ALLEN-BRADLEY

Bulletin 1395
Digital DC Drive
1350A & 2250A

Installation Manual

Important User Information

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage or economic loss.

Attentions help you:

- Identify a hazard.
- Avoid the hazard.
- Recognize the consequences.

IMPORTANT: Identifies information that is especially important for successful application and understanding of the product.

DANGER labels may be located on or inside the drive to alert people that dangerous voltage may be present.

1395 Digital DC Drive 1350A & 2250A

Installation Manual Publication 1395-5.70 – November, 1995

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Introduction, Inspection & Storage

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Chapter 1

Introduction, Inspection and Storage

Manual Objectives

The purpose of this manual is to provide the user with the necessary information to install, program, start up and maintain the 1350A and 2250A version of the 1395 DC Drive. This manual should be read in its entirety before operating, servicing or initializing the 1395 Drive. This manual must be consulted first, as it will reference other 1395 manuals for troubleshooting or option initialization.

Who Should Use This Manual

This manual is intended for qualified service personnel responsible for setting up and servicing the 1395 DC Drive. You must have previous experience with and a basic understanding of electrical terminology, programming procedures, required equipment and safety precautions, as typical applications will consist of a properly rated DC motor, with or without feedback based on performance requirements, a line impedance device (line reactor or isolation transformer) and the 1395. A programming terminal is required to set up the drive and for enhanced monitoring and diagnostics.

ATTENTION: Only personnel familiar with the 1395 Drive and the associated machinery should plan or implement the installation, start-up, and subsequent maintenance of the Drive. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: An incorrectly applied or installed Drive can result in component damage or a reduction in product life. Wiring or application errors such as undersizing the motor, incorrect or inadequate AC supply or excessive ambient temperatures may result in damage to the Drive or motor.

ATTENTION: This Drive contains ESD (Electrostatic Discharge sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen-Bradley Publication 8000-4.5.2, *Guarding against Electrostatic Damage* or any other applicable ESD protection handbook.

Chapter Objective

Chapter 1 in addition to detailing drive features and specifications, also supplies the information needed to unpack, properly inspect and if necessary, store the 1395 Drive.

Standard Drive Features

The 1395 is a microprocessor Digital DC Drive available in:

- 400 – 2000 HP, four quadrant, armature regenerative two quadrant field
- 400 – 2000 HP, non-regenerative
- AC Input Circuit Breaker
- DC Contactor
- Field regulation over a 6 to 1 speed range.
- Programmable Functions:
  - Independent Acceleration/Deceleration adjustment
  - Preset Speeds
  - Jog Speeds
  - Current Limit
  - Tapered Current Limit
  - Tach Loss Recovery
  - System Reset
- Protective Features:
  - Instantaneous Overcurrent
  - Motor Overload
  - Feedback Loss
  - Field Loss
  - Field Economy
  - Tach Loss Recovery
  - System Reset
- NEMA 1 Construction
- Basic Input/Outputs

Options

- 115VAC Discrete Adapter Board Provides:
  - 4 Digital Inputs, 120 VAC
  - 2 Digital Outputs, Contact type 125 VAC
  - 4 Analog Inputs +/– 10 VDC
  - 4 Analog Outputs, +/– 10 VDC
- 24VDC Discrete Adapter Board Provides:
  - 4 Digital Inputs, 24VDC
  - 2 Digital Outputs, Contact type 24 VDC
  - 4 Analog Inputs, +/– 10 VDC
  - 4 Analog Outputs, +/– 10 VDC
- Digital Reference Adapter Board Provides:
  - 1 Digital Reference Input
  - 10 Discrete Inputs 24 VDC
  - 5 Discrete Outputs 24 VDC
  - 2 Analog Inputs +/–10 VDC
  - 2 Analog Outputs +/–10 VDC

- Node Adapter Board
  The board allows the Bulletin 1395 to be controlled using an Allen-Bradley PLC® Programmable Controller from the PLC3® or PLC5® family. This board connects directly to the RIO scanner
- Multi-Communications Adapter Board
  Contains the hardware necessary to connect the 1395 to Allen-Bradley's RIO or Data Highway Plus® communication links.

Accessories

- Isolation Transformers, AC Line Reactors.
- Program Terminals.

Receiving

It is the responsibility of the user to thoroughly inspect the equipment before accepting the shipment from the freight company. Check the item(s) received against the purchase order. If any items are obviously damaged, it is the responsibility of the user not to accept delivery until the freight agent has noted the damage on the freight bill. Should any concealed damage be found during unpacking, it is again the responsibility of the user to notify the freight agent. The shipping container must be left intact and the freight agent should be requested to make a visual inspection of the equipment.

Unpacking

Remove all packing material, wedges, or braces from within and around the drive. Remove all packing material from the cooling fans (when equipped) and the heat sink.

IMPORTANT: Before the installation and start-up of the drive, a general inspection of the mechanical integrity (i.e. loose parts, wires, connections, etc.) should be made.

Inspection

After unpacking, check the item(s) nameplate catalog number against the purchase order.

Storing

The drive should remain in its shipping container prior to installation. If the equipment is not to be used for a period of time, it must be stored according to the following instructions in order to maintain warranty coverage:

- Store in a clean, dry location.
- Store within an ambient temperature range of 0° to 65°C (32° to 149°F).
- Store within a relative humidity range of 5% to 95%, non-condensing.
- Do not store equipment where it could be exposed to a corrosive atmosphere.
- Do not store equipment in a construction area.

Specifications

Electrical:

Input Voltages –	230 – 660VAC +/– 10%, 3 phase
Input Power –	912kVA @460VAC, 1308 kVA @ 660VAC
Input Frequency –	50/60Hz +/– 3 Hz.
Output Voltage –	240VDC @ 230VAC Input 500VDC @ 460VAC Input 550/600 VDC @ 575VAC Input 700 VDC @ 660VAC Input
Output Horsepower (Continuous) –	400 to 600 HP @ 230VAC 700 to 1250 HP @ 460VAC 1000 – 2000 HP @ 660VAC
Output Current–	1350 and 2250 Amps Continuous
Field Voltage–	120 – 150VDC, 230VAC 230 – 300VDC, 460 – 660VAC Field Voltage Source is selectable between internal or external supply.
Field Current–	650mA – 40A (standard) 975mA – 60A DC (optional)
Field Control–	A 6:1 speed range with an encoder or DC tach feedback
Field Economy–	Programmable enable, time delay, power on standby
Armature Firing–	Phase sequence insensitive, Regenerative/ Non–regenerative
Output Waveform–	6 pulse, full wave, NEMA Code C
Controller Current Output –	150% for one minute, 200% for 10 seconds, 260% for 5 seconds
Armature Control –	Tapered current limit,di/dt limit, Instantaneous overcurrent, Programmable motor overload

Speed Regulation:

Encoder –	0.01% of set speed (over a 10:1 speed range); 0.001% of top speed (over a 100:1 speed range).
DC Tachometer –	0.5% of top speed with 5PY tachometer; 0.1% of top speed with BC42 tachometer.
Armature Voltage –	2% of top speed

Feedback Devices:

DC Tachometer –	5 PY, BC42 or equal

Feedback Devices: Cont.

Encoder –	Incremental, dual channel; 12 volts, 500mA, isolated with differential transmitter, 102.5 kHz max. Quadrature : 90° ± 27° @ 25°C, Duty Cycle: 50% ± 10% Source/ Sink capable, A–B 845H or equal.

External Inputs:

Enable/Contingency Coast Stop –	24VDC / 115VAC, hard-wired to DC contactor
System Reset –	24VDC / 115VAC, Isolated
Motor Thermostat –	24VDC / 115VAC, Isolated
Communication Port –	RS–422 for programming terminal

External Outputs:

Drive Ready/Faulted–	N.O. relay contact, open when drive faulted or de-energized, closed when ready. Contact rating – 1 ADC @ 24 VDC or 0.5A @ 120VAC

Environmental

Ambient Operating Temperature	0° to 40°C (32° – 104° F)
Relative Humidity	5% to 95%, non-condensing
Altitude	3,300 feet (1,000 meters)

Standard Features

Accel/Decel	0.1 to 6553.5 seconds, independently programmable.
Preset Speeds	5 adjustments, programmable
Jog Speeds	2 adjustments, programmable
“S” Ramp	Programmable
Motor Operated Pot (MOP)	10 adjustments, programmable

Options

Discrete Adapter Board;

Digital Inputs (4) –	24VDC or 120VAC, 10 mA. NOTE: A separate board and part number is used for each voltage rating.
Digital Outputs (2) –	Dry relay contacts rated at 0.6A at 125VAC or 2.0A at 30VDC.
Analog Inputs (4) –	0 to +/– 10VDC, differential input impedance – 20K ohms.
Analog Outputs (4) –	–10 to + 10VDC, 1mA minimum output impedance – 200 ohms.
Power Supply (For external use) –	+10VDC, 4mA maximum, –10VDC, 4mA maximum.

Digital Reference Board;

Digital Reference Input (1) –	Current source and sink input for high common mode noise immunity. Nominal 5VDC or 12VDC interface (internal hardware configurable), + 10mA nominal current source/sink requirements.
Digital Inputs (10) –	24VDC Nominal; 18VDC minimum, 28VDC maximum; 10 mA nominal.
Discrete Outputs (5) –	24VDC nominal; Current sourcing type driver; Diode clamped for inductive load; 18VDC minimum, 28VDC maximum; 1.5VDC saturation, 100mA maximum load.
Analog Inputs (2) –	0 to +/– 10 VDC, differential input impedance– differential > 1m ohm; 20K ohms (single ended to analog common).
Analog Outputs (2) –	–10 to +10VDC, 2.5mA maximum output impedance – 200 ohms.
Power Supply – (for external use)	+10VDC, 4mA maximum, –10VDC, 4mA maximum.
Node Adapter Board;	This board allows the Bulletin 1395 to be controlled using an Allen-Bradley PLC controller from either the PLC3 or PLC5 family. The board connects directly to the RIO scanner.

Multi–Communications Adapter Board;	This board contains two Digital Communication channels.
Communications Channels (2) –	Each channel can be configured as either Allen-Bradley Remote I/O (RIO) or Allen-Bradley Data Highway + (DH+) interfaces. Compatible with PLC3, PLC5/250, PLC5/15, PLC5/25, PLC5/40, PLC5/60 and Controlview.
Function Blocks (4)	These programmable function blocks can be used to manipulate data.
Discrete Input (1)	One programmable discrete input is available (24VDC or 115VAC).

Chapter 2

Hardware Description

400 – 600 HP; 230VAC
700 – 1250 HP; 460VAC
1000 – 2000 HP; 660 VAC

Introduction

Chapter 2 contains both a general description of the major hardware components of the 1395 drive and background information to support the procedures detailed in other chapters of this manual. You should use this chapter in conjunction with the Installation chapter when installing 400 – 600 HP, 230VAC, and 700 – 1250 HP, 460VAC and 1000 – 2000 HP, 660 VAC Series A Drives.

Terminology

A brief description of new terms and concepts covered in Chapter 2 is presented here:

Adapter Board – Circuit board containing hardware and software required to interface external devices such as Allen-Bradley PLC or Discrete I/O devices to the 1395 drive.

Interface – Hardware and associated software required to transfer information and/or control signals from one device to another.

Microbus – Hardware and associated software designed by Allen-Bradley for the exchange of digital information at the microprocessor level. The microbus is used for the transfer of information between adapter boards and the main control board.

Port – Hardware located on the main control board which allows for connection of one adapter board to the microbus. There are two ports on the main control board.

Programming Terminal – Device used for programming and monitoring operation on the 1395 drive. The programming terminal is provided in two packages: digital handheld terminal and door-mounted terminal.

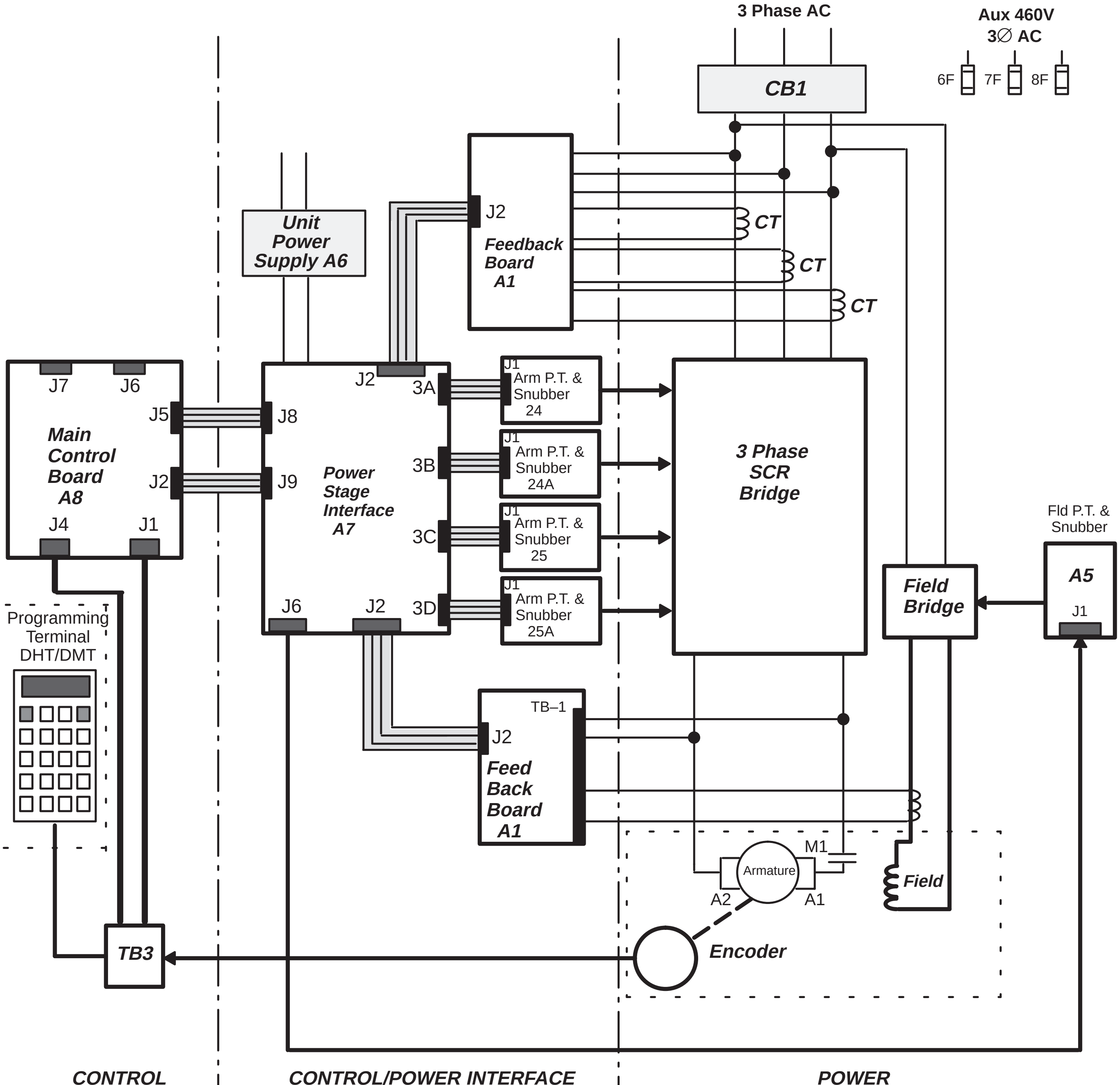
Hardware Overview

Figure 2.1 provides an overview of the hardware components associated with the high horsepower 1395 drive. Hardware can be broken into one of three categories:

- Control boards
- Control/Power interface hardware.
- Power hardware

This chapter describes in general all of the major hardware components. Figures provided in this chapter are drawn based on hardware functionality. Some components may be repeated in several different diagrams.

Figure 2.1
Hardware Overview



Armature Bridge Components

A general description of the components in the armature bridge (Figures 2.2 and 2.3) and their operation is detailed here:

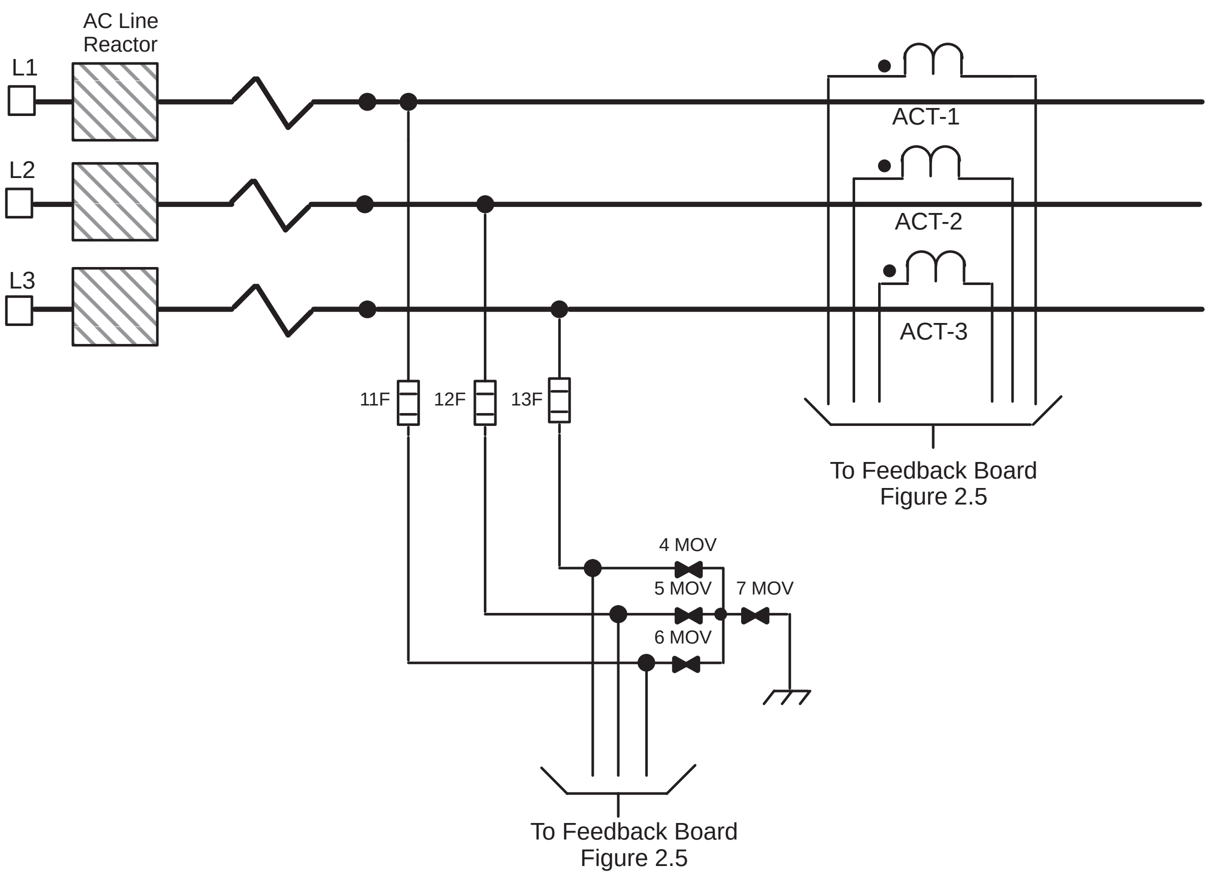
AC Line Reactor – When connecting the drive directly to the main distribution system an AC line reactor must be used to guard against system disturbance.

When an isolation transformer matched to the unit rating is used, an AC line reactor is not required.

Synchronization – The three-phase input to the drive is tapped and fused using fuses 11F, 12F and 13F (Fig. 2.2) and enters the feedback board. The feedback board scales down the voltage before being sent to the power stage interface where it is used to develop the synchronizing information to be used by the Main Control Board.

AC Current Feedback – Current Transformers ACT-1, ACT-2 and ACT-3 (Figure 2.2) are used to provide current feedback information to the feedback board. The feedback board rectifies the three-phase feedback and scales the DC voltage before being sent to the power stage interface. The DC voltage representing the current feedback is passed directly through the power stage interface and sent to the main control board.

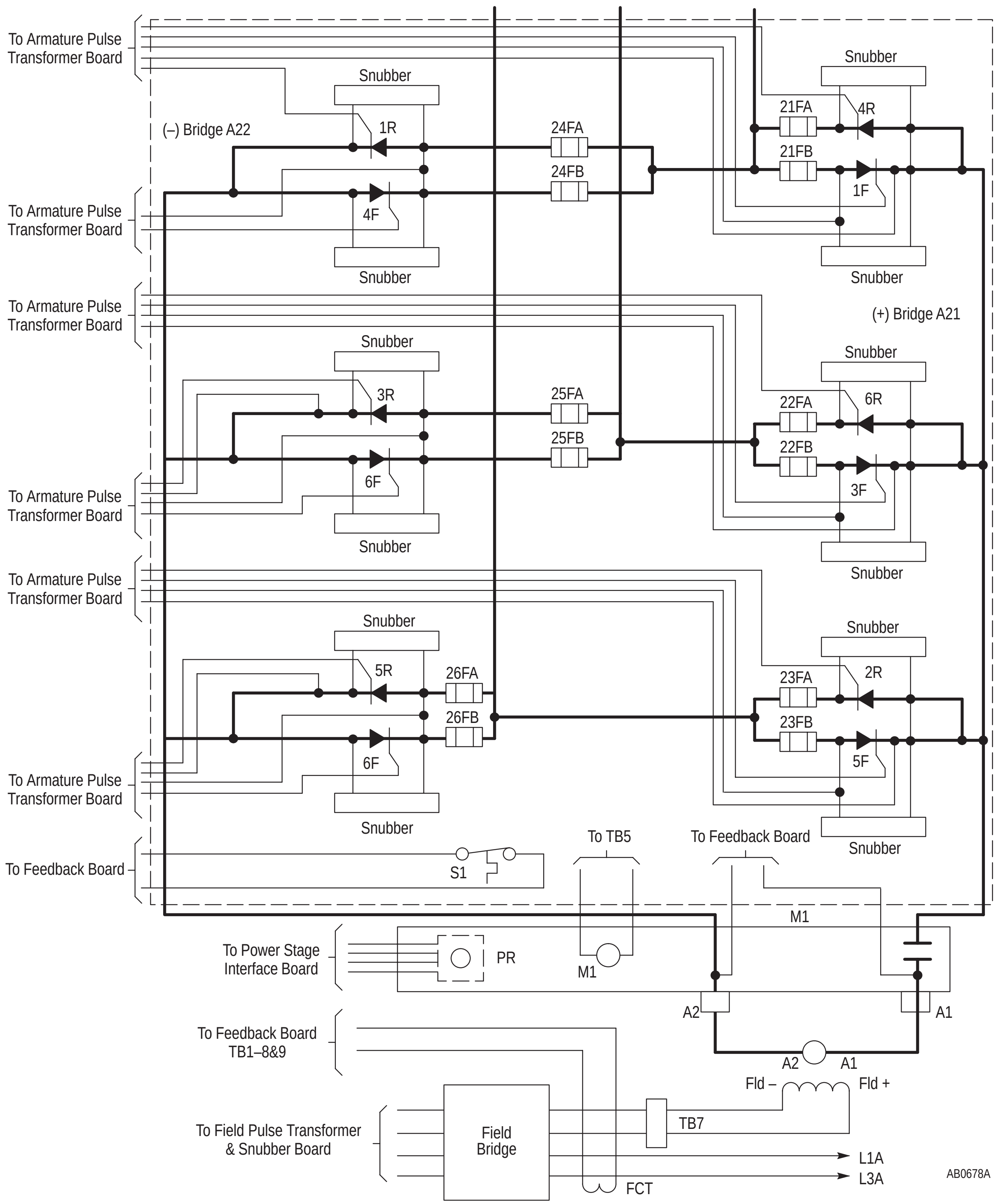
Figure 2.2
Armature Bridge Components (INPUT)



Surge Suppression – The Surge Suppressor Network (4 MOV, 5MOV, 6MOV and 7MOV Fig. 2.2) protects the Feedback Board from high voltage line spikes and line surges.

DC Current Sensing – DC overcurrent sensing is provided using a DC transducer.

Figure 2.3



SCR Packaging – SCR packaging in the 1395 consists of 1 hockey puck type SCR.

Pulse Transformer/Snubber Boards – All four boards are identical and are mounted directly to the armature bridge bus bars. R-C networks contained on the board are used to protect the SCRs against voltage transients (dv/dt).

DC Contactor – Output of the armature bridge is connected to the DC motor through the main DC contactor M1 (Fig. 2.3). Coil voltage to M1 is controlled by contacts from the pilot relay PR and external 115 VAC control input entering at TB5-9 and -10.

NOTE: To provide DC Contactor energization a jumper or other external circuitry must be connected to TB5-9 and -10.

Bridge Output Connections – Bridge output connections labeled A1 and A2 (Fig. 2.3) correspond to the NEMA standards for connection to the A1 and A2 leads of the DC motor.

Field Bridge Components

A general description of the components in the field bridge (Fig. 2.4) and their operation is covered here:

Supply Voltage – In addition to being used for synchronization, the three-phase voltage from fuses F11, F12 and F13 is sent to TB1 on the Feedback Board where two of the three-phases are routed to the input of the field supply power bridge (labeled Field L1 and Field L3 on Figure 2.4).

Field Current Feedback – Current transformer FCT provides field current feedback information to the feedback board at TB-8 and -9. The feedback board rectifies the single phase feedback and scales the DC voltage using a burden resistor selected by the position of Jumper J1 on the feedback board before being sent to the power stage interface. The DC voltage representing field current feedback is passed directly through the power stage interface and sent to the main control board.

Surge Suppression – Surge suppressor 3MOV protects the field power bridge from high voltage line spikes and line surges on the incoming AC line. 2MOV protects the motor field windings from line spikes on the output of the field bridge.

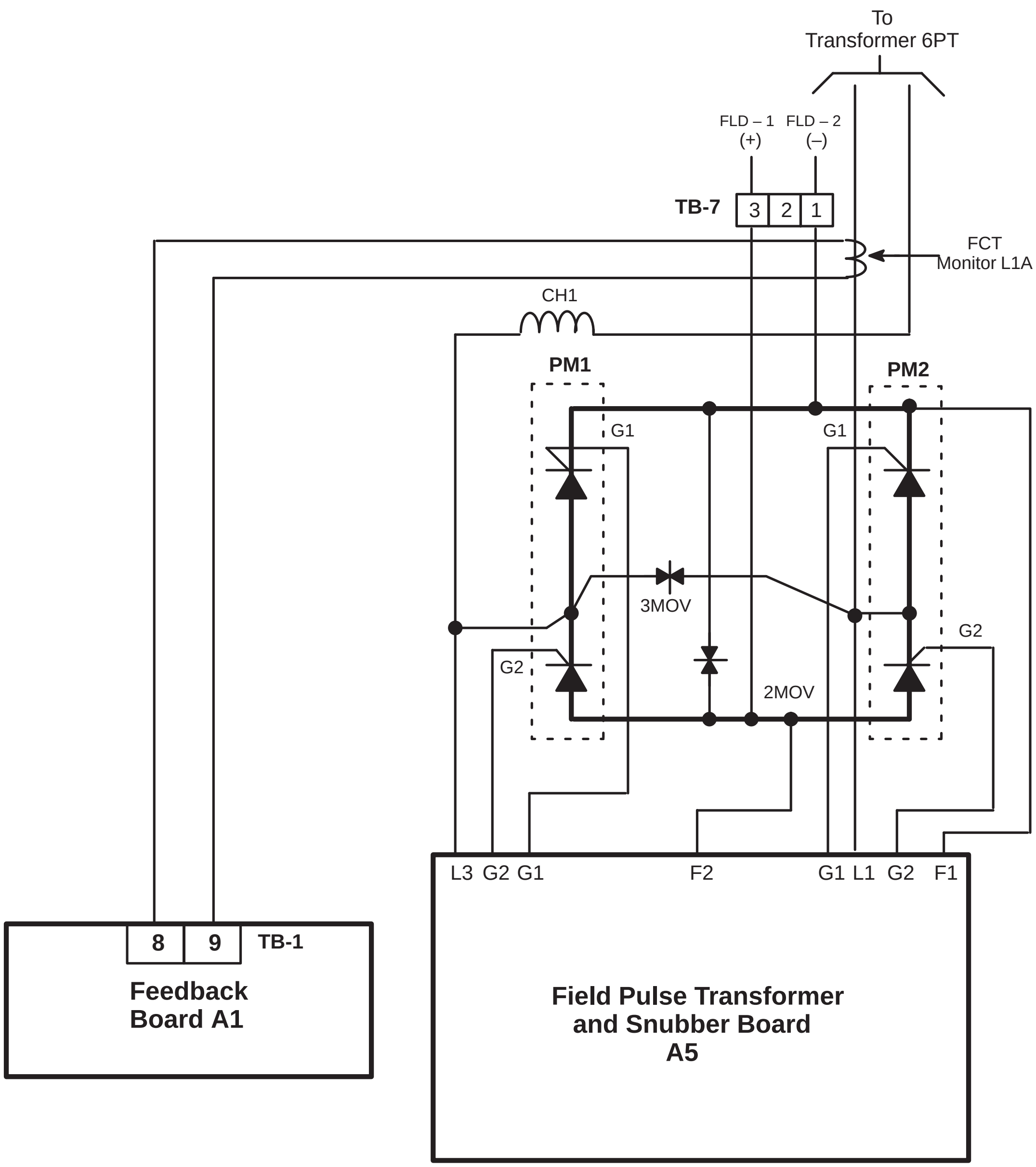
Line Choke – Line Choke CH1 protects the field power bridge SCRs from rapid rate of current changes.

SCR Modules – Field bridge SCRs are contained in modules made up of two SCRs per package (PM1 and PM2).

Field Pulse Transformer and Snubber Board – The Field Pulse Transformer Board provides the gate firing pulses and switching voltage transient (dv/dt) protection for the field SCRs.

Bridge Output Connections – The output of the field bridge is connected to TB2-1 and -2 which in turn is connected to the field leads of the motor. The terminal labeled F+ on TB2 is connected to the F1 lead of the motor and terminal F– to the F2 lead.

Figure 2.4
Field Bridge Components



Control Boards

Feedback Board – Figure 2.5 illustrates the major hardware points on the board. The primary function of the board is to provide scaling and transfer of feedback signals coming from power bridge devices being sent to the Power Stage Interface and eventually to the Main Control Board.

Figure 2.5
Feedback Board (A1) Overview

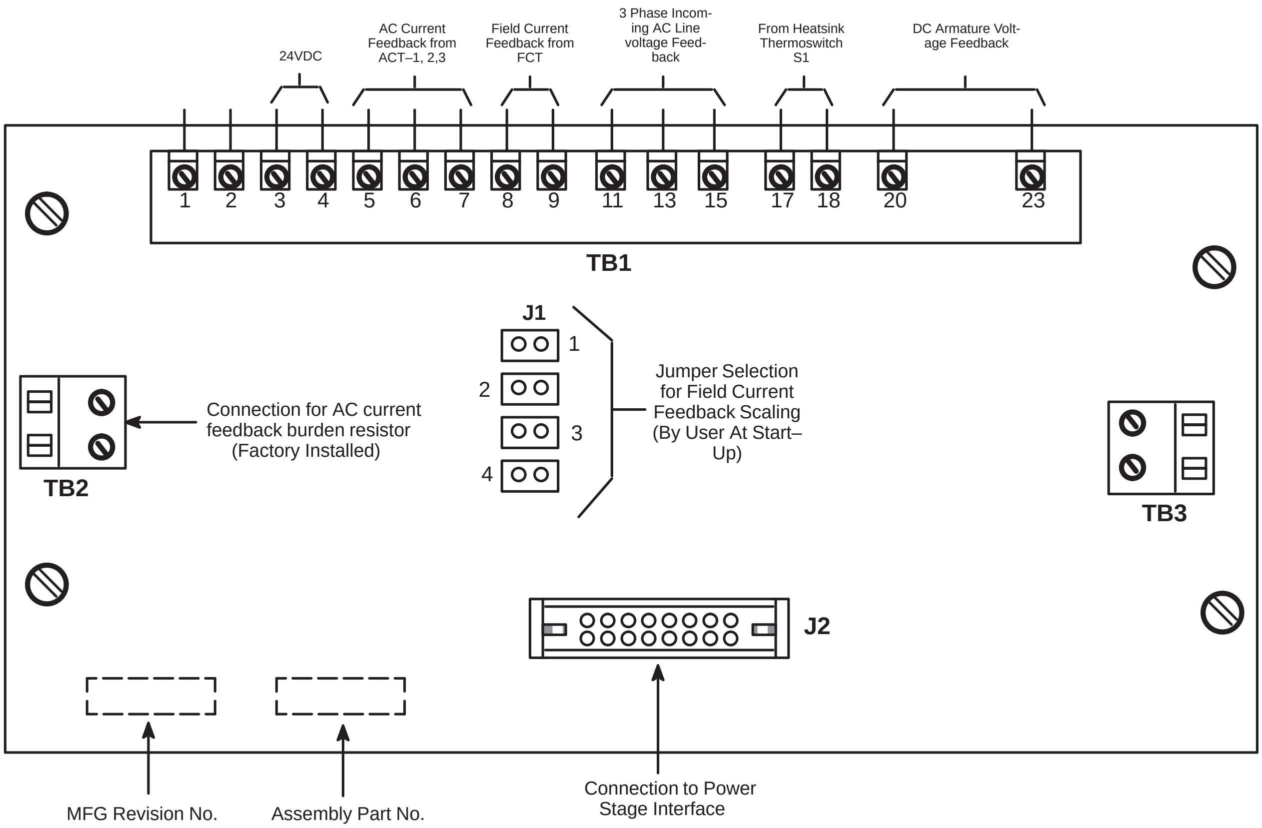


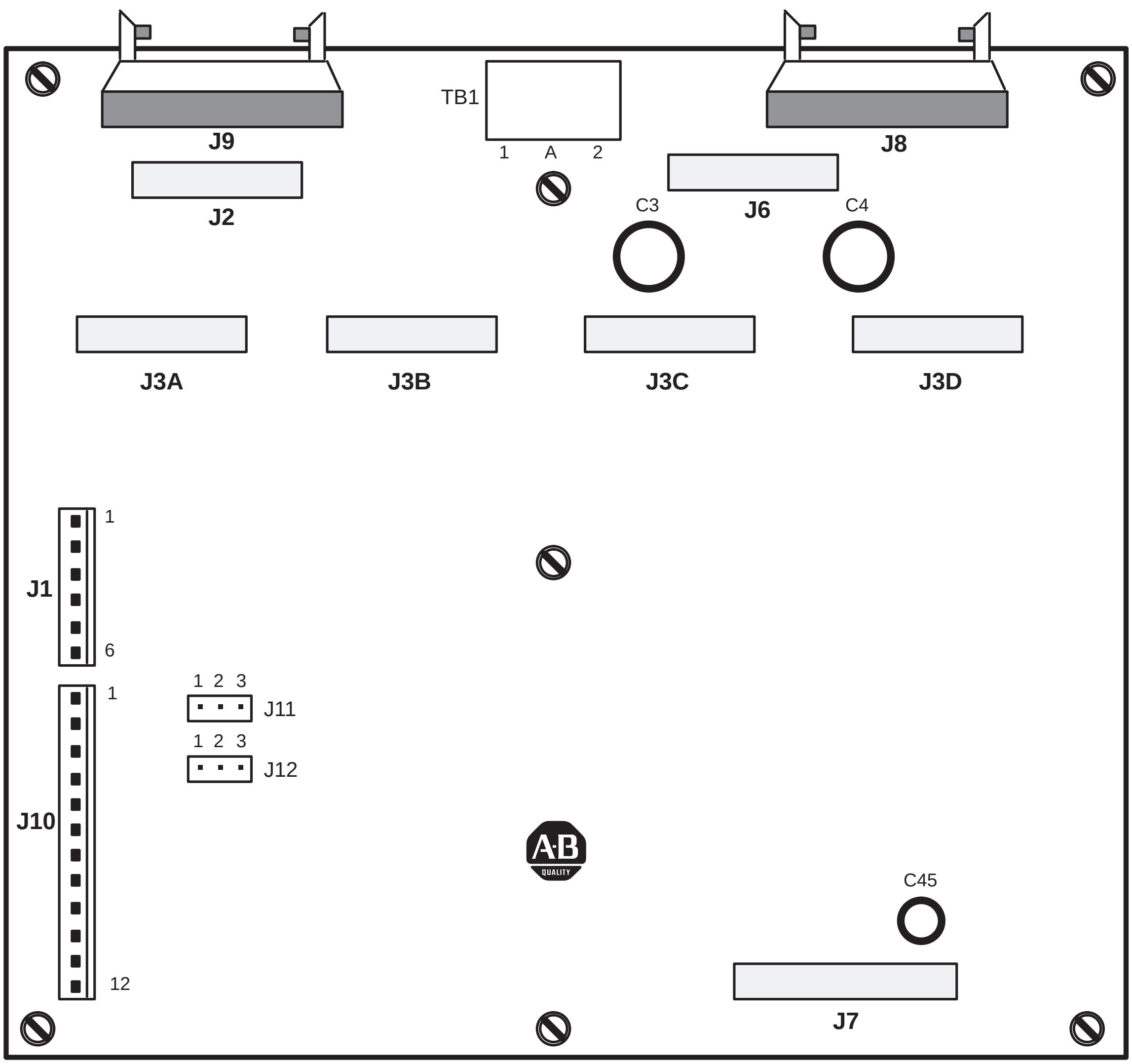
Table 2.A
Feedback Board Jumpers

J1 Jumper Position	Standard Field	Optional Field
1	42.4A	70.7A
2	18.5A	30.7A
3	8.7A	14.5A
4	2.4A	4.0A

Power Stage Interface (A7) – The primary function of this board is to provide interface between the Main Control Board, and the Power Bridge boards such as the Pulse Transformer and Snubber boards, and the Power Bridge boards such as the Pulse Transformer and Snubber boards and the Feedback Board. The primary functions performed by the Power Stage Interface (Figure 2.6) include:

- Distribution of DC Control power to Main Control Board.
- Provide 3 phase line synchronization signals to Main Control Board.
- Produce all Armature and Field bridge SCR gate signals from control signals provided by the Main Control Board.
- Contactor and other logic control with interface to Main Control Board for these functions.

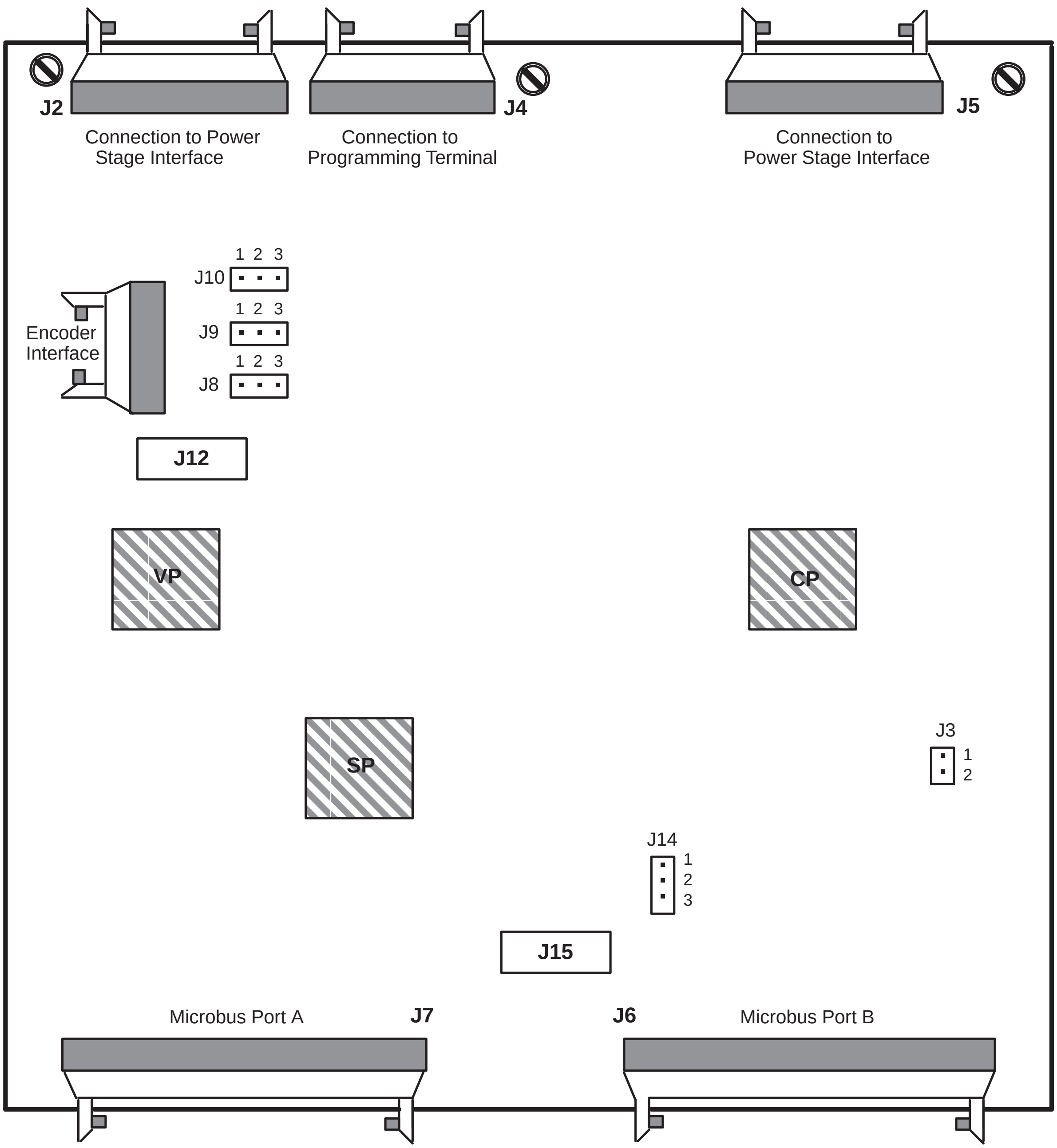
Figure 2.6
Power Stage Interface Hardware Location



Main Control Board (A8) – The Main Control Board (Figure 2.7) performs all control functions of the 1395 drive. Hardware located on the board is used to support operation of the microprocessor program. The primary functions performed include:

- Microbus interface.
- Control Firmware
- Analog signal interface
- Develop gate signals sent to the Power Stage Interface

Figure 2.7
Main Control Board Hardware Location

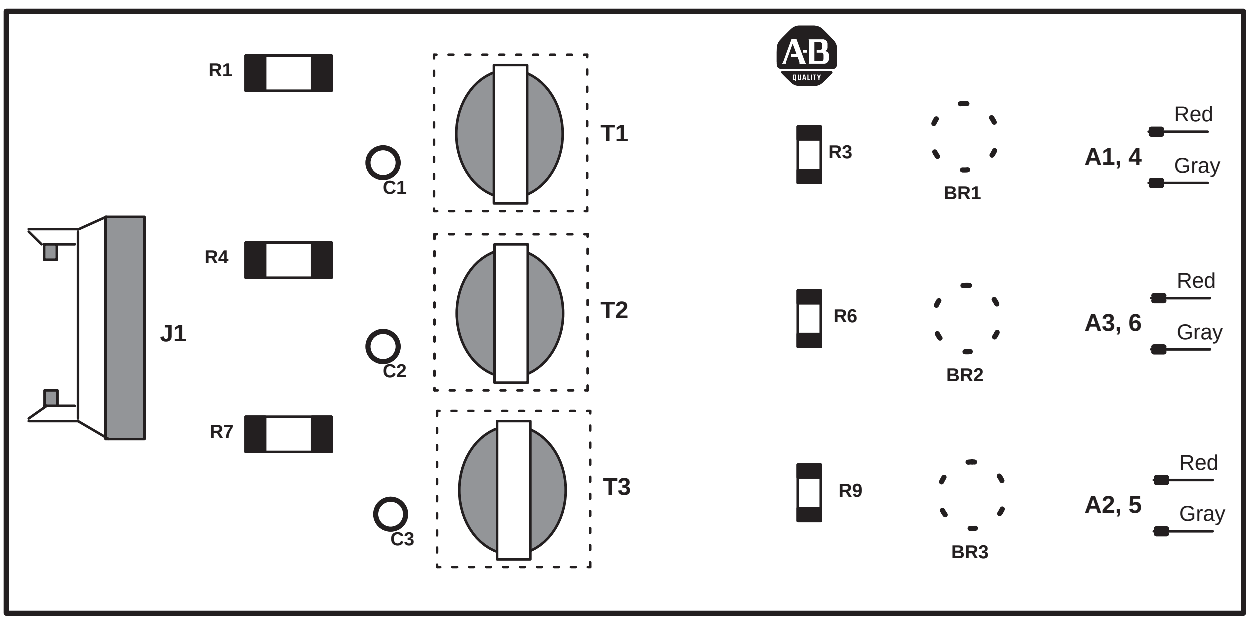


Armature Pulse Transformer (A24, A24A, A25, A25A) –
The primary functions of the Armature Pulse Transformer Board (Figure 2.8) include:

- Isolate power bridge circuitry from control circuitry.

There are 4 Armature Pulse Transformer Boards. Each board is associated with each of 4 commutation groups. There are four boards for the Regen and two for the Non-Regen. The board is physically mounted on the armature power bridge, with screw terminals used to mount the board also used as the connections to the incoming AC line and DC bus. SCR connections are made at the spade terminals with the red and gray color designations on the right side of the board.

Figure 2.8
Armature Pulse Transformer Board Hardware Location

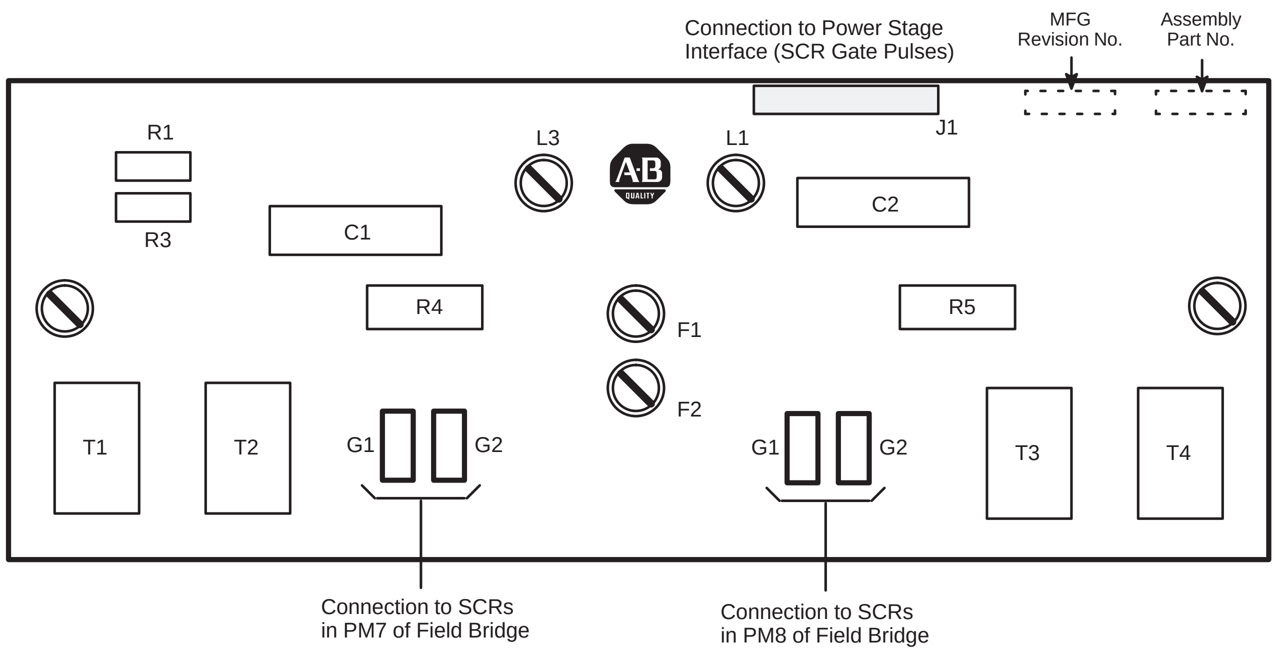


Field Pulse Transformer and Snubber Board (A5) – The primary functions of the Field Pulse Transformer and Snubber Board (Figure 2.9) include:

- Isolate field bridge circuitry from control circuitry.
- Provide dv/dt protection across SCRs.

The board is physically mounted on the field power bridge buswork, with the screw terminals used to mount the board also being used as the connections to the incoming AC line and DC bus.

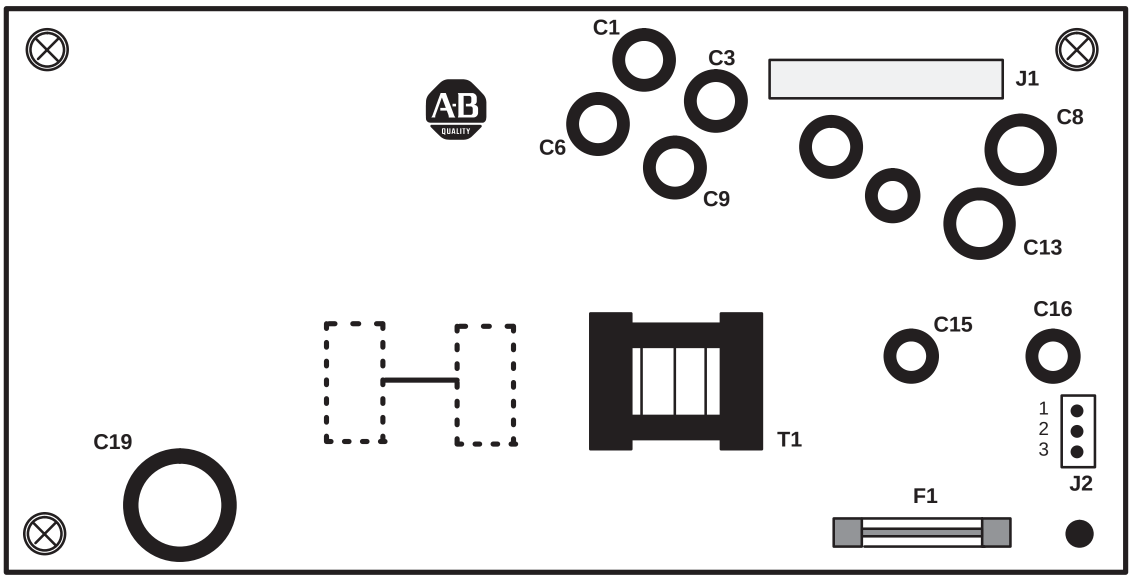
Figure 2.9
Field Pulse Transformer and Snubber Board Hardware Location



Peripheral Devices

Unit Power Supply (A6) – The Unit Power Supply 115VAC input comes from the 115VAC power supply on the 6PT transformer. The AC voltage is rectified and regulated to produce +5VDC and + 12VDC control voltages which are distributed to the 1395 control boards through the Power Stage Interface. Figure 2.10 shows the location of the Unit Power Supply components.

Figure 2.10
Unit Power Supply Hardware Location

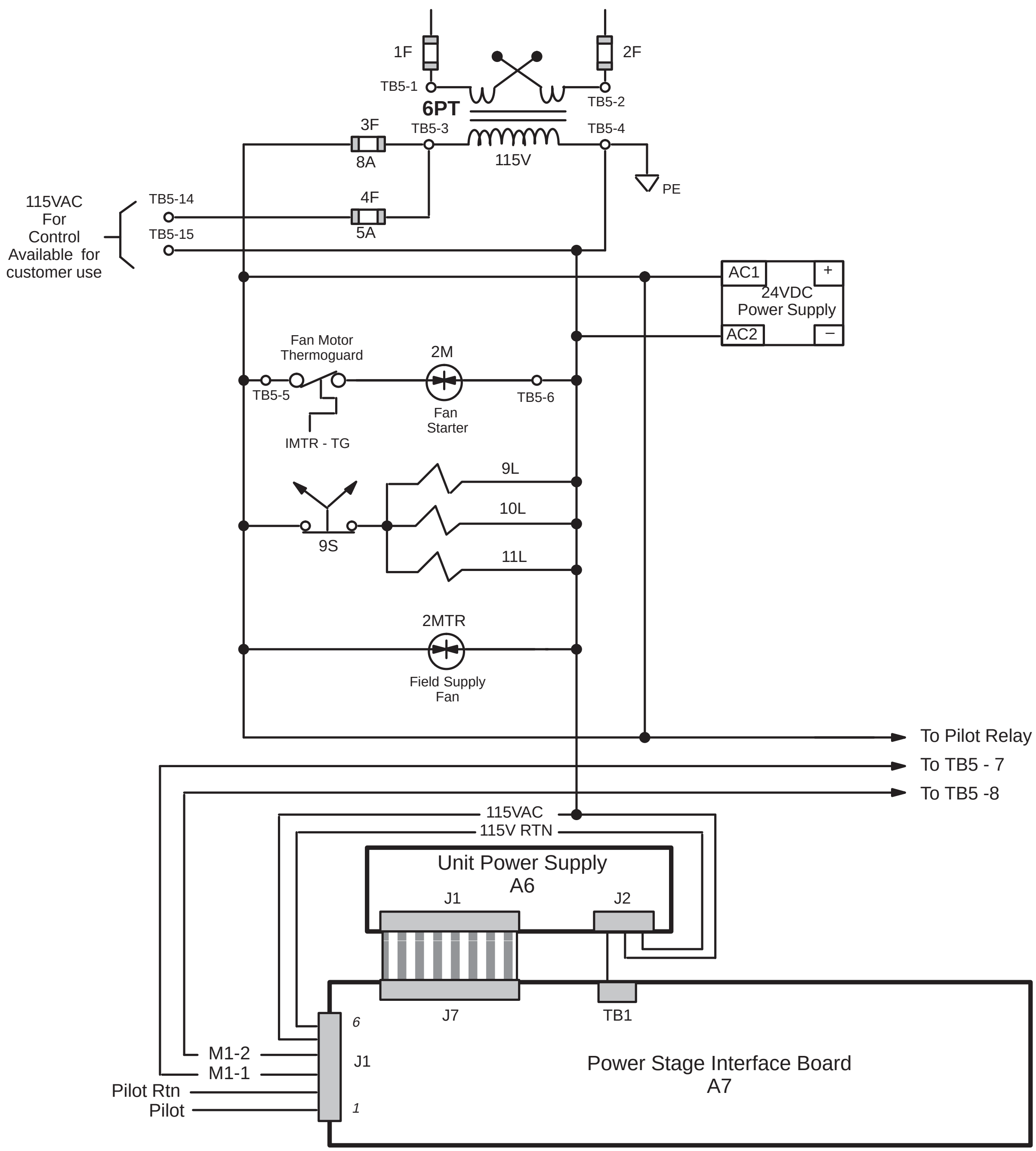


24VDC Power Supply (A2) – The 24VDC Power Supply 115VAC input comes from the 115VAC power supply on the 6PT transformer. The AC voltage is rectified and regulated to produce +24VDC which is supplied to the Feedback Board.

