

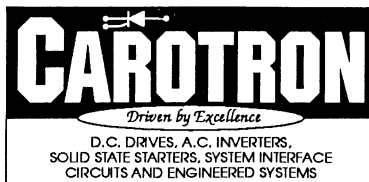


Instruction Manual

Models

E06020-000
E06040-000
E06060-000
E06075-000
E06100-000
E06125-000
E06150-000
E12020-000
E12040-000
E12060-000
E12075-000
E12100-000
E12125-000
E12150-000





3204 Rocky River Road
Heath Springs, SC 29058
Phone: (803) 286-8614
FAX: (803) 286-6063

Table of contents

1. General Description	5
2. Specifications	6
2.1 Electrical	6
2.2 Physical	7
3. Installation	7
3.1 Control Installation	7
3.2 Wiring Guidelines	8
4. Terminal Connections & Functions .8	
4.1 A.C. Power Connections and Fusing	8
4.2 Motor Connections	9
4.3 Operator Connections	10
4.4 Signal Wiring Connections	12
5 Programming & Adjustments	15
5.1 Programming Jumpers	15
5.2 Adjustment Potentiometers	17
5.3 DCM Checkpoints, Circuit Testpoints and Buffered Outputs	19
6. Start-up Procedure	20
6.1 Adjustment and Programming Presets	20
6.2 Initial Pretest and Power-up	20
6.3 Motor Start-up	21
6.4 Calibration and Fine Tuning	21
7. Special Circuit Functions & Operating Modes	23
7.1 Fault Conditions	23
7.2 FWD/REV Direction Enable Controls	23
7.3 Current Limit By External Signals	24
7.4 Summing Input Signal	24
7.5 Buffered Monitoring Signals	24
7.6 Field Economy and External Field Supplies	24
8. Spare Parts	25
8.1 Printed Circuit Assemblies	25
8.2 Connector/Cable Assemblies	25
8.3 Fuses	26
8.4 Power Bridge Components	26

9. Drawings and Tables

List of Figure Drawings:

Figure 1A: Size and Mounting Dimensions	7
Figure 1B: Size and Mounting Dimensions	7
Figure 2: 230 VAC Line and Control Voltage Wiring	8
Figure 3: 460 VAC Line and Control Voltage Wiring	8
Figure 4: Low Voltage (150 VDC) Field Connection	9
Figure 5: High Voltage (300 VDC) Field Connection	9
Figure 6: Connections for External Field Supply	9
Figure 7: Motor Armature, Contactor and D.B. Resistor Connections	10
Figure 8: Operator and Contactor Coil Connections	11
Figure 9: Auxiliary Control Signals	12
Figure 10: Reference Input Connections	12
Figure 11: Buffered Monitoring Outputs	13
Figure 12: Tachometer and Encoder Connections	13

List of Tables:

Table 1: Three Phase Line Current and Transformer Ratings	9
Table 2: Armature Contactor and Dynamic Brake Resistor Ratings	11
Table 3: Armature Current Range Programming	15
Table 4: Control Board Adjustments	17
Table 5: Monitoring Outputs	19

List of Drawings:

D11312-sh1 Elite® Control Board Schematic	28
D11312-sh2 Elite® Control Board Schematic	29
D11312-sh3 Elite® Control Board Schematic	30
D11312-sh4 Elite® Control Board Schematic	31
D11111 Elite® Control Board Assembly	32
C11367 Elite® Control Board Block Diagram	33
D11590 E06000 Series Personality Board Schematic and Assembly	34
D11591 E12000 Series Personality Board Schematic and Assembly	35
C11115 Elite® Relay Board Schematic	36
D11117 Elite® Relay Board Assembly	37
C11118 Elite® Power Supply Board Schematic	38
C11120 Elite® Power Supply Board Assembly	39
C11127 Elite® Fuse Board Schematic	40
D11129 Elite® Fuse Board Assembly	41
D11351-sh1 Elite® Trigger Board Schematic	42
D11351-sh2 Elite® Trigger Board Schematic	43
D11123-000 E06000 Series Trigger Board Assembly	44
D11123-001 E12000 Series Trigger Board Assembly	45
C11592 Elite® C.T. Board Schematic and Assembly	46
D11593 General Assembly, Elite® Fuse Chassis	47
D11594 General Final Assembly, Elite® E06000 Series	48
D11595 General Final Assembly, Elite® E12000 Series	49
D11168 Wiring Diagram, Elite® E06000 Series 20-75 HP	50
D11167 Wiring Diagram, Elite® E12000 Series 20-75 HP	51
D11494 Wiring Diagram, Elite® E06000 Series 100-150 HP	52
D11495 Wiring Diagram, Elite® E12000 Series 100-150 HP	53
C11246 General Elite® Connections	54
D11596 General Assembly, Contactor Option Chassis	55
D11350 Wiring Diagram, Elite® E06000 and E12000 Option Chassis	56
D11376 Elite® Contactor Option Chassis Dimensions	57



General Description

The Elite® series of D.C. motor controls provide full range speed and torque control of 5-300 HP D.C. motors rated for NEMA type "C" power supplies. The E06000 series for non-regenerative applications and the E12000 regenerative series are offered in compact panel mounted assemblies. There are 10 basic models in each series. Please refer to the Elite® 200-300 HP manual for information on higher HP drives.

Each model is easily programmed for operation on 230 VAC, 380 VAC and 460 VAC line supplies. 230 VAC input models supply variable armature voltage up to 240 VDC and a fixed field supply of 150 VDC. 380 VAC input models supply variable armature voltage up to 415 VDC and a fixed field supply of 230 VDC. 460 VAC input models supply variable armature voltage up to 500 VDC with a fixed field at 300 VDC. All models feature a field economy circuit to automatically reduce the field supply voltage 35% when stopped for a time period adjustable by the customer from 1 minute to 3 minutes.

Semiconductor line fuses are provided for A.C. line protection with auxiliary line fuses for optional equipment and the field supply. Also provided is fuse protection for the 115 VAC control voltage input.

Standard relay logic interfaces with customer supplied operators for Emergency Stop, Ramp Stop, Run, Jog, and Forward/Reverse direction control on the E12000 regenerative models.

The E12000 series regenerative models provide full four quadrant operation. This means direction of motor rotation can be electronically reversed without switching the motor contactor and that motoring or braking torque can be supplied in both the forward and reverse directions.

Available options include contactor run/brake chassis models, braking resistors, a disconnect switch, blower starters, and enclosures. Also a drive circuit monitor, model DCM100-000, is available to assist in set-up and troubleshooting by plugging into a Control Board connector to easily access 20 separate signals.

Features

- Programmable for 230, 380 or 460 VAC 3 phase line input
- Insensitive to phase rotation of A.C. input
- Full 10 ampere rated field supply with provisions for interfacing the Field Loss circuit to an external field supply or regulator
- Automatic Field Economy with customer adjustable "delay after stop" to reduce "idling" field voltage by 35%
- Current transformers for isolated armature current sensing
- High impedance isolation for armature and line voltage sensing
- Electrically isolated power modules rated at 1400 volts PIV and 1000 volts/microsecond DVDT
- Individual SCR R-C networks for transient protection
- Semiconductor line fuses for power circuit protection
- Thermostatically controlled fan (on forced ventilated models) to extend life of the fan
- Latching FAULT logic for safety shutdown with form "C" contact output and LED indicators for Phase Loss, Field Loss, Heatsink Overtemp and Overcurrent.
- 5 jumper selectable armature current ranges for each model to match motor rated armature current
- Timed Foldback current limiting and Overcurrent Trip with four programmable time periods. Allows operating current up to 150% of selected current range for chosen time period; then after time period, 15, 30, 45 or 60 seconds, "folds back" current to 112%. Continued operation with load sustained above 105% current for the chosen time period, 1 min 15 sec, 2 min 30 sec, 3 min 45 sec or 5 minutes, will result in Overcurrent Trip.
- Control of positive and negative (regen models only) motor torque from external pot or voltage reference
- Lockout of either direction of motor rotation from external contact (reverse on regen models only)
- Independently adjustable linear acceleration and deceleration for both forward and reverse directions with two ranges, 1-8 seconds and 8-60 seconds for each.
- Speed feedback is jumper selectable for Armature Voltage, D.C. Tachometer voltage (7,50 or 100 V/1000 RPM), A.C. Tachometer voltage (45 or 90 V/1000 RPM) or Digital Encoder (300 PPR)

- D.C. Tachometer voltage is insensitive to polarity
- 12 VDC @ 100mA rated encoder power supply
- Summing input for auxiliary input signals with on-board trim pot for scaling and jumper selection for polarity
- Buffered armature current signal output
- Buffered velocity signal output
- Buffered velocity reference signal output
- Inner current loop type control circuit for responsive and precise control of motor speed and torque
- 115 VAC logic for customer operator interface
- Zero speed logic for controlled ramp-to-stop (braking torque supplied by regen models only)
- Jog Delay circuit to allow rapid jogging without de-energizing armature contactor to give longer contactor life
- Terminal strip access to velocity loop output and current loop input for versatile control functions
- Additional LED's for operating status, Run, Jog, Zero speed and Foldback
- All important adjustment potentiometers mounted on de-pluggable "Personality Board" to allow Control board replacement while preserving crucial set-up parameters. Critical pots are multiturn and common customer adjustments are single turn with a knob
- Multilevel construction with hinged cover and sub-panel allows ready access to all printed circuit boards, fuses and power components for ease of service and replacement

2 Specifications

2.1 Electrical

A.C. INPUT - 3 PHASE SUPPLY

- 230 VAC $\pm 10\%$, 3 phase, 50/60 Hz ± 2 Hz
- 380 VAC $\pm 10\%$, 3 phase, 50/60 Hz ± 2 Hz
- 460 VAC $\pm 10\%$, 3 phase, 50/60 Hz ± 2 Hz

A.C. INPUT - SINGLE PHASE CONTROL VOLTAGE SUPPLY

- 115 VAC $\pm 10\%$, 1 phase, 50/60 Hz ± 2 Hz

ARMATURE OUTPUT

- 0 to 240 VDC @ 230 VAC input
- 0 to 415 VDC @ 380 VAC input
- 0 to 500 VDC @ 460 VAC input

FIELD OUTPUT

- 150 VDC, 10 amps max @ 230 VAC input
- 230 VDC, 10 amps max @ 380 VAC input
- 300 VDC, 10 amps max @ 460 VAC input

NOTE: With drive stopped, Field Economy function reduces field voltage by 35% after adjustable time delay

ACCESSORY OUTPUTS

- Power Supplies
 - +12 VDC @ 100 mA encoder supply
 - +10 VDC @ 5 mA auxiliary speed reference supply
 - 10 VDC @ 5 mA auxiliary speed reference supply
 - +7.5 VDC @ 5 mA current reference supply
 - 7.5 VDC @ 5 mA current reference supply

- Buffered Signal Outputs
 - ± 10 VDC Total Reference Setpoint
 - +5 VDC Motor Speed Signal
 - ± 5 VDC Armature current Signal
- FAULT relay contact output: form "C", 3 amps max
- Armature Contactor Coil output : Circuit rated at 5 amps max; actual current available dependent on Control Voltage Supply transformer rating
- Auxiliary 3 phase output, fused at 10 amperes per leg

HORSEPOWER RANGE : NON-REGEN MODELS

- E06020-000: 36 Amps; 10 HP @ 240 VDC, 20 HP @ 500 VDC
- E06040-000: 71 Amps; 20 HP @ 240 VDC, 40 HP @ 500 VDC
- E06060-000: 107 Amps; 30 HP @ 240 VDC, 60 HP @ 500 VDC
- E06075-000: 140 Amps; 40 HP @ 240 VDC, 75 HP @ 500 VDC
- E06100-000: 174 Amps; 50 HP @ 240 VDC, 100 HP @ 500 VDC
- E06125-000: 206 Amps; 60 HP @ 240 VDC, 125 HP @ 500 VDC
- E06150-000: 256 Amps; 75 HP @ 240 VDC, 150 HP @ 500 VDC

HORSEPOWER RANGE : REGEN MODELS

- E12020-000: 36 Amps; 10 HP @ 240 VDC, 20 HP @ 500 VDC

- E12040-000: 71 Amps; 20 HP @ 240 VDC, 40 HP @ 500 VDC
- E12060-000: 107 Amps; 30 HP @ 240 VDC, 60 HP @ 500 VDC
- E12075-000: 140 Amps; 40 HP @ 240 VDC, 75 HP @ 500 VDC
- E12100-000: 174 Amps; 50 HP @ 240 VDC, 100 HP @ 500 VDC
- E12125-000: 206 Amps; 60 HP @ 240 VDC, 125 HP @ 500 VDC
- E12150-000: 256 Amps; 75 HP @ 240 VDC, 150 HP @ 500 VDC

SPEED REGULATION

- Armature Feedback: $\pm 1\%$ of base speed
- Tachometer Feedback: $\pm 0.5\%$ of base speed
- Encoder Feedback: $\pm 0.5\%$ of base speed

TORQUE REGULATION

- $\pm 2\%$ of range selected

SPEED RANGE

- 20:1 motor dependent

TEMPERATURE RANGE

- Chassis : 0 to 55° degrees C
- Enclosed : 0 to 40° degrees C

ADJUSTMENTS : FUSE BD. - ALL MODELS

- Delay Time

ADJUSTMENTS : E06000-000 SERIES PERSONALITY BOARD

- P1, Velocity Integral
- P2, Velocity Proportional
- P3, I (current) Integral
- P4, I (current) Proportional
- P5, Positive I (current) Limit
- P6, I.R. Comp
- P7, Sum Trim
- P8, Integral Null
- P9, Max Speed
- P10, Accel Rate
- P11, Decel Rate
- P12, Jog Speed
- P13, Min Speed (Available Fall '95)

ADJUSTMENTS : E12000-000 SERIES PERSONALITY BOARD

- P1, Velocity Integral
- P2, Velocity Proportional
- P3, I (current) Integral
- P4, I (current) Proportional
- P5, Positive I (current) Limit
- P6, Negative I (current) Limit
- P7, I.R. Comp
- P8, Sum Trim
- P9, Integral Null
- P10, Fwd Max
- P11, Fwd Accel
- P12, Rev Accel
- P13, Jog Speed
- P14, Rev Max
- P15, Fwd Decel
- P16, Rev Decel

2.2 Physical

Refer to Figure 1A and 1B for size and mounting dimensions. The Elite® control provides clearance holes for 5/16 inch mounting hardware. Shipping weight of all basic models is 70 lbs.

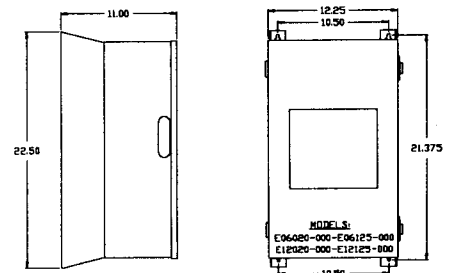


FIGURE 1A

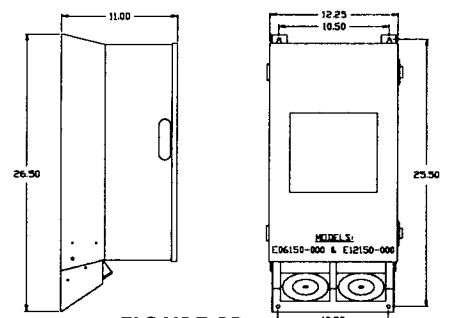


FIGURE 1B

3 Installation

3.1 Control Installation

Elite® motor controls require mounting in an upright position in an area that will permit adequate airflow for cooling and ready access for making connections and for servicing.

Because cooler air is drawn in from the bottom and exhausted from the top, these areas should be kept clear for about a six inch distance. Stacking of controls with one mounted above the other should be minimized to so that the upper control is not ventilated with hot exhaust air from the lower control.

Enclosures should be sized to provide adequate surface area for dissipating heat or provided with forced ventilation with outside air from a duct system or enclosure fan. They should be mounted to a cool surface not exposed to heat generated by nearby equipment.

Excess ambient temperatures within enclosures can reduce the life expectancy of electronic components and cause heatsink Overtemperature fault on the Elite® control. Contact Carotron for assistance in sizing enclosures for particular horsepower ratings.

3.2 Wiring Guidelines

To prevent electrical interference and to minimize start-up problems, adhere to the following guidelines, and the National Electric Code.

Make no connections to ground other than the designated grounding stud located in the upper left corner of the drive interior.

Use fully insulated and shielded cable for all signal wiring. This includes all potentiometer (pot), tachometer, encoder, and summing input wires. The shield should be connected at one end only to circuit common at terminals TB2B-13, 15 or 21. The other end of the shield should be clipped and insulated to prevent the possibility of accidental grounding.

Signal level wiring such as listed above should be routed separately from high level wiring such as armature, field, operator control and relay control wiring. When these two types of wire must cross, they should cross at right angles to each other.

Any relays, contactors, starters, solenoids or electro-mechanical devices located in close proximity to or on the same line supply as the motor control should have a transient suppression device such as an MOV or R-C snubber connected in parallel with its coil. The suppressor should have short leads and should be connected as close to the coil as possible.

Field wiring terminals TB1, TB2, and TB3 should be torqued to 9 in-lbs. Refer to Section 4.1 and 4.2 for line and armature torque levels.

4 Terminal Connections & Functions

4.1 A.C. Power Connections and Fusing

The semiconductor fuse holder terminals L1, L2 and L3 are the line input terminals for the SCR power bridge and for the Fuse Board. These field wiring terminals should be torqued to 70 in-lbs. on the 20-75 HP models and 150 in-lbs. on the 100-150 HP models. Carotron recommends that customers install the wiring lug under the fuse, removing the flat washers under the fuse as necessary. The semiconductor fuses provide protection for the power bridge and armature circuit only and are sized according to the armature current rating of the control. See the Spare Parts listing for recommended fuse and wiring lug sizes.

Jumper J1 selects the proper line input level. Refer to Section 5.1 for more information.

The Fuse Board provides separate fusing of the three phase line supply. Inputs to these fuses are at factory wiring terminals TB4-1, 2 and 3.

The motor field voltage supply, control transformer primary and customer auxiliary outputs at

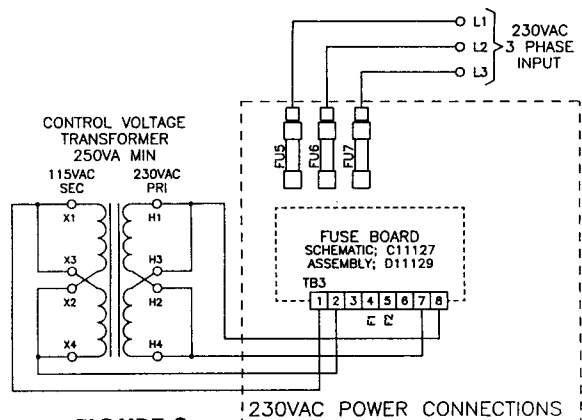


FIGURE 2

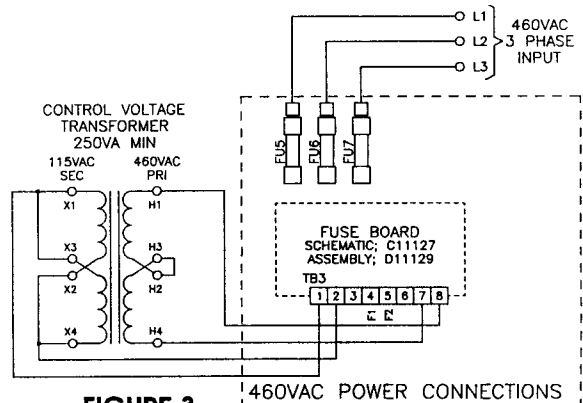


FIGURE 3

TB3-6, 7 and 8 are protected by 10 ampere, 500 VAC rated fuses. The primary of the control voltage transformer should be connected to TB3-7 and 8.

An additional 5 ampere, 250 VAC fuse is connected to the 115 VAC input at TB3-1 and 2 for the control transformer secondary to protect the AC relay/contactor logic and the heatsink fan on forced ventilated models. Further protection is provided for the power supplies by a 0.5 ampere, 250 VAC fuse on the Power Supply Board.

Refer to Figures 2 and 3 for A.C. power connections. Shown are 230 and 460 VAC three phase power and the 115 VAC single phase control voltage supply connections.

NOTE: Carotron recommends the use of three phase DIT, drive isolation type transformers. While Elite® controls do not require these transformers for proper operation, they can be helpful in reducing the effects of line transients on this control and generated by this control on other products and can provide fault current limiting in the event of severe motor or control failure.

Table 1 to the right is meant as a general guide in sizing line supply transformers and wiring.

4.2 Motor Connections

FIELD

Most motor fields consist of two windings that are connected in parallel for 150 VDC operation and in series for 300 VDC operation. Refer to Figures 4 and 5 for typical connections to TB3, terminals 4 and 5. The winding leads are individually marked and have a polarity that must be observed for proper and safe operation. Since direction of rotation is controlled by field polarity as well as armature polarity, it is sometimes more convenient to use the smaller field leads when

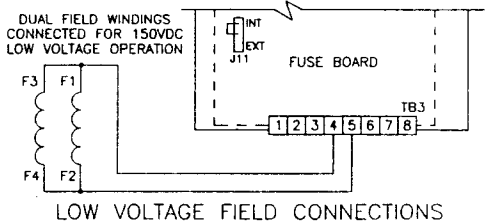


FIGURE 4

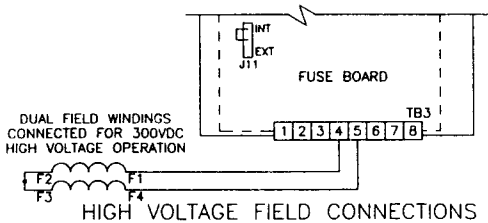


FIGURE 5

making corrections to the direction of rotation during initial installation. An energized field should never be switched by relay, contactor, switch or any other manual or electro-mechanical device.

TABLE 1: THREE PHASE LINE CURRENT AND TRANSFORMER RATINGS

Drive Model	Motor HP	Arm Volts	Approx. Full Load Line Amps	3 Phase DIT KVA Rating
E06020-000	5		18	7.5
E12020-000	7.5	240	26	11
	10		34	14
E06040-000	15	240	50	20
E12040-000	20		65	27
E06060-000	25	240	84	34
E12060-000	30		98	40
E06075-000	40	240	118	51
E12075-000				
E06100-000	50	240	148	63
E12100-000				
E06125-000	60	240	174	75
E12125-000				
E06150-000	75	240	212	93
E12150-000				
E06020-000	5		9	7.5
E12020-000	7.5		14	11
	10	500	18	14
	15		25	20
	20		34	27
E06040-000	25		40	34
E12040-000	30	500	47	40
	40		63	51
E06060-000	50	500	78	63
E12060-000	60		93	75
E06075-000	75	500	106	93
E12075-000				
E06100-000	100	500	141	118
E12100-000				
E06125-000	125	500	177	145
E12125-000				
E06150-000	150	500	213	175
E12150-000				

Carotron Elite® motor controls are designed to sense field current and will indicate an open circuit in the field windings, wiring or fusing by initiating a Field Loss Fault condition.

The sensing circuit can be interfaced with an external regulator or field supply by connecting its F1 output to TB3-3 as shown in Figure 6.

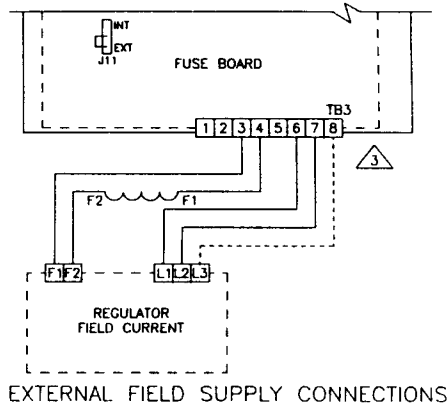
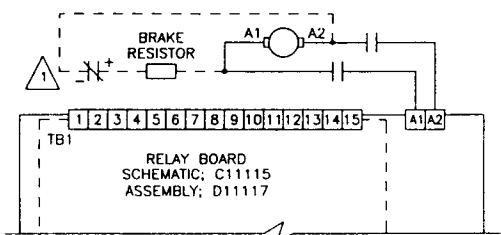


FIGURE 6

WARNING!!! When interfacing with an external field supply, programming jumper J11 must be placed in the EXT position to prevent damage to the Elite® control or external supply.

