CHOICE® D.C. MOTOR CONTROL

Instruction Manual

Models

CDC320-000

CDC340-000

CDC360-000

CDC375-000

CDC3150-000

CAROTRON

Driven by Excellence

D.C. DRIVES, A.C. INVERTERS,
SOLID STATE STARTERS, SYSTEM INTERFACE
CIRCUITS AND ENGINEERED SYSTEMS

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1 General Description

CHOICE® CDC300 Series

The CHOICE® CDC300 Series of non regenerative D. C. motor controls provides a full range of speed or torque control for 5-150 HP D.C. motors rated for NEMA type "D" power.

Five basic models are offered in a compact panel mount assembly. Each model is customer connectable for operation at 230 VDC or 460 VAC three phase input. When operated with 230 VAC input, each unit supplies variable armature voltage up to 240 VDC and a fixed supply of 150 VDC. For operation with 460 VAC input, each model supplies up to 500 VDC for armature voltage and a fixed field supply of 300 VDC.

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

Standard relay logic interfaces with separately supplied operators for Emergency Stop, Ramp Stop, Run Forward, Jog Forward, and also Run Reverse and Jog Reverse when the unit is operated with separately supplied Forward and Reverse armature contactors. (NOTE: A Reverse contactor is required only when the Reverse Run and Jog modes are desired.)

Additional models include options such as armature contactors, brake resistors, disconnect switches, blower starters, enclosures, field economy, etc.

An accessory drive circuit monitor, Model DCM100-000, is available to assist in set-up and troubleshooting by plugging in to the control board to easily access 20 separate signals.

Features

- Re-connectable for 230 or 460 VAC three phase line input.
- Hall Effect sensor for isolated armature current feedback.
- 10 megohm impedance isolation for armature voltage feedback
- Independently adjustable linear acceleration and deceleration from 1 – 60 seconds.
- Electrically isolated power modules rated 1400 volts PIV and 1000 volts/microsecond DVDT
- Semiconductor fuses for power circuit protection
- R-C networks for AC line transient protection
- 10 ampere rated field supply with provisions for interfacing an optional external field supply to the field loss circuit
- Latching Fault logic for safety shutdown with LED indicators for Phase Loss, Field Loss, Heatsink Overtemp and Overcurrent
- Foldback current limit to allow 1 minute overload and then foldback to 112% of the current range selected
- Over Current trip when motor current is sustained at 112% of range selected for 5 minutes
- Speed feedback is jumper selectable for Armature Voltage, DC Tachometer Voltage (7, 50 or 100 V/1000 RPM) or Digital Encoder (300 PPR)
- Tachometer feedback is insensitive to input polarity
- 12 VDC @ 50 mA available for encoder power supply
- Summing input for auxiliary input signals with on board trim pot for scaling and jumper selection for polarity

- Terminal strip access to Accel/Decel output, Velocity Loop output and Current Loop input for versatile control functions
- Inner Current Loop for responsive and precise control of motor torque and speed
- Insensitive to phase rotation of AC line input
- Status LED's for Run, Zero Speed, Jog and Foldback
- 115 VAC logic for pushbutton operator interface

- Zero speed logic for ramp to stop and anti-plugging protection
- Jog Delay circuit to allow rapid jogging without de-energizing the armature contactor to give longer contactor life
- 5 armature current ranges are jumper selectable for each model to match motor armature current
- High Frequency multi-pulse trigger circuit for reliable SCR rating

2 Specifications & Technical Data

2.1 Electrical

A. C. Input

- 230 VAC ±10%, 3 phase, 50/60 Hz ± 2Hz
- 460 VAC ±10%, 3 phase, 50/60 Hz ± 2Hz

Armature Output

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

Field Output – 10 Amperes Maximum

- 150 VDC @ 230 VDC input
- 300 VDC @ 460 VDC input

Horsepower Range

- Model CDC320-000: 10 HP @ 240 VDC, 36 Amps; 20 HP @ 500 VDC, 36 Amps
- Model CDC340-000: 20 HP @ 240 VDC, 71 Amps; 40 HP @ 500 VDC, 71 Amps
- Model CDC360-000: 30 HP @ 240 VDC, 107 Amps; 60 HP @ 500 VDC, 107 Amps
- Model CDC375-000: 40 HP @ 240 VDC, 140 Amps; 75 HP @ 500 VDC, 140 Amps
- Model CDC3150-000 VDC: 75 HP @ 240 VDC, 256 Amps; 150 HP @ 500 VDC, 256 Amps

Speed Regulation

- Armature Feedback: ±1.0% of base speed
- Tachometer or Encoder feedback: ±0.5% of base speed

Toque Regulation

- ±2% of range selected

Adjustments

- Minimum Speed
- Maximum Speed
- Jog Speed
- Sum Trim
- Acceleration
- Deceleration
- Voltage Gain
- Current Gain
- IR Compensation
- Current Limit
- Current Offset
- Current Calibration

Speed Range

- 20:1 motor dependent

Temperature

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

2.2 Physical

- Refer to Section 9, Drawings D10522 and D10816 for size and mounting dimensions

3 Installation

3.1 Motor Installation

The first step in motor installation is to review the nameplate data and verify compatibility with the motor control. Check the horsepower rating, armature voltage and field voltage requirements. Check the A.C. line supply level. The CHOICE® maximum armature and field voltage outputs are dependent on the line (see specifications) and must be verified before the motor is connected.

When the motor is connected with Armature and Field lead polarities as shown in Figures 1 through 5, shaft rotation will be in the clockwise direction as viewed from the drive shaft end.

3.2 Motor Ventilation

Motor blowers, when used, can be operated from the auxiliary line supply output at TB2. The blower should operate anytime 3 phase power is applied to the control and the motor field is energized. Whether forced ventilated or not, common sense should be used to assure that clean, dry cooling air is provided. Air intakes and outlets on the motor should have no restrictions and filters should be clean and in place at all times.

3.3 Motor Connections

The size of motor armature and field wiring should be based on the motor nameplate full load ratings and should be installed in accordance with local electrical codes.

Field

Most motor fields consist to two windings that are connected in parallel for 150 VDC operation and in series for 300 VDC operation. Refer to Figures 1 and 2 for typical connections. Each winding has a polarity that must be observed for proper and safe operation of the motor.

Since direction of rotation is controlled by field polarity as well as armature polarity, it is usually more convenient to use the field leads when making direction corrections.

Carotron CHOICE® controls are designed to sense field current and will indicate an open circuit in the field windings or external wiring by initiating a Field Fault condition. The sensing circuit can be interfaced with an external regulator or field supply by connecting as shown in Figure 3.

WARNING!!! When interfacing an external field supply, programming jumper J7 must be placed in the EXT position to prevent damage to the CHOICE® control and 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 are made. Refer to Tables 1 and 2 for armature and contactor rating and to Figures 4 and 5 for connections.

Thermostat

Many motors include "J" or "P" leads that connect to an internal normally closed thermostat. Connecting it to TB3 as shown in Figures 8 and 9 will cause a motor over temperature condition to shut down the control as in an Emergency Stop condition.

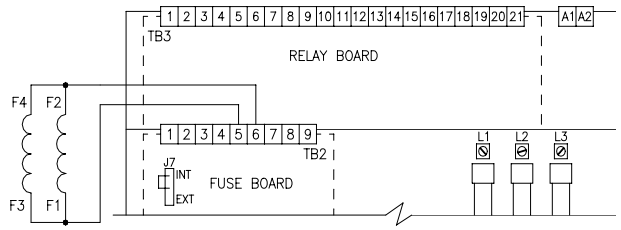
3.4 Control installation

The control requires an upright mounted position in an enclosure sized to provide adequate airflow and heat dissipation. Some

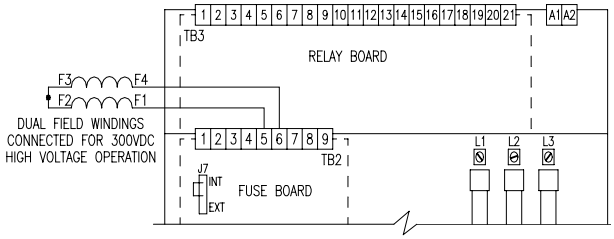
enclosures may need forced ventilation with outside air from a duct system or from an internal fan. Contact the factory for assistance in determining enclosure size for a particular horsepower rating.

CDC340-000 through CDC3150-000 have internal fans that circulate air in a horizontal direction through the center of the control and require that the sides of the control be free of obstructions that would hamper the air flow.

Optional or auxiliary items added to the control such as contactors, starters, brake resistors, and signal conditioning cards should be located for convenience and to minimize wire lengths. Consideration should also be given to that item's ability to add heat and potential for injecting electrical noise into the motor control circuitry.



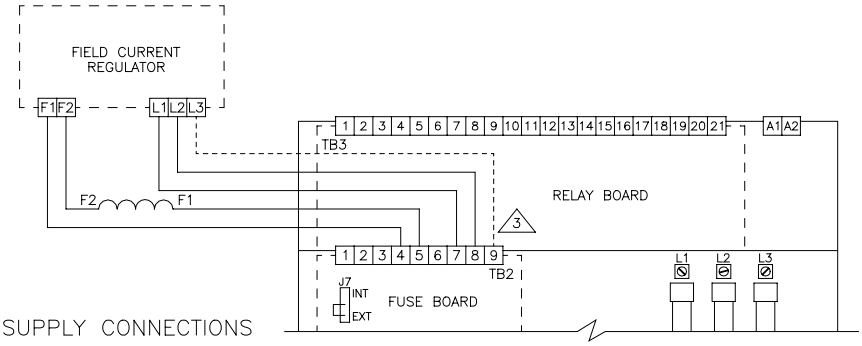
LOW VOLTAGE FIELD CONNECTIONS
FIGURE 1



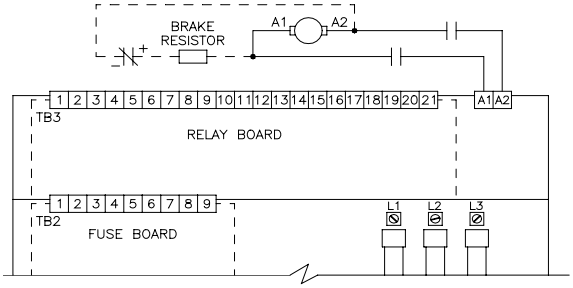
HIGH VOLTAGE FIELD CONNECTIONS
FIGURE 2

WARNING!
J7 ON THE FUSE BOARD MUST BE PLACED IN THE EXT POSITION WHEN USING AN EXTERNAL FIELD SUPPLY/REGULATOR WITH THE CHOICE CONTROL.

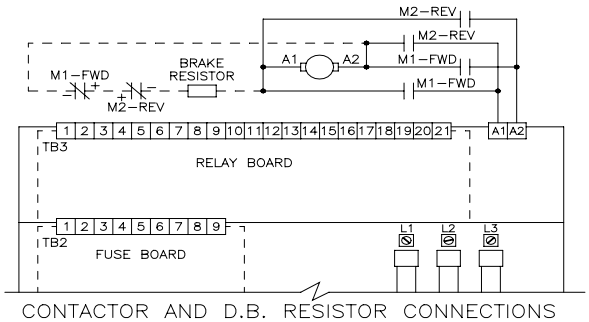
NOTES;
1. THESE CONNECTIONS INTERFACE AN EXTERNAL FIELD SUPPLY OR REGULATOR WITH THE CHOICE CONTROL FIELD LOSS CIRCUIT. THE POSITIVE FIELD CURRENT AVAILABLE AT TB2–5 IS LIMITED TO 10 AMPS BY FU2.
2. THE VOLTAGE SUPPLY FOR TB2–7,8 AND 9 IS FUSED AT 10 AMPS BY FU4,FU5 AND FU6 AND IS TAKEN FROM THE CUSTOMER 3 PHASE AC INPUT SUPPLY CONNECTED TO THE SEMICONDUCTOR FUSES AT TERMINALS L1,L2 AND L3.
3. THE CONNECTION TO TB2–9 IS NOT REQUIRED WITH REGULATORS OPERATING FROM A SINGLE PHASE AC VOLTAGE SUPPLY.



EXTERNAL FIELD SUPPLY CONNECTIONS
FIGURE 3



CONTACTOR AND D.B. RESISTOR CONNECTIONS
NON REVERSING MODELS
FIGURE 4



CONTACTOR AND D.B. RESISTOR CONNECTIONS
REVERSING MODELS
FIGURE 5

TABLE 1
ARMATURE CONTACTORS & D.B. RESISTORS

Drive Model	Motor HP	Armature Voltage	Contactor Rating	D.B. Resistor Rating
CDC320-000	5	240	30 Amps	10 Ohms, 300 W
CDC320-000	7.5	240	30 Amps	5 Ohms, 600 W
CDC320-000	10	240	40 Amps	4.4 Ohms, 750 W
CDC340-000	15	240	56 Amps	3 Ohms, 1000 W
CDC340-000	20	240	75 Amps	2.2 Ohms, 1500 W
CDC360-000	25	240	110 Amps	1.7 Ohms, 2000 W
CDC360-000	30	240	110 Amps	1.7 Ohms, 2000 W
CDC375-000	40	240	180 Amps	1.3 Ohms, 2080 W
CDC3150-000	50	240	180 Amps	0.62 Ohms, 2232 W
CDC3150-000	60	240	260 Amps	0.62 Ohms, 2232 W
CDC3150-000	75	240	260 Amps	0.62 Ohms, 2232 W
CDC320-000	5	500	30 Amps	40 Ohms, 375 W
CDC320-000	7.5	500	30 Amps	20 Ohms, 750 W
CDC320-000	10	500	30 Amps	20 Ohms, 750 W
CDC320-000	15	500	30 Amps	14 Ohms, 1000 W
CDC320-000	20	500	40 Amps	10 Ohms, 1500 W
CDC340-000	25	500	56 Amps	7 Ohms, 2000 W
CDC340-000	30	500	56 Amps	6 Ohms, 2000 W
CDC340-000	40	500	75 Amps	5 Ohms, 3000 W
CDC360-000	50	500	110 Amps	3.4 Ohms, 4000 W
CDC360-000	60	500	110 Amps	3.4 Ohms, 4000 W
CDC375-000	75	500	180 Amps	2.6 Ohms, 4160 W
CDC3150-000	100	500	180 Amps	1.24 Ohms, 4464 W
CDC3150-000	125	500	260 Amps	1.24 Ohms, 4464 W
CDC3150-000	150	500	260 Amps	1.24 Ohms, 4464 W

TABLE 2
ARMATURE CURRENT RANGE PROGRAMMING

Drive Model	Motor HP	Armature Voltage	Approx. Full Load Armature Amps Rating	J6 Position
CDC320-000	5	240	18.0	60%
CDC320-000	7.5	240	28.1	80%
CDC320-000	10	240	36.6	100%
CDC340-000	15	240	55.0	80%
CDC340-000	20	240	70.5	100%
CDC360-000	25	240	91.1	80%
CDC360-000	30	240	107.0	100%
CDC375-000	40	240	140.0	100%
CDC3150-000	50	240	174.0	60%
CDC3150-000	60	240	206.0	80%
CDC3150-000	75	240	256.0	100%
CDC320-000	5	500	8.5	20%
CDC320-000	7.5	500	13.2	40%
CDC320-000	10	500	17.2	60%
CDC320-000	15	500	25.2	80%
CDC320-000	20	500	35.1	100%

TABLE 2 (cont.)
ARMATURE CURRENT RANGE PROGRAMMING

Drive Model	Motor HP	Armature Voltage	Approx. Full Load Armature Amps Rating	J6 Position
CDC340-000	25	500	43.0	60%
CDC340-000	30	500	51.0	80%
CDC340-000	40	500	65.4	100%
CDC360-000	50	500	83.7	80%
CDC360-000	60	500	97.4	100%
CDC375-000	75	500	121.0	100%
CDC3150-000	100	500	161.0	60%
CDC3150-000	125	500	203.0	80%
CDC3150-000	150	500	245.0	100%

TABLE 3
3 PHASE LINE CURRENT & TRANSFORMER RATINGS

Drive Model	Motor HP	Armature Voltage	Approx. Full Load Line Amps	3 Phase Transformer KVA Rating – DIT Type
CDC320-000	5	240	18	7.5
CDC320-000	7.5	240	26	11
CDC320-000	10	240	34	14
CDC340-000	15	240	50	20
CDC340-000	20	240	65	27
CDC360-000	25	240	84	34
CDC360-000	30	240	98	40
CDC375-000	40	240	118	51
CDC3150-000	50	240	148	63
CDC3150-000	60	240	174	75
CDC3150-000	75	240	212	93
CDC320-000	5	500	9	7.5
CDC320-000	7.5	500	14	11
CDC320-000	10	500	18	14
CDC320-000	15	500	25	20
CDC320-000	20	500	34	27
CDC340-000	25	500	40	34
CDC340-000	30	500	47	40
CDC340-000	40	500	63	51
CDC360-000	50	500	78	63
CDC360-000	60	500	93	75
CDC375-000	75	500	106	93
CDC3150-000	100	500	141	118
CDC3150-000	125	500	177	145
CDC3150-000	150	500	213	175

3.5 Control Connections

3.5.1 WARNING!!!

Dangerous high voltage is present within the CHOICE® control unit. Do not attempt to adjust, service or troubleshoot the control without exercising extreme caution and being fully alert.

Parts of the circuitry are electrically HOT to ground and can cause a fatal shock. Instruments connected to the control should not have a grounded chassis, cabinet or test lead.

Service personnel must not stand on or touch grounded metal surfaces such as the control chassis, enclosure or any other grounded metal part.

3.5.2 Wiring Precautions

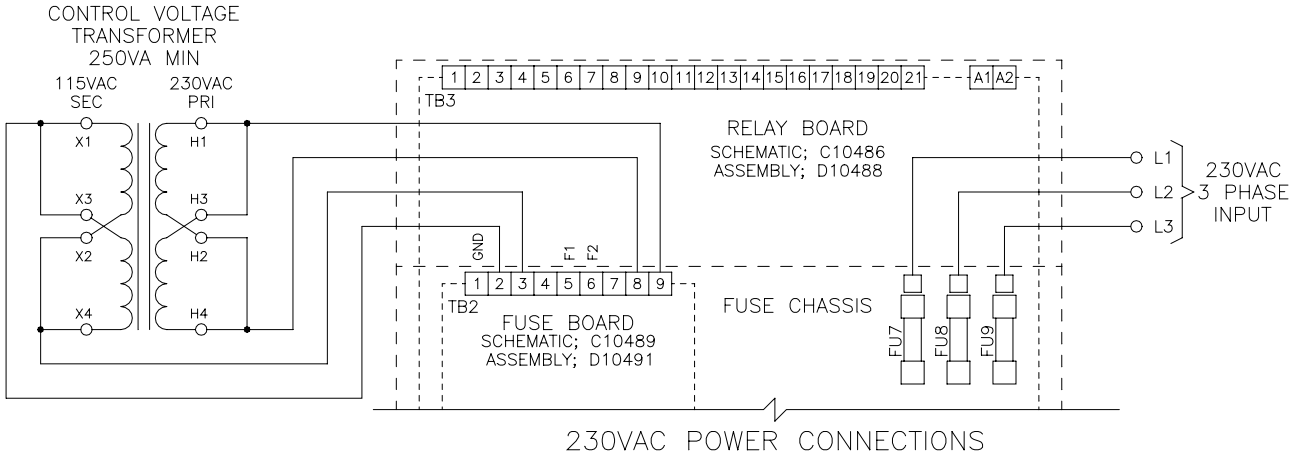
To prevent electrical interference and to minimize start-up problems, adhere to the following guidelines.

- Connect no terminal to ground other than TB2-1
- Use fully insulated and shielded cable for all signal level wiring. This includes potentiometer, tachometer and Summing input wires. The shield should be connected to one end only to circuit common. 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. Where the two types of wire must cross, they should cross at right angles to each other.
- Any relays, contactors, starters, solenoids, or other 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 a MOV or an R-C snubber connected in parallel with its coil. The suppressor should have leads that are as short as possible and should be located as close as possible to the coil terminals.

3.5.3 A.C. Power Connections

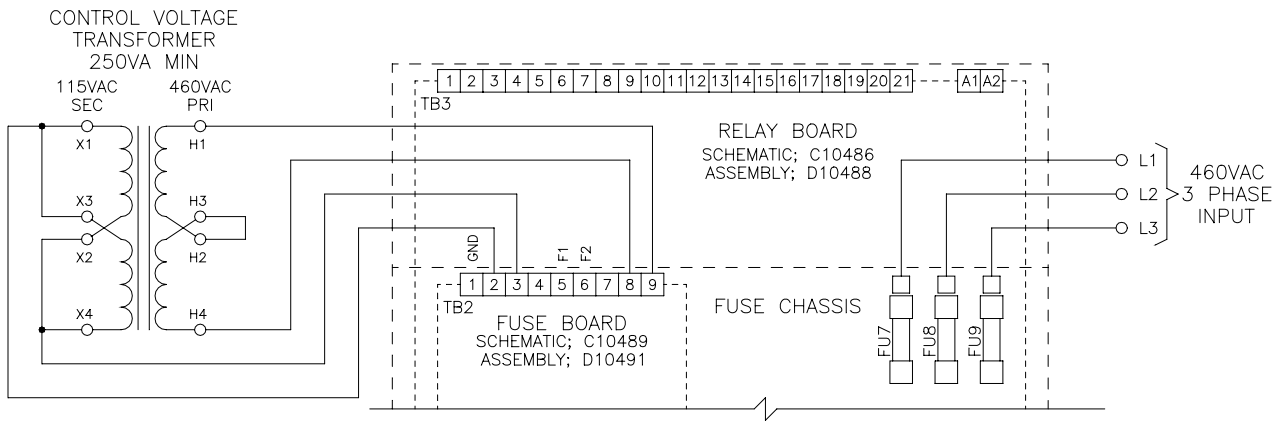
Refer to Figures 6 and 7 for A.C. power connections. Shown are the 230 or 430 VAC three phase power connections and the single phase 120 VAC control voltage supply connections.

NOTE: To assure safe sequencing of the D.C. power bridge components, the control transformer primary must be fed from TB2-8 and 9 as shown.



230VAC POWER CONNECTIONS

FIGURE 6



460VAC POWER CONNECTIONS

FIGURE 7

Table 3 is used as a general guide in sizing line supply transformers and line wiring. Wire must be sized and installed per local electrical codes. Factors such as load duty cycle and length of wire run are application dependent and should be considered along with the data in the table.

Also keep in mind that line and armature current can reach 150% of full load ratings for short duration and may affect the intermittent ratings of supply feeds, fuses, breakers, etc.

3.5.4 Armature Contactors and Brake Resistors

Table 1 lists recommended armature contactor and dynamic braking resistor ratings for particular motor sizes. Table 2 lists typical full load armature current ratings for the various motors. Connect these items per Figures 4 and 5.

3.5.5 Customer Operator and Coil Connections

All push-buttons operator and contactor coil connections are made at TB3. All items connected TB3 will be controlling or controlled by 120 VAC logic and must be rated accordingly.

The motor thermostat, E-STOP and RAMP STOP operator contacts must handle contactor inrush or making current which can exceed 13 amperes at the 1600 VA rating of the largest contactor although the continuous full load rating is typically less than 2 amperes.

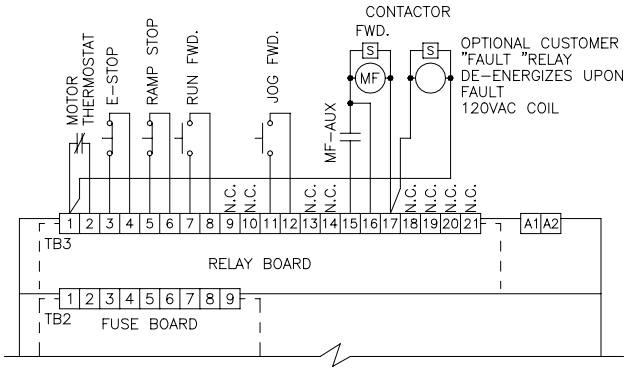
The RUN and JOG operator contacts control pilot relays that are 1.2 VA rated or about 11 mA.

Refer to figures 8 and 9 when making these connections.