Power Distribution

115VAC Control Voltage – Figure 2.11 illustrates the distribution of 115VAC control voltage within the Bulletin 1395. Single phase 115VAC control voltage, is provided by the 6PT transformer at TB5-14 and -15. Fuse 4F provides protection against short circuits on the 115VAC input to the drive. TB5 (an internal terminal block) distributes control voltage to components within the 1395.

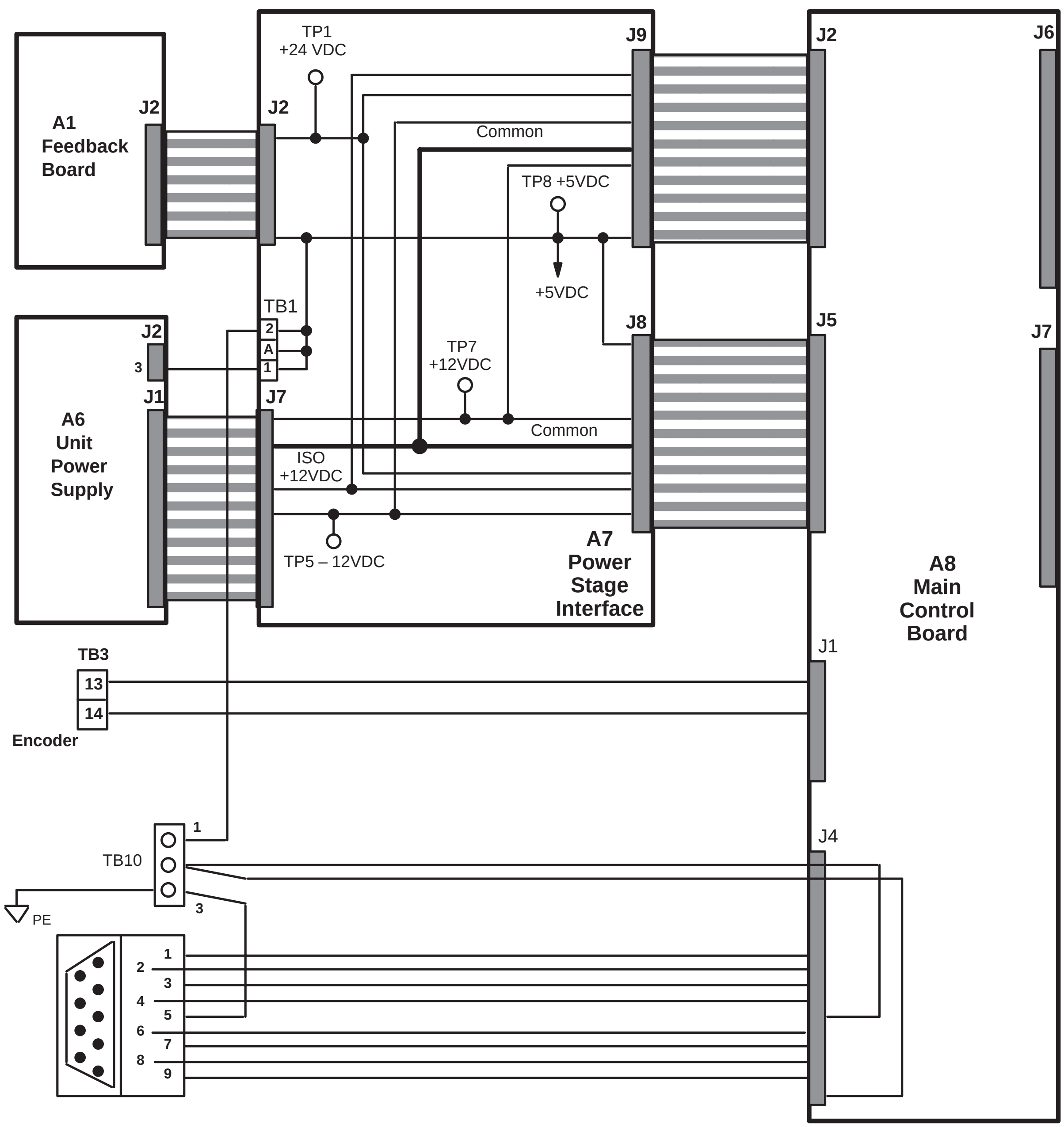
Figure 2.11
115 VAC Control Voltage Distribution



DC Control Voltage Distribution – The Unit Power Supply converts 115VAC (supplied as shown in Figure 2.12) to +5VDC and the +/–12VDC control voltages. In addition to the voltages supplied by the Unit Power Supply, the Power Stage Interface converts 115VAC to 24VDC which is used for relay logic and provides the supply voltage to the SCR Pulse Transformer and Snubber boards to produce SCR gate signals for the armature and field.

Control Common – Control Common in the Bulletin 1395 is connected to signal ground TB10-2. Refer to Chapter 4 for installation detail.

Figure 2.12
DC Power Distribution and Control Common



Relay Logic

Main Contactor (M1) Control – Figure 2.13 illustrates the hardware associated with the control of the coil voltage applied to the Main DC contactor M1. The coil voltage originates at an external 115VAC source. The source voltage may be interrupted before being input to the drive at TB5-9 and -10 by the use of externally controlled contacts. These external contacts may include an external master coast stop, PLC controlled contacts, permissive contacts, etc. Main contactor M1 coil voltage is controlled within the 1395 through the Power Stage Interface when M1 is energized. This signal is rectified and optically isolated to produce a 5V logic signal CVERIFY which is sent to the Main Control Board.

Pilot Relay (PR) Control – K2 and K3 contacts on the PSI Board in series with the 115VAC Coast Stop input to the drive, control coil voltage to the Pilot Relay.

ECOAST Stop – The “ECOAST Stop” as defined and illustrated, is a contingency circuit designed to stop the motor in event of a malfunction in the solid state interface drive software.

When an ECOAST Stop is initiated, the DC loop contactor is de-energized and the motor will coast to a stop unless the drive is equipped with optional dynamic braking circuitry.

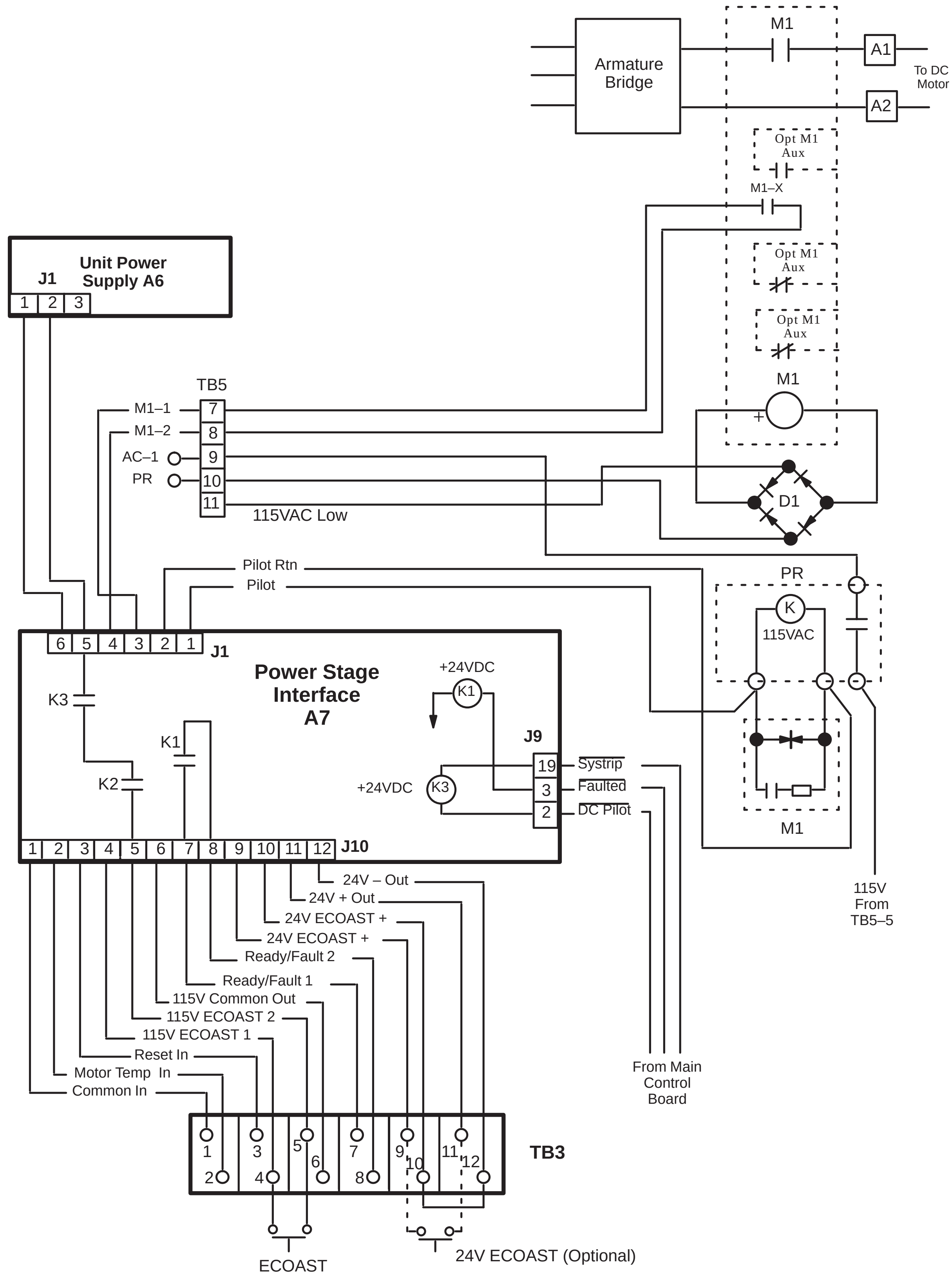
The optional dynamic braking circuitry is designed to develop 150% – 200% of rated motor torque for braking when an ECOAST Stop is initiated. Braking torque decreases with speed. This option is not recommended for repetitive operation.

Relay K2 on the Power Stage Interface is the ECOAST Stop relay and is controlled by +24VDC. As shown in Figure 2.13, +24VDC from the Power Stage Interface is connected to TB3-12 and -11. At this point, an external (dry) 24VDC ECOAST stop contact could be used to control the application of 24VDC to K2 through TB3-9. TB3-12 and -10 should always be jumpered together to provide a return path for 24VDC. If an external 24VDC ECOAST Stop contact is not used, then TB3-9 and -11 must be jumpered.

In addition to the 24VDC ECOAST Stop, there is an 115VAC ECOAST Stop circuit which is also provided as standard in the 1395. 115VAC enters the power stage interface from TB5 and is distributed to TB3-4. Between TB3-4 and -5, an external (dry) ECOAST Stop contact may be connected. If an external 115VAC ECOAST stop circuit is not used, TB3-4 and 5 must be jumpered. 115VAC is returned to the Power Stage Interface from TB3-5 and sent to contacts of K2. From here it proceeds to the contacts of K3 on the Power Stage Interface. The 115VAC ECOAST Stop Signal is also sent to an isolation circuit which converts the 115VAC to a +5VDC control Signal ECOAST which is sent to the Main Control Board.

Main Control Relay – K3 on the Power Stage Interface is the main control relay which controls turn on voltage to the coil of the pilot relay PR. K3 is controlled by logic signals from the Main Control board entering the Power Stage Interface through ribbon connector J9. The two signals which control K3 are the SYSTRIP and the DCPILOT signals. In order for K3 to energize PR, there must be no system fault and there must be a DC pilot relay turn-on command. If both these conditions are met, K3 is energized, and PR is in turn energized.

Figure 2.13
Relay Logic



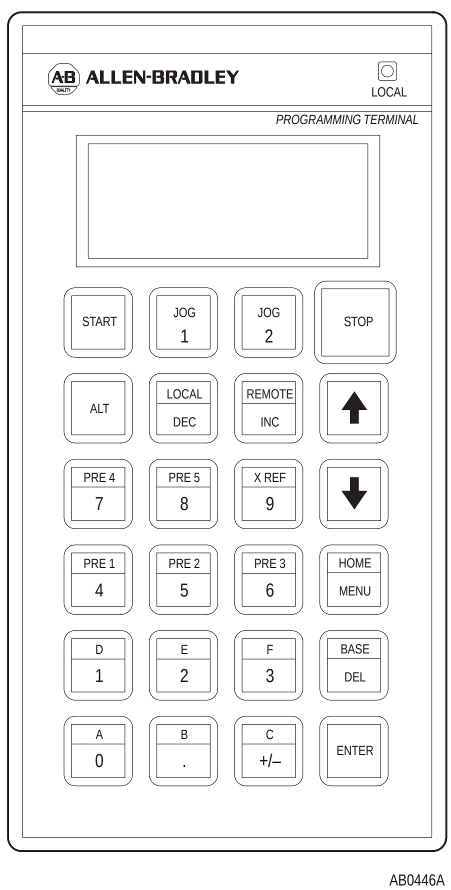
Options

Programming Terminal Interface – The Handheld Programming Terminal (HHT) is used to access information in the firmware of the 1395. Keypads on both the handheld programming terminal and the door-mounted terminal (shown in Figure 2.14) can be used to perform the following functions:

- Monitor real time parameter values
- Change parameter values
- Start/Stop the drive (depending on Model of Programming Terminal)
- Set drive configuration
- Backup parameter values to EEPROM
- Monitor fault information

Interface between the 1395 Main Control Board and the handheld Programming Terminal is accomplished using a 9 pin type connector physically mounted on the end of TB3. The cable coming from the D-shell connector is connected to J4 on the Main Control Board. For a detailed description of the Programming Terminal, refer to the Programming Terminal Installation and Operation Manual.

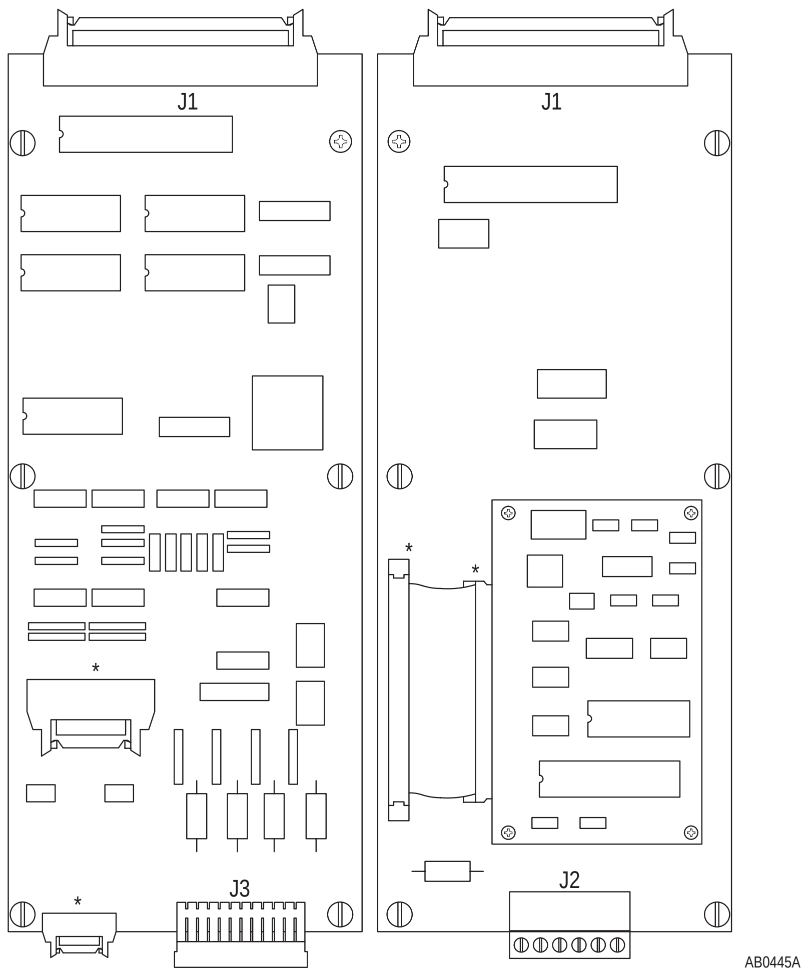
Figure 2.14
Programming Terminal



Adapter Boards – External control devices such as a PLC, discrete operators devices, etc., are interfaced with the Main Control Board through one of the two microbus ports, labeled PORT A (J7) and PORT B (J6) on the Main Control Board. The microbus is a 60 line bus designed specifically for the transfer of data between microprocessors. The microbus is used on the Main Control Board to transfer data between devices on the board. Additionally, hardware on the Main Control Board allows data transfer between the microprocessor on the Main Control Board and external devices through the two microbus Ports.

Information coming from external devices must be changed first to the format required by the microbus before being input to the microbus Port. The processing of data is accomplished through the use of the following adapter boards:

Figure 2.15
Construction and Location of Adapter Boards



Discrete Adapter Board

The Discrete Adapter Board connects directly to the Main Control Board using Port A of the Microbus interface. All user connections to the board are made at Terminal Block TB-3 located at the bottom of the 1395 Drive.

Digital Inputs – The Discrete Adapter Board contains four discrete inputs for either 120VAC signals or 24VDC signals. These optically coupled inputs provide a means for external control of the 1395 via pushbuttons, relays, switches, etc.
The inputs are preconfigured for the following signals: STOP, JOG, START, CLEAR FAULT.

Digital Outputs – Two discrete outputs are provided through control of two on-board relays. The contact rating is 0.6A at 125VAC and 0.2A at 30VDC. These outputs allow the 1395 to signal various operating states of the Drive.
The outputs are preconfigured for the following signals: DRIVE RUNNING, AT ZERO SPEED.

Analog Inputs – Four preprogrammed 12-bit analog to digital inputs. These inputs allow a +/– 10VDC analog signal to be converted to a +/– 2048 digital signal, thus providing 4.88 millivolts per bit resolution. Through programming of associated Scale and Offset parameters the effective range of the converted signal can be extended to +/–32767.
The analog inputs are preconfigured for the following signals: VELOCITY REFERENCE, TACH VELOCITY, TRIM REFERENCE.

Analog Outputs – Four preprogrammed 11 bit digital to analog outputs. These outputs allow a +/– 1024 drive signal to be converted to a +/–10VDC analog analog output, thus giving 9.76 millivolts per bit resolution. Through programming of associated Scale and Offset parameters the effective range of the Drive signal can be extended to +/– 32767.
The analog outputs are preconfigured for the following signals: VELOCITY FEEDBACK, FIELD CURRENT FEEDBACK, ARMATURE CURRENT FEEDBACK and ARMATURE VOLTAGE FEEDBACK.

All inputs and outputs have the flexibility to be reconfigured by the user for other signals. For a detailed description of the discrete adapter refer to the Discrete Adapter Manual.

Digital Reference Adapter Board

The Digital Reference Adapter Board connects directly to the Main Control Board using Port A of the Microbus interface. This interface supplies the Adapter Board with all logic voltages and communication capabilities. The Digital Reference Adapter has the following inputs and outputs:

Digital Reference Input – One digital reference input which produces a digital reference command for the Drive. The Adapter Board is set up by default for the encoder input signal to be single channel dual edge (i.e. both the rising edge and falling edge are used by the counting logic).

Digital Inputs – Ten programmable discrete inputs for 24VDC signals. They can be connected to any Sink parameter such as the Logic command word. All ten inputs are LED indicated for high input level visibility. These optically coupled inputs provide a means for external control of the 1395 via pushbuttons, relays, switches, etc.

The inputs are preconfigured for the following signals: RUN REFERENCE SELECT A,B,C, RAMP DISABLE, JOG2, JOG1, NORMAL STOP, START, CLOSE CONTACTOR, CLEAR FAULT.

Digital Outputs – Five programmable solid state outputs are provided. These 24VDC outputs, can be connected to any source parameter such as the logic status word. All five outputs have LEDs indicating when the signal is on.

These outputs are preconfigured for the following signals: ZERO SPEED, DRIVE RUNNING, READY, AT CURRENT LIMIT, AT SET SPEED.

Analog Inputs – Two programmable analog inputs allow a +/– 10 Volt signal through a 12 bit A to D converter, thus providing 4.88 millivolts per bit resolution.

The inputs are preconfigured for the following signals: VELOCITY REFERENCE, TACH VELOCITY.

Analog Outputs – Two programmable analog outputs allow a signal to be converted to a +/– 10VDC analog output through a 11 bit digital to analog converter, thus giving 9.76 millivolts per bit resolution. Through programming of associated Scale and Offset parameters the effective range of the Drive signal can be extended to +/– 32767. The digital Drive signal can be any of the 1395 run time parameters.

All user connections to the board are made at terminal block TB3 located at the bottom of the 1395 Drive.

The outputs are preconfigured for the following signals, VELOCITY FEEDBACK, ARMATURE CURRENT FEEDBACK.

All inputs and outputs have the flexibility to be reconfigured by the user for other signals.

For a detailed description of the Digital Reference Adapter, refer to the Digital Reference Adapter Manual.

Node Adapter Board

The Node Adapter Board provides an interface between external devices and the Main Control Board of the 1395. The board allows the 1395 to be controlled using an Allen-Bradley PLC Controller from either the PLC3 or PLC5 family.

The Node Adapter Board is not preconfigured. Refer to the Node Adapter Manual for hardware and integration information.

Multi-Communication Board

The Multi-Communication Adapter Board provides a sophisticated interface to Allen-Bradley PLC controllers and other equipment capable of communicating over serial communications links.

The Multi-Communication Adapter is not preconfigured. Refer to the Multi-Communication Board Software/Hardware Reference Manual for hardware and integration information.

Chapter 3

Functional Description

Introduction

Chapter 3 contains a general description of the functionality of the 1395 drive. This description is intended to provide sufficient background information to support other procedures in this manual and to enable the reader to:

- Configure the parameters of the drive.
- Interface the drive with peripheral devices such as an Allen-Bradley PLC, discrete operators I/O and the Programming Terminal.

This chapter is not intended to be an all encompassing technical description of the 1395 drive.

Terminology

Following is a brief description of new terms and concepts covered in Chapter 3.

Configuration The process of linking Sink to Source Parameters.

Fast Parameter Fast parameters are all parameters whose values are updated every 4msec, and are used for the real time data input and output of the drive. Fast parameters are backed up in volatile memory only.

Interface Hardware and associated software required to transfer information and/or control signals from one device to another.

Microbus Hardware and associated software designed by Allen-Bradley for the exchange of digital information at the microprocessor level. The Microbus is used for the transfer of information between Adapter Boards and the Main Control Board.

Port Hardware located on the Main Control Board which allows for connection of one Adapter Board to the Microbus. There are two ports on the Main Control Board.

Parameter Memory location used to store drive data. Each parameter is given a number called the parameter number. The parameter value may be specified in decimal or hexadecimal. When specified in hexadecimal, the word “Hex” will appear after the parameter value.

Parameter Table	Table of parameter entries for all Configuration and Setup parameters used in the drive.
Source	Fast parameter used as a source of data.
Sink	Fast parameter used to receive data input.

Functional Overview

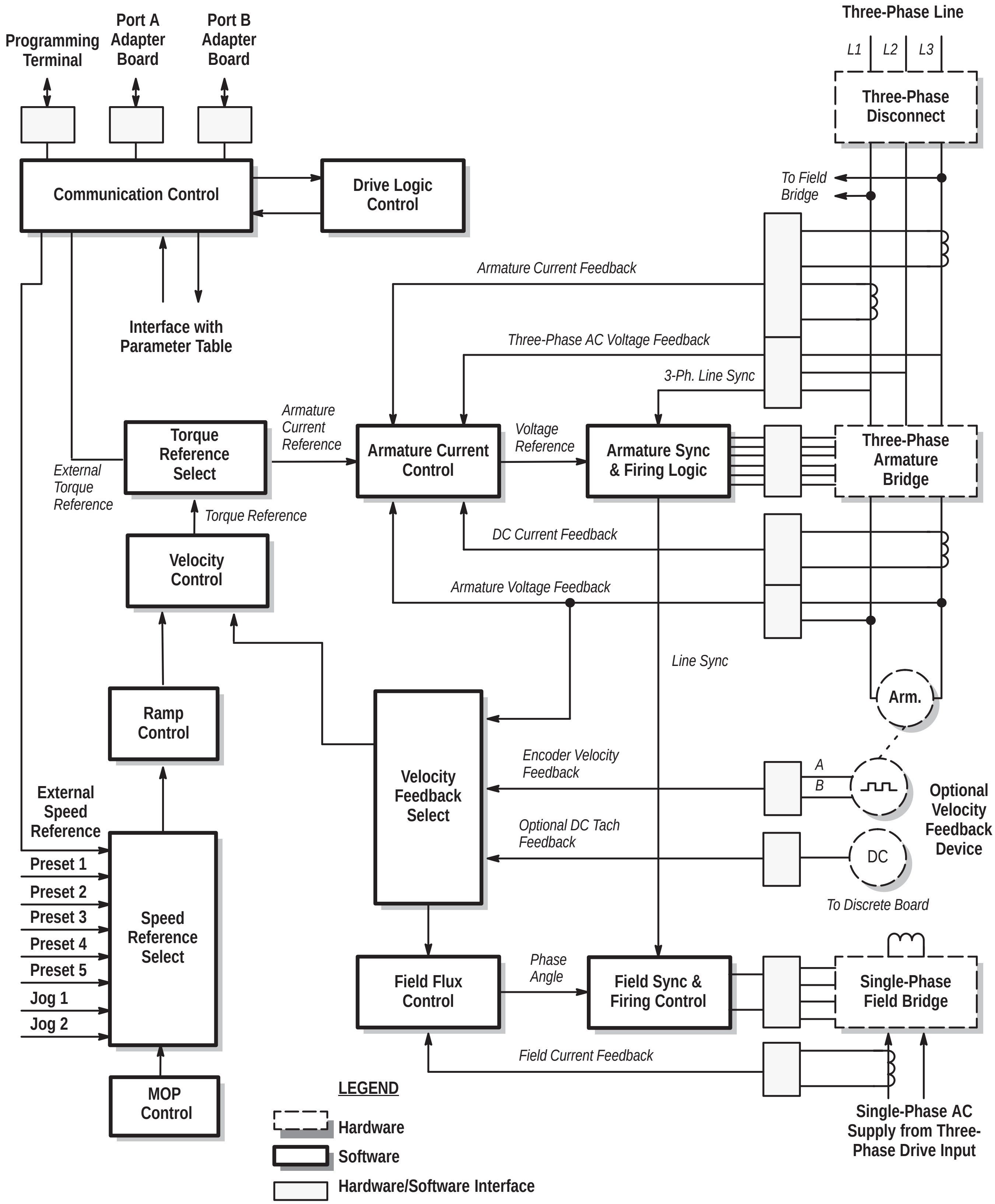
General

Figure 3.1 provides an overview of the major blocks associated with the control functions of the Bulletin 1395. All control functions in the 1395 are performed through the use of parameters which can be changed with a Programming Terminal.

Feedback information is derived from hardware devices as shown on the right side of Figure 3.1. Analog signals are converted to digital signals for use by the drive. Control signals may be provided to the drive from up to two optional Adapter Boards.

All setup and operation information used by the drive is stored in a system parameter table. Every parameter including Setup and Configuration parameters (Sources and Sinks) has an entry in the parameter table. For example, Parameter 154 is named the “Vel Ref Whole” parameter and contains a number representing the velocity reference. The velocity reference can originate from an external control device such as a potentiometer connected to the Discrete Adapter Board or a signal coming from a PLC.

Figure 3.1
Functional Overview



Communication Control

The Communication Control block controls all of the data transfer. The Programming Terminal communicates with the drive through an RS-422 serial communication link. Internal communication in the drive is accomplished using a Microbus which is a specialized microprocessor bus designed by Allen-Bradley. In addition to internal communication, transfer of data between the drive and up to two Adapter Boards is provided through the Microbus. The hardware used for this interface is known as a Microbus Port. Two ports (labeled A and B) are available. Adapter Boards provide an interface between external control hardware such as discrete devices, PLC's, etc.

Drive Logic Control

This block controls the operating state of the drive in response to the logic command input. Selection of various reference parameters (i.e. speed reference) and control modes (i.e. droop) are performed in the drive Logic Control. In addition to controlling the state of the drive, the drive Logic Control monitors the present operating condition of the drive and provides this information as available feedback to external control devices. The drive Logic Control also monitors fault sensing.

Speed Reference Selection

There are five preset speeds stored in parameters in the drive. Additionally, an *External Speed Reference* and one of two Jog inputs may be selected as the velocity reference input to the drive. The Speed Reference Select block uses information provided from the drive Logic Control to determine which of the available references will be used as the input to the Velocity Control. The selected reference is sent to a ramp before being sent as the velocity reference input to the Velocity Control.

Velocity Feedback Select

The drive has been designed for normal operation using one of three possible means of velocity feedback. Hardware for interfacing the drive to a digital encoder is provided as standard in the drive. Armature voltage is constantly monitored by the drive and can be used for velocity feedback. If a DC tachometer is used for speed feedback, the drive must be equipped with a Discrete Adapter Board connected to Port A of the Microbus.

IMPORTANT: An external voltage divider for the DC Tach will be needed to obtain the correct voltage for the Discrete Adapter Board analog input circuit.

Feedback in the form of an analog signal from the DC tach is sent to the Discrete Board, converted to a digital signal and scaled for input to the Velocity Feedback Select block. The Velocity Feedback Select block uses information stored in a drive setup parameter to determine which of the feedback signals is to be sent to the Velocity Control.

Velocity Control

The Velocity Control compares the velocity reference to the velocity feedback to determine the velocity error.

Torque Reference Select

The 1395 can operate as either a speed regulated or a torque regulated drive, and therefore has the capability to accept either a velocity reference or a torque reference input. In addition, the Torque Reference Select block allows the drive to operate as a torque regulated drive and still have the velocity control operational. In this case, the drive can receive both a velocity reference and a torque reference at the same time. The Torque Reference Select block selects from either the output of the Velocity Control, or the External Torque Reference or both, depending on the mode of operation being commanded from the Drive Logic Control block. The reference which is selected is scaled based on the motor ratings to a current reference.

Armature Current Control

Armature current reference is compared to the *Armature Current Feedback* derived from the output of the current transformers (CT's). The Armature Current Control block produces a *Voltage Reference* which is applied to the Armature Sync and Firing Logic. In addition, the Armature Current Control monitors the *Three-Phase AC Voltage* and *Armature Voltage Feedback*.

Armature Sync and Firing Logic

The *Voltage Reference* output from the Armature Current Control is converted to a phase angle reference and then a time reference. The signal is then synchronized to the incoming three-phase line to produce the gate firing pulse for the SCRs located in the Armature Bridge. The Logic also provides synchronizing information to the Field Sync and Firing Logic.

Field Flux Control

The Field Current Control uses the *Field Flux Reference* from the Velocity Control to develop a field current reference. This reference is then compared to the *Field Current Feedback* derived from the current transformers in the incoming AC line to the Field Bridge. The error between the field current reference and feedback produces a field *Phase Angle* which is sent to the Field Sync and Firing Logic.

Field Sync and Firing Logic

The *Phase Angle* output from the Field Current Control is converted to a time reference which is synchronized to the *Line Sync* signal from the Armature Sync and Firing Logic to produce the gate firing pulses for the SCRs.

Configuration

Figure 3.2 shows an overview of the parameters associated with configuration of the drive. The 1395 has been designed to accept control input through the use of Adapter Boards. A portion of the drive control has been designed to act as a black box from the point of view of external devices. In order to perform the control functions required by the specific application, it is necessary to configure various control and reference information such as logic commands, speed reference and torque reference. Additionally, for the external control equipment to monitor the operating conditions in the drive (logic status, actual speed, actual armature current etc.), configuration provides a way for this information to be transferred to the external devices.

Sink Parameters

Several parameters associated with the control logic have been set aside specifically for the task of receiving input information from external control devices. These parameters are called “Sinks.” Figure 3.2 illustrates some of the Sink parameters used for input to the control logic. Refer to Table 3.A for a listing of Sink parameters.

Figure 3.2
Source and Sink Parameters (Partial)

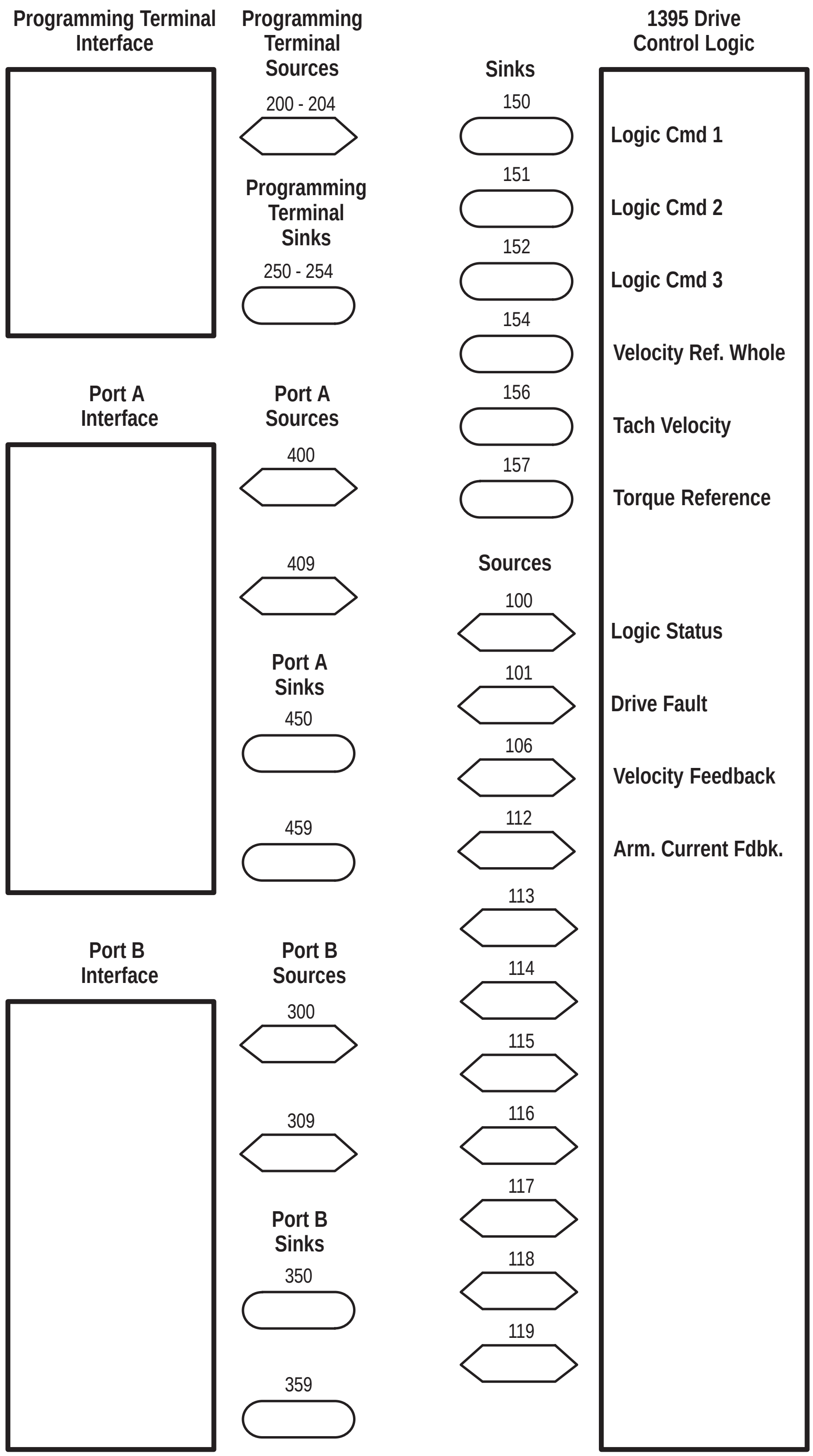


Table 3.A
Control Sink Parameters

Number	Name	Function
150	Logic Cmd 1	First 16 Bit Logic Command Word
151	Logic Cmd 2	Second 16 Bit Logic Command Word
152	Logic Cmd 3	Third 16 Bit Logic Command Word (Program Terminal)
153	Vel Ref Fraction	External Velocity Reference Fractional Part
154	Vel Ref Whole	External Velocity Reference Whole Part
156	Tach Velocity	Tachometer feedback signal coming from analog tach or other external velocity feedback device
157	Torque Reference	Torque Reference input. Used when drive operates as a torque regulator.
159	Flux Feed Fwd	External flux reference used as a feed forward term in field regulator.
160	CEMF Reference	Counter EMF Reference. Used when drive is operated as a torque regulator
161	Process Trim Ref	Process Trim Reference Input
162	Proc Trim Fdbk	Process Trim feedback derived from external sensing device
163	Vel Indirect 1	Indirect parameter, linked to slow Parameter 600
164	Vel Indirect 2	Indirect parameter, linked to slow Parameter 601
165	Vel Indirect 3	Indirect parameter, linked to slow Parameter 602
166	Vel Indirect 4	Indirect parameter, linked to slow Parameter 603

The function of each Sink parameter has been pre-defined and cannot be changed. For example, Parameter 151 (Logic Cmd 2) has been specifically set aside for the function of drive logic control. Because each Sink parameter has been defined for a specific use, each Sink parameter will have a specific data type and units of measure.

For example, Parameter 151 (Logic Cmd 2) is a 16 bit word where each bit has been defined for a specific function such as Start, Stop, Close Contactor, etc. A description of each parameter is provided in Chapter 7.

The specific external control devices which can be interfaced with the drive are defined by the type of Adapter Boards connected to Microbus Ports A and B on the Main Control Board. For example, the drive could be controlled by discrete hardware such as push buttons and pots. In this case, a Discrete Adapter Board would be required to interface the discrete control hardware to Port A. If interface with a PLC is desired, a Node Adapter Board is required in Port B.

Each Adapter Board also has Sink parameters associated with it as shown in Figure 3.2.

Source Parameters

Information input to a Sink parameter must originate from a Source parameter which transmits the information through the Microbus Ports. As shown in Figure 3.2, there are 10 Source parameters associated with each of the ports. The specific hardware devices associated with the Source parameters are determined by the Adapter Board which has been physically connected to the port. For example, if a Discrete Adapter Board has been connected to Port A, then Parameter 400 is defined as a 16 bit word, where 4 of the bits can be controlled directly by the 4 digital inputs to the board. If a Node Adapter Board has been connected to Port B, then Parameter 300 is defined as a 16 bit word, where all 16 bits are directly controlled by the program in the PLC. Refer to Chapter 6 for details on pre-configuration of the 1395 drive.

The control logic also provides Source parameters which may be used to send information to the Sink parameters associated with the Microbus Ports. Some of the Source parameters associated with the control logic have been shown in Figure 3.2. Table 3.B lists the Source parameters associated with the control logic.

There are additional sets of configuration links that cross the fast and slow parameter interface. These are called “indirect parameters”. The velocity processor has Parameters 600 through 603 that link to fast Parameters 163 through 166. The system processor has slow Parameters 840 through 844 that link to fast Parameters 10 through 14.

Indirect Parameters – These parameters allow data to be transferred between fast and slow parameters. There are a total of nine indirect parameters, four for the Velocity Processor and five for the System Processor.

The Velocity Processor parameters transfer a fast data value to a slow parameter value. When a configuration link is made with a Velocity Processor indirect parameter (Parameters 163 – 166), the real time data value is transferred to the parameter number specified in the corresponding Velocity select parameter (Parameters 600 to 603). Therefore, the real time data value is copied to a velocity processor setup parameter.

The System Processor indirect parameters transfer a slow data value to a fast source parameter. When a configuration link is made with a system Processor indirect parameter (Parameters 10 to 14), the data value programmed in the corresponding System select parameter (Parameter 840 to 844) is transferred to the indirect parameter. Therefore, a constant real time value is established which can be modified by entering a new value in the system select parameters.

Table 3.B
Control Logic Source Parameters

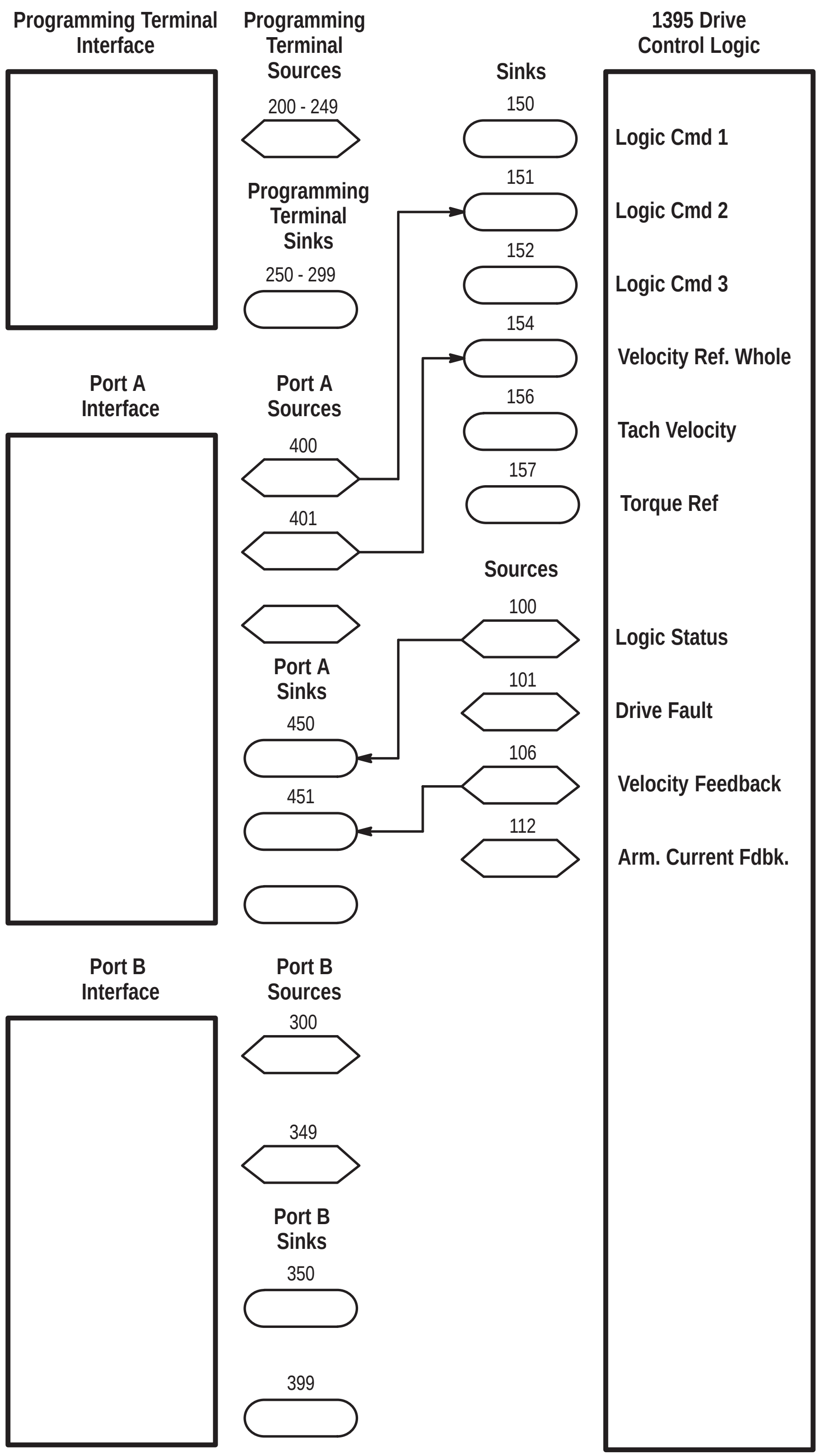
Number	Name	Function
100	Logic Status	16 bit word used to indicate the present operating condition of the drive.
101	Drive Fault	16 bit word used to indicate fault conditions in the drive.
102	Pre Ramp Vel Ref	Velocity reference output from the Velocity Reference Control
103	Ramp Vel Ref	Velocity reference output from the Ramp Control.
104	Final Vel Ref	Velocity Reference input to the Velocity PI Control which is the sum of the output from the Ramp Control, Process Trim and Droop functions.
105	Arm Voltage Fdbk	Actual armature voltage.
106	Velocity Fdbk	Final velocity feedback used as input to the Velocity PI Control.
107	Position Fdbk	Final position feedback used as input to the position control portion of the Velocity PI Control
108	Vel Feed Fwd	Error term used in proportional path of the velocity PI regulator
109	Position Error	Error between position reference and position feedback (P107)
110	Torque Command	Internal Torque Reference
111	Arm Current Ref	Torque command scaled by flux command.
112	Arm Current Fdbk	Actual armature current.
113	Arm Cur PI Out	Output of the Armature Current PI Control
114	Arm Cur Fire Ang	P113 converted to an angle reference modified by discontinuous current adaptation when operating in discontinuous current range.
115	Flux Command	Output of the field flux control.
116	AC Line Voltage	Actual three-phase input line voltage.
117	Fld Current Ref	Flux command scaled by the Field Flux Linearization Table.
118	Fld Current Fdbk	Actual field current.
119	Proc Trim Output	Output of velocity trim control.

Linking Source to Sink Parameters

In order for information from a Source parameter to be input to a Sink parameter, a link must be made between the two desired parameters. For example, to send the information from Parameter 400 (first Source parameter associated with Port A) to Parameter 151 (pre-defined as Logic Cmd 2, input), then Parameter 151 must be linked to Parameter 400. Linking of Parameter 151 to 400 is shown in Figure 3.3.

Linking of parameters is accomplished using the drive Setup Mode on the Programming Terminal. The drive will allow a total of 20 links to be made. There are two fixed links that cannot be altered or reconfigured, thereby allowing a maximum of 18 user configurable links. Linking of Sources to Sinks is referred to as “Configuring” the drive. For a complete description of how to use the Programming Terminal to configure the drive, refer to the Programming Terminal Instruction Manual. It should be noted that the 1395 drive is shipped from the factory pre-configured. The user has the capability of reconfiguring the drive as required.

Figure 3.3
Linking Sources to Sinks



The specific function and data requirements for each source parameter associated with the ports is defined by the Sink parameter from the control firmware to which it is linked. For example, in Figure 3.3, Parameter 400 is linked to Parameter 151 (Logic Cmd 2). Because Logic Cmd 2 has been pre-defined as a 16 bit control word, Parameter 400 must be handled by the Adapter Board, and in turn by the external control devices, as the 16 bit control word Logic Cmd 2 (i.e. Parameter 400 takes on the meaning of Logic Cmd 2).

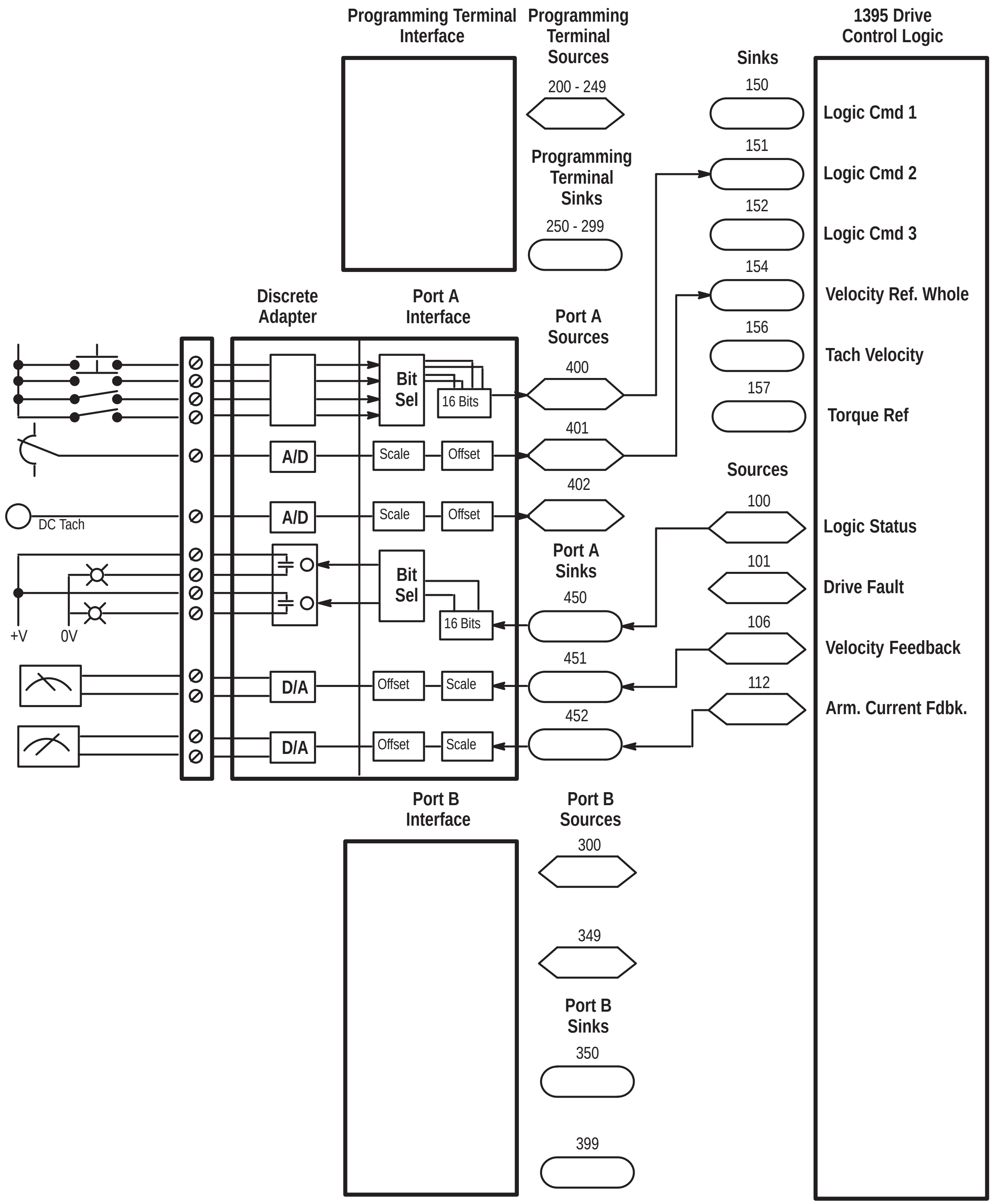
The same condition is true for Sink parameters associated with the Microbus Ports. For this reason, Sink and Source parameters associated with the ports have no meaning until they are linked to Source and Sink parameters from the control logic. Information may be flowing between the hardware connected to the Adapter Boards and the Source and Sink parameters associated with the corresponding Microbus Port, but until the Sink and Source parameters associated with the port are linked to control logic Source and Sink parameters, no transfer of data to the drive control will occur.

Example Configuration Using Discrete Adapter Board – Figure 3.4 shows a Discrete Adapter Board connected to Port A. The Discrete Adapter Board provides for up to four 24VDC/115VAC digital inputs, four analog inputs, two digital output contacts, and four analog outputs. Wiring to the actual discrete devices is provided through terminal TB3 in the drive package. Logic in the drive allows for scaling of input information for each analog input, before it is sent to the respective Source parameters. There are four Source parameters associated with the analog inputs, (Parameters 401-404 for Port A and 301-304 for Port B).

The four digital inputs to the drive are all sent to bits in a single 16 bit word which is to be used as a logic command input word. Parameters 400 for Port A and 300 for Port B are used for this purpose. Each of the four digital inputs to the Discrete Board can be configured to go to any of the 16 bits in the logic word for each port. The hardware of the Discrete Board, therefore, defines the possible usage for each of the Source and Sink parameters associated with the specific Port to which the Board has been connected.

In Figure 3.4 the Discrete Board has been connected to Port A, so only the Port A Source and Sink Parameters are defined by the hardware of the Discrete Board. Parameter 400, by definition of the Discrete Board must be linked in the Drive to to one of the logic command Sink parameters. In this example, Parameter 400 is linked to Parameter 151, Logic Command 2, so the four digital inputs to the Discrete Board will directly control four of the bits in Logic Command 2. Parameter 401, which is associated with the first analog input to the Discrete board is linked to Parameter 154, which means the analog signal entering the Discrete Board is defined as the External Velocity Reference input to the Control Logic.

Figure 3.4
Discrete Adapter Board Configuration Example



In this example, the speed feedback is being provided by a DC tachometer. The standard drive control is set up to use a digital Encoder for speed feedback, therefore, the standard hardware of the drive does not have an input for DC tach feedback. In this case, the DC tach feedback must be provided through the Discrete Board as an analog input as shown in Figure 3.4. The speed feedback derived from the tach appears at Parameter 402, and is linked to Parameter 156 which is the Tach Velocity input to the Control Logic and is used for external speed feedback.

In a similar manner, information from the Control Logic is linked to Sink parameters associated with Port A to provide digital and analog outputs from the Discrete Board as shown in Figure 3.4. Data flow between the Control Logic and other Adapter Boards may be traced in the same manner. For detailed information pertaining to the hardware and parameters associated with each Adapter Board, refer to the Installation and Maintenance Manual for that specific board.

