ELITEPRO®

Digital D.C. Drive

Instruction Manual

Models

EPN020-000	EPR020-000
EPN040-000	EPR040-000
EPN060-000	EPR060-000
EPN075-000	EPR075-000
EPN100-000	EPR100-000
EPN125-000	EPR125-000
EPN150-000	EPR150-000
EPN200-000	EPR200-000
EPN250-000	EPR250-000
EPN300-000	EPR300-000
EPN400-000	EPR400-000
EPN500-000	EPR500-000
EPN600-000	EPR600-000

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

The Elite® Pro Series of D.C. motor controls provide microprocessor control of speed and torque control of 5-600HP D.C. motors rated for NEMA type "C" power supplies. The EPN series for non-regenerative applications and the EPR regenerative series are offered in compact panel mounted assemblies.

2 Specifications

2.1 Electrical

A.C. Input Voltage Range - 3 Phase Supply
- 230-460 VAC ± 10%, 50/60 Hz ± 2 Hz

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

External A.C. Line Field Supply - 1 Phase Supply (Optional)
- 230-460 VAC ± 10%, 50/60 Hz ± 2 Hz

Field Output
- Voltage
  0-200VDC @ 230 VAC input
  0-330VDC @ 380 VAC input
  0-400VDC @ 460 VAC input
- Current
  EPx020-000 thru EPx060-000: 8A max
  EPx075-000 thru EPx150-000: 10A max
  EPx200-000 thru EPx600-000: 12A max

Power Supplies
- +24V Unregulated Digital Input Supply: 50mA
- +12V Unregulated Encoder/Freq. Input Supply: 100mA
- +10V Regulated Reference Supply: 50mA
- -10V Regulated Reference Supply: 50mA

Digital Inputs (7 Total)
- Sink Mode
  Vil=20.0 VDC max
  Vih=0.0 VDC min to 17.0 VDC max
- Source Mode
  Vil=5.0 VDC max
  Vih=8.0 VDC min to 30.0 VDC max

Analog Inputs
- Voltage inputs (5 Total)
  Max Input: ±10 VDC
  Input Impedance, Inputs 1-4: 1MΩ
  Input Impedance, Input 5: 20kΩ
- Current inputs (4 Total)
  Max Input: ±20 mADC
  Input Impedance: 270Ω
- Tachometer input
  Max Input: ±200 V (AC or DC)

Encoder Input
- Frequency: 200kHz max, quadrature square wave (single ended or differential)
- Voltage: 12 VDC max

Frequency Input
- Frequency: 40kHz max, square wave
- Voltage: 12 VDC max
  Vil=0.0 VDC to 2.0 VDC max
  Vih=3.0 VDC min to 12.0 VDC max

Relay Outputs (3 Total)
Form-C contact:
- 2 A @ 115 VAC
- 2 A @ 60 VDC

Armature Pilot Relay Output
- 30 A @ 120 VAC
- 30 A @ 28 VDC

Analog Outputs (2 Total)
- ±10 VDC max, 20mADC max

Frequency/Digital Output
- Frequency: 2kHz max, square wave
- Output current: 20mA max
- Output voltage: 16VDC max

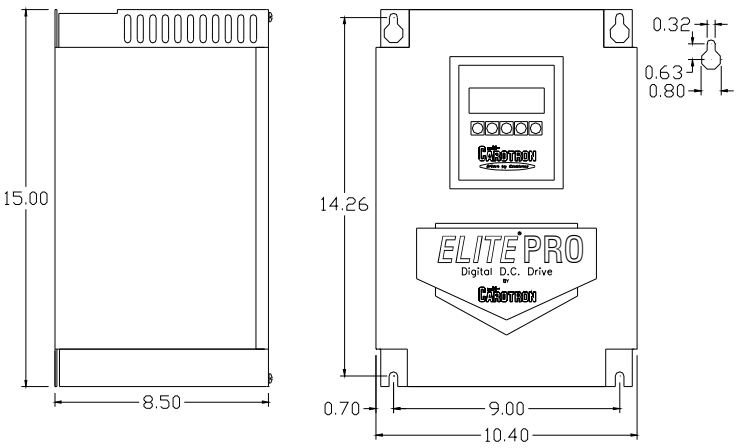
Speed Regulation
- Armature Feedback: ±1%
- Tachometer Feedback: ±0.01%
- Encoder Feedback (1024 min.): ±0.01%

Torque Regulation
- ±1% of Range Selected

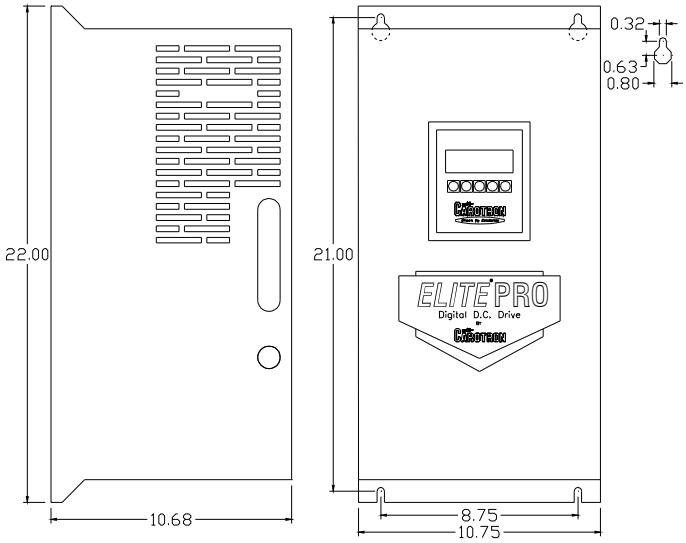
Speed Range
- 100:1 typical when using tachometer or encoder feedback. May be less depending upon motor characteristics

Temperature Range
- Chassis: 0-55°C
- Enclosed: 0-40°C

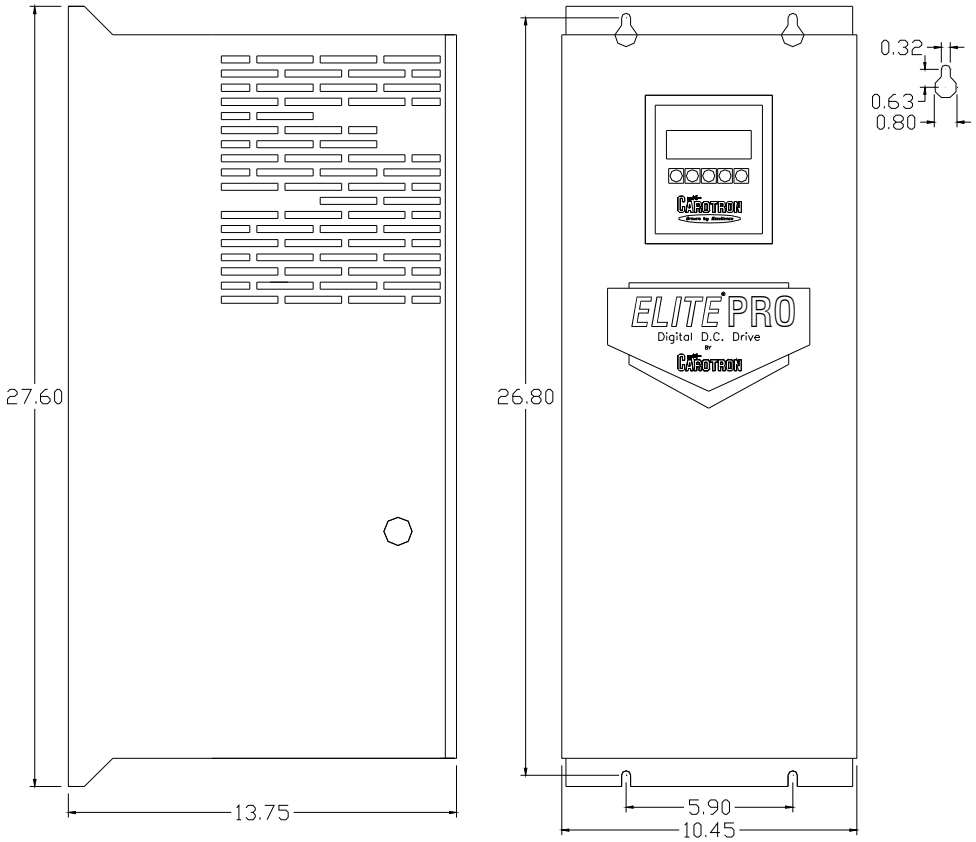
2.2 Physical



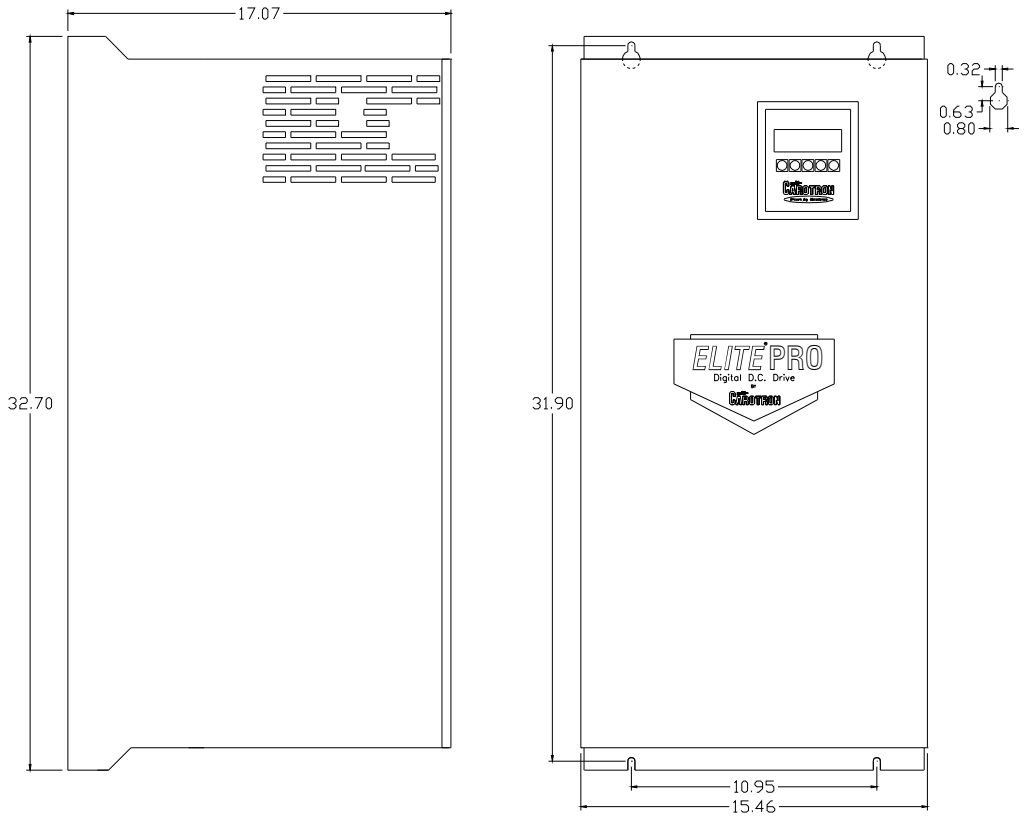
EPx020-000 thru EPx060-000



EPx075-000 thru EPx150-000



EPx200-000 thru EPx400-000



EPx500-000 thru EPx600-000

Figure 1

3 Installation

3.1 Control Installation

Elite Pro 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 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 Over-Temperature fault on the Elite Pro 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.

Make no connections to ground other than the designated terminal strip location.

Use fully insulated and shielded cable for all signal wiring. The shield should be connected at 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. 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.

4 Terminal Connections & Functions

4.1 AC Power Connections & Fusing

Terminals L1, L2, and L3 are the AC line inputs for the armature power bridge. High speed semiconductor fuses must be provided externally. Refer to Figure 3 on the next page and Table 21 in the *Spare Parts Section* on page 78 for common manufacturers and part numbers.

Table 1: Model Rating Data

Drive Model	Arm Volts	Motor HP	Approx. Full Load Line Amps	3 Phase DIT KVA Rating	Arm Amps	Contactor Rating	D.B. Resistor Rating
EPx020-000	240	5	18	7.5	18	40 Amps	10Ω, 300W
		7.5	26	11	28.1		5Ω, 600W
		10	34	14	36		4.4Ω, 750W
	500	5	9	7.5	8.5	40 Amps	40Ω, 375W
		7.5	14	11	13.2		20Ω, 750W
		10	18	14	17.2		20Ω, 750W
		15	25	20	25.2		14Ω, 1000W
		20	34	27	36		10Ω, 1500W
EPx040-000	240	15	50	20	55	75 Amps	3Ω, 1000W
		20	65	27	71		2.2Ω, 1500W
	500	25	40	34	43	75 Amps	7Ω, 2000W
		30	47	40	51		6Ω, 2000W
		40	63	51	71		5Ω, 3000W
EPx060-000	240	25	84	34	91.1	110 Amps	1.7Ω, 2000W
		30	98	40	107		
	500	50	78	63	83.7	110 Amps	3.4Ω, 4000W
		60	93	75	107		
EPx075-000	240	40	118	51	140	180 Amps	1.3Ω, 2080W
	500	75	106	93	140	180 Amps	2.6Ω, 4160W
EPx100-000	240	50	148	63	174	180 Amps	0.62Ω, 2232W
	500	100	141	118	174	180 Amps	1.24Ω, 4464W
EPx125-000	240	60	174	75	206	260 Amps	0.62Ω, 2232W
	500	125	177	145	206	260 Amps	1.24Ω, 4464W
EPx150-000	240	75	212	93	256	260 Amps	0.62Ω, 2232W
	500	150	213	175	256	260 Amps	1.24Ω, 4464W
EPx200-000	240	100	282	118	340	360 Amps	0.47Ω, 4700W
	500	200	283	220	340	360 Amps	1.02Ω, 6500W
EPx250-000	240	125	354	145	425	535 Amps	0.37Ω, 5300W
	500	250	353	275	425	535 Amps	0.82Ω, 11000W
EPx300-000	240	150	426	175	510	535 Amps	0.31Ω, 7000W
	500	300	423	330	510	535 Amps	0.65Ω, 14600W
EPx400-000	240	200	555	220	688	Consult Factory	Consult Factory
	500	400	555	440	688		
EPx500-000	240	250	694	275	850	Consult Factory	Consult Factory
	500	500	694	550	850		
EPx600-000	240	300	832	330	1020	Consult Factory	Consult Factory
	500	600	832	660	1020		

Carotron recommends the use of three phase DIT, drive isolation type transformers. While Elite Pro 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. Refer to Table 1 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 Figure 2. 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 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.

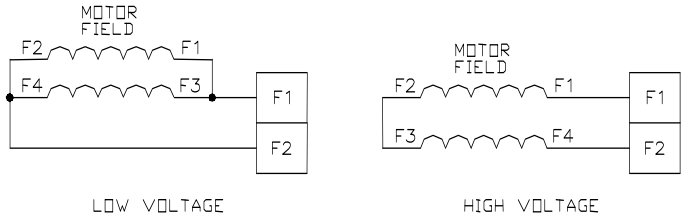


Figure 2

In some cases, the field voltage required by a motor exceeds the maximum obtainable field voltage that can be derived with the required AC line voltage for the motor armature. In these cases, an external single phase AC supply for the field bridge must be used. The supply connects to FL1 and FL2 and must be in phase with the armature supplies L1 and L2. Refer to Figure 3. Jumpers J8 and J9 on the trigger board need to be moved from internal to external.

For example, if a motor has a 240VDC armature rating, 230VAC lines must be connected to L1, L2, and L3. The maximum field voltage attainable from the field bridge with 230VAC input is 200VDC. In order to obtain the required 240VDC field, a single phase 460VAC supply can be connected to FL1 and FL2.

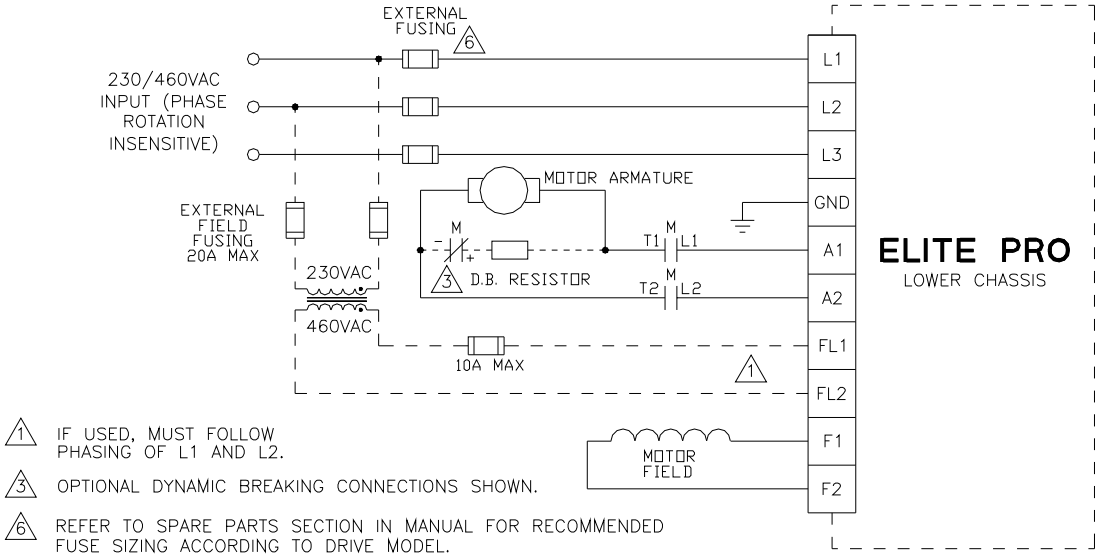


Figure 3

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 1 for typical armature voltage, current, contactor and dynamic braking resistor ratings.

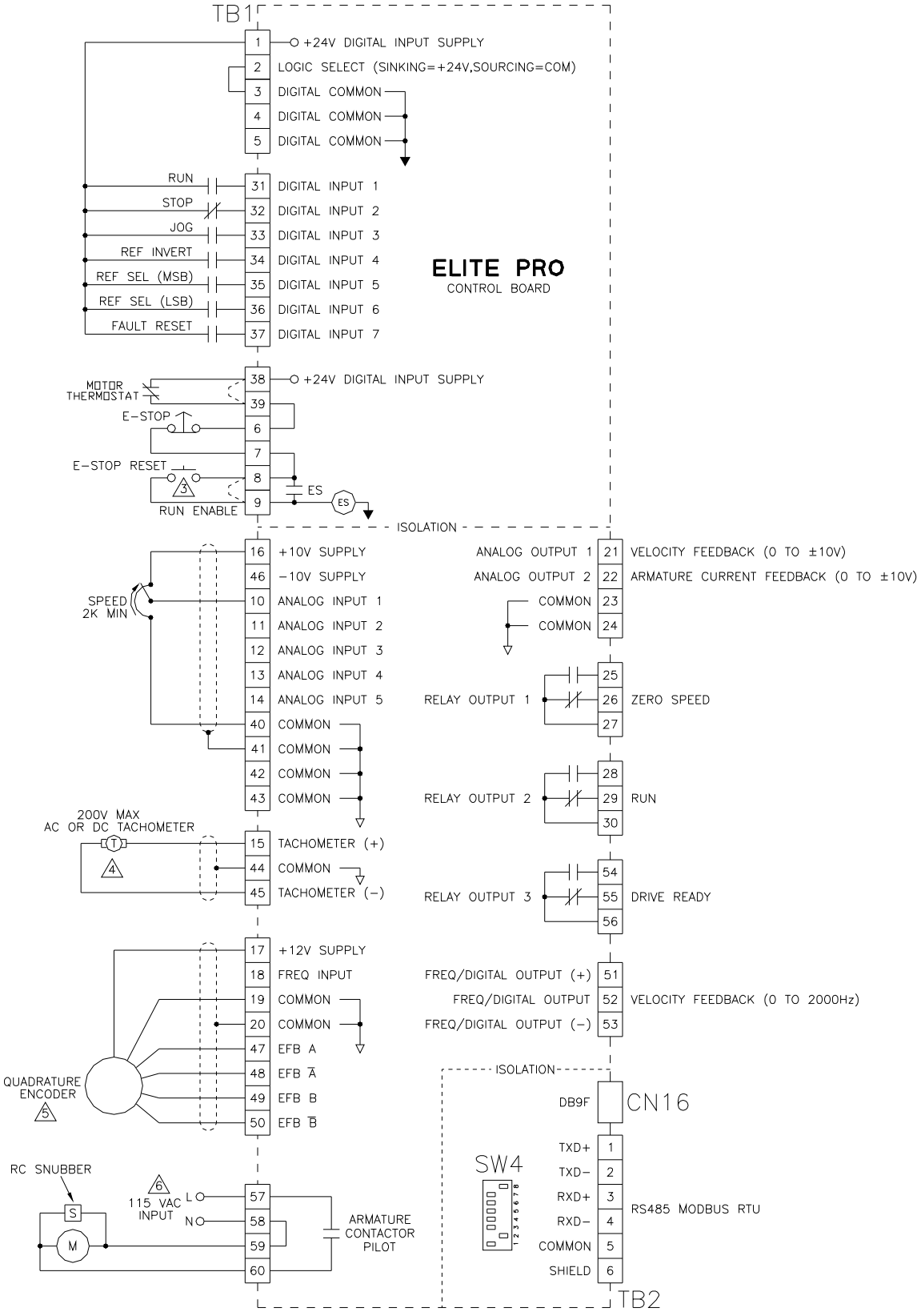
Note : When present, the **S1** and **S2** for the **SERIES** field winding is placed in series with the armature leads on the non-regenerative models. It should not be used with the EPR Series regenerative models and the leads should not be connected and should be individually insulated. On non-regenerative 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 the thermostat to TB1-38 & 39 as shown in Figure 4 will allow a motor over-temperature condition to shut down the control as in an Emergency Stop condition.

4.3 Signal Connections

Figure 4 shows the typical signal connections to an Elite Pro drive. When operated, the Emergency Stop contacts at terminals 6 and 7 will immediately clamp all control signals. 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 1 for recommended resistor values. If a maintained Emergency Stop push-button is used, the E-Stop Reset contacts at TB1-8 & 9 can be jumpered. Otherwise, a momentary push-button E-Stop can be reset by closing the E-Stop Reset contacts.



3 JUMPER CAN BE SUBSTITUTED FOR ESTOP RESET IF MAINTAINED ESTOP IS USED.

4 OPTIONAL TACHOMETER FEEDBACK CONNECTIONS SHOWN.

5 OPTIONAL QUADRATURE ENCODER FEEDBACK CONNECTIONS SHOWN.

6 115 VAC SHOWN FOR ARMATURE CONTACTOR COIL. ACTUAL VOLTAGE REQUIRED DEPENDENT UPON ARMATURE CONTACTOR USED.

Figure 4

5 Human Machine Interface (HMI)

5.1 Description of Interface

The Human Machine Interface (HMI) is the primary method for accessing the drive parameters. It allows custom user configuration, monitoring, and troubleshooting. The HMI consists of a 4 line by 20 characters display. Five softkeys are used to navigate and select parameters within the menu. The function of each softkey is defined by the text displayed directly above the button. Listed below are the navigational softkey functions and their descriptions:

Softkey	Direction	Description
SEL	⇒	Enters deeper into the menu.
ESC	⇐	Returns to the previous menu.
UP	⇑	Scrolls up through the menu.
DOWN	⇓	Scrolls down through the menu.
ENT	•	Change parameter value

Table 2: Navigation Softkey Functions

Parameters can be changed or adjusted by two different methods via the keypad interface. When adjusting a numerical value, the Roll & Shift method is used. The keys in Table 3 are used to change the parameter value.

Softkey	Name	Description
+	Increment	Increments the digit currently highlighted by the cursor.
-	Decrement	Decrements the digit currently highlighted by the cursor.
>	Shift	Shifts the cursor one digit to the right.
ENT	Enter	Accepts the current value and returns to previous screen.

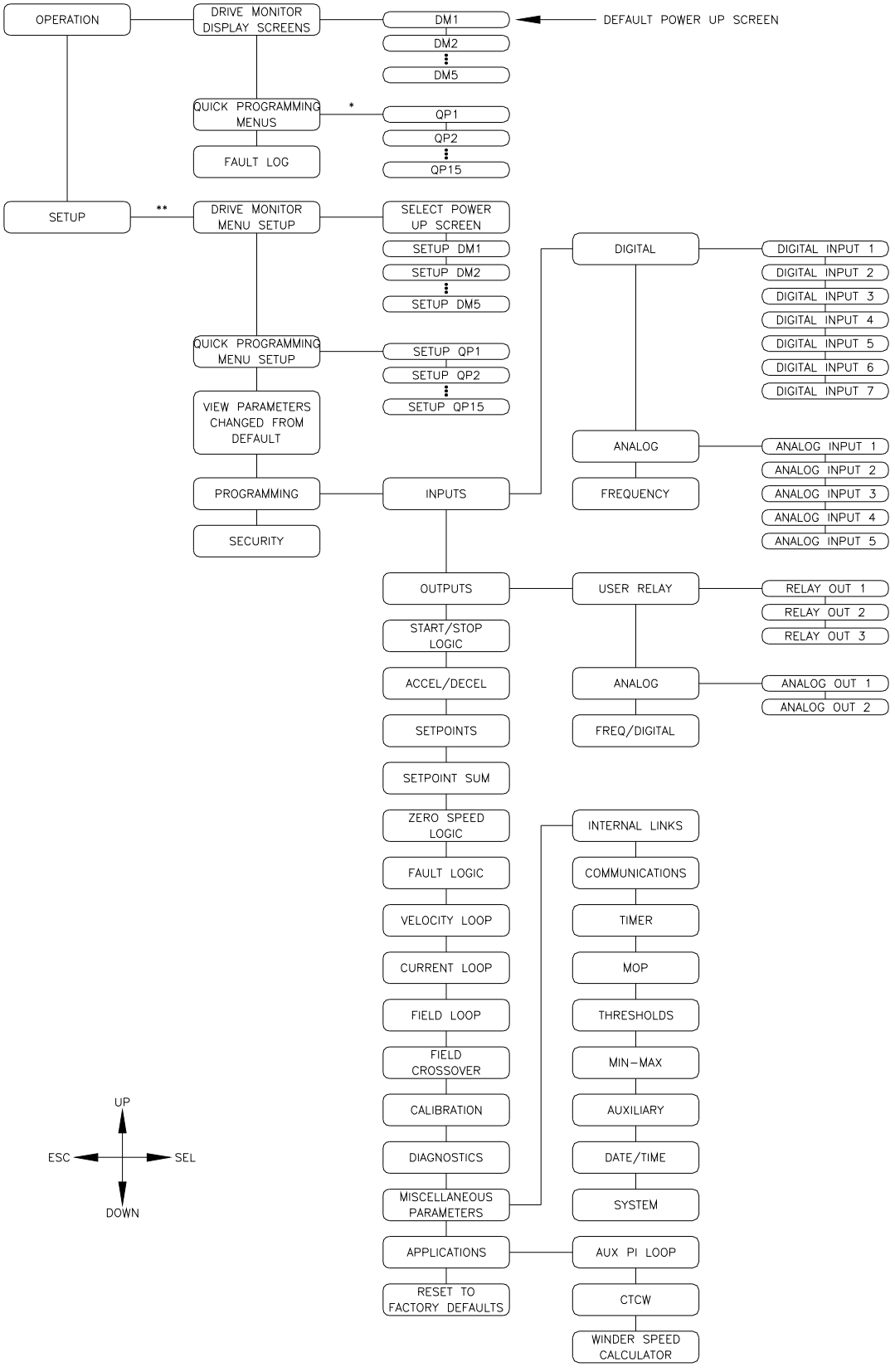
Table 3: Roll & Shift Functions

Some parameters (mainly Source & Destination) can be changed by the Roll & Shift Method or by using the Parameter Guide. In these cases, the softkey options will have ENT and SEL as choices. Choosing ENT will allow the Source or Destination parameter to be selected by directly entering its Tag value via the Roll & Shift method described above. Note this method requires the user to know before hand the Tag value of the desired parameter. If the user does not know the Tag value and does not wish to look it up via the manual, the SEL softkey can be chosen to enter into the Parameter Guide. This utility allows the user to scroll through an organized list of parameters by using the navigation softkeys (refer to Table 2) and select one by its Name instead of its Tag number.

Note: When parameters are altered, the changes must be saved, otherwise changes will be lost after a drive reset or power loss. Whenever the user exits the Programming section, the drive will prompt you to save parameters. The Save command is also accessible in the Setup|Programming|Misc Parameters|System section and the Quick Programming Menu 15 (QP15).

When power is applied to the drive, the display shows the current firmware version. After a 5 second timeout or the DWN softkey is pressed, the display changes to a user selectable menu screen. In the factory preset configuration, this is the Display Monitoring Screen 1 (DM1) showing the drive model and status. The menu is divided into two basic sections, Operation and Setup as shown in Table 4.

Table 4: Elite Pro Abbreviated Programming Chart



* Level 1 password is required when entering this section (if password protection is enabled).
** Level 2 password is required when entering this section (if password protection is enabled).

Operation Menu

The Operation section contains the Drive Monitor (DM), Quick Programming (QP), and Fault Log menu screens.

Drive Monitor Display Screens & Quick Programming Menus

The DM and QP sections contain menus for frequently used parameters, and can be customized to display different parameters. The QP menu screens require a level 1 password (if enabled) while the DM screens do not. If a parameter being displayed in a DM or QP screen can be edited and the Adjust Permission for that screen is set to Allow, a softkey will be labeled P1 or P2 on the bottom line. Pressing the P1 and/or P2 softkey allows parameter adjustment. P1 corresponds to the first parameter (line 2) and P2 to the second parameter (line 3).

Fault Log

The Fault Log section displays the Present Fault Status and the Latched Fault Status screens. The CLR softkey can be used to clear any latched faults only when there are no present faults active. The SEL softkey enters the Fault History where the last 5 faults along with the date and time are recorded. Fault #1 is the most recent while #5 is the oldest.

Setup Menu

The Setup menu section contains 5 submenus that allow the function and operation of the Elite Pro drive to be modified.

Drive Monitor Menu Setup

This section allows customization to screens DM1-DM5 along with the power up DM screen designation. Each of the 5 Drive Monitoring Screens can be configured to display any of the Elite Pro's parameter settings under the Setup section. Each screen has 3 lines that can be configured. The last line is reserved for the softkey functions. Line 1 (top line of the display) can display up to 16 alphanumeric text characters. Lines 2 and 3 can be configured to display text (20 alphanumeric), a parameter tag value, text (10 alphanumeric) and a parameter tag value, or drive status. The Visibility setting controls if the screen is displayed. The Adjust Permission controls whether or not the writable parameter values can be edited by using the P1 and/or P2 softkeys. Note that if two parameters are shown on one screen, the Adjust Permission option affects both parameters. Table 5 shows the factory presets for the DM and QP screens.

Quick Programming Menu Setup

The QP menu screen setup is identical to the DM screens described above.

View Parameters Changed from Default

This section is a troubleshooting aid that displays parameters that are not set to the factory presets. The PRV (previous) and NXT (next) softkeys allow you to scroll through the list. The DFT (default) softkey displays the default value while the RST (reset) softkey will reset the currently displayed parameter to its factory preset value.

Programming

The Programming section contains all of the drive's operating parameters. Refer to the *Programming & Adjustments Section* on page 19 for a detailed explanation of each parameter.

Security

The Elite Pro provides three security levels for access to drive parameters. Level 0 does not require a password, while levels 1 and 2 each have a unique password. The Security section contains the level 1 and level 2 passwords. In the factory preset configuration, the level 1 and level 2 passwords are not enabled and all drive parameters are fully accessible. If and when the passwords are set, the following applies:

The Drive Monitor Display Screens (DM1-5) and the Fault Log require no password (Level 0). The Quick Programming Menus (QP1-15) require a level 1 password to be entered for access. All other menus require a level 2 password.

DM/QP Screen	Line 1	Line 2	Line 3	Visibility	Adjust Permission
DM1	ELITE PRO	TT: MODEL NUM (411)	STATUS:	SHOW	ALLOW
DM2	MOTOR SPEED	TT: REFERENCE (217)	TT: ACTUAL (200)	SHOW	DENY
DM3	ARMATURE	TT: VOLTS (417)	TT: CURRENT (114)	SHOW	ALLOW
DM4	FIELD	TT: VOLTS (335)	TT: CURRENT (338)	SHOW	ALLOW
DM5	LOOPS	TT: VELOC OUT (205)	TT: CURR OUT (106)	SHOW	ALLOW
QP1	SETPOINT REF1&2	TT: REF1 (218)	TT: REF2 (219)	SHOW	ALLOW
QP2	SETPOINT REF3&J	TT: REF3 (220)	TT: JOG REF (221)	SHOW	ALLOW
QP3	SETUP SCREEN 1	TT: FWD ACCEL (226)	TT: FWD DECEL (227)	SHOW	ALLOW
QP4	SETUP SCREEN 2	TT: REV ACCEL (228)	TT: REV DECEL (229)	SHOW	ALLOW
QP5	SETUP SCREEN 3	TT: FWD MAX (190)	TT: REV MAX (191)	SHOW	ALLOW
QP6	SETUP SCREEN 4	TT: POS CURLIM (99)	TT: NEG CURLIM (100)	SHOW	ALLOW
QP7	SETUP SCREEN 5	TT: MIN SPEED (236)	TT: LOGIC SEL (245)	SHOW	ALLOW
QP8	SETUP SCREEN 6	TT: MAX MTRCUR (123)	TT: MAX VOLTS (128)	SHOW	ALLOW
QP9	SETUP SCREEN 7	TT: TACH TYPE (127)	TT: TACH INVRT (126)	SHOW	ALLOW
QP10	SETUP SCREEN 8	TT: IR COMP (131)	TEXT: -	SHOW	ALLOW
QP11	SETUP SCREEN 9	TT: FIELD SET (330)	TT: FIELD VLTS (335)	SHOW	ALLOW
QP12	SETUP SCREEN 10	TT: NETWK ADDR (434)	TEXT: -	SHOW	ALLOW
QP13	-	TEXT: -	TEXT: -	SHOW	ALLOW
QP14	-	TEXT: -	TEXT: -	SHOW	ALLOW
QP15	LOAD/SAVE	TT: P1 TO LOAD (407)	TT: P2 TO SAVE (406)	SHOW	ALLOW

TT=TEXT & TAG, - = BLANK TEXT

Table 5: Drive Monitor & Quick Programming Presets

6 Start Up Procedure

The Elite Pro comes from the factory preset to run a 240VDC armature motor in Velocity Mode with Armature Feedback. The drive is scaled to provide 100% armature current of the drive model.

6.1 Pretest

6.1.1 Verify each leg of the 3 phase power supply. Input voltage should be checked ahead of the supplying circuit breaker, disconnect switch, etc. before it is switched on.

6.1.2 Connections should be visually inspected and checked for tightness. An ohmmeter can be used to check for ground faults. **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.

6.1.3 Proceed to Sections 6.2, 6.3, or 6.4 depending on type of setup desired.

6.2 Adjustment Procedure: Velocity Regulator

6.2.1 Adjust external speed reference (Analog Input 1) at terminal 10 to 0 volts.

6.2.2 Apply A.C. power to the control.

6.2.3 Using the HMI, go to the Setup|Programming|Calibration section and set the following parameters to match the nameplate values:

Nameplate Motor Armature Current (123)
Nameplate Motor Armature Voltage (128)

6.2.4 If other than Armature Feedback is desired, also set the following per the feedback device in the Setup|Programming|Calibration section:

Encoder Feedback

a. Set **Encoder Lines (124)** to encoder resolution.
b. Set **100% Encoder RPM (125)** to the full speed RPM level.

Tachometer Feedback

a. Select the base speed tachometer voltage with jumpers J6 (Hundreds), J5 (Tens), & J7 (Ones). For example, if the maximum tachometer voltage is 87.5 VDC, set J6=0, J5=80, and J7=8.

b. Set **Tachometer Type (127)** to AC or DC.

6.2.5 The field supply can operate in either closed loop current control or open loop voltage control. Setup the field supply as follows depending on the desired mode of operation. Note that the field setup parameters are under the Setup|Programming|Field Loop section.

Closed Loop Current Control

a. Set Field I Demand(339) as follows:

- EPx020-000 thru EPx060-000 Models

$$\text{Field I Demand (339)} = \frac{\text{Nameplate Field Amps}}{8\text{A}} \times 100$$

- EPx075-000 thru EPx150-000 Models:

$$\text{Field I Demand (339)} = \frac{\text{Nameplate Field Amps}}{10\text{A}} \times 100$$

- EPx200-000 thru EPx600-000 Models:

$$\text{Field I Demand (339)} = \frac{\text{Nameplate Field Amps}}{12\text{A}} \times 100$$

b. Set **Open Loop Field Select (329)** to False.

Open Loop Voltage Control

a. Set **Field Economy Enable (332)** to False.
b. Adjust **Open Loop Field Setpoint (330)** until **Field Voltage (335)** equals the motor nameplate rating.
c. **Set Field Economy Enable (332)** to True.

6.2.6 If parameters were not saved when exiting the programming section, navigate to QP15 screen and select P2 to Save.

6.2.7 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. All parameters in this section are located in the Setup|Programming|Velocity Loop section unless specified otherwise.

1. Momentarily close the Run pushbutton (Digital Input 1) at terminal 31. The armature contactor should close. Slowly increase the external speed reference to approximately 20%. Observe the direction of rotation and if wrong, correct by removing control power and reversing the motor armature or field wires. If used, observe proper polarization of the series field winding per the instructions in Section 4.2.
2. Proper tachometer or encoder operation can be checked while running in Armature Feedback (AFB). As above, run the drive at 20% speed. Monitor **Armature Feedback (AFB, 194)** and compare this level with **Tachometer Feedback (TFB, 195)** or **Encoder Feedback (EFB, 196)**. If the levels are approximately equal, then TFB or EFB can be selected with **Feedback Select (197)** when the drive is stopped. (The following feedback parameters in this step are located in Setup|Programming|Calibration Section.) If the TFB or EFB signals are the wrong polarity, set **Invert FB (126)** to True. If the TFB level is not correct, verify proper scaling per jumpers J5, J6, and J7. If an AC tachometer is used, set **Tachometer Type (127)** to AC. If the EFB level is not correct, verify the **Encoder Lines (124)** and **100% Encoder RPM (125)** are set correctly.
3. If the drive is a regenerative model and the application requires reverse direction, close the Reference Invert contact (Digital Input 4). Verify that the motor reverses direction.
4. The 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.
5. Run drive and increase the reference to maximum. Use the **Forward Max Speed Scale (190)** and **Reverse Max Speed Scale (191)** to adjust for rated armature

voltage or desired maximum motor speed. Stop the drive.

6. Test the Jog function (Digital Input 3) and adjust **Jog Reference (221)** (located in Setup|Programming|Setpoints Section) for desired speed.
7. If parameters were not saved when exiting the programming section, navigate to QP15 screen and select P2 to Save.

6.3 Adjustment Procedure: Constant Horsepower

6.3.1 Initially setup Elite Pro as a Velocity Regulator via Section 6.2 to run at the motor's base speed via tachometer or encoder feedback with closed loop field control.

6.3.2 In the Setup|Programming|Field Crossover Section, set the following:

a. **Field Crossover Enable (423)** to True
b. **Min Field Current Demand (424)** to nameplate top speed field current.

6.3.3 Go to the Setup|Programming|Velocity Loop section and set **100% RPM Level (199)** to the new top speed motor RPM. Go to the Setup|Programming|Fault Logic section and set **Velocity Feedback Loss Inhibit (248)** to True.

6.3.4 If using a tachometer for feedback, rescale the tach voltage feedback to the top speed voltage via jumpers J5,6 & 7 on control board. Otherwise, rescale the encoder feedback by changing Setup|Programming|Calibration|**100% Encoder RPM (125)** to the new top speed motor RPM.

6.3.5 If parameters were not saved when exiting the programming section, navigate to QP15 screen and select P2 to Save.

6.3.6 Start drive and slowly increase the external speed reference. Field Current should slowly begin decreasing when the **Armature Feedback (194)** reaches the **Field Crossover Setpoint (425)** which is typically set to 85%. Continue increasing external speed reference to maximum and verify rated armature voltage and top speed field current levels.

6.4 Adjustment Procedure: Torque Regulator

6.4.1 Adjust external torque reference (Analog Input 1) at terminal 10 to 0 volts.

6.4.2 Apply A.C. power to the control.

6.4.3 Using the HMI, go to the Setup|Programming|Calibration section and set the following parameters to match the nameplate values:

Nameplate Motor Armature Current (123)
Nameplate Motor Armature Voltage (128)

6.4.4 Setup Field output via Section 6.2.5.

6.4.5 Go to the Setup|Programming|Current Loop section, and set **Drive Mode (109,110)** to Torque.

6.4.6 If desired, go to the Setup|Programming|Accel/Decel section, and set desired accel/decel settings. Overspeed protection can be tailored by adjusting the **Overspeed Level (223)** in the Setup|Programming|Fault Logic section.

6.4.7 If parameters were not saved when exiting the programming section, navigate to QP15 screen and select P2 to Save.

6.4.8 Drive setup is now complete. Momentarily pressing the Run pushbutton will start the drive and provide torque commanded by the external reference.

6.5 Adjustment Procedure: CTCW (Constant Tension Center Winder)

6.5.1 Verify proper connection and operation of the Elite Pro by setting up the drive as a velocity regulator (refer to section 6.1 and 6.2).

6.5.2 In the Setup|Programming|Applications|CTCW Section, set the following:

a. **Diameter Select (442)** depending upon the desired diameter calculation method.
b. **Diameter Memory Reset (447)** to True.
c. **Tension Setpoint (441)** to 0.00%.
d. **Core (446)** to the ratio of the core diameter to that of the max diameter:

$$\text{Core (446)} = \frac{\text{core diameter}}{\text{maximum diameter}} \times 100\%$$

6.5.3 (Note: This step can be skipped if **Diameter Select (442)** is set to External Diameter Ratio). With an empty core loaded on the winder, start the line and run at full line speed. Use a hand tachometer to measure the surface speed of the line. While monitoring the surface speed of the empty core with the hand tachometer, increase the speed reference to the Elite Pro (Analog Input 1 by default) until it matches the surface speed of the line. Make note of the value of **Velocity Feedback Filtered (198)** parameter in the Setup|Programming|Velocity Loop Section. Enter this value into the **100% Winder Speed (444)** in the Setup|Programming|Applications|CTCW Section. Decrease the reference to the Elite Pro and stop the line.

6.5.4 (Note: This step can be skipped if **Diameter Select** is set to Line/Winder. The following assumes that the external diameter sensor is connected to Analog Input #2. If other than this input is used, make changes to the following setup accordingly.) Typically, the external diameter sensor should be configured to provide minimum signal with an empty core and maximum signal with a full roll. In the Setup|Programming|Inputs|Analog|Analog 2 Section, set **Analog Input 2 Destination (24)** to **DiaRatio (445)**. With an empty core on the winder, perform the 0% calibration under Calibrate Analog Input. Load or simulate a full roll and perform the 100% calibration.

6.5.5 A signal proportional to line speed should be connected to one of the analog or frequency inputs. (The following assumes that the line speed signal is connected to the Frequency Input. If an input other than this is used, make changes to the following setup accordingly.) In the Setup|Programming|Inputs|Frequency Section set the **Frequency Input Destination (63)** to **Line Speed (443)**. With the line stopped, perform the 0% calibration under Calibrate Frequency Input. Next, run the line up to full speed and perform the 100% calibration. The Bias and Gain parameter for the analog or frequency input should be 0.00% and 100.00% respectively (default).

6.5.6 With the drive stopped, select torque mode by changing Setup|Programming|Current Loop|**Drive Mode (109,110)** from Velocity to Torque. In the Setup|Programming|Misc Parameters|Internal Links Section, modify **Internal Link 3 Source (370)** from **Ramp Output (225)** to **Total Torque (455)**. (The above assumes that the factory preset configuration is loaded.)

6.5.7 Navigate to the Setup|Programming|Applications|CTCW Section. Start the Elite Pro drive with 0% line speed reference. Slowly increase the **Static Friction Torque (462)** parameter until the winder just begins to turn. Decrease slightly until the winder stops turning. Increase the line speed to 100%. Slowly increase **Friction Compensation (448)** until **Winder Speed (452)** is equal to or slightly above 100%. Use care to supply only enough compensation to reach 100%.

6.5.8 The **Inertia Compensation (449)** adjustment is made to match the acceleration rate of the winder to the acceleration rate of the line by compensating for inertia. This can easily be done by using a dual trace oscilloscope (preferably storage type) to compare the line and winder speed signals during acceleration. Otherwise, material can be loaded and observed during acceleration. Slackening of the material indicates too little compensation while tightening indicates too much compensation.

6.5.9 Material should now be loaded. The **Tension Setpoint (441)** should be adjusted to provide the desired tension level on the material. Verify proper tension through acceleration up to and at full line speed.

6.5.10 In many applications, the best rolls are "built" when tension is highest at the core and mid-diameter and decreases or tapers off during the remaining diameter increase. **Taper Diameter (456)** sets the diameter level where tapering begins. The amount of tapering is controlled by the **Taper Percentage (457)** parameter. These settings are usually adjusted by winding material and observing the roll to determine the point at which constant tension problems begin to occur. Most likely, any problem noticed at a

particular diameter actually started earlier in the roll. Set **Taper Diameter (456)** to the diameter level at which tapering is required. Start a new roll of material and wind until tapering is required. As material is wound further, adjust **Taper Percentage (457)** to control the level of taper.

6.5.11 In most applications, the diameter memory function is not needed and **Diameter Memory Reset (447)** can remain set to True. However, in cases where restarting partially completed rolls is a problem, a digital input should be configured to control the Diameter Memory Reset parameter. This will allow the memory function to be active as rolls are built. **WARNING! THIS REQUIRES RESETTING THE DIAMETER MEMORY BEFORE RESTARTING A NEW ROLL!**

6.5.12 If parameters were not saved when exiting the programming section, navigate to QP15 screen and select P2 to Save.

6.6 Calibration & Fine Tuning

1. If using AFB, the **IR Compensation (131)** parameter can be adjusted to improve the speed regulation with load changes. Adjustment is best done when the motor or machine can be loaded normally. If the motor is normally operated at a particular speed, adjust **IR Compensation** 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 **IR Compensation (131)** parameter 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 AFB to measure speed. Armature voltage is not an exact indication of loaded motor speed!
2. The **Current Proportional Gain (107)**, **Current Integral Time (108)**, **Velocity Proportional Gain (201)**, and **Velocity Integral Time (202)** parameters are preset by Carotron to provide stable and responsive performance under most load conditions. When required, the drive performance can be optimized for a particular application or to correct undesirable operation by use of these adjustments. The adjustments are complex though and can adversely affect operation if not properly set. In general, the settings that give the most stable operation do not always give the fastest response.

   Current Loop

   The current loop can be manually tuned by directly applying a stepped reference and monitoring the current feedback. In order to adjust properly, connect an oscilloscope between common and the Armature IFB testpoint on CN11. Using the HMI, temporarily set **Ramp Bypass (305)** to True. The rotor shaft must not rotate during this procedure. Therefore, set **Field Enable (331)** to False to remove voltage from the shunt field. Set the drive to torque mode by setting **Drive Mode (109,110)** to Torque. Run the drive and apply a step change to the external reference and monitor the current feedback. The signal should respond quickly with minimum overshoot. Adjust the **Current Proportional Gain (107)** and **Current Integral Time (108)** parameters to obtain a critically damped waveform as seen in Figure 5. Increasing the proportional gain improves the response but increases the overshoot. Reducing the integral time improves the response but can cause instability if set too low. Return **Ramp Bypass**, **Field Enable**, & **Drive Mode** to their previous settings when complete.

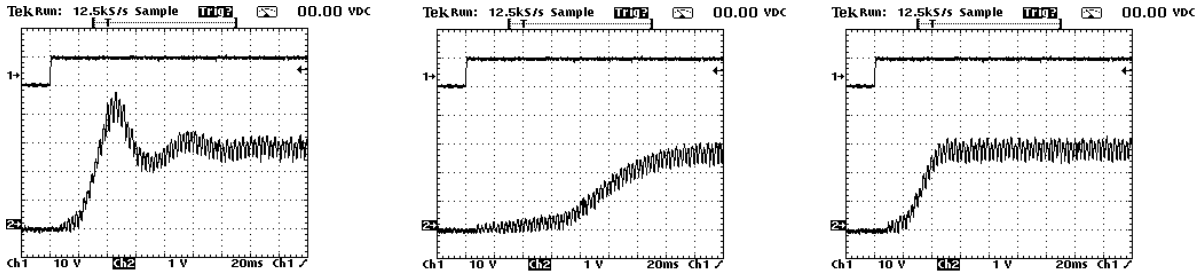


Figure 5

Velocity Loop

In order to adjust properly, connect an oscilloscope to Analog Output 1 Terminal 21 (Velocity Feedback). Using the HMI, temporarily set the **Ramp Bypass (305)** parameter to True. Run the drive and apply a step change to the external speed reference. Observe the response to the drive. The motor speed should respond quickly with minimum overshoot. Adjust the **Velocity Proportional Gain (201)** and **Velocity Integral Time (202)** parameters to obtain a critically damped waveform as seen in Figure 6. Increasing the proportional gain improves the response but increases the overshoot. Reducing the integral time improves the response but can cause instability if set too low. Once complete, return **Ramp Bypass (305)** to False.

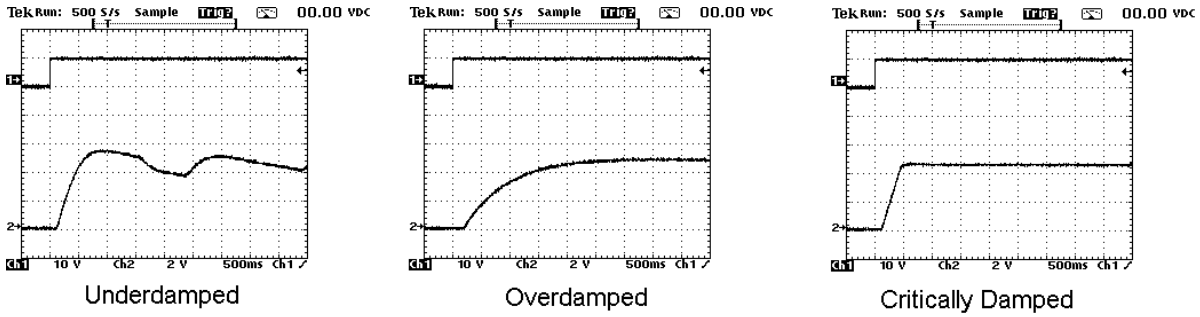


Figure 6

6.7 Password Protection

If password protection is required, set the appropriate passwords under the Setup|Security section.

7 Programming & Adjustments

Programming and adjustment of the Elite Pro is accomplished by changing parameter settings. Each parameter has a descriptive name and a tag (or number) identifier. Parameters are grouped together in blocks according to their function. The following sections contain each software block diagram and descriptions of each parameter function. Refer to Figure 7 for key conventions that are used in the block diagrams. Each parameter is one of three types: Read-Only (RO), Inhibit Change while Running (ICR), or Read-Write (RW). ICR parameters can be changed only when the drive is in the Stop mode.

