590 DRV *LINK* DC Drive

Product Manual

Version 3 Software

Procedures detailed in this manual are designed to be performed by personnel with sufficient training and/or experience. Only sufficiently qualified personnel familiar with the construction and operation of industrial drive equipment and the dangers of working with high-voltage electrical systems should attempt installation, adjustment, operation, or service of this equipment. Failure to follow these guidelines could result in damage to the equipment and severe injury or loss of life to personnel. If you are unsure of your qualifications or do not understand certain procedures in this manual, contact Eurotherm Drives Customer Service for assistance. Before attempting any procedures in this manual, including installation, verify that the model numbers on the product and in this manual match. If any discrepancy is found, contact Customer Service immediately.
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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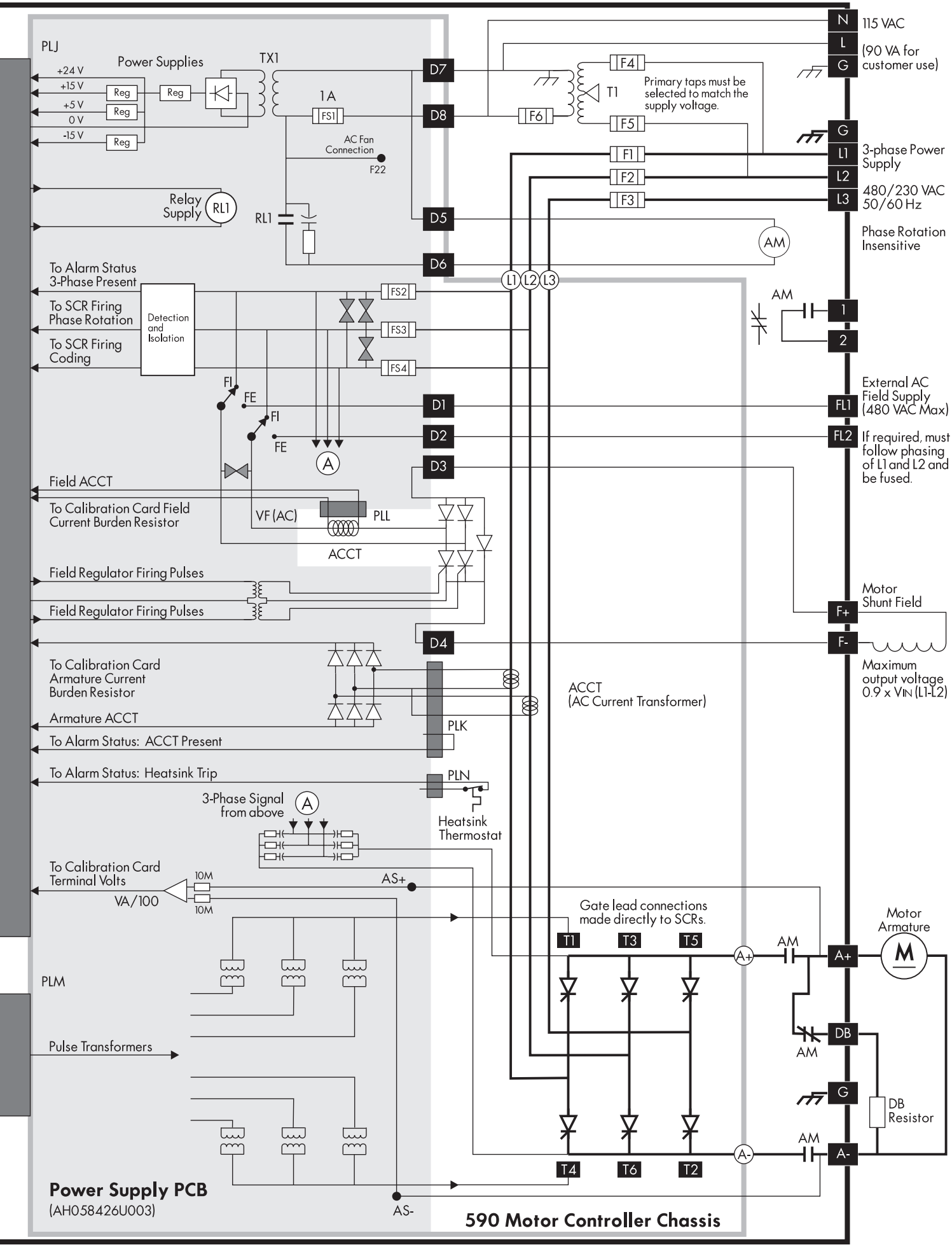

590 DRV *LINK* DC Drive Block Diagram – Version 3 – Non-Regenerative

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.

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.

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.

Caution

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

Caution

This equipment was tested before it left our factory. However, before installation and start up, inspect all equipment for transit damage, loose parts, packing materials, etc.

Caution

Ruptured semiconductor devices may release toxic materials. Contact Eurotherm Drives or the semiconductor manufacturer for proper disposal procedures for semiconductors or other material.

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

EUROTHERM DRIVES INCORPORATED – TERMS AND CONDITIONS (ABRIDGED)

The following text will in no way alter or void the contents of the Eurotherm Drives, Inc. - Terms and Conditions of Sale. It is only intended to clarify the responsibilities of each party.

Delivery, Title and Risk

. . . DELIVERY TO COMMON CARRIER OR POSTAL AUTHORITIES AT RESTON, VIRGINIA SHALL CONSTITUTE DELIVERY AND PASSING OF TITLE TO THE CUSTOMER, WHO SHALL THEREAFTER BE RESPONSIBLE FOR DELAYS, LOSS OR DAMAGE IN TRANSIT.

Warranty and Liability

A. Warranty of equipment found within 12 months after delivery thereof to be defective by reason of faulty materials, workmanship, or design.

(i) The Customer will:

(a) notify Eurotherm Drives, Inc. within four weeks of the defect becoming apparent

(b) return the equipment forthwith, freight paid, to the premises of Eurotherm Drives, Inc. or

(c) at the option of Eurotherm Drives, Inc. make the equipment available at the Customer's premises for attention by Eurotherm Drives, Inc. personnel. Where the equipment is repaired on the Customer's premises, the Customer accepts liability for the payment of travel and subsistence expenses of Eurotherm Drives, Inc. personnel.

(ii) Eurotherm Drives, Inc. will:

(a) repair or (at its option) replace any equipment manufactured by Eurotherm Drives, Inc.

(b) for goods not manufactured by Eurotherm Drives, Inc., convey to the Customer only the benefits it may recover under any guarantee the manufacturer gives to Eurotherm Drives, Inc.

B. Eurotherm Drives, Inc. accepts no liability under this clause:

(i) for damage sustained in transit, (liability for which is dealt with in paragraph 8 hereof);

(ii) for defects caused

(a) by not following the instructions supplied with the equipment during installation, operation or maintenance or

(b) by wear and tear, accident or misuse, improper operation or neglect or

(c) by fitting any equipment which does not comply with Eurotherm Drives, Inc. recommendations or

(d) otherwise as a result of failure of the Customer to comply in full with any manual or handbook containing the technical specifications and operating instructions supplied by Eurotherm Drives, Inc. with the equipment;

(iii) where equipment has been used for an application other than that specified at the time the Order was acknowledged or not in accordance with Eurotherm Drives, Inc. instructions;

(iv) where the Customer has failed to observe the terms of payment for the equipment and all other obligations imposed by these terms and conditions.

C. Where equipment has been ordered, obtained or manufactured to the Customer's own design or specification, Eurotherm Drives, Inc. can accept no liability for any failure or defect in such equipment except insofar as such failure or defect arises directly as a result of the failure of Eurotherm Drives, Inc. to follow the design or specification provided.

Eurotherm Drives, Inc. gives no warranty as to the fitness for any particular purpose of goods supplied to the Customer's design or specification.

The Customer shall indemnify Eurotherm Drives, Inc. in respect of all liability, loss or damage suffered by Eurotherm Drives, Inc. as a result of Eurotherm Drives, Inc. following designs or specifications provided by the Customer including any such liability suffered as a result of a claim by a third party for infringement of intellectual property rights.

D. Except as specifically set out herein, Eurotherm Drives, Inc. shall be under no liability in respect of the quality, conditions or description of equipment or for any loss or damage howsoever caused to the Customer or to any other person and any term, condition or representation to the contrary whether express or implied by statute, common law or otherwise is hereby expressly excluded.

E. NO IMPLIED STATUTORY WARRANTY OR MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE SHALL APPLY.

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Chapter 1 INTRODUCTION

SCOPE

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

OVERVIEW OF THE 590 DRV *LINK* DC DRIVE

The 590 DRV *LINK* DC drive is a DC motor controller package containing a 590 *LINK* DC drive, DC contactor, AC supply fusing to protect the DC drive's thyristors and a control power transformer.

The 590 DRV *LINK* DC 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 above 100 HP, the supply is limited to 230/460 VAC. Control of the 590 DRV *LINK* DC drive drive is fully digital and configurable *only* over a Eurotherm Drives *LINK* system fiber optic network through the *LINK* configuration software package (ConfigEd), and the diagnostic software package (SAM).

Figure 1.1 - 590 *LINK* DRV Digital DC Drive

Attention

This manual assumes the user has purchased and is familiar with the software packages ConfigEd and SAM. The ability to configure, commission and troubleshoot this product is limited to the degree of understanding and experience with these software tools.

Four-quadrant, regenerative and two-quadrant, non-regenerative versions of each frame size of the 590 DRV *LINK* drive are available. Each type includes full transient and overload protection and uses highly advanced electronic control of motor acceleration and deceleration, 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 only.

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.

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 sent as digital values over the *LINK* network giving greater control accuracy and repeatability than standard 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

Field Regulator: 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 be further enhanced to 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.

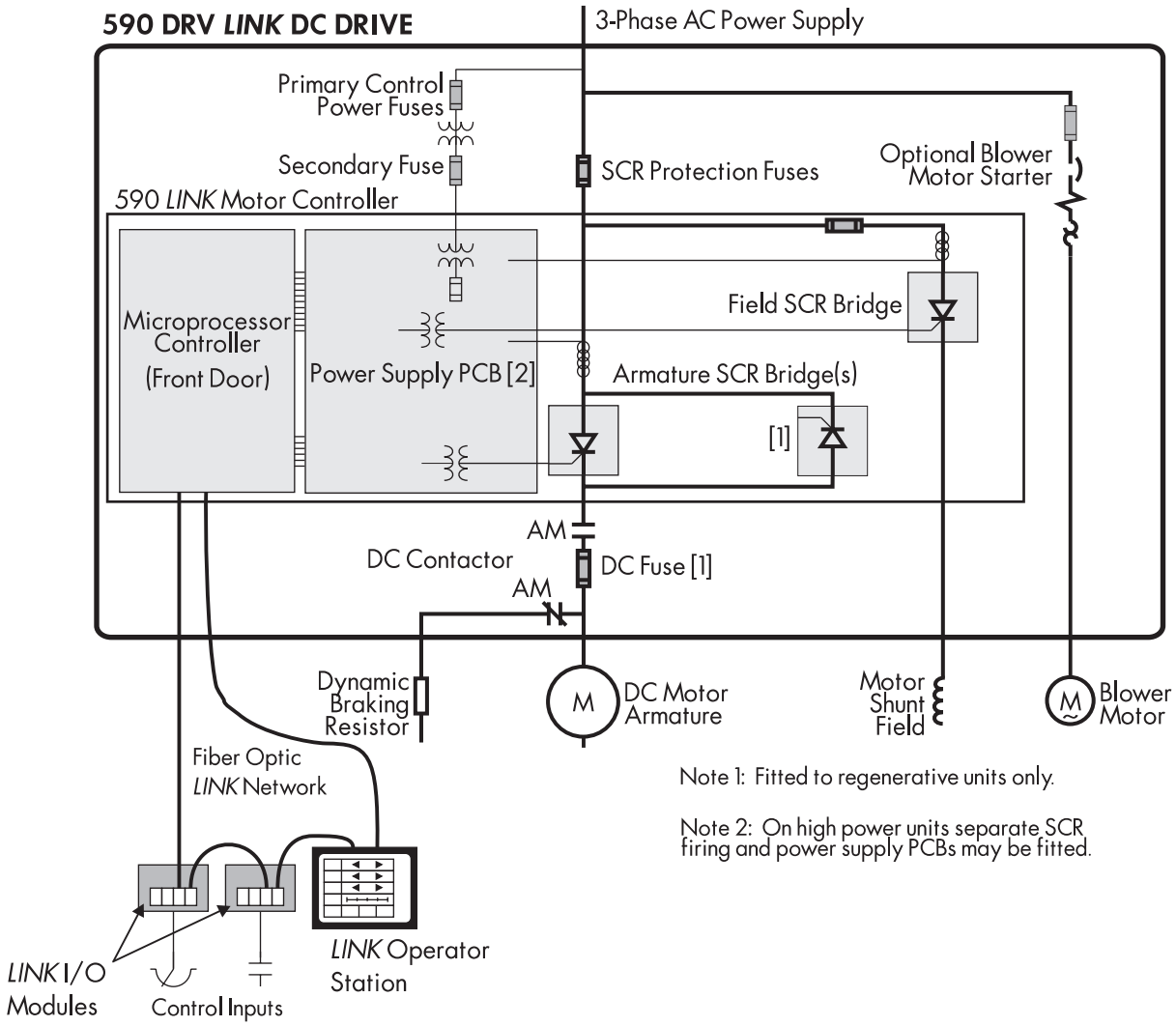


Figure 1.2 - 590 *LINK* DRV Block Diagram

Other Features

- **Power Isolation:** the 590 DRV *LINK* DC 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 *LINK* DC 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 spare parts needed to maintain a multi-drive system.

UNPACKING & SPECIAL HANDLING

Read this section before you remove the 590 DRV *LINK* DC drive from its packing materials. Though engineered for heavy industrial use, you can damage the 590 DRV *LINK* DC drive 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.

WARNING!

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

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 *LINK* 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 *LINK* 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 *LINK* 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.

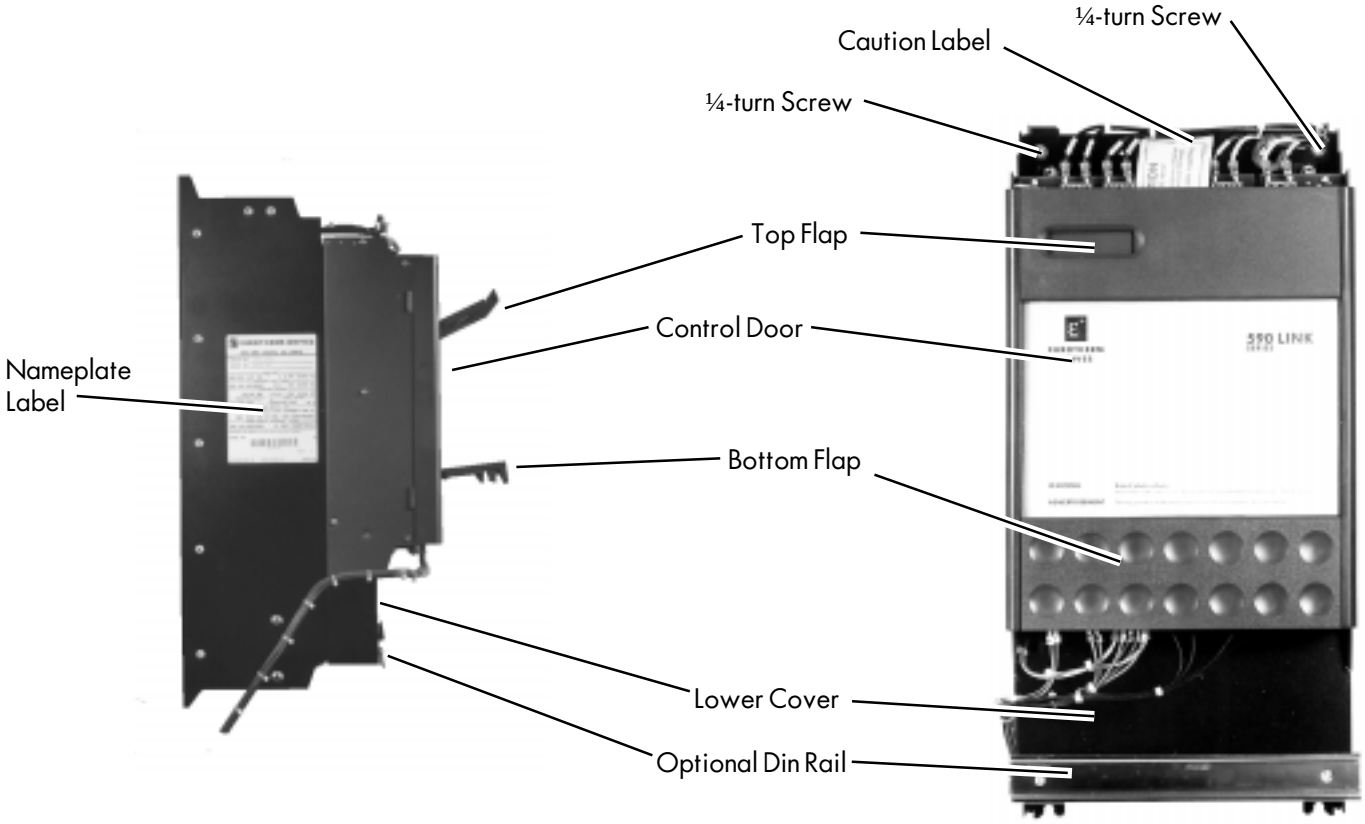


Figure 2.1 - 590 DRV Digital DC Drive Front and Side Views (30 HP Unit Shown)

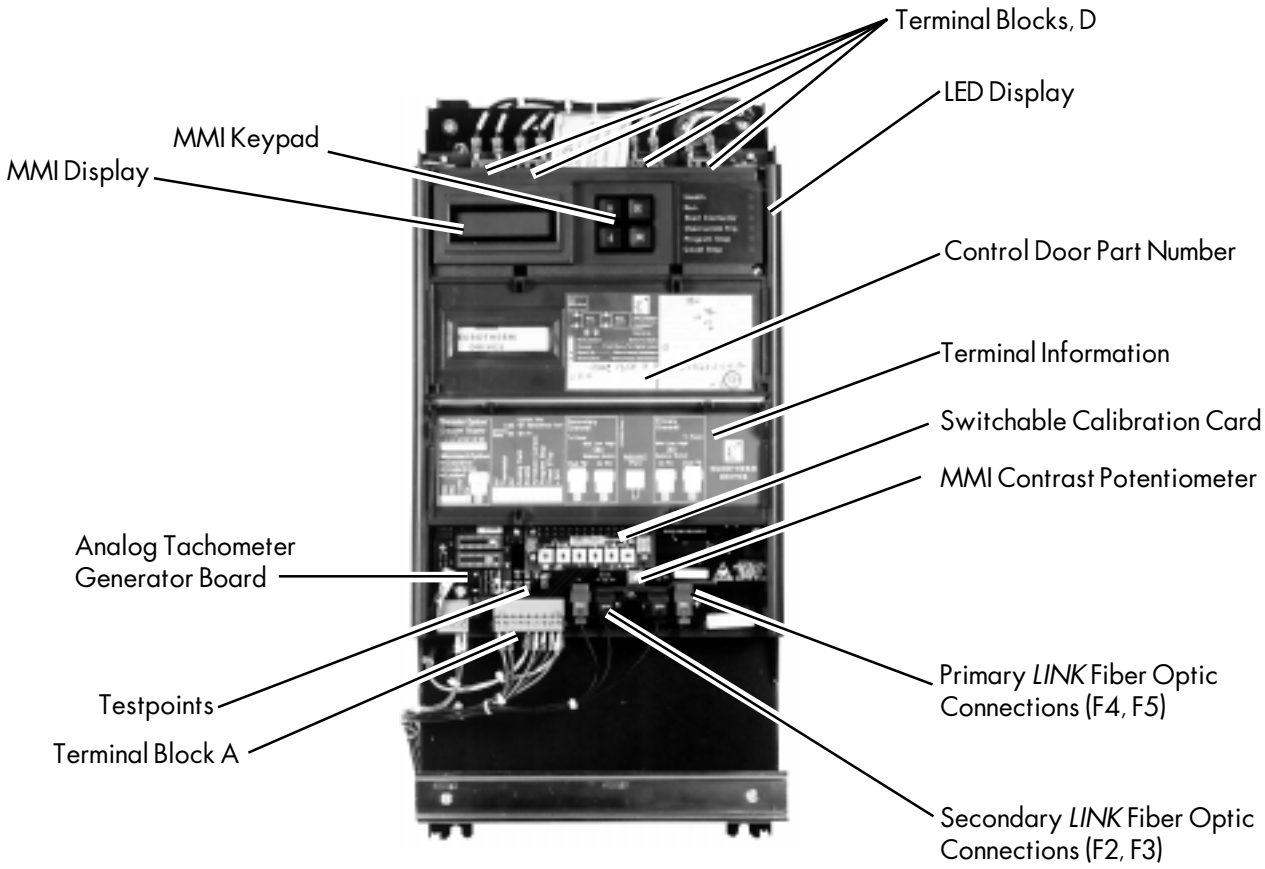


Figure 2.3 - 590 DRV *LINK* DC drive with Front Cover Panels Open (30 HP Model Shown)

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.

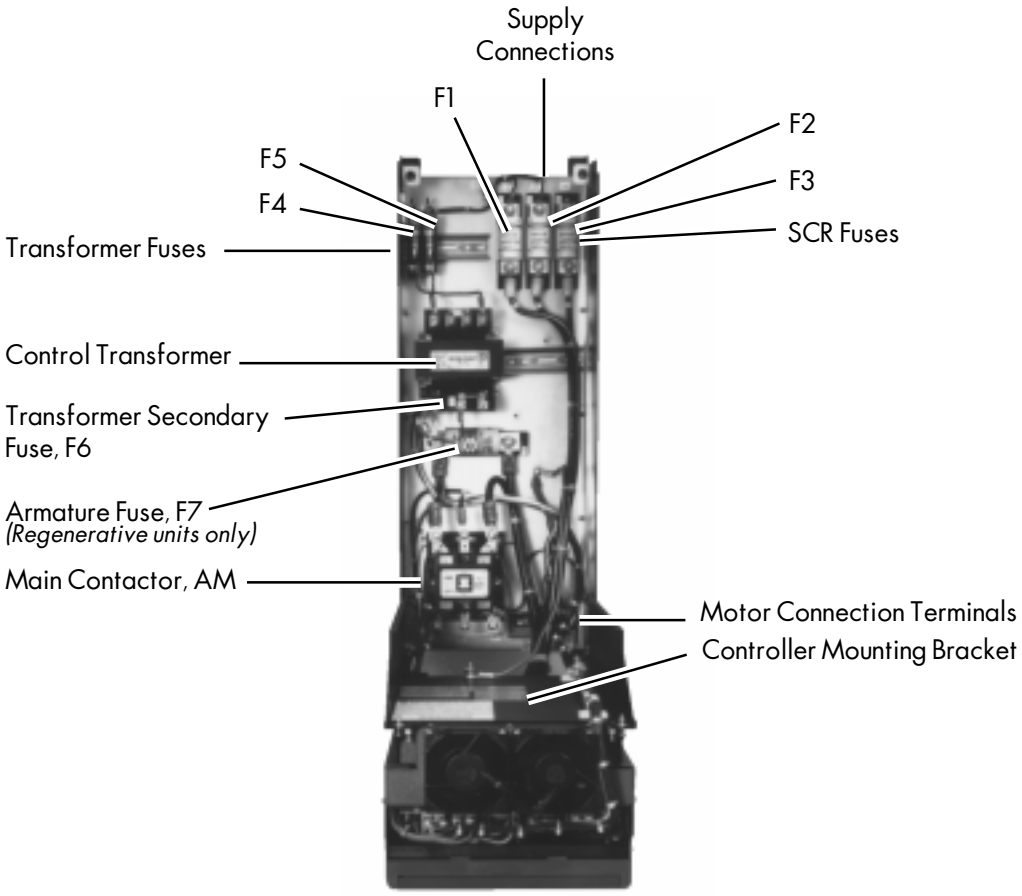


Figure 2.3 - Power Chassis (30 through 100 HP Units)

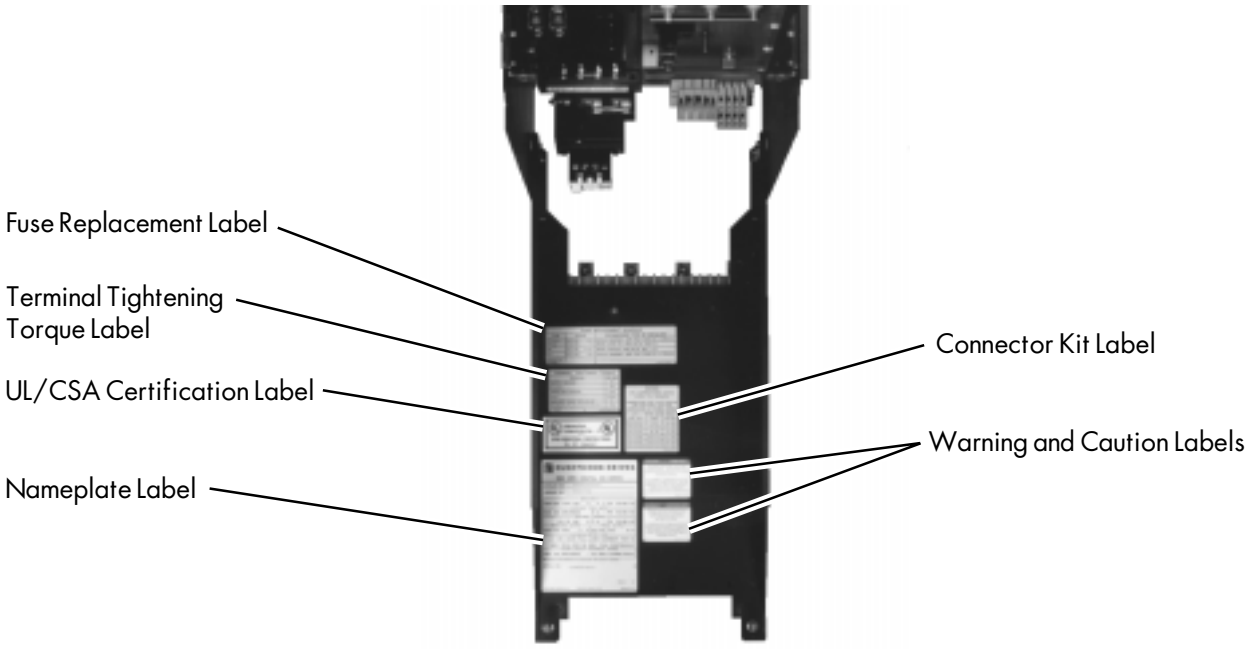


Figure 2.4 - Label Location On Controller Mounting Plate (30 through 100 HP Units)

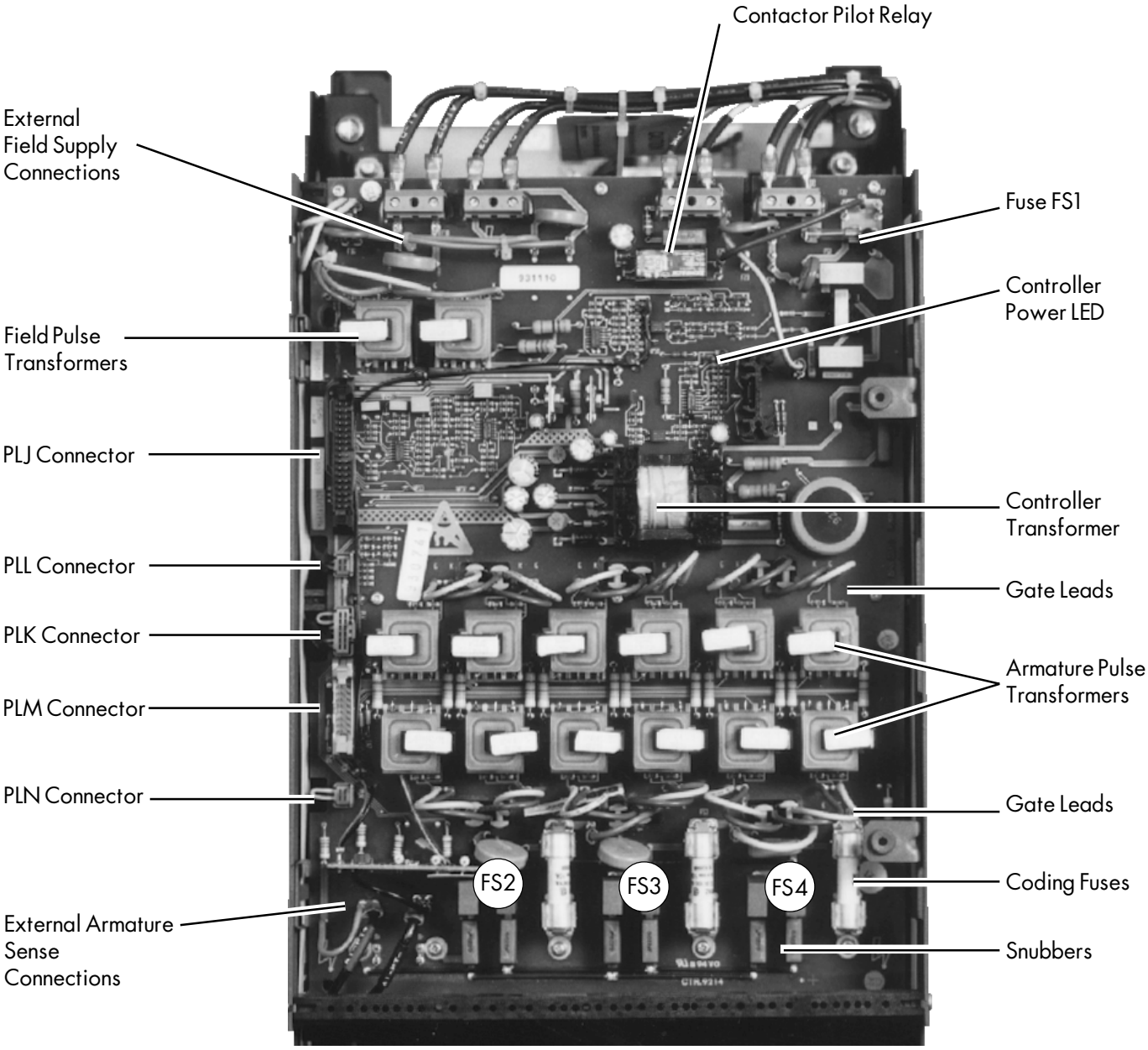


Figure 2.5 - Power Supply Board - AH385851U002 - Regen
AH385851U003 - Non-regen (not shown)

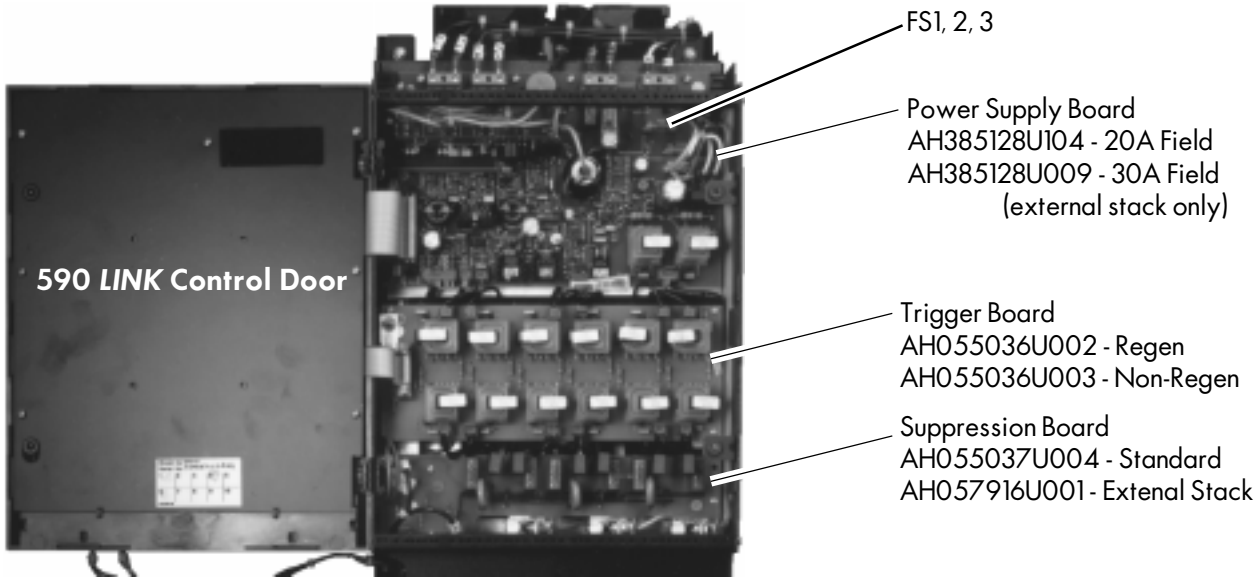


Figure 2.6 - Three-part Power Supply Drives [Used on DRVs Rated 330 Amps (200 HP) and Larger]

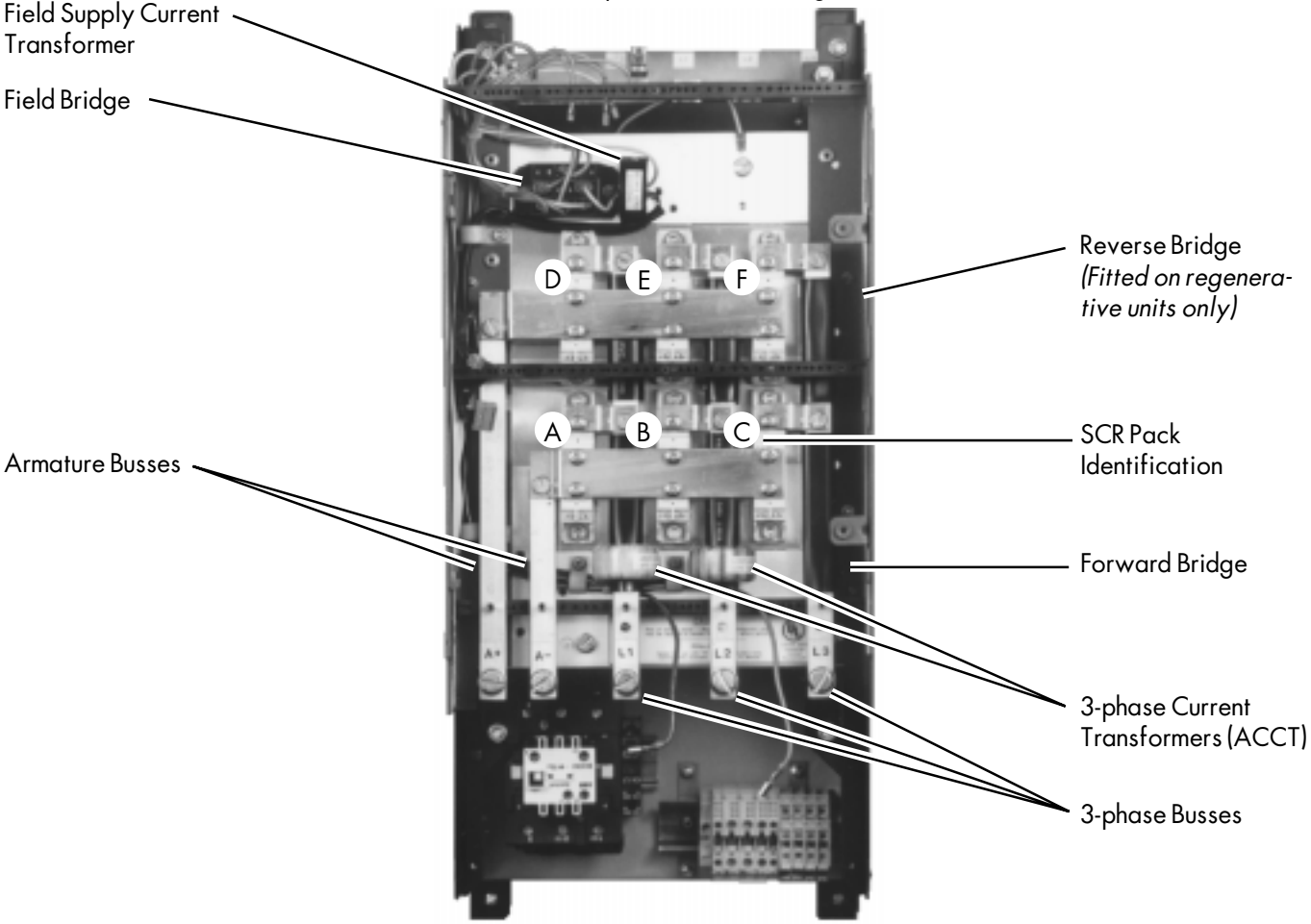


Figure 2.7 - SCRs and Power Busses (Power Supply Board Removed)

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).

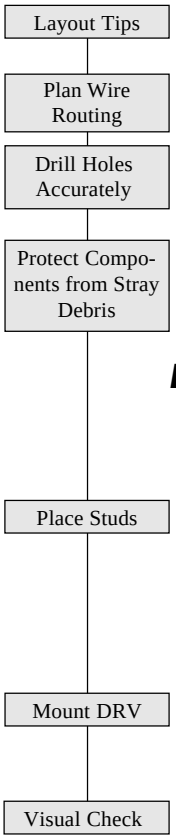
The table below lists the heat dissipation in Watts of 590 DRV Digital drives through 400 horsepower (at 500 VDC). The "*" in the catalog number designates either "R" or "N" (for regenerative or non-regenerative).

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

Figure 3.1 - Heat Dissipation Loads

NOTE. Total watts for 250 - 400 horsepower models can be reduced by 80% if the fan is mounted outside the enclosure.

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

Connector Kits

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

Branch Circuit Protection (A)

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.

Choose Wire Size

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

Ground Connections

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.

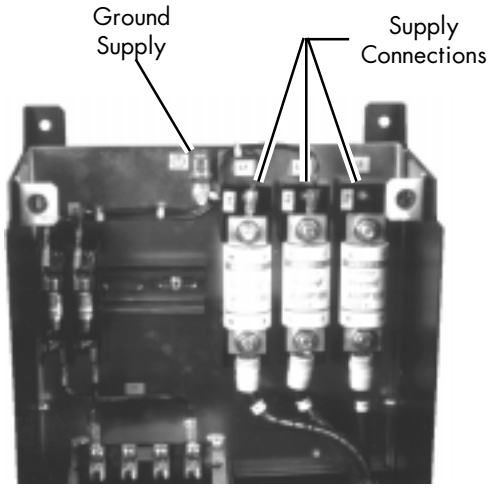
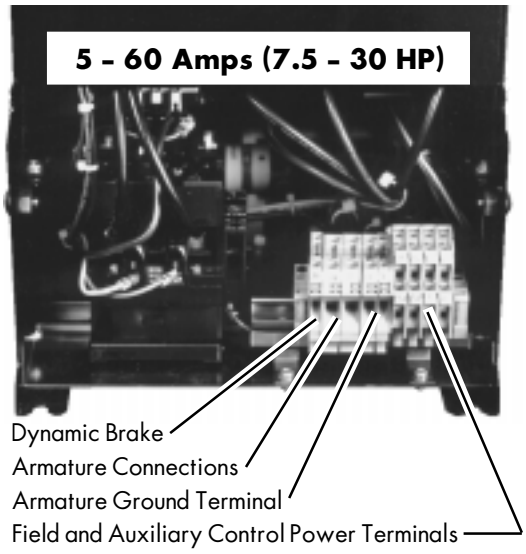


Figure 3.2 - Three Phase Connections (30 through 100 HP Models)



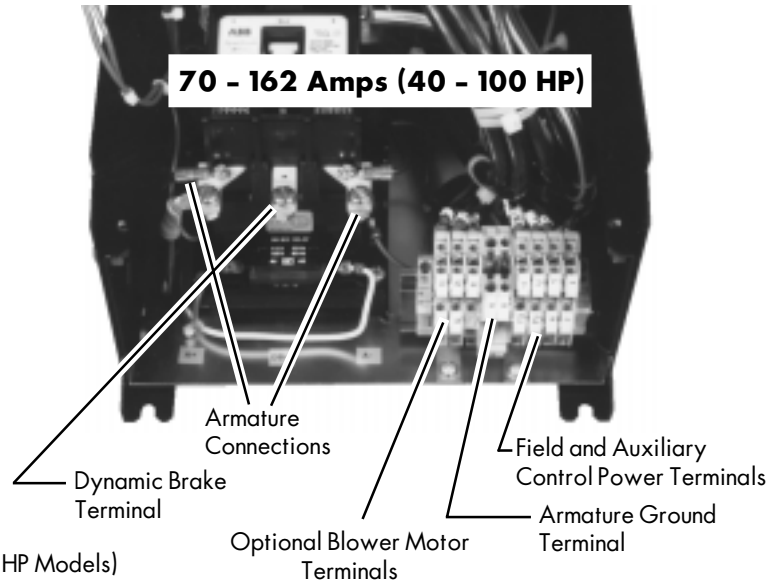


Figure 3.3 - Motor Connections (30 through 100 HP Models)

Isolation TX

Line Reactors

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 Armature

Install Overload

B

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.

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

Connect Field

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).

Ext. Fld. Supply

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.

Ext. Fld. Supply for 250 A or Less Units

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

1. 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).

Move RED Wire

Move YELLOW Wire

Fuse @ no more than 10 A.

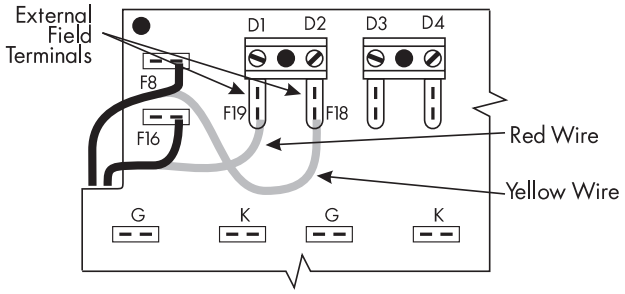


Figure 3.4 - External Field Supply Jumper Connections for Units Rated through 250A

3 Board Power Supply?

See Appendix F

   - 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 F for the field controller jumper connections.

2. 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).

330 thru 675 A DRV?

Move RED Wire to F8.

Move YELLOW Wire to F16.

Fuse @ no more than 20 A.

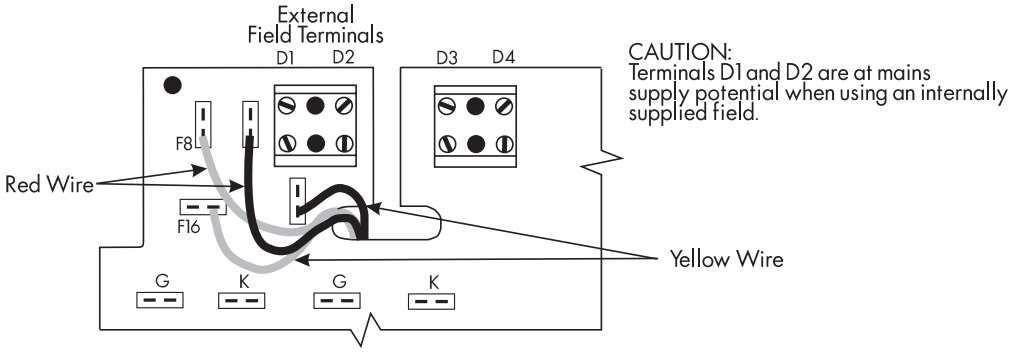


Figure 3.5 - External Field Supply Jumper Connections for Units Rated 330 through 675 A.

- Externally protect the supply with suitable branch circuit protection fuses rated for the supply voltage. The external fuse rating should not exceed 20 A.

External Stack? Refer to Appendix F

3. FOR EXTERNAL STACK CONTROLLERS or 500 to 1000 HP MODELS (units equipped for a 30 A field, maximum), SEE Appendix F.

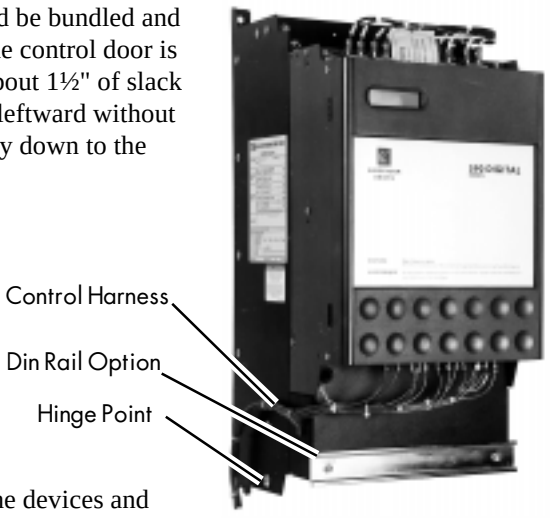
Control Wiring

Route Control Wiring to Left of Drive

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.

Optional DIN Rail

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.



Nearly all of the 590 *LINK* DRV's control functions (such as DRIVE START, CURRENT LIMIT and the drive's TOTAL SPEED SETPOINT) are handled over the *LINK* network through software. Certain key drive control signals and functions such as enable, dynamic braking, program and coast stopping are hardware driven through terminal block A.

WARNING!

The connectors to terminal block A 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.

Thermistor

Over Temperature Device

Auxiliary Blower Overload

(E)

If the motor is fitted with overtemperature sensing devices such as thermistors or thermostats, connect the devices in series between terminals A1 (0V) and A2 (THERMISTOR). If the motor has a blower, the 590 *LINK* DRV should provide power to the blower through an optional blower motor protector. An auxiliary, normally-opened contact on the blower motor protector option is wired to terminals 3 and 4. Connect terminal 3 to drive terminal A1 (0V) and terminal 4 through the motor overtemperature device to drive terminal A2 (THERMISTOR) so that either motor overtemperature or a blower motor overcurrent failure will shut down the controller. If a blower, thermistor or thermostat is not used, jumper terminal A1 to A2.

Enable

Enable A5

Terminal A5 (ENABLE) is connected to terminal A9 (+24V) internally through a normally-opened contact on the DRV main contactor. The drive remains disabled until the main contactor pole is closed.

(F)

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.

Armature Current Feedback Terminal

Armature Current A6

You can connect a meter to terminal A6 (ARMATURE CURRENT) to monitor the motor DC armature current. Refer to Appendix A for the terminal's output rating and signal scaling. This connection is optional.

The jumper LK21, located on the control board below the Test Points (see Figure 6.21), sets this output to a bipolar (±5 VDC) signal. Remove the jumper for a unipolar (0 to 5 VDC) signal. All units are shipped with this jumper in place.

Program and Coast Stop

Regen E-Stop

Program Stop A7

Connect terminal A7 (PROGRAM STOP) to terminal A9 (+24V) through a normally open contact of an emergency stop relay. Removing +24 volts from terminal A7 causes a controlled, regenerative stop (for regenerative drives only).

(G)

(H)

Connect terminal A8 (COAST STOP) to A9 (+24V) through a time delayed-off, normally open contact of an emergency stop relay. The delayed-off contact on A8 acts as a fail safe, allowing the drive to coast to a stop after the time delay.

Non-regen Stop

Coast Stop A8

For coast stopping (non-regenerative drives), permanently jumper terminal A7 to A8 and connect terminal A8 to A9 (+24 VDC) through a non-delayed, normally open contact off the emergency stop relay. The drive will coast stop immediately upon activating an emergency stop condition.

(K)

Caution

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 human safety.

Dynamic Braking

Dynamic Braking

The drive will dynamic brake if wired for coast stopping and a properly sized resistor is connected as shown in Figure 3.23. The contactor in all 590 DRV *LINK* drives rated 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.

Zero Speed Interlock

(I)

NOTE. The dynamic brake contactor pole is rated to make, but not interrupt DC motor current. To avoid damaging the contact, interlock the drive *LINK* ZERO SPEED signal to the drive start logic within the *LINK* configuration logic to prevent the drive from restarting until the motor has reached standstill. Or, interlock the start logic through hardware using relays and *LINK* digital modules.

(J)

For dynamic braking with either regenerative or non-regenerative drives, wire terminals A7 and A8 for coast stopping, as shown at (K).

Speed Feedback

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

Speed Feedback Options

- 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 Part Nos.

Feedback Board	**part no.**
• Switchable Analog Tachometer Generator Board	AH385870U001
• +5 VDC Encoder Receiver Board	AH387775U005
• +12 VDC Encoder Receiver Board	AH387775U012
• +15 VDC Encoder Receiver Board	AH387775U015
• +24 VDC Encoder Receiver Board	AH387775U024
• 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.

Feedback Board Installation

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.

Must use Switch Cal Card if Using Switch Tach Board

(L)

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.

Resistor Cal Card? Connect Tach to A3 and A4

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.

Switch Cal Card? Connect Tach to G1&G2 or G3&G4

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.

Use Shielded Cable

Ground Shield at DRV *Only*

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.

Wire-ended Electrical Encoders

Encoder Option

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.

Use Shielded 3 x Twisted Pair

(M)

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

Microtach Option

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.

Glass vs. Plastic

Microtach Supply Requirement

(N)

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

Composite FO Cable

½" 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.

LINK NETWORK CONNECTIONS

The *LINK* fiber optic connections are shown in Figure 3.10. The drive has two pairs of communication ports, each with a RED transmit terminal and a BLACK receive terminal. The right two ports, F4 (primary receive) and F5 (primary transmit), support a simple ring network topology. The left pair, F2 (secondary transmit) and F3 (secondary receive), are used for redundant or tapped ring topologies.

Simple, Tapped & Redundant Rings

Simple, redundant and tapped *LINK* network rings are shown below in Figures 3.7, 3.8 and 3.9. Detailed information on each type of ring can be found in the *LINK* Overview Manual (HA350678A).

P

Q

Plastic vs. Glass Fiber Optic Cable

The 590 *LINK* DRV communicates over the *LINK* network over plastic fiber optic cable. The drive's fiber optic ports accept plastic (T&B) connectors which require only a set of pliers for termination to the plastic fiber optic cable. L5206-2-00 *LINK* fiber optic repeaters may be required if the fiber optic run exceeds the drive's transmission distance rating for plastic cable. Part numbers for plastic fiber optic connectors and signal repeaters are listed in Appendix G.

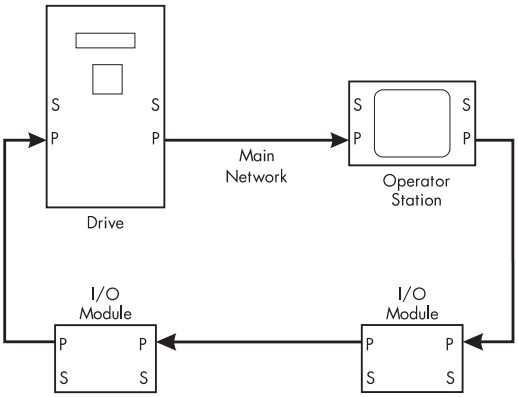


Figure 3.7 - Simple Fiber Optic Topology

Transmission Distances

You can adjust the transmission power level of each fiber optic transmitter by setting the transmission range switches on the drive's control board. These switches are located above F3 and F4, the receive ports of each channel (see Figure 3.10). Transmission ranges are listed in Appendix A, Technical Description.

Being highly noise immune, the fiber optic cable may be installed with high voltage or control voltage cabling.

NOTE. Avoid installing the fiber optic cable in a manner which exceeds the cable's minimum bend radius, or otherwise damages the cable.

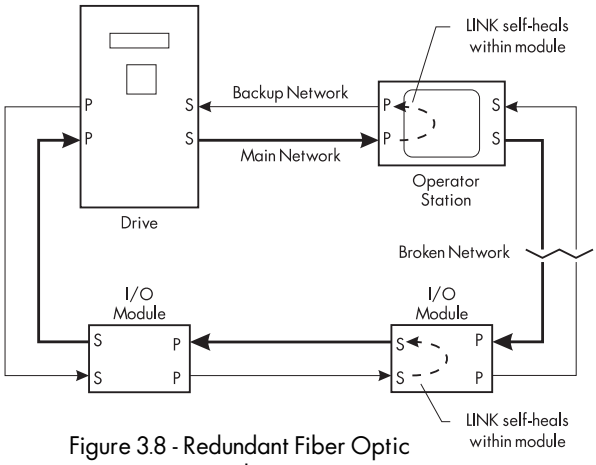


Figure 3.8 - Redundant Fiber Optic Topology

Seal off FO3 if not Used

When using a simple topology, seal off the black secondary channel receiver (F3) with a plastic fiber optic connector so that the unused port's receiver avoids detecting stray light. The drive is shipped with such a connector fitted.

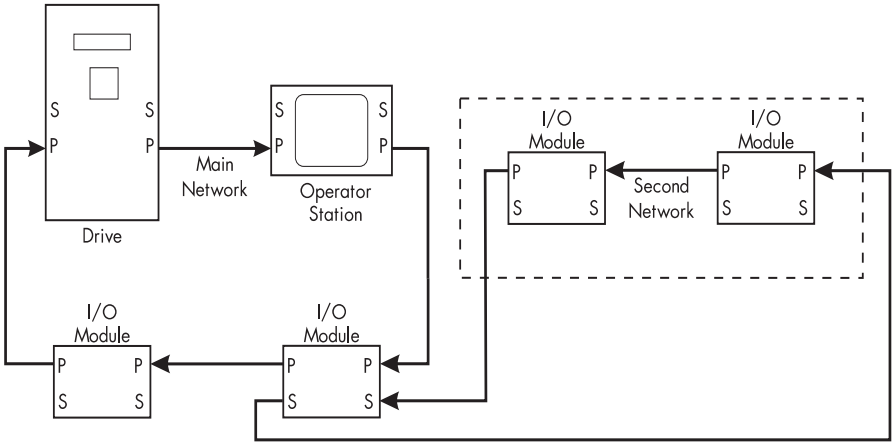


Figure 3.9 - Tapped Fiber Optic Topology

HARDWARE SETTINGS

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

Calibration Boards

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 *LINK* DRV main control door under the lower, hinge-up access panel as shown in Figure 3.10. 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.

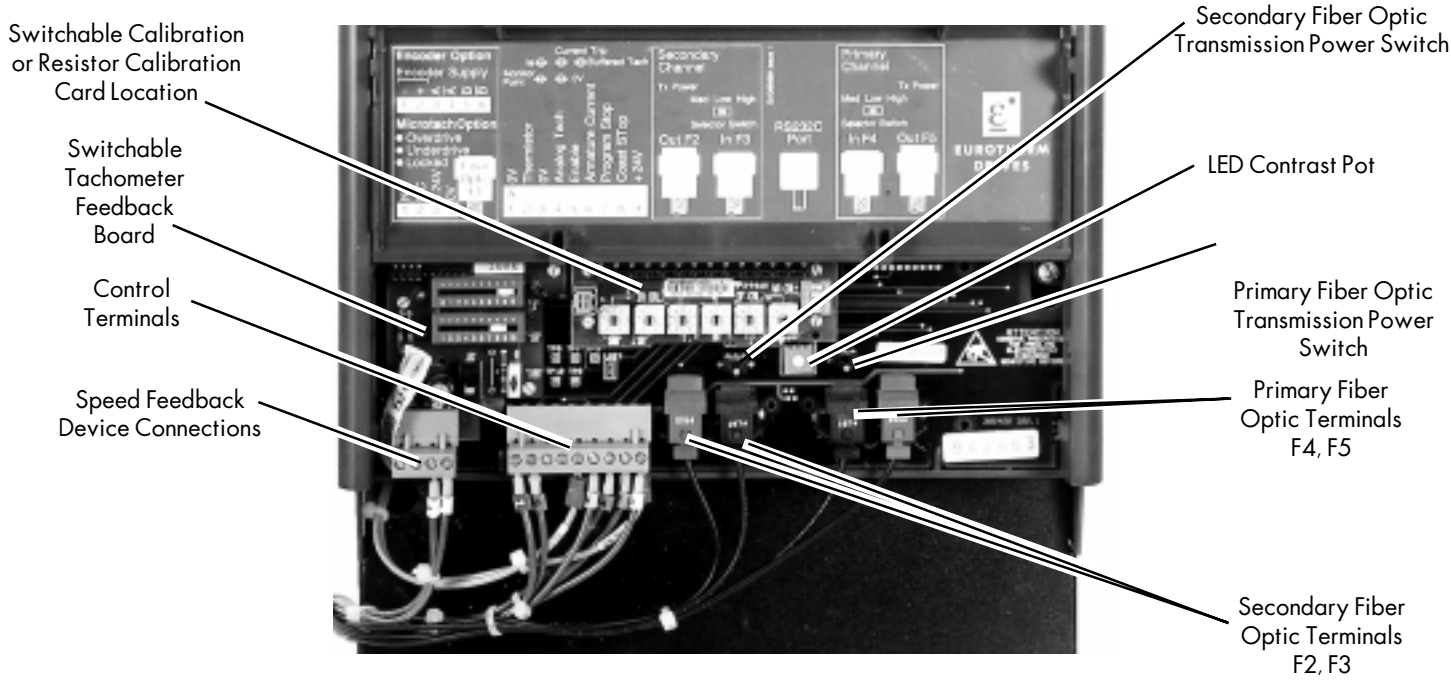


Figure 3.10 - Close up View of Lower Portion of 590 *LINK* Control Board (Switchable Calibration Card Shown)

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

WARNING!

Do *not* swap calibration boards or change any board settings while applying power to the 590 *LINK* DRV. Do *not* interchange calibration boards or switch the calibration settings without first verifying that they match the motor's nameplate rating. Failure to heed this warning can lead to mechanical damage and injury to personnel.

Resistor Calibration Card (AH058529U001)

Resistor values on the plug-in resistor calibration card scales 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.

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

NOTE. 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.

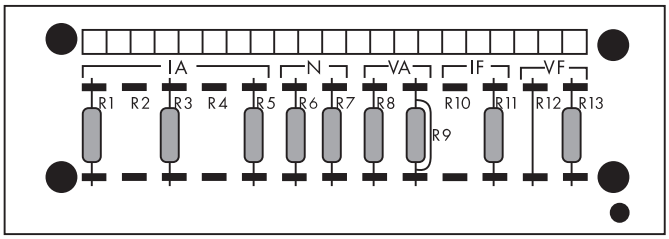


Figure 3.11 - Resistor Calibration Card

Armature Current Calibration

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:

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

   You can verify this value by using the formula:

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

Tachometer Generator Calibration

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

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

<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:

$$R6 = 120\ k\Omega$$
$$R7 = 68\ k\Omega$$
$$R_E = \frac{(\text{Tachometer Generator Volts} - 200)\ k\Omega}{5}$$

>200V Signal

External Resistor Sizing

   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 tachmometer generators require a full-wave diode bridges to rectify the AC tachometer generator voltage output into DC.

Fine Tune: See Chapter 5

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

Armature Voltage Calibration

3. Armature voltage feedback calibration

$$R8 + R9 = \frac{(\text{Armature Voltage} - 100)\ k\Omega}{10}$$

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

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

Field Current Calibration

Field Current Control

Field Voltage Control

Field Current Cal with External Stacks

Field Voltage Cal

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:

$$R_{IF} = \frac{3000}{\text{(Full Field Current)}}\ \Omega$$

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:

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

When using an external stack controller (types 598 and 599) is used, the field current calibration resistor is calculated with this formula:

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

NOTE. If necessary, change SETUP PARAMETERS:: CALIBRATION:: FIELD I CAL in the MMI, or CAL FIELD CURRENT in SAM to refine the calibration for the required field current.

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 kΩ 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.

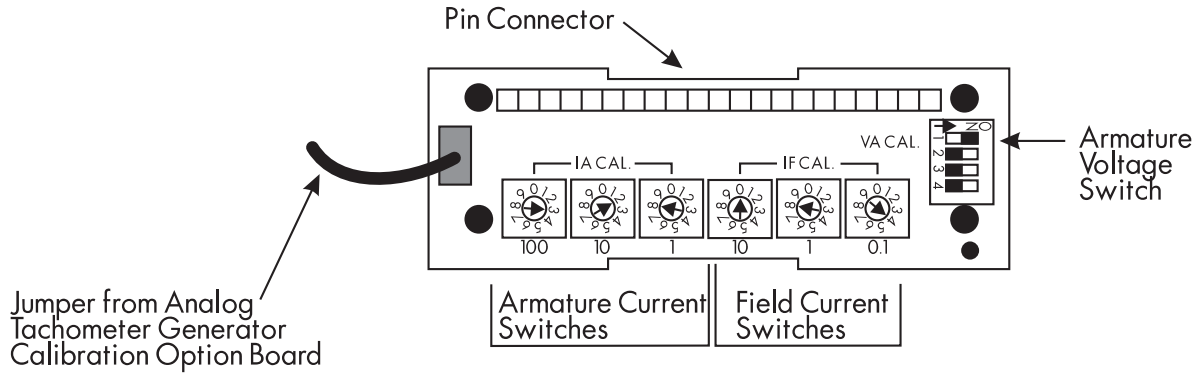


Figure 3.12 - Switchable Calibration and Tachometer Boards

Set Armature Voltage

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 3.13 to select different voltages.

   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.

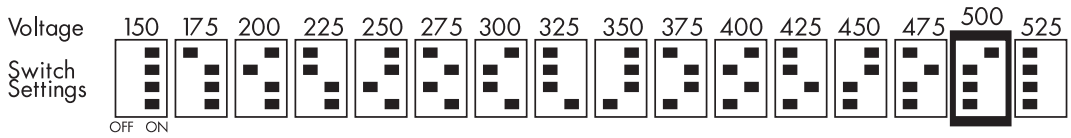


Figure 3.13 - Armature Voltage Switch Settings

Fine Tune: Adjust ARMATURE V CAL

NOTE. Change SETUP PARAMETERS::CALIBRATION:: ARMATURE V CAL in the MMI, or CAL ARMATURE VOLTAGE in SAM 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.

Set Armature Current

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 3.12 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 Field Current

3. 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 *LINK* DRV models. Turn the rotary switches to the appropriate setting for your motor. Figure 3.10 is set for a 8.4 amp field. Use SETUP PARAMETERS:: CALIBRATION:: FIELD I CAL in the MMI, or CAL FIELD CURRENT in SAM to fine tune the calibration.

   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 *LINK* DRVs 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

Check Transformer Tap Against Supply

Use Loose Supplied Fuses for 230 VAC Supply

The 590 controller within the DRV derives its control power through a DRV mounted control transformer connected to one phase of the incomming 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 460 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 tansformer as shown in the right of Figure 3.11.

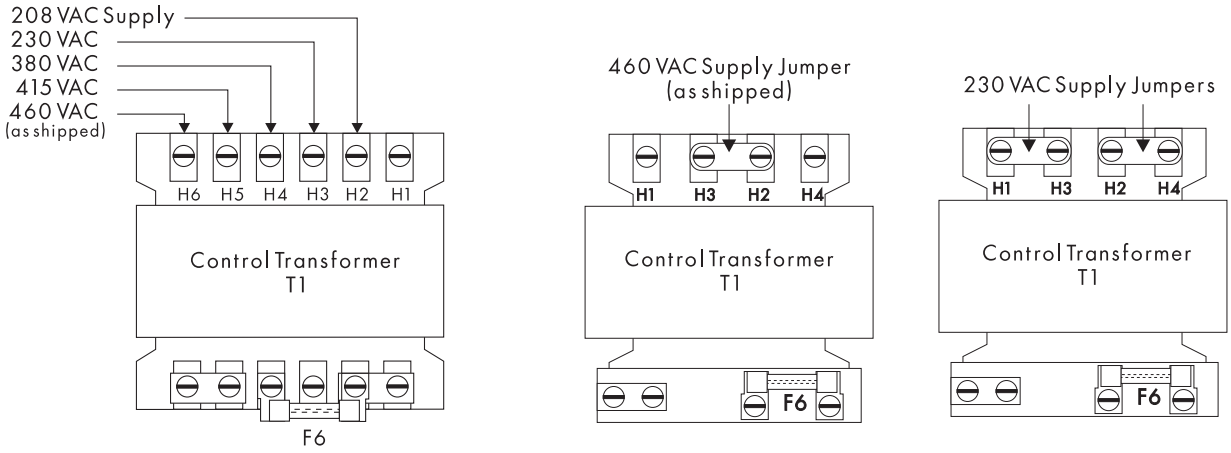
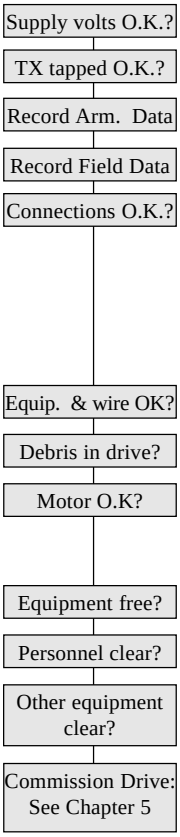


Figure 3.11 - Control Transformer Settings

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.



1. Check the main power supply voltage.
2. Verify that the control transformer is tapped for the main supply voltage.
3. Record the armature voltage and current ratings.
4. Record the field voltage and current rating.
5. Check all external wiring circuits:

   Supply connections

   Control connections

   Motor connections
6. Visually check for damaged equipment or wiring.
7. Look for any loose wire ends, drilling chips, etc. lodged in the drive or electrical equipment.
8. Inspect the motor, especially the commutator, for any debris. Ensure the brushes are properly seated and the brush spring tensions are adequate. If possible, check that the motor and blower (if fitted) can be turned freely by hand.
9. Check that rotation of the machinery in either direction will not cause a hazard.
10. Ensure all personnel are clear of other parts of the equipment that may be affected by powering up.
11. Verify that other equipment will not be adversely affected by powering up.