Auto-tuning

The 1395 drive contains software that enables the drive to test and tune its current loop, velocity loop and field flux loop upon command. These features can be operated from the available program terminals or through a PLC program. Several of these tests require that the motor be capable of running at base speed. The choices available are detailed below.

– **Current Loop Test**. This feature checks the drive armature bridge for shorts or open circuits, verifies that armature voltage sensing is operating and measures the motor armature circuit.

– **Current Loop Tune**. This feature uses the information determined by the current loop test to tune the drive current loop.

– **Velocity Loop Motor Test** This feature calculates the motor inertia by running the motor under a controlled set of circumstances. The motor must be disconnected from the load to run this test.

– **Velocity Loop System Test**. This feature calculates the system inertia by running the motor under a controlled set of circumstances. The motor must be connected to the load to run this test.

– **Velocity Loop Tune**. This feature programs the drive velocity loop gains based on the information determined by the velocity loop motor and system tests.

– **Field Flux Tune**. This feature calibrates the drive field flux table to the actual motor field. The motor must be capable of running to complete this procedure. Due to the reduction of available torque, it may be necessary to disconnect the load to run this procedure.

Current Loop Tuning

As previously explained, the current loop tuning function performs two separate functions. First, it checks the armature bridge of the drive to assure that it is functional. Second, it tests and tunes the current loop gains of the drive. The current loop function can affect the following parameters:

Parameter No.	Description
734	K Discontinuous
735	KP Armature Loop
736	KI Armature Loop
741	Desired Current Loop Bandwidth
742	Maximum Current Loop Bandwidth

In addition, the parameters listed below are used by the current loop function during the test and tune procedure. These parameters must be set up correctly for the tuning function to work properly.

Parameter No.	Description
743	Current Loop Damping Factor
733	Armature Bridge Type

Current Test

The Autotune Current Test function requires the DC contactor to close and armature current to conduct through the DC motor for the diagnostic tests to work properly and Parameter 734 to be set correctly. Full field is applied during autotune, slight motor rotation is expected. The diagnostic tests first check for shorted SCRs by firing one SCR at a time with the DC contactor open. If current conducts through an SCR, then the software reports which SCR is shorted. However, the tests cannot identify multiple shorted SCRs.

Next, the diagnostic tests check for open components (open SCRs, open gate leads, disconnected motor, etc.) in the armature bridge after the DC contactor closes. Parameter 733 (Armature Bridge Type), has to be set properly before the Autotune Current Test is enabled. Otherwise, if the drive is non-regenerative and contains only six armature SCRs, the armature tests will erroneously report that the reverse armature bridge did not conduct (CP-120 REV SCRS DID NOT CONDUCT).

Finally, the average discontinuous current is measured and Parameter 734 (K Discontinuous) is updated. If the maximum discontinuous current varies from pulse to pulse by too much (12.5 percent of full load), then the drive will fault. Parameter 734 is a function of the DC motor inductance connected to the drive. The diagnostic tests also verify that the armature voltage has the correct polarity while measuring the maximum discontinuous current or else the tests will report a fault.

Current Tune

The Autotune Current Tune calculates the maximum current loop bandwidth and current loop gains. The KP and KI Armature Loop gains (Parameters 735 and 736) are based on the maximum discontinuous current (Parameter 734), desired Current Loop Bandwidth (Parameter 741) and Damping Factor (Parameter 743). Parameter 734 is used by autotuning to calculate the current loop gains because Parameter 734 is inversely proportional to the armature inductance. Autotuning does not look at the actual current loop response to determine the gains or verify the actual bandwidth. Therefore, the desired bandwidth should be used as a measure of relative performance and not absolute performance. For example, if maximum performance is desired, then the desired bandwidth should be set equal to the maximum bandwidth.

The current processor limits the desired bandwidth that the user has entered to the maximum bandwidth calculated by the drive, which cannot be modified by the user. Whenever the user enters or reads the desired bandwidth, the current processor recalculates the maximum bandwidth (Parameter 742) and limits the desired bandwidth. Next, the current loop gains are calculated based on the damping factor, desired bandwidth, maximum discontinuous current and the AC line frequency which is measured by the current processor.

When Autotune Current Tune is executed, the present values for the desired bandwidth and damping factor specify the desired dynamic behavior of the current loop. If the user wants to tune the current loop with a different value of damping factor, the parameter has to be updated before the tune is executed. The current loop will be more responsive and reproduce the current reference more accurately if the bandwidth is increased. However, the current may exhibit more noise and overshoot as the current loop bandwidth is increased. Typically, the bandwidth should be set to about 90% of maximum to provide fast performance yet minimize the effects of noise and possible excessive overshoot. The damping factor influences the amount of overshoot the current loop will exhibit during a transient. The current will typically exhibit more overshoot and become oscillatory (underdamped) as the damping factor is reduced below one. For a damping factor above one, armature current should not exhibit much overshoot and have a slower rise time for a given current loop bandwidth.

Velocity Loop Tuning

The velocity loop tuning functions enable you to calibrate the drive to the motor and the system connected to the motor. The velocity loop function can effect the following parameters:

Parameter No.	Description
613	Motor inertia
659	KI Velocity Loop
660	KP Velocity Loop
700	Velocity Loop Desired Bandwidth
701	Velocity Loop Maximum Bandwidth
703	System Inertia

In addition, the parameters listed below are used by the velocity loop function during test and tune. These parameters must be set up properly for the tuning function to work properly.

Parameter No.	Description
698	Auto Tune I Lim
699	Auto Tune Speed
702	Velocity Loop Damping Factor

Velocity Loop Motor Test

The motor test calculates the motor inertia (Parameter 613) by running the drive through a defined velocity profile. When the profile is complete, torques and acceleration/deceleration times are used to calculate motor inertia. The armature current used during the test is set by Parameter 698. The default is 25% of rated Motor Current (Parameter 611).

If acceleration time is excessive during Velocity Loop Autotune, Parameter 698 may have to be increased.

The maximum velocity that the motor will run at, is determined by Parameter 699. The test is most accurate when Parameter 699 is set to base speed. However, acceptable results can be achieved at lower speeds. In all cases the motor must be disconnected from the load (system, process or machine) for this test to yield accurate results.

Velocity Loop System Test

The system test calculates the inertia of the system that is connected to the motor by running the drive/system through a defined velocity profile. When the profile is complete, torques and acceleration/deceleration times are used to calculate System Inertia (Parameter 703).

As with the motor test, the maximum velocity that the motor and system will run at is determined by Parameter 699. In order to obtain accurate results the motor must be connected to the load (system, process or machine).

Velocity Loop Tune

This function calibrates the velocity loop gains (Parameters 659 and 660), based on the results of the motor and system tests. These tests should be run prior to attempting to tune the velocity loop to assure that the drive has the latest information.

Field Flux Tuning

The Field Flux Tuning function calculates the field current values required to obtain specific field flux levels and calibrates the flux parameters accordingly. Field Flux Tuning is not performed if Armature Voltage Feedback is used as the feedback device type (Parameter 621).

It also calculates the rated field current and adjusts the Rated Field Current (Parameter 612) as required.

The field flux tuning function does not control the motor speed directly. This is done to allow the function to calibrate the drive regardless of the drive regulator type. For example, speed regulated, torque regulated or torque follower drives can all be calibrated with this feature.

In order to calibrate the field flux properly, the actual motor speed must match the value specified in Parameter 699. Also, best results are obtained if the motor is run at base speed. Gains must also be entered for KI Flux (677) and KP Flux (673). The defaults are recommended.

Trending

The 1395 has four internal trend buffers which can be programmed to monitor select fast parameters. These buffers are particularly useful during the commissioning of the drive. They can be used to monitor motor status, logic command or other important information.

Each trend has the following features:

- The parameter to be trended can be specified.
- The parameter number (operand X) whose value will be monitored for a trigger condition can be specified. The parameter number (operand Y), whose value will be compared against the monitored parameter to determine if a trigger should occur, can be specified.
- The operator used to determine what condition(s) will cause a trigger is established.
- The rate at which the chosen parameter is selected is changeable.
- The number of samples taken after the trigger has occurred is changeable.
- Each trend can be setup as one shot or multiple occurrence. When setup as one shot, the trend has to be enabled after each trigger occurrence. When setup as multiple occurrence, the trend buffer will restart immediately after the trend data has been sent to the output buffer.
- Each trend can be deactivated so that it does not monitor for a trigger occurrence.
- Each trend output buffer can be linked to an external device. The rate at which the sampled data is transferred to the external device is also adjustable. This feature requires that the trends be set as “one-shot”.
- Trend buffers can be triggered from other trend buffers. This gives you the capability of recording up to 400 consecutive data samples for a given parameter.

- Once a trend buffer is activated, it continuously samples the selected parameter. When it is triggered, each buffer will take an additional number of samples as specified by the Post Sample Parameter. When finished sampling, the data is transferred to an output buffer where it can be displayed or sent to an external device.

An example of a typical trend buffer is shown below:

Parameter to be monitored:	Parameter 106 (Velocity feedback)
Trend Trigger operand X	Parameter 106
Trend Trigger operand Y	Parameter 900 (signed trend constant). The value in 900 will be set to 100 RPM (Actual value is entered in Internal Units)
Trend Operator	Greater than (.GT)
Samples after trigger	80
Trend sample rate	Trend buffer sample rate, this will be set to 24 ms.
Continuous trigger	One shot, the trend will have to be reset after each trigger.
Trend Enable	Activate
Trend Output Rate	Output buffer data rate.

When setting up a trend buffer, the following equation is used for comparison of operand X and Y.
[operand X] [operator] [operand Y]

The example above would result in the following formula:
When [Parameter 106] is [greater than] [Parameter 900] the trend buffer will be triggered.

Using the setup above, Parameter 106 would be monitored. When its value exceeded 100 RPM the trend buffer would be triggered and 80 more samples (at a rate of 1 every 24 ms) would be taken. Once the sampling is complete the data would be transferred to the output buffer and the trend would be deactivated.

General Logic Description

A general block diagram (software overview) of the 1395 logic is shown in Figure 3.5. Each of the major functions has a circled reference number assigned to it, which corresponds to the general software functional description given in this section.

All diagrams used for the logic description in this manual use a function block representation of the actual software function being performed. Calibration and adjustment of the 1395 consists of changing the values of specific parameters.

Velocity Reference Control *(Circle 1)*

The 1395 is capable of selecting one of 8 possible speed reference values. The speed reference value which is selected is determined by the currently active Logic Command Word (Parameter 150, 151, 152). Bits 0, 1 and 2 of the logic command provide the binary data to select from 0 through 7 (which corresponds to the 8 speed reference options). Velocity Reference is a two parameter external velocity reference expressed in Drive Units (4096 = Base Speed). Parameter 154 supplies the whole number part, while Parameter 153 supplies the fractional part of the external reference. Also selectable are five different preset speeds, defined in Parameters 633 through 637. In addition, Logic Command, bits 0,1 and 2 can be used to select the output of a MOP as the speed reference. Selecting the MOP function output as a reference bypasses the Jog select function. The MOP output will enter directly into the speed limit block. Parameters 649 and 650, MOP max and MOP Min speeds, are used to limit the maximum and minimum MOP speeds that can be reached using the MOP INC and MOP DEC function.

Bits 9 and 10 of logic command select the Jog function as the speed reference. Two jog speeds are available; Parameter 638 represents Jog l and Parameter 639 represents Jog 2. These jog speeds can be defined as either forward or reverse speed references.

The selected speed reference then enters a speed limit block. The maximum and minimum limit of the speed reference are adjustable by changing the values of Forward Speed Limit (Parameter 608) and Reverse Speed Limit (Parameter 607). Forward Speed Limit sets the maximum speed reference for the forward direction, and Reverse Speed Limit sets the maximum speed reference for the reverse direction.

Pre-Ramp Velocity Reference (Parameter 102) indicates the value of the velocity reference that has been currently selected by the Velocity Reference Control. Parameter 102 is also the input to the Ramp Control. Two parameters control the accel and decel rates of the Ramp function. Accel Time, (Parameter 651), defines the time in seconds for the output of the Ramp to go from zero to base speed (linear beyond base speed). This rate applies to both forward and reverse speed references. Decel Time (Parameter 652), defines the time in seconds for the output of the Ramp to go from base speed to zero speed reference in both the forward and reverse directions. In addition to the Ramp function, an “S” filter function has been provided. Desired Contour (Parameter 653), specifies the rounding of the edges of the velocity profile or "S" filtering. These functions can be bypassed by setting bit 5 in Logic Command.

Ramp Velocity Reference (Parameter 103), is the output of the Ramp and Contour function blocks. The value of this parameter is conditionally offset by the Droop function (if used), to become the Final Velocity Reference (Parameter 104). The output of the Droop Control *(Circle 6)* is derived from Torque Command (Parameter 110), along with Droop Percent (Parameter 657) and Droop Gain (Parameter 658). Ramp Velocity Reference (Parameter 103), is the output of the Ramp and Contour function blocks. The value contained in this parameter is conditionally offset by the Droop and Process Trim functions (if used), to become the Final Velocity Reference, (Parameter 104). The output of the Droop Control (Circle 6) is derived from Torque Command (Parameter 110), along with Droop Percent, (Parameter 657) and Droop Gain, (Parameter 658). The Process Trim Control (Circle 4) allows either the speed reference or torque reference to be trimmed according to the process. It contains its own PI Control block, along with filters and limiting functions. A selection block in logic, controlled by Process Trim Select (Parameter 628), sends the output to be summed with the input to the velocity loop, or summed with External Torque Reference (Parameter 157), to be used as a torque reference.

Velocity Feedback Control *(Circle 4)*

The 1395 allows different methods of motor speed feedback. A digital encoder, analog DC tachometer or armature voltage may be selected as feedback methods. Feedback Device Type (Parameter 621), selects the source for motor velocity feedback. Velocity Filter Select (Parameter 631) provides the option of using a filter and designating what type it will be. The output of the Feedback Filter block provides the Velocity Feedback (Parameter 106). The "No Feedback" option is typically used for drives operating as torque regulators (torque mode select).

Velocity PI Control *(Circle 5)*

Compares the speed reference value from the Velocity Reference Control to the actual motor speed, from the Velocity Feedback Control. The Final Velocity Reference (Parameter 104), is modified by KF Velocity (Parameter 661). This parameter controls the amount of velocity reference that will be summed with velocity feedback. This is filtered and modified through a Proportional/Integral (PI) Control function. The proportional gain of the PI Control is determined by the value of KP Velocity Loop (Parameter 660). A value of 8 in Parameter 660 will provide a gain of 1. The integral gain of the PI Control is determined by the value of KI Velocity Loop (Parameter 659). The output of the velocity control firmware is a torque reference, which is limited before being applied to the torque selection block.

Process Trim *(Circle 7)*

Process Trim Reference (Parameter 161), and Process Trim Feedback (Parameter 162), are summed to provide the error signal into the filter block. Process Trim Filter Constant (Parameter 713), determines the gain of a single pole filter used in the process trim. The output of the filter is used as the input to the process trim P/I regulator. Process Trim KI Gain (Parameter 715) controls the integral gain, and Process Trim KP (Parameter 716), controls the proportional gain. The output of the PI Control is limited by adjustable high and low limits. Process Trim Low Limit (Parameter 717), specifies the low limit of the process trim trim output value. Process Trim High Limit (Parameter 718), specifies the high limit. Immediately prior to the the limit test, the output of the process trim regulator is scaled by a gain factor. Process Trim Trim Output Gain (Parameter 719), specifies the gain value to use. Process Trim Preload (Parameter 714), is used to preset the integral term prior to enabling of the process trim function. Logic Command bit 15, activates the process trim function. Process Trim Select, (Parameter 628), contains one of three selections for determining where the output of the process trim regulator will be applied. Possible selections include trim velocity reference, trim torque reference, or no use of the process trim output. If used to trim the velocity reference, the output is summed with the velocity reference, to produce Final Velocity Reference (Parameter 104). The sum will be limited by Parameter 721 Proc Trim Lo Sum and Parameter 722 Proc Trim Hi Sum. If used to trim the torque reference, the output is summed with External Torque Command (Parameter 157), to produce an input to the Torque Select block.

Torque Select *(Circle 8)*

Selects the reference input to the Current Control, based on the value of Torque Mode (Parameter 625). Torque Mode is a number coded parameter which allows operation under several different torque modes.

There are two possible reference inputs to choose from. The output of the Velocity PI Control, which has been converted to a torque reference, is used as an internal torque reference. If the drive is a stand alone drive, or considered the Master drive of a system, this reference could be used. The external Torque Reference, (Parameter 157), is used to supply an external torque reference for the drive. This could be used if the drive was a slave drive in a system. This parameter can also be modified by summing the Process Trim Output when the Process Trim Select (Parameter 628) selects the torque reference to trim. The external torque reference is also used when either the “Min” or “Max” torque modes are selected. These functions automatically make a selection between the external torque reference value and the output of the Velocity PI Control.

Torque Command, (Parameter 110), indicates the latest torque reference value. This value is converted to an armature current reference by dividing by the motor Field Flux Command, to be used in the Current PI Control. The value is also used as an input to the Droop Control.

Feedback Control *(Circle 14)*

Two current transformers (CT's) sense armature current flow. The current feedback is scaled using Motor Armature Full Load Amps (Parameter 611) and Rated Armature Bridge Current (Parameter 615). Parameter 112 is the average armature current feedback value. The field current transducer (FCT) provides field current feedback to the control which is scaled by Rated Field Motor Current (Parameter 612) and Rated Field Bridge Current (Parameter 616). The average field current can be read by Parameter 118.

Tach Loss Recovery

When Tach Loss Recovery is selected, it allows the Drive to continue operation under armature voltage control in the event that the primary feedback device fails (the primary device can be an encoder or DC tach). The switchover occurs automatically and does not shut the Drive down.

This feature also provides an option for configuring a tach loss as a Warning Fault. This is done with Parameter 691 "Tach Switch Sel". If Parameter 691 is set to one, the Tach Loss Recovery feature is activated and Tach Loss becomes a Warning fault. If Parameter 691 is set to zero, a tach loss causes a soft fault. The default value for Parameter 691 is zero (tach loss recovery disabled).

When enabled, the Tach Loss feature operates as follows:

Velocity feedback from an encoder or tach is compared against velocity feedback derived from armature voltage. When the magnitude (absolute value) of the difference between the two feedbacks exceeds the Tach Loss Window (new Parameter 688), for a period of time in excess of 40 msec., an automatic switchover to Armature Volts Feedback will occur.

When a loss of feedback is detected in Tach Loss Recovery mode, the following action is automatically taken by the drive:

1. Change the velocity loop $K_p$and K_i gains to new values that will provide stable operation under armature voltage control. These gains are supplied by two Parameters (689 for Tach Loss K_i and 690 for Tach Loss K_p).
2. Freeze the field flux to the value present at the time of the Tach Loss.
3. Issue a Tach Loss warning via the Logic Status Word (Parameter 100 bit1 = 0, bit 0 = 1) and the VP Fault Word (Parameter 101 bit 0 = 1).
4. Change the Feedback Device parameter to the Armature Voltage Feedback value (set Parameter 621 to 1).
5. The forward and reverse speed limits are set to the speed value at the time of the Tach Loss.

These changes remain in effect until a "Clear Faults" command is issued, or until the feedback device selection is changed back to its original value.

From this point on, the drive will continue running in Armature Voltage Feedback mode. If you were to make the original feedback device functional again, it would be possible to switch back to it through one of two methods:

1. Change the value of the feedback device parameter (Parameter 621) to the original feedback type. NOTE: If the drive is running while this change is made, the drive will check to make certain the feedback from the primary feedback device is within the tach loss window. If it is, the switch will be honored and the parameter values will be restored to their previous values. If not, the switchover will not be allowed.
2. Issue a "Clear Faults" command to the Drive. The fault will be cleared, and the Drive will be reset to it's previous feedback device, gains and field flux level. Note that this command is only honored when the Drive is not running.

Current Reference Control *(Circle 9)*

The output of the Torque Reference Select block is applied to a limiting function block. Forward Bridge Current Limit (Parameter 663) and Reverse Bridge Current Limit (Parameter 664), specify the largest allowable positive and negative motor armature current that can be commanded. The limited current is then applied to a Torque Taper function block. Start Taper Speed (Parameter 665) defines the motor speed above which torque tapering will begin. End Taper Speed (Parameter 666) defines the speed above which the Minimum Taper Current (Parameter 667) will be used as the upper limit for armature current reference. The output of these function blocks is the Armature Current Reference (Parameter 111). This value is scaled using Parameters 611 and 615, and summed with Armature Current Feedback. The difference between the reference and feedback value is filtered and modified through a P/I Control Function. Armature Loop Proportional Gain (Parameter 735) determines the proportional gain of the current regulator. Armature Loop Integral Gain (Parameter 736) determines the integral gain. Parameter 734 is used to linearize the armature current loop for discontinuous current operation. The output of the Armature Current P/I Control block is converted to a time and sent to the armature SCR bridge.

Field Flux Control *(Circle 11 and 12)*

Provides information for field weakening, flux reference and field flux linearization. Several parameters are required to develop this information:

– Feedback Device Type (Parameter 621) provides the Flux Reference Selection block with feedback information.

– Flux Mode Select (Parameter 627) enables options in the flux control module.

– Field Flux Reference (Parameter 676) defines the highest flux reference that can be applied to the motor field.

– Field Economy Reference (Parameter 674) specifies the field flux flux reference to the motor. The flux value specified by this parameter will be in use when the motor has been stopped for the time specified in the Field Economy Delay (Parameter 675).

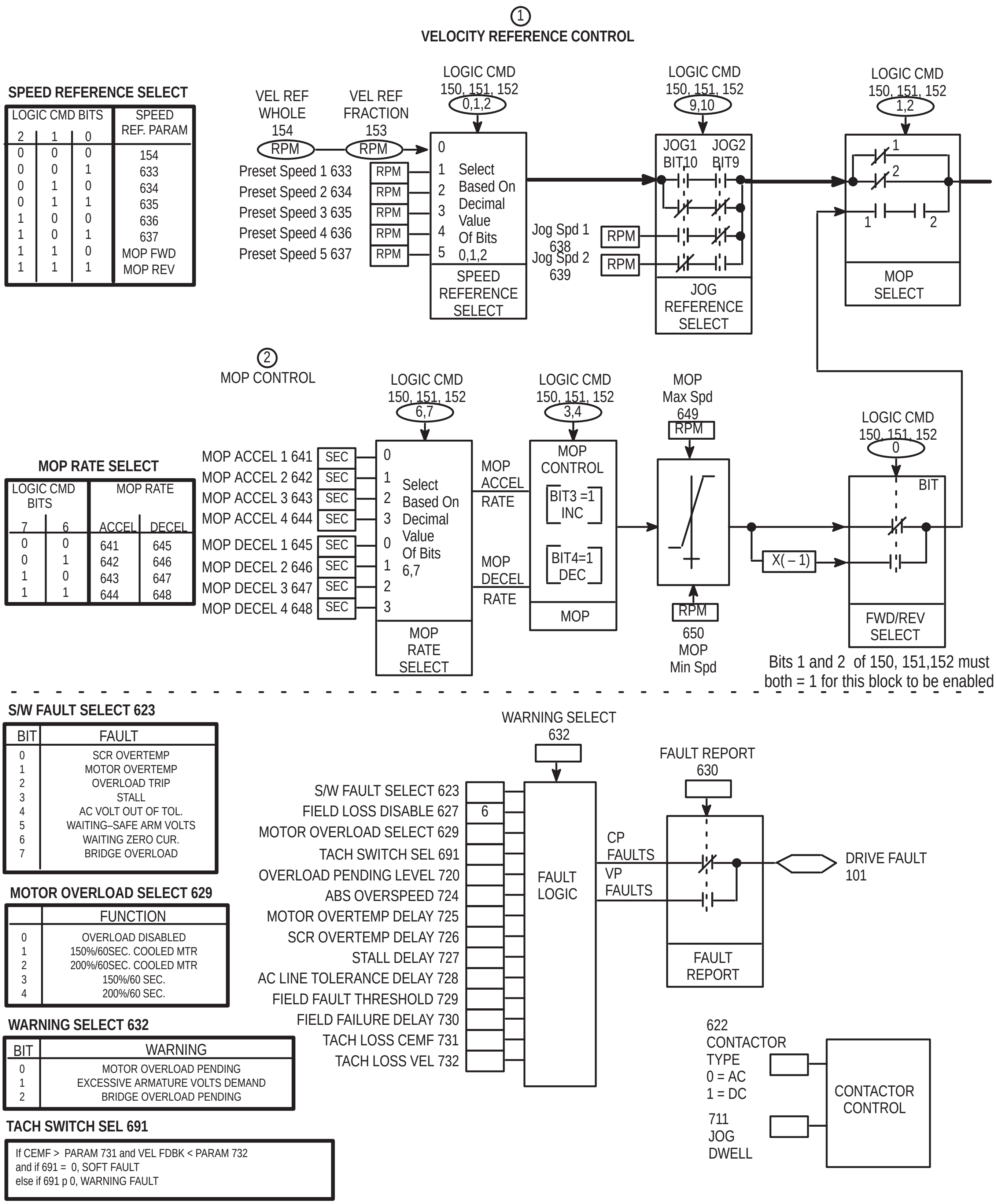
– Minimum Field Regulate Speed (Parameter 686), and velocity Fdbk, (Parameter 106), are required for Field Weakening. The drive will go into field weakening when actual speed is greater than base speed, unless defined otherwise by Minimum Field Regulate Speed (Parameter 686). This parameter specifies the minimum speed at which field weakening control and CEMF regulation begins.

The drive will go into field weakening when actual speed is greater than base speed. The CEMF regulation is always active when flux mode select (Parameter 627), field weakening (bit 1) is enabled. The output of these two blocks is applied to a Field Flux Linearization function, whose output becomes Field Current Reference (Parameter 117). This field current reference value is summed with the field current feedback value in the Field PI Control.

Field PI Control *(Circle 13)*

Field Current Feedback provided from the Feedback Control indicates the latest field current feedback value and is summed with Field Current Reference, and applied to the Field Pl Control. Parameter 737 determines the proportional gain and Parameter 738 determines the integral gain. The output of the Field PI Control is converted to a time and is sent to the field SCR bridge.

Figure 3.5
1395 Block Diagram



SPEED REFERENCE SELECT

LOGIC CMD BITS 2	1	0	SPEED REF. PARAM
0	0	0	154
0	0	1	633
0	1	0	634
0	1	1	635
1	0	0	636
1	0	1	637
1	1	0	MOP FWD
1	1	1	MOP REV

MOP RATE SELECT

LOGIC CMD BITS 7	6	MOP RATE ACCEL	DECEL
0	0	641	645
0	1	642	646
1	0	643	647
1	1	644	648

S/W FAULT SELECT 623

BIT	FAULT
0	SCR OVERTEMP
1	MOTOR OVERTEMP
2	OVERLOAD TRIP
3	STALL
4	AC VOLT OUT OF TOL.
5	WAITING–SAFE ARM VOLTS
6	WAITING ZERO CUR.
7	BRIDGE OVERLOAD

MOTOR OVERLOAD SELECT 629

	FUNCTION
0	OVERLOAD DISABLED
1	150%/60SEC. COOLED MTR
2	200%/60SEC. COOLED MTR
3	150%/60 SEC.
4	200%/60 SEC.

WARNING SELECT 632

BIT	WARNING
0	MOTOR OVERLOAD PENDING
1	EXCESSIVE ARMATURE VOLTS DEMAND
2	BRIDGE OVERLOAD PENDING

TACH SWITCH SEL 691

If CEMF > PARAM 731 and VEL FDBK < PARAM 732
and if 691 = 0, SOFT FAULT
else if 691 p 0, WARNING FAULT

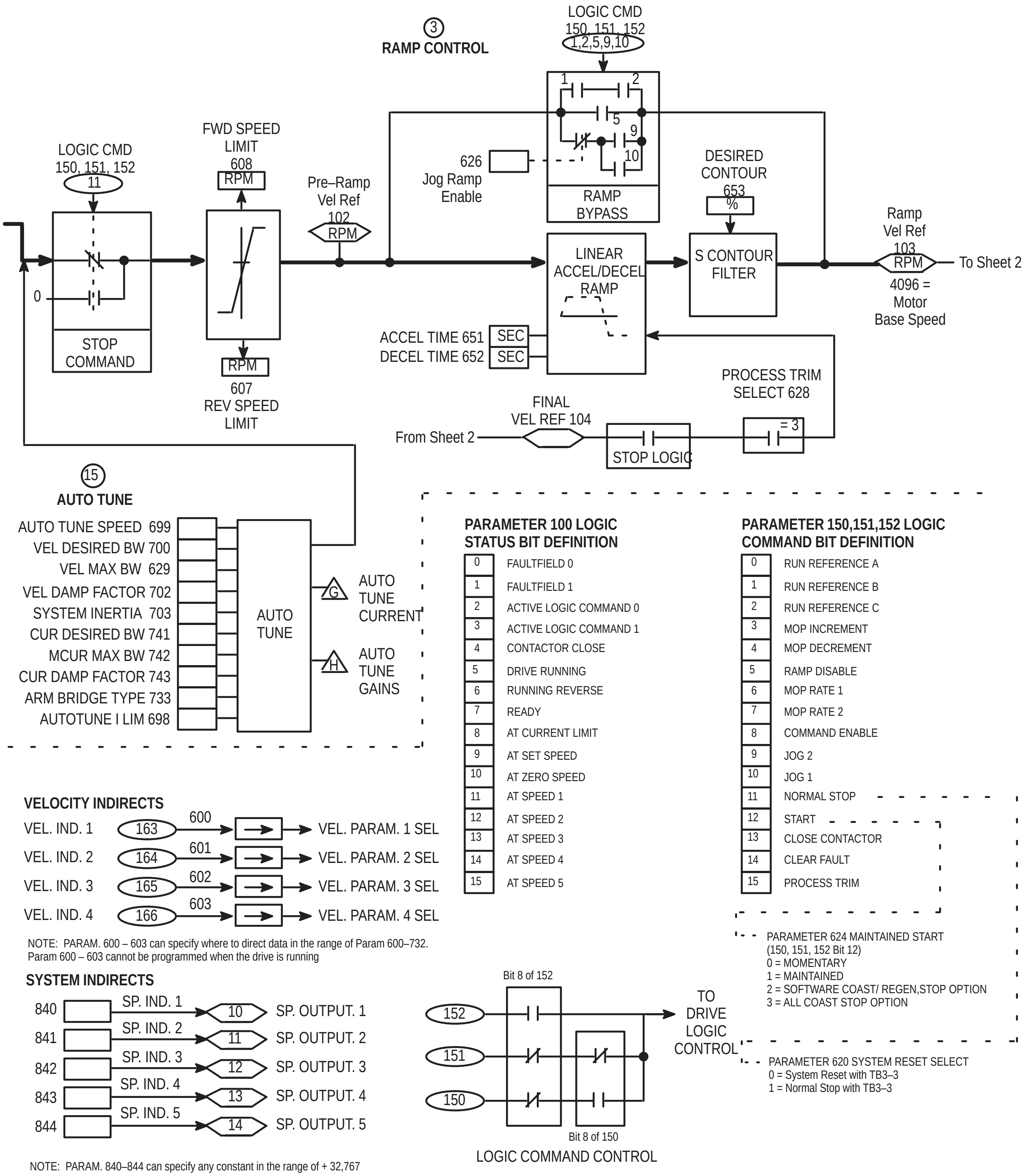
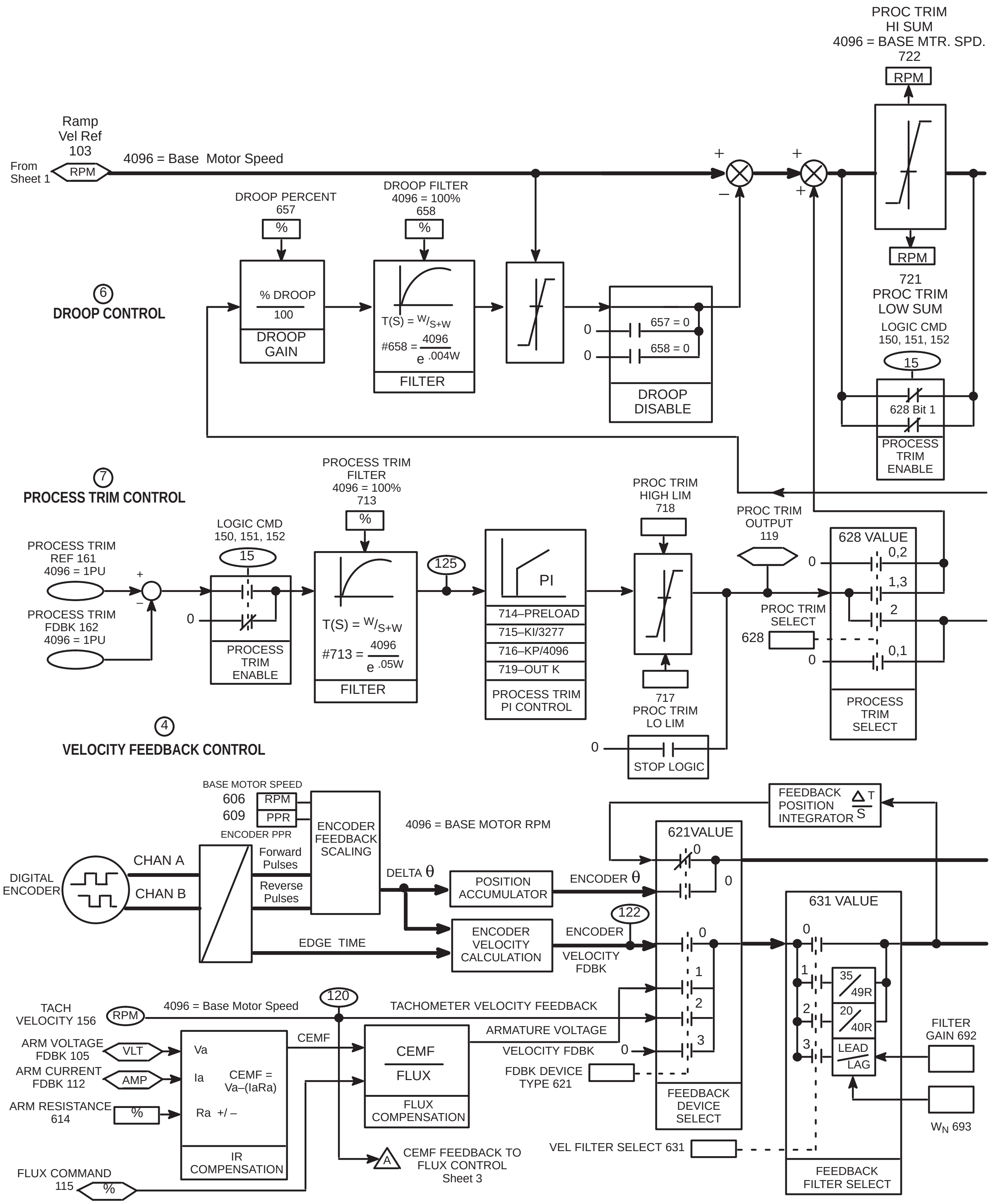

3
RAMP CONTROL
LOGIC CMD
150, 151, 152
1,2,5,9,10
1
2
5
9
10
RAMP BYPASS
626
Jog Ramp
Enable
LOGIC CMD
150, 151, 152
11
0
STOP COMMAND
FWD SPEED LIMIT
608
RPM
RPM
607
REV SPEED LIMIT
Pre–Ramp
Vel Ref
102
RPM
LINEAR ACCEL/DECEL RAMP
DESIRED CONTOUR
653
%
S CONTOUR FILTER
Ramp
Vel Ref
103
RPM
To Sheet 2
4096 =
Motor
Base Speed
ACCEL TIME 651
SEC
DECEL TIME 652
SEC
PROCESS TRIM
SELECT 628
FINAL
VEL REF 104
From Sheet 2
STOP LOGIC
= 3
15
AUTO TUNE
AUTO TUNE SPEED 699
VEL DESIRED BW 700
VEL MAX BW 629
VEL DAMP FACTOR 702
SYSTEM INERTIA 703
CUR DESIRED BW 741
MCUR MAX BW 742
CUR DAMP FACTOR 743
ARM BRIDGE TYPE 733
AUTOTUNE I LIM 698
AUTO TUNE
G
AUTO TUNE CURRENT
H
AUTO TUNE GAINS
PARAMETER 100 LOGIC STATUS BIT DEFINITION
0 FAULTFIELD 0
1 FAULTFIELD 1
2 ACTIVE LOGIC COMMAND 0
3 ACTIVE LOGIC COMMAND 1
4 CONTACTOR CLOSE
5 DRIVE RUNNING
6 RUNNING REVERSE
7 READY
8 AT CURRENT LIMIT
9 AT SET SPEED
10 AT ZERO SPEED
11 AT SPEED 1
12 AT SPEED 2
13 AT SPEED 3
14 AT SPEED 4
15 AT SPEED 5
PARAMETER 150,151,152 LOGIC COMMAND BIT DEFINITION
0 RUN REFERENCE A
1 RUN REFERENCE B
2 RUN REFERENCE C
3 MOP INCREMENT
4 MOP DECREMENT
5 RAMP DISABLE
6 MOP RATE 1
7 MOP RATE 2
8 COMMAND ENABLE
9 JOG 2
10 JOG 1
11 NORMAL STOP
12 START
13 CLOSE CONTACTOR
14 CLEAR FAULT
15 PROCESS TRIM
PARAMETER 624 MAINTAINED START
(150, 151, 152 Bit 12)
0 = MOMENTARY
1 = MAINTAINED
2 = SOFTWARE COAST/ REGEN,STOP OPTION
3 = ALL COAST STOP OPTION
PARAMETER 620 SYSTEM RESET SELECT
0 = System Reset with TB3–3
1 = Normal Stop with TB3–3
VELOCITY INDIRECTS
VEL. IND. 1
163
600
VEL. PARAM. 1 SEL
VEL. IND. 2
164
601
VEL. PARAM. 2 SEL
VEL. IND. 3
165
602
VEL. PARAM. 3 SEL
VEL. IND. 4
166
603
VEL. PARAM. 4 SEL
NOTE: PARAM. 600 – 603 can specify where to direct data in the range of Param 600–732.
Param 600 – 603 cannot be programmed when the drive is running
SYSTEM INDIRECTS
840
SP. IND. 1
10
SP. OUTPUT. 1
841
SP. IND. 2
11
SP. OUTPUT. 2
842
SP. IND. 3
12
SP. OUTPUT. 3
843
SP. IND. 4
13
SP. OUTPUT. 4
844
SP. IND. 5
14
SP. OUTPUT. 5
NOTE: PARAM. 840–844 can specify any constant in the range of + 32,767
Bit 8 of 152
152
151
150
Bit 8 of 150
TO DRIVE LOGIC CONTROL
LOGIC COMMAND CONTROL

Figure 3.5 (Sheet 2 of 3) 1395 Block Diagram



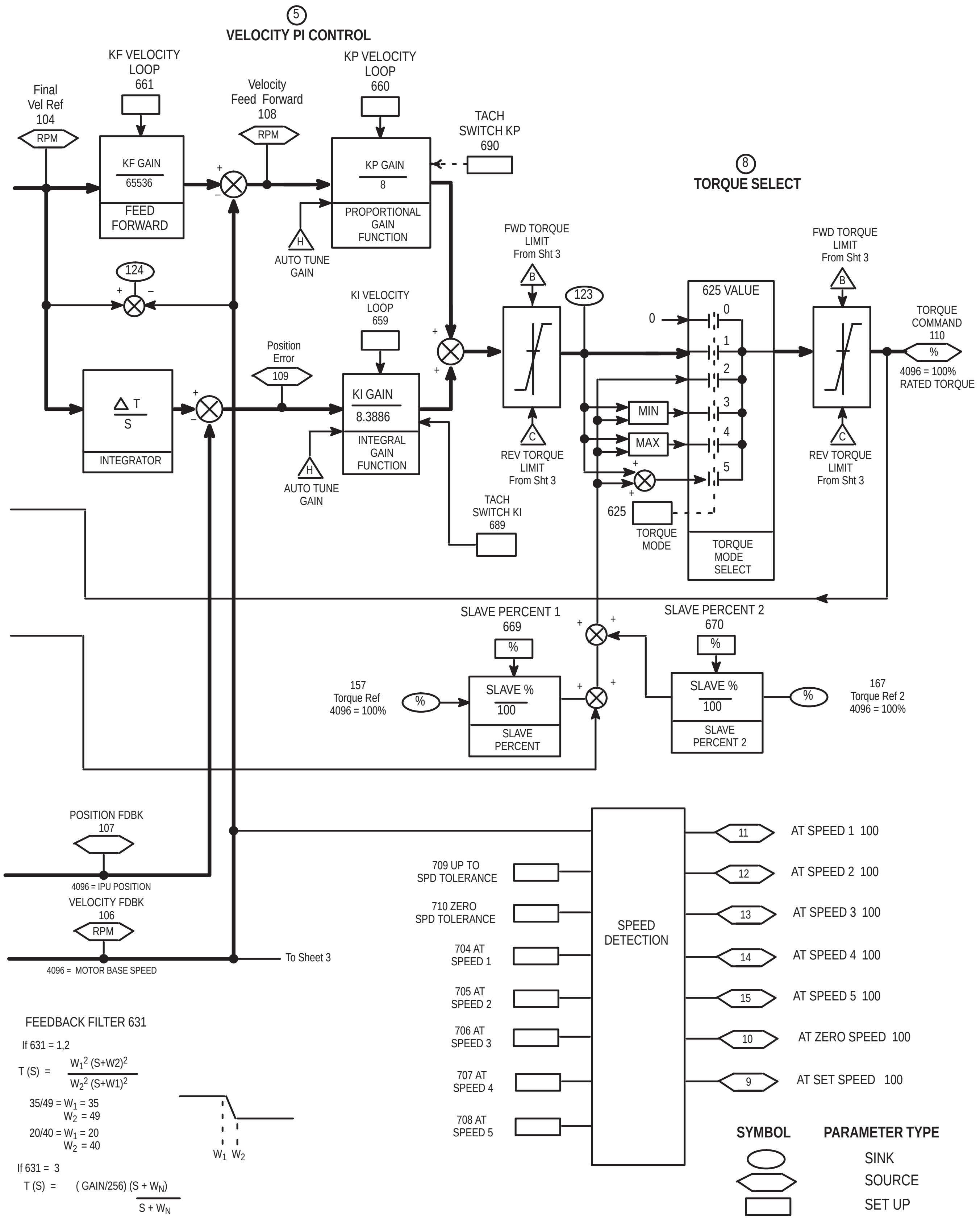
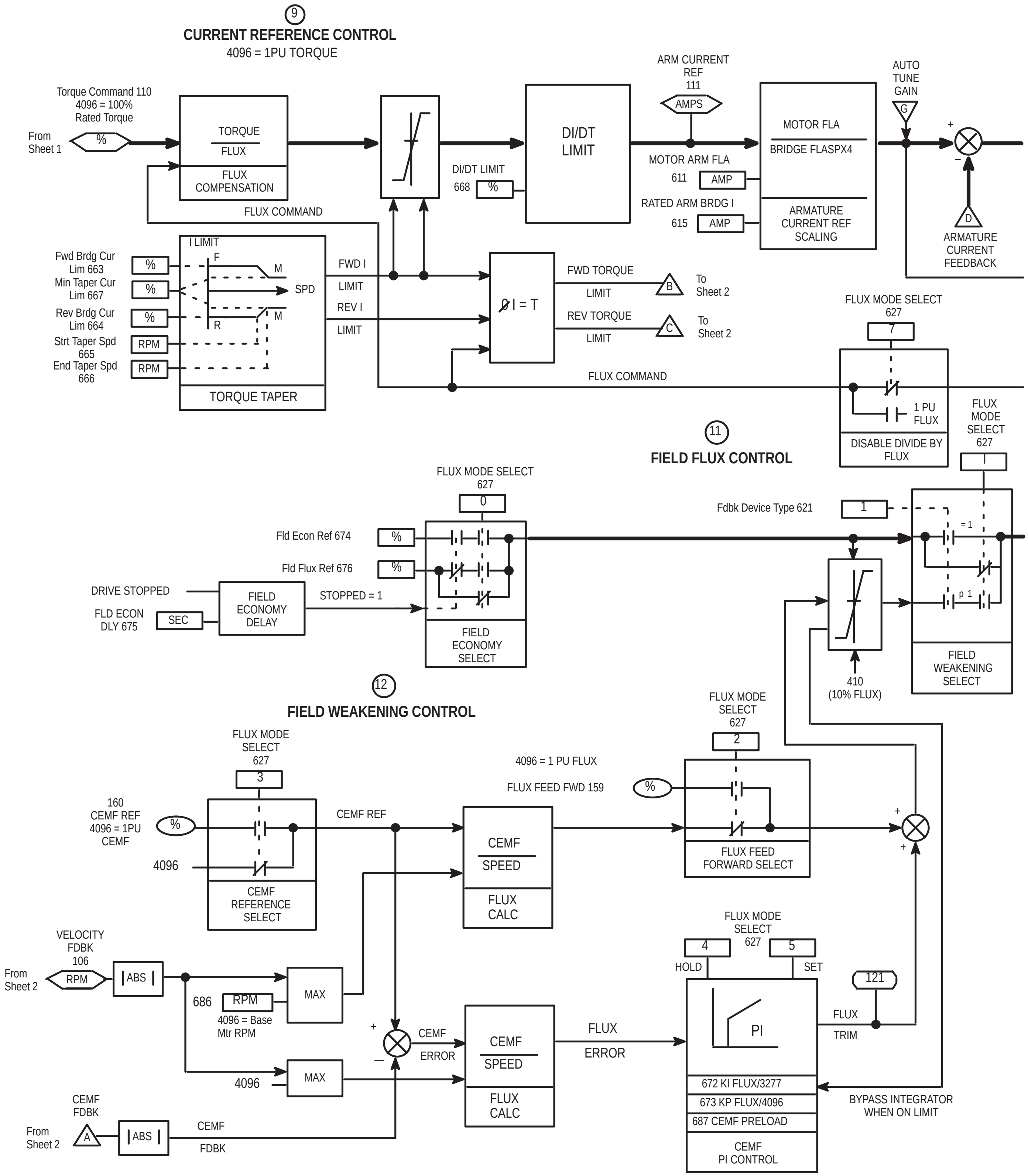
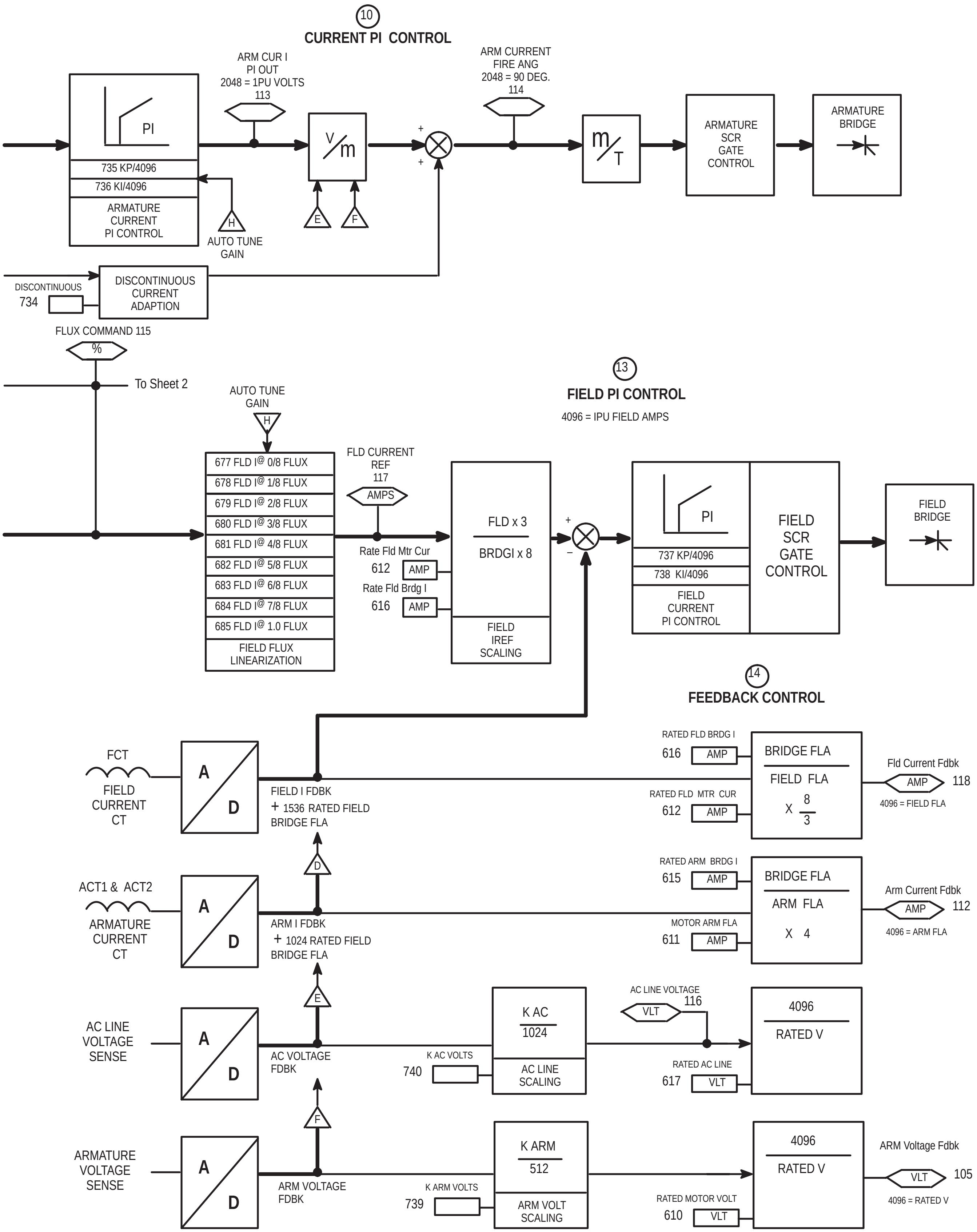

5
VELOCITY PI CONTROL
Final
Vel Ref
104
RPM
KF VELOCITY
LOOP
661
KF GAIN
65536
FEED
FORWARD
Velocity
Feed Forward
108
RPM
KP VELOCITY
LOOP
660
KP GAIN
8
PROPORTIONAL
GAIN
FUNCTION
TACH
SWITCH KP
690
H
AUTO TUNE
GAIN
124
KI VELOCITY
LOOP
659
Position
Error
109
KI GAIN
8.3886
INTEGRAL
GAIN
FUNCTION
T
S
INTEGRATOR
H
AUTO TUNE
GAIN
TACH
SWITCH KI
689
8
TORQUE SELECT
FWD TORQUE
LIMIT
From Sht 3
B
123
C
REV TORQUE
LIMIT
From Sht 3
625 VALUE
0
1
2
3
4
5
MIN
MAX
625
TORQUE
MODE
TORQUE
MODE
SELECT
FWD TORQUE
LIMIT
From Sht 3
B
C
REV TORQUE
LIMIT
From Sht 3
TORQUE
COMMAND
110
%
4096 = 100%
RATED TORQUE
SLAVE PERCENT 1
669
%
SLAVE %
100
SLAVE
PERCENT
157
Torque Ref
4096 = 100%
%
SLAVE PERCENT 2
670
%
SLAVE %
100
SLAVE
PERCENT 2
%
167
Torque Ref 2
4096 = 100%
POSITION FDBK
107
4096 = IPU POSITION
VELOCITY FDBK
106
RPM
4096 = MOTOR BASE SPEED
To Sheet 3
709 UP TO
SPD TOLERANCE
710 ZERO
SPD TOLERANCE
704 AT
SPEED 1
705 AT
SPEED 2
706 AT
SPEED 3
707 AT
SPEED 4
708 AT
SPEED 5
SPEED
DETECTION
11
AT SPEED 1 100
12
AT SPEED 2 100
13
AT SPEED 3 100
14
AT SPEED 4 100
15
AT SPEED 5 100
10
AT ZERO SPEED 100
9
AT SET SPEED 100
FEEDBACK FILTER 631
If 631 = 1,2
T (S) = W1² (S+W2)² / W2² (S+W1)²
35/49 = W1 = 35
W2 = 49
20/40 = W1 = 20
W2 = 40
W1 W2
If 631 = 3
T (S) = (GAIN/256) (S + WN) / S + WN
SYMBOL
PARAMETER TYPE
SINK
SOURCE
SET UP

Figure 3.5 *(Sheet 3 of 3)* 1395 Block Diagram




10
CURRENT PI CONTROL
ARM CUR I
PI OUT
2048 = 1PU VOLTS
113
ARM CURRENT
FIRE ANG
2048 = 90 DEG.
114
PI
735 KP/4096
736 KI/4096
ARMATURE
CURRENT
PI CONTROL
V/m
E
F
H
AUTO TUNE
GAIN
m/T
ARMATURE
SCR
GATE
CONTROL
ARMATURE
BRIDGE
DISCONTINUOUS
734
DISCONTINUOUS
CURRENT
ADAPTION
FLUX COMMAND 115
%
To Sheet 2
AUTO TUNE
GAIN
13
FIELD PI CONTROL
4096 = IPU FIELD AMPS
677 FLD I@ 0/8 FLUX
678 FLD I@ 1/8 FLUX
679 FLD I@ 2/8 FLUX
680 FLD I@ 3/8 FLUX
681 FLD I@ 4/8 FLUX
682 FLD I@ 5/8 FLUX
683 FLD I@ 6/8 FLUX
684 FLD I@ 7/8 FLUX
685 FLD I@ 1.0 FLUX
FIELD FLUX
LINEARIZATION
FLD CURRENT
REF
117
AMPS
Rate Fld Mtr Cur
612
AMP
Rate Fld Brdg I
616
AMP
FLD x 3
BRDGI x 8
FIELD
IREF
SCALING
737 KP/4096
738 KI/4096
FIELD
CURRENT
PI CONTROL
FIELD
SCR
GATE
CONTROL
FIELD
BRIDGE
14
FEEDBACK CONTROL
FCT
FIELD
CURRENT
CT
A
D
FIELD I FDBK
+ 1536 RATED FIELD
BRIDGE FLA
RATED FLD BRDG I
616
RATED FLD MTR CUR
612
BRIDGE FLA
FIELD FLA
X 8/3
Fld Current Fdbk
118
4096 = FIELD FLA
ACT1 & ACT2
ARMATURE
CURRENT
CT
ARM I FDBK
+ 1024 RATED FIELD
BRIDGE FLA
RATED ARM BRDG I
615
MOTOR ARM FLA
611
BRIDGE FLA
ARM FLA
X 4
Arm Current Fdbk
112
4096 = ARM FLA
AC LINE
VOLTAGE
SENSE
AC VOLTAGE
FDBK
K AC VOLTS
740
K AC
1024
AC LINE
SCALING
AC LINE VOLTAGE
VLT
116
RATED AC LINE
617
4096
RATED V
ARMATURE
VOLTAGE
SENSE
ARM VOLTAGE
FDBK
K ARM VOLTS
739
K ARM
512
ARM VOLT
SCALING
RATED MOTOR VOLT
610
ARM Voltage Fdbk
105
4096 = RATED V

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Chapter 4

Installation

Chapter Objectives

The following data will guide you in planning the installation of the Bulletin 1395. Since most start-up difficulties are the result of incorrect wiring, every precaution must be taken to assure that the wiring is done as instructed.

