NOTE: Combination

starter does **not include** thermal overload heaters. Available with OMEGAPAK 3500 controllers only.

MOD B13 provides a circuit breaker type combination starter and MOD D13 provides a fusible switch type combination starter.

3.2.4 POWER AND GROUND BUS MOD A12 THROUGH U12.

Various combinations of power and ground bus are available to permit the OMEGAPAK 3500 controller to be arranged in a motor control center line-up. Power and ground bus matches that used in Square D Model 4 motor control centers.

3.2.5 METERS

The meters described below are available in kit form for remote mounting or factory installed in the controller.

MOD A14 (Kit Class 8804, Type AM-1)
Analog Speed Meter - 3-1/2 inch meter with indicating scale of 0-100% speed. This meter is connected to the Main Control Board. A 0-5vdc signal is used to drive this meter.

MOD D14 (Kit Class 8804, Type DM-1) ①
Digital Speed Meter - 3-1/2 inch meter selectable to indicate 0-100% speed or 0-1999 RPM (Maximum RPM indication is 1999). This meter is connected to the same terminal points as the analog meter (MOD A14) described above.

MOD T15
Elapsed Time Meter - 3-1/2 inch meter with indicating scale of 99999.9 hours maximum. This meter is connected to the Main Control Board (refer to wiring diagram section of this Service Bulletin).

MOD V15 (Kit Class 8804, Type AM-2)
Analog Voltmeter - 3-1/2 inch meter with indicating scale of 0-125% of rated output voltage. This meter is connected to the main control board. A 0-5 vdc signal drives this meter.

MOD F15 (Kit Class 8804, Type DM-1) ①
Digital Voltmeter - 3-1/2 inch meter adjustable to read 0-100.0% of rated output voltage. This meter is driven by the same 0-5 vdc signal as the analog voltmeter.

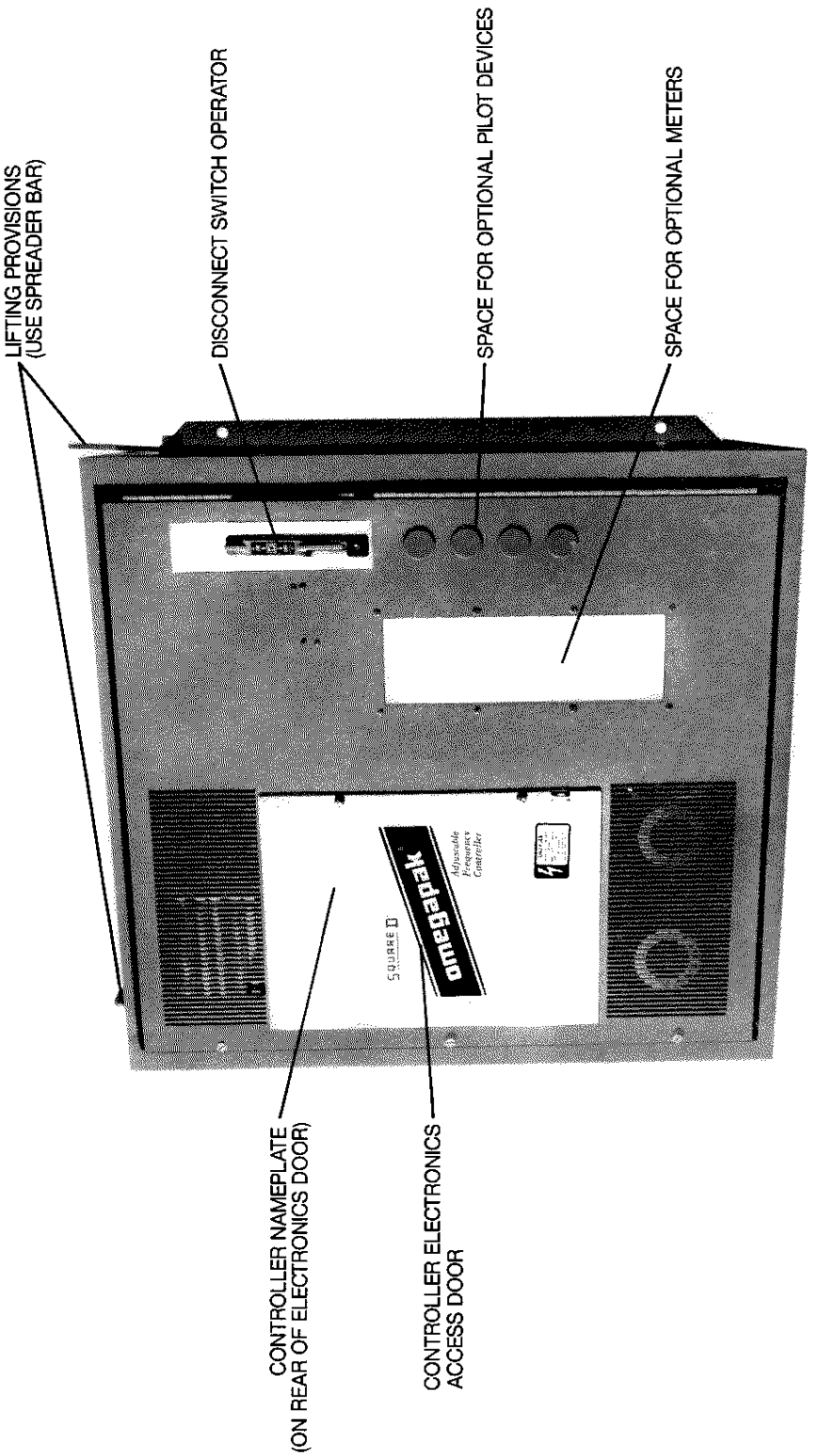
MOD A15 (Kit Class 8804, Type AM-3)
Analog Ammeter - 3-1/2 inch meter with indicating scale to read 0-150% of rated controller output current. This meter is connected to the main control board. A 0-5 vdc signal drives this meter.

MOD G15 (Kit Class 8804, Type DM-1) ①
Digital Ammeter - 3-1/2 inch meter adjustable to read 0-150.0% of rated controller output current. This meter is driven by the same 0-5 vdc signal as the analog ammeter.

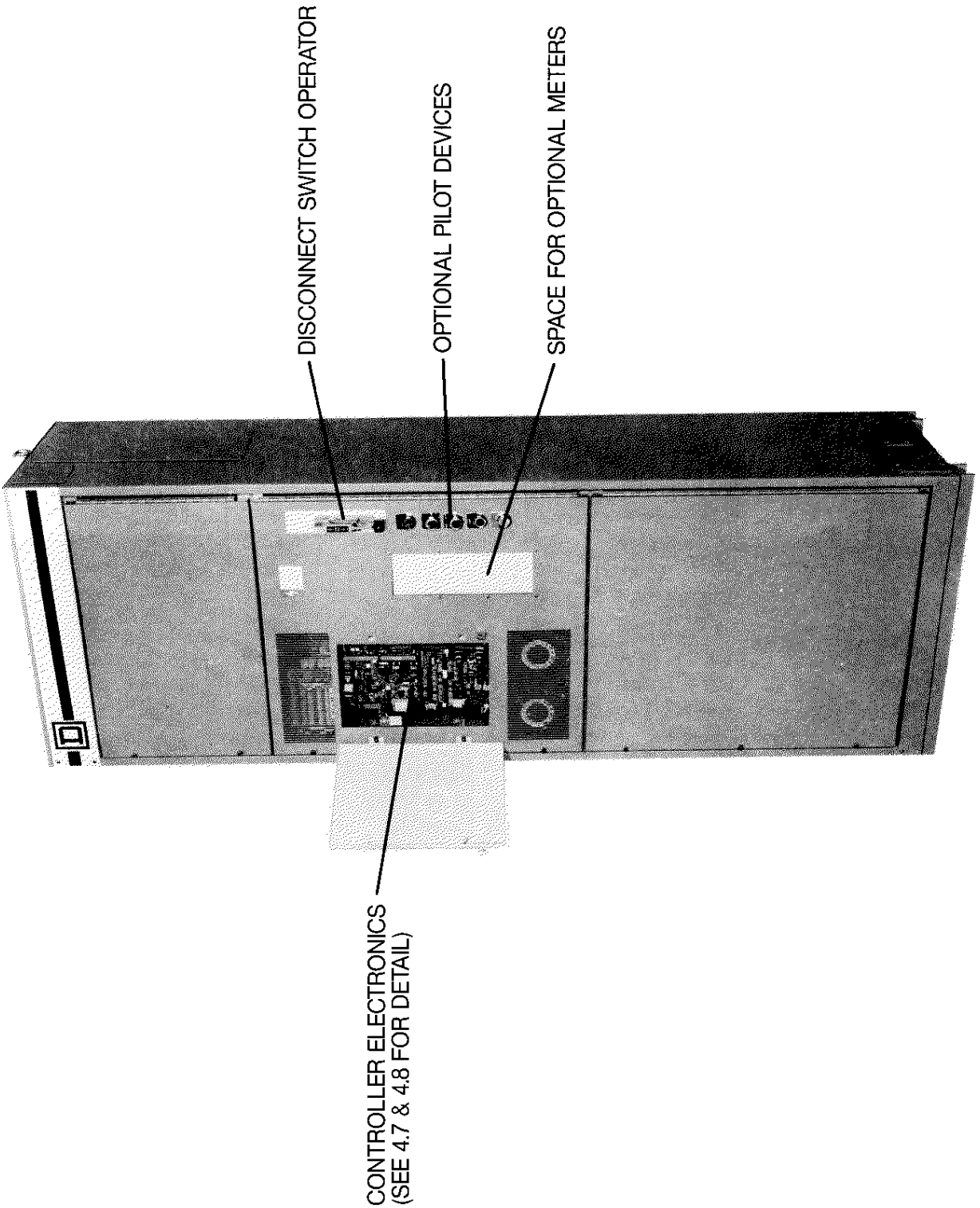
① The Class 8804 Type DM-1 meter can be field adjusted to display speed, voltage or current.

4.0 CONTROLLER PHOTOS

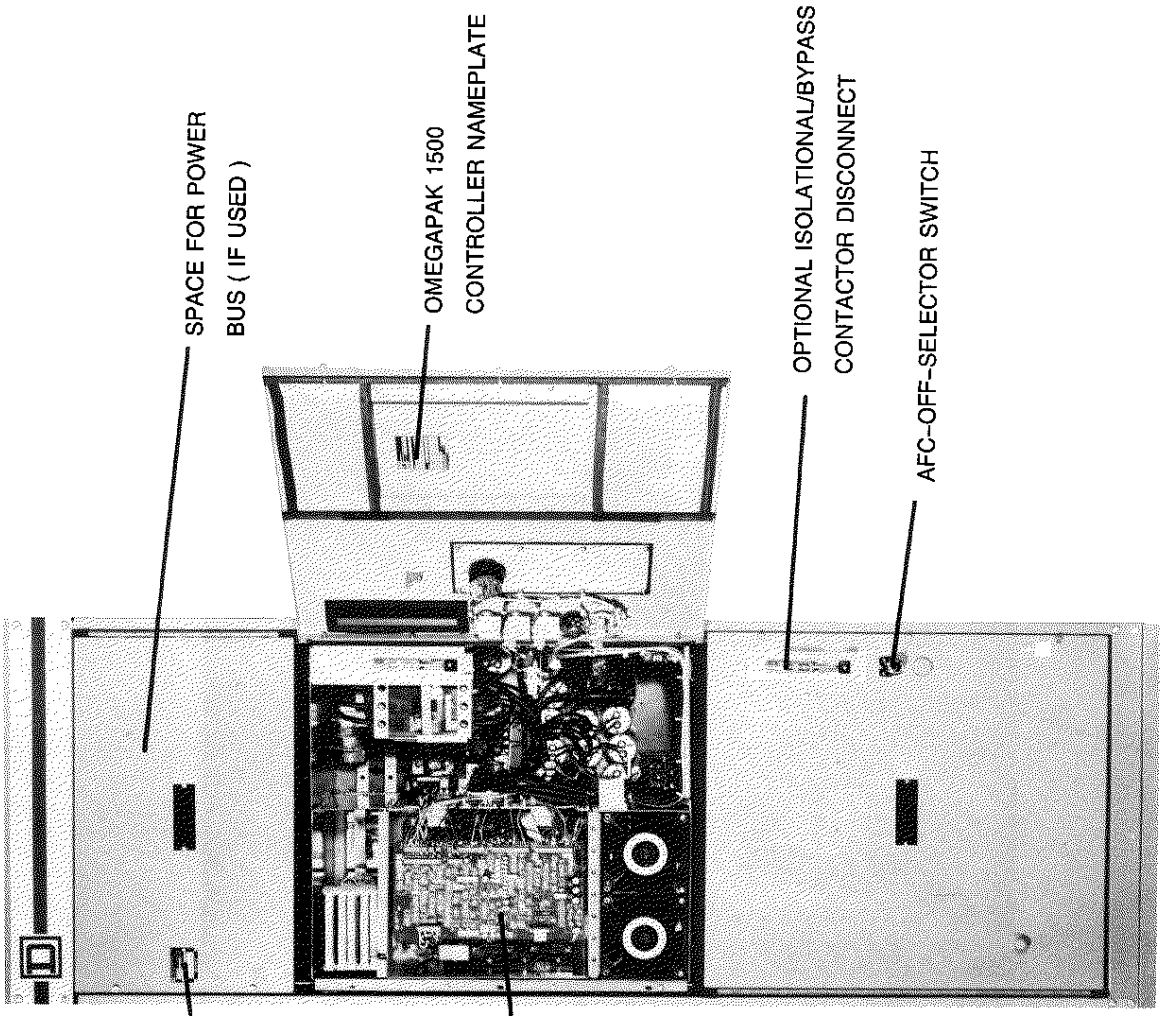
4.1 OMEGAPAK 1500 CONTROLLER



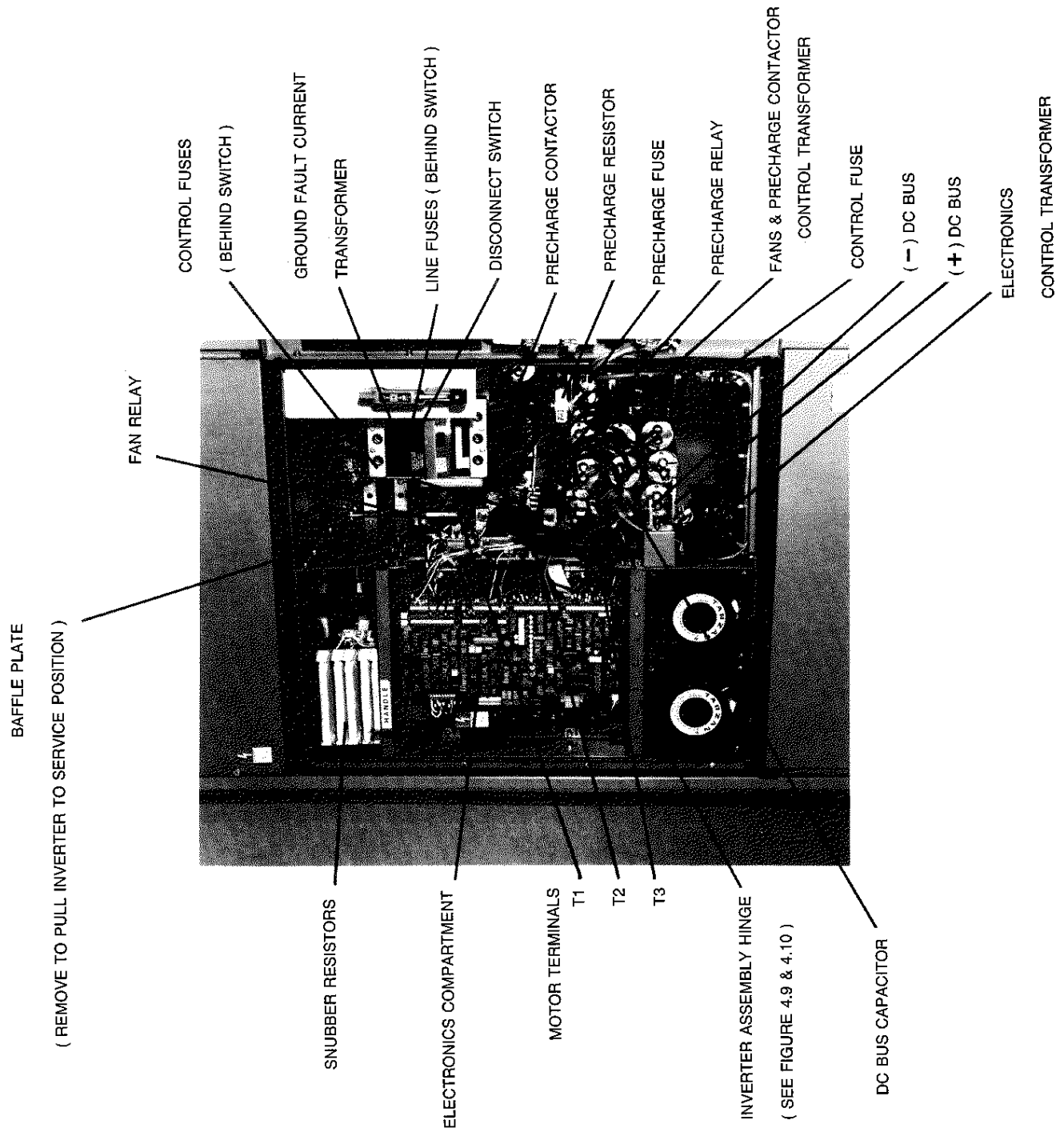
4.2 OMEGAPAK 3500 CONTROLLER — WITH ELECTRONICS DOOR OPEN



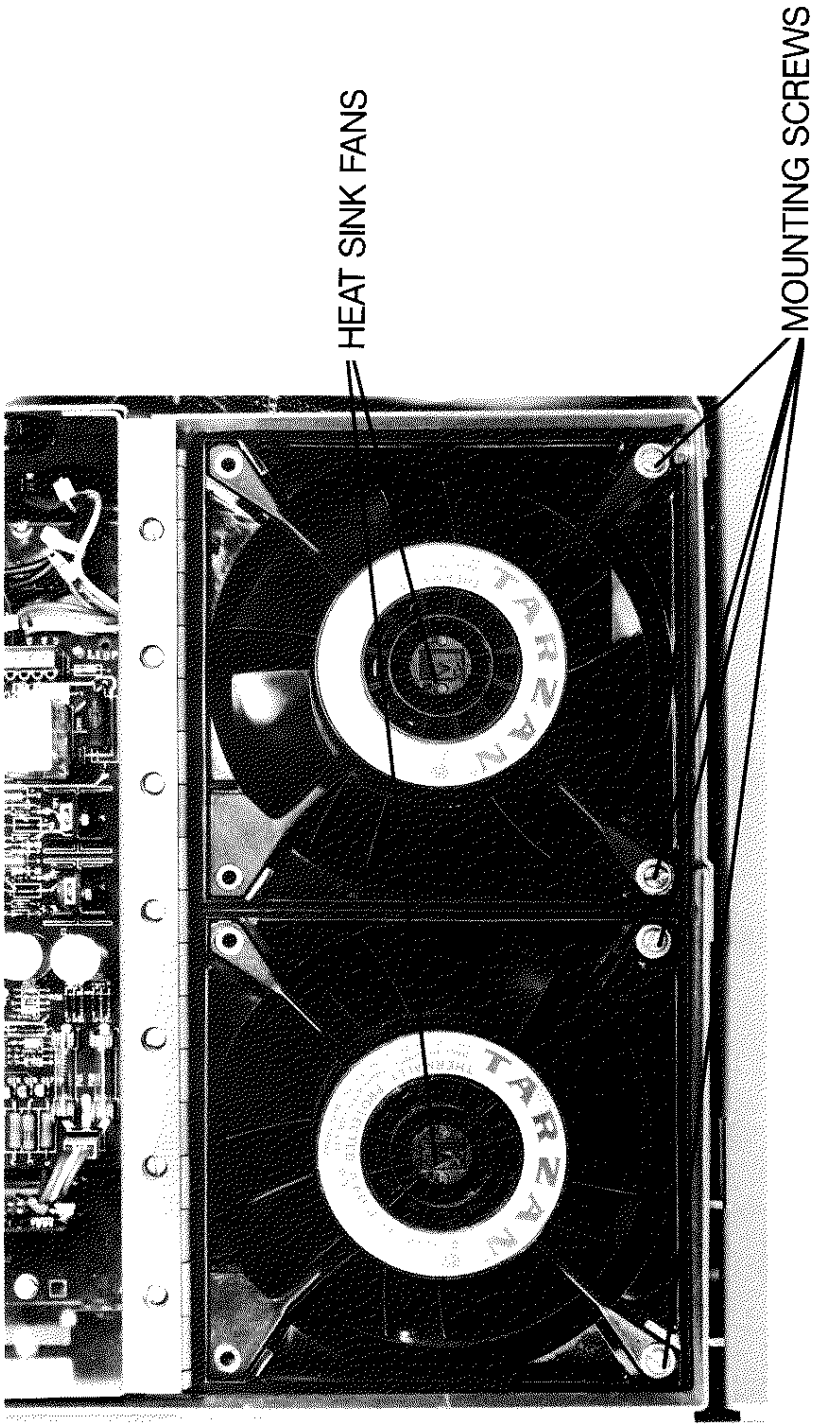
4.3 OMEGAPAK 3500 CONTROLLER — WITH MAIN DOOR OPEN



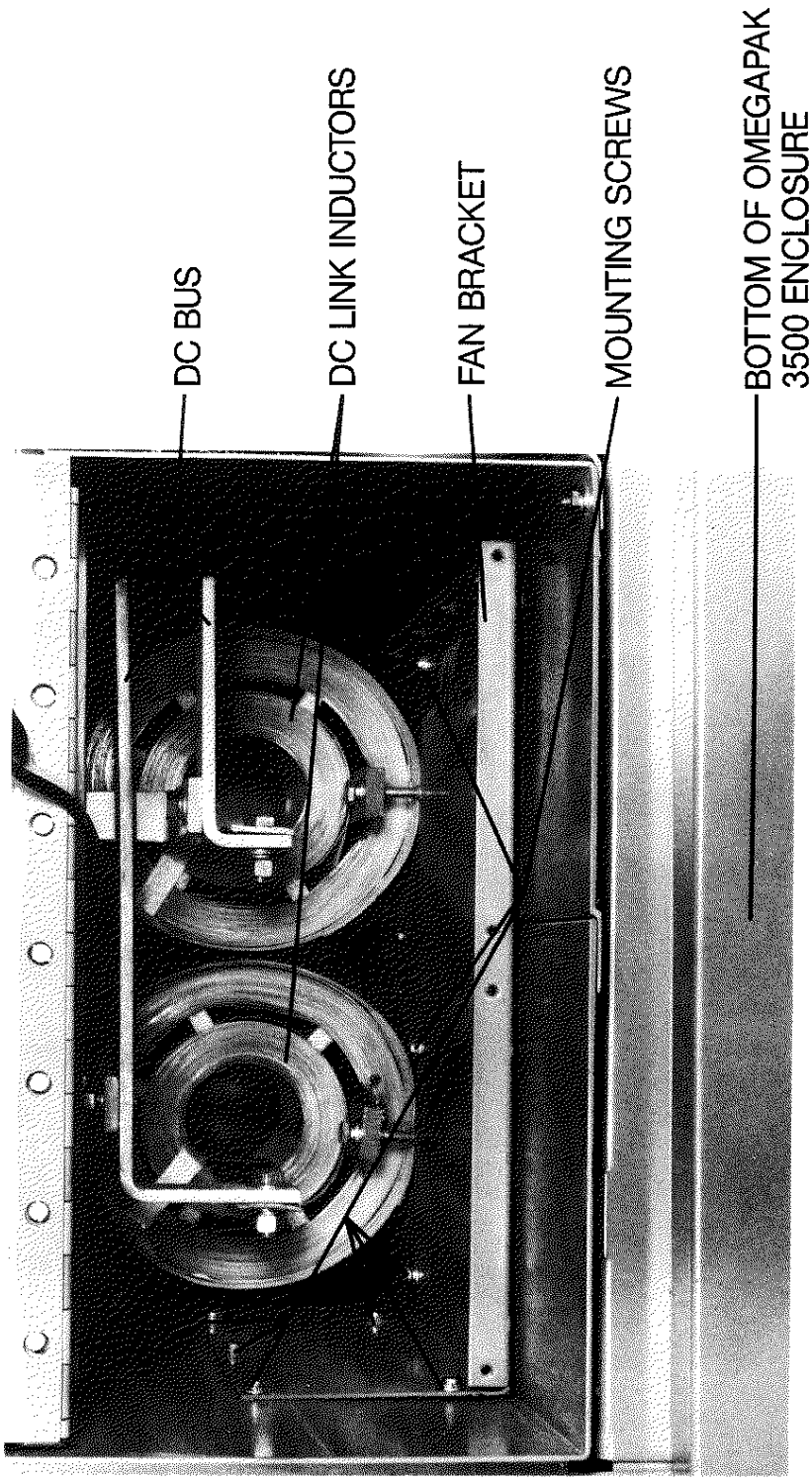
4.4 CLOSE-UP OF CONTROLLER INSIDE



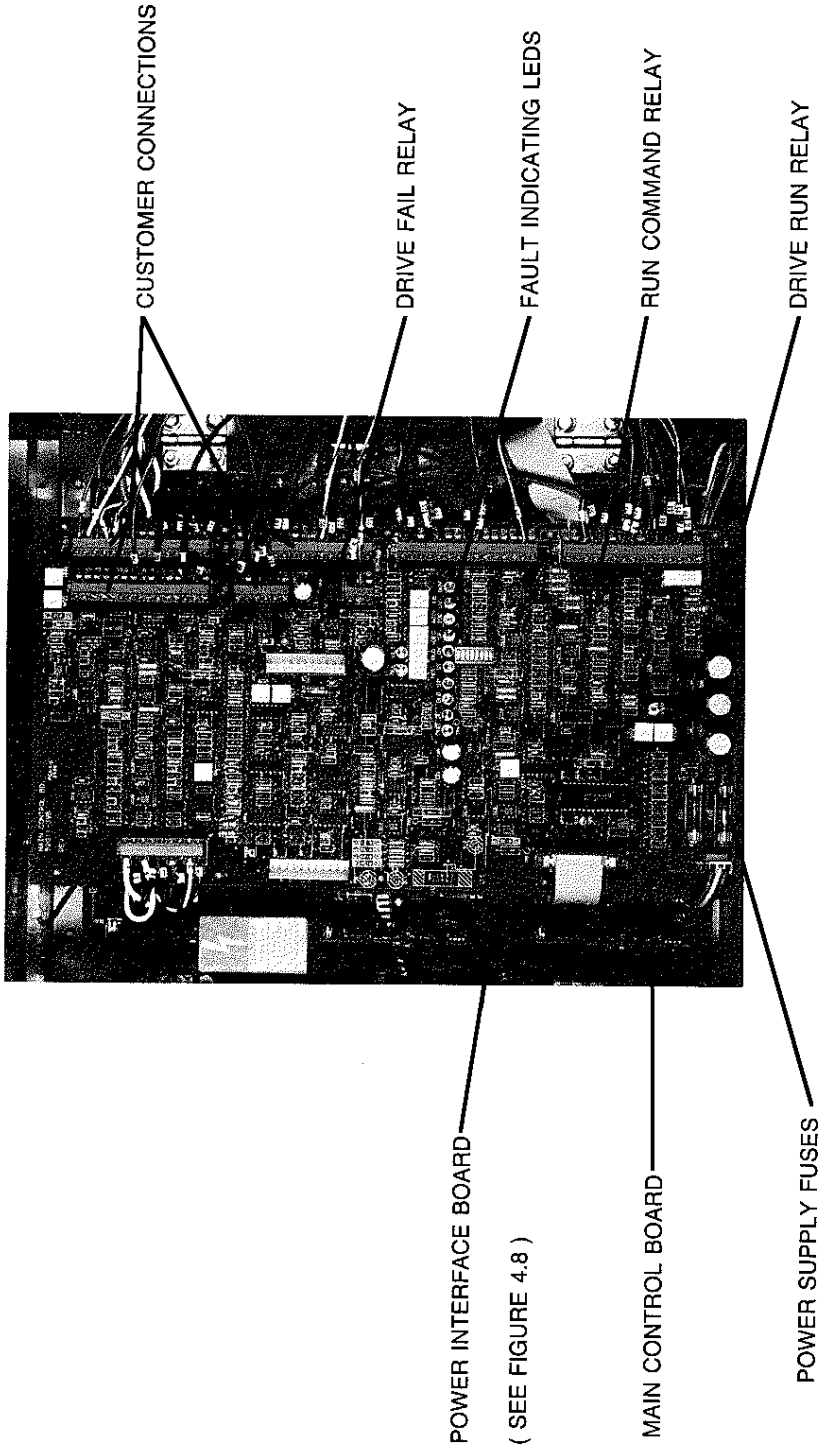
4.5 GROUND BUS ACCESS — HEATSINK FAN REMOVAL



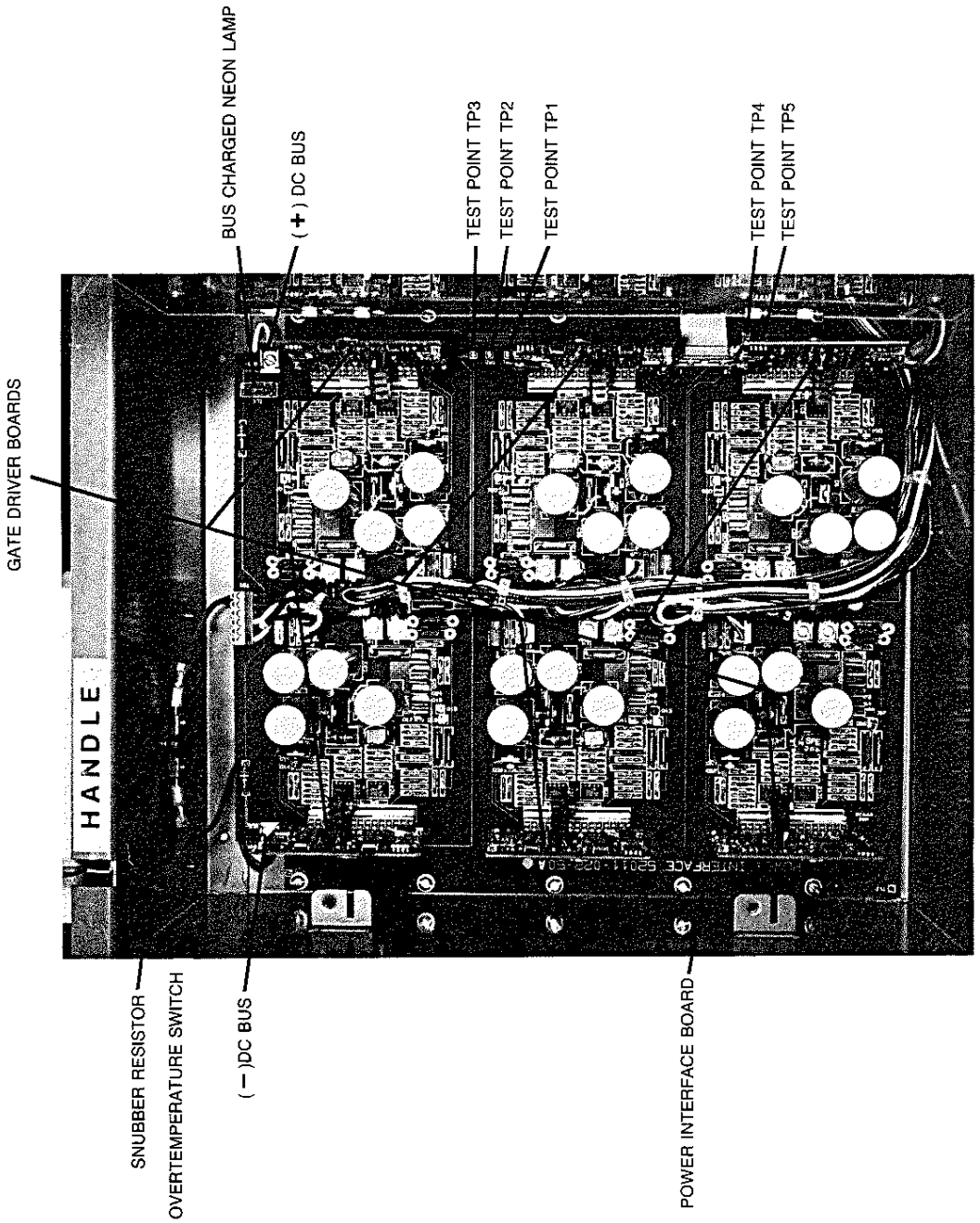
4.6 GROUND BUS ACCESS — FAN BRACKET REMOVAL



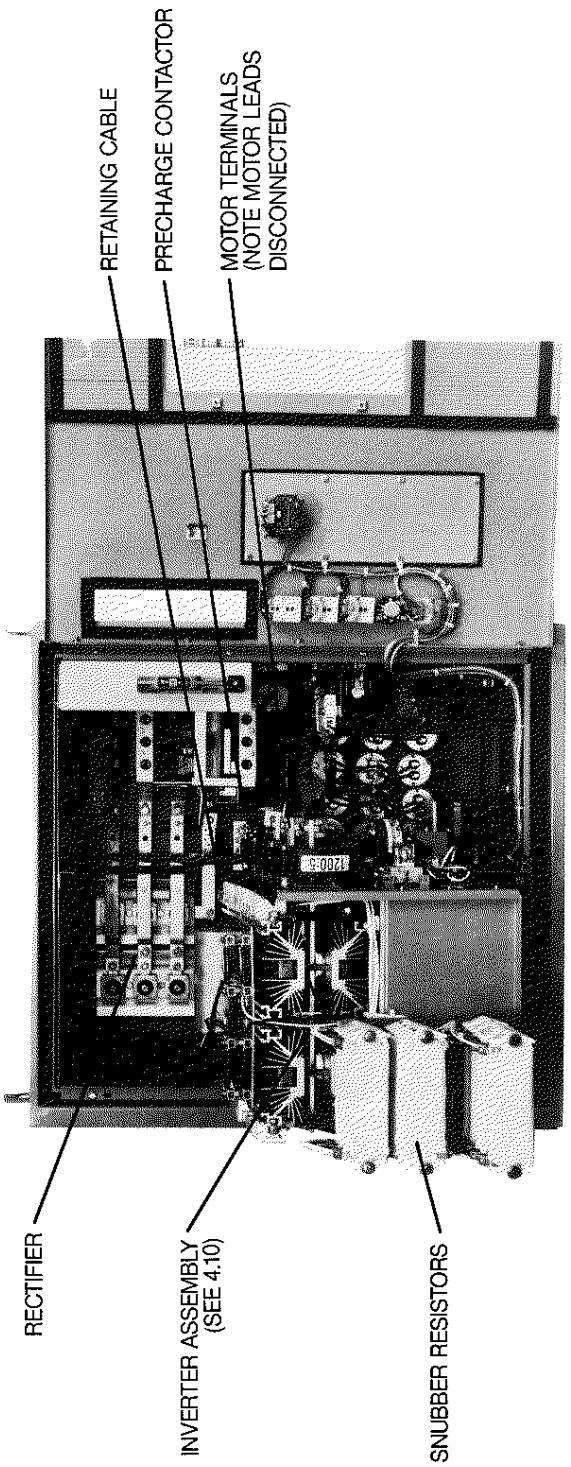
4.7 CLOSE-UP OF MAIN CONTROL AND OPTION BOARD



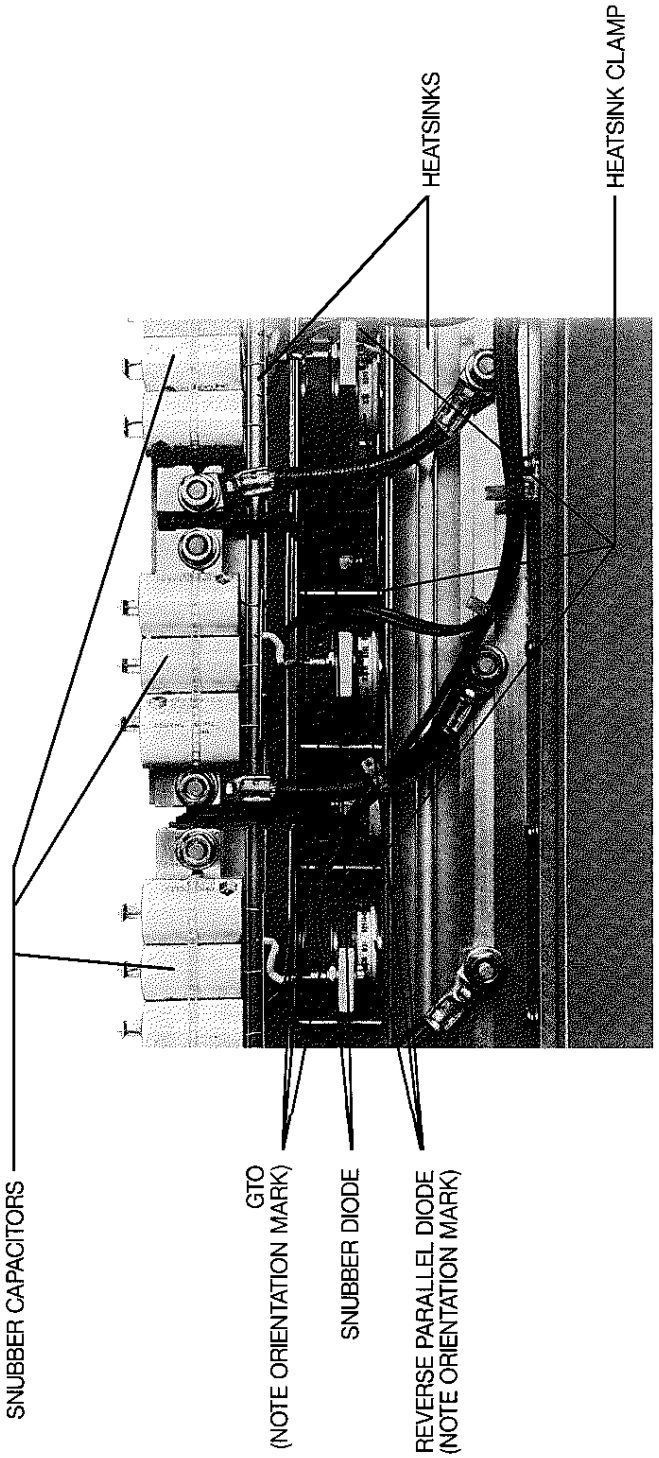
4.8 CLOSE-UP OF POWER INTERFACE BOARD



4.9 INVERTER IN SERVICE POSITION



4.10 CLOSE-UP OF INVERTER ASSEMBLY



5.0 INITIAL START-UP PROCEDURE

5.1 INITIAL START-UP PROCEDURE

The OMEGAPAK controller has been tested at the factory and should require only minor adjustments to complete the field installation. This start-up procedure should be followed step by step. In case of difficulty refer to the TROUBLESHOOTING section of this service bulletin.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT FIVE MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

WITH ALL INCOMING POWER REMOVED, make the following equipment settings and adjustment:

A. Verify that all equipment disconnect means are open.

B. Connect the Control Power Transformer primary taps as illustrated in Section 6.0, Figures 6.1, for the system input voltage. Refer to Section 4.0, OMEGAPAK Controller Photo for location of the control power transformers.

