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# 590 DRV Digital DC Drive

## Product Manual

### Version 3 Software

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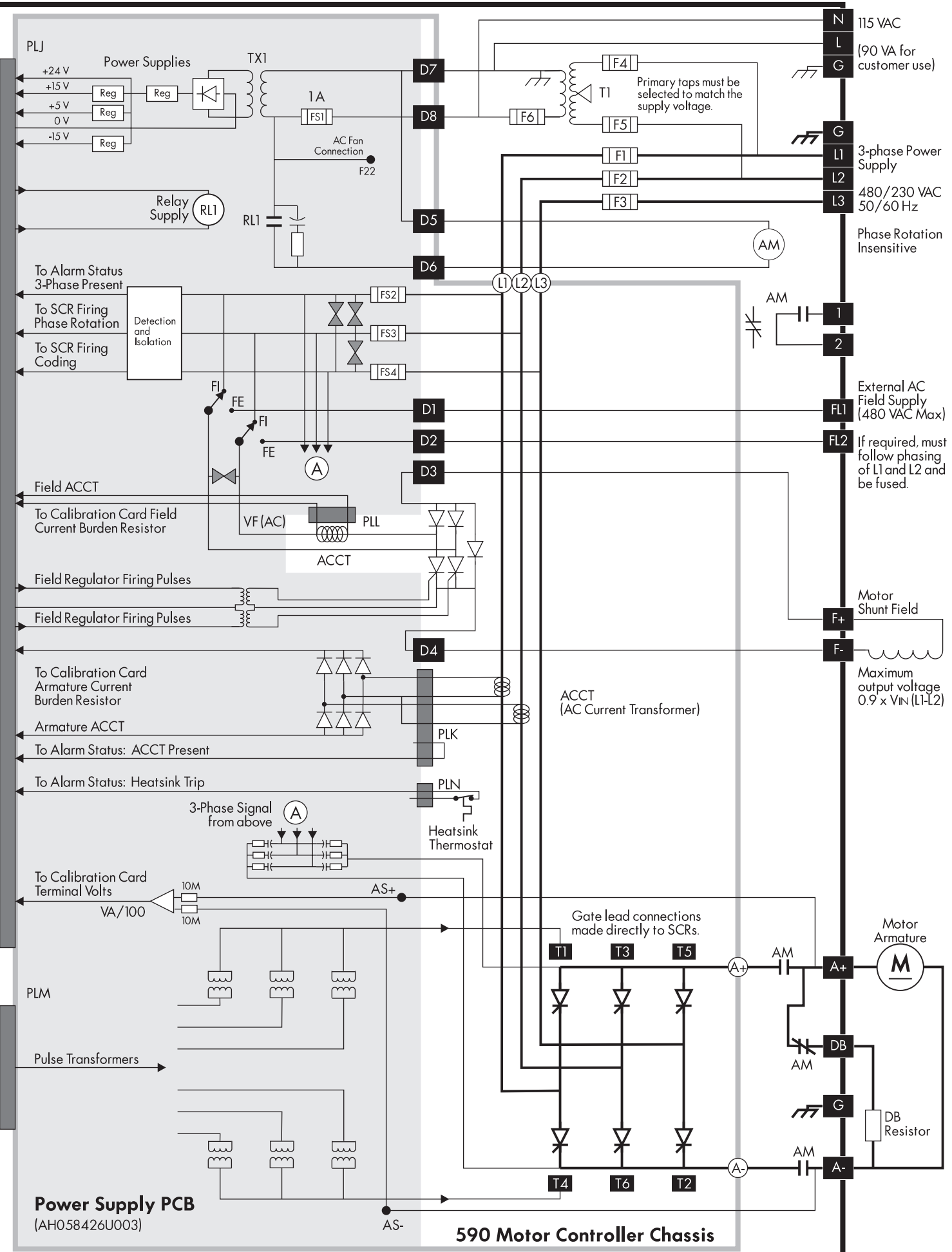
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Procedures in this manual may contain Warnings, Cautions, and Notes. A Warning gives the reader information which, if disregarded, could cause injury or death. A Caution provides the reader with advice which, if disregarded, could cause damage to the equipment. A Note furnishes additional information for added emphasis or clarity.

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**590 DRV Digital DC Drive Block Diagram - Version 3 - Non-Regenerative**

## Safety

Procedures in this manual may contain Warnings, Cautions, and Notes. A Warning gives the reader information which, if disregarded, could cause injury or death. A Caution provides the reader with advice which, if disregarded, could cause damage to the equipment. A Note furnishes additional information for added emphasis or clarity.

The customer is responsible for assessing his or her ability to carry out the procedures in this manual. Make sure you understand a procedure and the precautions necessary to carry it out safely *before* beginning. If you are unsure of your ability to perform a function, or have questions about the procedures listed in this manual, contact Eurotherm Drives Customer Service at (704) 588-3246.



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### **WARNING!**

Only qualified personnel who thoroughly understand the operation of this equipment and any associated machinery should install, start-up, or attempt maintenance of this equipment.

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### **WARNING!**

This equipment uses hazardous voltages during operation. Never work on it or any other control equipment or motors without first removing *all* power supplies.

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### **Caution**

This equipment contains ESD (Electrostatic Discharge) sensitive parts. Observe static control precautions when handling, installing, and servicing this device.

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### **Caution**

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### **Caution**

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NOTE. The installation of this equipment must comply with all applicable national and local electrical codes.

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# Chapter 1 INTRODUCTION

## SCOPE

This manual covers the 590 DRV Digital series of regenerative and non-regenerative DC motor controllers.

## OVERVIEW OF THE 590 DRV DIGITAL DRIVE

The 590 DRV Digital drive is a DC motor controller package containing a 590 Digital DC drive, DC contactor, AC supply fusing to protect the DC drive's thyristors and a control power transformer. For models rated 7.5 through 100 HP (500 VDC armature applications), all parts are mounted in a rugged, black anodized aluminum chassis. The components for all higher horsepower models mount on a panel. 500 through 900 HP models include a separate, external thyristor stack.

The 590 DRV Digital drive controls the DC output voltage and current for DC shunt field and permanent magnet motors. Models rated through 100 HP accept standard, three-phase, 208/230/380/415/460 volts AC, 50/60 Hz supplies; for models rated 125 through 900 HP, the supply is limited to 230/460 VAC.

The 590 DRV Digital drive is available as a four-quadrant, regenerative or a two-quadrant, non-regenerative drive. Each includes full transient and overload protection and uses highly advanced electronic control of motor acceleration and deceleration of speed and torque. Regenerative drives include two fully controlled thyristor bridges for forward and reverse control of speed and torque. Non-regenerative units have one thyristor bridge for operation in only one direction of rotation.

The Man Machine Interface [MMI] display simplifies start up and troubleshooting by automatically displaying the first fault. It is a powerful diagnostic tool with access to all alarms and most parameters within the drive. Light emitting diode [LED] indicators on the front panel display the drive's operating status.

You can configure the drive software either through the MMI or with ConfigEd Lite, a configuration program compatible with most IBM compatible personal computers (PCs) running Windows™.

**NOTE.** 590 DRV Digital DC drives rated through 300 HP are Underwriter Laboratory (UL®) approved for use in the United States and Canada.

## STANDARD FEATURES

### Main Features

**Microprocessor Control:** a 16 bit microprocessor controls the drive and offers:

- Real-time fiber optic communications
- Complex control algorithms not possible with simple analog devices
- Control circuitry built around standard software blocks.

**Digital Accuracy:** All setpoints and variables are accessible either through analog inputs or digitally over a serial computer communications link. Speed and current loops are processed digitally giving greater control accuracy and repeatability than analog drives.

**Feedback Options:** the drive supports four types of speed feedback:

- Armature voltage feedback (standard), which requires no feedback device, connections or isolator
- Analog AC or DC tachometer generators
- Wire-ended electrical encoders
- Plastic (5701) or glass (5901) fiber optic Microtach encoders



Figure 1.1 - 590 DRV Digital DC Drive

**Field Regulator:** a full-wave, half-controlled, single-phase thyristor bridge with transient and overload protection powers the motor field. The regulator provides either a fixed voltage or fixed current source, depending on the selected mode of operation. The field current mode can also provide field weakening for systems requiring extended speed range or constant horsepower control.

**On-board Fuse Protection and Contactor:** each drive has AC thyristor fuses and a DC contactor. Regenerative models have DC output fuse protection.

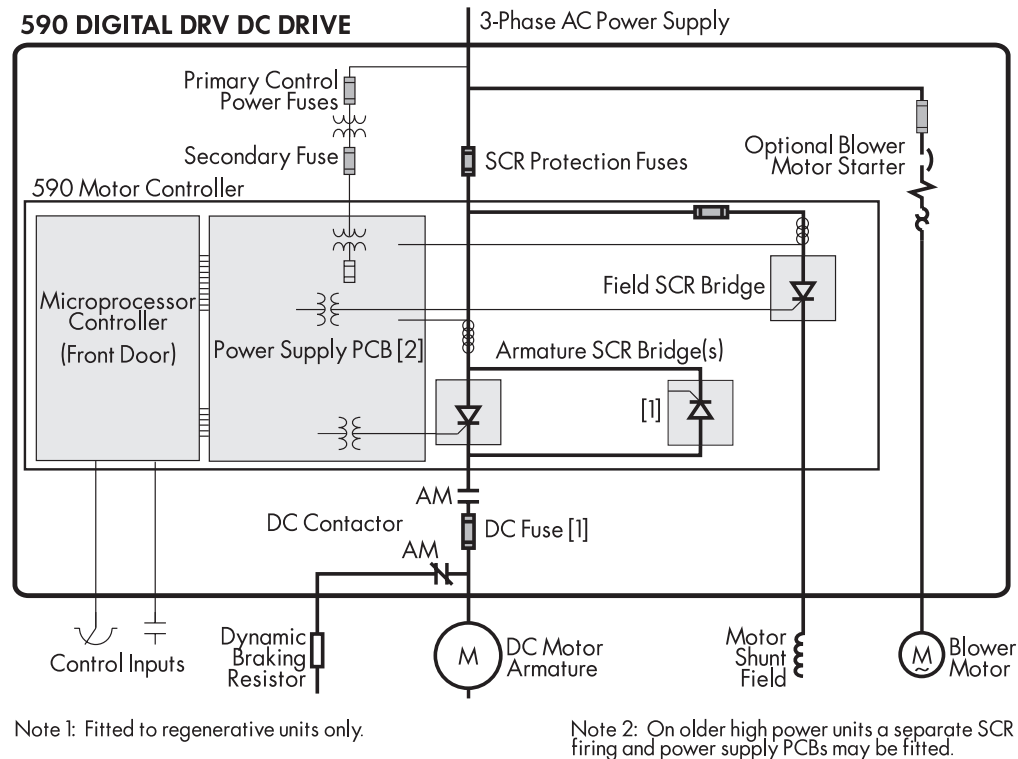


Figure 1.2 - 590 DRV Digital DC Drive Block Diagram

## Other Features

- **Power Isolation:** the 590 DRV Digital drive's control circuitry is electrically isolated from the power circuitry, enhancing system interconnection and safety.
- **Phase Rotation Insensitivity:** the supply power can be connected in any phase order to the drive's main input supply.

### Caution

While the 590 DRV Digital drive is not sensitive to phase rotation, the auxiliary 120 VAC between drives is. Do *not* tie the neutral wires from different 120 VAC sources together if the phases are rotated from drive to drive.

- **Frequency Auto Ranging:** the control circuitry automatically adjusts to accept supply frequencies from 40-70Hz and possesses high noise immunity from supply born interference.
- **Man-Machine Interface (MMI):** a two-line alphanumeric liquid crystal display (LCD) automatically displays the first fault the drive registers. A four button keypad greatly enhances troubleshooting, tuning and commissioning. Drive inputs and outputs and drive parameters are accessible through the LCD and the keypad and through the software package SAM.

- **Drive Status Indicators:** six LED's indicate the drive's alarm and run status.
- **Simple Calibration:** switch selectable calibration of armature voltage, armature current and field current. Fine tuning is performed through drive software.
- **Current Loop Autotune:** a built in AUTOTUNE routine automatically tunes drive current loop.

The drives are designed for simple, economical panel mounting. Disconnecting and reconnecting the controller, if necessary, is simplified by plug-in connectors. Standardized parts helps reduce the variety of spares needed to maintain a multi-drive system.

## UNPACKING & SPECIAL HANDLING

Read this section before you remove the 590 DRV Digital drive from its packing materials. Though engineered for heavy industrial use, you can damage the unit by handling it improperly.

Remove the foam cover and fold back the antistatic plastic wrap from around the drive. Carefully remove any other packing material from around the drive and place it out of the way. Save the box and foam inserts for use should you ever need to return the drive. Improper packaging can lead to transit damage.

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### WARNING!

The 590 DRV Digital drive weighs more than 50 lbs. Be certain you can safely lift and move this weight before attempting to remove it from its container.

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Using proper lifting techniques, remove the drive from its packing case. Do not attempt to lift or move the drive by its terminal connections as they are not designed for that purpose. Lift the drive instead by the solid metal frame on which it is constructed (see Figure 1.3). Lay the drive on a flat surface with the access panel covers up and make sure that you do not damage any protruding terminal connections.



Figure 1.3 - Top Hand-hold Location





## Chapter 2 IDENTIFICATION

This chapter contains photographs of the 590 DRV Digital drive and the 590 controller showing the locations of labels, fuses and other components.

### COMPONENT IDENTIFICATION

Figures 2.3, 2.4, 2.5, and 2.6 identify the parts contained in 590 DRV Digital drives rated 7.5 through 100 HP. These parts are discussed in the succeeding chapters. Figure 2.3 shows the fuses, transformer, and contactor in the power chassis. Figure 2.4 shows the location of the labels on the back side of the controller mounting bracket. Figure 2.5 identifies the components on the controller's power supply board. Figure 2.6 shows a controller with a 3-part power supply board. This configuration is used in all 330 amps (200 HP at 500 VDC) and larger DRVs. Figure 2.7 shows the inside of the 590 controller after the power supply board is removed.

### LABELING

Labels are affixed to each 590 DRV Digital drive. These labels lists electrical requirements, fuse replacement information, terminal tightening torque ratings, safety warnings and the unit's model and serial numbers.

### Nameplate Label

For 7.5 through 100 HP models, the nameplate label is on the left side of the power chassis (see Figure 2.1) as you face a mounted drive. A duplicate label is also inside the unit on the back side of the controller mounting plate. Both list the drive's model and catalog number, revision number, serial number, corresponding manual number and electrical rating information. Make sure you have all the nameplate label information available when contacting Eurotherm Drives for service assistance.

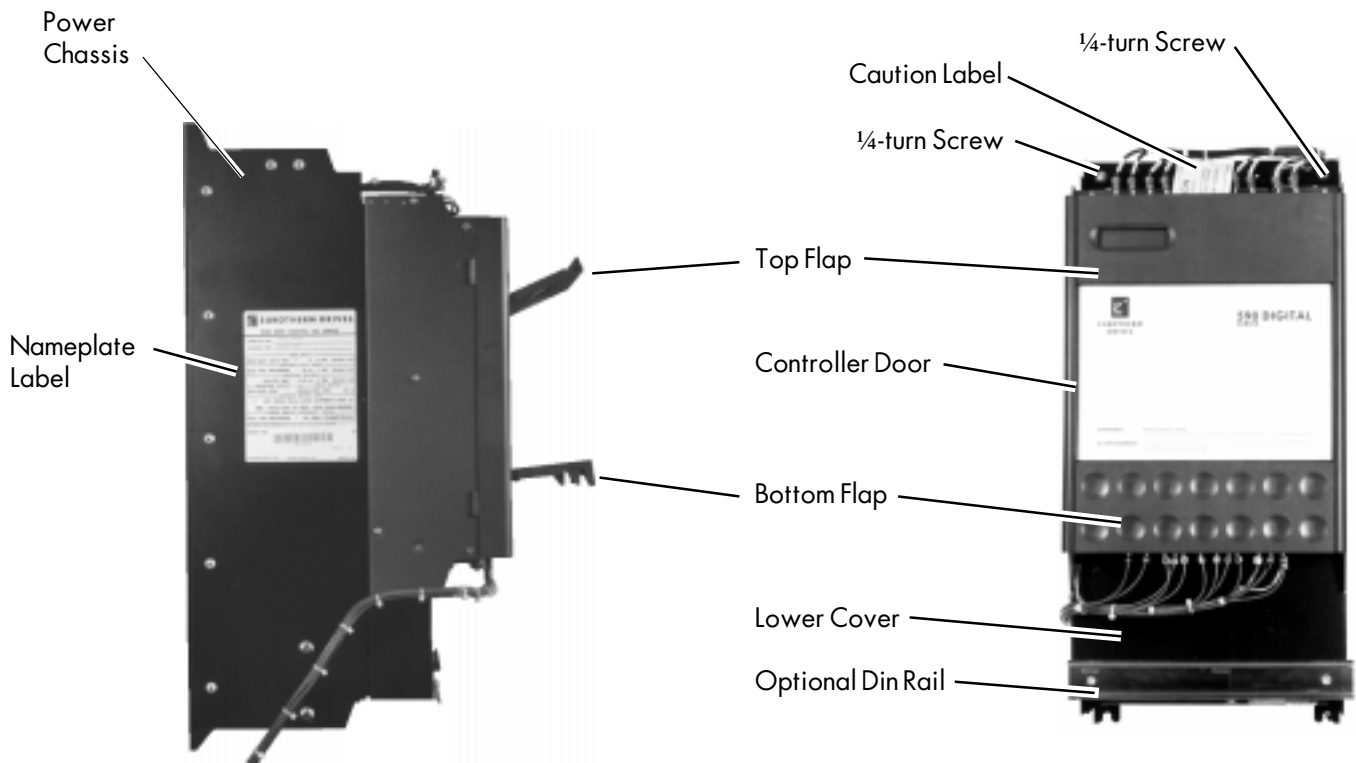


Figure 2.1- 590 DRV Digital DC Drive Front and Side Views (30 HP Unit Shown)

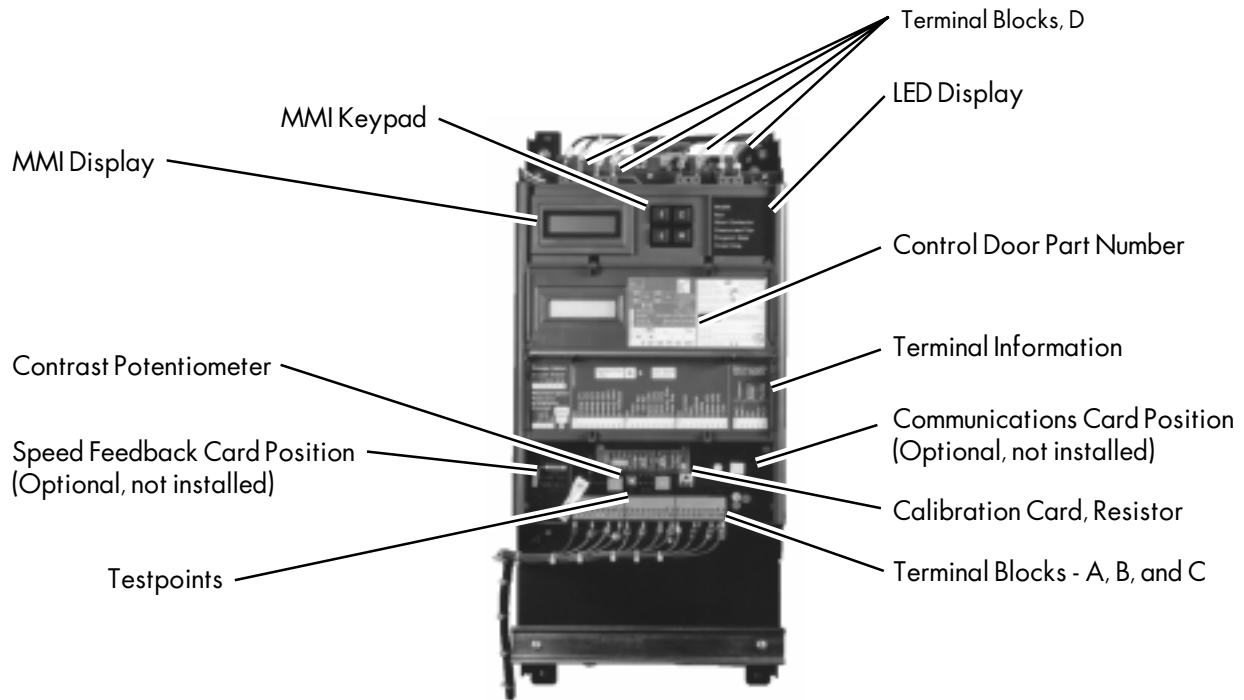


Figure 2.2 - 590 DRV Digital DC Drive with Cover Panels Open (30 HP Model Shown)

## Fuse Replacement Label

The fuse replacement label for 7.5 through 100 HP models is located on the back side of the controller mounting panel (see Figure 2.4). It is visible when the top section of the DRV (including the controller) is lowered for access to the fuses and drive terminations. To access this area, loosen the two ¼-turn screws at the top of the drive section, just above the controller. Gently lower the top section until it comes to rest. If working on a bench, insert a spare bolt in each of the hinge slots at the base of the top section to provide protection against the drive closing unexpectedly. Refer to this label when replacing fuses and make sure the replacement fuses meet the label requirements.

NOTE. Figure 2.4 shows a 7.5 to 30 HP DRV chassis mounted to a back panel and opened to display the labels. The unit is oriented so that the operator is looking down at the labels. Wiring has been removed for clarity.

## Terminal Tightening Torque Label

The terminal tightening torque label (see Figure 2.4) for 7.5 through 100 HP models is located below the fuse replacement label. Refer to it when making electrical connections to avoid overtighten the terminals.

## Connector Kit Label

The connector kit label (see Figure 2.4) is located next to the terminal tightening torque label. It lists the catalog numbers of connector kits used for connecting power wires to the drive. It also lists the appropriate cable rating for each size power terminal.

## LABELING ON HIGH HORSEPOWER MODELS

The nameplate label, fuse replacement schedule and terminal torque label for higher horsepower models (models rated 150 HP and above) are located on the DRV mounting panel.

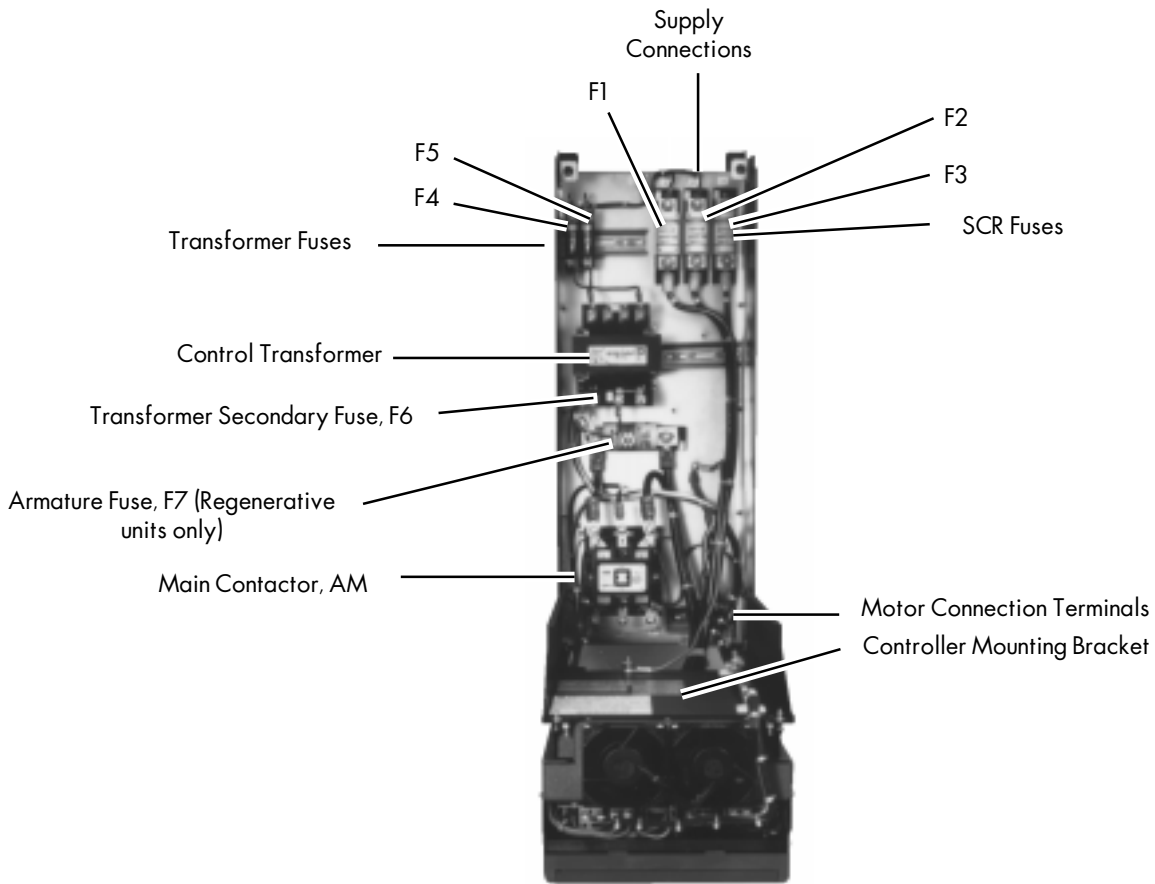


Figure 2.3 - Power Chassis (30 through 100 HP Units)

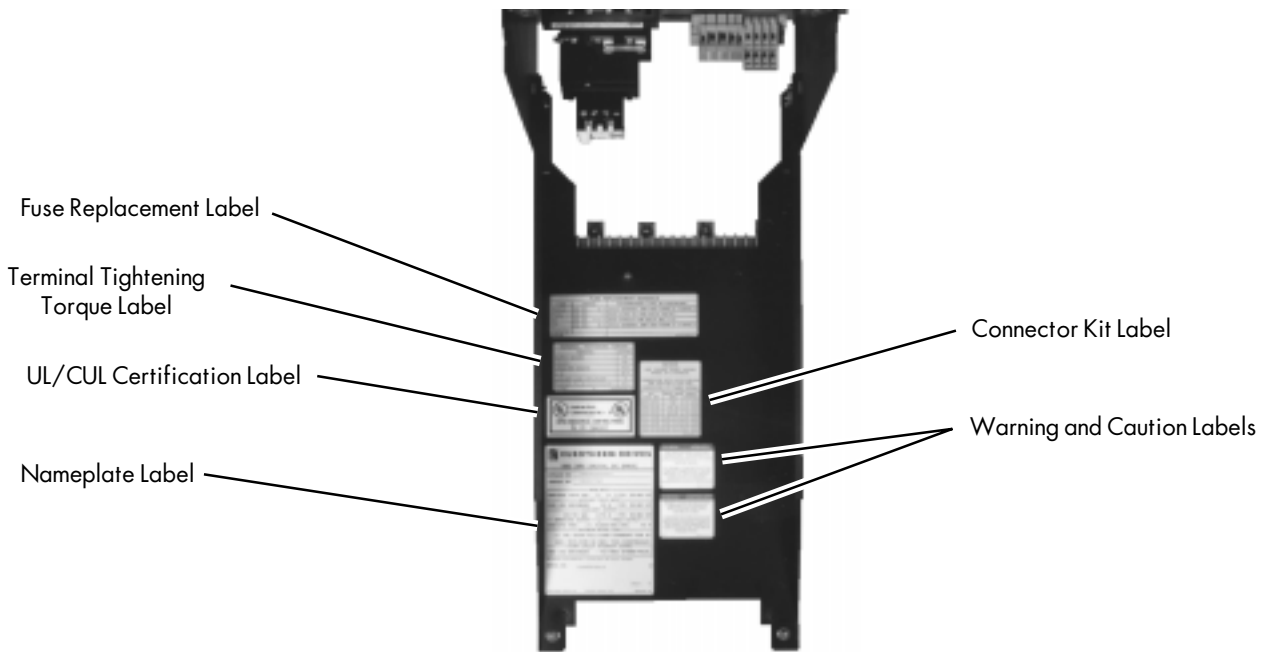


Figure 2.4 - Label Location On Controller Mounting Plate (30 through 100 HP Units)

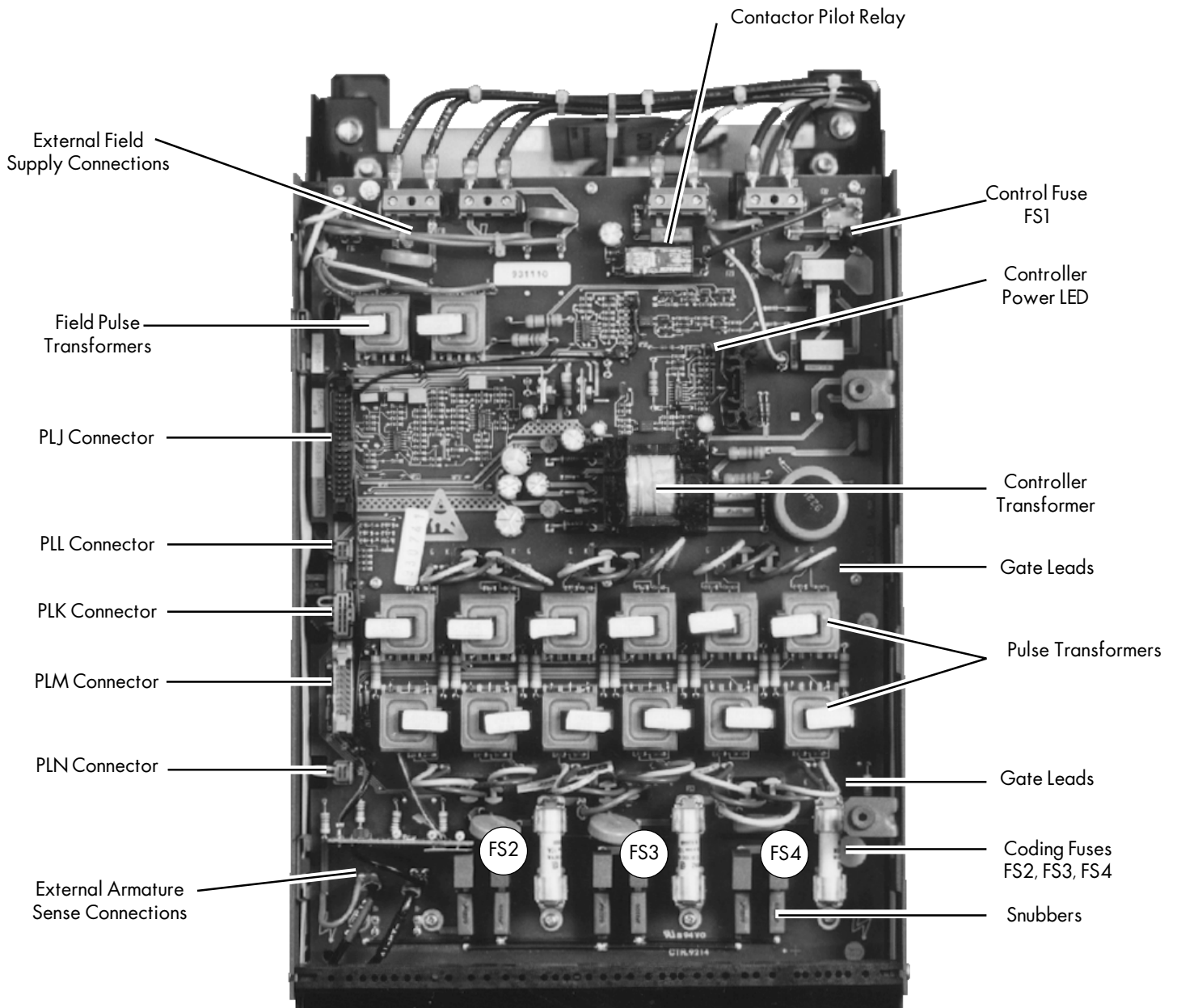


Figure 2.5 - Power Supply Board - AH385851U002 - Regen  
 AH385851U003 - Non-regen (not shown)

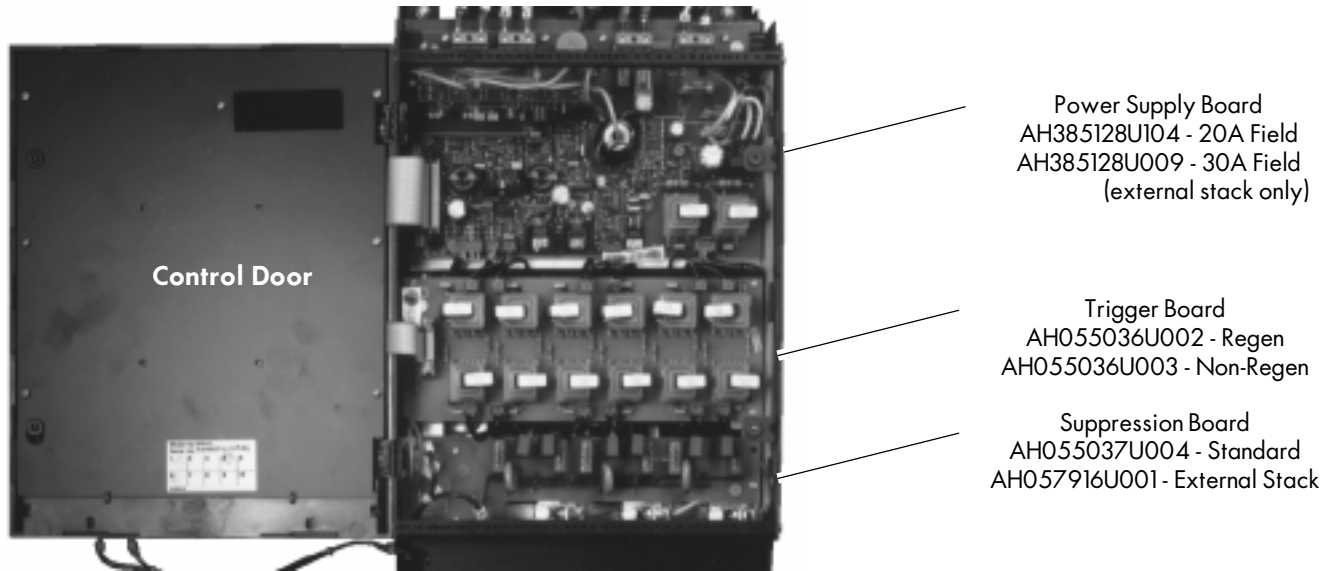


Figure 2.6 - Three-part Power Supply Drives [Used on DRVs Rated 330 Amps (200 HP) and Larger]

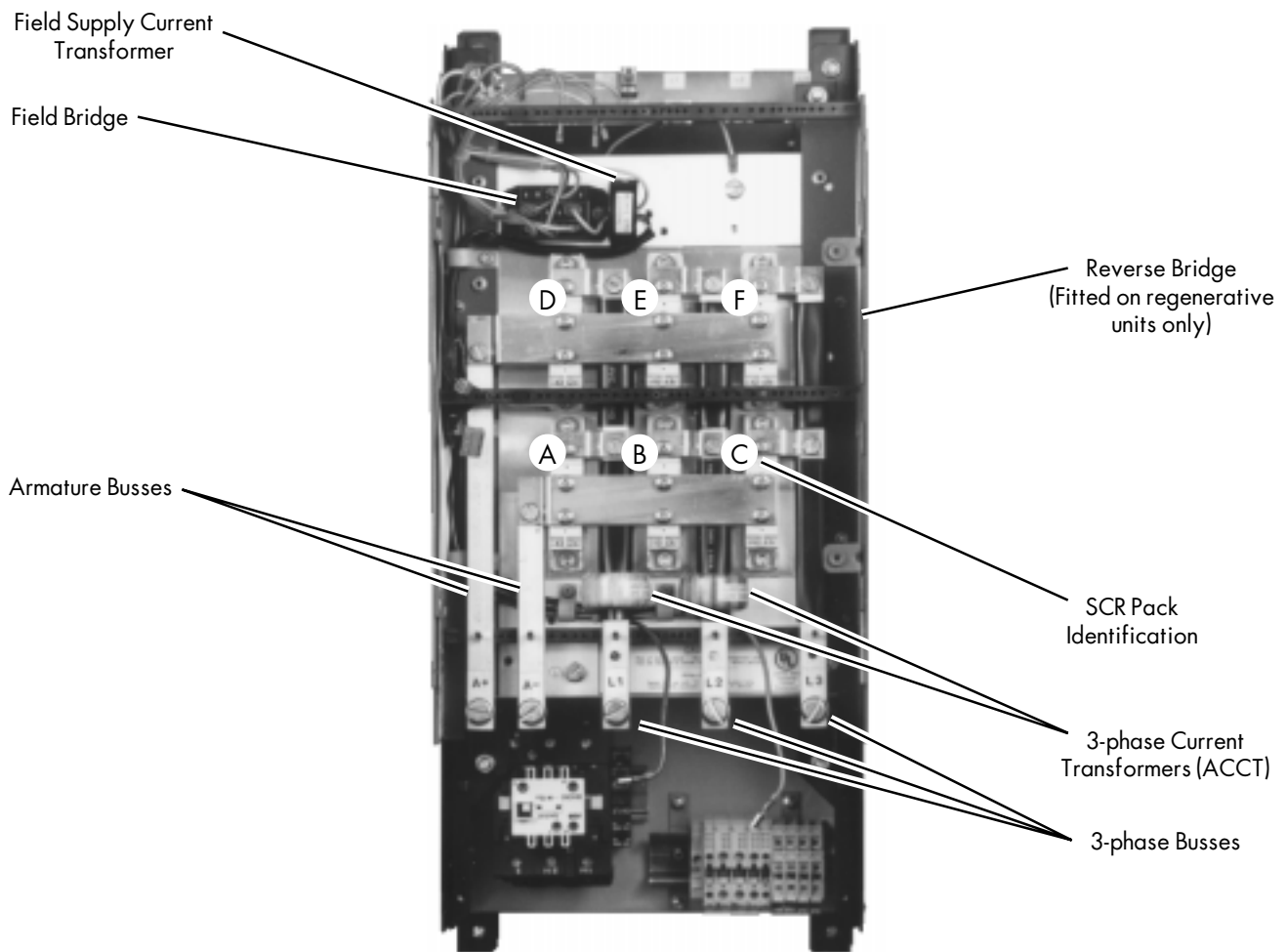


Figure 2.7 - SCRs and Power Buses (Power Supply Board Removed)



## Chapter 3 INSTALLATION AND WIRING

The 590 DRV Digital drive is designed to be relatively simple to install. You should review these procedures *before* beginning them. If you do not understand the instructions or are unsure of your ability to perform the procedures, contact Eurotherm Drives Customer Service.

### RECOMMENDED TOOLS

Installing a 590 DRV Digital drive requires a few standard hand tools. A socket wrench to fit either ¼-20 or M6 (as applicable) bolts and nuts is needed to mount the drive to the panel. Screwdrivers and a wire crimping tool are needed to make various electrical connections. For installing DRVs larger than 162 amps, wrenches are needed to make some of the electrical connections. Below is a list of some of the required tools.

Socket wrench with a 6 inch extension	
Deep sockets	M10, M13, M17, 7/16", ½"
Screwdrivers	Phillips #2, Flat blade - 0.5 x 3.0 mm, 0.6 x 3.5 mm, 0.8 x 4.0 mm
Small wire cutters	

### VENTILATION AND COOLING REQUIREMENTS

The drive must be able to dissipate the heat generated during use. Therefore, mount the unit in a manner that allows a free flow of cool air vertically through the drive. Reserve a minimum 1½"(38mm) clearance on the left side of the drive to give the cover panels room to open properly. For 7.5 through 60 HP rated models, allow a minimum of 4"(100mm) of clear space above and below the drive to ensure adequate free air flow. Leave an additional 2"(50mm) clearance above and below models rated 75 through 100 HP. Refer to the technical illustrations at the end of this chapter for fan clearances required on all force fan ventilated units.

When mounting drives one above the other, allow at least 7"(175mm) between the top and bottom drives. Each drive requires the same clearance as required when used singly. When mounting drives next to each other, leave 1½"(38mm) left to right between units.

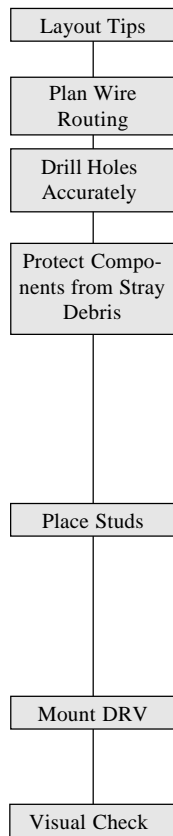
Make sure the unit is not mounted on or next to equipment that will cause the drive to overheat. Normal maximum ambient operating temperature is 113°F (45°C). Above this limit, the controller must be derated. The maximum ambient operating temperature is 131°F (55°C).

The table below lists the heat dissipation in Watts of 590 DRV Digital drives through 400 horsepower (at 500 VDC). The "\*" in the catalog number designates either "R" or "N" (for regenerative or non-regenerative).

Catalog Number	Motor Rating, HP at 500V	Motor FLC, Amps	Total Watts	Catalog Number	Motor Rating, HP at 500V	Motor FLC, Amps	Total Watts
955D-8*751	3	5	68	955D-8*62	60	90	316
955D-8*751	5	9	76	955D-8*752	75	123	458
955D-8*751	7.5	13	88	955D-8*13	100	164	607
955D-8*22	15	27	135	955D-8*1253	125	205	673
955D-8*22	20	34	164	955D-8*153	150	246	866
955D-8*32	25	43	161	955D-8*23	200	330	1130
955D-8*32	30	51	195	955D-8*253	250	405	1413
955D-8*42	40	67	267	955D-8*33	300	480	1625
955D-8*62	50	83	291	955D-8*43	400	648	1722

Figure 3.1 - Heat Dissipation Loads

## MOUNTING INSTRUCTIONS



The 590 DRV Digital drive is designed to mount directly onto a vertical, flat surface. Refer to the technical illustrations for your model at the end of this chapter for mounting centers and hardware recommendations. 7.5 through 100 HP models are designed with the incoming three-phase supply connections at the top and the motor, and cooling blower and control connections at the bottom. Units rated 125 through 400 HP have AC main input and DC armature terminations located at the bottom of their panels and terminals mounted on the left for the motor field connections and optional motor blower connections. Keep terminal locations in mind when mounting the drive to accommodate proper wire routing.

**NOTE.** Holes for the mounting bolts or screws must be placed accurately.

When drilling mounting holes, cover any DRVs or any other components already mounted to the panel to protect them from stray metal filings.

### Mounting 7.5 through 100 HP Units

Insert the mounting studs from the back side of the panel. Attach lock washers and nuts part way onto the lower mounting studs. They will help keep the drive in place when mounting.

---

#### **WARNING!**

The 590 DRV Digital drive units weighs more than 50 lbs. Use proper lifting techniques when moving.

---

Lower the bottom slots of the 590 DRV Digital drive onto the studs, making sure the studs are between the washers and the panel. Once the drive is resting on the bottom studs, lean it back onto the top two studs. Attach lock washers and nuts on the top studs and finger tighten. Finger tighten the lower studs as well to hold the drive in place. Finally, use the socket wrench to tighten all four nuts securely.

Visually check the drive and its housing for packing material, mounting debris, or any other material that could damage and/or restrict the operation of the equipment.

## WIRING PROCEDURES

Wiring the 590 DRV is not difficult. Be sure to use proper terminals and ensure that all wiring and protection devices are sized properly. Observe *all* warning messages. Failure to follow safety precautions can lead to equipment damage, injury or death.

---

#### **WARNING!**

Make sure all wiring connections meet or exceed applicable local and national electrical codes. Be sure to fit branch circuit and motor overload protection.

---

The wiring procedures in this manual apply to a 590 DRV Digital drive configured for general purpose speed control operation. Wiring configurations for custom systems or for optional applications are too numerous and complex to include here. For system configurations, refer to the schematics packaged with those systems.

**NOTE.** Figure 3.20, located on the fold-out page at the end of this chapter, shows the connections described in the following sections. The balloons **(A)** in the left margin of the following text help locate the circuit in the figures.

Incorrect wiring is a common cause of start up problems. If you have questions about wiring procedures, contact Eurotherm Drives Customer Service.

---

#### **WARNING!**

Whenever working on wiring connections, completely isolate all power supplies from the drive on which you are working.

---

A label on the inside of the DRV or on the DRV mounting panel lists the tightening torques for all user terminals. Do *not* overtighten connections when installing wires.



## Power Wiring

Incoming AC supply and output motor connections are shown in Figure 3.2 and 3.3. If you need electrical terminals for motor and supply connections, Eurotherm Drives has UL-approved crimp terminal kits available in the following armature current ranges:

Amps	Terminal Kit Catalog No.
13	955-CK13
35	955-CK35
50	955-CK50
66	955-CK66
98	955-CK98
122	955-CK122
164	955-CK164

### Caution

The semiconductor fuses fitted to *all* 590 DRVs protect only the SCRs in the drive and do *not* provide branch circuit protection. You *must* fit branch circuit protection to the incoming power supply.

The power wires must have a minimum rating of 1.1 x FULL LOAD CURRENT. For UL requirements, the wires must be rated for 1.25 x FULL LOAD CURRENT. Control wiring must be 18 gauge or larger.

### Supply Connections

The 590 DRV Digital drive has ground terminals for each incoming and outgoing supply. A substantial connection must be made to the incoming supply ground terminal near terminals L1, L2, and L3 (Figure 3.2). The ground terminals at the bottom of the drive can be used for armature ground and grounding the auxiliary 120 VAC loads.

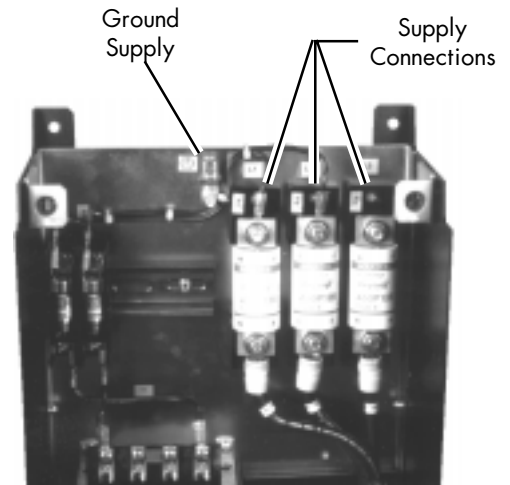


Figure 3.2 - Three Phase Connections (30 through 100 HP Models)

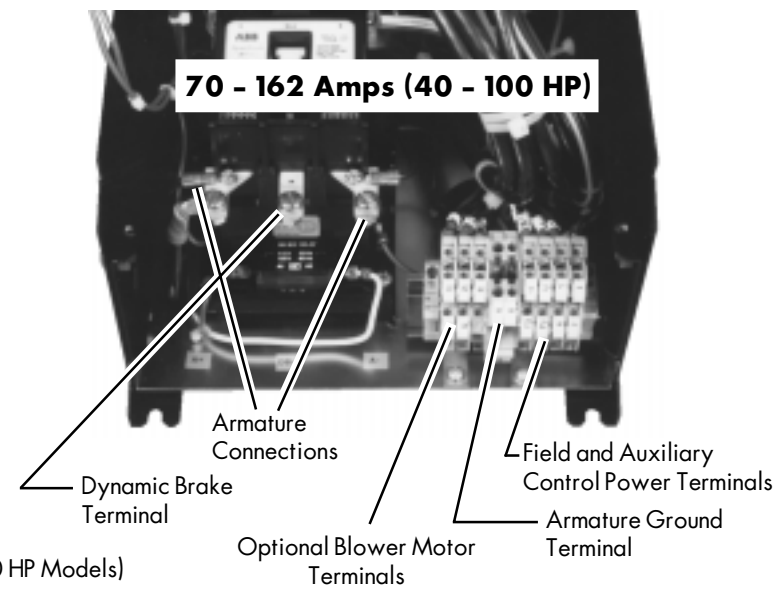
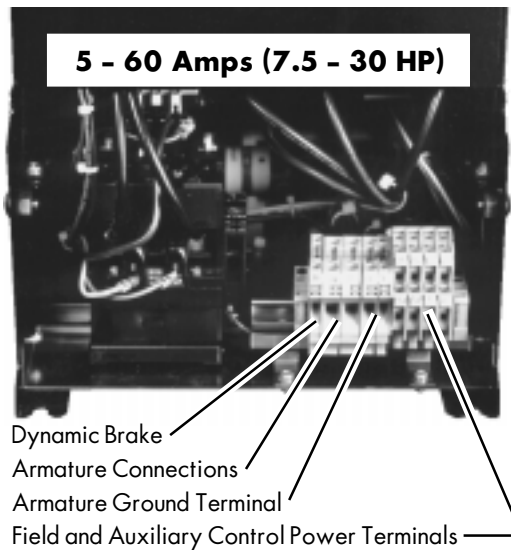
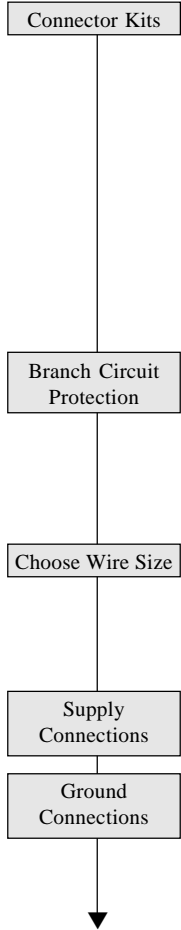
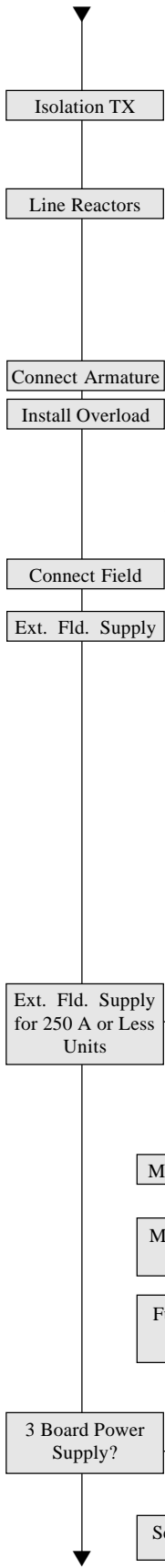


Figure 3.3 - Motor Connections (30 through 100 HP Models)



Connect the main AC power supply to terminals L1, L2, and L3 (see Figure 3.2) through the correctly sized branch circuit protection and an AC line reactor or dedicated drive isolation transformer. Eurotherm Drives stocks a series of reactors designed to connect to the 590 DRV Digital AC supply terminals. The part numbers for the reactors are:

Reactor Rating (RMS)	Reactor Part No.
35 amp	CO055192
70 amp	CO055193
110 amp	CO055253
180 amp	CO055255*

\* Requires interposing terminals between the DRV supply and the reactor.

### Armature Connections

Connect the motor armature to terminals A+ and A- (Figure 3.3). To comply with national and local electrical codes, external DC overload protection *must* be provided.

**B**

If you are using dynamic braking to stop the motor, connect the negative armature lead through a suitably rated dynamic brake resistor to terminal DB+.

### Motor Field Connections

**C**

If you are supplying the drive field regulator internally or from the main supply, connect the motor field (-) to terminal F- and field (+) to terminal F+ (Figure 3.3).

**D**

If the drive's field regulator requires an external field supply (for example when a 240 volt field is required on a 240 volt armature motor), connect the supply wires to terminals FL1 for phase L1 and FL2 for L2.

### Caution

An "out-of-phase" external supply can blow fuses and cause faulty operation. The AC field supply is normally fed internally from L1 and L2. Some motors require field voltages greater than the mains supply at L1, L2, and L3. This external field supply must be "in phase" with the main supply. The supply connection to terminal FL1 must be in phase with the supply on terminal L1 and FL2 must be in phase with the supply on L2.

Depending on the drive's field regulator rating, reconnect the field supply jumpers on the controller power board as described below:

- FOR MODELS RATED THROUGH 150 HP or 250 A (units rated for a 10 A field, maximum):
  - Verify that power is disconnected, then move the RED wire from internal terminal F16 to internal terminal F19 and move the YELLOW wire from F8 to F18 (see Figure 3.4).

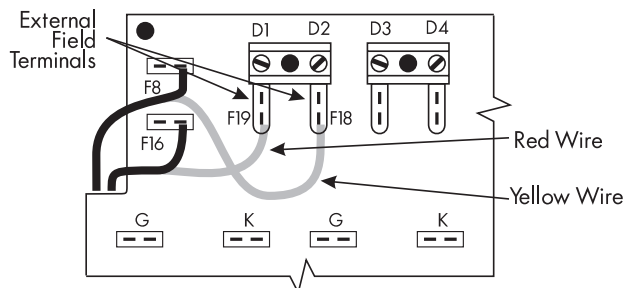


Figure 3.4 - External Field Supply Jumper Connections for Units Rated through 250A

- Externally protect the supply with suitable branch circuit protection fuses rated for the supply voltage. The external fuse rating should not exceed 10 A.
- When using an external field supply for drives fitted with three-board power supplies, refer to Appendix L for the field controller jumper connections.

- FOR MODELS RATED 200 to 400 HP, or 330 to 675 A, (units rated for a 20 A field, maximum):

**WARNING!**

Terminals FL1 and FL2 for DRV's rated 330 to 675 A are at line voltage and may present a shock hazard.

- Verify that power is disconnected, then move the RED wire from its existing position to internal terminal F8, and the YELLOW wire from its existing position to internal terminal F16 (see Figure 3.5).

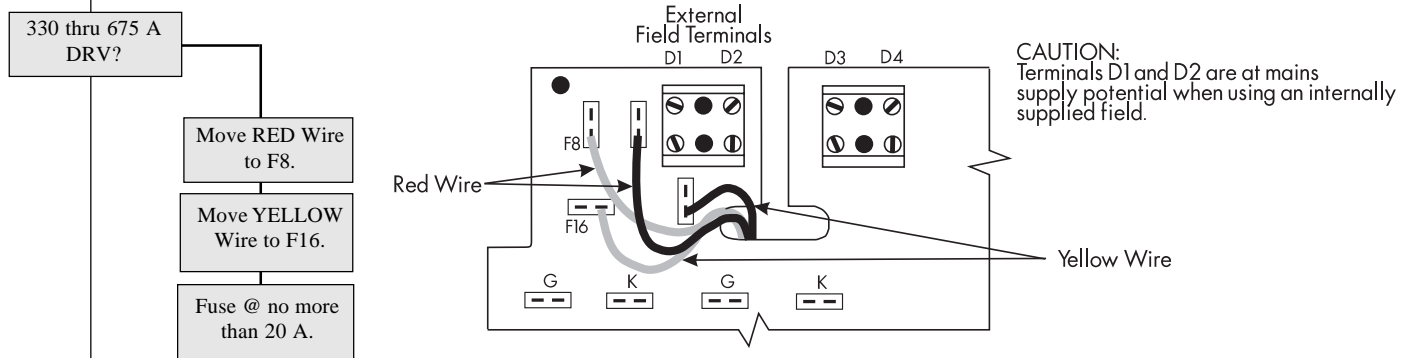


Figure 3.5 - External Field Supply Jumper Connections for Units Rated 330 through 675 A.

- Externally protect the supply with suitable branch circuit protection fuses rated for the supply voltage. The external fuse rating should not exceed 20 A.
- FOR EXTERNAL STACK CONTROLLERS or 500 to 1000 HP MODELS (units equipped for a 30 A field, maximum), SEE Appendix L.

**Control Wiring**

The control wiring described in the following section should be bundled and routed to the left side of the controller (see Figure 3.6) so the control door is free to open for access to the power supply board. Leave about 1½" of slack in the control wiring harness and trail the wiring down and leftward without straining the connections. Route the wire harness diagonally down to the lower left mounting foot of the DRV. This permits opening the control door and folding the drive open without putting stress on the wires.

An optional 10 inch piece of 7.5 mm deep DIN rail can be mounted to the lower cover (see Figure 3.6). This option is designed to hold potentiometer boards, relays or other signal devices. To prevent exceeding the overall 590 DRV Digital drive depth limit of 11.5 inches, the depth of these components must not exceed three inches.

Wire harnesses from these devices should be kept tight to the devices and routed to the left side of the drive with the drive harness. Be sure that any devices or harnesses mounted on the DRV do not interfere with any devices mounted on the panel below when the unit is hinged down for service and maintenance access.

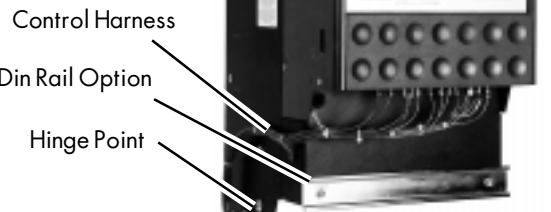
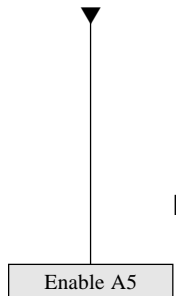


Figure 3.6 - Wire Harness Routing

Route Control Wiring to Left of Drive

Optional DIN Rail

**WARNING!**

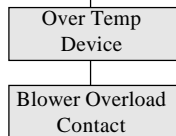
The connectors to terminal blocks A, B and C must be isolated signal voltages. Never perform high voltage resistance or dielectric strength tests without first completely disconnecting the drive from the circuit being tested.

**Enable**

Terminal C5 (ENABLE) is connected to terminal C9 (+24V) internally through a normally-opened auxiliary contact on the DRV main contactor. The drive remains disabled until the main contactor poles are closed.

**WARNING!**

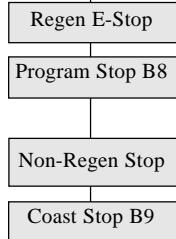
The drive *must* be disabled and power should be removed before servicing the equipment. First stop the drive and make sure the main contactor has deenergized, then remove power.

**Thermistor**

Terminals A1 and C1 are zero volt signal connections common to the return of the drive's +24 VDC internally regulated supply. If the motor is fitted with overtemperature sensing devices such as thermistors or thermostats, connect the devices in series between terminals C1 (0V) and C2 (THERMISTOR). If the motor has an external blower motor, wire an auxiliary contact from the blower starter's overload trip circuitry in series with the motor's over temperature device and terminals C2 and C1.

**Program And Coast Stop**

For a regenerative emergency stop (regen units only), connect terminal B8 (PROGRAM STOP) to terminal C9 (+24 VDC) through a normally-opened contact of an emergency stop relay. Also connect terminal B9 (COAST STOP) to terminal C9 through a time-delayed off, normally-opened contact on the same emergency stop relay. Activating the E-Stop circuit removes +24 VDC from B8 and regenerates the motor power back into the main supply. The delayed-off contact on B9 (COAST STOP) acts as a fail safe, allowing the drive to coast to a stop after the time delay.



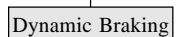
For non-regenerative drives or for coast stopping with regenerative models, permanently jumper terminal B8 to B9 and connect terminal B9 to +24 VDC (terminal C9) through a non-delayed, normally-opened contact of the emergency stop relay. Upon activating an emergency stop condition, the drive will coast stop immediately.

**WARNING!**

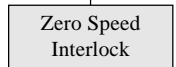
The emergency stop relay should not be considered part of the normal sequencing of the system and should be triggered only in circumstances involving equipment damage or safety.

**Dynamic Braking**

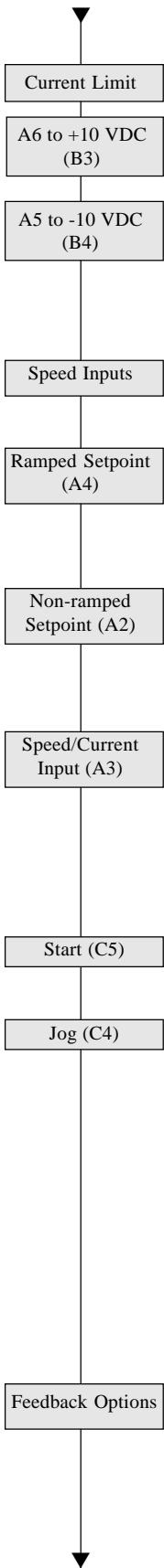
The drive will dynamic brake if wired for coast stopping and a properly sized resistor is connected as shown in Figure 3.20. The contactor in all 590 DRV Digital drives through 250 HP includes a normally closed, dynamic braking DC contactor pole. It is rated to carry full load armature current upon closing. The start-stop circuitry should be designed to prevent the motor from restarting and the pole from opening until *after* the motor reaches zero speed.



NOTE. The dynamic brake contactor pole is rated to make, but not interrupt DC motor current. To avoid damaging the contact, interlock the drive's ZERO SPEED output signal to the DRIVE START logic to prevent the drive from restarting until the motor has reached standstill.



For regenerative or non-regenerative drives, dynamic braking may be used as an alternative, emergency stopping method. The wiring scheme is shown at the lower left in Figure 3.20.



**Current Limit**

For most applications, connect terminal A6 (ANALOG INPUT 5) to terminal B3 (+10 VDC REFERENCE) and connect terminal A5 (ANALOG INPUT 4) to terminal B4 (-10 VDC REFERENCE). This sets the drive's positive and negative current limit clamps to +100% and -100% respectively for forward and reverse motor operation and allows you to adjust the MAIN CURRENT LIMIT parameter from 0 to 200%. If you need to control the main current limit externally, connect a 10kW potentiometer between terminal B3 (+10 VDC REFERENCE) and terminal B1 (0 VDC). Connect the wiper to terminal A6. You can then adjust the current limit from 0 to 200% if SETUP PARAMETERS:: CURRENT LOOP::MAIN CURR. LIMIT is set to 200.00%.

**Speed Demand**

For normal operation, connect the speed demand signal to terminal A4 (RAMP SETPOINT). This input is scaled so that +10 VDC input equals maximum forward speed demand (+100%), and -10 VDC input equals maximum reverse speed demand (-100%).

Connect the ends of an external 10kW potentiometer to terminal B3 (+10 VDC REFERENCE) and terminal B4 (-10 VDC REFERENCE) and the wiper to terminal A4. For non-reversing applications, the speed demand needs only to operate between 0 and +10 VDC. Connect the high, or clockwise end of the potentiometer to B3 and the low or counterclockwise end to the 0 VDC terminal, A1 (SIGNAL GROUND).

Terminal A2 (SPEED SETPOINT NO. 1) is an additional, non-ramped speed demand input which sums with the drive's other speed inputs. Connect your speed demand to this terminal for non-ramped speed control.

Terminal A3 (SPEED SETPOINT NO. 2 or CURRENT DEMAND) is a hardwired input which functions either as a non-ramped speed or current demand. The state of control terminal C8 (I DMD. ISOLATE) determines the operating mode of the input. When tied to +24 VDC (terminal C9), A3 is a direct current demand input to the drive's current loop. When terminal C8 is left open-circuited, A3 is a non-ramped speed demand input and sums with the other drive speed loop inputs.

**Start/Stop Input**

Connecting terminal C9 through a normally-open contact to terminal C3 (RUN) provides normal start/stop control. When the contact is open, the drive will attempt to perform a controlled stop; when it is closed, the drive will start.

**Jog Input**

Terminal C4 (JOG) is connected through a normally-open contact to terminal C9 for jog applications. Interlock the jog relay contact with the run relay coils as shown at (I) in Figure 3.20.

**Armature Current Feedback Terminal**

You can connect a meter to terminal A9 (ARMATURE CURRENT) to monitor the motor DC armature current. The output is hardwired and *not* software configurable. Refer to Appendix A for the terminal's output rating and signal scaling. This connection is optional.

**Speed Feedback**

The 590 DRV Digital drive accepts the following types of speed feedback signals:

- armature voltage feedback
- analog AC or DC tachometer generator feedback
- wire-ended electrical encoder feedback
- plastic (5701) or glass (5901) fiber optic Microtach encoder feedback.

Armature voltage feedback, the default, does not require a feedback device, external isolator or any external connections. All other types of speed feedback requires external connections from the feedback device to a separately ordered controller mounted option board. The part numbers for each type of feedback option board is listed below. Appendix A contains technical information on each.

### Feedback Board

	<b>part no.</b>
• Switchable Analog Tachometer Generator Board .....	AH385870U001
• +5 VDC Encoder Receiver Board .....	AH38777 5U005
• +12 VDC Encoder Receiver Board .....	AH38777 5U012
• +15 VDC Encoder Receiver Board .....	AH38777 5U015
• +24 VDC Encoder Receiver Board .....	AH38777 5U024
• 5701 Microtach (Plastic Fiber Optic) Feedback .....	AH058654U001
• 5901 Microtach (Glass Fiber Optic) Feedback .....	AH386025U001

### Feedback Receiver Board Installation

Each speed feedback board mounts on the lower left portion of the control door as shown in Figure 3.10. Terminal assignments for each option board are listed in Appendix A and in the documentation shipped with the boards.

To install the receiver board on the drive control board:

1. Remove the packaging from the feedback receiver board.

#### **Caution**

Encoder and Microtach receiver boards contain electrostatic discharge (ESD) sensitive parts. Observe static control precautions when handling and installing the board.

2. Align the 10 pin connector on the option board with the controller pins on the lower left of the control board.
3. Carefully push the receiver board onto the pins taking care not to bend the pins. All four white support standoffs should engage the control board. If installing a switchable analog tachometer generator calibration board, be sure to connect the jumper on the right side of the board to its mating jack on the switchable calibration card.
4. Refer to Appendix A for specific instructions on terminating the feedback device to the receiver option board.

### Analog Tachometer Generators

All drives rated *through* 400 horsepower are shipped with a switchable calibration card. If you are using an analog tachometer generator as speed feedback, you *must* order the analog tachometer generator board (AH385870U001), which scales the tachometer generator feedback signal. DRVs rated 500 horsepower and *above* are shipped with a resistor calibration card which scales the drive to the motor's parameters and also calibrates analog speed feedback signals.

**NOTE.** If a resistor calibration card option is used *and* the drive uses an analog tachometer generator as feedback, a switchable tachometer generator feedback board is not needed.

When using the resistor calibration card, tachometer generator connections are made to terminals A1 and A4. Connect the positive tachometer generator output signal wire to terminal A4. Refer to Appendix A for scaling instructions.

- P** The switchable tachometer calibration board option supports both AC and DC analog tachometers generators with a calibration range of 10 to 209 volts. The calibration resistors and the board switch settings coarsely scale the speed feedback signal. Adjust parameters in the MMI for fine tuning (refer to Chapter 3). Refer to Appendix A for wiring and technical information on the analog tachometer feedback card.
- Q**

The signal cable for the analog tachometer generator *must* be shielded over its entire length.

**NOTE.** Ground the tachometer generator shield at the drive end only to avoid ground loops.

Feedback Board  
Part Nos.

Feedback Board  
Installation

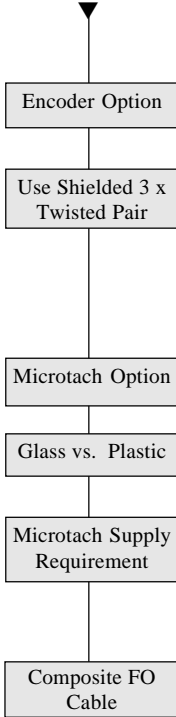
Must use Switch  
Cal Card if Using  
Switch Tach  
Board

Resistor Cal Card?  
Connect Tach to  
A3 and A4

Use Shielded  
Cable

Ground Shield at  
DRV Only

### Wire-ended Electrical Encoders



The drive can accept a standard, 4-channel, quadrature complimentary, wire-ended electrical encoder signal as speed feedback. Four feedback boards are available, each having a different supply voltage rating. Complimentary line driver encoders are recommended. Refer to Appendix A for typical encoder connection listings.

**NOTE.** When using an wire-ended electrical encoder as feedback, be sure to use three channel, twisted, shielded cable and to ground the shield at the drive end only. Belden 8777 cable is recommended.

### Microtachs

Fiber optic encoders (or Microtachs) come in either glass or plastic. While the glass Microtachs (5901) can transmit a feedback signal over a long range without a repeater, they require a special termination tool to properly cut and polish the glass fiber optic cable. The 5701 Microtach is used with plastic fiber optic cable which needs only a set of pliers for termination. The signal range for plastic, however, is limited and may require a Microtach repeater. Repeater part numbers are listed in Appendix A.

Each type of Microtach requires its own receiver board, listed above, and may be powered directly from the drive's +24 VDC supply.

1/2" diameter composite plastic fiber optic cable is available. The cable includes two 16 AWG conductors with a plastic fiber optic conductor sheathed in a protective plastic coating. This cable is recommended when running plastic fiber optic cable within conduit. Refer to Appendix A for part numbers.

## HARDWARE SETTINGS

After wiring the drive, it must be properly calibrated and the control transformer must be correctly tapped.

### Drive Calibration

Either of two types of calibration cards scale the drive to the motor's armature voltage, armature current and field current. One card uses solder-in resistors, the other uses adjustable switches. The calibration board plugs into the 590 DRV main control door under the lower, hinge-up access panel as shown in Figure 3.7.

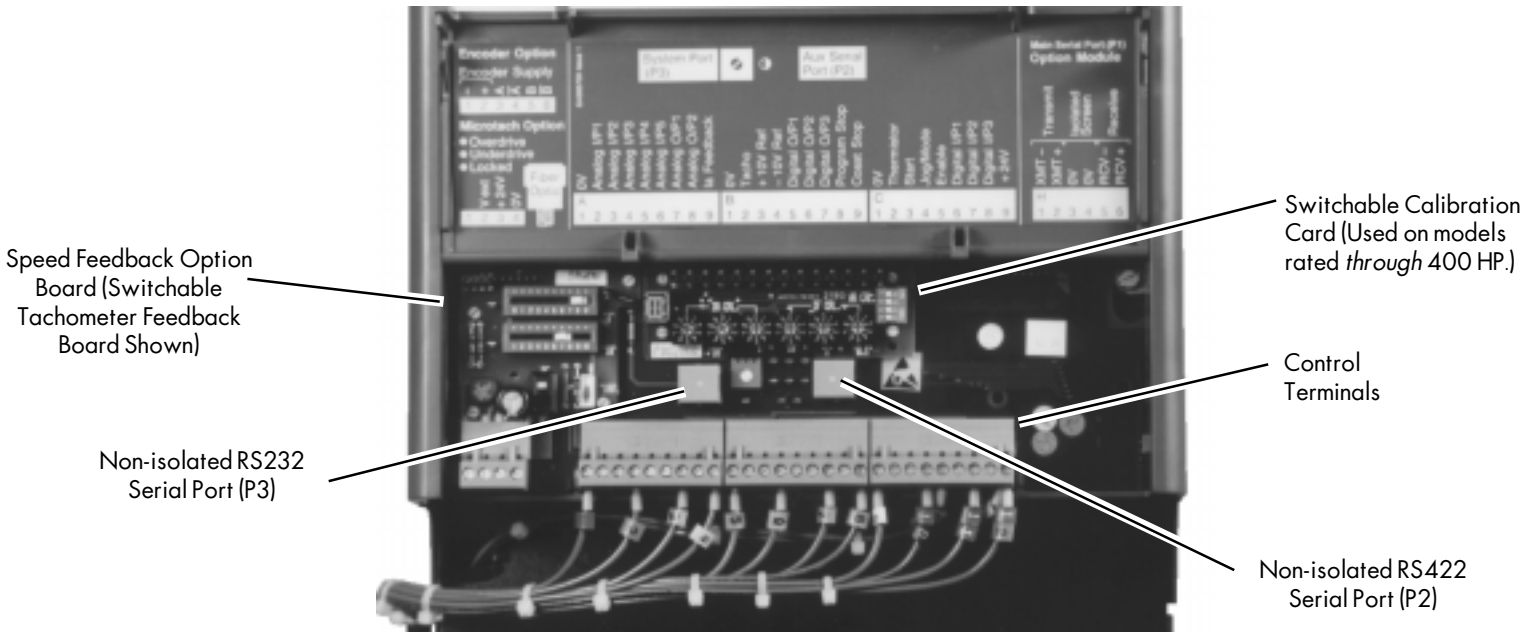


Figure 3.7 - Calibration Cards Location (Switchable Calibration Card Shown)



Must use Switch Tach Board if Using Switch Cal Card

A switchable calibration card ships with all 590 DRV Digital drives rated through 400 HP. Models rated 500 HP and above ship with a resistor calibration card. You can order the resistor card on lower horsepower models as an option.

NOTE. The drive *must* use the switchable tachometer generator feedback board if using the switchable calibration card.

**WARNING!**

Do *not* swap calibration boards or change any board settings while applying power to the 590 DRV Digital drive. Do *not* interchange calibration boards or switch the calibration settings without first verifying that they match the motor's nameplate rating. Mechanical damage and injury to personnel can result.

**Resistor Calibration Card (AH058529U001)**

Resistor values on the card scale the controller to the motor armature current, AC of DC tachometer generator feedback, armature voltage feedback, field current, and field voltage. Use the formulas below to determine the correct resistor values for your application.

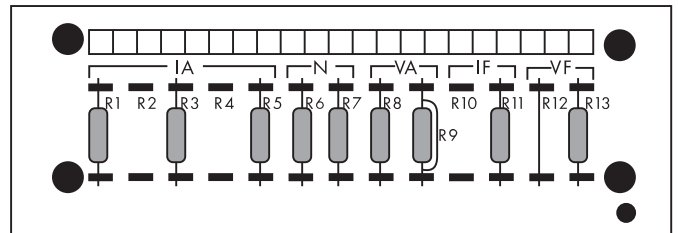


Figure 3.8 - Resistor Calibration Board

Calibration resistors should be of good quality metal film type, 2 percent tolerance, ¼ watt (or better). Actual resistance values should measure within ±10 percent of the calculated values.

1. Armature current calibration

The parallel connection of resistors R1, R2, R3, R4, and R5 calibrates the drive to the motor armature current. The combined value  $R_{IA}$  of all these resistors is calculated as follows:

$$R_{IA} = \frac{2200 \text{ W}}{(\text{Full Load Current} - 1)}$$

You can verify this value by using the formula:

$$1/R_{IA} = 1/R1 + 1/R2 + 1/R3 + 1/R4 + 1/R5$$

NOTE. The armature current calibration scaling resistors for external stack controllers (models rated 500 HP and greater) are fitted on the suppression board. See drawing HC352526 at the end of Appendix F for the resistor location and sizing.

**Caution**

Use ½ watt, metal film type, 2 percent tolerance resistors for current calibration on external stack controllers. Double this wattage rating for each 450 A of armature current.

2. Tachometer generator calibration

a. For full speed tachometer generator voltage up to 200 volts:

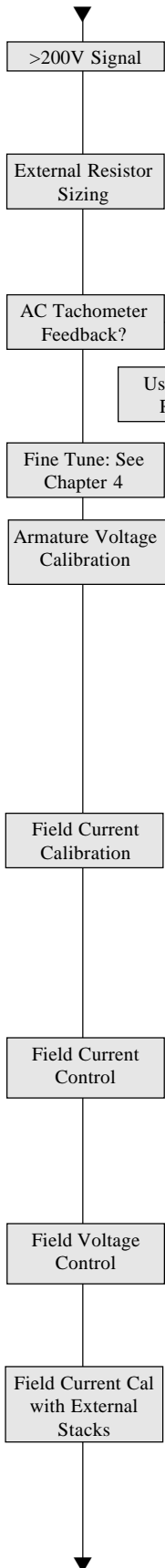
$$R6 + R7 = (\text{Tachometer Generator Volts} - 10) \text{ kW}$$

Armature Current Calibration

Tachometer Generator Calibration

<200V Signal.





b. For full speed tachometer generator output larger than 200 volts, an external resistor ( $R_E$ ) is required in series with tachometer generator connection to terminal B2. The suggested values for R6 and R7 are:

$$R6 = 120 \text{ kW}$$

$$R7 = 68 \text{ kW}$$

$$R_E = \frac{\text{Tachometer Generator Volts} - 200}{5} \text{ kW}$$

The external resistor must be large enough to dissipate the power,  $P_{RE}$ , determined below.

$$P_{RE} = (\text{Tachometer Generator Volts} - 200) \times 5 \text{ milliwatts}$$

c. The controller accepts only a DC signal as tachometer generator feedback. Accordingly, motors with AC tachometer generators require a full-wave diode bridges to rectify the AC tachometer generator voltage output into DC.

d. Fine tuning is performed within the software (refer to the *Calibrate Speed Feedback* section in Chapter 5).

3. Armature voltage feedback calibration

$$R8 + R9 = \frac{\text{Armature Voltage} - 100}{10} \text{ kW}$$

The minimum allowable armature voltage is 100V with R8 and R9 having no resistance (0W).

NOTE. If necessary, refine the calibration by adjusting SETUP PARAMETERS:: CALIBRATION:: ARMATURE V CAL in the MMI.

4. Field current calibration

**WARNING!**

If using field current control, this resistor must be calibrated correctly; otherwise, equipment damage and possible injury to personnel may result.

Field current is scaled by resistors R10 and R11 connected in parallel. The combined value of these resistors is calculated as follows:

$$R_{IF} = \frac{3000 \text{ W}}{\text{Full Field Current}}$$

NOTE. Calibrate the field current for 0.2 Amps (15 kW) when running the drive in field VOLTAGE CONTROL mode to set a small detection threshold for field loss alarm sensing.

The combined value of the parallel resistors can be verified by the formula:

$$R_{IF} = \frac{R10 \times R11 \text{ W}}{R10 + R11}$$

When using an external stack controller (500 HP and larger rated models), the field current calibration resistor is calculated with the formula:

$$R_{IF} \text{ external stack} = \frac{4000 \text{ W}}{\text{Full Field Current}}$$

NOTE. If necessary, change SETUP PARAMETERS:: CALIBRATION:: FIELD I CAL in the MMI.

5. Field voltage calibration.

Calibrating the drive for the motor field voltage is not required; however, resistors R12 and R13 are connected in series and must total 100 kW to assure best performance.

**Switchable Calibration Card (AH385457U001)**

The switchable calibration card is shipped on all models rated through 400 HP. The card, shown below in Figure 3.9, calibrates the drive for the motor armature voltage, armature current, and field current.

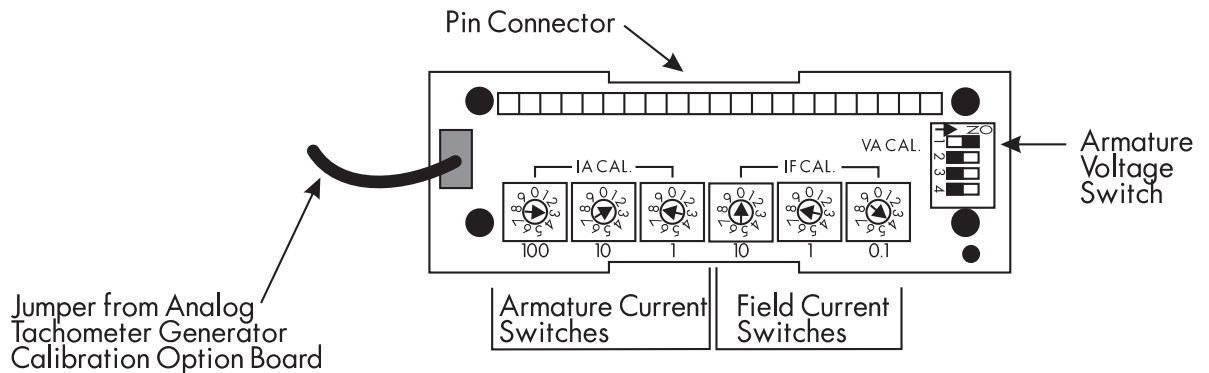


Figure 3.9 - Switchable Calibration Card

To calibrate the drive:

1. Set the armature voltage to the motor's nameplate rating. Use the four-position switch on the right end of the calibration board to select the setting. The default setting is 500 volts. Use Figure 3.10 to select different voltages.

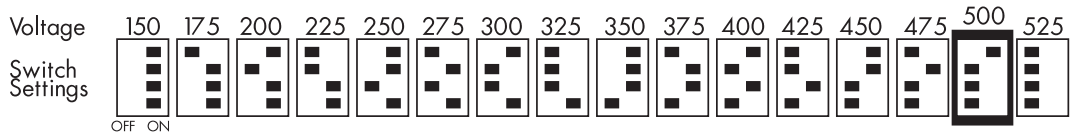


Figure 3.10 - Armature Voltage Switch Settings

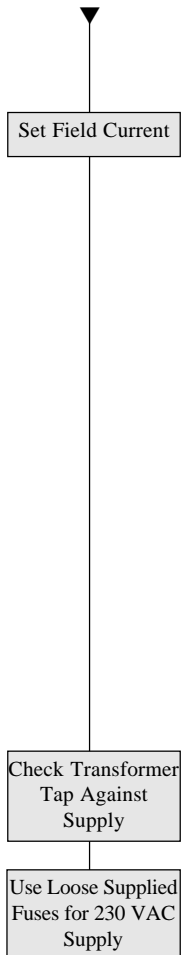
Armature voltage can be set from 150 through 525 volts. The switches step through the range in 25 volt increments. Choose the setting closest to the motor's armature voltage rating. When in doubt, set it to the next highest setting.

**NOTE.** Change SETUP PARAMETERS::CALIBRATION:: ARMATURE V CAL in the MMI to refine the calibration for the required armature voltage, if necessary. No change is needed for 500 volt armatures. For 240 armatures, choose the 250 volt settings and set ARMATURE V CAL to 1.0417 (250 ÷ 240). Refer to Appendix B for detailed instructions using the MMI to adjust parameters.

2. Set the armature current to the motor's nameplate rating minus one (1) amp. Armature current is set in units of amps using the left three rotary switches for hundreds, tens, and ones. The range for these switches is from 1 to 720 amps. Turn the rotary switches to the appropriate settings for your motor. Figure 3.9 is set for a 329 amp motor.

**WARNING!**

Do not exceed the drive or motor rating; such action could cause equipment damage. Do not change the calibration settings when the main contactor is energized.



- Set the field current to the motor's nameplate rating. Field current is set in units of amps, using the right three rotary switches for tens, ones, and tenths. As with armature current, the range depends on the type of drive. The overall range is from 0.1 - 19.9A with 590 DRV Digital drive models. Turn the rotary switches to the appropriate setting for your motor. Figure 3.9 is set for a 8.4 amp field. Use SETUP PARAMETERS:: CALIBRATION:: FIELD I CAL in the MMI.

NOTE. Some motors list two field currents. Always choose the "hot" field current when calibrating the drive.

**WARNING!**

The field current settings must match the motor nameplate rating value or the motor could overspeed and lead to mechanical damage and/or injury to personnel.

**WARNING!**

Do not exceed the field circuitry rating of the controller when setting the field current. 590 DRV Digital drives through 270 amp armatures are limited to 10 amp fields. Drives up to 675 amp armatures have field circuitry rated to 20 amps. Above 675 amps, the controllers have 30 amp field circuitry.

**Control Transformer**

The 590 controller within the DRV derives its control power through a DRV mounted control transformer connected to one phase of the incoming main three phase power. This transformer must be tapped to match the incoming supply voltage. Models rated 7.5 through 100 HP accept 208/230/380/415/460 volts AC, 50/60 Hz supplies. The default connection is for 460 volts. When other supplies are used, move the wire at position H6 to the position for the desired voltage, as shown in left of Figure 3.11.

For models rated 125 through 900 HP, the control transformer primary supply is limited to 230/460 VAC and are shipped with the tap set for 480 VAC. These drives are shipped with two sets of primary fuses (F4 and F5). For 230 volt supplies, use the loose fuses provided with the DRV and tap the primary of the transformer as shown in the right of Figure 3.11.

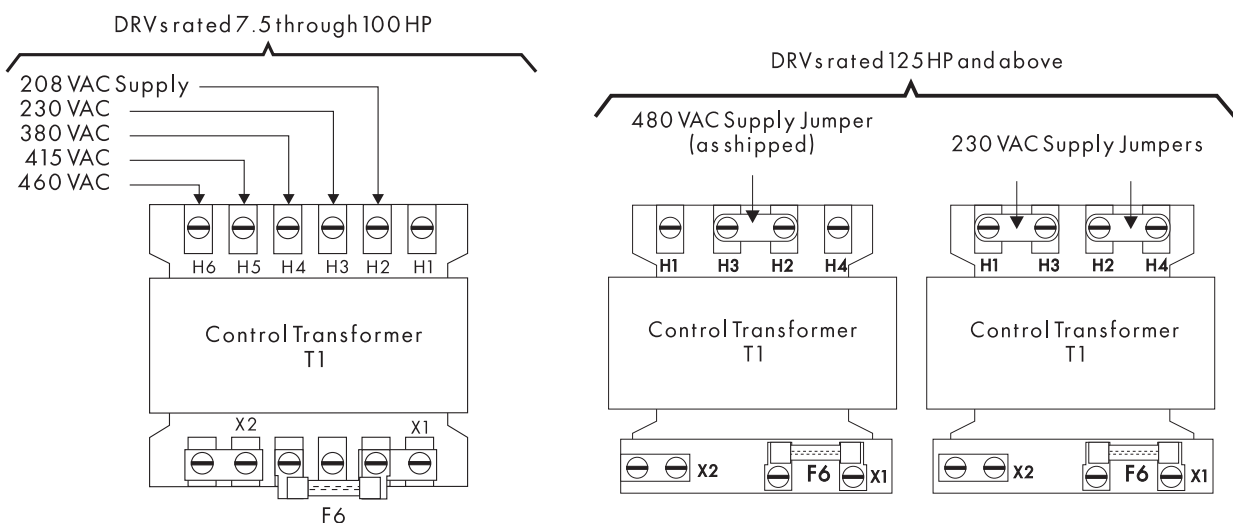
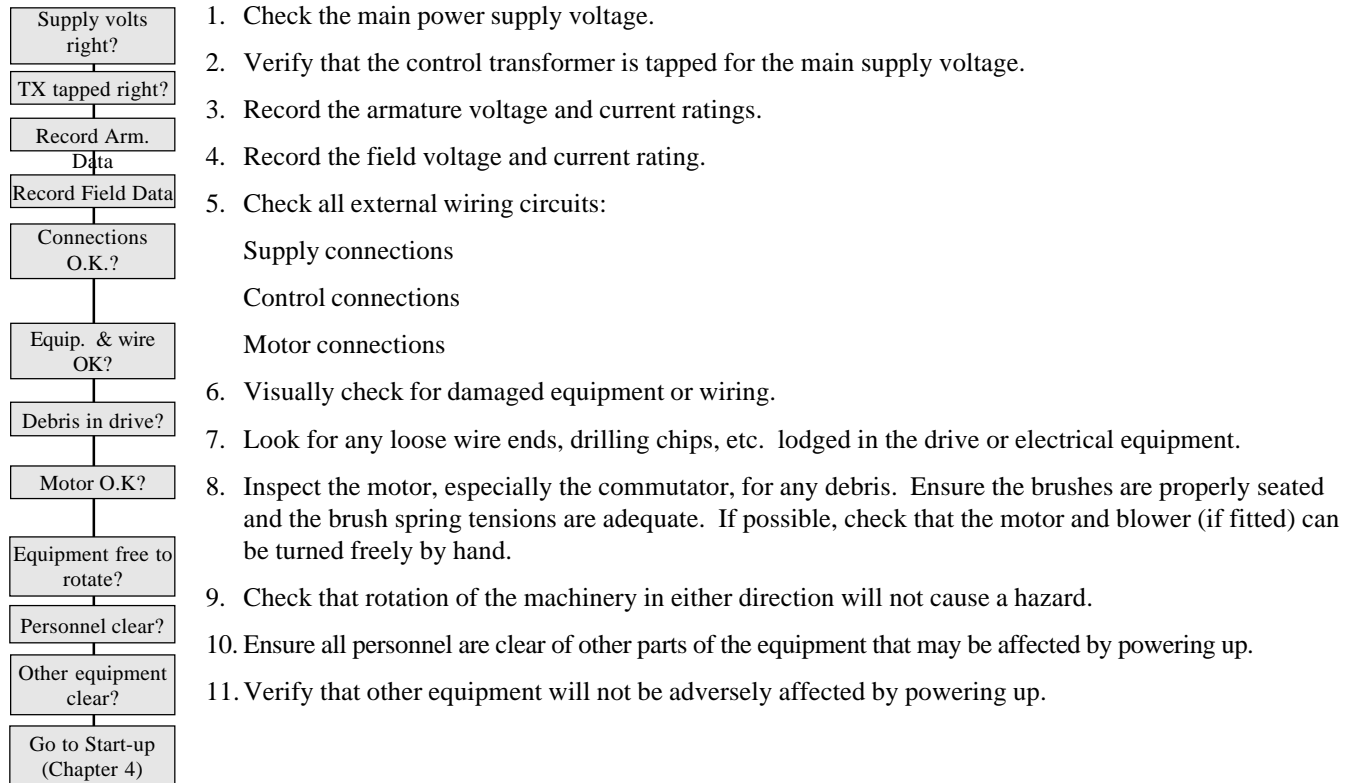


Figure 3.11 - Control Transformer Settings



## FINAL INSPECTIONS

After installing and wiring the drive, complete the following checks. They will assure the drive and motor can be safely powered up without injuring personnel or damaging equipment.



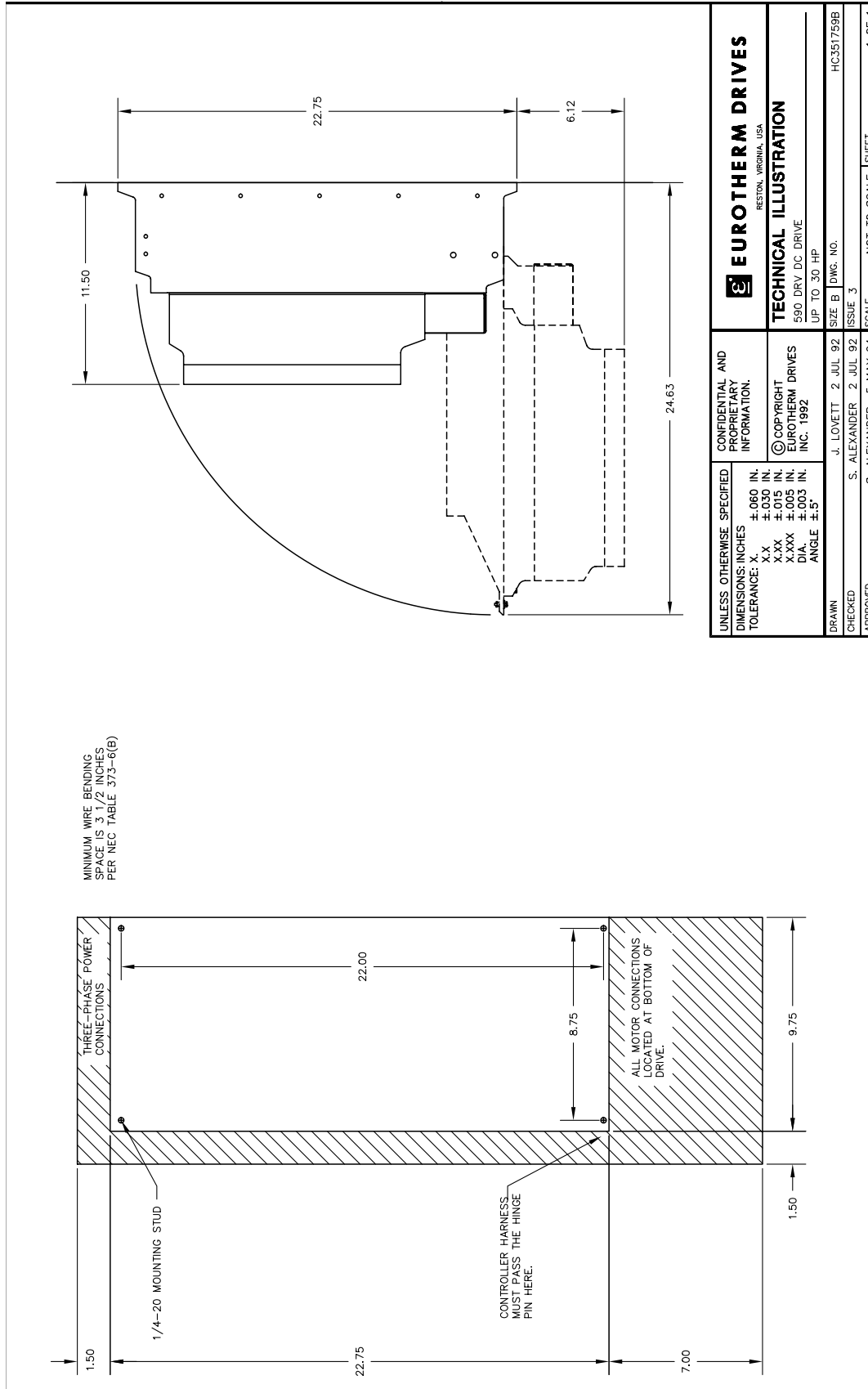


Figure 3.12 -  
30 Hp @ 500 VDC  
15 Hp @ 240 VDC



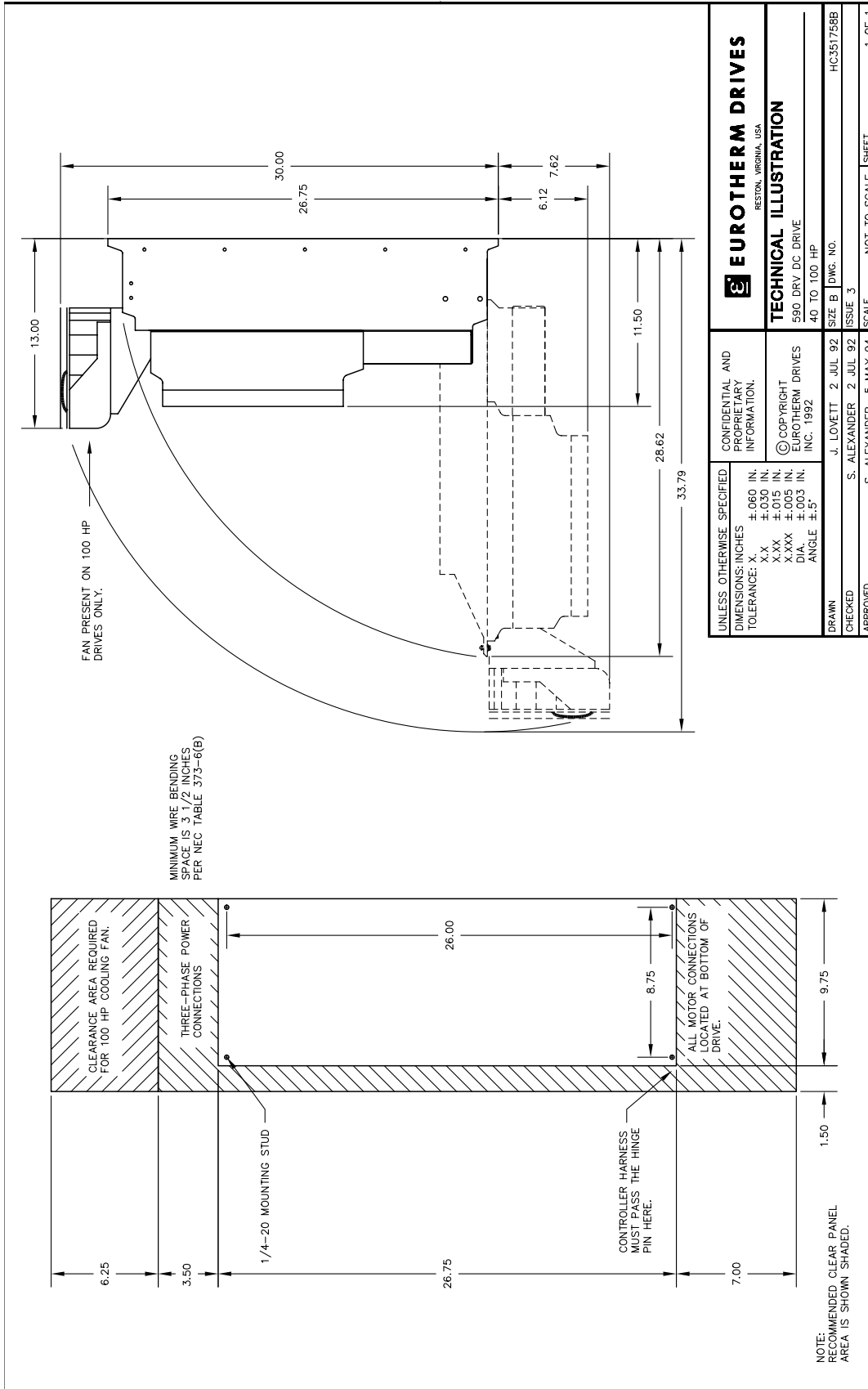


Figure 3.13-  
100 Hp @ 500 VDC  
50 Hp @ 240 VDC

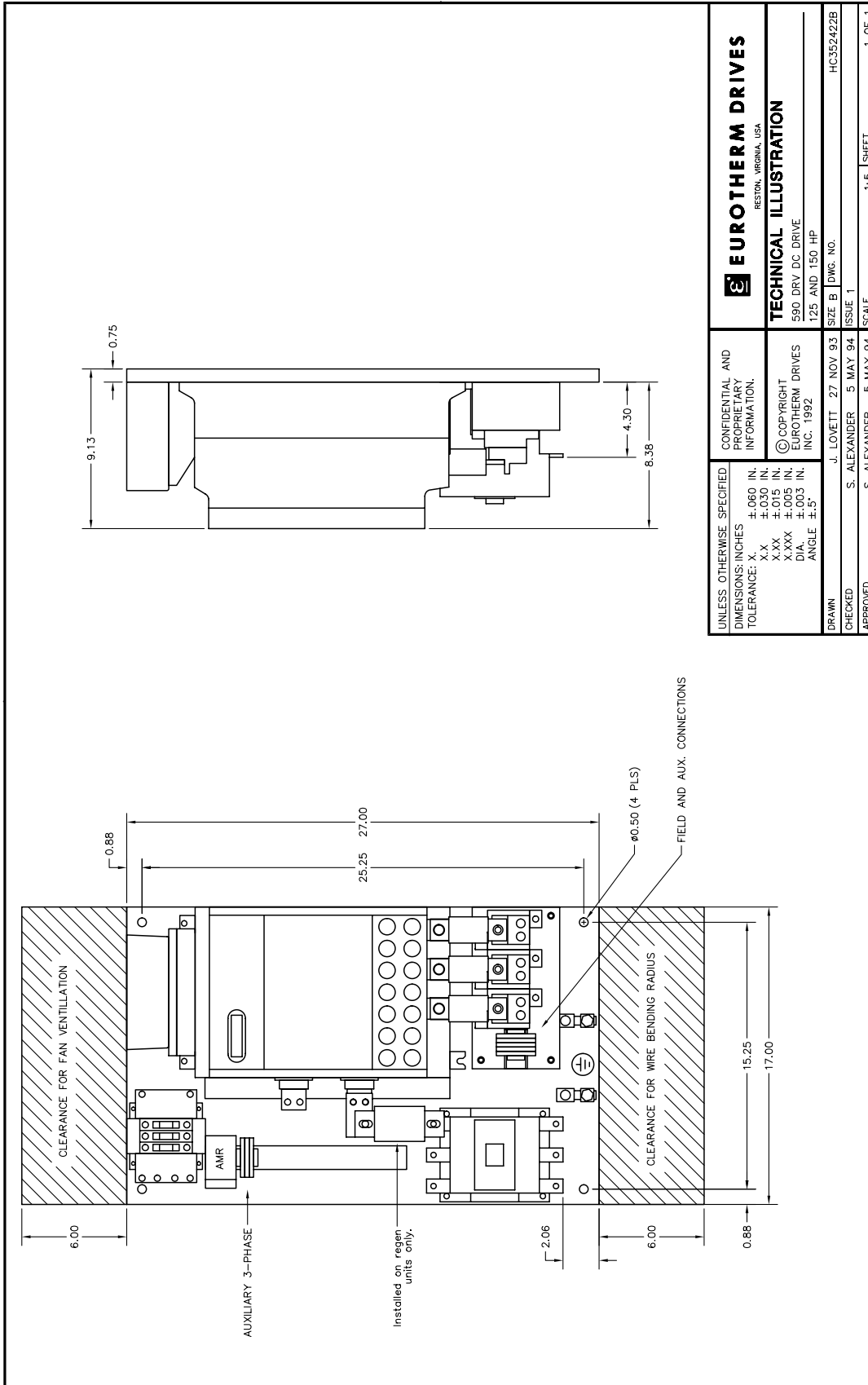


Figure 3.14 -  
 150 Hp @ 500 VDC  
 75 Hp @ 240 VDC



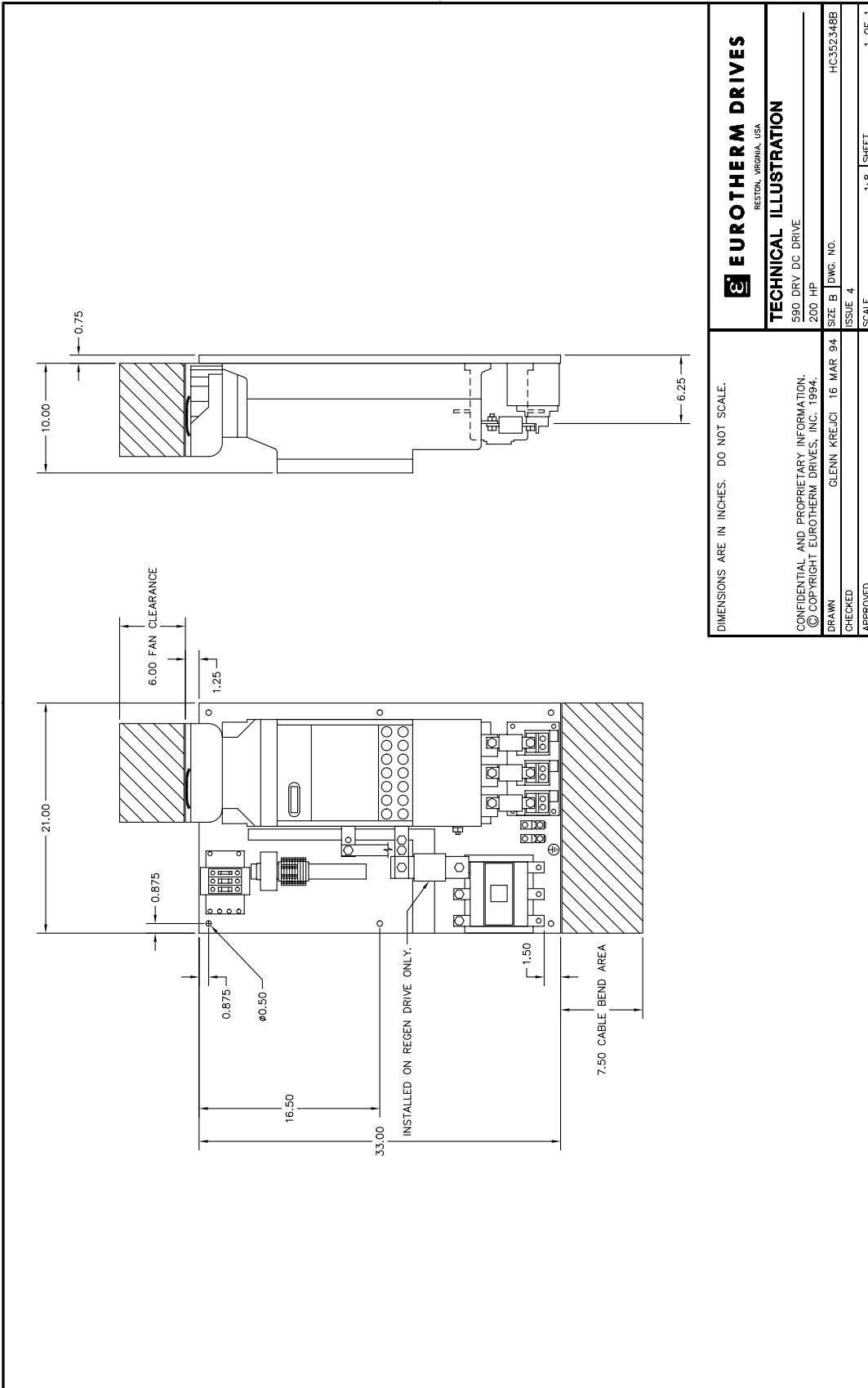


Figure 3.15 -  
200 Hp @ 500 VDC  
100 Hp @ 240 VDC



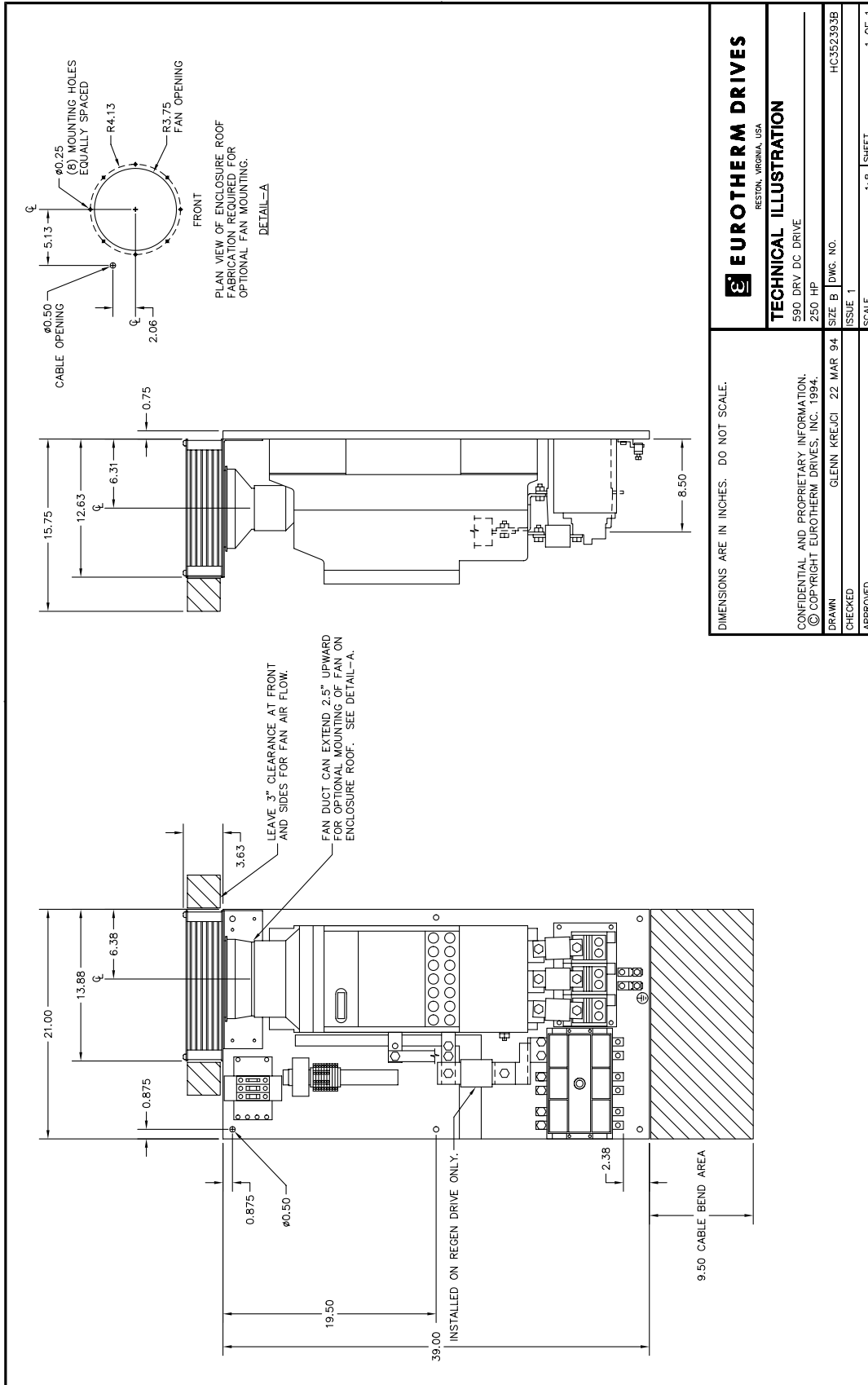


Figure 3.16 -  
250 Hp @ 500 VDC  
125 Hp @ 240 VDC



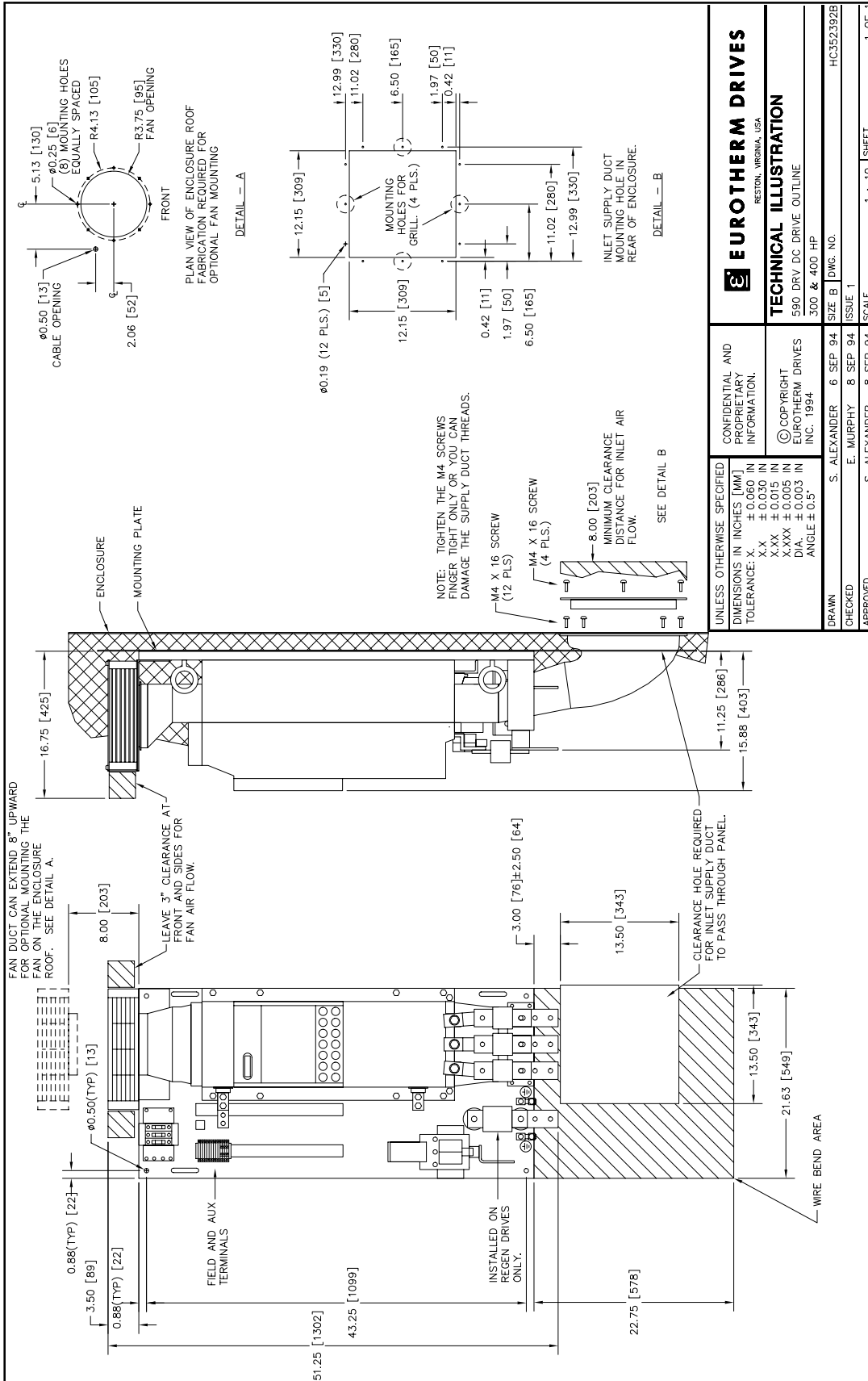


Figure 3.17 -  
 400 Hp @ 500 VDC  
 200 Hp @ 240 VDC

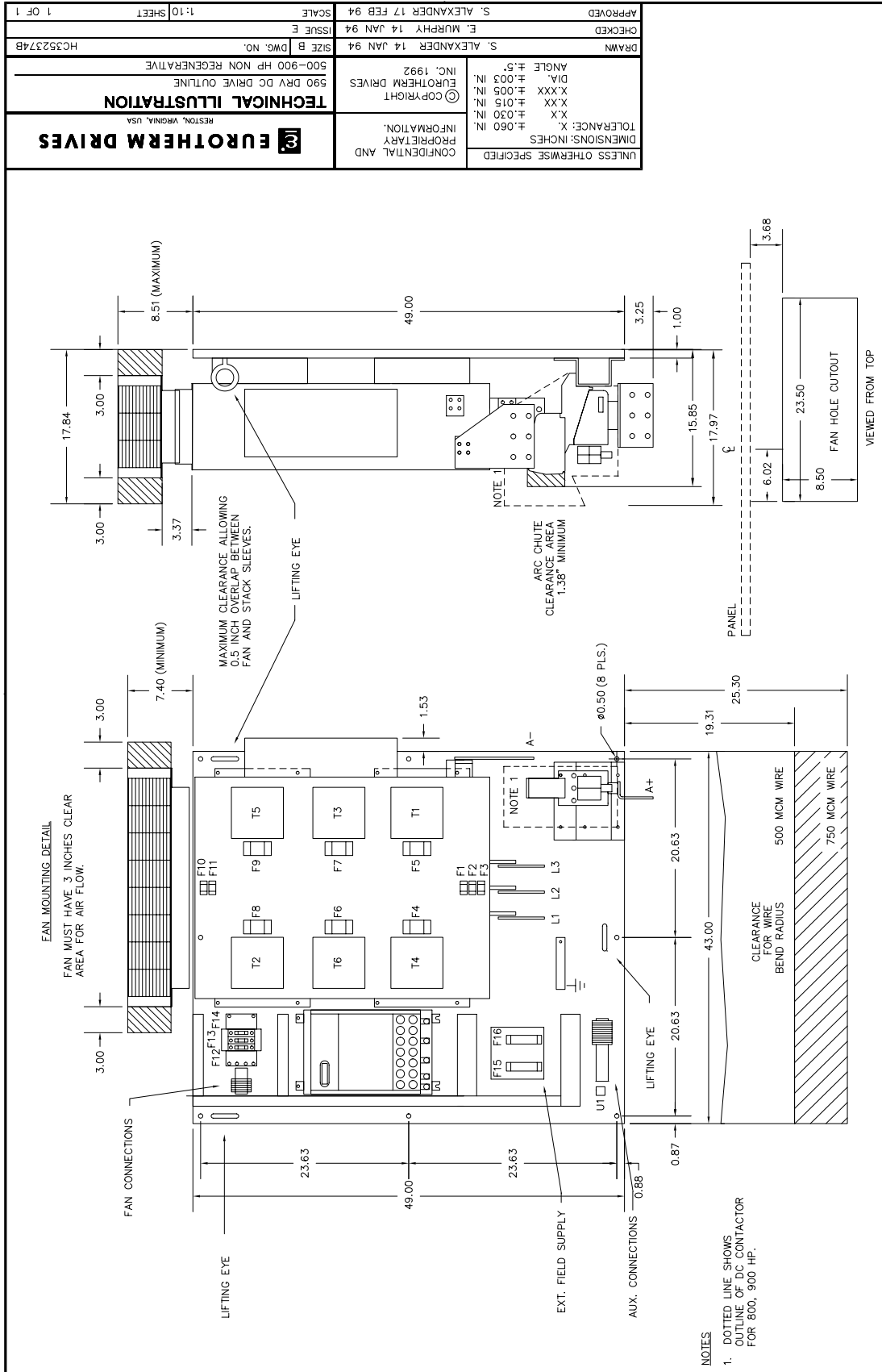


Figure 3.18 -  
 Non-regenerative  
 500 - 900 Hp  
 @ 500 VDC  
 250 - 450 Hp  
 @ 240 VDC



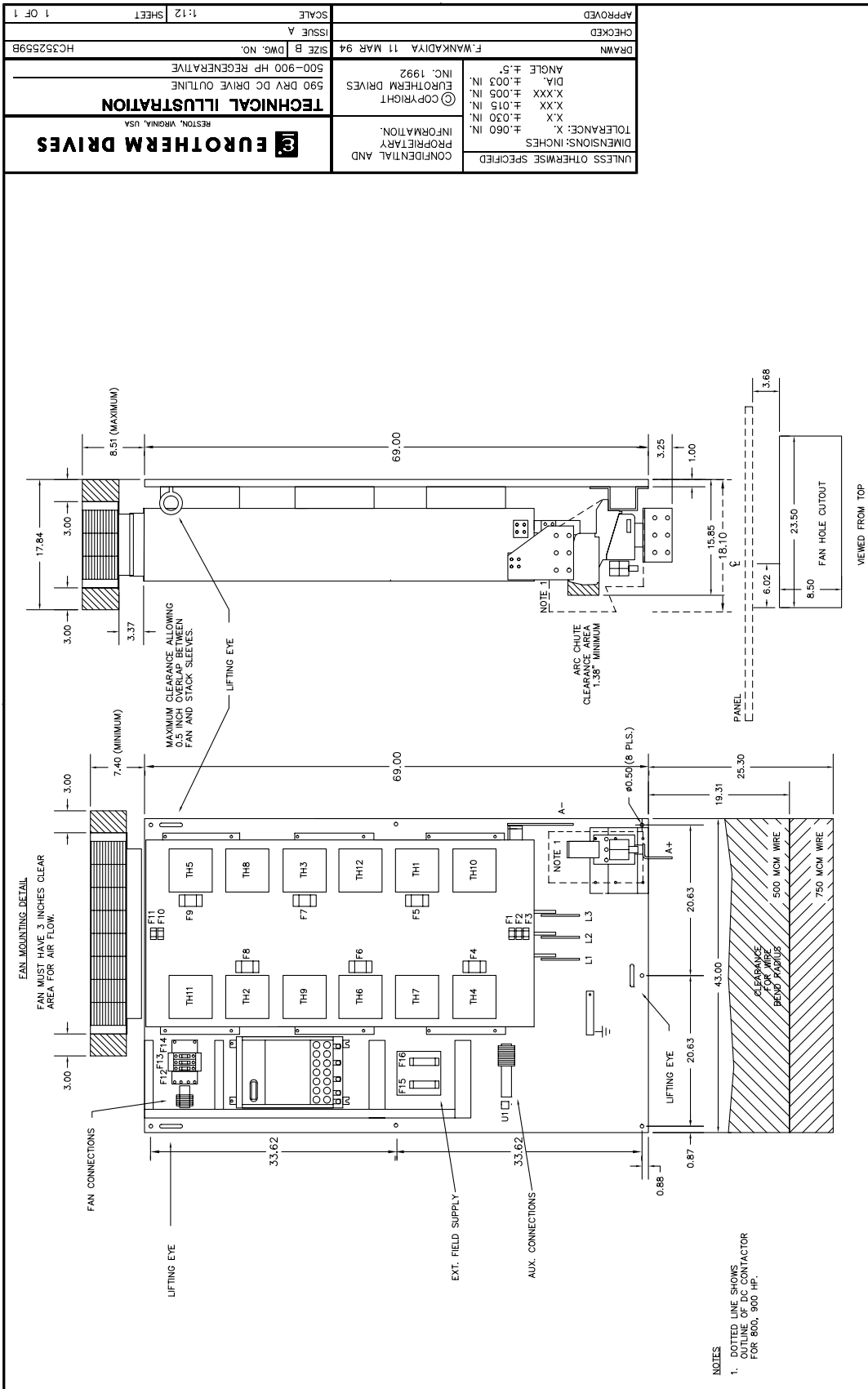


Figure 3.19 - Regenerative 500 - 900 Hp @ 500 VDC 250 - 450 Hp @ 240 VDC



# Chapter 4 START UP AND ADJUSTMENT

The 590 DRV Digital drive is shipped with a default configuration designed to control a shunt or permanent magnet field DC motor. You can adjust the drive's parameters or change its configuration to achieve optimum performance and perform specific control applications.