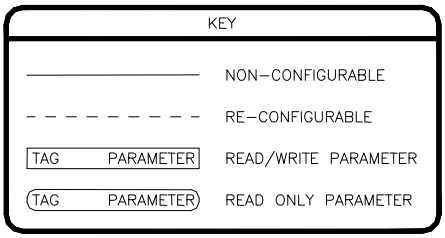


Figure 7

Note: When parameters are altered, the changes must be saved,

otherwise changes will be lost after a drive reset or power loss. Whenever the user exits the Programming section, the drive will prompt you to save parameters. The Save command is also accessible in the Setup|Programming|Misc Parameters|System section and the Quick Programming Menu 15 (QP15).

7.1 Accel/Decel Block

The Accel/Decel block controls the rate at which a reference changes.

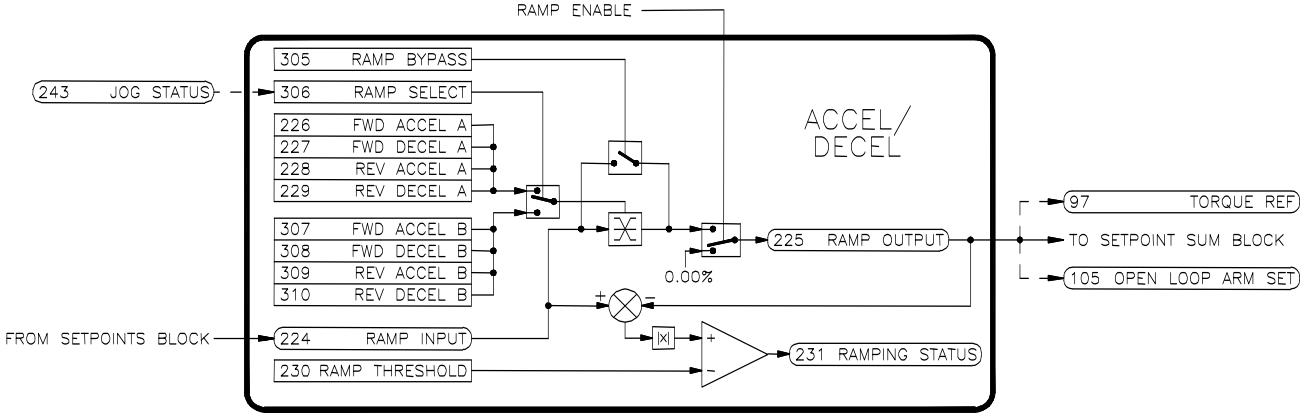


Figure 8

Ramp Bypass (305)
Ramp Bypass disables the Accel/Decel rates and simply passes the **Ramp Input** through to the **Ramp Output**.

Ramp Select (306)
Ramp Select selects between two independently adjustable ramp blocks. This parameter is preset to use Block A in the RUN mode and Block B in the Jog mode.

Forward/Reverse Accel/Decel A/B (226-229, 307-310)
The accel and decel adjustments control the amount of time that it takes for the reference to make a 100% change.

Ramp Input (224, Read-Only)
Input level from the Setpoints block.

Ramp Output (225, Read-Only)
Output level. The factory preset configuration links this parameter to **Torque Reference**, & **Open Loop Arm Set**.

Ramping Status (231, Read-Only)
The **Ramping Status** parameter signals when **Ramp Output** is changing.

Ramp Threshold (230)
Ramp Threshold adjusts the level at which the **Ramping Status** parameter is active.

7.2 Setpoints Block

The Setpoints block selects between multiple references.

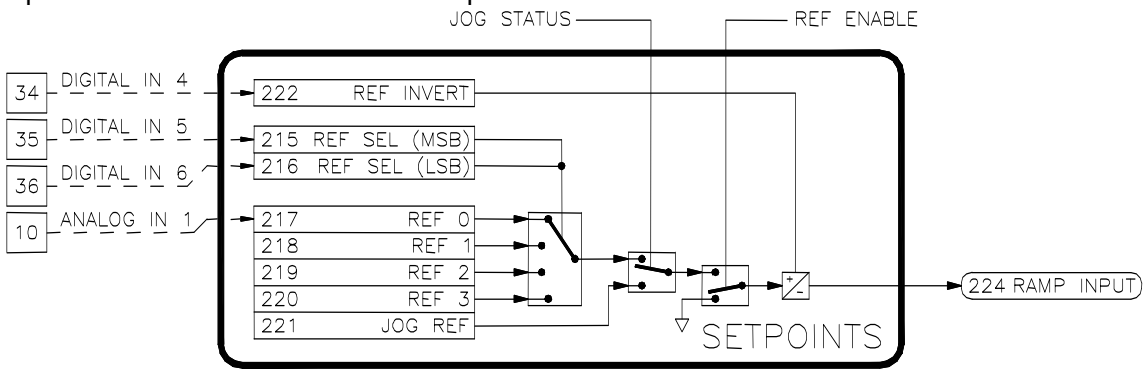


Figure 9

Reference n (217-220)
Internal references 0-3 are 4 independently adjustable references that can be used in the Run mode. **Analog Input 1** is factory preset to Reference 0.

Jog Reference (221)
Internal reference that is used in the Jog mode.

Reference Select (215, 216)
The **Reference Select** parameters select between the 4 internal references. Parameter 215 in the Most Significant Bit (MSB) and parameter 216 is the Least Significant Bit (LSB). In the factory preset configuration, Digital Inputs 5 and 6 control the **Reference Select** parameters and ignore input from the keypad. If no external input is controlling the parameters, the Toggle softkey on the keypad scrolls through each of the selections.

MSB	LSB	Reference
0	0	Ref 0
0	1	Ref 1
1	0	Ref 2
1	1	Ref 3

Table 6: Reference Selection

Reference Invert (222)
The **Reference Invert** parameter inverts the polarity of the selected reference.

7.3 Setpoint Sum Block

The Setpoint Sum Block sums 4 different references to obtain the **Velocity Demand**.

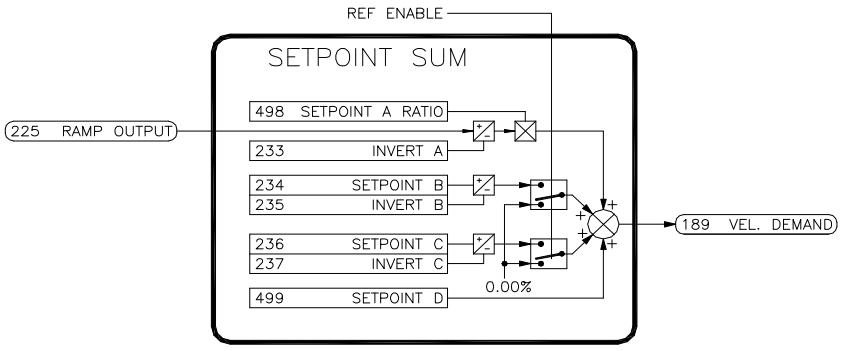


Figure 10

Setpoint A Ratio (498)
Allows scaling of the Ramp Output signal before being summed with Setpoints B & C.

Setpoing D (499)
This parameter differs from Setpoints B & C in that it is not clampded when the drive is in the Stop or Ramp Stop modes. An application block's output is typically linked here when it uses the the Ramp Output parameter. Use this parameter with caution! This signal must be clamped external to this block or the drive will not stop when commanded.

7.4 Start/Stop Logic Block

The Start/Stop Logic block controls the starting and stopping of the Elite Pro. If the drive is running when **Drive Ready** becomes False, the contactor will open and the motor will coast to a stop. The drive cannot enter the Run or Jog modes while **Drive Ready** is False.

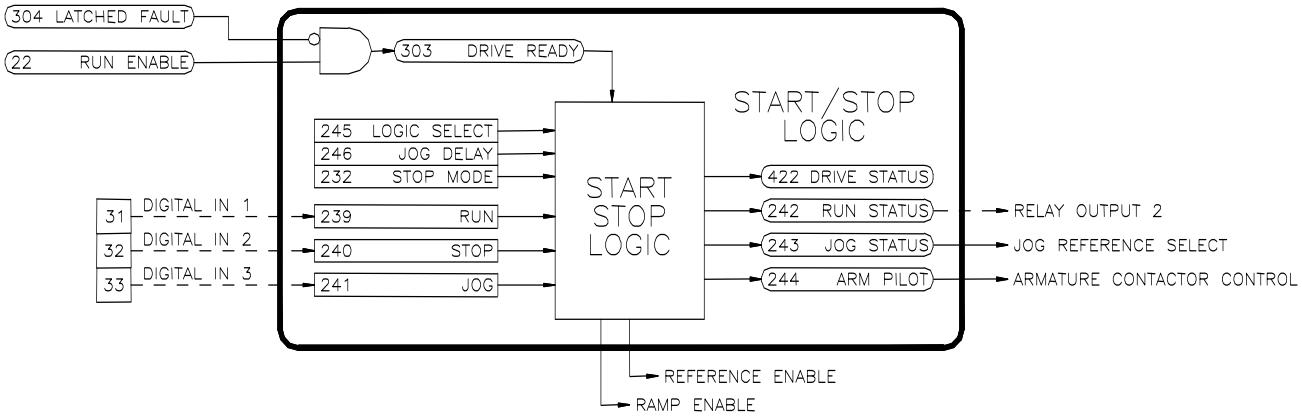


Figure 11

Logic Select (245)
The **Logic Select** allows the customer to choose between 3 wire (momentary) or 2 wire (maintained) run control inputs. The **Jog** input is always a maintained input regardless of this selection. The Factory preset is 3 wire. Warning, when in 2 wire (maintained) mode, the **Stop** control input is not functional. Starting and stopping of the drive is controlled by **Run** control input.

Jog Delay (246)
This adjustment serves to extend the mechanical life of the armature contactor by reducing the number of mechanical operations in an application where a high rate of repeat "jogging" is performed. When the Jog button is pressed and then released, the reference is immediately clamped to stop the motor but the contactor is held energized for up to ten seconds. Pressing the Jog button again within this "delay" period will cause the motor to immediately jog and will reset the delay.

Run (239)
The **Run** control input is used to put the drive into the run mode. Depending on the **Logic Select** parameter, this input can be either momentary or maintained. **Digital input 1** writes to this parameter in the factory preset configuration. **Drive Ready** must be True for this input to operate.

Stop (240)
The **Stop** control input is used to stop the drive when **Logic Select** is set for 3 Wire (momentary) mode. The manner in which the drive is stopped is controlled by the **Stop Mode** parameter. **Digital input 2** writes to this parameter in the factory preset configuration.

Stop Mode (232)
The **Stop Mode** parameter selects between 3 type of stopping methods. The Ramp Stop selection will stop the drive using the Accel/Decel rates. Quick Stop provides a rapid current-limit stop. The Coast Stop selection clamps all the loops, and allows the motor to coast to stop. Stopping time will be determined by the inertia, friction, and loading characteristics.

Jog (241)
The **Jog** control input is used to run the drive while the Jog button is pressed. The Jog Reference is selected instead of References 0-3 in the Setpoints block. Digital input 3 writes to this parameter in the factory preset configuration. **Drive Ready** must be True for this input to operate.

Run Status (242, Read-Only)
The **Run Status** is a status output that becomes True when the drive is in the Run mode. In the factory preset configuration, this parameter controls **Relay Output 2**.

Jog Status (243, Read-Only)
The **Jog Status** is a status output that becomes True when the drive is in the Jog mode. In the factory preset configuration, this parameter writes to Ramp Select in the Accel/Decel block.

Armature Pilot (244, Read-Only)
The **Armature Pilot** is a status output that becomes True when the drive is in the Run or Jog modes. This output is used to control the armature contactor.

Drive Ready (303, Read-Only)
The **Drive Ready** parameter indicates the status of the drive. If there are no latched faults and the **Run Permit** input is True, **Drive Ready** is True and the drive can be started. If at any time there is a fault or the **Run Permit** becomes False, **Drive Ready** is forced to the False state and the drive is shutdown. In the factory preset configuration, this parameter controls **Relay Output 3**.

Drive Status (422, Read-Only)
The Drive Status parameter indicates the state of the Elite Pro drive. Refer to Table 7. Note this parameter is not directly accessible from the keypad.

Drive Status	Elite Pro Mode
0	Stop
1	Run
2	Ramping to Stop (from Run)
3	Jog
4	Ramping to Stop (from Jog)
5	Jog Delay
6	Quick Stop
7	Coast Stop
8	Emergency Stop

Table 7: Drive Status

7.5 Zero Speed Logic Block

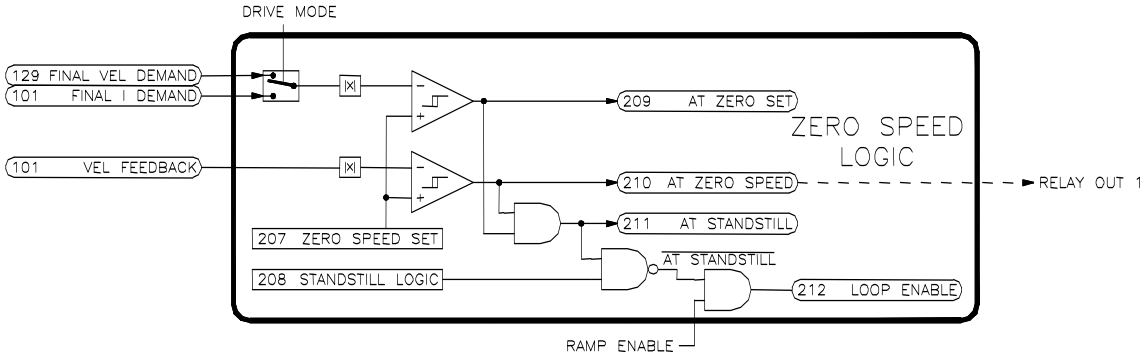


Figure 12

Zero Speed Setpoint (207)
The **Zero Speed Setpoint** parameter sets the Zero Speed threshold. This level determines the speed at which the control loops are clamped and the armature contactor is de-energized after a Stop command has been given to the drive.

At Zero Set (209, Read-Only)
When in velocity mode, **At Zero Set** is True when the **Final Velocity Demand** is below the **Zero Speed Setpoint**. Likewise, when in torque mode, **At Zero Set** is True when the **Final Current Demand** is below the **Zero Speed Setpoint**.

At Zero Speed (210, Read-Only)
At Zero Speed is True when the **Velocity Feedback** is below the **Zero Speed Setpoint**.

At Standstill (211, Read-Only)
At Standstill is True when the when **At Zero Set** and **At Zero Speed** are True.

Standstill Logic (208)
In applications where the drive is in the Run mode with zero velocity reference, motor creepage may be apparent under some load conditions. Setting **Standstill Logic** to True will cause the Velocity Loop and Current Loops to be disabled when **At Standstill** is True, eliminating motor creepage. Note that **Standstill Logic** should not be used in applications where the drive is required to produce holding torque or tension at Zero Speed. **Standstill Logic** can also cause delays when the armature bridge switches direction in regenerative models under certain loading conditions.

Loop Enable (212, Read-Only)
The **Loop Enable** parameter determines if the Velocity and Control Loops are active. **Loop Enable** is controlled by the **Standstill Logic** and Ramp Enable.

7.6 Velocity Loop Block

The Velocity Loop uses a closed loop Proportional-Integral (PI) loop to maintain desired speed. The Loop Enable output from the Zero Speed Logic Block determines when the PI loop is active.

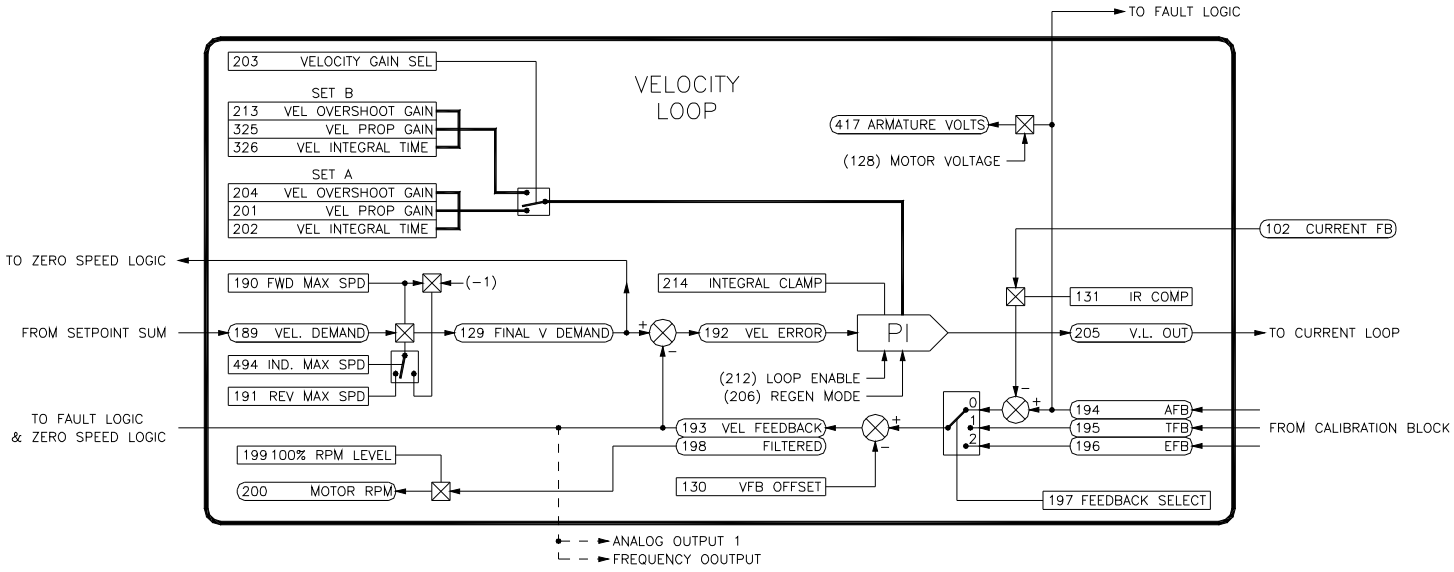


Figure 13

Velocity Demand (189, Read-Only)
The **Velocity Demand** is the main input to the velocity loop.

Independent Speed Scales (494)
When this parameter is True, the max speed scaling is set by two separate parameters, **Forward Max Speed** and **Reverse Max Speed**. When False, both the forward and reverse speed levels are adjusted by the **Forward Max Speed**.

Forward Max Speed (190)
The **Forward Max Speed** parameter scales the **Velocity Demand** signal for the forward direction. Thus, this parameter sets the maximum allowable speed of the drive in the forward direction. When **Independent Speed Scales** is False, this parameter sets the maximum speed for the reverse direction as well.

Reverse Max Speed (191)
When **Independent Speed Scales** is True, the **Reverse Max Speed** parameter scales the **Velocity Demand** signal for the reverse direction. Thus, this parameter sets the maximum allowable speed of the drive in the reverse direction.

Final Velocity Demand (129, Read-Only)
The **Final Velocity Demand** equates to the **Velocity Demand** after it has been scaled by the **Forward Max Speed Scale** or **Reverse Max Speed Scale** adjustments. The **Final Velocity Demand** level is the desired speed reference for the PI loop.

Armature Feedback (AFB, 194, Read-Only)
Armature Feedback uses the motor voltage as a velocity feedback. **AFB** must be selected if

no other feedback device such as a tachometer or encoder is used. Even if another feedback device is used, **Feedback Select** should be set to **AFB** initially to verify proper operation of the external feedback device. The IR Comp signal sums with the AFB signal to become the Velocity Feedback.

Tachometer Feedback (TFB, 195, Read-Only)
Tachometer Feedback displays the level of feedback from an externally connected D.C. or A.C. tachometer. This level is dependent on parameters **AC Tach**, **Invert Feedback**, and the jumpers J5, J6, and J7 on the control board.

Encoder Feedback (EFB, 196, Read-Only)
Encoder Feedback displays the level of feedback from an externally connected quadrature encoder. This level is dependent on parameters **Invert Feedback**, **Encoder Lines**, and **100% Encoder RPM**.

Feedback Select (197, ICR)
Feedback Select chooses one of the three feedback signals: **AFB**, **TFB**, or **EFB**.

Velocity Feedback (193, Read-Only)
The feedback signal designated by **Feedback Select** and the **Velocity Feedback (VFB) Offset** parameters are summed together to produce the **Velocity Feedback**. This parameter value is also filtered to produce an averaged reading.

IR Compensation (131)
Internal Resistance losses in the motor armature can cause decreased speed regulation on loaded motors when using armature voltage as the velocity feedback. The **IR Comp** adjustment can be used to increase the speed regulation by summing a small amount of negative **Current Feedback** with the **Armature Voltage Feedback**. Refer to Section 6.4 for detailed adjustment procedure.

VFB (Velocity Feedback) Offset (130)
This adjustment allows any offset in the velocity feedback circuit to be nulled. Proper adjustment should yield 0.00% at the **Velocity Feedback** parameter when the drive is not turning.

Velocity Error (192, Read-Only)
The **Final Velocity Demand** and the **Velocity Feedback** signals are summed together to produce the **Velocity Error** for the PI loop.

Velocity Gain Select (203)
The Velocity PI loop uses three adjustments (**Proportional Gain**, **Integral Time**, & **Velocity Overshoot Gain**) to fine-tune the response of the drive. As the application process is running, external conditions or variables may change (diameter of a roll for example). In some cases, it may be desirable to switch to an alternate set of loop adjustments so that the drive can better respond to the new operating conditions. The **Velocity Gain Select** parameter selects between two sets of Velocity Loop parameters, sets A and B.

Velocity Gain Select	Set Selected
0	A
1	B

Table 8: Velocity Gain Selection

Velocity Proportional Gain (201, 325)
The **Velocity Proportional Gain** scales the output based upon the **Velocity Error**. Increasing the gain improves the response of the drive but can also increase overshoot.

Velocity Integral Time (202, 326)
The **Velocity Integral Time** adjustment eliminates steady-state error. Decreasing the integral time improves the response of the drive. However, setting it too low can cause oscillation. The adjustment is in seconds and corresponds to the amount of time that the signal would take to integrate from 0 to maximum with 100% **Velocity Error**.

Velocity Overshoot Gain (204, 213)
The **Setpoint Weight** parameter can be used to control the amount of overshoot. Adjustment of the **Velocity Integral Gain** and **Velocity Integral Time** parameters should be done with the **Setpoint Weight** set to 100%. This in effect gives standard PI loop operation. If needed, the **Setpoint Weight** can then be reduced.

Integral Clamp (214)
When **Integral Clamp** is True, the integral signal is clamped to zero in the PI loop, yielding proportional control only.

Velocity Loop Output (205, Read-Only)
The output of the Velocity PI loop. This is the input to the Current PI loop when in velocity mode.

Armature Voltage (417, Read-Only)
The AFB signal along with the **Nameplate Motor Voltage** is used to calculate the actual **Armature Voltage**.

100% RPM Level (199)
The **100% RPM Level** is used to scale the **Filtered Velocity Feedback**, which is in percentage, to RPM. Enter the corresponding RPM level that the drive runs when at 100% speed.

Motor RPM (200, Read-Only)
This is the actual speed of the motor as calculated by the **100% RPM Level** and the **Filtered Velocity Feedback** measurement.

7.7 Current Loop Block

The Current Loop uses a closed loop Proportional-Integral (PI) loop to maintain desired armature current or motor torque. The Loop Enable output from the Zero Speed Logic Block determines when the PI loop is active.

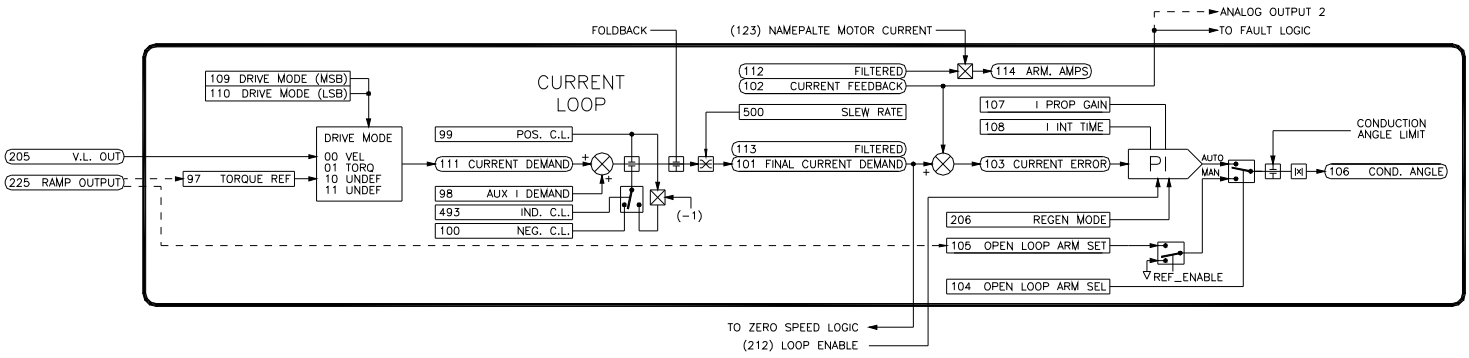


Figure 14

Drive Mode (109, 110)
The two mode select parameters determine the operating mode of the drive. Parameter 109 in the Most Significant Bit (MSB) and parameter 110 is the Least Significant Bit (LSB). The Toggle softkey on the keypad scrolls through each of the selections.

MSB	LSB	Mode
0	0	Velocity
0	1	Torque
1	0	Undefined (1)
1	1	Undefined (2)

Table 9: Drive Modes

Torque Reference (97)
When in Torque mode, the **Current Demand** is equal to the **Torque Reference**. The **Velocity Loop Output** is ignored. The Ramp Output writes to this parameter in the factory preset configuration.

Current Demand (111, Read-Only)
When in Velocity mode, the **Current Demand** is equal to the **Velocity Loop Output**. **Torque Reference** is ignored.

Auxiliary Current Demand (98)
The **Auxiliary Current Demand** serves as a bias that is summed with the **Current Demand** signal.

Independent Current Limits (493)
When this parameter is True, the current limit levels are set by the two separate adjustments, **Positive Current Limit** and **Negative Current Limit**. When False, both the positive and negative current limit levels are adjusted by the **Positive Current Limit**.

Positive Current Limit (99)
This adjustment sets the maximum level of positive current that can be demanded by the current loop. Positive current is used when the drive is motoring in the forward direction or regenerating in the reverse direction. When **Independent Current Limits** is False, this parameter also sets negative current limit level.

Negative Current Limit (100)
When **Independent Current Limits** is False, this adjustment sets the maximum level of negative current that can be demanded by the current loop. Negative current is used when the drive is motoring in the reverse direction or regenerating in the forward direction.

Slew Rate Limit (500)
This parameter limits the rate of change of the Current Demand. The setting is as follows:

$$\text{Slew Rate (Amps/sec)} = \frac{\text{p[123]} \times 6f \times \text{p[500]}}{100}$$

where p[123] is parameter 123 Nameplate Motor Current, f is line frequency (typically 50 or 60 Hz), and p[500] is parameter 500 Slew Rate Limit. Note: setting this adjustment to zero disables the slew rate limit function.

Final Current Demand (101, filtered-113, Read-Only)
The **Current Demand** and **Auxiliary Current Demand** signals sum together and are limited by the **Positive Current Limit** and **Negative Current Limit** parameters to form the **Final Current Demand**. This signal can also be limited by the Foldback logic to 107%. A filtered

version of this signal is also provided (113).

Current Feedback (IFB, 102, filtered-112, Read-Only)
The **Current Feedback** is derived from two of the three incoming AC lines and is used by the PI loop to regulate the amount of armature current in the motor. The signal is also used to provide **IR Compensation** to the AFB signal in the Velocity Loop. A filtered version of this signal is also provided (112).

Current Error (103, Read-Only)
The **Final Current Demand** and the **Current Feedback** sum together to form the **Current Error** signal for the PI loop.

Current Proportional Gain (107)
The **Current Proportional Gain** scales the output based upon the **Current Error**. Increasing the gain improves the response of the drive but can also increase overshoot.

Current Integral Time (108)
The **Current Integral Time** adjustment eliminates steady-state error. Decreasing the integral time improves the response of the drive. However, setting it too low can cause oscillation. The adjustment is in seconds and corresponds to the amount of time that the signal would take to integrate from 0 to maximum with 100% **Current Error**.

Regen Mode (206, ICR)
When set to False, the **Regen Mode** parameter allows Elite Pro Regenerative models to emulate a non-regen drive by clamping the negative portions of the Velocity Integral and Current Integral signals. On non-regen drives, this parameter is ignored.

Open Loop Armature Select (104, ICR)
When set to True, the conduction angle sent to the trigger board can be manually controlled by **Open Loop Armature Setpoint**. This diagnostic tool can be used to eliminate the Velocity and Current Loops from the control. Care must be taken when using this mode because there is no current limit protection. Remember to set this parameter back to False once diagnosis is complete.

Open Loop Armature Setpoint (105)
When **Open Loop Armature Select** is True, **Open Loop Armature Setpoint** sets the **Conduction Angle** directly. The **Ramp Output** parameter writes to this parameter in the factory preset configuration.

Conduction Angle (106, Read-Only)
Normally the **Conduction Angle** is the output of the Current Loop. However, if **Open Loop Armature Select** is True, the **Conduction Angle** equals **Open Loop Armature Setpoint**. This signal controls the SCRs in the armature bridge circuit.

Armature Amps (114, Read-Only)
Armature Amps displays the actual motor current from the **Filtered Current Feedback** signal and the **Nameplate Motor Current** parameters.

7.8 Field Loop Block

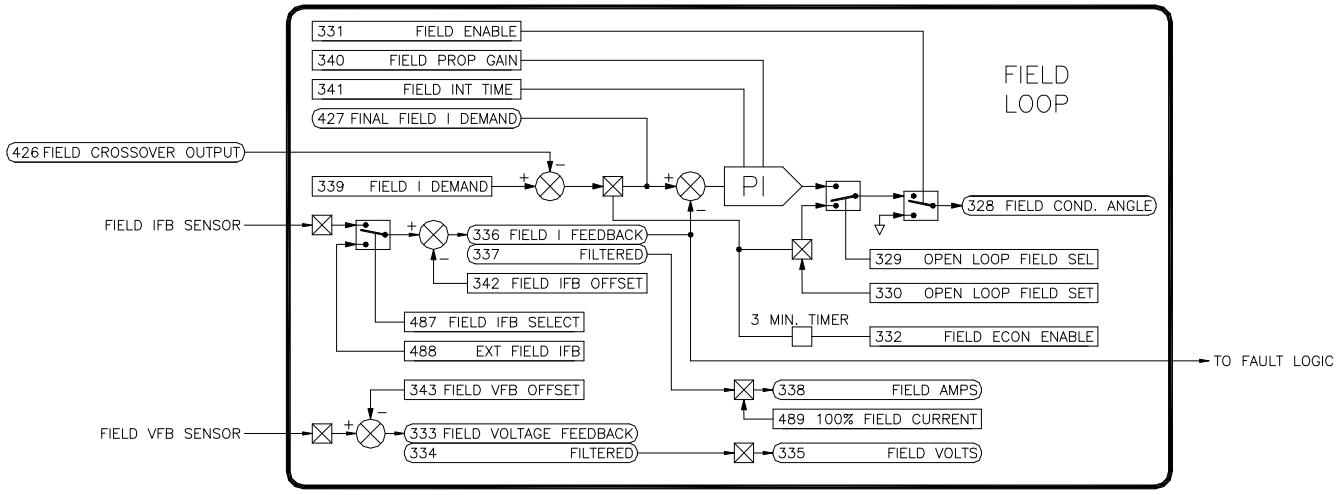


Figure 15

Field Enable (331, ICR)

Field Enable must be set to True in order for the Elite Pro to produce any field output.

Field Current Demand (339)

The **Field Current Demand** is an input that sets the desired level of field current.

EPx020-000 thru EPx060-000 models:

$$\text{Field I Demand (339)} = \frac{\text{Nameplate Field Amps}}{8\text{A}} \times 100\%$$

EPx075-000 thru EPx150-000 models:

$$\text{Field I Demand (339)} = \frac{\text{Nameplate Field Amps}}{10\text{A}} \times 100\%$$

EPx200-000 thru EPx600-000 models:

$$\text{Field I Demand (339)} = \frac{\text{Nameplate Field Amps}}{12\text{A}} \times 100\%$$

Final Field Current Demand (427)

The **Field Crossover Output** is subtracted from **Field Current Demand** to produce the Final Field Current Demand signal. Note that this signal can be scaled down if the drive enters the Field Economy mode.

Field Current Feedback (336, Read-Only)

The **Field Current Feedback** is used by the Field PI loop to regulate the field current in the closed loop mode. This signal sums with the Field Current Demand to produce an error signal that is the input to the PI loop.

Field Proportional Gain (340)

The **Field Proportional Gain** scales the output based upon the error. Increasing the gain improves the response of the field but can also increase overshoot.

Field Integral Time (341)

The **Field Integral Time** adjustment eliminates steady-state error. Decreasing the integral time improves the response. However, setting it too low can cause oscillation. The adjustment is in seconds and corresponds to the amount of time that the signal would take to integrate from 0 to maximum with 100% error.

Open Loop Field Select (329)

When set to True, the field supply operates in manual or open loop voltage control. The **Open Loop Field Setpoint** is used as the **Field Conduction Angle** for the field SCRs. This produces a voltage output on the field. When set to False, the field operates in the automatic

or closed loop current control. The field current is regulated by the Field PI loop.

Open Loop Field Setpoint (330)
When **Open Loop Field Select** is True, this parameter controls the **Field Conduction Angle**. Note that this signal can be scaled down if the drive enters the Field Economy mode.

Field Conduction Angle (328, Read-Only)
This parameter shows the level of field conduction. In open loop operation, this parameter is equal to the **Open Loop Field Setpoint**. In closed loop control, this is the output of the Field PI Loop.

Field Economy Enable (332)
The Elite Pro Field Economy feature can help extend the life of a motor by reducing motor heating due to the field. The field voltage or current can automatically be reduced when the drive is in the Stop mode after a 3 minute delay. The field will automatically return to its normal level when the Run or Jog mode is entered. This feature can be enabled by setting this parameter to True. In open loop mode, the field is reduced by about 56%. In closed loop control, the field current is reduced by 50%. If the **Min Field I Demand** (Field Crossover block) parameter is set to a value other than 0.00%, the field is reduced to this value.

Field IFB (Current Feedback) Offset (342)
This adjustment allows any offset in the Field IFB circuit to be nulled. Proper adjustment should yield 0.00% at the **Field Current Feedback** parameter when no field current is present.

Field Voltage Feedback Offset (343)
This adjustment allows any offset in the Field VFB circuit to be nulled. Proper adjustment should yield 0.00% at the **Field Voltage Feedback** parameter when no field current is present.

Field Amps (338, Read-Only)
This parameter contains the actual field current in amps. This value is scaled by the **100% Field Amps** only when the **Field Current Feedback Select** is set to external.

Field Voltage (335, Read-Only)
This parameter contains the actual field voltage in volts.

Field Current Feedback Select (487)
Set this parameter to external when interfacing to an external field current regulator.

External Field Current Feedback (488)
This parameter is used when interfacing to an external field current regulator. Typically, an analog input is used to provide the current feedback signal.

100% Field Current (489)
Scales the **Field Amps** display only when **Field Current Feedback** is external.

7.9 Field Crossover Block

Field Crossover (also called field weakening or constant horsepower) control allows motor operation above base speed by reducing the field current. Stable operation is achieved by allowing the armature voltage to control the field current. An external tachometer or encoder feedback signal is necessary for proper operation (i.e. armature feedback cannot be used).

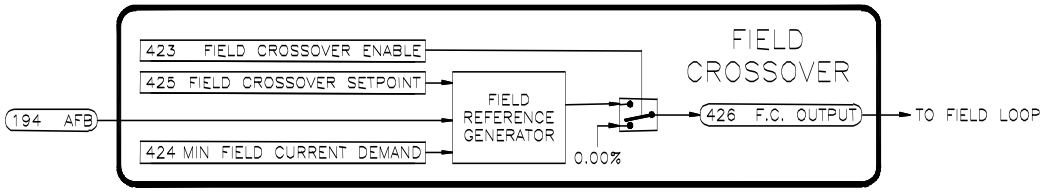


Figure 16

Field Crossover Enable (423, ICR)
Field Crossover control is enabled when set to True.

Field Crossover Setpoint (425)
The **Armature Feedback** level at which Field Crossover operation begins. Typically, this parameter is set to 85%. As the **Armature Feedback** increases beyond this threshold, the field current is reduced. When rated armature voltage is reached (at 100%), the field current will have been reduced to the **Minimum Field Current Demand** level.

Minimum Field Current Demand (424)
The minimum level to which the field current can be reduced. The motor nameplate and/or databook will commonly list this value as the rated field current for top speed. This parameter should be set accordingly:

EPx020-000 thru EPx060-000 models:

$$\text{Minimum Field Current Demand (424)} = \frac{\text{Nameplate Top Speed Field Amps}}{8\text{A}} \times 100\%$$

EPx075-000 thru EPx150-000 models:

$$\text{Minimum Field Current Demand (424)} = \frac{\text{Nameplate Top Speed Field Amps}}{10\text{A}} \times 100\%$$

EPx200-000 thru EPx600-000 models:

$$\text{Minimum Field Current Demand (424)} = \frac{\text{Nameplate Top Speed Field Amps}}{12\text{A}} \times 100\%$$

Field Crossover Output (426, Read-Only)
The output of the Field Crossover block is used to subtract from the **Field Current Demand** setpoint in the Field Loop.

7.10 Digital Inputs Block

The Elite Pro has 7 customer configurable digital inputs. Each digital input can write a value to any writable parameter. An additional digital input is the **Run Permit**.

Destination (1-7, ICR)
The tag number of the parameter where the digital input information is to be sent.

Open Value (8-14)*
When the pushbutton on the digital input is open, the value in this parameter is sent to the destination parameter.

Closed Value (15-21)*
When the pushbutton on the digital input is closed, the value in this parameter is sent to the destination parameter.

Status (132-138, Read-Only)
Each digital input state can be viewed for diagnostic purposes.

Run Enable (22, Read-Only)
Typically, an Emergency Stop button and motor thermostat are connected in series to the **Run Enable** digital input. This input signals the drive to immediately de-energize the armature contactor pilot relay and clamp all loops.

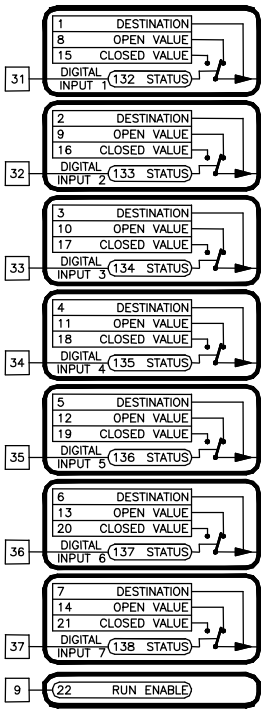


Figure 17

* Note that the units and number of decimal places of this parameter will change to match that of the Destination parameter.

Example - Digital Input
Using Digital Input 4 to select between two Jog speed references of 20.00% and 40.00%:

1. While the drive is stopped, go to Setup|Programming|Inputs|Digital|Digital Input 4 menu.
2. Set Digital Input 4 **Destination** to **Jog Reference** (221).
3. Set Digital Input 4 **Open Value** to 20.00%.
4. Set Digital Input 4 **Closed Value** to 40.00%.

Digital Input 4 will now write the value of 20.00% to **Jog Reference** when the pushbutton is open. When closed, it will write the value of 40.00%.

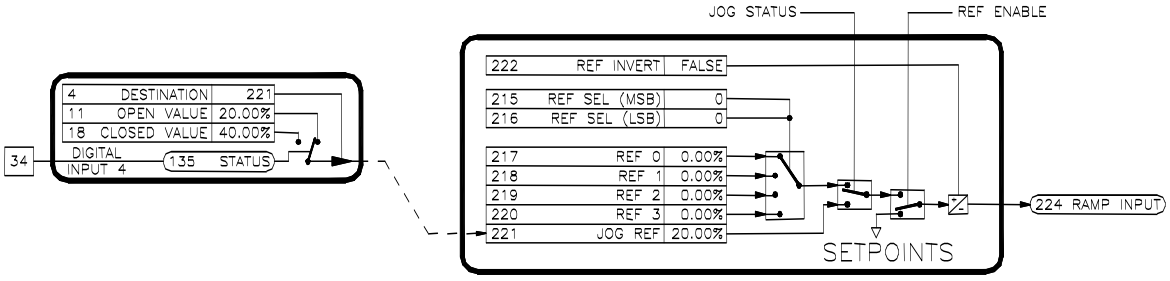


Figure 18

7.11 Analog Inputs Block

The Elite Pro has 5 customer configurable analog inputs. Analog inputs 1-4 can be configured as voltage or current inputs. Analog input 5 is hardwired as a voltage input. Each input can be configured to write to any writeable parameter.

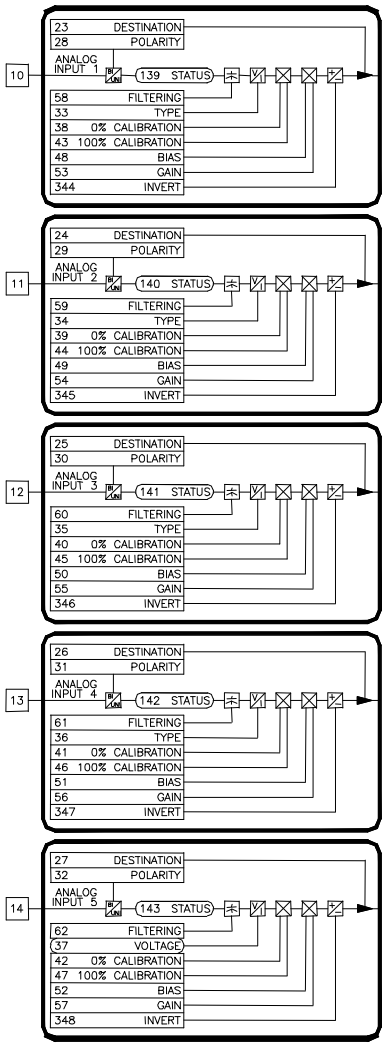


Figure 19

Destination (23-27, ICR)
The tag number of the parameter where the analog input information is to be sent.

Polarity (28-32)
If the input signal is positive only, set to Unipolar. Otherwise, set to Bipolar for positive and negative inputs.

Filtering (58-62)
An averaging filter can be applied to the incoming signal to reduce the effects of noise. Increasing the value increases the filtering.

Type (33-37)
Select either Voltage or Current depending on the type of input signal. Note that Analog Input 5 is hardwired as a Voltage input.

Calibrate Analog Input
The Calibrate Analog Input screen provides menu assisted instructions for setting the 0% Calibration and 100% Calibration parameters.

0% Calibration (38-42)
This calibration value corresponds to the 12 bit value from the A2D when the input signal is at zero for bipolar signals, and the minimum signal for unipolar signals. This defines 0% input signal. For proper operation, the **0% Calibration** value must be

less than the **100% Calibration** value.

100% Calibration (43-47)
This calibration value corresponds to the 12 bit value from the A2D when the input signal is at its maximum level. This defines 100% input signal. For proper operation, the **100% Calibration** value must be greater than the **0% Calibration** value.

Bias (48-52) Refer to footnote on p.32
The **Bias** parameter is only used in unipolar inputs and defines the minimum value when 0% signal is input.

Gain (53-57) Refer to footnote on p.32
The **Gain** parameter defines the value when the input is at 100%.

Invert (344-348)
When set to True, the analog input value is inverted before being sent to the destination parameter.

Status (139-143, Read-Only)
Each analog input A2D reading can be viewed for diagnostic purposes. The resolution and scaling of the inputs are dependent upon the Bipolar and Type parameters. See chart below for typical readings:

Voltage		
	Unipolar	Bipolar
10V	4095	2047
5V	2047	1023
0V	0	0
-5V	-	-1024
-10V	-	-2048

Current		
	Unipolar	Bipolar
20mA	4095	2047
10mA	2047	1023
0mA	0	0
-10mA	-	-1024
-20mA	-	-2048

Table 10: Analog Input Status Readings

Example - Bipolar Analog Input
Setup Analog Input 2 as a bipolar voltage input to control the internal Reference 3 parameter. Define the voltage input so that 5V corresponds to 25.00% speed.

1. While the drive is stopped, go to Setup|Programming|Inputs|Analog|Analog Input 2 menu section.
2. Set **Analog Input 2 Destination** to **Reference 3** (220).
3. Set **Analog Input 2 Polarity** to Bipolar.
4. Set **Analog Input 2 Type** to Voltage.
5. Select Calibrate Analog Input
   - Step 1. Adjust external voltage to 0 Volts. Press ENT when done.
   - Step 2. Adjust external voltage to 5 Volts. Press ENT when done.
   - Step 3. The Elite Pro verifies that the 100% level is greater than the 0% level and displays the actual levels recorded during the calibration process. Press OK when done.
6. The **Analog Input 2 Bias** value is ignored with bipolar inputs.
7. Set **Analog Input 2 Gain** to 25.00%.

When 5V is applied to Analog Input 2, a value of 25.00% is written to the **Reference 3** parameter. When -5V is applied, a value of -25.00% is written to **Reference 3**.

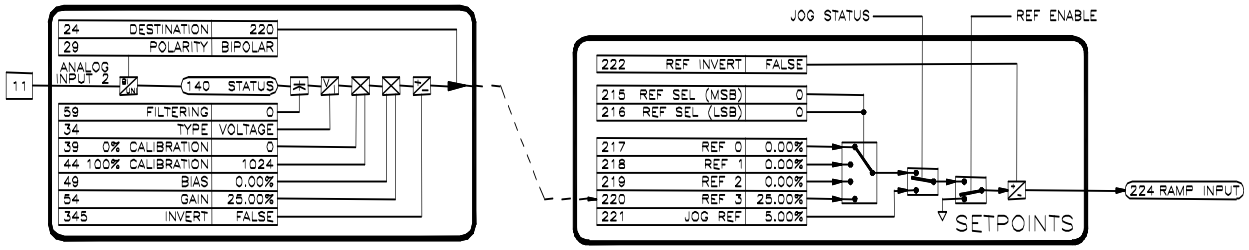


Figure 20

Example - Unipolar Analog Input

Setup **Analog Input 3** as a unipolar current input to control the internal **Setpoint C** parameter. Define the 4-20mA current input to produce 0.00%-75.00% speed.

1. While the drive is stopped, go to Setup|Programming|Inputs|Analog|Analog Input 3 menu section.
2. Set **Analog Input 3 Destination** to **Setpoint C** (236).
3. Set **Analog Input 3 Polarity** to Unipolar.
4. Set **Analog Input 3 Type** to Current.
5. Select Calibrate Analog Input
    Step 1. Adjust external current to 4mA. Press ENT when done.
    Step 2. Adjust external voltage to 20mA. Press ENT when done.
    Step 3. The Elite Pro verifies that the 100% level is greater than the 0% level and displays the actual levels recorded during the calibration process. Press OK when done.
6. Set **Analog Input 3 Bias** to 0.00%.
7. Set **Analog Input 3 Gain** to 75.00%.

When any current signal below 4mA is applied, Setpoint C equates to 0.00%. As the current increases to 20mA, Setpoint C increases to 75.00%.

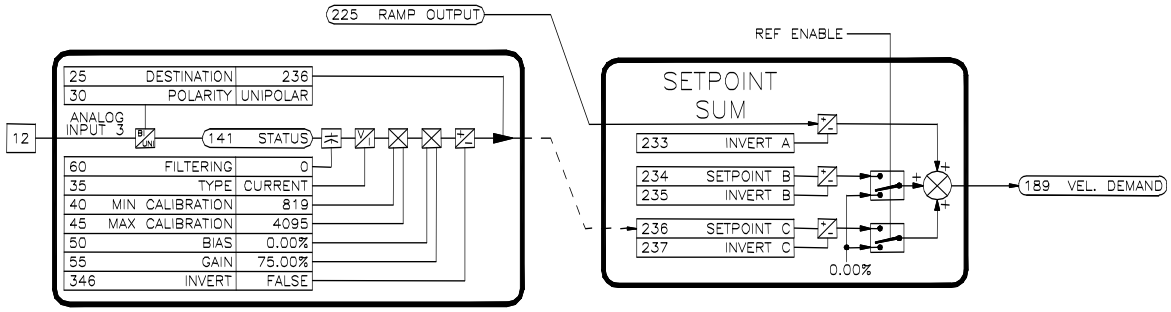


Figure 21

7.12 Frequency Input Block

The Elite Pro has 1 customer configurable frequency input that can be configured to write to any writeable parameter.

Destination (63, ICR)
The tag number of the parameter where the frequency or distance input information is to be sent.

Filtering (68)
A averaging filter can be applied to the incoming signal to reduce the effects of noise. Increasing the value increases the filtering.

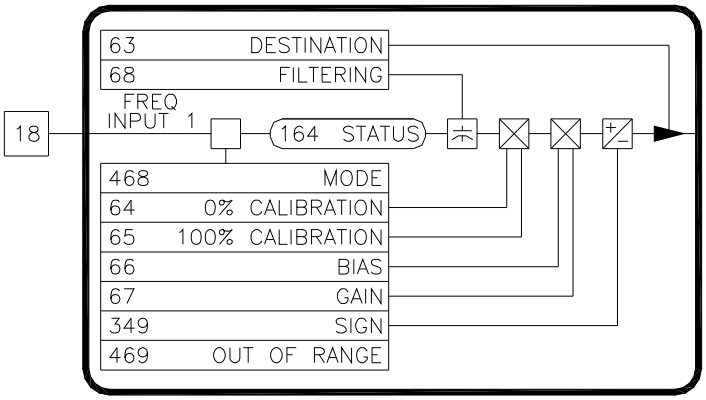


Figure 22

Mode (468)
The frequency input has two modes of operation: frequency or sonic.
In Frequency mode, the input measures the incoming frequency level. In Sonic mode, the input measures the incoming pulse width to determine a distance in inches. This mode requires an external Carotron Sonic transducer assembly.

Calibrate Frequency Input
The Calibrate Frequency Input screen provides menu assisted instructions for setting the 0% Calibration and 100% Calibration parameters.

0% Calibration (64)
This calibration value corresponds to the minimum frequency in Hertz or the minimum distance in inches that the input signal will provide. This defines 0% input signal. For proper operation, the **0% Calibration** value must be less than the **100% Calibration** value.

100% Calibration (65)
This calibration value corresponds to the maximum frequency in Hertz or the maximum distance in inches that the input signal will provide. This defines 100% input signal. For proper operation, the **100% Calibration** value must be greater than the **0% Calibration** value.

Bias (66) Refer to footnote on p.32
The **Bias** parameter defines the minimum value when 0% signal is input.

Gain (67) Refer to footnote on p.32
The **Gain** parameter defines the level written to the destination parameter when the input is at 100%.

Sign (349)
Since a single ended frequency signal has no polarity, the **Sign** parameter can be used to make the input signal positive or negative.

Status (164, Read-Only)
The actual frequency level in Hertz or distance in inches can be viewed for diagnostic purposes.