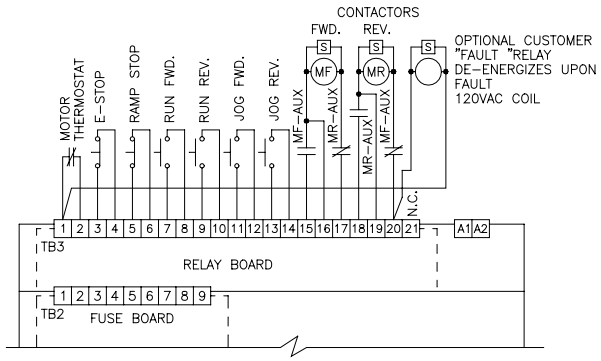
Additional connections for use of maintained contacts instead of push buttons are shown on Drawing C10549 in section 9.

3.5.6 Customer Signal Wiring Connections

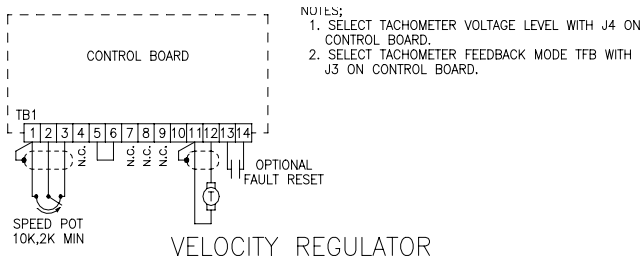
Signal wiring consists of low voltage and low current wires from signal sources such as potentiometer, encoders and tachometers, and they should connect according to Figures 10 and 11. Use wiring precautions as described in Section 3.5.2.



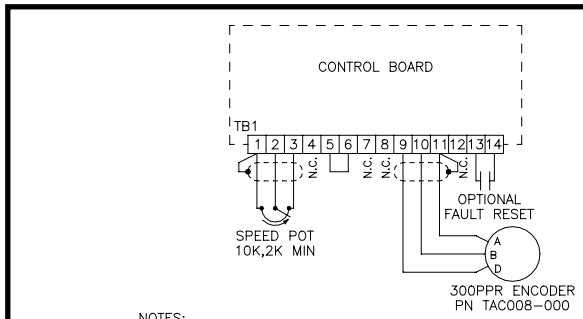
OPERATOR AND COIL CONNECTIONS
NON REVERSING MODELS
FIGURE 8



OPERATOR AND COIL CONNECTIONS
REVERSING MODELS
FIGURE 9



VELOCITY REGULATOR
MODE WITH TACHOMETER
FEEDBACK
FIGURE 10



NOTES;
1. SELECT ENCODER FEEDBACK MODE EFB WITH J3 ON CONTROL BOARD.

VELOCITY REGULATOR MODE
WITH ENCODER FEEDBACK
FIGURE 11

4 Customer Operator Functions

E-STOP (normally closed contact)

Operating the Emergency Stop will immediately kill the armature voltage and drop out the armature contactor. This duplicates the function of the motor thermostat.

RAMP STOP (normally closed contact)

Pressing the RAMP STOP push-button will clamp the speed reference at TB1-2 and cause the motor to decelerate to zero speed as set by the MIN SPEED pot.

RUN FWD (normally open contact)

The RUN FORWARD operator is used to start the motor on non-reversing models and for forward direction "start" on reversing models. Pressing RUN FWD will cause the motor to accelerate along the linear ramp to the set speed.

RUN REV (normally open contact)

RUN REVERSE is used to start the motor in the reverse direction when a reversing contactor has been added to the control. The motor will then follow the accel ramp to set speed.

JOG FWD (normally open contact)

JOG FORWARD will run the motor in the forward direction at the speed set by P4, JOG SPEED. The accel rate to jog speed is fixed. The motor will run as long as the jog button is depressed. When the button is released, the control output goes to zero. Three to four seconds later, the armature contactor de-energizes. This "jog delay" on contactor release will allow repeated jogging without cycling the contactor and will result in longer contactor life.

JOG REV (normally open contact)

JOG REVERSE is functional with the addition of a reverse contactor to the control. Operation is the same as JOG FWD but in the reverse direction.

Contactors and Braking Resistors

While the CHOICE® control will operate motors without the use of an armature contactor, **IT IS NOT RECOMMENDED.** Contactors are required to provide a fail safe disconnect of the motor from the control in the event of control or motor failure. Contactors and brake resistors are necessary for fast stopping (as opposed to coast to stop) in an EMERGENCY STOP condition.

The armature contactors must be DC voltage rated types with current capability equal to or greater than the motor full load current rating. Braking resistor wattage and resistance values also depend on motor ratings. Refer to Table 1 for recommended contactors and braking resistors for particular motor sizes.

5 Programming & Adjustment Descriptions

5.1 Programming Jumpers

Programming jumpers J1 through J6 and J8 are located on the Control Board. Jumper J7 is located on the Fuse Board.

J1 Field Loss

The CHOICE® control senses field current and indicates a fault when it is not present, and when J1 is in the NORMAL position. In applications where the on board field current sensing is not used, J1 can be placed in the BYPASS position to prevent a fault.

J2 Armature Volts

The maximum armature voltage depends on the level of three phase A.C. voltage applied to the control. For 230 VAC supplies, place J2 in the 240 position. For 460 VAC supplies, place J2 in the 500 position.

J3 Feedback

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

- When using armature voltage feedback, place J3 in the AFB position.
- A 300 PPR encoder can be used for feedback by placing J3 in the EFB position.
- Select tachometer feedback by placing J3 in the TFB position.

J4 Tach Volts

A variety of tachometers can be used for feedback. 7, 50, and 100 volts/1000RPM tachometers can be used. Place J4 in the position corresponding to the tach rating used.

J5 Sum Function

An auxiliary reference signal can be summed with the normal reference input from the pot. The position of J5 determines whether the auxiliary signal is added (+ position) or subtracted (- position).

CAUTION! Refer to Section 7.2 Summing Input Function for special safety instructions when using this custom input.

J6 Current Range

Each of the CHOICE® motor controls have a maximum armature current rating. J6 allows tailoring of the current sensing circuit in 20% increments to match the current scaling of the control to the actual full load current of the motor. This keeps the current control loop, the current limiting and the over-current fault circuits fully functional when operating motors with lower full load ratings than that of the control.

Example: A model CDC340-00 control has a maximum rating of 40 HP at 71 amperes armature current. To use a 25 HP motor rated at 43 amperes, determine 43 amps percentage of 71 amps.

$$43/71 \times 100 = 60.56\%$$

J6 would be placed in the 60% position. Always use the percentage setting closest to the calculated percentage. Refer to Table 2 for a listing of some typical motor ratings and the recommended J6 position.

J7 Field Supply Source

The CHOICE® control can be interfaced with an external field regulator supply so that the field current sensing circuit (Field Loss) is still functional. J7 programs that source by selection of INT for internal supply or EXT for external field regulator supply.

WARNING!!! J7 position must be placed in the EXT position when an external supply is used or serious damage to the motor control and regulator can occur!

J8 Static C.L. (Current Limit)

Move from NORMAL to STATIC C.L. position to disable the trigger circuit for static adjustment of the current limit setpoint. Start the drive and monitor TP19 (checkpoint K) to set the limit level. 5.0 VDC equals 100% current for the range programmed.

CAUTION! Move J8 only when the drive is stopped.

5.2 Customer Adjustments

All customer adjustment potentiometers are located on the Control Board. They are single turn cermet types with 180° of rotation. Each pot has an integral pointer with a screwdriver slot adjustment. With the control mounted normally, the pots will be at full counter-clock wise rotation when the pointer is in the "12 o'clock" position.

Most are configured to increase the parameter they are controlling with clock-wise rotation.

Examples:

- MAX SPEED increases armature voltage with CW rotation.
- ACCEL increases acceleration time with CW rotation.

Min Speed P7

The Minimum Speed sets the minimum armature output voltage when all other inputs are at zero. It can set up to 30% output voltage. This signal adds to and sets the starting point for the other reference signals.

MAX Speed P10

Maximum Speed trims the output of the accel/decel circuit and sets the maximum effect to the reference signal applied to TB1-2 by the external speed pot. P10 ranges the output from 0 to 110% when P7 is properly set.

Jog Speed P4

Jog Speed controls output only in the Jog mode and can produce up to 25% output. As with the Max Speed, its signal is summed with the Min Speed pot signal and the Summing Input signal.

Sum Trim P1

The Sum Trim controls the percentage affect of a signal applied to TB1-7, Summing Input. It can trim this signal to zero. Its maximum effect is controlled by the level of the Summing Input signal.

Accel P11

The Acceleration pot controls the time for the motor to accelerate along a linear ramp to the set speed. It can set the time from 1 to 60 seconds. CW (clockwise) rotation increases the time. The time period can be related approximately to the physical setting of the pot.

Example: Starting at minimum, full CCW, and rotating the pot 50% to mid-position would produce an approximate accel time of 30 seconds.

Decel P8

The Deceleration pot controls the time for the motor to decelerate along a linear ramp to the set speed. As with the ACCEL pot, a 60 second setting is at full CW rotation.

NOTE: The CHOICE® drive can control decel time only when the normal inherent decel time (coast down time) is equal to or shorter than the desired decel time.

P8 also controls decel time when the RAMP STOP command is given.

Voltage Gain P2

The Voltage Gain pot adjusts the proportional gain and response characteristic of the Velocity (voltage) Loop section and may be used to improve response and stability under certain conditions. CW rotation increases the gain.

Current Gain P5

The Current Gain pot adjusts the proportional gain and response characteristic of the Current (torque) Loop section and may be used to improve response and stability under certain conditions. CW rotation increases the gain.

IR Compensation P12

The IR Comp pot is functional only when operating in the AFB, armature feedback mode. It is used to improve motor speed regulation by using some of the current amplifier output as a positive feedback signal summed with the speed reference signal. Its effect is to keep motor speed from dropping as load is increased. This drop in speed is due to IR losses and those losses are usually greater in the lower half of the speed range. For these reasons, P12 is best adjusted with the actual load motor to be used, under normal loading conditions for the application and at the speed normally run. Refer to the adjustment procedure in section 6.4.

Current Limit P9

The Current Limit pot sets the maximum motor armature current and therefore torque that the CHOICE® control will allow. It is factory calibrated to 150% of the control full load rating when J6, Current Range, is in the 100% position. Once set, P9 will limit current to 150% of whatever current range is programmed by J6.

NOTE: The 150% current level is meant as an intermittant rating – the CHOICE® control will allow continuous loading at that level for only 1 minute.

5.3 Factory Adjustments

WARNING!!! Altering the factory settings of these pots may result in loss of protection and overloaded operation of the control and motor and may void the control and motor warranties.

Current Offset P3 & Current Cal P6

Location – Control Board

P3 and P6 are adjusted to give a calibrated current amplifier versus armature amps signal level. This signal level is critical to all current related functions, i.e. current feedback, current limiting, IR Compensation, current foldback, over-current fault, etc.

Bal 1 – P1 & Bal 2 – P2

Location – Power/Trigger Board.

Balance 1 and Balance 2 are adjusted with an oscilloscope to equalize the conduction angle of the three SCR's and the loading on the three phase AC line input.

6 Start-up Procedure

6.1 Adjustment Presets

Carotron CHOICE® controls are all functionally tested and calibrated with motor loads and should require further adjustment **only** to tailor operation for a particular application.

The adjustment presets are listed in the event that the condition of the control and its adjustment settings are unknown or in doubt.

Presets

Min Speed…..……full CCW
Max Speed…..……mid-range
Jog Speed…...……full-CCW
Sum Trim...……full-CCW
Accel……..……mid-range
Decel……. mid-range
Voltage Gain……. …1/3 CW
Current Gain……..……1/3 CW
IR Comp…….full CCW
Current Limit…...……..mid-range
Current Offset…….**Do not adjust-consult factory if altered**
Current Cal…… **Do not adjust-consult factory if altered**

Programming Jumpers

J1 through J6 should be placed in the positions appropriate to the motor and tach/encoder ratings for your application. Place J8 in NORMAL.

Verify the proper position of J7 on the Fuse Board.

6.2 Initial Power-up

The CHOICE® control has two separate powered circuits, the three phase input to the semiconductor fuses and the single phase 120 VAC to the control supply input at TB2-2 & 3 on the Fuse Board. The control supply comes from the secondary of the control transformer that has its primary fed from the fused output at TB2-8 & 9. This leaves single, three phase power feed to the control.

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

Connections should be visually inspected and tested with an ohmmeter. Measuring from each connection terminal to chassis ground with the ohmmeter on the R x 100K or greater scale will usually show any leakage paths to ground. Be suspicious of any reading less than 500K Ohms.

NOTE: An exception to this test might be required where the three phase supply terminals are fed by a grounded "Y" transformer secondary.

Step 1

Apply AC power to the control. Do not start or jog the motor at this time. The Zero Speed Led on the Control Board should be on. All other LED's should be off.

Step 2

Verify 120 VAC at TB-2 & 3. Verify proper field voltage at TB2-5 & 6; 150 VDC for 230 VAC inputs and 300 VDC for 460 VAC inputs.

6.3 Motor Start-up

During the following steps, the motor will be rotated. If high speed or wrong direction of rotation could damage your machine, it may be wise to de-couple the load from the motor until proper control is verified.

If tachometer or encoder coupling, ratings or connections are in doubt, the control can be started and run in Armature Feedback until proper control is verified.

Step 3

Turn the external Speed Pot to zero, full CCW. Press the FWD RUN push button. The RUN LED should light.

Step 4

While viewing the motor or measuring armature voltage, turn the MIN SPD pot CW until the motor begins to rotate at a low RPM. Then turn MIN SPD CCW until the motor just stops or voltage goes to zero.

Step 5

Adjust the Speed Pot to 25% or ¼ turn CW. When armature voltage or motor speed reaches about 6%, the ZERO SPEED LED should turn off. Verify proper direction of motor rotation. Now check encoder or tachometers for correct output levels.

Step 6

Press the Ramp Stop button. The RUN LED should turn off and the motor should decelerate to stop. As the speed passes the 6% level, the ZERO SPEED LED will turn on and the contactor will de-energize. Place the Feedback jumper, J3, in EFB or TFB position if required.

Step 7

Start the control again and then press E-STOP (Emergency Stop). The contactor should immediately de-energize and the motor will coast or brake to stop if brake resistors are used.

Step 8

Restart the control and increase the Speed Pot to maximum. Adjust the Max Speed for rated armature voltage, 240 or 500 VDC depending on line voltage, or desired motor maximum speed.

6.4 Calibration and Fine Tuning

Refer to the Description of Adjustments in section 5.2. Most of the adjustments on the CHOICE® control are straightforward and self-explanatory. A few have more complex functions and are discussed here.

IR Comp P12

As stated before, the IR Comp pot is functional only in the armature feedback, AFB, mode and is adjusted to keep motor speed from dropping as load is increased.

Adjustment is best performed when the motor or machine can be loaded normally. If the motor is normally operated at a particular speed, adjust the IR Comp while running at that speed. If the motor operates under load over a wide speed range, pick a point near the center of the range to make the adjustment. Adjust as follows:

Step 9

Operate the unloaded motor/machine at the normal or mid-range speed and note the exact speed.

Step 10

While still monitoring speed, apply a normal load. The drop in speed of fully a loaded motor will usually fall between 2% and 13%. Slowly turn the IR Comp clockwise until the loaded motor speed increases to the unloaded motor speed measured in the previous step. Making this adjustment may now cause the unloaded speed to be slightly higher. Repeat this step until there is no difference between the loaded and unloaded speeds.

Use care and do not adjust too high or speed increase with load and instability may result!

Voltage Gain P2

The Voltage Gain normally will not require any change from its 1/3 CW setting. Characteristics of some motors may cause an instability in the output that will be seen as an oscillation or pulsing in motor speed. This can be remedied by adjusting the Voltage Gain; usually clockwise.

Current Gain P5

The Current Gain normally will not require any change from its 1/3 CW setting. As with the Voltage Gain, this adjustment is mainly affected by the motor characteristics and may have a small affect on the motor stability. Altering its settings will have most effect when operating in current limit or Torque Regulator mode.

7 Special Circuit Functions and Operating Modes

7.1 Acceleration/Deceleration Circuit Output, TB1-4

Making the output of the Accel/Decel circuit accessible increases flexibility. In addition to providing the normal rate control of motor speed changes, it also provides rate control of torque changes when the drive is used as torque regulator – refer to Section 7.3. The output is ideal for mastering applications where the CHOICE® accel/decel adjustments can set the ramp rate for other drives. Use caution in this application to assure that isolation between controls is not compromised.

7.2 Summing Input Function, TB1-7

The Summing function allows an external signal to be added or subtracted from the Speed Pot signal. The Summing Input signal is not affected by the Accel and Decel adjustment as is the Speed Pot signal. The addition or subtraction function is determined by the J5 jumper position. This input does not affect operation in the Torque Regulator mode – refer to Section 7.3.

CAUTION! The Sum Trim pot, P1, should be used with the Max Speed, P10, to limit the total Armature Voltage to a safe level.

An 8.5 volts Summing signal can cause full rated armature voltage and speed without any Speed Pot signal applied! The maximum armature output voltage should not exceed Motor Nameplate Rated Armature Voltage by more than 10 (ten) percent.

CAUTION! Excessive motor/machine speed may be hazardous to operating personnel and could result in premature equipment failure.

7.3 Torque Regulator Mode Using C.L. (Current Loop) Input

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 at TB1-5. This must be a positive voltage signal no greater than 10 volts.

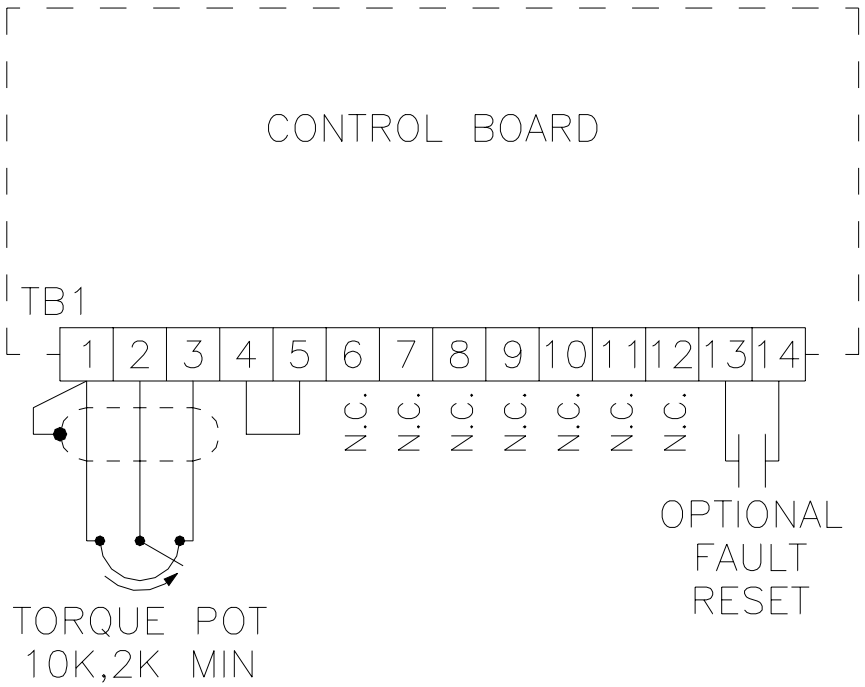
With the Current Range jumper, J6, in the 100% position and Current Limit pot, P9, at maximum, an 8.5 volts input will equal 100% motor torque/current output.

In many circumstances, an excessively quick rate of rise in motor torque and current can cause physical damage to machinery and product as well as electrical problems such as nuisance fuse blowing and tripping of circuits breakers. These problems are eliminated by connecting the C.L. input to the Accel/Decel Output at TB1-4 and applying the Torque reference signal to TB1-2. The Accel/Decel circuit input here is normally fed by the Speed pot, which now would function as a Torque pot. Rate of rise and fall of motor torque will now be controlled by the Accel and Decel pots. Refer to Figure 12 when making these connections.

The Current Limit pot, P9, acts as the "Maximum Torque" pot in this mode.

The Over Current fault and the current Foldback functions are fully operational in the Torque Regulator 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.



TORQUE REGULATOR MODE

FIGURE 12

8 Spare Parts

8.1 Printed Circuit Assemblies

Control Board: Part number D10485-…
Add dash numbers per tabulation depending on control model.

Model CDC320-000……P.N. D10485-001
Model CDC340-000……P.N. D10485-002
Model CDC360-000, CDC 375-000 and CDC3150-000……..….P.N. D10485-003

Relay Board:

Model CDC320-000 – CDC360-000
…….P.N. D10488-000
Model CDC375-000……P.N. D10488-001
Model CDC3150-000……..P.N. D10488-002

Fuse Board:

Models CDC320-000 – CDC360-000
……P.N. D10491-000
Model 375-000……..……..P.N. D10491-000
Model CDC3150-000……..P.N. D10491-001

Power/Trigger Board:

All models……P.N. D10494-000

IFB (Current Feedback) Board:

Model CDC3150-000 only……..D10748-003

8.2 Fuses – All models

FUI: 5 ampere slow blow type, 250 VAC
Carotron…….FUS1005-01
Bussmann…..……MDA-5
Littelfuse……326005

FU2-FU6: 10 ampere dual element, time delay, 500VAC
Carotron…….....FUS1008-03
Bussmann……..……FNQ 10
Littelfuse……FLQ 10

Fuses: FU7, FU8, FU9 Current rating per Model – all 500 VAC semiconductor types.

Model CDC320-000: 50 ampere
Carotron……..…….FUS1009-00
Bussmann…….FWH 50
Littelfuse……...L50S 50

Model CDC340-000: 100 ampere
Carotron…….FUS1009-01
Bussmann…...……FWH 100
Littelfuse…….……L50S 100

Model CDC360-000: 150 ampere
Carotron……FUS1009-02
Bussmann……...FWH 150
Littelfuse……L50S 150

Model CDC375-000: 175 ampere
Carotron…….FUS1009-03
Bussmann…..……FWH 175
Littelfuse…...……..L50S 175

Model CDC3150-000: 350 ampere
Carotron…….FUS1009-04
Bussmann……...FWH 350
Littelfuse…….L50S 350

8.3 Power Bridge Components

All devices are rated at 1400 volts repetitive peak off state and reverse voltage and have 1000 V/us dvdt.