IMPORTANT: The end user is responsible for completing the installation, wiring and grounding of the 1395 drive and for complying with all National and Local Electrical Codes.

ATTENTION: The following information is merely a guide for proper installation. The National Electrical Code and any other governing regional or local code will overrule this information. The Allen-Bradley Company **cannot** assume responsibility for the compliance or the noncompliance to any code, national, local or otherwise for the proper installation of this drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Environment

The drive must be mounted in a clean, dry, location. Contamination from oils, corrosive vapors and abrasive debris must be kept out of the enclosure. Temperatures around the drive must be kept between 0°C and 55°C (32°F and 131°F). Humidity must remain between 5% to 95% non-condensing. The drive can be applied at elevations of 3300 feet (1,000 meters) without derating. The drive current rating must be derated by 3% for each additional 1,000 feet (300 meters). Above 10,000 feet (3,000 meters), consult the local Allen-Bradley Sales Office.

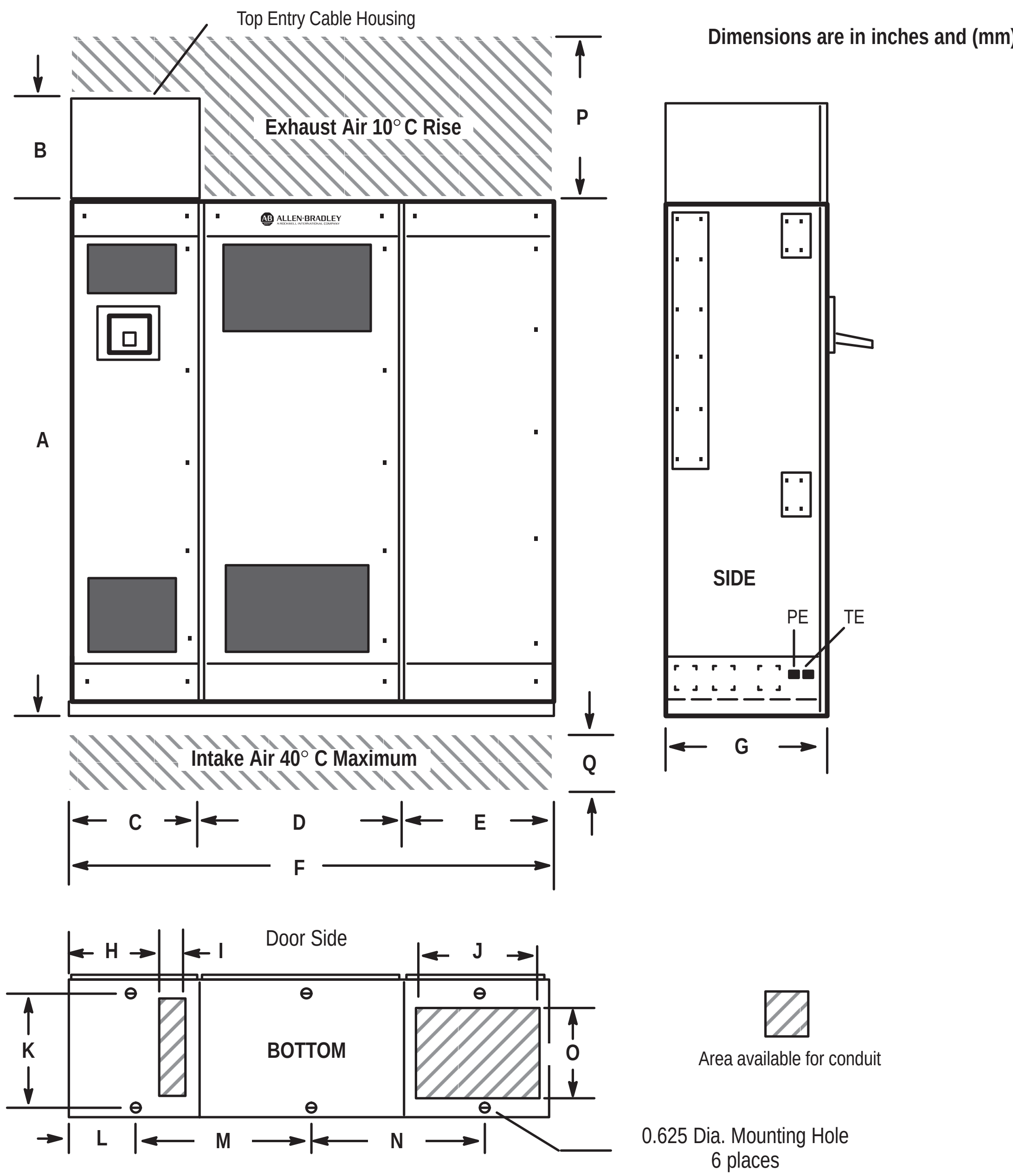
Mounting

The high horsepower 1395 drive is delivered in a three bay NEMA 1 cabinet. Mounting holes, cable entries and conduit areas are detailed in Figure 4.1. Refer to Figure 4.1 for cabinet dimensions.

ATTENTION: Shock hazard exists at motor armature terminals if gravity drop out contactor does not open. The drive **must** be mounted in the vertical position. Failure to observe this mounting practice can result in personal injury or death.

ATTENTION: The installation of the drive must be planned such that all cutting, drilling, tapping and welding can be accomplished with the drive removed from the enclosure. The drive is of the open type construction and any metal debris must be kept from falling into the drive. Metal debris or other foreign matter may become lodged in the drive circuitry resulting in component damage.

Figure 4.1
Nominal Dimensions **400 – 600 HP 230V**
700 – 1250 HP 460V
1000 – 2000 HP 660V



230V Drive	460V Drive	660V Drive	A	B	C	D	E	F
400-600 HP	700-1250 HP	1000-2000 HP	91.5 (2324)	18.0 (457)	20.0 (508)	35.0. (889)	25.0 (635)	80.0 (2032
			G	**H**	**I**	**J**	**K**	**L**
			25.0 (635)	14.25 (362)	4.61 (117)	22.72 (577)	21.56 (548)	10.0 (254)
			M	**N**	**O**	P	Q	
			27.5 (698)	30.0 (762)	18.56 (471)	12 (305)	9 (229)	

Cooling Airflow

In order to maintain proper cooling, the drive must be mounted in a vertical position (fuses in the upper left hand corner). The recommended minimum clearance for the drive is 12 inches top, 6 inches sides and 9 inches front as shown in Figure 4.1.

The drive design produces up to a 10°C or 18°F air temperature rise when the drive is operated at full capacity. Precautions should be taken not to exceed the maximum inlet ambient air temperature of 40°C (104°F). If the drive is in an enclosed cabinet, air circulation fans or a closed circuit heat exchanger may be required.

The heat loss for additional equipment that is mounted in the enclosure should be added to the heat loss of the drive.

Wiring Clearance

Although the minimum clearance should be maintained for proper cooling, this space may not always provide proper wiring clearance. The minimum allowable wire bending radius may necessitate that extra space be provided to accommodate power wiring. Consult the governing code for the proper wiring method.

Disconnect

IMPORTANT: The user is responsible for completing the installation of the drive system and to comply with all National and Local Electrical Codes. The following information is to be used as a reference only.

ATTENTION: Hazard of electric shock or equipment damage exist if drive is not installed correctly. The National Electrical Code (NEC) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

Wire Size and Type

Wire sizes must be selected individually, observing all applicable safety and NEC regulations. The minimum permissible wire size does not necessarily result in the best operating economy. Due to the drive overload capacity, the conductors for the transformer primary and secondary must be sized (at a minimum) for 125% of the maximum motor current. The motor armature conductors must also be rated for 125% of the full load motor current. Motor field conductors should be run with no less than 14 gauge wire. The distance between the drive and motor may affect the size of the conductors used.

Shielded type wire is recommended in control circuits for protection against interference. A shielded wire is required for all signal wires. The recommended conductor size must be a minimum of 24 AWG. The best interference suppression is obtained with a wire having an individual shield for every pair. Table 4.A provides a listing and description of cable types and wiring recommendations. Figure 4.2 shows recommended cable shielding.

Figure 4.2
Cable Shielding Recommendations

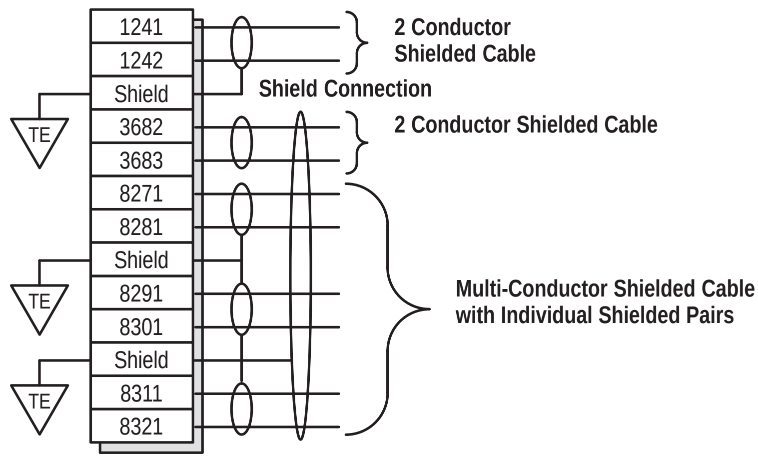


Table 4.A
Cable and Wiring Recommendations

Category	Wiring Class	Signal Definition	Signal Examples	Cable Type	Minimum Spacing in Inches between Classes – Steel Conduit/Tray: 1	2/3/4	5/6	7/8	9/10/11	Spacing Notes
Power	1	AC Power (600V or greater)	2.3kV 3/Ph AC Lines	per NEC & Local Codes	0	3/9	3/9	3/18	Note6	1/2/5
	2	AC Power (less than 600V)	460V 3/Ph AC Lines	per NEC & Local Codes	3/9	0	3/6	3/12	Note 6	1/2/5
	3	DC Power	DC Motor Armature	per NEC & Local Codes						
	4	DC Power	Reg. DC Motor Field	per NEC & Local Codes						
Control	5	115VAC/DC Logic	Relay Logic/PLC I/O Motor Thermostat	per NEC & Local Codes	3/9	3/6	0	3/9	Note 6	1/2/5
		115VAC Power	Power Supplies, Instruments							
	6	24VAC/DC Logic	PLC I/O	per NEC & Local Codes						
Signal (Process)	7	Analog Signals, DC Supplies	Reference/Feedback Signal, 5 to 24VDC	Shielded Cable – Belden 8735, 8737, 8404	3/ 18	3/ 12	3/9	0	1/3	2/3/4/5
		Digital (low speed)	TTL							
	8	Digital (high speed)	I/O, Encoder, Counter Pulse Tach	Shielded Cable – Belden 9728, 9730						
Signal (Comm)	9	Serial Communication	RS-232, 422 to Terminals/Printers	Shielded Cable – Belden RS-232 – 8735, 8737 RS-422 – 9729, 9730	Note 6			1/3	0	
	11	Serial Communication (greater than 20k baud)	PLC Remote I/O, PLC Data Highway	Twinaxial Cable – Belden 9463, A-B 1770-CD						

Example: Spacing relationship between 480VAC incoming power leads and 24VDC logic leads.

– 480VAC leads are Class 2 ; 24VDC leads are Class 6
– For separate steel conduits, the conduits must be 3 inches (76 mm) apart
– In a cable tray, the two groups of leads are to be 6 inches (152 mm) apart

Spacing Notes:

1. Both outgoing and return current carrying conductors are to be pulled in same conduit or laid adjacent in tray.
2. Cables of the following classes can be grouped together.
   A. Class 1; Equal to or above 601 volts.
   B. Classes 2,3, and 4 may have their respective circuits pulled in the same conduit or layered in the same tray.
   C. Classes 5 and 6 may have their respective circuits pulled in the same conduit or layered in the same tray.
   NOTE: Bundle may not exceed conditions of NEC 310.
   D. Classes7 and 8 may have their respective circuits pulled in the same conduit or layered in the same tray.
   NOTE: Encoder cables run in a bundle may experience some amount of EMI coupling. The circuit application may dictate separate spacing.
   E. Classes 9, 10 and 11 may have their respective circuits pulled in the same conduit or layered in the same tray.
   Communication cables run in a bundle may experience some amount of EMI coupling and corresponding communication faults. The application may dictate separate spacing.
3. All wires of class 7 through 11 MUST be shielded per the recommendations.
4. In cable trays, steel separators are advisable between the class groupings.
5. If conduit is used, it must be continuous and composed of magnetic steel.
6. Spacing of communication cables to classes 2 through 6 is:

CONDUIT SPACING	THROUGH AIR
I 3– 20A – 3 inches	6 inches
20A3 I 3100KVA – 6 inches	12 inches
I > 100KVA – 12 inches	24 inches

General Notes

1. Steel conduit is recommended for all wiring classes. (Classes 7-11).
2. Spacing shown between classes is the minimum required for parallel runs less than 400 feet. Greater spacing should be used where possible.
3. Shields for shielded cables must be connected at one end only. The other end should be cut back and insulated. Shields for cables from a cabinet to an external device must be connected at cabinet end. Shields for cables from one cabinet to another must be connected at the source end cabinet. Splicing of shielded cables, if absolutely necessary, should be done so that shields remain continuous and insulated from ground.
4. Power wire is selected by load. 16AWG is the minimum recommended size for control wiring.

Grounding Procedures

The purpose of grounding is to:

- Limit dangerous voltages on exposed parts to ground potential in the event of an electrical fault.
- To facilitate proper overcurrent device operation when ground fault conditions are incurred.
- To provide for electrical interference suppression.

The general grounding concept for the 1395 is shown in Figure 4.3 and explained below.

Safety Ground (PE) – is the safety ground required by code. The ground bus can be connected to adjacent building steel (girder, joist) or a floor ground loop, provided grounding points comply with NEC regulations. Multiple connections are permitted, but Do Not ground at the same point as the Signal Ground (TE). The minimum distance between Signal and Safety Ground is 10 feet (3 meters). The ground bus requires a maximum of 1 ohm resistance to ground.

Power Feeder – Each power feeder from the substation transformer to the drive must be provided with properly sized ground cables. Simply utilizing the conduit or cable armor as a ground is not adequate. The conduit or cable armor and ground wires should be bonded to substation ground at both ends. Each transformer enclosure and/or frame must be bonded to ground at a minimum of two locations.

Motor Connection – Each DC motor frame must be bonded to grounded building steel within 20 feet (6 meters) of its location and tied to the drives PE via ground wires within the power cables and/or conduit. Bond the conduit or cable armor to ground at both ends. The ground wire size and installation must be per NEC Article 250.

Signal Ground (TE) – must be connected to an earth ground by a continuous separate lead (insulated #6 AWG or larger).

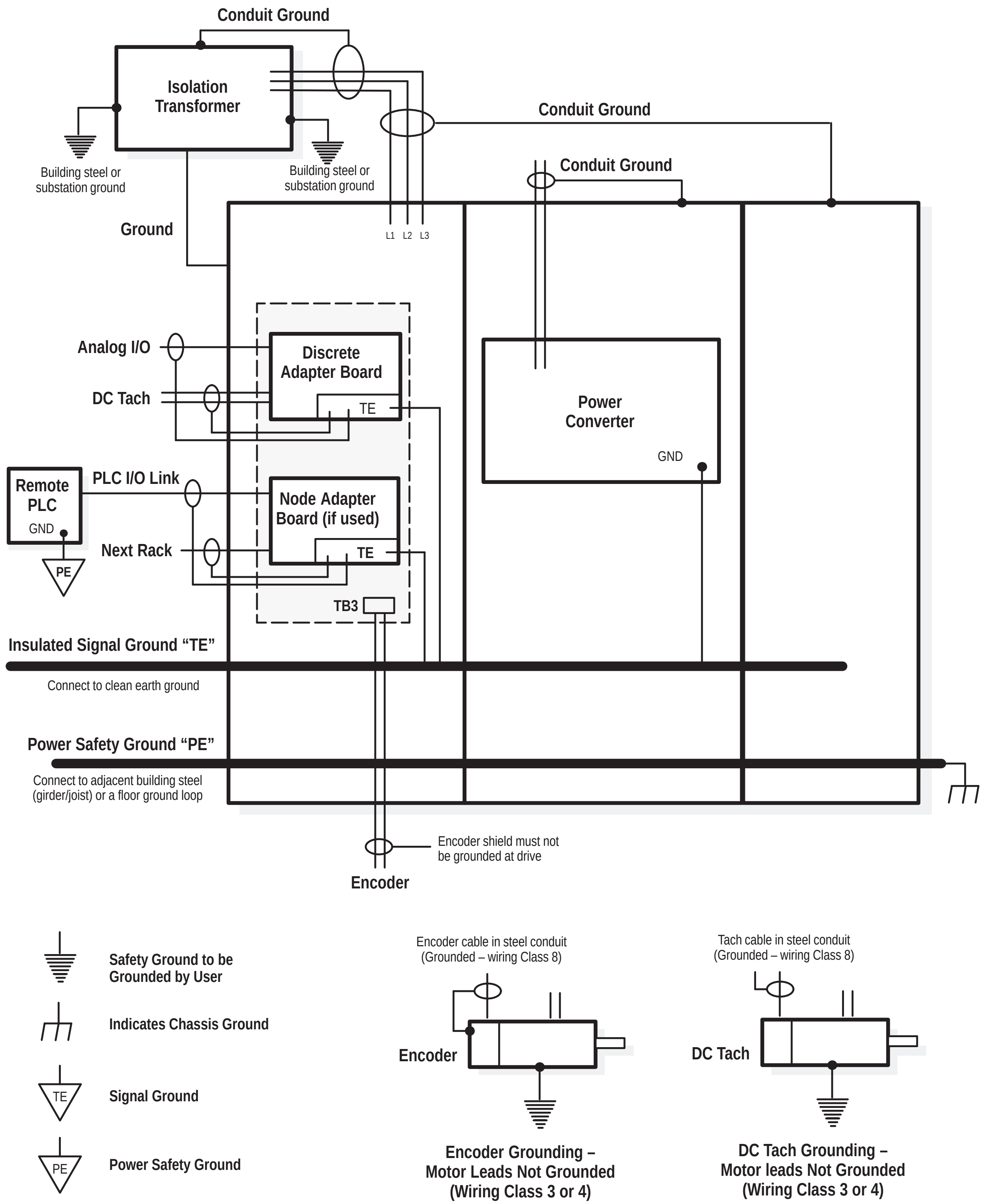
The PLC I/O Communication Link must be run in grounded steel conduit. The conduit should be bonded to ground at both ends. Ground the cable shield at the drive end only.

Encoder Connections – if required, must be routed in grounded steel conduit. The conduit must be grounded at both ends. Ground the cable shield at the motor only.

Tachometer Connections – if required, must be routed in grounded steel conduit. The conduit must be grounded at both ends. Ground the cable shield at the drive end Only.

Refer to the auxiliary device instruction manual for special grounding recommendations.

Figure 4.3
1395 High Horsepower Grounding Practices



As previously explained, two different types of grounds are used in the 1395 drive. They are defined as follows:

Safety Ground (PE) – A Safety Ground is normally required by the electrical code and is defined externally as PE ground. Main PE is located on the bottom of the cabinet on the left side .

Signal Ground (TE) – The Signal Ground point is used for all control signals internal to the drive. Depending on the application, TE may be connected to a system TE bus or connected to PE ground. TE is located on the bottom of the cabinet

Table 4.B
Signal Ground (TE)

Rating	Wiring Connection
400 – 600 HP 230VAC 700 – 1250 HP 460VAC 1000 – 2000 HP 660VAC	TE – Bus

Table 4.C
Safety Ground (PE) Connections

Rating	Ground Terminal
400 – 600 HP 230VAC 700 – 1250 HP 460VAC 1000 – 2000 HP 660VAC	PE – Bus

Power Wiring Procedure

The following procedure provides the steps needed to properly perform the power wiring connections to the 1395 drive.

Using Table 4.D, verify that the motor field is compatible with the DC field voltage output of the drive.

Table 4.D
Standard Field Voltage Output

AC Incoming Voltage to Drive	DC Supply Output Voltage to Field
230VAC	150VDC
460VAC	300VDC
660VAC	300VDC

1. Connect the motor armature and field leads to produce proper direction of motor rotation. Table 4.E lists the connections required to produce counterclockwise rotation of the motor when viewed from the commutator end with a positive speed reference input to the drive.

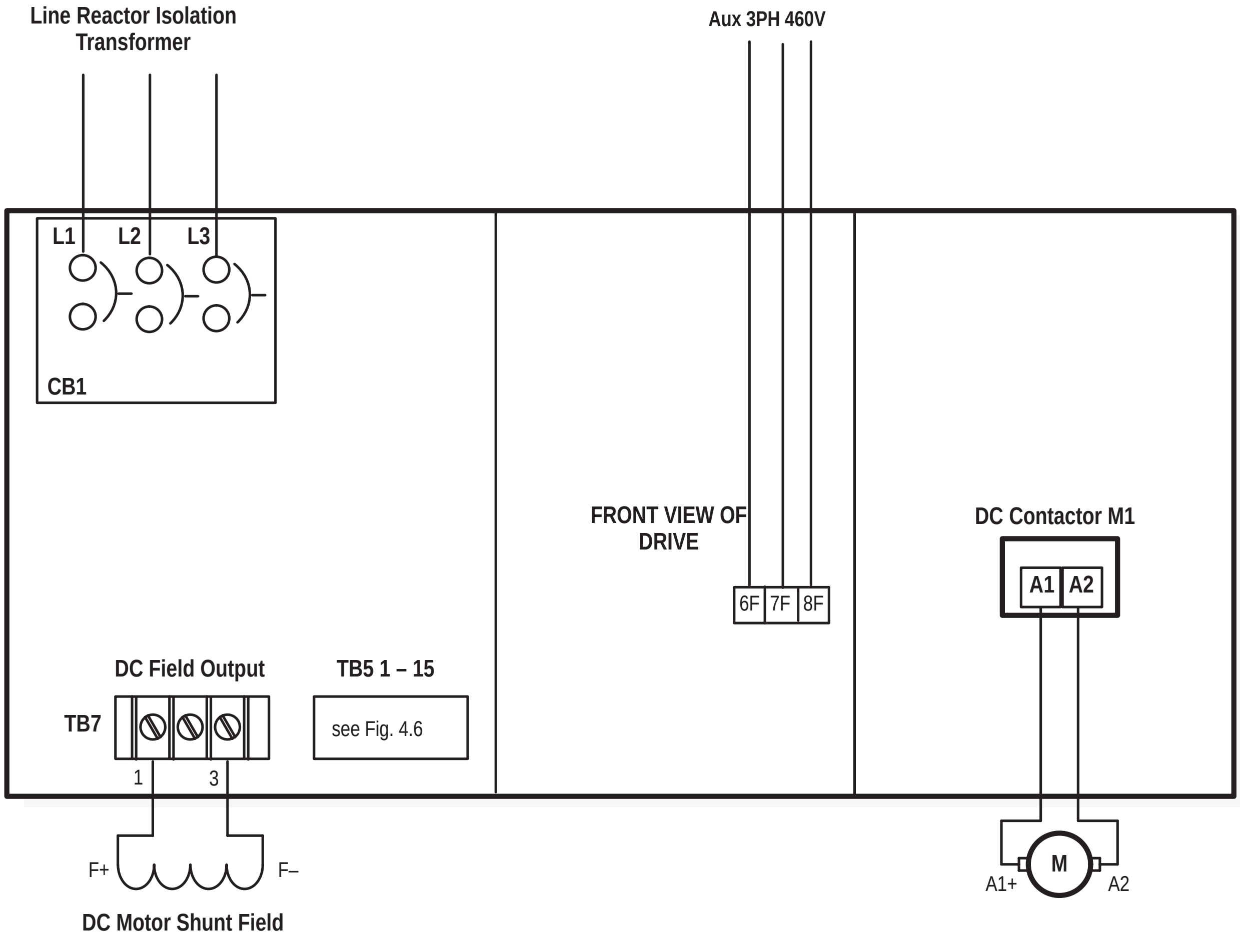
Table 4.E
Motor Connections for CCW Rotation

Connection	Drive Terminal Connection	Motor Lead
Motor Field	TB7–1 TB7–3	F1(+) F2 (–)
Motor Armature	A1 A2	A1 (+) A2 (–)

2. The 1395 is supplied with semi-conductor fuses for bridge protection. A line reactor must be used between the main distribution system and the drive. An isolation transformer can also be used. Refer to Figure 4.4 for AC input wiring at the main fuses.

   Connect incoming three-phase AC line power to the AC Input Circuit Breaker.

Figure 4.4
Power Connections – Standard Field Voltage



Circuit Board Jumper Connections

There are several jumpers located on different boards in the 1395 that are used to configure the drive for a specific application.

1. Verify that the motor field current jumper, is in the proper location per Table 4.F. Obtain the motor full field current data from the motor nameplate. The position of the jumper is determined by both the drive current rating and DC shunt field current rating. Use the drive current rating to select the column in Table 4.F and the field current to select the field current jumper position.

Table 4.F
Field Current Jumper Setting

J1 Jumper on Feedback Bd.	400 – 600 HP 240VDC	700 – 1250 HP 500VDC	1000 – 2000 HP 700VDC
1	42.4 A	42.4 A	42.4 A
2	18.5 A	18.5 A	18.5 A
3	8.7 A	8.7 A	8.7 A
4	2.4 A	2.4 A	2.4 A

2. Verify that the voltage selection for the Reset and Motor Thermostat inputs is correct. Jumpers J11 and J12 on the Power Stage Interface Board determine whether the voltage used for the Reset and Motor Thermostat inputs is 24VDC or 115VAC. Both switches should be in the same position (See Table 4.G).

Table 4.G
Power Stage Interface Board Jumper Settings

Jumper	Position	Purpose
J11	1 – 2	115VAC Motor Thermoguard Input
	2 – 3	24VDC Motor Thermoguard Input
J12	1 – 2	115VAC Motor Reset Input
	2 – 3	24 VDC Motor Reset Input

3. Verify that the encoder voltage selection is correct. If an encoder is used, the drive can provide +12VDC (500 mA) to power the encoder. Check the encoder documentation to determine which voltage is to be used, then verify that jumpers J8 through J10 on the Main Control Board are in the proper position. See Table 4.H for jumper settings.

Table 4.H
Main Control Board Jumper Settings (connected jumpers)

Jumper	+5VDC Position	+12VDC Position	Purpose
J8	1 – 2	2 – 3	Encoder Voltage Selection
J9	1 – 2	2 – 3	Encoder Voltage Selection
J10	1 – 2	2 – 3	Encoder Voltage Selection
J14	1 – 2 2 – 3		EE Write Enabled EE Write Disabled

NOTE: The encoder jumpers J8 – J10 are set for the voltage output of the encoder.

ATTENTION: Jumpers J8 through J10 must all be in the same position. To guard against possible damage to the Main Control Board, ensure that jumpers are positioned correctly for your application.

Table 4.I
Main Control Board Jumper Settings (non-connected jumpers)

Jumper	Purpose
J12	Internal Use, Do Not Use
J13	Internal Use, Do Not Use
J15	Internal Use, Do Not Use

ATTENTION: No connections should be attempted on jumpers J12, J13, and J15. Making connection at these jumpers could cause damage to the Main Control Board.

Control Connections

All control wiring to external devices except for contactor control is terminated in the drive at terminal block TB3. Signal definitions for terminals 1-20 have been predetermined and are independent of drive application. Figure 4.5 illustrates these terminals with their signal definitions.

TB3 is attached to a mounting rail at the bottom of the drive chassis. It provides a wiring connection for customer supplied control and signal devices, along with encoder interface and auxiliary peripheral devices.

Additional individual terminal blocks can be attached to the mounting rail to meet application requirements. These additional terminal blocks are supplied when using an adapter board, to allow for I/O to and from the drive.

Control Wiring Procedure

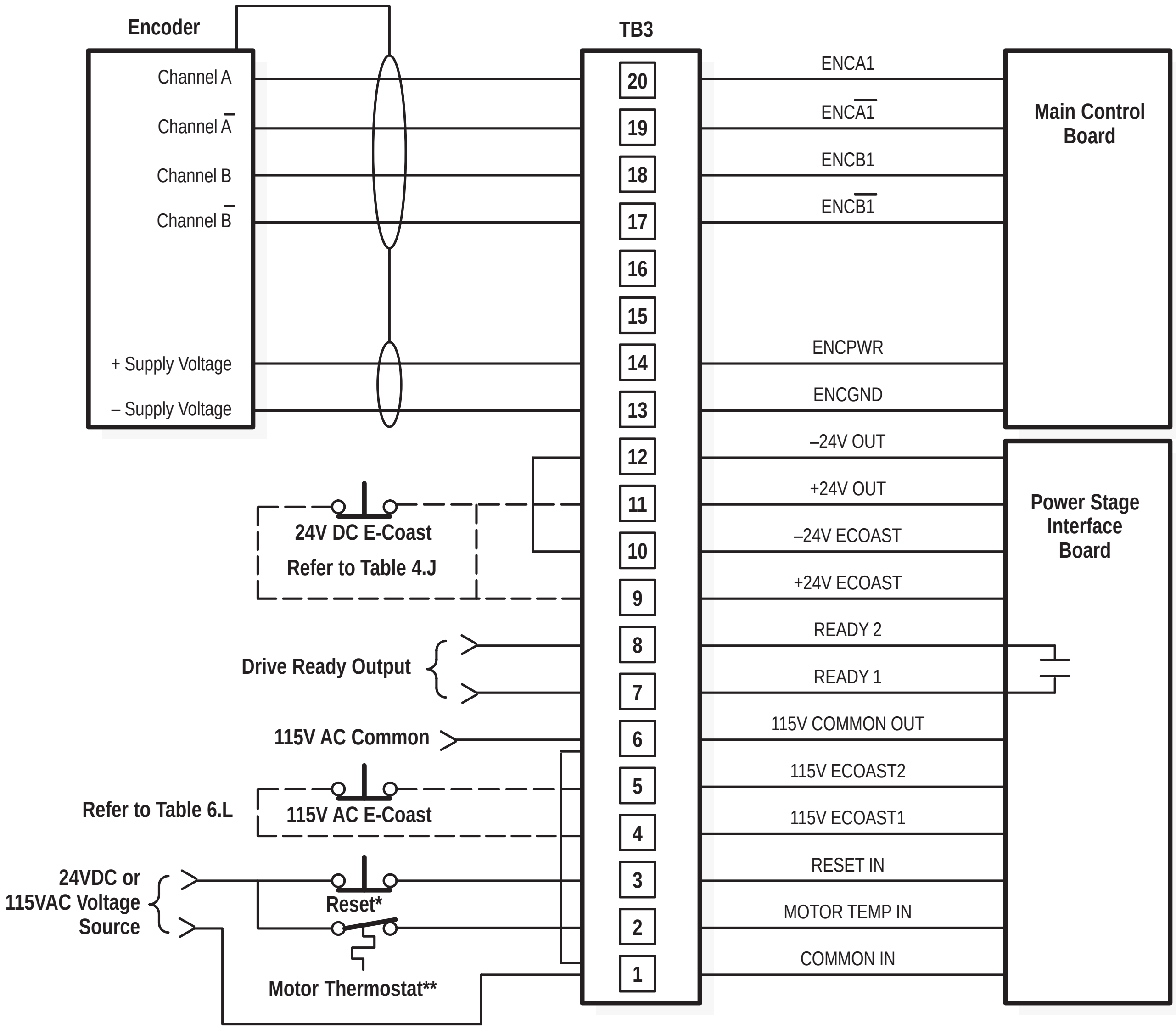
1. If an encoder is used, wire it to TB3. Refer to the encoder instruction manual for proper wiring to the drive.
   a) Terminals 19 and 20 connect to differential encoder output A (NOT) and A.
   b) Terminals 17 and 18 connect to differential encoder output B (NOT) and B.
   c) Terminals 15 and 16 are reserved for future use and are not to be used.
   d) Terminal 14 provides + 12VDC (500 mA max.) power to the encoder. Some encoders limit the + 12VDC supply internally to + 5VDC for the output. Consult the encoder documentation to determine whether the encoder output signal level is + 12 or + 5VDC. Jumpers J8 - J10 on the Main Control Board must be properly positioned to correspond to the encoder output voltage.
   e) Terminal 13 provides connection to the encoder supply voltage common (ground).
   f) The encoder shield must be connected to the encoder case (ground).
   g) The encoder cable must be separate from armature and field leads, refer to Table 4.A.
   h) Maximum encoder cable length is 500 feet (150 meters). For other lengths contact your Allen-Bradley Sales Representative.

ATTENTION: The Start/Stop circuitry in this drive is composed of solid-state components. If hazards due to accidental contact with moving machine components or unintentional flow of liquid, gas or solids exist, a hardwired Stop circuit must be used with this drive. For 115VAC control, this circuitry may be added at terminals 4 and 5 of TB3.

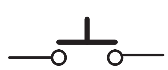
ATTENTION: If Dynamic Braking is used as an alternative stopping method, Do Not use a hard-wired Stop device that removes AC line power. This will de-energize the shunt field, causing a loss of the DB effect and the motor will coast to a stop. Hazards to personnel may exist if the machine is allowed to coast to a stop.

ATTENTION: The user has the ultimate responsibility to determine which stopping method is best suited to the application and will meet applicable standards for operator safety.

Figure 4.5
TB3 Terminal Descriptions



** If no thermostat is used, 115VAC or 24VDC must still be applied to TB3 terminal 2.



* If parameter 620 = 0, then the Reset input requires a N.O. pushbutton as shown above. Closing the pushbutton causes System Reset to occur. This is the default value for the 1395.

* If parameter 620 = 1, then the Normal Stop input requires a N.C. pushbutton as shown above. Opening the pushbutton causes Normal Stop to occur.

NOTE: If N.C. is used, and 620 = 0, Drive will be in a continuous reset condition.
If N.O. is used, and 620 = 1, A Stop will be present in Logic Cmd 1 Par.150

2. Wire Emergency Coast Stop Circuit (ECOAST).

   The drive has the capability to accept an ECOAST input from either a 24VDC or 115VAC contact. The contact must be normally closed and will typically be a Stop pushbutton. Refer to the following paragraphs, Figure 4.5 and Table 4.J for connection information.

   If a 24VDC ECOAST is desired, the contacts of the ECOAST device must be wired between terminals 9 and 11 of TB3. Jumpers must then be connected between terminals 4 and 5 and 10 and 12 of TB3.

   If a 115VAC ECOAST is desired, the contacts of the ECOAST device must be wired between terminals 4 and 5 of TB3. Jumpers must then be connected between terminals 9 and 11 and 10 and 12 of TB3.

Table 4.J
ECoast Connections

	ECoast Input	
TB-3 Terminals	**24VDC**	**115VAC**
4 and 5	Jumper	N.C. Contact Device
9 and 11	N.C. Contact Device	Jumper
10 and 12	Jumper	Jumper

ATTENTION: Applying improper input voltage could damage the Power Stage Interface Board. Jumpers J11 and J12 on the Power Stage Interface Board must be set for the proper input voltage before applying power to these inputs.

3. Wire the Motor Thermostat Circuit. Terminal TB3-2 is used to receive either a 24VDC or 115VAC input (derived from an external voltage source) when the motor thermostat contact is closed. The contacts of the motor thermostat must be N.C. The drive interprets a high voltage at TB3-2 as a normal expected condition. Refer to Figure 4.5 for further connection information.

4. Reset/Normal Stop.

   This input is programmable to provide either a System Reset function or a Normal Stop function. It accepts a 115VAC or 24VDC input voltage. System Reset Select (parameter 620) determines which function this input provides.

   The System Reset function requires a N.O. operator device which closes to cause a reset. A reset input causes the drive to perform a power-up sequence. **Any data not previously stored in EEPROM memory will be lost.**

   The Normal Stop function requires a N.C. operator device. When opened, the drive will stop (the type of stop is determined by Param 624). This may be used to provide an additional stop to the drive.

5. Connect Programming Terminal. Connect the 9 pin D-style connector of the Programming Terminal to the D-style connector (labeled DHT) mounted on the TB3 mounting rail. Refer to the Programming Terminal Installation and Operation Manual for further details.

Adapter Boards

Discrete Adapter Board

The Discrete Adapter Board is connected to Microbus Port A with wiring to external devices being accomplished at TB3, terminals 23 to 52.

The drive is shipped pre-configured, meaning that all of the inputs and outputs are linked to a predefined signal. To change the configuration, refer to the Discrete Adapter Manual.

Figure 4.7 shows the 1395 standard configuration for the Discrete Adapter Board. The user has the flexibility to configure the drive for a particular application. Refer to the Discrete Adapter Manual for detailed information.

115VAC Connection – The 115VAC power source can be wired to be referenced or not referenced to common (zero volts) as shown in Fig. 4.6.

Figure 4.6
Typical 115VAC Digital Input Connections

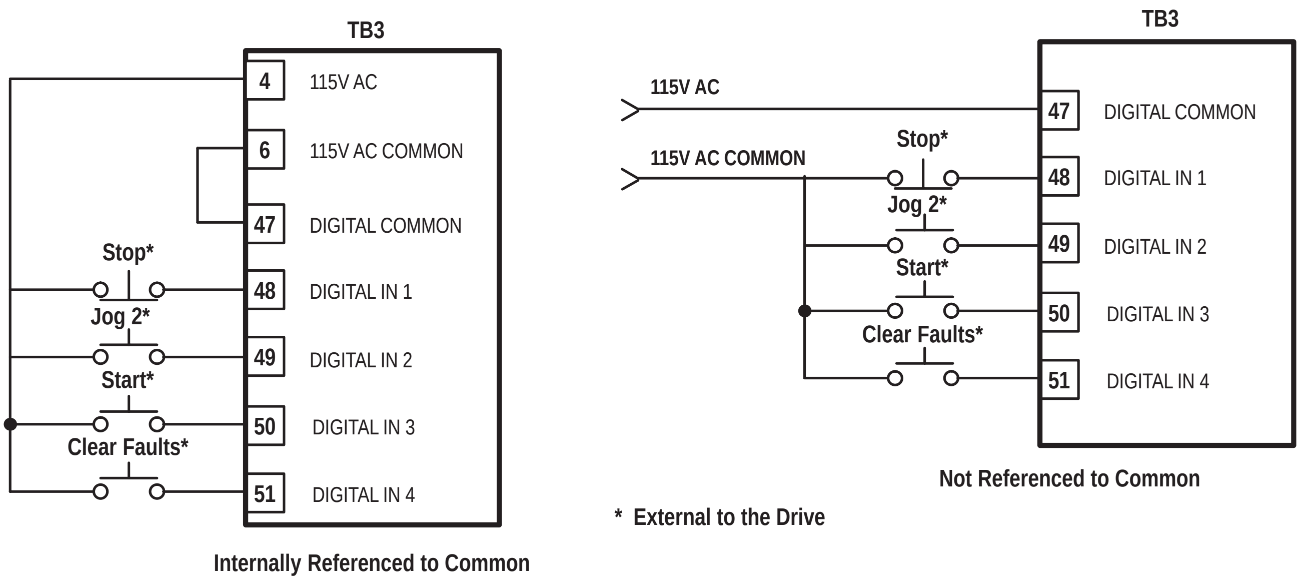
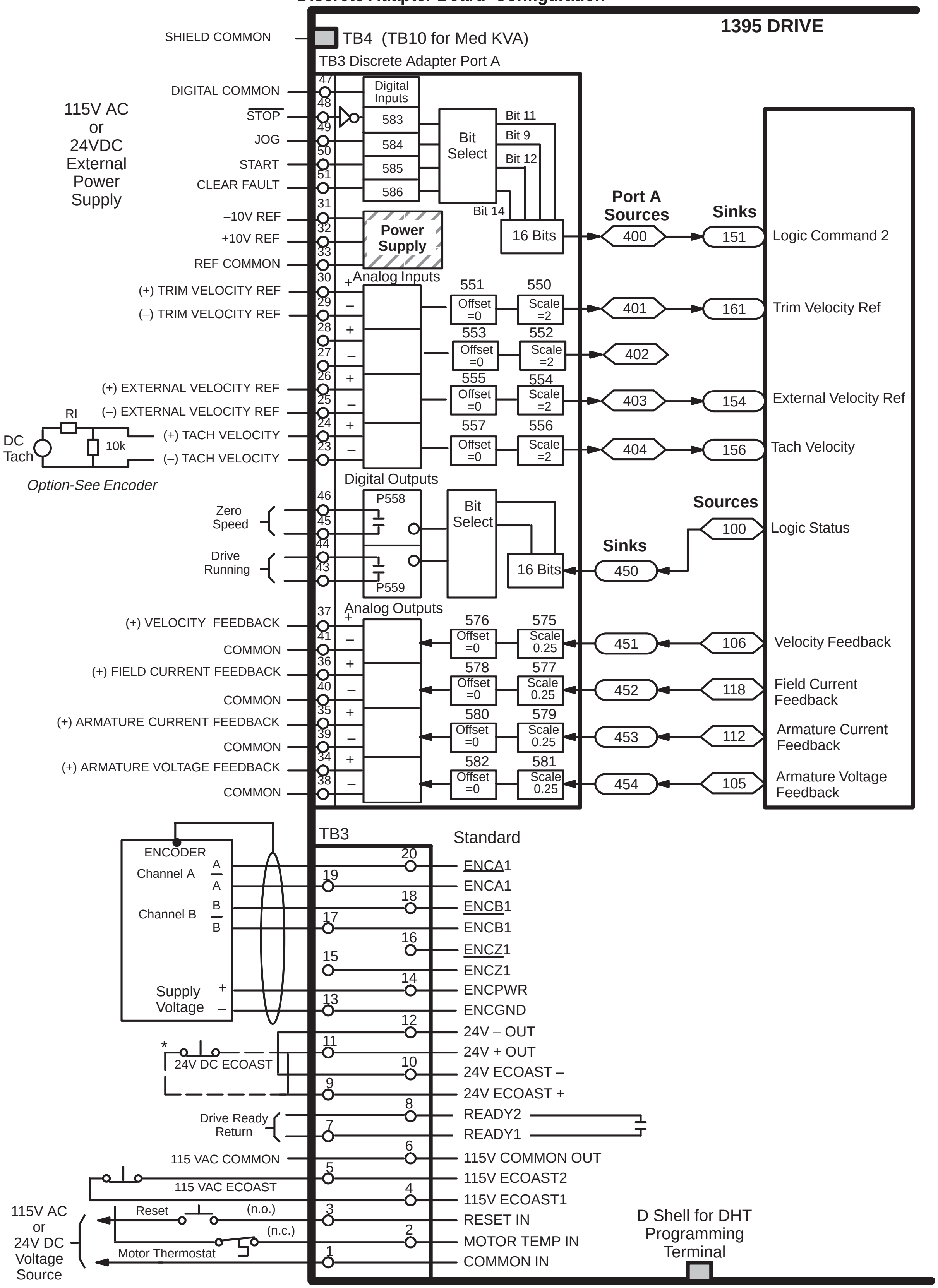
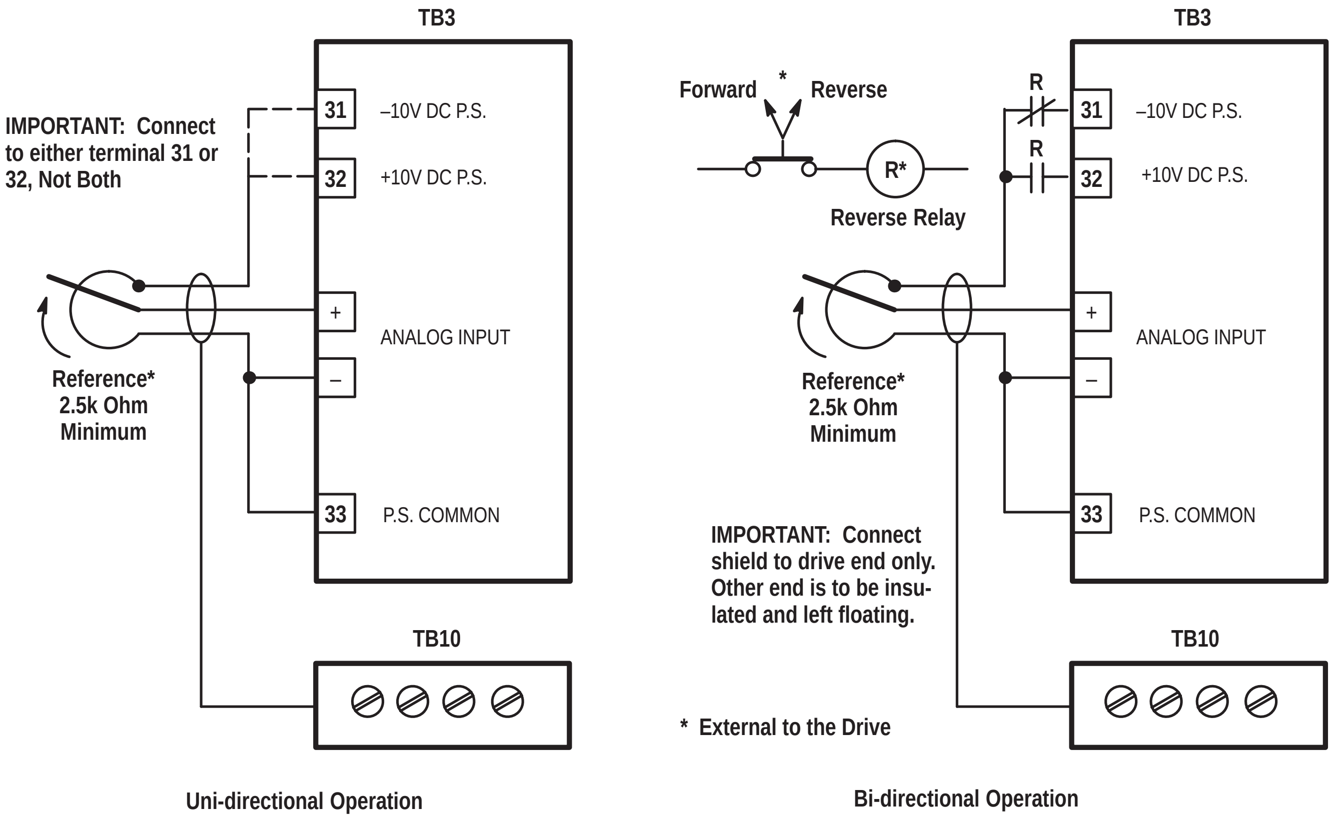


Figure 4.7
Discrete Adapter Board Configuration



Analog Input – Velocity and Trim Reference. Connections for the velocity and trim reference inputs can be for uni- or bi-directional operation, using the internal drive ±10VDC power supply (see Fig. 4.8).

Figure 4.8
Typical Analog Input Connections



Tach Velocity – The analog tachometer device generates a DC voltage that is direction sensitive and proportional to speed. The tach output must be connected to an analog input channel on the Discrete Adapter Board. Most industrial tachs have an output greater than the ±10V range of the analog inputs. The tach output must be scaled down, by an external voltage divider network, so that the entire speed range of the motor can be represented by a ± 9V feedback signal.

ATTENTION: Connecting a tach which has an output range greater than ±10V directly to the analog input channel can severely damage the adapter board.

The tach signal then must be scaled in the adapter board to determine the proper relationship of output voltage/motor velocity to base speed in Drive Units. This scaled configuration data must then be linked to Parameter 156 “Tach Velocity”.

Many problems relate to the scaling of the tach signals. Below is a procedure for checking the scaling of the analog tach feedback for proper drive operation.

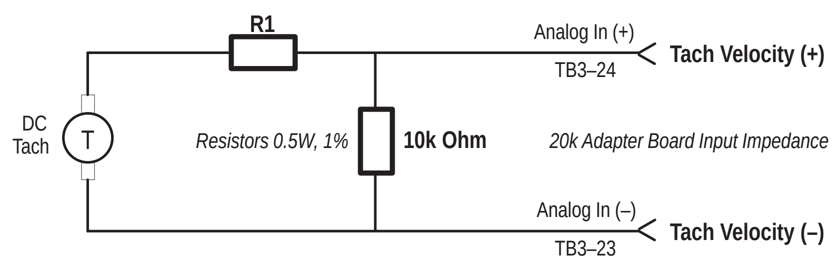
1. Determine the Volts/RPM rating of the tach (refer to tach name plate). Multiply this rating times the absolute maximum speed the motor will be commanded to accelerate to. This value should also be programmed in Parameter 607 “Rev Speed Lim” and 608 “Fwd Speed Lim” to assure that the velocity command will be properly clamped.

   Volts/RPM Rating x Max Speed = Max Volts Output

2. The Max Volts output must then be scaled to a level within the ±10V analog input channel range. This can be accomplished by using a voltage divider network external to the drive. The voltage divider will take the Max Volts output and scale it to a maximum 9V input. This allows for protection against 10% overshoot.

Figure 4.9 uses a l0k ohm resistor across the input channel. Rl represents the dropping resistor for the scaling network. To determine the value of Rl use the equation that follows (R1 should be rated for 0.5W, 1%).

Figure 4.9
Scaling Circuit



$$\frac{\text{(Max Volts Output)} \times 6666}{9V} - 6666 = R1$$

3. The analog input channel on the adapter board must now be scaled to represent an accurate velocity feedback signal. First determine the analog input signal for base speed. Parameter numbers are given in ( ) where applicable.

$$\frac{\text{Base Motor Speed (606)} \times 9V}{\text{Max Speed}} = \text{Base Speed Input}$$

4. The input voltage at base speed is then converted to Raw Adapter Units according to the following equation.

$$\frac{\text{Base Speed Input} \times 2048}{10} = \text{Raw Adapter Units}$$

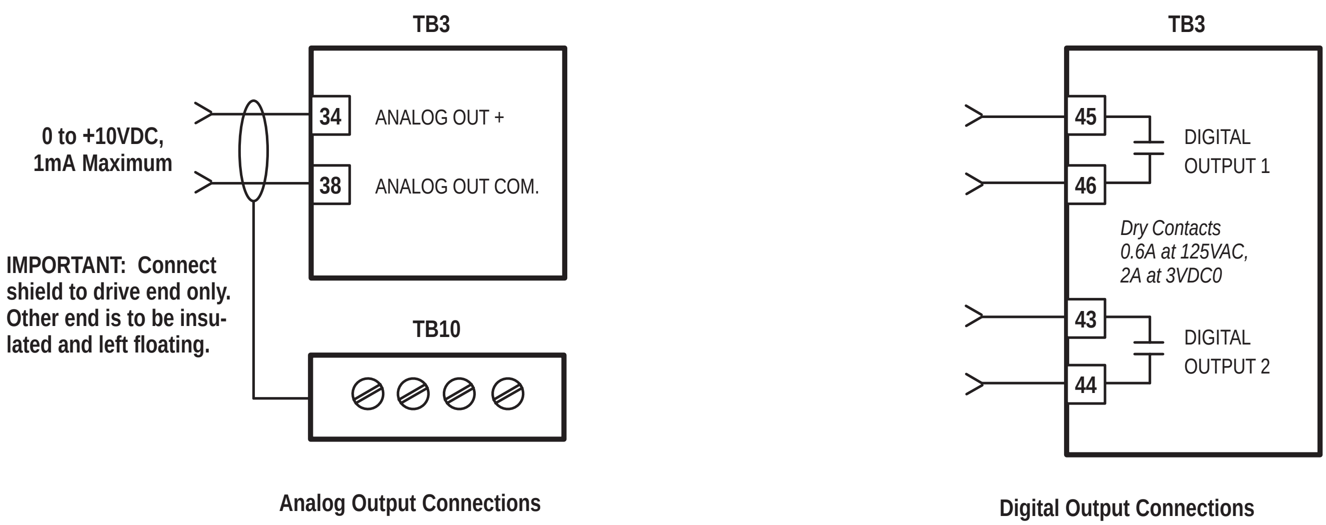
5. The Raw Adapter Units are then used to determine the correct scaling parameter value according to the equation below.

$$\frac{4096}{\text{Raw Adapter Units}} = \text{Scaling Parameter Value}$$

6. The Scaling Parameter Value should then be entered into the associated analog input scaling set-up parameter. This procedure will be correct to within 5%. Verify that the scaling is correct by measuring the actual motor velocity with a hand tachometer. Fine tune the scaling by adjusting the appropriate value to minimize any error.
7. Any drift at zero speed can be minimized by adjusting the offset parameter associated with the channel in use.

Analog Output – Figure 4.10 shows typical analog and digital output connections.

Figure 4.10
Typical Output Connections



Digital Reference Adapter Board

The Digital Reference Adapter Board is connected to Microbus Port A with wiring to external devices at terminals 23 to 62 of TB3.