ARMATURE

The armature leads are usually the highest current wires associated with the drive and warrant special attention to sizing based on current rating as well as length of run. Extra care should be used where terminations and splices are made. Refer to Table 2 for typical armature voltage, current, contactor and dynamic braking resistor ratings.



CONTACTOR AND D.B. RESISTOR CONNECTIONS

NOTES:

- 1 POLARIZATION NOT APPLICABLE TO REVERSING MODELS

FIGURE 7

Figure 7 shows the armature, contactor and brake resistor connections to the A1/A2 terminal block. These terminals should be torqued to 50 in-lbs. on drives up to 75 HP and 275 in-lbs. on all other models. The contactor coil will connect to TB1-14 and 15 as shown in Figure 8.

NOTE: When present, the S1 and S2 for the SERIES field winding is placed in series with the

armature leads on the non-regenerative models. It should not be used with the E12000 Series regenerative models and the leads should not be connected and should be individually insulated. On non-regenerative models the series field winding polarity must be kept at the same polarity as the shunt field winding, i.e. F1 and S1 the same, F2 or F4 and S2 the same.

MOTOR THERMOSTAT

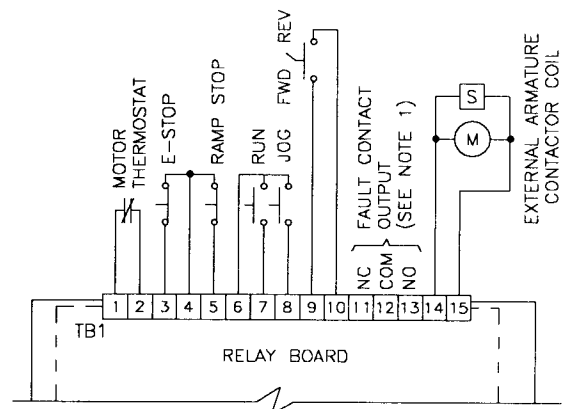
Most motors include "J" or "P" leads that connect to an internal normally closed thermostat. Connecting at TB1-1 and 2 as shown in Figure 8 will allow a motor over-temperature condition to shut down the control as in an Emergency Stop condition.

MOTOR BLOWER

When used, motor blowers should operate any time the motor field is energized. This operation is given by connecting to the auxiliary line outputs at TB3-6, 7 and 8 as per Figure 2 and 3 depending on the level of input voltage.

4.3 Operator Connections

All push-button and selector operator contacts and the contactor coil connect to TB1 located on the RELAY BOARD. Refer to Figure 8 for these connections. All items connected to TB1 will be controlling or controlled by 115 VAC logic and must be rated accordingly. A.C. current levels are 5 amps or less.



NOTES:

- 1. INTERNAL FAULT RELAY IS NORMALLY ENERGIZED. UPON FAULT CONDITION, THE CONTACTS WILL BE IN THE DE-ENERGIZED POSITIONS, AS LABELED.

OPERATOR AND COIL CONNECTIONS

FIGURE 8

TABLE 2 : ARMATURE CONTACTOR AND DYNAMIC BRAKE RESISTOR RATING

Drive Model	Motor HP	Arm Volts	Arm Amps	Contactor Rating	D.B.Resistor Rating
E06020-000 E12020-000	5 7.5 10	240	18.0 28.1 36.0	40 AMPS	10 Ohms, 300 W 5 Ohms, 600 W 4.4 Ohms, 750 W
E06040-000 E12040-000	15 20	240	55.0 70.5	75 AMPS	3 Ohms, 1000 W 2.2 Ohms, 1500 W
E06060-000 E12060-000	25 30	240	91.1 107.0	110 AMPS	1.7 Ohms, 2000 W 1.7 Ohms, 2000 W
E06075-000 E12075-000	40	240	140.0	180 AMPS	1.3 Ohms, 2080 W
E06100-000 E12100-000	50	240	174	180 AMPS	0.62 Ohms 2232 W
E06125-000 E12125-000	60	240	206	260 AMPS	0.62 Ohms 2232 W
E06150-000 E12150-000	75	240	256	260 AMPS	0.62 Ohms 2232 W
E06020-000 E12020-000	5 7.5 10 15 20	500	8.5 13.2 17.2 25.2 35.1	40 AMPS	40 Ohms, 375 W 20 Ohms, 750 W 20 Ohms, 750 W 14 Ohms, 1000 W 10 Ohms, 1500 W
E06040-000 E12040-000	25 30 40	500	43.0 51.0 65.4	75 AMPS	7 Ohms, 2000 W 6 Ohms, 2000 W 5 Ohms, 3000 W
E06060-000 E12060-000	50 60	500	83.7 97.4	110 AMPS	3.4 Ohms, 4000 W 3.4 Ohms, 4000 W
E06075-000 E12075-000	75	500	121.0	180 AMPS	2.6 Ohms, 4160 W
E06100-000 E12100-000	100	500	161	180 AMPS	1.24 Ohms 4464 W
E06125-000 E12125-000	125	500	203	260 AMPS	1.24 Ohms 4464 W
E06150-000 E12150-000	150	500	245	260 AMPS	1.24 Ohms 4464 W

TB1 TERMINALS 1-4

When operated, the motor thermostat and the Emergency Stop contacts at terminals 1 through 4 will immediately clamp all control signals on the control board. The armature contactor will also de-energize to disconnect the armature from the bridge output. Motor stopping time is determined by inertia and friction characteristics of the load and can be decreased by use of a brake resistor. Refer to Table 2 for recommended resistor values and Figure 7 for connections.

TB1 TERMINALS 4 AND 5

The Ramp Stop contact at terminals 4 and 5 will cause the motor to ramp to stop in the time set by the DECEL pot(s) and jumpers J8 and J9 on the CONTROL BOARD. Refer to section 5.1 for additional information on the programming jumpers. The deceleration ramp is linear. For example, ramping to stop from 50% speed will take 1/2 the stopping time from full speed. The ZERO SPEED circuit works in this stopping mode to hold the armature contactor energized until armature voltage decreases to approximately 5% of rated output.

NOTE: On the non-regen E06000 Series models, deceleration time can be controlled only when the desired stopping time is to be longer than the time inherently caused by the friction or load dynamics. Since negative running torque is not provided, decel time on these models can only be extended, not shortened.

TB1 TERMINALS 6 AND 7

Momentarily closing the RUN contact from 6 to 7 will cause the motor to accelerate linearly to the external Speed pot setting with time controlled by the accel pot(s) and the J8 and J9 jumpers.

TB1 TERMINALS 6 AND 8

Closing the JOG contact from 6 to 8 will accelerate the motor at a fixed exponential rate to the JOG pot setting. De-energization of the contactor by opening the contact can be instant or delayed 3-4 seconds by selecting the position of J12 on the RELAY BOARD. This can extend the mechanical life of the contactor in frequent jogging applications. Refer to Section 5.1 for J12 explanation.

TB1 TERMINALS 9 AND 10

On E12000 Series controls, direction of rotation is controlled by the FWD/REV selector operator at terminals 9 and 10. No connection gives reverse direction while forward is selected by connecting these terminals. Changing the direction command while running in the run or jog mode will cause the motor to immediately decelerate to zero speed and then accelerate to speed in the newly selected direction. The rate of accel and decel is internally

fixed to a couple of seconds for the jog mode and is controlled by the ACCEL and DECEL pots in the RUN mode. See Section 5.2 for additional information on the potentiometers.

These terminals must be jumpered on E06000 Series models.

TB1 TERMINALS 11, 12 AND 13

The FAULT contact outputs at terminals 11, 12 and 13 are part of the FAULT relay that supplies 115 VAC to all relay logic and customer wiring connected to TB1. This voltage is supplied from TB1-1 when the FAULT relay is in its normally energized state. When a fault condition occurs, the relay de-energizes. Note that the contacts at terminals 11,12 and 13 are labeled for their de-energized, fault mode condition. Refer to Section 7.1 for more information on FAULT CONDITIONS.

TB1 TERMINALS 14 AND 15

The 115 VAC contactor coil connects to terminals 14 and 15. The M-PILOT relay contacts supplying this voltage are rated in excess of 5 amperes inductive load at 115 VAC. The current available depends on the rating of the customer supplied control voltage transformer.

4.4 Signal Wiring Connections

All signal level wiring connects to TB2A and TB2B on the CONTROL BOARD. Observe the use of shielded cable and other wiring guidelines detailed in Section 3.2.

TB2A TERMINALS 1-4

Terminals 1-4 are FWD/REV Direction Enable control inputs for the Elite® Series controls. Refer to Figure 9.

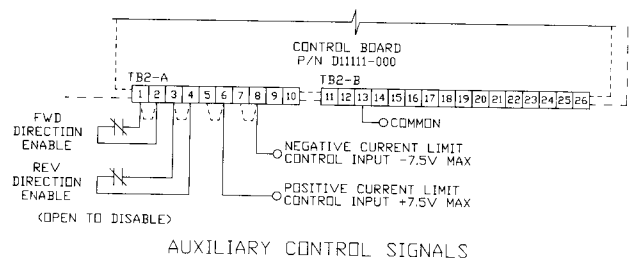


FIGURE 9

They are normally jumpered; 1 to 2 for forward direction and 3 to 4 for reverse on regenerative models; or are contact controlled when external lockout of direction is required. The contact should be rated for 12 VDC @ 20 mA, inductive load.

Example: limit switch control of a traverse operation.

NOTE: The run mode motoring function only is disabled, i.e. the E12000 Series models can still provide regenerative braking torque for either direction. Jog mode operation is not affected by these enable controls.

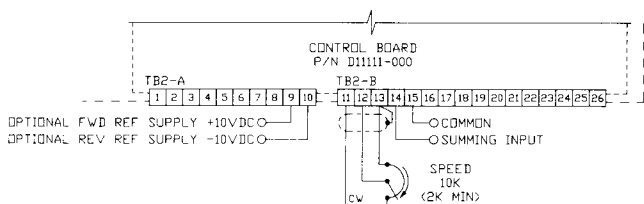
TB2A TERMINALS 5-8

Terminals 5-8 are current limit control inputs to allow limiting motor current by an external voltage signal. Terminals 5 and 7 are +7.5 VDC and -7.5 VDC respectively and are normally connected to terminals 6 and 8 respectively. The 7.5 volt levels correspond to 150% current level and are trimmed by the POS and NEG CURRENT LIMIT pots on the E12000 Series PERSONALITY BOARD. The voltage applied to terminals 6 or 8 should never be allowed to exceed 7.5 VDC. See Section 7.3 for more information.

TB2A TERMINALS 9 AND 10

Terminals 9 and 10 are the auxiliary ± 10 VDC reference supply outputs and are not normally used. Normal operation of regenerative models uses the FWD/REV SELECTOR and DIR relay on the RELAY BOARD to control the reference (speed pot) voltage polarity and therefore the direction of motor rotation.

CAUTION: These supplies are made available for specially engineered systems and when used directly can override normal direction control signals. Consult Carotron for additional information.



REFERENCE INPUT CONNECTIONS

FIGURE 10

TB2B TERMINALS 11, 12 AND 13

The speed reference potentiometer connects to 11, 12 and 13. Refer to Figure 10. Terminal 11 is the ± 10 VDC reference voltage supply selected by the FWD/REV operator. Terminal 11 is always +10 VDC on the non-regenerative models.

Terminal 12 takes the trimmed reference from the pot wiper to the inputs of the accel/decel control circuits. This is also the signal input that is further controlled by the DIRECTION ENABLE jumpers or contacts at terminals 1-4.

Terminal 13 along with 15 and 21 are circuit common of the isolated control circuit. The pot cw

terminal and the shield for the pot cable connect to 13.

TB2B TERMINALS 14 AND 15

Terminal 14 is the SUMMING INPUT terminal. A signal applied between 14 and circuit common at 15 can be trimmed by the Sum Trim pot on the PERSONALITY BOARD and be made to add or subtract from the run and jog mode reference signals. The combination of the summing signal and the speed reference gives a TOTAL REFERENCE SETPOINT which is internally limited to give a maximum armature output voltage no greater than 108% of the control rating.

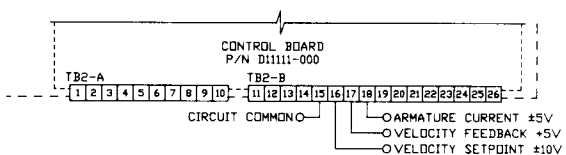
The SUM TRIM pot can provide a "min. speed" function by connecting TB2A-9 to TB2B-14 and placing J2 in the ADD position.

CAUTION: Because the Elite® E12000 Series regenerative models are electronic reversing type controls in which direction of motor rotation is controlled by the polarity of the TOTAL REFERENCE SETPOINT, a SUMMING Input signal which is subtracted from and exceeds the speed reference input can cause the direction of rotation to change without switching the FWD/REV selector operator.

Refer to Section 5.1 - J2 Sum Function for additional information on using the SUMMING Input.

TB2B TERMINALS 16, 17 AND 18

Buffered outputs for monitoring control operation are provided at terminals 16, 17 and 18. These outputs can source up to 10 mA current each and are used by measuring from circuit common at terminals 13, 15 or 21. Refer to Figure 11.



BUFFERED MONITORING OUTPUTS

FIGURE 11

Terminal 16 is the TOTAL REFERENCE SETPOINT and equals 10.0 VDC at 100% speed reference command. Positive polarity indicates a forward direction command (A1 motor terminal positive with respect to A2 motor terminal) and negative indicates a reverse command.

Terminal 17 is the VELOCITY FEEDBACK signal and equals +5.0 VDC at 100% motor speed. This voltage is always positive regardless of rotation direction and source of feedback, i.e. armature voltage, tachometer or encoder signal.

Terminal 18 is the armature current signal and equals 5.0 volts at 100% of the ARMATURE AMPS range selected by J4 on the control board. Positive polarity indicates positive motor current and negative polarity indicates negative motor current. Refer to Table 3 and Section 5.1 for additional information on the armature current signal and how it is programmed.

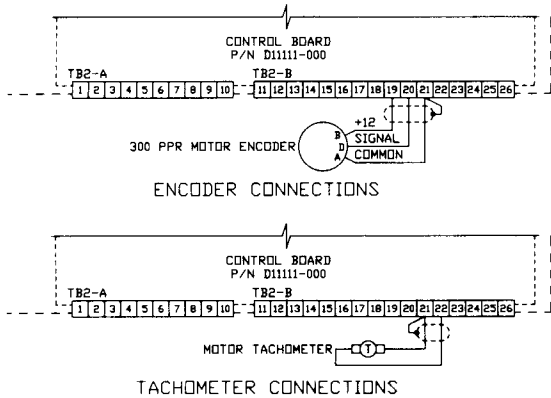


FIGURE 12

TB2B TERMINALS 19, 20, 21 AND 22

When used for velocity feedback, a 300PPR encoder is connected to terminals 19, 20 and 21. Carotron encoder PN TAC008-000 readily mounts to motors using a standard XPY tachometer kit and interfaces directly to these terminals. Refer to Section 5.1 and Figure 12 for more information on feedback selection and connections.

Terminal 19 is the +12 VDC encoder supply. Terminal 20 is the signal input. Terminal 21 is the circuit common connection for the common lead and the cable shield.

For AC or DC tachometer feedback, connect the tachometer leads to terminals 21 and 22. These terminals are not polarity sensitive.

Terminal 21 will be the shield and one signal

lead. Terminal 22 will be the second signal lead. Refer to Section 5.1 for information on selecting and programming the tachometer input level. Refer to Figure 12 for connections.

TB2B TERMINALS 23 AND 24

When required, an external FAULT RESET contact can be connected to terminals 23 and 24. This switch parallels the RESET on the CONTROL BOARD and resets the control from a fault condition.

NOTE: The control does not automatically restart when reset from a fault condition.

TB2B TERMINALS 25 AND 26

These terminals are normally jumpered in the speed regulator mode. However, Motor Torque instead of Speed can be regulated by controlling armature current instead of voltage. This is done by directly connecting a torque reference signal to the C.L. (Current Loop) input terminal, TB2B-26. This must be a voltage signal no greater than ± 10 volts.

With Current Range jumper, J4, in the 100% position and Current Limit pots P5 and P6 at maximum, a 5 volt input will equal 100% motor torque/current output.

The Over Current fault and the current Foldback functions are fully operational in the Direct Current Loop Access mode.

NOTE: There will be no direct armature voltage control in this mode. Since the control will supply whatever voltage is necessary to set a current and torque level, there is the possibility of over-speeding the motor in applications where the web could break and reduce or eliminate the torque loading. Where over-speeding could cause damage, a web breakage detector or speed sensing relay should be used to stop the motor control. Please consult factory on using this specially engineered function.

5 Programming & Adjustments

5.1 Programming Jumpers

Programming jumpers J1 through J10 are located on the control board.

J1 ARM VOLTS

The only programming required for converting an Elite® control from one 3 phase input voltage to another is the proper placement of J1. Because maximum armature voltage is determined by the A.C. line voltage level, this jumper selection must correspond to the line level as follows : 240 V for 230 VAC line, 415 V for 380 VAC line and 500 V for a 460 VAC line.

J2 SUM FUNCTION

The function of the SUMMING signal applied to TB2B-14 is controlled by J2. The signal is trimmed by the Sum Trim pot and combined with the speed reference to make the TOTAL REFERENCE SETPOINT and will add or subtract from it depending on the position of J2 and the direction command on regen models.

A positive signal from the speed or jog pot normally calls for forward rotation of the motor. On the regenerative models, negative polarity selects reverse direction. With Add selected at J2, a positive SUMMING signal will add to a positive (forward) reference. A negative SUMMING signal would subtract.

NOTE: With Add selected, a negative SUMMING signal greater than the positive reference would cause a net negative TOTAL REFERENCE SETPOINT and would cause REVERSE rotation even with forward direction selected. The same situation could occur if the SUMMING signal was positive and the SUBTRACT position was selected at J2. This logic applies regardless of the direction command by the FWD/REV selector.

With ADD selected, like polarity sig-

TABLE 3 : ARMATURE CURRENT RANGE PROGRAMMING

Drive Model	Motor HP	Arm Volts	Arm Amps.	J4 Position and Equiv. Amp. Rating
E06020-000 E12020-000	5 7.5 10	240	18.0 28.1 36.0	60% - 21.6 80% - 28.8 100% - 36.0
E06040-000 E12040-000	15 20	240	55.0 70.5	80% - 56.8 100% - 71.0
E06060-000 E12060-000	25 30	240	91.1 107.0	80% - 85.6 100% - 107
E06075-000 E12075-000	40	240	140.3	100% - 140
E06100-000 E12100-000	50	240	174.0	100% - 174
E06125-000 E12125-000	60	240	206.0	100% - 206
E06150-000 E12150-000	75	240	256.0	100% - 256
E06020-000 E12020-000	5 7.5 10 15 20	500	8.5 13.2 17.2 25.2 35.1	20% - 7.2 40% - 14.4 60% - 21.6 80% - 28.8 100% - 36.0
E06040-000 E12040-000	25 30 40	500	43.0 51.0 65.4	60% - 42.6 80% - 56.8 100% - 71.0
E06060-000 E12060-000	50 60	500	83.7 97.4	80% - 91.1 100% - 107
E06075-000 E12075-000	75	500	121.0	100% - 140
E06100-000 E12100-000	100	500	161.0	100% - 174
E06125-000 E12125-000	125	500	203.0	100% - 206
E06150-000 E12150-000	150	500	245.0	100% - 256

nals add; unlike polarities subtract from each other with the greatest signal having control of direction. With SUBTRACT selected, like polarities subtract from each other and unlike polarities add.

J3 JOG/SUM SELECT

As explained in the description of J2, the SUMMING signal is normally combined with both the RUN and JOG speed reference signals. Placing J3 in the (NOT) JOG/SUM position indicated by JOG/SUM with a bar drawn over it, prevents the SUMMING signal from being combined with the JOG reference.

J4 ARM AMPS

Each Elite® model has a full load current rating as listed in Section 2.0 Specifications under "Horsepower Range." Control operation, current limiting and overcurrent sensing are optimized for this rated current level when J4 is in the 100% position. Armature current at the 100% rating is scaled to 5.0 VDC CURRENT FEEDBACK level at the internal current processing circuit and at the BUFFERED CURRENT SIGNAL output at TB2B-18. When a motor rated at lower full load current level is used, J4 allows scaling of the lower signal in 20% increments to maintain a 5 volt current feedback level.

Example: A 36 ampere rated model E12020-000 control operated on a 230 VAC 3 phase supply connected to a 7.5 HP, 28.1 ampere motor should have J4 placed in the 80% position. This would give the control an equivalent 28.8 ampere rating.

Refer to Table 3 for typical control and motor ratings and suggested placement of J4.

J5 VEL FEEDBACK

Velocity (speed) feedback can come from either of several sources.

AFB selects armature voltage feedback, and must be selected when no other feedback device such as a tachometer or an encoder is to be used. Even then it should be selected during initial setup until proper feedback from the other device is verified. The AFB level is selected by J1.

TFB is selected when an A.C. or D.C. Tachometer on the motor being controlled is used for feedback. This is not to be confused with a follower tachometer used on another motor or location to provide a speed reference to the Elite® control. See J6 jumper description for tachometer voltage programming information.

EFB selects feedback input from a 300 PPR encoder.

J6 TACH VOLTS/1000RPM

When TFB is selected by J5, the J6 jumper po-

sition should be placed to match the nameplate output of the tachometer.

The voltage given reflects the tachometer output at 1000 RPM. The 7 position is for 7 volts per 1000 RPM D.C. tachometers. The 45-50 position is for 45 V/1000 RPM A.C. tachometers and 50 V/1000 D.C. tachometers. The 90-100 position corresponds to higher A.C./D.C. tachometer ratings.

J7 OVERCURRENT

The Elite® series controls have several armature current operated protection circuits. J7 controls the operating time of the Current FOLDBACK and the OVERCURRENT FAULT circuits. The J7 values refer to the FOLDBACK/OVERCURRENT FAULT times in seconds.

The control will temporarily allow motor currents up to 150% of the range selected by J4 - refer to Table 3. When current demanded by the load has exceeded 105% of the range for the J7 time period ahead of the slash, the control will FOLDBACK or clamp the current to a maximum of 112%. Continued excessive current for the time period behind the slash will cause the control to initiate an OVERCURRENT FAULT condition.

Example: In the previous example given in the description of J4, the control was scaled for a full load rating of 28.8 amps. With J7 in the 15/75s position, the FOLDBACK circuit will allow over 30.2 (105%) armature amps for 15 seconds, then current is Limited up to 32.3 (112%) amps for 75 additional seconds after which an OVERCURRENT FAULT will occur. During these time periods any reduction in current below 105% will reset the FOLDBACK/OVERCURRENT timers until the 105% level is again exceeded.

NOTE: Refer to Section 7.1 for more information on FAULT CONDITIONS.

J8 FWD TIME

J8 provides two ranges of acceleration and deceleration time for the FWD ACCEL and FWD DECEL pots on the PERSONALITY BOARD. The selected range, 1-8 or 8-60 seconds will be the same for the forward direction pots.

J9 REV TIME

J9, similar to J8, provides two time range selections for the REV ACCEL and REV DECEL pots. The time range selected will be the same for both reverse direction pots.

NOTE: J9 is not used on the E06000 series, non-regen models.

J10 FIELD LOSS BYPASS

Reference Section 4.2 - Field. The Elite® model controls are able to sense field current produced from the internal or an external field supply circuit.

For applications where field current sensing is not appropriate, the field loss signal must be bypassed to prevent a FIELD LOSS FAULT condition. This is done by moving J10 from NORMAL to the BYPASS condition.

J11 INT/EXT

J11, located on the FUSE BOARD, is used to interface the field current sensing circuit with an external field supply. Refer to Section 4.2 Motor Connections - Field and Figure 6.

WARNING!!! When interfacing with an external field supply, programming jumper J11 must be placed in the EXT position to prevent damage to the Elite® control or external supply.

J12 JOG DELAY

J12 is located on the RELAY BOARD. Refer to Section 4.3 Operator Connections - Terminals 6 and 8. De-energization of the contactor by opening the JOG operator contact can be instant or delayed 3-4 seconds by selecting the position of J12. The NORMAL position gives the 3-4 second drop-out delay and the DEFEAT position causes immediate de-energization of the armature contactor after "jogging."