Freewheeling (flyback) diode: Per model

Model CDC320-000 – CDC375-000:
80 ampere rating
Carotron……..……PMD1011-00
Semikron…….SKKE81/14
IR……..……..IRKE81-14

Model CDC3150-000: 165 ampere rating
Carotron……...PMD1015-00
AEG……...…..D171N1400K
IR……...……IRKE166-1400

SCR/Diode Module: Per model

Model CEC320-000: Each module rated at average current of 25 amperes

Carotron…...……PMD1010-02
Semikron……..SKKH26/14E
AEG...…….TD25N1400K0F

Model CDC340-000: Each module rated at average current of 55 amperes

Carotron……...PMD1010-01
Semikron…….SKKH56/14E
AEG……TD56N1400K0F

Model CDC360-000: Each module rated at average current of 90 amperes

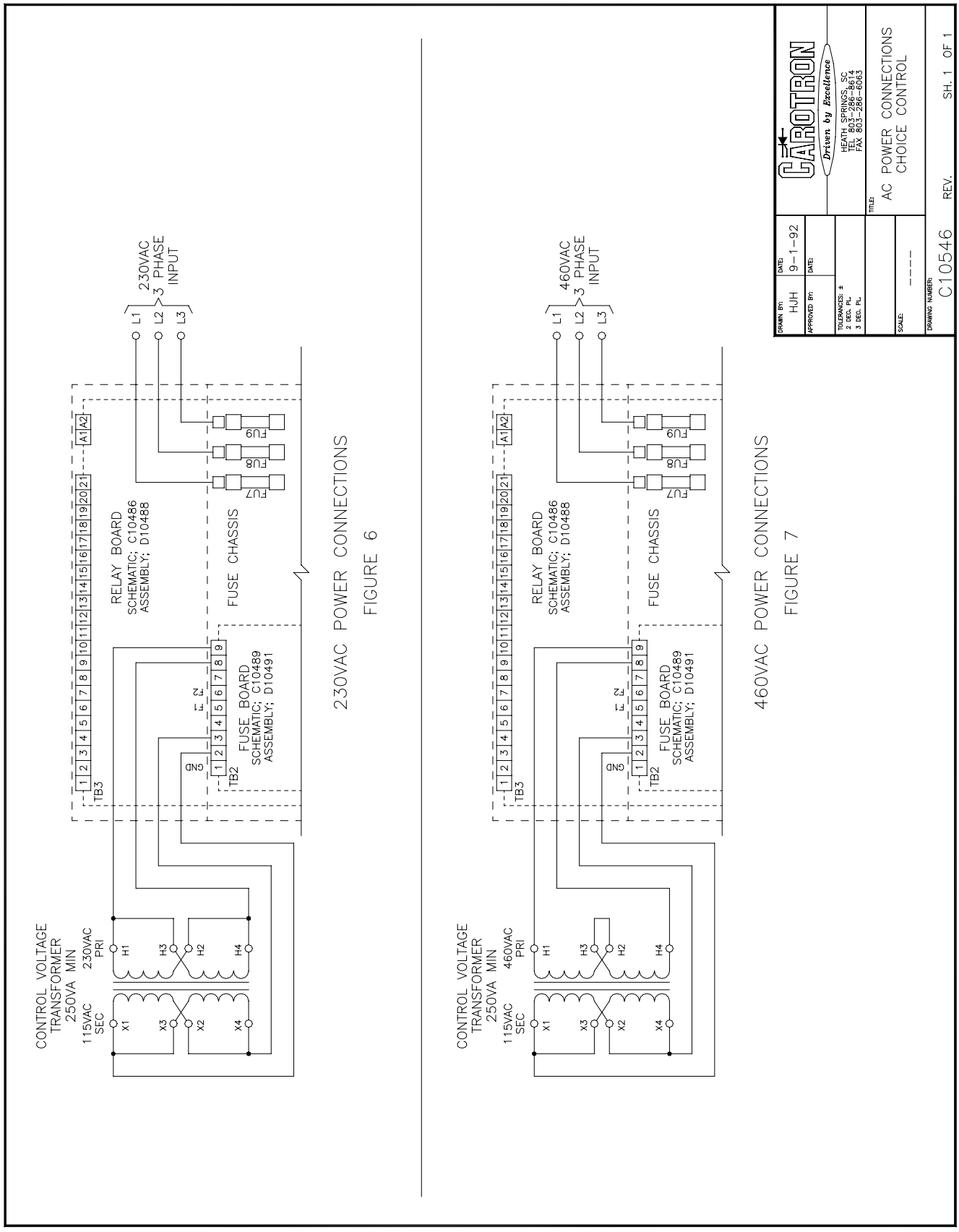
Carotron……...…PMD1010-00
Semikron…….SKKH91/14E
AEG……TD92N1400K0F

Model CDC375-000: 105 ampere rating

Carotron……...PMD1010-03
AEG…….TD105N1400K0F

Model CDC3150-000: 135 ampere rating

Carotron…...……PMD1014-00
AEG……..TD142N1400K0F
International Rectifier..IRKH136-14S90

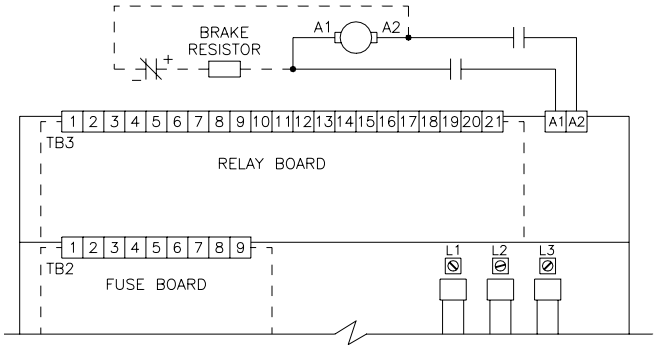


230VAC POWER CONNECTIONS

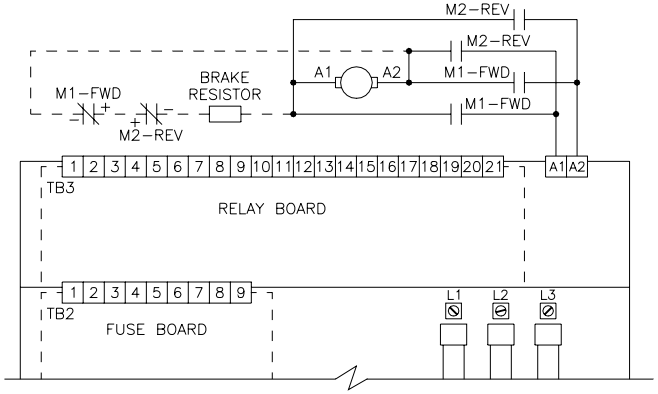
FIGURE 6

460VAC POWER CONNECTIONS

FIGURE 7



CONTACTOR AND D.B. RESISTOR CONNECTIONS
NON REVERSING MODELS
FIGURE 4



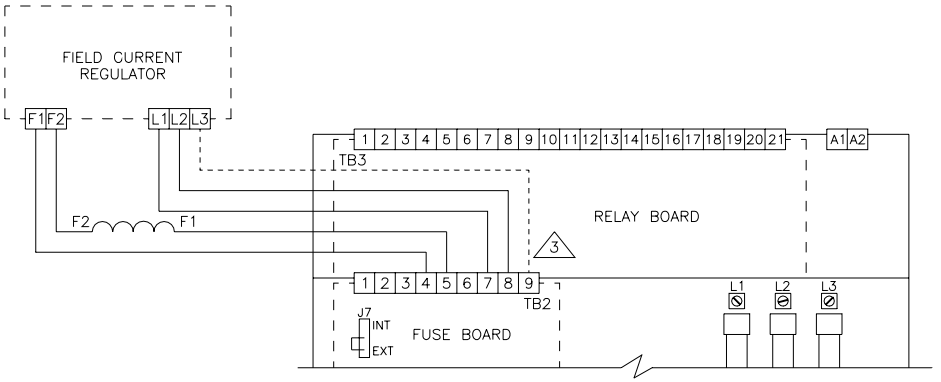
CONTACTOR AND D.B. RESISTOR CONNECTIONS
REVERSING MODELS
FIGURE 5

REV. A, 12-9-91

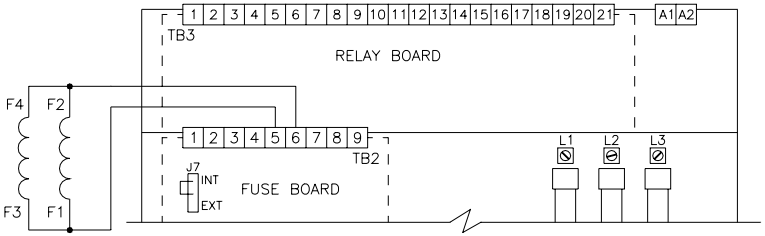
DRAWN BY: HJH	DATE: 9-1-92
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. .3 DEC. PL.	CAROTRON Driven by Excellence
	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE: ----	TITLE: ARMATURE CONTACTOR/ BRAKE RESISTOR CONN. CHOICE® CONTROL
DRAWING NUMBER: C10547 REV.	SH. 1 OF 1

WARNING!
J7 ON THE FUSE BOARD MUST BE PLACED IN THE EXT POSITION WHEN USING AN EXTERNAL FIELD SUPPLY/REGULATOR WITH THE CHOICE CONTROL.

NOTES;
1. THESE CONNECTIONS INTERFACE AN EXTERNAL FIELD SUPPLY OR REGULATOR WITH THE CHOICE CONTROL FIELD LOSS CIRCUIT. THE POSITIVE FIELD CURRENT AVAILABLE AT TB2–5 IS LIMITED TO 10 AMPS BY FU2.
2. THE VOLTAGE SUPPLY FOR TB2–7,8 AND 9 IS FUSED AT 10 AMPS BY FU4,FU5 AND FU6 AND IS TAKEN FROM THE CUSTOMER 3 PHASE AC INPUT SUPPLY CONNECTED TO THE SEMICONDUCTOR FUSES AT TERMINALS L1,L2 AND L3.
3. THE CONNECTION TO TB2–9 IS NOT REQUIRED WITH REGULATORS OPERATING FROM A SINGLE PHASE AC VOLTAGE SUPPLY.

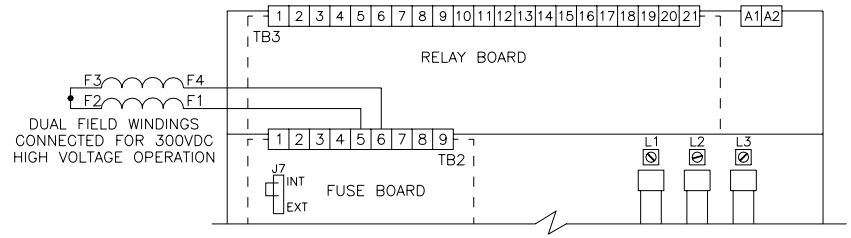


EXTERNAL FIELD SUPPLY CONNECTIONS
FIGURE 3



DUAL FIELD WINDINGS CONNECTED FOR 150VDC LOW VOLTAGE OPERATION

LOW VOLTAGE FIELD CONNECTIONS
FIGURE 1



DUAL FIELD WINDINGS CONNECTED FOR 300VDC HIGH VOLTAGE OPERATION

HIGH VOLTAGE FIELD CONNECTIONS
FIGURE 2

SYM	BY	DATE	REVISIONS
A	HJH	6–26–90	REV. F1,F2 FIG. 7

DRAWN BY: HJH	DATE: 9–1–92
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. 3 DEC. PL.	
SCALE: -----	
DRAWING NUMBER: C10548 REV.	SH. 1 OF 1

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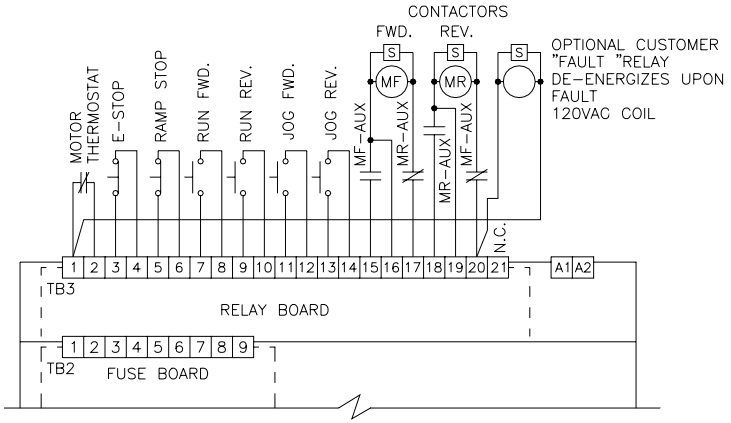
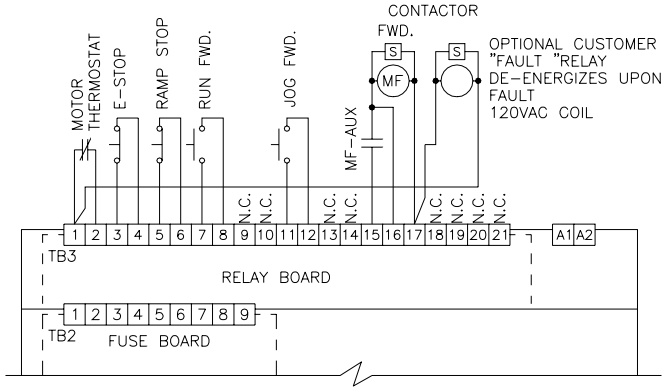
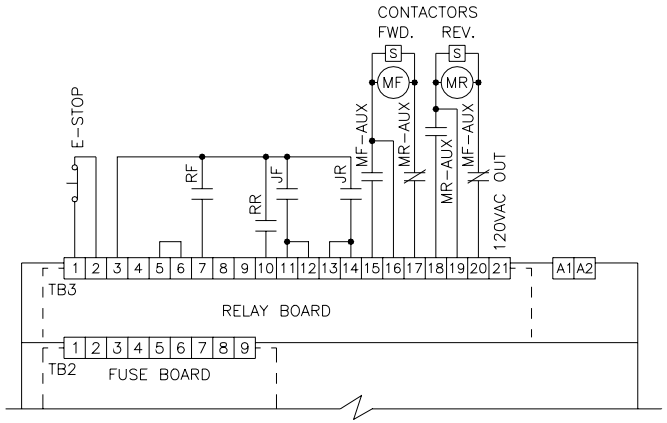
TITLE: MOTOR FIELD CONNECTIONS CHOICE CONTROL



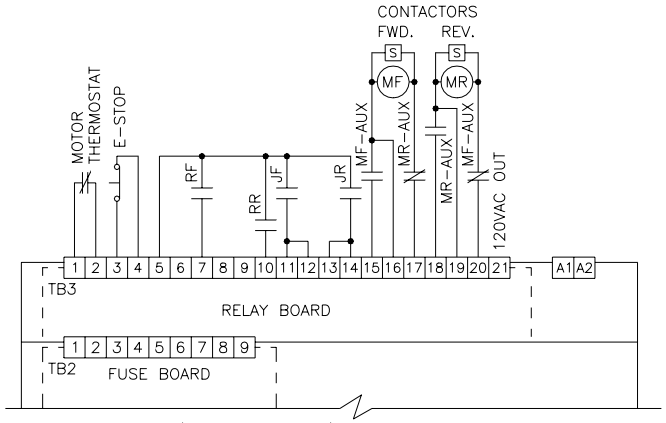
OPERATOR AND COIL CONNECTIONS
REVERSING MODELS
FIGURE 9



OPERATOR AND COIL CONNECTIONS
NON REVERSING MODELS
FIGURE 8



SINGLE (MAINTAINED) CONTACT CONTROL
D.B. AND COAST STOP



SINGLE (MAINTAINED) CONTACT CONTROL
RAMP STOP

REV. ADD FAULT RELAY,8-1-90

DRAWN BY: HJH	DATE: 5-14-90
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. 3 DEG. PL.	
SCALE: ----	
DRAWING NUMBER: C10549 REV. A	SH. 1 OF 1

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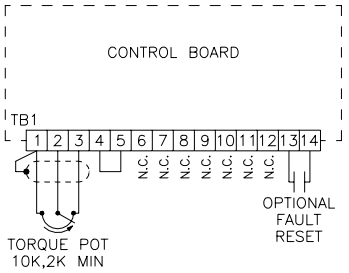
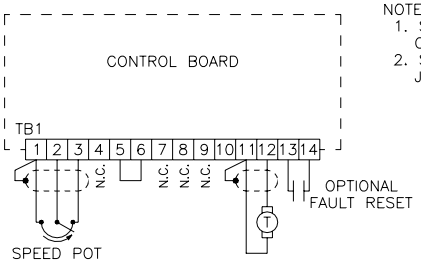
TITLE:
CUSTOMER OPERATOR AND
COIL CONNECTIONS
CHOICE CONTROL



TORQUE REGULATOR MODE

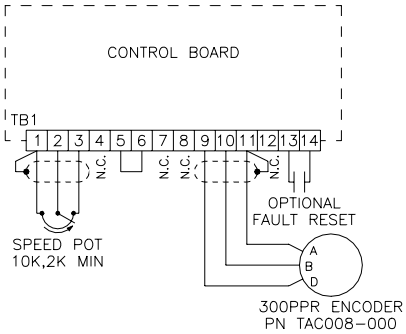
FIGURE 12



NOTES;
1. SELECT TACHOMETER VOLTAGE LEVEL WITH J4 ON CONTROL BOARD.
2. SELECT TACHOMETER FEEDBACK MODE TFB WITH J3 ON CONTROL BOARD.

VELOCITY REGULATOR MODE WITH TACHOMETER FEEDBACK

FIGURE 10



NOTES;
1. SELECT ENCODER FEEDBACK MODE EFB WITH J3 ON CONTROL BOARD.

VELOCITY REGULATOR MODE WITH ENCODER FEEDBACK

FIGURE 11

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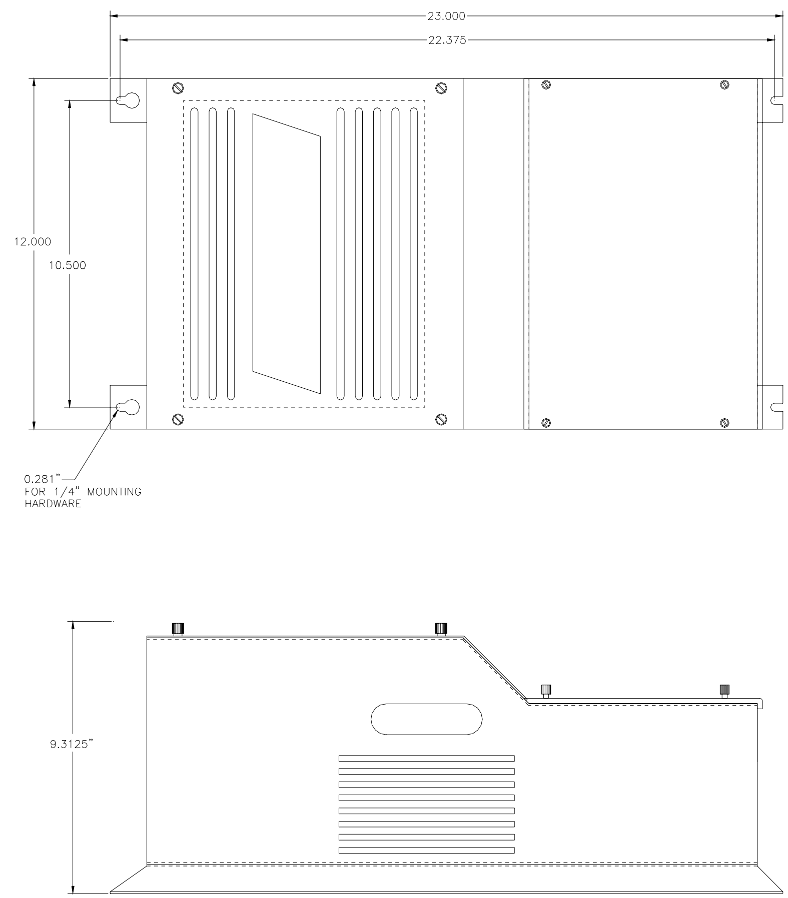
TOLERANCES: ± 2 DEC. PL. 3 DEC. PL.		TITLE: CUSTOMER SIGNAL WIRING CONNECTIONS CHOICE CONTROL
SCALE: ----		
DRAWING NUMBER: C10550	REV.	SH. 1 OF 1



BY	DATE	SYM	DESCRIPTION
HJH	10-5-94	A	HEIGHT WAS 9.750"

REVISIONS

DRAWN BY: HJH	DATE: 3-28-90
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. 3 DEC. PL.	
SCALE: ----	

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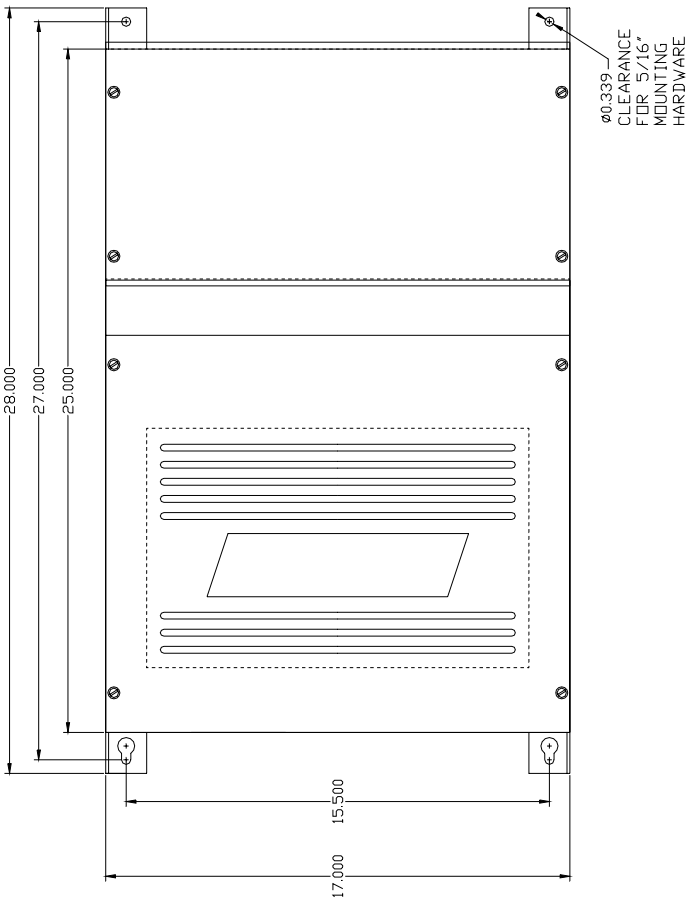
TITLE: DIMENSION DRAWING
CHOICE• CONTROL
CDC320-000 – CDC375-000

DRAWING NUMBER: D10522 REV. SH. 1 OF 1



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FAX 803-286-8663

DRAWN BY | DATE 5-9-95
APPROVED BY | DATE

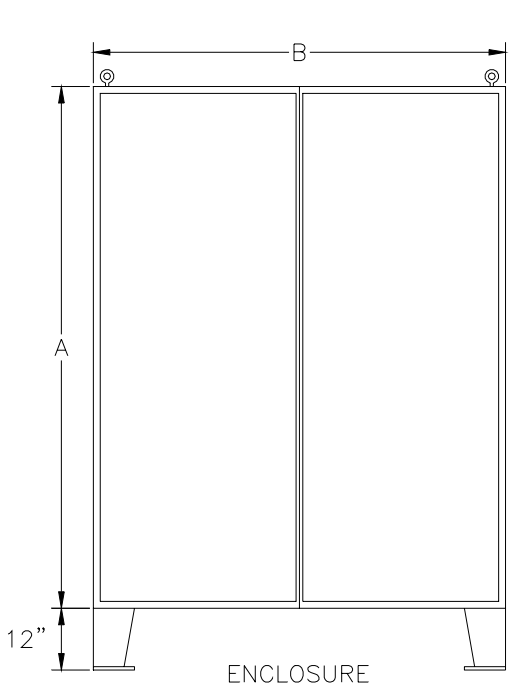
TOLERANCES: ±
2 DEC. PL.
3 DEC. PL.

TITLE: DIMENSION DRAWING
CDC3150-000 CONTROL

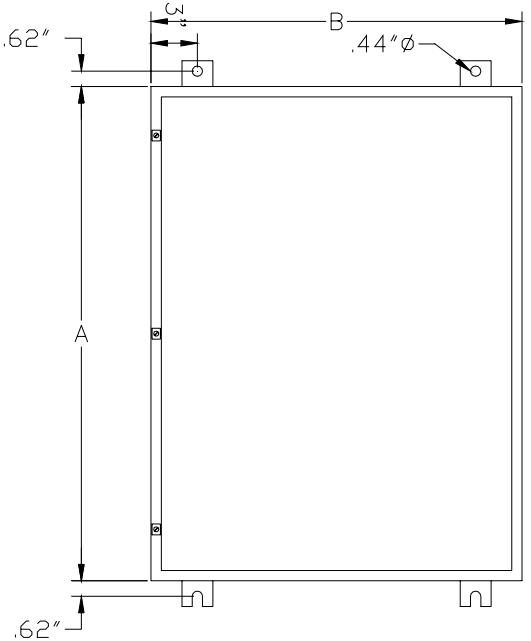
SCALE

DRAWING NUMBER D10816 REV.

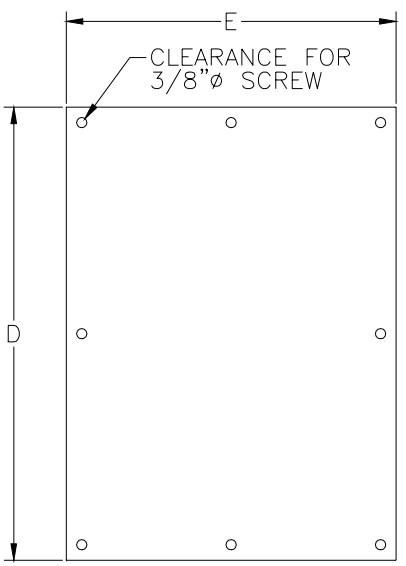
SH. 1 OF 1



ENCLOSURE
TWO DOOR



ENCLOSURE
SINGLE DOOR



PANEL

PANEL DIMENSIONS		
OPTIONAL DASH NO.	D x E	NOTES;
C15-C60	33 x 27	OMIT TOP AND BOTTOM CENTER MOUNTING HOLE
C75	45 x 33	
C100-C150	56 x 44	

NEMA 12 ENCLOSURE DIMENSIONS		
OPTIONAL DASH NO.	A x B x C	NOTES
001 & H01	36 x 30 x12	SINGLE DOOR WALL MOUNT
002 & H02	48 x 36 x16	SINGLE DOOR WALL MOUNT
003,H03 & H04	60 x 48 x16	TWO DOOR FLOOR MOUNT

C = DEPTH

DRAWN BY: HJH
DATE: 3-23-92
APPROVED BY:
DATE:
TOLERANCES: ± 2 DEC. PL. ± .0 DEC. PL.
SCALE:
DRAWING NUMBER: D10848 REV.