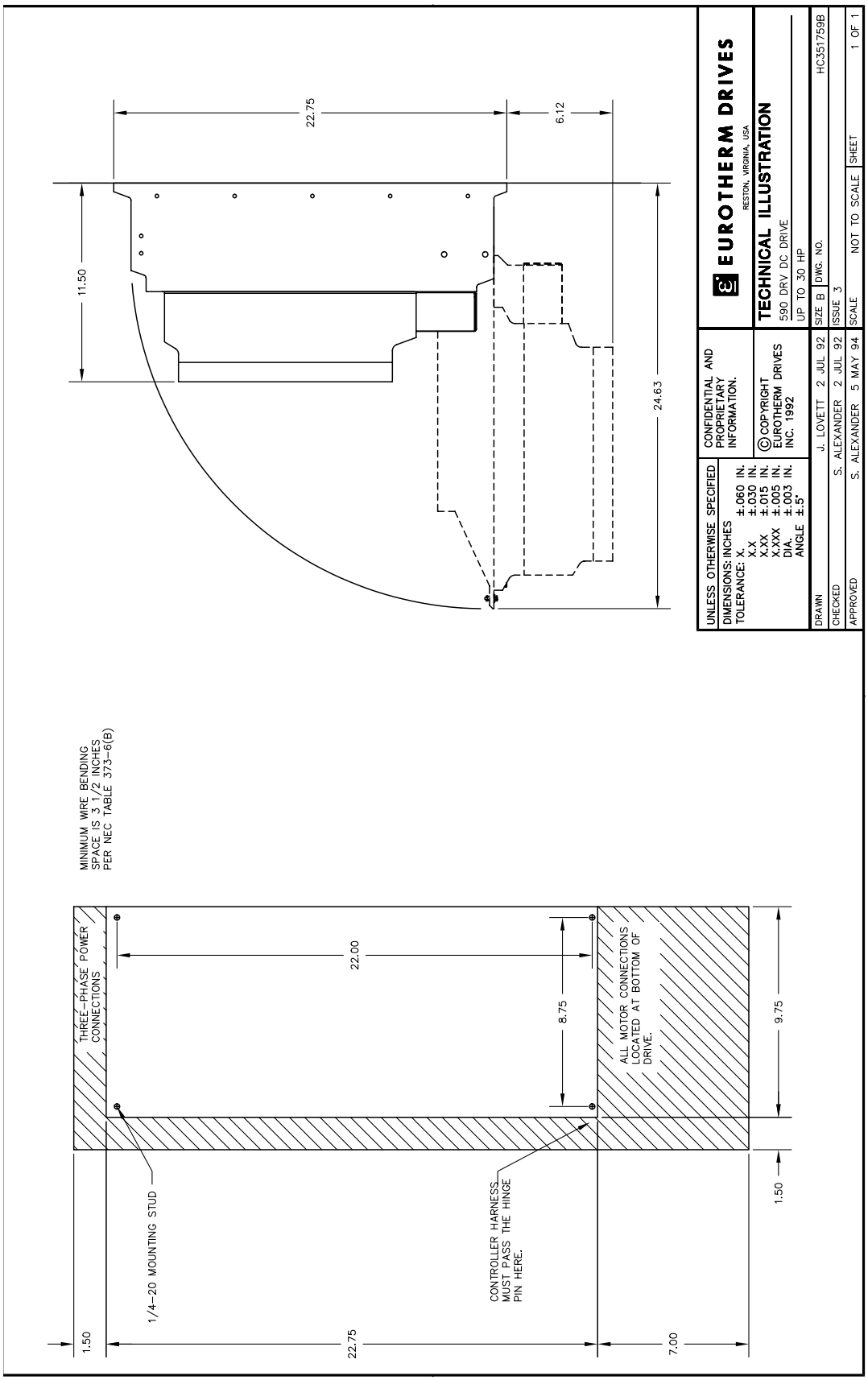


Figure 3.15 -
30 Hp @ 500 VDC
15 Hp @ 240 VDC

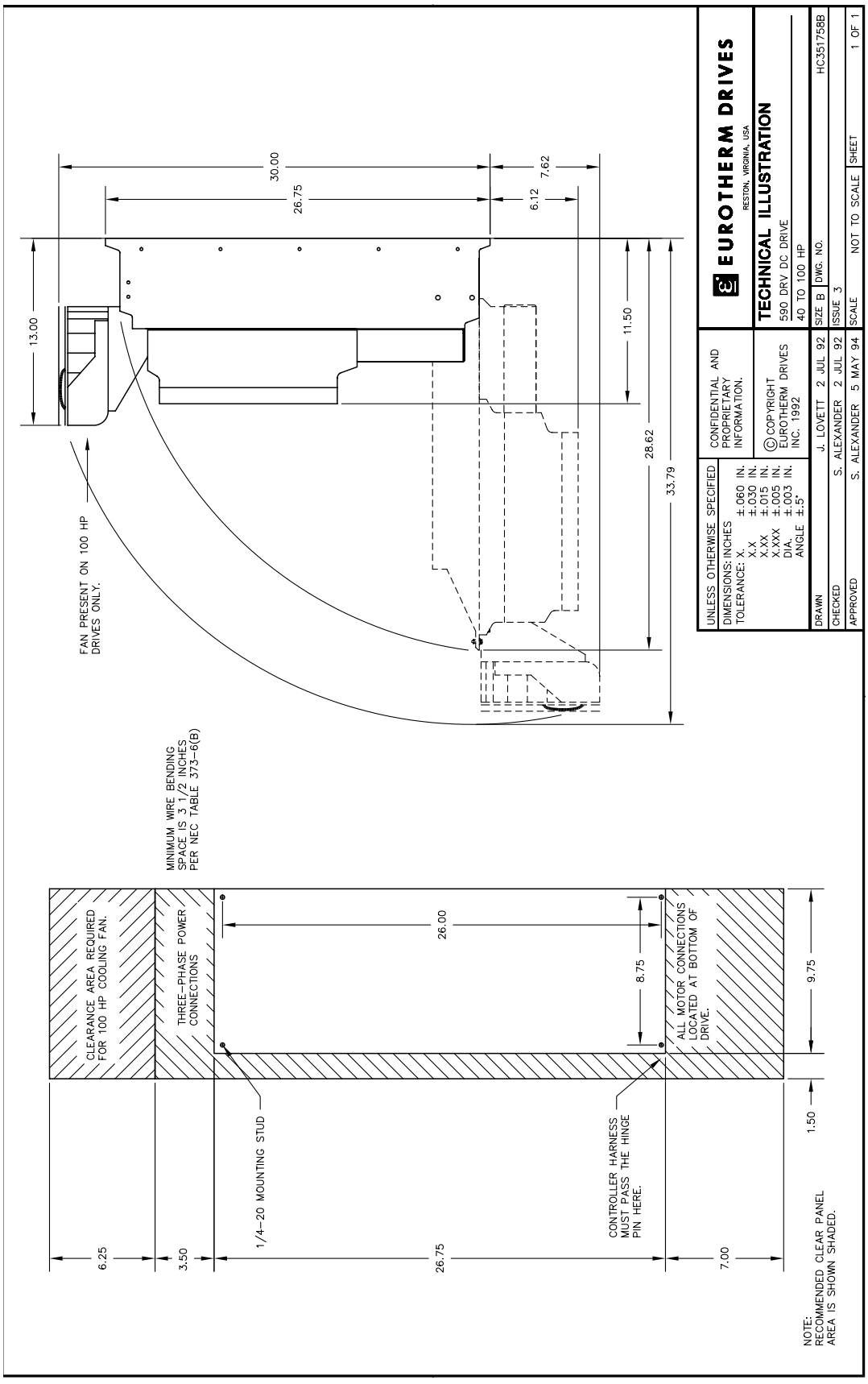


Figure 3.16 -
100 Hp @ 500 VDC
50 Hp @ 240 VDC

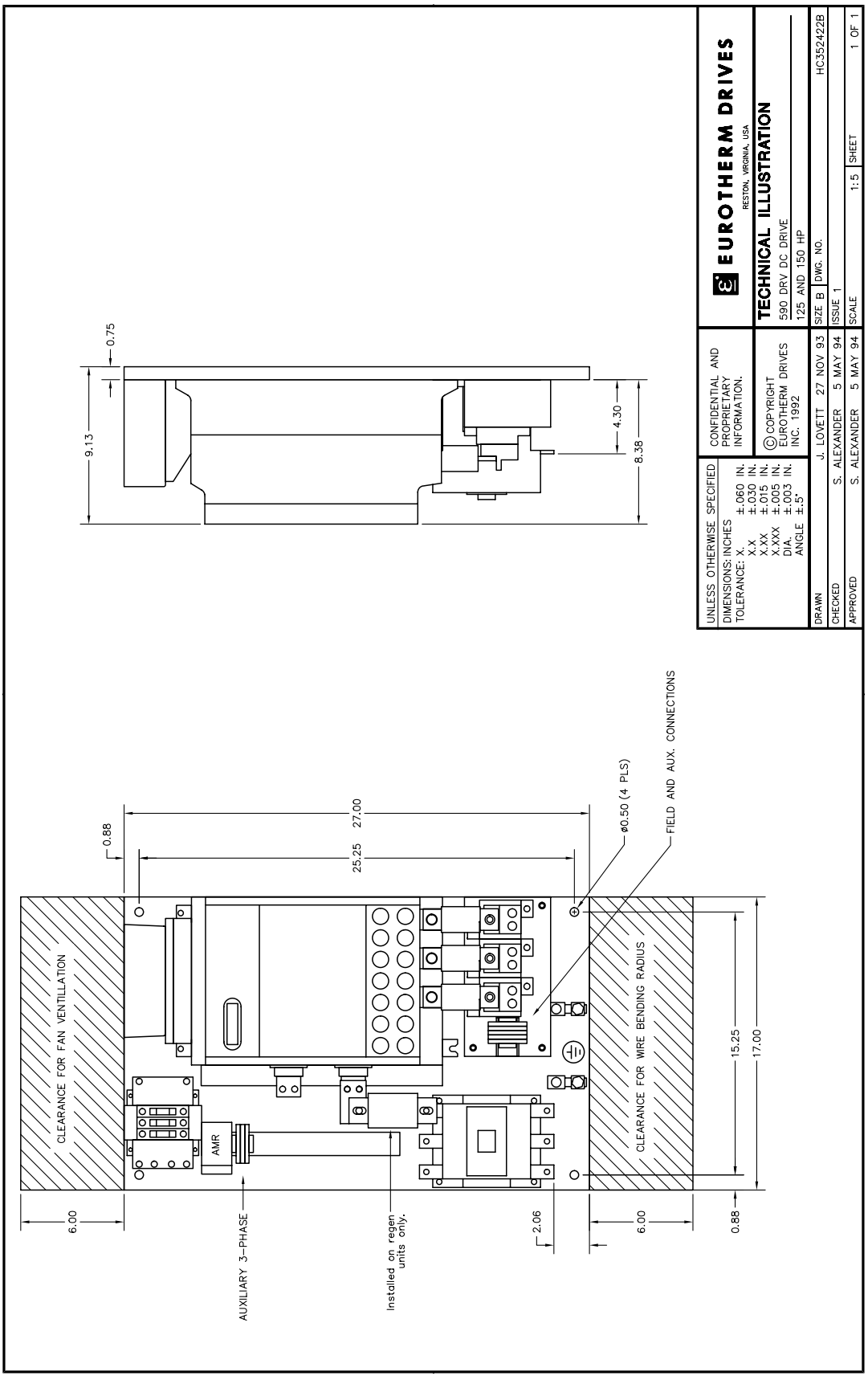


Figure 3.17 -
150 Hp @ 500 VDC
75 Hp @ 240 VDC

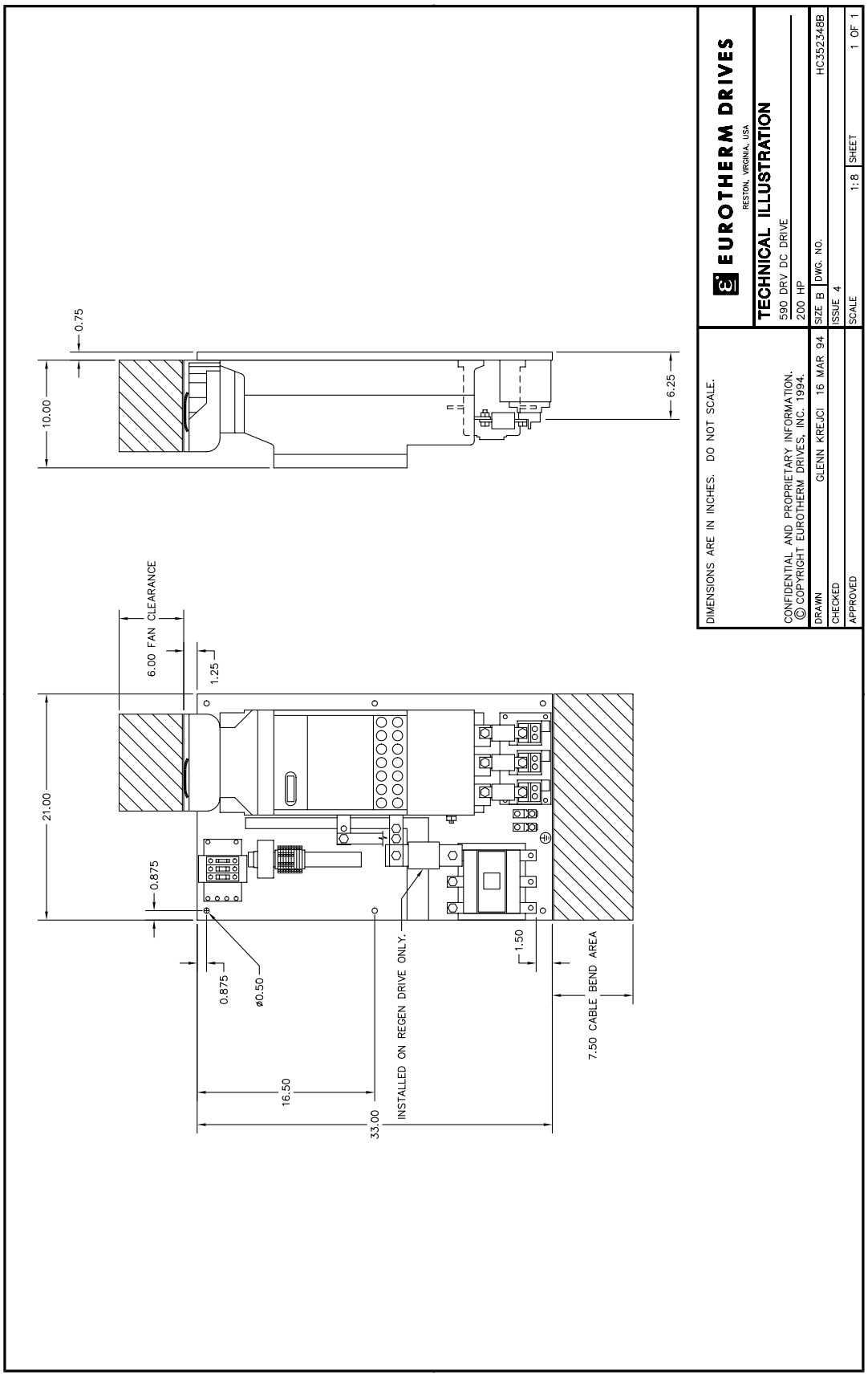


Figure 3.18 -
200 Hp @ 500 VDC
100 Hp @ 240 VDC

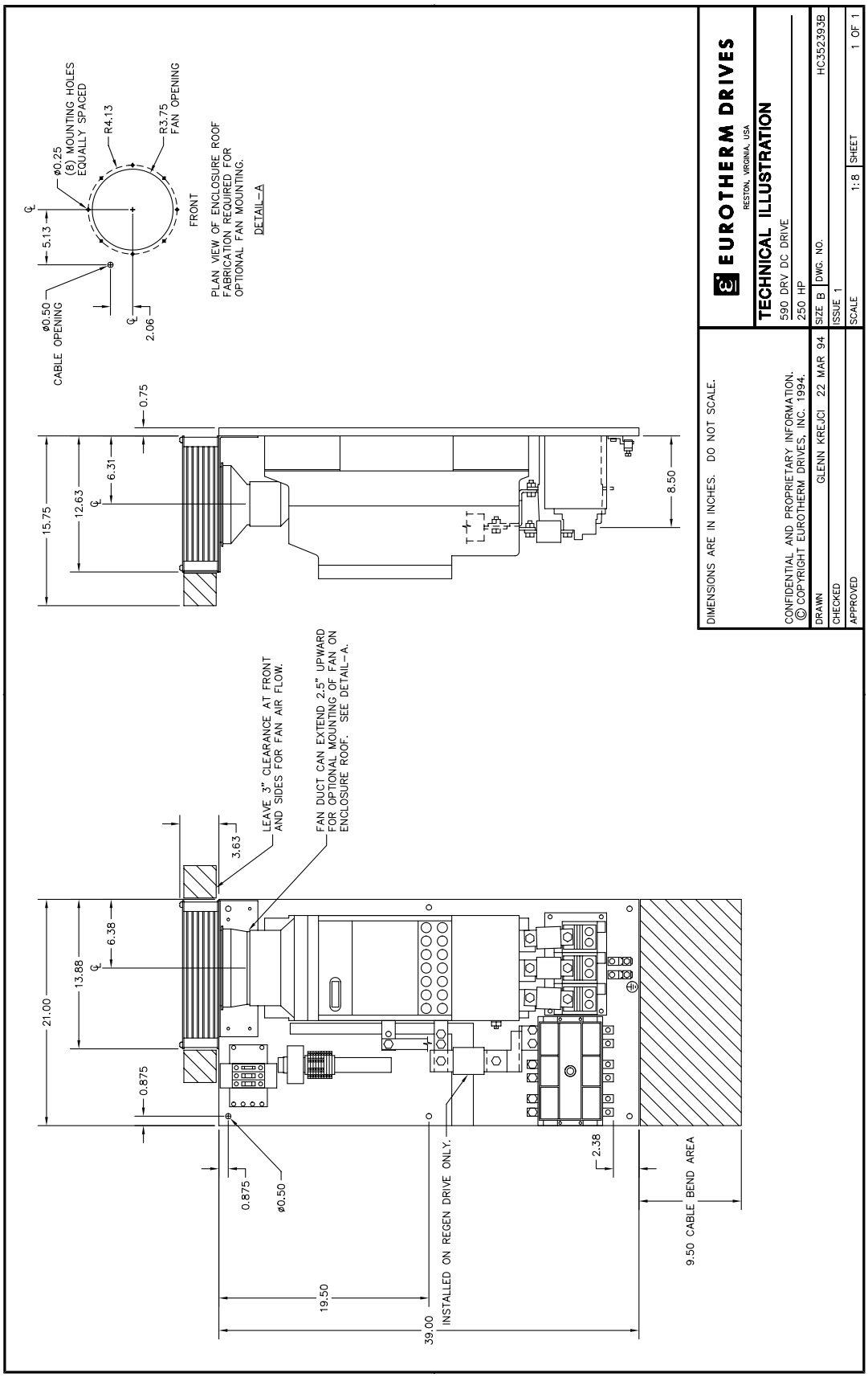


Figure 3.19 -
250 Hp @ 500 VDC
125 Hp @ 240 VDC

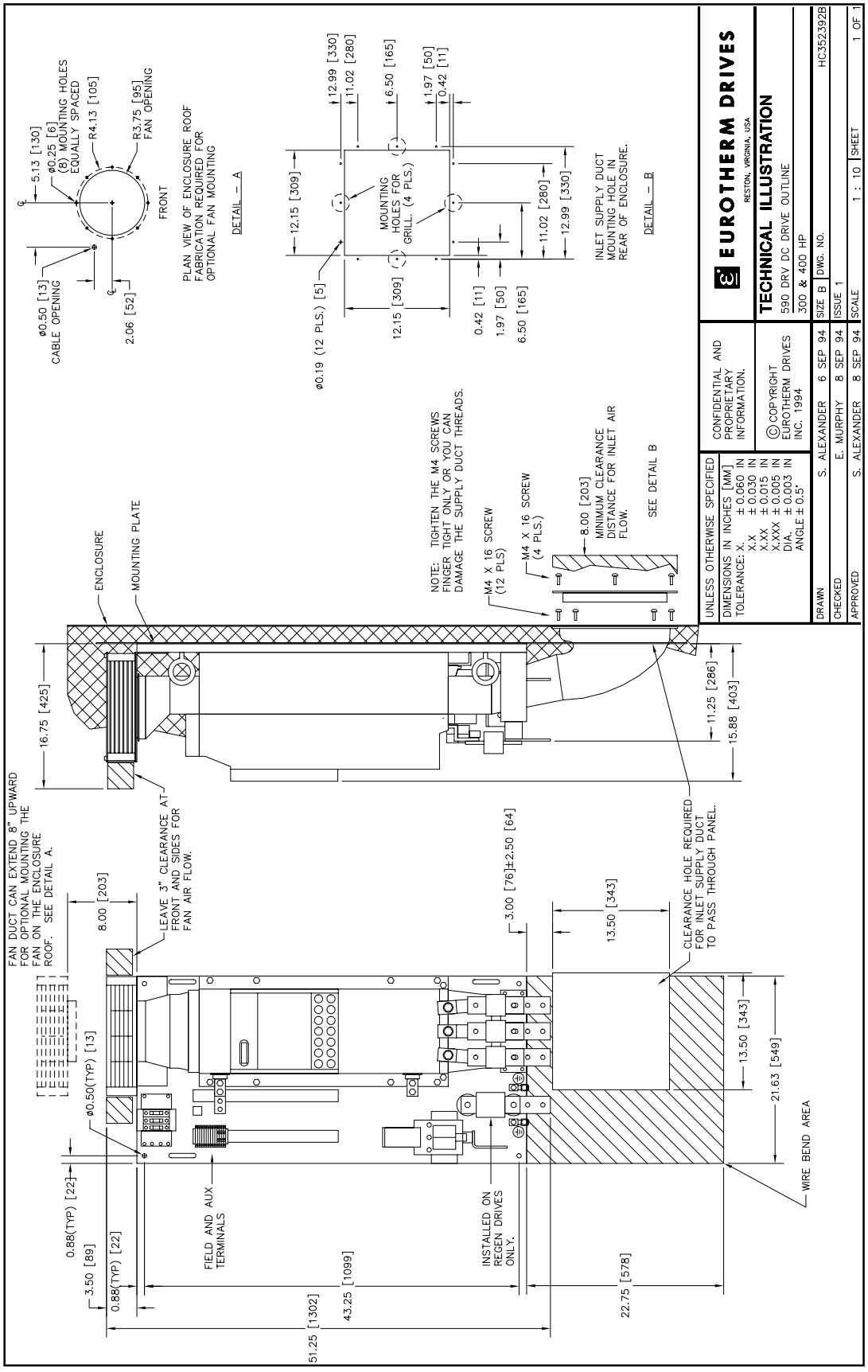


Figure 3.20 -
400 Hp @ 500 VDC
200 Hp @ 240 VDC

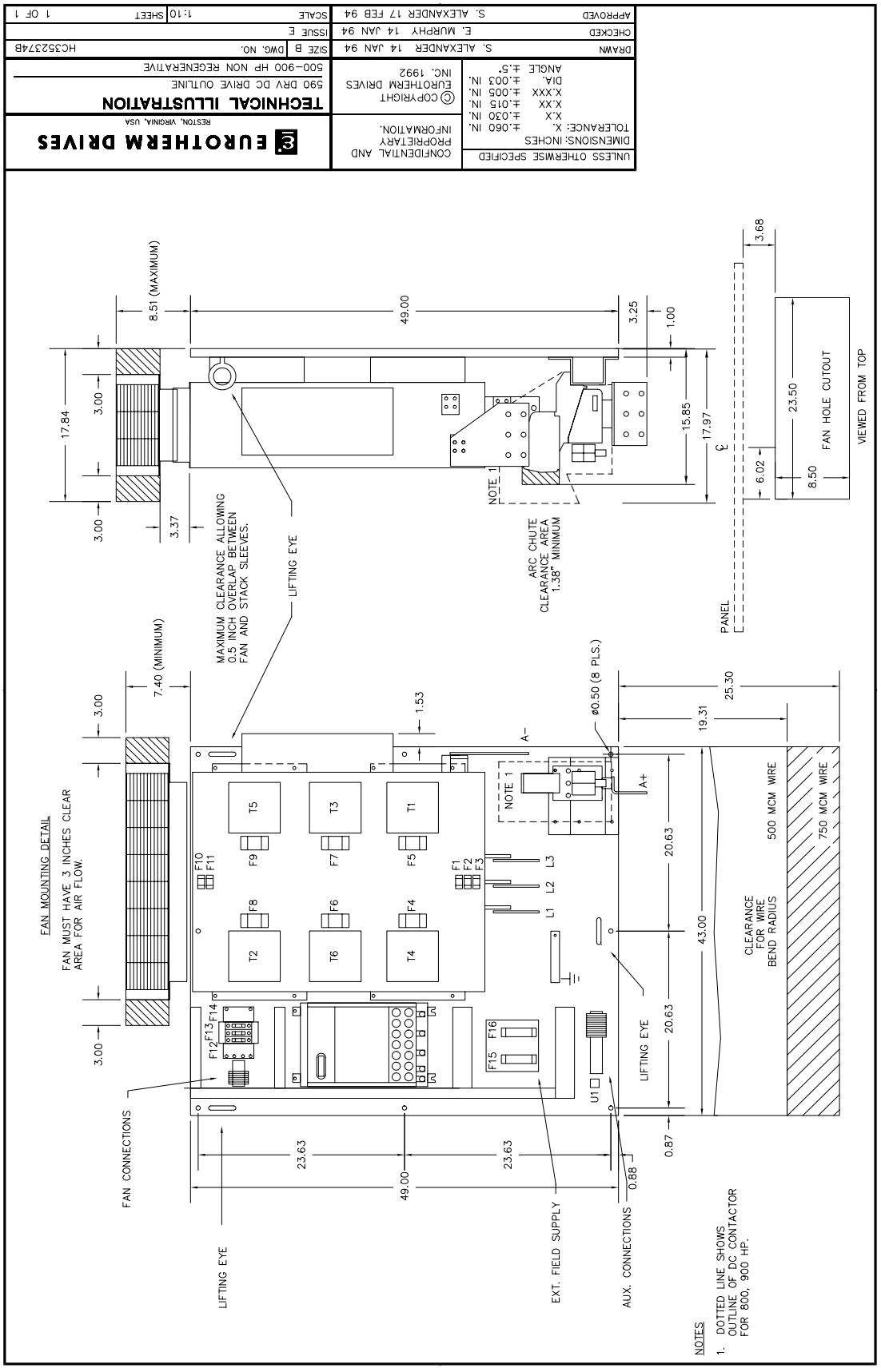


Figure 3.21 - Non-regenerative 500 - 900 Hp @ 500 VDC 250 - 450 Hp @ 240 VDC

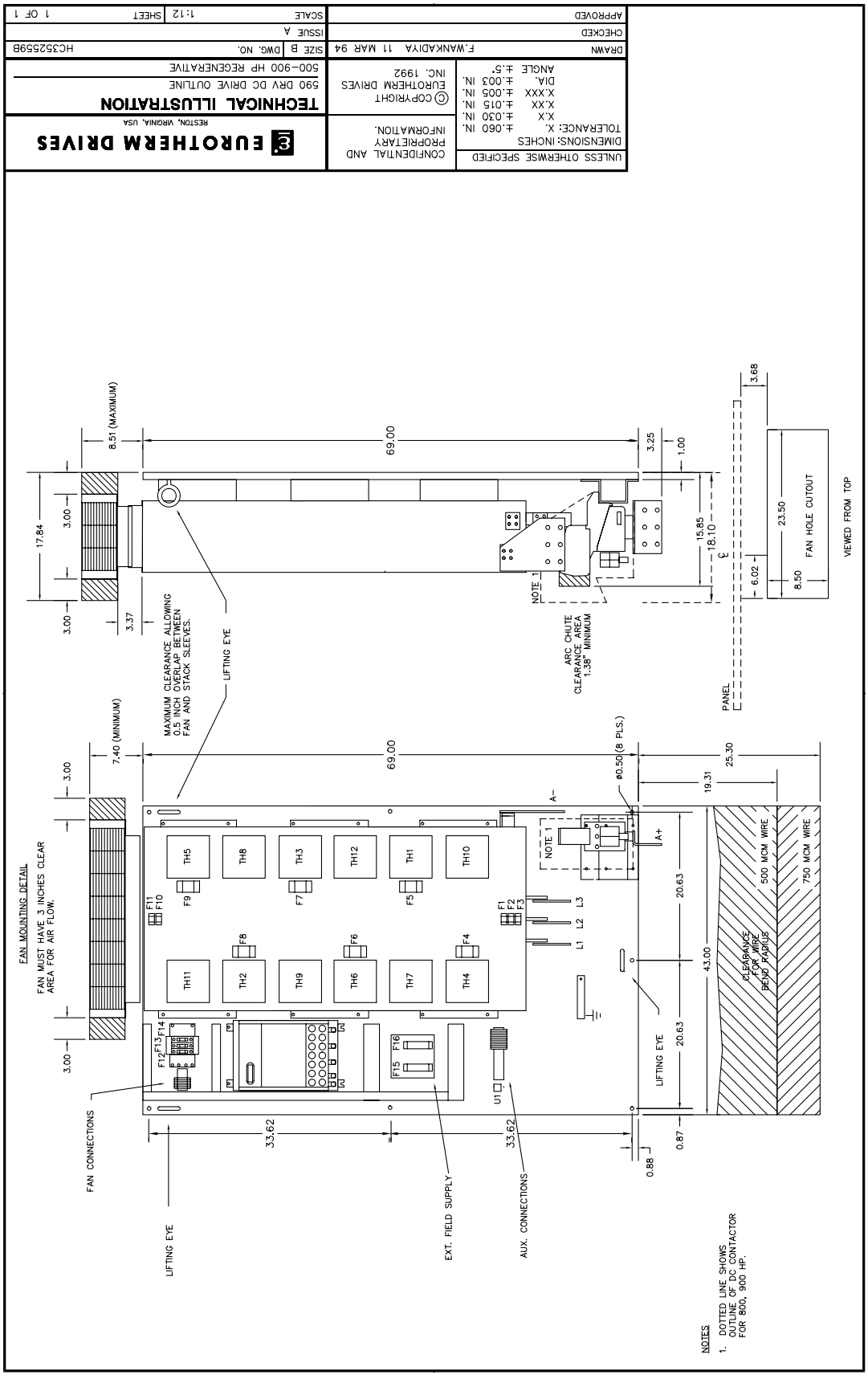
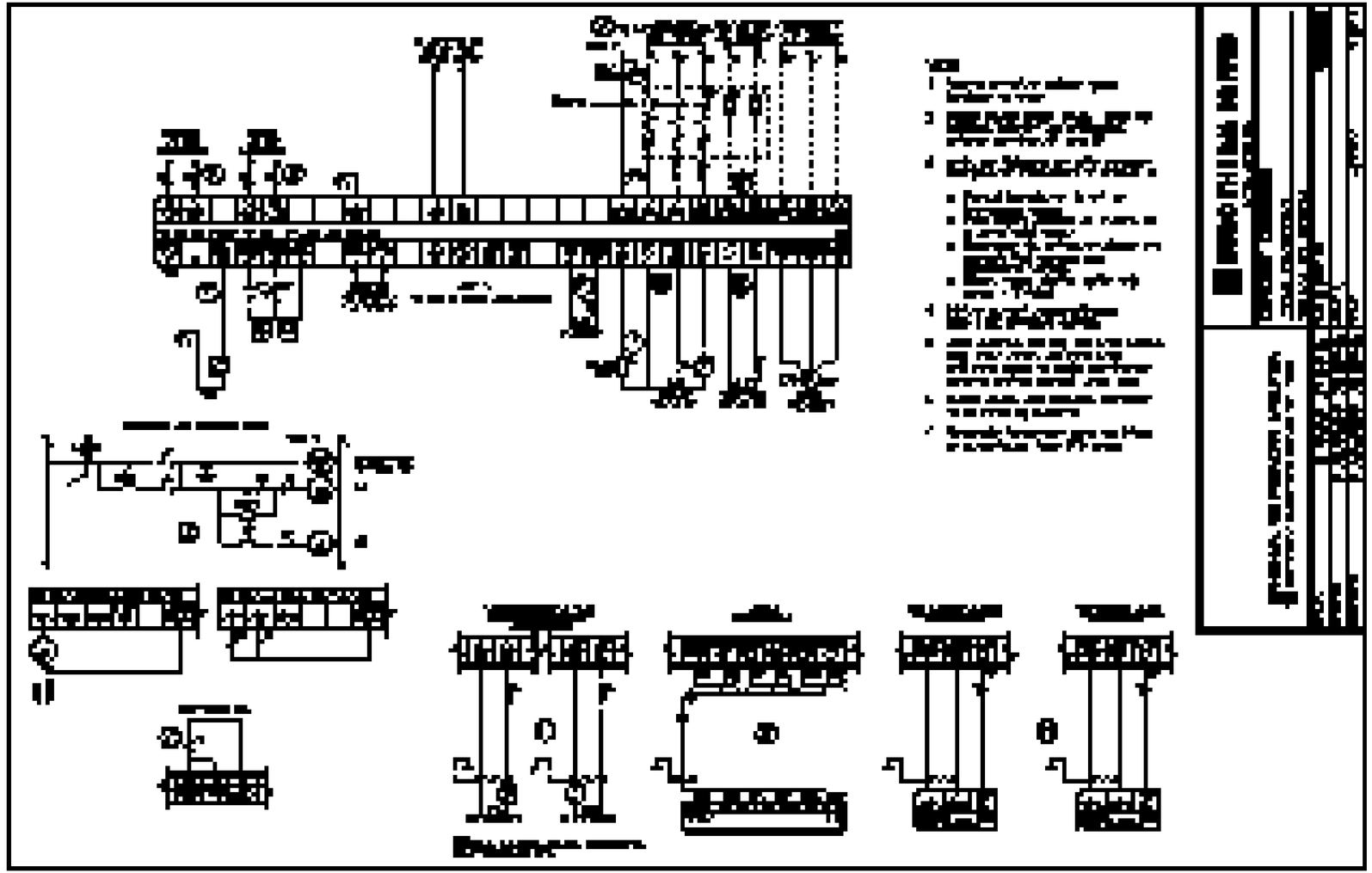


Figure 3.22 - Regenerative 500 - 900 Hp @ 500 VDC 250 - 450 Hp @ 240 VDC

Figure 3.23 - Wiring Schematic for 590 DRV *LINK* DC Drive



Chapter 4 *LINK* INTERFACE

The 590 DRV *LINK* drive communicates to other *LINK* drives and devices such as input and output modules over the *LINK* fiber optic network. This network operates over a high speed, real-time fiber optic bus optimized for process control. Each drive and *LINK* device is called a network node and is assigned a unique address. The fiber optic network operates as a distributed process control system and connects from each node in a closed loop. High speed messages are sent from 590 DRV *LINK* drive drives and *LINK* devices on the network to other nodes on the loop. *All* logic signals (such as the `DRIVE START` command) and value signals (such as `SPEED SETPOINT` and `SPEED FEEDBACK`) must be sent and received over the *LINK* network.

You can only configure the drive to send signals to and receive signals from other devices on the *LINK* network with the Eurotherm Drives software package ConfigEd. The Eurotherm Drives software package SAM (Setup and Monitor) is used only to monitor and change logic and value signals and drive parameters. Both software packages are compatible with personal computers (PCs) running the Microsoft Windows™ operating system.

NOTE. A thorough understanding of both Eurotherm Drives *LINK* software packages ConfigEd and SAM is essential to configuring, running and obtaining maximum utility of the 590 DRV *LINK* drive. Consult the ConfigEd manual RG353321 and the *LINK* Overview Manual HA350678A.

CHANGING DRIVE PARAMETERS WITH CONFIGED, SAM AND THE MMI

You can communicate with the drive and change its control parameters with the software tools SAM and ConfigEd, or directly with the drive MMI. The following sections describe how each software tool handles drive parameters.

NOTE. For clarity, all references to MMI parameters, menus or sub-menus appear in this manual in capitalized TIMES NEW ROMAN type. Any reference to a function, feature or parameter associated with or accessible through ConfigEd or SAM appears in this manual in capitalized `COURIER` type.

ConfigEd

In ConfigEd, the drive parameters are grouped into 14 software blocks, each dedicated to a specific aspect of drive control. Use ConfigEd to make signal connections to and from the 590 DRV *LINK* drive over the *LINK* network. You can also use ConfigEd to download drive parameter values, or to install configuration changes.

- As with any other *LINK* module, installing a configuration to a drive or module stops the drive from processing, receiving or sending messages over the network. Configuration changes to the drive or any other *LINK* module can only be downloaded off-line, or while the *LINK* network is in a non-processing state.

WARNING!

The ConfigEd `INSTALL` function prevents all drives and modules on the ring from processing any data during the download period. To avoid injury to personnel and mechanical damage, it is therefore recommended to install *only* after all drives on the network have been stopped.

- DRIVE INPUTS: Each *LINK* drive software block *input* (or input slot) has an associated slot number and has read/write capability. You can write signals from a *LINK* source node address to any input slot. You can also configure a remote *LINK* destination node address to a signal at the drive input slot.
- DRIVE OUTPUTS: Some drive parameters are read only and have no associated input slot number. These are considered to be *LINK* drive software block *outputs* (or output slots). The distinction between drive slot inputs and outputs is shown in Figure 4.1.

WARNING!

Configure only those *LINK* signals to drive slots which need to be changed for control of the drive. Inadvertently writing to other drive slots can cause unexpected results, injury and/or equipment damage. Avoid creating *LINK* connections to parameter slots which normally do not need to be altered during normal running operation.

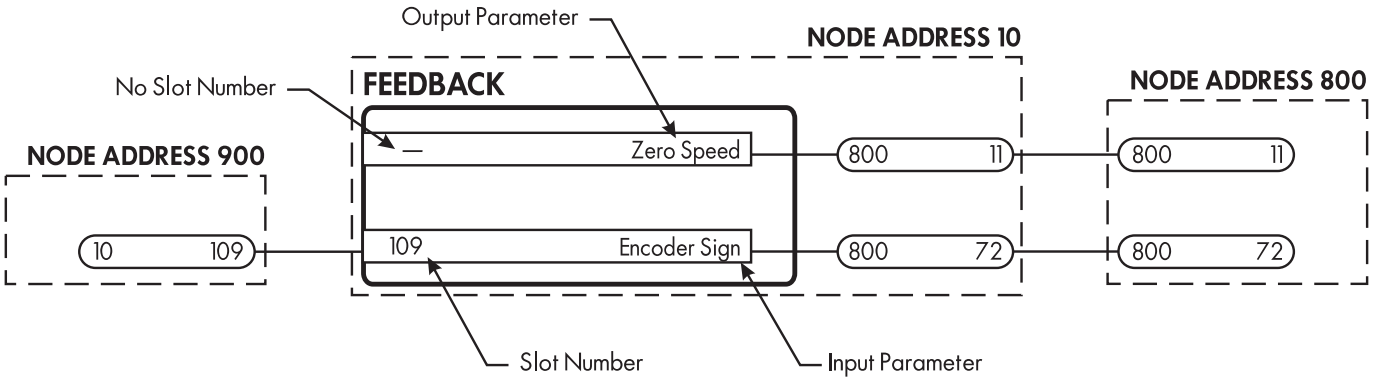


Figure 4.1 - Example of ConfigEd Software Block Inputs and Outputs

- Not all drive parameters available in ConfigEd have an associated input slot number and therefore cannot be written to over the *LINK* network.

The MMI

You can access most key drive parameters through the MMI so that you can tune the drive and make parameters changes without a personal computer.

- *All* drive parameters and input values can be set in ConfigEd and downloaded to the drive using the `INSTALL` command. Many parameters, however, are accessible through ConfigEd but do not appear in the MMI menus. Accordingly, not all parameters available in ConfigEd can be changed in the MMI.
- You can change drive parameter values with the MMI increase/decrease (as discussed in Appendix B). However, if a *LINK* signal is configured to that drive parameter's slot, the signal will overwrite that value whenever that *LINK* signal changes state. This applies to any *LINK* drive input slot, regardless of data type.

SAM

You can use SAM to monitor value signals, logic states and settings within the *LINK* system configuration. However, you cannot use SAM to make configuration changes.

- All *LINK* input and output parameters appearing in the graphical software blocks in ConfigEd are available in SAM.
- Appendix C presents a full discussion of each ConfigEd drive software block and lists the parameters and MMI equivalents. The appendix also includes a drawing showing the full software block functional block diagram. Appendix D lists the parameters alphabetically as they are grouped in the MMI. Appendix E gives the same listing, but groups the parameters by ConfigEd software block.

COMMUNICATING WITH THE 590 DRV *LINK* DRIVE

You can access data from the *LINK* network with SAM or ConfigEd using your personal computer serial port through an RS-232 connection. *LINK* input, output and processing modules have a serial port; the drives do not. This means that you must connect a valid *LINK* network between the drive and a *LINK* module to install a drive configuration with ConfigEd, or change or monitor drive parameters using SAM. Figure 4.2 shows a two-node, simple topology network for accessing the 590 DRV *LINK* drive with a computer.

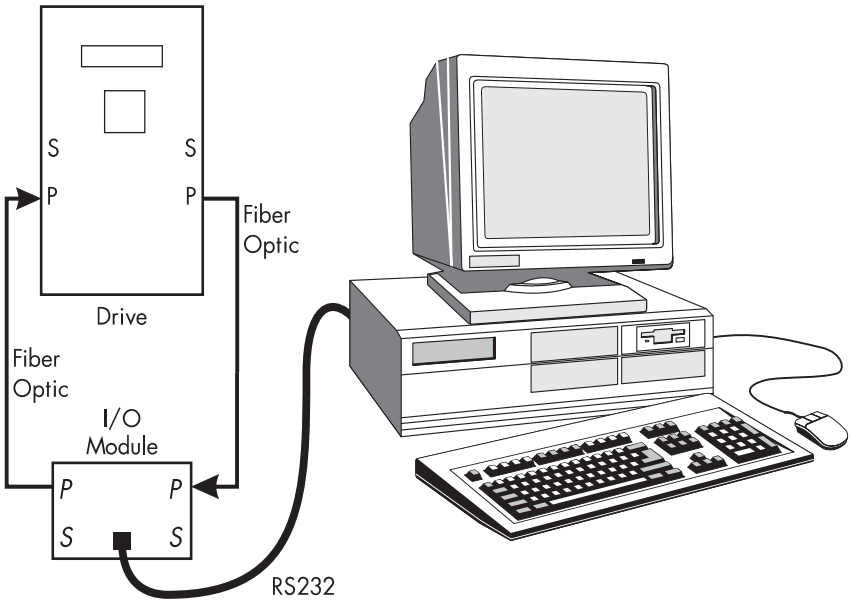


Figure 4.2 - Accessing a *LINK* Drive with a PC Through a Simple, Two Node Network

LINK DATA TYPE AND SIGNAL SCALING

LINK signals are represented within the *LINK* software environment as ordinal, logic or value data. The ranges of these signals are described below.

Data Type	Description	Range
Ordinal	Discrete, positive integer data.	0 to 65,535
Logic	Discrete, ordinal data limited to two states: TRUE (1) or FALSE (0).	0 or 1
Value	Continuous, "analog" data. Analog data is digitally represented in the *LINK* software as 16 bit floating point data, giving an accuracy of ±0.01%.	-100.00% to +100.00%

NOTE. All 590 DRV *LINK* drive input slots can accept all three types of data. However, its input slot number determines how the data is handled. Slot numbers of certain ranges are assigned to interpret the data as either ordinal, logic or value data. Each input slot expects to receive the correct type of data and cannot filter out or reject the wrong type. Be certain to write the correct, expected type of data to each input slot. Consult Appendix C, or the tables in Appendices D and E for the type of data each drive input slot expects.

Caution

Writing incorrect data types to drive input slot can cause unexpected control resulting in machine or equipment damage or injury to personnel.

Value Data Saturation

Any value data calculation performed within *LINK* must remain within the normalized range of ±100.00%. If a *LINK* calculation external to the drive produces a signal outside this range, the product of the calculation clamps to ±100.00%.

For example, if a trim signal is added to the drive's external current demand in *LINK* with an ADDER block, the inputs to the ADDER block must be scaled first so that the output always lies within the range of ±100.00%. In this instance,

a control signal of +80.00% added to a 30% trim signal produces a *LINK* sum of +100.00%, instead of +110.00% due to the clamping action of the normalization.

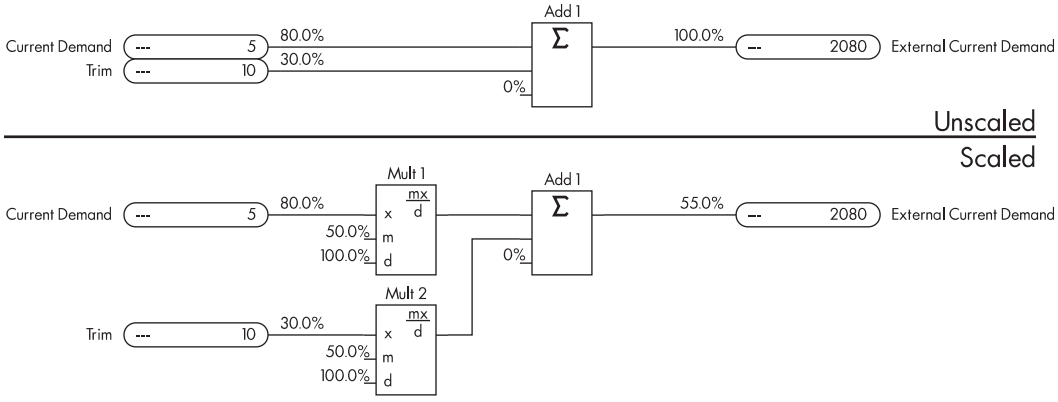


Figure 4.3 - Example of Value Data Saturation

To avoid saturation, scale the signals before the calculation as shown in the lower portion of Figure 4.3. The signal now will remain within the ±100.00% range. In this example, the actual current demand corresponding to a 55.00% EXTERNAL CURRENT DEMAND reference is 110.00% of the calibrated drive current, since the drive can produce twice the rated load current.

Drive Signal Scaling and Over-Range

The 590 DRV *LINK* drive's speed and current setpoint and feedback value signals are normalized for the *LINK* data environment. SAM displays the signal's actual, real world value. This scaling is tabulated below.

***LINK* Drive Input Signal**	***LINK* Input Value**	**Actual or SAM Value**
ALL Speed Setpoints	±100.00%	±120.00% setpoint
SPEED FEEDBACK	±100.00%	±120.00% speed feedback
EXTERNAL CURRENT DEMAND	±100.00%	±200.00% full load current
SPEED LOOP OUTPUT (CURRENT DEMAND in MMI)	±100.00%	±200.00% full load current
CURRENT FEEDBACK	±100.00%	±200.00% full load current

Speed Over-Range

All drive speed input and feedback parameters are scaled for 20% overspeed to maintain control at full speed. As a result all input signals connected the parameters must be scaled to 83.33% according to the formula:

$$\frac{\text{100.00\% (}\textit{LINK}\text{ Speed Reference)}}{\text{120.00\% (Drive Full Speed Reference)}} = 0.8333 \text{ or } 83.33\%$$

This applies to *all* drive speed reference signals (INPUT 0, INPUT 1, RAMP INPUT, SPEED DEMAND FAST INPUT), the drive's ZERO SPEED OFFSET, and to SPEED FEEDBACK, SETPOINT SUM, RAMP OUTPUT, and SPEED SETPOINT.

Figure 4.4 shows the effect of over-range scaling. The block diagram in the upper portion of the figure shows a speed reference signal configured to slot 2085 (SPEED DEMAND FAST INPUT) and a trim signal written to slot 2066 (INPUT 0). If the value at INPUT 0 is 100.00%, the drive cannot respond to a positive trim signal because TOTAL SETPOINT is already driven to its maximum. The trim signal is therefore ignored. Scaling the speed and trim signals by 83.33% with MULTIPLIER blocks from a remote source (address 900 as shown in the lower portion of the figure) corrects the problem. The 10% trim added to the speed reference of 100% now equals 110%, as desired.

Some *LINK* ConfigEd software blocks such as MASTER RAMP take this over-range scaling into account by multiplying their outputs by 83.33%. These outputs can then be connected directly to a drive speed input without further scaling.

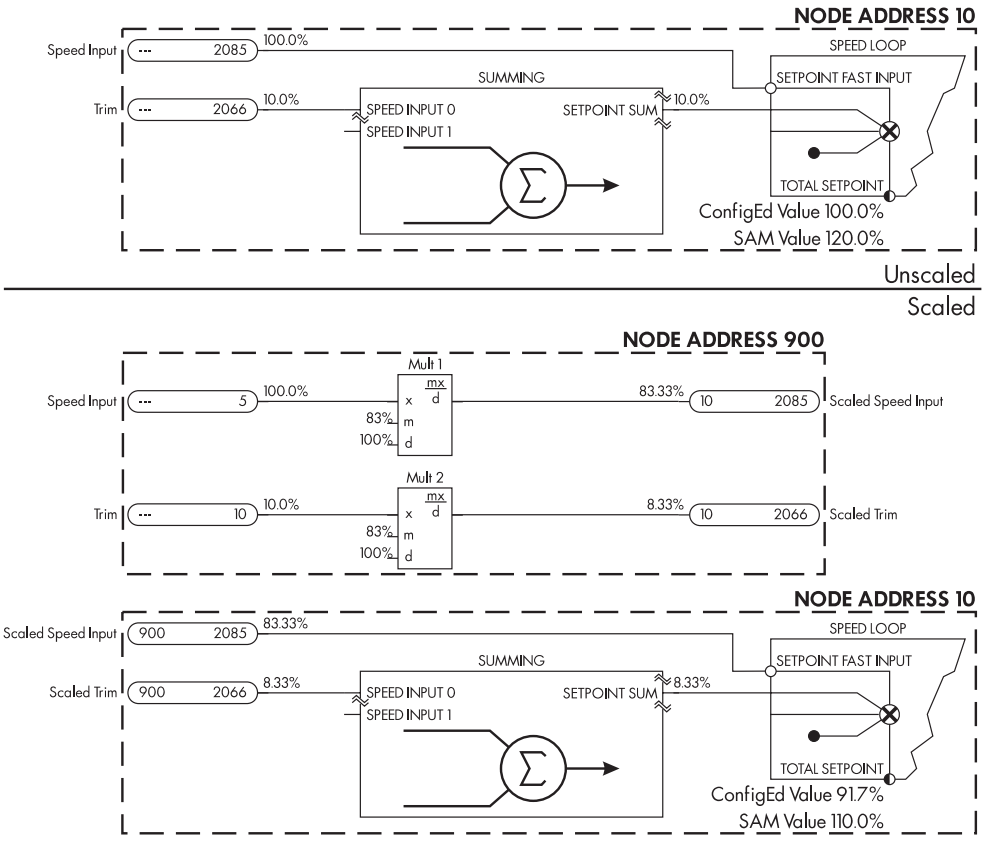


Figure 4.4 - SPEED LOOP Signal Scaling

NOTE. The drive's SPEED LOOP software block has an internal bipolar clamp on the speed demand of ± 105.00% maximum, which corresponds to a maximum *LINK* reference of ±87.50%. This allows ±5.00% trim range at full speed.

Current Loop Scaling

The 590 DRV *LINK* drive current loop input and feedback signals are scaled to accommodate the 200% overload capability of the drive. Current loop setpoint, feedback and all current limiting parameters including INVERSE TIME are scaled as:

$$\frac{\text{100.00\% (}\textit{LINK}\text{ Current Input)}}{\text{200.00\% (Full Load Current)}} = \text{0.5000 or 50.00\%}$$

DRIVE OUTPUT UPDATE RATES

When configuring an output slot for a drive output in ConfigEd, the software first prompts you for the destination address and slot number. You must then connect the drive output to this *LINK* output slot (refer to the section *Working With Drives* in Chapter 4 of the ConfigEd Manual, RG353321). The software then prompts you to select the CONNECTION TYPE, or the process speed of the *LINK* signal and offers four choices: FAST, MEDIUM, SLOW and SPECIAL. The transmission speeds, or update rates, of these settings are set in UPDATE RATES, located in the PARAMETERS drive software block. The settings are in units of "ticks", which are a function of the processing speed of the internal drive software.

NOTE. The default settings for UPDATE RATES are sufficient for most applications and normally should *not* be changed.

The processing capability of the receiving module on the *LINK* network is the limiting factor in determining which speed to select. If too many signal are sent at the FAST update rate to one module, the module will be unable to keep up with the processing demand and will most likely cease processing due to data overload, or crash. To avoid this problem, send only priority signals at the FAST rate and leave less critical signal update rates set to either SLOW, or MEDIUM. Refer to the list below as a guide to setting signal update rates:

Drive Signal	Recommended CONNECTION TYPE Setting
SPEED FEEDBACK	Medium
ZERO SPEED	Fast
COMPOSITE PROGRAM STOP	Fast
HEALTH FLAG	Fast
UNLATCHED HEALTH FLAG	Fast
ARMATURE CURRENT	Medium

SPECIAL is an extremely high speed update rate which clocks at the speed of the drive's current loop process rate. It is typically used when two independently driven motors are nipped together in a load share, master/slave arrangement where the master runs in speed control and the slave drive runs in torque control and follows the master's load, or ARMATURE CURRENT signal.

Caution

SPECIAL is reserved strictly for drive-to-drive signal connections. A receiving module *will* crash if a drive output signal is connected at this update rate.

DRIVE MEMORY AND SAVING PARAMETER VALUES

The 590 DRV *LINK* drive has three types of memory for handling data.

1. RAM: The drive reserves this memory area for normal running operation. On power up, the drive downloads EEPROM parameter values to this memory. Any changes to the drive parameters through the MMI or SAM are stored here.
2. EEPROM: Holds ConfigEd drive configuration settings. All SAM or MMI parameter changes are stored here whenever a MMI PARAMETER SAVE or a SAM EEPROM PARAMETER SAVE is performed.
3. EPROM: Contains the code for handling the current loop, speed loop and internal code for running the drive, and the default parameter values used to reset the drive. The user cannot write to EPROM memory.

All of the drive setup parameters accessible through the MMI can be changed with ConfigEd through the INSTALL command, and can be monitored and changed with SAM. Changes made with SAM or the MMI are stored in RAM *only*. When control power is disconnected, those changes are lost unless they are first saved to EEPROM using the MMI's PARAMETER SAVE function, or EEPROM PARAMETER SAVE in SAM.

Each time the drive is powered up, the drive downloads the *last* parameter settings loaded into EEPROM to RAM. These values could be parameter settings saved using PARAMETER SAVE, or settings downloaded to EEPROM from ConfigEd using the INSTALL command. To ensure that your ConfigEd configuration and drive have the same parameter values, you must:

- Perform a parameter save using SAM or the MMI, and
- Perform an UPDATE using ConfigEd.

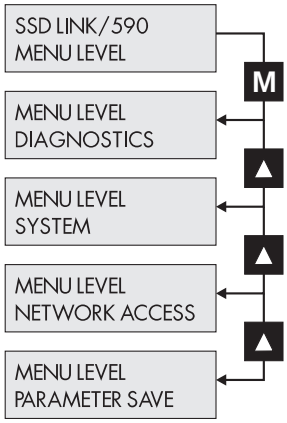


Figure 4.5 - MMI Path to PARAMETER SAVE

You can save parameter settings in the drive using the MMI or SAM, and back up the settings in your configuration files using the SAM and ConfigEd software packages. The software backup features are:

- Saving parameters with the MMI (PARAMETER SAVE), or through SAM (EEPROM PARAMETER SAVE): Uploads MMI and SAM drive parameter changes from RAM to the drive's EEPROM. These changes are reloaded into RAM upon power up.
- Saving parameters with SAM (BACKUP command):
  Creates a backup file containing all setup parameters stored EEPROM only. Any parameter changes not saved to EEPROM using the MMI PARAMETER SAVE function are not saved to the backup file. The file can be downloaded to the drive using the SAM RESTORE command.
- Saving parameters with ConfigEd (UPDATE command):
  Updates the *LINK* drive configuration file with parameters saved in EEPROM. Any parameter changes not saved to EEPROM are not updated in the drive's configuration files. You can reinstall the file to the drive using ConfigEd's INSTALL command.

Each method saves *only* the parameter settings stored in EEPROM.

Once final changes or tuning adjustments have been made using the MMI or SAM, it is strongly recommended to save those parameters using the SAVE PARAMETERS function within the MMI menu and then updating the drive configuration file using ConfigEd's UPDATE command.

Caution

A 590 DRV *LINK* drive downloads EEPROM parameter values to RAM any time a ConfigEd INSTALL command is performed on *any* node on the network.

Saving Parameters with the MMI or through SAM

To perform a parameter save with the MMI, enter the PARAMETER SAVE menu and use the ▲ key to save parameters. Figure 4.5 shows the MMI path to SAVE PARAMETERS. In SAM, select the SAVE button under the SET EEPROM PARAMETER SAVE in the PARAMETERS software block. This SAM method saves the parameters, then automatically turns off; it does not need to be cleared. The DO NOT USE button is restricted for Eurotherm Drives service personnel use *only*.

Refer to discussion in Appendix C on PARAMETERS for an example on configuring multiple drives for EEPROM PARAMETER SAVE from a single source through SAM.

DOCUMENTATION

It is highly recommended that you document the drive's setup parameters once the drive or drive system has been fully commissioned. This can be done using any of the following software features:

1. The ConfigEd PROJECT PRINT Command
   This command is located under the PROJECT pull down menu of the ConfigEd tool bar. ConfigEd PROJECT PRINT has the following features:
   - PROJECT PRINT: Prints the graphical depiction of the last saved version all selected *LINK* configuration files.
   - SAVE SOURCES: Updates the input source addresses of each slot within the printed module's configuration. If you have altered any *LINK* output slots destination addresses with ConfigEd, the new input slots automatically update to display the source slot addresses.
   - CLEAR UNUSED: Erases any source address numbers from *LINK* input slots if the source *LINK* output slot sending the data has been deleted.

- The SAVE SOURCES and CLEAR UNUSED features also apply to all *LINK* drive input slots of all *LINK* configurations printed. They help verify the validity of network connections and aid in troubleshooting system problems. A print out of the drive configuration also gives the drive's parameter values stored in EEPROM, provided an UPDATE is performed first.

2. The ConfigEd PROJECT DOCUMENT Command
   This function creates a text file on your personal computer hard disk which documents the connections and parameter values of all configuration files in a *LINK* project. It can be printed out and kept as a permanent record for troubleshooting.

Caution

The PROJECT PRINT and DOCUMENT commands operate only the *last* saved configuration file and can not reflect the configuration downloaded in the 590 DRV *LINK* drive or module. A configuration file saved on your hard disk can *not* be the actual configuration installed in a *LINK* drive or module. Look for the asterisk (*) in the PROJECT PRINT pop-up window indicating that a configuration has been changed and saved, but not installed.

Caution

A ConfigEd configuration file can not include the latest MMI or SAM changes to drive parameters. Be certain to SAVE PARAMETERS with the MMI or SAM, then UPDATE the configurations *before* executing PROJECT PRINT or DOCUMENT.

3. The ConfigEd FILE PRINT Command
   This function is located in the ConfigEd file menu. It prints out the configuration window open and active on your personal computer monitor *without* updating input slot information. FILE PRINT is located under the FILE pull down menu and provides a quick "screen print" facility. The print out reflects *only* what is displayed on the monitor and does not show any configuration or parameter changes unless a ConfigEd UPDATE and SAVE is executed first.

4. The SAM DOCUMENT MODULE Command
   This SAM feature creates a text file in the ConfigEd SCRATCHPAD listing the values of all SAM access points at the moment the module is documented. It effectively takes a snapshot of all SAM accessible drive slot inputs, parameter settings and software block outputs values.

5. The *LINK* Manager
   The *LINK* Manager is a database system used to install SAM and ConfigEd projects, and back up and maintain *LINK* system configurations. It is a separate software package requiring a modem and a PC running Microsoft Windows 3.1 software. It is recommended that you maintain a project database with *LINK* Manager and update all final changes to *LINK* system projects.

Consult the appropriate manual for further information on each of these software features.

Chapter 5 START UP AND ADJUSTMENT

The 590 DRV *LINK* is shipped with a default configuration designed to control a shunt or permanent magnet field DC motor. You can adjust drive parameters to tune the drive to achieve optimum performance or to perform specific control applications.

You can tune the drive using the drive's MMI, or with a Microsoft Windows™ based PC and the *LINK* software package SAM. This chapter takes you, step by step, through the start up procedure using the MMI. Refer to the ConfigEd manual RG353321 when starting up the drive using a PC.

Follow these procedures only *after* installing and wiring your 590 *LINK* DRV (see Chapter 3) and *after* reading Chapter 4. Review Appendix B to become familiar with the MMI before proceeding. Remember to use the M key (menu select) to enter a menu level, ▲ and ▼ to change parameter values or scroll through a menu level and E (the escape key) to back out of a menu level.

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

A flow chart on the left of each page marks each step of the start up procedure.

RECOMMENDED TOOLS

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

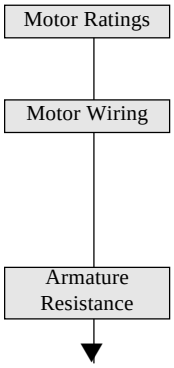
- IBM compatible personal computer with Microsoft Windows™ 3.1 or greater to run ConfigEd;
- Oscilloscope to monitor armature current waveform and speed feedback;
- Voltmeter to monitor motor armature and field voltage and check *LINK* system I/O levels;
- Ohmmeter to check signal continuity;
- Clamp-on, Hall effect ammeter to measure armature and field currents;
- Digital hand tachometer to check line or motor speed; and
- Fiber optic light meter kit L5231 to measure *LINK* and Microtach fiber optic signal strength.

WARNING!

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

CHECK MOTOR

After wiring and installing your 590 DRV *LINK* 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 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 Ω (about 3 Ω for motors rated under 10 HP).

Field Resistance

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

Insulation Checks

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.

WARNING!

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

Voltage & Current Calibration

4. Make sure *all* calibration settings on the 590 *LINK* DRV calibration board are set to the correct values for your motor dataplate information (see the calibration board information in Chapter 3). The standard 590 *LINK* DRV comes equipped with a switch selectable calibration board; special applications can require the resistor-adjustable board.

CHECK SUPPLY

WARNING!

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

Measure AC Supply

1. Measure each leg of the three-phase power supply to ensure they are within ±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 1.10% of the AC supply voltage. A 240 volt motor requires a 230 volt supply and a 500 volt motor needs a 480 volt supply. Consult the factory for other ratings.

Check Supply Against Motor Armature

Check Frequency

2. If a frequency meter is available, measure the incoming line frequency. The frequency should not vary more than ±10% of the acceptable range of 40 to 70 Hz.

Check Control Transformer

3. Verify the control transformer inside the 590 *LINK* DRV is tapped for the supply voltage.

Apply Power & Check Field Voltage

4. Connect power but do *not* start the drive. The drive should now receive control power and the MMI display should read RUNNING NETWORK DIAGNOSTICS or SSD *LINK*/590:: 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.

Check LEDs

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 A7 and A8) should be TRUE.

COMMISSION THE *LINK* NETWORK

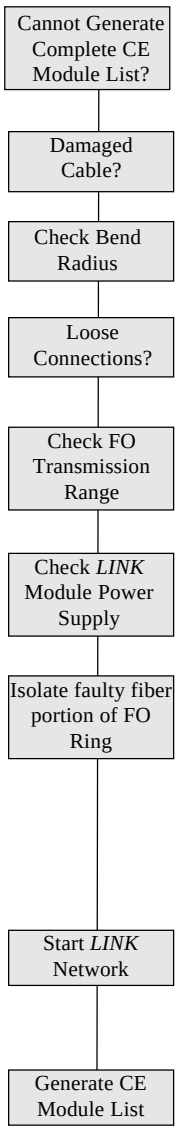
The *LINK* network must be healthy and running before continuing the start up. When control power is applied for the first time, the MMI displays the message RUNNING NETWORK DIAGNOSTICS and the HEALTH LED flashes indicating that the network is unhealthy (the fiber optic ring is broken) or not running, or both.

To access any node on the *LINK* network with SAM or ConfigEd you must be able to generate a complete `CE MODULE LIST`, which displays the status of all nodes on the fiber optic network, through the RS-232 port connection between your computer and a *LINK* module.

NOTE. Because the 590 DRV *LINK* drive has no RS-232 port available, connect your PC's serial port to the RS-232 connection on a *LINK* I/O, processor or serial module.

You can only generate a full `CE MODULE LIST` if *all* nodes on the network are powered correctly and the fiber optic ring is communicating from node to node. Use either the `FULL UPDATE` or `PARTIAL UPDATE` commands in the `WINDOW` pull down menu in SAM or ConfigEd to generate the list.

If the CE MODULE LIST is incomplete, or you are unable to generate a list, check the following:



1. Verify that each node on the network properly transmits and receives a valid fiber optic light signal. If the network consists of a simple topology, only the primary red channel on each drive and *LINK* module should transmit light once control power is applied. Both the primary and secondary transmit channels should transmit light for redundant or tapped configured nodes.
2. Check for damaged fiber optic cables, sharp kinks or tight cable bends which have exceeded the minimum allowable bend radius.
3. Check for loose fiber optic T&B terminal connections.
4. Check the drive's fiber optic transmission power level. An attenuated signal can be too low to drive the receiver circuit on the next node on the fiber optic ring. A signal that's too strong can overdrive the next node's receiver circuit. Use the light meter kit L5231 to measure the dBm strength of the light signal and consult the document HW351772, included with the kit, to determine whether the strength of the signal falls within the accepted tolerance range. Adjust the transmission power level of each channel as needed by changing the settings of the transmission switches on the drive's control board. These switches are adjacent to the fiber ports as shown in Figure 3.10 and Figure 6.19. The transmission distances are listed in Appendix A.
5. Check the supply to each *LINK* drive and each *LINK* network module. The LEDs on all *LINK* modules on the ring should flash if they are powered correctly. Check the supply of each drive on the network. The display on each 590 DRV *LINK* drive should read RUNNING NETWORK:: DIAGNOSTICS.
6. If you are satisfied that all nodes on the network transmit and receive a valid fiber optic signal, and you are still unable to generate a complete CE MODULE LIST, break the network ring down into smaller loops. Try generating a CE MODULE LIST on this smaller network to isolate the faulty portion of the overall fiber optic loop.

