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DELTA SERIES **JULY 2003**

DELTA S

INSTRUCTION BOOK

INDUSTRIAL INDEXING SYSTEMS, Inc.

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Approved By:

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Notes:

1) Appendix A, page A-4, dated September 2003, supersedes Appendix A, page A-4, dated June 2003.

2) Section 4, page 4-11, dated October 2003, supersedes Section 4, page 4-11, dated July 2003. Appendix B, page B-2, dated October 2003, supersedes Appendix B, page B-2, dated June 2003.

3) Section 6, page 6-6, dated March 2004, supersedes Section 6, page 6-6, dated July 2003. Section 10, page 10-3, dated March 2004, supersedes Section 10, page10-3, dated June 2003.

4) Section 6, page 6-6, dated June 2004, supersedes Section 6, page 6-6, dated March 2004. Appendix B, pages B-4 and B-5, dated June 2004, supersedes Appendix B, pages B-4 and B-5, dated June 2003. C-329YYY supersedes C-320YYY. DINT-350 revision N supersedes DINT-350 revision K.

5) Appendix B, dated November 2004, supersedes Appendix B, dated June 2003.

6) Table of Contents, page vi, dated August 2005, supersedes Table of Contents, page vi, dated June 2003. Section 6, page 6-6 dated August 2005, supersedes Section 6, page 6-6, dated June 2004. Appendix A, added DBM120 series motors. Appendix B, added cables for the DBM120 series motors.

7) Section 6, page 6-6, dated March 2006, supersedes Section 6, page 6-6, dated August 2005.

8) Appendix B, DINT-300 drawing, Revision M, supersedes Appendix B, DINT-300, Revision L.

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INTRODUCTION

Thank you for selecting Industrial Indexing Systems' Delta Series products. You join many other companies around the world in your choice of these powerful, flexible motion control products.

The Delta S Driver is based on the Delta Driver, with the addition of a SERCOS adapter, which allows the driver to interface to SERCOS Interface™[1] Master controllers.

The small, lightweight Delta S Drivers combine the latest in all-digital electronic design, SMT circuit board construction and clever engineering to deliver high performance, advanced features and reasonable cost. Compact, high power density motors provide low rotor inertia, making them the logical choice for positioning and indexing applications.

Delta S Drivers have a wide array of features, including 2 powerful embedded high speed 32-bit RISC processors, membrane keypad, high visibility 5-digit LED display and a SERCOS status display, Analog and Digital I/0, programmable limit switches, S-curve profiling, auto servo tuning, fault history log and many more. Dozens of operational parameters can be programmed, either through the front panel or using your IBM-compatible computer. And the PC software allows quick set-up for a full range of diagnostics and PC oscilloscope functions to display speed and current waveforms on your computer.

High-resolution resolver feedback is standard on Delta S products. Other available choices include encoder feedback and Power Off absolute feedback.

[1] SERCOS Interface is a trademark of Interest Groupe SERCOS

SECTION 1 - OVERVIEW

This manual is organized so that information is easy to find and easy to use. It begins by detailing how to identify the basic electrical characteristics of Delta S Drivers and Delta Motors, and provides comprehensive product specifications.

Next, detailed sections are given of the parameter settings both through the integrated keypad and by SERCOS Identification numbers. Sections on Power and Driver Wiring, Regen Resistor selection and Dynamic and Mechanical Braking follow. A Troubleshooting section can aid you in the unlikely event that anything goes wrong.

Motor and Driver Speed/Torque Curves follow this information, allowing you to match Drivers and Motors to your specific applications. A final section which contains cables and various Mechanical Drawings round out this manual.

1.1 IDENTIFYING DELTA S PACKAGES

Delta S packages can be identified as follows.

Your Delta S package model number uses this designation:

DELTA S-XYYYYABCD,

WHERE:

- X = motor series
  - Blank = standard
  - A = A series
  - B = B series
  - C = Custom
  - D = D series
  - E = E series
- YYYY = is the rated mechanical output wattage of the package
- A =
  - H = 3000 rpm rated motor
  - M = 2000 rpm rated motor
  - L = 1500 rpm rated motor
  - C = custom speed
- B =
  - R = resolver based system
  - RA = absolute resolver sensor based system
  - E = encoder based system
  - EA = absolute encoder sensor based system
- C =
  - A = 220 VAC system, single or three phase
  - B = 120 VAC system, single phase (only for smallest drive and only up to 200 watts)
- D = motor and driver options where
  - B = integral brake option
  - I = 14 bit analog input
  - J = Sourcing I/O Expansion board
  - K = Sinking I/O Expansion board
  - 1X = 1 cycle resolver
  - others as defined in future

Example: A Delta S package designated DELTA S-120HRB is a 120-watt motor, with a 3000 rpm rated motor, a resolver based system, 120 VAC system. If this same package was equipped with an integral brake, it would be designated DELTA S-120HRBB.

1.2 IDENTIFYING DELTA S DRIVES

Delta S Drivers can be identified as follows. This information is on the Driver label:

Your Delta S Driver model number uses this designation:

DS-CURRENT/ZYX,

WHERE:
- CURRENT = Peak Driver Current in amps (rms)
- Z = feedback method:
  - R = resolver feedback
  - E = encoder feedback
  - RA = absolute resolver feedback
  - EA = absolute encoder feedback
- Y = input voltage:
  - A = 220 VAC input (single or three phase)
  - B = 115 VAC input (single phase) - only available up to 200 watts
- X = option:
  - I = 14 bit analog input A & D converter
  - J = Sourcing I/O Expansion board
  - K = Sinking I/O Expansion board

Example: A Delta S Driver designated DS-8.5/RB has a peak current rating of 8.5 A rms, resolver feedback, and 115 VAC 1∅ input voltage.

1.3 IDENTIFYING DELTA MOTORS

Delta Motors can be identified as follows. This information is on the Motor label:

Your Delta Motor model number uses this designation:

DBM-SERIES WATTAGE/SPEED YZ,

WHERE:

- SERIES = Motor series
  - Blank = standard
  - A = A series
  - B = B series
  - C = Custom
  - D = D series
  - E = E series
- WATTAGE = Rated Motor Power in watts
- SPEED = Rated Motor Speed in hundreds of RPMs
- Y = feedback method:
  - R = resolver feedback
  - E = encoder feedback
  - RA = absolute resolver feedback
  - EA = absolute encoder feedback
- Z = B for a motor with an integral brake
  - T for windings with "Tropical" fungus protection
  - W for washdown sealing
  - 1X = 1 cycle resolver

Example: A Delta Motor designated DBM-120/30R is a 120-watt motor with a 3000 rpm rated speed and resolver feedback. If this same motor was equipped with an integral brake, it would be designated DBM-120/30RB. If the same motor was equipped with "Tropical" fungus protection, it would be designated DBM-120/30RT and with a brake, it would be designated DBM-120/30RBT.

SECTION 2 - DESCRIPTION

The Delta S is a SERCOS Interface compatible servo drive. When interfaced to a SERCOS Master controller, access can be made to a wide variety of hardware features along with the SERCOS standard motion configurations.

The external connections that exist on the Delta S are shown in **Figure 2.1**, and consist of 2 RS-232 ports, 8 digital inputs and 8 digital outputs standard, 2 analog inputs, SERCOS Fiber Optic Transmitter and Receiver, as well as motor, resolver, and power connections. The Delta drive also has an analog monitor output that is capable of representing either speed or torque as a function of voltage relative to +/- 3 vdc.