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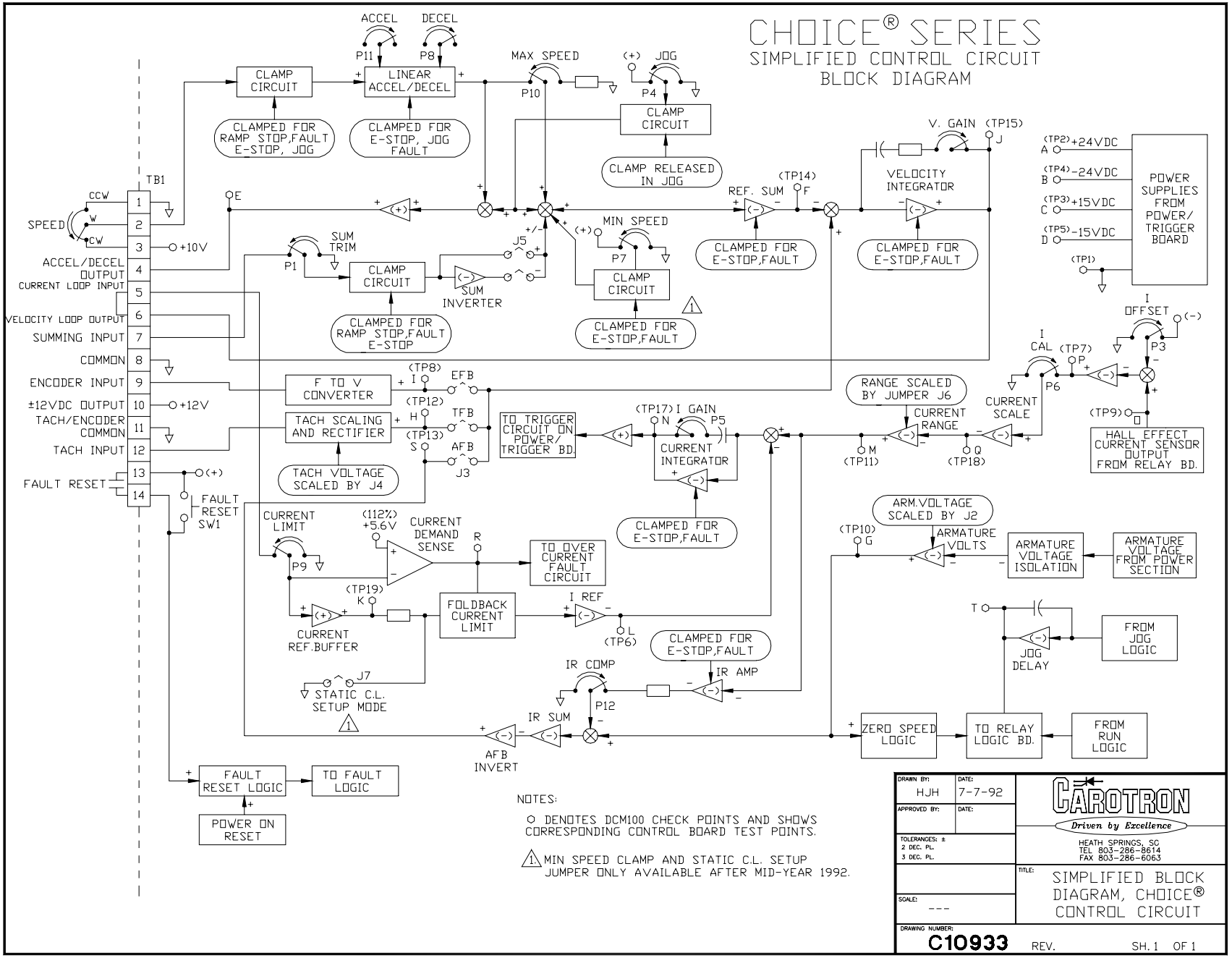
FAX 803-286-6063

TITLE: CHOICE™ OPTION CHASSIS AND ENCLOSURE DIMENSIONS

SH.1 OF 1


CHOICE® SERIES
SIMPLIFIED CONTROL CIRCUIT
BLOCK DIAGRAM
ACCEL
DECEL
P11
P8
MAX SPEED
P10
(+) JOG
P4
CLAMP CIRCUIT
LINEAR ACCEL/DECEL
CLAMPED FOR RAMP STOP,FAULT E-STOP, JOG
CLAMPED FOR E-STOP, JOG FAULT
CLAMP CIRCUIT
CLAMP RELEASED IN JOG
V. GAIN (TP15)
J
VELOCITY INTEGRATOR
(TP14)
REF. SUM
F
CLAMPED FOR E-STOP,FAULT
CLAMPED FOR E-STOP,FAULT
(TP2)+24VDC
A
(TP4)-24VDC
B
(TP3)+15VDC
C
(TP5)-15VDC
D
(TP1)
POWER SUPPLIES FROM POWER/ TRIGGER BOARD
TB1
CCW
SPEED
W
CW
1
2
3
+10V
4
ACCEL/DECEL OUTPUT
5
CURRENT LOOP INPUT
6
VELOCITY LOOP OUTPUT
7
SUMMING INPUT
8
COMMON
9
ENCODER INPUT
10
±12VDC OUTPUT
+12V
11
TACH/ENCODER COMMON
12
TACH INPUT
13
14
FAULT RESET
(+)
FAULT RESET SW1
E
SUM TRIM
P1
CLAMP CIRCUIT
CLAMPED FOR RAMP STOP,FAULT E-STOP
J5
SUM INVERTER
MIN SPEED
(+)
P7
CLAMP CIRCUIT
CLAMPED FOR E-STOP,FAULT
1
I OFFSET
(-)
P3
I CAL
(TP7)
P
P6
CURRENT SCALE
(TP9)
Q
HALL EFFECT CURRENT SENSOR OUTPUT FROM RELAY BD.
F TO V CONVERTER
(TP8)
I
EFB
TACH SCALING AND RECTIFIER
(TP12)
H
TFB
(TP13)
S
AFB
J3
TACH VOLTAGE SCALED BY J4
TO TRIGGER CIRCUIT ON POWER/ TRIGGER BD.
(TP17) I GAIN
N
P5
CURRENT INTEGRATOR
CLAMPED FOR E-STOP,FAULT
RANGE SCALED BY JUMPER J6
CURRENT RANGE
M
(TP11)
Q
(TP18)
ARM.VOLTAGE SCALED BY J2
(TP10)
G
ARMATURE VOLTS
ARMATURE VOLTAGE ISOLATION
ARMATURE VOLTAGE FROM POWER SECTION
CURRENT LIMIT
P9
(112%) +5.6V
CURRENT DEMAND SENSE
R
TO OVER CURRENT FAULT CIRCUIT
(TP19)
K
CURRENT REF.BUFFER
FOLDBACK CURRENT LIMIT
I REF
L
(TP6)
CLAMPED FOR E-STOP,FAULT
T
JOG DELAY
FROM JOG LOGIC
IR COMP
P12
IR AMP
J7
STATIC C.L. SETUP MODE
1
IR SUM
AFB INVERT
ZERO SPEED LOGIC
TO RELAY LOGIC BD.
FROM RUN LOGIC
FAULT RESET LOGIC
TO FAULT LOGIC
POWER ON RESET
NOTES:
○ DENOTES DCM100 CHECK POINTS AND SHOWS CORRESPONDING CONTROL BOARD TEST POINTS.
1. MIN SPEED CLAMP AND STATIC C.L. SETUP JUMPER ONLY AVAILABLE AFTER MID-YEAR 1992.
DRAWN BY: HJH
DATE: 7-7-92
APPROVED BY:
DATE:
TOLERANCES: ± 2 DEC. PL. 3 DEC. PL.
SCALE: ---
DRAWING NUMBER: C10933
REV.
SH. 1 OF 1
CAROTRON
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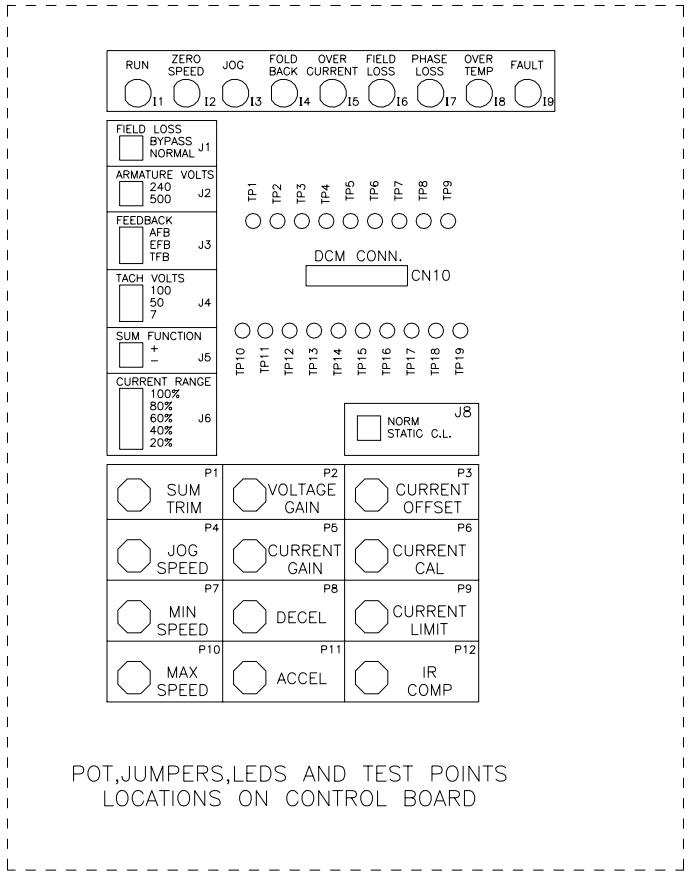
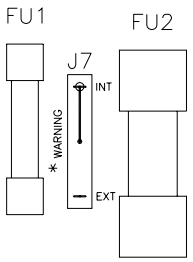
TEL 803-286-8614
FAX 803-286-6063
TITLE: SIMPLIFIED BLOCK DIAGRAM, CHOICE® CONTROL CIRCUIT



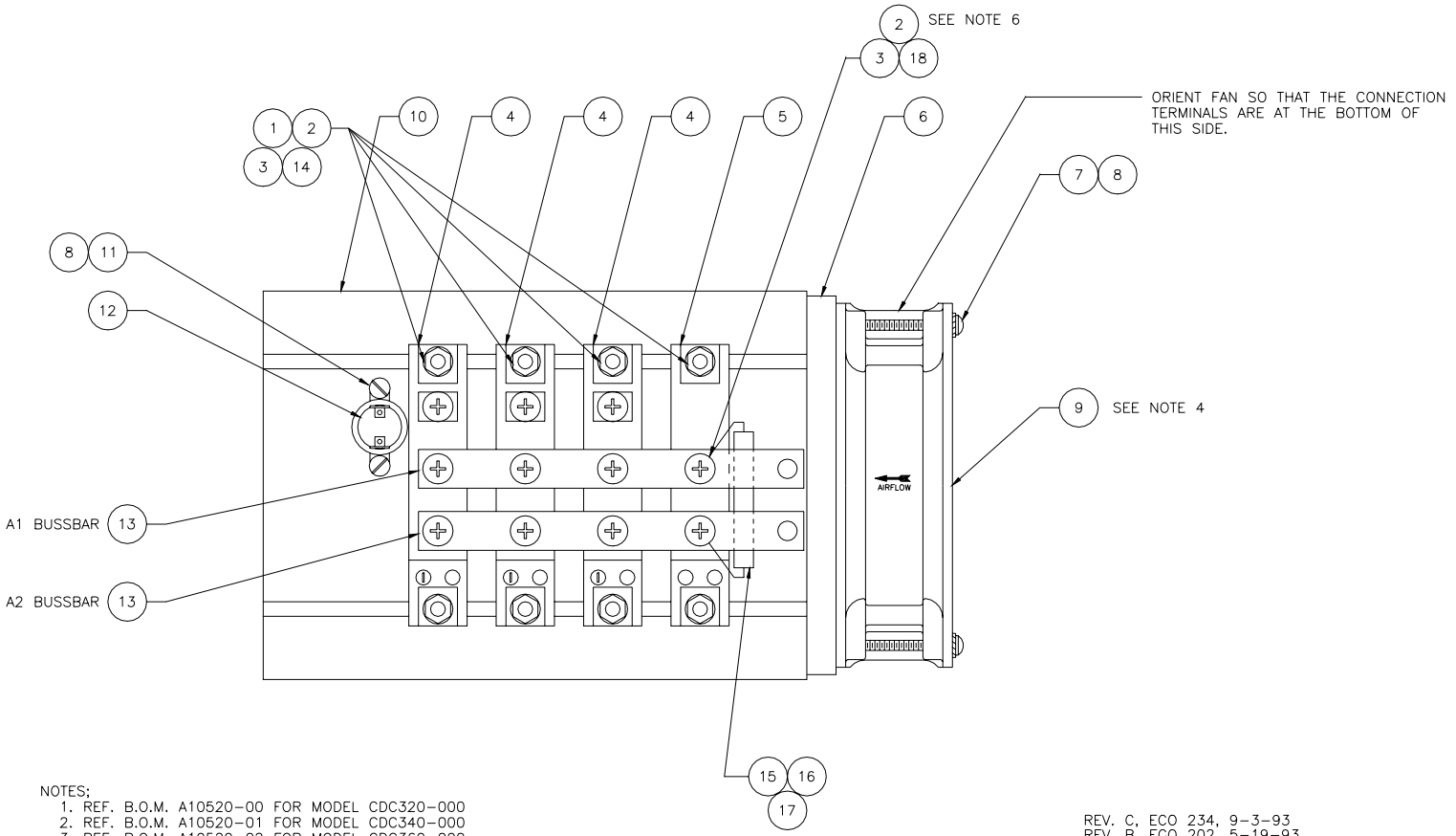
POT,JUMPERS,LEDS AND TEST POINTS
LOCATIONS ON CONTROL BOARD



J7 LOCATED ON FUSE BOARD

*WARNING–SEE FIELD OPTION CONNECTION INFORMATION

DRAWN BY: HJH	DATE: 9-1-92	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± .2 DEC. PL. .5 DEC. PL.		TITLE: ADJUSTMENT LOCATION CHOICE CONTROL
SCALE: ----		
DRAWING NUMBER: C10551 REV. A		SH. 1 OF 1



NOTES:
1. REF. B.O.M. A10520-00 FOR MODEL CDC320-000
2. REF. B.O.M. A10520-01 FOR MODEL CDC340-000
3. REF. B.O.M. A10520-02 FOR MODEL CDC360-000
4. FAN AND ASSOCIATED HARDWARE ARE NOT USED ON CDC320-000
5. REF. SCHEMATIC A10552.
6. REF. B.O.M. A10520-003 FOR CDC375-000, SHORT A1 BUSSBAR AND LONGER SCREW FOR A1 BUSSBAR TO ITEM 5 DIODE TERMINAL CONNECTION.

REV. C, ECO 234, 9-3-93
REV. B, ECO 202, 5-19-93

DRAWN BY: HJH	DATE: 3-27-90
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. .5 DEC. PL.	
SCALE: ------	
DRAWING NUMBER: C10520 REV.	SH. 1 OF 1

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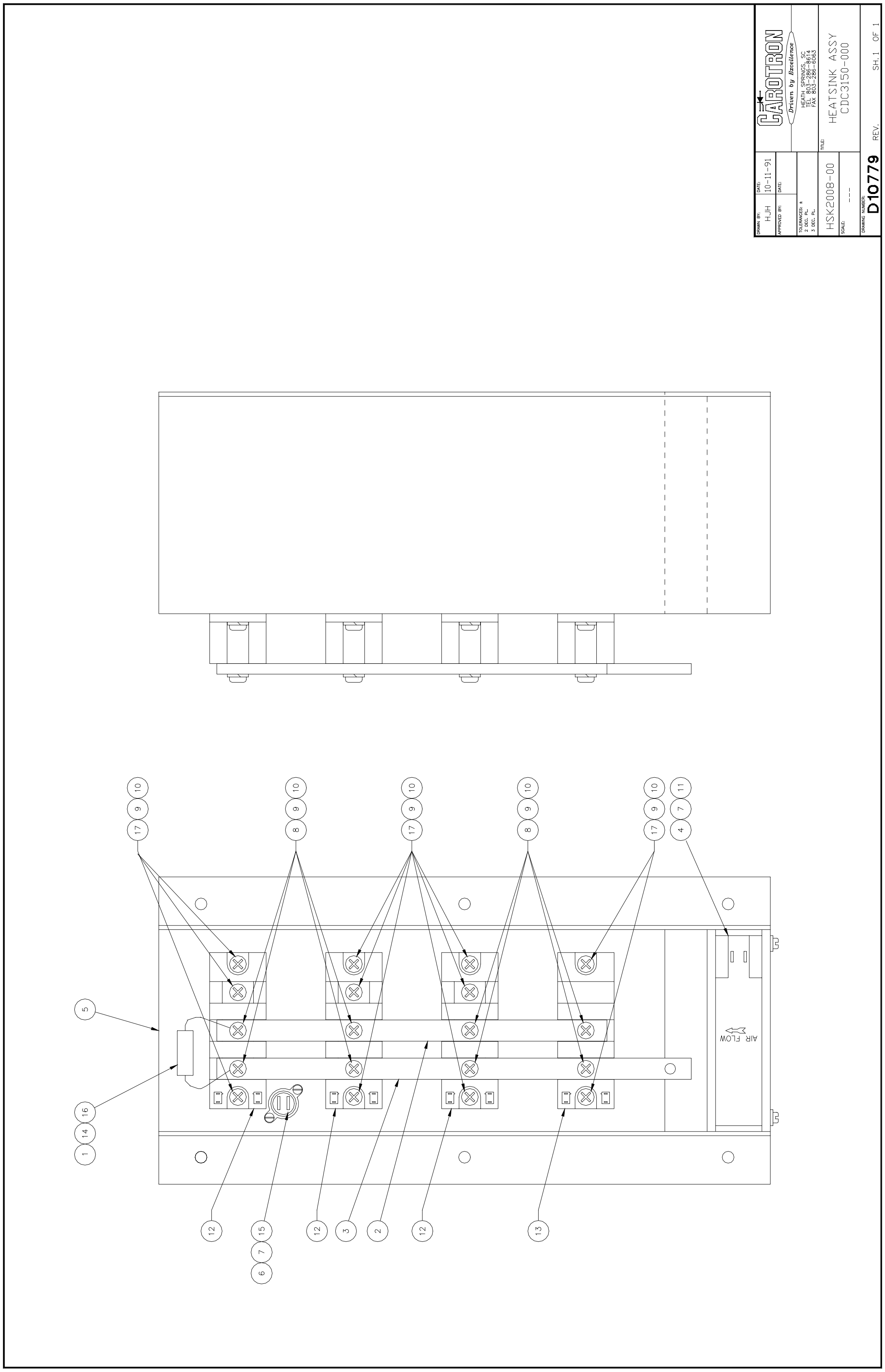
FAX 803-286-6063

TITLE:
ASSEMBLY
CHOICE® HEATSINK
MODELS CDC320-000
TO CDC375-000


CAROTRON
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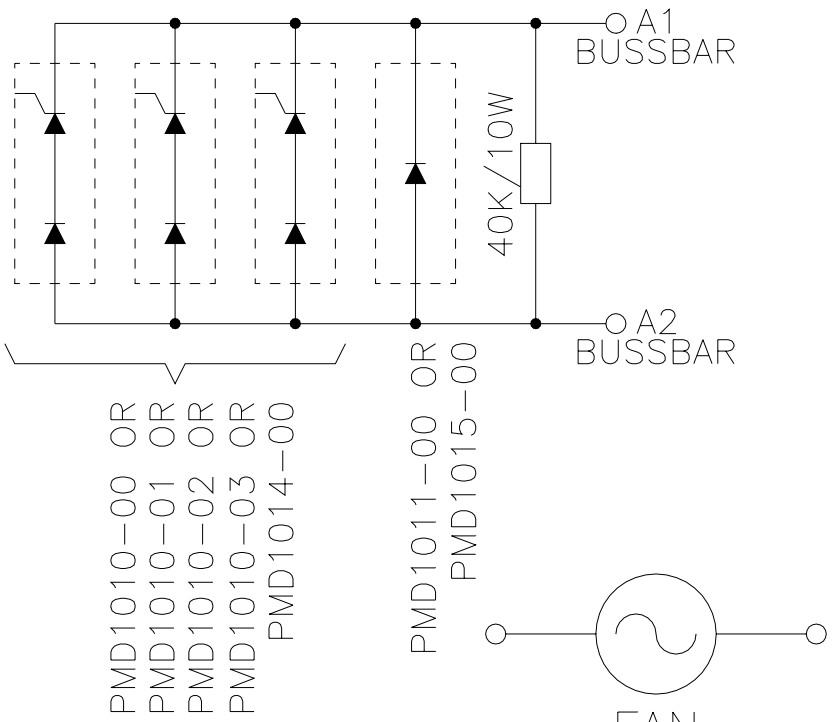
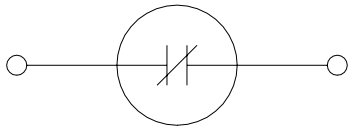
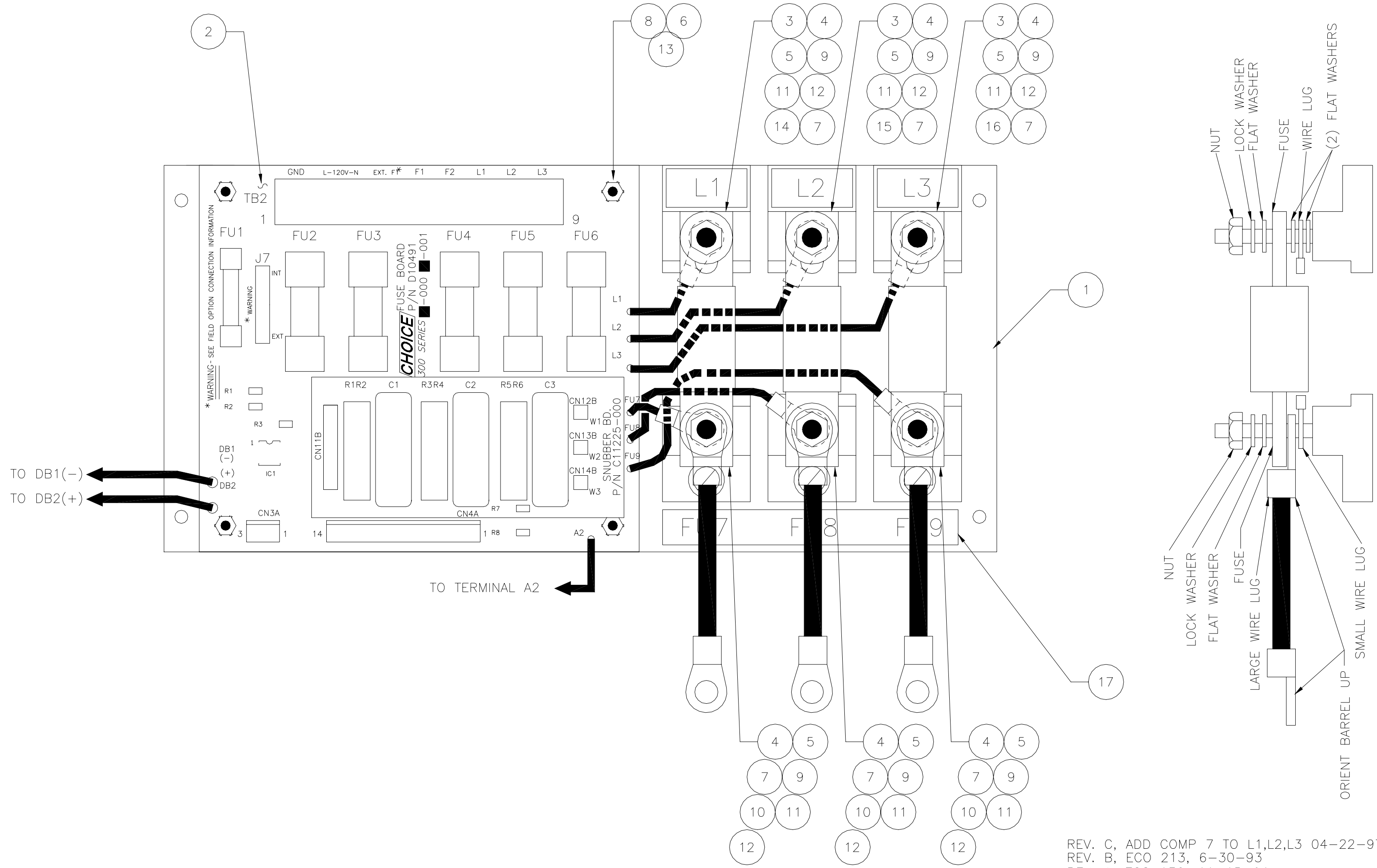
TEL 803-286-8614
FAX 803-286-6063
DRAWN BY: HJH
DATE: 10-11-91
APPROVED BY:
DATE:
TITLE: HEATSINK ASSY
CDC3150-000
HSK2008-00
SCALE: ---
DRAWING NUMBER: D10779
REV.
SH.1 OF 1
AIR FLOW