The drive is shipped pre-configured, meaning that all of the inputs and outputs are linked to a predefined signal. To change the configuration refer to the Digital Reference Adapter Manual.

Figure 4.10 shows the 1395 standard configuration for the Digital Reference Adapter Board. The drive has the flexibility to be reconfigured for the application or as required.

24VDC Connection – A properly sized 24VDC power supply is required to power the 24 volt inputs.

Digital Reference Input – The Digital Reference Adapter Board contains one digital reference command for the drive. The board is set up by default for the encoder input signal to be single channel, dual edge (i.e. both the rising and edges are used by the counting logic). The hardware is configured for +5VDC signal inputs with jumpers J6 and J7 in the 1 – 2 position. For a +12VDC signal the jumpers must be placed in the 2 – 3 position.

ATTENTION: To guard against possible component damage, ensure that jumpers are positioned correctly.

Figure 4.11 shows the typical encoder connection used as a signal for the digital reference input. This encoder can be machine mounted or mounted on the motor of the lead section.

Figure 4.11
Encoder Connections

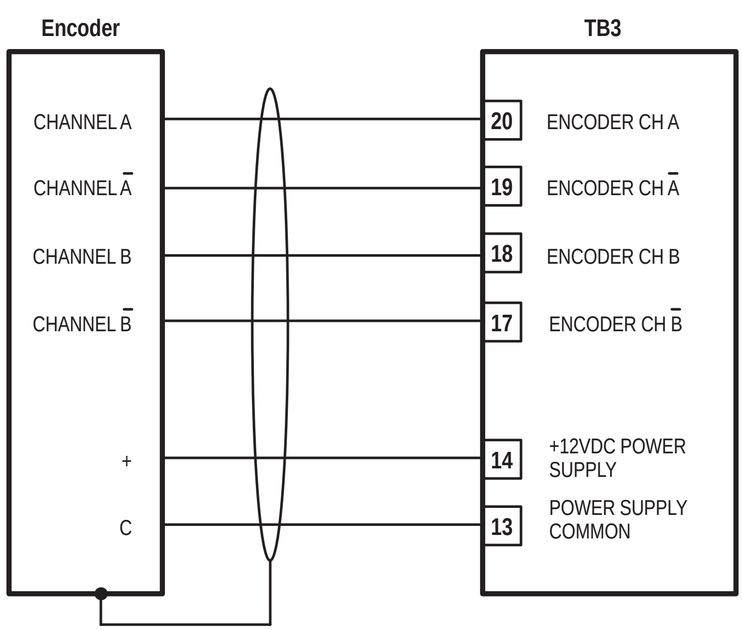


Figure 4.12
Digital Reference Adapter Board Configuration

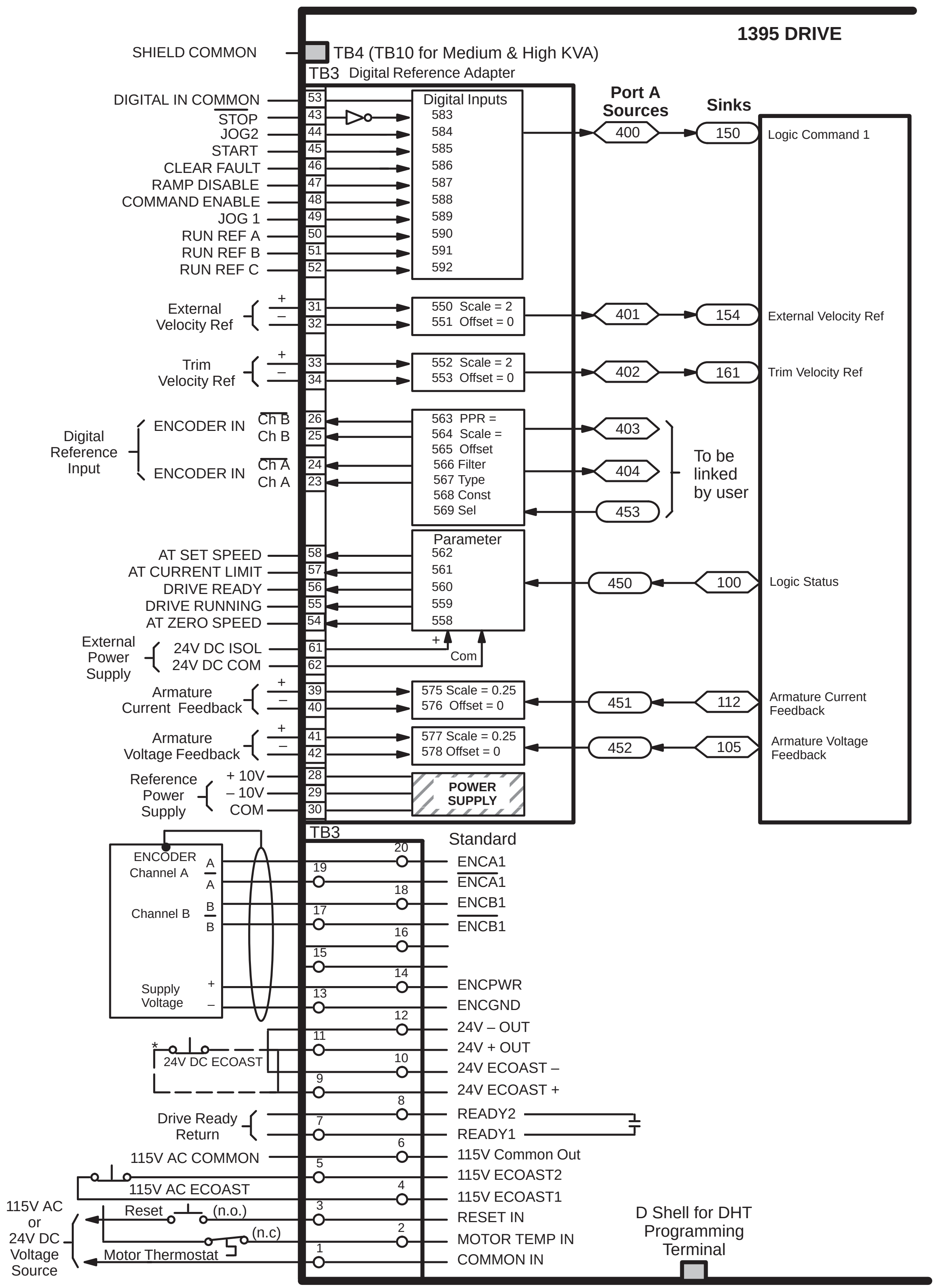
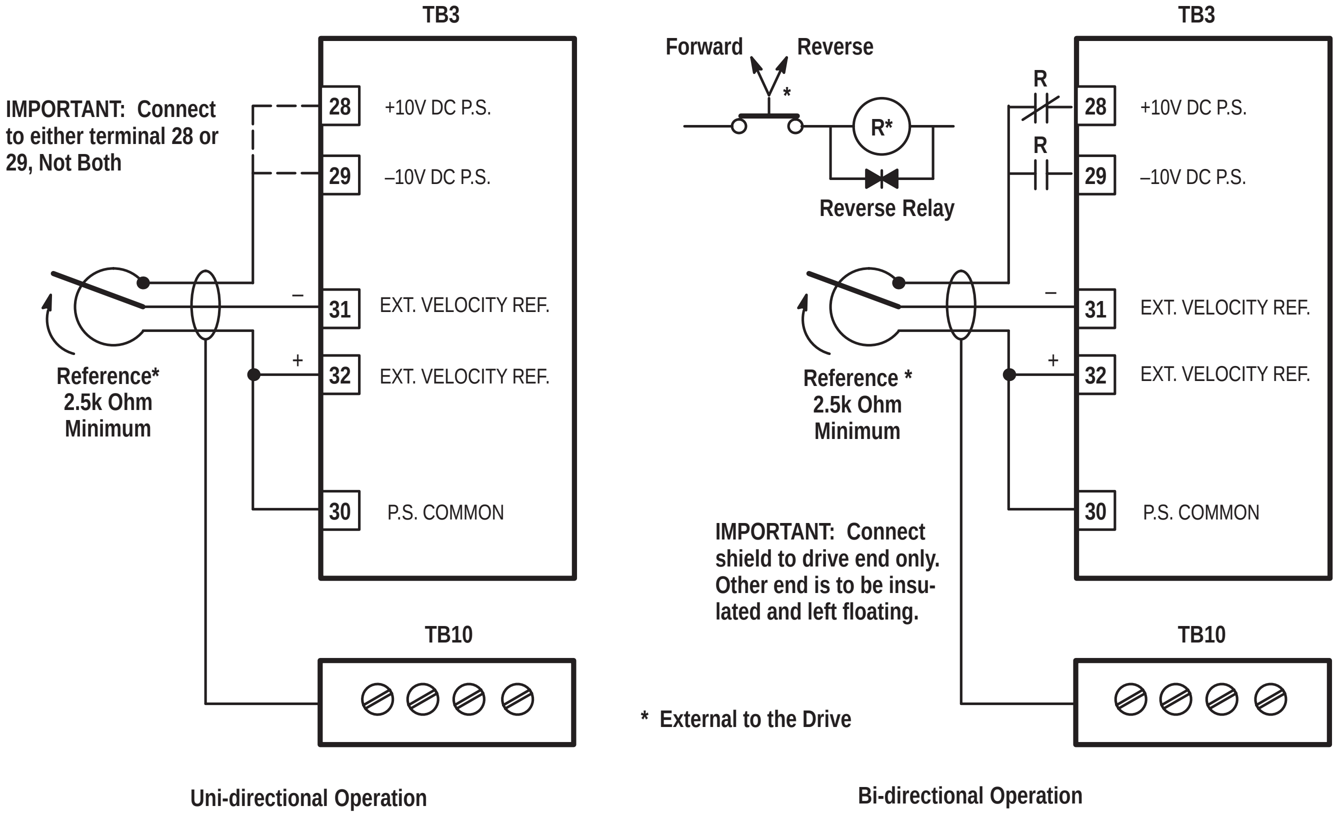


Figure 4.13
Typical Analog Input Connections



Analog Input – Velocity and Trim Reference

Connections for the velocity and trim reference inputs can be for uni- or bi-directional operation, using the internal drive ±10VDC power supply (see Figure 4.13).

Tach Velocity – The Digital Reference Adapter Board is not pre-configured for DC tachometer feedback. The user will have to reconfigure the drive by replacing the Trim Velocity Reference (parameter 161) with the Tach Velocity (parameter 156).

The analog tachometer device generates a DC voltage that is direction sensitive and proportional to speed. The tach output must be connected to an analog input channel on the Discrete Adapter Board. Most industrial tachs have an output greater than the ±10V range of the analog inputs. The tach output must be scaled down, by an external voltage divider network, so that the entire speed range of the motor can be represented by a ±9V feedback signal.

ATTENTION: Connecting a tach which has an output range greater than ±10V directly to the analog input channel can severely damage the adapter board.

The tach signal then must be scaled in the adapter board to determine the proper relationship of output voltage/motor velocity to base speed in Drive Units. This scaled configuration data must then be linked to Parameter 156 "Tach Velocity."

Many problems relate to the scaling of the tach signals. Below is a procedure for checking the scaling of the analog tach feedback for proper drive operation.

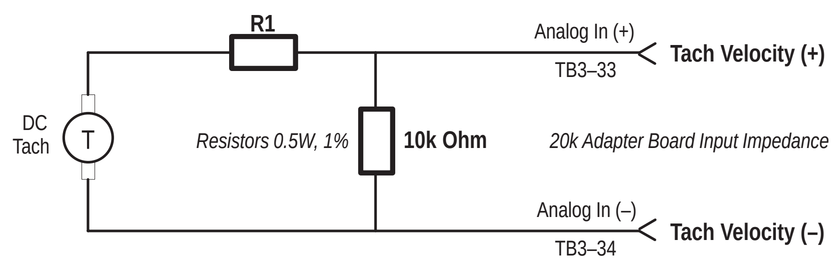
1. Determine the Volts/RPM rating of the tach (refer to tach name plate). Multiply this rating times the absolute maximum speed the motor will be commanded to accelerate to. This value should also be programmed in Parameter 607 "Rev Speed Lim" and 608 "Fwd Speed Lim" to assure that the velocity command will be properly clamped.

   Volts/RPM Rating x Max Speed = Max Volts Output

2. The Max Volts output must then be scaled to a level within the ±10V analog input channel range. This can be accomplished by using a voltage divider network external to the drive. The voltage divider will take the Max Volts output and scale it to a maximum 9V input. This allows for protection against 10% overshoot.

Figure 4.14 uses a l0k ohm resistor across the input channel. Rl represents the dropping resistor for the scaling network. To determine the value of Rl use the equation that follows:

Figure 4.14
Scaling Circuit



$$\frac{\text{(Max Volts Output) x 6666}}{\text{9V}} - 6666 = R1$$

3. The analog input channel on the adapter board must now be scaled to represent an accurate velocity feedback signal. First determine the analog input signal for base speed. Parameter numbers are given in ( ) where applicable.

$$\frac{\text{Base Motor Speed (606) x 9V}}{\text{Max Speed}} = \text{Base Speed Input}$$

4. The input voltage at base speed is then converted to Raw Adapter Units according to the following equation.

$$\frac{\text{Base Speed Input x 2048}}{10} = \text{Raw Adapter Units}$$

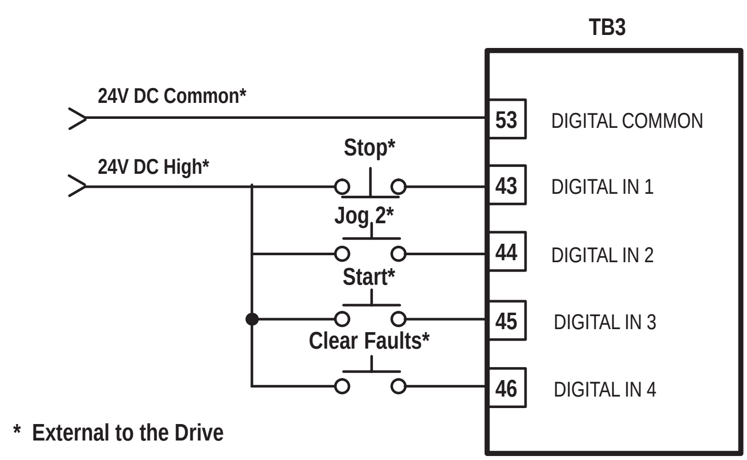
5. The Raw Adapter Units are then used to determine the correct scaling parameter value according to the equation below.

$$\frac{4096}{\text{Raw Adapter Units}} = \text{Scaling Parameter Value}$$

6. The Scaling Parameter Value should then be entered into the associated analog input scaling set-up parameter. This procedure will be correct to within 5%. Verify that the scaling is correct by measuring the actual motor velocity with a hand tachometer. Fine tune the scaling by adjusting the appropriate value to minimize any error.
7. Any drift at zero speed can be minimized by adjusting the offset parameter associated with the channel in use.

Digital Input – Figure 4.15 shows a typical digital input connection.

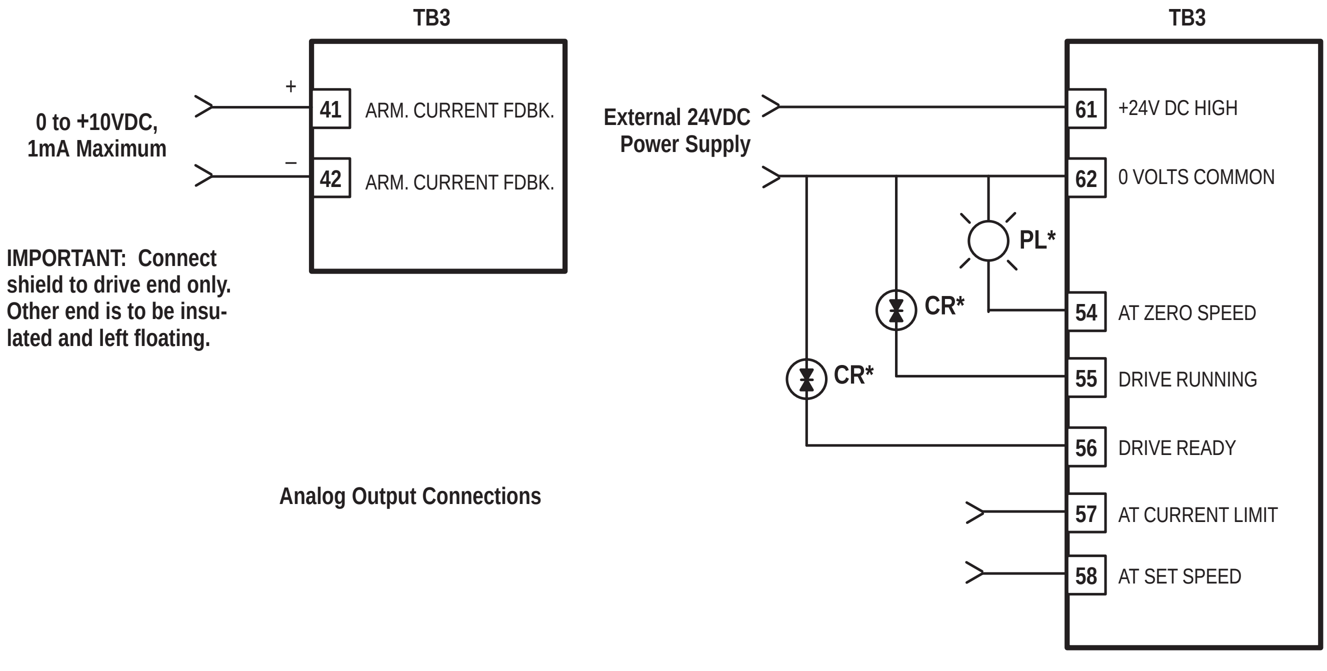
Figure 4.15
Typical 24VDC Digital Input Connections using External Power Supply



Analog/Digital Output

Figure 4.16 shows typical analog and digital output connections.

Figure 4.16
Typical Output Connections



* External to the Drive

Node Adapter Board

The Node Adapter Board is connected to Microbus Port B and is not preconfigured. Refer to the Node Adapter manual for configuration information.

Multi-Communications Adapter Board

The Multi-Communications Board is not preconfigured. Refer to the Multi Communications Adapter manual for configuration and installation information.

Chapter 5

Programming Parameters

Introduction

This chapter contains the information required to assist the user in programming the drive for a specific application after initial start-up. Drives are shipped programmed with default values and are preconfigured for the options installed.

The drive parameters can be divided into the following categories:

Basic – The Basic parameters that must be programmed at the time of start-up.

Setup – The Setup parameters are default values that may require changing during start-up.

Speed Reference – The Speed Reference parameters are used as speed reference sources for the drive.

Input – The Input parameters accept information from sources outside the drive.

Autotune – The Autotune parameters are automatically set by the drive control during start-up. Occasionally, they may require modification by the user.

Status – The Status parameters provide information about the drive and its operation.

Terminology

The definition of terms related to the parameter table include:

Configuration – The process of linking Sink to Source parameters.

Configuration Parameters – Parameters used to transfer data between the drive control and external devices. The Configuration Parameters are categorized into two types:

1. Source Parameters – Fast parameter used as a source of data.
2. Sink Parameters – Fast parameter used to receive data input.

Drive Units – The actual value of the parameter as it is stored within the Drive parameter table. The drive units may be converted to engineering units or to hexidecimal for display using the Programming Terminal, or may be displayed directly in drive units. All internal values in the drive are in terms of Per Unit numbering.

Engineering Units – A label given to parameter data which specifies what units are to be used to display the parameter value on the Programming Terminal. Examples of engineering units include: RPM, % etc.

Fast Parameter – Fast parameters are all parameters whose values are updated every 2 milliseconds. Fast parameters are used for the real time data input and output of the drive. Fast parameters are NOT backed up in non-volatile memory.

Non-Volatile Memory – Data memory in the drive which retains the values of all data even when power is disconnected from the drive control. EEPROM (Electrically Erasable Programmable Read Only Memory) chips are used for the 1395 non-volatile memory to store some of the drive parameters.

Parameter Table – Table of parameter entries for all configuration and setup parameters used in the drive.

Parameter Entry – Information stored in the drive which contains the parameter number, parameter data and all other information related to the specific parameter.

Parameter – Memory location used to store drive data. Each parameter is given a number called the parameter number. The parameter value may be specified in decimal, or in hexadecimal. When specified in hexadecimal, the word "Hex" will appear after the parameter value.

Per Unit Numbering – Per Unit numbering is a numbering system which defines a specific numeric value as representing 100% of a particular quantity being measured. The number 4096 is used in many places in the drive to represent 1 Per Unit (100%) [pu].

For Example: The number 4096 in Parm 106 (Velocity Fdbk) represents base motor speed. The number 4096 in Parm 105 (Arm Voltage Fdbk) represents rated motor armature voltage.

Real Time Data – Real Time data is defined as any data which is updated at a rate equal to or faster than that required by the control in order to regulate the drive within the desired bandwidth. All Fast Parameters are considered to be real time within the 1395 Drive.

Set Up Parameter – Parameter which is used to store information required by the drive in order to perform the regulation functions of the drive. Setup parameters include parameters used for calibration, scaling and some selection functions required to setup the drive for operation. Data stored in Setup parameters may be backed up in non-volatile memory (EEPROM).

ATTENTION: The user should become familiar with the programming terminal manual 1300-5.5 before attempting any change of parameters.
DO NOT INITIALIZE THE DRIVE UNDER EEPROM MODE. PRECONFIGURED DATA AND PARAMETERS WILL REVERT TO DEFAULT VALUES.

Parameter Table Structure

All data used by the 1395 control to perform the drive functions is stored in the Parameter Table. Each parameter entry in the parameter table contains the information illustrated in Figure 5.1.

Figure 5.1
Parameter Entry

Parameter Number
Hex
Units
Name
Init. Value
Min
Max
EE
Function/Classification

The parameter data may be obtained by the Programming Terminal or by external devices connected to either Port A or Port B using the appropriate Adapter Board. The various elements of the parameter data are defined as :

Parm – The parameter number in decimal.

Hex – Parameter number in hexidecimal.

Units – Indicates the units displayed for the parameter value using the Programming Terminal and displaying the value using engineering units.

Name – Parameter name as it appears on the Programming Terminal.

Init – Parameter value as it will appear after the Drive Initialize command has been sent from the Programming Terminal. The Init values are the same as the default values listed in the Parameter Descriptions section of this chapter.

Min – Minimum allowable value for the parameter. If no min value is given, the parameter has not been assigned a minimum limit.

Max – Maximum allowable value for the parameter. If no max value is given, the parameter has not been assigned a maximum limit.

EE – Indicates whether the parameter can be backed up in EEPROM.

Function/Classification – Indicates the control function to which the parameter is associated, and its classification.

Data Types

The Actual Value portion of the parameter entry for each parameter in the parameter table is a 16 bit word. The data represented by this 16 bit word is one of the three following types:

Numerical Data – 16 bit binary integer which can represent signed integers from –32,768 to +32767 or unsigned integers from 0 to +65535.

16 Bit Field Select – 16 bit word where each bit is used to enable/disable a specific drive function.

1 Bit Field Select – A single bit used to enable/disable a specific drive function. For 1 bit field select type data, the entire 16 bit word is stored in the parameter entry, but only the first bit (bit 0) is used.

Parameter Table Storage

Whenever power is applied to the drive control, the entire parameter table is copied from EEPROM to RAM (Random Access Memory). All information stored in RAM is lost when power is disconnected. All Set-Up parameters in the drive required for the basic calibration and scaling of the control functions must be retained even when power is disconnected from the drive, so that the setup information does not need to be re-entered into the drive every time power is re-applied. EEPROM memory is used to store the values of the Setup Parameters when the drive is not powered up.

Whenever a parameter value is changed, either from the Programming Terminal, or through an external device connected to Port A or B, the new information is stored in the RAM of the drive. If this data will be stored in the EEPROM, the Drive must be commanded to copy the parameter data from the RAM to the EEPROM. This is done using a write to EEPROM command (available on the Programming Terminal through the EEPROM mode).

In addition to the parameter values, the configuration information (linking Source to Sink parameters) is also stored in the RAM of the drive. Whenever a change to the configuration is to be backed up in EEPROM, the EEPROM write command must be given.

For details on saving parameters refer to the Programming Terminal Operation Manual.

Table 5.A
Parameters

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
1	1H	Trend 1 Output						Fast Source
2	2H	Trend 2 Output						Fast Source
3	3H	Trend 3 Output						Fast Source
4	4H	Trend 4 Output						Fast Source
10	AH	SP Output 1						Fast Source from Param 840
11	BH	SP Output 2						Fast Source from Param 841
12	CH	SP Output 3						Fast Source from Param 842
13	DH	SP Output 4						Fast Source from Param 843
14	EH	SP Output 5						Fast Source from Param 844
50	032H	Trend 1 Input						Fast Sink
51	033H	Trend 2 Input						Fast Sink
52	034H	Trend 3 Input						Fast Sink
53	035H	Trend 4 Input						Fast Sink
100	64H	Logic Status						Logic Control
101	65H	Drive Fault						Fault Detection
102	66H	Pre Ramp Vel Ref	RPM					Ramp Control
103	67H	Ramp Vel Ref	RPM					Ramp Control
104	68H	Final Vel Ref	RPM					Velocity Ref Control
105	69H	Arm Voltage Fdbk	VLT					Feedback Control
106	6AH	Velocity Fdbk	RPM					Velocity Fdbk Control
107	6BH	Position Fdbk						Velocity Fdbk Control
108	6CH	Vel Feed Fwd	RPM					Velocity PI Control
109	6DH	Position Error						Velocity PI Control
110	6EH	Torque Command	%					Torque Select
111	6FH	Arm Current Ref	AMP					Current Ref Control
112	70H	Arm Current Fdbk	AMP					Feedback Control
113	71H	Arm Cur PI Out						Current PI Control
114	72H	Arm Cur Fire Ang						Current PI Control
115	73H	Flux Command	%					Field Flux Control
116	74H	AC Line Voltage	VLT					Feedback Control
117	75H	Fld Current Ref	AMP					Field Flux Control
118	76H	Fld Current Fdbk	AMP					Feedback Control
119	77H	Proc Trim Output						Process Trim Control
120	78H	CEMF Feedback	VLT					Software Test Point
121	79H	Flux Trim	%					Software Test Point
122	80H	Encoder Velocity	RPM					Software Test Point

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
123	81H	Velocity PI Output	%					Software Test Point
124	82H	Velocity Error	RPM					Software Test Point
125	83H	Process Trim PI Input						Software Test Point
150	96H	Logic Cmd 1						Logic Control/Input
151	97H	Logic Cmd 2						Logic Control/Input
152	98H	Logic Cmd 3						Logic Control/Input
153	99H	Vel Ref Fraction						Velocity Ref Control/Input
154	9AH	Vel Ref Whole	RPM					Velocity Ref Control/Input
156	9CH	Tach Velocity	RPM					Velocity Fdbk Control/Input
157	9DH	Torque Reference	%					Torque Select
159	9FH	Flux Feed Forward	%					Field Flux Control
160	A0H	CEMF Reference	%					Field Flux Control
161	A1H	Process Trim Ref						Process Trim Control/Input
162	A2H	Process Trim Fdbk						Process Trim Control/Input
163	A3H	Vel Indirect 1						Fast Sink, Pointer in 600
164	A4H	Vel Indirect 2						Fast Sink, Pointer in 601
165	A5H	Vel Indirect 3						Fast Sink, Pointer in 602
166	A6H	Vel Indirect 4						Fast Sink, Pointer in 603
167	A7H	Torque Reference 2	%					Torque Select
200	C8H	DHT In Par 1						Fast Source
201	C9H	DHT In Par 2						Fast Source
202	CAH	DHT In Par 3						Fast Source
203	CBH	DHT In Par 4						Fast Source
204	CCH	DHT In Par 5						Fast Source
250	FAH	DHT Out Par 1						Fast Sink
251	FBH	DHT Out Par 2						Fast Sink
252	FCH	DHT Out Par 3						Fast Sink
253	FDH	DHT Out Par 4						Fast Sink
254	FEH	DHT Out Par 5						Fast Sink
300	12CH	Pt B IN Par 1						Fast Source
301	12DH	Pt B IN Par 2						Fast Source
302	12EH	Pt B In Par 3						Fast Source
303	12FH	Pt B In Par 4						Fast Source
304	130H	Pt B In Par 5						Fast Source
305	131H	Pt B In Par 6						Fast Source
306	132H	Pt B In Par 7						Fast Source
307	133H	Pt B In Par 8						Fast Source

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
308	134H	Pt B IN Par 9						Fast Source
309	135H	Pt B In Par10						Fast Source
350	15EH	Pt B Out Par 1						Fast Sink
351	15FH	Pt B Out Par 2						Fast Sink
352	160H	Pt B Out Par 3						Fast Sink
353	161H	Pt B Out Par 4						Fast Sink
354	162H	Pt B Out Par 5						Fast Sink
355	163H	Pt B Out Par 6						Fast Sink
356	164H	Pt B Out Par 7						Fast Sink
357	165H	Pt B Out Par 8						Fast Sink
358	166H	Pt B Out Par 9						Fast Sink
359	167H	Pt B Out Par 10						Fast Sink
400	190H	Pt A IN Par 1						Fast Source
401	191H	Pt A In Par 2						Fast Source
402	192H	Pt A In Par 3						Fast Source
403	193H	Pt A In Par 4						Fast Source
404	194H	Pt A In Par 5						Fast Source
405	195H	Pt A In Par 6						Fast Source
406	196H	Pt A IN Par 7						Fast Source
407	197H	Pt A IN Par 8						Fast Source
408	198H	Pt A IN Par 9						Fast Source
409	199H	Pt A IN Par 10						Fast Source
450	1C2H	Pt A OUT Par 1						Fast Sink
451	1C3H	Pt A Out Par 2						Fast Sink
452	1C4H	Pt A Out Par 3						Fast Sink
453	1C5H	Pt A OUT Par 4						Fast Sink
454	1C6H	Pt A OUT Par 5						Fast Sink
455	1C7H	Pt A OUT Par 6						Fast Sink
456	1C8H	Pt A OUT Par 7						Fast Sink
457	1C9H	Pt A OUT Par 8						Fast Sink
458	1CAH	Pt A OUT Par 9						Fast Sink
459	1CBH	Pt A OUT Par 10						Fast Sink
500	1F4H	Pt B IN Cnfg 1					EE	Configuration
501	1F5H	Pt B IN Cnfg 2					EE	Configuration
502	1F6H	Pt B IN Cnfg 3					EE	Configuration
503	1F7H	Pt B IN Cnfg 4					EE	Configuration
504	1F8H	Pt B IN Cnfg 5					EE	Configuration
505	1F9H	Pt B IN Cnfg 6					EE	Configuration

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
506	1FAH	Pt B IN Confg 7					EE	Configuration
507	1FBH	Pt B IN Confg 8					EE	Configuration
508	1FCH	Pt B IN Confg 9					EE	Configuration
509	1FDH	Pt B IN Config 10					EE	Configuration
510	1FEH	Pt B IN Config 11					EE	Configuration
511	1FFH	Pt B IN Config 12					EE	Configuration
512	200H	Pt B IN Config 13					EE	Configuration
513	201H	Pt B IN Config 14					EE	Configuration
514	202H	Pt B IN Config 15					EE	Configuration
515	203H	Pt B IN Config 16					EE	Configuration
516	204H	Pt B IN Config 17					EE	Configuration
517	205H	Pt B IN Config 18					EE	Configuration
518	206H	Pt B IN Config 19					EE	Configuration
519	207H	Pt B IN Config 20					EE	Configuration
520	208H	Pt B IN Config 21					EE	Configuration
521	209H	Pt B IN Config 22					EE	Configuration
522	20AH	Pt B IN Config 23					EE	Configuration
523	20BH	Pt B IN Config 24					EE	Configuration
524	20CH	Pt B IN Config 25					EE	Configuration
525	20DH	Pt B OUT Config 1					EE	Configuration
526	20EH	Pt B OUT Config 2					EE	Configuration
527	20FH	Pt B OUT Config 3					EE	Configuration
528	210H	Pt B OUT Config 4					EE	Configuration
529	211H	Pt B OUT Config 5					EE	Configuration
530	212H	Pt B OUT Config 5					EE	Configuration
531	213H	Pt B OUT Config 7					EE	Configuration
532	214H	Pt B OUT Config 8					EE	Configuration
533	215H	Pt B OUT Config 9					EE	Configuration
534	216H	Pt B OUT Config 10					EE	Configuration
535	217H	Pt B OUT Config 11					EE	Configuration
536	218H	Pt B OUT Config 12					EE	Configuration
537	219H	Pt B OUT Config 13					EE	Configuration
538	21AH	Pt B OUT Config 14					EE	Configuration
539	21BH	Pt B OUT Config 15					EE	Configuration
540	21CH	Pt B OUT Config 16					EE	Configuration
541	21DH	Pt B OUT Config 17					EE	Configuration
542	21EH	Pt B OUT Config 18					EE	Configuration
543	21FH	Pt B OUT Config 19					EE	Configuration

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
544	220H	Pt B OUT Cnfg 20					EE	Configuration
545	221H	Pt B OUT Confg 21					EE	Configuration
546	222H	Pt B OUT Confg 22					EE	Configuration
547	223H	Pt B OUT Config 23					EE	Configuration
548	224H	Pt B OUT Config 24					EE	Configuration
549	225H	Pt B OUT Config 25					EE	Configuration
550	226H	Pt A IN Config 1					EE	Configuration
551	227H	Pt A IN Config 2					EE	Configuration
552	228H	Pt AIN Config 3					EE	Configuration
553	229H	Pt A IN Config 4					EE	Configuration
554	22AH	Pt A IN Config 5					EE	Configuration
555	22BH	Pt A IN Config 6					EE	Configuration
556	22CH	Pt A IN Config 7					EE	Configuration
557	22DH	Pt A IN Config 8					EE	Configuration
558	22EH	Pt A IN Config 9					EE	Configuration
559	22FH	Pt A IN Config 10					EE	Configuration
560	230H	Pt A IN Config 11					EE	Configuration
561	231H	Pt A IN Config 12					EE	Configuration
562	232H	Pt A IN Config 13					EE	Configuration
563	233H	Pt A IN Config 14					EE	Configuration
564	234H	Pt A IN Config 15					EE	Configuration
565	235H	Pt A IN Config 16					EE	Configuration
566	236H	Pt A IN Config 17					EE	Configuration
567	237H	Pt A IN Config 18					EE	Configuration
568	238H	Pt A IN Config 19					EE	Configuration
569	239H	Pt A IN Config 19					EE	Configuration
570	23AH	Pt A IN Config 21					EE	Configuration
571	23BH	Pt A IN Config 22					EE	Configuration
572	23CH	Pt A IN Config 23					EE	Configuration
573	23DH	Pt A IN Config 24					EE	Configuration
574	23EH	Pt A IN Config 25					EE	Configuration
575	23FH	Pt A OUT Config 1					EE	Configuration
576	240H	Pt A OUT Config 2					EE	Configuration
577	241H	Pt A OUT Config 3					EE	Configuration
578	242H	Pt A OUT Config 4					EE	Configuration
579	243H	Pt A OUT Config 5					EE	Configuration
580	244H	Pt A OUT Config 6					EE	Configuration
581	245H	Pt A OUT Config 7					EE	Configuration
582	246H	Pt A OUT Config 8					EE	Configuration

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
583	247H	Pt A OUT Confg 9					EE	Configuration
584	248H	Pt A OUT Confg 10					EE	Configuration
585	249H	Pt A OUT Config 11					EE	Configuration
586	24AH	Pt A OUT Config 12					EE	Configuration
587	24BH	Pt A OUT Config 13					EE	Configuration
588	24CH	Pt A OUT Config 14					EE	Configuration
589	24DH	Pt A OUT Config 15					EE	Configuration
590	24EH	Pt A OUT Config 16					EE	Configuration
591	24FH	Pt A OUT Config 17					EE	Configuration
592	250H	Pt A OUT Config 18					EE	Configuration
593	251H	Pt A OUT Config 19					EE	Configuration
594	252H	Pt A OUT Config 20					EE	Configuration
595	253H	Pt A OUT Config 21					EE	Configuration
596	254H	Pt A OUT Config 22					EE	Configuration
597	255H	Pt A OUT Config 23					EE	Configuration
598	256H	Pt A OUT Config 24					EE	Configuration
599	257H	Pt A OUT Config 25					EE	Configuration
600	258H	Vel Param Sel 1		600	600	732	EE	Pointer for Param 163
601	259H	Vel Param Sel 2		601	600	732	EE	Pointer for Param 164
602	25AH	Vel Param Sel 3		602	600	732	EE	Pointer for Param 165
603	25BH	Vel Param Sel 4		603	600	732	EE	Pointer for Param 166
606	25EH	Base Motor Speed	RPM	1750	1	6000	EE	Velocity Fdbk Cntrl
607	25FH	Rev Speed Limit	RPM	–B.S.	–6xB.S.	0	EE	Ramp Control
608	260H	Fwd Speed Limit	RPM	B.S.	0	+6 x B.S.	EE	Ramp Control
609	261H	Encoder PPR		1024	100	32767	EE	Vel Fdbk Cntrl
610	262H	Rated Motor Volt	VOLTS	240	75	800	EE	Feedback Control
611	263H	Motor Arm FLA	AMPS	0.2	0.1	3276.7	EE	Feedback Control
612	264H	Rate Fld Mtr Cur	AMPS	0.1	0.1	32767	EE	Feedback Control
613	265H	Motor Inertia	SECS	6.0	0.01	10	EE	
614	266H	Arm Resistance	%	5.0	0	100	EE	Velocity Fdbk Cntrl
615	267H	Rated Arm Brdg I	AMPS	20.0	0.1	3276.7	EE	Feedback Control
616	268H	Rated Fld Brdg I	AMPS	10.0	10.0	3276.7	EE	Feedback Control
617	269H	Rated AC Line	VOLTS	460.0	460.0	660	EE	Feedback Control
620	26CH	System Reset Select		0	0	1	EE	Logic Control
621	26DH	Fdbk Device Type		1	0	3	EE	Velocity Fdbk Cntrl
622	26EH	Contactor Device		1	0	1	EE	Logic Control
623	26FH	Fault Select		*			EE	Fault Detection
624	270H	Maintain Start		1	0	3	EE	Logic Control

* See Parameter Description

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
625	270H	Torque Mode		1	0	5	EE	Torque Select
626	272H	Jog Ramp Enable		0	0	1	EE	Ramp Cntrl/Set-up
627	273H	Flux Mode Select		*			EE	Field Flux Control/Set-Up
628	274H	Proc Trim Select		0	0	2	EE	Process Trim Control/Set-Up
629	275H	MTR Overload Sel		1	0	4	EE	Fault Detection/Setup
630	276H	Fault Report		1	0	1	EE	Fault Detection/Set-Up
631	277H	Vel Filter Sel		0	0	3	EE	Velocity Ref Cntrl/Setup
632	278H	Warning Select	*				EE	Fault Detection/Setup
633	279H	Preset Speed 1	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
634	27AH	Preset Speed 2	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
635	27BH	Preset Speed 3	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
636	27CH	Preset Speed 4	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
637	27DH	Preset Speed 5	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
638	27EH	Jog Speed 1	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
639	27FH	Jog Speed 2	RPM	0	–6xB.S.	+6xB.S.	EE	Velocity Ref Cntrl/Spd Ref
641	281H	MOP Accel 1	SEC	0.1	0.1	6553.5	EE	MOP Control
642	282H	MOP Accel 2	SEC	0.1	0.1	6553.5	EE	MOP Control
643	283H	MOP Accel 3	SEC	0.1	0.1	6553.5	EE	MOP Control
644	284H	MOP Accel 4	SEC	0.1	0.1	6553.5	EE	MOP Control
645	285H	MOP Decel 1	SEC	0.1	0.1	6553.5	EE	MOP Control
646	286H	MOP Decel 2	SEC	0.1	0.1	6553.5	EE	MOP Control
647	287H	MOP Decel 3	SEC	0.1	0.1	6553.5	EE	MOP Control
648	288H	MOP Decel 4	SEC	0.1	0.1	6553.5	EE	MOP Control
649	289H	MOP Max Speed	RPM	1750	0	+6xB.S.	EE	MOP Control
650	290H	MOP Min Speed	RPM	0	0	+6xB.S.	EE	MOP Control
651	291H	Accel Time	SEC	10	0.1	6553.5	EE	Ramp Control
652	292H	Decel Time	SEC	10	0.1	6553.5	EE	Ramp Control
653	293H	Desired Contour	%	0	0	100	EE	Ramp Control
657	297H	Droop Percent	%	0	0	25.5	EE	Droop Control/Set-Up
658	298H	Droop Filter	%	0	0	100%	EE	Droop Control/Set-Up
659	299H	KI Velocity Loop		256	0	32767	EE	Velocity PI Control/Autotune
660	29AH	KP Velocity Loop		64	0	1600	EE	Velocity PI Control/Autotune
661	29BH	KF Velocity Loop		65535	0	65535	EE	Velocity PI Control/Autotune
663	29EH	Fwd Brdg Cur Lim	%	50%	0.0244	260	EE	Current Ref Control
664	2A0H	Rev Brdg Cur Lim	%	50%	0.0244	260	EE	Current Ref Control
665	2A1H	Strt Taper Speed	RPM	B.S.	B.S./4096	+6xB.S.	EE	Current Ref Control/Set-Up
666	2A2H	End Taper Speed	RPM	B.S.	B.S./4096	+6xB.S.	EE	Current Ref Control/Set-Up
667	2A3H	Min Taper Current	%	100	0.0244	260	EE	Current Ref Control/Set-Up
668	2A4H	DI/DT Limit	%	12.5	0.0244	260	EE	Current Ref Control/Set-Up
669	2A5H	Slave Percent	%	100	–200	200	EE	Torque Control/Set-Up

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
670	2A6H	Slave Percent 2		0	–200	200	EE	Torque Control/Setup
672	2A8H	KI Flux		1638	0	32767	EE	Field Weak Control/Set-Up
673	2A9H	KP Flux		4096	0	32767	EE	Field Weak Control/Set-Up
674	2AAH	Fld Economy Ref	%	50	0	100	EE	Field Flux Control/Set-Up
675	2ABH	Fld Economy Ref	Sec	30	0	6553.5	EE	Field Flux Control/Set-Up
676	2ACH	Fld Flux Ref	%	100	0.0244	125	EE	Field Flux Control/Set-Up
677	2ADH	Fld I @ 0/8 Flux	%	0	0	100	EE	Field Flux Control/Autotune
678	2AEH	Fld I @ 1/8 Flux	%	6.6	0	100	EE	Field Flux Control/Autotune
679	2AFH	Fld I @ 2/8 Flux	%	14.3	0	100	EE	Field Flux Control/Autotune
680	2B0H	Fld I @ 3/8 Flux	%	23.1	0	100	EE	Field Flux Control/Autotune
681	2B1H	Fld I @ 4/8 Flux	%	33.3	0	100	EE	Field Flux Control/Autotune
682	2B2H	Fld I @ 5/8 Flux	%	45.5	0	100	EE	Field Flux Control/Autotune
683	2B3H	Fld I @ 6/8 Flux	%	60.0	0	100	EE	Field Flux Control/Autotune
684	2B4H	Fld I @ 7/8 Flux	%	77.7	0	100	EE	Field Flux Control/Autotune
685	2B5H	Fld I @ 1.0Flux	RPM	100	0	100	EE	Field Flux Control/Autotune
686	2B6H	Fld Weaken Spd.	RPM	B.S.	B.S./8	+6xB.S.	EE	Field Weak Control
687	2B7H	CEMF Reg. Preload	%	0	–799.9	799.9	EE	Field Flux Control
688	2B8H	Tach Switch Tol.	RPM	10%B.S	0	B.S	EE	Tach Loss Recovery/Set-Up
689	2B9H	Tach Switch Ki		50	0	65535	EE	Tach Loss Recovery/Set-Up
690	2C0H	Tach Switch Kp		10	0	65535	EE	Tach Loss Recovery/Set-Up
691	2C1H	Tach Switch Select		0	0	1	EE	Tach Loss Recovery/Set-Up
692	2BCH	Kn Filter		512	–32767	+32767	EE	Set-Up
693	2BDH	Wn Filter		300	1	500	EE	Set-Up
698	2C2H	Auto Tune I Lim	RPM	25	.0244	100	EE	Auto Tuning Setup/Autotune
699	2C3H	Auto Tune Speed	RPM	B.S.	– B.S.	B.S.	EE	Auto Tuning Setup/Autotune
700	2C4H	Vel Desired BW	Rad/Sec	5	0.1	150	EE	Auto Tuning Setup/Autotune
701	2C5H	Vel Max BW	Rad/Sec	50	50	150	EE	Auto Tuning Setup/Autotune
702	2C6H	Vel Damp Factor		1.0	1.0	3.0	EE	Auto Tuning Setup/Autotune
703	2C7H	System Inertia	Sec	2.0	2.0	655.0	EE	Auto Tuning Setup/Autotune
704	2C8H	At Speed 1	RPM	0	0	+6xB.S.	EE	Velocity Ref Cntrl/ Spd Ref
705	2CAH	At Speed 2	RPM	BS/8	BS/8	+6xB.S.	EE	Velocity Ref Cntrl/ Spd Ref
706	2CBH	At Speed 3	RPM	BS/4	BS/4	+6xB.S.	EE	Velocity Ref Cntrl/ Spd Ref
707	2CCH	At Speed 4	RPM	BS/2	BS/2	+6xB.S.	EE	Velocity Ref Cntrl/ Spd Ref
708	2CDH	At Speed 5	RPM	BS	BS	+6xB.S.	EE	Velocity Ref Cntrl/ Spd Ref
709	2CEH	Up To Speed Tol	RPM	BS/100	–6xB.S.	B.S./10	EE	Logic Control/Set-Up
710	2CFH	Zero Speed Tol	RPM	BS/100	0	+6xB.S.	EE	Logic Control/Set-Up
711	2D0H	Jog Dwell	SEC	0	0	6553.5	EE	Logic Control/Set-Up
713	2D1H	Proc Trim Fltr K		0	0	100	EE	Process Trim Control/Set-Up
714	2D2H	Proc Trim Preload		0	–32767	32767	EE	Process Trim Control/Set-Up
715	2D3H	Proc Trim KI		1638	0	32767	EE	Process Trim Control/Set-Up
716	2D4H	Proc Trim KP		4096	0	32767	EE	Process Trim Control/Set-Up

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
717	2D4H	Proc Tri Lo Lim		–4096	–32767	32767	EE	Process Trim Control/Set-Up
718	2D5H	Proc Trim Hi Lim		4096	–32767	32767	EE	Process Trim Control/Set-Up
719	2D6H	Proce Trim Out K		1.000	–16.0	+16.0	EE	Process Trim Control/Set-Up
720	2D7H	Ovld Pend Level	%	115	0.0244	260	EE	Fault Detection/Set-Up
721	2D8H	Proc Trim Lo Sum	RPM	–6xB.S.	–6xB.S.	0	EE	Process Trim Control/Setup
722	2D8H	Proc Trim Hi Sum	RPM	+6xB.S.	+6xB.S.	+6xB.S.	EE	Process Trim Control/Set-Up
724	2D9H	ABS Overspeed	RPM	B.S./10	0	B.S.	EE	Process Trim Control/Set-Up
725	2DCH	Ext Overtemp Dly	SEC	1.0	0.1	3276.7	EE	Fault Detection/Set-Up
726	2DDH	SCR Overtemp Dly	SEC	1.0	0.1	3276.7	EE	Fault Detection/Set-Up
727	2DEH	Stall Delay	SEC	10.0	0	100	EE	Fault Detection/Set-Up
728	2DFH	AC Line Tol Dly	SEC	0.1	0	1.0	EE	Fault Detection/Set-Up
729	2E0H	Field Fault Threshold	%	30	0	100	EE	Fault Detection/Set-Up
730	2E1H	Fld Failure Dly	SEC	1.0	0.1	5.0	EE	Fault Detection/Set-Up
731	2E2H	Tach Loss CEMF	%	10.01	0	50.0	EE	Fault Detection/Set-Up
732	2E3H	Tach Loss Vel	%	2.002	.2441	50.0	EE	Fault Detection/Set-Up
733	2E4H	Arm Bridge Type		1	0	1	EE	Auto Tuning Setup/Basic
734	2E5H	K Discontinuous		1024	33	2048	EE	Current PI Control/Autotune
735	2E6H	KP Armature Loop		710	0	32767	EE	Current PI Control/Autotune
736	2E7H	KI Armature Loop		90	0	32767	EE	Current PI Control/Autotune
737	2E8H	KP Field Loop		16384	0	32767	EE	Field PI Control/Set-Up
738	2E9H	KI Field Loop		168	0	32767	EE	Field PI Control/Set-Up
739	2EAH	K Arm Volts		12500	3000	25000	EE	Feedback Control/Basic
740	2EBH	K AC Volts		7225	2000	15000	EE	Feedback Control/Basic
741	2ECH	Cur Desired BW	Rad/Sec	500	100	1000	EE	AutoTuning Setup/Autotune
742	2EDH	Cur Max BW	Rad/Sec	500	100	1000	EE	AutoTuning Setup/Autotune
743	2EEH	Cur Damp Factor		1.0	0.8	3.0	EE	AutoTuning Setup/Autotune
780		Firmware Ver No.	X.XX	X.XX				
840	348H	SP Indirect 1		0	–32767	32767	EE	SP Control/Configuration
841	349H	SP Indirect 2		0	–32767	32767	EE	SP Control/Configuration
842	34AH	SP Indirect 3		0	–32767	32767	EE	SP Control/Configuration
843	34BH	SP Indirect 4		0	–32767	32767	EE	SP Control/Configuration
844	34CH	SP Indirect 5		0	–32767	32767	EE	SP Control/Configuration
900		Trend Sign Val		0	–32767	32767	EE	Trend Function
901		Trend Sign Val		0	–32767	32767	EE	Trend Function
902		Trend Sign Val		0	–32767	32767	EE	Trend Function
903		Trend Sign Val		0	–32767	32767	EE	Trend Function
904		Trend Logic Val		0	0	*	EE	Trend Function
905		Trend Logic Val		0	0	*	EE	Trend Function

* See Parameter Description

Table 5.A Cont.

PARM	HEX	NAME	UNITS	INIT	MIN	MAX	EE	FUNCTION/CLASSIFICATION/PORT
906		Trend Logic Val		0	0	32767	EE	Trend Function
907		Trend Logic Val		0	0	32767	EE	Trend Function
908		Trend Unsign Val		0	0	+16.0	EE	Trend Function
909		Trend Unsign Val		0	0	260	EE	Trend Function
910		Tr1 Opnd Parm X		100	1	947	EE	Trend Function
911		Tr1 Opnd Parm Y		904	1	947	EE	Trend Function
912		Tr1 Operator		.AND	.GT	.NOR	EE	Trend Function
913		Tr1 Sample Rate	SEC	0.02	0.004	30	EE	Trend Function
914		Tr1 Post Samples		30	0	99	EE	Trend Function
915		Tr1 Cont Trigger		1	0	1	EE	Trend Function
916		Tr1 Enable		0	0	1	EE	Trend Function
917		Tr1 Output Rate	SEC	0.04	0.004	30	EE	Trend Function
920		Tr2 Opnd Param X		100	1	947		Trend Function
921		Tr2 Opnd Param Y		904	1	947		Trend Function
922		Tr2 Operator		.AND	.GT	.NOR		Trend Function
923		Tr2 Sample Rate	SEC	0.02	0.004	30		Trend Function
924		Tr2 Post Samples		30	0	99		Trend Function
925		Tr2 Mult Trigger		1	0	1		Trend Function
926		Tr2 Enable		0	0	1		Trend Function
927		Tr2 Output Rate	SEC	0.04	0.004	30		Trend Function
930		Tr3 Opnd Param X		100	1	947		Trend Function
931		Tr3 Opnd Param Y		904	1	947		Trend Function
932		Tr3 Operator		.AND	.GT	.NOR		Trend Function
933		Tr3 Sample Rate	SEC	0.02	0.004	30		Trend Function
934		Tr3 Post Samples		30	0	99		Trend Function
935		Tr3 Mult Trigger		1	0	1		Trend Function
936		Tr3 Enable		0	0	1		Trend Function
937		Tr3 Output Rate	SEC	0.04	0.004	30		Trend Function
940		Tr4 Opnd Param X		100	1	947		Trend Function
941		Tr4 Opnd Param Y		904	1	947		Trend Function
942		Tr4 Operator		.AND	.GT	.NOR		Trend Function
943		Tr4 Sample Rate	SEC	0.02	0.004	30		Trend Function
944		Tr4 Post Samples		30	0	99		Trend Function
945		Tr4 MultTrigger		1	0	0		Trend Function
946		Tr4 Enable		0	0	1		Trend Function
947		Tr4 Output Rate	SEC	0.04	0.004	30		Trend Function

NOTE: All parameter numbers not listed in this table are currently not in use.

Parameter Descriptions

This section provides a brief description of the parameters in Bulletin 1395. The programming terminal for the 1395 is also used for other products. Parameters not used by the 1395 will appear as “NOT USED, NOT CHANGEABLE”. Information is provided in the following format:

Parameter Number – Parameter Name [Parameter Name as it appears on the Programming Terminal].

Internal Units – Definition of per unit numbers used internally by the Bulletin 1395 Control.

Programming Terminal Units – Scaled engineering units which appear on the Programming Terminal.

Minimum – Minimum value in engineering units where possible.

Maximum – Maximum value in engineering units where possible.

Default – Initial default in engineering units where possible.

Description – Brief Description of the use and operation of the parameter.