C. Connect the Control Power Transformer primary taps for the Isolation Contactor or Isolation and By-Pass Contactor (if used) as illustrated in Section 6.0, Figure 6.2, for the system input voltage. Refer to Section 4.0, OMEGAPAK Controller Photos for location of the control power transformer.

D. Temporarily place a jumper from TB1-89 to TB1-91.

E. Temporarily disconnect and isolate the analog follower input signal wiring from TB1.

F. Set selection switches SW1 through SW8 on the main control board as required. See Section 6.0, Figure 6.3. Refer to Section 8.0, Selection Switch Placement chart, for location of switch.

G. Configure the snip-out resistors on the main control board as required. See Section 6.0, Figure 6.4. Refer to Section 8.0, Snip-Out Resistor Placement chart, for location of resistors.

H. The following adjustments on the main control board were factory set as follows. Refer to Section 8.0, Potentiometer Placement chart, for location of potentiometers. *Do not adjust any potentiometers unless directed in the start-up procedure.*

+ 10VDC SUPPLY ADJUST (P1)*	+ 10vdc
DECELERATION TIME (P2)	Maximum (full clockwise)
ACCELERATION TIME (P3)	Maximum (full clockwise)
MAXIMUM SPEED (P4)	60 Hz Output with nominal speed ref.
HAND MINIMUM SPEED (P5)	Minimum 3 Hz (full counterclockwise)
GAIN ADJUST (P6)*	Optimized for controller
MOTOR CURRENT LIMIT (P7)	Maximum (full clockwise)
OVERLOAD THRESHOLD (P8)	Maximum (full clockwise)
FREQUENCY CLOCK TRIGGER (P9)	Optimized for controller
VOLTAGE BOOST (P10)	Minimum (full counterclockwise)
REFERENCE CLOCK TRIGGER (P11)*	Optimized for controller
OUTPUT CLOCK TRIGGER (P12)*	Optimized for controller
VOLTS/HERTZ TRIM (P13)*	Optimized for standard motor

* Designates potentiometers that have been factory sealed. **DO NOT ADJUST!**

I. Set the HAND-OFF-AUTO Switch to OFF①.

J. Set the MANUAL SPEED adjustment potentiometer to minimum (full counterclockwise).

K. Confirm that the Isolation-Bypass Unit (if used) AFC-Off-Line selector switch is in the OFF position.

L. Check wiring of input power, panel ground, motor, manual speed potentiometer (if remote) and Hand-Off-Auto① circuit con-

nections, (if remote). Refer to Section 11.0 for the controller connection diagram and wiring diagram for remote control station.

M. Verify that the incoming line voltage at the line side of the disconnecting means is within +10% to −5% of the controller nameplate input voltage.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

CONTROLLER PANEL MUST BE PROPERLY GROUNDED BEFORE APPLYING POWER. CLOSE AND SECURE ENCLOSURE DOOR BEFORE APPLYING POWER.

WITH INCOMING POWER PRESENT

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

CERTAIN ADJUSTMENTS AND TEST PROCEDURES REQUIRE THAT POWER BE APPLIED TO THIS CONTROLLER. WHEN WORKING WITH ENERGIZED EQUIPMENT, EXTREME CAUTION MUST BE EXERCISED AS HAZARDOUS VOLTAGES EXIST. THE ENCLOSURE DOOR MUST BE CLOSED AND SECURED WHILE TURNING ON POWER, OR STARTING AND STOPPING THIS CONTROLLER.

N. Close and secure the enclosure door. Close the equipment disconnect means. The Power On lamp (if used) should light. Other lamps (if used) may be tested by pushing their lenses (if push to test lamps are used).

O. Verify that **only** the following lamps are lighted: (LED 1) PWR on the Main Control Board, and Neon Lamp (IL1) on the Power Interface Board. Refer to Section 8.0, LED Placement chart, for location of LED's and Section 4.0 Controller Photos for location of Neon lamp.

P. If an Isolation-Bypass unit is not used proceed to Step T.

Q. If the Isolation-Bypass unit is used, turn the AFC-Off-Line selector switch to the Line position. If necessary, adjust the disconnect means trip setting to the lowest value that will not result in nuisance tripping. The motor should accelerate to full speed. Check the motor rotation. If it is incorrect, stop the drive by turning the AFC-Off-Line selector switch to Off. **REMOVE ALL POWER!**

R. Correct the phase sequence of the motor by reversing motor leads T1 and T2 at the output of the Isolation-Bypass unit. Reapply power.

S. Turn the Isolation-Bypass unit (if used) AFC-Off-Line selector switch to AFC.

T. Close and secure the enclosure door. Turn the Hand-Off-Auto① Selector Switch to Hand. Slowly turn the Manual Speed adjustment potentiometer clockwise to accelerate the drive motor. Check the direction of motor rotation. If correct, proceed to Step Z. If incorrect, stop drive. **REMOVE ALL POWER!**

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT FIVE MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THAT THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

U. Correct the direction of motor rotation by one of the following methods:

1. If Isolation-Bypass is not used, reverse any two leads connected to output terminals T1, T2, T3.
2. Remove Snip-Out Resistor R186. Refer to Section 8.0, Snip-Out Resistor Placement Chart, for location of resistor.

V. Reset the Manual Speed adjustment potentiometer setting to minimum speed (full counterclockwise). Close and secure the enclosure door then, reapply power and restart the controller.

W. Slowly increase the Manual Speed adjustment potentiometer setting to maximum (full clockwise). The motor speed should follow. If the motor will not accelerate or an IOC trip occurs during acceleration, refer to Section 6.0, Controller Adjustment, for setting of the Voltage Boost Potentiometer (P10).

X. Check the maximum motor speed. Adjust the Maximum Speed Potentiometer (P4) on the main control board to obtain motor rated speed.

Y. Return the Manual Speed adjustment potentiometer to minimum setting (full counterclockwise). The motor speed should follow.

Z. Slowly adjust the Hand Minimum Speed potentiometer (P5) on the main control board to obtain the desired minimum speed.

AA. Using the Manual Speed adjustment potentiometer adjust the motor speed for the point of maximum motor current. (This must not exceed the motor or controller nameplate current.) Slowly turn the Overload Threshold Adjust Potentiometer (P8) on the main control board counterclockwise until the Overload Timer (LED 3) OLT lights. Now, slowly turn P8 clockwise until the Overload Timer (LED 3) OLT just extinguishes. Then turn P8 an additional 5 degrees clockwise rotation.

CAUTION

THIS CONTROLLER DOES NOT PROVIDE OVERTEMPERATURE PROTECTION FOR THE MOTOR AT ALL SPEEDS OR LOADING CONDITIONS. A MOTOR THERMAL SENSOR IS RECOMMENDED.

BB. The Acceleration Time (P3) and Deceleration Time (P2) Potentiometers on the main control board may be adjusted to suit individual applications. If an overvoltage trip occurs during deceleration, increase the deceleration time setting. If OV tripping persists, refer to Section 6.1.5.

BB1. If a Hand-Off-Auto Switch is supplied, proceed to Step CC, otherwise proceed to EE.

CC. Turn the Hand-Off-Auto① switch to Auto.

CCA. This step sets the signal level of analog follower inputs. For this application, the supply must be connected as shown in Figure 5.2.A. The controller as shipped will accept 0-10vdc or 4-20 madc for automatic speed control. If operation from a 4-20 ma signal is required, a jumper must be installed from Main Control Board terminal TB1-11 to TB1-71. Refer to Section 11, Drawing 11.7.3. This is shown in Figure 5.2.B.

DD. Turn the Hand-Off-Auto① selector switch to Off.

EE. REMOVE ALL POWER!

DANGER

HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT 5 MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THAT THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

FF. Remove the jumper from TB1-89 to TB1-91 installation in Step D. Reconnect any wires removed in Step E.

KK. This completes the initial start-up and adjustment procedure. The controller is now set for most applications. If your application requires different operational characteristics, refer to Section 6.0, Controller Adjustment Description, in this service bulletin.

Abnormal Operation

Refer to Section 7.0, Diagnostic Indicating Lights, if any of the following LED's on the Main Control Board are illuminated.

A. Undervoltage (UV)
B. Overvoltage (OV)
C. Shoot Through (ST)
D. Ground Fault (GF)
E. Instantaneous overcurrent (IOC)
F. Overload (OLD)
G. Overtemperature (OT)
H. Bus Undervoltage (BUV)

① The Hand-Off-Auto selector switch may not always be used. Refer to Section 11.0, for other control configurations, either controller mounted or remote mounted.

FIGURE 5.2.A

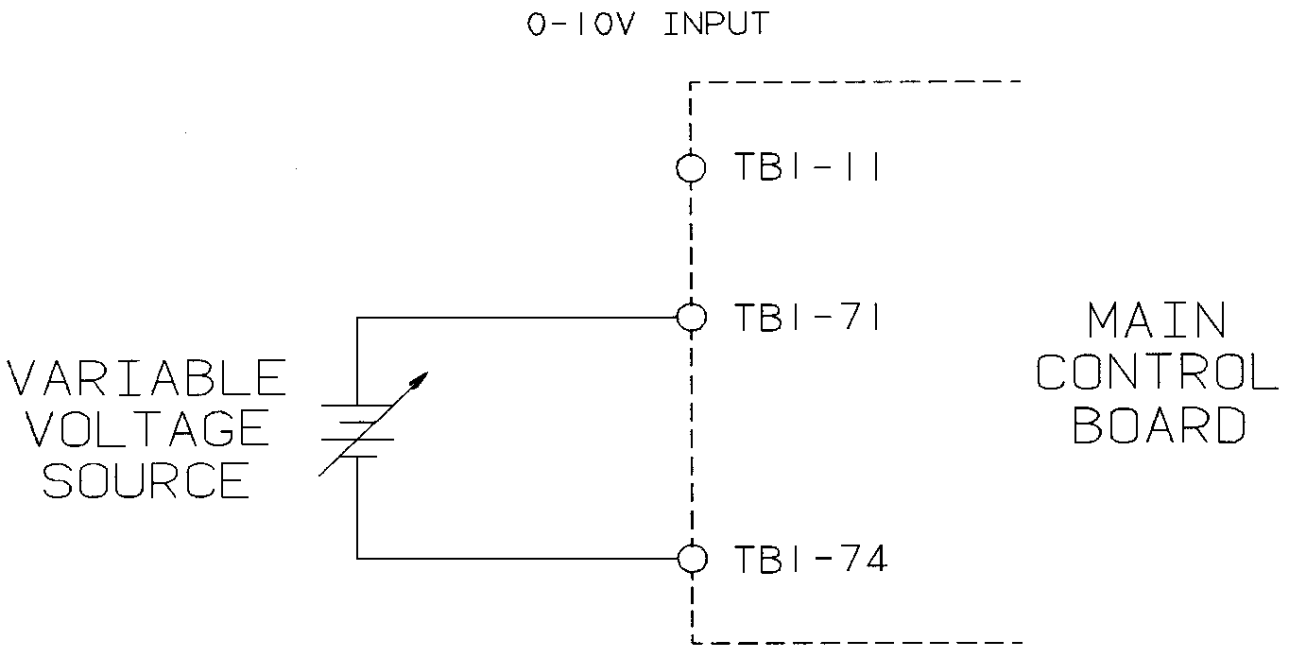
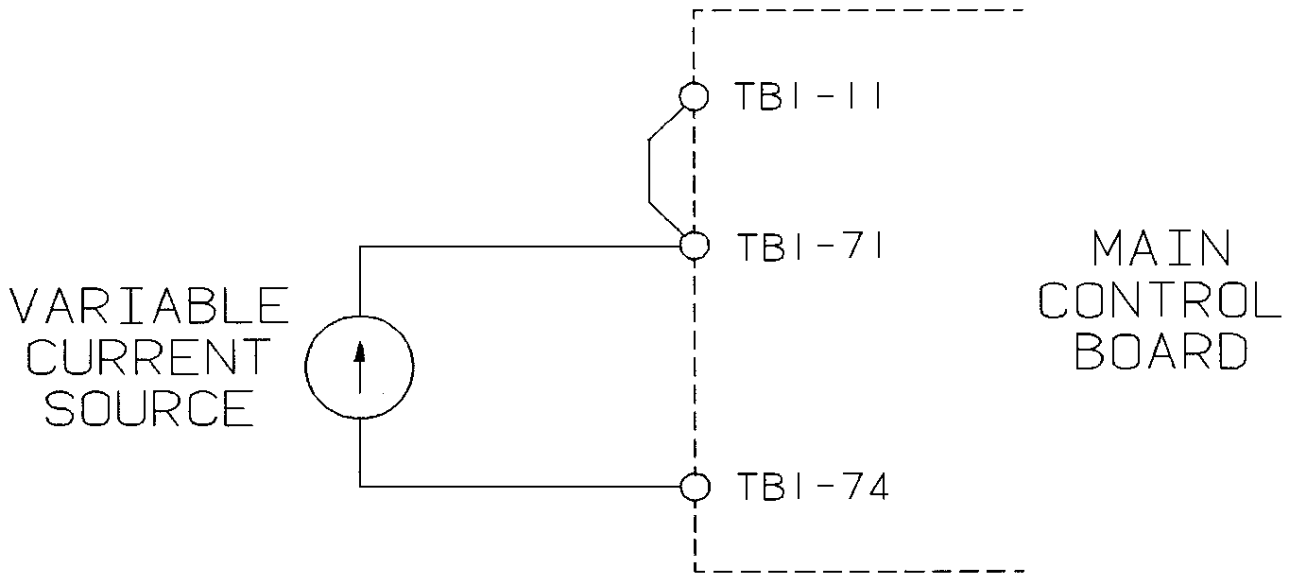


FIGURE 5.2.B
4-20MA DC INPUT



6.0 CONTROLLER ADJUSTMENTS

A number of adjustments have been provided in the OMEGAPAK controller for modifying the controller operating characteristics. These adjustments include Printed Wiring Board mounted Selection Switches, Snip-Out Resistors and Potentiometers. If the controller contains optional equipment there may be adjustments associated with these too. Each adjustment is described in the following paragraphs.

CAUTION

DO NOT CHANGE THE POSITION OF ANY PRINTED WIRING BOARD SWITCH OR REMOVE ANY PRINTED WIRING BOARD WITH THE DRIVE RUNNING. TO DO SO MAY CAUSE AN EQUIPMENT MALFUNCTION.

6.1 MAIN CONTROL BOARD ADJUSTMENTS

The adjustments on the main control board are:

INPUT VOLTAGE SELECTION
INPUT FREQUENCY SELECTION
CONTROLLER FAULT LOCKOUT SELECTION
POTENTIOMETER ADJUSTMENTS

6.1.1 INPUT VOLTAGE SELECTION

The controller is factory set to operate from 460vac. To operate the OMEGAPAK controller from 200vac or 230vac, the control power transformers jumper connections and Main Control Board selection switches must be repositioned. If optional isolation or isolation and by-pass contactor is used, there are wiring jumper changes necessary to operate from 200vac or 230vac. The procedure is as follows:

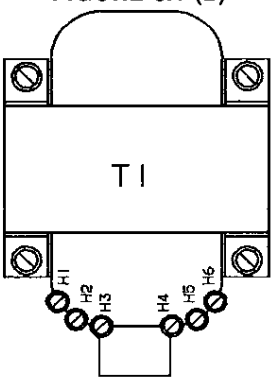
1. Reconnect the control power transformers jumper connections for the desired system input voltage as illustrated in Figures 6.1 and 6.2. (Refer to Section 4.0, Controller Photo, for control power transformer locations).

2. Set the selection switches SW1, SW3, SW6, SW7, and SW8 on the main control board for the desired system input voltage, motor voltage, and motor base frequency as illustrated in Figure 6.3. (Refer to Section 8.0, selection switch placement chart, main control board, for selection switch location).

FIGURE 6.1 (A)

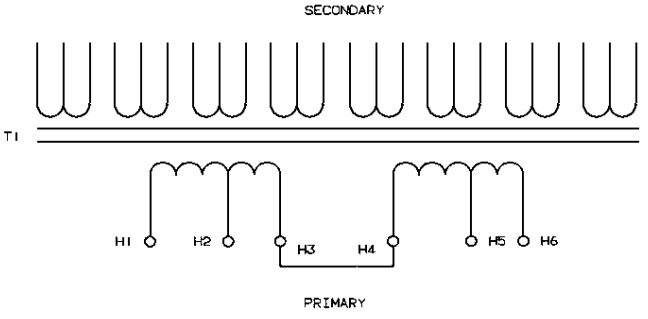
CONTROL TRANSFORMER CONNECTION ELECTRONICS CONTROL POWER (T1)		
SYSTEM INPUT VOLTAGE	PRIMARY TAPS	JUMPER CONNECTIONS
200	H1, H5	H1 TO H4, H2 TO H5
230	H1, H6	H1 TO H4, H3 TO H6
460	H1, H6	H3 TO H4

FIGURE 6.1 (B)



TERMINAL & JUMPER LOCATIONS
460V OPERATION

FIGURE 6.1 (C)

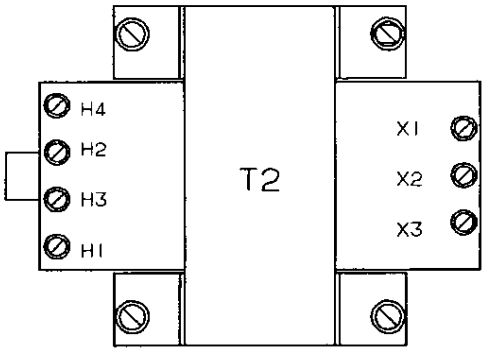


CONNECTION DIAGRAM
460V OPERATION

FIGURE 6.2 (A)

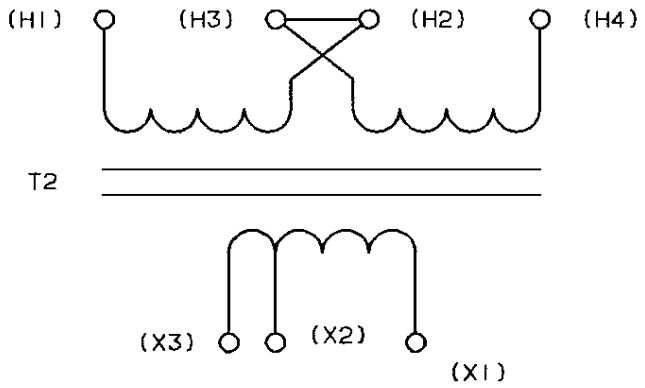
CONTROL TRANSFORMER CONNECTION FANS AND PRECHARGE CONTACTOR CONTROL POWER (T2)			
SYSTEM INPUT VOLTAGE	PRIMARY TAPS	SECONDARY TAPS	JUMPER CONNECTIONS
200	H1, H4	X1, X3	H1 TO H3, H2 TO H4
230	H1, H4	X1, X2	H1 TO H3, H2 TO H4
460	H1, H4	X1, X2	H2 TO H3

FIGURE 6.2 (B)



TERMINAL AND JUMPER LOCATIONS
460V OPERATION

FIGURE 6.2 (C)



CONNECTION DIAGRAM
460V OPERATION

3. If optional isolation or isolation and bypass contactors are used with the OMEGAPAK 3500 controllers, their control power transformer jumper connections must be reconnected to operate from 200vac or 230vac as illustrated in Figure 6.2. (Refer to Section 4.0, OMEGAPAK Controller Photo, for control power transformer location.)

6.1.2 INPUT FREQUENCY SELECTION

The controller is factory set to operate from 60 Hertz power. To operate the controller from 50 Hertz power, one (1) Main Control Board Snip-Out Resistor (R164) must be removed as illustrated in Figure 6.4. (Refer to Section 8.0, Snip-Out Resistor Placement chart, Main Control Board, for snip-out resistor location).

6.1.3 CONTROLLER FAULT LOCKOUT SELECTION

The controller is factory set to Lockout, requiring manual reset, on the first fault detected. Controller faults that will cause lockout are:

Overvoltage (OV)
Shoot Through (ST)
Ground Fault (GF)
Overload (OLD)
Instantaneous Overcurrent (IOC)
Overtemperature (OT)
Bus Undervoltage (BUV)

If first fault lockout is not desired, the controller can be set up for second fault lockout. Second fault lockout applies to overvoltage (OV) only. When the controller is set up for second fault lockout operation, the drive will stop for 7 seconds, or the duration of the fault (whichever is longer), upon the first fault then restart automatically if two-wire control is used. If a second fault occurs within 28 seconds after the first fault the drive will stop and lockout.

To adjust the controller for two fault operation, one (1) Main Control Board Snip-Out Resistor (R144) must be removed as illustrated in Figure 6.4. (Refer to Section 8.0, Snip-Out Resistor Placement chart, Main Control Board, for snip-out resistor location).

NOTE: All controller faults can be manually reset by depressing an external Reset Button connected between TB1-33 and TB1-22 on the main control board (see

component placement chart for terminal locations) or by interrupting power to the controller input.

An undervoltage (UV) trip condition will stop the drive but will not cause a controller lockout. After the undervoltage (UV) fault subsides the drive will immediately restart on two wire control systems. Systems with three wire control will require a manual restart.

6.1.4 CONSTANT OR VARIABLE VOLTS/HERTZ SELECTION

The controller is factory set for constant volts/HZ operation. To select a variable volts/HZ operation, Main Control Board Snipout Resistors (R170 and R180) must be removed. Removing the snipout resistors indicated will result in a reduced volts/Hertz ratio at reduced frequencies. The major effect is reduced motor noise; however, a slight savings of energy may also be realized.

Removal is optional for variable torque loads; however, the resistors **must not** be removed if the load requires high breakaway torque. Figure 6.5 graphically illustrates the effect of the resistors.

NOTE: Variable Voltz/Hz mode will require adjustment of the Voltage Boost Potentiometer (P1O). Refer to Section 6.1.6 potentiometer adjustments for adjustment procedure.

6.1.5 CONTROLLED/UNCONTROLLED STOP SELECTION

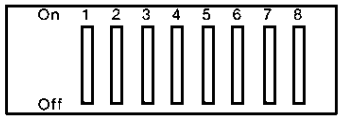
The controller is set for a controlled stop with SW2 closed. With the controlled stop selected, the motor will decelerate at the ramp setting when a stop is requested. With SW2 open, the uncontrolled stop is selected. The motor will now coast to a stop when a stop is requested. However, the motor will still decelerate at the ramp rate when the speed reference is reduced; regardless of SW2 setting. The uncontrolled stop may be selected when the power regenerated from a decelerating load is great enough to trip the controller on overvoltage even at the maximum acceptable deceleration ramp setting.

FIGURE 6.3
MAIN CONTROL BOARD DIP SWITCH SETTINGS

Switch	Function					
	Controller Input/Motor Nameplate (Base) Voltage Select					
	Input (V)	200	230	230	460	460①
	Base (V)	200	200	230	400	460①
SW1		X	X	X	O	O*
SW3		X	X	O	O	O*
SW6		O	O	O	X	X*
SW7		O	O	O	X	O*
SW8	Nameplate (Base) Frequency Select②					
	60 Hertz X*					50 Hertz O
SW2	Controlled/Uncontrolled Stop Selection					
	Motor Will Decelerate To A Stop On Deceleration Ramp Setting X*					Motor Will Coast To A Stop O
SW4 SW5	NOT USED					

① This switch setting also applies to 380 volts input and a 380 V motor. It is necessary to select 50 Hertz operation on SW8 to get the correct volts/Hertz relationship and adjust potentiometer P4 maximum speed (MSD) per section 6.1.6 to achieve a base frequency of 50 Hertz.
② Operation from a 50 Hertz supply also requires removal of snip-out resistors per Figure 6.4.

Typical Printed Wiring Board Switch



Depress this end to close (ON) switch

Depress this end to open (OFF) switch

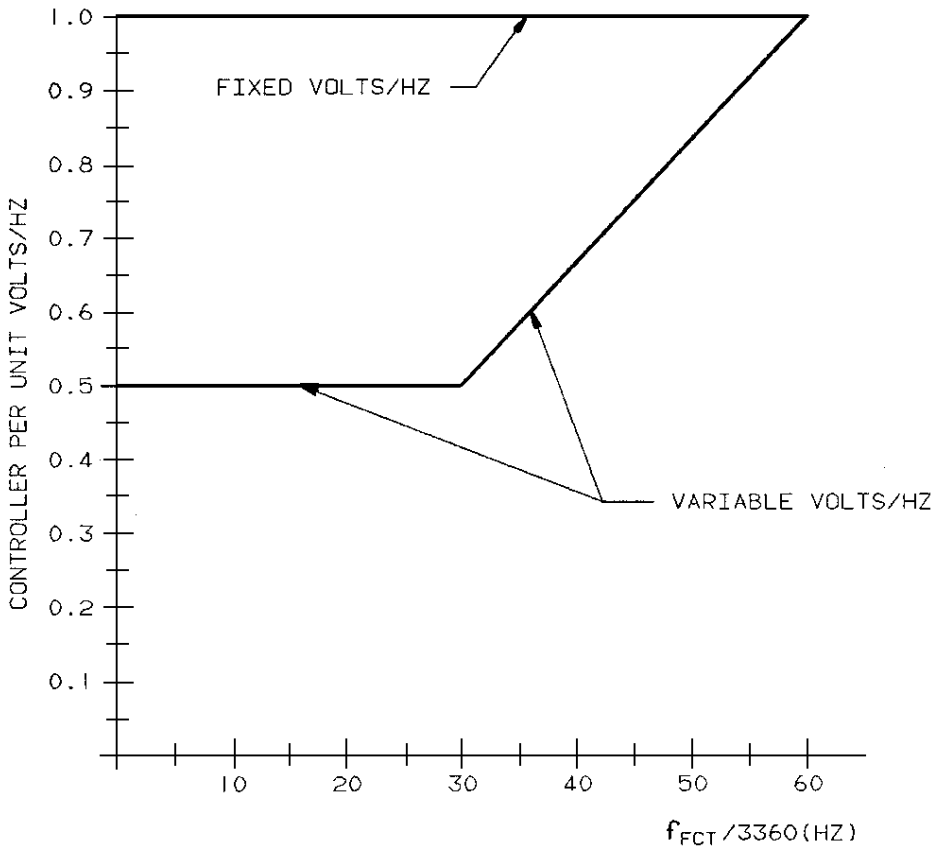
X = Closed Switch (ON)
O = Open Switch (OFF)
* = Factory Setting

FIGURE 6.4
MAIN CONTROL BOARD SNIP-OUT RESISTORS① ②

Snip-Out Resistor	Function	Condition
R164	50 Hz or 60 Hz Operation③	Installed: 60 Hz operation Removed: 50 Hz operation
R144	One or two fault lockout — all faults except UV	Installed: Drive will lockout upon one fault. Removed: Drive will stop for 7 sec. upon 1st fault and will lockout upon 2nd fault occurring 28 sec. after 1st fault.
R180 R170	Constant or variable V/Hz (see Figure 6.5)	Installed: Constant V/Hz ratio maintained permitting constant torque at reduced speed. Removed: Reduced V/Hz ratio at reduced output frequency for variable torque load.
R186	Reverse Rotation	Installed: Forward Rotation Removed: Reverse Rotation.

① Controllers are shipped with all snip-out components installed.
② If a component is to be removed, it is suggested that one lead be snipped and required operation confirmed before completely removing the component.
③ Switch SW8 on the Main Board must also be positioned per Figure 6.3 if a 50 Hz base frequency is also desired.

Figure 6.5



VOLTS/HZ VS. OUTPUT FREQUENCY (THEORETICAL)
(WITHOUT VOLTAGE BOOST)

6.1.6 POTENTIOMETER ADJUSTMENTS

The potentiometer adjustments were factory set as described in the initial start-up procedure. Certain potentiometers are not expected to ever require adjustment. These have been factory sealed.

If further adjustments are necessary, adjust potentiometers one at a time in the following order.

P1- Positive 10V (+10V) — This potentiometer allows adjustment of the +10 volts regulated power supply. Potentiometer (P1) is factory adjusted and sealed. **This potentiometer should not be adjusted in the field.**

P2- Deceleration Time (DEC) — This potentiometer controls the amount of time for the output frequency to decrease from 60 Hertz to 3 Hertz. The Deceleration Time (DEC) potentiometer operates in the same manner as the Acceleration Time (ACC) potentiometer. This potentiometer is factory set for 75 second deceleration time.

With the motor running at full speed, stop the motor and observe the length of time that it takes to decelerate to zero speed. Clockwise rotation of the Deceleration Time (DEC) potentiometer increases deceleration time.

If a high inertia load is present: Deceleration time set too fast could cause an overvoltage trip. If this occurs increase the deceleration time setting.

P3- Acceleration Time (ACC) — The potentiometer controls the amount of time for the output frequency to increase from 3 Hertz to 60 Hertz. The time is adjustable from 6 to 75 seconds. This potentiometer is factory set for 75 second acceleration time. With the motor stopped, turn the Manual Speed potentiometer to the maximum setting. Start the motor and observe the length of time that it takes to accelerate to full speed. Clockwise rotation of the Acceleration Time (ACC) potentiometer increases acceleration ramp time.

P4- Maximum Speed (MSD) — This potentiometer is used to control the controller output frequency when the Manual Speed potentiometer (controller mounted or remote mounted) is set at its maximum level (full clockwise). This potentiometer is factory set so that the output frequency will be 60 Hertz when the Manual Speed potentiometer is set full clockwise. The Maximum Speed (MSD) potentiometer has an adjustment range of 40 Hertz to 60 Hertz (33 Hertz to 50 Hertz if a 50 Hertz Base Frequency is selected per Figure 6.3 and 6.4).

The Maximum Speed (MSD) potentiometer must be adjusted if a maximum frequency other than 60 Hertz is required. Clockwise rotation increases output frequency.

P5- Hand Minimum Reference (HMR) — This potentiometer controls the minimum speed the motor will run, when the Manual Speed potentiometer (controller mounted or remote mounted) is set at minimum level (full counterclockwise). This potentiometer is factory set to produce an output frequency of 3 Hertz when the Manual Speed potentiometer is set full counterclockwise. The Hand Minimum Reference (HMR) potentiometer has an adjustable range of 3 Hertz to 54 Hertz.

CAUTION

THIS CONTROLLER DOES NOT PROVIDE OVER-TEMPERATURE PROTECTION FOR THE MOTOR AT ALL SPEEDS OR LOADING CONDITIONS. A MOTOR THERMAL SENSOR IS RECOMMENDED.

The minimum speed is set by rotating the Manual Speed potentiometer to the minimum level (full counterclockwise) and adjusting the Hand Minimum Reference (HMR) clockwise for desired minimum motor speed.

P6- GAIN (GA) — Sets the gain in the current feedback circuit to compensate for component tolerances. This potentiometer is factory adjusted and sealed. **It must not be field adjusted. The warranty is voided if the seal is broken.**

P7- Motor Current Limit (MCL) — This potentiometer limits the maximum motor running current in the range of 75-120% of the controller maximum output rated current. The Motor Current Limit (MCL) potentiometer is factory set full clockwise to allow maximum current to be delivered to the motor.

If less than 120% current limit setting is required for a particular application the potentiometer can be adjusted counterclockwise.

P8- Overload Threshold (OLD) — This potentiometer is used to set the threshold at which the overload timer will be activated. The Overload Threshold (OLD) potentiometer is factory set full clockwise which corresponds to 115% of the controller output rated current.

If the motor current exceeds 115% of the controller output rated current, an overload timer will activate and the Overload Timer (LED 3) OLT will light. Should the current remain above the setpoint for 60 seconds, the drive will trip out. If the controller is to be used with a motor whose full load current is less than the controller output rated current, an adjustment will be required.

CAUTION

THIS CONTROLLER DOES NOT PROVIDE OVER-TEMPERATURE PROTECTION FOR THE MOTOR AT ALL SPEEDS OR LOADING CONDITIONS. A MOTOR THERMAL SENSOR IS RECOMMENDED.

All main control board potentiometer adjustments should be made before attempting to adjust the Overload Threshold (OLD) potentiometer. The adjustment procedure must be followed:

Adjustment Procedure

A. Start the motor

B. Adjust the Manual Speed potentiometer for the point of maximum motor current. (This must not exceed 100% of motor nameplate current or controller rated output current)

C. Slowly turn the Overload Threshold (OLD) potentiometer counterclockwise until the Overload Timer (LED 3) OLT lights.

D. Slowly turn the Overload Threshold (OLD) potentiometer until the Overload Timer (LED 3) OLT extinguishes.

E. Turn Overload Threshold (OLD) potentiometer clockwise an additional 5 degrees.

P9- Frequency Clock Trigger (FCT) — This potentiometer is used to improve the linearity of output frequency vs input speed reference. This potentiometer is factory adjusted and sealed. **This potentiometer should not be adjusted in the field.**

P10- Voltage Boost (EB) — This potentiometer increases the Volts per Hertz (V/Hz) ratio at frequencies 20 Hertz and below. In high starting torque rapid acceleration or reduced volts/Hertz applications the V/Hz ratio must be increased at low frequencies to compensate for IR losses in the motor windings. This potentiometer is factory set for zero (0) voltage boost. If the motor accelerates normally, this potentiometer should not be adjusted.

If the motor will not accelerate normally or nuisance IOC trips are experienced during acceleration, this potentiometer must be adjusted.

Energize the controller with the motor loaded and adjust the Manual Speed potentiometer (controller mounted or remote mounted) to the maximum speed position. If the motor does not accelerate, or if nuisance tripping occurs, stop the controller and turn the voltage boost (EB) clockwise approximately 10 degrees. Repeat this procedure until the motor accelerates normally. Do not turn the potentiometer any further than necessary to accelerate the motor.

NOTE: If the VOLTAGE BOOST (EB) potentiometer is set too high, the controller will lock up in current limit and inhibit the acceleration ramp. If this condition occurs it will be necessary to reduce the setting of the Voltage Boost (EB) potentiometer until the motor will accelerate.

P11- Reference Clock Trigger (RCT) — This potentiometer determines the maximum inverter switching frequency. This potentiometer is factory adjusted and sealed. **This potentiometer should not be adjusted in the field.**

P12- Output Clock Trigger (OCT) — This potentiometer sets the interlock delay, which is the time between periods of conduction of GTO's in the same leg of the inverter. **This potentiometer should not be adjusted in the field.**

P13- Volts/Hertz (VHZ) — This potentiometer allows trimming of the volts per Hertz ratio of the controller output. The Voltz/Hertz (P13) potentiometer is factory adjusted and sealed. **This potentiometer should not be adjusted in the field.**

6.2 METER ADJUSTMENTS

Analog or digital speed indicating meters can be furnished factory installed on OMEGAPAK 1500 or 3500 controllers only or furnished in kit form for remote mounting.

6.2.1 Analog Speed Indicating Meter (MOD A14) (Kit Class 8804, Type AM-1) (Scale 0-100%)

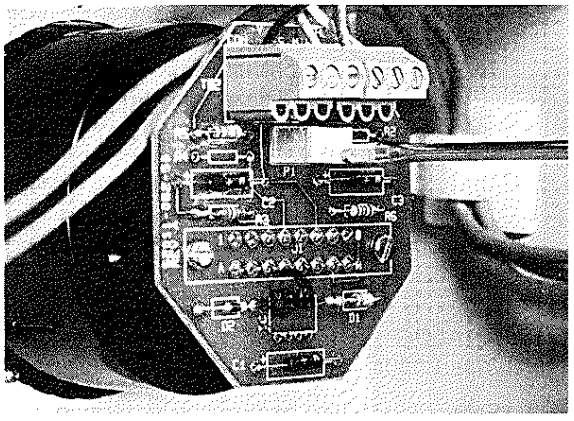
— A factory installed analog speed indicating meter is set to indicate 100% (full scale) at 60 Hertz output frequency. If the controller is to operate over the range of 0-60 Hertz no field adjustment will be necessary. A meter reading of 100% corresponds to 100% of motor rated speed.

6.2.2 Digital Speed Indicating Meter (MOD D14) (Kit Class 8804, Type DM-1) (Scale 0-199.9 or 0-1999)

— A factory installed digital speed indicating meter is factory set to indicate 100.0 at 60 Hertz output frequency. This corresponds to 100% of motor rated speed. If the controller is to operate over the range of 0-60 Hertz and percent of motor rated speed is the desired indication, no adjustment is necessary.