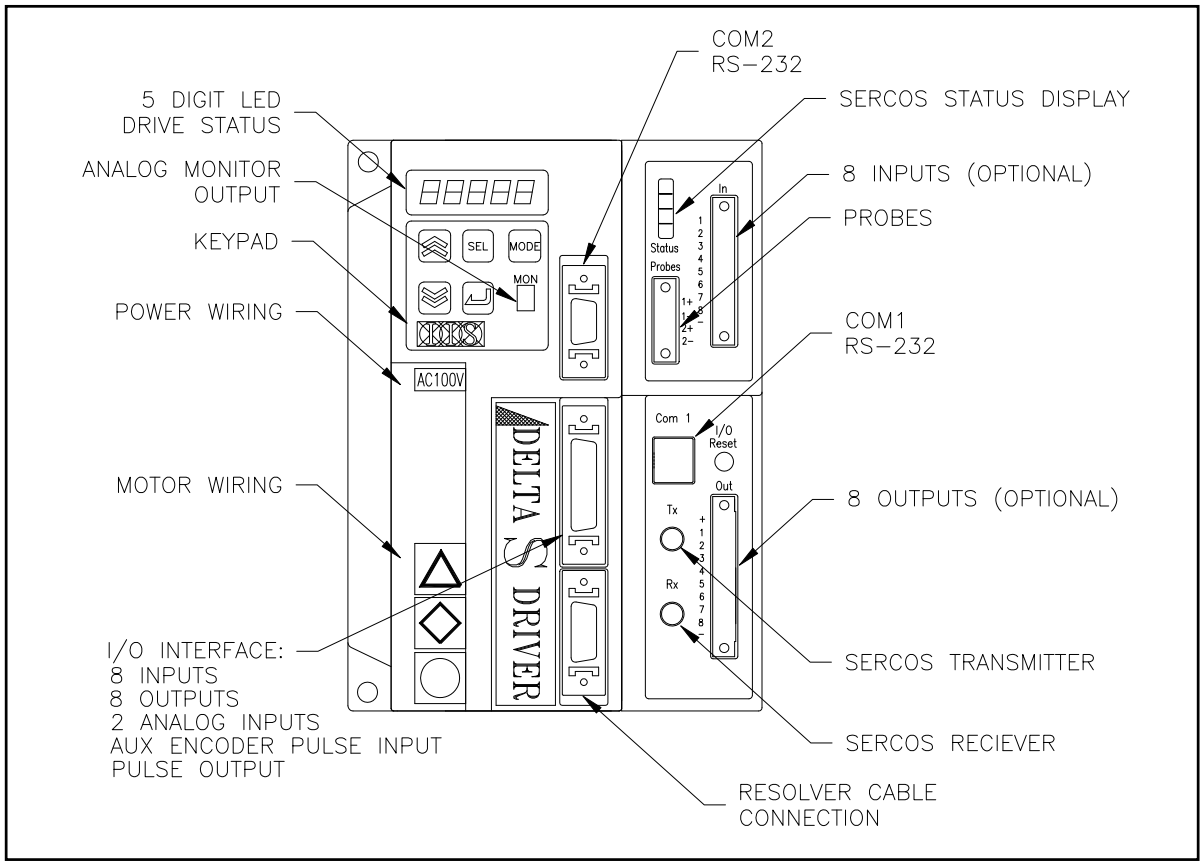


Figure 2.1 - Delta S Layout

2.1 COMPONENTS

2.1.1 STATUS INDICATORS

1. Drive Status Display - This is a 5-digit seven segment display which indicates the current status of the Delta driver. A fault on the drive would be represented by AL - ## which indicates an alarm with an associated two digit number. These alarm codes and their descriptions can be found in **Section 12 - Alarm & Status Codes**.

2. SERCOS Status Display- This 4 LED array provides status information on the current state of the SERCOS Interface. For further information on this display, see **Section 12 - Alarm & Status Codes** in this manual.

2.1.2 CONNECTORS

1. Com 1 - This 6-pin RJ-11 connector is an RS-232 serial communication port. This port is utilized to update the firmware in the SERCOS Adapter.

2. Com 2 - This 14-pin connector is an RS-232 serial communication port. With PC software this port can be used to download, upload, or change drive parameters, drive diagnostics, and PC oscilloscope functions.

3. I/O Interface- This connector provides access to the onboard I/O, including 8 optically isolated inputs, 8 optically isolated outputs, 2 analog inputs, auxiliary encoder pulse input and pulse output. IIS offers two cable options to this connector; there is the C-719YYY cable with ferruled ends or the C-716006 cable that terminates at the DINT-300, which provides terminal blocks for I/O wiring.

4. SERCOS Transmitter/Receiver- These fiber optic ports allow the drive to be interfaced to a SERCOS Master Controller.

5. Probes- High Speed Optically Isolate inputs that can be configured to trap the motor feedback position.

6. Resolver Cable Connector - This is a 20-pin mini D connector used for resolver feedback from the motor to the drive.

7. Motor/Power wiring terminals - These are terminal blocks used to wire the incoming AC line voltage as well as the motor cable.

8. Monitor Output - This is a connector that provides access to an analog output signal. The signal is can be defined as a conversion of torque or speed.

SECTION 3 - SPECIFICATIONS

3.1 DRIVER SPECIFICATIONS

Delta S Driver	DS-1.5/RB	DS-1.5/RA	DS-4.25/RB	DS-4.25/RA
Weight	3.3 lb 1.5 kg	3.3 lb 1.5 kg	3.3 lb 1.5 kg	3.3 lb 1.5 kg

Delta S Driver	DS-8.5/RB	DS-8.5/RA	DS-17.5/RA	DS-35/RA	DS-50/RA	DS-70/RA	DS-115/RA
Weight	3.3 lb 1.5 kg	3.3 lb 1.5 kg	5.5 lb 2.5 kg	10 lb 4.5 kg	10 lb 4.5 kg	24 lb 11 kg	35 lb 16 kg

3.1.1 MOTOR OUTPUT

Delta S Driver	DS-1.5/RB	DS-1.5/RA	DS-4.25/RB	DS-4.25/RA
Motor Output	PWM, 3 Phase, sine wave			
Continuous Output Current	1.0 A rms	1.0 A rms	2.8 A rms	2.8 A rms
Max. Output Current See **Figure 3.1**	1.5 A rms	1.5 A rms	4.25 A rms	4.25 A rms
Motor Ripple Frequency	20 kHz	20 kHz	20 kHz	20 kHz

Delta S Driver	DS-8.5/RB	DS-8.5/RA	DS-17.5/RA	DS-35/RA	DS-50/RA	DS-70/RA	DS-115/RA
Motor Output	PWM, 3 Phase, sine wave						
Continuous Output Current	2.1 A rms	3.4 A rms	5.7 A rms	14.1 A rms	18.4 A rms	28.3 A rms	56.6 A rms
Max. Output Current See **Figure 3.1**	8.5 A rms	8.5 A rms	17.5 A rms	35.0 A rms	50.0 A rms	70.0 A rms	115.0 A rms
Motor Ripple Frequency	20 kHz	20 kHz	20 kHz	20 kHz	20 kHz	10 kHz	10 kHz

3.1.2 POWER SUPPLY

Delta S Driver	DS-1.5/RB	DS-1.5/RA	DS-4.25/RB	DS-4.25/RA
Main Bus Power Supply Voltage	1 Phase, Nominal: 110 VAC, Max Range: 85-126 VAC, 50/60 Hz	1 Phase, Nominal: 220 VAC, Max Range: 170-264 VAC, 50/60 Hz	1 Phase, Nominal: 110 VAC, Max Range: 85-126 VAC, 50/60 Hz	1 Phase, Nominal: 220 VAC, Max Range: 170-264 VAC, 50/60 Hz
Main Supply Capacity	350 VA	350 VA	350 VA	350 VA
Control Voltage	Powered by main circuit supply			
Control Capacity	Powered by main circuit supply			
Main Circuit Heat Loss	17 W	17 W	17 W	17 W
Control Circuit Heat Loss	23 W	23 W	23 W	23 W
Regeneration Absorption Capacity	13 W + 17 J	13 W + 17 J	13 W + 17 J	13 W + 17 J

Delta S Driver	DS-8.5/RB	DS-8.5/RA	DS-17.5/RA	DS-35/RA	DS-50/RA	DS-70/RA	DS-115/RA
Main Bus Power Supply Voltage	1 Phase, Nominal: 110 VAC, Max Range: 85-126 50/60 Hz	1 Phase, Nominal: 220 VAC, Max Range: 170-264 VAC, 50/60 Hz		3 Phase, Nominal: 220 VAC, Max Range: 170-264 VAC, 50/60 Hz			
Main Supply Capacity	570 VA	1.2 KVA	2.5 KVA	5.3 KVA	6.7 KVA	13 KVA	25 KVA
Control Voltage	Powered by main circuit supply			Single phase, 170-264 VAC, 50/60 Hz			
Control Capacity	Powered by main circuit supply			70 VA		80 VA	110 VA
Main Circuit Heat Loss	20 W	27 W	47 W	110 W	130 W	250 W	400 W
Control Circuit Heat Loss	23 W	23 W	23 W	26 W	26 W	30 W	60 W
Regeneration Absorption Capacity	17 W + 17 J	24 W + 17 J	37 W + 22 J	160 W + 38 J	180 W + 54 J	300 W + 94 J	480 W + 188 J

3.1.3 CONTROL PERFORMANCE

Feedback	Resolver
Feedback Resolution	12000 bits/rev * number of resolver cycles ie. 2X resolver = 2*12000 bits/rev = 24000 bits/rev. See motor drawings in **Appendix A.6** for resolver type.
Feedback Accuracy	18 arc minutes spread for motors with 95 mm mounting face or smaller ±20 arc minutes for B series motors 8 arc minute spread for all other motors
Speed Regulation	Load (0%-100%): ±0.02% Power (85-126 VAC or 170-264 VAC): ±0.02% Temperature (0-55°C/32-131°F): ±0.2%
Torque Regulation	Power (85-126 VAC or 170-264 VAC): ±2% Temperature (0-55°C/32-131°F): ±2%

Feedback	Encoder
Feedback Resolution	See motor drawings in **Appendix A.8** for encoder type.
Feedback Accuracy	Less than 2 arc minutes.
Speed Regulation	Load (0%-100%): ±0.02% Power (85-126 VAC or 170-264 VAC): ±0.02% Temperature (0-55°C/32-131°F): ±0.2%
Torque Regulation	Power (85-126 VAC or 170-264 VAC): ±2% Temperature (0-55°C/32-131°F): ±2%

3.1.4 ENVIRONMENT

Storage Temperature	-10 to 70°C/14-158°F
Operating Temperature	0 to 55°C/32-131°F
Humidity	35 to 90% Relative Humidity, non-condensing
Shock and Vibration	1 G or less
Operating Conditions	Free of dust, liquids, metallic particles and corrosive gases. Use in a pollution degree 2 environment.
Drive Enclosure	The drive is rated as "open type equipment" by Underwriters Laboratories, Inc.