5.2 Adjustment Potentiometers

The CONTROL BOARD adjustments for all Elite® models are listed in Table 4. Note that the negative current and reverse adjustments are not present on the E06000, non-regenerative, models, and min speed is not present on E12000 models.

TABLE 4: CONTROL BOARD ADJUSTMENTS

E12/(E06) Adjustment Name	E12000 Person. Board Label	E06000 Person. Board Label
VELOCITY INTEGRAL	P1	P1
VELOCITY PROPORTIONAL	P2	P2
I (CURRENT) INTEGRAL	P3	P3
I (CURRENT) PROPORTIONAL	P4	P4
POSITIVE I (CURRENT) LIMIT	P5	P5
NEGATIVE I (CURRENT) LIMIT	P6	N.A.
I.R. COMP	P7	P6
SUM TRIM	P8	P7
INTEGRAL NULL	P9	P8
FWD MAX (MAX SPEED)	P10	P9
FWD ACCEL (ACCEL RATE)	P11	P10
REV ACCEL	P12	N.A.
JOG SPEED	P13	P12
REV MAX	P14	N.A.
FWD DECEL (DECEL RATE)	P15	P11
REV DECEL	P16	N.A.
MIN SPEED	N.A.	P13

An additional adjustment, DELAY TIME, is located in all models on the FUSE BOARD and is designated P1 on that assembly.

The description of adjustments is divided into sections; the first being the more common customer adjustments and the latter those adjustments with more complex functions.

5.2.1 Common Customer Adjustments

FWD MAX (MAX SPEED)

The FWD MAX is a single turn knob adjust pot that trims the output of the FWD accel/decel circuit. It controls the maximum positive armature voltage or forward speed from 20% to 108% of rated output.

REV MAX

The REV MAX is a single turn knob adjust pot that trims the output of the REV accel/decel circuit. It controls the maximum negative armature voltage or reverse speed from 20% to 108% of rated output.

MIN SPEED

The MIN SPEED is a single turn knob adjust pot. It sets the minimum armature voltage or speed from 0% up to 30% of rated output on E06000 models.

FWD ACCEL (ACCEL RATE)

The FWD ACCEL is a single turn knob adjust pot that controls the Acceleration time in the forward direction. Its range is set at 1-8 or 8-60 seconds by the position of J8 on the CONTROL BOARD. Clockwise rotation increases the acceleration time.

REV ACCEL

The REV ACCEL is a single turn knob adjust pot that controls the acceleration time in the reverse direction. Its range is set at 1-8 or 8-60 seconds by the position of J9 on the CONTROL BOARD. Clockwise rotation increases the acceleration time.

FWD DECEL (DECEL RATE)

The FWD DECEL is a single turn knob adjust pot that controls the deceleration time in the forward direction. Its range is set at 1-8 or 8-60 seconds by the position of J8 on the CONTROL BOARD. Clockwise rotation increases the deceleration time.

NOTE: On the non-regen E06000 Series models, deceleration time can be controlled only when the desired stopping time is to be longer than the time inherently caused by the friction or load

dynamics. Since negative running torque is not provided, decel time on these models can only be extended, not shortened.

REV DECEL

The REV DECEL is a single turn knob adjust pot that controls the deceleration time in the reverse direction. Its range is set at 1-8 or 8-60 seconds by the position of J9 on the CONTROL BOARD. Clockwise rotation increases the deceleration time.

JOG SPEED

The JOG SPEED is a single turn knob adjust pot that sets the speed when the JOG button is depressed. Direction is controlled by the FWD/REV selector. Its range is from 0% to 40% of rated output.

POSITIVE I (CURRENT) LIMIT

Positive I Limit is a single turn screwdriver adjust pot used to set the maximum allowable positive motor current. Clockwise increases the current from 5% up to 150% of the rating programmed by jumper J4. Refer to Table 3 for these ratings. Positive current can be limited in both the forward motoring and reverse braking modes of operation.

NEGATIVE I (CURRENT) LIMIT

Negative I Limit is a single turn screwdriver adjust pot used to set the maximum allowable negative motor current. Clockwise increases the current from 5% up to 150% of the rating programmed by jumper J4. Refer to Table 3 for these ratings. Negative Current can be limited in both the reverse motoring and forward braking modes of operation.

NOTE: An external current limit signal applied at TB2A is trimmed by the I Limit pots. Refer to Section 4. 4 - TB2A Terminals 5 - 8.

I . R . COMP

The I.R. COMPENSATION pot signal is automatically added when AFB is selected by J5. The signal is proportional to load current and is added to the reference to keep speed from dropping with an increase in load. This is not required when a velocity feedback device such as a tachometer or encoder is used. The pot range is 0 to 6% of the IFB signal and is scaled by J4ARMAMPS. The amount of compensation required is dependent on motor characteristics and must be adjusted with the actual motor and load used. Refer to Section 6.4 for calibration information.

DELAY TIME

DELAY TIME is a single turn knob adjust pot used to set the time period after the control is

stopped before the motor field current is automatically reduced by the FIELD ECONOMY circuit. The pot ranges from 1 to 3 minutes with counter-clockwise rotation increasing time.

5.2.2 Complex Adjustments

These pots are all multiturn (20-25 turns) screwdriver adjustable types.

SUM TRIM

The SUM TRIM pot is used to scale the SUMMING signal applied to TB2B. Refer to Section 4.4 - TB2B terminals 14 and 15 and Section 5.1 J2 Sum Function for a description of this signal and its use.

INTEGRAL NULL

The INTEGRAL NULL can be used to alter control performance when the TOTAL REFERENCE SETPOINT is being rapidly reduced to zero or is maintained at zero with the control started. The high gain of the VELOCITY INTEGRAL circuit can cause direction overshoot or motor creeping under some load conditions. The INTEGRAL NULL counter-acts the high gain by using a limited amount of the current loop output as a negative feedback. This causes a low gain area around zero that eliminates these problems. There is a small trade off in a reduction in regulation.

NOTE: Elite® Drives manufactured after Fall '95 incorporate an integral null circuit that is locked out above zero speed. This eliminates the reduction in speed regulation above Zero Speed.

VELOCITY INTEGRAL

The VELOCITY INTEGRAL is a trimming pot that gives a 20 to 1 change in the velocity loop integral time constant. Clockwise rotation increases the time or decreases the response rate.

VELOCITY PROPORTIONAL

The VELOCITY PROPORTIONAL gives a 4 to 1 change in the velocity loop Proportional gain. Clockwise rotation increases the gain.

The VELOCITY INTEGRAL and VELOCITY PROPORTIONAL signals are summed to produce the TORQUE DEMAND signal.

I (CURRENT) INTEGRAL

The I INTEGRAL is a trimming pot that gives a 10 to 1 change in the current loop Integral time constant. Clockwise rotation increases the time or decreases the response rate.

I (CURRENT) PROPORTIONAL

The I PROPORTIONAL gives a 2 to 1 change in the current loop proportional gain. Clockwise rotation increases the gain.

The I INTEGRAL and I PROPORTIONAL signals are summed to produce the VCO input signal.

5.3 DCM Checkpoints, Circuit Testpoints & Buffered Outputs

TABLE 5: MONITORING OUTPUTS

Signal Being Monitored	DCM Check Point	Test Point Letter	Buffered Output Terminal
+24 VDC	A	TP8	-
-24 VDC	B	TP10	-
+15 VDC	C	TP9	-
-15 VDC	D	TP11	-
+12 VDC RELAY	E	TP4	TB2A-1 & 3
+6 VDC	F	TP2	-
-6 VDC	G	TP3	-
TOTAL REFERENCE SETPOINT	H	TP19	TB2B-16
FWD ACCEL/DECEL	I	TP13	-
REV ACCEL/DECEL	J	TP22	-
(E12000 Series only)			
SCALED ARMATURE VOLTAGE	K	TP15	TB2B-17 Positive only
SCALED TACHOMETER VOLTAGE	L	TP18	TB2B-17 Positive only
SCALED ENCODER VOLTAGE	M	TP20	TB2B-17 Positive only
VELOCITY INTEGRAL	N	TP17	-
VELOCITY PROPORTIONAL	O	TP14	-
I (CURRENT) INTEGRAL	P	TP12	-
I (CURRENT) PROPORTIONAL	Q	TP16	-
CURRENT DEMAND	R	TP5	-
CURRENT FEEDBACK	S	TP21	TB2B-18
VCO REFERENCE	T	TP6	-
CIRCUIT COMMON	-	TP1, 1A & 7	TB2B-13,15 & 22
CURRENT LOOP ERROR	-	TP23	-

Refer to Table 5 for a listing of the monitoring outputs on the Elite® models.

+24 VDC AND -24 VDC

As unregulated power supplies, these voltages can normally deviate ± 4 VDC with line voltage and load variations.

+15, -15, +12 RELAY, +6 AND -6 VDC

These are regulated power supplies that will vary no more than 5% with a $\pm 10\%$ change in line voltage.

TOTAL REFERENCE SETPOINT

Refer to Section 4.4 Terminal TB2B-16 and Section 5.1 J2 Sum Function. The TOTAL REFERENCE SETPOINT equals 10.0 VDC at 100% speed reference command. Positive polarity indicates a forward direction command (A1 motor terminal

positive with respect to A2 motor terminal) and negative indicates a reverse command.

FORWARD ACCEL/DECEL

The Forward Accel/Decel circuit output shows the positive RUN reference as rate controlled by the ACCEL and DECEL pots.

REVERSE ACCEL/DECEL

The Reverse Accel/Decel circuit output shows the negative RUN reference as rate controlled by the ACCEL and DECEL pots.

SCALED ARMATURE VOLTAGE

The armature voltage signal selected by J1, 240, 415 or 500 VDC, is scaled to a 5 volt level and used for velocity feedback in the AFB mode, for zero speed sensing and for control of the ACCEL/DECEL circuits. The polarity is same as the armature voltage polarity.

SCALED TACHOMETER VOLTAGE

The tachometer voltage selected by J6 is scaled to a 5 volt level at motor base speed and used for velocity feedback in the TFB mode. The polarity is the same as the armature voltage polarity.

SCALED ENCODER VOLTAGE

The 300 PPR encoder signal is scaled to 5 volts at motor base speed and used for velocity feedback in the

EFB mode. The polarity is the same as the armature voltage polarity.

NOTE: The scaled velocity feedback signal selected by J5 is combined with the TOTAL REFERENCE SETPOINT to produce the velocity loop error input. The selected feedback is also precisely rectified and supplied as a positive polarity only BUFFERED VELOCITY FEEDBACK at TB2B-17.

VELOCITY INTEGRAL

This is the velocity loop Integral signal before it is combined with the velocity proportional signal to give the Torque reference signal.

VELOCITY PROPORTIONAL

This is the velocity loop proportional signal before it is combined with the velocity integral signal to give the Torque reference signal.

I (CURRENT) INTEGRAL

This is the current loop integral signal before it is combined with the current proportional signal to give the VCO signal.

I (CURRENT) PROPORTIONAL

This is the current loop proportional signal before it is combined with the current integral signal to give the VCO signal.

CURRENT DEMAND

The Torque reference signal is combined with any CURRENT LIMIT or FOLDBACK signal to give the CURRENT DEMAND.

CURRENT FEEDBACK

The armature current signal is scaled according to the control rating and position of J4, see Table 3. The scaled signal is summed with the CURRENT DEMAND signal to produce the current loop error input.

VCO REFERENCE

The VCO REFERENCE is the precisely rectified current loop output signal and controls the frequency of the oscillator input to the trigger circuit.

CURRENT LOOP ERROR

This signal is produced by summing the current feedback and current demand signals. It is input to the current loop.

6

Start-Up Procedure

6.1 Adjustment & Programming Presets

Carotron Elite® controls are all functionally tested and calibrated with motor loads and should require further calibration only to tailor operation for a specific application. The adjustment presets are listed in the event that the condition of the control and its adjustments are unknown or in doubt.

Potentiometer Presets

VELOCITY INTEGRAL	1/3 CW
VELOCITY PROPORTIONAL	1/3 CW
I (CURRENT) INTEGRAL	1/3 CW
I (CURRENT) PROPORTIONAL	1/3 CW
POSITIVE I (CURRENT) LIMIT	full CW
NEGATIVE I (CURRENT) LIMIT	full CW
I.R. COMP	full CCW
SUM TRIM	full CCW
INTEGRAL NULL	full CCW
FWD MAX (MAX SPEED)	mid-range
FWD ACCEL (ACCEL RATE)	mid range
REV ACCEL	mid-range
JOG SPEED	mid-range
REV MAX	mid-range
FWD DECEL (DECEL RATE)	mid-range
REV DECEL	mid-range
MIN SPEED	full CCW

Refer to Section 5.2 for detailed information on the potentiometers.

PROGRAMMING JUMPER PRESETS

Jumpers J1, J4, J6, J10 and J11 should be placed in the positions appropriate to the line, motor and feedback device rating. J5 should be placed initially in the AFB position until proper encoder or tachometer operation is verified.

Jumpers J2, J3, J7, J8, J9 and J12 will be placed according to the specific application requirements.

Refer to Section 5.1 for detailed information on the programming jumpers.

6.2 Initial Pretest & Power-Up

PRETEST

The Elite® control has two separate powered circuits, the three phase input to the semiconductor fuses and the single phase 115 VAC from the control voltage transformer. With the control transformer connected as detailed in Section 4.1, only a three phase power feed to the control is required.

Power should not be applied to the control until proper input voltage level and connections are verified. Input voltage should be checked ahead of the supplying circuit breaker, disconnect switch, etc. before it is switched on.

Connections should be visually inspected and checked for tightness. An ohmmeter can be used to check for ground faults. Even though the Elite® control circuit is isolated and can be grounded, it is not necessary and is generally undesirable because other circuits connected to it may not be

isolated and because of the possibility of ground loops, noise conditions caused by shields being connected at more than one place. Ground faults in un-isolated circuits for the armature and field can cause fuse blowing and damage to the motor and control.

To check for grounds with an ohmmeter, select a high resistance scale such as R x 100K ohms or greater. Test from each connection terminal (including shields) to chassis ground and be suspicious of any resistance reading less than 500K ohms.

NOTE: An exception to this test would be made where the A.C. line supply is connected to a grounded "Y" type transformer secondary.

Power-up

STEP 1

Apply A.C. power to the control. **Do not run or jog at this time.** The ZERO SPEED LED should be on. The FAULT relay should be energized. Refer to Section 7.1.

STEP 2

Verify 115 VAC at TB3-1 & 2 and proper field voltage at TB3-4 & 5, 150VDC for 230VAC inputs, 230VDC for 380VAC inputs and 300VDC for 460VAC inputs.

NOTE: Rated field voltage is present after power-up only for the time period set by the DELAY TIME pot on the fuse board. Refer to Section 7.6 for more information.

A Carotron DCM100-000 Drive Circuit Monitor can be used at this time to measure the power supply outputs, CHECKPOINTS A through G. Refer to Table 5 for a list of monitoring points.

6.3 Motor Start-Up

During the following steps the motor will be rotated. If excessive speed or wrong direction of rotation could damage the load, it may be wise to de-couple the load until proper control is verified. Output can be monitored with a voltmeter by measuring SCALED ARMATURE VOLTAGE at testpoint 15 (TP15), by using a DCM100-000 at Checkpoint K – see Section 5.3, by reading the scaled VELOCITY FEEDBACK at TB2B-17 or by measuring armature voltage.

STEP 3

Turn the external Speed pot to zero or full CCW. Note the direction selected on regen models and press the RUN pushbutton. The RUN LED should light.

Increase the Speed pot setting to 20% and observe acceleration to set speed. The Zero Speed LED should turn off at approximately 5% output.

Observe the direction of rotation and if wrong correct by removing control power and reversing the motor armature or field leads. If used, observe proper polarization of the series field winding per the instructions in Section 4.2.

Proper tachometer or encoder operation can be checked while running in AFB mode and comparing the TOTAL REFERENCE SETPOINT or ENCODER VOLTAGE signal to the SCALED ARMATURE VOLTAGE signal using the test-points or the DCM100-000 CHECKPOINTS. If the alternate feedback signal level is close to the AFB level, it can be safely used for feedback.

STEP 4

Ramp Stop and Emergency Stop functions should be tested initially from a low operating speed. Refer to Section 4.3 for descriptions of these stopping methods and proper cycling of the armature contactor.

STEP 5

Increase the Speed reference to maximum. Use the FWD or REV MAX pot(s) to adjust for rated armature voltage, 240, 415 or 500 VDC, or desired motor maximum speed.

STEP 6

Test the JOG function and set desired JOG speed. Select J12 for desired contactor operation in the JOG mode. See Section 5.1 for a description of J12.

6.4 Calibration & Fine Tuning

Refer to the description of adjustment potentiometers in Section 5.2. Most of the Elite® adjustments are straightforward and self explanatory. Those discussed here have more complex functions or adjustment procedures.

I.R. COMP

As mentioned before, the I.R. COMP is functional only in the AFB mode and is used to keep motor speed from decreasing as load is increased. Adjustment is best done when the motor or machine can be loaded normally. If the motor is normally operated at a particular speed, adjust the I.R. COMP while running at that speed. If the motor operates under load over a wide speed range, pick a speed near mid-range to make the adjustment. Adjust as follows:

Operate the unloaded motor at the normal or mid-range speed and note the exact speed. While still monitoring speed, apply normal load. The reduction in speed of a fully loaded motor will

usually fall between 2% and 13% of rated or "base" speed. Slowly increase the I.R. COMP adjustment clockwise until the loaded speed equals the unloaded speed measured in the previous step. Making this adjustment may now cause the unloaded speed to be slightly higher. Repeat this procedure until there is no difference between loaded and unloaded speed levels.

Use care not to set the adjustment too high or speed increase with load and instability may result.

NOTE: For this adjustment, do not use **SCALED ARMATURE VOLTAGE** to measure speed. Armature voltage is not an exact indication of loaded motor speed!

INTEGRAL NULL

Adjustment of the INTEGRAL NULL pot is sometimes required when the control is continually operated in the RUN mode with a zero speed reference or when very rapid stopping is required. With maintained zero reference, creeping can occur and depending on dynamics of the load and response of the control, rapid stopping can cause an overshoot through zero speed or back-up in motor rotation at stop. If either of these conditions is apparent, increase the INTEGRAL NULL in the clockwise direction to minimize the symptoms.

NOTE: Because there is a small reduction in speed regulation, **DO NOT** make this adjustment unless these symptoms are apparent in normal operation. Elite® Drives manufactured after Fall '95 incorporate an integral null circuit that is locked out above zero speed. This eliminates the reduction in speed regulation above Zero Speed.

I PROPORTIONAL, I INTEGRAL, VELOCITY PROPORTIONAL AND VELOCITY INTEGRAL

The INTEGRAL and PROPORTIONAL adjustments, P1-P4, as preset by Carotron will provide stable and responsive performance under most load conditions. Therefore, any observed instability should first be evaluated as a possible load induced condition.

Cyclic variation in armature current and in motor speed can indicate mechanical coupling or machine loading conditions. If mechanically induced, the instability repetition rate or frequency can usually be related to a motor or machine rotation rate or loading cycle. In this situation, the instability frequency will change in coincidence with any motor speed change.

Instability in the control output due to incorrect adjustment would usually be present over a range of speed and would not usually change frequency in coincidence with speed. Because the response of the control can sometimes be altered to partially compensate for mechanically induced instability, it is sometimes difficult to determine if the load change is affecting control output stability or if control output is affecting the load stability. Decoupling the load can help make this determination.

When re-adjustment of the control loops is determined, start first with the I (current) loop adjustments.

The factory presets P1-P4 at 33% resistance. The adjustment pots are approximately 20-25 turns and have no mechanical stops. When rotated past the end of their resistance range, a faint clicking noise can be heard. You must keep track of the number of turns to know your setting within the adjustment range. If the clicking cannot be heard, count turns on the screwdriver until more than 30 turns have been made. Then rotate in the opposite direction for 8 to 10 turns to set at 1/3 rotation.

I INTEGRAL

The I INTEGRAL controls a 10 to 1 change in the current loop integral time constant. Counter-clockwise rotation decreases the time or increases the response rate.

I PROPORTIONAL

The I PROPORTIONAL controls a 2 to 1 change in the current loop proportional gain. Clockwise rotation increases the gain and response.

VELOCITY INTEGRAL

The VELOCITY INTEGRAL is a trimming pot that gives a 20 to 1 change in the velocity loop integral time constant. Clockwise rotation increases the time or decreases the response rate.

VELOCITY PROPORTIONAL

The VELOCITY PROPORTIONAL gives a 4 to 1 change in the velocity loop proportional gain. Clockwise rotation increases the gain.

The VELOCITY INTEGRAL and VELOCITY PROPORTIONAL signals are summed to produce the TORQUE DEMAND signal.

The I INTEGRAL and I PROPORTIONAL signals are summed to produce the VCO input signal.

7 Special Circuit Functions & Operating Modes

7.1 Fault Conditions

The Elite® models have four latching type FAULT conditions which cause a control safety shutdown with form "C" contact output and LED indication of the condition. They are Phase Loss, Field Loss, Heatsink Overtemp and Overcurrent.

The LED indicators are located on the PERSONALITY BOARD and are visible from the front of the control with the front panel opened or closed.

The FAULT contact outputs are at TB1 terminals 11, 12 and 13 and are part of the FAULT relay that supplies 115 VAC to all relay logic and customer wiring connected to TB1. This voltage is supplied from TB1-1 when the FAULT relay is in its normally energized state. When a FAULT condition occurs, the relay deenergizes and the control is disabled as in an EMERGENCY STOP condition. The control cannot be restarted until the FAULT is corrected and the RESET button on the CONTROL BOARD or the external FAULT RESET contact at TB2B terminals 23 and 24 is momentarily closed.

NOTE: The control does not automatically restart when reset from a fault condition.

The various FAULT Conditions operate as follows:

PHASE LOSS

A momentary loss, approximately 2 cycles, of any of the three phase line inputs will cause Phase Loss. This time period provides protection of the control without causing sensitivity to line transients.

FIELD LOSS

Discontinuity of the motor field current due to blown fuses, open wiring, open windings, etc. will cause Field Loss.

HEATSINK OVERTEMP

Power bridge heatsink temperature in excess of the safe operating area of the SCR and diode power

components will cause Heatsink Overtemp. This could result from continued operation above control load rating, excessive ambient temperature or problems with enclosure forced ventilation or the heatsink fan.

The Overtemp FAULT cannot be reset until heatsink temperature has been reduced approximately 15°C below the trip point.

OVERCURRENT FAULT

OVERCURRENT FAULT is a timed overload condition controlled by the J4 ARMAMPS and the J7 OVERCURRENT range programming jumpers. Refer to Section 5.1 for further information. The control will temporarily allow motor currents up to 150% of the range selected by J4 refer to Table 3. When CURRENT DEMANDED by the load has exceeded 105% of the range for the J7 time period ahead of the slash, the control will FOLDBACK or clamp the current to a maximum of 112%. Continued current demand for the time period behind the slash will cause the control to initiate an OVERCURRENT FAULT condition.

7.2 FWD/REV Direction Enable Controls

The FWD/REV Direction Enable control inputs at TB2A terminals 1-4 provide internal reference clamping for the normal speed reference applied to TB2B-12. Operating either input will prevent motoring in the direction selected.

Refer to Figure 9 - they are normally jumpered; 1 to 2 for forward direction and 3 to 4 for reverse on regenerative models; or are contact controlled when external lockout of direction is required.

NOTE: The RUN mode motoring function only is disabled, i.e. the E12000 Series models can still provide regenerative braking torque for either direction. JOG mode operation is not affected by these enable controls.

7.3 Current Limit by External Signals

Refer to Figure 9 – the Current Limit Control inputs at TB2A terminals 5-8 allow limiting motor current or torque by an external voltage signal. Terminals 5 and 7 are +7.5 VDC and -7.5 VDC respectively and are normally connected to terminals 6 and 8 respectively. The 7.5 volt levels correspond to 150% current level. Refer to Section 5.1 Programming Jumpers and Table 3 for determining the control current rating.

The inputs at terminals 6 and 8 are trimmed by the POS and NEG CURRENT LIMIT pots on the E12000 Series PERSONALITY BOARD and for custom tension control applications will be connected to an externally generated torque reference signal. The voltage applied terminals 6 or 8 should **never** be allowed to exceed 7.5 VDC.