NOTE. Consult the ConfigEd or SAM user manuals if you are still unable to generate a complete CE MODULE LIST after completing the above procedures.
Once you have determined that the fiber optic ring is healthy, generate a complete CE MODULE LIST through the RS-232 communications port. The status of each module in the SAM or ConfigEd MODULE LIST should read HALTED or PEER HALTED. Use the RESTART command in either SAM or ConfigEd to start the halted module. After the halted module restarts, the other nodes on the network should switch from the PEER HALTED status to the OK status. The LED on each *LINK* module and each 590 DRV *LINK* drive Health LED should now glow steadily. The MMI should briefly display the message SSD *LINK*/590:: ISSUE 3.X, then switch to SSD *LINK*/590:: MENU LEVEL and allow pushbutton access to the main menu level.

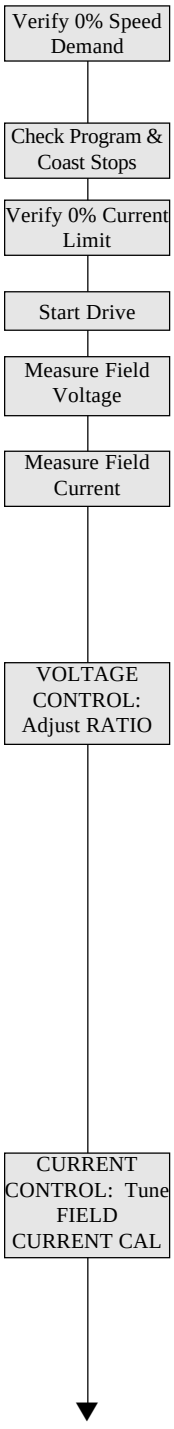
NOTE. After commissioning, the *LINK* network should remain healthy and automatically restart each time power is recycled. Each 590 DRV *LINK* drive should then allow access to the MMI. Consult Eurotherm Customer Service if the *LINK* network requires a restart after cycling power.

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.

NOTE. The fiber optic network must be healthy and *all* nodes on the *LINK* ring must have an OK status to commission or run the 590 DRV *LINK* drive.



1. Give a 0% speed demand to the drive. Check the drive speed reference inputs in the MMI under DIAGNOSTICS:: SETPOINT SUM OUTPUT and SPEED SETPOINT. If starting up directly from SAM, ensure that `TOTAL SETPOINT` under `SPEED LOOP` is zero. Also ensure that the SETPOINT 4 speed reference under SETUP PARAMETERS:: SPEED LOOP:: SETPOINTS is at 0%. This speed input is set only through the MMI and with the ConfigEd `INSTALL` command.
2. Ensure the PROGRAM STOP and COAST STOP LEDs are on (+24 VDC at terminals A7 and A8).
3. Set SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to 0.00%. Or, use SAM to set the drive `MAIN CURRENT LIMIT` to 0%.
4. Start the drive either by using a configured *LINK* system start input or by using SAM to set the *LINK* `DRIVE START` input TRUE. 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. The motor field parameters are found in SAM under the `FIELD` *LINK* software block.

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.

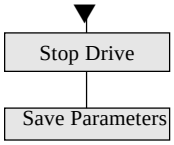
NOTE. Because a DC motor's field impedance increases with temperature, the field current of a motor in voltage control can read lower than the nameplate rating when the field is initially powered. The current should rise to its nominal value as the motor warms up.

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. The field *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, use the MMI of SAM to save parameters. Refer to *Saving Parameters with the MMI or Through SAM* in Chapter 4 for instruction.

ADJUST CURRENT LOOP (AUTOTUNE)

Caution

This is an essential step in setting up your 590 DRV *LINK* drive and *cannot* be overlooked.

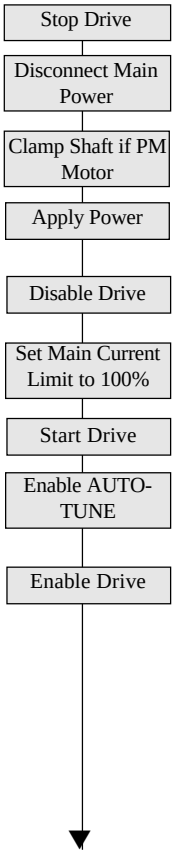
The AUTOTUNE function tunes the current loop automatically and sets the proportional gain, integral gain, and the discontinuous/continuous breakpoint for optimum drive response for a given motor. The drive cannot achieve peak performance without properly setting these parameters. Perform a complete AUTOTUNE 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.

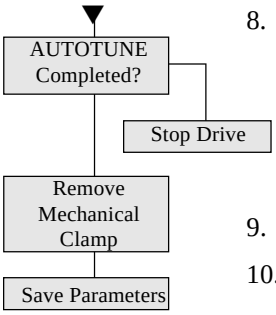
WARNING!

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. Ensure that the drive is stopped, 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 A7 and A8).
4. Disable the drive by removing +24 VDC from terminal A5 (ENABLE) or by disabling the armature current with `QUENCH` under `CURRENT LOOP` in SAM. 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, or by enabling `AUTOTUNE` with SAM in the `CURRENT LOOP` software block. The drive should start but should not generate motor current.
7. Enable the armature current. At this point, the 590 DRV *LINK* 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. Use the MMI or SAM to save parameters when finished, then BACKUP or UPDATE the drive's software configuration file with SAM or ConfigEd.

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 6.21 in Chapter 6 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.

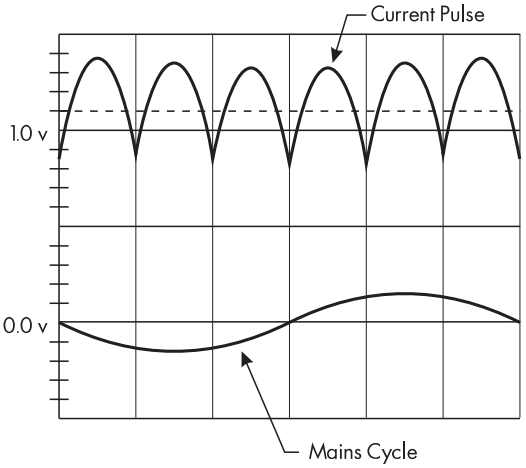
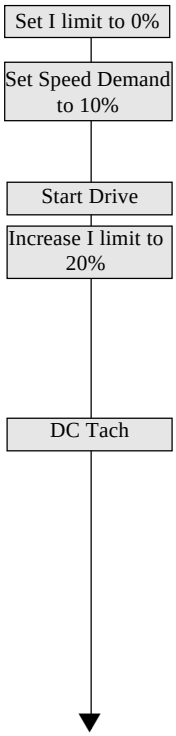


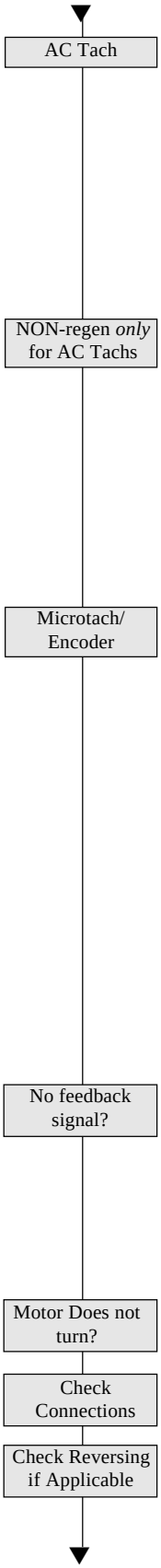
Figure 5.1 - Armature Current Waveform

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. Set your *LINK* system or SAM speed reference to +10%. Make certain that any trim speeds or additional setpoints are set to 0%. Verify that the MMI DIAGNOSTICS:: SPEED DEMAND is +10%, or monitor TOTAL SETPOINT under SPEED LOOP in SAM. You can monitor all the drive's speed references in the MMI in SETUP PARAMETERS:: SPEED LOOP:: SETPOINTS.
3. Start the drive, then slowly increase SETUP PARAMETERS:: CURRENT LOOP:: CURRENT LIMIT to approximately 20%.
4. The drive should regulate the motor 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.
- For AC tachometer generator feedback, the 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 DC controller, even if the speed reference is always positive. To avoid this problem, use the 591 *LINK* DRV (non-regenerative) drive with an AC tachometer generator mounted motor. Or, use the regenerative 590 DRV *LINK* drive and disable the drive's reverse bridge thyristors under SETUP PARAMETERS:: CURRENT LOOP:: REGEN MODE. This corresponds to SET CURRENT LOOP 2-QUAD MODE under the CURRENT LOOP software block in SAM.

- Did the motor rotate in the wrong direction but at the correct speed? Reverse the field connections.

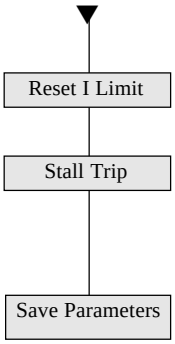
c. For motors fitted with 5701/5901 Microtachs or wire-ended electrical encoders:

- 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. Use SAM or ConfigEd to BACKUP or UPDATE the drive's software file *LINK* configuration.

5. If the motor continues to run away after checking the feedback sign and field polarity, check whether the drive is actually receiving its speed feedback signal. Monitor DIAGNOSTICS:: TACH VOLTS when using an analog tachometer generator, or monitor ANALOG TACH FEEDBACK in the FEEDBACK software block with SAM. For Microtach or wire-ended encoders, check DIAGNOSTICS:: ENCODER RPM, or DIGITAL TACH in the SAM FEEDBACK block. 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 DIAGNOSTICS:: CURRENT FEEDBACK in the MMI. If CURRENT FEEDBACK still reads 0.00%, turn the power off and check the armature connections. If the problem persists, refer to Chapter 6 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.

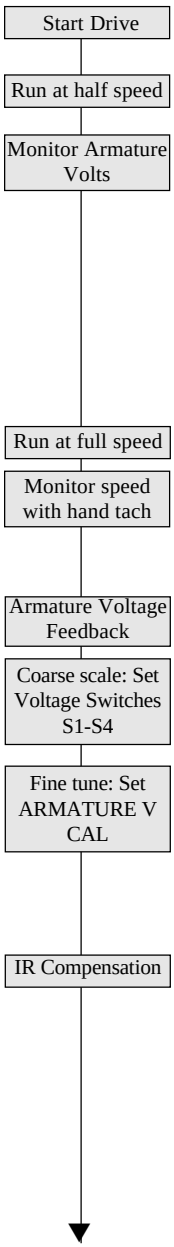


8. After you have correctly set the direction of rotation, reset CURRENT LIMIT to the desired value. If in doubt, set CURRENT LIMIT to 110% to correspond to 110 % full load current. If CURRENT LIMIT is set to a maximum 200%, and the motor runs into an overload condition, the current limit automatically 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 use the MMI or SAM to save parameters when finished. BACKUP or UPDATE the drive's software configuration file with SAM or ConfigEd.

SPEED FEEDBACK CALIBRATION



Start the drive and gradually increase the speed demand signal to 50 percent and monitor DIAGNOSTICS:: TERMINAL VOLTS, which is displayed as a percentage. (The SAM diagnostic is ARMATURE VOLTS under the SPEED LOOP software block.) Measure the actual armature voltage on the drive output with a DC voltmeter. The meter and TERMINAL VOLTS should read within 10% of the actual value. For example, when measuring armature volts at terminals A+ and A- with a digital volt meter, a 500 volt armature should read 250 volts at 50% speed demand, and the MMI should display 50% under TERMINAL VOLTS. If the reading is not within 10% of the expected value, check the drive's voltage calibration before continuing (see Chapter 3).

NOTE. When using field weakened motors, the TERMINAL VOLTS values will vary non-linearly over the full speed range of the motor. Below base speed, the motor armature voltage varies proportionately with motor speed. Above base speed, the armature voltage should remain constant as the motor speed increases.

Increase the speed demand to maximum and check the shaft speed accuracy with a hand tachometer. Measure the armature voltage. If fine adjustment is needed, adjust the drive's calibration as appropriate 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 selection 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. The SAM equivalent is SET ARMATURE CAL in the FEEDBACK software block. Changes outside this range require re-calibration of the motor voltage switch settings on the switchable calibration card, or refitting resistors on the resistor calibration card as described in Chapter 3.

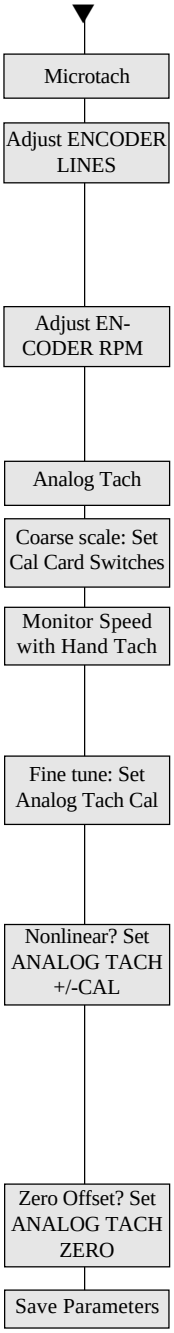
   IR COMPENSATION SETUP
   Properly setting the IR COMPENSATION parameter, or motor loss compensation, improves the speed accuracy when running in armature voltage feedback.

   a. Run the motor without a load. Monitor the actual speed with a hand tachometer.

   b. With the same speed setpoint, run the motor at full load and monitor the actual speed again with a hand tachometer.

   c. Adjust IR COMPENSATION until the full-load speed is the same as the no-load speed.

   NOTE. Too much IR COMPENSATION causes instability.



2. 5701/5901 MICROTACH OR WIRE-ENDED ELECTRICAL ENCODERS

   First, ensure that the CALIBRATION:: ENCODER LINES parameter equals the pulses per revolution rating of the encoder (1000 for Microtachs).

   Next, 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. You can read the feedback encoder rpm under DIAGNOSTICS:: ENCODER RPM in the MMI or in SAM under the FEEDBACK software block. Speed match the motor through the ratio calculation:

   $$\textbf{New ENCODER rpm Setting} = \frac{\textbf{Present ENCODER rpm Setting x Desired rpm}}{\textbf{Measured rpm}}$$

3. AC/DC ANALOG TACHOMETER GENERATOR FEEDBACK

   Settings on the analog tachometer generator feedback option card give a coarse scaling of the analog tachometer generator feedback voltage. Adjust drive software parameters to fine tune the feedback. 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:

   $$\textbf{New ANALOG TACH CAL Setting} = \frac{\textbf{Present ANALOG TACH CAL Setting x Desired rpm}}{\textbf{Measured rpm}}$$

   The gain range varies from 1.1000 to 0.9800, or -10% to +2% trim. The SAM equivalent is located under the FEEDBACK software block. Changes outside this range require a re-calibration of the feedback calibration card as described in Chapter 3.

   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. The SAM equivalents are located under the FEEDBACK software block.

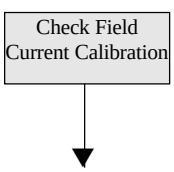
   NOTE. It is usually unnecessary to change the ANALOG TACH -CAL and the ANALOG TACH +CAL parameters from their default value of 1.0000, except in cases of extreme non-linearity. For a tachometer whose observed accuracy is within the tachometer's rated accuracy, adjustment is not recommended and will complicate speed calibration.
   Some tachometer generators generate a nonzero voltage at zero speed. Use the MMI parameter ANALOG TACH ZERO to tune out the offset.

4. Use the MMI or SAM to save parameters when finished, then BACKUP or UPDATE the drive's software configuration file with SAM or ConfigEd.

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 motors 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.

Enable Field & Check mode is CURRENT CONTROL

Enable FIELD WEAKENING

Set MIN FIELD CURRENT

Set MAX VOLTS to 100%

Run @ Base Speed

Increase above base speed & speed track, if necessary

Check Reverse Speed

Save Parameters

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. All field control parameters are located in the `FIELD` block in SAM.
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:

   (minimum field current ÷ maximum field current) × 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 the parameters with the MMI or ConfigEd. `UPDATE` the drive's software configuration file with ConfigEd.

ADJUST SPEED LOOP

Connect Scope to pin TP9

Tune SPEED LOOP *after* AUTOTUNE

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 6.19 in Chapter 6).

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.

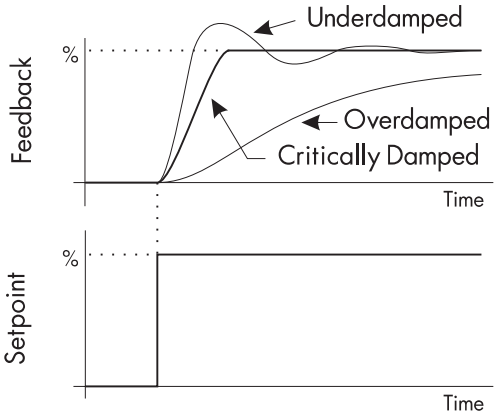
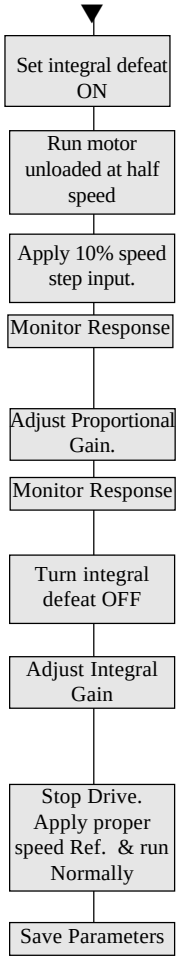


Figure 5.2 - Response to Step Input



1. While tuning the proportional gain, set SETUP PARAMETERS:: SPEED LOOP:: INT. DEFEAT to ON, or use SAM to disable the speed loop integral gain.
2. Run the motor at a typical operating speed using SAM, or a *LINK* analog reference. This speed reference should be constant (any varying trim signal should be switched out) and should not exceed 50% .
3. Toggle +1.0 VDC, or +10% speed, into an analog *LINK* input module, or switch in a +10% change in speed demand using SAM to provide a step change in speed for verifying the speed loop performance. Use the *non-ramped* speed inputs (either drive `INPUT 0` or `INPUT 1`) for the step change input.

   Check the speed loop performance with an oscilloscope as the total setpoint toggles between its speed demand and speed demand +10%. Monitor the speed feedback with an oscilloscope at the proper test point pin on the control board. Ideally, the speed response on the oscilloscope should be critically damped, or rapid changes with minimum overshoot (see Figure 5.2) with step changes to the speed demand. Increase SETUP PARAMETERS:: SPEED LOOP:: PROP. GAIN until the response is critically damped.
4. Once stable proportional control is attained, re-enable the speed loop integral control by setting SETUP PARAMETERS:: SPEED LOOP:: INT. DEFEAT to OFF in the MMI, or through SAM.
5. Check the speed loop performance again by making step changes to the drive speed demand. 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. This value can be too small for large inertia loads and cause the system to be unstable from the start.
6. Stop the drive and remove the step signal from the auxiliary *LINK* speed input, if used, and run normally.
7. Use the MMI or SAM to save parameters when finished, then BACKUP or UPDATE the drive's software configuration file with SAM or ConfigEd.

OTHER PARAMETERS

Other parameters, for example ramp rates, can be important for process control. Different ramp rates are available for various conditions. The table below shows the drive ramp functions, their MMI location and their associated *LINK* input slots:

Condition	**MMI Parameter Name**	***LINK* Software Block**	***LINK* Slot Number**
Speed Setpoint Change	RAMPS:: RAMP ACCEL TIME	RAMPS	2089
Speed Setpoint Change	RAMPS:: RAMP DECEL TIME	RAMPS	2090
Speed Setpoint Change	RAMPS:: % S RAMP	RAMPS	2252
Normal Controlled Stop Deceleration	STOP RATES:: STOP TIME	START-STOP	2226
Fast Stop Deceleration	STOP RATES:: PROGRAM STOP TIME	START-STOP	2132

SAVING PARAMETERS

After completing the final changes and tuning adjustments it is strongly recommended to:

1. Save the drive parameters using the MMI's SAVE PARAMETER function;
2. Update the drive's ConfigEd configuration file using ConfigEd's UPDATE command; and
3. Create a back up file of the drive using SAM's BACK UP function.

Refer to Chapter 3 for a discussion on drive memory and saving drive parameter values.

PASSWORD PROTECTION

You can secure the 590 DRV *LINK* drive in a password-protected mode to safeguard the parameters you have set with the MMI. At initial power up, the password is set to the hexadecimal value 0x0000. The MMI is in a restricted mode if the controller password is set to any other value. In this mode, the MMI display can display parameters, but parameter values cannot be altered using the four MMI pushbuttons. You can still, however, make parameter changes through SAM or with the `INSTALL` command in ConfigEd.

Entering a Password

To access the password configuration procedure from the main menu:

- scroll to the PASSWORD menu,
- hit M to enter,
- hit M again to enter the ENTER PASSWORD sub-menu,
- scroll with ▼ or ▲ to enter the password number on the display.

Changing a Password

The 590 DRV *LINK* drive is 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 can use the CHANGE PASSWORD function to set your own restricted password.

- PASSWORD
- M to enter Password sub-menu
- ▲ or ▼ to CHANGE PASSWORD
- M to enter the CHANGE PASSWORD sub-menu
- ▲ or ▼ 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 authorized access. Save the password with the MMI PARAMETER SAVE function or through SAM.

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

> NOTE. Be sure to record the new password. You will be unable to change parameters without your password.

4-BUTTON RESET

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

Chapter 6 TROUBLESHOOTING

This chapter is divided into five sections. The first section guides the user through initial troubleshooting procedures. The subsequent four sections deal with Status LED indicators, Alarm Messages, 590 DRV *LINK* drive hardware problems, and *LINK* configuration problems.

The MMI and the drive LED's offer the quickest way of finding simple drive and system faults. More advanced troubleshooting requires the SAM and ConfigEd software packages.

INITIAL TROUBLESHOOTING PROCEDURE

Most drive problems are encountered during commissioning or soon after start up. These problems frequently result from *LINK* configuration errors in the *LINK* system software, or improperly set drive setup parameters. If you encounter a problem upon start up of your 590 DRV *LINK* drive, review the installation procedures in Chapter 3 and the start up and adjustment procedures in Chapter 5. Verify that the setup parameters are appropriate for the motor and the application. After you have checked the wiring, parameter setup values and your *LINK* configuration, proceed to the troubleshooting methods in this chapter.

Use the flowchart in Figure 6.1 to begin troubleshooting.

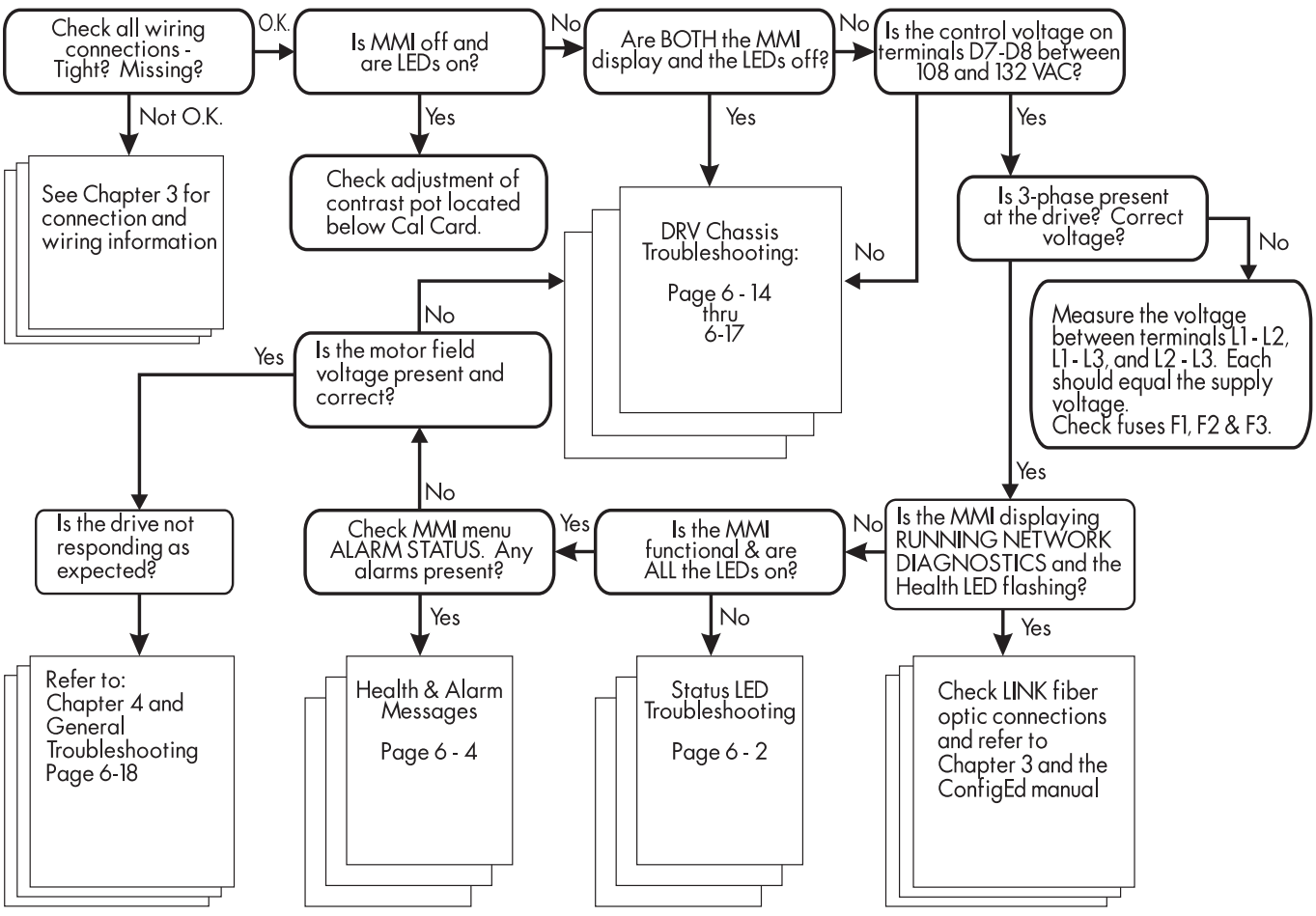


Figure 6.1 - Initial Troubleshooting Procedure

RECOMMENDED TOOLS

You will need the following tools for most troubleshooting procedures:

- Voltmeter
- Megger
- IBM compatible personal computers running Windows™ version 3.1 or later and the software package ConfigEd

Use the following tools for more advanced problem-solving:

- Oscilloscope
- Hand tachometer

You may also need screwdrivers and/or wrenches for rewiring incorrect or loose electrical connections.

STATUS LED TROUBLESHOOTING

Six light emitting diode [LED] indicators are located just to the right of the MMI display. The LEDs provide instant feedback on the status of the drive in six categories; 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 16 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 when the drive receives a *LINK* DRIVE START command (slot 52), the start contactor energizes, the thyristor bridge circuit enables and the drive is healthy. The RUN LED turns off if the drive is disabled. This LED also turns off if the drive's internal start relay de-energizes, or if an alarm 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 A7 (PROGRAM STOP) and A8 (COAST STOP). These terminals are normally switched to terminal A9 +24 VDC through an external emergency stop relay.

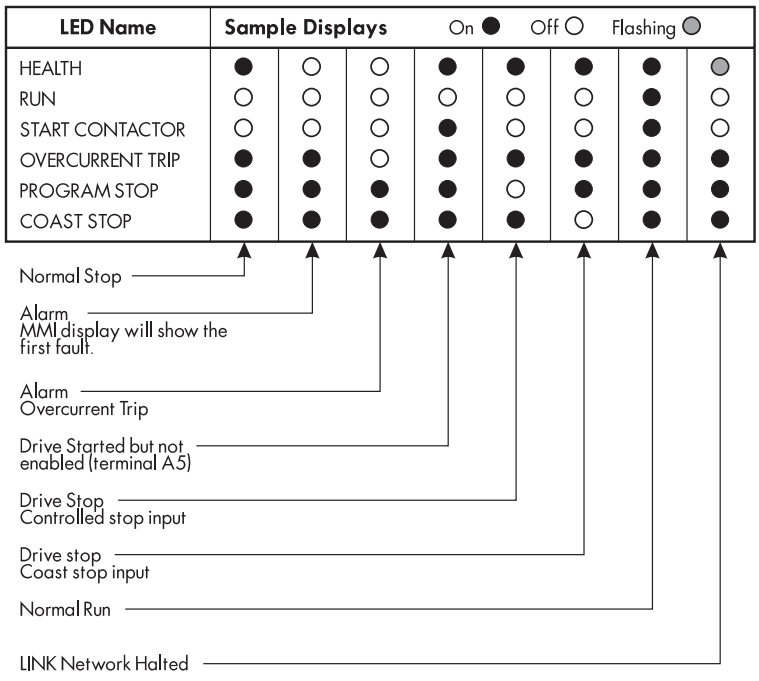


Figure 6.2 - Sample LED Status Modes

All six LEDs are on under normal running conditions. Figure 6.2 shows the LED states after common actions and other faults occur. An unlit LED indicates a problem preventing controller operation and requires user attention. The table in Figure 6.3 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. Use SAM to check LINK drive system.
		AUTOTUNE has been successfully or unsuccessfully attempted	A successful AUTOTUNE has been compeleted if the MMI registers no alarms. Re-AUTOTUNE if alarms AUTOTUNE FAILED or AUTOTUNE ABORT occurs.
	MEANING WHEN FLASHING	**POSSIBLE CAUSE**	**CORRECTIVE ACTION**
	Drive LINK network has failed or is unhealthy.	LINK network may be unhealthy, or halted. LINK network module may be failed or halted.	Check whether fiber optic LINK network is broken. Use SAM or ConfigEd to check LINK network.
LED NAME	**MEANING WHEN OFF**	**POSSIBLE CAUSE**	**CORRECTIVE ACTION**
RUN	The drive is not enabled or in the RUN state.	The thyristor bridge is disabled	Check all enable input (terminal A5) circuitry. Check LINK drive start hardware input circuitry.
		Another alarm is present.	Go to the ALARM MESSAGES section for troubleshooting tips.
START CONTACTOR	The start contactor is open.	Internal drive start relay not pulling in contactor.	Check for loose contactor coil wires.
OVERCURRENT TRIP	Armature current has exceeded 300 percent full load. The LCD display registers OVER I TRIP message.	Armature current loop incorrectly calibrated.	Check if current calibration switch settings match nominal armature current.
		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 A7. The main contactor drops 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 A7.	Check emergency stop relay and connections to terminal block A.
			Check all safety interlocks in the external logic.
		24 VDC supply has failed.	Check whether 24 VDC supply, if used, at terminal A9 is overloaded. Check power board.
COAST STOP	24 VDC signal not present at terminal A8. The SCR stack disables 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 reaching A8.	Check emergency stop relay and connections to terminal block A.
			Check all safety interlocks in the external logic.
		24 VDC supply has failed.	Check whether 24 VDC supply, if used, at terminal C9 is overloaded. Check if power board is faulty.

Figure 6.3 - Status LED Troubleshooting Procedures

HEALTH & ALARM MESSAGES

The controller continuously monitors 16 alarms while the drive is running. These alarms are combined to provide an overall "controller healthy" logic variable. This variable corresponds to the *LINK* outputs HEALTH FLAG and UNLATCHED HEALTH FLAG which are available in the ConfigEd software block HEALTH. The HEALTH software block and its outputs are discussed in depth in Appendix C.

If a fault occurs while the controller is running, the drive immediately inhibits the thyristor firing circuit, the main contactor de-energizes and the MMI displays the *last* fault registered, or the fault which interrupts controller operation.

The tables in Figures 6.4 through 6.9 describe the different alarms the MMI displays when the drive trips out on a fault, the 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 if fully inserted on mounting pins on control door.
*** 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 recommen- ded 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 AUTOTUNEing 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 AUTONE purposes.

Figure 6.4 - Alarm Messages

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** 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 anlog 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 repaeater 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 integiry 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 INTIAL 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].
*** 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 FS1.
		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 VENTILAION & 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.

Figure 6.5 - Alarm Messages (Continued)

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** 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.
*** 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.

Figure 6.6 - Alarm Messages (Continued)

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** 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.
*** 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.

Figure 6.7 - Alarm Messages (Continued)

DISPLAY MESSAGE	MEANING	POSSIBLE CAUSE	CORRECTIVE ACTION
*** 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 6.8 - 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 6.9 - 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 the MMI displays any of the symbolic message listed in Figure 6.10, 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 6.10 - Symbolic Error Messages

HEALTH WORD, HEALTH STORE & THE ALARM STATUS MENU

Figure 6.11 lists the *LINK* ordinal value assignments for each of the 16 monitored drive alarms. Each alarm corresponds to an ordinal value indicated in the HEALTH STORE *LINK* output. Performing a GET operation on HEATH STORE in SAM returns the text message of the alarm. Each output also corresponds to a hexadecimal value indicated in the HEALTH STORE BITMAP *LINK* output. Both of these parameters are in the ConfigEd software block HEALTH and correspond, respectively, to LAST ALARM and HEALTH STORE in the MMI menu ALARM STATUS. The table below also indicates whether the faults can be overridden in the SETUP PARAMETERS::INHIBIT ALARMS MMI menu and also lists the delay time of each alarm.

HEALTH STORE Ordinal Value	Alarm	Hex Value	Inhibit	Delay Time
0	no active alarms	0x0000	---	---
1	Overspeed	0x0001	no	0.75sec
2	Missing Pulse	0x0002	no	60 sec
3	Field Overcurrent	0x0004	---	---
4	Fin Temp	0x0008	---	---
5	Motor Overtemperature	0x0010	no	15 sec
6	Armature Overvolts	0x0020	---	---
7	Speed Feedback Fail	0x0040	yes	0.1 sec
8	Encoder/Microtach Failed	0x0080	yes	0.0 sec
9	Field Failure	0x0100	---	---
10	Three Phase Failure	0x0200	no	0.0 sec
11	Phase Lock Failure	0x0400	no	0.5 sec
12	*LINK* Network Error	0x0800	no	0.0 sec
13	Stall Trip	0x1000	yes	0.0 sec
14	Overcurrent Trip	0x2000	no	0.0 sec
15	Cal Board Missing	0x4000	---	---
16	ACCTS Failed	0x8000	---	---

Figure 6.11 - Drive Health Alarm Bits

Alarm Process

The controller trips out on the first alarm it detects and displays that alarm in the MMI under ALARM STATUS:: LAST ALARM until another fault trips out the drive, or until control power is removed. The hexadecimal code for that alarm is saved in HEALTH STORE. HEALTH STORE resets when the drive is restarted. All subsequent alarms are not displayed.

The HEALTH WORD register holds the hexadecimal sum of all faults occurring since the drive was last started. It 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. Removing control power resets both HEALTH WORD and HEALTH STORE and resets LAST ALARM to NO ACTIVE ALARMS.

HEALTH WORD, HEALTH STORE, and LAST ALARM can be monitored in the MMI under the ALARM STATUS menu. A *LINK* L5203 serial module, or a L5203 *LINK* Gateway module, can read the hexadecimal values from the *LINK* outputs HEALTH WORD and HEALTH STORE BITMAP values over the *LINK* network for monitoring and further processing. You may also configure the HEALTH STORE ordinal *LINK* output to a *LINK* L5102 operator station to annunciate the drive alarm.

This example below shows how HEALTH WORD, HEALTH STORE, and LAST ALARM are updated. Assume that during normal operation, the following fault sequence occurs: the motor overheats and the drive first trips out on a motor overtemperature alarm (hex value 0x0010). The motor then cools down, the drive is restarted, but then immediately blows a thyristor fuse and trips out on a three phase failure alarm (0x0200) and a phase lock failure (0x0400). During such a sequence HEALTHWORD and HEALTH STORE and LAST ALARM will read:

Before the fault sequence occurs, the registers and LCD read:

HEALTH WORD	HEALTH STORE	LAST ALARM	*LINK* HEALTH STORE Output
0x0000	0x0000	NO ACTIVE ALARMS	0

When the motor overheats:

HEALTH WORD	HEALTH STORE	LAST ALARM	*LINK* HEALTH STORE Output
0x0010	0x0010	MOTOR TEMP	5

When the motor cools down, the registers and LCD read:

HEALTH WORD	HEALTH STORE	LAST ALARM	*LINK* HEALTH STORE Output
0x0000	0x0010	MOTOR TEMP	5

Upon restarting:

HEALTH WORD	HEALTH STORE	LAST ALARM	*LINK* HEALTH STORE Output
0x0000	0x0000	MOTOR TEMP	0

When the fuse blows, main power is lost *and* the phase lock alarm fails:

0x0200 + 0x0400 = 0x0600

HEALTH WORD	HEALTH STORE	LAST ALARM	*LINK* HEALTH STORE Output
0x0600	0x0200	POWER FAILED	10

After replacing the fuse and restarting:

HEALTH WORD	HEALTH STORE	LAST ALARM	*LINK* HEALTH STORE Output
0x0000	0x0200	POWER FAILED	10

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

You can monitor many analog and logic signals on the MMI display under the DIAGNOSTICS menu. Most are also available as a SAM monitor point. The MMI diagnostic points are "read only" and are very useful in troubleshooting. Figures 6.12 and 6.13 list the diagnostic points in alphabetical order. They also list the SAM equivalent diagnostic and give the SAM and MMI signal ranges and the equivalent ConfigEd software block parameters.

MMI Diagnostic	Description	SAM Diagnostic	SAM or MMI Range	LINK Output	LINK Range
ACTUAL NEG I LIM	Overall negative current limit value.	None	± 200%	None	None
ACTUAL POS I LIM	Overall positive current limit value.	None	± 200%	None	None
AT CURRENT LIMIT	Current demand is clamped by the overall current limit.	None	True/False	None	None
AT STANDSTILL	Drive is at zero speed when speed demand is zero.	STANDSTILL: Get At Standstill	True/False	Standstill/At Standstill	1=True, 0=False
AT ZERO SETPOINT	At zero speed demand.	STANDSTILL: Get At Zero Setpoint	True/False	Standstill/At Zero Setpoint	1=True, 0=False
AT ZERO SPEED	Speed feedback is below zero speed threshold.	FEEDBACK:: Get At Zero Speed	True/False	Feedback/At Zero Speed	1=True, 0=False
BACK EMF	Calculated motor back EMF (armature volts minus IR compensation).	None	± 150%	None	None
CURRENT DEMAND	Current loop demand (speed error PI output or external current demand clamped by all the current limits).	CURRENT LOOP: Get Current Demand	± 200%	Speed Loop/Speed Loop Output (equals current demand only when Current Demand Enable is FALSE)	± 100%
CURRENT FEEDBACK	Scaled and filtered armature current.	CURRENT LOOP: Get Current Feedback	± 200%	Current Loop/Armature Current	± 100%
DRIVE ENABLE	Current and speed loops are enabled/disabled..	CURRENT LOOP: Get Global Quench	Quenched/ Unquenched	Current Loop/ Global Quench	1=Enabled, 0=Disabled
DRIVE START	LINK start command (slot 52).	START-STOP: Get Start	True/False	Start-Stop/Drive Started	1=On, 0=Off
ENABLE	State of ENABLE terminal A5.	None	None	None	None
ENCODER	Encoder speed feedback.	FEEDBACK: Get Digital Tach	Signal is scaled to value set by Cal Encoder RPM	Feedback/Digital Tach	Ordinal ouput scaled to value set by Cal Encoder RPM
FIELD DEMAND	Field current demand.	FIELD: Get Field Demand	± 100%	Field/Field Demand	± 100%
FIELD ENABLE	None	FIELD: Get Field Enable	Enabled/Disabled	None	None
FIELD FIRING ANGLE	None	None	?? - ??	None	None
FIELD I FBK.	Scaled motor field current feedback.	FIELD: Get Field Current	0-100%	Field/Field Current	0-100%

Figure 6.12 - Drive Diagnostics

MMI Diagnostic	Description	SAM Diagnostic	SAM/MMI Range	LINK Ouput	LINK Range
INVERSE TIME O/P	Symmetrical inverse time current curve clamp level.	CURRENT LOOP: Get Inverse Time	0-200%	Current Loop/Inverse Time Output	0-100%
NEG I CLAMP	The set negative current limit clamp value.	CLAMPS: Get Negative Clamp	± 200%	None	None
OPERATING MODE	Indicates whether drive is started; status of run LED.	None	Stop/Run/Jog	None	None
POS I CLAMP	The set positive current limit clamp value.	CLAMPS: Get Positive Clamp	± 200%	None	None
PROGRAM /COAST STOP	State of A7 and Program Stop LINK input (slot 1122), or terminal A8.	None	True = Inactive (drive NOT program or coast stopped), False = Active (drive IS program or coast stopped)	None	None
RAMP OUTPUT	Setpoint ramp output.	RAMPS: Get Ramp Output	± 120%	Ramps/Ramp Output	± 100%
RAMPING	If the difference between the ramp input and the ramp output is greater than the "RAMP THRESHOLD", then "RAMPING" is TRUE	RAMPS: Get Ramping	True = Ramping, False = Not ramping	Ramps/Ramping	1 = ramping, 0 = not ramping
SPEED DEMAND	Speed Loop/Total Setpoint ouput AFTER Start-Stop block.	None	±120%	None	± 100%
SPEED ERROR	Difference between speed demand and speed feedback.	SPEED LOOP: Get Speed Error	± 100%	Speed Loop/Speed Error	± 100%
SPEED FEEDBACK	Speed loop feedback.	FEEDBACK: Get Speed Feedback	±120%	Speed Loop/Speed Feedback	± 100%
SPEED SETPOINT	Speed Loop/Total Setpoint including the ramp output BEFORE the Start-Stop block.	SPEED LOOP: Get Total Setpoint	±120%	Speed Loop/Total Setpoint	± 100%
SPT SUM OUTPUT	Setoint summation output of INPUT 1 and INPUT 0.	SUMMING: Get Setpoint Sum	±120%	Summing/Setpoint Sum	± 100%
STALL TRIP	Armature current is above STALL THRESHOLD and motor is AT ZERO SPEED but drive is not AT ZERO SETPOINT.	HEALTH: Stall Trip	OK/FAILED	Health/Stall Trip	1=OK, 0=Failed
START	Status of slot 52, Drive Start.	None	ON / OFF	None	ON / OFF
TACH INPUT	Scaled analog tachogenerator feedback.	FEEDBACK: Analog Tach Feedback	± 120%	Feedback/Analog Tach Feedback	± 100%
TERMINAL VOLTS	Scaled drive armature terminal voltage.	SPEED LOOP: Amature Voltage	± 120%	Speed Loop/Armature Voltage	± 100%

Figure 6.13 - Drive Diagnostics (Continued)

590 DRV CHASSIS TROUBLESHOOTING

This section contains the flow charts for identifying hardware problems in the 590 DRV *LINK* drive.

Control Power Procedure

This flowchart troubleshoots problems associated with the control transformer.

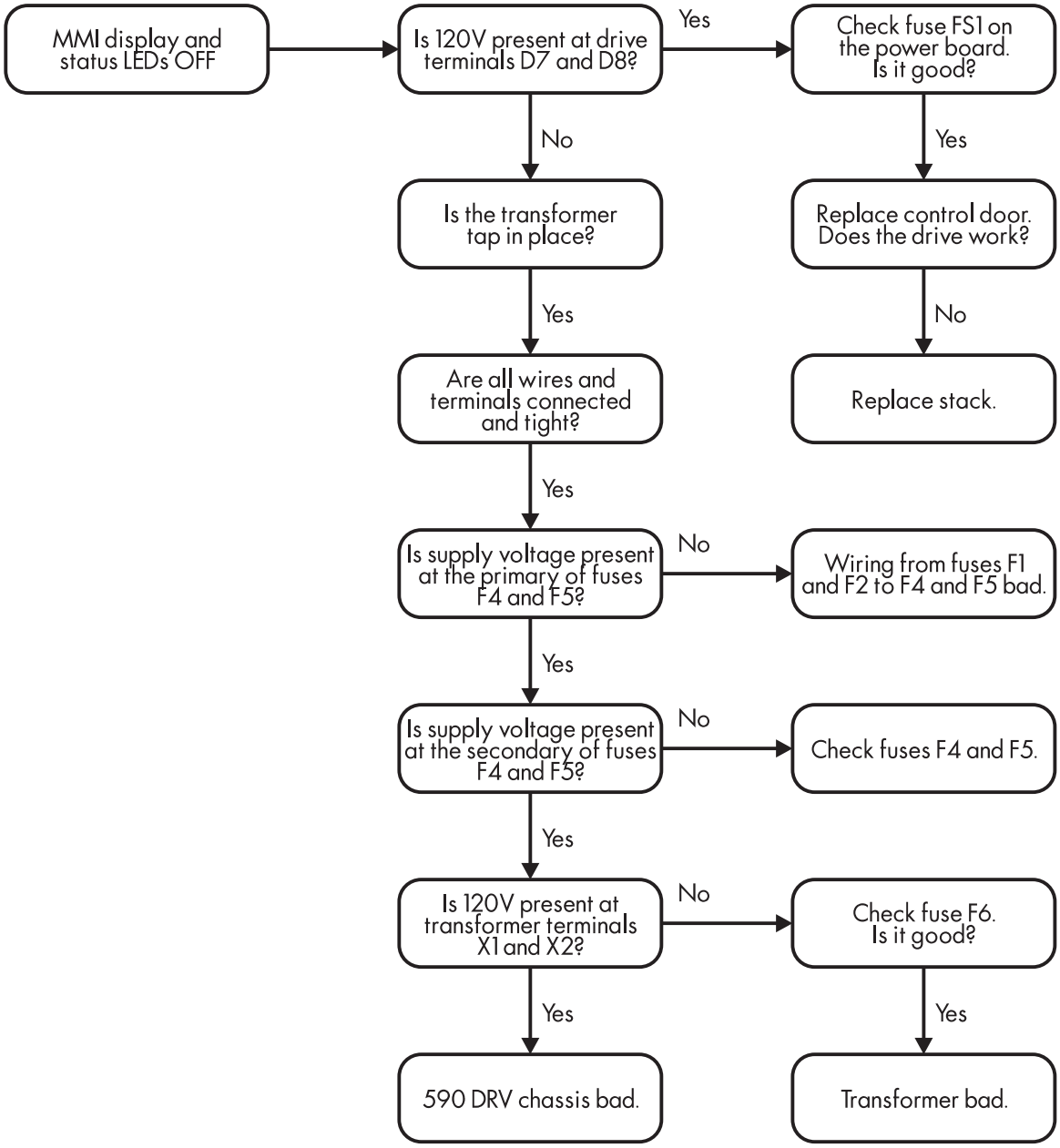


Figure 6.14 - 590 *LINK* DRV Hardware Control Power Troubleshooting Flowchart

Field Connections Procedure

Motor uses external field supply and the field is missing.

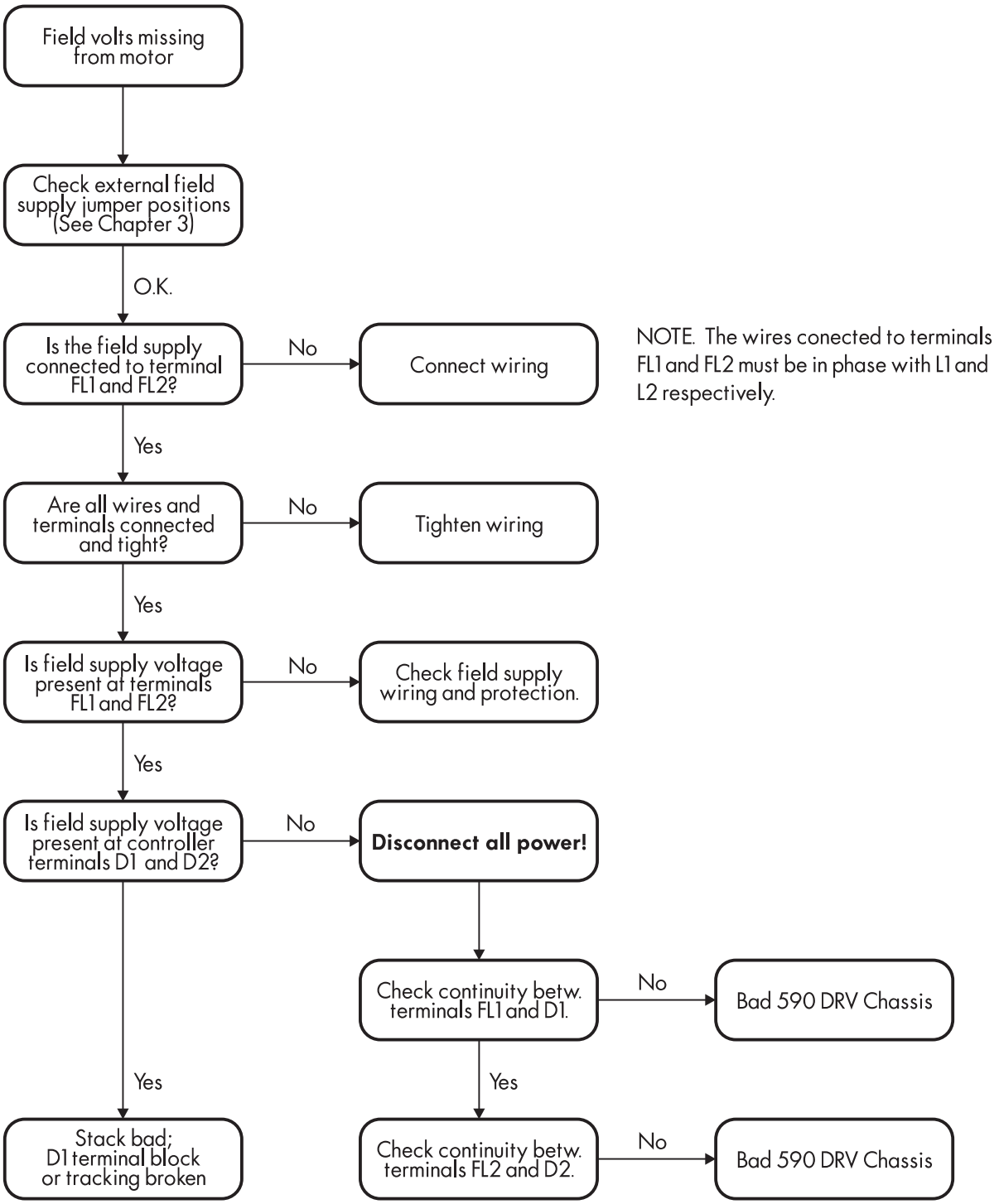


Figure 6.15 - 590 *LINK* DRV Field Troubleshooting Flowchart

Contactor Procedure

This flowchart is used for troubleshooting problems associated with the main contactor, AM, including wiring.

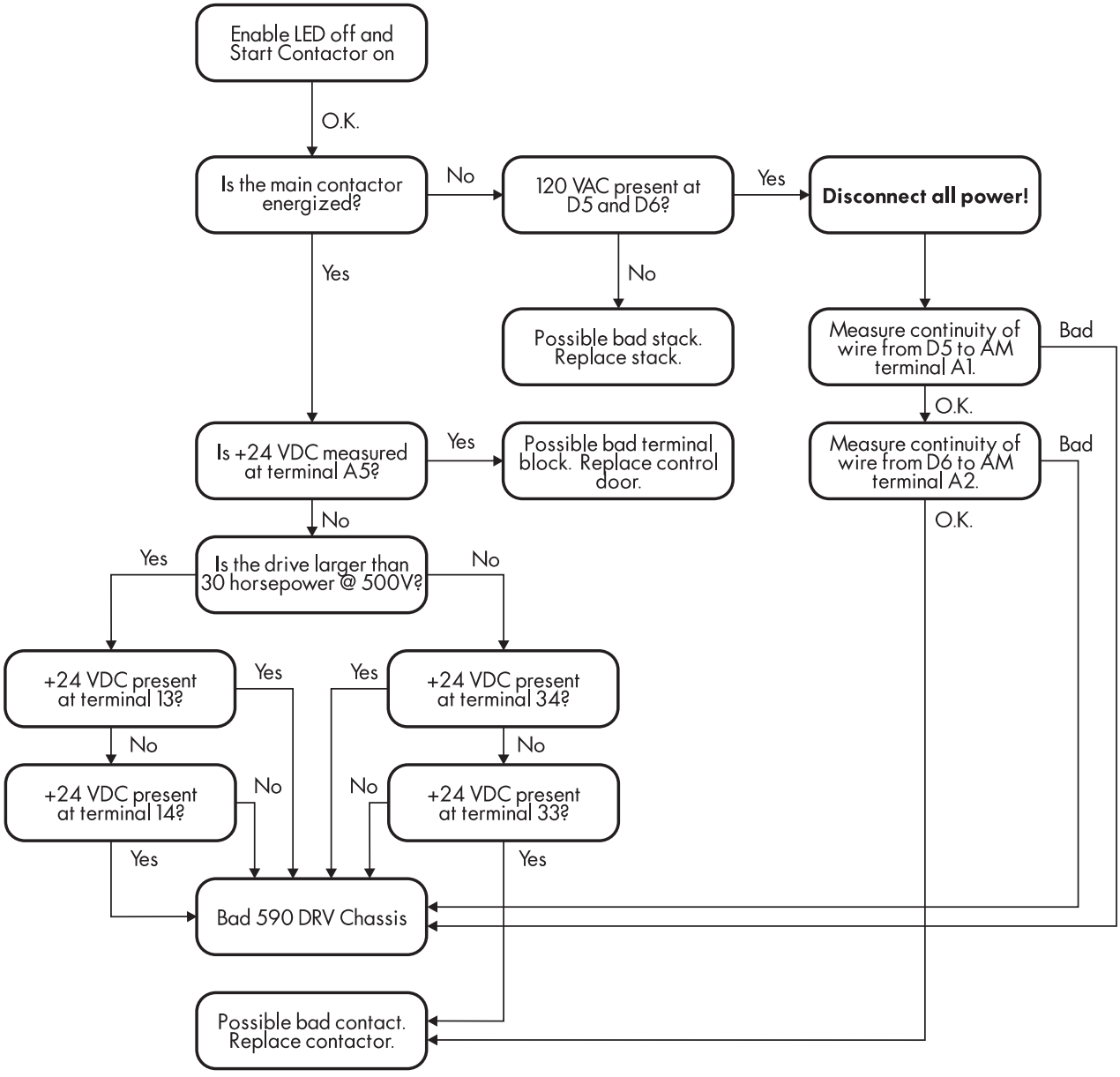


Figure 6.16 - 590 *LINK* DRV Contactor Troubleshooting Flowchart

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 6.17 as they appear on the drive heatsink, from left to right.

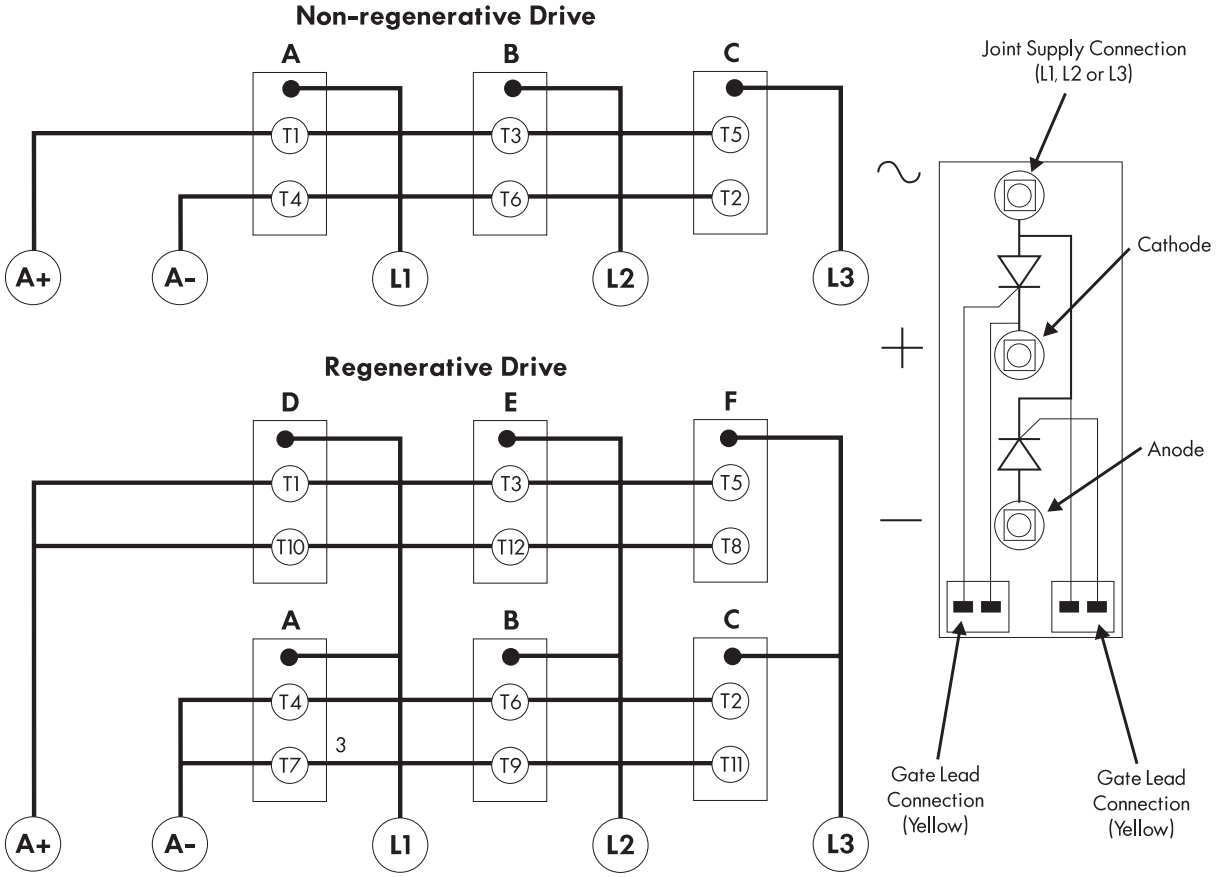


Figure 6.17 - SCR Layout

Use the tables in Figure 6.18 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 > 1 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 1 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 W if good. A schematic of the SCR pack appears in the right of Figure 6.17. 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 6.18 - SCR Test Charts

MOTOR CHECKS

Several alarm messages are caused by problems with the motor. Most motor problems relate to insulation breakdown, overtemperature or 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 1 W. Insulation measurements should be greater than 10 MW.

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

Caution

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

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.

GENERAL TROUBLESHOOTING

This section discusses common performance problems you may encounter with the 590 DRV *LINK* drive. *LINK* configuration errors and improper drive parameter settings cause most performance problems.

Use the ConfigEd SAM feature to track signals when troubleshooting software problems. With a print out of the *LINK* software configuration, trace the signal from its external starting point (usually beginning at a *LINK* I/O module) and monitor it at each point along the path using your PC. This should uncover mis-addressed parameters, unwanted offsets, and mis-calibrated parameters.

No SPEED DEMAND, or Motor Will Not Turn

1. Check all speed demand setpoints on the MMI under SETUP PARAMETERS:: SPEED LOOP:: SETPOINTS. Monitor the values of SETPOINTS 1 through 4. Use SAM to check the outputs SETPOINT SUM in the SUMMING block, TOTAL SETPOINT in the START-STOP block and the RAMP OUTPUT in RAMPS.
2. If using the drives RAMP INPUT (slot 2067), check whether the ramp is either held at zero output or reset to zero.
3. Check SETUP PARAMETERS::CURRENT LOOP::I DEMAND ISOLATE in the MMI, or use SAM to check the CURRENT DEMAND ENABLE parameter under EXTERNAL ENABLES software block. If this parameter is enabled and the drive receives no external current demand, the drive cannot produce armature current and, therefore, cannot generate torque to rotate the motor shaft. A speed setpoint of any value will not generate motor torque since the speed loop output has been switched out of the current loop demand input.
4. Check *all* the drive's current limit clamps: MAIN CURRENT LIMIT, POSITIVE CURRENT CLAMP, NEGATIVE CURRENT CLAMP, INVERSE TIME AIMING POINT and CURRENT PROFILE:: IMAX BRK1(SPD1) and IMAX BRK2(SPD2). Since each clamp can independently limit the motor current, all must be nonzero for the drive to produce current. All these current clamps are SAM accessible.
5. Check the *LINK* system configuration using the ConfigEd SAM feature to trace the desired speed reference signal. If a *LINK* analog input is used to derive the speed demand, check the input's external wiring. Also verify that the input channel in the *LINK* analog module's (L5201-2-02) configuration is enabled.
6. Check whether the drive is in current limit, or whether the motor is stalled.

Motor Will Not Respond to a Change in Speed or Current Demand

Recheck the *LINK* system configurations for a properly connected reference signal. If a ConfigEd software block generates or processes the speed or current signal, verify that the source software block is being properly triggered. A software block which is not repetitively clocked will not update value outputs if its value inputs are changed. [Refer to the *LINK* Overview Manual (HA350678A) for an in depth discussion and examples on properly configuring and designing a *LINK* system.]

Unwanted SPEED OFFSET

Use SAM and the MMI to monitor each speed input to the drive. The total speed demand to the drive speed loop is the sum of six possible inputs: INPUT 0, INPUT 1, RAMP INPUT, SETPOINT FAST INPUT, ZERO SPEED OFFSET and SETPOINT 4. You may alter or monitor the first three of these with the ConfigEd SAM feature or with the MMI. SETPOINT FAST INPUT can be monitored only with SAM. Especially check SETPOINT 4; you can only change and read this parameter with the MMI.

Motor Speed Drift

Motor speed drift often occurs when the drive is speed matched incorrectly. Check the speed of the motor shaft with a hand tachometer and re-calibrate the speed according to the instructions in Chapter 5. Be certain that the drive receives a steady speed reference and that all speed trims are set to zero when speed matching.

If speed drift continues after re-calibration and an analog tachometer generator is used, check for tachometer generator non-linearity. Use the ANALOG TACH + CAL and ANALOG TACH - CAL to correct for poor regulation. Replace the tachometer generator if the non-linearity cannot be eliminated.

LINK Configuration Errors

LINK software errors often cause many drive and system problems. They frequently result from mismatched *LINK* input and output slots. These errors result from an incorrect destination slot number or address in the source *LINK* output slot, or the wrong slot number in the *LINK* input, or destination slot. Avoid them by carefully cross-checking configuration slot number and address information in the *LINK* configuration diagrams.

1. DRIVE *LINK* SLOT DOES NOT RECEIVE SIGNAL: If no *LINK* slot connection exits, the destination slot never receives the intended, transmitted *LINK* signal. From your IBM compatible personal computer, enable the `SAVE SOURCES` and `CLEAR UNUSED` options and use `PROJECT PRINT` to print out the *LINK* configuration diagrams in ConfigEd. This feature updates the *LINK* destination input slots with *LINK* source output slot information and prints out the graphical configuration of your system. It tells the user whether *LINK* output slots are connected to nonexistent or incorrect input slots or addresses.

   NOTE. Be certain to use ConfigEd's `UPDATE` function before printing to ensure that you are indeed printing out the actual software configurations loaded in your system. You may also obtain a textual slot listing using the ConfigEd `DOCUMENT` function.

2. DRIVE PARAMETER TOGGLES BETWEEN TWO VALUES OR STATES: Check whether two signals are sent to the same drive slot. Because *LINK* messages are only sent when their value changes, the slot switches between the two when either changes state. The drive will oscillate between the two signals if they are sent at a periodic rate. Again, incorrect or mismatched slot addressing over the *LINK* network causes this problem. Cross-check *LINK* connections by first using `UPDATE` in SAM, then using `SAVE SOURCES` and the `PROJECT PRINT` command in ConfigEd.
3. *LINK* VALUE SIGNAL IS CLAMPED: All value signals within the *LINK* environment are normalized to ±1.0000, or ±100.00%. This means that if a *LINK* calculation mathematically produces a signal outside this range, the result of the calculation clamps to ±100.00%. When this occurs, the drive may not receive the full range of an intended signal. Refer to Chapter 4 for a discussion on *LINK* signal value saturation and value ranges.
4. INCORRECT PARAMETER SETTINGS: This problem usually occurs when the parameters are not saved or if they are overwritten when using the ConfigEd `INSTALL` or SAM `RESTORE` commands. Be sure to SAVE PARAMETERS with the MMI and update the Configuration files with ConfigEd `UPDATE` after you tune the drive and properly set its parameters. Refer to Chapter 4 for an explanation of these software features.

Consult the *LINK* Configuration Manual (RG350672) and the *LINK* Overview Manual (HA350678A) for further information concerning *LINK* configuration.

SAM DOCUMENT MODULE Command

DOCUMENT MODULE creates a text file in the SAM Scratchpad showing the values of all SAM access points at the moment the module is documented. The command effectively takes a snapshot of all SAM accessible drive slot inputs, parameter settings and software block outputs values. You may save the Scratchpad to a file or print out a hard copy.

Test Points

The drive has several test points located on the control board under its lower cover flap. These signals are useful for advanced troubleshooting with an oscilloscope. They are shown in Figure 6.19. The table in Figure 6.20 lists their designations and signal ranges.