The drive can be tuned or configured using the drive's MMI, or by using a computer running the software package ConfigEd Lite. This chapter guides the user through the start up procedure using the MMI.

Follow these procedures only *after* installing and wiring your 590 DRV Digital drive (see Chapter 3). Review Appendix B to become familiar with the MMI before proceeding.

When an instruction refers to a MMI procedure, the menu levels are shown as a path with double colons “::” delimiting each lower menu level, for example:

SETUP PARAMETERS:: RAMPS:: ACCEL TIME

## RECOMMENDED TOOLS

Equipment recommended to set up your 590 DRV Digital drive and tune a motor include:

- IBM compatible PC with Microsoft Windows™ 3.0 or greater to run ConfigEd Lite
- Oscilloscope to monitor armature current waveform and speed feedback
- Voltmeter to monitor motor armature and field voltage and check control signal levels
- Ohmmeter to check signal continuity
- Clamp-on, Hall effect ammeter to measure armature and field currents
- Digital hand tachometer to check line or motor speed

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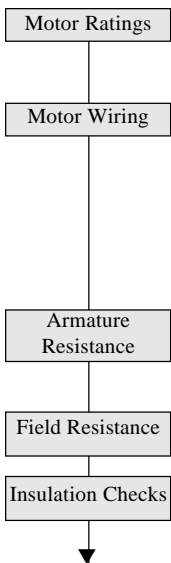
### WARNING!

Confirm all wiring connections are correct before attempting start up procedures.

---

## CHECK MOTOR

After wiring and installing the 590 DRV Digital drive, make these motor checks *before* applying power.



1. Check and record nameplate information from the motor for future reference.
2. Verify that the motor wiring agrees with the motor installation drawings, if available. Be sure to check the motor field wiring. Some motors have two winding fields which require a series or parallel connection depending on the supply and torque requirements. Verify that the drive field supply output does not exceed the voltage rating of the motor field. If this voltage exceeds the field rating, supply the field power externally with the correct AC supply (refer to Figure 3.4 or 3.5 in Chapter 3).
3. Use an ohmmeter to check insulation and continuity on the motor's armature and field. Use the following as a guide for measuring continuity and resistance through the armature and field:

Armature resistance < 1 W (about 3 W for motors rated under 10 HP).

$$\text{Field resistance} = \frac{\text{Motor nameplate field voltage}}{\text{Motor nameplate field current}}$$

Insulation checks help ensure that there are no shorts in the motor. Use an ohmmeter set to its highest setting and measure the resistance between each conductor and ground. All readings should be greater than 10 MW. If available, use a megger to check for insulation faults in the motor armature and field windings.

Voltage & Current  
Calibration

### WARNING!

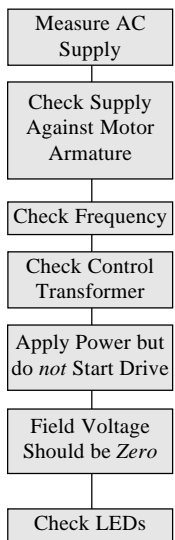
Disconnect or isolate motor connections from the controller before performing a megger insulation, or high voltage tests on the motor windings.

4. Make sure *all* settings on the 590 DRV Digital drive calibration card are set to the correct values for your motor dataplate information (see the calibration card information in Chapter 3). Standard 590 DRV Digital drives up *through* 400 HP come equipped with a switch selectable calibration card; higher horsepower models require the resistor-adjustable calibration card.

## CHECK SUPPLY

### WARNING!

Measure and verify the power supply to the drive *before* applying power to the input of the drive.

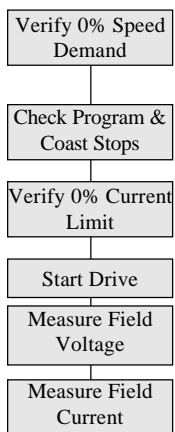


1. Measure each leg of the three-phase power supply to ensure they are within  $\pm 10\%$  of motor supply requirements. The controller has multiple ratings. Check whether the supply is suitable to attain the maximum desired armature voltage. Generally, the maximum armature voltage for a three phase DC drive is 110% of the AC supply voltage. A 240 VDC armature motor requires a 230 VAC supply; 500 VDC motor needs a 480 VAC supply. Consult the factory for other ratings.
2. If a frequency meter is available, measure the incoming line frequency. The frequency should not vary more beyond the acceptable range of 40 to 70 Hz.
3. Verify that the control transformer inside the 590 DRV Digital drive is tapped for the supply voltage.
4. Connect power but do *not* start the drive. The drive should now receive control power and the MMI display should read 590 DC DRIVE:: MENU LEVEL. Check the motor field voltage with a voltmeter once power is on. If the drive is supplying voltage to the motor field, the field should not receive power until the drive is started.
5. Check that the six diagnostic LED's show a normal stop condition (that is, the RUN and START LEDs are off with the other four LEDs illuminated) and that the motor is free to rotate. The PROGRAM and COAST STOP inputs (terminals B8 and B9) should be TRUE.

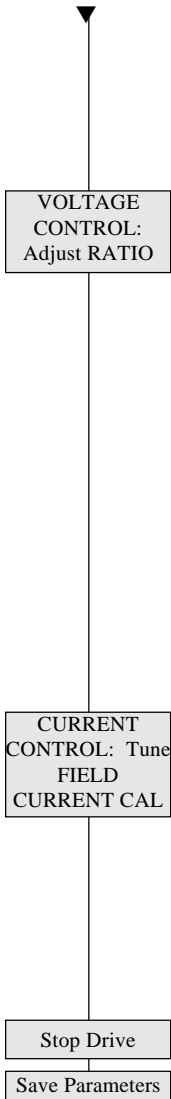
## INITIAL DRIVE START

### WARNING!

Before starting the drive for the first time, make sure that your motor is uncoupled from the load, or ensure that the motor load can move without causing mechanical damage or danger to personnel.



1. Give a 0% speed demand to the drive. Check all drive speed reference inputs in the MMI under DIAGNOSTICS:: SETPOINT SUM OUTPUT and SPEED SETPOINT. Ensure that the total speed setpoint to the drive is zero.
2. Set SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to 0.00%.
2. Ensure the PROGRAM STOP and COAST STOP LEDs are on (+24 VDC at terminals B8 and B9).
3. Set SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to 0.00%.
4. Start the drive by energizing terminal C3 (START/RUN). If the drive is wired to supply power to the motor field, measure the field voltage with a DC voltmeter and verify that it matches the motor nameplate rating. Measure the motor field current if a Hall effect current meter is available. If the motor field voltage or current is incorrect, follow the steps below to tune in the correct field supply.



**WARNING!**

Failure to set up the field supply correctly can cause dangerous overspeed conditions resulting in serious equipment damage or injury to personnel. Do not continue the start up procedure until the DC field supply is within its required rating.

**FIELD IN VOLTAGE CONTROL:**

- i. Set the field control mode to voltage control by setting SETUP PARAMETERS:: FIELD CONTROL:: FLD CTRL MODE IS to VOLTAGE CONTROL. Check that the motor field current setting is calibrated for 0.2 amps. If using a resistor calibration card, make certain the field voltage calibration resistors R12 and R13 total to 100 kW .
- ii. Measure the field voltage on terminals F- and F+ and verify that it equals the motor nameplate rating.
- iii. Adjust SETUP PARAMETERS:: FIELD CONTROL:: VOLTAGE VARIABLES:: RATIO OUT/IN until the voltage equals field voltage rating on the motor nameplate label.
- iv. Measure the motor field current if a Hall effect current meter is available.

**NOTE.** Because a DC motor's field impedance increases with temperature, the field current of a motor in voltage control can read lower than the nameplate rating when the field is initially powered. The current should rise to its nominal value as the motor warms up.

**FIELD IN CURRENT CONTROL:**

- i. Set the field control mode to current control by setting SETUP PARAMETERS:: FIELD CONTROL:: FLD CTRL MODE IS to CURRENT CONTROL

**NOTE.** FLD CTRL MODE IS *must* be set to CURRENT CONTROL when operating the motor in field weakening mode.

- ii. Measure the motor field current if a Hall effect current meter and adjust SETUP PARAMETERS:: CALIBRATION:: FIELD I CAL until the measured field current equals the field current rating on the motor nameplate label.

5. Stop the drive.

6. If any changes were made to the drive's parameters settings, SAVE PARAMETERS.

**ADJUST CURRENT LOOP (AUTOTUNE)**

**Caution**

This is an essential step in setting up your 590 DRV Digital drive and *should not* be overlooked.

The AUTOTUNE function tunes the current loop automatically and sets the proportional gain, integral gain, and the discontinuous/continuous breakpoint for optimum drive response for a given motor. The drive cannot achieve peak performance without properly setting these parameters. Perform a complete AUTOTUNE procedure at least once with each controller/motor combination, or if the motor armature or field windings have been rewound.

**NOTE.** AUTOTUNE may not work on motors with either very long or very short time constants (for example, very short time constant permanent magnet motors). In these instances the current loop must be tuned manually. Contact Eurotherm Drives Customer Service for assistance.

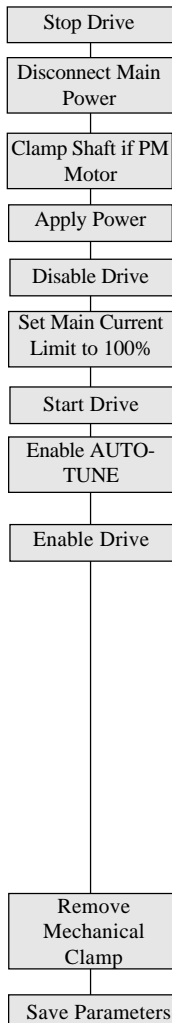
AUTOTUNE can be used for shunt-wound, compound-wound, and permanent magnet motors. The shaft on compound-wound and permanent magnet motors must be locked for AUTOTUNE to work. For shunt wound motors, the shaft may need to be clamped if a residual field causes the motor to rotate during AUTOTUNE. Any rotation of the motor during the AUTOTUNE procedure causes AUTOTUNE to abort.



## AUTOTUNE Procedure

### WARNING!

Make sure it is safe to power and turn the motor and that operation of the motor and the drive will not pose a danger to personnel or equipment.



1. Stop the drive (remove the START/RUN signal) then disconnect the main supply power.
2. The motor shaft may need to be clamped to prevent rotation during the AUTOTUNE procedure. If you are using a permanent magnet motor, it *must* be clamped.
3. Turn on the main supply power. Make sure the PROGRAM STOP and COAST STOP LEDs are on (+24 VDC at terminals B8 and B9).
4. Disable the drive by removing +24 VDC from terminal C5 (ENABLE). This can also be done with the MMI under SETUP PARAMETERS:: AUX I/O.
5. Set SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to 100%, the MMI default setting.
6. Start the drive, then enable AUTOTUNE by setting SETUP PARAMETERS:: CURRENT LOOP:: AUTOTUNE to ON. The drive should start but should not generate motor current.
7. Enable the armature current. At this point, the drive performs the AUTOTUNE function automatically, setting the following parameters:
  - a. SETUP PARAMETERS:: CURRENT LOOP:: PROP. GAIN
  - b. SETUP PARAMETERS:: CURRENT LOOP:: INT. GAIN
  - c. SETUP PARAMETERS:: CURRENT LOOP:: DISCONTINUOUS

These parameters give optimum performance of the current loop and should *not* be adjusted outside the AUTOTUNE algorithm.
8. Once AUTOTUNE is finished, the main contactor should open automatically, signaling the end of the procedure. The controller returns to a safe, stopped condition with the HEALTH, RUN and START CONTACTOR LED's turned off. If the motor rotates during the procedure, AUTOTUNE ceases automatically causing an AUTOTUNE FAILURE alarm. Removing the RUN or ENABLE signals during AUTOTUNE also aborts this procedure (in both cases, the armature current is disabled and the main contactor opens).
9. Remove the clamp, if fitted, from the motor.
10. SAVE PARAMETERS when finished.

### Armature Current Waveform Check

Because there is no field voltage, the drive conducts full load current through the armature during an AUTOTUNE. You can monitor the armature current waveform with an oscilloscope to verify correct operation of the controller. Attach the oscilloscope leads to the Armature Current test point and the Sig. Ground test point. Refer to Figure 5.21 in Chapter 5 for the drive's test point locations. At full rated current, the armature current signal should average 5.0 volts. There should be six current pulses per mains cycle at all times. The pulses should be uniformly shaped and evenly spaced (see Figure 5.1), each with a width of 2.8 mS on 60 Hertz supplies, and 3.3 mS on 50 Hertz supplies.

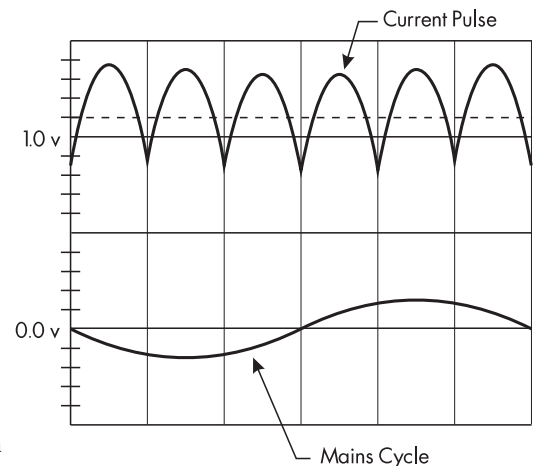
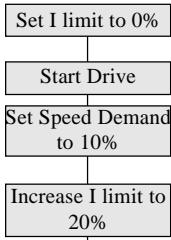


Figure 4.1- Armature Current Waveform

## MOTOR ROTATION CHECK

This procedure verifies that the motor shaft rotates in control and in the desired direction.



1. Set SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to 0%.
2. Start the drive and set your drive speed reference potentiometer to +1.0 VDC or +10%. Make certain that any trim speeds or additional setpoints are set to 0%. Check that DIAGNOSTICS:: SPT. SUM OUTPUT is indeed +10%. You can monitor all the drive's speed references under SETUP PARAMETERS:: SPEED LOOP:: SETPOINTS.
3. Slowly increase SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to approximately 20%.
4. The motor speed should increase to 10% speed in the desired direction. If the feedback or field polarity is incorrect, the motor will either run away, or run in control in the wrong direction. If either situation occurs, stop the drive, disconnect the main supply and external field supply (if used) and check the following:
  - a. For motors fitted with analog DC tachometer generators:
    - Did the motor run away in the correct direction? Reverse the tachometer generator wires.
    - Did the motor run away in the wrong direction? Reverse the field connections.
    - Did the motor rotate in the wrong direction but at the correct speed? Reverse both the field and tachometer generator connections.
  - b. For motors fitted AC tachometer generators:
    - Did the motor run away in the correct direction or in the wrong direction? Reapply power and check the speed setpoint. Because an AC tachometer generator provides a unipolar output regardless of direction of rotation, the drive is limited to speed control in one direction only.

DC Tach

AC Tach

This speed reference *must* be positive. If the motor ran away in reverse, provide a positive speed reference and reverse the field connections.

### Caution

A runaway condition always exists when using an AC tachometer generator on a regenerative model DC controller, even if the speed reference is always positive. To avoid this problem, use the 591SP (non-regenerative) drive on a motor with an AC tachometer generator. Or, use the regenerative 590 DRV Digital drive and disable the drive's reverse bridge thyristors under SETUP PARAMETERS:: CURRENT LOOP:: REGEN MODE.

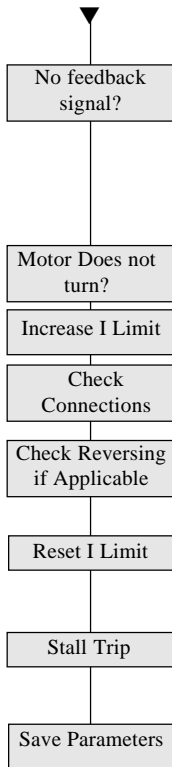
NON-regen *only*  
for AC Tachs

- Did the motor rotate in the wrong direction but at the correct speed? Reverse the field connections.
- c. For motors fitted with 5701/5901 Microtachs or wire-ended electrical encoders:
    - Did the motor run away in the correct direction? Reconnect the drive supply and change the feedback sign by setting SETUP PARAMETERS:: SPEED LOOP:: ENCODER SIGN to POSITIVE or NEGATIVE as required.
    - Did the motor run away in the wrong direction? Reverse the field leads.
    - Did the motor rotate in the wrong direction but at the correct speed? Reverse the field connections, reconnect the drive supply and reverse the feedback sign by setting ENCODER SIGN to POSITIVE or NEGATIVE as required.

### Caution

When changing set up parameters (such as feedback polarity), be certain to save the change before disconnecting control power or the set up will be lost.

Microtach/  
Encoder



5. If the motor continues to run away after checking the feedback sign and field polarity check whether the drive actually receives its speed feedback signal. Monitor **DIAGNOSTICS:: TACH VOLTS** when using an analog tachometer generator. For Microtach or wire-ended encoders, check **DIAGNOSTICS:: ENCODER RPM**. Verify the connections and supply wiring to the feedback device if it fails to generate a feedback signal. If the drive trips on either **SPEED FEEDBACK** alarm or **ENCODER FAILED** alarm, verify that the **SPDFBK ALARM LEVEL**, **ENCODER RPM** and **ENCODER LINES** parameters are properly set.

6. If the motor does not turn at all, increase the **CURRENT LIMIT** to 50% or greater and monitor **DIAGNOSTIC:: CURRENT FEEDBACK**. If **CURRENT FEEDBACK** still reads 0.00%, turn the power off and check the armature connections. If the problem persists, refer to Chapter 7 for detailed troubleshooting information.

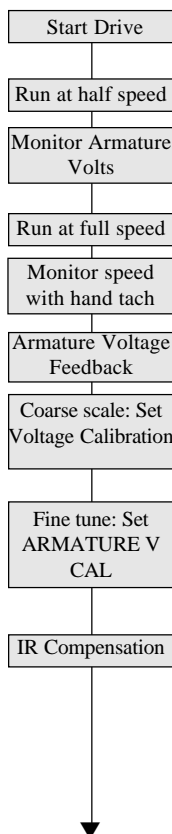
7. If the drive is regenerative and the application requires reverse rotation, provide a negative speed demand, start the drive and verify that the motor runs in the reverse direction.

8. After you have correctly set the direction of rotation, reset **CURRENT LIMIT** to the desired value. If in doubt, set **CURRENT LIMIT** to 110% to correspond to 110% full load current. If **CURRENT LIMIT** is set to a maximum 200%, and the motor runs into an overload condition, the current limit automatically reduces on an inverse time curve from the overload level down to 110% full load current.

**NOTE.** The motor may overheat if it continues to rotate while at current limit. Thermal protection should be provided. If the motor is overloaded and there is insufficient controller current to maintain rotation, the motor will stall, and the controller will trip out on the **STALL TRIP** alarm if this alarm is enabled.

9. Stop the drive then **SAVE PARAMETERS**.

## SPEED FEEDBACK CALIBRATION



Start the drive, gradually increase the speed demand signal to 50% and monitor **DIAGNOSTICS:: TERMINAL VOLTS**. Measure the armature voltage on the drive output with a DC voltmeter. **TERMINAL VOLTS** should read within 10% of the actual value. For example, when measuring armature volts at terminals A+ and A- with a voltmeter, a 500 VDC armature should read 250 VDC at 50% speed demand and **TERMINAL VOLTS** should be within 45 to 55%. If the reading is outside this range, check the drive's voltage calibration before continuing.

Increase the speed demand to 100% and check the shaft speed accuracy with a hand tachometer. Measure the armature voltage. If fine adjustment is needed, adjust the drive's calibration according to the speed feedback selection.

### 1. ARMATURE VOLTAGE FEEDBACK

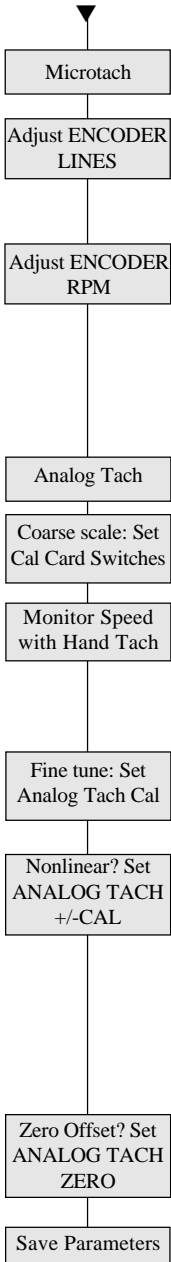
Armature voltage feedback uses the motor's back EMF as speed feedback and is the drive's default feedback setting. It requires no feedback device, isolator or additional external connections. The scaling parameter, **SETUP PARAMETERS:: CALIBRATION:: ARMATURE V CAL**, fine tunes the drive's armature voltage calibration and has a range of 1.1000 to 0.9800, corresponding to -10% to +2% trim. Changes outside this range require re-calibration as described in Chapter 3.

### IR COMPENSATION SETUP

Properly setting the **IR COMPENSATION** parameter, or motor loss compensation, improves the speed accuracy when running in armature voltage feedback.

- Run the motor without a load. Monitor the actual speed with a hand tachometer.
- With the same speed setpoint, run the motor at full load and monitor the actual speed again with a hand tachometer.
- Adjust **IR COMPENSATION** until the full load speed is the same as the no load speed.

**NOTE.** Too much **IR COMPENSATION** causes instability.



2. MICROTACH or WIRE-ENDED ELECTRICAL ENCODERS

- Ensure that the CALIBRATION:: ENCODER LINES parameter equals the pulses per revolution rating of the encoder (1000 for Microtachs). You can read the feedback encoder rpm under DIAGNOSTICS:: ENCODER RPM in the MMI or in SAM under the FEEDBACK software block.
- Adjust the calibration parameter SETUP PARAMETERS:: CALIBRATION:: ENCODER RPM to accurately tune the motor rotational speed to the roll speed with a hand tachometer. Either feedback device gives an absolute rotational speed for which adjustment is unnecessary; however, the process may require an accurately set speed calibration. Speed match the motor through the ratio calculation:

$$\text{New ENCODER Rpm Setting} = \text{Present ENCODER Rpm Setting} \times \frac{\text{Desired Rpm}}{\text{Measured Rpm}}$$

3. AC/DC ANALOG TACHOMETER GENERATOR

- Settings on the analog tachometer generator feedback option card or resistor values on the resistor calibration card give a coarse scaling of the analog tachometer generator feedback voltage. Fine tune the feedback by adjusting drive software parameters.

Use a hand tachometer to measure the motor speed and adjust SETUP PARAMETERS:: CALIBRATION:: ANALOG TACH CAL to scale the overall feedback. Speed match the motor through the ratio calculation:

$$\text{New ANALOG TACH CAL Setting} = \frac{\text{Present ANALOG TACH CAL Setting} \times \text{Desired Rpm}}{\text{Measured Rpm}}$$

The gain range varies from 1.1000 to 0.9800, or -10% to +2% trim. Changes outside this range require a re-calibration of the feedback calibration card as described in Appendix A.

- Use CALIBRATION:: ANALOG TACH -CAL and ANALOG TACH +CAL to tune out a nonlinear analog tachometer generator response *only*. Adjust ANALOG TACH +CAL for a non-linearity at the positive high volt (full speed forward) end of the response curve; change ANALOG TACH -CAL to tune out a non-linearity at the negative high volt (full speed reverse) end. These parameters vary over a range of 1.1000 to 0.9800, but are generally left at 1.0000.

NOTE. It is usually unnecessary to change the ANALOG TACH -CAL and the ANALOG TACH +CAL parameters from their default value of 1.0000, except in cases of extreme non-linearity. For a tachometer whose observed accuracy is within the tachometer's rated accuracy, adjustment is not recommended and will complicate speed calibration.

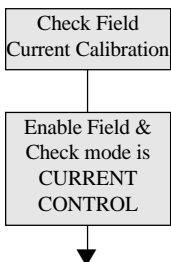
- Some tachometer generators generate a nonzero voltage at zero speed. Use ANALOG TACH ZERO to tune out the offset.

4. SAVE PARAMETERS when finished.

**SETUP FOR FIELD WEAKENING**

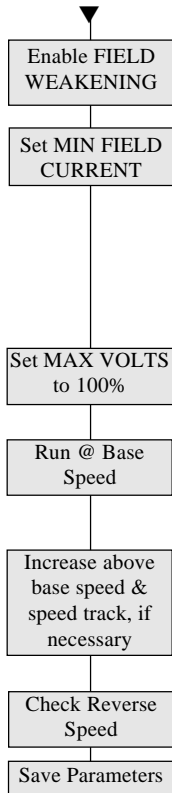
If the motor requires field weakening to achieve top speed, follow these steps.

NOTE. Field weakening requires tachometer generator, wire-ended or Microtach encoder speed feedback.



1. With no power supplied to the drive, set the field current calibration on the switchable or resistor calibration card as described in Chapter 3. Many field weakened motor give the field current as two values, a minimum and a maximum, indicating the field weakened range of the motor. Calibrate the motor field for the larger of these two values.
2. Set SETUP PARAMETERS:: FIELD CONTROL:: FIELD CTRL MODE IS to CURRENT CONTROL and verify the field is enabled by monitoring parameter SETUP PARAMETERS:: FIELD CONTROL:: FIELD ENABLE.





3. Verify that SETUP PARAMETERS:: FIELD CONTROL:: FLD CURRENT VARS:: FLD WEAK VARS:: FLD WEAK ENABLE is ENABLED:
4. Ensure that SETUP PARAMETERS:: FIELD CONTROL:: FLD CURRENT VARS:: FLD WEAK VARS:: MIN FLD CURRENT is set correctly for the motor to reach top speed. MIN FLD CURRENT is calculated using the formula:

$$(\text{minimum field current} \div \text{maximum field current}) \times 90\%$$

This sets MIN FLD CURRENT 10 percent lower than the field calculated to reach full speed. The minimum and maximum field currents are found on the motor nameplate label. The 10 percent cushion should overcome any inaccuracies in the nameplate data.

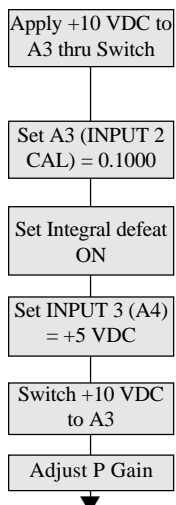
5. Adjust the maximum armature volts to 100 percent using parameter SETUP PARAMETERS:: FIELD CONTROL:: FLD CURRENT VARS:: FLD WEAK VARS:: MAX VOLTS.
6. Run the drive up to base speed. Monitor DIAGNOSTICS:: TERMINAL VOLTS to verify that the armature voltage is approximately equal to the value calculated in the previous step.
7. Increase speed above base speed by adjusting the speed potentiometer, checking that the motor armature volts remain constant while the field gradually decreases. Gradually increase to maximum speed, monitoring armature volts at maximum speed. Adjust the speed using the appropriate speed feedback calibration parameters, for example ANALOG TACH CAL when using analog tachometer generator feedback.
8. For regenerative, reversing drives, check the maximum reverse speed. Correct any asymmetry in a reversing drive by adjusting SETUP PARAMETERS:: CALIBRATION:: ZERO SPD. OFFSET.
9. Stop the drive and SAVE PARAMETERS.

## ADJUST SPEED LOOP

After calibrating the motor speed, tune the speed loop proportional gain (PROP. GAIN) and integral time constant (INT. TIME CONST) settings for optimum speed response. For this procedure, monitor the speed feedback with an oscilloscope at the Analog Tach test point pin on the control board (refer to Figure 5.19 in Chapter 5).

**NOTE.** Adjust the speed loop only *after* tuning the current loop with AUTOTUNE. Make certain the motor is connected to the load it will normally be running.

PROP. GAIN scales the output based upon the input speed error. Increasing PROP. GAIN improves response time but also increases overshoot. INT. TIME CONST eliminates steady-state error. Reducing INT. TIME CONST improves response, but will cause instability if set too short.



1. Connect terminal B3 (+10 VDC) through a switch to terminal A3. This will provide the step change input for verifying speed loop performance.
2. Calibrate terminal A3 for 10% output by setting SETUP PARAMETERS:: SPEED LOOP:: SETPOINTS:: RATIO 2 (A3) to 0.1000.
3. Set SETUP PARAMETERS:: SPEED LOOP:: INT. DEFEAT to ON. This disables the integral gain.
4. Run the motor at a typical operating speed through the speed ramp input, terminal A4. The speed should not exceed 50 percent.
5. Check the speed loop performance by making step changes using the switch at terminal A3. Increase SETUP PARAMETERS:: SPEED LOOP:: PROP. GAIN until the response is critically damped as illustrated above.

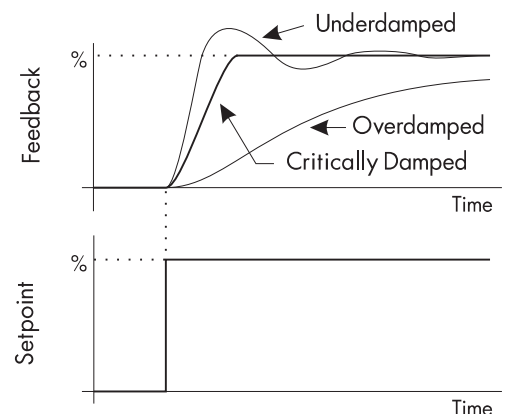
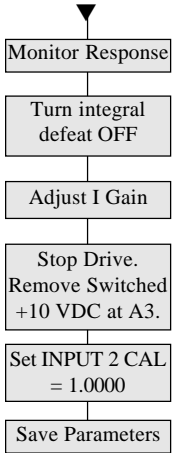


Figure 4.2 - Response to Step Input



6. Once stable proportional control is attained, set SETUP PARAMETERS:: SPEED LOOP:: INT. DEFEAT to OFF.
  7. Check the speed loop performance by making step changes using the switch at terminal A3. Reduce SETUP PARAMETERS:: SPEED LOOP:: INT. TIME CONST until the response is critically damped.
- NOTE. The default value for INT. TIME CONST is 0.5 seconds. That value may be too small for large inertia loads and cause the system to be unstable from the start.
8. Stop the drive and remove the switched signal from terminal A3.
  9. Reset the calibration for terminal A3 back to 100% by setting SYSTEM:: CONFIGURE I/O:: ANALOG INPUTS:: ANIN 2 (A3) to 1.0000, then run normally.
  10. SAVE PARAMETERS.

### OTHER PARAMETERS

Other parameters, for example ramp rates, may be important for the process. Different ramp rates are available for various conditions:

Condition	Parameter Name	Menu
Speed Setpoint Change	RAMP ACCEL TIME and RAMP DECEL TIME	RAMPS
Jog Acceleration/Deceleration	RAMP RATE	JOG/SLACK
Controlled Stop Deceleration	STOP TIME	STOP RATES
Fast Stop Deceleration	PROGRAM STOP TIME	STOP RATES
Electronic MOP Control	INCREASE RATE and DECREASE RATE	RAISE/LOWER

Appendix C fully discusses the functionality and scaling of all drive parameters.

### RECORDING PARAMETERS

It is important to have a hard copy of your drive parameters. This copy might consist of writing down the information on a chart, saving the parameters to a computer disk, or printing the parameters using an external computer. The parameter list in Appendix C has two empty columns for manually recording the drive parameters.

To save the parameters as either a hexadecimal ASCII file or as a text file ready for printing, connect a computer to the P3 serial port. Use a telecommunications program, such as Procomm™, Windows Terminal™, or other terminal emulation programs. Refer to "Using Microsoft® Windows™ to Document and Clone 590 DRV Digital Drives" (HA352155) for detailed instructions using Windows Terminal™ for uploading and downloading drive parameters. Appendix G also contains general information for using P3 to upload and download drive parameters.

### PASSWORD PROTECTION

To safeguard the parameters you have set with the MMI, you can configure the 590 DRV Digital drive in a password-protected mode. At the initial power up, the DISPLAY PASSWORD command is automatically cleared to zero. If the controller password is set at any value other than zero, the MMI is in a restricted mode and the MMI display can be displayed but not altered.

### Entering a Password

To access the password configuration procedure from the main menu:

- PASSWORD
- M to enter the Password sub-menu
- M to enter the ENTER PASSWORD sub-menu
- ▲ to enter the password on the screen.

## Changing a Password

All 590 DRV Digital drives are shipped with the default password 0x0000 which is displayed in the MMI. If the default password does not work, contact your supplier for the new password. Once you have entered the correct code, you may use the CHANGE PASSWORD function to set your own restricted password.

- PASSWORD
- M to enter Password sub-menu
- ▲ to CHANGE PASSWORD
- M to enter the CHANGE PASSWORD sub-menu
- ▲ to enter a different value (password)
- E to back out one step
- ▲ to move to CLEAR PASSWORD display
- M to clear the password

This clears from view the password you have entered, protecting the settings from those without access to the password.

With password protection installed in your 590 DRV, the parameters available through the MMI can be viewed but not be altered without first entering that password. To edit parameters, you must reenter the password and repeat the procedure described above.

**NOTE.** Be sure to record the new password. If you lose your password, you will be unable to change parameters.

## 4-Button Reset

A 4-Button Reset loads the drive's default parameters into the drive's operating memory; erasing all customized settings and connections. It is often used to reset the drive when troubleshooting procedures fail. See Appendix B for more information on using the MMI and performing a 4-Button Reset.

# Chapter 5 TROUBLESHOOTING

The most valuable tools for finding and resolving faults are the MMI and the LED display. You can also monitor alarms and troubleshoot faults remotely through a computer interface if a RS422 serial communications option card (AH385826U001) is installed on the drive.

## INITIAL TROUBLESHOOTING PROCEDURE

Most drive problems are encountered during commissioning or soon after start-up. Problems frequently result from incorrect installation or errors in configuring the drive. If you encounter a problem upon initial start up of your 590 DRV Digital drive, review the installation procedures in Chapter 3 and the start up and adjustment procedures in Chapter 4. If you have reviewed your installation and initial start up procedures and all seems to be in order, proceed to the troubleshooting methods in this chapter.

Use the flowchart in Figure 5.1 to begin troubleshooting.

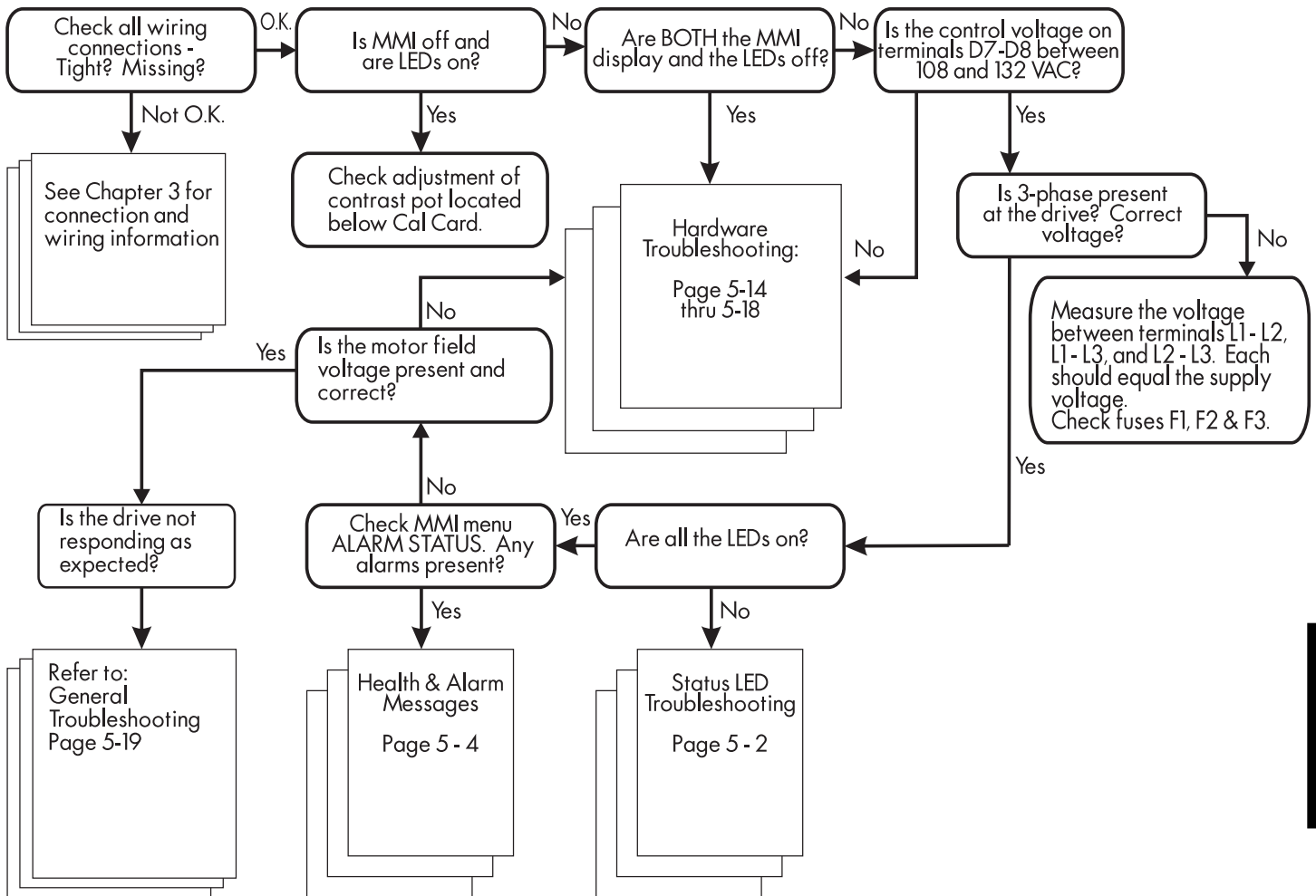


Figure 5.1 - Initial Troubleshooting Procedure





## Recommended Tools

You will need the following tools for most troubleshooting procedures:

- Voltmeter
- Megger

If available, the following tools can provide more detailed information for problem-solving:

- Oscilloscope
- Hand tachometer

You may also need screwdrivers and/or wrenches to restore electrical connections that are incorrect or have come loose.

## STATUS LED TROUBLESHOOTING

Six light emitting diode [LED] indicators are located just to the right of the MMI display. The LEDs indicate six status conditions on the drive: health, run, start contactor, overcurrent trip, program stop, and coast stop.

## LED Functions

The HEALTH and RUN LEDs are software driven. The health LED turns ON when control power is applied and remains ON if the drive passes all 18 diagnostic alarm points the drive continuously monitors while running. If an alarm fault occurs, the drive's MMI displays the associated alarm message and the HEALTH LED turns off. The RUN LED turns ON after the following sequence occurs: the drive receives start command through the RUN or JOG input (terminals C3 or C4), the drive is healthy, the thyristor bridge circuit enables and the start contactor energizes. The RUN LED turns OFF whenever the drive is disabled. This LED also turns OFF if the drive's internal start relay de-energizes, or if a fault occurs.

The four remaining LEDs— START CONTACTOR, OVERCURRENT TRIP, PROGRAM STOP, and COAST STOP— are hardware driven. The START CONTACTOR LED is ON whenever the drive's internal start relay is energized. PROGRAM STOP and COAST STOP are ON whenever +24 VDC is connected to terminals B8 (PROGRAM STOP) and B9 (COAST STOP). These terminals are normally switched to terminal C9 +24 VDC through an external emergency stop relay.

LED Name	Sample Displays				On ●	Off ○
	●	○	○	●	●	○
HEALTH	●	○	○	●	●	○
RUN	○	○	○	○	○	●
START CONTACTOR	○	○	○	●	○	●
OVERCURRENT TRIP	●	●	○	●	●	●
PROGRAM STOP	●	●	●	●	○	●
COAST STOP	●	●	●	●	●	○

Normal Stop —

Alarm —

Alarm  
MMI display will show the first fault.

Alarm  
Overcurrent Trip

Drive Started but not enabled (C3)

Drive Stop  
Controlled stop input

Drive stop  
Coast stop input

Normal Run —

Figure 5.2 - Sample LED Status Modes

All six LEDs are ON under normal running conditions. Figure 5.2 shows the LED states after common actions and other faults occur. An unlit LED indicates a problem that prevents controller operation and requires user attention. The table in Figure 5.3 shows what to check when an LED is off.

LED NAME	MEANING WHEN OFF	POSSIBLE CAUSE	CORRECTIVE ACTION
HEALTH	Fault has occurred and is shown by the other LED status' and the MMI display.	Any of the drive's possible fault conditions.	Check the MMI for alarms. Go to the ALARM MESSAGES section for troubleshooting tips.
RUN	The drive is not enabled or in the RUN state.	The thyristor bridge is disabled	Check all enable input (terminal C5) circuitry.
		The main contactor is de-energized.	Check for loose wires from the drive to the contactor coil.
		Another alarm is present.	Go to the ALARM MESSAGES section for troubleshooting tips.
START CONTACTOR	The start contactor is open.	24 VDC signal is not present at terminal C3.	Check the RUN circuitry.
OVERCURRENT TRIP	Armature current has exceeded 300 percent full load.	The armature is calibrated wrong.	Check the armature current calibration on the calibration board.
		Mechanical binding on the motor is preventing free movement.	Inspect motor couplings, linkages, bearings, etc.
		Field voltage too low.	Check field supply and verify motor field voltage.
PROGRAM STOP	24 VDC signal not present at terminal B8. The main contactor will drop out once the motor has completed a controlled stop.	Emergency stop is engaged or other external logic or safety interlocks are preventing 24 VDC from being present at B8.	Ensure the "B" terminal block is fully engaged on the control door. Check all safety interlocks in the external logic.
		24 VDC supply has failed.	Check for 24 VDC at terminal C9 or the external 24 VDC supply if used.
COAST STOP	24 VDC signal not present at terminal B9. The main contactor is de-energized and the motor will coast to a stop.	Emergency stop is engaged or other external logic or safety interlocks are preventing 24 VDC from being present at B9.	Ensure the "B" terminal block is fully engaged on the control door. Check all safety interlocks in the external logic.
		24 VDC supply has failed.	Check for 24 VDC at terminal C9 or the external 24 VDC supply if used.

Figure 5.3 - Status LED Troubleshooting Procedures

## HEALTH, ALARM MESSAGES AND THE TRIP RESET

The controller continuously monitors 19 alarms while the drive is running. These alarms are gated together to provide an overall "controller healthy" logic variable. This variable corresponds to the ALARM STATUS software block output HEALTHY (tag number 122).

The default shipped drive configuration of the 590 DRV Digital drive tags the HEALTHY logic parameter to digital O/P 2 (terminal B6).

If a fault occurs while the controller is running, HEALTHY switches FALSE and the drive immediately inhibits the thyristor firing circuit. The drive then deenergizes the main contactor and the MMI displays the *last* fault registered, or the fault which interrupts controller operation. If TRIP RESET (parameter tag 305 set under the SETUP PARAMETERS:: INHIBIT ALARMS menu) is TRUE, the HEALTHY output remains FALSE until the RUN input (terminal C3) switches LOW, as shown in the left portion of Figure 5.4.

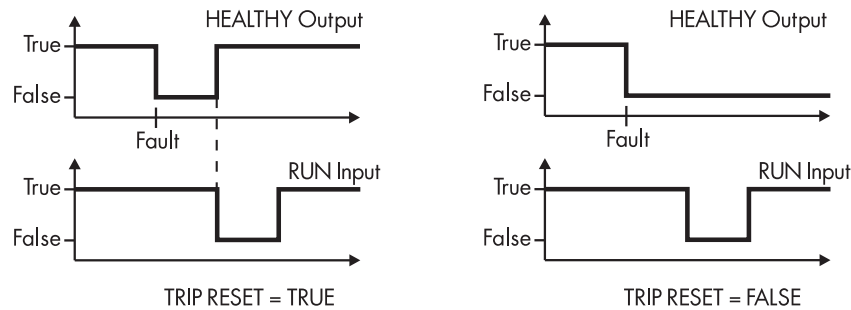


Figure 5.4 - HEALTHY Output Logic

If a restart is attempted without first clearing the fault, HEALTHY will again switch FALSE and the drive will not enable the thyristors and reenergize the main contactor. If TRIP RESET is FALSE, the drive cannot restart regardless of the state of the RUN input or whether or not the fault is cleared.

The tables in Figures 5.5 through 5.10 describe the different alarms the MMI displays when the drive trips out on a fault, the fault's symptoms and recommended corrective action.

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** ALARM *** 3 PHASE FAILED	One or more phases of the 3 phase supply is missing, or below 208 volts.	Supply voltage low or a phase is missing.	Check 3 phase input voltages L1, L2, L3.
		Blown fuse.	Check fuses F1, F2, F3, FS4, FS5, and FS6 and external line fuses. Check armature current calibration does not exceed drive rating.
		Loose wiring.	Check all power wiring for tightness.
		Defective power supply pcb.	Replace power supply pcb.
*** ALARM *** ACCTS FAILED	ACCT (Alternating Current Current Transformer) armature feedback sensing hardware interlock not made.	Plug PLK not inserted or output wires of ACCT severed.	Insert PLK in socket on power supply PCB. Check output wires of ACCT.
*** ALARM *** AUTOTUNE ABORTED	Enable, or Start/Run commands removed before AUTOTUNE procedure completed.	Wrong AUTOTUNE sequence followed.	Repeat AUTOTUNE procedure.
		AUTOTUNE incomplete. (After 2 minutes drive will time out if still in AUTOTUNE mode).	Repeat AUTOTUNE procedure. If problem persists contact Eurotherm Drives customer service.
*** ALARM *** CAL CARD	Calibration hardware interlock not made.	Calibration card missing or improperly fitted.	Check that calibration card is fully inserted on mounting pins on control door.

Figure 5.5 - Alarm Messages

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** ALARM *** AUTOTUNE ERROR	Motor rotation detected during Autotune process (speed feedback greater than 20%), or Field current detected during AUTOTUNE. (Field current greater than 6%).	Residual motor flux when field regulator disabled.	Lock motor armature and repeat AUTOTUNE procedure.
		Series field winding connected in motor.	Series fields are not recommended for regenerative drives and the series field winding should normally be left open circuit. If a series field is required, either lock the motor shaft or temporarily disconnect the series field and repeat the AUTOTUNE procedure.
		Permanent magnet motor.	Lock motor armature and repeat AUTOTUNE procedure.
		Separately supplied field.	Disable external field supply and repeat AUTOTUNE procedure.
		Old style power chassis with field diode bridge.	On older units fitted with a diode bridge field supply the field wiring must be disconnected to achieve zero current for AUTOTUNE purposes.
*** ALARM *** ENCODER FAILED	Feedback hardware removed or not fitted when ENCODER FEEDBACK has been selected, or Microtach feedback has fiber optic overdrive, underdrive, or phase lock alarm when Encoder Feedback has been selected (see Microtach Feedback).	Encoder or Microtach feedback option card incorrectly fitted to control door.	Check that encoder or Microtach feedback card is properly fitted to the control door. If using an analog tachometer or armature voltage feedback, make sure that the SPEED FEEDBACK SELECT parameter is set to ANALOG TACH or ARM VOLT FBK.
		Fiber optic cable too long or cable distorted (bend radius too small for example) resulting in too weak a signal at Microtach receiver [under drive].	Check the fiber optic cable run for bends, kinks and continuity. Ensure that the cable installation does not exceed bend radius of fiber optic cable.
		Fiber optic cable too short resulting in too strong a signal at Microtach receiver [over drive].	PLASTIC CABLE: back cable slightly out of hardened input receiver and retighten. GLASS CABLE: attenuate fiber optic signal with longer cable run or by setting (if used) the 5702 or 5904 repeater launch power to lower setting.
*** ALARM *** FIELD FAILED	Field current below 6% in Current Control Mode, or below 12% in Voltage Control Mode.	Field circuit open or shorted.	Check integrity of wiring from drive to motor. Check for continuity, proper termination and insulation wear.
		Using permanent magnet motor.	Disable field using parameter FIELD ENABLE in SETUP PARAMETERS::FIELD CONTROL.
		Drive field current miscalibrated.	Repeat field supply set up procedure in Chapter 5 [see INITIAL DRIVE START and SETUP FOR FIELD WEAKENING].
		Field supply fuse blown.	Check FS4, FS5 or external AC field supply fuses if fitted. Verify motor rating plate current does not exceed drive field current output capability. Check motor field winding resistance. Using a megger, check field wiring for a possible short to ground.
		Field thyristor block defective.	Replace defective field thyristor block.
		Power supply board failed.	Disable field fail alarm by setting SETUP PARAMETERS::INHIBIT ALARMS::FIELD FAIL to INHIBIT. Set MAIN I LIMIT to 0.00%, then start drive and measure field voltage and current. If present, replace power supply board.
		External field supply connected incorrectly.	Check the external field supply phasing [see WIRING PROCEDURES in Chapter 3].

Figure 5.6 - Alarm Messages (Continued)



DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** ALARM *** FIELD OVER I	Field over current. Field current exceeds 120% (alarm only operates if field is in Current Control Mode).	Drive field current miscalibrated.	Repeat field supply set up procedure.
		External field supply connected incorrectly.	Check the external field supply phasing (see Chapter 3).
*** ALARM *** HEATSINK TRIP	Heatsink thermostat open; drive overheated.	Fan failure or obstruction.	Check drive fan rotating (when fans fitted).
		Fan fuse blown.	Check FSI.
		Plug PLN not fully inserted.	Check heatsink plug PLN fully inserted in power supply pcb.
		Inadequate enclosure ventilation.	Check enclosure fan and filter. Check location of drive meets manual installation requirements.
		Extreme ambient temperature.	Measure enclosure internal temperature. Fit ventilation fans or air conditioning if ambient exceeds drive specification [see VENTILATION & COOLING REQUIREMENTS in Chapter 3].
		Drive miscalibrated.	Check drive calibration. Mis-calibration can cause overheating.
INITIALIZING IA FBK CAL FAIL	Armature current feedback calibration fail during the power-up self test.	Armature current feedback current transformers miswired.	Check ACCT wiring and PLK jumpers on the power supply board.
		Control board defective.	Replace control board.
*** ALARM *** MISSING PULSE	Missing armature current pulse. Irregular armature current waveform detected. (Armature current must be 1.5 times the discontinuous current level and missing pulse must be present for 60 seconds for alarm to operate).  NOTE. Ripple from the speed loop can cause unstable current.	Drive not AUTOTUNEd (Unstable current loop).	Perform the AUTOTUNE procedure.
		SCR gate connection loose.	Check SCR gate connections from the trigger board to the SCR gate leads.
		SCR defective.	Check SCRs with an ohmmeter: See SCR Troubleshooting in this chapter.
		SCR firing pcb defective.	Replace the pcb.
		Motor has opened or shorted coil.	Check the motor with an ohmmeter and megger for insulation and continuity.
		Coupling between motor and feedback device slipping	Stop drive and isolate power. Check coupling tightness.
		Feedback device noisy or defective.	Replace tachometer generator if noise is present while observing feedback with an oscilloscope.
		Bottom two LEDs on the 5701 or 5901 Microtach receiver board are out.	Weak feedback signal intensity; check connections, fiber optic wire integrity, and transmission distances.
		Speed loop gain too high.	Retune drive speed loop.

Figure 5.7 - Alarm Messages (Continued)

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** ALARM *** OVER I TRIP	Armature over current trip. Armature current has exceeded 300% of calibration value.	Drive not AUTOTUNEd (Unstable current loop).	The drive AUTOTUNE procedure MUST be followed for the motor the drive is to control. Repeat the AUTOTUNE procedure.
		Drive incorrectly calibrated.	Check the calibration settings.
		Manual tuning of drive leaves current loop unstable.	Current loop response may be manually adjusted only AFTER AUTOTUNing is complete. Check current loop response. THIS IS NOT RECOMMENDED!
		Coupling between motor and feedback device slipping.	Stop drive and isolate power. Check coupling tightness.
		Motor armature faulty.	Check motor resistance to ground. Check for armature shorts.
		Loss of 3 phase supply during regeneration.	Check 3-phase supply branch circuit protection and SCR fuses, F1, F2, and F3.
		ENABLE (A5) activating before DRIVE START when using a DC contactor.	Activate ENABLE (A5) with auxiliary contact off DC contactor. Check for other wires at terminal A5.
		Control Door or Power Supply PCB faulty.	Replace defective board.
*** ALARM *** OVER SPEED	Drive speed feedback exceeded 125% of calibrated value.	Improperly set maximum speed parameters.	Use hand tachometer to ensure proper speed and adjust the speed calibration parameter.
		Wrong type of feedback selected in SPD FDBK SELECT parameter in MMI.	Change parameter to match feedback type.
		Calibration board set incorrectly for analog tachometer generator feedback.	Verify calibration resistors, R6 and R7 or the switchable calibration board settings. Check AC/DC tach switch.
		Improper calibration of drive speed feedback, encoder ppr selection for example.	Recalibrate the speed feedback. Set ENCODER LINES to proper ppr of feedback encoder.
		Improper tuning of speed loop parameters drive overshooting or unstable.	Retune drive speed loop (see Chap 5).
		Coupling between motor and feedback device slipping.	Stop drive and isolate power. Check tightness of coupling.
		Feedback device noisy or defective.	Replace tachometer generator. Use scope & check for noise.
		Bottom two LEDs on the 5701 or 5901 Microtach receiver board are out.	Weak feedback signal intensity; check signal dB, connections, fiber optic wire integrity, and transmission distances.
		Field weakening parameters incorrectly set.	Reconfigure the field weakening parameters as described in Chapter 5.
		Drive operating as current regulator.	Check external speed loop adjustments.

Figure 5.8 - Alarm Messages (Continued)



DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** ALARM *** OVER VOLTS (VA)	Armature voltage exceeded 120% of calibrate value.	Drive miscalibrated for motor armature voltage.	Check armature voltage calibration matches motor nameplate information
		Drive miscalibrated for field voltage ratio [voltage mode] or field current [current or field weakening mode].	Check field calibration of drive. Check field current not exceeding motor name plate data.
		Armature open circuit.	Check armature wiring. Check armature fuse F7 (regenerative units only).
		Motor maximum speed set incorrectly causing armature voltage to exceed nameplate rating	Change maximum speed parameter to match the nameplate rating.
		Field weakening parameters set incorrectly if using an extended speed range motor.	Change field weakening parameters for use with an extended speed range motor. See Chapter 5.
*** ALARM *** PHASE LOCK	Drive SCR firing phase lock loop unable to lock to supply waveform.	One or more phases of supply low, too high or missing.	Check all three phases of the supply, other equipment on the same supply may be generating voltage in a missing phase. Check fuses F1, F2, F3, FS4, FS5 and FS6.
		Supply waveform badly distorted.	Install line chokes and/or isolation transformers if not present with drive.
		Power supply pcb or control door defective.	Replace the power supply board.
		Supply frequency outside 45-65 Hz range.	Change supply for one within the 45 to 65 Hz range.
*** ALARM *** SPD FEEDBACK	Difference between armature voltage and speed feedback signals exceeded speed feedback alarm threshold setting, or Tachometer feedback signal wrong polarity.	Wrong polarity speed feedback signal.	Reverse tachometer leads, or swap encoders connections.
		Armature volts miscalibrated.	Check armature voltage calibration resistors, R8 and R9, on calibration card or the switchable calibration board settings are correct.
		Tachometer generator miscalibrated.	Check tachometer calibration resistors, R6 and R7, on calibration card are calibrated for the proper feedback voltage at motor top speed.
		Armature voltage sensing leads miswired or damaged.	Check wiring of armature voltage sensing wires AS+, AS- from DC contactor to power supply board.
		Coupling between motor and feedback device slipping.	Stop drive and isolate power. Check tightness of coupling.
		Feedback device noisy or defective.	Replace tachometer generator if noise is observed on the feedback signal with an oscilloscope.
		Bottom two LEDs on the 5701 or 5901 Microtach receiver board are out.	Weak feedback signal intensity; check connections, fiber optic wire integrity, and transmission distances.
		Motor has opened or shorted coils.	Check the motor for insulation and continuity.
		Analog tachometer feedback wires or shield came loose or shorted to ground.	Reconnect the wiring.

Figure 5.9 - Alarm Messages (Continued)

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** ALARM *** STALL TRIP	Drive stall trip has operated  NOTE. The stall trip operates when: Arm. current > Stall Threshold, and the motor is At Zero Speed for a time longer than the Stall Trip Delay (default = 10s).	Stall timer set too short for load acceleration.	Increase stall trip delay and/or stall trip threshold if STALL TRIP is being used.
		Field current below motor nameplate if the drive is in field current control mode.	Confirm motor field current with DC clamp on meter or current meter. Check drive field calibration.
		Field connection miswired.	Check motor field wiring is in accordance to motor prints.
		Motor unable to deliver sufficient torque.	Check motor not undersized for load requirements.
		Mechanical binding of the motor.	Check for mechanical problems which may cause the motor to stall out.
		Field voltage is not set correctly if the drive is in field voltage control mode.	Adjust the RATIO OUT/IN parameter in the field calibration settings section.
*** ALARM *** THERMISTOR	Motor thermistor / thermostat input open or high impedance, motor over temperature.	Motor thermal protection device not wired to drive or thermistor/thermostat open circuited.	Check A1 and A2 connections to drive. Jumper A1 to A2 if motor not fitted with thermal protection device (thermistor/thermostat).
		Blower motor rotating in wrong direction (force ventilated motors).	Check direction of fan agrees with arrow on motor blower assembly, or motor manual.
		Blower filter clogged.	Clean or replace filter.
		Motor operating at low speed/high current.	TEFC motors do not generate sufficient flow of air to provide sustained full load current at low speed. Check gearing and /or reduce mechanical load. Use a higher power motor or provide additional cooling method independent of motor RPM.
		Drive miscalibrated.	Check motor armature and current calibration matches motor name plate information.
		Field miswired.	Check motor field wiring matches motor wiring diagram for field supply.

Figure 5.10 - Alarm Messages (Continued)



## SYMBOLIC ERROR MESSAGES

Symbolic error messages are caused by internal software or hardware errors and will have no obvious meaning to the end user. If a symbolic message appears, cycle power on the controller to clear the fault. If the message repeats, call Eurotherm Drives Customer Service.

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
0xF003	Pre-Ready Fault	Coding not present	Replace power board or chassis. If using an external stack, check the coding supply first.
0xF100	CAM Full		Call Eurotherm Drives Customer Service.
0xFF01	Internal software error in slot-read()		Call Eurotherm Drives Customer Service.
0xFF02	Unimplemented micro opcode		Call Eurotherm Drives Customer Service.
0xFF03	Aux power fail	Controller power supply failure	Check the 120 volt supply to the controller.
0xFF04	"Trap" software interrupt		Call Eurotherm Drives Customer Service.
0xFF05	Internal software error in slot-read-pass()		Call Eurotherm Drives Customer Service.
0xFF05	Internal software error in slot-write()		Call Eurotherm Drives Customer Service.

Figure 5.11 - Symbolic Error Messages

## ALARM PROCESS

The hexadecimal code for the first alarm is saved in HEALTH STORE. HEALTH STORE resets when the drive is restarted. The alarm is also saved in LAST ALARM and stored until another fault trips out the drive or if the control power is removed. All subsequent alarms are not displayed.

The first alarm as well as any subsequent alarms are stored in HEALTH WORD. HEALTH WORD is updated continuously and shows the *current* condition of all alarms. As an alarm is cleared, HEALTH WORD reflects the new condition of all remaining alarms.

You can monitor HEALTH WORD, HEALTH STORE, and LAST ALARM in the MMI under the ALARM STATUS menu.

## Alarm Status

This table lists the bit assignments of the MMI alarms in HEALTH WORD and HEALTH STORE in hexadecimal format. The table also indicates whether you can override the alarm with the SETUP PARAMETERS:: INHIBIT ALARMS menu and lists the delay time of each alarm, if any.

Bit	MMI Alarm	Description	Hex Value	Inhibit?	Delay Time
0	OVERSPEED	motor overspeed	0x0001	no	---
1	MISSING PULSE	unstable or missing armature current pulses	0x0002	no	0.75 sec
2	FIELD OVER I	motor field overcurrent	0x0004	no	---
3	HEATSINK TRI	heatsink over temperature	0x0008	no	---
4	THERMISTOR	motor over temperature	0x0010	no	15 sec
5	OVERVOLTS (VA)	motor armature overvolts	0x0020	no	---
6	SPEED FEEDBACK	speed feedback failure	0x0040	yes	0.1 sec
7	ENCODER FAILED	encoder or microtack signal failure	0x0080	yes	---

Bit	MMI Alarm	Description	Hex Value	Inhibit?	Delay Time
8	FIELD FAILED	field current too low	0x0100	yes	---
9	3 PHASE FAILED	3 phase supply input not present	0x0200	no	---
10	PHASE LOCKED	AC synchronization failed	0x0400	no	0.5 sec
11	5703 RECEIVER ERROR	P3 port receiver error (noisy or failed)	0x0800	yes	---
12	STALL TRIP	motor stall trip timed-out	0x1000	yes	---
13	OVER I TRIP	motor armature overcurrent	0x2000	no	---
14	CALCARD	calibration card not fitted	0x4000	no	---
15	ACCTS FAILED	external ACCTs not connected	0x8000	no	---
--	AUTOTUNE ERROR	autotune operational error (shaft rotate)	-----	no	---
--	AUTOTUNE ABORT	autotune execute aborted or timed-out	-----	no	---

This example shows how HEALTH WORD, HEALTH STORE, and LAST ALARM are updated.

During operation, the controller trips on P3 PORT ALARM (0x0800), the drive loses three-phase power when an SCR fuse blows (0x0200) and the motor overheats causing the thermistor to open (0x0010). HEALTH WORD is:

$$0x0800 + 0x0200 + 0x0010 = 0x0A10.$$

HEALTH WORD	HEALTH STORE	LAST ALARM
0x0A10	0x0800	P3 PORT ALARM

During troubleshooting, the motor cools down and the thermistor closes.

HEALTH WORD	HEALTH STORE	LAST ALARM
0x0A00	0x0800	P3 PORT ALARM

The P3 PORT ALARM is cleared and the drive is restarted and immediately trips with a 3 PHASE FAILED alarm.

HEALTH WORD	HEALTH STORE	LAST ALARM
0x0200	0x0200	3 PHASE FAILED

The fuse is replaced and three-phase power is turned on.

HEALTH WORD	HEALTH STORE	LAST ALARM
0x0000	0x0200	3 PHASE FAILED

The drive is restarted.

HEALTH WORD	HEALTH STORE	LAST ALARM
0x0000	0x0000	3 PHASE FAILED

**NOTE.** Before restarting a drive after troubleshooting the first alarm, it is good practice to monitor HEALTH WORD to assure all alarms have been cleared. This can reduce down time.

## DRIVE DIAGNOSTICS

Many signals can be monitored in the MMI display. The diagnostic parameters are "read-only" and are very useful for tracing configuration problems. The following tables contain a description of each parameter and its range. Parameters denoted with an asterisk (\*) are the controller's analog or digital I/O. The drive has been shipped with its I/O tagged to the parameter listed in the description field.

Parameter	Description	Tag	Range
ACTUAL NEG I LIM	Overall negative current limit value	61	± 200%
ACTUAL POS I LIM	Overall positive current limit value	67	± 200%
ANIN 1 (A2)*	Speed setpoint no. 1.	50	± 10V
ANIN 2 (A3)	Hardwired. Speed setpoint no. 2 or current demand if C8 = ON.	51	± 10V
ANIN 3 (A4)*	Speed setpoint no. 3 (ramped).	52	± 10V
ANIN 4 (A5)*	Speed setpoint no. 4 or negative current clamp if C6 = ON	53	± 10V
ANIN 5 (A6)*	Main current limit or positive current clamp if C6 = ON	54	± 10V
ANOUT 1 (A7)*	Scaled speed feedback.	55	± 10V
ANOUT 2 (A8)*	Total speed setpoint.	56	± 10V
AT CURRENT LIMIT	Current demand is being restrained by the overall current limit	42	TRUE / FALSE
AT STANDSTILL	AT ZERO SPEED and "AT ZERO SETPOINT"	79	TRUE / FALSE
AT ZERO SETPOINT	At zero speed demand	78	TRUE / FALSE
AT ZERO SPEED	At zero speed feedback	77	TRUE / FALSE
BACK EMF	Calculated motor back EMF including IR. compensation	60	± 150%
CURRENT DEMAND	Current loop demand (speed error PI output or external current demand clamped by all the current limits)	299	± 200%
CURRENT FEEDBACK	Scaled and filtered armature current	298	± 300%
DIGIN 1 (C6)*	Symmetrical current clamps / Asymmetrical (bipolar) current clamps (ON = Bipolar).	71	ON / OFF
DIGIN 2 (C7)*	Ramp hold input (ON = Hold).	72	ON / OFF
DIGIN 3 (C8)*	Current demand isolate; giving speed or current mode of operation. (ON = Current mode)	73	ON / OFF
DIGOUT 1 (B5)*	At zero speed.	74	ON / OFF
DIGOUT 2 (B6)*	Drive healthy. Health is also displayed on a front panel LED and is always ON when the start is low	75	ON / OFF
DIGOUT 3 (B7)*	Drive ready to run (all alarms healthy and mains synchronization achieved)	76	ON / OFF
DRIVE ENABLE	Drive speed and current loop are enabled / disabled	84	ENABLED / DISABLED
DRIVE START	Controller start / run command	82	ON / OFF
ENABLE (C5)	Electronic enable / disable terminal (ON = Enabled)	70	ON / OFF
ENCODER	Encoder speed feedback in RPM	206	± 6000 RPM
INVERSE TIME O/P	Inverse time clamp output level	203	0 to 200%
JOG INPUT (C4)	Jog / Take-up slack terminal	69	ON / OFF
NEG I CLAMP	Negative current clamp	88	± 200%
OPERATING MODE	Indicates whether the drive is in RUN, JOG 1, STOP, etc.	212	
PID CLAMPED	Indicates the PID output has reached either the positive or negative limit.	416	TRUE/FALSE

Figure 5.12 - Diagnostic Parameters

Parameter	Description	Tag	Range
PID ERROR	Displays the difference between the setpoint (INPUT 1) and the feedback signal (INPUT 2) in the PID function block.	415	± 105.00%
PID OUTPUT	Output of the PID function block.	417	± 315.00%
POS I CLAMP	Positive current clamp	87	± 200%
PROGRAM STOP	State of program stop (terminal B8). When B8 is at 24V then "PROGRAM STOP" is FALSE and the program stop front panel LED is also ON	80	TRUE / FALSE
RAISE/LOWER O/P	Value of the raise / lower ramp function	264	± 300%
RAMP OUTPUT	Setpoint ramp output	85	± 100%
RAMPING	If the difference between the ramp input and the ramp output is greater than the "RAMP THRESHOLD", then "RAMPING" is TRUE	113	TRUE / FALSE
SPEED DEMAND	Speed loop total setpoint after the ramp-to-zero block	89	± 105%
SPEED ERROR	Speed loop error	297	± 150%
SPEED FEEDBACK	Speed loop feedback	207	± 150%
SPEED SETPOINT	Speed loop total setpoint including the ramp output before the ramp-to-zero function	63	± 150%
SPT. SUM OUTPUT	Setpoint summation output	86	± 200% (default 105%)
STALL TRIP	Armature current is above "STALL THRESHOLD" and "AT ZERO SPEED" but not AT ZERO SETPOINT	112	OK / FAILED
START (C3)	Start / Run terminal	68	ON / OFF
TACH INPUT [B2]	Scaled analog tachogenerator feedback	308	± 110%
TERMINAL VOLTS	Scaled terminal volts	57	± 125%

Figure 5.13 - Diagnostic Parameters (Continued)

## HARDWARE TROUBLESHOOTING

This section contains troubleshooting information and a flowchart for identifying and correcting hardware problems in the 590 DRV Digital drive.

NOTE. Repair of the 590 DRV is limited basic part replacement only. Troubleshooting and electronic component replacement at the board level is *not* recommended. Only the control and power boards, the control fuse F1 and the SCR packs are designed to be replaced. Refer to Chapter 6, Service and Maintenance, for drive assembly and disassembly instructions.

---

### Caution

Completely isolate power before making any wiring changes, replacing fuses, or making any jumper changes.

---

## Control Power Missing

The 590 drive derives its control power from an internal power supply circuit requiring a 110 VAC supply with a frequency range of 40 to 70 Hz. This power is normally supplied off one phase of the main drive supply through a DRV mounted control transformer. For DRVs rated through 100 HP, this control transformer has multiple primary taps for supplies of 208/230/380/415 and 460 VAC. For models rated above 125 through 900 HP, the primary of the control transformer is limited to 230/460 VAC.

The flowchart in Figure 5.14 shows the troubleshooting procedure for correcting a missing or low control power supply. The control power is missing when the drive's LCD display and its LED's are all out.

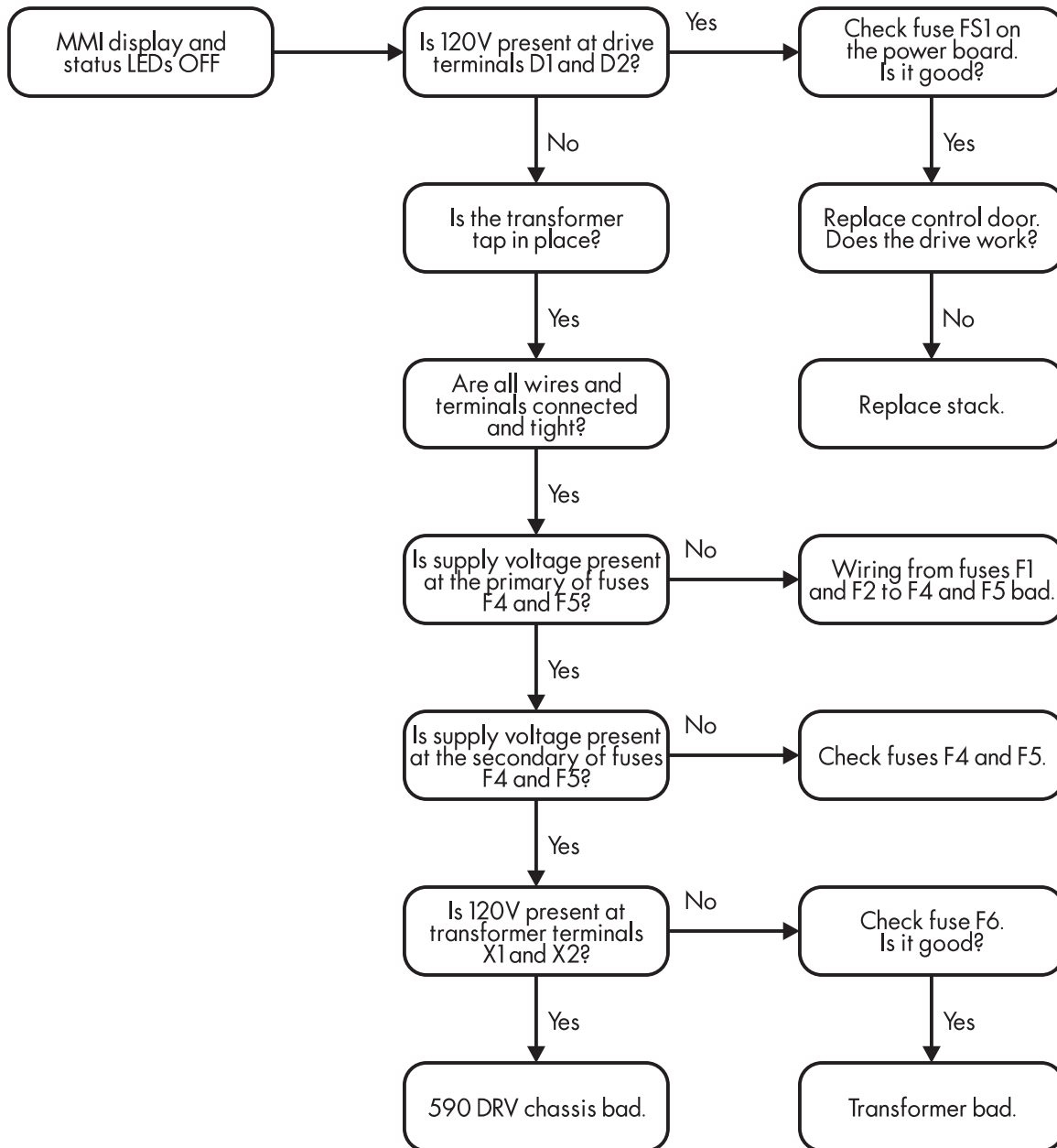


Figure 5.14 - Control Power Troubleshooting Flowchart

## Field Fail Procedure

If the motor field supply fails while the drive is running a motor, the drive should trip on either an OVERSPEED alarm, or a FIELD FAILED alarm.

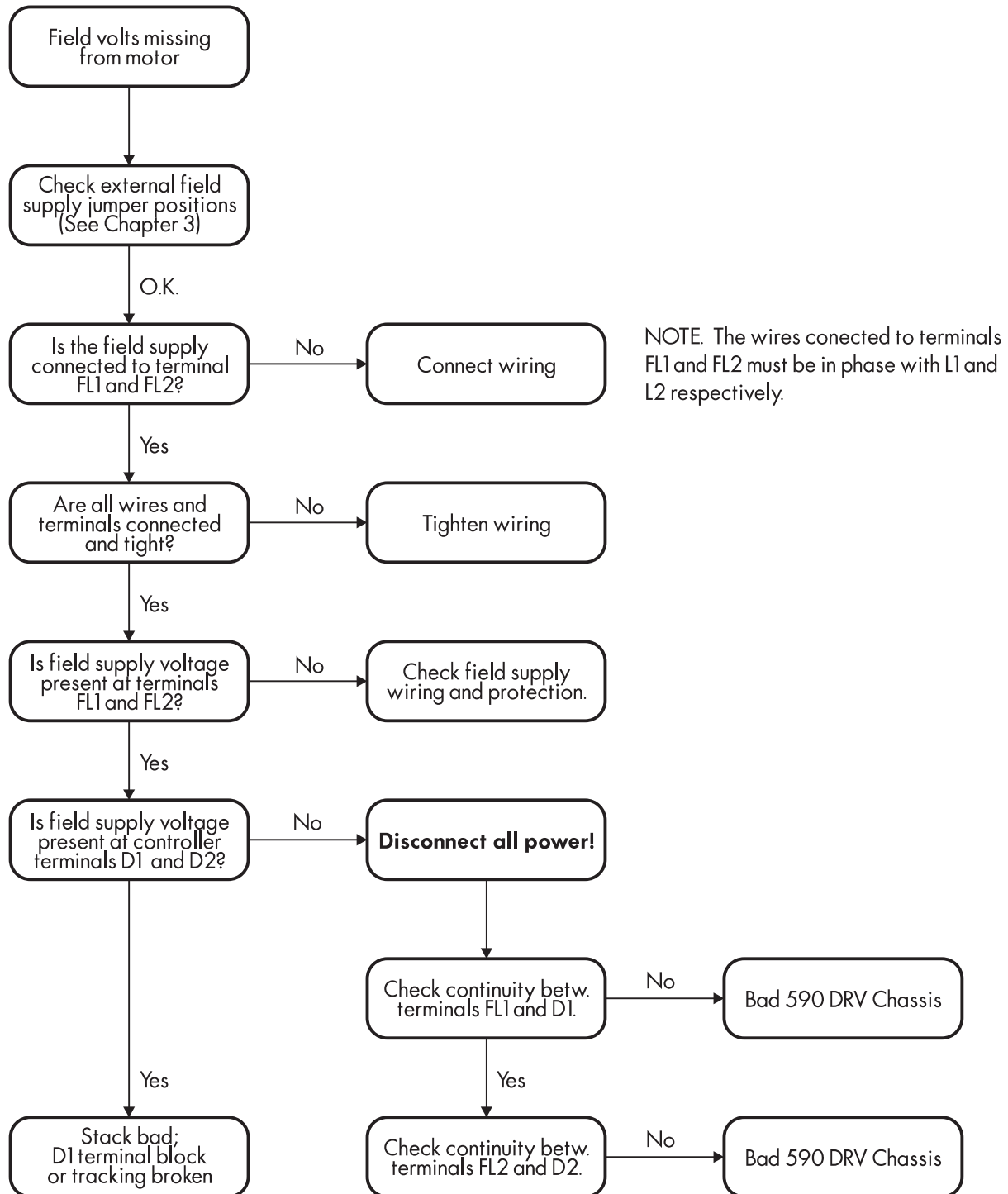


Figure 5.15 - Field Power Troubleshooting Flowchart

### Contractor Failed Procedure

This flowchart is used for troubleshooting problems associated with the main contactor, AM, including wiring. Refer to the Schematic Diagrams in Appendix L when troubleshooting.

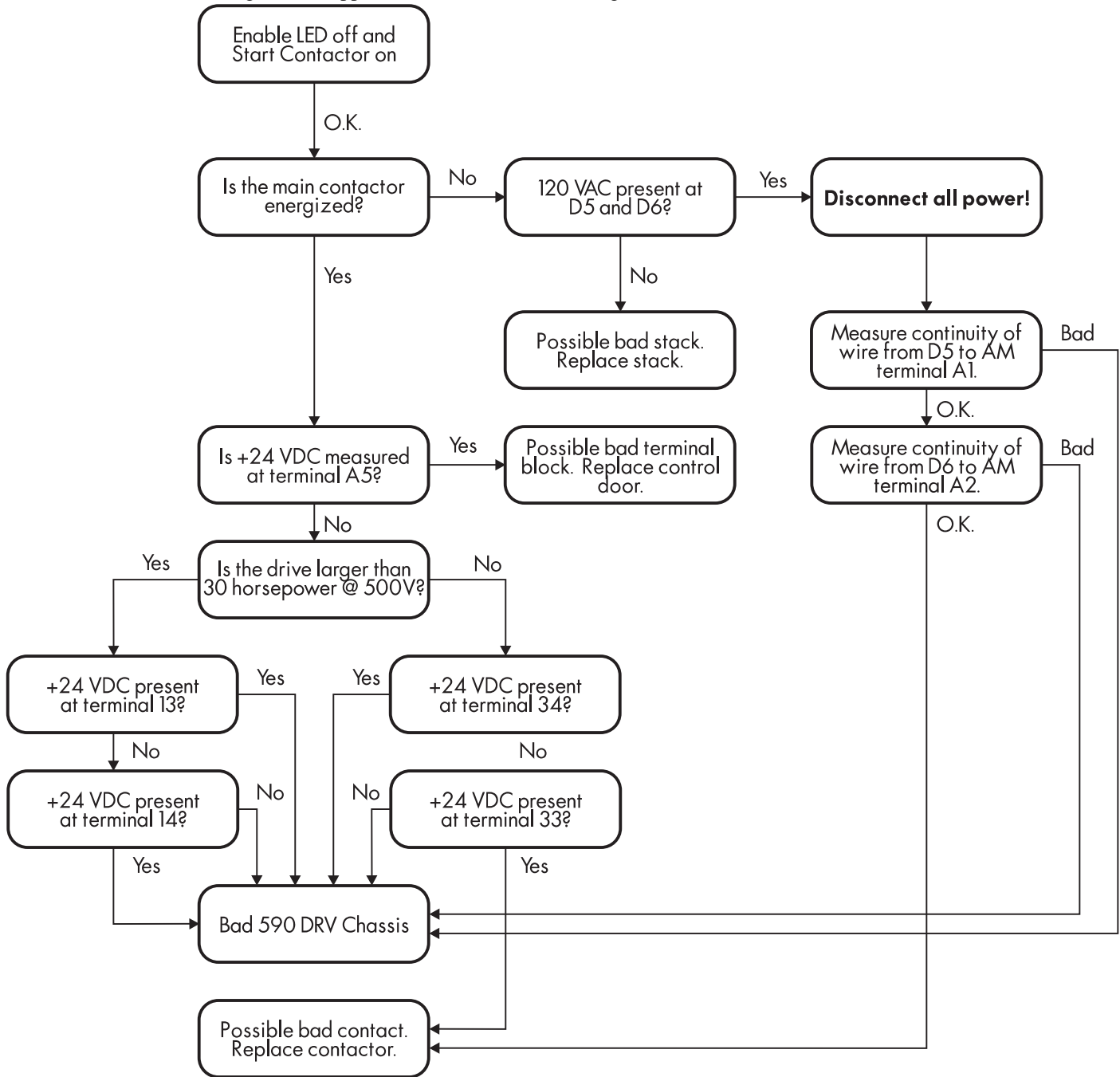


Figure 5.16 - Troubleshooting Flowchart for Faulty DC Contactor





## SCR Troubleshooting

Non-regenerative drives contain three SCR packs, A, B, and C. Each SCR pack contains two thyristors. Three additional SCR packs (D, E, and F) mount above SCR packs A, B and C for regenerative drives. The layout of the SCR packs is shown in Figure 5.17 as they appear on the drive heatsink, from left to right.

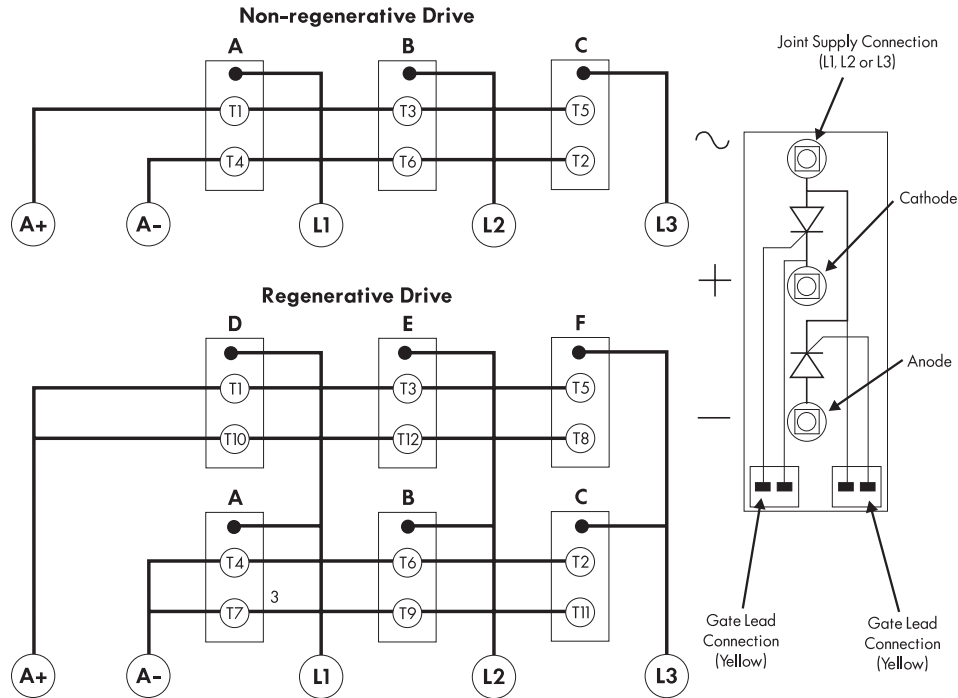


Figure 5.17 - SCR Layout

Use the tables in Figure 5.18 to determine which SCR pack is bad. The tables show the SCR being tested and the SCR pack that contains it. Measure the resistance between each armature and supply terminal. A good SCR will measure greater than one MW when read from the armature to the supply terminal. Reverse the leads and repeat these measurements between the supply and armature terminals. Bad (shorted) SCRs should measure zero to one kW.

Remove the power supply board (see Chapter 7) and measure the resistance between the gate and the cathode. It should measure between 18 and 40  $\Omega$  if good. A schematic of the SCR pack appears in the right of Figure 5.17. The outer most terminals connected to yellow leads at the bottom of each SCR pack are the thyristor gate terminations.

Non-regenerative Drives			
TERMINAL	L1	L2	L3
A+	T1 (A)	T3 (B)	T5 (C)
A-	T4 (A)	T6 (B)	T2 (C)

Regenerative Drives			
TERMINAL	L1	L2	L3
A+	T1/T10 (D)	T3/T12 (E)	T5/T8 (F)
A-	T4/T7 (A)	T6/T9 (B)	T2/T11 (C)

Figure 5.18 - SCR Test Charts

## Motor Checks

Several alarm messages are caused by problems with the motor. Most motor problems relate to insulation breakdown, overtemperature and armature brush and commutation problems. Check the motor armature and field with a megger to ensure that the motor winding insulation has not degraded and shorted one conductor to another or to ground. Continuity checks require an ohmmeter for determining whether motor windings or leads have opened or shorted. Continuity measurements should be less than one  $\Omega$ . Insulation measurements should be greater than 10  $M\Omega$ .

NOTE. Armature resistance for motors less than 10 HP (7.5 KW) can measure up to 3  $\Omega$ .

---

### Caution

Disconnect the motor leads from the drive before using a megger to check for motor ground faults.

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Also check the motor commutator for flashover. Clean the commutator and motor brushes if worn or dirty. If the motor is fitted with a blower, change or clean the blower filter regularly.

## CONFIGURATION ERRORS AND GENERAL TROUBLESHOOTING

Many of the problems are associated with configuration errors. You can avoid them by carefully following the configuration guidelines in Appendix C and Appendix D.

Use the software block diagram (located on the inside cover) to track signals when troubleshooting software problems. Refer to the drawing at the end of Appendix D for a more detailed software block diagram. Trace the signal from its start and monitor it at each point along the path using the MMI display. That should uncover mis-tagged parameters, unwanted offsets, and mis-calibrated parameters.

The software package ConfigEd Lite displays drive configurations in graphical form on a personal computer (PC) monitor. You can track down configuration errors easily by referring to this graphical representation of your configuration. Use the ConfigEd Lite PRINT function to obtain a hard copy (refer to the ConfigEd Lite manual RG352747).

---

### Caution

Because you can make configuration changes through the drive MMI, the configuration downloaded in your 590 DRV may not match the ConfigEd Lite file on your PC. Be certain to update your drive configuration data files with the ConfigEd Lite UPDATE command *before* printing out your configuration.

---

## Common Performance Problems

### Parameter Toggles Between Two Conditions

This problem occurs when two parameters write to a third parameter. The two parameters overwrite each other and fight for control of the problem parameter.

### No SPEED DEMAND

If all the analog signals are connected to the proper terminals and have the correct sign, I DMD. ISOLATE may be set incorrectly. Monitor terminal C8; if it is OFF, at 0 VDC, terminal C8 may have been tagged for a nonstandard function. Monitor parameter SETUP PARAMETERS::CURRENT LOOP::I DMD. ISOLATE. It should be DISABLED for speed control. If I DMD. ISOLATE is ENABLED, only a signal at terminal A3, ANALOG I/P 2, will create a current demand needed to turn the motor.

## SPEED SETPOINT has an Unwanted Offset

Terminal A8, TOTAL SPEED SETPOINT, is compiled from SETPOINTS 1 through 4. Monitor each setpoint individually in SETUP PARAMETERS::SPEED LOOP::SETPOINTS. If one is incorrect, i.e. has been left at an undesired value, simply "dial it" back to zero.

## Signal Does Not Get Through the RAMP

When parameter RAMP HOLD is ON, the ramp output is held to its last input value. Set RAMP HOLD to OFF to allow the signal to change.

## TEST POINTS

The drive has various test points located on the control board which can be used for signal monitoring with an oscilloscope. Test points locations are shown in Figure 5.19. The table in Figure 5.20 shows the signal test point assignments and their scaling ranges.

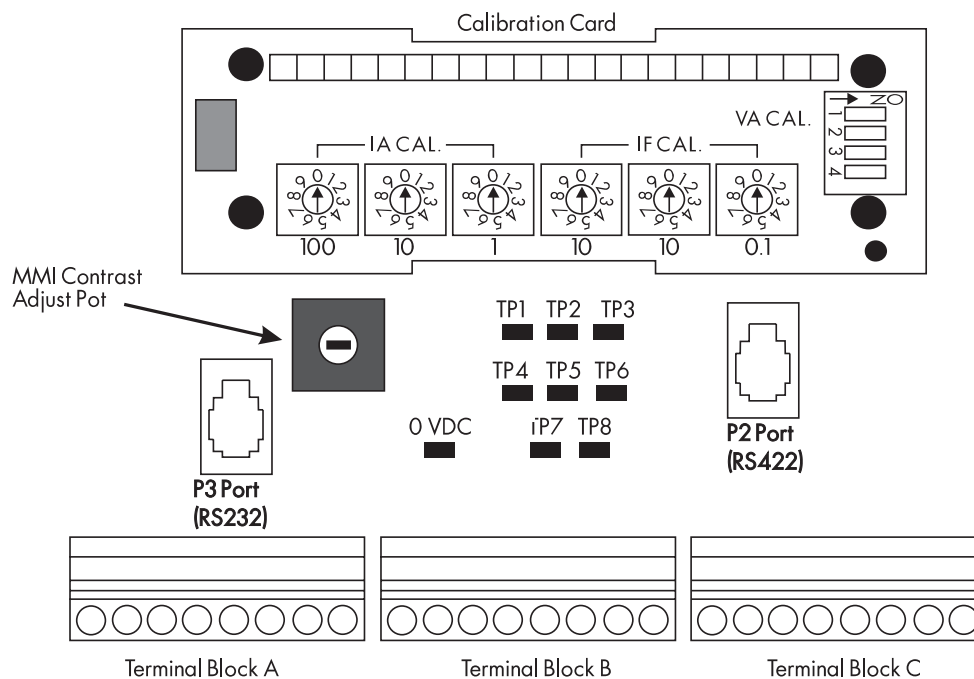


Figure 5.19 - Drive Status LEDs and Test Point Locations

Test Point	Description	Range
TP1	Armature current feedback	$\pm 2.2$ volts $= \pm 200\%$
TP2	Buffered analog tachometer	$\pm 10$ volts $= \pm 100\%$
TP3	Armature volts (% of calibration card setting)	$\pm 10$ volts $= \pm 100\%$
TP4	Field current	4 volts = 100%
TP5	Not used	
TP6	Overcurrent trip (transition on a trip)	12 volts to -15 volts
TP7	Internal diagnostic for Eurotherm Drives use	
TP8	Not used	
0 V	Signal common	0 volts

Figure 5.20 - Drive Test Point Descriptions and Scaling

## CONTACTING CUSTOMER SERVICE

If you have reviewed your installation and start up procedures and followed the troubleshooting guide but still cannot solve a persistent problem, contact Eurotherm Drives Customer Service at (704) 588-3246. Make certain you have the following information available before calling:

<b>Information</b>	<b>Source</b>
Catalog number, revision number, serial number	590 DRV Serial Number Label (located on the left side of the drive heatsink base);
Horsepower, armature current and voltage, field current and voltage, full speed;	Motor Nameplate
Voltage per 1000 RPM (analog device), counts per revolution (digital device);	Speed Feedback Device Nameplate
Applications Information	System Drawings.

Also, make certain to have information available on your particular application and the operating environment. When you are in contact with our service department, describe the problem in detail, the steps you have taken to rectify it and the results of your efforts.



## Chapter 6 SERVICE AND MAINTENANCE

Because of its solid state design, the 590 DRV Digital drive has few items requiring service or maintenance. Service typically is a matter of replacing fuses, checking electrical contacts, and isolating problems in the overall system application.

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### Caution

Service procedures must be performed by qualified personnel with an understanding of the dangers inherent in high voltage applications and the precautions necessary when servicing industrial equipment. The customer is responsible for assessing the technical competency of in-house service personnel.

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### CONTACTING EUROTHERM DRIVES FOR SERVICE

Before calling Eurotherm Drives Customer Service, make sure you have the following information available:

#### Information

Catalog number, revision number, serial number  
 Motor horsepower, armature current and voltage, field current and voltage, base and top speed ratings  
 Speed voltage feedback per 1000 RPM (analog device), or counts per revolution (digital device)  
 Applications information

#### Source

590 DRV Digital drive serial number label (located on the left side of the drive heatsink base);  
 Motor nameplate  
 Speed feedback device nameplate  
 System drawings.

### Warranty information

Detailed warranty information is contained in the Standard Conditions of Sale document IA058393C which is included with each order. Warranty information also precedes the *Contents* section of this manual.

### Required tools and equipment

Tools needed for routine service operations include basic hand tools — screwdrivers, wrenches, etc. Each procedure has a list of the required tools.

### SERVICE PROCEDURES

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#### WARNING!

Only qualified service personnel should attempt to repair or replace parts in the 590 DRV.

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#### WARNING!

Isolate the entire 590 DRV drive from electrical power before attempting to work on its components.

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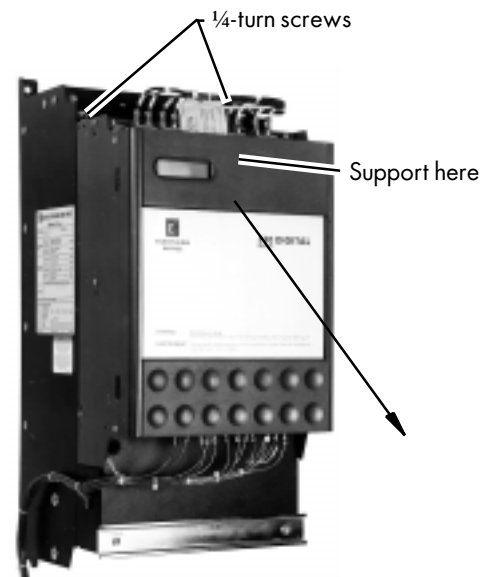


Figure 6.1 - Opening the 590 DRV

To access the internal parts of the power section, loosen the two ¼-turn screws holding the controller top to the drive at the top of the controller case.

### WARNING!

Loosening the ¼-turn screws while the 590 DRV is mounted vertically will allow the controller section to pivot downward. Support the controller section while loosening the screws and lower it gently to its fully open position.

If you are working on the 590 DRV on a workbench, insert a spare M8 or 5/16-18 bolt through each of the hinge slots at the bottom of the drive to prevent the controller from dropping onto the power section while you are working inside.

Once finished inside, remove the extra bolts being used as stops (if applicable) and return the controller section to its position covering the base. Secure the controller section by tightening the ¼-turn screws.

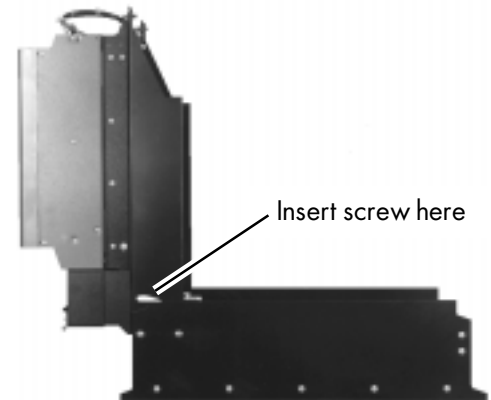


Figure 6.2 - Securing the 590 DRV Open

## PREVENTIVE MAINTENANCE

Users should perform regular preventive maintenance every six months to ensure long life and continued usefulness of the 590 DRV. Keep the drive and its components clean, check auxiliary fans if fitted, and make sure connections and mounting bolts have not loosened from vibration.

### Required tools

This procedure requires a torque wrench and a torque screwdriver.

### Procedure

The red, white, and blue control wires can be checked by gently attempting pulling the wires out of the terminals. The terminals should hold the wires firmly in place. The 14 gauge black wires connected to the top green terminal D1 through D4 and connected to the bottom terminals (F+, F-, FL1, and FL2) can also be checked by hand.

All the remaining wires should be checked with a torque wrench. The torque specification label on the drive lists the tightening torque specifications.

1. Remove the lower cover.
2. Inspect all visible wiring and terminals for evidence of burning and/or abrasion.
3. Verify the tightness of:
  - a. Power and ground wires connected to the controller. (TORQUE)
  - b. All connections to the DC contactor. (TORQUE)
  - c. Connections on both sides of the control terminals.
  - d. Control and field wires at the top green terminals, D1 through D8.
4. Open the chassis by loosening the two ¼-turn screws.



Figure 6.3 - 590 DRV with Lower Cover Removed

5. Inspect all wiring and terminals for evidence of burning and abrasion.
6. Verify the tightness of:
  - a. Line and load fuse connections to fuses F1, F2, F3, F4, F5, and F7 (if fitted). (TORQUE)
  - b. The three ground stud connections. (TORQUE)
  - c. Control transformer connections.
7. Remove any loose debris.
8. Close the drive and lock in place with the ¼-turn screws.
9. Re-attach the lower cover.

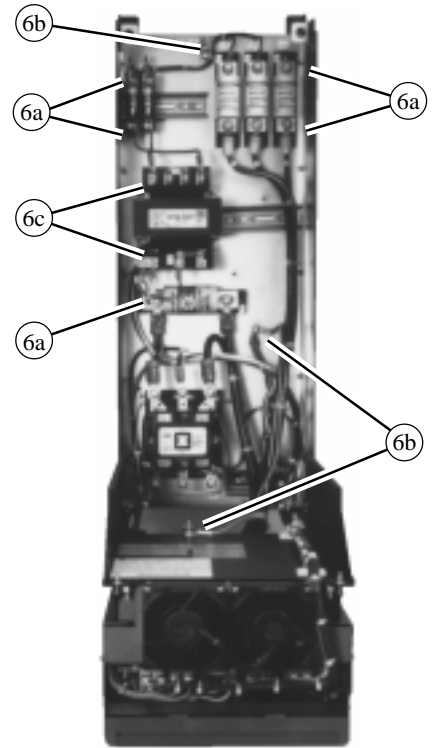


Figure 6.4 - Inside Power Section

## REMOVING LOWER COVER

### Required Tools

This procedure requires a #2 Phillips screwdriver.

### Procedure

#### Removing the Lower Cover

1. Remove the two (2) 8-32 x 3/8 Phillips head screws (A) holding the lower cover in place.
2. Slide the cover down to disengage the lances and then remove it from the chassis.

#### Caution

The "drive enable" harness is routed through the slot on the left side of the lower cover. Take care not to snag the harness when removing the cover.

NOTE. The lower cover is held in place by two lances (B). When replacing the cover, slide the cover up into the lances and then tighten the screws.

#### Replacing the Lower Cover

3. Route the "drive enable" harness through the slot.

#### Caution

Do not crimp or mash the enable harness between the lower cover and the frame when replacing the lower cover.

4. Place the cover on the frame and slide it up until it engages the lances.
5. Install the two screws to hold the bottom of the cover in place.

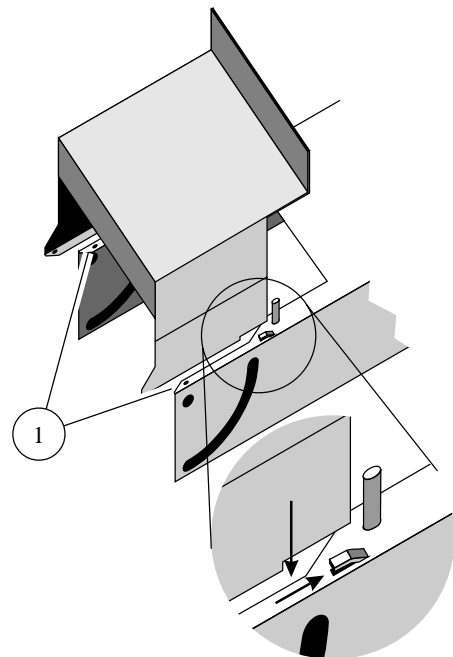


Figure 6.5 - Lower Cover Detail



## CHANGING THE CONTROLLER DOOR

### Required Tools

This procedure requires a 3/16 inch flat blade screwdriver.

### Procedure

1. Disconnect the control wire terminals, terminal blocks A, B, and C, from the control door.
2. Loosen the two captive screws holding the door closed. They are located under the top and bottom flaps.
3. Open the door.
4. Disconnect the two ribbon connectors at the left side of the power supply board. To release the connectors, push the locking tabs away from the ribbon cable.
5. Push the screwdriver into the slot of the top hinge. Use inward pressure to release the hinge from the locking lance. Pull the door out of the slot slightly to keep it out of the lance.
6. Repeat step 4 for the bottom hinge.
7. Now that both hinges are released, pull the door gently away from the chassis. The door must be pulled evenly out of the slots or it will bind in place.
8. Repeat this procedure in the reverse order to install the control door.

NOTE. Remember to switch the calibration cards to save the original door's calibration settings.

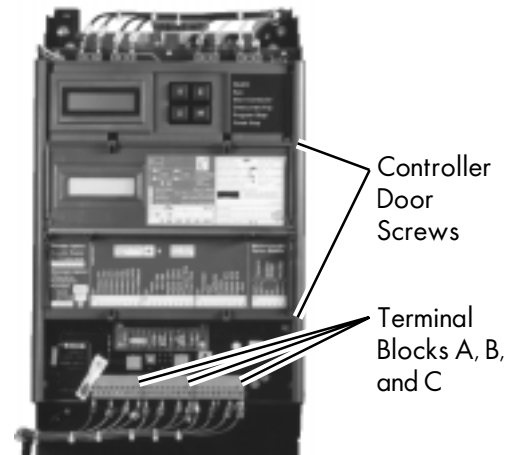


Figure 6.6 - Controller Door Screws

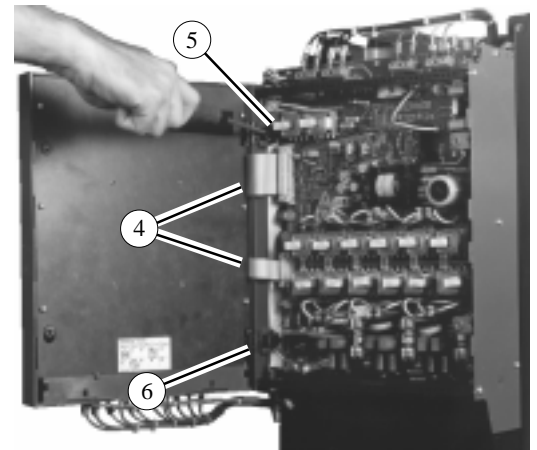


Figure 6.7 - Removing the Control Door

## REPLACING THE CONTROLLER

### Required Tools

This procedure requires a #2 Phillips head screwdriver, 7/16 deep socket, 10mm and 13mm sockets, and a small flat blade screwdriver.

### Procedure

1. Disconnect the control wire terminals, terminals A, B, and C, from the controller door and remove the lower cover.
2. Disconnect the three 3-phase wires (A), two armature wires, and the ground wire (B). The ground wire is held in place with a M6 hex head screw. The other wires are secured with M8 hex head screws.

NOTE. Older controllers and replacement drives are supplied with slotted head screws. Save the hex head screws for use with the 590 DRV and return the slotted head screws.

3. Disconnect the eight wires connected at the top of the controller in green terminals D1 through D8 (C).
4. Remove the four 1/4-20 nuts (D) holding the controller to the chassis.
5. Reverse the order of these steps when installing a replacement controller.

NOTE. Remember to switch the calibration cards to save the original door's calibration settings.

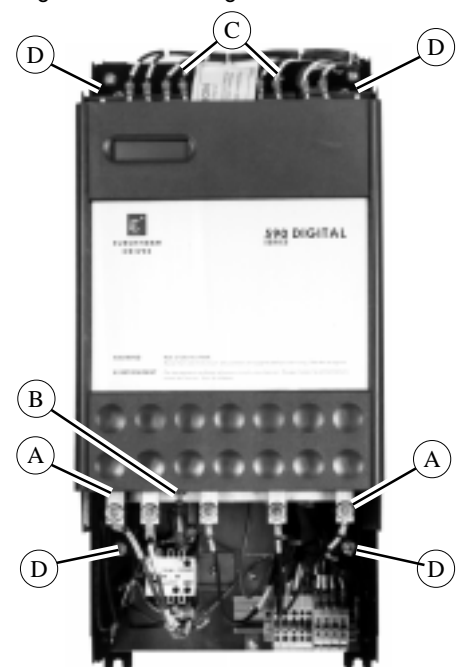


Figure 6.8 - Controller Mounting Screws

## REMOVING THE POWER SUPPLY BOARD

This procedure shows how to remove and reattach the power supply board.

### Required Tools

Removing the power supply board requires a #2 Phillips head screwdriver, a flat blade screwdriver, and a pair of needle nose pliers.

### Procedure

1. Use electrostatic discharge safety procedures to eliminate static charges from the technician, tools, and work area.
2. Remove the controller door (see the controller door procedures).
3. Remove the two support bars (A) held in place by the phillips head screws. Flat head screws are located on the left side (B). Do not remove the screws retaining the power supply board. The top support bar is removed in Figure 6.9.
4. Disconnect the following wires:
  - a. Field, contactor, and controller supply wires (C) in terminal blocks D1 through D8 at the top of the drive.
  - b. Armature sense wires (D) from the 0.10 male tabs.

---

#### Caution

Be careful not to loosen the terminal blocks from the PC board.

---

- c. The YELLOW and BROWN wires (E) (*field supply*) attached to stake F16 and the RED and VIOLET wires (F) (*field supply*) attached to stake F8 at the upper left part of the board.
  - d. The GREY wire (G) (*negative field supply*) attached to stake F6 (near terminal D3). The ORANGE wire (H) (*positive field supply*) attached to stake F7 (near terminal D4) at the upper left part of the board.
  - e. The RED, ORANGE, and YELLOW wires (I) (*field gate wires*) connected to stakes G, K, and G at the upper left part of the board.
  - f. The YELLOW/GREEN wire (J) (*RFI ground*) at the upper right part of the board.
  - g. The BROWN, BLUE, and YELLOW/GREEN wires (K) (*fan supply*) connected to stakes F27, F24, and F23 respectively (*if fitted*).
  - h. Connectors PLL, PLK, and PLM (L) on the left side of the board (*if necessary*).
  - i. The VIOLET wire (M) (*field supply*) adjacent to fuse FS2 and the BROWN wire (N) (*field supply*) adjacent to fuse FS3 at the lower part of the board.
5. Remove the SCR gate lead pairs using the needle nose pliers. Grasp the center of the PINK gate lead guide (O) with the pliers and gently pull away from the board. The gate lead guides hold both gate leads in place.

---

#### WARNING!

Do not pull the gate lead pairs out by the wires. This can damage the guide and make the gate leads unusable.

---

NOTE. When replacing a gate lead guide, the RED wire must face to the center of the hole. For example, after two gate lead guides are in place, the red wires must be next to each other.

6. Remove the screws at the top (3) (P), center (3) (Q), and bottom (5) (R) of the board.

---

#### Caution

Be careful to capture the lock washers on the five (5) bottom screws.

---

7. Now the board is free to be removed. Slide the board as far to the right as it will go. Tilt the left side of the board up and then lift the board out of the chassis. Make sure none of the loose wires catch on the board or components as you lift the board out of the chassis.

### Caution

This board has several sensitive and surface mount components which can be damaged if mishandled.

8. To reinstall the power supply board (or a replacement), reverse the order of the steps. Be sure to pull the wires (identified in Figure 6.9 as J, L, M, and N) through the board before fastening it in place.

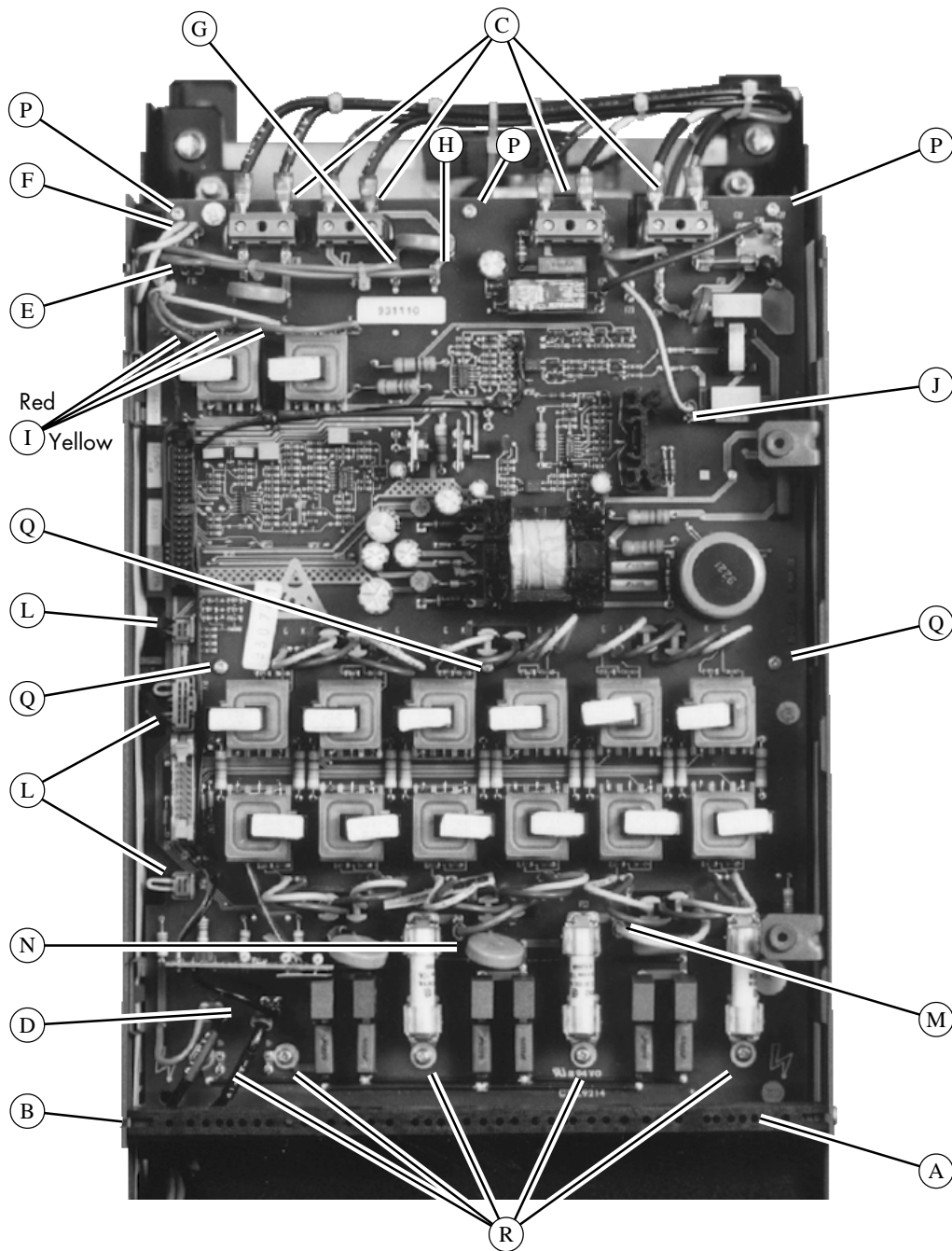


Figure 6.9 - Inside View of 590 Controller

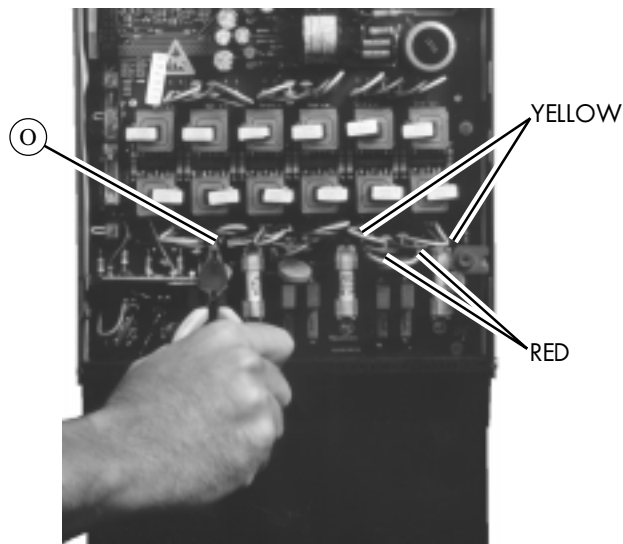


Figure 6.10 - Gate Lead Guides

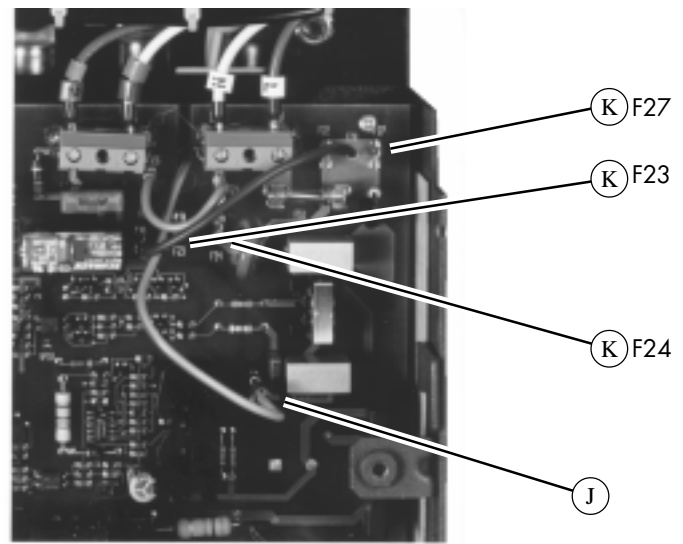


Figure 6.11 - Fan and Ground Connections

## REPLACING SCRS

NOTE. Before attempting to replace an SCR, perform the SCR troubleshooting procedure in Chapter 7 to identify the defective SCR.