Out of Range (469)
When the input is in Sonic mode, **Out of Range** will become True anytime the measured distance falls outside of the 0% and 100% calibration levels. For example, if the 0% and 100% calibrations are set as 12.00 inches and 20.00 inches respectively, **Out of Range** will be True for any distance less than 12 or greater than 20 inches. The output value written to the destination parameter is held at its last valid value when **Out of Range** is True.

Example 1 - Frequency Input
Setup the Elite Pro to follow an encoder signal from a lead drive. The max speed of the lead drive is 1750 RPM with a 1024 line encoder. This gives a maximum frequency of 29866 Hz as shown below:

$$1750\frac{\text{revolutions}}{\text{minute}}\times\frac{1\,\text{minute}}{60\,\text{seconds}}\times\frac{1024\,\text{pulses}}{1\,\text{revolution}}=29866\frac{\text{pulses}}{\text{second}}=29866\,\text{Hz}$$

1. While the drive is stopped, go to Setup|Programming|Inputs|Frequency Input menu section.
2. Set the **Frequency Input Destination** to **Setpoint B** (234).
3. Set the **Frequency Input Min Calibration** to 0 Hz.
4. Set the **Frequency Input Max Calibration** to 29866 Hz.
5. Set the **Frequency Input Bias** to 0.00%.
6. Set the **Frequency Input Gain** to 100.00%.

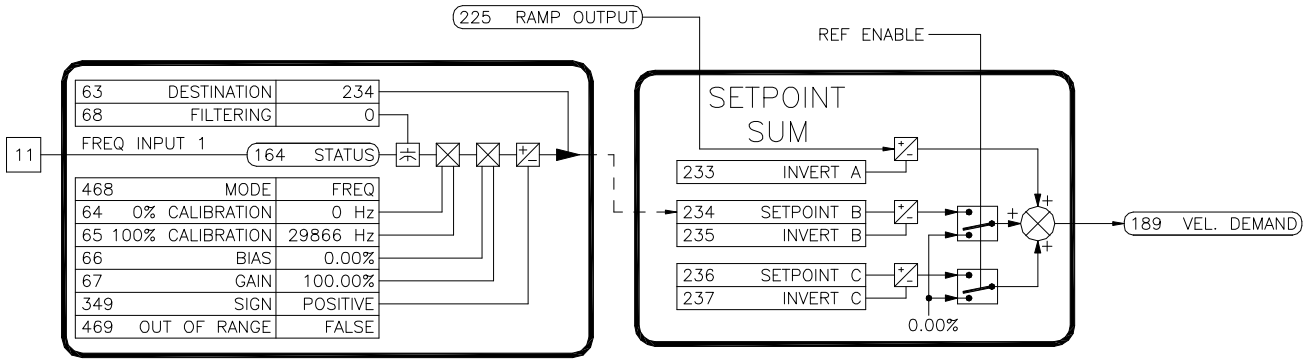


Figure 23

Example 2 - Sonic (Distance) Input
Setup the Elite Pro to measure the diameter of a roll and provide this diameter information to the Winder Speed Calculator.

1. Connect the Sonic transducer per C12671 on page 108. Note Switch SW3 on Control Board must be in Int position.
2. While the drive is stopped, navigate to the Setup|Programming|Outputs|Frequency/Digital Output menu section.
3. Set the **Frequency/Digital Mode** to Sonic.
4. Set **Frequency/Digital Source** to **Aux 1** (115).
5. Go to the Setup|Programming|Miscellaneous Parameters|Auxiliary menu section.
6. Set **Aux Parameter 1** to 0.35% to output a 7 Hz clock signal to the transducer.
7. Go to the Setup|Programming|Inputs|Frequency Input menu section.
8. Set the **Frequency Input Destination** to **Diameter Ratio** (431).
9. With an empty core, observe the distance reading displayed in **Frequency Input Status**.
10. Set **Frequency Input 100% Calibration** to this value (maximum distance).
11. Load a full roll or place an object in front of the transducer to simulate a full roll.
12. Set **Frequency Input 0% Calibration** to the value displayed in **Frequency Input Status** (minimum distance).
13. Set **Frequency Input Bias** to 100.00%.
14. Set **Frequency Input Gain** to 0.00%.

Steps 13 and 14 are done so that the Diameter Ratio value will have the correct sense (i.e., 0.00% at Core and 100.00% at maximum diameter). Thus, with an empty core, the Diameter Ratio parameter should be equal to 0.00%. As the diameter increases to its maximum,

Diameter Ratio should increase to 100.00%.

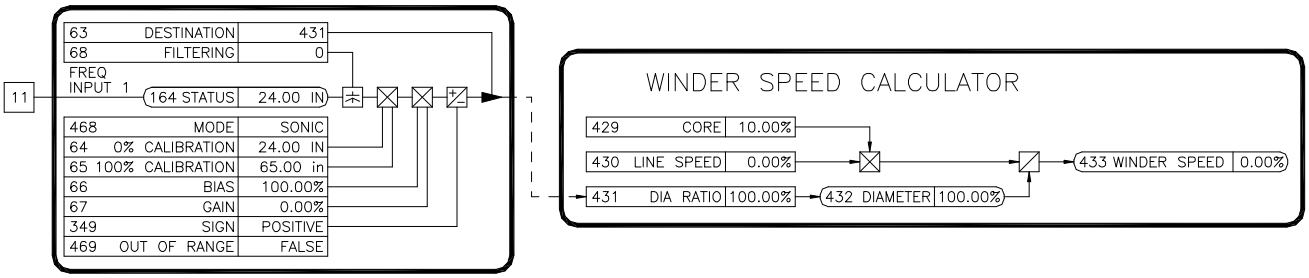


Figure 24

7.13 Relay Outputs Block

The Elite Pro has 3 customer configurable form C relay outputs. Each relay can be configured to turn on (or energize) at a programmable level and turn off (or de-energize) at a different level. Thus the relay outputs have built in hysteresis that can be completely controlled by the customer. Figure 25 shows the relay outputs in the off state.

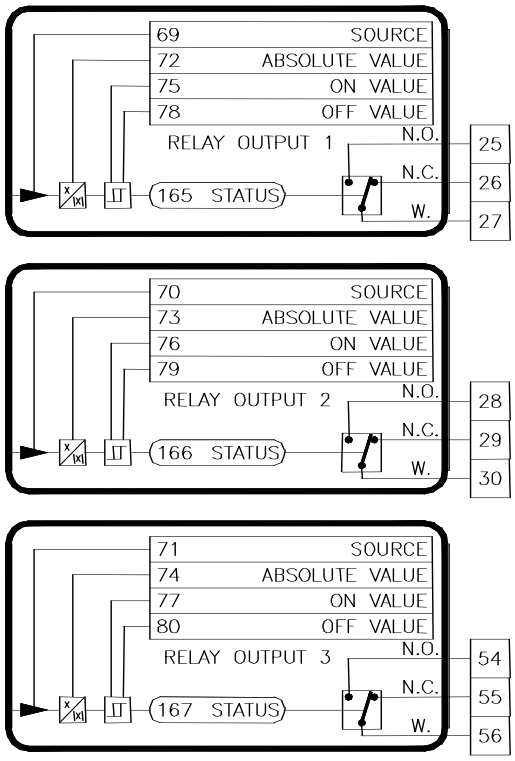


Figure 25

Source (69-71, ICR)
The tag number of the parameter from which data is to be taken.

Absolute Value (72-74)
When **Absolute Value** is True, the absolute value of the source data is used to provide a positive only level. This allows bipolar signals to operate the relays properly regardless of the signal polarity.

On Value (75-77)*
The threshold level that the source signal must equal or exceed in order for the relay to turn on (or energize).

Off Value (78-80) *
The threshold level that the source signal must equal or fall below in order for the relay to turn off (or de-energize).

Status (165-167, Read-Only)
The state of each relay can be viewed for diagnostic purposes. 0 indicates off, 1 indicates on.

Example - Relay Output
Setup Relay Output 2 to signal when the drive speed is above 50% with a hysteresis of 2%.

1. While the drive is stopped, go to Setup|Programming|Outputs|Relay|Relay Output 2 menu section.
2. Set **Relay Output 2** Source to **Velocity Feedback** (193).
3. Set **Relay Output 2 Absolute Value** to True.
4. Set **Relay Output 2 On Value** to 50.00%.

* Note that the units and number of decimal places of this parameter will change to match that of the Source parameter.

5. Set **Relay Output 2 Off Value** to 48.00 %.
   Relay Output 2 will energize when the drive speed equals or exceeds 50.00% and will de-energize when the speed equals or falls below 48.00%. A hysteresis level was used to prevent the relay from 'chattering' (continually energizing and de-energizing) when the drive runs at 50.00% speed. Setting the Absolute Value parameter to True allows the relay to work in the reverse direction as well.

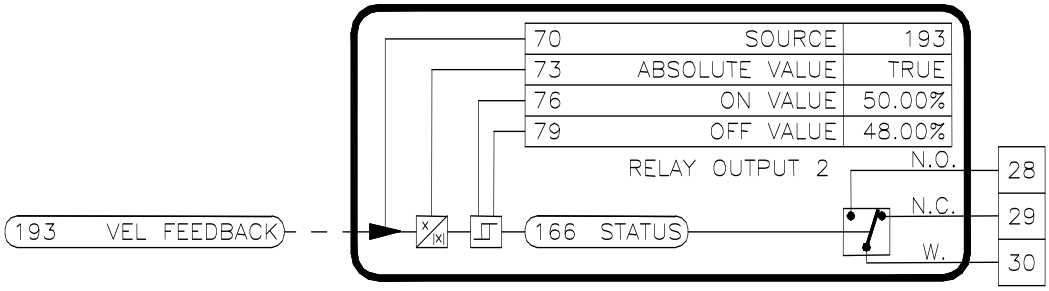


Figure 26

7.14 Analog Outputs Block

The Elite Pro has 2 customer configurable analog voltage outputs. Each output can supply up to 20 mA, and can therefore be configured to serve as an open loop current output if the load impedance is known.

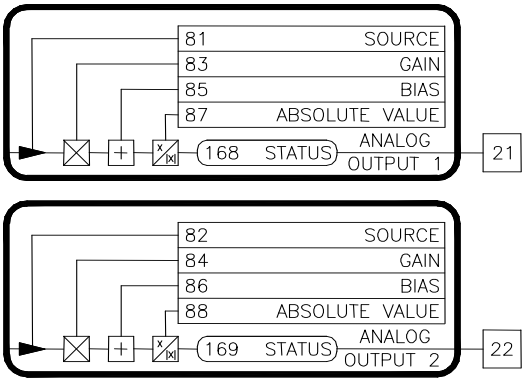


Figure 27

Source (81, 82, ICR)
The tag number of the parameter from which data is to be taken.

Gain (83, 84)
The analog output level is controlled by the Gain setting. Nominally, a source value of 100% will produce 10V output with the Gain set at 100%.

$$\text{Gain} = \frac{\text{Desired Full Scale Voltage}}{10\text{V}} \times 100\%$$

Bias (85, 86)
The Bias adjustment can be used to set a minimum output.

Absolute Value (87, 88)
If set to True, the output will be forced to a positive polarity regardless of the input signal polarity.

Status (168, 169, Read-Only)
Each DAC output (12 bit + sign) can be viewed for diagnostic purposes. See below for common readings.

Output Voltage	Sensor Reading
10V	4095
5V	2047
0V	0
-5V	-2048
-10V	-4095

Table 11: Analog Output Readings

Example - Analog Output

Setup Analog Output 1 to output the **Ramp Output** signal. Scale the analog output so that a 100.00% value from the **Ramp Output** gives 5V.

1. While the drive is stopped, go to Setup|Programming|Outputs|Analog|Analog Output 1 menu section.
2. Set **Analog Output 1 Source** to **Ramp Output** (225).
3. Set **Analog Output 1 Bias** to 0.00%.
4. Set **Analog Output 1 Gain** to 50%:

$$\text{Gain} = \frac{\text{Desired Full Scale Voltage}}{10\text{V}} \times 100\% = \frac{5\text{V}}{10\text{V}} \times 100\% = 50\%$$

5. Set **Analog Output 1 Absolute Value** to False.

Analog Output 1 will give a 5V full-scale version of **Ramp Output**. If a 10V full-scale signal were required, the **Analog Output 1 Gain** should be set to 100% in Step 3.

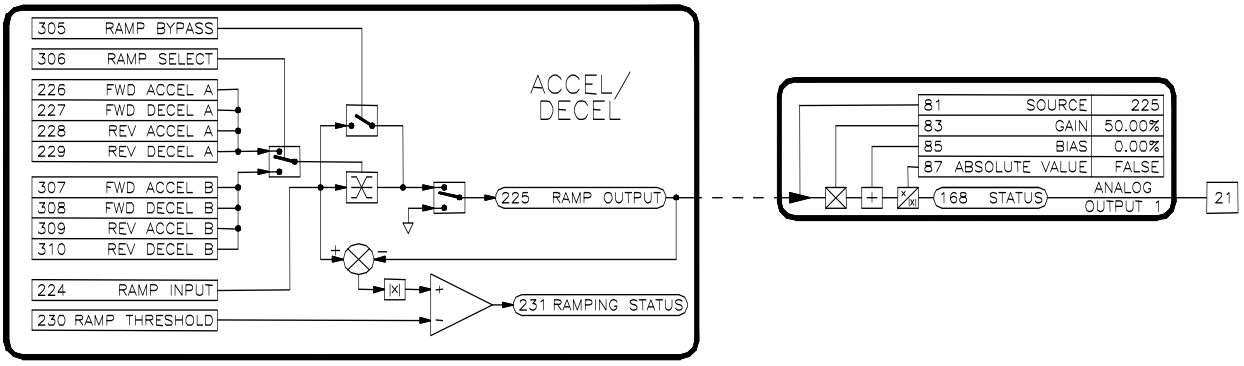


Figure 28

7.15 Frequency/Digital Output Block

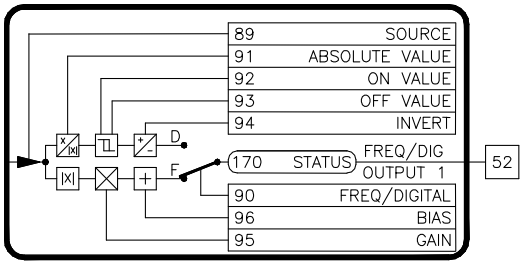


Figure 29

The Elite Pro has a configurable digital output that can be setup to output logic values (on/off) or numeric values in the form of a frequency output. Note: The Frequency/Digital Output is an open collector opto-coupler output. A voltage must be supplied at the required terminals for the output to function properly when switch SW3 is in the external position. Refer to Example Connections D12326. Otherwise, the internal 5V supply can be used by selecting the internal position.

Frequency/Digital Mode (90)
This parameter selects the type of output desired: frequency or digital.

Source (89, ICR)
The tag number of the parameter from which data is to be taken.

Absolute Value (Applicable for Digital Output Only) (91)
When **Absolute Value** is True, the absolute value of the source data is used to provide a positive only level. This allows bipolar signals to operate the output properly regardless of the signal polarity.

On Value (Applicable for Digital Output Only) (92) Refer to footnote **Error! Bookmark not defined.**on p.38
The threshold level that the source signal must equal or exceed in order for the digital output to be on.

Off Value (Applicable for Digital Output Only) (93) Refer to footnote on p.38
The threshold level that the source signal must equal or fall below in order for the digital output to be off.

Invert (Applicable for Digital Output Only) (94)
When Invert is True, the output logic is inverted.

Gain (Applicable for Frequency Output Only) (95)
The Gain adjustment is used to scale the maximum output. 100.00% gain equates to 2000 Hz output. This value can be calculated as follows:

$$\text{Gain} = \frac{\text{Desired Full Scale Output in Hertz}}{2000\ \text{Hz}} \times 100\%$$

Bias (Applicable for Frequency Output Only) (96)
The Bias adjustment can be used to set a minimum output.

Status (170, Read-Only)
The level of the frequency/digital output can be viewed for diagnostic purposes. In the frequency mode, the sensor indicates the actual frequency level output in Hertz. In the digital output mode, 0 indicates the output is off (low), while -1 indicates the output is on (high).

Example - Frequency Output
Setup the Frequency Output to monitor the Armature Current Feedback. A full-scale level of 1800 Hz should correspond to 100% current.
1. While the drive is stopped, go to Setup|Programming|Outputs|Frequency/Digital menu

section.

2. Set the **Frequency/Digital Mode** to Frequency.
3. Set the **Frequency/Digital Source** to **Current Feedback** (102).
4. Set **Frequency Output Bias** to 0.00%.
5. Set the **Frequency Gain** to 90.00%:

$$\text{Gain} = \frac{\text{Desired Full Scale Output in Hertz}}{2000\ \text{Hz}} \times 100\% = \frac{1800\ \text{Hz}}{2000\ \text{Hz}} \times 100\% = 90.00\%$$

The Frequency Output will give a 1800 Hz full-scale signal of **Current Feedback**. If a 2000 Hz full-scale signal were required, the **Gain** should be set to 100% in Step 5.

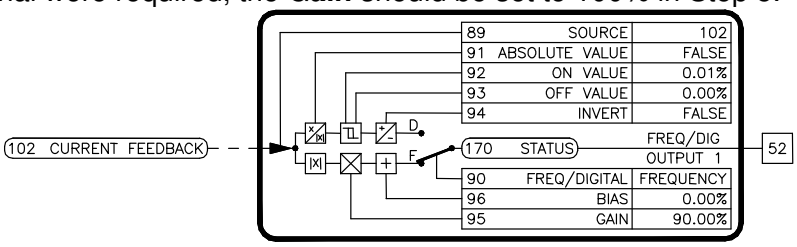


Figure 30

Example - Digital Output

Setup the Digital Output to indicate when the Elite Pro is in the Jog mode. The output should be inverted logic (off when in the Jog mode and on at all other times).

1. While the drive is stopped, go to Setup|Programming|Outputs|Frequency/Digital Output menu section.
2. Set the **Frequency/Digital Mode** to Digital.
3. Set the **Frequency/Digital Source** to **Jog Status** (243).
4. Set the **Digital Output On Value** to 1 (True).
5. Set the **Digital Output Off Value** to 0 (False).
6. Set the **Digital Output Invert** to True.

The Digital Output will be off (0 Volts) when the drive is in the Jog mode. The output will be on (positive voltage) at all other times.

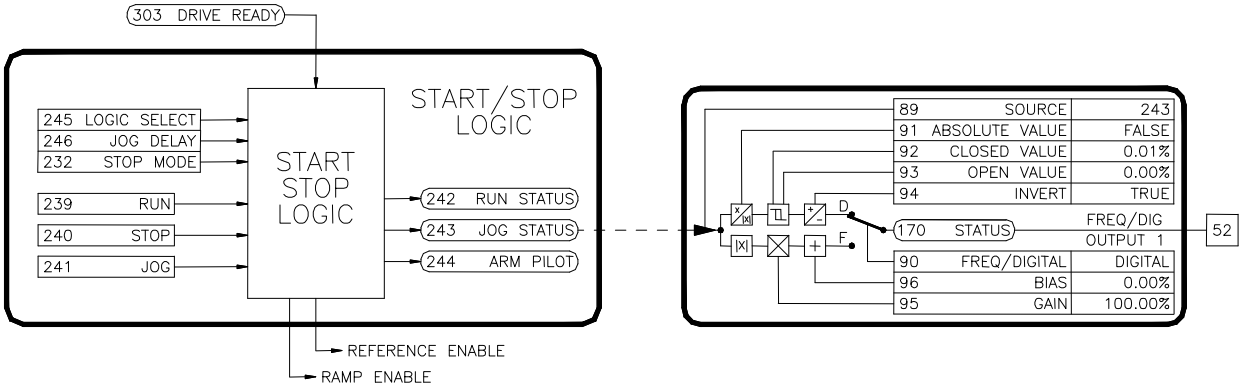


Figure 31

7.16 Calibration Block

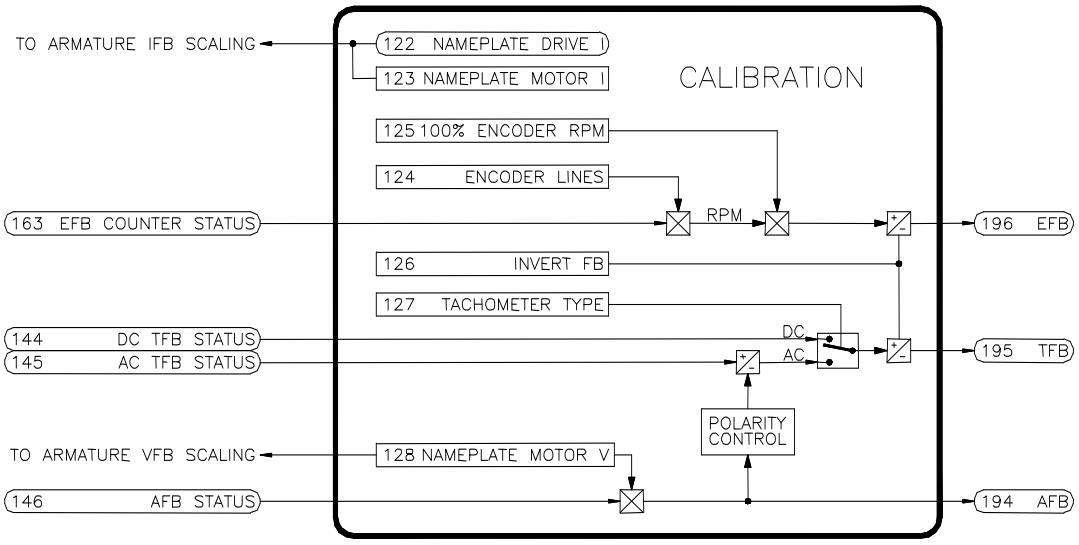


Figure 32

Nameplate Drive Current (122, Read-Only)
This parameter contains the full load current rating of the drive.

Nameplate Motor Current (123)
The motor nameplate armature current rating should be entered here. This allows the Elite Pro to scale the Current Feedback signal for proper operation. The Elite Pro can supply up to 150% of this value, but only for a short duration. See the **Armature Current Foldback Time** in the Fault Logic Block for more information.

Encoder Lines (124)
If quadrature encoder feedback is used, set this parameter according to the code in Table 12 to match the nameplate rating of the encoder. The nameplate rating may be listed as Encoder Lines, Cycles per Revolution or Pulses per Revolution (PPR). The factory preset is 1024. The 256 and 512 settings while provided, are not recommended because they cannot provide a feedback resolution of less than 1 RPM. If the resolution of the encoder used does not match one of the values in the table, choose the one that is closest. Refer to the **100% Encoder RPM** parameter for scaling of the non-standard feedback.

Code	Encoder Lines
0	256
1	512
2	1024
3	2048

Table 12: Encoder Lines

100% Encoder RPM (125)
This parameter is used to scale the encoder feedback signal. If the encoder resolution matches one of the values in Table 12, set this parameter to the maximum speed the drive will run in RPM. If the encoder resolutions do not match, set via the following:

$$100\%\,\text{Encoder RPM} = \frac{\text{Actual Encoder Lines}}{\text{Encoder Lines (124)}} \times \text{Maximum Motor RPM}$$

Tachometer Type (127)
Selects between a DC or an AC tachometer. Since an AC tachometer cannot convey direction of rotation, the armature feedback signal is used to supply the polarity for directional control.

Invert Feedback (126)
The encoder and tachometer feedback signals are polarity sensitive. The polarity is used to determine the direction of rotation of the motor. If the encoder or tachometer wires are reversed, this parameter can be used to quickly invert the polarity of the feedback signals for proper operation without re-wiring.

Nameplate Motor Voltage (128)
The nameplate armature voltage rating of the motor should be entered here. This allows the Elite Pro to correctly scale the armature feedback signal.

7.17 Diagnostics Block

The diagnostics section is provided to aid in troubleshooting. The majority of the status parameters are analog to digital readings. A few of the status readings are scaled and converted to provide helpful monitoring data and are listed below.

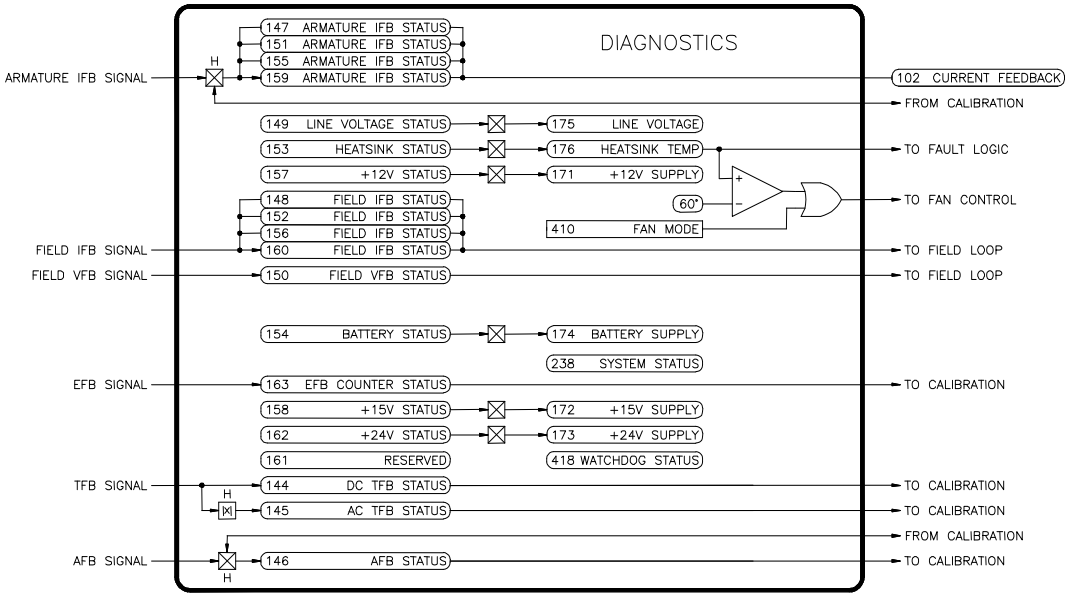


Figure 33

Line Voltage (175)
Line Voltage provides an approximation of the line to line AC input voltage.

Heatsink Temperature (176)
A thermistor on the heatsink monitors the temperature and is used to control the heatsink fans. The temperature is also used to shutdown the drive due to excessive heating.

Fan Mode (410)
In Auto mode, the heatsink fans turn on and off due to the Heatsink Temperature. The fans can be manually turned on for testing by setting Fan Mode to On.

Voltage Supplies (171-174)
The +12V, +15V, +24V, and +3V Battery supplies can be monitored.

System Status (238)
An internal status register that can be decoded to show the source of a processor reset: power-on, illegal address, software, watchdog or external reset.

Reset Source	Hex Code
Power-On	0x8000
Illegal Address	0x1000
Software	0x0400
Watchdog	0x0200
External	None of above

Table 13: System Status

Watchdog Status (418)
An internal status register displaying a code for the source of a watchdog reset. Each firmware block has a hexadecimal weight as shown below.

Firmware Block	Hex Code
Main Loop	0x0001
A2D Interrupt (TCINT1)	0x0002
Current Loop	0x0004
Velocity Loop	0x0008
Field Loop	0x0010

Table 14: Watchdog Status

7.18 Miscellaneous Block - Internal Links

The internal links can be used to connect or link parameters together. The Elite Pro provides 20 links for custom configuration. Each link has a source and a destination.

Note: When two parameters with different numbers of decimal places are linked together the following occurs: The source parameter value is reformatted into an integer without any decimal places. The number of decimal places of the destination parameter is then applied to the resulting integer. For example, if a source parameter has a value of 12.34% (2 decimals) and it is linked to an accel/decel time parameter (1 decimal), 12.34% is converted to an integer value of 1234, and then reformatted with 1 decimal place, 123.4. Therefore, the destination will contain the value 123.4 seconds.

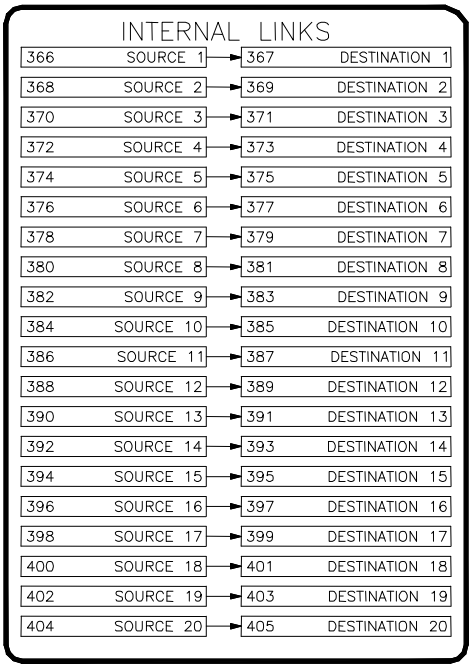


Figure 34

Source
The tag of the source parameter.

Destination (ICR)
The tag of the destination parameter.

Example - Internal Link
Setup an internal link from Forward Accel A to Forward Decel A. Whenever the Forward Accel A parameter is changed, the Forward Decel A parameter is also changed to the same value.
1. While the drive is stopped, go to Setup|Programming|Miscellaneous Parameters|Internal

Links|Internal Link 5.

2. Set **Internal Link 5 Source** to **Forward Accel A (226)**.
3. Set **Internal Link 5 Destination** to **Forward Decel A (227)**.

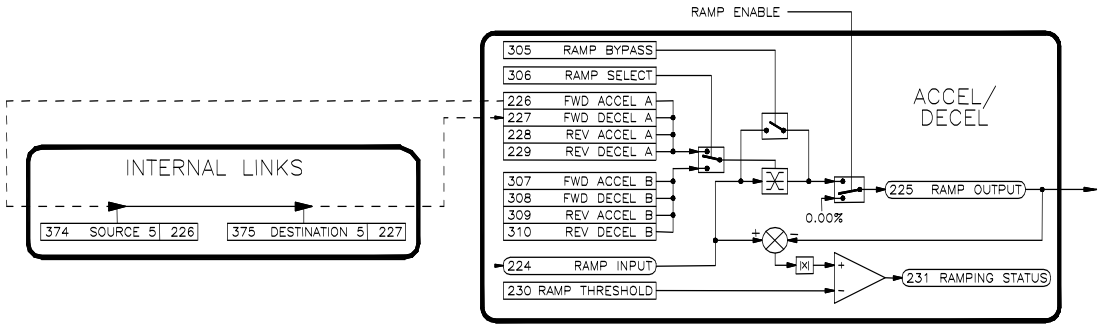


Figure 35

7.19 Miscellaneous Block - Communications

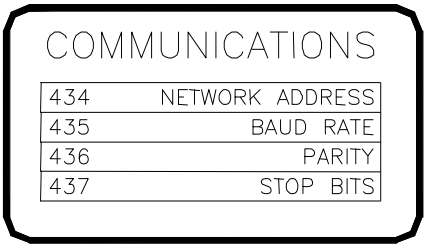


Figure 36

The Communication parameters control the 'Modbus' serial port interface available at CN16 (DB9) and TB2 (terminal strip).

Network Address (434)
The **Network Address** is used to distinguish one device on the network from others. Each device on a Modbus network must have a different address.

Baud Rate (435)
This parameter sets the transmit and receive rate of data over the serial communications port. All devices on the network should be set to the same value.

Parity (436)
The **Parity** parameter sets the type of byte level error checking that is used. All devices on the network should be set to the same value.

Stop Bits (437)
Sets the number of stop bits used per byte. Normally, all devices on the network should be set to the same value. In the Modbus specification, the number of stop bits is determined by the parity selection. One stop bit should be used with Even or Odd parity, and two stop bits should be used with No parity. However, at very high baud rates, like 38400, Carotron recommends that the Stop Bits setting in the master be set to two stop bits regardless of the setting in the Elite Pro or other slave devices. The extra stop bit sent from the master will not cause any communications errors (even if the other slave devices are set to one stop bit), but may help the master establish communication with all devices on the network.

7.20 Miscellaneous Block - MOP

The MOP (Motor Operated Potentiometer) block provides a means to control a reference level via external contact closures for Increase, Decrease, and Reset.

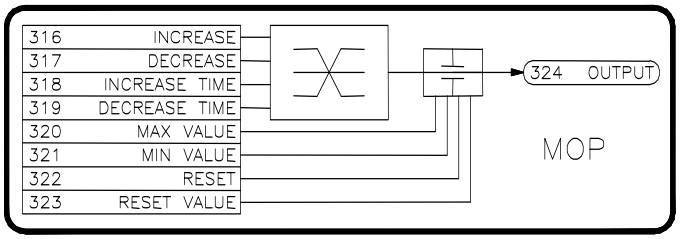


Figure 37

Increase (316)
When True, the **Output** increases at a rate controlled by **Increase Time** up to a maximum value determined by **Max Value**.

Decrease (317)
When True, the **Output** decreases at a rate controlled by **Decrease Time** down to a minimum value determined by **Min Value.**

Increase Time (318)
The **Increase Time** adjustment controls the amount of time that it takes for the **Output** to change from 0.00% to 100.00%.

Decrease Time (319)
The **Decrease Time** adjustment controls the amount of time that it takes for the **Output** to change from 100.00% to 0.00%.

Max Value (320)
The upper limit of the **Output**.

Min Value (321)
The lower limit of the **Output**.

Reset (322)
When True, the **Output** is reset to the **Reset Value** level.

Reset Value (323)
The level the **Output** is immediately set to when the **Reset** is True.

Output (324, Read-Only)
The output of the MOP Block.

Example - MOP
Setup the MOP block to control Setpoint B. Define Digital Input 4 as the Increase input, Digital Input 5 as the Decrease input, and Digital Input 6 as the Reset Input. The MOP should operate between 0.00% and 50.00% with Accel and Decel times of 20.0 seconds. The Reset Value should be 5.00%.

1. While the drive is stopped, go to Setup|Programming|Inputs|Digital menu section.
2. Set **Digital Input 4 Destination** to **Increase (316)**.
3. Set **Digital Input 4 Open Value** to 0 (False).
4. Set **Digital Input 4 Closed Value** to 1 (True).
5. Set **Digital Input 5 Destination** to **Decrease (317)**.
6. Set **Digital Input 5 Open Value** to 0 (False).
7. Set **Digital Input 5 Closed Value** to 1 (True).
8. Set **Digital Input 6 Destination** to **Reset (322)**.
9. Set **Digital Input 6 Open Value** to 0 (False).
10. Set **Digital Input 6 Closed Value** to 1 (True).

11. Go to Setup|Programming|Miscellaneous Parameters|MOP menu section.
12. Set **Increase Time** and **Decrease Time** to 20.0 seconds.
13. Set **Max Value** to 50.00%, **Min Value** to 0.00%, and **Reset Value** to 5.00%.
14. Go to Setup|Programming|Miscellaneous Parameters|Internal Links menu section
15. Set **Internal Link 14 Source** to **Output (324)**.
16. Set **Internal Link 14 Destination** to **Setpoint B (234)**.

With the drive in the RUN mode, Digital Input 4 will cause the speed of the drive to increase, while Digital Input 5 will cause the speed to decrease. Digital Input 6 will reset the speed immediately to 5.00%.

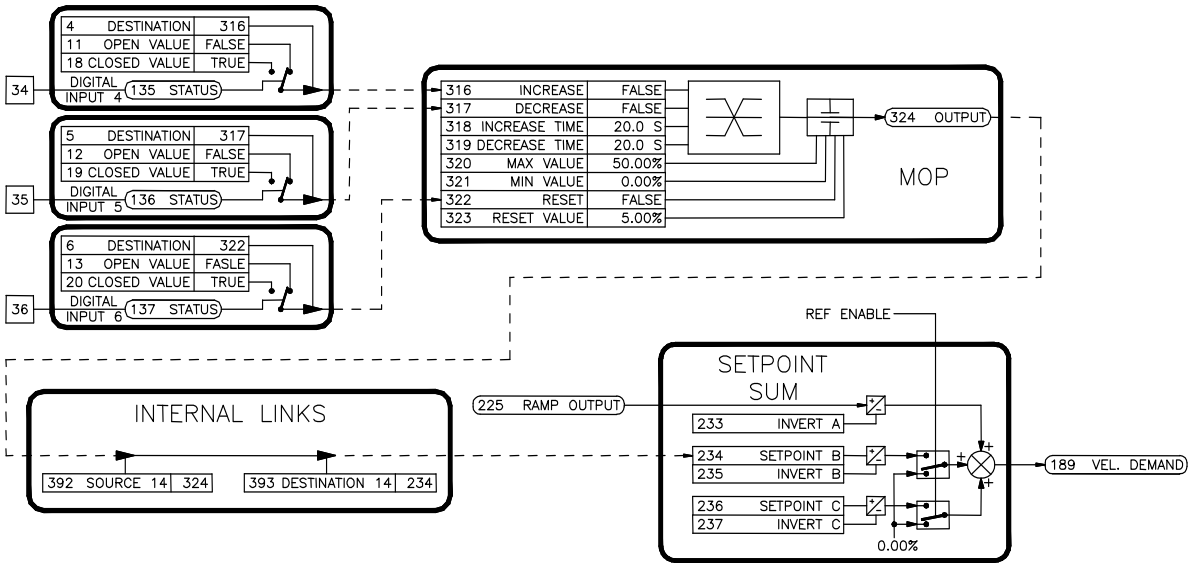


Figure 38

7.21 Miscellaneous Block - System Parameters

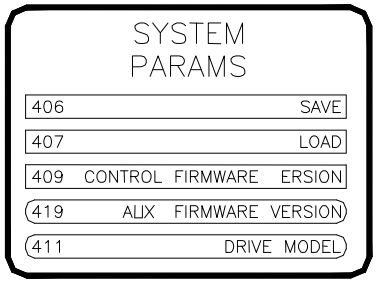


Figure 39

Save (406, ICR)
Any parameter changes made must be saved or they will be lost on a power-down or a processor reset. Toggling Save to True will save the parameters into the onboard EEPROM. Note that the Save function can only be performed when the drive is in the Stop mode.

Load (407, ICR)
The Load command can be used to load the last saved configuration. This may also be achieved by cycling the power to the drive or performing a processor reset.

Control Firmware Version (409, Read-Only)
Contains the firmware version level of the code for the DSP.

Aux Firmware Versions (419, Read-Only)
Contains the firmware version level of the Comm Processor in the upper 8 bits and the Menu Data in the lower 8 bits.

Trigger Board Firmware Version (491, Read-Only)
Contains the Trigger Board firmware version level.

Drive Model (411, Read-Only)
Contains the drives model number.

7.22 Miscellaneous Block - Thresholds

The threshold block can be used to monitor the level of an internal parameter. A threshold can then be set to select between two setpoints. The threshold block contains two identical threshold detectors designated A and B.

Input (177, 183)
The value of the internal parameter that serves as the control for the switch. An input or internal link must be used to connect the desired parameter to this input.

Threshold (178, 184)
The level of the **Input** where the switch activates.

Hysteresis (179, 185)
Provides a hysteresis level that the **Input** must exceed or fall below.

Greater Than (181, 187)
When the **Input** is greater than the **Threshold**, this value is sent to the **Output**.

Less Than or Equal (180, 186)
When the **Input** is less than or equal to the **Threshold**, this value is sent to the **Output**.

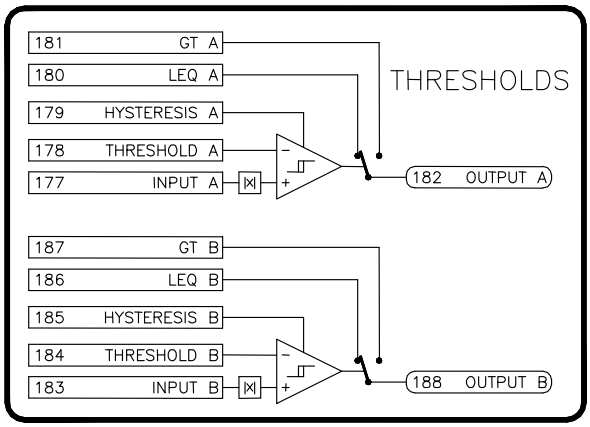


Figure 40

Output (182, 188, Read-Only)
Contains either the **Greater Than** or **Less Than or Equal** values depending on the comparison between the **Input** and the **Threshold**.

Example - Thresholds
Setup the threshold block to monitor analog input 3. The analog signal ranges from 0.0 to 10.0 Volts and should switch the velocity loop gain schedule when it reaches 6.0 volts.

1. While the drive is stopped, go to Setup|Programming|Inputs|Analog|Analog Input
2. Set the **Analog Input 3 Destination** to **Input A** (177). All other Analog Input 3 parameters are assumed to be set to the factory settings.
3. Go to the Threshold section under Miscellaneous.
4. Set **Threshold A** to 60.00% (6 Volts is 60% of 10 Volts)
5. Set **Hysteresis A** to 5.00%.
6. Set **Greater Than A** to 0.01% (True).
7. Set **Less Than or Equal A** to 0.00% (False).
8. Go to the Internal Links section under Miscellaneous.
9. Set **Internal Link 10 Source** to **Output A** (182).
10. Set Internal Link 10 Destination to **Velocity Gain Select** (203).

The 0 to 10 Volt signal at Analog Input 3 is converted to a 0 to 100.00% value by the analog input. This value is sent to **Input A** and compared to the **Threshold A** level of 60.00%. When the signal starts out, it is below the threshold level and the **Output A** is equal to the **Less Than or Equal** setting of 0.00%. The Internal Link copies this value to the **Velocity Gain Select** parameter. When the signal level exceeds 60.00% (6 Volts), the **Greater Than** value (0.01%) is copied to **Output A**. The Internal Link copies the **Output A** value to the **Velocity Gain Select** parameter. The 0.01% value is interpreted by the **Velocity Gain Select** as a 1 and the velocity loop uses **Velocity Gain Set B**.

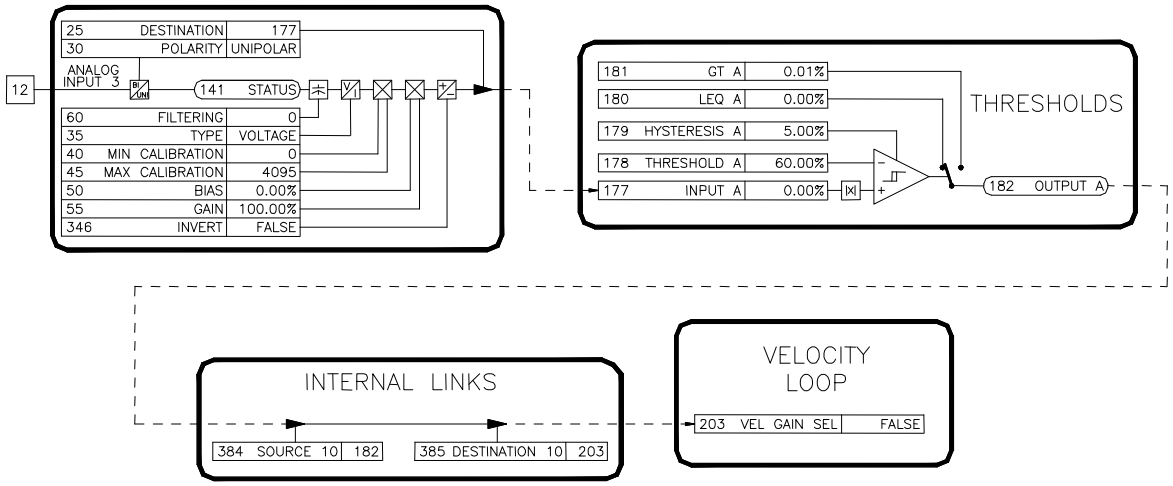


Figure 41

7.23 Miscellaneous Block - Timer

The timer block is a modified version of the threshold block. Instead of monitoring a parameter as the threshold block does, a timer is monitored. When the timer exceeds the threshold, a switch position is toggled, sending selected

levels to the output.

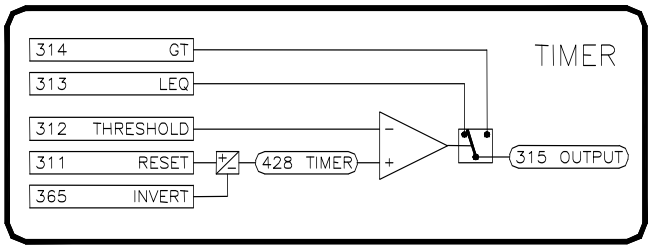


Figure 42

Timer Reset (311)
This parameter resets and holds the timer at 0 when True. A False value enables the timer and counting begins. The timer range is 0.0 to 240.0 seconds.

Timer Invert (365)
Normally, when the **Timer Reset** signal is True (any non-zero value), the timer is in the reset and hold mode. The **Invert** parameter can be used to invert the logic, so that a False value causes the timer to reset and hold.

Timer Threshold (312)
The value that the **Timer** must count up to before the switch toggles.

Timer (428)
The value of the Timer.

Timer Greater Than (314)
When the timer is greater than the **Threshold**, this value is sent to the **Output**.

Timer Less Than or Equal (313)
When the timer is less than or equal to the **Threshold**, this value is sent to the **Output**.

Timer Output (315, Read-Only)
Contains either the **Greater Than** or **Less Than or Equal** values depending on the comparison between the timer and the **Threshold**.

Example - Timer
With the drive in Torque mode, setup the timer to provide an additional torque of 20.00% for

1.0 second after the drive has started. This feature is sometimes used on winders with oversized mechanics. Extra torque is momentarily needed to overcome the static friction in the system. However, once in motion, this torque is no longer needed.

1. While the drive is stopped, go to Setup|Programming|Miscellaneous Parameters|Internal Links menu section.
2. Set **Internal Link 14 Source** to **Run Status (242)**.
3. Set **Internal Link 14 Destination** to **Timer Reset (311)**.
4. Set **Internal Link 15 Source** to **Timer Output (315)**.
5. Set **Internal Link 15 Destination** to **Auxiliary Current Demand** (98).
6. Go to the Timer section under Miscellaneous.
7. Set **Timer Invert** to True.
8. Set **Timer Threshold** to 1.0 second.
9. Set **Timer Greater Than** to 0.00%.
10. Set **Timer Less Than or Equal** to 20.00%.

When the drive is in the Stop mode, **Run Status** is False. Since **Timer Invert** is set to True, this causes the Timer to be reset, and the **Timer Less Than or Equal** value of 20.00% is sent to the **Timer Output** and to the **Auxiliary Current Demand** parameter. When the drive enters the Run mode, a torque reference of 20.00% is immediately present. **Run Status** is now True, enabling the Timer. After one second, the **Timer** exceeds the **Timer Threshold**, and the **Timer Greater Than** value of 0.00% is sent to **Timer Output**. As above, the internal link sends the **Timer Output** value to the **Auxiliary Current Demand** signal.

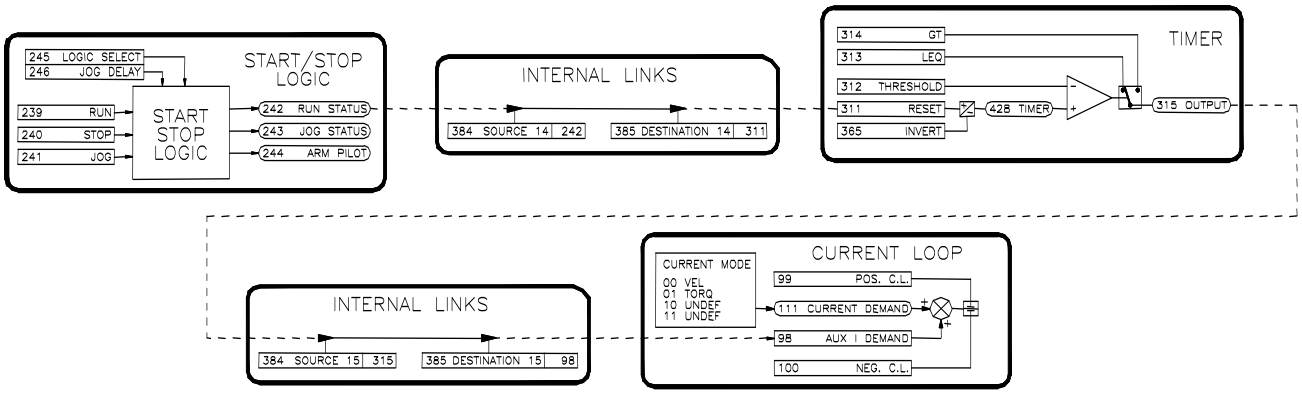


Figure 43

7.24 Miscellaneous Block - Min Max

The Min Max block is a setup and adjustment tool that can be used to measure the fluctuation of a signal and record the minimum and maximum values.

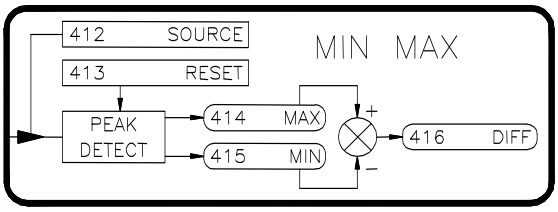


Figure 44

Source (412)
The tag number of the parameter from which data is to be taken.

Reset (413)
When True, the **Minimum** and **Maximum** values are cleared to zero.

Minimum (415, Read-Only)
The minimum peak level that the source data has achieved since the last **Reset**.

Maximum (414, Read-Only)
The maximum peak level that the source data has achieved since the last **Reset**.

Difference (416, Read-Only)
The mathematical difference of the **Maximum** and **Minimum** values.

7.25 Miscellaneous Block - Auxiliary Parameters

The Elite Pro provides 7 auxiliary parameters for general use. One specific function the auxiliary parameters are used for is to tie an input to an output.

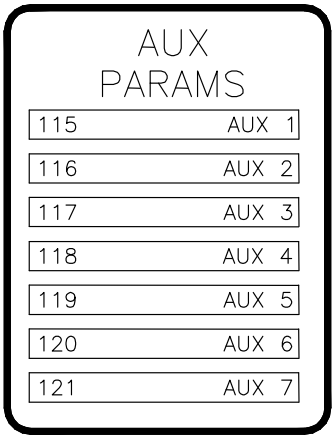


Figure 45

Example - Auxiliary Parameters
A frequency to voltage conversion is needed for another portion of the system that the drive is installed in. Instead of using an external individual frequency to voltage card, the Elite Pro can perform the conversion using its frequency input and an analog output. Setup the Elite Pro to convert a 0 to 4000 Hz signal to a voltage signal of 0 to 7.5VDC.

1. While the drive is stopped, go to the Frequency Input section.
2. Set the **Frequency Input Destination** to **Auxiliary 1** (115),
3. Set the **Frequency Input Min Calibration** to 0 Hz.
4. Set the **Frequency Input Max Calibration** to 4000 Hz.
5. The **Frequency Input Bias** and **Gain** parameters should be set the factory presets of 0.00% and 100.00%.
6. Go to the Analog output section.
7. Set **Analog Output 1 Source** to **Auxiliary 1** (115).
8. Set **Analog output 1 Bias** to 0.00%.
9. Set **Analog Output 1 Gain** to 75.00%(7.5VDC/10.0VDC=75%).

Analog Output 1 should now give the desired voltage levels.