3.1.5 SERCOS INTERFACE

Interface Version	V01.02
Topology	Multi drop fiber optic ring
Transmission Rates	2, 4, 8 and 16 MB/second

3.1.6 STANDARD DIGITAL INPUTS/OUTPUTS

Standard Sinking I/O	Control Input	24 VDC 8 ma: common to +24V, optically isolated
	Control Output	24 VDC 40 ma: common to 24G, optically isolated
Optional Sinking I/O DINT-300K	Control Input	24 VDC 6 ma: common to +24V, optically isolated
	Control Output	24 VDC 400 ma: common to 24G, optically isolated
Optional Sourcing I/O DINT-300S	Control Input	24 VDC 6 ma: common to 24G, optically isolated
	Control Output	24 VDC 400 ma: common to +24V, optically isolated
Internal Power Supply	24 VDC ± 15% 100 ma maximum, ground isolated	
External Power Supply	24 VDC ± 15%	

3.1.7 OPTIONAL DIGITAL INPUTS/OUTPUTS EXPANSION BOARD

3.1.7.1 SOURCING I/O OPTION "J"

Input	24 VDC 5 ma: common to 24G, optically isolated
Output	24 VDC 500 ma common to +24V, optically isolated
Internal Power Supply	24 VDC ± 15%

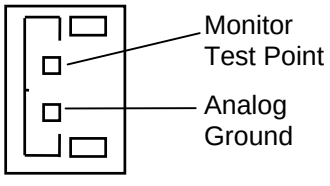
3.1.7.2 SINKING I/O OPTION "K"

Input	24 VDC 5 ma: common to +24V, optically isolated
Output	24 VDC 500 ma common to 24G, optically isolated
Internal Power Supply	24 VDC ± 15%

3.1.8 PROBE INPUTS

Probe Input 1 Probe Input 2	24 VDC 5 ma

3.1.9 ANALOG I/O SIGNALS

Analog Input 1 and Analog Input 2	Maximum Input Voltage: ± 10 VDC Input Impedance: 18 kΩ A/D resolution: 1/1024 at ±10V (10 bit Standard, 14 bit Optional) Scaleable with setup parameter
Monitor Output	Maximum Voltage Swing: ± 3 VDC at 1 ma Output Impedance: 330 Ω Accuracy: ±8% Monitor Scaling Speed: 3V equals motor rated speed Torque: 3V equals motor peak torque C-722006 Monitor Cable Available 

3.1.10 HIGH SPEED DIGITAL I/O SIGNALS

Auxiliary Encoder Pulse Input FMA and /FMA FMB and /FMB	On voltage: 5 VDC ± 5% at 17 ma maximum Off voltage: 1 VDC ± 5% less than 1 ma 200 KHz maximum frequency in pulse-pulse or pulse-direction modes 50 KHz in AB quadrature mode Optically isolated
Pulse Output APD and /APD BPD and /BPD ZPD and /ZPD	RS422 output: AM26LS31 or equiv. 400 kHz maximum frequency

3.1.11 PROTECTION

Fault Checks	Under Voltage, Over Voltage, Motor Short, Output Short, Feedback Loss, Regeneration Resistor Over Temperature and Malfunction, Driver Over Temperature, Motor rms Torque (motor overheat) Driver Rated Current, Over Speed, Motor Stall, Dynamic or Mechanical Brake Failure, Following Error, Internal Watchdog Timer, Processor Diagnostics
Output Short Circuit Protection	The drives are suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 volts maximum when protected by a circuit breaker having an interrupting rating not less than 5000 rms symmetrical amperes, 240 volts maximum.

3.2 MOTOR SPECIFICATIONS

3.2.1 GENERAL

Duty	Continuous at rated speed and rated torque
Type	Permanent magnet synchronous
Insulation	Class F
Sealing	See motor drawings in **Appendix A.6, A.7 & A.8**
Storage Temperature	-10 to +70ºC/14 to 158ºF
Ambient Operating Temperature	-10 to +40ºC/14 to 104ºF
Shock and Vibration	2 G's
Mounting	Motor can be mounted in any position

3.2.2 FEEDBACK DEVICE

Type: Resolver	Resolver control transformer See motor drawings in **Appendix A.6 & A.7**
Type: Encoder	ABZ plus UVW 5V line driver See motor drawings in **Appendix A.8**

3.2.3 OTHER

Weight Shaft Loading Brake Specifications Dimensions	See motor drawings in **Appendix A.6, A.7 & A.8**
Torque Ratings Speed Torque Curves	See specifications in **Appendix A.4**