7.4 Summing Input Signal

The Summing Input at TB2B-14 is trimmed by the SUMTRIM pot on the PERSONALITY BOARD and can be made to add or subtract from the RUN and JOG mode reference signals.

The combination of the summing signal and the speed reference gives a TOTAL REFERENCE SETPOINT which is internally limited to give a maximum armature output voltage no greater than 108% of the control rating.

The function of the SUMMING signal is controlled by J2 and the direction command on regen models. With ADD selected at J2, a positive SUMMING signal will add to a positive (forward) reference. A negative SUMMING signal would subtract.

NOTE: With ADD selected, a negative SUMMING signal greater than the Positive reference would cause a net negative TOTAL REFERENCE SETPOINT and would cause REVERSE rotation on regenerative models even with forward direction selected. The same situation could occur if the SUMMING signal was positive and the SUBTRACT position was selected at J2. This logic applies regardless of the direction command by the FWD/REV selector.

With ADD selected, like polarity signals add; unlike polarities subtract from each other with the greatest signal having control of direction. With SUBTRACT selected, like polarities subtract from each other and unlike polarities add.

Placing J3 in the (NOT) JOG/SUM position prevents the SUMMING signal from being combined with the JOG reference.

The SUM TRIM pot can provide a "min. speed" function by connecting TB2A-9 to TB2B-14 and placing J2 in the ADD position. Refer to Section 5.1 for descriptions of the programming jumpers.

7.5 Buffered Monitoring Signals

Buffered outputs for monitoring control operation are provided at terminals 16, 17 and 18. These outputs can source up to 10 mA current each and are used by measuring from CIRCUIT COMMON at terminals 13, 15 or 21. Refer to Figure 11, Section 4.4 - TB2B Terminals 16, 17 and 18 and Table 5 for a description of these terminals and the signals they provide.

7.6 Field Economy & External Field Supplies

FIELD ECONOMY

All Elite® models feature a FIELD ECONOMY circuit to automatically reduce the field supply voltage 35% after being stopped for a time period adjustable by the customer. This time is controlled by a single turn knob adjust DELAY TIME pot located on the FUSE BOARD. The pot ranges from 1 to 3 minutes with counter-clockwise rotation increasing time. The FIELD ECONOMY function is not operational with an externally connected field supply.

EXTERNAL FIELD SUPPLIES

The external field supply connection is used to interface an optional FIELD CURRENT REGULATOR for constant horsepower load applications and when a non-standard field voltage requirement exists.

Refer to Section 4.2 Motor Connections - Field and Figure 6. The FIELD LOSS FAULT function will still operate when J11, located on the FUSE BOARD, is used to interface the field current sensing circuit with the external field supply.

WARNING!!! When interfacing with an external field supply, programming jumper J11 must be placed in the EXT position to prevent damage to the Elite® control or external supply.

8

Spare Parts

8.1 Printed Circuit Assemblies

CONTROL BOARD

All E12000 and E06000 Series models part number D11111-000

PERSONALITY BOARD

All E12000 Series models part number C11114-000

All E06000 Series models part number C11135-000

RELAY BOARD

All E12000 and E06000 Series models part number D11117-000

POWER SUPPLY BOARD

All E12000 and E06000 Series models part number C11120-000

TRIGGER BOARD

All E12000 Series models part number D11123-001

All E06000 Series models part number D11123-000

C.T. (CURRENT TRANSFORMER) BOARD

Models E12020-000 and E06020-000 part number C11126-000

Models E12040-000 and E06040-000 part number C11126-001

Models E12060-000 and E06060-000 part number C11126-002

Models E12075-000 and E06075-000 part number C11126-003

Models E12100-000 and E06100-000 part number C11126-004

Models E12125-000 and E06125-000 part number C11126-005

Models E12150-000 and E06150-000 part number C11126-006

FUSE BOARD

Models E12020-000, E12040-000, E06020-000 and E06040-000 part number D11129-000

All other models part number D11129-001

8.2 Connector/ Cable Assemblies

SAME FOR ALL MODELS

Cable 1 Assembly part number A11178-000

Cable 2 Assembly part number CNT1065-00

Cable 3 Assembly part number A11179-000

Cable 4 Assembly part number CNT1066-00

Cable 5 Assembly part number CNT1066-00

Cable 6 Assembly part number CNT1067-00

Cable 7 Assembly part number CNT1065-00

E06 MODELS

Cable 8 Assembly part number A11180-001

Cable 9 Assembly part number A11181-000

E12 MODELS

Cable 8 Assembly part number A11180-000

Cable 9 Assembly part number A11182-000

20-75 HP MODELS

Cable 10 Assembly part number A11183-000

Cable 11 Assembly part number A11184-000

100-150 HP MODELS

Cable 10 Assembly part number A11183-001

Cable 11 Assembly part number A11184-001

MODEL DEPENDENT

L1, L2, L3 pressure terminal connectors per model

Models E12020-000 – E12075-000

Models E06020-000 – E06075-000

Carotron CNT1012-09

T&B F4-14

Panduit P4-14R-E

Models E12100-000 – E12125-000

Models E06100-000 – E06125-000

Carotron CNT1012-15

T&B G2-14

Panduit P2-14R-X

Models E12150-000 and E06150-000

Carotron CNT1012-17

T&B H10-14

Burndy YA25-L2

8.3 Fuses

SAME FOR ALL MODELS

FU1, FU2, FU3: 10 ampere, dual element, time delay, 500 VAC located on the FUSE BOARD

Carotron	FUS1008-03
Bussmann	FNQ-10
Littelfuse	FLQ-10

FU4: 5 ampere, 250 VAC, dual element, time delay located on the FUSE BOARD

Carotron	FUS1005-01
Bussmann	MDA-5
Littelfuse	326005

FU8: 0.5 ampere, 120 VAC, dual element, time delay- located on the Power Supply Board

Carotron	FUS1006-05
Bussmann	MDL-1/2
Littelfuse	313.500

MODEL DEPENDENT

FU5, FU6, FU7 Current rating per model, 500 VAC semiconductor types

Model E12020-000 & E06020-000: 50 ampere

Carotron	FUS1009-00
Bussmann	FWH50
Shawmut	A50QS50-4

Model E12040-000 & E06040-000: 100 ampere

Carotron	FUS1009-01
Bussmann	FWH100
Shawmut	A50QS100-4

Model E12060-000 & E06060-000: 150 ampere

Carotron	FUS1009-02
Bussmann	FWH150
Shawmut	A50QS150-4

Model E12075-000 & E06075-000: 175 ampere

Carotron	FUS1009-03
Bussmann	FWH175
Shawmut	A50QS175-4

Model E12100-000 & E06100-000:250 ampere

Carotron	FUS1009-05
Bussmann	FWH250
Littelfuse	L50S250

Model E12125-000 & E06125-000:300 ampere

Carotron	FUS1009-06
Bussmann	FWH300
Littelfuse	L50S300

Model E12150-000 & E06150-000:350 ampere

Carotron	FUS1009-04
Bussmann	FWH350
Littelfuse	L50S350

8.4 Power Components

ARMATURE BRIDGE

All armature bridge devices are dual SCR isolated power modules rated at 1400 volts repetitive peak off state and reverse voltage and have 1000 V/uS dvdt. There are 3 each on E06000 Series models, PMD1-3, and 3 additional, PMD4-6, on E12000 Series models. Current ratings are per control model.

Model E12020-000 & E06020-000: 31 ampere

Carotron	PMD1025-00
AEG/Eupec	TT31N14KOF
Semikron	SKKT42/14E

Model E12040-000 & E06040-000: 56 ampere

Carotron	PMD1026-00
AEG/Eupec	TT56N14KOF
Semikron	SKKT57/14E

Model E12060-000 & E06060-000: 91 ampere

Carotron	PMD1027-00
AEG/Eupec	TT92N14KOF
Semikron	SKKT92/14E

Model E12075-000 & E06075-000: 105 ampere

Carotron	PMD1019-00
AEG/Eupec	TT105N14KOF
Semikron	SKKT106/14E

Model E12100-000 & E06100-000:131 ampere

Carotron	PMD1029-00
AEG/Eupec	TT131N14KOF

Model E12125-000, E12150-000,

E06125-000 & E06150-000:162 ampere

Carotron	PMD1021-00
AEG/Eupec	TT162N14KOF

NOTE: IR (International Rectifier) and Crydom have similar power module ratings but are not pin-for-pin compatible with the above listed parts. The gate and cathode signal leads are reversed on the second SCR device. Furthermore, Semikron also makes a power module rated similarly to the 131 and 162 amp modules. However, the gate and cathode signals are reversed on both SCR devices. Consult the factory for assistance in making substitutions for the recommended spares listed above.

FIELD SUPPLY

The field supply uses the same power components for all models.

FIELD SUPPLY

The field supply uses the same power components for all models.

PMD9, dual diode, 22 ampere, 1400 volts

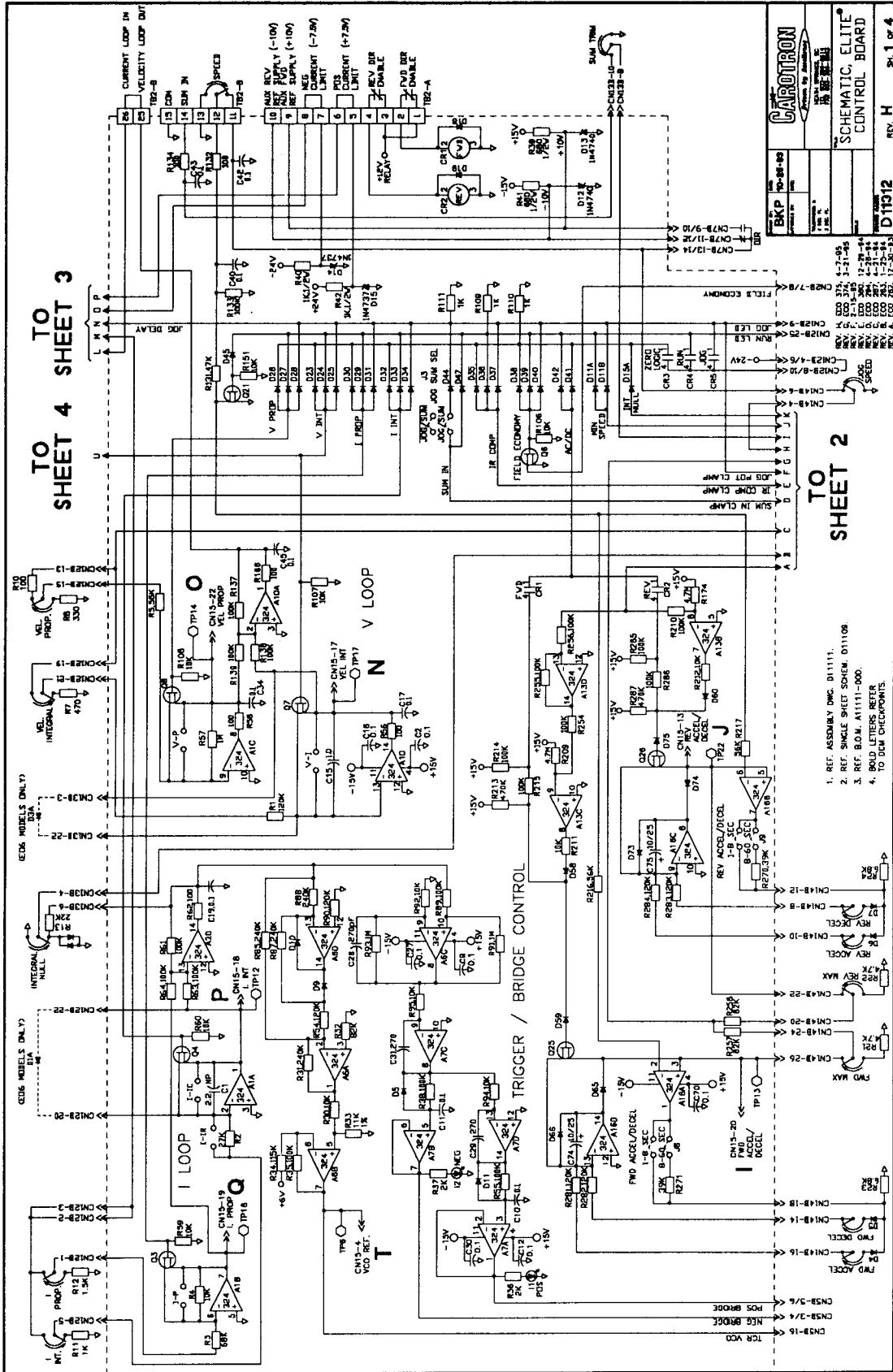
CarotronPMD1024-00
AEG/Eupec DD22S1400K-K

PMD10, SCR/diode, 25 ampere, 1400 volts

CarotronPMD1010-02
AEG/Eupec TD25N14KOF
Semikron SKKH25/14E

PMD7 and PMD8, diode doubler, 25 ampere, 50 volts

CarotronPMD1009-00
EDI FPID2505



CAROTRON
 DIVISION OF
 GENERAL ELECTRIC

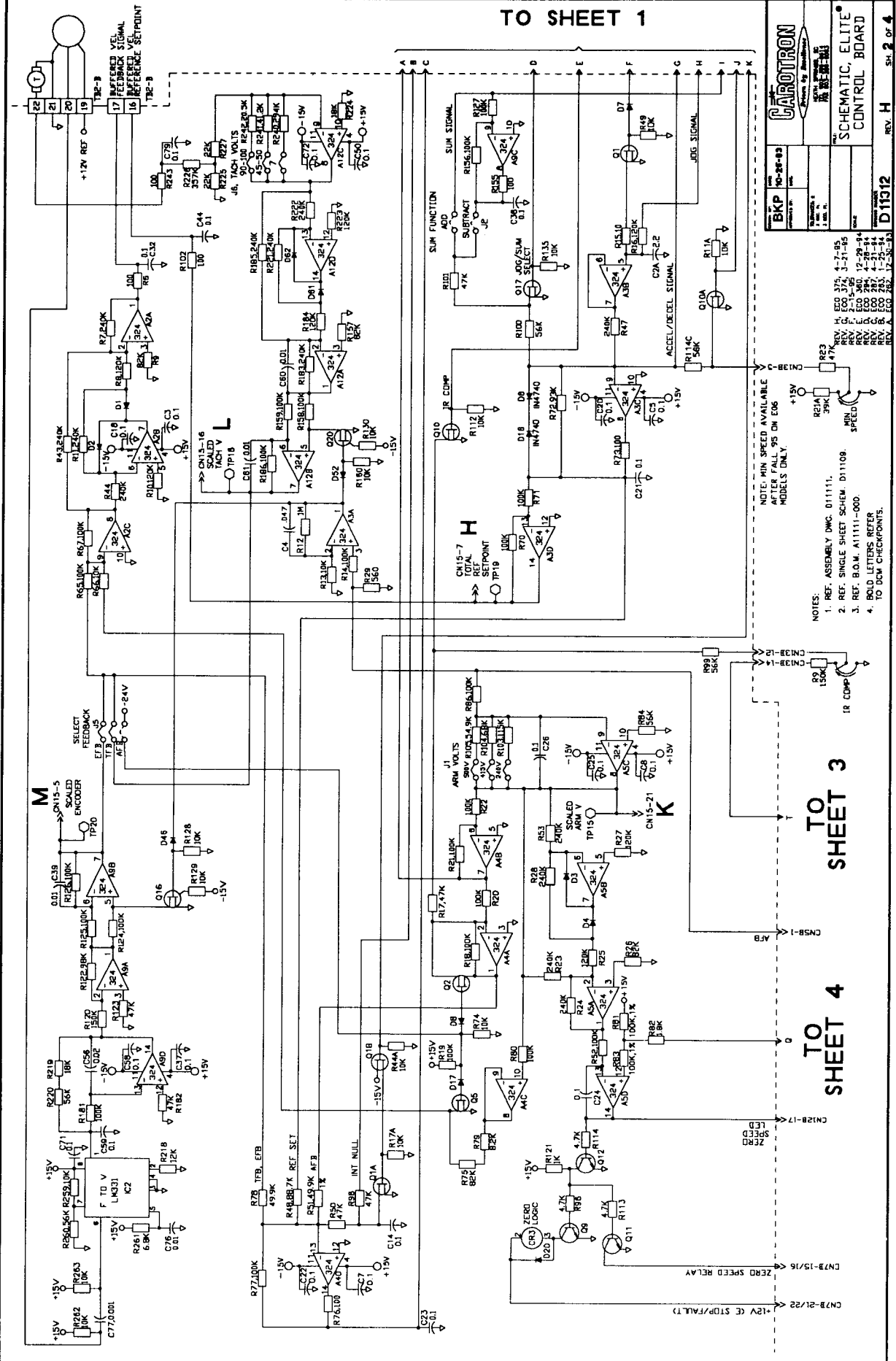
BKP 10-26-83

REV. H
 DATE: 11-20-84
 BY: J. M. H.

SCHEMATIC, ELITE CONTROL BOARD

D11912

SH. 2 OF 4



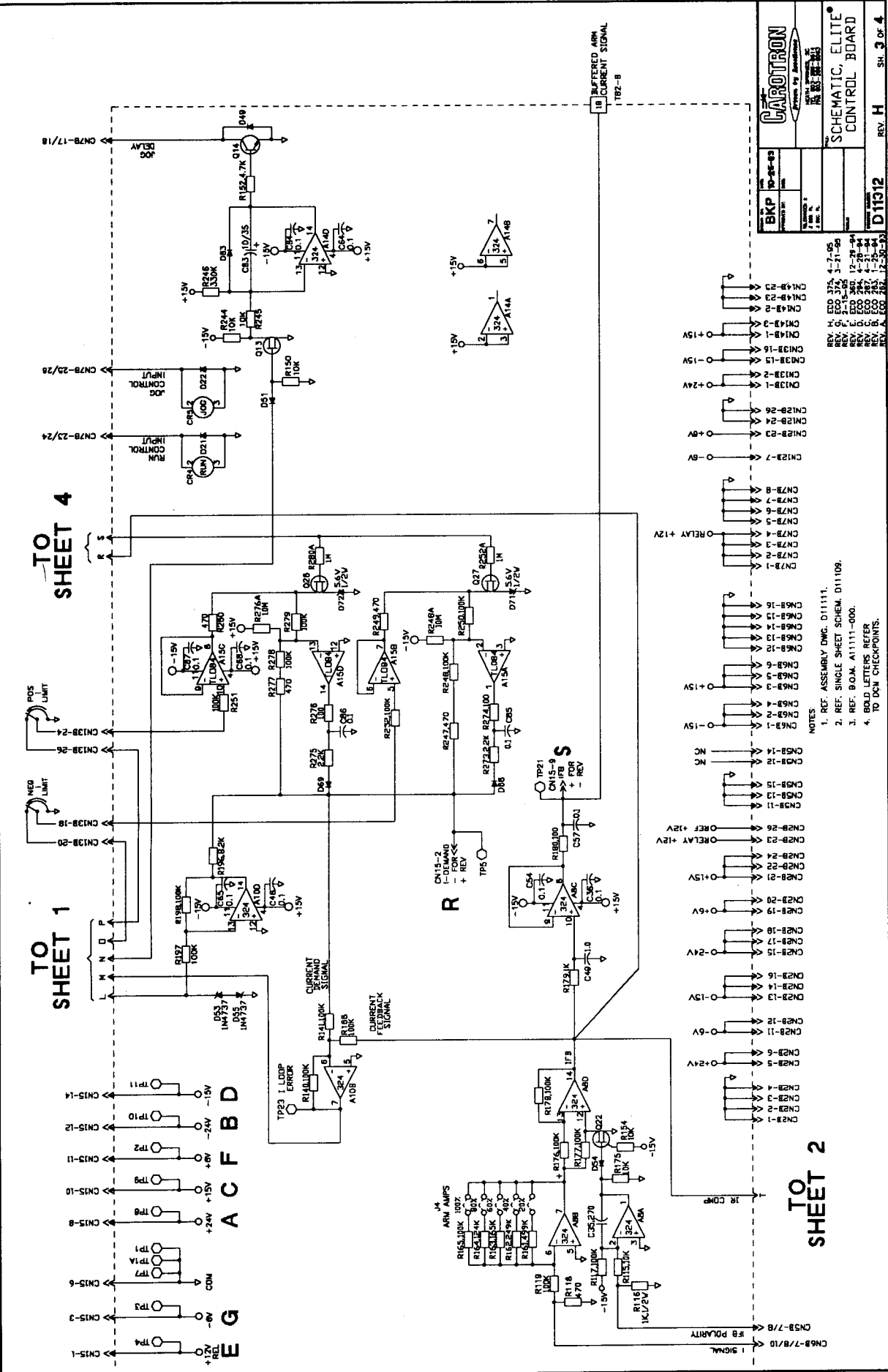
TO SHEET 3

TO SHEET 4

- NOTES:
1. REF. ASSEMBLY DWG. 011111.
 2. REF. SINGLE SHEET SCHEM. D1109.
 3. REF. B.O.M. A11111-000.
 4. BOLD LETTERS REFER TO DCN CHECKPOINTS.
- NOTE: MIN SPEED AVAILABLE AFTER FALL '95 ON E06 MODELS ONLY.

REV. 1, E.O. 375, 4-7-65
 REV. 2, E.O. 12812, 3-21-66
 REV. 3, E.O. 12812, 12-29-64
 REV. 4, E.O. 12812, 4-21-64
 REV. 5, E.O. 12812, 1-25-64
 REV. 6, E.O. 12812, 1-25-64
 REV. 7, E.O. 12812, 12-29-64
 REV. 8, E.O. 12812, 12-29-64
 REV. 9, E.O. 12812, 12-29-64
 REV. 10, E.O. 12812, 12-29-64

- NOTES
1. REF. ASSEMBLY DWG. D11111.
 2. REF. SINGLE SHEET SCHEM. D11109.
 3. REF. B.O.M. A11111-400.
 4. BOLD LETTERS REFER TO DCN CHECKPOINTS.