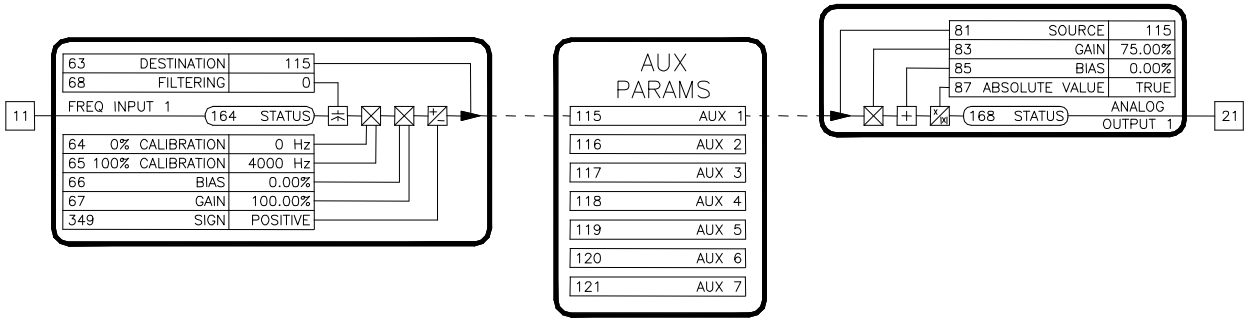


Figure 46

7.26 Miscellaneous Block - General Parameters

The Elite Pro provides 12 general use parameters. Typically, these parameters are used as a control block interface to HMI (Human Machine Interface) displays. Note: these parameters are not accessible via the keypad, but can be accessed using the ProLink software.

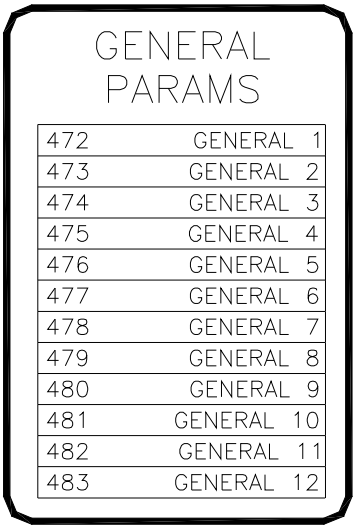


Figure 47

7.27 Miscellaneous Block - Set Time & Date

The Elite Pro provides a Real Time Clock (RTC) that is used to provide date and time information to the fault log.

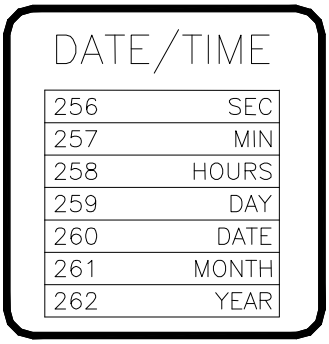


Figure 48

Year (262)
Two digit year from 00-99.

Month (261)
Two digit month from 1-12.

Date (260)
Two digit date from 1-31.

Day (259)
One digit day from 1-7 representing Sunday - Saturday.

Hours (258)
Two digit hours from 00 to 23.

Minutes (257)
Two digit minutes from 00 to 59.

Seconds (256)
Two digit seconds from 00 to 59. Note: This parameter is not directly accessible from the keypad, but can be accessed via ProLink software.

7.28 Fault Logic Block

The Elite Pro monitors multiple fault signals for drive protection. When any one of these inputs signals a fault condition, the Elite Pro immediately shuts down the trigger circuit, clamps all loops, and de-energizes the armature contactor pilot relay. The drive will then coast to stop or D.B Stop if dynamic breaking resistors are provided.

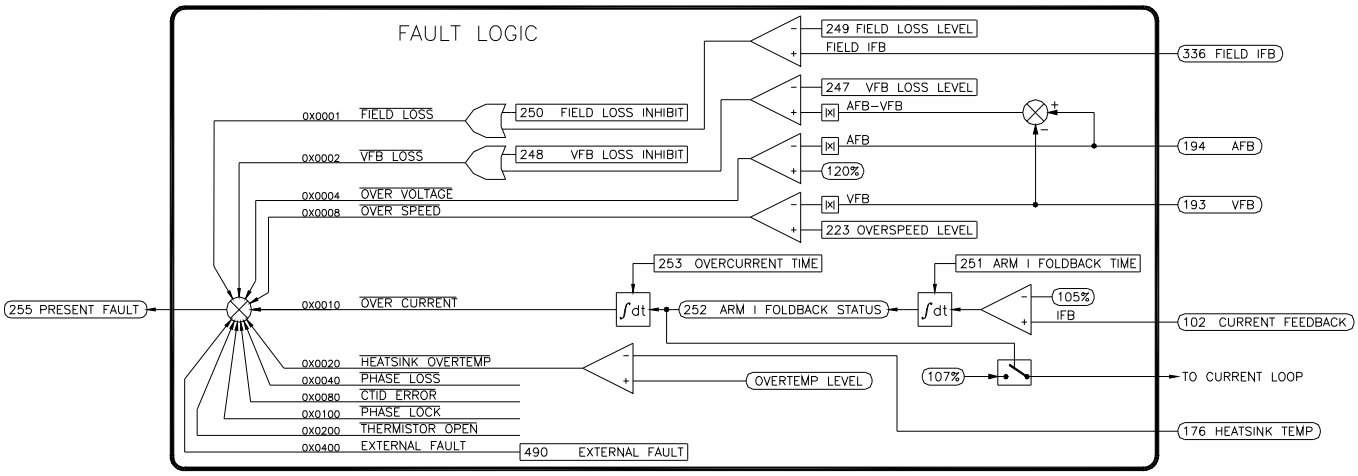


Figure 49

Field Loss Level (249)
The shunt field current is monitored and if it falls below this level, a field loss fault is generated.

Field Loss Inhibit (250)
If permanent magnet motors or non-motor loads are used with the Elite Pro, the Field Loss Inhibit parameter can be set to True to inhibit the field loss fault.

VFB (Velocity Feedback) Loss Level (247)
This fault provides for a means to quickly shutdown the drive if the encoder or tachometer feedback signal is lost due to a device failure or a wire break. Protection is provided by comparing the encoder or tachometer feedback signal with the armature feedback. Under normal operating conditions, these two values should be roughly the same. This adjustment provides a threshold that must be obtained before a fault is generated. Nominally this is set to 50.00%.

VFB Loss Inhibit (248)
The VFB Loss Fault can be inhibited by setting this parameter to True.

Overspeed Level (223)
The overspeed level defines a threshold speed. If the drive exceeds this threshold, an overspeed fault is generated. This fault is especially useful in winding applications when the drive is used in torque mode.

Armature Current Foldback Time (251)
The Elite Pro can provide up to 150% of the **Nameplate Motor Current** rating for a given

time before the drive automatically foldsback the current limit to 107%. This parameter adjusts the amount of time the drive must exceed 105% current before foldback is entered.

Armature Current Foldback Status (252, Read-Only)
This status parameter indicates when the drive is in Foldback mode and is limiting the current output to a maximum of 107%.

Overcurrent Time (253)
At the same time the foldback timer begins, an overcurrent timer also begins counting. If the drive continually exceeds 105% current for the Overcurrent Time, an overcurrent fault is generated.

External Fault (490)
This parameter provides an interface for external devices to generate a fault. Typically, a digital input is used to write to this parameter.

7.29 Fault Log Block

The Elite Pro keeps a log file of the last 5 faults along with the date and time. Each time a new fault occurs, the oldest fault data is lost.

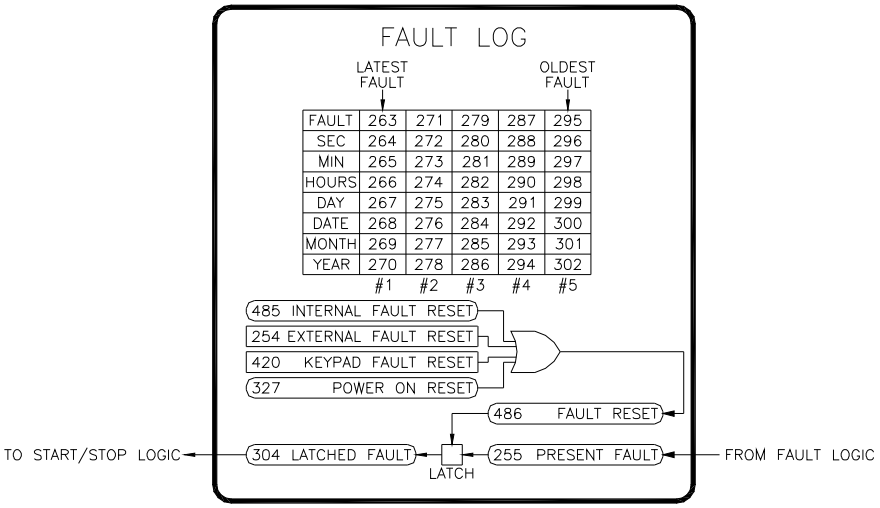


Figure 50

Present Fault Status (255, Read-Only)
Each of the signals that can cause a fault are individually coded with a hexadecimal weight and summed (in Fault Logic Block) to produce the **Present Fault Status** parameter. This parameter can be examined to determine if there are any faults currently present. Multiple fault codes sum together. For example, Fault Code 0x0141 is Phase Lock, Phase Loss, & Field Loss.

Code	Fault	Cause
0x0001	Field Loss	field current feedback < field loss level
0x0002	VFB Loss	loss of feedback signal
0x0004	Over Voltage	armature voltage >120%
0x0008	Over Speed	velocity feedback > overspeed level
0x0010	Over Current	drive exceeded 105% current for timed period
0x0020	Over Temp	heatsink temperature over limit
0x0040	Phase Loss	loss of at least one of the 3 AC line inputs
0x0080	CT ID Error	no CT ID Board installed
0x0100	Phase Lock	phase lock not achieved
0x0200	Thermistor Open	heatsink thermistor open
0x0400	External Fault	external fault present

Table 15: Fault Codes

Latched Fault Status (304, Read-Only)
The signal or signals that generated the fault are latched and stored into this parameter and the fault log. This is done to help identify the actual cause of the fault.

External Fault Reset (254)
The **External Fault Reset** parameter is typically written to by a digital input and can be used

to reset drive faults externally.

Internal Fault Reset (485)
The **Internal Fault Reset** displays the status of the Fault Reset pushbutton on the control board.

Power On Reset (327, Read-Only)
The **Power On Reset** is used to automatically clear any latched faults on power up. Note: This parameter is not directly accessible for viewing from the keypad.

Fault Reset (486)
Fault Reset displays the logical 'OR' result of the **Internal Fault Reset**, **External Fault Reset**, **Keypad Fault Reset**, and the **Power On Reset**. The **Present Fault Status** parameter must be equal to zero (indicating no faults) before the **Fault Reset** can clear the **Latched Fault Status**.

7.30 Applications Block - Auxiliary PI Loop

An Auxiliary PI loop is provided for system integration with dancers potentiometers or loadcells. The block provides for Proportional and Integral loop control.

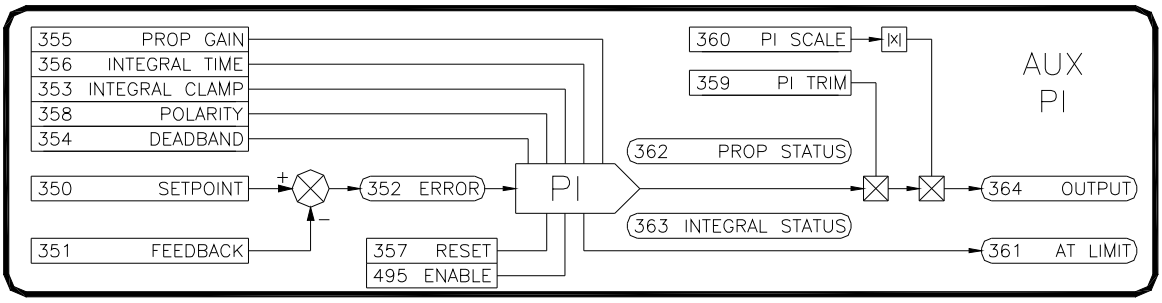


Figure 51

Setpoint (350)
The desired position on dancer systems or the desired tension on loadcell control.

Feedback (351)
The dancer feedback signal or loadcell feedback signal. This signal will typically come from one of the Analog Inputs.

Error (352, Read-Only)
The difference between the desired **Setpoint** and the actual **Feedback**.

Proportional Gain (355)
The **Proportional Gain** scales the output based upon the **Error**. Increasing the gain improves the loop response but can also increase overshoot.

Integral Time (356)
The **Integral Time** adjustment eliminates steady-state error. Decreasing the integral time improves loop response. However, setting it too low can cause oscillation. The adjustment is in seconds and corresponds to the amount of time that the **PI Output** signal would take to integrate from 0.00% to 100%.

Integral Clamp (353)
When **Integral Clamp** is True, the integral signal is clamped to zero in the PI loop, yielding proportional control only.

Polarity (358)
The **Polarity** parameter controls whether the **PI Output** needs to be unipolar (positive only) or bipolar (positive and negative).

Deadband (354)
The **Deadband** adjustment is used to provide a window of tolerance in the error signal that the integral circuit will ignore. This is commonly used to ignore small dancer movements.

Reset (357)
When True, resets the **PI Output** to zero.

Enable (495)
When False, resets the **PI Output** to zero.

PI Trim (359)
The **PI Trim** adjustment controls the amount of correction that the **PI Output** can provide.

PI Scale (360)
The **PI Scale** adjustment provides for a method to scale the **PI Output** via an external signal. This signal is typically a line speed signal from an Analog Input.

Output (364, Read-Only)
The output of the PI loop after being modified by the **PI Trim** and **PI Scale** parameters.

Proportional Status (362, Read-Only)
The individual proportional component of the **PI Output**. This parameter is provided for aid in setup and tuning.

Integral Status (363, Read-Only)
The individual integral component of the **PI Output**. This parameter is provided for aid in setup and tuning.

At Limit (361, Read-Only)
When the Integral signal saturates at ±100.00%, the **At Limit** parameter becomes True. This may indicate that the **PI Trim** parameter may need to be increased. This parameter is provided for aid in setup and tuning.

7.31 Applications Block - Winder Speed Calculator

A problem encountered in center driven wind and unwind applications is the nonlinear relationship between the diameter of a roll and the motor speed required to maintain constant surface speed of the roll during diameter increase or decrease. A plot of this relationship shows a hyperbolic curve.

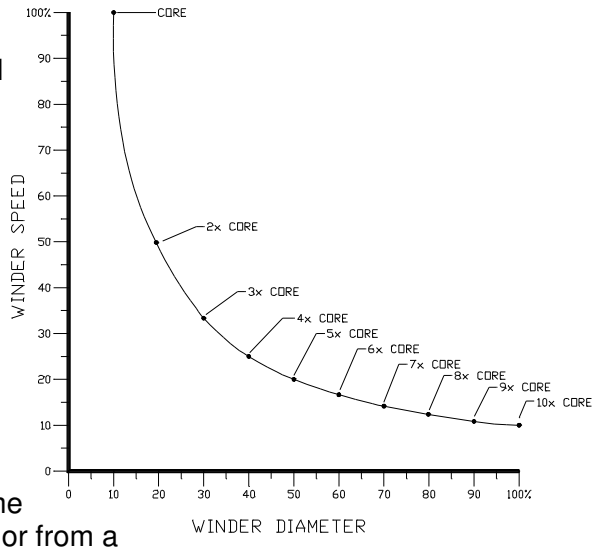


Figure 52

With inputs proportional to line speed and roll diameter, the required Winder or Unwinder Motor Speed can be calculated. The rate of material pay-out from a center driven unwinder would be held constant during roll diameter decrease. The line speed signal could come from a tachometer on the line drive or mounted on the machine to sense speed. The diameter signal could come from an ultrasonic measuring unit like the SONICTRAC® or from a mechanical measuring device such as a rider arm and pot. The scaled line speed is divided by the scaled diameter signal to generate the center drive speed reference. Depending on required system response, a dancer or other device may be required for limited transient compensation between the center winder/unwinder and other driven parts of a line.

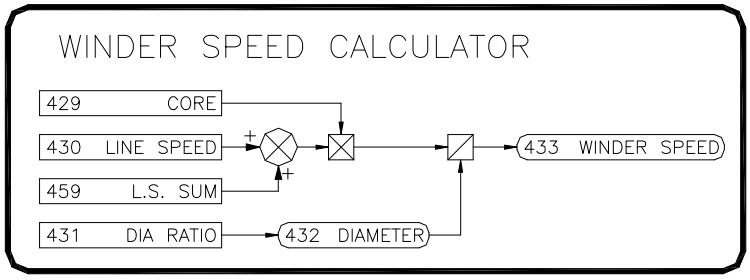


Figure 53

Core (429)
The size of an empty core expressed as a percentage with respect to the maximum diameter. If multiple size cores and/or maximum diameters are used, calculate using the smallest core and the largest maximum diameter.

$$\text{Core} = \frac{\text{core diameter}}{\text{maximum diameter}} \times 100\%$$

Line Speed (430)
This signal will typically come from one of the analog or frequency inputs and should be scaled to range from 0.00% to 100.00%.

Line Speed Sum (459)
This parameter provides a place to sum a signal with the **Line Speed** before it is multiplied by the **Core** and divided by the **Diameter**. A typical use would be to sum in the output of the Aux PI Block in order to proved dancer or loadcell trim.

Diameter Ratio (431)
This scaled diameter signal will typically come from one of the Analog Inputs, and should be scaled with an empty Core to read 0.00%. With the maximum diameter roll, this signal should read 100.00%.

Diameter (432, Read-Only)
The diameter expressed as a percentage of the maximum diameter. This value is calculated from the **Diameter Ratio** and **Core** parameters.

Winder Speed (433, Read-Only)
The center driven speed of the winder/unwinder.

7.32 Applications Block - CTCW (Constant Tension Center Winder)

The CTCW block allows an Elite Pro drive to provide constant or taper tension control without external tension sensors. The CTCW block provides a torque reference output that is composed of diameter torque, inertia torque, friction torque, and static friction torque.

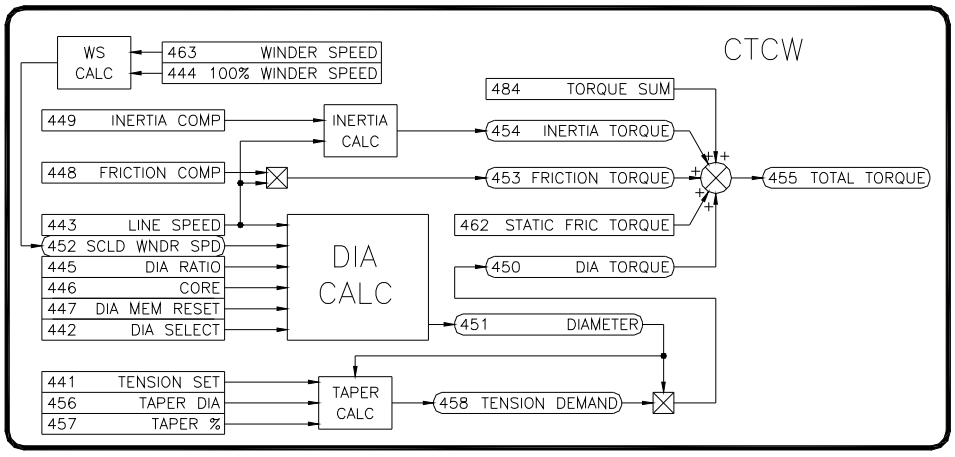


Figure 54

Inertia Compensation (449)
Additional torque is required by the winder drive when the line is accelerating. This parameter is used in conjunction with **Line Speed** to control the amount of additional **Inertia Torque**.

Inertia Torque (454, Read-Only)
The amount of additional torque supplied to the winder drive when the line is accelerating.

Friction Compensation (448)
Torque is required to overcome the dynamic friction in the mechanics of the drive train. Friction loading typically increases with speed. The amount of **Friction Torque** is controlled by **Friction Compensation** and **Line Speed**.

Friction Torque (453, Read-Only)
The amount of torque supplied to the winder drive proportional to line speed.

Static Friction Torque (462)
Torque is required to overcome the static friction in the mechanics of the drive train. This parameter sums with all the other torque signals to produce the **Total Torque** signal.

Line Speed (443)
An external analog or frequency signal proportional to the speed of the line is typically linked to this parameter. **Line Speed** is used in calculating **Inertia Torque** and **Friction Torque**. The scaling of the analog or frequency input should be set so this parameter reads 0.00% when the line is stopped and 100.00% at full line speed.

Winder Speed (463)
The winder speed feedback. Typically this signal is linked from **Velocity Feedback** in the Velocity Loop block. This signal is used along with the Line Speed to calculate **Diameter**. It is only used when the Line/Winder method of diameter calculation is selected by **Diameter Select**.

100% Winder Speed (444)
This parameter defines the 100% level of the **Winder Speed** and is only used when the Line/Winder method of **Diameter** calculation is selected by **Diameter Select**.

Scaled Winder Speed (452, Read-Only)
The center driven feedback speed of the winder. This parameter is used to calculate **Diameter** along with **Line Speed** when **Diameter Select** is set to Line/Winder.

Diameter Ratio (445)
This parameter is used only when **Diameter Select** is set to External Diameter. This scaled diameter signal will typically come from one of the analog inputs, and should be scaled with an empty Core to read 0.00%. With the maximum diameter roll, this signal should read 100.00%.

Core (446)
The size of an empty core expressed as a percentage with respect to the maximum diameter. If multiple size cores and/or maximum diameters are used, calculate using the smallest core and the largest maximum diameter.

$$\text{Core} = \frac{\text{core diameter}}{\text{maximum diameter}} \times 100\%$$

Diameter Memory Reset (447)
The diameter calculator provides a diameter memory function to maintain the speed based diameter levels during stop. This allows the CTCW block to provide the required torque to maintain constant/taper tension even when the line is stopped. When this parameter is True, the diameter memory is reset.

Diameter Select (442)
Controls the method of diameter calculation. When set to Line/Winder, the **Line Speed** is divided by the **Winder Speed** to determine the **Diameter**. The External Diameter Ratio option should be used when an external device (such as a sonic measuring unit) is used to directly measure the diameter.

Diameter (451, Read-Only)
The diameter expressed as a percentage of the maximum diameter. This parameter along with the **Tension Demand** parameter is used to calculate the **Diameter Torque**.

Tension Setpoint (441)
Controls the level of tension applied to the material by the winder drive. This parameter along with the **Tension Sum**, **Taper Diameter** and **Taper Percentage** is used to calculate **Tension Demand**.

Taper Diameter (456)
In some cases, decreasing tension (taper tension) is desirable to prevent telescoping and/or wrinkling of inner layers of material. The **Taper Diameter** parameter sets the diameter level at which the decreasing tension level starts.

Taper Percentage (457)
Sets the amount of decreasing tension (taper tension). If no taper tension is desired, set to 0.00%.

Tension Demand (458, Read-Only)
The desired taper tension level. This value is used with the **Diameter** to calculate the **Diameter Torque**.

Diameter Torque (454, Read-Only)
In order to provide constant tension, the winder torque must increase proportionally to the increase in diameter.

Total Torque (455, Read-Only)
The sum of the **Inertia Torque**, **Friction Torque**, **Static Friction Torque**, **Diameter Torque,** and **Torque Sum** parameters. The **Friction Torque, Static Friction Torque, Diameter Torque**, and **Torque Sum** levels are first summed and limited to 100%. The **Inertia Torque** is then summed and the total is limited to 150%. This parameter should be linked to **Torque Reference** and the **Drive Mode** set to Torque for proper operation.

Torque Sum (484)
This parameter provides an auxiliary summing point before the **Total Torque** is calculated. A typical use would be to sum in a correction signal from the output of the PID block when loadcells are used with the CTCW Calculator.

7.33 Parameter Tables

The following two tables lists all the Elite Pro parameters and their properties. Table 16 is sorted by Tag Number and Table 17 is sorted by Parameter Name. ICR stands for ***I**nhibit **C**hange while **R**unning* and identifies the parameters that cannot be modified while the drive is running. Furthermore, RO indicates ***R**ead-**O**nly* parameters.

Table 16: Parameters by Tag

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
0	Trash	-32768	32767			0	None	
1	Digital Input 1 Term 31 Destination	0	500	ICR		239	Digital Input	
2	Digital Input 2 Term 32 Destination	0	500	ICR		240	Digital Input	
3	Digital Input 3 Term 33 Destination	0	500	ICR		241	Digital Input	
4	Digital Input 4 Term 34 Destination	0	500	ICR		222	Digital Input	
5	Digital Input 5 Term 35 Destination	0	500	ICR		215	Digital Input	
6	Digital Input 6 Term 36 Destination	0	500	ICR		216	Digital Input	
7	Digital Input 7 Term 37 Destination	0	500	ICR		254	Digital Input	
8	Digital Input 1 Term 31 Open Value	0:False*	1:True*			0:False	Digital Input	
9	Digital Input 2 Term 32 Open Value	0:False*	1:True*			1:True	Digital Input	
10	Digital Input 3 Term 33 Open Value	0:False*	1:True*			0:False	Digital Input	
11	Digital Input 4 Term 34 Open Value	0:False*	1:True*			0:False	Digital Input	
12	Digital Input 5 Term 35 Open Value	0:False*	1:True*			0:False	Digital Input	
13	Digital Input 6 Term 36 Open Value	0:False*	1:True*			0:False	Digital Input	
14	Digital Input 7 Term 37 Open Value	0:False*	1:True*			0:False	Digital Input	
15	Digital Input 1 Term 31 Closed Value	0:False*	1:True*			1:True	Digital Input	
16	Digital Input 2 Term 32 Closed Value	0:False*	1:True*			0:False	Digital Input	
17	Digital Input 3 Term 33 Closed Value	0:False*	1:True*			1:True	Digital Input	
18	Digital Input 4 Term 34 Closed Value	0:False*	1:True*			1:True	Digital Input	
19	Digital Input 5 Term 35 Closed Value	0:False*	1:True*			1:True	Digital Input	
20	Digital Input 6 Term 36 Closed Value	0:False*	1:True*			1:True	Digital Input	
21	Digital Input 7 Term 37 Closed Value	0:False*	1:True*			1:True	Digital Input	
22	Run Enable Term 7	0:Open	1:Closed		RO	0:Open	Digital Input	
23	Analog Input 1 Term 10 Destination	0	500	ICR		217	Analog Input	
24	Analog Input 2 Term 11 Destination	0	500	ICR		0	Analog Input	
25	Analog Input 3 Term 12 Destination	0	500	ICR		0	Analog Input	
26	Analog Input 4 Term 13 Destination	0	500	ICR		0	Analog Input	
27	Analog Input 5 Term 14 Destination	0	500	ICR		0	Analog Input	
28	Analog Input 1 Term 10 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
29	Analog Input 2 Term 11 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
30	Analog Input 3 Term 12 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
31	Analog Input 4 Term 13 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
32	Analog Input 5 Term 14 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
33	Analog Input 1 Term 10 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
34	Analog Input 2 Term 11 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
35	Analog Input 3 Term 12 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
36	Analog Input 4 Term 13 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
37	Analog Input 5 Term 14 Type	0:Current	1:Voltage		RO	1:Voltage	Analog Input	
38	Analog Input 1 Term 10 0% Calibration	-2048	4095			0	Analog Input	
39	Analog Input 2 Term 11 0% Calibration	-2048	4095			0	Analog Input	
40	Analog Input 3 Term 12 0% Calibration	-2048	4095			0	Analog Input	
41	Analog Input 4 Term 13 0% Calibration	-2048	4095			0	Analog Input	
42	Analog Input 5 Term 14 0% Calibration	-2048	4095			0	Analog Input	
43	Analog Input 1 Term 10 100% Calibration	0	4095			4095	Analog Input	
44	Analog Input 2 Term 11 100% Calibration	0	4095			4095	Analog Input	
45	Analog Input 3 Term 12 100% Calibration	0	4095			4095	Analog Input	
46	Analog Input 4 Term 13 100% Calibration	0	4095			4095	Analog Input	
47	Analog Input 5 Term 14 100% Calibration	0	4095			4095	Analog Input	
48	Analog Input 1 Term 10 Bias	0.00%*	200.00%*			0.00%	Analog Input	
49	Analog Input 2 Term 11 Bias	0.00%*	200.00%*			0.00%	Analog Input	
50	Analog Input 3 Term 12 Bias	0.00%*	200.00%*			0.00%	Analog Input	
51	Analog Input 4 Term 13 Bias	0.00%*	200.00%*			0.00%	Analog Input	
52	Analog Input 5 Term 14 Bias	0.00%*	200.00%*			0.00%	Analog Input	
53	Analog Input 1 Term 10 Gain	0.00%*	200.00%*			100.00%	Analog Input	
54	Analog Input 2 Term 11 Gain	0.00%*	200.00%*			100.00%	Analog Input	
55	Analog Input 3 Term 12 Gain	0.00%*	200.00%*			100.00%	Analog Input	
56	Analog Input 4 Term 13 Gain	0.00%*	200.00%*			100.00%	Analog Input	
57	Analog Input 5 Term 14 Gain	0.00%*	200.00%*			100.00%	Analog Input	
58	Analog Input 1 Term 10 filtering	0	15			0	Analog Input	
59	Analog Input 2 Term 11 filtering	0	15			0	Analog Input	
60	Analog Input 3 Term 12 filtering	0	15			0	Analog Input	
61	Analog Input 4 Term 13 filtering	0	15			0	Analog Input	
62	Analog Input 5 Term 14 filtering	0	15			0	Analog Input	
63	Frequency Input Term 18 Destination	0	500	ICR		0	Frequency Input	

* The Min and Max values shown are according to the factory presets for its Source/Destination parameter. If the Source/Destination parameter is modified, the Min and Max values will change according to the new Source/Destination parameter.

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
64	Frequency Input Term 18 0% Calibration	0 Hz	60000 Hz			0 Hz	Frequency Input	
65	Frequency Input Term 18 100% Calibration	0 Hz	60000 Hz			40000 Hz	Frequency Input	
66	Frequency Input Term 18 Bias	0.00%*	200.00%*			0.00%	Frequency Input	
67	Frequency Input Term 18 Gain	0.00%*	200.00%*			100.00%	Frequency Input	
68	Frequency Input Term 18 filtering	0	15			0	Frequency Input	
69	User Relay 1 Term 25-27 Source	0	500	ICR		210	User Relay	
70	User Relay 2 Term 28-30 Source	0	500	ICR		242	User Relay	
71	User Relay 3 Term 54-56 Source	0	500	ICR		303	User Relay	
72	User Relay 1 Term 25-27 Absolute Value	0:False	1:True			1:True	User Relay	
73	User Relay 2 Term 28-30 Absolute Value	0:False	1:True			1:True	User Relay	
74	User Relay 3 Term 54-56 Absolute Value	0:False	1:True			1:True	User Relay	
75	User Relay 1 Term 25-27 On Value	0:False*	1:True*			1:True	User Relay	
76	User Relay 2 Term 28-30 On Value	0:False*	1:True*			1:True	User Relay	
77	User Relay 3 Term 54-56 On Value	0:False*	1:True*			1:True	User Relay	
78	User Relay 1 Term 25-27 Off Value	0:False*	1:True*			0:False	User Relay	
79	User Relay 2 Term 28-30 Off Value	0:False*	1:True*			0:False	User Relay	
80	User Relay 3 Term 54-56 Off Value	0:False*	1:True*			0:False	User Relay	
81	Analog Output 1 Term 21 Source	0	500	ICR		193	Analog Output	
82	Analog Output 2 Term 22 Source	0	500	ICR		102	Analog Output	
83	Analog Output 1 Term 21 Gain	-200.00%	200.00%			100.00%	Analog Output	
84	Analog Output 2 Term 22 Gain	-200.00%	200.00%			100.00%	Analog Output	
85	Analog Output 1 Term 21 Bias	-100.00%	100.00%			0.00%	Analog Output	
86	Analog Output 2 Term 22 Bias	-100.00%	100.00%			0.00%	Analog Output	
87	Analog Output 1 Term 21 Absolute Value	0:False	1:True			0:False	Analog Output	
88	Analog Output 2 Term 22 Absolute Value	0:False	1:True			0:False	Analog Output	
89	Freq/Digital Output Term 52 Source	0	500	ICR		193	F/D Output	
90	Frequency/Digital Term 52 Mode	0:Freq	1:Digital			0:Freq	F/D Output	
91	Digital Output Term 52 Absolute Value	0:False	1:True			1:True	F/D Output	
92	Digital Output Term 52 On Value	-200.00%*	200.00%*			100.00%	F/D Output	
93	Digital Output Term 52 Off Value	-200.00%*	200.00%*			0.00%	F/D Output	
94	Digital Output Term 52 Invert	0:False	1:True			0:False	F/D Output	
95	Frequency Output Term 52 Gain	0.00%	200.00%			100.00%	F/D Output	
96	Frequency Output Term 52 Bias	0.00%	100.00%			0.00%	F/D Output	
97	Torque Reference	-150.00%	150.00%			0.00%	Current Loop	
98	Aux Current Demand	-150.00%	150.00%			0.00%	Current Loop	
99	Positive C.L.	0.00%	150.00%			150.00%	Current Loop	
100	Negative C.L.	-150.00%	0.00%			-150.00%	Current Loop	
101	Final Current Demand	-150.00%	150.00%		RO	0.00%	Current Loop	
102	Current Feedback	-150.00%	150.00%		RO	0.00%	Current Loop	
103	Current Error	-300.00%	300.00%		RO	0.00%	Current Loop	
104	Open Loop Arm Select	0:False	1:True	ICR		0:False	Current Loop	
105	Open Loop Arm Set Pt	-100.00%	100.00%			0.00%	Current Loop	
106	Conduction Angle Demand	0.00%	100.00%		RO	0.00%	Current Loop	
107	Current Proportional Gain	0.00	25.00			2.50	Current Loop	
108	Current Integral Time	0.010 Secs	30.000 Secs			0.164 Secs	Current Loop	
109	Drive Mode (MSB)	0	1			0	Current Loop	
110	Drive Mode (LSB)	0	1			0	Current Loop	
111	Current Demand	-150.00%	150.00%		RO	0.00%	Current Loop	
112	Current Feedback {Filtered}	-150.00%	150.00%		RO	0.00%	Current Loop	
113	Final Current Demand {Filtered}	-150.00%	150.00%		RO	0.00%	Current Loop	
114	Armature Amps	0.0 Amps	1530.0 Amps		RO	0.0 Amps	Current Loop	
115	Aux 1 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
116	Aux 2 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
117	Aux 3 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
118	Aux 4 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
119	Aux 5 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
120	Aux 6 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
121	Aux 7 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
122	Nameplate Drive Current	Per Model	Per Model		RO	Per Model	Calibration	
123	Nameplate Motor Current	0.0 Amps	Per Model			Per Model	Calibration	
124	Encoder Lines	0:256,1:512,2:1024,3:2048				2:1024	Calibration	
125	100% Encoder RPM	0 RPM	10000 RPM			1750 RPM	Calibration	
126	Invert FB	0:False	1:True			0:False	Calibration	
127	Tachometer Type	0:DC	1:AC			0:DC	Calibration	
128	Nameplate Motor Voltage	0.0 Volts	500.0 Volts			240.0 Volts	Calibration	
129	Final Velocity Demand	-105.00%	105.00%		RO	0.00%	Velocity Loop	
130	VFB Offset	-10.00%	10.00%			0.00%	Velocity Loop	
131	IR Compensation	0.00%	10.00%			0.00%	Velocity Loop	
132	Digital Input 1 Term 31 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
133	Digital Input 2 Term 32 Status	0:Open	1:Closed		RO	0:Open	Digital Input	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
134	Digital Input 3 Term 33 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
135	Digital Input 4 Term 34 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
136	Digital Input 5 Term 35 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
137	Digital Input 6 Term 36 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
138	Digital Input 7 Term 37 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
139	Analog Input 1 Term 10 Status	-2048	4095		RO	0	Analog Input	
140	Analog Input 2 Term 11 Status	-2048	4095		RO	0	Analog Input	
141	Analog Input 3 Term 12 Status	-2048	4095		RO	0	Analog Input	
142	Analog Input 4 Term 13 Status	-2048	4095		RO	0	Analog Input	
143	Analog Input 5 Term 14 Status	-2048	4095		RO	0	Analog Input	
144	DC TFB Status	-2048	4095		RO	0	Diagnostics	
145	AC TFB Status	-2048	4095		RO	0	Diagnostics	
146	AFB Status	-2048	4095		RO	0	Diagnostics	
147	Armature IFB Status #1	0	1023		RO	0	Diagnostics	
148	Field IFB Status #1	0	1023		RO	0	Diagnostics	
149	Line Voltage Status	0	1023		RO	0	Diagnostics	
150	Field VFB Status	0	1023		RO	0	Diagnostics	
151	Armature IFB Status #2	0	1023		RO	0	Diagnostics	
152	Field IFB Status #2	0	1023		RO	0	Diagnostics	
153	Heatsink Status	0	1023		RO	0	Diagnostics	
154	Battery Status	0	1023		RO	0	Diagnostics	
155	Armature IFB Status #3	0	1023		RO	0	Diagnostics	
156	Field IFB Status #3	0	1023		RO	0	Diagnostics	
157	+12V Status	0	1023		RO	0	Diagnostics	
158	+15V Status	0	1023		RO	0	Diagnostics	
159	Armature IFB Status #4	0	1023		RO	0	Diagnostics	
160	Field IFB Status #4	0	1023		RO	0	Diagnostics	
161	Reserved [ADCIN11]	0	1023		RO	0	Diagnostics	
162	+24V Status	0	1023		RO	0	Diagnostics	
163	EFB Counter Status	0 Hz	65535 Hz		RO	0 Hz	Diagnostics	
164	Frequency Input Term 18 Status	0 Hz	60000 Hz		RO	0 Hz	Freq Input	
165	Relay Output 1 Term 25-27 Status	0	1		RO	0	User Relay	
166	Relay Output 2 Term 28-30 Status	0	1		RO	0	User Relay	
167	Relay Output 3 Term 54-56 Status	0	1		RO	0	User Relay	
168	Analog Output 1 Term 21 Status	-4095	4095		RO	0	Analog Output	
169	Analog Output 2 Term 22 Status	-4095	4095		RO	0	Analog Output	
170	Freq/Dig Output Term 52 Status	-1	2000		RO	0	F/D Output	
171	+12V Supply	0.0 Volts	15.0 Volts		RO	0.0 Volts	Diagnostics	
172	+15V Supply	0.0 Volts	18.7 Volts		RO	0.0 Volts	Diagnostics	
173	+24V Supply	0.0 Volts	30.4 Volts		RO	0.0 Volts	Diagnostics	
174	Battery Supply	0.0 Volts	5.0 Volts		RO	0.0 Volts	Diagnostics	
175	Line Voltage	0.0 Volts	600.0 Volts		RO	0.0 Volts	Diagnostics	
176	Heatsink Temperature	0 C	115 C		RO	0 C	Diagnostics	
177	Input A	-200.00%	200.00%			0.00%	Misc Thresholds	
178	Threshold A	0.00%	200.00%			1.00%	Misc Thresholds	
179	Hysteresis A	0.00%	200.00%			0.00%	Misc Thresholds	
180	Less Than or Equal A	-200.00%	200.00%			0.00%	Misc Thresholds	
181	Greater Than A	-200.00%	200.00%			1.00%	Misc Thresholds	
182	Output A	-200.00%	200.00%		RO	0.00%	Misc Thresholds	
183	Input B	-200.00%	200.00%			0.00%	Misc Thresholds	
184	Threshold B	0.00%	200.00%			1.00%	Misc Thresholds	
185	Hysteresis B	0.00%	200.00%			0.00%	Misc Thresholds	
186	Less Than or Equal B	-200.00%	200.00%			0.00%	Misc Thresholds	
187	Greater Than B	-200.00%	200.00%			1.00%	Misc Thresholds	
188	Output B	-200.00%	200.00%		RO	0.00%	Misc Thresholds	
189	Velocity Demand	-100.00%	100.00%		RO	0.00%	Velocity Loop	
190	Forward Max Speed Scale	0.00%	105.00%			100.00%	Velocity Loop	
191	Reverse Max Speed Scale	-105.00%	0.00%			-100.00%	Velocity Loop	
192	Velocity Error	-230.00%	230.00%		RO	0.00%	Velocity Loop	
193	Velocity Feedback	-125.00%	125.00%		RO	0.00%	Velocity Loop	
194	Armature Feedback	-120.00%	120.00%		RO	0.00%	Velocity Loop	
195	Tach Feedback	-125.00%	125.00%		RO	0.00%	Velocity Loop	
196	Encoder Feedback	-125.00%	125.00%		RO	0.00%	Velocity Loop	
197	Feedback Select	0:AFB, 1:TFB, 2:EFB		ICR		0:AFB	Velocity Loop	
198	Velocity Feedback Filtered	-125.00%	125.00%		RO	0.00%	Velocity Loop	
199	100% RPM Level	0 RPM	10000 RPM			1750 RPM	Velocity Loop	
200	Motor RPM	0 RPM	20000 RPM		RO	0 RPM	Velocity Loop	
201	Velocity Prop Gain A	0.00	100.00			9.00	Velocity Loop	
202	Velocity Integral Time A	0.010 Secs	30.000 Secs			0.158 Secs	Velocity Loop	
203	Velocity Gain Select	0	1			0	Velocity Loop	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
204	Velocity Overshoot Gain A	0.00%	100.00%			100.00%	Velocity Loop	
205	Velocity Loop Output	-150.00%	150.00%		RO	0.00%	Velocity Loop	
206	Regenerative Mode	0:False	1:True	ICR		1:True	Current Loop	
207	Zero Speed Setpoint	1.00%	25.00%			2.00%	Zero Speed	
208	Standstill Logic	0:False	1:True			0:False	Zero Speed	
209	At Zero Set	0:False	1:True		RO	1:True	Zero Speed	
210	At Zero Speed	0:False	1:True		RO	1:True	Zero Speed	
211	At Standstill	0:False	1:True		RO	1:True	Zero Speed	
212	Loop Enable	0:False	1:True		RO	0:False	Zero Speed	
213	Velocity Overshoot Gain B	0.00%	100.00%			100.00%	Velocity Loop	
214	Integral Clamp	0:False	1:True			0:False	Velocity Loop	
215	Reference Select (MSB)	0	1			0	Setpoints	
216	Reference Select (LSB)	0	1			0	Setpoints	
217	Reference 0	-200.00%	200.00%			0.00%	Setpoints	
218	Reference 1	-200.00%	200.00%			0.00%	Setpoints	
219	Reference 2	-200.00%	200.00%			0.00%	Setpoints	
220	Reference 3	-200.00%	200.00%			0.00%	Setpoints	
221	Jog Reference	-200.00%	200.00%			5.00%	Setpoints	
222	Reference Invert	0:False	1:True			0:False	Setpoints	
223	Overspeed Level	0.00%	125.00%			125.00%	Fault Logic	
224	Ramp Input	-150.00%	150.00%		RO	0.00%	Accel/Decel	
225	Ramp Output	-150.00%	150.00%		RO	0.00%	Accel/Decel	
226	Forward Accel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
227	Forward Decel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
228	Reverse Accel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
229	Reverse Decel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
230	Ramp Threshold	0.00%	100.00%			5.00%	Accel/Decel	
231	Ramping Status	0:False	1:True		RO	0:False	Accel/Decel	
232	Stop Mode	0:Ramp,1:Quick,2:Coast				0:Ramp	Start/Stop	
233	Setpoint A Invert	0:False	1:True			0:False	Setpoint Sum	
234	Setpoint B	-200.00%	200.00%			0.00%	Setpoint Sum	
235	Setpoint B Invert	0:False	1:True			0:False	Setpoint Sum	
236	Setpoint C	-200.00%	200.00%			0.00%	Setpoint Sum	
237	Setpoint C Invert	0:False	1:True			0:False	Setpoint Sum	
238	System Status Register	0x0000	0xFFFF		RO	0x0000	Diagnostics	
239	Run	0:False	1:True			0:False	Start/Stop	
240	Stop	0:False	1:True			0:False	Start/Stop	
241	Jog	0:False	1:True			0:False	Start/Stop	
242	Run Status	0:False	1:True		RO	0:False	Start/Stop	
243	Jog Status	0:False	1:True		RO	0:False	Start/Stop	
244	Armature Pilot	0:False	1:True		RO	0:False	Start/Stop	
245	Start/Stop Logic Select	0:Three Wire	1:TwoWire			0:Three Wire	Start/Stop	
246	Jog Delay	0.0 Secs	10.0 Secs			3.0 Secs	Start/Stop	
247	VFB Loss Level	0.00%	100.00%			50.00%	Fault Logic	
248	VFB Loss Inhibit	0:False	1:True			0:False	Fault Logic	
249	Field Loss Level	0.00%	100.00%			6.00%	Fault Logic	
250	Field Loss Inhibit	0:False	1:True			0:False	Fault Logic	
251	Armature I Foldback Time	0.0 Secs	60.0 Secs			15.0 Secs	Fault Logic	
252	Armature I Foldback Status	0:False	1:True		RO	0:False	Fault Logic	
253	Overcurrent Time	0.0 Secs	240.0 Secs			45.0 Secs	Fault Logic	
254	External Fault Reset	0:False	1:True			0:False	Fault Logic	
255	Present Fault Status	0x0000	0xFFFF		RO	0x0000	Fault Logic	
256	Seconds	0	59			-	Fault Logic	
257	Minute	0	59			-	Fault Logic	
258	Hour	0	23			-	Fault Logic	
259	Day	1	7			-	Fault Logic	
260	Date	1	31			-	Fault Logic	
261	Month	1	12			-	Fault Logic	
262	Year	0	99			-	Fault Logic	
263	Fault #1	0x0000	0xFFFF		RO	-	Fault Logic	
264	Seconds #1	0	59		RO	-	Fault Logic	
265	Minute #1	0	59		RO	-	Fault Logic	
266	Hour #1	0	23		RO	-	Fault Logic	
267	Day #1	1	7		RO	-	Fault Logic	
268	Date #1	1	31		RO	-	Fault Logic	
269	Month #1	1	12		RO	-	Fault Logic	
270	Year #1	0	99		RO	-	Fault Logic	
271	Fault #2	0x0000	0xFFFF		RO	-	Fault Logic	
272	Seconds #2	0	59		RO	-	Fault Logic	
273	Minute #2	0	59		RO	-	Fault Logic	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
274	Hour #2	0	23		RO	-	Fault Logic	
275	Day #2	1	7		RO	-	Fault Logic	
276	Date #2	1	31		RO	-	Fault Logic	
277	Month #2	1	12		RO	-	Fault Logic	
278	Year #2	0	99		RO	-	Fault Logic	
279	Fault #3	0x0000	0xFFFF		RO	-	Fault Logic	
280	Seconds #3	0	59		RO	-	Fault Logic	
281	Minute #3	0	59		RO	-	Fault Logic	
282	Hour #3	0	23		RO	-	Fault Logic	
283	Day #3	1	7		RO	-	Fault Logic	
284	Date #3	1	31		RO	-	Fault Logic	
285	Month #3	1	12		RO	-	Fault Logic	
286	Year #3	0	99		RO	-	Fault Logic	
287	Fault #4	0x0000	0xFFFF		RO	-	Fault Logic	
288	Seconds #4	0	59		RO	-	Fault Logic	
289	Minute #4	0	59		RO	-	Fault Logic	
290	Hour #4	0	23		RO	-	Fault Logic	
291	Day #4	1	7		RO	-	Fault Logic	
292	Date #4	1	31		RO	-	Fault Logic	
293	Month #4	1	12		RO	-	Fault Logic	
294	Year #4	0	99		RO	-	Fault Logic	
295	Fault #5	0x0000	0xFFFF		RO	-	Fault Logic	
296	Seconds #5	0	59		RO	-	Fault Logic	
297	Minute #5	0	59		RO	-	Fault Logic	
298	Hour #5	0	23		RO	-	Fault Logic	
299	Day #5	1	7		RO	-	Fault Logic	
300	Date #5	1	31		RO	-	Fault Logic	
301	Month #5	1	12		RO	-	Fault Logic	
302	Year #5	0	99		RO	-	Fault Logic	
303	Drive Ready	0:False	1:True		RO	0:False	Start Stop Logic	
304	Latched Fault Status	0x0000	0xFFFF		RO	0x0000	Fault Logic	
305	Ramp Bypass	0:False	1:True			0:False	Accel/Decel	
306	Ramp Select	0:False	1:True			0:False	Accel/Decel	
307	Forward Accel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
308	Forward Decel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
309	Reverse Accel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
310	Reverse Decel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
311	Timer Reset	0:False	1:True			1:True	Misc Timer	
312	Timer Threshold	0.0 Secs	240.0 Secs			5.0 Secs	Misc Timer	
313	Timer Less Than or Equal To	-100.00%	100.00%			0.00%	Misc Timer	
314	Timer Greater Than	-100.00%	100.00%			1.00%	Misc Timer	
315	Timer Output	-100.00%	100.00%		RO	0.00%	Misc Timer	
316	MOP Increase	0:False	1:True			0:False	Misc MOP	
317	MOP Decrease	0:False	1:True			0:False	Misc MOP	
318	MOP Increase Time	0.0 Secs	600.0 Secs			5.0 Secs	Misc MOP	
319	MOP Decrease Time	0.0 Secs	600.0 Secs			5.0 Secs	Misc MOP	
320	MOP Max Value	-100.00%	100.00%			100.00%	Misc MOP	
321	MOP Min Value	-100.00%	100.00%			-100.00%	Misc MOP	
322	MOP Reset	0:False	1:True			0:False	Misc MOP	
323	MOP Reset Value	-100.00%	100.00%			0.00%	Misc MOP	
324	MOP Output	-100.00%	100.00%		RO	0.00%	Misc MOP	
325	Velocity Prop Gain B	0.00	100.00			9.00	Velocity Loop	
326	Velocity Integral Time B	0.010 Secs	30.000 Secs			0.058 Secs	Velocity Loop	
327	Power On Reset	0:False	1:True		RO	0:False	Fault Logic	
328	Field Conduction Angle	0.00%	100.00%		RO	0.00%	Field Loop	
329	Open Loop Field Select	0:False	1:True			1:True	Field Loop	
330	Open Loop Field Setpoint	0.00%	100.00%			67.00%	Field Loop	
331	Field Enable	0:False	1:True	ICR		1:True	Field Loop	
332	Field Economy Enable	0:False	1:True			0:True	Field Loop	
333	Field VFB	0.00%	125.00%		RO	0.00%	Field Loop	
334	Field VFB {Filtered}	0.00%	125.00%		RO	0.00%	Field Loop	
335	Field Voltage	0.0 Volts	400.0 Volts		RO	0.0 Volts	Field Loop	
336	Field IFB	0.00%	100.00%		RO	0.00%	Field Loop	
337	Field IFB {Filtered}	0.00%	100.00%		RO	0.00%	Field Loop	
338	Field Amps	0.00 Amps	10.00 Amps		RO	0.00 Amps	Field Loop	
339	Field Current Demand	0.00%	100.00%			0.00%	Field Loop	
340	Field Prop Gain	0.00	20.00			0.20	Field Loop	
341	Field Integral Time	0.001 Secs	30.000 Secs			0.200 Secs	Field Loop	
342	Field IFB Offset	-20.00%	20.00%			0.00%	Field Loop	
343	Field VFB Offset	-20.00%	20.00%			0.00%	Field Loop	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
344	Analog Input 1 Term 10 Invert	0:False	1:True			0:False	Analog Input	
345	Analog Input 2 Term 11 Invert	0:False	1:True			0:False	Analog Input	
346	Analog Input 3 Term 12 Invert	0:False	1:True			0:False	Analog Input	
347	Analog Input 4 Term 13 Invert	0:False	1:True			0:False	Analog Input	
348	Analog Input 5 Term 14 Invert	0:False	1:True			0:False	Analog Input	
349	Frequency Input Term 18 Sign	0:Positive	1:Negative			0:Positive	Freq Input	
350	Aux PI Setpoint	-100.00%	100.00%			0.00%	App Aux PI	
351	Aux PI Feedback	-100.00%	100.00%			0.00%	App Aux PI	
352	Aux PI Error	-200.00%	200.00%		RO	0.00%	App Aux PI	
353	Aux PI Integral Clamp	0:False	1:True			0:False	App Aux PI	
354	Aux PI Deadband Setpoint	-30.00%	30.00%			0.00%	App Aux PI	
355	Aux PI Proportional Gain Setpoint	0.00	5.00			1.00	App Aux PI	
356	Aux PI Integral Time Setpoint	0.100 Secs	60.000 Secs			0.200 Secs	App Aux PI	
357	Aux PI Reset	0:False	1:True			0:False	App Aux PI	
358	Aux PI Polarity	0:Unipolar	1:Bipolar			1:Bipolar	App Aux PI	
359	Aux PI Trim Setpoint	0.00%	100.00%			100.00%	App Aux PI	
360	Aux PI Scale Setpoint	-100.00%	100.00%			100.00%	App Aux PI	
361	Aux PI At Limit	0:False	1:True		RO	0:False	App Aux PI	
362	Aux PI Proportional Status	0.00%	100.00%		RO	0.00%	App Aux PI	
363	Aux PI Integral Status	0.00%	100.00%		RO	0.00%	App Aux PI	
364	Aux PI Output	0.00%	100.00%		RO	0.00%	App Aux PI	
365	Timer Reset Invert	0:False	1:True			0:False	Misc Timer	
366	Internal Link 1 Source	0	500			243	Misc Internal Links	
367	Internal Link 1 Destination	0	500	ICR		306	Misc Internal Links	
368	Internal Link 2 Source	0	500			225	Misc Internal Links	
369	Internal Link 2 Destination	0	500	ICR		105	Misc Internal Links	
370	Internal Link 3 Source	0	500			225	Misc Internal Links	
371	Internal Link 3 Destination	0	500	ICR		97	Misc Internal Links	
372	Internal Link 4 Source	0	500			0	Misc Internal Links	
373	Internal Link 4 Destination	0	500	ICR		0	Misc Internal Links	
374	Internal Link 5 Source	0	500			0	Misc Internal Links	
375	Internal Link 5 Destination	0	500	ICR		0	Misc Internal Links	
376	Internal Link 6 Source	0	500			0	Misc Internal Links	
377	Internal Link 6 Destination	0	500	ICR		0	Misc Internal Links	
378	Internal Link 7 Source	0	500			0	Misc Internal Links	
379	Internal Link 7 Destination	0	500	ICR		0	Misc Internal Links	
380	Internal Link 8 Source	0	500			0	Misc Internal Links	
381	Internal Link 8 Destination	0	500	ICR		0	Misc Internal Links	
382	Internal Link 9 Source	0	500			0	Misc Internal Links	
383	Internal Link 9 Destination	0	500	ICR		0	Misc Internal Links	
384	Internal Link 10 Source	0	500			0	Misc Internal Links	
385	Internal Link 10 Destination	0	500	ICR		0	Misc Internal Links	
386	Internal Link 11 Source	0	500			0	Misc Internal Links	
387	Internal Link 11 Destination	0	500	ICR		0	Misc Internal Links	
388	Internal Link 12 Source	0	500			0	Misc Internal Links	
389	Internal Link 12 Destination	0	500	ICR		0	Misc Internal Links	
390	Internal Link 13 Source	0	500			0	Misc Internal Links	
391	Internal Link 13 Destination	0	500	ICR		0	Misc Internal Links	
392	Internal Link 14 Source	0	500			0	Misc Internal Links	
393	Internal Link 14 Destination	0	500	ICR		0	Misc Internal Links	
394	Internal Link 15 Source	0	500			0	Misc Internal Links	
395	Internal Link 15 Destination	0	500	ICR		0	Misc Internal Links	
396	Internal Link 16 Source	0	500			0	Misc Internal Links	
397	Internal Link 16 Destination	0	500	ICR		0	Misc Internal Links	
398	Internal Link 17 Source	0	500			0	Misc Internal Links	
399	Internal Link 17 Destination	0	500	ICR		0	Misc Internal Links	
400	Internal Link 18 Source	0	500			0	Misc Internal Links	
401	Internal Link 18 Destination	0	500	ICR		0	Misc Internal Links	
402	Internal Link 19 Source	0	500			0	Misc Internal Links	
403	Internal Link 19 Destination	0	500	ICR		0	Misc Internal Links	
404	Internal Link 20 Source	0	500			0	Misc Internal Links	
405	Internal Link 20 Destination	0	500	ICR		0	Misc Internal Links	
406	Save	0	1	ICR		0	Misc System	
407	Load	0	2	ICR		0	Misc System	
408	Re-Initialize	0	1	ICR		0	Misc System	
409	Control Firmware Version	0	255		RO	-	Misc System	
410	Fan Mode	0:Auto	1:On			0:Auto	Diagnostics	
411	Drive Model	0	65535		RO	0	Misc System	
412	Min Max Source	0	500			0	Misc MinMax	
413	Min Max Reset	0:False	1:True			0:False	Misc MinMax	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
414	Max Peak	-200.00%	200.00%		RO	0.00%	Misc MinMax	
415	Min Peak	-200.00%	200.00%		RO	0.00%	Misc MinMax	
416	Min Max Difference	-200.00%	200.00%		RO	0.00%	Misc MinMax	
417	Armature Voltage	-600.0 Volts	600.0 Volts		RO	0.0 Volts	Velocity Loop	
418	Watchdog Status	0x0000	0xFFFF		RO	0x0000	Misc System	
419	Aux Firmware Versions	0	65535		RO	-	Misc System	
420	Keypad Fault Reset	0	1			0	None	
421	Command Entry	0	65535			0	None	
422	Drive Status	0	8		RO	0	Start/Stop	
423	Field Crossover Enable	0:False	1:True	ICR		0:False	Field Crossover	
424	Min Field Current Demand	0.00%	100.00%			0.00%	Field Crossover	
425	Field Crossover Setpoint	0.00%	95.00%			85.00%	Field Crossover	
426	Field Crossover Output	0.00%	100.00%		RO	0.00%	Field Crossover	
427	Final Field Current Demand	0.00%	100.00%		RO	0.00%	Field Loop	
428	Timer	0.0 Secs	240.0 Secs		RO	0.0 Secs	Misc Timer	
429	Core	0.00 %	100.00 %			10.0 %	App Winder Speed	
430	Line Speed	0.00 %	100.00 %			0.00 %	App Winder Speed	
431	Diameter Ratio	0.00 %	100.00 %			0.00 %	App Winder Speed	
432	Diameter	0.00 %	100.00 %		RO	0.00 %	App Winder Speed	
433	Winder Speed	0.00 %	100.00 %		RO	0.00 %	App Winder Speed	
434	Network Address	1	255			1	Misc Comm.	
435	Baud Rate	2400,4800,9600,19200,38400				38400	Misc Comm.	
436	Parity	0:None, 1:Odd, 2:Even				None	Misc Comm.	
437	Stop Bits	1	2			2	Misc Comm.	
438	Addressing Mode	0:No Offset	1: Offset			1: Offset	Misc Comm.	
439	Parameters Changed	0:False	1:True		RO	0:False	Misc System	
440	Total Parameters	0	65535		RO	500	Misc System	
441	Tension Setpoint	0.00 %	100.00 %			0.00 %	App CTCW	
442	Diameter Select	0:Off, 1:Line/Winder, 2: Ext Dia				0:Off	App CTCW	
443	Line Speed	0.00 %	100.00 %			0.00 %	App CTCW	
444	100% Winder Speed Calibration	0.00 %	100.00 %			0.00 %	App CTCW	
445	External Diameter Ratio	0.00 %	100.00 %			0.00 %	App CTCW	
446	Core	0.00 %	100.00 %			0.00 %	App CTCW	
447	Diameter Memory Reset	0:False	1:True			0:False	App CTCW	
448	Friction Compensation	0.00 %	100.00 %			0.00 %	App CTCW	
449	Inertia Compensation	0.00 %	50.00 %			0.00 %	App CTCW	
450	Diameter Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
451	Diameter	0.00 %	100.00 %		RO	0.00 %	App CTCW	
452	Scaled Winder Speed Ratio	0.00 %	100.00 %		RO	0.00 %	App CTCW	
453	Friction Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
454	Inertia Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
455	Total Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
456	Taper Diameter	0.00 %	100.00 %			0.00 %	App CTCW	
457	Taper Percentage	0.00 %	100.00 %			0.00 %	App CTCW	
458	Tension Demand	0.00 %	100.00 %		RO	0.00 %	App CTCW	
459	Line Speed Sum	0.00 %	100.00 %			0.00 %	App Winder Speed	
460	Addressing Mode Test 1	0	65535		RO	21845	Misc System	
461	Addressing Mode Test 2	0	65535		RO	43690	Misc System	
462	Static Friction Torque	0.00 %	100.00 %			0.00 %	App CTCW	
463	Winder Speed Ratio	0.00 %	100.00 %			0.00 %	App CTCW	
464	Data Logger Signal Source	0	500			0	-	
465	Data Logger Trigger Source	0	500			0	-	
466	Data Logger Control	0	2			0	-	
467	Data Logger Samples	1	10000			10000	-	
468	Reserved	-200.00%	200.00%			0.00%	-	
469	Reserved	-200.00%	200.00%			0.00%	-	
470	Reserved	-200.00%	200.00%			0.00%	-	
471	Reserved	-200.00%	200.00%			0.00%	-	
472	General Param 1	0	65535			0	-	
473	General Param 2	0	65535			0	-	
474	General Param 3	0	65535			0	-	
475	General Param 4	0	65535			0	-	
476	General Param 5	0	65535			0	-	
477	General Param 6	0	65535			0	-	
478	General Param 7	0	65535			0	-	
479	General Param 8	0	65535			0	-	
480	General Param 9	0	65535			0	-	
481	General Param 10	0	65535			0	-	
482	General Param 11	0	65535			0	-	
483	General Param 12	0	65535			0	-	