NOTES;
1. REFER TO ASSEMBLY C10520
2. REFER TO B.O.M. A10520-XX

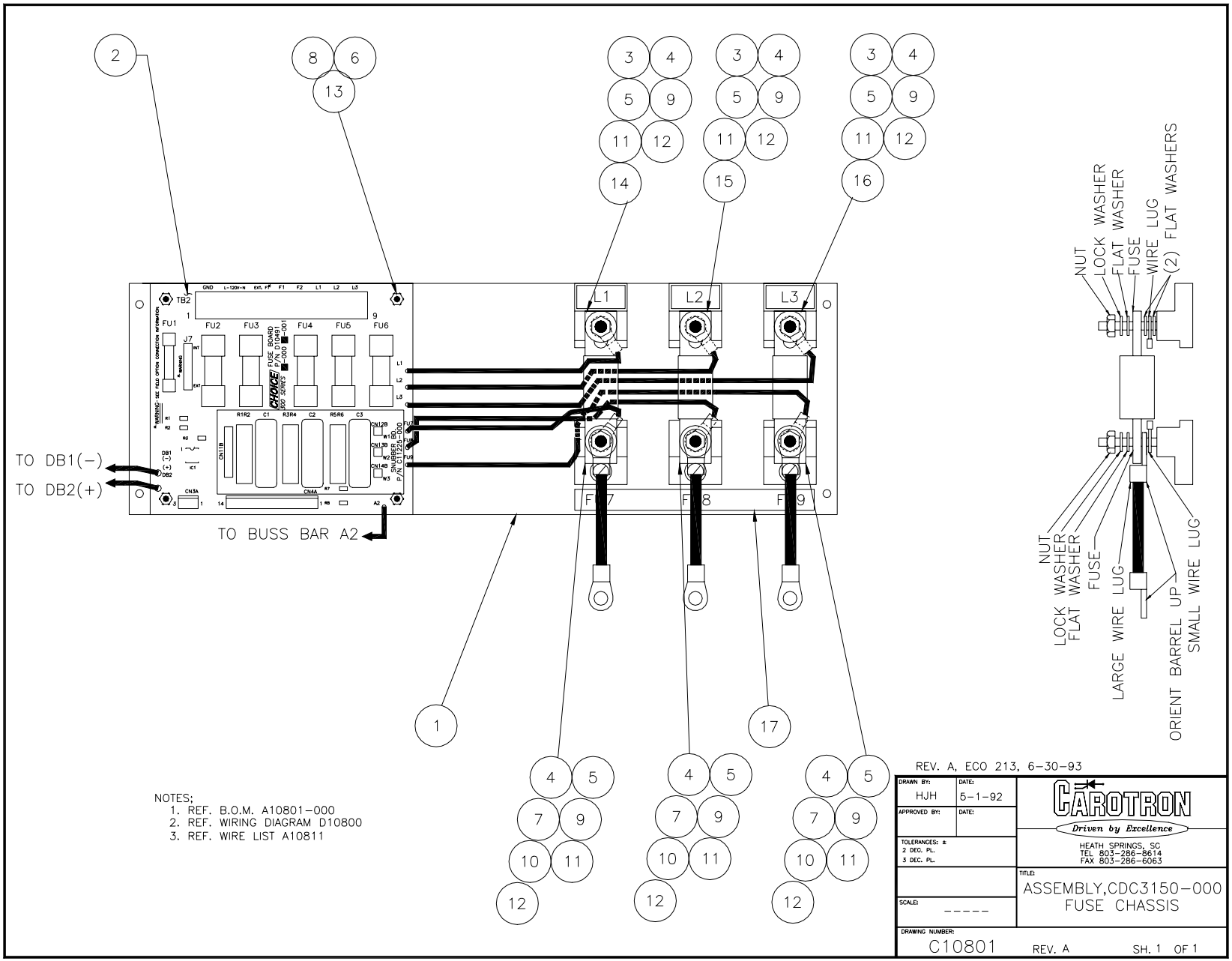
CAROTRON				
TITLE: SCHEMATIC, CHOICE™ POWER BRIDGE/HEATSINK ASSY.			DWG. NO. A10552	
DRAWN BY: HJH	APPROVED BY:	DATE: 7-7-92	SCALE:	SHEET 1 OF 1



REV. C, ADD COMP 7 TO L1,L2,L3 04-22-97
REV. B, ECO 213, 6-30-93
REV. A, ECO 136, 11-15-91

NOTES;
1. REF. B.O.M. A10524-00 FOR MODEL CDC320-000
2. REF. B.O.M. A10524-01 FOR MODEL CDC340-000
3. REF. B.O.M. A10524-02 FOR MODEL CDC360-000
4. REF. B.O.M. A10524-03 FOR MODEL CDC375-000
5. REF. WIRING DIAGRAM D10535

DRAWN BY: HJH	DATE: 7-2-92	CAROTRON *Driven by Excellence* HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
APPROVED BY:	DATE:	
TOLERANCES: ± 2 DEC. PL. 3 DEC. PL.		
C10524-000		TITLE: ASSEMBLY, CHOICE FUSE CHASSIS MODELS CDC320-000 TO CDC375-000
SCALE: -----		
DRAWING NUMBER: C10524	REV. B	SH. 1 OF 1


TO DB1(−)
TO DB2(+)
TO BUSS BAR A2
L1
L2
L3
FU7
FU8
FU9
NUT
LOCK WASHER
FLAT WASHER
FUSE
WIRE LUG
(2) FLAT WASHERS
LARGE WIRE LUG
ORIENT BARREL UP
SMALL WIRE LUG
NOTES;
1. REF. B.O.M. A10801−000
2. REF. WIRING DIAGRAM D10800
3. REF. WIRE LIST A10811
REV. A, ECO 213, 6−30−93
DRAWN BY: HJH
DATE: 5−1−92
APPROVED BY:
DATE:
TOLERANCES: ±
2 DEC. PL.
3 DEC. PL.
SCALE: _____
CAROTRON
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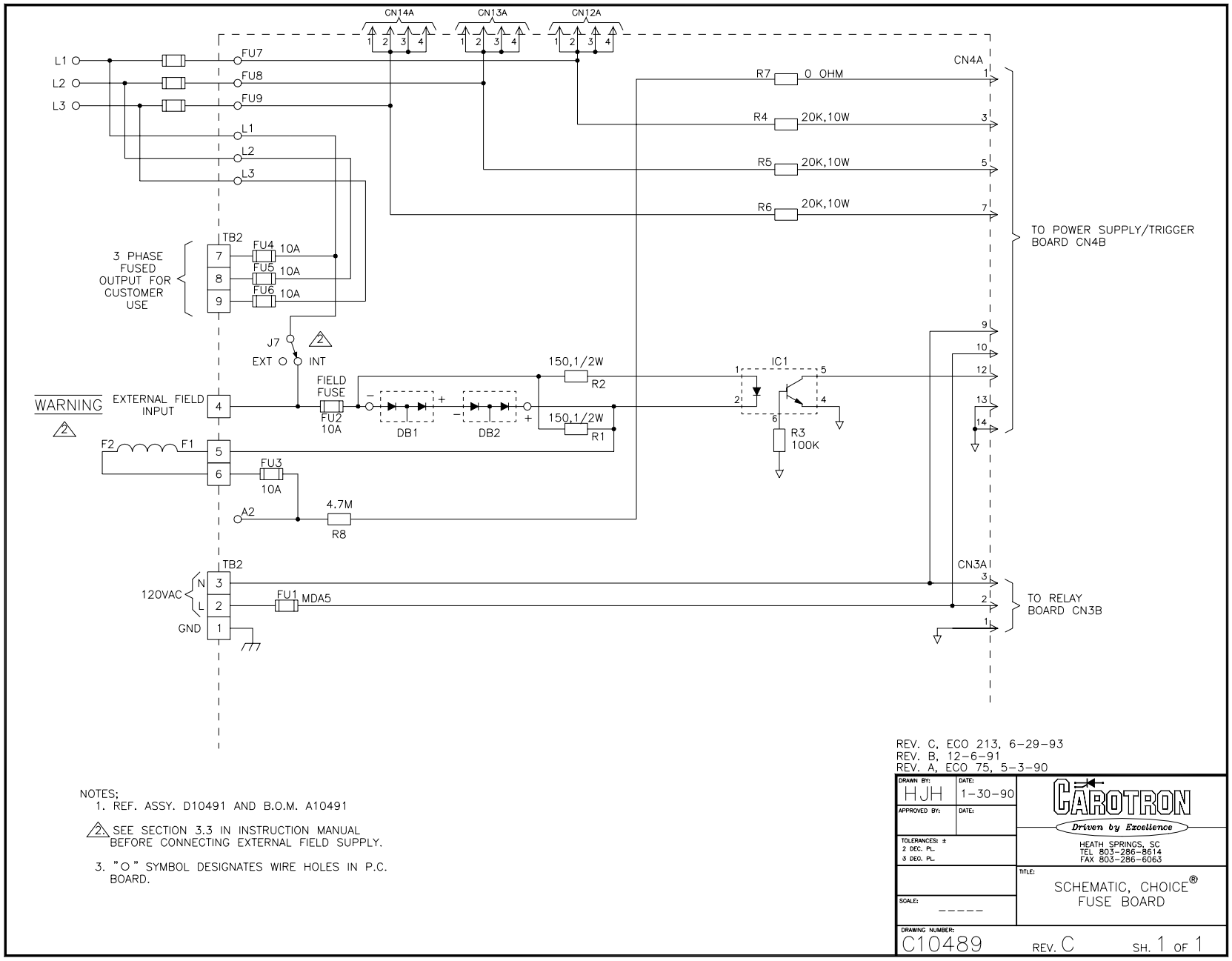
HEATH SPRINGS, SC
TEL 803−286−8614
FAX 803−286−6063
TITLE:
ASSEMBLY,CDC3150−000
FUSE CHASSIS
DRAWING NUMBER:
C10801
REV. A
SH. 1 OF 1



NOTES;
1. REF. ASSY. D10491 AND B.O.M. A10491

2. SEE SECTION 3.3 IN INSTRUCTION MANUAL BEFORE CONNECTING EXTERNAL FIELD SUPPLY.

3. "O" SYMBOL DESIGNATES WIRE HOLES IN P.C. BOARD.

REV. C, ECO 213, 6-29-93
REV. B, 12-6-91
REV. A, ECO 75, 5-3-90

DRAWN BY: HJH	DATE: 1-30-90
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. .5 DEG. PL.	
SCALE: -----	
DRAWING NUMBER: C10489 REV. C	SH. 1 OF 1

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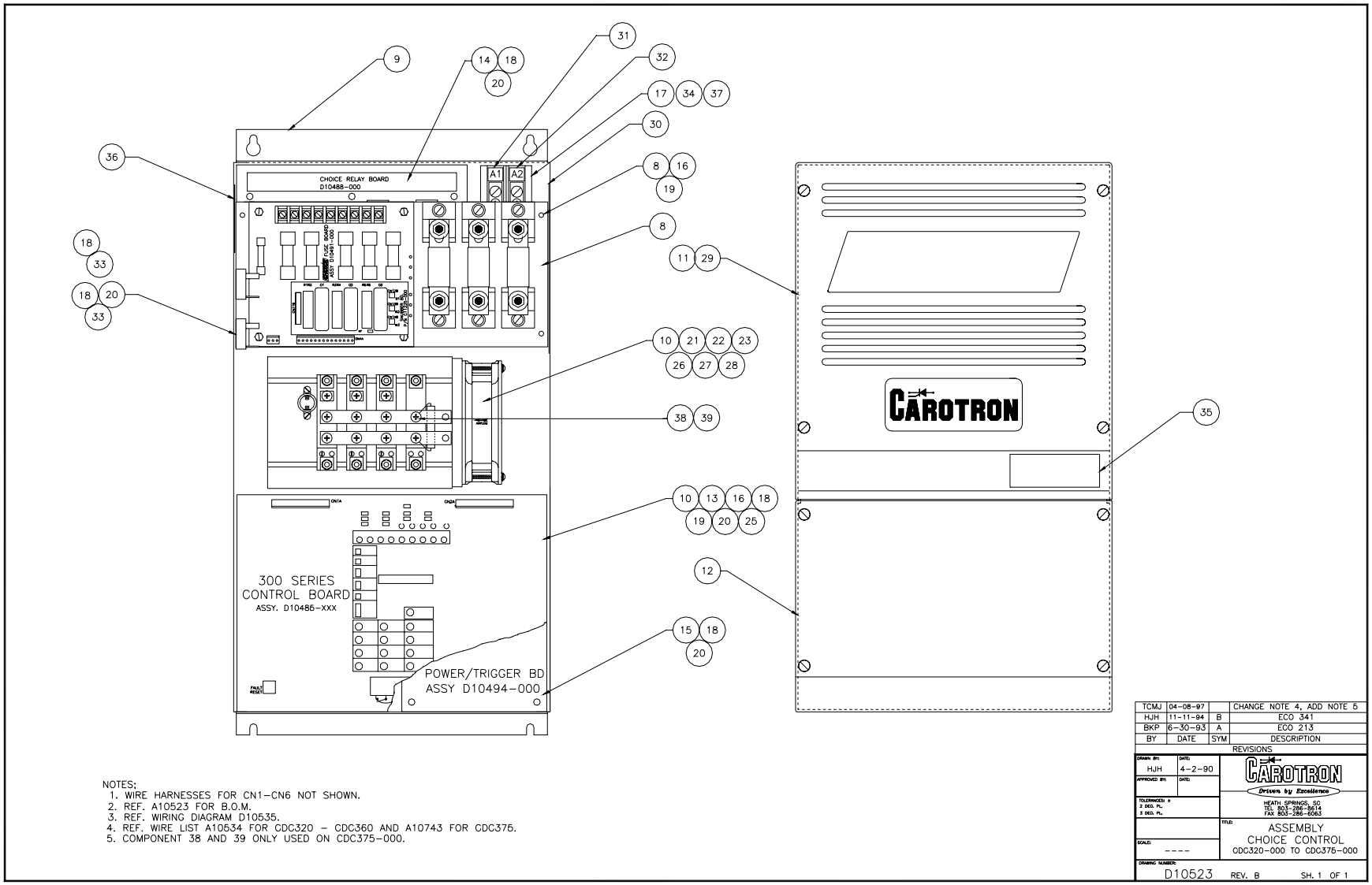
FAX 803-286-6063

TITLE: SCHEMATIC, CHOICE® FUSE BOARD



NOTES:
1. WIRE HARNESSES FOR CN1-CN6 NOT SHOWN.
2. REF. A10523 FOR B.O.M.
3. REF. WIRING DIAGRAM D10535.
4. REF. WIRE LIST A10534 FOR CDC320 - CDC360 AND A10743 FOR CDC375.
5. COMPONENT 38 AND 39 ONLY USED ON CDC375-000.

BY	DATE	SYM	DESCRIPTION
TCMJ	04-08-97		CHANGE NOTE 4, ADD NOTE 5
HJH	11-11-94	B	ECO 341
BKP	6-30-93	A	ECO 213

REVISIONS

DRAWN BY: HJH DATE: 4-2-90
APPROVED BY: DATE:
TOLERANCES: ± 2 DEG. PL. ± DEG. PL.
SCALE: ----

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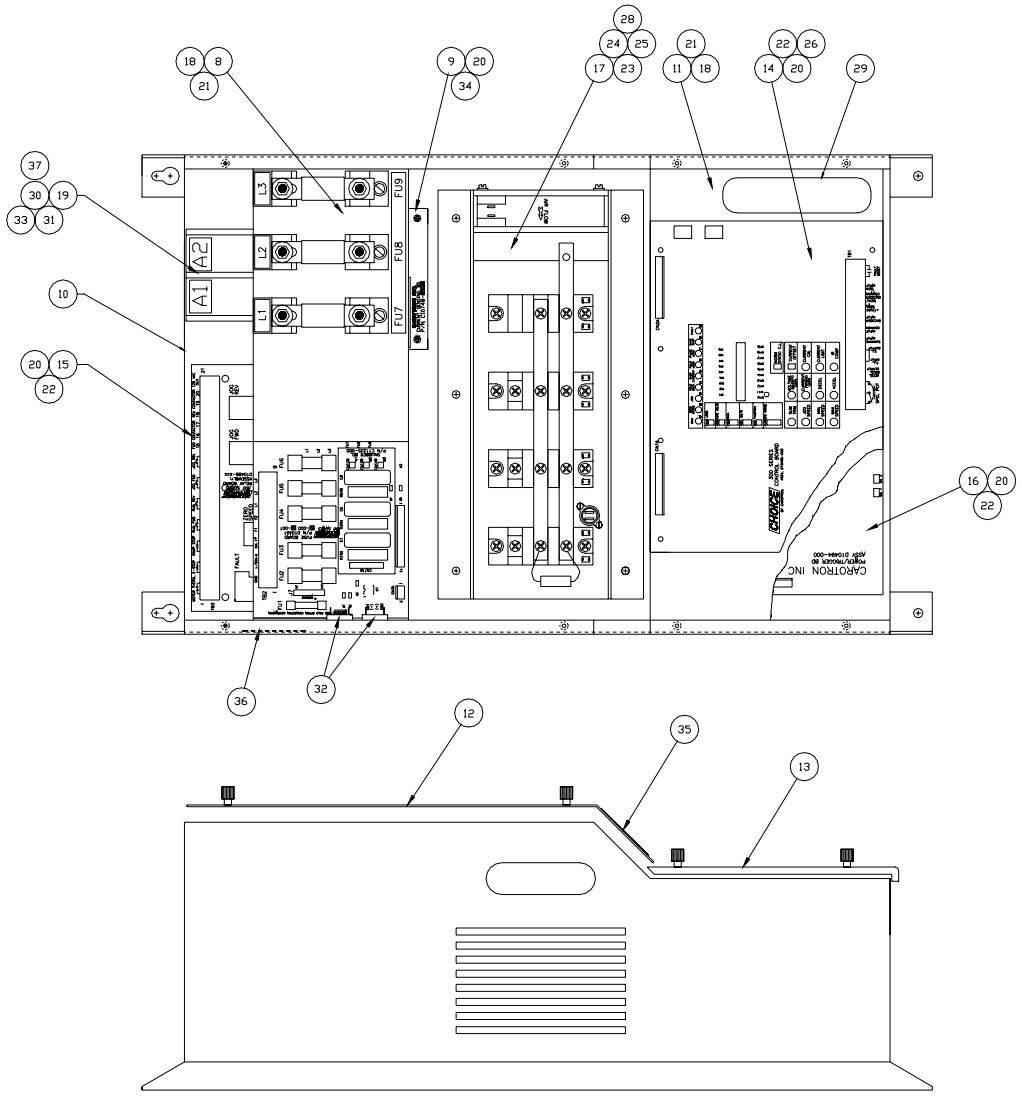
FAX 803-286-6063

TITLE: ASSEMBLY
CHOICE CONTROL
CDC320-000 TO CDC375-000

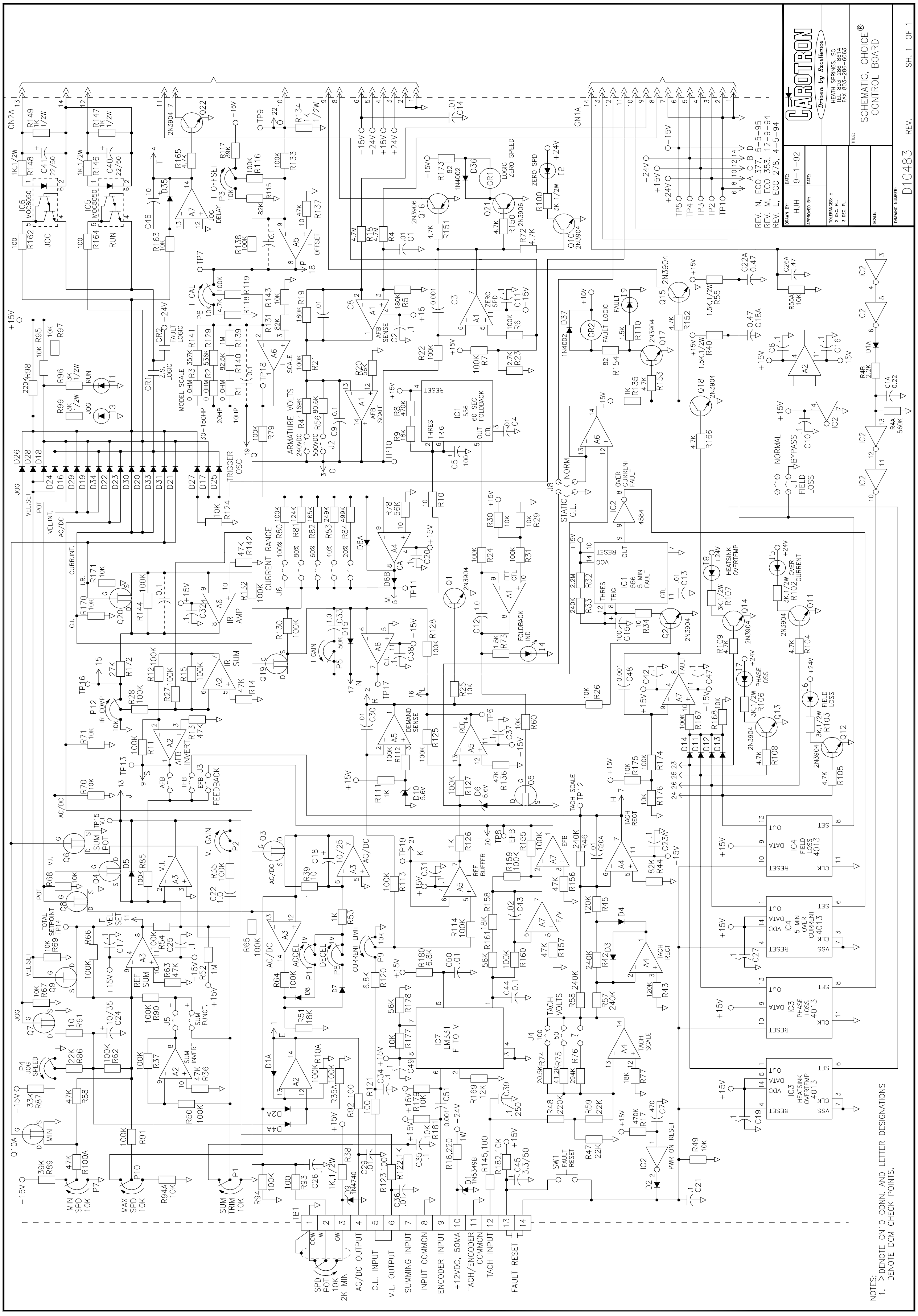
DRAWING NUMBER: D10523 REV. B SH. 1 OF 1