For illustrative purposes, SCR letter F is assumed to be defective in the following procedure.

### Required Tools

Replacing SCRs requires a #2 Phillips head screwdriver, a 3/8 inch flat blade screwdriver, and a 4mm Allen wrench.

### Procedure

1. Remove the center PC board support (A) to expose the top bank of SCRs. It is held in place by two Phillips head screws (B). This step is only required when replacing SCRs D, E, or F.

---

#### Caution

When installing the PC board support, the two pieces of insulating paper must also be put into position. They are held in place by the PC board support.

---

2. Disconnect the slotted head screw holding the customer armature buss bar (C) to the SCR buss bar (D). Capture the lock washer. Non-regenerative drives connect both customer buss bars to the SCR buss bar. Both buss bars must be disconnected.
3. Remove the armature buss bar(s) across the top of the SCR bank with the defective SCR (D). Save the six (6) M5 x 10 Phillips head screws (E).

NOTE. Regenerative drives have one armature buss bar across the top of an SCR bank. Non-regenerative drives have both armature bus bars attached to the top of the SCR bank.

4. Remove the appropriate buss bar (F) connecting the SCR to the 3-phase buss bar. It is held in place by one (1) M5 x 10 Phillips head screw (G) and one (1) M6 x 10 slotted head screw (H). Capture the M6 lock washer.
5. Remove two (2) M5 x 18 socket head screws (I) holding the defective SCR in place. This requires a 4 mm Allen wrench.

6. Repeat this procedure in the reverse order when replacing SCRs. The tightening torques for installing SCRs and reassembling the buss bars are:

SCR mounting screws	M5 x 18 socket head	3.3 - 4.4 lb-ft (4.5 - 6.0 Nm)
SCR buss bar screws	M5 x 10 Phillips head	1.8 - 2.6 lb-ft (2.4 - 3.5 Nm)
3-phase buss bar screws	M6 x 10 slotted head	1.8 - 2.6 lb-ft (2.4 - 3.5 Nm)

**Caution**

All connections must be made using the correct tightening torque. Overtightening could strip the threads in the heatsink or the SCR making them unusable.

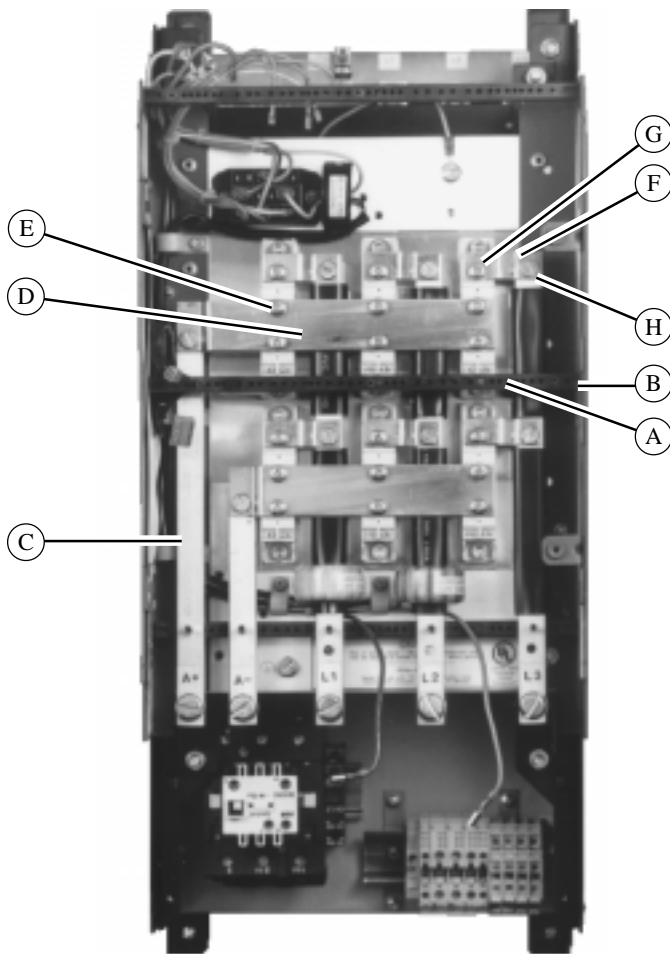


Figure 6.12 - Power Supply Board Removed

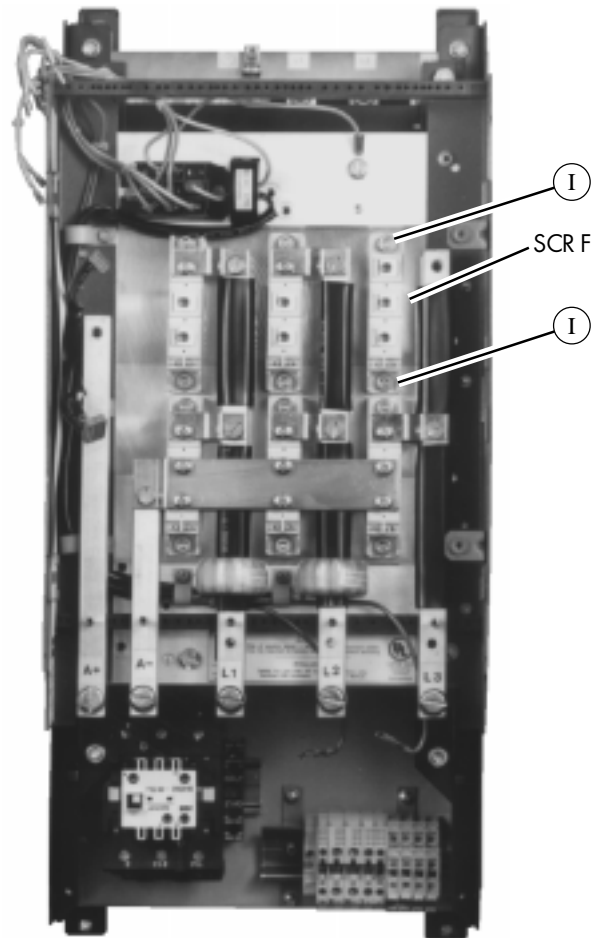


Figure 6.13 - SCR Bussing Removed for SCR F

## Appendix A TECHNICAL DESCRIPTION

This appendix lists the controller features and specifications and provides a description of the controller terminals.

### CONTROL CIRCUITS

Control circuitry is fully isolated from main power supply. A 16-bit microprocessor performs the majority of the control functions in the 590 DRV Digital drive. External digital and analog I/O terminal communicate directly with the drive microprocessor. RS422 serial communication which provides access to all drive parameters for computer interfacing is available as an option.

Functions performed by the drive's microprocessor include:

- Current and speed loop processing
- Alarm recognition and first fault indication
- MMI display and keypad
- LED diagnostics
- Thyristor firing algorithms
- RS422 communication via intelligent peripherals (P1 and P2 ports)
- RS232 communication (P3 port)
- Speed and Current loop signal processing and setpoint summing and scaling.
- Digital to analog output via 10/12 bit D/A convertor
- Analog to digital conversion

### POWER CIRCUITS

The 590 DRV Digital drive provides DC armature control by either a fully regenerative (four quadrant), two-pulse thyristor bridge or a non-regenerative (two quadrant), two-pulse thyristor bridge.

Each type of bridge includes suppression to limit the rise of volts across the thyristor, thus reducing the risk of false triggering and keeping the maximum applied voltage within the thyristor rating limits. The four quadrant bridge is configured to provide regenerative capability and reverse speed and torque operation.

The motor field rectifier is a half-controlled, full wave thyristor bridge circuit which can provide a fixed field voltage supply or field current regulation with field weakening.

### OVERVIEW OF FEATURES

Certification	All 590 DRV models rated through 300 HP are Underwriter Laboratory (UL <sup>®</sup> ) approved for use in the United States and Canada
Control Action	Fully Digital Fully isolated from power circuitry Software configurable through Man Machine Interface (MMI) or through independent Windows <sup>™</sup> compatible software package ConfigEd Lite Advanced PI with fully adaptive current loops for optimum dynamic performance Self-tuning current loop using Autotune algorithm Adjustable speed PI with integral defeat and adaptive gain profiling Process PID for loadcell or dancer position control Winder control blocks Field regulation and weakening
Speed Control	Armature feedback with IR compensation (standard with each drive) Analog tachometer generator feedback option 5701 Microtach (plastic fiber optic) feedback option 5901 Microtach (glass fiber optic) feedback option Wire-ended electrical encoder feedback option
Speed Range	100 to 1 typical when using tachometer generator feedback.

Steady State Error	2%	Armature voltage feedback
	0.1%	Analog tachometer generator feedback
	0.01%	Wire-ended electrical encoder approved feedback
	0.01%	5701/5901 Microtach fiber optic encoder feedback
	0.0%	(absolute) Quadraloc Mark II digital controller.
Signal Resolution	10 bits ( $\pm 0.0001$ accuracy)	
Encoder Resolution	Maximum Microtach frequency 50 kHz	
	Maximum encoder frequency 100 kHz	
	Frequency (Hz) = Encoder Lines per Revolution $\times$ RPM $\div$ 60.	
Adjustments	All adjustments performed with software, either by on-board push buttons and liquid crystal display (Man Machine Interface) or through independent Windows™ software package ConfigEd Lite. RS422 serial communications is also available as an option.	
Calibration	DRVs rated 7.5 through 400 HP are calibrated using switch selectable calibration boards DRVs rated 500 HP and larger are calibrated using resistor calibration boards	
Protection	High speed semiconductor fuses DC output fuse (regenerative units only) DC loop contactor N/C DB pole, standard (up through 300 HP) dV/dT protection (snubbers) High energy MOVs Overcurrent (instantaneous) alarm Overcurrent (inverse time— adjustable) Field failure alarm Field overcurrent alarm Speed feedback failure alarm (in current regulator mode) Motor overvoltage alarm Motor overspeed alarm Motor over temperature alarm SCR gate trigger failure alarm SCR over temperature alarm (force ventilated units) Motor stall detection alarm Zero speed detection Standstill "zero speed deadband" logic.	
Diagnostics	Fully computerized with first fault latch and automatic display Digital LCD monitoring (MMI) Full diagnostic information available through MMI and over optional RS422 serial communications interface (port P1) LED status indication.	

## SPECIFICATIONS

### Storage and Operating Environment

Operating Temperature	0 - 55°C (32 - 131°F)
	Derate all units 1% per degree Celsius above 45°C (113°F)
Altitude	Controllers rated for use below 500 meters (1640 feet). Derate controllers above 500 meters at 1% per 200 meters (656 feet) to a maximum altitude of 5000 meters (16,400 feet).
Storage	-20 - 55°C (-4 - 131°F)
	Protect from direct sunlight
	Ensure a dry, corrosive-free environment
Humidity	85% relative humidity maximum
Atmosphere	Non-flammable, non-condensing, non-corrosive

## Electrical Ratings (590 Single-board power supply: AH385851U002/U003)

Main input supply	Three-phase, 50-60 Hertz, phase rotation insensitive; no adjustment necessary for frequency change Voltage ranges: 208/230/380/415/480 VAC AC rms Supply current: $0.85 \times$ calibrated DC armature current
Control supply	voltage range: 110/240 VAC selectable, single-phase, 40-70 Hertz Protection fuse: 3 amps @ 250 volts (FS1)
Force-ventilated units	100 VA fans
Reference supplies	+10 VDC @ 10 mA maximum - 10 VDC @ 10 mA maximum
DC supply	+24 VDC nominal, internally regulated Maximum externally available output capacity: 17 W (700 mA)
Field supply	10 amps, 500 volts
Isolating contactor	10 amps, 250 volts

## Electrical Ratings (Three-board power supply: AH385128U004/U104)

Drive input supply	Three-phase, 50-60 Hertz, phase rotation insensitive; no adjustment necessary for frequency change Voltage ranges: 208/230/380/415/480 VAC AC rms Supply current: $0.85 \times$ calibrated DC armature current
Control supply	Voltage range: 110/240 VAC selectable, single-phase, 45-65 Hertz Protection fuse: 400mA @ 250 volts (FS3)
Force-ventilated units	100 VA fans fused @ 1A (FS1)
Reference Supplies	+10VDC $\pm$ 0.01 @ 10mA maximum -10 VDC $\pm$ 0.01 @ 10mA maximum
DC Supply	+24 VDC nominal, internally regulated Maximum externally available output capability: 6W (250mA)
Field supply	10 amps, 500 volts (20 amps for U104)
Isolating contactor	10 amps, 250 volts, fused @ 3A (FS2)

## DC Supply Loading

The following list shows the DC loading of Eurotherm Drives products. Add up all the loads on the auxiliary supply to ensure that power demand is within the output specifications. If the demand exceeds the output capacity, add an auxiliary power supply to the system.

DC supply loading	5701 Microtach encoder and receiver option board	1.8 W or 75 mA
	Electrical encoder and receiver option board	1.8 W or 75 mA
	Serial link option board	1.0 W or 40 mA
	Signal relay, typical	1.2 W or 50 mA
	5702/1 repeater	1.2 W or 50 mA
	5702/2 terminal rail repeater	1.2 W or 50 mA
	5702/3 encoder to fiber optic converter	1.2 W or 50 mA
	5702/5 splitter	1.8 W or 75 mA
	5702/6 marker pulse repeater	1.2 W or 50 mA
	5703/1 and 5703/2 Peer-to-peer communications option	1.7 W or 70 mA
	<i>Sample configuration</i>	5701 Microtach encoder and receiver option board
Serial link option board		1.0 W or 40 mA
2 Signal relays		2.4 W or 100 mA
	<b>Total</b>	<b>5.2 W or 215 mA</b>



## 590 Controller Output Ratings

This table lists the ratings for 590 controllers used in DRVs through 400 horsepower.

Controller Type	590/1					592/	594/5		596/7	
	Power Rating @ 500 VDC (Horsepower)	20	40	60	75	100	150	200	250	300
Output Current (Amps)	35	70	99	135	164	246	330	405	506	650
Maximum Ambient Temperature (°C)	45	45	45	45	45	45	45	45	45	45
Cooling Forced (F) or Natural (N)	N	N	F	F	F	F	F	F	F	F
Cooling Fan Integral (I) or Separate (S)	N/A	N/A	I	I	I	I	I	S	S	S
Field Current (Amps)	10	10	10	10	10	10	20	20	20	20
Field Supply Voltage (max)	500	500	500	500	500	500	500	500	500	500

Figure A.1 - 590 DC Drive Controller Output Ratings

### Power Loss

Refer to Figure 3.1 for power dissipations.

### Mechanical Ratings

Control Termination	Plug-in connectors			
Supply Termination	Crimped wires to lugged terminals			
Armature Termination	Compression terminals through 30 HP Crimped wires to lugged terminals larger than 30 HP			
Field Termination	Compression terminals			
Ventillation	590 and 591	80 hp	100 m <sup>3</sup> /hr	58.86 cfm
	590 and 591	100 hp	300 m <sup>3</sup> /hr	176.57 cfm
	592 and 593	150 hp	350 m <sup>3</sup> /hr	206.00 cfm
	594 and 595	250 hp	490 m <sup>3</sup> /hr	288.40 cfm
	596 and 597	400 hp	1000 m <sup>3</sup> /hr	588.58 cfm
Dimensions	Refer to the drawings at the end of Chapter 3 for DRV dimensions.			

### HARDWARE BLOCK DIAGRAM

Refer to the diagrams on the inside front cover for the 590 DRV Digital drive terminal blocks and connections.

### 590 SOFTWARE BLOCK DIAGRAM

A drawing of the drive software block diagram is printed on the manual's inside front cover. A more detailed diagram appears in the fold out drawing at the end of Appendix D. See Appendix C and Appendix M for a detailed description of each software block. Refer to Appendix D for instruction on configuring software within the drive through the MMI. You may also configure the drive using a personal computer with the Windows™ compatible software package ConfigEd Lite through the serial port P3.

## RS422 COMMUNICATIONS

The 590 DRV Digital drive has two RS422 communications ports:

1. P1, an optional, isolated main port. P1 interfaces through a separately ordered and mounted board (part no. AH385826U001) and enables the controller to communicate with a host computer or PLC. It offers the following features:
  - Serial communications multi-dropping permits connecting up to sixteen drives or devices to one computer serial port. Because most computers include a RS232 serial port, you must convert RS422 drive protocol to RS232 using a D240 Communications Converter Module (SD350549) available from Eurotherm Drives.
  - A bussed, digital wiring system replaces multi-wire analog cabling and reduces cable costs.
  - Digital transmission is less noise-prone than analog signals and improves data transmission accuracy. Using intelligent devices at either end of the serial link allows signal error checking, which virtually eliminates electrical noise induced data errors.
2. P2, a non-isolated, auxiliary port. P2 is integrated into the control board and allows the drive to communicate with other Eurotherm products *only*. Communication through a common buss and protocol assures compatibility with Eurotherm temperature and process controllers, supervisors, data loggers and other drives. Use the isolated P1 port for serial communications with other products.

Both ports include hardware to provide balanced line driver and receiver signal levels and provide full system support using the Eurotherm Drives bisynchronous communications protocol. This protocol is discussed more fully in Appendix H.

## RS232 COMMUNICATIONS

The 590 DRV Digital drive also has a RS232 serial communications port, system port (P3), which is integrated into the control board and allows uploading and downloading of drive configurations to and from a remote location using a personal computer (PC). You can also transfer, modify and save drive configurations with a PC running the Windows™ compatible software package ConfigEd Lite through this port. Refer to Appendix G for further information and the ConfigEd Lite manual, RG352747.

## TERMINAL LISTING

The A, B, and C terminal blocks under the lower controller access panel are the connecting points for the myriad controls and accessories that make up the 590 DRV controller system. The terminals and their purposes are summarized below; more detailed descriptions follow.

Number	Name	Purpose
A1	0v	Signal ground
A2	Analog input 1	Speed setpoint
A3	Analog input 2	Auxiliary speed setpoint/current demand
A4	Analog input 3	Ramped speed setpoint
A5	Analog input 4	Auxiliary current clamp neg.
A6	Analog input 5	Main current limit/auxiliary current clamp pos.
A7	Analog output 1	Buffered speed feedback
A8	Analog output 2	Total speed setpoint/current demand
A9	Current meter output	Buffered current output
B1	0v	Signal ground
B2	DC tach input	Tach input (with resistor calibration board, AH058529U001, installed)
B3	+10 VDC reference	External +10v reference
B4	-10 VDC reference	External -10v reference
B5	Digital output 1	Zero speed output
B6	Digital output 2	Drive healthy
B7	Digital output 3	Drive ready
B8	Program stop input	Controlled ramp stop
B9	Coast stop input	Coast stop
C1	0v	Power ground
C2	Thermistor input	Motor temperature sensor input
C3	Start/run input	Start/run control
C4	Jog	Jog
C5	Enable input	Enable control
C6	Digital input 1	Current clamp selection
C7	Digital input 2	Ramp hold
C8	Digital input 3	Current demand supply
C9	+24 VDC supply	
G1	AC	AC tachometer connection
G2	AC	AC tachometer connection
G3	DC+	DC tachometer positive volt connection
G4	DC-	DC tachometer 0 volt connection
L1	Line 1	3-phase supply, phase 1
L2	Line 2	3-phase supply, phase 2
L3	Line 3	3-phase supply, phase 3
G	Ground, supply	Ground connection for 3-phase supply
A+	Armature +	Motor connection for armature, positive
A-	Armature -	Motor connection for armature, negative
DB+	Dynamic Brake +	Dynamic Brake connection, positive

G	Ground, motor	Ground connection for motor ground
G	Ground, aux	Ground connection for 120 VAC supply
F+	Field +	Motor connection for field, positive
F-	Field -	Motor connection for field, negative
FL1	External Field +	External field supply connection L1
FL2	External Field -	External field supply connection L2
120L	120 VAC Line	Auxillary 120 VAC supply, line
120N	120 VAC Neutral	Auxillary 120 VAC supply, neutral
1	M contact	Normally open auxillary contact
2	M contact	Normally open auxillary contact

## TERMINAL SPECIFICATIONS

The following sections list the specifications for the input and output terminals.

### Analog Input and Output Terminals

Resolution	10 bits plus sign; i.e. 10mV 0.1% of full scale deflection
Input Impedance	100k $\Omega$ with a 1 ms filter for terminal A3 and a 2 ms filter for the other terminals.
Maximum Input Sample Rate	5 ms; 3 ms for terminal A3
Input Overload Capability	+10% (11 VDC for terminal B2)
Output Capacity	$\pm$ 10 VDC at 5 mA; Short circuit protected.
Output Update Rate	5 ms
Output Overdrive Capability	10% (11 VDC)

### Digital Input Terminals

Input Voltage	+24 VDC (nominal); +30 VDC maximum
Input Impedance	4.7 k $\Omega$
Sample Time	5 ms
Threshold	16 VDC (typical)
Input Voltage Low	< 6 VDC
Input Voltage High	> 18 VDC

### Digital Output Terminals

Output Voltage	+24 VDC
Output Current	+50 mA maximum (Source)
Output Update Rate	5 ms
Output Impedance	Negligible up to 50 mA; <i>not</i> short circuit protected.

The terminals are active high and source current from the terminal to the load. The load must be connected between the output and the signal ground. A "free-wheel" diode is included in the output to protect the output transistor when switching inductive loads such as relays.

## TERMINAL DESCRIPTIONS

### A1/0 VDC (Signal)

This terminal is the zero VDC reference for signals only, i.e., signals originating from terminal blocks A and B. It must *not* be used as a return point for currents originating from terminal block C.

### A2/Analog Input 1

This terminal is the speed setpoint.

### A3/Analog Input 2

This terminal serves as either the AUXILIARY SPEED SETPOINT or CURRENT DEMAND, as determined by the configuration of DIGITAL INPUT 3 at terminal C8. If C8 is an open circuit, the function is speed setpoint; if C8 is at +24 VDC, the function is current demand. This input is hardwired and not software configurable.

### A4/Analog Input 3

This terminal is the RAMPED SPEED SETPOINT.

### A5/Analog Input 4

This terminal is the negative current clamp (see analog input 5, below).

### A6/Analog Input 5

This terminal serves as either the MAIN CURRENT LIMIT or the POSITIVE CURRENT CLAMP, as determined by the configuration of DIGITAL INPUT 1 on terminal C6. If C6 is an open circuit, ANALOG INPUT 5 is the MAIN CURRENT LIMIT; if terminal C6 is at +24 VDC, ANALOG INPUT 5 is the POSITIVE CURRENT CLAMP and ANALOG INPUT 4 is the NEGATIVE CURRENT CLAMP.

### A7/Analog Output 1

This terminal is the SPEED FEEDBACK OUTPUT.

### A8/Analog Output 2

This terminal is the TOTAL SPEED FEEDBACK.

### A9/Current Meter Output

This terminal carries the BUFFERED ARMATURE CURRENT FEEDBACK, in either bipolar or unipolar form, as set with the SETUP PARAMETERS, CALIBRATION, ARMATURE I (A9) parameter with the MMI. The default output is  $\pm 10$  VDC equals  $\pm 200\%$ . This output is hardwired and not software configurable.

### B1/0 VDC (Signal)

This terminal is the ZERO VOLT REFERENCE for an analog tachometer generator signal only.

### B2/Analog Tachometer Generator Input

No connection. Do *not* use as a jumpering or connection point for external wiring.

### B3/+10 VDC Reference

This terminal is for the positive reference supply.

### B4/-10 VDC Reference

This terminal is for the negative reference supply.

### B5/Digital Output 1

This terminal serves as the connection for ZERO SPEED detection, and provides +24 VDC when at ZERO SPEED. It can be modified with the MMI using the SETUP PARAMETERS, STANDSTILL, ZERO THRESHLD parameter.

### B6/Digital Speed Output 2

This terminal provides a latched +24 VDC signal for the DRIVE HEALTHY condition signal. DRIVE HEALTHY is TRUE whenever there are no software or hardware alarms present. It is reset when the RUN signal is removed from C3.

### **B7/Digital Output 3**

This terminal provides a +24 VDC signal for the DRIVE READY message. DRIVE READY is TRUE whenever there are no software or hardware alarms present.

### **B8/Program Stop**

This terminal is for a controlled ramp stop input. When the PROGRAM STOP input is held at +24 VDC, the drive operates as configured; when it is at zero volts or is an open circuit, the controller causes a controlled (or program) stop as defined in the SETUP PARAMETERS::STOP RATES parameters.

NOTE. Non-regenerative drives cannot perform program stops; they will instead coast to a stop.

### **B9/Coast Stop**

This terminal is for uncontrolled stop input. When the COAST STOP input is at +24 VDC, the drive operates normally. When it is at zero volts or is an open circuit, the main contactor is open, the drive is not enabled (see description for terminal C5), and the motor coasts to a stop.

### **C1/0v (Power Common)**

This terminal is the control and relay common. It is not connected to ground.

### **C2/Thermistor**

This terminal is for motor over-temperature protection input. DC motors should be protected against sustained thermal overloads by fitting temperature-sensitive resistors or switches. Sensors should be connected in series between terminals C1 and C2. If the optional blower motor starter is installed, the auxiliary contact should also be connected in series with the sensors. Terminals C1 and C2 must be linked if over-temperature sensors are not used.

### **C3/Start/Run**

This terminal is for the START/RUN input. When a +24 VDC input is applied to this terminal, the controller will operate as long as there are no alarms, the PROGRAM STOP and COAST STOP signals are **true** (at +24 VDC), and the controller is enabled. When the input is removed, The drive stops in the time set by STOP TIME in SETUP PARAMETERS::STOP RATES.

### **C4/Jog**

This terminal is for JOG/SLACK SPEED CONTROL. When a +24 VDC signal is at this terminal and a 0 VDC signal is at terminal C3, the drive jogs. When the +24 VDC is removed, the drive ramps to zero speed.

### **C5/Enable**

This terminal inhibits controller operation electronically. If the enable input is at zero volts or open circuited, all control loops will be inhibited and the controller will not generate current. When switching power to the motor using a DC contactor, connect this terminal through an auxiliary, normally-opened contact on the contactor to C9 (+24 VDC). This terminal is internally connected to the auxiliary contact of the DC contactor on DRV models.

### **C6/Digital Input 1**

This terminal selects the CURRENT CLAMP MODE. At zero volts, it sets ANALOG INPUT 5 (terminal A6) to be the main unipolar current limit. When ON (at +24 VDC), ANALOG INPUT 5 is the POSITIVE CURRENT CLAMP and ANALOG INPUT 4 is the NEGATIVE CURRENT CLAMP.

### **C7/Digital Input 2**

This terminal is for the RAMP HOLD signal. If the input is held ON (+24 VDC), the RAMP GENERATOR OUTPUT is frozen at the last value regardless of the ramped setpoint input. When OFF (0 VDC), the ramp output follows

the RAMPED SETPOINT INPUT at the rate or change determined by the acceleration, deceleration ramp time, and "S-ramp" parameters.

### **C8/Digital Input 3**

This terminal is the CURRENT DEMAND ISOLATE, which changes the drive operation from speed control to current control. When DIGITAL INPUT 3 is ON (+24 VDC), ANALOG INPUT 2 provides the current demand and the speed loop is disconnected; when OFF (0 VDC), the speed loop is in control and ANALOG INPUT 2 is an auxiliary speed setpoint.

### **C9/+24v Supply**

This terminal is for current output, which can be used to activate the DIGITAL INPUT, PROGRAM STOP, and COAST STOP terminals, and other 24 VDC devices. It has a maximum output of 700mA for a single board power supply.

NOTE: The load on terminal C9 combined with the other +24 VDC loads must not exceed 700mA. See the Electrical Ratings information earlier in this appendix.

### **G1 and G2/Analog AC Tachometer Input**

Analog AC tachometer generator signals connect to these terminals. Switch settings on the switchable tachometer feedback board, AH385870U001, scale the input signal.

### **G3/Analog DC Tachometer Positive Input**

The positive wire from an analog DC tachometer generator connects to this terminal. Switch settings on the switchable tachometer feedback board, AH385870U001, scale the input signal.

### **G4/Analog DC Tachometer Negative Input**

This is the 0 volt connection for DC tachometer input signals.

### **L1, L2, L3/3-Phase Supply**

These terminals and the associated ground terminal provide the connection for the 3-phase supply. The supply voltage can be 208/230/380/415/480 VAC for models rated *through* 400 HP. 500 HP and higher rated models are limited to a 230 or 480 VAC supply. The control transformer taps must be changed to match the 3-phase supply voltage.

### **A+, A-/Armature**

These terminals and the associated ground terminal provide the connection point for the motor armature. For 500 volt armature motors up to 30 horsepower, the terminals are compression type terminals. Up to 100 horsepower, the connections are made using screw terminals and require ring terminals on the wires.

### **DB+/Dynamic Brake +**

This terminal connects the positive end of the dynamic braking resistor to the motor through a normally closed contact on the main contactor.

### **F+, F-/Motor Field**

These terminals provide the connection point for the motor field supply.

### **FL1, FL2/External Field Supply**

When an external field supply is required, it is connected to these terminal. FL1 and FL2 must be in the same phase as L1 and L2, respectively. Jumpers in the controller must also be moved to connect the external supply to the controller. This circuitry is rated to 500 VAC maximum.

### **1, 2/M Contact**

These terminals connect to an auxiliary normally open contact on the main contactor.

### **120L, 120N/120 VAC Aux Supply**

These terminals and their associated ground can supply up to 100 VA of 120 VAC from the internal transformer.

## FEEDBACK OPTION CARDS

The 590 DRV Digital drive is preconfigured to run in armature voltage feedback control, which requires no feedback device. Accordingly, each is shipped without a feedback option card. Order one of the four cards described below when using an analog tachometer generator, Microtach or wired-ended encoder for speed feedback.

### Switchable Tachometer Feedback card (AH385870U001)

The switchable tachometer generator feedback board supports AC and DC analog tachometer generators. It can be used with analog tachometer generators with a feedback voltage range of 10 to 199 volts at full speed.

#### Features

- Simplified calibration using switches to scale the feedback voltage.
- 0.1% steady state accuracy.

#### Specifications

DC power supply loading	50 mA
Tachometer generator supply range	10 to 199 volts AC/DC
Terminal Wire Size	22 to 14 AWG (0.5 to 1.5 mm <sup>2</sup> )
Terminal Tightening Torque	5.3 lb-in (0.6 Nm)

#### Recommended Spare Parts

Keep only one tachometer generator feedback card as a spare.

#### Installation Information

Figure A.3 shows a close up of the card. Terminal connections are also shown.

1. For DC analog tachometer generators, connect the negative lead to terminal G4 and the positive lead to G3.
2. Connect AC analog tachometers leads to terminals G1 and G2. These inputs are polarity insensitive.

NOTE. Be certain to wire the tachometer generator leads to the feedback card with shielded cable and to ground the shield at one end only, to avoid creating ground loops.

#### Calibration

1. Set the tachometer generator type by setting SW4 up for AC tachometer generators, or down for DC tachometer generators.
2. Set the ones and tens switches to the calibration volts by sliding the appropriate 10-position switch to the correct value. To add one hundred volts, switch the two-position switch (SW3) down. This *coarsely* scales the analog tachometer generator signal.

In general, the voltage output of an analog AC or DC tachometer generator is a function of speed or is rated in volts per 1000 rpms so that:

$$\text{SPEED FEEDBACK VOLTAGE}_{\text{Max}}(\text{volts}) = \text{MOTOR SPEED}_{\text{Max}}(\text{RPM}) \times \text{TACHRATING} \left( \frac{\text{volts}}{1000 \text{ RPM}} \right)$$

This rating should be on the nameplate of the tachometer generator. Fine tuning is performed within the software (refer to the *Speed Feedback Calibration* section in Chapter 4).

If the full speed feedback voltage exceeds 200 VDC, use an external resistive scaling network to drop the feedback voltage to within this range.

3. For AC tachometer generators, the switch settings will be about 1.3 times greater than the voltage measured at the input terminals G1 and G2 due to the rectifier offset.

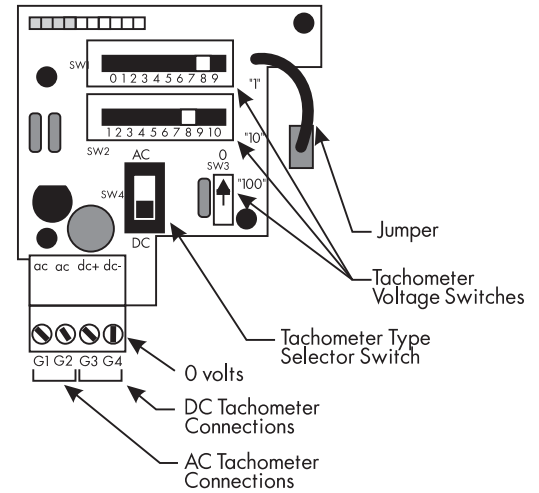


Figure A.2 - Switchable Analog Tachometer Feedback Card



## 5701 (Plastic Fiber Optic) Microtach Receiver Card (AH058654U001)

The 5701 Microtach Receiver Option is used with the 5701 Microtach encoder to provide a highly accurate speed feedback measurement. The option uses the Eurotherm Drives patented fiber optic 5701 encoder output transmission circuitry for noise immune data transfer over *plastic* fiber optic cable. A convenient board-mounted, plug-in terminal block and fiber optic receiver terminal are provided for field connections.

### Features

- Electrically noise immune plastic fiber optic cable to transmit the speed feedback signal from the 5701 Microtach encoder.
- 0.01% steady state accuracy through the use of the 5701 Microtach encoder or a standard encoder interfaced to the 5702/3 encoder to fiber optic converter unit.
- Supplies +24 VDC to the 5701 Microtach encoder.
- Plastic fiber optic cable requires only a standard set of pliers to attach the cable to the T&B connectors.

### Specifications

DC Power Supply Loading	75 mA
Maximum Frequency	50 kHz
Fiber Optic Cable Type	.0394 inch (1 mm) OD plastic fiber optic
Terminal Wire Size	14 - 22 AWG (0.5 - 1.5mm <sup>2</sup> )
Terminal Tightening Torque	5.3 lb-in (0.6 Nm)

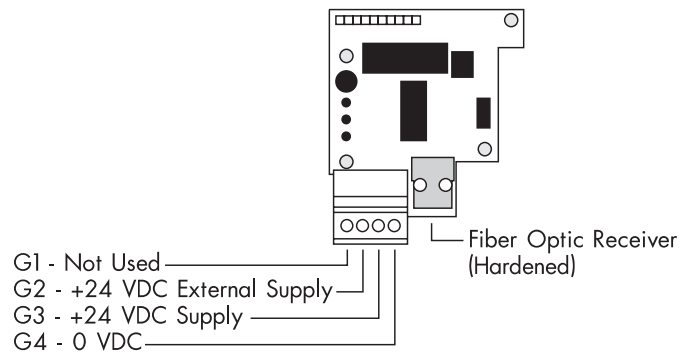


Figure A.3 - 5701 Microtach Receiver Card

Recommended 5701 Microtach Spare Parts		
Quantity	Part Number	Description
1	AH058654U001	Plastic fiber optic microtach receiver board
1	CM059748U050	Composite plastic fiber optic cable (50 meters, 164 ft.)
1	CI055069	Plastic fiber optic T&B termination plug - red
1	LA385204	Plastic fiber optic cable cutter
1	L5231	Fiber optic light meter with T&B adaptor
1	5701/4	Plastic fiber optic microtach encoder

Related 5701 Microtach Parts	
Part Number	Description
CM059748U050	Plastic composite fiber optic cable (50 meters, 164 ft.)
CM059748U150	Plastic composite fiber optic cable (150 meters, 492 ft.)
CM059748U200	Plastic composite fiber optic cable (200 meters, 656 ft.)
CM059748U300	Plastic composite fiber optic cable (300 meters, 984 ft.)
5401/1	Plastic fiber optic microtach repeater (NEMA 4)
5401/2	Plastic fiber optic microtach repeater (DIN rail mount)

## 5701 Installation Information

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### Caution

This option contains ESD sensitive parts. Observe static control precautions when handling, installing, and servicing this option.

---

1. Use the Fiber Optic Cable Cutter (LA385204) to dress the fiber optic cable connecting to the option card. The cable must be cleanly and squarely cut to work properly. The Microtach encoder end of the fiber optic cable requires a red fiber optic plug (CI055069) for termination.
2. Loosen the screws on the metal fiber optic connector on the feedback board and insert the cable. Carefully push the cable into the connector until it is fully engaged. Retighten the screws.
3. Refer to Chapter 4 for calibration instructions.

The 5701 Microtach encoder is a 1000 PPR incremental encoder with digitally encoded fiber optic output. The option card supplies +24 VDC power to the encoder and decodes the fiber optic encoder signal. The controller supplies the +24 VDC through terminals G3 and G4. Connect an external +24 VDC supply through the option card to terminal G2 (see Figure A.5) if the controller +24 VDC supply is at capacity and unable to provide sufficient power.

Figure A.4 shows the Microtach receiver connected to the 5701 Microtach. The power terminals in the encoder are marked '+' and '-'.

The 5701 Microtach encoder has several mounting options. See the catalog for the mounting option you require.

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### Caution

The 5701 Microtach encoder is not suitable for use in a hazardous area.

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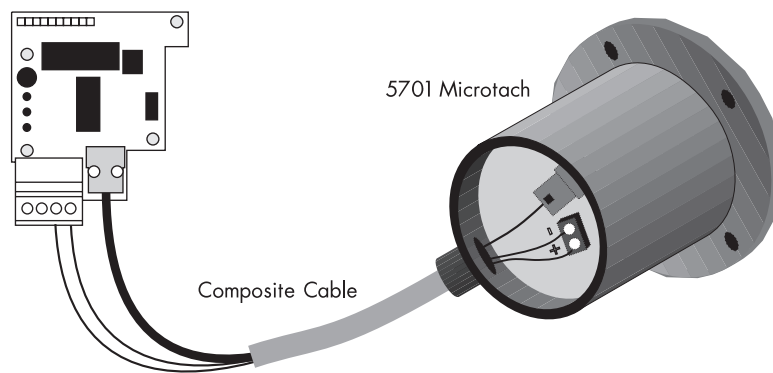


Figure A.4 - Connecting a 5701 Microtach to the 5701 Microtach Receiver Card

## 5901 (Glass Fiber Optic) Microtach Receiver Card (AH386025U001)

The 5901 Microtach Receiver Option is used with the 5901 Microtach encoder to provide highly accurate speed feedback measurement. It provides all the features of the 5701 Microtach with the additional advantage of *glass* fiber optic cable. A convenient board-mounted plug-in terminal block and fiber optic receiver terminal are provided for field connections. The 5901 Microtach Receiver Option board offers the following advantages:

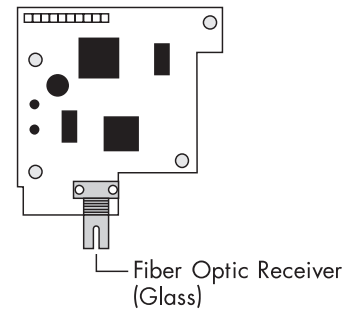


Figure A.5 - 5901 Microtach Receiver Card

### Features

- Electrically noise immune glass fiber optic cable to transmit the speed feedback signal from the 5901 Microtach encoder.
- Glass fiber optic cable allows long transmission distances without repeaters.
- 0.01 % steady state accuracy through the use of the 5901 Microtach encoder.

### Specifications

DC Power Supply Loading	125mA
Maximum Frequency	50K Hz
Fiber Optic Cable Type	62.5 to 250 micron diameter glass fiber optic cable using ST fiber optic connectors
Terminal Wire Size	14 - 22 AWG (0.5 - 1.5 mm <sup>2</sup> )
Terminal Tightening Torque	5.3 pound-inches (0.6 Nm)

#### Recommended 5901 Microtach Spare Parts

Quantity	Part Number	Description
1	AH386025U001	Glass fiber optic microtach receiver board
6	CI352599	230 Micron glass ST crimp-cleave connector
6	CI352673	Cable anchor for 230 micron glass ST crimp-cleave
6	CI352674	Crimp sleeve for 230 micron glass ST crimp-cleave
1	JA352597	Crimp & cleave glass fiber optic ST termination kit
1	JA352398	ST Fiber optic light meter adaptor
1	L5231	Fiber optic light meter with T&B adaptor
1	5901/4	Glass fiber optic microtach encoder

NOTE. The 5901 glass fiber optic Microtach requires a glass fiber optic type ST termination kit for cutting, polishing and terminating either end of the glass fiber optic cable.

NOTE. The L5231 light meter ships with a T&B adaptor installed for measuring plastic fiber optic light transmission. Order the ST fiber optic adaptor (JB352398) to measure glass fiber optic transmission with the same light meter.

NOTE. The 5901 Microtach is limited to 150 meters (492 ft.) for 62.5 to 125 micron diameter glass cable, and 1000 meters (3280 ft.) for 200 micron diameter glass cable

#### Related 5901 Microtach Parts

Part Number	Description
CM352600U103	200 micron diameter, non-terminated glass fiber optic cable (1000 meters, 3281 ft.)
CM352692U102	230 micron diameter, ST terminated one-end only, glass fiber optic cable (100 meters, 328 ft.)
CM352692U251	230 micron diameter, ST terminated one-end only, glass fiber optic cable (25 meters, 82 ft.)
CM352692U501	230 micron diameter, ST terminated one-end only, glass fiber optic cable (50 meters, 164 ft.)
CM352692U751	230 micron diameter, ST terminated one-end only, glass fiber optic cable (75 meters, 246 ft.)

## 5901 Installation Information

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### Caution

This option contains ESD sensitive parts. Observe static control precautions when handling, installing, and servicing this option.

---

1. Use the connector kit JA352597 to properly terminate ST terminals to both ends of the glass fiber optic cable. Each ST terminal requires a cleave crimp, a cable anchor and crimp sleeve.
2. After attaching the cable ST terminals, connect the cable to the Microtach and receiver card.
3. Refer to Chapter 4 for calibration instructions.
4. The 5901 Microtach encoder is a 1000 PPR incremental encoder with digitally encoded fiber optic output. Power the encoder from the drive's +24 VDC supply (terminals C1 and C9) or from an external supply if the drive's +24 VDC power rail is at capacity . Figure A.9 shows the Microtach receiver connected to the 5901 Microtach. The power terminals in the encoder are marked '+' and '-'.
5. The 5901 Microtach encoder has several mounting options. See the catalog for the mounting option you require.

---

### Caution

The 5901 Microtach encoder is not suitable for use in a hazardous area.

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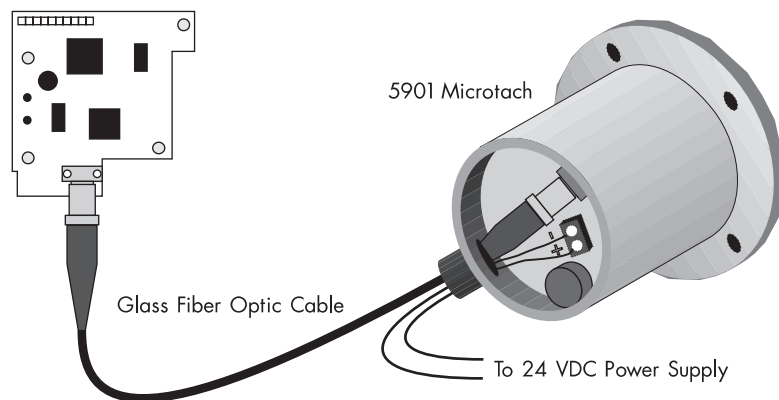


Figure A.6 - Connecting a 5901 Microtach to the 5901 Microtach Receiver Card

## Wire-ended Encoder Receiver Card (AH387775Uxxx)

The Wire-ended Encoder Receiver Option allows standard encoders to be connected directly to the motor controller and to provide highly accurate speed feedback measurement. It mounts directly to the Main Control Board by means of four support standoffs and a 10-pin interface connector built into the board. A convenient board-mounted plug-in terminal block is provided for field connections.

### Features

- Contains two optically isolated differential inputs for channels A and B.
- Decoding logic to interface the encoder to the microprocessor
- Supplies fixed voltage, isolated encoder power.

Four cards are available, each designed for a specific encoder voltage supply requirement.

Catalog Number	Description
AH387775U005	+5 VDC encoder receiver option card
AH387775U012	+12 VDC encoder receiver option card
AH387775U015	+15 VDC encoder receiver option card
AH387775U024	+24 VDC encoder receiver option card

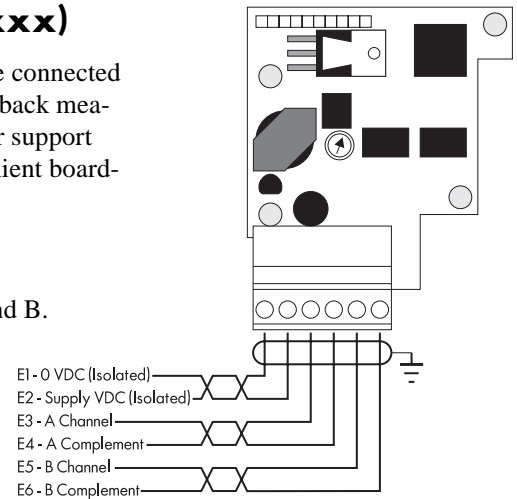


Figure A.7 - Wire-ended Encoder Receiver Card

### Specifications

Maximum Frequency	100 K Hz
Receiver Current	10 mA per channel
Input Format	Two differential channels in quadrature (3.5 V minimum)
Encoder Supply	2 Watts maximum
Motor Controller DC Power Supply Loading	1.4 times output power
Terminal Wire Size, Maximum	16 AWG
Terminal Tightening Torque	3.5 pound-inches (0.4 Nm)

### Recommended Spare Parts

Keep one Encoder Receiver board as a spare for each type of encoder used. Ensure that the spare's output supply matches the encoder's supply voltage input. Supplying an encoder with an incorrect supply can damage the encoder.

### Electrical Encoder Installation Information

#### Caution

This option contains ESD sensitive parts. Observe static control precautions when handling, installing, and servicing this option.

1. Connect the encoder as shown in Figure A.6.
2. Install all wiring as instructed in the Eurotherm Drives Installation Note Sheet (HG050610). Also refer to drawing HG351946, the Installation Notes which are shipped with the card. Exercise special care wiring the encoders to the option board due to the low signal levels. Be sure to use three channel twisted pair shielded cable. Belden 8777 cable is recommended. The shielded cable must be grounded at the controller *only*.
3. Refer to Chapter 4 for calibration instructions.

## Application Notes

### External Power Supply

In cases when the encoder receiver card or the drive cannot supply enough power for the encoder, use an external power supply connected directly to the encoder. The supply should be isolated from ground; that is, neither the 0 VDC nor the +VDC should be connected to ground.

### Single Ended Encoders

When using single ended encoders:

1. Connect the A and B channels to terminals E3 and E5 as shown in Figure A.6.
2. Jumper terminals E4 (A Complement) and E6 (B Complement) to E1 (0 VDC).

## Encoder Types

### Avtron Manufacturing, Inc.

All the Avtron encoders, models M738, M785, M938, and M939, use the same color code and terminal numbers for interconnection. The standard column lists the normal color code and terminal numbers. The M193 does not have terminal numbers but uses the same color code.

Option Terminal	Standard	M193A
E1: 0 VDC	A - BLK	BLK
E2: +VDC Supply	B - RED	RED
E3: A	D - GRN	GRN
E4: A Complement	G - YEL	YEL
E5: B	E - BLU	BLU
E6: B Complement	H - GRY	GRY

### BEI Optical Encoder

Models E25, H25 and L25 use encoders with the 12 or 15 VDC supply. Use the M16 plug columns for connecting E25, H25, L25 and H40 encoders.

Option Terminal	M16 Plug	M18 Plug	Model H38
E1: 0 VDC	F	F	2
E2: +VDC Supply	D	D	3
E3: A	A	A	4
E4: A Complement	C	H	7
E5: B	B	B	5
E6: B Complement	E	I	8

### Dynapar

The table below lists the series of Dynapar Optical Encoders compatible with the Encoder Receiver Option. Use encoders with the line driver output for 12 or 15 VDC operation.

Option Terminal	625 525 526	EX625	60 60P	90	H20 6 pin	H20 7 pin	H20 10 pin
E1: 0 VDC	F	C	C	BLK	A	F	F
E2: +VDC Supply	D	V+	E	WHT (B/W)	B	D	D
E3: A	A	A	B	RED	E	A	A
E4: A Complement	H	A Complement	G	WHT (R/W)	C	C	C
E5: B	B	B	D	ORG	D	B	B
E6: B Complement	I	B Complement	H	WHT (O/W)	F	E	E



# Appendix B USING THE MAN MACHINE INTERFACE

## DEFINITION & SCOPE

The Man Machine Interface (MMI) is the primary tool for communicating with the 590 DRV Digital drive. It allows the user to custom configure the drive, tune it for optimal performance and monitor its operation and diagnostic points.

The MMI consists of a two-line alphanumeric liquid crystal display (LCD) and a four-button keypad mounted on the front of the drive. Drive parameters are monitored in the MMI display window and changed using the four-button keypad.

**NOTE.** You can also configure drive parameters with a personal computer using the Windows™ compatible software package ConfigEd Lite through serial port P3, or monitor and adjust parameters with a PC using the RS422 serial interface option through serial port P1.

## USING THE MMI

### Access and Adjustment

The MMI is located under a hinged cover at the top of the 590 controller (see Figure 2.2). To open the cover, reach to the top of the control door and locate an indentation at the top center of the panel. Lightly grasp the cover at the indentation and gently pull out and downward.

The display of the MMI has a 2-line, 16-character liquid crystal readout designed to provide clear and simple feedback to the user. The upper line of the display shows the current menu or parameter. The lower line shows the next menu or parameter or the value/status of the parameter shown on the upper line.

A contrast potentiometer allows the user to adjust the intensity of the MMI display. It is located under the lower panel below the calibration card (see Figure 5.19). The `MENUS::MENU DELAY` parameter adjusts the rate MMI items change. Increasing the value for `MENU DELAY` slows the rate the menus change.

English is the default language displayed in the MMI. It can be changed to a second language, French, by changing the parameter `MENUS::LANGUAGE` to the other selection.

### Operation

The four buttons below the MMI display allow the user to scroll through the various menus and view or modify the parameters. In so doing, the user can easily find information and adjust drive parameters to fit the application of the drive. Key functions are as follows:

- M/menu select** Enters the menu or chooses the parameter shown on the second line of the MMI display. This key will not alter any parameters.
- E/escape** Exits the current selection and returns to the preceding menu. This key will not alter any parameters.
- ▲/up arrow** Scroll up through the menus or parameters displayed on the lower line of the display. When displaying a modifiable parameter on the upper line, ▲ either increases its value or selects another option. These options are shown on the lower line of the MMI display.
- ▼/down arrow** Scroll down through the menus or parameters displayed on the lower line of the display. When a modifiable parameter is displayed on the upper line, ▼ either decreases its value or selects another option.

## SOFTWARE OVERVIEW

A trained technician can adjust the drive using the MMI to tune motor performance and create configurations custom suited to the user's application. Appendix C discusses the parameters used to tune the drive. Appendix D shows the methods and techniques for configuring the internal connections, electronically changing control paths.



## MMI Menu Structure

The menu tree structure of the MMI display has been designed to allow non-expert users to read and set parameters controlling the drive with a minimum of work and potential for confusion.

The core of the system is MENU LEVEL which contains the eight functional areas of the controller. The following list describes the functions performed in each MENU LEVEL category and refers to the section within the manual that discusses the menu in depth.

Menu Level	Description
Diagnostics	Contains the parameters for monitoring the status of the controller. (See Chapter 5, Troubleshooting.)
Set Up Parameters	Parameters for calibrating and tuning the controller to the application. (Refer to Appendix C, Setup Parameters.)
Password	Allows the user to set up password protection for the drive configuration. (See Chapter 4, Start-up and Adjustment.)
Alarm Status	Contains parameters for monitoring the fault status of the controller. (Refer to Chapter 5, Troubleshooting.)
Menus	Settings for changing the MMI user interface. (Refer to this appendix. See below.)
Parameter Save	Menus for saving the current configuration and settings to EEPROM. (See Chapter 4, Start-up and Adjustment.)
Serial Links	Configures the RS232 and RS422 serial ports. (See Appendix H, Serial Communications.)
System	Contains the parameters for configuring the input and output terminals and internal connections. (See Appendix D, I/O Configuration.) This sub-menu also displays the firmware issue level and contains menus reserved for advanced drive troubleshooting. These advanced menus are available only in a restricted password mode. Only qualified Eurotherm Drives service personnel have access to these menus.  SYSTEM also contains the miniLINK setup menu. Newer issue 590 Digital drive firmware has superseded most miniLINK functions. Refer to the appropriate miniLINK manual for miniLINK documentation.

Figure B.1 shows the complete MMI menu structure. When using the figure, the M key moves to the right, E moves to the left, and ▲ and ▼ move up and down the menu lists. The complete menu structure for the MMI is often not needed for most applications. To simplify your work with the MMI, you can use a reduced menu mode by setting MENUS::FULL MENUS to DISABLED. The reduced list of menus is identified in Figure B.1 by the "\*" in the right side of the menu box.

MENU LEVEL is entered by pressing the M key from the default start up display. Pressing the ▲ key takes the user up through the categories in MENU LEVEL. To investigate the sub-menus, press the M key again.

Once at the appropriate sub-menu item, use the M key again to choose the parameter or option sub-menu, then use the ▲ and ▼ keys once again to modify the value or option. When finished, use the E key to back out of the menu structure, first to the sub-menu, then the main menus, until you reach the starting screen.

For example, from the default start up menu, press M to enter MENU LEVEL; press the ▼ key once to advance to the SETUP PARAMETERS menu item. Press the M key again to enter the SETUP PARAMETERS sub-menu. Use the ▲ or ▼ key to scroll through RAMPS, AUX I/O, etc.

## Default Settings

The 590 DRV Digital drive is shipped with MMI settings that represent a common set of parameters for general use. These settings are listed in Appendix C. Use caution when modifying these settings to ensure the new settings are the most appropriate for your situation.

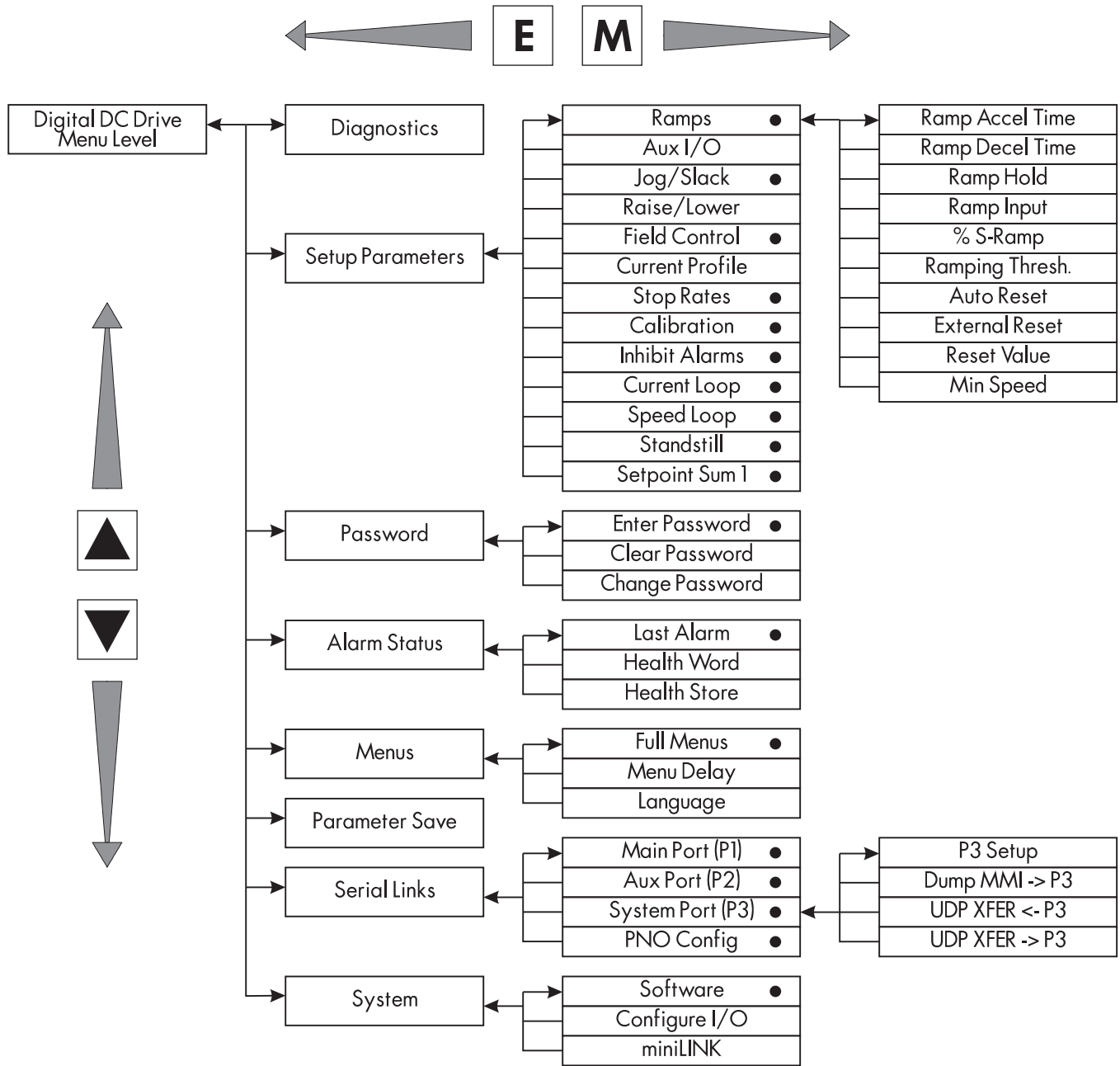
If you unintentionally change menu settings and cannot remember how to reset individual parameters, return all parameters to default by performing a four-button reset. To do so, hold down all four MMI buttons (M, E, ▲, ▼) while reapplying power to the drive. This restores the drive's default settings.

**NOTE.** These default settings do not match the "as-shipped" settings if Eurotherm Drives has modified the drive configuration at your request for your specific application.



**WARNING!**

If your 590 DRV Digital drive was ordered with special features or configurations or if you have entered non-default values in the MMI settings, a four-button reset will overwrite these settings. Before attempting to modify existing parameter settings, record them in this manual (Appendix E) so you can reenter them later, if necessary. Or, upload the drive configuration as an ASCII file through the drive's P3 port using a personal computer. You may also update your configuration using the ConfigEd Lite software package.



● Displayed when FULL MENUS is DISABLED.

Figure B.1 - 590 Digital Drive Menu Tree



## Appendix C SETUP PARAMETERS

The shipping configuration in the 590 DRV Digital drive allows the user to start up and run a DC motor in simple speed control. The power of the 590SP, however, is its configurability and its ability to be tuned for optimum performance or for a specific control application. The parameters which are most frequently adjusted for tuning and performance are in the SETUP PARAMETERS MMI menu. They are categorized by sub-menus. Each sub-menu acts as a function block within the drive's overall software block diagram which processes logic signals and speed or current input signals.

This chapter describes the functionality of *only* the drive parameters located within SETUP PARAMETERS. Refer to Appendix M for descriptions and application information of the parameters within the SPECIAL BLOCKS menu.

You can adjust the drive's parameter settings either through the MMI under the SETUP PARAMETERS sub-menu or by using a personal computer (PC) running the software package ConfigEd Lite (see the ConfigEd Lite Software Manual RG352747). You can also configure the drive— or connect and reconnect signals between drive function blocks and I/O terminals— either through the MMI or with a PC. For software configuration through the MMI, refer to Appendix D.

This chapter is arranged in the order the sub-menus, or function blocks, appear in the MMI. Each section contains a description of the function block's parameters, a schematic block diagram and a table listing all the block's parameters, a description of each parameter and the parameter's signal range and "as shipped" default value. The configuration tag number corresponding to each drive parameter also appears in the table. In addition, each section includes a drawing illustrating how to access the parameter function block through the MMI. Additional information, such as timing diagrams, follow the block diagram.

**NOTE.** The inside front cover contains a full drawing showing how all the drive's function blocks process input, output and control signals and how each block interfaces with the drive's overall control. A more detailed software block diagram appears in the fold-out drawing at the end of Appendix D.

Appendix I list all the drive's parameters by tag number. Appendix J presents the same table in menu order and Appendix K lists the parameters alphabetically.

Figure C.1 shows how to access the RAMPS function block through the MMI. Upon power-up, the MMI displays the software version and then the message shown at the top of the illustration. Pressing the "M" key changes the display to read the next block down. The ▼ key changes the menu location from DIAGNOSTICS to SETUP PARAMETERS. Pressing "M" again brings the display to the RAMPS menu. To change or monitor any of the RAMPS parameters, press "M", then press ▲ or ▼ to scroll through the RAMPS menu parameters.

The drive's parameters and function block inputs and outputs are defined as either a percentage if they are continuous, or as boolean value (1 or 0) if they are discrete. Depending on how the drive is configured, these parameters can represent physical entities such as motor speed or current. Tagging function block inputs or outputs to other software function blocks or to real world signals defines what the function block inputs or outputs represent. For example, the output from RAISE/LOWER can represent current demand if sent to the current loop or a speed setpoint if sent to the speed loop.

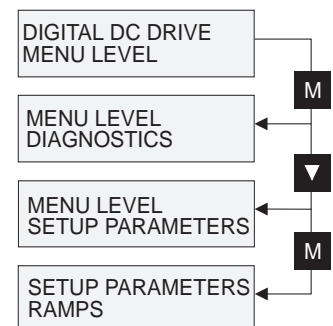
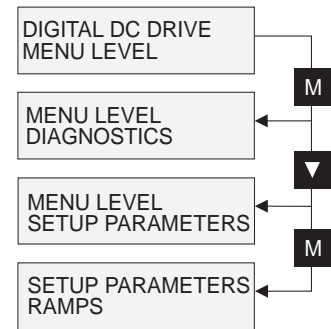


Figure C.1 - Sample MMI Path

## RAMPS

The RAMPS parameters set the shape and duration of the ramp used for starting and changing speeds. The STOP RATES menu contains a separate deceleration rate for controlled stopping of the drive.

Note: This block is ignored by the drive unless SYSTEM:: CONFIGURE I/O:: BLOCK DIAGRAM:: RAMP O/P DEST is connected to a nonzero tag. The default connection is to tag 291.



## Inputs and Outputs

The default inputs are ANALOG I/P 3 for a ramped speed input and DIGITAL I/P 2 for RAMP HOLD. The default output connection is to SETPOINT 3 in the speed loop.

The block has two outputs, RAMPING and RAMP OUTPUT.

## Description

The input signal has a minimum speed clamp. MIN SPEED sets the minimum ramp input speed when the drive is enabled.

RAMP INPUT is routed to the JOG/SLACK block to be modified as determined by the JOG inputs. The S/Linear ramp block shapes the signal to produce the RAMP OUTPUT signal.

The RAMPING output becomes TRUE when the absolute value of the difference between RAMP OUTPUT and the JOG/SLACK block output exceeds RAMPING THRESH.

RAMP ACCEL TIME and RAMP DECEL TIME set the acceleration and deceleration times taken for input changes. %S RAMP adds a "S" shaped section to the linear ramp. When set to 0.00%, the ramp will be linear. As the percent is increased, up to 350 percent of the ramp time is added to the linear ramp creating more gradual starting and stopping. The formula for the actual ramp time is shown below. Ramp time is the value of parameters RAMP ACCEL TIME or RAMP DECEL TIME.

$$\text{Actual Ramp Time} = \text{RAMP TIME} \times (3.5 \times \%S \text{ RAMP}/100 + 1)$$

RAMP HOLD stops the ramp from changing. When DIGITAL I/P 2 is ON, the ramp stays at the last ramp value.

The reset signal can have two sources, a RUN signal or an external reset signal. When AUTO RESET is ENABLED, the ramp resets whenever a RUN signal is given at terminal C3. Connecting a digital input to EXTERNAL RESET allows an external source to reset the ramp.

## Parameters

Tag	Parameter	Description	Range	Default
2	RAMP ACCEL TIME	Acceleration time for 100 percent change	0.1 - 600.0 Secs	10.0 Secs
3	RAMP DECEL TIME	Deceleration time for 100 percent change	0.1 - 600.0 Secs	10.0 Secs
118	RAMP HOLD	When ON, the ramp output is held at the last value. It is overridden by a ramp reset.	ON/OFF	OFF
5	RAMP INPUT	Input value	±100.00%	0.00%
266	%S RAMP	Percentage of the ramp with a S-shaped curve.	0.00 to 100.00%	2.50%
286	RAMPING THRESH.	Threshold used to determine whether the ramp is active.	0.00 - 100.00%	0.50%
287	AUTO RESET	When ENABLED, the ramp is reset whenever SYSTEM RESET is TRUE (tag 374), i.e. every time the drive is started	ENABLED/DISABLED	ENABLED
288	EXTERNAL RESET	When ENABLED, the ramp is reset to zero or RESET VALUE.	ENABLED/DISABLED	DISABLED
422	RESET VALUE	Ramp output value when the ramp is reset by an external reset. (When EXTERNAL RESET is ENABLED.)	±300.00%	0.00%
126	MIN SPEED	A bidirectional clamp connected directly to RAMP INPUT.	0.00 to 100.00%	0.00%

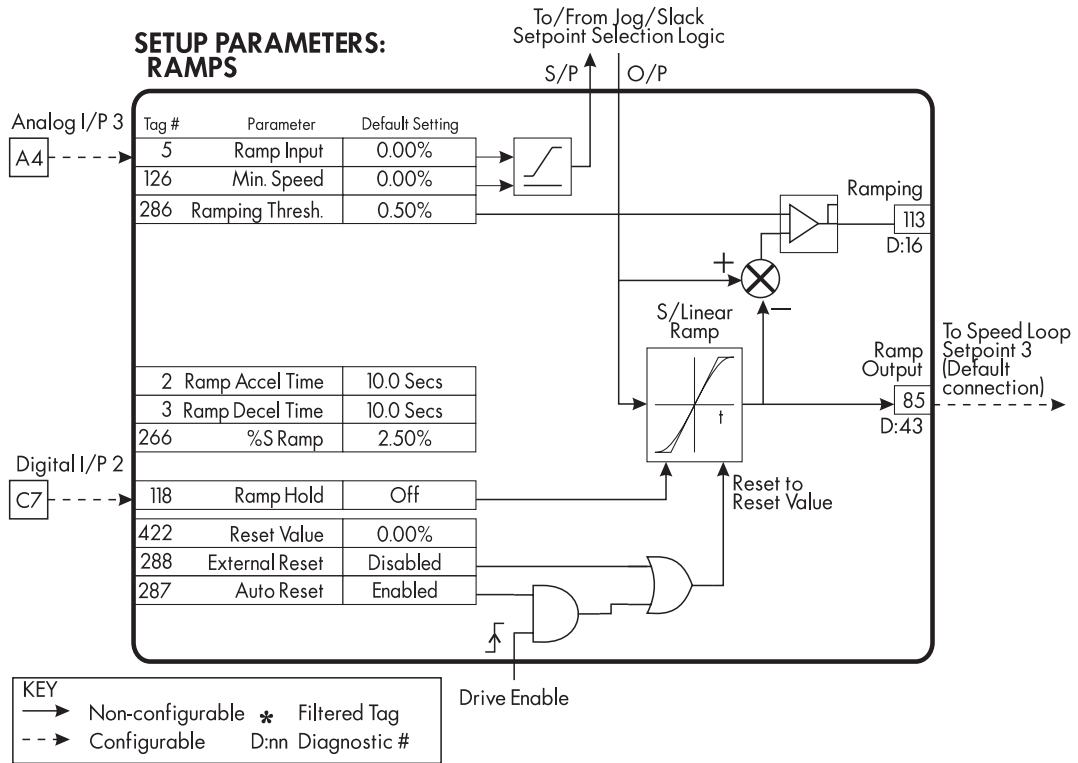


Figure C.2 - Ramps

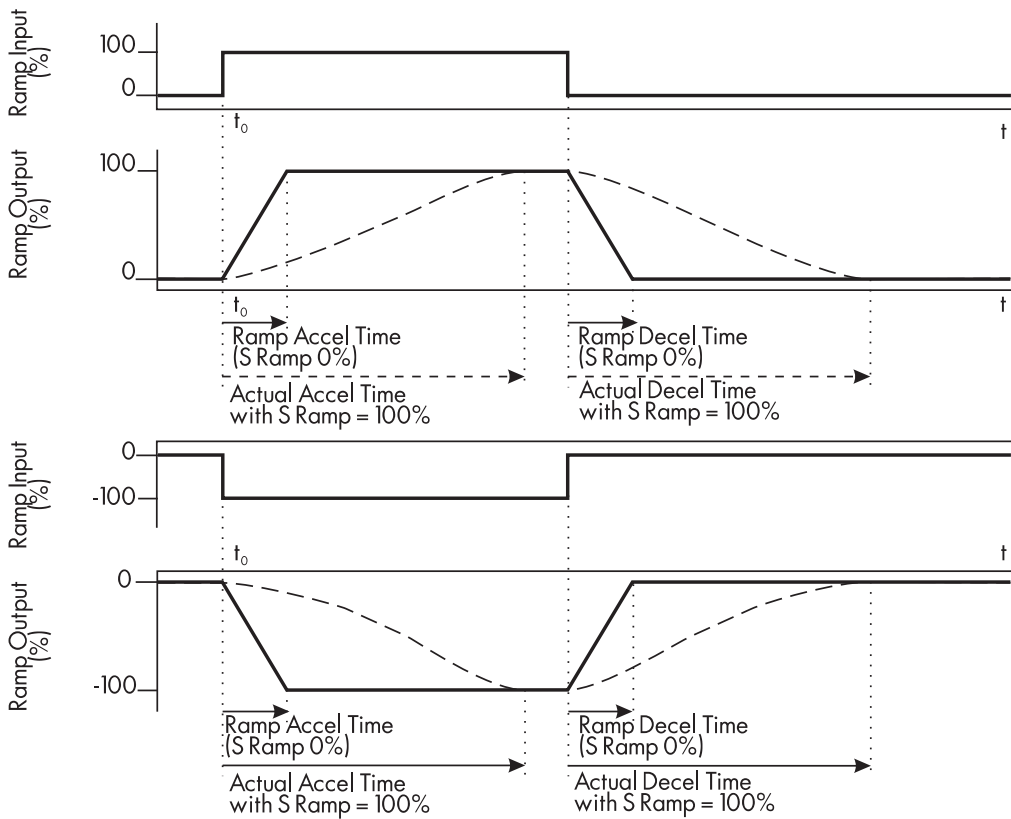


Figure C.3 - Ramp Accelerate and Decelerate Times



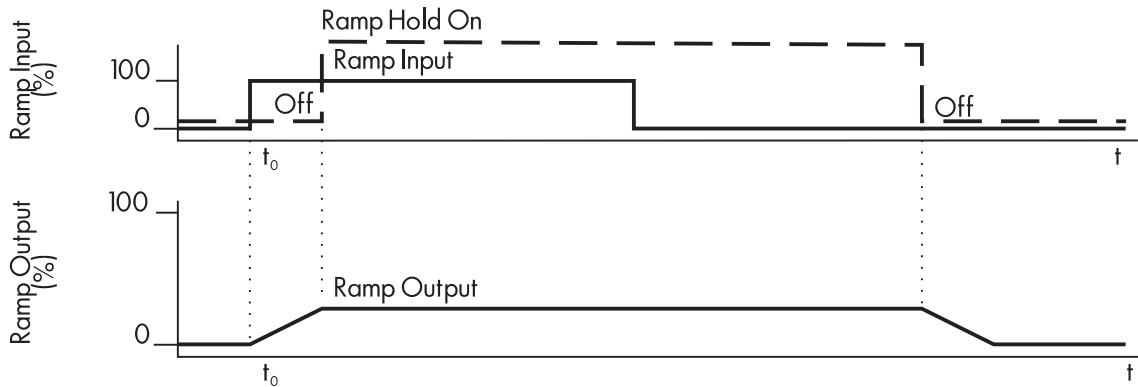


Figure C.4 - Ramp Hold

The ramp will function when a ramp input is present. When DIGITAL I/P 2 is ON, RAMP HOLD stops the ramp output from changing. Even when the ramp input signal is removed, RAMP HOLD keeps the ramp output from changing. Once RAMP HOLD is OFF, the ramp resumes.

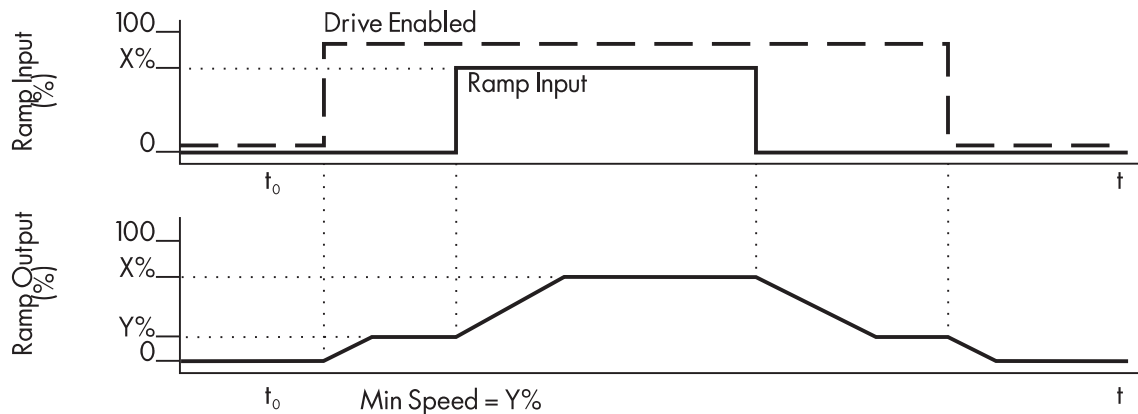


Figure C.5 - Minimum Speed

This figure shows the effect of setting MIN. SPEED above 0.00%. When the drive is enabled, the ramp output cannot fall below the value set by MIN. SPEED.

Notice the ramp rates are used when changing the output from minimum speed to zero speed. Notice also that in this example the ramp output only increases to X% since the ramp input signal is limited to X%.

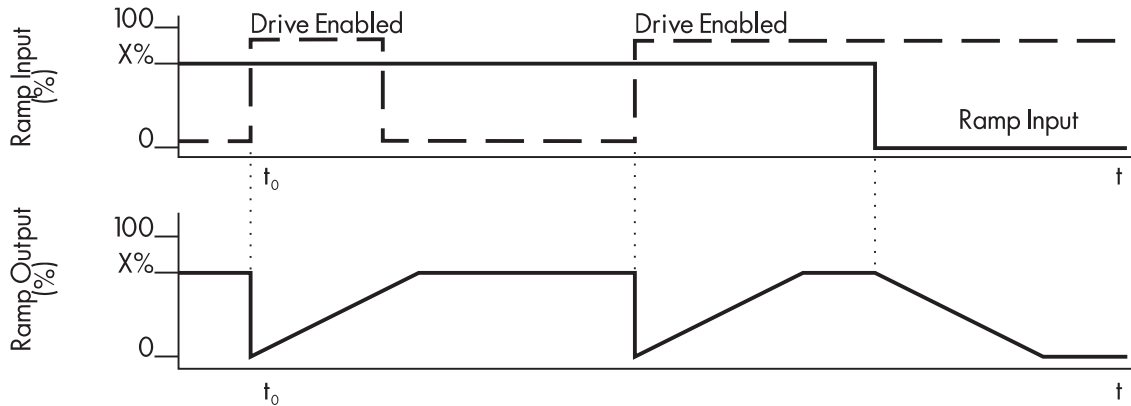


Figure C.6 - Auto Reset

When AUTO RESET is ENABLED, the ramp output resets to RESET VALUE each time the drive is enabled. In this example, RESET VALUE is 0.00%. It does not reset if the drive is disabled.

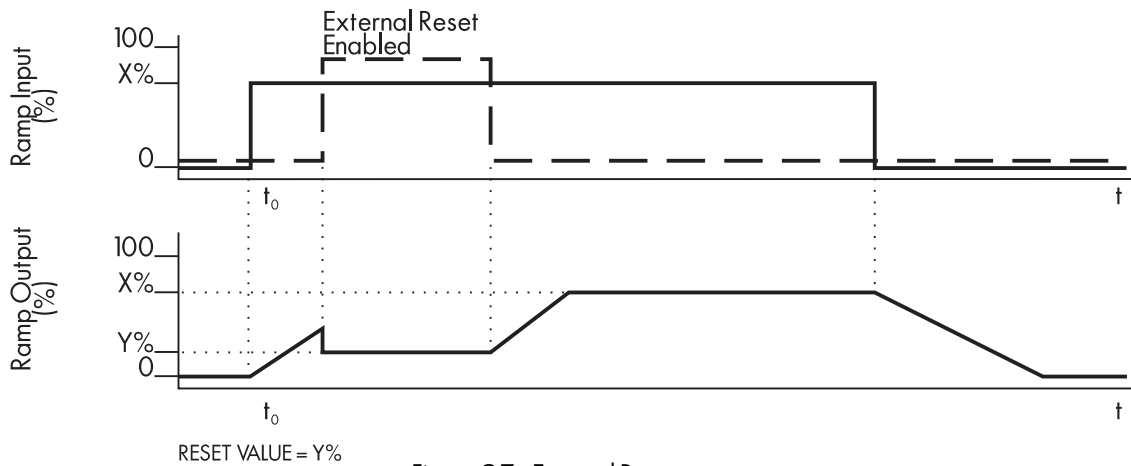


Figure C.7 - External Reset

The ramp input is set to X% at time  $t_0$ . The ramp output will increase at the ramp rate. While EXTERNAL RESET is ENABLED, the ramp output resets to RESET VALUE. When EXTERNAL RESET is DISABLED, the ramp output continues to follow input signal.





## AUX I/O

The AUX I/O parameters allow an external computer or PLC to access or control input and output terminals using serial communications (see Appendix H).

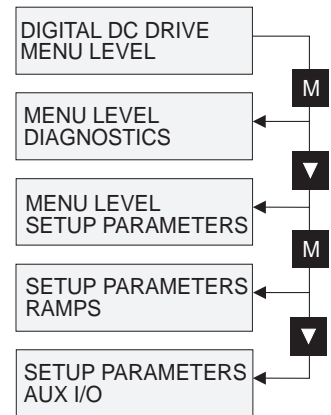
## Inputs and Outputs

START, JOG, and ENABLE from digital input terminals C3, C4 and C5, respectively, connect directly to the AUX I/O block. Output signals are then sent to the drive start and drive enable logic and the JOG/SLACK function block.

## Description

The external device sends its signal directly to the required tag (PNO). The auxiliary inputs for START, JOG, and ENABLE allow the normal terminal signal to be "ANDed" with a corresponding auxiliary signal from an external computer or PLC.

The remaining five auxiliary outputs allow external computers to directly control the output terminals. These connections are set in SYSTEM::CONFIGURE I/O.



## Parameters

Tag	Parameter	Description	Range	Default
161	AUX START	Combined with START signal at terminal C3	ON/OFF	ON
227	AUX JOG	Combined with JOG signal at terminal C4	ON/OFF	ON
168	AUX ENABLE	Combined with ENABLE signal at terminal C5	ON/OFF	ON
94	AUX DIGOUT 1	Digital output 1	ON/OFF	OFF
95	AUX DIGOUT 2	Digital output 2	ON/OFF	OFF
96	AUX DIGOUT 3	Digital output 3	ON/OFF	OFF
128	ANOUT 1	Analog output 1	±100.00%	0.00%
129	ANOUT 2	Analog output 2	±100.00%	0.00%

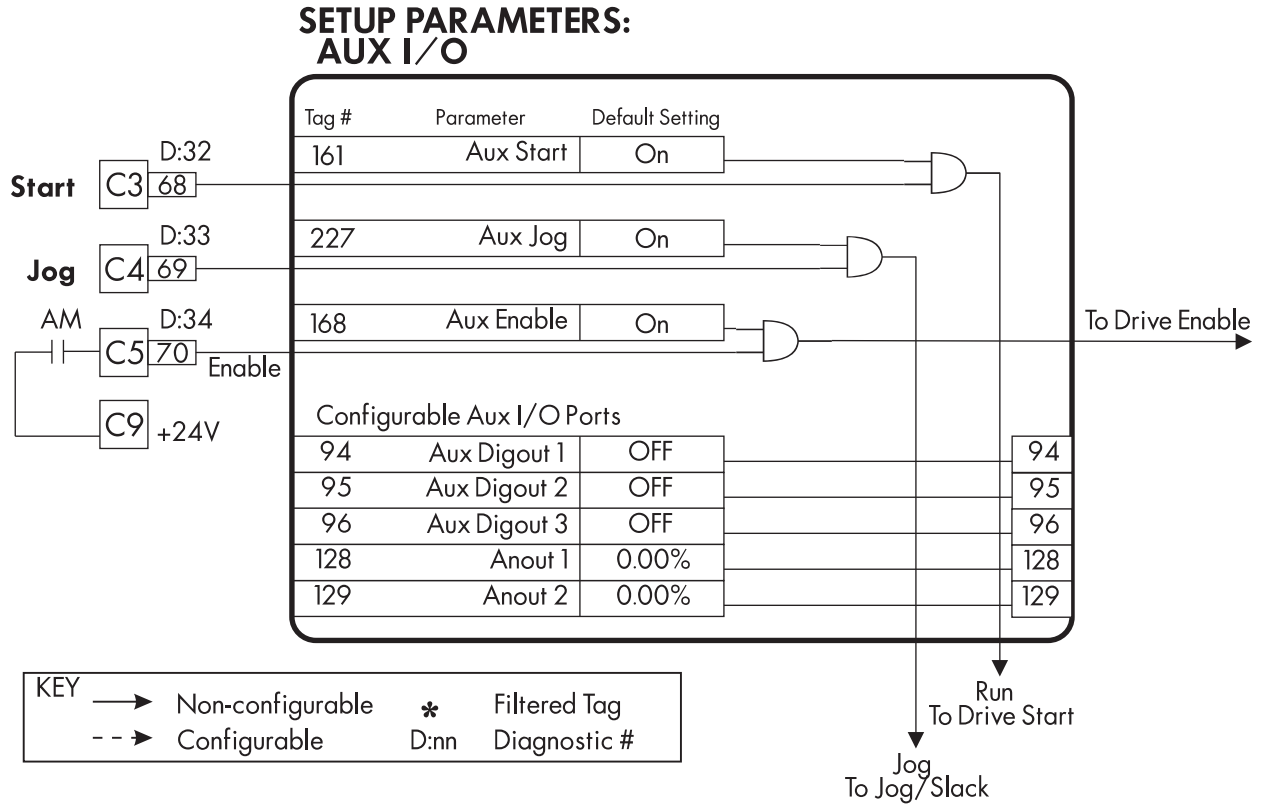


Figure C.8 - Aux I/O

## JOG/SLACK

The JOG/SLACK parameters can modify or replace the ramp input speed demand to provide jog, take up slack and crawl speed functions. Use a spare digital input to switch between modes and achieve full functionality.

## Inputs and Outputs

JOG/SLACK receive run and jog signals via AUX I/O and the speed demand from RAMPS. A mode input from an unused digital input terminal is optional. The output is connected to the S/Linear ramp in RAMPS.

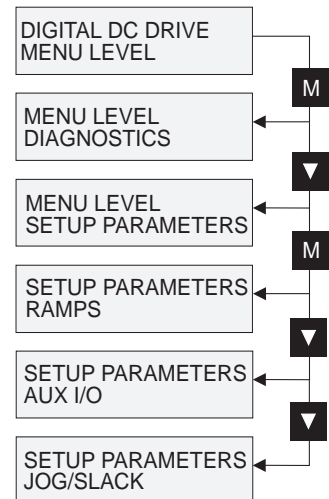
## Description

The signal from RAMPS is modified as required by the MODE, JOG, and RUN settings. These settings are shown in the Setpoint Selection table in the block diagram.

When using the jog function and the RUN signal is OFF, then the jog speed demand replaces the input signal. MODE selects between jog setpoints 1 and 2. The jog RAMP RATE replaces the RAMP ACCEL TIME and RAMP DECEL TIME in RAMPS. %S RAMP is also set to 0.00%.

When running, the jog signal performs a "take up slack" function. When a jog signal is received, the take up slack setpoint is added to the ramp input. MODE and JOG settings work in concert to select between the two take-up slack setpoints.

In crawl speed mode, CRAWL SPEED replaces the ramp input as the output signal.



## Parameters

Tag	Parameter	Description	Range	Default
218	JOG SPEED 1	Jog speed setpoint 1	±100.00%	5.00%
219	JOG SPEED 2	Jog speed setpoint 2	±100.00%	-5.00%
253	TAKE UP 1	Take up slack speed setpoint 1	±100.00%	5.00%
254	TAKE UP 2	Take up slack speed setpoint 2	±100.00%	-5.00%
225	CRAWL SPEED	Crawl speed setpoint	±100.00%	10.00%
228	MODE	Selects jog speed setpoints, take up setpoints, and the crawl setpoint.	TRUE/FALSE	FALSE
355	RAMP RATE	Ramp time for jogging. Acceleration and deceleration times are the same.	0.1 to 600.0 Secs	1.0 Secs

### SETUP PARAMETERS: JOG / SLACK

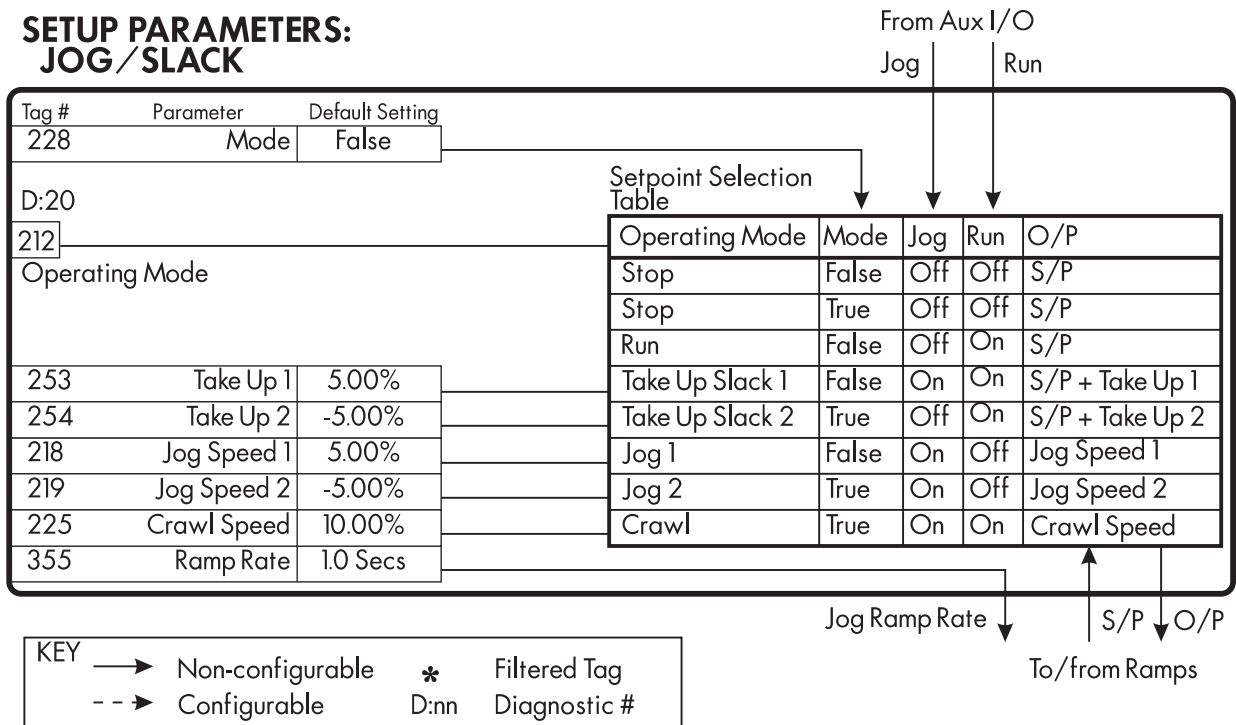


Figure C.9 - Jog/Slack

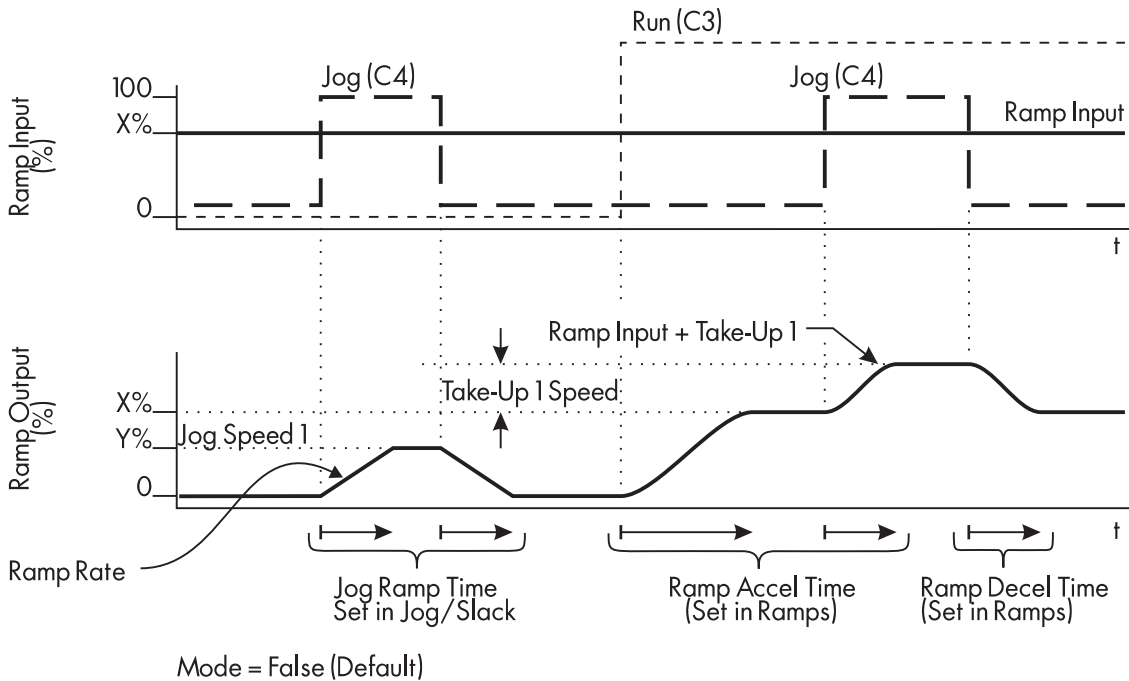


Figure C.10 - Jog/Slack Operation

## RAISE/LOWER

RAISE/LOWER provides electronic motor operated potentiometer (MOP) functionality.

Note: This block is ignored by the drive unless SYSTEM:: CONFIGURE I/O:: BLOCK DIAGRAM:: RAISE/LOWER DEST is connected to a non-zero tag.

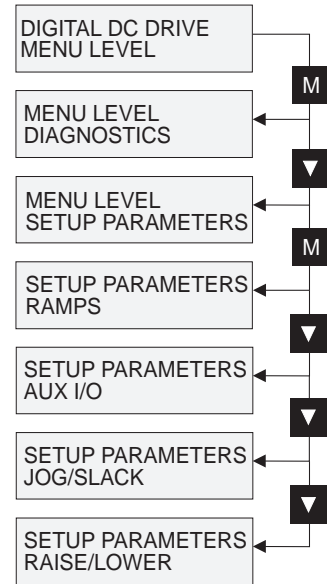
## Inputs and Outputs

The default configuration has no inputs or outputs connected.

## Description

RAISE INPUT, when TRUE, increases the output at the rate determined by INCREASE RATE. LOWER INPUT decreases the output as determined by DECREASE RATE. MIN VALUE and MAX VALUE limits the total change by the amounts set.

When EXTERNAL RESET is TRUE, the output is set to RESET VALUE.



## Parameters

Tag	Parameter	Description	Range	Default
255	RESET VALUE	Loaded into the output on power-up or when EXTERNAL RESET is TRUE.	±300.00%	0.00%
256	INCREASE RATE	Rate of change of an increasing output value.	0.1 to 600.0 Secs	10.0 Secs
257	DECREASE RATE	Rate of change of a decreasing output value.	0.1 to 600.0 Secs	10.0 Secs
261	RAISE INPUT	Command to raise the output value.	TRUE/FALSE	FALSE
262	LOWER INPUT	Command to lower the output value.	TRUE/FALSE	FALSE
258	MIN VALUE	Minimum ramp output clamp.	±300.00%	-100.00%
259	MAX VALUE	Maximum ramp output clamp.	±300.00%	+100.00%
307	EXTERNAL RESET	When TRUE, sets the output to the RESET VALUE.	TRUE/FALSE	FALSE

### SETUP PARAMETERS: RAISE/LOWER

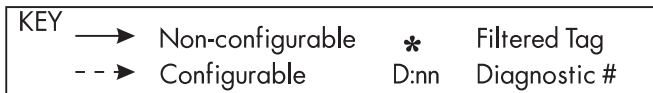
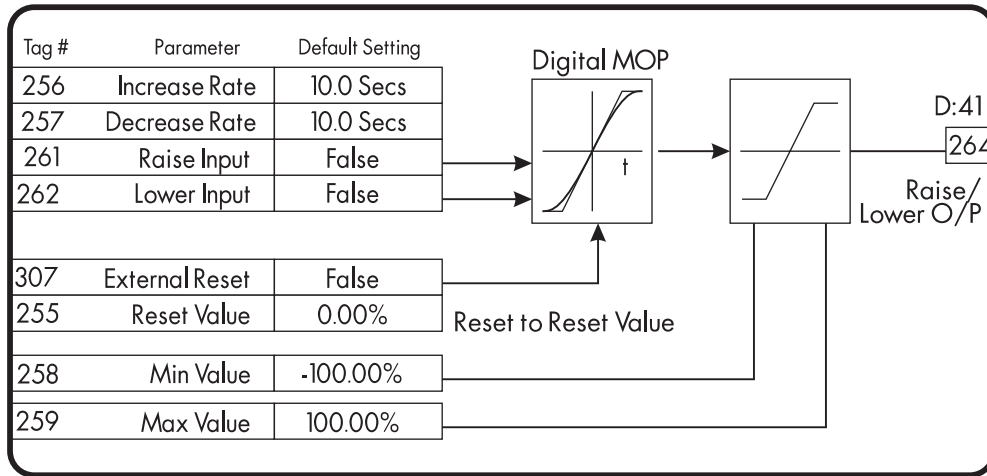


Figure C.11 - Raise/Lower

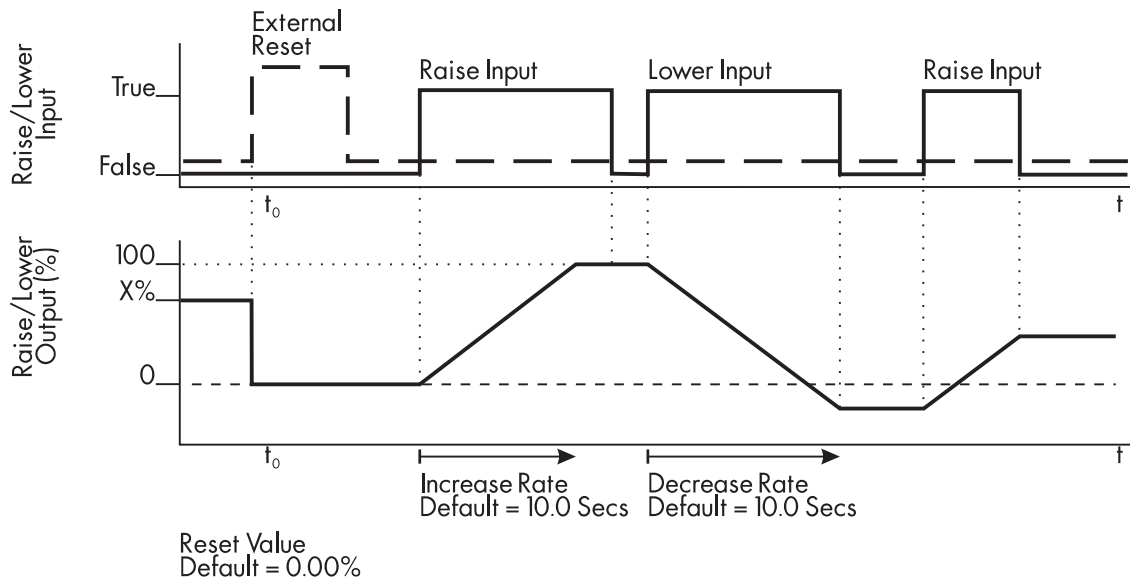


Figure C.12 - Raise/Lower Operation

These curves illustrate the raise/lower functionality. When EXTERNAL RESET is set TRUE, the raise/lower output resets to RESET VALUE (default = 0.00%). When RAISE INPUT is TRUE, the output increases at INCREASE RATE. The output cannot exceed MAX VALUE. The reverse is true when LOWER INPUT is TRUE. The lower input reduces the output at DECREASE RATE. The output cannot drop below MIN VALUE. Removing the raise or lower signal before the output reaches its maximum or minimum value prevents the ramp from changing and leaves it at its last output value. Setting both RAISE INPUT and LOWER INPUT to TRUE at the same time creates a ramp hold condition.



## FIELD CONTROL

The parameters and sub-menus in the FIELD CONTROL block control the drive's full wave, single phase, motor field thyristor bridge circuit. Field weakening is a standard feature on all 590 controllers.

## Inputs and Outputs

The inputs to FIELD CONTROL come from FLD VOLTAGE VARS and FLD CURRENT VARS. DRIVE ENABLE is also used by the FLD QUENCH DELAY to delay disabling the field when RUN is removed.

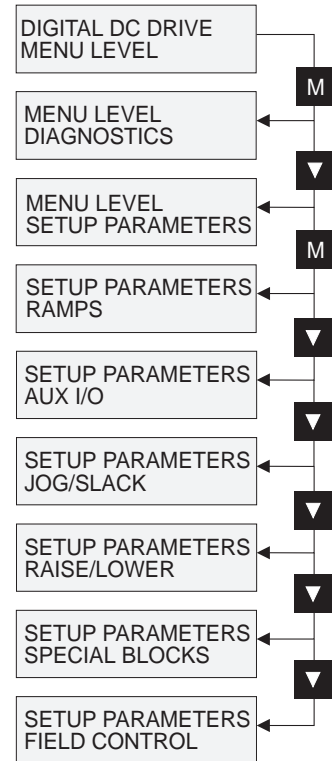
The AC field voltage is the only input to FLD VOLTAGE VARS.

## Description

FIELD ENABLE disables the field thyristor bridge and is used in permanent motor applications. Disabling the field automatically overrides the field fail alarm. If FIELD ENABLE is ENABLED, you can select between voltage and current control under FLD CONTROL MODE IS. The default is VOLTAGE CONTROL.

In VOLTAGE CONTROL mode, set the value of RATIO OUT/IN to provide the correct field voltage. This control mode provides open-loop phase angle control of the field thyristor bridge. To set RATIO OUT/IN, divide the desired DC field voltage by the AC input voltage and multiply by 100.

CURRENT CONTROL mode uses closed loop current control for accurate motor field control and field weakening. A sensor monitors motor field current and compares the current feedback to the calibrated drive field current. The processed error between the two sets the phase angle firing of the field thyristors.



## Parameters

Tag	Parameter	Description	Range	Default
170	FIELD ENABLE	Enables and disables the drive motor field control.	ENABLED/DISABLE	
209	FIELD CONTROL MODE	Selects between open loop VOLTAGE CONTROL or closed loop CURRENT CONTROL.	VOLTAGE CURRENT	VOLTAGE
185	FIELD QUENCH DELAY	Sets the period the field is kept on when the drive is disabled. When using dynamic braking, the field must be kept on after the drive is disabled until the motor reaches zero speed.	0.0 to 600.0 seconds	0.00 seconds
186	FLD QUENCH MODE	When QUENCHED the field is entirely disabled when the drive is disabled. In STANDBY, the field output reduces is 50% of the AC RMS field supply when the drive is disabled.	QUENCHED/STANDBY	QUENCHED

## FIELD VOLTAGE VARS

210	RATIO OUT/IN	Sets the ratio of the output DC field voltage to the RMS field supply voltage when FIELD CONTROL MODE is set to VOLTAGE CONTROL. The factory setting is 65.00%.	0.00 to 100.00%	90.00%
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### SETUP PARAMETERS: FIELD CONTROL

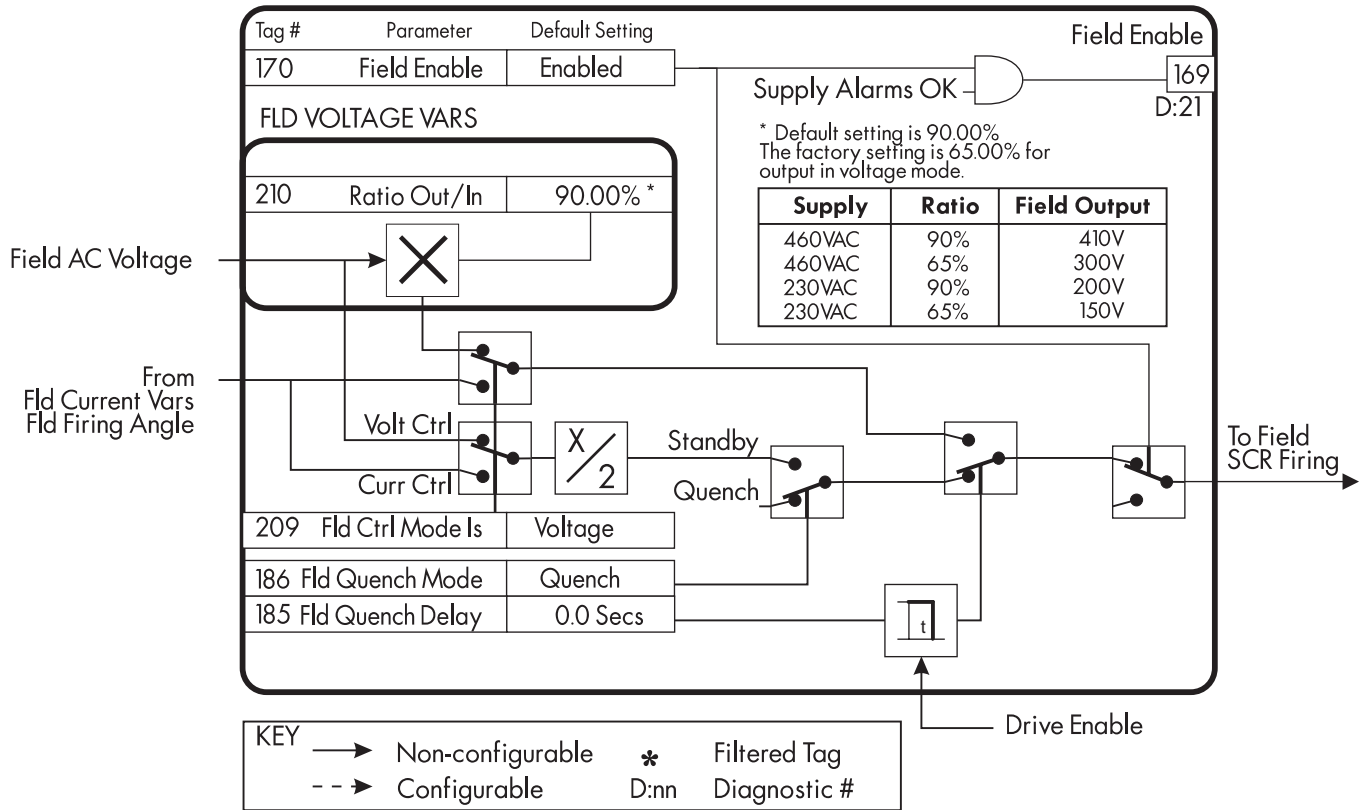


Figure C.13 - Field Control



## FIELD CONTROL::FLD CURRENT VARS

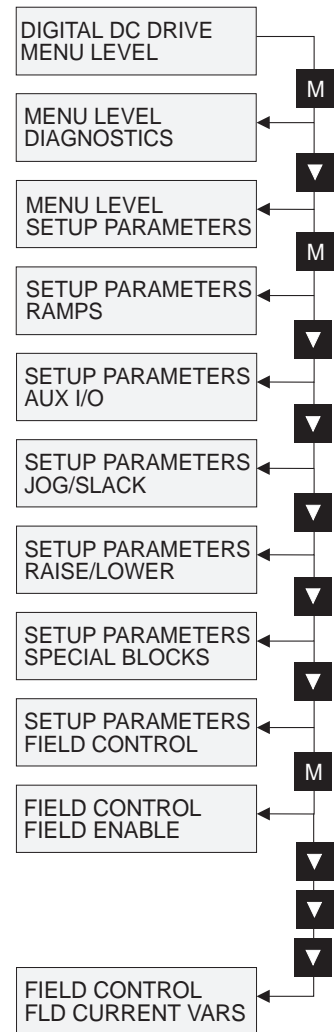
These variables tune the field current loop with proportional and integral control.

### Inputs and Outputs

The inputs to FLD CURRENT VARS are the field current feedback from calibration and the field weakening current demand from FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS. The output, FLD FIRING ANGLE, is the field current loop demand for the FIELD CONTROL block.

### Description

Tuning PROP. GAIN and INT. GAIN adjusts the response of the field current demand. For most applications, leave SETPOINT at its default setting of 100%. You may need to change this value for some applications (for instance, a counter EMF winder).



### Parameters

Tag	Parameter	Description	Range	Default
171	SETPOINT	Field current setpoint.	0.00 to 100.00%	100.00%
173	PROP. GAIN	Proportional gain adjustment of field current PI loop.	0.00 to 100.00	0.10
172	INT. GAIN	Integral gain adjustment fo the field current PI loop.	0.00 to 100.00	1.28

### SETUP PARAMETERS: FIELD CONTROL: FLD CURRENT VARS

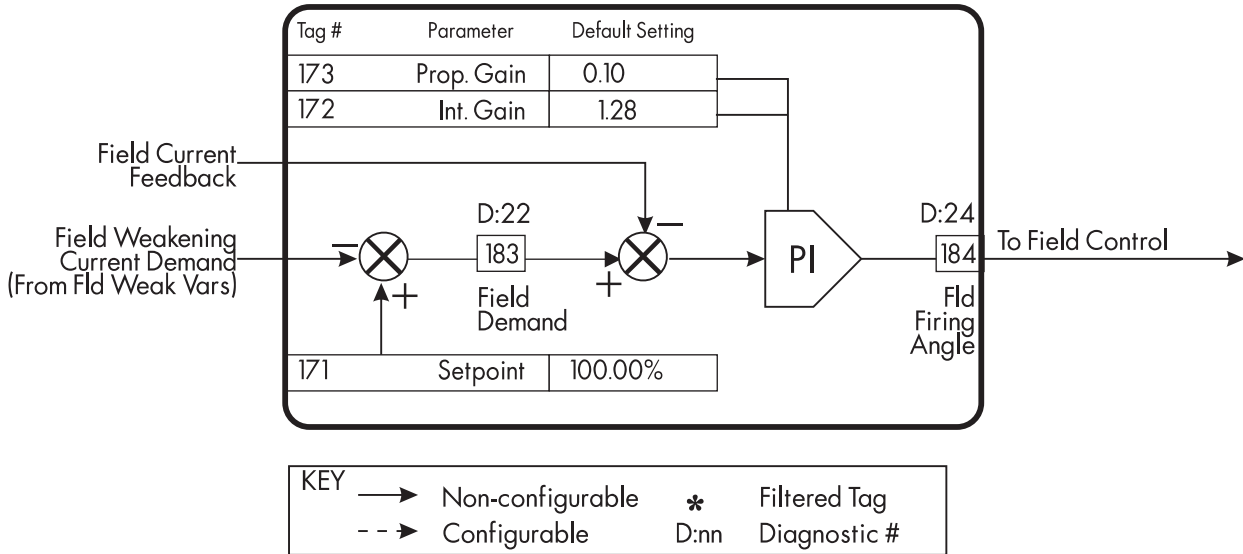


Figure C.14 - Field Current Variables

## FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS

Field weakening allow DC motors to operate above base speed in the constant horse-power control range. For stable operation, the drive *must* have a speed feedback signal generated by either an analog tachometer generator, Microtach or wire-ended encoder.

### Inputs and Outputs

The input to FLD WEAK VARS is the BACK EMF from CALIBRATION. The output provides the field weakening current demand to FLD CURRENT VARS.

### Description

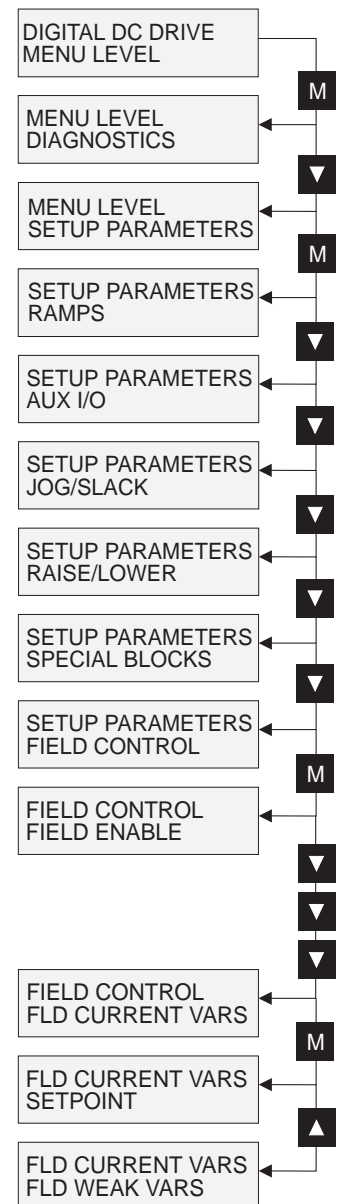
Setting FLD WEAK ENABLE to ENABLED activates the control loop for controlling the motor back EMF during field weakening.

EMF LEAD, EMF LAG and EMF GAIN tune the control loop for field weakening. The units for the lead and lag terms are in hundredths of milliseconds. Multiply the value by 100 to yield milliseconds. The gain term should also be multiplied by 100 to yield the actual gain term.

MAX VOLTS sets the voltage level where field weakening begins. When set to 100%, field weakening begins at the drive calibrated voltage determined by the resistor, or switchable calibration card settings and the value set in ARMTURE V CAL. During startup, MAX VOLTS can be set lower than 100% during actual operation.

MIN FLD CURRENT should be set 10% below the desired field current needed to attain maximum speed. This allows enough field current for the drive to maintain transient control of the motor. Setting this parameter below 6.00% will trip the FIELD FAIL alarm.

The back EMF feedback filter limits armature voltage overshoot when the motor accelerates through base speed. The ratio BEMF FBK LEAD to BEMF FBK LAG should be greater than one to provide an overall lead for the filter. Ratios should be kept below three for stable control. When they are equal, the BEMF filter is disabled.