Tag	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
484	Torque Sum	-100.00%	100.00%			0.00%	App CTCW	
485	Internal Fault Reset	0:False	1:True		RO	0:False	Fault Log	
486	Fault Reset	0:False	1:True		RO	0:False	Fault Log	
487	Field Current Feedback Select	0:Internal	1:External			0:Internal	Field Loop	
488	External Field Current Feedback	0.00%	100.00%			0.00%	Field Loop	
489	100% Field Current Feedback	0.00 Amps	100.00 Amps			8.00 Amps	Field Loop	
490	External Fault	0:False	1:True		RO	0:False	Fault Logic	
491	Trigger Board Firmware Version	0	255		RO	-	Misc System	
492	Boot Loader Firmware Version	0	255		RO	-	Misc System	
493	Independent Current Limits	0:False	1:True			1:True	Current Loop	
494	Independent Speed Scales	0:False	1:True			1:True	Velocity Loop	
495	Aux PI Enable	0:False	1:True			1:True	App Aux PI	
496	Command Data	0	65535			0	-	
497	Actual Tension	0.00%	100.00%			0.00%	App CTCW	
498	Setpoint A Ratio	-100.00%	100.00%			100.00%	Setpoint Sum	
499	Setpoint D	-200.00%	200.00%			0.00%	Setpoint Sum	
500	Slew Rate Limit	0.00%	100.00%			100.00%	Current Loop	

Table 17: Parameters by Name

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
157	+12V Status	0	1023		RO	0	Diagnostics	
171	+12V Supply	0.0 Volts	15.0 Volts		RO	0.0 Volts	Diagnostics	
158	+15V Status	0	1023		RO	0	Diagnostics	
172	+15V Supply	0.0 Volts	18.7 Volts		RO	0.0 Volts	Diagnostics	
162	+24V Status	0	1023		RO	0	Diagnostics	
173	+24V Supply	0.0 Volts	30.4 Volts		RO	0.0 Volts	Diagnostics	
125	100% Encoder RPM	0 RPM	10000 RPM			1750 RPM	Calibration	
489	100% Field Current Feedback	0.00 Amps	100.00 Amps			8.00 Amps	Field Loop	
199	100% RPM Level	0 RPM	10000 RPM			1750 RPM	Velocity Loop	
444	100% Winder Speed Calibration	0.00 %	100.00 %			0.00 %	App CTCW	
145	AC TFB Status	-2048	4095		RO	0	Diagnostics	
497	Actual Tension	0.00%	100.00%			0.00%	App CTCW	
438	Addressing Mode	0:No Offset	1: Offset			1: Offset	Misc Comm.	
460	Addressing Mode Test 1	0	65535		RO	21845	Misc System	
461	Addressing Mode Test 2	0	65535		RO	43690	Misc System	
146	AFB Status	-2048	4095		RO	0	Diagnostics	
38	Analog Input 1 Term 10 0% Calibration	-2048	4095			0	Analog Input	
43	Analog Input 1 Term 10 100% Calibration	0	4095			4095	Analog Input	
48	Analog Input 1 Term 10 Bias	0.00%*	200.00%*			0.00%	Analog Input	
23	Analog Input 1 Term 10 Destination	0	437	ICR		217	Analog Input	
58	Analog Input 1 Term 10 filtering	0	15			0	Analog Input	
53	Analog Input 1 Term 10 Gain	0.00%*	200.00%*			100.00%	Analog Input	
344	Analog Input 1 Term 10 Invert	0:False	1:True			0:False	Analog Input	
28	Analog Input 1 Term 10 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
139	Analog Input 1 Term 10 Status	-2048	4095		RO	0	Analog Input	
33	Analog Input 1 Term 10 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
39	Analog Input 2 Term 11 0% Calibration	-2048	4095			0	Analog Input	
44	Analog Input 2 Term 11 100% Calibration	0	4095			4095	Analog Input	
49	Analog Input 2 Term 11 Bias	0.00%*	200.00%*			0.00%	Analog Input	
24	Analog Input 2 Term 11 Destination	0	500	ICR		0	Analog Input	
59	Analog Input 2 Term 11 filtering	0	15			0	Analog Input	
54	Analog Input 2 Term 11 Gain	0.00%*	200.00%*			100.00%	Analog Input	
345	Analog Input 2 Term 11 Invert	0:False	1:True			0:False	Analog Input	
29	Analog Input 2 Term 11 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
140	Analog Input 2 Term 11 Status	-2048	4095		RO	0	Analog Input	
34	Analog Input 2 Term 11 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
40	Analog Input 3 Term 12 0% Calibration	-2048	4095			0	Analog Input	
45	Analog Input 3 Term 12 100% Calibration	0	4095			4095	Analog Input	
50	Analog Input 3 Term 12 Bias	0.00%*	200.00%*			0.00%	Analog Input	
25	Analog Input 3 Term 12 Destination	0	500	ICR		0	Analog Input	
60	Analog Input 3 Term 12 filtering	0	15			0	Analog Input	
55	Analog Input 3 Term 12 Gain	0.00%*	200.00%*			100.00%	Analog Input	
346	Analog Input 3 Term 12 Invert	0:False	1:True			0:False	Analog Input	
30	Analog Input 3 Term 12 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
141	Analog Input 3 Term 12 Status	-2048	4095		RO	0	Analog Input	
35	Analog Input 3 Term 12 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
41	Analog Input 4 Term 13 0% Calibration	-2048	4095			0	Analog Input	
46	Analog Input 4 Term 13 100% Calibration	0	4095			4095	Analog Input	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
51	Analog Input 4 Term 13 Bias	0.00%*	200.00%*			0.00%	Analog Input	
26	Analog Input 4 Term 13 Destination	0	500	ICR		0	Analog Input	
61	Analog Input 4 Term 13 filtering	0	15			0	Analog Input	
56	Analog Input 4 Term 13 Gain	0.00%*	200.00%*			100.00%	Analog Input	
347	Analog Input 4 Term 13 Invert	0:False	1:True			0:False	Analog Input	
31	Analog Input 4 Term 13 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
142	Analog Input 4 Term 13 Status	-2048	4095		RO	0	Analog Input	
36	Analog Input 4 Term 13 Type	0:Current	1:Voltage			1:Voltage	Analog Input	
42	Analog Input 5 Term 14 0% Calibration	-2048	4095			0	Analog Input	
47	Analog Input 5 Term 14 100% Calibration	0	4095			4095	Analog Input	
52	Analog Input 5 Term 14 Bias	0.00%*	200.00%*			0.00%	Analog Input	
27	Analog Input 5 Term 14 Destination	0	500	ICR		0	Analog Input	
62	Analog Input 5 Term 14 filtering	0	15			0	Analog Input	
57	Analog Input 5 Term 14 Gain	0.00%*	200.00%*			100.00%	Analog Input	
348	Analog Input 5 Term 14 Invert	0:False	1:True			0:False	Analog Input	
32	Analog Input 5 Term 14 Polarity	0:Unipolar	1:Bipolar			0:Unipolar	Analog Input	
143	Analog Input 5 Term 14 Status	-2048	4095		RO	0	Analog Input	
37	Analog Input 5 Term 14 Type	0:Current	1:Voltage		RO	1:Voltage	Analog Input	
87	Analog Output 1 Term 21 Absolute Value	0:False	1:True			0:False	Analog Output	
85	Analog Output 1 Term 21 Bias	-100.00%	100.00%			0.00%	Analog Output	
83	Analog Output 1 Term 21 Gain	-200.00%	200.00%			100.00%	Analog Output	
81	Analog Output 1 Term 21 Source	0	500	ICR		193	Analog Output	
168	Analog Output 1 Term 21 Status	-4095	4095		RO	0	Analog Output	
88	Analog Output 2 Term 22 Absolute Value	0:False	1:True			0:False	Analog Output	
86	Analog Output 2 Term 22 Bias	-100.00%	100.00%			0.00%	Analog Output	
84	Analog Output 2 Term 22 Gain	-200.00%	200.00%			100.00%	Analog Output	
82	Analog Output 2 Term 22 Source	0	500	ICR		102	Analog Output	
169	Analog Output 2 Term 22 Status	-4095	4095		RO	0	Analog Output	
114	Armature Amps	0.0 Amps	1530.0 Amps		RO	0.0 Amps	Current Loop	
194	Armature Feedback	-120.00%	120.00%		RO	0.00%	Velocity Loop	
252	Armature I Foldback Status	0:False	1:True		RO	0:False	Fault Logic	
251	Armature I Foldback Time	0.0 Secs	60.0 Secs			15.0 Secs	Fault Logic	
147	Armature IFB Status #1	0	1023		RO	0	Diagnostics	
151	Armature IFB Status #2	0	1023		RO	0	Diagnostics	
155	Armature IFB Status #3	0	1023		RO	0	Diagnostics	
159	Armature IFB Status #4	0	1023		RO	0	Diagnostics	
244	Armature Pilot	0:False	1:True		RO	0:False	Start/Stop	
417	Armature Voltage	-600.0 Volts	600.0 Volts		RO	0.0 Volts	Velocity Loop	
211	At Standstill	0:False	1:True		RO	1:True	Zero Speed	
209	At Zero Set	0:False	1:True		RO	1:True	Zero Speed	
210	At Zero Speed	0:False	1:True		RO	1:True	Zero Speed	
115	Aux 1 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
116	Aux 2 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
117	Aux 3 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
118	Aux 4 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
119	Aux 5 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
120	Aux 6 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
121	Aux 7 Param	-200.00%	200.00%			0.00%	Misc Aux Params	
98	Aux Current Demand	-150.00%	150.00%			0.00%	Current Loop	
419	Aux Firmware Versions	0	65535		RO	-	Misc System	
361	Aux PI At Limit	0:False	1:True		RO	0:False	App Aux PI	
354	Aux PI Deadband Setpoint	-30.00%	30.00%			0.00%	App Aux PI	
495	Aux PI Enable	0:False	1:True			1:True	App Aux PI	
352	Aux PI Error	-200.00%	200.00%		RO	0.00%	App Aux PI	
351	Aux PI Feedback	-100.00%	100.00%			0.00%	App Aux PI	
353	Aux PI Integral Clamp	0:False	1:True			0:False	App Aux PI	
363	Aux PI Integral Status	0.00%	100.00%		RO	0.00%	App Aux PI	
356	Aux PI Integral Time Setpoint	0.100 Secs	60.000 Secs			0.200 Secs	App Aux PI	
364	Aux PI Output	0.00%	100.00%		RO	0.00%	App Aux PI	
358	Aux PI Polarity	0:Unipolar	1:Bipolar			1:Bipolar	App Aux PI	
355	Aux PI Proportional Gain Setpoint	0.00	5.00			1.00	App Aux PI	
362	Aux PI Proportional Status	0.00%	100.00%		RO	0.00%	App Aux PI	
357	Aux PI Reset	0:False	1:True			0:False	App Aux PI	
360	Aux PI Scale Setpoint	-100.00%	100.00%			100.00%	App Aux PI	
350	Aux PI Setpoint	-100.00%	100.00%			0.00%	App Aux PI	
359	Aux PI Trim Setpoint	0.00%	100.00%			100.00%	App Aux PI	
154	Battery Status	0	1023		RO	0	Diagnostics	
174	Battery Supply	0.0 Volts	5.0 Volts		RO	0.0 Volts	Diagnostics	
435	Baud Rate	2400,4800,9600,19200,38400				38400	Misc Comm.	
492	Boot Loader Firmware Version	0	255		RO	-	Misc System	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
500	Command Data	0	65535			0	-	
421	Command Entry	0	65535			0	None	
106	Conduction Angle Demand	0.00%	100.00%		RO	0.00%	Current Loop	
409	Control Firmware Version	0	255		RO	-	Misc System	
429	Core	0.00 %	100.00 %			10.0 %	App Winder Speed	
446	Core	0.00 %	100.00 %			0.00 %	App CTCW	
111	Current Demand	-150.00%	150.00%		RO	0.00%	Current Loop	
103	Current Error	-300.00%	300.00%		RO	0.00%	Current Loop	
102	Current Feedback	-150.00%	150.00%		RO	0.00%	Current Loop	
112	Current Feedback {Filtered}	-150.00%	150.00%		RO	0.00%	Current Loop	
108	Current Integral Time	0.010 Secs	30.000 Secs			0.164 Secs	Current Loop	
107	Current Proportional Gain	0.00	25.00			2.50	Current Loop	
466	Data Logger Control	0	2			0	-	
467	Data Logger Samples	1	10000			10000	-	
464	Data Logger Signal Source	0	500			0	-	
465	Data Logger Trigger Source	0	500			0	-	
260	Date	1	31			-	Fault Logic	
268	Date #1	1	31		RO	-	Fault Logic	
276	Date #2	1	31		RO	-	Fault Logic	
284	Date #3	1	31		RO	-	Fault Logic	
292	Date #4	1	31		RO	-	Fault Logic	
300	Date #5	1	31		RO	-	Fault Logic	
259	Day	1	7			-	Fault Logic	
267	Day #1	1	7		RO	-	Fault Logic	
275	Day #2	1	7		RO	-	Fault Logic	
283	Day #3	1	7		RO	-	Fault Logic	
291	Day #4	1	7		RO	-	Fault Logic	
299	Day #5	1	7		RO	-	Fault Logic	
144	DC TFB Status	-2048	4095		RO	0	Diagnostics	
432	Diameter	0.00 %	100.00 %		RO	0.00 %	App Winder Speed	
451	Diameter	0.00 %	100.00 %		RO	0.00 %	App CTCW	
447	Diameter Memory Reset	0:False	1:True			0:False	App CTCW	
431	Diameter Ratio	0.00 %	100.00 %			0.00 %	App Winder Speed	
442	Diameter Select	0:Off,1:Line/Winder,2:Ext Dia			0:Off	App CTCW		
450	Diameter Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
15	Digital Input 1 Term 31 Closed Value	0:False*	1:True*			1:True	Digital Input	
1	Digital Input 1 Term 31 Destination	0	500	ICR		239	Digital Input	
8	Digital Input 1 Term 31 Open Value	0:False*	1:True*			0:False	Digital Input	
132	Digital Input 1 Term 31 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
16	Digital Input 2 Term 32 Closed Value	0:False*	1:True*			0:False	Digital Input	
2	Digital Input 2 Term 32 Destination	0	500	ICR		240	Digital Input	
9	Digital Input 2 Term 32 Open Value	0:False*	1:True*			1:True	Digital Input	
133	Digital Input 2 Term 32 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
17	Digital Input 3 Term 33 Closed Value	0:False*	1:True*			1:True	Digital Input	
3	Digital Input 3 Term 33 Destination	0	500	ICR		241	Digital Input	
10	Digital Input 3 Term 33 Open Value	0:False*	1:True*			0:False	Digital Input	
134	Digital Input 3 Term 33 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
18	Digital Input 4 Term 34 Closed Value	0:False*	1:True*			1:True	Digital Input	
4	Digital Input 4 Term 34 Destination	0	500	ICR		222	Digital Input	
11	Digital Input 4 Term 34 Open Value	0:False*	1:True*			0:False	Digital Input	
135	Digital Input 4 Term 34 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
19	Digital Input 5 Term 35 Closed Value	0:False*	1:True*			1:True	Digital Input	
5	Digital Input 5 Term 35 Destination	0	500	ICR		215	Digital Input	
12	Digital Input 5 Term 35 Open Value	0:False*	1:True*			0:False	Digital Input	
136	Digital Input 5 Term 35 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
20	Digital Input 6 Term 36 Closed Value	0:False*	1:True*			1:True	Digital Input	
6	Digital Input 6 Term 36 Destination	0	500	ICR		216	Digital Input	
13	Digital Input 6 Term 36 Open Value	0:False*	1:True*			0:False	Digital Input	
137	Digital Input 6 Term 36 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
21	Digital Input 7 Term 37 Closed Value	0:False*	1:True*			1:True	Digital Input	
7	Digital Input 7 Term 37 Destination	0	500	ICR		254	Digital Input	
14	Digital Input 7 Term 37 Open Value	0:False*	1:True*			0:False	Digital Input	
138	Digital Input 7 Term 37 Status	0:Open	1:Closed		RO	0:Open	Digital Input	
91	Digital Output Term 52 Absolute Value	0:False	1:True			1:True	F/D Output	
94	Digital Output Term 52 Invert	0:False	1:True			0:False	F/D Output	
93	Digital Output Term 52 Off Value	-200.00%*	200.00%*			0.00%	F/D Output	
92	Digital Output Term 52 On Value	-200.00%*	200.00%*			100.00%	F/D Output	
110	Drive Mode (LSB)	0	1			0	Current Loop	
109	Drive Mode (MSB)	0	1			0	Current Loop	
411	Drive Model	0	65535		RO	0	Misc System	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
303	Drive Ready	0:False	1:True		RO	0:False	Start Stop Logic	
422	Drive Status	0	8		RO	0	None	
163	EFB Counter Status	0 Hz	65535 Hz		RO	0 Hz	Diagnostics	
196	Encoder Feedback	-125.00%	125.00%		RO	0.00%	Velocity Loop	
124	Encoder Lines	0:256,1:512,2:1024,3:2048				2:1024	Calibration	
445	External Diameter Ratio	0.00 %	100.00 %			0.00 %	App CTCW	
490	External Fault	0:False	1:True		RO	0:False	Fault Logic	
254	External Fault Reset	0:False	1:True			0:False	Fault Logic	
488	External Field Current Feedback	0.00%	100.00%			0.00%	Field Loop	
410	Fan Mode	0:Auto	1:On			0:Auto	Diagnostics	
263	Fault #1	0x0000	0xFFFF		RO	-	Fault Logic	
271	Fault #2	0x0000	0xFFFF		RO	-	Fault Logic	
279	Fault #3	0x0000	0xFFFF		RO	-	Fault Logic	
287	Fault #4	0x0000	0xFFFF		RO	-	Fault Logic	
295	Fault #5	0x0000	0xFFFF		RO	-	Fault Logic	
486	Fault Reset	0:False	1:True		RO	0:False	Fault Log	
197	Feedback Select	0:AFB, 1:TFB, 2:EFB		ICR		0:AFB	Velocity Loop	
338	Field Amps	0.00 Amps	10.00 Amps		RO	0.00 Amps	Field Loop	
328	Field Conduction Angle	0.00%	100.00%		RO	0.00%	Field Loop	
423	Field Crossover Enable	0:False	1:True	ICR		0:False	Field Crossover	
426	Field Crossover Output	0.00%	100.00%		RO	0.00%	Field Crossover	
425	Field Crossover Setpoint	0.00%	95.00%			85.00%	Field Crossover	
339	Field Current Demand	0.00%	100.00%			0.00%	Field Loop	
487	Field Current Feedback Select	0:Internal	1:External			0:Internal	Field Loop	
332	Field Economy Enable	0:False	1:True			0:True	Field Loop	
331	Field Enable	0:False	1:True	ICR		1:True	Field Loop	
336	Field IFB	0.00%	100.00%		RO	0.00%	Field Loop	
337	Field IFB {Filtered}	0.00%	100.00%		RO	0.00%	Field Loop	
342	Field IFB Offset	-20.00%	20.00%			0.00%	Field Loop	
148	Field IFB Status #1	0	1023		RO	0	Diagnostics	
152	Field IFB Status #2	0	1023		RO	0	Diagnostics	
156	Field IFB Status #3	0	1023		RO	0	Diagnostics	
160	Field IFB Status #4	0	1023		RO	0	Diagnostics	
341	Field Integral Time	0.001 Secs	30.000 Secs			0.200 Secs	Field Loop	
250	Field Loss Inhibit	0:False	1:True			0:False	Fault Logic	
249	Field Loss Level	0.00%	100.00%			6.00%	Fault Logic	
340	Field Prop Gain	0.00	20.00			0.20	Field Loop	
333	Field VFB	0.00%	125.00%		RO	0.00%	Field Loop	
334	Field VFB {Filtered}	0.00%	125.00%		RO	0.00%	Field Loop	
343	Field VFB Offset	-20.00%	20.00%			0.00%	Field Loop	
150	Field VFB Status	0	1023		RO	0	Diagnostics	
335	Field Voltage	0.0 Volts	400.0 Volts		RO	0.0 Volts	Field Loop	
101	Final Current Demand	-150.00%	150.00%		RO	0.00%	Current Loop	
113	Final Current Demand {Filtered}	-150.00%	150.00%		RO	0.00%	Current Loop	
427	Final Field Current Demand	0.00%	100.00%		RO	0.00%	Field Loop	
129	Final Velocity Demand	-105.00%	105.00%		RO	0.00%	Velocity Loop	
226	Forward Accel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
307	Forward Accel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
227	Forward Decel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
308	Forward Decel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
190	Forward Max Speed Scale	0.00%	105.00%			100.00%	Velocity Loop	
170	Freq/Dig Output Term 52 Status	-1	2000		RO	0	F/D Output	
89	Freq/Digital Output Term 52 Source	0	500	ICR		193	F/D Output	
64	Frequency Input Term 18 0% Calibration	0 Hz	60000 Hz			0 Hz	Frequency Input	
65	Frequency Input Term 18 100% Calibration	0 Hz	60000 Hz			40000 Hz	Frequency Input	
66	Frequency Input Term 18 Bias	0.00%*	200.00%*			0.00%	Frequency Input	
63	Frequency Input Term 18 Destination	0	500	ICR		0	Frequency Input	
68	Frequency Input Term 18 filtering	0	15			0	Frequency Input	
67	Frequency Input Term 18 Gain	0.00%*	200.00%*			100.00%	Frequency Input	
349	Frequency Input Term 18 Sign	0:Positive	1:Negative			0:Positive	Freq Input	
164	Frequency Input Term 18 Status	0 Hz	60000 Hz		RO	0 Hz	Freq Input	
96	Frequency Output Term 52 Bias	0.00%	100.00%			0.00%	F/D Output	
95	Frequency Output Term 52 Gain	0.00%	200.00%			100.00%	F/D Output	
90	Frequency/Digital Term 52 Mode	0:Freq	1:Digital			0:Freq	F/D Output	
448	Friction Compensation	0.00 %	100.00 %			0.00 %	App CTCW	
453	Friction Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
472	General Param 1	0	65535			0	-	
481	General Param 10	0	65535			0	-	
482	General Param 11	0	65535			0	-	
483	General Param 12	0	65535			0	-	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
473	General Param 2	0	65535			0	-	
474	General Param 3	0	65535			0	-	
475	General Param 4	0	65535			0	-	
476	General Param 5	0	65535			0	-	
477	General Param 6	0	65535			0	-	
478	General Param 7	0	65535			0	-	
479	General Param 8	0	65535			0	-	
480	General Param 9	0	65535			0	-	
181	Greater Than A	-200.00%	200.00%			1.00%	Misc Thresholds	
187	Greater Than B	-200.00%	200.00%			1.00%	Misc Thresholds	
153	Heatsink Status	0	1023		RO	0	Diagnostics	
176	Heatsink Temperature	0 C	115 C		RO	0 C	Diagnostics	
258	Hour	0	23			-	Fault Logic	
266	Hour #1	0	23		RO	-	Fault Logic	
274	Hour #2	0	23		RO	-	Fault Logic	
282	Hour #3	0	23		RO	-	Fault Logic	
290	Hour #4	0	23		RO	-	Fault Logic	
298	Hour #5	0	23		RO	-	Fault Logic	
179	Hysteresis A	0.00%	200.00%			0.00%	Misc Thresholds	
185	Hysteresis B	0.00%	200.00%			0.00%	Misc Thresholds	
493	Independent Current Limits	0:False	1:True			1:True	Current Loop	
494	Independent Speed Scales	0:False	1:True			1:True	Velocity Loop	
449	Inertia Compensation	0.00 %	50.00 %			0.00 %	App CTCW	
454	Inertia Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
177	Input A	-200.00%	200.00%			0.00%	Misc Thresholds	
183	Input B	-200.00%	200.00%			0.00%	Misc Thresholds	
214	Integral Clamp	0:False	1:True			0:False	Velocity Loop	
485	Internal Fault Reset	0:False	1:True		RO	0:False	Fault Log	
367	Internal Link 1 Destination	0	500	ICR		306	Misc Internal Links	
366	Internal Link 1 Source	0	500			243	Misc Internal Links	
385	Internal Link 10 Destination	0	500	ICR		0	Misc Internal Links	
384	Internal Link 10 Source	0	500			0	Misc Internal Links	
387	Internal Link 11 Destination	0	500	ICR		0	Misc Internal Links	
386	Internal Link 11 Source	0	500			0	Misc Internal Links	
389	Internal Link 12 Destination	0	500	ICR		0	Misc Internal Links	
388	Internal Link 12 Source	0	500			0	Misc Internal Links	
391	Internal Link 13 Destination	0	500	ICR		0	Misc Internal Links	
390	Internal Link 13 Source	0	500			0	Misc Internal Links	
393	Internal Link 14 Destination	0	500	ICR		0	Misc Internal Links	
392	Internal Link 14 Source	0	500			0	Misc Internal Links	
395	Internal Link 15 Destination	0	500	ICR		0	Misc Internal Links	
394	Internal Link 15 Source	0	500			0	Misc Internal Links	
397	Internal Link 16 Destination	0	500	ICR		0	Misc Internal Links	
396	Internal Link 16 Source	0	500			0	Misc Internal Links	
399	Internal Link 17 Destination	0	500	ICR		0	Misc Internal Links	
398	Internal Link 17 Source	0	500			0	Misc Internal Links	
401	Internal Link 18 Destination	0	500	ICR		0	Misc Internal Links	
400	Internal Link 18 Source	0	500			0	Misc Internal Links	
403	Internal Link 19 Destination	0	500	ICR		0	Misc Internal Links	
402	Internal Link 19 Source	0	500			0	Misc Internal Links	
369	Internal Link 2 Destination	0	500	ICR		105	Misc Internal Links	
368	Internal Link 2 Source	0	500			225	Misc Internal Links	
405	Internal Link 20 Destination	0	500	ICR		0	Misc Internal Links	
404	Internal Link 20 Source	0	500			0	Misc Internal Links	
371	Internal Link 3 Destination	0	500	ICR		97	Misc Internal Links	
370	Internal Link 3 Source	0	500			225	Misc Internal Links	
373	Internal Link 4 Destination	0	500	ICR		0	Misc Internal Links	
372	Internal Link 4 Source	0	500			0	Misc Internal Links	
375	Internal Link 5 Destination	0	500	ICR		0	Misc Internal Links	
374	Internal Link 5 Source	0	500			0	Misc Internal Links	
377	Internal Link 6 Destination	0	500	ICR		0	Misc Internal Links	
376	Internal Link 6 Source	0	500			0	Misc Internal Links	
379	Internal Link 7 Destination	0	500	ICR		0	Misc Internal Links	
378	Internal Link 7 Source	0	500			0	Misc Internal Links	
381	Internal Link 8 Destination	0	500	ICR		0	Misc Internal Links	
380	Internal Link 8 Source	0	500			0	Misc Internal Links	
383	Internal Link 9 Destination	0	500	ICR		0	Misc Internal Links	
382	Internal Link 9 Source	0	500			0	Misc Internal Links	
126	Invert FB	0:False	1:True			0:False	Calibration	
131	IR Compensation	0.00%	10.00%			0.00%	Velocity Loop	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
241	Jog	0:False	1:True			0:False	Start/Stop	
246	Jog Delay	0.0 Secs	10.0 Secs			3.0 Secs	Start/Stop	
221	Jog Reference	-200.00%	200.00%			5.00%	Setpoints	
243	Jog Status	0:False	1:True		RO	0:False	Start/Stop	
420	Keypad Fault Reset	0	1			0	None	
304	Latched Fault Status	0x0000	0Xffff		RO	0x0000	Fault Logic	
180	Less Than or Equal A	-200.00%	200.00%			0.00%	Misc Thresholds	
186	Less Than or Equal B	-200.00%	200.00%			0.00%	Misc Thresholds	
430	Line Speed	0.00 %	100.00 %			0.00 %	App Winder Speed	
443	Line Speed	0.00 %	100.00 %			0.00 %	App CTCW	
459	Line Speed Sum	0.00 %	100.00 %			0.00 %	App Winder Speed	
175	Line Voltage	0.0 Volts	600.0 Volts		RO	0.0 Volts	Diagnostics	
149	Line Voltage Status	0	1023		RO	0	Diagnostics	
407	Load	0	2	ICR		0	Misc System	
212	Loop Enable	0:False	1:True		RO	0:False	Zero Speed	
414	Max Peak	-200.00%	200.00%		RO	0.00%	Misc MinMax	
424	Min Field Current Demand	0.00%	100.00%				Field Crossover	
416	Min Max Difference	-200.00%	200.00%		RO	0.00%	Misc MinMax	
413	Min Max Reset	0:False	1:True			0:False	Misc MinMax	
412	Min Max Source	0	500			0	Misc MinMax	
415	Min Peak	-200.00%	200.00%		RO	0.00%	Misc MinMax	
257	Minute	0	59			-	Fault Logic	
265	Minute #1	0	59		RO	-	Fault Logic	
273	Minute #2	0	59		RO	-	Fault Logic	
281	Minute #3	0	59		RO	-	Fault Logic	
289	Minute #4	0	59		RO	-	Fault Logic	
297	Minute #5	0	59		RO	-	Fault Logic	
261	Month	1	12			-	Fault Logic	
269	Month #1	1	12		RO	-	Fault Logic	
277	Month #2	1	12		RO	-	Fault Logic	
285	Month #3	1	12		RO	-	Fault Logic	
293	Month #4	1	12		RO	-	Fault Logic	
301	Month #5	1	12		RO	-	Fault Logic	
317	MOP Decrease	0:False	1:True			0:False	Misc MOP	
319	MOP Decrease Time	0.0 Secs	600.0 Secs			5.0 Secs	Misc MOP	
316	MOP Increase	0:False	1:True			0:False	Misc MOP	
318	MOP Increase Time	0.0 Secs	600.0 Secs			5.0 Secs	Misc MOP	
320	MOP Max Value	-100.00%	100.00%			100.00%	Misc MOP	
321	MOP Min Value	-100.00%	100.00%			-100.00%	Misc MOP	
324	MOP Output	-100.00%	100.00%		RO	0.00%	Misc MOP	
322	MOP Reset	0:False	1:True			0:False	Misc MOP	
323	MOP Reset Value	-100.00%	100.00%			0.00%	Misc MOP	
200	Motor RPM	0 RPM	20000 RPM		RO	0 RPM	Velocity Loop	
122	Nameplate Drive Current	Per Model	Per Model		RO	Per Model	Calibration	
123	Nameplate Motor Current	0.0 Amps	Per Model			Per Model	Calibration	
128	Nameplate Motor Voltage	0.0 Volts	500.0 Volts			240.0 Volts	Calibration	
100	Negative C.L.	-150.00%	0.00%			-150.00%	Current Loop	
434	Network Address	1	255			1	Misc Comm.	
104	Open Loop Arm Select	0:False	1:True	ICR		0:False	Current Loop	
105	Open Loop Arm Set Pt	-100.00%	100.00%			0.00%	Current Loop	
329	Open Loop Field Select	0:False	1:True			1:True	Field Loop	
330	Open Loop Field Setpoint	0.00%	100.00%			67.00%	Field Loop	
182	Output A	-200.00%	200.00%		RO	0.00%	Misc Thresholds	
188	Output B	-200.00%	200.00%		RO	0.00%	Misc Thresholds	
253	Overcurrent Time	0.0 Secs	240.0 Secs			45.0 Secs	Fault Logic	
223	Overspeed Level	0.00%	125.00%			125.00%	Fault Logic	
439	Parameters Changed	0:False	1:True		RO	0:False	Misc System	
436	Parity	0:None, 1:Odd, 2:Even				None	Misc Comm.	
99	Positive C.L.	0.00%	150.00%			150.00%	Current Loop	
327	Power On Reset	0:False	1:True		RO	0:False	Fault Logic	
255	Present Fault Status	0x0000	0xFFFF		RO	0x0000	Fault Logic	
305	Ramp Bypass	0:False	1:True			0:False	Accel/Decel	
224	Ramp Input	-150.00%	150.00%		RO	0.00%	Accel/Decel	
225	Ramp Output	-150.00%	150.00%		RO	0.00%	Accel/Decel	
306	Ramp Select	0:False	1:True			0:False	Accel/Decel	
230	Ramp Threshold	0.00%	100.00%			5.00%	Accel/Decel	
231	Ramping Status	0:False	1:True		RO	0:False	Accel/Decel	
217	Reference 0	-200.00%	200.00%			0.00%	Setpoints	
218	Reference 1	-200.00%	200.00%			0.00%	Setpoints	
219	Reference 2	-200.00%	200.00%			0.00%	Setpoints	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
220	Reference 3	-200.00%	200.00%			0.00%	Setpoints	
222	Reference Invert	0:False	1:True			0:False	Setpoints	
216	Reference Select (LSB)	0	1			0	Setpoints	
215	Reference Select (MSB)	0	1			0	Setpoints	
206	Regenerative Mode	0:False	1:True	ICR		1:True	Current Loop	
408	Re-Initialize	0	1	ICR		0	Misc System	
165	Relay Output 1 Term 25-27 Status	0	1		RO	0	User Relay	
166	Relay Output 2 Term 28-30 Status	0	1		RO	0	User Relay	
167	Relay Output 3 Term 54-56 Status	0	1		RO	0	User Relay	
468	Reserved	-200.00%	200.00%			0.00%	-	
469	Reserved	-200.00%	200.00%			0.00%	-	
470	Reserved	-200.00%	200.00%			0.00%	-	
471	Reserved	-200.00%	200.00%			0.00%	-	
161	Reserved [ADCIN11]	0	1023		RO	0	Diagnostics	
228	Reverse Accel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
309	Reverse Accel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
229	Reverse Decel Time A	0.1 Secs	600.0 Secs			5.0 Secs	Accel/Decel	
310	Reverse Decel Time B	0.1 Secs	600.0 Secs			10.0 Secs	Accel/Decel	
191	Reverse Max Speed Scale	-105.00%	0.00%			-100.00%	Velocity Loop	
239	Run	0:False	1:True			0:False	Start/Stop	
22	Run Enable Term 7	0:Open	1:Closed		RO	0:Open	Digital Input	
242	Run Status	0:False	1:True		RO	0:False	Start/Stop	
406	Save	0	1	ICR		0	Misc System	
452	Scaled Winder Speed Ratio	0.00 %	100.00 %		RO	0.00 %	App CTCW	
256	Seconds	0	59			-	Fault Logic	
264	Seconds #1	0	59		RO	-	Fault Logic	
272	Seconds #2	0	59		RO	-	Fault Logic	
280	Seconds #3	0	59		RO	-	Fault Logic	
288	Seconds #4	0	59		RO	-	Fault Logic	
296	Seconds #5	0	59		RO	-	Fault Logic	
233	Setpoint A Invert	0:False	1:True			0:False	Setpoint Sum	
498	Setpoint A Ratio	-100.00%	100.00%			100.00%	Setpoint Sum	
234	Setpoint B	-200.00%	200.00%			0.00%	Setpoint Sum	
235	Setpoint B Invert	0:False	1:True			0:False	Setpoint Sum	
236	Setpoint C	-200.00%	200.00%			0.00%	Setpoint Sum	
237	Setpoint C Invert	0:False	1:True			0:False	Setpoint Sum	
499	Setpoint D	-200.00%	200.00%			0.00%	Setpoint Sum	
500	Slew Rate Limit	0.00%	100.00%			100.00%	Current Loop	
208	Standstill Logic	0:False	1:True			0:False	Zero Speed	
245	Start/Stop Logic Select	0:Three Wire	1:TwoWire			0:Three Wire	Start/Stop	
462	Static Friction Torque	0.00 %	100.00 %			0.00 %	App CTCW	
240	Stop	0:False	1:True			0:False	Start/Stop	
437	Stop Bits	1	2			2	Misc Comm.	
232	Stop Mode	0:Ramp,1:Quick,2:Coast				0:Ramp	Start/Stop	
238	System Status Register	0x0000	0xFFFF		RO	0x0000	Diagnostics	
195	Tach Feedback	-125.00%	125.00%		RO	0.00%	Velocity Loop	
127	Tachometer Type	0:DC	1:AC			0:DC	Calibration	
456	Taper Diameter	0.00 %	100.00 %			0.00 %	App CTCW	
457	Taper Percentage	0.00 %	100.00 %			0.00 %	App CTCW	
458	Tension Demand	0.00 %	100.00 %		RO	0.00 %	App CTCW	
441	Tension Setpoint	0.00 %	100.00 %			0.00 %	App CTCW	
484	Tension Sum	-100.00%	100.00%			0.00%	App CTCW	
178	Threshold A	0.00%	200.00%			1.00%	Misc Thresholds	
184	Threshold B	0.00%	200.00%			1.00%	Misc Thresholds	
428	Timer	0.0 Secs	240.0 Secs		RO	0.0 Secs	Misc Timer	
314	Timer Greater Than	-100.00%	100.00%			1.00%	Misc Timer	
313	Timer Less Than or Equal To	-100.00%	100.00%			0.00%	Misc Timer	
315	Timer Output	-100.00%	100.00%		RO	0.00%	Misc Timer	
311	Timer Reset	0:False	1:True			1:True	Misc Timer	
365	Timer Reset Invert	0:False	1:True			0:False	Misc Timer	
312	Timer Threshold	0.0 Secs	240.0 Secs			5.0 Secs	Misc Timer	
97	Torque Reference	-150.00%	150.00%			0.00%	Current Loop	
440	Total Parameters	0	65535		RO	500	Misc System	
455	Total Torque	0.00 %	100.00 %		RO	0.00 %	App CTCW	
0	Trash	-32768	32767			0	None	
491	Trigger Board Firmware Version	0	255		RO	-	Misc System	
72	User Relay 1 Term 25-27 Absolute Value	0:False	1:True			1:True	User Relay	
78	User Relay 1 Term 25-27 Off Value	0:False*	1:True*			0:False	User Relay	
75	User Relay 1 Term 25-27 On Value	0:False*	1:True*			1:True	User Relay	
69	User Relay 1 Term 25-27 Source	0	500	ICR		210	User Relay	

	Parameter Name	Min	Max	ICR	RO	Preset	Menu Block	User
73	User Relay 2 Term 28-30 Absolute Value	0:False	1:True			1:True	User Relay	
79	User Relay 2 Term 28-30 Off Value	0:False*	1:True*			0:False	User Relay	
76	User Relay 2 Term 28-30 On Value	0:False*	1:True*			1:True	User Relay	
70	User Relay 2 Term 28-30 Source	0	500	ICR		242	User Relay	
74	User Relay 3 Term 54-56 Absolute Value	0:False	1:True			1:True	User Relay	
80	User Relay 3 Term 54-56 Off Value	0:False*	1:True*			0:False	User Relay	
77	User Relay 3 Term 54-56 On Value	0:False*	1:True*			1:True	User Relay	
71	User Relay 3 Term 54-56 Source	0	500	ICR		303	User Relay	
189	Velocity Demand	-100.00%	100.00%		RO	0.00%	Velocity Loop	
192	Velocity Error	-230.00%	230.00%		RO	0.00%	Velocity Loop	
193	Velocity Feedback	-125.00%	125.00%		RO	0.00%	Velocity Loop	
198	Velocity Feedback Filtered	-125.00%	125.00%		RO	0.00%	Velocity Loop	
203	Velocity Gain Select	0	1			0	Velocity Loop	
202	Velocity Integral Time A	0.010 Secs	30.000 Secs			0.158 Secs	Velocity Loop	
326	Velocity Integral Time B	0.010 Secs	30.000 Secs			0.058 Secs	Velocity Loop	
205	Velocity Loop Output	-150.00%	150.00%		RO	0.00%	Velocity Loop	
204	Velocity Overshoot Gain A	0.00%	100.00%			100.00%	Velocity Loop	
213	Velocity Overshoot Gain B	0.00%	100.00%			100.00%	Velocity Loop	
201	Velocity Prop Gain A	0.00	100.00			9.00	Velocity Loop	
325	Velocity Prop Gain B	0.00	100.00			9.00	Velocity Loop	
248	VFB Loss Inhibit	0:False	1:True			0:False	Fault Logic	
247	VFB Loss Level	0.00%	100.00%			50.00%	Fault Logic	
130	VFB Offset	-10.00%	10.00%			0.00%	Velocity Loop	
418	Watchdog Status	0x0000	0xFFFF		RO	0x0000	Misc System	
433	Winder Speed Ratio	0.00 %	100.00 %		RO	0.00 %	App Winder Speed	
463	Winder Speed Ratio	0.00 %	100.00 %			0.00 %	App CTCW	
262	Year	0	99			-	Fault Logic	
270	Year #1	0	99		RO	-	Fault Logic	
278	Year #2	0	99		RO	-	Fault Logic	
286	Year #3	0	99		RO	-	Fault Logic	
294	Year #4	0	99		RO	-	Fault Logic	
302	Year #5	0	99		RO	-	Fault Logic	
207	Zero Speed Setpoint	1.00%	25.00%			2.00%	Zero Speed	

8 Serial Network Communications

The serial interface is a standard feature on all Elite Pro drives. The interface enables other equipment such as a computer or programmable logic controller (PLC) to monitor, modify, and/or log data. The network is physically implemented on an RS-485 medium (2 or 4 wire selectable) using the Modbus software protocol. Refer to D12586 in the Prints Section for network connection information.