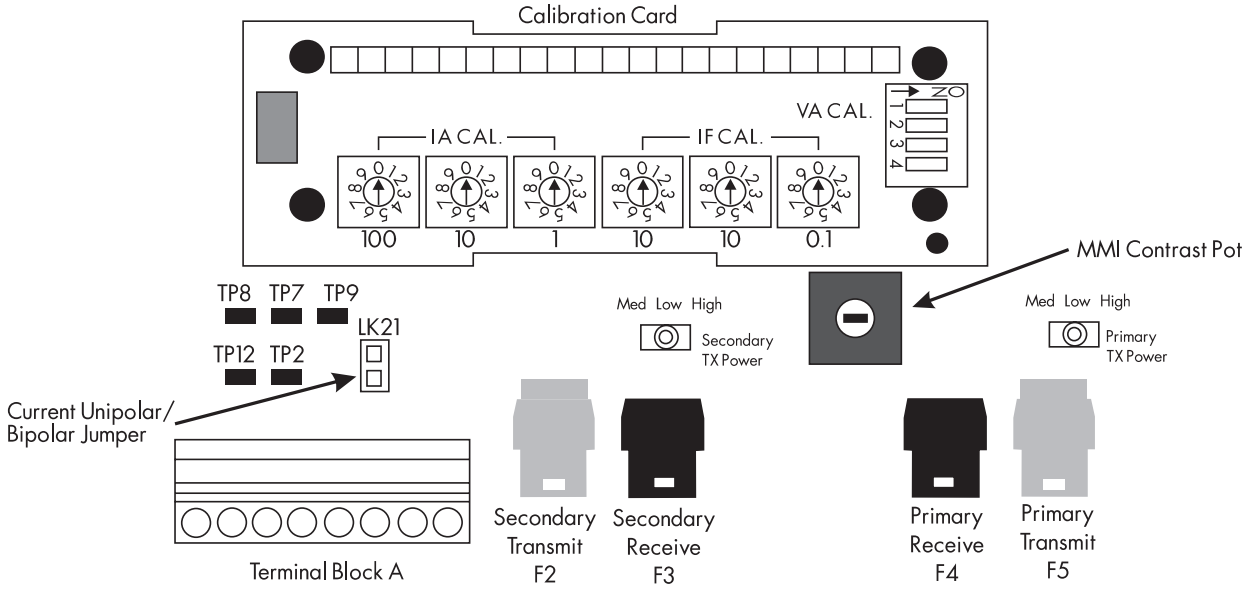


Figure 6.19 - Close up of the 590 *LINK* Control Board

Test Point	Description	Range
TP8	Armature current feedback	0 to +10.0 volts = 0 to +200% full load current (LK21 jumpered) 10.0 volts = ±200% full load current (LK21 not jumpered)
TP9	Buffered analog tachometer	0 to +4.6 volts = 0 to 100% speed (magnitude only)
TP7	Overcurrent trip (transition on a trip)	+5 volts = normal -15 volts = tripped
TP12	Monitor point for PEEK diagnostic (Signal tagged to drive speed feedback)	0 volts = full speed reverse 2.2 volts = zero speed 4.4 volts = full speed forward
TP2	0 V Signal common	0 volts

Figure 6.20 - Test Point Scaling

CONTACTING CUSTOMER SERVICE

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

Information	Source
Catalog number, revision number, serial number	590 DRV *LINK* drive Serial Number Label (located on the left side of the drive heatsink base);
Motor horsepower, armature current and voltage, field current and voltage, base and top speed ratings	Motor Nameplate
Voltage per 1000 RPM (analog device), counts per revolution (digital device)	Speed Feedback Device nameplate
8-Digit *LINK* Configuration Project Number (99xxxxxx)	System Drawings
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 7 SERVICE AND MAINTENANCE

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

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.

Contacting Eurotherm Drives for Service

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

Information	Source
Catalog number, revision number, serial number	590 DRV *LINK* drive serial number label (located on the left side of the drive heatsink base);
Motor horsepower, armature current and voltage, field current and voltage, base and top speed ratings	Motor nameplate
Speed voltage feedback per 1000 RPM (analog device), or counts per revolution (digital device)	Speed feedback device nameplate
LINK configuration project number (99xxxxxx)	System drawings
Applications information	System drawings.

Customer service engineers also need to know the application the drive performs and the work environment.

Warranty information

Detailed warranty information is contained in the Standard Conditions of Sale document IA058393C which is included with each order. An abbreviated version appears after the Warnings page in the front 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

WARNING!

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

WARNING!

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

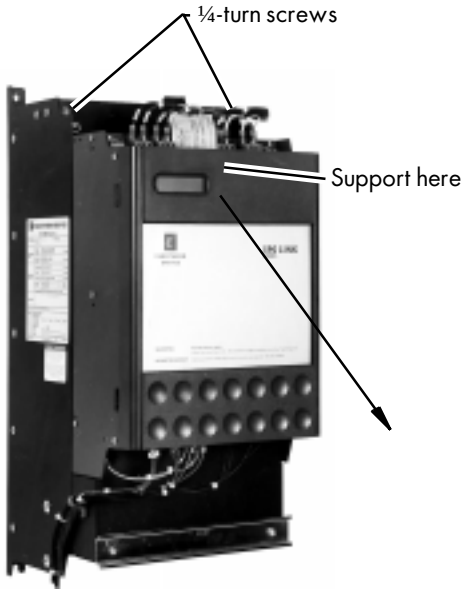


Figure 7.1 - Opening the 590 DRV *LINK* drive

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 *LINK* drive 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 *LINK* drive 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.

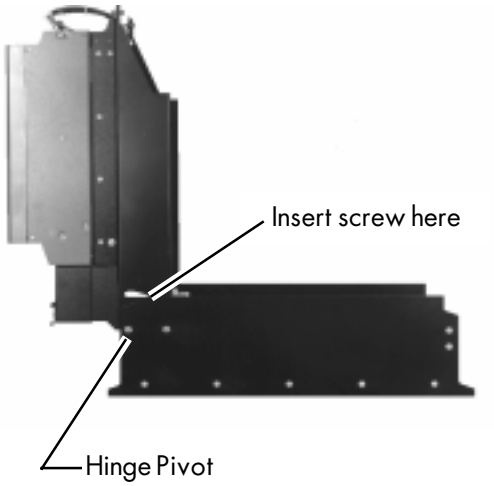


Figure 7.2 - Securing the 590 DRV *LINK* drive Open

PREVENTIVE MAINTENANCE

Preventive maintenance every six months is recommended to ensure long life and continuous operation of the 590 DRV *LINK* drive. 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 7.3 - 590 DRV *LINK* drive 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. Reattach the lower cover.

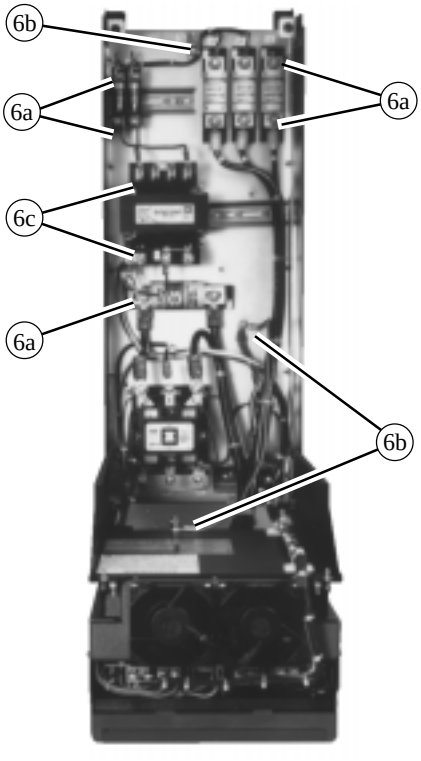


Figure 7.4 - Inside Power Section

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.

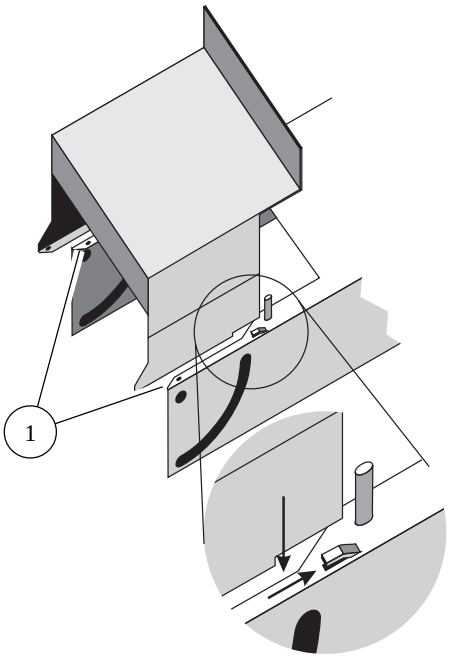


Figure 7.5 - Lower Cover Detail

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 and the tach board connections 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.

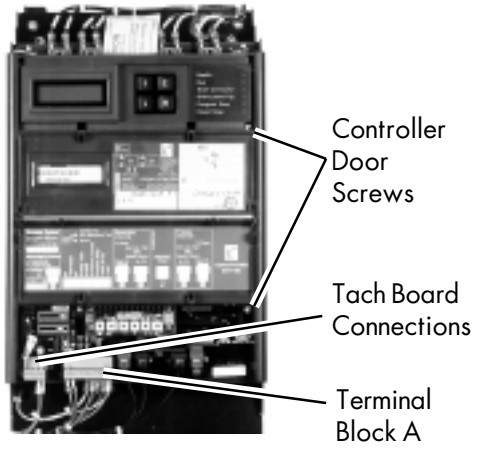


Figure 7.6 - Controller Door Screws

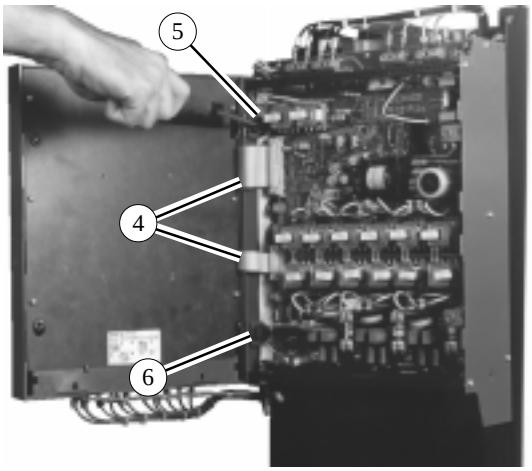


Figure 7.7 - Removing the Control Door

REPLACING THE CONTROLLER

Required Tools

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

Procedure

1. Disconnect the control wire terminals, terminal block A, from the controller door and remove the lower cover.
2. Disconnect the three supply 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 *LINK* drive 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 ¼-20 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.

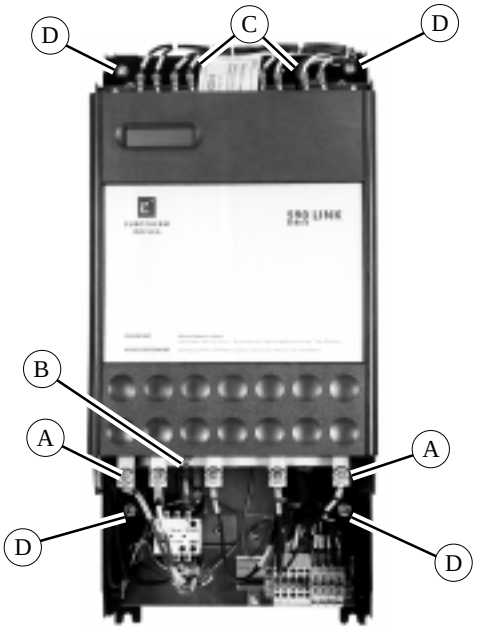


Figure 7.8 - Controller Mounting Screws

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 7.9.
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 7.9 as J, L, M, and N) through the board before fastening it in place.

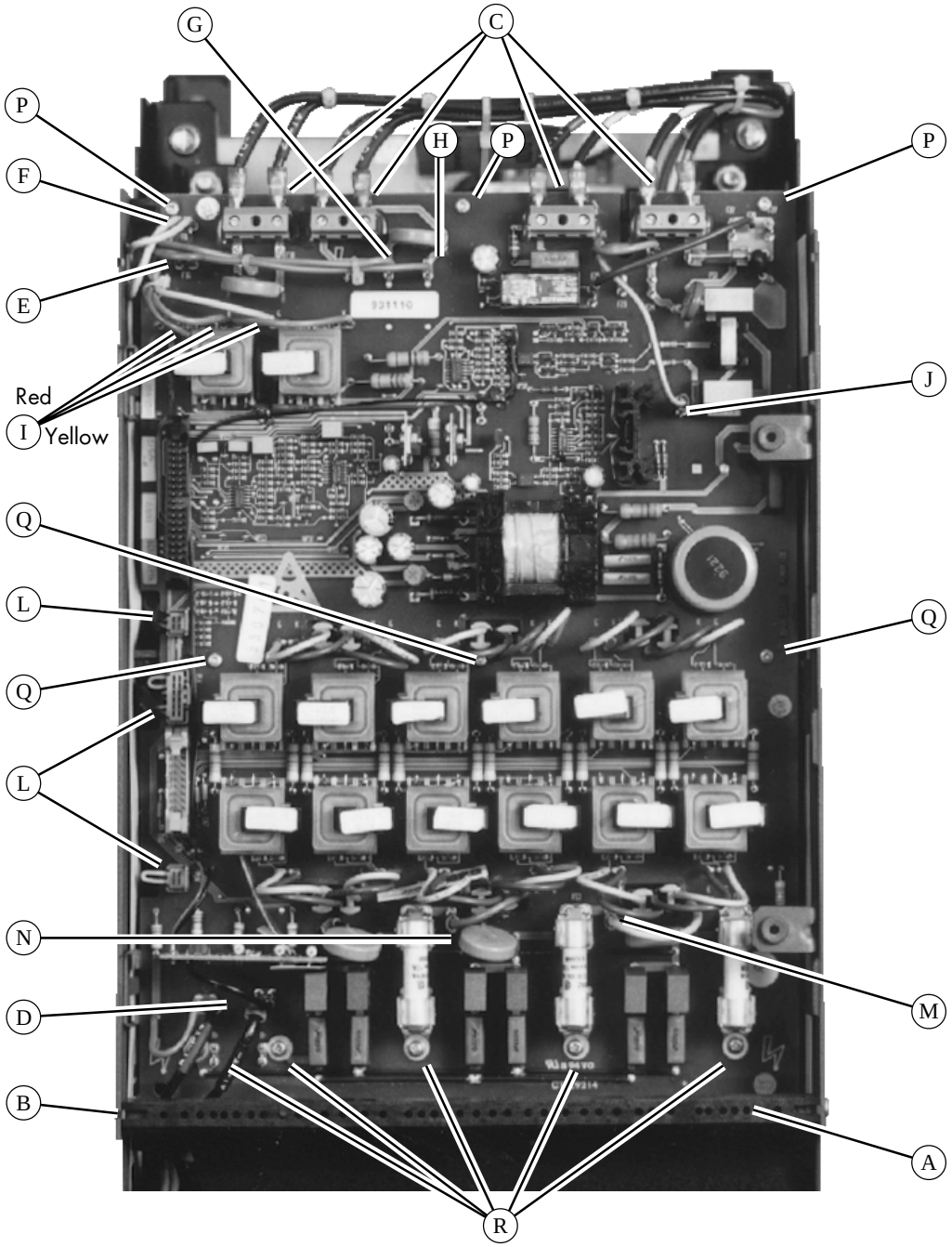


Figure 7.9 - Inside View of 590 Controller

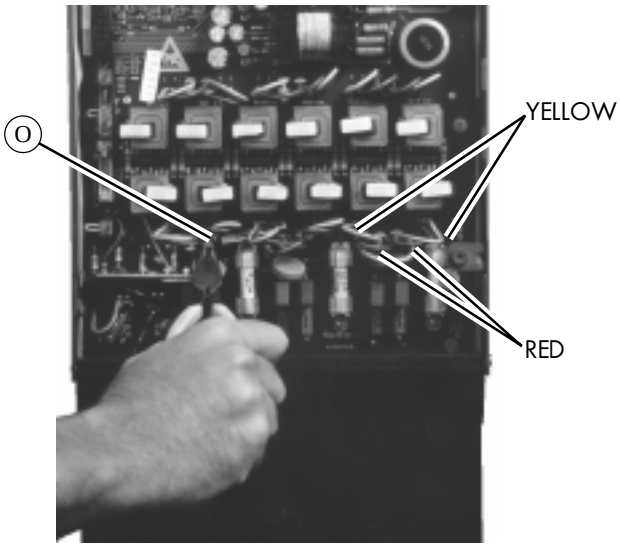


Figure 7.10 - Gate Lead Guides

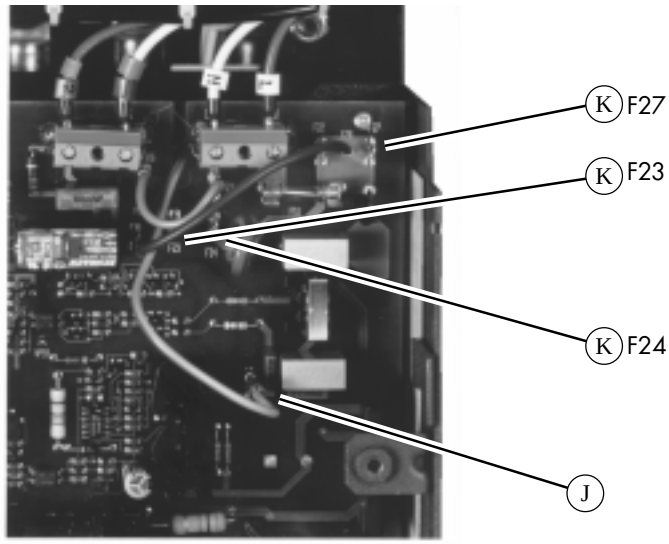


Figure 7.11 - Fan and Ground Connections

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 4 mm 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.

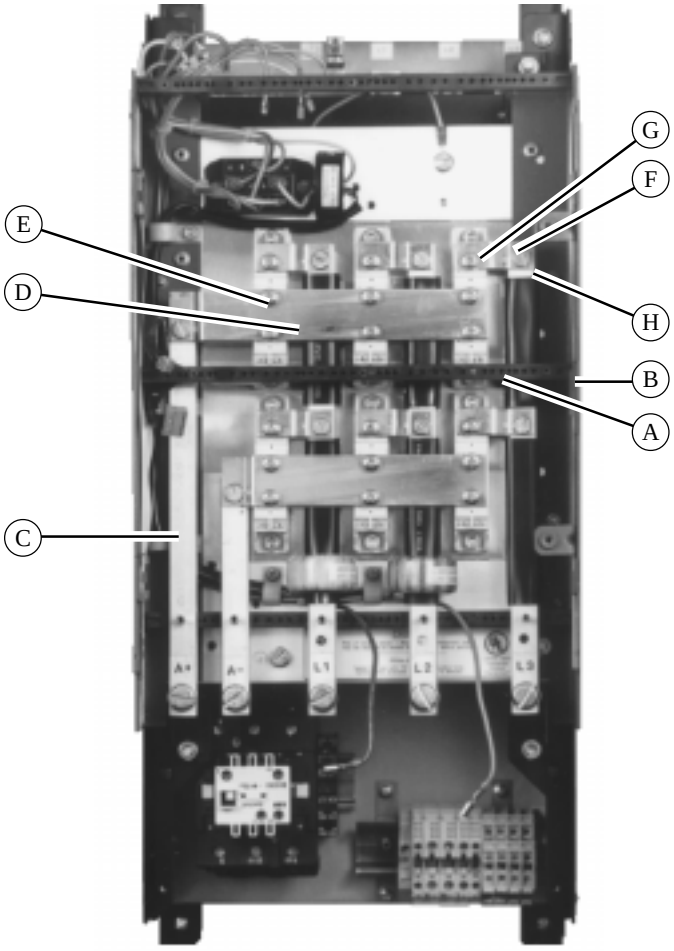


Figure 7.12 - Power Supply Board Removed

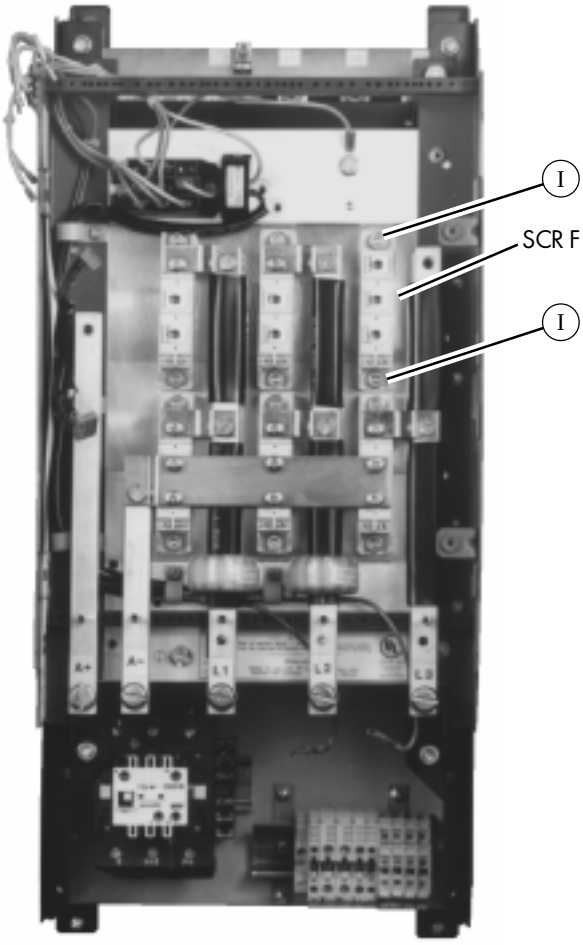


Figure 7.13 - SCR Bussing Removed for SCR F

Appendix A TECHNICAL DESCRIPTION

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

CONTROL CIRCUITS

A 16-bit microprocessor performs the majority of the control functions in the 590 DRV *LINK* digital drive. External *LINK* digital and analog input/output and processor modules communicate directly with the drive microprocessor over a fiber optic network to provide signal interfacing and input/output data scaling.

> NOTE. Other than the hardwired, low volt signal inputs ENABLE, THERMISTOR, PROGRAM and COAST STOP and the ARMATURE CURRENT output, all input and output control and communication with the drive is performed exclusively over the Eurotherm *LINK* fiber optic control network.

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
- Speed and Current loop signal processing and setpoint summing and scaling.

POWER CIRCUITS

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

Each type of bridge includes suppression to limit the rise of volts across the thyristor. This reduces the risk of false triggering and keeps the applied voltage from exceeding the thyristor rating. The four quad bridge models provide regenerative capability and reverse speed and torque operation.

The armature thyristor bridge is protected by semiconductor fuses mounted in the power chassis. The controller also has electronic protection at 200 percent of full load current for 10 seconds, and 150 percent for 30 seconds.

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. A "fly-wheel" diode dissipates the motor field energy on stopping..

OVERVIEW OF FEATURES

Control Circuits	Fully isolated from power supply	
Control Action	Fully Digital Software configurable and distributive process controlled over fiber optic network 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 Field regulation and weakening	
Speed Control	5701 plastic Microtach fiber optic encoder feedback option 5901 glass Microtach fiber optic encoder feedback option Wire-ended electrical encoder feedback option Analog tachometer generator fitted option Armature feedback with IR compensation (default shipped)	
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

Encoder Resolution	Maximum Microtach frequency 50 kHz Maximum encoder frequency 100 kHz Frequency (Hz) = Encoder Lines per Revolution × RPM ÷ 60
Adjustments	All adjustments performed with software, either by on-board push buttons and liquid crystal display (Man Machine Interface) or through SAM or ConfigEd software over fiber optic network.
Calibration	Drive speed and current loops normalized to motor ratings through voltage and current switch settings on the switch selectable calibration board or optional resistor calibration board. 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 Analog tachometer speed feedback scaled through switch setable calibration board with direct-read slide switches, or through resistor calibration board, if used. Drive software fine tunes and scales other types of speed feedback.
Protection	All models require external branch circuit protection High speed thyristor semiconductor fuses DC output fuse (regenerative models only) DC loop contactor N/C DB pole standard up to 300 HP dV/dT protection (snubbers) High energy MOVs Overcurrent (instantaneous) Overcurrent (inverse time— adjustable) Field failure detection Field overcurrent (current regulator mode) Speed feedback alarm failure Motor overvoltage alarm failure Motor overspeed alarm failure Motor over temperature SCR over temperature (force-ventilated units only) SCR gate trigger failure Motor stall detection Zero speed detection Standstill "zero speed deadband" logic
Diagnostics	Fully computerized with first fault latch and automatic display Digital LCD monitoring through Man Machine Interface (MMI) Full diagnostic information available through MMI and over *LINK* fiber optic network through SAM software LED status indication

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 × 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 × 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 ± 0.01 @ 10mA maximum –10 VDC ± 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)

CONTROLLER OUTPUT RATINGS

This table lists the output ratings at maximum ambient temperature for 590 *LINK* DRV controllers 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	400
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 Contoller Output Ratings

FIBER OPTIC TRANSMISSION DISTANCES

SWITCH POSITION	TRANSMISSION POWER	TRANSMISSION RANGE
Middle	Low	0 to 20 m (0 to 65 ft.)
Left	Medium	21 to 40 m (68 to 131 ft.)
Right	High	41 to 60 m (134 to 196 ft.)

Figure A.2 - Fiber Optic Transmission Distances

DC SUPPLY LOADING

The following list shows the DC loading of Eurotherm Drives products. Ensure that the loading does not exceed the +24 VDC supply rating. Add an auxiliary power supply if the demand exceeds the output capacity.

5701 Plastic Microtach encoder/receiver option board	1.8 VA or 75 mA
Wire-ended electrical encoder and receiver option board	1.8 VA or 75 mA
5702/1 Microtach repeater	1.2 VA or 50 mA
5702/2 Microtach terminal rail repeater	1.2 VA or 50 mA
5702/3 Microtach to fiber optic converter	1.2 VA or 50 mA
5702/5 Microtach splitter	1.8 VA or 75 mA
5702/6 Microtach marker pulse repeater	1.2 VA or 50 mA
ALL *LINK* processor and analog and digital I/O modules:	
L5201-2-02-013 analog I/O	4 VA or 167 mA
L5202-2-01-013 digital I/O	4 VA or 167 mA
L5207-2-00-013 processor	4 VA or 167 mA
L5209-2-02-013 digital input	4 VA or 167 mA
LINK fiber optic repeater L5206	1.4 VA or 63 mA

Sample configuration	5901 Microtach encoder/receiver option board	1.8 VA or 75 mA
	5702/1 Microtach repeater	1.2 VA or 50 mA
	L5201-2-02-013 analog I/O	4 VA or 167 mA
	L5209-2-02-013 digital input	4 VA or 167 mA
	L5207-2-00-013 processor	4 VA or 167 mA
	Total	15 VA or 626 mA

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			
Ventilation	590 and 591	80 Hp	100 m³/hr	59 cfm
	590 and 591	100 Hp	300 m³/hr	177 cfm
	592 and 593	150 Hp	350 m³/hr	206 cfm
	594 and 595	250 Hp	490 m³/hr	288 cfm
	596 and 597	400 Hp	1000 m³/hr	589 cfm
Access	Hinge-down cover for MMI keypad and LED display Hinge-up cover for control circuit terminals and optional modules Hinge-out cover for controller circuitry Hinge-down controller module, allowing access to SCR fuses.			

Dimensions — Dimensions vary for different frame sizes. Refer to the outline drawings in Figures 3.15 through 3.22 at the end of Chapter 3.

SOFTWARE BLOCK DIAGRAM

Refer to the diagrams on the inside front cover of this manual for the 590 DRV *LINK* drive slot connections. Appendix C presents a block-by-block discussion of the software block diagram and includes a detailed block diagram at the end of the appendix. *LINK* slot numbers and their associated parameters are listed in Appendices D and E.

TERMINAL LISTING

The controller terminals are summarized below. A more detailed description and the ratings of each terminal follows this listing.

Number	Name	Purpose
A1	0v	Signal commmon
A2	Thermistor input	Motor temperature sensor input
A3	0v/DC Tach input (-)	Signal common/Tach connection (-) with resistor calibration card AH058529U001
A4	DC Tach input (+)	Tach connection (+) with resistor calibration card AH058529U001
A5	Enable input	Drive enable input
A6	Current meter output	±10 VDC = ±200% current
A7	Program stop input	Controlled ramp stop
A8	Coast stop input	Coast stop
A9	+24v 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
FL1	External Field +	External field supply connection L1
FL2	External Field -	External field supply connection L2
G	Ground, supply	Ground connection for three phase supply
L1	Line 1	three phase supply, phase 1
L2	Line 2	three phase supply, phase 2
L3	Line 3	three phase supply, phase 3
A+	Armature +	Motor connection for armature, positive
A-	Armature -	Motor connection for armature, negative
DB+	Dynamic Brake +	Dynamic brake connection, positive
F+	Field +	Motor connection for field, positive
F-	Field -	Motor connection for field, negative
G	Ground, motor	Ground connection for motor ground
G	Ground, aux	Ground connection for 120 VAC supply
T1	Blower supply	AC blower starter output (if fitted)
T2	Blower supply	AC blower starter output (if fitted)
T3	Blower supply	AC blower starter output (if fitted)
L	120 VAC Line	Auxiliary 120 VAC supply output, line
N	120 VAC Neutral	Auxiliary 120 VAC supply output, neutral

Number	Name	Purpose
1	AM contact	Normally opened main contactor auxiliary contact
2	AM contact	Normally opened main contactor auxiliary contact
3	CB1 contact	Normally opened blower contactor auxiliary contact (if fitted)
4	CB1 contact	Normally opened blower contactor auxiliary contact (if fitted)

TERMINAL DESCRIPTIONS

Control Terminals

A1/0V (Signal)
Zero volt DC signal reference. Connection point for motor overtemperature series connection, if used.

A2/Thermistor
This terminal senses motor overtemperature. DC motors should have temperature-sensitive resistors or switches attached to protect against sustained thermal overloads. These sensors should be normally-closed type, and should open on overtemperature. Connect these sensors in series between terminals A1 and A2. The drive trips out on a THERMISTOR alarm if the resistance between A1 and A2 rises above 1.8K Ohms, ±200 Ohms. If the motor is fitted with a blower, connect an auxiliary contact from the blower motor starter in series with the sensors. Connect terminal A1 to A2 if overtemperature sensors are not used.

A3/0V (Signal)
Zero volt DC signal reference. Connection point for the ZERO VOLT REFERENCE for a DC analog tachometer generator signal (if using resistor calibration card AH058529U001).

A4/Analog Tachometer Generator Input
This terminal, with terminal A3, provides the connecting points for an analog DC tachometer generator when the resistor calibration card, AH058529U001, is used. Calibration of the tachometer generator feedback is performed with the MMI using the SETUP PARAMETERS, CALIBRATION, ANALOG TACH CAL parameter.

A5/Enable
This terminal is for the ENABLE input, which provides a means of inhibiting controller operation electronically. It is connected internally to an auxiliary normally-open contact on the DC contactor. If the enable input is at zero volts, all control loops will be inhibited and the controller will not function.

A6/Buffered Armature Current
This terminal provides an armature current reading for indication and diagnostic use. It is scaled to ±10VDC = ±200% full load scaled armature current.

Rating: ±10VDC at ±5 mA, short circuit protected; 5ms update rate.

A7/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. Breaking the +24 VDC connection causes a controlled (or program) stop as defined in the SETUP PARAMETERS::STOP RATES parameters.

NOTE. Disconnecting A7 on a non-regenerative drive while running causes the motor to coast to rest.

A8/Coast Stop
This terminal is for an uncontrolled, coast stop input. When held at +24 VDC, the drive operates normally. When shorted to zero volts or open circuited, the drive instantly inhibits the thyristors and interrupts current flow, then drops out the main contactor allowing the motor to coast to rest.

A9/+24 VDC Supply
This terminal is used to activate the ENABLE, PROGRAM STOP, and COAST STOP terminals, and power other +24 VDC devices.

Maximum output: 700mA.

NOTE. Ensure that the load on terminal A9 combined with the other +24 VDC loads does not exceed 700mA. See the Electrical Ratings information earlier in this appendix.

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. For larger drives, 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.

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.

F+, F-/Motor Field
These terminals provide the connection point for the motor field supply.

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/Three Phase Supply
These terminals and the associated ground terminal provide the connection for the three phase supply. The control transformer taps must be changed to match the 3-phase supply voltage.

1, 2/M Contact
These terminals connect to an auxiliary normally open contact on the main contactor.

3, 4/M Contact
These terminals connect to an auxiliary normally open contact on the motor blower circuit protector, if fitted. The contact should be wired in series with the motor over temperature device and tied to the drive terminal A2 (THERMISTOR) and A1 (0V).

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.

T1, T2, T3/ Motor Blower Supply
AC motor blower supply (optionally mounted).

A

FEEDBACK OPTION CARDS

The 590 DRV *LINK* 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^2)
Terminal Tightening Torque	5.3 lb-in (0.6 Nm)

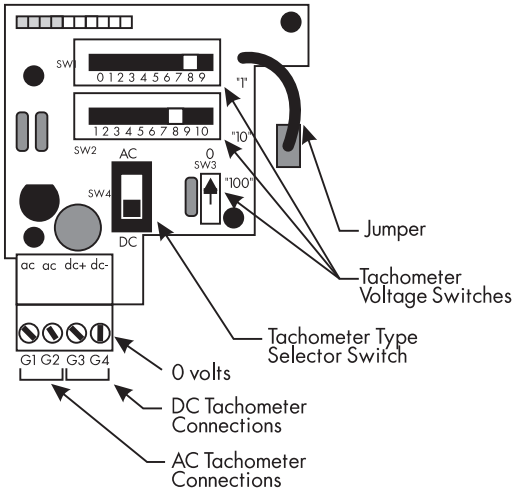


Figure A.3 - Switchable Analog Tachometer Feedback Card

Recommended Spare Parts

Keep only one tachometer generator feedback card as a spare.

Installation Information

Figure A.4 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:

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

   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.

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.

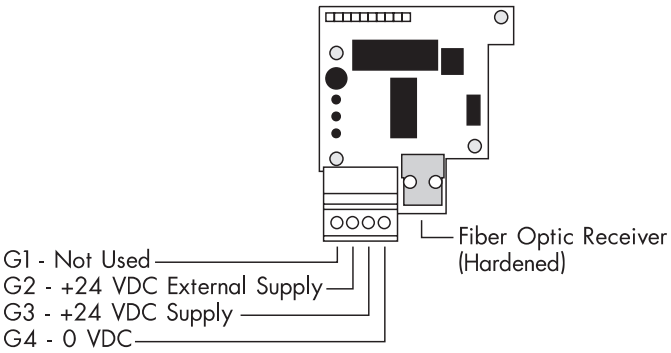


Figure A.4 - 5701 Microtach Receiver Card

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^2)
Terminal Tightening Torque	5.3 lb-in (0.6 Nm)

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.)
5702/1	Plastic fiber optic microtach repeater (NEMA 1)
5702/2	Plastic fiber optic microtach repeater (DIN rail mount)

5701 Installation Information

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.6) if the controller +24 VDC supply is at capacity and unable to provide sufficient power.

Figure A.5 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.

Caution

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

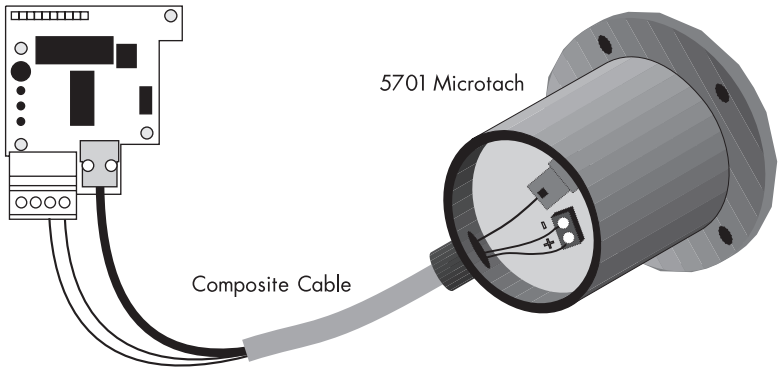


Figure A.5 - Connecting a 5701 Microtach to the 5701 Microtach Receiver Card

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:

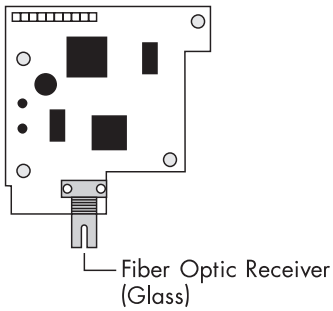


Figure A.6 - 5901 Microtach Receiver Card

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^2)
Terminal Tightening Torque	5.3 pound-inches (0.6 Nm)

Recommended 5901 Microtach Spare Parts		
Quantity	**Part Number**	**Description**
1	AH386025U001	Plastic fiber optic microtach receiver board
12	CI352599	Composite plastic fiber optic cable (50 meters, 164 ft.)
12	CI352673	Plastic fiber optic T&B termination plug - red
12	CI352674	Plastic fiber optic cable cutter
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 enoder

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.)

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

5901 Installation Information

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.

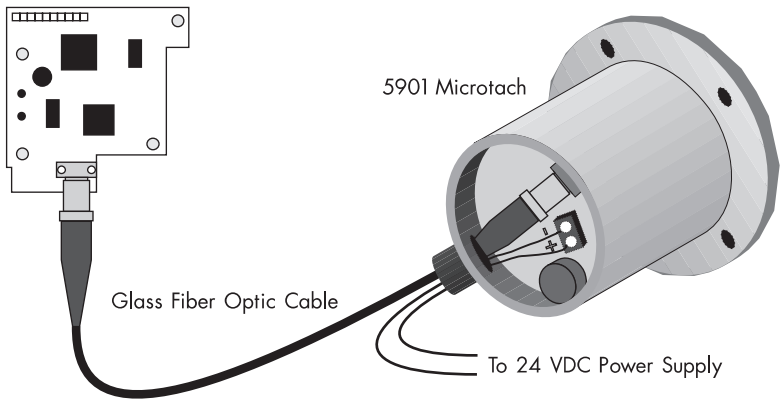


Figure A.7 - Connecting a 5901 Microtach to the 5901 Microtach Receiver Card

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.

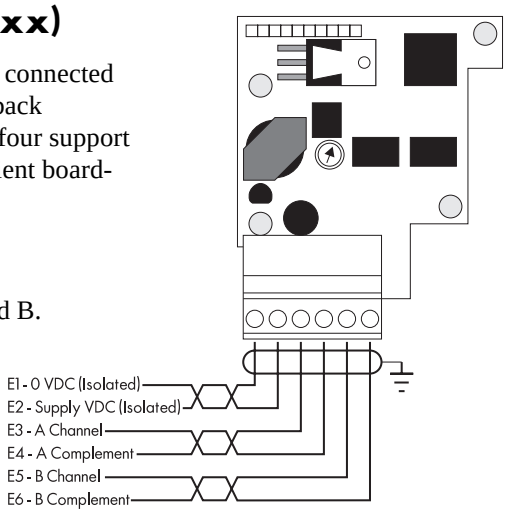


Figure A.8 - Wire-ended Encoder Receiver Card

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

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.7.
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.7.
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 (MMI)

DEFINITION & SCOPE

The Man Machine Interface (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. The keypad allows the user to scroll through the various menus and view or modify parameters.

Customers may use a personal computer (PC) running the software package ConfigEd to change drive parameters or use the SAM feature of ConfigEd to monitor drive signals. However, the MMI offers the user a quick and easy method of adjusting drive parameters, tuning the drive, diagnosing faults and monitoring drive operation without using a PC.

> NOTE. The MMI displays drive alarms, diagnostic values and allows you to alter drive parameter settings. You cannot use the MMI to configure signals to and from the drive over the *LINK* network. Refer to the *LINK* ConfigEd manual (RG353321) and the *LINK* Overview manual (HA350678A) for instructions on configuring logic and value signals to and from the drive.

USING THE MMI

Access and Adjustment

The MMI is located under a hinged cover at the top of the 590 controller (see Figure 2.3). 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 6.19). 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.

MMI MENU STRUCTURE

The MMI menu is structured as a nested tree and has been designed for users to easily read and set drive parameters.

The main level of the menu system is MENU LEVEL which contains nine main control menus of the MMI. The following list briefly 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 performance or status of the controller. Parameters may be monitored but not changed in this menu. (See Chapter 6, Troubleshooting.)
Setup Parameters	Parameters for calibrating and tuning the controller for a specific application. (See Appendix C, *LINK* Software Block Diagrams.)
Password	Allows the user to set password protection for the drive configuration. (See Chapter 5, Start-up and Adjustment.)
Alarm Status	Contains parameters for monitoring the fault status of the controller. (See Chapter 6, Troubleshooting.)
LINK Support	Contains *LINK* network configuration information. (Refer to the discussion on PARAMETERS in Appendix C.)
Menus	Settings for adjusting the MMI user interface. (See below.)
Parameter Save	Menus for saving the current configuration and settings to EEPROM. (See Chapter 4, The *LINK* Interface)
Network Access	Reserved for *LINK* system configuration parameters external to the drive to be displayed in the MMI. (Refer to Appendix C.)
System	Displays the software issue level. Also contains menus reserved for advanced drive troubleshooting and are available only in a restricted password mode. Only qualified Eurotherm Drives personnel have access to these menus.

Figure B.1 shows the complete MMI menu structure. The complete menu tree is often not needed for most applications. To simplify your work with the MMI, you can reduce the menu tree size 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.

The parameter MENU DELAY in MENUS sets the delay, or response time of the LCD when any pushbuttons is pressed. The default is set to 30 and can also be adjusted with the MENU SPEED parameter in ConfigEd under the PARAMETERS software block. A higher value increases the menu delay time. The setting is unavailable in SAM.

Enter MENU LEVEL by pressing the M key from the default start up display. Scroll through the menus within the main level by pressing the ▲ or ▼ key. Press the M key again to enter any of the menus within the main MENU LEVEL.

Upon scrolling to the desired 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, or select another sub-menu. 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, MENU LEVEL.

> 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 (4-BUTTON RESET)

All 590 DRV *LINK* drives are shipped with a common set of default parameter settings designed for standard speed control of a DC motor. These default settings are listed in Appendecies C, D, E and F. They are stored in the drive's EPROM, a memory location inaccessible to the user. As such, you can reload, but cannot alter the default settings.

If necessary, you can reload default settings by performing a 4-button reset. A 4-button reset is useful when you have incorrectly changed many parameter settings and wish to quickly reload default settings rather than individually change each parameter back to its original value.

To reset the drive's parameters, hold down all four MMI buttons (M, E, ▲, ▼) while reapplying control power. This downloads the default settings from the drive's EPROM memory to the drive's operating memory location (RAM). Any parameter values previously saved in EEPROM using PARAMETER SAVE remain unchanged.

NOTE. The default settings overwrite the EEPROM settings only when performing a PARAMETER SAVE subsequent to a 4-button reset.

Caution

Be certain to save the default drive parameters to EEPROM with PARAMETER SAVE *immediately after* performing a 4-button reset. Otherwise, any incorrect parameters settings will reload to RAM when control power is cycled.

Refer to Chapter 4 for details on saving parameters, drive memory locations and documenting configurations.

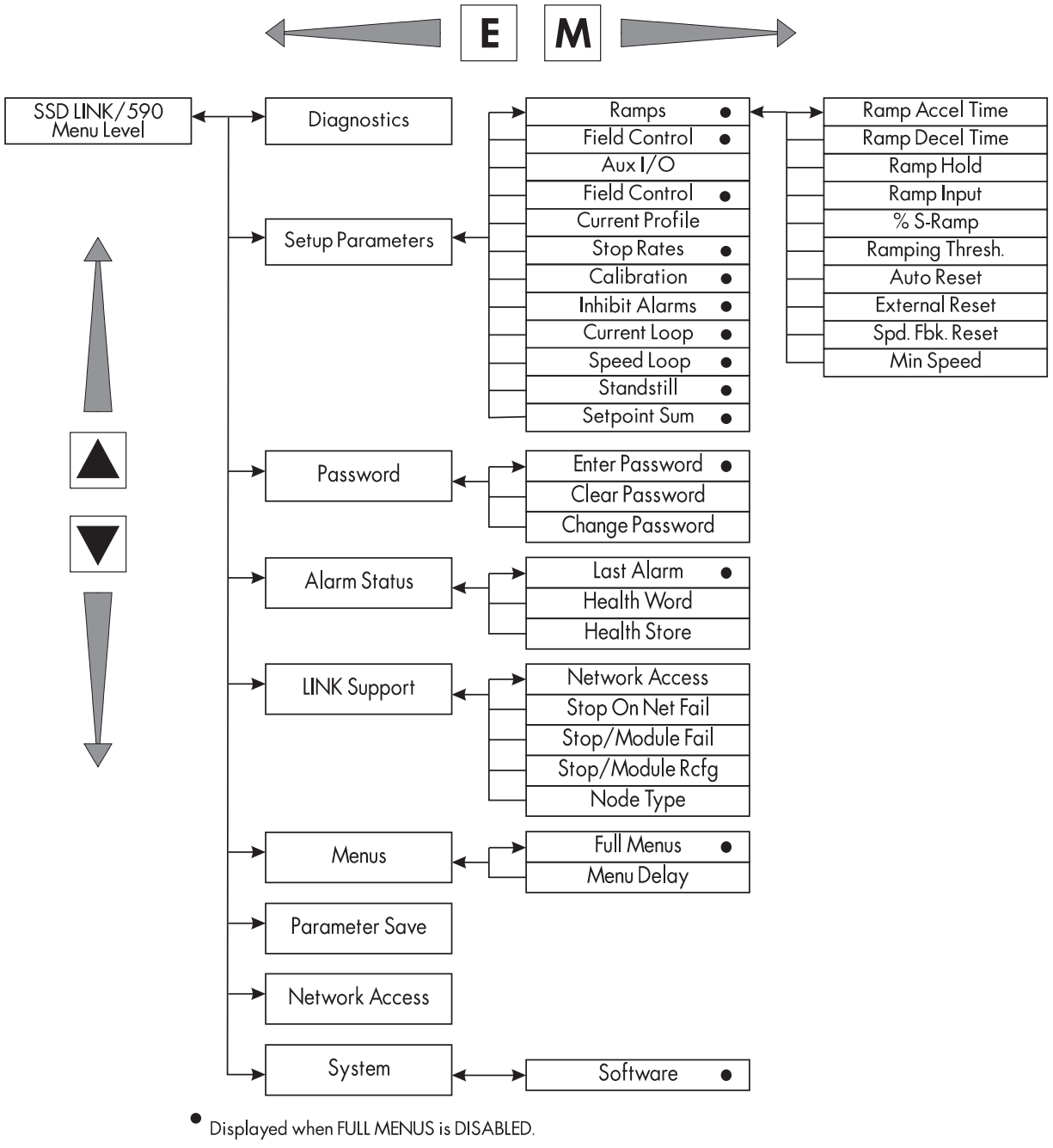


Figure B.1 - Basic Menu Tree

Appendix C *LINK* SOFTWARE BLOCK DIAGRAMS

The 590 *LINK* DRV drive parameters are organized in the ConfigEd software block diagram into 14 software blocks. Each software block is dedicated to a specific aspect of drive control. The sections in this appendix discuss each of the 14 software blocks and includes a block diagram showing each software block's I/O slots and their corresponding MMI parameters. The description of each block also contain illustrations, demonstrating the steps required to access the parameter through the MMI, and tables, describing each parameter and its MMI equivalent. Where relevant, a section will include timing diagrams.

The fold out drawing at the end of this appendix shows the drive's complete ConfigEd software block diagram. A diagram of the MMI menu tree appears in Appendix B and a complete parameter listing, sorted alphabetically, appears in Appendix D (grouped by MMI menu) and Appendix E (arranged by ConfigEd software block title).

Parameters in the software block diagram of the 590 *LINK* DRV are grouped by control function, whereas the MMI menu structure is organized on the basis of keypad function with each menu dedicated to a different MMI function. In most cases, the ConfigEd software blocks have an MMI menu or sub-menu equivalent. For instance, the ConfigEd software block RAMPS corresponds directly to the MMI sub-menu SETUP PARAMETER:: RAMPS.

NOTE. Some drive parameters can be set only through ConfigEd, and cannot be accessed through the MMI, or through SAM.

NOTE. For clarity, all references to MMI parameters, menus or sub-menus appear in this manual in capitalized TIMES NEW ROMAN type. Any reference to a function, feature or parameter associated with or accessible through ConfigEd or SAM appears in this manual in capitalized COURIER type.

This list shows the *LINK* software block equivalent of each MMI menu or sub-menu.

	ConfigEd Software Block	**MMI Menu or Sub-menu**
	LINK outputs of *all* software blocks	DIAGNOSTICS
	CLAMPS	(under SETUP PARAMETERS:: CURRENT LOOP)
	CURRENT LOOP	SETUP PARAMETERS:: CURRENT LOOP
	none (within CURRENT LOOP)	SETUP PARAMETERS:: CURRENT PROFILE
*	none (within CURRENT LOOP)	SETUP PARAMETERS:: INVERSE TIME
	none	SETUP PARAMETERS:: AUX I/O
	EXTERNAL ENABLES	(under SETUP PARAMETERS:: CURRENT LOOP)
	FEEDBACK	SETUP PARAMETERS:: CALIBRATION
	FIELD	SETUP PARAMETERS:: FIELD CONTROL
	HEALTH	ALARM STATUS
	HEALTH	SETUP PARAMETERS:: INHIBIT ALARMS
	NETWORK ACCESS	NETWORK ACCESS
	PARAMETERS	*LINK* SUPPORT
	PARAMETERS	MENUS
	PARAMETERS (EEPROM parameter save)	PARAMETER SAVE
*	PEEK	SYSTEM:: PEEK
	RAMPS	SETUP PARAMETERS:: RAMPS
	SPEED LOOP	SETUP PARAMETERS:: SPEED LOOP
	STANDSTILL	SETUP PARAMETERS:: STANDSTILL
	START-STOP	SETUP PARAMETERS:: STOP RATES
	SUMMING	SETUP PARAMETERS:: SETPOINT SUM
	none	PASSWORD

* These functions appear in the restricted password mode only.

CLAMPS

NOTE. The CLAMPS software block parameters are located in the CURRENT LOOP MMI sub-menu.

The CLAMPS software block limits the positive and negative current demand of CURRENT LOOP.

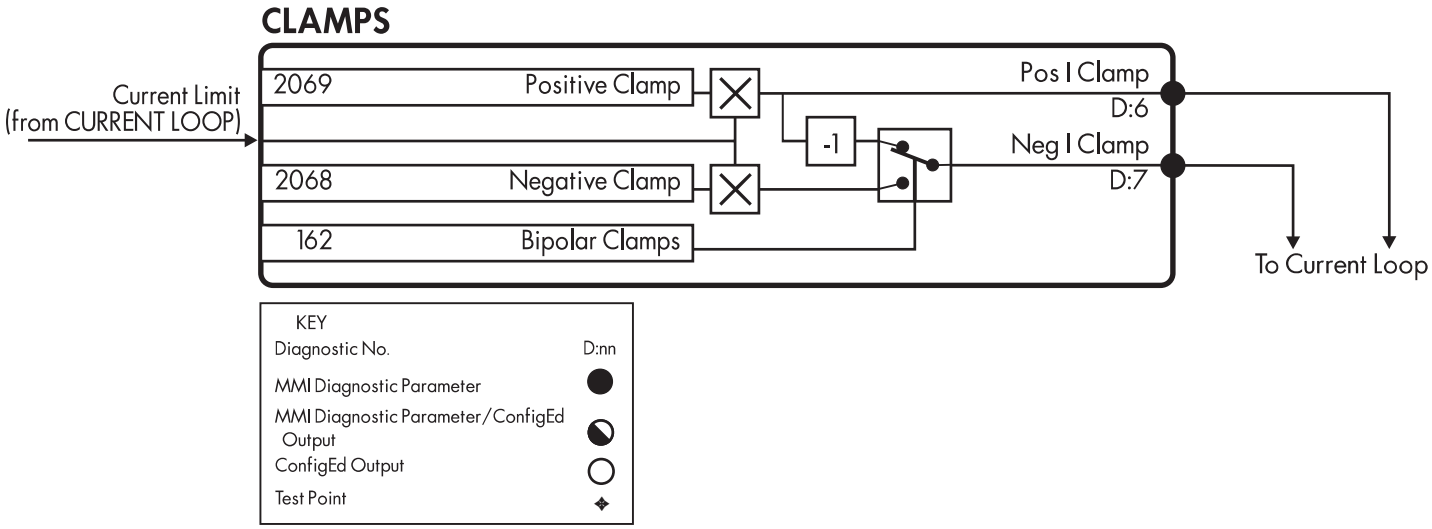


Figure C.1 - CLAMPS Software Block

CURRENT LIMIT (from CURRENT LOOP) symmetrically scales the positive and negative clamp parameters. By default, BIPOLAR CLAMPS is DISABLED and the clamps are symmetrical. Only POSITIVE CLAMP sets the clamp limits. When BIPOLAR CLAMPS is ENABLED, the clamps are asymmetrical so that POSITIVE CLAMP sets the maximum positive current demand and NEGATIVE CLAMP sets the maximum negative current demand.

Caution

Always set POSITIVE CLAMP algebraically higher than NEGATIVE CLAMP. Otherwise, NEGATIVE CLAMP can be inadvertently set to a positive value which can cause a runaway condition.

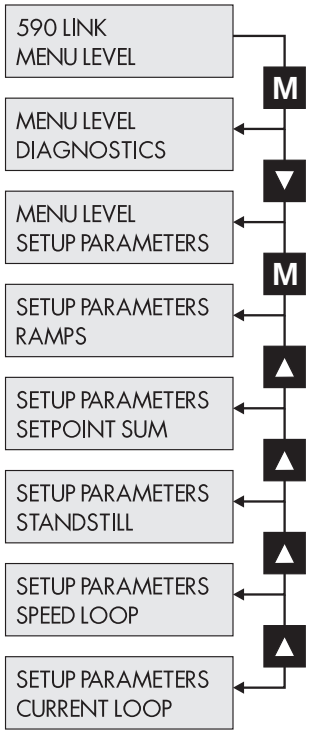
CLAMPS acts independently of the other drive current limit parameters. A lower current limit parameter value will override a CLAMPS setting.

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
2069	POSITIVE CLAMP	Positive current clamp when BIPOLAR CLAMPS is ENABLED. Clamps both the positive and negative current demand when BIPOLAR CLAMPS is DISABLED.	±100.00%	±100.00%	100.00%
2068	NEGATIVE CLAMP	Negative current clamp when BIPOLAR CLAMPS is ENABLED. Has no affect when BIPOLAR CLAMPS is DISABLED.	±100.00%	±100.00%	-100.00%
162	BIPOLAR CLAMPS	Selects between bipolar and unipolar clamps. DISABLED: POSITIVE CLAMP symmetrically clamps current demand. ENABLED: POSITIVE CLAMP & NEGATIVE CLAMP work independently.	ENABLED/DISABLED	1=ENABLED 0=DISABLED	DISABLED

CURRENT LOOP

The CURRENT LOOP software block calculates the signal that produces the firing phase angle for the drive's thyristors. The current demand is supplied from either the SPEED LOOP software block in speed control applications or, externally, for direct torque control of the motor. Four different clamps limit the current demand: positive and negative clamps, current profile and inverse time overload.



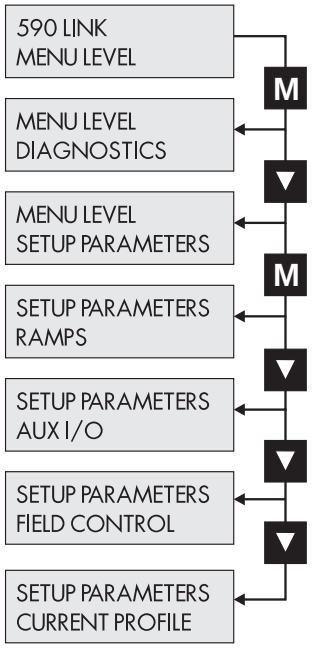
Inputs and Outputs

The inputs are:

- SPEED LOOP OUTPUT from SPEED LOOP;
- current feedback sensed from the AC current transformer;
- the positive and negative current limit clamps from the CLAMPS;
- AUX CURRENT DEMAND for adding in an auxiliary current demand;
- QUENCH, an enable/disable input; and
- EXTERNAL CURRENT DEMAND, which allows the user to provide a direct current demand for torque control.

The main output is the motor ARMATURE CURRENT. It can be monitored as an analog voltage on control board terminal A6. Terminal A6 is usually reserved for a meter display. Armature current is also available as a test point (see Figure 6.19). ARMATURE CURRENT can be either unipolar or bipolar depending on the setting of IA UNI-BIPOLAR. In general, this parameter is set to bipolar for regenerative drives and unipolar for nonregenerative models. GLOBAL QUENCH indicates whether the current loop is enabled and producing armature current.

Description



When running in armature voltage feedback, the drive uses the motor back EMF as speed feedback. Back EMF equals armature volts minus armature current losses. The amount of armature current loss compensation is set by IR COMPENSATION.

EXTERNAL ENABLES supplies the input current demand to CURRENT LOOP. The default signal is for speed control and SPEED LOOP OUTPUT is supplied. For current control, set CURRENT DEMAND ENABLE to TRUE and connect the current demand directly to EXTERNAL CURRENT DEMAND.

> NOTE. The SAM parameter and MMI diagnostic CURRENT DEMAND corresponds to the *LINK* input EXTERNAL CURRENT DEMAND when CURRENT DEMAND ENABLE is TRUE, and corresponds to SPEED LOOP OUTPUT when CURRENT DEMAND ENABLE is FALSE.

AUX CURRENT DEMAND is available for adding a current trim signal.

Four separate clamps — current profile, positive clamp, negative clamp, and inverse time overload — limit the current demand. They function independently. The lowest setting clamps the current demand during normal control.

> NOTE. During a program stop, PROGRAM STOP I LIMIT overrides *all* current limit settings.

CURRENT LIMIT symmetrically scales the parameters POSITIVE CLAMP and NEGATIVE CLAMP. Both POSITIVE CLAMP and NEGATIVE CLAMP are located in the CLAMPS software block.

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.

> NOTE. The MMI has a dedicated sub-menu, SETUP PARAMETERS:: CURRENT PROFILE for the current profiling parameters.

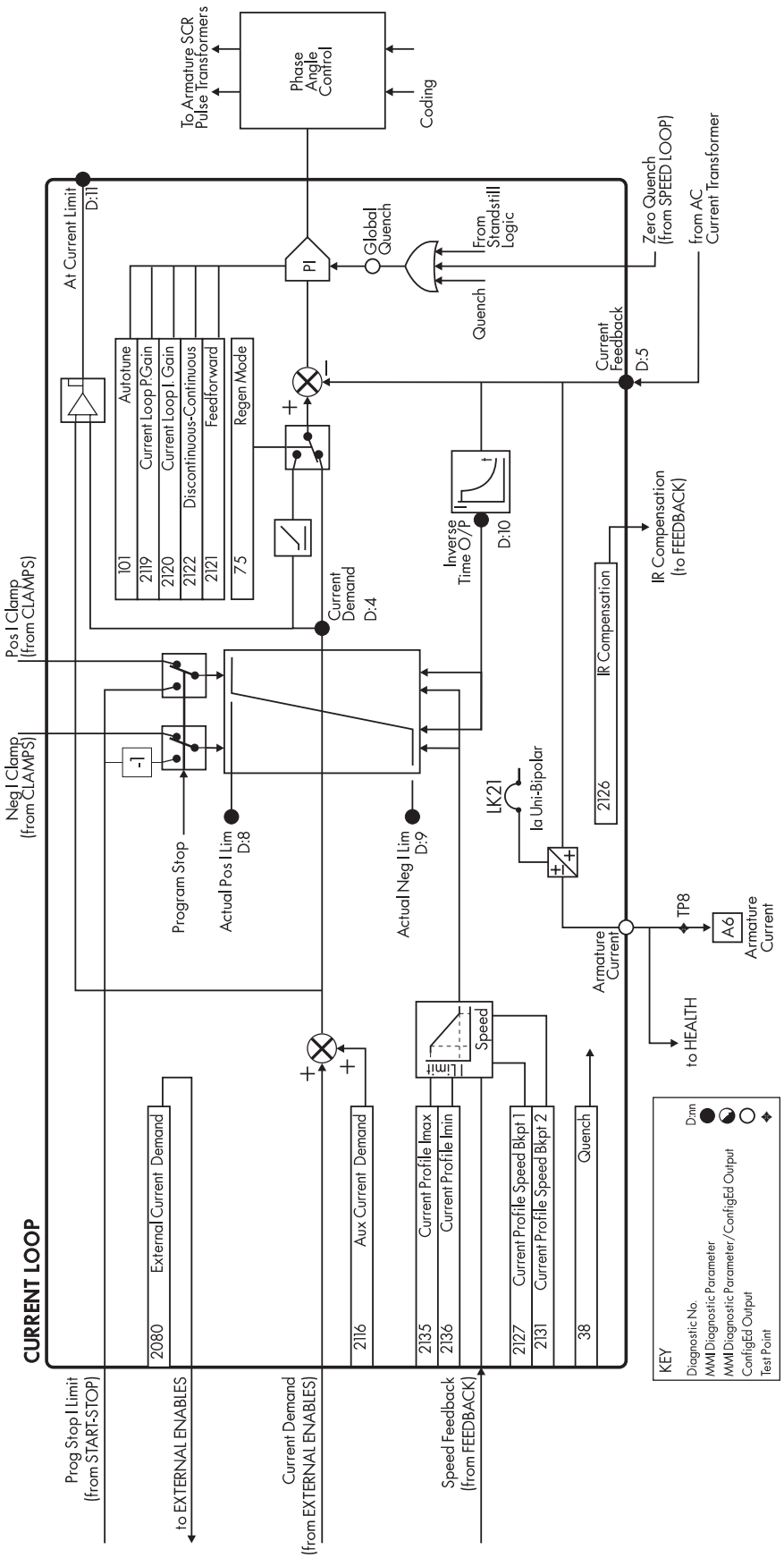


Figure C.2 - CURRENT LOOP Software Block

INVERSE TIME sets a time dependent threshold for overload current capability. The drive can produce current over this amount based on an inverse time curve. If set for 110%, the drive can produce 200% full load current for 10 seconds, drop to 150% for 60 seconds, then diminish to 110% rated current. The drive will then run at 110% full load current indefinitely.

Caution

Setting INVERSE TIME beyond its default setting of 110% can cause motor and equipment damage and possible injury to personnel. Do not change this parameter without first consulting with the Eurotherm Drives service department.

REGEN MODE changes a regenerative drive to non-regenerative (2-quad mode) control by disabling the reverse thyristor bridge. This prevents regenerative drive operation and the ability to run the motor in reverse.

The AUTOTUNE function automatically tunes the current loop to a specific motor for optimum response. It sets the PROPORTIONAL GAIN, INTEGRAL GAIN and DISCONTINUOUS parameters (refer to the AUTOTUNE procedure in Chapter 4).

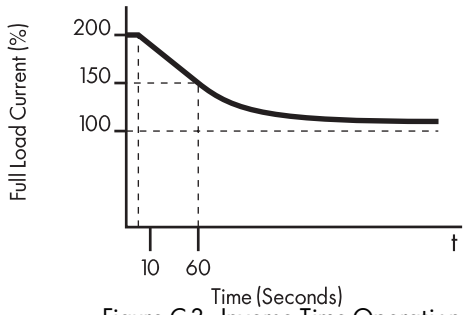


Figure C.3 - Inverse Time Operation

Four current profiling parameters allow the user to customize the current demand over a defined speed range. When SPEED FEEDBACK exceeds CURRENT PROFILE SPEED BKPT 1, the current profile begins scaling the current demand as set by CURRENT PROFILE I MAX. As SPEED FEEDBACK increases toward CURRENT PROFILE SPEED BKPT 2, the current demand drops to CURRENT PROFILE I MIN. The current demand remains at this point if speed exceeds CURRENT PROFILE SPEED BKPT 2.

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
101	AUTOTUNE	Toggles the AUTOTUNE procedure on and off.	ON/OFF	1=ON, 0=OFF	OFF
2116	AUX CURRENT DEMAND	Additional current demand input. Corresponds to the ADDITIONAL DEM in the MMI.	±200.00%	±100.00%	0.00%
2081	CURRENT LIMIT	Symmetrically limits the current demand.	0.00 to 200.00%	0.00 to 100.00%	100.00%
75	REGEN MODE	When disabled, sets the drive for non-regenerative, 2-quad mode operation.	ENABLED/DISABLED	1=ENABLED (regen) 0=DISABLED (non-regen)	ENABLED
2120	CURRENT LOOP I GAIN	Integral gain for armature current PI loop.	0.00 to 200.00	0.00 to 100.00%	3.50
2119	CURRENT LOOP P GAIN	Proportional gain for armature current PI loop.	0.00 to 200.00	0.00 to 100.00%	45.00
2135	CURRENT PROFILE I MAX	Current limit value at or below SPEED BKPT 1 IMAX BRK 1 (SPD1) in CURRENT PROFILE MMI sub-menu	0.00 to 200.00%	0 to 100.00%	200.00%
2136	CURRENT PROFILE I MIN	Current limit value between SPEED BKPT 1 and SPEED BKPT 2 (IMAX BRK 2 (SPD2) in CURRENT PROFILE MMI sub-menu).	0.00 to 200.00%	0 to 100.00%	200.00%
2127	CURRENT PROFILE SPEED BKPT 1	Speed breakpoint 1 where current profiling begins. SPD BRK 1 (LOW) in CURRENT PROFILE MMI sub-menu.	0.00 to 100.00%	0 to 100.00%	100.00%
2131	CURRENT PROFILE SPEED BKPT 2	Speed breakpoint 2 where current profiling begins. SPD BRK 2 (HIGH) in CURRENT PROFILE MMI sub-menu.	0.00 to 100.00%	0 to 100.00%	100.00%
2122	DISCONTINUOUS-CONTINUOUS	Sets the boundary between the discontinuous and continuous regions of the current signal.	0.00 to 200.00%	0.00 to 100.00%	12.00%
# 2080	EXTERNAL CURRENT DEMAND	External current demand input. Enabled only when CURRENT DEMAND ENABLE input is TRUE.	±200.00%	±100.00%	0.00%

Input Parameters

	Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
*	2121	FEEDFORWARD	Feed forward term used for open loop current control. Indicates whether a successful AUTOTUNE has been performed. 2.00= no AUTOTUNE, 9.22 = drive has been AUTOTUNE-ed.	0.10 to 50.00	0.00 to 100.00%	2.00
	243	IA UNI-BIPOLAR	Changes CURRENT FEEDBACK output from bipolar to unipolar. Corresponds to MMI parameter ARMATURE I in CALIBRATION sub-menu.	Unipolar=OFF Bipolar=ON	1=ON (bipolar) 0=OFF (unipolar)	bipolar
*	2138	INVERSE TIME	Sets the amount of current the drive can produce indefinitely on a time-inverse overload current capability curve from 200% full load current.	±200.00%	±100.00%	+110.00%
	2126	IR COMP	Offsets the motor IR drop to improve speed regulation when running in armature voltage feedback. Locatedin the CALIBRATION sub-menu in the MMI.	0.00 to 100.00%	0 to 100.00%	0.00%
#	38	QUENCH	Resets the drive's speed and current loops to zero.	Quenched=current OFF Unquenched=current ON	1=quenched (OFF) 0=unuenched (ON)	enabled (unquenched)

These parameters cannot be changed through the MMI.