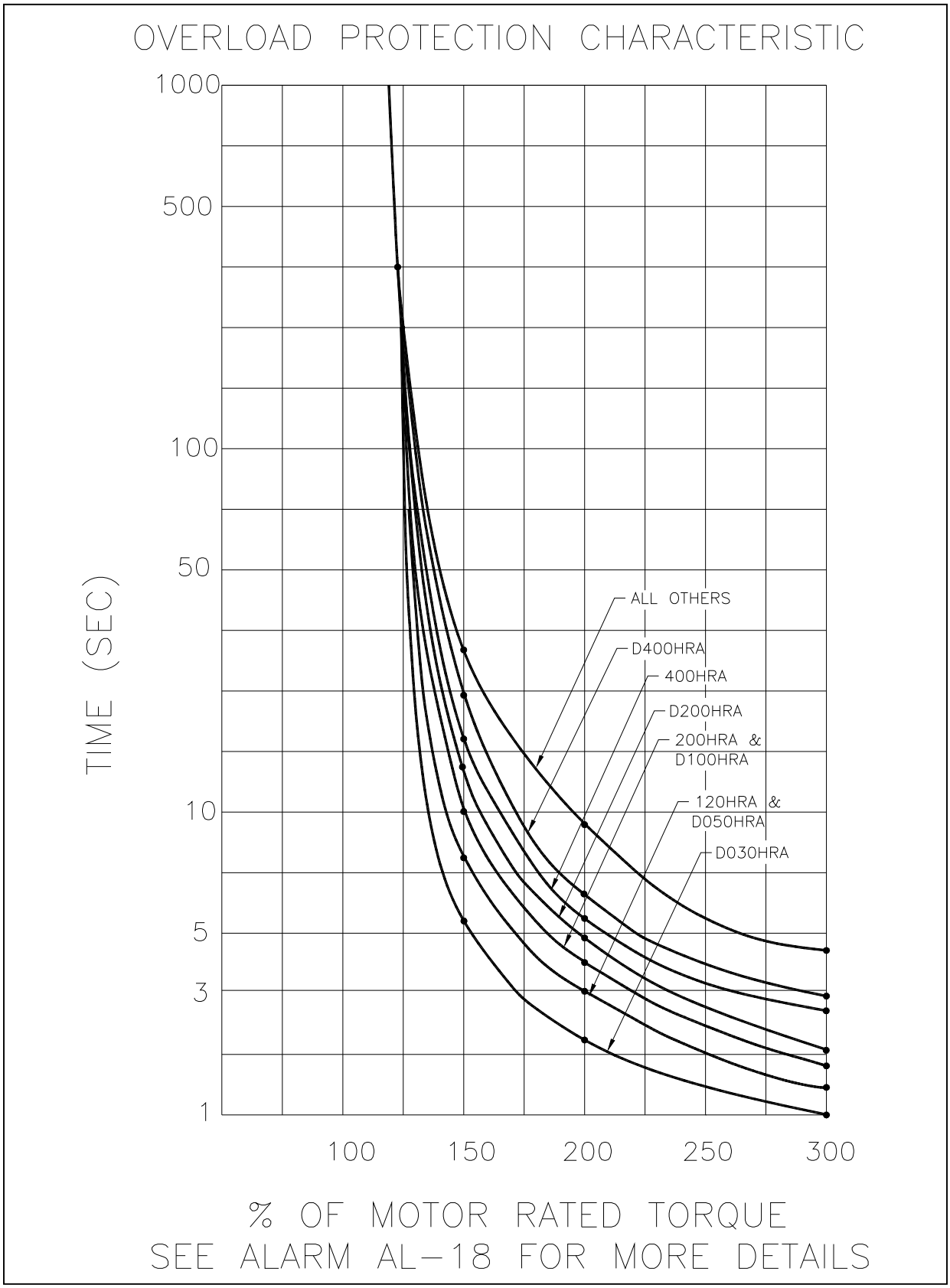


Figure 3.1 - Delta S Overload Protection Characteristic

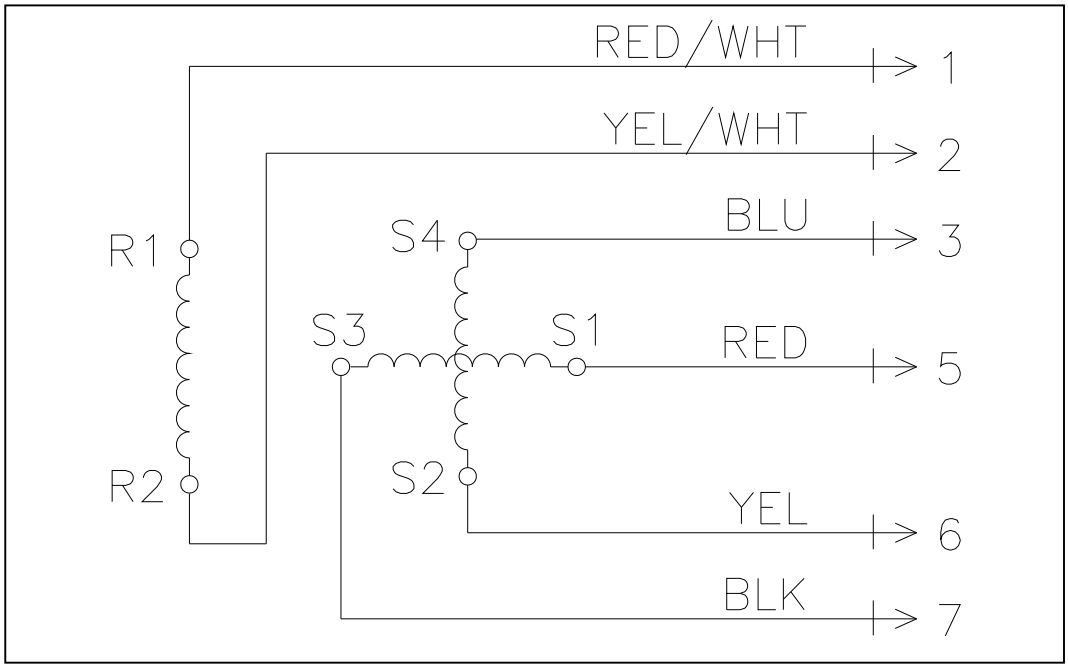


Figure 3.2 - Standard Resolver Wiring Connections for DBM-XXX/15R and DBM-500/30R and Larger

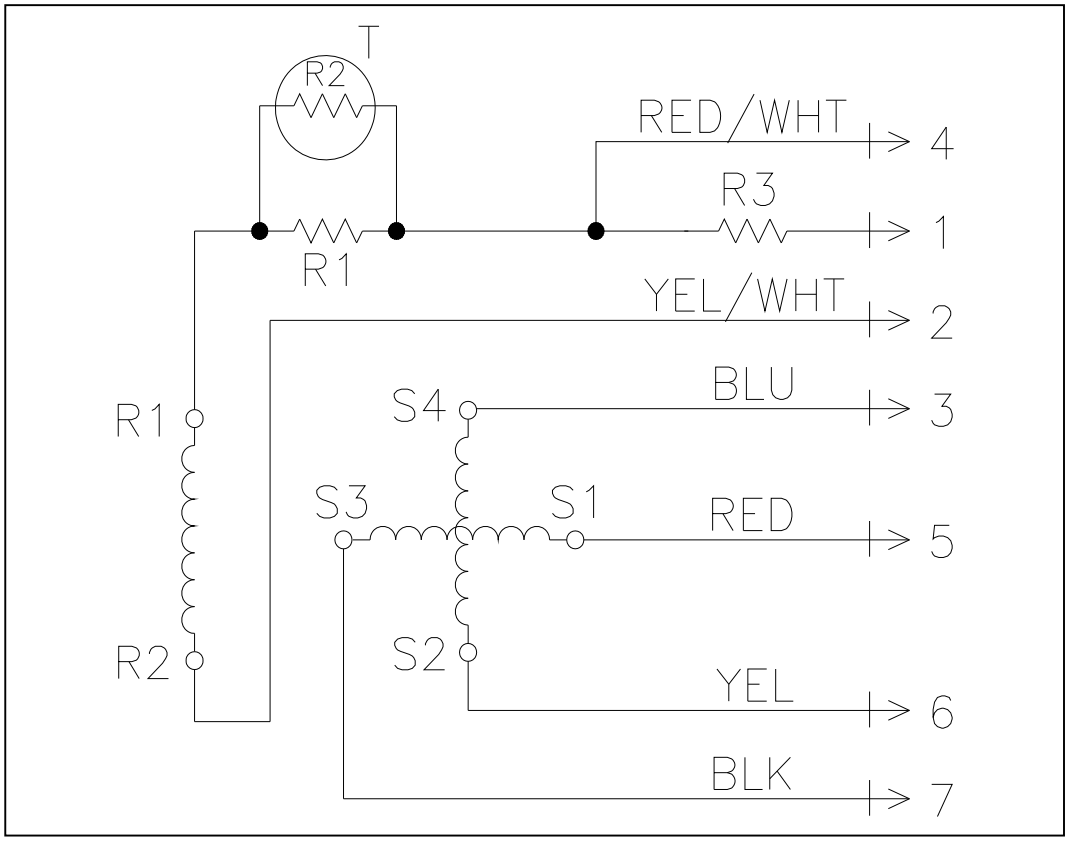


Figure 3.3 - Alternate Resolver Wiring Connections for DBM-XXX/15R and DBM-500/30R and Larger

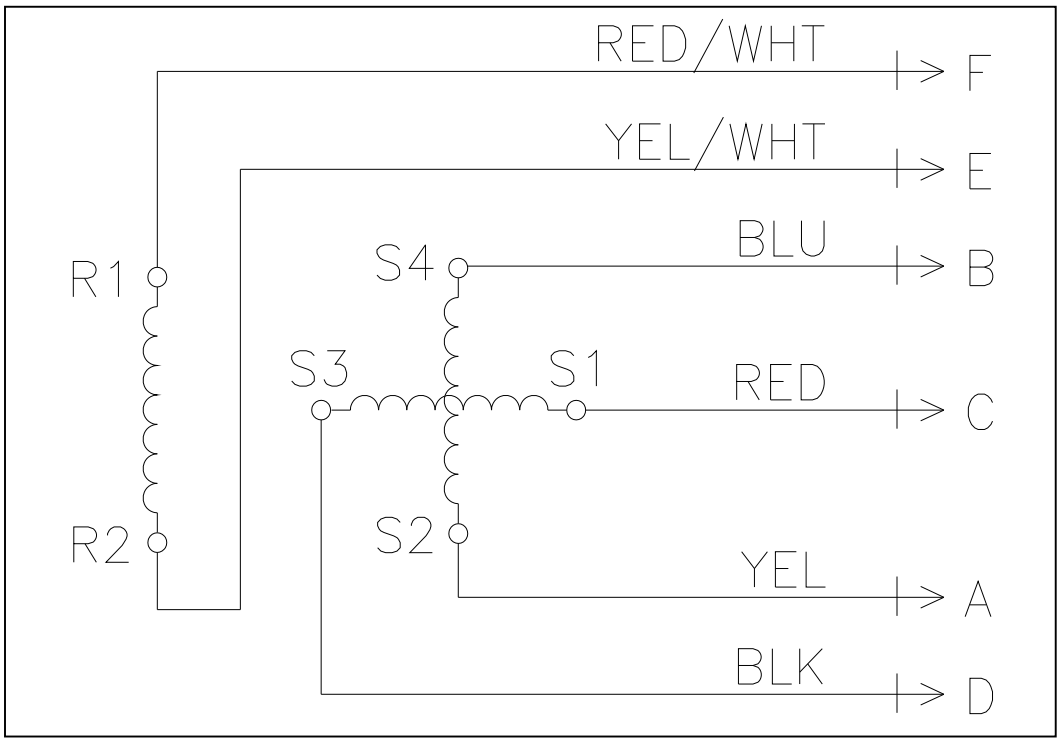


Figure 3.4 - Standard Resolver Wiring Connections for DBM-120/30R, DBM-200/30R, DBM-400/30R, DBM-BXXX/30R, DBM-D30/30R and DBM-D50/30R

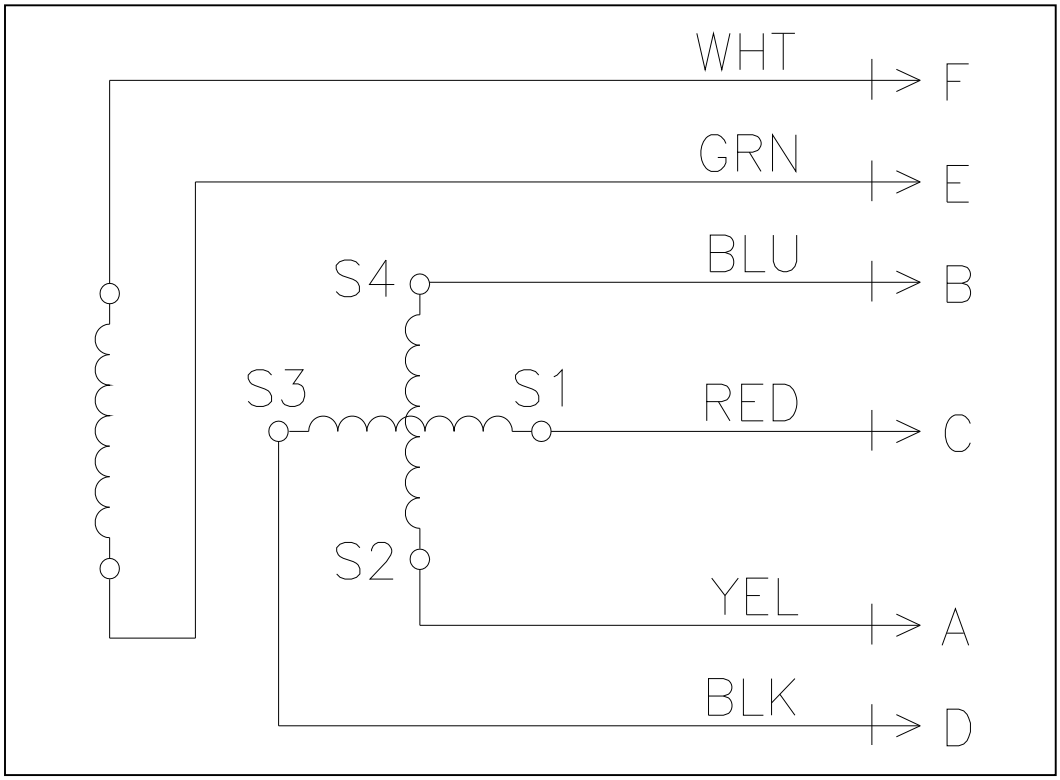


Figure 3.5 - Alternate Resolver Wiring Connections for DBM-120/30R, DBM-200/30R and DBM-400/30R