FIGURE 6.10

PRINTED WIRING BOARD FOR DIGITAL INDICATING METER



CONVERSION TO FREQUENCY READOUT — To change calibration of the speed meter to indicating **approximate** output frequency it is only necessary to adjust the Calibration Potentiometer (P1) on the rear of the meter. With the controller operating at maximum speed as factory set (60 Hertz output), adjust the meter calibration potentiometer to produce a meter reading of 60.0.

If the controller maximum speed has been changed from the factory set maximum speed, the meter can be calibrated using a dc voltmeter. Measure the voltage between terminals MTR (+) and COM (−) on the Printed Wiring Board (see Figure 6.10) and adjust the controller Manual Speed Adjust potentiometer until the voltmeter reads exactly 2.5vdc. This voltage corresponds to 60 Hertz output. Adjust the Meter Calibration potentiometer to read 60.0

NOTE: The meter provides only a relative indication of output frequency.

CONVERSION TO RPM READOUT — The digital speed meter is capable of displaying RPM over the range of 0-1999 RPM. To convert the meter to RPM readout it is

necessary to clip out resistor R6 located on the Printed Wiring Board on the rear of the meter (see Figure 6.10). This disables the decimal point. The controller should then be operated at 60 Hertz and the motor speed measured with a tachometer. The Meter Calibration potentiometer located on the rear of the meter should be adjusted until the meter indication corresponds to the tachometer reading.

Alternate method — Measure the voltage between terminal MTR (+) and COM (−) on the Speed Indicating Meter Printed Wiring Board. Adjust the controller speed to produce a voltmeter reading of 2.5vdc. This corresponds to a controller operating frequency of 60 Hertz. Adjust the Meter Calibration potentiometer until the meter reads the motor rated speed as shown on the motor nameplate.

6.2.3 **ANALOG VOLTMETER** (MOD V15) (Kit Class 8804 Type AM-2) (Scale 0-125%)

Factory installed analog voltmeters are set to read 100% with 460 volts output from the controller. This meter operates from a 0-5 vdc signal from the controller. Meter output signals correspond to controller output voltages as follows:

4 vdc = 460V
2 vdc = 230V
1.74 vdc = 200V

If the controller is to be used on 230V or 200V systems, it will be necessary to recalibrate the meter. The meter can be calibrated by the following procedure:

1. Connect a D.C. Voltmeter between terminals TB1-26 (+) and TB1-31 (−) on the Main Control Board. Energize the controller and increase the output frequency until a reading of 4.0 vdc is obtained for 460V operation, 2.0 vdc is obtained for 230V operation or 1.74 vdc is obtained for 200V operation. This indicates the controller is operating at rated output voltage.
2. Adjust the potentiometer on the meter's printed wiring board, for 100% voltage output indication.
3. Remove the D.C. Voltmeter from the Main Control Board. The Voltmeter is now calibrated and should read all intermediate voltages accurately.

Note: Due to the complex output waveform from the controller, attempts to measure the controller output terminal voltage will produce erroneous readings and is therefore not recommended.

6.2.4 **DIGITAL VOLTMETER** (MOD F15) (Kit Class 8804 Type DM-1) (Scale 0-100.0%)

Follow the procedure for adjusting the analog voltmeter described in Section 6.2.3.

6.2.5 **ANALOG AMMETER** (MOD A15) (Kit Class 8804 Type AM-3) Scale 0-150%)

Factory installed analog ammeters are set to read 100% when the controller delivers rated output current as stamped on the controller nameplate. This meter operates from a 0-5 vdc signal from the controller (5 vdc = 150%) of rated output current. The meter can be calibrated by the following procedure:

1. Connect a D.C. Voltmeter between terminals TB1-30 (+) and TB1-31 (−) on the Main Control Board. Energize the controller, with a connected motor load, and increase the controller frequency until a reading of at least 1.0 vdc is obtained.
2. Calculate the percent controller rated output current using the following formula.

   Percent rated current = 30 x Measured voltage in Step 1.
3. Adjust the potentiometer on the meter's printed wiring board, for the percent rated current output indication as calculated in Step 2.
4. Remove the D.C. Voltmeter from the Main Control Board. The Ammeter is now calibrated and should read all the intermediate currents accurately.

6.2.6 **DIGITAL AMMETER** (MOD G15) (Kit Class 8804 Type DM-1) Scale 0-150.0%.

Follow the procedure for adjusting the analog ammeter described in Section 6.2.5.

7.0 DIAGNOSTIC AND STATUS INDICATING LIGHTS

There are nineteen (19) diagnostic and status indicating, Light Emitting Diodes (LED's) & one Neon light in a basic controller. The LED's and Neon light are located on the following printed wiring boards:

Basic Controller:

- Main Control Board — Thirteen (13) LED's
- Gate Driver Board — One (1) LED on each board (there are a total of six (6) gate driver boards).
- Power Interface board — One (1) Neon Light

These LED's provide a visual indication of protective functions and circuit status. When diagnosing a controller operational problem the prospective LED will illuminate to indicate what protective function was activated. There are some LED's lighted when power is applied to the controller. The function of each indicator is described in the following 7.1 through 7.4 paragraphs. (Refer to Section 8.0, LED Placement chart, Main Control Board for location of LED's and Section 4.0, Controller Photo, for location of Neon Light.)

7.1 MAIN CONTROL BOARD LED'S

PWR (LED 1) Power - Indicates when power is available for the control ciruits. Should be illuminated whenever there is power applied to the controller.

MCL (LED 2) Motor Current Limit - Will illuminate whenever the current to the motor is at the level determined by the Motor Current Limit Adjustment Potentiometer (P7).

OLT (LED 3) The Overload Timer - Illuminates whenever the controller output current exceeds the level determined by potentiometer P5 (overload adjust). If this level is exceeded for 1 minute the controller faults on Overload (OLD) and the Overload (LED 4) OLD (IL8) will light. It is important to recognize that the overload timing circuitry has an electronic memory characteristic much as a thermal overload unit possesses a thermal memory. The memory characteristic functions such that it requires approximately the same amount of time for the timer to reset as was required to accumulate that amount of time. For example, after faulting on OLD approximately 1 minute is required to reset the timer. If the Main Control Board fault reset button was depressed 10 seconds after faulting on OLD and the controller was started with an overload condition present (LED 3 illuminated) it would be only 10 seconds before the controller faulted on OLD (as opposed to 60 seconds initially). Along the same lines the (LED 3) OLT does not have to be activated continuously for 60 seconds, but rather, must only average on for 60 seconds. The above comments relating to the electronic memory characteristic are valid only if power to the controller is not removed and reapplied. The removal of power from the controller results in the immediate reset of the OLT.

OLD (LED 4) Overload - Will illuminate when the controller output current has exceeded the current setting of the Overload Threshold Potentiometer (P8) for one minute. To extinguish this LED will require the controller to be reset.

OT (LED 5) Overtemperature - and precharge contactor failure. Will illuminate if the controller is subject to excessive ambient temperature or upon loss of cooling air. Will also illuminate if the precharge contactor fails to pick up when power is applied to the controller. To extinguish this LED will require the controller to be reset.

ST (LED 6) Shoot Through - Will illuminate when the dc bus voltage falls below 100v or 50v, the level being determined by the system voltage selection switch (SW6). To extinguish this LED will require the controller to be reset.

OV (LED 7) Overvoltage - Will illuminate whenever the bus voltage exceeds 900vdc or 450vdc, the level is determined by the System Voltage Selection switch (SW6). To extinguish this LED will require the controller to be reset.

GF (LED 8) Ground Fault - Will illuminate when there is current flowing from the controller output to ground. When ground current is detected, trip out will be instantaneous. To extinguish this LED will require the controller to be reset.

IOC (LED9) Instantaneous Overcurrent - Will illuminate when there is 135% of the controller peak maximum output rated current sensed by the output current transformers. To extinguish this LED will require the controller to be reset.

UV (LED10) Undervoltage - Will illuminate whenever line voltage to the controller is less than 87.5% of the rated voltage. This LED will extinguish when line voltage is 95% of the rated voltage.

BUV (LED11) Bus Undervoltage - Will illuminate whenever the bus voltage is less than 400vdc or 200vdc, the level is determined by the system voltage selection switch (SW6).

DE (LED12) Drive Enable - Will illuminate whenever the drive is running.

PUD (LED13) Power Up Delay - Illuminates nominally for 1.5 seconds when power is initially applied to the controller. If the following conditions occur, the LED will also be illuminated:

1. An undervoltage conditon
2. A closed circuit between TB1-33 and TB1-22 (Fault reset closed) see Section 11.0, Drawing 11.7.3.
3. An open circuit between TB1-3 and TB1-22 (Fault Reset Open). This circuit will be used with Isolation-Bypass. See Section 11.0, Drawing 11.7.3.

7.2 GATE DRIVER BOARD LED

IL1- This LED will not illuminate until the controller is operating. During controller operation the LED will illuminate continuously.

7.3 POWER INTERFACE BOARD NEON

IL1- This Neon indicates presence of dc bus voltage at the inverter. This Neon should be illuminated anytime power is applied to the controller. The Neon will remain illuminated after power is removed from the controller until the voltage across the dc bus is less than 100vdc.

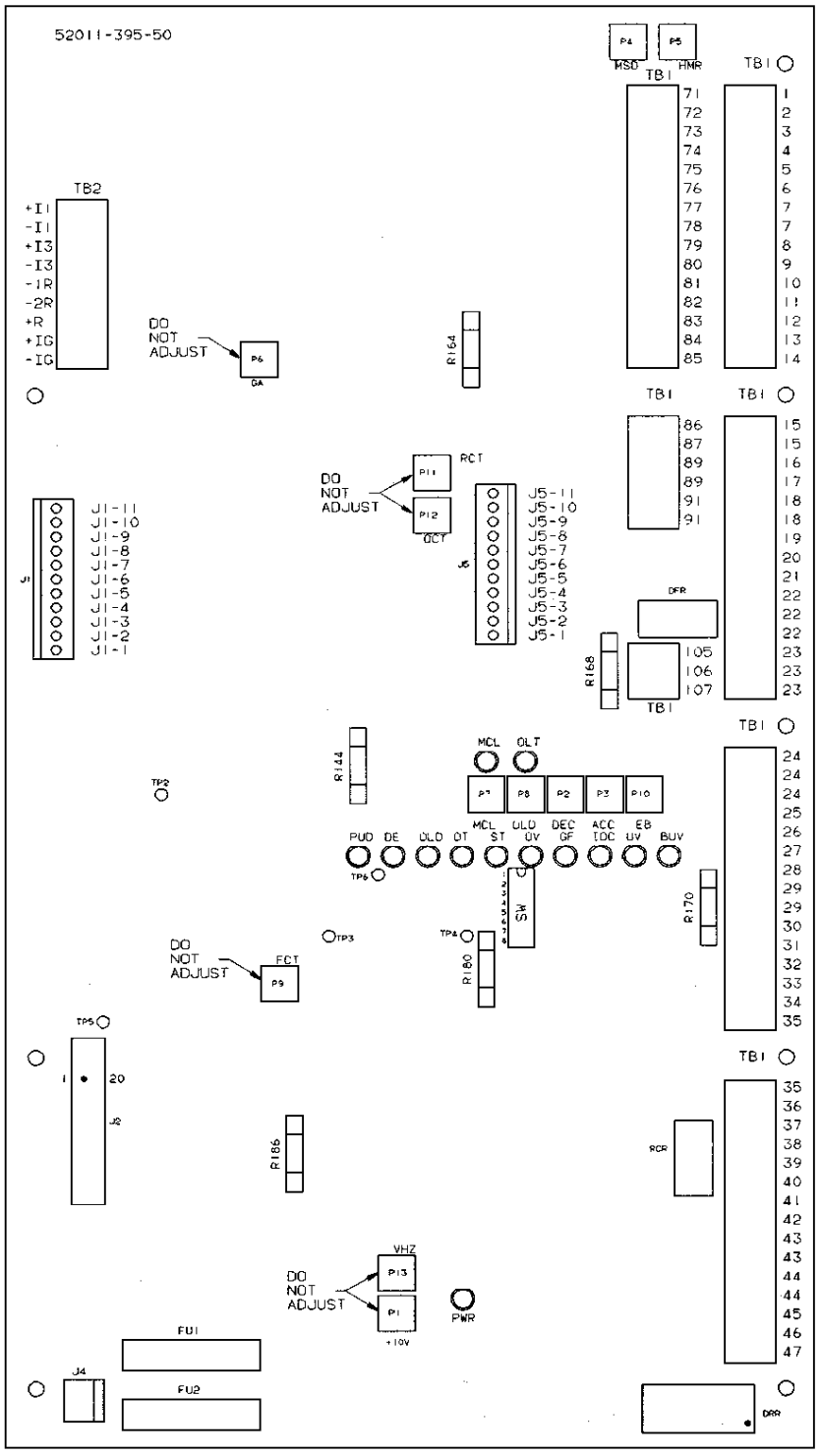
7.4 STAND-BY MODE LAMP STATUS

There are a large variety of possible lamp indications while the controller is operating, however it is possible to predict the condition of most of the lamps while in a stand-by condition. Standby is defined as "Power applied with the drive stopped". The following tabulation contains the lamp conditions for the stand-by mode.

Lamps Main Control Board	On	Off	Indeterminate	Comments
PWR	X			
UV		X		May flicker momentarily when power is applied
OV		X		
ST		X		
GF		X		
IOC		X		
OLD		X		
OT		X		
OLT		X		
PUD		X		illuminates for approximately 1.5 sec when power is applied and then extinguishes
BUV		X		
MCL		X		
DE		X		
Gate Driver Board				
IL1		X		6 of these/1 for each gate driver
Power Interface Board Neon	X			

8.0 POTENTIOMETER, SELECTION SWITCH, LED & SNIP-OUT COMPONENT PLACEMENT CHART

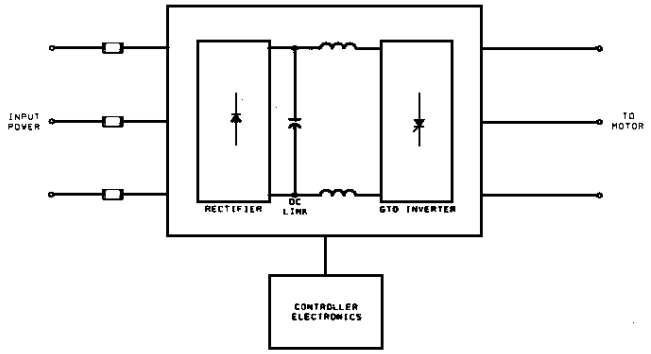
8.1 MAIN CONTROL BOARD



9.0 CONTROLLER OPERATION

9.1 BLOCK DIAGRAM DESCRIPTION

FIGURE 9.1
OMEGAPAK CONTROLLER
BLOCK DIAGRAM



RECTIFIER

The rectifier section consists of six power diodes arranged in a three phase, full wave bridge configuration. Its purpose is to change fixed voltage, fixed frequency ac voltage to dc voltage.

DC LINK

The dc link couples the rectifier output to the Inverter input. The dc link includes capacitors to smooth the voltage present on the rectifier output plus inductors to limit the rate of change of current during output short circuit conditions.

INVERTER

The inverter section consists of six Gate Turn-Off (GTO) Thyristors which, under control of the OMEGAPAK controller electronics, reconstruct a three phase ac waveform for application to a standard three phase ac motor. A Sine Coded Pulse Width Modulation (PWM) switching technique is used.

Section 11, drawing 11.1.1 details the controller power circuit.

CONTROLLER ELECTRONICS

Electronic circuitry located on a main control board generates all signals necessary to control the turn-on and turn-off of the Inverter GTOs for controlling the output frequency and voltage. The electronics also contains circuitry to protect the controller against various fault conditions and Light Emitting Diodes (LEDs) to indicate controller status. Refer to Section 11, Drawing 11.7.3 for a block diagram of the controller electronics.

9.2 CONTROL CIRCUIT SEQUENCE

The flexibility of available pilot devices to control the OMEGAPAK controller makes possible a wide range of control circuit sequences. The descriptions of operation have been limited to those which are most commonly used.

9.2.1 Pilot Lights, Elapsed Time Meter and Heat Sink Fan(s)

For pilot lights, elapsed time meter and heat sink fan control circuit sequence, refer to Section 11.0, diagram 11.2.6 and the description below.

MOD P16

The Power On light (if used) will illuminate when power is applied to the controller.

MOD R16

The Run light (if used) will illuminate when the Drive Run Relay (DRR) N.O. contact closes. This same relay contact will also energize the heat sink fan relay.

MOD F16

The Drive Fail light (if used) will illuminate when the Drive Fail Relay (DFR) N.C. contact closes. This light is normally not lighted until a controller protective circuit has caused an abnormal shutdown, dropping out the drive fail relay (DFR).

MOD T15

The Elapsed Time Meter (if used) will be energized when the Drive Run Relay (DRR) N.O. contact closes.

9.2.2 Start-Stop Push Buttons and Manual Speed Potentiometer (MOD S10) (Class 9001, Type CA-31 Assembled Control Station)

For operation of the control circuit sequence, refer to Section 11.0, diagram 11.2.2 and the description following:

Power Up Delay

When power is first applied to the controller, the power up delay circuit will transmit a 1.5-second signal that is applied to fault latch circuits to ensure reset of the latches when the drive is energized. In addition, this Power Up Delay or Reset signal is OR-ed with fault signals and applied to the Run Command Relay and

Drive Run Relay Circuits to prevent energizing of these relays until power up is complete. During operation, if an AC Undervoltage condition occurs, there will also be a power up reset signal when voltage recovers. Two external Reset buttons can produce the same effect as the Power Up Delay. Fault reset open produces a reset by opening connection between TB1-3 and TB1-22. Fault reset closed produces a reset by shorting TB1-33 to TB1-22.

Starting Sequence

A. Pressing the Start push button will energize the Run Command Relay (RCR) and the Drive Run Relay (DRR). This will cause the RCR N.O. Contact between terminals 40 and 34 to close to seal around the Start push button. At the same time, the Drive Enable (DE) LED will light.

B. The controller should now be operating with the output frequency controlled by the manual speed potentiometer.

Normal Stopping Sequence

A. Pressing the Stop push button deenergizes the RCR causing the electronics to drop out of the Run Mode and the RCR N.O. Contact between terminals 40 and 34 to open breaking the seal around the Start push button.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. The controller is now stopped.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR and DFR relays deenergized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop. The Drive Fail Light (if used) will illuminate.

9.2.3 Hand-Automatic Selector Switch, Start-Stop Push Buttons and Manual Speed Potentiometer (Mod. No. A10) (Class 9001, Type CA-42 Assembled Control Station)

For operation of the control circuit sequence, refer to Section 11.0, diagram 11.2.3 and the description below:

Hand Mode

A. Placing the Hand-Auto (H-A) Selector Switch in the Hand position causes the following:

1) Opens the circuit between terminals 91 and 34 disabling the automatic start contacts.

2) Closes the circuit between terminal 89 and the Stop push button enabling the Start-Stop push buttons.

3) Opens the circuit between terminal 22 (−V unreg.) and terminal 78 (Hand/Auto) reference select to switch control of the output frequency to the manual speed potentiometer.

Power Up Delay

When power is first applied to the controller, the power up delay circuit will transmit a 1.5-second signal that is applied to fault latch circuits to ensure reset of the latches when the drive is energized. In addition, this Power Up Delay or Reset signal is OR-ed with fault signals and applied to the Run Command Relay and Drive Run Relay Circuits prevent energizing of these relays until power up is complete. During operation, if an AC Undervoltage condition occurs, there will also be a power up reset signal when voltage recovers. Two external Reset buttons can produce the same effect as the Power Up Delay. Fault reset open produces a reset by opening connection between TB1-3 and TB1-22. Fault reset closed produces a reset by shorting TB1-33 to TB1-22.

Starting Sequence

A. Pressing the Start push button will energize the Run Command Relay (RCR) and the Drive Run Relay (DRR). This will cause the RCR N.O. Contact between terminals 40 and 34 to close to seal

around the Start push button. At the same time, the Drive Enable (DE) LED will light.

B. The controller should now be operating with the output frequency controlled by the manual speed potentiometer.

Normal Stopping Sequence

A. Pressing the Stop push button deenergizes the RCR causing the electronics to drop out of the Run Mode and the RCR N.O. Contact between terminals 40 and 34 to open breaking the seal around the Start push button.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. The controller is now stopped.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR, and DFR relays deenergized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop. The drive fail light (if used) will illuminate.

Auto Mode

A. Placing the Hand-Auto (H-A) selector switch in the Auto position causes the following:

1) Opens the circuit between terminal 89 and the Stop push button disabling the Start-Stop push buttons.

2) Closes the circuit between terminals 91 and 34 enabling the automatic start contact.

3) Closes the circuit between terminal 22 (−V unreg.) and terminal 78 (Hand/Auto) reference select to switch control of the output frequency to an analog input follower signal.

Start Sequence

A. Closing the user supplied contact between terminals 44 and 89 energizes the Run Command Relay (RCR) and the Drive Run Relay (DRR). The Drive Enable (DE) LED will light.

Energizing the RCR causes the following:

1) The RCR N.O. contact between terminals 40 and 34 closes but has no effect since power to the Stop push button has been disabled.

B. The controller should now be operating with the output frequency controlled by the analog input follower signal.

Normal Stopping Sequence

A. Opening the automatic start contact deenergizes the RCR causing the electronics to drop out of the run mode and the RCR N.O. contact between terminals 40 and 34 opens, however, this contact has no effect in the auto mode.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. The controller is now stopped.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR, and DFR relays de-energized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop.

C. A DFR N.C. contact will close illuminating the Drive Fail pilot light (if used). Refer to Section 11.0 diagram 11.2.1.

9.2.4 Hand-Off-Automatic selector switch, and Manual Speed potentiometer (Mod. No. H10)

For operation of the control circuit sequence, refer to Section 11.0, diagram 11.2.4 and the description below:

Power Up Delay

When power is first applied to the controller, the power up delay circuit will transmit a 1.5-second signal that is applied to fault latch circuits to ensure reset of the latches when the drive is energized. In addition, this Power Up Delay or Reset signal is OR-ed with fault signals and applied to the Run Command Relay and Drive Run Relay circuits to prevent energizing of these relays until power up is complete. During operation, if an AC Undervoltage condition occurs, there will also be a power up reset signal when voltage recovers. Two external Reset buttons can produce the same effect as the Power Up Delay. Fault Reset Open produces a Reset by opening connection between TB1-3 and TB1-22. Fault Reset Closed produces a reset by shorting TB1-33 to TB1-22.

Hand Mode

A. Placing the Hand-Off-Auto (H-O-A) selector switch in the Off position disables controller operation.

B. Placing the Hand-Off-Auto (H-O-A) selector switch in the Hand position causes the following:

   1) The H-O-A contact between terminals 91 and 34 opens disabling the Automatic Start contact.

   2) The H-O-A contact between terminals 22 (– V unreg.) and 78 (Hand-Auto) opens causing the output frequency to respond to the manual speed potentiometer.

   3) The H-O-A contact between terminals 89 and 34 closes, energizing the Run Command Relay (RCR) coil and the Drive Run Relay (DRR) coil. The Drive Enable (DE) LED will light.

C. Energizing RCR causes the RCR N.O. contact between terminals 40 and 34 to close but has no effect.

D. The controller should now be operating with the output frequency controlled by the manual speed potentiometer.

Normal Stopping Sequence

A. Moving the H-O-A selector switch to the Off position deenergizes the RCR causing the RCR N.O. contact between terminals 40 and 34 to open, however, this contact has no effect in the hand mode.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. The controller is now stopped.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR, and DFR relays deenergized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop.

C. A DFR N.C. contact will close illuminating the Drive Fail pilot light (if used). Refer to Section 11.0 diagram 11.2.1.

Auto Mode

A. Placing the Hand-Off-Auto (H-O-A) selector switch in the Auto mode causes the following:

   1) The H-O-A contact between terminals 91 and 34 closes to enable the controller to start when the automatic start contact closes.

   2) The H-O-A contact between terminals 89 and 34 opens preventing the controller from being manually started.

   3) The H-O-A contact between terminals 22(– V unreg.) and 78 (Hand-Auto) closes causing the output frequency to respond to an analog input follower signal.

B. Closing the automatic start contact energizes the Run Command Relay (RCR) and the Drive Run Relay (DRR). The Drive Enable (DE) LED will light. Energizing the RCR causes the RCR N.O. contact between terminals 40 and 34 to close but has no effect.

C. The controller should now be operating with the output frequency controlled by the analog input follower signal.

Normal Stopping Sequence

A. Opening the automatic start contact or moving the H-O-A switch to the OFF position deenergizes the RCR removing the start-stop signal at TB1-42. The RCR N.O. contact between terminals 40 and 34 opens, however, this contact has no effect.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. The controller is now stopped.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR, and DFR relays deenergized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop.

C. A DFR N.C. contact will close illuminating the Drive Fail pilot light (if used). Refer to Section 11.0 diagram 11.2.1.

9.2.5 OMEGAPAK 3500 controller with optional Isolation Contactor (Mod C13) or optional Isolation/Bypass Contactor (Mod B13 or Mod D13) and Hand-Off-Auto Selector Switch and Manual Speed Pctentiometer (Mod H10).

For operation of the control circuit sequence, refer to Section 11.0 diagram 11.2.4 and the description below.

Operation With Isolation Contactor

(Diagram 11.2.4) Note: AFC-Off-Line switch is not used and a jumper is installed between terminals 22 and 3.

Power Up Delay

When power is first applied to the controller, the power up delay circuit will transmit a 1.5-second signal that is applied to fault latch circuits to ensure reset of the latches when the drive is energized. In addition, this Power Up Delay or Reset signal is OR-ed with fault signals and applied to the Run Command Relay and Drive Run Relay circuits to prevent energizing of these relays until power up is complete. During operation, if an AC Undervoltage condition occurs, there will also be a power up reset signal when voltage recovers. Two external Reset buttons can produce the same effect as the Power Up Delay. Fault Reset Open produces a Reset by opening connection between TB1-3 and TB1-22. Fault Reset Closed produces a reset by shorting TB1-33 to TB1-22.

Hand Mode

A. Placing the Hand-Off-Auto (H-O-A) selector switch in the Hand position causes the following:

1) The H-O-A contact between terminal 91 and 34 opens disabling the Automatic Start contact.

2) The H-O-A contact between terminals 22 (–V unreg.) and 78 (Hand-Auto) opens causing the output frequency to respond to the manual speed potentiometer.

3) The H-O-A contact between terminals 89 and 34 closes, energizing the Run Command Relay (RCR) coil and the Drive Run Relay (DRR) coil. The Drive Enable (DE) LED will light.

B. Energizing RCR causes the following:

1) The RCR N.O. contact between terminals 37 and 39 closes to energize the Isolation Contactor (IC) (refer to diagram 11.3.5).

2) The RCR N.O. contact between terminals 40 and 34 closes however, this contact has no effect.

C. Energizing the Isolation Contactor (IC) shown on 11.3.12 causes the following:

1) The IC N.O. contact between terminal 41 and 42 closes completing the start circuit.

2) The IC N.C. contact between terminals 41 and 86 opens however, this contact has no effect.

D. The controller should now be operating with the output frequency controlled by the Manual Speed Potentiometer.

Normal Stopping Sequence

A. Moving the H-O-A selector switch to the OFF position deenergizes the RCR causing the electronics to drop out of the run mode and the following:

1) The RCR N.O. contact between terminals 40 and 34 opens, however, this contact has no effect.

2) The RCR N.O. contact between terminal 37 and 39 opens but the Isolation Contactor does not drop out because the DRR N.O. contact between terminals 45 and 46 remains closed. Refer to Section 11.0, Diagram 11.2.4.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. Dropping out DRR also causes IC to be deenergized.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR and DFR relays deenergized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop.

C. A DFR N.C. contact will close illuminating the Drive Fail pilot light (if used). Refer to Section 11.0 diagram 11.2.1.

Auto Mode

A. Placing the Hand-Off-Auto (H-O-A) selector switch in the Auto mode causes the following:

1) The H-O-A contact between terminals 91 and 34 closes to enable the controller to start when the automatic start contact closes.

2) The H-O-A contact between terminals 89 and 34 opens preventing the controller from being manually started.

3) The H-O-A contact between terminals 22 (−V unreg.) and 78 (Hand/Auto) closes causing the output frequency to respond to an analog input follower signal.

B. Closing the automatic start contact energizes the Run Command Relay (RCR) and the Drive Run Relay (DRR). The Drive Enable (DE) LED will light.

C. Energizing RCR causes the following:

1) The RCR N.O. contact between terminals 40 and 34 closes, however, this contact has no effect.

2) The RCR N.O. contact between terminals 37 and 39 closes to energize the Isolation Contactor (IC). See Section 11.0, diagram 11.2.4.

D. Energizing the Isolation Contactor (IC) shown on Diagram 11.3.5 causes the following:

1) The IC N.O. contact between terminal 41 and 42 closes completing the start circuit.

2) The IC N.C. contact between terminals 41 and 86 opens, however, this contact has no effect.

E. The controller should now be operating with the output frequency controlled by the analog input signal.

Normal Stopping Sequence

A. Opening the automatic start contact deenergizes the RCR causing the electronics to drop out of the Run Mode and the following:

1) The RCR N.O. contact between terminals 40 and 34 opens, however, this contact has no effect in the auto mode.

2) The RCR N.O. contact between terminal 37 and 39 opens but the Isolation Contactor does not drop out because the DRR N.O. contact between terminals 45 and 46 remains closed. Refer to Section 11.0, Diagram 11.2.4.

B. With SW2 closed (See Figure 6.3), the motor will decelerate to a stop and DRR will drop out when the output frequency has reached minimum. With SW2 open, the motor will coast to a stop and DRR will drop out immediately after the controller is told to stop.

C. Dropping out DRR also causes IC to be deenergized.

Abnormal Stopping Sequence

A. Operation of a protective circuit will cause immediate controller shutdown upon occurrence of a fault condition. The electronic circuitry will keep the RCR, DRR, and DFR relays deenergized until the controller is reset.

B. The controller will stop immediately and the motor will coast to a stop.

C. An additional DFR N.C. contact will close illuminating the Drive Fail pilot light (if used). Refer to Section 11.0 diagram 11.2.1.

Operation With Isolation/Bypass Contactors

(Diagrams 11.2.4 and 11.3.6). Note: AFC-Off-Line switch used — jumper between terminals 22 and 3 removed.

AFC (Adjustable Frequency Controller) Mode

A. Placing the AFC-Off-Line selector switch in the AFC position causes the following:

1) The AFC-Off-Line contact between terminals 22 (– V unreg.) and 3 (Fault Reset Open) closes resetting the controller and permitting normal operation.

2) The AFC-Off-Line contact on diagram 11.3.6 opens preventing the Bypass contactor from being energized.

B. The controller operation is now as described for the Isolation Contactor.

Bypass Mode

A. Placing the AFC-Off-Line selector switch in the Line position causes the following:

1) The AFC-Off-Line contact between terminals 22 (– V unreg.) and 3 (Fault Reset Open) opens to place the controller in the stop (Reset) mode.

2) The AFC-Off-Line contact on diagram 11.3.6 closes to energize the Bypass Contactor (BC).

B. The motor line starts and is now operating at constant speed from ac line voltage and frequency and will continue to operate independent of the adjustable frequency controller.

10.0 TROUBLESHOOTING & MAINTENANCE GUIDE

CONTENTS

***Designates Troubleshooting Flow Charts — located at end of Section 10.**

10.0.1 MAINTENANCE

During normal use, the drive controller will require minimum maintenance. However, good maintenance practice requires periodic inspection of the controller. The maintenance periods should be scheduled based on the particular operating environment of the controller, but should not exceed one year.

CAUTION

ONLY AUTHORIZED SERVICE PERSONNEL FAMILIAR WITH THIS EQUIPMENT SHOULD BE ALLOWED TO SERVICE THE CONTROLLER.

General maintenance procedures for Square D control gear are covered in Square D publication 30072-200-50. Procedures specific to this controller are as follows.

1. Standby lamp status should be verified per Section 7.4.
2. Drive controller operation should be observed. Any deviations from normal operation may be an indication of a controller malfunction. A thorough investigation should be made to determine the cause.
3. Check operation of any push-to-test pilot lamps.
4. **Remove all power**

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT 5 MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THAT THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

5. Tilt-out the power semiconductor assembly following the procedure found in this Section.
6. Inspect and clean all air passageways in controller using a vacuum cleaner. *Do not* use a compressed air source.
7. Inspect and clean all insulation systems within the controller using a vacuum cleaner. *Do not* use a compressed air source. *Do not "megger" controller!*
8. Check integrity of all mechanical fasteners.
9. Check integrity of all electrical fasteners and joints.
10. Check controller grounding means.
11. Check capacitor bank for damaged or bulging cans. Replace as required.
12. Inspect all electrical components for damage.
13. Reclose power semiconductor assembly following the procedure found in this Section.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

DO NOT ENERGIZE OR ATTEMPT TO OPERATE THE CONTROLLER WITH THE SEMICONDUCTOR ASSEMBLY IN THE SERVICE POSITION. ALL HEATSINK ASSEMBLIES ARE ELECTRICALLY HOT WHEN THE CONTROLLER IS ENERGIZED AND WHILE THE DC BUS CAPACITORS ARE CHARGED.

During normal maintenance or in the event that troubleshooting indicates possible power semiconductor failure (inverter GTO's or rectifier diodes) the power semiconductor assembly can be tilted out into the service position as shown in Section 4, Figure 4.9. The following procedure *must* be followed to safely accomplish this task.

1. Remove all power

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT 5 MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THAT THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

2. Verify that the controller is securely attached to its mounting surface.
3. Remove the metal plate at the top right portion of the power semiconductor assembly. Refer to Section 4, Figure 4.4 for the location of the plate.
4. Disconnect motor leads from the controller terminals.
5. Grasp the handle near the top of the power semiconductor assembly and carefully pull. The semiconductor assembly is hinged at the bottom and will tilt out approximately 90 degrees. A retaining cable will hold the assembly in the service position.
6. Lower the semiconductor assembly into the service position and insure that the retaining cable is securely attached.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

DO NOT ENERGIZE OR ATTEMPT TO OPERATE THE CONTROLLER WITH THE SEMICONDUCTOR ASSEMBLY IN THE SERVICE POSITION. ALL HEATSINK ASSEMBLIES ARE ELECTRICALLY HOT WHEN THE CONTROLLER IS ENERGIZED AND WHILE THE DC BUS CAPACITORS ARE CHARGED.

7. Reverse the above procedure to return the controller to operating condition. Observe the retaining cable during the closing process to insure that it does not snag on any components or interfere with complete closing of the power semiconductor assembly.

CAUTION
CONSULT YOUR LOCAL SQUARE D REPRESENTATIVE BEFORE ATTEMPTING ANY MAINTENANCE ON THE POWER SEMICONDUCTOR ASSEMBLY.

10.0.2 TROUBLESHOOTING, GENERAL

A number of diagnostic and status indicating lights (refer to Section 7.0, Diagnostic Indicating LED's and Neon Light) have been included on the Main Control Board, Power Interface Board, and Gate driver Boards. The intent of these lights is to provide visual indication of a number of controller operating and protective circuit functions to assist in maintenance and troubleshooting.

The following troubleshooting guide can best be utilized by observing the status of the lights and reviewing the symptoms listed to determine which possible problems could cause the observed light pattern. To view the lights, the controller door must be open with power applied to the controller. If the controller trips while operating, the lights must be viewed before power is removed because removing and re-applying power resets the fault indicators.

CAUTION
ONLY AUTHORIZED SERVICE PERSONNEL FAMILIAR WITH THIS EQUIPMENT SHOULD BE ALLOWED TO SERVICE THE CONTROLLER.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

MANY PARTS INCLUDING ELECTRONIC PRINTED WIRE BOARDS IN THIS CONTROLLER OPERATE AT LINE VOLTAGE. DO NOT TOUCH. USE ONLY ELECTRICALLY INSULATED TOOLS WHILE MAKING ADJUSTMENTS.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

CERTAIN ADJUSTMENTS AND TEST PROCEDURES REQUIRE THAT POWER BE APPLIED TO THIS CONTROLLER. WHEN WORKING WITH ENERGIZED EQUIPMENT, EXTREME CAUTION MUST BE EXERCISED AS HAZARDOUS VOLTAGES EXIST. THE ENCLOSURE DOOR MUST BE CLOSED AND SECURED WHILE TURNING ON POWER, OR STARTING AND STOPPING THIS CONTROLLER.

When used in conjunction with the diagnostic and status indicating lights this guide facilitates troubleshooting to the individual printed wiring board level.

The troubleshooting procedure is organized into 4 basic units. The first unit (10.1) covers general problems which are identified by a basic description (e.g. — "Controller will not start"). The second section (10.2) consists of specific faults annunciated by LED illuminations (e.g. — "Instantaneous Overcurrent (LED 9)"). The third section (10.3) attempts to include those items not covered in 1 or 2 such as LED illuminations which contain useful problem-solving information but are not fault indicators. The fourth and last section (10.4) is comprised of troubleshooting techniques which support the first 3 sections.

If troubleshooting indicates the necessity of component replacement, observe all precautions.

DANGER
HAZARD OF ELECTRICAL SHOCK OR BURN

BEFORE SERVICING, TURN OFF POWER SUPPLY(S) TO THIS EQUIPMENT. WAIT 5 MINUTES. MEASURE CAPACITOR VOLTAGES TO VERIFY THAT THEY ARE ZERO. DO *NOT* SHORT ACROSS CAPACITORS WITH VOLTAGE PRESENT.