* MMI parameter available only in the password protected mode.

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	Diagnostic
GLOBAL QUENCH	AND-ed function output of ConfigEd QUENCH input A5, enable, drive healthy and MMI parameter AUX ENABLE.	Quenched=current OFF Unquenched=current ON	1=current OFF 0=current ON	DRIVE ENABLE
ARMATURE CURRENT	Drive armature current feedback.	±100% = ±200% Current Fbk if IA UNI-BIPOLAR set to bipolar; 0 to 100% = 0 to 200% Current Fbk if IA UNI-BIPOLAR set to unipolar.	±100.00% (bipolar) or 0 to 100% (unipolar)	CURRENT FEEDBACK

EXTERNAL ENABLES

EXTERNAL ENABLES has only one input, CURRENT DEMAND ENABLE, which switches the current demand input to CURRENT LOOP from SPEED LOOP OUTPUT to EXTERNAL CURRENT DEMAND. Set CURRENT DEMAND ENABLE to ENABLE to select EXTERNAL CURRENT DEMAND when running in torque control. Set it to DISABLE when running in speed control.

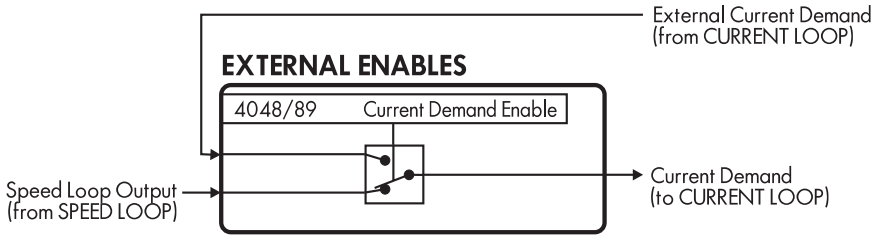


Figure C.4 - EXTERNAL ENABLES Software Block

NOTE. When the CURRENT DEMAND ENABLE slot is enabled, the drive tranfers control of Current Demand to the EXTERNAL CURRENT DEMAND input (slot 2080) only after the *LINK* network updates the data at slot 2080. Until then, the SPEED LOOP OUTPUT writes to the Current Demand.

C

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
89/4048	CURRENT DEMAND ENABLE	Switches the current demand of CURRENT LOOP from SPEED LOOP OUTPUT to EXTERNAL CURRENT DEMAND. Equivalent to I DMD. ISOLATE MMI sub-menu CURRENT LOOP.	external/internal	1=external (enable) 0=internal (disable)	internal

FEEDBACK

The FEEDBACK software block selects and calibrates the motor speed feedback. Refer to the Speed Calibration section

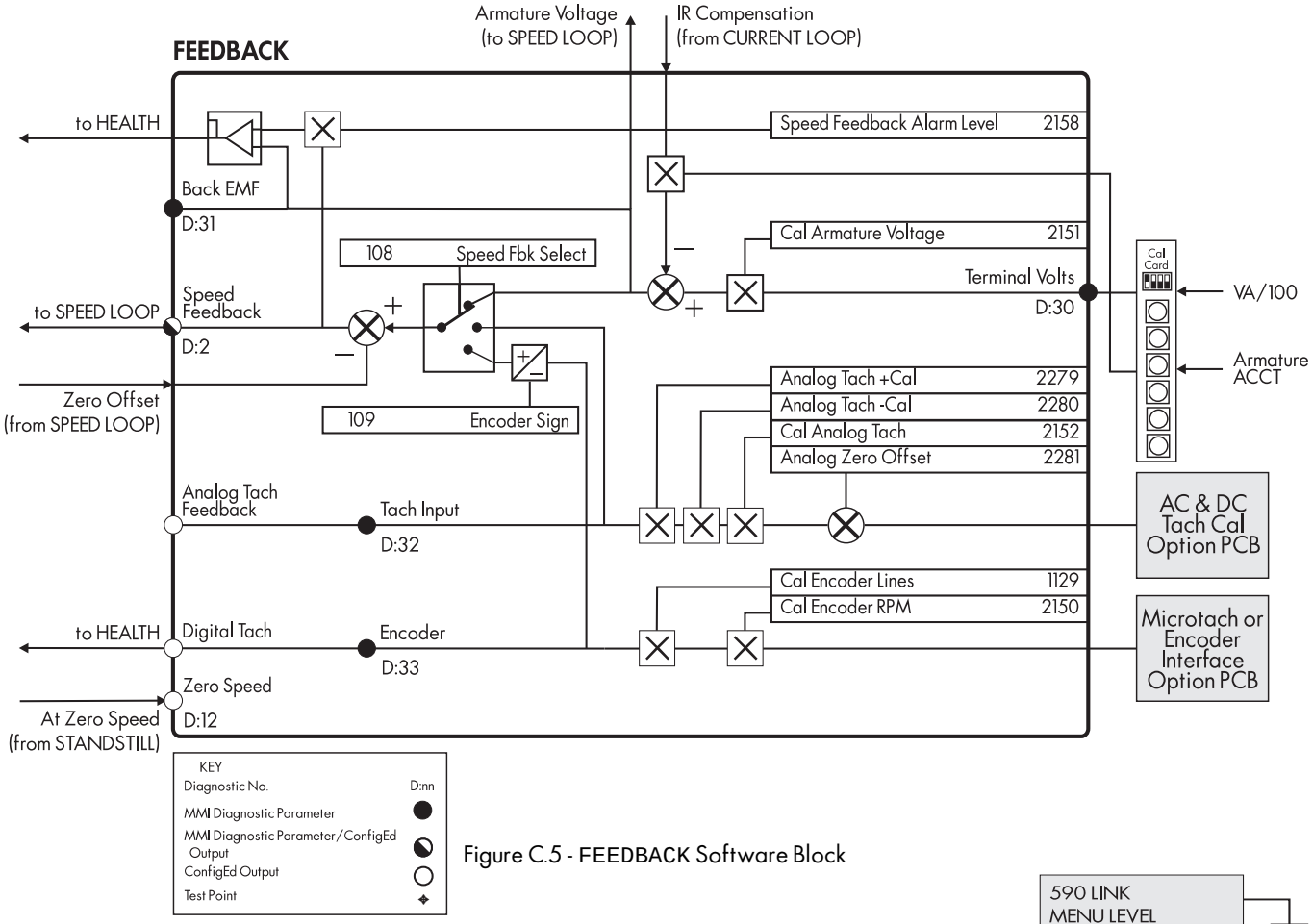
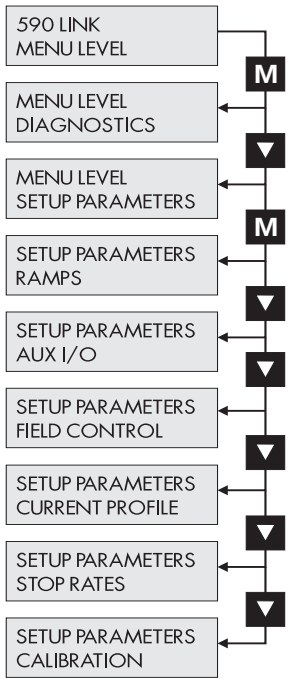


Figure C.5 - FEEDBACK Software Block

in Chapter 4 for instructions on adjusting these parameters.

NOTE. The FEEDBACK parameters can be found in the MMI under the SETUP PARAMETERS:: CALIBRATION sub-menu.



Description

SPEED FEEDBACK SELECT determines the speed feedback source. The default, ARMATURE VOLTAGE FEEDBACK, uses internal circuitry to derive speed feedback. Select ENCODER when using either a Microtach or a wire-ended electrical encoder for speed feedback. Select ANALOG TACH when using an AC or DC tachometer generator to measure motor speed.

CAL ANALOG TACH, ANALOG TACH +CAL, ANALOG TACH -CAL and ANALOG ZERO OFFSET calibrate analog AC and DC tachometer generators. ENCODER RPM and ENCODER LINES scale electrical encoders and Microtachs. CAL ARMATURE VOLTAGE tunes the armature volt calibration switch settings on the drive control board.

The feature ANALOG TACH AVERAGING averages the current tachometer generator signal with the previous average to generate a more stable feedback signal. When enabled, it improves steady state speed stability but may degrade dynamic speed response

of the drive. To enable this feature, you must use ConfigEd and download it to the drive with the INSTALL command. It can be set through the MMI in the restricted password mode. It cannot be set in SAM.

The drive compares the BACK EMF with the scaled SPEED FEEDBACK. If the scaled SPEED FEEDBACK is greater than the SPEED FEEDBACK ALARM LEVEL, the drive triggers a SPEED FEEDBACK ALARM.

Input Parameters

	Slot	Input Parameter	Description	MMI/SAM Range	*LINK* Range	Default
*	---	ANALOG TACH AVERAGING	Averages tach feedback signal to produce a more stable feedback signal.	ENABLE/DISABLE	---	DISABLED
	2279	ANALOG TACH +CAL	Scales the motor speed feedback curve for non-linearity at high forward speed.	0.9800 to 1.1000	89.00 to 100.00%	1.0000
	2280	ANALOG TACH -CAL	Scales the motor speed feedback curve for non-linearity at high reverse speed.	0.9800 to 1.1000	89.00 to 100.00%	1.0000
	2281	ANALOG ZERO OFFSET	Nulls out nonzero tachometer generator feedback voltage at zero speed.	±5.000%	±5.000%	0.2000%
	2152	CAL ANALOG TACH	Scales the motor speed to read 100% at the actual required speed.	0.9800 to 1.1000	89.00 to 100.00%	1.0000
	2151	CAL ARMATURE VOLTAGE	Scales the armature volts to read 100% at the base motor armature voltage. Fine tunes the armature voltage switch scaling.	0.9800 to 1.1000	89.00 to 100.00%	1.0000
	1129	CAL ENCODER LINES	Set to the encoder's lines per revolution.	10 to 5000 lines	0 to 5000 ordinal	1000 lines
	2150	CAL ENCODER RPM	Set to the motor's maximum speed. For use with electrical encoder or Microtach feedback.	0 to 6000 RPM	0 to 32,767 ordinal	1000 RPM
	109	ENCODER SIGN	Allows the speed feedback signal to be reversed. The MMI equivalent for this parameter is located in the SPEED LOOP sub-menu.	POSITIVE/NEGATIVE	1=POSITIVE 0=NEGATIVE	POSITIVE
	2158	SPEED FEEDBACK ALARM LEVEL	The threshold that the difference between speed feedback and back EMF voltage must exceed before the speed feedback alarm activates.	0.0 to 100.00%	0.00 to 100.00%	50.0%
	108	SPEED FEEDBACK SELECT	Selects the source of the speed feedback signal. The MMI equivalent for this parameter is located in the SPEED LOOP sub-menu.	0=ARM VOLTS FBK 1=ANALOG TACH 2=ENCODER	0 to 2 ordinal	ARM VOLTS FBK

* MMI parameter available only in the password protected mode.

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	MMI Diagnostic
ANALOG TACH FEEDBACK	Scaled analog tachometer generator feedback	±120.00%	±100.00%	TACH INPUT
DIGITAL SPEED FEEDBACK	Digital encoder feedback.	±6000 rpm	±100.00%	ENCODER
SPEED FEEDBACK	Scaled speed feedback.	±120%	±100.00%	SPEED FEEDBACK
ZERO SPEED	Logic signal indicating whether speed feedback is greater than the STANDSTILL THRESHOLD.	TRUE/FALSE	1/0	AT ZERO SPEED

FIELD

The 590 LINK DRV powers the motor field through a single phase,full-wave, half-controlled thyristor bridge circuit. The drive can control the motor field three ways:

1. open loop voltage control;
2. closed loop current control;
3. closed loop current control with motor field weakening (for extended speed range motors).

Main Field Control Parameters

FIELD ENABLE enables and disables the motor field thyristor circuitry. For most applications, the field circuitry is enabled and the 590 *LINK* DRV powers the motor field. Disable the field circuitry when the drive is controlling permanent magnet field motors or when the motor field is powered independently.

NOTE. The drive software prevents disabling the field with FIELD ENABLE while the drive is started.

Any alarm condition also immediately disables the field control circuity. Disabling the field automatically overrides the FIELD FAILURE alarm.

The controller can deliver reduced power to the motor field after the drive is stopped by setting FIELD QUENCH MODE to STANDBY. This reduces the firing signal to the field thyristor bridge by 50%. Use this feature to keep the motor warmed up while the drive is stopped. Setting this parameter to QUENCH disables the field control circuitry when the drive stops.

The FIELD QUENCH DELAY sets a delay-off time for the field control circuity. After the drive stops, the controller delivers full power to the field during the delay time, then drops to a reduced field power if FIELD QUENCH MODE is set to STANDBY, or to zero field power if set to QUENCH. Set FIELD QUENCH DELAY to a non-zero value to ensure that the motor can generate stopping torque in dynamic brake applications.

CAL FIELD CURRENT fine tunes the field current switch or resistor scaling on the drive calibration card.

NOTE. CAL FIELD CURRENT corresponds to FIELD I CAL in the SETUP PARAMETERS:: CALIBRATION sub-menu in the MMI.

Field Voltage Control

FIELD CONTROL MODE selects the field control mode between VOLTAGE and CURRENT control. The default selection is VOLTAGE control.

In VOLTAGE CONTROL mode, the drive provides open-loop phase angle control of the field. FIELD RATIO sets the DC field voltage as a ratio of the AC field supply. Divide the desired motor field voltage by the field AC supply voltage (RMS value) and multiply by 100 to correctly set FIELD RATIO. The chart below gives the settings required for common motor field voltages for different supplies.

NOTE. The maximum amount of DC voltage the field control thyristor bridge can generate is only 90% of the AC input RMS voltage:

$VDC_{FIELD} = VAC_{SUPPLY}$ x [FIELD RATIO], where $VAC_{SUPPLY} = V_{RMS}$
[$VDC_{MAX} = V_{RMS}$ x 0.90 if FIELD RATIO is set to 100%]

Field Current Control and Field Weakening

Setting FIELD CONTROL MODE to CURRENT CONTROL enables an internal field current PI control loop which accurately regulates the motor field current. The loop compares FIELD DEMAND— or the loop's setpoint— to the scaled FIELD CURRENT feedback signal. The FIELD DEMAND parameter is generally set to 100% (the default), but is changed in some applications such as with counter EMF winders. Proportional and integral terms process the resulting error to generate the correct phase firing angle for the field thyristors. The field PI block output, FLD

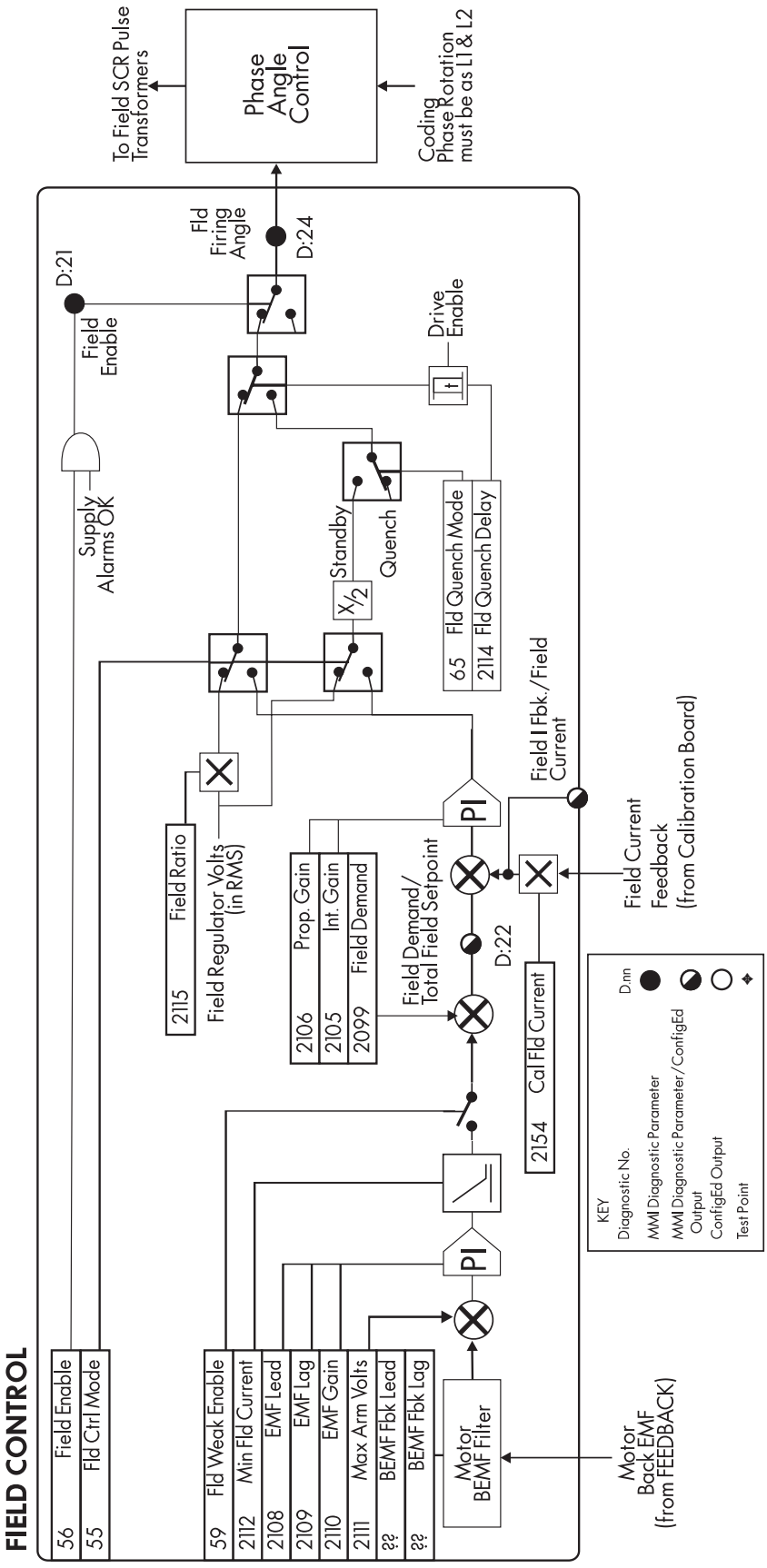


Figure C.6 - Field Control Software Block

FIRING ANGLE, can be read in the MMI only. PROP GAIN and INT GAIN set the loop response for stable current regulation.

> NOTE. The ConfigEd parameter FIELD DEMAND corresponds to the MMI parameter SETPOINT under SETUP PARAMETERS:: FLD CURRENT VARS.

FIELD WEAKENING ENABLE allows DC motors designed with extended speed capability to operate in the field weakened or constant horsepower control range. Enabling this parameter introduces another control loop, the armature PI loop, into the control process to help generate the total field current demand signal for the field current PI loop.

> NOTE. For field weakening control, enable FIELD WEAKENING ENABLE and set FIELD CONTROL MODE to CURRENT CONTROL.

This outer armature PI loop filters the motor BACK EMF— or the motor armature voltage after compensating for IR losses— and compares it to MAX ARMATURE VOLTS. The parameters EMF LEAD, EMF LAG and EMF GAIN process the difference between the two signals. MAX ARMATURE VOLTS is set as a percentage of the drive's calibrated armature voltage to the level at which field weakening begins. Normally, the drive is calibrated for the armature voltage at base speed and this parameter is set to 100%. The result is added to FIELD DEMAND, which is also normally left at its default value of 100%. The sum of these two signals, or the *LINK* output TOTAL FIELD SETPOINT, is the total field current demand signal for the field current PI loop.

> NOTE. TOTAL FIELD SETPOINT corresponds to the MMI diagnostic FIELD DEMAND.

When the motor runs below base speed, BACK EMF is lower than MAX ARMATURE VOLTS and the armature PI is saturated at +100%. This signal is added to a FIELD DEMAND of +100% so that TOTAL FIELD SETPOINT is clamped in *LINK* at +100% and the drive regulates the field current normally. As the motor speed increases past base speed, BACK EMF attempts to rise above MAX ARMATURE VOLTS and the armature PI integrates down in value, eventually going negative and trimming TOTAL FIELD SETPOINT to a value less than +100%. The current PI loop then regulates the field field current at this lower TOTAL FIELD SETPOINT value to weaken the motor field. As the drive speed demand continues to increase, the motor speeds up until the armature PI output reaches the MINIMUM FIELD CURRENT clamp setting. This scales the field weakening range and limits the field current from dropping further.

Input Parameters

Slot	Input Parameter	Description	MMI/SAM Range	*LINK* Range	Default
2151	CAL FIELD CURRENT	Fine tunes the current loop scaling	0.9800 to 1.1000		
---	BEMF FBK LEAD	Lead time of the BEMF filter.	0.9800 to 1.1000	89.00 to 100.00%	1.0000
* ---	BEMF FBK LEAD	Lead time of the BEMF filter.	0.9800 to 1.1000	89.00 to 100.00%	1.0000
2110	EMF GAIN	Adjusts gain of armature control loop when in field weakening.	0.00 TO 100.00	0.00 to 100.00%	0.30
2109	EMF LAG	Lag time adjstment of armature control loop when in field weakening.	0.00 to 200.00	0.00 to 100.00%	40.00
2108	EMF LEAD	Lag time adjstment of armature control loop when in field weakening.	0.10 TO 50.00	0.00 to 100.00%	2.00
55	FIELD CONTROL MODE	Selects between open loop, phase angle VOLTAGE CONTROL or closed loop CURRENT CONTROL.	VOLTAGE CONTROL/ CURRENT CONTROL	1=VOLTAGE CONTROL 0=CURRENT CONTROL	VOLTAGE CONTROL
2099	FIELD DEMAND	Sets the setpoint for the current PI control loop when in CURRENT CONTROL mode. Added to the armature PI loop output when FIELD WEAKENING ENABLE is enabled. Equivalent to FLD CURRENT VARS:: SETPOINT in the MMI.	0.00 to 100.00%	0.00 to 100.00%	100.00%
56	FIELD ENABLE	Enables and disables the drive motor field control.	ENABLE/DISABLE	1 = ENABLE 0=DISABLE	ENABLED

* Not available in MMI or SAM; set only in ConfigEd

Input Parameters

2114	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
65	FIELD 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/STNADBY	1=STANDBY 0=QUENCHED	QUENCHED
2115	FIELD RATIO	Sets the ratio of the output DC field voltage to the RMS field supply voltage when FIELD CONTROL MODE is set to VOLTAGE CONTROL.	0.00 to 100.00%	0.00 to 100.00%	67.00%
59	FIELD WEAKENING ENABLE	Enables the field weakening control.	ENABLE/DISABLE	1 = ENABLE 0=DISABLE	DISABLED
2111	MAX ARMATURE VOLTS	Sets the voltage level where field weakening begins	0.00 to 100.00%	0.00 to 100.00%	0.00%
2112	MIN FIELD CURRENT	Minimum value of field current for maximum speed.	0.00 to 100.00%	0.00 to 100.00%	10.00%
2106	PROPORTIONAL GAIN	Proportional gain adjustment of the current PI loop.	0.00 to 100.00	0.00 to 100.00	0.10
2105	INTEGRAL GAIN	Integral gain adjustment of the current PI loop.	0.00 to 100.00	0.00 to 100.00	1.28

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	MMI Diagnostic
FIELD CURRENT	Scaled motor field current feedback.	+100.00%	0.00 to 100.00%	FIELD I FBK.
TOTAL FIELD SETPOINT	Sum of FIELD DEMAND and armture volt PI loop output when FIELD WEAKENING is enabled; equal to FIELD DEMAND when FIELD WEAKENING is disabled.	0 to 100.00%	0.00 to 100.00%	FIELD DEMAND
---	Status of field control circuit.	ENABLE/DISABLE	---	* FIELD ENABLE
---	Firing angle of field thyristors.	0 to ?? DEG	---	* FLD. FIRING ANGLE

* Diagnostic unavailable in SAM and not available as a *LINK* output.

HEALTH

The HEALTH software block contains latched and unlatched bits indicating the health status of the drive, a drive ready signal and registers used for decoding specific drive alarm messages. You can also inhibit several of the 14 continuously monitored drive alarms so that drive operation is not interrupted if the alarm trips.

NOTE. The HEALTH output parameters are found in the ALARM STATUS menu of the MMI. You can inhibit alarms in the MMI under the SETUP PARAMETERS:: INHIBIT ALARMS sub-menu.

WARNING!

Do not inhibit alarms if there is any danger to personnel or equipment.

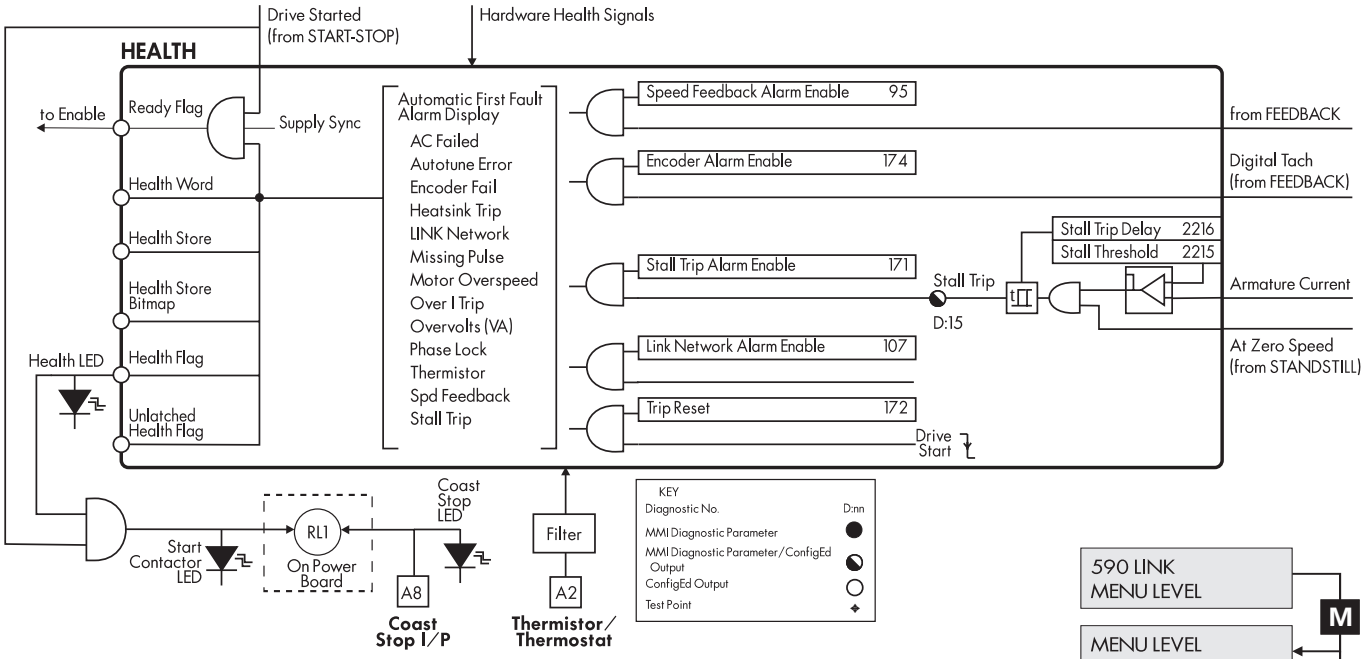


Figure C.7 - HEALTH Software Block

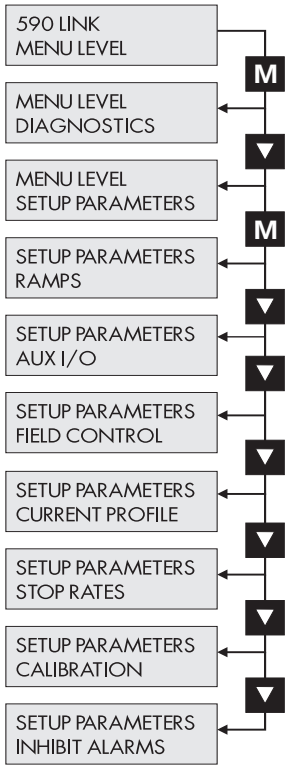
Description

STALL TRIP DELAY and STALL THRESHOLD set the time delay and the stall current alarm trip level respectively. The STALL TRIP ALARM trips when STALL TRIP ALARM is enabled and the scaled armature current exceeds the STALL THRESHOLD for a time period exceeding the STALL TRIP DELAY.

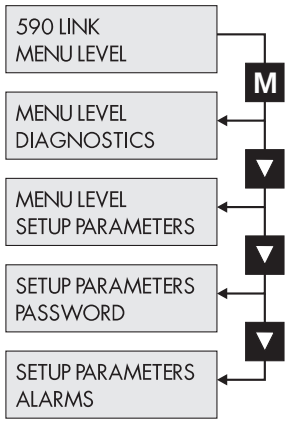
Setting *LINK* NETWORK to inhibit prevents the drive from indicating a *LINK* network fault. This has the same effect as setting either *LINK* FAIL STOP SELECT, MODULE FAILED STOP SELECT, or MODULE RCFG STOP SELECT in the PARAMETERS block to IGNORE. The drive continues to run after a *LINK* network error occurs even though the fiber optic network cannot transmit or receive data. The drive will transmit the fault over the *LINK* network if its transmit fiber optic connection remains unbroken.

Caution

The drive will not respond to system controls if a *LINK* network failure occurs while *LINK* NETWORK is inhibited.



DRIVE READY indicates that the drive is ready to conduct armature current. This output goes TRUE after the following sequence: the DRIVE START input goes TRUE, the main contactor closes and a time delay elapses allowing the drive circuitry time to synchronize to the main supply. DRIVE READY is typically used to control mechanical brakes.



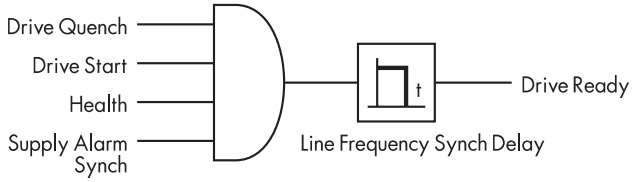


Figure C.8 - READY Flag Logic

HEALTH FLAG and UNLATCHED HEALTH FLAG indicate the health status of the drive and are reset by the rising or falling edge of the DRIVE START signal.

TRIP RESET allows the drive to be restarted after a fault occurs. When TRUE, faults are cleared any time DRIVE START goes FALSE. The drive trips out when fault occurs again. When FALSE, the faults are latched permanently and HEALTH FLAG and UNLATCHED HEALTH FLAG remain FALSE regardless of the state of DRIVE START. TRIP RESET must be set TRUE to reset the health flags and to restart the drive.

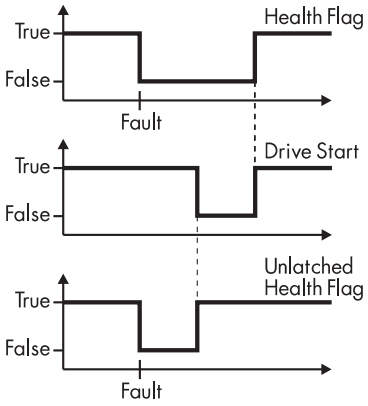


Figure C.9 - HEALTH FLAG Logic

Each alarm is assigned a number, 1 through 16. HEALTH STORE outputs the number of the first drive fault recorded since the drive was last started. If multiple alarms occur, HEALTH STORE indicates the fault which trips out the drive. GET HEALTH STORE in SAM, and LAST ALARM in the ALARM STATUS MMI menu, annunciates the alarm. HEALTH STORE BITMAP provides a hexadecimal code for this fault. HEALTH WORD is the hexadecimal sum of all faults occurring since control power was last applied to the drive. When the fault is cleared and the drive is restarted, HEALTH STORE resets to 0 (OK in SAM). LAST ALARM in the MMI annunciates the alarm until the control power is cycled, or when the ▼ key is hit. Refer to Chapter 5 for a discussion on the alarm process.

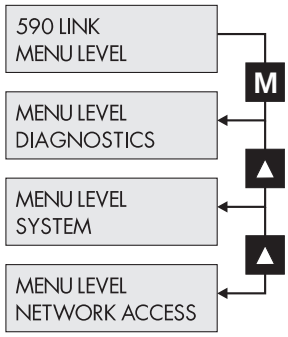
Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
174	ENCODER ALARM ENABLE	Enables the encoder option board alarm.	ENABLED/INHIBITED	1=Enable 0=Inhibit	ENABLED
107	*LINK* NETWORK ALARM ENABLE	Enables the *LINK* NETWORK alarm.	ENABLED/INHIBITED	1=Enable 0=Inhibit	ENABLED
95	SPEED FEEDBACK ALARM ENABLE	Enables the speed feedback alarm.	ENABLED/INHIBITED	1=Enable 0=Inhibit	ENABLED
171	STALL TRIP ALARM ENABLE	Enables the stall trip alarm.	ENABLED/INHIBITED	1=Enable 0=Inhibit	INHIBITED
2216	STALL TRIP DELAY	Stall Trip Alarm delay time. The MMI equivalent for this parameter is located in the CALIBRATION sub-menu.	0.1 to 600.0 Secs	0.017 to 100.00%	10.0 Secs
2215	STALL THRESHOLD	Stall current feedback threshold. The MMI equivalent for this parameter is located in the CALIBRATION sub-menu.	0.00 to 200.00%	0.00 to 100.00%	95.00%
172	TRIP RESET	When FALSE, faults are latched permanently and HEALTH FLAG and UNLATCHED HEALTH FLAG remains OFF. Set TRIP RESET true to clear faults. When TRUE, faults are cleared whenever drive DRIVE START is toggled FALSE.	TRUE/FALSE	1=Enable 0=Inhibit	TRUE

Output Parameters

***LINK* Name**	**Description**	**SAM Range**	***LINK* Range**	**Diagnostic**
HEALTH FLAG	Initially TRUE; goes FALSE when the drive detects a fault. Resets on the *rising* edge of DRIVE START.	0x1 = HEALTHY 0x0 = UNHEALTHY	1 = HEALTHY 0 = UNHEALTHY	none
HEALTH STORE	16 bit word which encodes the first fault the drive detects since the *last* start command.	Annuciated alarm (text)	1 to 16 ORDINAL	ALARM STATUS:: LAST ALARM
HEALTH STORE BITMAP	Hexadecimal value of the alarm causing the faults. The assignments are listed in Chapter 6.	see Chapter 6	see Chapter 6	ALARM STATUS:: HEALTH STORE
HEALTH WORD BITMAP	Register holding the hexadecimal sum of all faults occurring since the drive was last started. As an alarm is cleared, HEALTH WORD reflects the new condition of all remaining alarms. (Refer to Chapter 6 for an example of this feature.)	see Chapter 6	see Chapter 6	ALARM STATUS:: HEALTH WORD
READY FLAG	Indicates drive is started, healthy and ready to produce current.	READY/NOT READY	1 = READY 0 = NOT READY	none
UNLATCHED HEALTH	Initially TRUE; goes FALSE when the drive detects a fault. Resets on the *falling* edge of DRIVE START.	0x1 = HEALTHY 0x0 = UNHEALTHY	1 = HEALTHY 0 = UNHEALTHY	none
STALL TRIP	Indicates a stall trip conidition. TRUE when current feedback exceeds STALL THRESHOLD while drive is at zero speed for a period longer than STALL TRIP DELAY. Active only when STALL TRIP ALARM ENABLE is TRUE.	NORMAL/TRIPPED	0 = NORMAL 1 = TRIPPED	*** ALARM *** STALL TRIPPED

NETWORK ACCESS



NETWORK ACCESS allows the user to access *LINK* parameters and signals on the *LINK* network through the MMI. Value and logic signals are configured from source parameters to the block's input slots, or configured from NETWORK ACCESS output slots to destination parameters. The drive has 10 slots for logic signals and 10 slots for value signals.

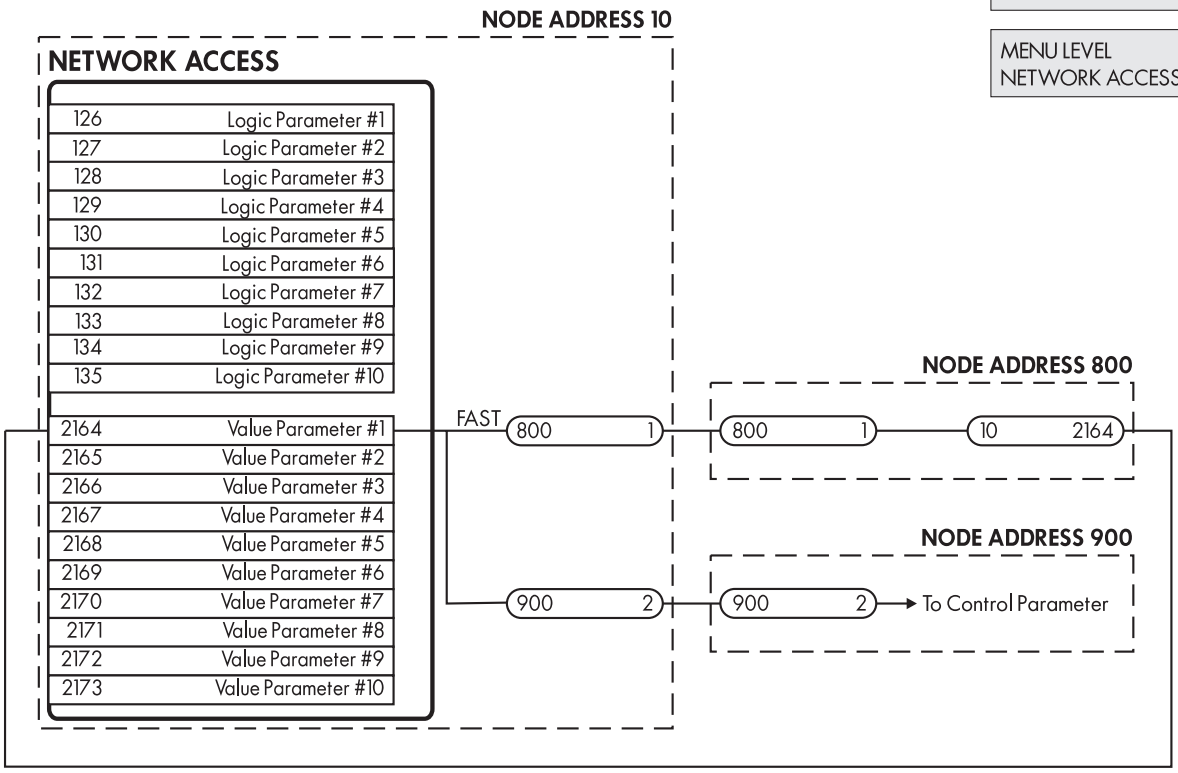


Figure C.10 - Configuring a *LINK* Node Parameter Using NETWORK ACCESS

To use the MMI to display a *LINK* network signal, connect the source to an appropriate logic or value slot in NETWORK ACCESS.

To use the MMI to change a parameter on the *LINK* network, connect the NETWORK ACCESS parameter to the desired address and slot. The MMI will not display the setting without connecting the output to the input as shown in Figure C.9. Set the output connection type to *fast* for a responsive MMI update.

Although you may set and display external *LINK* parameters from this menu, the MMI menu text cannot be changed.

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK Range*	Default
126	LOGIC PARAMETER #1	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
127	LOGIC PARAMETER #2	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
128	LOGIC PARAMETER #3	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
129	LOGIC PARAMETER #4	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
130	LOGIC PARAMETER #5	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
131	LOGIC PARAMETER #6	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
132	LOGIC PARAMETER #7	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE

Input Parameters

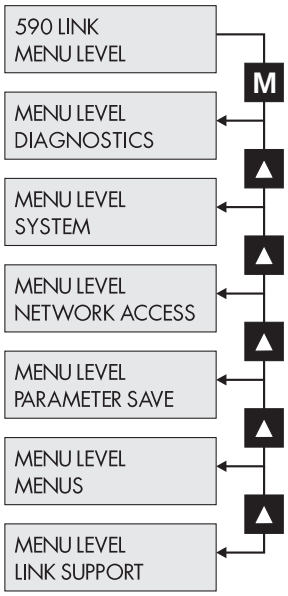
Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
133	LOGIC PARAMETER #8	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
134	LOGIC PARAMETER #9	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
135	LOGIC PARAMETER #10	Input for displaying a *LINK* source logic parameter.	TRUE/FALSE	1/0	FALSE
2164	VALUE PARAMETER #1	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2165	VALUE PARAMETER #2	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2166	VALUE PARAMETER #3	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2167	VALUE PARAMETER #4	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2168	VALUE PARAMETER #5	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2169	VALUE PARAMETER #6	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2170	VALUE PARAMETER #7	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2171	VALUE PARAMETER #8	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2172	VALUE PARAMETER #9	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%
2173	VALUE PARAMETER #10	Input for displaying a *LINK* source value parameter.	±100.00%	±100.00%	0.00%

Output Parameters

LINK Name	Description	MMI/SAM Range	*LINK* Range
LOGIC PARAMETER #1	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #2	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #3	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #4	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #5	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #6	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #7	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #8	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #9	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
LOGIC PARAMETER #10	Output for setting a *LINK* destination logic parameter.	TRUE/FALSE	1/0
VALUE PARAMETER #1	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #2	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #3	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #4	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #5	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #6	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #7	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #8	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #9	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%
VALUE PARAMETER #10	Output for setting a *LINK* destination value parameter.	±100.00%	±100.00%

PARAMETERS

The PARAMETERS software block allows you to configure how the drive will respond when the *LINK* network stops processing. You can set these parameters in ConfigEd only. You can monitor the settings in the MENUS MMI menu.



Description

Whenever a *LINK* module or drive enters a halted state, the *LINK* network stops sending messages. The network stops processing in these situations:

- MODULE RECONFIGURATION
  When downloading a configuration to module or drive using the ConfigEd INSTALL command, the drive or module enters a HALTED state and cannot process or transmit any new network messages. All other modules or drives on the network enter a PEER HALTED state.
- MODULE FAILED
  An internal error has caused a module or drive to fail. As with reconfiguration, the node stops processing and transmitting new network messages.
- *LINK* FAILED
  The *LINK* fiber optic network is broken and message transmission is interrupted, or one or several nodes are receiving an unacceptably high number of error messages.

The drive can be configured to respond to a communication failure in any of the following ways:

- IGNORE the event and continue running;
- Switch to a program stop (regenerative drives only); or
- Switch to a coast stop.

The default setting for all three *LINK* failed functions is REGEN STOP.

The *LINK* network only sends messages when data changes state. If the network stops communicating, none of the drive's input parameters change. As a result, the drive is unlikely to maintain the intended control of the motor.

WARNING!

Unless provision has been made to control the drive in the event of a *LINK* failure, do *not* set either of these parameters to the IGNORE mode.

PARAMETERS also has an ordinal output, NETWORK TYPE, indicating the drive's preconfigured node type. The node type is set in the EDIT menu in ConfigEd and can be monitored, but not changed in either SAM or the MMI.

EEPROM PARAMETER SAVE is also available in the PARAMETERS block and is equivalent to PARAMETER SAVE in the MMI. Use this input when configuring drives on a *LINK* network to remotely save parameters in all

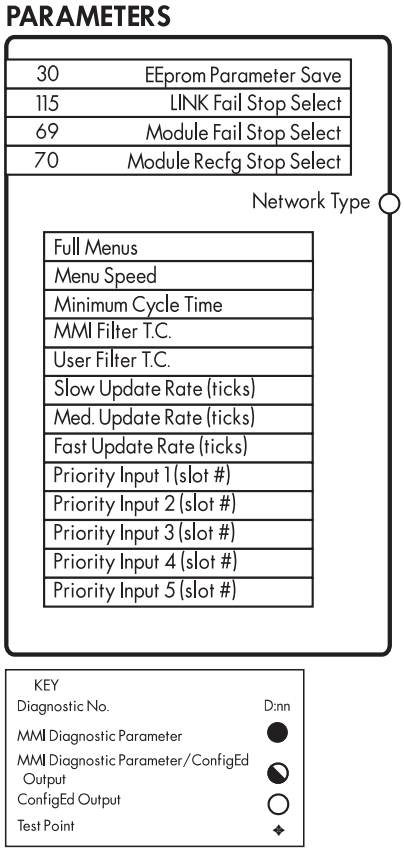


Figure C.11 - PARAMETERS Software Block

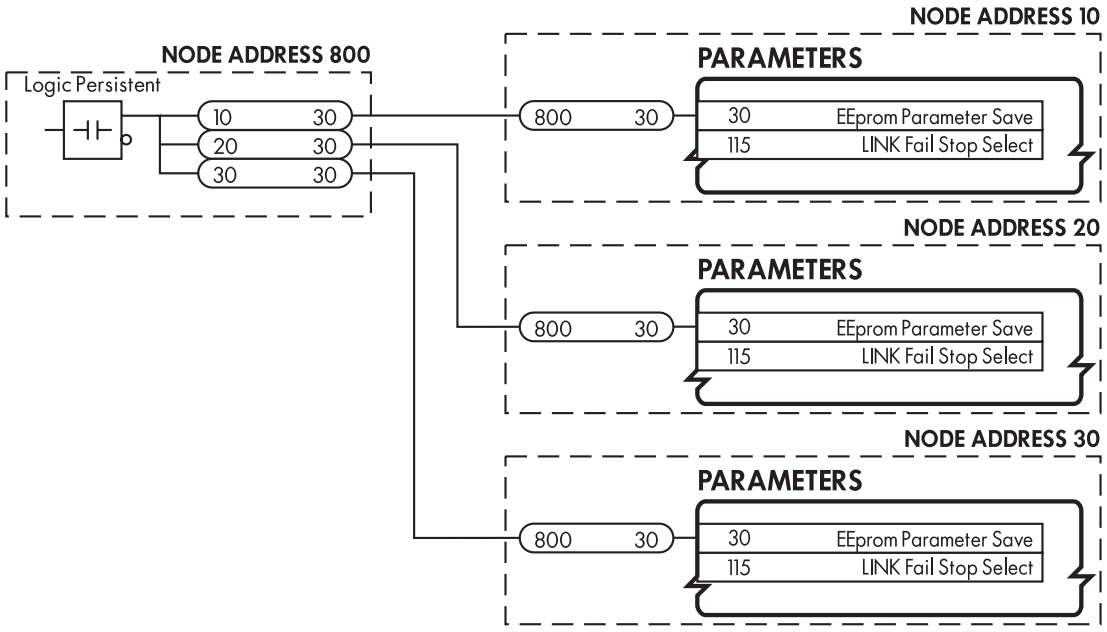


Figure C.12 - Configuration to SAVE PARAMETERS to Multiple Drives Remotely Using SAM.

drives using SAM. (See Figure C.11.) Setting Logic Persistent in address 800 TRUE signals each drive to save the parameter changes in RAM to EEPROM.

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
30	EEPROM PARAMETER SAVE	Saves parameter values set in the drive's RAM memory to the drive's EEPROM memory. Equivalent to MMI PARAMETER SAVE function.	SAVE/FINISHED	1=Active (save) 0=Inactive 2=Failed	0
# 115	*LINK* FAIL STOP SELECT	Drive response on event of a *LINK* network failure.	DISABLE ENABLE REGEN STOP ENABLE COAST STOP	0 = Disable 1 = Program stop 2 = Coast stop	2 (enable regen stop)
# 69	MODULE FAIL STOP SELECT	Drive response on event of a *LINK* module failure.	DISABLE ENABLE REGEN STOP ENABLE COAST STOP	0 = Disable 1 = Program stop 2 = Coast stop	2 (enable regen stop)
# 70	MODULE RCFG STOP SELECT	Drive response on event of a *LINK* module reconfiguration.	DISABLE ENABLE REGEN STOP ENABLE COAST STOP	0 = Disable 1 = Program stop 2 = Coast stop	2 (enable regen stop)

These parameters cannot be changed through the MMI.

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	MMI Diagnostic
NETWORK TYPE	Type of *LINK* network node, as set in the EDIT menu in ConfigEd.	simple/tapped/ redundant/aux tap	2 = Simple 3 = Tapped 7 = Redundant 11 = Aux tapped	*LINK* SUPPORT:: NODE TYPE

PEEK

The PEEK software block is reserved for qualified Eurotherm Drives personnel only. It is used for advanced trouble-shooting and drive control. Parameters within this software block can be accessed through the MMI under SYSTEM:: PEEK. This sub-menu appears only in the password restricted mode.

RAMPS

The RAMPS software block sets the start and stop time duration and other control functions of the ramp input. It only affects the ConfigEd RAMP INPUT speed signal. It is combined with the other speed inputs in the SPEED LOOP to produce the TOTAL SETPOINT signal. Other speed inputs to the drive are not ramped. The START-STOP software block contains a separate deceleration rate for a controlled fast stop.

RAMP MIN SPEED sets the minimum ramp input speed when the drive is enabled. RAMPING toggles TRUE when the absolute value of the difference between RAMP OUTPUT and RAMP INPUT exceeds RAMPING THRESH.

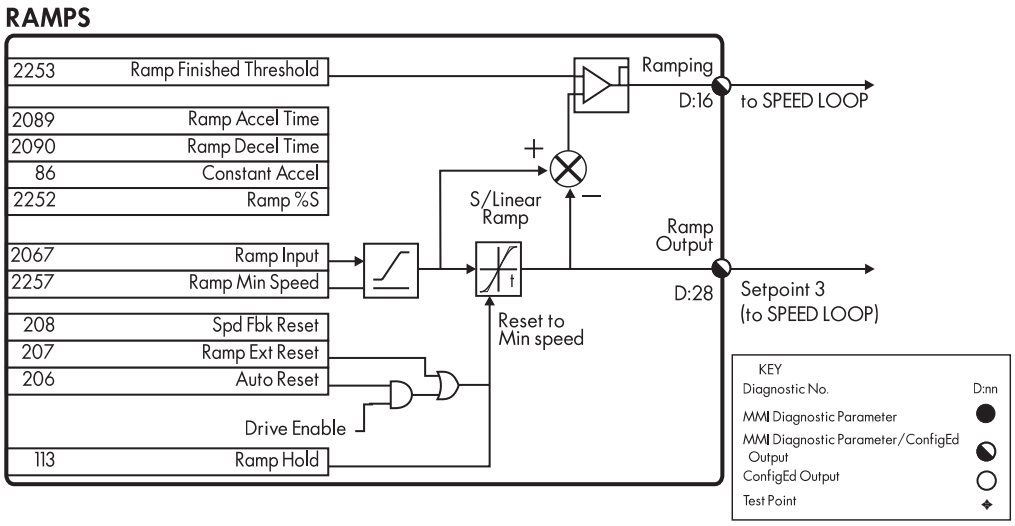


Figure C.13 - RAMPS Software Block

RAMPS shapes the RAMP INPUT signal to produce the RAMP OUTPUT signal. RAMP ACCEL TIME and RAMP DECEL TIME set the acceleration and deceleration times taken for input changes. RAMP S % integrates the ramp output signal to further smooth out the ramp signal. When set to 0.00%, the ramp will be linear. As the RAMP S % is increased, up to 350% 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 the parameters RAMP ACCEL TIME or RAMP DECEL TIME.

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

The *LINK* logic slot RAMP HOLD stops the ramp from changing. When TRUE, RAMP OUTPUT remains its last value.

You can reset the ramp three ways:

1. Reset the ramp every time the *LINK* DRIVE START input goes TRUE when AUTO RESET is enabled. Setting AUTO RESET FALSE leaves RAMP OUTPUT at its last value before the start signal was removed.
2. Reset the ramp when the speed feedback reaches the STANDSTILL THRESHOLD level set in STANDSTILL when SPD FBK RESET is enabled.
3. Reset the ramp manually using RAMP EXTERNAL RESET.

CONSTANT ACCEL determines whether the ramp operates in two or four quad mode. When set TRUE (the default), RAMP ACCEL TIME sets the ramp time for increasing speed, regardless of direction. RAMP DECEL TIME sets the ramp time for decreasing speed, again regardless of direction. When set FALSE, RAMP ACCEL TIME sets the ramp time of a signal moving from an algebraically lower to high speed, regardless of direction. Similarly, RAMP DECEL TIME sets the ramp time of a signal moving from an algebraically higher to lower speed, regardless of direction.

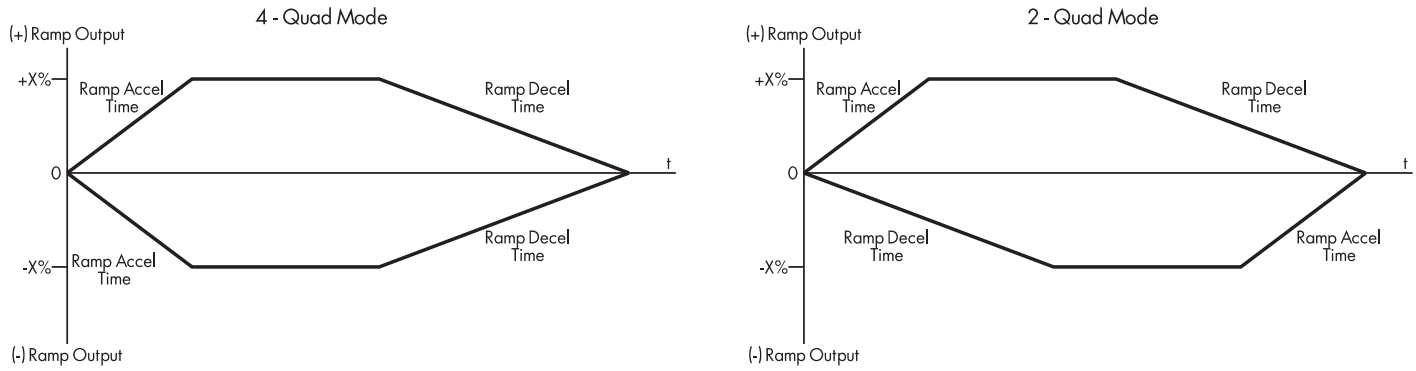


Figure C.14 - CONSTANT ACCEL (2-Quad Vs. 4-Quad Ramp).
CONSTANT ACCEL ENABLED in left diagram (default); CONSTANT ACCEL DISABLED in right diagram.

C

NOTE. Overspeed and *LINK* Signal Scaling:
Like other *LINK* speed inputs, RAMP INPUT accepts an overspeed range of ±20.00% to accommodate continuous operation of the drive speed control loop. Therefore, scale all *LINK* speed reference signals by 0.8333 to account for this overspeed capability so that an 83.33% *LINK* signal yields a 100% speed reference to RAMP INPUT. Refer to Chapter 3 for more information on *LINK* data ranges and signal scaling.

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
206	EXTERNAL RESET	Allows an external *LINK* signal to reset the ramp.	ENABLED/DISABLED	1 = Reset 0 = Ramping	DISABLED
2257	MIN SPEED	A bidirectional clamp connected directly to the RAMP INPUT.	±120%	±100.00%	0.00%
* 86	CONSTANT ACCEL	Changes the ramping action from 4 quad to 2 quad control when FALSE.	ENABLED/DISABLED	1 = Enable 0 = Disabled	ENABLED
2089	RAMP ACCEL TIME	Acceleration time for 100 percent change of the RAMP INPUT.	0.1 - 600.0 Secs	0.00 to 100.00%	10.0 Secs
2090	RAMP DECEL TIME	Deceleration time for 100 percent change of the RAMP INPUT.	0.1 - 600.0 Secs	0.00 to 100.00%	10.0 Secs
207	AUTO RESET	When ENABLED, the ramp is reset every time the drive is started.	ENABLED/DISABLED	1 = Enable 0 = Disabled	ENABLED
113	RAMP HOLD	When ON, the ramp output is held at the last value. Overridden by a ramp reset.	ON= hold OFF= ramp	1 = Hold 0 = Ramp	OFF
2067	RAMP INPUT	Input value.	±120%	±100.00%	0.00%
2252	RAMP S%	Percentage of the ramp with a S-shaped curve.	0.00 - 100.00%	0.00 to 100.00%	5.00%
286	RAMPING THRESH.	Threshold used to determine whether the ramp is active.	0.00 - 100.00%	0.00 to 100.00%	0.50%
208	SPD FBK RESET	Ramp resets when speed feedback reaches the drive's ZERO SPEED THRESHOLD.	ENABLED/DISABLED	1 = Enable 0 = Disabled	DISABLED

* MMI parameter available only in the restricted password mode.

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	MMI Diagnostic
RAMPING	TRUE when |ramp output - ramp input| > ramp threshold	TRUE/FALSE	1 = Ramping 0 = Held or reset	RAMPING
RAMP OUTPUT	Output value sent to SPEED LOOP	±120%	±100.00%	RAMP OUTPUT

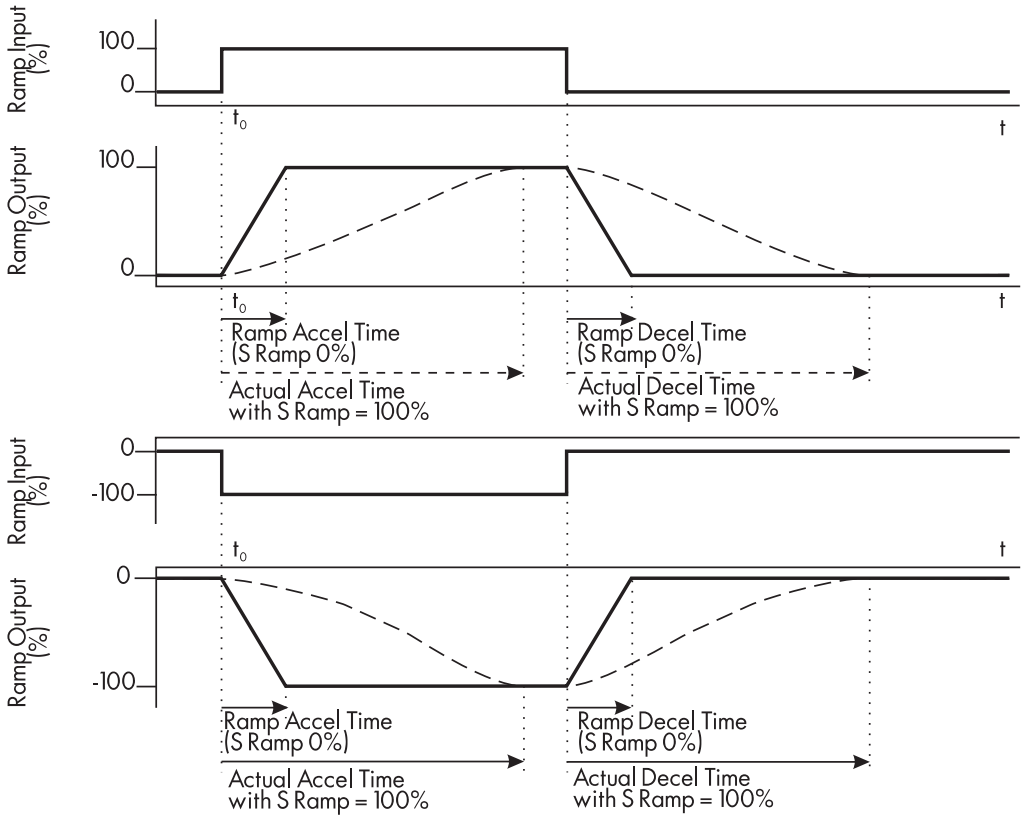


Figure C.13 - Ramp Accelerate and Decelerate Times

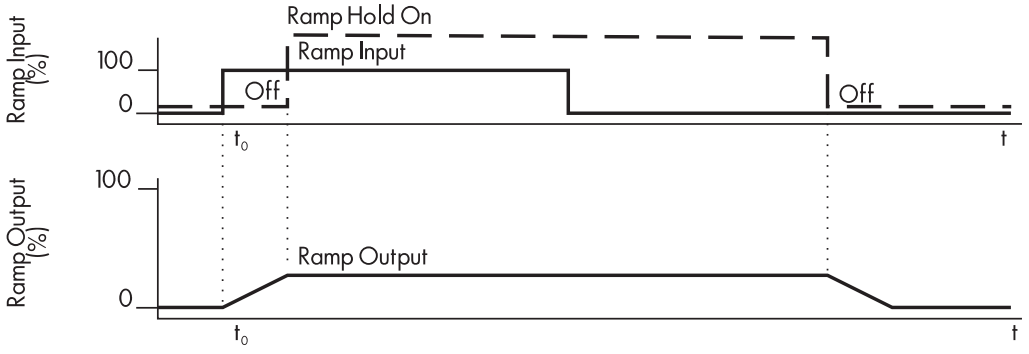


Figure C.15 - Ramp Hold

Ramping occurs when the ramp is not in the hold state and the ramp input changes. When set TRUE, the RAMP HOLD input 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 toggles FALSE, the ramping resumes.

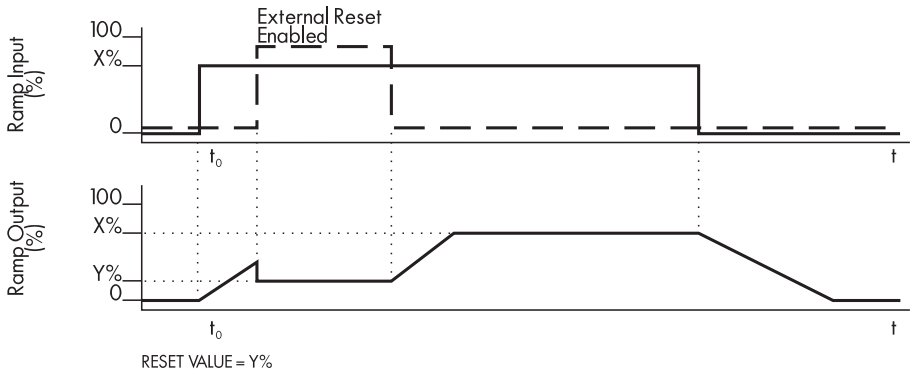


Figure C.16- External Reset

The ramp input is set to X% at time t_0. The output increases to the ramp input value at the RAMP ACCEL TIME. The ramp output resets to RAMP MIN SPEED (or Y%) when RAMP EXT RESET is set TRUE. When set FALSE, the ramp output continues to follow the input signal.

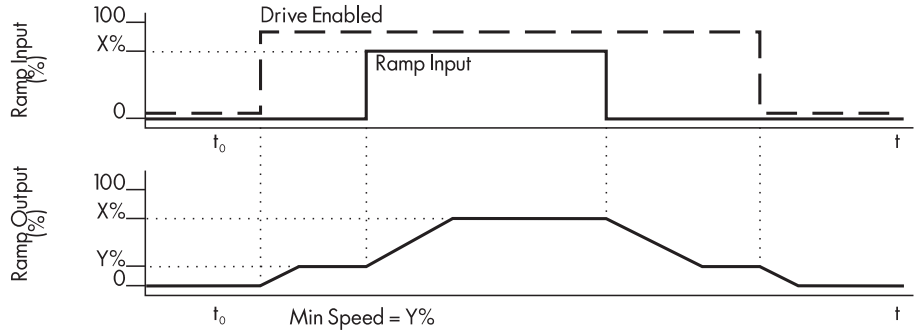


Figure C.17 - Minimum Speed

Figure C.17 shows the effect of setting RAMP MIN SPEED above 0.00% to a value Y%. When the drive is enabled, the ramp output cannot fall below the value set by RAMP MIN SPEED.

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

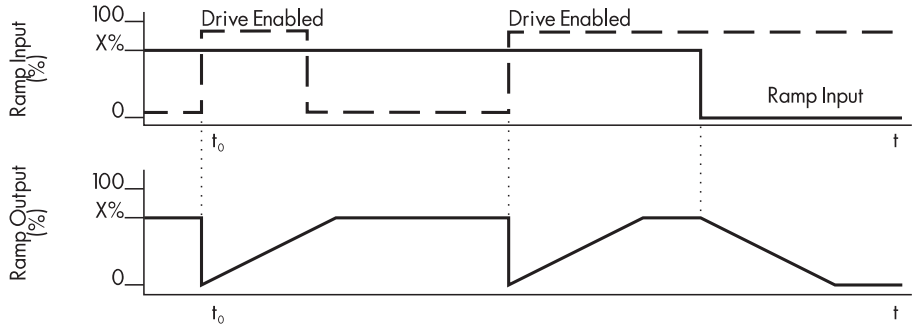


Figure C.18 - RAMP EXT RESET ENA (AUTO RESET)

When RAMP EXT RESET ENA (or AUTO RESET in the MMI) is enabled, the ramp output resets to RAMP MIN SPEED each time the drive is enabled. In this example, RAMP MIN SPEED is 0.00%. It does not reset if the drive is disabled.

SPEED LOOP

The SPEED LOOP block processes the drive's speed demand and speed feedback to produce the current demand for the current loop. Parameters within the block select the type of speed feedback source, tune the speed loop gains and clamp and scale the speed setpoints.

Description

ZERO OFFSET is added to the SPEED FEEDBACK signal to remove motor creep at zero speed. This parameter is not a speed reference input and is used *only* to the keep the motor shaft from rotating.

Caution

The drive *will not* trigger an OVERSPEED ALARM if OVERSPEED LEVEL is set above the default setting of 118.00%. Do *not* change this parameter. The MMI parameter is accessible in the password protect mode only.

SETPOINT FAST INPUT is sampled during each execution of the speed loop. Use this input when the process requires a very high performance controller in conjunction with external control loops. This input can be scaled with RATIO 2. You may invert its sign with SIGN 2. Both RATIO 2 and SIGN 2 are unavailable in SAM, but may be changed with the MMI or through ConfigEd INSTALL.

TOTAL SETPOINT is the sum of:

- SETPOINT SUM (the sum of INPUT 0 and INPUT 1 from SUMMING),
- RAMP OUTPUT,
- SETPOINT FAST INPUT, and
- SETPOINT 4, a speed reference which has no *LINK* slot, but can be set with ConfigEd INSTALL or through the MMI.