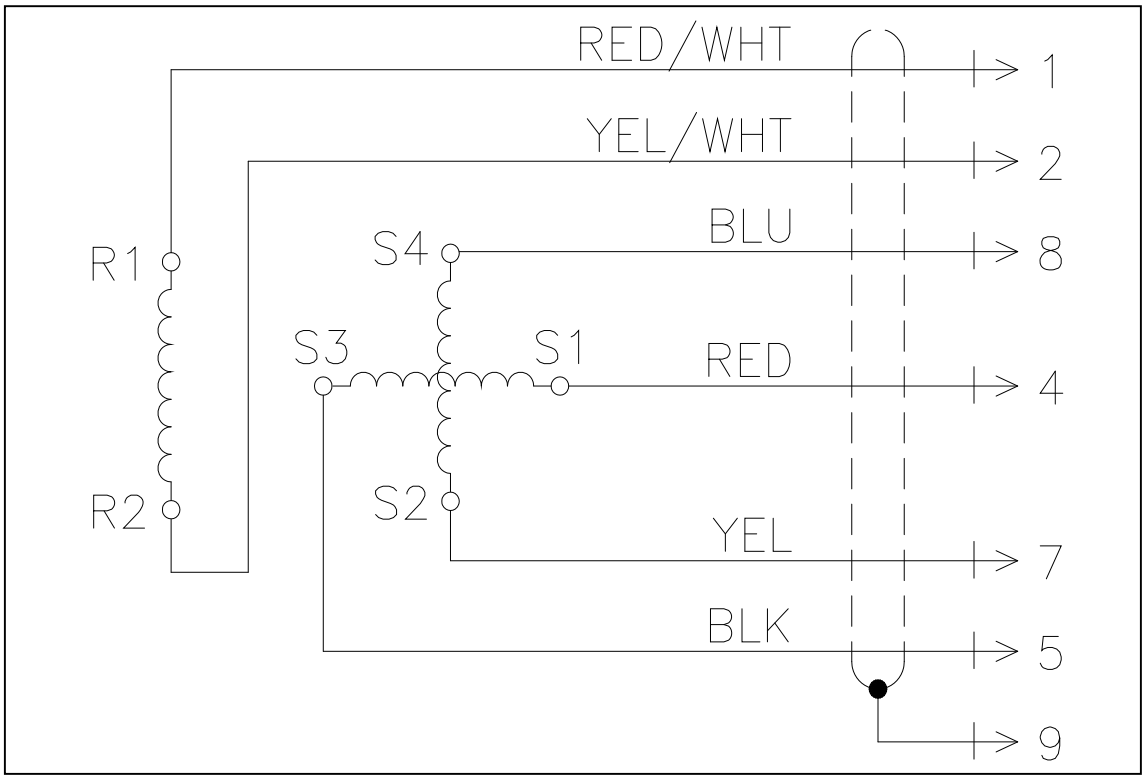


Figure 3.6 - Standard Resolver Wiring Connections for DBM-D100/30R Through DBM-D800/30R

SECTION 4 - KEYPAD PROGRAMMING

The Delta S Driver is a fully digital driver that has a rich set of motion control building blocks that are configurable using the driver's software. A built in keypad and display can be used to set internal parameters that configure the driver's software.

An easy to use menu scheme allows the user to:

- Activate optional features
- Monitor key parameters and alarms
- Adjust driver parameters
- Manual or automatic tuning of the motor and driver
- Manual testing of driver operation

The drivers' keypad and display are shown in **Figure 4.1**. The functions are as follows:

- **LED DISPLAY** is a 5-digit unit that displays coded messages, alarms and parameter values. Messages are displayed in coded bit patterns, hexadecimal, decimal and coded letters.
- **UP-ARROW** is used to navigate around the minor menu loops, to increase the value of a parameter and in combination with other keys for special functions.
- **DOWN-ARROW** is used to navigate around the minor menu loops, to decrease the value of a parameter and in combination with other keys for special functions.
- **SELECT** is used to identify which digit of the display is selected for modification (flashing). This key is also used in combination with the **CONFIRM** key to prepare a parameter for modification.
- **MODE** is used to navigate the main menu loop and to return to the main menu loop from the minor loops.
- **CONFIRM** is used to confirm a parameter value and to set into non-volatile memory and to reset alarms. This key is also used in combination with the **SELECT** key to prepare a parameter for modification.
- **FLASHING DECIMAL POINT** indicates that an alarm is active.

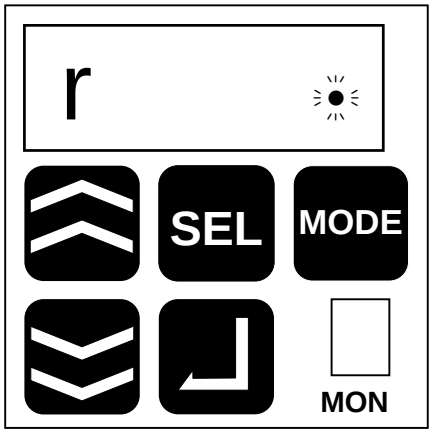


Figure 4.1 - Delta S Driver Keypad and Display

4.1 NAVIGATING THE DRIVER'S MENU

The menu structure for programming the driver consists of a main menu loop with several minor menu loops and the Special Menu. The main menu loop and partial sections of the minor loops are shown in **Figure 4.2**.

The major loop is shown vertically on the left side of the diagram. There are four major items on the main menu loop. Each of these items are the starting point for minor menu loops.

- **STATUS DISPLAY** minor menu loop contains drive and motor status displays such as motor speed, motor position, following error, etc.
- **DIAGNOSTIC DISPLAY** minor menu loop provides diagnostic information such as I/O status, alarms and alarm history.
- **ADJUST PARAMETER** minor menu loop contains parameters that are typically adjusted by the user. Parameters include speed scaling, servo tuning values and load inertia setting.
- **USER PARAMETER** minor menu loop contains basic configuration parameters that are usually set once per application such as control mode, motor type, electronic gear ratio and analog polarity.
- **HP PARAMETER** is a sub-menu loop from the **USER PARAMETER** minor menu. This sub-menu loop also contains configuration parameters that are less frequently used or modified.

The MODE key is used to move around the main menu loop. Once the main menu is positioned on the first parameter of a minor loop the ⏫ and ⏬ keys are used to move around the minor menu loop. When in the minor menu loop the ↵ and ⏫ or the ↵ and ⏬ keys move through the parameters in jumps of 10 rather then 1. The MODE mode key can be used to move from anywhere in the minor menu back to the main menu loop.

The HP parameter sub-menu is entered by putting the main menu loop on UP-02 and pressing and holding the SEL key then pressing both the ⏫ and ⏬ keys. Once in the HP sub-menu the ⏫ and ⏬ keys are used to move around the sub-menu. The MODE must be pressed twice quickly to move from the HP sub-menu back to the UP minor menu.

The Special Function Menu is used for Auto Tuning, manual jogging of the motor and forcing outputs. **Section 4.3** describes the Special Function Menu.