Parameters (Numerical)

Parameter 10 – SP Output 1 [SP Output 1]

Internal Units :
Programming Terminal units :
Description : This is a fast source from Parameter 840

Parameter 11 – SP Output 2 [SP Output 2]

Internal Units :
Programming Terminal units :
Description : This is a fast source from Parameter 841

Parameter 12 – SP Output 3 [SP Output 3]

Internal Units :
Programming Terminal units :
Description : This is a fast source from Parameter 842

Parameter 13 – SP Output 4 [SP Output 4]

Internal Units :
Programming Terminal units :
Description : This is a fast source from Parameter 843

Parameter 14 – SP Output 5 [SP Output 5]

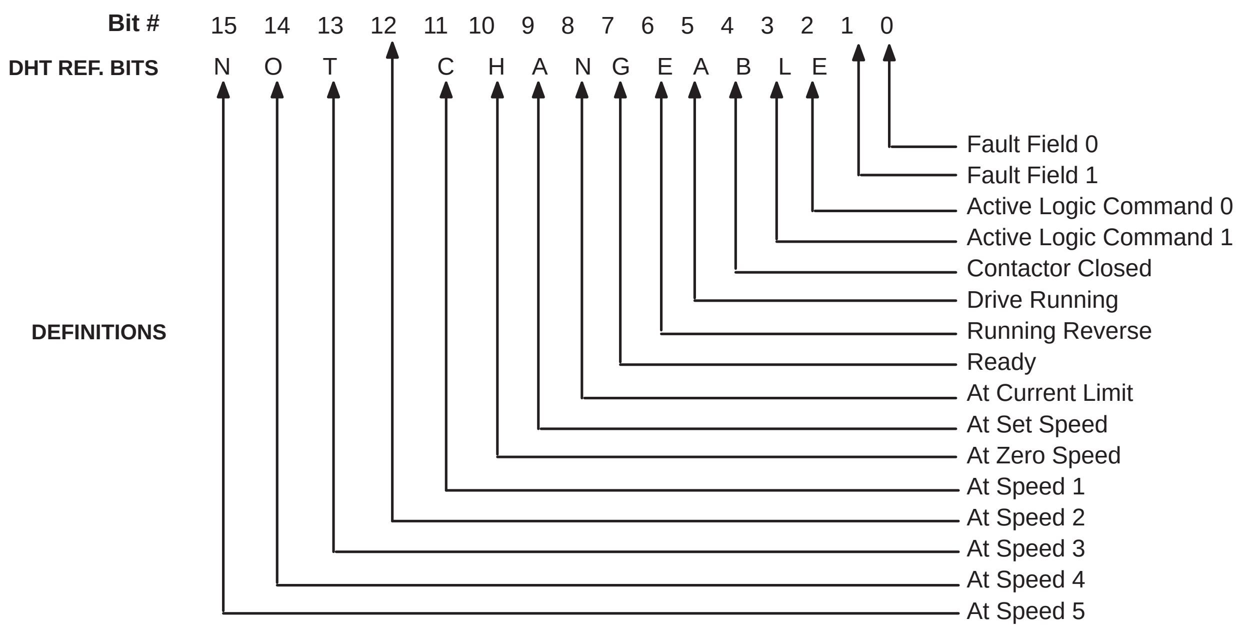
Internal Units :
Programming Terminal units :
Description : This is a fast source from Parameter 844

Parameter 100 – Logic Status [Logic Status]

Internal Units : None

Programming Terminal units : Bit Field

Description : This is a word of status data that indicates conditions within the Drive in boolean logic. Where a bit is set to 1, the corresponding condition in the drive is true, otherwise the condition is false. The bits in the Logic Status word are defined as:



Fault Field 0, 1 (Bits 0, 1) : This 2-bit field denotes the fault status of the Drive as follows:

Flt. Fld. 1	Flt. Fld. 0	DEFINITION
0	0	No Fault
0	1	Warning Fault
1	0	Soft Fault
1	1	Hard Fault

Active Logic Command 0,1 (Bits 2,3) : This 2-bit field denotes the logic command the Drive is acting upon as follows:

Logic CMD 1	Logic CMD. 0	DEFINITION
0	1	Parm 150
1	0	Parm 151
1	1	Parm 152

Contactor closed (Bit 4) : A 1-bit field indicating the status of the contactor. 1 denotes contactor closed and 0 denotes open.

Drive running (Bit 5) : A 1-bit field, when set to 1, indicates the drive has acknowledged the start or jog inputs in the logic command and is regulating speed. 1 denotes Drive is running and zero not running.

Running reverse (Bit 6) : A 1-bit field, indicating the motor is moving at a non-zero velocity in the reverse direction. 1 denotes reverse rotation and 0 denotes zero or forward rotation.

Ready (Bit 7) : A 1-bit field, when set to 1, indicates the drive is ready to accept a start command, and regulate to the speed or torque selected. Set to 0 indicates not ready. Conditions required for ready are: no Stop input from any logic command, no hard or soft fault, ECOAST closed and less than 15% armature voltage. The ready will be set to 0 unless all of the previous conditions are true.

At current limit (Bit 8) : A 1-bit field that is set to 1 when the armature current request exceeds the forward or reverse bridge current limit value. It is set to 0 if the armature current request is within the forward and reverse bridge limits. The armature current reference (Parameter 111) is compared to the forward bridge current limit (Parameter 663) and the reverse bridge current limit (Parameter 664) to accomplish this.

At set speed (Bit 9) : A 1-bit field that is set to 1 when the actual velocity of the motor is within a tolerance of the selected reference speed. Otherwise, set to 0. Internally in the drive, feedback velocity is compared to the pre ramp velocity reference (Parameter 102), and if the difference is within the up to speed tolerance (Parameter 709), the at speed bit is set to 1.

At zero speed (Bit 10) : A 1-bit field that is set to 1 when the actual velocity of the motor is within a tolerance of zero speed. Otherwise, set to 0. Internally in the drive, if the feedback velocity (Parameter 106) is within the zero speed tolerance band (Parameter 710), then at zero speed bit is set to 1.

At speed 1 (Bit 11) : A 1-bit field that is set to 1 when the actual velocity of the motor is within a tolerance of the at speed 1 setpoint. Otherwise, set to 0. Internally in the drive, feedback velocity (Parameter 106) is compared to at speed 1 (Parameter 704), and if the absolute value of the difference is within the up to speed tolerance (Parameter 709), the at speed 1 bit is set to 1.

At speed 2 (Bit 12) : A 1-bit field that is set to 1 when the actual velocity of the motor is within a tolerance of the at speed 2 setpoint. Otherwise, set to 0. Internally in the drive, feedback velocity (Parameter 106) is compared to at speed 2 (Parameter 705), and if the absolute value of the difference is within the up to speed tolerance (Parameter 709), the at speed 2 bit is set to 2.

At speed 3 (Bit 13) : A 1-bit field that is set to 1 when the actual velocity of the motor is greater than the at speed 3 setpoint. Otherwise, set to 0. Internally in the drive, if the feedback velocity (Parameter 106) is greater than or equal to at speed 3 (Parameter 706), the at speed 3 bit is set to 1.

At speed 4 (Bit 14) : A 1-bit field that is set to 1 when the actual velocity of the motor is greater than the at speed 4 setpoint. Otherwise, set to 0. Internally in the drive, if the feedback velocity (Parameter 106) is greater than or equal to at speed 4 (Parameter 707), the at speed 4 bit is set to 1.

At speed 5 (Bit 15) : A 1-bit field that is set to 1 when the actual velocity of the motor is greater than the at speed 5 setpoint. Otherwise, set to 0. Internally in the drive, if the feedback velocity (Parameter 106) is greater than or equal to at speed 5 (Parameter 708), the at speed 5 bit is set to 1.

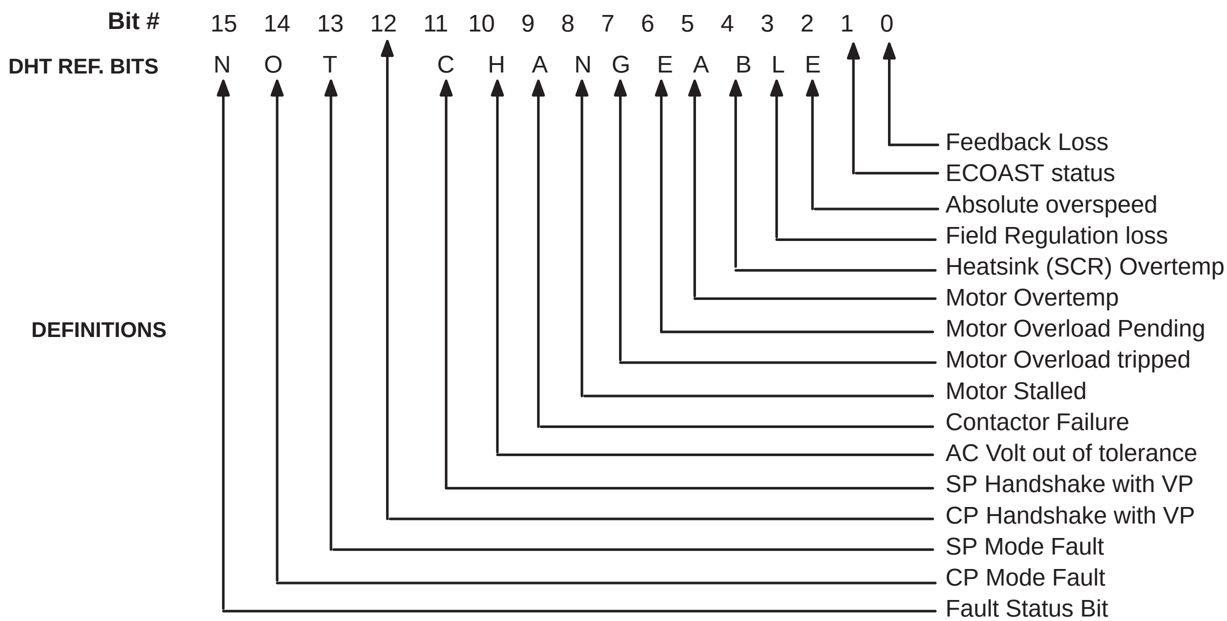
Parameter 101 – Drive Fault [Drive Fault]

Internal units : None

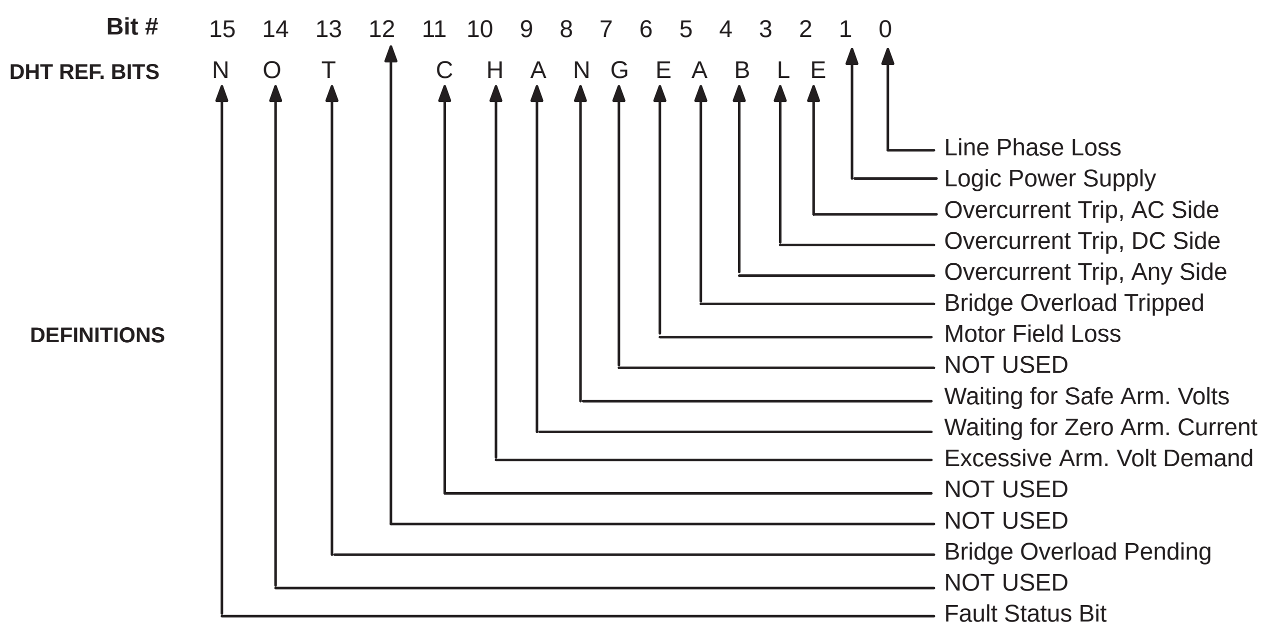
DHT units : Bit field

Description : A status word maintained by the Drive stating a fault is true (bit set to 1) or false (bit set to 0). Fault Report (Parameter 630) determines if Velocity Control faults will be reported (630 = 1) or if Current Control faults will be reported (630 = 0). Bit 15 is a status bit that indicates which control faults are being reported. If bit 15 = 1, velocity control faults are being reported. If bit 15 = 0, current control faults are being reported. The bits in the drive fault word are defined as:

IF VELOCITY CONTROL FAULTS ARE SELECTED: (630 = 1)



IF CURRENT CONTROL FAULTS ARE SELECTED: (630 = 0)



For detailed descriptions of the bits in Parameter 101 refer to the 1395 Troubleshooting Manual.

Parameter 102 – Pre Ramp Velocity Reference [Pre Ramp Vel Ref]

Internal Units : 4096 = 1000h = 1 pu = base motor speed

Programming Terminal units : RPM

Description : This parameter indicates the value of the velocity reference that has been currently selected by the reference control. When a 32 bit velocity reference is used, this will be the most significant 16 bits or upper word. This data is input to the velocity reference ramp software.

Parameter 103 – Ramp Velocity Reference [Ramp Vel Ref]

Internal Units : 4096 = 1000h = 1 pu = base motor speed

Programming Terminal units : RPM

Description : This parameter indicates the value of the Ramp Velocity Reference after being processed by the Linear Accel/Decel Ramp and S Contour filter. The number contained in this variable is conditionally offset by the output of the Droop and Process Trim functions and then becomes the Final Velocity Reference (Parm 104).

The value of Parm 103 represents the most significant 16 bits or upper word when a 32 bit speed reference is in use.

Parameter 104 – Final Velocity Reference [Final Vel Ref]

Internal units : 4096 = 1000h = 1 pu = base motor speed

Programming Terminal units : RPM

Description: This parameter indicates the value of the Ramp Velocity Reference after being offset by the Droop Compensation and Process Trim output variables.

The value of Parameter 104 represents the most significant 16 bits or upper word when a 32 bit speed reference is in use.

Parameter 105 – Armature Voltage Feedback [Arm Voltage Fdbk]

Internal units : 4096 = 1000h = 1 PU = rated Motor voltage

Programming Terminal units : volts

Description: This parameter indicates the present value of the armature voltage feedback. It is scaled in internal units so that a value of 4096 represents rated motor voltage.

Parameter 106 – Velocity Feedback [Velocity Fdbk]

Internal Units : 4096 = 1000h = 1 PU = base motor speed

Programming Terminal units : RPM

Description : Velocity Feedback indicates the latest measured motor velocity. This information could originate from a digital encoder, analog tachometer, or armature voltage feedback, depending upon the selected feedback device (Parameter 621).

Parameter 107 – Position Feedback [Position Fdbk]

Internal Units : 4096 = 1000h = 1 PU = 1 pu position

Programming Terminal units : None

Description : Position Feedback indicates the latest measured angular motor position. This information could originate from a digital encoder, analog tachometer, or armature voltage feedback, depending upon the selected feedback device (Parameter 621). This signal will be scaled so that 31250 represents the change in motor position that will occur over 1 second when running at base motor speed. It is also true that the position change per motor revolution is equal to 1,875,000/ base motor speed in RPM

Parameter 108 – Velocity Feed Forward [Vel Feed Fwd]

Internal Units : 4096 = 1000h = 1 PU = base motor speed

Programming Terminal units : RPM

Description : Velocity Feed Forward indicates the difference between the Final Velocity Reference (parm 104) multiplied by the KF term and Velocity Feedback (parm 106). This value, when multiplied by the KP Velocity Loop gain divided by 8, becomes the proportional part of the Torque Command.

Parameter 109 – Position Error [Position Error]

Internal Units : 4096 = 1000h = 1 pu position

Programming Terminal units : None

Description : Position Error indicates the difference between the Position Reference and Position Feedback (parm 107). Position Reference is the integrated value of Parm 104 (Final Vel Ref) and has the same units as Parm 107 (Position Feedback). Position Error when multiplied by the KI Velocity Loop gain, becomes the integral part of the Torque Command (Parm 110).

Parameter 110 – Torque Command [Torque Command]

Internal Units : 4096 = 1000h = 1 PU = 100% rated torque

Programming Terminal units : Percent rated torque

Description : Torque Command indicates the latest “torque reference” value. 100% rated torque is the motor torque produced at rated motor armature current and rated motor field current.

The source of the Torque Command is determined by the selection made in Torque Mode (parm 625).

Parameter 111 – Armature Current Reference [Arm Current Ref]

Internal Units : 4096 = 1000h = 1 PU = 100% rated arm. current

Programming Terminal units : Amps

Description : The parameter indicates the latest armature current reference value. This is the Torque Command after it has been divided by the Flux Command, range limited to the forward and reverse current limits, and then slew limited to the di/dt limit value (parm 668).

Parameter 112 – Armature Current Feedback [Arm Current Fdbk]

Internal Units : 4096 = 1000h = 1 PU = 100% rated arm. current

Programming Terminal units : Amps

Description : This parameter indicates the latest armature current feedback value.

Parameter 113 – Armature Current PI Output [Arm Current PI Out]

Internal Units : 2048 = 1 pu armature voltage

Programming Terminal units : None

Description : This parameter indicates the latest output of the armature current PI regulator.

Parameter 114 – Armature Current Firing Angle [Arm Cur Fire Ang]

Internal Units : 2048 = 90 degrees

Programming Terminal units : None

Description : This parameter indicates the latest armature current firing angle, angle of retard, alpha.

Parameter 115 – Flux Command [Flux Command]

Internal Units : 4096 = 1000h = 1 PU = 100% rated field flux

Programming Terminal units: Percent rated field flux

Description : This parameter indicates the latest field flux reference value as determined by the field control. When field weakening, this parameter may be less than the Field Flux Reference (Parm 676) or the Field Economy Reference (parm 674).

100% rated field flux represents the motor field flux present when operating at base motor speed with the rated armature voltage present across the armature. For a constant motor speed, as field flux is reduced, the armature voltage should decrease proportionally. The field flux linearization table (para 677 thru 685) ensures that the relationship between field flux and armature voltage remains linear.

Parameter 116 – AC Line Voltage [AC Line Voltage]

Internal Units : volts x 10

Programming Terminal units: Volts

Description : This parameter indicates the latest AC line voltage as measured by the drive.

Parameter 117 – Field Current Reference [Fld Current Ref]

Internal units : 4096 = 1000h = 1 pu = 100% rated motor field current

Programming Terminal units: Amps

Description : This parameter indicates the latest field current reference as calculated by the drive. This value is derived from the Flux Command by use of the flux linearization table (Parm 677 – 685).

Parameter 118 – Field Current Feedback [Fld Current Fdbk]

Internal units : 4096 = 1000h = 1 pu = 100% rated motor field current
Programming Terminal units: Amps
Description : This parameter indicates the latest field current feedback value as measured by the drive.

Parameter 119 – Process Trim Output [Proc Trim Output]

Internal units : 4096 = 1000h = 1 pu
Programming Terminal units: None
Description : This parameter represents the scaled and limited output of the process trim function. The Process trim consists of a general purpose PI regulator that uses reference and feedback inputs (parms 161 and 162). The number contained in this parameter may also be used to offset the velocity or torque reference by making the appropriate selection in Process Trim Select (Parm 628).

Parameter 120 – CEMF Feedback [CEMF Feedback]

Internal units : 4096 = 100% rated motor voltage
Programming Terminal units: Volts
Minimum Value: N/A
Maximum Value: N/A
Default Value: N/A
Function: Software Test Point
Description : This is the value of CEMF used as a feedback value for the CEMF PI regulator in the drive. It is calculated by subtracting the motor IR drop from the actual Armature Voltage Feedback. The Armature Resistance Parameter (#614) is used to calculate the motor IR Drop.

Parameter 121 – Flux Trim [Flux Trim]

Internal units : 4096 = 100% rated motor voltage
Programming Terminal units: %
Minimum Value: N/A
Maximum Value: N/A
Default Value: N/A
Function: Software Test Point
Description : This is the value of Field Flux Trim from the output CEMF regulator in the Drive.

Parameter 122 – Encoder Velocity [Encoder Velocity]

Internal units : 4096 = base motor speed
Programming Terminal units: RPM
Minimum Value: N/A
Maximum Value: N/A
Default Value: N/A
Function: Software Test Point
Description : This is the measured velocity feedback from the encoder feedback

Parameter 123 – Velocity PI Output [Velocity PI Out]

Internal units : 4096 = 100% rated motor torque
Programming Terminal units: %
Minimum Value: N/A
Maximum Value: N/A
Default Value: N/A
Function: Software Test Point
Description : This is the value of the output of the Velocity PI Regulator. This value will match the value in Torque Command (Parameter110) when in Speed Mode (Parameter 625 = 1).

Parameter 124 – Velocity Error [Velocity Error]

Internal units : 4096 = base motor speed
Programming Terminal units: RPM
Minimum Value: N/A
Maximum Value: N/A
Default Value: N/A
Function: Software Test Point
Description : This is the difference between the Final Velocity Reference (Parameter 104) and Velocity Feedback (Parameter 106).

Parameter 125 – Process Trim PI Input [PTrim PI Input]

Internal units : 4096 = 1 per unit
Programming Terminal units: None
Minimum Value: N/A
Maximum Value: N/A
Default Value: N/A
Function: Software Test Point
Description : This is the input to the Process Trim Regulator.

Parameter 150 – Logic Command 1 [Logic Cmd 1]

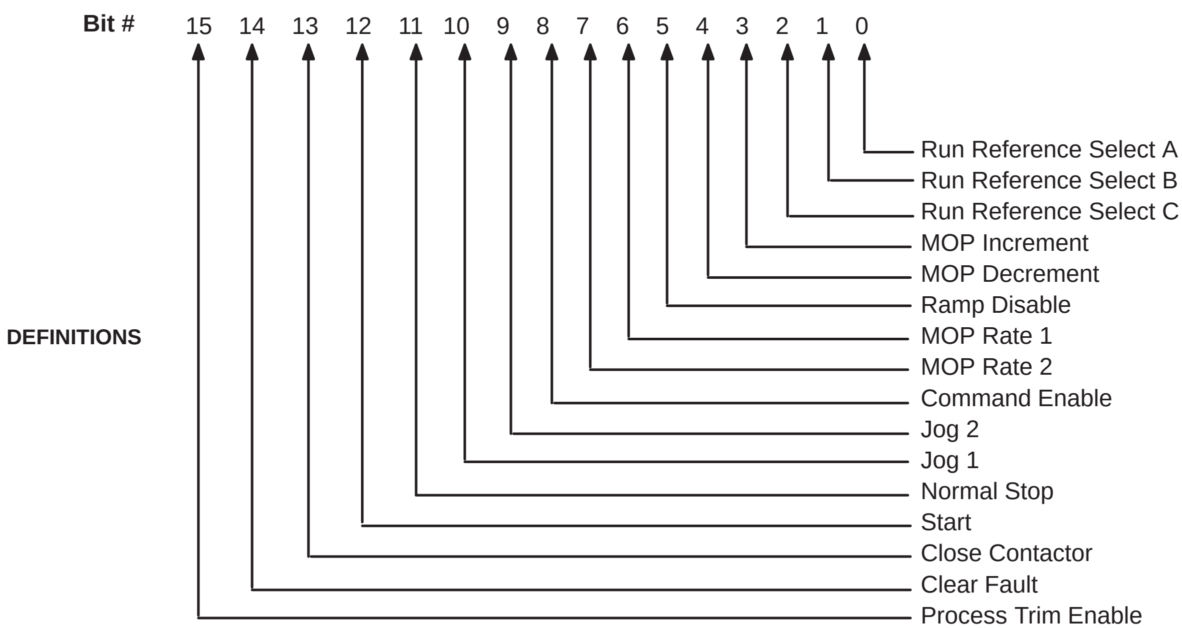
Internal units : None

Programming Terminal units: Bit Field

Description : This is a word of fast data used to control drive logic operation. The information is contained in binary (boolean) form. If a bit is set, the associated function is enabled, otherwise the function is disabled (inactive).

The functions contained in Logic Command 1 are similar to those in Logic Command 2 and 3. The software checks the state of this signal in Logic Command 1 before making the selection of Logic Command 1 or 2. In Logic Command 2, the command enable bit is ignored. Regardless of the selected Logic Command word (1, 2, or 3), a Stop request from any Logic Command word will be honored.

The bits in the Logic Command words are defined as follows:



In addition to the basic bit definitions provided above, several bits are used together for the purpose of selection. Bits 0,1,2 are grouped to determine which speed reference is used for input to the velocity control. Bits 6 and 7 are used to determine which MOP Accel/Decel rates are in effect. Bit usage is defined in Tables 5.B and 5.C.

Run Reference Select (bits 0,1,2) : These three bits select the velocity reference for the motor. The Start input in the logic command will close the contactor and the drive will run the motor at the velocity selected by these run reference select bits. For each run reference select combination, there corresponds a speed reference parameter.

Table 5.B
Logic Command Word Bits 0,1,2

2	1	0	Definition	Selected Parms
0	0	0	External Speed Reference	154
0	0	1	Preset Speed 1	633
0	1	0	Preset Speed 2	634
0	1	1	Preset Speed 3	635
1	0	0	Preset Speed 4	636
1	0	1	Preset Speed 5	637
1	1	0	MOP Forward Speed	MOP
1	1	1	MOP Reverse Speed	MOP

External speed reference indicates Parameters 153 and 154 will be the velocity reference.

Preset speeds 1 to 5 indicate Parameters 633 to 637 respectively, will be the selected velocity reference.

MOP forward speed selects the positive MOP command velocity. MOP reverse speed selects the negative MOP command velocity. For the MOP function, the start input will cause the MOP forward/reverse speed to be set to the MOP minimum speed (Parameter 650)

MOP increment (Bit 3): A 1-bit field when set to 1, will cause the MOP to increase speed by the rate selected in the MOP rate bits (6,7) in the logic command. The MOP command velocity will continue to increase until this bit is cleared or a speed limit is reached. This limit can be the MOP Min Speed (Parameter 650) or the reverse speed limit (Parameter 607).

Ramp Disable (Bit 5) : A 1-bit field that will disable the ramp function in the Drive when set to 1. The ramp function limits the rate of change of velocity command, or acceleration/deceleration, to the rate set by the Accel Time and Decel Time parameters (Parameters 651 and 652). The ramp velocity reference (Parameter 103) becomes the same value as the Pre Ramp Velocity reference (Parameter 102) when the ramp disable is set to 1. Ramp disable will also cause the MOP ramp to be bypassed when performing a stop function with a MOP reference selected.

MOP rate 1, 2 (Bits 6,7): A 2-bit field, that will specify the accel and decel rates to be used by the MOP controller. There are four possible rates. Accel and Decel rates are separately adjustable by Parameters 641 to 648. The Table for this two bit field is shown in Table 5.C.

Table 5.C
Logic Command Word Bits 6, 7

Bit 7	Bit 6	Definition	Selected Parms
0	0	MOP 1 accel, decel	641, 645
0	1	MOP 2 accel, decel	642, 646
0	0	MOP 3 accel, decel	643, 647
1	1	MOP 4 accel, decel	644, 648

Command Enable (Bit 8) : A 1-bit field used to select one of the three logic commands in the Drive. For details see Table 5.D.

If the command enable bit is set to 1 in Logic Command 3, then Logic Command 3 is the active logic command accepted by the Drive. If the command enable bit in logic command 3 is set to 0, then the Logic Command 1 is checked. If the command enable in Logic Command 1 is set to 1, then Logic Command 1 is the active logic command accepted by the drive. If the command enable in Logic Command 1 is set to 0, the Logic Command 2 is the active logic command accepted by the Drive. The Logic Command 2 enable bit is ignored.

Table 5.D
Logic Command Word Bit 8

Bit 8	1	0
Logic Command 1	Drive Active From Logic Command 1	Drive Active From Logic Command 2
Logic Command 2	BIT 8 IGNORED	BIT 8 IGNORED
Logic Command 3	Drive Active From Logic Command 3	Logic Command 1 Checked

A Stop request from any Logic Command word will always be acknowledged, regardless of the state of the command enable bit.

Jog 2 (Bit 9) : A 1-bit field specifying the drive to select the Jog 2 Speed (Parameter 639). When set to 1, the contactor will close and velocity regulation will begin.

The drive will continue to run using the Jog 2 Speed reference until this bit is set to 0. At this time, velocity reference will be set to zero and the drive will regenerate to a stop. Once the motor has stopped, velocity regulation will stop. The contactor will remain closed for the time specified by Jog Dwell (Parameter 711). The ramp function can be selected while jogging by properly programming JOG RAMP ENABLE (Parameter 626).

Jog 1 (Bit 10) : A 1-bit field specifying the drive to select the Jog 1 Speed (Parameter 638). When set to 1, the contactor will close and velocity regulation will begin.

The drive will continue to run using the Jog 1 speed reference until this bit is set to 0. At this time, velocity reference will be set to zero and the drive regenerate to a stop. Once the motor has stopped, velocity regulation will stop. The contactor will remain closed for the time specified by Jog Dwell (Parameter 711). For jogging, the ramp function may be using the Jog Ramp Enable (Parameter 626).

Normal Stop (Bit 11) : A 1-bit field specifying the drive to decelerate the motor to zero velocity, and when at zero velocity, open the contactor. The normal stop bits in both Logic Command 1,2 and 3 are active, regardless of the state of the command enable bit in Logic Command 1 or 3. Normal Stop will override the Start function.

Important: Refer to Chapter 6 – Installation, for important information and warnings regarding stop mode interfaces with the 1395.

Start (Bit 12) : A 1-bit field specifying the drive to close the contactor and run the motor at the speed specified in the reference select A, B or C in the logic command (bits 0,1,2). This bit will be treated as a maintained signal if the Maintained Start (Parameter 624) is set to 1. For a maintained Start, the motor will stop should this bit be cleared. If maintained Start is not selected (Parameter 624 = 0), this bit will be latched by the Drive and a Stop input will be required to stop the motor.

Close Contactor (Bit 13) : A 1-bit field when set to 1, closes the motor contactor. When set to 0, opens the contactor. On the rise of this input, the contactor will be manually closed. The contactor will remain closed until this bit is set to 0, or a hard fault, soft fault or ECOAST request occurs.

Clear Fault (Bit 14) : A 1-bit field that will clear all hard and soft faults present in the Drive when set to 1. When set to 0, the clear faults is inactive.

Process trim enable (Bit 15): A 1-bit field that will make the Process trim function active when set to 1. The Process Trim Reference and Feedback (Parameters 161,162) will be used to generate the Process Trim Output (Parameter 119). When this bit is set to 0, the Process Trim Output is set to zero and the Process Trim Reference and Feedback inputs are not used.

Parameter 151 – Logic Command 2 [Logic Cmd 2]

Internal units : None

Programming Terminal units: Bit Field

Description : This word controls Drive logic operation when the Command/Enable bit in Logic Command 1 or Logic Command 3 is low (0). The Stop request bit in Logic Command 2 is active, regardless of the Command/Enable selection status. All other functions present in Logic Command 2 are identical to Logic Command 1.

Parameter 152 – Logic Command 3 [Logic Cmd 3]

Internal units : None
Programming Terminal units: Bit Field

Description : This controls Drive logic operation when the Programming Terminal is in control of the Drive. All functions present in Logic Command 3 are identical to Logic Command 1. The Command/Enable bit in logic command 3 will select Drive control with logic command 3 (if set) regardless of the state of the Command/Enable bit in other logic words. The Stop bit in logic command word 3 is logically OR'D with the Stop bits in logic command word 1 and 2.

Parameter 153 – Velocity Reference Fraction [Vel Ref Fraction]

Internal units : 65535 = ffffh = base motor speed / 4096
Programming Terminal units: None

Description : This word supplies the fractional part of an external velocity reference when external velocity control has been selected in the Logic Command word. The data contained in this word represents the low order, fractional portion of a 32 bit velocity reference.

The motor base speed value is always equated to the following number representation:

Parm 154	Parm 153
+/– 4,096	0

Use of this parameter allows extended resolution when specifying an external velocity reference. Note that a value of 32768 (8000h) is equivalent to 1/2 of 1 unit of reference in Parameter 154. Similarly, 16384 (4000h) is equivalent to 1/4 of 1 unit of reference, and 65535 (ffffh) is equivalent to 65535/65536 or 1 unit of reference. In this way, Parameter 153 can be thought of as a means of specifying an additional fraction of one unit of velocity reference for Parameter 154. If fraction resolution is not needed, then Parameter 153 should not be linked and its value will be defaulted to zero.

Parameter 154 – Velocity Reference Whole [Vel Ref Whole]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM

Description : This word supplies the whole number part of an external velocity reference when external velocity control has been selected in the Logic Command word. The data contained in this word represents the high order, whole number portion of a 32 bit velocity reference.

Parameter 156 – Tach Velocity [Tach Velocity]

Internal units : 4096 = 1000h = 1 pu = base motor speed

Programming Terminal units: RPM

Description : This word supplies a motor velocity feedback signal when an analog tachometer is used. This input will typically be linked to an analog input parameter from the Discrete Adapter Board. The analog scaling for the adapter should be set up so that a value of 4096 in this parameter represents base motor speed.

When Tach Velocity is used for velocity feedback, a value of “2” must be entered in Feedback Device Type (Parm 621).

Parameter 157 – Torque Reference [Torque Reference]

Internal units : 4096 = 1000h = 1 pu = 100% rated motor torque

Programming Terminal units: Percent rated motor torque

Description : This word supplies an external motor torque reference to the Drive. The external torque reference can be selected by setting Torque Mode (Parm 625) to a value of “2”. The external torque reference can also be modified by summing the Process Trim output when the Process Trim Select (Parm 628) contains a value of “2”.

The external torque reference input is also used when either the “minimum” or “maximum” torque modes are selected (parm 625). These functions automatically make a selection between the external torque reference value and the output of the velocity speed regulator.

The external torque reference input should be scaled so that a value of 4096 represents 100% rated motor torque. This is the torque that the motor would produce when operating at rated armature current and rated field current.

Parameter 159 – Flux Feed Forward [Flux Feed Fwd]

Internal units : 4096 = 1000h = 1 pu = 100% motor field flux

Programming Terminal units: Percent of full motor field flux.

Description : This word supplies an external flux reference to the Drive. The drive will use this input when the External Feed Forward Enable Bit is set in Flux Mode Select (Parm 627).

This input could be used to bypass the flux calculation in the flux control software. The flux calculation produces a flux command that is inversely proportional to speed when motor speeds are above the Minimum Field Regulate Speed.

Parameter 160 – CEMF Reference [CEMF Reference]

Internal units : 4096 = 1000h = 100% motor CEMF

Programming Terminal units: Percent of full motor CEMF.

Description : This word supplies a n external CEMF reference to the flux control. This input would be used when it is desired to operate the field flux control in the CEMF mode of operation. The Drive will use this input when the CEMF Control Enable bit is set in Flux Mode Select (Parm 627).

The flux control will use the CEMF reference input as both the variable in the flux calculation and also as the reference input to the CEMF regulator. The flux calculation produces a flux command that is inversely proportional to speed when motor speeds are above the Field Weakening Speed (Parm 686).

Parameter 161 – Process Trim Reference [Process Trim Ref]

Internal units : 4096 = 1000h = 1pu

Programming Terminal units : None

Description : This is the reference input value for Velocity Trim. When the Process Trim function has been enabled by setting the Trim Enable bit in the Logic Command parameter, then this input will be used by the process trim PI regulator. Process trim will then update the Process Trim Output (parm 119) based on the value of this input.

5-60**Parameter 162 – Process Trim Feedback [Process Trim Fdbk]**

Internal units : 4096 = 1000h = 1pu

Programming Terminal units : None

Description : This is the feedback value for Process Trim. When the Process Trim has been enabled by setting the Process Trim Enable bit in the Logic Command parameter, then this input will be used by the process trim PI regulator. Process Trim will then update the Process Trim Output parameter based on the value of this input.

Parameter 163 – Velocity Indirect 1 [Vel Indirect 1]

Internal units :

Programming Terminal units :

Description : This is the Fast Sink, with its pointer in Parameter 600, Velocity Parameter Select 1.

Parameter 164 – Velocity Indirect 2 [Vel Indirect 2]

Internal units :

Programming Terminal units :

Description : This is the Fast Sink, with its pointer in Parameter 601, Velocity Parameter Select 2.

Parameter 165 – Velocity Indirect 3 [Vel Indirect 3]

Internal units :

Programming Terminal units :

Description : This is the Fast Sink, with its pointer in Parameter 602, Velocity Parameter Select 3.

Parameter 166 – Velocity Indirect 4 [Vel Indirect 4]Veloc

Internal units :
Programming Terminal units :
Description : This is the Fast Sink, with its pointer in Parameter 603, Velocity Parameter Select 4.

Parameter 167 – Torque Reference 2 [Torque Ref 2]

Internal units : 4096 = 100% Rated Motor Torque
Programming Terminal units : Percent Rated Motor Torque
Minimum Value: NA
Maximum Value: NA
Default Value: 0
Function: Torque Control

Description : This is a Parameter Sink that can be used to bring a second Torque Reference into the Drive. The data that is linked to this parameter is scaled using the Slave % 2 parameter and then summed with the Torque Reference value from Parameter #157.

Parameter 600 – Velocity Parameter 1 Select [Vel Param 1 Sel]

Internal units : RPM
Programming Terminal units: RPM
Minimum Value: 600
Maximum Value: 732
Default Value: 600

Description : This is the pointer for Parameter 163 Velocity Indirect 1

Parameter 601 – Velocity Parameter 2 Select [Vel Param 2 Sel]

Internal units : RPM
Programming Terminal units: RPM
Minimum Value: 600
Maximum Value: 732
Default Value: 601

Description : This is the pointer for Parameter 164 Velocity Indirect 2

Parameter 602 – Velocity Parameter 3 Select [Vel Param 3 Sel]

Internal units : RPM
Programming Terminal units: RPM
Minimum Value: 600
Maximum Value: 732
Default Value: 602

Description : This is the pointer for Parameter 165 Velocity Indirect 3

Parameter 603 – Velocity Parameter 4 Select [Vel Param 4 Sel]

Internal units : RPM
Programming Terminal units: RPM
Minimum Value: 600
Maximum Value: 732
Default Value: 603

Description : This is the pointer for Parameter 166 Velocity Indirect 4

Parameter 606 – Base Motor Speed [Base Motor Speed]

Internal units : RPM
Programming Terminal units: RPM
Minimum Value: 1
Maximum Value: 6000
Default Value: 1750

Description : Nameplate base motor speed in RPM.

Parameter 607 – Reverse Speed Limit [Rev Speed Limit]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: 0
Default Value: – base speed

Description : This parameter sets a limit on velocity reference in the negative direction and is dependent on the value entered for Base Motor Speed (Parm 606). The full numerical range for Parm 607 is 0 to –6 x the value entered in Parm 606. The reverse motor speed will not be allowed to exceed this value. This parameter is also used together with the absolute overspeed parameter to determine when an absolute overspeed fault will occur. Note that the value entered for this parameter must be negative.

Parameter 608 – Forward Speed Limit [Fwd Speed Limit]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: 0
Maximum Value: 6 x base speed
Default Value: base speed

Description : This parameter sets a limit on velocity reference in the positive direction and is dependent on the value entered for Base Motor Speed (Parm 606). The full numerical range for Parm 607 is 0 to +6 x the value entered in Parm 606. The forward motor speed will not be allowed to exceed this value. This parameter is also used together with the Absolute Overspeed Parameter to determine when an Absolute Overspeed Fault will occur.

Parameter 609 – Encoder PPR [Encoder PPR]

Internal units : pulses per revolution
Programming Terminal units: PPR
Minimum Value: 100
Maximum Value: 32767
Default Value: 1024

Description : Pulse Per Revolution rating of feedback device when using an encoder mounted on the motor. The encoder is used to determine motor feedback velocity.

Parameter 610 – Rated Motor Voltage [Rated Motor Volt]

Internal units : volts x 10
Programming Terminal units: VOLTS
Minimum Value: 75
Maximum Value: 700
Default Value: 240
Function: Torque Control
Description : Nameplate rated motor voltage. This should be the measured armature voltage when the motor is running at base speed with rated field current.

Parameter 611 – Motor Armature Full Load Amps [Motor Arm FLA]

Internal units : Amps x 10
Programming Terminal units: AMPS
Minimum Value: 0.1
Maximum Value: 32767
Default Value: 0.2
Description : Nameplate rated motor armature current

Parameter 612 – Rated Field Motor Current [Rate Fld Mtr Cur]

Internal units : Amps x 10
Programming Terminal units: AMPS
Minimum Value: 0.1
Maximum Value: 32767
Default Value: 0.1
Description : Nameplate rated motor field current.

Parameter 613 – Motor Inertia [Motor Inertia]

Internal units : seconds x 100
Programming Terminal units: Seconds
Minimum Value: 0.01
Maximum Value: 10.00
Default Value: 6.0
Description : This parameter represents the time, in seconds, taken for the uncoupled motor to accelerate from zero speed to base speed with rated motor armature and field current applied.

Parameter 614 – Armature Resistance [Arm Resistance]

Internal units : 4096 = 1000h = 1 per unit = 100% of rated armature voltage.
Programming Terminal units: Percent of rated armature voltage
Minimum Value: 0%
Maximum Value: 100.0%
Default Value: 5.0%

Description: This parameter represents the armature resistance drop (IR Compensation), expressed as a percent of rated armature volts, that would be measured with the armature locked and with rated motor armature and field current applied. Typical values do not exceed 5%.

Parameter 615 – Rated Armature Bridge Current [Rated Arm Brdg I]

Internal units : Amps x 10
Programming Terminal units: AMPS
Minimum Value: 0.1
Maximum Value: 32767
Default Value: 20.0
Description: The drive armature bridge current per the Table in the Parameter Programming Procedures portion of the Start-Up chapter.

Parameter 616 – Rated Field Bridge Current [Rated Fld Brdg I]

Internal units : Amps x 10
Programming Terminal units: AMPS
Minimum Value: 0.1
Maximum Value: 32767
Default Value: 10.0

Description: The drive field bridge current rating. Used for Field Current Feedback scaling, Field Flux and Field Weakening Control.

Parameter 617 – Rated AC Line Voltage [Rated AC Line]

Internal units : Volts x 10
Programming Terminal units: VOLTS
Minimum Value: 150
Maximum Value: 660
Default Value: 460.0
Description: The AC line voltage connected to the drive.

Parameter 620 – System Reset Select [Sys Reset Select]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1
Default Value: 0

Description: This parameter determines whether terminal TB3-3 provides the System Reset function or the Logic Command Stop function. The choices are:

0 = System Reset

1 = Normal Stop

The System Reset function requires a Normally Open operator device which closes to cause a reset. A reset then allows the 1395 to perform its power up sequence. Any data not previously stored in EEPROM will be lost.

The Logic Command Normal Stop function requires a Normally Closed operator device. When opened, the drive will stop. The stop method (ramp stop, coast stop, regen stop, etc.) will be determined by the setting of parameter 624 (maintain start) and the logic command parameter that has control of the Drive.

Parameter 621 – Feedback Device Type [Fdbk Device Type]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 2
Default Value: 1

Description: Is the selected source for motor velocity feedback. Choices are:

0 = Encoder feedback.

1 = Armature voltage feedback. This limits the motor speed to base speed or less.

2 = Analog tachometer feedback. When choosing this function, an analog input should be linked to parameter 156 (Tach Velocity).

3 = No feedback device in use. This will disable the speed regulator and tach loss fault detection. This is used in torque mode applications.

Parameter 622 – Contactor Type [ContactorType]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1
Default Value: 1

Description: Parameter 622 selects the location of the contactor in the circuit. The choices are:

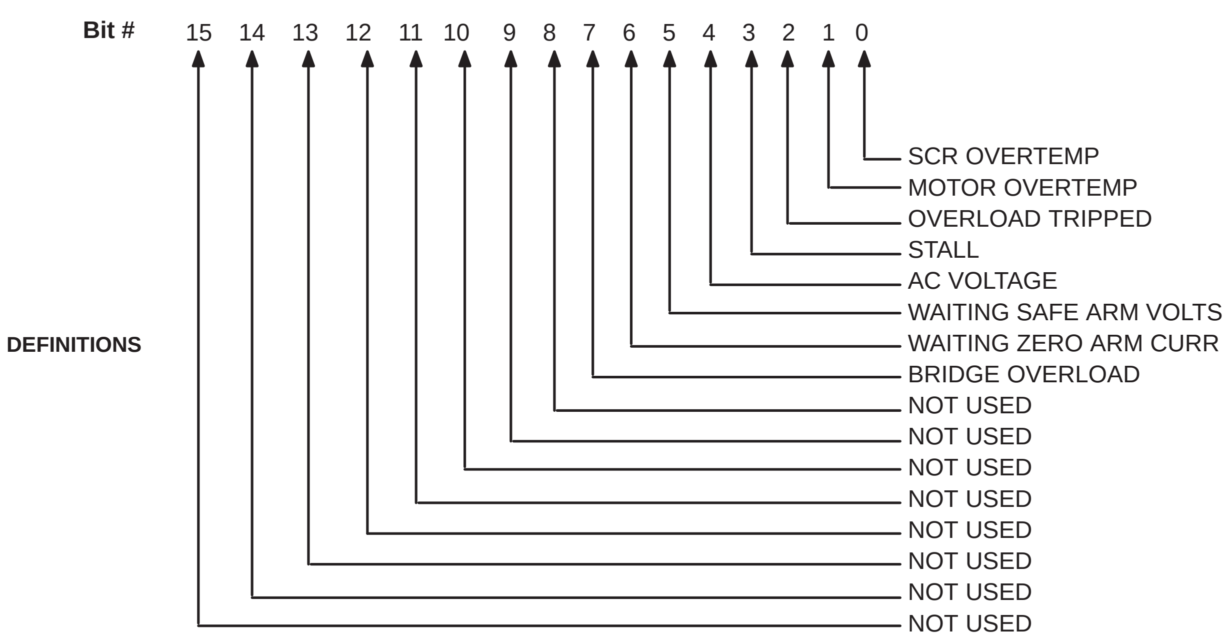
AC Contactor Mode, 0 = Contactor interrupts AC supply. Contactor will not automatically close/open with Drive Start/Stop operation.

DC Contactor Mode, 1 = Contactor interrupts DC armature circuit. Contactor will automatically close/open with Drive Start/Stop operation.

Parameter 623 – Fault Select [Fault Select]

Internal units : None
Programming Terminal units: Bit adjustable units
Minimum Value: All bits off
Maximum Value: All bits on
Default Value: All bits set to 1

Description: This word indicates the boolean selection of soft or warning configurable faults for the drive. If a bit is set to 1, the corresponding fault is treated as soft, otherwise it is considered a warning. Soft faults disable drive operation. Warning faults are only reported and the drive may continue to run (Refer to the Troubleshooting manual for a detailed description of these faults). The bits in this word are selected as follows:



Parameter 624 – Maintained Start [Maintain Start]

Internal units : None

Programming Terminal units: 0/1 selection

Minimum Value: 0

Maximum Value: 3

Default Value: 2

Description: Parameter 624 selects the type of Start signal required in the logic command word. Choices are:

0 = Start signal treated as a momentary input. The drive will latch the start input. A Stop bit will be required to unlatch the start function.

1 = Start signal treated as a maintained input. The motor will stop should the Start bit become 0, or the Stop bit become 1.

2 = Software Coast / Regen Stop option. The start signal will be treated as a maintained input. The Drive will Regen Stop when the start bit is removed. The Drive will Coast Stop when the Stop bit is set.

3= All Coast Stop option. The start signal will be treated as a maintained input. The Drive will Coast Stop (phase back SCR firing and open Main Contactor) under all Stop conditions:

- Remove Start bit
- Set Stop bit
- Remove Jog bit

IMPORTANT: Refer to Chapter 6 – Installation, for important information and warnings regarding stop mode interfaces with the 1395.

Parameter 625 – Torque Mode [Torque Mode]

Internal units : None

Programming Terminal units: 0/1 selection

Minimum Value: 0

Maximum Value: 5

Default Value: 1

Description: Parameter 625 selects the torque command source within the Drive. Choices are:

0 = Zero torque command under all conditions.

1 = Velocity regulator output

2 = External torque reference comes from parameters 157 (Torque Reference).

3 = Minimum select of 1 & 2. Selecting this function will automatically connect this algebraic minimum of either the velocity regulator output or the external torque reference to the torque mode.

4 = Maximum select of 1 & 2. Selecting this function will automatically connect the algebraic maximum of either the velocity regulator output or the external torque reference to the torque mode.

5 = Load Response (sum of 1 & 2). Selecting this function will automatically take the algebraic sum of the velocity regulator output and the external torque reference to the torque mode.

Parameter 626 – Jog Ramp Enable [Jog Ramp Enable]

Internal units : None
Programming Terminal units: 0/1 selection
Minimum Value: 0
Maximum Value: 1
Default Value: 0
Description: Parameter 626 selects the use of velocity reference ramp while jogging. Choices are:
0 = No ramp when jogging
1 = Use ramp when jogging

Parameter 627 – Flux Mode Select [Flux Mode Select]

Internal units : None
Programming Terminal units: Bit adjustable field
Minimum Value: All Bits Off
Maximum Value: All Bits On
Default Value: Bit 0 On, all others off.
Description: This word is used to enable options for field weakening and field economy.
Bit 0 – Field Economy Enable. When Field Economy is selected, the field economy reference (param 674) specifies the field command (param 115) when the motor has been stopped for the time specified in the field economy delay (param 675).

Bit 1 – Field Weakening Enable. When field weaken enable is selected, the field flux command will be supplied by the field weakening control software. This also enables the CEMF regulator output as a trim for the field flux command.

Bit 2 – External Feed Forward Enable. When the External Flux Feed Forward option is selected, the flux feed forward value (parm 159) is used as the basis for determining the field flux command (param 115). The field weaken enable bit must also be on for this option to be effective.

Bit 3 – Counter EMF Control Enable. When external CEMF Reference is selected, the external CEMF reference value (parm 160) divided by the absolute value of velocity feedback (parm 106) will be used as the basis for determining the field flux command (parm 115). The CEMF regulator with the gains nonzero (parms 672, 673), can offset the feed forward term. To disable CEMF regulation when using the external feed forward, set the KI, KP gain to zero. The Field weaken enable bit must also be on for this option to be effective.

Bit 4 – CEMF Hold: When set, this bit holds the integral term and output of the CEMF regulator to the last value before the bit was set. When clear, the CEMF regulator is not affected.

Bit 6 – Disable Field Loss Detection: When set, this bit will disable the check for field loss. This feature could be used in applications where external field supplies or permanent magnet motors are used. When clear, field loss detection is active. Caution should be used when disabling the Field Loss Detection feature. Damage to equipment or injury to personnel could occur during an undetected field loss with non-permanent magnet type motors.

Bit 7 – No Flux Compensation: When set, the torque command will not be divided by Flux to Produce the Armature Current Command. As a result, the flux will be treated as 100%, even if the field is weakened. If bit 7 is set to 0, the torque command will be divided by flux to produce the armature current command.

Parameter 628 – Process Trim Select [Proc Trim Select]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 3
Default Value: 0
Description: This is a word of data containing one of two selections for applying the output of the process trim regulator. Possible selections are:

0 = Do not use process trim output
1 = Trim velocity reference
2 = Trim torque reference
3 = Trim Velocity with Ramp Stop

Parameter 629 – Motor Overload Select [Mtr Overload Sel]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 4
Default Value: 1
Description: This parameter specifies a selection of motor overload characteristics:

0 = Overload function disabled
1 = 60 seconds to trip at 150% armature current for externally cooled motors.
2 = 60 seconds to trip at 200% armature current for externally cooled motors.
3 = 60 seconds to trip at 150% armature current for self cooled motors.
4 = 60 seconds to trip at 200% armature current for self cooled motors.

Parameter 630 – Fault Report [Fault Report]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1
Default Value: 1
Description: This parameter selects whether Velocity or Current Control fault status will be written to the FAULT WORD (Parm 101).
0 = Select Current Processor Faults
1 = Select Velocity Processor Faults

Parameter 631 – Velocity Feedback Filter Select [Vel Filter Selct]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 3
Default Value: 0
Description: This parameter selects a 2 pole feedback filter that will be used. One of three selections can be made as follows:
0 = No filter
1 = 35/49 radian filter
2 = 20/40 radian filter
3 = Lead/Lag Velocity Filter

Parameter 632 – Warning Select [Warning Select]

Internal units : None
Programming Terminal units: Bit field
Minimum Value: All bits off
Maximum Value: All bits on
Default Value: 1
Description: This parameter can enable/disable certain warning fault detection. If set to a 1, that particular fault will not be reported in the fault word (parameter 100), or in the fault queue. If set to 0, the fault will be detected and reported as usual. The following bits define the fault:
Bit 0 – Motor overload pending
Bit 1 – Excessive Armature volts demand
Bit 2 – Bridge overload pending

Parameter 633 – Preset Speed 1 [Preset Speed 1]

Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the drive when preset 1 has been selected in the logic command word.

Parameter 634 – Preset Speed 2 [Preset Speed 2]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the drive when preset 2 has been selected in the logic command word.

Parameter 635 – Preset Speed 3 [Preset Speed 3]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the drive when preset 3 has been selected in the logic command word.

Parameter 636 – Preset Speed 4 [Preset Speed 4]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the drive when preset 4 has been selected in the logic command word.

Parameter 637 – Preset Speed 5 [Preset Speed 5]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the Drive when preset 5 has been selected in the logic command word.