### Parameters

Tag	Parameter	Description	Range	Default
174	FLD.WEAK ENABLE	Enables field weakening mode.	ENABLED/DISABLED	DISABLED
175	EMF LEAD	Lead time adjustment of the PI loop.	0.00 to 50.00	2.00
176	EMF LAG	Lag time adjustment of the PI loop.	0.00 to 200.00	40.00
177	EMF GAIN	Gain adjustment of the PI loop.	0.00 to 100.00	0.30
179	MIN FLD CURRENT	Minimum value for field current needed for max speed.	0.00 to 100.00%	10.00%
178	MAX VOLTS	Voltage level where field weakening begins.	0.00 to 100.00%	100.00%
191	BEMF FBK LEAD	Lead time for BEMF filter	10 to 5000 msecs	100
192	BEMF FBK LAG	Lag time for BEMF filter	10 to 5000 msecs	100

**SETUP PARAMETERS:  
FIELD CONTROL:  
FLD CURRENT VARS:  
FLD WEAK VARS**

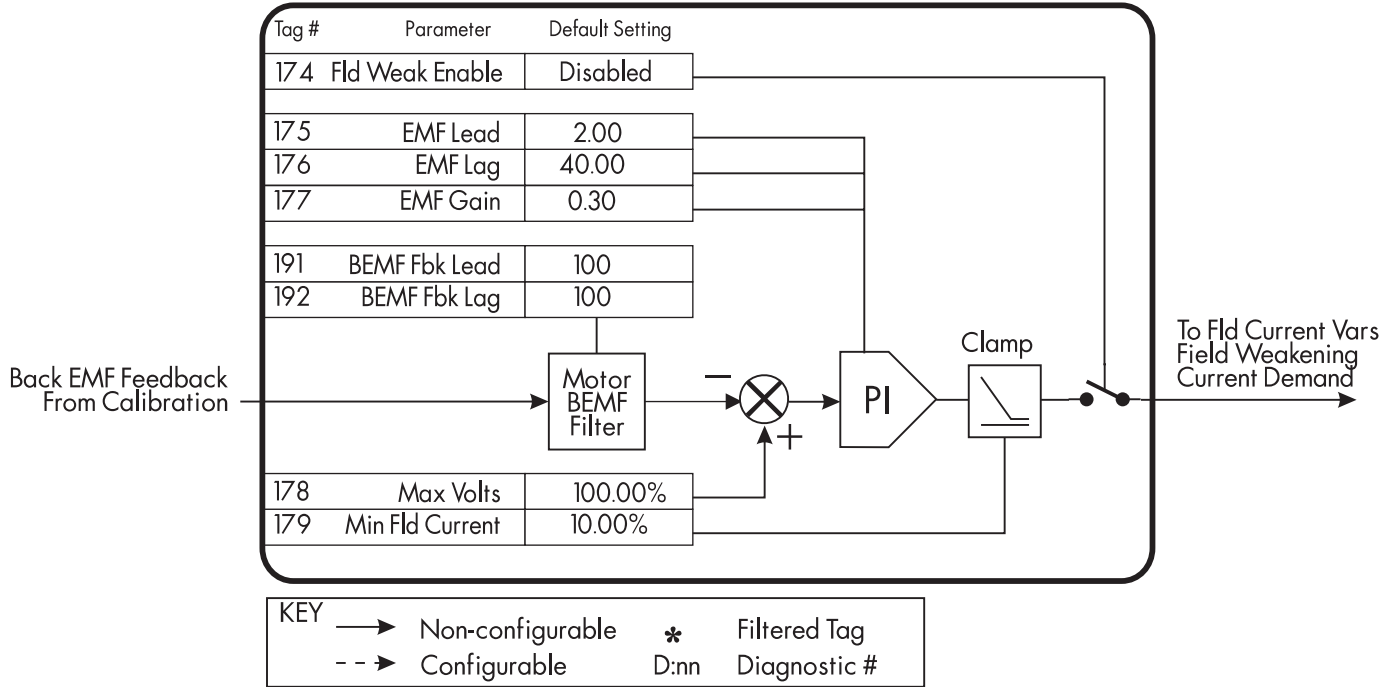


Figure C.15 - Field Weakening Variables

## CURRENT PROFILE

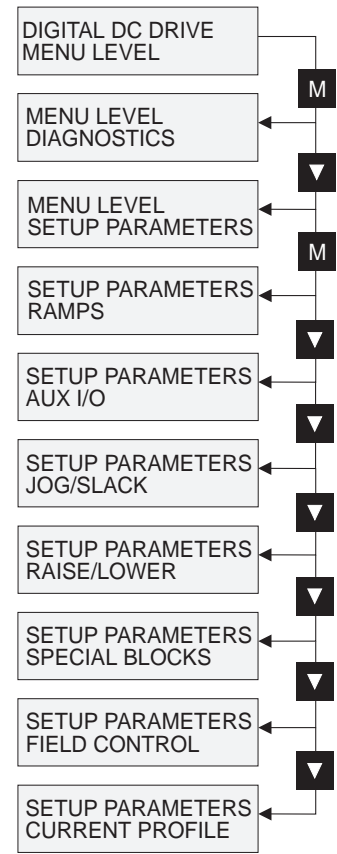
CURRENT PROFILE scales the current limit for applications where motors have a reduced ability to commutate the armature current at low field currents. Normally this is required when using field weakening.

## Inputs and Outputs

SPEED FEEDBACK from the speed loop is the input. The output changes the CURRENT LIMIT CLAMP in the current loop.

## Description

When SPEED FEEDBACK exceeds SPD BRK 1 (LOW), the current profile begins scaling the current limit as set by I MAX BRK1 (SPD1). As the SPEED FEEDBACK increases toward SPD BRK2 (HIGH), the current limit is reduced toward I MAX BRK2 (SPD2). When the speed exceeds SPD BRK2 (HIGH) the current limit remains at the I MAX BRK2 (SPD2) setting.



## Parameters

Tag	Parameter	Description	Range	Default
32	SPD BRK 1 (LOW)	Speed breakpoint 1 where current profiling begins.	0.00 to 100.00%	100.00%
31	SPD BRK 2 (HIGH)	Speed breakpoint 2 where current profiling ends.	0.00 to 100.00%	100.00%
93	IMAX BRK 1 (SPD1)	Current limit value at or below SPD BRK 1.	0.00 to 200.00%	200.00%
33	IMAX BRK 2 (SPD2)	Current limit value at or above SPD BRK 2.	0.00 to 200.00%	200.00%

### SETUP PARAMETERS: CURRENT PROFILE

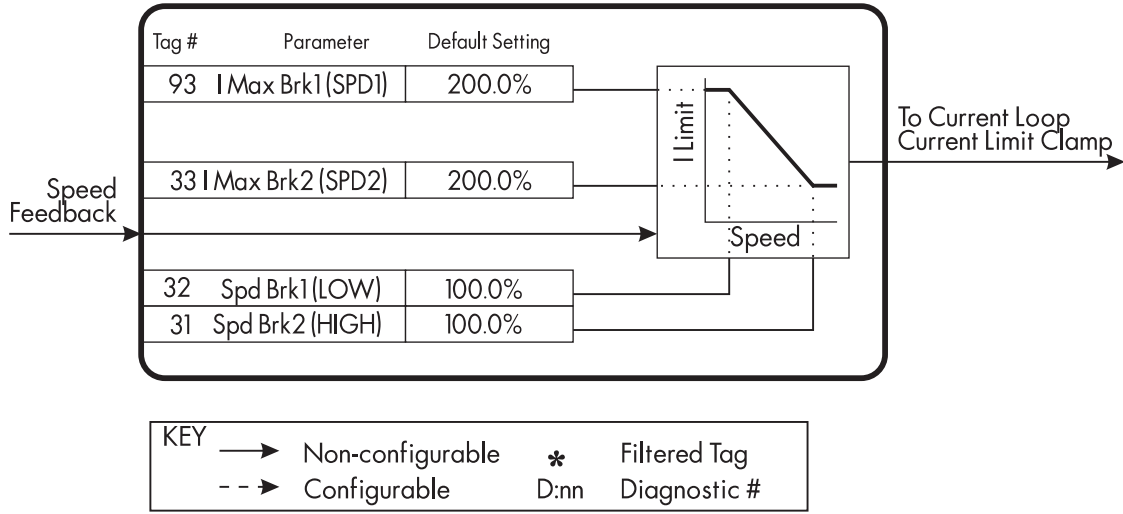


Figure C.16 - Current Profile

## STOP RATES

The STOP RATES parameters are used when stopping using a normal stop or a program stop.

## Inputs and Outputs

Inputs are SPEED SETPOINT and SPEED FEEDBACK from the speed loop, RUN from terminal C3, and PROGRAM STOP from terminal B8. The outputs are SPEED DEMAND to the speed loop, PROG STOP I LIMIT to the current loop, and signals to the coast stop and drive enable logic.

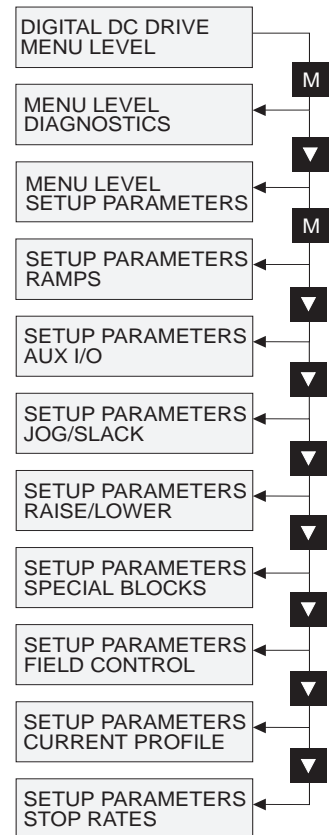
## Description

A normal stop occurs when the RUN signal is removed from terminal C3. It ramps the speed demand to zero at a rate set by STOP TIME. Non-regenerative drives will stop no faster than the coast stop rate. Regenerative drives use STOP TIME to set the duration of the stop. After the stop, the contactor de-energizes and the drive disables. The STOP LIMIT timer starts when C3 goes to zero volts. If the drive speed has not reached STOP ZERO SPEED within the STOP LIMIT time, the contactor de-energizes and the drive disables.

During normal stops, CONTACTOR DELAY delays de-energizing the contactor after the motor reaches zero speed. When STOP ZERO SPEED is set above 0.25%, the drive disables during the contactor delay. Below 0.25%, the drive disables after the contactor delay. This is useful when using the jog function to prevent multiple operations of the contactor. CONTACTOR DELAY is overridden when terminal C5 is at zero volts.

PROGRAM STOP provides a controlled fast stop using regenerative drives. The stop time is set by PROGRAM STOP TIME. The timer starts once terminal B8 goes to zero volts. When the drive reaches STOP ZERO SPEED, the contactor de-energizes and the drive disables. PROGRAM STOP LIMIT sets the maximum time the program stop can take before the contactor de-energizes and the drive disables.

PROG STOP I LIM sets the current limit in the current loop during a program stop. Other current limits can override it.



## Parameters

Tag	Parameter	Description	Range	Default
27	STOP TIME	Time to reach zero speed when performing a normal stop.	0.1 to 600.0 Secs	10.0 Secs
217	STOP LIMIT	The maximum time a controlled stop can take in a normal stop before the drive will coast stop.	0.0 to 600.0 Secs	60.0 Secs
302	CONTACTOR DELAY	The time the contactor stays energized after the STOP ZERO SPEED limit is reached.	0.1 to 600.0 Secs	1.0 Secs
26	PROG STOP TIME	Time to reach zero speed when performing a program stop.	0.1 to 600.0 Secs	0.1 Secs
216	PROG STOP LIMIT	The maximum time a program stop can take before the contactor is de-energized and the drive is disabled.	0.0 to 600.0 Secs	60.0 Secs
91	PROG STOP I LIM	Current limit when performing a program stop.	0.00 to 200.00%	100.00%
29	STOP ZERO SPEED	Threshold where the CONTACTOR DELAY timer starts.	0.00 to 100.00%	2.00%

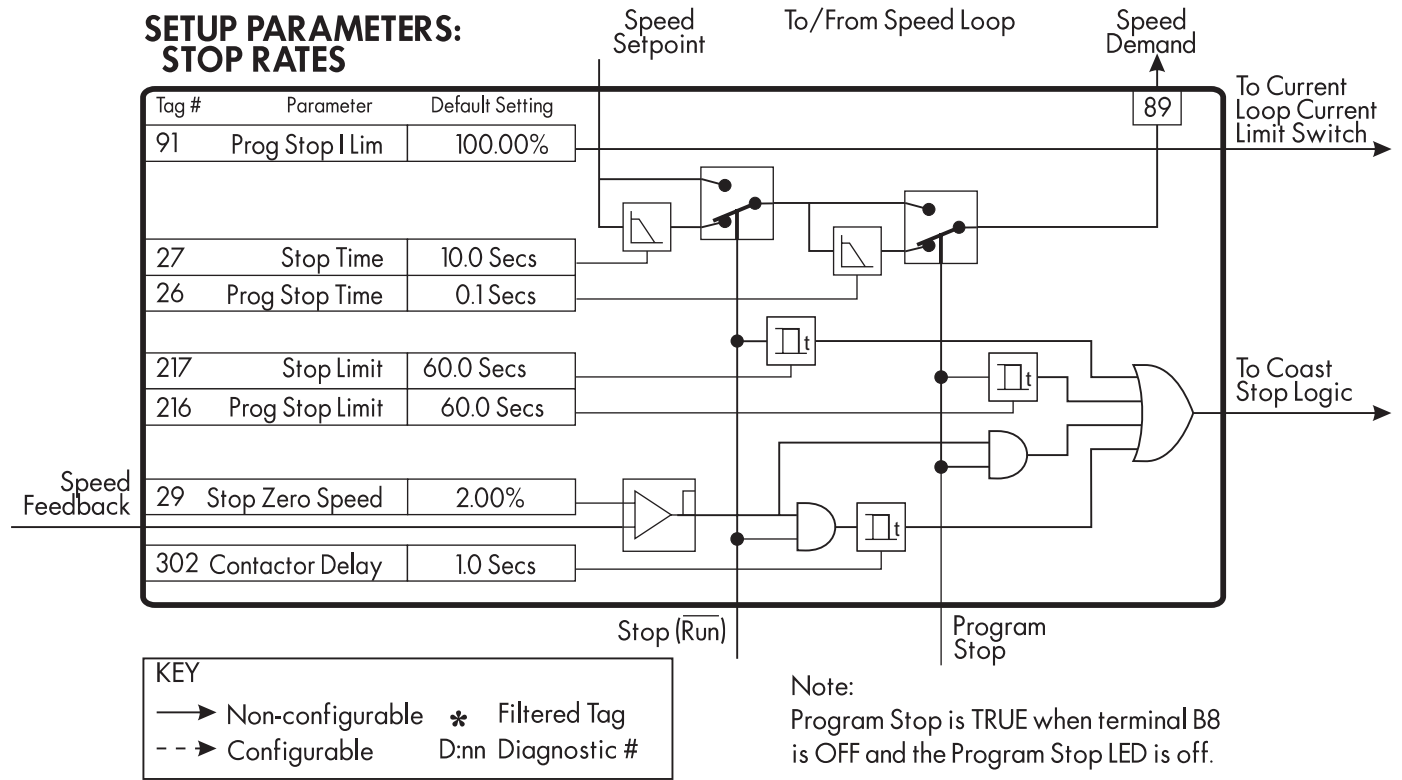


Figure C.17 - Stop Rates



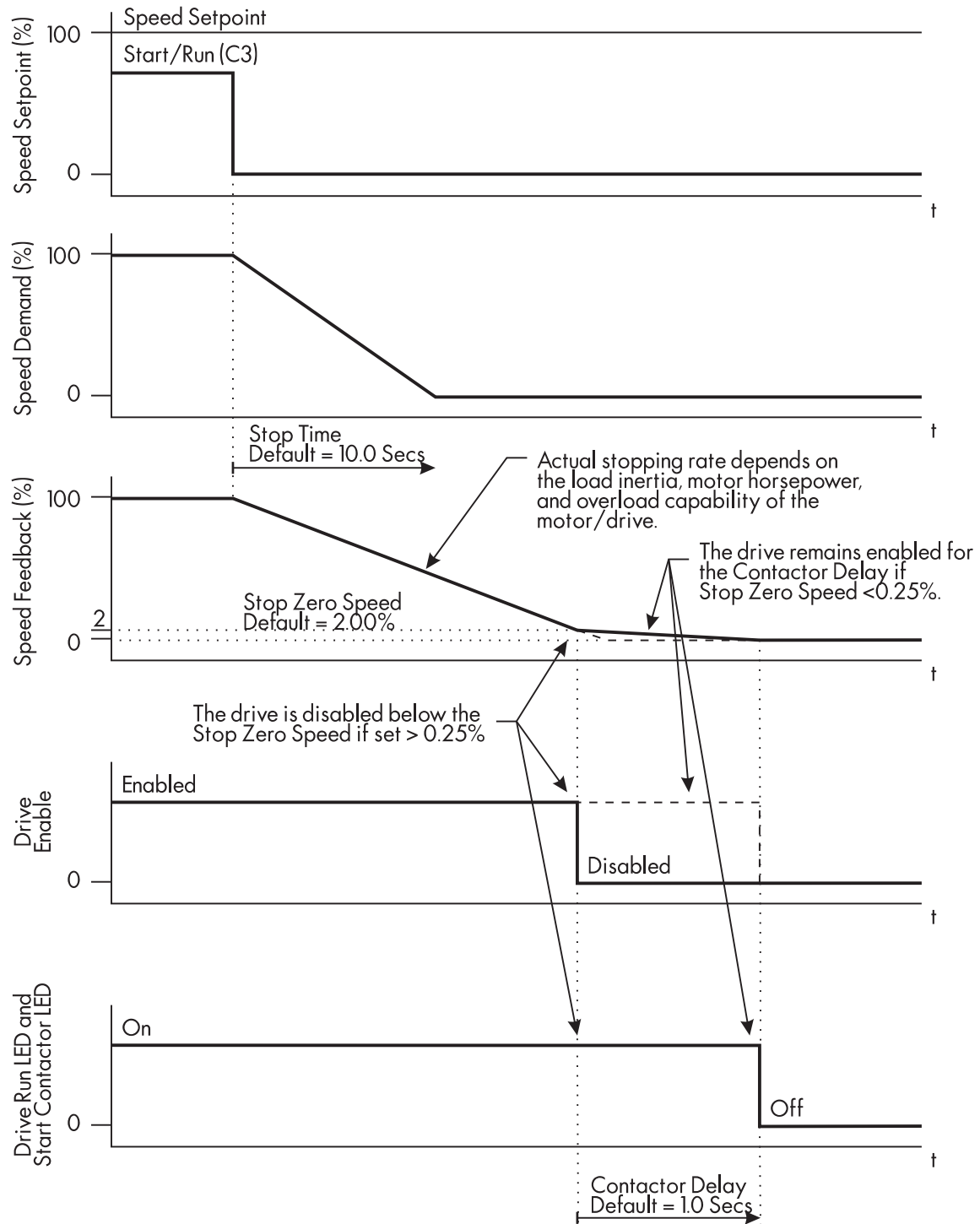


Figure C.18 - Sequences During a Normal Stop

STOP ZERO SPEED settings below 0.25% will keep the drive enabled after reaching STOP ZERO SPEED for the CONTACTOR DELAY time. This setup is useful in jog applications.

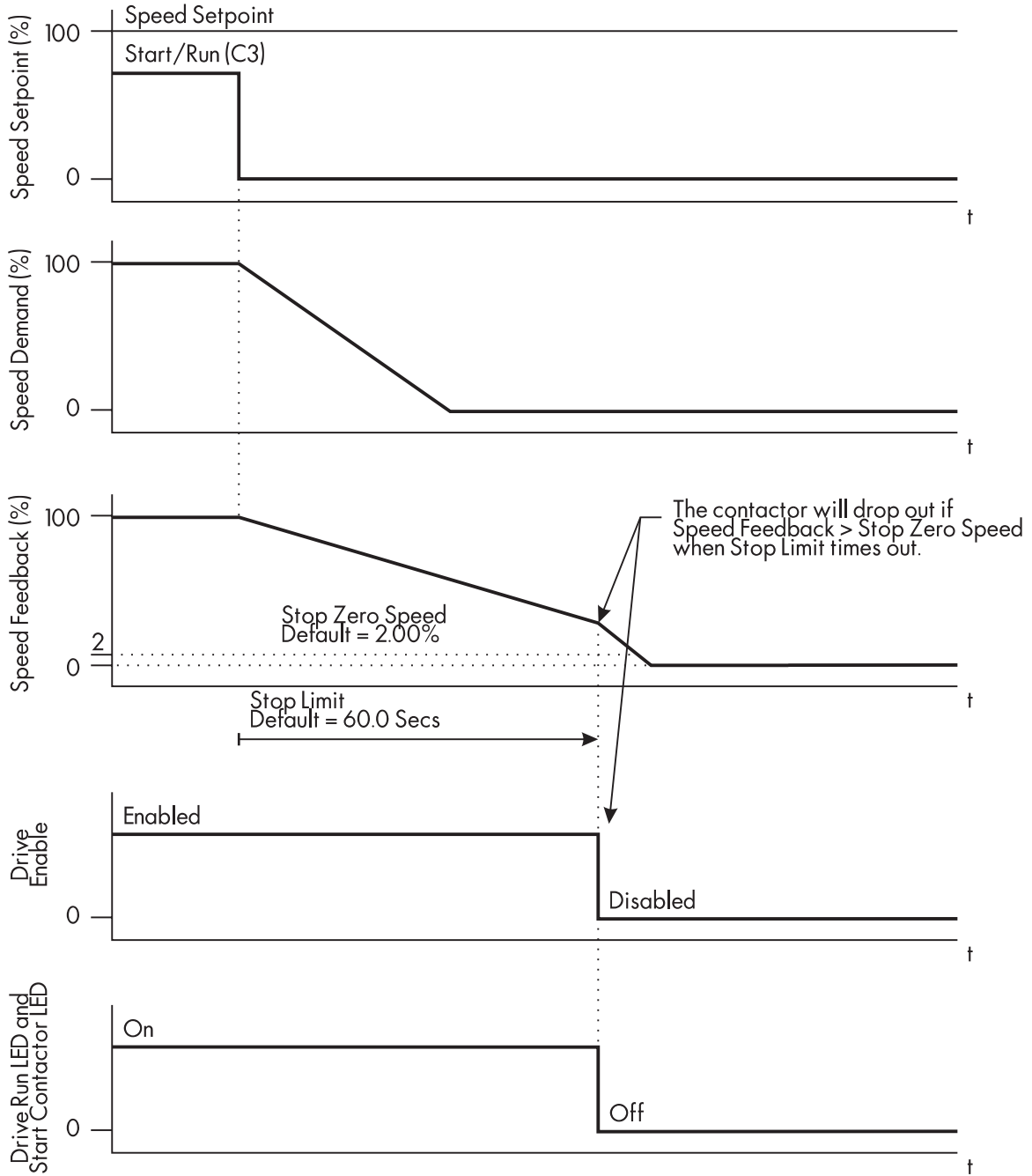


Figure C.19 - Sequences When a Normal Stop Times Out

These curves illustrate the sequence when a normal stop takes longer than the STOP LIMIT time. The drive disables and the contactor de-energizes at that time.

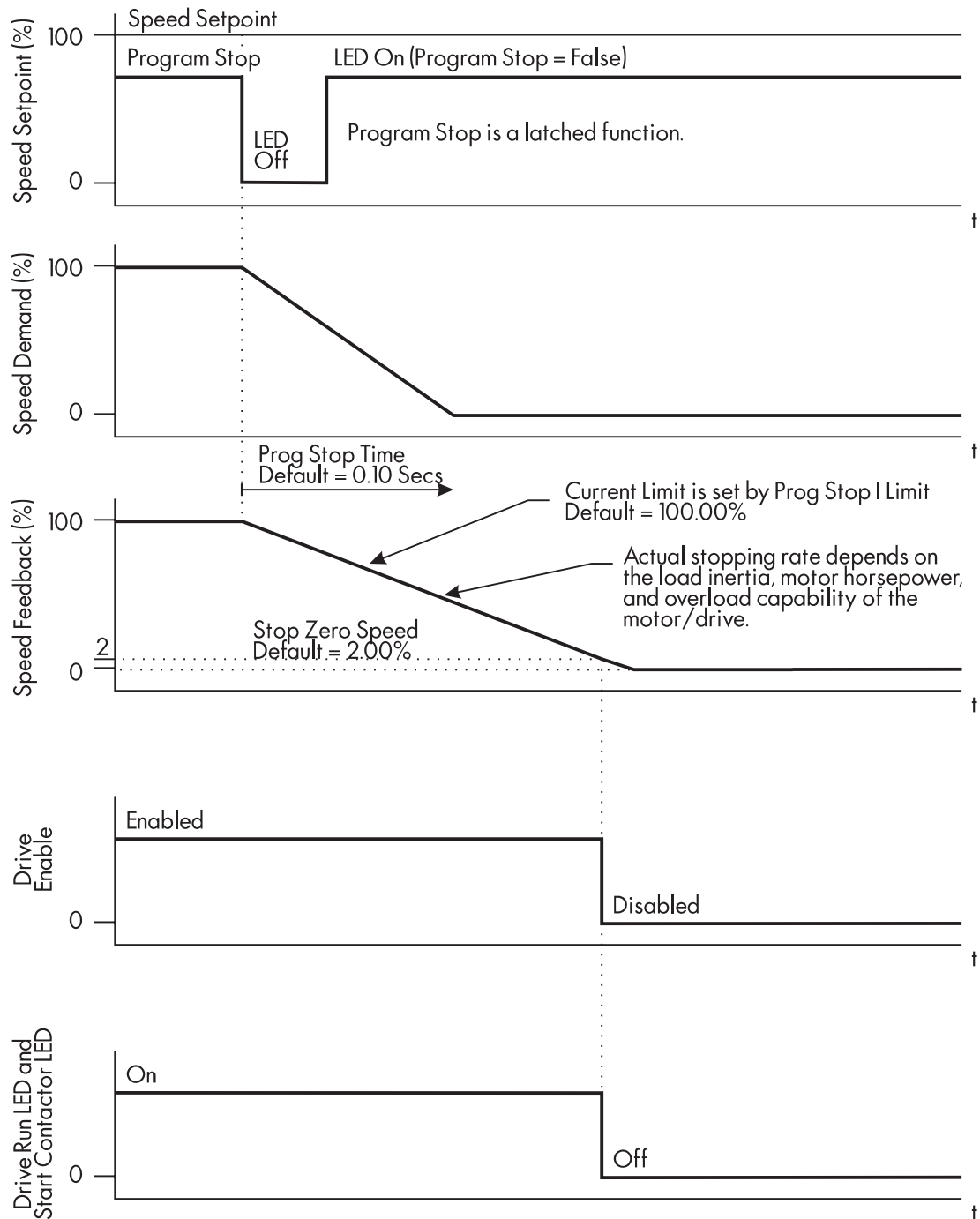


Figure C.20 - Sequences for a Program Stop

PROGRAM STOP is a latched function. Once a PROGRAM STOP signal is received (terminal B8 goes to zero volts), the stop continues even if 24 volts is reconnected to terminal B8.

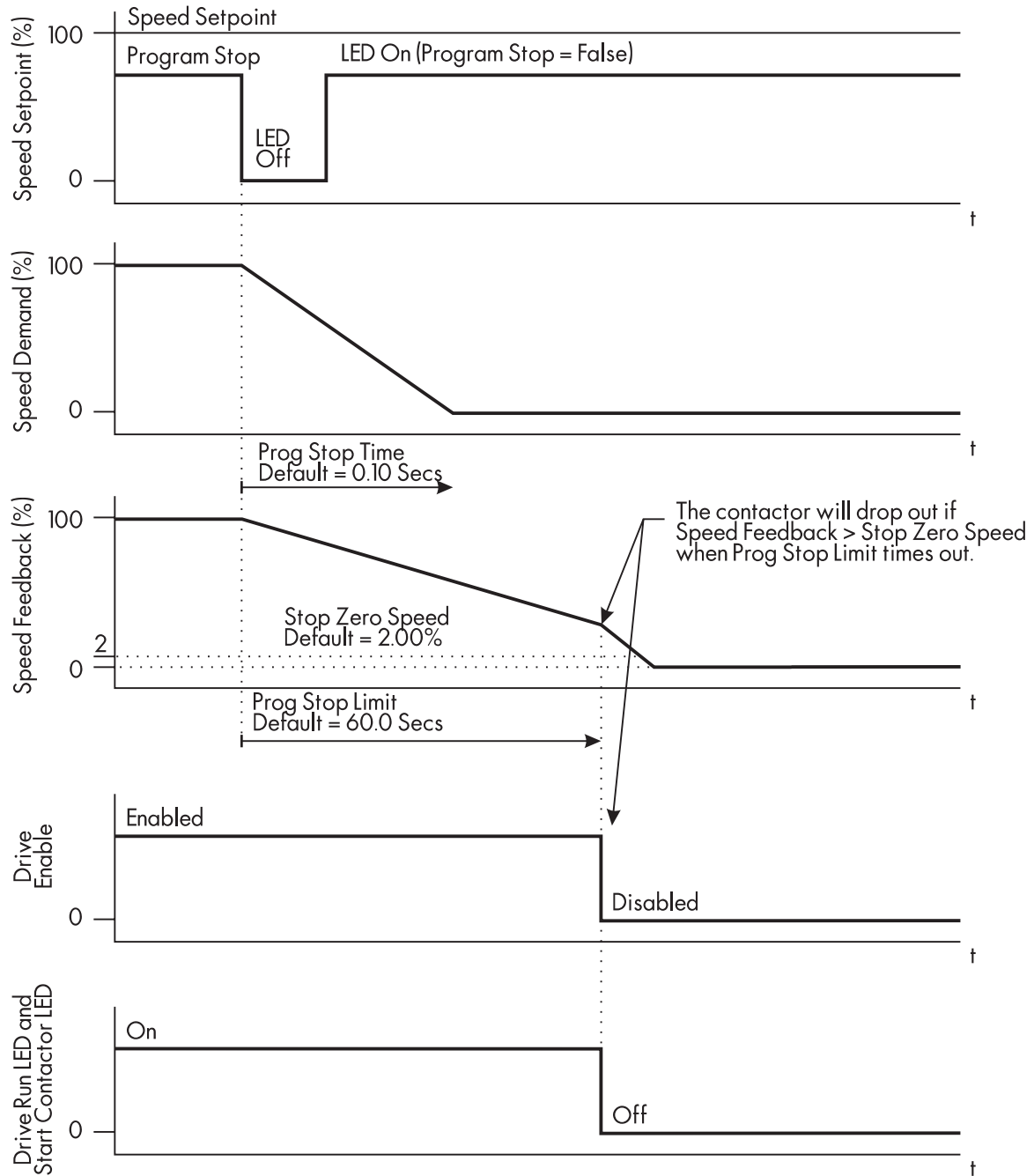


Figure C.21 - Sequences when a Program Stop Times Out

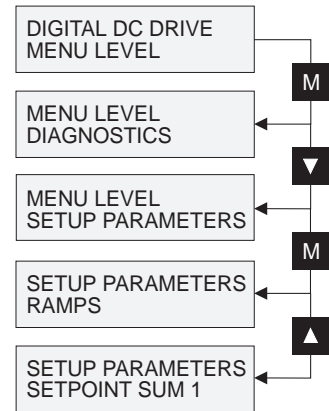
The time out logic is the same for both a normal stop and a program stop. PROGRAM STOP LIMIT, however, sets the maximum duration of a program stop before the contactor de-energizes and the drive disables.



## SETPOINT SUM 1

SETPOINT SUM 1 allows the summing and scaling of three analog inputs to produce SPT. SUM OUTPUT.

Note: This block is ignored by the drive unless SYSTEM:: CONFIGURE I/O:: BLOCK DIAGRAM:: SPT SUM 1 DEST is connected to a nonzero tag. The default connection is to tag 289.



## Inputs and Outputs

ANALOG I/P 1, terminal A2, is the default input. The default output, SPT. SUM OUTPUT, connects to SETPOINT 1 in the speed loop.

## Description

INPUT 0 and INPUT 1 have individual ratio and divider scalers, and signs. INPUT 1 has an additional deadband function set by DEADBAND WIDTH. When the input is within the deadband, the output clamps to zero to ignore any noise. This parameter is useful when digital setpoints are used (for example from a 5703, serial communications, or the RAISE LOWER function block). The inputs have symmetrical limits set by LIMIT. INPUT 2 has no scaling or limits.

The output after INPUT 0, INPUT 1, and INPUT 2 are summed is also clamped by LIMIT before producing SPT. SUM OUTPUT.

## Parameters

Tag	Parameter	Description	Range	Default
6	RATIO 1	Multiplicative scaling for INPUT 1.	±3.0000	1.0000
208	RATIO 0	Multiplicative scaling for INPUT 0.	±3.0000	1.0000
8	SIGN 1	Polarity for INPUT 1.	POSITIVE/NEGATIVE	POSITIVE
292	SIGN 0	Polarity for INPUT 0.	POSITIVE/NEGATIVE	POSITIVE
419	DIVIDER 1	Divider scaling for INPUT 1.	±3.0000	1.0000
420	DIVIDER 0	Divider scaling for INPUT 0.	±3.0000	1.0000
131	DEADBAND WIDTH	Range within which the output is clamped at zero.	0.0 to 100.0%	0.0%
375	LIMIT	Symmetrical limit for intermediate scaling and the total output.	0.00 to 200.00%	105.00%
423	INPUT 2	INPUT 2 value.	±200.00%	0.00%
100	INPUT 1	INPUT 1 value.	±200.00%	0.00%
309	INPUT 0	INPUT 0 value.	±200.00%	0.00%

### SETUP PARAMETERS: SETPOINT SUM 1

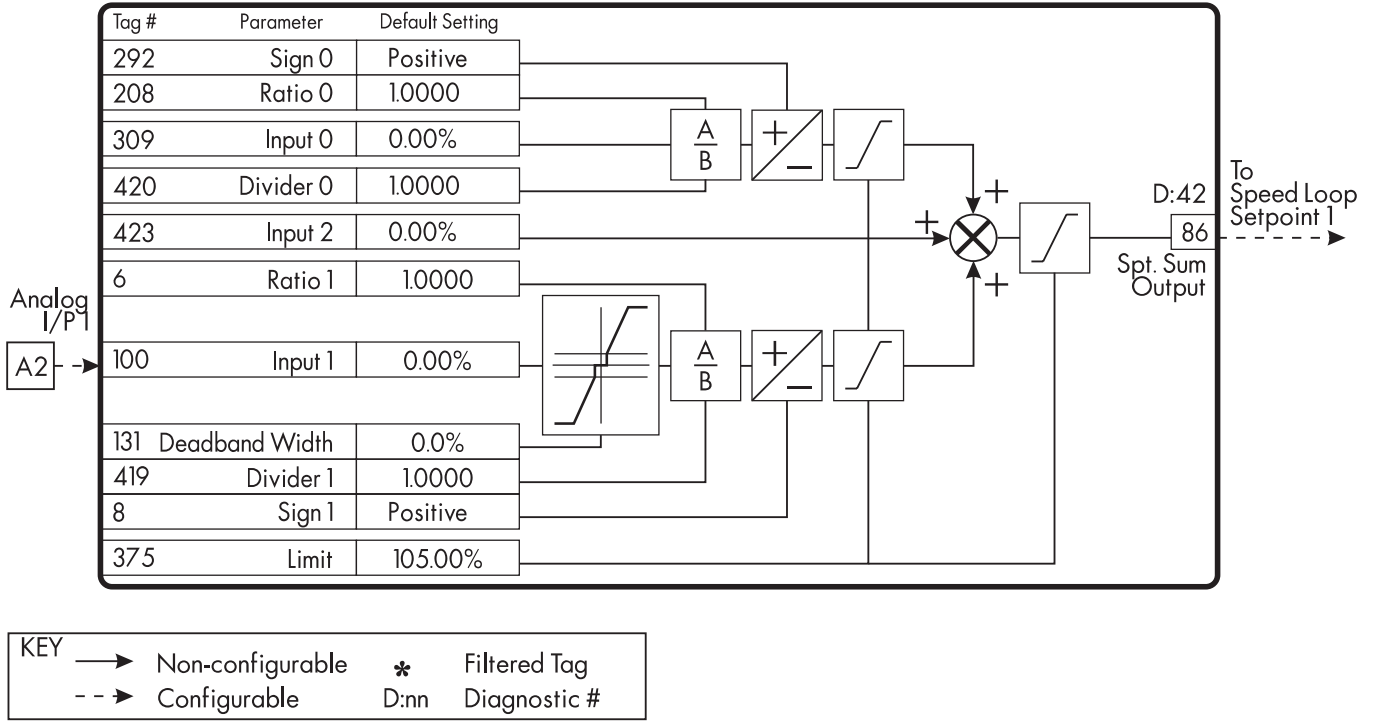


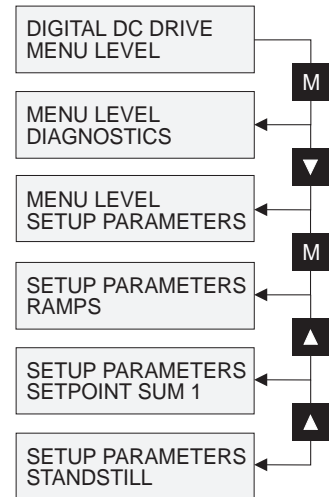
Figure C.22 - Setpoint Sum

## STANDSTILL

STANDSTILL determines when the speed setpoint is zero and the motor has stopped.

### Inputs and Outputs

The inputs are SPEED FEEDBACK from the speed loop and SPEED SETPOINT from setpoints. The outputs are AT ZERO SPEED, AT STANDSTILL, and AT ZERO SETPOINT. AT ZERO SPEED is connected to DIGITAL O/P 1, terminal B5, in the default configuration. A "not at standstill" signal is sent to the drive enable logic.



### Description

When SPEED FEEDBACK is less than ZERO THRESHOLD, the AT ZERO SPEED output is ON. AT ZERO SETPOINT is ON when SPEED SETPOINT is less than ZERO THRESHOLD. When both AT ZERO SPEED and AT ZERO SETPOINT are ON, AT STANDSTILL is ON signaling the motor has stopped.

When STANDSTILL LOGIC is ENABLED, the SCR firing circuits are disabled, the main contactor remains energized and the RUN LED stays on when the drive is at standstill. The drive remains in this state until standstill drops out. That is, when the speed setpoint or speed feedback rise above the zero threshold.

STANDSTILL LOGIC is useful in maintaining absolute zero speed but can cause problems in web handling applications using tension feedback. At zero speed, the SCR's turn off allowing web tension to pull the driven roll in reverse. Once the drive no longer senses it is at zero speed, the SCR's turn back on causing the motor to move forward and regulate tension. An oscillation condition can result as the drive SCR's turn on and off trying to maintain a fixed position.

### Parameters

Tag	Parameter	Description	Range	Default
11	STANDSTILL LOGIC	When enabled, inhibits the controller when at zero setpoint and zero speed.	ENABLED/DISABLED	DISABLED
12	ZERO THRESHOLD	Threshold for setting the zero setpoint and zero speed. Controls the zero speed relay output.	0.00 to 100.00%	2.00%

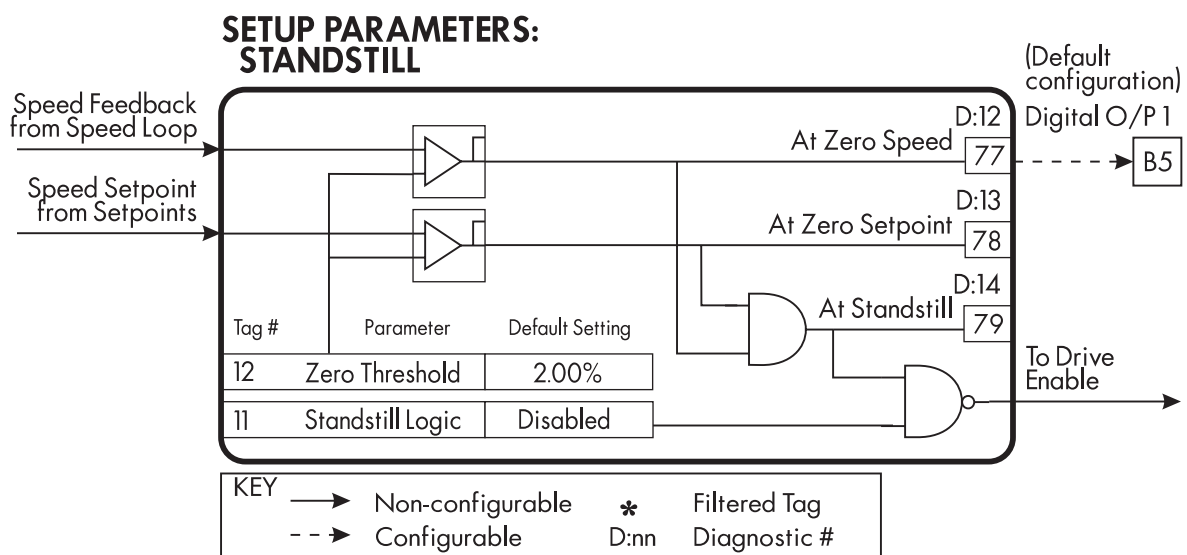


Figure C.23 - Standstill

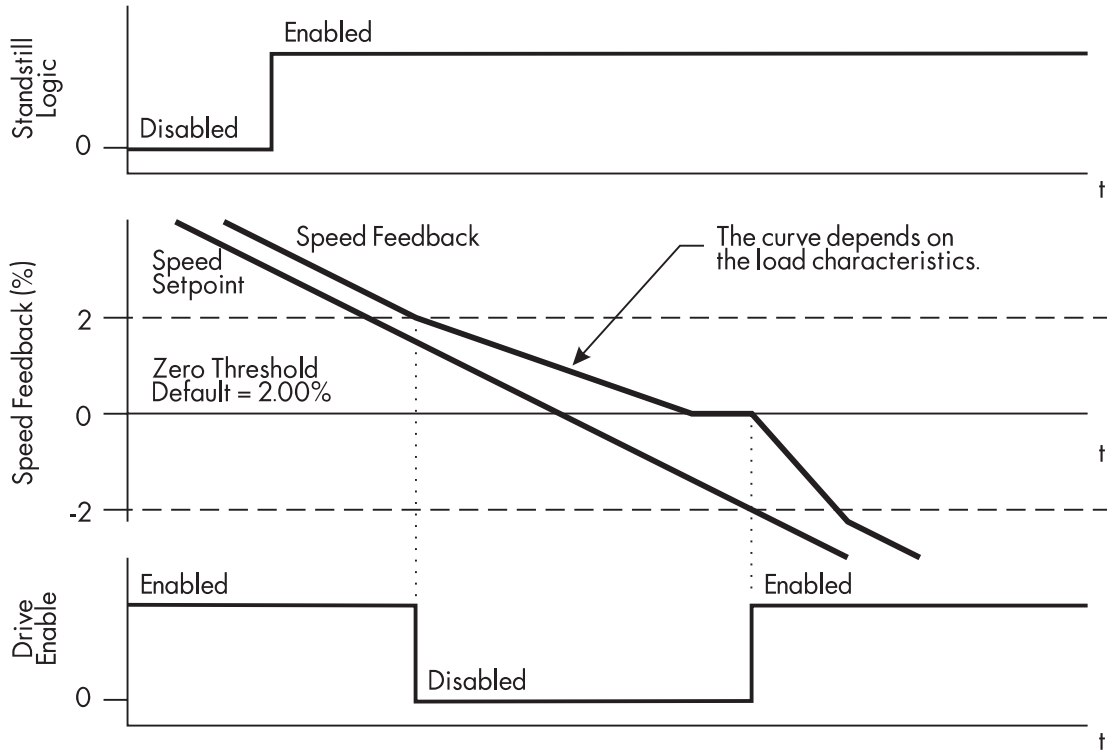


Figure C.24 - Standstill Logic

These curves show the drive's operation when STANDSTILL LOGIC is ENABLED. When both the speed feedback and speed setpoint signals are within the ZERO THRESHOLD, the drive is disabled.



## SPEED LOOP

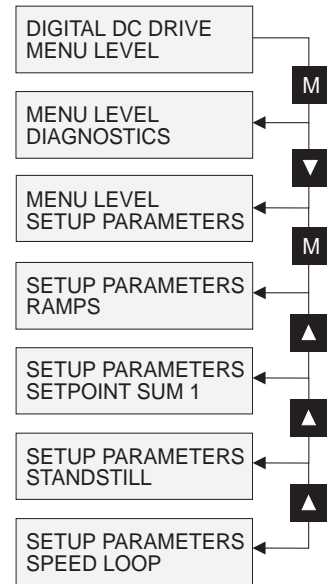
SPEED LOOP selects the speed feedback source and tunes the speed loop PI to produce a current demand.

### Inputs and Outputs

The speed loop has four inputs:

1. SPEED DEMAND from STOP RATES
2. Speed feedback as either armature volts, analog tach, or encoder from CALIBRATION.
3. ZERO SPD OFFSET from CALIBRATION
4. DRIVE ENABLE from the drive enable logic

The two outputs are CURRENT DEMAND and SPEED ERROR.



### Description

SPEED FBK SELECT determines the source of the speed feedback signal. The default, ARM VOLTS FBK, uses internal circuitry to derive speed feedback. The other selections require external devices to provide the feedback signal.

SPEED DEMAND is summed algebraically with SPEED FEEDBACK to yield SPEED ERROR. When the drive is enabled, SPEED ERROR is controlled by the PI loop. Proportional and integral profiling is performed in the ADVANCED::ADAPTION sub-menu described in the next section.

The resulting current demand signal is routed to the CURRENT LOOP block and to the ADVANCED::ZERO SPD. QUENCH sub-menu.

### Parameters

Tag	Parameter	Description	Range	Default
14	PROP. GAIN	Proportional gain adjustment.	0.00 to 200.00	10.00
13	INT. TIME CONST.	Integral gain adjustment.	0.001 to 30.000 Secs	0.500 Secs
202	INT. DEFEAT	When ON it inhibits integral control yielding proportional control only.	ON/OFF	OFF
49	ENCODER SIGN	Allows the encoder or Microtach signal to be reversed.	POSITIVE/NEGATIVE	POSITIVE
47	SPEED FBK SELECT	Selects the source of the speed feedback signal.	ARM VOLTS FBK ANALOG TACH ENCODER ENCODER/ANALOG	ARM VOLTS FBK

### SETUP PARAMETERS: SPEED LOOP

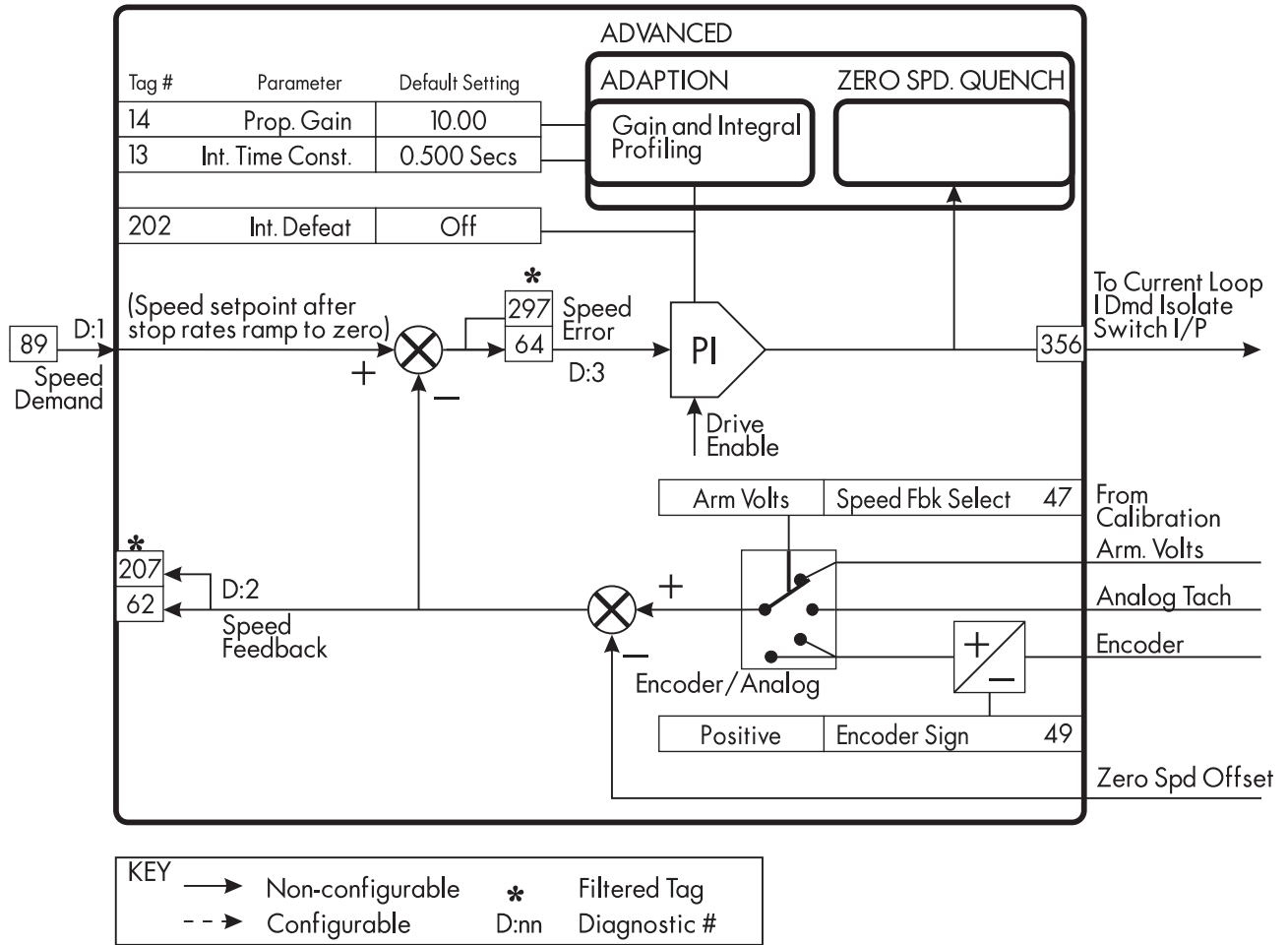


Figure C.25 - Speed Loop

### SPEED LOOP::ADVANCED

ADVANCED has two sub-menus, ADAPTION and ZERO SPD. QUENCH. ADAPTION changes the proportional and integral profiles. ZERO SPD. QUENCH disables SCR firing when the drive is stopped.

### Inputs and Outputs

ADVANCED has one input, RAMPING from RAMPS.

Inputs for ADAPTION are PROP. GAIN and INT. TIME CONST. from the speed loop. Its outputs are profiled proportional and integral gains for the speed loop.

Inputs for ZERO SPD. QUENCH are SPEED DEMAND, SPEED FEEDBACK, and CURRENT DEMAND. The output is a signal for disabling the armature SCR firing.

### Description

I GAIN IN RAMP scales the integral gain when the drive is ramping. When RAMPING is TRUE, the integral gain from ADAPTION is switched through the I GAIN IN RAMP scaler. This can be used to prevent integral windup caused by very high inertia loads during ramping.

### ADAPTION

ADAPTION allows you to profile the drive's speed loop proportional and integral gains to certain drive parameters. The gains change when the motor speed feedback reaches the thresholds determined by SPD BRK1 (LOW) and SPD BRK2 (HIGH).

At or below SPD BRK1 (LOW), the speed loop uses the PROP. GAIN and INT. TIME CONST. values set in ADAPTION as its PI loop gains. Between SPD BRK1 (LOW) and SPD BRK2 (HIGH), profiling occurs and the speed loop gains are determined by another parameter value according to the MODE selection. Above SPD BRK2

(HIGH) the PROP. GAIN and INT. TIME CONST. settings in SPEED LOOP are used.

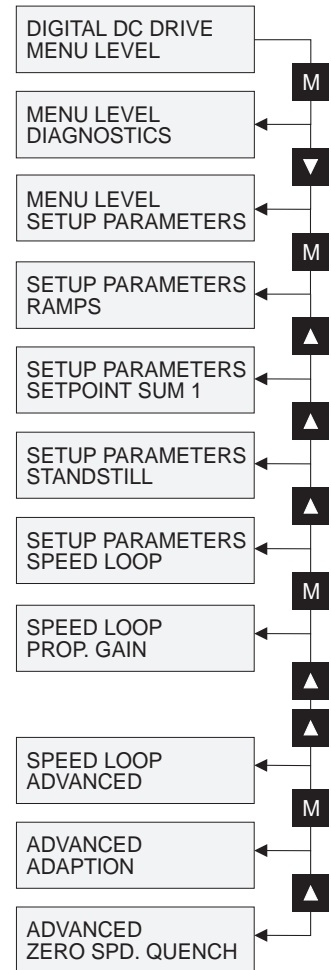
MODE selects the parameter for profiling the speed loop PI gains when the motor speed is between the two speed breakpoints. Mode 0 (the default) disables the profiling so that the speed loop uses PROP. GAIN and INT. TIME CONST. in SPEED LOOP as its PI loop gain settings, regardless of motor speed. Mode 1 uses SPEED FEEDBACK as the gain profiling source; mode 2 uses SPEED ERROR; and mode 3 uses CURRENT DEMAND.

### ZERO SPD. QUENCH

ZERO SPD. QUENCH, when TRUE, disables the current loop when SPEED DEMAND, SPEED FEEDBACK, and CURRENT DEMAND have all dropped to the threshold levels set by ZERO SPD. LEVEL and ZERO IAD LEVEL. The speed loop remains enabled and the contactor stays energized. This permits the current loop to be enabled very quickly.

### Parameters

Tag	Parameter	Description	Range	Default
274	I GAIN IN RAMP	Scales the integral gain during ramping.	0.0 to 2.0000	1.0000
<b>ADAPTION</b>				
268	MODE	Selects the speed breakpoint input signal.	0 to 3	0
269	SPD BRK1 (LOW)	Speed breakpoint 1 to start gain profiling.	0.00 to 100.00%	1.00%
270	SPD BRK2 (HIGH)	Speed breakpoint 2 to stop gain profiling.	0.00 to 100.00%	5.00%
271	PROP. GAIN	Proportional gain used below SPD BRK1 (LOW).	0.00 to 200.00	5.00
272	INT. TIME CONST.	Integral time constant used below SPD BRK1 (LOW).	0.001 to 30.000 Secs	0.500 Secs
<b>ZERO SPD. QUENCH</b>				
284	ZERO SPD. LEVEL	SPEED DEMAND and SPEED FEEDBACK thresholds for disabling the current loop.	0.00 to 200.00%	0.50%
285	ZERO IAD LEVEL	Current demand threshold for disabling the current loop.	0.00 to 200.00%	1.50%



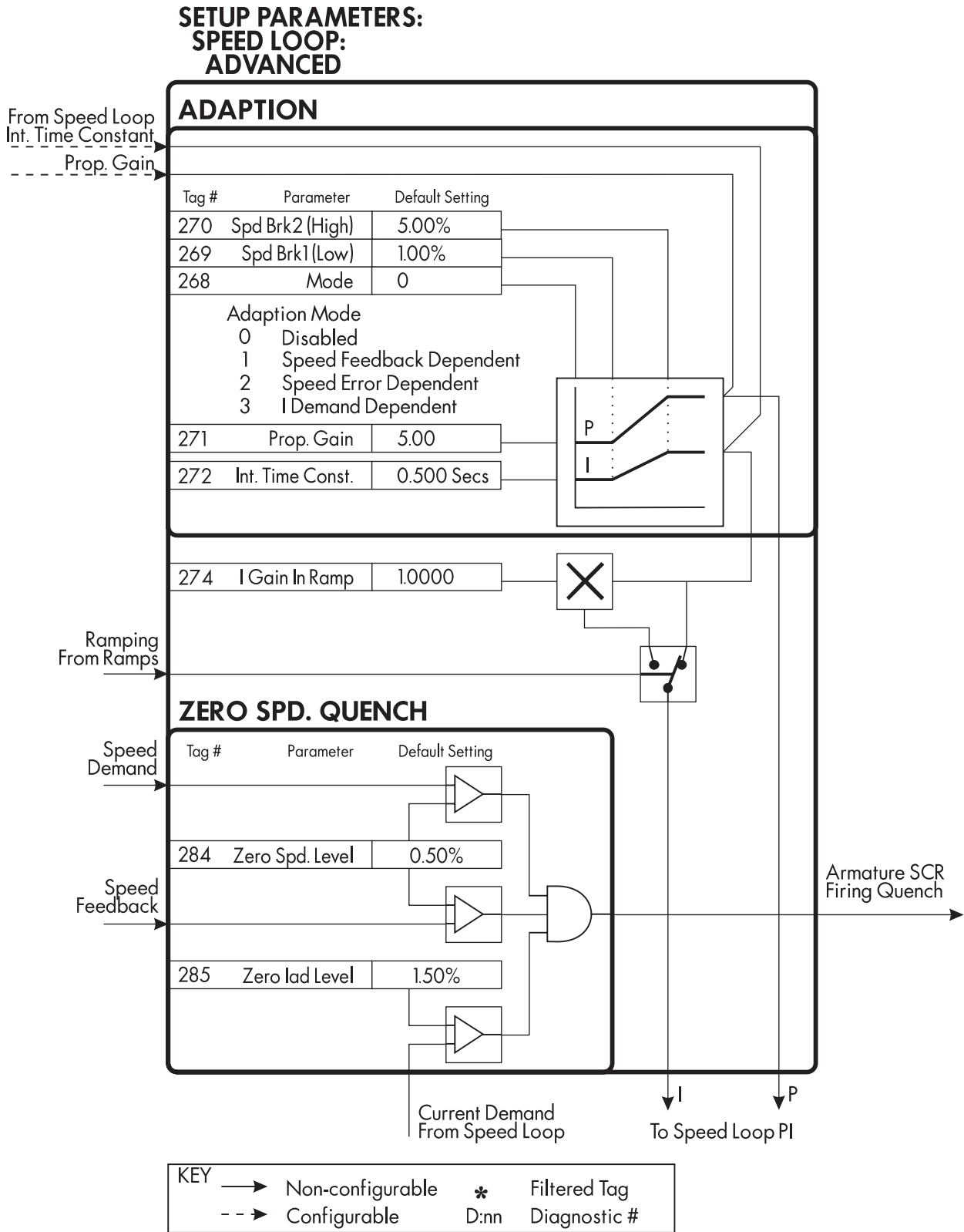


Figure C.26 - Speed Loop Advanced Parameters



## SPEED LOOP::SETPOINTS

SETPOINTS combine four setpoints into a total speed setpoint.

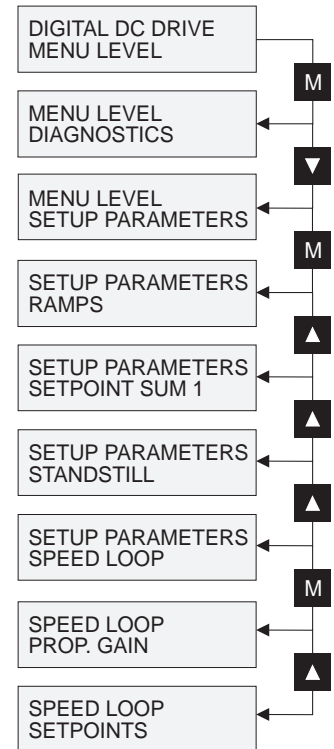
### Inputs and Outputs

The default inputs to SETPOINTS are analog input 2, terminal A3, ratioed 5703 output, SPT. SUM O/P, RAMP OUTPUT, and I DMD ISOLATE. The output is SPEED SETPOINT.

### Description

Speed setpoint 2 is connected directly to terminal A3. It is scanned synchronously with the current loop. RATIO 2 (A3) and SIGN 2 (A3) scale the input to become SETPOINT 2 (A3). SETPOINT 2 is summed with setpoints 1, 3, and 4. The result is clamped by MAX DEMAND and MIN DEMAND to create SPEED SETPOINT.

When I DMD ISOLATE is ON, the signal from terminal A3 is routed to the current loop and disconnected from SETPOINTS.



### Parameters

Tag	Parameter	Description	Range	Default
289	SETPOINT 1	Speed setpoint 1	±105%	0.00%
9	SIGN 2 (A3)	Speed setpoint 2 sign.	POSITIVE/NEGATIVE	POSITIVE
7	RATIO 2 (A3)	Speed setpoint 2 ratio.	±3.0000	1.0000
290	SETPOINT 2 (A3)	Speed setpoint 2; non-configurable	±105%	0.00%
291	SETPOINT 3	Speed setpoint 3	±105%	0.00%
41	SETPOINT 4	Speed setpoint 4	±105%	0.00%
357	MAX DEMAND	Maximum output limit	0.00 to 105.00%	105.00%
358	MIN DEMAND	Minimum output limit	-105.00 to 0.00%	-105.00%

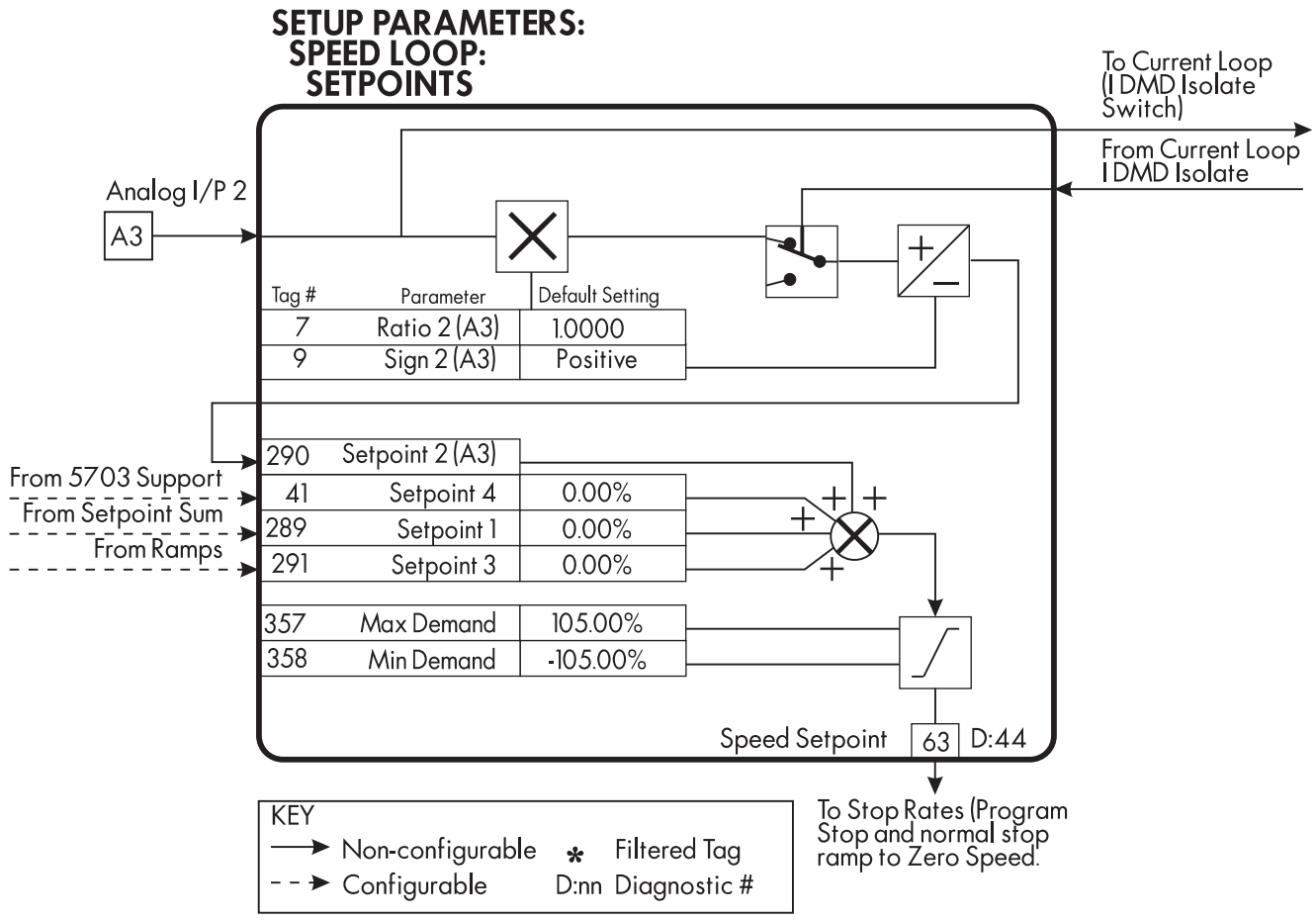


Figure C.27 - Speed Loop Setpoints

## CURRENT LOOP

CURRENT LOOP takes the current demand, limits it through four clamps, and then uses a PI loop to control the output.

### Inputs and Outputs

The inputs are current demand from the speed loop or terminal A3, current limit clamps from CURRENT PROFILE and the inverse time overload, and current feedback from CALIBRATION. The default configuration uses digital inputs 1 and 3 for switching modes and analog inputs 4 and 5 for setting current clamps.

### Description

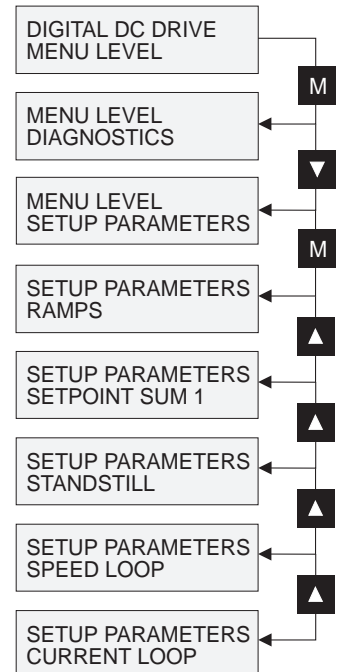
With I DMD. ISOLATE disabled, the current loop uses the current demand from the speed loop. When enabled, ANALOG I/P 2, terminal A3 supplies the current demand. With default scaling, 10 VDC on terminal A3 is 100% current demand. An additional current input, ADDITIONAL DEM, can be added to the current demand. Four separate clamps, current profile, inverse time overload, bipolar clamps, and main current clamps, can each limit the current demand.

With BIPOLAR CLAMPS disabled, the clamps are symmetrical and are set by POS. I CLAMP. When enabled, the clamps are asymmetrical, bipolar. In bipolar mode, POS. I CLAMP sets the maximum positive current and NEG. I CLAMP sets the maximum negative current. POS. I CLAMP must always be set algebraically higher

than NEG. I CLAMP. As a result, NEG. I CLAMP can be set to a positive value. CUR. LIMIT/SCALER scales both POS. I CLAMP and NEG. I CLAMP.

MAIN CURR. LIMIT sets symmetric clamps outside scaling from the CUR. LIMIT/SCALER parameter.

A non-regenerative controller should have set DISABLED for proper motor control. If REGEN MODE is DISABLED, negative current demands are clamped to zero. Current feedback is subtracted from the current demand and the result is controlled by the PI loop. The result provides SCR phase angle control.



### Parameters

Tag	Parameter	Description	Range	Default
15	CUR. LIMIT/SCALER	Scales the bipolar/unipolar clamps.	0.00 to 200.00%	100.00%
421	MAIN CURR. LIMIT	Independent symmetric current clamp.	0.00 to 200.00%	200.00%
16	PROP. GAIN	Proportional gain for armature current PI loop.	0.00 to 200.00	45.00
17	INT. GAIN	Integral gain for armature current PI loop.	0.00 to 200.00	3.50
18	AUTOTUNE	Turns the AUTOTUNE procedure on.	ON/OFF	OFF
137	DISCONTINUOUS	Sets the boundary between the discontinuous and continuous regions of the current signal.	0.00 to 200.00%	12.00%
30	ADDITIONAL DEM	Additional current demand input.	±200.00%	0.00%
90	BIPOLAR CLAMPS	Selects between bipolar and unipolar clamps.	ENABLED/DISABLED	DISABLED
201	REGEN MODE	When disabled, sets the drive for non-regenerative operation.	ENABLED/DISABLED	ENABLED
301	POS. I CLAMP	Positive current clamp when BIPOLAR CLAMPS is ENABLED.	±100.00%	100.00%
48	NEG. I CLAMP	Negative current clamp when BIPOLAR CLAMPS is ENABLED.	±100.00%	-100.00%
119	I DMD. ISOLATE	When enabled, disables the speed loop and selects terminal A3 as the current demand input.	ENABLED/DISABLED	DISABLED

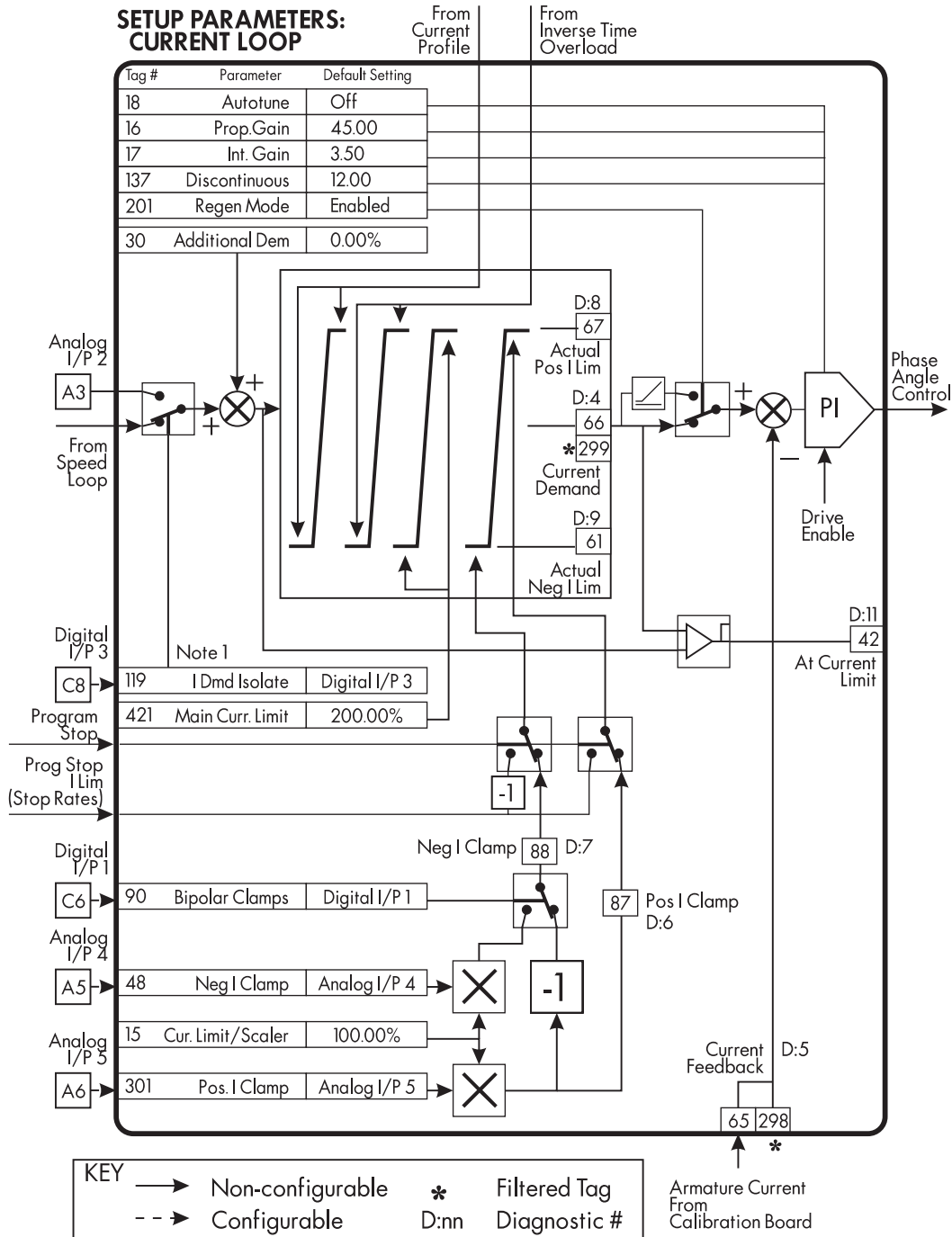


Figure C.28 - Current Loop



## INHIBIT ALARMS

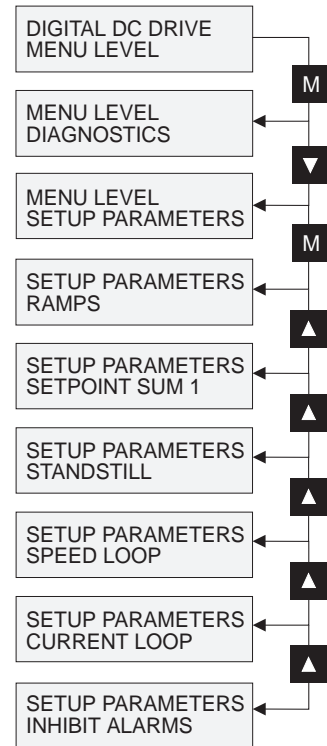
INHIBIT ALARMS allows you to disable certain alarms and leave drive operation uninterrupted if the related fault occurs.

### Description

**Caution**

Do *not* inhibit any alarms if a danger to personnel or equipment may result.

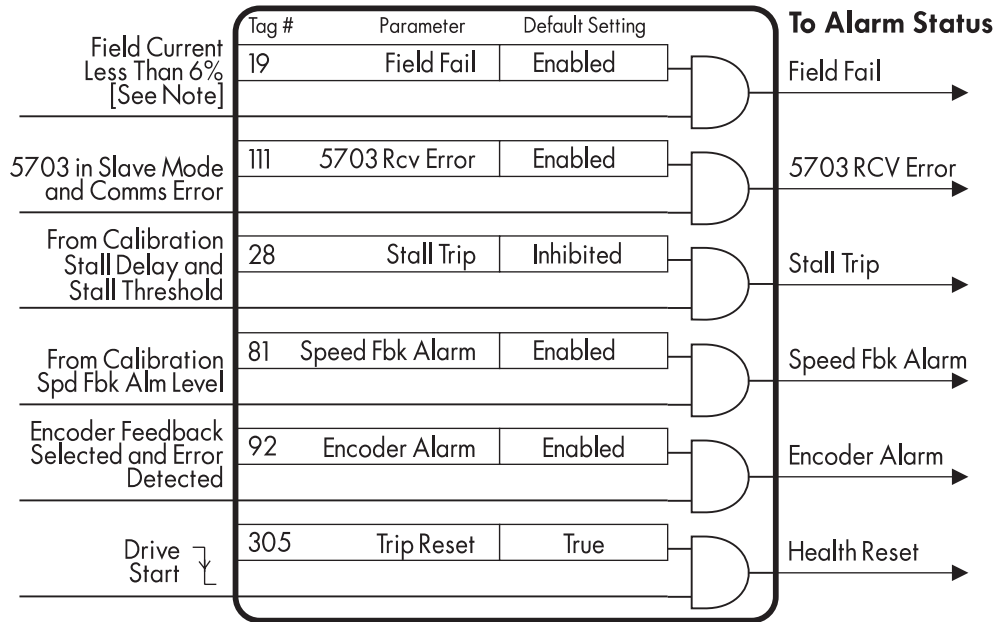
The stall trip alarm can be inhibited in applications requiring extended operation at zero speed.



### Parameters

Tag	Parameter	Description	Range	Default
111	5703 RCV ERROR	When INHIBITED, disables 5703 serial communications receive error.	ENABLED/INHIBITED	ENABLED
28	STALL TRIP	When INHIBITED, stops the stall trip alarm from tripping out contactor.	ENABLED/INHIBITED	INHIBITED
305	TRIP RESET	When FALSE, faults are latched permanently and the HEALTHY output remains OFF even when toggling the RUN input, terminal C3. To reset the drive, TRIP RESET must be set to TRUE. When TRUE, faults are cleared whenever a RUN signal is given to terminal C3.	TRUE/FALSE	TRUE
81	SPEED FBK ALARM	When INHIBITED, disables the speed feedback alarm.	ENABLED/INHIBITED	ENABLED
92	ENCODER ALARM	When INHIBITED, disables the encoder option board alarm.	ENABLED/INHIBITED	ENABLED

### SETUP PARAMETERS: INHIBIT ALARMS



Note: Field fail threshold is 6% in current control and 12% in voltage control.

KEY	→	Non-configurable	*	Filtered Tag
	- - →	Configurable	D:nn	Diagnostic #

Figure C.29 - Inhibit Alarms



## CALIBRATION

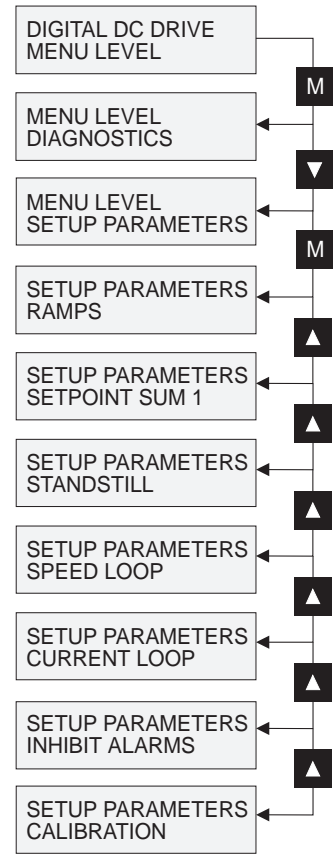
The CALIBRATION block scales the signals from the calibration card and speed feedback board.

### Description

Each input signal from the calibration board and the speed feedback board can be digitally scaled to provide greater precision.

Back EMF is created by subtracting armature current losses (IR COMPENSATION) from armature volts. This result is subtracted from speed feedback to trigger the speed feedback alarm.

The armature current signal is used to set the stall trip alarm.



### Parameters

Tag	Parameter	Description	Range	Default
20	ARMATURE V CAL.	Scales the armature volts to read 100% at the actual required voltage.	0.9800 to 1.1000	1.0000
21	IR COMPENSATION	Offsets the motor's IR drop to improve regulation when using armature voltage feedback.	0.00 to 100.00%	0.00%
22	ENCODER RPM	Set to the motor's maximum speed. For use with encoder feedback.	0 to 6000 RPM	1000 RPM
24	ENCODER LINES	Set to the encoder's lines per revolution.	10 to 5000 lines	1000 lines
23	ANALOG TACH CAL	Scales the motor speed to read 100% at the actual required speed.	0.9800 to 1.1000	1.0000
10	ZERO SPD. OFFSET	Used to set speed feedback to zero when the motor is not moving.	±5.00%	0.00%
25	ARMATURE I (A9)	Selects the current meter output, terminal A9, as bipolar or unipolar.	UNIPOLAR/BIPOLAR	BIPOLAR
180	SPDFBK ALM LEVEL	The threshold that the difference between speed feedback and back EMF voltage must exceed before the speed feedback alarm will activate.	0.0 to 100.0%	50.0%
263	STALL THRESHOLD	Stall current feedback threshold.	0.00 to 200.00%	95.00%
224	STALL TRIP DELAY	Delay time before the stall output becomes TRUE.	0.1 to 32.7 Secs	10.0 Secs
182	FIELD I CAL.	Scales the motor's field current to read 100% at the actual field current value.	0.9800 to 1.1000	1.0000

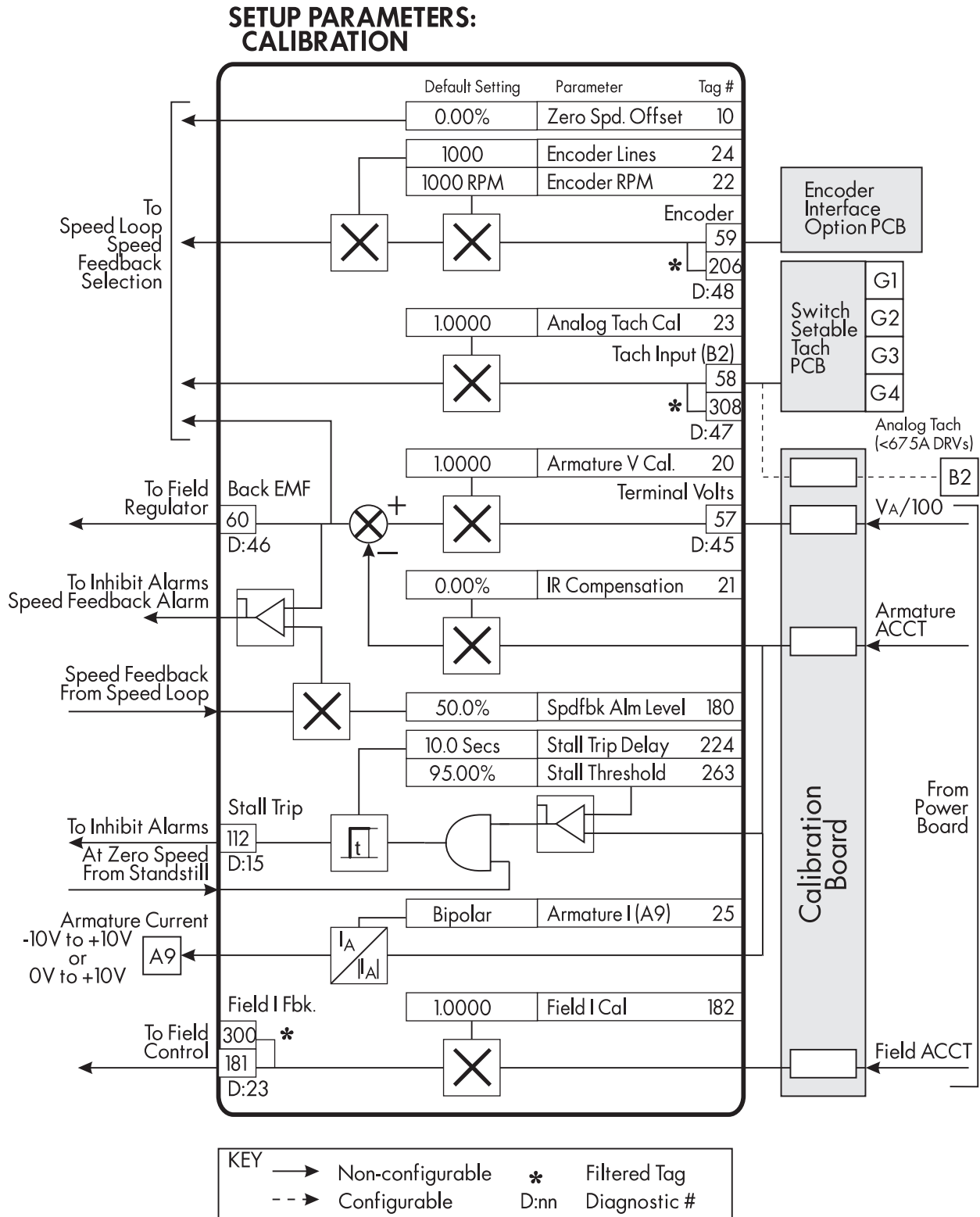


Figure C.30 - Calibration



## Appendix D I/O CONFIGURATION - SYSTEM MENU

### INTRODUCTION

To customize performance and get optimum use out of the 590 DRV Digital drive, you may need to configure, or reroute software connections to and from the drive's inputs and outputs and to and from the drive's software blocks. You can configure the drive and change software block parameter values either through the MMI or with a personal computer (PC) running the software package ConfigEd Lite (see the ConfigEd Lite Software Manual RG352747).

This chapter describes how to scale and configure drive input and output signals through the MMI under the SYSTEM::CONFIGURE I/O sub-menus ANALOG INPUTS, ANALOG OUTPUTS, DIGITAL INPUTS and DIGITAL OUTPUTS. Serial communication through the drive's P3 communications port can be re-configured through the CONFIGURE 5703 sub-menu. The sub-menus BLOCK DIAGRAM, and INTERNAL LINKS allow advanced configuration between parameters within the drive software blocks and I/O.

**NOTE.** For a description of each of the drive's software blocks accessible under the SETUP PARAMETERS menu, refer to Appendix C. Parameters under the SPECIAL BLOCKS sub-menu are discussed in Appendix M.

The chapter is arranged in the order the sub-menus (or function blocks) appear in the MMI under SYSTEM::CONFIGURE I/O. Each section describes the function block's parameters and contains a schematic block diagram of the function block. It also includes a table which lists the block's parameters, gives each parameter's signal range and default value and provides a brief description of each parameter. The configuration tag number associated with each drive parameter also appears in the table. In addition, each section includes a drawing illustrating how to access the parameter function block through the MMI. Configuration examples follow each schematic block diagram.

**NOTE.** The inside front cover contains a full drawing showing how all the drive's function blocks process input, output and control signals and how each block interfaces with the drive's overall control. A more detailed software block diagram appears in the fold-out drawing at the end of this appendix (Figure D.20).

### MMI Access to CONFIGURE I/O

Figure D.1 shows how to access the CONFIGURE I/O::ANALOG INPUTS sub-menu through the MMI. Upon power-up, the MMI briefly displays the software version and then changes to the message shown at the top of the figure. Pressing the "M" key changes the display to read the next block in the menu tree, DIAGNOSTICS. The ▲ key scrolls display up from DIAGNOSTICS to SYSTEM. Pressing "M" at SYSTEM puts the user in SOFTWARE, the first sub-menu of the SYSTEM menu. Press ▼ to scroll down to CONFIGURE I/O and "M" again to enter that sub-menu. Scroll down to ANALOG INPUTS by pressing ▼ and press "M" for configuration access to the drive's analog I/O. Press ▲ or ▼ to scroll through the analog I/O parameters. Hit "E" to return to the main CONFIGURE I/O menu level, then use the ▲ and ▼ keys to scroll to the other sub-menus within CONFIGURE I/O.

### Parameter types

Each drive parameter is associated with a unique address, or "tag." When "connecting" any parameter to drive inputs, outputs, or links, this tag is designated as the source or destination address. Appendix I list all the drive's parameters by tag number. Appendix J presents the same table in menu order and Appendix K sorts the parameters alphabetically.

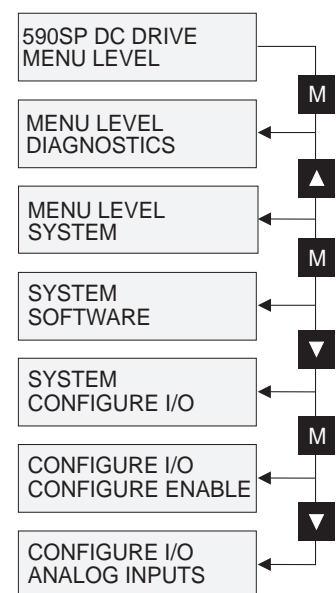


Figure D.1 - Sample MMI Path

There are only two types of parameters : logic or value. Logic parameters are boolean— or either ON (1) or OFF (0). The MMI displays logic signals in a variety ways, each associated with the ON and OFF state like ENABLED/DISABLED, TRUE/FALSE, POSITIVE/NEGATIVE, or EVEN/ODD.

Value parameters have a signal range which depends on its function. The display is normally formatted as appropriate (for example in percent). In all cases these values will not exceed five digits. For example, 100.00% is handled by the controller as 10000 and 30.00 as 3000. Other value parameters can be HEX numbers, ordinals, and lists. The ranges of these values depend on the parameter type.

## Configuration procedure

Before making any configuration changes with the MMI, you must set CONFIGURE ENABLE to ENABLED. After completing all the changes, it must be reset to DISABLED to accept the changes.

**NOTE.** The drive disallows making configuration changes while running and will trip out on the alarm failure CONFIGURATION ENABLED if the drive is started while CONFIGURE ENABLE is ENABLED.

To make configuration changes with the MMI, follow the procedure below:

1. Set parameter CONFIGURE ENABLE to ENABLED.
2. Find the input or output you want to change.
3. Change the source and/or destination tag as required.
4. Set the or analog or digital I/O parameter calibrations as needed.
5. Set parameter CONFIGURE ENABLE to DISABLED.
6. SAVE PARAMETERS.

---

### Caution

Be sure to save parameters after making configuration changes. All changes made will be lost if power is cycled prior to saving parameters.

---

## ANALOG INPUTS

The 590 series controller has five analog inputs. Analog input 2 can be scaled but its destination is fixed. All the other inputs are fully configurable.

### Parameters

Tag	Parameter	Description	Range	Default
<b>ANIN 1 (A2)</b>				
230	CALIBRATION	Input scaling ratio.	±3.0000	1.0000
231	MAX VALUE	Maximum value of the scaled input.	±300.00%	100.00%
232	MIN VALUE	Minimum value of the scaled input.	±300.00%	-100.00%
246	DESTINATIONTAG	Destination tag for the scaled input signal. The default is setpoint sum INPUT1.	0 to 499	100

### ANIN 2 (A3)

Analog input 2 connects directly into the speed loop / current loop. It is scanned synchronously with the current loop, about every 3.33 msecs. The other inputs are scanned about every 7 msecs. This input should be used for any signal whose response is critical, for example a trim input from a Microloc, a cut to length application, etc.

233	CALIBRATION	Input scaling ratio.	±3.0000	1.0000
234	MAX VALUE	Maximum value of the scaled input.	±200.00%	100.00%
235	MIN VALUE	Minimum value of the scaled input.	±200.00%	-100.00%

### ANIN 3 (A4)

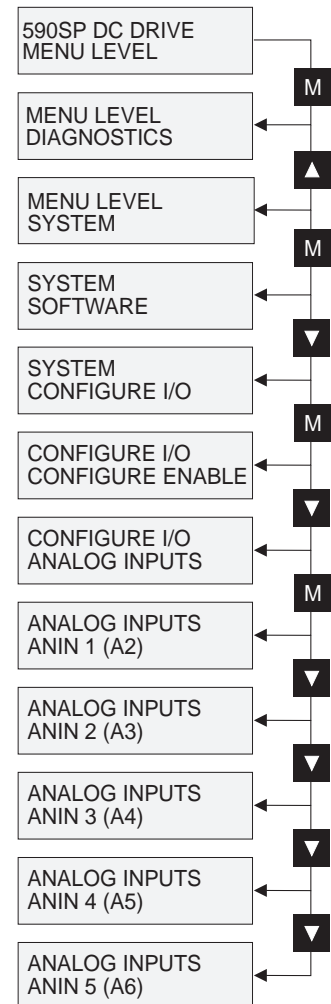
236	CALIBRATION	Input scaling ratio.	±3.0000	1.0000
237	MAX VALUE	Maximum value of the scaled input.	±300.00%	100.00%
238	MIN VALUE	Minimum value of the scaled input.	±300.00%	-100.00%
249	DESTINATIONTAG	Destination tag for the scaled input signal. The default is RAMP INPUT.	0 to 499	5

### ANIN 4 (A5)

239	CALIBRATION	Input scaling ratio.	±3.0000	1.0000
240	MAX VALUE	Maximum value of the scaled input.	±300.00%	100.00%
241	MIN VALUE	Minimum value of the scaled input.	±300.00%	-100.00%
250	DESTINATIONTAG	Destination tag for the scaled input signal. The default is NEG. I CLAMP.	0 to 499	48

### ANIN 5 (A6)

242	CALIBRATION	Input scaling ratio.	±3.0000	1.0000
243	MAX VALUE	Maximum value of the scaled input.	±300.00%	100.00%
244	MIN VALUE	Minimum value of the scaled input.	±300.00%	-100.00%
247	DESTINATIONTAG	Destination tag for the scaled input signal. The default is POS. I CLAMP.	0 to 499	301





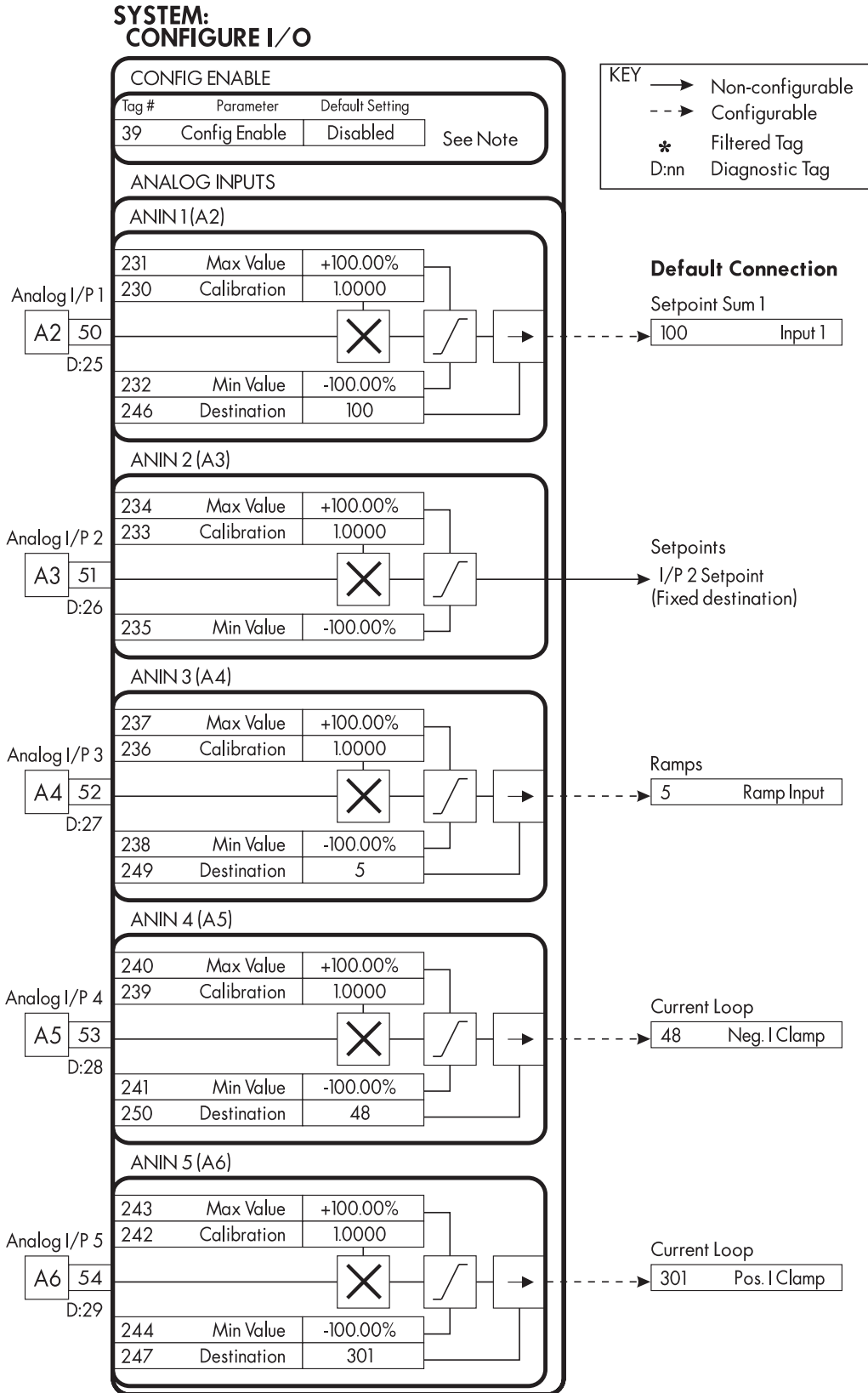


Figure D.2 - Analog Inputs Block Diagram

## Analog Inputs - Examples

Inputs can be connected to any writable parameter. The read/write status of each parameter is listed in the right-hand column in Appendices G, H, and I. RO is read only and RW is read/write.

### Controlling the accel time of the drive ramp through analog input 1

In this example, an operator wishes to control the acceleration time of the drive speed ramp over a 0 to 30 second range with an external potentiometer. The ends of the pot are connected to the drive's 0 to +10 VDC supply (terminals A1 and B3) and the wiper of the pot to terminal A2. Because the range of both the acceleration and deceleration times are scaled as 0 to 100.00% = 600.0 secs, the signal needs to be scaled to give 30 seconds at 100.00%, or when the potentiometer is turned up to +10 VDC. Otherwise, the pot will have a large, unresponsive deadband range and a small but highly sensitive adjustment range at its low end making accurate setting difficult.

$$\frac{30 \text{ seconds}}{600.0 \text{ seconds}} = \frac{\text{CALIBRATION}}{100.00\%}, \quad \text{CALIBRATION} = 5.00\%$$

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag numbers for the RAMP ACCEL TIME using the table in Appendix I (tag number 2).
3. Set ANIN 1 (A2)::DESTINATION TAG to 2 (RAMP ACCEL TIME).
4. Set ANIN 1 (A2)::CALIBRATION to 0.0500 (5.00%).
5. Set MAX CLAMP to 100.00%. (Default)
6. Set MIN CLAMP to 0.00%.%
7. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

Analog input 1 (terminal A2) now controls the speed ramp acceleration rate over a range of 0 to 30 seconds. An input of 10 volts yields a 30 second acceleration time. The deceleration rate of the speed ramp remains fixed at its default setting of 10 seconds.

NOTE. If you wish to control *both* the accel and decel time from a single external source, you must configure the Analog Input 1 block output to two destinations using an internal link. Refer to the INTERNAL LINKS section appearing later in this chapter.

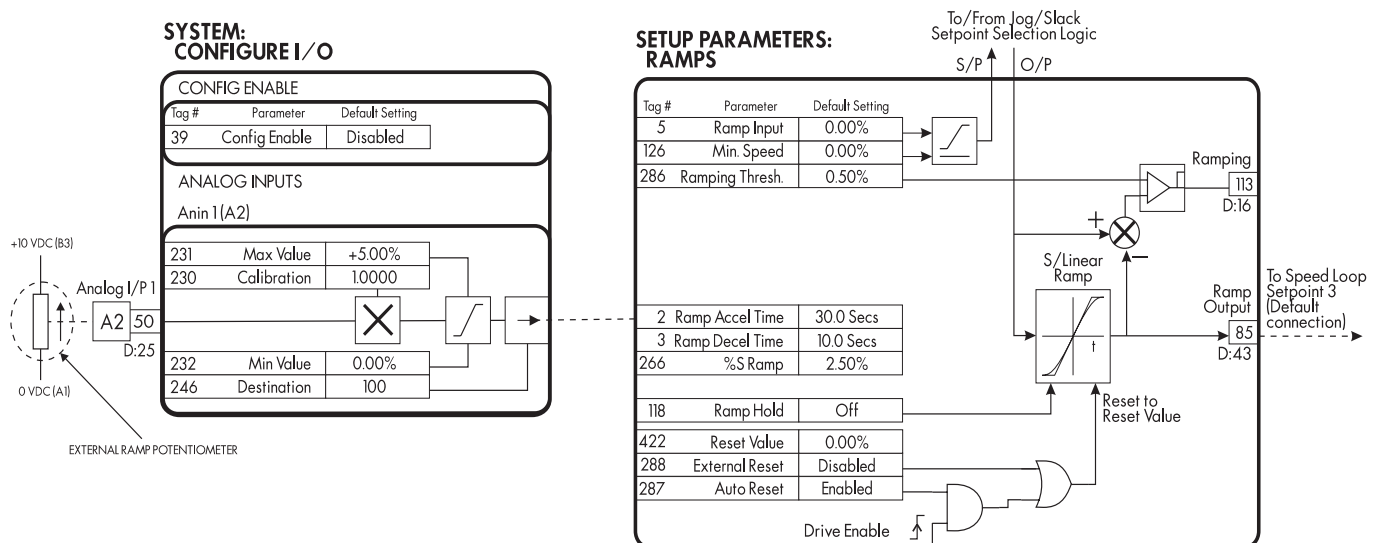


Figure D.3 - Controlling the Ramp Accel Time Using an External Potentiometer Wired to an Analog Input



## Using analog input 1 with digital input 1 for reversing a unipolar setpoint

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Set ANIN 3 (A4)::DESTINATION TAG to 0. This step disconnects input 3 from RAMP INPUT.
3. Set BLOCK DIAGRAM::SPT SUM O/P DEST to 5
4. Set DIGIN 1 (C6)::DESTINATION TAG to 8
5. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

This configuration allows a unipolar signal, 0 to +10 volt for example, at analog input 1 to control forward and reverse motor control. Analog input 1 connects to SETPOINT SUM 1:: INPUT 1 by default. Motor direction is changed by switching the input signal at digital input 1. When HIGH, SETPOINT SUM 1:: SIGN 1 is POSITIVE causing forward direction. When LOW, it is NEGATIVE causing reverse direction. SETPOINT SUM 1:: SPT. SUM OUTPUT connects to RAMP INPUT to allow smooth acceleration and deceleration.

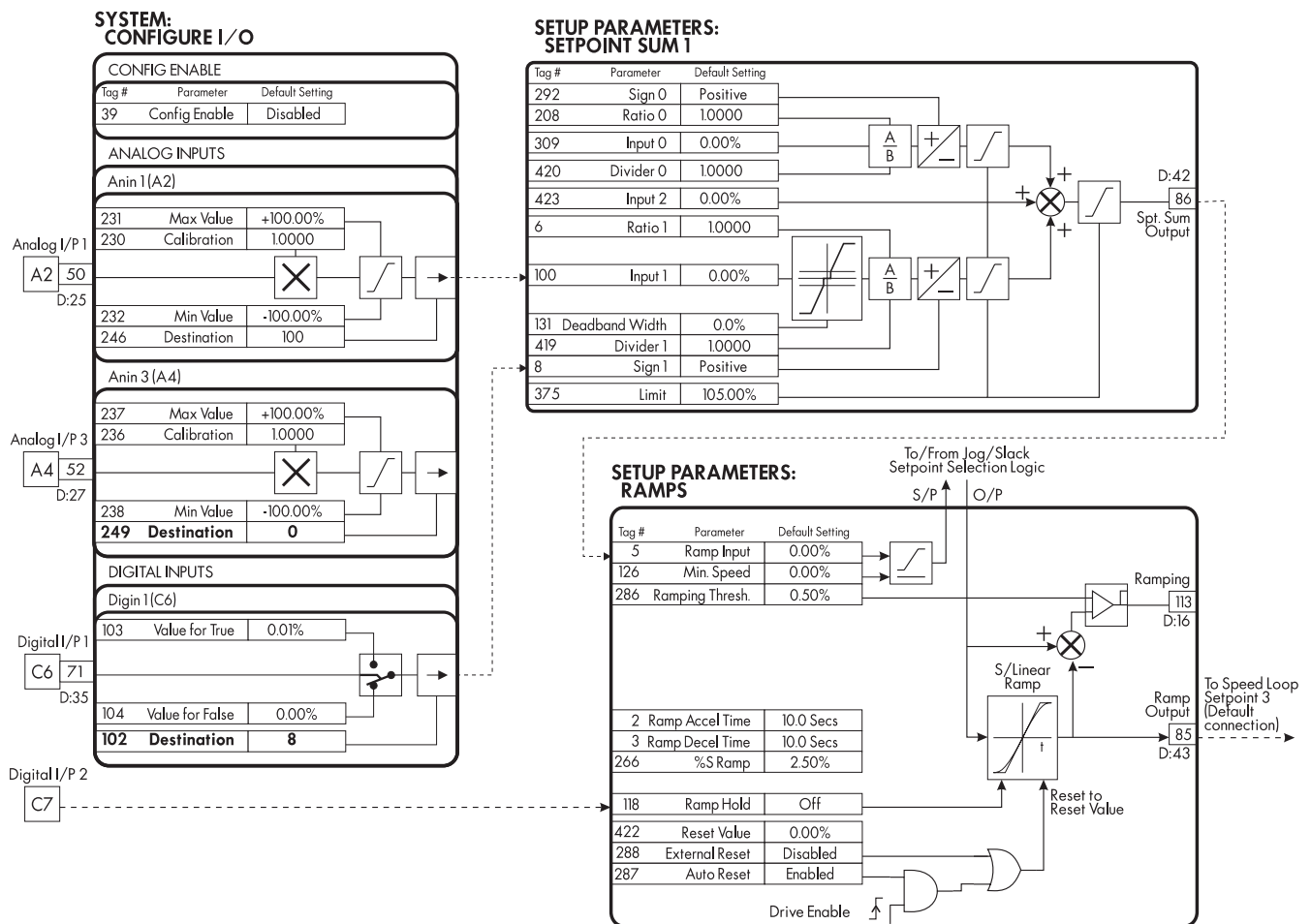


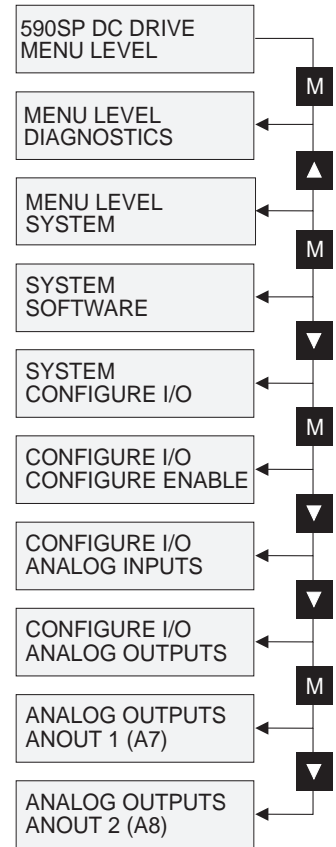
Figure D.4 - Bipolar Output from a Unipolar Input Using an Analog and a Digital Input

## ANALOG OUTPUTS

The 590 series controller has two configurable analog outputs.

### Parameters

Tag	Parameter	Description	Range	Default
<b>ANOUT 1 (A7)</b>				
245	% TO GET 10V	Scaler value to get a 10 volt output.	±300.00%	100.00%
362	MODULUS	When TRUE, all output is positive, (negative values are made positive).	TRUE/FALSE	FALSE
464	OFFSET	Offset to shift the output value.	±100.00%	0.00%
251	SOURCETAG	Source tag for the output signal. The default is speed feedback.	0 to 499	62
<b>ANOUT 2 (A8)</b>				
248	% TO GET 10V	Scaler value to get a 10 volt output.	±300.00%	100.00%
363	MODULUS	When TRUE, all output is positive, (negative values are made positive).	TRUE/FALSE	FALSE
465	OFFSET	Offset to shift the output value.	±100.00%	0.00%
252	SOURCETAG	Source tag for the output signal. The default is speed setpoint.	0 to 499	63



### SYSTEM: CONFIGURE I/O: ANALOG OUTPUTS

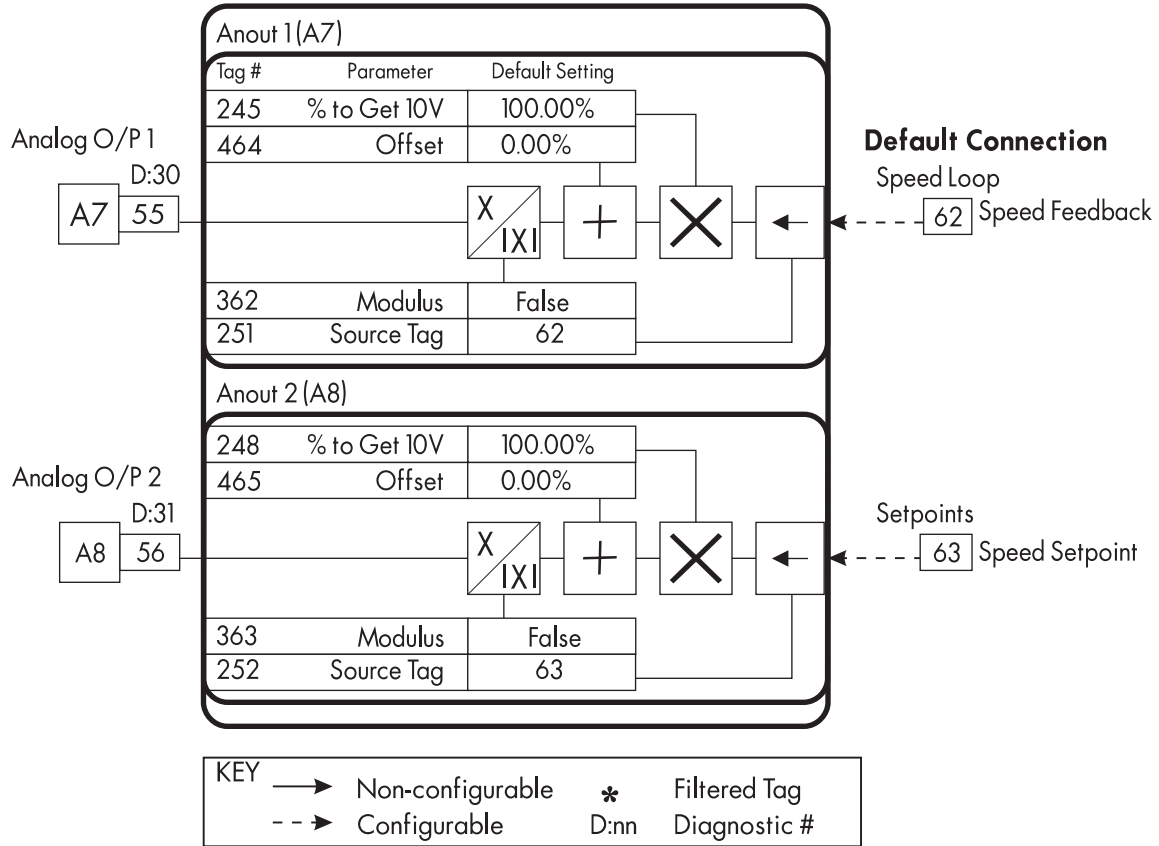


Figure D.5 - Analog Outputs Block Diagram

## Analog Outputs - Examples

The source of an analog output signal can be read from any parameter. It is important to remember that other parameters do not "send" signals to the output terminal. An output terminal "retrieves" the signal from the parameter described by its SOURCE TAG parameter.

The % TO GET 10 VDC value is based on the range of the source. It can be set positive or negative which will set the sign of the output. For parameters whose values are not in percent, the range is based on the unformatted quantity reformatted into percent. For example, tag number 300 would become 3.00%.

MODULUS will determine whether the output is bipolar or unipolar. When TRUE, the output is unipolar (will not go negative). Negative values will be clamped to zero.

### Reading FIELD I FBK. through analog output 1

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag number associated with field current feedback in the parameter list in Appendix I. (It is 300.)
3. Set ANALOG OUTPUTS::ANOUT 1 (A7):: SOURCE TAG to 300.
4. Set ANALOG OUTPUTS::ANOUT 1 (A7):: % TO GET 10 VDC to 100% (Default).
5. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

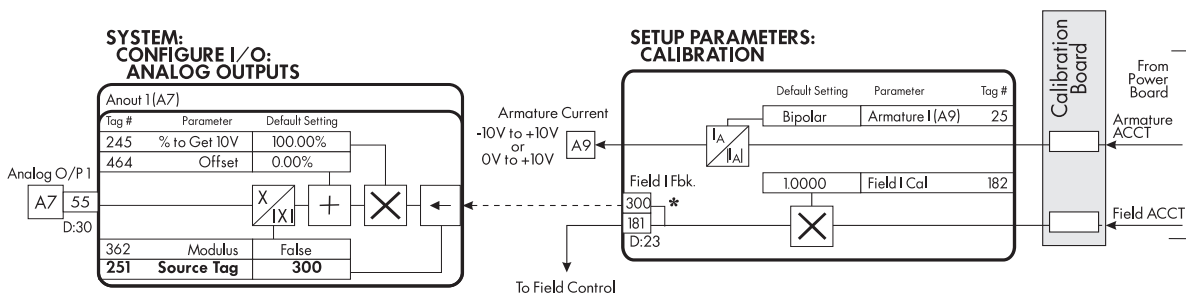


Figure D.6 - Reading FIELD I FBK Using an Analog Output

### Connecting the serial link to analog output 1

This allows analog output 1 to read values written by an external device to PNO 58 (ASCII 3A) which is AUX ANOUT 1.

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag number for AUX ANOUT 1 in the parameter list in Appendix I. (It is 128.)
3. Set ANALOG OUTPUTS::ANOUT 1 (A7):: SOURCE TAG to 128.
4. Set ANALOG OUTPUTS::ANOUT 1 (A7):: % TO GET 10V to 100% (Default).
5. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

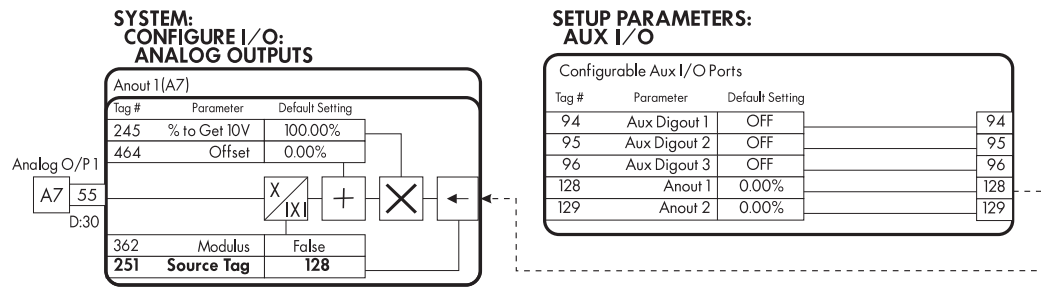


Figure D.7 - Reading a Serial Communications Signal Using an Analog Output

## Connecting current demand to analog output 2

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
  2. Find the tag number for current demand in the parameter list in Appendix I. (It is 66.)
  3. Set ANALOG OUTPUTS::ANOUT 2 (A8):: SOURCE TAG to 66.
  4. Set ANALOG OUTPUTS::ANOUT 2 (A8):: % TO GET 10V to 200%.
  5. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.
- Setting % TO GET 10V at 200% results in 5 volts output when current feedback is at 100%.

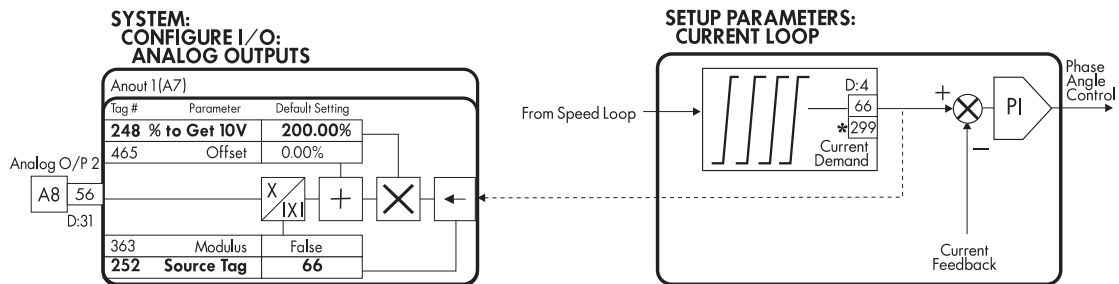


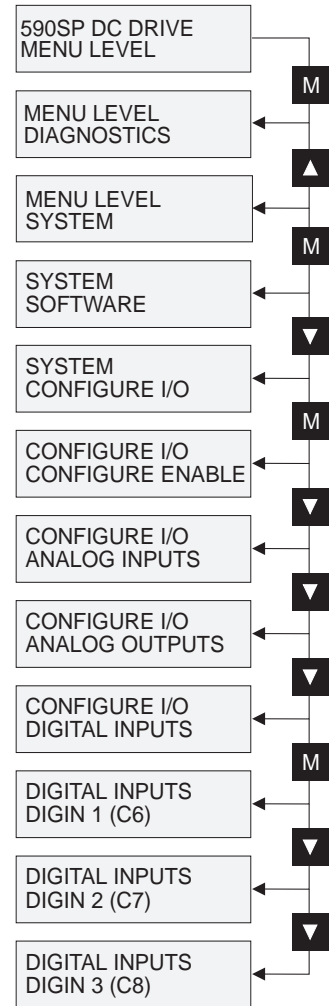
Figure D.8 - Reading Current Demand Using an Analog Output

## DIGITAL INPUTS

The 590 series controller has three configurable digital inputs.