When contacting Square D for troubleshooting assistance or requesting service, it is necessary to have the information requested on the controller trouble sheet available. If the controller is to be returned to Square D, a completed copy of the sheet must be inserted in the controller before packing for shipment. Several copies of the controller trouble sheet are provided at the end of the troubleshooting section.

10.1.4 EXCESSIVE MOTOR TEMPERATURE

Motor Overheating can result from the following items:

1. Motor incorrectly sized for load. Measure motor current and compare to nameplate rating.
2. Since most motors are cooled by internal shaft-mounted fans, the motor rated current capacity will decrease with speed due to decreased fan speed. If substantial motor torque is required at low speed, motor overtemperature may occur. The motor manufacturer should be consulted to determine the correct motor selection for such applications.
3. Verify that voltage output is correct per 10.4.2.

NOTE: With the advent of modern insulation materials, many motors are capable of operating at relatively high winding temperatures. Therefore, motors which seem hot-to-the-touch may be operating well within their temperature limits. The motor nameplate should be consulted as to the class of the motor's insulation system. To properly determine a motor's temperature, the procedures described in NEMA MG-1 may be followed.

10.2.7 OVERTEMPERATURE (OT) LED (LED 5)

The overtemperature (OT) LED (LED 5) will illuminate whenever the normally closed switch, as shown on the control elementary diagram (refer to the table of contents under Section 11 to determine the drawing number) connected between terminals TB1-28 and TB1-22 through tie-point TB1-18 is opened. In this event the following items should be checked:

1. Excessive ambient temperature per Section 3.1.4.
2. Controller cooling fan failure (location per Section 4).
3. Loose or defective electrical connection.
4. Check for tripped motor thermal switch if the motor is so equipped. Refer to Section 10.1.4, excessive motor temperature.
5. Defective precharge relay or precharge contactor.
6. Dirty heatsink assembly or blocked air flow. See Section 10.0.1.

10.3.1 UNDERVOLTAGE (UV) (LED 10)

The undervoltage LED is illuminated whenever the controller input line voltage falls below 87.5% of rated line voltage (per Section 3.1.1). There is hysteresis in this circuitry so that voltage must rise back to a level of 95% rated voltage before the undervoltage condition is removed. While in a UV condition the precharge relay is de-energized and the drive is inhibited from running. In the event of an undervoltage condition consider the following items:

1. Low AC input per specifications of Section 3.1.1.
2. Momentary AC line dip — controller will automatically reset and run if 2-wire control is used. Three-wire control circuits will require that the start button be depressed.
4. Refer to 10.4.3 and perform a control power supply check.

10.4.2 VOLTAGE OUTPUT

Improper voltage output may cause Overload, Instantaneous Over Current, or insufficient torque. Perform the following to verify that the voltage output is correct.

1. Perform the voltage balance procedure per 10.4.4. If no imbalance is found, continue to the next step.
2. **Remove all power. Read and observe caution notes concerning controller servicing.**
3. With the motor leads disconnected from terminals T1, T2, and T3, adjust the input speed signal until the voltage between TB1-4(+) and TB1-6 (common) on the Main Control Board (refer to Figure 8.1) is 1.25 VDC.
4. With the controller at this frequency, measure the voltage between TB1-26(+) and TB1-6 (common). Compare this measured voltage (V) to the voltage listed in Table 1 for the switch configuration of the controller under examination. The measured voltage should be within ± 10% of the tabulated value.
5. If the conditions of (4) are not satisfied, confirm the integrity of the voltage feedback per 10.4.6.
6. If voltage feedback is functioning properly, replace the Main Control Board.

TABLE 1
Main Control Board Dip Switch Settings①

Input Voltage	Motor Voltage	Resistors② R170 R180	SW1	SW3	SW6	SW7	SW8	V (±10%) @ TB1-26
200V	200V	I	X	X	O	O	*	.87V
230V	200V	I	X	X	O	O	*	.87V
230V	230V	I	X	O	O	O	*	1.00V
460V	400V	I	O	O	X	X	*	1.74V
460V	460V	I	O	O	X	O	*	2.00V
200V	200V	R	X	X	O	O	*	.44V
230V	230V	R	X	O	O	O	*	.50V
460V	400V	R	O	O	X	X	*	87V
460V	460V	R	O	O	X	O	x	1.00V

X-Closed Switch (On)

O-Open Switch (Off)

* -Either position is acceptable

①Refer to Section 6, controller adjustments for additional information on the proper setting of the dip switches.
②I = Installed, R = Removed, refer to Figure 8.1 Snip-out Resistors

10.4.4 CONTROLLER OUTPUT VOLTAGE MEASUREMENT

Controller output voltage can indicate a potential gating problem. The following procedure illustrates this concept:

1. **Remove all power. Read and observe caution notes concerning controller servicing.**
2. With all power removed, remove motor leads from terminals T1, T2, and T3 so that controller output is open circuited. Read and observe caution notes concerning controller servicing.

3. Start the controller and adjust the output frequency to 60 HZ by varying input speed signal until the DC voltage between TB1-4(+) and TB1-6 (common) is 2.5VDC (see Section 8.1 for location of TB1). Note: if the controller is capable of hand or automatic operation, the hand mode should be used and speed should be varied with the manual speed potentiometer.

4. Measure the line to line output voltages from T1 to T2, T2 to T3, and T1 to T3 (see Section 4.0 for location). These voltages should be within 5% of each other. The actual voltage reading is not important. Because of the complex output waveform, different voltmeters may read different values. The major concern is that all three readings indicate balanced voltages. If not, this indicates a problem in a gating channel. The output which is common to the two lowest line-to-line readings is driven by the two suspect gating channels. As an example, suppose V(T1—T2) = 400V, V(T2—T3) = 500V, and V(T1—T3) = 400. Since T1 is common to V(T1—T2)) and V(T1—T3), the two lowest readings, there is a problem in the gating circuitry or GTOs that drive that terminal.

To correct the problem, the following items should be replaced sequentially. Read and observe caution notes concerning controller servicing.

1. The pair of gate drivers associated with that output terminal (illustrated in Section 4).
2. Ribbon cable between the Main Control Board and Power Interface Board.
3. Main Control Board
4. Power Interface Board — be certain to use two known good Gate Drivers in the positions which drive the suspect terminal.

If Steps 1 - 4 above do not correct the problem, contact the factory.

10.4.5 SHORTED INVERTER GATE TURN-OFF THYRISTOR (GTO)

Remove all power from the controller. Read and observe caution notes concerning controller servicing. Disconnect the motor leads at terminals T1, T2 and T3. With an ohmmeter on the RX10 scale perform the measurements in Table 2. If a low resistance measurement is encountered where a high resistance measurement is expected, a shorted GTO is indicated. The terms high and low resistance are relative and comparison with the other measurements should clarify a questionable reading. Note: A shorted GTO could be the result of some other problem. Failure to determine the cause may result in failure of the replacement GTO. Contact your local Square D representative if a shorted GTO is suspected.

TABLE 2

Ohmmeter* + Lead	Ohmmeter* − Lead	Measurement (Resistance)
+ Bus	T1	High
+ Bus	T2	High
+ Bus	T3	High
T1	+ Bus	Low
T2	+ Bus	Low
T3	+ Bus	Low
− Bus	T1	Low
− Bus	T2	Low
− Bus	T3	Low
T1	− Bus	High
T2	− Bus	High
T3	− Bus	High

*Refer to Section 4, controller photos to determine the location of terminals.

10.4.6 VOLTAGE FEEDBACK

This procedure verifies the integrity of the controller output voltage sense resistors, both DC bus voltage and motor terminal voltages and the ribbon cable which conveys voltage feedback information from the Power Interface Board to the Main Control Board. Defective voltage feedback usually results in Instantaneous Over Current (LED 9) or Shoot Through trips (LED 6).

1. Remove all power. Read and observe caution notes concerning controller servicing.
2. With all power removed, disconnect the motor leads from terminals T1, T2 and T3. Refer to Section 4 for the location of T1, T2 and T3.
3. Remove the ribbon cable between the Main Control Board and the Power Interface Board.
4. Place one lead of an ohmmeter on test point TP3 of the Power Interface Board (PIB) and the other lead on terminal T1 (refer to Section 4 to determine the location). The meter should read 3 megohms. If not, replace the Power Interface Board.
5. Repeat Step 4 for test point TP4 and terminal T2.
6. Repeat Step 4 for test point TP5 and terminal T3.
7. Repeat Step 4 for test point TP1 and + bus terminal.
8. Repeat Step 4 for test point TP2 and − bus terminal.
9. Place the meter on the RX1 scale and check the continuity of the ribbon cable. Each conductor should read two ohms or less. If any are of a higher value, replace the ribbon cable.

10.4.7 BUS CAPACITOR

An open bus capacitor may result in overvoltage (OV) or shoot through (ST). A shorted bus capacitor will result in blown incoming line fuses. Capacitors which initially fail shorted, blowing the input line fuses, will generally open-circuit after the internal protective mechanism operates to clear the capacitor's internal short circuit. This condition can be visually detected by examining the top of the capacitor. The top of the capacitor will be bulged outward creating a dome shape. This failed capacitor and any blown input line fuses should be replaced and the possible loss of input lines to the controller should be investigated. If a failed capacitor is suspected, but is not visually detectable, a general indication of capacitor condition can be obtained with an analog ohmmeter. **Remove power from the controller. Read and observe caution notes concerning controller servicing.** With the meter scaling at RX1000 connect the meter leads across the capacitor terminals. A shorted capacitor will indicate low resistance, an open capacitor will indicate infinity, and a good capacitor will deflect momentarily and then return to the infinity position.

10.5 TROUBLESHOOTING DATA

PLACE THE TROUBLE SHEET WITH THE AUTHORIZED RETURN PAPER RECEIVED FROM YOUR LOCAL SQUARE D REPRESENTATIVE.

The purpose of the "Trouble Sheet" is to obtain as much pertinent information about the controller as possible. By fully filling out the following form the time to repair the controller and the cost of troubleshooting the controller are reduced. The following is an explanation of the type of information needed on this form.

USER NAME AND ADDRESS: Where the controller is installed

PERSON TO CONTACT: Someone at the user who is familiar with the problem and application. Contact for additional information may be required.

CONTROLLER DATA: Completely fill in the sample nameplate given on the bottom of the form.

MOTOR DATA: Fill in the requested information. If you have multiple motors give the information for all the motors controlled by the AFC.

APPLICATION DATA:

- Ambient temperature
- Type of load being controlled (i.e. conveyor, mixer, pump, fan, etc.)
- Basic power flow from supply to motor. Indicate if any contactors or circuit breakers are installed before the motor, or between the controller and motor. Is there any line bypass or across-the-line start capabilities?
- Is this a multiple motor scheme? Are the motors started all at the same time or sequenced?
- Type of speed control
  Hand pot, analog input signal (4-20 ma or 0-10V dc).
- If remote control wiring is installed detail the functions (start-stop, hand-off-auto, etc.) and the terminals to which your wiring is connected.

PROBLEM INFORMATION:

Description of Symptoms:

- Does fault occur
  - When only power is on the controller
  - When start button is pushed
  - When changing speeds
  - When running at constant speed
  - When stopping
  - When motor load changes
- Does problem have a pattern (i.e. does problem occur at same time during day?) or is the problem random?
- Signs of visual damage (bulging capacitor cans, blown fuses, discoloration on boards)

CONTROLLER TROUBLE SHEET

DETAIL TROUBLESHOOTING STEPS TAKEN

In the service bulletins there are a number of troubleshooting steps to be taken. List the steps taken and the results of those steps. If you have done any troubleshooting on your system detail those steps and results also.

USER NAME_____

ADDRESS_____

CITY, STATE, ZIP_____

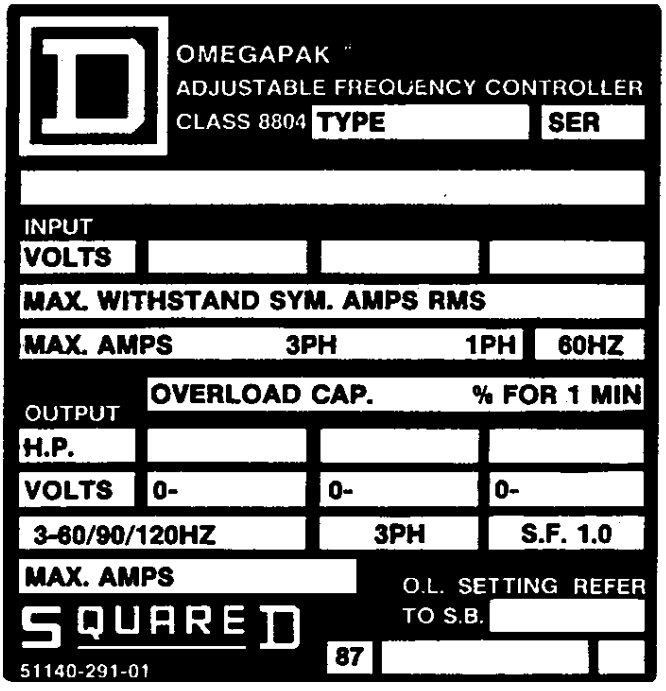
PERSON TO CONTACT_____

PHONE_____

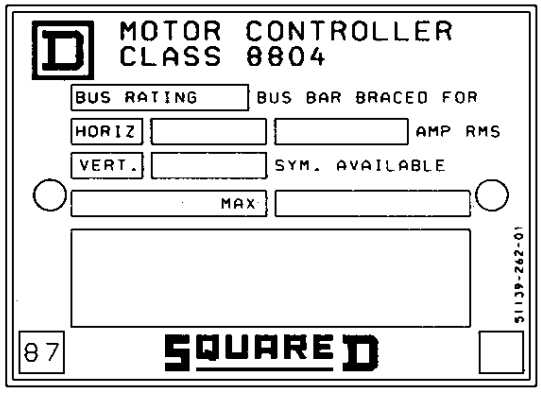
PURCHASER (DISTRIBUTOR)_____ P.O. # (IF AVAILABLE_____

CONTROLLER DATA: (FILL IN NAMEPLATE INFORMATION)

1500 CONTROLLER NAMEPLATE



3500 CONTROLLER NAMEPLATE



MOTOR DATA:

HP_____ VOLTAGE_____ FULL LOAD CURRENT_____

SERVICE FACTOR_____ NEMA DESIGN_____ SPEED_____

APPLICATION DATA:

APPLICATION (DESCRIBE)_____

_____

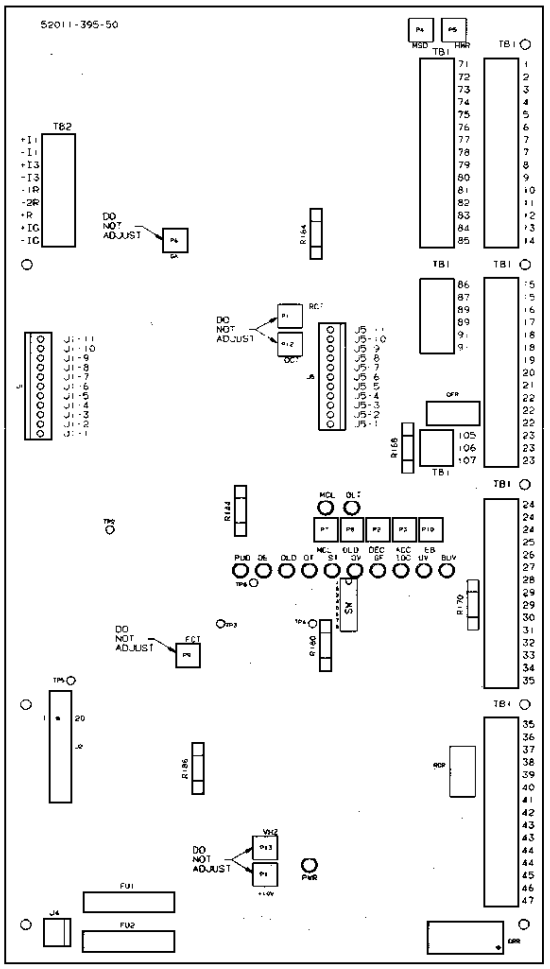
_____

SPEED RANGE: MAX. SPEED_____ MIN. SPEED_____ DUTY CYCLE_____

CONTROLLER TROUBLE SHEET (continued)

PROBLEM INFORMATION:

LED'S THAT ARE ILLUMINATED (MARK ON DRAWING) NO. OF GATE DRIVER LED'S ON_____



LENGTH OF TIME CONTROLLER HAS OPERATED PROPERLY:

_____ MONTHS, OR PROBLEM OCCURRED AT START-UP _____

DESCRIPTION OF SYMPTOMS_____

_____

_____

DETAIL TROUBLESHOOTING STEPS TAKEN_____

_____

_____

_____

_____

CONTROLLER TROUBLE SHEET

DETAIL TROUBLESHOOTING STEPS TAKEN

In the service bulletins there are a number of troubleshooting steps to be taken. List the steps taken and the results of those steps. If you have done any troubleshooting on your system detail those steps and results also.

USER NAME_____

ADDRESS_____

CITY, STATE, ZIP_____

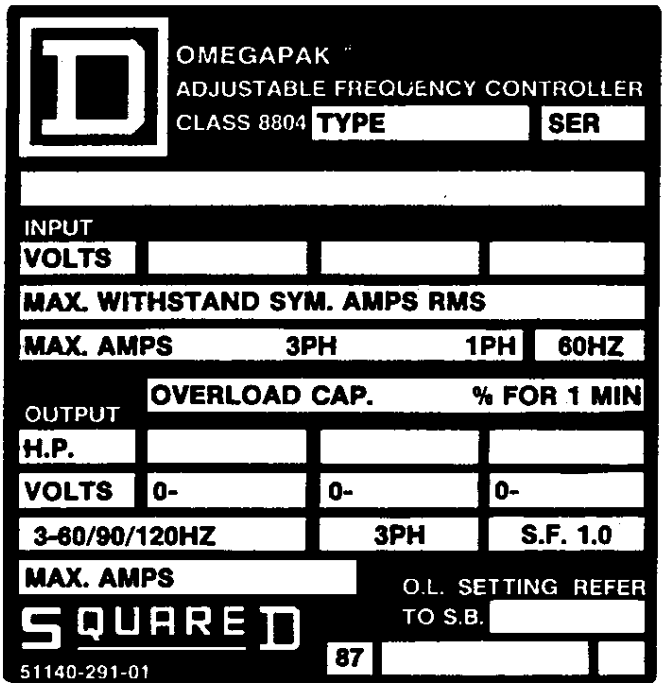
PERSON TO CONTACT_____

PHONE_____

PURCHASER (DISTRIBUTOR)_____ P.O. # (IF AVAILABLE_____

CONTROLLER DATA: (FILL IN NAMEPLATE INFORMATION)

1500 CONTROLLER NAMEPLATE



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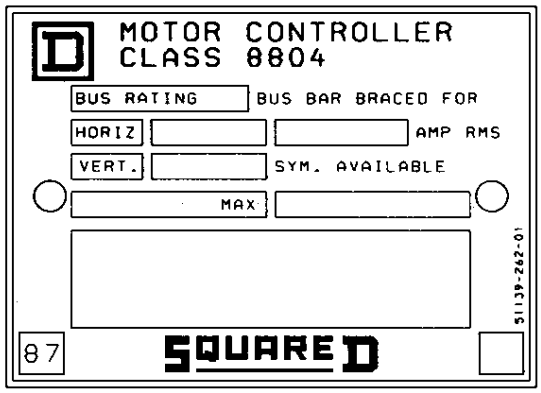


MOTOR DATA:

HP_____ VOLTAGE_____ FULL LOAD CURRENT_____

SERVICE FACTOR_____ NEMA DESIGN_____ SPEED_____

APPLICATION DATA:

APPLICATION (DESCRIBE)_____

_____

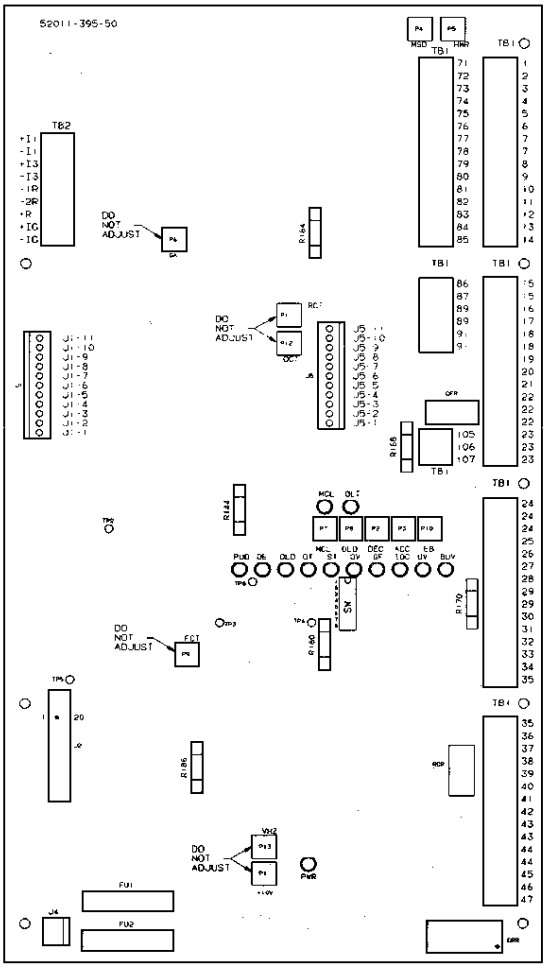
_____

SPEED RANGE: MAX. SPEED_____ MIN. SPEED_____ DUTY CYCLE_____

CONTROLLER TROUBLE SHEET (continued)

PROBLEM INFORMATION:

LED'S THAT ARE ILLUMINATED (MARK ON DRAWING) NO. OF GATE DRIVER LED'S ON_____



LENGTH OF TIME CONTROLLER HAS OPERATED PROPERLY:

_____ MONTHS, OR PROBLEM OCCURRED AT START-UP _____

DESCRIPTION OF SYMPTOMS_____

_____

_____

DETAIL TROUBLESHOOTING STEPS TAKEN_____

_____

_____

_____

_____

CONTROLLER TROUBLE SHEET

DETAIL TROUBLESHOOTING STEPS TAKEN

In the service bulletins there are a number of troubleshooting steps to be taken. List the steps taken and the results of those steps. If you have done any troubleshooting on your system detail those steps and results also.

USER NAME_____

ADDRESS_____

CITY, STATE, ZIP_____

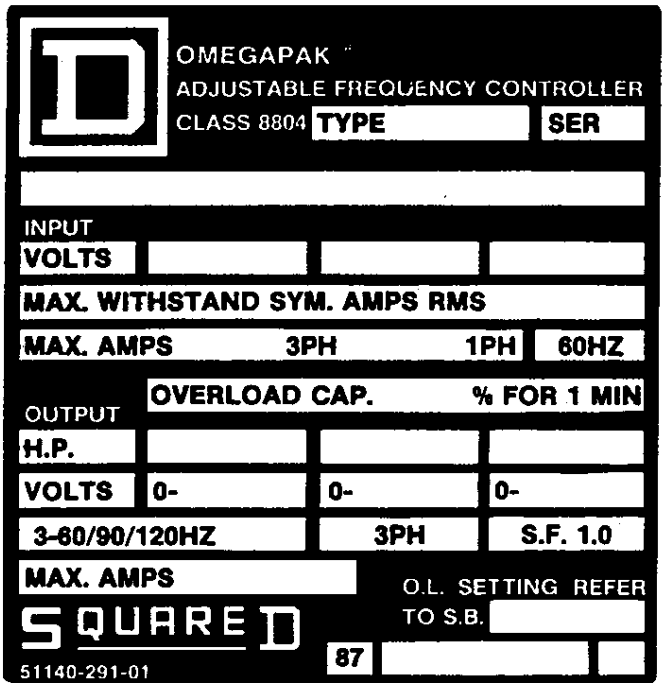
PERSON TO CONTACT_____

PHONE_____

PURCHASER (DISTRIBUTOR)_____ P.O. # (IF AVAILABLE_____

CONTROLLER DATA: (FILL IN NAMEPLATE INFORMATION)

1500 CONTROLLER NAMEPLATE



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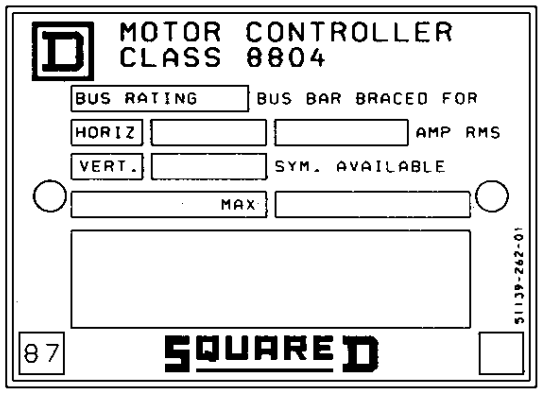


MOTOR DATA:

HP_____ VOLTAGE_____ FULL LOAD CURRENT_____

SERVICE FACTOR_____ NEMA DESIGN_____ SPEED_____

APPLICATION DATA:

APPLICATION (DESCRIBE)_____

_____

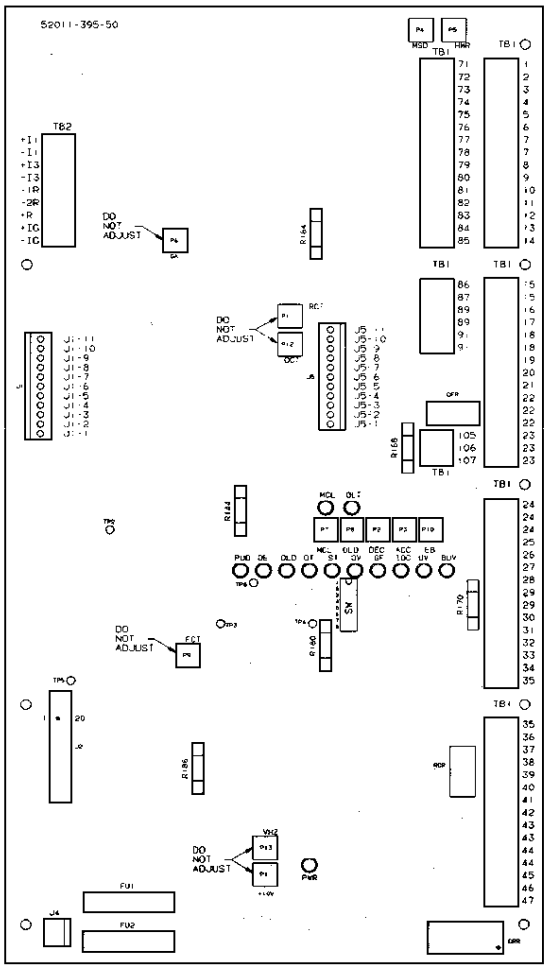
_____

SPEED RANGE: MAX. SPEED_____ MIN. SPEED_____ DUTY CYCLE_____

CONTROLLER TROUBLE SHEET (continued)

PROBLEM INFORMATION:

LED'S THAT ARE ILLUMINATED (MARK ON DRAWING) NO. OF GATE DRIVER LED'S ON_____



LENGTH OF TIME CONTROLLER HAS OPERATED PROPERLY:

_____ MONTHS, OR PROBLEM OCCURRED AT START-UP _____

DESCRIPTION OF SYMPTOMS_____

_____

_____

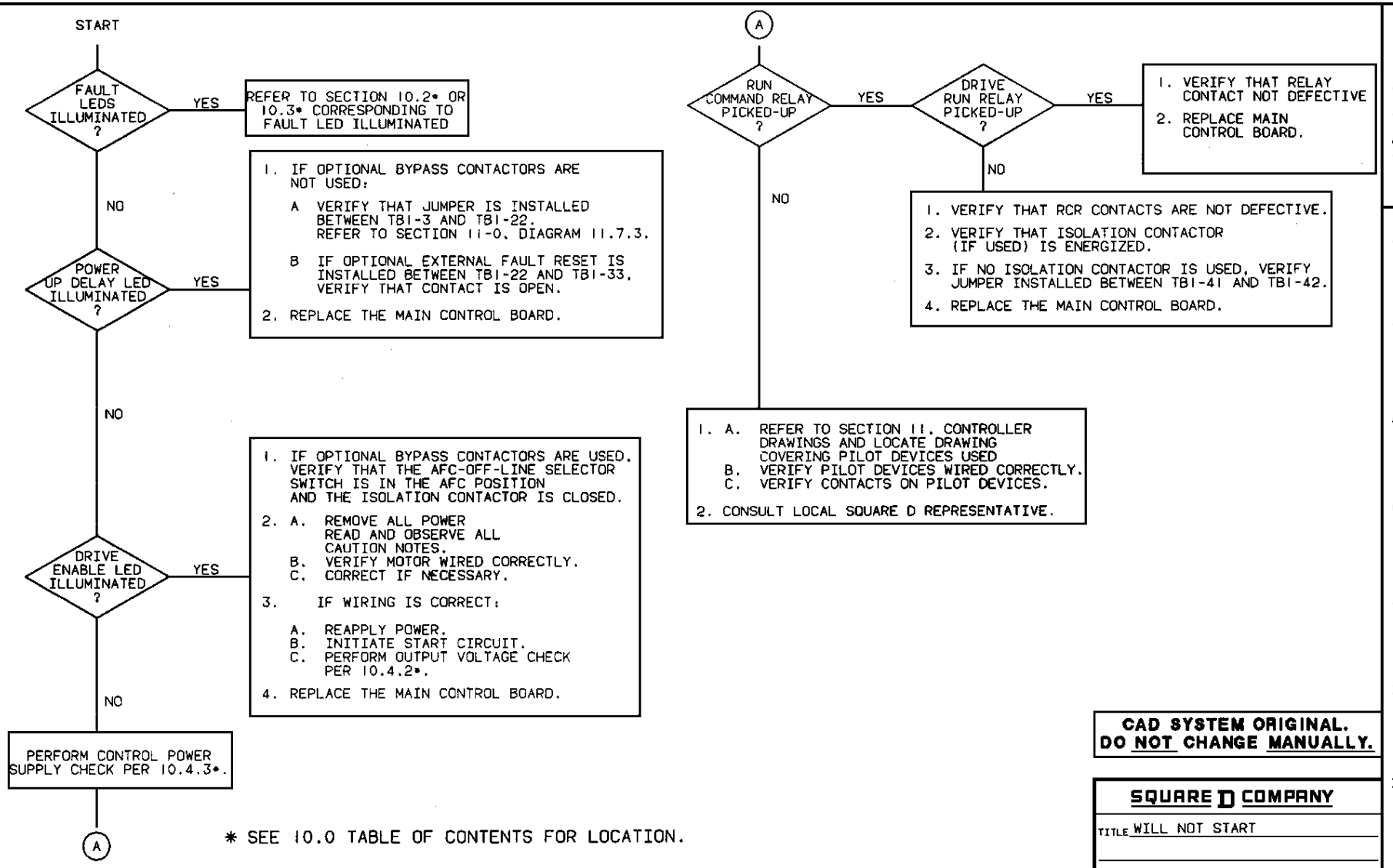
DETAIL TROUBLESHOOTING STEPS TAKEN_____

_____

_____

_____

_____



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE WILL NOT START

CLASS____ TYPE ____ FORM____ SER.___

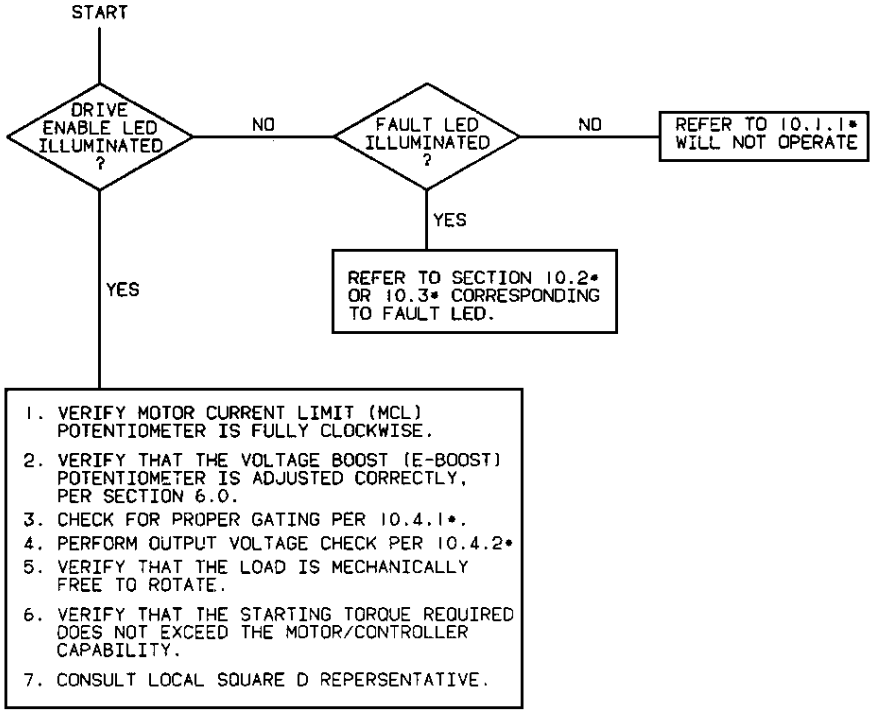
REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6 | NEXT ASSEM | PROJ.NO.

DATE DRN. 12-86 | DATE REL. | DRN. | CKD. | APP'D

DRG. NO. 10.1.1 MASTER | SHEET 1 OF 1

10.1.1



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE WILL NOT ACCELERATE

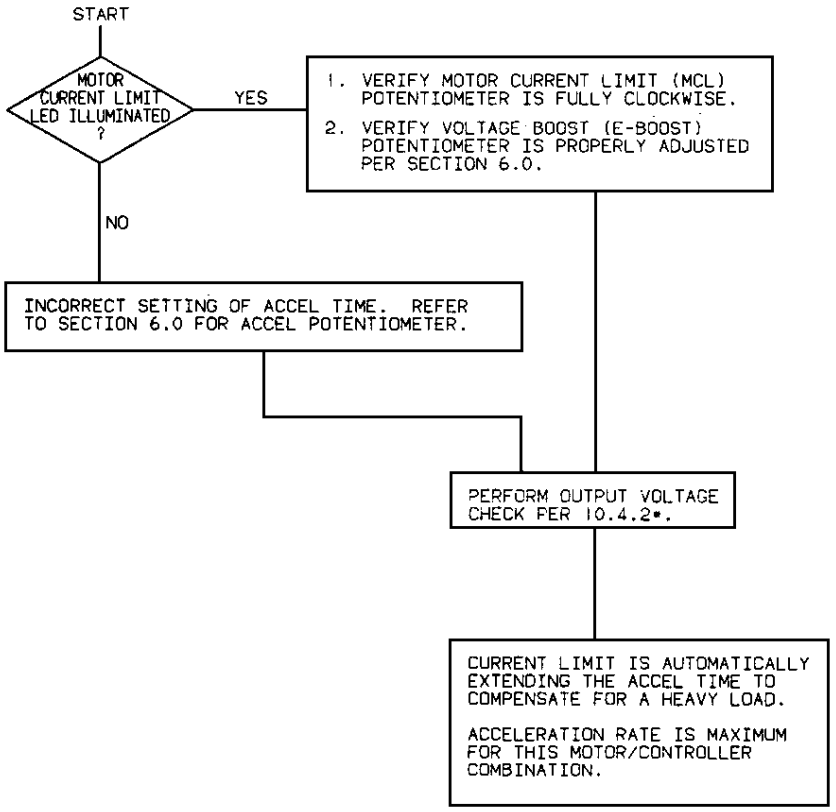
CLASS____ TYPE ____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6 | NEXT ASSEM | PROJ.NO.

DATE DRN. 12-86 | DATE REL. | DRN. | CHD. | APP'D

DRG. NO. 10.1.2 MASTER SHEET 1 OF 1



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE ACCELERATES TOO SLOWLY

CLASS____ TYPE ____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6
NEXT ASSEM
PROJ.NO.

DATE DRN. 12-86 | DATE REL. | DRN. | CHD. | APP'D

DRG. NO. 10.1.3 — MASTER — SHEET 1 OF 1

10.1.3

START

WILL FAULT CONDITION RESET ?

NO

MEASURE VOLTAGE FROM POWER TERMINALS +BUS TO - BUS. REFER TO SECTION 4, CONTROLLER PHOTOS TO LOCATE TERMINALS.

V(+BUS TO - BUS)SHOULD BE:

V(SYSTEM)	V(+ BUS TO - BUS)
460 VAC	600-715 VDC
230 VAC	300-358 VDC
200 VAC	270-311 VDC

RECORD THE VALUE MEASURED. THIS WILL BE LABELED "VALUE A".

IS V(+ BUS TO - BUS) CORRECT ?

YES

NO

1. VERIFY THAT:
   - A. INCOMING LINE VOLTAGE IS CORRECT.
   - B. ALL THREE PHASES ARE PRESENT.
   - C. POWER FUSES ARE NOT BLOWN.
2. REMOVE ALL POWER. READ AND OBSERVE ALL CAUTION NOTES. VERIFY THAT THE THERMAL SWITCH IS NOT OPEN AND THE PRECHARGE RESISTORS ARE NOT DEFECTIVE. ALSO VERIFY THAT ALL CONNECTIONS ARE TIGHT AND NO SIGNS OF OVERHEATING ARE APPARENT.

YES

DOES ST ILLUMINATE IMMEDIATELY ON START ?

YES

ANY GATE DRIVER LEDS ILLUMINATED BEFORE STARTING ?

NO

1. CHECK FOR SHORTED GTO PER 10.4.5*.
2. CHECK FOR SHORT IN MOTOR OR WIRING TO MOTOR.
3. REMOVE ALL POWER. READ AND OBSERVE ALL CAUTION NOTES. CHECK DC BUS CAPACITORS PER 10.4.7*.
4. CONSULT LOCAL SQUARE D REPRESENTATIVE.