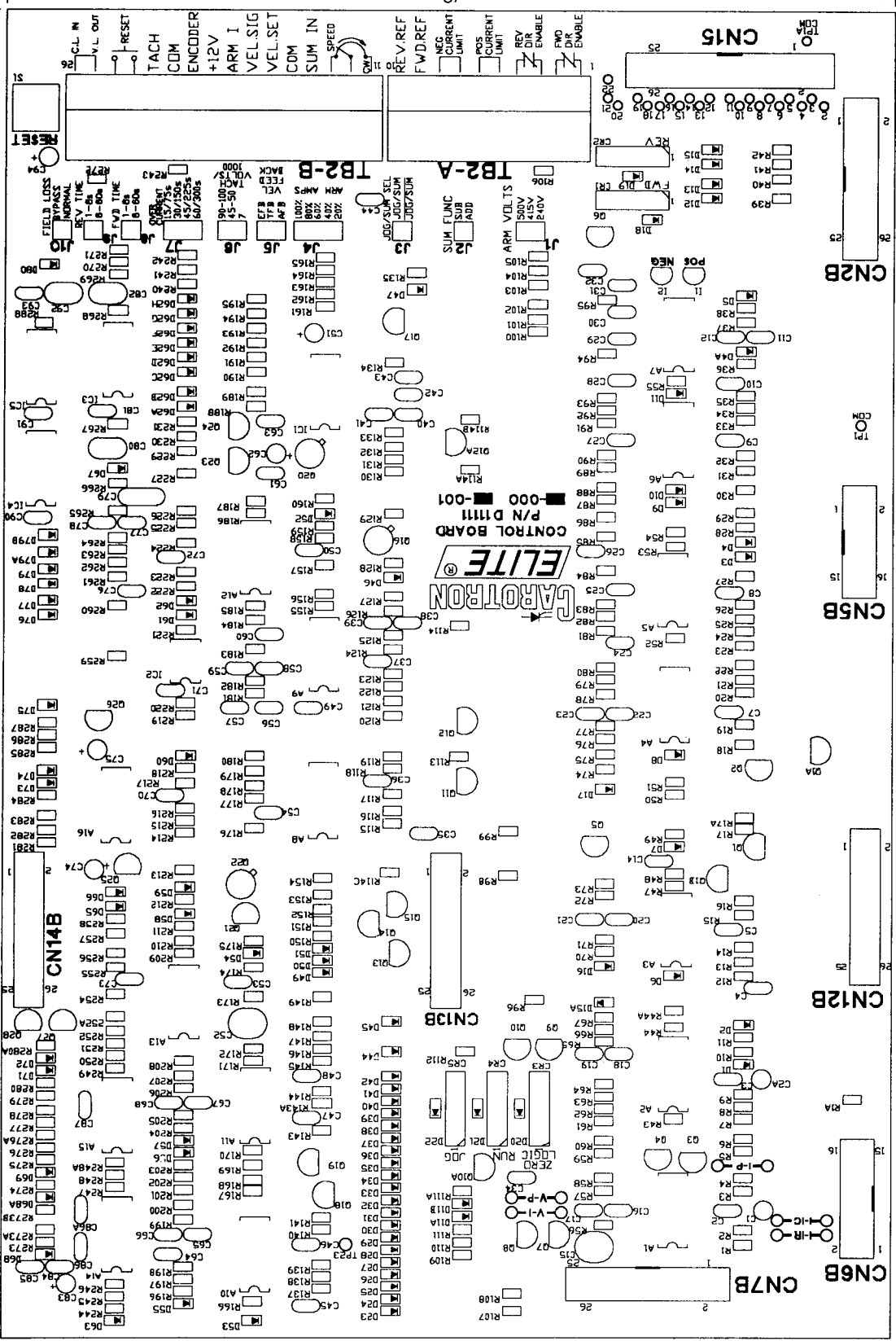
TO SHEET 4

TO SHEET 1

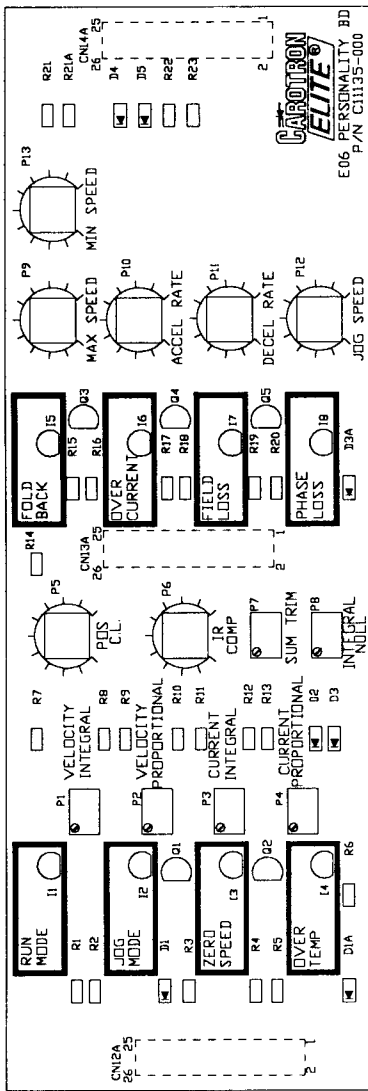
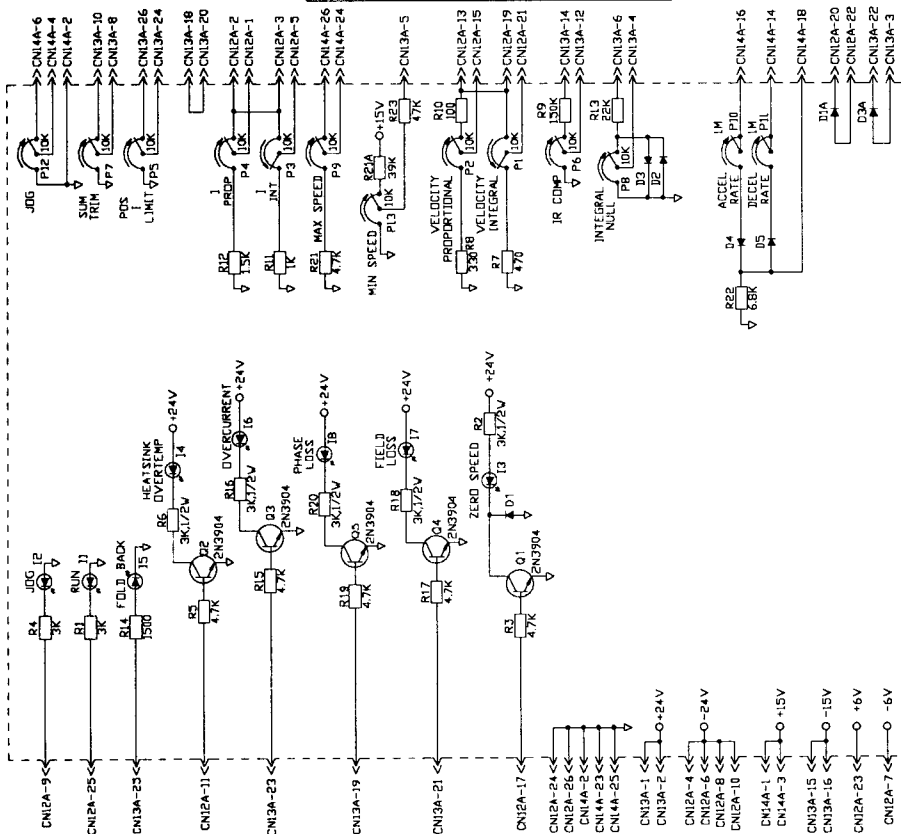
TO SHEET 2

13.500

9.000



- NOTES:
 1. REF. ONE PAGE SCHEMATIC D11109.
 2. REF. 4 PAGE SCHEMATIC D11312.
 3. REF. B.O.M. A11111-XXX.



ASSEMBLY C11133

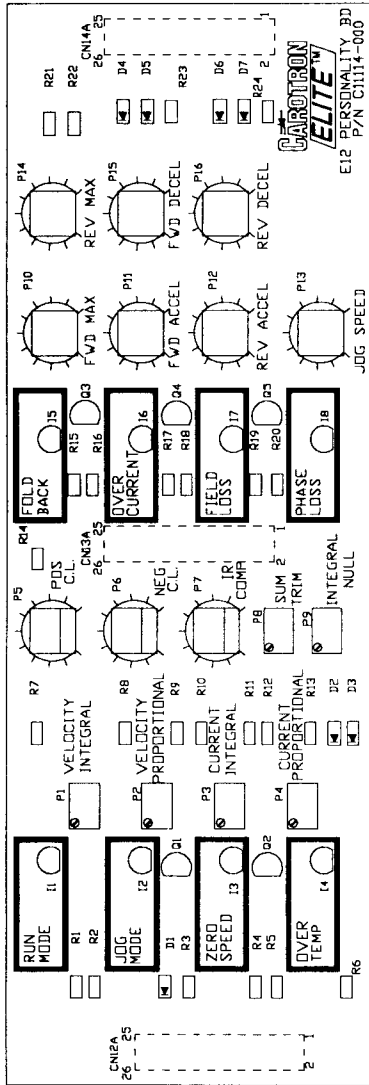
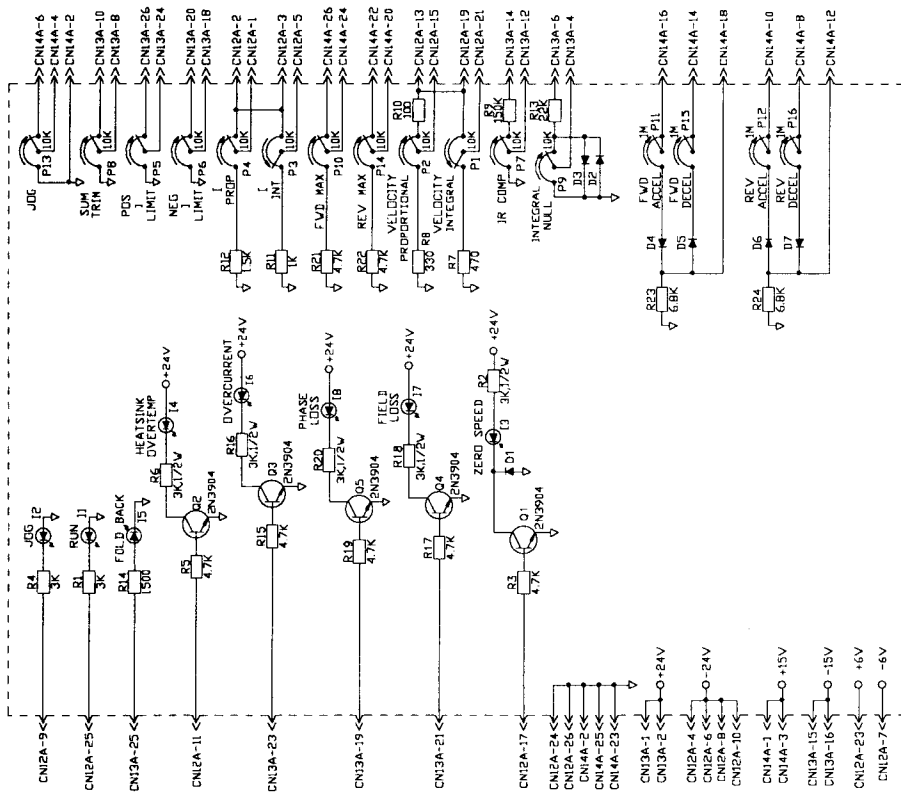
REV. ECD 378, 4-7-95
REV. ECD 230, 8-17-93

SCHEMATIC C11133

REV. ECD 378, 4-7-95
REV. ECD 230, 8-17-93
REV. ECD 294, 4-28-94
REV. ECD 569, 1-13-94
REV. ECD 542, 10-4-93
REV. ECD 230, 8-17-93

BKP	REV. 0/4	REV. 0/4	REV. 0/4
Carotron by Danaher			
SCHEMATIC & ASSEMBLY ELITE E06000 SERIES PERSONALITY BOARD			
D11590			SH. 1 OF 1

ELITE
E06 PERSONALITY BD
P/N C11133-000

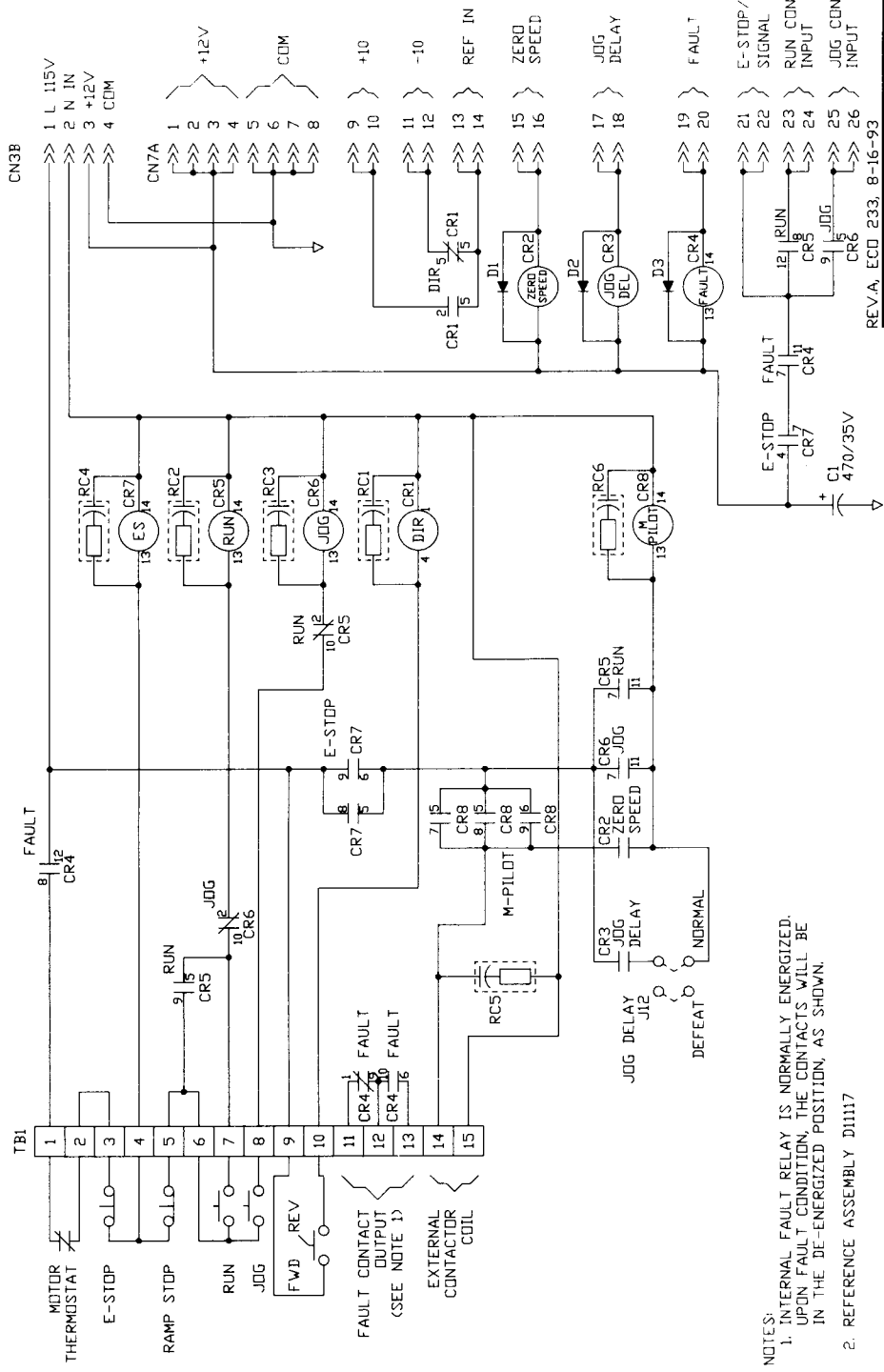


ASSEMBLY C11114
 REVA, ECO 231, 8-16-93

SCHEMATIC C11112

- REV. E, ECO 375, 4-10-95
- REV. D, ECO 323, 8-22-94
- REV. C, ECO 294, 4-28-94
- REV. B, ECO 242, 10-4-93
- REV. A, ECO 231, 8-16-93

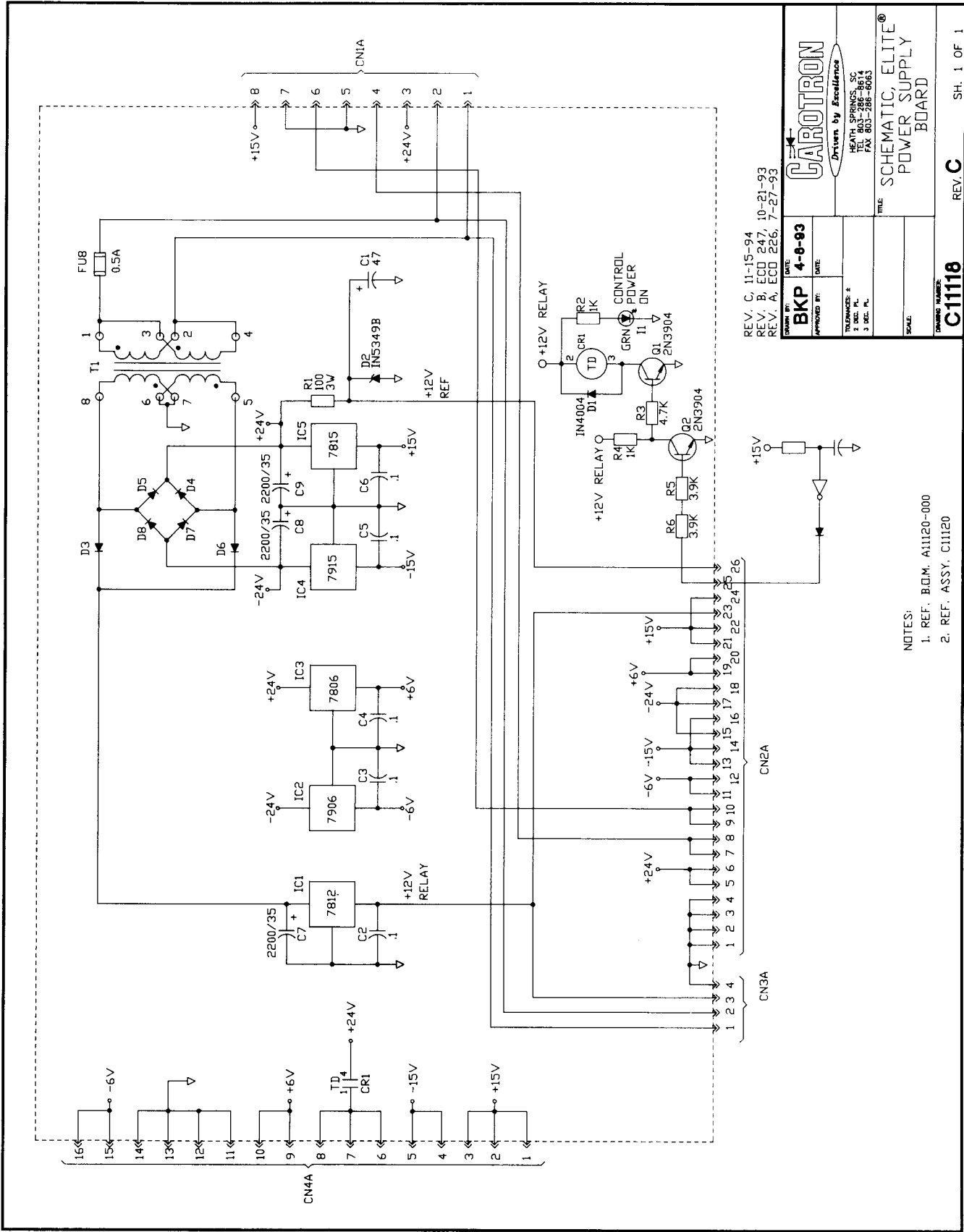
BKP 12/1/84		
DATE P.	BY:	
1. REV. E, ECO 375, 4-10-95 2. REV. D, ECO 323, 8-22-94 3. REV. C, ECO 294, 4-28-94 4. REV. B, ECO 242, 10-4-93 5. REV. A, ECO 231, 8-16-93		THE SCHEMATIC & ASSEMBLY ELITE E12000 SERIES PERSONALITY BOARD
DATE: 12/1/84 BY:		
DRAWING NO. C11114-000		REV. A SH. 1 OF 1



NOTES:
 1. INTERNAL FAULT RELAY IS NORMALLY ENERGIZED. UPON FAULT CONDITION, THE CONTACTS WILL BE IN THE DE-ENERGIZED POSITION, AS SHOWN.
 2. REFERENCE ASSEMBLY D11117

REV. A, ECD 233, 8-16-93

DATE: 4/6/83	DATE:
APPROVED BY: UBJ	APPROVED BY:
ISSUANCES: #	ISSUANCES: #
3 REV. P.L.	3 REV. P.L.
SCALE:	SCALE:
 Driven by Excellence HEATH SPRINGS, SC TEL: 803-288-8030 FAX: 803-288-8043	
TITLE: SCHEMATIC, ELITE® RELAY PC BOARD	
FORMING NUMBER: C11115	REV. A
	SH. 1 OF 1



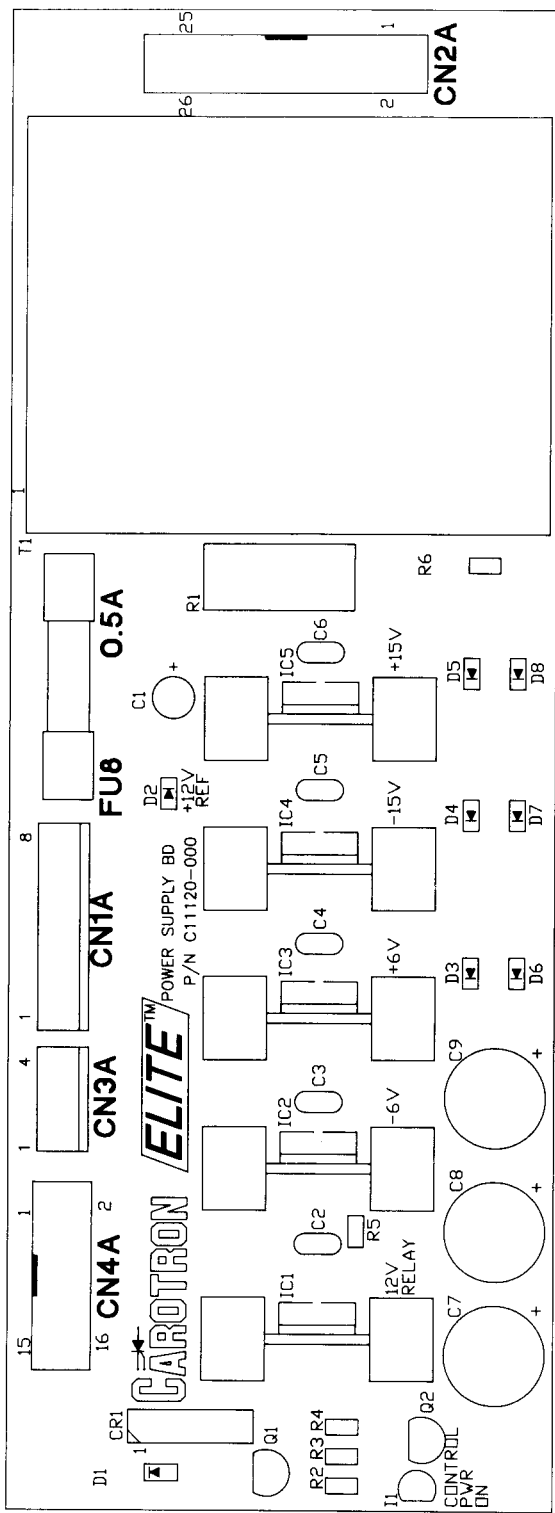
REV. C, 11-15-94
 REV. B, ECO 247, 10-21-93
 REV. A, ECO 226, 7-27-93

DATE BKP 4-0-93	
APPROVED BY: _____	DATE: _____
TELEPHONE # _____	
FAX # _____	
SCALE _____	
DRAWING NUMBER C11110	
REV. C	
SH. 1 OF 1	

Carotron
Driven by Excellence
 HEATH SPRINGS, SC
 TEL 803-286-8614
 FAX 803-286-8063

TITLE
**SCHEMATIC, ELITE®
 POWER SUPPLY
 BOARD**

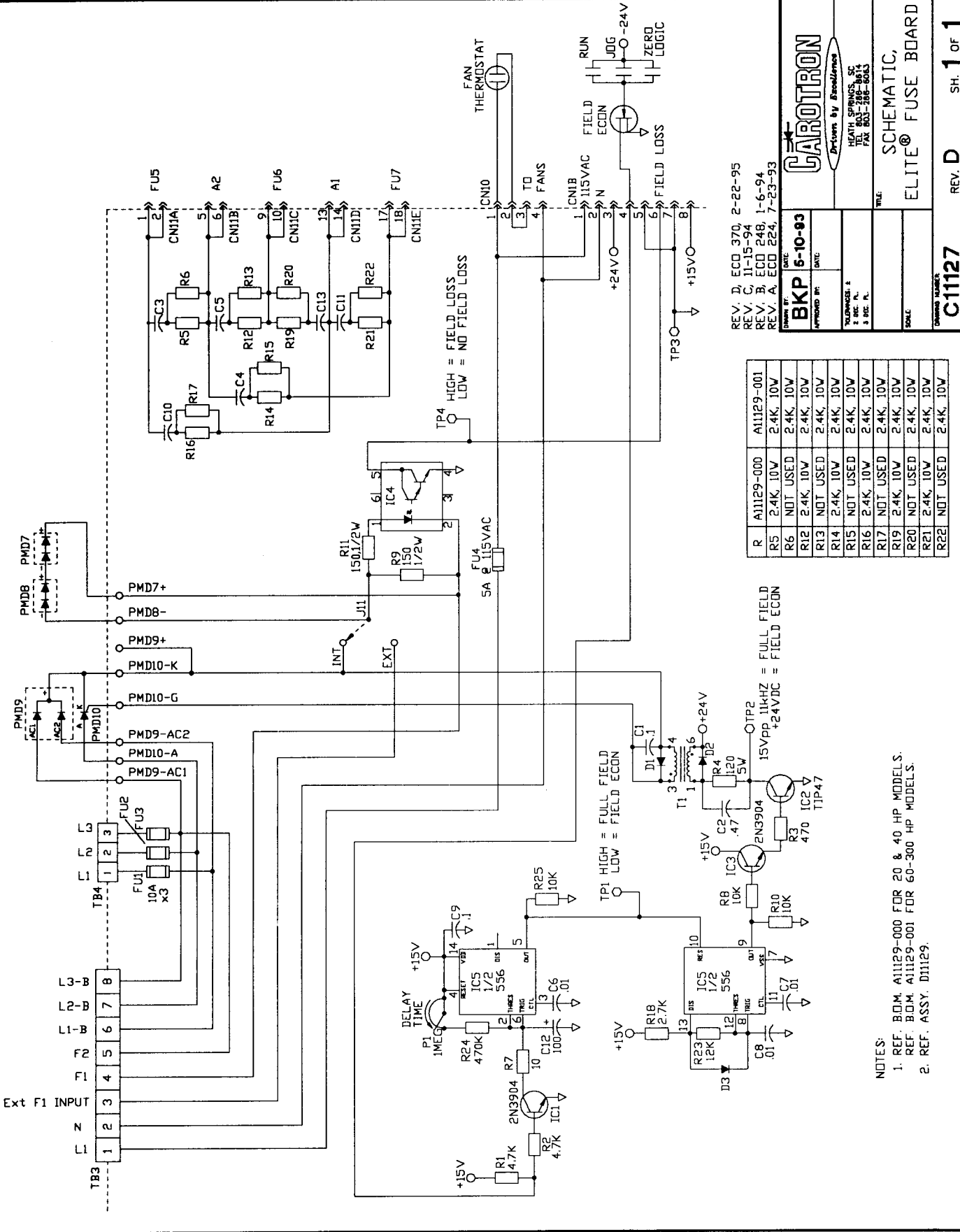
- NOTES:
1. REF. B.O.M. A11120-000
 2. REF. ASSY. C11120



- NOTES:
1. REF. SCHEMATIC C11118
 2. REF. B.O.M. A11120

REV. B, ECO 247, 2-8-94
 REV. A, ECO 226, 7-27-93

CAROTRON <i>Driven by Excellence</i> HEATH SPRINGS, SC P.O. BOX 286 FAX 803-286-8083	DATE: 5-10-93 APPROVED BY:
TOLERANCES: 1 RES. PL. 3 RES. PL.	TITLE: ELITE™ ASSEMBLY POWER SUPPLY BOARD
SCALE: 2=1	DRAWING NUMBER: C11120
REV. B	SH. 1 OF 1

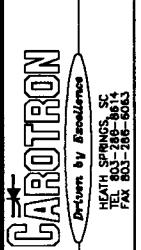


NOTES:
 1. REF. B.O.M. A11129-000 FOR 20 & 40 HP MODELS.
 2. REF. B.O.M. A11129-001 FOR 60-300 HP MODELS.
 2. REF. ASSY. D11129.