4.1 NAVIGATING THE DRIVER'S MENU (cont'd)

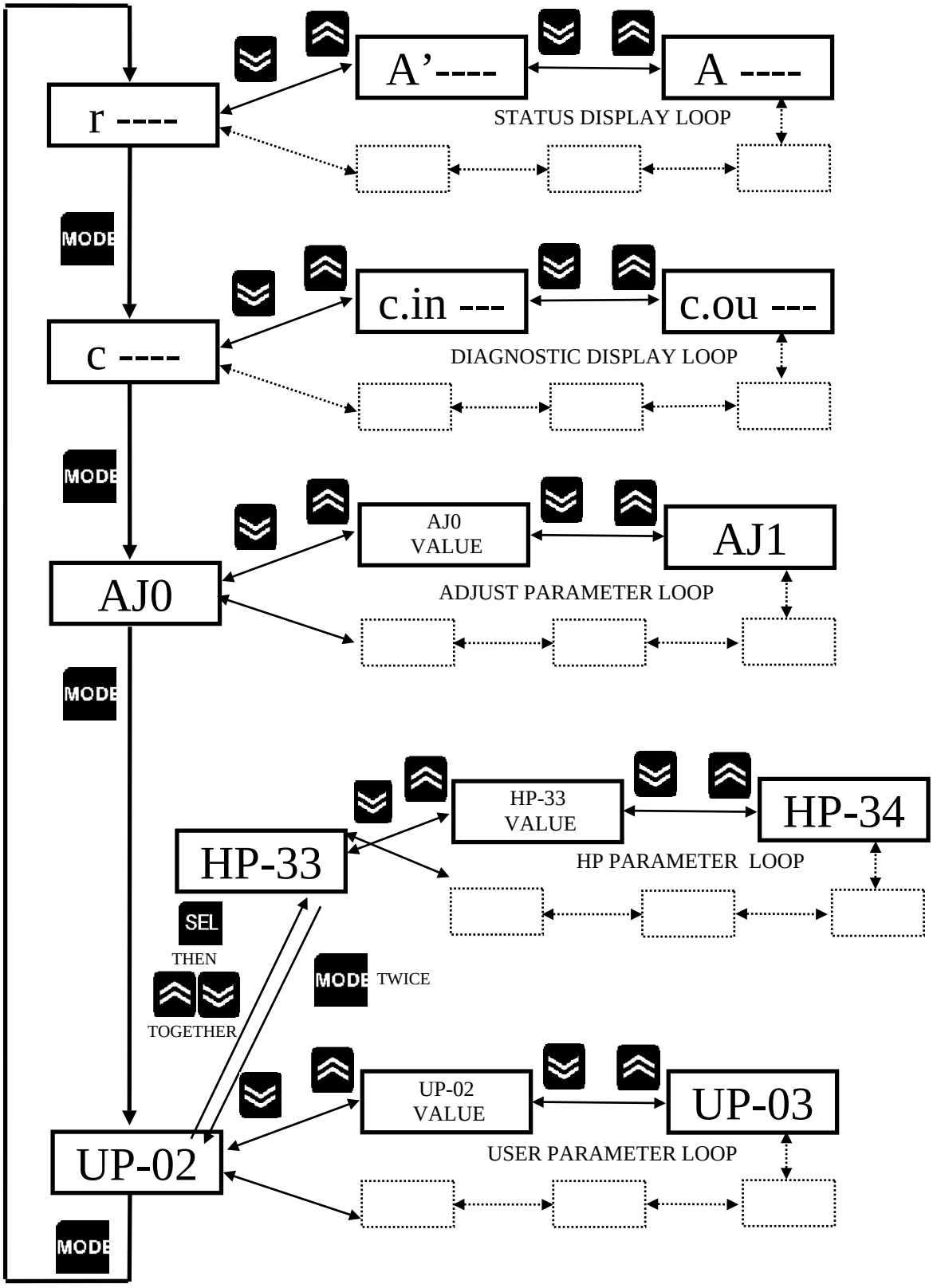


Figure 4.2 - Main Menu Loop and Minor Loops

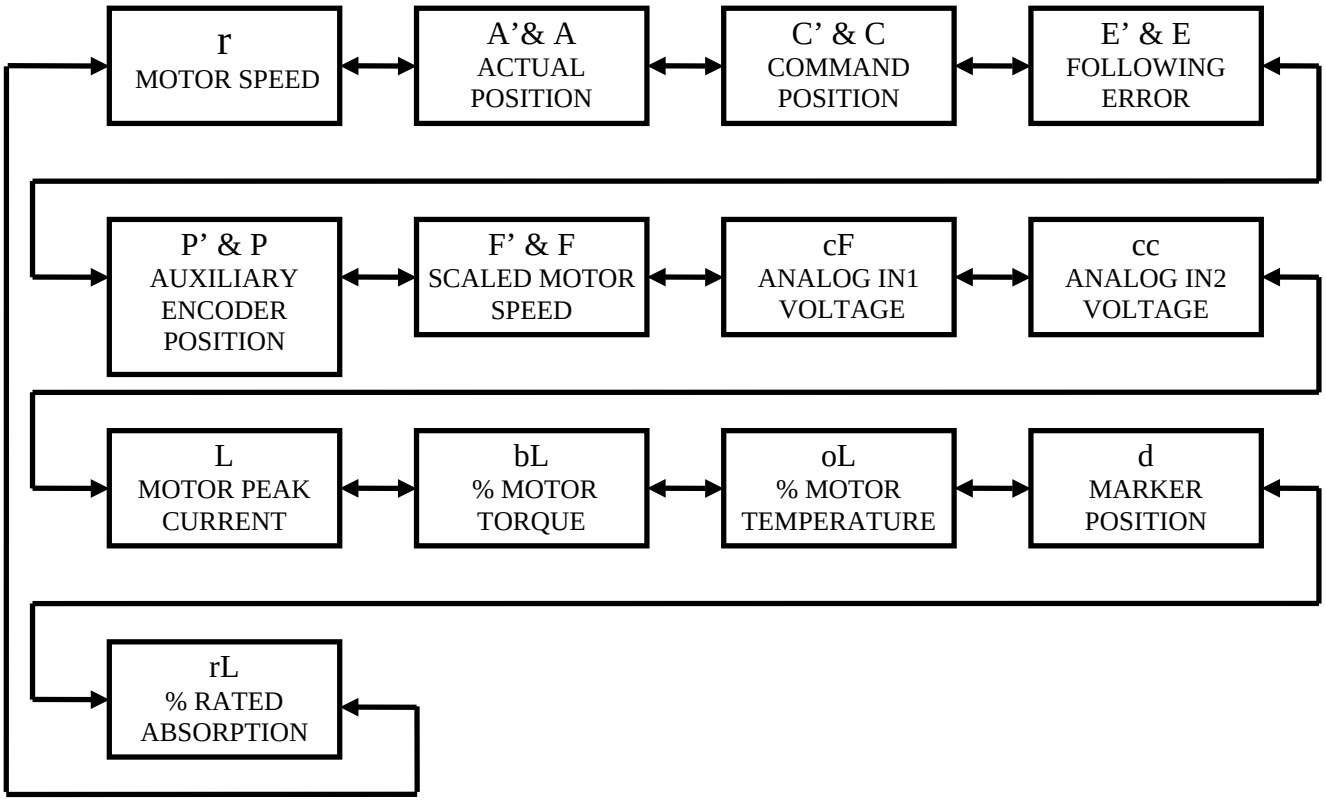
4.1.1 STATUS DISPLAY MENU LOOP

The Status Display Menu Loop provides a real time display of motor and driver status. The display format uses the left most digits for a coded message of the item to be displayed and the right most digits are the value. The coded item on the left will flash indicating negative (-) value. The sign convention is (+) is CCW and (-) is CW.

Some of the display values, such as A' & A, are too large for a single display so they are broken into two sections and are displayed on two successive menu displays. The prime (') symbol indicates the upper four (4) digits or most significant section and the non-prime symbol indicates lower four (4) digits. For example, if successive displays reads [A' 1466] and [A 6789], the ACTUAL POSITION is 14666789.

Parameters can only be read in the Status Display Menu. The driver is set to the (r) Motor Speed at power application. Any alarm will overwrite the display.

The Status Display Menu is organized as follows:



4.1.1 STATUS DISPLAY MENU LOOP (cont'd)

Status Display Descriptions:

DISPLAY ITEM	SYMBOL	RANGE & UNITS	CONTENTS
Motor rpm	**r**	±4000 RPM	Displays the speed of motor.
Actual Position	**A' A**	±9999999 Bits	Displays the actual position of the motor. With resolver feedback, the 0.0 position at power up is referenced to the nearest resolver 0.0. The Delta motors have a 2X resolver, and have two 0.0 points or markers per motor shaft rotation. When the count exceeds display range, 9999999 appears.
Command Position	**C' C**	±9999999 Bits	Displays the command position of the driver (scaled by UP-05/UP-04 similar to A' A above). When the count exceeds display range, 9999999 appears.
Following Error	**E' E**	±9999999 Bits	Displays the difference between command position and actual position. Used in position control mode only.
Auxiliary Encoder Pulse Position	**P' P**	+32767~ 32768 Pulses	Displays the auxiliary encoder position register. This counter is a signed 16-bit counter with a range of +32767 to -32768. Counter rolls over when it reaches the maximum count (ring counter).
Scaled Motor Speed	**F' F**	±9999999 RPM	Displays the speed of the motor scaled by HP-41/HP-42. This used typically used to display "machine speed" if the speed exceeds display range, 9999999 appears.
Analog In1 Voltage	**cF**	±10.0 V	Displays the input voltage for Analog Input 1.
Analog In2 Voltage	**cc**	±10.0 V	Displays the input voltage for Analog Input 2
Motor Peak Current	**L**	±160.0 A (peak)	Displays the output current to motor. "A (peak)" shows the peak value of AC current.
% Motor Torque	**bL**	0~255%	Displays the load ratio (output torque/rated torque) * 100%. The time constant for calculating this ratio is set by HP-33.
% Motor Temperature	**oL**	0~110%	Displays calculated motor temperature as a % of the maximum rating. The electronic motor thermal limit alarm activates at 110% (AL-17). **oL** initializes to 90% at power on.
Marker Position	**d**	0~359.9 deg	Displays the motor shaft angle from the motor marker ZPD position. The driver has N marker ZPD positions depending on the resolver/encoder installed in the motor. (i.e. a motor with a 2X resolver has 2 ZPD positions per motor revolution, see motor drawings in **Appendix A.6, A.7 & A.8**). If the motor has 3X resolver and 3 ZPD positions, this display will go from 0.0 to 359.9 degrees 3 times per motor rotation.
% Rated Absorption	**rL**	0~100%	For DS-1.5, DS-4.25, DS-8.5 and DS-17.5 the display is (motor absorption torque/motor rated torque) * 100%. For DS-35 and up the display is % rating of the regeneration resistor capacity (UL-31).