YES

DISCONNECT RIBBON CABLE FROM JACK J2 ON THE MAIN CONTROL BOARD.

NO

(A)

(B)

STEP 1

USING THE MEASURED VALUE FOR VOLTAGE FROM POWER TERMINALS LABELED "VALUE A", SUBSTITUTE THAT VALUE INTO THE APPLICABLE FORMULA:

V(SYSTEM)	FORMULA
460V	"VALUE A" / 500 = X
230V	"VALUE A" / 250 = X
200V	"VALUE A" / 250 = X

RECORD THE VALUE OF X FOR USE IN STEP 2

STEP 2

MEASURE THE DC VOLTAGE BETWEEN PINS J5-6(COMMON) AND J5-10 (+) ON THE J5 TERMINAL JACK OF THE MAIN CONTROL BOARD. REFER TO FIGURE 8.1 FOR JACK LOCATION. CAUTION: DO NOT SHORT TEST LEADS OF MEASURING DEVICE AGAINST ANY OTHER PINS ON THE J-5 TERMINAL JACK.

COMPARE THIS VALUE TO THE VALUE OF X CALCULATED IN STEP 1.

DOES STEP 2 EQUAL STEP 1 VALUE ±10% ?

YES

REPLACE THE MAIN CONTROL BOARD.

NO

1. CHECK CONTINUITY OF RIBBON CABLE BETWEEN THE MAIN CONTROL AND POWER INTERFACE BOARDS. REPLACE IF ANY READING EXCEEDS 2 OHMS.
2. REPLACE THE MAIN CONTROL BOARD.
3. REPLACE THE POWER INTERFACE BOARD.

* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE ST LED ILLUMINATES

CLASS ____ TYPE ____ FORM ____ SER. ____

REV.	DATE	REVISION DESCRIPTION	BY

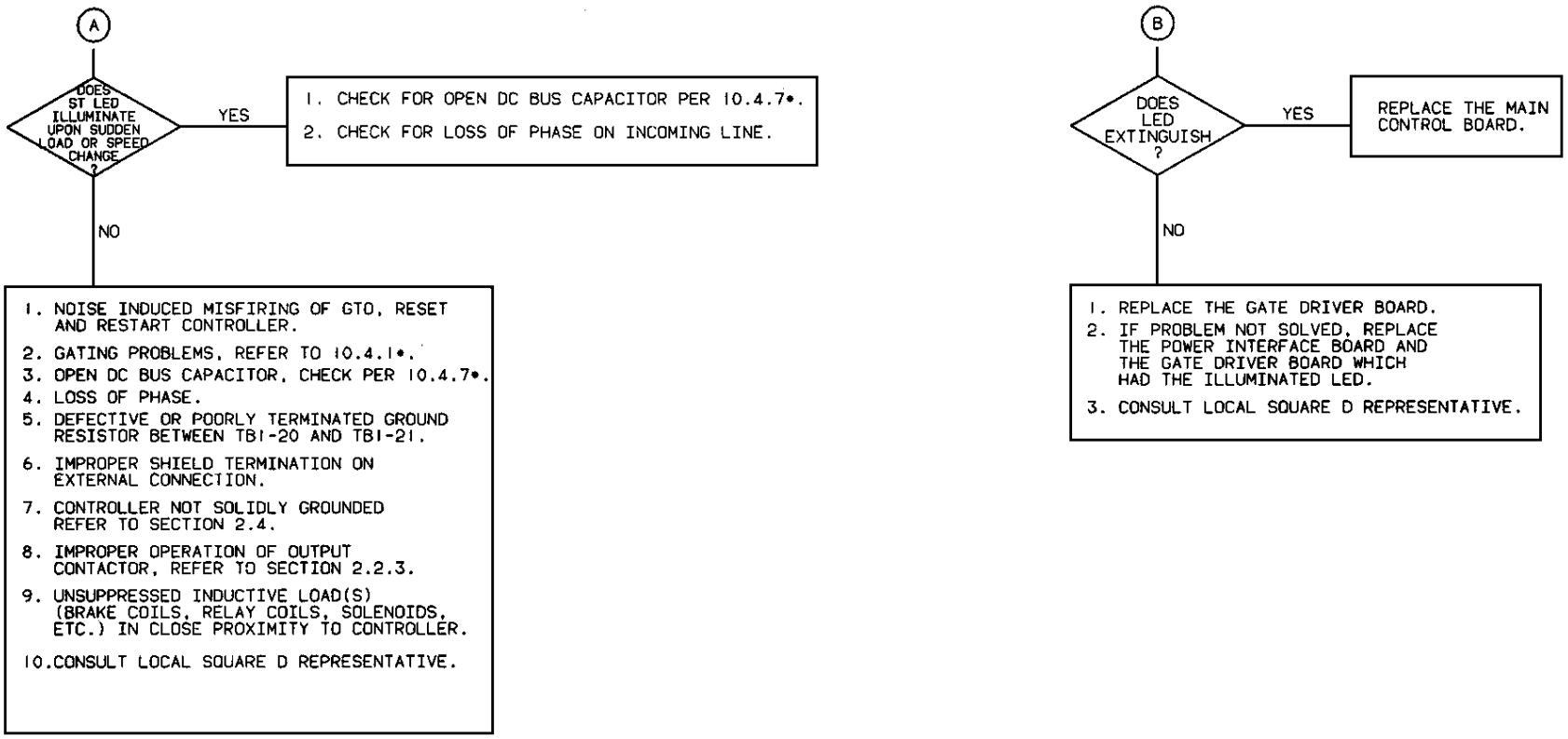
REF. 8804-6 | NEXT ASSEM | PROJ.NO.

DATE DRN. 2-87 | DATE REL. | DRN. | CHD. | APP'D

DRG. NO. MASTER 10.2.1

SHEET 1 OF 2

10.2.1



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE ST LED ILLUMINATES

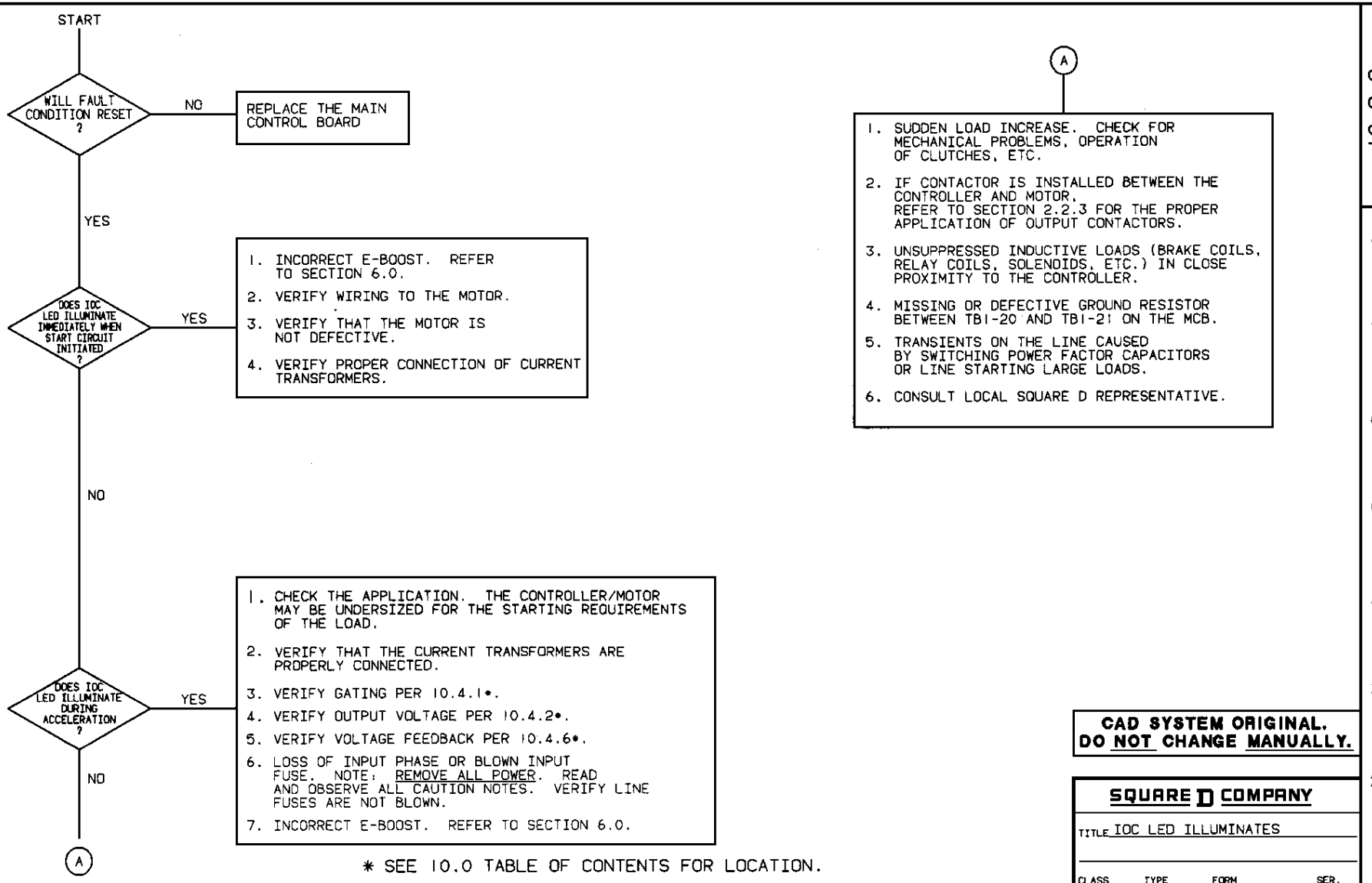
CLASS____ TYPE ____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6
NEXT ASSEM
PROJ.NO.

DATE DRN. 12-86 | DATE REL. | ORG. NO. 10.2.1 | MASTER | SHEET 2 OF 2
DRN. | CHD. | APP'D

10.2.1



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE IOC LED ILLUMINATES

CLASS _____ TYPE _____ FORM _____ SER. ___

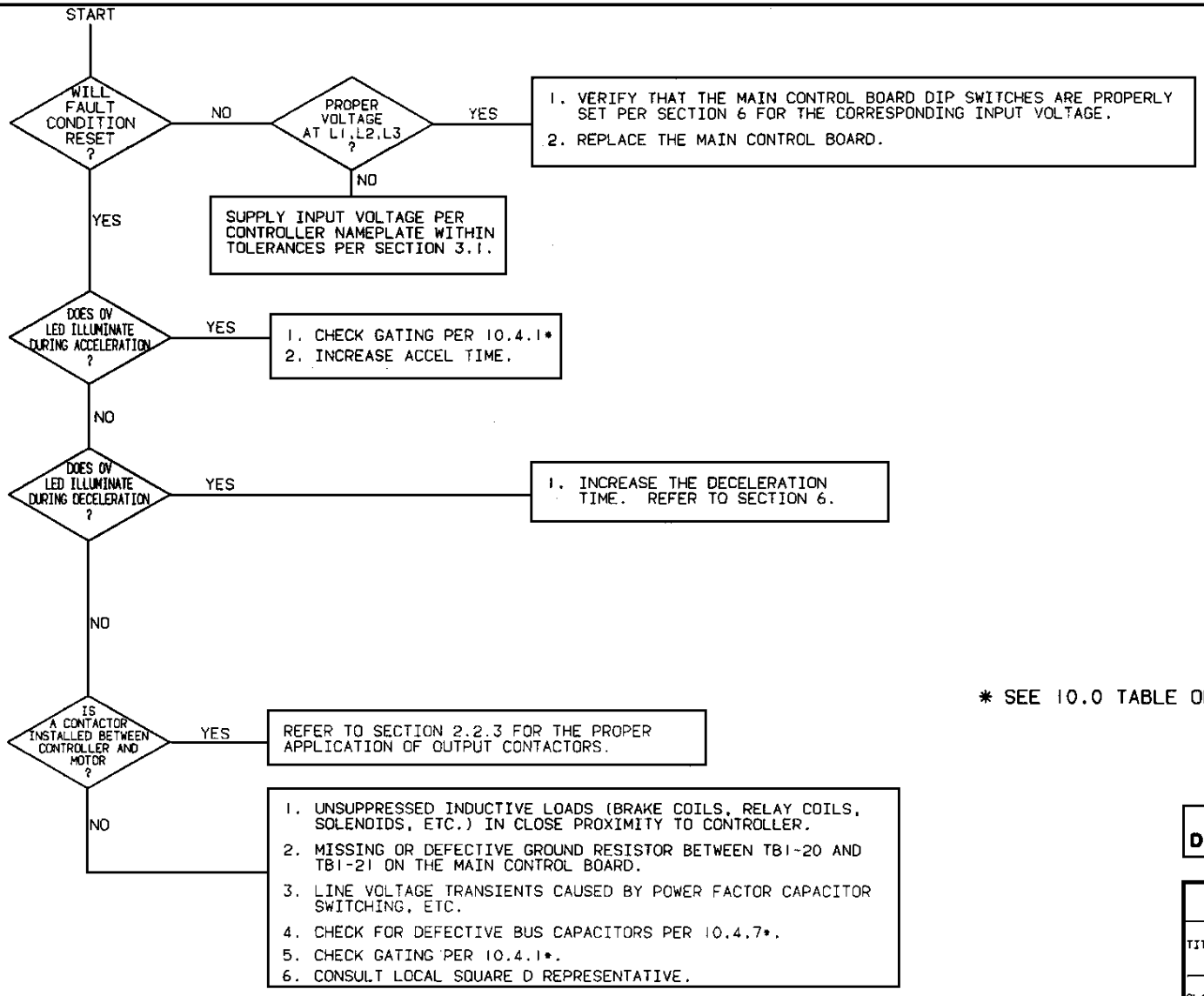
REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6 | NEXT ASSEM | PROJ. NO.

DATE DRN. 12-86 | DATE REL. | DRN. | CKD. | APP'D

DRG. NO. 10.2.2 **MASTER** SHEET 1 OF 1

10.2.2



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE OV LED ILLUMINATES

CLASS____ TYPE ____ FORM_____ SER.___

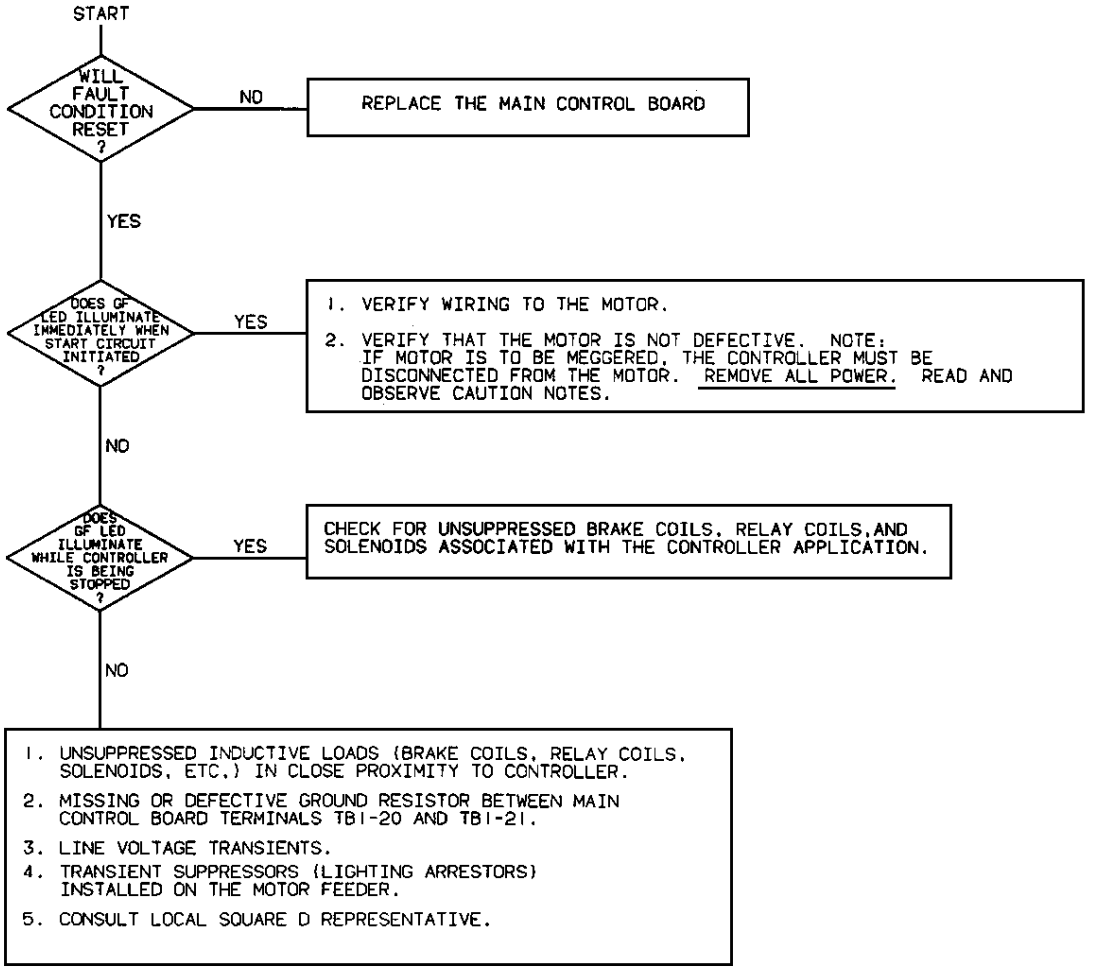
REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6
NEXT ASSEM
PROJ.NO.

DATE DRN. 12-86 | DRN. | CHD. | APP'D | DATE REL.

DRG. NO. 10.2.3 MASTER SHEET 1 OF 1

10.2.3



10.2.4

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE GF LED ILLUMINATES

CLASS ____ TYPE ____ FORM ____ SER. ____

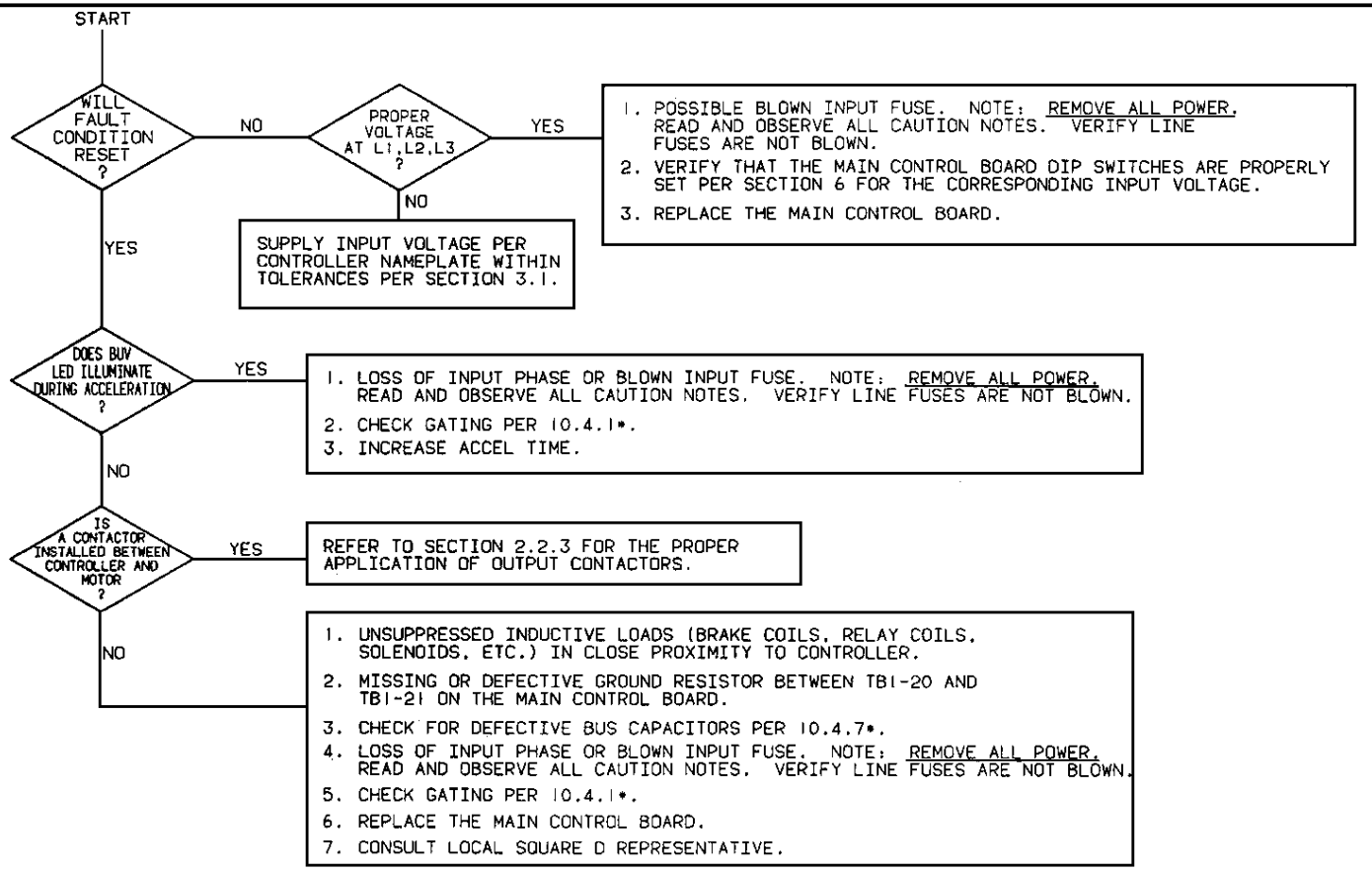
REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-3.7.6
NEXT ASSEM
PROJ.NO.

DATE DRN. 2-86 | DATE REL. | DRN. | CKD. | APP'D

DRG. NO. 10.2.4 **MASTER**

SHEET 1 OF 1



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE BUV LED ILLUMINATES

CLASS____ TYPE ____ FORM_____ SER.__

REV.	DATE	REVISION DESCRIPTION	BY

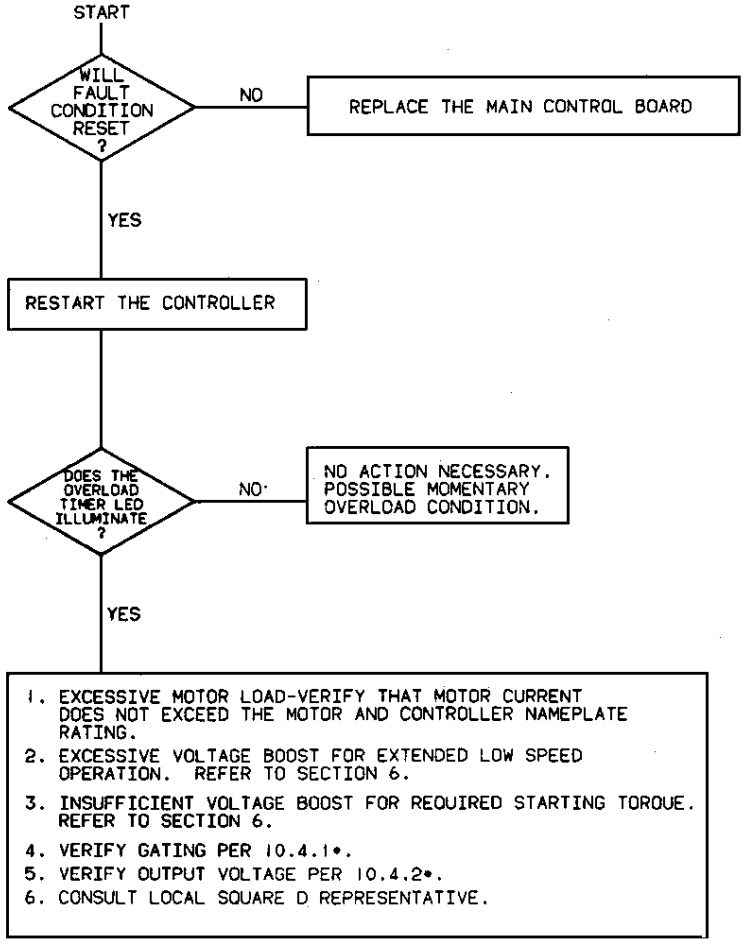
REF. 8804-7,6
NEXT ASSEM
PROJ.NO.

DATE DRN. 12-86 | DRN. | CKD. | APP'D | DATE REL.

DRG. NO. 10.2.5 MASTER

SHEET 1 OF 1

10.2.5



* SEE 10.0 TABLE OF CONTENTS FOR LOCTAION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

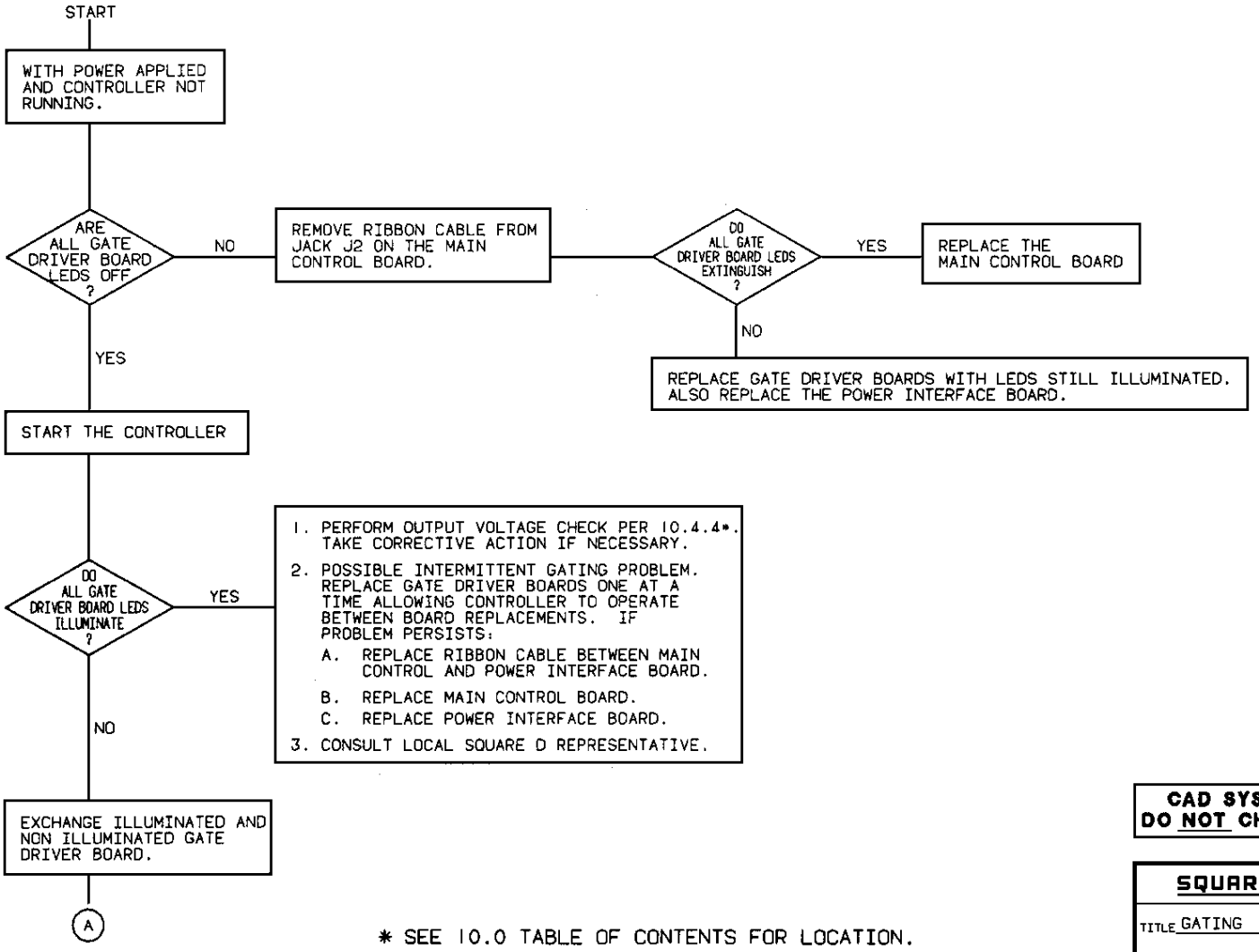
TITLE OLD LED ILLUMINATES

CLASS____ TYPE____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6 | NEXT ASSEM | PROJ.NO.

DATE DRN. 12-86 | DRN. | CKD. | APP'D | DATE REL. | DRG. NO. 10.2.6 | MASTER | SHEET 1 OF 1



* SEE 10.0 TABLE OF CONTENTS FOR LOCATION.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE GATING

CLASS____ TYPE ____ FORM____ SER.___

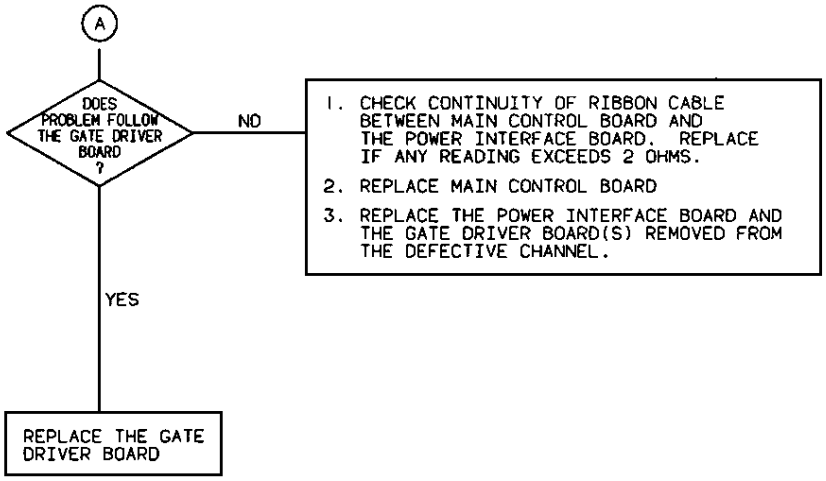
REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6 | NEXT ASSEM | PROJ.NO.

DATE DRN. 12-86 | DRN. | CKD. | APP'D | DATE REL.

DRG. NO. 10.4.1 | MASTER | SHEET 1 OF 2

10.4.1



CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE GATING

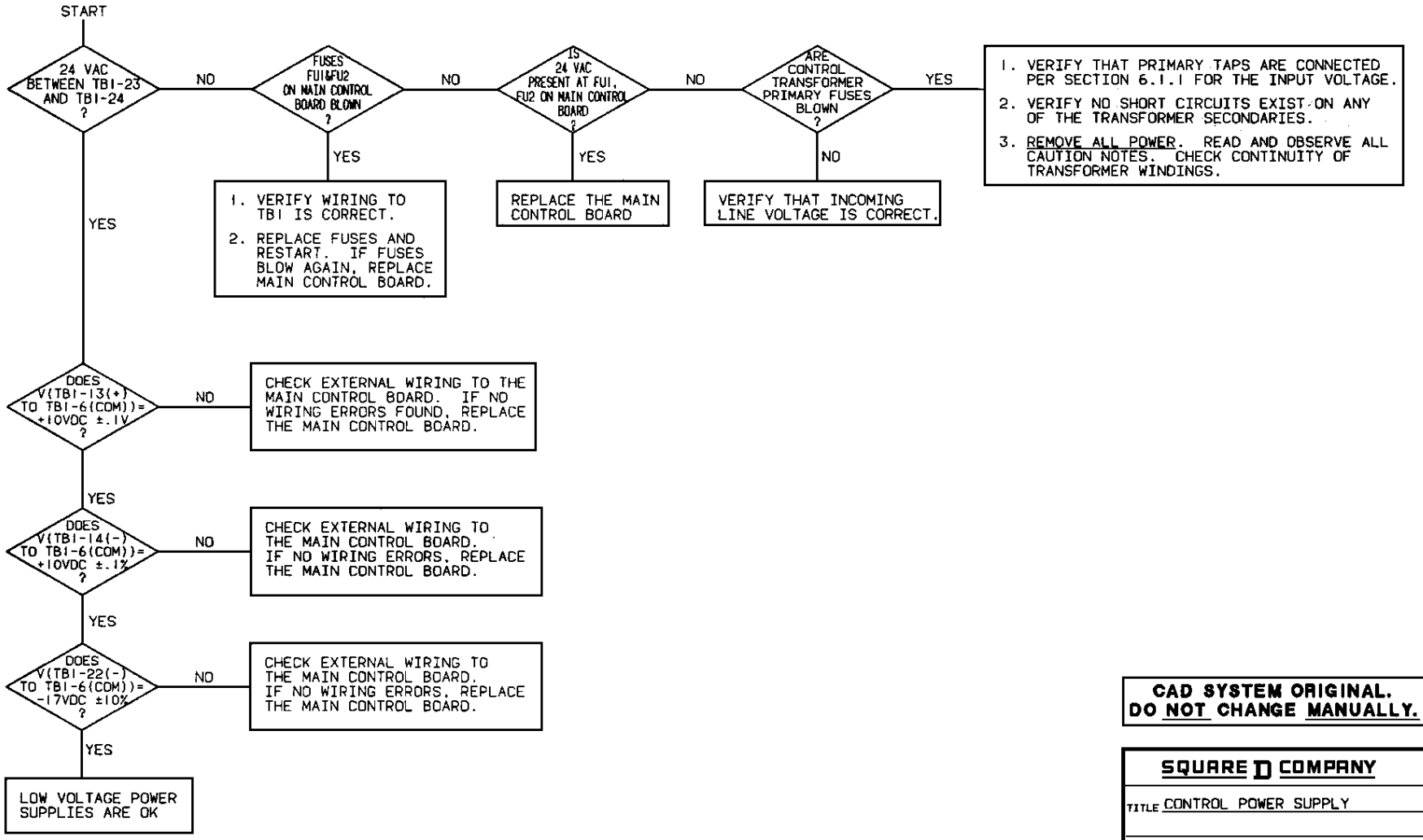
CLASS____ TYPE ____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-3.7.6
NEXT ASSEM
PROJ.NO.

DATE DRN. 2-86 | DATE REL. | DRG. NO. 10.4.1 | MASTER | SHEET 2 OF 2
DRN. | CHD. | APP'D

10.4.1



CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONTROL POWER SUPPLY

CLASS____ TYPE ____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-7.6 | NEXT ASSEM | PROJ.NO.

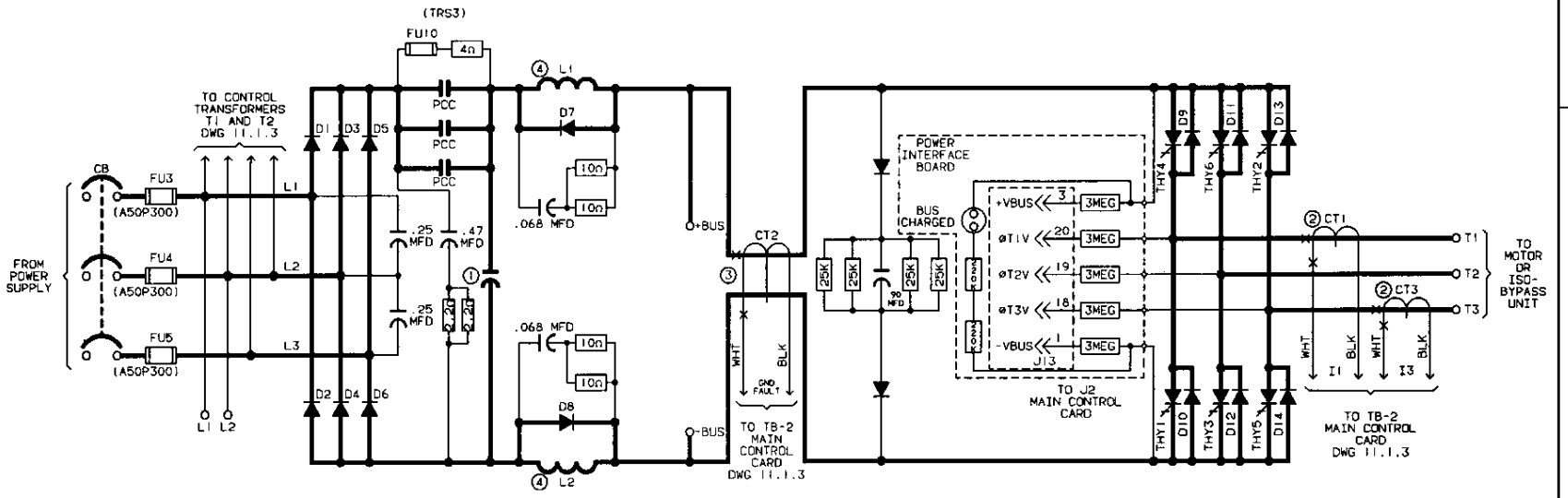
DATE DRN. 12-86 | DATE REL. | DRN. | CHD. | APP'D

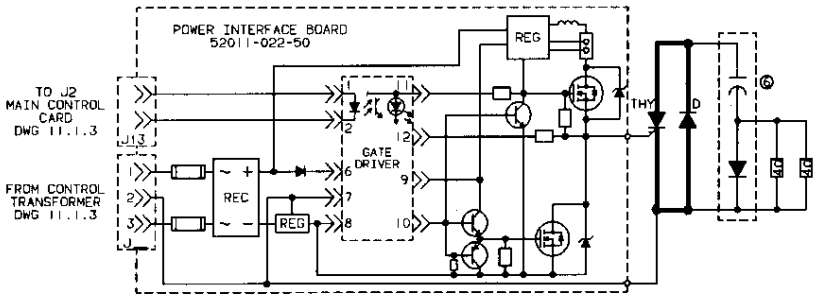
DRG. NO. 10.4.3 | MASTER | SHEET 1 OF 1

10.4.3

NOTE: Any reference to horsepower is at 460V unless stated otherwise. All controllers can be reconnected for 230V or 200V operation as detailed in Section 6.