REV. D, ECO 370, 2-22-95
 REV. C, 11-15-94
 REV. B, ECO 248, 1-6-94
 REV. A, ECO 224, 7-23-93

DATE: **BKP 6-10-93**
 APPROVED BY: _____

DESIGNED BY: _____
 1. INC. P.
 2. INC. P.
 3. INC. P.



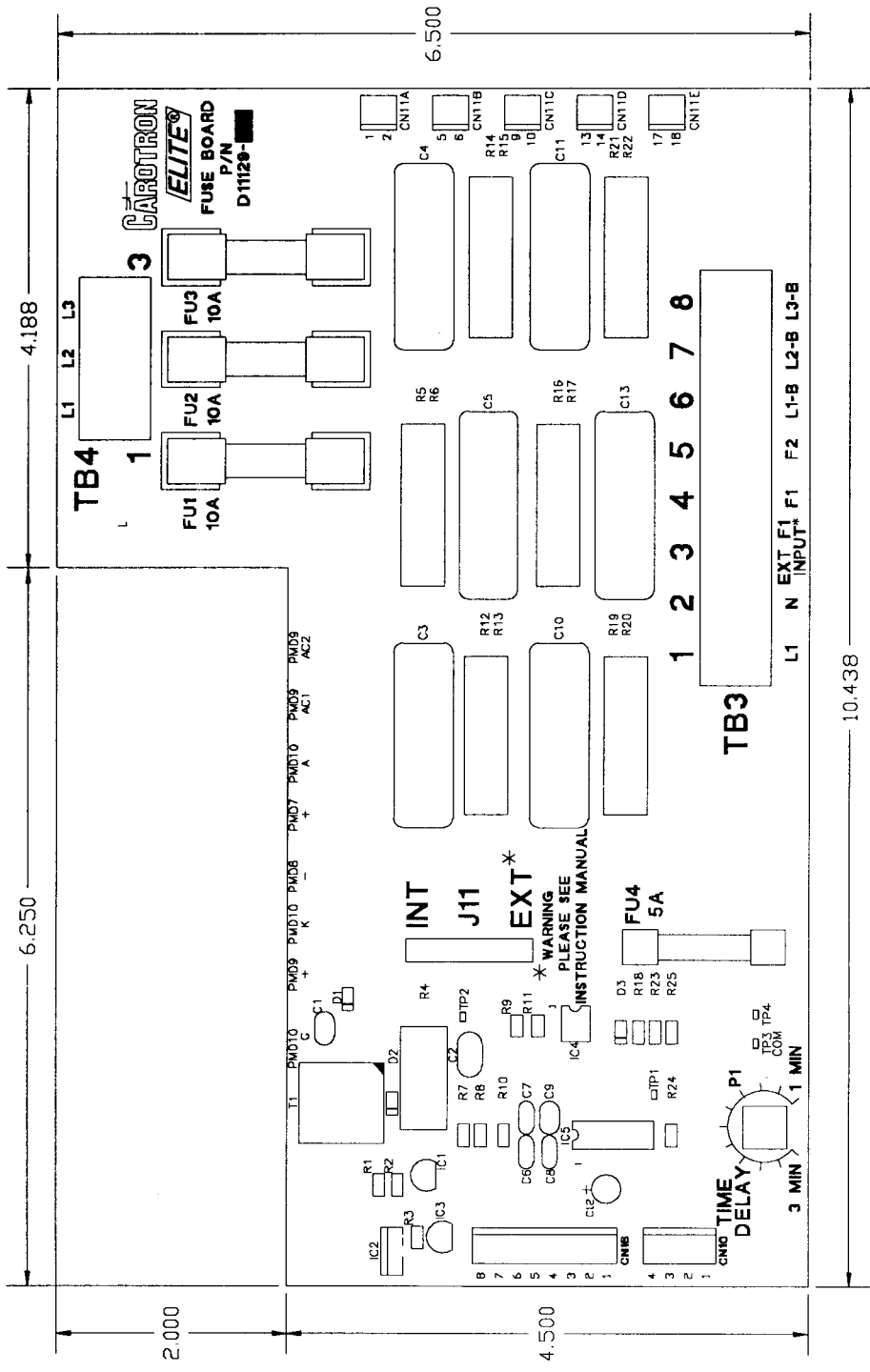
HEATH SPRINGS, SC
 TEL. 803-786-8614
 FAX 803-786-6063

TITLE: SCHEMATIC,
 ELITE® FUSE BOARD

REV. D

C11127

SH. 1 OF 1



REV. D ECD 373, 3-9-95
 REV. C ECD 270, 1-15-94
 REV. B ECD 224, 7-23-93

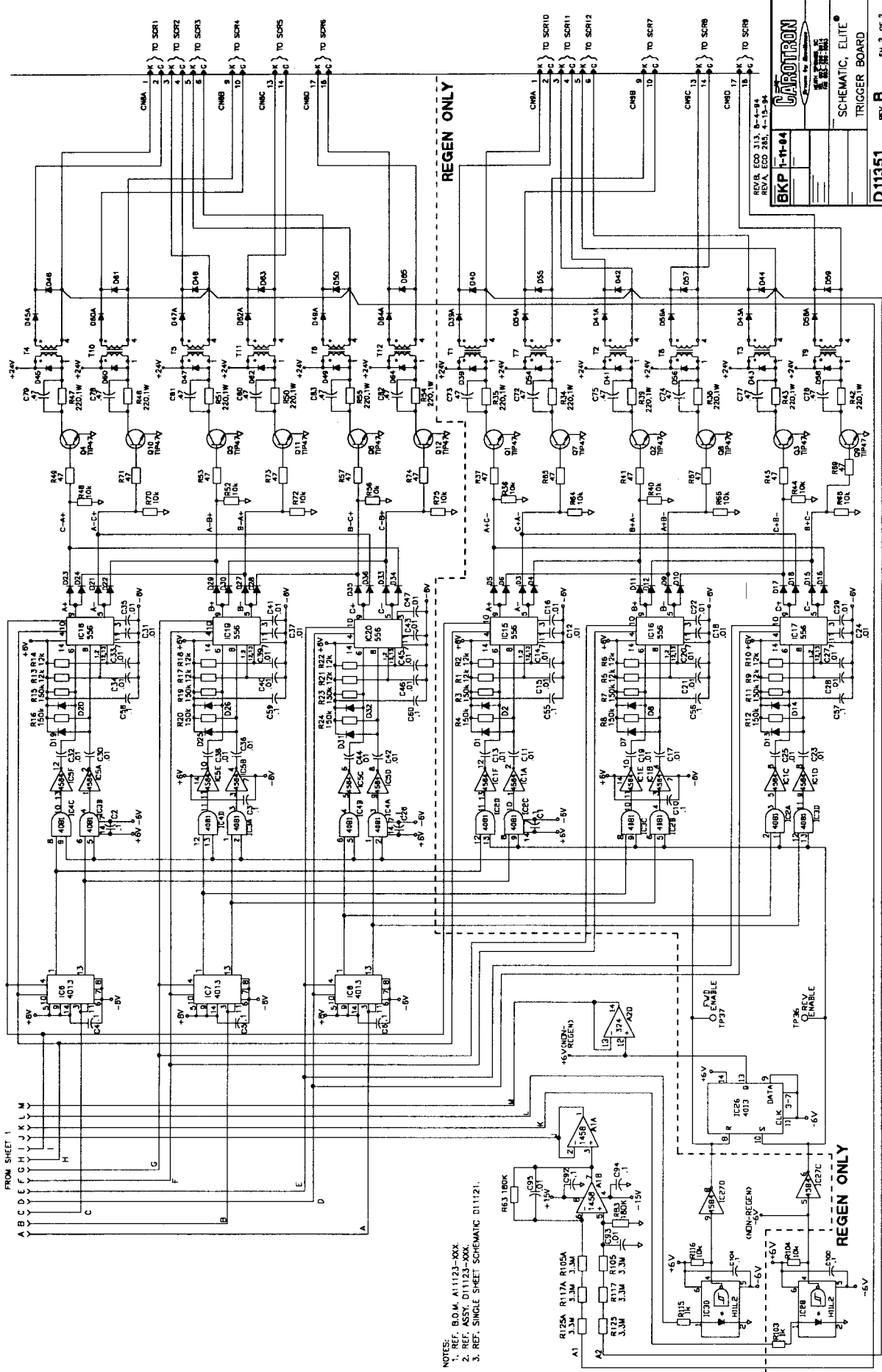
WORM 15-10-03

ASSEMBLY, ELITE®
 FUSE BOARD

2=1

D11129 REV. D SH. 1 OF 1

NOTES:
 1. REF. SCHEMATIC C11127
 2. REF. B.O.M. A11129-000 FOR 20-40 HP MODELS.
 REF. B.O.M. A11129-001 FOR 60-300 HP MODELS.



FROM SHEET 1
A
B
C
D
E
F
G
H
I
J
K
L
M

- NOTES:
 1. REF. BOM A11123-XXX
 2. REF. BOM D11123-XXX
 3. REF. SINGLE SHEET SCHEMATIC D11121.

REV. ECD 11.5. 84-84
 REV. A ECD 28.5. 4-15-84

CAROTRON
 A Division of
 BKP 1-11-84

SCHEMATIC, ELITE
 TRIGGER BOARD

D11351 REV. B SH. 2 OF 2

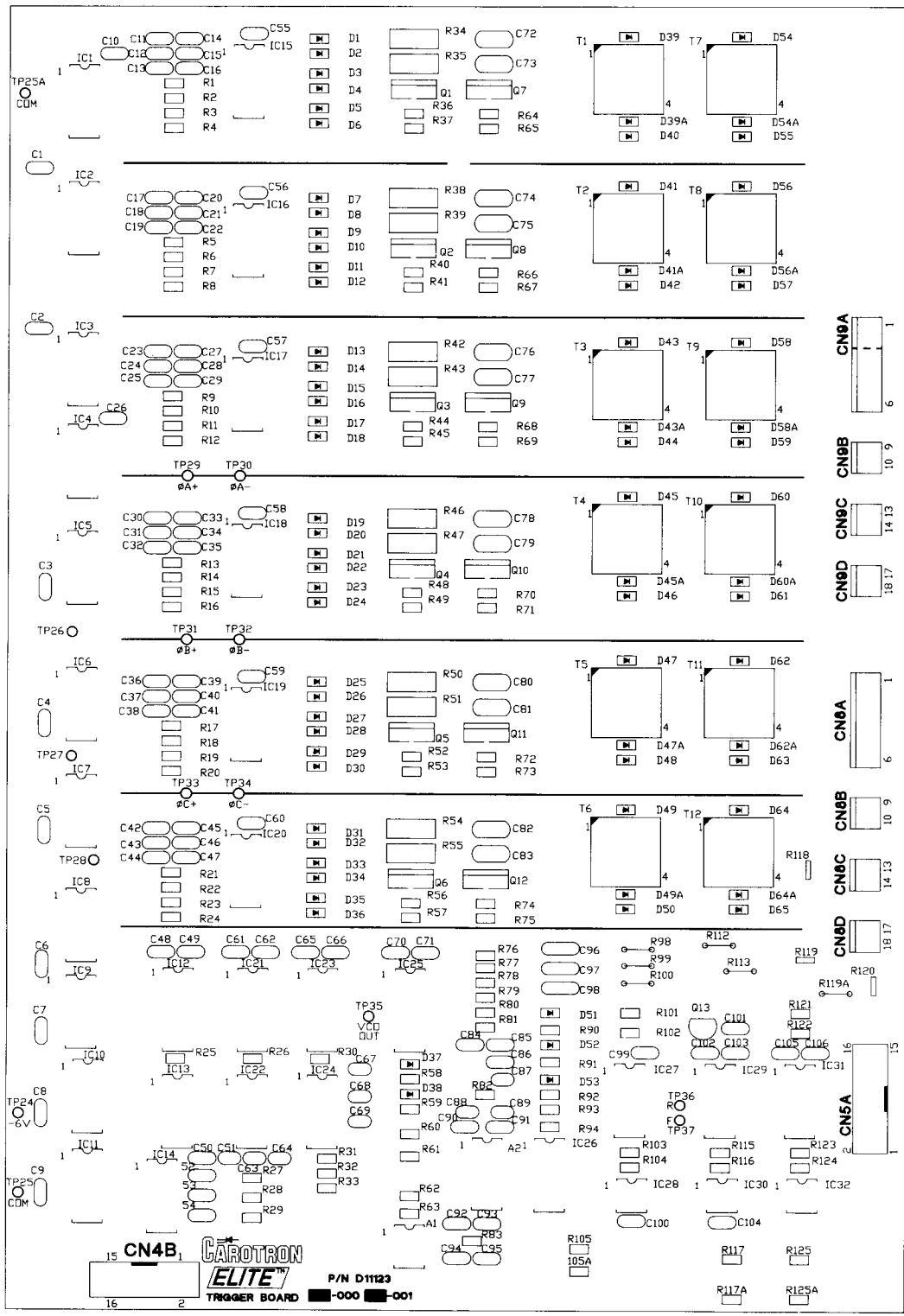
REV. C, ECD 313, 8-4-94
 REV. B, ECD 285, 4-28-94
 REV. A, ECD 229, 8-13-93

CAROTRON
 Division of Amstar

WEL
 ELITE™ ASSEMBLY
 E12 TRIGGER BOARD

REV. C
 2=1

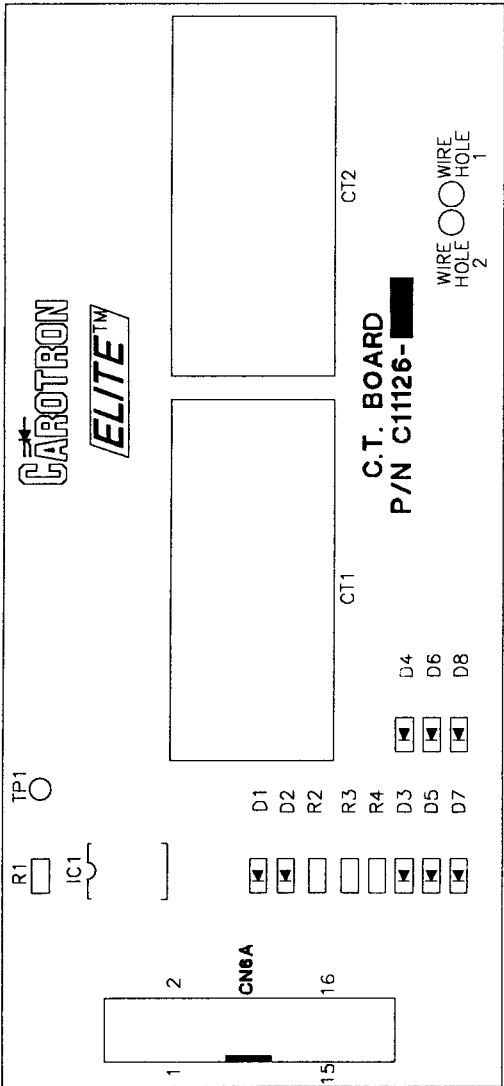
D11123-001 REV. C SH. 1 OF 1



NOTES:
 1. REF. SINGLE PAGE SCH. D11121.
 2. REF. TWO PAGE SCH. D111351.
 3. REF. B.O.M. A11123-001.



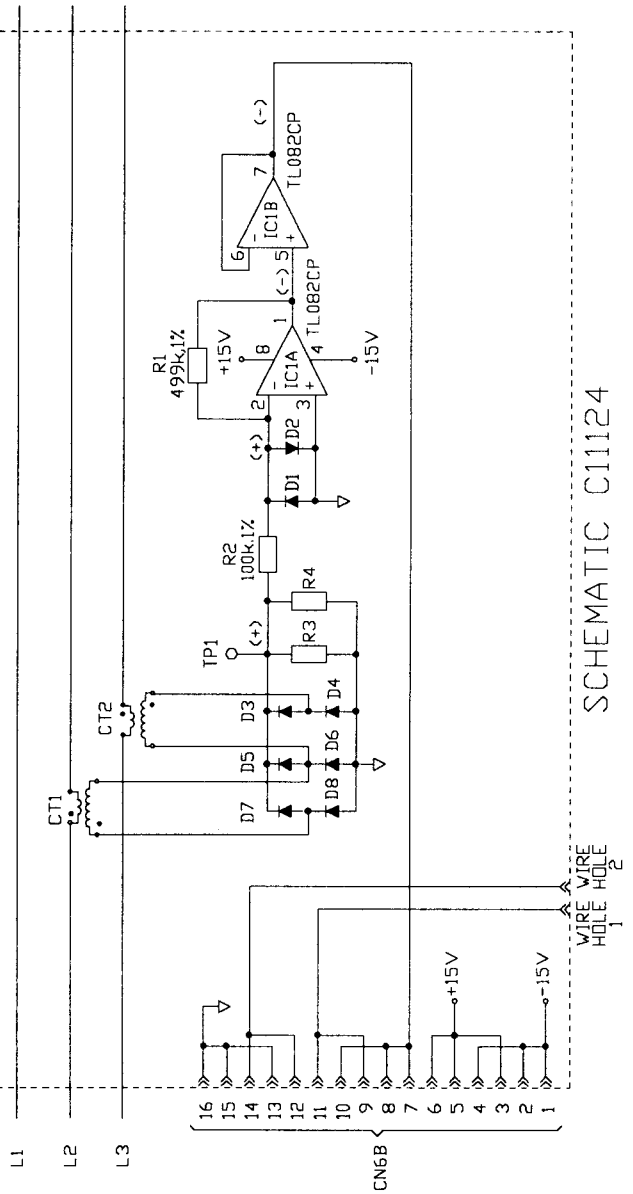
C.T. BOARD
P/N C11126-



ASSEMBLY C11126

NOTES:
1. C.T.'S 1 & 2 NOT USED ON
-007,-008, OR -009 ASSEMBLIES.

TO
SCR MODULES



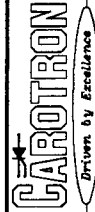
SCHEMATIC C11124

ASSY.	HP	R3	R4
A11126-000	10/20	243 OHMS	374 OHMS
A11126-001	20/40	732 OHMS	NOT USED
A11126-002	30/60	100 OHMS	100 OHMS
A11126-003	40/75	68 OHMS	84 OHMS
A11126-004	50/100	57 OHMS	57 OHMS
A11126-005	60/125	47 OHMS	47 OHMS
A11126-006	75/150	20 OHMS	NOT USED
A11126-007	100/200	34 OHMS	34 OHMS
A11126-008	125/250	28 OHMS	28 OHMS
A11126-009	150/300	23.7 OHMS	23.7 OHMS

DRAWN BY: **BKP** DATE: **12/2/84**

APPROVED BY: DATE:

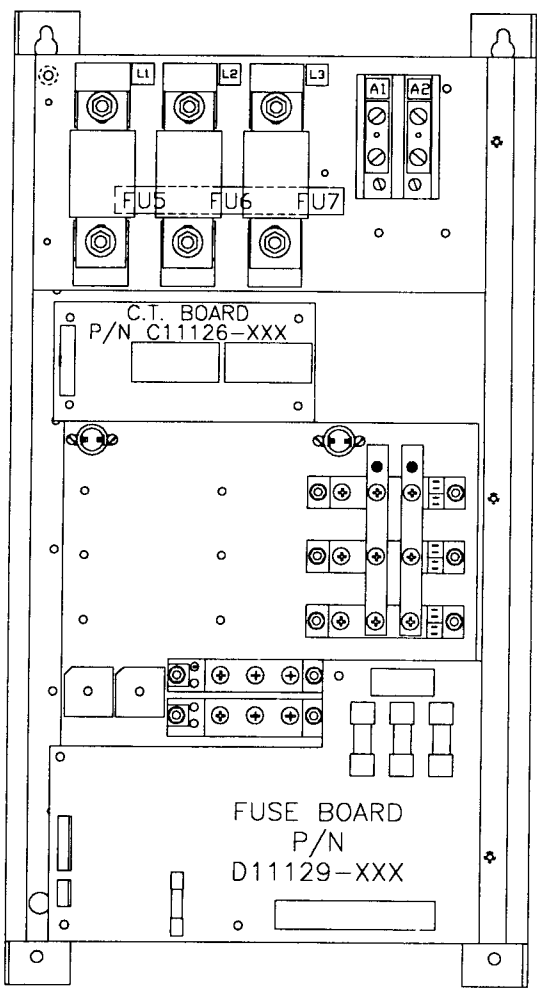
TOLERANCES:
1 DEC. PL.
2 DEC. PL.
3 DEC. PL.