### Parameters

Tag	Parameter	Description	Range	Default
<b>DIGIN 1 (C6)</b>				
103	VALUE FOR TRUE	Value sent to the destination when terminal C6 is at 24VDC.	±300.00%	0.01%
104	VALUE FOR FALSE	Value sent to the destination when terminal C6 is at 0VDC.	±300.00%	0.00%
102	DESTINATION TAG	Destination tag for the input signal. The default is BIPOLAR CLAMPS.	0 to 499	90
<b>DIGIN 2 (C7)</b>				
106	VALUE FOR TRUE	Value sent to the destination when terminal C7 is at 24VDC.	±300.00%	0.01%
107	VALUE FOR FALSE	Value sent to the destination when terminal C7 is at 0VDC.	±300.00%	0.00%
105	DESTINATION TAG	Destination tag for the input signal. The default is RAMP HOLD.	0 to 499	118
<b>DIGIN 3 (C8)</b>				
109	VALUE FOR TRUE	Value sent to the destination when terminal C8 is at 24VDC.	±300.00%	0.01%
110	VALUE FOR FALSE	Value sent to the destination when terminal C8 is at 0VDC.	±300.00%	0.00%
108	DESTINATION TAG	Destination tag for the input signal. The default is IDMD ISOLATE.	0 to 499	119





### SYSTEM: CONFIGURE I/O: DIGITAL INPUTS

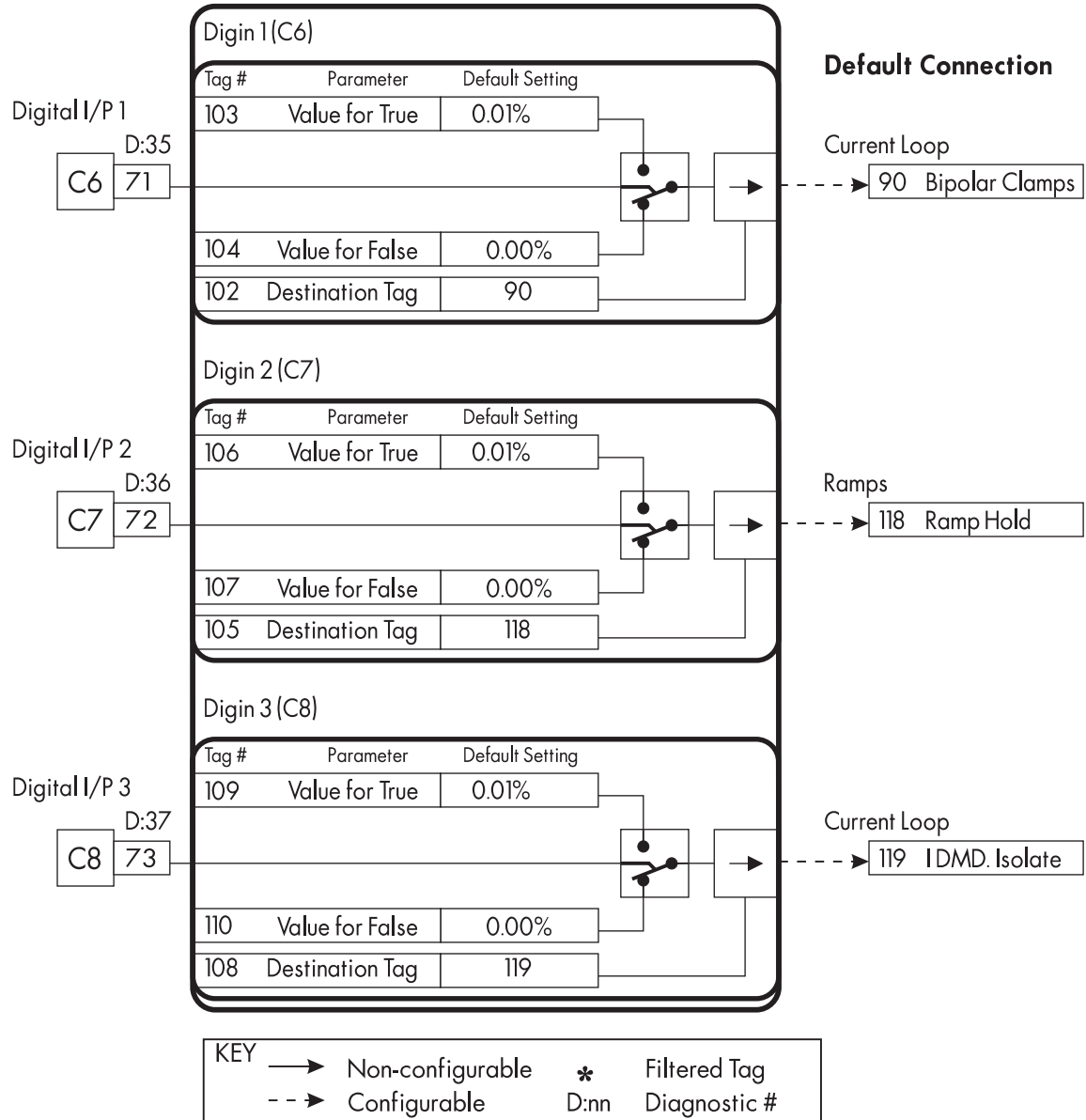


Figure D.9 - Digital Inputs Block Diagram

## Digital Inputs - Examples

Digital inputs can be connected to read/write parameters only. These inputs are useful for switching states of LOGIC parameters. LOGIC parameters are those whose ranges are ON/OFF, TRUE/FALSE, ENABLED/DISABLED, etc. They can also send two fixed values to a VALUE parameter as determined by the state of the input terminal.

### Using digital inputs with LOGIC parameters

The default connections in the 590 DRV Digital drive allow the digital inputs to switch LOGIC parameters. These are the connections from terminal C6 to tag 90 (BIPOLAR CLAMPS), C7 to tag 118 (RAMP HOLD), and C8 to tag 119 (I DMD. ISOLATE). In each case, the state of the terminal switches the destination parameter on or off by sending a 1 or 0. Since the format of the VALUE FOR TRUE and VALUE FOR FALSE parameters is in percent, 0 is equal to 0.00% and 1 is equal to 0.01%.

### Inverting the Input Signal

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Set DIGIN 1 (C6)::VALUE FOR TRUE to 0.00%.
3. Set VALUE FOR FALSE to 0.01%.
4. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

Digital input 1 now sends a 0 when the input signal is TRUE and 1 when it is FALSE.

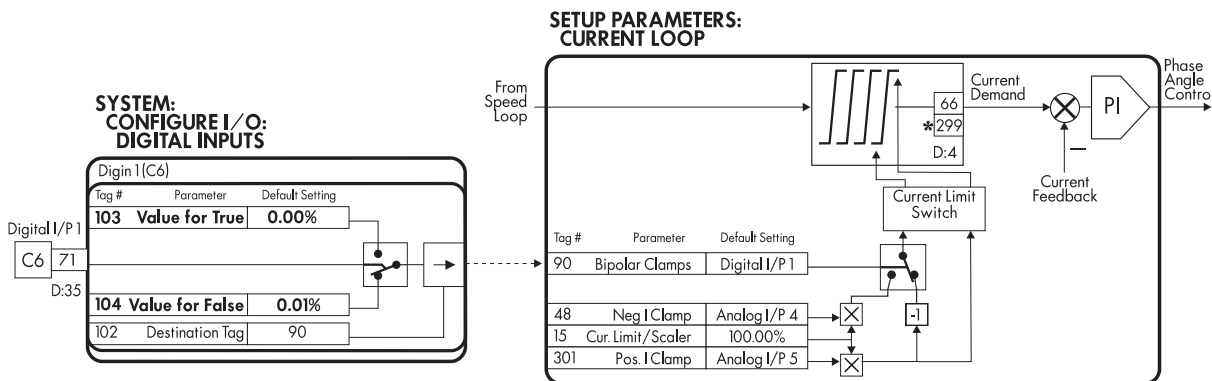


Figure D.10 - Inverted Signal Using a Digital Input

### Connecting digital input 1 to speed loop prop gain

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag number for the speed loop prop gain in the parameter list in Appendix I. (It is 14.)
3. Set DIGIN 1 (C6)::DESTINATION TAG to 14.
4. Set VALUE FOR TRUE to 10.00.
5. Set VALUE FOR FALSE to 30.00
6. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

Digital input 1 now sets SPEED LOOP::PROP. GAIN to two values depending upon its state. When it is HIGH, PROP. GAIN is at 10.00 and when LOW, PROP. GAIN is at 30.00.

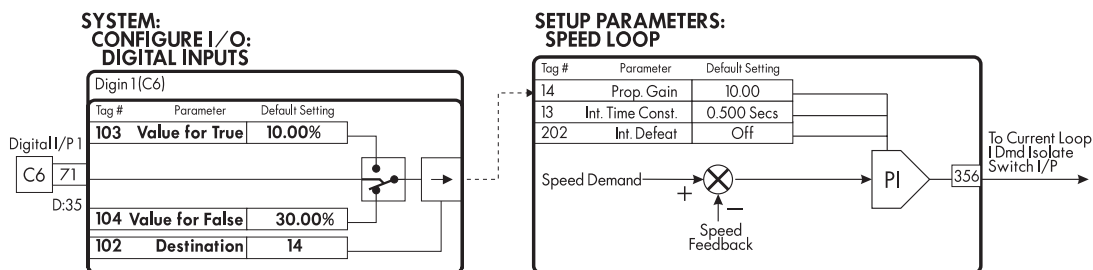


Figure D.11 - Changing a Value Parameter Using a Digital Input

### Using digital inputs to switch signal sources

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag number for LINK 1's source tag in the parameter list in Appendix H. (It is 364.)
3. Set DIGIN 1 (C6)::DESTINATION TAG to 364.
4. Find the tag number for AUX I/O::ANOUT 2 in the parameter list in Appendix H. (It is 129.)
5. Set DIGIN 1 (C6)::VALUE FOR TRUE to 1.29%.
6. Find the tag number for AUX I/O::ANOUT 1 in the parameter list in Appendix H. (It is 128.)
7. Set DIGIN 1 (C6)::VALUE FOR FALSE to 1.28%.
8. Find the tag number for SETPOINT SUM::INPUT 0 in the parameter list in Appendix H. (It is 309.)
9. Set LINK 1::DESTINATION TAG to 309.
10. Set AUX I/O::ANOUT 1 to 10%.
11. Set AUX I/O::ANOUT 2 to 20%.
12. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

This example uses an internal link to route two signals to INPUT 0. The state of digital input 1 determines the number held by LINK 1 :: SOURCE TAG. When TRUE, it is 129. When FALSE, the tag is 128. LINK 1:: SOURCE TAG retrieves the value from ANOUT 1 or 2 depending on the tag and routes it to SETPOINT SUM 1:: INPUT 0. The signal switches between 10 and 20 percent. This is useful for switching between two jog setpoints.

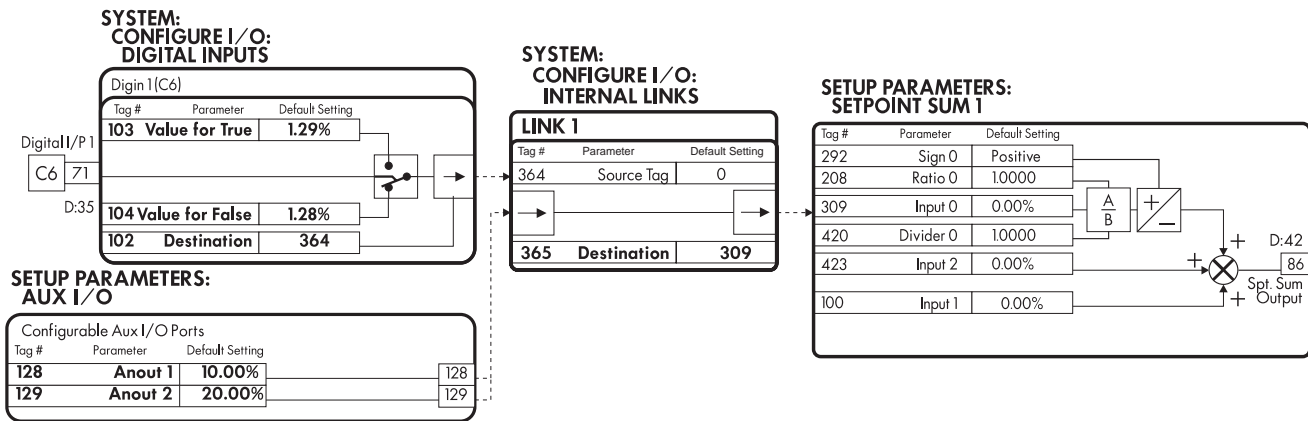


Figure D.12 - Switching Signal Sources Using a Digital Input

### Using digital inputs for jog forward and jog reverse functionality

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag number for JOG/SLACK:: MODE tag in the parameter list in Appendix H. (It is 228.)
3. Set DIGIN 1 (C6)::DESTINATION TAG to 228.
4. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

This configuration allows jog forward and jog reverse functionality. When terminal C4 is energized, the drive jogs forward using JOG SPEED 1, 5.00%. When both C4 and C6 are energized, OPERATING MODE switches to JOG 2. In this mode, the drive jogs in reverse using JOG SPEED 2, -5.00%.

See the Jog/Slack section in Appendix C for more information using this feature.

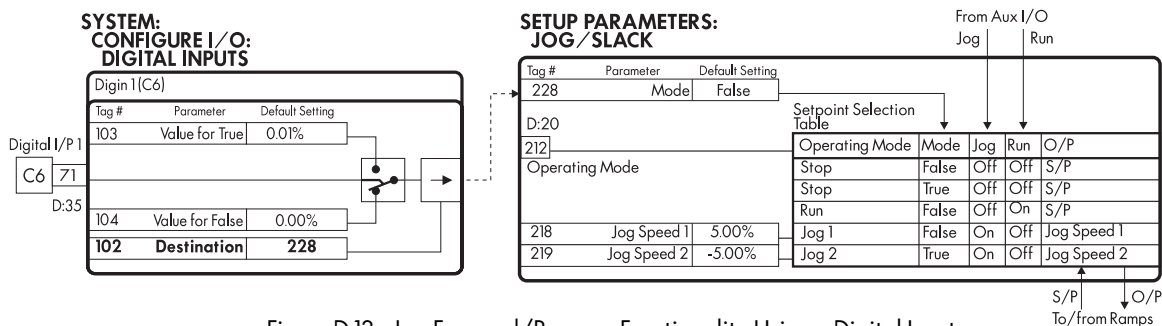


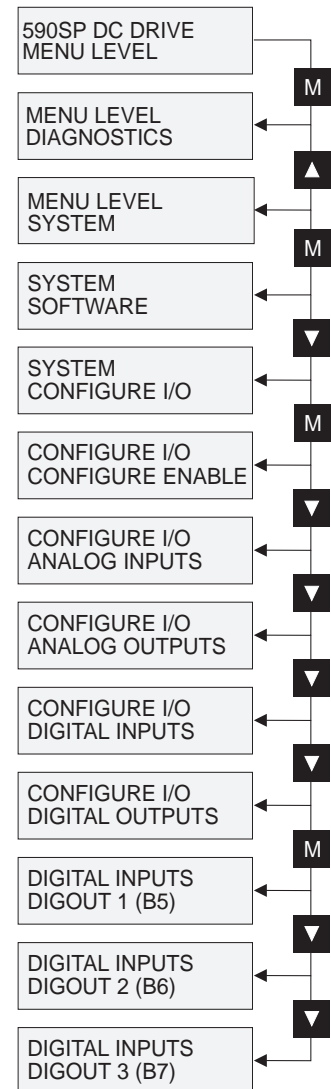
Figure D.13 - Jog Forward/Reverse Functionality Using a Digital Input

## DIGITAL OUTPUTS

The 590 series controller has three digital outputs. Each output is configurable.

### Parameters

Tag	Parameter	Description	Range	Default
<b>DIGOUT 1 (B5)</b>				
195	THRESHOLD (>)	The threshold the source value must exceed for the output to be at 24VDC.	±300.00%	0.00%
43	MODULUS	When TRUE, the absolute value of the source value is used for the threshold test.	TRUE/FALSE	TRUE
97	SOURCETAG	Source tag of the value used to set the output. The default is AT ZERO SPEED.	0 to 499	77
359	INVERTED	When TRUE, inverts the output.	TRUE/FALSE	FALSE
<b>DIGOUT 2 (B6)</b>				
196	THRESHOLD (>)	The threshold the source value must exceed for the output to be at 24VDC.	±300.00%	0.00%
44	MODULUS	When TRUE, the absolute value of the source value is used for the threshold test.	TRUE/FALSE	TRUE
98	SOURCETAG	Source tag of the value used to set the output. The default is the HEALTH FLAG (LED).	0 to 499	122
360	INVERTED	When TRUE, inverts the output.	TRUE/FALSE	FALSE
<b>DIGOUT 3 (B7)</b>				
197	THRESHOLD (>)	The threshold the source value must exceed for the output to be at 24VDC.	±300.00%	0.00%
45	MODULUS	When TRUE, the absolute value of the source value is used for the threshold test.	TRUE/FALSE	TRUE
99	SOURCETAG	Source tag of the value used to set the output. The default is the READY FLAG.	0 to 499	125
361	INVERTED	When TRUE, inverts the output.	TRUE/FALSE	FALSE



### SYSTEM: CONFIGURE I/O: DIGITAL OUTPUTS

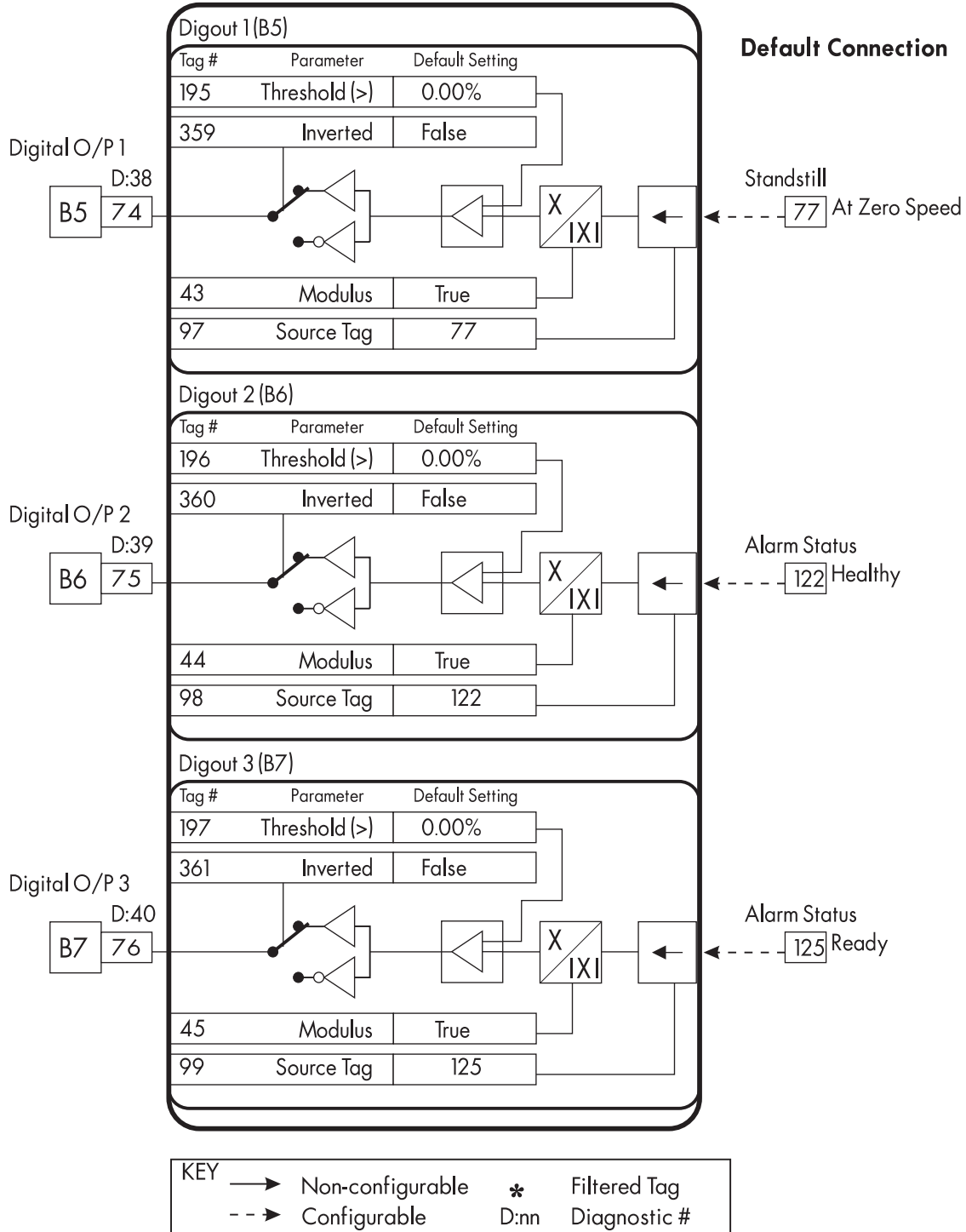


Figure D.14 - Digital Outputs Block Diagram

## Digital Outputs - Examples

Digital outputs can read all parameters (the same as the analog outputs). When used with a VALUE parameter, MODULUS removes the sign from the value (so -100 becomes 100). The THRESHOLD (>) parameter determines when the output is HIGH or LOW. The input signal must exceed the parameter for the output to go HIGH. INVERTED, when TRUE, inverts the result of the output from the threshold test.

### Reading speed feedback through digital output 1

In this example, the output will be HIGH when the absolute value of the speed feedback is larger than 50%.

1. Find the tag number for speed feedback in the parameter list in Appendix I. (It is 62.)
2. Set DIGITAL OUTPUTS::DIGOUT 1 (B5):: SOURCE TAG to 62.
3. Set DIGITAL OUTPUTS::DIGOUT 1 (B5):: THRESHOLD(>) to 50%.
4. Set DIGITAL OUTPUTS::DIGOUT 1 (B5):: MODULUS to TRUE (Default).
5. Set DIGITAL OUTPUTS::DIGOUT 1 (B5):: INVERTED to FALSE (Default).

This option is useful for generating an up-to-speed output.

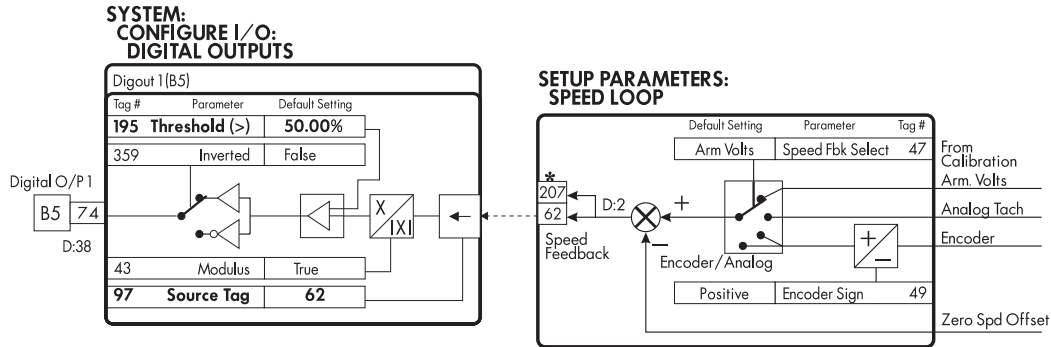


Figure D.15 - Reading Speed Feedback a Digital Output

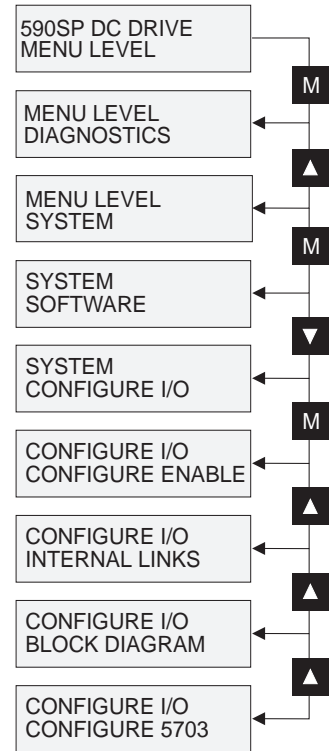


### CONFIGURE 5703

The 5703 peer-to-peer communication option transfers parameters from drive to drive through the serial port, P3. See Appendix E for additional information on the option.

#### Parameters

Tag	Parameter	Description	Range	Default
134	SOURCETAG	Source tag of the value to be sent to the 5703. The default is SPEED DEMAND.	0 to 499	89
135	DESTINATIONTAG	Destination tag of the value received from the 5703. The default is SETPOINT 4 in the speed loop.	0 to 499	41



#### SYSTEM: CONFIGURE I/O: CONFIGURE 5703

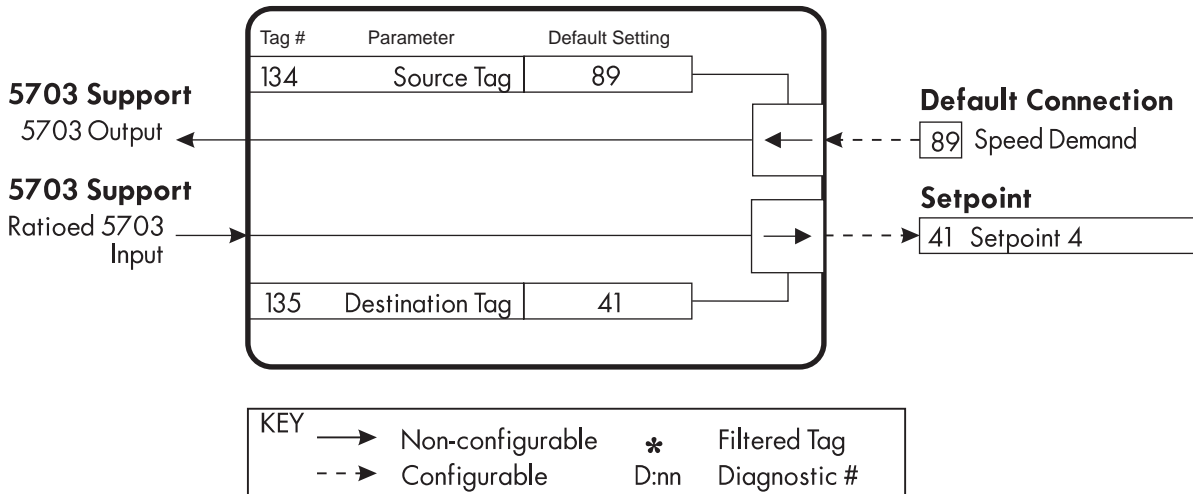


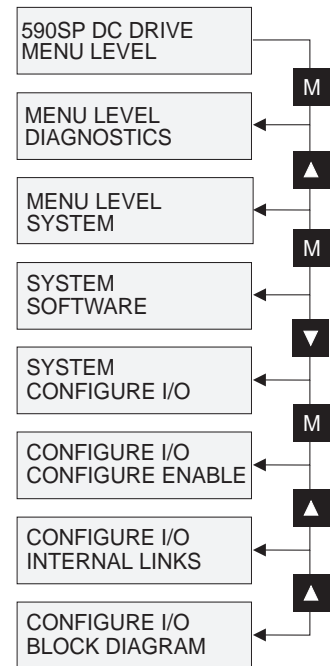
Figure D.16 - Configure 5703 Block Diagram

### BLOCK DIAGRAM

The parameters in Block Diagram connect the outputs of Raise/Lower, Ramps, Setpoint Sum 1, and the Special Blocks functions to destinations as required. These functions are only executed when the destinations are connected to a nonzero tag. If a function is not required, set its destination to tag 0. This causes the processor to ignore the function and reduces processor loading.

#### Parameters

Tag	Parameter	Description	Range	Default
260	RAISE/LOWERDEST	RAISE/LOWER output destination. The default is no connection.	0 to 499	0
293	RAMP O/PDEST	RAMPS output destination. The default is SETPOINT 3 in the speed loop.	0 to 499	291
294	SPT SUM1DEST	SETPOINT SUM 1 output destination. The default is SETPOINT 1 in the speed loop.	0 to 499	289
400	PID O/PDEST	PID output destination. The default is no connection.	0 to 499	0
431	DIAMETER	DIAMETER CALC. output destination. The default is no connection.	0 to 499	0
442	TAPER	TAPER CALC. output destination. The default is no connection.	0 to 499	0
450	SETPOINT SUM 2	SETPOINT SUM 2 output destination. The default is no connection.	0 to 499	0
435	POS. ICLAMP	TORQUE CALC. positive clamp output destination. The default is no connection.	0 to 499	0
436	NEG. ICLAMP	TORQUE CALC. negative clamp output destination. The default is no connection.	0 to 499	0





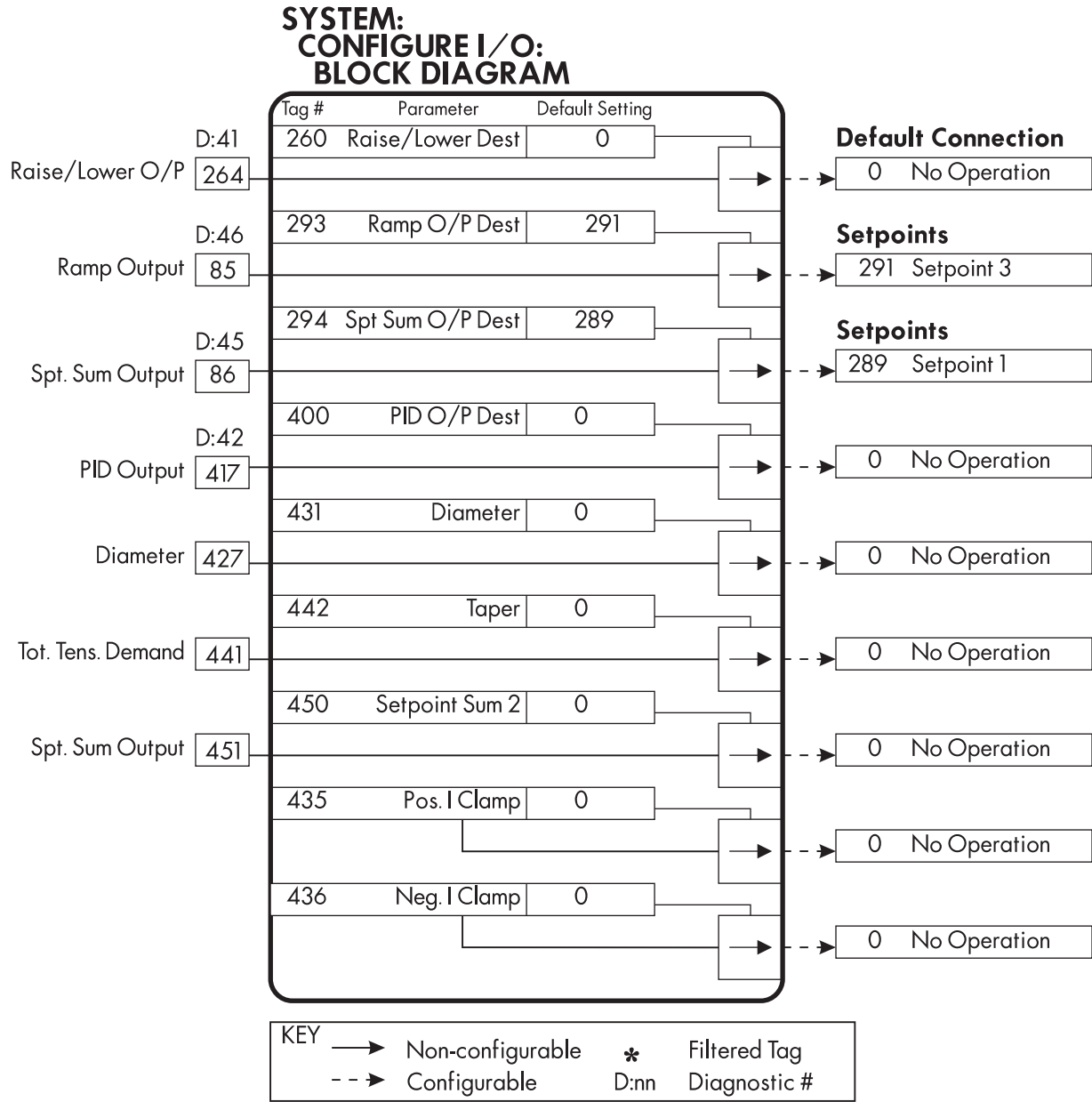


Figure D.17 - Block Diagram

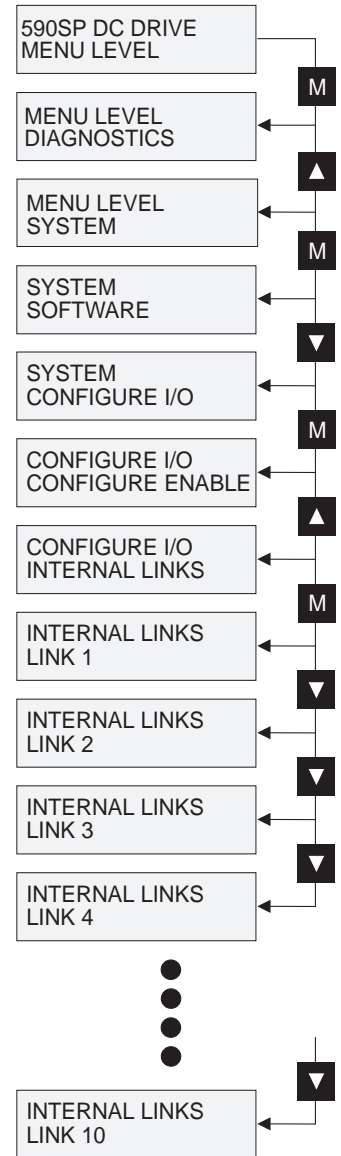
### INTERNAL LINKS

The drive has ten INTERNAL LINKS. They have two common uses; connecting an internal input to an internal output and connecting an input terminal to multiple destinations.

None of the links are connected in the default configuration.

#### Parameters

Tag	Parameter	Description	Range	Default
<b>LINK 1</b>				
364	SOURCETAG	Source tag of the input value.	0 to 499	0
365	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 2</b>				
366	SOURCETAG	Source tag of the input value.	0 to 499	0
367	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 3</b>				
368	SOURCETAG	Source tag of the input value.	0 to 499	0
369	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 4</b>				
370	SOURCETAG	Source tag of the input value.	0 to 499	0
371	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 5</b>				
454	SOURCETAG	Source tag of the input value.	0 to 499	0
455	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 6</b>				
456	SOURCETAG	Source tag of the input value.	0 to 499	0
457	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 7</b>				
458	SOURCETAG	Source tag of the input value.	0 to 499	0
459	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 8</b>				
460	SOURCETAG	Source tag of the input value.	0 to 499	0
461	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 9</b>				
467	SOURCETAG	Source tag of the input value.	0 to 499	0
468	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0
<b>LINK 10</b>				
469	SOURCETAG	Source tag of the input value.	0 to 499	0
470	DESTINATION TAG	Dest. tag of the input value.	0 to 499	0



**SYSTEM:  
CONFIGURE I/O:  
INTERNAL LINKS**

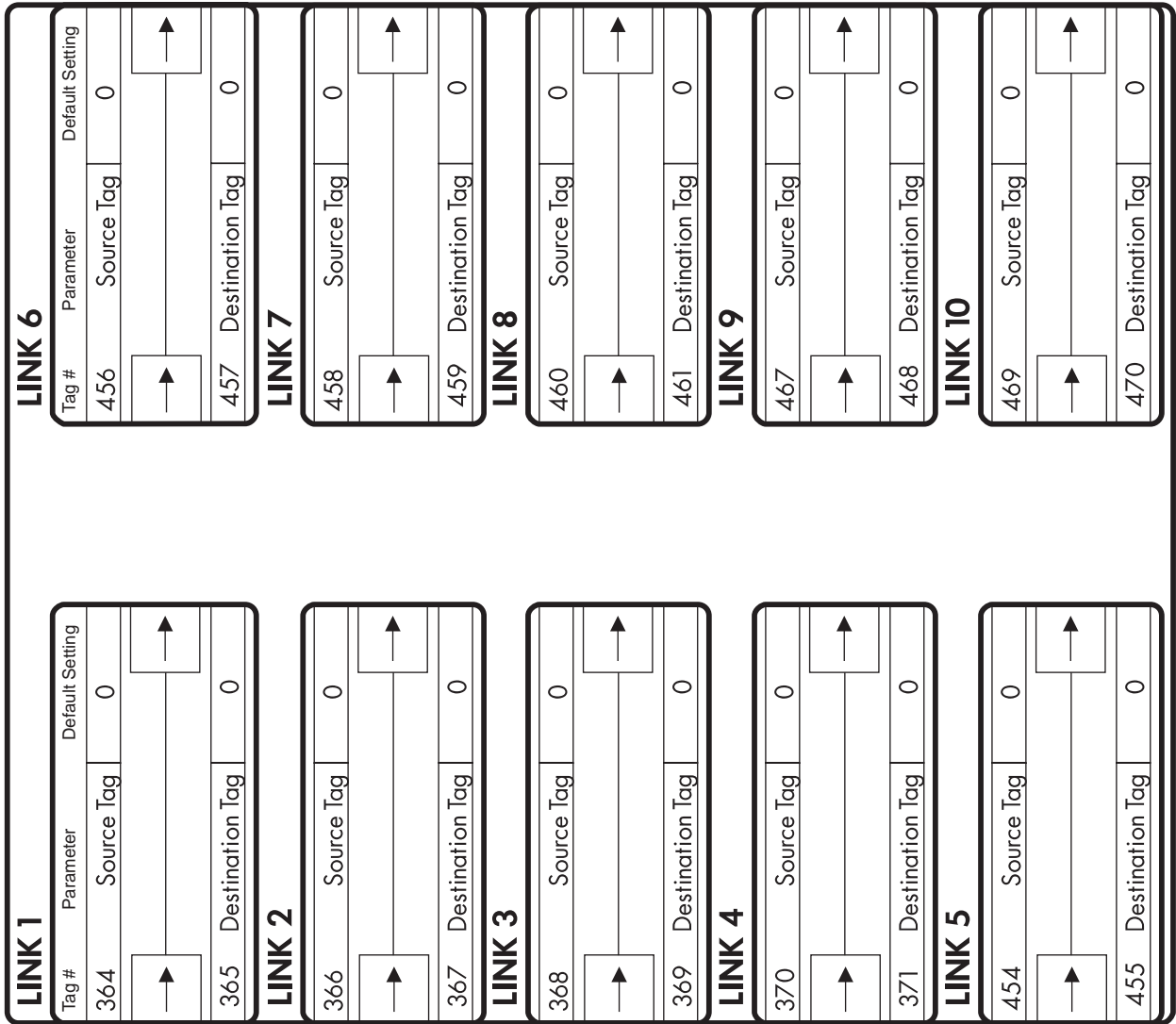


Figure D.18 - Internal Links Block Diagram

## Internal Links - Example

### Controlling both the accel and decel times of the drive ramp through analog input 1

This example is similar to the first example in the Analog Inputs section of this chapter. As before, the ends of the external pot are connected to the drive's 0 to +10 VDC supply (terminals A1 and B3), the wiper of the pot is connected to terminal A2 and the calibration parameter of the Analog Input 1 is set to 5.00% to scale the input signal to 30 seconds, maximum. However, in this instance INTERNAL LINK 1 is used to allow the external pot to control *both* the acceleration and deceleration time of the ramp.

1. Set CONFIGURE I/O::CONFIGURE ENABLE to ENABLE.
2. Find the tag numbers for both RAMP ACCEL TIME and RAMP DECEL TIME in the parameter list in Appendix I. (They are 2 and 3.)
3. Set ANIN 1 (A2)::DESTINATION TAG to 2 (RAMP ACCEL TIME).
4. Set ANIN 1 (A2)::CALIBRATION to 0.0500 (5.00%).
5. Set MAX CLAMP to 100.00%. (Default)
6. Set MIN CLAMP to 0.00%.
7. Exit the ANALOG INPUTS sub-menu and scroll down to INTERNAL LINKS. Enter INTERNAL LINKS.
8. Set the SOURCE TAG of LINK 1 to tag number 2, RAMP ACCEL TIME, which is also the destination tag of the output of the block Analog Input 1.
9. Set the DESTINATION TAG of LINK to tag number 3, RAMP DECEL TIME.
10. Reset CONFIGURE I/O::CONFIGURE ENABLE to DISABLE.

Analog Input 1 (terminal A2) now controls *both* the speed ramp acceleration and deceleration times over a range of 0 to 30 seconds. An input of 10 VDC sets the ramp up and down times 30 seconds.

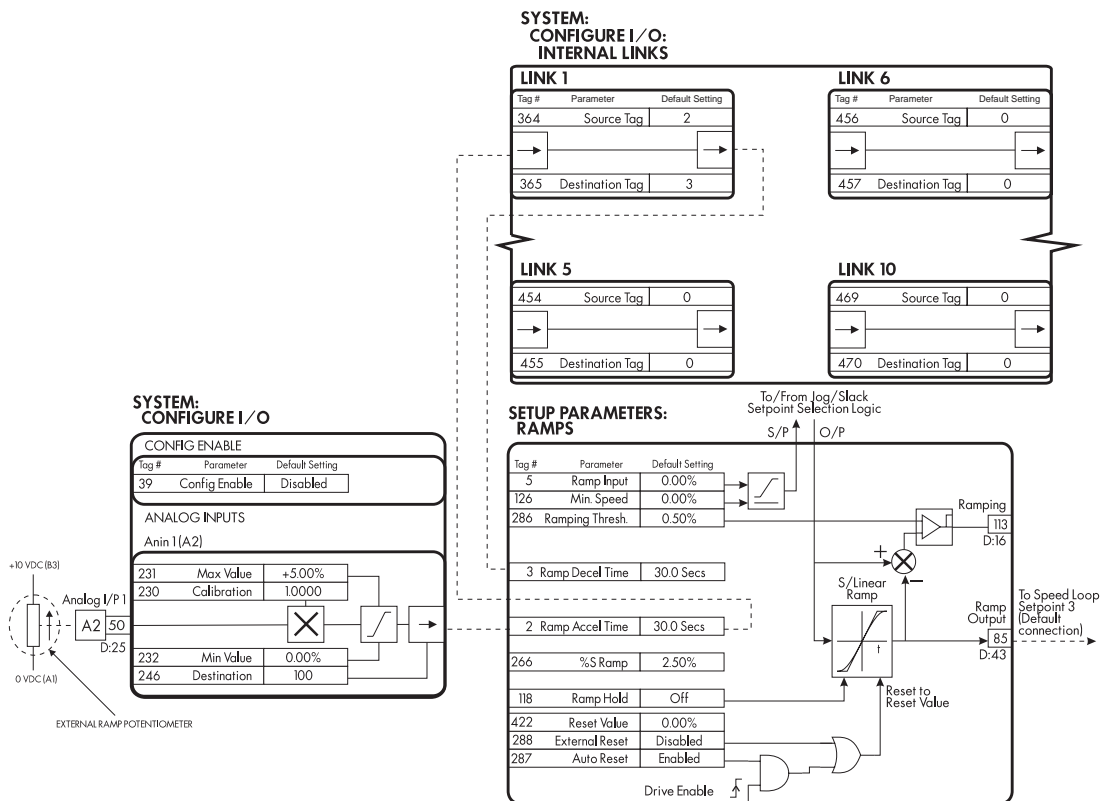
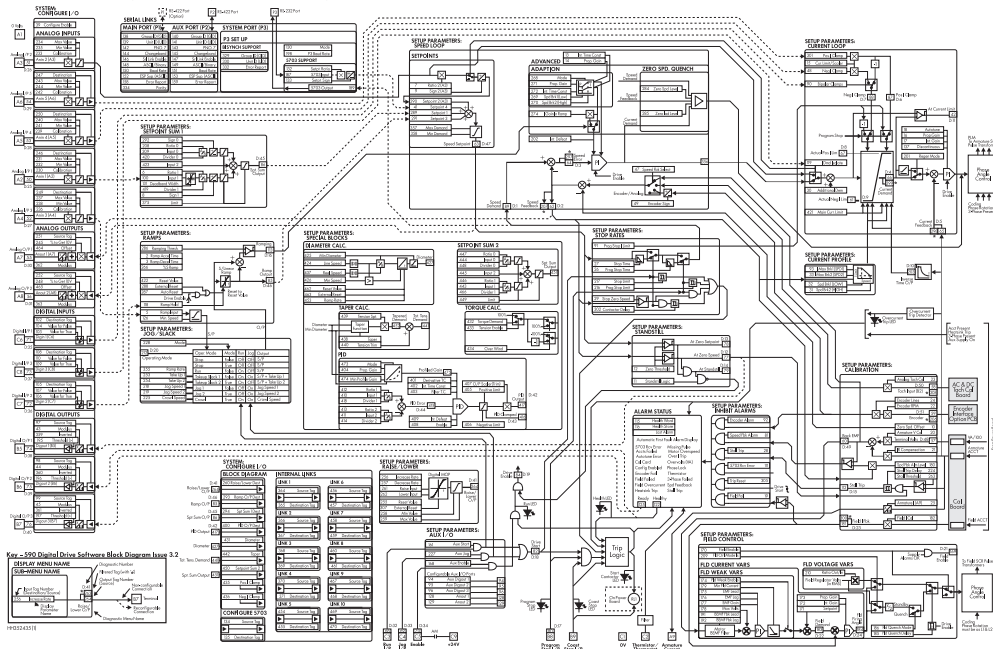


Figure D.19 - Controlling both the Ramp Accel and Decel Time Using an External Potentiometer Wired to an Analog Input





Figure D.20 - 590 DRV Digital DC Drive Software Block Diagram



## Appendix E MMI PARAMETER LIST

The following listing of version 3.2 MMI parameters contains the default MMI values. Use it to keep track of any modifications you may make during installation and commissioning. Any parameters changed by the factory before shipping are listed in the column SETTING 1.

NOTE. The default settings (column 1) overwrite any configuration changes made by either the factory or by the customer if you perform a four-button reset . Before performing a reset, write down your custom settings in the columns provided so that you may reenter them if they are inadvertently overwritten or lost.

TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>SETUP PARAMETERS</b>					
<b>SETUP PARAMETERS::RAMPS</b>					
2	RAMP ACCEL TIME	10.0 SECS			
3	RAMP DECEL TIME	10.0 SECS			
118	RAMP HOLD	OFF			
5	RAMP INPUT	0.00%			
266	% S-RAMP	2.50%			
286	RAMPING THRESH.	0.50%			
287	AUTO RESET	ENABLED			
288	EXTERNAL RESET	DISABLED			
422	RESET VALUE	0.00%			
126	MIN SPEED	0.00%			
<b>SETUP PARAMETERS::AUX I/O</b>					
161	AUX START	ON			
227	AUX JOG	ON			
168	AUX ENABLE	ON			
94	AUX DIGOUT 1	OFF			
95	AUX DIGOUT 2	OFF			
96	AUX DIGOUT 3	OFF			
128	ANOUT 1	0.00%			
129	ANOUT 2	0.00%			
<b>SETUP PARAMETERS::JOG/SLACK</b>					
218	JOG SPEED 1	5.00%			
219	JOG SPEED 2	-5.00%			
253	TAKE UP 1	5.00%			
254	TAKE UP 2	-5.00%			
225	CRAWL SPEED	10.00%			
228	MODE	FALSE			
355	RAMP RATE	1.0 SECS			
<b>SETUP PARAMETERS::RAISE/LOWER</b>					
255	RESET VALUE	0.00%			
256	INCREASE RATE	10.0 SECS			
257	DECREASE RATE	10.0 SECS			
261	RAISE INPUT	FALSE			
262	LOWER INPUT	FALSE			



TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
258	MIN VALUE	-100.00%			
259	MAX VALUE	100.00%			
307	EXTERNAL RESET	FALSE			
<b>SETUP PARAMETERS::SPECIAL BLOCKS</b>					
<b>Setup Parameters::Special Blocks::Diameter Calc.</b>					
424	LINE SPEED	0.00%			
437	REEL SPEED	0.00%			
425	MIN DIAMETER	10.00%			
426	MIN SPEED	5.00%			
462	RESET VALUE	10.00%			
463	EXTERNAL RESET	DISABLED			
453	RAMP RATE	5.0 SECS			
427	DIAMETER	0.00%			
<b>Setup Parameters::Special Blocks::Taper Calc.</b>					
438	TAPER	0.00%			
439	TENSION SPT.	0.00%			
452	TAPERED DEMAND	0.00%			
440	TENSION TRIM	0.00%			
441	TOT.TENS.DEMAND	0.00%			
<b>Setup Parameters::Special Blocks::Torque Calc.</b>					
432	TORQUE DEMAND	0.00%			
433	TENSION ENABLE	ENABLED			
434	OVER WIND	ENABLED			
<b>Setup Parameters::Special Blocks::Setpoint Sum 2</b>					
445	INPUT 2	0.00%			
443	INPUT 1	0.00%			
444	INPUT 0	0.00%			
446	RATIO 1	1			
447	RATIO 0	1			
466	DIVIDER 1	1			
448	DIVIDER 0	1			
449	LIMIT	100.00%			
451	SPT SUM OUTPUT	0.00%			
<b>Setup Parameters::Special Blocks::PID</b>					
404	PROP. GAIN	1			
402	INT. TIME CONST.	5.00 SECS			
401	DERIVATIVE TC	0.000 SECS			
405	POSITIVE LIMIT	100.00%			
406	NEGATIVE LIMIT	-100.00%			
407	O/P SCALER(TRIM)	0.2			
410	INPUT 1	0.00%			
411	INPUT 2	0.00%			
412	RATIO 1	1			



TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>Setup Parameters::Special Blocks::PID (continued)</b>					
413	RATIO 2	1			
418	DIVIDER 1	1			
414	DIVIDER 2	1			
408	ENABLE	ENABLED			
409	INT. DEFEAT	OFF			
403	FILTER T.C.	0.100 SECS			
473	MODE	0			
474	MIN PROFILE GAIN	20.00%			
475	PROFILED GAIN	0			
<b>SETUP PARAMETERS::FIELD CONTROL</b>					
170	FIELD ENABLE	ENABLED			
209	FLD CTRL MODE IS	VOLTAGE CONTROL			
185	FLD QUENCH DELAY	0.0 SECS			
186	FLD. QUENCH MODE	QUENCH			
<b>Setup Parameters::Field Control::Fld Voltage Vars</b>					
210	RATIO OUT/IN	90.00%	65.00%		
<b>Setup Parameters::Field Control::Fld Current Vars</b>					
171	SETPOINT	100.00%			
173	PROP. GAIN	0.1			
172	INT. GAIN	1.28			
<b>Setup Parameters::Field Control::Fld Current Vars::Fld Weak Vars</b>					
174	FLD. WEAK ENABLE	DISABLED			
175	EMF LEAD	2			
176	EMF LAG	40			
177	EMF GAIN	0.3			
179	MIN FLD CURRENT	10.00%			
178	MAX VOLTS	100.00%			
191	BEMF FBK LEAD	100			
192	BEMF FBK LAG	100			
<b>SETUP PARAMETERS::CURRENT PROFILE</b>					
32	SPD BRK1 (LOW)	100.00%			
31	SPD BRK2 (HIGH)	100.00%			
93	IMAX BRK1 (SPD1)	200.00%			
33	IMAX BRK2 (SPD2)	200.00%			
<b>SETUP PARAMETERS::STOP RATES</b>					
27	STOP TIME	10.0 SECS			
217	STOP LIMIT	60.0 SECS			
302	CONTACTOR DELAY	1.0 SECS			
26	PROG STOP TIME	0.1 SECS			
216	PROG STOP LIMIT	60.0 SECS			
91	PROG STOP LIM	100.00%			
29	STOP ZERO SPEED	2.00%			

TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>SETUP PARAMETERS::CALIBRATION</b>					
20	ARMATURE V CAL	1			
21	IR COMPENSATION	0.00%			
22	ENCODER RPM	1000 RPM			
24	ENCODER LINES	1000			
23	ANALOG TACH CAL	1			
10	ZERO SPD. OFFSET	0.00%			
25	ARMATURE I (A9)	BIPOLAR			
180	SPDFBK ALM LEVEL	50.00%			
263	STALL THRESHOLD	95.00%			
224	STALL TRIP DELAY	10.0 SECS			
188	OVER SPEED LEVEL	125.00%			
182	FIELD I CAL	1			
<b>SETUP PARAMETERS::INHIBIT ALARMS</b>					
19	FIELD FAIL	ENABLED			
111	5703 RCV ERROR	ENABLED			
28	STALL TRIP	INHIBITED			
305	TRIP RESET	TRUE			
81	SPEED FBK ALARM	ENABLED			
92	ENCODER ALARM	ENABLED			
<b>SETUP PARAMETERS::CURRENT LOOP</b>					
15	CUR LIMIT/SCALER	100.00%			
421	MAIN CURR. LIMIT	200.00%			
16	PROP. GAIN	45			
17	INT. GAIN	3.5			
18	AUTOTUNE	OFF			
137	DISCONTINUOUS	12.00%			
30	ADDITIONAL DEM	0.00%			
90	BIPOLAR CLAMPS	DISABLED			
201	REGEN MODE	ENABLED	Disabled (Non-regen units only.)		
301	POS. I CLAMP	0.00%			
48	NEG. I CLAMP	0.00%			
119	I DMD. ISOLATE	DISABLED			
<b>SETUP PARAMETERS::SPEED LOOP</b>					
14	PROP. GAIN	10			
13	INT. TIME CONST.	0.500 SECS			
202	INT. DEFEAT	OFF			
49	ENCODER SIGN	POSITIVE			
47	SPEED FBK SELECT	ARM VOLTS FBK			
<b>Setup Parameters::Speed Loop::Advanced</b>					
<b>Setup Parameters::Speed Loop::Advanced::Adaption</b>					
268	MODE	0			
269	SPD BRK1 (LOW)	1.00%			
270	SPD BRK2 (HIGH)	5.00%			

TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>Setup Parameters::Speed Loop::Advanced::Adaption (continued)</b>					
271	PROP. GAIN	5			
272	INT. TIME CONST.	0.500 SECS			
<b>Setup Parameters::Speed Loop::Advanced::Zero Spd. Quench</b>					
284	ZERO SPD. LEVEL	0.50%			
285	ZERO IAD LEVEL	1.50%			
<b>Setup Parameters::Speed Loop::Setpoints</b>					
289	SETPOINT 1	0.00%			
289	SETPOINT 1	0.00%			
9	SIGN 2 (A3)	POSITIVE			
7	RATIO 2 (A3)	1			
290	SETPOINT 2 (A3)	0.00%			
291	SETPOINT 3	0.00%			
41	SETPOINT 4	0.00%			
357	MAX DEMAND	105.00%			
358	MIN DEMAND	-105.00%			
<b>SETUP PARAMETERS::STANDSTILL</b>					
11	STANDSTILL LOGIC	DISABLED			
12	ZERO THRESHOLD	2.00%			
<b>SETUP PARAMETERS::SETPOINT SUM 1</b>					
6	RATIO 1	1			
208	RATIO 0	1			
8	SIGN 1	POSITIVE			
292	SIGN 0	POSITIVE			
419	DIVIDER 1	1			
420	DIVIDER 0	1			
131	DEADBAND WIDTH	0.00%			
375	LIMIT	105.00%			
423	INPUT 2	0.00%			
100	INPUT 1	0.00%			
309	INPUT 0	0.00%			
<b>PASSWORD</b>					
120	ENTER PASSWORD	0x0000			
121	CHANGE PASSWORD	0x0000			
<b>ALARM STATUS</b>					
115	HEALTH WORD	0x4210			
116	HEALTH STORE	0x0000			
<b>MENUS</b>					
37	FULL MENUS	ENABLED			
38	MENU DELAY	30			
	LANGUAGE	ENGLISH			



TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>SERIAL LINKS</b>					
<b>SERIAL LINKS::MAIN PORT (P1)</b>					
146	SRL LINK ENABLE	ENABLED			
138	GROUP ID (GID)	0			
139	UNIT ID (UID)	0			
148	ASCII / BINARY	ASCII			
150	BAUD RATE	9600			
152	ESP SUP. (ASCII)	DISABLED			
144	CHANGE BAND (BIN)	0.00%			
158	ERROR REPORT	0x00C0			
142	PNO. 7	0xFFFF			
334	PARITY	EVEN			
<b>SERIAL LINKS::AUX PORT (P2)</b>					
147	SRL LINK ENABLE	ENABLED			
140	GROUP ID (GID)	0			
141	UNIT ID (UID)	0			
149	ASCII / BINARY	ASCII			
151	BAUD RATE	9600			
153	ESP SUP. (ASCII)	DISABLED			
145	CHANGE BAND (BIN)	0.00%			
159	ERROR REPORT	0x00C0			
143	PNO. 7	0xFFFF			
<b>SERIAL LINKS::SYSTEM PORT (P3)</b>					
	DUMP MMI -> P3				
	UDP XFER <- P3				
	UDP XFER -> P3				
<b>Serial Links::System Port (P3)::P3 Setup</b>					
130	MODE	DISABLED			
198	P3 BAUD RATE	9600			
<b>Serial Links::System Port (P3)::P3 Setup::5703 Support</b>					
132	SETPT. RATIO	0			
133	SETPT. SIGN	POSITIVE			
187	5703 INPUT	0.00%			
189	5703 OUTPUT	0.00%			
<b>Serial Links::System Port (P3)::P3 Setup::Bisynch Support</b>					
329	GROUP ID (GID)	0			
330	UNIT ID (UID)	0			
332	ERROR REPORT	0x00C0			
<b>SERIAL LINKS::PNO CONFIG</b>					
312	PNO 112	0			
313	PNO 113	0			
314	PNO 114	0			
315	PNO 115	0			

TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>SERIAL LINKS::PNO CONFIG (continued)</b>					
316	PNO116	0			
317	PNO117	0			
318	PNO118	0			
319	PNO119	0			
320	PNO120	379			
321	PNO121	380			
322	PNO122	381			
323	PNO123	382			
324	PNO124	383			
325	PNO125	384			
326	PNO126	385			
327	PNO127	0			
<b>SYSTEM</b>					
	SOFTWARE	ISSUE: 3.2			
<b>SYSTEM::CONFIGURE I/O</b>					
39	CONFIGURE ENABLE	DISABLED			
<b>System::Configure I/O::Analog Inputs</b>					
<b>System::Configure I/O::Analog Inputs::ANIN 1 (A2)</b>					
230	CALIBRATION	1			
231	MAX VALUE	100.00%			
232	MIN VALUE	-100.00%			
246	DESTINATION TAG	100			
<b>System::Configure I/O::Analog Inputs::ANIN 2 (A3)</b>					
233	CALIBRATION	1			
234	MAX VALUE	100.00%			
235	MIN VALUE	-100.00%			
<b>System::Configure I/O::Analog Inputs::ANIN 3 (A4)</b>					
236	CALIBRATION	1			
237	MAX VALUE	100.00%			
238	MIN VALUE	-100.00%			
249	DESTINATION TAG	5			
<b>System::Configure I/O::Analog Inputs::ANIN 4 (A5)</b>					
239	CALIBRATION	1			
240	MAX VALUE	100.00%			
241	MIN VALUE	-100.00%			
250	DESTINATION TAG	48			
<b>System::Configure I/O::Analog Inputs::ANIN 5 (A6)</b>					
242	CALIBRATION	1			
243	MAX VALUE	100.00%			
244	MIN VALUE	-100.00%			
247	DESTINATION TAG	301			



TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>System::Configure I/O::Analog Outputs::ANOUT 1 (A7)</b>					
245	% TO GET 10V	100.00%			
362	MODULUS	FALSE			
464	OFFSET	0.00%			
251	SOURCE TAG	62			
<b>System::Configure I/O::Analog Outputs::ANOUT 2 (A8)</b>					
248	% TO GET 10V	100.00%			
363	MODULUS	FALSE			
465	OFFSET	0.00%			
252	SOURCE TAG	63			
<b>System::Configure I/O::Digital Inputs</b>					
<b>System::Configure I/O::Digital Inputs::DIGIN 1 (C6)</b>					
103	VALUE FOR TRUE	0.01%			
104	VALUE FOR FALSE	0.00%			
102	DESTINATION TAG	90			
<b>System::Configure I/O::Digital Inputs::DIGIN 2 (C7)</b>					
106	VALUE FOR TRUE	0.01%			
107	VALUE FOR FALSE	0.00%			
105	DESTINATION TAG	118			
<b>System::Configure I/O::Digital Inputs::DIGIN 3 (C8)</b>					
109	VALUE FOR TRUE	0.01%			
110	VALUE FOR FALSE	0.00%			
108	DESTINATION TAG	119			
<b>System::Configure I/O::Digital Outputs</b>					
<b>System::Configure I/O::Digital Outputs::DIGOUT 1 (B5)</b>					
195	THRESHOLD (>)	0.00%			
43	MODULUS	TRUE			
97	SOURCE TAG	77			
359	INVERTED	FALSE			
<b>System::Configure I/O::Digital Outputs::DIGOUT 2 (B6)</b>					
196	THRESHOLD (>)	0.00%			
44	MODULUS	TRUE			
98	SOURCE TAG	122			
360	INVERTED	FALSE			
<b>System::Configure I/O::Digital Outputs::DIGOUT 3 (B7)</b>					
197	THRESHOLD (>)	0.00%			
45	MODULUS	TRUE			
99	SOURCE TAG	125			
361	INVERTED	FALSE			
<b>System::Configure I/O::Configure 5703</b>					
134	SOURCE TAG	89			
135	DESTINATION TAG	41			

TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
260	RAISE/LOWER DEST	0			
293	RAMP O/P DEST	291			
294	SPT SUM1 DEST	289			
400	PID O/P DEST	0			
431	DIAMETER	0			
442	TAPER	0			
450	SETPOINT SUM 2	0			
435	POS. I CLAMP	0			
436	NEG. I CLAMP	0			
<b>System::Configure I/O::Internal Links</b>					
<b>System::Configure I/O::Internal Links::LINK 1</b>					
364	SOURCE TAG	0			
365	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 2</b>					
366	SOURCE TAG	0			
367	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 3</b>					
368	SOURCE TAG	0			
369	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 4</b>					
370	SOURCE TAG	0			
371	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 5</b>					
454	SOURCE TAG	0			
455	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 6</b>					
456	SOURCE TAG	0			
457	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 7</b>					
458	SOURCE TAG	0			
459	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 8</b>					
460	SOURCE TAG	0			
461	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 9</b>					
467	SOURCE TAG	0			
468	DESTINATION TAG	0			
<b>System::Configure I/O::Internal Links::LINK 10</b>					
469	SOURCE TAG	0			
470	DESTINATION TAG	0			
<b>SYSTEM::miniLINK</b>					
339	VALUE 1	0.00%			
340	VALUE 2	0.00%			
341	VALUE 3	0.00%			



TAG	PARAMETER NAME	DEFAULT	SETTING 1	SETTING 2	SETTING 3
<b>SYSTEM::miniLINK (continued)</b>					
342	VALUE 4	0.00%			
343	VALUE 5	0.00%			
344	VALUE 6	0.00%			
345	VALUE 7	0.00%			
379	VALUE 8	0.00%			
380	VALUE 9	0.00%			
381	VALUE 10	0.00%			
382	VALUE 11	0.00%			
383	VALUE 12	0.00%			
384	VALUE 13	0.00%			
385	VALUE 14	0.00%			
346	LOGIC 1	OFF			
347	LOGIC 2	OFF			
348	LOGIC 3	OFF			
349	LOGIC 4	OFF			
350	LOGIC 5	OFF			
351	LOGIC 6	OFF			
352	LOGIC 7	OFF			
353	LOGIC 8	OFF			

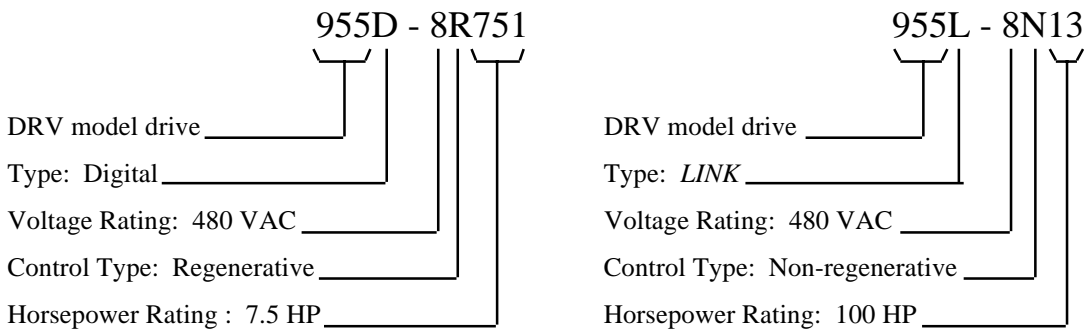


## Appendix F SPARE PARTS LISTS

There are three types of 590 DRVs available: a *LINK* version, a digital model and an analog version. Each type of DRV uses a different control board mounted on the same power module chassis and have the same power frame ranges. This appendix contains the spare parts lists for *all* versions of 590 DRVs.

### DECODING THE CATALOG NUMBER

The number 955 indicates that the unit is a DRV model motor controller. The next letter determines the type of controller door. The letter A is for analog, D is for 590 digital, L is for 590 *LINK* and LX indicates a 570 *LINK* controller door. The next number indicates the voltage rating (8 for 480 VAC) and the following letter determines whether the unit's control type is regenerative (R) or non-regenerative (N). The last field indicates the unit's horsepower rating. The *last digit* determines the number of places required to move the decimal to the right of the first of the *remaining* digits in that field to give the DRV's horsepower rating. For example:



NOTE. All horsepower ratings are based on 500 VDC armature motors.

The sample label in Figure F.1 shows a 955 L... indicating a *LINK* controller door. The revision of the door is the number to the right of the decimal point (3.12 in the example). 955L - 8R22 indicates that it is a regenerative, 20 HP, 480 VAC, 590 *LINK* DRV.

### ORDERING SPARE PARTS

When ordering spare parts or requesting technical assistance from Eurotherm Drives, please provide the unit's **catalog** number and **revision** number. Both numbers are printed on the 590 DRV serial number label. Figure G.1 shows the locations of both numbers on the label. This label is located both on the left side and on the inside drive mounting

**EUROTHERM DRIVES**  
590 DRV DC Drive

Catalog No. 955 <b>D</b> -8R22		Revision SS.DD	
Maximum Input	Main Supply	480/230 ±10% VAC, 3-phase, 50/60 Hz	29 Amps
	Auxiliary Field	500 VAC, 1-phase 50/60 Hz	1.0 Amps
Maximum Output	Armature	500/240 VDC	34 Amps
	Field	300/150 VDC	1.0 Amps
	Auxiliary	120/115 VAC, 1-phase	0.75 Amps
	Motor Size	at 500 VDC at 240 VDC	20 Hp 1.0 Hp
Overload		200% Full Load Current for 10 Secs	
Serial No.	9322USF0001		

See manual for operation at other input and output voltages.

Options (Ordered separately):  
 654D-RS422  
 655-ENRX  
 655-MTRX  
 955-BMS  
 Other \_\_\_\_\_ Amps  
 5V  12V  15V  24V

Eurotherm Drives, Inc. Reston, Virginia, USA GA338707 (3)

bracket of 7.5 through 100 HP models of all types of 590 DRVs. See Chapter 2 for label location illustrations. The **revision** number is printed in the upper right corner of the label.

## READING THE SPARE PARTS LISTS

The spare parts lists are organized by controller door type and power module. They list the parts and Eurotherm Drives part numbers unique to each version control door. Another table lists feedback option card part numbers which must be ordered with each drive depending on the type of motor speed feedback used.

The power module spares lists identify each model DRV by catalog number less the letter for the controller door. Each table lists all parts, their corresponding Eurotherm Drives part numbers and the quantity of each part used for that model DRV. The **DRV Revision** column lists the model revision in which the parts were used.

EXAMPLE. The example below shows the first three parts used in the power module of model 955\*-8R22 (a 480 VAC, 20 HP regenerative model). The contactor DB351539 was used in revisions 1 and 2 and 5 through 8. It was replaced by contactor DB051417 for revisions 3 and 4. The power supply board AH385851U004 used on revisions 4 through 8 replaced AH385851U002, which was used on revisions 1 through 3. The separate controller field suppression board AH055037U004 was used on revisions 1 through 3 and not used on later revisions.

Description	Part Number	DRV Revision	Qty.
<b>955*-8R22 20 hp Regenerative Drive 480 VAC (35 A)</b>			
Contactor, AM-DC 3P 2NO 1NC 500 VDC 56 A	DB351539	1-2, 5-8	1
	DB051417	3-4	1
Controller Power Supply Board	AH385851U002	4-8	1
	AH385128U004	1-3	1
Controller Field Suppression Board	AH055037U004	1-3	1

**CONTROLLER DOOR PARTS LISTS**

Description	Part Number	DRV Revision	Qty.
<b>955D.... 590 Digital DC Drives</b>			
Controller Calibration Card	AH058529U001	8	1
Controller Calibration Card, Switchable	AH385457U001	8	1
Controller Door, 590 Digital	590D/00/000	8	1
NOTE: All drives 400 horsepower and larger use the AH058529U001 resistor calibration card.			

Description	Part Number	DRV Revision	Qty.
<b>955L.... LINK 590 DC Drives</b>			
Controller Resistor Calibration Card	AH058529U001	10 - 12	1
Controller Switchable Calibration Card	AH385457U001	10 - 12	1
Controller Door 590 LINK, with Resistor Calibration Card	590LD/00/001	10 - 12	1
Controller Door 590 LINK, with Switchable Calibration Card	590LDC/00/001	10 - 12	1
Controller Switchable Tachometer Calibration Card	AH385870U001	10 - 12	1
NOTE: All drives 400 horsepower and larger use the AH058529U001 resistor calibration card.			

Description	Part Number	DRV Revision	Qty.
<b>955LX.... LINK 570 DC Drive</b>			
Controller Calibration Card	AH055028U001	19	1
Controller Door 570L	LA058388U001	19	1

Description	Part Number	DRV Revision	Qty.
<b>955A.... ANALOG DC Drives</b>			
Controller Door 590 Analog	590AD/00/000	2	1

**SPEED FEEDBACK RECEIVER OPTIONS LIST**

Speed Feedback Card Option	Part Number
Switchable Analog Tachometer Generator Calibration Card	AH385870U001
+5 VDC Wire-ended Encoder Receiver Card	AH387775U005
+12 VDC Wire-ended Encoder Receiver Card	AH387775U012
+15 VDC Wire-ended Encoder Receiver Card	AH387775U015
+24 VDC Wire-ended Encoder Receiver Card	AH387775U024
5701 Microtach Receiver Card (Plastic Fiber Optic)	AH058654U001
5901 Microtach Receiver Card (Glass Fiber Optic)	AH386025U001

**POWER MODULE PARTS LISTS**

Description	Part Number	DRV Revision	Qty.
<b>955*-8N751 7.5 hp Non-Regenerative Drive 480 VAC (13 A)</b>			
Contactora, AM - DC 3P 2NO1NC 500 VDC 15A	DB351537	1-6	1
Controller Power Supply Board	AH385851U003	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U003	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 40 A	CS350260	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 1A	CH352006U010	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 1-1/2A	CH352015U015	1-6	1
SCR, 1600 V, 26 A	CF385522U016	1-6	3
Transformer Control, TX - 150 VA 208-230-380-415-460/120 VAC	CO352610	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R751 7.5 hp Regenerative Drive 480 VAC (13 A)</b>			
Contactora, AM - DC 3P 2NO1NC 500 VDC 15A	DB351537	1-6	1
Controller Power Supply Board	AH385851U002	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U002	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 40 A	CS351628	1-6	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 40 A	CS350260	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 1A	CH352006U010	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 1-1/2A	CH352015U015	1-6	1
SCR, 1600 V, 26 A	CF385522U016	1-6	6
Transformer Control, TX - 150 VA 208-230-380-415-460/120 VAC	CO352610	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N22 20 hp Non-Regenerative Drive 480 VAC (35 A)</b>			
Contactora, AM - DC 3P 2 NO 1 NC 500 VDC 56 A	DB351539	1-2, 5-8	1
	DB051417	3-4	1
Controller Power Supply Board	AH385851U003	4-8	1
	AH385128U004	1-3	1
Controller Field Suppression Board	AH055037U004	1-3	1
Controller Trigger Board	AH055036U003	1-3	1
Controller Transformer, T1	CO056935	1-8	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-8	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	4-8	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-3	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	4-8	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-3	1
FS2 - 250 VAC 3 A	CH020033	1-3	1
FS3 - 400 mA	CH540042	1-3	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 40 A	CS350260	1-8	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 1A	CH352006U010	1-8	2
Fuse DRV Transformer Load, F6 - 250 VAC 1-1/2A	CH352015U015	1-8	1
SCR, 1600 V, 26 A	CF385522U016	1-8	3
Transformer Control, TX - 150 VA 208-230-380-415-460/120 VAC	CO352610	1-8	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R22 20 hp Regenerative Drive 480 VAC (35 A)</b>			
Contactora, AM - DC 3P 2 NO 1 NC 500 VDC 56 A	DB351539	1-2, 5-8	1
	DB051417	3-4	1
Controller Power Supply Board	AH385851U002	4-8	1
	AH385128U004	1-3	1
Controller Field Suppression Board	AH055037U004	1-3	1
Controller Trigger Board	AH055036U002	1-3	1
Controller Transformer, T1	CO056935	1-8	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-8	1
Fuse Controller Power Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	4-8	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-3	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	4-8	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-3	1
FS2 - 250 VAC 3 A	CH020033	1-3	1
FS3 - 400 mA	CH540042	1-3	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 40 A	CS351628	1-8	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 40 A	CS350260	1-8	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 1A	CH352006U010	1-8	2
Fuse DRV Transformer Load, F6 - 250 VAC 1-1/2A	CH352015U015	1-8	1
SCR, 1600 V, 26 A	CF385522U016	1-8	6
Transformer Control, TX - 150 VA 208-230-380-415-460/120 VAC	CO352610	1-8	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N32 30 hp Non-Regenerative Drive 480 VAC (50 A)</b>			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 56 A	DB351539	1-2, 5-8	1
	DB051417	3-4	1
Controller Power Supply Board	AH385851U003	4-8	1
	AH385128U004	1-3	1
Controller Field Suppression Board	AH055037U004	1-3	1
Controller Trigger Board	AH055036U003	1-3	1
Controller Transformer, T1	CO056935	1-8	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-8	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	4-8	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-3	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	4-8	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-3	1
FS2 - 250 VAC 3 A	CH020033	1-3	1
FS3 - 400 mA	CH540042	1-3	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 60 A	CS351627	1-8	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 1A	CH352006U010	1-8	2
Fuse DRV Transformer Load, F6 - 250 VAC 1-1/2A	CH352015U015	1-8	1
SCR, 1600 V, 56 A	CF385524U016	1-8	3
Transformer Control, TX - 150 VA 208-230-380-415-460/120 VAC	CO352610	1-8	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R32 30 hp Regenerative Drive 480 VAC (50 A)</b>			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 56 A	DB351539	1-2, 5-8	1
	DB051417	3-4	1
Controller Power Supply Board	AH385851U002	4-8	1
	AH385128U004	1-3	1
Controller Field Suppression Board	AH055037U004	1-3	1
Controller Trigger Board	AH055036U002	1-3	1
Controller Transformer, T1	CO056935	1-8	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-8	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	4-8	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-3	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	4-8	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-3	1
FS2 - 250 VAC 3 A	CH020033	1-3	1
FS3 - 400 mA	CH540042	1-3	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 80 A	CS350428	1-8	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 60 A	CS351627	1-8	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 1A	CH352006U010	1-8	2
Fuse DRV Transformer Load, F6 - 250 VAC 1-1/2A	CH352015U015	1-8	1
SCR, 1600 V, 56 A	CF385524U016	1-8	6
Transformer Control, TX - 150 VA 208-230-380-415-460/120 VAC	CO352610	1-8	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N42 40 hp Non-Regenerative Drive 480 VAC (66 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 7.5 A	DB351540	1-6	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-6	1
Controller Power Supply Board	AH385851U003	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U003	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 80 A	CS350261	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-6	1
SCR, 1600 V, 56 A	CF385524U016	1-6	3
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R42 40 hp Regenerative Drive 480 VAC (66 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 7.5 A	DB351540	1-6	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-6	1
Controller Power Supply Board	AH385851U002	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U002	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004			
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 100 A	CS350400	1-6	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 80 A	CS350261	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-6	1
SCR, 1600 V, 56 A	CF385524U016	1-6	6
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N62 60 hp Non-Regenerative Drive 480 VAC (98 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 110 A	DB351541	1-6	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-6	1
Controller Power Supply Board	AH385851U003	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U003	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Fan	DL047934	1-6	1
Field Regulator, 1400 V, 28 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 125 A	CS350262	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-6	1
SCR, 1600 V, 91 A	CF385524U016	1-6	3
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R62 60 hp Regenerative Drive 480 VAC (98 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 110 A	DB351541	1-6	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-6	1
Controller Power Supply Board	AH385851U002	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U002	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Fan	DL047934	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 125 A	CS350401	1-6	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 125 A	CS350262	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-6	1
SCR, 1600 V, 91 A	CF385524U016	1-6	6
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-6	1



Description	Part Number	DRV Revision	Qty.
<b>955*-8N752 75 hp Non-Regenerative Drive 480 VAC (122 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 130A	DB351542	1-6	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-6	1
Controller Power Supply Board	AH385851U003	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U003	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Fan	DL047934	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 150 A	CS350263	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-6	1
SCR, 1600 V, 91 A	CF385525U016	1-6	3
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R752 75 hp Regenerative Drive 480 VAC (122 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 130A	DB351542	1-6	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-6	1
Controller Power Supply Board	AH385851U002	3-6	1
	AH385128U004	1-2	1
Controller Field Suppression Board	AH055037U004	1-2	1
Controller Trigger Board	AH055036U002	1-2	1
Controller Transformer, T1	CO056935	1-6	1
Fan	DL047934	1-6	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-6	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	3-6	3
F1, F2, F3 - 600 VAC 10 A	CH430014	1-2	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	3-6	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH020033	1-2	1
FS3 - 400 mA	CH540042	1-2	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 150 A	CS351629	1-6	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 150 A	CS350263	1-6	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-6	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-6	1
SCR, 1600 V, 91 A	CF385525U016	1-6	6
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-6	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N13 100 hp Non-Regenerative Drive 480 VAC (162 A)</b>			
Contactora, AM - DC 3P 2 NO 1 NC 500 VDC 202A	DB352019	1-5	1
Contactora, AM - DC Aux Contact 1 NO 1 NC	DB351585	1-5	1
Controller Power Supply Board	AH385851U003	1-5	1
Controller Transformer, T1	CO056935	1-5	1
Fan	DL049140	1-5	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-5	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	1-5	3
Fuse Controller Power Supply, AH385851U003, FS1 - 250 VAC 3 A	CH540033	1-5	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 17.5 A	CS350264	1-5	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-5	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-5	1
SCR, 1600 V, 91 A	CF385525U016	1-5	3
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-5	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R13 100 hp Regenerative Drive 480 VAC (162 A)</b>			
Contactora, AM - DC 3P 2 NO 1 NC 500 VDC 202A	DB352019	1-5	1
Contactora, AM - DC Aux Contact 1 NO 1 NC	DB351585	1-5	1
Controller Power Supply Board	AH385851U002	1-5	1
Controller Transformer, T1	CO056935	1-5	1
Fan	DL049140	1-5	1
Field Regulator, 1400 V, 15 A	CF057273U014	1-5	1
Fuse Controller Coding Supply, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	1-5	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3 A	CH540033	1-5	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 225 A	CS352023	1-5	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 17.5 A	CS350264	1-5	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A	CH352006U020	1-5	2
Fuse DRV Transformer Load, F6 - 250 VAC 2-1/2 A	CH352015U025	1-5	1
SCR, 1600 V, 91 A	CF385525U016	1-5	6
Transformer Control, TX - 250 VA 208-230-380-415-460/120 VAC	CO352611	1-5	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N1253 125 hp Non-Regenerative Drive 480 VAC (205 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 600 VDC 202A	DB352019	1- 4	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1- 4	1
Contactora, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1- 4	1
Controller Power Supply Board, 10 A	AH385851U003	2- 4	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1- 4	1
Fan 110 V	DL043707	1- 4	1
Field Regulator, 1400 V, 15 A	CF057273U014	1- 4	1
Fuse Controller Coding Supply, AH385851U003, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2- 4	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U004, FS1 - 250 VAC 3A	CH540033	2- 4	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1A	CH460013	1	1
FS2 - 250 VAC 3 A	CH460033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 300 A	CS350265	1- 4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1- 4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1- 4	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1- 4	1
SCR, 1400 V, 160 A	CF057366U014	1- 4	3
Suppressor RC Link, 110-280 VAC	CZ353295	1- 4	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1- 4	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R1253 125 hp Regenerative Drive 480 VAC (205 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 600 VDC 202A	DB352019	1- 4	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1- 4	1
Contactora, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1- 4	1
Controller Power Supply Board, 10 A	AH385851U002	2- 4	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1- 4	1
Fan 110 V	DL043707	1- 4	1
Field Regulator, 1400 V, 15 A	CF057273U014	1- 4	1
Fuse Controller Coding Supply, AH385851U002, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2- 4	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3A	CH540033	2- 4	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1A	CH460013	1	1
FS2 - 250 VAC 3 A	CH460033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 300 A	CS350402	1- 4	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 300 A	CS350265	1- 4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1- 4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1- 4	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1- 4	1
SCR, 1400 V, 160 A	CF057366U014	1- 4	6
Suppressor RC Link, 110-280 VAC	CZ353295	1- 4	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1- 4	1



Description	Part Number	DRV Revision	Qty.
<b>955*-8N153 150 hp Non-Regenerative Drive 480 VAC (255 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 600 VDC 258A	DB352020	1- 4	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1- 4	1
Contactora, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1- 4	1
Controller Power Supply Board, 10 A	AH385851U003	2- 4	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1- 4	1
Fan 110 V	DL043707	1- 4	1
Field Regulator, 1400 V, 15 A	CF057273U014	1- 4	1
Fuse Controller Coding Supply, AH385851U003, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2- 4	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U004, FS1 - 250 VAC 3A	CH540033	2- 4	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1A	CH460013	1	1
FS2 - 250 VAC 3 A	CH460033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 300 A	CS350265	1- 4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1- 4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1- 4	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1- 4	1
SCR, 1400 V, 160 A	CF057366U014	1- 4	3
Suppressor RC Link, 110-280 VAC	CZ353295	1- 4	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1- 4	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R153 150 hp Regenerative Drive 480 VAC (255 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 600 VDC 258A	DB352020	1- 4	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1- 4	1
Contactora, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1- 4	1
Controller Power Supply Board, 10 A	AH385851U002	2- 4	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1- 4	1
Fan 110 V	DL043707	1- 4	1
Field Regulator, 1400 V, 15 A	CF057273U014	1- 4	1
Fuse Controller Coding Supply, AH385851U002, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2- 4	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3A	CH540033	2- 4	1
Fuse Controller Power Supply, AH385128U004, FS1 - 250 VAC 1A	CH460013	1	1
FS2 - 250 VAC 3 A	CH460033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 350 A	CS352024	1- 4	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 300 A	CS350265	1- 4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1- 4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1- 4	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1- 4	1
SCR, 1400 V, 160 A	CF057366U014	1- 4	6
Suppressor RC Link, 110-280 VAC	CZ353295	1- 4	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1- 4	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N23 200 hp Non-Regenerative Drive 480 VAC (330 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 500 VDC 332A	DB352021	1-7	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-7	1
Contactora, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1-7	1
Controller Power Supply Board, 20A	AH385621U001	6-7	1
	AH385128U104	1-5	1
Controller Suppressor Board	AH386001U001	6-7	1
	AH056760U001	1-5	1
Controller Trigger Board	AH055036U003	1-7	1
Controller Transformer, T1	CO056935	1-7	1
Fan 110 V	DL049140	1-7	1
Field Regulator, 1400 V, 28 A	CF057274U014	1-7	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1-7	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	6-7	1
FS1 - 250 VAC 1 A	CH460013	1-5	1
FS2 - 250 VAC 3 A	CH460033	1-5	1
FS3 - 250 VAC 400 mA	CH540042	1-5	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 400 A	CS350267	1-7	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1-7	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1-7	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1-7	1
SCR, 1400 V, 250 A	CF056719U014	1-7	3
Suppressor RC Link, 110-280 VAC	CZ353295	1-7	1
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1-7	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R23 200 hp Regenerative Drive 480 VAC (330 A)</b>			
Contactora, AM - DC 3P 2 NO 1NC 600 VDC 332A	DB352021	1-7	1
Contactora, AM - DC Aux Contact 1NO 1NC	DB351585	1-7	1
Contactora, AMR - AC 3P 3 NO 1NC 600 VAC 20A	DB353128	1-7	1
Controller Power Supply Board, 20A	AH385621U001	6-7	1
	AH385128U104	1-5	1
Controller Suppressor Board	AH386001U001	6-7	1
	AH056760U001	1-5	1
Controller Trigger Board	AH055036U002	1-7	1
Controller Transformer, T1	CO056935	1-7	1
Fan 110 V	DL049140	1-7	1
Field Regulator, 1400 V, 28 A	CF057274U014	1-7	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1-7	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	6-7	1
FS1 - 250 VAC 1 A	CH460013	1-5	1
FS2 - 250 VAC 3 A	CH460033	1-5	1
FS3 - 250 VAC 400 mA	CH540042	1-5	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 450 A	CS352025	1-7	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 400 A	CS350267	1-7	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1-7	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1-7	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1-7	1
SCR, 1400 V, 250 A	CF056719U014	1-7	6
Suppressor RC Link, 110-280 VAC	CZ353295	1-7	1
Transformer Control, TX - 500VA 460, 230/120 VAC	CO352012	1-7	1



Description	Part Number	DRV Revision	Qty.
<b>955*-8N253 250 hp Non-Regenerative Drive 480 VAC (425 A)</b>			
Contact, AM - DC 3P 2 NO 1NC 600 VDC 520A	DB352022	4	1
Contact, AM - DC Aux Contact 1NO 1NC	DB351585	4	1
Contact, AM - DC 3P 2 NO 1NC 600 VDC 630A	DB352471	1-3	1
Contact, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1-4	1
Controller Power Supply Board, 20A	AH385621U001	3-4	1
	AH385128U104	1-2	1
Controller Suppressor Board	AH386001U001	3-4	1
	AH056760U001	1-2	1
Controller Trigger Board	AH055036U003	1-4	1
Controller Transformer, T1	CO056935	1-4	1
Fan Assembly, B1 - 110 V	DLO44536	1-4	1
Field Regulator, 1400 V, 28 A	CF057274U014	1-4	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1-4	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	3-4	1
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH460033	1-2	1
FS3 - 250 VAC 400 mA	CH540042	1-2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 500 A	CS352004	1-4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (480V Operation)	CH352006U040	1-4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 6.25 A (230V Operation)	CH352006U062	1-4	2
Fuse DRV Transformer Load, F6 - 250 VAC 7 A	CH352124U070	1-4	1
SCR, 1400 V, 250 A	CF056719U014	1-4	6
Suppressor RC Link, 110-280 VAC	CZ353295	1-4	1
Transformer Control, TX - 750VA 460, 230/120 VAC	CO352013	1-4	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R253 250 hp Regenerative Drive 480 VAC (425 A)</b>			
Contact, AM - DC 3P 2 NO 1NC 600 VDC 520A	DB352022	4	1
Contact, AM - DC Aux Contact 1NO 1NC	DB351585	4	1
Contact, AM - DC 3P 2 NO 1NC 600 VDC 630A	DB352471	1-3	1
Contact, AMR - AC 3P 3 NO 1NC 600 VAC 10A	DB353128	1-4	1
Controller Power Supply Board, 20A	AH385621U001	3-4	1
	AH385128U104	1-2	1
Controller Suppressor Board	AH386001U001	3-4	1
	AH056760U001	1-2	1
Controller Trigger Board	AH055036U002	1-4	1
Controller Transformer, T1	CO056935	1-4	1
Fan Assembly, B1 - 110 V	DLO44536	1-4	1
Field Regulator, 1400 V, 28 A	CF057274U014	1-4	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1-4	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	3-4	1
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH460033	1-2	1
FS3 - 250 VAC 400 mA	CH540042	1-2	1
Fuse DRV Armature, F7 - Semiconductor 650 VAC 600 A	CS352026	1-4	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 500 A	CS352004	1-4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (480V Operation)	CH352006U040	1-4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 6.25 A (230V Operation)	CH352006U062	1-4	2
Fuse DRV Transformer Load, F6 - 250 VAC 7 A	CH352124U070	1-4	1
SCR, 1400 V, 250 A	CF056719U014	1-4	6
Suppressor RC Link, 110-280 VAC	CZ353295	1-4	1
Transformer Control, TX - 750VA 460, 230/120 VAC	CO352013	1-4	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N33 300 hp Non-Regenerative Drive 480 VAC (506 A)</b>			
Contactora, AM - DC IP 1NO650 VDC 1200A	DB352128	1-3	1
Controller Power Supply Board, 20A	AH385621U001	3	1
	AH385128U104	1-2	1
Controller Suppressor Board	AH386001U001	3	1
	AH056760U001	1-2	1
Controller Trigger Board	AH055036U003	1-3	1
Controller Transformer, T1	CO056935	1-3	1
Fan Assembly, B1 - 110 V	DL044536	1-3	1
Fan Muffin, 110 V	DL049612	1-3	2
Field Regulator, 1400 V, 28 A	CF057274U014	1-3	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1-3	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	3	1
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH460033	1-2	1
FS3 - 250 VAC 400 mA	CH540042	1-2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 600 A	CS352005	1-3	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1-3	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1-3	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH350737	1-3	1
SCR, 1400 V, 630 A	CF049824U014	1-3	3
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1-3	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R33 300 hp Regenerative Drive 480 VAC (506 A)</b>			
Contactora, AM - DC IP 1NO 650 VDC 1200A	DB352128	1-3	1
Controller Power Supply Board, 20A	AH385621U001	3	1
	AH385128U104	1-2	1
Controller Suppressor Board	AH386001U001	3	1
	AH056760U001	1-2	1
Controller Trigger Board	AH055036U002	1-3	1
Controller Transformer, T1	CO056935	1-3	1
Fan Assembly, B1 - 110 V	DL044536	1-3	1
Fan Muffin, 110 V	DL049612	1-3	2
Field Regulator, 1400 V, 28 A	CF057274U014	1-3	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1-3	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	3	1
FS1 - 250 VAC 1 A	CH460013	1-2	1
FS2 - 250 VAC 3 A	CH460033	1-2	1
FS3 - 250 VAC 400 mA	CH540042	1-2	1
Fuse DRV Armature, F7 - Semiconductor 650 VAC 700 A	CS352027	1-3	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 600 A	CS352005	1-3	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1-3	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1-3	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1-3	1
SCR, 1400 V, 630 A	CF049824U014	1-3	6
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1-3	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8N43 400 hp Non-Regenerative Drive 480 VAC (675 A)</b>			
Contactora, AM - DC IP 1NO 600 VDC I200A	DB352128	1 - 2	1
Controller Power Supply Board, 20A	AH385621U001	2	1
	AH385128U104	1	1
Controller Suppressor Board	AH386001U001	2	1
	AH056760U001	1	1
Controller Trigger Board	AH055036U003	1 - 2	1
Controller Transformer, T1	CO056935	1 - 2	1
Fan Assembly, B1 - 110 V	DL044536	1 - 2	1
Fan Muffin, 110 V	DL049612	1 - 2	2
Field Regulator, 1400 V, 28 A	CF057274U014	1 - 2	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1 - 2	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	2	1
FS1 - 250 VAC 1 A	CH460013	1	1
FS2 - 250 VAC 3 A	CH460033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 800 A	CS350737	1 - 2	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1 - 2	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1 - 2	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1 - 2	1
SCR, 1400 V, 760 A	CF054425	1 - 2	3
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1 - 2	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R43 400 hp Regenerative Drive 480 VAC (675 A)</b>			
Contactora, AM - DC IP 1NO 600 VDC I200A	DB352128	1 - 2	1
Controller Power Supply Board, 20A	AH385621U001	2	1
	AH385128U104	1	1
Controller Suppressor Board	AH386001U001	2	1
	AH056760U001	1	1
Controller Trigger Board	AH055036U002	1 - 2	1
Controller Transformer, T1	CO056935	1 - 2	1
Fan Assembly, B1 - 110 V	DL044536	1 - 2	1
Fan Muffin, 110 V	DL049612	1 - 2	2
Field Regulator, 1400 V, 28 A	CF057274U014	1 - 2	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1 - 2	3
Fuse Controller Power Supply, FS1 - 250 VAC 3 A	CH540033	2	1
FS1 - 250 VAC 1 A	CH460013	1	1
FS2 - 250 VAC 3 A	CH460033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 800 A	CS352028	1 - 2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 800 A	CS350737	1 - 2	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1 - 2	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1 - 2	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1 - 2	1
SCR, 1400 V, 760 A	CF054425	1 - 2	6
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1 - 2	1



Description	Part Number	DRV Revision	Qty.
<b>955*-8N53 500 hp Non-Regenerative Drive 480 VAC (830 A)</b>			
Contactora, AM - DC IP 1NO 1000 VDC A	DB352128	1	1
Controller Gate Lead	LA056240	1	6
Controller Power Supply Board	AH385128U009	1	1
Controller Suppressor Board	AH057916U001	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly	LA058868	1	1
Field SCR Module, 1600 V	CF048884	1	2
Field Diode Module, 1600 V	CW050363	1	1
Fuse Controller Armature Sense, F7, F8 - 600 VAC, 32A	6.621CPURGB1432	1	2
Fuse Controller Coding Supply, F4, F5, F6 - 600 VAC, 32A	6.621CPURGB1432	1	3
Fuse Controller Power Supply, FS1 - 250 VAC 1A	CH020013	1	1
FS2 - 250 VAC 3 A	CH540033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Supply, F9 - 14 - Semiconductor 700 VAC 700 A	6.6URB32TDF0700	1	6
Fuse DRV Transformer Supply, F1, F2 - 600 VAC 3 A (480V Operation)	CH352006U030	1	2
Fuse DRV Transformer Supply, F1, F2 - 600 VAC 5 A (230V Operation)	CH352006U050	1	2
Fuse DRV Transformer Load, F3 - 250 VAC 5 A	CH351788	1	1
SCR, 1600 V, 600 A	CF049826	1	6
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1	1

Description	Part Number	DRV Revision	Qty.
<b>955*-8R53 500 hp Regenerative Drive 480 VAC (830 A)</b>			
Contactora, AM - DC IP 1NO 1000 VDC A	DB352128	1	1
Controller Gate Lead	LA056240	1	12
Controller Power Supply Board	AH385128U009	1	1
Controller Suppressor Board	AH057916U001	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly	LA058868	1	1
Field SCR Module, 1600 V	CF048884	1	2
Field Diode Module, 1600 V	CW050363	1	1
Fuse Controller Armature Sense, F7, F8 - 600 VAC, 32A	6.621CPURGB1432	1	2
Fuse Controller Coding Supply, F4, F5, F6 - 600 VAC, 32A	6.621CPURGB1432	1	3
Fuse Controller Power Supply, FS1 - 250 VAC 1A	CH020013	1	1
FS2 - 250 VAC 3 A	CH540033	1	1
FS3 - 250 VAC 400 mA	CH540042	1	1
Fuse DRV Supply, F9 - 14 - Semiconductor 700 VAC 700 A	6.6URB32TDF0700	1	12
Fuse DRV Transformer Supply, F1, F2 - 600 VAC 3 A (480V Operation)	CH352006U030	1	2
Fuse DRV Transformer Supply, F1, F2 - 600 VAC 5 A (230V Operation)	CH352006U050	1	2
Fuse DRV Transformer Load, F3 - 250 VAC 5 A	CH351788	1	1
SCR, 1600 V, 600 A	CF049826	1	12
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1	1



F

# Appendix G RS232 SYSTEM PORT (P3)

## SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP

The SYSTEM PORT(P3) is a non-isolated RS232 serial communications port integrated on the 590 DRV Digital drive control board. The port is used off-line (while the drive is stopped) for transferring and saving drive configuration files using a personal computer (PC) running a serial communications program, or on-line (while running) with the Eurotherm Drives model 5703 Peer-to-Peer Communications Converter. You can also use the P3 port to transfer configuration files with a PC running the Windows™ compatible software package ConfigEd Lite. (Refer to the ConfigEd Lite manual RG352747.)

The parameters, tags and signal ranges associated with SYSTEM PORT (P3) are listed below.

### Parameters

Tag	Parameter	Description	Range	Default
130	MODE	Determines the function of the 5703 unit if present.	DISABLED/ 5703 MASTER/ 5703 SLAVE	DISABLED
198	P3 BAUD RATE	Transmission rate	300 - 57600	9600
<b>5703 SUPPORT</b>				
132	SETPT. RATIO	Input scaling ratio	±3.0000	0.0000
133	SETPT. SIGN	Input sign	POSITIVE/NEGATIVE	POSITIVE
187	5703 INPUT	Value written to the drive	±300.00	0.00%
189	5703 OUTPUT	Value read by the 5703 out of the drive.	±300.00	0.00%

### BISYNCH SUPPORT

329	GROUP ID (GID)	Group identification number.	0 to 7	0
330	UNIT ID (UID)	Unit identification number.	0 to 15	0
332	ERROR REPORT	Communications error code.		0x00C0

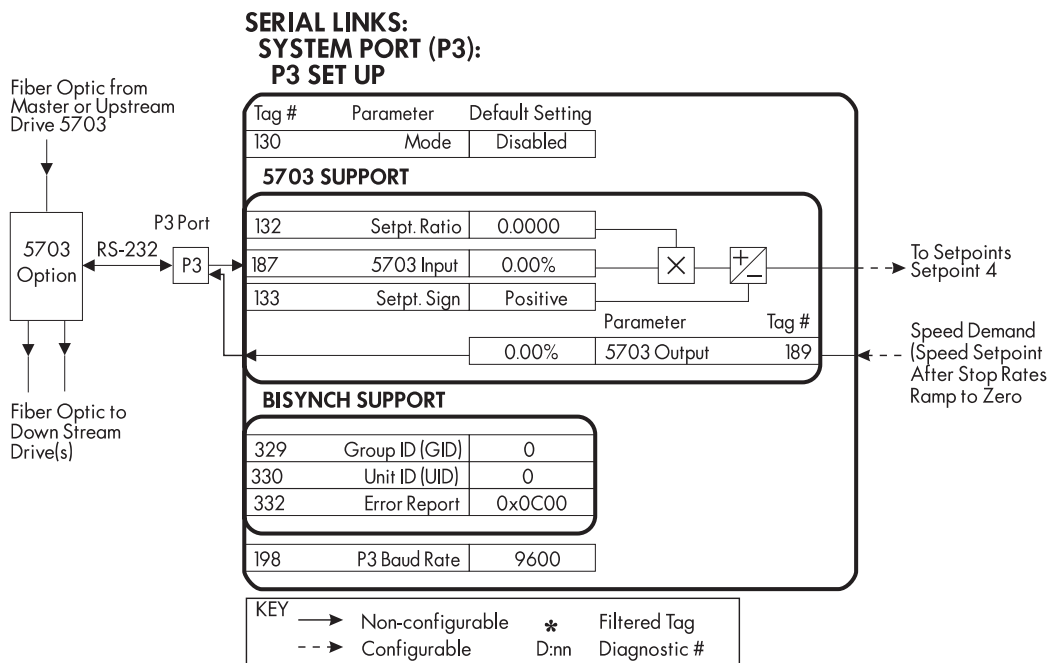
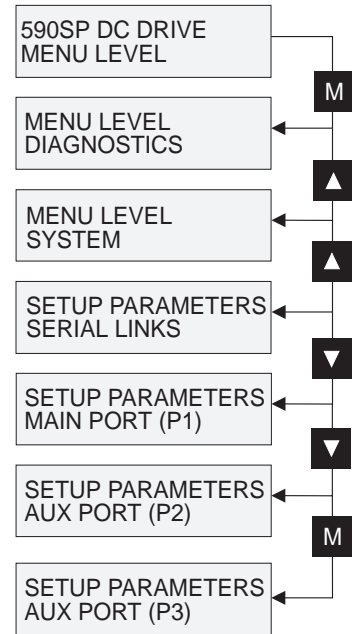


Figure G.1 - P3 Set Up Block Diagram



## UDP (UPLOAD-DOWNLOAD PROTOCOL) SUPPORT

Use the P3 port to transfer ASCII files containing the drive's configuration and parameter settings between the 590 Digital drive and a host computer.

The transfer uses a simple ASCII file structure and XON / XOFF protocol. Most communications packages use this protocol. Host computers successfully tested include IBM PCs XT/AT, running both Windows™ and MS-DOS® and Psion Organiser 3, among others.

Transferring data from the 590 Digital drive to a host computer is defined as **downloading**; transferring data in the other direction, or from a host computer to the 590 Digital drive, is known as **uploading**.

### UDP Menu Parameter Settings

The MMI menu path below shows the parameters settings required for UDP file transfer.

- SERIAL LINKS
  - SYSTEM PORT (P3)
    - P3 SETUP
      - MODE DISABLED      5703 Setup Mode.
      - 5703 SUPPORT      Sub-menu for 5703 parameters.
      - P3 BAUD RATE      Baud rate for the P3 Port.
    - DUMP MMI -> P3      Transfer the MMI text file from drive to the host computer.
    - UDP XFER <- P3      Transfer configuration parameter file from host computer to drive (upload).
    - UDP XFER -> P3      Transfer configuration parameter file from drive to host computer (download).

NOTE. When transferring, or uploading or downloading files, remember to disable the 5703 mode.

### Communication Port Setup

For UDP data and text file transfers, set the host computer communication port settings as follows:

9600 Baud	8 bits
1 Stop bit	XON/XOFF handshaking
NO parity	UDP transfer procedure

NOTE. Set the drive's P3 BAUD RATE to match the computer's communication port transmission rate.

#### Caution

The P3 Communications port has +24 VDC on two pins. Use the correct cable (Eurotherm Drives part number CM351909) to avoid damaging the host computer. This cable is described on page E-3.

### Download MMI (DUMP MMI -> P3)

Follow these steps to transfer an ASCII *text description only* of the MMI from the 590 Digital drive to a host computer. This information fully documents *all* the 590 Digital drive's parameter and configuration settings in a clear and easy to read ASCII text format. You can print out the file as permanent documentation or to troubleshoot performance problems.

NOTE. The MMI dump documents the drive's *current* settings, *not* the settings stored in EEPROM.

1. Connect the 590 Digital drive P3 port using the appropriate lead to the host computer.
2. Ensure that the drive's P3 MODE is set to DISABLE.
3. Save the 590 Digital drive's parameter settings using PARAMETER SAVE to ensure that the drive's EEPROM parameters matches the drive's current parameter settings.
4. Using a standard communications package, prepare the host computer to receive an ASCII file. Set the host computer's communications port parameters to the settings listed above. Be sure the baud rate setting at both ends of the serial communications setup match. Use the file extension .MMI to differentiate it from .UDP format files.
5. Enable the host computer to begin receiving data.

- Start the MMI text download from the 590 Digital drive by selecting “DUMP MMI—> P3”.

NOTE. Enabling the transmitting port in a serial communications setup initiates data transfer. Therefore, enable the receiving port—the host computer, in this case— *before* beginning communication at the transmitting port, or the drive's P3 port.

- The file ends with the CTRL-Z character. This character automatically closes the file in some serial communications software packages. If not, close the file manually once the 590 Digital drive MMI indicates that it has finished transferring data and when the host computer has stopped scrolling text.

The file can now be treated as any ASCII text file.

### UDP Download (UDP XFER -> P3)

A UDP download transfers the actual parameter and configuration settings from the 590 Digital drive to a host computer. This file fully records *all* the 590 Digital drive's settings stored in EEPROM in a binary format and can be used as a back up file if the current drive settings are lost or if the drive is replaced.

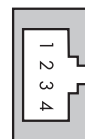
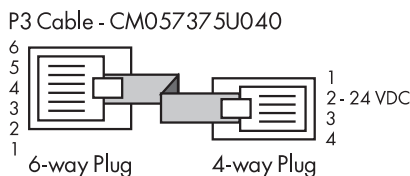
NOTE. A UDP download documents the drive's settings stored in EEPROM since the *last* PARAMETER SAVE was performed. Any parameter or configuration changes *not* saved to the EEPROM are not recorded within the UDP file.

- Connect the 590 Digital drive P3 port using the appropriate lead to the host computer.
- Ensure that the drive's P3 MODE is set to DISABLE.
- Save the 590 Digital drive's parameter settings using PARAMETER SAVE to ensure that the drive's EEPROM parameters matches the drive's current parameter settings.
- Using a standard communications package, prepare the host computer to receive an ASCII file. Set the host computer's communications port parameters to the settings listed above. Be sure the baud rate setting at both ends of the serial communications setup match. Use the file extension .UDP to differentiate it from .MMI text files.
- Enable the host computer to begin receiving data.
- Start the UDP download from the 590 Digital drive by selecting “UDP XFER—> P3”.

NOTE. Enabling the transmitting port in a serial communications setup initiates data transfer. Therefore, enable the receiving port—the host computer, in this case— *before* beginning communication at the transmitting port, or the drive's P3 port.

- The file ends with the CTRL-Z character. This character automatically closes the file in some serial communications software packages. If not, close the file manually once the 590 Digital drive MMI indicates that it has finished transferring data and when the host computer has stopped scrolling text. The last line of the file should read :00000001FF.

The file can now be treated as any ASCII data file.



P3 Port Connector  
(Looking into the connector on the drive)

6 - way Connector to DB9/DB25 Connector

6 - way Connector	4 - way Connector	P3 Pin	P3 Signal	Cable	DB - 9		DB - 25	
					Female	Male	Female	Male
5	1	1	0 VDC	Black	5	5	7	7
4	2	2	24 VDC	Red	N/C	N/C	N/C	N/C
3	3	3	TX	Green	2	3	2	3
2	4	4	RX	Yellow	3	2	3	2



## UDP Upload (UDP XFER <- P3)

A UDP Upload transfers a parameter file from the host computer to the 590 Digital drive. This information is written directly to EEPROM, so all the drive's current settings will be overwritten.

1. Connect the 590 Digital drive P3 port using the appropriate lead to the host computer.
2. Ensure that the drive's P3 MODE is set to DISABLE.
3. Using a standard communications package, prepare the host computer to send an ASCII file. Set the host computer's communications port parameters to the settings listed above. Be sure the baud rate setting at both ends of the serial communications setup match.
4. Start uploading to the 590 Digital drive by selecting "UDP XFER <- P3"
5. When the 590 Digital drive says "RECEIVING", begin the file transmission at the host computer.
6. The file ends in a :00000001FF which the 590 Digital drive uses to close the file.
7. As the MMI should indicate, reset the 590 Digital drive by pressing the 'E' key.

## Serial Link Port P3 Lead

### Caution

There is 24 volts on Pin 2 of the P3 Port. This may damage your PC or the 590 Digital drive if connected to the serial port.

## 5703 (PEER-TO-PEER COMMUNICATIONS OPTION) SUPPORT

The 5703 Peer-to-Peer Communications Option (catalog No. 655-RS232) passes a 16-bit signal between drives through a fiber-optic link and the P3 port on each 590 Digital drive. Otherwise, port P3 is used off-line for uploading and downloading of configuration data. The drive's P3 port operates at RS232 compatible signal levels and the 5703 converts the electrical RS232 signals to fiber optic for transmission over plastic fiber optic cable to a 5703 located at another drive, then back again for RS232 reception.

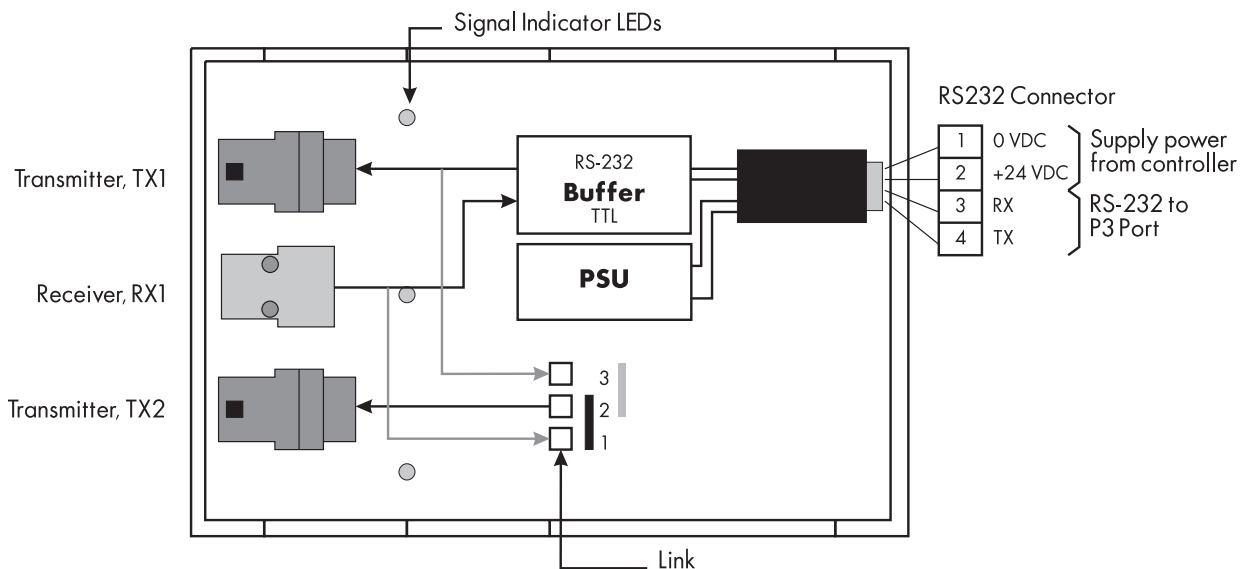


Figure G.2 - 5703 Layout

Normally, an analog signal setpoint is used to speed coordinate several drives. The 5703 allows one signal to be digitally transmitted from drive-to-drive over fiber optic cable. This introduces highly accurate speed setpoint tracking between drive sections without the signal drift and induced noise problems inherent with analog control. For accurate speed tracking, encoder speed feedback is required.

The 5703 also supports master/slave ratioed speed locking, although the unit is not intended to supplant Quadraloc—which integrates external speed/phase and position locked loops—in applications requiring absolute speed or position control.

## Hardware Description

The 5703 is housed in a DIN rail mountable box and is provided with a “ribbon” cable to connect into the controller’s RS232 port. Fiber optic cable interconnects the speed signal from unit to unit. A connection diagram is shown in Figure G.3.

**NOTE.** To limit transmission errors, the ribbon cable length must not exceed 4 meters.

The 5703 unit converts RS232 electric data signals into light; it does not alter or modify the signals in any other way. The drive software within the motor controller interprets the received electrical data as a speed reference signal.

The 5703 has one fiber optic receiver and two fiber optic transmitters. The fiber optic receiver RX1 receives data from the “preceding” unit. The primary transmitter TX1 always sends data to the “follower” unit from the “master” unit transmitting through the 5703’s RS232 port. The additional fiber optic transmitter TX2 retransmits the incoming signal at RX1, or provides a second output signal for the “master” RS232 reference, giving the unit wide functionality. A link determines the function of the TX2. When the link is connected to positions 1 and 2, TX2 repeats the signal received at RX1. When connected to positions 2 and 3, it sends the same output signal as TX1, or the data transmitted through the RS232 port. Figure G.2 shows the 5703 board layout and the two link positions.

The settings under the MMI sub-menu 5703 SUPPORT determine how the drive interprets the data transmitted and received between the 590 Digital drive P3 port the 5703 RS232 port. Refer to the Installation Instructions (HG351943) included with the Peer-to-Peer Communications Option for further configuration settings and application information.

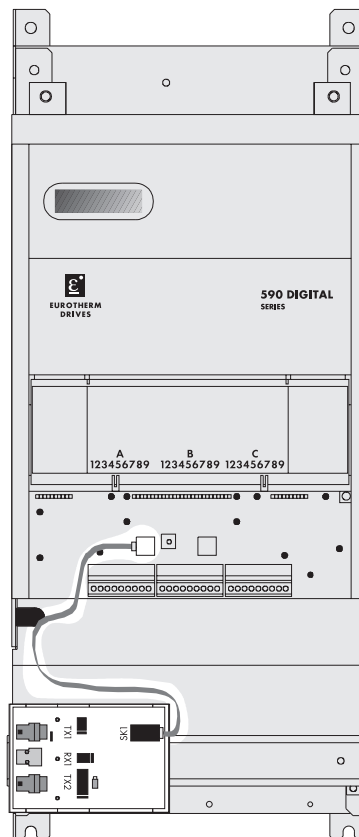


Figure G.3 - 5703 Connection Drawing (Shown on a 590 Digital Drive)







## **Appendix H RS422 COMMUNICATIONS (PORTS P1 & P2)**

The supervisory communications optional interface makes supervising and monitoring 590 Digital drives simple. It provides an isolated RS422 serial data port that can be installed on each drive. These serial links can be bussed together to allow an intelligent device to monitor or update the parameters of a network of drives. Refer to the documentation shipped with the option for detailed technical and wiring information.

The 590 Digital drive supports both ASCII and Binary Communications.

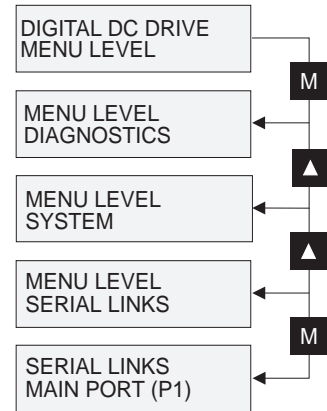
Using this link, a supervisory computer can perform periodic setpoint updating, control sequencing, and data collection while each drive is in continuous local control.

### SERIAL LINKS::MAIN PORT (P1)

The MAIN PORT (P1) requires an optional communications board (catalog number 654D-RS422). It provides an isolated RS422 communications port required for interfacing to PLCs, supervisory computers, etc.

#### Parameters

Tag	Parameter	Description	Range	Default
146	SRL LINK ENABLE	Enables or disables the P1 port.	ENABLED/DISABLED	DISABLED
138	GROUP ID (GID)	Group identification number	0 to 7	0
139	UNIT ID (UID)	Unit identification number	0 to 15	0
148	ASCII/BINARY	Sets the transmission mode to ASCII or Binary.	ASCII/BINARY	ASCII
150	BAUD RATE	The transmission rate.	300 - 19200	9600
152	ESP SUP. (ASCII)	Enables support of Eurotherm's ESP supervisory software format.	ENABLED/DISABLED	DISABLED
144	CHANGE BAND (BIN)	The threshold a value must change before a it will be read by the serial link.	0 - 327.67%	0.00%
158	ERROR REPORT	Communications error code.		0x00C0
334	PARITY	Parity	EVEN/ODD	EVEN
142	PNO. 7	Sets the multiparameter polling status of each PNO block.	0x0000 to 0xFFFF	0xFFFF



### SERIAL LINKS: MAIN PORT (P1)

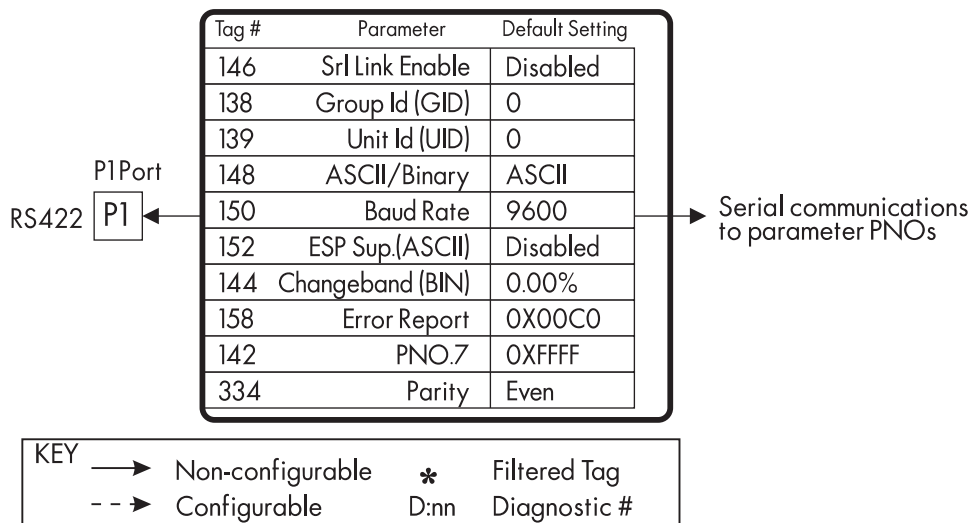


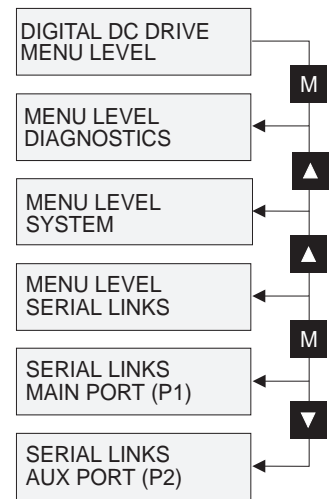
Figure H.1 - Main Port (P1) Block Diagram

### SERIAL LINKS::AUX PORT (P2)

The AUX PORT (P2) provides a non-isolated RS422 serial port to the 590 Digital drive. This port is designed for use with other Eurotherm Drives products only. The isolated communications option for the P1 port should be used for all foreign communication requirements.