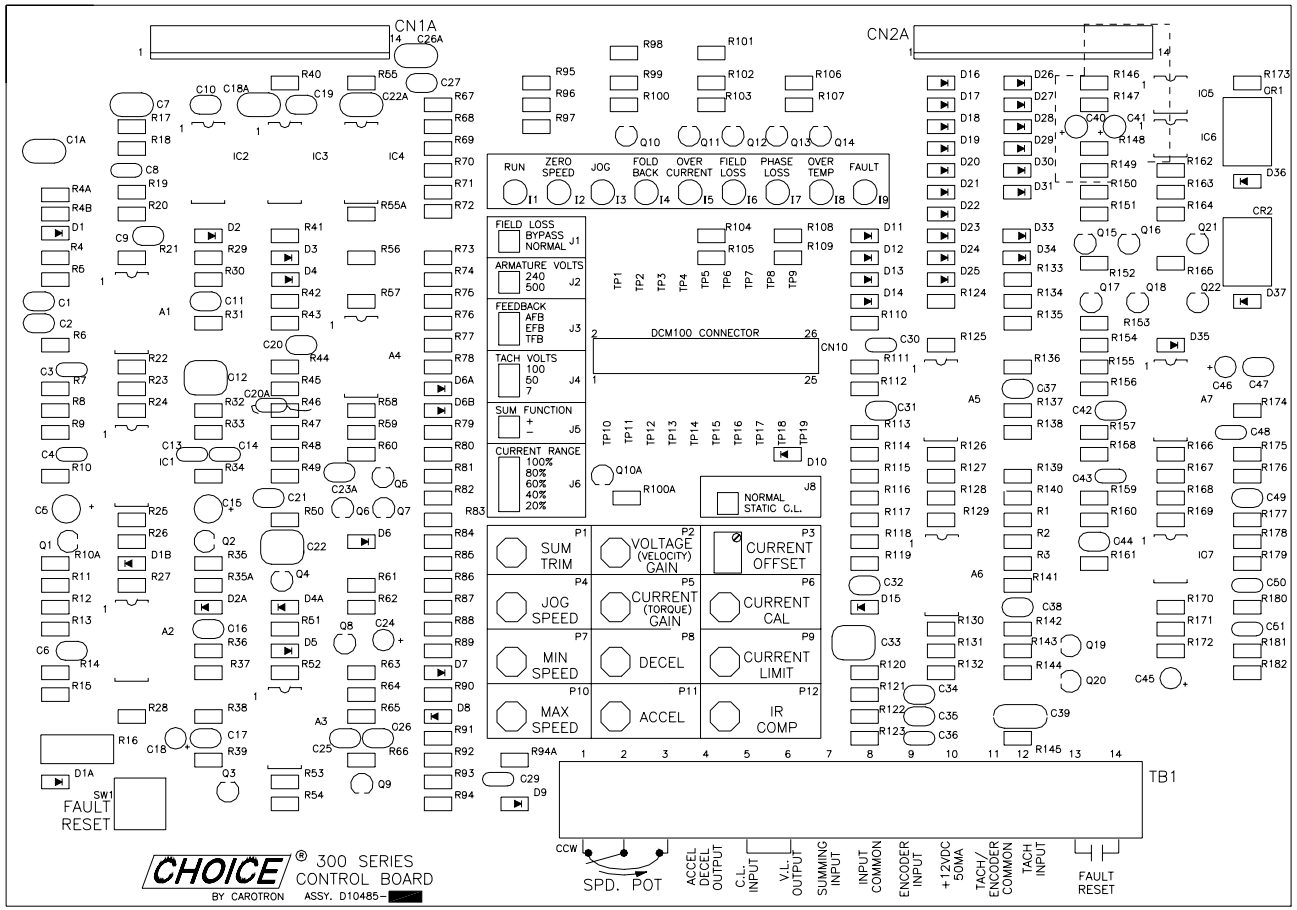


NOTES;
1. REF. WIRE LIST A10810
2. REF. B.O.M. A10809-000
3. REF. WIRING DIAGRAM D10800

REV. B, ECO 341, 11-11-94
REV. A, ECO 213, 6-30-93

DRAWN BY: / DATE:	CAROTRON — Driven by Excellence
APPROVED BY: / DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEG. PL. ± 5 DEG. PL.	TITLE: ASSEMBLY CDC3150-000 CHOICE® CONTROL
SCALE:	
DRAWING NUMBER: D10809	REV. B SH. 1 OF 1


CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
SCHEMATIC, CHOICE® CONTROL BOARD
D10483
SH. 1 OF 1
DRAWN BY: HJH
DATE: 9-1-92
REV. N, ECO 377, 5-5-95
REV. M, ECO 353, 12-9-94
REV. L, ECO 278, 4-5-94
NOTES:
1. > DENOTE CN10 CONN. AND LETTER DESIGNATIONS DENOTE DCM CHECK POINTS.

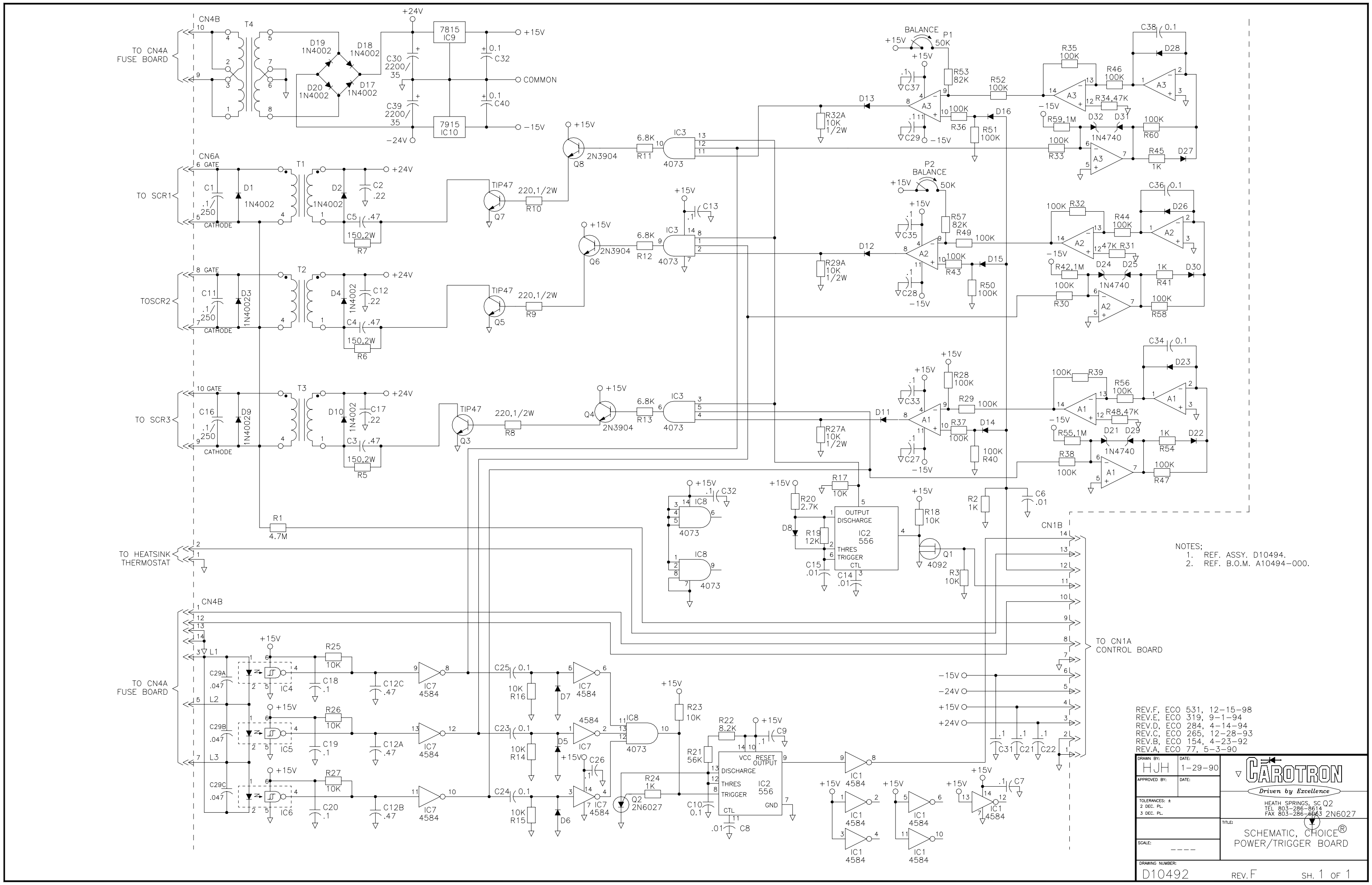


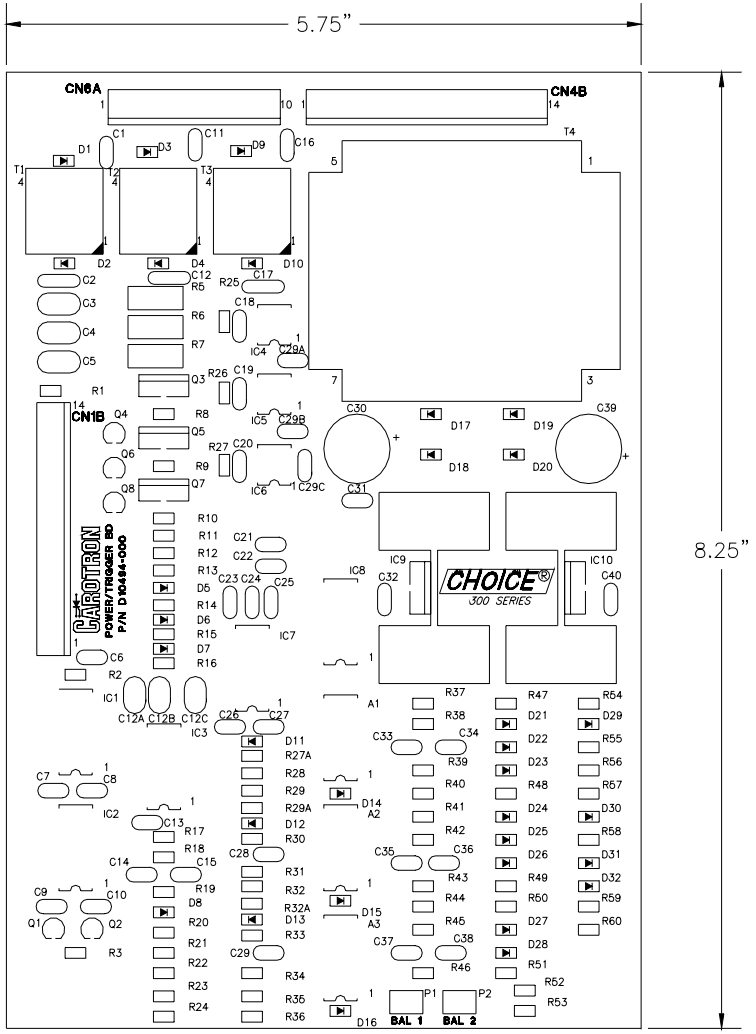
NOTES:

1. REF. B.O.M. A10485
2. REF. SCHEM. D10483

REV.K, ECO 377, 5-5-95
REV.J, ECO 203, 5-18-93
REV.I, ECO 199, 4-15-93
REV.H, ECO 178, 12-2-92
REV.G, ECO 175, 11-4-92
REV.F, ECO 167, 4-30-92
REV.E, ECO 153, 2-12-92
REV.D, ECO 94, 11-12-90
REV.C, ECO 92, 10-15-90
REV.B, ECO 78, 4-10-90

DRAWN BY: HJH	DATE: 9-1-92
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEG. PL. ± 5 DEG. PL.	CAROTRON Driven by Excellence
	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE: -----	TITLE: ASSEMBLY,CHOICE CONTROL BOARD
DRAWING NUMBER: D10485	REV. SH. 1 OF 1

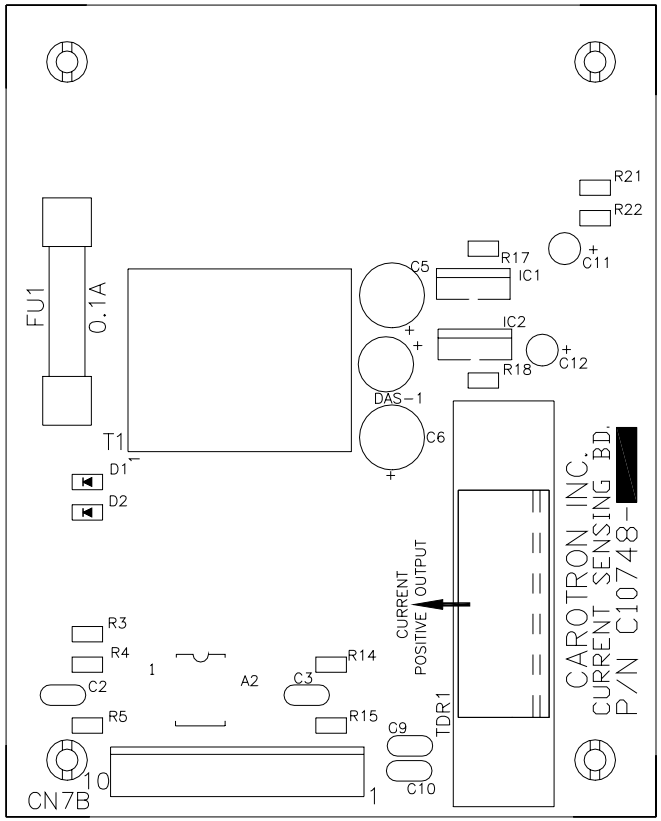

NOTES;
1. REF. ASSY. D10494.
2. REF. B.O.M. A10494-000.
REV.F, ECO 531, 12-15-98
REV.E, ECO 319, 9-1-94
REV.D, ECO 284, 4-14-94
REV.C, ECO 265, 12-28-93
REV.B, ECO 154, 4-23-92
REV.A, ECO 77, 5-3-90
DRAWN BY: HJH
DATE: 1-29-90
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
SCHEMATIC, CHOICE®
POWER/TRIGGER BOARD
DRAWING NUMBER: D10492
REV. F
SH. 1 OF 1
TO CN4A FUSE BOARD
TO SCR1
TOSCR2
TO SCR3
TO HEATSINK THERMOSTAT
TO CN1A CONTROL BOARD
BALANCE



NOTES:
1. REF. B.O.M. A10494-000.
2. REF. SCHEM. D10492.

REV. C, ECO 319, 9-7-94
REV. B, ECO 77, 4-11-90

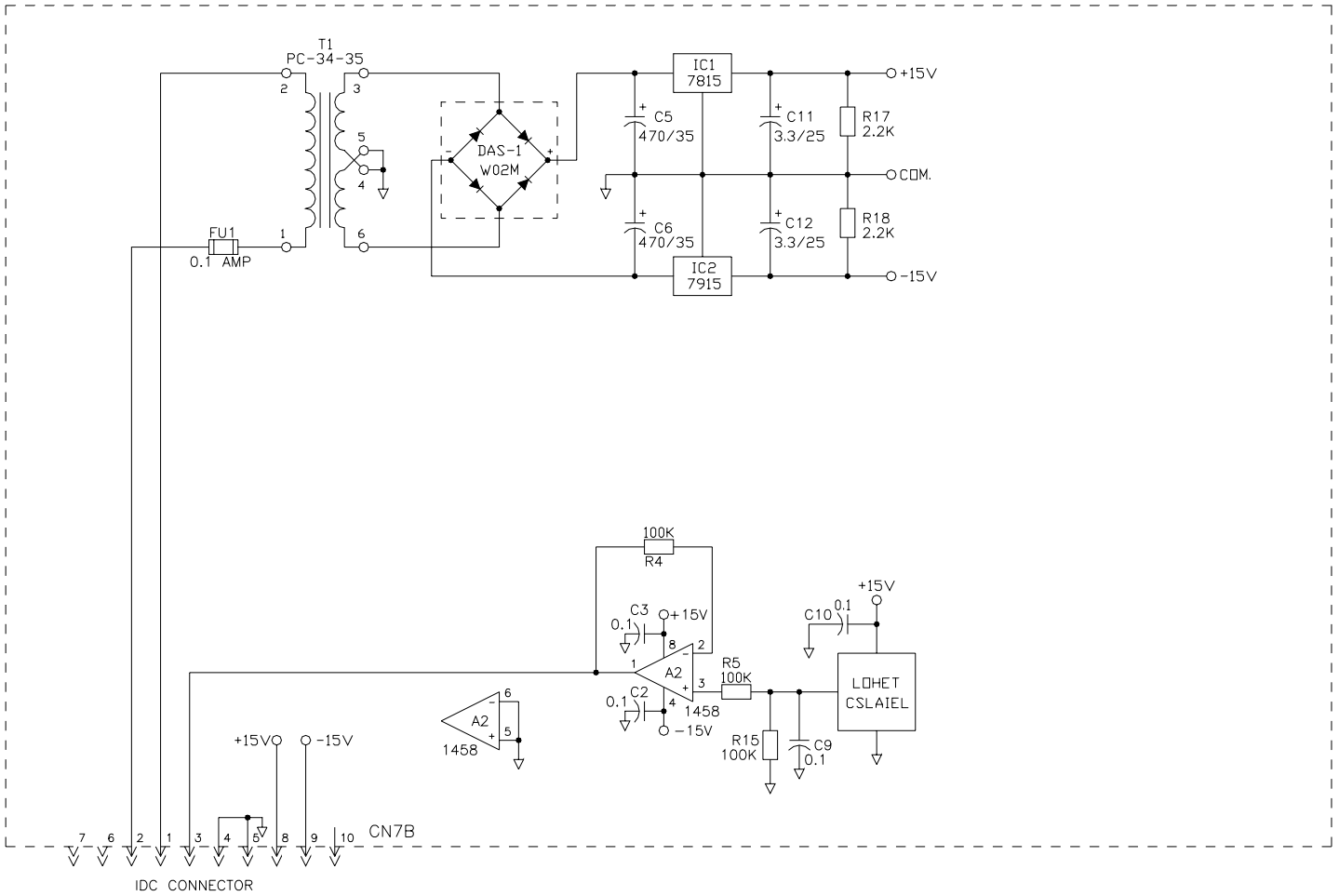
DRAWN BY: HJH	DATE: 5-12-90	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEG. PL. ± DEG. PL.		TITLE: ASSEMBLY, CHOICE PWR./TRGR. BOARD
SCALE:		
DRAWING NUMBER: D10494	REV. C	SH. 1 OF 1



NOTES;
1. REF. SCHEMATIC C10815.
2. REF. B.O.M. A10748-003.
3. WRITE IN 003 WITHIN WHITE RECTANGLE.

REV. A, ECO 165, 6-29-92

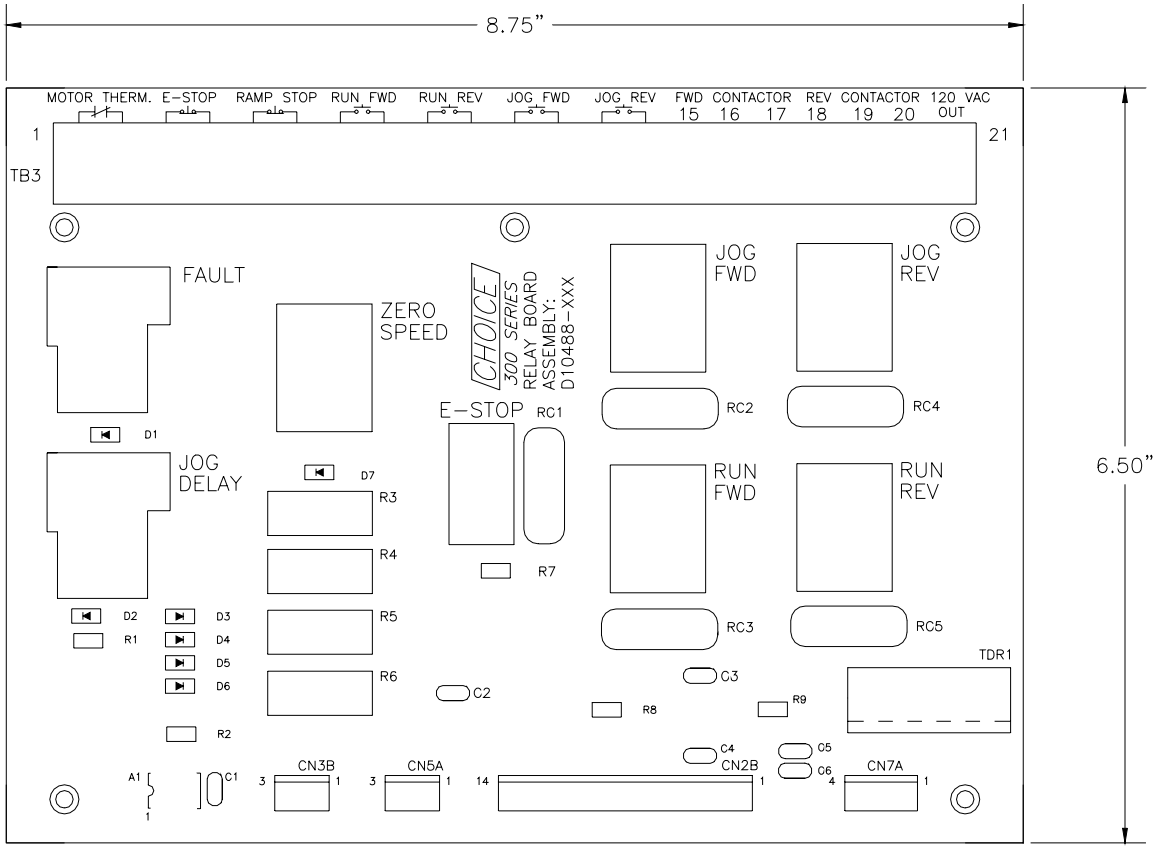
DRAWN BY: HJH	DATE: 8-5-91
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. .5 DEC. PL.	CAROTRON Driven by Excellence HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:	TITLE: ASSEMBLY CHOICE® IFB BOARD
DRAWING NUMBER: C10748-003REV.	SH. 1 OF 1



NOTES;
1. REF. ASSY. C10748-003.