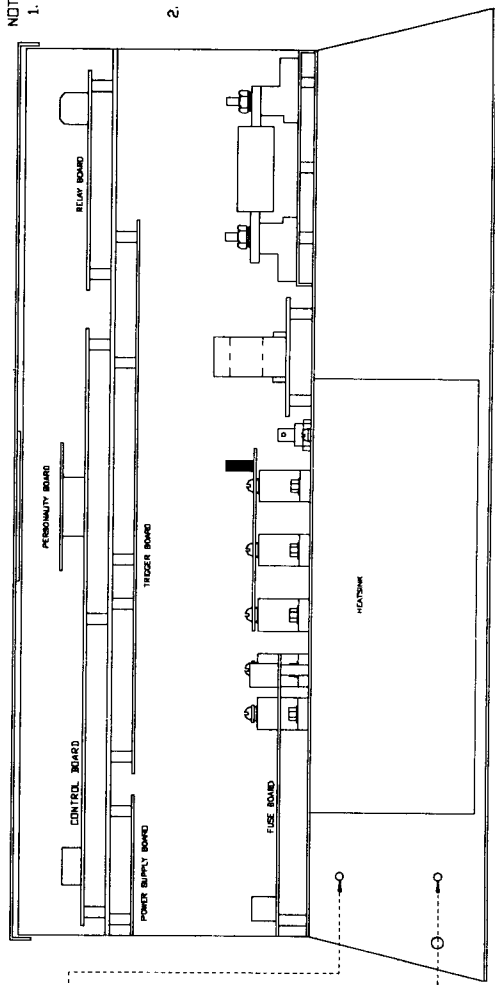
HEATH SPRINGS, NC
P.O. BOX 18674
Raleigh, NC 27616
FAX 803-286-8063

SCALE: TITLE: SCHEMATIC & ASSEMBLY,
ELITE® C.T. BOARD

DRAWING NUMBER: **C11592** REV. A SH. 1 OF 1

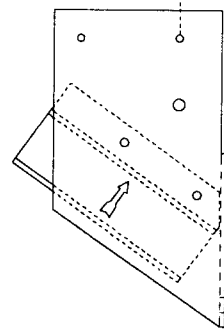
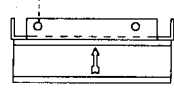


(CONTROL BOARD CHASSIS REMOVED)

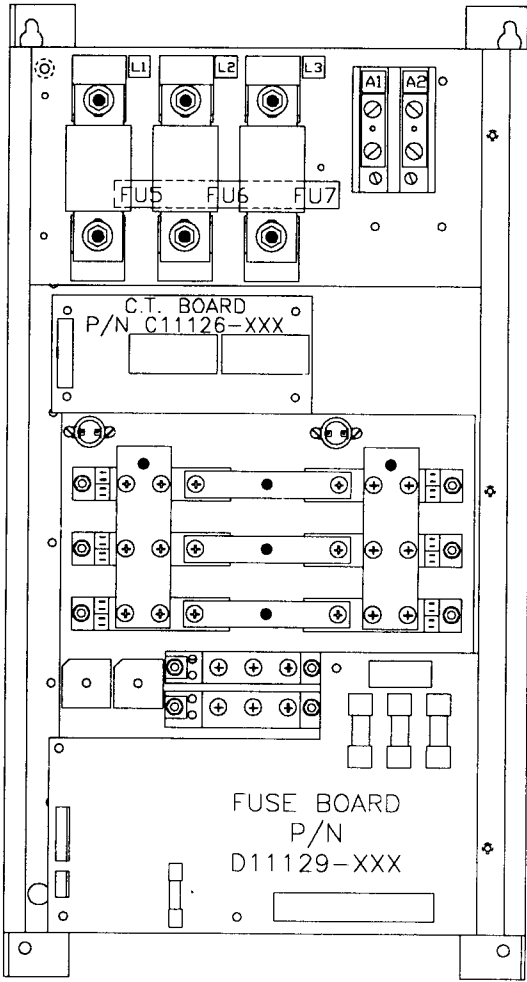


NOTES:

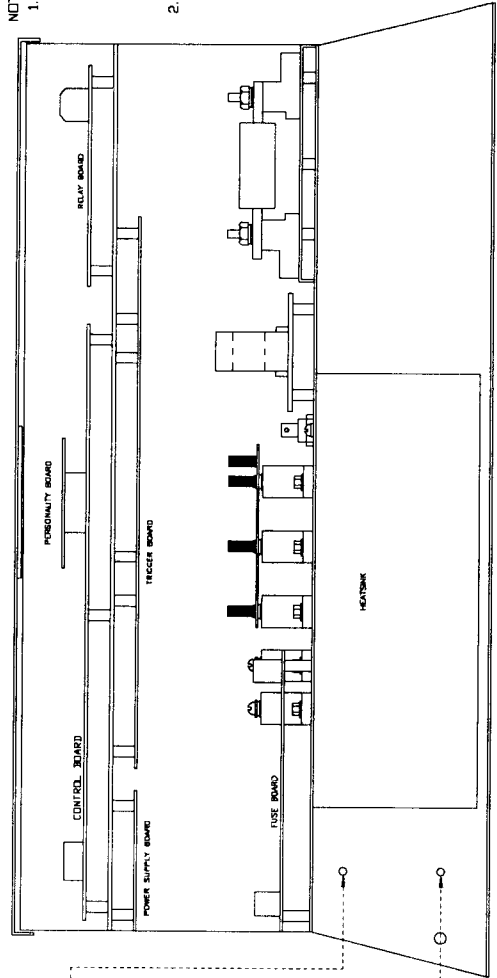
1. REF. ASSY. D11176-000 & WIRE LIST A11195 FOR MODEL E06020-000.
 REF. ASSY. D11176-001 & WIRE LIST A11191 FOR MODEL E06040-000.
 REF. ASSY. D11176-002 & WIRE LIST A11191 FOR MODEL E06060-000.
 REF. ASSY. D11176-003 & WIRE LIST A11192 FOR MODEL E06075-000.
 REF. ASSY. D11434-000 & WIRE LIST A11436 FOR MODEL E06100-000.
 REF. ASSY. D11434-001 & WIRE LIST A11437 FOR MODEL E06125-000.
 REF. ASSY. D11434-002 & WIRE LIST A11438 FOR MODEL E06150-000.
2. REF. WIRING DIAGRAM D11168 FOR 20-75 HP E06 MODELS.
 REF. WIRING DIAGRAM D11494 FOR 100-150 HP E06 MODELS.



BKP		REV. 1 OF 1	
DATE	BY	REV.	BY
CAROTRON Precision for Professionals			
100% QUALITY CONTROL 100% INSPECTION 100% RELIABILITY			
GENERAL FINAL ASSEMBLY		ELITE 20-150 HP E06 MODELS	
D11594			

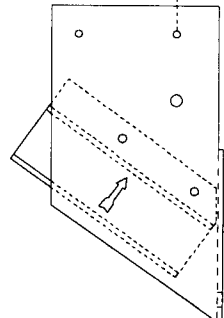
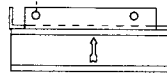


(CONTROL BOARD CHASSIS REMOVED)

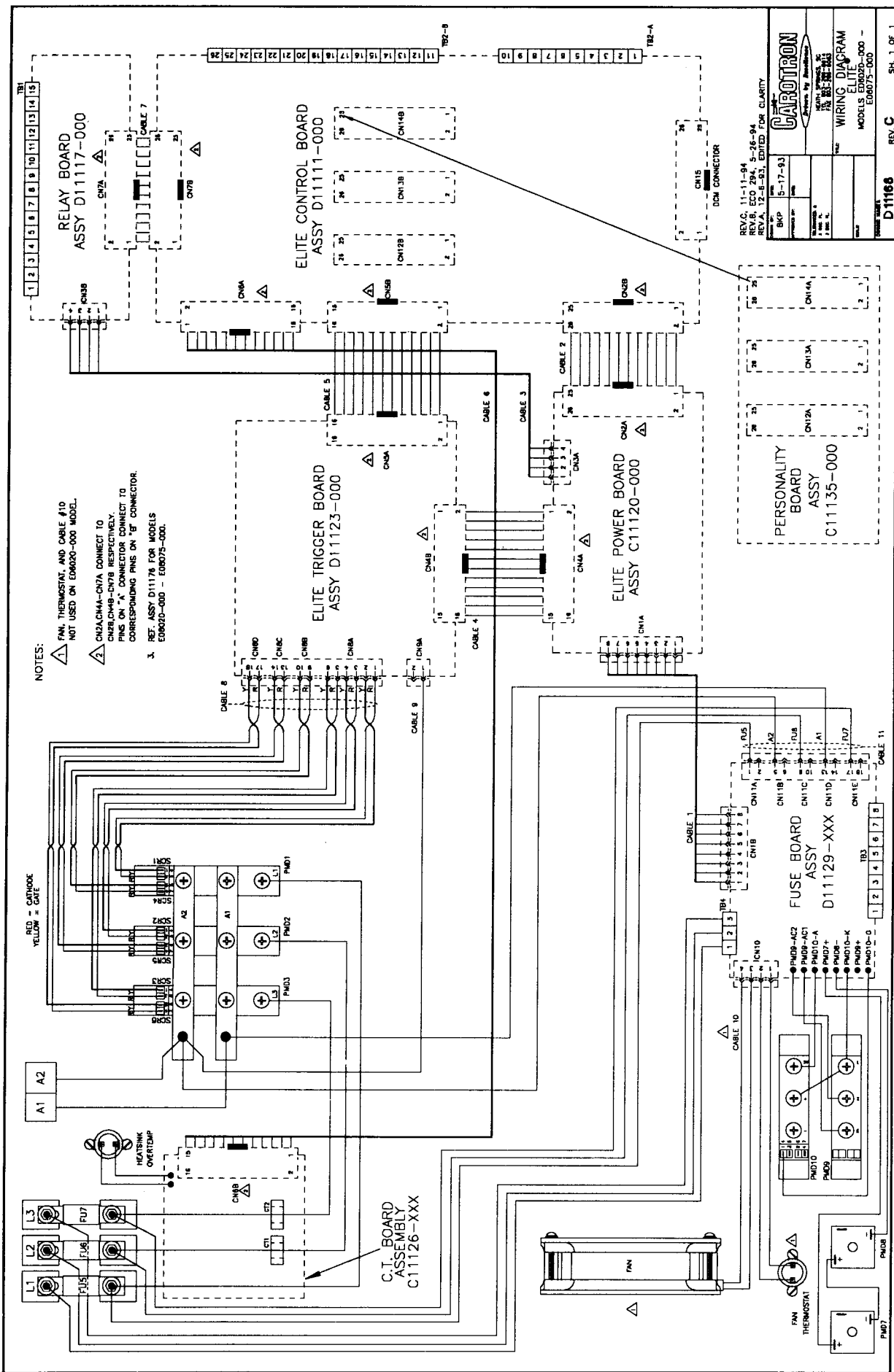


NOTES:

1. REF. ASSY. D11177-000 & WIRE LIST A11196 FOR MODEL E12020-000.
 REF. ASSY. D11177-001 & WIRE LIST A11187 FOR MODEL E12040-000.
 REF. ASSY. D11177-002 & WIRE LIST A11187 FOR MODEL E12060-000.
 REF. ASSY. D11177-003 & WIRE LIST A11193 FOR MODEL E12075-000.
 REF. ASSY. D11435-000 & WIRE LIST A11439 FOR MODEL E12100-000.
 REF. ASSY. D11435-001 & WIRE LIST A11440 FOR MODEL E12125-000.
 REF. ASSY. D11435-002 & WIRE LIST A11441 FOR MODEL E12150-000.
2. REF. WIRING DIAGRAM D11167 FOR 20-75 HP E12 MODELS.
 REF. WIRING DIAGRAM D11495 FOR 100-150 HP E12 MODELS.



BKP		REV. 1	
DATE	BY	DATE	BY
Produced by CAROTRON CAROTRON, INC. 1000 W. 10th St. Grand Rapids, MI 49508			
PART NO.		REV.	
D11595		1	
GENERAL FINAL ASSEMBLY ELITE 20-150 HP E12 MODELS			



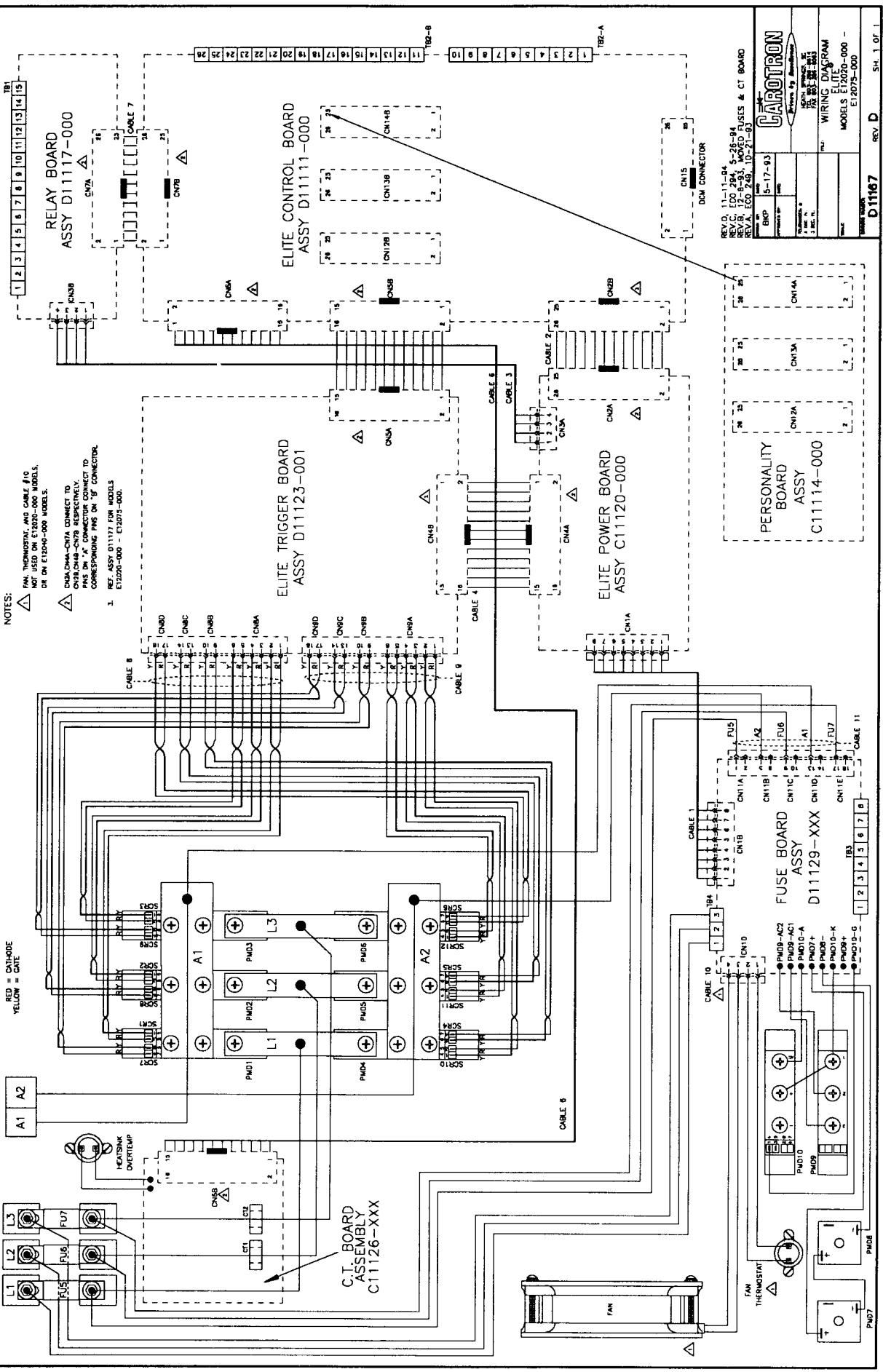
NOTES:

- △ FAN, THERMOSTAT AND CABLE #10 NOT USED ON EM0020-000 MODEL.
- △ CN2A/CN4A-CN7A CONNECT TO PINS ON 'A' CONNECTOR CORRESPONDING PINS ON 'B' CONNECTOR.
- 3. REF. ASSY D11178 FOR MODELS EM0020-000 - EM0075-000.

REV. C	SH. 1 OF 1
D11166	
REV. C 11-11-94	REV. B, ECO 294, 5-26-94
REV. A, 12-6-93, EDITED FOR CLARITY	
BKP 5-17-93	DATE
DESIGNED BY	DATE
DRAWN BY	DATE
WIRING DIAGRAM	
MODEL S EM0020-000 - EM0075-000	

NOTES:

- △ FAN THERMOSTAT AND CABLE #10 NOT USED ON E12020-000 MODELS OR ON E12040-000 MODELS.
- △ CN2A-CN2A CONNECT TO CN2B-CN2B RESPECTIVELY. CN3A-CN3A CONNECT TO CN3B-CN3B RESPECTIVELY. CORRESPONDING PINS ON 5' CONNECTOR.
- 1. REF. ASSY D11117 FOR MODELS E12200-000 - E12070-000.



REV. D 11-1-84 5-28-84
 REV. C EDO 294 1-1-84
 REV. B EDO 248 10-21-83
 REV. A EDO 248 10-21-83

CAROTRON
 Carotron Inc. - A Division of
 General Electric

WIRING DIAGRAM
 MODELS E1100-000 -
 E12070-000

DCM CONNECTOR

PERSONALITY BOARD ASSY C1114-000

RELAY BOARD ASSY D1117-000

ELITE CONTROL BOARD ASSY D1111-000

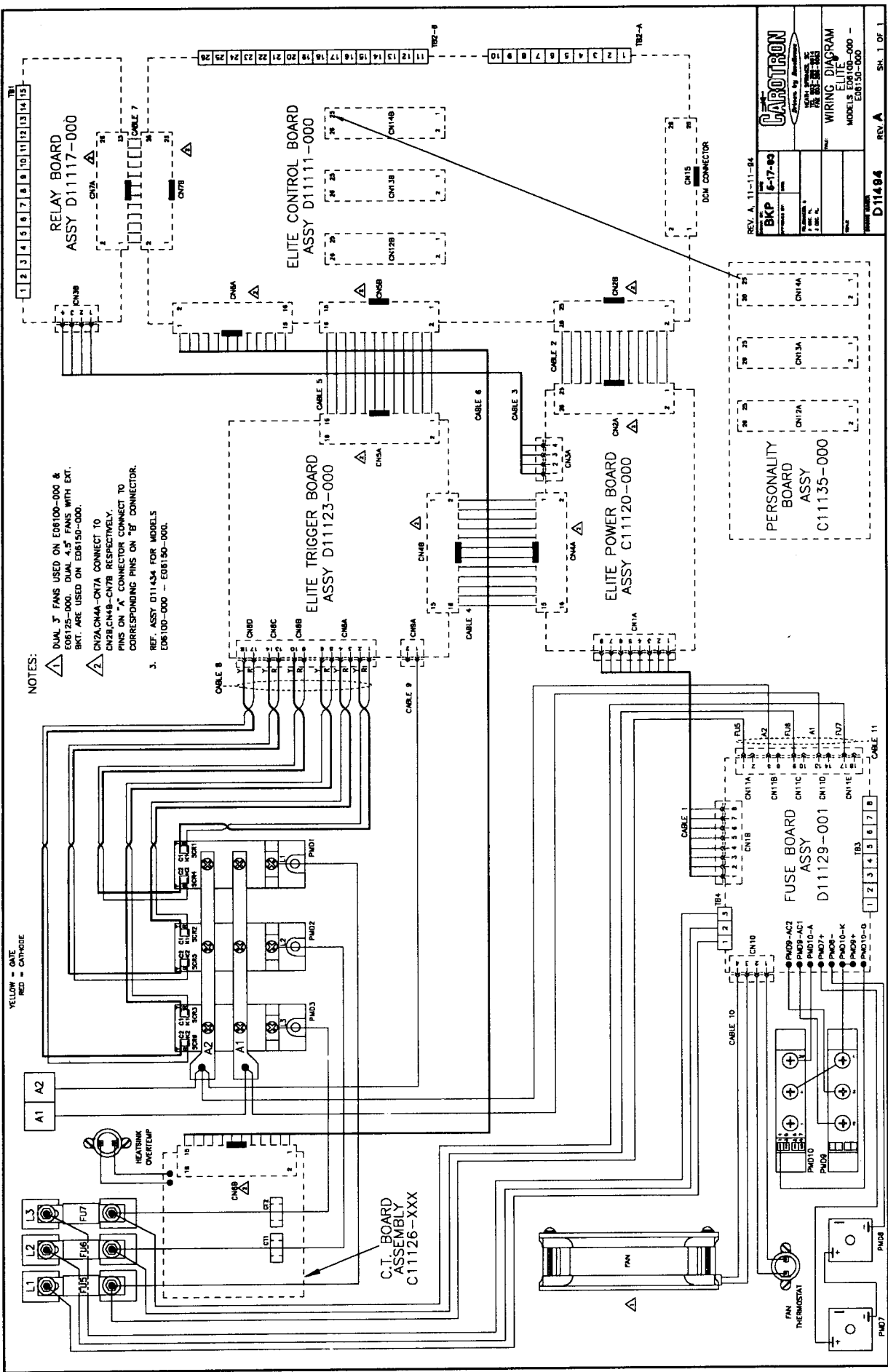
ELITE TRIGGER BOARD ASSY D1123-001

ELITE POWER BOARD ASSY C1120-000

FUSE BOARD ASSY D11129-XXX

C.T. BOARD ASSEMBLY C11126-XXX

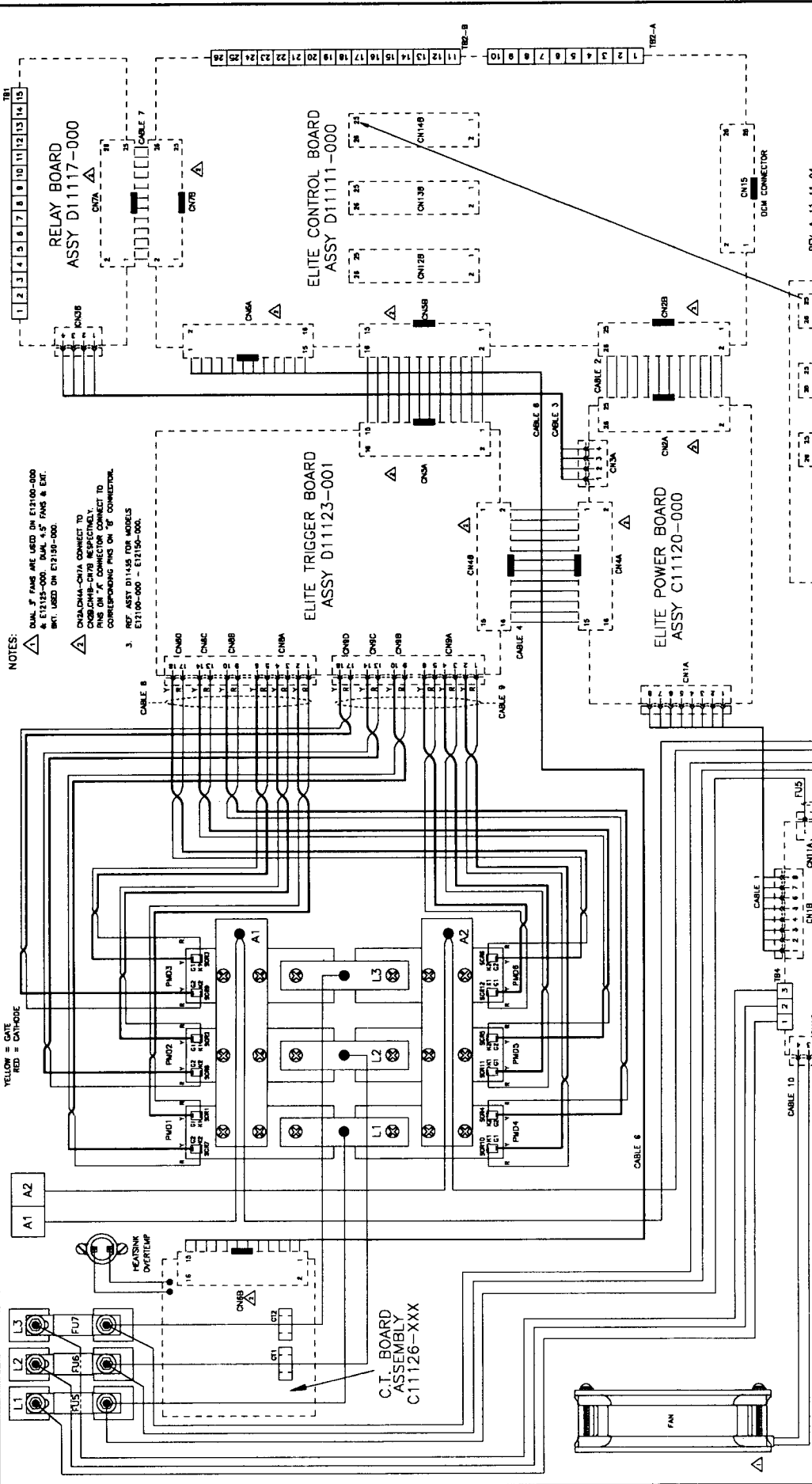
FAN THERMOSTAT



- NOTES:
- 1. DUAL 3" FANS USED ON E06100-000 & E06125-000. DUAL 4.5" FANS WITH EXT. BKT. ARE USED ON E06150-000.
 - 2. CN2A/CN4A-CN7A CONNECT TO CN2B/CN4B-CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
 - 3. REF. ASSY D11434 FOR MODELS E06100-000 - E06150-000.