#### Parameters

Tag	Parameter	Description	Range	Default
147	SRL LINK ENABLE	Enables or disables the P2 port.	ENABLED/DISABLED	DISABLED
140	GROUP ID (GID)	Group identification number	0 to 7	0
141	UNIT ID (UID)	Unit identification number	0 to 15	0
149	ASCII/BINARY	Sets the transmission mode to ASCII or Binary.	ASCII/BINARY	ASCII
151	BAUD RATE	The transmission rate.	300 - 19200	9600
153	ESP SUP. (ASCII)	Enables support of Eurotherm's ESP supervisory software format.	ENABLED/DISABLED	DISABLED
145	CHANGEBAND (BIN)	The threshold a value must change before a it will be read by the serial link.	0 - 327.67%	0.00%
159	ERROR REPORT	Communications error code.		0x00C0
143	PNO.7	Sets the multiparameter polling status of each PNO block.	0x0000 to 0xFFFF	0xFFFF



### SERIAL LINKS: AUX PORT (P2)

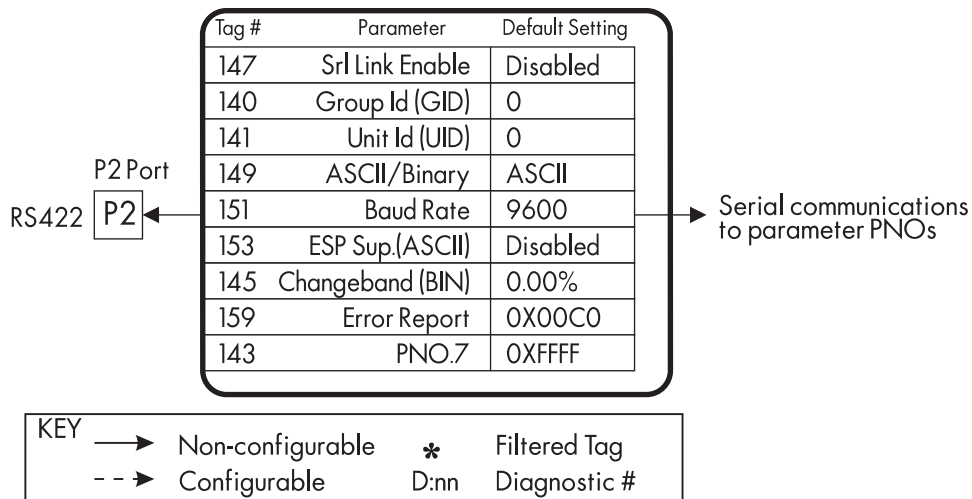


Figure H.2 - Aux Port (P2) Block Diagram

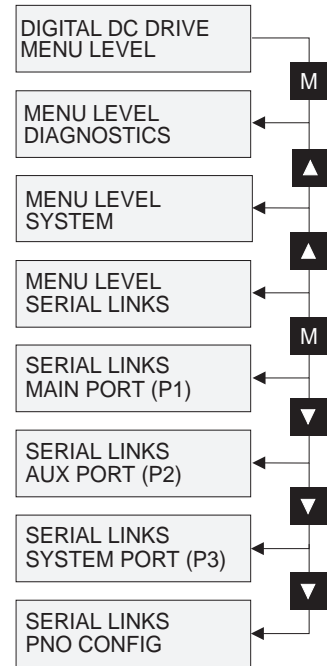


## SERIAL LINKS::PNO CONFIG

Provides user configurable serial link parameters. To configure these PNOs, SYSTEM:: CONFIGURE I/O:: CONFIGURE ENABLE must be set to ENABLED. When the parameter is enabled, the serial communication link is disabled. Communications restarts once CONFIGURE ENABLE is set back to DISABLED.

### Parameters

Tag	Parameter	Description	Range	Default
312	PNO 112	User configurable to any tag.	0 to 499	0
313	PNO 113		0 to 499	0
314	PNO 114		0 to 499	0
315	PNO 115		0 to 499	0
316	PNO 116		0 to 499	0
317	PNO 117		0 to 499	0
318	PNO 118		0 to 499	0
319	PNO 119		0 to 499	0
320	PNO 120		0 to 499	379
321	PNO 121		0 to 499	380
322	PNO 122		0 to 499	381
323	PNO 123		0 to 499	382
324	PNO 124		0 to 499	383
325	PNO 125		0 to 499	384
326	PNO 126		0 to 499	385
327	PNO 127		0 to 499	0



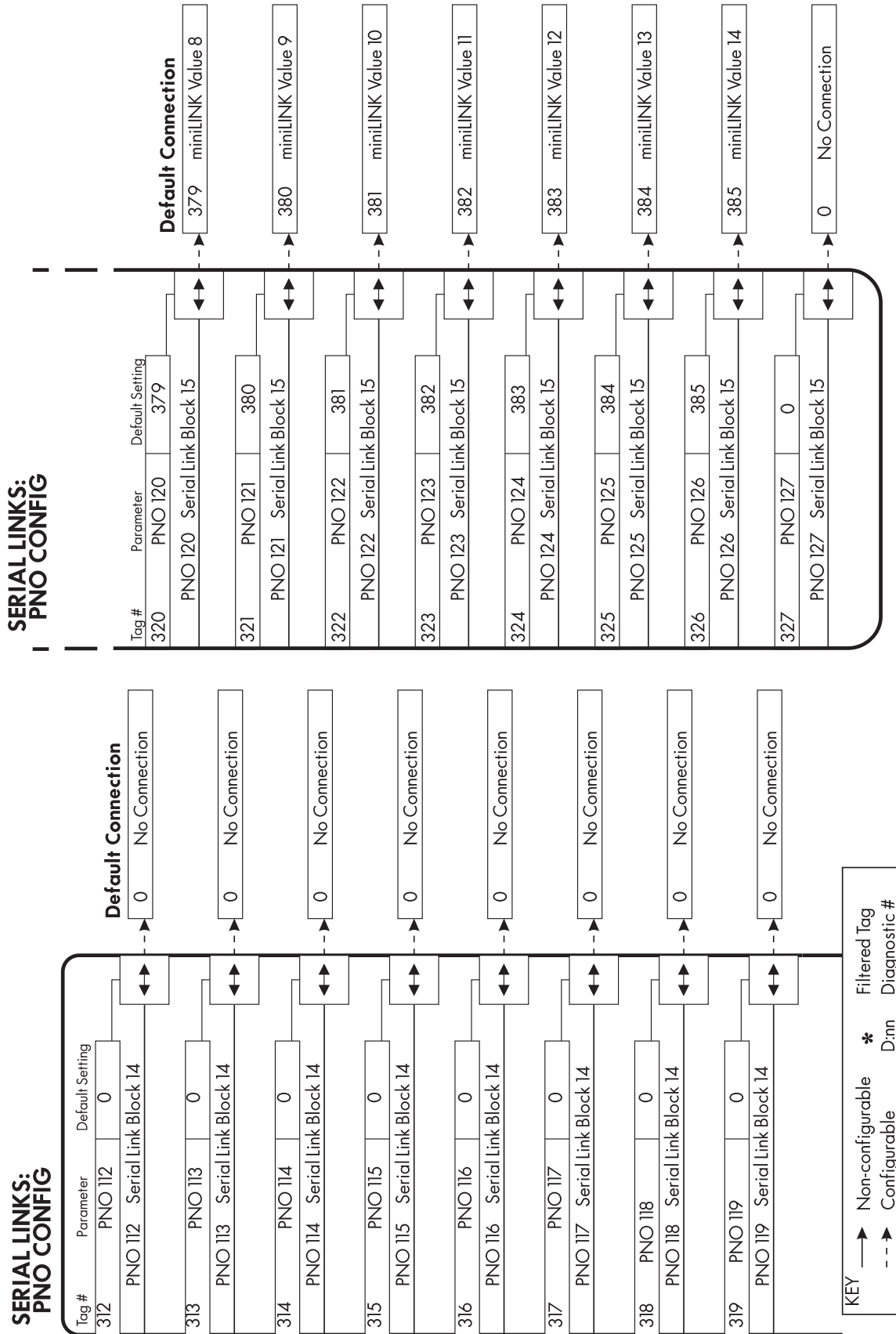


Figure H.3 - PNO Config Block Diagram

## COMMUNICATIONS STANDARD

The communications protocol used by Eurotherm group instruments, including Eurotherm Drives, comes under the heading of Binary Synchronous Communications Data Link Control (BSCDLC). The communication mode conforms to the following American National Standard definition:

ANSI standard                      x3.28

Revision                              1976

Establishment and Termination Control Procedures Subcategory 2.5

Two-way Alternate, Non switched Multipoint with Centralized Operation and Fast Select.

Message Transfer Control Procedure Subcategory B1

Message Associated Blocking, with Longitudinal Checking and Single Acknowledgment.

The standard is known by the abbreviation

ANSI - x3.28 - 2.5 - B1.

It is part of an internationally recognized ANSI standard protocol called BISYNCH (Binary Synchronous) and known by the abbreviation x3.28. The standard is widely used by manufacturers of computers, computer peripherals, and communications equipment.

## Multi Drop Supervisory Link

Transmission Standard	RS422 (bidirectional)
Protocol	ANSI-X3.28-2.5-B1
Data Rates	300,600,1200,2400,4800, 9600 or 19200 baud
Character Format (300 to 9600 baud)	ASCII + 1 start, 1 parity and 1 stop bit. [10 BIT]
Parity	Binary - 1 start, 7 data, 1 control, 1 parity, and 1 stop bit [11 BIT] Even

## Digital Communications

Electrical connections	4-wire differential
No. of drivers and receivers allowed per line	1 driver 16 receivers
Maximum cable length	4000 ft/1200 meters

## ASCII (AMERICAN STANDARD CODE FOR INFORMATION INTERCHANGE)

ASCII is a binary code which represents letters, digits, and control signals (collectively called characters). The code, originated by the American National Standards Institute (ANSI), has become a worldwide standard for information interchange. The code uses a seven-bit binary word to represent all the letters, digits, punctuation marks, and control signals. A complete list of these codes is at the end of this appendix.

## Protocol

The protocol defines the string, or sequence of characters called a message, which must be sent between communicating instruments to produce specific responses. The sequence of characters usually comprises control characters, an instrument address, a parameter mnemonic, and data.

## Control Characters

Control characters are ASCII binary codes which define actions rather than information. Below lists the six ASCII codes used.

ASCII-HEX	Parameter Code	Description
02	(STX)	Start of text
03	(ETX)	End of text
04	(EOT)	End of transmission
05	(ENQ)	Inquiry
06	(ACK)	Positive acknowledge
15	(NAK)	Negative acknowledge

## Instrument Address

The 590 Digital drive or associated Eurotherm instrument has an address, the first digit being the “group” number (GID) in the range 0 to 7, the second a “unit” number (UID) in the range 0 to F. This yields 128 different addresses from 00 to FF.

## Parameter Mnemonic

Each Eurotherm instrument has parameters defined within its program structure, which are specified by a two character mnemonic. Instruments exchange information by using these mnemonics.

Examples are:

Mnemonic	Description
10	Analog input 1
0F	Instrument health word
09	Drive speed demand

Complete tables of the 590 Digital drive mnemonics are given in Serial Link Mnemonics and Parameter Number Allocation sections.

## Data

Data consists of three types:

- i. Numerical Data      The parameter refers to either a positive or negative number such as a level, setpoint, gain, or result within the instrument.
- ii. Boolean Data      A Boolean parameter, such as a switch, can be monitored or set as enabled or disabled from the serial link. It is accessed as part of a status word as defined below.
- iii. Status Information      The parameter refers to a binary word. Each bit within the word is a significant switch within the program structure.

Examples of numerical data are:

Mnemonic	Parameter Name	Description
23	Speed loop error	A number in the range $\pm 100.00\%$
0B	Current demand	A number in the range $\pm 200.00\%$
22	Digital tach	A number in the range $\pm 6000$ RPM

Examples of status information are:

Mnemonic	Parameter Name	Bit	Description
0F	Health word	1	Missing pulse alarm
		9	Three-phase present
		13	Current trip alarm

The Serial Link Mnemonics and Parameter Number Allocation sections contain complete information on the data types and the status words.

## Data Format

The 590 Digital drive uses an ASCII free-format mode of operation for data transfer to make it easy to implement with languages such as BASIC, PASCAL, FORTRAN, and assembler languages. As a result, users can create simple supervisory systems to run on an IBM PC.

### Numerical Data (Format 21 - Free Format Numeric)

Numerical data is transferred by transmitting a string of characters. The length of the string is determined by the value itself. No leading or trailing zeros are needed to normalize the string length. That is:

1	can be sent as	1.00, 1.0, 1., or 1
-2.2	can be sent as	-2.20 or -2.2
19.99	is sent as	19.99

### Status Information (Format 23 - Hexadecimal)

Status information is transmitted by encoding the data into a hexadecimal format. The number of characters in the encoded data determines the length of the string. The hexadecimal data is preceded by a '>' sign to differentiate it from numerical data.

Note: Hexadecimal refers to the common practice of computing in the base of 16 rather than the base of 10. The sixteen numbers used are 0 to 9 and A to F. As a result, an 8 bit byte is represented by two characters in the range 00 to FF, while a 16 bit word is represented by four characters in the range 0000 to FFFF.

## Data Transfer Sequence

The data transfer sequence in the ASCII mode offers the following facilities:

- i. Asking questions (known as polling)
  - a. Single parameter poll
  - b. Continuous polling of one parameter
  - c. Sequential polling down the parameter list (fast polling)
- ii. Setting parameters (known as selection)
  - a. Single parameter update
  - b. Continuous updating of one or more individual parameters

## Serial Data Transmission

When an ASCII character is sent by serial data transmission, the bit pattern is transmitted in a fixed order. Start and stop bits indicate the start and finish of that pattern.

The seven bit ASCII code is usually extended by one bit called the parity bit. The parity bit shows whether the total number of bits in each character code is odd or even. Eurotherm protocol requires that the parity bit indicates even parity; that is, the parity bit is set if the number of bits in an ASCII character is odd. The serial data pattern also allows the use of multiple stop bits. Eurotherm protocol; however, dictates that there is only one stop bit if the data rate is greater than 110 baud. The 590 Digital drive and its instruments use 300 to 9600 baud.



## Reading Information by Computer

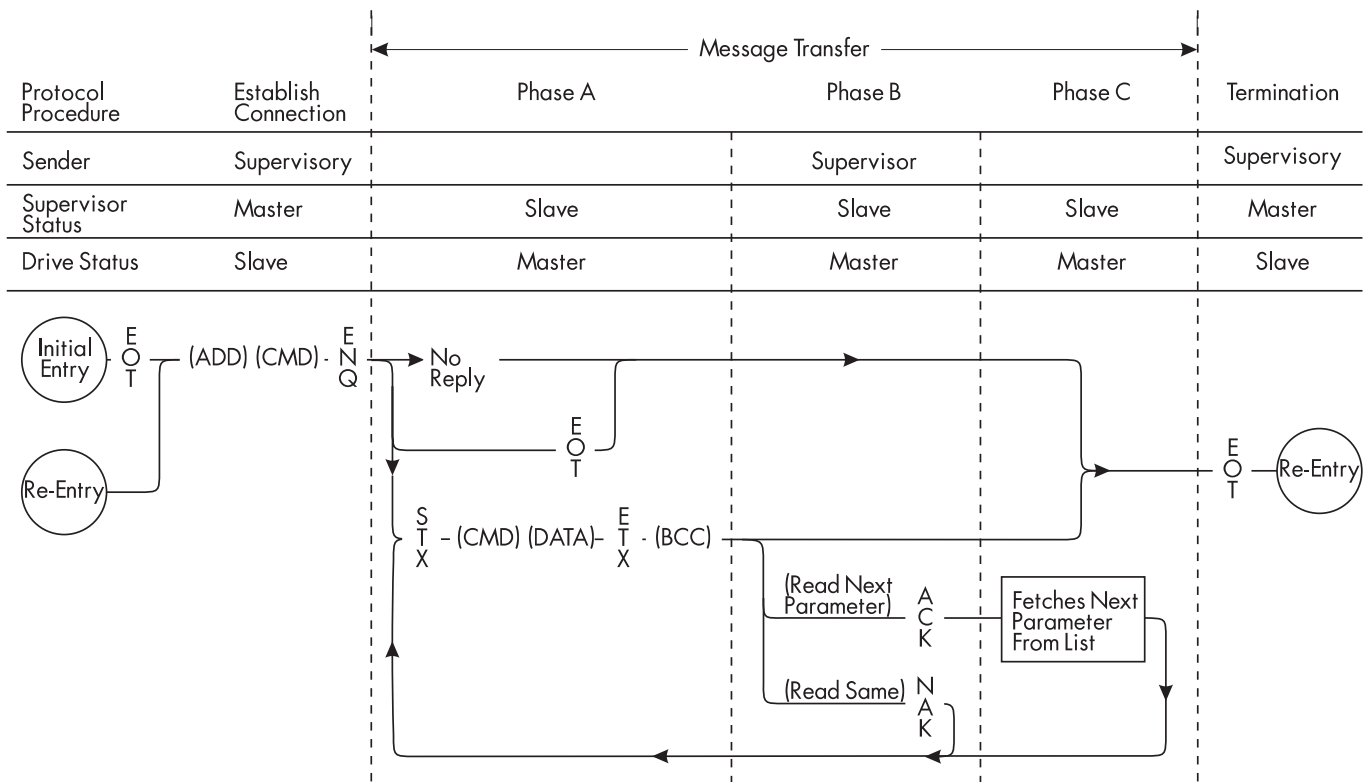


Figure H.4 - Poll Sequence for Transmitting Data from the 590 DRV Controller to the Supervisor.

## Reading Information by Computer

### Inquiry

The computer initially has master status, with the 590 Digital drive in slave status. It begins by transmitting a message, known as the “establish connection” message, which is represented by the following format:

(EOT) (GID) (GID) (UID) (UID) (C1) (C2) (ENQ)

These symbols are defined as follows:

(EOT) This control character resets all instruments on the link and causes them to examine the next four transmitted characters to see if they correspond with their group/unit address identifiers.

(GID) These characters represent the required group address identifier (repeated for security).

(UID) These characters represent the required unit address identifier (repeated for security).

Together the (GID) and (UID) define the address of a particular instrument. If, for example, GID = 3 and UID = 4, then the instrument to be addressed is number 34.

(C1)(C2) These characters specify the parameter by mnemonic.

(ENQ) This character indicates the end of the message, and that it is an inquiry.

Transmitting this message initiates a response procedure from the 590 Digital drive.

## Valid Response Message

After the message has been sent, the computer adopts slave status and expects to receive a reply from the 590 Digital drive. In so doing, the 590 Digital drive assumes master status and, if the 590 Digital drive has successfully received the message in full, it responds in the following form:

(STX) (C1) (C2) (D1) (D2) (D3)...(DN) (ETX) (BCC)

which constitutes a message defined as:

(STX) Start of text

(C1)(C2) Parameter specified by mnemonic

(D1 to DN) Value of the requested parameter (the string may be of any length as determined by the data). The 590 Digital drive responds with the shortest message which represents the data value. If the data value is an integer (decimal part is 0), then it does not send a decimal point. Trailing zeros in the decimal numbers are not sent.

(ETX) End of text

(BCC) Block check character - verification digit which is the character generated by taking the exclusive OR of the ASCII values of all the characters transmitted after and excluding (STX) up to and including (ETX).

For example, in a message where (D1) to (DN) is 5 characters:

(BCC) = (C1) EOR (C2) EOR (D1) EOR (D2) EOR (D3) EOR (D4) EOR (D5) EOR (ETX)

where EOR = Exclusive OR

The computer must check this (BCC) before accepting the reply as valid. Also, the software must be able to extract the number from the data string taking into account the protocol of the data transmission.

Note: If the 590 Digital drive receives the message but does not recognize the mnemonic, it will respond with (EOT). The (EOT) returns control to the computer.

## Further Inquiry and Termination

The computer then assumes master status again and has three optional responses:

i. Repeat Parameter Facility (NAK)

If the computer transmits a (NAK) after the valid reply, it causes the 590 Digital drive to re-send the parameter that it just sent. This allows the computer to continually monitor a parameter without having to reestablish the connection.

ii. Scroll Mode Facility (ACK)

If the computer transmits an (ACK) after a valid reply, it causes the 590 Digital drive to fetch the next parameter from the parameter list. This facility enables the computer to continuously sequence through all the parameters of the 590 Digital drive.

iii. Terminate Communication (EOT)

The termination procedure is entered when an instrument is no longer required, when a 590 Digital drive does not respond to a message, or when a 590 Digital drive replies with an (EOT) character. The computer assumes master status and transmits an (EOT) character to enable all the instruments on the data link to be responsive to the next GID-UID address parameter.

## No Response

Under certain circumstances, the computer may not receive a response from the 590 Digital drive. This could be due to any of the following reasons:

- i. Group/Unit address identifiers are not recognized.
- ii. An error (for example parity) is found in one or more of the characters up to and including (ENQ).
- iii. Communications loop failure perhaps due to noise or selecting the wrong baud rate.
- iv. Hardware failure.
- v. Parameter SERIAL LINKS::MAIN PORT (P1)::SRL LINK ENABLE is disabled.

In these cases the computer should be programmed to “time-out”, that is, wait for a response for a short time (160 msec minimum) before trying again.

## Sending information from the computer

### Establish Connection

Connection is established when a 590 Digital drive sends:

(EOT) (GID) (GID) (UID) (UID)

followed immediately by the data transfer

(STX) (C1) (C2) (D1) (D2) (D3).....(DN) (ETX) (BCC)

Note: The data transfer message is identical to that transmitted by a 590 Digital drive when giving a valid reply.

The symbols of this message are defined as follows:

(STX) Start of text character

(C1)(C2) Parameter specified by mnemonic

(D1 to DN) Parameter value

(ETX) End of text character

(BCC) Block Check Character - verification check digit which is the exclusive OR of (C1) to (ETX) inclusive and must be calculated by the computer before transmission.

### Responses

After completing the transmission, the 590 Digital drive responds to it by sending (ACK), (NAK), or by giving no reply.

- i. Positive acknowledgment (ACK)

After the 590 Digital drive receives the message, it performs the following tasks:

- a. Checks for any parity errors in the message.
- b. Verifies that the (BCC) character corresponds to the data pattern received.
- c. Verifies that the (C1), (C2) command characters are a valid mnemonic that may be written to.
- d. Verifies that the data (D1 to DN) is valid and not out-of-range.
- e. Updates the parameter with the new value contained in the message.

Only when all these tasks have been successfully completed does the 590 Digital drive send the (ACK) response to the computer. This signifies that the message was correctly received and implemented. If any of the checks fail, the 590 Digital drive immediately sends a negative acknowledgment.

Note: When data is out-of-range, the drive returns (NAK) and discards the data.

ii. Negative acknowledgment (NAK)

If the message fails any of the above checks, the 590 Digital drive sends (NAK) response to the computer. This signifies that the message received by the 590 Digital drive contained an error and it has not updated the parameter. At this point, the computer may repeat the command by sending the data transfer string without reestablishing connection until it receives an (ACK) response.

iii. No Reply

The computer may not receive a response from the 590 Digital drive. This could be due to any of the following reasons:

- a. Group/Unit address identifiers are not recognized.
- b. An error (e.g. parity) is found in one or more of the characters up to and including (BCC).
- c. Communications loop failure perhaps due to noise or selecting the wrong baud rate.
- d. Hardware failure.
- e. Parameter SERIAL LINKS::MAIN PORT (P1)::SRL LINK ENABLE is disabled.

In these cases the computer should be programmed to 'time-out', that is, wait for a response for a short time (160 msec minimum) before trying again.

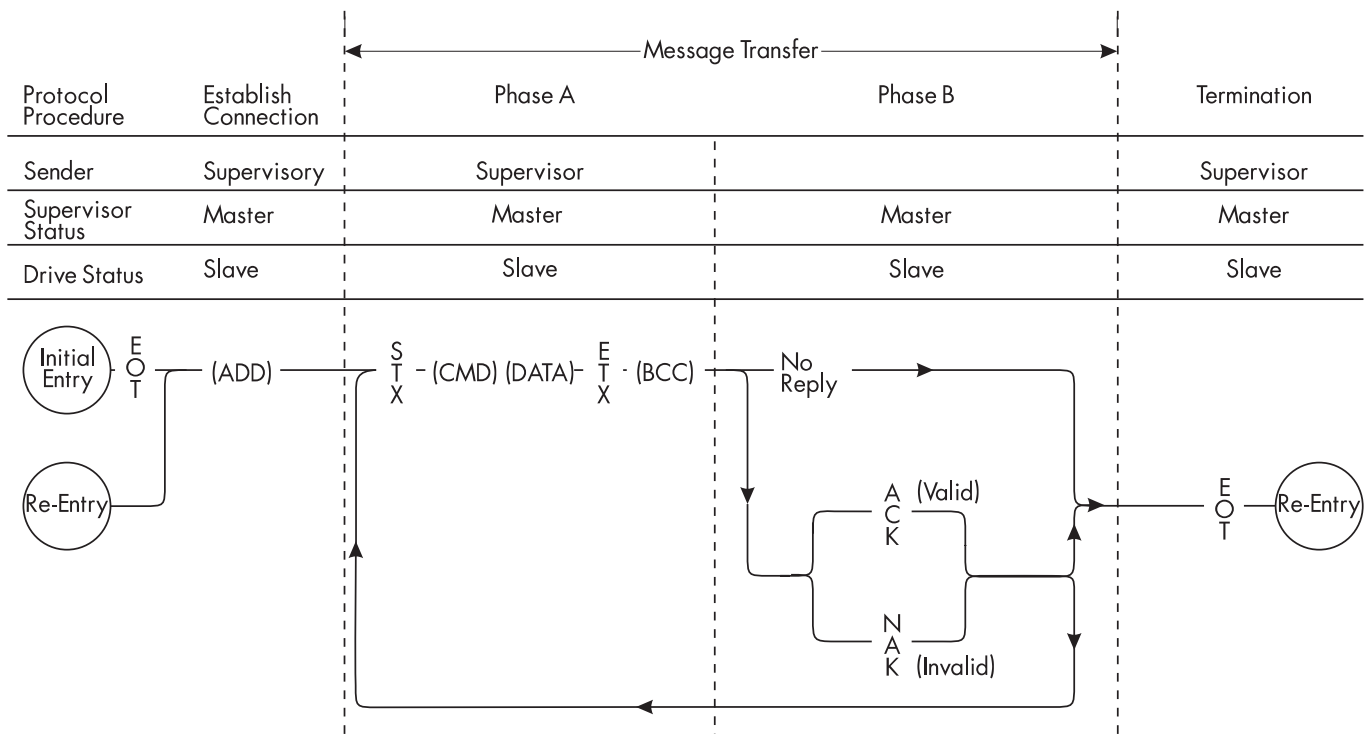


Figure H.5 - Selection Sequence for Transmitting Data from the Supervisor to the 590 DRV Controller

## Termination

The computer uses the termination procedure when it wishes to stop selecting one 590 Digital drive and establish connection with another. This is achieved by sending the 'establish connection' sequence. The computer retains master status and transmits an (EOT) character to reset all instruments on the data link to be responsive to the next GID-UID address parameter.

## BINARY COMMUNICATIONS

This mode is similar to the ASCII mode. This section concentrates on presenting parts that are different from the ASCII mode.

## Specifications

### Character Format

Each byte is transmitted as 11 bits rather than the 10-bit format used by the ASCII mode. This is because a control bit is used to indicate control characters or data characters. The format is represented by the following:

1 Start bit (LOW)

7 Data bits (LSB first)

1 Control bit

1 Even parity bit

1 Stop bit (HIGH)

Note: The control bit is 0 for control characters and 1 for data characters.

### The Message

Messages received from the supervisor can be in any of several modes. They can be divided into two categories; the first is "main messages" and the second is "continuation messages." Before presenting the format of these messages, the following defines the symbols used in the messages. These symbols are divided into two parts, control characters and data characters.

### Control Characters

- |       |  |
|-------|--|
| (EOT) | Indicates the end of transmission. The master sends it at the start of a new message to clear the line.  |
| (STX) | Start of text character.   |
| (ENQ) | Inquiry character. The master sends it as the last character of any type of a polling message.   |
| (ETX) | End of text character. It is followed by another character containing the checksum.  |
| (ETB) | End of block character. The 590 Digital drive sends it instead of the (ETX) when it wishes to reply to a multi parameter inquiry. The (ETB) indicates the end of a block, but not the end of a message. Each block contains information on up to eight parameters. The (ETB) is used in replies to inquiry polling and multiparameter polling (these are explained below). |
| (ACK) | Positive acknowledgment character.   |
| (NAK) | Negative acknowledgment character.   |

## Data Characters

- (INO) Instrument number. It contains the address of the slave drive and is equivalent to combining the GID and UID characters of the ASCII mode.
- (PNO) Parameter number. It is equivalent to combining the C1 and C2 characters of the ASCII mode and is sent as a hexadecimal number rather than two ASCII characters.
- (D1), (D2) and (D3) These three characters contain both the value and the mode number. The format is explained in the Types of Messages section.
- (CCC) Connection check control character. It contains the checksum of all the characters following the (EOT) character in the message.
- (BCC) Verification digit generated by taking the exclusive OR of the ASCII values of all characters transmitted after and excluding (STX) up to and including (ETX)

## Types of Messages

The two types of messages are main messages and continuation messages.

### Main Messages

The main messages are subdivided into four types. They are:

#### Selection

The supervisor writes to one parameter,

(EOT) (INO) (CCC) (STX) (PNO) (D1) (D2) (D3) (ETX) (BCC)

where the (BCC) character contains the checksum of all characters following the (STX).

Note: (CCC) is the checksum of the characters following an (EOT) and is therefore equal to (INO) in selection and inquiry-polling messages.

#### Polling

The supervisor requests to read the value of one parameter.

(EOT) (INO) (PNO) (CCC) (ENQ)

#### Inquiry Polling

The supervisor requests to read all the parameters in block 1 that have changed since the last read by an amount greater than or equal to changeband, PNO 4.

(EOT) (INO) (CCC) (ENQ)

#### Multiparameter polling

The supervisor requests to read a given number of parameters. That number is referred to as the count number (CNO). It is included in the request message. The drive sends the reply in blocks of up to 8 parameters.

(EOT) (INO) (PNO) (CNO) (CCC) (ENQ)

Multiparameter polling can also perform pseudo-inquiry polling. A pseudo-inquiry poll occurs on blocks defined by PNO 7 when (PNO) is set to the first parameter in a block (for example 8, 16, 24, etc.) and (CNO) is set to 8. See the table for Block 0 in the List of PNO Assignments section of this chapter for detailed information about PNO 7.

## Continuation messages

In addition to the above, there are two types of continuation messages (sent by the supervisor). These are:

D1	2 through 6  0 and 1	Mode number: 0 = XXXX. 1 = XXX.X 2 = XX.XX 3 = X.XXX 4 = .XXXX  Bits 14 and 15 of the value.
D2	0 through 6	Bits 7 through 13 of the value.
D3	0 through 6	Bits 0 through 6 of the value.

Next (send next item from a list) (ACK)

Only valid if sent following a multiparameter poll.

Repeat (repeat last reply) (NAK)

Only valid if sent following any type of poll. It requests a repetition of the previous reply.

## Data Format

Data values are presented in three consecutive characters, D1, D2 and D3. These characters include the mode name and the value read from or written to one of the parameters. A data character is represented by setting its MSB (bit 7). The contents of these characters are as follows:

## Transmission Rate

The transmission rate can be set to 300, 600, 1200, 2400, 4800, 9600, or 19200 baud.

## Serial Transmission

During serial communications, the 590 Digital drive acts as a slave and replies to messages sent from a master. It responds by transmitting a reply of one character or more than one character.

### One character response

The character can be:

(ACK) Sent after receiving a correct message.

(NAK) or (EOT) Sent after detecting a fault.

### More than one character response

This message is sent to reply to any type of a polling message. The reply is in the form:

(STX) (PNO) (D1) (D2) (D3) (ETX) (BCC)

For multiparameter polling, the reply can consist of more than one message. It is divided into a group of messages (blocks). The (ETX) character is only sent at the end of the last message. In other messages, the (ETX) is replaced by an (ETB) to indicate an end of a block rather than the end of reply, as explained earlier.

## NEW SERIAL LINK FEATURES

1. There are more PNO numbers available.
2. Serial port P1 (isolated RS422/-485) supports even (default) or odd parity.
3. The new serial link PNO numbers include some dedicated parameters, similar to those already present in previous versions of software, and also 16 configurable parameters. The 16 configurable parameters have PNO's 112 to 127 (ASCII mnemonics 70 to 7F). These can be made to point to any TAG number, either via the MMI under SERIAL LINKS::PNO CONFIG, or via the serial link. PNO's 96 to 111 (ASCII mnemonics 60 to 6F) are pointers associated with PNO's 112 to 127.

For example:

If PNO 96 = 123, then PNO 112 will access TAG number 123.

If PNO 100 = 234, then PNO 116 will access TAG number 234

## List of PNO Assignments

### Block 0

PNO	Access	Description
0	R/O	Instrument Identifier. Same as ASCII mnemonic II.
1	R/W	Error report. Same as ASCII mnemonic EE. Writing any value resets this PNO to its default (decimal 192).
2		Reserved
3		Reserved
4	R/W	Change band. In an inquiry poll or pseudo-inquiry poll (see PNO 7), a value must have changed by an amount equal to or greater than the change band before it will be reported. Change band is measured in the smallest units applicable to each parameter. For example, if CHANGE BAND = 10, then a parameter with one decimal point must change by 1.0, and a parameter with two decimal points must change by 0.10 before they will be reported.
5	R/O	Serial link configuration. Bit nos.      Description 0 - 3            0 = 300 1 = 600 2 = 1200 3 = 2400 4 = 4800 5 = 9600 (default) 6 = 19200 4 - 15          Reserved
6		Reserved
7	R/W	Control word for multiparameter polling. For the purpose of multiparameter polling, the PNOs are arranged in 16 blocks of 8. Bit 0 of this parameter controls block 0 (PNO 0 to 7), bit 1 controls block 1 (PNO 8 to 15) .... bit 15 controls block 15 (PNO 120 to 127).  When a bit is 1 (default), a multiparameter poll on this block operates normally, as defined in the Types of Messages section.  When a bit is 0, a multiparameter poll on this block, with PNO = multiple of 8, and CNO = 8, performs an inquiry poll instead (a pseudo-inquiry poll).



**Block 1**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
8	08	063	R/O	-	21	xxx.xx		Speed Setpoint
9	09	089	R/O	-	21	xxx.xx		Speed Demand
10	0A	062	R/O	-	21	xxx.xx		Speed Feedback
11	0B	066	R/O	-	21	xxx.xx		Current Demand
12	0C	065	R/O	-	21	xxx.xx		Current Feedback
13	0D	183	R/O	-	21	xxx.xx		Field Demand
14	0E	181	R/O	-	21	xxx.xx		Field Feedback
15	0F	115	R/O	-	23	xxxxx		Health Word
				0				Over Speed
				1				Missing Pulse
				2				Field Over Current
				3				Fin Over Temperature
				4				Motor Over Temperature
				5				Over Volts
				6				Speed Feedback
				7				Encoder Fail
				8				Field Fail
				9				Three Phase
				10				Phase Lock Loop
				11				5703 Receive Error
				12				Stall Trip
				13				Over Current Trip
				14				Cal. Card
				15				ACCTS Failed.

**Block 2**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
16	10	050	R/O	-	21	xxx.xx		Analog I/P 1
17	11	051	R/O	-	21	xxx.xx		Analog I/P 2
18	12	052	R/O	-	21	xxx.xx		Analog I/P 3
19	13	053	R/O	-	21	xxx.xx		Analog I/P 4
20	14	054	R/O	-	21	xxx.xx		Analog I/P 5
21	15	067	R/O	-	21	xxx.xx		Actual +ve Current Limit
22	16	061	R/O	-	21	xxx.xx		Actual -ve Current Limit
23	17	040	R/O	-	23	xxxxx		
-		068		0				Start Input
-		069		1				Jog Input
-		070		2				Enable Input
-		071		3				Digital Input 1
-		072		4				Digital Input 2
-		073		5				Digital Input 3
-		-		6				Program Stop Input
-		-		7				Coast Stop Input
-		074		8				Digital Output 1
-		075		9				Digital Output 2
-		076		10				Digital Output 3
-		-		11-15				Reserved

**Block 3**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
24	18	030	R/W		21	xxx.xx	±200.00	Additional Current Demand
25	19	015	R/W		21	xxx.xx	0/200.00	Main Current Limit
26	1A	087	R/O		21	xxx.xx	0/200.00	+ve Current Clamp
27	1B	088	R/O		21	xxx.xx	0/200.00	-ve Current Clamp
28	1C	016	R/W		21	xxx.xx	0/200.00	Current Loop P Gain
29	1D	017	R/W		21	xxx.xx	0/200.00	Current Loop I Gain
30	1E	171	R/W		21	xxx.xx	0/100.00	Field Current Setpoint
31	1F	116	R/O		23	xxxxx		Health Store
				0				Over Speed
				1				Missing Pulse
				2				Field Over Current
				3				Fin Over Temperature
				4				Motor Over Temperature
				5				Field Over Volts
				6				Speed Feedback
				7				Encoder Fail
				8				Field Fail
				9				Three Phase
				10				Phase Lock Loop
				11				5703 Receive Error
				12				Stall Trip
				13				Over Current Trip
				14				Cal. Card
				15				ACCTS Failed.

**Block 4**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
32	20	060	R/O		21	xxx.xx		Armature Volts
33	21	058	R/O		21	xxx.xx		Analog Tach
34	22	059	R/O		21	xxxxx		Encoder
35	23	064	R/O		21	xxx.xx		Speed Error
36	24	132	R/W		21	x.xxxx	±3.0000	P3 Setpoint Ratio
37	25	014	R/W		21	xxx.xx	0/200.00	Speed Loop P Gain
38	26	013	R/W		21	xx.xxx	0.001/30.000	Speed Loop Time Constant (SEC)
39	27				23	xxxxx		
		161	R/W	0			0/1	Aux. Start
		168	R/W	1			0/1	Aux. Enable
		-		2-7				Reserved
		288	R/W	8			0/1	External Ramp Reset
		287	R/W	9			0/1	Auto Reset
		113	R/O	10				Ramping
		303	R/W	11			0/1	Reset Ramp to Speed Feedback

**Block 5**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
40	28	006	R/W		21	x.xxxx	±3.0000	Ratio 1
41	29	007	R/W		21	x.xxxx	±3.0000	Ratio 2
42	2A	086	R/O		21	xxx.xx		Set Point Sum Output
43	2B	002	R/W		21	xxx.x	0.1/600.0	Ramp Accel. Time
44	2C	003	R/W		21	xxx.x	0.1/600.0	Ramp Decel. Time
45	2D	085	R/O		21	xxx.xx	-	Ramp Output
46	2E	041	R/W		21	xxx.xx	±105.00	Speed Setpoint 4
47	2F				23	xxxxxx		
		082	R/O	0				Drive Start
		084	R/O	1				Drive Enable
		122	R/O	2				Health Flag
		125	R/O	3				Ready
				4-7				Reserved
		079	R/O	8				At Standstill
		112	R/O	9				Stall Trip Warning
				10-15				Reserved

**Block 6**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
48	30	026	R/W		21	xxx.x	0.1/600.0	P-Stop time
49	31	027	R/W		21	xxx.x	0.1/600.0	N-Stop time
50	32	091	R/W		21	xxx.xx	0/200.00	P-Stop Current Limit
51	33	029	R/W		21	xxx.xx	0/100.00	Stop Zero Speed Threshold
52	34	005	R/W		21	xxx.xx	±100.00	Ramp Input
53	35	100	R/W		21	xxx.xx	±200.00	Setpoint Sum Input 1
54	36	309	R/W		21	xxx.xx	±200.00	Setpoint Sum Input 0
55	37				23	xxxxxx		
		94	R/W	0			0/1	Aux. Digital Output 1
		95	R/W	1			0/1	Aux. Digital Output 2
		96	R/W	2			0/1	Aux. Digital Output 3
		-		3-7				Reserved
		292	R/W	8			0/1	Sign 0
		8	R/W	9			0/1	Sign 1
		9	R/W	10			0/1	Sign 2
				11-15				Reserved

**Block 7**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
56	38	055	R/O		21	xxx.xx		Analog Output 1
57	39	056	R/O		21	xxx.xx		Analog Output 2
58	3A	128	R/W		21	xxx.xx	±100.00	Aux. Analog Output 1
59	3B	129	R/W		21	xxx.xx	±100.00	Aux. Analog Output 2
60	3C	266	R/W		21	xxx.xx	0/100.00	% S-Ramp
61	3D	264	R/O		21	xxx.xx		Raise / Lower Output
62	3E	255	R/W		21	xxx.xx	±300.00	Raise / Lower Reset Value
63	3F	-			23	xxxxxx		
-		261	R/W	0			0/1	Raise / Lower Raise Input
-		262	R/W	1			0/1	Raise / Lower Lower Input
-		307	R/W	2			0/1	Raise / Lower Reset

**Block 8**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
64	40	218	R/W		21	xxx.xx	±100.00	Jog Speed 1
65	41	219	R/W		21	xxx.xx	±100.00	Jog Speed 2
66	42	253	R/W		21	xxx.xx	±100.00	Take Up 1
67	43	254	R/W		21	xxx.xx	±100.00	Take Up 2
68	44	225	R/W		21	xxx.xx	±100.00	Crawl Speed
71	47	-			23	xxxxx		
-		228	R/W	0			0/1	Jog Mode
-		227	R/W	1			0/1	Auxiliary Jog

**Block 9**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
72	48	208	R/W		21	x.xxxx	±3.0000	Ratio 0
73	49	309	R/W		21	xxx.xx	±200.00	Input 0
74	4A	48	R/W		21	xxx.xx	±100.00	Pre-set -ve Current Limit
75	4B	301	R/W		21	xxx.xx	±100.00	Pre-set +ve Current Limit

**Block 10**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
80	50	103	R/W		21	xxx.xx	±300.00	Value for TRUE Digital Input 1
81	51	104	R/W		21	xxx.xx	±300.00	Value for FALSE Digital Input 1
82	52	106	R/W		21	xxx.xx	±300.00	Value for TRUE Digital Input 2
83	53	107	R/W		21	xxx.xx	±300.00	Value for FALSE Digital Input 2
84	54	109	R/W		21	xxx.xx	±300.00	Value for TRUE Digital Input 3
85	55	110	R/W		21	xxx.xx	±300.00	Value for FALSE Digital Input 3

**Block 11**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
88	58	339	R/W		21	xxx.xx	±300.00	Value 1
89	59	340	R/W		21	xxx.xx	±300.00	Value 2
90	5A	341	R/W		21	xxx.xx	±300.00	Value 3
91	5B	342	R/W		21	xxx.xx	±300.00	Value 4
92	5C	343	R/W		21	xxx.xx	±300.00	Value 5
93	5D	344	R/W		21	xxx.xx	±300.00	Value 6
94	5E	345	R/W		21	xxx.xx	±300.00	Value 7
95	5F	-			23	xxxxx		
-		346	R/W	0			0/1	Logic 1
-		347	R/W	1			0/1	Logic 2
-		348	R/W	2			0/1	Logic 3
-		349	R/W	3			0/1	Logic 4
-		350	R/W	4			0/1	Logic 5
-		351	R/W	5			0/1	Logic 6
-		352	R/W	6			0/1	Logic 7
-		353	R/W	7			0/1	Logic 8

**Block 12**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
96	60	312	R/W		21	xxxxx		Pointer for PNO 112
97	61	313	R/W		21	xxxxx		Pointer for PNO 113
98	62	314	R/W		21	xxxxx		Pointer for PNO 114
99	63	315	R/W		21	xxxxx		Pointer for PNO 115
100	64	316	R/W		21	xxxxx		Pointer for PNO 116
101	65	317	R/W		21	xxxxx		Pointer for PNO 117
102	66	318	R/W		21	xxxxx		Pointer for PNO 118
103	67	319	R/W		21	xxxxx		Pointer for PNO 119

**Block 13**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
104	68	320	R/W		21	xxxxx		Pointer for PNO 120
105	69	321	R/W		21	xxxxx		Pointer for PNO 121
106	6A	322	R/W		21	xxxxx		Pointer for PNO 122
107	6B	323	R/W		21	xxxxx		Pointer for PNO 123
108	6C	324	R/W		21	xxxxx		Pointer for PNO 124
109	6D	325	R/W		21	xxxxx		Pointer for PNO 125
110	6E	326	R/W		21	xxxxx		Pointer for PNO 126
111	6F	327	R/W		21	xxxxx		Pointer for PNO 127

**Block 14**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
112	70	PNO 96	†		†	†	†	Configurable PNO 0
113	71	PNO 97	†		†	†	†	Configurable PNO 1
114	72	PNO 98	†		†	†	†	Configurable PNO 2
115	73	PNO 99	†		†	†	†	Configurable PNO 3
116	74	PNO 100	†		†	†	†	Configurable PNO 4
117	75	PNO 101	†		†	†	†	Configurable PNO 5
118	76	PNO 102	†		†	†	†	Configurable PNO 6
119	77	PNO 103	†		†	†	†	Configurable PNO 7

**Block 15**

PNO	ASCII mnemonic	TAG	Access type	Bit data format	ASCII data format	Binary	Limits	Description
120	78	PNO 104	†		†	†	†	Configurable PNO 8
121	79	PNO 105	†		†	†	†	Configurable PNO 9
122	7A	PNO 106	†		†	†	†	Configurable PNO 10
123	7B	PNO 107	†		†	†	†	Configurable PNO 11
124	7C	PNO 108	†		†	†	†	Configurable PNO 12
125	7D	PNO 109	†		†	†	†	Configurable PNO 13
126	7E	PNO 110	†		†	†	†	Configurable PNO 14
127	7F	PNO 111	†		†	†	†	Configurable PNO 15

† = These fields depend on the destination TAG number



## Inquiry polling

In normal inquiry polling mode, block 1 is polled.

## References

- 1 HP022047C. Eurotherm International Bisynch Communications Handbook.
- 2 (additions) 570 Product Manual. Part nos. HA056929 (main body), HA058040

## SERIAL LINK MNEMONICS & PARAMETER NUMBER ALLOCATION

### Eurotherm Group Standard Parameters

Each of the Eurotherm Group instruments which support ASCII protocol contains a minimum set of parameters. These are known as the Prime Set and allow access to the following:

Mnemonic	Description	Access	Function
BL	Buffer Length	R/O	Returns 4646 <sub>16</sub> indicating that both transmit and receive buffers are 46 <sub>16</sub> bytes long.
CI	Configuration Information	R/O	Returns 4CCC <sub>16</sub> indicating that the drive supports both fixed and variable length data formats, and that the drive is a single-function device.
EE	Error Report	R/W	Returns one of the following to indicate the status of serial link transmissions: 00C0 No errors 01C7 Unknown mnemonic 02C2 Block check character fail 03C1 Parity error on received data 03C2 Framing or overrun error 05C8 Attempt to write to a read-only mnemonic 07C7 Invalid message format 08C8 Value in selection message out of range  Writing any value to mnemonic EE resets it to 00C0.
II	Instrument Identifier	R/W	Returns the value of a parameter, the default value of which is 5900.
MN	Mode Number	R/O	Returns a fixed value 08C1 (the full Eurotherm standard is not supported).
VO	Version Number	R/O	Returns the software version number in the upper two characters, and the release number in the lower two characters. For example issue 2.3 returns 0203.

In addition to the Prime Set, each drive or instrument supports an application set of parameters to allow fast access to commonly required variables such as process variables, setpoints, and PI gains.

All parameters can be found by polling the instrument identifier parameter and then sequentially polling until the instrument identifier parameter is repeated. This will result in a circular list that contains all supported by the instrument.

### Common ASCII Codes

ASCII CODES		ASCII-HEX
STX	Start of Text	02
ETX	End of Text	03
EOT	End of Transmission	04
ENQ	Inquiry	05
ACK	Positive Acknowledge	06
NAK	Negative Acknowledge	15
	Space	20
-	Minus Sign	2D
.	Decimal Point	2E
0		30
1		31
2		32
3		33
4		34
5		35
6		36
7		37
8		38
9		39
>	(greater than)	3E

### HEX-ASCII Table (complete list)

00	NUL	20	space	40	@	60	,
01	SOH	21	!	41	A	61	a
02	STX	22	"	42	B	62	b
03	ETX	23	£	43	C	63	c
04	EOT	24	\$	44	D	64	d
05	ENQ	25	%	45	E	65	e
06	ACK	26	&	46	F	66	f
07	BEL	27	'	47	G	67	g
08	BS	28	(	48	H	68	h
09	HT	29	)	49	I	69	i
0A	LF	2A	*	4A	J	6A	j
0B	VT	2B	+	4B	K	6B	k
0C	FF	2C	,	4C	L	6C	l
0D	CR	2D	-	4D	M	6D	m
0E	SO	2E	.	4E	N	6E	n
0F	SI	2F	/	4F	O	6F	o
10	DLE	30	0	50	P	70	p
11	DC1(X-ON)	31	1	51	Q	71	q
12	DC2	32	2	52	R	72	r
13	DC3(XOFF)	33	3	53	S	73	s
14	DC4	34	4	54	T	74	t
15	NAK	35	5	55	U	75	u
16	SYN	36	6	56	V	76	v
17	ETB	37	7	57	W	77	w
18	CAN	38	8	58	X	78	x
19	EM	39	9	59	Y	79	y
1A	SUB	3A	:	5A	Z	7A	z
1B	ESC	3B	;	5B	[	7B	{
1C	FS	3C	<	5C	/	7C	
1D	GS	3D	=	5D	]	7D	}
1E	RS	3E	>	5E	^	7E	~
1F	US	3F	¿	5F	-	7F	DEL



## APPLICATION NOTES

It is possible to make serial communications operate without following all the recommendations in this section; however, the recommendations will promote greater reliability.

## Host Computer

If possible, avoid using host computers which take their transmitter to a high impedance state (tri-state) when idling. If it is unavoidable, then it is essential to use properly screened cable, such as suggested below.

## Terminations

The drive farthest from the host computer should have a terminating resistor. The terminating resistor should be changed to match the characteristic impedance of the cable, typically 100 to 150Ω. The resistors on all other drives should be removed.

## Cable Routing

Daisy chain one drive to the next; avoid spurs. Connect the host computer at one end of the daisy-chain. The host computer's TX+ terminal connects to all the RX+ terminals along the daisy chain. Its RX+ terminal connects to all the drive's TX+ terminals in the chain. This same pattern is followed for the TX- and RX- terminals. See Figure H.6 for an illustration of the wiring scheme.

## Grounding

Connect the screens of both pairs of wires to ground at the host computer. If possible, connect the host computer's transmitter/receiver zero volts reference to ground.

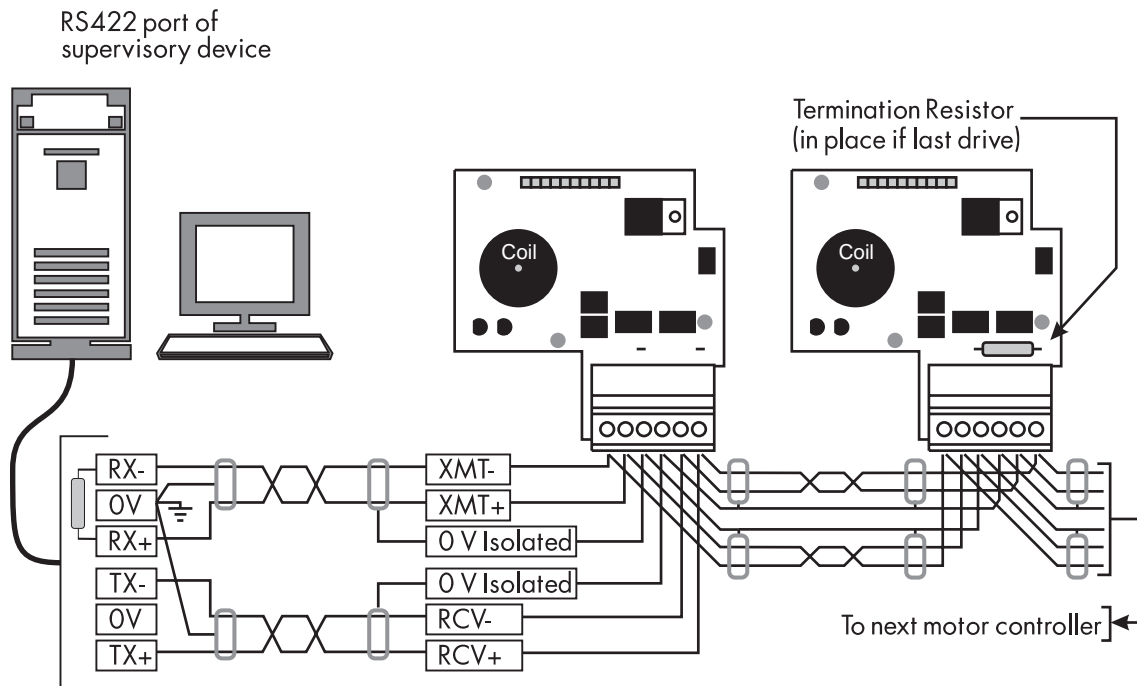


Figure H.6 - Serial Link Connections



### Serial Link Cable Selection

Use cable which has two twisted pairs, with each pair individually screened, as shown below. The characteristic impedance should be between 100 and 150Ω

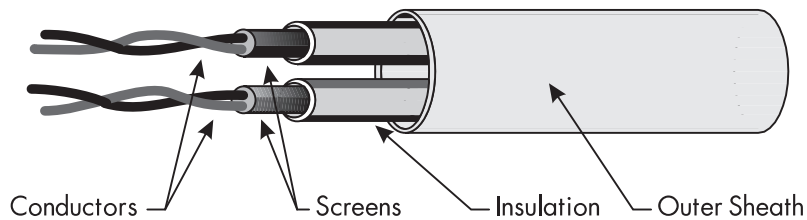


Figure H.7 - Shielded Cable Illustration





## Appendix I PARAMETER LIST BY TAG NUMBER

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
0	Trash Can			0	0	RW
1	EEprom Checksum			-	-	
2	RAMP ACCEL TIME	SETUP PARAMETERS::RAMPS	10.0 SECS	1	6000	RW
3	RAMP DECEL TIME	SETUP PARAMETERS::RAMPS	10.0 SECS	1	6000	RW
4	CONSTANT ACCEL	SETUP PARAMETERS::RAMPS	ENABLED	0	1	RW
5	RAMP INPUT	SETUP PARAMETERS::RAMPS	0.00%	-10000	10000	RW
6	RATIO 1	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
7	RATIO 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	1	-30000	30000	RW
8	SIGN 1	SETUP PARAMETERS::SETPOINT SUM 1	POSITIVE	0	1	RW
9	SIGN 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	POSITIVE	0	1	RW
10	ZERO SPD. OFFSET	SETUP PARAMETERS::CALIBRATION	0.00%	-500	500	RW
11	STANDSTILL LOGIC	SETUP PARAMETERS::STANDSTILL	DISABLED	0	1	RW
12	ZERO THRESHOLD	SETUP PARAMETERS::STANDSTILL	2.00%	0	10000	RW
13	INT. TIME CONST.	SETUP PARAMETERS::SPEED LOOP	0.500 SECS	1	30000	RW
14	PROP. GAIN	SETUP PARAMETERS::SPEED LOOP	10	0	20000	RW
15	CUR.LIMIT/SCALER	SETUP PARAMETERS::CURRENT LOOP	100.00%	0	20000	RW
16	PROP. GAIN	SETUP PARAMETERS::CURRENT LOOP	45	0	20000	RW
17	INT. GAIN	SETUP PARAMETERS::CURRENT LOOP	3.5	0	20000	RW
18	AUTOTUNE	SETUP PARAMETERS::CURRENT LOOP	OFF	0	1	RW
19	FIELD FAIL	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
20	ARMATURE V CAL.	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
21	IR COMPENSATION	SETUP PARAMETERS::CALIBRATION	0.00%	0	10000	RW
22	ENCODER RPM	SETUP PARAMETERS::CALIBRATION	1000 RPM	0	6000	RW
23	ANALOG TACH CAL	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
24	ENCODER LINES	SETUP PARAMETERS::CALIBRATION	1000	10	5000	RW
25	ARMATURE I (A9)	SETUP PARAMETERS::CALIBRATION	BIPOLAR	0	1	RW
26	PROG STOP TIME	SETUP PARAMETERS::STOP RATES	0.1 SECS	1	6000	RW
27	STOP TIME	SETUP PARAMETERS::STOP RATES	10.0 SECS	1	6000	RW
28	STALL TRIP	SETUP PARAMETERS::INHIBIT ALARMS	INHIBITED	0	1	RW
29	STOP ZERO SPEED	SETUP PARAMETERS::STOP RATES	2.00%	0	10000	RW
30	ADDITIONAL DEM	SETUP PARAMETERS::CURRENT LOOP	0.00%	-20000	20000	RW
31	SPD BRK2 (HIGH)	SETUP PARAMETERS::CURRENT PROFILE	100.00%	0	10000	RW
32	SPD BRK1 (LOW)	SETUP PARAMETERS::CURRENT PROFILE	100.00%	0	10000	RW
33	IMAX BRK2 (SPD2)	SETUP PARAMETERS::CURRENT PROFILE	200.00%	0	20000	RW
34	FIELD FBKSTOP	SYSTEM::RESERVED	155	0	1000	RW
35	FIELD FFRSTOP	SYSTEM::RESERVED	209	0	10000	RW
36	IFFB DELAY	SYSTEM::RESERVED	20	0	255	RW
37	FULL MENUS	MENUS	ENABLED	0	1	RW
38	MENU DELAY	MENUS	30	0	65535	RW
39	CONFIGURE ENABLE	SYSTEM::CONFIGURE I/O	DISABLED	0	1	RW
40	System I/O Digital			-	-	
41	SETPOINT 4	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
42	AT CURRENT LIMIT	DIAGNOSTICS	FALSE	0	1	RO
43	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	TRUE	0	1	RW
44	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	TRUE	0	1	RW
45	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	TRUE	0	1	RW
46	Reserved					
47	SPEED FBK SELECT	SETUP PARAMETERS::SPEED LOOP	ARM VOLTS FBK	0	3	RW
48	NEG. I CLAMP	SETUP PARAMETERS::CURRENT LOOP	0.00%	-10000	10000	RW
49	ENCODER SIGN	SETUP PARAMETERS::SPEED LOOP	POSITIVE	0	1	RW
50	ANIN 1 (A2)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
51	ANIN 2 (A3)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
52	ANIN 3 (A4)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
53	ANIN 4 (A5)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
54	ANIN 5 (A6)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
55	ANOUT 1 (A7)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
56	ANOUT 2 (A8)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
57	TERMINAL VOLTS	DIAGNOSTICS	0.00%	-12500	12500	RO
58	Analog Tach Feedback Unfiltered			-	-	RO
59	Encoder Feedback Unfiltered			-	-	RO
60	BACK EMF	DIAGNOSTICS	0.00%	-15000	15000	RO

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
61	ACTUAL NEG I LIM	DIAGNOSTICS	0.00%	-20000	20000	RO
62	Speed Feedback Unfiltered			-	-	RO
63	SPEED SETPOINT	DIAGNOSTICS	0.00%	-30000	30000	RO
64	Speed Loop Error Unfiltered			-	-	RO
65	Current Feedback Unfiltered			-	-	RO
66	Current Demand Unfiltered			-	-	RO
67	ACTUAL POS I LIM	DIAGNOSTICS	0.00%	-20000	20000	RO
68	START (C3)	DIAGNOSTICS	OFF	0	1	RO
69	JOG INPUT (C4)	DIAGNOSTICS	OFF	0	1	RO
70	ENABLE (C5)	DIAGNOSTICS	OFF	0	1	RO
71	DIGIN 1 (C6)	DIAGNOSTICS	OFF	0	1	RO
72	DIGIN 2 (C7)	DIAGNOSTICS	OFF	0	1	RO
73	DIGIN 3 (C8)	DIAGNOSTICS	OFF	0	1	RO
74	DIGOUT 1 (B5)	DIAGNOSTICS	ON	0	1	RO
75	DIGOUT 2 (B6)	DIAGNOSTICS	ON	0	1	RO
76	DIGOUT 3 (B7)	DIAGNOSTICS	OFF	0	1	RO
77	AT ZERO SPEED	DIAGNOSTICS	TRUE	0	1	RO
78	AT ZERO SETPOINT	DIAGNOSTICS	TRUE	0	1	RO
79	AT STANDSTILL	DIAGNOSTICS	TRUE	0	1	RO
80	PROGRAM STOP	DIAGNOSTICS	TRUE	0	1	RO
81	SPEED FBK ALARM	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
82	DRIVE START	DIAGNOSTICS	OFF	0	1	RO
83	Main Contactor		Off	0	1	RO
84	DRIVE ENABLE	DIAGNOSTICS	DISABLED	0	1	RO
85	RAMP OUTPUT	DIAGNOSTICS	0.00%	-10000	10000	RO
86	SPT SUM OUTPUT	DIAGNOSTICS	0.00%	-20000	20000	RO
87	POS. I CLAMP	DIAGNOSTICS	0.00%	-20000	20000	RO
88	NEG. I CLAMP	DIAGNOSTICS	0.00%	-20000	20000	RO
89	SPEED DEMAND	DIAGNOSTICS	0.00%	-10500	10500	RO
90	BIPOLAR CLAMPS	SETUP PARAMETERS::CURRENT LOOP	DISABLED	0	1	RW
91	PROG STOP I LIM	SETUP PARAMETERS::STOP RATES	100.00%	0	20000	RW
92	ENCODER ALARM	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
93	IMAX BRK1 (SPD1)	SETUP PARAMETERS::CURRENT PROFILE	200.00%	0	20000	RW
94	AUX DIGOUT 1	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
95	AUX DIGOUT 2	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
96	AUX DIGOUT 3	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
97	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	77	0	499	RW
98	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	122	0	499	RW
99	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	125	0	499	RW
100	INPUT 1	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
101	MIN BS DEAD TIME	SYSTEM::RESERVED	500	0	6000	RW
102	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	90	0	499	RW
103	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	0.01%	-30000	30000	RW
104	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	0.00%	-30000	30000	RW
105	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	118	0	499	RW
106	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	0.01%	-30000	30000	RW
107	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	0.00%	-30000	30000	RW
108	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	119	0	499	RW
109	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	0.01%	-30000	30000	RW
110	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	0.00%	-30000	30000	RW
111	5703 RCV ERROR	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
112	STALL TRIP	DIAGNOSTICS	OK	0	1	RO
113	RAMPING	DIAGNOSTICS	FALSE	0	1	RO
114	Alarm Sequence State			-	-	RO
115	HEALTH WORD	ALARM STATUS	0x4210	0	FFFF	RO
116	HEALTH STORE	ALARM STATUS	0x0000	0	FFFF	RO
117	Health Inhibit Diagnostic			0	FFFF	RO
118	RAMP HOLD	SETUP PARAMETERS::RAMPS	OFF	0	1	RW
119	I DMD. ISOLATE	SETUP PARAMETERS::CURRENT LOOP	DISABLED	0	1	RW
120	ENTER PASSWORD	PASSWORD	0x0000	0	FFFF	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
121	CHANGE PASSWORD	PASSWORD	0x0000	0	FFFF	RW
122	Health Flag (LED)		0	0	1	RO
123	PEEK DATA	SYSTEM::PEEK	0x0078	24	FFFF	RW
124	PEEK SCALE	SYSTEM::PEEK	8	0	65535	RW
125	Ready Flag (LED)		0	0	1	RO
126	MIN SPEED	SETUP PARAMETERS::RAMPS	0.00%	0	10000	RW
127	Dump Enable		0	0	1	RW
128	ANOUT 1	SETUP PARAMETERS::AUX I/O	0.00%	-10000	10000	RW
129	ANOUT 2	SETUP PARAMETERS::AUX I/O	0.00%	-10000	10000	RW
130	MODE	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP	DISABLED	0	4	RW
131	DEADBAND WIDTH	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	0	10000	RW
132	SETPT. RATIO	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0	-30000	30000	RW
133	SETPT. SIGN	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	POSITIVE	0	1	RW
134	SOURCE TAG	SYSTEM::CONFIGURE I/O::CONFIGURE 5703	89	0	499	RW
135	DESTINATION TAG	SYSTEM::CONFIGURE I/O::CONFIGURE 5703	41	0	499	RW
136	FEED FORWARD	SETUP PARAMETERS::CURRENT LOOP	2	10	5000	RW
137	DISCONTINUOUS	SETUP PARAMETERS::CURRENT LOOP	12.00%	0	20000	RW
138	GROUP ID (GID)	SERIAL LINKS::MAIN PORT (P1)	0	0	7	RW
139	UNIT ID (UID)	SERIAL LINKS::MAIN PORT (P1)	0	0	15	RW
140	GROUP ID (GID)	SERIAL LINKS::AUX PORT (P2)	0	0	7	RW
141	UNIT ID (UID)	SERIAL LINKS::AUX PORT (P2)	0	0	15	RW
142	PNO. 7	SERIAL LINKS::MAIN PORT (P1)	0xFFFF	0	FFFF	RW
143	PNO. 7	SERIAL LINKS::AUX PORT (P2)	0xFFFF	0	FFFF	RW
144	CHANGE BAND (BIN)	SERIAL LINKS::MAIN PORT (P1)	0.00%	0	32767	RW
145	CHANGE BAND (BIN)	SERIAL LINKS::AUX PORT (P2)	0.00%	0	32767	RW
146	SRL LINK ENABLE	SERIAL LINKS::MAIN PORT (P1)	ENABLED	0	1	RW
147	SRL LINK ENABLE	SERIAL LINKS::AUX PORT (P2)	ENABLED	0	1	RW
148	ASCII / BINARY	SERIAL LINKS::MAIN PORT (P1)	ASCII	0	1	RW
149	ASCII / BINARY	SERIAL LINKS::AUX PORT (P2)	ASCII	0	1	RW
150	BAUD RATE	SERIAL LINKS::MAIN PORT (P1)	9600	300	19200	RW
151	BAUD RATE	SERIAL LINKS::AUX PORT (P2)	9600	300	19200	RW
152	ESP SUP. (ASCII)	SERIAL LINKS::MAIN PORT (P1)	DISABLED	0	1	RW
153	ESP SUP. (ASCII)	SERIAL LINKS::AUX PORT (P2)	DISABLED	0	1	RW
154	II	SYSTEM::RESERVED	0x5900	0	FFFF	RW
155	Serial Link Version Number					
156	Config Info					
157	Block Length					
158	ERROR REPORT	SERIAL LINKS::MAIN PORT (P1)	0x00C0	-	-	RW
159	ERROR REPORT	SERIAL LINKS::AUX PORT (P2)	0x00C0	-	-	RW
160	Mode Number					
161	AUX START	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
162	MIN MMI CYCLE TM	SYSTEM::RESERVED	80	0	65535	RW
163	ILOOP PI MODE	SYSTEM::RESERVED	2	0	2	RW
164	TOGGLE PERIOD	SYSTEM::RESERVED	160	0	FFFF	RW
165	TOGGLE REF 1	SYSTEM::RESERVED	0.00%	-30000	30000	RW
166	SEL INT/CUR/SPD	SYSTEM::RESERVED	2	0	3	RW
167	TOGGLE REF 2	SYSTEM::RESERVED	0.00%	-30000	30000	RW
168	AUX ENABLE	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
169	FIELD ENABLE	DIAGNOSTICS	DISABLED	0	1	RO
170	FIELD ENABLE	SETUP PARAMETERS::FIELD CONTROL	ENABLED	0	1	RW
171	SETPOINT	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	100.00%	0	10000	RW
172	INT. GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	1.28	0	10000	RW
173	PROP. GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	0.1	0	10000	RW
174	FLD. WEAK ENABLE	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	DISABLED	0	1	RW
175	EMF LEAD	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	2	10	5000	RW
176	EMF LAG	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	40	0	20000	RW
177	EMF GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	0.3	0	10000	RW
178	MAX VOLTS	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100.00%	0	10000	RW
179	MIN FLD CURRENT	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	10.00%	0	10000	RW
180	SPDFBK ALM LEVEL	SETUP PARAMETERS::CALIBRATION	50.00%	0	10000	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
181	Field Current Feedback	Unfiltered				
182	FIELD I CAL	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
183	FIELD DEMAND	DIAGNOSTICS	0.00%	0	10000	RO
184	FLD FIRING ANGLE	DIAGNOSTICS	0 DEG	0	180	RO
185	FLD QUENCH DELAY	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	0.0 SECS	0	6000	RW
186	FLD QUENCH MODE	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	QUENCH	0	1	RW
187	5703 INPUT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0.00%	-30000	30000	RW
188	OVER SPEED LEVEL	SETUP PARAMETERS::CALIBRATION	125.00%	0	20000	RW
189	5703 OUTPUT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0.00%	-30000	30000	RO
190	PEAK HW SLOPE	SYSTEM::RESERVED	163	0	65535	RW
191	BEMF FBK LEAD	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100	10	5000	RW
192	BEMF FBK LAG	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100	10	5000	RW
193	TICK LENGTH	SYSTEM::RESERVED	3502	0	65535	RO
194	DISC ADAPT POT	SYSTEM::RESERVED	2341	0	10000	RW
195	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	0.00%	-30000	30000	RW
196	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	0.00%	-30000	30000	RW
197	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	0.00%	-30000	30000	RW
198	P3 BAUD RATE	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP	9600	300	57600	RW
199	DELAY	SETUP PARAMETERS::INVERSE TIME	10.0 SECS	1	6000	RW
200	RATE	SETUP PARAMETERS::INVERSE TIME	60.0 SECS	1	6000	RW
201	REGEN MODE	SETUP PARAMETERS::CURRENT LOOP	ENABLED	0	1	RW
202	INT. DEFEAT	SETUP PARAMETERS::SPEED LOOP	OFF	0	1	RW
203	INVERSE TIME O/P	DIAGNOSTICS	200.00%	0	20000	RO
204	AIMING POINT	SETUP PARAMETERS::INVERSE TIME	110.00%	0	20000	RW
205	dl/dt	SYSTEM::RESERVED	35.00%	0	20000	RW
206	ENCODER	DIAGNOSTICS	0 RPM	0	6000	RO
207	SPEED FEEDBACK	DIAGNOSTICS	0.00%	-30000	30000	RO
208	RATIO 0	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
209	FLD CTRL MODE IS	SETUP PARAMETERS::FIELD CONTROL	VOLTAGE CONTROL	0	1	RW
210	RATIO OUT/IN	SETUP PARAMETERS::FIELD CONTROL::FLD VOLTAGE VARS	90.00%	0	10000	RW
211	HEALTH INHIBIT	SYSTEM::RESERVED	0x0000	0	FFFF	RW
212	OPERATING MODE	DIAGNOSTICS	STOP	0	7	RO
213	ZERO CUR OFFSET	SYSTEM::RESERVED	0	0	65535	RW
214	ZCD THRESHOLD	SYSTEM::RESERVED	6	0	65535	RW
215	G&L Power Meter					
216	PROG STOP LIMIT	SETUP PARAMETERS::STOP RATES	60.0 SECS	0	6000	RW
217	STOP LIMIT	SETUP PARAMETERS::STOP RATES	60.0 SECS	0	6000	RW
218	JOG SPEED 1	SETUP PARAMETERS::JOG/SLACK	5.00%	-10000	10000	RW
219	JOG SPEED 2	SETUP PARAMETERS::JOG/SLACK	-5.00%	-10000	10000	RW
220	12 BIT DAC	SYSTEM::RESERVED	DISABLED	0	1	RW
221	MMI FILTER T.C.	SYSTEM::RESERVED	80	0	65535	RW
222	PRED STEP	SYSTEM::RESERVED	3	0	65535	RW
223	SCAN THRESHOLD	SYSTEM::RESERVED	4	0	65535	RW
224	STALL TRIP DELAY	SETUP PARAMETERS::CALIBRATION	10.0 SECS	1	6000	RW
225	CRAWL SPEED	SETUP PARAMETERS::JOG/SLACK	10.00%	-10000	10000	RW
226	PEAK HW OFFSET	SYSTEM::RESERVED	195	0	20000	RW
227	AUX JOG	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
228	MODE	SETUP PARAMETERS::JOG/SLACK	FALSE	0	1	RW
229	PRECSN/RESTR CHK	SYSTEM::RESERVED	2	0	3	RW
230	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	1	-30000	30000	RW
231	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	100.00%	-30000	30000	RW
232	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	-100.00%	-30000	30000	RW
233	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	1	-30000	30000	RW
234	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	100.00%	-30000	30000	RW
235	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	-100.00%	-30000	30000	RW
236	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	1	-30000	30000	RW
237	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	100.00%	-30000	30000	RW
238	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	-100.00%	-30000	30000	RW
239	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	1	-30000	30000	RW
240	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	100.00%	-30000	30000	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
241	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	-100.00%	-30000	30000	RW
242	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	1	-30000	30000	RW
243	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	100.00%	-30000	30000	RW
244	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	-100.00%	-30000	30000	RW
245	% TO GET 10V	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	100.00%	-30000	30000	RW
246	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	100	0	499	RW
247	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	301	0	499	RW
248	% TO GET 10V	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	100.00%	-30000	30000	RW
249	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	5	0	499	RW
250	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	48	0	499	RW
251	SOURCE TAG	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	62	0	499	RW
252	SOURCE TAG	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	63	0	499	RW
253	TAKE UP 1	SETUP PARAMETERS::JOG/SLACK	5.00%	-10000	10000	RW
254	TAKE UP 2	SETUP PARAMETERS::JOG/SLACK	-5.00%	-10000	10000	RW
255	RESET VALUE	SETUP PARAMETERS::RAISE/LOWER	0.00%	-30000	30000	RW
256	INCREASE RATE	SETUP PARAMETERS::RAISE/LOWER	10.0 SECS	1	6000	RW
257	DECREASE RATE	SETUP PARAMETERS::RAISE/LOWER	10.0 SECS	1	6000	RW
258	MIN VALUE	SETUP PARAMETERS::RAISE/LOWER	-100.00%	-30000	30000	RW
259	MAX VALUE	SETUP PARAMETERS::RAISE/LOWER	100.00%	-30000	30000	RW
260	RAISE/LOWER DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
261	RAISE INPUT	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
262	LOWER INPUT	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
263	STALL THRESHOLD	SETUP PARAMETERS::CALIBRATION	95.00%	0	20000	RW
264	RAISE/LOWER O/P	DIAGNOSTICS	0.00%	-30000	30000	RO
265	ANALOG IP OFFSET	SYSTEM::RESERVED	2	-30000	30000	RW
266	% S-RAMP	SETUP PARAMETERS::RAMPS	2.50%	0	10000	RW
267	Reserved					
268	MODE	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	0	0	3	RW
269	SPD BRK1 (LOW)	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	1.00%	0	10000	RW
270	SPD BRK2 (HIGH)	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	5.00%	0	10000	RW
271	PROP. GAIN	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	5	0	20000	RW
272	INT. TIME CONST.	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	0.500 SECS	1	30000	RW
273	POS. LOOP P GAIN	SETUP PARAMETERS::SPEED LOOP::ADVANCED	0.00%	-20000	20000	RW
274	I GAIN IN RAMP	SETUP PARAMETERS::SPEED LOOP::ADVANCED	1	0	20000	RW
275	I COMP	SETUP PARAMETERS::SPEED LOOP::ADVANCED	0.00%	-10000	10000	RW
276	PLL PROP	SYSTEM::RESERVED	80	0	20000	RW
277	PLL INT	SYSTEM::RESERVED	32	0	20000	RW
278	PLL Error		0	-	-	RO
279	ARM ENDSTOP	SYSTEM::RESERVED	12200	0	20000	RW
280	HF C/O DISC GAIN	SYSTEM::RESERVED	1800	0	20000	RW
281	HF C/O FILTER TC	SYSTEM::RESERVED	3	0	20000	RW
282	BEMF THRESHOLD	SYSTEM::RESERVED	4	0	20000	RW
283	SCAN TC	SYSTEM::RESERVED	10	0	20000	RW
284	ZERO SPD. LEVEL	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ZERO SPD. QUENCH	0.50%	0	20000	RW
285	ZERO IAD LEVEL	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ZERO SPD. QUENCH	1.50%	0	20000	RW
286	RAMPING THRESH.	SETUP PARAMETERS::RAMPS	0.50%	0	10000	RW
287	AUTO RESET	SETUP PARAMETERS::RAMPS	ENABLED	0	1	RW
288	EXTERNAL RESET	SETUP PARAMETERS::RAMPS	DISABLED	0	1	RW
289	SETPOINT 1	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
290	SETPOINT 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RO
291	SETPOINT 3	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
292	SIGN 0	SETUP PARAMETERS::SETPOINT SUM 1	POSITIVE	0	1	RW
293	RAMP O/P DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	291	0	499	RW
294	SPT SUM 1 DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	289	0	499	RW
295	User Filter Input		0	-30000	30000	RW
296	User Filter Output		0	-30000	30000	RO
297	SPEED ERROR	DIAGNOSTICS	0.00%	-30000	30000	RO
298	CURRENT FEEDBACK	DIAGNOSTICS	0.00%	-30000	30000	RO
299	CURRENT DEMAND	DIAGNOSTICS	0.00%	-30000	30000	RO
300	FIELD I FBK.	DIAGNOSTICS	0.00%	-30000	30000	RO

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
301	POS. I CLAMP	SETUP PARAMETERS::CURRENT LOOP	0.00%	-10000	10000	RW
302	CONTACTOR DELAY	SETUP PARAMETERS::STOP RATES	1.0 SECS	1	6000	RW
303	Reserved					
304	Reserved			0	1	RW
305	TRIP RESET	SETUP PARAMETERS::INHIBIT ALARMS	TRUE	0	1	RW
306	SOURCE TAG	SETUP PARAMETERS::STANDSTILL	89	0	499	RW
307	EXTERNAL RESET	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
308	TACH INPUT (B2)	DIAGNOSTICS	0.00%	-30000	30000	RO
309	INPUT 0	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
310	AUTOCAL	SYSTEM::RESERVED	ENABLED	0	1	RW
311	IINST OFFSET	SYSTEM::RESERVED	2	0	20000	RW
312	PNO 112	SERIAL LINKS::PNOCONFIG	0	0	499	RW
313	PNO 113	SERIAL LINKS::PNOCONFIG	0	0	499	RW
314	PNO 114	SERIAL LINKS::PNOCONFIG	0	0	499	RW
315	PNO 115	SERIAL LINKS::PNOCONFIG	0	0	499	RW
316	PNO 116	SERIAL LINKS::PNOCONFIG	0	0	499	RW
317	PNO 117	SERIAL LINKS::PNOCONFIG	0	0	499	RW
318	PNO 118	SERIAL LINKS::PNOCONFIG	0	0	499	RW
319	PNO 119	SERIAL LINKS::PNOCONFIG	0	0	499	RW
320	PNO 120	SERIAL LINKS::PNOCONFIG	379	0	499	RW
321	PNO 121	SERIAL LINKS::PNOCONFIG	380	0	499	RW
322	PNO 122	SERIAL LINKS::PNOCONFIG	381	0	499	RW
323	PNO 123	SERIAL LINKS::PNOCONFIG	382	0	499	RW
324	PNO 124	SERIAL LINKS::PNOCONFIG	383	0	499	RW
325	PNO 125	SERIAL LINKS::PNOCONFIG	384	0	499	RW
326	PNO 126	SERIAL LINKS::PNOCONFIG	385	0	499	RW
327	PNO 127	SERIAL LINKS::PNOCONFIG	0	0	499	RW
328	ESP SUP. (ASCII)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	DISABLED	0	1	RW
329	GROUP ID (GID)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0	0	7	RW
330	UNIT ID (UID)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0	0	15	RW
331	CHANGEBAND (BIN)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0.00%	0	32767	RW
332	ERROR REPORT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0x00CO	-	-	RW
333	PNO. 7	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0xFFFF	0	FFFF	RW
334	PARITY	SERIAL LINKS::MAIN PORT (P1)	EVEN	0	1	RW
335	DISABLE MEAN FBK	SYSTEM::RESERVED	FALSE	0	1	RW
336	CHANGEOVER BIAS	SYSTEM::RESERVED	0x4780	-	-	RW
337	Thermistor State (Warning)			0	1	RO
338	Reserved			0	1	RO
339	VALUE 1	SYSTEM::miniLINK	0.00%	-30000	30000	RW
340	VALUE 2	SYSTEM::miniLINK	0.00%	-30000	30000	RW
341	VALUE 3	SYSTEM::miniLINK	0.00%	-30000	30000	RW
342	VALUE 4	SYSTEM::miniLINK	0.00%	-30000	30000	RW
343	VALUE 5	SYSTEM::miniLINK	0.00%	-30000	30000	RW
344	VALUE 6	SYSTEM::miniLINK	0.00%	-30000	30000	RW
345	VALUE 7	SYSTEM::miniLINK	0.00%	-30000	30000	RW
346	LOGIC 1	SYSTEM::miniLINK	OFF	0	1	RW
347	LOGIC 2	SYSTEM::miniLINK	OFF	0	1	RW
348	LOGIC 3	SYSTEM::miniLINK	OFF	0	1	RW
349	LOGIC 4	SYSTEM::miniLINK	OFF	0	1	RW
350	LOGIC 5	SYSTEM::miniLINK	OFF	0	1	RW
351	LOGIC 6	SYSTEM::miniLINK	OFF	0	1	RW
352	LOGIC 7	SYSTEM::miniLINK	OFF	0	1	RW
353	LOGIC 8	SYSTEM::miniLINK	OFF	0	1	RW
354	EEProm Write		0	0	2	RW
355	RAMP RATE	SETUP PARAMETERS::JOG/SLACK	1.0 SECS	1	6000	RW
356	Speed Loop Output		0	-20000	20000	RO
357	MAX DEMAND	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	105.00%	0	10500	RW
358	MIN DEMAND	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	-105.00%	-10500	0	RW
359	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	FALSE	0	1	RW
360	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	FALSE	0	1	RW



TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
361	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	FALSE	0	1	RW
362	MODULUS	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	FALSE	0	1	RW
363	MODULUS	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	FALSE	0	1	RW
364	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 1	0	0	499	RW
365	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 1	0	0	499	RW
366	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 2	0	0	499	RW
367	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 2	0	0	499	RW
368	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 3	0	0	499	RW
369	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 3	0	0	499	RW
370	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 4	0	0	499	RW
371	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 4	0	0	499	RW
372	Raise Lower Delta		0	-	-	RO
373	System Ramp Delta		0	-	-	RO
374	System Reset		0	0	1	RO
375	LIMIT	SETUP PARAMETERS::SETPOINT SUM 1	105.00%	0	20000	RW
376	Running		0	0	1	RO
377	UDP Length			-	-	RW
378	UDP Base			-	-	RW
379	VALUE 8	SYSTEM::miniLINK	0.00%	-30000	30000	RW
380	VALUE 9	SYSTEM::miniLINK	0.00%	-30000	30000	RW
381	VALUE 10	SYSTEM::miniLINK	0.00%	-30000	30000	RW
382	VALUE 11	SYSTEM::miniLINK	0.00%	-30000	30000	RW
383	VALUE 12	SYSTEM::miniLINK	0.00%	-30000	30000	RW
384	VALUE 13	SYSTEM::miniLINK	0.00%	-30000	30000	RW
385	VALUE 14	SYSTEM::miniLINK	0.00%	-30000	30000	RW
386	FILTER T.C.	SYSTEM::RESERVED	20	0	20000	RW
387	Reserved					
388	SYNC OFFSET	SYSTEM::RESERVED	0	-30000	30000	RW
389	Reserved					
390	Reserved					
391	Reserved					
392	Reserved					
393	Reserved					
394	Reserved					
395	Reserved					
396	Reserved					
397	Reserved					
398	Reserved					
399	Reserved					
400	PID O/P DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
401	DERIVATIVE TC	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.000 SECS	0	10000	RW
402	INT. TIME CONST.	SETUP PARAMETERS::SPECIAL BLOCKS::PID	5.00 SECS	1	10000	RW
403	FILTER T.C.	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.100 SECS	0	10000	RW
404	PROP. GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	0	1000	RW
405	POSITIVE LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	100.00%	0	10500	RW
406	NEGATIVE LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	-100.00%	-10500	0	RW
407	O/P SCALER(TRIM)	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.2	-30000	30000	RW
408	ENABLE	SETUP PARAMETERS::SPECIAL BLOCKS::PID	ENABLED	0	1	RW
409	INT. DEFEAT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	OFF	0	1	RW
410	INPUT 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.00%	-30000	30000	RW
411	INPUT 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.00%	-30000	30000	RW
412	RATIO 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
413	RATIO 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
414	DIVIDER 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
415	PID ERROR	DIAGNOSTICS	0.00%	-10500	10500	RO
416	PID CLAMPED	DIAGNOSTICS	FALSE	0	1	RO
417	PID OUTPUT	DIAGNOSTICS	0.00%	-31500	31500	RO
418	DIVIDER 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
419	DIVIDER 1	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
420	DIVIDER 0	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
421	MAIN CURR. LIMIT	SETUP PARAMETERS::CURRENT LOOP	200.00%	0	20000	RW
422	RESET VALUE	SETUP PARAMETERS::RAMPS	0.00%	-30000	30000	RW
423	INPUT 2	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
424	LINE SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	-10500	10500	RW
425	MIN DIAMETER	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	10.00%	0	10000	RW
426	MIN SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	5.00%	0	10000	RW
427	DIAMETER	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	0	10000	RO
428	Modulus of Line Speed		0.00%	0	10500	RO
429	Modulus of Reel Speed		0.00%	0	10500	RO
430	Diameter Unfiltered		0.00%	0	10000	RO
431	DIAMETER	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
432	TORQUE DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	0.00%	-20000	20000	RW
433	TENSION ENABLE	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	ENABLED	0	1	RW
434	OVER WIND	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	ENABLED	0	1	RW
435	POS. I CLAMP	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
436	NEG. I CLAMP	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
437	REEL SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	-10500	10500	RW
438	TAPER	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RW
439	TENSION SPT.	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	0	10000	RW
440	TENSION TRIM	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RW
441	TOT.TENS.DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RO
442	TAPER	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
443	INPUT 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
444	INPUT 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
445	INPUT 2	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
446	RATIO 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
447	RATIO 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
448	DIVIDER 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
449	LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	100.00%	0	20000	RW
450	SETPOINT SUM 2	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
451	SPT SUM OUTPUT	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-20000	20000	RO
452	TAPERED DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	0	10000	RO
453	RAMP RATE	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	5.0 SECS	1	6000	RW
454	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 5	0	0	499	RW
455	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 5	0	0	499	RW
456	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 6	0	0	499	RW
457	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 6	0	0	499	RW
458	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 7	0	0	499	RW
459	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 7	0	0	499	RW
460	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 8	0	0	499	RW
461	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 8	0	0	499	RW
462	RESET VALUE	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	10.00%	0	10000	RW
463	EXTERNAL RESET	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	DISABLED	0	1	RW
464	OFFSET	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	0.00%	-10000	10000	RW
465	OFFSET	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	0.00%	-10000	10000	RW
466	DIVIDER 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
467	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 9	0	0	499	RW
468	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 9	0	0	499	RW
469	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 10	0	0	499	RW
470	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 10	0	0	499	RW
471	STANDBY FIELD	SYSTEM::RESERVED	50.00%	0	10000	RW
472	Speed Feedback State (Warning)		0	0	1	RO
473	MODE	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0	0	4	RW
474	MIN PROFILE GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	20.00%	0	10000	RW
475	PROFILED GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0	0	1000	RO
476	3-PHASE FIELD	SYSTEM::RESERVED	DISABLED			RW
	LANGUAGE	MENUS	ENGLISH			RW
	UP TO ACTION	PARAMETER SAVE				RW
	DUMP MMI -> P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
	UDP XFER <- P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
	UDP XFER -> P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
	SOFTWARE	SYSTEM	ISSUE: 3.2			RW

## Appendix J PARAMETER LIST BY MENU

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
116	HEALTH STORE	ALARM STATUS	0x0000	0	FFFF	RO
115	HEALTH WORD	ALARM STATUS	0x4210	0	FFFF	RO
61	ACTUAL NEG I LIM	DIAGNOSTICS	0.00%	-20000	20000	RO
67	ACTUAL POS I LIM	DIAGNOSTICS	0.00%	-20000	20000	RO
50	ANIN 1 (A2)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
51	ANIN 2 (A3)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
52	ANIN 3 (A4)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
53	ANIN 4 (A5)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
54	ANIN 5 (A6)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
55	ANOUT 1 (A7)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
56	ANOUT 2 (A8)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
42	AT CURRENT LIMIT	DIAGNOSTICS	FALSE	0	1	RO
79	AT STANDSTILL	DIAGNOSTICS	TRUE	0	1	RO
78	AT ZERO SETPOINT	DIAGNOSTICS	TRUE	0	1	RO
77	AT ZERO SPEED	DIAGNOSTICS	TRUE	0	1	RO
60	BACK EMF	DIAGNOSTICS	0.00%	-15000	15000	RO
299	CURRENT DEMAND	DIAGNOSTICS	0.00%	-30000	30000	RO
298	CURRENT FEEDBACK	DIAGNOSTICS	0.00%	-30000	30000	RO
71	DIGIN 1 (C6)	DIAGNOSTICS	OFF	0	1	RO
72	DIGIN 2 (C7)	DIAGNOSTICS	OFF	0	1	RO
73	DIGIN 3 (C8)	DIAGNOSTICS	OFF	0	1	RO
74	DIGOUT 1 (B5)	DIAGNOSTICS	ON	0	1	RO
75	DIGOUT 2 (B6)	DIAGNOSTICS	ON	0	1	RO
76	DIGOUT 3 (B7)	DIAGNOSTICS	OFF	0	1	RO
84	DRIVE ENABLE	DIAGNOSTICS	DISABLED	0	1	RO
82	DRIVE START	DIAGNOSTICS	OFF	0	1	RO
70	ENABLE (C5)	DIAGNOSTICS	OFF	0	1	RO
206	ENCODER	DIAGNOSTICS	0 RPM	0	6000	RO
183	FIELD DEMAND	DIAGNOSTICS	0.00%	0	10000	RO
169	FIELD ENABLE	DIAGNOSTICS	DISABLED	0	1	RO
300	FIELD I FBK.	DIAGNOSTICS	0.00%	-30000	30000	RO
184	FLD.FIRING ANGLE	DIAGNOSTICS	0 DEG	0	180	RO
203	INVERSE TIME O/P	DIAGNOSTICS	200.00%	0	20000	RO
69	JOG INPUT (C4)	DIAGNOSTICS	OFF	0	1	RO
88	NEG. I CLAMP	DIAGNOSTICS	0.00%	-20000	20000	RO
212	OPERATING MODE	DIAGNOSTICS	STOP	0	7	RO
416	PID CLAMPED	DIAGNOSTICS	FALSE	0	1	RO
415	PID ERROR	DIAGNOSTICS	0.00%	-10500	10500	RO
417	PID OUTPUT	DIAGNOSTICS	0.00%	-31500	31500	RO
87	POS. I CLAMP	DIAGNOSTICS	0.00%	-20000	20000	RO
80	PROGRAM STOP	DIAGNOSTICS	TRUE	0	1	RO
264	RAISE/LOWER O/P	DIAGNOSTICS	0.00%	-30000	30000	RO
85	RAMP OUTPUT	DIAGNOSTICS	0.00%	-10000	10000	RO
113	RAMPING	DIAGNOSTICS	FALSE	0	1	RO
89	SPEED DEMAND	DIAGNOSTICS	0.00%	-10500	10500	RO
297	SPEED ERROR	DIAGNOSTICS	0.00%	-30000	30000	RO
207	SPEED FEEDBACK	DIAGNOSTICS	0.00%	-30000	30000	RO
63	SPEED SETPOINT	DIAGNOSTICS	0.00%	-30000	30000	RO
86	SPT SUM OUTPUT	DIAGNOSTICS	0.00%	-20000	20000	RO
112	STALL TRIP	DIAGNOSTICS	OK	0	1	RO
68	START (C3)	DIAGNOSTICS	OFF	0	1	RO
308	TACH INPUT (B2)	DIAGNOSTICS	0.00%	-30000	30000	RO
57	TERMINAL VOLTS	DIAGNOSTICS	0.00%	-12500	12500	RO
37	FULL MENUS	MENUS	ENABLED	0	1	RW
	LANGUAGE	MENUS	ENGLISH			RW
38	MENU DELAY	MENUS	30	0	65535	RW
	UP TO ACTION	PARAMETER SAVE				RW
121	CHANGE PASSWORD	PASSWORD	0x0000	0	FFFF	RW
120	ENTER PASSWORD	PASSWORD	0x0000	0	FFFF	RW
149	ASCII / BINARY	SERIAL LINKS::AUX PORT (P2)	ASCII	0	1	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
151	BAUD RATE	SERIAL LINKS::AUX PORT (P2)	9600	300	19200	RW
145	CHANGE BAND (BIN)	SERIAL LINKS::AUX PORT (P2)	0.00%	0	32767	RW
159	ERROR REPORT	SERIAL LINKS::AUX PORT (P2)	0x00CO	-	-	RW
153	ESP SUP. (ASCII)	SERIAL LINKS::AUX PORT (P2)	DISABLED	0	1	RW
140	GROUP ID (GID)	SERIAL LINKS::AUX PORT (P2)	0	0	7	RW
143	PNO. 7	SERIAL LINKS::AUX PORT (P2)	0xFFFF	0	FFFF	RW
147	SRL LINK ENABLE	SERIAL LINKS::AUX PORT (P2)	ENABLED	0	1	RW
141	UNIT ID (UID)	SERIAL LINKS::AUX PORT (P2)	0	0	15	RW
148	ASCII / BINARY	SERIAL LINKS::MAIN PORT (P1)	ASCII	0	1	RW
150	BAUD RATE	SERIAL LINKS::MAIN PORT (P1)	9600	300	19200	RW
144	CHANGE BAND (BIN)	SERIAL LINKS::MAIN PORT (P1)	0.00%	0	32767	RW
158	ERROR REPORT	SERIAL LINKS::MAIN PORT (P1)	0x00CO	-	-	RW
152	ESP SUP. (ASCII)	SERIAL LINKS::MAIN PORT (P1)	DISABLED	0	1	RW
138	GROUP ID (GID)	SERIAL LINKS::MAIN PORT (P1)	0	0	7	RW
334	PARITY	SERIAL LINKS::MAIN PORT (P1)	EVEN	0	1	RW
142	PNO. 7	SERIAL LINKS::MAIN PORT (P1)	0xFFFF	0	FFFF	RW
146	SRL LINK ENABLE	SERIAL LINKS::MAIN PORT (P1)	ENABLED	0	1	RW
139	UNIT ID (UID)	SERIAL LINKS::MAIN PORT (P1)	0	0	15	RW
312	PNO 112	SERIAL LINKS::PNOCONFIG	0	0	499	RW
313	PNO 113	SERIAL LINKS::PNOCONFIG	0	0	499	RW
314	PNO 114	SERIAL LINKS::PNOCONFIG	0	0	499	RW
315	PNO 115	SERIAL LINKS::PNOCONFIG	0	0	499	RW
316	PNO 116	SERIAL LINKS::PNOCONFIG	0	0	499	RW
317	PNO 117	SERIAL LINKS::PNOCONFIG	0	0	499	RW
318	PNO 118	SERIAL LINKS::PNOCONFIG	0	0	499	RW
319	PNO 119	SERIAL LINKS::PNOCONFIG	0	0	499	RW
320	PNO 120	SERIAL LINKS::PNOCONFIG	379	0	499	RW
321	PNO 121	SERIAL LINKS::PNOCONFIG	380	0	499	RW
322	PNO 122	SERIAL LINKS::PNOCONFIG	381	0	499	RW
323	PNO 123	SERIAL LINKS::PNOCONFIG	382	0	499	RW
324	PNO 124	SERIAL LINKS::PNOCONFIG	383	0	499	RW
325	PNO 125	SERIAL LINKS::PNOCONFIG	384	0	499	RW
326	PNO 126	SERIAL LINKS::PNOCONFIG	385	0	499	RW
327	PNO 127	SERIAL LINKS::PNOCONFIG	0	0	499	RW
	DUMP MMI -> P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
	UDP XFER -> P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
	UDP XFER <- P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
130	MODE	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP	DISABLED	0	4	RW
198	P3 BAUD RATE	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP	9600	300	57600	RW
187	5703 INPUT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0.00%	-30000	30000	RW
189	5703 OUTPUT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0.00%	-30000	30000	RO
132	SETPT. RATIO	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0	-30000	30000	RW
133	SETPT. SIGN	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	POSITIVE	0	1	RW
332	ERROR REPORT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0x00CO	-	-	RW
329	GROUP ID (GID)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0	0	7	RW
330	UNIT ID (UID)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0	0	15	RW
128	ANOUT 1	SETUP PARAMETERS::AUX I/O	0.00%	-10000	10000	RW
129	ANOUT 2	SETUP PARAMETERS::AUX I/O	0.00%	-10000	10000	RW
94	AUX DIGOUT 1	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
95	AUX DIGOUT 2	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
96	AUX DIGOUT 3	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
168	AUX ENABLE	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
227	AUX JOG	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
161	AUX START	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
23	ANALOG TACH CAL	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
25	ARMATURE I (A9)	SETUP PARAMETERS::CALIBRATION	BIPOLAR	0	1	RW
20	ARMATURE V CAL.	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
24	ENCODER LINES	SETUP PARAMETERS::CALIBRATION	1000	10	5000	RW
22	ENCODER RPM	SETUP PARAMETERS::CALIBRATION	1000 RPM	0	6000	RW
182	FIELD I CAL.	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
21	IR COMPENSATION	SETUP PARAMETERS::CALIBRATION	0.00%	0	10000	RW
180	SPDFBK ALM LEVEL	SETUP PARAMETERS::CALIBRATION	50.00%	0	10000	RW
263	STALL THRESHOLD	SETUP PARAMETERS::CALIBRATION	95.00%	0	20000	RW
224	STALL TRIP DELAY	SETUP PARAMETERS::CALIBRATION	10.0 SECS	1	6000	RW
10	ZERO SPD. OFFSET	SETUP PARAMETERS::CALIBRATION	0.00%	-500	500	RW
30	ADDITIONAL DEM	SETUP PARAMETERS::CURRENT LOOP	0.00%	-20000	20000	RW
18	AUTOTUNE	SETUP PARAMETERS::CURRENT LOOP	OFF	0	1	RW
90	BIPOLAR CLAMPS	SETUP PARAMETERS::CURRENT LOOP	DISABLED	0	1	RW
15	CUR.LIMIT/SCALER	SETUP PARAMETERS::CURRENT LOOP	100.00%	0	20000	RW
137	DISCONTINUOUS	SETUP PARAMETERS::CURRENT LOOP	12.00%	0	20000	RW
119	I DMD. ISOLATE	SETUP PARAMETERS::CURRENT LOOP	DISABLED	0	1	RW
17	INT. GAIN	SETUP PARAMETERS::CURRENT LOOP	3.5	0	20000	RW
421	MAIN CURR. LIMIT	SETUP PARAMETERS::CURRENT LOOP	200.00%	0	20000	RW
48	NEG. I CLAMP	SETUP PARAMETERS::CURRENT LOOP	0.00%	-10000	10000	RW
301	POS. I CLAMP	SETUP PARAMETERS::CURRENT LOOP	0.00%	-10000	10000	RW
16	PROP. GAIN	SETUP PARAMETERS::CURRENT LOOP	45	0	20000	RW
201	REGEN MODE	SETUP PARAMETERS::CURRENT LOOP	ENABLED	0	1	RW
93	IMAX BRK1(SPD1)	SETUP PARAMETERS::CURRENT PROFILE	200.00%	0	20000	RW
33	IMAX BRK2(SPD2)	SETUP PARAMETERS::CURRENT PROFILE	200.00%	0	20000	RW
32	SPD BRK1 (LOW)	SETUP PARAMETERS::CURRENT PROFILE	100.00%	0	10000	RW
31	SPD BRK2 (HIGH)	SETUP PARAMETERS::CURRENT PROFILE	100.00%	0	10000	RW
170	FIELD ENABLE	SETUP PARAMETERS::FIELD CONTROL	ENABLED	0	1	RW
209	FLD CTRL MODE IS	SETUP PARAMETERS::FIELD CONTROL	VOLTAGE CONTROL	0	1	RW
185	FLD QUENCH DELAY	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	0.0 SECS	0	6000	RW
186	FLD. QUENCH MODE	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	QUENCH	0	1	RW
172	INT. GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	1.28	0	10000	RW
173	PROP. GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	0.1	0	10000	RW
171	SETPOINT	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	100.00%	0	10000	RW
192	BEMF FBK LAG	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100	10	5000	RW
191	BEMF FBK LEAD	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100	10	5000	RW
177	EMF GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	0.3	0	10000	RW
176	EMF LAG	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	40	0	20000	RW
175	EMF LEAD	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	2	10	5000	RW
174	FLD. WEAK ENABLE	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	DISABLED	0	1	RW
178	MAX VOLTS	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100.00%	0	10000	RW
179	MIN FLD CURRENT	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	10.00%	0	10000	RW
210	RATIO OUT/IN	SETUP PARAMETERS::FIELD CONTROL::FLD VOLTAGE VARS	90.00%	0	10000	RW
111	5703 RCV ERROR	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
92	ENCODER ALARM	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
19	FIELD FAIL	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
81	SPEED FBK ALARM	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
28	STALL TRIP	SETUP PARAMETERS::INHIBIT ALARMS	INHIBITED	0	1	RW
305	TRIP RESET	SETUP PARAMETERS::INHIBIT ALARMS	TRUE	0	1	RW
225	CRAWL SPEED	SETUP PARAMETERS::JOG/SLACK	10.00%	-10000	10000	RW
218	JOG SPEED 1	SETUP PARAMETERS::JOG/SLACK	5.00%	-10000	10000	RW
219	JOG SPEED 2	SETUP PARAMETERS::JOG/SLACK	-5.00%	-10000	10000	RW
228	MODE	SETUP PARAMETERS::JOG/SLACK	FALSE	0	1	RW
355	RAMP RATE	SETUP PARAMETERS::JOG/SLACK	1.0 SECS	1	6000	RW
253	TAKE UP 1	SETUP PARAMETERS::JOG/SLACK	5.00%	-10000	10000	RW
254	TAKE UP 2	SETUP PARAMETERS::JOG/SLACK	-5.00%	-10000	10000	RW
257	DECREASE RATE	SETUP PARAMETERS::RAISE/LOWER	10.0 SECS	1	6000	RW
307	EXTERNAL RESET	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
256	INCREASE RATE	SETUP PARAMETERS::RAISE/LOWER	10.0 SECS	1	6000	RW
262	LOWER INPUT	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
259	MAX VALUE	SETUP PARAMETERS::RAISE/LOWER	100.00%	-30000	30000	RW
258	MIN VALUE	SETUP PARAMETERS::RAISE/LOWER	-100.00%	-30000	30000	RW
261	RAISE INPUT	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
255	RESET VALUE	SETUP PARAMETERS::RAISE/LOWER	0.00%	-30000	30000	RW
266	% S-RAMP	SETUP PARAMETERS::RAMPS	2.50%	0	10000	RW
287	AUTO RESET	SETUP PARAMETERS::RAMPS	ENABLED	0	1	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
288	EXTERNAL RESET	SETUP PARAMETERS::RAMPS	DISABLED	0	1	RW
126	MIN SPEED	SETUP PARAMETERS::RAMPS	0.00%	0	10000	RW
2	RAMP ACCEL TIME	SETUP PARAMETERS::RAMPS	10.0 SECS	1	6000	RW
3	RAMP DECEL TIME	SETUP PARAMETERS::RAMPS	10.0 SECS	1	6000	RW
118	RAMP HOLD	SETUP PARAMETERS::RAMPS	OFF	0	1	RW
5	RAMP INPUT	SETUP PARAMETERS::RAMPS	0.00%	-10000	10000	RW
286	RAMPING THRESH.	SETUP PARAMETERS::RAMPS	0.50%	0	10000	RW
422	RESET VALUE	SETUP PARAMETERS::RAMPS	0.00%	-30000	30000	RW
131	DEADBAND WIDTH	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	0	10000	RW
420	DIVIDER 0	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
419	DIVIDER 1	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
309	INPUT 0	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
100	INPUT 1	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
423	INPUT 2	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
375	LIMIT	SETUP PARAMETERS::SETPOINT SUM 1	105.00%	0	20000	RW
208	RATIO 0	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
6	RATIO 1	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
292	SIGN 0	SETUP PARAMETERS::SETPOINT SUM 1	POSITIVE	0	1	RW
8	SIGN 1	SETUP PARAMETERS::SETPOINT SUM 1	POSITIVE	0	1	RW
427	DIAMETER	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	0	10000	RO
463	EXTERNAL RESET	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	DISABLED	0	1	RW
424	LINE SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	-10500	10500	RW
425	MIN DIAMETER	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	10.00%	0	10000	RW
426	MIN SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	5.00%	0	10000	RW
453	RAMP RATE	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	5.0 SECS	1	6000	RW
437	REEL SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	-10500	10500	RW
462	RESET VALUE	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	10.00%	0	10000	RW
401	DERIVATIVE TC	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.000 SECS	0	10000	RW
418	DIVIDER 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
414	DIVIDER 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
408	ENABLE	SETUP PARAMETERS::SPECIAL BLOCKS::PID	ENABLED	0	1	RW
403	FILTER T.C.	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.100 SECS	0	10000	RW
410	INPUT 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.00%	-30000	30000	RW
411	INPUT 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.00%	-30000	30000	RW
409	INT. DEFEAT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	OFF	0	1	RW
402	INT. TIME CONST.	SETUP PARAMETERS::SPECIAL BLOCKS::PID	5.00 SECS	1	10000	RW
474	MIN PROFILE GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	20.00%	0	10000	RW
473	MODE	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0	0	4	RW
406	NEGATIVE LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	-100.00%	-10500	0	RW
407	O/P SCALER(TRIM)	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.2	-30000	30000	RW
405	POSITIVE LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	100.00%	0	10500	RW
475	PROFIED GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0	0	1000	RO
404	PROP. GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	0	1000	RW
412	RATIO 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
413	RATIO 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
448	DIVIDER 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
466	DIVIDER 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
444	INPUT 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
443	INPUT 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
445	INPUT 2	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
449	LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	100.00%	0	20000	RW
447	RATIO 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
446	RATIO 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
451	SPT SUM OUTPUT	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-20000	20000	RO
438	TAPER	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RW
452	TAPERED DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	0	10000	RO
439	TENSION SPT.	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	0	10000	RW
440	TENSION TRIM	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RW
441	TOT.TENS.DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RO
434	OVER WIND	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	ENABLED	0	1	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
433	TENSION ENABLE	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	ENABLED	0	1	RW
432	TORQUE DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	0.00%	-20000	20000	RW
49	ENCODER SIGN	SETUP PARAMETERS::SPEED LOOP	POSITIVE	0	1	RW
202	INT. DEFEAT	SETUP PARAMETERS::SPEED LOOP	OFF	0	1	RW
13	INT. TIME CONST.	SETUP PARAMETERS::SPEED LOOP	0.500 SECS	1	30000	RW
14	PROP. GAIN	SETUP PARAMETERS::SPEED LOOP	10	0	20000	RW
47	SPEED FBK SELECT	SETUP PARAMETERS::SPEED LOOP	ARM VOLTS FBK	0	3	RW
274	I GAIN IN RAMP	SETUP PARAMETERS::SPEED LOOP::ADVANCED	1	0	20000	RW
272	INT. TIME CONST.	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	0.500 SECS	1	30000	RW
268	MODE	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	0	0	3	RW
271	PROP. GAIN	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	5	0	20000	RW
269	SPD BRK1 (LOW)	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	1.00%	0	10000	RW
270	SPD BRK2 (HIGH)	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	5.00%	0	10000	RW
285	ZERO IAD LEVEL	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ZERO SPD. QUENCH	1.50%	0	20000	RW
284	ZERO SPD. LEVEL	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ZERO SPD. QUENCH	0.50%	0	20000	RW
357	MAX DEMAND	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	105.00%	0	10500	RW
358	MIN DEMAND	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	-105.00%	-10500	0	RW
7	RATIO 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	1	-30000	30000	RW
289	SETPOINT 1	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
290	SETPOINT 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RO
291	SETPOINT 3	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
41	SETPOINT 4	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
9	SIGN 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	POSITIVE	0	1	RW
11	STANDSTILL LOGIC	SETUP PARAMETERS::STANDSTILL	DISABLED	0	1	RW
12	ZERO THRESHOLD	SETUP PARAMETERS::STANDSTILL	2.00%	0	10000	RW
302	CONTACTOR DELAY	SETUP PARAMETERS::STOP RATES	1.0 SECS	1	6000	RW
91	PROG STOP LIM	SETUP PARAMETERS::STOP RATES	100.00%	0	20000	RW
216	PROG STOP LIMIT	SETUP PARAMETERS::STOP RATES	60.0 SECS	0	6000	RW
26	PROG STOP TIME	SETUP PARAMETERS::STOP RATES	0.1 SECS	1	6000	RW
217	STOP LIMIT	SETUP PARAMETERS::STOP RATES	60.0 SECS	0	6000	RW
27	STOP TIME	SETUP PARAMETERS::STOP RATES	10.0 SECS	1	6000	RW
29	STOP ZERO SPEED	SETUP PARAMETERS::STOP RATES	2.00%	0	10000	RW
39	SOFTWARE CONFIGURE ENABLE	SYSTEM	ISSUE: 3.2			RW
230	CALIBRATION	SYSTEM::CONFIGURE I/O	DISABLED	0	1	RW
246	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	1	-30000	30000	RW
231	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	100	0	499	RW
232	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	100.00%	-30000	30000	RW
233	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	1	-30000	30000	RW
234	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	100.00%	-30000	30000	RW
235	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	-100.00%	-30000	30000	RW
236	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	1	-30000	30000	RW
249	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	5	0	499	RW
237	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	100.00%	-30000	30000	RW
238	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	-100.00%	-30000	30000	RW
239	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	1	-30000	30000	RW
250	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	48	0	499	RW
240	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	100.00%	-30000	30000	RW
241	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	-100.00%	-30000	30000	RW
242	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	1	-30000	30000	RW
247	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	301	0	499	RW
243	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	100.00%	-30000	30000	RW
244	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	-100.00%	-30000	30000	RW
245	% TO GET 10V	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	100.00%	-30000	30000	RW
362	MODULUS	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	FALSE	0	1	RW
464	OFFSET	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	0.00%	-10000	10000	RW
251	SOURCE TAG	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	62	0	499	RW
248	% TO GET 10V	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	100.00%	-30000	30000	RW
363	MODULUS	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	FALSE	0	1	RW
465	OFFSET	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	0.00%	-10000	10000	RW



TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
252	SOURCE TAG	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	63	0	499	RW
431	DIAMETER	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
436	NEG. I CLAMP	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
400	PID O/P DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
435	POS. I CLAMP	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
260	RAISE/LOWER DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
293	RAMP O/P DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	291	0	499	RW
450	SETPOINT SUM 2	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
294	SPT SUM 1 DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	289	0	499	RW
442	TAPER	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
135	DESTINATION TAG	SYSTEM::CONFIGURE I/O::CONFIGURE 5703	41	0	499	RW
134	SOURCE TAG	SYSTEM::CONFIGURE I/O::CONFIGURE 5703	89	0	499	RW
102	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	90	0	499	RW
104	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	0.00%	-30000	30000	RW
103	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	0.01%	-30000	30000	RW
105	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	118	0	499	RW
107	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	0.00%	-30000	30000	RW
106	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	0.01%	-30000	30000	RW
108	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	119	0	499	RW
110	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	0.00%	-30000	30000	RW
109	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	0.01%	-30000	30000	RW
359	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	FALSE	0	1	RW
43	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	TRUE	0	1	RW
97	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	77	0	499	RW
195	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	0.00%	-30000	30000	RW
360	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	FALSE	0	1	RW
44	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	TRUE	0	1	RW
98	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	122	0	499	RW
196	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	0.00%	-30000	30000	RW
361	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	FALSE	0	1	RW
45	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	TRUE	0	1	RW
99	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	125	0	499	RW
197	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	0.00%	-30000	30000	RW
365	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 1	0	0	499	RW
364	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 1	0	0	499	RW
367	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 2	0	0	499	RW
366	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 2	0	0	499	RW
369	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 3	0	0	499	RW
368	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 3	0	0	499	RW
371	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 4	0	0	499	RW
370	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 4	0	0	499	RW
455	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 5	0	0	499	RW
454	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 5	0	0	499	RW
457	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 6	0	0	499	RW
456	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 6	0	0	499	RW
459	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 7	0	0	499	RW
458	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 7	0	0	499	RW
461	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 8	0	0	499	RW
460	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 8	0	0	499	RW
468	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 9	0	0	499	RW
467	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 9	0	0	499	RW
470	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 10	0	0	499	RW
469	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 10	0	0	499	RW
346	LOGIC 1	SYSTEM::miniLINK	OFF	0	1	RW
347	LOGIC 2	SYSTEM::miniLINK	OFF	0	1	RW
348	LOGIC 3	SYSTEM::miniLINK	OFF	0	1	RW
349	LOGIC 4	SYSTEM::miniLINK	OFF	0	1	RW
350	LOGIC 5	SYSTEM::miniLINK	OFF	0	1	RW
351	LOGIC 6	SYSTEM::miniLINK	OFF	0	1	RW
352	LOGIC 7	SYSTEM::miniLINK	OFF	0	1	RW