Parameter 638 – Jog 1 Speed [Jog 1 Speed]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the Drive when Jog 1 has been selected in the logic command word.

Parameter 639 – Jog 2 Speed [Jog 2 Speed]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0
Description: This will be the velocity reference used by the Drive when Jog 2 has been selected in the logic command word.

Parameter 641 – Mop Accel 1 [Mop Accel 1]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 6553.5
Default Value: 0.1
Description: This parameter determines the acceleration rate of the MOP generated velocity reference when Mop rate 1 has been selected in the logic command word. The units are in seconds to accelerate from 0 to base speed.

Parameter 642 – Mop Accel 2 [Mop Accel 2]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 6553.5
Default Value: 0.1
Description: This parameter determines the acceleration rate of the MOP generated velocity reference when Mop rate 2 has been selected in the logic command word. The units are in seconds to accelerate from 0 to base speed.

Parameter 643 – Mop Accel 3 [Mop Accel 3]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 6553.5
Default Value: 0.1
Description: This parameter determines the acceleration rate of the MOP generated velocity reference when Mop rate 3 has been selected in the logic command word. The units are in seconds to accelerate from 0 to base speed.

Parameter 644 – Mop Accel 4 [Mop Accel 4]

Internal units : Seconds x 10

Programming Terminal units: Seconds

Minimum Value: 0.1

Maximum Value: 6553.5

Default Value: 0.1

Description: This parameter determines the acceleration rate of the MOP generated velocity reference when Mop rate 4 has been selected in the logic command word. The units are in seconds to accelerate from 0 to base speed.

Parameter 645 – Mop Decel 1 [Mop Decel 1]

Internal units : Seconds x 10

Programming Terminal units: Seconds

Minimum Value: 0.1

Maximum Value: 6553.5

Default Value: 0.1

Description: This parameter determines the deceleration rate of the MOP generated velocity reference when Mop rate 1 has been selected in the logic command word. The units are in seconds to decelerate from base speed to zero speed.

Parameter 646 – Mop Decel 2 [Mop Decel 2]

Internal units : Seconds x 10

Programming Terminal units: Seconds

Minimum Value: 0.1

Maximum Value: 6553.5

Default Value: 0.1

Description: This parameter determines the deceleration rate of the MOP generated velocity reference when Mop rate 2 has been selected in the logic command word. The units are in seconds to decelerate from base speed to zero speed.

Parameter 647 – Mop Decel 3 [Mop Decel 3]

Internal units : Seconds x 10

Programming Terminal units: Seconds

Minimum Value: 0.1

Maximum Value: 6553.5

Default Value: 0.1

Description: This parameter determines the deceleration rate of the MOP generated velocity reference when Mop rate 3 has been selected in the logic command word. The units are in seconds to decelerate from base speed to zero speed.

Parameter 648 – Mop Decel 4 [Mop Decel 4]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 6553.5
Default Value: 0.1
Description: This parameter determines the deceleration rate of the MOP generated velocity reference when Mop rate 4 has been selected in the logic command word. The units are in seconds to decelerate from base speed to zero speed.

Parameter 649 – Mop Max Speed [Mop Max Speed]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: 0
Maximum Value: +6 x base speed
Default Value: base speed
Description: This parameter will limit the maximum MOP speed that can be reached. The MOP generated reference velocity will always be less than or equal to this number. The MOP reference speed will also be limited to values less than or equal to Forward Speed Limit (Parm 608), or Reverse Speed Limit (Parm 607) depending on the selected MOP direction.

Parameter 650 – Mop Min Speed [Mop Min Speed]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: 0
Maximum Value: +6 x base speed
Default Value: 0
Description: This parameter will determine the minimum MOP speed that can be reached using the MOP decrease in the logic command. This is also the speed setpoint used when a Start function is executed with the MOP velocity reference selected in the logic control word.

Parameter 651 – Accel Time [Accel Time]

Internal units : seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 6553.5
Default Value: 10.0
Description: This parameter determines the acceleration rate of the velocity reference selected. Units are measured in seconds to accelerate from 0 to base speed. The acceleration ramp applies to speed changes away from zero speed in either the forward or reverse direction. The velocity ramp function can be bypassed by setting bit 5 to 1 in the logic command word.

Parameter 652 – Decel Time [Decel Time]

Internal units : seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 6553.5
Default Value: 10.0
Description: This parameter determines the deceleration rate of the velocity reference for all references. Units are measured in seconds taken to decelerate from base speed to 0 speed. The deceleration ramp applies to speed changes toward zero speed in either the forward or reverse direction. The velocity ramp function can be bypassed by setting a bit 5 to 1 in the logic command word.

Parameter 653 – Desired Contour [Desired Contour]

Internal units : 4096 = 1000h = 100% contour effect
Programming Terminal units: Percent of full contour
Minimum Value: 0%
Maximum Value: 100.0%
Default Value: 0%
Description: This parameter specifies the rounding of the edges of the velocity profile or “S” filtering. This parameter affects the gain of a single pole filter that is cascaded with the velocity ramp function. Increasing the value of this parameter causes the edges of the velocity reference curve to be more rounded. 100% contour represents maximum velocity reference filtering. 0% contour will disable the velocity filter function.

Parameter 657 – Droop Percent [Droop Percent]

Internal units : % droop effect x 10
Programming Terminal units: Percent of base speed @ full load current.
Minimum Value: 0%
Maximum Value: 25.5%
Default Value: 0%
Description: This parameter specifies the percent of base speed that the velocity reference will be reduced when at full load current. For example; given a motor running at base speed and no load, for 5% droop, the speed becomes 95% of base speed at full load current. 0% Droop disables the Droop function.

Parameter 658 – Droop Filter (Gain) [Droop Filter]

Internal units : 4096 = 1000h = 100% droop filtering
Programming Terminal units: Percent of maximum Droop filtering
Minimum Value: 0%
Maximum Value: 100.0%
Default Value: 93%
Description: This parameter determines the gain of a single pole filter used in the droop. A filter is used to correct for stability problems caused by subtracting a function of velocity error from the velocity reference. 100% Droop filtering provides the maximum Droop filtering effect. 0% Droop filter value will disable the entire Droop function.

Parameter 659 – KI Velocity Loop [KI Velocity Loop]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 256
Description: This parameter controls the integral error gain of the velocity regulator. For example: If KI = 8, then 1 pu Velocity Error for 1 second will produce 1 pu Torque Reference.

Parameter 660 – KP Velocity Loop [KP Velocity Loop]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1600
Default Value: 64
Description: This parameter controls the proportional error gain of the velocity regulator. For example: If KP = 8, then 1 pu Velocity Error for 1 second will produce 1 pu Torque Reference.

Parameter 661 – KF Velocity Loop [KF Velocity Loop]

Internal units : none
Programming Terminal units: none
Minimum Value: 0
Maximum Value: 65535
Default Value: 65535
Description: This parameter controls feed forward gain of the velocity regulator.
Setting the KF gain to a value less than one reduces velocity feedback overshoot in response to a step change in velocity reference. The velocity loop response to a step change in load is unaffected by the KF term.

Parameter 663 – Forward Bridge Current Limit [Fwd Brdg Cur Lim]

Internal units : 4096 = 1000h = 100% rated motor current
Programming Terminal units: Percent of rated motor current
Minimum Value: 0.024%
Maximum Value: 260%
Default Value: 50%
Description: This parameter specifies the largest allowable positive motor armature current that will be commanded. Attempts by the speed regulator to exceed this level will be limited to this value. The DC Armature current cannot exceed 2000 Amps.

Parameter 664 – Reverse Bridge Current Limit [Rev Brdg Cur Lim]

Internal units : 4096 = 1000h = 100% rated motor current
Programming Terminal units: Percent of rated motor current
Minimum Value: 0.024%
Maximum Value: 260%
Default Value: 50%
Description: This parameter specifies the largest allowable negative motor armature current that will be commanded. Attempts by the speed regulator to exceed this level will be limited.

Parameter 665 – Start Taper Speed [Strt Taper Speed]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: Base Motor Speed/4096
Maximum Value: 6 x base speed
Default Value: base motor speed
Description: This parameter is associated with the torque taper function. Torque Tapering will begin when motor speed exceeds this speed.

Parameter 666 – End Taper Speed [End Taper Speed]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: Base Motor Speed/4096
Maximum Value: 6 x base speed
Default Value: base motor speed
Description: This parameter is associated with the Torque Taper function. Minimum Taper Current will be used as the upper limit for armature current reference when speed exceeds this speed.

Parameter 667 – Minimum Taper Current [Min Taper Cur]

Internal units : 4096 = 1000h = 100% rated motor current
Programming Terminal units: percent of rated motor current
Minimum Value: 0.024%
Maximum Value: 260%
Default Value: 100%
Description: This is the armature current limit value that will be used for motor speeds above the End Taper Speed value. The final armature current reference value will be limited to a number less than or equal to this number.

Parameter 668 – DI/DT Limit [dI/dT Limit]

Internal units : 4096 = 1000h = 100% rated motor current
Programming Terminal units: percent of rated motor current
Minimum Value: 0.024%
Maximum Value: 260%
Default Value: 12.5%
Description: This parameter specifies the largest change in armature current reference that will be allowed per 4.0 msec sample. A value of 100% indicates that the armature current reference will be allowed to change by no more than rated motor current in a 4.0 msec period.

Parameter 669 – Slave Percent [Slave Percent]

Internal units :
Programming Terminal units: %
Minimum Value: –200
Maximum Value: 200
Default Value: 100
Description: The torque command will be multiplied by slave percent, when the torque mode in Parameter 625 = 2.

Parameter 670 – Slave Percent 2 [Slave Percent 2]

Internal units : 4096 = 1000h = unity gain
Programming Terminal units: Percent gain
Minimum Value: –200%
Maximum Value: 200%
Default Value: 0%
Description: Torque Reference 2 will be scaled by the gain specified in this parameter. The scaled torque will then be summed with the scaled torque reference value from Parameter #157.

Parameter 672 – KI Flux [KI Flux]

Internal units : gain / 3277
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 1638
Description: This parameter controls the integral gain of the CEMF Regulator. For example; If KI flux is equal to 32767, then 1 pu CEMF error will produce 1 pu flux command in 1 second.
The CEMF Regulator is a classical PI regulator that is activated by setting an enable bit in Flux Mode Select (Parm 627). It is used to trim the flux command based on the difference between CEMF Reference (Parm 160) and CEMF Feedback. Trim is limited to a minimum value of 10% of flux command.

Parameter 673 – KP Flux [KP Flux]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 4096
Description: This parameter controls the proportional gain of the CEMF Regulator. For example; If KP flux is equal to 32767, then 1 PU CEMF error will produce 1 pu flux command.

Parameter 674 – Field Economy Reference [Fld Economy Ref]

Internal units : 4096 = 1000h = 100% full motor flux.
Programming Terminal units: percent of full motor field flux.
Minimum Value: 0%
Maximum Value: 100%
Default Value: 50%
Description: This parameter specifies the full flux reference value for the motor when field economy has been enabled in Flux Mode Select (Parm 627). The flux specified by this parameter will be in use when the motor has been stopped for the time specified in Field Economy Delay (Parm 675).

Parameter 675 – Field Economy Delay [Fld Economy Dly]

Internal units : seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0
Maximum Value: 6553.5
Default Value: 30.0
Description: This parameter specifies the time delay, in seconds, after the motor stops before selection of field economy flux reference. This parameter is applicable only when field economy has been enabled by setting a bit in the Flux Mode Select (Parm 627).

Parameter 676 – Field Flux Reference [Fld Flux Ref]

Internal units : 4096 = 1000h = 100% full motor flux.

Programming Terminal units: percent of full motor field flux.

Minimum Value: 0.024%

Maximum Value: 125%

Default Value: 100%

Description: This parameter specifies the full flux reference value for the motor. This value is the highest flux reference value that can be applied to the motor field. For a drive running below base speed (no field weakening), this is the flux value that will be in use.

Parameter 677 – Field Current at 0/8 Flux [Fld I @ 0/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current

Programming Terminal units: None

Minimum Value: 0%

Maximum Value: 100%

Default Value: 0%

Description: This is the first entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 0 armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current. This should always be at 0%.

Parameter 678 – Field Current at 1/8 Flux [Fld I @ 1/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current

Programming Terminal units: None

Minimum Value: 0%

Maximum Value: 100%

Default Value: 6.6%

Description: This is the second entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 12.5% armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 679 – Field Current at 2/8 Flux [Fld I @ 2/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current
Programming Terminal units: None
Minimum Value: 0%
Maximum Value: 100%
Default Value: 14.3%
Description: This is the third entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 25% armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 680 – Field Current at 3/8 Flux [Fld I @ 3/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current
Programming Terminal units: Percent rated field current
Minimum Value: 0%
Maximum Value: 100%
Default Value: 23.1%
Description: This is the fourth entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 37.5% rated armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 681 – Field Current at 4/8 Flux [Fld I @ 4/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current
Programming Terminal units: Percent rated field current
Minimum Value: 0%
Maximum Value: 100%
Default Value: 33.1%
Description: This is the fifth entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 50% rated armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 682 – Field Current at 5/8 Flux [Fld I @ 5/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current

Programming Terminal units: Percent rated field current

Minimum Value: 0%

Maximum Value: 100%

Default Value: 45.5%

Description: This is the sixth entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 62.5% rated armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 683 – Field Current at 6/8 Flux [Fld I @ 6/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current

Programming Terminal units: Percent rated field current

Minimum Value: 0%

Maximum Value: 100%

Default Value: 60%

Description: This is the seventh entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 75 % rated armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 684 – Field Current at 7/8 Flux [Fld I @ 7/8 FLUX]

Internal units : 4096 = 1000h = 100% rated field current

Programming Terminal units: Percent rated field current

Minimum Value: 0%

Maximum Value: 100%

Default Value: 77.7%

Description: This is the eighth entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 87.5 % rated armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current.

Parameter 685 – Field Current at 1.0 Flux [Fld I @ 1/0 FLUX]

Internal units : 4096 = 1000h = 100% rated field current

Programming Terminal units: Percent rated field current

Minimum Value: 0%

Maximum Value: 100%

Default Value: 100%

Description: This is the eighth entry in a 9 element lookup table for converting flux reference commands to field current reference. The lookup conversion is used to linearize the field current reference with respect to flux. This value corresponds to the field current required to produce 100 % rated armature volts when the motor is running at base speed and is in terms of internal units where 4096 = 100% rated field current. This should always be 100%.

Parameter 686 – Field Weakened Speed [Fld Weaken Speed]

Internal units : 4096 = 1000h = base motor speed

Programming Terminal units: RPM

Minimum Value: base speed/8

Maximum Value: 6 x base speed

Default Value: base motor speed

Description: This parameter specifies the speed at which field weakening control and CEMF regulation begins. Field weakening and CEMF operation is enabled by setting bits in the Flux Mode Select (Parm 627). A typical value used for the Field Weakened Speed, is base motor speed.

Parameter 687 – CEMF Reg Preload [CEMF Reg Preload]

Internal units : 4096 = 1000H = 1 pu Flux

Programming Terminal units: Percent of unity flux

Minimum Value: –799.9%

Maximum Value: 799.9%

Default Value: 0

Description: This parameter is associated with the CEMF reset function (bit 5) in parameter 627. When the reset bit is set high, the integral term and output of the CEMF regulator will be set to the value in this parameter. This parameter is scaled so that 1 pu flux = 4096.

Parameter 688 – Tach Switch Tolerance [Tach Switch TOL]

Internal units : 4096 = base motor speed

Programming Terminal units: RPM

Minimum Value: 0

Maximum Value: base speed

Default Value: 10% base speed

Function: Tach Loss Recovery

Description: This parameter establishes the window for detection of tach loss when the Tach Loss Recovery feature is selected. When the active feedback device (encoder or tach) deviates from the Armature Voltage derived feedback for more than 40 msec, then a Tach Switchover will occur.

Parameter 689 – Tach Switch Ki [Tach Switch KI]

Internal units : None

Programming Terminal units: None

Minimum Value: 0

Maximum Value: 65535

Default Value: 50

Function: Tach Loss Recovery

Description: This parameter establishes the Ki gain that will be used in the Velocity Regulator, following an automatic Tach Switchover to Armature Voltage Feedback.

Parameter 690 – Tach Switch Kp [Tach Switch KP]

Internal units : None

Programming Terminal units: None

Minimum Value: 0

Maximum Value: 65535

Default Value: 10

Function: Tach Loss Recovery

Description: This parameter establishes the Kp gain that will be used in the Velocity Regulator, following an automatic Tach Switchover to Armature Voltage Feedback.

Parameter 691 – Tach Switch Select [Tach Switch SEL]

Internal units : None

Programming Terminal units: None

Minimum Value: 0

Maximum Value: 1

Default Value: 0

Function: Tach Loss Recovery

Description: This parameter selects the automatic Tach Switchover to Armature Voltage Feedback feature. When set to a one, a malfunction of the selected velocity feedback device will cause a warning to be reported and the drive will continue to run using Armature Voltage feedback. When set to a zero (default value), a tach loss condition will cause a soft fault to occur and the drive will coast stop.

Parameter 692 – Kn Filter

Internal units :

Programming Terminal units:

Minimum Value: –32767

Maximum Value: +32767

Default Value: 512

Description: When using a lead/lag filter and Parameter #631 = 3, the gain of the filter can be selected. The transfer function G (s) = [(kn/256) s + ωn] / (s + ωn) describe the filter.

Parameter 693 – Wn Filter

Internal units :

Programming Terminal units:

Minimum Value: 1

Maximum Value: 500

Default Value: 300

Description: Filter Frequency Break Point (–3db). When using a lead/lag filter and Parameter #631 = 3, the natural frequency of the filter can be selected. The transfer function G(s) = [(kn/256) s +ωn] / (s + ωn) describe the filter.

Parameter 698 – Auto Tune Current Limit [Auto Tune I Lim]

Internal units : 4096 = 1000H = 100%

Programming Terminal units: %

Minimum Value: .0244%

Maximum Value: 100%

Default Value: 25%

Description: This parameter specifies the armature current that is applied to the motor during the Velocity motor test and Velocity system test.

Parameter 699 – Auto Tune Speed [Auto Tune Speed]

Internal units : 4096 = 1000H = 1 pu = Base motor speed

Programming Terminal units: RPM

Minimum Value: –Base Speed

Maximum Value: +Base Speed

Default Value: +Base Speed

Description: This parameter is the top speed of the motor during an auto tune velocity motor test, velocity system test, and field flux tune. For a field flux tune, the motor must be at the auto tune speed before performing the field flux tune.

Parameter 700 – Velocity Desired Bandwidth [Vel Desired BW]

Internal units : RAD x 10

Programming Terminal units: RAD/Sec

Minimum Value: 0.1

Maximum Value: 150

Default Value: 5

Description: This parameter specifies the velocity loop bandwidth requested by the user and determines (along with parameter 702) the dynamic behavior of the velocity loop. The desired bandwidth is limited to the maximum achievable bandwidth which is calculated by the velocity processor (VP) during auto tune system test. The velocity loop becomes more responsive and reproduces the velocity reference more accurately as the bandwidth is increased. However, the velocity may exhibit more oscillation and overshoot as it is increased.

Parameter 701 – Velocity Maximum Bandwidth [Vel Max BW]

Internal units : RAD x 10

Programming Terminal units: RAD/Sec

Minimum Value: 0.1

Maximum Value: 150

Default Value: 50

Description: This parameter specifies the maximum achievable velocity loop bandwidth as calculated by the VP. The maximum bandwidth is a function of the velocity loop damping factor (Parameter 702) and the system inertia. The VP updates the parameter during auto tuning and whenever the user reads this parameter. The maximum velocity loop bandwidth is not changeable by the user.

Parameter 702 – Velocity Damping Factor [Vel Damp Factor]

Internal units : None
Programming Terminal units: None
Minimum Value: 0.5
Maximum Value: 3.0
Default Value: 1.0
Description: This parameter (along with Parameter 700) determines the dynamic behavior of the velocity loop. The damping factor influences the amount of overshoot the velocity loop will exhibit during a transient. The velocity will typically exhibit more overshoot and become oscillatory (underdamped) as the damping factor is reduced below 1. For a damping factor above 1, the velocity loop should not exhibit much overshoot and have a slower rise time for a given velocity loop bandwidth.

Parameter 703 – System Inertia [System Inertia]

Internal units : Secs x 100
Programming Terminal units: SECS
Minimum Value: 0.01
Maximum Value: 655.0
Default Value: 2.0
Description: This parameter represents the time, in seconds, for a motor coupled to a load, to accelerate from zero to base speed at rated armature and field current. This parameter is calculated by the auto tune velocity system.

Parameter 704 – At Speed 1 [At Speed 1]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: 0 rpm
Description: This parameter specifies a setpoint for determining when the motor has reached a given speed. When the motor feedback speed is within the Up to Speed Tolerance (Parm 709) from the AT SPEED 1 setpoint, then the AT SPEED 1 output bit in the Logic Status (Parm 100) will be set to 1. Up to speed tolerance sets hysteresis for the At Speed 1 output.

Parameter 705 – At Speed 2 [At Speed 2]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: base speed/8 rpm
Description: This parameter specifies a setpoint for determining when the motor has reached a given speed. When the motor feedback speed is within the Up to Speed Tolerance (Parm 709) from the AT SPEED 2 setpoint, then the AT SPEED 2 output bit in the Logic Status parameter (Parm 100) will become set. Up to speed tolerance sets hysteresis for the At Speed 2 output.

Parameter 706 – At Speed 3 [At Speed 3]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: base speed/4 rpm
Description: This parameter is used to specify the at speed 3 setpoint in the logic status (parameter 100, bit 13). This 1 bit field is set to 1 when the actual velocity of the motor is greater than the at speed 3 setpoint. Otherwise, set to 0. Internally, if the Velocity Feedback (Parm 106) is greater than or equal to at speed 3 (parameter 706), the speed 4 bit is set to 1. Otherwise it is set to 0.

Parameter 707 – At Speed 4 [At Speed 4]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: base speed/2 rpm
Description: This parameter is used to specify the at speed 4 setpoint in the logic status (parameter 100, bit 14). This 1 bit field is set to 1 when the actual velocity of the motor is greater than the at speed 4 setpoint. Otherwise, set to 0. Internally, if the Velocity Feedback (Parm 106) is greater than or equal to at speed 4 (parameter 707), the speed 4 bit is set to 1. Otherwise it is set to 0.

Parameter 708 – At Speed 5 [At Speed 5]

Internal units : 4096 = 1000h = 1 pu = base motor speed
Programming Terminal units: RPM
Minimum Value: –6 x base speed
Maximum Value: +6 x base speed
Default Value: base speed rpm
Description: This parameter is used to specify the at speed 5 setpoint in the logic status (parameter 100, bit 15). This 1 bit field is set to 1 when the actual velocity of the motor is greater than the at speed 5 setpoint. Otherwise, set to 0. Internally, if the Velocity Feedback (Parm 106) is greater than or equal to at speed 5 (Parm 708), the speed 5 bit is set to 1. Otherwise it is set to 0.

Parameter 709 – Up To Speed Tolerance [Up to Speed Tol]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: 0 rpm
Maximum Value: +base speed / 10
Default Value: base speed / 100
Description: This parameter establishes a band around the At Speed setpoints (Parameters 704 to 708) that will be used to determine when to update the At Speed bit, parameter 100 bits 11 – 15 and the At Set Speed bit, parameter 100 bit 9 in the Logic Status word. Refer to the descriptions for the At Speed setpoints for more information.

Parameter 710 – Zero Speed Tolerance [Zero Speed Tol]

Internal units : 4096 = 1000h = 1 PU = base motor speed
Programming Terminal units: RPM
Minimum Value: 0 rpm
Maximum Value: 6 x base speed
Default Value: base speed / 100
Description: This parameter establishes a band around zero speed that will be used to determine when to update the At Zero Speed bit, parameter 100, bit 10 in the Logic Status word. This output is checked using the same method as At Speed 1 and 2 except the set point is fixed at zero speed.

Parameter 711 – Jog Dwell [Jog Dwell]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.0
Maximum Value: 6553.5
Default Value: 0
Description: This parameter specifies dwell time before the contactor opens when completing a jog function.

Parameter 713 – Process Trim Filter Constant [Proc Trim Fltr K]

Internal units : 4096 = 1000h = 100% process trim filtering

Programming Terminal units: percent of maximum process trim filtering

Minimum Value: 0%

Maximum Value: 100%

Default Value: 0%

Description: This parameter determines the gain of a single pole filter used in the Process Trim. The input to the filter is the difference between the Process Trim Reference parameter (161) and the Process Trim Feedback parameter (162). The output of the filter is used as the input to the process trim PI regulator.

100% Process Trim Filtering provides the maximum filtering effect. When 0% is used for the Process Trim Filter constant, the filter will be disabled.

Parameter 714 – Process Trim Preload [Proc Trim Preload]

Internal units : 4096 = 1000h = 100% Process Trim Preload

Programming Terminal units: None

Minimum Value: –32767

Maximum Value: 32767

Default Value: 0

Description: This parameter is used to preset the integral term of the Process Trim regulator.

Parameter 715 – Process Trim KI Gain [Proc Trim KI]

Internal units : gain/3277

Programming Terminal units: None

Minimum Value: 0

Maximum Value: 32767

Default Value: 1638

Description: This parameter controls the integral gain of the Process Trim regulator. If KI Process Trim equals 3277, the 1 pu Process Trim PI regulator output will equal 1 pu in 1 second, for 1 pu Process Trim error.

Parameter 716 – Process Trim KP [Proc Trim KP]

Internal units : gain/4096

Programming Terminal units: None

Minimum Value: –32767

Maximum Value: +32767

Default Value: +4096

Description: This parameter controls the integral gain of the Process Trim regulator. If KP Process Trim is equal to 4096, then 1 pu Process Trim PI regulator output will equal 1 pu for 1 pu Process Trim error.

Parameter 717 – Process Trim Low Limit [Proc Trim Lo Lim]

Internal units : 1000h = 4096 = 1 PU
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: –4096
Description: The output of the process trim regulator is limited by adjustable high and low limits. This parameter specifies the low limit of the Process Trim output value .

Parameter 718 – Process Trim High Limit [Proc Trim Hi Lim]

Internal units : 1000h = 4096 = 1 PU
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: +4096
Description: The output of the Process Trim regulator is limited by adjustable high and low limits. This parameter specifies the high limit of the Process Trim output value.

Parameter 719 – Process Trim Output Gain [Proc Trim Out K]

Internal units : 800h = 2048 = unity gain
Programming Terminal units: None
Minimum Value: –16.00
Maximum Value: +16.00
Default Value: 1.0 (unity gain)
Description: The output of the Process Trim regulator is scaled by a gain factor. This occurs immediately before the application upper & lower limit. This parameter specifies the gain value to use. Positive or negative gains may be used. A negative gain value will invert the Process Trim output.

Parameter 720 – Overload Pending Level [Ovld Pend Level]

Internal units : 4096 = 1000H = 100% rated motor current
Programming Terminal units: percent of rated motor current
Minimum Value: 0.024%
Maximum Value: 260%
Default Value: 115%
Description: This parameter determines the armature current level at which an overload pending fault will occur.

Parameter 721 – Process Trim Low Sum [Proc Trim Low Sum]

Internal units : 4096 = 1000H = 1 PU = base motor speed

Programming Terminal units: RPM

Minimum Value: –6 x BS RPM

Maximum Value: 0 RPM

Default Value: –6 x Base Speed RPM

Description: This parameter is associated with the Speed trim option of the Process Trim Select Parameter (#628 = 1). Parameter 721 will be in use when the speed trim option is enabled and the Process Trim Regulator has been enabled. The value in Parameter #721 will be used as the lower limit on the sum of the Ramp Velocity Reference (Param #103) and the output of Process Trim (Param #119). The limited sum will appear as the Final Velocity Reference (Param #104).

Parameter 722 – Process Trim High Sum [Proc Trim High Sum]

Internal units : 4096 = 1000H = 1 PU = base motor speed

Programming Terminal units: RPM

Minimum Value: 0 RPM

Maximum Value: +6 x BS RPM

Default Value: +6 x BS RPM

Description: This parameter is the upper limit on the sum of the Ramp Velocity Reference (param 103) and the output of Process Trim (param #119). Parameter 722 will be in use when the speed trim option is enabled and the Process Trim Regulator has been enabled. The value in Parameter 722 will be used as the high limit on the sum of the Ramp Velocity Reference (Parm 103) and the output of Process Trim (Param 119). The limited sum will appear as the Final Velocity Reference (Param 104).

Parameter 724 – Absolute Overspeed [ABS Overspeed]

Internal units : 4096 = 1000h = 1 PU = base motor speed

Programming Terminal units: RPM

Minimum Value: 0

Maximum Value: +Base Speed

Default Value: B.S./10

Description: This parameter indicates the incremental speed above Forward Speed Limit (Parm 608) or Reverse Speed Limit (Parm 607) that is allowable before an absolute overspeed fault is indicated.

Parameter 725 – External Overtemperature Delay [Ext Overtemp Dly]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 3276.7
Default Value: 1.0
Description: This parameter specifies the length of time that the motor overtemperature discrete input must be low before a motor overtemperature fault will be indicated.

Parameter 726 – SCR Overtemperature Delay [SCR Overtemp Delay]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0.1
Maximum Value: 3276.7
Default Value: 1.0
Description: This parameter specifies the length of time that the heatsink overtemperature discrete input must be low before a SCR overtemperature fault will be indicated.

Parameter 727 – Stall Delay [Stall Delay]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0
Maximum Value: 100.0
Default Value: 10.0
Description: This parameter specifies the length of time that the drive must be in current limit and at zero speed before a stall fault will be indicated.

Parameter 728 – AC Line Tolerance Delay [AC Line Tol Delay]

Internal units : Seconds x 10
Programming Terminal units: Seconds
Minimum Value: 0
Maximum Value: 1.0
Default Value: 0.1
Description: This parameter specifies the length of time that the supply voltage is allowed to exceed +10% of the rated value (parameter 617) before a voltage out of tolerance fault will be indicated.

Parameter 729 – Field Fault Threshold [Fld Flt Thresh]

Internal units : 4096 = 1000h = 1 PU = 100% rated motor field current

Programming Terminal units: Per cent rated field current

Minimum Value: 0%

Maximum Value: 100%

Default Value: 30%

Description: This parameter is used to set the threshold for activating the motor loss fault in the CP fault word (parameter 101, bit 6). Internally, if the field current reference (parameter #117) is greater than the field current threshold (parameter #729) and the field current feedback (parameter #118) is less than 10% of threshold, a field loss fault occurs. A value of zero disables the field loss fault detection.

Parameter 730 – Field Failure Delay [Fld Failure Dly]

Internal units : Seconds x 10

Programming Terminal units: Seconds

Minimum Value: 0.1

Maximum Value: 5.0

Default Value: 1.0

Description: This parameter indicates the length of time that the field current feedback value can deviate by more than 50% of field current reference before a field loss condition is indicated.

Parameter 731 – Tach Loss CEMF [Tach Loss CEMF]

Internal Units: 4096 = 1000h = 100% of full CEMF

Programming Terminal Units: %

Minimum Value: 0 %

Maximum Value: 50%

Default Value: 10.01%

Description: This parameter sets the CEMF level, above which a Tach (or encoder) Loss Fault will occur. CEMF is obtained from the Armature Voltage Feedback level, less the calculated IR drop. Units for this parameter are in percent of full CEMF. The velocity feedback must also be less than the level set by parameter 732 for a Tach Loss fault to be detected.

Parameter 732 – Tach Loss Velocity [Tach Loss Vel]

Internal Units: 4096 = 1000h = 100% base motor speed

Programming Terminal Units: %

Minimum Value: 0.244 %

Maximum Value: 50%

Default Value: 2.002%

Description: This parameter sets the velocity feedback level, below which a Tach (or encoder) Loss Fault will occur. Units for this parameter are in percent of base motor speed. The CEMF level must also be greater than the level set by parameter 731 for a Tach Loss fault to be detected.

Parameter 733 – Armature Bridge Type [Arm Bridge Type]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1
Default Value: 1
Description: Selects the type of armature bridge (regenerative or nonregenerative). The choices are:
0 = Nonregenerative Drive. The armature bridge has 6 SCRs.
1 = Regenerative Drive. The armature bridge consists of 12 SCRs.

Parameter 734 – K Discontinuous [K Discontinuous]

Internal units : 1024 = 400h = Full load current
Programming Terminal units: None
Minimum Value: 33
Maximum Value: 2048
Default Value: 1024
Description: Represents the average value of current feedback at the cross over point between discontinuous and continuous armature current. Used to linearize the armature current loop and calculate the armature current loop gains.

Parameter 735 – KP Armature Loop [KP Armature Loop]

Internal units : 4096 = unity gain
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 710
Description: The proportional gain for the PI regulator in the armature current loop.

Parameter 736 – KI Armature Loop [KI Armature Loop]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 90
Description: The integral gain for the PI regulator in the armature current loop.

Parameter 737 – KP Field Loop [KP Field Loop]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 16384
Description: The proportional gain for the PI regulator in the field current loop.

Parameter 738 – KI Field Loop [KI Field Loop]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 32767
Default Value: 168
Description: The integral gain for the PI regulator in the field current loop.

Parameter 739 – K Armature Volts [K Arm Volts]

Internal units : 10 x armature volts at maximum A/D input
Programming Terminal units: None
Minimum Value: 3000
Maximum Value: 25000
Default Value: 12500
Description: A parameter which scales the analog armature voltage (±2.5 volt = ±512 a/d value) into ten times the actual armature voltage. K ARM VOLT should be equal to ten times the armature voltage required to produce 5 volts on TP 27. The typical value depends on the feedback board installed in the Drive. The typical value for a 500 V feedback board is 12500 and the Typical value for a 240 V feedback board is 6400.

The Programming Terminal can be used to to determine the proper value for K ARM Volt. With the motor rotating at some nominal speed to produce armature voltage, enter the typical value for K ARM VOLT. Measure the armature voltage to the motor while the motor is rotating and compare it to the value on the Programming Terminal at parameter 105. Increase K ARM VOLT if the armature voltage read from the Programming Terminal is low, or decrease it if the armature voltage reading is too high.

Parameter 740 – K AC Volts [K AC Volts]

Internal units : 10 x AC volts at maximum A/D input
Programming Terminal units: None
Minimum Value: 2000
Maximum Value: 15000
Default Value: 7225
Description: A parameter which scales the analog line voltage feedback (5 volt = 1024 A/D value) into ten times the actual RMS AC voltage. K AC VOLTS should be equal to ten times the line voltage required to produce 5 volts on TP 4. The typical value depends on the feedback board installed in the Drive. The typical value for a 460V feedback board is 7225 and the typical value for a 230V feedback board is 3800.

The Programming Terminal can be used to determine the proper value for K AC Volt. Enter the typical value for K ARM VOLT. Measure the line voltage to the Drive and compare it to the reading on the Programming Terminal at parameter 116. Increase K AC VOLT if the armature voltage read from the Programming Terminal is low, or decrease it if the line voltage reading is too high.

Parameter 741 – Desired Current Loop Bandwidth [Cur Desired BW]

Internal units : None

Programming Terminal units: RAD/Sec.

Minimum Value: 100

Maximum Value: 1000

Default Value: 402

Description: This parameter specifies the armature current loop bandwidth requested by the user and determines (along with Parameter 743) the dynamic behavior of the current loop.

The desired bandwidth is limited to the maximum achievable bandwidth which is calculated by the current processor (CP). The current loop becomes more responsive and reproduces the current reference more accurately as the bandwidth is increased. However, the current may exhibit more noise and overshoot as the current loop bandwidth is increased. Typically, the bandwidth should be set as high as possible so that the velocity loop performance is not limited by the current loop.

Parameter 742 – Maximum Current Loop Bandwidth [Cur Max BW]

Internal units : None

Programming Terminal units: RAD/Sec

Minimum Value: 100

Maximum Value: 1000

Default Value: 500

Description: This parameter specifies the maximum achievable armature current loop bandwidth as calculated by the CP. The maximum bandwidth as calculated by the CP. The maximum bandwidth is a function of the current loop damping factor (Parameter 743) and the AC line frequency. The CP updates this parameter during autotuning and whenever the user reads this parameter. The maximum current loop bandwidth is not changeable by the user.

Parameter 743 – Current Damping Factor [Cur Damp Factor]

Internal units : None

Programming Terminal units: None

Minimum Value: 0.8

Maximum Value: 3.0

Default Value: 1.0

Description: This parameter (along with Parameter 741) determines the dynamic behavior of the armature current loop. The damping factor influences the amount of overshoot the current loop will exhibit during a transient. The current will typically exhibit more overshoot and become oscillatory (underdamped) as the damping factor is reduced below one. For a damping factor above one, armature current loop should not exhibit much overshoot and have a slower rise time for a given current loop bandwidth.

Parameter 780 – 1395 Version Number [1395 Version No]

Internal units : None

Programming Terminal units: None

Description: This non-changeable parameter specifies the current firmware version number on the Main Control Board, comprising the VP, SP and CP.

Parameter 840 – SP Indirect 1 [SP Indirect 1]

Internal units : None

Programming Terminal units: None

Minimum Value: –32767

Maximum Value: +32767

Default Value: 0

Description: When programmed, appears as a constant Source parameter value at parameter 10, and can be linked to a Sink parameter.

Parameter 841 – SP Indirect 2 [SP Indirect 2]

Internal units : None

Programming Terminal units: None

Minimum Value: –32767

Maximum Value: +32767

Default Value: 0

Description: When programmed, appears as a constant Source parameter value at parameter 11, and can be linked to a Sink parameter.

Parameter 842 – SP Indirect 3 [SP Indirect 3]

Internal units : None

Programming Terminal units: None

Minimum Value: –32767

Maximum Value: +32767

Default Value: 0

Description: When programmed, appears as a constant Source parameter value at parameter 12 and can be linked to a Sink parameter.

Parameter 843 – SP Indirect 4 [SP Indirect 4]

Internal units : None

Programming Terminal units: None

Minimum Value: –32767

Maximum Value: +32767

Default Value: 0

Description: When programmed, appears as a constant Source parameter value at parameter 13 and can be linked to a Sink parameter.

Parameter 844 – SP Indirect 5 [SP Indirect 5]

Internal units : None
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: 0
Description: When programmed, appears as a constant Source parameter value at parameter 14 and can be linked to a Sink parameter.

Parameter 900 – Trend Constant Signed Value [Trend Sign Val]

Internal units : None
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: 0
Description: This parameter specifies a signed constant value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y.

Parameter 901 – Trend Constant Signed Value [Trend Sign Val]

Internal units : None
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: 0
Description: This parameter specifies a signed constant value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y.

Parameter 902 – Trend Constant Signed Value [Trend Sign Val]

Internal units : None
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: 0
Description: This parameter specifies a signed constant value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y.

Parameter 903 – Trend Constant Signed Value [Trend Sign Val]

Internal units : None
Programming Terminal units: None
Minimum Value: –32767
Maximum Value: +32767
Default Value: 0
Description: This parameter specifies a signed constant value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y.

Parameter 904 – Trend Constant Logic Value [Trend Logic Val]

Internal units : None
Programming Terminal units: None
Minimum Value: 0000 0000 0000 0000
Maximum Value: 1111 1111 1111 1111
Default Value: 0000 0000 0000 0000
Description: This parameter specifies a bit(s) value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y. The default value is zero.

Parameter 905 – Trend Constant Logic Value [Trend Logic Val]

Internal units : None
Programming Terminal units: None
Minimum Value: 0000 0000 0000 0000
Maximum Value: 1111 1111 1111 1111
Default Value: 0000 0000 0000 0000
Description: This parameter specifies a bit(s) value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y. The default value is zero.

Parameter 906 – Trend Constant Logic Value [Trend Logic Val]

Internal units : None
Programming Terminal units: None
Minimum Value: 0000 0000 0000 0000
Maximum Value: 1111 1111 1111 1111
Default Value: 0000 0000 0000 0000
Description: This parameter specifies a bit(s) value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y. The default value is zero.

Parameter 907 – Trend Constant Logic Value [Trend Logic Val]

Internal units : None
Programming Terminal units: None
Minimum Value: 0000 0000 0000 0000
Maximum Value: 1111 1111 1111 1111
Default Value: 0000 0000 0000 0000
Description: This parameter specifies a bit(s) value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y. The default value is zero.

Parameter 908 – Trend Constant Unsigned Value [Trend Unsign Val]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 65535
Default Value: 0
Description: This parameter specifies an unsigned constant value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y.

Parameter 909 – Trend Constant Unsigned Value [Trend Unsign Val]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 65535
Default Value: 0
Description: This parameter specifies an unsigned constant value used for trend trigger evaluation. This parameter number is entered when programming Trend Operand Parameter X or Y.

Parameter 910 – Trend 1 Operand Parameter X [Tr 1 Opnd X Param]

Internal units : None
Programming Terminal units: None
Minimum Value: 1
Maximum Value: 947
Default Value: 100
Description: This parameter specifies the first of two parameter numbers for the trend trigger evaluation. The data value for the entered parameter number is used in the trigger evaluation.

Parameter 911 – Trend 1 Operand Parameter Y [Tr 1 Opnd Y Param]

Internal units : None
Programming Terminal units: None
Minimum Value: 1
Maximum Value: 947
Default Value: 904
Description: This parameter specifies the second of two parameter numbers used for the trend trigger evaluation. The data value for the entered parameter number is used in the trigger evaluation.

Parameter 912 – Trend 1 Operator [Tr 1 Operator]

Internal units : None

Programming Terminal units: None

Minimum Value: 1

Maximum Value: 8

Default Value: 5

Description: This parameter specifies the operator used in Parameters 910 and 911 for the trend trigger evaluation. The available operators are:

1 – Greater Than	(.GT.)
2 – Less Than	(.LT.)
3 – Equals	(.EQ.)
4 – Not Equals	(.NE.)
5 – Logical AND	(.AND.)
6 – Logical NAND	(.NAND.)
7 – Logical OR	(.OR.)
8 – Logical NOR	(.NOR.)

Parameter 913 – Trend 1 Sampling Rate [Tr 1 Sample Rate]

Internal units : 1 = 0.001 secs.

Programming Terminal units: Secs

Minimum Value: 0.004

Maximum Value: 30.0

Default Value: 0.020

Description: This parameter specifies the interval at which the data for the fast source parameter, linked with the Trend fast sink parameter, is sampled. It is programmable in increments of 4ms. All values are rounded down to the nearest 4ms.

Parameter 914 – Trend 1 Samples After Trigger Condition is True [Tr 1 Post Samples]

Internal units : None

Programming Terminal units: None

Minimum Value: 0

Maximum Value: 99

Default Value: 30

Description: This parameter specifies the number of data samples for the fast source parameter to gather once the trigger evaluation becomes true.

Parameter 915 – Trend 1 Contiguous Trigger Switch [Tr 1 Cont Trigger]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1
Default Value: 1
Description: This parameter specifies the type of trend. The choices are One Shot Trend, 0 = Once the trigger condition is true, and the number of samples after the trigger is taken (as programmed in 914) are gathered, the trend will halt.
Continuous Trend, 1 = Once the trigger condition is true, and the number of samples after the trigger is taken (as programmed in 914) are gathered, the trend will continue looking for the next occurrence when the trigger condition is true.

Parameter 916 – Trend 1 Enable Trend [Tr 1 Enable]

Internal units : None
Programming Terminal units: None
Minimum Value: 0
Maximum Value: 1
Default Value: 0
Description: This parameter is a switch that enables (activates) or disables (de-activates) the trend. The choices are:

Disable, 0 = Immediately terminates the trend (if it is activated).

Enable, 1 = Starts the trend provided a link has been established with the corresponding Trend 1 Input source fast parameter. Otherwise, the trend is automatically disabled.

Parameter 917 – Trend 1 Output Transmit Rate [Tr 1 Output Rate]

Internal units : 1 = 0.001 secs
Programming Terminal units: Secs
Minimum Value: 0.004
Maximum Value: 30.0
Default Value: 0.040
Description: This parameter specifies the rate at which ordered, sampled data (indicating the trend has triggered and taken post samples) is copied to the Trend Fast source parameter and subsequently transferred to the configured fast sink parameter number. It is programmable in 4 ms increments. All values are rounded down to the nearest 4ms.

Parameters 920 to 927 are identical to parameters 910 to 917 for Trend Buffer 2.

Parameters 930 to 937 are identical to parameters 910 to 917 for Trend Buffer 3.

Parameters 940 to 947 are identical to parameters 910 to 917 for Trend Buffer 4.

Chapter 6

Start-Up

Introduction

This chapter is a detailed step-by-step procedure for the proper start up and tuning of the 1395 drive. Among the procedures to be performed in this chapter are the following:

- Basic drive tuning procedures.
- Verification of proper supply voltages.
- Calibrate drive set-up parameters.
- Configure drive I/O

The Start Up checklist must be used to record all data.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Hazardous voltages may exist in the cabinet even with the circuit breaker in the off position. Recommended practice is to disconnect and lock out control equipment from power sources, and discharge stored energy in capacitors, if present. If it is necessary to work in the vicinity of energized equipment, the Safety Related Practices of NFPA 70E, "ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES" must be followed.
DO NOT work alone on energized equipment!

ATTENTION: Potentially fatal voltages may result from improper usage of an oscilloscope and other test equipment. The oscilloscope chassis may be at potentially fatal voltage if not properly grounded. If an oscilloscope is used to measure high voltage waveforms, use only a dual channel oscilloscope in the differential mode with X-100 probes. It is recommended that the oscilloscope be used in the A minus B Quasi-differential mode with the oscilloscope chassis grounded to an earth ground. Refer to equipment safety instructions for all test equipment before using with the 1395.

ATTENTION: Only qualified personnel familiar with the 1395 DC Drive and its associated machinery should plan and implement the installation, startup and subsequent maintenance of the Drive. Failure to comply may result in personal injury and/or equipment damage.

ATTENTION: The CMOS devices used on the control circuit boards can be destroyed or damaged by static charges. If personnel will be working near static sensitive devices, they must be appropriately grounded. If you are not familiar with static control procedures, before servicing, reference Allen-Bradley Publication 8000-4.5.2, Guarding against Electrostatic Damage or any other applicable ESD protection handbook.

Terminology

A brief description of new terms and concepts covered in Chapter 8 includes:

Configuration Parameter – Parameter used to transfer data between the Drive control and external devices. The Configuration Parameters are categorized into two types:

1. Source Parameters
2. Sink Parameters

Parameter – A memory location used to store drive data. Each parameter is given a number called the parameter number. The parameter value may be specified in decimal, or in hexidecimal. When specified in hexidecimal, a letter "h" will appear after the parameter number.

Programming Terminal – Device used for programming, monitoring operation and performing diagnostic functions on the 1395 drive. The Programming Terminal is provided in two packages, Digital Handheld Terminal and Door-Mounted Terminal.

Programming Parameter – Parameters used to store information required by the drive in order to perform the regulation functions of the drive.

Required Tools and Equipment

The following equipment is required for start-up and tuning.

- Multimeter capable of 1000VDC/750VAC, with input resistance of at least 1 megohm.
- Test Leads for multimeter
- Assorted screwdrivers (Phillips and blade) and a set of open end wrenches.
- Clamp on Ammeter (AC and DC with current ratings to match drive ratings)
- Programming Terminal

Recommended Tools and Equipment

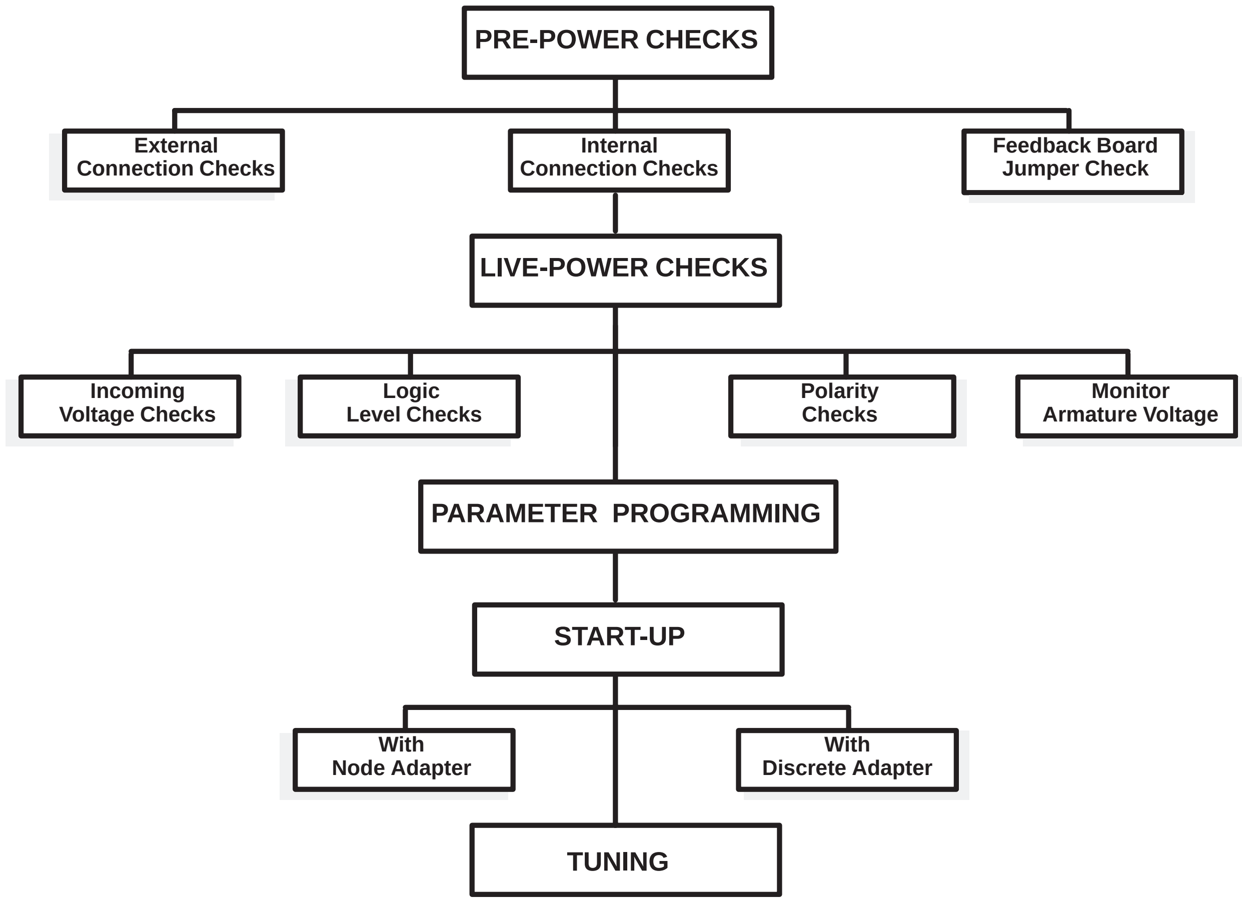
The following equipment is recommended for start-up and tuning.

- Dual trace oscilloscope with A minus B quasi differential capability
- X100 probes for oscilloscope

General

Only qualified electrical technicians and/or electrical engineers familiar with solid state controls and circuitry should attempt a 1395 start-up. It is imperative that personnel familiarize themselves with the functional description portion of this manual, and the operation of the Programming Terminal (refer to Pub 1300-5.5) before attempting any start-up procedures. Figure 6.1 outlines the sequence that is required to start-up the 1395 drive.

Figure 6.1
Bulletin 1395 Start-Up Sequence



Pre-Power Checks

1. Verify all procedures listed in Chapter 4 Installation, have been properly completed.
2. If you have not already done so, record the following information on the Pre-Power Checklist Table on page 6-4.
   - Drive order number
   - Drive nameplate data
   - Motor nameplate data
   - Tachometer/Encoder data (if applicable)
   - Adapter boards used
   - External devices interfaced with Drive such as PLC, discrete I/O etc.

Table 6.A
Pre-Power Checks

DRIVE NAMEPLATE DATA: ______________________________

Catalog Number: ______________________________

S/N: ______________________

Ser: ______________________

AC Input Field:	__________	Volts	__________	Amps
AC Input Armature:	__________	Volts	__________	Amps
DC Output Field:	__________	Volts	__________	Amps
DC Output Armature:	__________	Volts	__________	Amps

HP: ________

MOTOR NAMEPLATE DATA:

Manufacturer: ______________________

Model Number: ______________________

Serial Number: ______________________

Type: ______________

HP: ______________

RPM: ______________

Arm	__________	Volts	__________	Amps
Field	__________	Volts	__________	Amps

Wound Type: __________

Frame: __________

TACHOMETER/ENCODER NAMEPLATE DATA:

Manufacturer: ______________________

Model Number: ______________________

Serial Number: ______________________

Type: ______________

Rated Supply Voltage (encoder only): ________________ Volts

Rated Output Voltage

Encoder ______________ Volts square wave

Encoder Pulse per Revolution (PPR) ________

DC Tach ________ Volts at ________ RPM

Voltage Measurement

1. Before applying power to the Drive ensure that the ECOAST input to TB3-4 and 5 is locked in the open state. The DC contactor must remain in the open state while the following measurements are being made.
2. Apply the main power source to the drive.
3. Record the following AC voltage measurements in Tables 6.E – 6.G.
   - Three-phase source voltages L1 to L2, L2 to L3 and L3 to L1. The three-phase voltage should be equal to the rated drive AC input voltage on the drive nameplate +/– 10%.

     If the voltage is not within tolerance, verify that the drive rating is correct for the application. If the drive rating is correct, change the incoming line voltage so that it complies with the Drive rating.
   - Field AC input voltage measurements are per Table 6.B. The voltage should be equal to the rated drive AC field voltage input on the drive nameplate +/– 10%.

     If the voltage is not within tolerance, determine whether a field transformer is required and has been used.

Table 6.B
Field AC Voltage Measurements

Horsepower	Drive Voltage	Field AC Input Measurement
400 – 600	230	TB7 – 1 to 3
700 – 1250	460	TB7 – 1 to 3
1000 – 2000	660	TB7 – 1 to 3

   - Single phase control voltage must be measured as shown in Table 6.C. The voltage should be 115VAC +/– 10%.