REV.A, ECO 165, 6-29-92

DRAWN BY: HJH	DATE: 12-3-91
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. 3 DEG. PL.	CAROTRON *Driven by Excellence* HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE: ---	TITLE: SCHEMATIC; CHOICE® IFB BOARD
DRAWING NUMBER: C10815	REV. A SH. 1 OF 1



NOTES:
1. REF. B.O.M. A10488-000 AND SCHEMATIC C10486 FOR MODELS CDC320-CDC360
2. REF. B.O.M. A10488-001 AND SCHEMATIC C10486 FOR MODEL CDC375-000
2. REF. B.O.M. A10488-002 AND SCHEMATIC C10793 FOR MODEL CDC3150-000

REV. B, ECO 133, 10-17-91
REV. A, ECO 81, 7-23-90

DRAWN BY: DATE:
APPROVED BY: DATE:
TOLERANCES: ± 2 DEC. PL. ± DEC. PL.
SCALE:

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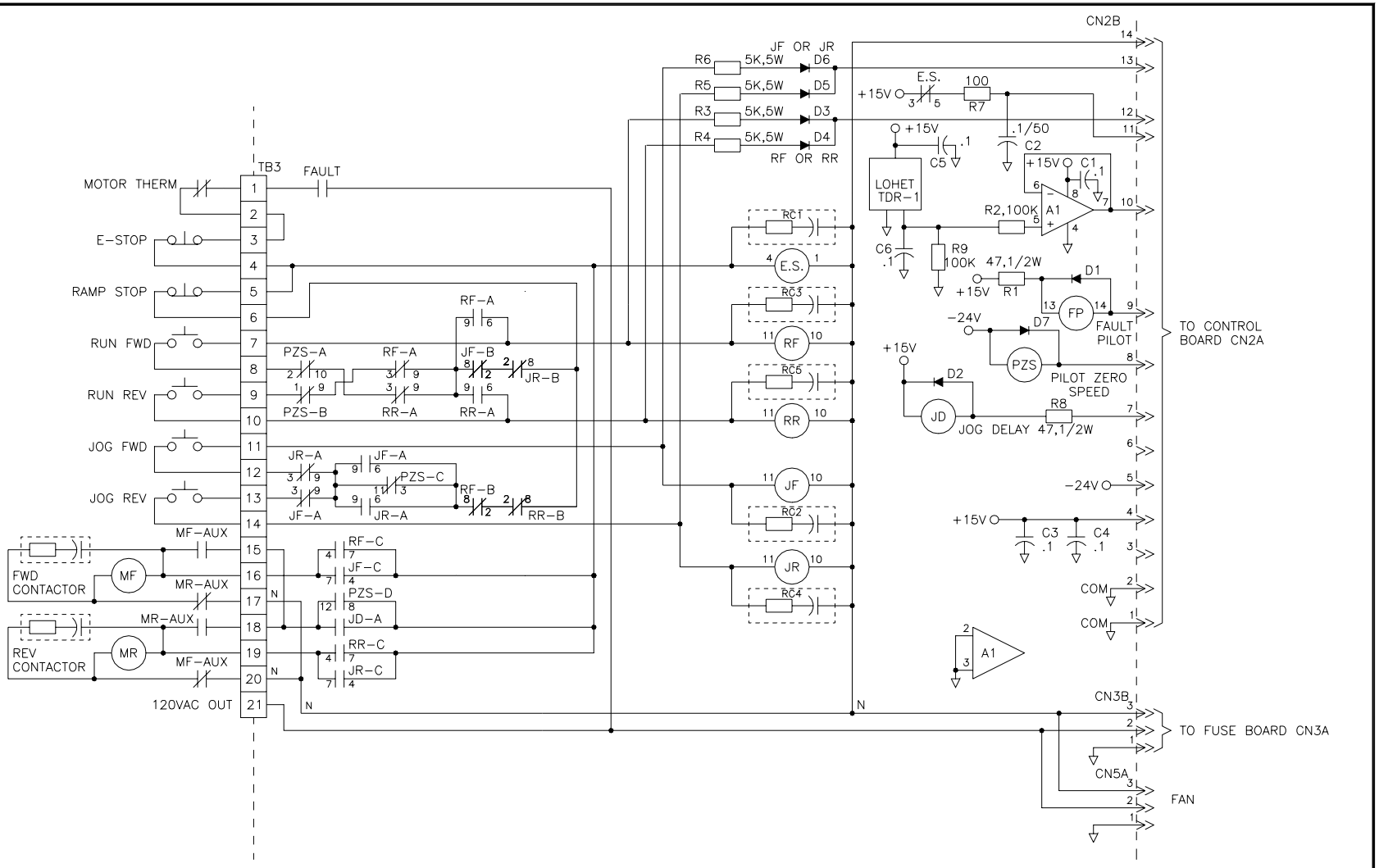
TITLE: ASSEMBLY, CHOICE RELAY BOARD

DRAWING NUMBER: D10488 REV. A SH. 1 OF 1



NOTES:
1. REF. ASSY. D10488-000 AND B.O.M. A10488-000 FOR CDC320-CDC360
2. REF. ASSY. D10488-001 AND B.O.M. A10488-001 FOR CDC375

DRAWN BY: HJH	DATE: 6-11-90
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. 3 DEC. PL.	
SCALE: -----	
DRAWING NUMBER: C10486	REV. SH. 1 OF 1

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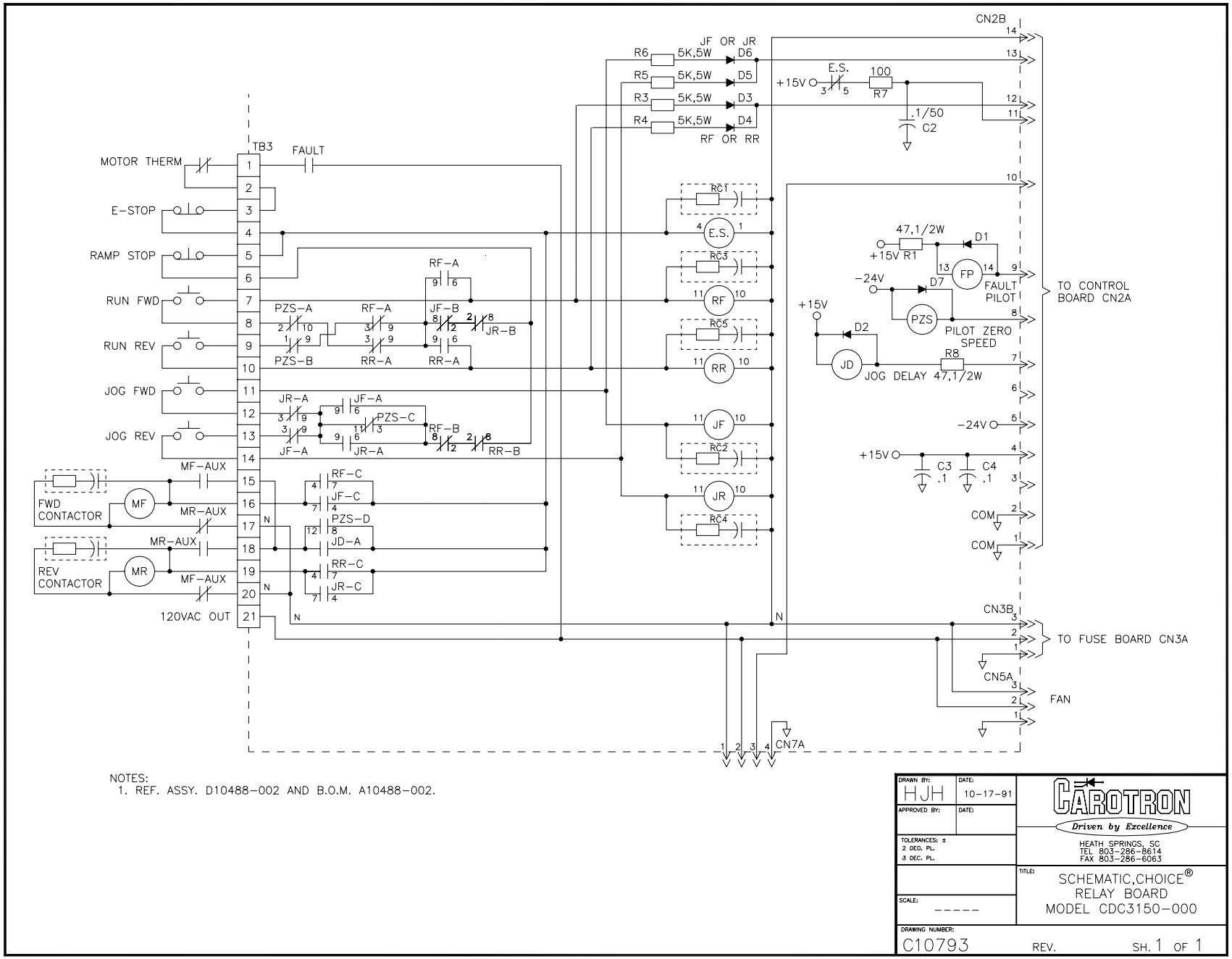
FAX 803-286-6063

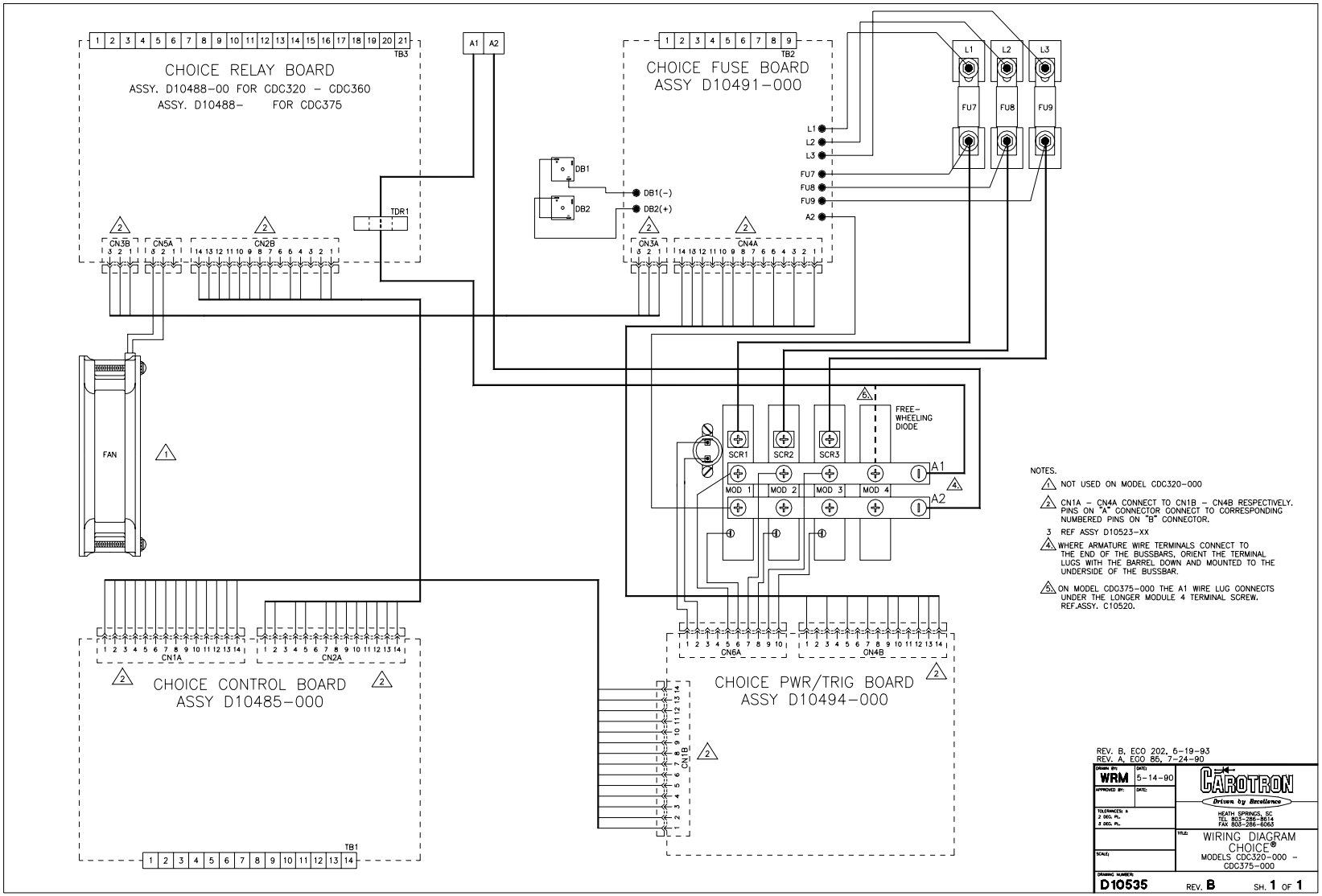
TITLE:
SCHEMATIC, CHOICE®
RELAY BOARD
MODELS CDC320-CDC375

REV. B, ECO 133, 10-17-91
REV. A, ECO 81 ,6-26-90



NOTES:
1. REF. ASSY. D10488-002 AND B.O.M. A10488-002.

DRAWN BY: HJH	DATE: 10-17-91	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEC. PL. .3 DEC. PL.		TITLE: SCHEMATIC,CHOICE® RELAY BOARD MODEL CDC3150-000
SCALE: -----		
DRAWING NUMBER: C10793	REV.	SH. 1 OF 1



NOTES.

1. NOT USED ON MODEL CDC320-000
2. CN1A - CN4A CONNECT TO CN1B - CN4B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING NUMBERED PINS ON "B" CONNECTOR.
3. REF ASSY D10523-XX
4. WHERE ARMATURE WIRE TERMINALS CONNECT TO THE END OF THE BUSSBARS, ORIENT THE TERMINAL LUGS WITH THE BARREL DOWN AND MOUNTED TO THE UNDERSIDE OF THE BUSSBAR.
5. ON MODEL CDC375-000 THE A1 WIRE LUG CONNECTS UNDER THE LONGER MODULE 4 TERMINAL SCREW. REF.ASSY. C10520.

REV. B, ECO 202, 6-19-93
REV. A, ECO 86, 7-24-90

DRAWN BY: WRM	DATE: 5-14-90
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. ± 3 DEC. PL.	
SCALE:	
DRAWING NUMBER: D10535	REV. B

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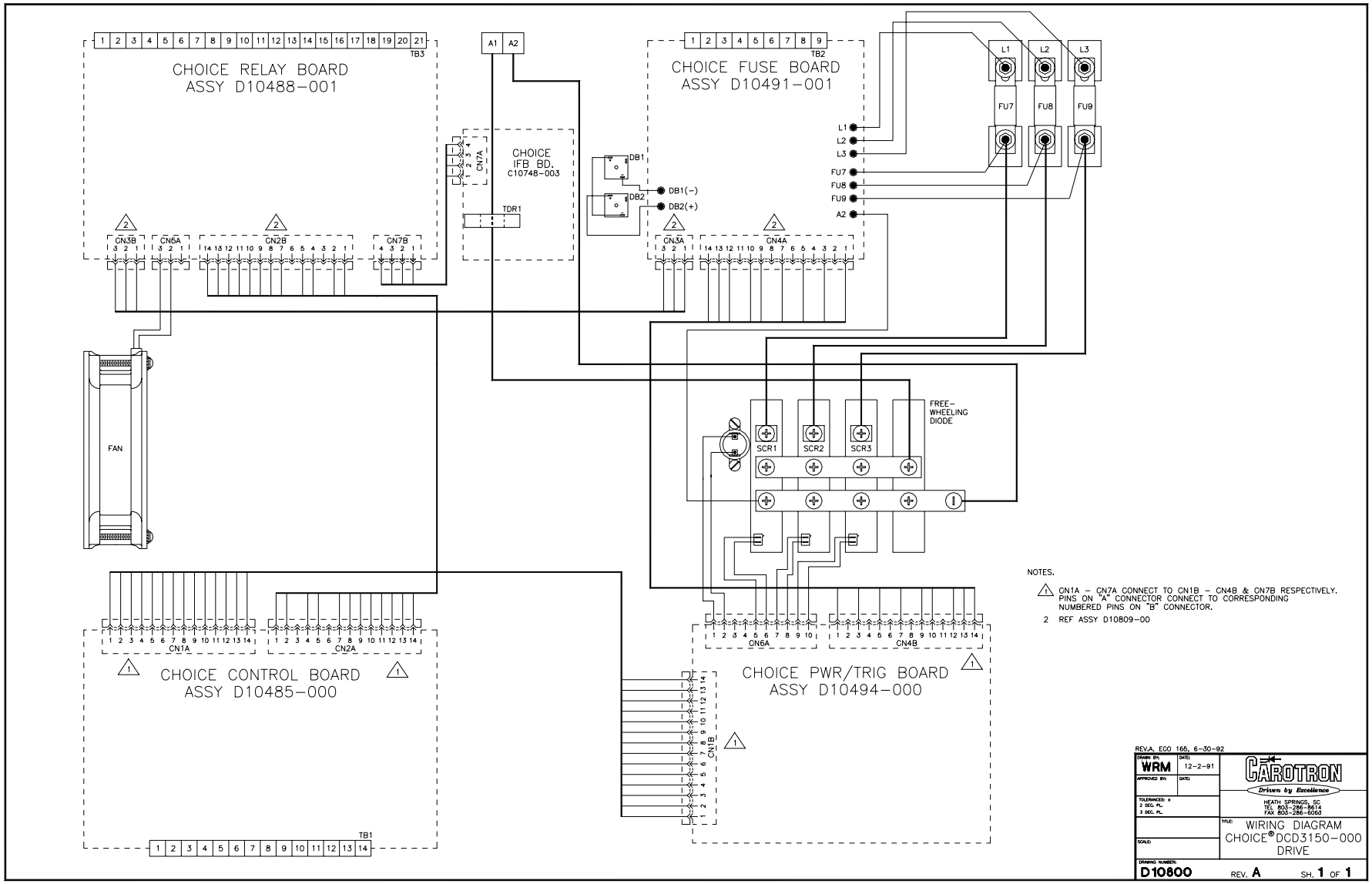
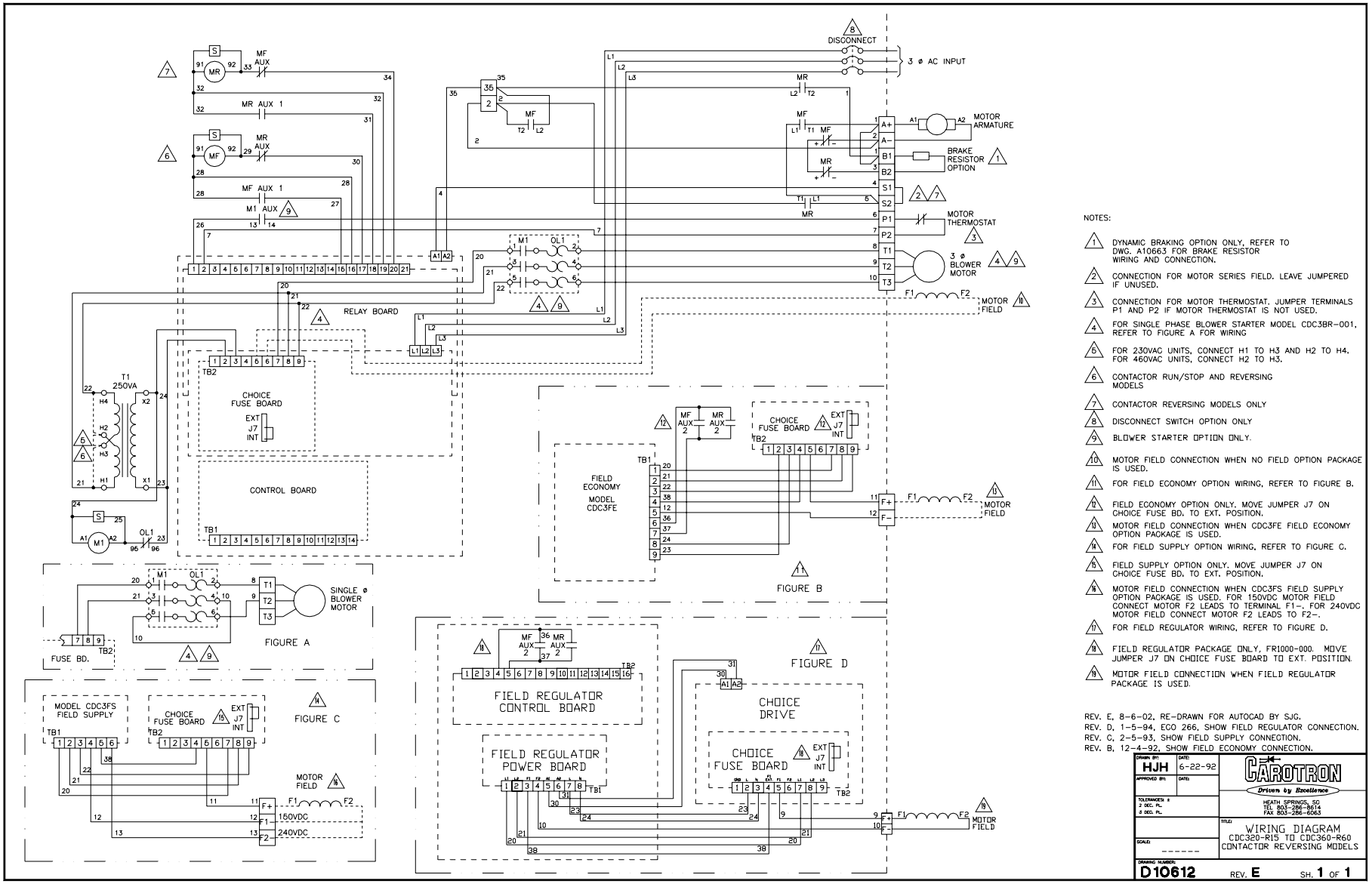
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6065

TITLE: WIRING DIAGRAM CHOICE® MODELS CDC320-000 - CDC375-000

SH. 1 OF 1


CHOICE RELAY BOARD
ASSY D10488-001
TB3
CHOICE FUSE BOARD
ASSY D10491-001
TB2
CHOICE
IFB BD.
C10748-003
CN7A
TDR1
DB1
DB2
DB1(-)
DB2(+)
A1
A2
L1
L2
L3
FU7
FU8
FU9
CN3B
CN5A
CN2B
CN7B
CN3A
CN4A
FAN
SCR1
SCR2
SCR3
FREE-
WHEELING
DIODE
CN1A
CN2A
CHOICE CONTROL BOARD
ASSY D10485-000
TB1
CN6A
CN4B
CN1B
CHOICE PWR/TRIG BOARD
ASSY D10494-000
NOTES.
1 CN1A - CN7A CONNECT TO CN1B - CN4B & CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING NUMBERED PINS ON "B" CONNECTOR.
2 REF ASSY D10809-00
REV.A, ECO 166, 6-30-92
DRAWN BY: WRM
DATE: 12-2-91
APPROVED BY:
DATE:
TOLERANCES: ±
2 DEC. PL.
3 DEC. PL.
SCALE:
DRAWING NUMBER: D10800
REV. A
SH. 1 OF 1
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6065
TITLE:
WIRING DIAGRAM
CHOICE® DCD3150-000
DRIVE

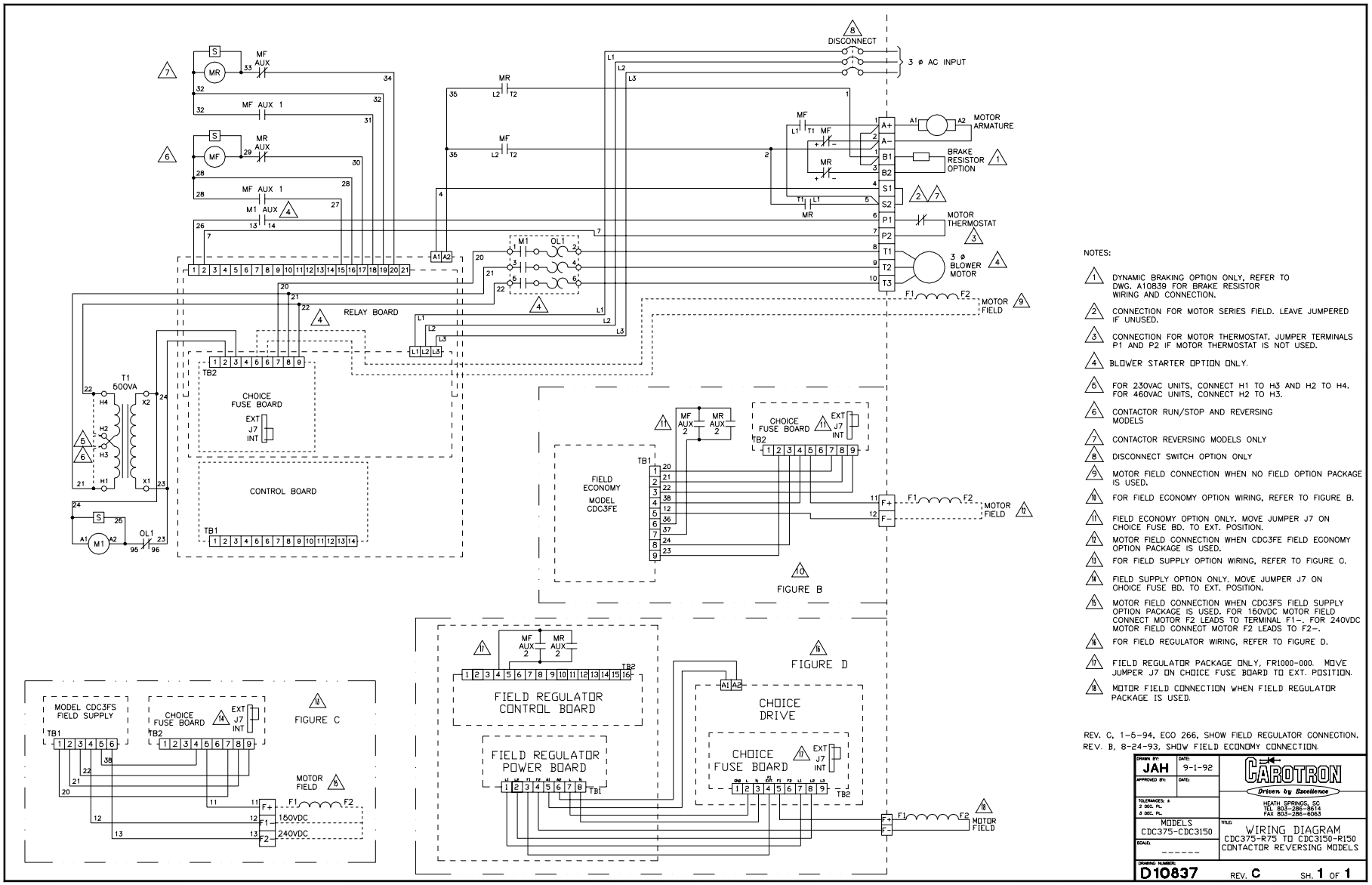


NOTES:

1. DYNAMIC BRAKING OPTION ONLY, REFER TO DWG. A10663 FOR BRAKE RESISTOR WIRING AND CONNECTION.
2. CONNECTION FOR MOTOR SERIES FIELD. LEAVE JUMPERED IF UNUSED.
3. CONNECTION FOR MOTOR THERMOSTAT. JUMPER TERMINALS P1 AND P2 IF MOTOR THERMOSTAT IS NOT USED.
4. FOR SINGLE PHASE BLOWER STARTER MODEL CDC3BR-001, REFER TO FIGURE A FOR WIRING
5. FOR 230VAC UNITS, CONNECT H1 TO H3 AND H2 TO H4. FOR 460VAC UNITS, CONNECT H2 TO H3.
6. CONTACTOR RUN/STOP AND REVERSING MODELS
7. CONTACTOR REVERSING MODELS ONLY
8. DISCONNECT SWITCH OPTION ONLY
9. BLOWER STARTER OPTION ONLY.
10. MOTOR FIELD CONNECTION WHEN NO FIELD OPTION PACKAGE IS USED.
11. FOR FIELD ECONOMY OPTION WIRING, REFER TO FIGURE B.
12. FIELD ECONOMY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
13. MOTOR FIELD CONNECTION WHEN CDC3FE FIELD ECONOMY OPTION PACKAGE IS USED.
14. FOR FIELD SUPPLY OPTION WIRING, REFER TO FIGURE C.
15. FIELD SUPPLY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
16. MOTOR FIELD CONNECTION WHEN CDC3FS FIELD SUPPLY OPTION PACKAGE IS USED. FOR 150VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO TERMINAL F1−. FOR 240VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO F2−.
17. FOR FIELD REGULATOR WIRING, REFER TO FIGURE D.
18. FIELD REGULATOR PACKAGE ONLY, FR1000-000. MOVE JUMPER J7 ON CHOICE FUSE BOARD TO EXT. POSITION.
19. MOTOR FIELD CONNECTION WHEN FIELD REGULATOR PACKAGE IS USED.