<b>TAG</b>	<b>PARAMETER NAME</b>	<b>MENU</b>	<b>DEFAULT</b>	<b>MIN</b>	<b>MAX</b>	
353	LOGIC 8	SYSTEM::miniLINK	OFF	0	1	RW
339	VALUE 1	SYSTEM::miniLINK	0.00%	-30000	30000	RW
340	VALUE 2	SYSTEM::miniLINK	0.00%	-30000	30000	RW
341	VALUE 3	SYSTEM::miniLINK	0.00%	-30000	30000	RW
342	VALUE 4	SYSTEM::miniLINK	0.00%	-30000	30000	RW
343	VALUE 5	SYSTEM::miniLINK	0.00%	-30000	30000	RW
344	VALUE 6	SYSTEM::miniLINK	0.00%	-30000	30000	RW
345	VALUE 7	SYSTEM::miniLINK	0.00%	-30000	30000	RW
379	VALUE 8	SYSTEM::miniLINK	0.00%	-30000	30000	RW
380	VALUE 9	SYSTEM::miniLINK	0.00%	-30000	30000	RW
381	VALUE 10	SYSTEM::miniLINK	0.00%	-30000	30000	RW
382	VALUE 11	SYSTEM::miniLINK	0.00%	-30000	30000	RW
383	VALUE 12	SYSTEM::miniLINK	0.00%	-30000	30000	RW
384	VALUE 13	SYSTEM::miniLINK	0.00%	-30000	30000	RW
385	VALUE 14	SYSTEM::miniLINK	0.00%	-30000	30000	RW





## Appendix K PARAMETER LIST BY PARAMETER NAME

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
187	5703 INPUT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0.00%	-30000	30000	RW
189	5703 OUTPUT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0.00%	-30000	30000	RO
111	5703 RCV ERROR	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
61	ACTUAL NEG I LIM	DIAGNOSTICS	0.00%	-20000	20000	RO
67	ACTUAL POS I LIM	DIAGNOSTICS	0.00%	-20000	20000	RO
30	ADDITIONAL DEM	SETUP PARAMETERS::CURRENT LOOP	0.00%	-20000	20000	RW
23	ANALOG TACH CAL	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
50	ANIN 1 (A2)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
51	ANIN 2 (A3)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
52	ANIN 3 (A4)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
53	ANIN 4 (A5)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
54	ANIN 5 (A6)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
128	ANOUT 1	SETUP PARAMETERS::AUX I/O	0.00%	-10000	10000	RW
55	ANOUT 1 (A7)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
129	ANOUT 2	SETUP PARAMETERS::AUX I/O	0.00%	-10000	10000	RW
56	ANOUT 2 (A8)	DIAGNOSTICS	0.00 VOLTS	-10000	10000	RO
25	ARMATURE I (A9)	SETUP PARAMETERS::CALIBRATION	BIPOLAR	0	1	RW
20	ARMATURE V CAL.	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
149	ASCII / BINARY	SERIAL LINKS::AUX PORT (P2)	ASCII	0	1	RW
148	ASCII / BINARY	SERIAL LINKS::MAIN PORT (P1)	ASCII	0	1	RW
42	AT CURRENT LIMIT	DIAGNOSTICS	FALSE	0	1	RO
79	AT STANDSTILL	DIAGNOSTICS	TRUE	0	1	RO
78	AT ZERO SETPOINT	DIAGNOSTICS	TRUE	0	1	RO
77	AT ZERO SPEED	DIAGNOSTICS	TRUE	0	1	RO
287	AUTO RESET	SETUP PARAMETERS::RAMPS	ENABLED	0	1	RW
18	AUTOTUNE	SETUP PARAMETERS::CURRENT LOOP	OFF	0	1	RW
94	AUX DIGOUT 1	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
95	AUX DIGOUT 2	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
96	AUX DIGOUT 3	SETUP PARAMETERS::AUX I/O	OFF	0	1	RW
168	AUX ENABLE	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
227	AUX JOG	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
161	AUX START	SETUP PARAMETERS::AUX I/O	ON	0	1	RW
60	BACK EMF	DIAGNOSTICS	0.00%	-15000	15000	RO
151	BAUD RATE	SERIAL LINKS::AUX PORT (P2)	9600	300	19200	RW
150	BAUD RATE	SERIAL LINKS::MAIN PORT (P1)	9600	300	19200	RW
192	BEMF FBK LAG	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100	10	5000	RW
191	BEMF FBK LEAD	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100	10	5000	RW
90	BIPOLAR CLAMPS	SETUP PARAMETERS::CURRENT LOOP	DISABLED	0	1	RW
230	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	1	-30000	30000	RW
233	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	1	-30000	30000	RW
236	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	1	-30000	30000	RW
239	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	1	-30000	30000	RW
242	CALIBRATION	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	1	-30000	30000	RW
121	CHANGE PASSWORD	PASSWORD	0x0000	0	FFFF	RW
145	CHANGE BAND (BIN)	SERIAL LINKS::AUX PORT (P2)	0.00%	0	32767	RW
144	CHANGE BAND (BIN)	SERIAL LINKS::MAIN PORT (P1)	0.00%	0	32767	RW
39	CONFIGURE ENABLE	SYSTEM::CONFIGURE I/O	DISABLED	0	1	RW
302	CONTACTOR DELAY	SETUP PARAMETERS::STOP RATES	1.0 SECS	1	6000	RW
225	CRAWL SPEED	SETUP PARAMETERS::JOG/SLACK	10.00%	-10000	10000	RW
15	CUR.LIMIT/SCALER	SETUP PARAMETERS::CURRENT LOOP	100.00%	0	20000	RW
299	CURRENT DEMAND	DIAGNOSTICS	0.00%	-30000	30000	RO
298	CURRENT FEEDBACK	DIAGNOSTICS	0.00%	-30000	30000	RO
131	DEADBAND WIDTH	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	0	10000	RW
257	DECREASE RATE	SETUP PARAMETERS::RAISE/LOWER	10.0 SECS	1	6000	RW
401	DERIVATIVE TC	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.000 SECS	0	10000	RW
246	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	100	0	499	RW
249	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	5	0	499	RW
250	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	48	0	499	RW
247	DESTINATION TAG	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	301	0	499	RW
135	DESTINATION TAG	SYSTEM::CONFIGURE I/O::CONFIGURE 5703	41	0	499	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
102	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	90	0	499	RW
105	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	118	0	499	RW
108	DESTINATION TAG	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	119	0	499	RW
365	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 1	0	0	499	RW
367	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 2	0	0	499	RW
369	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 3	0	0	499	RW
371	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 4	0	0	499	RW
455	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 5	0	0	499	RW
457	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 6	0	0	499	RW
459	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 7	0	0	499	RW
461	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 8	0	0	499	RW
468	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 9	0	0	499	RW
470	DESTINATION TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 10	0	0	499	RW
427	DIAMETER	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	0	10000	RO
431	DIAMETER	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
71	DIGIN 1 (C6)	DIAGNOSTICS	OFF	0	1	RO
72	DIGIN 2 (C7)	DIAGNOSTICS	OFF	0	1	RO
73	DIGIN 3 (C8)	DIAGNOSTICS	OFF	0	1	RO
74	DIGOUT 1 (B5)	DIAGNOSTICS	ON	0	1	RO
75	DIGOUT 2 (B6)	DIAGNOSTICS	ON	0	1	RO
76	DIGOUT 3 (B7)	DIAGNOSTICS	OFF	0	1	RO
137	DISCONTINUOUS	SETUP PARAMETERS::CURRENT LOOP	12.00%	0	20000	RW
420	DIVIDER 0	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
448	DIVIDER 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
419	DIVIDER 1	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
418	DIVIDER 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
466	DIVIDER 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
414	DIVIDER 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
84	DRIVE ENABLE	DIAGNOSTICS	DISABLED	0	1	RO
82	DRIVE START	DIAGNOSTICS	OFF	0	1	RO
	DUMP MMI -> P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
177	EMF GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	0.3	0	10000	RW
176	EMF LAG	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	40	0	20000	RW
175	EMF LEAD	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	2	10	5000	RW
408	ENABLE	SETUP PARAMETERS::SPECIAL BLOCKS::PID	ENABLED	0	1	RW
70	ENABLE (C5)	DIAGNOSTICS	OFF	0	1	RO
206	ENCODER	DIAGNOSTICS	0 RPM	0	6000	RO
92	ENCODER ALARM	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
24	ENCODER LINES	SETUP PARAMETERS::CALIBRATION	1000	10	5000	RW
22	ENCODER RPM	SETUP PARAMETERS::CALIBRATION	1000 RPM	0	6000	RW
49	ENCODER SIGN	SETUP PARAMETERS::SPEED LOOP	POSITIVE	0	1	RW
120	ENTER PASSWORD	PASSWORD	0x0000	0	FFFF	RW
159	ERROR REPORT	SERIAL LINKS::AUX PORT (P2)	0x00C0	-	-	RW
158	ERROR REPORT	SERIAL LINKS::MAIN PORT (P1)	0x00C0	-	-	RW
332	ERROR REPORT	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0x00C0	-	-	RW
153	ESP SUP. (ASCII)	SERIAL LINKS::AUX PORT (P2)	DISABLED	0	1	RW
152	ESP SUP. (ASCII)	SERIAL LINKS::MAIN PORT (P1)	DISABLED	0	1	RW
307	EXTERNAL RESET	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
288	EXTERNAL RESET	SETUP PARAMETERS::RAMPS	DISABLED	0	1	RW
463	EXTERNAL RESET	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	DISABLED	0	1	RW
183	FIELD DEMAND	DIAGNOSTICS	0.00%	0	10000	RO
169	FIELD ENABLE	DIAGNOSTICS	DISABLED	0	1	RO
170	FIELD ENABLE	SETUP PARAMETERS::FIELD CONTROL	ENABLED	0	1	RW
19	FIELD FAIL	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
182	FIELD I CAL.	SETUP PARAMETERS::CALIBRATION	1	9800	11000	RW
300	FIELD I FBK.	DIAGNOSTICS	0.00%	-30000	30000	RO
403	FILTER T.C.	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.100 SECS	0	10000	RW
209	FLD CTRL MODE IS	SETUP PARAMETERS::FIELD CONTROL	VOLTAGE CONTROL	0	1	RW
185	FLD QUENCH DELAY	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	0.0 SECS	0	6000	RW
186	FLD. QUENCH MODE	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	QUENCH	0	1	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
174	FLD. WEAK ENABLE	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	DISABLED	0	1	RW
184	FLD.FIRING ANGLE	DIAGNOSTICS	0 DEG	0	180	RO
37	FULL MENUS	MENUS	ENABLED	0	1	RW
140	GROUP ID (GID)	SERIAL LINKS::AUX PORT (P2)	0	0	7	RW
138	GROUP ID (GID)	SERIAL LINKS::MAIN PORT (P1)	0	0	7	RW
329	GROUP ID (GID)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0	0	7	RW
116	HEALTH STORE	ALARM STATUS	0x0000	0	FFFF	RO
115	HEALTH WORD	ALARM STATUS	0x4210	0	FFFF	RO
119	I DM.D. ISOLATE	SETUP PARAMETERS::CURRENT LOOP	DISABLED	0	1	RW
274	I GAIN IN RAMP	SETUP PARAMETERS::SPEED LOOP::ADVANCED	1	0	20000	RW
93	IMAX BRK1(SPD1)	SETUP PARAMETERS::CURRENT PROFILE	200.00%	0	20000	RW
33	IMAX BRK2(SPD2)	SETUP PARAMETERS::CURRENT PROFILE	200.00%	0	20000	RW
256	INCREASE RATE	SETUP PARAMETERS::RAISE/LOWER	10.0 SECS	1	6000	RW
309	INPUT 0	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
444	INPUT 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
100	INPUT 1	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
410	INPUT 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.00%	-30000	30000	RW
443	INPUT 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
423	INPUT 2	SETUP PARAMETERS::SETPOINT SUM 1	0.00%	-20000	20000	RW
411	INPUT 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.00%	-30000	30000	RW
445	INPUT 2	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-30000	30000	RW
409	INT. DEFEAT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	OFF	0	1	RW
202	INT. DEFEAT	SETUP PARAMETERS::SPEED LOOP	OFF	0	1	RW
17	INT. GAIN	SETUP PARAMETERS::CURRENT LOOP	3.5	0	20000	RW
172	INT. GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	1.28	0	10000	RW
402	INT. TIME CONST.	SETUP PARAMETERS::SPECIAL BLOCKS::PID	5.00 SECS	1	10000	RW
13	INT. TIME CONST.	SETUP PARAMETERS::SPEED LOOP	0.500 SECS	1	30000	RW
272	INT. TIME CONST.	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	0.500 SECS	1	30000	RW
203	INVERSE TIME O/P	DIAGNOSTICS	200.00%	0	20000	RO
359	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	FALSE	0	1	RW
360	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	FALSE	0	1	RW
361	INVERTED	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	FALSE	0	1	RW
21	IR COMPENSATION	SETUP PARAMETERS::CALIBRATION	0.00%	0	10000	RW
69	JOG INPUT (C4)	DIAGNOSTICS	OFF	0	1	RO
218	JOG SPEED 1	SETUP PARAMETERS::JOG/SLACK	5.00%	-10000	10000	RW
219	JOG SPEED 2	SETUP PARAMETERS::JOG/SLACK	-5.00%	-10000	10000	RW
	LANGUAGE	MENUS	ENGLISH			RW
375	LIMIT	SETUP PARAMETERS::SETPOINT SUM 1	105.00%	0	20000	RW
449	LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	100.00%	0	20000	RW
424	LINE SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	-10500	10500	RW
346	LOGIC 1	SYSTEM::miniLINK	OFF	0	1	RW
347	LOGIC 2	SYSTEM::miniLINK	OFF	0	1	RW
348	LOGIC 3	SYSTEM::miniLINK	OFF	0	1	RW
349	LOGIC 4	SYSTEM::miniLINK	OFF	0	1	RW
350	LOGIC 5	SYSTEM::miniLINK	OFF	0	1	RW
351	LOGIC 6	SYSTEM::miniLINK	OFF	0	1	RW
352	LOGIC 7	SYSTEM::miniLINK	OFF	0	1	RW
353	LOGIC 8	SYSTEM::miniLINK	OFF	0	1	RW
262	LOWER INPUT	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
421	MAIN CURR. LIMIT	SETUP PARAMETERS::CURRENT LOOP	200.00%	0	20000	RW
357	MAX DEMAND	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	105.00%	0	10500	RW
259	MAX VALUE	SETUP PARAMETERS::RAISE/LOWER	100.00%	-30000	30000	RW
231	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	100.00%	-30000	30000	RW
234	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	100.00%	-30000	30000	RW
237	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	100.00%	-30000	30000	RW
240	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	100.00%	-30000	30000	RW
243	MAX VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	100.00%	-30000	30000	RW
178	MAX VOLTS	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	100.00%	0	10000	RW
38	MENU DELAY	MENUS	30	0	65535	RW
358	MIN DEMAND	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	-105.00%	-10500	0	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
425	MIN DIAMETER	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	10.00%	0	10000	RW
179	MIN FLD CURRENT	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::FLD WEAK VARS	10.00%	0	10000	RW
474	MIN PROFILE GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	20.00%	0	10000	RW
126	MIN SPEED	SETUP PARAMETERS::RAMPS	0.00%	0	10000	RW
426	MIN SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	5.00%	0	10000	RW
258	MIN VALUE	SETUP PARAMETERS::RAISE/LOWER	-100.00%	-30000	30000	RW
232	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 1 (A2)	-100.00%	-30000	30000	RW
235	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 2 (A3)	-100.00%	-30000	30000	RW
238	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 3 (A4)	-100.00%	-30000	30000	RW
241	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 4 (A5)	-100.00%	-30000	30000	RW
244	MIN VALUE	SYSTEM::CONFIGURE I/O::ANALOG INPUTS::ANIN 5 (A6)	-100.00%	-30000	30000	RW
130	MODE	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP	DISABLED	0	4	RW
228	MODE	SETUP PARAMETERS::JOG/SLACK	FALSE	0	1	RW
473	MODE	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0	0	4	RW
268	MODE	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	0	0	3	RW
362	MODULUS	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	FALSE	0	1	RW
363	MODULUS	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	FALSE	0	1	RW
43	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	TRUE	0	1	RW
44	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	TRUE	0	1	RW
45	MODULUS	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	TRUE	0	1	RW
88	NEG. I CLAMP	DIAGNOSTICS	0.00%	-20000	20000	RO
48	NEG. I CLAMP	SETUP PARAMETERS::CURRENT LOOP	0.00%	-10000	10000	RW
436	NEG. I CLAMP	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
406	NEGATIVE LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	-100.00%	-10500	0	RW
407	O/P SCALER(TRIM)	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0.2	-30000	30000	RW
464	OFFSET	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	0.00%	-10000	10000	RW
465	OFFSET	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	0.00%	-10000	10000	RW
212	OPERATING MODE	DIAGNOSTICS	STOP	0	7	RO
434	OVER WIND	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	ENABLED	0	1	RW
198	P3 BAUD RATE	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP	9600	300	57600	RW
334	PARITY	SERIAL LINKS::MAIN PORT (P1)	EVEN	0	1	RW
266	% S-RAMP	SETUP PARAMETERS::RAMPS	2.50%	0	10000	RW
245	% TO GET 10V	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	100.00%	-30000	30000	RW
248	% TO GET 10V	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	100.00%	-30000	30000	RW
416	PID CLAMPED	DIAGNOSTICS	FALSE	0	1	RO
415	PID ERROR	DIAGNOSTICS	0.00%	-10500	10500	RO
400	PID O/P DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
417	PID OUTPUT	DIAGNOSTICS	0.00%	-31500	31500	RO
312	PNO 112	SERIAL LINKS::PNOCONFIG	0	0	499	RW
313	PNO 113	SERIAL LINKS::PNOCONFIG	0	0	499	RW
314	PNO 114	SERIAL LINKS::PNOCONFIG	0	0	499	RW
315	PNO 115	SERIAL LINKS::PNOCONFIG	0	0	499	RW
316	PNO 116	SERIAL LINKS::PNOCONFIG	0	0	499	RW
317	PNO 117	SERIAL LINKS::PNOCONFIG	0	0	499	RW
318	PNO 118	SERIAL LINKS::PNOCONFIG	0	0	499	RW
319	PNO 119	SERIAL LINKS::PNOCONFIG	0	0	499	RW
320	PNO 120	SERIAL LINKS::PNOCONFIG	379	0	499	RW
321	PNO 121	SERIAL LINKS::PNOCONFIG	380	0	499	RW
322	PNO 122	SERIAL LINKS::PNOCONFIG	381	0	499	RW
323	PNO 123	SERIAL LINKS::PNOCONFIG	382	0	499	RW
324	PNO 124	SERIAL LINKS::PNOCONFIG	383	0	499	RW
325	PNO 125	SERIAL LINKS::PNOCONFIG	384	0	499	RW
326	PNO 126	SERIAL LINKS::PNOCONFIG	385	0	499	RW
327	PNO 127	SERIAL LINKS::PNOCONFIG	0	0	499	RW
143	PNO. 7	SERIAL LINKS::AUX PORT (P2)	0xFFFF	0	FFFF	RW
142	PNO. 7	SERIAL LINKS::MAIN PORT (P1)	0xFFFF	0	FFFF	RW
87	POS. I CLAMP	DIAGNOSTICS	0.00%	-20000	20000	RO
301	POS. I CLAMP	SETUP PARAMETERS::CURRENT LOOP	0.00%	-10000	10000	RW
435	POS. I CLAMP	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
405	POSITIVE LIMIT	SETUP PARAMETERS::SPECIAL BLOCKS::PID	100.00%	0	10500	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
475	PROFIED GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	0	0	1000	RO
91	PROG STOP I LIM	SETUP PARAMETERS::STOP RATES	100.00%	0	20000	RW
216	PROG STOP LIMIT	SETUP PARAMETERS::STOP RATES	60.0 SECS	0	6000	RW
26	PROG STOP TIME	SETUP PARAMETERS::STOP RATES	0.1 SECS	1	6000	RW
80	PROGRAM STOP	DIAGNOSTICS	TRUE	0	1	RO
16	PROP. GAIN	SETUP PARAMETERS::CURRENT LOOP	4.5	0	20000	RW
173	PROP. GAIN	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	0.1	0	10000	RW
404	PROP. GAIN	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	0	1000	RW
14	PROP. GAIN	SETUP PARAMETERS::SPEED LOOP	10	0	20000	RW
271	PROP. GAIN	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	5	0	20000	RW
261	RAISE INPUT	SETUP PARAMETERS::RAISE/LOWER	FALSE	0	1	RW
260	RAISE/LOWER DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
264	RAISE/LOWER O/P	DIAGNOSTICS	0.00%	-30000	30000	RO
2	RAMP ACCEL TIME	SETUP PARAMETERS::RAMPS	10.0 SECS	1	6000	RW
3	RAMP DECEL TIME	SETUP PARAMETERS::RAMPS	10.0 SECS	1	6000	RW
118	RAMP HOLD	SETUP PARAMETERS::RAMPS	OFF	0	1	RW
5	RAMP INPUT	SETUP PARAMETERS::RAMPS	0.00%	-10000	10000	RW
293	RAMP O/P DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	291	0	499	RW
85	RAMP OUTPUT	DIAGNOSTICS	0.00%	-10000	10000	RO
355	RAMP RATE	SETUP PARAMETERS::JOG/SLACK	1.0 SECS	1	6000	RW
453	RAMP RATE	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	5.0 SECS	1	6000	RW
113	RAMPING	DIAGNOSTICS	FALSE	0	1	RO
286	RAMPING THRESH.	SETUP PARAMETERS::RAMPS	0.50%	0	10000	RW
208	RATIO 0	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
447	RATIO 0	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
6	RATIO 1	SETUP PARAMETERS::SETPOINT SUM 1	1	-30000	30000	RW
412	RATIO 1	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
446	RATIO 1	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	1	-30000	30000	RW
413	RATIO 2	SETUP PARAMETERS::SPECIAL BLOCKS::PID	1	-30000	30000	RW
7	RATIO 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	1	-30000	30000	RW
210	RATIO OUT/IN	SETUP PARAMETERS::FIELD CONTROL::FLD VOLTAGE VARS	90.00%	0	10000	RW
437	REEL SPEED	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	0.00%	-10500	10500	RW
201	REGEN MODE	SETUP PARAMETERS::CURRENT LOOP	ENABLED	0	1	RW
255	RESET VALUE	SETUP PARAMETERS::RAISE/LOWER	0.00%	-30000	30000	RW
422	RESET VALUE	SETUP PARAMETERS::RAMPS	0.00%	-30000	30000	RW
462	RESET VALUE	SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.	10.00%	0	10000	RW
171	SETPOINT	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS	100.00%	0	10000	RW
289	SETPOINT 1	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
290	SETPOINT 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RO
291	SETPOINT 3	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
41	SETPOINT 4	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	0.00%	-10500	10500	RW
450	SETPOINT SUM 2	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
132	SETPT. RATIO	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	0	-30000	30000	RW
133	SETPT. SIGN	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::5703 SUPPORT	POSITIVE	0	1	RW
292	SIGN 0	SETUP PARAMETERS::SETPOINT SUM 1	POSITIVE	0	1	RW
8	SIGN 1	SETUP PARAMETERS::SETPOINT SUM 1	POSITIVE	0	1	RW
9	SIGN 2 (A3)	SETUP PARAMETERS::SPEED LOOP::SETPOINTS	POSITIVE	0	1	RW
	SOFTWARE	SYSTEM	ISSUE: 3.2			RW
251	SOURCE TAG	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 1 (A7)	62	0	499	RW
252	SOURCE TAG	SYSTEM::CONFIGURE I/O::ANALOG OUTPUTS::ANOUT 2 (A8)	63	0	499	RW
134	SOURCE TAG	SYSTEM::CONFIGURE I/O::CONFIGURE 5703	89	0	499	RW
97	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	77	0	499	RW
98	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	122	0	499	RW
99	SOURCE TAG	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	125	0	499	RW
364	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 1	0	0	499	RW
366	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 2	0	0	499	RW
368	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 3	0	0	499	RW
370	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 4	0	0	499	RW
454	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 5	0	0	499	RW
456	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 6	0	0	499	RW

TAG	PARAMETER NAME	MENU	DEFAULT	MIN	MAX	
458	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 7	0	0	499	RW
460	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 8	0	0	499	RW
467	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 9	0	0	499	RW
469	SOURCE TAG	SYSTEM::CONFIGURE I/O::INTERNAL LINKS::LINK 10	0	0	499	RW
32	SPD BRK1 (LOW)	SETUP PARAMETERS::CURRENT PROFILE	100.00%	0	10000	RW
269	SPD BRK1 (LOW)	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	1.00%	0	10000	RW
31	SPD BRK2 (HIGH)	SETUP PARAMETERS::CURRENT PROFILE	100.00%	0	10000	RW
270	SPD BRK2 (HIGH)	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ADAPTION	5.00%	0	10000	RW
180	SPDFBK ALM LEVEL	SETUP PARAMETERS::CALIBRATION	50.00%	0	10000	RW
89	SPEED DEMAND	DIAGNOSTICS	0.00%	-10500	10500	RO
297	SPEED ERROR	DIAGNOSTICS	0.00%	-30000	30000	RO
81	SPEED FBK ALARM	SETUP PARAMETERS::INHIBIT ALARMS	ENABLED	0	1	RW
47	SPEED FBK SELECT	SETUP PARAMETERS::SPEED LOOP	ARM VOLTS FBK	0	3	RW
207	SPEED FEEDBACK	DIAGNOSTICS	0.00%	-30000	30000	RO
63	SPEED SETPOINT	DIAGNOSTICS	0.00%	-30000	30000	RO
294	SPT SUM 1 DEST	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	289	0	499	RW
86	SPT SUM OUTPUT	DIAGNOSTICS	0.00%	-20000	20000	RO
451	SPT SUM OUTPUT	SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2	0.00%	-20000	20000	RO
147	SRL LINK ENABLE	SERIAL LINKS::AUX PORT (P2)	ENABLED	0	1	RW
146	SRL LINK ENABLE	SERIAL LINKS::MAIN PORT (P1)	ENABLED	0	1	RW
263	STALL THRESHOLD	SETUP PARAMETERS::CALIBRATION	95.00%	0	20000	RW
112	STALL TRIP	DIAGNOSTICS	OK	0	1	RO
28	STALL TRIP	SETUP PARAMETERS::INHIBIT ALARMS	INHIBITED	0	1	RW
224	STALL TRIP DELAY	SETUP PARAMETERS::CALIBRATION	10.0 SECS	1	6000	RW
11	STANDSTILL LOGIC	SETUP PARAMETERS::STANDSTILL	DISABLED	0	1	RW
68	START (C3)	DIAGNOSTICS	OFF	0	1	RO
217	STOP LIMIT	SETUP PARAMETERS::STOP RATES	60.0 SECS	0	6000	RW
27	STOP TIME	SETUP PARAMETERS::STOP RATES	10.0 SECS	1	6000	RW
29	STOP ZERO SPEED	SETUP PARAMETERS::STOP RATES	2.00%	0	10000	RW
308	TACH INPUT (B2)	DIAGNOSTICS	0.00%	-30000	30000	RO
253	TAKE UP 1	SETUP PARAMETERS::JOG/SLACK	5.00%	-10000	10000	RW
254	TAKE UP 2	SETUP PARAMETERS::JOG/SLACK	-5.00%	-10000	10000	RW
438	TAPER	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RW
442	TAPER	SYSTEM::CONFIGURE I/O::BLOCK DIAGRAM	0	0	499	RW
452	TAPERED DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	0	10000	RO
433	TENSION ENABLE	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	ENABLED	0	1	RW
439	TENSION SPT.	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	0	10000	RW
440	TENSION TRIM	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RW
57	TERMINAL VOLTS	DIAGNOSTICS	0.00%	-12500	12500	RO
195	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 1 (B5)	0.00%	-30000	30000	RW
196	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 2 (B6)	0.00%	-30000	30000	RW
197	THRESHOLD (>)	SYSTEM::CONFIGURE I/O::DIGITAL OUTPUTS::DIGOUT 3 (B7)	0.00%	-30000	30000	RW
432	TORQUE DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TORQUE CALC.	0.00%	-20000	20000	RW
441	TOT.TENS.DEMAND	SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC.	0.00%	-10000	10000	RO
305	TRIP RESET	SETUP PARAMETERS::INHIBIT ALARMS	TRUE	0	1	RW
	UDP XFER -> P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
	UDP XFER <- P3	SERIAL LINKS::SYSTEM PORT (P3)				RW
141	UNIT ID (UID)	SERIAL LINKS::AUX PORT (P2)	0	0	15	RW
139	UNIT ID (UID)	SERIAL LINKS::MAIN PORT (P1)	0	0	15	RW
330	UNIT ID (UID)	SERIAL LINKS::SYSTEM PORT (P3)::P3 SETUP::BISYNCH SUPPORT	0	0	15	RW
	UP TO ACTION	PARAMETER SAVE				RW
339	VALUE 1	SYSTEM::miniLINK	0.00%	-30000	30000	RW
340	VALUE 2	SYSTEM::miniLINK	0.00%	-30000	30000	RW
341	VALUE 3	SYSTEM::miniLINK	0.00%	-30000	30000	RW
342	VALUE 4	SYSTEM::miniLINK	0.00%	-30000	30000	RW
343	VALUE 5	SYSTEM::miniLINK	0.00%	-30000	30000	RW
344	VALUE 6	SYSTEM::miniLINK	0.00%	-30000	30000	RW
345	VALUE 7	SYSTEM::miniLINK	0.00%	-30000	30000	RW
379	VALUE 8	SYSTEM::miniLINK	0.00%	-30000	30000	RW
380	VALUE 9	SYSTEM::miniLINK	0.00%	-30000	30000	RW



<b>TAG</b>	<b>PARAMETER NAME</b>	<b>MENU</b>	<b>DEFAULT</b>	<b>MIN</b>	<b>MAX</b>	
381	VALUE 10	SYSTEM::miniLINK	0.00%	-30000	30000	RW
382	VALUE 11	SYSTEM::miniLINK	0.00%	-30000	30000	RW
383	VALUE 12	SYSTEM::miniLINK	0.00%	-30000	30000	RW
384	VALUE 13	SYSTEM::miniLINK	0.00%	-30000	30000	RW
385	VALUE 14	SYSTEM::miniLINK	0.00%	-30000	30000	RW
104	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	0.00%	-30000	30000	RW
107	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	0.00%	-30000	30000	RW
110	VALUE FOR FALSE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	0.00%	-30000	30000	RW
103	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 1 (C6)	0.01%	-30000	30000	RW
106	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 2 (C7)	0.01%	-30000	30000	RW
109	VALUE FOR TRUE	SYSTEM::CONFIGURE I/O::DIGITAL INPUTS::DIGIN 3 (C8)	0.01%	-30000	30000	RW
285	ZERO IAD LEVEL	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ZERO SPD. QUENCH	1.50%	0	20000	RW
284	ZERO SPD. LEVEL	SETUP PARAMETERS::SPEED LOOP::ADVANCED::ZERO SPD. QUENCH	0.50%	0	20000	RW
10	ZERO SPD. OFFSET	SETUP PARAMETERS::CALIBRATION	0.00%	-500	500	RW
12	ZERO THRESHOLD	SETUP PARAMETERS::STANDSTILL	2.00%	0	10000	RW





## **Appendix L MISCELLANEOUS DRAWINGS**

This appendix contains wiring diagrams and schematic diagrams of several 590 DRV Digital DC Drives. The wiring diagrams show the wiring connections between the SCR chassis and the power supply boards. These drawings also show the assembly of the SCR bussing. The schematic diagrams show the internal wiring connections of the drive.





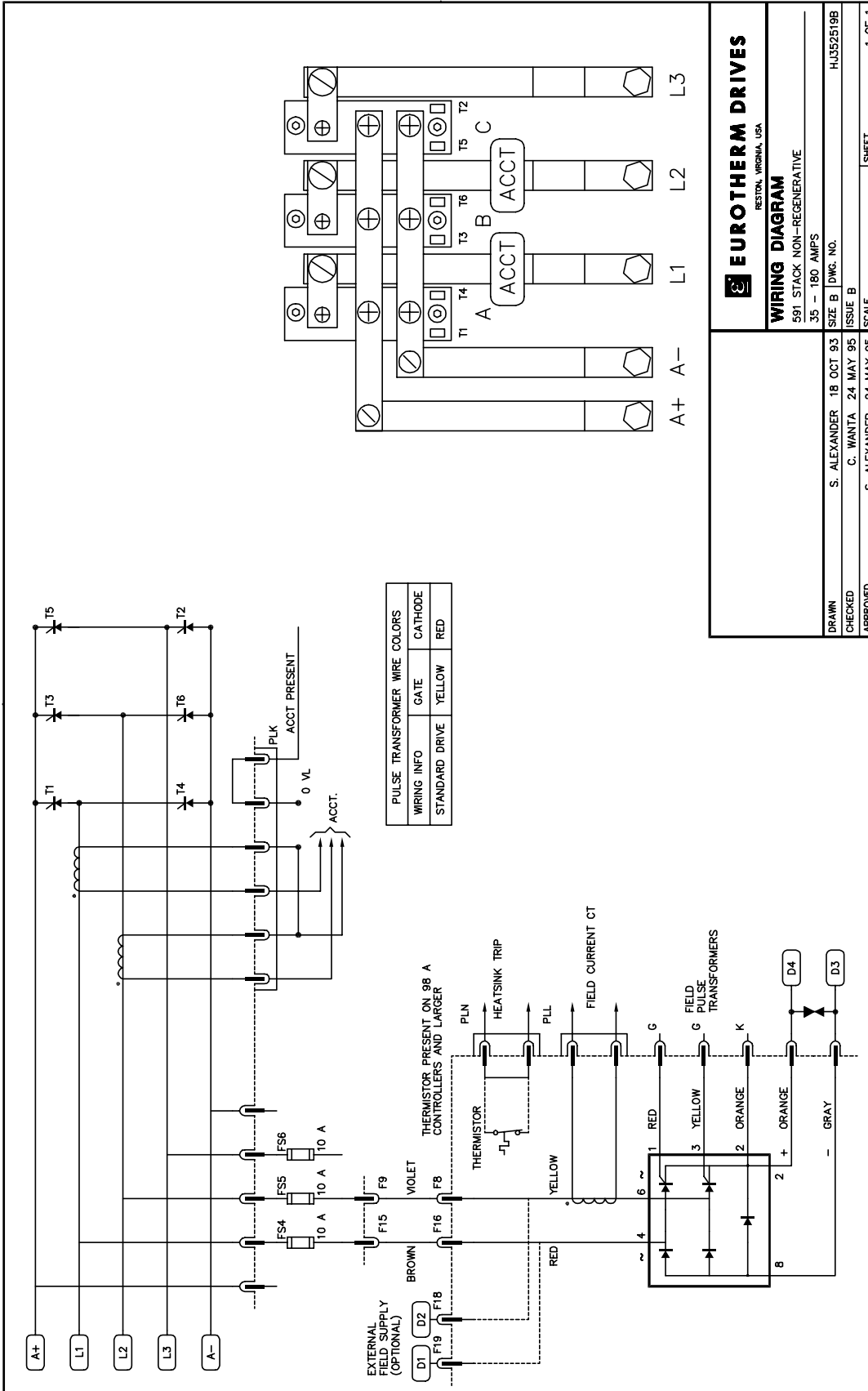
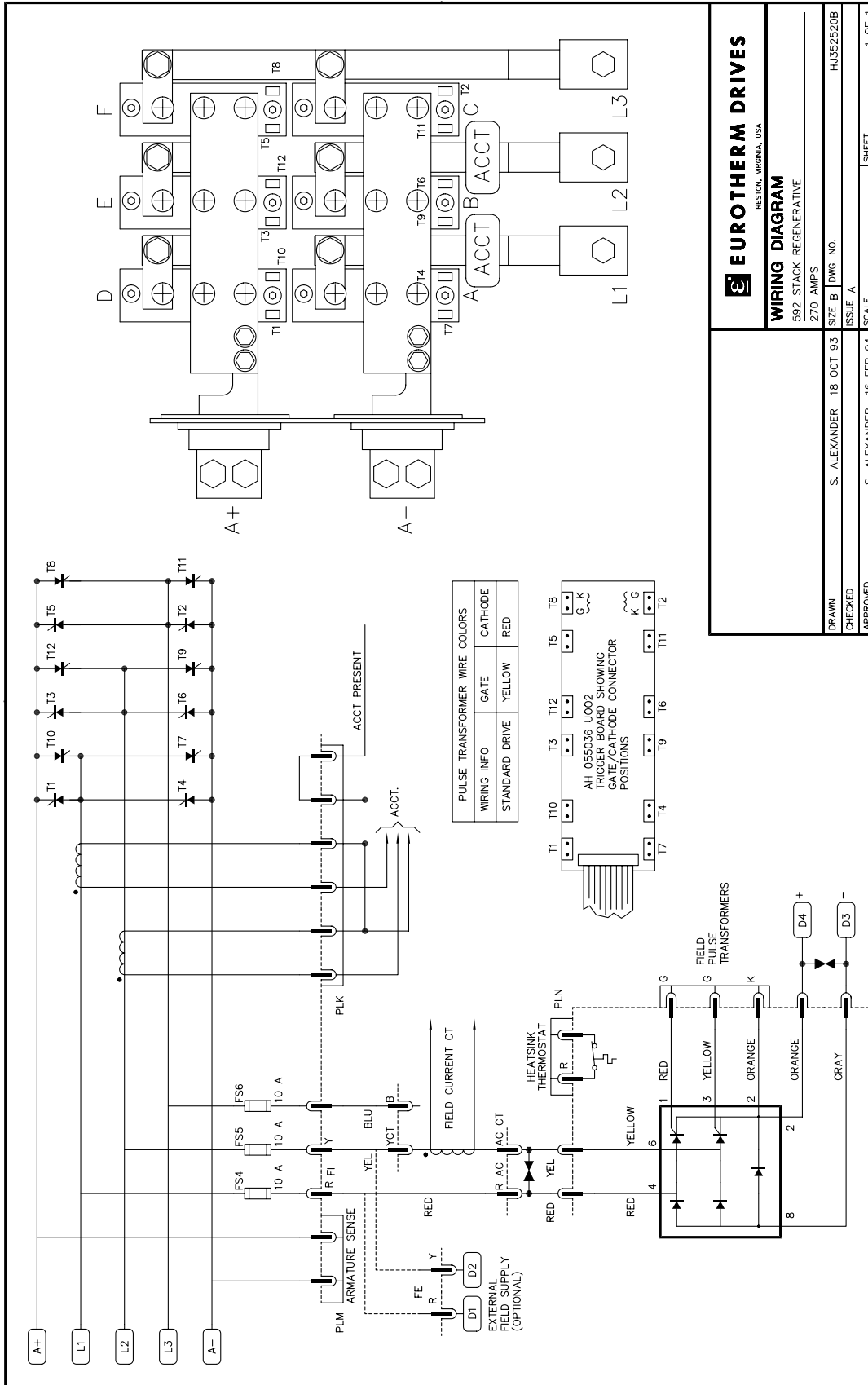


Figure L.2 - 591 Controller, Non-regenerative





**EUROTHERM DRIVES**  
RESTON, VIRGINIA, USA

**WIRING DIAGRAM**  
592 STACK REGENERATIVE  
270 AMPS

DRAWN	S. ALEXANDER	18 OCT 93
CHECKED		
APPROVED	S. ALEXANDER	16 FEB 94

DWG. NO.	HJ352520B
ISSUE A	
SCALE	— SHEET
	1 OF 1

Figure L.3 - 592 Controller, Regenerative

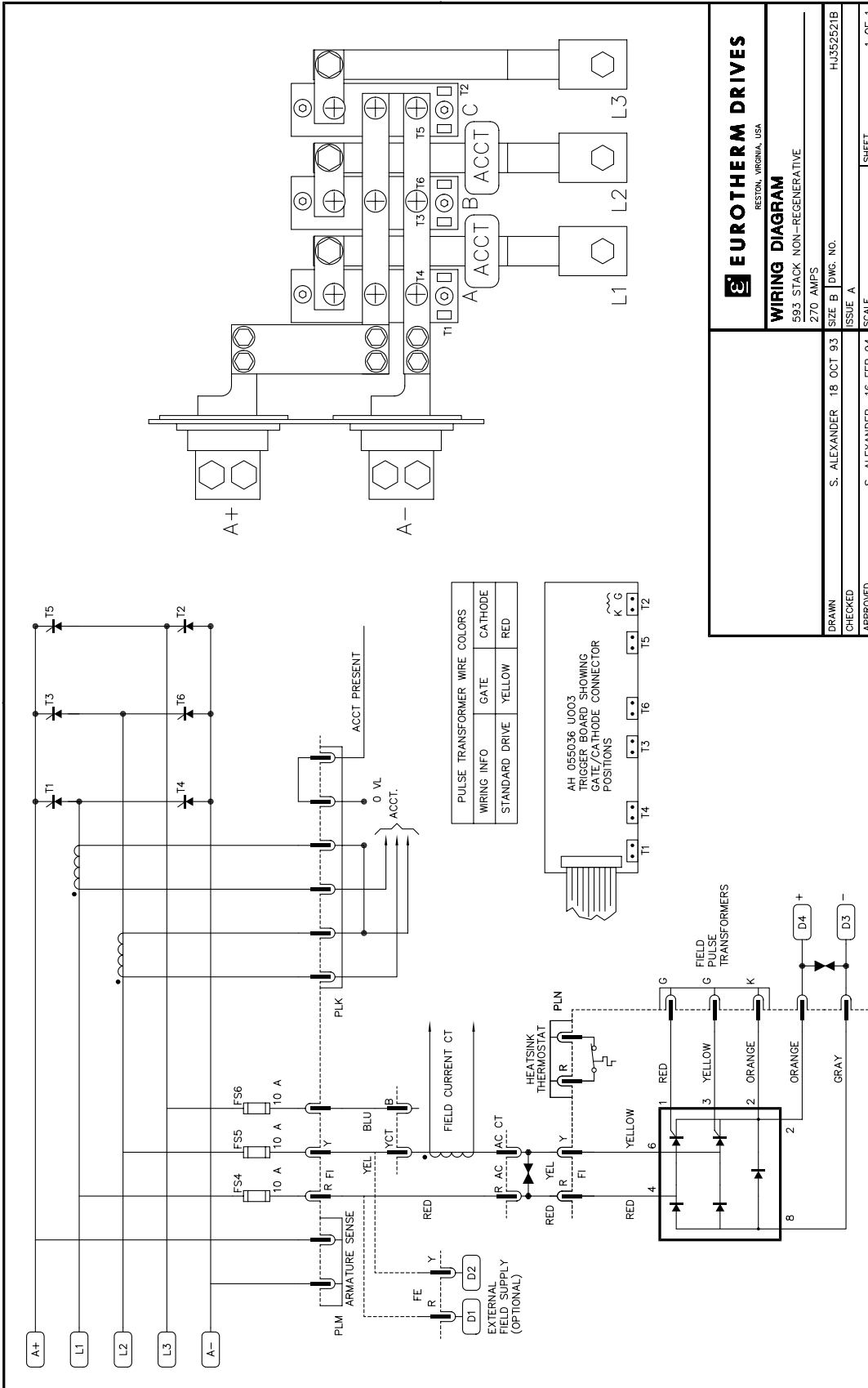


Figure L.4 - 593 Controller, Non-regenerative







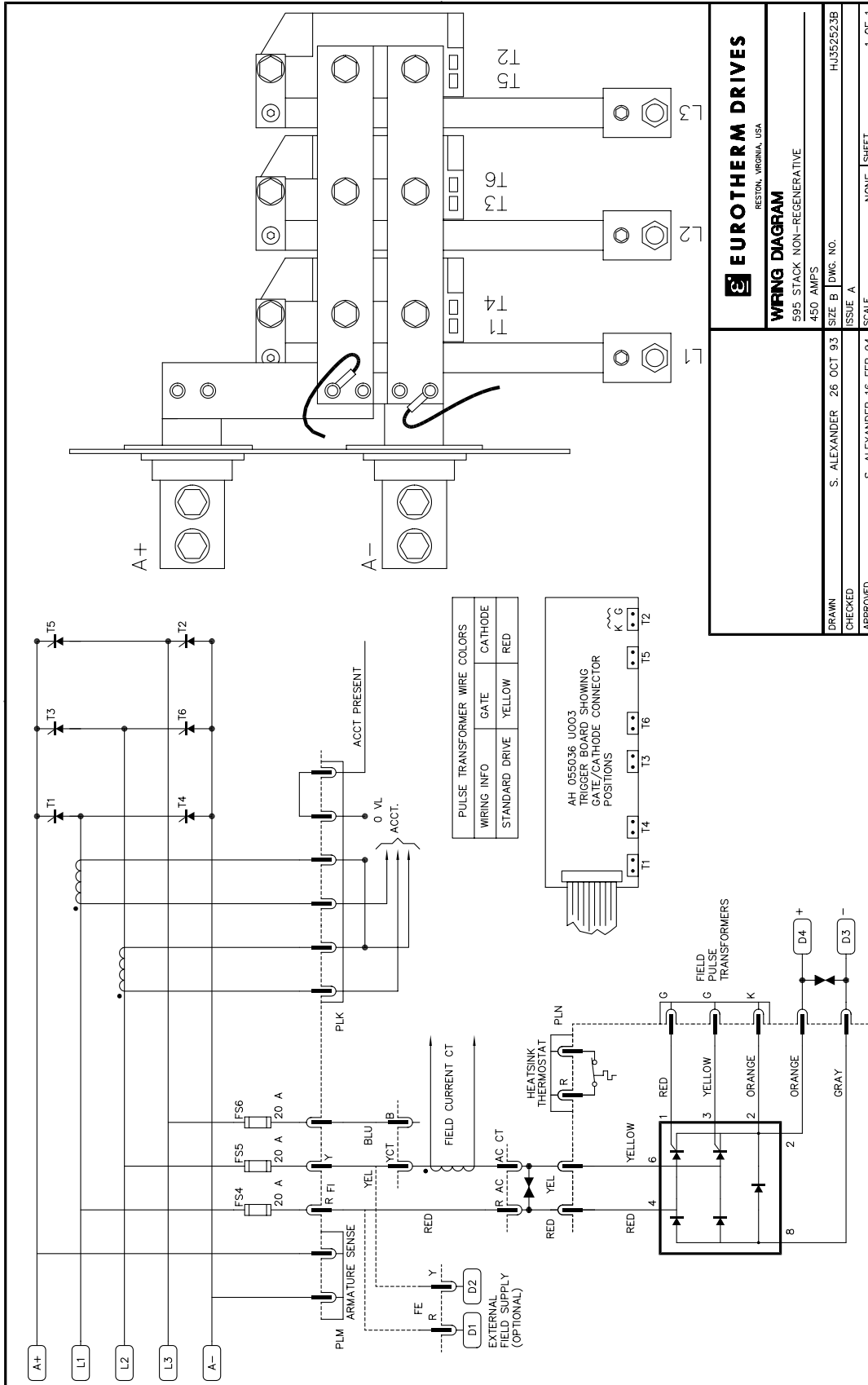


Figure L.6 - 595 Controller, Non-Regenerative



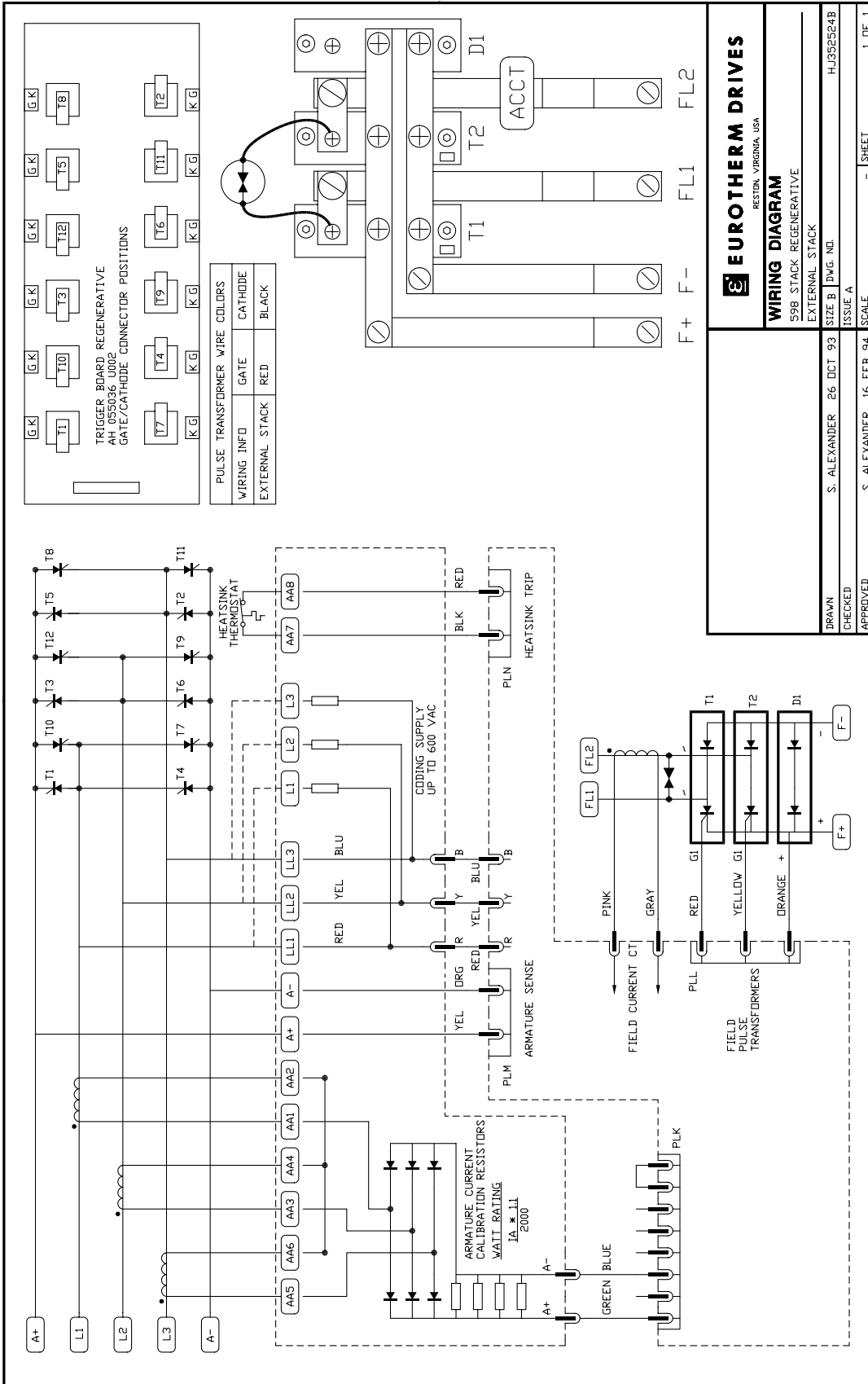


Figure L7 - External Stack (598) Controller, Regenerative

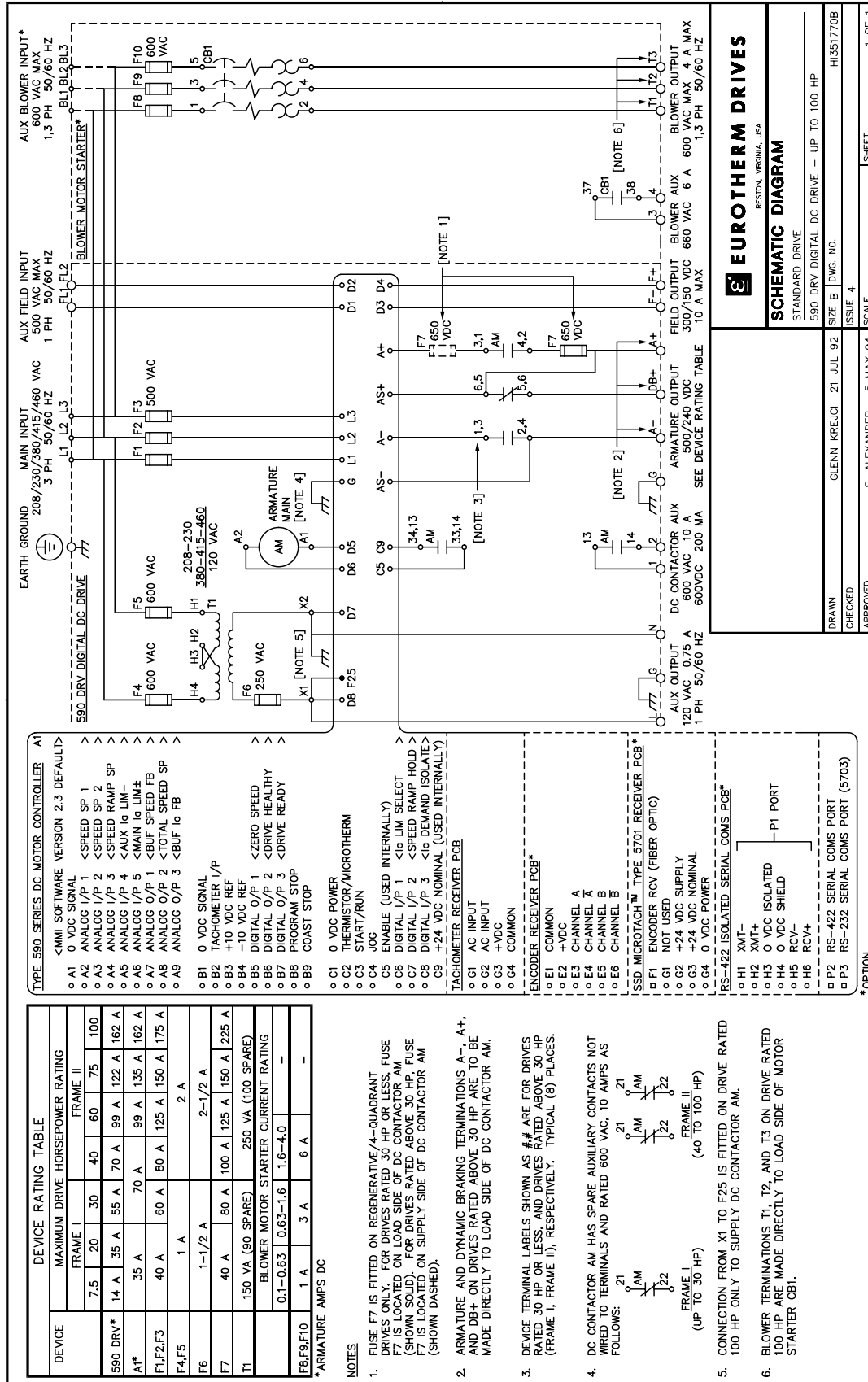


Figure L.8 - Schematic Diagram Up to 100 Hp

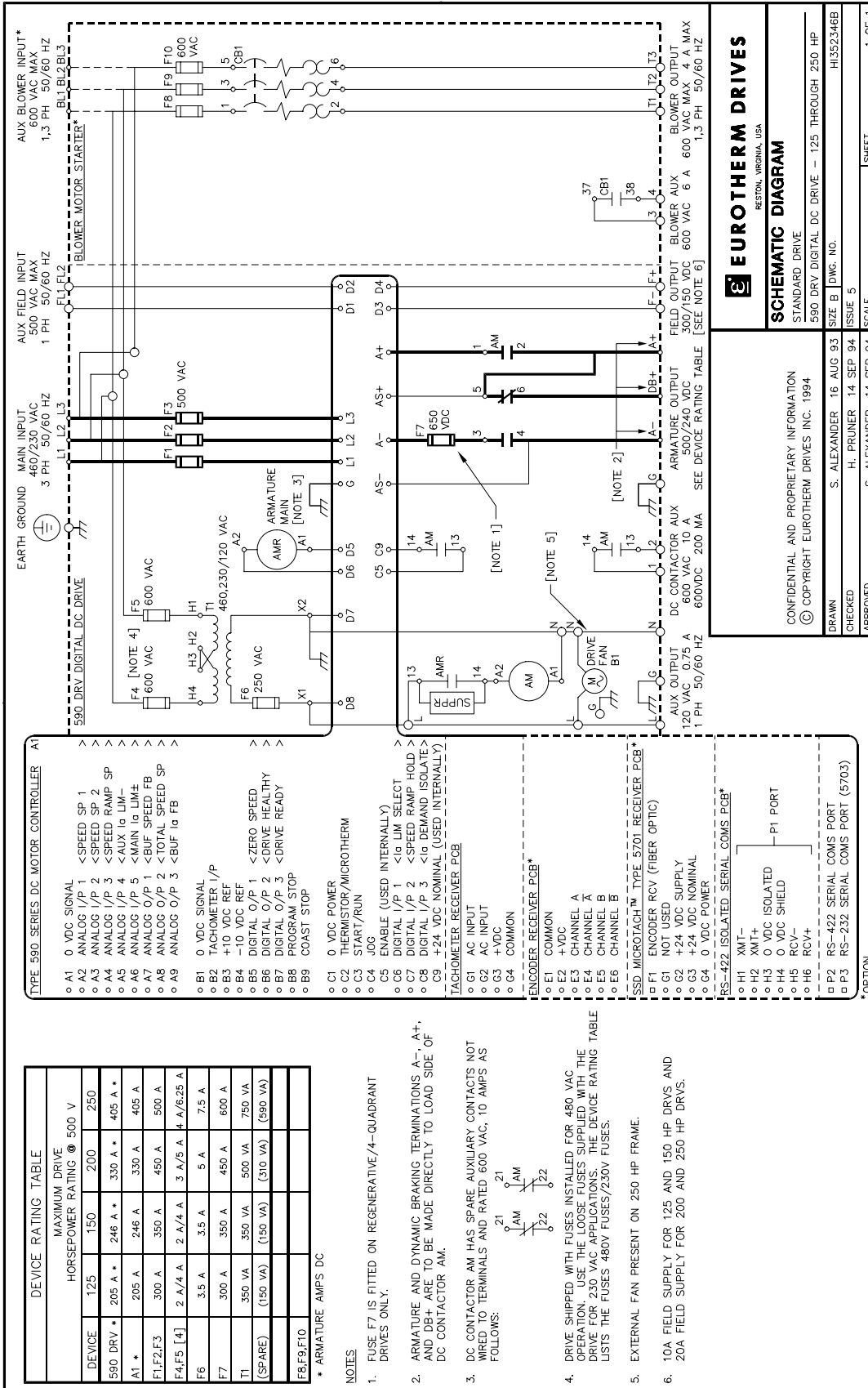


Figure L.9 - Schematic Diagram 125 through 250 Hp

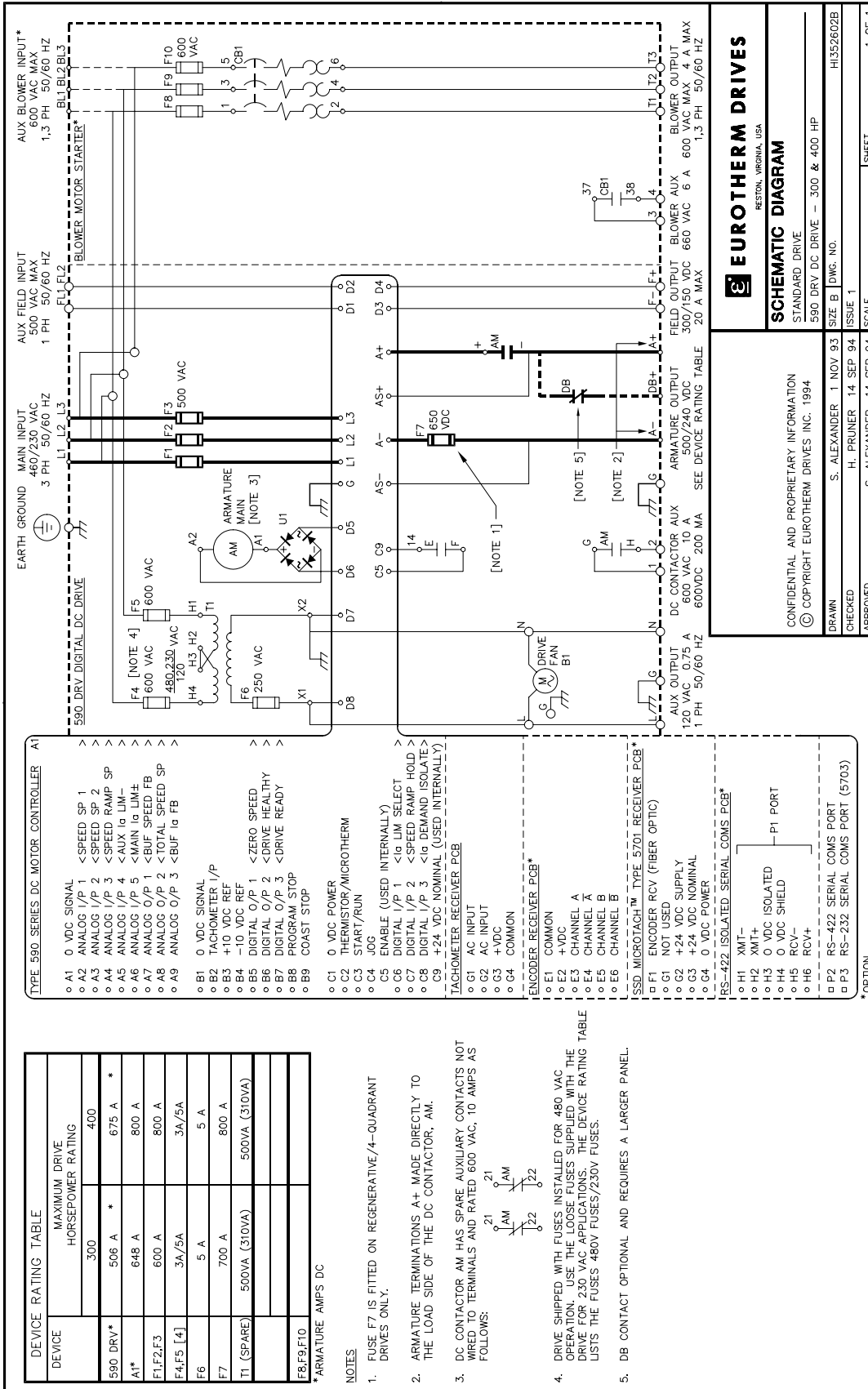
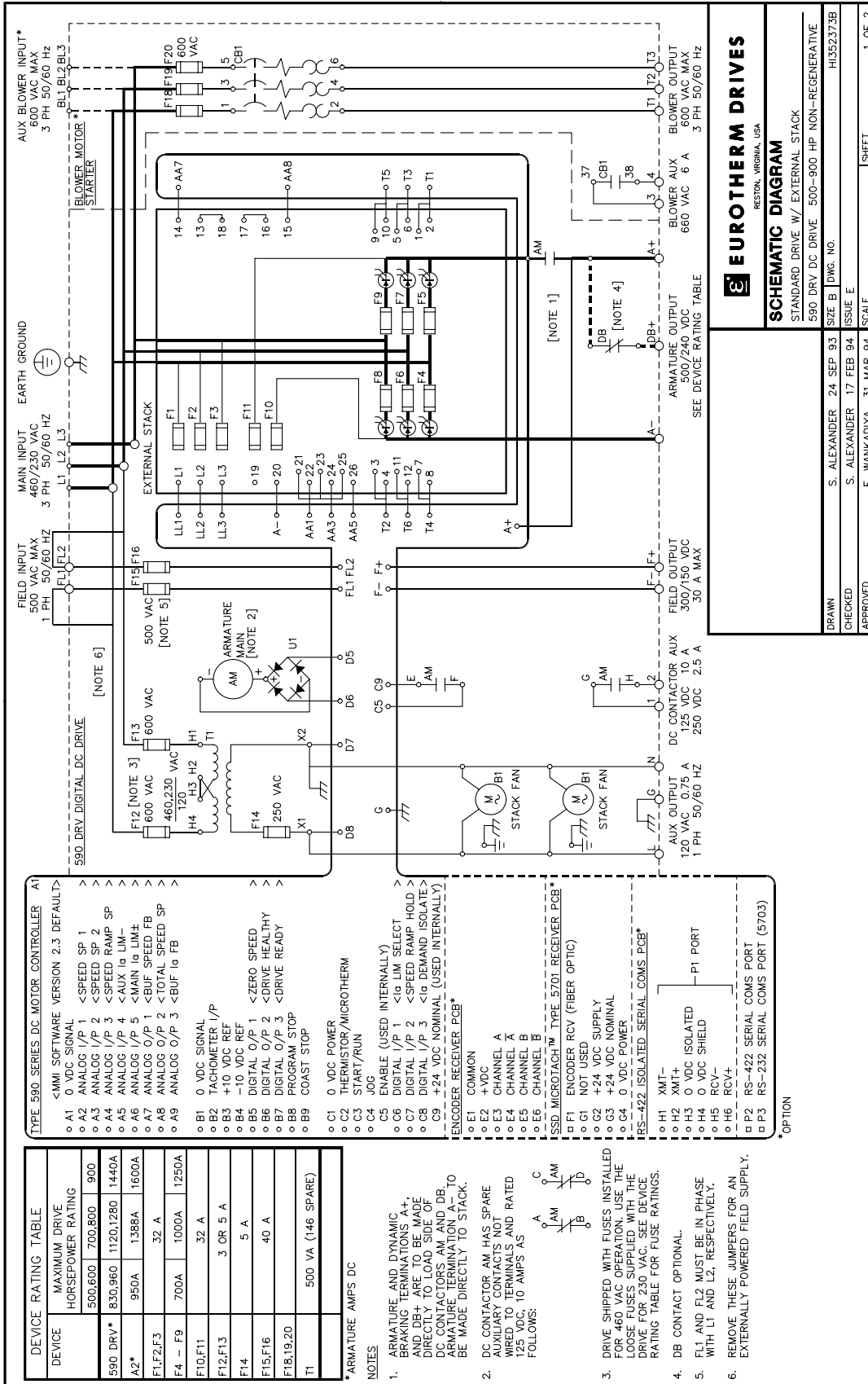


Figure L.10 - Schematic Diagram 300 through 400 Hp



- TYPE 590 SERIES DC MOTOR CONTROLLER**
- > <MI SOFTWARE VERSION 2.3 DEFAULT>
  - > <SPEED SP 1>
  - > <SPEED SP 2>
  - > <SPEED RAMP SP>
  - > <AUX Ia LIM->
  - > <MAIN Ia LIM->
  - > <BUF SPEED FB>
  - > <TOTAL SPEED SP>
  - > <BUF Ia FB>
- OPTIONAL**
- > <0 VDC SIGNAL>
  - > <TACHOMETER I/P>
  - > <+10 VDC REF>
  - > <-10 VDC REF>
  - > <3 OR 5 A>
  - > <5 A>
  - > <40 A>
  - > <PROGRAM STOP>
  - > <COAST STOP>
  - > <0 VDC POWER>
  - > <THERMISTOR/MICROTHERM>
  - > <START/RUN>
  - > <JOG>
  - > <ENABLE (USED INTERNALLY)>
  - > <DIGITAL I/P 1 <Ia LIM SELECT>
  - > <DIGITAL I/P 2 <SPEED RAMP HOLD>
  - > <DIGITAL I/P 3 <Ia DEMAND ISOLATE>
  - > <+24 VDC NOMINAL (USED INTERNALLY)>
- ENCODER RECEIVER PCB\***
- > <COMMON>
  - > <+VDC>
  - > <CHANNEL A>
  - > <CHANNEL X>
  - > <CHANNEL B>
  - > <CHANNEL B<
- SSD MICROTECH™ TYPE 5701 RECEIVER PCB\***
- > <ENCODER RCV (FIBER OPTIC)>
  - > <NOT USED>
  - > <+24 VDC SUPPLY>
  - > <+24 VDC NOMINAL>
  - > <0 VDC POWER>
  - > <RS-422 ISOLATED SERIAL COMS PCB\*>
  - > <XMT->
  - > <XMT+>
  - > <0 VDC ISOLATED>
  - > <0 VDC SHIELD>
  - > <RCV->
  - > <RCV+>
  - > <RS-422 SERIAL COMS PORT (5703)>
  - > <RS-232 SERIAL COMS PORT (5703)>

DEVICE	MAXIMUM DRIVE HORSEPOWER RATING
590 DRV*	830,960 1120,1280 1440A
A2*	950A 1368A 1600A
F1,F2,F3	32 A
F4 - F9	700A 1000A 1250A
F10,F11	32 A
F12,F13	3 OR 5 A
F14	5 A
F15,F16	40 A
F18,19,20	500 VA (146 SPARE)

- \* ARMATURE AMPS DC**
- NOTES**
- ARMATURE AND DYNAMIC BRAKING TERMINATIONS A+, AND DB+ ARE TO BE MADE DIRECTLY TO LOAD SIDE OF CONTACTORS AM AND DB. DYNAMIC TERMINALS (A+ AND DB+) TO BE MADE DIRECTLY TO STACK.
  - DC CONTACTOR AM HAS SPARE AUXILIARY CONTACTS NOT WIRED TO TERMINALS AND RATED 125 VDC, 10 AMPS AS FOLLOWS:
- 
- DRIVE SHIPPED WITH FUSES INSTALLED FOR 460 VAC OPERATION. USE THE LOOSE FUSES SUPPLIED WITH THE DRIVE FOR 230 VAC. SEE DEVICE RATING TABLE FOR FUSE RATINGS.
  - DB CONTACT OPTIONAL.
  - F1 AND F2 MUST BE IN PHASE WITH L1 AND L2, RESPECTIVELY.
  - REMOVE THESE JUMPERS FOR AN EXTERNALLY POWERED FIELD SUPPLY.

**EUROTHERM DRIVES**  
RESTON, VIRGINIA, USA

**SCHEMATIC DIAGRAM**

STANDARD DRIVE W/ EXTERNAL STACK  
590 DRV DC DRIVE 500-900 HP NON-REGENERATIVE

DATE: 24 SEP 93  
DRAWN BY: S. ALEXANDER  
CHECKED BY: S. ALEXANDER  
APPROVED BY: F. WANKADIYA

SIZE: B  
DWG. NO.: H1552373B  
ISSUE: E  
SCALE: SHEET 1 OF 2

Figure L.11 - Schematic Diagram 500 - 900 Hp Non-Regenerative (Page 1)



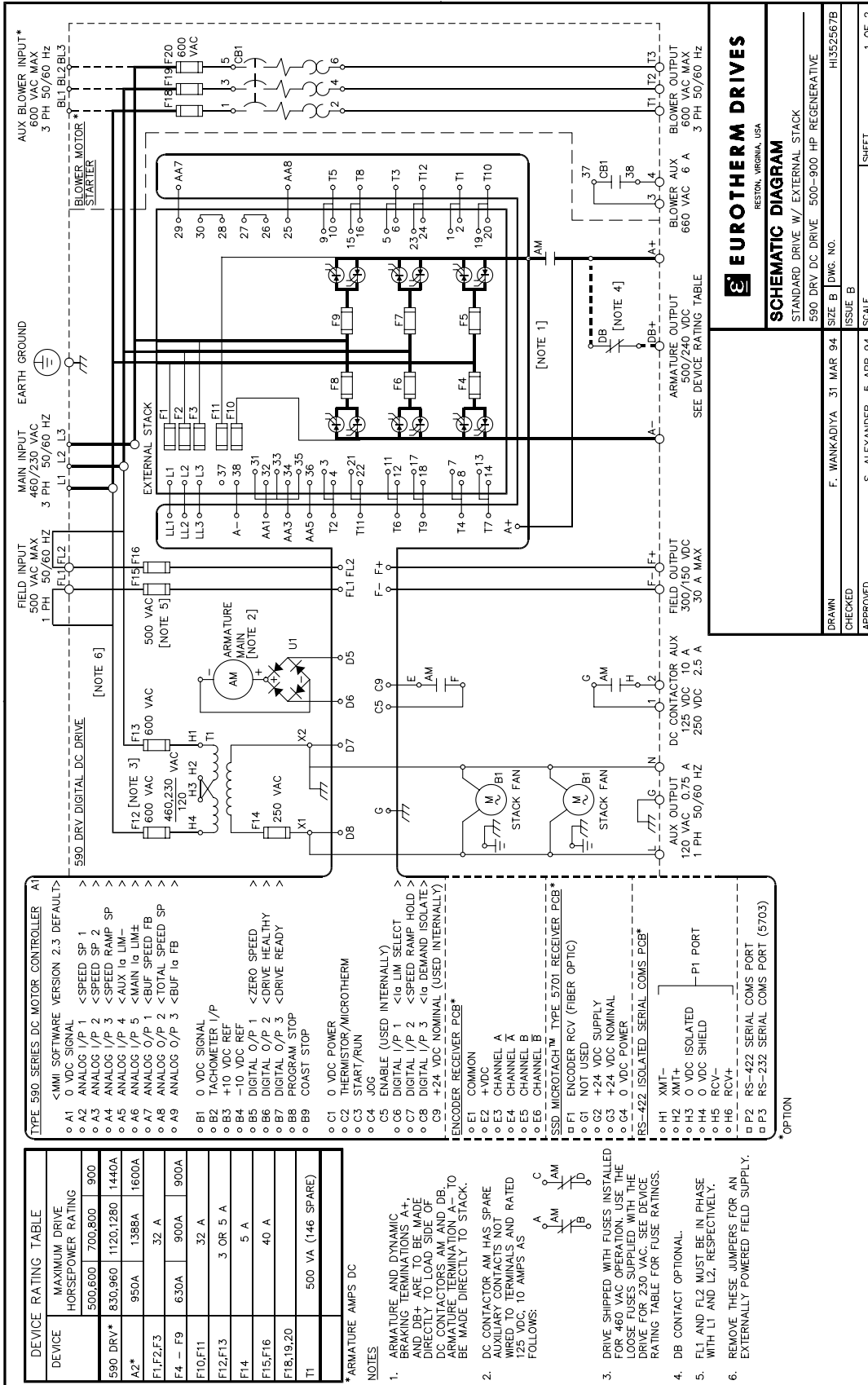


Figure L13 - Schematic Diagram 500 - 900 Hp Regenerative (Page 1)



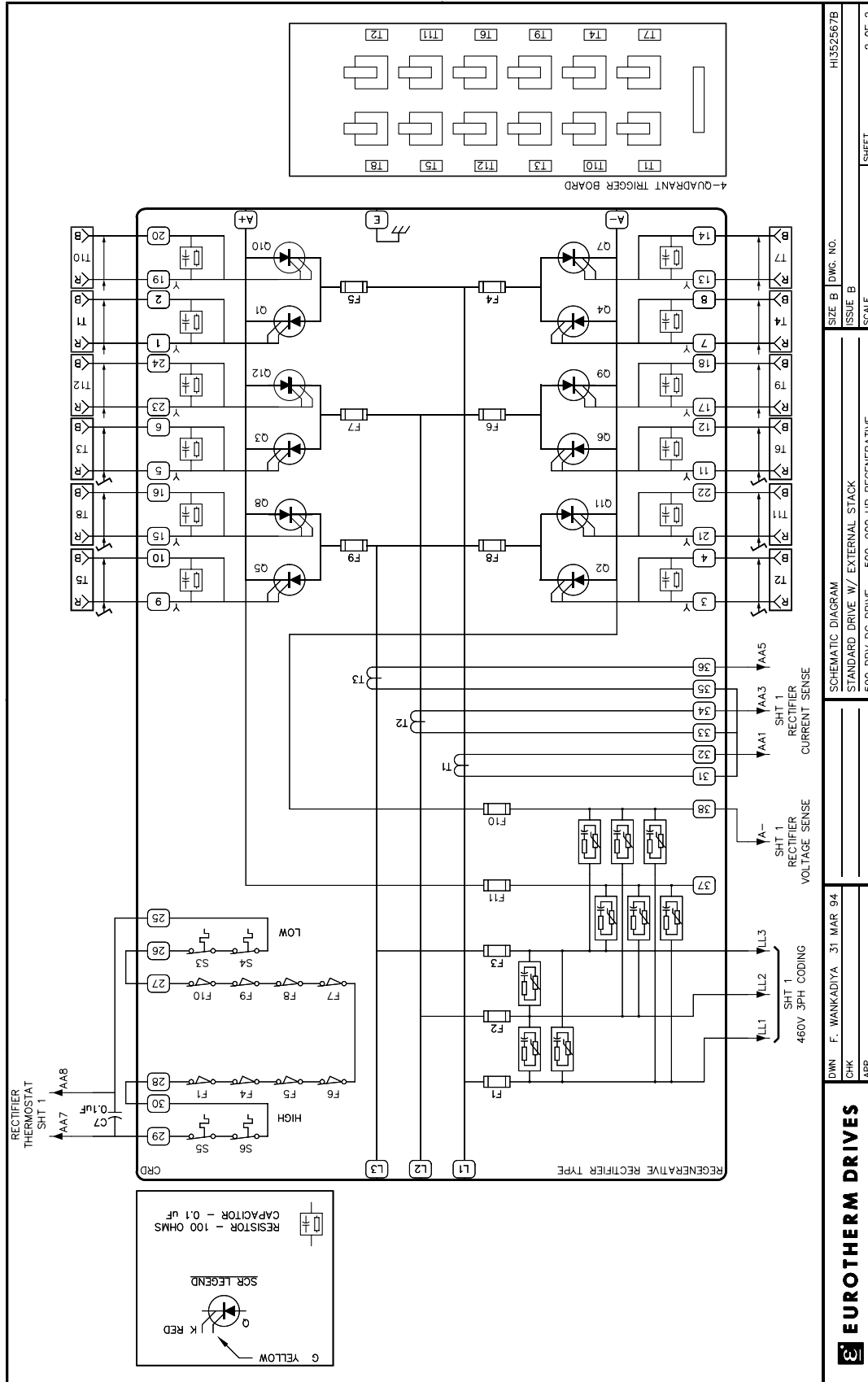


Figure L.14 - Schematic Diagram 500 - 900 Hp Regenerative (Page 2)

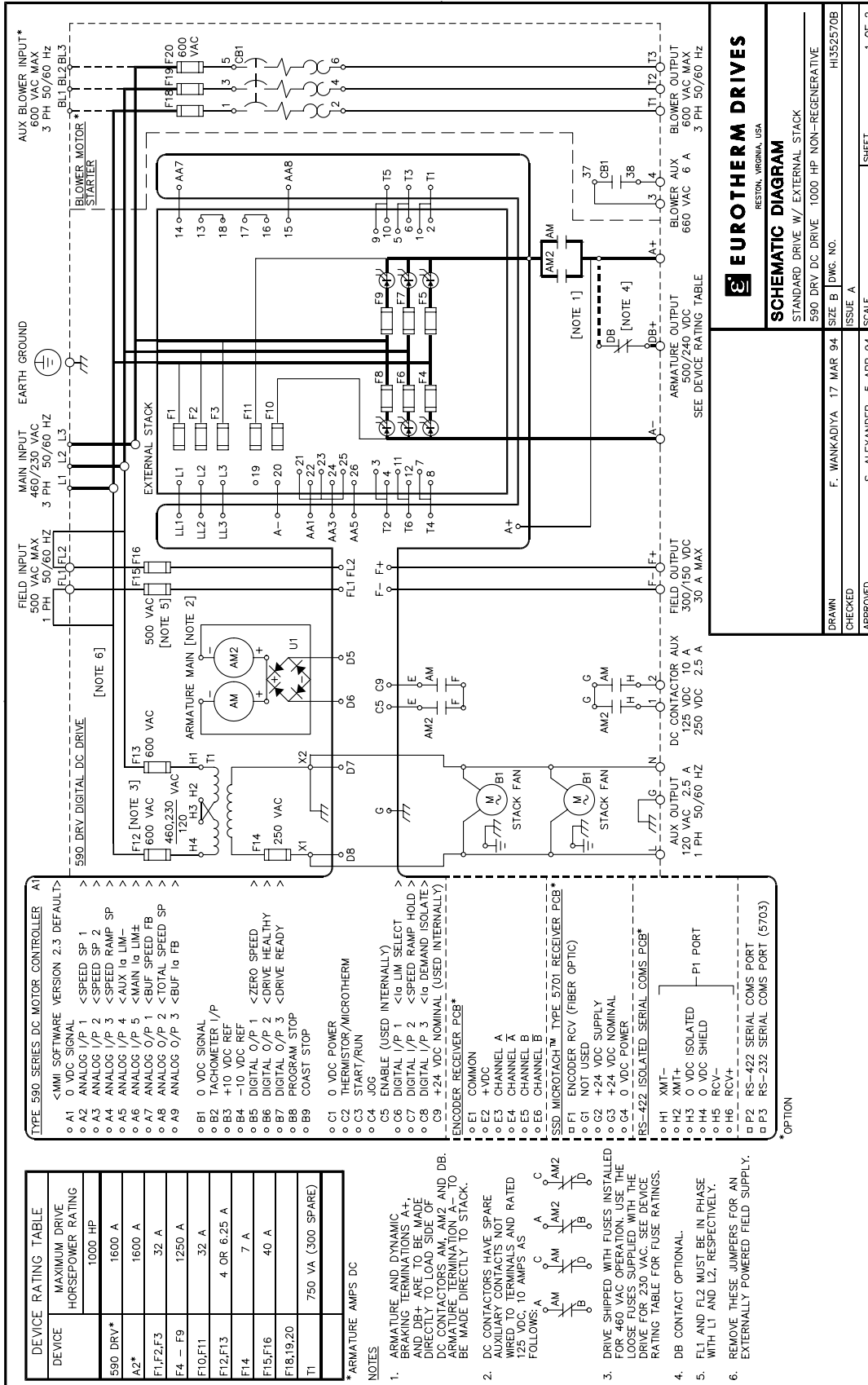


Figure L.15 - Schematic Diagram 1000 Hp Non-Regenerative (Page 1)

**EUROTHERM DRIVES**  
RESTON, VIRGINIA, USA

**SCHEMATIC DIAGRAM**

STANDARD DRIVE W/ EXTERNAL STACK  
590 DRV DC DRIVE 1000 HP NON-REGENERATIVE

DRAWN: F. WANKADIYA 17 MAR 94  
CHECKED: [ ]  
APPROVED: S. ALEXANDER 5 APR 94

SIZE: B [ ]  
DWS. NO.: H1352570B  
ISSUE: A  
SCALE: SHEET

1 OF 2

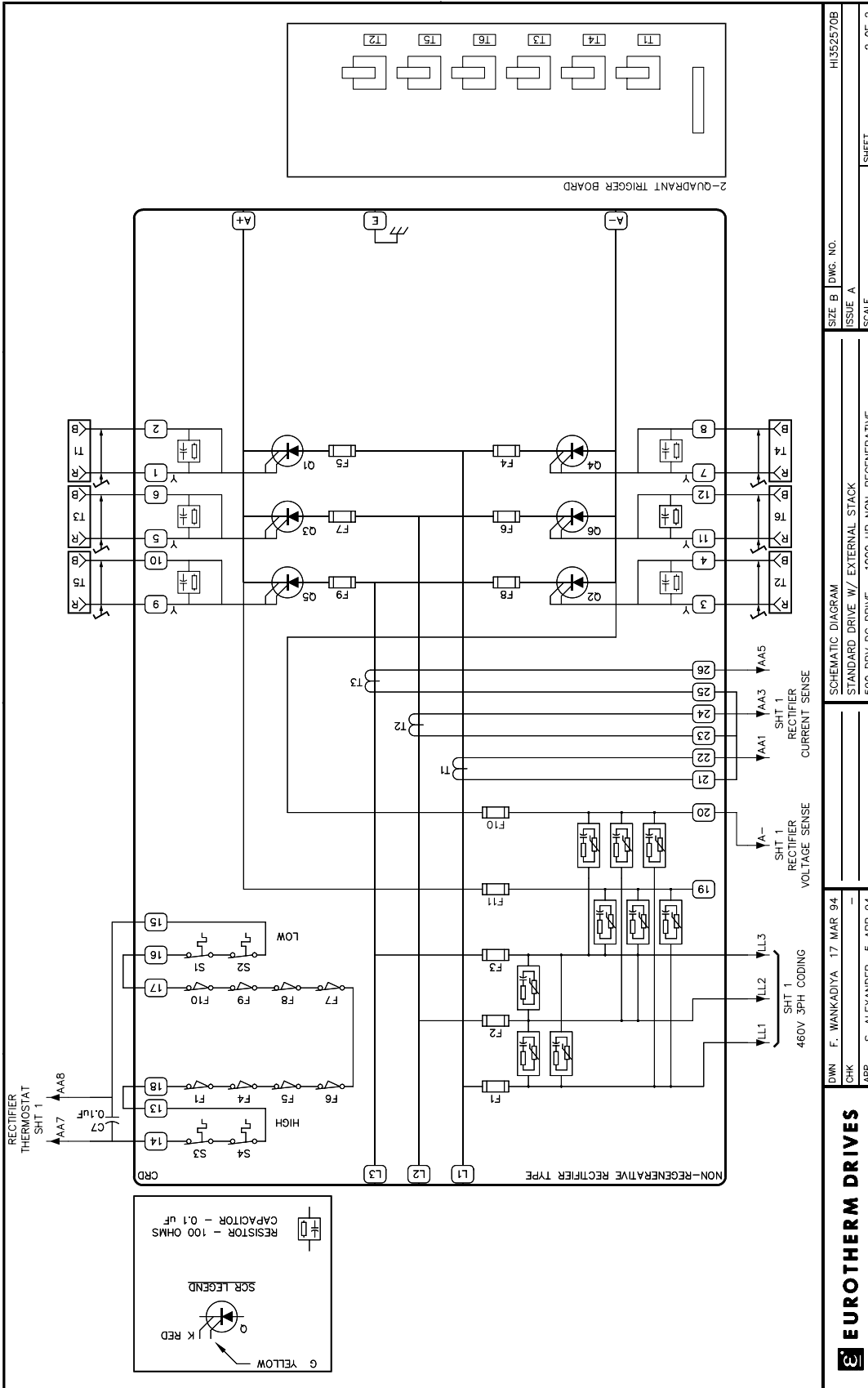
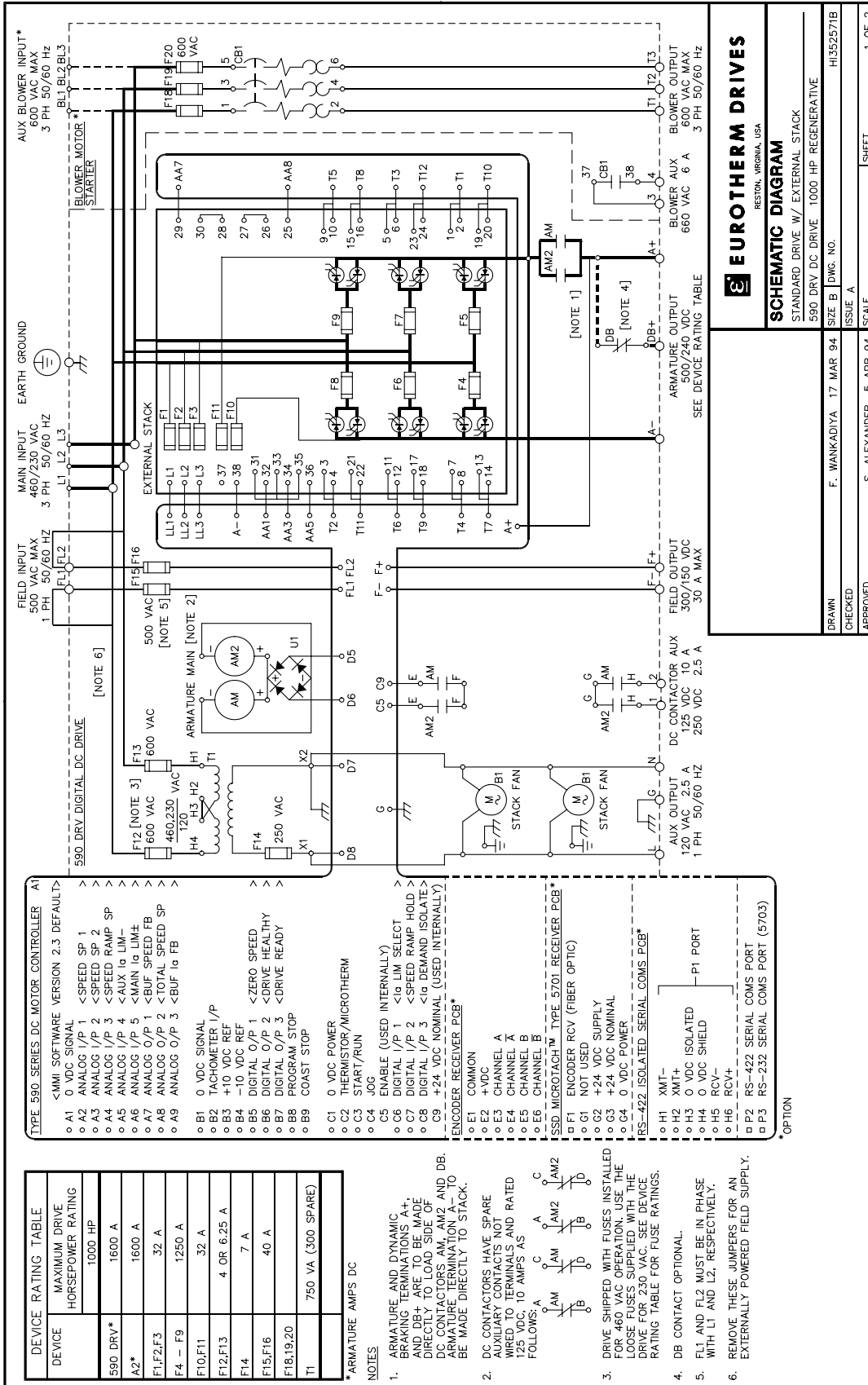


Figure L.16 - Schematic Diagram 1000 Hp Non-Regenerative (Page 2)



- TYPE 590 SERIES DC MOTOR CONTROLLER**
- > A1 0 VDC SIGNAL
  - > A2 ANALOG I/P 1 <SPEED SP 1
  - > A3 ANALOG I/P 2 <SPEED SP 2
  - > A4 ANALOG I/P 3 <SPEED RAMP SP
  - > A5 ANALOG I/P 4 <AUX Ia LIM-
  - > A6 ANALOG I/P 5 <MAIN Ia LIM±
  - > A7 ANALOG O/P 1 <BUF SPEED FB
  - > A8 ANALOG O/P 2 <TOTAL SPEED SP
  - > A9 ANALOG O/P 3 <BUF Ia FB
  - > B1 0 VDC SIGNAL
  - > B2 TACHOMETER I/P
  - > B3 +10 VDC REF
  - > B4 -10 VDC REF
  - > B5 DIGITAL I/P 1 <ZERO SPEED
  - > B6 DIGITAL I/P 2 <DRIVE HEALTHY
  - > B7 DIGITAL O/P 3 <DRIVE READY
  - > B8 PROGRAM STOP
  - > B9 COAST STOP
  - > C1 0 VDC POWER
  - > C2 THERMISTOR/MICROTHERM
  - > C3 START/RUN
  - > C4 JOG
  - > C5 ENABLE (USED INTERNALLY)
  - > C6 DIGITAL I/P 1 <Ia LIM SELECT
  - > C7 DIGITAL I/P 2 <SPEED RAMP HOLD
  - > C8 DIGITAL I/P 3 <Ia DEMAND ISOLATE>
  - > C9 +24 VDC NOMINAL (USED INTERNALLY)
- ENCODER RECEIVER PCB\***
- > E1 COMMON
  - > E2 +VDC
  - > E3 CHANNEL A
  - > E4 CHANNEL B
  - > E5 CHANNEL B
  - > E6 CHANNEL B
- SSD\_MICROTACH™ TYPE 5701 RECEIVER PCB\***
- > F1 ENCODER RCY (FIBER OPTIC)
  - > G1 NOT USED
  - > G2 +24 VDC SUPPLY
  - > G3 +24 VDC NOMINAL
  - > G4 0 VDC POWER
  - > RS-422 ISOLATED SERIAL COMS PCB\*
  - > H1 XMT-
  - > H2 XMT+
  - > H3 0 VDC ISOLATED
  - > H4 RCY-
  - > H5 RCY+
  - > H6 RCY+
  - > P2 RS-422 SERIAL COMS PORT
  - > P3 RS-232 SERIAL COMS PORT (5703)

DEVICE	MAXIMUM DRIVE HORSEPOWER RATING	1000 HP
590 DRV*	1600 A	
A2*	1600 A	
F1,F2,F3	32 A	
F4 - F9	1250 A	
F10,F11	32 A	
F12,F13	4 OR 6.25 A	
F14	7 A	
F15,F16	40 A	
F18,19,20	750 VA (300 SPARE)	

- \*ARMATURE AMPS DC
- NOTES**
- ARMATURE AND DYNAMIC BRAKING TERMINATIONS A+, AND DB+ ARE TO BE MADE TO THE DRIVE SIDE OF DC CONTACTORS MAIN 2 AND DB. ARMATURE TERMINATION A- TO BE MADE DIRECTLY TO STACK.
  - DC CONTACTORS HAVE SPARE AUXILIARY CONTACTS NOT WIRED TO TERMINALS AND RATED 125 VDC, 10 AMPS AS FOLLOWS:
    - A
    - B
    - C
    - AM
    - AM2
  - DRIVE SHIPPED WITH FUSES INSTALLED FOR 460 VAC OPERATION. USE THE LOOSE FUSES SUPPLIED WITH THE DRIVE FOR 230 VAC. SEE DEVICE RATING TABLE FOR FUSE RATINGS.
  - DB CONTACT OPTIONAL.
  - F11 AND F12 MUST BE IN PHASE WITH L1 AND L2, RESPECTIVELY.
  - REMOVE THESE JUMPERS FOR AN EXTERNALLY POWERED FIELD SUPPLY.

**EUROTHERM DRIVES**  
RESTON, VIRGINIA, USA

**SCHEMATIC DIAGRAM**

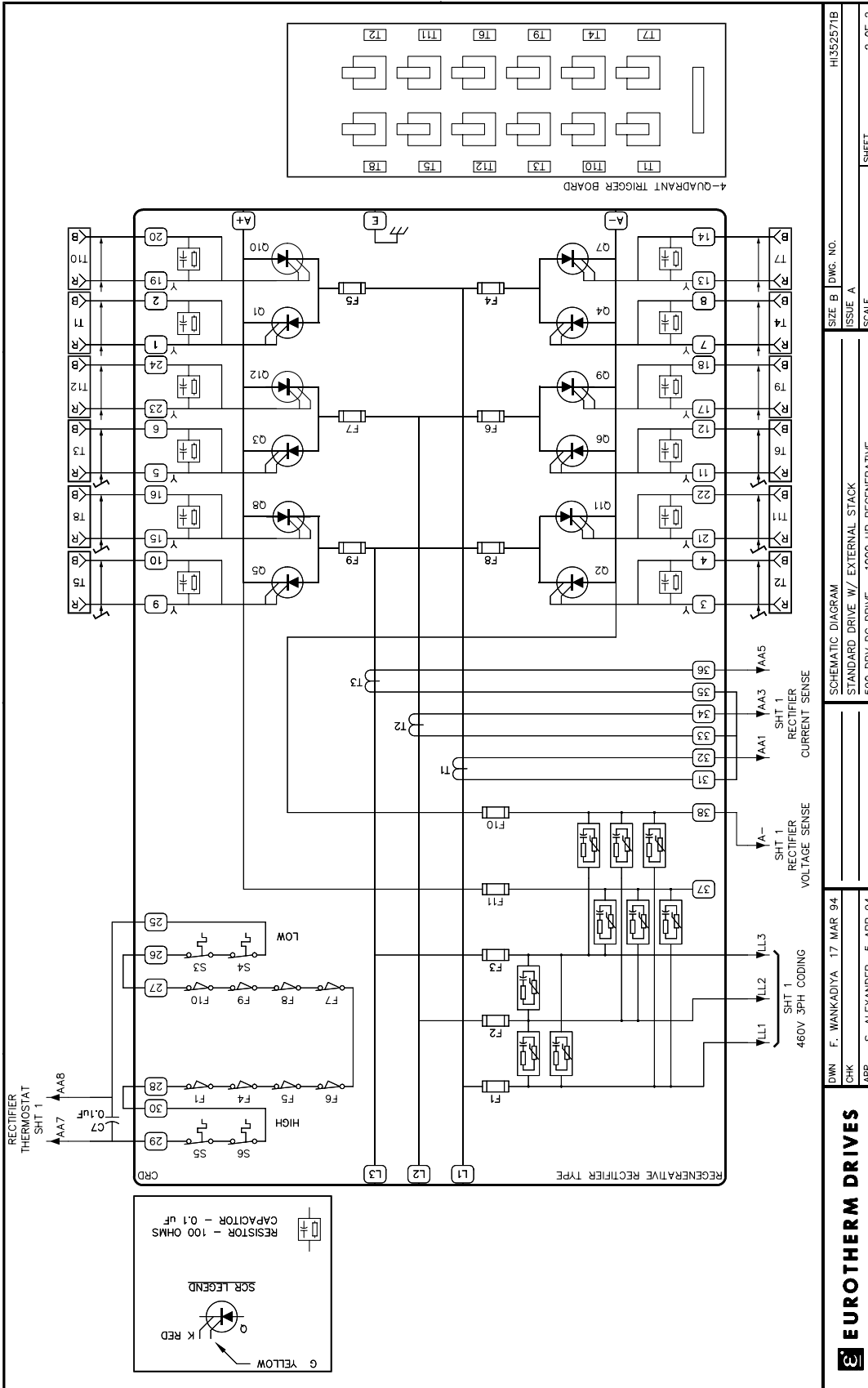
STANDARD DRIVE W/ EXTERNAL STACK  
590 DRV DC DRIVE 1000 HP REGENERATIVE

DRAWN F. WANKADIYA 17 MAR 94  
CHECKED  
APPROVED

ISSUE A  
SCALE  
SHEET

HIS52571B  
1 OF 2

Figure L.17 - Schematic Diagram 1000 Hp Regenerative (Page 1)



<b>EUROTHERM DRIVES</b> <small>RESTON, VIRGINIA, USA</small>		DWN: F. WANKADIA 17 MAR 94 CHK: S. ALEXANDER 5 APR 94 APP:	SCHEMATIC DIAGRAM STANDARD DRIVE W/ EXTERNAL STACK 590 DRV DC DRIVE - 1000 HP REGENERATIVE	SIZE B DWG. NO. H1352571B ISSUE A SCALE SHEET 2 OF 2
---	--	--	--	---

Figure L.18 - Schematic Diagram 1000 Hp Regenerative (Page 2)

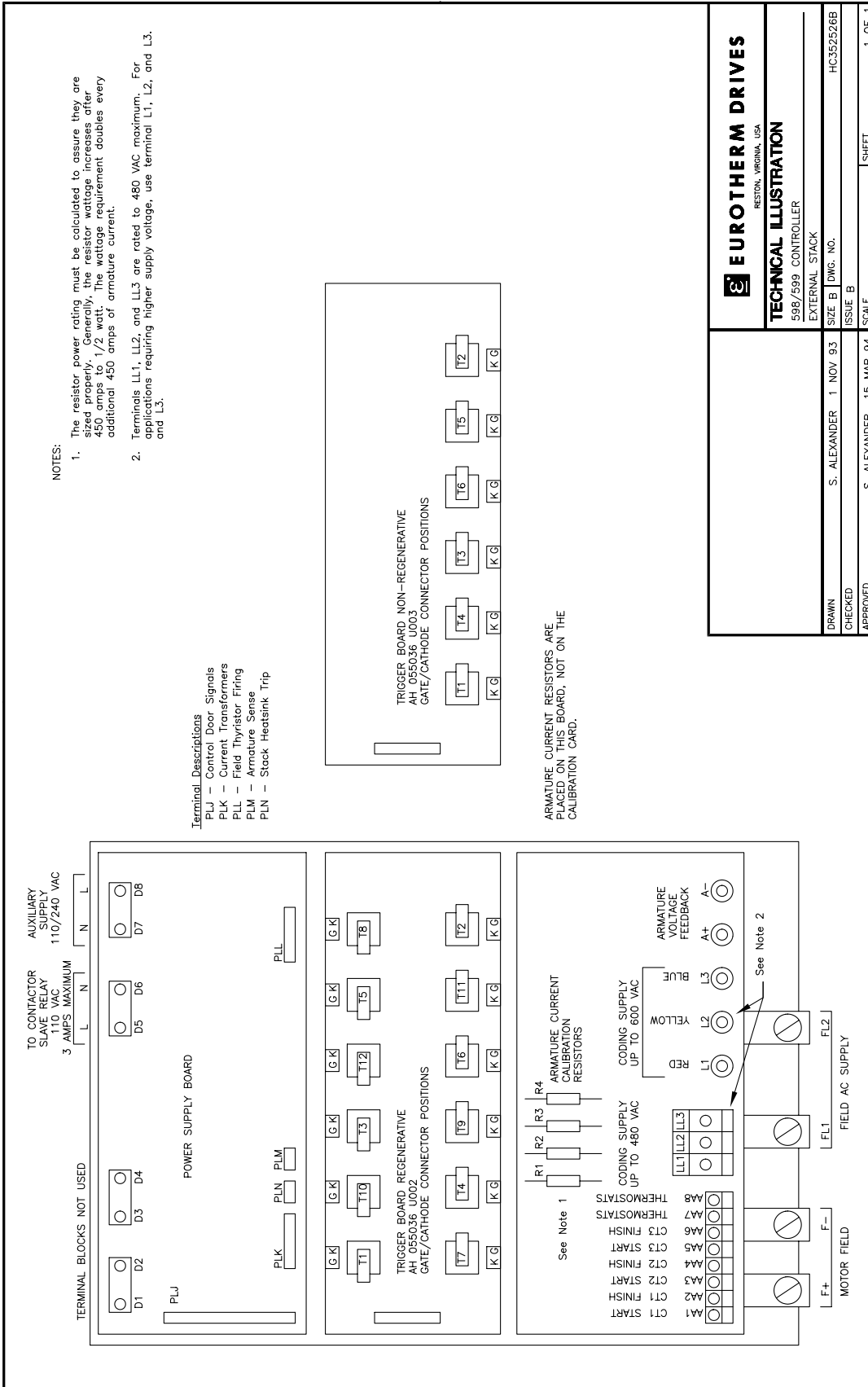


Figure L.19 - Technical Illustration 598 Controller Power Supply Boards

### EXTERNAL FIELD WIRING FOR THREE-BOARD POWER SUPPLIES

Early model 590 drives rated 164 A through 675 A use a three-board power supply design.

When supplying the field externally on a three-board power supply drive rated 164 A through 270 A, move the field supply jumpers on the power supply board as shown in Figure L.20. Move the RED wire from internal terminal FI to internal terminal FE-R and the YELLOW wire from FI to FE-Y. Protect the supply externally using suitable branch circuit protection fuses rated for the supply voltage. The fuses should be no larger than 10 A.

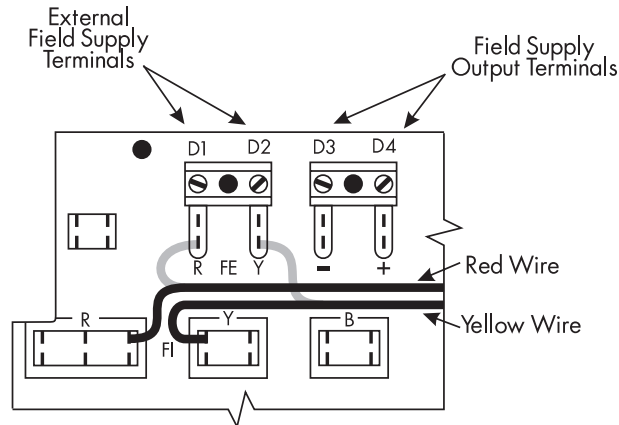


Figure L.20 - External Field Connections - 3-Board Power Supplies

For drives with three-board power supplies rated 270 A to 675 A, rewire the field supply leads as shown in Figure L.21. Remove the the RED and YELLOW wires from their stake connectors and clip off each wire's stake connector. Strip each lead 3/8" and terminate them into the correct screw terminal, as shown in the figure. Protect the supply externally using suitable branch circuit protection fuses rated for the supply voltage. The fuses should be no larger than 20 A.

NOTE. Once the wires are stripped and connected, they will be too short to reconnect *back* to the original stake connectors for an internal field supply source.

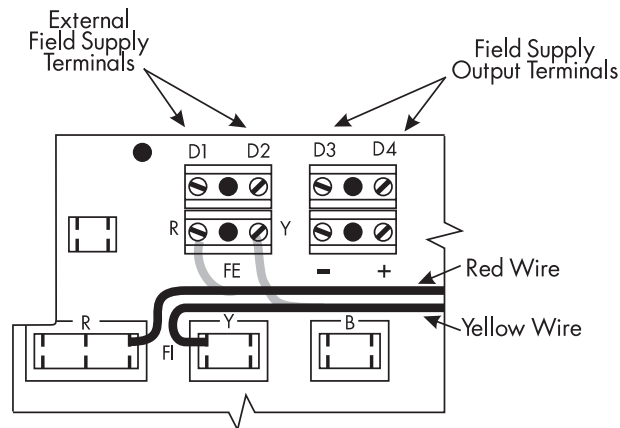


Figure L.21 - External Field Connections - 3-Board Power Supplies

#### Caution

An "out-of-phase" external supply can blow fuses and cause faulty operation. The AC field supply is normally fed internally from L1 and L2. Occasionally, motors require field voltages greater than can be supplied by the main L1, L2, and L3 supply. This external field supply must be "in phase" with the main supply. The supply to terminal FL1 must connect to the same phase on terminal L1 and the FL2 must connect to the supply phase on L2.



## EXTERNAL STACK FIELD WIRING

Refer to NOTE 5 and NOTE 6 in the drawings for external stack drives (500 through 1000 HP) in Figures L.11, L.13, L.15 and L.17. Connect the external AC field supply to terminal connections FL1 and FL2. The field supply circuitry is fused internally at 30 A within the 590 DRV controller whether the supply is provided internally or externally.

Fuse the external field supply externally at 30 A if you are using the 598/599 controller *without* a DRV package. A drawing of the power supply boards within the 598 external stack controller appears in Figure L.19.



## Appendix M SPECIAL BLOCKS AND APPLICATION NOTES

### INTRODUCTION

The SPECIAL BLOCKS menu contains five function blocks used to add winder and section control capability to the 590 DRV Digital drive: DIAMETER CALC., TAPER CALC., TORQUE CALC., SETPOINT SUM 2, and PID.

This chapter is arranged in the order these menus appear in the MMI. Each section contains a description of the function block, a block diagram and a list of parameters. In addition, a drawing at the beginning of each section illustrates how to access the function block through the MMI. Additional information and diagrams are placed after the block diagram.

Tag numbers are associated with each function block parameter and are used to configure the 590 DRV Digital drive. Each function block diagram lists the tag number, MMI parameter name, description, signal range and default value.

Application notes begin on page M-11. They contain sample open-loop winder applications (CPW), closed-loop winder applications (SPW), and section control applications (SC).

## DIAMETER CALC.

DIAMETER CALC. is used to calculate roll diameters in winder applications. It calculates diameter by dividing the LINE SPEED by REEL SPEED. The resulting diameter is a percentage of the maximum full roll diameter. A lead section, adjacent line section, or surface driven speed sensing device is required to supply the line speed signal. The winder or unwind drive's motor speed feedback provides the reel speed input.

NOTE. This block is ignored by the drive unless SYSTEM::CONFIGURE I/O:: BLOCK DIAGRAM::DIAMETER is connected to a non-zero tag.

The ratio of the minimum core diameter to the maximum roll diameter determines the operating range of the diameter calculator. MIN DIAMETER is set to that ratio using the expression:

$$\text{Minimum Core Outside Diameter} \div \text{Maximum Full Roll Diameter} \times 100\%$$

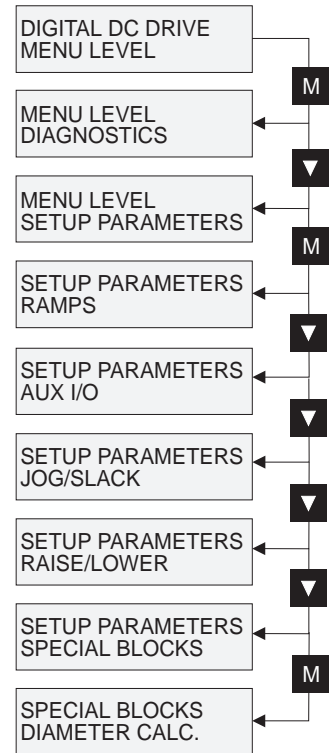
The magnitude of LINE SPEED is compared with MIN SPEED to determine when the diameter calculator will operate. When LINE SPEED is above MIN SPEED the calculator is on; below MIN SPEED, DIAMETER is held at the last calculated diameter.

When EXTERNAL RESET is TRUE, RESET VALUE is used as the diameter output.

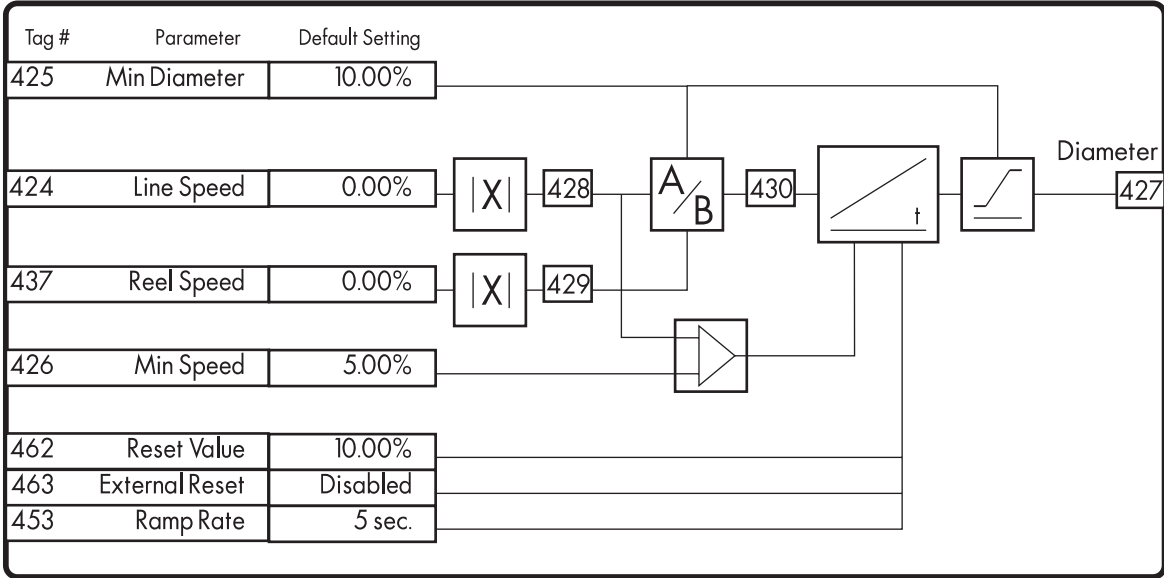
NOTE. In turret winder applications, LINE SPEED will usually be above MIN SPEED. During roll changes, EXTERNAL RESET must be held TRUE for the new spindle until the web has been transferred and the diameter is calculated properly. RESET VALUE must be set to the appropriate new core value for a rewind or new roll diameter for an unwind.

RAMP RATE adjusts the filtering of the diameter output. Its setting is the time it takes for a 100 percent change in DIAMETER. For example, at the default setting of 5.0 seconds, a 50 percent step change in diameter would take 2.5 seconds for the output diameter output to display the change.

Tag Parameter	Description		
<b>Range</b>			
424 Line Speed	The line speed input from analog input 3.	±105.00%	0.00%
437 Reel Speed	The winder speed from the Speed Feedback signal.	±105.00%	0.00%
425 Min Diameter	Set to the minimum core diameter as a percentage of the maximum roll diameter. Used in the diameter calculation and as a clamp for the diameter output.	0.00 - 100.00%	10.00%
426 Min Speed	The threshold for line speed below which the block stops calculating new diameters.	0.00 - 100.00%	5.00%
462 Reset Value	This is the diameter preset used when changing rolls. It is the value of the diameter loaded when External Reset is Enabled.	0.00 - 100.00%	10.00%
463 External Reset	Sets the diameter to Reset Value when Enabled.	Enabled/Disabled	Disabled
453 Ramp Rate	Linear filter used to smooth the diameter output.	0.1 - 600.0 Secs	5.0 Secs
427 Diameter	Output of the Diameter Calc. function block.	0.00 - 100.00%	



**SETUP PARAMETERS:  
SPECIAL BLOCKS:  
DIAMETER CALC.**



KEY	—>	Non-configurable	*	Filtered Tag
	- ->	Configurable	D:nn	Dagnostic #

Figure M.1 - Diameter Calculator



### TAPER CALC.

TAPER CALC. uses two inputs, tension setpoint and taper setpoint, to create the tension demand. The operator usually controls these setpoints.

NOTE. This block is ignored by the drive unless SYSTEM:: CONFIGURE I/O:: BLOCK DIAGRAM:: TAPER is connected to a non-zero tag.

Taper is a common requirement for winders. It reduces the tension as the roll diameter increases. A profiler adjusts the tension using the equation:

$$(100\% - \text{TAPER} \times (1 - \text{MIN DIAMETER} \div \text{DIAMETER}))$$

to yield a hyperbolic taper output. MIN DIAMETER and DIAMETER are linked internally to DIAMETER CALC. The profile is displayed in Figure M.2.

The result is multiplied by TENSION SPT to get TAPER DEMAND. When the taper setpoint is at 100 percent the motor produces constant torque, that is a constant current from core to full roll, and the tension falls off as the roll builds.

TENSION TRIM allows the tension demand to be adjusted for example when using closed loop trim. The result is TOT. TENS. DEMAND.