     If not, correct the incoming control voltage so it falls within the tolerance range.

Table 6.C
115VAC Voltage Measurements

Horsepower	Drive Voltage	115VAC Measurement Points
400 – 600	230VAC	TB5 – 14 & 15
700 – 1250	460VAC	TB5 – 14 & 15 or 3 & 4
1000 – 2000	660VAC	TB5 – 14 & 15

4. Record the following DC voltage measurements in Tables 6.E and 6.D. If any voltage measurement is incorrect, refer to the Troubleshooting manual for guidelines.
   - +5 +/– 0.15 VDC measured at TP 51 (+) with respect to TP 52 (–) on the Main Control Board.
   - +12 +/– 0.48 VDC measured at TP 55 (+) with respect to TP57 (–) on the Main Control Board.
   - –12 +/– 0.48 VDC measured at TP56 (+) with respect to TP57 (–) on the Main Control Board.

- +5 +/– 0.15 VDC measured at TP58 (+) with respect to TP53 (–) on the Main Control Board.
- +12 +/– 0.48 VDC measured at TP54 (+) with respect to TP53 (–) on the Main Control Board.
- +24 +/– 6 VDC is measured at the Power Stage Interface (PSI) as outlined in Table 6.D.

Table 6.D
24VDC Voltage Measurements

Horsepower	Drive Voltage	24VDC Measurement Points
400 – 600	230VAC	TP1 (+) with respect to TP6 (+)
700 – 1250	460VAC	TP1 (+) with respect to TP6 (+)
1000 – 2000	660VAC	TP1 (+) with respect to TP6 (+)

Table 6.E
Voltage Measurements

Test Points	Expected Voltage	Measured Voltage
AC VOLTAGES:		
L1 to L2	Rated AC Input	
L2 to L3	Rated AC Input	
L3 to L1	Rated AC Input	
TB7–1 to TB7–3	Rated DC Field Output	
TB5–3 to TB5–4	115VAC +/–10%	
MAIN CONTROL BOARD:		
TP51 to TP52	+5 +/– 0.15 VDC	
TP55 to TP57	+12 +/– 0.48 VDC	
TP56 to TP57	–12 +/– 0.48 VDC	
TP58 to TP53	+5 +/– 0.15 VDC	
TP54 to TP53	+12 +/– 0.48 VDC	
PSI BOARD:		
TP1 to TP6	+24 +/– 6 VDC	

Standard Control I/O Checks

The ECOAST Stop and Reset/Normal Stop inputs are supplied as basic drive inputs. Verify the proper operation of these inputs using the following steps. If an input does not produce the expected results, verify correct operation of the appropriate power supply.

1. Apply power to the Drive.
2. If a 24 VDC ECOAST stop circuit is used, measure the voltage from TB3-11 to -9 with the ECOAST stop contact open and closed. With the contact closed, the voltage should be 0 VDC. With the contact open, the voltage should be 24VDC.
3. If a 115VAC ECOAST stop circuit is used, measure the voltage from TB3-4 to -5 with the ECOAST stop contact open and closed. With the contact closed, the voltage should be 0 VAC. With the contact open, the voltage should be 115VAC.
4. If a 24VDC Reset circuit is used, measure the voltage from TB3-1 to -3 with the reset contact open and closed. With the contact closed, the voltage should be +24 VDC. With the contact open, the voltage should be 0VDC.
5. If a 115VAC Reset circuit is used, measure the voltage from TB3-1 to -3 with the reset contact open and closed. With the contact closed, the voltage should be 115 VAC. With the contact open, the voltage should be 0VAC.

Parameter Programming Procedures

All drives are shipped preconfigured. Before making any changes review Chapters 3 and 4. Parameter values are changed using the PARAMETER mode in the Drive Programming Terminal. Before beginning any changes, become thoroughly familiar with the Programming Terminal and its manual.

To match the Drive control to a specific application, several setup parameters must be scaled for feedback and other applications. A description of each of these parameters is provided in Chapter 5 of this manual. Some of the information previously recorded in Table 6.A will be required for proper scaling of parameters.

Units of measure for all parameters listed in this section are in terms of Programming Terminal units.

Before starting this procedure, make certain that the ECOAST input is locked in the open state. The DC contactor must remain open while the following parameter setup is being performed.

Parameter Explanations:

Basic Parameters: Tailor the motor to the drive.
Set-Up Parameters: Used for calibration, scaling and special functions.
Speed Reference Parameters: Define the source for the drive speed command.
Input Parameters: Accept information from sources outside the drive.
Adapter Board Parameters: Define the signals for the specific applications.

Table 6.F
Basic Parameters

Parm	Parameter Name	Classification	Value
606	Base Motor Speed	Motor Nameplate	
607	Rev Speed Limit	Application	
608	Fwd Speed Limit	Application	
609	Encoder PPR	Encoder Nameplate	
610	Rated Motor Volt	Motor Nameplate	
611	Motor Arm FLA	Motor Nameplate	
612	Rated FLD Mtr Cur	Motor Nameplate	
615	Rated Arm Brdg I	Table 6.G	
616	Rated Field Brdg I	Table 6.H	
617	Rated AC Line	AC Input Voltage to Drive	
621	Feedback Device Type	Motor Feedback	
629	Motor Overload Select	Motor Enclosure	
651	Accel Time	Application	
652	Decel Time	Application	
663	Fwd Brdg Current Limit	Application	
664	Rev Bridge Current Limit	Application	
733	Arm Bridge Type	Drive Nameplate	
739	K Arm Volts	Table 6.I	
740	K AC Volts	Table 6.I	

Table 6.G
Rated Arm Brdg I (Parm 615)

HP @230VAC, 250VDC	Rated Armature Bridge Current
400 HP	1350 Amps, DC
500 HP	2250 Amps, DC
600 HP	2250 Amps, DC
HP@ 460VAC, 500VDC	**Rated Armature Bridge Current**
700 HP	1350 Amps, DC
800 HP	1350 Amps, DC
900 HP	2250 Amps, DC
1000 HP	2250 Amps, DC
1250 HP	2250 Amps, DC
HP@ 660VAC, 700VDC	**Rated Armature Bridge Current**
900 HP	1350 Amps, DC
1000 HP	1350 Amps, DC
1250 HP	2250 Amps, DC
1500 HP	2250 Amps, DC
1750 HP	2250 Amps, DC
2000 HP	2250 Amps, DC

Table 6.H
Rated Fld Brdg I Settings (Parameter 616)

J1 Jumper	400 – 600 HP, 240VDC	700 – 1250 HP, 500VDC	1000 – 2000 HP, 700VDC
1	42.4 A	42.4 A	42.4 A
2	18.5 A	18.5 A	18.5 A
3	8.7 A	8.7 A	8.7 A
4	2.4 A	2.4 A	2.4 A

Table 6.I
Basic Parameters — Feedback Scaling

Parm	Parameter Name	Description
739	K Arm Volts	Numerical value used to scale the armature voltage feedback. Values to be entered at this time are: 6414 = for 150 – 300 rated arm voltage 12321 = for 300 – 575 rated arm voltage 16017 = for 575 – 700 rated arm voltage
740	K AC Volts	Numerical value used to scale the incoming AC line voltage feedback. Values to be entered at this time are: 3872 = for 150 – 300 rated AC line voltage 7473 = for 300 – 575 rated AC line voltage 9747 = for 575 – 660 rated AC line voltage

Table 6.J
Set-Up Parameters

Parm	Parameter Name	Classification	Value
614	Armature Resistance	Motor Characteristics	
620	System Reset Select	Application	
623	Fault Select	Application	
624	Maintained Start	Application	
626	Jog Ramp Enable	Application	
627	Flux Mode Select	Application	
628	Process Trim Select	Application	
630	Fault Report	Application	
631	Velocity Feedback Filter Select	Application	
632	Warning Select	Application	
653	Desired Contour	Application	
657	Droop Percent	Application	
658	Droop Filter	Application	
665	Start Taper Speed	Motor Commutation Limit	
666	End Taper Speed	Motor Commutation Limit	
667	Minimum Taper Current	Motor Commutation Limit	
672	KI Flux	Application	
673	KP Flux	Application	
676	Field Flux Reference	Application	
704	At Speed 1	Application	
705	At Speed 2	Application	
706	At Speed 3	Application	
707	At Speed 4	Application	
708	At Speed 5	Application	
709	Up to Speed Tolerance	Application	
710	Zero Speed Tolerance	Application	
711	Jog Dwell	Application	
717	Process Trim Low Limit	Application	

Table 6.J
Set-Up Parameters (cont.)

Parm	Parameter Name	Classification	Value
718	Process Trim High Lim	Application	
721	Process Trim Low Sum	Application	
722	Process Trim High Sum	Application	
724	Absolute Overspeed	Application	
727	Stall Delay	Application	
729	Field Fault Threshold	Application	
730	Field Failure Delay	Application	
731	Tach Loss CEMF	Application	
732	Tach Loss Velocity	Application	
737	KP Field Loop	Application	
738	KI Field Loop	Application	

Table 6.K
Speed Reference Parameters

Parm	Parameter Name	Classification	Value
633	Preset Speed 1	Application	
634	Preset Speed 2	Application	
635	Preset Speed 3	Application	
636	Preset Speed 4	Application	
637	Preset Speed 5	Application	
638	Jog Speed 1	Application	
639	Jog Speed 2	Application	

Table 6.L
Input Parameters

Parm	Parameter Name	Classification	Value
150	Logic Command 1	Application	
151	Logic Command 2	Application	
152	Logic Command 3	Application	
153	Velocity Reference Fraction	Application	
154	Velocity Reference Whole	Application	
156	Tach Velocity	Application	
161	Process Trim Reference	Application	

Adapter Parameters

In order to operate the drive from external control devices it first must be configured by linking Source Parameters to Sink Parameters as described in the Configuration section of Chapter 5. The drive can be controlled by either discrete I/O devices using the Discrete or Digital Reference Adapter Board, or an Allen-Bradley PLC3 or 5 using the Node Adapter Board or the Multi-Communication Adapter. The 1395 is factory preconfigured as shown in Tables 6.M and 6.N. The user has the flexibility of reconfiguring the drive to tailor it to his specific requirement. Refer to the specific Adapter manual for all configuration and parameter information.

Table 6.M
Drive Pre-Configuration Table — Discrete Adapter

Link	Sink Parameter	Linked to Source Parm
1	151	400
2	161	401
3	154	403
4	156	404
5	450	100
6	451	106
7	452	118
8	453	112
9	454	105
10		
11		
12		
13		
14		
15		
16		
17		
18		
19*	152	200
20*	250	100

Table 6.N
Driver Pre-Configuration Table — Digital Reference Adapter

Link	Sink Parameter	Linked to Source Parm
1	150	400
2	154	401
3	161	402
4	450	100
5	451	112
6	452	105
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19*	152	200
20*	250	100

* Cannot be changed by the user

Up to 18 links of Source to Sink parameters may be made using the programming Terminal Drive Set-Up mode. Two of the potential twenty links are permanently linked in order to maintain critical communications paths between the programming terminal and the 1395 Drive. This leaves 18 programmable source to sink parameters. The configuration section in Chapter 3 of this manual lists all of the allowable Source and Sink parameters associated with the Drive control.

If the drive is reconfigured, record the links in Table 6.O and backup the data in the Drive using EEPROM function in the Programming Terminal.

Table 6.O
Drive Configuration Table

Link	Sink Parameter	Linked to Source Parm
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19*	152	200
20*	250	100

* Cannot be changed by the user

Motor and Feedback Polarity Checks

IMPORTANT: Prior to checking motor polarity it is recommended that parameters 607, 608, 663 and 664 be set at less than 25% of their final value in order to limit speed and torque at a low level for initial power checks and to avoid possible component damage.

1. Turn off and lock out all power to the drive.
2. When checking motor polarity, the drive will have power applied and the motor will rotate. It is recommended that the motor be temporarily uncoupled from the load.
3. If the motor cannot be uncoupled from the load, the following motor checks are recommended:
   a) All electrical connections are tight.
   b) The brushes are properly seated.
   c) The motor shaft is free to rotate.

4. Connect DC Voltmeter to Terminal A1 (+) and A2 (–) at the output of the main contactor.
5. Apply power to the Drive.
6. Rotate motor shaft in CCW (counter clockwise) direction as viewed from the commutator end, using an externally applied mechanical force to the motor shaft.
7. Measure the voltage at A1 (+) and A2 (–). Set the meter range to 50 VDC to start with, and then work down until a reading can be obtained. Voltage should be positive at A1 with respect to A2 (voltage magnitude is unimportant).

   If polarity is correct, go to the next section: Verification of Drive Calibration. If polarity is incorrect, Remove power immediately.
8. Make certain power is turned off and locked out.
9. Switch armature leads A1 and A2. If tachometer feedback is used, the tachometer leads must also be switched. If an encoder is used, one of the channel leads must also be switched. Verify that the direction of rotation has been corrected by switching the power back on. Turn off power.
10. Verify correct polarity of velocity feedback. Rotate the motor shaft in CCW direction as viewed from the commutator end using an externally applied mechanical force. Using the Programming Terminal, verify that the speed feedback value is positive at Parm 106 (Velocity Fdbk).

    If polarity is incorrect, and an encoder or tachometer is used, verify that wiring for the device is correct.

    If polarity is incorrect, and armature feedback is used, verify that the motor armature and field leads are properly connected to the drive output.

Verification of Drive Calibration

1. Verify correct scaling of AC Line Voltage feedback. Measure the incoming AC line voltage and verify that the RMS value is equal to the value shown in Parm 116 (AC Line Voltage).

   If the value of Parm 116 does not match the measured incoming AC line voltage, change the value of Parameter 740 (K AC Volts) until the measured voltage agrees with Parm 116. Increasing Parm 740 increases the value in Parm 116.
2. Enable the normal operation of the ECOAST circuit by removing the lock on the input to TB3-4 to 5 that was holding it in the open state.
3. Enter a speed reference of <25% base speed using whichever external device has been configured to send data to Parm 154. Verify correct value by observing Parm 154 (Vel Ref Whole).
4. Command the drive to start and accelerate to the velocity reference of Parm 154 using the Normal Start input from the external device which has been previously configured to control the normal start/stop operation of the drive.
5. Verify that the motor starts and accelerates to the set speed by comparing the value of Parm 154 (Vel Ref Whole) to Parm 106 (Velocity Fdbk).

6. Verify correct scaling of Armature voltage feedback. Measure the armature voltage at A1 and A2 output connections of the Drive. Verify that the voltage measured is the same as the value shown in Parm 105 (Arm Voltage Fdbk).

   If the value of Parm 105 is incorrect, change the value of Parm 739 (K ARM Volts) until the measured voltage agrees with Parm 105. Increasing Parm 739 increases Parm 105.

7. Verify correct scaling of speed feedback. Measure the actual motor speed at the motor shaft. Verify that the value measured at the shaft is the same as Parm 106 (Velocity Fdbk).

   If actual speed measured at the shaft doesn't match the value of Parm 106:

   a. For encoder feedback, verify that both Parm 606 and 609 are properly entered.
   b. For tachometer feedback, verify that the scaling parameters associated with the analog input from the Discrete Adapter Board for the tachometer feedback are properly scaled. Scaling should be set so that at base speed,the value at Parm 156 is base speed (4096 in drive units)

8. Verify correct scaling of Armature current feedback. Measure the armature current at the A1 or A2 output connections of the Drive. Verify that the current measured is equal to the value shown in Parm 112 (Arm Current Fdbk).

   If value is incorrect, verify that the value of Parm 611 (Motor Arm FLA) and Parm 615 (Rated Arm Brdg I) is correct.

9. Verify correct scaling of field current feedback. Measure the field current by placing a clamp-on-ammeter at F+. Verify that the current measured is equal to the value shown in Parm 118 (Fld Current Feedback).

   If value is incorrect, verify that the value of Parm 612 (Rate Fld Mtr Cur) and Parm 616 (Rated Fld Brdg I) is correct.

10. Stop Drive.

Drive Tuning (Drive Setup/Autotune/Current)

The following parameters should be set-up prior to using the Auto-Tuning features:

PARM	DESCRIPTION	PRESENT VALUE	SET TO
661	KF Velocity Loop	______________	45875
676	Field Flux Reference	______________	100%
698	Auto Tune I Limit	______________	See Note
699	Auto Tune Speed	______________	Base Speed if Possible
702	Velocity Loop Damping Factor	______________	Default Value Recommended
733	Armature Bridge Type	______________	refer to cat. no.
743	Current Loop Damping Factor	______________	Default Value Recommended

NOTE: The default value can be used initially. If the test fails on motor stalled (VP-18) or Profile Timeout (VP-50), the Auto Tune I Limit (Parm 698) may be set too low.

Current Loop Test – The following procedure explains how to tune the current loop. To simplify the operation, it is recommended that the tuning be done using one of the Bulletin 1300 Programming Terminals.

1. Verify that the motor is connected to the Drive.
2. Select the Current test option on the Programming Terminal.

NOTE: The field is enabled during part of the current loop test. If desired, the user can reduce Parm 676 – Field Flux Reference to lessen the amount of motor rotation. However, the current loop test may be less accurate.

ATTENTION: The current loop test closes the Drive contactor and applies power to the motor armature. Potentially fatal voltages may be present at this time.

IMPORTANT: The drive start command must be true for the entire time the test is being performed. If a stop command is issued anytime during the test, the motor will stop and the test will be aborted. Check parameter 624 (Maintain Start) to determine if the start command is latched or momentary.

3. Start the drive when requested to do so by the Program Terminal. The drive contactor will pick up and then drop out. At this time the program terminal will indicate whether the test was successful. If it was, continue to the next step, otherwise refer to the troubleshooting section. The test just performed writes the value of parameters 734, 742 and 741 when option to save in EEPROM is executed.

Current Loop Tune – This procedure calibrates the current loop gain based on the information generated by the current loop test.

1. Select the current tune option (Drive Setup/Autotune/Current Tune) on the program terminal.
2. Follow the instructions given by the Program Terminal.
3. The Program Terminal will indicate when the tuning has been completed. The test just performed writes the value of parameters 735 and 736 when option to save in EEPROM is executed.

Velocity Loop Motor Test – This procedure calculates the motor inertia. If the motor inertia is known, it can be entered directly into parameter 613 and you can proceed to the Velocity Loop System Test.

1. Verify that the motor is disconnected from the machine (the motor is not loaded). If the motor cannot be disconnected, user must program parameter 613 based on the motor inertia.
2. Select the Velocity Motor Test option (Drive Setup/Autotune/VelMtr Test) on the program terminal.

ATTENTION: The Velocity Motor Test closes the Drive contactor and operates the motor up to speed specified by Param 699. Verify that you wish to operate your motor at this speed (Parm 699), as equipment damage could occur depending on the application.

IMPORTANT: The Drive start command must be true for the entire time the test is being performed. If a stop command is issued anytime during the test, the motor will stop and the test will be aborted. Check parameter 624 (maintain start) to determine if the start command is latched or momentary.

3. Start the Drive when requested to do so by the program terminal. The motor will begin to accelerate to the speed specified by parameter 699 (Auto Tune Speed) at the armature current specified by parameter 698
(Autotune I Lim). When it reaches that speed it will begin to decelerate to zero speed.

   NOTE: If the test fails on a motor stalled (VP-18) or Profile Timeout
(VP-50) the Auto Tune I Limit (698) may be set too low. Increase the value of Parameter 698 and run the test again. When the test is complete, the Drive contactor will drop out and the program terminal will indicate the status of the test.
4. If the test was successful, continue to the Velocity System Test, otherwise refer to the Troubleshooting Manual.

Velocity Loop System Test – This procedure calculates the system inertia (param. 703), maximum bandwidth (param. 701). If these values are known they can be entered directly and you can proceed to the Field Flux Tuning procedure.

1. Connect the motor to the machine.
2. Select the Velocity System Test (Drive Setup/Autotune/Vel Sys Test) option on the program terminal.

IMPORTANT: The Drive start command must be true for the entire time the test is being performed. If a stop command is issued anytime during the test, the motor will stop and the test will be aborted. Check parameter 624 (maintain start) to determine if the start command is latched or momentary.

ATTENTION: The Velocity Motor Test closes the Drive contactor and operates the motor up to speed specified by Param 699.

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3. Start the Drive when requested to do so by the program terminal. The motor (and load) will begin to accelerate to the speed specified by parameter 699 (Auto Tune Speed) at the armature current specified by parameter 698 (Autotune I Lim). When it reaches that speed, it will begin to decelerate to zero speed.

   NOTE: If the test fails on a motor stalled (VP-18) or Profile Timeout (VP-50) the Auto Tune I Limit (param 698) may be set too low. Increase the value of Parameter 698 and run the test again.

   When the test is complete, the Drive contactor will drop out and the program terminal will indicate the status of the test.
4. If the test was successful, continue to the Velocity Loop Tuning Procedure, otherwise refer to the Troubleshooting Manual.
   The test just performed writes the value of parameters 703 and 701 when option to save in EEPROM is executed.

Velocity Loop Tuning – This procedure tunes the velocity loop of the Drive based on the information supplied by the Motor and System tests.

1. Select the Velocity Loop Tune option (Drive Setup/Autotune/Vel Tune) on the program terminal.
2. The program will display the maximum bandwidth possible and allow you to de-tune the loop from there. Enter a new bandwidth or press ENTER to accept the current value.
3. The Drive will now calibrate the velocity loop gains and return the status of the tuning procedure.
4. If the tune was successful, continue to the Field Flux Tuning Procedure,otherwise refer to the troubleshooting manual.
   The test just performed writes the value of parameter 659, 660 and 700 when option to save in EEPROM is executed.

Field Flux Tuning – This procedure will setup the field flux table (parameters 677 through 684) and the rated motor field current (parameter 612) based on the actual motor characteristics.

1. Record the value of the field flux reference (Parm. 676).
2. Set the field flux reference and the field economy reference to 100%.
3. Set KI, KP for the CEMF regulator (Params 672, 673), to their default value.
4. Set Parameter 612, the rated motor field current to ± 50% of the actual value, from the motor nameplate data.

IMPORTANT: The drive Start command must be true for the entire time the test is being performed. If a stop command is issued anytime during the test, the motor will stop and the test will be aborted. Check parameter 624 (maintain start) to determine if the start command is latched or momentary.

5. Start the drive and run it at the same speed as specified by parameter 699.
6. Select the Field Flux Tune option (Drive Setup/Autotune/Vel Tune) using the program terminal.
7. The Field Flux tuning will begin. It takes approximately 5 to 60 seconds for the test to complete, at which time the program terminal will indicate that the test has been completed and the option of saving this information in EEPROM can be executed.

Application Setup

NOTE: Prior to doing any further application specific programming, the application parameters 607, 608, 663 and 664 will have to be programmed for their final value.

There are several parameters associated with the use of the drive for specific applications. At this point, the basic drive control has been tuned for simple speed control. If it is desired to operate the drive using one of the optional functions, refer to Chapter 5 for a description of the parameters associated with these functions. In addition to set up of the drive parameters associated with these functions, it is also necessary to verify correct configuration of the Source to Sink parameters for the external control device being used to control the drive for the specific application. Refer to the appropriate adapter board Instruction Manual for a description of how to use the adapter board and how to interface the adapter board to the drive to command various drive functions.

Once the drive has been fully tuned and configured:

1. Record the values of all parameters in the Parameter Value Tables located in Chapter 7.
2. Use the EEPROM mode in the Programming Terminal to save all parameters in EEPROM.

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Chapter 7

Reference Materials

Introduction

This chapter contains reference materials intended to provide additional information pertaining to the 1395 such as:

- Configuration Parameter lists
- Start-up Parameter Tables
- An alphabetical listing of all parameters.
- Glossary

Configuration Parameter List

Record all configuration and linking as finalized during start-up in the following tables:

Table 7.A
Fast Source Parameters (Configuration & Linking)

Parameter	Description	Linked To Parameter
1	TREND 1 OUTPUT	
2	TREND 2 OUTPUT	
3	TREND 3 OUTPUT	
4	TREND 4 OUTPUT	
10	SP OUTPUT 1	
11	SP OUTPUT 2	
12	SP OUTPUT 3	
13	SP OUTPUT 4	
14	SP OUTPUT 5	
50	TREND 1 INPUT	
51	TREND 2 INPUT	
52	TREND 3 INPUT	
53	TREND 4 INPUT	
100	LOGIC STATUS	
	BIT 0 = FAULT FIELD 0	
	BIT 1 = FAULT FIELD 1	
	BIT 2 = ACTIVE LOGIC COMMAND 0	
	BIT 3 = ACTIVE LOGIC COMMAND 1	
	BIT 4 = CONTACTOR CLOSE	
	BIT 5 = DRIVE RUNNING	
	BIT 6 = RUNNING REVERSE	
	BIT 7 = READY	
	BIT 8 = AT CURRENT SPEED	
	BIT 9 = SET SPEED	
	BIT 10 = AT ZERO SPEED	
	BIT 11 = AT SPEED 1	
	BIT 12 = AT SPEED 2	
	BIT 13 = AT SPEED 3	
	BIT 14 = AT SPEED 4	
	BIT 15 = AT SPEED 5	
101	DRIVE FAULT	
102	PRE RAMP VELOCITY REFERENCE	
103	RAMP VELOCITY REFERENCE	

Table 7.A
Fast Source Parameters cont.

Parameter	Description	Linked To Parameter
104	FINAL VELOCITY REFERENCE	
105	ARMATURE VOLTAGE FEEDBACK	
106	VELOCITY FEEDBACK	
107	POSITION FEEDBACK	
108	VELOCITY FEED FORWARD	
109	POSITION ERROR	
110	TORQUE COMMAND	
111	ARMATURE CURRENT REFERENCE	
112	ARMATURE CURRENT FEEDBACK	
113	ARMATURE CURRENT PI OUTPUT	
114	ARMATURE CURRENT FIRING ANGLE	
115	FLUX COMMAND	
116	AC LINE VOLTAGE	
117	FIELD CURRENT REFERENCE	
118	FIELD CURRENT FEEDBACK	
119	PROCESS TRIM OUTPUT	

Table 7.B
Fast Sink Parameters (Configuration and Linking)

Parameter	Description	Linked To Parameter
150	LOGIC COMMAND 1	
	BIT 0 = RUN REFERENCE A	
	BIT 1 = RUN REFERENCE B	
	BIT 2 = RUN REFERENCE C	
	BIT 3 = MOP INCREMENT	
	BIT 4 = MOP DECREMENT	
	BIT 5 = RAMP DISABLE	
	BIT 6 = MOP RATE 1	
	BIT 7 = MOP RATE 2	
	BIT 8 = COMMAND ENABLE	
	BIT 9 = JOG 2	
	BIT 10 = JOG 1	
	BIT 11 = NORMAL STOP	
	BIT 12 = START	
	BIT 13 = CLOSE CONTACTOR	
	BIT 14 = CLEAR FAULT	
	BIT 15 = PROCESS TRIM	

Table 7.B
Fast Sink Parameters cont.

Parameter	Description	Linked To Parameter
151	LOGIC COMMAND 2	
	BIT 0 = RUN REFERENCE A	
	BIT 1 = RUN REFERENCE B	
	BIT 2 = RUN REFERENCE C	
	BIT 3 = MOP INCREMENT	
	BIT 4 = MOP DECREMENT	
	BIT 5 = RAMP DISABLE	
	BIT 6 = MOP RATE 1	
	BIT 7 = MOP RATE 2	
	BIT 8 = COMMAND ENABLE	
	BIT 9 = JOG 2	
	BIT 10 = JOG 1	
	BIT 11 = NORMAL STOP	
	BIT 12 = START	
	BIT 13 = CLOSE CONTACTOR	
	BIT 14 = CLEAR FAULT	
	BIT 15 = PROCESS TRIM	
152	LOGIC COMMAND 3	
	BIT 0 = RUN REFERENCE A	DHT Parameter 200 HARD LINKED
	BIT 1 = RUN REFERENCE B	
	BIT 2 = RUN REFERENCE C	
	BIT 3 = MOP INCREMENT	
	BIT 4 = MOP DECREMENT	
	BIT 5 = RAMP DISABLE	
	BIT 6 = MOP RATE 1	
	BIT 7 = MOP RATE 2	
	BIT 8 = COMMAND ENABLE	
	BIT 9 = JOG 2	
	BIT 10 = JOG 1	
	BIT 11 = NORMAL STOP	
153	VELOCITY REFERENCE FRACTION	
154	VELOCITY REFERENCE WHOLE	
156	TACH VELOCITY	
157	TORQUE REFERENCE	
159	FLUX FEED FORWARD	
160	CEMF REFERENCE	
161	PROCESS TRIM REFERENCE	
162	PROCESS TRIM FEEDBACK	
163	VEL INDIRECT 1 (PAR 600)	
164	VEL INDIRECT 2 (PAR 601)	
165	VEL INDIRECT 3 (PAR 602)	
166	VEL INDIRECT 4 (PAR 603)	
167	TORQUE REFERENCE 2	

Parameter Value List

Record all parameter values or PLC references as finalized during start-up in the following tables:

Table 7.C
Parameter Values

Parameter	Description	Value	PLC Reference
600	VELOCITY PARAM 1 SEL (PAR 163)		
601	VELOCITY PARAM 2 SEL (PAR 164)		
602	VELOCITY PARAM 3 SEL (PAR 165)		
603	VELOCITY PARAM 4 SEL (PAR 166)		
606	BASE MOTOR SPEED		
607	REVERSE SPEED LIMIT		
608	FORWARD SPEED LIMIT		
609	ENCODER PPR		
610	RATED MOTOR VOLTAGE		
611	MOTOR ARMATURE FLA		
612	RATED FIELD MOTOR CURRENT		
613	MOTOR INERTIA		
614	ARMATURE RESISTANCE		
615	RATED ARMATURE BRIDGE CURRENT		
616	RATED FIELD BRIDGE CURRENT		
617	SYSTEM RESET SELECT		
620	RATED AC LINE VOLTAGE		
621	FEEDBACK DEVICE TYPE		
	0 = ENCODER		
	1 = ARMATURE VOLTS		
	2 = ANALOG TACH		
	3 = NO FDBK		
622	CONTACTOR TYPE		
	AC = 0 (INTERRUPTS AC SUPPLY)		
	DC = 1 (INTERRUPTS DC ARM CIRCUIT)		
623	HARD FAULT SELECT		
	BIT 0 = SCR OVERTEMP		
	BIT 1 = MOTOR OVERTEMP		
	BIT 2 = OVERLOAD TRIP		
	BIT 3 = STALL		
	BIT 4 = AC VOLTAGE OUT OF TOLERANCE		
	BIT 5 = WAITING SAFE ARM VOLTS		
	BIT 6 = WAITING ZERO CURRENT		
	BIT 7 = BRIDGE OVERLOAD		
624	MAINTAINED START		
	0 = MOMENTARY		
	1 = MAINTAINED		
625	TORQUE MODE		
	0 = ZERO TORQUE MODE		
	1 = VELOCITY REG. OUTPUT		
	2 = EXTERNAL TORQUE REF		
	3 = MIN SELECTION OF 1 & 2		
	4 = MAX SELECTION OF 1 & 2		
	5 = LOAD RESPONSE OF 1 & 2)		

Table 7.C
Parameter Values cont.

Parameter	Description	Value	PLC Reference
626	JOG RAMP ENABLE		
	0 = NO RAMP USED		
	1 = RAMP USED		
627	FLUX MODE SELECT		
	BIT 0 = FIELD ECONOMY ENABLE		
	BIT 1 = FIELD WEAKENING ENABLE		
	BIT 2 = EXTERNAL FEED FORWARD		
	BIT 3 = COUNTER EMF SELECTED		
	BIT 4 = CEMF HOLD		
	BIT 5 = CEMF RESET		
	BIT 6 = DISABLE FIELD LOSS DETECTION		
628	PROCESS TRIM SELECT		
	0 = DISABLE PROCESS TRIM		
	1 = SPEED TRIM		
	2 = TORQUE TRIM		
629	MOTOR OVERLOAD SELECT		
	0 = OVERLOAD FUNCTION DISABLED		
	1 = 60 SEC TO TRIP @ 150% COOLED MTRS		
	2 = 60 SEC TO TRIP @ 200% COOLED MTRS		
	3 = 60 SEC TO TRIP @ 150% MTRS		
	4 = 60 SEC TO TRIP @ 200% MTRS		
630	FAULT REPORT		
	0 = NO FILTER		
	1 = VP FAULTS		
631	FEEDBACK FILTER SELECT		
	0 = NO FILTER		
	1 = 35/49 RADIAN FILTER		
	2 = 20/40 RADIAN FILTER		
632	WARNING SELECT		
633	PRESET SPEED 1		
634	PRESET SPEED 2		
635	PRESET SPEED 3		
636	PRESET SPEED 4		
637	PRESET SPEED 5		
638	JOG SPEED 1		
639	JOG SPEED 2		
641	MOP ACCEL 1		
642	MOP ACCEL 2		
643	MOP ACCEL 3		
644	MOP ACCEL 4		
645	MOPDECEL 1		
646	MOP DECEL 2		
647	MOP DECEL 3		
648	MOP DECEL 4		

Table 7.C
Parameter Values cont.

Parameter	Description	Value	PLC Reference
649	MOP MAX SPEED		
650	MOP MIN SPEED		
651	ACCEL TIME		
652	DECEL TIME		
653	DESIRED CONTOUR		
657	DROOP PERCENT		
658	DROOP FILTER		
659	KI VELOCITY LOOP		
660	KP VELOCITY LOOP		
661	KF VELOCITY LOOP		
663	FORWARD BRIDGE CURRENT LIMIT		
664	REVERSE BRIDGE CURRENT LIMIT		
665	START TAPER SPEED		
666	END TAPER SPEED		
667	MIN TAPER SPEED		
668	dI/dT LIMIT		
669	SLAVE PERCENT		
670	SLAVE PERCENT 2		
672	KI FLUX		
673	KP FLUX		
674	FIELD ECONOMY REFERENCE		
675	FIELD ECONOMY DELAY		
676	FIELD FLUX REFERENCE		
677	FIELD CURRENT AT 0/8 FLUX		
678	FIELD CURRENT AT 1/8 FLUX		
679	FIELD CURRENT AT 2/8 FLUX		
680	FIELD CURRENT AT 3/8 FLUX		
681	FIELD CURRENT AT 4/8 FLUX		
682	FIELD CURRENT AT 5/8 FLUX		
683	FIELD CURRENT AT 6/8 FLUX		
684	FIELD CURRENT AT 7/8 FLUX		
685	FIELD CURRENT AT 1/0 FLUX		
686	FIELD WEAKEN SPEED		
687	CEMF REG PRELOAD		
688	TACH SWITCH TOL		
689	TACH SWITCH Ki		
690	TACH SWITCH Kp		
691	TACH SWITCH SELECT		
698	AUTO TUNE I LIMIT		
699	AUTO TUNE SPEED		
700	VEL DESIRED BW		
701	VEL MAX BW		
702	VEL DAMP FACTOR		
703	SYSTEM INERTIA		

Table 7.C
Parameter Values cont.

Parameter#	Description	Value	PLC Reference
704	AT SPEED 1		
705	AT SPEED 2		
706	AT SPEED 3		
707	AT SPEED 4		
708	AT SPEED 5		
709	UP TO SPEED TOLERANCE		
710	ZERO SPEED TOLERANCE		
711	JOG DWELL		
713	PROCESS TRIM FILTER K		
714	PROCESS TRIM PRELOAD		
715	PROCESS TRIM KI GAIN		
716	PROCESS TRIM KP		
717	PROCESS TRIM LO LIM		
718	PROCESS TRIM HI LIM		
719	PROCESS TRIM OUTPUT GAIN		
720	OVERLOAD PEND LEVEL		
721	PROCESS TRIM LOW SUM		
722	PROCESS TRIM HI SUM		
724	ABSOLUTE OVERSPEED		
725	EXTERNAL OVERLOAD DELAY		
726	SCR OVERTEMP DLY		
727	STALL DELAY		
728	AC LINE TOL DLY		
729	FIELD FAULT THRESHOLD		
730	FIELD FAILURE DLY		
731	TACH LOSS CEMF		
732	TACH LOSS VEL		
733	ARM BRIDGE TYPE		
734	K DISCONTINUOUS		
735	KP ARMATURE LOOP		
736	KI ARMATURE LOOP		
737	KP FIELD LOOP		
738	KI FIELD LOOP		
739	K ARM VOLTS		
740	K AC VOLTS		
741	CUR DESIRED BW		
742	CUR MAX BW		
743	CUR DAMP FACTOR		
780	FIRMWARE VER NO.		

Table 7.D
Internal Configuration Parameters

Parameter	Description	Internal Parameter	Linked to Fast Sink Parameter	Description
840	SP INDIRECT 1	10		
841	SP INDIRECT 2	11		
842	SP INDIRECT 3	12		
843	SP INDIRECT 4	13		
844	SP INDIRECT 5	14		

Table 7.E
Trend Value Parameters

Parameter	Description	Value	PLC Reference
900	TREND SIGN VALUE		
901	TREND SIGN VALUE		
902	TREND SIGN VALUE		
903	TREND SIGN VALUE		
904	TREND LOGIC VALUE		
905	TREND LOGIC VALUE		
906	TREND LOGIC VALUE		
907	TREND LOGIC VALUE		
908	TREND UNSIGN VALUE		
909	TREND UNSIGN VALUE		

Table 7.F
Trend Buffer Parameters

Trend Buffer #1 is linked to parameter:

The output of Trend Buffer #1 is linked to parameter:

Description	Parameter	Parameter Range	Parameter Value
TREND 1 Operand Parameter X	910	1 through 947	
TREND 1 Operand Parameter Y	911	1 through 947	
TREND 1 Operator	912	GT, LT,EQ, AND, NAND, OR, NOR	
TREND 1 sample rate	913	0.004 thru 30 seconds	
TREND 1 post samples	914	0 – 99	
TREND 1 multiple trigger	915	OFF, ON	
TREND 1 enable	916	OFF, ON	
TREND 1 output rate	917	0.004 thru 30 seconds	

Table 7.F Trend Buffer Parameters (cont.)

Trend Buffer #2 is linked to parameter:

The output of Trend Buffer #2 is linked to parameter:

Description	Parameter	Parameter Range	Parameter Value
TREND 2 Operand Parameter X	920	1 through 947	
TREND 2 Operand Parameter Y	921	1 through 947	
TREND 2 Operator	922	GT, LT,EQ, AND, NAND, OR, NOR	
TREND 2 sample rate	923	0.004 thru 30 seconds	
TREND 2 post samples	924	0 – 99	
TREND 2 multiple trigger	925	OFF, ON	
TREND 2 enable	926	OFF, ON	
TREND 2 output rate	927	0.004 thru 30 seconds	

Table 7.F Trend Buffer Parameters (cont.)

Trend Buffer #3 is linked to parameter:

The output of Trend Buffer #3 is linked to parameter:

Description	Parameter	Parameter Range	Parameter Value
TREND 3 Operand Parameter X	930	1 through 947	
TREND 3 Operand Parameter Y	931	1 through 947	
TREND 3 Operator	932	GT, LT,EQ, AND, NAND, OR, NOR	
TREND 3 sample rate	933	0.004 thru 30 seconds	
TREND 3 post samples	934	0 – 99	
TREND 3 multiple trigger	935	OFF, ON	
TREND 3 enable	936	OFF, ON	
TREND 3 output rate	937	0.004 thru 30 seconds	

Table 7.F Trend Buffer Parameters (cont.)

Trend Buffer #4 is linked to parameter:

The output of Trend Buffer #4 is linked to parameter:

Description	Parameter	Parameter Range	Parameter Value
TREND 4 Operand Parameter X	940	1 through 947	
TREND 4 Operand Parameter Y	941	1 through 947	
TREND 4 Operator	942	GT, LT,EQ, AND, NAND, OR, NOR	
TREND 4 sample rate	943	0.004 thru 30 seconds	
TREND 4 post samples	944	0 – 99	
TREND 4 multiple trigger	945	OFF, ON	
TREND 4 enable	946	OFF, ON	
TREND 4 output rate	947	0.004 thru 30 seconds	

Alphabetical Parameter Reference Listing

Parameter Reference Listing (Alphabetical)

PARAMETER NAME	PARAMETER NO.	PAGE REFERENCE
Fld I @ 0/8 Flux	677	5-51
Fld I @ 1/8 Flux	678	5-51
Fld I @ 2/8 Flux	679	5-52
Fld I @ 3/8 Flux	680	5-52
Fld I @ 4/8 Flux	681	5-52
Fld I @ 5/8 Flux	682	5-53
Fld I @ 6/8 Flux	683	5-53
Fld I @ 7/8 Flux	684	5-53
Fld I @ 1.0 Flux	685	5-54
Fld Weakened Speed	686	5-54
Flux Feed Forward	159	5-30
Flux Command	115	5-22
Flux Mode Select	627	5-39
Flux Trim	121	5-23
Fwd Brdg Cur Lim	663	5-48
Fwd Speed Lim	608	5-33
Jog Dwell	711	5-60
Jog Ramp Enable	626	5-39
Jog 1 Speed	638	5-42
Jog 2 Speed	639	5-43
K AC Volts	740	5-67
K Arm Volts	739	5-67
K Discontinuous	734	5-66
KF Velocity Loop	661	5-47
KI Armature Loop	736	5-66
KI Field Loop	738	5-67
KI Flux	672	5-50
KI Velocity Loop	659	5-47
KP Armature Loop	735	5-66
KP Field Loop	737	5-66
KP Flux	673	5-50
KP Velocity Loop	660	5-47
Logic Command 1	150	5-25
Logic Command 2	151	5-28
Logic Command 3	152	5-29
Logic Status	100	5-16
Maintain Start	624	5-38
Minimum Tapered Current	667	5-49

Parameter Reference Listing (Alphabetical)

PARAMETER NAME	PARAMETER NO.	PAGE REFERENCE
MOP Accel 1 – 4	641 – 644	5-43 – 5-44
MOP Decel 1 – 4	645 – 648	5-44 – 5-45
MOP Max Speed	649	5-45
MOP Min Speed	650	5-45
Motor Arm FLA	611	5-34
Motor Inertia	613	5-34
Mtr Overload Sel	629	5-40
Overload Pending	720	5-62
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Process Trim Lo Lim	717	5-62
Process Trim Lo Sum	721	5-63
Process Trim Output Gain	719	5-62
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Rated Motor Volt	610	5-34
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Rev Brdg Cur Lim	664	5-48
Rev Speed Lim	607	5-33
SCR Overtemp Dly	726	5-64
Slave Percent 2	670	5-49
Stall Delay	727	5-64
SP Indirect 1 – 5	840 – 844	5-69 – 5-70
SP Output 1 – 5	10 – 14	5-15

Parameter Reference Listing (Alphabetical)

PARAMETER NAME	PARAMETER NO.	PAGE REFERENCE
System Inertia	703	5-58
System Reset Select	620	5-36
Strt Taper Speed	665	5-48
Tach Loss CEMF	731	5-63
Tach Loss Vel	732	5-63
Tach Switch Ki	689	5-55
Tach Switch Kp	690	5-55
Tach Switch Select	691	5-56
Tach Switch Tol	688	5-55
Tach Velocity	156	5-30
Torque Command	110	5-21
Torque Mode	625	5-38
Torque Reference	157	5-30
Torque Reference 2	167	5-32
Trend 1 Contig Trigger Swtch	915	5-74
Trend Constant Signed Value	900 – 903	5-70
Trend Constant Logic Value	904 – 907	5-71
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Trend Enable Trend	916 (926, 936, 946)	5-74, 5-74
Trend Operand Parameter X	910 (920, 930, 940)	5-72, 5-74
Trend Operand Parameter Y	911 (921, 931, 941)	5-72, 5-74
Trend Operator	912 (922, 932, 942)	5-73, 5-74
Trend Output Transmit Rate	917 (927, 937, 947)	5-74, 5-74
Trend Sampling Rate	913 (923, 933, 943)	5-73, 5-74
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Up to Speed Tol	709	5-60
Vel Desired BW	700	5-57
Vel Damp Factor	702	5-58
Velocity Error	124	5-24
Velocity Feedback	106	5-20
Velocity Feed Forward	108	5-21
Velocity Filter Sel	631	5-41
Velocity Indirect 1	163 – 166	5-31 – 5-32
Velocity Max BW	701	5-57
Velocity PI Output	123	5-24
Velocity Ref Fraction	153	5-29
Velocity Ref Whole	154	5-29
Warning Select	632	5-41
Zero Speed Tol	710	5-60

Glossary

Adapter Board – A circuit board required to convert information to and from an external device to the format required by the Main Control Board microbus.

Analog – A control system with continuously adjustable voltage or current level.

Binary – A numbering system using the base 2 Radix. The value can be 0 or 1.

Bit – One binary digit of data consisting of 0 or 1.

Default – Value provided for a parameter as part of the program when the Drive is initially started.

Programming Terminal – Programming device used to enter and monitor parameters in the Bulletin 1395 Drive.

Digital – A control system that uses two specific voltage or current signal levels which correspond to 1 or 0.

Configuration Parameter – A variable that is used to pass values between processes on a real time basis for Drive control.

Fault – A Drive condition that is monitored and displayed on the Programming Terminal.

Firmware – The non-changeable portion of the software program that defines relationships between the parameters.

Hardware – That portion of the software program that defines relationships between the parameters.

Hexadecimal – Number system using the base 16, Radix.

Interface – Hardware and associated software required to transfer information and/or control signals from one device to another.

Microbus – Hardware and associated software designed by Allen-Bradley for the exchange of digital information between the microprocessor chips at the microprocessor level. The microbus is used for transfer of information between the control microprocessors located on the Main Control Board. In addition, it allows for connection of two adapter boards through two ports.

Microprocessor – A silicon chip that can be programmed to process data.

Setup Parameter – A variable that is given a constant value for a specified application.

Parameter – A memory address that is used to store data for use by the program. The data stored in the parameter can be either variable or constant.

Port – Hardware located on the Main Control Board which allows for connection of one Adapter Board to the microbus.

Reset – A signal used to return a function to its initial state.

Scaling – A number used as a multiplier, so chosen that it will cause a set quantity to fall within a given range of values.

Software – Programs, procedures, rules and documentation pertaining to the operation of the computer system.

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Chapter 8

Renewal Parts

Introduction

Chapter 8 provides an overview of the 1395 High Horsepower components that are available as renewal parts and the required quantity of each item. Figure 8.1 is provided to show the approximate component locations. For part number and pricing information, refer to the 1395 Renewal Parts publication.

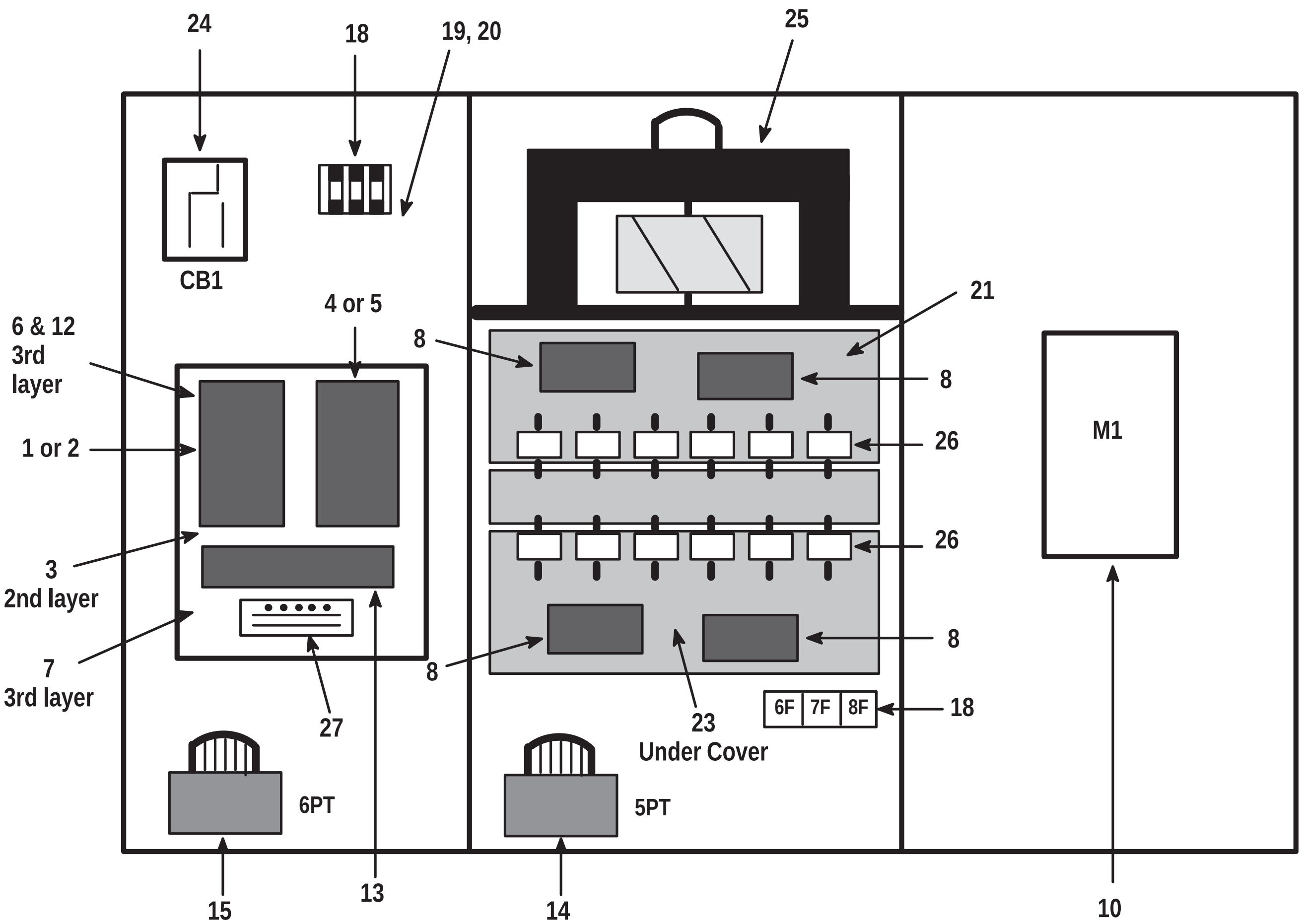
400 – 600HP, 230VAC
700 – 1250HP, 460VAC
1000 – 2000HP, 660VAC

Reference Number	Description	Quantity
1	Digital Reference Adapter Board	1
2	Discrete Adapter Board	1
3	Main Control Board	1
4	Multi Communication Board	1
5	Node Adapter Board	1
6	Power Stage Interface Board	1
7	24VDC Power Supply Board	1
8	Armature Pulse Transformer Board	4
9	Auxiliary Contact M1, N.C. (Option)	1 to 3
10	Contactor M1	1
11	Field Pulse Transformer & Snubber Brd	1
12	Unit Power Supply	1
13	Feedback Board	1
14	Transformer 5PT 660/460	1
15	Transformer 6PT 460/115	1
16-20	Fuses	

	230VAC	460VAC	660VAC
1F, 2F	149856 (KLDR-10)	149860 (KLDR-7)	149860 (KLDR-7)
3F	149858 (KLDR-8)	149858 (KLDR-8)	149858 (KLDR-8)
4F	149862 (KLDR-5)	149862 (KLDR-5)	149862 (KLDR-5)
6F,7F,8F	146932 (CCMR-7.5)	146924 (CCMR-3.5)	146924 (CCMR-3.5)
11F,12F,13F	25A, 600VAC (KTK-R-25)	25A, 600VAC (KTK-R-25)	25A, 700VAC, (A70p25-1)
21FA-26FA 21FB-26FB	900A, 700VAC, (SPP-7F900)	900A, 700VAC, (SPP-7F900)	900A, 700VAC, (SPP-7F900)

Reference Number	Description	Quantity
20	Fuses, Line	3
21	Heatsink Thermoswitch	1
22	SCR Armature Non Regenerative SCR Armature Regenerative	3 6
23	SCR Module, Field	1
24	Circuit Breaker CB1	1
25	DC Bridge Fan Unit	1
26	SCR Bridge Fuses (21FA – 26FA and 21FB – 26FB)	12
27	Terminal Block TB3	1

Figure 8.1
1395 Part Locations



Notes

Notes

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Notes

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PUBLICATION NAME ____________________

PUBLICATION NUMBER, DATE AND PART NUMBER (IF PRESENT) ____________________

✓ **CHECK THE FUNCTION THAT MOST CLEARLY DESCRIBES YOUR JOB.**

- ❑ SUGGEST / RESPONSIBLE FOR THE PURCHASE OF EQUIPMENT
- ❑ MAINTAIN / OPERATE PROGRAMMABLE MACHINERY
- ❑ DESIGN / IMPLEMENT ELECTRICAL SYSTEMS
- ❑ TRAIN/EDUCATE MACHINE USERS
- ❑ SUPERVISE FLOOR OPERATIONS

✓ **WHAT LEVEL OF EXPERIENCE DO YOU HAVE WITH EACH OF THE FOLLOWING PRODUCTS?**

	NONE	LITTLE	MODERATE	EXTENSIVE
PROGRAMMABLE CONTROL	❑	❑	❑	❑
AC / DC DRIVES	❑	❑	❑	❑
PERSONAL COMPUTERS	❑	❑	❑	❑
NC / CNC CONTROLS	❑	❑	❑	❑
DATA COMMUNICATIONS / LAN	❑	❑	❑	❑

✓ **RATE THE OVERALL QUALITY OF THIS MANUAL BY CIRCLING YOUR RESPONSE BELOW. (1) = POOR (5) = EXCELLENT**

HELPFULNESS OF INDEX / TABLE OF CONTENTS	1	2	3	4	5
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ACCURACY AND COMPLETENESS	1	2	3	4	5
QUALITY COMPARED TO OTHER COMPANIES' MANUALS	1	2	3	4	5
QUALITY COMPARED TO OTHER ALLEN-BRADLEY MANUALS	1	2	3	4	5

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