REV. E, 8-6-02, RE-DRAWN FOR AUTOCAD BY SJG.
REV. D, 1-5-94, ECO 266, SHOW FIELD REGULATOR CONNECTION.
REV. C, 2-5-93, SHOW FIELD SUPPLY CONNECTION.
REV. B, 12-4-92, SHOW FIELD ECONOMY CONNECTION.

DRAWN BY: HJH	DATE: 6-22-92
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. ± .0 DEC. PL.	CAROTRON "Driven by Excellence" HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE: ------	TITLE: WIRING DIAGRAM CDC320-R15 TO CDC360-R60 CONTACTOR REVERSING MODELS
DRAWING NUMBER: D10612	REV. E SH. 1 OF 1

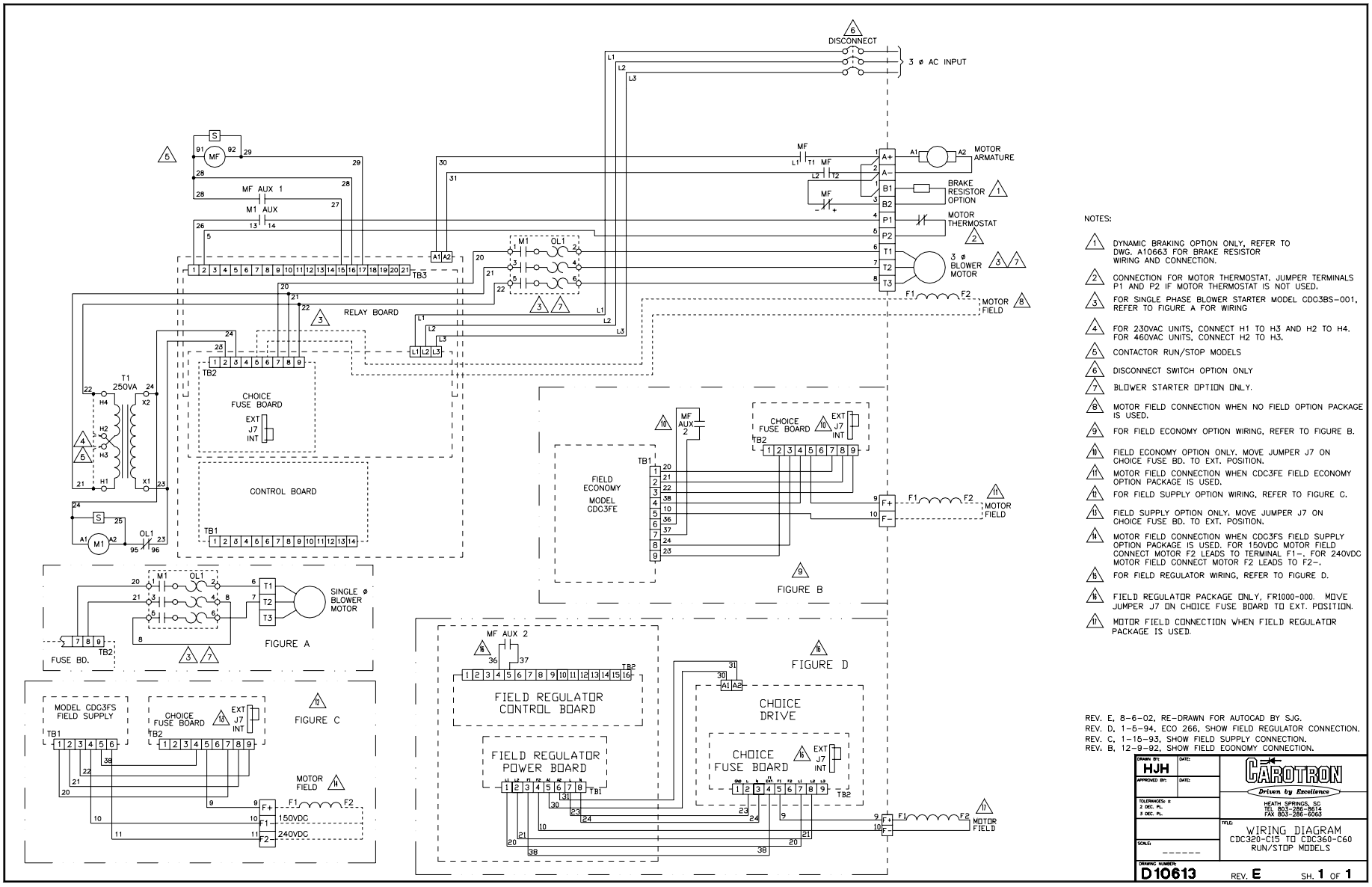


NOTES:

1. DYNAMIC BRAKING OPTION ONLY. REFER TO DWG. A10839 FOR BRAKE RESISTOR WIRING AND CONNECTION.
2. CONNECTION FOR MOTOR SERIES FIELD. LEAVE JUMPERED IF UNUSED.
3. CONNECTION FOR MOTOR THERMOSTAT. JUMPER TERMINALS P1 AND P2 IF MOTOR THERMOSTAT IS NOT USED.
4. BLOWER STARTER OPTION ONLY.
5. FOR 230VAC UNITS, CONNECT H1 TO H3 AND H2 TO H4. FOR 460VAC UNITS, CONNECT H2 TO H3.
6. CONTACTOR RUN/STOP AND REVERSING MODELS
7. CONTACTOR REVERSING MODELS ONLY
8. DISCONNECT SWITCH OPTION ONLY
9. MOTOR FIELD CONNECTION WHEN NO FIELD OPTION PACKAGE IS USED.
10. FOR FIELD ECONOMY OPTION WIRING, REFER TO FIGURE B.
11. FIELD ECONOMY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
12. MOTOR FIELD CONNECTION WHEN CDC3FE FIELD ECONOMY OPTION PACKAGE IS USED.
13. FOR FIELD SUPPLY OPTION WIRING, REFER TO FIGURE C.
14. FIELD SUPPLY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
15. MOTOR FIELD CONNECTION WHEN CDC3FS FIELD SUPPLY OPTION PACKAGE IS USED. FOR 160VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO TERMINAL F1−. FOR 240VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO F2−.
16. FOR FIELD REGULATOR WIRING, REFER TO FIGURE D.
17. FIELD REGULATOR PACKAGE ONLY, FR1000-000. MOVE JUMPER J7 ON CHOICE FUSE BOARD TO EXT. POSITION.
18. MOTOR FIELD CONNECTION WHEN FIELD REGULATOR PACKAGE IS USED.

REV. C, 1-5-94, ECO 266, SHOW FIELD REGULATOR CONNECTION.
REV. B, 8-24-93, SHOW FIELD ECONOMY CONNECTION.

DRAWN BY: JAH	DATE: 9-1-92
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. ± 3 DEC. PL.	CAROTRON "Driven by Excellence" HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE: ------	MODELS CDC375-CDC3150
DRAWING NUMBER: D10837	REV. C
	TITLE: WIRING DIAGRAM CDC375-R75 TO CDC3150-R150 CONTACTOR REVERSING MODELS
	SH. 1 OF 1

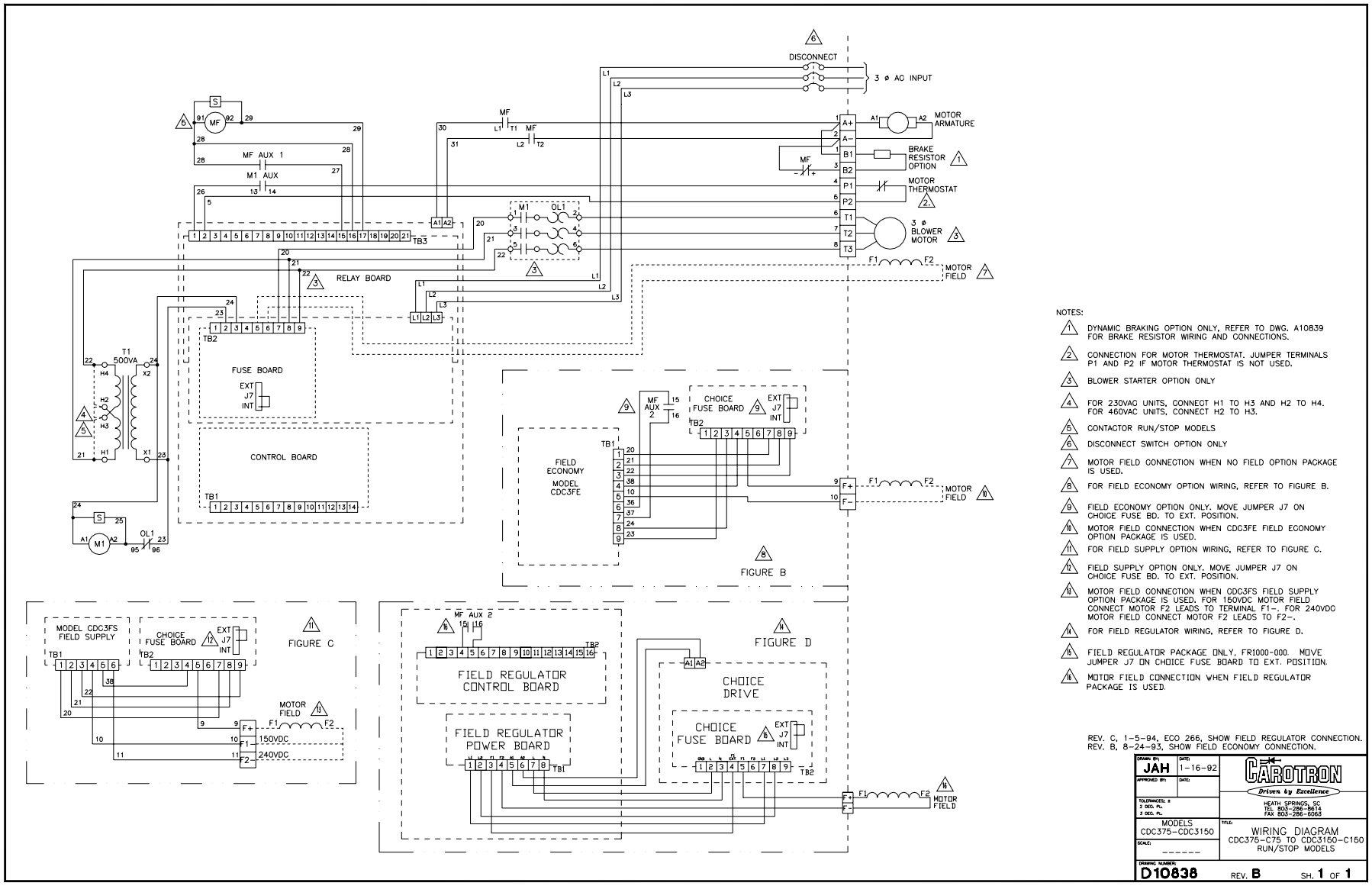


NOTES:

1. DYNAMIC BRAKING OPTION ONLY, REFER TO DWG. A10663 FOR BRAKE RESISTOR WIRING AND CONNECTION.
2. CONNECTION FOR MOTOR THERMOSTAT. JUMPER TERMINALS P1 AND P2 IF MOTOR THERMOSTAT IS NOT USED.
3. FOR SINGLE PHASE BLOWER STARTER MODEL CDC3BS-001, REFER TO FIGURE A FOR WIRING
4. FOR 230VAC UNITS, CONNECT H1 TO H3 AND H2 TO H4. FOR 460VAC UNITS, CONNECT H2 TO H3.
5. CONTACTOR RUN/STOP MODELS
6. DISCONNECT SWITCH OPTION ONLY
7. BLOWER STARTER OPTION ONLY.
8. MOTOR FIELD CONNECTION WHEN NO FIELD OPTION PACKAGE IS USED.
9. FOR FIELD ECONOMY OPTION WIRING, REFER TO FIGURE B.
10. FIELD ECONOMY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
11. MOTOR FIELD CONNECTION WHEN CDC3FE FIELD ECONOMY OPTION PACKAGE IS USED.
12. FOR FIELD SUPPLY OPTION WIRING, REFER TO FIGURE C.
13. FIELD SUPPLY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
14. MOTOR FIELD CONNECTION WHEN CDC3FS FIELD SUPPLY OPTION PACKAGE IS USED. FOR 150VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO TERMINAL F1-. FOR 240VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO F2-.
15. FOR FIELD REGULATOR WIRING, REFER TO FIGURE D.
16. FIELD REGULATOR PACKAGE ONLY, FR1000-000. MOVE JUMPER J7 ON CHOICE FUSE BOARD TO EXT. POSITION.
17. MOTOR FIELD CONNECTION WHEN FIELD REGULATOR PACKAGE IS USED.

REV. E, 8-6-02, RE-DRAWN FOR AUTOCAD BY SJG.
REV. D, 1-5-94, ECO 266, SHOW FIELD REGULATOR CONNECTION.
REV. C, 1-15-93, SHOW FIELD SUPPLY CONNECTION.
REV. B, 12-9-92, SHOW FIELD ECONOMY CONNECTION.

DRAWN BY: HJH DATE:	CAROTRON Driven by Excellence
APPROVED BY: DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEC. PL. ± 3 DEC. PL.	TITLE: WIRING DIAGRAM CDC320-C15 TO CDC360-C60 RUN/STOP MODELS
SCALE: ------	
DRAWING NUMBER: D10613	REV. E SH. 1 OF 1



NOTES:

1. DYNAMIC BRAKING OPTION ONLY, REFER TO DWG. A10839 FOR BRAKE RESISTOR WIRING AND CONNECTIONS.
2. CONNECTION FOR MOTOR THERMOSTAT. JUMPER TERMINALS P1 AND P2 IF MOTOR THERMOSTAT IS NOT USED.
3. BLOWER STARTER OPTION ONLY
4. FOR 230VAC UNITS, CONNECT H1 TO H3 AND H2 TO H4. FOR 460VAC UNITS, CONNECT H2 TO H3.
5. CONTACTOR RUN/STOP MODELS
6. DISCONNECT SWITCH OPTION ONLY
7. MOTOR FIELD CONNECTION WHEN NO FIELD OPTION PACKAGE IS USED.
8. FOR FIELD ECONOMY OPTION WIRING, REFER TO FIGURE B.
9. FIELD ECONOMY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
10. MOTOR FIELD CONNECTION WHEN CDC3FE FIELD ECONOMY OPTION PACKAGE IS USED.
11. FOR FIELD SUPPLY OPTION WIRING, REFER TO FIGURE C.
12. FIELD SUPPLY OPTION ONLY. MOVE JUMPER J7 ON CHOICE FUSE BD. TO EXT. POSITION.
13. MOTOR FIELD CONNECTION WHEN CDC3FS FIELD SUPPLY OPTION PACKAGE IS USED. FOR 150VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO TERMINAL F1-. FOR 240VDC MOTOR FIELD CONNECT MOTOR F2 LEADS TO F2-.
14. FOR FIELD REGULATOR WIRING, REFER TO FIGURE D.
15. FIELD REGULATOR PACKAGE ONLY, FR1000-000. MOVE JUMPER J7 ON CHOICE FUSE BOARD TO EXT. POSITION.
16. MOTOR FIELD CONNECTION WHEN FIELD REGULATOR PACKAGE IS USED.

REV. C, 1-5-94, ECO 266, SHOW FIELD REGULATOR CONNECTION.
REV. B, 8-24-93, SHOW FIELD ECONOMY CONNECTION.

DRAWN BY: JAH	DATE: 1-16-92
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEG. FL. ± 2 DEG. FL.	
MODELS: CDC375-CDC3150	TITLE: WIRING DIAGRAM CDC375-C75 TO CDC3150-C150 RUN/STOP MODELS
SCALE: ------	
DRAWING NUMBER: D10838	REV. B SH. 1 OF 1

CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063

Notes:

Standard Terms & Conditions of Sale

1. General

The Standard Terms and Conditions of Sale of Carotron, Inc. (hereinafter called "Company") are set forth as follows in order to give the Company and the Purchaser a clear understanding thereof. No additional or different terms and conditions of sale by the Company shall be binding upon the Company unless they are expressly consented to by the Company in writing. The acceptance by the Company of any order of the Purchaser is expressly conditioned upon the Purchaser's agreement to said Standard Terms and Conditions. The acceptance or acknowledgement, written, oral, by conduct or otherwise, by the Company of the Purchaser's order shall not constitute written consent by the Company to addition to or change in said Standard Terms and Conditions.

2. Prices

Prices, discounts, allowances, services and commissions are subject to change without notice. Prices shown on any Company published price list and other published literature issued by the Company are not offers to sell and are subject to express confirmation by written quotation and acknowledgement. All orders of the Purchaser are subject to acceptance, which shall not be effective unless made in writing by an authorized Company representative at its office in Heath Springs, S.C. The Company may refuse to accept any order for any reason whatsoever without incurring any liability to the Purchaser. The Company reserves the right to correct clerical and stenographic errors at any time.

3. Shipping dates

Quotation of a shipping date by the Company is based on conditions at the date upon which the quotation is made. Any such shipping date is subject to change occasioned by agreements entered into previous to the Company's acceptance of the Purchaser's order, governmental priorities, strikes, riots, fires, the elements, explosion, war, embargoes, epidemics, quarantines, acts of God, labor troubles, delays of vendors or of transportation, inability to obtain raw materials, containers or transportation or manufacturing facilities or any other cause beyond the reasonable control of the Company. In no event shall the Company be liable for consequential damages for failure to meet any shipping date resulting from any of the above causes or any other cause.

In the event of any delay in the Purchaser's accepting shipment of products or parts in accordance with scheduled shipping dates, which delay has been requested by the Purchaser, or any such delay which has been caused by lack of shipping instructions, the Company shall store all products and parts involved at the Purchaser's risk and expense and shall invoice the Purchaser for the full contract price of such products and parts on the date scheduled for shipment or on the date on which the same is ready for delivery, whichever occurs later.

4. Warranty

The Company warrants to the Purchaser that products manufactured or parts repaired by the Company, will be free, under normal use and maintenance, from defects in material and workmanship for a period of one (1) year after the shipment date from the Company's factory to the Purchaser. The Company makes no warranty concerning products manufactured by other parties.

As the Purchaser's sole and exclusive remedy under said warranty in regard to such products and parts, including but not limited to remedy for consequential damages, the Company will at its option, repair or replace without charge any product manufactured or part repaired by it, which is found to the Company's satisfaction to be so defective; provided, however, that (a) the product or part involved is returned to the Company at the location designated by the Company, transportation charges prepaid by the Purchaser; or (b) at the Company's option the product or part will be repaired or replaced in the Purchaser's plant; and also provided that Cc) the Company is notified of the defect within one (1) year after the shipment date from the Company's factory of the product or part so involved.

The Company warrants to the Purchaser that any system engineered by it and started up under the supervision of an authorized Company representative will, if properly installed, operated and maintained, perform in compliance with such system's written specifications for a period of one (1) year from the date of shipment of such system.

As the Purchaser's sole and exclusive remedy under said warrant in regard to such systems, including but not limited to remedy for consequential damages, the Company will, at its option, cause, without charges any such system to so perform, which system is found to the Company's satisfaction to have failed to so perform, or refund to the Purchaser the purchase price paid by the Purchaser to the Company in regard thereto; provided, however, that (a) Company and its representatives are permitted to inspect and work upon the system involved during reasonable hours, and (b) the Company is notified of the failure within one (1) year after date of shipment of the system so involved.

The warranties hereunder of the Company specifically exclude and do not apply to the following:

a. Products and parts damaged or abused in shipment without fault of the Company.

b. Defects and failures due to operation, either intentional or otherwise, (l) above or beyond rated capacities, (2) in connection with equipment not recommended by the Company, or (3) in an otherwise improper manner.

c. Defects and failures due to misapplication, abuse, improper installation or abnormal conditions of temperature, humidity, abrasives, dirt or corrosive matter.

d. Products, parts and systems which have been in any way tampered with or altered by any party other than an authorized Company representative.

e. Products, parts and systems designed by the Purchaser.

f. Any party other than the Purchaser.

The Company makes no other warranties or representation, expressed or implied, of merchantability and of fitness for a particular purpose, in regard to products manufactured, parts repaired and systems engineered by it.

3. Terms of payment

Standard terms of payment are net thirty (30) days from date of the Company invoice. For invoice purposed, delivery shall be deemed to be complete at the time the products, parts and systems are shipped from the Company and shall not be conditioned upon the start up thereof. Amounts past due are subject to a service charge of 1.5% per month or fraction thereof.

6. Order cancellation

Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either party, the Purchaser shall pay to the Company the reasonable costs, expenses, damages and loss of profit of the Company incurred there by, including but not limited to engineering expenses and expenses caused by commitments to the suppliers of the Company's subcontractors, as determined by the Company.

7. Changes

The Purchaser may, from time to time, but only with the written consent of an authorized Company representative, make a change in specifications to products, parts or systems covered by a purchase order accepted by the company. In the event of any such changes, the Company shall be entitled to revise its price and delivery schedule under such order.

8. Returned material

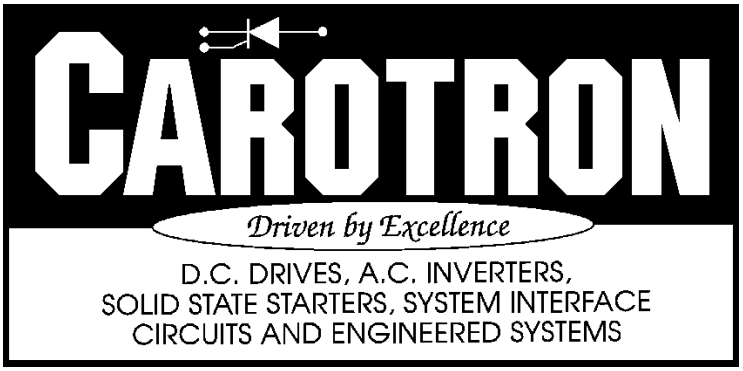
If the Purchaser desires to return any product or part, written authorization thereof must first be obtained from the Company which will advise the Purchaser of the credit to be allowed and restocking charges to be paid in regard to such return. No product or part shall be returned to the Company without a "RETURNTAG" attached thereon which has been issued by the Company.

9. Packing

Published prices and quotations include the Company's standard packing for domestic shipment. Additional expenses for special packing or overseas shipments shall be paid by the Purchaser. If the Purchaser does not specify packing or accepts parts unpacked, no allowance will be made to the Purchaser in lieu of packing.

10. Standard transportation policy

Unless expressly provided in writing to the contrary, products, parts and systems are sold f.o.b. first point of shipment. Partial shipments shall be permitted, and the Company may invoice each shipment separately. Claims for non-delivery of products, parts and systems, and for damages thereto must be filed with the carrier by the Purchaser. The Company's responsibility therefor shall cease when the carrier signs for and accepts the shipment.



3204 Rocky River Road
Heath Springs, SC 29058
Phone: (803) 286-8614
Fax: (803) 286-6063
Email: saleserv@carotron.com
Web: www.carotron.com
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Issued 08-30-2004