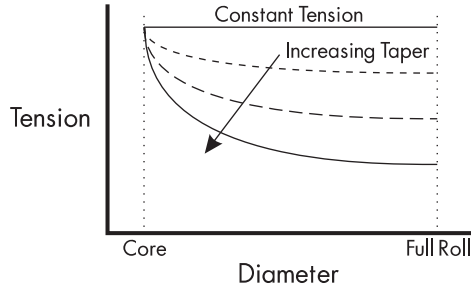
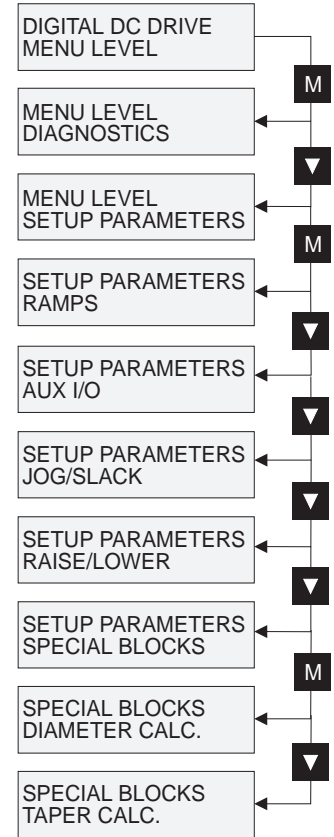
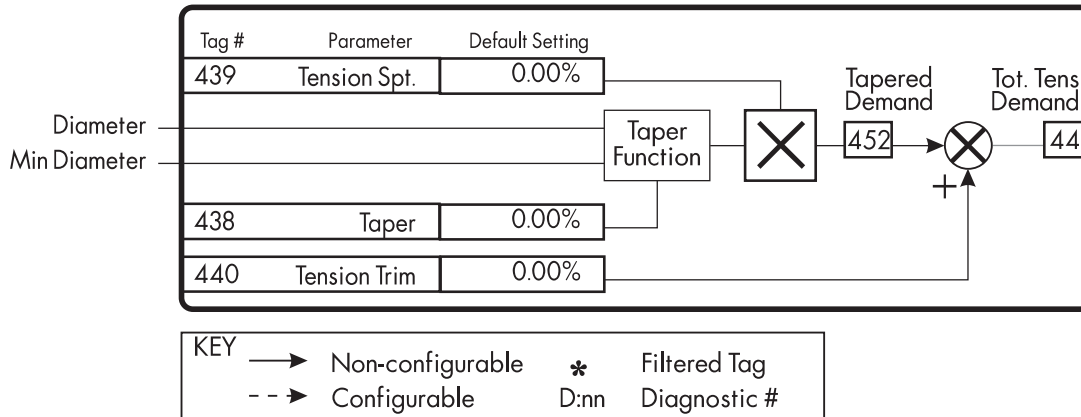


Figure M.2 - Taper Profile



Tag	Parameter	Description	Range	Default
438	Taper	Taper setpoint input for determining the amount of taper in the tension demand.	±100.00%	0.00%
439	Tension Spt.	Tension setpoint input.	0.00 - 100.00%	0.00%
452	Taper Demand	Tension demand before adding Tension Trim.	0.00 - 100.00%	
440	Tension Trim	Tension Trim input.	±100.00%	0.00%
441	Tot. Tens. Demand	Output of the Taper Calc. function block.	±100.00%	

### SETUP PARAMETERS: SPECIAL BLOCKS: TAPER CALC.



KEY	→	Non-configurable	*	Filtered Tag
	-->	Configurable	D:nn	D diagnostic #

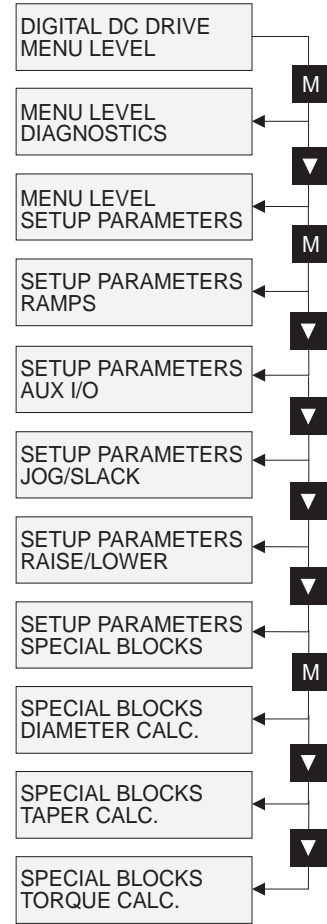
Figure M.3 - Tension Demand



## TORQUE CALC.

This block performs two functions. First, it switches the drive from speed mode to tension mode using the TENSION ENABLE switch. Second, it switches the current limits as required for over or under winding. When TENSION ENABLE is ENABLED, one current clamp (chosen by OVER WIND) uses the TENSION DEMAND signal and the other uses the default value.

NOTE. This block is ignored by the drive unless SYSTEM:: CONFIGURE I/O:: BLOCK DIAGRAM:: POS. I CLAMP and NEG. I CLAMP is connected to a non-zero tag.



Tag	Parameter	Description	Range	Default
432	Torque Demand	Torque Calc. block input signal.	±100.00%	0.00%
433	Tension Enable	When enabled, connects the Torque Demand input to the current limit clamps.	Enabled/Disabled	Enabled
434	Over Wind	Reverses the sign of the output clamps for over/under winding.	Enabled/Disabled	Enabled

### SETUP PARAMETERS: SPECIAL BLOCKS: TORQUE CALC.

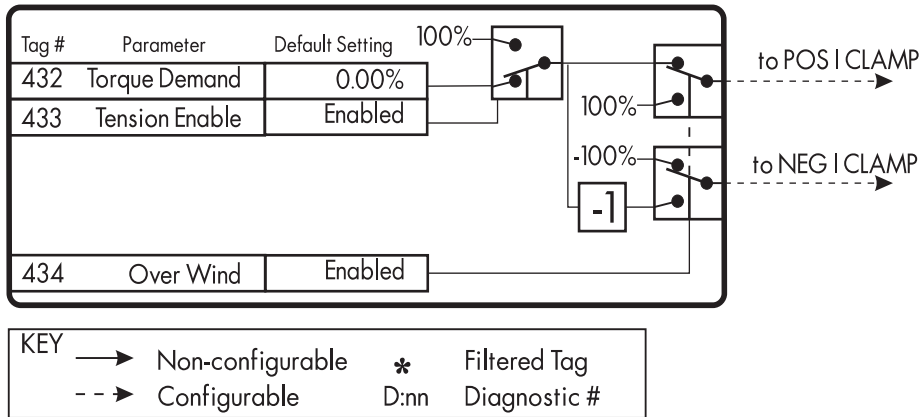


Figure M.4 - Torque Calculator

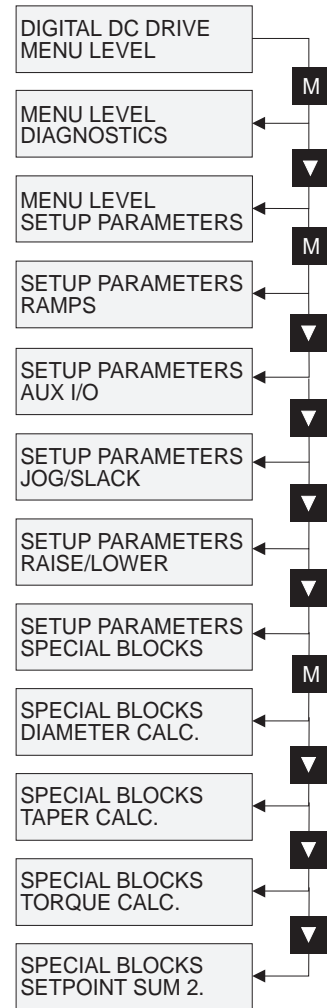


## SETPOINT SUM 2

SETPOINT SUM 2 allows two scalable inputs and one unscalable input to be combined. These are used for friction compensations in CPW and basic summing for SPW.

Inputs 0 and 1 can be scaled individually using their respective ratio and divider parameters. LIMIT sets symmetrical clamps for inputs 0 and 1 and the final output.

NOTE. This block is ignored by the drive unless SYSTEM::CONFIGURE I/O:: BLOCK DIAGRAM:: SETPOINT SUM 2 is connected to a non-zero tag.



Tag	Parameter	Description	Range	Default
445	Input 2	Unscaled input.	±300.00%	0.00%
443	Input 1	Scaled input.	±300.00%	0.00%
444	Input 0	Scaled input.	±300.00%	0.00%
446	Ratio 1	Multiplier term for Input 1.	±3.0000	1.0000
447	Ratio 0	Multiplier term for Input 0.	±3.0000	1.0000
466	Divider 1	Divider term for Input 1.	±3.0000	1.0000
448	Divider 0	Divider term for Input 0.	±3.0000	1.0000
449	Limit	Symmetrical limit for Inputs 0 and 1 as well as the Setpoint Sum 2 block output.	0.00 - 200.00%	100.00%
451	Spt. Sum Output	Output of the Setpoint Sum 2 block.	±200.00%	



**SETUP PARAMETERS:  
SPECIAL BLOCKS:  
SETPOINT SUM 2**

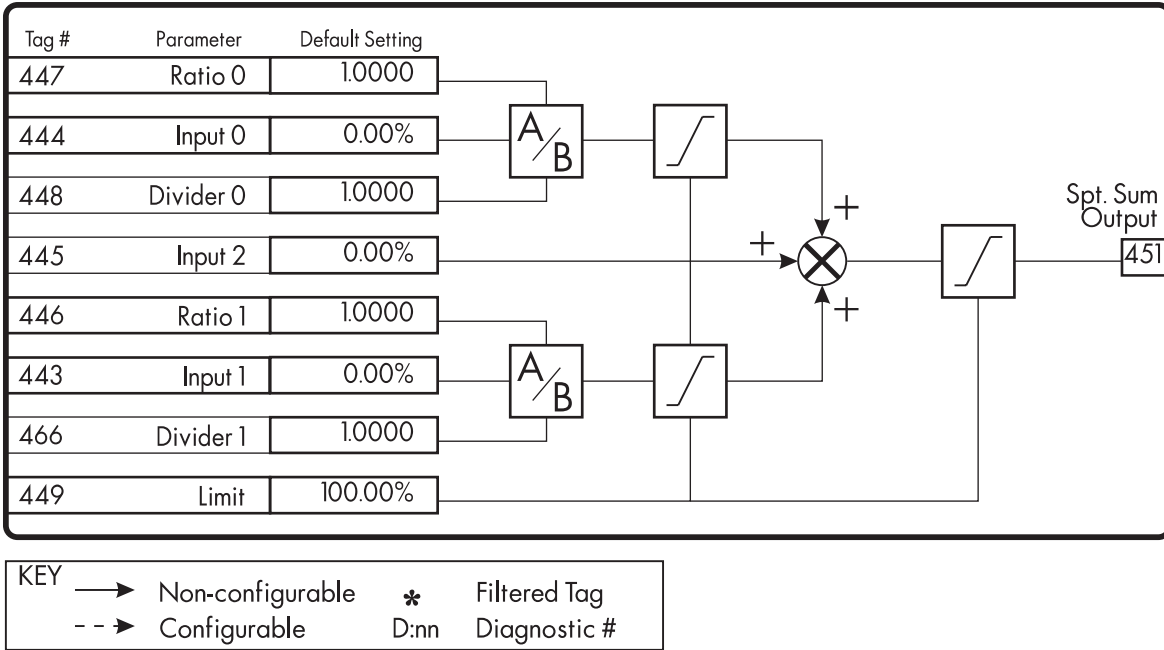


Figure M.5- Setpoint Sum 2



## PID

The PID block executes a Proportional + Integral + Derivative control algorithm with an added filter to attenuate high-frequency noise. P, PD, PI, or PID can be selected as required. The algorithm modifies the error between the setpoint and the feedback with the proportional, integral, and derivative terms. The error is clamped internally to  $\pm 105$  percent maximum.

**NOTE.** This block is ignored by the drive unless SYSTEM:: CONFIG-URE I/O:: BLOCK DIAGRAM:: PID is connected to a non-zero tag.

The proportional, integral, and derivative terms are scaled by the PROP. GAIN, INT. TIME CONST., and DERIVATIVE TC, respectively. An additional gain profiler can modify the proportional gain as the roll diameter changes. Figure M.8 shows how the proportional gain changes when using the profiler.

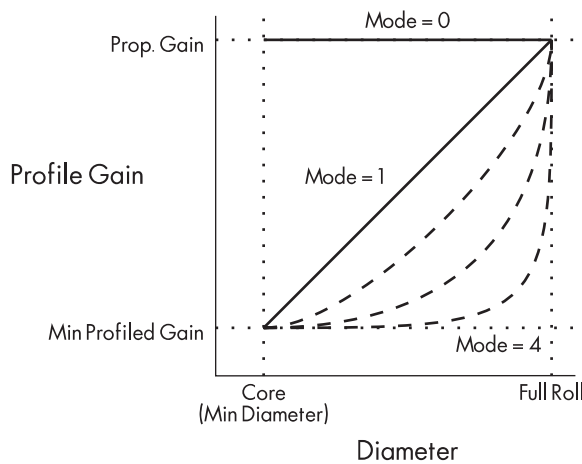
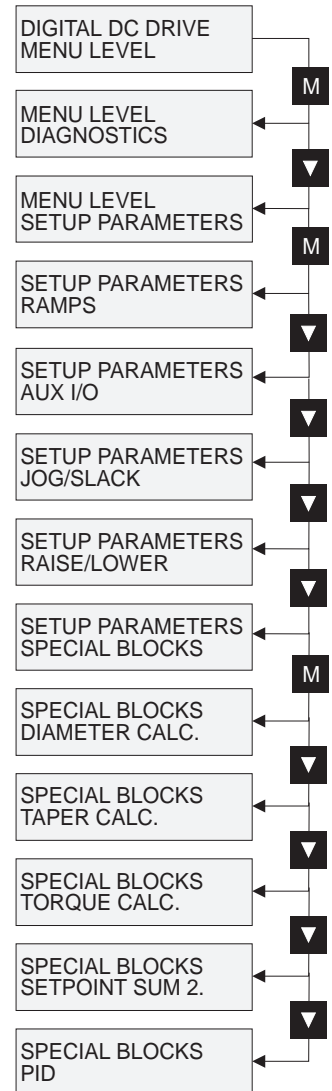


Figure M.6 - Gain Profiler

Proportional gain scales the output based upon the input error. Increasing PROP. GAIN will improve the response time while increasing overshoot. MODE selects the proportional gain profile. When set to 0, the proportional gain remains constant over the entire roll. Changing the value of MODE increases the profile as shown in Figure M.8. PROP. GAIN and MIN PROFILE GAIN set the maximum and minimum gains over the range of diameters as the roll builds.

Integral eliminates steady-state error. Reducing INT. TIME CONST. improves response; however, if it is set too short, it will cause instability. The integral value is clamped internally by the settings of POSITIVE LIMIT and NEGATIVE LIMIT. It is also held at the last value when the PID CLAMPED output is TRUE. Setting INTEGRAL DEFEAT to ON will disable the integral gain term.

Tag	Parameter	Description	Range	Default
410	Input 1	PID setpoint input.	$\pm 300.00\%$	0.00%
412	Ratio 1	Multiplier term for Input 1.	$\pm 3.0000$	1.0000
418	Divider 1	Divider term for Input 1.	$\pm 3.0000$	1.0000
411	Input 2	PID feedback input.	$\pm 300.00\%$	0.00%
413	Ratio 2	Multiplier term for Input 2.	$\pm 3.0000$	1.0000
414	Divider 2	Divider term for Input 2.	$\pm 3.0000$	1.0000
409	Integral Defeat	When On the integral term is disabled.	Off/On	Off
408	Enable	Enables or disables the PID output.	Disabled/Enabled	Enabled
417	PID Output	Output of the PID block.	$\pm 315.00\%$	
415	PID Error	The difference between Input 1 and Input 2.	$\pm 105.00\%$	
416	PID Clamped	Signals that one of the PID limits has been reached.	False/True	
404	Prop. Gain	Maximum limit of the proportional gain.	0.0 - 100.0	1.0





**SETUP PARAMETERS:  
SPECIAL BLOCKS:  
PID**

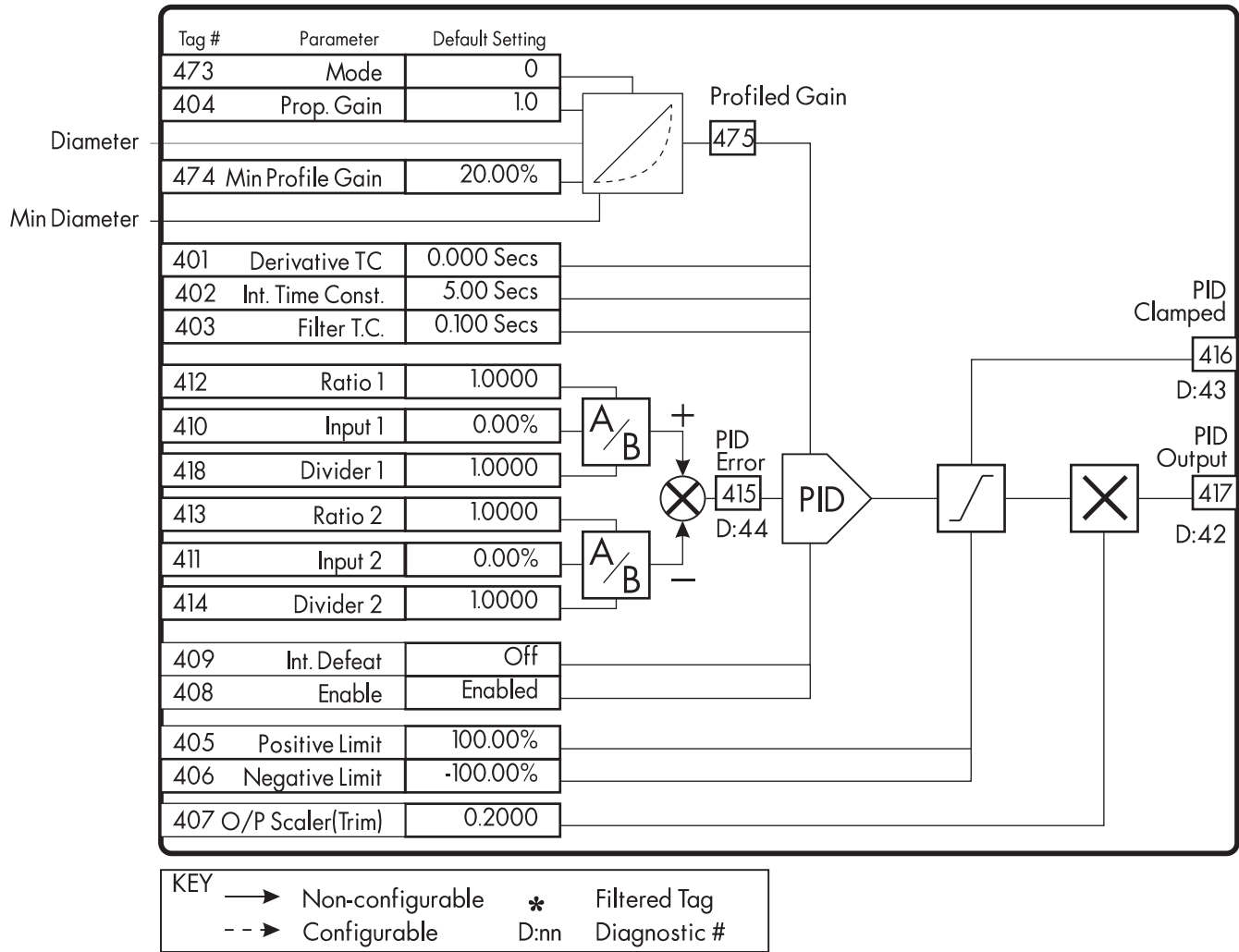


Figure M.7- Setpoint Sum 2

Tag	Parameter	Description	Range	Default
475	Profiled Gain	The proportional gain after profiling. If Mode = 0, then Profiled Gain equals Prop. Gain.	0.0 - 100.0	
473	Mode	Determines the shape of the proportional gain profile. The higher the setting, the steeper the curve of the profiled gain.	0 - 4	0
474	Min Profile Gain	The minimum gain of the proportional gain profiler when Mode is greater than 0.	0.00 - 100.00%	20.00%
402	Int. Time Const.	Integral time constant value.	0.01 - 100.00 Secs	5.00 Secs
401	Derivative TC	Derivative time constant value. When set to 0.000, the derivative term is removed.	0.00 - 10.000 Secs	0.000 Secs
403	Filter T.C.	A first-order filter for removing high frequency noise from the PID output. When set to 0.00, the filter is removed.	0.00 - 10.000 Secs	0.100 Secs
405	Positive Limit	Positive limit of the PID output.	0.00 - 105.00%	+100.00%
406	Negative Limit	Negative limit of the PID output.	-105.00 - 0.00%	-100.00%
407	Output Scaler (Trim)	Sets the percentage of PID output to be used as trim.	±3.0000	0.2000



Derivative gain instantaneously boosts the PID output signal. Increasing DERIVATIVE TC decreases the damping which causes overshoot and oscillations in most cases resulting in an unacceptable system response.

**NOTE.** For most applications, derivative gain is never used and is usually left at its default value of 0.000 seconds.

Derivative gain can improve response in some dancer tension controlled systems, particularly those systems with high inertia dancers which need an instantaneous response to overcome the weight of the dancer roll. For loadcell controlled tension systems, derivative gain is almost *never* used.

Figure M.6 shows the types of system responses possible. In underdamped systems, the output oscillates and the settling time increases. Critically damped systems have no overshoot or oscillations. They reach the setpoint within the desired response time. Overdamped systems do not oscillate but do not reach the setpoint within the desired response time.

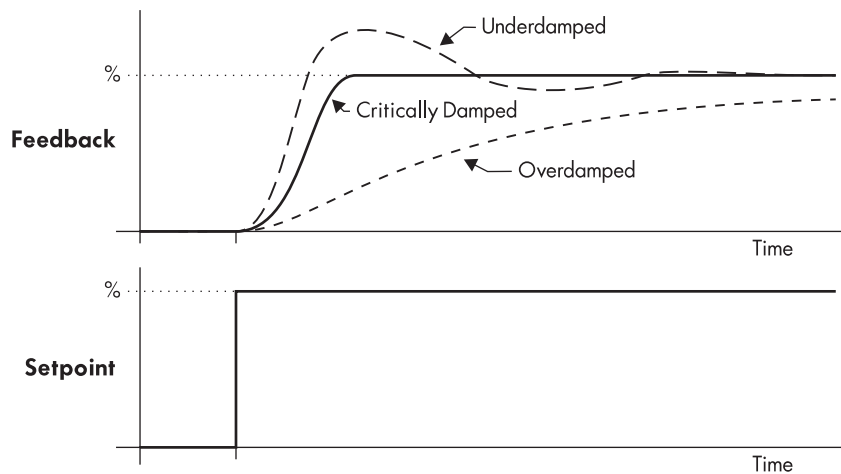


Figure M.8 - System Response to a Step-function Input

FILTER T.C. is a first-order filter used to attenuate high-frequency noise. Increasing its value reduces the affect of high-frequency feedback changes.

PID ENABLE, when DISABLED, sets the proportional, integral, and derivative terms to zero, yielding a zero output. This is used when a turret winder is in speed mode during a roll change, for example.

O/P SCALER (TRIM) scales the PID output to produce the speed trim. It sets the amount of overspeed the PID trim produces and the polarity of the trim. The polarity should be positive when the feedback devices are upstream of the drive and negative when downstream of the drive.

The trim range value depends on the nature of the web. It needs to be greater for an extensible web than for a non-extensible web. In addition, the extensible web will require a higher control loop gain which comes with the greater trim range. If required, trim ranges for two different types of web can be selected by configuring an unused digital input to set two different values of trim range (see Extensible/Non-extensible Webs on page M-37).

Operators can read the PID error, PID output, setpoint, and feedback in the drive's MMI by monitoring the following values.

1. PID ERROR is displayed in DIAGNOSTICS::PID ERROR.
2. PID OUTPUT is displayed in DIAGNOSTICS::PID OUTPUT.
3. The setpoint is monitored at SETUP PARAMETERS::SPECIAL BLOCKS::PID::INPUT 1.
4. The feedback is monitored at SETUP PARAMETERS::SPECIAL BLOCKS::PID::INPUT 2.

## APPLICATION NOTES

The following sections contain sample configurations using the SPECIAL BLOCKS functionality. They also have operating suggestions for using 590 Digital drive features.

NOTE. To use these configurations, the drive must be provided with firmware version 3.X or later.

Each section contains a simplified block diagram showing the configuration's connections. The user must make those connections before the control options will function. These configurations are available from Eurotherm Drives on disk as an ASCII file for uploading to the drive.

NOTE. The following configurations are samples. Users can customize them for their applications or use the SPECIAL BLOCKS functionality as needed.

### WARNING

The control terminals of the drive are fully isolated from all power circuits and should not be connected to other non-isolated circuits. In the interests of safety and to minimize electrical noise, it is recommended that the drive 0 volts common terminal be connected to ground either directly at the drive or at one point in the system.

## 590 Terminal Designations

Figure M.9 lists the types and functions of the 590 Digital series DC motor controller terminals when using Current Programmed Winder, Speed Programmed Winder, or Section Control configurations described later in this chapter.

Drive Terminal	Software Reference	Current Programmed Winder Function	Speed Programmed Winder Function	Section Control Function
A2	Analog Input 1	Preset Diameter	Preset Diameter	Draw/Ratio
A3	Analog Input 2	Not Connected	Tension/Dancer Feedback	Not Connected
A4	Analog Input 3	Line Speed Reference	Line Speed Reference	Line Speed Reference
A5	Analog Input 4	Tension Setpoint	Tension Setpoint	Tension Setpoint
A6	Analog Input 5	Taper Setpoint	Taper Setpoint	Tension Feedback
A7	Analog Output 1	Reel Speed Output	Dancer Loading Output	Section Speed
A8	Analog Output 2	Diameter Output	Diameter Output	Total Speed Setpoint
C4	Jog	Tension Enable	Jog	Torque Mode
C6	Digital Input 1	Overwind	Overwind	Reverse
C7	Digital Input 2	Preset Enable	Preset Enable	Not Connected
C8	Digital Input 3	Not Connected	Tension Enable	PID Enable

Figure M.9 - Terminal Functions

## OPEN-LOOP WINDER (CPW)

This configuration provides standard features used in center winder applications including: diameter calculation with memory and preset, tension and taper, loss compensation, and over/under winding. It can control unwinds or rewinds for single-spindle and turret winders. The configuration uses four function blocks in the SPECIAL BLOCKS menu; DIAMETER CALC., TAPER CALC., TORQUE CALC., and SETPOINT SUM 2.

**NOTE.** This configuration does not support field weakening. A configuration containing field range compensation is available. Call Eurotherm Drives Customer Support at (703) 471-4565 for detailed instructions using this option.

A current programmed winder, CPW, provides constant tension center winder control by programming the motor armature current. The tension control is open-loop, that is, it does not use a dancer or loadcell feedback signal. The drive maintains constant tension by controlling the motor torque. It keeps the torque proportional to the tension demand and compensates for changing roll diameter with additional compensation for frictional losses.

**NOTE.** For accurate tension control, frictional losses must be small (and repeatable) compared to the torque required to provide web tension.

## Description

Figures M.11 and M.13 show typical winder and unwind applications. The diameter is reset before starting a new roll by using terminal A2, EXTERNAL DIAMETER PRESET, for the diameter setting and C7, PRESET ENABLE, to select the preset diameter. The drive starts when terminal C3, RUN, is set ON. Setting terminal C4 to ON selects tension mode. Once the line gets above a minimum speed the diameter calculator begins calculating the roll diameter.

**NOTE.** This configuration has disabled the JOG function, normally operated by terminal C4. Other configurations can retain the JOG function.

In tension mode, an overspeed (underspeed for unwinds) is added to saturate the speed loop because the web holds the winder at line speed. With the speed loop saturated, the drive is current limited by the torque demand. If the web breaks, the winder increases to the speed loop limits, preventing a runaway.

Terminal C6, OVERWIND, changes the polarity of the torque demand and overspeed for overwinding or underwinding.

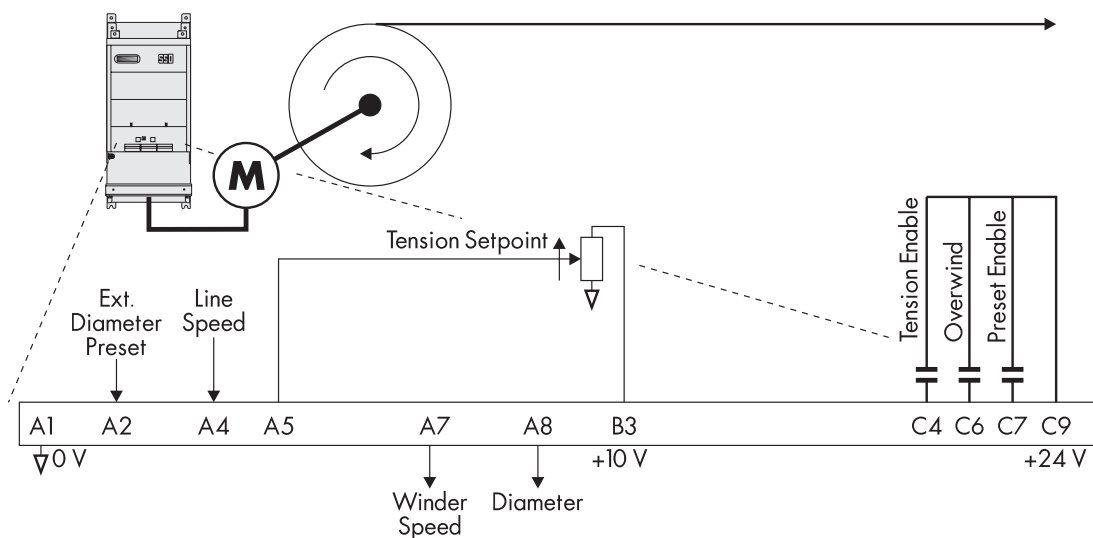


Figure M.10 - Unwind Application

TAPER CALC. uses signals from terminals A5, TENSION SETPOINT, and A6, TAPER SETPOINT, to produce the tension demand. SETPOINT SUM 2 multiplies the tension demand by diameter to produce the torque demand. The torque demand is then combined with compensations for frictional losses to produce the final torque used to control the motor. Taper is generally used only on winders to reduce telescoping and produce an even wind as the roll builds.

Loss compensations have static and dynamic components. The static part is a fixed value for overcoming static loss or stiction. The dynamic part is proportional to speed. It compensates for the dynamic loss or windage. Figure M.11 shows the static and dynamic compensations. The combined losses increase torque demand in rewinds and decrease it in unwinds.

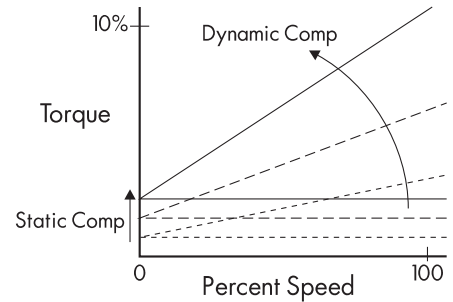


Figure M.11 - Friction Loss Compensation

TORQUE CALC. uses the torque demand from SETPOINT SUM 2 to control the current limits. It controls the positive or negative current limits depending on the selection of overwinding or underwinding. The current limit is only controlled by the torque demand when C4 is ON, otherwise the current limit is at the normal maximum value for speed mode.

### Turret Winder Applications

Turret winders use two spindles to transfer the web from one spindle to the other without stopping the line. Each spindle requires its own drive. An unwind splices from the emptying roll to a new, full roll. A rewind transfers the web from the full roll to a new core.

To achieve this, the winders must operate in two modes, speed mode and tension mode. Speed mode is required to match the surface speed of the new core or new, full roll to the line speed for the splice. Tension mode is required after the splice or transfer.

Before starting in speed mode, the operator sets the diameter to core for a rewind or to the diameter of the new roll for an unwind by inputting the correct value in terminal A2, EXTERNAL DIAMETER PRESET. Setting C7, PRESET ENABLE, to ON keeps the diameter at the preset diameter until the transfer is completed.

Then the spindle is started using terminal C3, RUN. The drive ramps up to the correct speed so the roll's surface speed matches the line speed. The splice or transfer can occur at that point. When the web is transferred to the new roll or core, tension mode is enabled by setting terminal C4 to ON and the old roll is stopped. At this point, C7 is set OFF to allow the diameter calculator to calculate the correct diameter. The new roll continues in tension mode until the next roll change.

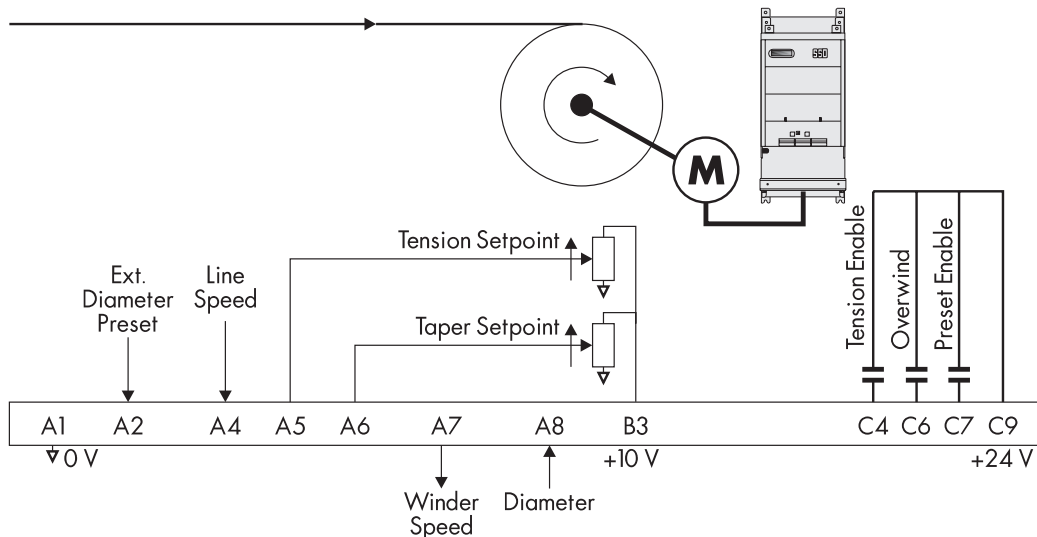


Figure M.12 - Rewind Application



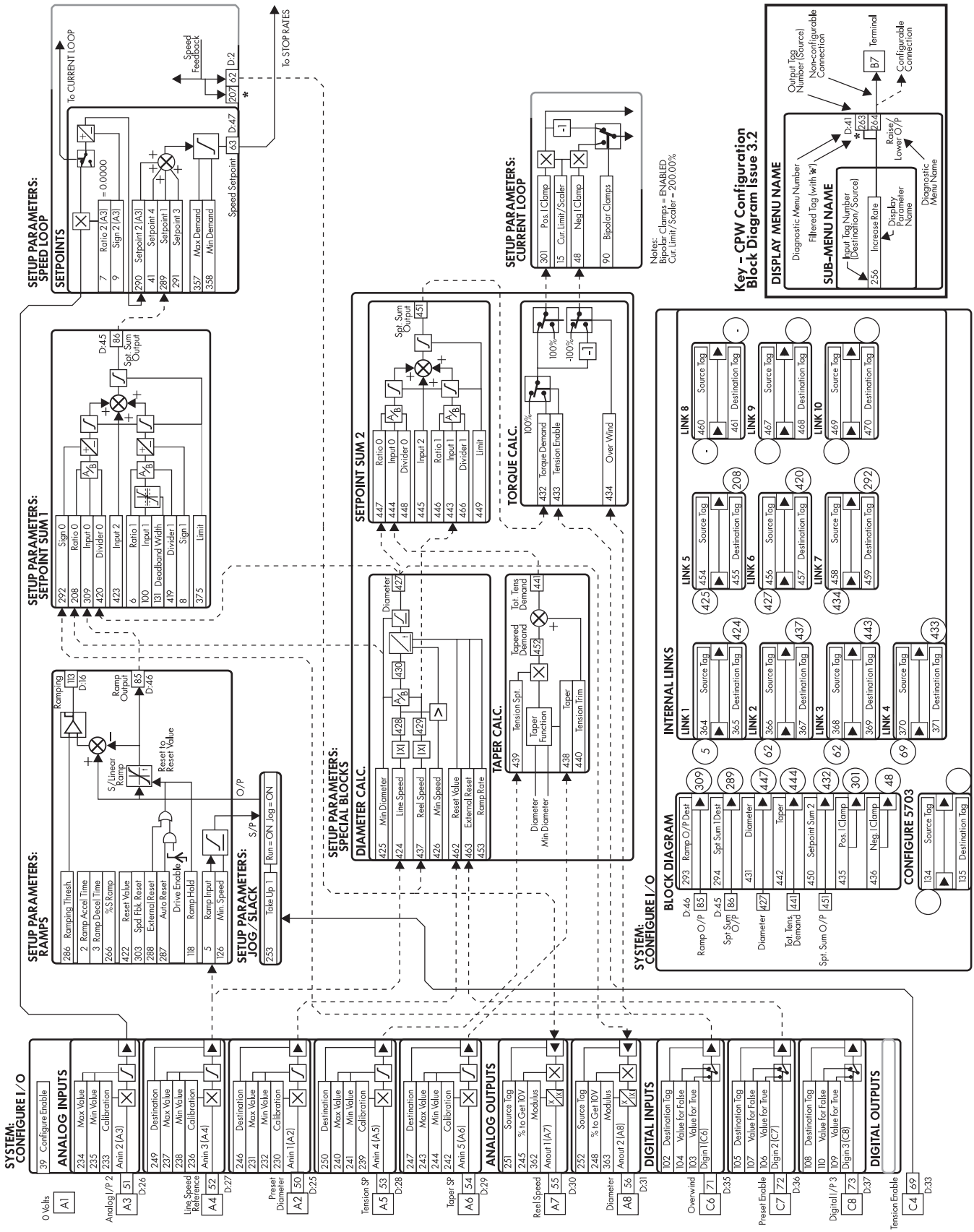


Figure M.13 - CPW Configuration Block Diagram

## Installation

These parameters are located in the SYSTEM::CONFIGURE I/O menu.

### Block Diagram Parameters

Parameter Name	Tag	Description
RAMP O/P DEST	= 309	SETPOINT SUM 1::INPUT 0
DIAMETER	= 447	SETPOINT SUM 2::RATIO 0
TAPER	= 444	SETPOINT SUM 2::INPUT 0
SETPOINT SUM 2	= 432	TORQUE CALC.::TORQUE DEMAND
POS. I CLAMP	= 301	CURRENT LOOP::POS. I CLAMP
NEG. I CLAMP	= 48	CURRENT LOOP::NEG. I CLAMP

### Internal Links

LINK 1:: SOURCE TAG	= 5	RAMPS::RAMP INPUT
DESTINATION TAG	= 424	DIAMETER::LINE SPEED
LINK 2:: SOURCE TAG	= 62	Speed Feedback Unfiltered
DESTINATION TAG	= 437	DIAMETER CALC.::REEL SPEED
LINK 3:: SOURCE TAG	= 429	Modulus of Reel Speed
DESTINATION TAG	= 443	SETPOINT SUM 2::INPUT 1
LINK 4:: SOURCE TAG	= 69	Jog Input
DESTINATION TAG	= 433	TORQUE CALC.::TENSION ENABLE
LINK 5:: SOURCE TAG	= 425	DIAMETER CALC.::MIN DIAMETER
DESTINATION TAG	= 208	SETPOINT SUM 1::RATIO 0
LINK 6:: SOURCE TAG	= 427	DIAMETER CALC.::DIAMETER
DESTINATION TAG	= 420	SETPOINT SUM 1::DIVIDER 0
LINK 7:: SOURCE TAG	= 434	TORQUE CALC.::OVER WIND
DESTINATION TAG	= 292	SETPOINT SUM 1::SIGN 0

### Terminal I/O

ANIN 1:: DESTINATION TAG	= 462	DIAMETER CALC.::RESET VALUE
--------------------------	-------	-----------------------------

NOTE. The analog input 1 connection is only required for applications using multiple core sizes.

ANIN 3:: DESTINATION TAG	= 5	RAMPS::RAMP INPUT
ANIN 4:: DESTINATION TAG	= 439	TAPER CALC.:: TENSION SPT.
ANIN 5:: DESTINATION TAG	= 438	TAPER CALC.:: TAPER
DIGIN 1::DESTINATION TAG	= 434	TORQUE CALC.::OVER WIND
DIGIN 2::DESTINATION TAG	= 463	DIAMETER CALC.::EXTERNAL RESET

### Other Parameters

Set SETUP PARAMETERS::CURRENT LOOP::BIPOLAR CLAMPS to ENABLED.  
 Set SETUP PARAMETERS::CURRENT LOOP::CURR. LIMIT/SCALER to 200%.  
 Set SETUP PARAMETERS::SPEED LOOP::SETPOINTS::RATIO 2 (A3) to 0.0000.

## Input Signal Descriptions

### Diameter Preset

For a simple rewind, the only diameter preset required may be one core diameter. This diameter can be set directly by changing SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC.::RESET VALUE. For this to work, terminal A2's DESTINATION TAG must be connected to a destination other than 462.

For an unwind or rewind using varying new core sizes or parent roll sizes, the diameter must be set for each roll. Configure terminal A2, EXTERNAL DIAMETER PRESET, to set RESET VALUE by setting analog input 1's DESTINATION TAG to 462. A 0 to +10 volt signal now provides the preset where +10 volts is the full or maximum roll diameter. That signal can be generated by an operator potentiometer, a Eurotherm Drives 5570 Ranger ultrasonic transducer (catalog number 311-LB), or other diameter input device.

## Line Speed Reference

A line speed reference is required for the diameter calculator to work. It should be scaled to produce +10 volts at full speed and connected into terminal A4, LINE SPEED. If this signal comes from a source other than a Eurotherm Drives motor controller, it may need to be scaled and isolated. This signal is connected to parameter SETUP PARAMETERS:: SPECIAL BLOCKS:: DIAMETER CALC.: LINE SPEED. If type 5703 Peer-to-Peer Communications Modules are used, digital line speed signal may be substituted for the 0 - 10 volt analog signal.

## Tension Setpoint

The tension setpoint of 0 to +10 volts is connected to terminal A5, TENSION SP. Typically this signal could come from a potentiometer supplied from the drive's +10 volt terminal, B3. This signal is connected to parameter SETUP PARAMETERS:: SPECIAL BLOCKS:: TAPER CALC.: TENSION SPT. If the serial communications option is installed, the tension setpoint could be generated by a PLC, supervisory computer, or 5721 operator station.

## Taper Setpoint

A taper setpoint, if required, of 0 to +10 volts should be connected to A6, TAPER SETPOINT. The range of taper can be set by the MAX VALUE and MIN VALUE for the analog input in the CONFIGURE I/O menu. This signal is connected to parameter SETUP PARAMETERS:: SPECIAL BLOCKS:: TAPER CALC.: TAPER. If the serial communications option is installed, the taper setpoint could be generated by a PLC, supervisory computer, or 5721 operator station.

## Tension Enable

Connecting 24 VDC to terminal C4 selects tension mode. When used with a run signal at terminal C3, C4 adds an overspeed, TAKE UP 1, to saturate the speed loop.

## Overwind/Underwind

Digital input terminal C6, OVERWIND, selects the winding direction, ON for overwinding and OFF for underwinding. If only unidirectional winding is required, set the winding direction manually using parameter SETUP PARAMETERS:: SPECIAL BLOCKS:: OVER WIND. Remember to disconnect terminal C6 by changing its DESTINATION TAG to 0 in the CONFIGURE I/O menu.

## Preset Enable

24 VDC at digital input terminal C7, PRESET ENABLE, selects the PRESET ENABLE. When ON, the diameter memory is preset to the diameter preset input value or minimum diameter as described earlier.

For a simple rewind, an operator can use a pushbutton to reset to core when the full roll is removed and a new roll is started. For an unwind, the operator presets the new roll diameter using either a potentiometer, a 5570 Ranger ultrasonic transducer, or some other diameter input device.

## Current Limit

CUR. LIMIT/SCALER is set to 200 percent. Set MAIN CURR. LIMIT to suit the application, normally 120 percent.



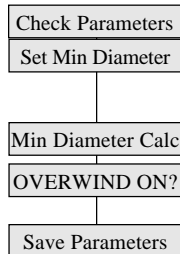
## Startup Procedure

The following procedures describe the steps for starting up CPW winders.

### Speed Mode

#### Initial Setup

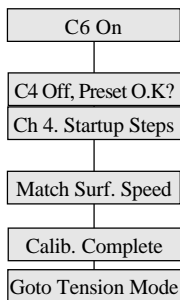
These steps customize the drive for the calibration phase.



1. Check that all parameters are set to the default values described in the installation section.
2. Set MIN DIAMETER to the core as a percentage of full roll. If there is more than one core size, it should be set to the smallest, for example, if the smallest core is 3.5 inches and the maximum full roll is 42 inches then MIN DIAMETER is:  
$$3.5 / 42 * 100 = 8.33 \text{ percent}$$
3. Set OVERWIND to ON by connecting +24 volts to terminal C6 (or via the MMI if C6 is being used for some other function).
4. Save the parameters.

#### Calibration

This section calibrates the drive in speed mode.



1. Connect 24 VDC to terminal C7, DIAMETER PRESET ENABLE, to force the diameter hold to stay on (this is for initial calibration only).
2. Ensure C4 is OFF (tension mode) and monitor SPECIAL BLOCKS:: DIAMETER CALC:: DIAMETER to see that the diameter is preset to core. If the diameter does not equal the minimum diameter, momentarily jumper +24 volts to C7, DIAMETER PRESET ENABLE.
3. Start up the drive as described in Chapter 4, that is, AUTOTUNE the current loop, optimize the speed loop, etc. Use terminal A4, LINE SPEED REFERENCE, as the speed demand input.
4. Load an empty core into the winder and match the core surface speed to the line speed using the 590 encoder or tachometer calibration as appropriate.

At this point the drive and winder should be functioning correctly in speed control. When starting up turret winders, repeat the above procedure for the second spindle.

### Tension Mode

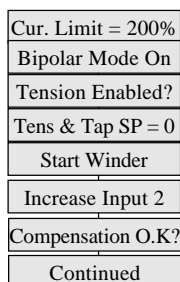
The winder is calibrated in two phases; first, the static losses are determined and, second, the dynamic losses.

#### WARNING

Some of the following procedures require manually turning or stopping the spindles. Any suggestions of turning or stopping the winder spindle by hand while the motor is energized should only be performed by experienced personnel who are capable of evaluating the potential hazards and who are totally satisfied that the procedure is safe.

NOTE. Unwind applications require loss compensations to be negative.

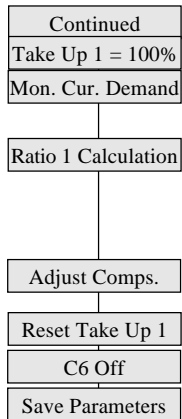
#### Static Losses



1. Verify that CUR. LIMIT/SCALER is set to 200 percent and BIPOLAR MODE is ENABLED.
2. Set tension enable, C4, to ON.
3. Set TENSION SETPOINT, A5, and TAPER SETPOINT, A6, to zero.
4. Start the winder with the tension enabled by connecting +24 volts into terminal C3, RUN. The winder should not turn because there is no tension demand and, as yet, no compensations.
5. Slowly increase SETUP PARAMETERS::SPECIAL BLOCKS::SETPOINT SUM 2::INPUT 2 (static compensation) until the spindle turns and then reduce it gradually until it just stops turning. Now the motor should have nearly enough current to make the spindle break away. It should be possible to start and stop the spindle by hand with very little effort.



## Dynamic Losses



- Set JOG/SLACK::TAKE UP 1 to 100 percent and increase the tension setpoint signal. The spindle should run up to full speed.
- Reduce the tension setpoint signal to 0.00% and monitor DIAGNOSTICS:: CURRENT DEMAND. Set SETPOINT SUM 2:: RATIO 1 (dynamic compensation) using the formula:  

$$\text{RATIO 1} = ((\text{CURRENT DEMAND} \div 2) - \text{SETPOINT SUM 2::INPUT 2}) \times 100$$
 Now the motor should have just enough current to keep the spindle running. If the friction is increased slightly using light pressure on the shaft, it should be possible to reduce the speed and the spindle should maintain the reduced speed after removing the pressure. Check the loss compensation throughout the speed range. If the speed changes at high speeds, adjust RATIO 1; if the speed changes at low speeds, adjust INPUT 2 until they are optimized.
- Reset JOG/SLACK:: TAKE UP 1 to 10 percent.
- Set EXTERNAL PRESET ENABLE, C6, to OFF.
- Save the parameters.

## Unwind

After completing the initial start-up, verify the unwind is accurately tuned for all diameters and speeds by using the following procedure.



- Web the line from the full roll.
- Verify the diameter is preset to full roll.
- Set TENSION SETPOINT to a suitable value for the web material.
- Start the unwind.
- Check the tension at standstill.
- Start the line and check the running tension. As the roll builds down, verify the diameter calculator output is operating correctly. The line must be running above MIN SPEED for the diameter calculator to operate.

## Rewind

After completing the initial start-up, verify the rewind is accurately tuned for all diameters and speeds by using the following procedure.



- Fit an empty core.
- Web the line and transfer onto the winder core.
- Verify the diameter is preset to core.
- Set TENSION SETPOINT and TAPER SETPOINT to suitable values for the web material.
- Start the rewind.
- Check the tension at standstill
- Start the line and check the running tension. As the roll builds up, verify the diameter calculator output is operating correctly. The line must be running above MIN SPEED for the diameter calculator to operate.

## CLOSED-LOOP SPEED PROGRAMMED WINDER (SPW)

A speed programmed winder, SPW, provides closed-loop center winder control. It programs the motor speed using either loadcell or dancer feedback for tension control.

This configuration provides standard features used in center winder applications including: diameter calculation with memory and preset, tension and taper, PID for loadcell tension or dancer position control, and over/under winding. It can control unwinds or rewinds for single-spindle and turret winders. The configuration uses four function blocks in the SPECIAL BLOCKS; DIAMETER CALC., TAPER CALC., SETPOINT SUM 2, and PID.

### Description

Figures M.15 and M.16 show typical SPW applications. SPW applications use closed-loop trim to modify the winder speed. Line speed is conditioned in RAMPS before being combined with the tension trim in SETPOINT SUM 2. The result, SPT. SUM OUTPUT, is scaled by DIAMETER and MIN DIAMETER in SETPOINT SUM 1 to produce the speed demand.

TAPER CALC.:: TOT. TENS DEMAND uses inputs to terminals A5, TENSION SETPOINT, and A6, TAPER SETPOINT, to produce a diameter compensated tension demand. It produces either the tension setpoint for loadcell applications or dancer loading signal for dancer applications. TAPER SETPOINT is not used in unwind applications.

Terminal C6, OVERWIND, switches the speed demand sign for overwinding or underwinding. The winder can change directions by changing the LINE SPEED signal at terminal A4 to the opposite sign.

### Loadcell Applications

In loadcell applications, the controller attempts to keep the tension at the loadcell constant by varying the winder speed. The setting at terminal A5, TENSION SETPOINT, sets the desired loadcell tension. In TAPER CALC., the tension setpoint is compensated for diameter and taper. The output, TOT. TENS DEMAND, is the PID setpoint signal at PID:: INPUT 1.

PID compares the setpoint, PID:: INPUT 1, with TENSION FEEDBACK from terminal A3. The output, PID OUTPUT, is the tension loop trim used in SETPOINT SUM 2.

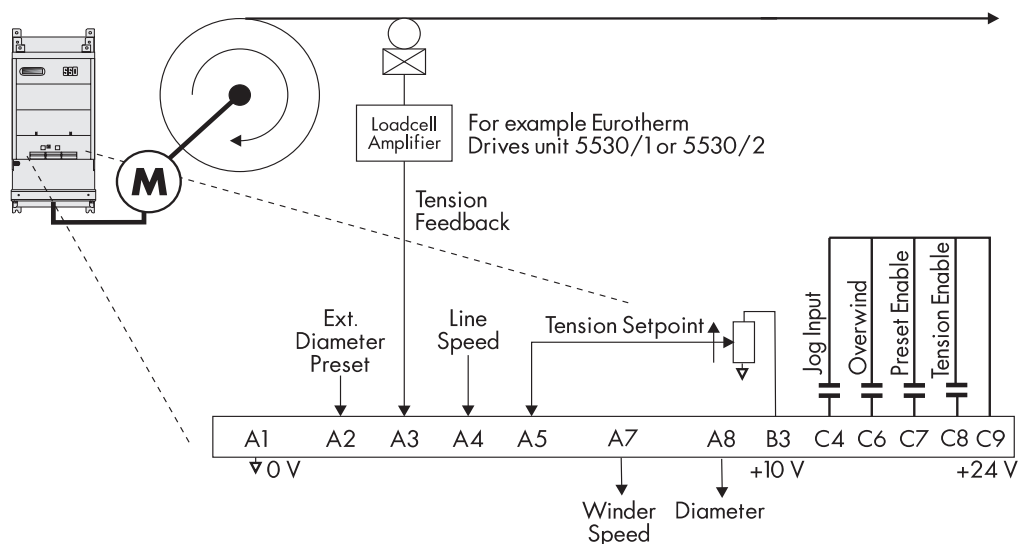


Figure M.14 - Unwind SPW Application with Loadcell Feedback



## Dancer Position Applications

In dancer position applications, the controller attempts to keep the dancer stationary by varying the winder speed. TAPER CALC. uses signals from terminals A5, TENSION SETPOINT, and A6, TAPER SETPOINT, to produce the dancer loading. Dancer loading affects web tension by setting the force the dancer exerts on the web.

The PID setpoint, PID:: INPUT 1, is a fixed value set in the MMI representing the desired position of the dancer. The user must remove the connection to PID:: INPUT 1 to manually set the dancer position. PID compares PID:: INPUT 1 with the actual dancer position, TENSION FEEDBACK at terminal A3. The output, PID OUTPUT, is the position loop trim used in SETPOINT SUM 2.

## Turret Winder Applications

Turret winders use two spindles to transfer the web from one spindle to the other without stopping the line. Each spindle requires its own drive. An unwind splices from the emptying roll to a new, full roll. A rewind transfers the web from the full roll to a new core.

To achieve this, the winders must operate in two modes, speed mode and tension mode. Speed mode is required to match the surface speed of the new core or new, full roll to the line speed for the splice. Tension mode is required after the splice or transfer.

Before starting in speed mode, the operator sets the diameter to core for a rewind or to the diameter of the new roll for an unwind by inputting the correct value in terminal A2, EXTERNAL DIAMETER PRESET. Setting C7, PRESET ENABLE, to ON keeps the diameter at the preset diameter until the transfer is completed.

Then the spindle is started using terminal C3, RUN. The drive ramps up to the correct speed so the roll's surface speed matches the line speed. The splice or transfer can occur at that point. When the web is transferred to the new roll or core, tension mode is enabled by setting terminal C8, TENSION ENABLE, to ON and the old roll is stopped. At this point, C7 is set OFF to allow the diameter calculator to calculate the correct diameter. The new roll continues in tension mode until the next roll change.

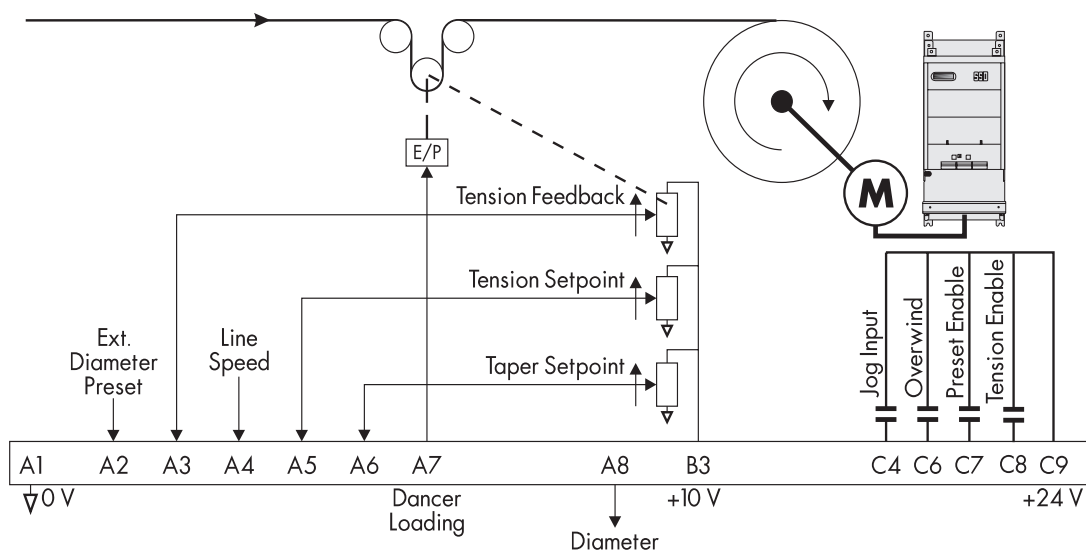


Figure M.15 - Rewind SPW Application with Dancer Position Feedback

## Installation

These parameters are located in the SYSTEM::CONFIGURE I/O menu.

### Block Diagram Parameters

Parameter Name	Tag	Description
RAMP O/P DEST	= 444	SETPOINT SUM 2::INPUT 0
SPT SUM 1 DEST	= 289	SPEED LOOP::SETPOINT 1
PID O/P DEST	= 443	SETPOINT SUM 2::INPUT 1
DIAMETER	= 420	SETPOINT SUM 1::DIVIDER 0
TAPER	= 410	PID::INPUT 1 (for loadcell feedback only)
SETPOINT SUM 2	= 309	SETPOINT SUM 1::INPUT 0

### Internal Links

LINK 1:: SOURCE TAG	= 51	ANIN 2 (A3)
DESTINATION TAG	= 411	PID::INPUT 2
LINK 2:: SOURCE TAG	= 5	RAMPS::RAMP INPUT
DESTINATION TAG	= 424	DIAMETER CALC::LINE SPEED
LINK 3:: SOURCE TAG	= 62	Unfiltered Speed Feedback
DESTINATION TAG	= 437	DIAMETER CALC::REEL SPEED
LINK 4:: SOURCE TAG	= 425	DIAMETER CALC::MIN DIAMETER
DESTINATION TAG	= 208	SETPOINT SUM 1::RATIO 0

### Terminal I/O

ANIN 1:: DESTINATION TAG	= 462	DIAMETER CALC::RESET VALUE
ANIN 3:: DESTINATION TAG	= 5	RAMPS::RAMP INPUT
ANIN 4:: DESTINATION TAG	= 439	TAPER CALC::TENSION SPT.
CALIBRATION	= 0.9000	
ANIN 5:: DESTINATION TAG	= 438	TAPER CALC::TAPER
DIGIN 1::DESTINATION TAG	= 292	SETPOINT SUM 1::SIGN 0
DIGIN 2::DESTINATION TAG	= 463	DIAMETER CALC::EXTERNAL RESET
DIGIN 3::DESTINATION TAG	= 408	PID::ENABLE
ANOUT 1::SOURCE TAG	= 441	TAPER CALC::TOT. TENS DEMAND
ANOUT 2::SOURCE TAG	= 427	DIAMETER CALC::DIAMETER

### Other Parameters

CURRENT LOOP::BIPOLAR CLAMPS	= ENABLED
SPECIAL BLOCKS::PID::DIVIDER 2	= 0.1000.
SPEED LOOP::SETPOINTS::RATIO 2 (A3)	= 0.0000.

## Input Signal Descriptions

### Diameter Preset

For a simple rewind, the only diameter preset required may be one core diameter. This diameter can be set directly by changing SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC::RESET VALUE. For this to work, terminal A2's DESTINATION TAG must be connected to a destination other than 462.

For an unwind or rewind using varying new core sizes or parent roll sizes, the diameter must be set for each roll. Configure terminal A2, EXTERNAL DIAMETER PRESET, to set RESET VALUE by setting analog input 1's DESTINATION TAG to 462. A 0 to +10 volt signal now provides the preset where +10 volts is the full or maximum roll diameter. That signal can be generated by an operator potentiometer, a Eurotherm Drives 5575 Ranger ultrasonic transducer (catalog number 5575-LB), or other diameter input device.

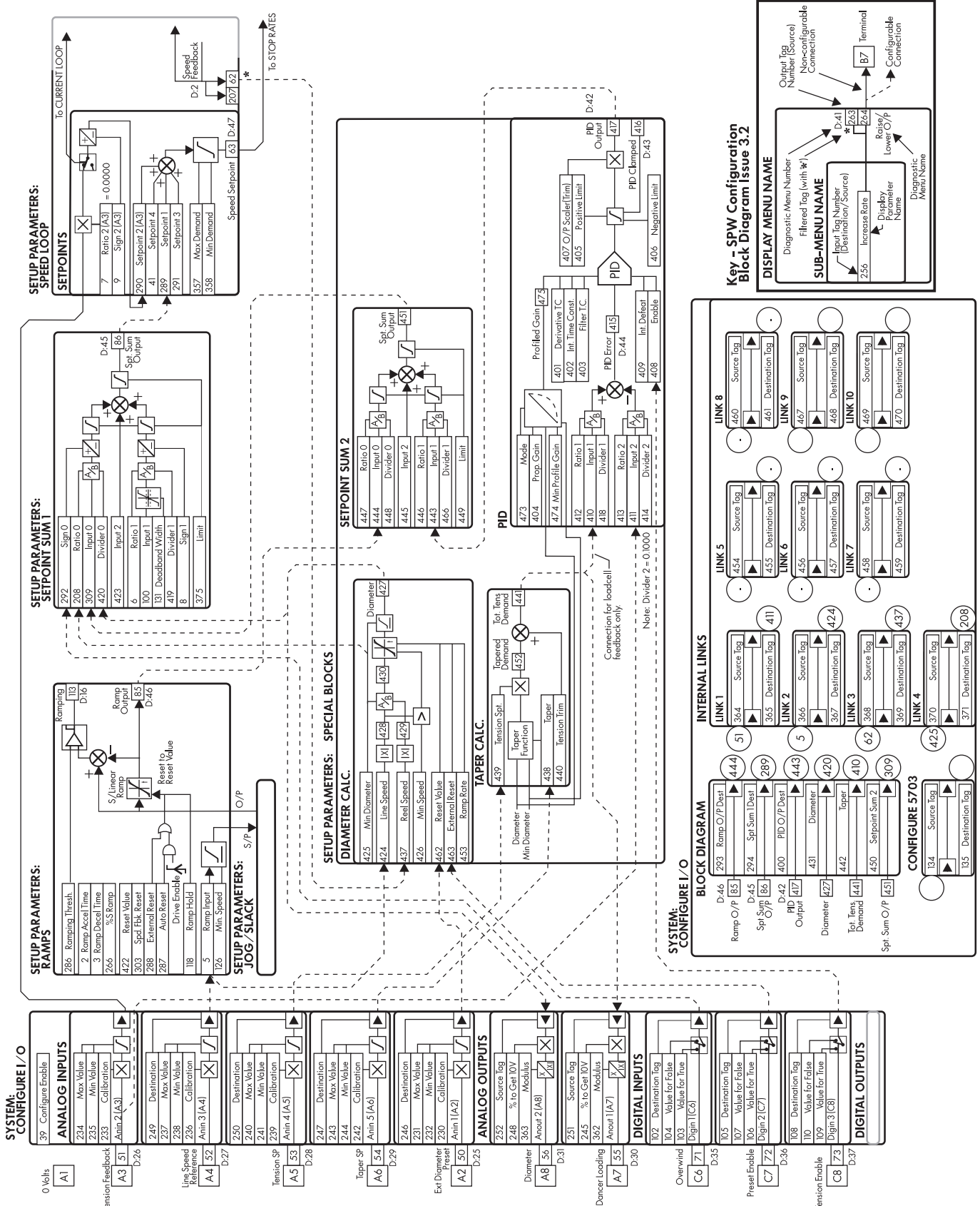


Figure M.16 - SPW Configuration Block Diagram

## Tension Feedback

The loadcell tension feedback or dancer position signal is connected to terminal A3, TENSION FEEDBACK. Full tension should be scaled to be +9 volts to allow 10 percent over range. When a dancer is used, the drive requires a minimum range of three volts.

## Line Speed Reference

A line speed reference is required for the diameter calculator to work. It should be scaled to produce +10 volts at full speed and connected into terminal A4, LINE SPEED REF. If this signal comes from a source other than a Eurotherm Drives motor controller, it may need to be scaled and isolated. This signal is connected to parameter SETUP PARAMETERS::SPECIAL BLOCKS::DIAMETER CALC::LINE SPEED. If type 5703 Peer-to-Peer Communications Modules are used, digital line speed signal may be substituted for the 0 - 10 volt analog signal.

## Tension Setpoint

The tension setpoint of 0 to +10 volts (scaled internally to 90 percent using parameter ANIN 4 (A5):: CALIBRATION) is connected to terminal A5, TENSION SP. Typically this signal could come from a potentiometer supplied from the drive's +10 volt terminal, B3. This signal is connected to parameter SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC::TENSION SPT. If the serial communications option is installed, the tension setpoint could be generated by a PLC, supervisory computer, or 5721 operator station.

## Taper Setpoint

A taper setpoint, if required, of 0 to +10 volts should be connected to A6, TAPER SETPOINT. The range of taper can be set by the MAX VALUE and MIN VALUE for the analog input in the CONFIGURE I/O menu. This signal is connected to parameter SETUP PARAMETERS::SPECIAL BLOCKS::TAPER CALC::TAPER. If the serial communications option is installed, the taper setpoint could be generated by a PLC, supervisory computer, or 5721 operator station.

## Overwind/Underwind

Digital input terminal C6, OVERWIND, selects the winding direction, ON for overwinding and OFF for underwinding. If only unidirectional winding is required, set the winding direction manually using parameter SETUP PARAMETERS::SPECIAL BLOCKS::OVER WIND. Remember to disconnect terminal C6 by changing its DESTINATION TAG to 0 in the CONFIGURE I/O menu.

## Preset Enable

24 VDC at digital input terminal C7, PRESET ENABLE, selects the PRESET ENABLE. When ON, the diameter memory is preset to the diameter preset input value or minimum diameter as described earlier.

For a simple rewind, the operator can use a pushbutton to reset to core when the full roll is removed and a new roll is started. For an unwind, the operator presets the new roll diameter using either a potentiometer, a 5570 Ranger ultrasonic transducer, or some other diameter input device.

## Tension Enable

Digital input C8, TENSION ENABLE, switches the drive from strict speed control to closed-loop, tension regulation control. This input should be ON when the winder is started and OFF when it is jogged.

## Jog

JOG is selected by digital input C4. The jog direction can be selected by terminal C6, OVERWIND.

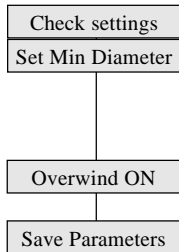
## Startup Procedure

The following procedures describe the steps for starting up SPW winders.

### Speed Mode

#### Initial Setup

These steps customize the drive for the calibration phase.

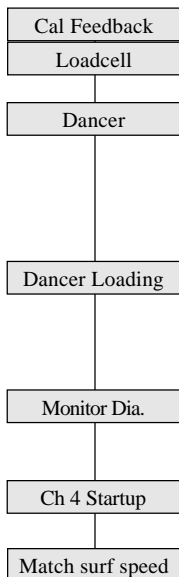


1. Check that all parameters are set to the default values described in the installation section.
2. Set the MIN DIAMETER to the core as a percentage of full roll. If there is more than one core size, it should be set to the smallest, for example if the smallest core is 3.5 inches and the maximum full roll is 42 inches then the MIN DIAMETER is:  

$$3.5 / 42 * 100 = 8.33 \text{ percent}$$
3. Set OVERWIND to ON by connecting +24 volts to terminal C6 (or via the MMI if C6 is being used for some other function).
4. Save the parameters.

#### Calibration

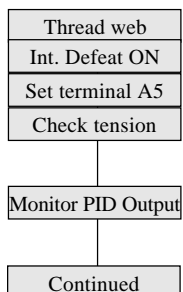
This section calibrates the drive in speed mode.



1. Calibrate the feedback device.
  - a. **Loadcells:** Follow the loadcell manufacturer's manual to calibrate the loadcells. Calibrate the loadcell amplifier output for +9 VDC = full tension to allow the tension loop to maintain control at 10 percent over full tension. The tension signal should be positive at terminal A3 with respect to terminal A1 (0 VDC).
  - b. **Dancers:** Check the dancer position feedback. Optimally it should vary from 0 VDC when the dancer is in the fully tight position to +10 VDC in the fully loose position. A smaller range is acceptable but may require resetting the dancer position setpoint. For example, if the swing is from +5 VDC to +9 VDC, then the setpoint should be set at 70 percent to control the dancer at mid-position.  
 Dancer loading, if controlled from the drive, should be checked and calibrated at the voltage to pressure transducer. The drive dancer loading output is 9 VDC at full tension. This can be adjusted using the CONFIGURE I/O:: ANALOG OUTPUTS:: ANOUT 1:: % TO GET 10V value for analog output A7, DANCER LOADING.
2. Ensure terminal C8, TENSION ENABLE, is OFF and monitor SPECIAL BLOCKS:: DIAMETER CALC:: DIAMETER is preset to core. If the diameter does not equal the minimum diameter, momentarily jumper +24 volts to C7, DIAMETER PRESET ENABLE.
3. Start up the drive as described in Chapter 4, that is, AUTOTUNE the current loop, optimize the speed loop, etc. Use terminal A4, LINE SPEED REFERENCE, as the speed demand input.
4. Load an empty core into the winder and match the core surface speed to the line speed using the 590 drive encoder or analog tachometer calibration as appropriate.

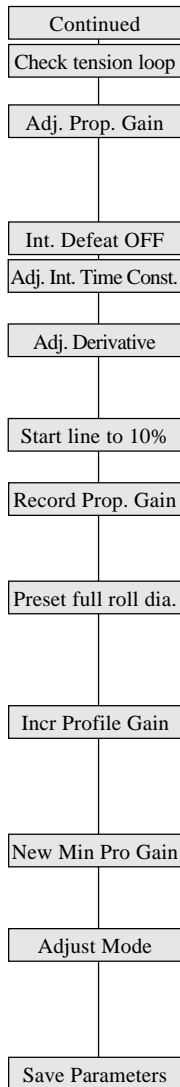
At this point the feedback device, drive, and winder should be functioning correctly. When starting up turret winders, repeat the above procedure for the second spindle.

### Tension Mode



1. Thread the web through the machine and attach it to the core.
2. Initially, set INT. DEFEAT to ON to provide proportional control only.
3. Set terminal A5, TENSION SETPOINT, to a reasonable value for the web.
4. With the line stopped, start the winder with the TENSION ENABLE set ON. The winder should control tension, if not check the polarity of the feedback and trim.
5. The scaled PID OUTPUT can be monitored in DIAGNOSTICS in the MMI. Monitoring the PID trim output can be very useful for diagnosing problems because it shows the state of the PID. Two other diagnostic parameters are also available for monitoring the PID state, PID CLAMPED and PID ERROR. However, remember effects of the O/P SCALER(TRIM). For example, if O/P SCALER(TRIM) is set to 10 percent, then reading 10 percent on PID OUTPUT will indicate the PID has saturated.





6. Check the tension loop performance by making step changes to the tension demand and monitoring the tension feedback. Increasing the proportional gain gives faster response but at some point the winder will become unstable. If this occurs, reduce the gain until it regains stability. The proportional gain is controlled by a profiler using PROP. GAIN, MIN PROFILE GAIN, and MODE. The default for MODE is 0 causing PROFILED GAIN to equal PROP. GAIN. It keeps the gain at PROP. GAIN throughout the diameter range. As a result, adjust PROP. GAIN during initial tests at standstill with an empty core.
7. Once stable proportional control is achieved, set the INT. DEFEAT to OFF.
8. The integral action ensures a zero steady-state error at all line speeds. INT. TIME can be reduced to improve response; however, if the time is set too short, instability will occur.
9. Derivative action may be useful to increase the damping of the position loop; especially with large rolls. Adjust DERIVATIVE TC as necessary. For loadcell tension control, DERIVATIVE TC should not be required so leave it set to zero.
10. Start the line and increase the speed to about 10 percent of full speed. Monitor the tension control and adjust the tuning as required.
11. With the proportional gain optimized at core, record the PROP. GAIN value. Now it is necessary to check the performance at full roll. Either run the line until a full roll is wound or, stop the line and replace the empty core with a full roll and re-attach the web.
13. Before performing the stability tests with a full roll, the full roll diameter must be preset. Set the input to terminal A2, EXTERNAL DIAMETER PRESET, to 10 volts for full roll diameter. 24 volts at terminal C7, PRESET ENABLE, sets the diameter to 100 percent. The diameter can be monitored at SPECIAL BLOCKS:: DIAMETER CALC::: DIAMETER.
14. At this point, PROP. GAIN probably needs to be increased to produce optimum performance at full roll. If this is the case, adjust MIN PROFILE GAIN to give optimum performance throughout the roll. MIN PROFILE GAIN should be reduced by the amount the PROP. GAIN was increased as shown in the equation below.
 
$$\text{MIN PROFILE GAIN}_{\text{NEW}} = (\text{PROP. GAIN}_{\text{OLD}} / \text{PROP. GAIN}_{\text{NEW}}) * 100\%$$

For example, if the PROP. GAIN at core was 10 percent and it was increased to 20 percent at full roll, reduce MIN PROFILE GAIN from the default 100 percent to 50 percent.
15. MODE allows the change of proportional gain with diameter to be varied. The winder performance should be monitored throughout the buildup of the roll at various line speeds. MODE would be changed so the proportional gain at each diameter fits the required gain profile better. The higher the setting for MODE, the lower the gain at smaller diameters.
16. Save parameters

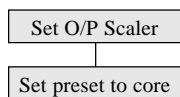
### Winders with Dancer Feedback

The start-up procedure using dancer feedback is the same as for loadcell feedback except for the following changes:

#### Unwinds

Follow the same procedure used for rewinds except as follows.

#### Speed Mode



- 2a. Set O/P SCALER(TRIM) to -10 percent. This sets the correct loop polarity so that the loadcell or dancer feedback remain unchanged.
- 2b. Set terminal C7, PRESET ENABLE, to ON. Initially, set terminal A2, EXTERNAL DIAMETER PRESET to core.

#### Tension mode

An unwind cannot run at any speed with an empty core. As a result, after completing the test at standstill with an empty core, step 8, skip directly to full roll tests, step 13.



## SECTION CONTROL (SC)

A typical process line contains a number of sections using one or more control modes. This configuration provides the standard features required by a line drive section to perform Draw, Ratio, Loadcell, Dancer position, or Torque control. It also includes Reverse, Anti-reverse, Agitate, Slack take-up/pay-out, Jog, Ramp, and Raise/Lower. Pull rolls, coaters, ovens, treaters, laminators, presses, and more can be controlled with the 590 drive.

Figures M.18 and M.19 illustrate typical loadcell and dancer control applications, respectively.

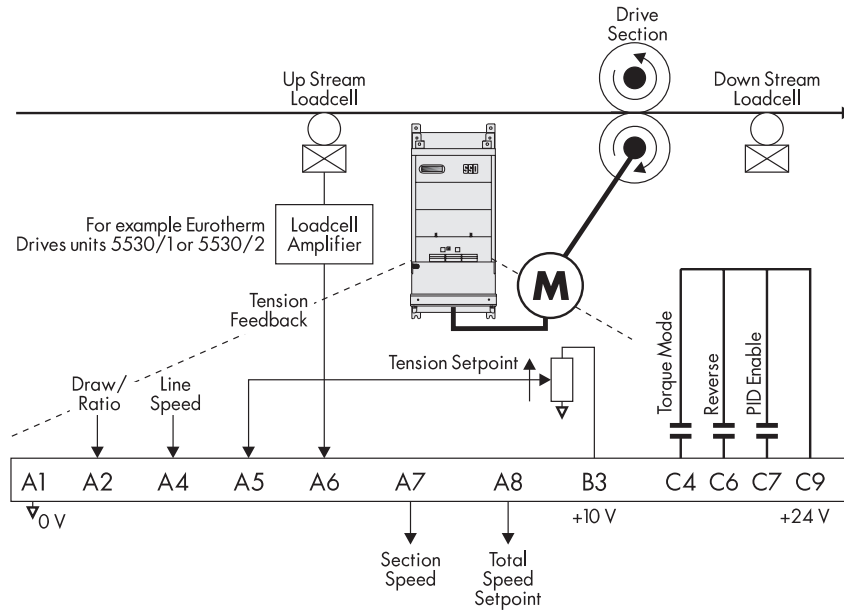


Figure M.17 - Loadcell Application

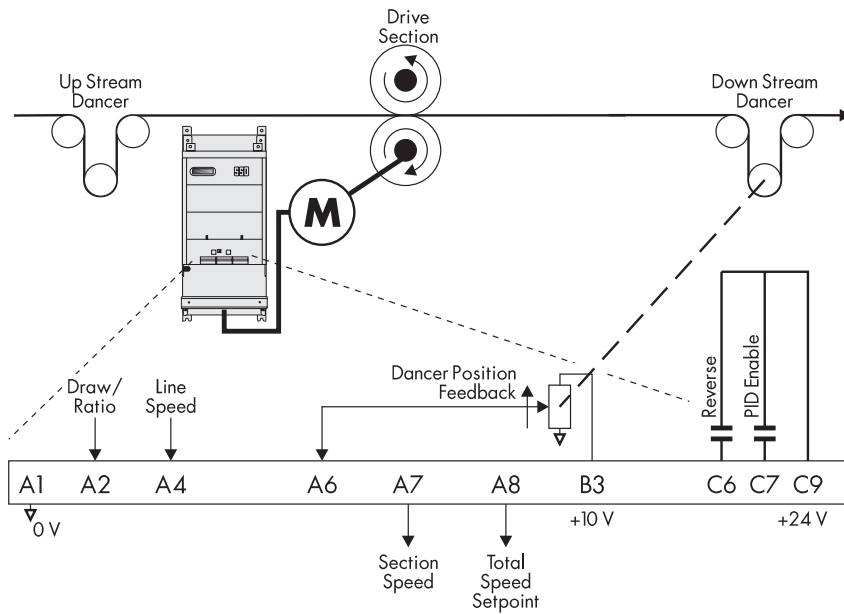


Figure M.18 - Dancer Position Application



## Control Modes

SC provides the drive with control features required for a line drive section. SC uses drive terminals for all inputs and outputs, both analog and digital. These terminals may need to be re-configured depending on the functions required for the particular application.

A typical web process line will have a master or lead drive that sets the speed of the line and other slave drives which follow in a variety of ways. The primary control requirement is usually to maintain a reasonable tension between sections. Section control may be achieved in a number of ways.

### Draw

Draw mode is the nearest approximation to an old fashioned line shaft with its mechanical variators. It works well even when the section has little or no grip on the web although in those applications it will not control tension. In draw mode, the slave drive is speed controlled with a percentage difference from the line speed reference. The speed difference or *draw*, which is usually small, stretches the web if it is extensible and the speed difference is positive, or permits the web to contract if the speed difference is negative.

When draw is used with non-extensible webs, very accurate speed control is required to provide acceptable tension control. With these materials, a very small speed difference either causes the web to be too loose or too tight. This application uses the Digital Draw feature discussed later in this chapter.

### Ratio

Ratio control is speed control. It is similar to draw except that it is specified as a ratio of the line speed instead of a percentage difference. Ratio control generally varies over a much wider operating range than draw. Ratio is typically used by sections that have no effect on web tension but is required by the manufacturing process, for example on coater applicators and metering rolls.

### Torque

Torque control is an open loop method of controlling tension because there is no direct tension measurement. It assumes that the process losses are small so the web tension will be proportional to torque at the motor shaft. The drive section torque is proportional to motor armature current and the speed is determined by the web speed assuming the drive section does not slip.

**NOTE.** To achieve constant tension throughout the speed range, use a constant torque motor. A motor with a field range will produce less torque as the speed increases above its base speed.

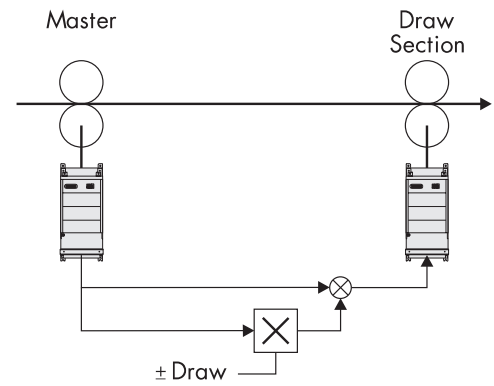


Figure M.19 - Draw

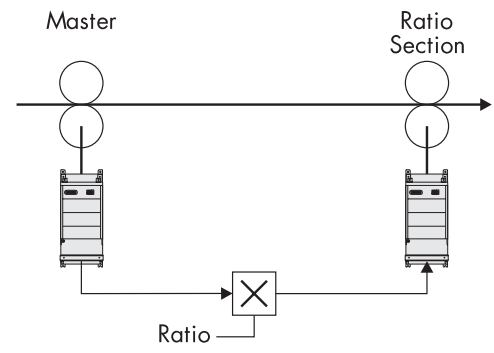


Figure M.20 - Ratio

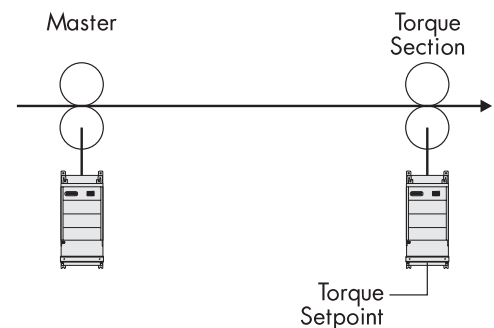


Figure M.21 - Torque

## Tension

Draw controls speed but does not directly control tension. Tension control uses an outer control loop to adjust the section speed. The loadcell provides the feedback signal for the control loop. Speed is adjusted to keep the feedback signal from the loadcell at a fixed value, the tension setpoint.

## Dancer Position

Dancer position control also uses an outer control loop to adjust the section speed. The dancer applies force to the web throughout its range of movement. Loading the dancer, usually by using pneumatics, determines the force and therefore the tension in the web. To keep the web tension constant, the drive section must control the web speed so that the dancer stays in a fixed position.

## Additional Features

Line sections often require additional control features. The SC configuration has the following features built in. See the "Using Section Control" section for details on their use.

## Reverse

Reversing allows sections such as coaters and laminators to reverse directions to accommodate a web path change to coat the other side of the web.

## Anti-reverse

Anti-reverse is required where reversing a section may cause mechanical damage to the machine or may be hazardous to the operator.

## Agitate

Agitate or *Sunday* drive is a feature used for coater and printer sections to keep the coater turning at a low speed when the line has stopped to prevent the coating material from solidifying.

## Slack Take-up/pay-out

A line in draw control, such as a paper machine, can be difficult to get running. It often needs the ability to speed up or slow down one section relative to another to remove loops of slack web without disturbing the preset draw. Slack take-up offers this capability. Similarly, pay-out allows the operator to introduce slack in the web, for example when performing a splice.

## Jog

Many sections need individual jog for positioning, clearing wrap-ups, or cleaning.

## Ramp

A section ramp, independent from the main line ramp, allows an individual section to accelerate gradually. This permits it to speed up to match the main line and to decelerate smoothly as required by the process.

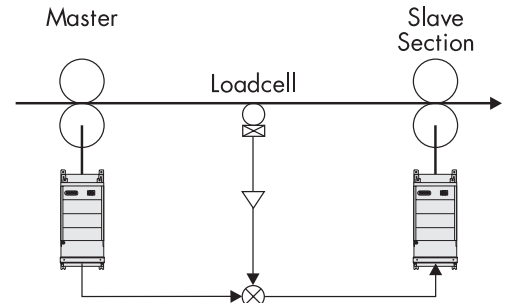


Figure M.22 - Tension

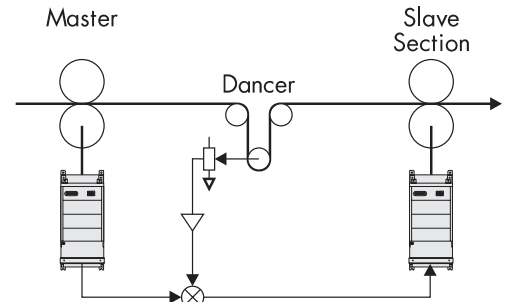


Figure M.23 - Dancer Position

## Raise/Lower (Motor Operated Potentiometer Function)

The Raise/Lower function uses digital inputs to increase and decrease Draw, Ratio, or Tension. This permits gauge controls or other automatic systems with logic outputs to connect directly with the drive.

## Installation

These parameters are located in the SYSTEM::CONFIGURE I/O menu.

### Block Diagram Parameters

Parameter Name	Tag	Description
RAMP O/P DEST	= 309	SETPOINT SUM 1:: INPUT 0
SPT SUM 1 DEST	= 289	SPEED LOOP:: SETPOINTS:: SETPOINT 1
PID O/P DEST	= 423	SETPOINT SUM 1:: INPUT 2
SETPOINT SUM 2	= 432	TORQUE CALC.:: TORQUE DEMAND
POS. I CLAMP	= 301	CURRENT LOOP:: POS. I CLAMP
NEG. I CLAMP	= 48	CURRENT LOOP:: NEG. I CLAMP

### Internal Links

LINK 1:: SOURCE TAG	= 8	SETPOINT SUM 1::SIGN 1
DESTINATION TAG	= 292	SETPOINT SUM 1::SIGN 0
LINK 2:: SOURCE TAG	= 62	Speed Feedback Unfiltered
DESTINATION TAG	= 443	SETPOINT SUM 2:: INPUT 1
LINK 3:: SOURCE TAG	= 69	Jog Input
DESTINATION TAG	= 433	TORQUE CALC.::TENSION ENABLE
LINK 4:: SOURCE TAG	= 85	RAMPS::RAMP OUTPUT
DESTINATION TAG	= 100	SETPOINT SUM 1:: INPUT 1
LINK 5:: SOURCE TAG	= 434	TORQUE CALC.::OVER WIND
DESTINATION TAG	= 8	SETPOINT SUM 1::SIGN 1
LINK 6:: SOURCE TAG	= 444	SETPOINT SUM 2:: INPUT 0
DESTINATION TAG	= 410	PID:: INPUT 1 (for loadcell tension control only)

### Terminal I/O

ANIN 1:: DESTINATION TAG	= 6	SETPOINT SUM 1:: RATIO 1
ANIN 3:: DESTINATION TAG	= 5	RAMPS::RAMP INPUT
ANIN 4:: DESTINATION TAG	= 444	SETPOINT SUM 2:: INPUT 0
ANIN 5:: DESTINATION TAG	= 411	PID:: INPUT 2
DIGIN 1::DESTINATION TAG	= 434	TORQUE CALC.:: OVER WIND
DIGIN 2::DESTINATION TAG	= 408	PID:: ENABLE

### Other Parameters

CURRENT LOOP::BIPOLAR CLAMPS	=	ENABLED.
CURRENT LOOP::CUR. LIMIT/SCALER	=	200%.
SPEED LOOP::SETPOINTS::RATIO 2 (A3)	=	0.0000.

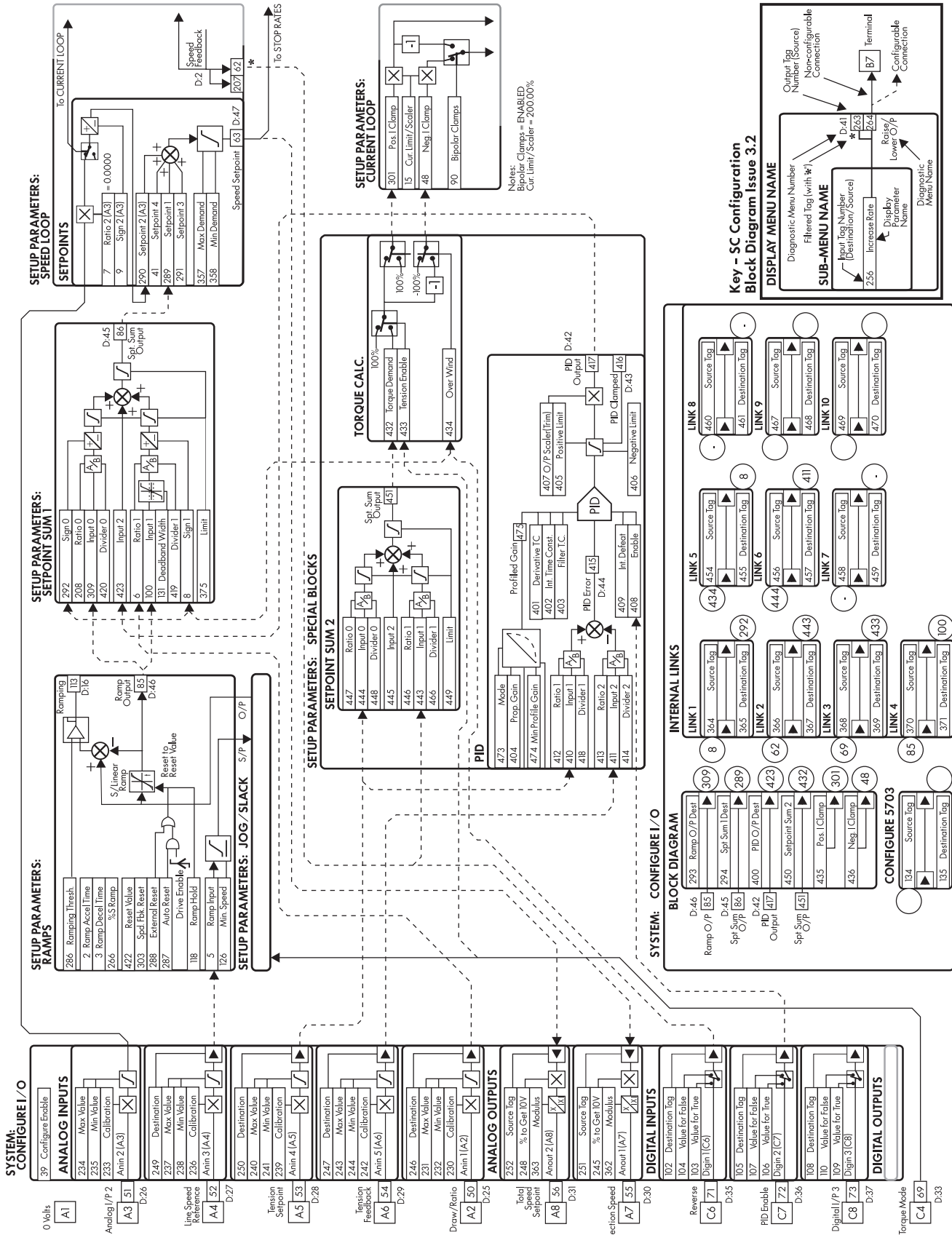


Figure M.24 - SC Configuration Block Diagram

## Input Signal Descriptions

This section describes the functions of the terminals used in the SC configuration.

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### WARNING

The control terminals of the drive are fully isolated from all power circuits and should not be connected to other non-isolated circuits. In the interests of safety and to minimize electrical noise, it is recommended that the drive 0 volts common terminal be connected to ground either directly at the drive or at one point in the system.

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### Draw/Ratio

The draw/ratio signal is connected to terminal A2. It should read +10 volts for maximum draw or ratio. The CALIBRATION parameter for terminal analog input 2 can convert the input signal to the desired output range, 5 percent maximum draw for example.

### Line Reference

A line speed reference is required because the feedback device provides only a speed trim signal. It should be scaled to +10 volts at full speed and connected into terminal A4, LINE SPEED REFERENCE. The 5703 Peer-to-Peer communications unit may alternatively be used for a digital line reference.

### Tension Setpoint

The tension setpoint of 0 to +10 volts (scaled internally using CALIBRATION) connects to terminal A5, TENSION SETPOINT. Typically this signal comes from a potentiometer supplied from the drive's +10 volt terminal, B3.

For dancer position applications, this input is not required. The user can enter the setpoint directly in the MMI in parameter SPECIAL BLOCKS:: PID:: INPUT 1 if terminal A5 is connected to a DESTINATION TAG other than 410. The setpoint will normally be set at the same value as the feedback signal with the dancer positioned midway between stops, for example if the feedback range is 10 to 90 percent, the setpoint would be 50 percent.

### Tension Feedback

The tension feedback signal from a loadcell must be scaled using a loadcell amplifier, such as the Eurotherm Drives 5530/1 or 5530/2, before connecting into terminal A6, TENSION FEEDBACK, on the 590 drive. At full tension, the output should be adjusted to read +9 volts to allow 10 percent overrange.

The dancer position is the tension feedback in dancer applications. The dancer uses a position transducer with a signal range of 0 to +10 volts. The simplest type of transducer is a potentiometer coupled to the dancer shaft and supplied with +10 volts by the drive's terminal B3. The optimum mechanical arrangement provides nearly full potentiometer rotation for the full dancer travel. At the cost of resolution, less rotation is acceptable down to a minimum of about 30 percent or 3 volts change.

### Reverse

Reverse, terminal C6, changes the direction of the line section. It is connected to OVER WIND and SETPOINT SUM 1:: SIGN 0 and SIGN 1 for changing directions in torque and speed modes. Other tension modes require configuration changes to assure the speed demand changes correctly.

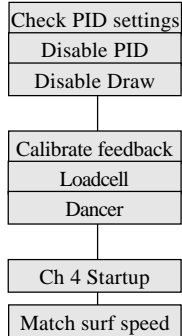
### PID Enable

The PID needs to be enabled for the tension loop to operate. The enable input is at terminal C7, PID ENABLE. It cannot be permanently connected to +24 volts or the integral will saturate and cause poor initial performance. Usually the PID should be enabled when the drive is started, tension control is selected, and the section nip is closed.

## Startup Procedures for Tension or Dancer Position Control

The following procedures describe a methodology for starting and tuning a tension control line drive section. The first steps assure the drive section parts are calibrated correctly. The PID setup steps tune the section for best performance.

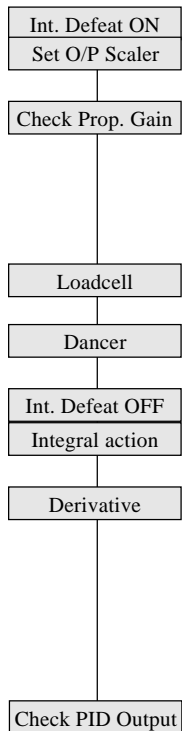
### Initial Section Setup



1. Set all the PID parameters to the default values (see Appendix H).
2. Disable PID:: ENABLE at terminal C7.
3. Verify SETPOINT SUM 1:: RATIO 0 is set to 100.00 percent and set terminal A2, DRAW/RATIO, to 0 volts.
4. Calibrate the feedback device.
  - a. When using loadcell feedback, see the manufacturer's manual for calibration instructions.
  - b. When using dancer feedback, verify that the dancer polarity is correct and the dancer position setpoint is for mid-position.
5. Start up the drive as described in Chapter 4 (that is, AUTOTUNE the current loop, etc.).
6. Match the roll surface speed of the line drive section to the master drive surface speed using the 590 encoder or tachometer calibration as appropriate.

At this point, the loadcell or dancer, drive, and drive sections should be functioning properly.

### PID Adjustment



1. Set INT. DEFEAT to ON to provide proportional control only.
2. Set O/P SCALER (TRIM) to suit the type of web. As a rough guide, use 2 to 5 percent for a non-extensible web and 5 to 10 percent for an extensible web.
3. With a web in the machine, run the line at a low speed with the PID enabled, terminal C7. Check the tension loop performance by making step changes in tension and monitoring the feedback. Increasing PROP. GAIN gives faster response but at some point the section will become unstable. When the section becomes unstable, reduce PROP. GAIN a little until it regains stability.
  - a. For loadcell feedback, check the performance by making step changes in the tension demand and monitoring the tension feedback.
  - b. For dancer feedback, check the performance by manually moving the dancer and watching it return to the center position.
4. After achieving stable proportional control, set INT. DEFEAT to OFF.
5. The integral action ensures a zero steady state error at all line speeds. Reduce INT. TIME CONST. to improve response; however, if the time is set too short, instability will occur.
6. Derivative gain can improve stability, particularly where the PID has a wide control range, or for tension systems using high inertia dancer rolls. If the position loop response is overdamped, increase DERIVATIVE TC slowly until the response is critically damping.
 

NOTE. PID tension controlled systems are highly sensitive to changes in derivative gain. Make changes in the DERIVATIVE TC in small increments *only*.

In most cases, derivative gain introduces oscillations and system instability and therefore should not be used. Loadcell feedback systems usually do not require derivative gain. For loadcell control, leave DERIVATIVE TC set to zero.
7. PID OUTPUT can be monitored in the DIAGNOSTICS menu of the MMI. This can be very useful when diagnosing problems. If the speed tracking is incorrect, PID OUTPUT will rise because the PID must provide an increasing trim as speed rises. If the web is slipping at the tension control section, PID OUTPUT will saturate at 100 percent since the trim cannot produce tension. If the trim polarity is incorrect, PID OUTPUT will saturate and the web will be either too tight or too loose.

## Other Settings

### Trim Range

O/P SCALER (TRIM) scales the PID output to produce the speed trim. It sets the amount of overspeed the PID trim produces and the polarity of the trim. The polarity should be positive when the feedback devices are upstream of the drive and negative when downstream of the drive.



For dancer applications, the feedback signal should be connected to be more positive when the web is tight and less positive when the web is slack. In this arrangement, dancer feedback will increase the speed when the web is slack.

The trim range value depends on the nature of the web. It needs to be greater for an extensible web than for a non-extensible web. In addition, the extensible web requires a higher control loop gain which comes with the greater trim range. If required, trim ranges for two different types of web can be selected by configuring an unused digital input to set two different values of trim range (see Extensible/Non-extensible Webs, page M-37).

## Tension

The tension in dancer applications is determined by the air pressure or weight loading on the dancer. The drive only controls the dancer position.

## Other Features

This section explains how to use the many features available in the SC configuration.

## Draw

To select draw mode, set SETPOINT SUM 1:: RATIO 0 to 100 percent. The input at terminal A2, DRAW/RATIO, sets the amount of draw by adjusting SETPOINT SUM 1:: RATIO 1. It is multiplied by the line speed, terminal A4, and then added to the line speed to produce the speed demand.

Calibrating analog input 1 in CONFIGURE I/O sets the draw range. In draw mode, the draw range is normally set to about -5 to +5 percent. To set a 5 percent range, set CONFIGURE I/O:: ANALOG INPUTS:: ANIN 1 (A2):: CALIBRATION to 0.0500. Then, +10 volts on terminal A2 produces +5 percent draw and -10 volts produces -5 percent draw.

Terminal A2 can also be limited by MAX VALUE and MIN VALUE, *clamps*, with defaults of +100 and -100 percent. If a draw range of more than 100 percent is required, the clamps must be increased accordingly. The clamps can be set to lower values if asymmetric draw is required. For positive draw only, limit the input at A2 to 0 to +10 volts.

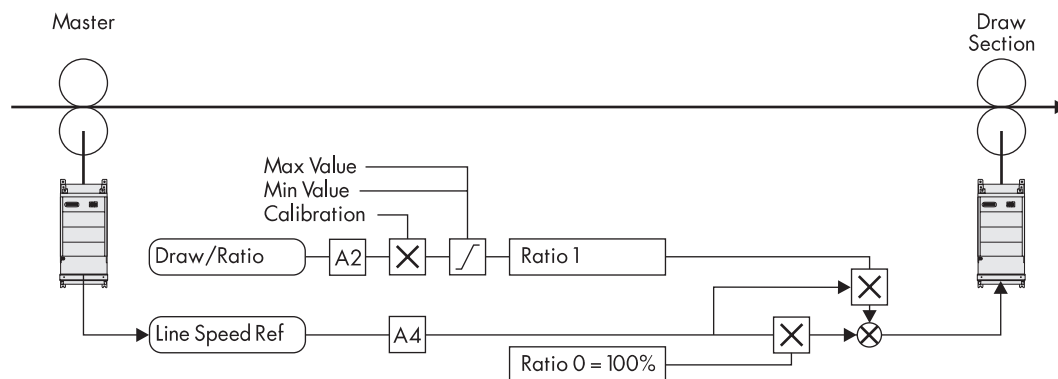


Figure M.25 - Draw

## Cascade Draw

When two or more draw sections follow in line after a master drive section, cascading their line speed references instead of having each section following the master can be more useful. To cascade the speed references, connect the total speed setpoint signal, terminal A8, from the first section to the line speed reference input, terminal A4, of the second section. Similarly, take the second section's total speed setpoint into the line speed reference of the third section, etc. This allows a change to the draw setting of the first section to be passed to following sections while maintaining their relative speeds.

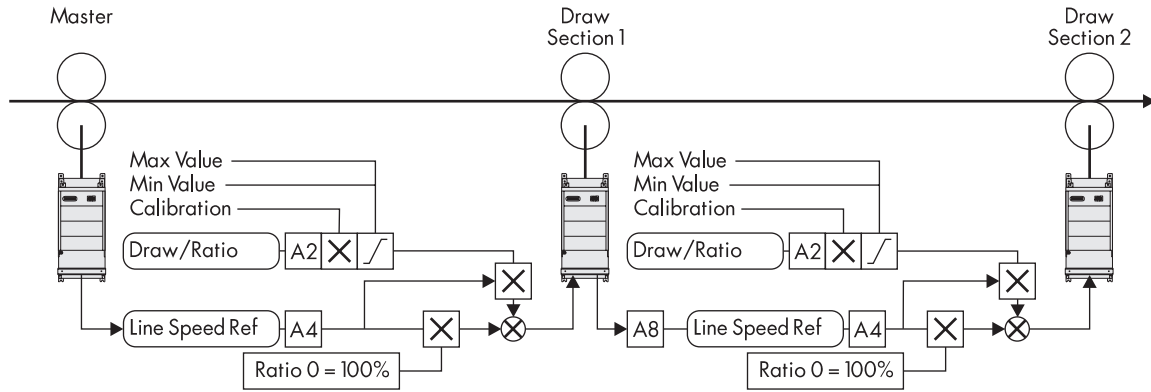


Figure M.26 - Cascade Draw

### Digital Draw

Using draw with non-extensible materials requires very small speed differences between line drive sections which, in turn, requires very precise speed control. Analog inputs and outputs may not provide adequate precision or stability. The digital 590 drive's speed accuracy can be greatly improved by direct, serial connection between drives using the 5703 Peer-to-Peer interface (catalog number 655-RS232). This interface should be used with digital speed feedback from an encoder or the 5701 optical encoder. Refer to Appendix E for use of the 5703.

To use draw with the 5703, re-configure the drive as follows:

Menu	Parameter	Setting
CONFIGURE I/O		
ANALOG INPUTS:: ANIN 3 (A4)::	DESTINATION TAG	0
CONFIGURE 5703::	SOURCE TAG	63
	DESTINATION TAG	5
SYSTEM PORT (P3):: 5703 SUPPORT::	SETPT. RATIO	1.0000
	SETPT. SIGN	POSITIVE
	5703 MODE	MASTER or SLAVE

Remember to save the changes with the PARAMETER SAVE menu in the drive.

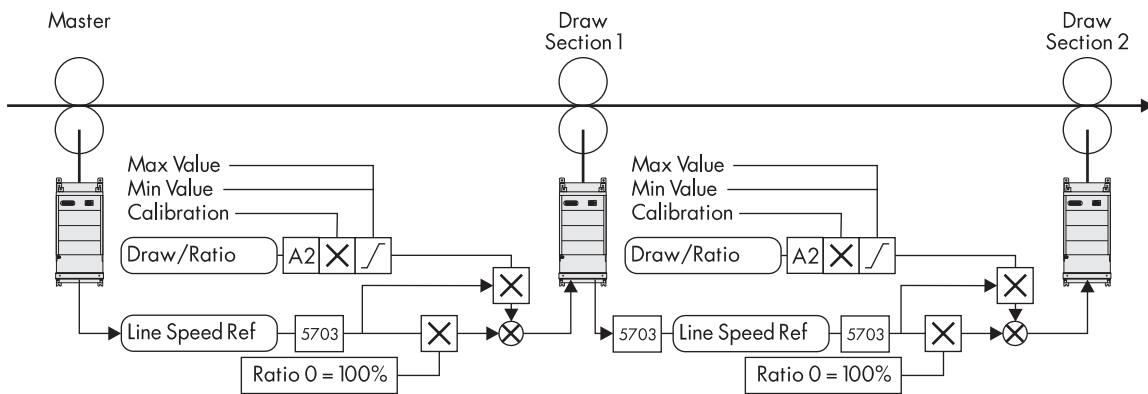


Figure M.27 - Digital Draw



## Ratio

Ratio mode sets the section speed to the line speed multiplied by the ratio input. To select ratio mode, set SETPOINT SUM 1:: RATIO 0 to 0.00 percent. Terminal A4, LINE SPEED REFERENCE, supplies the line speed signal. Terminal A2, DRAW/RATIO, receives the ratio setpoint. It is multiplied by the line speed to produce the speed demand.

The maximum range of terminal A2 is -300 to +300 percent. To set a ratio range of 50 to 200 percent, set ANALOG INPUTS:: ANIN 1 (A2):: CALIBRATION to 2.0000, MAX VALUE to +200.00%, and MIN VALUE to +50.00%. Now 0 to 10 volts on input A2 produces a ratio of 50 to 200 percent. The overall speed demand is clamped to a maximum of 105 percent so ratios of more than 100 percent can only be used at less than full line speed.

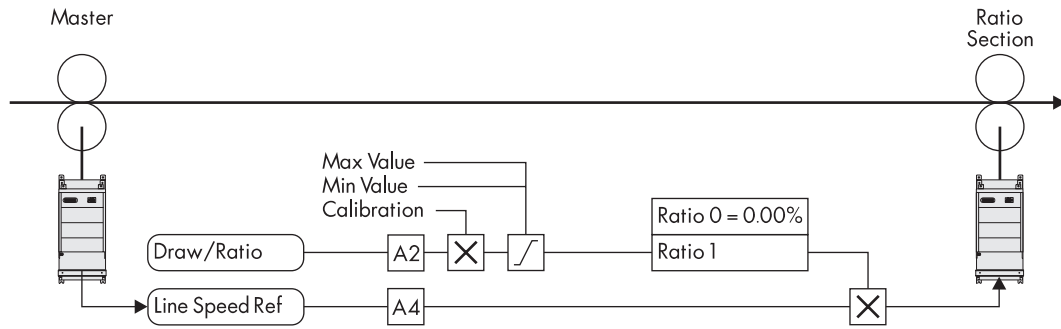


Figure M.28 - Ratio

## Torque

Torque mode is armature current control. To achieve current control, an overspeed is added to the line speed demand. Since the actual section speed is held at line speed by the web, the speed loop saturates causing the current demand to equal the current limit. This function is similar to that discussed earlier in this chapter's CPW section.

24 VDC at terminal C4 selects torque mode. JOG/SLACK:: TAKE UP 1 sets the overspeed. It determines how much faster than line speed the section runs if it is not held back by the web, for example if the web breaks. Current loop parameter BIPOLAR CLAMPS must be set to ENABLED and CUR. LIMIT/SCALER set to 200 percent.

The signal at terminal A5, TENSION SETPOINT, sets the initial tension demand. It is combined with the loss compensations to produce the current limit. Follow the instructions in the CPW section, pages M-17 and M-18, for setting up the loss compensation parameters. Terminal C6, REVERSE, is connected to TORQUE CALC:: OVER WIND. 24 VDC at terminal C6 switches the current limits, permitting the section to run in reverse.

NOTE. Set PID:: ENABLE to OFF when running in torque mode.

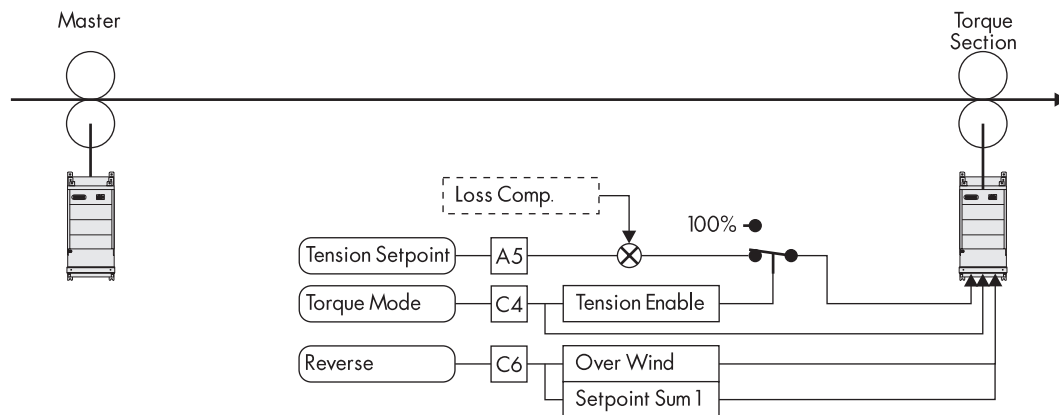


Figure M.29 - Torque



## Reverse

The motor rotation can be reversed by terminal C8, REVERSE. This SC configuration only works when in torque, draw, or ratio mode. To provide a section reverse ability for tension feedback modes, change the configuration to route the line speed reference and trim signals through SETPOINT SUM 1 parameters INPUT 0 and INPUT 1.

## Anti-reverse

If it is necessary to ensure that a section does not reverse, even if reversing would be required to maintain tension or dancer position, then use the Anti-reverse function. Set SPEED LOOP:: SETPOINTS:: MIN DEMAND to 0.00% to achieve anti-reverse.

Anti-reverse causes the tension control loop integral to saturate if the control loop asks for reverse speed. Anti-reverse only operates with a unidirectional section. If terminal C8, REVERSE, is selected, the setpoint will be clamped to zero.

## Agitate

Use parameter RAMPS:: MIN SPEED to set the agitate speed.

MIN SPEED should be set to about 5 percent. When the drive section is started, the speed ramps up to MIN SPEED. When the line speed exceeds this agitate speed, the section will follow the line. MIN SPEED will only have an effect if the line speed is reduced again below the agitate value.

NOTE. The nip must be opened and the PID must be disabled when the line speed is below the agitate speed.

## Ramp

The line reference signal sent to the drive goes through a ramp. This ramp controls the acceleration to agitate speed, if used, and allows the section to be started and stopped while the line is running. The ramp parameters are located in SETUP PARAMETERS:: RAMPS.

NOTE. The ramp accelerate and decelerate times should be set significantly faster than the line ramp so that the section can always keep up with the line.

## Jog

The jog function is not provided in this SC configuration.

## Slack Take-up/pay-out

Slack Take-up/pay-out is a speed increase while running to take up slack web. It can only be used in draw or ratio mode. If the drive is running and the jog terminal, C4, is energized, the drive speed increases by an amount set in parameter TAKE-UP 1. This configuration uses this feature to provide the overspeed in torque mode. The parameters are found in SETUP PARAMETERS:: JOG/SLACK:: TAKE-UP 1 or TAKE-UP 2 or MODE.

The speed increase is ramped to provide smooth control of the section and any cascaded sections. TAKE-UP SLACK 2 can be set negative to pay-out slack and is selected by MODE in the JOG/SLACK menu. This function can be controlled by an unused terminal by re-configuring a digital input to tag 228. See Chapter 5 for full details of the jog / slack functions.

## Raise/Lower

The Raise/Lower block provides a MOP function. It can be used to set draw or tension setpoints by using digital inputs. Two digital input terminals need to be re-configured, one to RAISE INPUT, tag 261, and the other to LOWER

INPUT, tag 262. The output of the Raise/Lower function is connected to SETPOINT SUM 1:: RATIO 1, tag 6, or SETPOINT SUM 2:: INPUT 0, tag 444. The analog input that is replaced, either A2, DRAW/RATIO or A5, TENSION SETPOINT, must have its destination tag set to zero.

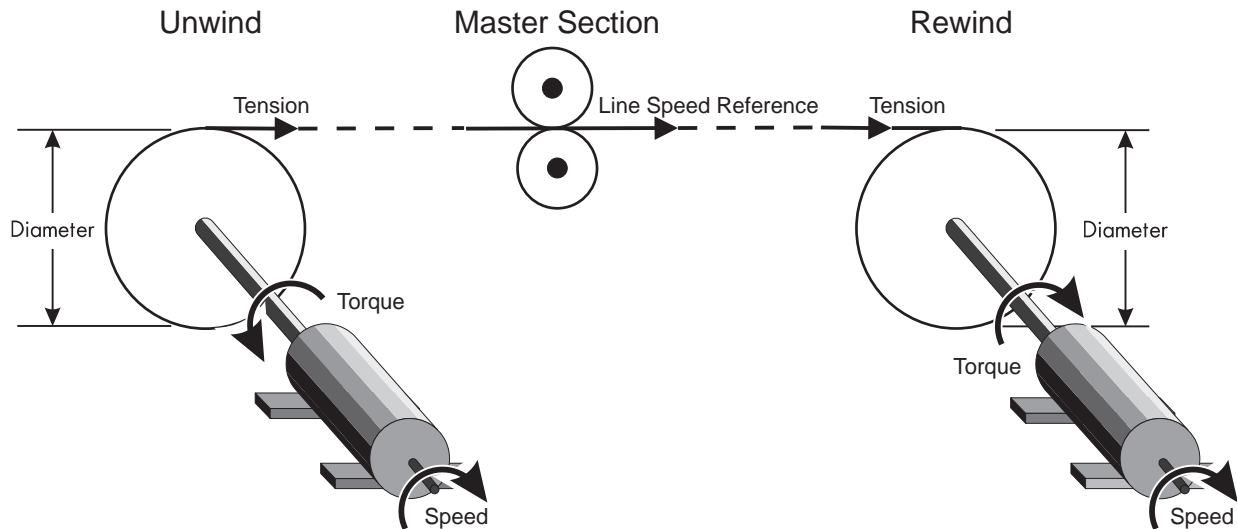
### Extensible/Non-extensible Webs

When using loadcell tension control, the PID trim loop O/P SCALER (TRIM) needs to be higher for extensible web than for non-extensible web. For machines running a variety of materials, it may be necessary to be able to select different gains.

A digital input can be used to select two values of trim range. In the CONFIGURE I/O menu, select an unused digital input, set VALUE FOR TRUE to 10 percent, for example, and VALUE FOR FALSE to 5 percent, and DESTINATION TAG to 407, O/P SCALER (TRIM). Now the operator can select the extensible trim range by setting the digital input high. VALUE FOR TRUE and VALUE FOR FALSE must be adjusted to give the best trim ranges for extensible and non-extensible webs.

### SIMPLE WINDER EQUATIONS

Below are equations used to determine winder torque and horsepower requirements.



$$\text{Diameter (ft)} = \frac{1}{\pi} \times \left[ \frac{\text{Line Speed (ft/min)}}{\text{Winder Speed (rpm)}} \right]$$

$$\text{Torque}_{\text{Tension}} \text{ (lbf)} = \text{Tension (lbf)} \times \frac{\text{Diameter (ft)}}{2}$$

$$\text{Torque}_{\text{Total}} \text{ (lbf)} = \text{Torque}_{\text{Tension}} \text{ (lbf)} + \text{Torque}_{\text{Friction}} \text{ (lbf)} + \text{Torque}_{\text{Inertia}} \text{ (lbf)}$$

$$\text{Horsepower}_{\text{Web}} = \left[ \frac{\text{Line Speed (ft/min)} \times \text{Tension (lbf)}}{33000} \right]$$

$$\text{Horsepower}_{\text{Winder}} = \left[ \text{Horsepower}_{\text{Web}} \times \frac{\text{Diameter Build-up}}{\text{Constant Hp Range}} \right] + \text{Horsepower}_{\text{Friction}} + \text{Horsepower}_{\text{Inertia}}$$

$$\text{Horsepower} = \left[ \frac{2\pi \times \text{Motor Speed (rpm)} \times \text{Motor Torque (lbf)}}{33000} \right]$$

Figure M.30 - Winder Equations