RS485 Multidrop Network Wiring

All network wiring should use the TB2 terminal strip located on the right-hand side of the unit. DIP switch SW4 should be set as follows:

SW4 DIP Switch	
Position	Description
1	Fail-Safe Bias
2	Fail-Safe Bias
3	Terminator
4	2-Wire
5	2-Wire
6-8	Reserved

Table 18: SW4 DIP Switch Settings

Fail-Safe Biasing

Failsafe biasing is required to bias the communication lines to a known state when no devices are communicating (i.e., driving the bus). Fail-safe biasing should be active in **ONLY** one unit in the network. Placing positions 1 & 2 in the closed (down) position activates the Fail-Safe biasing. In some cases, the network master may provide this biasing, and therefore would not need to be activated on one of the slave units. (Refer to master documentation.)

Terminator

Terminating resistors are required at each end of a daisy chained RS-485 network in order to provide clean, error free signal transmissions. If the Elite Pro is at one end of the daisy chained network, activate the terminating resistor by placing position 3 in the closed position (down).

2-Wire

RS-485 networks can operate in either a 2-Wire or 4-Wire configuration. In 4-Wire mode, the transmit and receive signals use separate twisted wire pairs. In 2-Wire mode, the transmit and receive signals share the same twisted wire pair. If a 2-Wire network is used, place positions 4 & 5 in the closed (down) position. This provides an internal connection from TXD+ to RXD+ and from TXD- to RXD-, and eliminates the need to add jumpers externally to the drive between these points.

RS232 Singledrop Wiring (CN16)

Connector CN16 is provided to allow a device with an RS-232 serial port a quick and easy method to connect to the drive. This connection can only be used in a singledrop environment (i.e., only one slave device) and cannot be used along with TB2. (If the drive is wired in a network via TB2, unplug the TB2 terminal strip before plugging into CN16.) Position 2 of DIP switch SW4 should be closed (down) and all others positions should be open to use CN16.

Also available is Carotron's ProLink software that can be used to setup the Elite Pro via a PC. Features include loading/saving drive parameters to a file, graphical interface, & **Pro**fessors to aid in complex setups.

9 Spare Parts

9.1 Printed Circuit Assemblies

Control Board
All models D12155-000

Trigger Board
Models EPN020-000 thru EPN060-000 ..... D13073-002
Models EPR020-000 thru EPR060-000 ..... D13073-003
Models EPN075-000 thru EPN150-000 ..... D13073-004
Models EPR075-000 thru EPR150-000 ..... D13073-005
Models EPN200-000 thru EPN600-000 ..... D13073-000
Models EPR200-000 thru EPR600-000 ..... D13073-001

CT ID Board
Models EPx020-000 ..... C12164-000
Models EPx040-000 ..... C12164-001
Models EPx060-000 ..... C12164-002
Models EPx075-000 ..... C12164-003
Models EPx100-000 ..... C12164-004
Models EPx125-000 ..... C12164-005
Models EPx150-000 ..... C12164-006
Models EPx200-000 ..... C12164-007
Models EPx250-000 ..... C12164-008
Models EPx300-000 ..... C12164-009
Models EPx400-000 ..... C12164-010
Models EPx500-000 ..... C12164-011

Processor Board
All models A12150-000

Power Supply Board
All models C12572-000

9.2 Fuses

Trigger Board: FU1, FU2, FU3: Dual Element, Time Delay, 500VAC

Model	Amps	Carotron P/N	Manufacturer P/N
EPx020-000 thru EPx060-000	10	FUS1008-03	Bussmann FNQ-10 Littelfuse FLQ-10
EPx075-000 thru EPx600-000	15	FUS1008-04	Bussmann FNQ-15 Littelfuse FLQ-15

Table 19: Trigger Board Fuses

Power Supply Board: F1, F2, F3: 1 Ampere, Time Delay, 600VAC

Model	Amps	Carotron P/N	Manufacturer P/N
All Models	1	FUS1007-00	Bussmann FNQ-R-1 Littelfuse KLDR-1

Table 20: Power Supply Board Fuses

Recommended Line Fuses: Semiconductor (Very Fast Acting), 500VAC
(Not included with basic drive package)

Model	Amps	Carotron P/N	Manufacturer P/N
EPx020-000	50	FUS1009-00	Bussmann FWH50 Littelfuse L50S50
EPx040-000	100	FUS1009-01	Bussmann FWH100 Littelfuse L50S100
EPx060-000	150	FUS1009-02	Bussmann FWH150 Littelfuse L50S150
EPx075-000	175	FUS1009-03	Bussmann FWH175 Littelfuse L50S175
EPx100-000	250	FUS1009-05	Bussmann FWH250 Littelfuse L50S250
EPx125-000	300	FUS1009-06	Bussmann FWH300 Littelfuse L50S300
EPx150-000	350	FUS1009-04	Bussmann FWH350 Littelfuse L50S350
EPx200-000	450	FUS1009-07	Bussmann FWH450 Littelfuse L50S450
EPx250-000	600	FUS1009-08	Bussmann FWH600 Littelfuse L50S600
EPx300-000	700	FUS1009-09	Bussmann FWH700 Littelfuse L50S700
EPx400-000	1000	FUS1009-12	Bussmann FWH1000
EPx500-000	1200	FUS1009-13	Bussmann FWH1200
EPx600-000	1400	FUS1009-14	Bussmann FWH1400

Table 21: Recommended Line Fuses

9.3 Power Components

Armature Bridge

All armature bridge devices are dual SCR isolated power modules rated at 1400 volts (minimum) repetitive peak off state and reverse voltage and have 1000V/uS dvdt. There are 3 each on EPN Series models, PMD3-5, and 3 additional, PMD6-8, on EPR Series models. Current ratings are per control model.

NOTE: The IR (Internaltional Rectifier) modules are not pin-for-pin compatible with the Eupec and Semikron modules. The gate and cathode signal leads on IR modules are reversed on the second SCR device. Consult factory for assistance when replacing a Eupec or Semikron module with an IR module or vice-versa.

Model	Amps	Carotron P/N	Manufacturer P/N
EPx020-000	31	PMD1025-00	Eupec TT31N14KOF Semikron SKKT42/14E IR IRKT41/14A
EPx040-000	56	PMD1026-00	Eupec TT56N14KOF Semikron SKKT57/14E IR IRKT56/14A
EPx060-000	92	PMD1027-00	Eupec TT92N14KOF Semikron SKKT92/14E IR IRKT91/14A
EPx075-000	105	PMD1019-00	Eupec TT105N14KOF Semikron SKKT106/14E IR IRKT105/14A
EPx100-000	131	PMD1029-00	Eupec TT131N14KOF IR IRKT136/14
EPx125-000 EPx150-000	162	PMD1021-00	Eupec TT162N14KOF IR IRKT162/14
EPx200-000 EPx250-000 EPx300-000	251	PMD1031-00	Eupec TT251N14KOF IR IRKT250/14
EPx400-000	500	PMD1033-00	Powerex LD431650
EPx500-000 EPx600-000	700	PMD1034-00	Powerex PD431607

Table 22: Armature Bridge Modules

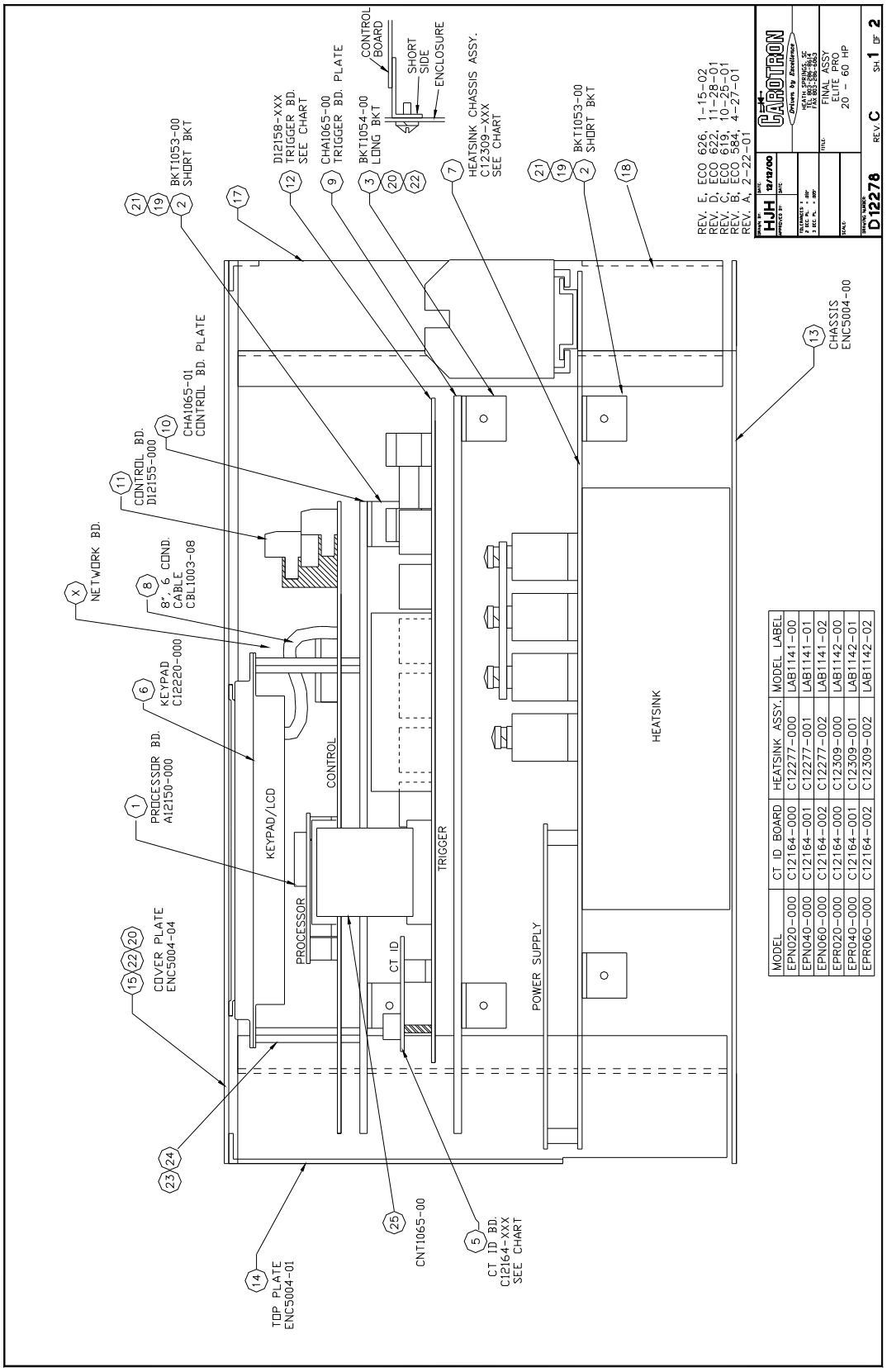
Field Supply

The Field Supply uses one dual SCR isolated power module (PMD1) rated at 1400 volts (minimum), and one dual diode module (PMD2) also rated at 1400 volts (minimum).

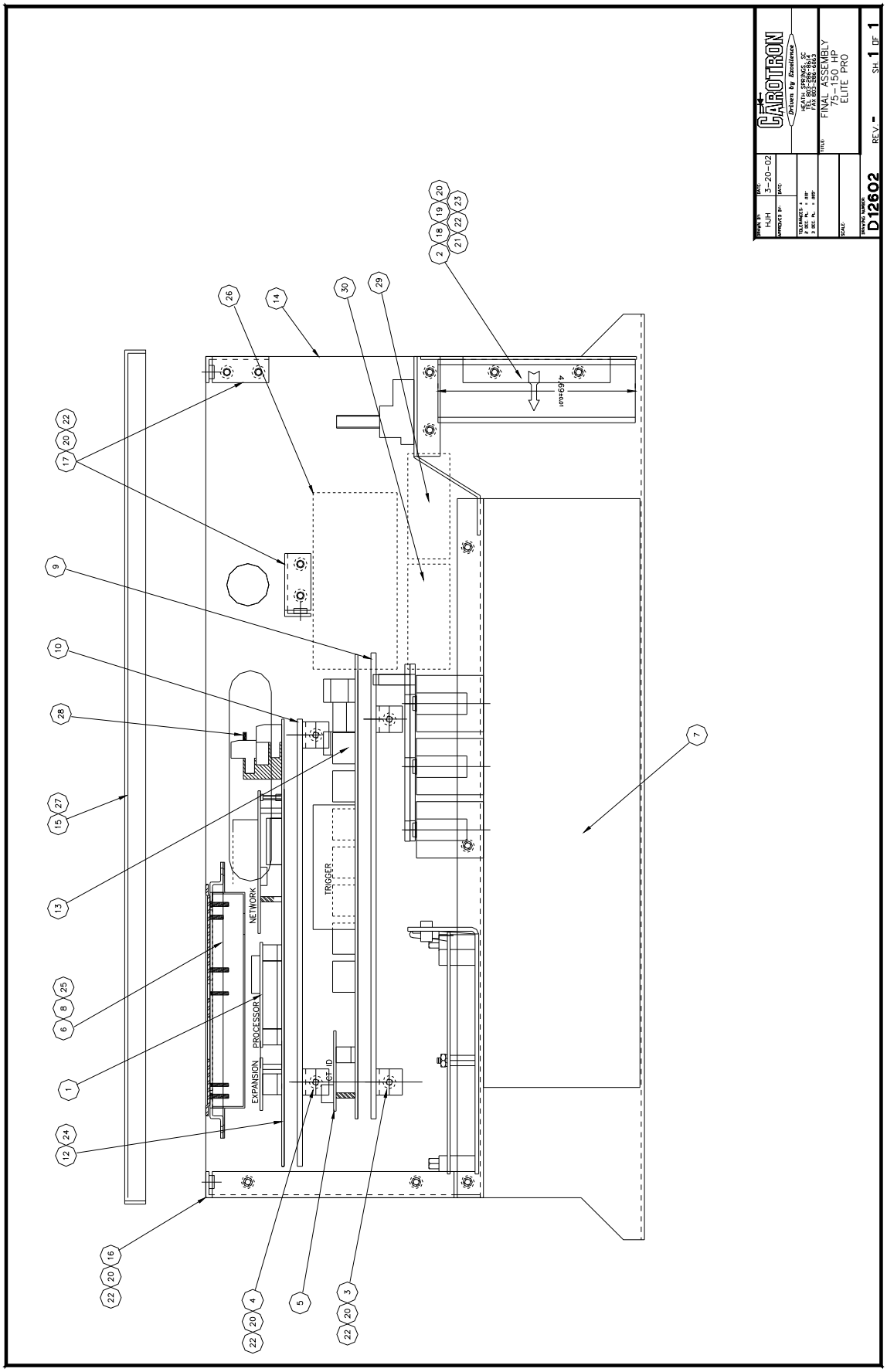
Model	Module	Amps	Carotron P/N	Manufacturer P/N
All Models	PMD1	31	PMD1025-00	Eupec TT31N14KOF Semikron SKKT42/14E
All Models	PMD2	31	PMD1028-00	Eupec DD31N14K Semikron SKKD26/14

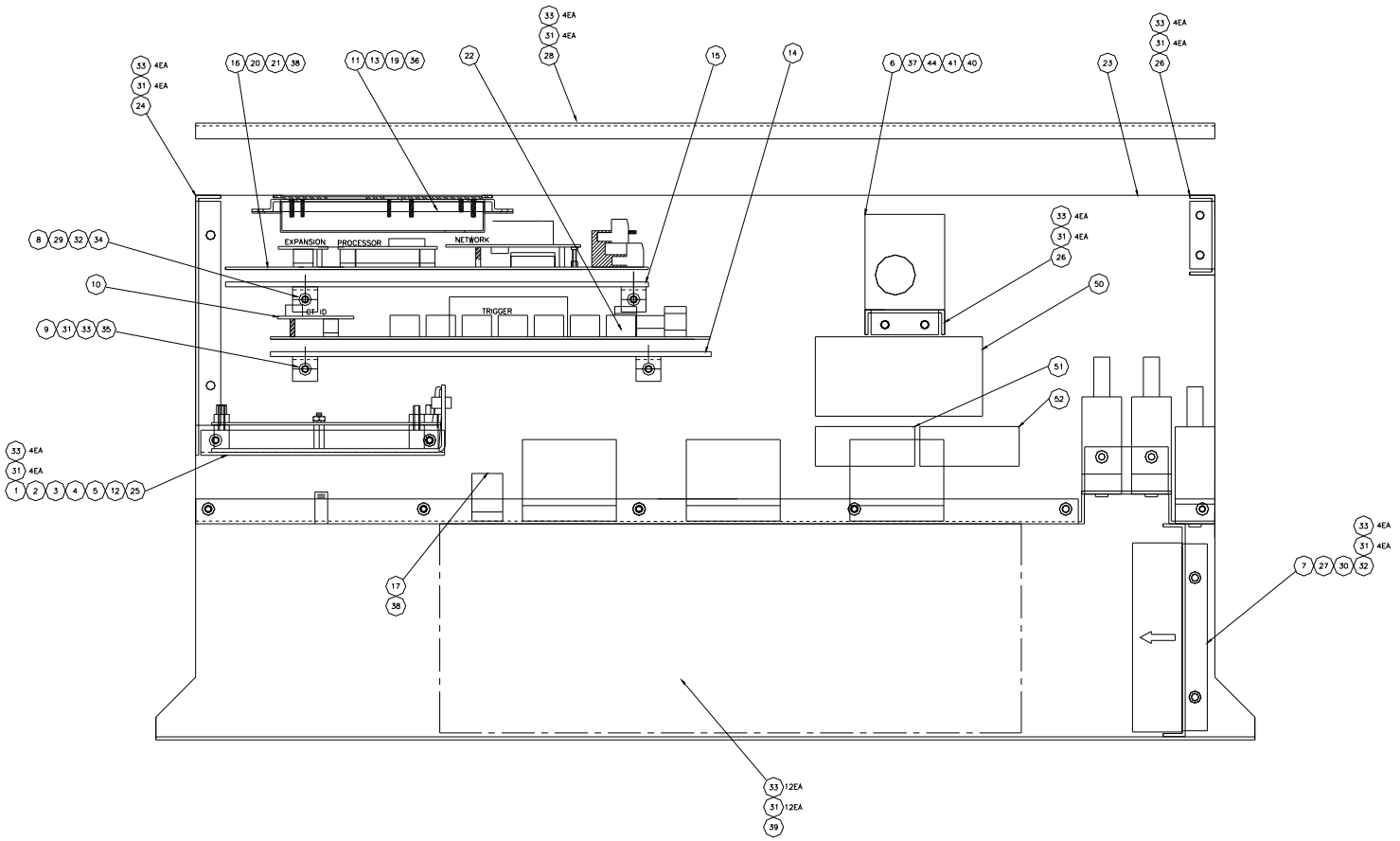
Table 23: Field Supply Modules

Prints



MODEL	CT ID BOARD	HEATSINK ASSY.	MODEL LABEL
EPN020-000	C12164-000	C12277-000	LAB1141-00
EPN040-000	C12164-001	C12277-001	LAB1141-01
EPN060-000	C12164-002	C12277-002	LAB1141-02
EPR020-000	C12164-000	C12309-000	LAB1142-00
EPR040-000	C12164-001	C12309-001	LAB1142-01
EPR060-000	C12164-002	C12309-002	LAB1142-02

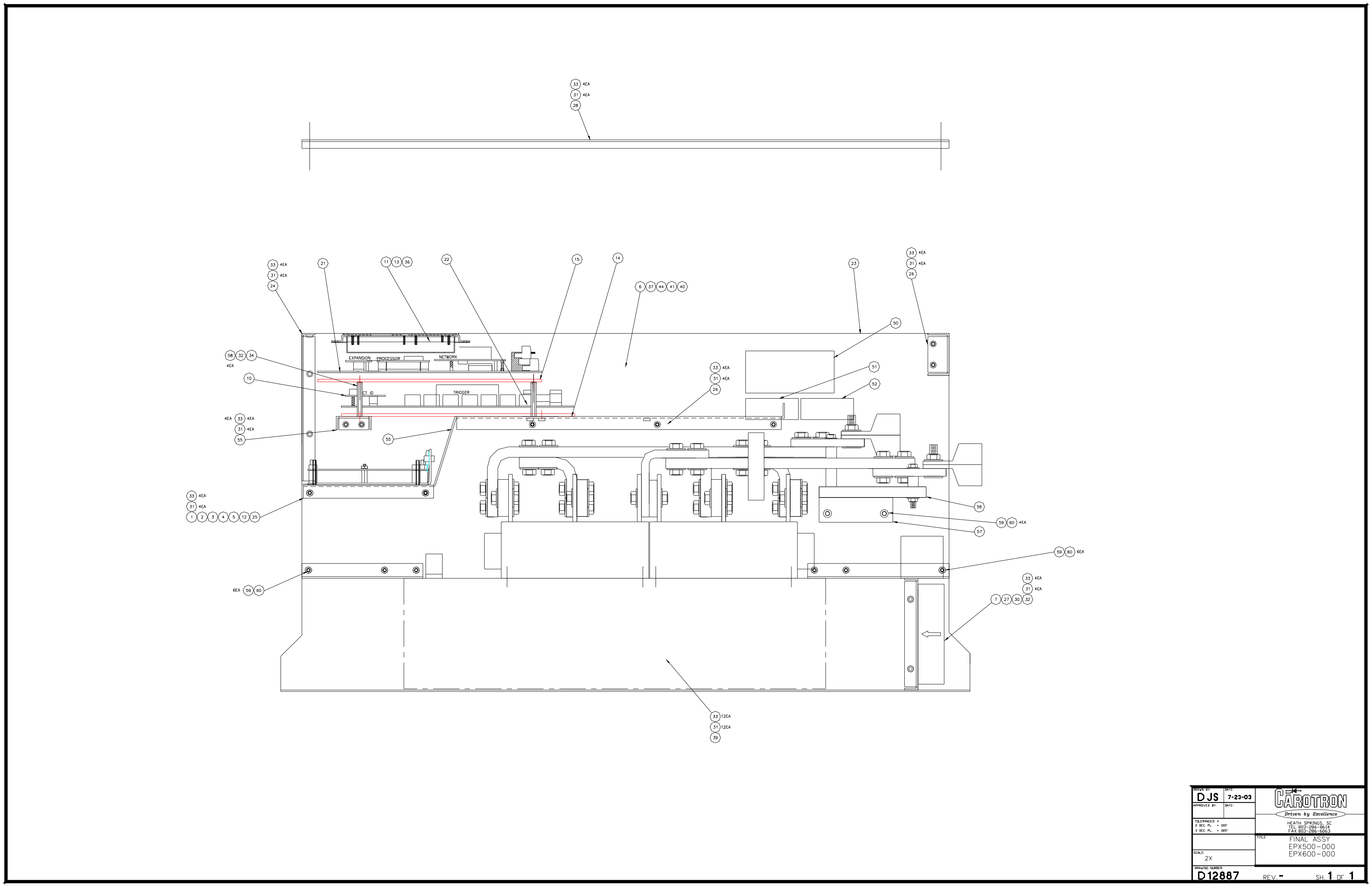

CAROTRON
Drivers by Excellence
HEATH SPRINGS, SC
TEL 803-286-4664
FAX 803-286-4663
DRAWN BY: HJH
DATE: 3-20-02
APPROVED BY:
DATE:
TOLERANCES: 1 PLC ± .030
2 DEC ± .010
3 DEC ± .005
TITLE: FINAL ASSEMBLY 75-150 HP ELITE PRO
SCALE:
FINAL NUMBER: D12602
REV - SH 1 OF 1
4.69±0.01
TRIGGER
NETWORK
PROCESSOR
EXPANSION
LED

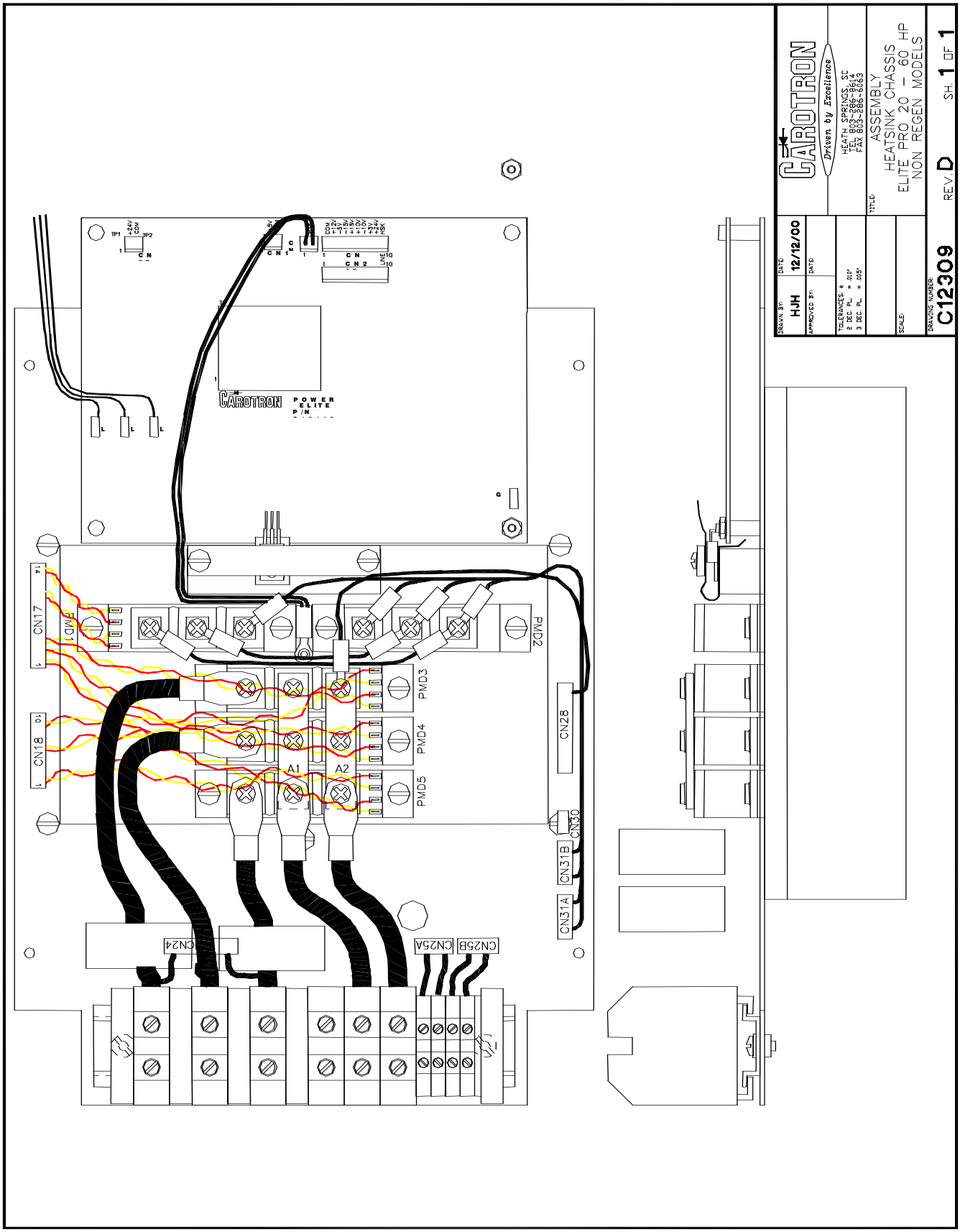


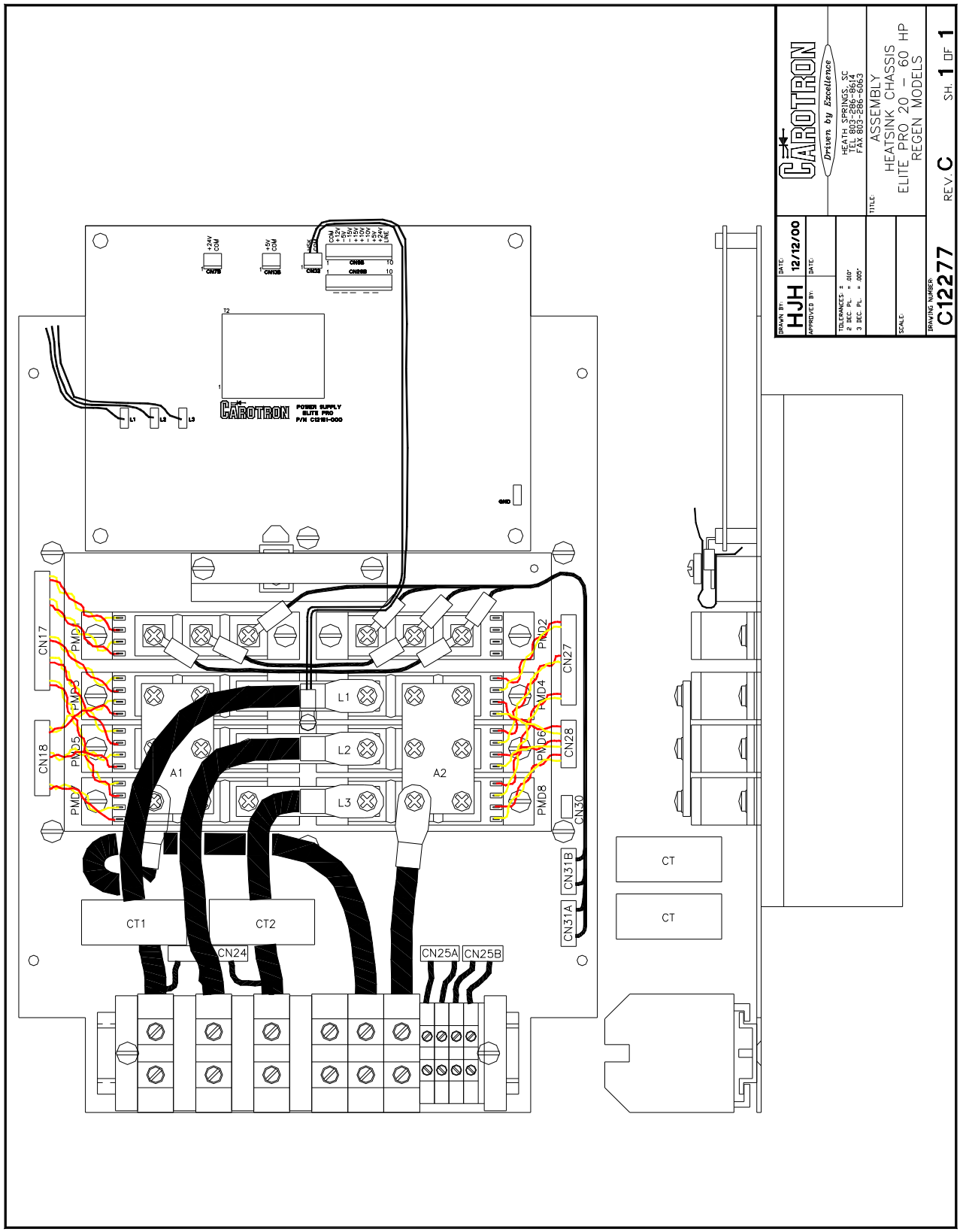
W/D: D12778
H/S ASSY:
EPN200-000 D12874
EPN250-000 D12874
EPN300-000 D12874
EPN400-000 D12798

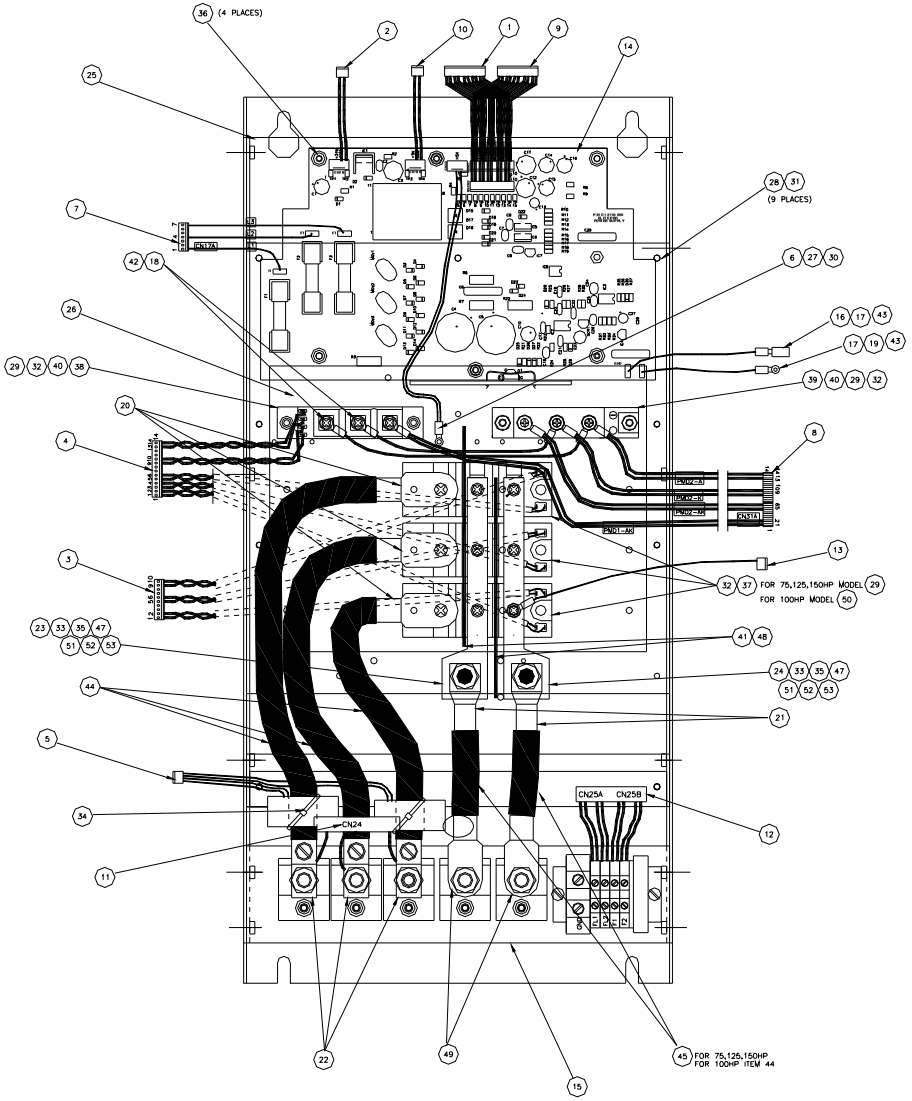
W/D: D12809
H/S ASSY:
EPR200-000 D12877
EPR250-000 D12877
EPR300-000 D12877
EPR400-000 D12878

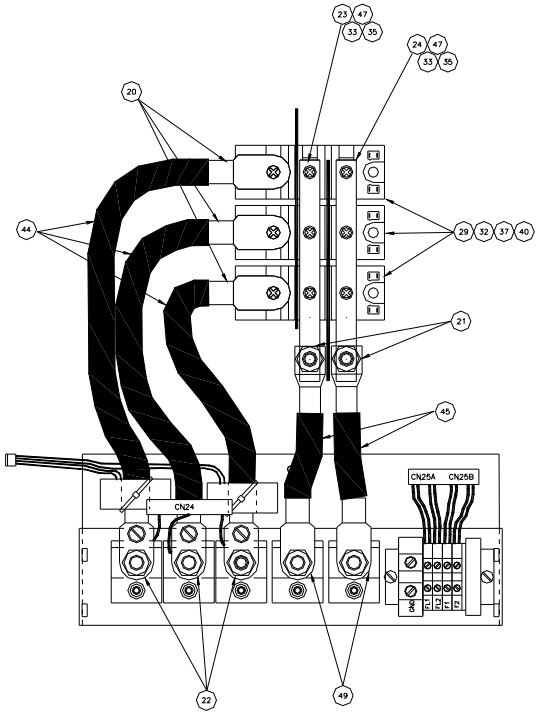
DRAWN BY: DJS	DATE: 6-19-03
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC PL. = .010" ± 3 DEC PL. = .005"	CAROTRON Driven by Excellence HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:	TITLE: FINAL ASSEMBLY ELITE PRO 200-400 HP
DRAWING NUMBER: D12797	REV. - SH. 1 OF 1


EXPANSION
PROCESSOR
NETWORK
TRIGGER
CT ID
DRAWN BY: DJS
DATE: 7-23-03
APPROVED BY:
DATE:
TOLERANCES: ±
2 DEC. PL. = .010"
3 DEC. PL. = .005"
SCALE: 2X
DRAWING NUMBER: D12887
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: FINAL ASSY
EPX500-000
EPX600-000
REV. -
SH. 1 OF 1


CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE:
ASSEMBLY
HEATSINK CHASSIS
ELITE PRO 20 - 60 HP
NON REGEN MODELS
DRAWN BY: HJH
DATE: 12/12/00
APPROVED BY:
DATE:
TOLERANCES: ±
2 DEC. PL. = .010"
3 DEC. PL. = .005"
SCALE:
DRAWING NUMBER: C12309
REV. D
SH. 1 OF 1
CN17
CN18
PMD1
PMD2
PMD3
PMD4
PMD5
A1
A2
CN28
CN30
CN31B
CN31A
CN24
CN25A
CN25B
POWER ELITE


CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
DRAWN BY: HJH
DATE: 12/12/00
APPROVED BY:
DATE:
TOLERANCES: ± 2 DEC. PL. = .010"
± 3 DEC. PL. = .005"
TITLE: ASSEMBLY HEATSINK CHASSIS ELITE PRO 20 – 60 HP REGEN MODELS
SCALE:
DRAWING NUMBER: C12277
REV. C
SH. 1 OF 1
POWER SUPPLY ELITE PRO P/N C12181-000
CN17
CN18
CN27
CN28
CN30
CN31A
CN31B
CN24
CN25A
CN25B
PMD1
PMD2
PMD3
PMD4
PMD5
PMD6
PMD7
PMD8
L1
L2
L3
A1
A2
CT1
CT2
CT
CT

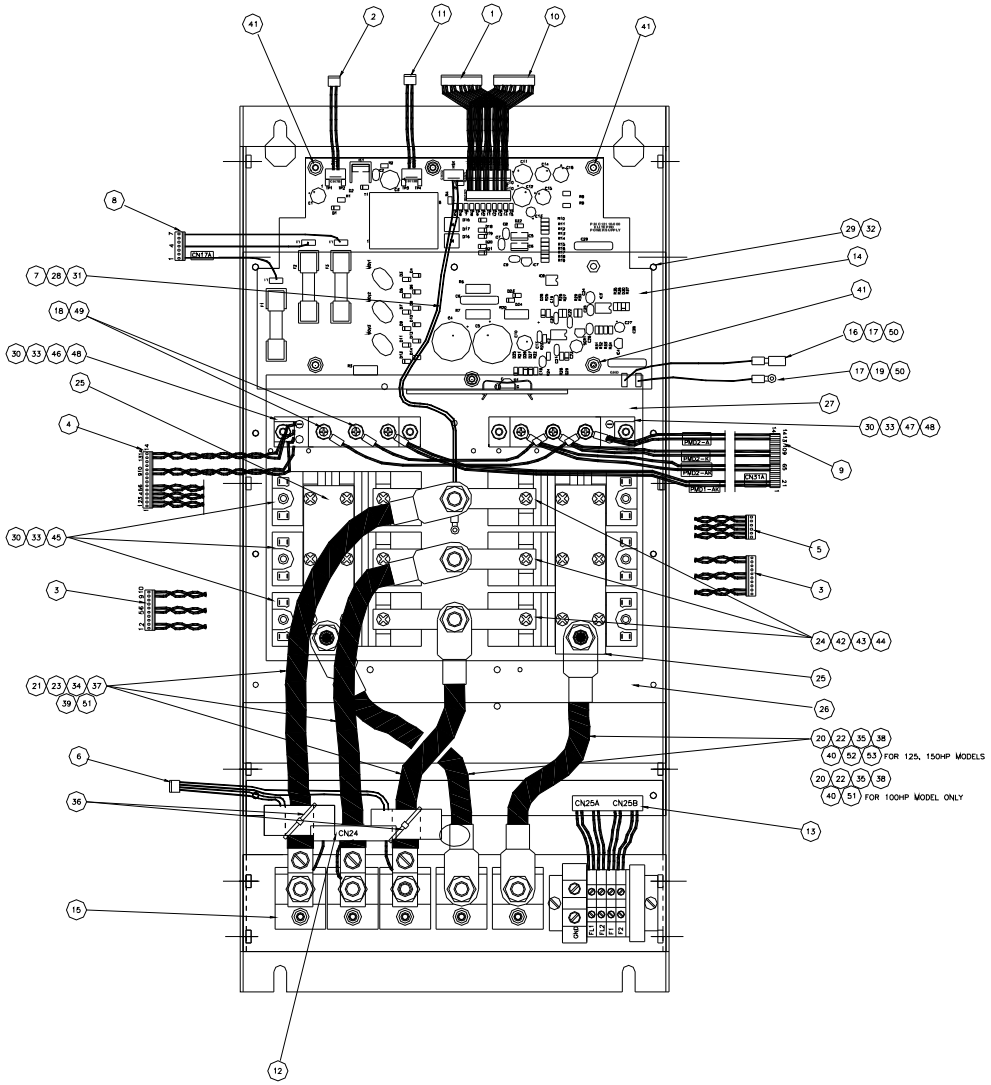


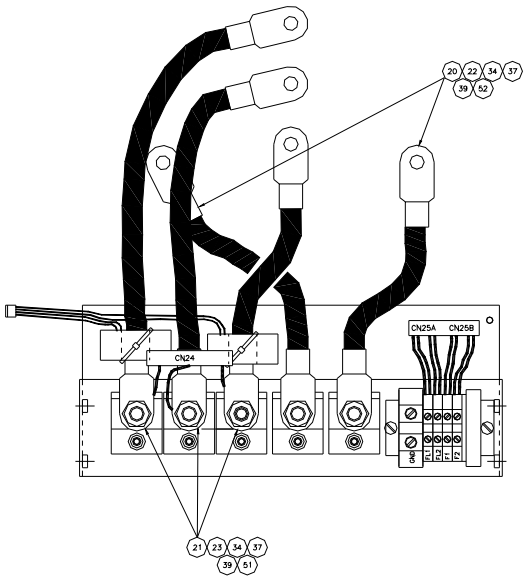


FOR 75 HP MODEL ONLY

ITEM 46 NOT USED ON 75 HP MODEL

DRAWN BY: HJH	DATE: 3/5/02	CAROTRON *Driven by Excellence*
APPROVED BY:	DATE:	HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"		TITLE: ASSEMBLY HEATSINK CHASSIS ELITE PRO 75 – 150 HP NON-REGEN MODELS
SCALE: 2=1		
DRAWING NUMBER: C12583	REV. -	SH. 1 OF 1

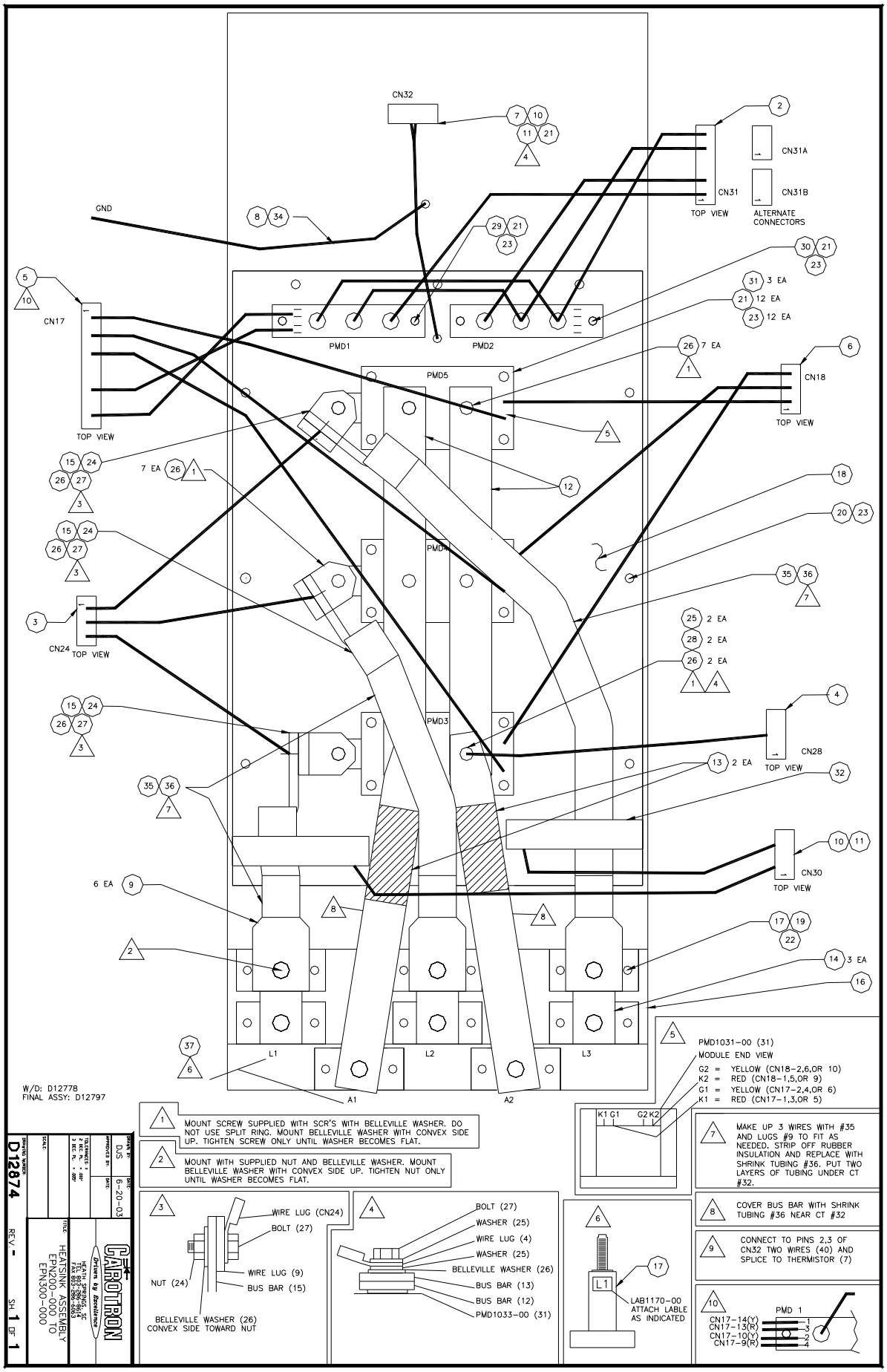


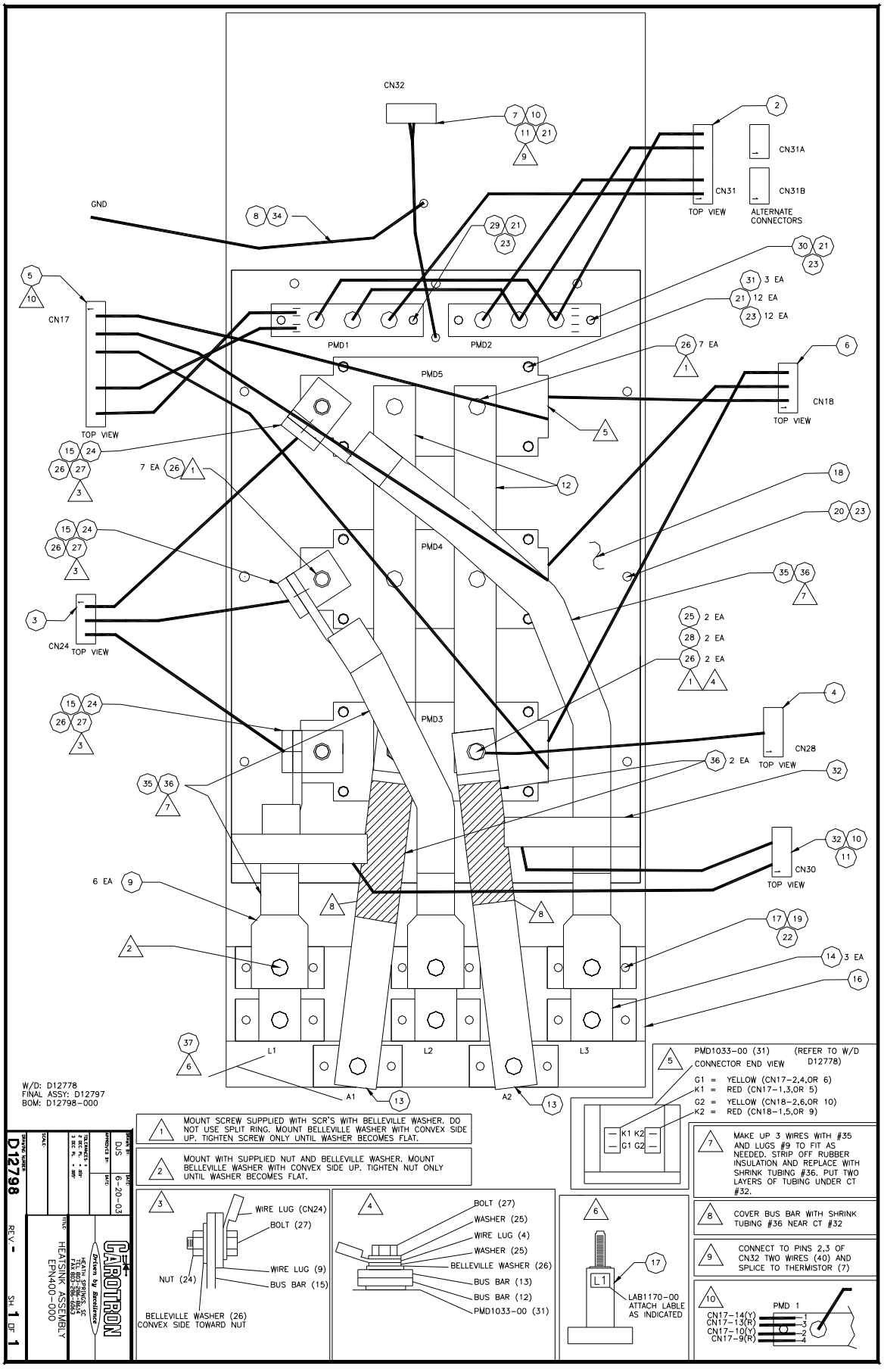


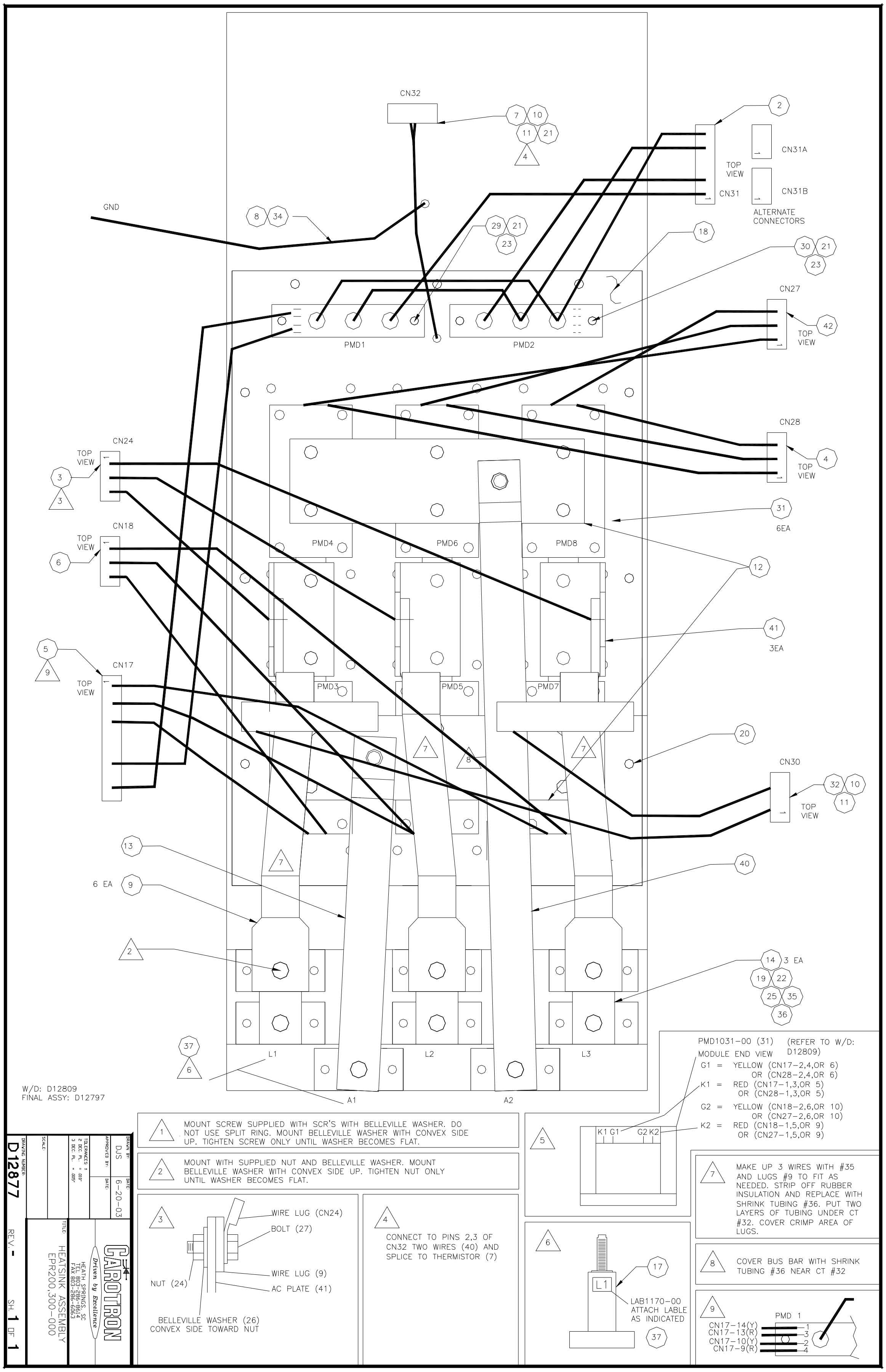
FOR 75 HP MODEL ONLY

ITEMS 35,38,49,42,43,44 & 53 NOT USED ON 75 HP MODELS

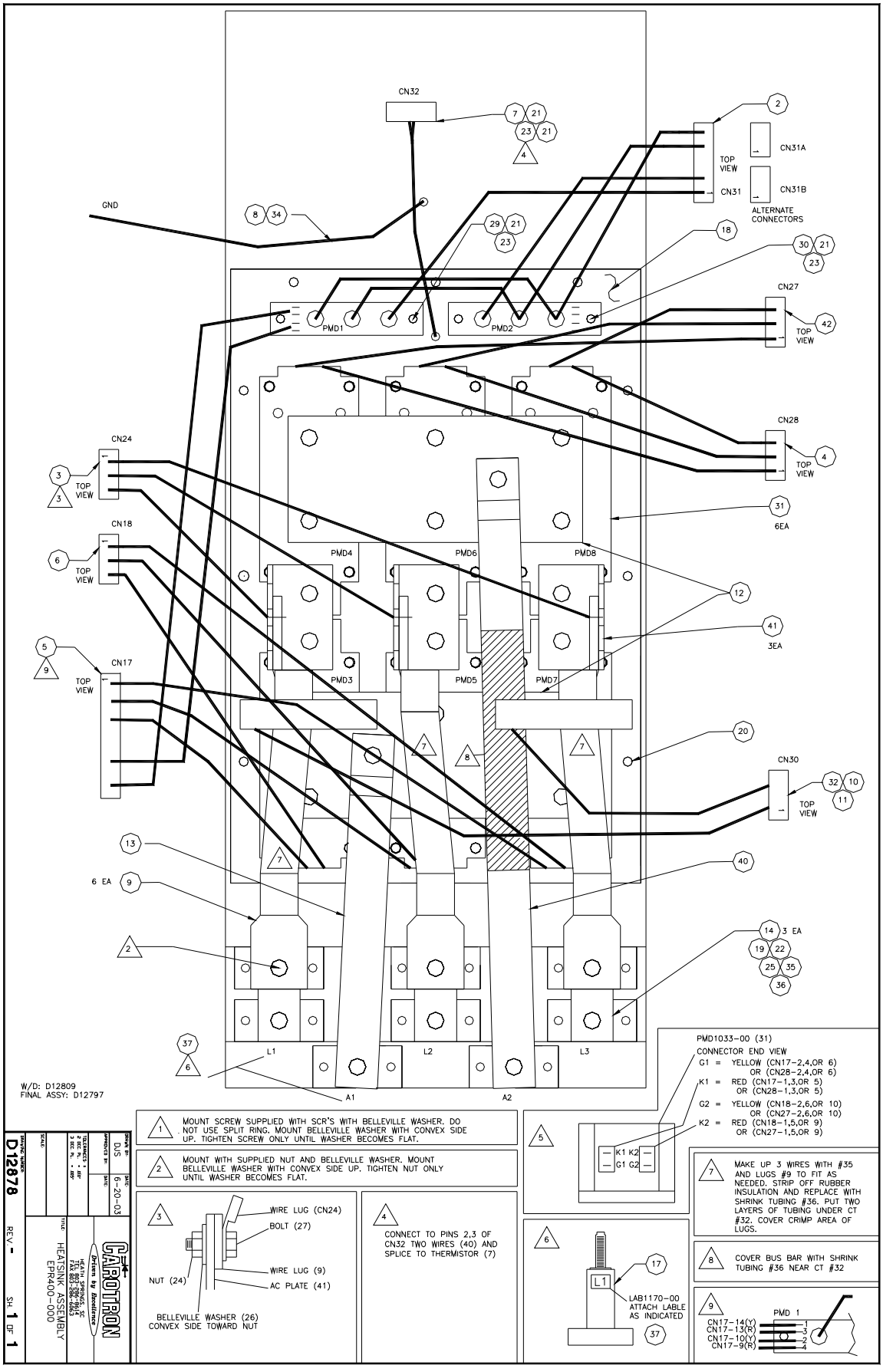
DRAWN BY: HJH	DATE: 3/28/02	CAROTRON Driven by Excellence
APPROVED BY:	DATE:	
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"		HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:		TITLE: ASSEMBLY HEATSINK CHASSIS ELITE PRO 75–150 HP REGEN MODELS
DRAWING NUMBER: C12584	REV.-	SH. 1 OF 1