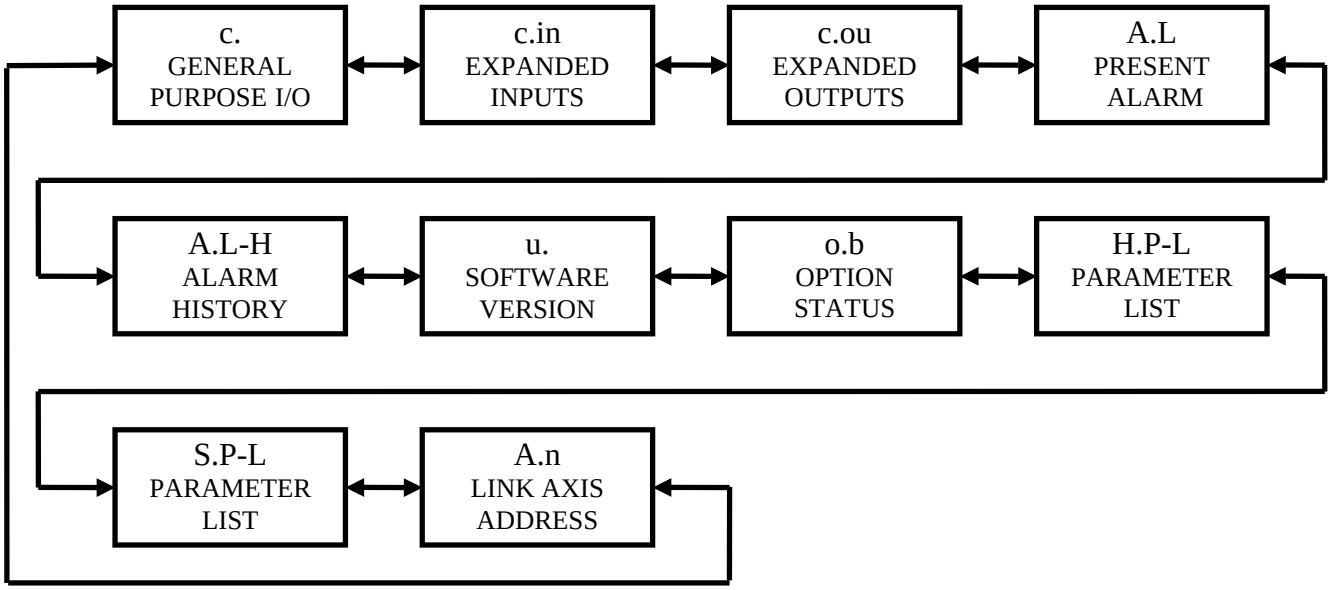
4.1.2 DIAGNOSTIC DISPLAY MENU LOOP

The Diagnostic Display Menu Loop provides a real time display of I/O points, alarms, alarm history and driver configurations. The display format uses the left most digits for a coded message of the item to be displayed and the right most digits are the value.

Some of the display values, such as A.L-H ALARM HISTORY require additional keystrokes to view the complete status. The additional keystrokes are described in the individual display descriptions.

Parameters can only be read in the Diagnostic Display Menu, with the exception that the ALARM HISTORY can be cleared.

The Diagnostic Display Menu Loop is organized as follows:



Diagnostic Display Descriptions:

DISPLAY ITEM	SYMBOL	CONTENTS
General purpose I/O	**c.**	Displays the current I/O status using the vertical segment bars in the display. The top half of the segment bar are inputs and the bottom half are outputs. The right most vertical bar is IN1 (top half) and OUT1 (bottom half). The vertical bar just to the right of the **c.** is IN8 (top half) and OUT8 (bottom half). When the bar is illuminated the I/O point is ON. The I/O point can be inverted using HP-44 & HP-45. See the individual signal level I/O diagrams in **Section 7**. IN8 ▌▌▌▌▌▌▌▌ IN1 OUT8 ▌▌▌▌▌▌▌▌ OUT1 **NOTE:** The IN9-IN16 and OUT9-OUT16 status cannot be viewed on display.
General Purpose Input	**c.in**	Not used.
General Purpose Output	**c.out**	Not used.

4.1.2 DIAGNOSTIC DISPLAY MENU LOOP (cont'd)

Diagnostic Display Descriptions (cont'd):

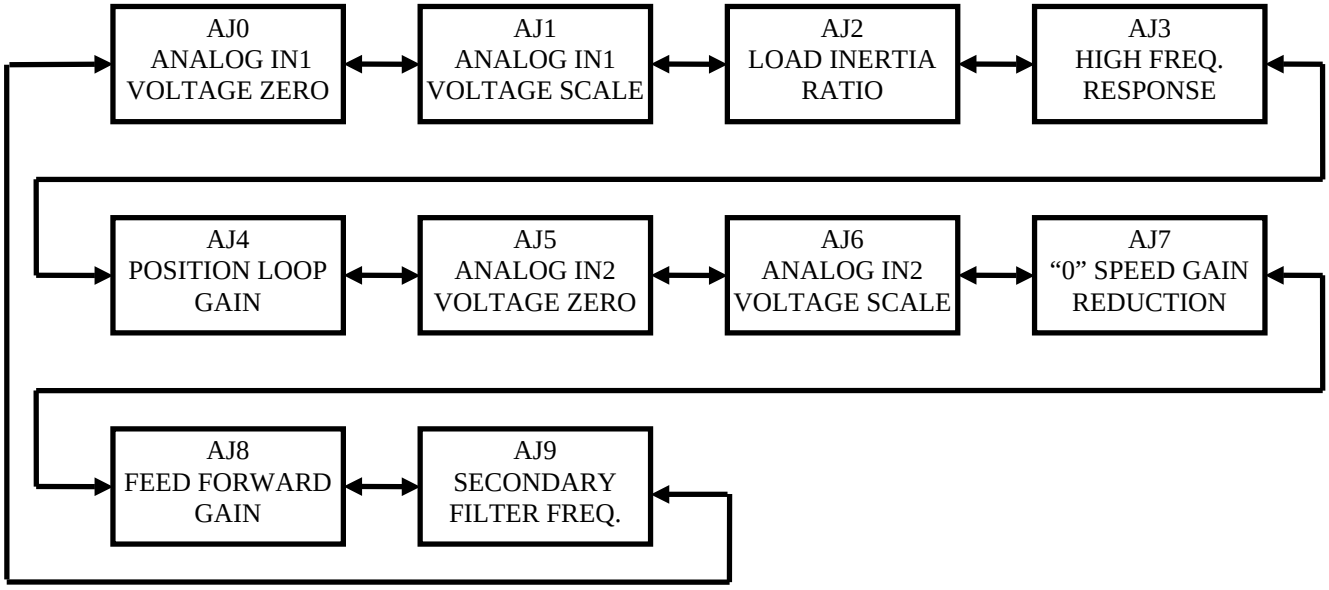
DISPLAY ITEM	SYMBOL	CONTENTS
Alarm	**A.L**	Displays the current alarm if present. **A.L** with no numbers indicates that there is no current alarm. **A.L #** indicates a current alarm code #. Most alarms can be reset with the ↵ key. See **Section 12** for alarm code descriptions and reset method.
Alarm History	**A.L-H** **0-E**	Displays the alarm history log for the previous 15 alarms. When SEL key and ↵ key are concurrently pressed, the **AL-H** display changes to **N.- #**, where **N** is the position of the alarm in the history log (0 most current, E oldest) and # is the alarm code. The history log can be scrolled forward and backward using the ⇈ and ⇊ keys. The MODE key returns to the **A.L-H** display. Clearing the complete alarm history is possible with software revision 10 and above. To clear the alarm history, use the MODE ⇈ ⇊ keys to navigate the menu until the A.L-H is in the display. • Concurrently press the ↵ and SEL keys and the display changes to N.- #. • Concurrently press the ⇈ and ⇊ keys while holding down the SEL key and the display changes to AHcLr. • Concurrently press the ↵ and SEL and the display starts flashing indicating alarm clearing, then press ↵ to complete the clearing procedure. Double clicking MODE goes back to 0.- and another press of MODE returns to A.L-H.
Software Version	**u.**	Displays the revision of the operating system software.
Option Status	**o.b**	Displays the status of any option modules installed. 04: No options 06: 14 bit A/D converter
HP Parameter Change History	**H.P-L**	Displays a history of the HP parameters that have been changed. When SEL key and ↵ key are concurrently pressed the display changes to a list of HP-# parameters that have been changed. The history log is 65 deep. The history log can be scrolled forward and backward using the ⇈ and ⇊ keys.
SP Parameter Change List	**S.P-L**	Displays a history of the SP that have been changed. When SEL key and ↵ key are concurrently pressed the display changes to a list of SP-# parameters that have been changed. The history log is 65 deep. The history log can be scrolled forward and backward using the ⇈ and ⇊ keys.
Link Axis No.	**A.n**	Not used.