CONTENTS





TYPICAL THYRISTOR GATING AND SNUBBER CIRCUIT FOR THY1 TO THY6

DRIVE H.P.	NO. OF CAP. CANS 90MFD PER CAN ①	MOTOR CURRENT XFMRS ②			GND FAULT CURRENT XFMR ③			POWER SEMI-CONDUCTORS			④ INDUCTORS L1 AND L2 (75 MICROHENRY)	⑤ SNUBBER CAPACITOR ASSEMBLY		
		RATIO	NO. OF TURNS		RATIO	NO. OF TURNS		GTOS	DIODES			MFD	+BUS	-BUS
			PRI.	SEC.		PRI.	SEC.	THY1-THY6	D1-D6	D7-D14				
60	12	600:5	1	0	600:5	1	0	52915-030-5001	52914-024-50	52914-028-52	51175-057-50	.75	52011-241-52	52011-241-55
75	15	750:5	1	0	600:5	1	0	52915-030-5001	52914-024-50	52914-028-52	51175-057-50	1.05	52011-241-51	52011-241-54
100	18	1000:5	1	0	600:5	1	0	52915-030-5001	52914-024-50	52914-028-52	51175-057-50	1.29	52011-241-50	52011-241-53
125	23	1200:5	1	0	600:5	1	0	52915-030-5001	52914-024-50	52914-028-52	51175-057-50	1.29	52011-241-50	52011-241-53

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

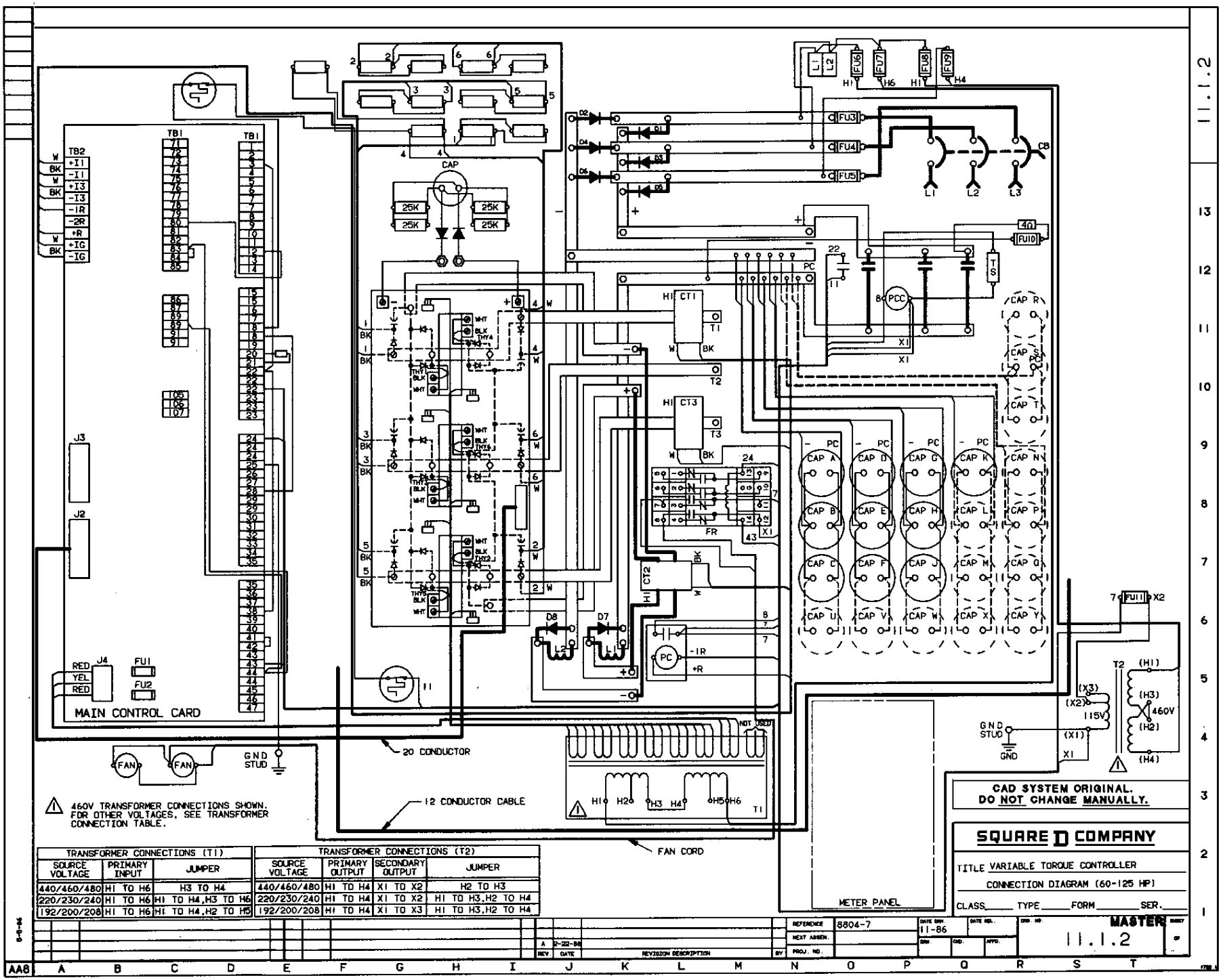
TITLE OMEGAPAK VARIABLE TORQUE CONTROLLER
POWER ELEMENTARY DIAGRAM (60 TO 125 HP)

CLASS 8804 TYPE ____ FORM ____ SER. ____

REV.	DATE	REVISION DESCRIPTION	BY

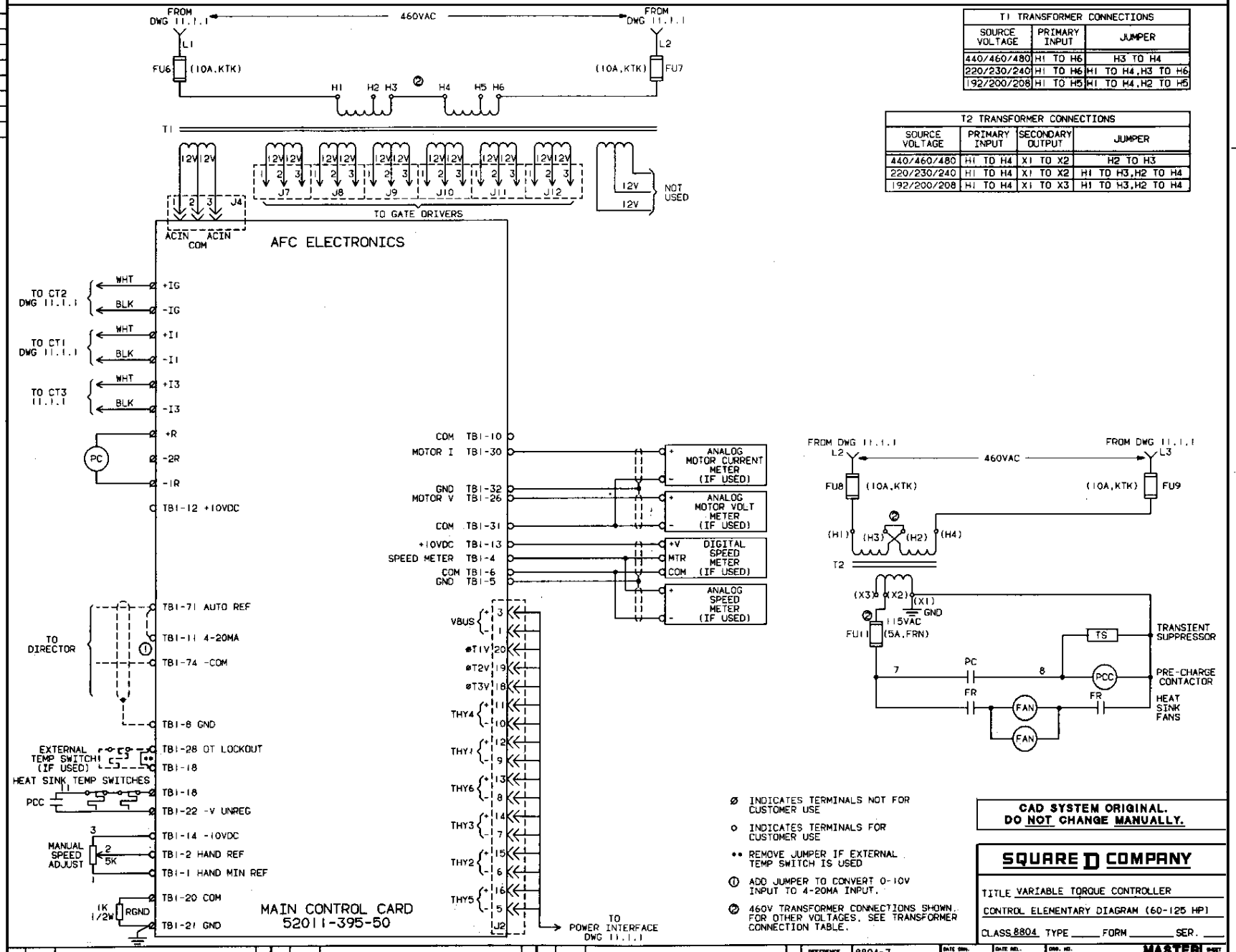
REFERENCE 8804-7
NEXT ASSEM.
PROJ. NO.
DATE DRN. 11-86
DRN. CHD. APPD.
DWG. NO. MASTER 11.1.1
SHEET

2/19/85



TRANSFORMER CONNECTIONS (T1)		
SOURCE VOLTAGE	PRIMARY INPUT	JUMPER
440/460/480	H1 TO H6	H3 TO H4
220/230/240	H1 TO H6	H1 TO H4, H3 TO H6
192/200/208	H1 TO H6	H1 TO H4, H2 TO H5

TRANSFORMER CONNECTIONS (T2)			
SOURCE VOLTAGE	PRIMARY OUTPUT	SECONDARY OUTPUT	JUMPER
440/460/480	H1 TO H4	X1 TO X2	H2 TO H3
220/230/240	H1 TO H4	X1 TO X2	H1 TO H3, H2 TO H4
192/200/208	H1 TO H4	X1 TO X3	H1 TO H3, H2 TO H4



T1 TRANSFORMER CONNECTIONS		
SOURCE VOLTAGE	PRIMARY INPUT	JUMPER
440/460/480	H1 TO H6	H3 TO H4
220/230/240	H1 TO H6	H1 TO H4, H3 TO H6
192/200/208	H1 TO H5	H1 TO H4, H2 TO H5

T2 TRANSFORMER CONNECTIONS			
SOURCE VOLTAGE	PRIMARY INPUT	SECONDARY OUTPUT	JUMPER
440/460/480	H1 TO H4	X1 TO X2	H2 TO H3
220/230/240	H1 TO H4	X1 TO X2	H1 TO H3, H2 TO H4
192/200/208	H1 TO H4	X1 TO X3	H1 TO H3, H2 TO H4

Ø INDICATES TERMINALS NOT FOR CUSTOMER USE

o INDICATES TERMINALS FOR CUSTOMER USE

** REMOVE JUMPER IF EXTERNAL TEMP SWITCH IS USED

① ADD JUMPER TO CONVERT 0-10V INPUT TO 4-20MA INPUT.

② 460V TRANSFORMER CONNECTIONS SHOWN. FOR OTHER VOLTAGES, SEE TRANSFORMER CONNECTION TABLE.

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE VARIABLE TORQUE CONTROLLER

CONTROL ELEMENTARY DIAGRAM (60-125 HP)

CLASS 8804 TYPE ____ FORM ____ SER. ____

REFERENCE	8804-7
NEXT ASSEM.	
PROJ. NO.	

DATE DRN. 11-86 | DATE REV. | DRN. | DES. | APPD.

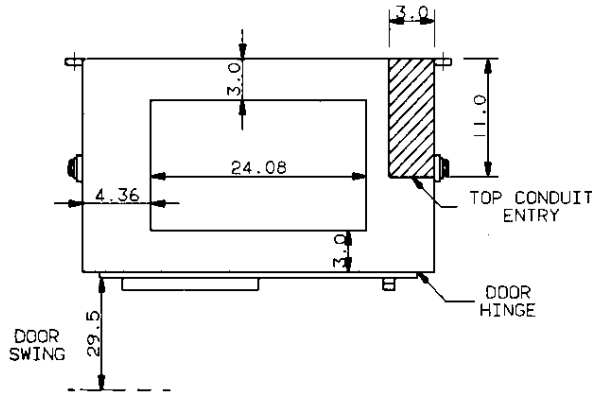
DWG. NO. 11.1.3 MASTER | SHEET

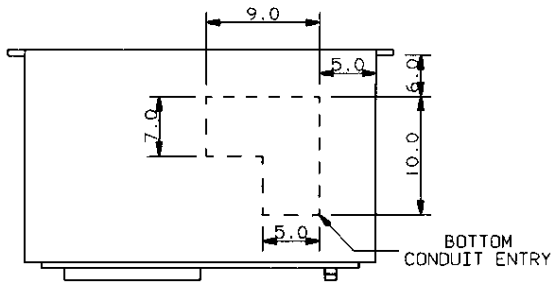
REV	DATE	REVISION DESCRIPTION	BY

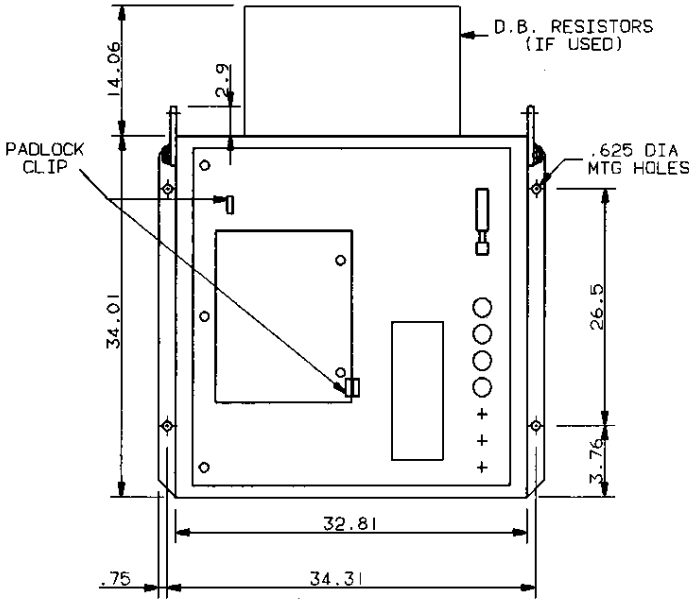
5-5-86

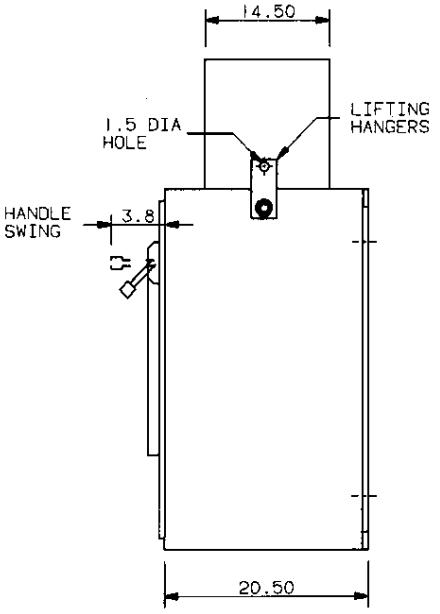
AA5 A B C D E F G H I J K L M N O P Q R S T

M 1 1 1 3 2 1









CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE OMEGAPAK 1500 CONTROLLER
OUTLINE DRAWING

CLASS____ TYPE____ FORM____ SER.___

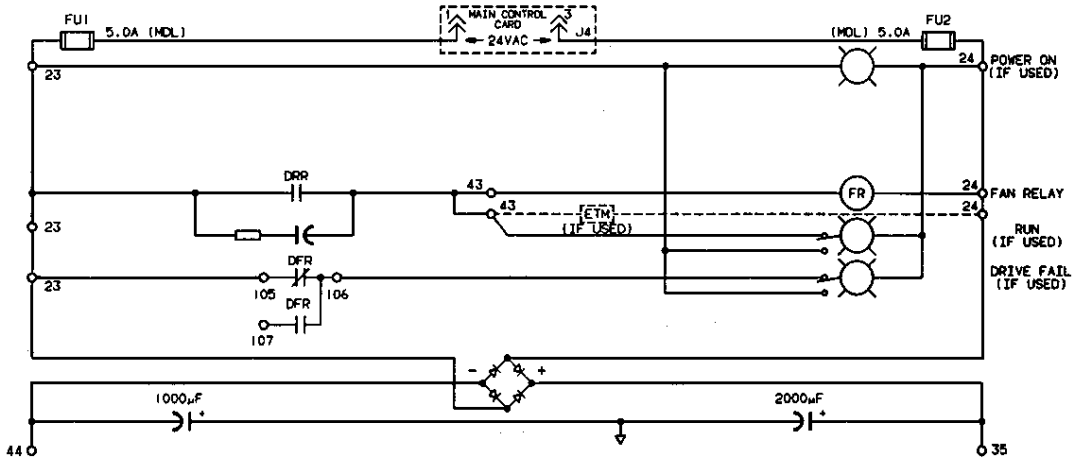
REV.	DATE	REVISION DESCRIPTION	BY

REF.
NEXT ASSEM.
PROJ. NO.

DATE DRN. 6-85 | DATE REL. | DRG. NO. 11.1.4 | ELEC FILE | SHEET OF

DRN. | CKD. | APP'D

11.1.4



CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONTROL CIRCUIT ELEMENTARY
FAN RELAY, OPTIONAL PILOT LIGHTS

CLASS____ TYPE____ FORM____ SER.____

REFERENCE	8804-7.6
NEXT ASSEM.	
PROJ. NO.	

DATE ISSUED 11-86 | DATE REL. | DWG. NO. MASTER 11.2.1 | SHEET

DRN. | CHD. | APPD.

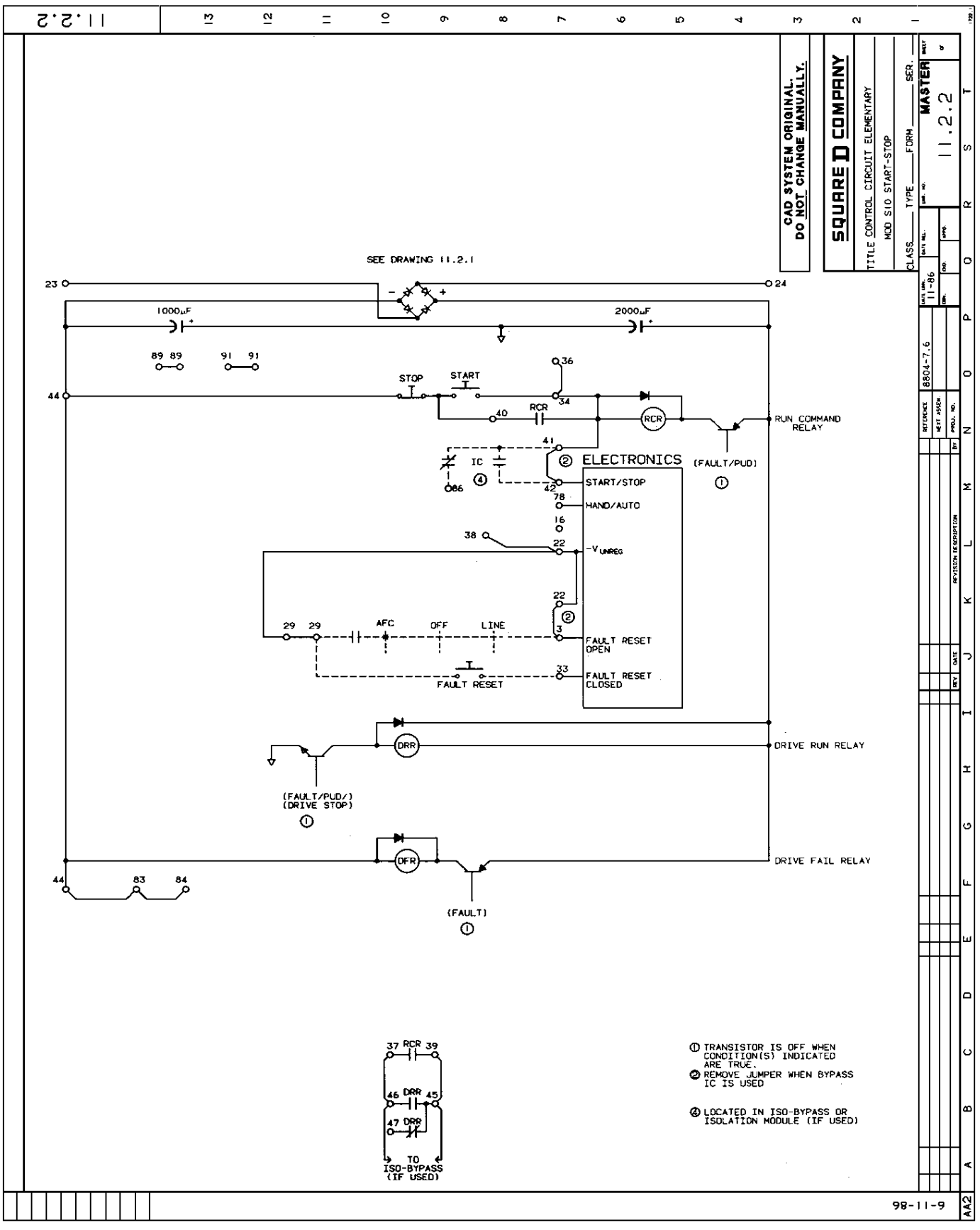
REV | DATE | REVISION DESCRIPTION | BY

11.2.1

6-11-86

AA2 A B C D E F G H I J K L M N O P Q R S T

1720-1


CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.
SQUARE D COMPANY
TITLE CONTROL CIRCUIT ELEMENTARY
MOD S10 START-STOP
CLASS ____ TYPE ____ FORM ____ SER. ____
MASTER
11.2.2
SEE DRAWING 11.2.1
23
24
1000μF
2000μF
89 89
91 91
44
STOP
START
36
34
40
RCR
RUN COMMAND RELAY
41
IC
86
ELECTRONICS
START/STOP
42
78
HAND/AUTO
16
38
22
-V UNREG
29 29
AFC
OFF
LINE
3
FAULT RESET OPEN
FAULT RESET
33
FAULT RESET CLOSED
(FAULT/PUD)
DRR
DRIVE RUN RELAY
(FAULT/PUD/)
(DRIVE STOP)
DFR
DRIVE FAIL RELAY
44
83
84
(FAULT)
37 RCR 39
46 DRR 45
47 DRR
TO ISO-BYPASS (IF USED)
① TRANSISTOR IS OFF WHEN CONDITION(S) INDICATED ARE TRUE.
② REMOVE JUMPER WHEN BYPASS IC IS USED
④ LOCATED IN ISO-BYPASS OR ISOLATION MODULE (IF USED)
8804-7.6
11-86
98-11-9
AA2

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONTROL CIRCUIT ELEMENTARY
MOD A10 HAND-AUTO START-STOP

CLASS ____ TYPE ____ FORM ____ SER. ____

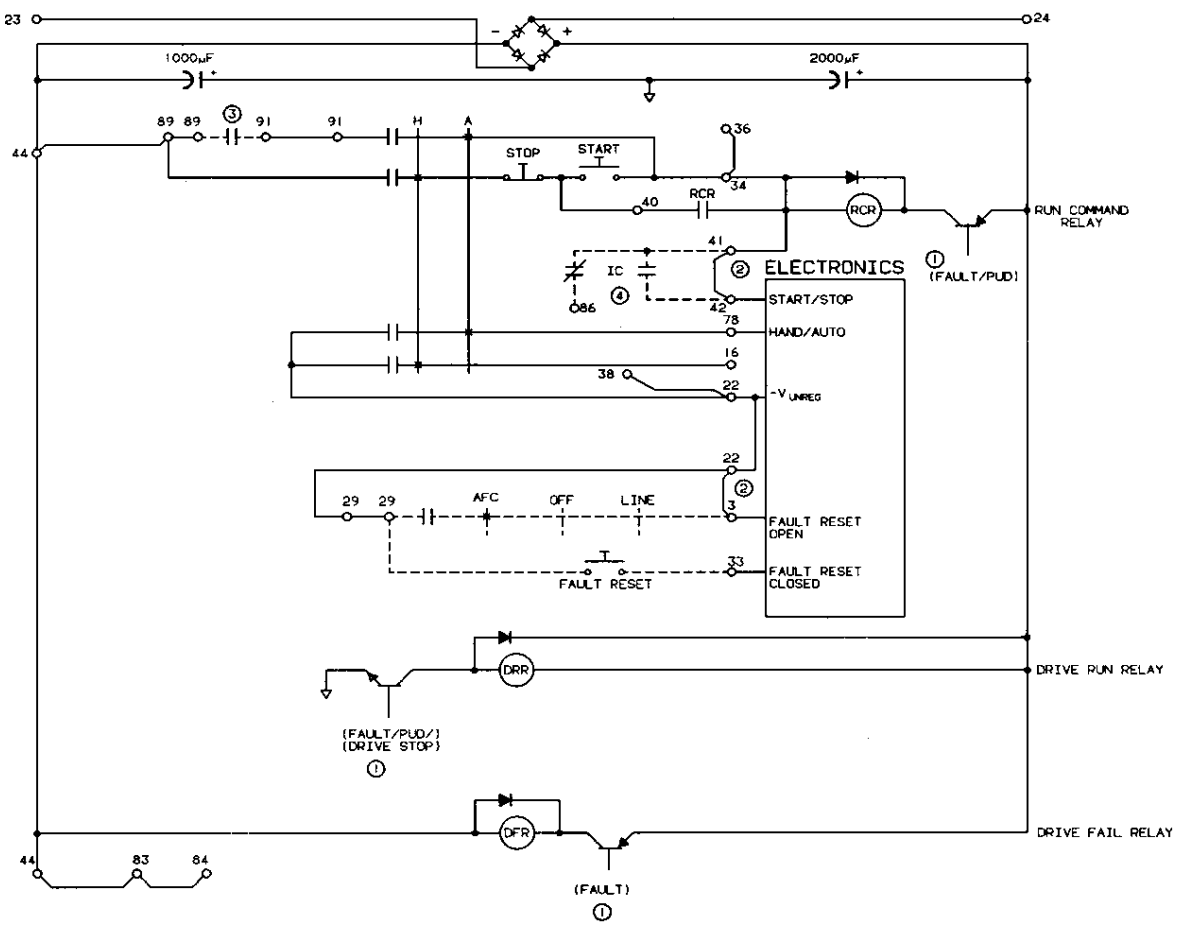
MASTER

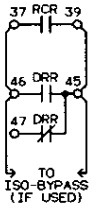
11.2.3

8804-7.6

11-86

SEE DRAWING 11.2.1





① TRANSISTOR IS OFF WHEN CONDITION(S) INDICATED ARE TRUE.
② REMOVE JUMPER WHEN BYPASS IC IS USED
③ SUPPLIED BY OTHERS. CLOSES TO RUN IN AUTO MODE.
④ LOCATED IN ISO-BYPASS OR ISOLATION MODULE (IF USED)

REVISION DESCRIPTION | DATE | BY

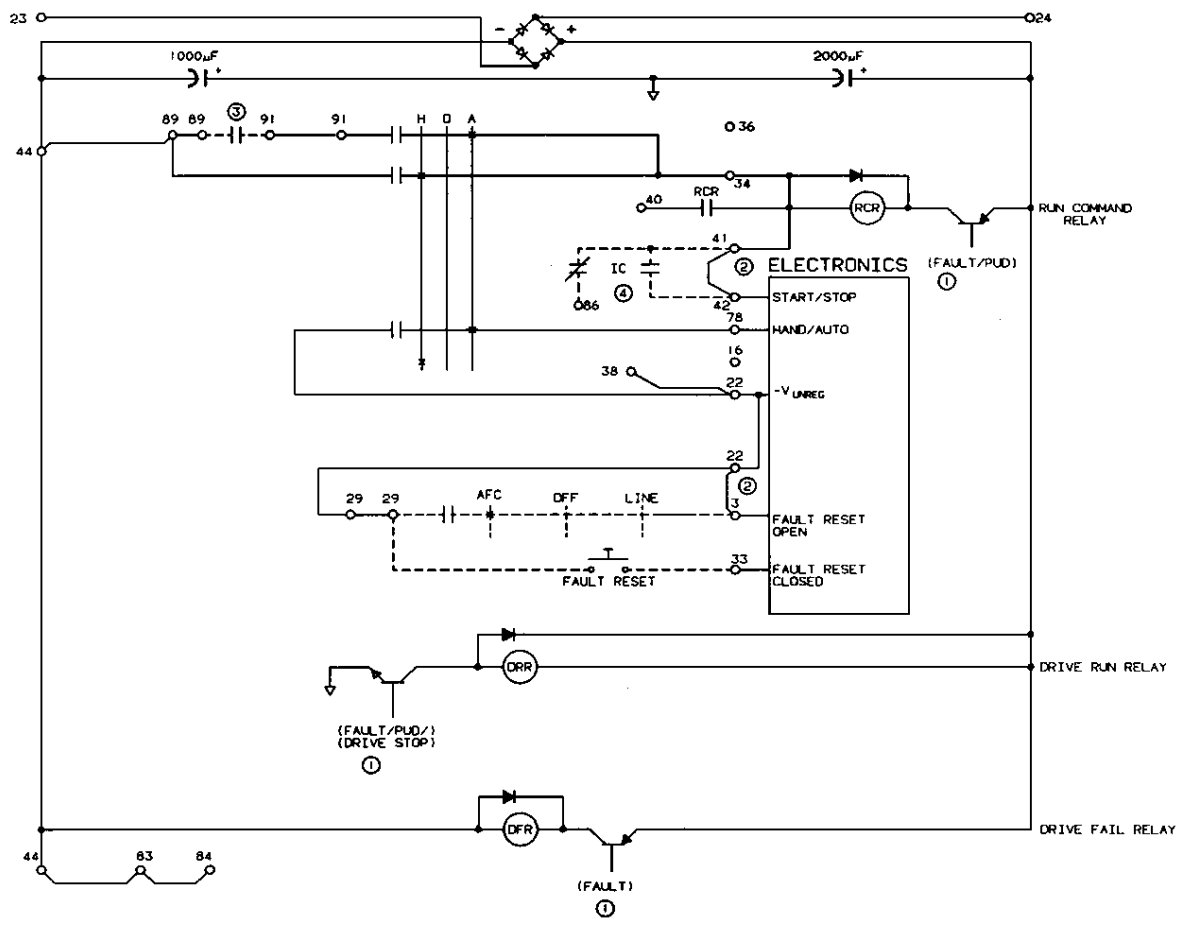
CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

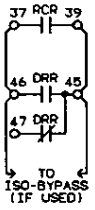
SQUARE D COMPANY

TITLE CONTROL CIRCUIT ELEMENTARY
MOD H10 HAND-OFF-AUTO
CLASS ____ TYPE ____ FORM ____ SER. ____ MASTER

11.2.4

SEE DRAWING 11.2.1





① TRANSISTOR IS OFF WHEN CONDITION(S) INDICATED ARE TRUE.
② REMOVE JUMPER WHEN BYPASS IC IS USED
③ SUPPLIED BY OTHERS. CLOSES TO RUN IN AUTO MODE.
④ LOCATED IN ISO-BYPASS OR ISOLATION MODULE (IF USED)

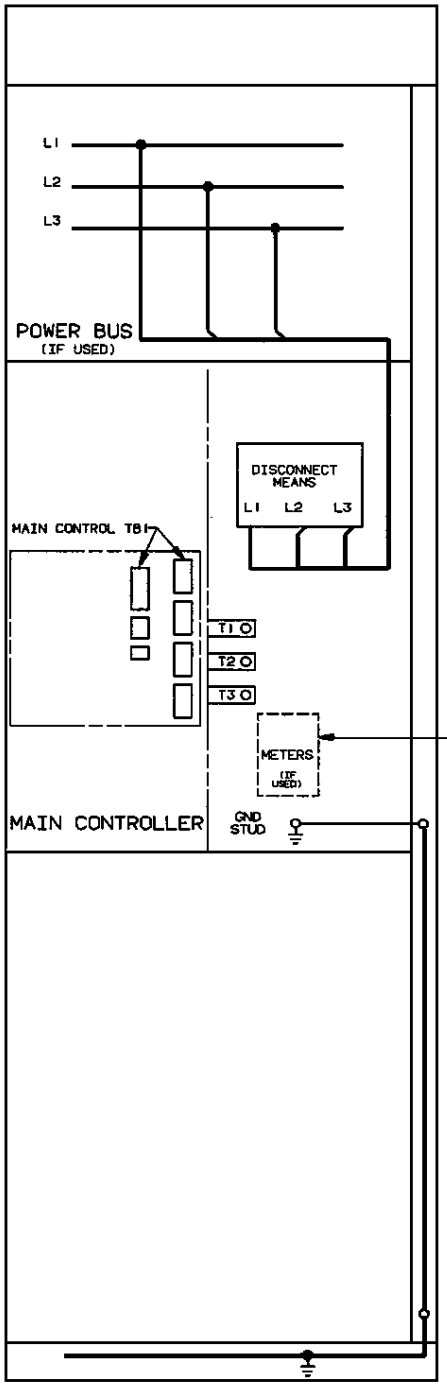
REFERENCE	8804-7.6
NEXT ASSEM	
PROJ. NO.	