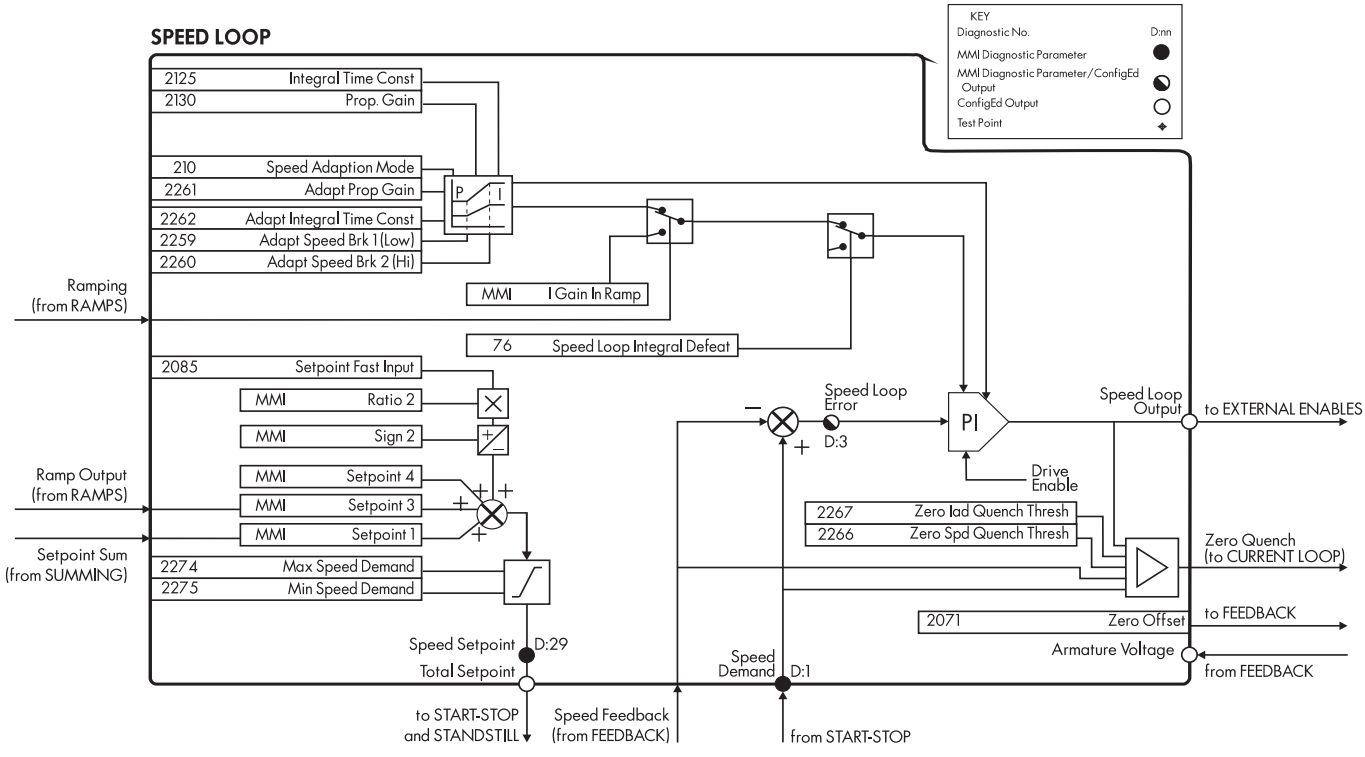
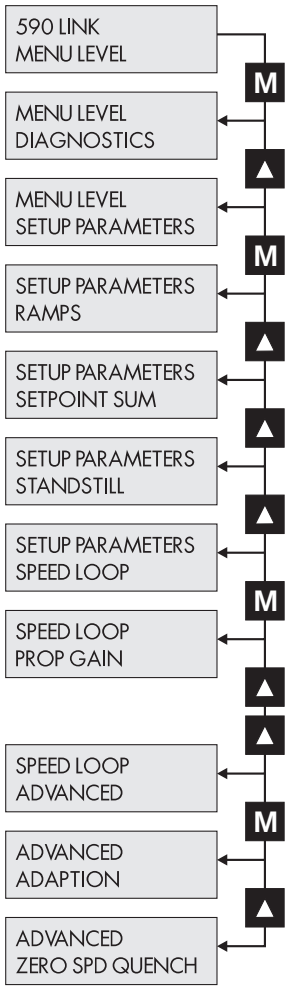


Figure C.19 - SPEED LOOP Control Parameters

You can monitor each of the speed signals in the MMI under the SETUP PARAMETERS:: SPEED LOOP:: SETPOINTS sub-menu. The parameters available in this sub-menu are listed below.



MMI SPEED LOOP::SETPOINTS Parameters

Slot	MMI Name	Description
—	SETPOINT 1	Connected to SETPOINT SUM output from the SUMMING software block.
—	SIGN 2	Speed setpoint 2 (SETPOINT FAST INPUT) sign. Set in the MMI or with ConfigEd INSTALL in SUMMING. Inaccessible through SAM.
—	RATIO 2	Speed setpoint 2 (SETPOINT FAST INPUT) ratio. Set in the MMI or with ConfigEd INSTALL in SUMMING. Inaccessible through SAM.
2085	SETPOINT 2	High speed *LINK* SETPOINT FAST INPUT. Cannot be changed through the MMI.
—	SETPOINT 3	Connected to RAMP OUTPUT in MMI, & output of RAMPS in *LINK*.
—	SETPOINT 4	Independent reference. Set in the MMI or with ConfigEd INSTALL. Inaccessible through SAM.

TOTAL SETPOINT is sent to START-STOP. The START-STOP block applies a stopping ramp to TOTAL SETPOINT during a normal stop or an emergency stop. The signal is then sent back to SPEED LOOP as SPEED DEMAND. SPEED FEEDBACK is subtracted from SPEED DEMAND to give SPEED ERROR. The loop's PI terms then process SPEED ERROR to generate SPEED LOOP OUTPUT (or the drive's current demand when the drive is in speed control).

NOTE. Overspeed and *LINK* Signal Scaling:
All *LINK* speed inputs accept an overspeed range of ±20.00% to accommodate continuous operation of the drive speed control loop. Therefore, scale all *LINK* speed reference signals by 0.8333 to account for this overspeed capability so that an 83.33% *LINK* signal yields a 100% speed reference. Refer to Chapter 3 for more information on *LINK* data ranges and signal scaling.

Adaption Parameters

Adaption changes the SPEED LOOP proportional and integral profiles for optimum drive response upon reaching speed demand breakpoints. It improves controller response for high inertia loads which vary with speed. ADAPT SPEED BRK1 (LOW) and ADAPT SPEED BRK2 (HIGH) determine the speed range for profiling. For a speed demand at or above ADAPT SPEED BRK1 (LOW), ADAPT PROP GAIN and ADAPT INTEGRAL TIME CONST, set the speed loop PI gains. For speeds at or above ADAPT SPEED BRK2 (HIGH), the original PI gain values are used. Between the two speeds, SPEED FEEDBACK, SPEED ERROR or SPEED LOOP OUTPUT profiles the PI gain according to the SPEED ADAPTION MODE setting.

SPEED ADAPTION MODE selects the input source. Mode 0 (default) disables the profiling so that the SPEED LOOP PI uses the original PROP. GAIN and INTEGRAL TIME CONST parameters settings regardless of the speed demand. Mode 1 uses SPEED FEEDBACK as the gain profiling source between the two speed breakpoints, mode 2 uses SPEED ERROR, mode 3 uses CURRENT DEMAND (SPEED LOOP OUTPUT).

NOTE. Most common motor load cycles do not require adaptive speed loop profiling.

Zero Speed Parameters

The ZERO SPEED parameters allow the drive to disable the CURRENT LOOP at zero speed without disabling the SPEED LOOP or de-energizing the contactor. This allows the CURRENT LOOP to be enabled quickly. When SPEED SETPOINT and SPEED FEEDBACK fall below ZERO SPD QUENCH THRESH and when SPEED LOOP OUTPUT falls below ZERO Ia QUENCH THRESH, ZERO SPEED QUENCH disables the CURRENT LOOP.

Other Parameters

I GAIN IN RAMP scales the integral gain while the drive is ramping. When RAMPING is TRUE, INTEGRAL TIME CONST is scaled by I GAIN IN RAMP. This can be used to prevent integral windup caused by very high inertia loads during ramping.

INERTIA COMP adds a portion of the derivative of the SPEED FEEDBACK signal to the SPEED LOOP summing junction. This can improve dynamic response of a high inertia load drive.

NOTE. Too much INERTIA COMP causes instability.

SPEED LOOP INTEGRAL DEFEAT switches INTEGRAL TIME CONST to zero when enabled and lets PROP. GAIN control the speed loop PI alone.

Main Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
2125	INTEGRAL TIME CONST	Integral gain adjustment.	.001 to 30.000 secs	0.00 to 100.00%	0.500 secs
2274	MAX DEMAND	Maximum output limit clamp.	0.00 to+105.00%	0.00 to +87.50%	105.00%
2275	MIN DEMAND	Minimum output limit clamp.	-105.00 to 0.00%	-87.50 to 0.00%	-105.00%
* 2217	OVERSPEED LEVEL	Level at which SPD FBK ALARM trips. Set in CALIBRATION MMI sub-menu.	0.00 to 200.00%	0 to 100.00%	118.00%
2130	PROP GAIN	Proportional gain adjustment.	0.00 to 200.00	0.00 to 100.00%	10.00
# 2085	SETPOINT FAST INPUT	Speed Input sampled at SPEED LOOP tick rate.	±105.00%	±87.50%	0.00%
2071	ZERO OFFSET	Offset to null out speed demand at zero speed.	±5.00%	±100.00%	0.00%

* MMI parameter available only in the password protected mode.

This parameter cannot be changed through the MMI.

Zero Speed Quench Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
2267	ZERO Ia QUENCH THRESH	Current Loop quenches if Current Demand < ZERO IAD LEVEL	0.00 to 200.00%	0.00 to 100.00%	1.50%
2266	ZERO SPD QUENCH THRESH	Zero speed quench level for Current Loop. Current Loop resets if Speed Demand *and* Speed Feedback < ZERO SPEED LEVEL.	0.00 to 200.00%	0.00 to 100.00%	0.50%

Adaption Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
2262	ADAPT INT TIME CONST	Integral time constant used during adaption.	0.001 to 30.000 Secs	0.00 to 100.00%	0.500 Secs
2261	ADAPT PROP GAIN	Proportional gain used during adaption.	0.00 to 200.00	0.00 to 100.00%	5.00
2259	ADAPT SPD BRK1 (LOW)	Speed breakpoint 1 to start gain profiling.	0.00 to 100.00%	0.00 to 100.00%	1.00%
2260	ADAPT SPD BRK2 (HI)	Speed breakpoint 2 to stop gain profiling.	0.00 to 100.00%	0.00 to 100.00%	5.00%
210	SPEED ADAPTION MODE	Selects the speed breakpoint input signal.	0=disabled 1=speed feedback 2=speed error, 3=current demand	0 to 3 ordinal	0

Other Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
2263	I GAIN IN RAMP	Scales the integral gain during ramping.	0.0 to 2.0000	0.00 to 100.00%	1.0000
76	SPEED LOOP INTEGRAL DEFEAT	When ON, it inhibits integral control yielding proportion control only.	ON (integral defeat is ON) OFF (integral defeat is OFF)	0=OFF 1=ON	OFF

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	Diagnostic
ARMATURE VOLTAGE	Scaled motor armature voltage feedback.	±200.00%	±100.00%	TERMINAL VOLTS
SPEED LOOP ERROR	Difference between Speed Demand and Speed Feedback.	±100%	±100.00%	SPEED ERROR
SPEED LOOP OUTPUT	Output of speed loop PI. Current Demand in speed control mode.	±120.00%	±100.00	CURRENT DEMAND
TOTAL SETPOINT	Sum of all of drive's speed references: SUMMING OUTPUT, RAMP OUPUT, SETPOINT FAST INPUT, SETPOINT 4.	±120.00%	±100.00	SPEED SETPOINT

STANDSTILL

The STANDSTILL software block determines whether the motor shaft has stopped turning based on SPEED DEMAND and SPEED FEEDBACK.

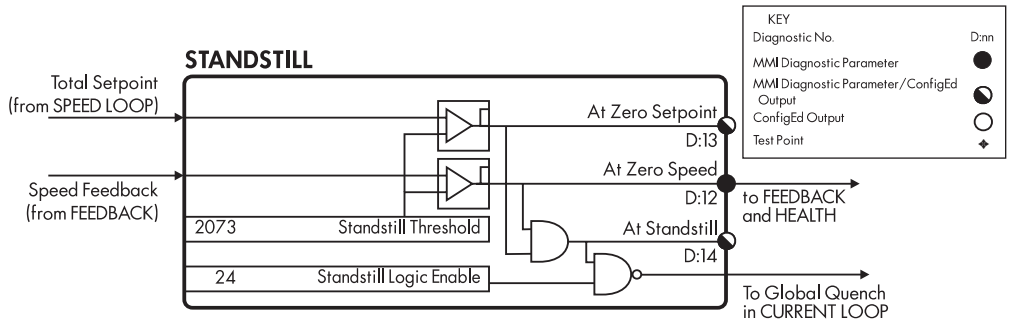


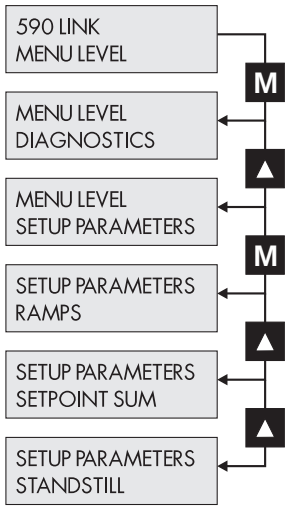
Figure C.20 - STANDSTILL Software Block

When SPEED FEEDBACK falls below the STANDTILL THRESHOLD setting (ZERO THRESHOLD in the MMI), ZERO SPEED switches TRUE. The *LINK* output ZERO SPEED signal is available in the FEEDBACK software block.

AT ZERO SETPOINT is ON when TOTAL SETPOINT is less than STANDTILL THRESHOLD. When both AT ZERO SPEED and AT ZERO SETPOINT are ON, AT STANDSTILL switches TRUE, signaling that the motor has stopped rotating.

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

Standstill Logic is useful in maintaining an absolute zero speed, but can cause problems in some web handling applications. At standstill, current flow is inhibited allowing the web tension to pull back on the roll. Movement of the shaft raises the speed feedback and the drive SCRs turn back on since the drive senses it is no longer at zero speed. The drive forces the motor to pull forward against the web, which again, drops the speed feedback below the threshold. The SCRs switch off again, and the web pulls back on the roll. The motor will then oscillate as the drive SCRs turn on and off trying to maintain a fixed roll position.



Input Parameters

	Slot	Input Parameter	Description	Range	*LINK* Range	Default
*	—	SOURCE TAG	Determines the drive parameter used to compare with the STANDSTILL THRESHOLD value. Cannot be set through SAM.	—	—	tag 89 (speed feedback)
	24	STANDSTILL LOGIC ENABLE	When enabled, inhibits the controller when at zero setpoint and zero speed.	ENABLED/DISABLED	0 = Disabled 1 = Enabled	Disabled
	2073	STANDSTILL THRESHOLD	Threshold for setting the zero setpoint and zero speed. Corresponds the ZERO THRESHOLD in the MMI.	0.00 to 5.00%	0.00 to 100.00%	2.00%

* MMI parameter available only in the password protected mode.

Output Parameters

LINK Output	Description	SAM Range	*LINK* Range	Diagnostic
AT STANDSTILL	Speed demand and speed feedback below STANDSTILL THRESHOLD.	TRUE/FALSE	1 = True 0 = False	AT STANDSTILL
AT ZERO SETPOINT	Drive speed demand below STANDSTILL THRESHOLD.	TRUE/FALSE	1 = True 0 = False	AT ZERO SETPOINT

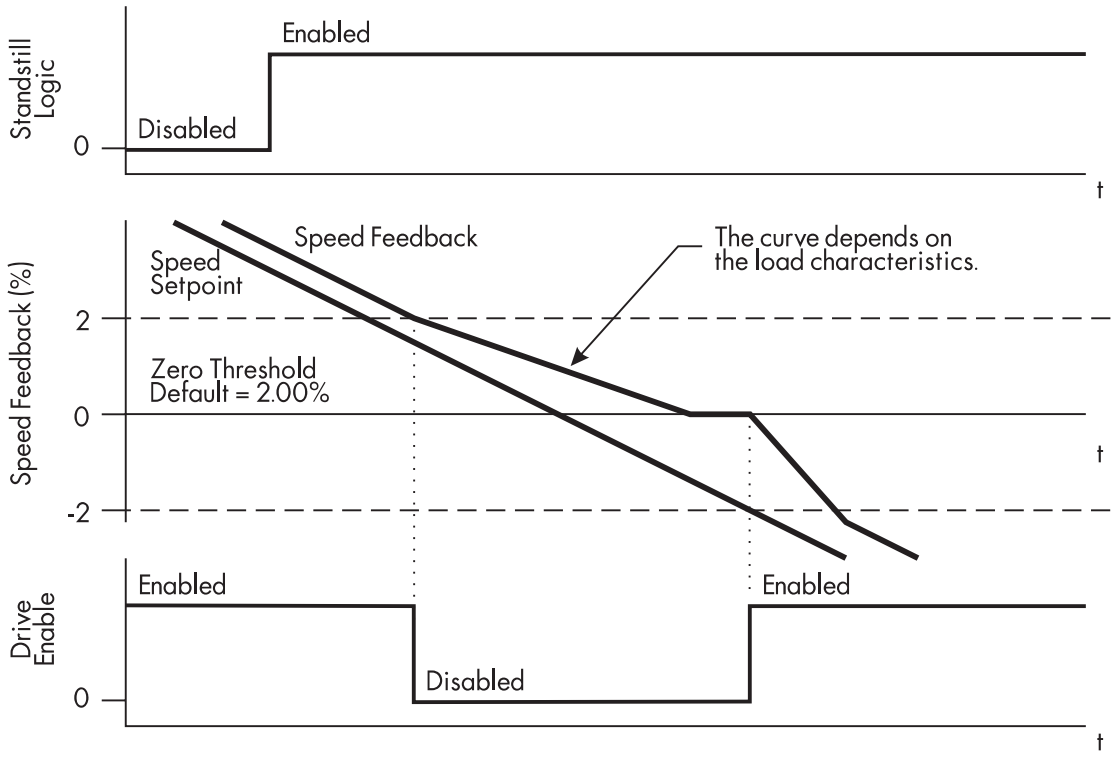


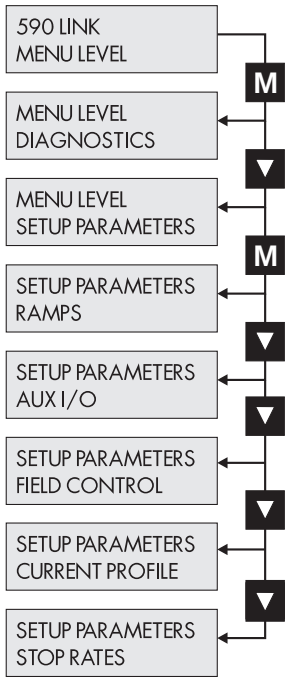
Figure C.21 - STANDSTILL Logic

When STANDSTILL LOGIC is enabled, the drive disables when both the speed feedback and speed setpoint signals are within the ZERO THRESHOLD.

START-STOP

The START-STOP software block contains the parameters for controlling the drive when it is stopping.

NOTE. All START-STOP parameters are found in the MMI SETUP PARAMETERS:: STOP RATES and the AUX I/O sub-menus.



Inputs and Outputs

The block's value inputs are SPEED FEEDBACK from FEEDBACK and TOTAL SET-POINT from SPEED LOOP.

The block's logic inputs include the *LINK* software slot inputs DRIVE START and PROGRAM STOP, and the hardwired Program Stop (terminal A7). AUX START and AUX ENABLE are both accessible only through the MMI.

The START-STOP value output is the final SPEED DEMAND signal that is sent to SPEED LOOP. There is no *LINK* output for this signal and it cannot be monitored in SAM. The logic outputs are COMPOSITE PROGRAM STOP and DRIVE STARTED.

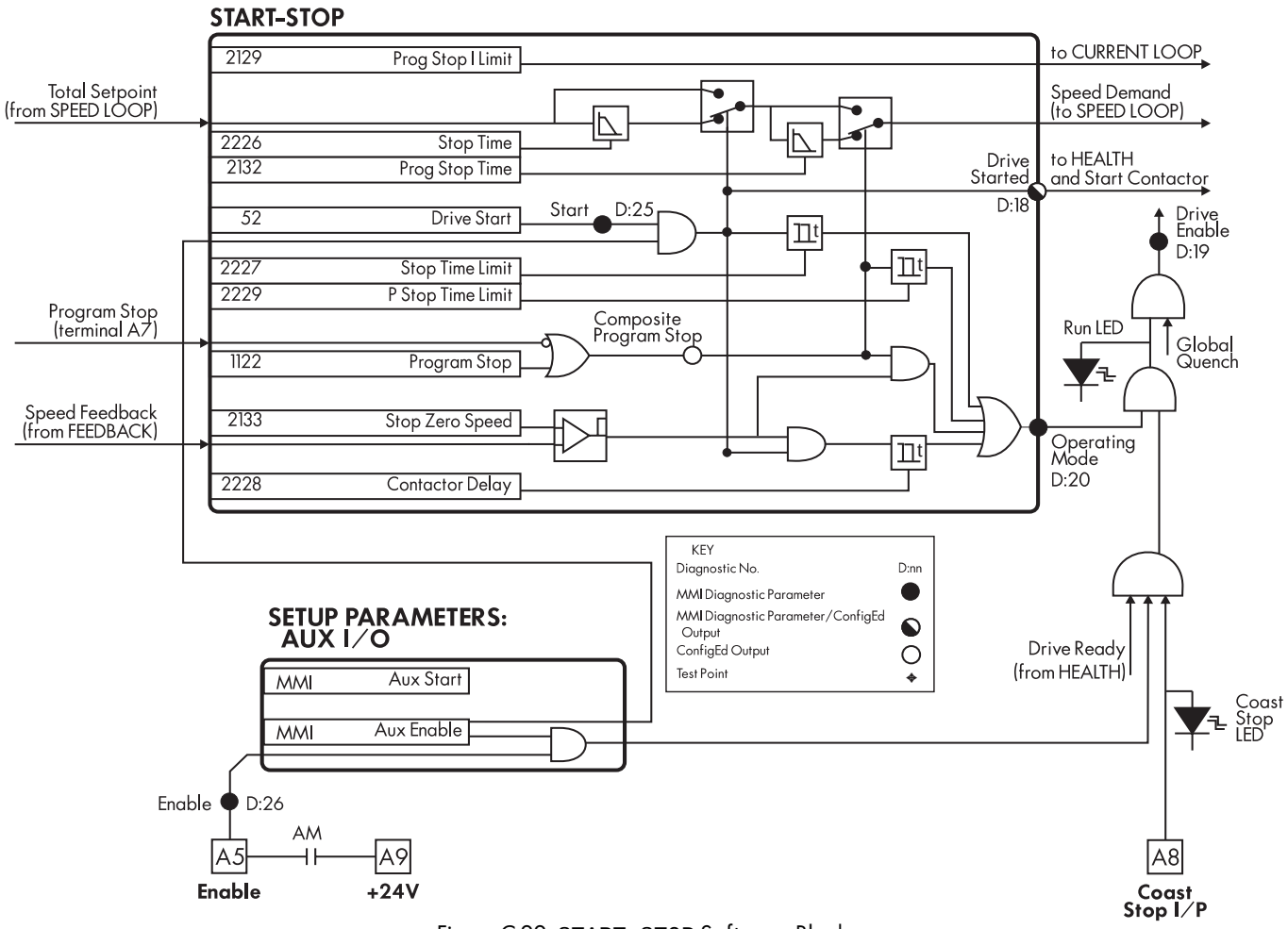


Figure C.22- START-STOP Software Block

Description

DRIVE START must be set TRUE for the drive to run. DRIVE START is AND-ed with the drive's healthy signal and AUX START.

A normal stop occurs when DRIVE START signal switches FALSE. It ramps TOTAL SETPOINT to zero at a rate set by STOP TIME. This ramp is independent of the RAMP DECEL TIME in RAMPS. A motor powered by a non-regenerative drive (591SP *LINK*) stops no faster than its natural coast stop rate. Regenerative drive powered motors ramp down at the STOP TIME rate. If the drive speed has not reached the STOP ZERO SPEED within the STOP LIMIT time, the current loop disables, the contactor de-energizes and the drive coasts to rest.

Caution

The overall start signal is *not* internally latched to ZERO SPEED. If DRIVE START is set FALSE, then immediately TRUE, the drive will restart before the shaft has stopped rotating. Interlock the start signal with the drive's ZERO SPEED output through external *LINK* logic to prevent a restart before reaching ZERO SPEED.

During normal stops, CONTACTOR DELAY delays de-energizing the contactor after the motor speed feedback reaches STOP ZERO SPEED. When STOP ZERO SPEED is set above 0.25%, the drive disables during the CONTACTOR DELAY time. If set below 0.25%, the drive disables after the delay. This is useful in preventing multiple operations of the contactor while jogging. Disabling the drive immediately overrides the CONTACTOR DELAY timer.

PROGRAM STOP provides an independently controlled fast stop for the regenerative 590 *LINK* DRV drive. This function is usually reserved for emergency stop conditions and completely overrides the normal stop drive functions. It is triggered when the hardwired terminal A7 goes to 0 VDC (is open circuited) or if the *LINK* software logic PROGRAM STOP input toggles TRUE. COMPOSITE PROGRAM STOP is TRUE if either PROGRAM STOP is TRUE or terminal A7 becomes open circuited. The MMI diagnostic PROGRAM STOP corresponds to this software block output.

Set PROGRAM STOP to FALSE to control program stop solely through terminal A7. The Program Stop LED on the front of the drive is driven directly by terminal A7 and disregards the state of the *LINK* PROGRAM STOP input.

WARNING!

For safety reasons, control the drive program stop action solely by hardwired control through terminal A7. Refer to Chapter 2 for program stop wiring.

PROGRAM STOP TIME sets the ramp time of a program stop and overrides STOP TIME or RAMP DECEL TIME. PROGRAM STOP LIMIT begins timing when COMPOSITE PROGRAM STOP goes TRUE and determines the maximum program stop time duration before the drive disables and switches to a coast stop.

PROG STOP I LIM sets the current limit in CURRENT LOOP during a program stop. It is independent of the current clamp settings in the CLAMPS or CURRENT LOOP software blocks.

Input Parameters

Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
—	AUX ENABLE	Drive current enabled when ON, +24VDC is at terminal A5 *and* current loop is unquenched (*LINK* slot 38 is TRUE) *and* drive is healthy. Under AUX I/O in MMI.	ON/OFF	—	ON
—	AUX START	Drive starts when ON *and* *LINK* start signal, slot 52 is TRUE *and* the drive is healthy. Under AUX I/O in MMI.	ON/OFF	—	ON
2228	CONTACTOR DELAY	The time the contactor stays energized after the STOP ZERO SPEED limit is reached.	0.1 to 600.0 Secs	0.0 to 100.00%	1.0 Secs
52	DRIVE START	*LINK* Drive Start signal. Logic AND-ed with AUX START Monitored in the MMI under DIAGNOSTICS:: START.	TRUE/FALSE	1=true/0=false	FALSE
1122	PROGRAM STOP	Initiates a Program Stop when TRUE. Signal is logic OR-ed with the hardwired program stop terminal A7.	TRUE/FALSE	1=true/0=false	FALSE

Input Parameters

Slot	Parameter	Description	MMI/SAM Range	*LINK* Range	Default
2129	PROG STOP I LIM	Current limit when performing a program stop.	0.00 to 100.00%	200.00%	0.0 to 100.00%
2229	PROG STOP LIMIT	The maximum time allowed for a program stop before the drive disables and the contactor de-energizes.	0.0 to 600.0 Secs	0.0 to 100.00%	60.0 Secs
2132	PROG STOP TIME	Time to reach zero speed when performing a program stop.	0.1 to 600.0 Secs	0.0 to 100.00%	0.1 Secs
2227	STOP LIMIT	Limits the maximum time a controlled stop can take during a normal stop before the drive will coast stop.	0.0 to 600.0 Secs	0.0 to 100.00%	60.0 Secs
2226	STOP TIME	Time to reach zero speed when performing a normal stop from 100% full speed.	0.1 to 600.0 Secs	0.0 to 100.00%	10.0 Secs
2133	STOP ZERO SPEED	Speed feedback threshold which triggers the CONTACTOR DELAY timer.	0.00 to 100.00%	0.0 to 100.00%	2.00%

Output Parameters

LINK Output	Description	SAM Range	*LINK* Range	MMI Diagnostic
COMPOSITE PROGRAM STOP	OR-ed result of terminal A7 (Program Stop) and Program Stop input slot.	ACTIVE/INACTIVE	1=ACTIVE/0=INACTIVE	PROGRAM STOP
DRIVE STARTED	Output of drive start condition.	ON/OFF	1=ON/0=OFF	DRIVE START

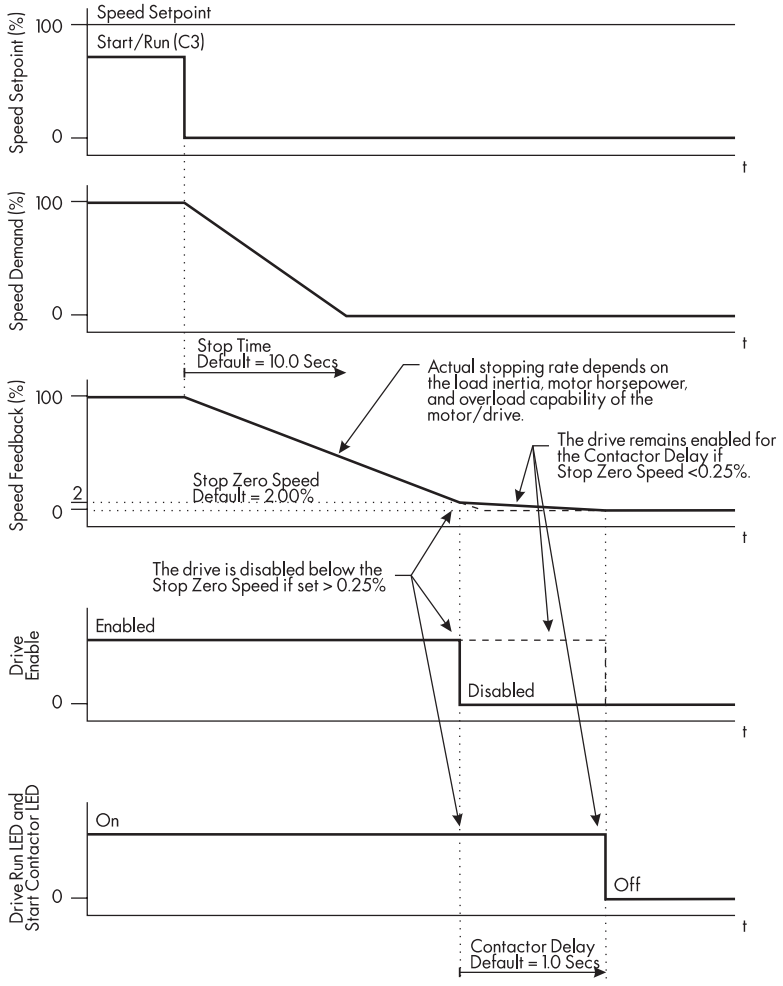


Figure C.23 - Sequences During a Normal Stop

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

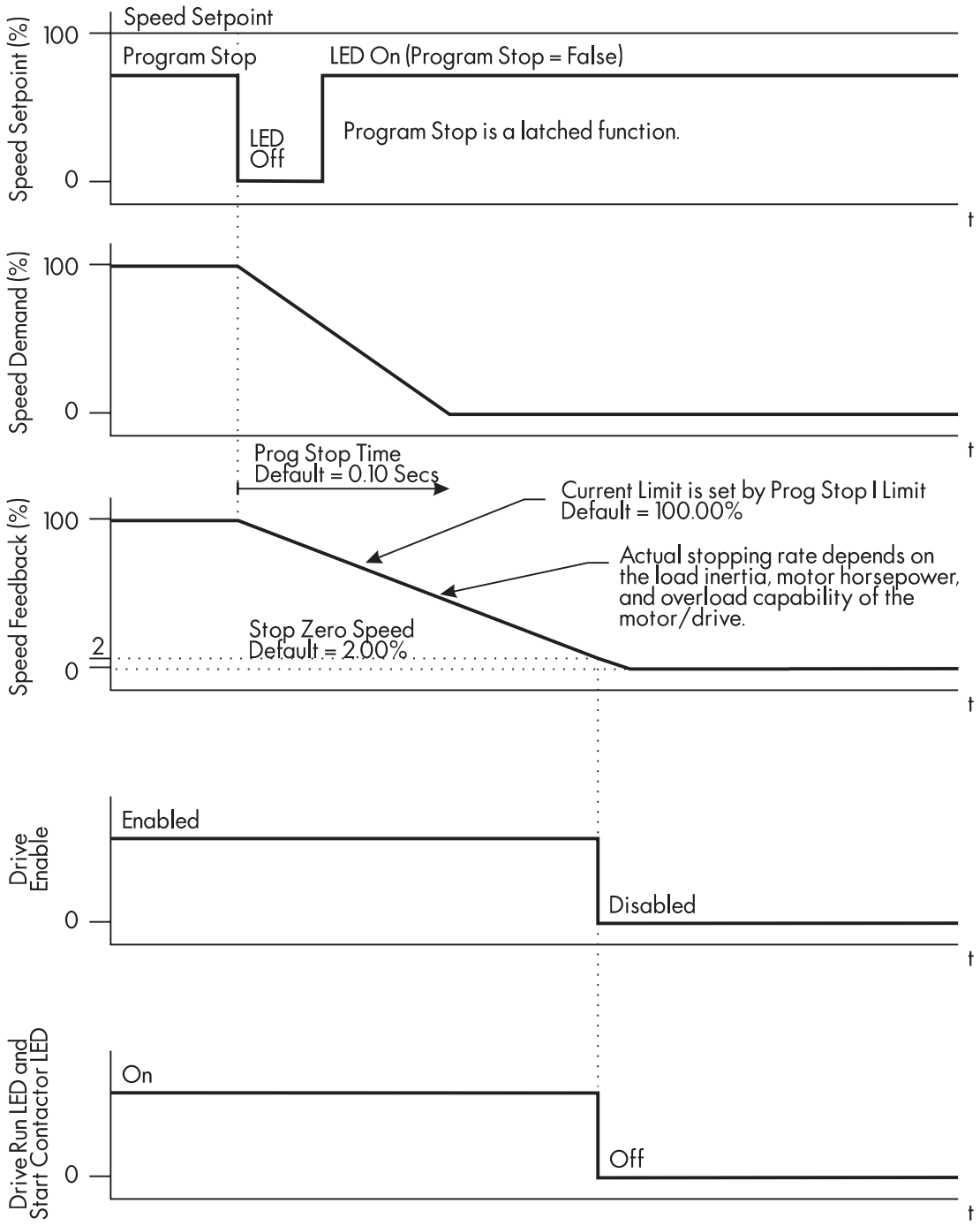


Figure C.24 - Sequences for a Program Stop

PROGRAM STOP is a latched function. Once a PROGRAM STOP signal is received; that is, terminal A7 open circuits or PROGRAM STOP is toggled TRUE, the stop continues even if 24 volts is reconnected to terminal or PROGRAM STOP goes FALSE.

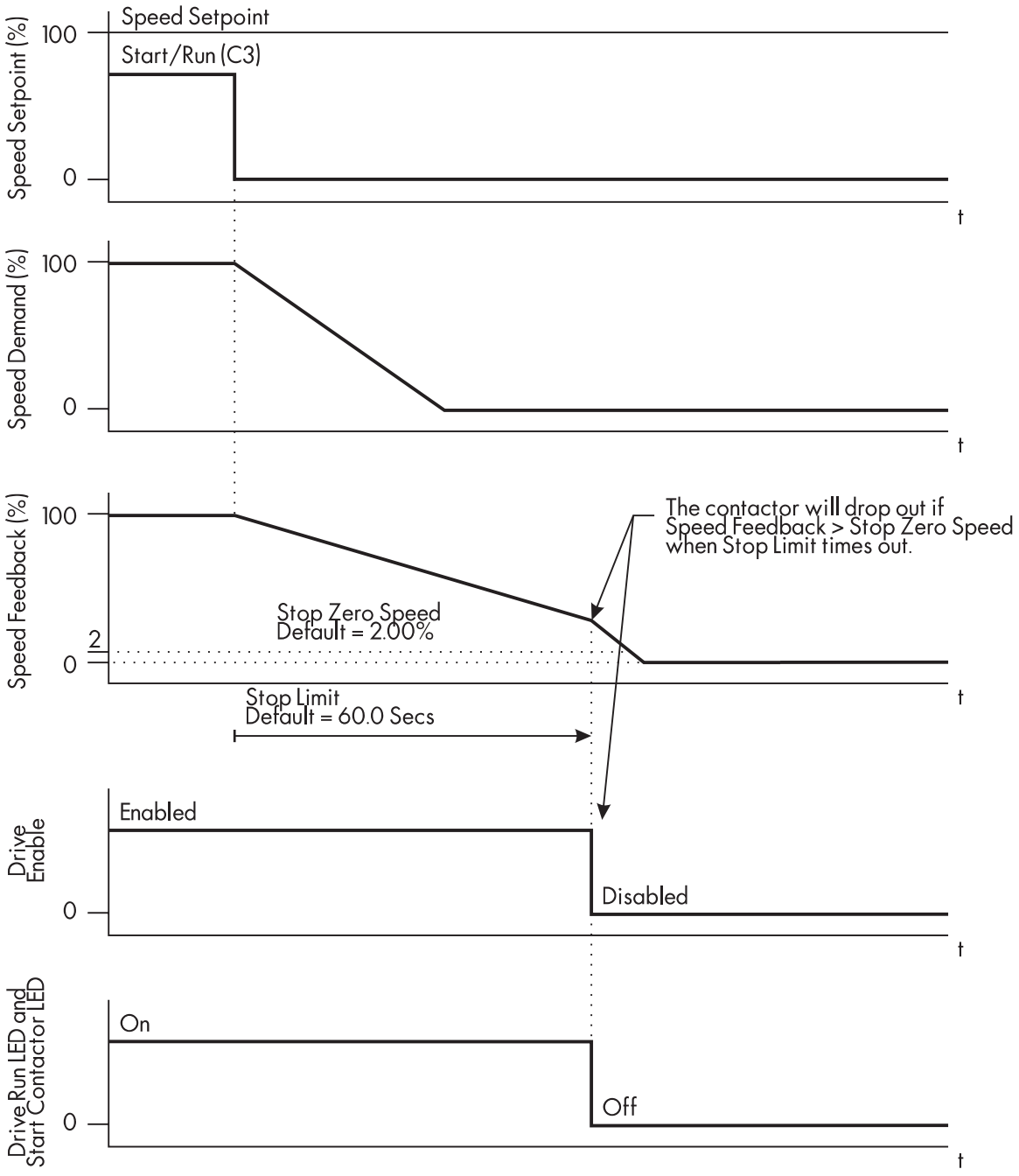


Figure C.25 - Sequences When a Normal Stop Times Out
These curves illustrate the sequence when a normal stop takes longer than the `STOP LIMIT` time. The drive disables and the contactor de-energizes at that time.

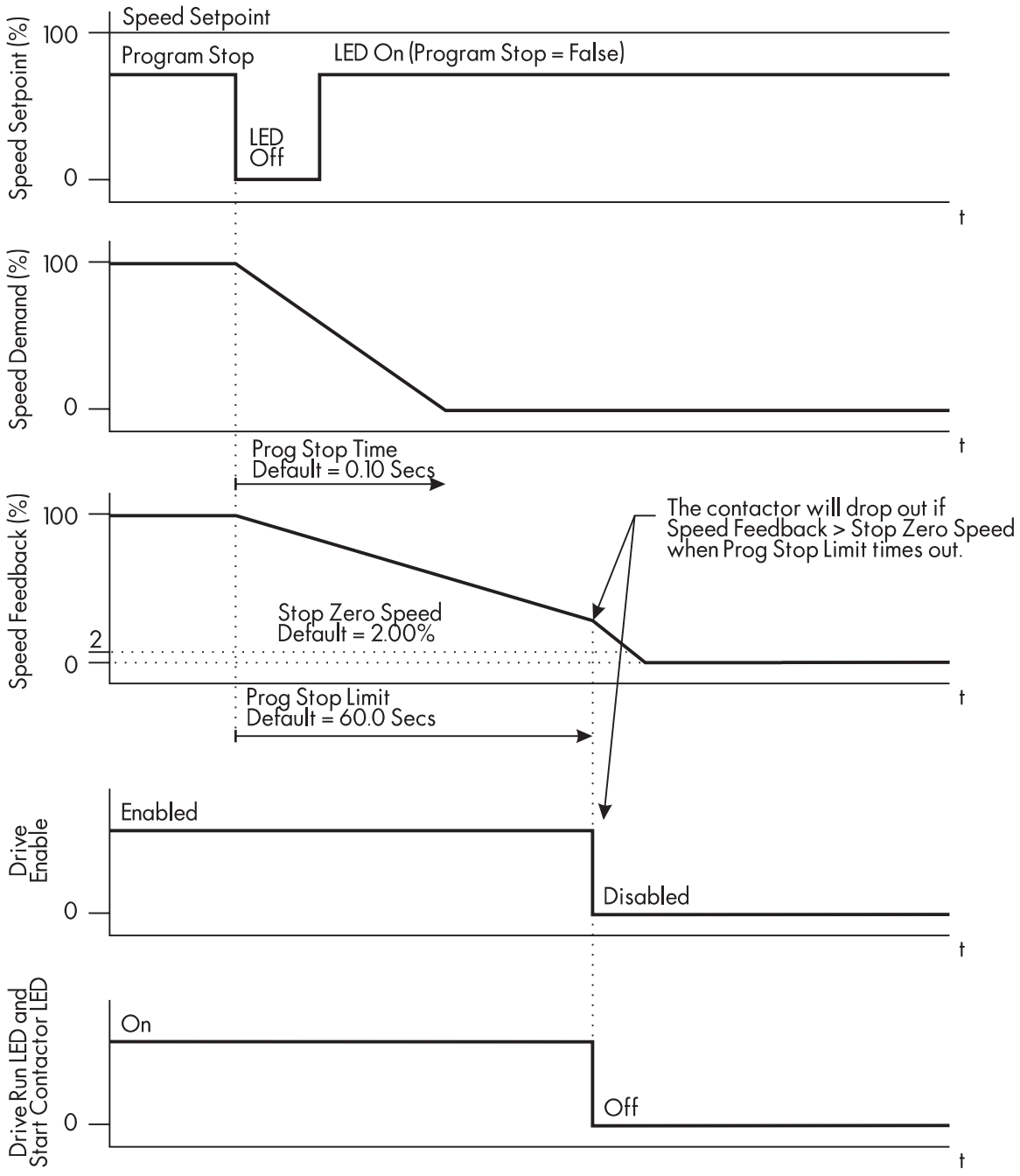


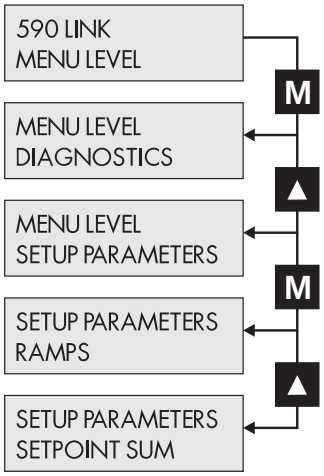
Figure C.26 - Sequences when a Program Stop Times Out
The time out logic is the same for both a normal stop and a program stop. PROGRAM STOP LIMIT, however, sets the maximum duration of a program stop before the contactor de-energizes and the drive disables.

SUMMING

The SUMMING block scales and sums two non-ramped speed inputs, INPUT 0 and INPUT 1. The block has a single output, SETPOINT SUM, which sums with the other speed setpoints in the SPEED LOOP to produce TOTAL SETPOINT.

NOTE. The SUMMING software block corresponds to the MMI sub-menu SETUP PARAMETERS:: SETPOINT SUM.

INPUT 0 and INPUT 1 have independent ratio scaling and sign inverting capability. You can also clamp SETPOINT SUM with SUM LIMIT. INPUT 1 has a DEADBAND WIDTH function set only through the MMI. For an input within the deadband, the output clamps to zero.



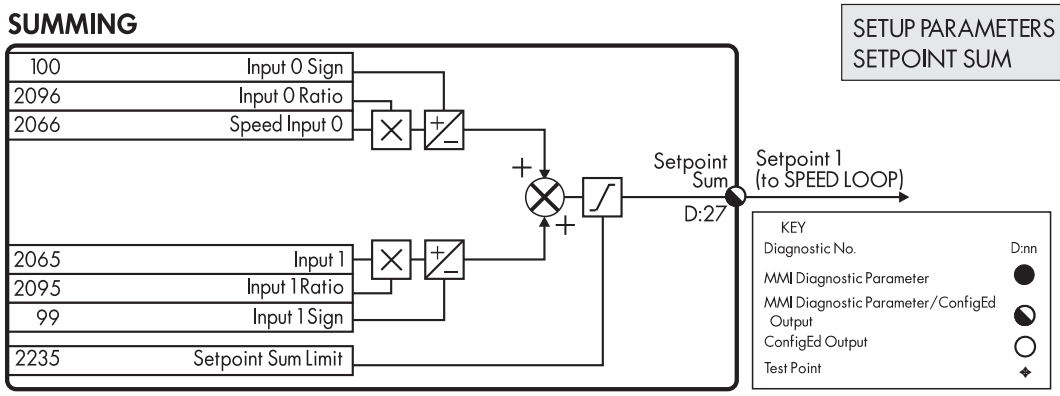


Figure C.27 - SUMMING Software Block

NOTE. Overspeed and *LINK* Signal Scaling:
Like other speed inputs, INPUT 0 and INPUT 1 can accept an overspeed range of ±20% to accommodate continuous operation of the drive speed control loop. Therefore, scale all *LINK* speed reference signals by 0.8333 to account for this overspeed capability so that an 83.33% *LINK* signal yields a 100% speed reference to INPUT 0 or INPUT 1. Refer to Chapter 3 for more information concerning *LINK* data ranges and signal scaling.

Input Parameters

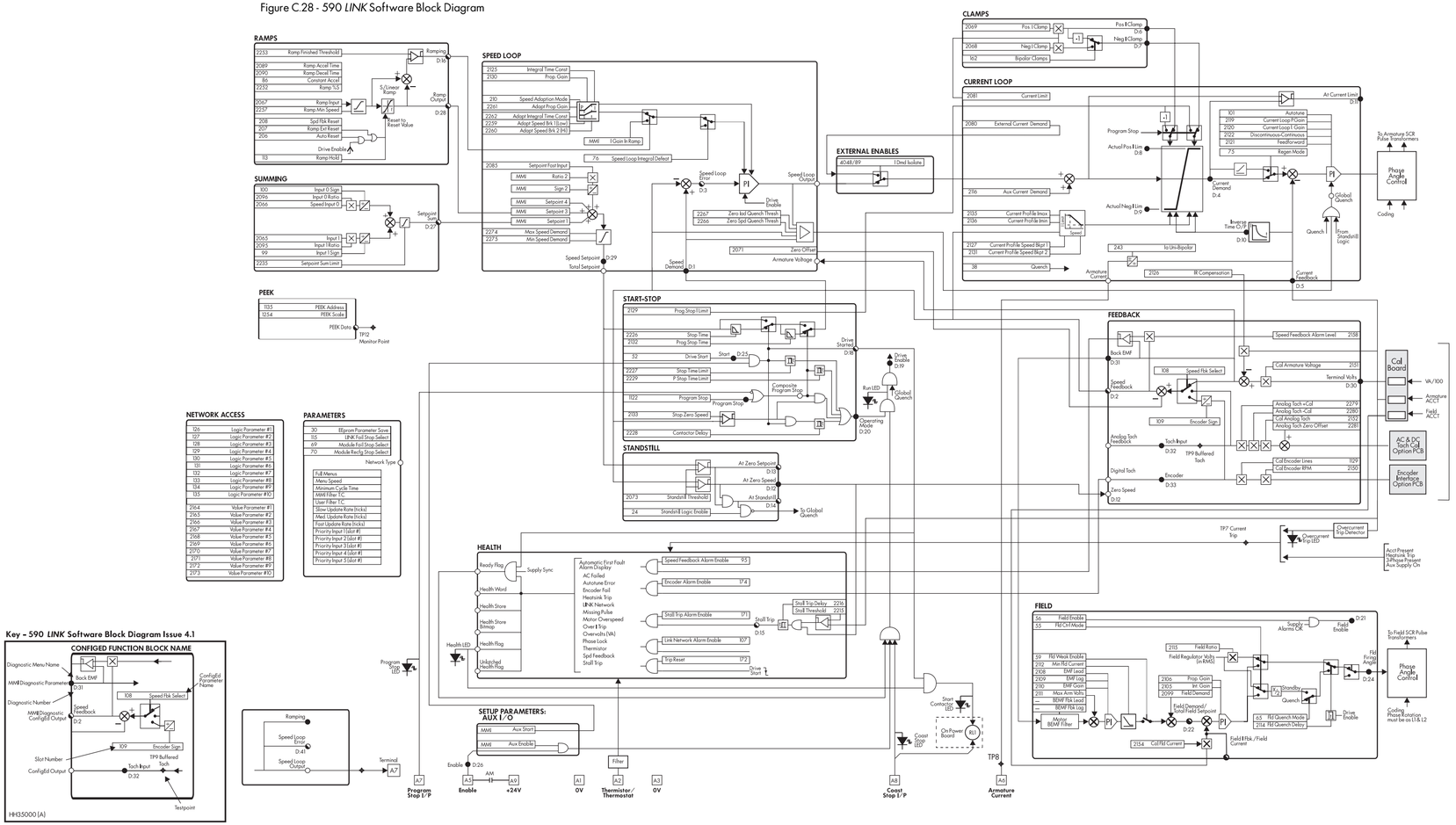
Slot	Name	Description	MMI/SAM Range	*LINK* Range	Default
—	DEADBAND WIDTH	Symmetrical range within which the output is clamped at zero.	0.0 to 100.0%	0.0 to 100.0%	0.0%
2066	INPUT 0	INPUT 0 value.	±105.00%	±87.50%	0.00%
2065	INPUT 1	INPUT 1 value.	±105.00%	±87.50%	0.00%
2096	RATIO 0	Multiplier scaling for INPUT 0	0 to 3.000	0 to 100.00%	1.0000
2095	RATIO 1	Multiplier scaling for INPUT 1	0 to 3.000	0 to 100.00%	1.0000
100	SIGN 0	Polarity for INPUT 0.	POSITIVE/NEGATIVE	1= Negative 0= Positive	POSITIVE
99	SIGN 1	Polarity for INPUT 1.	POSITIVE/NEGATIVE	1= Negative 0= Positive	POSITIVE
2235	SUM LIMIT	Symmetrical limit for the total sum output.	0.00 to 105%	0 to 87.5%	105.00%

Output Parameters

LINK Name	Description	SAM Range	*LINK* Range	MMI Diagnostic
SETPOINT SUM	Sum of INPUT 1 and INPUT 0 after scaling and sign and SUM LIMIT parameters are applied. Corresponds to SETPOINT 1 in the MMI SPEED LOOP.	±105.00%	±87.50%	SPT. SUM OUTPUT

C

Figure C.28 - 590 *LINK* Software Block Diagram



Appendix D PARAMETER LIST BY MMI NAME

	MMI Equivalent	LINK Slot/Output	Slot No.	LINK Signal Range	SAM or MMI Range	Default
	ALARM STATUS					
	ALARM STATUS::HEALTH STORE	Health/Health Store Bitmap	output	0 to 32,767 ordinal	see Figure 5.10, Health Alarm Bits	----
	ALARM STATUS::HEALTH WORD	Health/Health Word	output	0 to 65,535 ordinal	refer to Alarm Process in Chapter 5	----
	ALARM STATUS::LAST ALARM	Health/Health Store	output	0 to 16 ordinal	annunciated alarm	----
	DIAGNOSTICS					
	ACTUAL NEG I LIM	no corresponding LINK output available	n/a	n/a	±200%	----
	ACTUAL POS I LIM	no corresponding LINK output available	n/a	n/a	±200%	----
	AT CURRENT LIMIT	no corresponding LINK output available	n/a	n/a	true/false	----
	AT STANDSTILL	Standstill/At Standstill	output	1=true/0=false	1=@ standstill/ 0= not @ standstill	----
	AT ZERO SETPOINT	Standstill/At Zero Setpoint	output	1=true/0=false	1=@ zero sp/ 0= not @ zero sp	----
	AT ZERO SPEED	Feedback/Zero Speed	output	1=true/0=false	true/false	----
	BACK EMF	no corresponding LINK output available	n/a	n/a	±150%	----
	CURRENT DEMAND	Speed Loop/Speed Loop Output	output	±100%	±200%	----
	CURRENT FEEDBACK	Current Loop/Armature Current	output	±100%	±200%	----
	DRIVE ENABLE	Current Loop/Global Quench	output	1=enable/0=disable	enabled/disabled (quenched)	----
	DRIVE START	Start-Stop/Drive Started	output	1=started/0=stopped	on (started)/off (stopped)	----
	ENABLE	Current Loop/Quench	38	1 = Ia off / 0= Ia on	off (quenched)/on (unquenched)	unquenched (Ia on)
	ENCODER	Feedback/Digital Tach	output	±100%	±6000 rpm	----
	FIELD DEMAND	Field/Total Field Setpoint	output	0 to 100%	0.00 to 100.00%	----
	FIELD ENABLE	no corresponding LINK output available	n/a			
	FIELD I FBK.	Field/Field Current	output	0 to 100%	0.00 to 100.00%	----
	FLD. FIRING ANGLE	no corresponding LINK output available	n/a	n/a		
	INVERSE TIME O/P	Current Loop/Inverse Time	2138	0 to +100%	0 to +200%	----
	NEG I CLAMP	Clamps/Negative Clamp	2068	±100%	±200%	-100.00%
	OPERATING MODE	no corresponding LINK output available	n/a	0,1 ordinal	stop (0)/run (1)	----
	POS I CLAMP	Clamps/Positive Clamp	2069	±100%	±200%	100.00%
	PROG/COAST STOP	Start-Stop/Composite Program Stop	output	1=active,0=inactive	active/inactive	----
	RAMP OUTPUT	Ramps/Ramp Output	output	±100%	±120.00%	----
	RAMPING	Ramps/Ramping	output	1=true/0=false	true (ramping)/false (not ramping)	----
	SPEED DEMAND	Start-Stop/Start-Stop Output	n/a	±100%	±120%	----
	SPEED ERROR	Speed Loop/Speed Loop Error	output	±100%	±100%	----
	SPEED FEEDBACK	Feedback/Speed Feedback	output	±100%	±120.0%	----
	SPEED SETPOINT	Speed Loop/Total Setpoint	output	±100%	±120%	----
	SPT. SUM OUTPUT	Summing/Setpoint Sum	output	±87.5%	±105%	0.00%
	STALL TRIP	Health/Stall Trip	output	1=tripped/0=normal	tripped/normal (OK)	normal (OK)
	START	Start-Stop/Drive Start	52	1=start/0=stop	on (start)/ off (stop)	off (stop)
	TACH INPUT	Feedback/Analog Tach Feedback	output	±100%	±150%	----
	TERMINAL VOLTS	Speed Loop/Armature Voltage	output	±100%	±200%	----

* These MMI parameters available only in the password protect mode.
\# These parameters cannot be changed through the MMI.
† These ConfigEd parameters are reserved for authorized use only.
\+ Parameter inaccessible through SAM.

Appendix D PARAMETER LIST BY MMI NAME (Continued)

	MMI Equivalent	LINK Slot/Output	Slot No.	LINK Signal Range	SAM or MMI Range	Default
	LINK SUPPORT					
#	ADDRESS	no corresponding LINK output available	n/a	n/a	1 through 3000	----
#	NODE TYPE (read only in MMI and in SAM)	Parameters/Network Type	output	2, 3, 7, 11 ordinal	simple (2)/red (3)/tap (7)/aux tap (11)	simple
#	STOP ON NET FAIL (not setable in MMI)	Parameters/LINK Fail Stop Select	115	0,1,2 ordinal	coast (0)/no stop (1)/regen (2)	ena. regen stop
#	STOP/MODULE FAIL (not setable in MMI)	Parameters/Module Fail Stop Select	69	0,1,2 ordinal	coast/no stop/regen	ena. regen stop
#	STOP/MODULE RCFG (not setable in MMI)	Parameters/Module Recfg Stop Select	70	0,1,2 ordinal	coast/no stop/regen	ena. regen stop
	MENUS					
	MENUS::FULL MENUS	Parameters/Full Menus	n/a	enabled/disabled	enabled/disabled	enabled
	MENUS::MENU DELAY	Parameters/Menu Speed	n/a	0 to 65,535 ordinal	0 to 5000	30
	NETWORK ACCESS					
	LOGIC PARAM. 1	Network Access/Logic Parameter #1	126	1=true/0=false	true/false	false
	LOGIC PARAM. 2	Network Access/Logic Parameter #2	127	1=true/0=false	true/false	false
	LOGIC PARAM. 3	Network Access/Logic Parameter #3	128	1=true/0=false	true/false	false
	LOGIC PARAM. 4	Network Access/Logic Parameter #4	129	1=true/0=false	true/false	false
	LOGIC PARAM. 5	Network Access/Logic Parameter #5	130	1=true/0=false	true/false	false
	LOGIC PARAM. 6	Network Access/Logic Parameter #6	131	1=true/0=false	true/false	false
	LOGIC PARAM. 7	Network Access/Logic Parameter #7	132	1=true/0=false	true/false	false
	LOGIC PARAM. 8	Network Access/Logic Parameter #8	133	1=true/0=false	true/false	false
	LOGIC PARAM. 9	Network Access/Logic Parameter #9	134	1=true/0=false	true/false	false
	LOGIC PARAM. 10	Network Access/Logic Parameter #10	135	1=true/0=false	true/false	false
	VALUE PARAM. 1	Network Access/Value Paramater #1	2164	±100%	±100%	0.00%
	VALUE PARAM. 2	Network Access/Value Paramater #2	2165	±100%	±100%	0.00%
	VALUE PARAM. 3	Network Access/Value Paramater #3	2166	±100%	±100%	0.00%
	VALUE PARAM. 4	Network Access/Value Paramater #4	2167	±100%	±100%	0.00%
	VALUE PARAM. 5	Network Access/Value Paramater #5	2168	±100%	±100%	0.00%
	VALUE PARAM. 6	Network Access/Value Paramater #6	2169	±100%	±100%	0.00%
	VALUE PARAM. 7	Network Access/Value Paramater #7	2170	±100%	±100%	0.00%
	VALUE PARAM. 8	Network Access/Value Paramater #8	2171	±100%	±100%	0.00%
	VALUE PARAM. 9	Network Access/Value Paramater #9	2172	±100%	±100%	0.00%
	VALUE PARAM. 10	Network Access/Value Paramater #10	2173	±100%	±100%	0.00%
	PARAMETERS					
	PARAMETER SAVE	Parameters/EEPROM Parameter Save	30	1=save/0=cancel	saving/finished	----
†*	RESERVED::MIN MMI CYCLE TM	Parameters/Minimum Cycle Time	n/a	0 to 65,535 ordinal	0 to 65,535	80
†*	RESERVED::MMI FILTER T.C.	Parameters/MMI Filter T.C.	n/a	0 to 65,535 ordinal	0 to 65,535	20
†*	RESERVED::USER FILTER T.C.	Parameters/User Filter T.C.	n/a	0 to 65,535 ordinal	0 to 65,535	20
	SETUP PARAMETERS::AUX I/O					
	AUX ENABLE	Start-Stop/Drive Start	52	1/0	on/off	----
	AUX START	Start-Stop/Drive Start	52	1/0	on/off	

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\+ Parameter inaccessible through SAM.