CN32
CN31
CN31A
CN31B
TOP VIEW
ALTERNATE CONNECTORS
GND
CN17
PMD1
PMD2
PMD5
CN18
7 EA
12 EA
3 EA
CN24
PMD3
2 EA
CN28
CN30
6 EA
L1
L2
L3
A1
A2
W/D: D12778
FINAL ASSY: D12797
1 MOUNT SCREW SUPPLIED WITH SCR'S WITH BELLEVILLE WASHER. DO NOT USE SPLIT RING. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN SCREW ONLY UNTIL WASHER BECOMES FLAT.
2 MOUNT WITH SUPPLIED NUT AND BELLEVILLE WASHER. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN NUT ONLY UNTIL WASHER BECOMES FLAT.
3 WIRE LUG (CN24)
BOLT (27)
WIRE LUG (9)
BUS BAR (15)
NUT (24)
BELLEVILLE WASHER (26) CONVEX SIDE TOWARD NUT
4 BOLT (27)
WASHER (25)
WIRE LUG (4)
WASHER (25)
BELLEVILLE WASHER (26)
BUS BAR (13)
BUS BAR (12)
PMD1033-00 (31)
6 L1
LAB1170-00 ATTACH LABLE AS INDICATED
5 PMD1031-00 (31)
MODULE END VIEW
G2 = YELLOW (CN18-2,6,OR 10)
K2 = RED (CN18-1,5,OR 9)
G1 = YELLOW (CN17-2,4,OR 6)
K1 = RED (CN17-1,3,OR 5)
K1 G1 G2 K2
7 MAKE UP 3 WIRES WITH #35 AND LUGS #9 TO FIT AS NEEDED. STRIP OFF RUBBER INSULATION AND REPLACE WITH SHRINK TUBING #36. PUT TWO LAYERS OF TUBING UNDER CT #32.
8 COVER BUS BAR WITH SHRINK TUBING #36 NEAR CT #32
9 CONNECT TO PINS 2,3 OF CN32 TWO WIRES (40) AND SPLICE TO THERMISTOR (7)
10 PMD 1
CN17-14(Y)
CN17-13(R)
CN17-10(Y)
CN17-9(R)
DRAWING NUMBER D12874
REV. -
SH 1 OF 1
DRAWN BY DJS
APPROVED BY
DATE 6-20-03
SCALE
TOLERANCES ± .030 3 PLC. ± .005
TITLE HEATSINK ASSEMBLY EPN200-000 TO EPN300-000
CARLOTRON
Driven By Excellence
HEATH SPRINGS, SC
TEL 803-286-8804
FAX 803-286-8814


CN32
CN31
CN31A
CN31B
TOP VIEW
ALTERNATE CONNECTORS
GND
CN17
PMD1
PMD2
PMD5
PMD4
PMD3
CN18
CN24
CN28
CN30
7 EA
3 EA
12 EA
2 EA
6 EA
L1
L2
L3
A1
A2
W/D: D12778
FINAL ASSY: D12797
BOM: D12798-000
1 MOUNT SCREW SUPPLIED WITH SCR'S WITH BELLEVILLE WASHER. DO NOT USE SPLIT RING. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN SCREW ONLY UNTIL WASHER BECOMES FLAT.
2 MOUNT WITH SUPPLIED NUT AND BELLEVILLE WASHER. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN NUT ONLY UNTIL WASHER BECOMES FLAT.
3
WIRE LUG (CN24)
BOLT (27)
WIRE LUG (9)
BUS BAR (15)
NUT (24)
BELLEVILLE WASHER (26) CONVEX SIDE TOWARD NUT
4
BOLT (27)
WASHER (25)
WIRE LUG (4)
WASHER (25)
BELLEVILLE WASHER (26)
BUS BAR (13)
BUS BAR (12)
PMD1033-00 (31)
5
PMD1033-00 (31) (REFER TO W/D D12778)
CONNECTOR END VIEW
G1 = YELLOW (CN17-2,4,OR 6)
K1 = RED (CN17-1,3,OR 5)
G2 = YELLOW (CN18-2,6,OR 10)
K2 = RED (CN18-1,5,OR 9)
K1 K2
G1 G2
6
L1
17
LAB1170-00 ATTACH LABLE AS INDICATED
7 MAKE UP 3 WIRES WITH #35 AND LUGS #9 TO FIT AS NEEDED. STRIP OFF RUBBER INSULATION AND REPLACE WITH SHRINK TUBING #36. PUT TWO LAYERS OF TUBING UNDER CT #32.
8 COVER BUS BAR WITH SHRINK TUBING #36 NEAR CT #32
9 CONNECT TO PINS 2,3 OF CN32 TWO WIRES (40) AND SPLICE TO THERMISTOR (7)
10
PMD 1
CN17-14(Y)
CN17-13(R)
CN17-10(Y)
CN17-9(R)
1
3
2
4
DRAWN BY DJS
DATE 6-20-03
SCALE
D12798
REV -
SH 1 OF 1
TITLE HEATSINK ASSEMBLY EPN400-000
GE GARDTRON
Driven by Excellence
HEATH SPRINGS, SC
FAX 803-329-5003

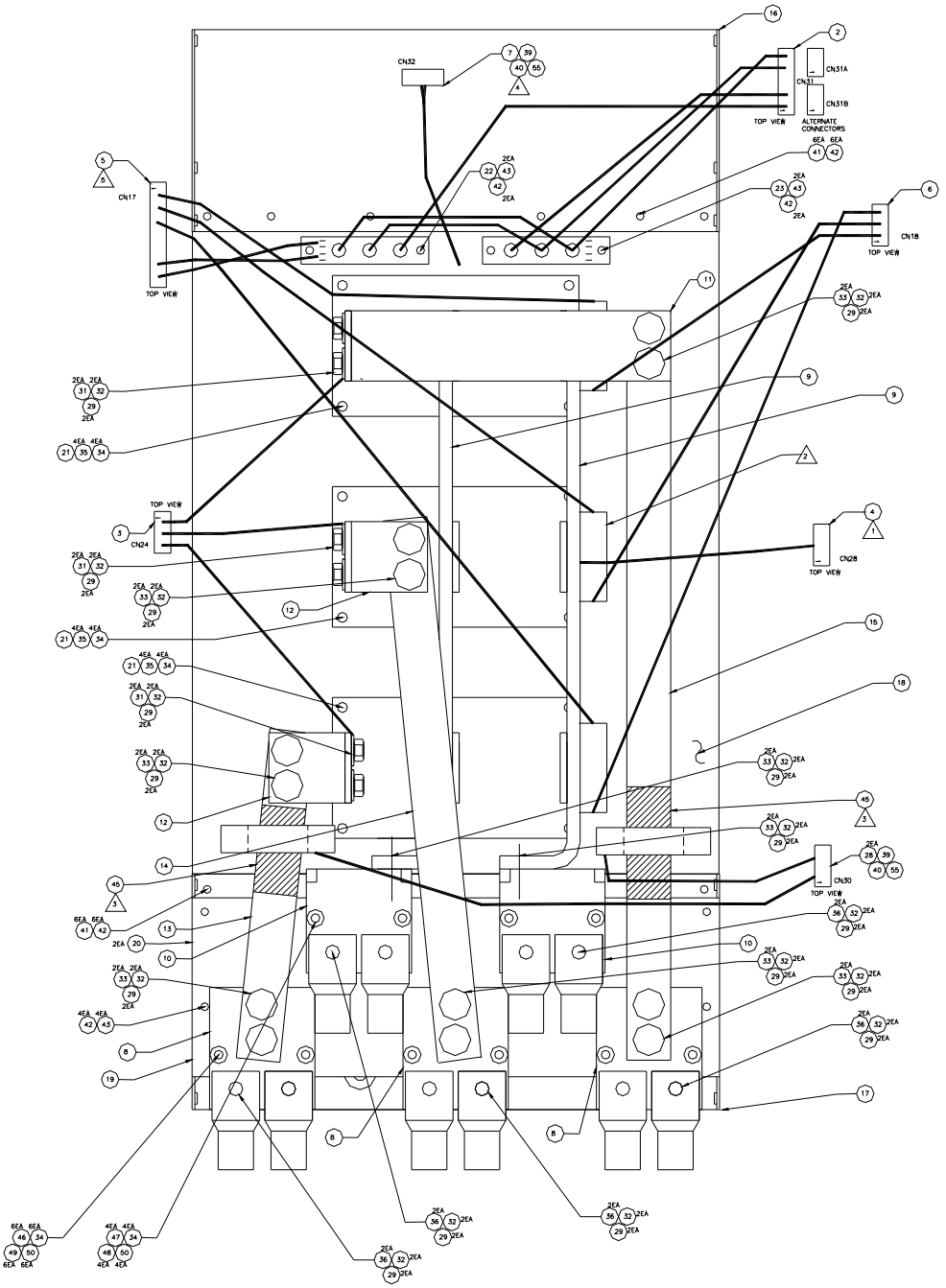


CN32
GND
CN31
CN31A
CN31B
TOP VIEW
ALTERNATE CONNECTORS
CN27
CN28
CN24
CN18
CN17
CN30
PMD1
PMD2
PMD3
PMD4
PMD5
PMD6
PMD7
PMD8
6EA
3EA
6 EA
3 EA
L1
L2
L3
A1
A2
W/D: D12809
FINAL ASSY: D12797
PMD1031-00 (31) (REFER TO W/D: D12809)
MODULE END VIEW
G1 = YELLOW (CN17-2,4,OR 6) OR (CN28-2,4,OR 6)
K1 = RED (CN17-1,3,OR 5) OR (CN28-1,3,OR 5)
G2 = YELLOW (CN18-2,6,OR 10) OR (CN27-2,6,OR 10)
K2 = RED (CN18-1,5,OR 9) OR (CN27-1,5,OR 9)
1 MOUNT SCREW SUPPLIED WITH SCR'S WITH BELLEVILLE WASHER. DO NOT USE SPLIT RING. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN SCREW ONLY UNTIL WASHER BECOMES FLAT.
2 MOUNT WITH SUPPLIED NUT AND BELLEVILLE WASHER. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN NUT ONLY UNTIL WASHER BECOMES FLAT.
3 WIRE LUG (CN24)
BOLT (27)
WIRE LUG (9)
AC PLATE (41)
NUT (24)
BELLEVILLE WASHER (26) CONVEX SIDE TOWARD NUT
4 CONNECT TO PINS 2,3 OF CN32 TWO WIRES (40) AND SPLICE TO THERMISTOR (7)
6 LAB1170-00 ATTACH LABLE AS INDICATED
7 MAKE UP 3 WIRES WITH #35 AND LUGS #9 TO FIT AS NEEDED. STRIP OFF RUBBER INSULATION AND REPLACE WITH SHRINK TUBING #36. PUT TWO LAYERS OF TUBING UNDER CT #32. COVER CRIMP AREA OF LUGS.
8 COVER BUS BAR WITH SHRINK TUBING #36 NEAR CT #32
9 PMD 1
CN17-14(Y)
CN17-13(R)
CN17-10(Y)
CN17-9(R)
D12877
REV. -
SH 1 OF 1
DJS
6-20-03
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
HEATSINK ASSEMBLY EPR200,300-000


CN32
CN31A
CN31
CN31B
ALTERNATE CONNECTORS
TOP VIEW
GND
PMD1
PMD2
CN27
CN28
CN24
CN18
CN17
CN30
PMD4
PMD6
PMD8
PMD3
PMD5
PMD7
6EA
3EA
6 EA
3 EA
L1
L2
L3
A1
A2
W/D: D12809
FINAL ASSY: D12797
PMD1033-00 (31)
CONNECTOR END VIEW
G1 = YELLOW (CN17-2,4,OR 6) OR (CN28-2,4,OR 6)
K1 = RED (CN17-1,3,OR 5) OR (CN28-1,3,OR 5)
G2 = YELLOW (CN18-2,6,OR 10) OR (CN27-2,6,OR 10)
K2 = RED (CN18-1,5,OR 9) OR (CN27-1,5,OR 9)
1 MOUNT SCREW SUPPLIED WITH SCR'S WITH BELLEVILLE WASHER. DO NOT USE SPLIT RING. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN SCREW ONLY UNTIL WASHER BECOMES FLAT.
2 MOUNT WITH SUPPLIED NUT AND BELLEVILLE WASHER. MOUNT BELLEVILLE WASHER WITH CONVEX SIDE UP. TIGHTEN NUT ONLY UNTIL WASHER BECOMES FLAT.
3 WIRE LUG (CN24)
BOLT (27)
WIRE LUG (9)
AC PLATE (41)
NUT (24)
BELLEVILLE WASHER (26) CONVEX SIDE TOWARD NUT
4 CONNECT TO PINS 2,3 OF CN32 TWO WIRES (40) AND SPLICE TO THERMISTOR (7)
5 K1 K2 G1 G2
6 L1 17 LAB1170-00 ATTACH LABLE AS INDICATED 37
7 MAKE UP 3 WIRES WITH #35 AND LUGS #9 TO FIT AS NEEDED. STRIP OFF RUBBER INSULATION AND REPLACE WITH SHRINK TUBING #36. PUT TWO LAYERS OF TUBING UNDER CT #32. COVER CRIMP AREA OF LUGS.
8 COVER BUS BAR WITH SHRINK TUBING #36 NEAR CT #32
9 PMD 1
CN17-14(Y)
CN17-13(R)
CN17-10(Y)
CN17-9(R)
DRAWING NUMBER D12878 REV. - SH 1 OF 1
SCALE
DRAWN BY DJS
APPROVED BY
DATE 6-20-03
TOLERANCES 1 PLACE ± .1 2 DEC PL ± .01 ANG ± 1°
TITLE HEATSINK ASSEMBLY EPR400-000
GARO TRON
Driven By Excellence
HEATH SPRINGS, SC
PH: 803-386-8844
FAX: 803-386-8884

READ PROCEDURE!!

PROCEDURE FOR ASSEMBLY OF D12885-000 HEATSINK ASSEMBLY
1) CLEAN ALL COPPER PIECES WITH SCOTCH-BRITE TO REMOVE OXIDE.
2) COAT ALL COPPER SURFACES WITH WD40. WIPE OFF EXCESS WITH PAPER TOWELS.
3) ALLOW SOLVENT IN WD40 TO EVAPORATE LEAVING CORROSION PROTECTION FILM.
4) MOUNT SCR MODULES (21) WITH HEATSINK GREASE ON HEATSINK(18)
5) MOUNT HEATSINK PLATES (16,17) ON HEATSINK.
6) MOUNT HEATSINK "TERMINAL ALIGNMENT FIXTURE" (SEE D12885 SHEET 2) TO HEATSINK ASSEMBLY
7) MOUNT TERMINAL SHELF (19) WITH MOUNTING BRACKETS (20) TO FIXTURE PLATES
8) ASSEMBLE BUS BARS AND TERMINAL PLATES MAKING BUSBARS PARALLEL TO HEATSINK SURFACE



WIRING DIA: D12789
HEATSINK ASSY: D12886
FINAL ASSY: D12797

1 — WIRE LUG (CN28); BOLT (35); SCR MODULE TAB(21); NUT (32); ARM B/B (9); BELLEVILLE WASHER (34) CONVEX SIDE TOWARD NUT

2 — PMD1034-00 (21) CONNECTOR TOP VIEW; K1 G1 G2 K2; GATE = G2 (YELLOW) CN18-2,6,OR 10; CATH = K2 (RED) CN18-1,5,OR 9; GATE = G1 (YELLOW) CN17-2,4,OR 6; CATH = K1 (RED) CN17-1,3,OR 5

3 — COVER BUS BAR WITH 2 LAYERS OF SHRINK TUBING #45 NEAR CT #28

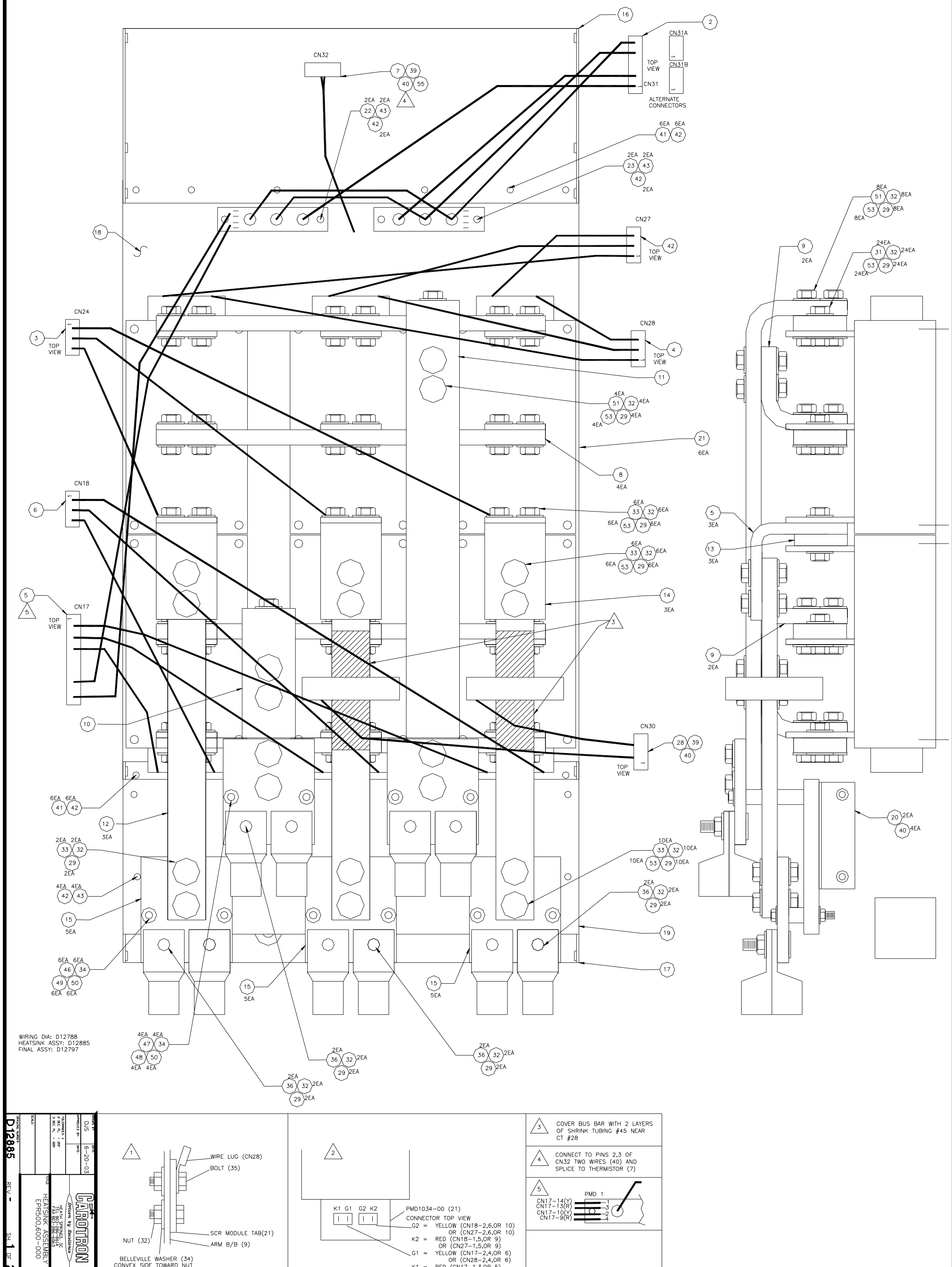
4 — CONNECT TO PINS 2,5 OF CN32 TWO WIRES (40) AND Ssplice TO THERMISTOR (7)

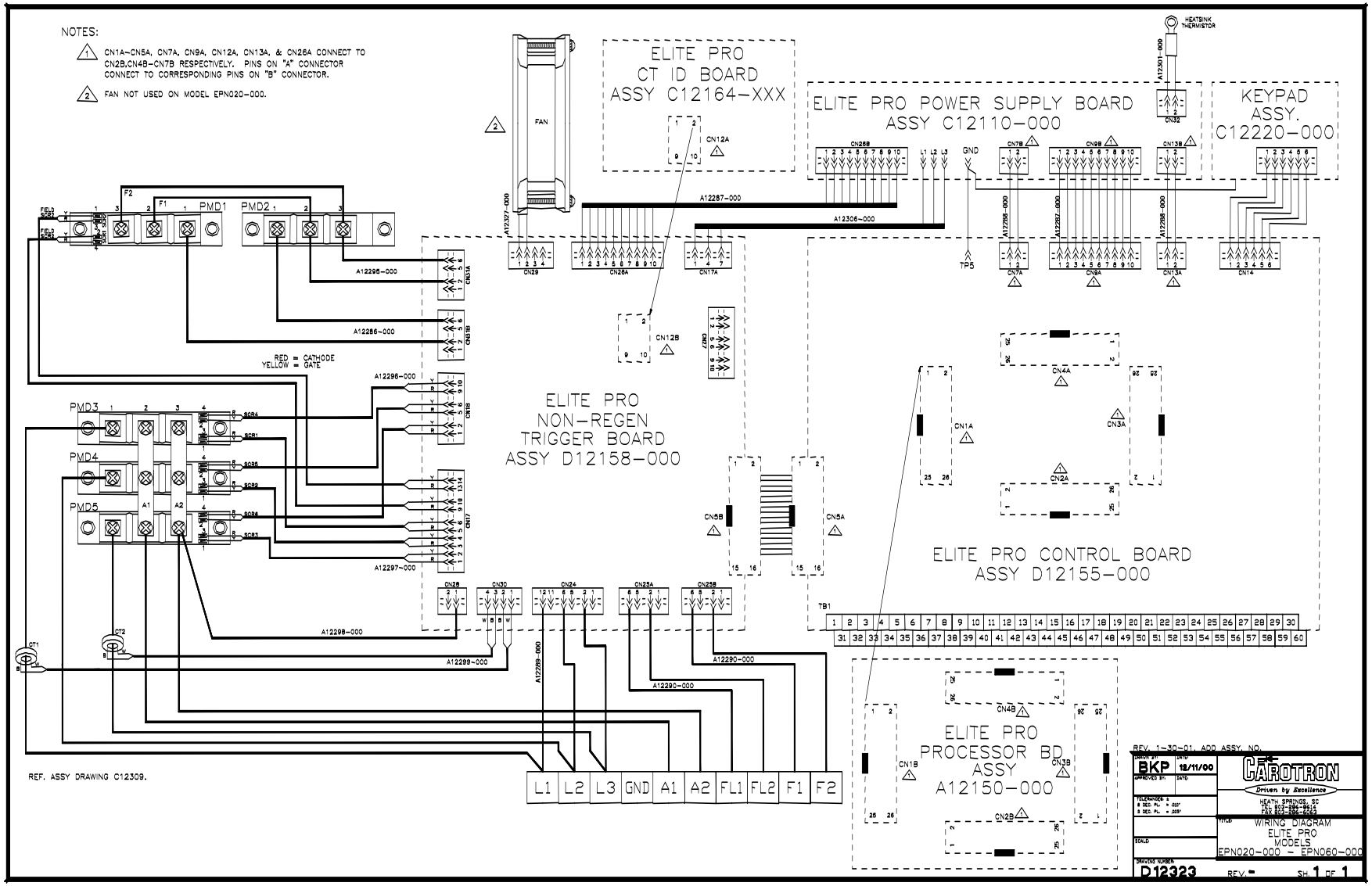
5 — PMD 1; CN17-14(Y); CN17-15(R); CN17-10(Y); CN17-9(R)

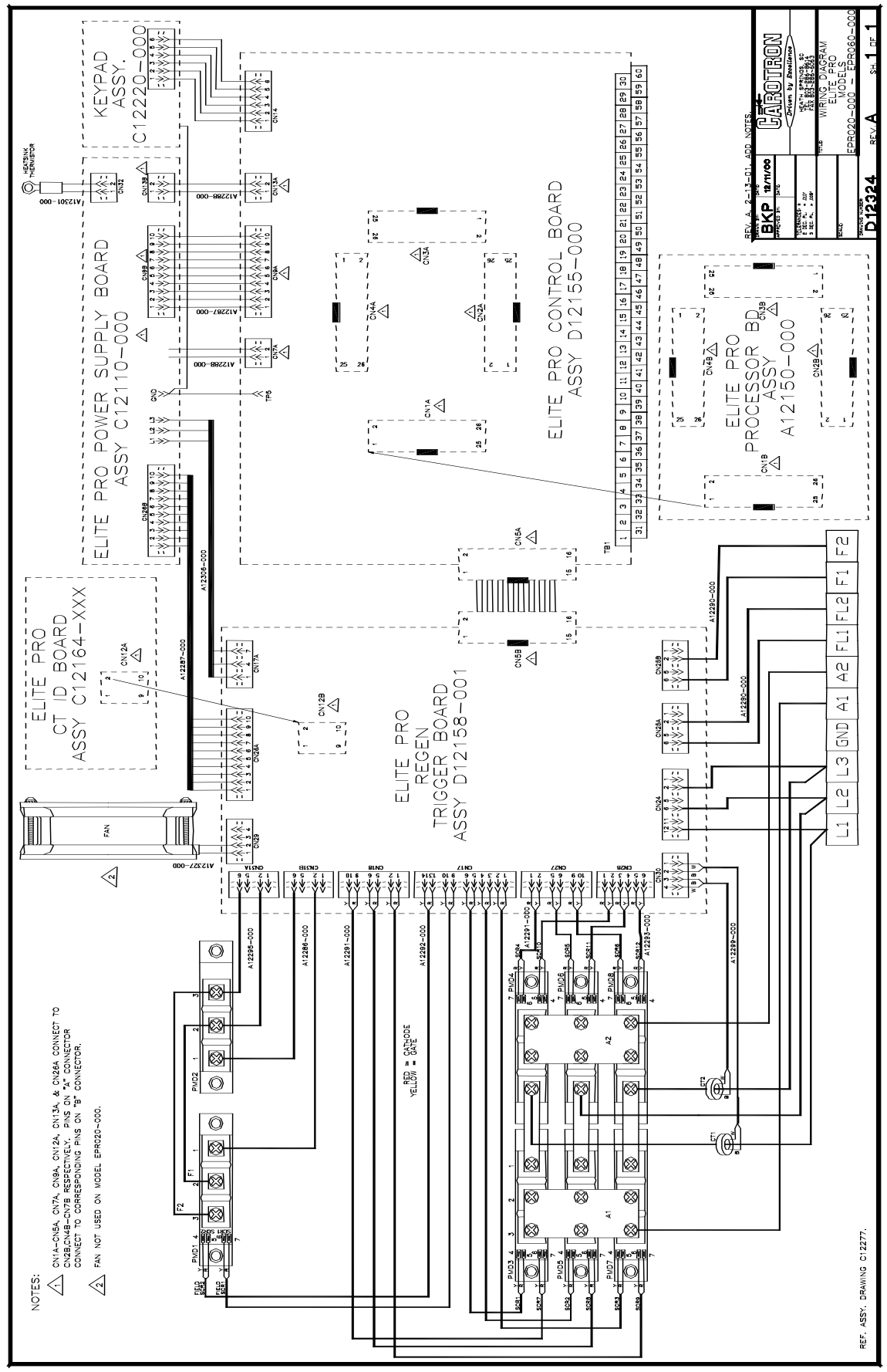
D12886 REV. - SH. 1 OF 1
HEATSINK ASSEMBLY
CARLOTRON

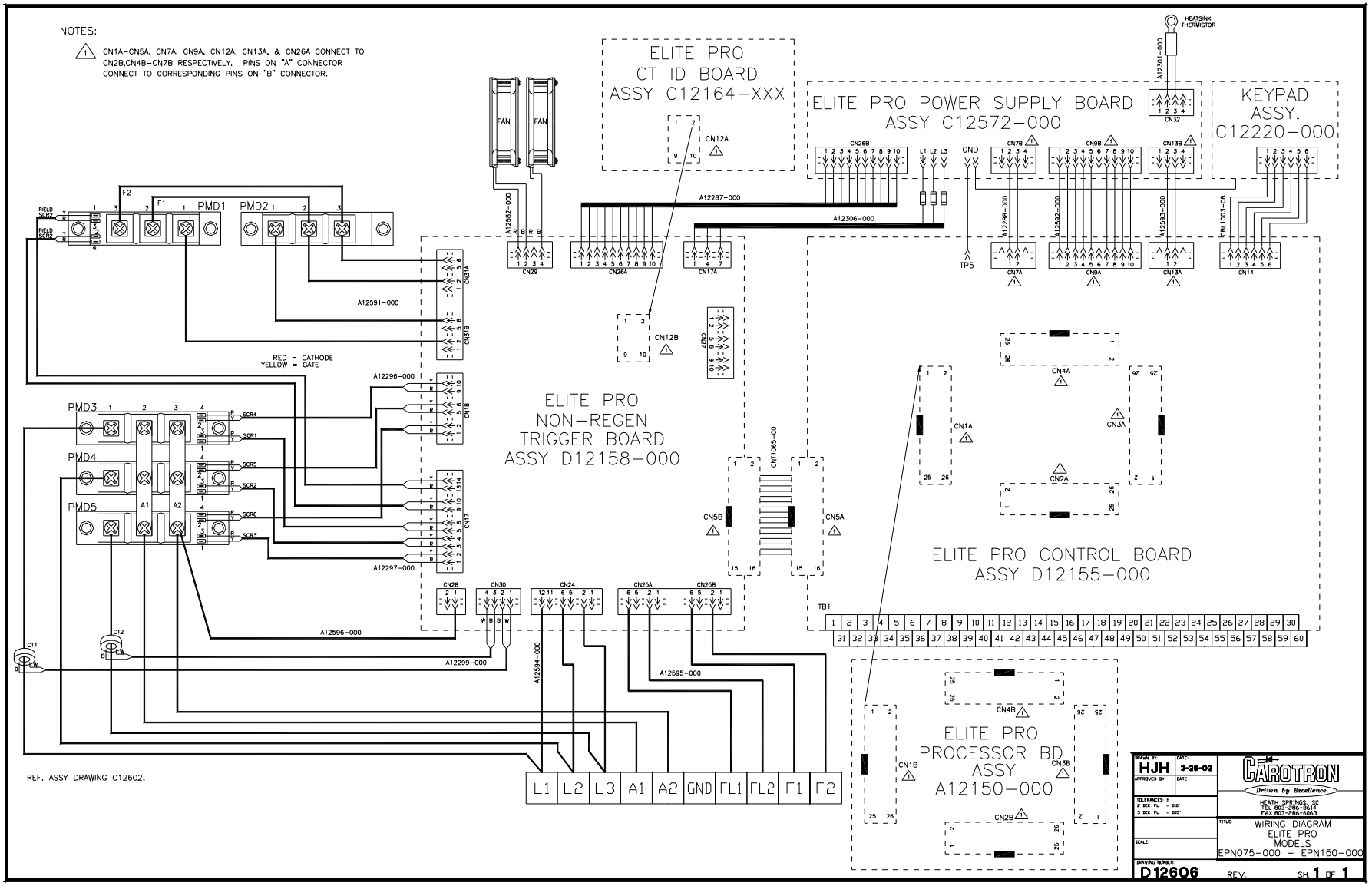
READ PROCEDURE!!

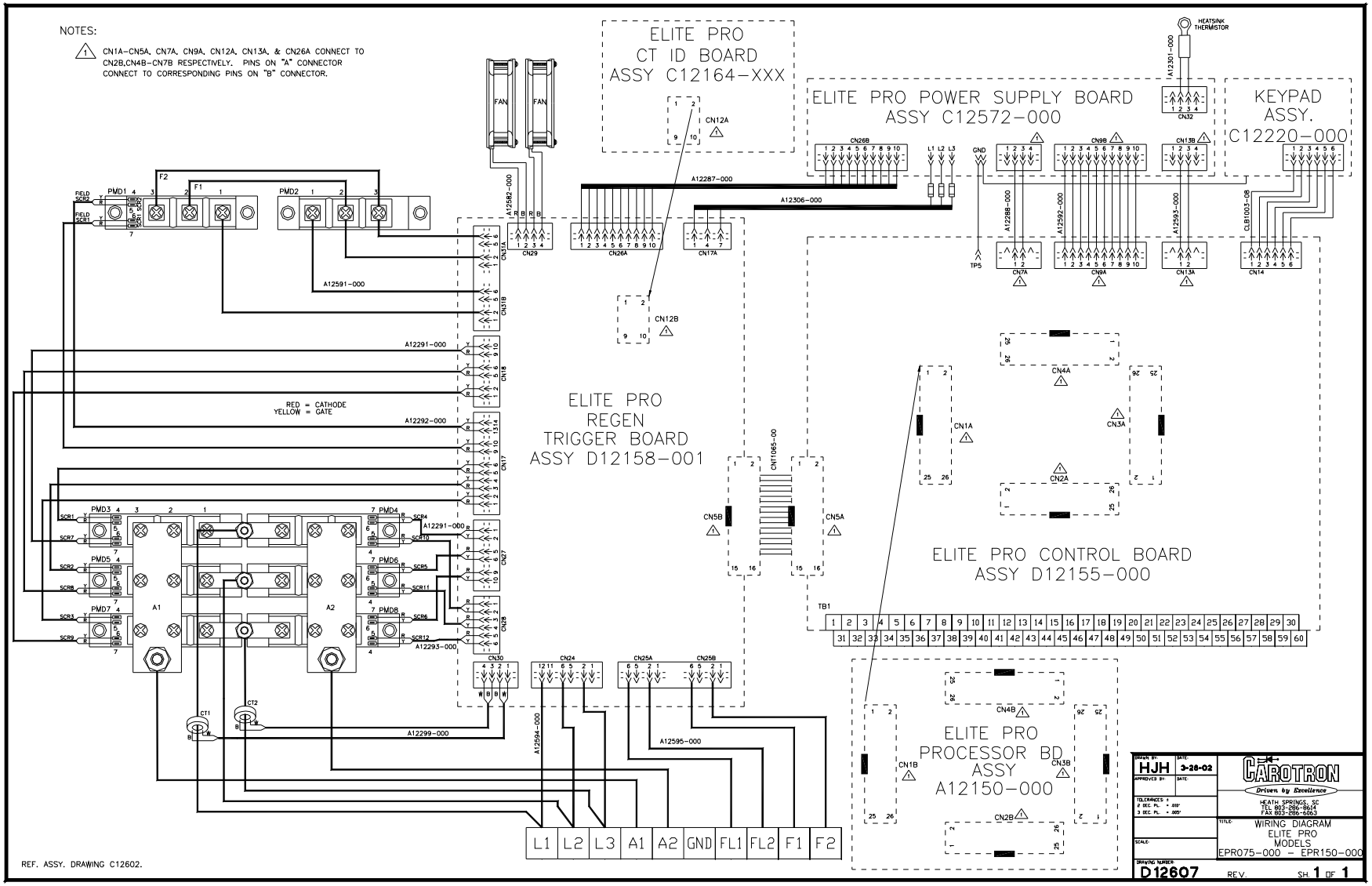
PROCEDURE FOR ASSEMBLY OF D12885-000 HEATSINK ASSEMBLY
1) CLEAN ALL COPPER PIECES WITH SCOTCH-BRITE TO REMOVE OXIDE.
2) COAT ALL COPPER SURFACES WITH WD40. WIPE OFF EXCESS WITH PAPER TOWELS.
3) ALLOW SOLVENT IN WD40 TO EVAPORATE LEAVING CORROSION PROTECTION FILM.
4) MOUNT SCR MODULES (21) WITH HEATSINK GREASE ON HEATSINK(18) AND WITH SCREWS LOOSE (34,35)
5) PUT 2 SPACERS(13) (TEMPORARILY) BETWEEN SCR MODULES WITH SCREWS AND WASHERS (32,33) TIGHTEN MOUNTING SCREWS ON SCR MODULES. REMOVE SPACERS ON FIRST PAIR OF SCRS AND DO THE NEXT TWO PAIRS.
6) MOUNT HEATSINK PLATES (16,17) ON HEATSINK.
7) MOUNT HEATSINK "TERMINAL ALIGNMENT FIXTURE" (SEE SHEET 2) TO HEATSINK ASSEMBLY
8) MOUNT TERMINAL SHELF (19) WITH MOUNTING BRACKETS (20) TO FIXTURE PLATES
9) ASSEMBLE BUS BARS AND TERMINAL PLATES MAKING BUSBARS PARALLEL TO HEATSINK SURFACE

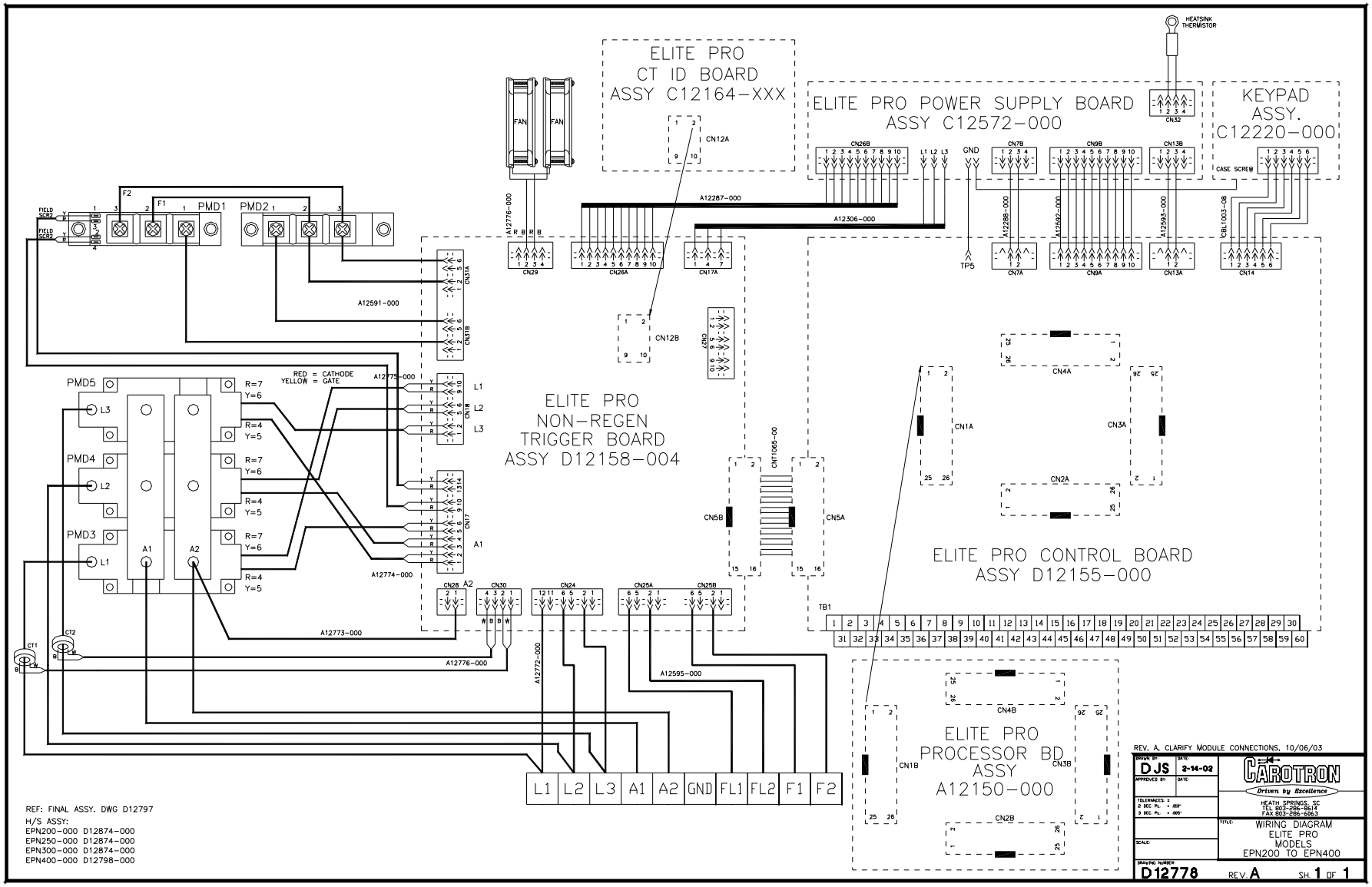


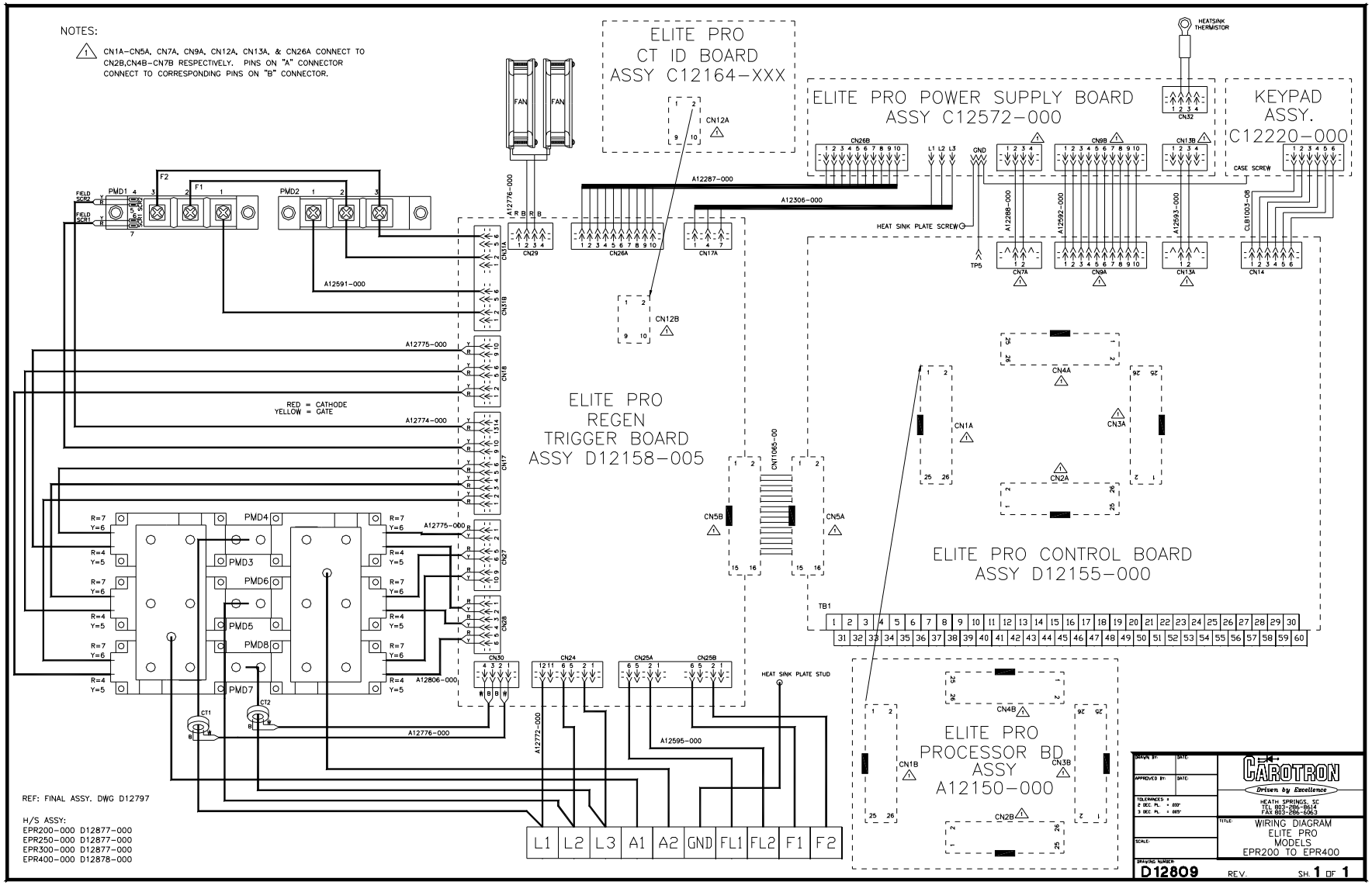

NOTES:
1 CN1A–CN5A, CN7A, CN9A, CN12A, CN13A, & CN26A CONNECT TO CN2B,CN4B–CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
2 FAN NOT USED ON MODEL EPN020–000.
ELITE PRO CT ID BOARD ASSY C12164–XXX
ELITE PRO POWER SUPPLY BOARD ASSY C12110–000
KEYPAD ASSY. C12220–000
HEATSINK THERMISTOR
FAN
A12307–000
A12287–000
A12306–000
A12295–000
A12286–000
A12296–000
A12297–000
A12298–000
A12299–000
A12290–000
RED = CATHODE
YELLOW = GATE
ELITE PRO NON–REGEN TRIGGER BOARD ASSY D12158–000
ELITE PRO CONTROL BOARD ASSY D12155–000
ELITE PRO PROCESSOR BD ASSY A12150–000
PMD1
PMD2
PMD3
PMD4
PMD5
F1
F2
CT1
CT2
TB1
L1 L2 L3 GND A1 A2 FL1 FL2 F1 F2
REF. ASSY DRAWING C12309.
REV. 1–30–01, ADD ASSY. NO.
DRAWN BY BKP
DATE 12/11/00
CAROTRON
Driven by Excellence
WIRING DIAGRAM
ELITE PRO
MODELS
EPN020–000 – EPN060–000
DRAWING NUMBER D12323
REV. –
SH. 1 OF 1