DATE ENG.	11-86
DRN.	
CHD	
APPD.	
DATE REL.	
ENG. NO.	
SHEET	OF

BY	DATE	REV'D	REVISION DESCRIPTION

98-11-9

AA3



NOTES:

1) FOR METER CONNECTIONS REFER TO DWG. 11.7.1

2) ALL DEVICES SHOWN WITH DASHED LINES ARE TO BE WIRED PER DIAGRAM, IF USED.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE OMEGAPAK 3500 CONT. 60-125 H.P.
WITH DISCONNECT

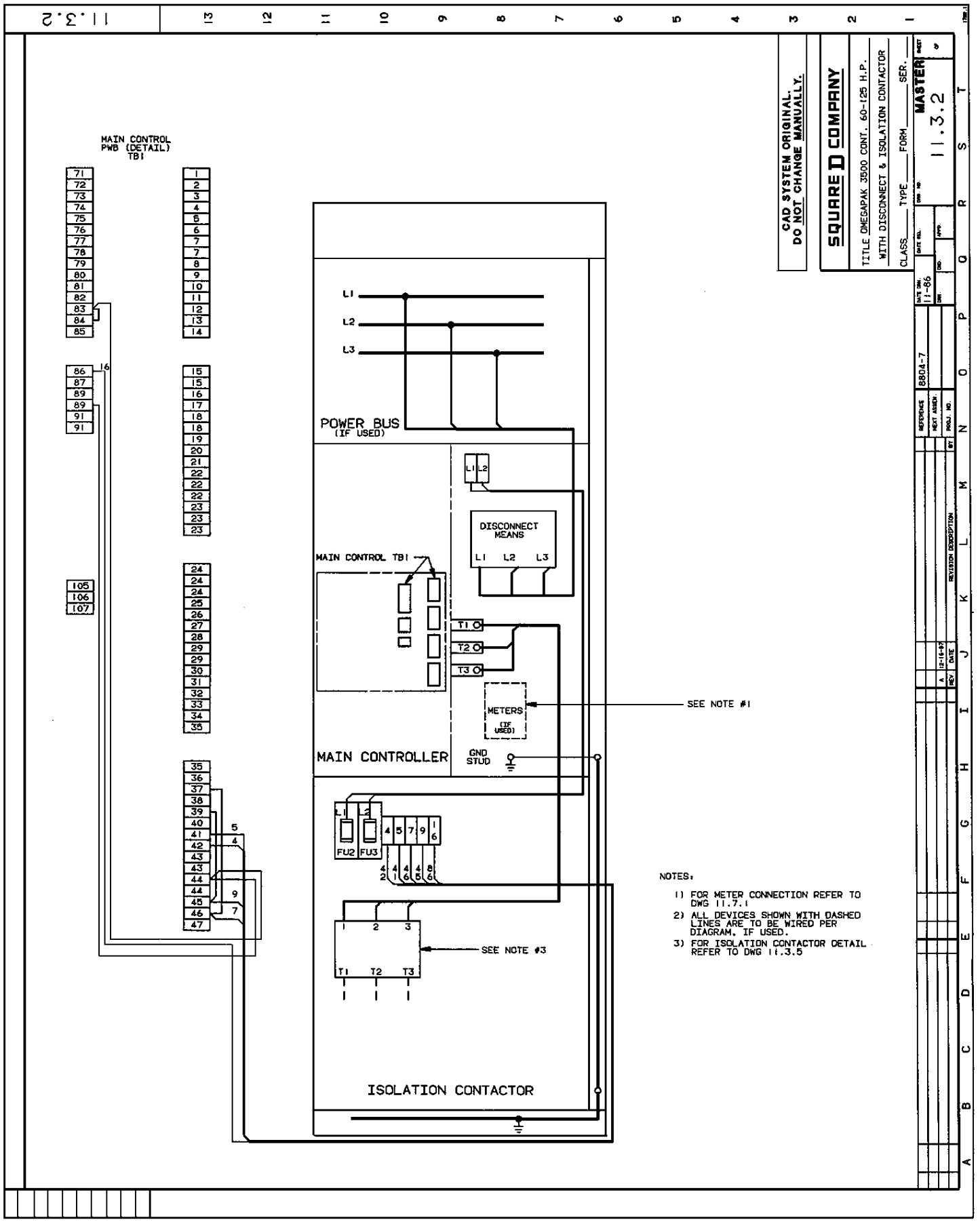
CLASS ____ TYPE ____ FORM ____ SER. ____

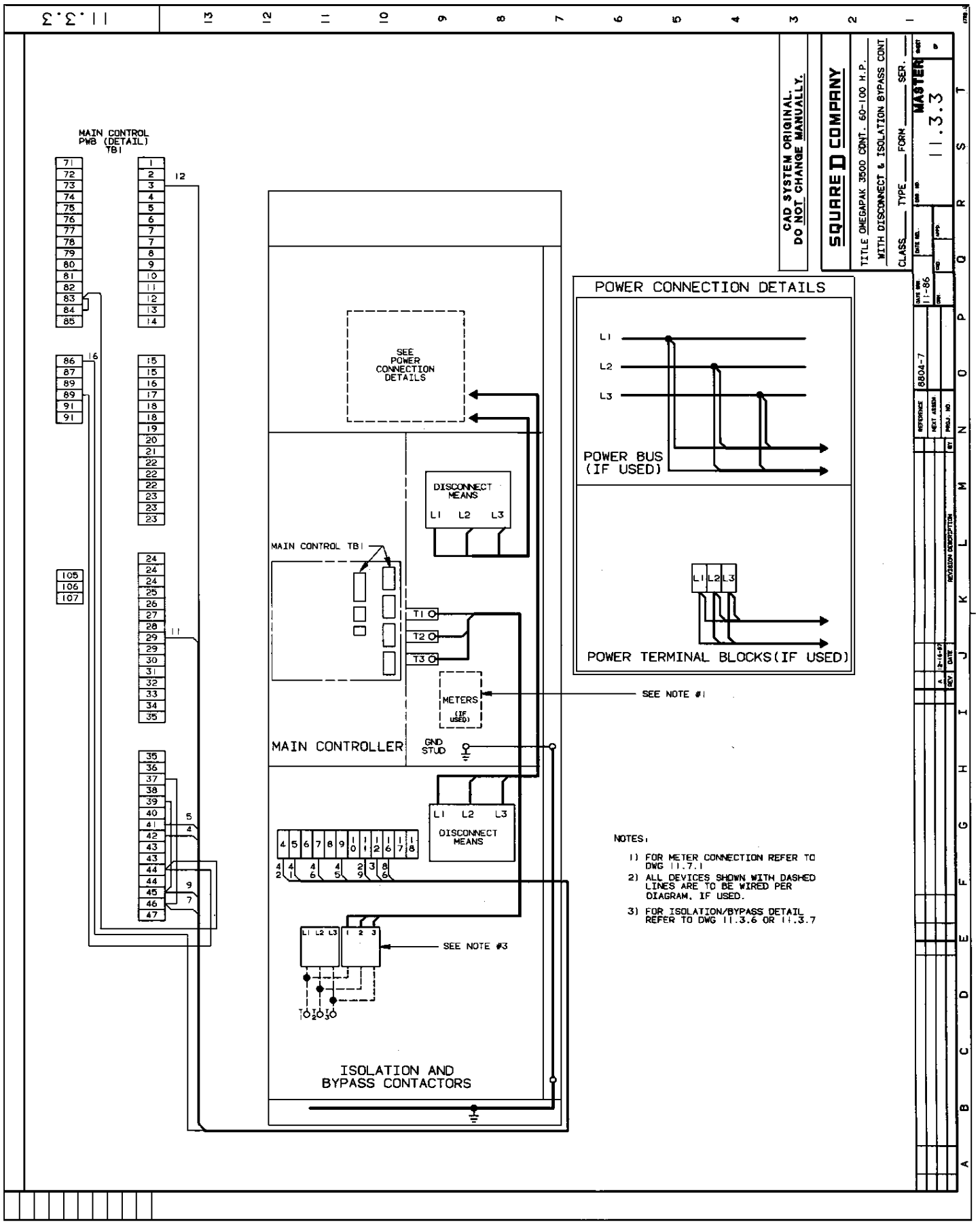
MASTER

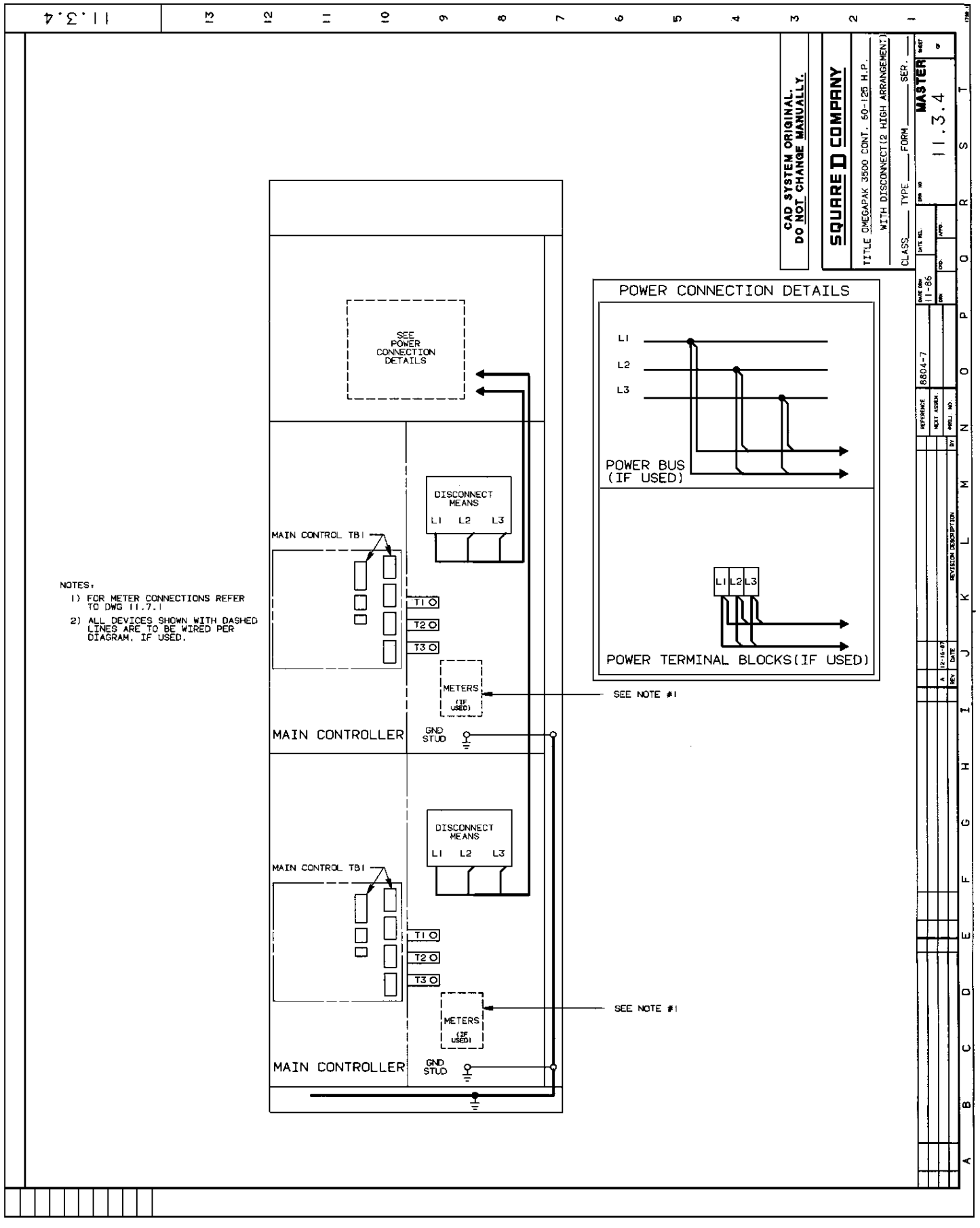
11.3.1

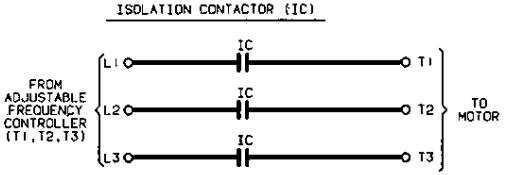
DATE ISS. 11-86

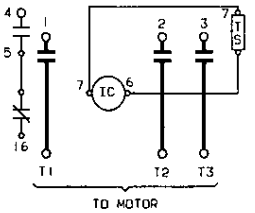
8804-7

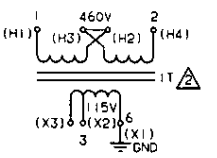

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.
SQUARE D COMPANY
TITLE OMEGAPAK 3500 CONT. 60-125 H.P.
WITH DISCONNECT & ISOLATION CONTACTOR
CLASS TYPE FORM SER.
MASTER
11.3.2
MAIN CONTROL PWB (DETAIL) TB1
POWER BUS (IF USED)
L1
L2
L3
DISCONNECT MEANS
MAIN CONTROL TB1
T1
T2
T3
METERS (IF USED)
SEE NOTE #1
MAIN CONTROLLER
GND STUD
FU2
FU3
SEE NOTE #3
ISOLATION CONTACTOR
NOTES:
1) FOR METER CONNECTION REFER TO DWG 11.7.1
2) ALL DEVICES SHOWN WITH DASHED LINES ARE TO BE WIRED PER DIAGRAM. IF USED.
3) FOR ISOLATION CONTACTOR DETAIL REFER TO DWG 11.3.5

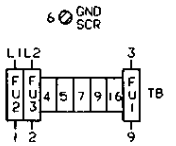

MAIN CONTROL PWB (DETAIL) TB1
SEE POWER CONNECTION DETAILS
DISCONNECT MEANS
L1 L2 L3
MAIN CONTROL TB1
T1
T2
T3
METERS (IF USED)
SEE NOTE #1
MAIN CONTROLLER
GND STUD
OISCONNECT MEANS
SEE NOTE #3
ISOLATION AND BYPASS CONTACTORS
POWER CONNECTION DETAILS
POWER BUS (IF USED)
POWER TERMINAL BLOCKS(IF USED)
NOTES:
1) FOR METER CONNECTION REFER TO DWG 11.7.1
2) ALL DEVICES SHOWN WITH DASHED LINES ARE TO BE WIRED PER DIAGRAM, IF USED.
3) FOR ISOLATION/BYPASS DETAIL REFER TO DWG 11.3.6 OR 11.3.7
CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.
SQUARE D COMPANY
TITLE OMEGAPAK 3500 CONT. 60-100 H.P. WITH DISCONNECT & ISOLATION BYPASS CONT
CLASS TYPE FORM SER.
MASTER
11.3.3
6804-7
11-86
12-14-87
A

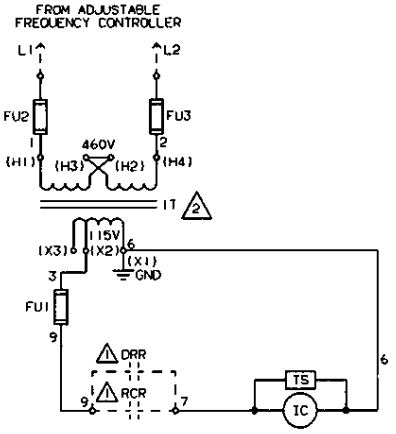

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.
SQUARE D COMPANY
TITLE OMEGAPAK 3500 CONT. 60-125 H.P.
WITH DISCONNECT(2 HIGH ARRANGEMENT)
CLASS ____ TYPE ____ FORM ____ SER. ____
MASTER
11.3.4
POWER CONNECTION DETAILS
L1
L2
L3
POWER BUS
(IF USED)
L1 L2 L3
POWER TERMINAL BLOCKS(IF USED)
SEE
POWER
CONNECTION
DETAILS
DISCONNECT
MEANS
L1 L2 L3
MAIN CONTROL TB1
T1
T2
T3
METERS
(IF
USED)
SEE NOTE #1
MAIN CONTROLLER
GND
STUD
NOTES:
1) FOR METER CONNECTIONS REFER TO DWG 11.7.1
2) ALL DEVICES SHOWN WITH DASHED LINES ARE TO BE WIRED PER DIAGRAM, IF USED.



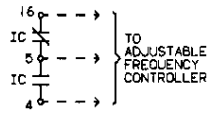








WIRE TABLE		
WIRE NO	SIZE AND COLOR	DEVICE DESIGNATION
1	16 GA RED	IT,FU2
2		IT,FU3
3		IT,FU1
4		IC,TB
5		IC,TB
6		GND SCR,IT,IC
7		IC,TB
9		FU1,TB
16		IC,TB



TRANSFORMER CONNECTIONS			
SOURCE VOLTAGE	PRIMARY INPUT	SECONDARY OUTPUT	JUMPER
440/460/480	H1 TO H4	X1 TO X2	H2 TO H3
220/230/240	H1 TO H4	X1 TO X2	H1 TO H3, H2 TO H4
192/200/208	H1 TO H4	X1 TO X3	H1 TO H3, H2 TO H4

NOTES:

1. LOCATED IN ADJUSTABLE FREQUENCY CONTROLLER

( ) INDICATES TERMINAL NUMBER ON DEVICE

2. 460V TRANSFORMER CONNECTIONS SHOWN. FOR OTHER VOLTAGES, SEE TRANSFORMER CONNECTION TABLE

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE ISOLATION CONTACTOR

CLASS 8804 TYPE ____ FORM ____ SER. ____

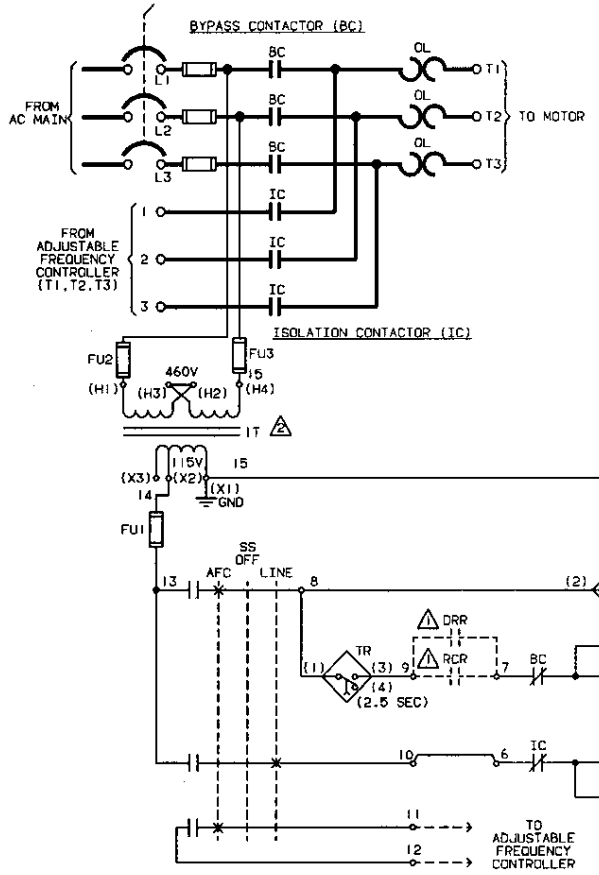
REV.	DATE	REVISION DESCRIPTION	BY
A	10-6-86		

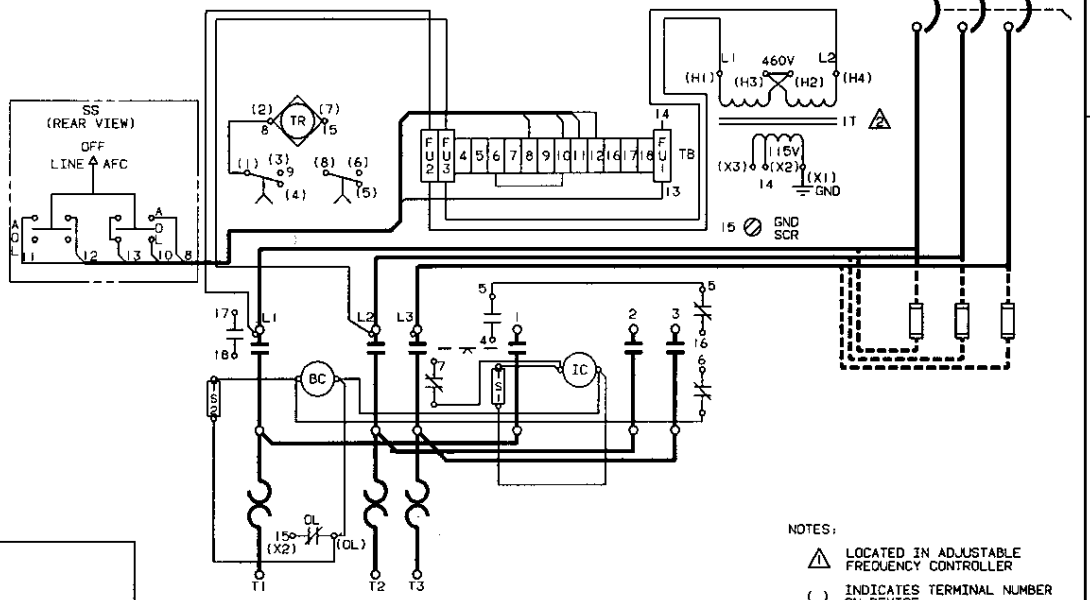
REFERENCE 8804-3.7
NEXT ASSEM.
PROJ. NO.
DATE DRN. 6-85
DRN. CHD. APPD.
DWG. NO. 11.3.5
MASTER
SHEET OF

11.5.1

A B C D E F G H I J K L M N O P Q R S T

1 2 3 4 5 6 7 9 10 11 12 13





NOTES:

1. LOCATED IN ADJUSTABLE FREQUENCY CONTROLLER
2. 460V TRANSFORMER CONNECTIONS SHOWN. FOR OTHER VOLTAGES, SEE TRANSFORMER CONNECTION TABLE.

( ) INDICATES TERMINAL NUMBER ON DEVICE

TRANSFORMER CONNECTIONS

SOURCE VOLTAGE	PRIMARY INPUT	SECONDARY OUTPUT	JUMPER
440/460/480	H1 TO H4	X1 TO X2	H2 TO H3
220/230/240	H1 TO H4	X1 TO X2	H1 TO H3, H2 TO H4
192/200/208	H1 TO H4	X1 TO X3	H1 TO H3, H2 TO H4

WIRE TABLE

WIRE NO	SIZE AND COLOR	DEVICE DESIGNATION
1 2 3		EXISTING NUMBERS ON IC AND BC
4	16 GA RED	IC,TB
5		IC,TB
6		IC,TB
7		BC,TB
8		TR,TB,SS
9		TR,TB
10		TB,SS
11		TB,SS
12		TB,SS
13		FU1,SS
14		IT,FU1
15		GND SCR,IT,TR,OL
16		IC,TB
17		BC,TB
18		BC,TB

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

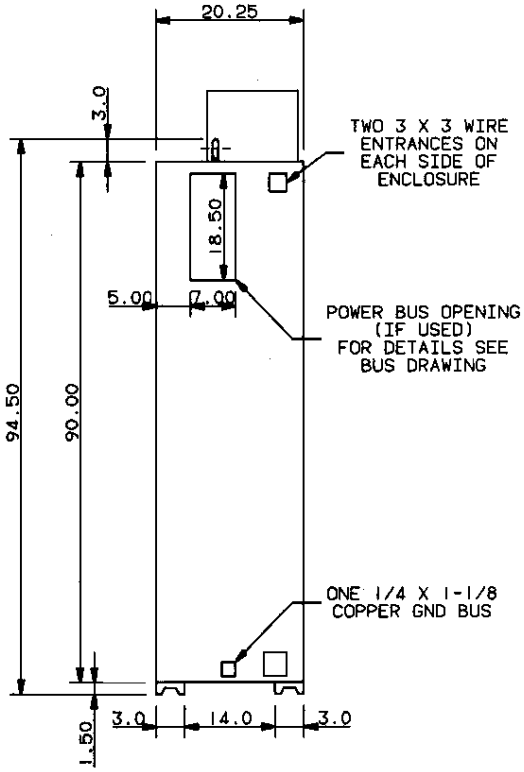
TITLE BY-PASS AND ISOLATION CONTACTORS

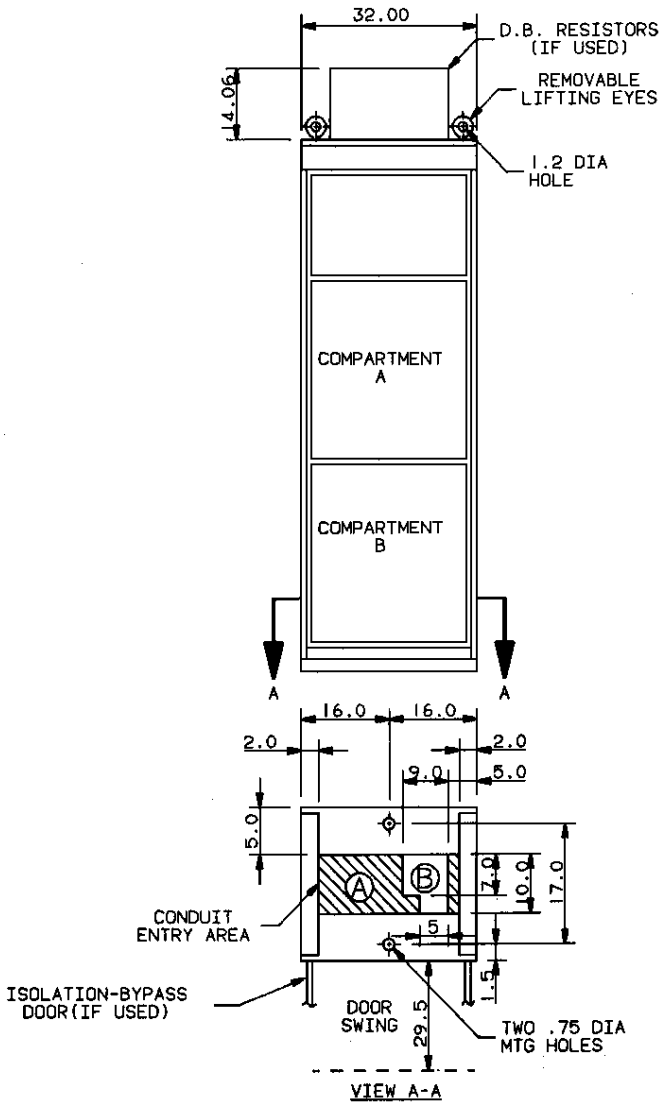
CLASS 8804 TYPE ____ FORM ____ SER. ____

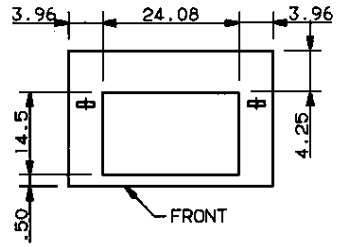
REV.	DATE	REVISION DESCRIPTION	BY

REFERENCE 8804-3.7
NEXT ASSEM.
PROJ. NO.
DATE DRN. 6-85
DATE REL.
DRN. CKD. APPD.
DWG. NO. MASTER 11.3.6
SHEET

11.3.6







TOP VIEW

CONDUIT ENTRY AREA	EQUIPMENT IN BOTTOM COMPARTMENT
Ⓑ	ADJ. FREQUENCY CONTROLLER
Ⓐ & Ⓑ	ISOLATION - BYPASS CONTACTORS

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE OMEGAPAK 3500 CONTROLLER
OUTLINE DRAWING

CLASS ____ TYPE ____ FORM ____ SER. ____

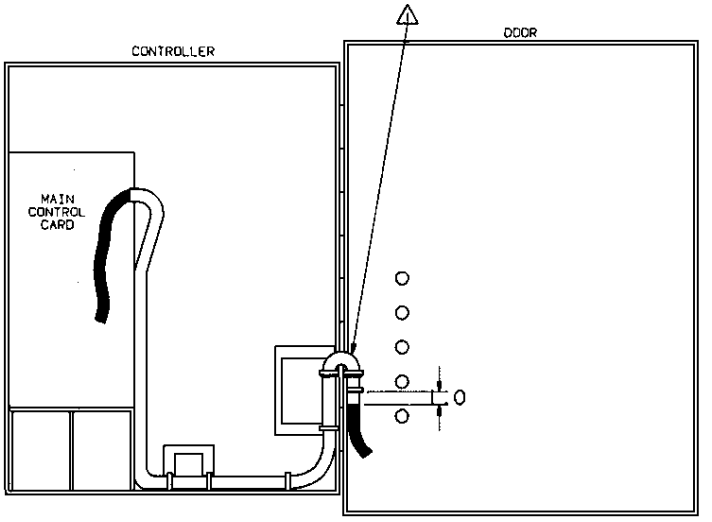
REV.	DATE	REVISION DESCRIPTION	BY

REF. 8804-3.7
NEXT ASSEM
PROJ. NO.
DATE DRN. 6-85
DRN.
CHD.
APP'D
DATE REL.
DRG. NO. MASTER 11.3.7
SHEET OF

11.3.7

NOTES:
ATTACH TIE ANCHORS USING EXISTING HARDWARE.
USE CABLE TIES TO SECURE LOOSE WIRES AFTER CONNECTIONS ARE MADE.

⚠ USE WIRE SLEEVING TO PROTECT CONTROL WIRES WHICH CROSS OVER HINGE.



CABLE ROUTING

GENERAL NOTES :

1. LIGHTS AND SWITCHES (WHEN USED) ARE TO BE ARRANGED IN FOLLOWING ORDER WITH THE UNUSED PORTION BEING AT THE BOTTOM OF THE FRONT PANEL:
   POWER LIGHT, RUN LIGHT, DRIVE FAIL LIGHT, INCOMPLETE SEQUENCE LIGHT, FORWARD-REVERSE, RUN-JOG, MAN. SPEED, HAND-OFF-AUTO, HAND-AUTO, START, STOP, E-STOP.
2. MAXIMUM COMBINATION OF SWITCHES AND LIGHTS CANNOT EXCEED SEVEN (7).
3. TWELVE (12) CONDUCTOR UNSHIELED CABLE USED ON ALL CONFIGURATIONS. SEPARATE INDIVIDUAL WIRES USED WHEN MORE ARE REQUIRED.
4. ALL SWITCH AND PUSHBUTTON OPERATORS ARE TO BE ORIENTED WITH THEIR LOCATING NIBS TO THE RIGHT (REAR VIEW OF DOOR) WITH CONTACT BLOCKS MOUNTED ON TOPSIDE OF OPERATOR.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

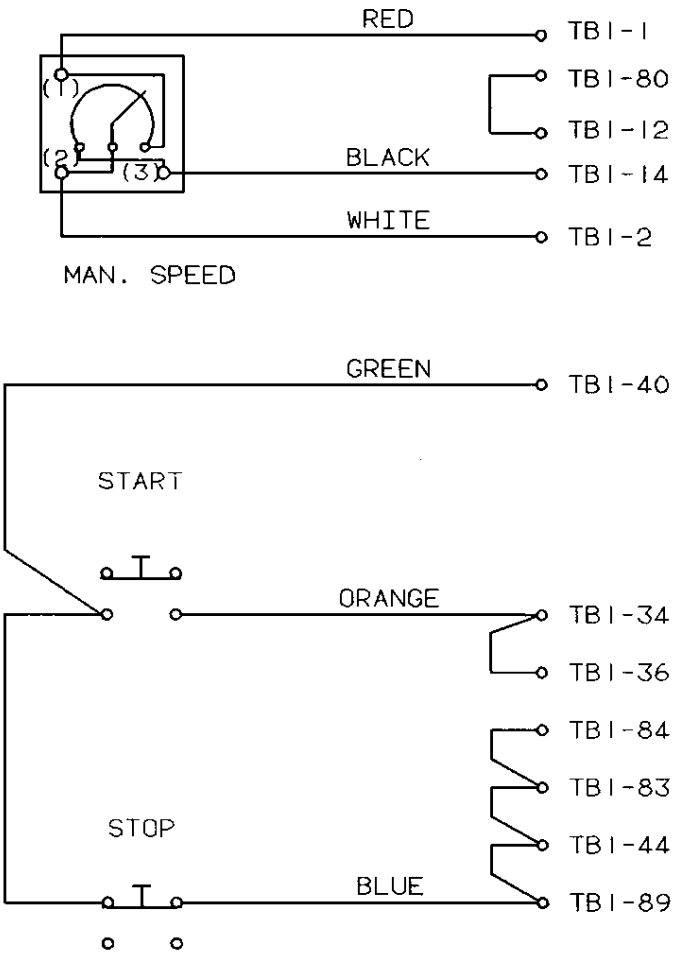
TITLE DOOR MOUNTED PILOT DEVICE
CABLE ROUTING
CLASS____ TYPE____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

REFERENCE 8803-3.7
NEXT ASSEM.
PROJ. NO.
DATE DRN. 6-85
DRN. CHD. APPD.
DWG. NO. MASTER 11.4.1
SHEET OF

11.4.1

A B C D E F G H I J K L M N O P Q R S T



MOD. NO. S10

CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM
START-STOP, MAN. SPD.

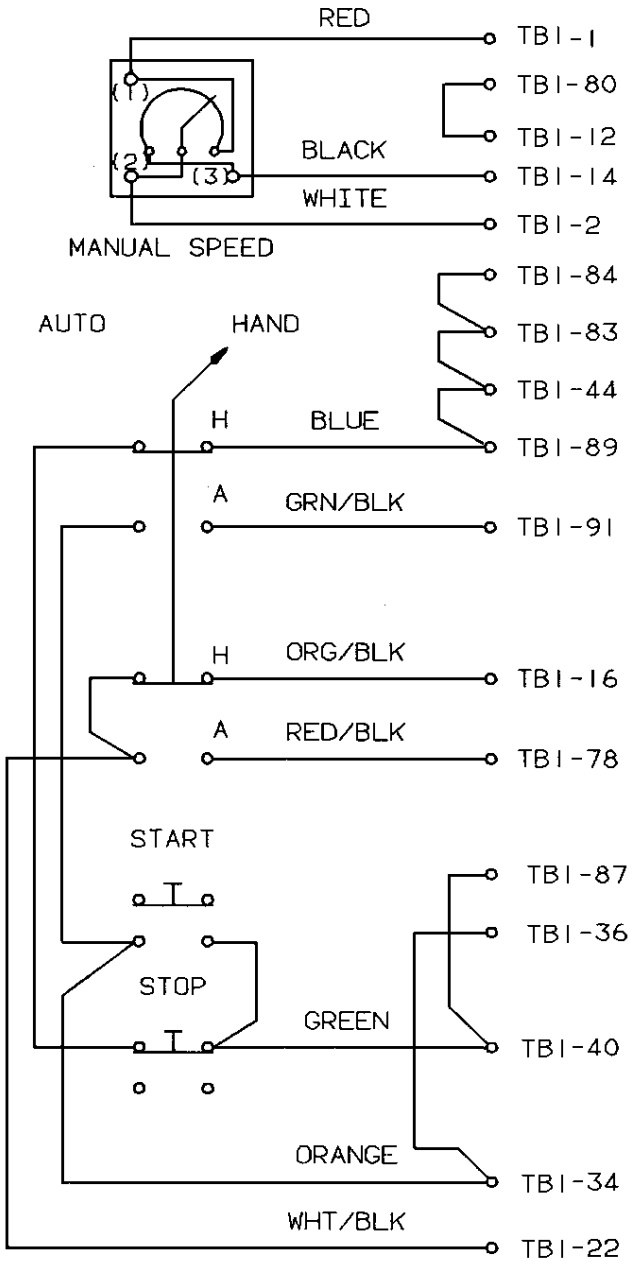
CLASS____ TYPE____ FORM____ SER.___

REF.	8804-7.6	DATE DRN. 11-86	DATE REL.	DRG. NO. MASTER 11.4.2	SHEET OF
NEXT ASSEM		DRN.	CKD.	APP'D	
PROJ. NO.					

REV.	DATE	REVISION DESCRIPTION	BY

SHEET 9F

DRG. NO. 11.4.2



MOD. NO. A10

CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM
HAND-AUTO,START-STOP,MAN. SPD

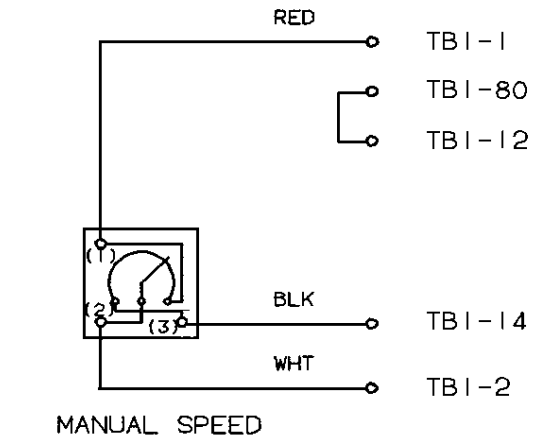
CLASS____ TYPE____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

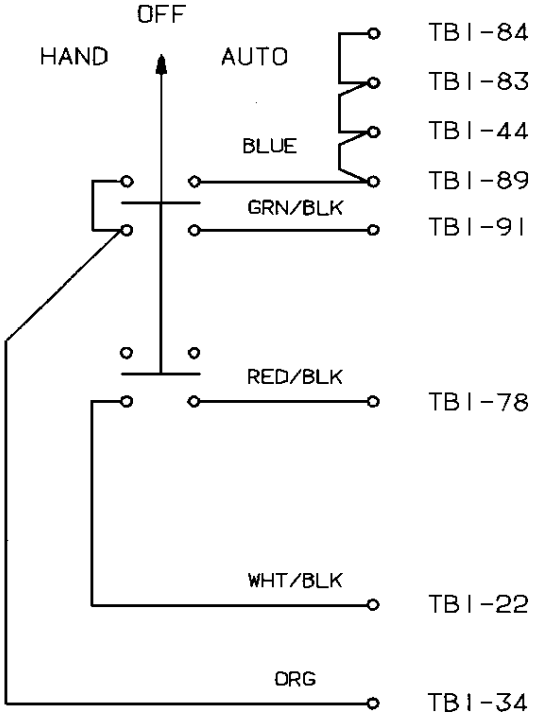
SHEET OF

DRG. NO. 11.4.3

REF.	8804-7.6	DATE DRN. 11-86	DATE REL.	DRG. NO.	MASTER	SHEET
NEXT ASSEM		DRN.	CKD. APP'D	11.4.3		OF
PROJ. NO.						



MANUAL SPEED



MOD. NO. H10

CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM
HAND-OFF-AUTO, MAN. SPEED

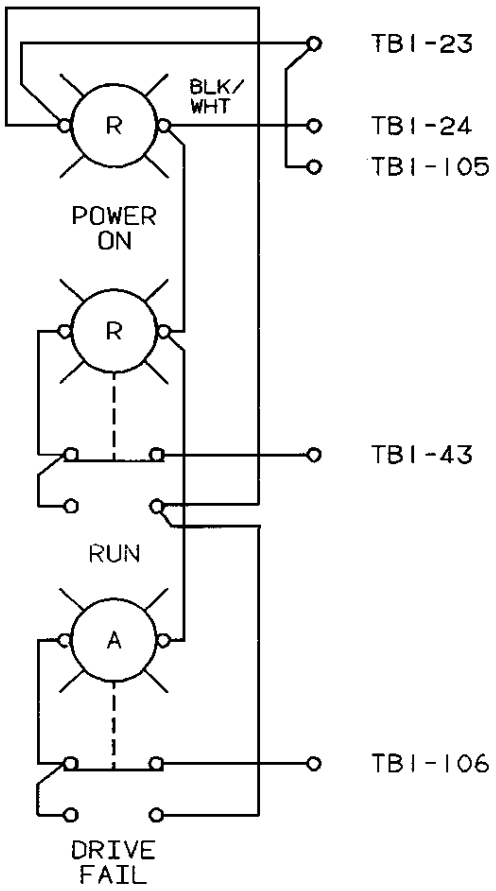
CLASS____ TYPE____ FORM_____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY

SHEET OF

DRG. NO. 11.4.4

REF.	8804-7.6	DATE DRN. 11-86	DATE REL.	DRG. NO. 11.4.4	MASTER
NEXT ASSEM		DRN.	CKD.	APP'D	SHEET OF
PROJ. NO.					



POWER ON -MOD. NO. P16
RUN -MOD. NO. R16
DRIVE FAIL -MOD. NO. F16

CAD SYSTEM ORIGINAL
DO NOT CHANGE MANUALLY.

REVISION DESCRIPTION | DATE | BY

REV.