Appendix D PARAMETER LIST BY MMI NAME (Continued)

	MMI Equivalent	LINK Slot/Output	Slot No.	LINK Signal Range	SAM or MMI Range	Default
	SETUP PARAMETERS::CALIBRATION					
	ANALOG TACH +CAL	Feedback/Analog Tach + Cal	2279	89 to 100%	0.98 to 1.10	1.0000
	ANALOG TACH -CAL	Feedback/Analog Tach - Cal	2280	89 to 100%	0.98 to 1.10	1.0000
	ANALOG TACH CAL	Feedback/Cal Analog Tach	2152	89 to 100%	0.98 to 1.10	1.0000
	ANALOG TACH ZERO	Feedback/Analog Tach Zero	2281	±100%	±5.00	0.00%
	ARMATURE V CAL	Feedback/Cal Armature Voltage	2151	89 to 100%	0.98 to 1.10	1.0000
	ENCODER LINES	Feedback/Cal Encoder Lines	1129	10 to 5000	10 to 5000 ordinal	1000
	ENCODER RPM	Feedback/Cal Enacoder RPM	2150	0 to 6000	0 to 32,767 oridnal	1000 rpm
	IR COMPENSATION	Current Loop/IR Comp	2126	0 to +100%	0 to +100%	0.00%
†*	OVER SPEED LEVEL	Speed Loop/Overspeed Level	2217	0 to +100%	0 to +200%	118.00%
	SPD FBK ALRM LEVEL	Feedback/Speed Feedback Alarm Level	2158	0 to 100%	0 to 100%	50.0%
	STALL THRESHOLD	Health/Stall Threshold	2215	0 to +100%	0 to +200%	95.00%
	STALL TRIP DELAY	Health/Stall Trip Delay	2216	0 to +100%	0.1 to 600.0 secs	10.0 secs
	ZERO SPD OFFSET	Speed Loop/Zero Offset	2071	±100%	±5.00%	0.00%
	SETUP PARAMETERS::CURRENT LOOP					
	ADDITIONAL DEM	Current Loop/Aux Current Demand	2116	±100%	±200%	0.00%
	AUTOTUNE	Current Loop/Autotune	101	1=active/0=inactive	on (active)/off (inactive)	off (inactive)
	BIPOLAR CLAMPS	Clamps/BipolarClamps	162	1=enable/0=disable	enabled/disabled	enabled
	CURRENT LIMIT	Current Loop/Current Limit	2081	0 to +100%	0 to +200%	100.00%
†	DISCONTINUOUS	Current Loop/Discontinuous-Continuous	2122	0 to +100%	0 to +200	12.00
†*	FEED FORWARD	Current Loop/Feedforward	2121	0 to +100%	0.10 to 50.00	2.00
	I DMD. ISOLATE	External Enables/Current Demand Enable	89/4048	1=external/0= internal	disabled/enabled	internal (disabled)
	INT. GAIN	Current Loop/Current Loop I Gain	2120	0 to +100%	0 to 200	3.50
	NEG. I CLAMP	Clamps/Negative Clamp	2068	±100%	±200%	-100.00%
	POS. I CLAMP	Clamps/Positive Clamp	2069	±100%	±200%	100.00%
	PROP. GAIN	Current Loop/Current Loop P Gain	2119	0 to +100%	0 to 200	45.00
	REGEN MODE	Current Loop/Regen Mode	75	1=regen/0=non-regen	1=enabled (regen) /0=disabled	enabled (regen)
	SETUP PARAMETERS::CURRENT PROFILE					
	IMAX BRK1 (SPD1)	Current Loop/Current Profile I Max	2135	0 to +100%	0 to +200%	+200.00%
	IMAX BRK2 (SPD2)	Current Loop/Current Profile I Min	2136	0 to +100%	0 to +200%	+200.00%
	SPD BRK1 (LOW)	Current Loop/Current Profile Speed Bkpt 1	2127	0 to +100%	0 to +100%	+100.00%
	SPD BRK2 (HIGH)	Current Loop/Current Profile Speed Bkpt 2	2131	0 to +100%	0 to +100%	+100.00%
	SETUP PARAMETERS::FIELD CONTROL					
	CALIBRATION::FIELD I CAL.	Field/Cal Field Current	2154	89 to 100%	0.98 to 1.10	1.0000
	FIELD ENABLE	Field/Field Enable	56	1=enabled/0=disabled	enabled/disabled	enabled
	FLD CONTROL MODE IS	Field/Field Control Mode	55	1=current/0=voltage	current/voltage	voltage
	FLD CURRENT VARS::FLD WEAKEN::BEMF LAG	Field/BEMF Lag	----	n/a	10 to 5000	100
	FLD CURRENT VARS::FLD WEAKEN::BEMF LEAD	Field/BEMF Lead	----	n/a	10 to 5000	100
	FLD CURRENT VARS::FLD WEAKEN::EMF GAIN	Field/EMF Gain	2110	0 to 100%	0.00 to 100.00	0.30

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Appendix D PARAMETER LIST BY MMI NAME (Continued)

	MMI Equivalent	LINK Slot/Output	Slot No.	LINK Signal Range	SAM or MMI Range	Default
	SETUP PARAMETERS::FIELD (Continued)					
	FLD CURRENT VARS::FLD WEAKEN::EMF LAG	Field/EMF Lag	2109	0 to 100%	0.00 to 200.00	2.00
	FLD CURRENT VARS::FLD WEAKEN::EMF LEAD	Field/EMF Lead	2108	0.2 to 100%	0.10 to 50.00	40.00
	FLD CURRENT VARS::FLD WEAKEN::FLD. WEAK ENABLE	Field/Field Weakening Enable	59	1=enabled/0=disabled	enabled/disabled	disabled
	FLD CURRENT VARS::FLD WEAKEN::MAX VOLTS	Field/Max Armature Volts	2111	0 to 100%	0.00 to 100.00%	100.00%
	FLD CURRENT VARS::FLD WEAKEN::MIN FLD CURRENT	Field/Minimum Field Current	2112	0 to 100%	0.00 to 100.00%	10.00%
	FLD CURRENT VARS::INT. GAIN	Field/Integral Gain	2105	0 to 100%	0.00 to 100.00	1.28
	FLD CURRENT VARS::PROP. GAIN	Field/Prop Gain	2106	0.1 to 100%	0.10 to 100.00	0.10
	FLD CURRENT VARS::SETPOINT	Field/Field Demand	2099	0 to 50%	0.00 to 100.00%	100.00%
	FLD QUENCH DELAY	Field/Field Quench Delay	2114	0 to 100%	0.0 to 600.0 secs	0.0 secs
	FLD VOLTAGE VARS::RATIO OUT/IN	Field/Field Ratio	2115	0 to 100%	0.00 to 100.00%	67.0%
	FLD. QUENCH MODE	Field/Field Quench Mode	65	1=standby/0=quench	standby/quench	quench
	SETUP PARAMETERS::INHIBIT ALARMS					
	ENCODER ALARM	Health/Encoder Alarm Enable	174	1=inhibit/0=enable	inhibited/enabled	enabled
	LINK NETWORK	Health/Link Network Alarm Enable	107	1=inhibit/0=enable	inhibited/enabled	enabled
	SPEED FBK ALARM	Health/Speed Feedback Alarm Enable	95	1=inhibit/0=enable	inhibited/enabled	enabled
	STALL TRIP	Health/Stall Trip Alarm Enable	171	1=inhibit/0=enable	inhibited/enabled	inhibited
	TRIP RESET	Health/Trip Reset	172	1=active/0=inactive	active (true)/inactive (false)	TRUE (active)
	SETUP PARAMETERS::INVERSE TIME					
*	AIMING POINT	Current Loop/Inverse Time	2138	0 to +100%	0 to +200%	110%
†*+	DELAY	Current Loop/Inverse Time Delay	2207	n/a	MMI: 0.1 - 600.0 sec	10.0 secs
†*+	RATE	Current Loop/Inverse Time Rate	2208	n/a	MMI: 0.1 - 600.0 sec	60.0 secs
	SETUP PARAMETERS::RAMPS					
	% S-RAMP	Ramps/Ramp S %	2252	0 to +100%	0 to +100%	5.00%
	CONSTANT ACCEL	Ramps/Ramp Constant Accel	86	1=inactive/0=active	inactive/active	inactive
	EXTERNAL RESET	Ramps/Ramp External Reset	207	1/0	enabled/disabled	disabled
	MIN SPEED	Ramps/Ramp Min Speed	2257	0 to +100.00%	0 to +120.00%	0.00%
	RAMP ACCEL TIME	Ramps/Ramp Accel Time	2089	0 to +100%	0.1 - 600.0 sec	10.0 secs
	RAMP DECEL TIME	Ramps/Ramp Decel Time	2090	0 to +100%	0.1 - 600.0 sec	10.0 secs
	RAMP HOLD	Ramps/Ramp Hold	113	0=ramp/1=hold	ramp/hold	ramp
	RAMP INPUT	Ramps/Ramp Input	2067	±100%	±120.00%	0.00%
	RAMPING THRESH	Ramps/Ramp Finished Thresh	2253	0 to +100%	0 to +100%	0.50%
	SPD. FBK. RESET	Ramps/Speed Fbk Reset	208	1=enable/0-disable	enabled/disabled	disabled
	SETUP PARAMETERS::RAMPS:AUTO RESET	Ramps/Ramp Ext Reset Enable	206	1=enable/0-disable	enabled/disabled	enabled
	SETUP PARAMETERS::SETPOINT SUM					
	INPUT 0	Summing/Speed Input 0	2066	±100%	±120%	0.00%
	INPUT 1	Summing/Speed Input 1	2065	±100%	±120%	0.00%
	LIMIT	Summing/Sum Limit	2235	0 to +87.5%	0 to +105%	105.00%
	RATIO 0	Summing/Input 0 Ratio	2096	±100%	±3.0000	1.0000
	RATIO 1	Summing/Input 1Ratio	2095	±100%	±3.0000	1.0000
	SIGN 0	Summing/Input 0 Sign	100	1=positive/0=negative	negative/positive	positive

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Appendix D PARAMETER LIST BY MMI NAME (Continued)

	MMI Equivalent	LINK Slot/Output	Slot No.	LINK Signal Range	SAM or MMI Range	Default
	SETUP PARAMETERS::SETPOINT SUM (Continued)					
	SIGN 1	Summing/Input 1 Sign	99	1=positive/0=negative	negative/positive	positive
	SETUP PARAMETERS::SPEED LOOP					
	ADVANCED::ADAPTATION::INT TIME CONST	Speed Loop/Adapt Integral Time Const	2262	0 to +100%	.001 to 30 secs	0.500 secs
	ADVANCED::ADAPTATION::MODE	Speed Loop/Speed Adaptation Mode	210	0,1,2,3 ordinal	MODE 0,1,2,3	0
	ADVANCED::ADAPTATION::PROP. GAIN	Speed Loop/Adapt Prop Gain	2261	0 to +100%	0 to 200	5.00
	ADVANCED::ADAPTATION::SPD BRK1 (LOW)	Speed Loop/Adapt Speed Brk 1 (low)	2259	0 to +100%	0 to +100%	1.00%
	ADVANCED::ADAPTATION::SPD BRK2 (HIGH)	Speed Loop/Adapt Speed Brk 2 (high)	2260	0 to +100%	0 to +100%	5.00%
	ADVANCED::I COMP	no corresponding LINK input slot available	n/a	n/a	±100%	0.00%
+*	ADVANCED::I GAIN IN RAMP	Speed Loop/I Gain In Ramp	2263	0 to +100%	0 to 2.0000	1.0000
	ADVANCED::ZERO SPD QUENCH::ZERO IAD LEVEL	Speed Loop/Zero Ia Quench Thresh	2267	0 to +100%	0 to +200%	0.50%
	ADVANCED::ZERO SPD QUENCH::ZERO SPD LEVEL	Speed Loop/Zero Speed Quench Thresh	2266	0 to +100%	0 to +200%	1.50%
	ENCODER SIGN	Feedback/Encoder Sign	109	1=positive/0=negative	positive/negative	positive
	INT. DEFEAT	Speed Loop/Integral Defeat	76	1=on/0=off	on (integral defeated)/off	off
	INT. TIME CONST.	Speed Loop/Integral Time Constant	2125	0 to +100%	.001 to 30 secs	0.500 secs
	PROP. GAIN	Speed Loop/Prop. Gain	2130	0 to +100%	0 to 200	10.00
	SETPOINTS::MAX DEMAND	Speed Loop/Max Speed Demand	2274	0 to +87.5%	0 to +105%	105.00%
	SETPOINTS::MIN DEMAND	Speed Loop/Min Speed Demand	2275	-87.5 to 0%	-105 to 0%	-105.00%
	SETPOINTS::RATIO 2	no corresponding LINK input slot available	n/a	n/a	±3.0000	1.0000
#	SETPOINTS::SETPOINT 1	Summing/Setpoint Sum	output	±87.5%	±105%	0.00%
#	SETPOINTS::SETPOINT 2	Speed Loop/Setpoint Fast Input	2085	±87.5%	±105%	0.00%
#+	SETPOINTS::SETPOINT 3	Ramps/Ramp Output	output	±100%	MMI: ±120.00%	0.00%
	SETPOINTS::SETPOINT 4	no corresponding LINK input slot available	n/a	n/a	±105%	0.00%
	SETPOINTS::SIGN 2	no corresponding LINK input slot available	n/a	n/a	positive/negative	positive
	SPEED FBK SELECT	Feedback/Speed Feedback Select	108	0,1,2 ordinal	arm (0)/tach (1)/enc (2)	arm volt fbk
	SETUP PARAMETERS::STANDSTILL					
*	SOURCE TAG	no corresponding LINK input slot available	n/a	n/a	----	89
	STANDSTILL LOGIC	Standstill/Standstill Logic Enable	24	1=enable/0-disable	enabled/disabled	disabled
	ZERO THRESHOLD	Standstill/Standstill Threshold	2073	0 to +100%	0 to +5.00%	2.00%
	SETUP PARAMETERS::STOP RATES					
	::CONTACTOR DELAY	Start-Stop/Contactor Delay	2228	0 to +100%	0.1 to 600.0 secs	1.0 secs
	::PROG STOP I LIM	Start-Stop/Prog Stop I Limit	2129	0 to +100%	0 to +200%	100.00%
	::PROG STOP LIMIT	Start-Stop/P Stop Time Limit	2229	0 to +100%	0.0 to 600.0 secs	60.0 secs
	::PROG STOP TIME	Start-Stop/Prog Stop Time	2132	0 to +100%	0.1 to 600.0 secs	60.0 secs
	::STOP LIMIT	Start-Stop/Stop Time Limit	2227	0 to +100%	0.0 to 600.0 secs	60.0 secs
	::STOP TIME	Start-Stop/Stop Time	2226	0 to +100%	0.1 to 600.0 secs	10.0 secs
	::STOP ZERO SPEED	Start-Stop/Stop Zero Speed	2133	0 to +100%	0 to +100%	2.00%
	SYSTEM::PEEK					
†*	PEEK DATA	Peek/Peek Data	output	n/a	n/a	----
†*	PEEK SCALE	Peek/Peek Scale	1254	0 to 65535	n/a	800

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Appendix D PARAMETER LIST BY MMI NAME (Continued)

	MMI Equivalent	LINK Slot/Output	Slot No.	LINK Signal Range	SAM or MMI Range	Default
	SETUP PARAMETERS::PEEK (Continued)					
†*	PEEK TAG	Peek/Peek Address	1135	0 to 65535	n/a	120
	PARAMETERS INACCESSIBLE THROUGH THE MMI					
	not available in MMI	Health/Health Flag	output	1=true/0=false	0x01=healthy /0x00=tripped	----
	not available in MMI	Health/Ready Flag	output	1=ready/0=not ready	SAM: ready/not ready	----
	not available in MMI	Health/Unlatched Health Flag	output	1=true/0=false	0x01=healthy /0x00=tripped	----
	not available in MMI	Start-Stop/Program Stop	1122	1=active,0=inactive	SAM: active/inactive	n/a
	not available in MMI or SAM	Current Loop/External Current Demand	2080	±100%	n/a	0.00%
	not available in MMI or SAM, set only in ConfigEd	Feedback/Analog Tach Averaging	----	n/a	n/a	enabled
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Fast Update Rates (ticks)	n/a	0 to 65,535 ordinal	n/a	10 ticks
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Med. Update Rates (ticks)	n/a	0 to 65,535 ordinal	n/a	50 ticks
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Priority Input 1 (slot #)	n/a	0 to 65,535 ordinal	n/a	0
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Priority Input 2 (slot #)	n/a	0 to 65,535 ordinal	n/a	0
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Priority Input 3 (slot #)	n/a	0 to 65,535 ordinal	n/a	0
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Priority Input 4 (slot #)	n/a	0 to 65,535 ordinal	n/a	0
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Priority Input 5 (slot #)	n/a	0 to 65,535 ordinal	n/a	0
†	not available in MMI or SAM, set only in ConfigEd	Parameters/Slow Update Rates (ticks)	n/a	0 to 65,535 ordinal	n/a	100 ticks
†	not available in MMI or SAM, set only in ConfigEd	Peek/Peek Tag Number	n/a	0 to 65535	n/a	150
†#+	not available in MMI or SAM, set only in ConfigEd	Ramps/Ramp Ouput Dest Tag	n/a	0 to 65535	n/a	291

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APPENDIX E PARAMETER LIST BY PARAMETER NAME

	LINK Slot/Output	Slot No.	MMI Equivalent	LINK Signal Range	SAM or MMI Range	Default
	CLAMPS					
	BipolarClamps	162	SETUP PARAMETERS::CURRENT LOOP::BIPOLAR CLAMPS	1=enable/0=disable	enabled/disabled	enabled
	Negative Clamp	2068	DIAGNOSTICS::NEG I CLAMP	±100%	±200%	-100.00%
	Negative Clamp	2068	SETUP PARAMETERS::CURRENT LOOP::NEG. I CLAMP	±100%	±200%	-100.00%
	Positive Clamp	2069	DIAGNOSTICS::POS I CLAMP	±100%	±200%	100.00%
	Positive Clamp	2069	SETUP PARAMETERS::CURRENT LOOP::POS. I CLAMP	±100%	±200%	100.00%
	CURRENT LOOP					
	Armature Current	output	DIAGNOSTICS::CURRENT FEEDBACK	±100%	±200%	----
	Autotune	101	SETUP PARAMETERS::CURRENT LOOP::AUTOTUNE	1=active/0=inactive	on (active)/ off (inactive)	off (inactive)
	Aux Current Demand	2116	SETUP PARAMETERS::CURRENT LOOP::ADDITIONAL DEM	±100%	±200%	0.00%
	Current Limit	2081	SETUP PARAMETERS::CURRENT LOOP::CURRENT LIMIT	0 to +100%	0 to +200%	100.00%
	Regen Mode	75	SETUP PARAMETERS::CURRENT LOOP::REGEN MODE	1=regen/0=non-regen	1=enabled (regen) /0=disabled	enabled (regen)
	Current Loop I Gain	2120	SETUP PARAMETERS::CURRENT LOOP::INT. GAIN	0 to +100%	0 to 200	3.50
	Current Loop P Gain	2119	SETUP PARAMETERS::CURRENT LOOP::PROP. GAIN	0 to +100%	0 to 200	45.00
	Current Profile I Max	2135	SETUP PARAMETERS::CURRENT PROFILE::IMAX BRK1 (SPD1)	0 to +100%	0 to +200%	+200.00%
	Current Profile I Min	2136	SETUP PARAMETERS::CURRENT PROFILE::IMAX BRK2 (SPD2)	0 to +100%	0 to +200%	+200.00%
	Current Profile Speed Bkpt 1	2127	SETUP PARAMETERS::CURRENT PROFILE::SPD BRK1 (LOW)	0 to +100%	0 to +100%	+100.00%
	Current Profile Speed Bkpt 2	2131	SETUP PARAMETERS::CURRENT PROFILE::SPD BRK2 (HIGH)	0 to +100%	0 to +100%	+100.00%
†	Discontinuous-Continuous	2122	SETUP PARAMETERS::CURRENT LOOP::DISCONTINUOUS	0 to +100%	0 to +200	12.00
	External Current Demand	2080	not available in MMI or SAM	±100%	n/a	0.00%
†*	Feedforward	2121	SETUP PARAMETERS::CURRENT LOOP::FEED FORWARD	0 to +100%	0.10 to 50.00	2.00
	Global Quench	output	DIAGNOSTICS::DRIVE ENABLE	1=enable/0=disable	enabled/disabled (quenched)	----
	Inverse Time	2138	DIAGNOSTICS::INVERSE TIME O/P	0 to +100%	0 to +200%	----
*	Inverse Time	2138	SETUP PARAMETERS::INVERSE TIME::AIMING POINT	0 to +100%	0 to +200%	110%
†*+	Inverse Time Delay	2207	SETUP PARAMETERS::INVERSE TIME::DELAY	n/a	MMI: 0.1 - 600.0 sec	10.0 secs
†*+	Inverse Time Rate	2208	SETUP PARAMETERS::INVERSE TIME::RATE	n/a	MMI: 0.1 - 600.0 sec	60.0 secs
	IR Comp	2126	SETUP PARAMETERS::CALIBRATION::IR COMPENSATION	0 to +100%	0 to +100%	0.00%
	Quench	38	DIAGNOSTICS::ENABLE	1 = Ia off / 0= Ia on	off (quenched)/ on (unquenched)	unquenched (Ia on)
	EXTERNAL ENABLES					
	Current Demand Enable	89/4048	SETUP PARAMETERS::CURRENT LOOP::I DMD. ISOLATE	1=external/0= internal	disabled/ enabled	internal (disabled)
	FEEDBACK					
	Analog Tach + Cal	2279	SETUP PARAMETERS::CALIBRATION::ANALOG TACH +CAL	89 to 100%	0.98 to 1.10	1.0000
	Analog Tach - Cal	2280	SETUP PARAMETERS::CALIBRATION::ANALOG TACH -CAL	89 to 100%	0.98 to 1.10	1.0000
	Analog Tach Averaging	----	not available in MMI or SAM, set only in ConfigEd	n/a	n/a	enabled
	Analog Tach Feedback	output	DIAGNOSTICS::TACH INPUT	±100%	±150%	----
	Analog Tach Zero	2281	SETUP PARAMETERS::CALIBRATION::ANALOG TACH ZERO	±100%	±5.00	0.00%
	Cal Analog Tach	2152	SETUP PARAMETERS::CALIBRATION::ANALOG TACH CAL	89 to 100%	0.98 to 1.10	1.0000
	Cal Armature Voltage	2151	SETUP PARAMETERS::CALIBRATION::ARMATURE V CAL	89 to 100%	0.98 to 1.10	1.0000
	Cal Enacoder RPM	2150	SETUP PARAMETERS::CALIBRATION::ENCODER RPM	0 to 6000	0 to 32,767 oridnal	1000 rpm
	Cal Encoder Lines	1129	SETUP PARAMETERS::CALIBRATION::ENCODER LINES	10 to 5000	10 to 5000 ordinal	1000
	Digital Tach	output	DIAGNOSTICS::ENCODER	±100%	±6000 rpm	----
	Encoder Sign	109	SETUP PARAMETERS::SPEED LOOP::ENCODER SIGN	1=positive/0=negative	positive/negative	positive
	Speed Feedback	output	DIAGNOSTICS::SPEED FEEDBACK	±100%	±120.0%	----

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† These ConfigEd parameters are reserved for authorized use only.

\+ Parameter inaccessible through SAM.

APPENDIX E PARAMETER LIST BY PARAMETER NAME (CONTINUED)

	LINK Slot/Output	Slot No.	MMI Equivalent	LINK Signal Range	SAM or MMI Range	Default
	FEEDBACK (Continued)					
	Speed Feedback Alarm Level	2158	SETUP PARAMETERS::CALIBRATION::SPD FBK ALRM LEVEL	0 to 100%	0 to 100%	50.0%
	Speed Feedback Select	108	SETUP PARAMETERS::SPEED LOOP::SPEED FBK SELECT	0,1,2 ordinal	arm (0)/tach (1)/enc (2)	arm volt fbk
	Zero Speed	output	DIAGNOSTICS::AT ZERO SPEED	1=true/0=false	true/false	----
	FIELD					
	Cal Field Current	2154	SETUP PARAMETERS::CALIBRATION::FIELD I CAL.	89 to 100%	0.98 to 1.10	1.0000
	BEMF Lag	----	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::BEMF LAG	n/a	10 to 5000	100
	BEMF Lead	----	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::BEMF LEAD	n/a	10 to 5000	100
	EMF Gain	2110	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::EMF GAIN	0 to 100%	0.00 to 100.00	0.30
	EMF Lag	2109	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::EMF LAG	0 to 100%	0.00 to 200.00	2.00
	EMF Lead	2108	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::EMF LEAD	0.2 to 100%	0.10 to 50.00	40.00
	Field Control Mode	55	SETUP PARAMETERS::FIELD CONTROL::FLD CONTROL MODE IS	1=current/0=voltage	current/voltage	voltage
	Field Current	output	DIAGNOSTICS::FIELD I FBK.	0 to 100%	0.00 to 100.00%	----
	Field Demand	2099	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::SETPOINT	0 to 50%	0.00 to 100.00%	100.00%
	Field Enable	56	SETUP PARAMETERS::FIELD ENABLE	1=enabled/0=disabled	enabled/disabled	enabled
	Field Quench Delay	2114	SETUP PARAMETERS::FLD QUENCH DELAY	0 to 100%	0.0 to 600.0 secs	0.0 secs
	Field Quench Mode	65	SETUP PARAMETERS::FLD. QUENCH MODE	1=standby/0=quench	standby/quench	quench
	Field Ratio	2115	...::FIELD CONTROL::FLD VOLTAGE VARS::RATIO OUT/IN	0 to 100%	0.00 to 100.00%	67.0%
	Field Weakening Enable	59	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::FLD. WEAK ENABLE	1=enabled/0=disabled	enabled/disabled	disabled
	Integral Gain	2105	...::FIELD CONTROL::FLD CURRENT VARS::INT. GAIN	0 to 100%	0.00 to 100.00	1.28
	Max Armature Volts	2111	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::MAX VOLTS	0 to 100%	0.00 to 100.00%	100.00%
	Minimum Field Current	2112	...::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::MIN FLD CURRENT	0 to 100%	0.00 to 100.00%	10.00%
	Prop Gain	2106	SETUP PARAMETERS::FIELD CONTROL::FLD CURRENT VARS::PROP. GAIN	0.1 to 100%	0.10 to 100.00	0.10
	Total Field Setpoint	output	DIAGNOSTICS:FIELD DEMAND			
	HEALTH					
	Encoder Alarm Enable	174	SETUP PARAMETERS::INHIBIT ALARMS::ENCODER ALARM	1=inhibit/0=enable	inhibited/enabled	enabled
	Health Flag	output	not available in MMI	1=true/0=false	0x01=healthy /0x00=tripped	----
	Health Store	output	ALARM STATUS::LAST ALARM	0 to 16 ordinal	annunciated alarm	----
	Health Store Bitmap	output	ALARM STATUS::HEALTH STORE	0 to 32,767 ordinal	see Figure 5.10, Health Alarm Bits	----
	Health Word	output	ALARM STATUS::HEALTH WORD	0 to 65,535 ordinal	refer to Alarm Process in Chapter 5	----
	Link Network Alarm Enable	107	SETUP PARAMETERS::INHIBIT ALARMS::LINK NETWORK	1=inhibit/0=enable	inhibited/enabled	enabled
	Ready Flag	output	not available in MMI	1=ready/0=not ready	SAM: ready/not ready	----
	Speed Feedback Alarm Enable	95	SETUP PARAMETERS::INHIBIT ALARMS::SPEED FBK ALARM	1=inhibit/0=enable	inhibited/enabled	enabled
	Stall Threshold	2215	SETUP PARAMETERS::CALIBRATION::STALL THRESHOLD	0 to +100%	0 to +200%	95.00%
	Stall Trip	output	DIAGNOSTICS::STALL TRIP	1=tripped/0=normal	tripped/normal (OK)	normal (OK)
	Stall Trip Alarm Enable	171	SETUP PARAMETERS::INHIBIT ALARMS::STALL TRIP	1=inhibit/0=enable	inhibited/enabled	inhibited
	Stall Trip Delay	2216	SETUP PARAMETERS::CALIBRATION::STALL TRIP DELAY	0 to +100%	0.1 to 600.0 secs	10.0 secs
	Trip Reset	172	SETUP PARAMETERS::INHIBIT ALARMS::TRIP RESET	1=active/0=inactive	active (true)/inactive (false)	TRUE (active)
	Unlatched Health Flag	output	not available in MMI	1=true/0=false	0x01=healthy /0x00=tripped	----
	NETWORK ACCESS					
	Logic Parameter #1	126	NETWORK ACCESS::LOGIC PARAM. 1	1=true/0=false	true/false	false
	Logic Parameter #2	127	NETWORK ACCESS::LOGIC PARAM. 2	1=true/0=false	true/false	false
	Logic Parameter #3	128	NETWORK ACCESS::LOGIC PARAM. 3	1=true/0=false	true/false	false
	Logic Parameter #4	129	NETWORK ACCESS::LOGIC PARAM. 4	1=true/0=false	true/false	false
	Logic Parameter #5	130	NETWORK ACCESS::LOGIC PARAM. 5	1=true/0=false	true/false	false

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+ Parameter inaccessible through SAM.

APPENDIX E PARAMETER LIST BY PARAMETER NAME (CONTINUED)

	LINK Slot/Output	Slot No.	MMI Equivalent	LINK Signal Range	SAM or MMI Range	Default
	NETWORK ACCESS (Continued)					
	Logic Parameter #6	131	NETWORK ACCESS::LOGIC PARAM. 6	1=true/0=false	true/false	false
	Logic Parameter #7	132	NETWORK ACCESS::LOGIC PARAM. 7	1=true/0=false	true/false	false
	Logic Parameter #8	133	NETWORK ACCESS::LOGIC PARAM. 8	1=true/0=false	true/false	false
	Logic Parameter #9	134	NETWORK ACCESS::LOGIC PARAM. 9	1=true/0=false	true/false	false
	Logic Parameter #10	135	NETWORK ACCESS::LOGIC PARAM. 10	1=true/0=false	true/false	false
	Value Paramater #1	2164	NETWORK ACCESS::VALUE PARAM. 1	±100%	±100%	0.00%
	Value Paramater #2	2165	NETWORK ACCESS::VALUE PARAM. 2	±100%	±100%	0.00%
	Value Paramater #3	2166	NETWORK ACCESS::VALUE PARAM. 3	±100%	±100%	0.00%
	Value Paramater #4	2167	NETWORK ACCESS::VALUE PARAM. 4	±100%	±100%	0.00%
	Value Paramater #5	2168	NETWORK ACCESS::VALUE PARAM. 5	±100%	±100%	0.00%
	Value Paramater #6	2169	NETWORK ACCESS::VALUE PARAM. 6	±100%	±100%	0.00%
	Value Paramater #7	2170	NETWORK ACCESS::VALUE PARAM. 7	±100%	±100%	0.00%
	Value Paramater #8	2171	NETWORK ACCESS::VALUE PARAM. 8	±100%	±100%	0.00%
	Value Paramater #9	2172	NETWORK ACCESS::VALUE PARAM. 9	±100%	±100%	0.00%
	Value Paramater #10	2173	NETWORK ACCESS::VALUE PARAM. 10	±100%	±100%	0.00%
	PARAMETERS					
	EEPROM Parameter Save	30	PARAMETER SAVE	1=save/0=cancel	saving/finished	----
†	Fast Update Rates (ticks)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	10 ticks
	Full Menus	n/a	MENUS::FULL MENUS	enabled/disabled	enabled/disabled	enabled
#	LINK Fail Stop Select	115	LINK SUPPORT::STOP ON NET FAIL (not setable in MMI)	0,1,2 ordinal	coast (0)/no stop (1)/regen (2)	ena. regen stop
†	Med. Update Rates (ticks)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	50 ticks
	Menu Speed	n/a	MENUS::MENU DELAY	0 to 65,535 ordinal	0 to 5000	30
†*	Minimum Cycle Time	n/a	RESERVED::MIN MMI CYCLE TM	0 to 65,535 ordinal	0 to 65,535	80
†*	MMI Filter T.C.	n/a	RESERVED::MMI FILTER T.C.	0 to 65,535 ordinal	0 to 65,535	20
#	Module Fail Stop Select	69	LINK SUPPORT::STOP/MODULE FAIL (not setable in MMI)	0,1,2 ordinal	coast/no stop/regen	ena. regen stop
#	Module Recfg Stop Select	70	LINK SUPPORT::STOP/MODULE RCFG (not setable in MMI)	0,1,2 ordinal	coast/no stop/regen	ena. regen stop
#	Network Type	output	LINK SUPPORT::NODE TYPE (read only in MMI and in SAM)	2, 3, 7, 11 ordinal	simple (2)/red (3)/tap (7)/aux tap (11)	simple
†	Priority Input 1(slot #)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	0
†	Priority Input 2 (slot #)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	0
†	Priority Input 3 (slot #)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	0
†	Priority Input 4 (slot #)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	0
†	Priority Input 5 (slot #)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	0
†	Slow Update Rates (ticks)	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65,535 ordinal	n/a	100 ticks
†*	User Filter T.C.	n/a	RESERVED::USER FILTER T.C.	0 to 65,535 ordinal	0 to 65,535	20
†	**PEEK**					
†*	Peek Address	1135	SYSTEM::PEEK::PEEK TAG	0 to 65535	n/a	120
†*	Peek Data	output	SYSTEM::PEEK::PEEK DATA	n/a	n/a	----
†*	Peek Scale	1254	SYSTEM::PEEK::PEEK SCALE	0 to 65535	n/a	800
†	Peek Tag Number	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65535	n/a	150

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APPENDIX E PARAMETER LIST BY PARAMETER NAME (CONTINUED)

	LINK Slot/Output	Slot No.	MMI Equivalent	LINK Signal Range	SAM or MMI Range	Default
	RAMPS					
	Ramp Accel Time	2089	SETUP PARAMETERS::RAMPS::RAMP ACCEL TIME	0 to +100%	0.1 - 600.0 sec	10.0 secs
	Ramp Constant Accel	86	SETUP PARAMETERS::RAMPS::CONSTANT ACCEL	1=inactive/0=active	inactive/active	inactive
	Ramp Decel Time	2090	SETUP PARAMETERS::RAMPS::RAMP DECEL TIME	0 to +100%	0.1 - 600.0 sec	10.0 secs
	Ramp Ext Reset Enable	206	SETUP PARAMETERS::RAMPS:AUTO RESET	1=enable/0-disable	enabled/disabled	enabled
	Ramp External Reset	207	SETUP PARAMETERS::RAMPS::EXTERNAL RESET	1/0	enabled/disabled	disabled
	Ramp Finished Thresh	2253	SETUP PARAMETERS::RAMPS::RAMPING THRESH	0 to +100%	0 to +100%	0.50%
	Ramp Hold	113	SETUP PARAMETERS::RAMPS::RAMP HOLD	0=ramp/1=hold	ramp/hold	ramp
	Ramp Input	2067	SETUP PARAMETERS::RAMPS::RAMP INPUT	±100%	±120.00%	0.00%
	Ramp Min Speed	2257	SETUP PARAMETERS::RAMPS::MIN SPEED	0 to +100.00%	0 to +120.00%	0.00%
†#+	Ramp Ouput Dest Tag	n/a	not available in MMI or SAM, set only in ConfigEd	0 to 65535	n/a	291
	RAMPS (Continued)					
	Ramp Output	output	DIAGNOSTICS::RAMP OUTPUT	±100%	±120.00%	----
#+	Ramp Output	output	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::SETPOINT 3	±100%	MMI: ±120.00%	0.00%
	Ramp S %	2252	SETUP PARAMETERS::RAMPS::% S-RAMP	0 to +100%	0 to +100%	5.00%
	Ramping	output	DIAGNOSTICS::RAMPING	1=true/0=false	true (ramping)/ false (not ramping)	----
	Speed Fbk Reset	208	SETUP PARAMETERS::RAMPS::SPD. FBK. RESET	1=enable/0-disable	enabled/disabled	disabled
	SPEED LOOP					
	Adapt Integral Time Const	2262	...SPEED LOOP::ADVANCED::ADAPTATION::INT TIME CONST	0 to +100%	.001 to 30 secs	0.500 secs
	Adapt Prop Gain	2261	...SPEED LOOP::ADVANCED::ADAPTATION::PROP. GAIN	0 to +100%	0 to 200	5.00
	Adapt Speed Brk 1(low)	2259	...SPEED LOOP::ADVANCED::ADAPTATION::SPD BRK1(LOW)	0 to +100%	0 to +100%	1.00%
	Adapt Speed Brk 2 (high)	2260	...SPEED LOOP::ADVANCED::ADAPTATION::SPD BRK2 (HIGH)	0 to +100%	0 to +100%	5.00%
	Armature Voltage	output	DIAGNOSTICS::TERMINAL VOLTS	±100%	±200%	----
+*	I Gain In Ramp	2263	SETUP PARAMETERS::SPEED LOOP::ADVANCED::I GAIN IN RAMP	0 to +100%	0 to 2.0000	1.0000
	Integral Defeat	76	SETUP PARAMETERS::SPEED LOOP::INT. DEFEAT	1=on/0=off	on (integral defeated)/ off	off
	Integral Time Constant	2125	SETUP PARAMETERS::SPEED LOOP::INT. TIME CONST.	0 to +100%	.001 to 30 secs	0.500 secs
	Max Speed Demand	2274	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::MAX DEMAND	0 to +87.5%	0 to +105%	105.00%
	Min Speed Demand	2275	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::MIN DEMAND	-87.5 to 0%	-105 to 0%	-105.00%
†*	Overspeed Level	2217	SETUP PARAMETERS::CALIBRATION::OVER SPEED LEVEL	0 to +100%	0 to +200%	118.00%
	Prop. Gain	2130	SETUP PARAMETERS::SPEED LOOP::PROP. GAIN	0 to +100%	0 to 200	10.00
#	Setpoint Fast Input	2085	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::SETPOINT 2	±87.5%	±105%	0.00%
	Speed Adaptation Mode	210	...SPEED LOOP::ADVANCED::ADAPTATION::MODE	0,1,2,3 ordinal	MODE 0,1,2,3	0
	Speed Loop Error	output	DIAGNOSTICS::SPEED ERROR	±100%	±100%	----
	Speed Loop Output	output	DIAGNOSTICS::CURRENT DEMAND	±100%	±200%	----
	Total Setpoint	output	DIAGNOSTICS::SPEED SETPOINT	±100%	±120%	----
	Zero Ia Quench Thresh	2267	...SPEED LOOP::ADVANCED::ZERO SPD QUENCH::ZERO IAD LEVEL	0 to +100%	0 to +200%	0.50%
	Zero Offset	2071	SETUP PARAMETERS::CALIBRATION::ZERO SPD OFFSET	±100%	±5.00%	0.00%
	Zero Speed Quench Thresh	2266	...SPEED LOOP::ADVANCED::ZERO SPD QUENCH::ZERO SPD LEVEL	0 to +100%	0 to +200%	1.50%
	STANDSTILL					
	At Standstill	output	DIAGNOSTICS::AT STANDSTILL	1=true/0=false	1=@ standstill/ 0= not @ standstill	----
	At Zero Setpoint	output	DIAGNOSTICS::AT ZERO SETPOINT	1=true/0=false	1=@ zero sp/ 0= not @ zero sp	----
	Standstill Logic Enable	24	SETUP PARAMETERS::STANDSTILL::STANDSTILL LOGIC	1=enable/0-disable	enabled/disabled	disabled
	Standstill Threshold	2073	SETUP PARAMETERS::STANDSTILL::ZERO THRESHOLD	0 to +100%	0 to +5.00%	2.00%

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APPENDIX E PARAMETER LIST BY PARAMETER NAME (CONTINUED)

	LINK Slot/Output	Slot No.	MMI Equivalent	LINK Signal Range	SAM or MMI Range	Default
	START-STOP					
	Composite Program Stop	output	DIAGNOSTICS::PROG/COAST STOP	1=active,0=inactive	active/inactive	----
	Contactor Delay	2228	SETUP PARAMETERS::STOP RATES::CONTACTOR DELAY	0 to +100%	0.1 to 600.0 secs	1.0 secs
	Drive Start	52	SETUP PARAMETERS::AUX I/O::AUX START	1/0	on/off	
	Drive Start	52	SETUP PARAMETERS::AUX I/O::AUX ENABLE	1/0	on/off	----
	Drive Started	output	DIAGNOSTICS::DRIVE START	1/0	on/off	----
	P Stop Time Limit	2229	SETUP PARAMETERS::STOP RATES::PROG STOP LIMIT	0 to +100%	0.0 to 600.0 secs	60.0 secs
	Prog Stop I Limit	2129	SETUP PARAMETERS::STOP RATES::PROG STOP I LIM	0 to +100%	0 to +200%	100.00%
	Prog Stop Time	2132	SETUP PARAMETERS::STOP RATES::PROG STOP TIME	0 to +100%	0.1 to 600.0 secs	60.0 secs
	Program Stop	1122	not available in MMI	1=active,0=inactive	SAM: active/inactive	n/a
	Start-Stop Output	n/a	DIAGNOSTICS::SPEED DEMAND	±100%	±120%	----
	Stop Time	2226	SETUP PARAMETERS::STOP RATES::STOP TIME	0 to +100%	0.1 to 600.0 secs	10.0 secs
	Stop Time Limit	2227	SETUP PARAMETERS::STOP RATES::STOP LIMIT	0 to +100%	0.0 to 600.0 secs	60.0 secs
	Stop Zero Speed	2133	SETUP PARAMETERS::STOP RATES::STOP ZERO SPEED	0 to +100%	0 to +100%	2.00%
	SUMMING					
	Input 0 Ratio	2096	SETUP PARAMETERS::SETPOINT SUM::RATIO 0	±100%	±3.0000	1.0000
	Input 0 Sign	100	SETUP PARAMETERS::SETPOINT SUM::SIGN 0	1=positive/0=negative	negative/positive	positive
	Input 1Ratio	2095	SETUP PARAMETERS::SETPOINT SUM::RATIO 1	±100%	±3.0000	1.0000
	Input 1 Sign	99	SETUP PARAMETERS::SETPOINT SUM::SIGN 1	1=positive/0=negative	negative/positive	positive
	Setpoint Sum	output	DIAGNOSTICS::SPT. SUM OUTPUT	±87.5%	±105%	0.00%
#	Setpoint Sum	output	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::SETPOINT 1	±87.5%	±105%	0.00%
	Speed Input 0	2066	SETUP PARAMETERS::SETPOINT SUM::INPUT 0	±100%	±120%	0.00%
	Speed Input 1	2065	SETUP PARAMETERS::SETPOINT SUM::INPUT 1	±100%	±120%	0.00%
	Sum Limit	2235	SETUP PARAMETERS::SETPOINT SUM::LIMIT	0 to +87.5%	0 to +105%	105.00%
	MMI PARAMETERS INACCESSIBLE THROUGH LINK					
	no corresponding LINK input slot available	----	....::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::BEMF LAG	n/a	10 to 5000	100
	no corresponding LINK input slot available	----	....::FIELD CONTROL::FLD CURRENT VARS::FLD WEAKEN::BEMF LEAD	n/a	10 to 5000	100
	no corresponding LINK input slot available	n/a	SETUP PARAMETERS::SPEED LOOP::ADVANCED::I COMP	n/a	±100%	0.00%
	no corresponding LINK input slot available	n/a	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::SETPOINT 4	n/a	±105%	0.00%
	no corresponding LINK input slot available	n/a	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::RATIO 2	n/a	±3.0000	1.0000
	no corresponding LINK input slot available	n/a	SETUP PARAMETERS::SPEED LOOP::SETPOINTS::SIGN 2	n/a	positive/negative	positive
*	no corresponding LINK input slot available	n/a	SETUP PARAMETERS::STANDSTILL::SOURCE TAG	n/a	----	89
	no corresponding LINK output available	n/a	DIAGNOSTICS::ACTUAL NEG I LIM	n/a	±200%	----
	no corresponding LINK output available	n/a	DIAGNOSTICS::ACTUAL POS I LIM	n/a	±200%	----
	no corresponding LINK output available	n/a	DIAGNOSTICS::AT CURRENT LIMIT	n/a	true/false	----
	no corresponding LINK output available	n/a	DIAGNOSTICS::BACK EMF	n/a	±150%	----
	no corresponding LINK output available	n/a	DIAGNOSTICS::FIELD ENABLE			
	no corresponding LINK output available	n/a	DIAGNOSTICS::FLD. FIRING ANGLE			
	no corresponding LINK output available	n/a	DIAGNOSTICS::OPERATING MODE	0,1 ordinal	stop (0)/run (1)	----
	no corresponding LINK output available	n/a	DIAGNOSTICS::START			
#	no corresponding LINK output available	n/a	LINK SUPPORT::ADDRESS	n/a	1 through 3000	----

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+ Parameter inaccessible through SAM.

Appendix F MISCELLANEOUS DRAWINGS

This appendix contains miscellaneous wiring and schematic diagrams of several 590 DRV *LINK* 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.