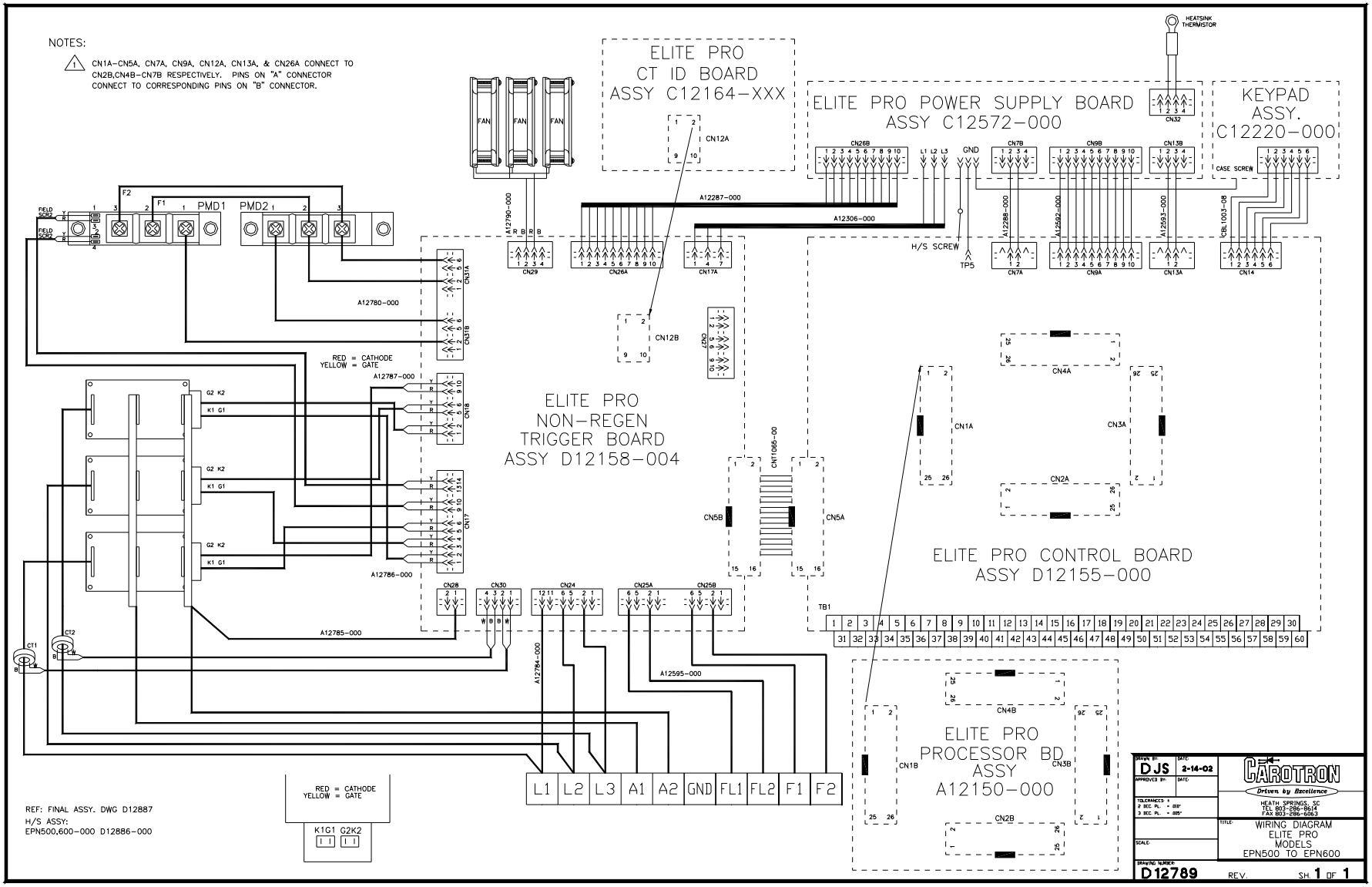

ELITE PRO POWER SUPPLY BOARD ASSY C12110-000
KEYPAD ASSY. C12220-000
ELITE PRO CONTROL BOARD ASSY D12155-000
ELITE PRO PROCESSOR BD ASSY A12150-000
ELITE PRO CT ID BOARD ASSY C12164-XXX
ELITE PRO REGEN TRIGGER BOARD ASSY D12158-001
HEATSINK THERMISTOR
FAN
L1 L2 L3 GND A1 A2 FL1 FL2 F1 F2
RED = CATHODE
YELLOW = GATE
NOTES:
1. CN1A-CN5A, CN7A, CN9A, CN12A, CN13A, & CN28A CONNECT TO CN28,CN4B-CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
2. FAN NOT USED ON MODEL EPR020-000.
REF. ASSY. DRAWING C12277.
CARLOTRON
WIRING DIAGRAM ELITE PRO MODELS EPR020-000 THRU EPR060-000
D12324
REV A
SH 1 OF 1

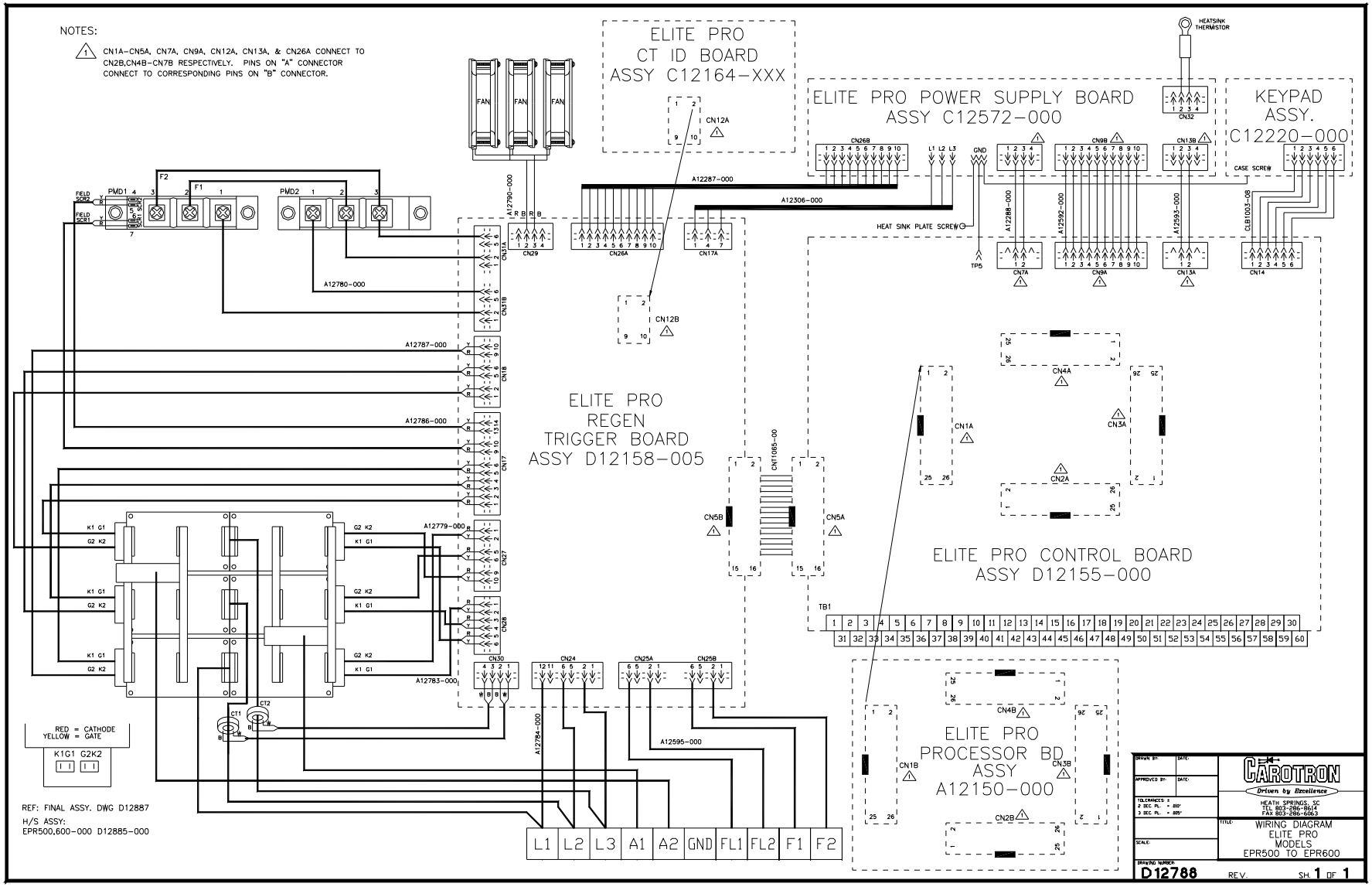

NOTES:
1 CN1A–CN5A, CN7A, CN9A, CN12A, CN13A, & CN26A CONNECT TO CN2B,CN4B–CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
ELITE PRO CT ID BOARD ASSY C12164–XXX
ELITE PRO POWER SUPPLY BOARD ASSY C12572–000
KEYPAD ASSY. C12220–000
HEATSINK THERMISTOR
A12301–000
FAN
FAN
A12282–000
A12287–000
A12306–000
A12288–000
A12592–000
A12593–000
CBL1003–08
TP5
GND
L1 L2 L3
CN12A
CN12B
CN26B
CN7B
CN9B
CN13B
CN32
CN29
CN26A
CN17A
CN7A
CN9A
CN13A
CN14
F2
F1
PMD1
PMD2
PMD3
PMD4
PMD5
A1
A2
FIELD SCR2
FIELD SCR1
SCR4
SCR1
SCR5
SCR2
SCR6
SCR3
CN31A
CN31B
CN18
CN17
CN7
A12591–000
A12296–000
A12297–000
RED = CATHODE
YELLOW = GATE
ELITE PRO NON–REGEN TRIGGER BOARD ASSY D12158–000
CNT1065–00
CN5B
CN5A
CN4A
CN3A
CN1A
CN2A
ELITE PRO CONTROL BOARD ASSY D12155–000
TB1
CN28
CN30
CN24
CN25A
CN25B
A12596–000
A12299–000
A12594–000
A12595–000
CT1
CT2
CN4B
CN1B
CN3B
CN2B
ELITE PRO PROCESSOR BD ASSY A12150–000
L1 L2 L3 A1 A2 GND FL1 FL2 F1 F2
REF. ASSY DRAWING C12602.
DRAWN BY: HJH
DATE: 3-28-02
APPROVED BY:
DATE:
TOLERANCES: ± 2 DEC PL. = .010" ± 3 DEC PL. = .005"
SCALE:
DRAWING NUMBER D12606
REV.
SH. 1 OF 1
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: WIRING DIAGRAM ELITE PRO MODELS EPN075–000 – EPN150–000

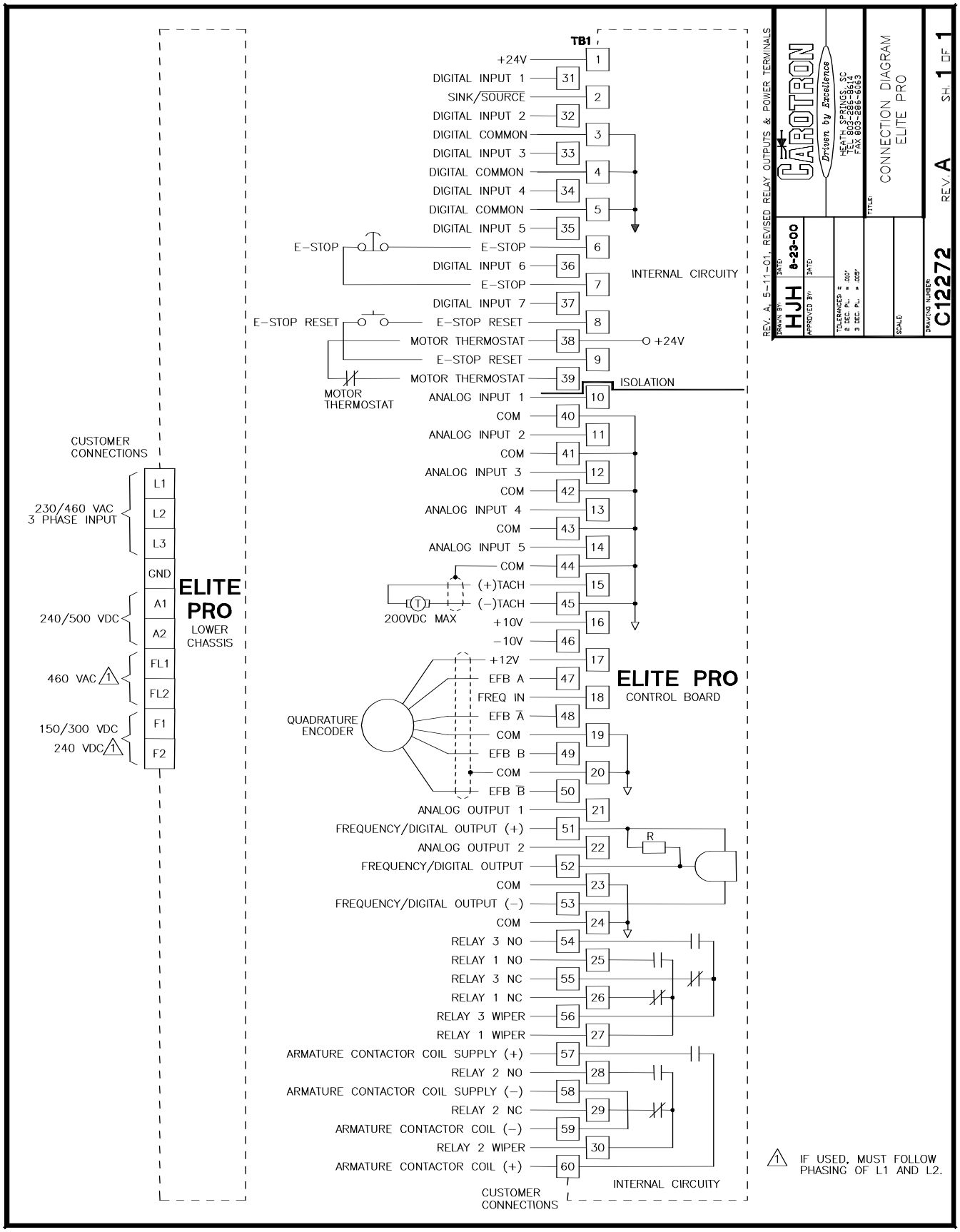

NOTES:
1 CN1A–CN5A, CN7A, CN9A, CN12A, CN13A, & CN26A CONNECT TO CN2B,CN4B–CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
ELITE PRO CT ID BOARD ASSY C12164–XXX
ELITE PRO POWER SUPPLY BOARD ASSY C12572–000
KEYPAD ASSY. C12220–000
ELITE PRO REGEN TRIGGER BOARD ASSY D12158–001
ELITE PRO CONTROL BOARD ASSY D12155–000
ELITE PRO PROCESSOR BD ASSY A12150–000
HEATSINK THERMISTOR
FAN
FAN
A12301–000
A12287–000
A12306–000
A12288–000
A12592–000
A12595–000
CLB1003–08
A12582–000
A12591–000
A12291–000
A12292–000
A12293–000
A12299–000
A12594–000
A12595–000
RED = CATHODE
YELLOW = GATE
CN1065–00
TB1
L1 L2 L3 A1 A2 GND FL1 FL2 F1 F2
REF. ASSY. DRAWING C12602.
DRAWN BY: HJH
DATE: 3-28-02
APPROVED BY:
DATE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: WIRING DIAGRAM ELITE PRO MODELS EPR075–000 – EPR150–000
SCALE:
DRAWING NUMBER D12607
REV.
SH. 1 OF 1

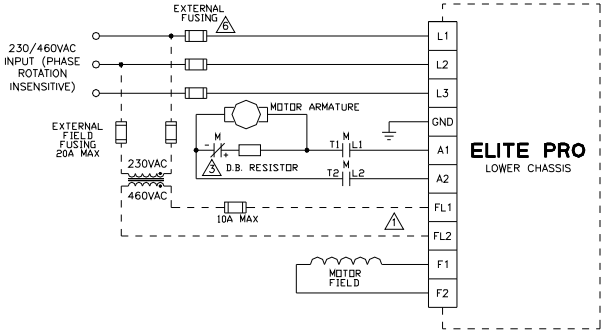

ELITE PRO
CT ID BOARD
ASSY C12164-XXX
CN12A
FAN
FAN
HEATSINK
THERMISTOR
ELITE PRO POWER SUPPLY BOARD
ASSY C12572-000
CN32
KEYPAD
ASSY.
C12220-000
CASE SCREW
CN26B
CN7B
CN9B
CN13B
L1 L2 L3
GND
A12287-000
A12306-000
A12776-000
A12288-000
A12592-000
A12593-000
CBL1003-08
CN29
CN26A
CN17A
CN7A
CN9A
CN13A
CN14
TP5
F2
F1
PMD1
PMD2
FIELD SCR2
FIELD SCR1
CN31A
CN31B
A12591-000
CN12B
CN42
ELITE PRO
NON-REGEN
TRIGGER BOARD
ASSY D12158-004
RED = CATHODE
YELLOW = GATE
A12775-000
PMD5
PMD4
PMD3
L3
L2
L1
R=7
Y=6
R=4
Y=5
CN18
CN17
A1
A2
A12774-000
CN28
CN30
CN24
CN25A
CN25B
A12773-000
A12776-000
A12772-000
A12595-000
CT1
CT2
CN5B
CN5A
CNT1065-00
CN4A
CN1A
CN3A
CN2A
ELITE PRO CONTROL BOARD
ASSY D12155-000
TB1
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
CN4B
CN1B
CN3B
CN2B
ELITE PRO
PROCESSOR BD
ASSY
A12150-000
L1 L2 L3 A1 A2 GND FL1 FL2 F1 F2
REF: FINAL ASSY. DWG D12797
H/S ASSY:
EPN200-000 D12874-000
EPN250-000 D12874-000
EPN300-000 D12874-000
EPN400-000 D12798-000
REV. A, CLARIFY MODULE CONNECTIONS. 10/06/03
DRAWN BY: DJS
DATE: 2-14-02
APPROVED BY:
DATE:
TOLERANCES: ± 2 DEC. PL. ± .005" 3 DEC. PL. ± .005"
SCALE:
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: WIRING DIAGRAM
ELITE PRO
MODELS
EPN200 TO EPN400
DRAWING NUMBER: D12778
REV. A
SH. 1 OF 1


NOTES:
1 CN1A–CN5A, CN7A, CN9A, CN12A, CN13A, & CN26A CONNECT TO CN2B,CN4B–CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
ELITE PRO CT ID BOARD ASSY C12164–XXX
ELITE PRO POWER SUPPLY BOARD ASSY C12572–000
KEYPAD ASSY. C12220–000
HEATSINK THERMISTOR
FAN
FAN
A12287–000
A12306–000
A12776–000
A12591–000
A12775–000
A12774–000
A12775–000
A12806–000
A12776–000
A12772–000
A12595–000
HEAT SINK PLATE SCREW
HEAT SINK PLATE STUD
CASE SCREW
ELITE PRO REGEN TRIGGER BOARD ASSY D12158–005
RED = CATHODE
YELLOW = GATE
ELITE PRO CONTROL BOARD ASSY D12155–000
ELITE PRO PROCESSOR BD ASSY A12150–000
PMD1
PMD2
PMD3
PMD4
PMD5
PMD6
PMD7
PMD8
F1
F2
CT1
CT2
TB1
L1 L2 L3 GND FL1 FL2 F1 F2
REF: FINAL ASSY. DWG D12797
H/S ASSY:
EPR200–000 D12877–000
EPR250–000 D12877–000
EPR300–000 D12877–000
EPR400–000 D12878–000
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803–286–8614
FAX 803–286–6063
WIRING DIAGRAM
ELITE PRO
MODELS
EPR200 TO EPR400
D12809
REV.
SH. 1 OF 1

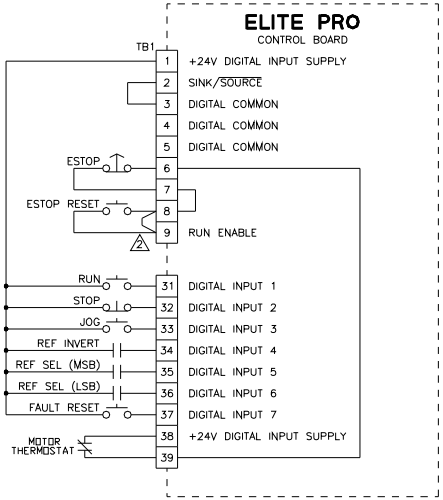

NOTES:
1 CN1A–CN5A, CN7A, CN9A, CN12A, CN13A, & CN26A CONNECT TO CN2B,CN4B–CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
ELITE PRO CT ID BOARD ASSY C12164–XXX
ELITE PRO POWER SUPPLY BOARD ASSY C12572–000
KEYPAD ASSY. C12220–000
HEATSINK THERMISTOR
FAN
FAN
FAN
CN12A
CN32
CN26B
CN7B
CN9B
CN13B
L1 L2 L3
GND
CASE SCREW
A12790–000
A12287–000
A12306–000
A12288–000
A12592–000
A12593–000
CBL1003–08
H/S SCREW
TP5
CN29
CN26A
CN17A
CN7A
CN9A
CN13A
CN14
F2
F1
PMD1
PMD2
FIELD SCR2
A12780–000
CN31A
CN31B
CN12B
CN27
RED = CATHODE
YELLOW = GATE
A12787–000
CN18
G2 K2
K1 G1
CN17
A12786–000
ELITE PRO NON–REGEN TRIGGER BOARD ASSY D12158–004
CN10165–00
CN5B
CN5A
CN1A
CN4A
CN3A
CN2A
ELITE PRO CONTROL BOARD ASSY D12155–000
CN28
CN30
CN24
CN25A
CN25B
TB1
A12785–000
A12784–000
A12595–000
CT1
CT2
CN4B
CN1B
CN3B
CN2B
ELITE PRO PROCESSOR BD ASSY A12150–000
L1 L2 L3 A1 A2 GND FL1 FL2 F1 F2
RED = CATHODE
YELLOW = GATE
K1G1 G2K2
REF: FINAL ASSY. DWG D12887
H/S ASSY:
EPN500,600–000 D12886–000
DRAWN BY: DJS
DATE: 2-14-02
APPROVED BY:
DATE:
TOLERANCES: 2 DEC PL. ±.01" 3 DEC PL. ±.005"
SCALE:
DRAWING NUMBER: D12789
REV.
SH 1 OF 1
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
TITLE: WIRING DIAGRAM ELITE PRO MODELS EPN500 TO EPN600


NOTES:
1. CN1A–CN5A, CN7A, CN9A, CN12A, CN13A, & CN26A CONNECT TO CN2B,CN4B–CN7B RESPECTIVELY. PINS ON "A" CONNECTOR CONNECT TO CORRESPONDING PINS ON "B" CONNECTOR.
ELITE PRO CT ID BOARD ASSY C12164–XXX
ELITE PRO POWER SUPPLY BOARD ASSY C12572–000
KEYPAD ASSY. C12220–000
HEATSINK THERMISTOR
FAN
FAN
FAN
CN12A
CN26B
CN32
CN9B
CN13B
CASE SCREW
F2
F1
PMD1
PMD2
FIELD SCR2
FIELD SCR1
A12790–000
A12287–000
A12306–000
A12288–000
A12592–000
A12593–000
CLB1003–08
HEAT SINK PLATE SCREW
TP5
CN7A
CN9A
CN13A
CN14
CN29
CN26A
CN17A
CN31A
CN31B
CN12B
A12780–000
A12787–000
A12786–000
ELITE PRO REGEN TRIGGER BOARD ASSY D12158–005
CN18
CN17
CN27
CN28
CN30
CN24
CN25A
CN25B
CNT1065–00
CN5B
CN5A
CN1A
CN4A
CN3A
CN2A
ELITE PRO CONTROL BOARD ASSY D12155–000
TB1
K1 G1
G2 K2
A12779–000
A12783–000
CT1
CT2
A12784–000
A12595–000
RED = CATHODE
YELLOW = GATE
K1G1 G2K2
REF: FINAL ASSY. DWG D12887
H/S ASSY:
EPR500,600–000 D12885–000
CN4B
CN1B
CN3B
CN2B
ELITE PRO PROCESSOR BD ASSY A12150–000
L1 L2 L3 A1 A2 GND FL1 FL2 F1 F2
CAROTRON
Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063
WIRING DIAGRAM
ELITE PRO
MODELS
EPR500 TO EPR600
D12788
REV.
SH. 1 OF 1

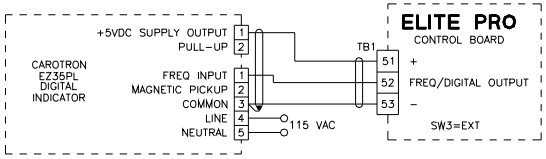

TB1
+24V
DIGITAL INPUT 1
SINK/SOURCE
DIGITAL INPUT 2
DIGITAL COMMON
DIGITAL INPUT 3
DIGITAL COMMON
DIGITAL INPUT 4
DIGITAL COMMON
DIGITAL INPUT 5
E-STOP
DIGITAL INPUT 6
E-STOP
DIGITAL INPUT 7
E-STOP RESET
MOTOR THERMOSTAT
E-STOP RESET
MOTOR THERMOSTAT
ANALOG INPUT 1
COM
ANALOG INPUT 2
COM
ANALOG INPUT 3
COM
ANALOG INPUT 4
COM
ANALOG INPUT 5
COM
(+)TACH
(−)TACH
+10V
−10V
+12V
EFB A
FREQ IN
EFB Ā
COM
EFB B
COM
EFB B̄
ANALOG OUTPUT 1
FREQUENCY/DIGITAL OUTPUT (+)
ANALOG OUTPUT 2
FREQUENCY/DIGITAL OUTPUT
COM
FREQUENCY/DIGITAL OUTPUT (−)
COM
RELAY 3 NO
RELAY 1 NO
RELAY 3 NC
RELAY 1 NC
RELAY 3 WIPER
RELAY 1 WIPER
ARMATURE CONTACTOR COIL SUPPLY (+)
RELAY 2 NO
ARMATURE CONTACTOR COIL SUPPLY (−)
RELAY 2 NC
ARMATURE CONTACTOR COIL (−)
RELAY 2 WIPER
ARMATURE CONTACTOR COIL (+)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60
INTERNAL CIRCUITY
ISOLATION
+24V
R
200VDC MAX
QUADRATURE ENCODER
ELITE PRO
CONTROL BOARD
CUSTOMER CONNECTIONS
INTERNAL CIRCUITY
CUSTOMER CONNECTIONS
230/460 VAC 3 PHASE INPUT
L1
L2
L3
GND
240/500 VDC
A1
A2
460 VAC 1
FL1
FL2
150/300 VDC
240 VDC 1
F1
F2
ELITE PRO
LOWER CHASSIS
1 IF USED, MUST FOLLOW PHASING OF L1 AND L2.
REV. A 5-11-01, REVISED RELAY OUTPUTS & POWER TERMINALS
DRAWN BY: HJH DATE: 8-23-00
APPROVED BY: DATE:
TOLERANCES: ± .010" 2 DEC PL. ± .005" 3 DEC PL. ± .003"
SCALE:
CAROTRON Driven by Excellence
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-8663
TITLE: CONNECTION DIAGRAM ELITE PRO
DRAWING NUMBER: C12272
REV. A
SH. 1 OF 1



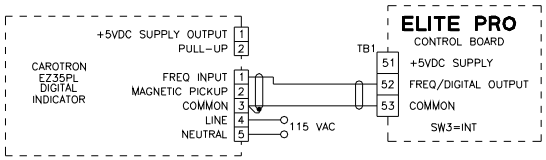
TYPICAL HIGH CURRENT CONNECTIONS



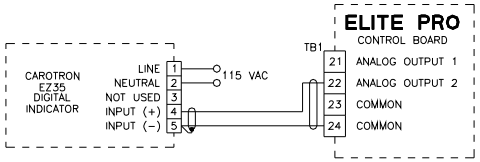
TYPICAL DIGITAL INPUT CONNECTIONS – SOURCING LOGIC (FACTORY PRESET)



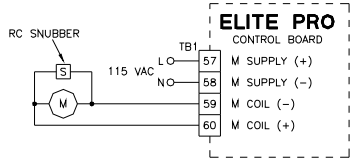
TYPICAL FREQUENCY OUTPUT CONNECTIONS – EXTERNAL SUPPLY



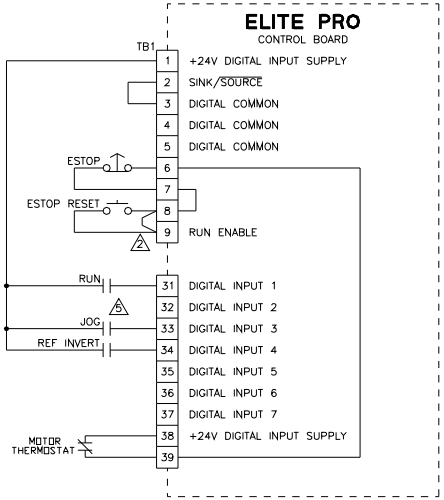
TYPICAL FREQUENCY OUTPUT CONNECTIONS – INTERNAL SUPPLY 4



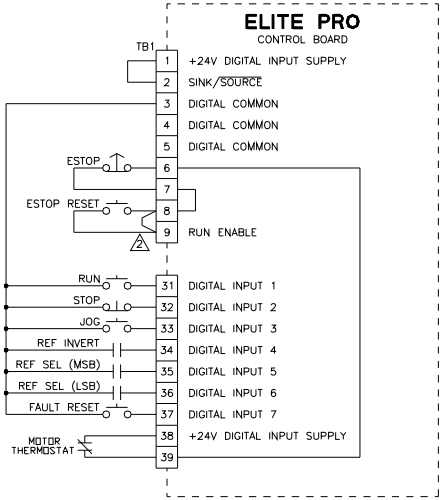
TYPICAL ANALOG OUTPUT CONNECTIONS



TYPICAL ARMATURE CONTACTOR COIL CONNECTIONS – 115VAC COIL



SINGLE CONTACT (MAINTAINED) CONTROL CONNECTIONS – SOURCING LOGIC

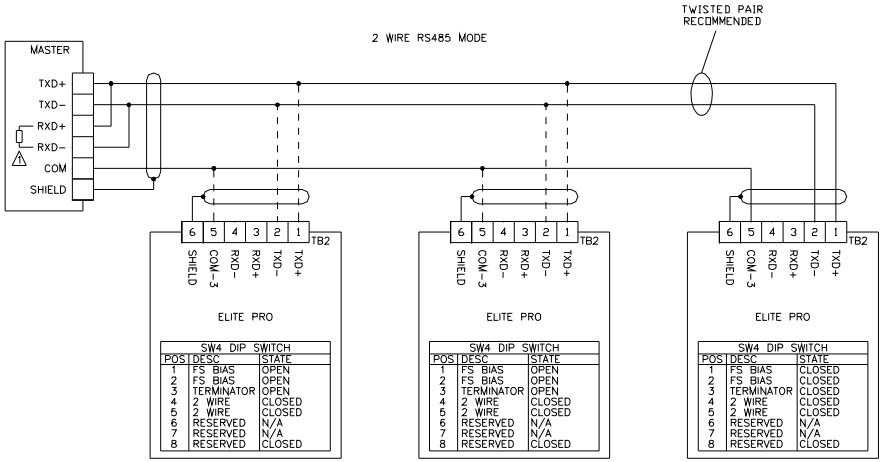


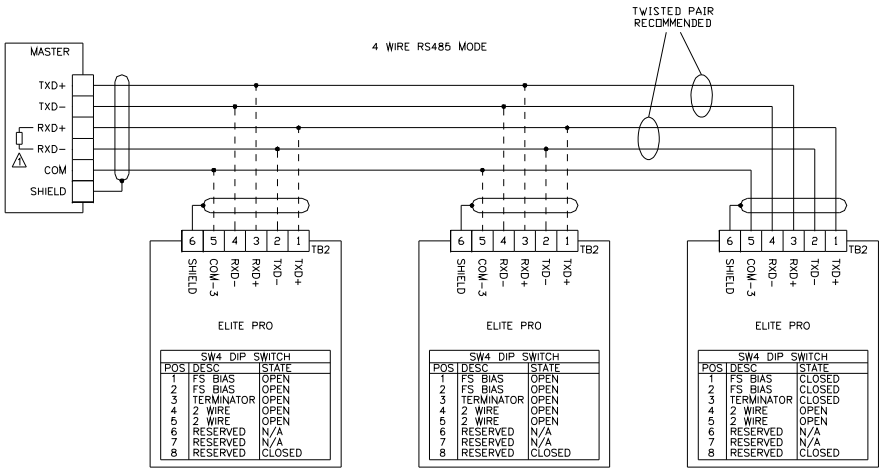
TYPICAL DIGITAL INPUT CONNECTIONS – SINKING LOGIC

1. IF USED, MUST FOLLOW PHASING OF L1 AND L2.
2. JUMPER CAN BE SUBSTITUTED FOR ESTOP RESET IF MAINTAINED ESTOP IS USED.
3. OPTIONAL DYNAMIC BREAKING CONNECTIONS SHOWN.
4. ALTHOUGH SHOWN, INTERNAL SUPPLY CONNECTION IS NOT RECOMMENDED. EXTERNAL CONNECTION PROVIDES BETTER NOISE IMMUNITY.
5. LOGIC SELECT (245) MUST BE SET TO 2 WIRE (MAINTAINED). WARNING, STOP (240) NO LONGER FUNCTIONS! RUN INPUT MUST BE OPENED OR ESTOP ACTIVATED TO STOP DRIVE.
6. REFER TO SPARE PARTS SECTION IN MANUAL FOR RECOMMENDED FUSE SIZING ACCORDING TO DRIVE MODEL.

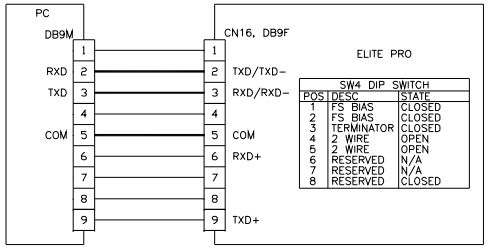
REV. C, 2/14/12, REVISED PUSHBUTTONS TO CONTACTS
REV. B, 6/25/01, ADDED EXTERNAL FIELD FUSING
REV. A, 5/14/01, REVISED HIGH CURRENT LAYOUT

DRAWN BY: BKP	DATE: 12/18/00
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC PL. = .010" ± 3 DEC PL. = .005"	CAROTRON Driven by Excellence HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6063
SCALE:	TITLE: EXAMPLE CONNECTIONS ELITE PRO
DRAWING NUMBER: D12326	REV. C SH. 1 OF 1





RS232 CONNECTIONS



ONLY WIRES 2, 3, & 5 ARE REQUIRED

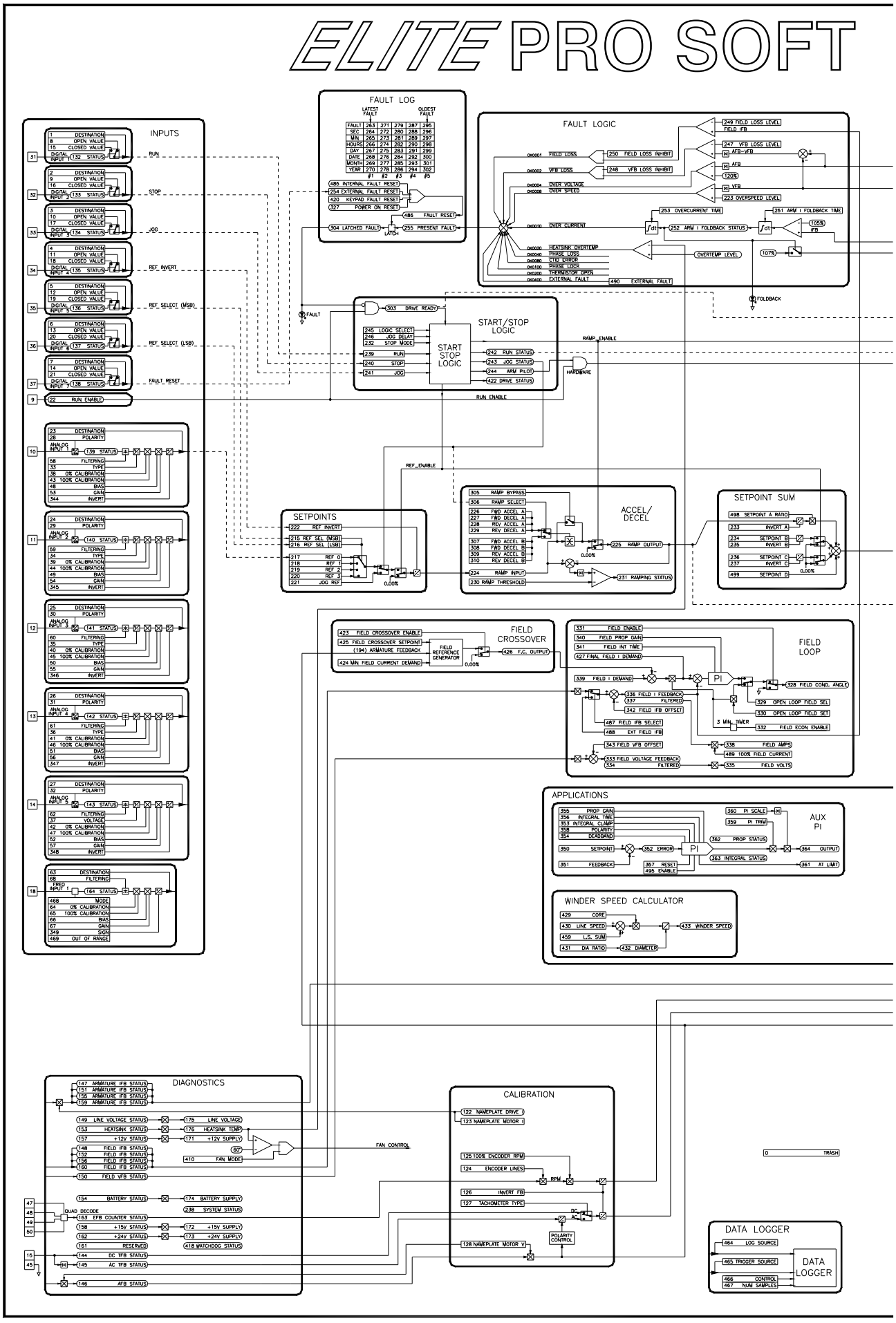
NOTES:

⚠ SINCE MASTER IS AT ONE END OF DAISY CHAINED BUS IN THIS EXAMPLE, ITS TERMINATING RESISTOR SHOULD BE ACTIVE (SWITCHED IN). IF MASTER DOES NOT PROVIDE TERMINATING RESISTOR INTERNALLY, ONE MAY NEED TO BE PROVIDED EXTERNALLY (RECOMMENDED VALUE: 120 OHMS). REFER TO MASTER DOCUMENTATION FOR FURTHER DETAILS.

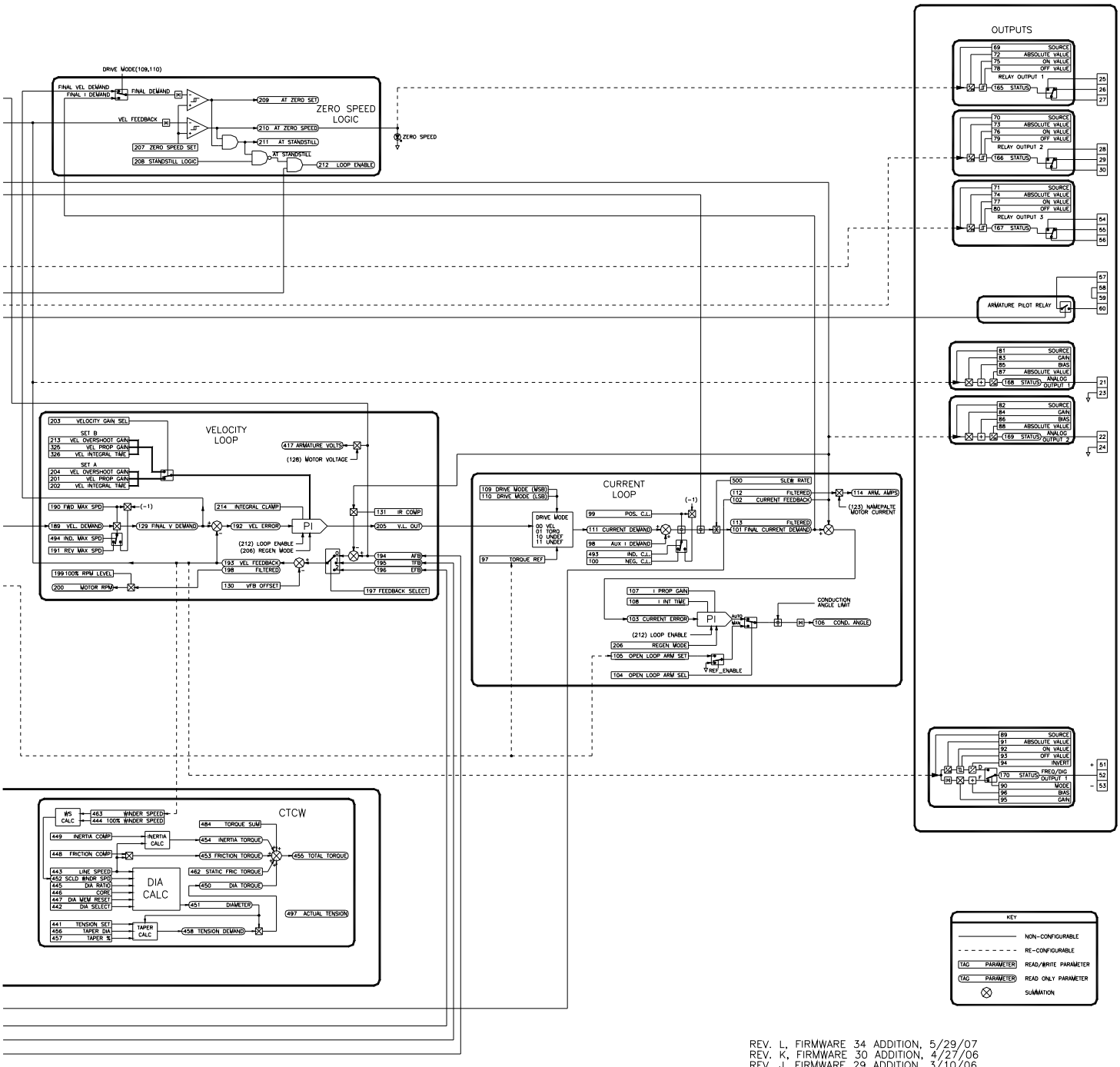
2. MAXIMUM TOTAL NETWORK LENGTH: 4000 FEET.

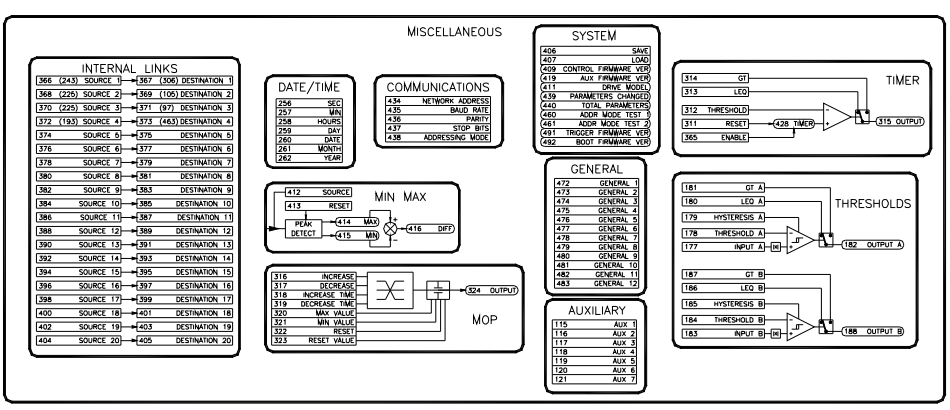
DRAWN BY: BKP	DATE: 1/15/02
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC PL. = .01" ± 3 DEC PL. = .005"	CAROTRON "Driven by Excellence" HEATH SPRINGS, SC TEL 803-286-8614 FAX 803-286-6963
SCALE:	TITLE: ELITE PRO MODBUS NETWORK CONNECTIONS
DRAWING NUMBER: D12586	REV. B SH. 1 OF 1

ELITE PRO SOFT



WARE BLOCK DIAGRAM





REV. L, FIRMWARE 34 ADDITION, 5/29/07
REV. K, FIRMWARE 30 ADDITION, 4/27/06
REV. J, FIRMWARE 29 ADDITION, 3/10/06
REV. I, ERROR CORRECTIONS, 3/30/05
REV. H, EXTERNAL FIELD REGULATOR ADDITIONS, 1/22/03
REV. G, SONIC INPUT ADDITION, 9/11/02
REV. F, TORQUE SUM ADDITION, 9/04/02
REV. E, DATA LOGER ADDITION, 8/01/02
REV. D, CTCW BLOCK ADDITION, 6/25/02
REV. C, COMMUNICATIONS BLOCK ADDITION, 11/5/01
REV. B, WINDER SPEED CALCULATOR ADDITION, 8/2/01
REV. A, FIELD CROSSOVER ADDITIONS, 4/17/01

DRAWN BY: BKP	DATE: 4/17/00
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"	
SCALE:	
DRAWING NUMBER: D12229	REV. L

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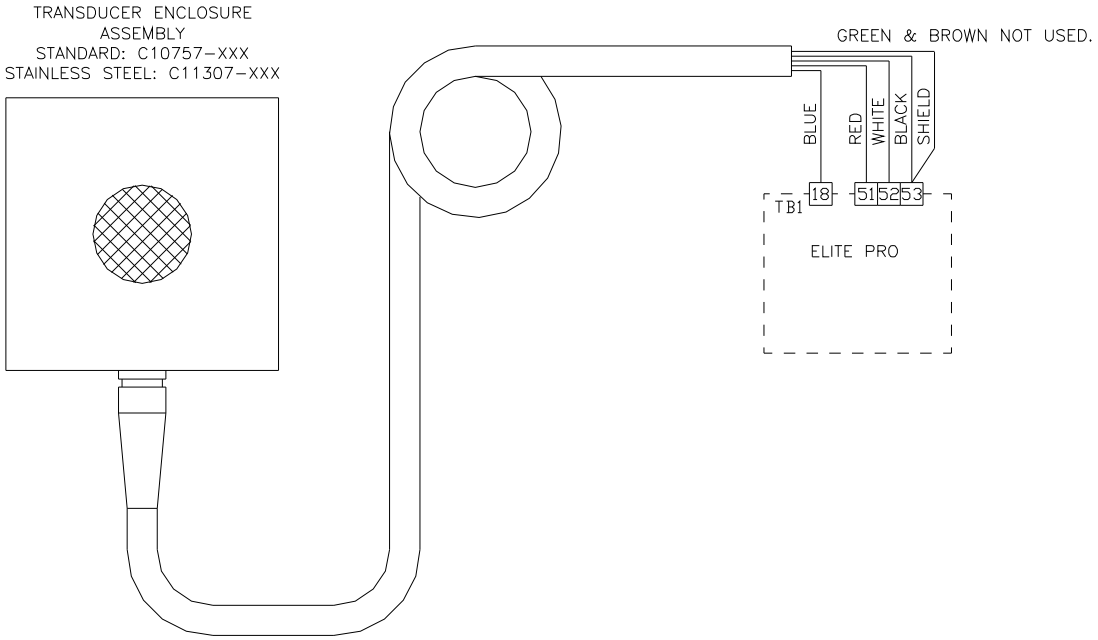
HEATH SPRINGS, SC
TEL 803-286-8614
FAX 803-286-6063

TITLE: ELITE PRO SOFTWARE BLOCK DIAGRAM

SH. 1 OF 1



NOTES:

1. SWITCH SW3 ON ELITE PRO CONTROL BOARD MUST BE IN THE INT (INTERNAL) POSITION.
2. ELITE PRO FREQUENCY/DIGITAL OUTPUT MUST BE CONFIGURED TO OUTPUT 7 HZ SIGNAL.
3. ELITE PRO FREQUENCY INPUT MUST BE IN THE SONIC MODE.

DRAWN BY: BKP	DATE: 8/02/02
APPROVED BY:	DATE:
TOLERANCES: ± 2 DEC. PL. = .010" 3 DEC. PL. = .005"	
SCALE:	
DRAWING NUMBER: C12671	REV. A

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

TITLE: ELITE PRO SONIC OPTION CONNECTION DIAGRAM

SH. 1 OF 1

11 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.

5. 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.

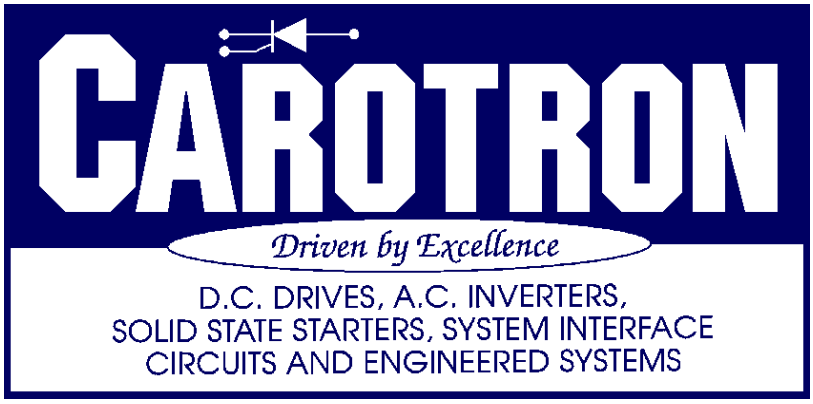
6. Order cancellation
Any cancellation by the Purchaser of any order or contract between the Company and the Purchaser must be made in writing and receive written approval of an authorized Company representative at its office in Heath Springs, S.C. In the event of any cancellation of an order by either 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.



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Issued 01-29-2016