SHEET 9 OF

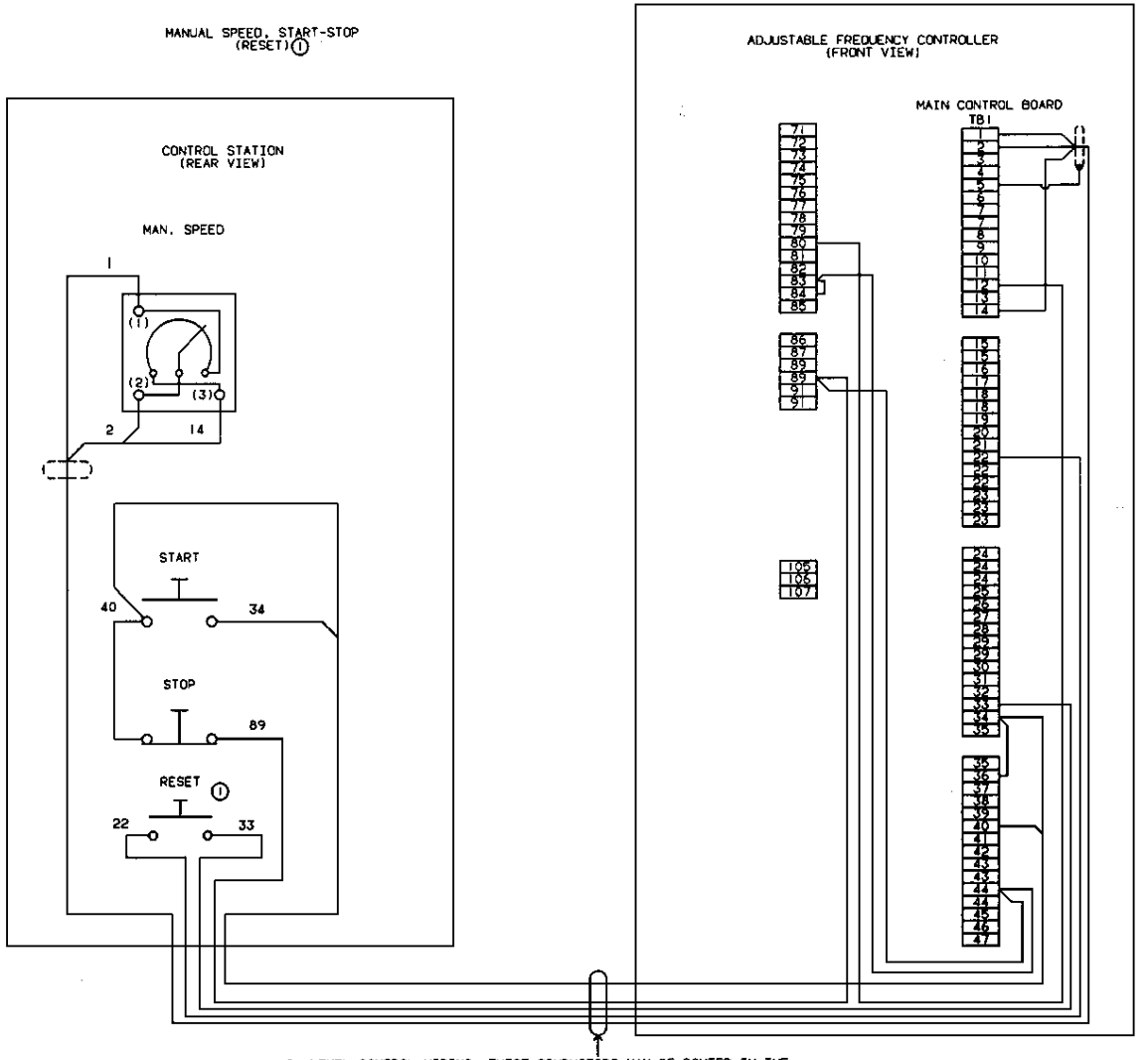
DRG. NO. 11.4.5

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM
DOOR MOUNTING PILOT LIGHTS

CLASS____ TYPE____ FORM_____ SER.___

REF.	8804-7.6	DATE DRN. 11-86	DATE REL.	DRG. NO.	MASTER	SHEET
NEXT ASSEM		DRN.	CKD.	APP'D	11.4.5	OF
PROJ. NO.						



LOW LEVEL CONTROL WIRING. THESE CONDUCTORS MAY BE ROUTED IN THE SAME RACEWAY. MAINTAIN 3" SEPARATION (CONDUIT) OR 12" SEPARATION (TRAY) FROM OTHER TYPES OF POWER OR CONROL WIRING. ALL CONDUCTORS TO BE #18 AWG MINIMUM. SHIELDED CABLE TO BE JACKETED. GROUND SHIELD ONLY WHERE SHOWN. INSULATE OTHER END OF SHIELDED CABLE.

① USED ON CA-31R CONTROL STATIONS ONLY.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM TYPE CA-31 &
CA-31R REMOTE OPERATOR STATION

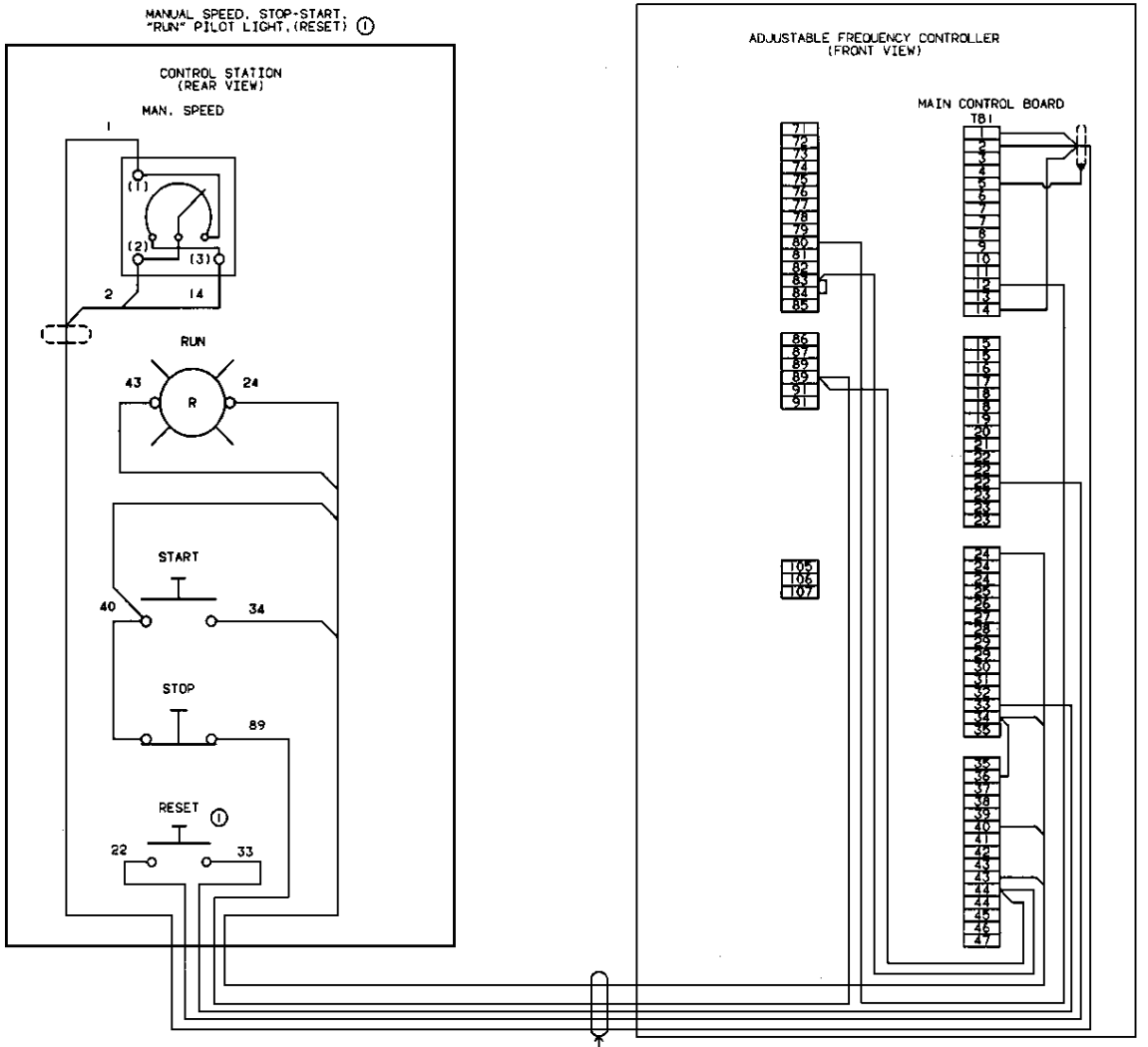
CLASS____ TYPE ____ FORM ____ SER. __

REV.	DATE	REVISION DESCRIPTION	BY
A	10-6-86		

REFERENCE 8804-7.6
NEXT ASSEM.
PROJ. NO.
DATE DRN. 11-86
DRN. DES. APPD.
DATE REL.
DRG. NO. MASTER 11.5.1
SHEET OF

11.5.1

1722.1



LOW LEVEL CONTROL WIRING. THESE CONDUCTORS MAY BE ROUTED IN THE SAME RACEWAY. MAINTAIN 3" SEPARATION (CONDUIT) OR 12" SEPARATION (TRAY) FROM OTHER TYPES OF POWER OR CONROL WIRING. ALL CONDUCTORS TO BE #18 AWG MINIMUM. SHIELDED CABLE TO BE JACKETED. GROUND SHIELD ONLY WHERE SHOWN. INSULATE OTHER END OF SHIELDED CABLE.

① USED ON CA-41R CONTROL STATIONS ONLY.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM TYPE CA-41 & CA-41R REMOTE OPERATOR STATION

CLASS____ TYPE____ FORM____ SER.____

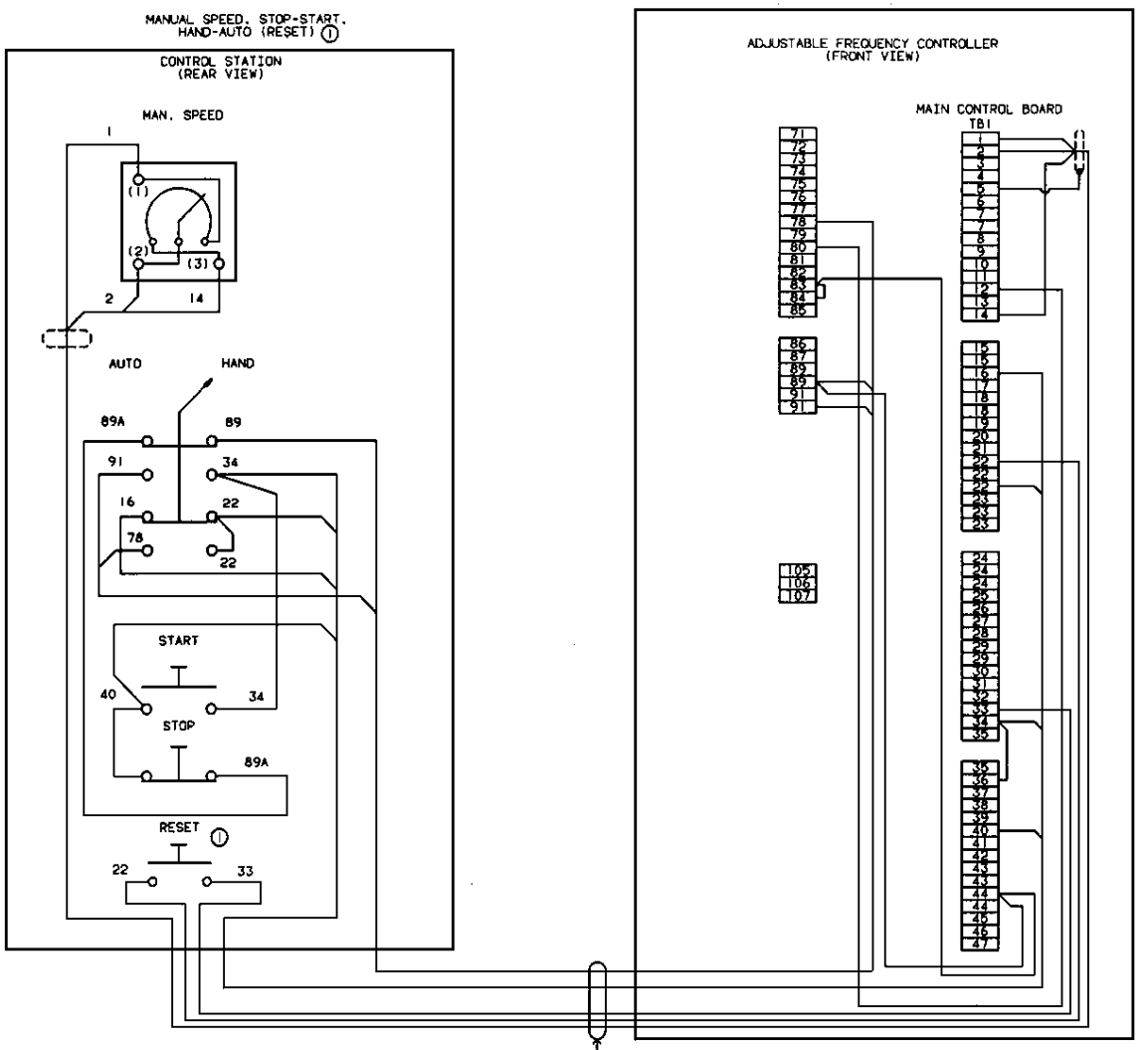
REV.	DATE	REVISION DESCRIPTION	BY
A	10-6-86		

REFERENCE 8804-7.6
NEXT ASSEM.
PROJ. NO.
DATE DRN. 11-86
DRN. CKD. APPD.
DWG. NO. MASTER 11.5.2
SHEET OF

11.5.2

A B C D E F G H I J K L M N O P Q R S T

1729.1



① USED ON CA-42R CONTROL STATIONS ONLY.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

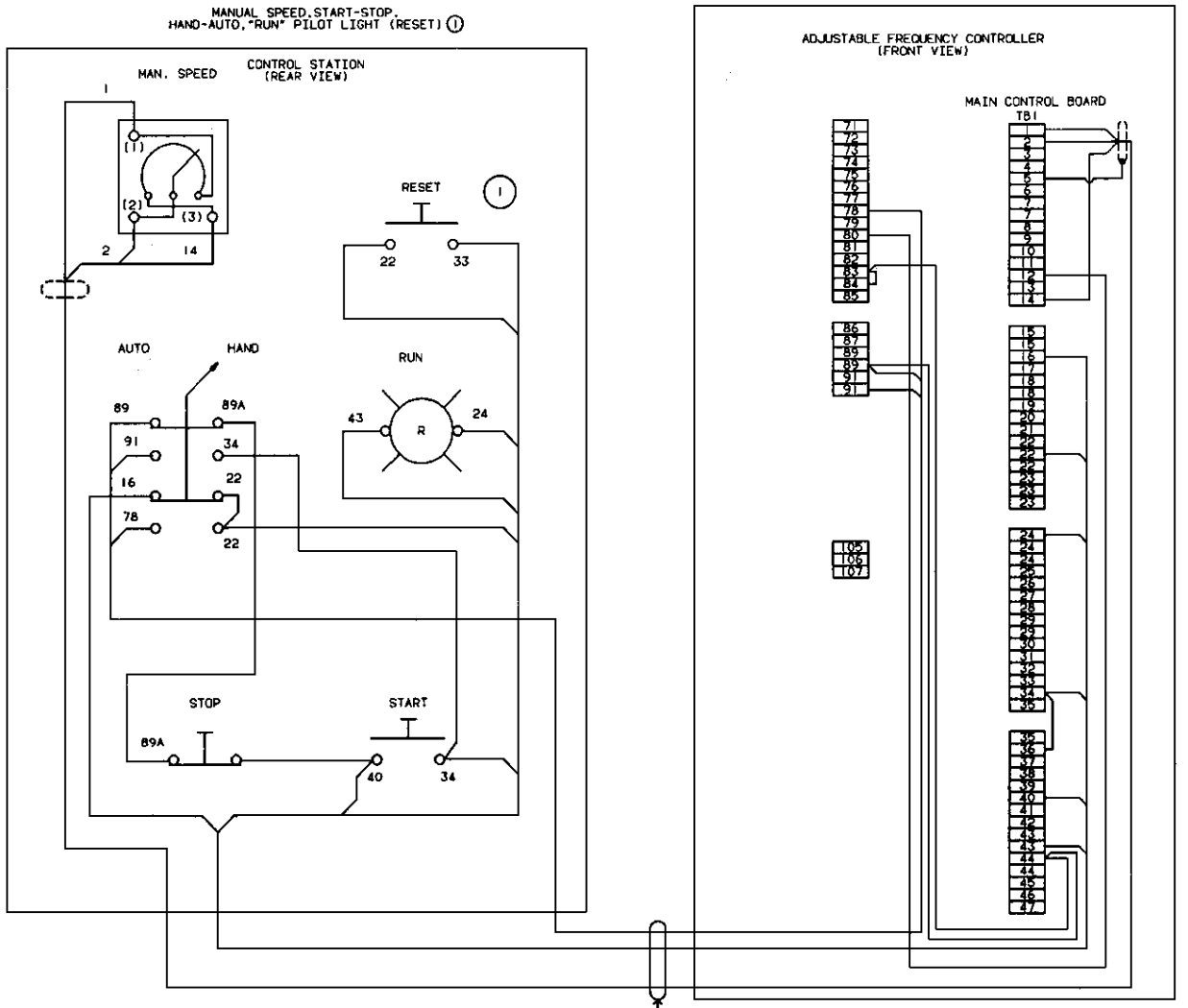
TITLE CONNECTION DIAGRAM TYPE CA-42 &
CA-42R REMOTE OPERATOR STATION

CLASS____ TYPE____FORM____ SER.___

REV.	DATE	REVISION DESCRIPTION	BY
A	10-6-86		

REFERENCE 8804-7.6
NEXT ASSEM.
PROJ. NO.
DATE DRN. 11-86
DRN. CKD. APPD.
DATE REV.
DRG. NO. MASTER 11.5.3
SHEET OF

11.5.3



LOW LEVEL CONTROL WIRING. THESE CONDUCTORS MAY BE ROUTED IN THE SAME RACEWAY. MAINTAIN 3" SEPARATION (CONDUIT) OR 12" SEPARATION (TRAY) FROM OTHER TYPES OF POWER OR CONROL WIRING. ALL CONDUCTORS TO BE #18 AWG MINIMUM. SHIELDED CABLE TO BE JACKETED. GROUND SHIELD ONLY WHERE SHOWN. INSULATE OTHER END OF SHIELDED CABLE.

① USED ON CA-65R CONTROL STATION ONLY.

CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE CONNECTION DIAGRAM TYPE CA-65 &
CA-65R REMOTE OPERATOR STATION

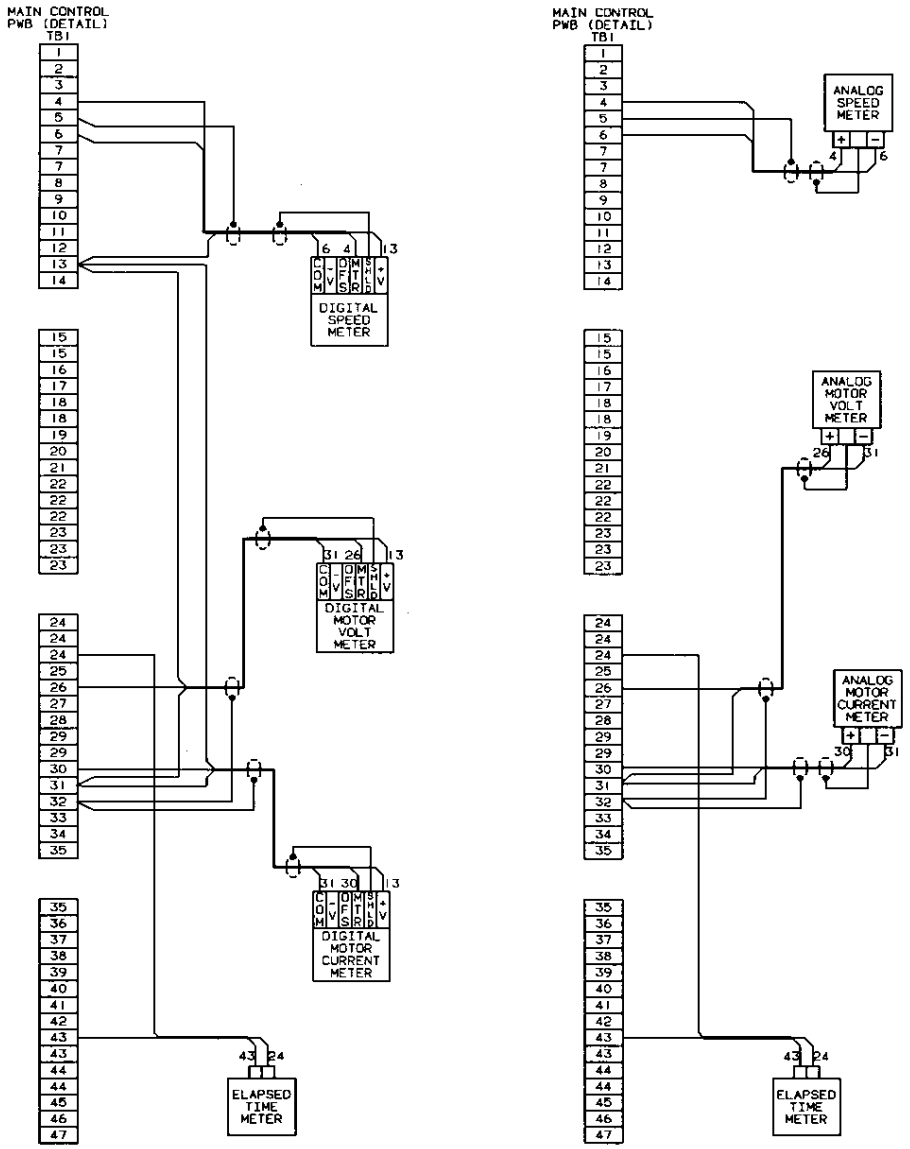
CLASS____ TYPE____ FORM____ SER.____

REV.	DATE	REVISION DESCRIPTION	BY
A	10-6-86		

REFERENCE 8804-7.6
NEXT ASSEM.
PROJ. NO.
DATE DRN. 11-86
DRN. CHD. APPD.
DWG. NO. MASTER 11.5.4
SHEET OF

11.5.4

A B C D E F G H I J K L M N O P Q R S T



CAD SYSTEM ORIGINAL.
DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE METER CONNECTION DIAGRAM

CLASS ____ TYPE ____ FORM ____ SER. ____

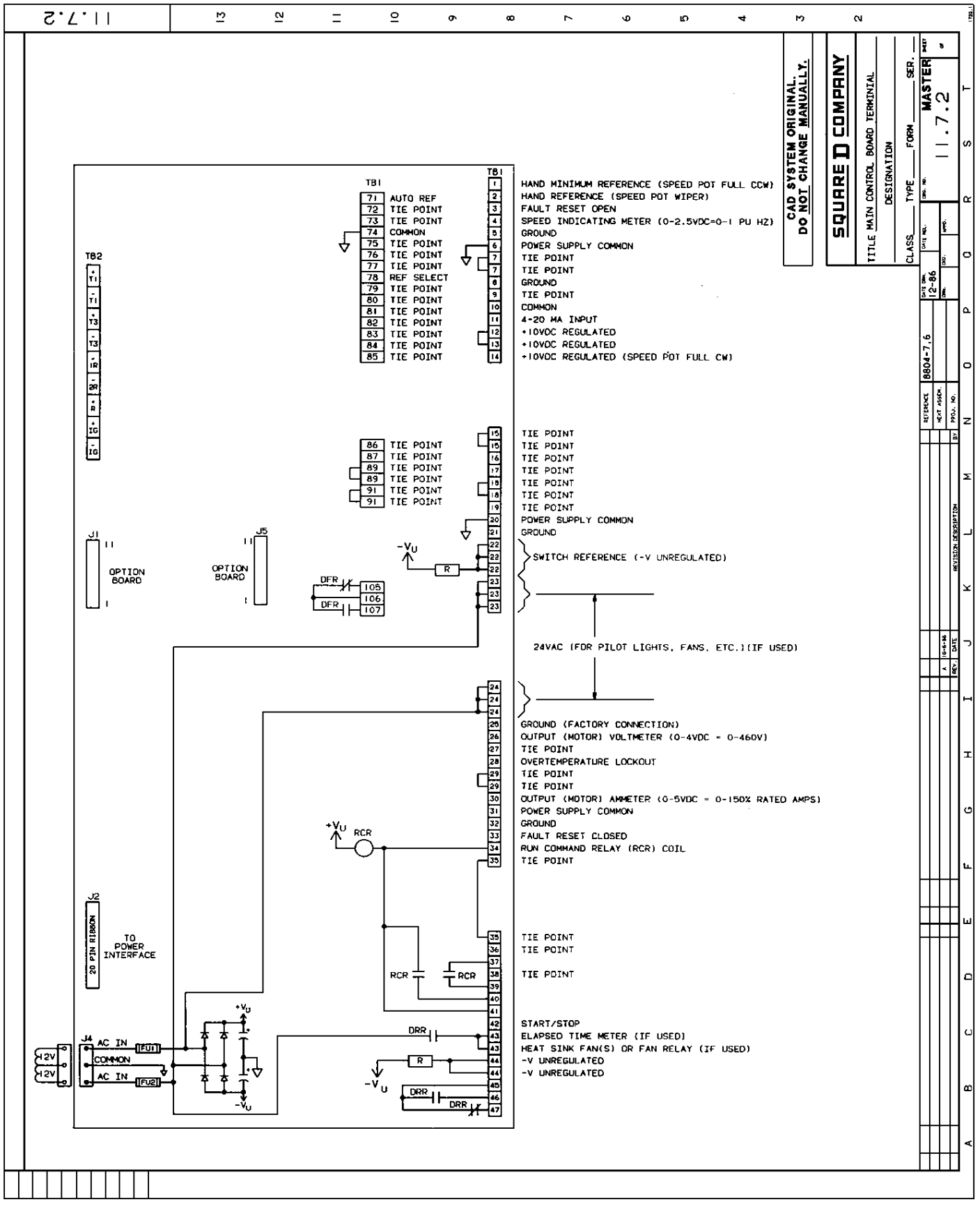
DWG. NO. MASTER 11.7.1 SHEET 1 OF 1

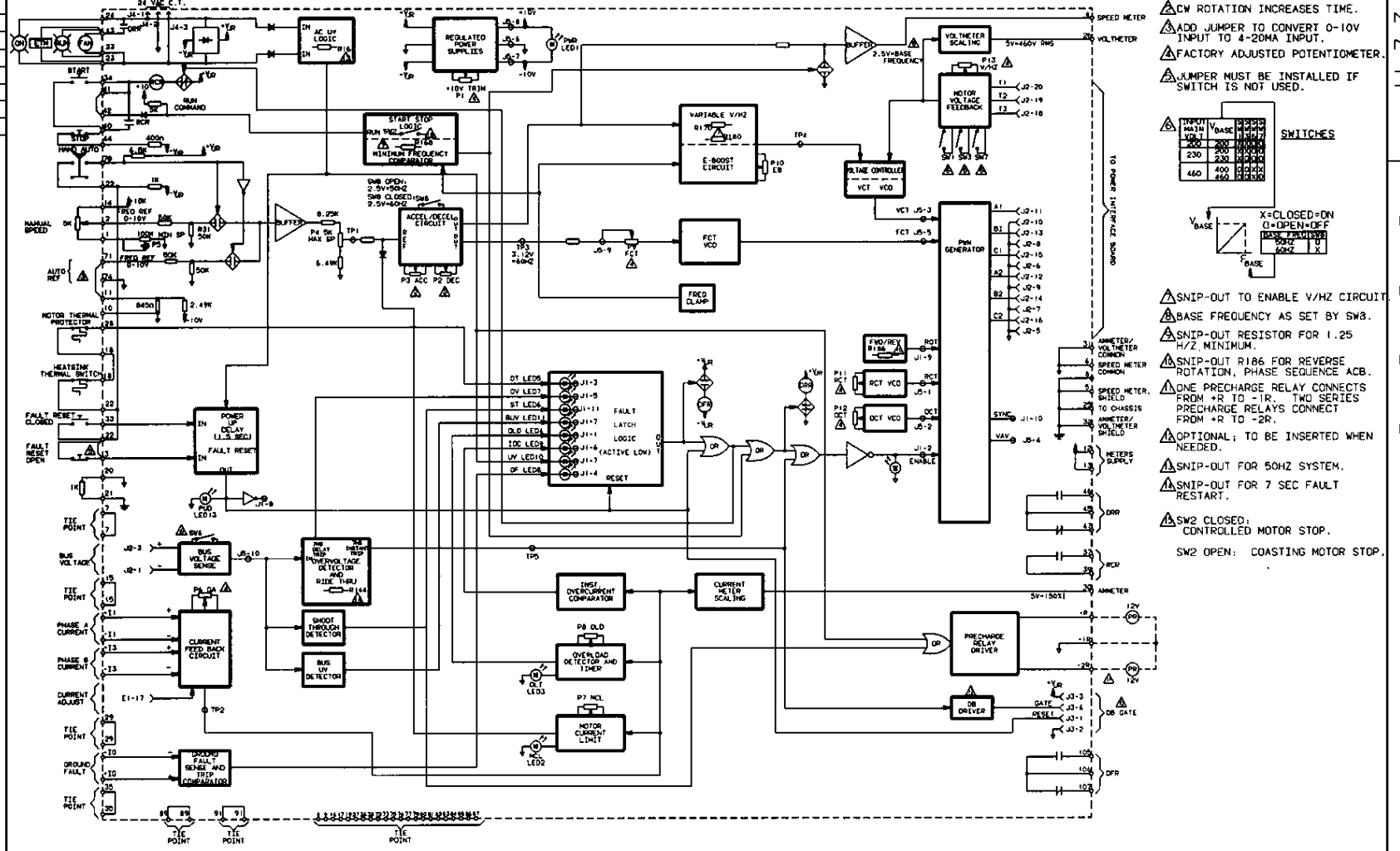
DATE DRN. 6-85 | DRN. | DES. | APPD. | DATE APPD.

REFERENCE 8804-3.11.7.6 | NEXT ASSEM. | PARTS LIST NO.

REV.	DATE	BY	REVISION DESCRIPTION
A	10-6-86		

11.7.1


CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.
SQUARE D COMPANY
TITLE MAIN CONTROL BOARD TERMINAL
DESIGNATION
CLASS ____ TYPE ____ FORM ____ SER. ____
MASTER
11.7.2
8804-7,6
12-86
TB1
TB2
71 AUTO REF
72 TIE POINT
73 TIE POINT
74 COMMON
75 TIE POINT
76 TIE POINT
77 TIE POINT
78 REF SELECT
79 TIE POINT
80 TIE POINT
81 TIE POINT
82 TIE POINT
83 TIE POINT
84 TIE POINT
85 TIE POINT
HAND MINIMUM REFERENCE (SPEED POT FULL CCW)
HAND REFERENCE (SPEED POT WIPER)
FAULT RESET OPEN
SPEED INDICATING METER (0-2.5VDC=0-1 PU HZ)
GROUND
POWER SUPPLY COMMON
TIE POINT
TIE POINT
GROUND
TIE POINT
COMMON
4-20 MA INPUT
+10VDC REGULATED
+10VDC REGULATED
+10VDC REGULATED (SPEED POT FULL CW)
86 TIE POINT
87 TIE POINT
89 TIE POINT
89 TIE POINT
91 TIE POINT
91 TIE POINT
TIE POINT
TIE POINT
TIE POINT
TIE POINT
TIE POINT
TIE POINT
TIE POINT
POWER SUPPLY COMMON
GROUND
J1
J5
OPTION BOARD
OPTION BOARD
-VU
R
DFR
DFR
105
106
107
SWITCH REFERENCE (-V UNREGULATED)
24VAC (FOR PILOT LIGHTS, FANS, ETC.)(IF USED)
GROUND (FACTORY CONNECTION)
OUTPUT (MOTOR) VOLTMETER (0-4VDC = 0-460V)
TIE POINT
OVERTEMPERATURE LOCKOUT
TIE POINT
TIE POINT
OUTPUT (MOTOR) AMMETER (0-5VDC = 0-150% RATED AMPS)
POWER SUPPLY COMMON
GROUND
FAULT RESET CLOSED
RUN COMMAND RELAY (RCR) COIL
TIE POINT
+VU
RCR
J2
20 PIN RIBBON
TO POWER INTERFACE
TIE POINT
TIE POINT
RCR
RCR
TIE POINT
START/STOP
ELAPSED TIME METER (IF USED)
HEAT SINK FAN(S) OR FAN RELAY (IF USED)
-V UNREGULATED
-V UNREGULATED
DRR
R
-VU
DRR
DRR
J4
AC IN
FU1
COMMON
AC IN
FU2
12V
12V
+VU
-VU



CW ROTATION INCREASES TIME.

ADD JUMPER TO CONVERT 0-10V INPUT TO 4-20MA INPUT.

FACTORY ADJUSTED POTENTIOMETER.

JUMPER MUST BE INSTALLED IF SWITCH IS NOT USED.

INPUT MAIN VOLT	V_{BASE}	SW5	SW6	SW7
200	200	X	X	X
230	230	X	X	X
460	400	X	X	X
	460	X	X	X

SWITCHES

X=CLOSED=ON
O=OPEN=OFF

BASE FREQUENCY	SW3	SW4
50HZ	O	O
60HZ	O	X

SNIP-OUT TO ENABLE V/HZ CIRCUIT.

BASE FREQUENCY AS SET BY SW3.

SNIP-OUT RESISTOR FOR 1.25 H/Z MINIMUM.

SNIP-OUT R186 FOR REVERSE ROTATION, PHASE SEQUENCE ACB.

ONE PRECHARGE RELAY CONNECTS FROM +R TO -1R. TWO SERIES PRECHARGE RELAYS CONNECT FROM +R TO -2R.

OPTIONAL; TO BE INSERTED WHEN NEEDED.

SNIP-OUT FOR 50HZ SYSTEM.

SNIP-OUT FOR 7 SEC FAULT RESTART.

SW2 CLOSED; CONTROLLED MOTOR STOP.

SW2 OPEN: COASTING MOTOR STOP.

POTENTIOMETERS			
COMP	FUNCTION	VALUE	DESIGNATION
*P1	+10V SUPPLY ADJUST	1K	+10 P1
P2	DECELERATION	10K	DEC P2
P3	ACCELERATION	10K	ACC P3
P4	MAX SPEED ADJUST	5K	MSD P4
P5	HAND MINIMUM REF	100K	HMR P5
*P6	CURRENT GAIN ADJUST	1K	GA P6
P7	MOTOR CURRENT LIMIT	5K	MCL P7
P8	OVERLOAD ADJUST	10K	OLD P8
*P9	FREQ CLOCK ADJUST	5K	FCY P9
P10	VOLTAGE BOOST	5K	EB P10
*P11	MAX SWITCH FREQ	50K	RCT P11
*P12	INTERLOCK DELAY	50K	OCT P12
*P13	V/HZ ADJUST	10K	VHZ P13

*POTENTIOMETERS FACTORY ADJUSTED AND SEALED.

LED'S		
COMP	FUNCTION	DESIGNATION
LED1	POWER	PWR
LED2	MOTOR CURRENT LIMIT	CL
LED3	OVERLOAD TIMER	OLT
LED4	OVERLOAD TRIP	OLD
LED5	OVER TEMPERATURE	OT
LED6	SHOOT THROUGH	ST
LED7	OVER VOLTAGE	OV
LED8	GROUND FAULT	GF
LED9	OVER CURRENT	IOC
LED10	AC UNDERVOLTAGE	UV
LED11	BUS UNDERVOLTAGE	BUV
LED12	DRIVE ENABLE	DE
LED13	POWER UP DELAY	PUD

TEST POINTS	
COMP	DESIGNATION
TP1	SPEED REFERENCE
TP2	CURRENT FEEDBACK
TP3	FREQUENCY CLOCK REF
TP4	VOLTAGE CONTROLLER REF
TP5	OV LOCKOUT TIMER
TP6	OV 30SEC TIMER

CAD SYSTEM ORIGINAL. DO NOT CHANGE MANUALLY.

SQUARE D COMPANY

TITLE MAIN CONTROL BOARD
BLOCK DIAGRAM

CLASS____ TYPE____ FORM____ SER.__

REV.	DATE	REVISION DESCRIPTION	BY
A	10-6-86		

REFERENCE 8804-7.6
NEXT ASSEM.
PROJ. NO.
DATE DRN. 12-86
DRN. CKD. APPD.
DATE REL.
DRG. NO. MASTER 11.7.3
SHEET OF

11.7.3

A B C D E F G H I J K L M N O P Q R S T

12.0 RENEWAL PARTS LIST

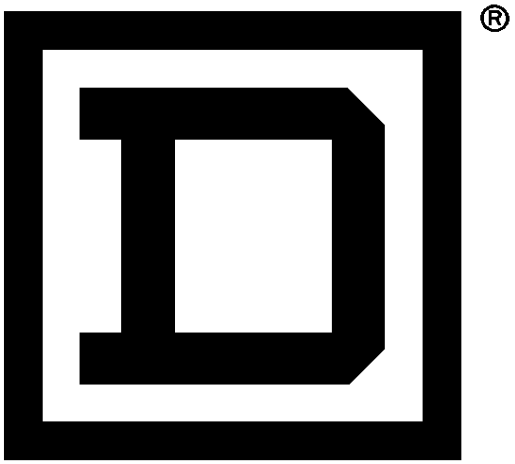
Description	Square D Part Number
Main Control Board	52011-395-50
Gate Driver Board	52011-003-50
Power Interface Board	52011-022-50
GTO (Thy 1 - Thy 6)	52915-030-5001
Rectifier Diode (D1-D6)	52914-024-50
Flyback Diode (D7-D14)	52914-028-52
Fuse (120V control, Primary — FU8, FU9) KTK-10	25419-10141
Fuse (120V control, Secondary — FU11) FRN-5	25413-00230
Fuse (Precharge Resistor — FU10) TRS 3	25428-00030
Fuse (24V Control, Primary — FU6, FU7) KTK-10	25419-10141
Fuse (Line-FU3-FU5) A50P300	25418-60300
Fuse (Main Control Board — FU1, FU2) MDL-5.0	25420-30500
DC Bus Capacitor	52904-018-50
Precharge Relay	52905-024-50
Precharge Contactor Coil	31074-40038

Snubber Assembly	60 HP Pt. No.	75 HP Pt. No.	100-125 HP Pt. No.
Plus Bus (3)	52011-241-52	52011-241-50	52011-241-50
Minus Bus (3)	52011-241-55	52011-241-54	52011-241-53

Isolation or Isolation/Bypass (If Used)

Control Transformer	Primary Fuses (FU2, FU3) KTK-10	Pt. No. 25419-10141
Control Transformer	Secondary Fuse (FU1) FNQ5	25419-60500

Contactor Coil	60-100 HP Pt. No.	125 HP Pt. No.
	31074-40038	31091-40038



Bulletin 8804-7 CS 5/87 10M

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