YELLOW - GATE
RED - CATHODE

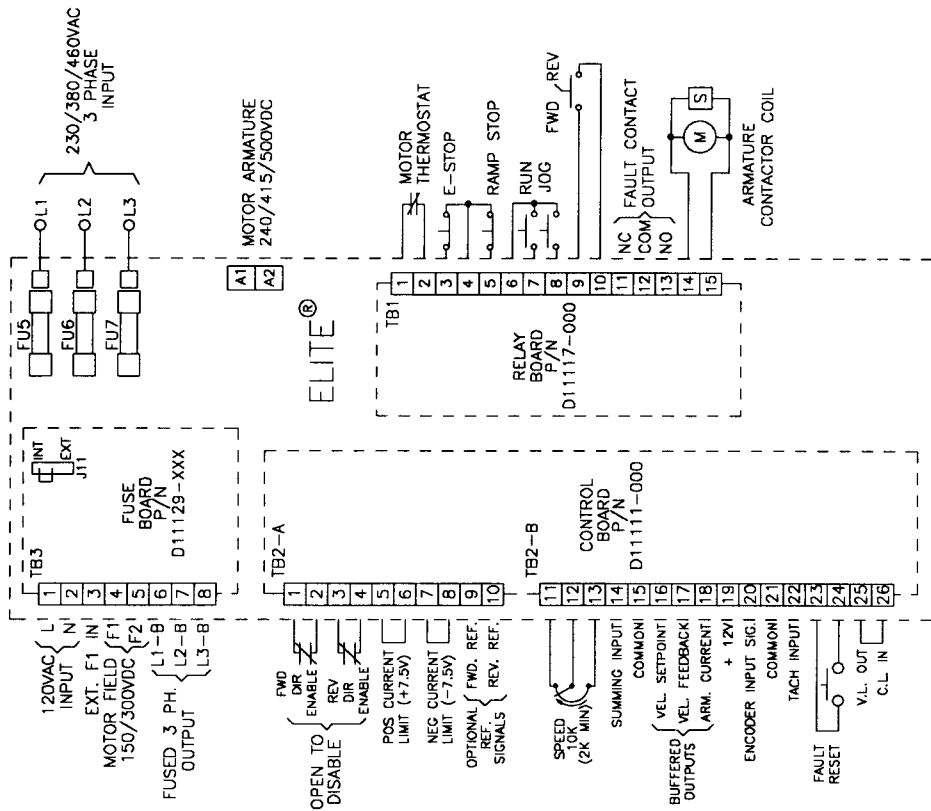
CAROTRON <small>Approved by Manufacturer</small>	
BKP 6-17-89	REV. A, 11-11-84
DATE	REV.
BY: [Signature]	BY: [Signature]
CHKD BY: [Signature]	CHKD BY: [Signature]
WIRING DIAGRAM	
ELITE	
MODELS E06100-000 -	
E06150-000	
PART NO. D11484	
REV. A SH. 1 OF 1	



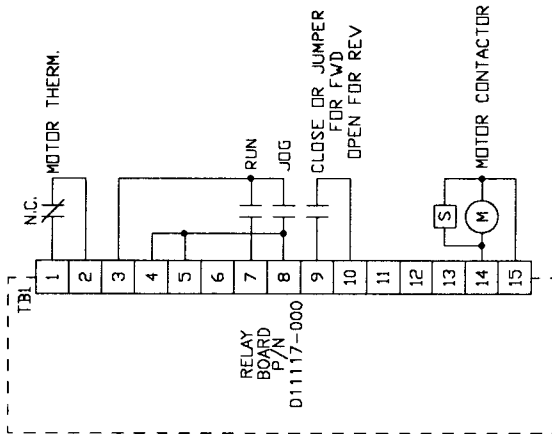
- NOTES:**
- △ DUAL 'P' FANS ARE USED ON E12100-000 & E12150-000. DUAL 'S' FANS & EXT. BKT. USED ON E12150-000.
 - △ CN1A/CN1A-CN1A CONNECT TO CN2B/CN1B-CN1B RESPECTIVELY. PINS ON 'P' CONNECTOR CONNECT TO CORRESPONDING PINS ON 'B' CONNECTOR.
 - 3. REF. ASSY D11145 FOR MODELS E12100-000 - E12150-000.

YELLOW = GATE
 RED = OUT-TO-DE

ELITE GENERAL CONNECTIONS

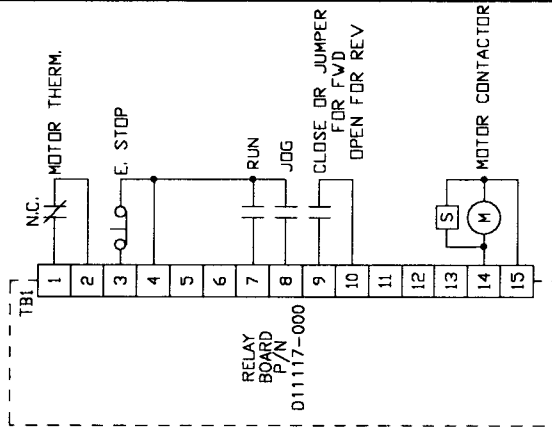


ELITE SINGLE CONTACT CONTROL FOR DYNAMIC BRAKE OR COAST TO STOP



SINGLE CONTACT (MAINTAINED) CONTROL FOR RUN AND JOG FUNCTIONS.

ELITE SINGLE CONTACT CONTROL FOR RAMP TO STOP OPERATION



SINGLE CONTACT (MAINTAINED) CONTROL FOR RUN AND JOG FUNCTIONS.

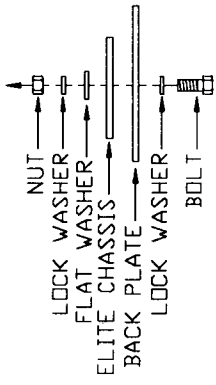
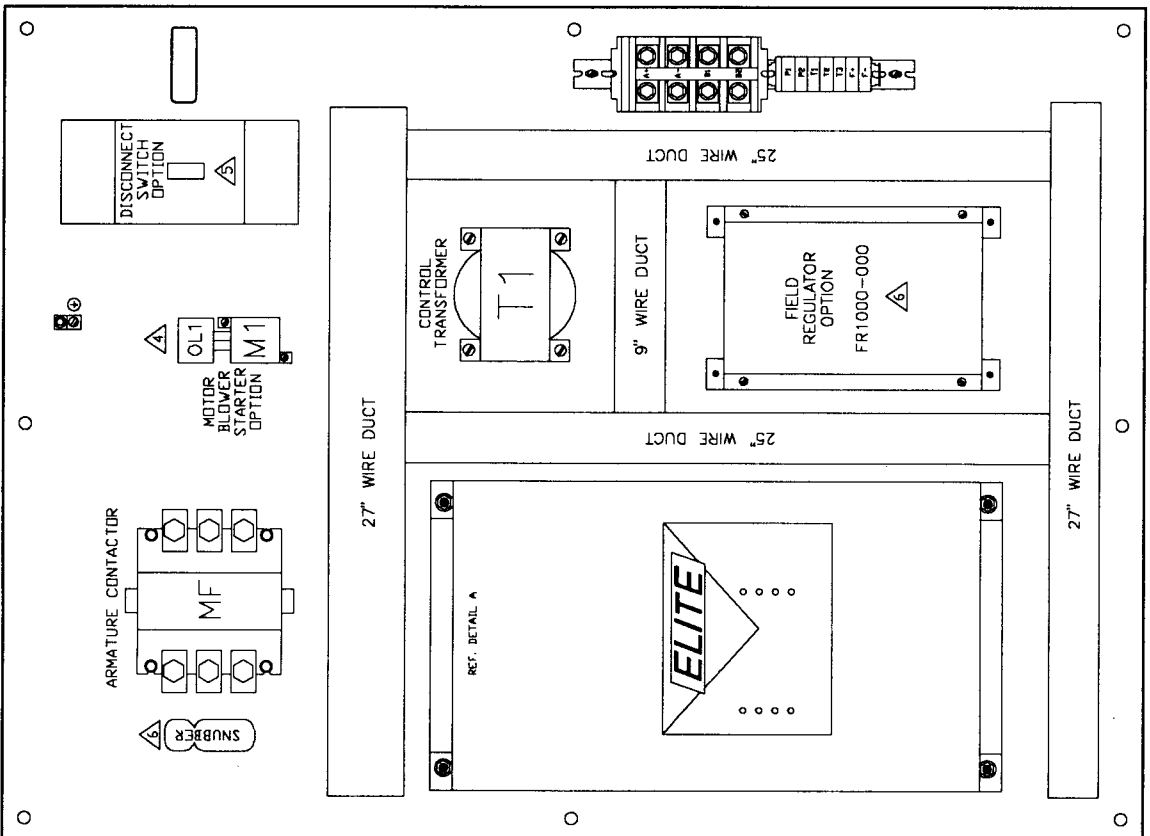
REV. B, ADD SINGLE CONTACT CONTROLS, 12-1-94
 REV. A, SPLIT TB2 TERMINAL STRIP, 7-7-94

DESIGN BY	DATE
WRM	9-21-93
APPROVED BY	DATE
TOLERANCES:	
1. DEC. P.	80.3-286-8674
2. DEC. P.	80.3-286-8674
3. DEC. P.	80.3-286-8683

CAROTRON
 Driven by Excellence
 HEATH SPURNS, SC
 TEL: 803-286-8674
 FAX: 803-286-8683

TITLE: GENERAL CONNECTIONS FOR ELITE®
 FOR ELITE®
 20-150 HP MODELS

DRAWING NUMBER: **C11246** REV. **B** SH. 1 of 1

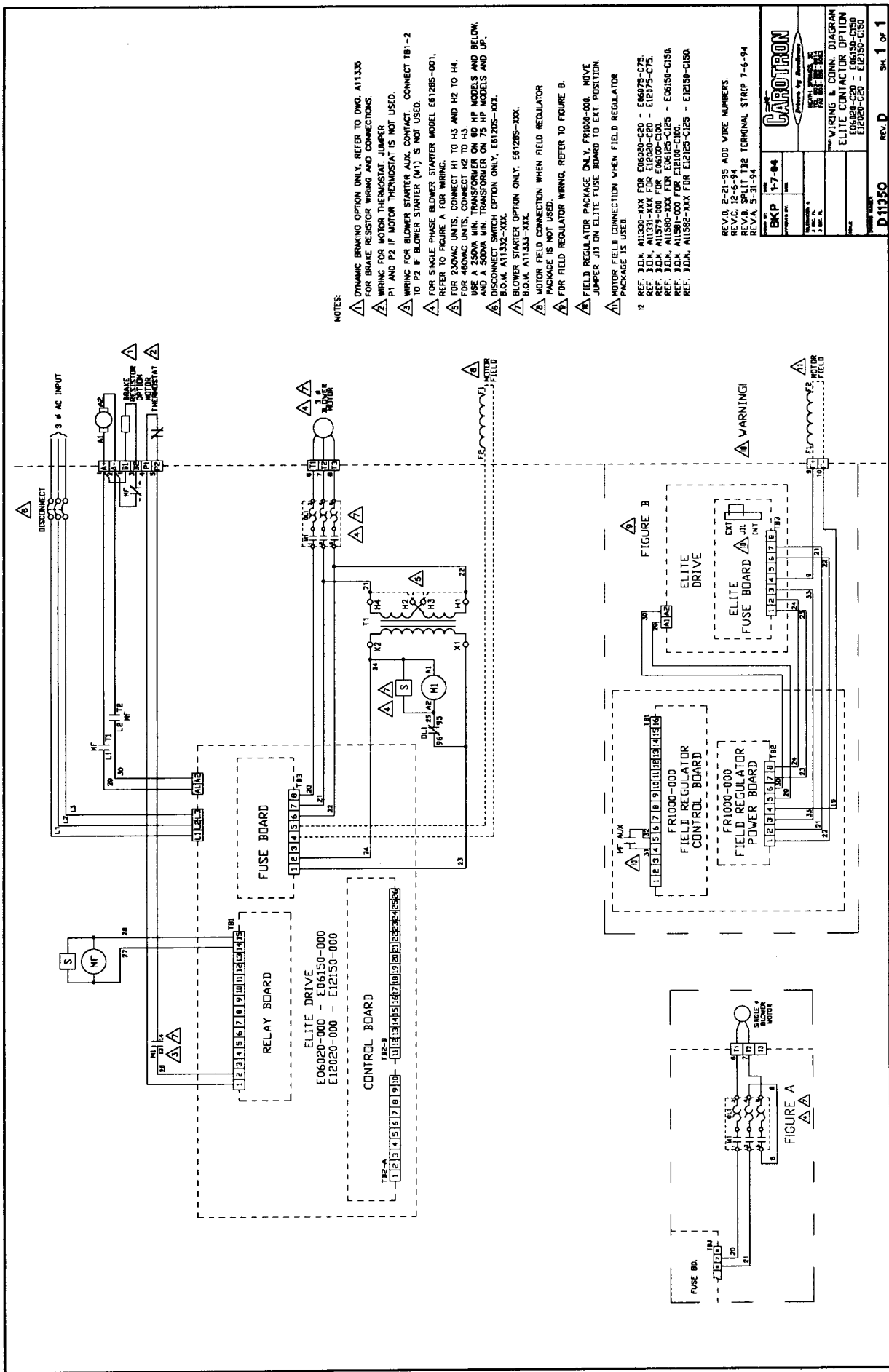


DETAIL A

NOTES:

1. REF. ASSY. D11330-000 & WIRE LIST A11337 FOR E06620-C20.
 REF. ASSY. D11330-001 & WIRE LIST A11338 FOR E06040-C40.
 REF. ASSY. D11330-002 & WIRE LIST A11339 FOR E06070-C60.
 REF. ASSY. D11330-003 & WIRE LIST A11339 FOR E06070-C60.
 REF. ASSY. D11579-000 & WIRE LIST A11546 FOR E06100-C08.
 REF. ASSY. D11580-000 & WIRE LIST A11547 FOR E06125-C123.
 REF. ASSY. D11580-001 & WIRE LIST A11548 FOR E06150-C150.
 REF. ASSY. D11580-002 & WIRE LIST A11548 FOR E06150-C150.
 REF. ASSY. D11331-000 & WIRE LIST A11337 FOR E12020-C20.
 REF. ASSY. D11331-001 & WIRE LIST A11338 FOR E12040-C40.
 REF. ASSY. D11331-002 & WIRE LIST A11338 FOR E12060-C60.
 REF. ASSY. D11331-003 & WIRE LIST A11339 FOR E12075-C75.
 REF. ASSY. D11331-000 & WIRE LIST A11549 FOR E12100-C00.
 REF. ASSY. D11331-001 & WIRE LIST A11550 FOR E12125-C25.
 REF. ASSY. D11582-000 & WIRE LIST A11551 FOR E12150-C150.
 REF. ASSY. D11582-001 & WIRE LIST A11551 FOR E12150-C150.
2. REF. WIRING DIAGRAM D11350.
 △ BLOWER STARTER OPTION ONLY, E6128S-XXX.
 B.O.M. A11332-XXX.
 △ DISCONNECT SWITCH OPTION ONLY, E612DS-XXX.
 B.O.M. A11332-XXX.
 △ FIELD REGULATOR OPTION ONLY, FR1000-000.
 FINAL ASSY. B.O.M. A11222-XXX.
3. REF. WIRING DIAGRAM D11350.
 △ BLOWER STARTER OPTION ONLY, E6128S-XXX.
 B.O.M. A11332-XXX.
 △ DISCONNECT SWITCH OPTION ONLY, E612DS-XXX.
 B.O.M. A11332-XXX.
 △ FIELD REGULATOR OPTION ONLY, FR1000-000.
 FINAL ASSY. B.O.M. A11222-XXX.

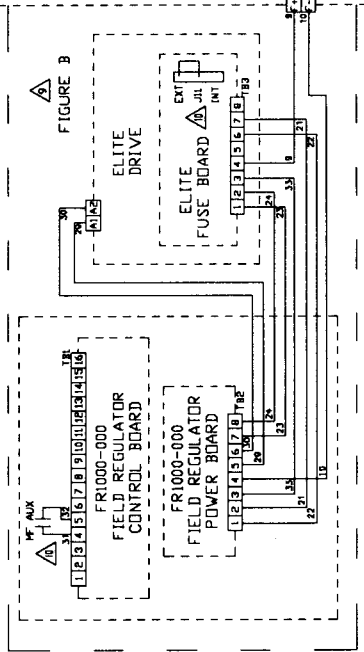
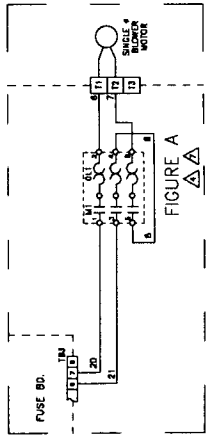
BKP REV. 8/2/84 DATE	1000000000 1000000000 1000000000 1000000000
GENERAL ASSEMBLY ELITE CONTACTOR OPTION CHASSIS, E06 & E12 20-150 HP MODELS	
D11596 REV. SH. 1 OF 1	



NOTES:

- ⚠ DYNAMIC BRAKING OPTION ONLY. REFER TO DWG. A11335 FOR BRAKE RESISTOR WIRING AND CONNECTIONS.
- ⚠ WIRING FOR MOTOR THERMOSTAT NUMBER P1 AND P2 IF MOTOR THERMOSTAT IS NOT USED.
- ⚠ WIRING FOR BLOWER STARTER AULX CONTACT. CONNECT T81-2 TO T72 IF BLOWER STARTER (M1) IS NOT USED.
- ⚠ FOR SINGLE PHASE BLOWER STARTER MODEL E81285-001, REFER TO FIGURE A FOR WIRING.
- ⚠ FOR 230VAC UNITS, CONNECT H1 TO H3 AND H2 TO H4.
- ⚠ USE 480VAC UNITS, CONNECT H2 TO H3.
- ⚠ USE 480VAC UNITS, TRANSFORMER ON 75 HP MODELS AND BELOW, AND A 500VA WKT. TRANSFORMER ON 75 HP MODELS AND UP.
- ⚠ DISCONNECT SWITCH OPTION ONLY, E81205-XXX, B.O.M. A11332-XXX.
- ⚠ BLOWER STARTER OPTION ONLY, E81285-XXX, B.O.M. A11333-XXX.
- ⚠ MOTOR FIELD CONNECTION WHEN FIELD REGULATOR PACKAGE IS NOT USED.
- ⚠ FOR FIELD REGULATOR WIRING, REFER TO FIGURE B.
- ⚠ FIELD REGULATOR PACKAGE ONLY, FR1000-000. MOVE JUMPER J11 ON ELITE FUSE BOARD TO EXT. POSITION.
- ⚠ MOTOR FIELD CONNECTION WHEN FIELD REGULATOR PACKAGE IS USED.

- 12 REF. 30A, A11330-XXX FOR E06600-C20 - E06975-C75.
- REF. 30A, A11331-XXX FOR E12000-C60 - E12075-C75.
- REF. 30A, A11332-XXX FOR E06150-C100 - E06150-C150.
- REF. 30A, A11333-XXX FOR E12100-C100 - E12100-C150.
- REF. 30A, A11334-XXX FOR E12150-C100 - E12150-C150.



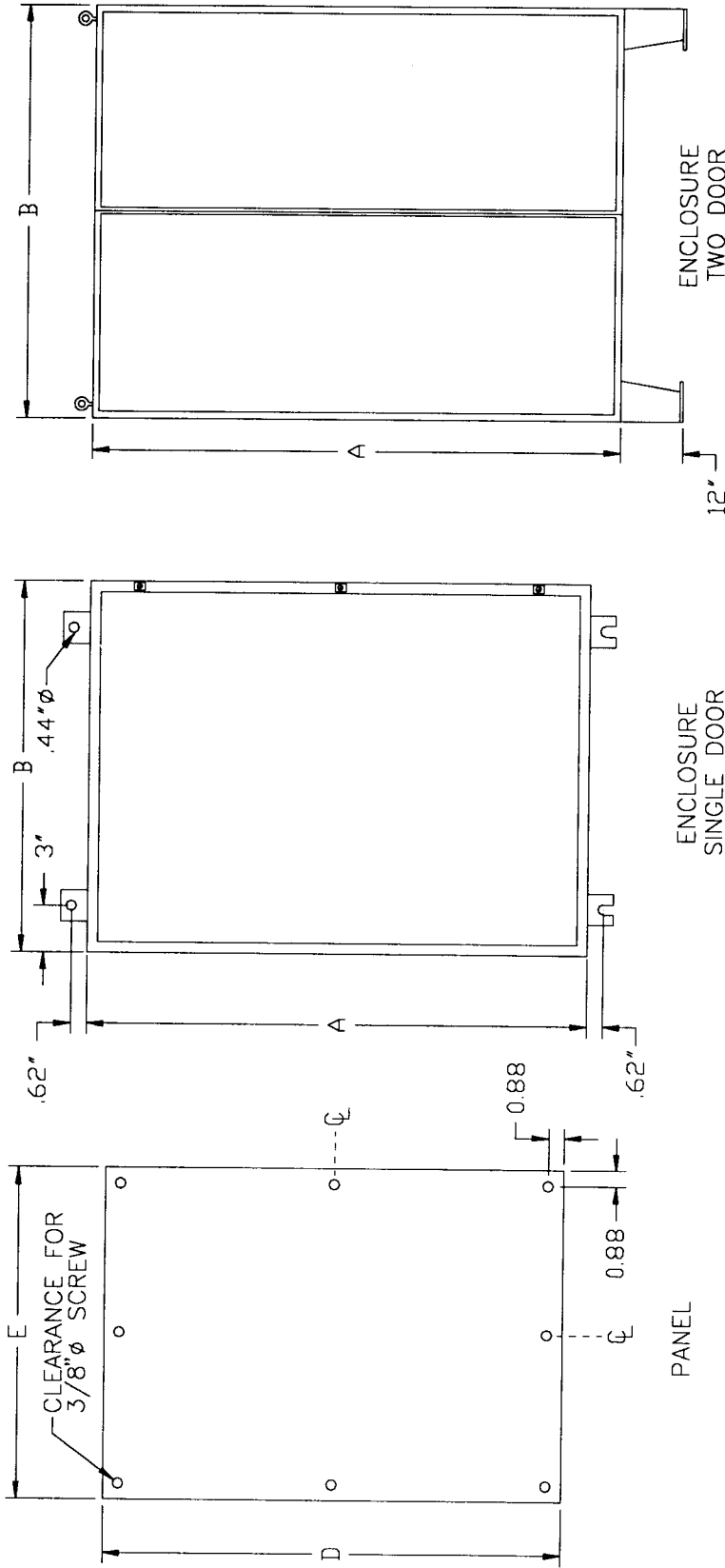
REV. D 2-21-95 ADD WIRE NUMBERS.
 REV.C 12-5-94
 REV.B SPLIT THE TERMINAL STRIP 7-6-94
 REV.A 5-31-94

SKP 7-7-94

DATE: _____
 BY: _____
 CHECKED BY: _____

WIRING & CONNECTION DIAGRAM
 ELITE CONTACTOR OPTION
 E06600-C20 - E06150-C150
 E12000-C60 - E12150-C150

REV. D **D11350** SH. 1 of 1



PANEL DIMENSIONS	
OPTIONAL DASH NO.	D x E x F
C20-C75	39 x 33 x 12
C100	45 x 33 x 12
C125-C150	56 x 44 x 12

F = DEPTH

NEMA 12 ENCLOSURE DIMENSIONS	
OPTIONAL DASH NO.	A x B x C
001 & H01	42 x 36 x 12
002 & H02	48 x 36 x 16
003, H03 & H04	60 x 48 x 16

C = DEPTH

NOTES:
 1. 'H' IN THE OPTION DASH NUMBER REPRESENTS AN EXTERNAL DISCONNECT HANDLE.

BKP 2-10-84
 Model No.
 Part No.
 Date
 Drawn by
 Checked by
 Approved by

CAROTRON
 Division of Hamilton
 1000 W. 10th St.
 Lincoln, NE 68502

Part No. **ELITE**
 ENCLOSURE DIMENSIONS
 20-150 HP MODELS

D11376 REV. B SH. 1 OF 1



**3204 Rocky River Road
Heath Springs, SC 29058
Phone: (803) 286-8614
Fax: (800) 286-6063**

**MAN1000-0C
Issued 10-23-08**