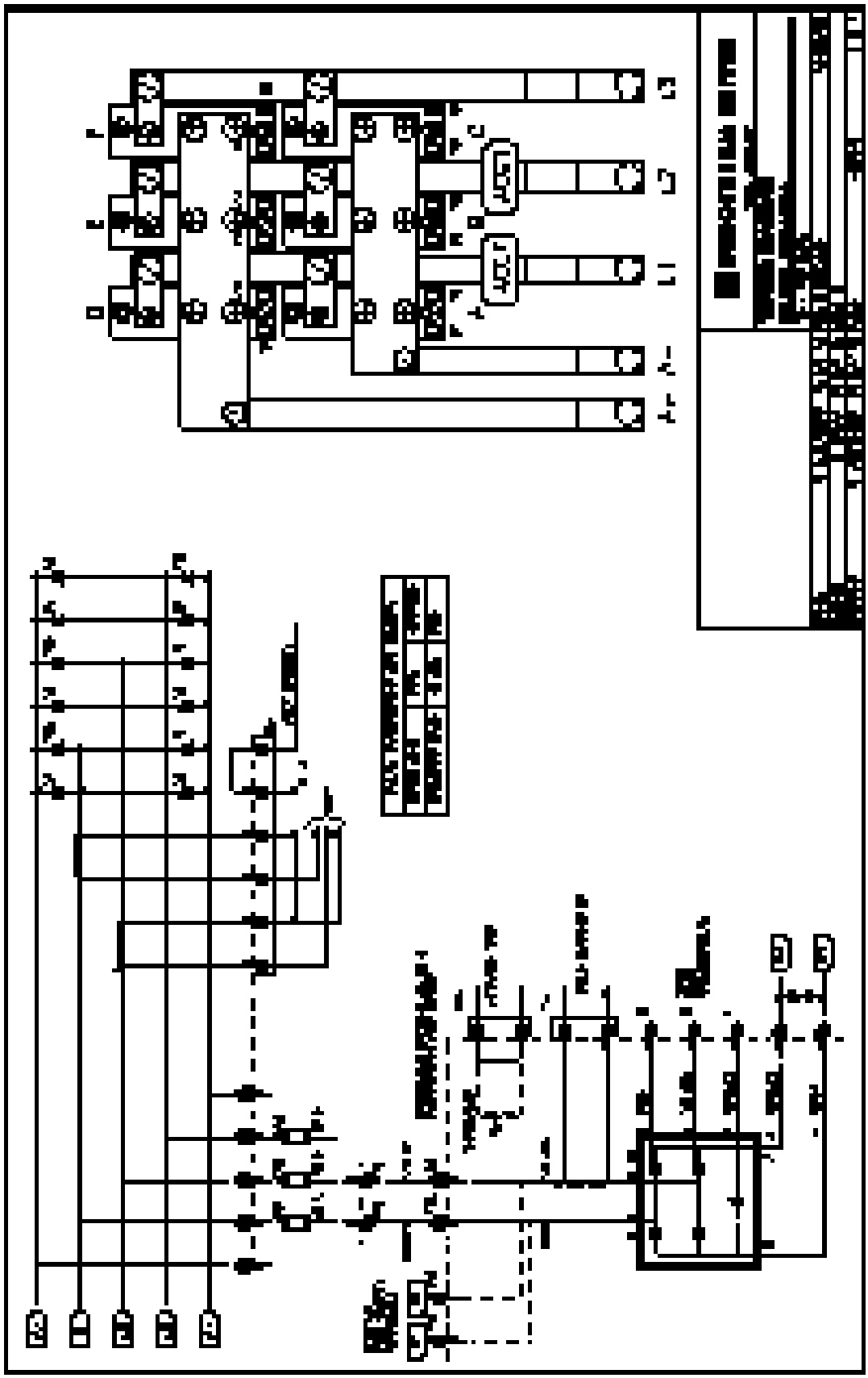


Figure F.1 - 590 Controller, Regenerative

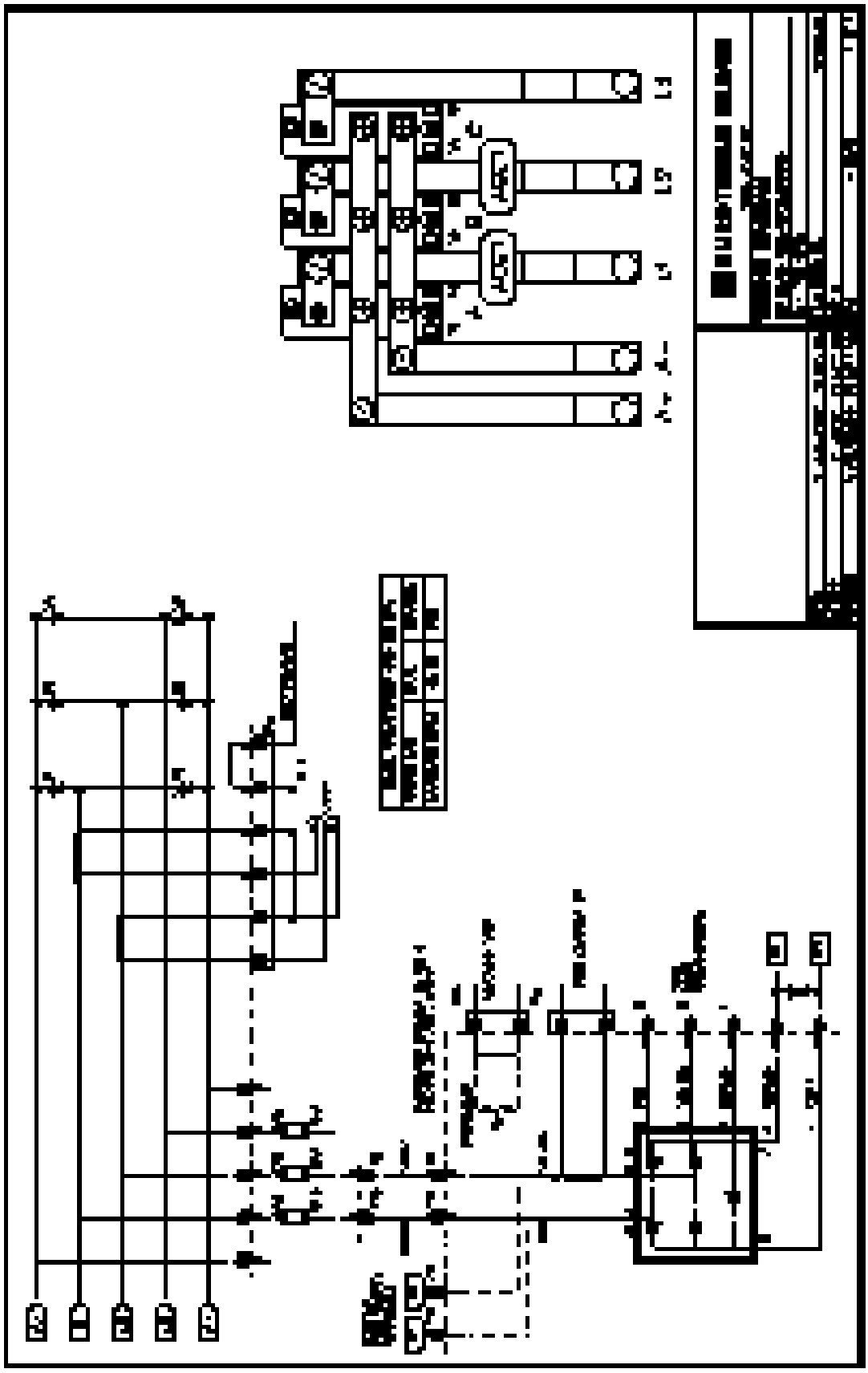


Figure F.2 - 591 Controller, Non-regenerative

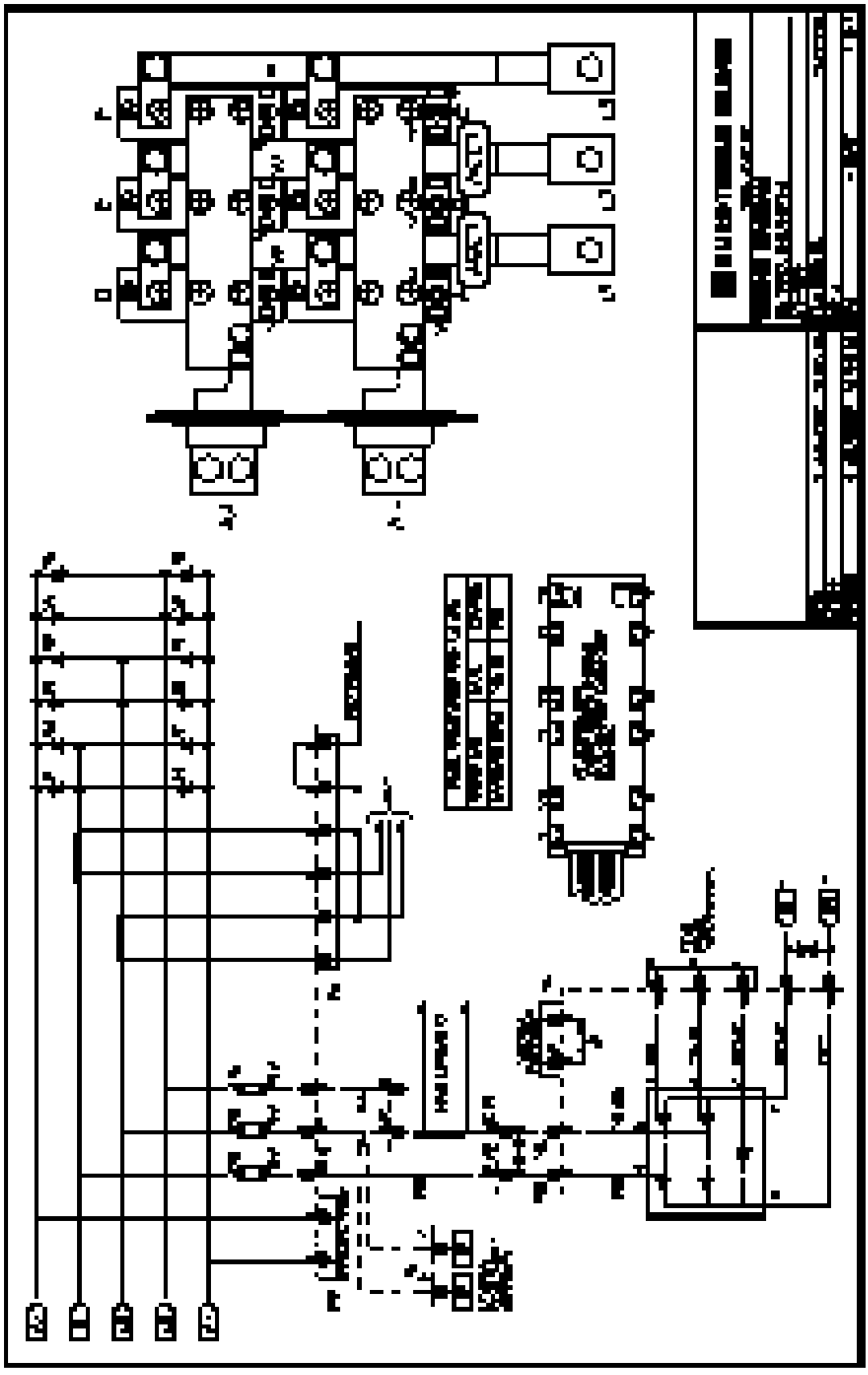


Figure F.3 - 592 Controller, Regenerative

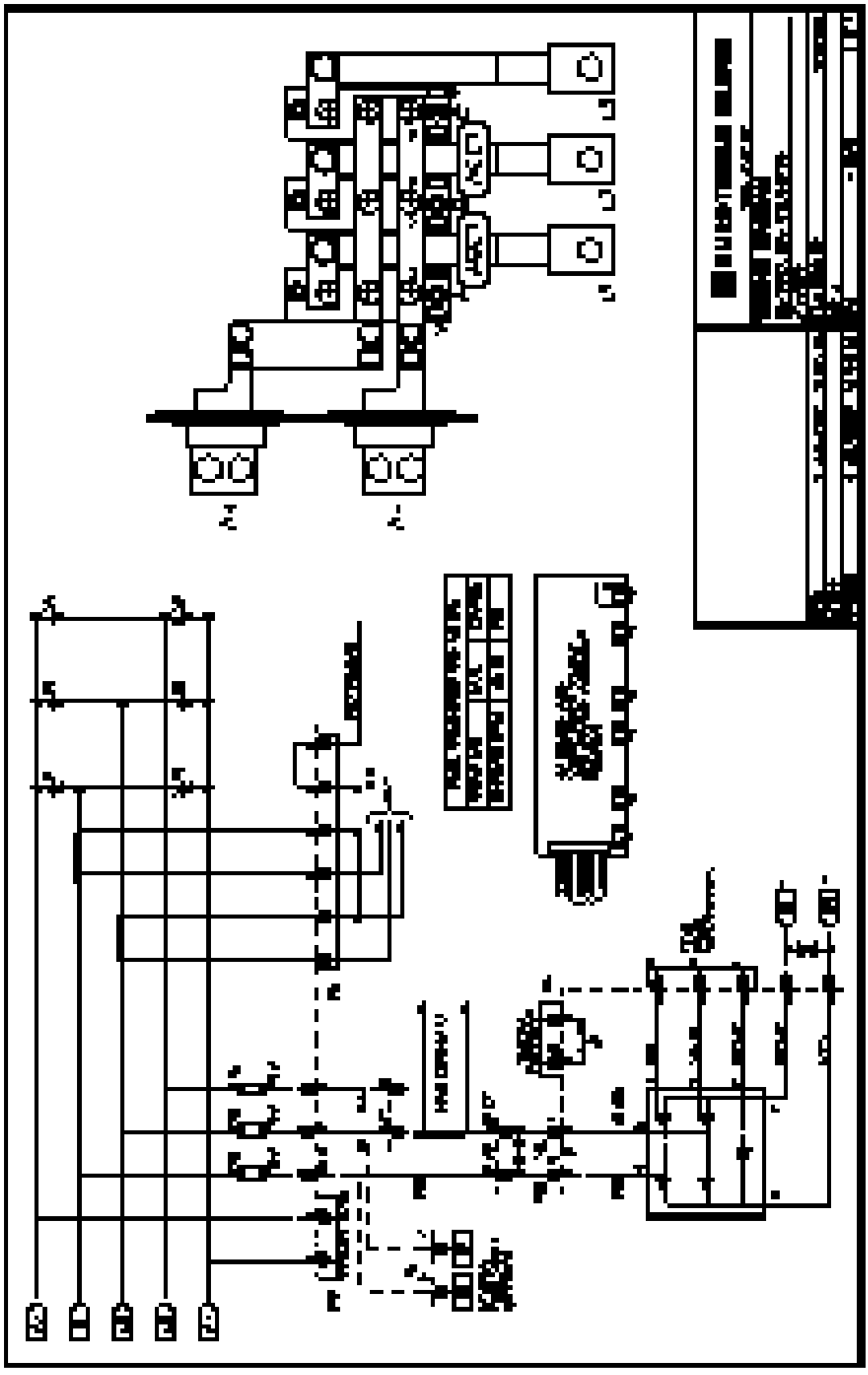


Figure F.4 - 593 Controller, Non-regenerative

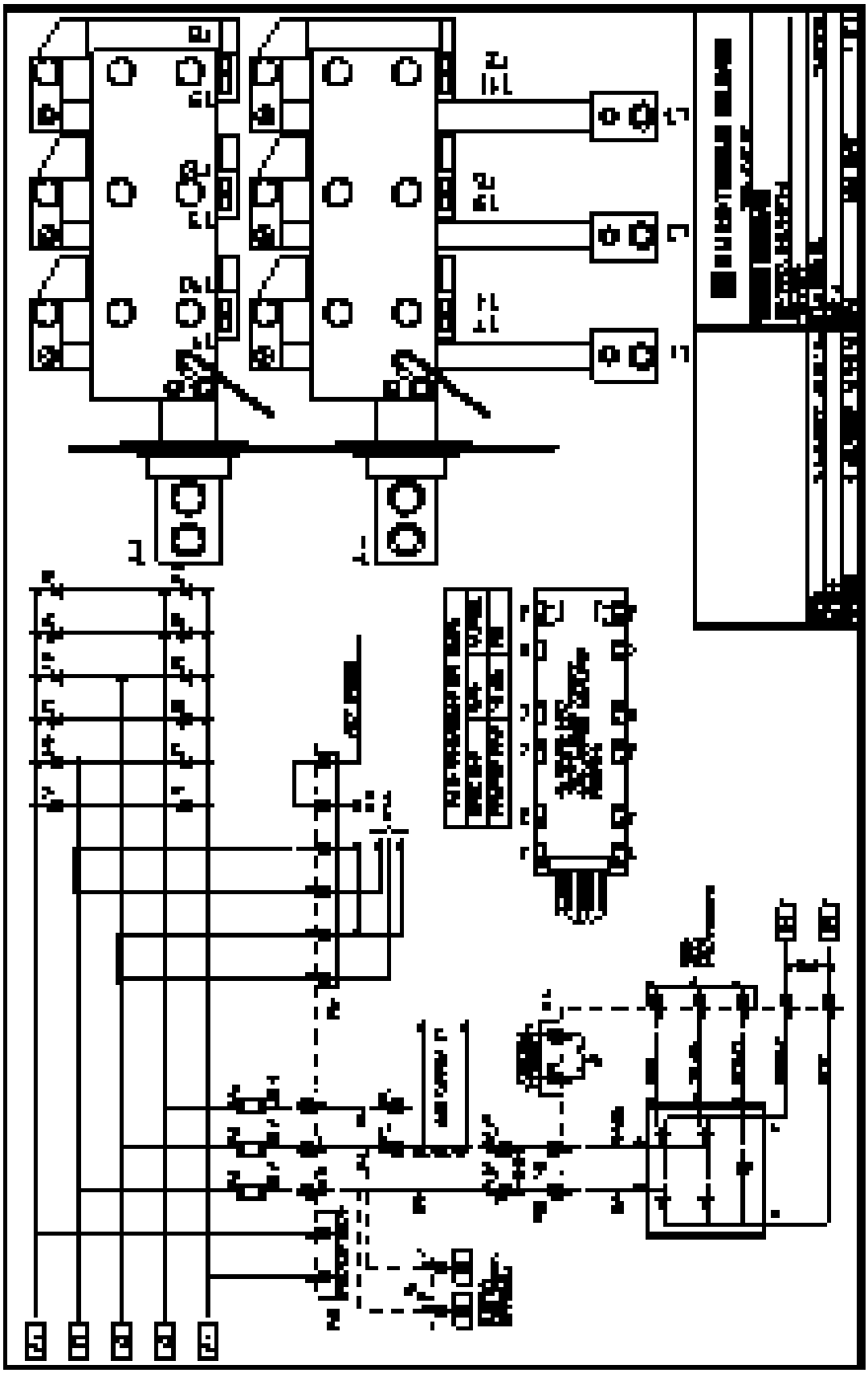


Figure F.5 - 594 Controller, Regenerative

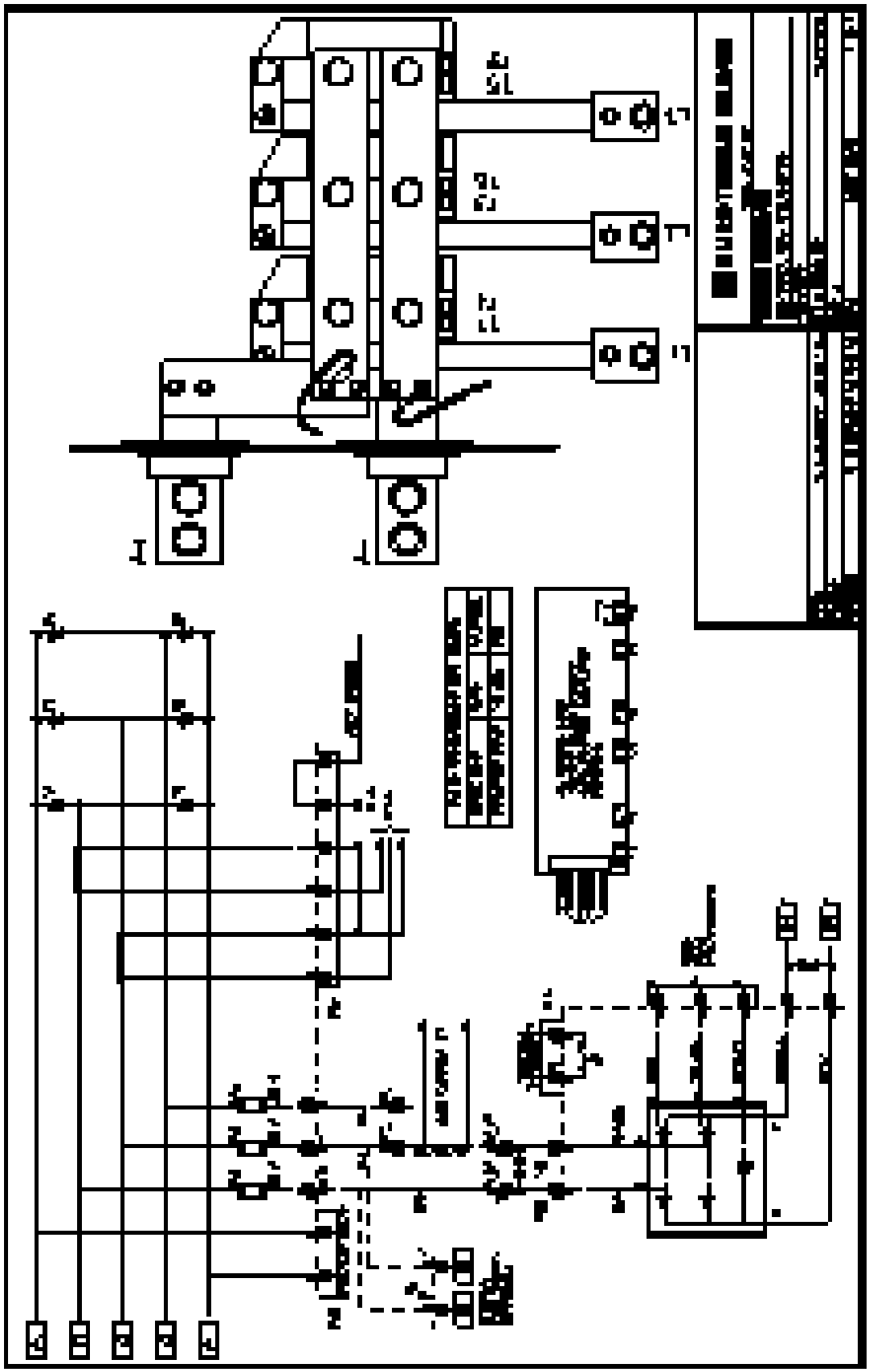


Figure F.6 - 595 Controller, Non-Regenerative

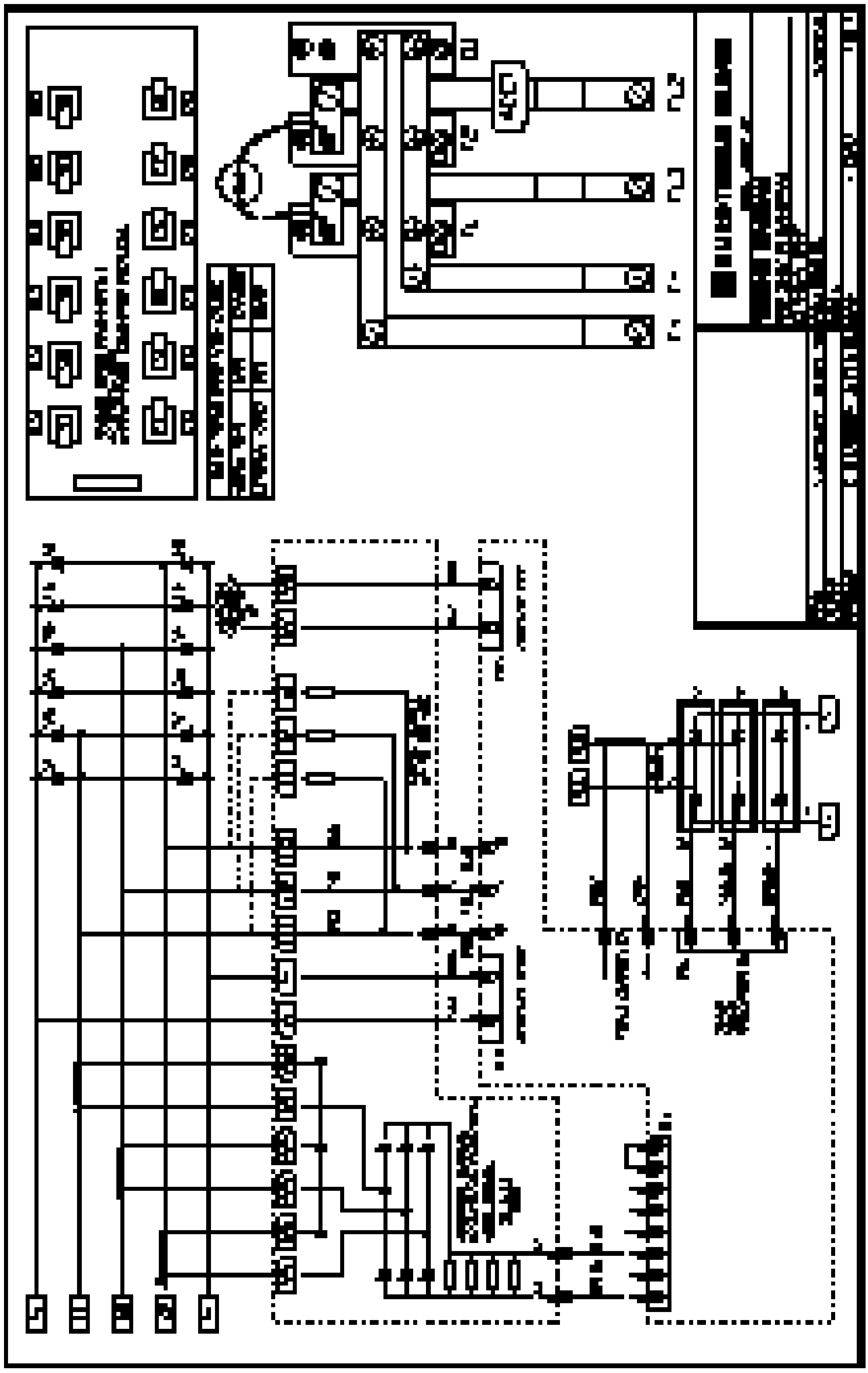


Figure F.7 - External Stack (598) Controller, Regenerative

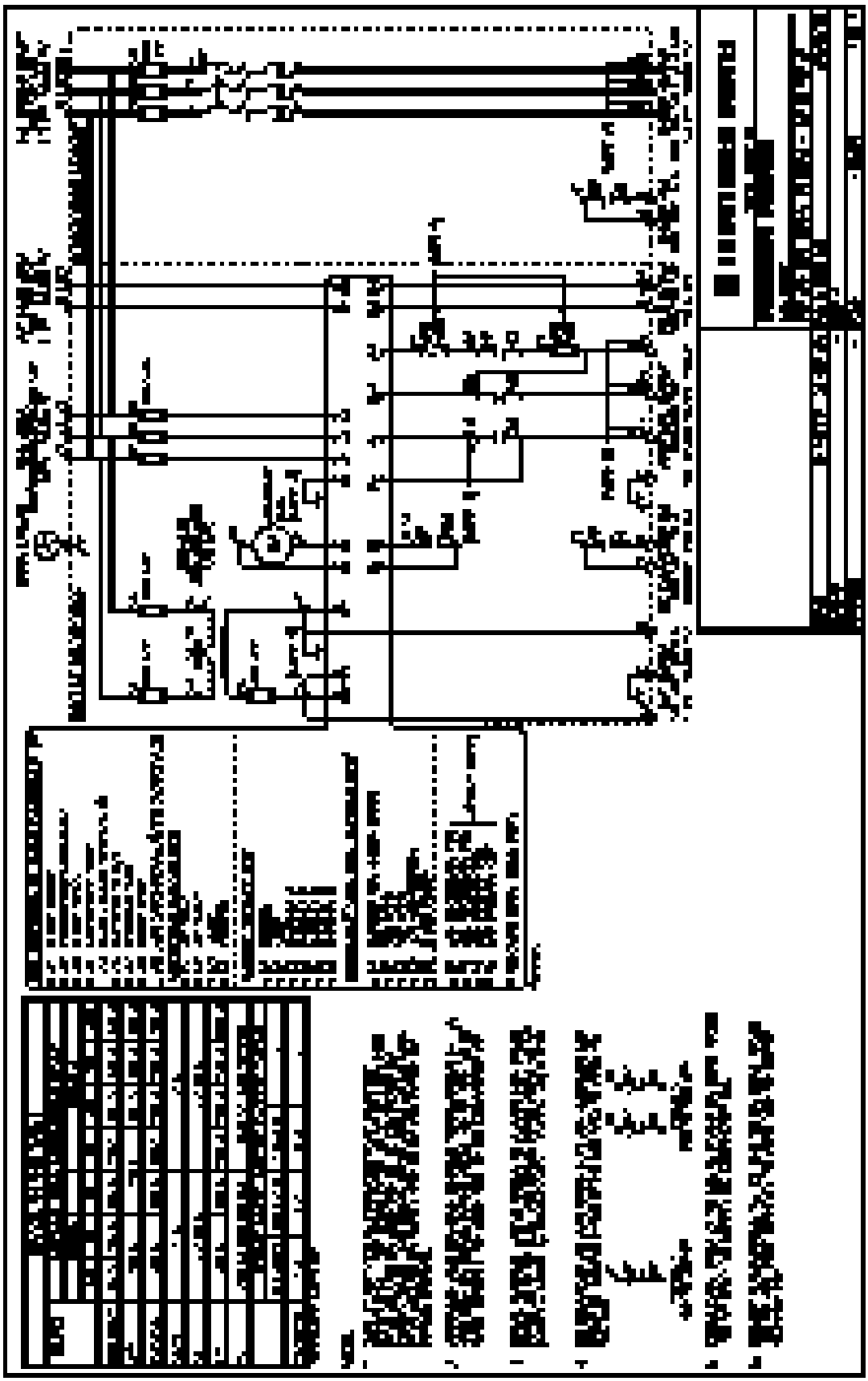


Figure F.8 - Schematic Diagram Up to 100 Hp

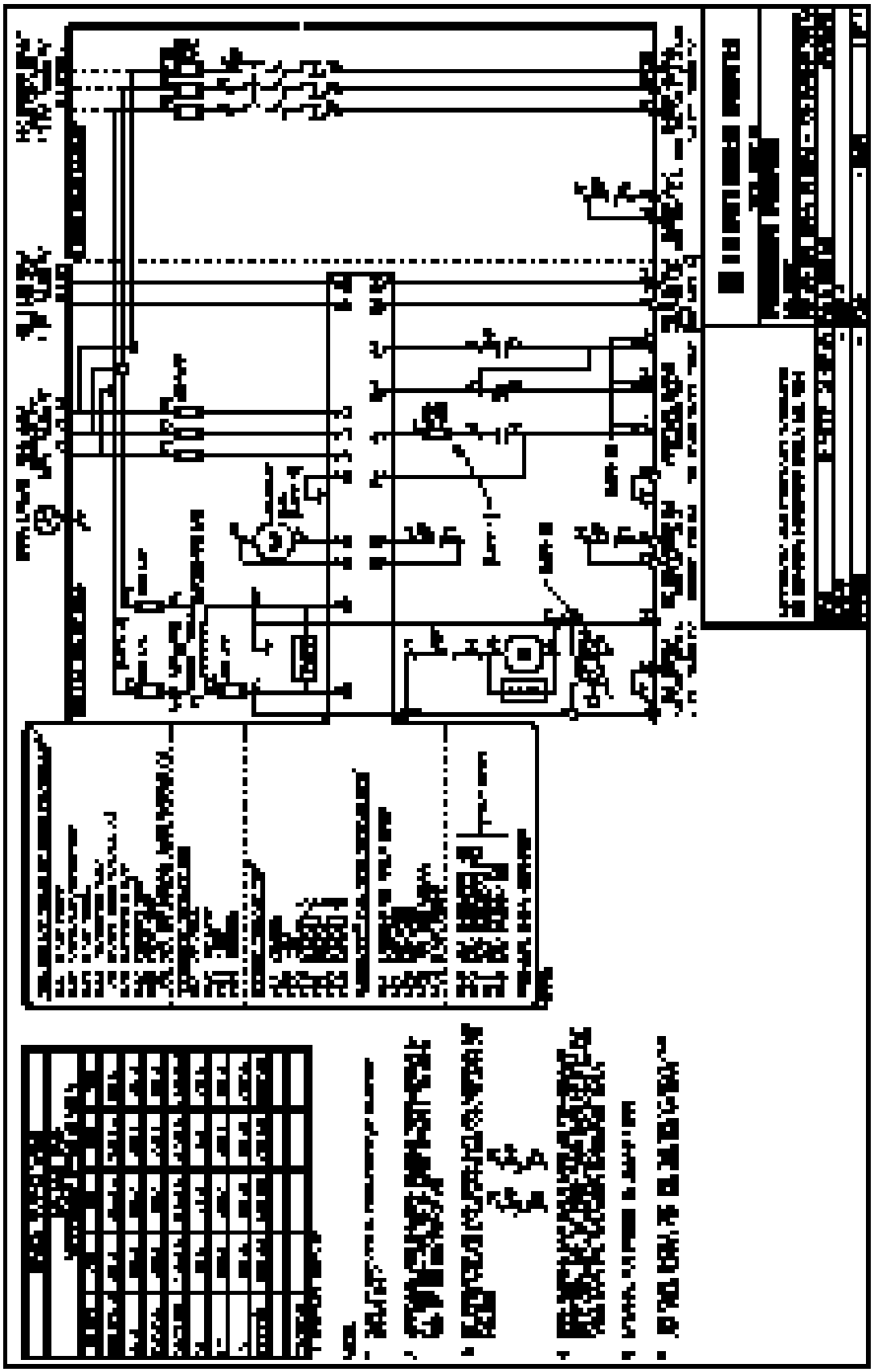


Figure F.9 - Schematic Diagram 125 through 250 Hp

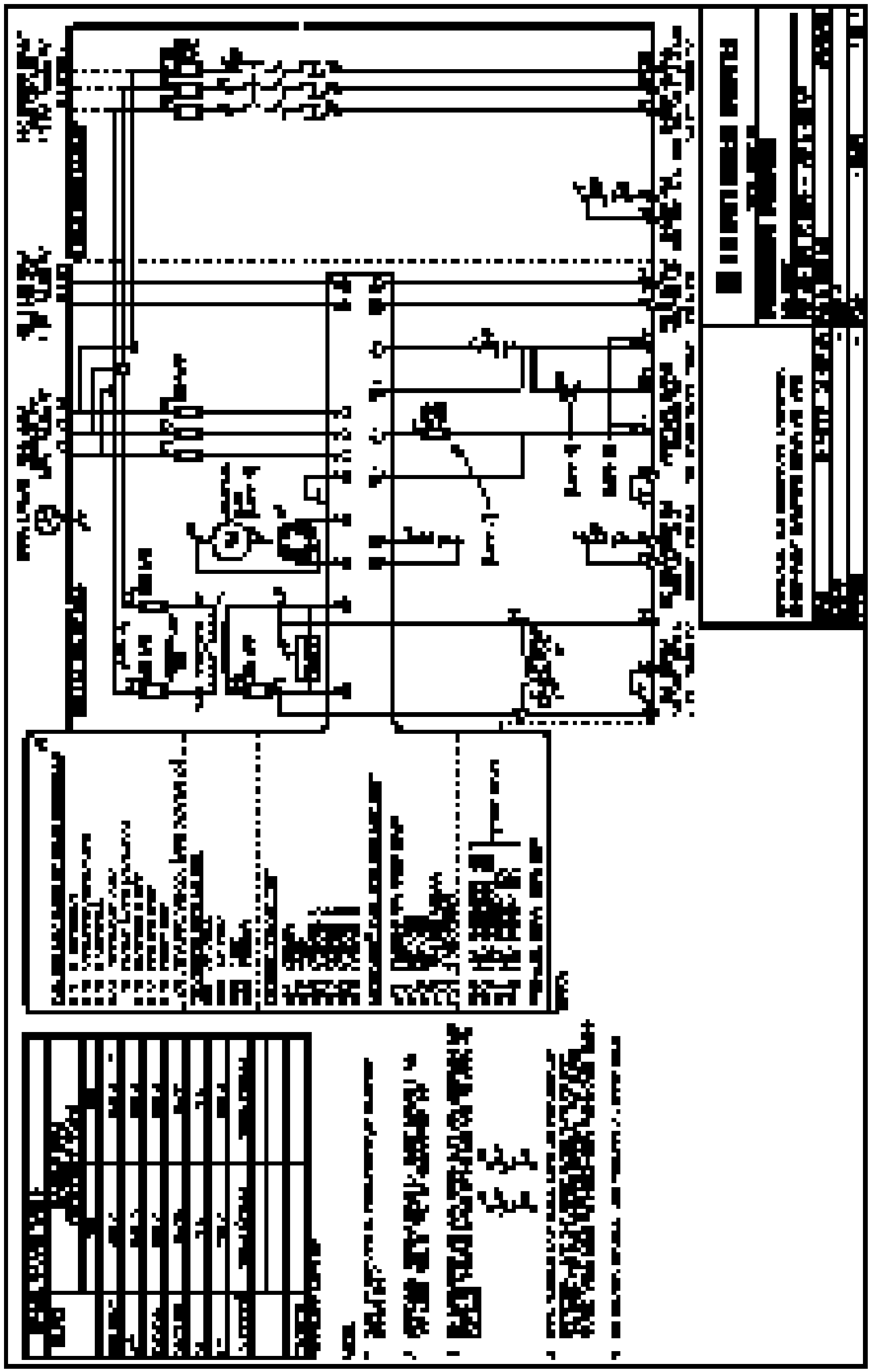


Figure F.10 - Schematic Diagram 300 through 400 Hp

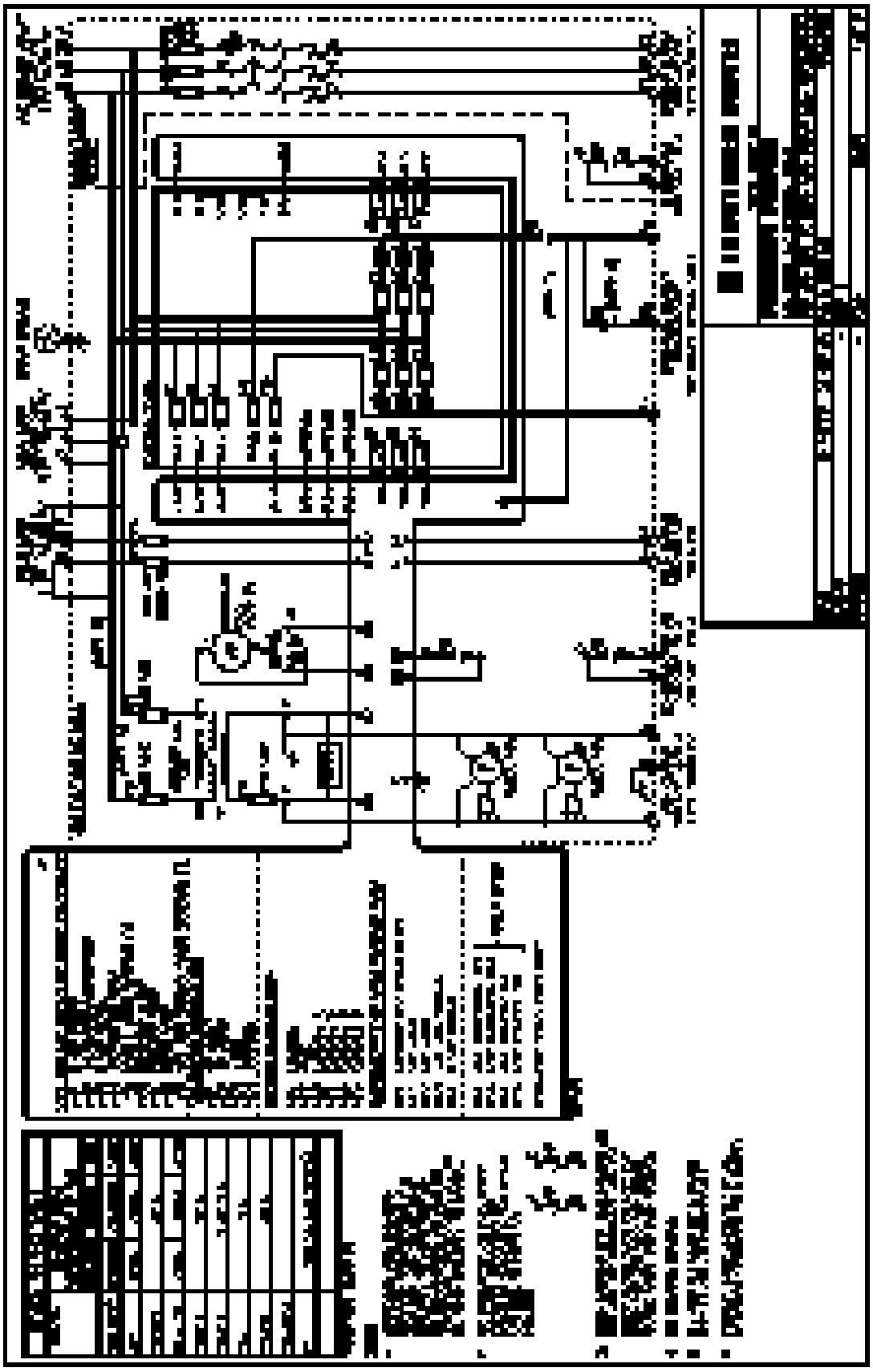


Figure F.11 - Schematic Diagram 500 - 900 Hp Non-Regenerative (Page 1)

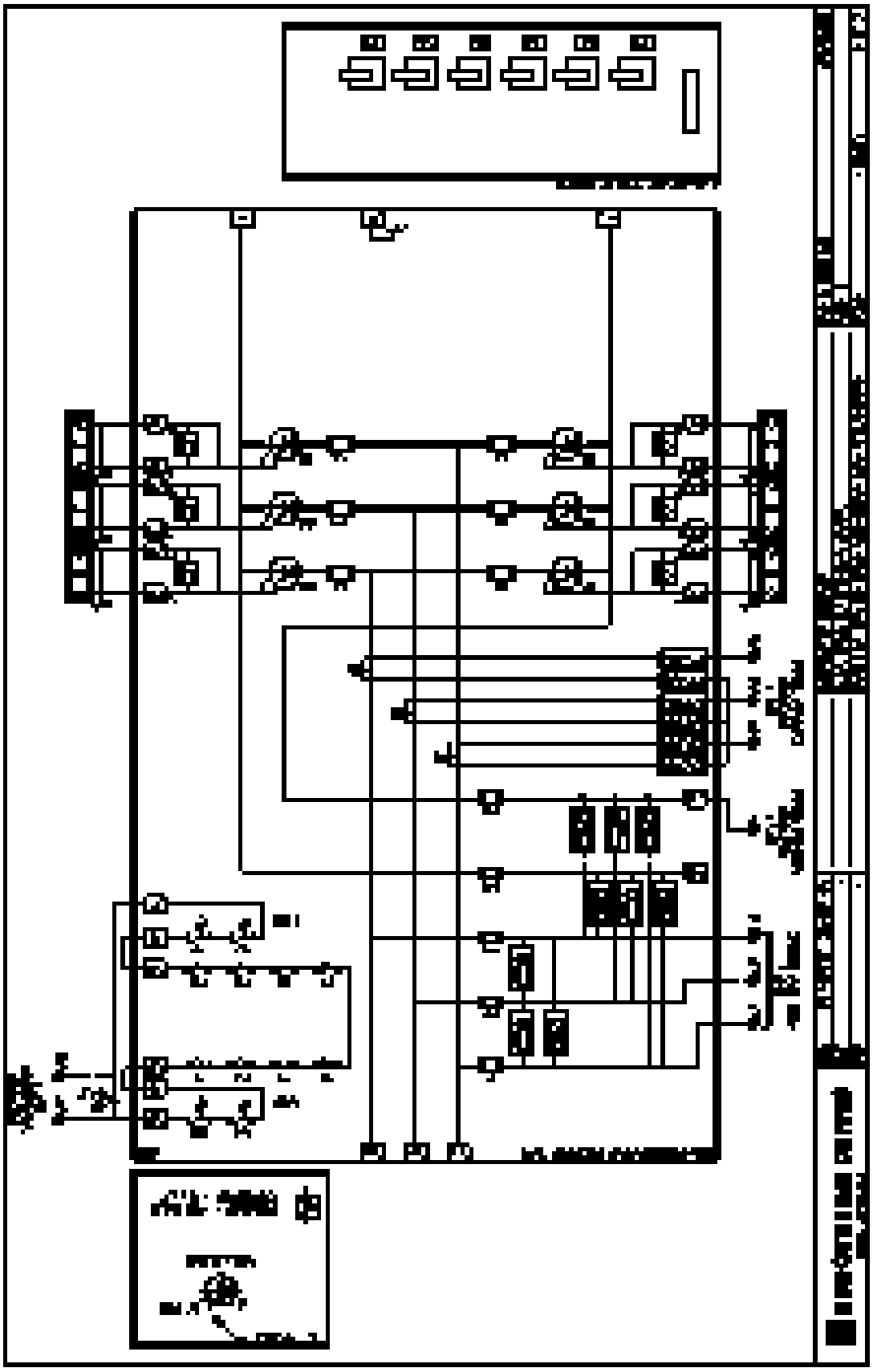


Figure F.12 - Schematic Diagram 500 - 900 Hp Non-Regeneraive (Page 2)

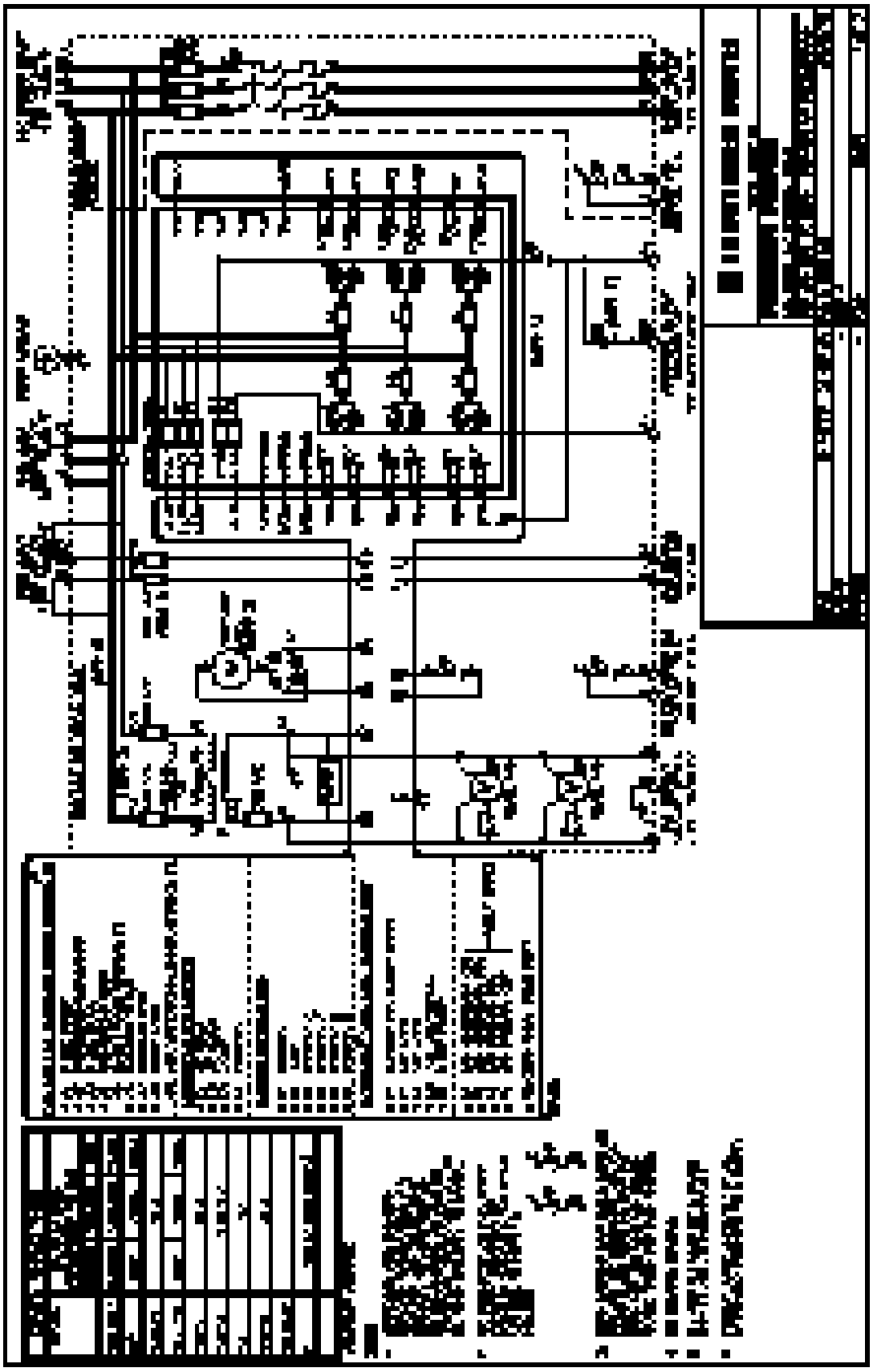


Figure F.13 - Schematic Diagram 500 - 900 Hp Regenerative (Page 1)

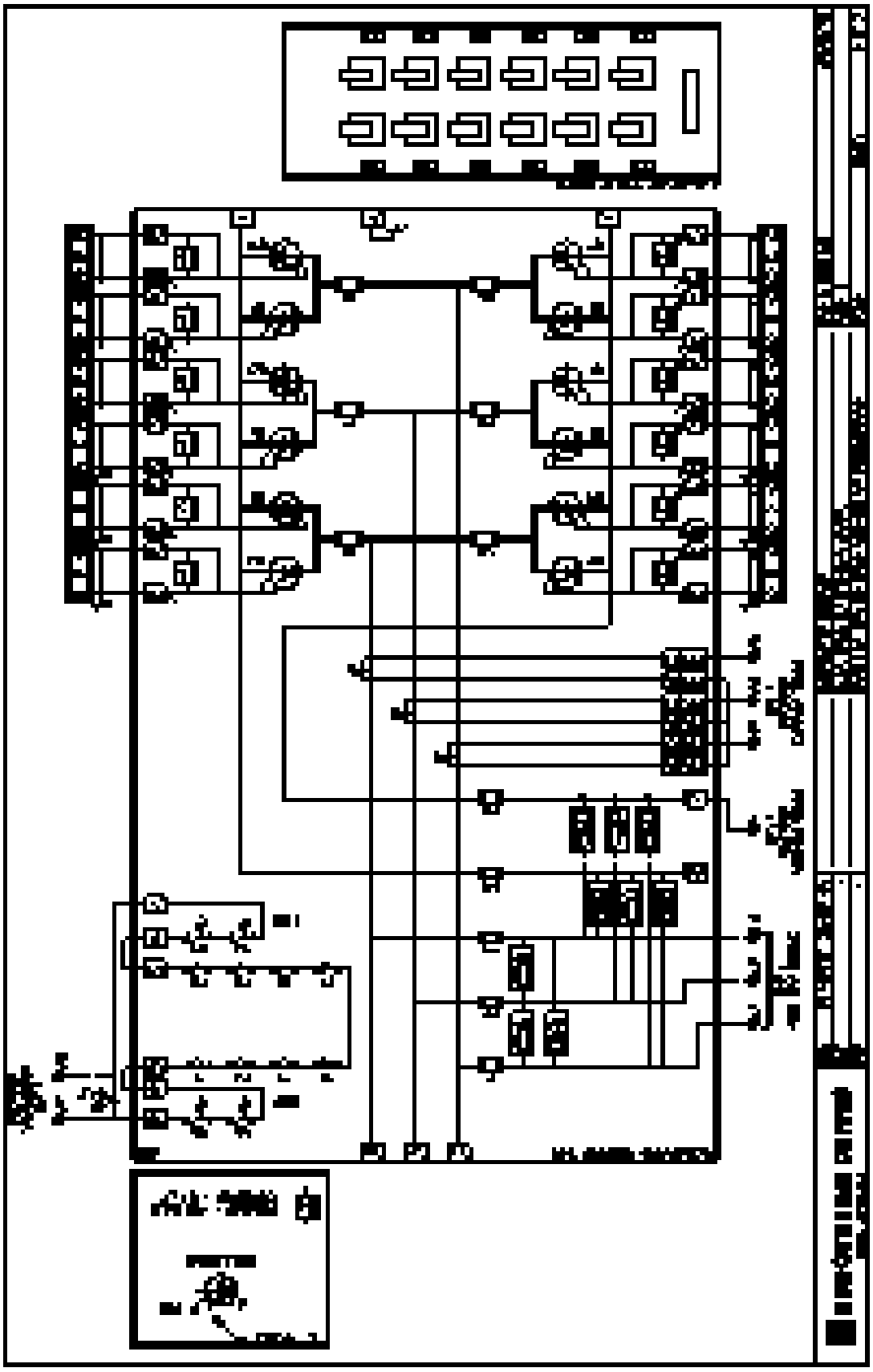


Figure F.14 - Schematic Diagram 500 - 900 Hp Regenerative (Page 2)

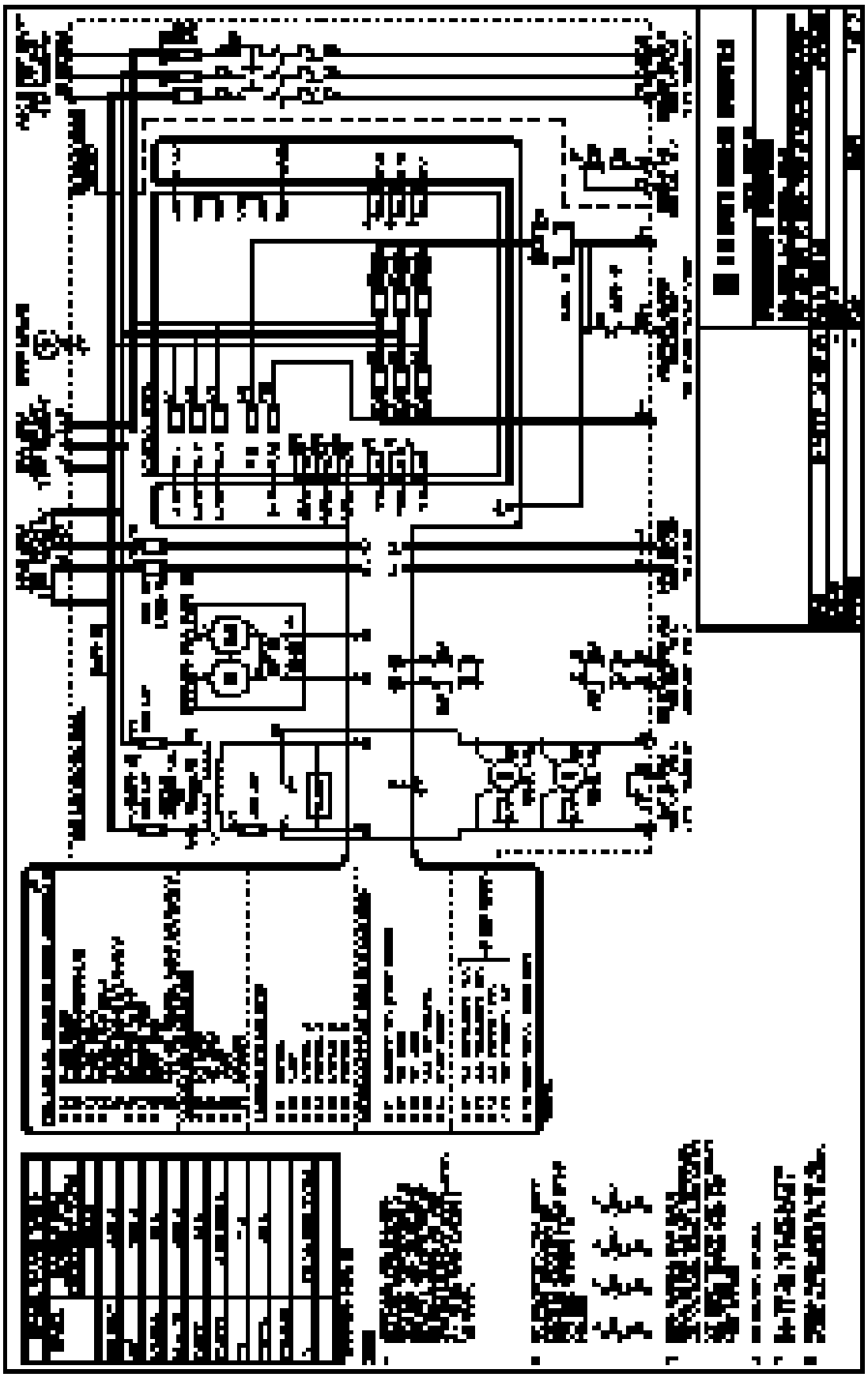


Figure F.15 - Schematic Diagram 1000 Hp Non-Regenerative (Page 1)

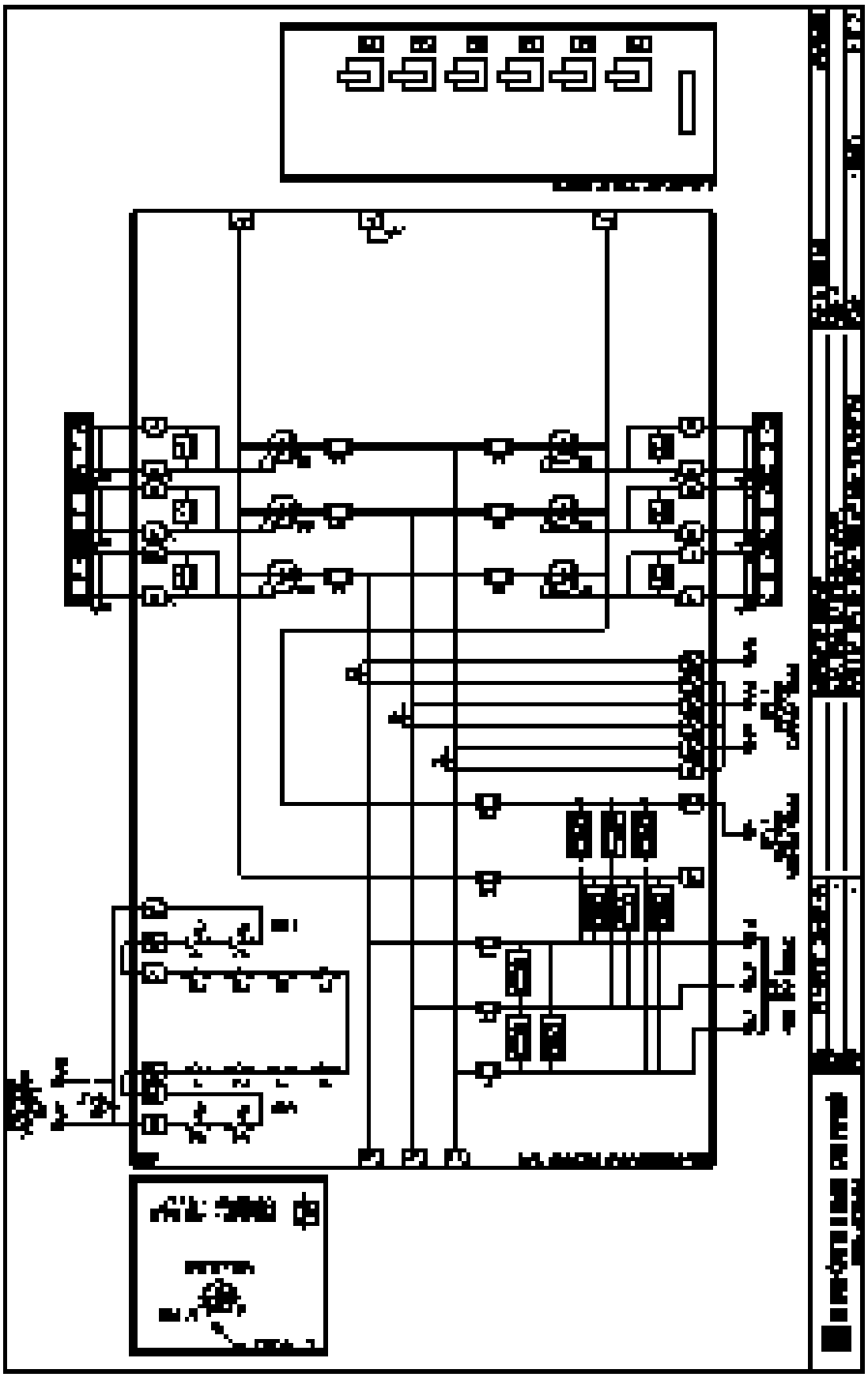


Figure F.16 - Schematic Diagram 1000 Hp Non-Regenerative (Page 2)

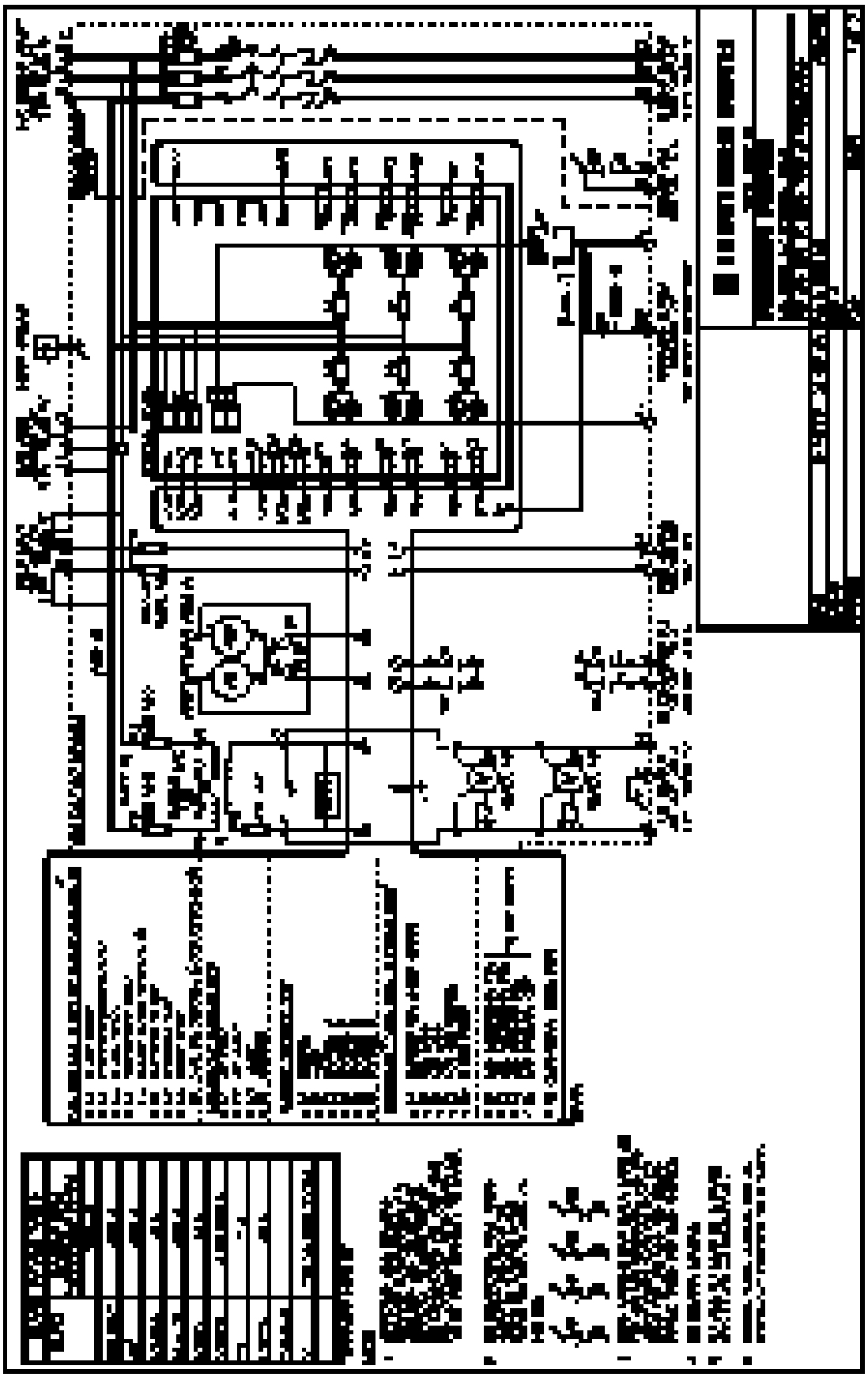


Figure F.17 - Schematic Diagram 1000 Hp Regenerative (Page 1)

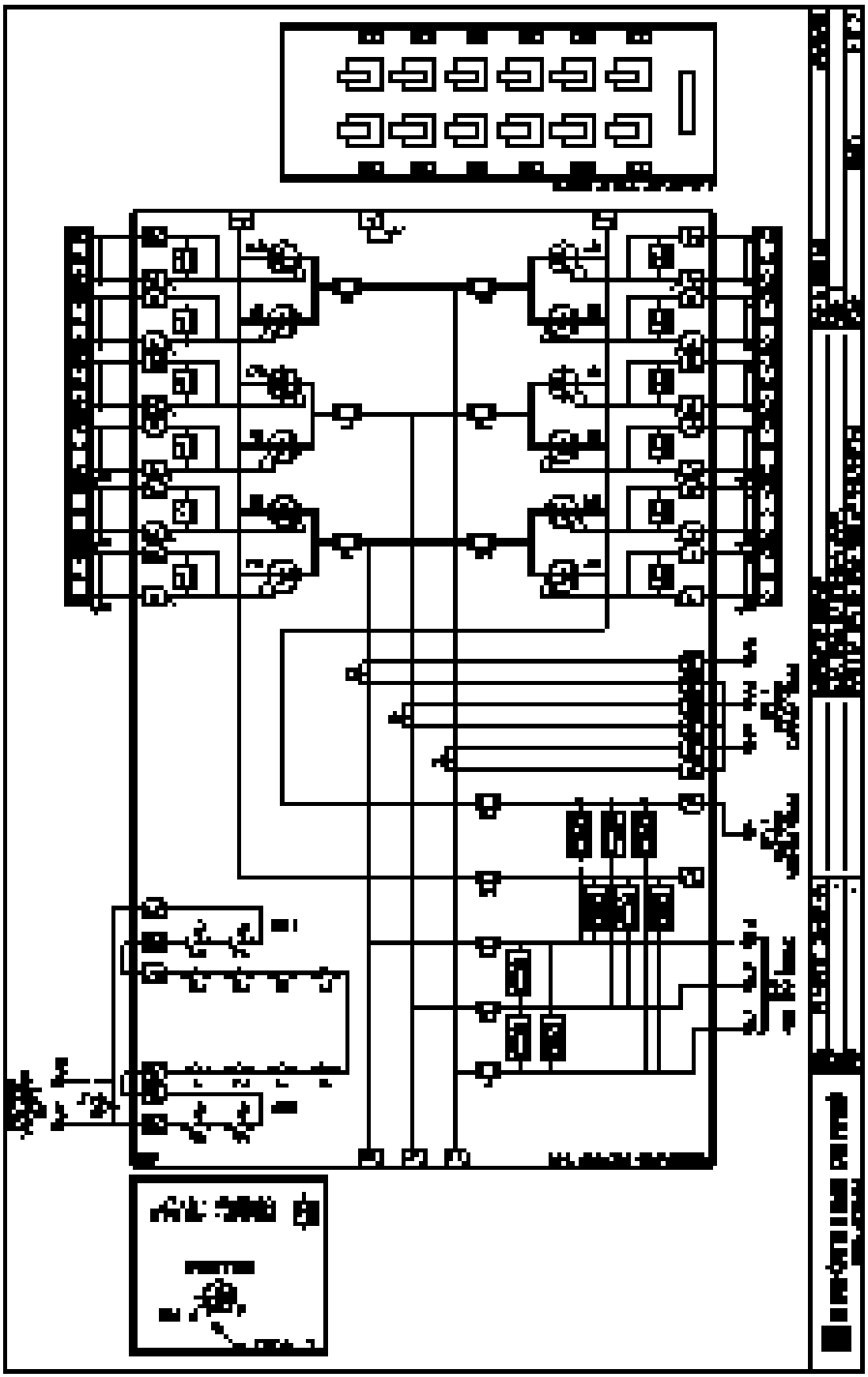


Figure F.18 - Schematic Diagram 1000 Hp Regenerative (Page 2)

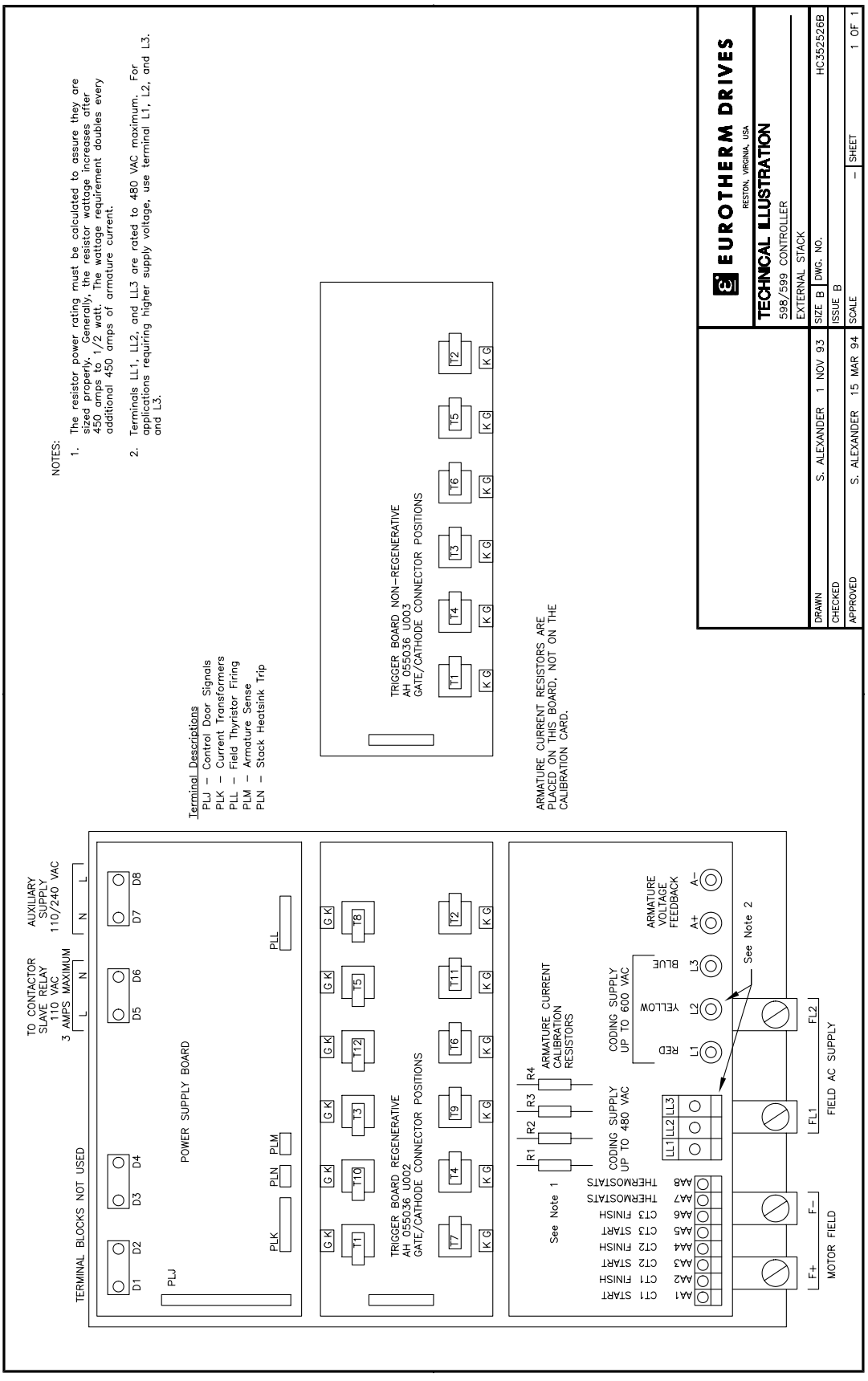


Figure F.19 - Technical Illustration 598 Controller Power Supply Boards

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 F.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.

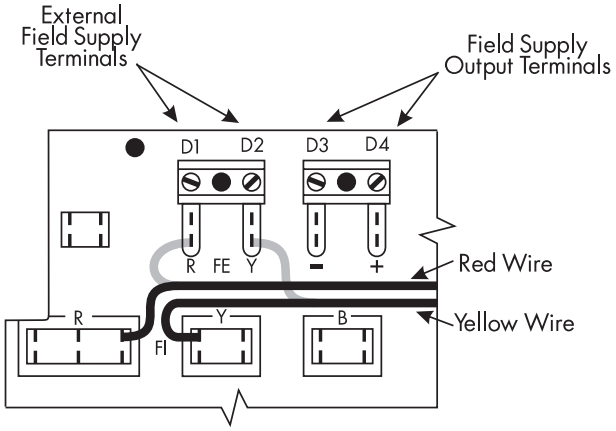


Figure F.20 - External Field Connections - 3-Board Power Supplies

For drives with three-board power supplies rated 270 A to 675 A, rewire the field supply leads as shown in Figure F.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 teminate 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 orginal stake connectors for an internal field supply source.

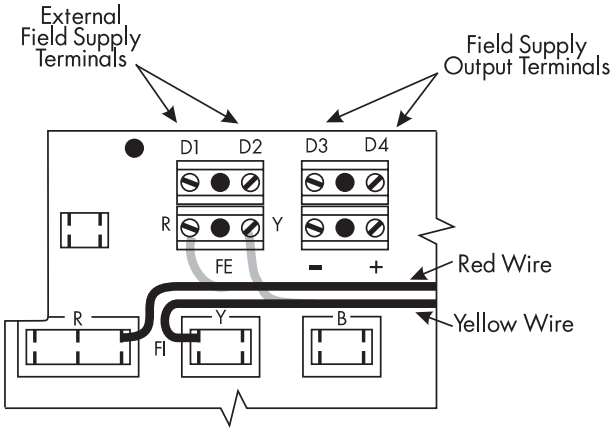


Figure F.21 - External Field Connections - 3-Board Power Supplies

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 F.11, F.13, F.15 and F.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.

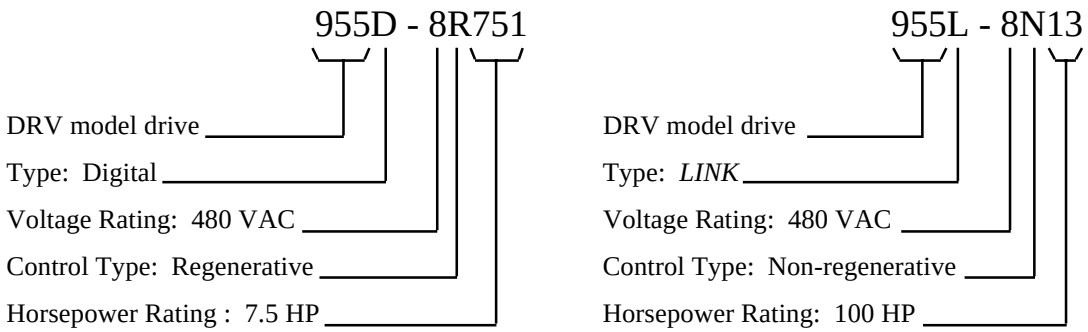
Fuse the external field supply externally at 30 A if you are using the 598/599 controller *without* a DRV package. A drawing of the power supply boards within the 598 external stack controller appears in Figure F.19.

Appendix G 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:

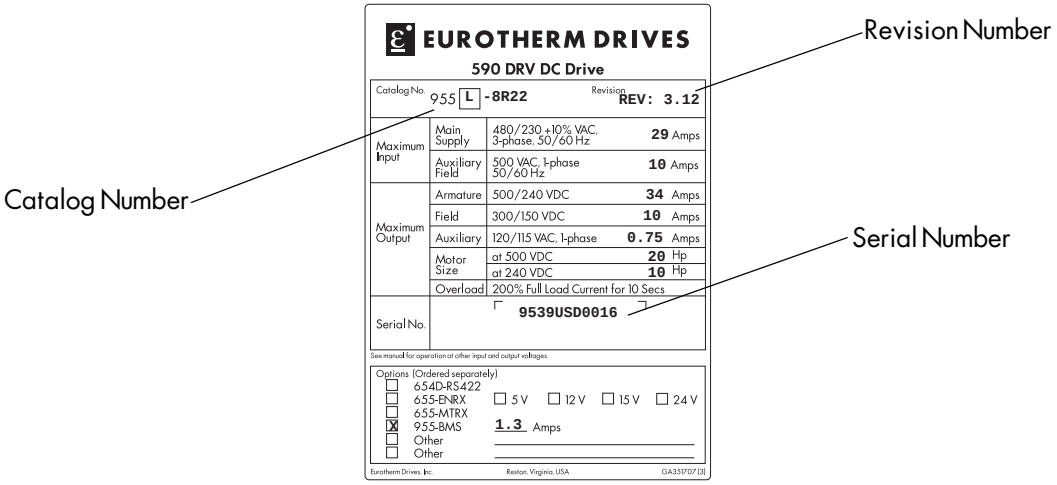


NOTE. *All* horsepower ratings are based on 500 VDC armature motors.

The sample label in Figure G.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



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 Revison** 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 1and 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 revisons 1 through 3 and not used on later revisions.

Description	Part Number	DRV Revision	Qty.
955*-8R22 20 hp Regenerative Drive 480 VAC (35 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 56 A	DB051417	3-4	1
	DB351539	1-2, 5	1
Controller Calibration Card	AH058529U001	1-4	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

LINK FIBER OPTIC CONNECTORS AND REPEATERS

Fiber Optic Connectors and Repeaters	Part Number
BLACK (receiver) plastic fiber optic connector	CI055070*
RED (transmitter) plastic fiber optic connector	CI055069*
LINK plastic fiber optic repeater	L5206-2-00
Universal Fiber Optic Converter	5904

* Refer to Appendix A when ordering fiber optic cable.

G

CONTROLLER DOOR PARTS LISTS

Description	Part Number	DRV Revision	Qty.
955D.... 590 Digital DC Drives			
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.
955L.... LINK 590 DC Drives			
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.
955LX.... LINK 570 DC Drive			
Controller Calibration Card	AH055028U001	19	1
Controller Door 570L	LA058388U001	19	1

POWER MODULE PARTS LISTS

Description	Part Number	DRV Revision	Qty.
955*-8N751 7.5 hp Non-Regenerative Drive 480 VAC (13 A)			
Contactor, AM - DC 3P 2 NO 1 NC 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.
955*-8R751 7.5 hp Regenerative Drive 480 VAC (13 A)			
Contactor, AM - DC 3P 2 NO 1 NC 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.
955*-8N22 20 hp Non-Regenerative Drive 480 VAC (35 A)			
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 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.
955*-8R22 20 hp Regenerative Drive 480 VAC (35 A)			
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 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.
955*-8N32 30 hp Non-Regenerative Drive 480 VAC (50 A)			
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.
955*-8R32 30 hp Regenerative Drive 480 VAC (50 A)			
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.
955*-8N42 40 hp Non-Regenerative Drive 480 VAC (66 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 75 A	DB351540	1 – 6	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	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.
955*-8R42 40 hp Regenerative Drive 480 VAC (66 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 75 A	DB351540	1 – 6	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	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.
955*-8N62 60 hp Non-Regenerative Drive 480 VAC (98 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 110 A	DB351541	1 – 6	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	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.
955*-8R62 60 hp Regenerative Drive 480 VAC (98 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 110 A	DB351541	1 – 6	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	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.
955*-8N752 75 hp Non-Regenerative Drive 480 VAC (122 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 130A	DB351542	1 – 6	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	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.
955*-8R752 75 hp Regenerative Drive 480 VAC (122 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 130A	DB351542	1 – 6	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	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.
955*-8N13 100 hp Non-Regenerative Drive 480 VAC (162 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 202A	DB352019	1 – 5	1
Contactor, 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 175 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.
955*-8R13 100 hp Regenerative Drive 480 VAC (162 A)			
Contactor, AM - DC 3P 2 NO 1 NC 500 VDC 202A	DB352019	1 – 5	1
Contactor, 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 175 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.
955*-8N1253 125 hp Non-Regenerative Drive 480 VAC (205 A)			
Contactor, AM - DC 3P 2 NO 1 NC 600 VDC 202A	DB352019	1 - 2	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	DB351585	1 - 2	1
Contactor, AMR - AC 3P 3 NO 1 NC 600 VAC 25A	DB353128	1 - 2	1
Controller Power Supply Board, 10 A	AH385851U003	2	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1 - 2	1
Fan 110 V	DL043707	1 - 2	1
Field Regulator, 1400 V, 15 A	CF057273U014	1 - 2	1
Fuse Controller Coding Supply, AH385851U003, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U004, FS1 - 250 VAC 3A	CH540013	2	1
Fuse Controller Power Supply, AH385128U004, 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 300 A	CS350265	1 - 2	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1 - 2	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1 - 2	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1 - 2	1
SCR, 1400 V, 250 A	CF057366U014	1 - 2	3
Suppressor RC Link, 110-280 VAC	CZ048331	1 - 2	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1 - 2	1

Description	Part Number	DRV Revision	Qty.
955*-8R1253 125 hp Regenerative Drive 480 VAC (205 A)			
Contactor, AM - DC 3P 2 NO 1 NC 600 VDC 202A	DB352019	1 - 2	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	DB351585	1 - 2	1
Contactor, AMR - AC 3P 3 NO 1 NC 600 VAC 25A	DB353128	1 - 2	1
Controller Power Supply Board, 10 A	AH385851U002	2	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1 - 2	1
Fan 110 V	DL043707	1 - 2	1
Field Regulator, 1400 V, 15 A	CF057273U014	1 - 2	1
Fuse Controller Coding Supply, AH385851U002, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3A	CH540013	2	1
Fuse Controller Power Supply, AH385128U004, 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 300 A	CS350402	1 - 2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 300 A	CS350265	1 - 2	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1 - 2	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1 - 2	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1 - 2	1
SCR, 1400 V, 250 A	CF057366U014	1 - 2	6
Suppressor RC Link, 110-280 VAC	CZ048331	1 - 2	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1 - 2	1

Description	Part Number	DRV Revision	Qty.
955*-8N153 150 hp Non-Regenerative Drive 480 VAC (255 A)			
Contactor, AM - DC 3P 2 NO 1 NC 600 VDC 258A	DB352020	1 - 2	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	DB351585	1 - 2	1
Contactor, AMR - AC 3P 3 NO 1 NC 600 VAC 25A	DB353128	1 - 2	1
Controller Power Supply Board, 10 A	AH385851U003	2	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1 - 2	1
Fan 110 V	DL043707	1 - 2	1
Field Regulator, 1400 V, 15 A	CF057273U014	1 - 2	1
Fuse Controller Coding Supply, AH385851U003, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U004, FS1 - 250 VAC 3A	CH540013	2	1
Fuse Controller Power Supply, AH385128U004, 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 300 A	CS350265	1 - 2	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1 - 2	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1 - 2	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1 - 2	1
SCR, 1400 V, 250 A	CF057366U014	1 - 2	3
Suppressor RC Link, 110-280 VAC	CZ048331	1 - 2	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1 - 2	1

Description	Part Number	DRV Revision	Qty.
955*-8R153 150 hp Regenerative Drive 480 VAC (255 A)			
Contactor, AM - DC 3P 2 NO 1 NC 600 VDC 258A	DB352020	1 - 2	1
Contactor, AM - DC Aux Contact 1 NO 1 NC	DB351585	1 - 2	1
Contactor, AMR - AC 3P 3 NO 1 NC 600 VAC 25A	DB353128	1 - 2	1
Controller Power Supply Board, 10 A	AH385851U002	2	1
	AH385128U004	1	1
Controller Suppressor Board	AH055037U004	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1 - 2	1
Fan 110 V	DL043707	1 - 2	1
Field Regulator, 1400 V, 15 A	CF057273U014	1 - 2	1
Fuse Controller Coding Supply, AH385851U002, FS2, FS3, FS4 - 600 VAC 10 A	CH430014	2	3
AH055037U004, FS4, FS5, FS6 - 600 VAC 10 A	CH430014	1	3
Fuse Controller Power Supply, AH385851U002, FS1 - 250 VAC 3A	CH540013	2	1
Fuse Controller Power Supply, AH385128U004, 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 350 A	CS352024	1 - 2	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 300 A	CS350265	1 - 2	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 2 A (480V Operation)	CH352006U020	1 - 2	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (230V Operation)	CH352006U040	1 - 2	2
Fuse DRV Transformer Load, F6 - 250 VAC 3.5 A	CH351788	1 - 2	1
SCR, 1400 V, 250 A	CF057366U014	1 - 2	6
Suppressor RC Link, 110-280 VAC	CZ048331	1 - 2	1
Transformer Control, TX - 350 VA 460, 230/120 VAC	CO352011	1 - 2	1

Description	Part Number	DRV Revision	Qty.
955*-8N23 200 hp Non-Regenerative Drive 480 VAC (330 A)			
Contactor, AM - DC 3P 2 NO 1NC 500 VDC 332A	DB352021	4	1
Contactor, AM - DC Aux Contact 1NO 1NC	DB351585	4	1
Contactor, AMR - AC 3P 3 NO 1NC 600 VAC 25A	DB353128	4	1
Controller Power Supply Board, 20A	AH385128U104	4	1
Controller Suppressor Board	AH056760U001	4	1
Controller Trigger Board	AH055036U003	4	1
Controller Transformer, T1	CO056935	4	1
Fan 110 V	DL049140	4	1
Field Regulator, 1400 V, 28 A	CF057274U014	4	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	4	3
Fuse Controller Power Supply, FS1 - 250 VAC 1 A	CH460013	4	1
FS2 - 250 VAC 3 A	CH460033	4	1
FS3 - 250 VAC 400 mA	CH540042	4	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 400 A	CS350267	4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	4	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	4	1
SCR, 1400 V, 250 A	CF056719U014	4	3
Suppressor RC Link, 110-280 VAC	CZ048331	4	1
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	4	1

Description	Part Number	DRV Revision	Qty.
955*-8R23 200 hp Regenerative Drive 480 VAC (330 A)			
Contactor, AM - DC 3P 2 NO 1NC 600 VDC 332A	DB352021	4	1
Contactor, AM - DC Aux Contact 1NO 1NC	DB351585	4	1
Contactor, AMR - AC 3P 3 NO 1NC 600 VAC 25A	DB353128	4	1
Controller Power Supply Board, 20A	AH385128U104	4	1
Controller Suppressor Board	AH056760U001	4	1
Controller Trigger Board	AH055036U002	4	1
Controller Transformer, T1	CO056935	4	1
Fan 110 V	DL049140	4	1
Field Regulator, 1400 V, 28 A	CF057274U014	4	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	4	3
Fuse Controller Power Supply, FS1 - 250 VAC 1 A	CH460013	4	1
FS2 - 250 VAC 3 A	CH460033	4	1
FS3 - 250 VAC 400 mA	CH540042	4	1
Fuse DRV Armature, F7 - Semiconductor 650 VDC 450 A	CS352025	4	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 400 A	CS350267	4	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	4	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	4	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	4	1
SCR, 1400 V, 250 A	CF057366U014	4	6
Suppressor RC Link, 110-280 VAC	CZ048331	4	1
Transformer Control, TX - 500VA 460, 230/120 VAC	CO352012	4	1

Description	Part Number	DRV Revision	Qty.
955*-8N253 250 hp Non-Regenerative Drive 480 VAC (425 A)			
Contactor, AM - DC 3P 2 NO 1 NC 600 VDC 630A	DB352471	1	1
Contactor, AMR - AC 3P 3 NO 1 NC 600 VAC 25A	DB353128	1	1
Controller Power Supply Board, 20A	AH385128U104	1	1
Controller Suppressor Board	AH056760U001	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly, B1 - 110 V	DL044536	1	1
Field Regulator, 1400 V, 28 A	CF057274U014	1	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1	3
Fuse Controller Power Supply, 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 500 A	CS352004	1	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (480V Operation)	CH352006U040	1	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 6.25 A (230V Operation)	CH352006U062	1	2
Fuse DRV Transformer Load, F6 - 250 VAC 7 A	CH352124U070	1	1
SCR, 1400 V, 250 A	CF057366U014	1	6
Suppressor RC Link, 110-280 VAC	CZ048331	1	1
Transformer Control, TX - 750VA 460, 230/120 VAC	CO352013	1	1

Description	Part Number	DRV Revision	Qty.
955*-8R253 250 hp Regenerative Drive 480 VAC (425 A)			
Contactor, AM - DC 3P 2 NO 1 NC 600 VDC 630A	DB352471	1	1
Contactor, AMR - AC 3P 3 NO 1 NC 600 VAC 25A	DB353128	1	1
Controller Power Supply Board, 20A	AH385128U104	1	1
Controller Suppressor Board	AH056760U001	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly, B1 - 110 V	DL044536	1	1
Field Regulator, 1400 V, 28 A	CF057274U014	1	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1	3
Fuse Controller Power Supply, 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 VAC 600 A	CS352026	1	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 500 A	CS352004	1	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 4 A (480V Operation)	CH352006U040	1	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 6.25 A (230V Operation)	CH352006U062	1	2
Fuse DRV Transformer Load, F6 - 250 VAC 7 A	CH352124U070	1	1
SCR, 1400 V, 250 A	CF057366U014	1	6
Suppressor RC Link, 110-280 VAC	CZ048331	1	1
Transformer Control, TX - 750VA 460, 230/120 VAC	CO352013	1	1

Description	Part Number	DRV Revision	Qty.
955*-8N33 300 hp Non-Regenerative Drive 480 VAC (506 A)			
Contactor, AM - DC 1P 1NO650 VDC 1200A	DB352128	1	1
Controller Power Supply Board, 20A	AH385128U104	1	1
Controller Suppressor Board	AH056760U001	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly, B1 - 110 V	DL044536	1	1
Fan Muffin, 110 V	DL049612	1	2
Field Regulator, 1400 V, 28 A	CF057274U014	1	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1	3
Fuse Controller Power Supply, 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 600 A	CS352005	1	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH350737	1	1
SCR, 1400 V, 630 A	CF049824U014	1	3
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1	1

Description	Part Number	DRV Revision	Qty.
955*-8R33 300 hp Regenerative Drive 480 VAC (506 A)			
Contactor, AM - DC 1P 1NO 650 VDC 1200A	DB352128	1	1
Controller Power Supply Board, 20A	AH385128U104	1	1
Controller Suppressor Board	AH056760U001	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly, B1 - 110 V	DL044536	1	1
Fan Muffin, 110 V	DL049612	1	2
Field Regulator, 1400 V, 28 A	CF057274U014	1	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1	3
Fuse Controller Power Supply, 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 VAC 700 A	CS352027	1	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 600 A	CS352005	1	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1	1
SCR, 1400 V, 630 A	CF049824U014	1	6
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1	1

Description	Part Number	DRV Revision	Qty.
955*-8N43 400 hp Non-Regenerative Drive 480 VAC (675 A)			
Contactor, AM - DC 1P 1NO 600 VDC 1200A	DB352128	1	1
Controller Power Supply Board, 20A	AH385128U104	1	1
Controller Suppressor Board	AH056760U001	1	1
Controller Trigger Board	AH055036U003	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly, B1 - 110 V	DL044536	1	1
Fan Muffin, 110 V	DL049612	1	2
Field Regulator, 1400 V, 28 A	CF057274U014	1	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1	3
Fuse Controller Power Supply, 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	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1	1
SCR, 1400 V, 760 A	CF054425	1	3
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1	1

Description	Part Number	DRV Revision	Qty.
955*-8R43 400 hp Regenerative Drive 480 VAC (675 A)			
Contactor, AM - DC 1P 1NO 600 VDC 1200A	DB352128	1	1
Controller Power Supply Board, 20A	AH385128U104	1	1
Controller Suppressor Board	AH056760U001	1	1
Controller Trigger Board	AH055036U002	1	1
Controller Transformer, T1	CO056935	1	1
Fan Assembly, B1 - 110 V	DL044536	1	1
Fan Muffin, 110 V	DL049612	1	2
Field Regulator, 1400 V, 28 A	CF057274U014	1	1
Fuse Controller Coding Supply, FS4, FS5, FS6 - 600 VAC 20 A	CH220024	1	3
Fuse Controller Power Supply, 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	1
Fuse DRV Supply, F1, F2, F3 - Semiconductor 500 VAC 800 A	CS350737	1	3
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 3 A (480V Operation)	CH352006U030	1	2
Fuse DRV Transformer Supply, F4, F5 - 600 VAC 5 A (230V Operation)	CH352006U050	1	2
Fuse DRV Transformer Load, F6 - 250 VAC 5 A	CH351788	1	1
SCR, 1400 V, 760 A	CF054425	1	6
Transformer Control, TX - 500 VA 460, 230/120 VAC	CO352012	1	1

Description	Part Number	DRV Revision	Qty.
955*-8N53 500 hp Non-Regenerative Drive 480 VAC (830 A)			
Contactor, AM - DC 1P 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 1 A	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.
955*-8R53 500 hp Regenerative Drive 480 VAC (830 A)			
Contactor, AM - DC 1P 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 1 A	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