4.1.3 ADJUSTMENT PARAMETER MENU LOOP

The Adjustment Parameter Menu Loop provides access to setup and tuning parameters that are commonly used. Each parameter is displayed in two successive displays. The coded parameter name appears on the first display and the parameter value appears on the second display. The ⩔ key will always move from the parameter-coded name to the parameter value. The ⩒ key will always move from the parameter value to the coded parameter name. If the parameter value is negative, a (-) sign appears in the left most digit of the display.

Parameters can be read or written in the Adjust Parameter Menu Loop. The procedure to write into a parameter is found in **Section 4.2**.

The Adjustment Parameter Menu Loop is organized as follows:



4.1.3 ADJUSTMENT PARAMETER MENU LOOP (cont'd)

ADJUSTMENT PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
ANALOG INPUT 1 VOLTAGE ZERO OFFSET	**AJ0**	±10.00 V	Factory Preset	Sets the zero offset of the Analog Input 1(AN1). It can be set in two ways: 1. Automatically: by concurrently pressing SEL ↵ (all digits flash) and then pressing ↵. The driver will read the analog voltage and create an offset equal and opposite to the analog voltage present at the time. To get a true 0.00 offset, short Analog Input 1 to analog ground before doing the auto zero procedure. 2. Manually: by concurrently pressing SEL ↵ (all digits flash) and then concurrently pressing ⇈ SEL. Then adjust the individual digits with ⇈ ⇊.
ANALOG INPUT 1 VOLTAGE SCALER	**AJ1**	3~40.00 V	10.00V	Sets the voltage desired to obtain full scale on the Analog Input 1 (AN1). For example, if full scale on the analog input is desired at 4.5 VDC input voltage, set AJ1 to 4.50.
LOAD INERTIA RATIO	**AJ2**	0~100.0	1.0 Times	Sets the baseline frequency response of the driver using the ratio of the load inertia/motor inertia for a rigidly coupled load. If the load is not rigidly coupled, the value entered may vary from the calculated value. If the value is set too high, the motor and driver may become unstable and oscillate. This parameter is set automatically during auto tuning.
HIGH FREQUENCY RESPONSE	**AJ3**	0.1~20.0	1.0	Sets the high frequency response of the driver. The higher the number the more responsive. If the value is set too high, the motor and driver may become unstable and oscillate. The value in AJ3 is unit less and works in concert with AJ2. This parameter is set automatically during auto tuning.
POSITION LOOP DC GAIN	**AJ4**	1~200	30 Rad/sec	Sets the DC gain of the position control loop. A higher value in AJ4 results in stiffer, faster response. If the value is set too high, the motor and driver may become unstable and oscillate. This parameter is set automatically during auto tuning.

4.1.3 ADJUSTMENT PARAMETER MENU LOOP (cont'd)

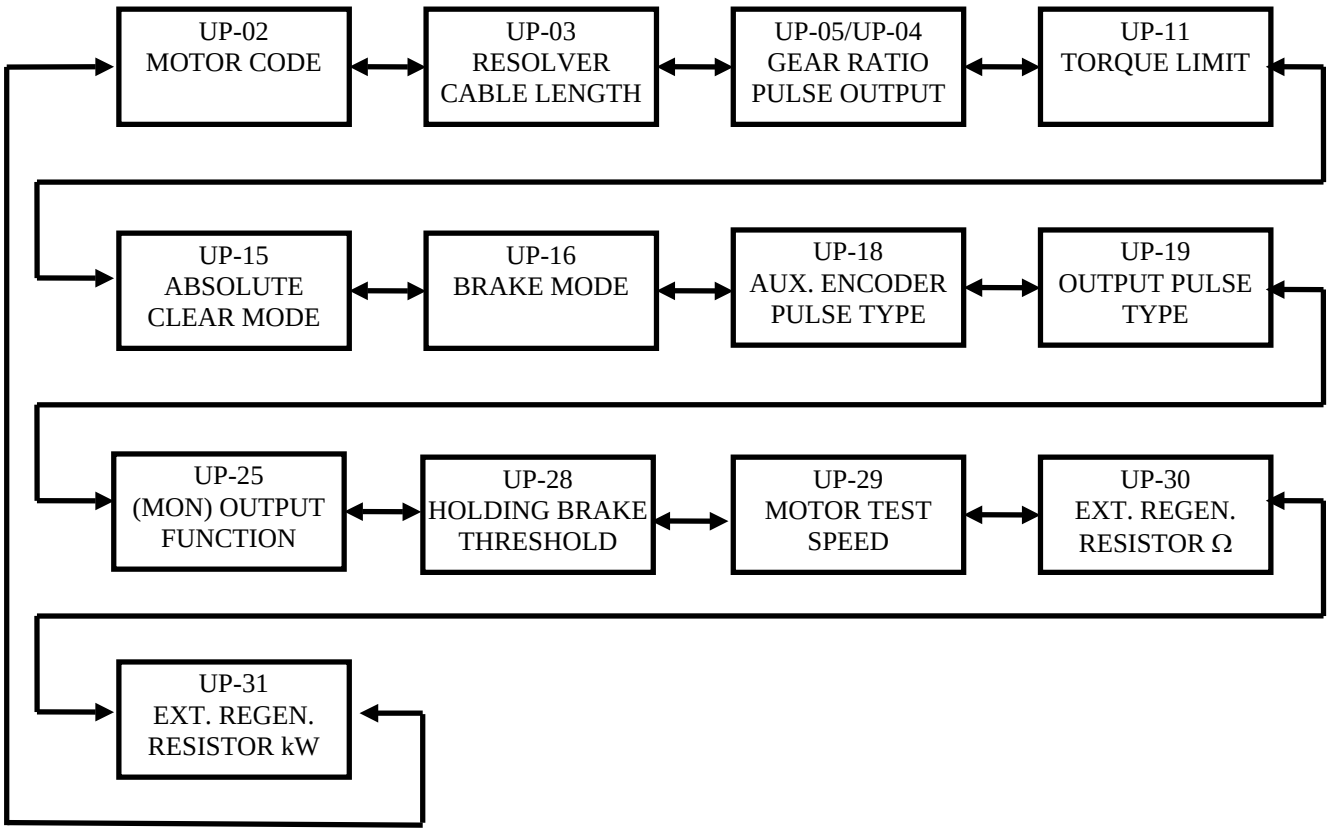
ADJUSTMENT PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
ANALOG INPUT 1 VOLTAGE ZERO OFFSET	**AJ5**	±10.00 V	Factory Preset	Sets the zero offset Analog Input 2 (AN2). It can be set in two ways: 1 Automatically: by concurrently pressing SEL ↵ (all digits flash) and then pressing ↵. The driver will read the analog voltage and create an offset equal and opposite to the analog voltage present at the time. To get a true 0.00 offset, short Analog Input 2 to analog ground before doing the auto zero procedure. 2 Manually: by concurrently pressing SEL ↵ (all digits flash) and then concurrently pressing ⇈ SEL. Then adjust the individual digits with ⇈ ⇊.
ANALOG INPUT 2 VOLTAGE SCALER	**AJ6**	3~40.00 V	10.00V	Set the voltage desired to obtain full scale on the Analog Input 2 (AN2). For example, if full scale on the analog input is desired at 4.5 VDC input voltage, set AJ6 to 4.50.
ZERO SPEED GAIN REDUCTION	**AJ7**	0~10000	0	Sets the amount of gain reduction at zero speed. The gain is reduced when the motor is below the speed set in UP-08 and at the set values when the speed is above UP-08.
FEED FORWARD GAIN	**AJ8**	0~2.0 Times	0 Times	Sets the feed forward gain in the position loop. A value of 1.0 results in 0.0 following error. Less than 1.0 will produce a lag between the actual motor position and the commanded position and greater than 1.0 produces a lead. The lead or lag will be proportional to speed at non 1.0 settings.
SECONDARY FILTER	**AJ9**	400~20000 rad/s	6000 rad/s	Sets the notch frequency of a velocity loop anti-resonance filter. This filter can be used to cancel machine or servo resonance.

4.1.4 USER PARAMETER MENU LOOP

The User Parameter Menu Loop provides access to basic setup parameters that are commonly used. Each parameter is displayed in two successive displays. The coded parameter name appears on the first display and the parameter value appears on the second display. The ⏫ key will always move from the parameter-coded name to the parameter value. The ⏬ key will always move from the parameter value to the coded parameter name.

Parameters can be read or written in the User Parameter Menu Loop. The procedure to write into a parameter is found in **Section 4.2**.

The User Parameter Menu Loop is organized as follows:



4.1.4 USER PARAMETER MENU LOOP (cont'd)

USER PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
MOTOR CODE	**UP-02**	0000~FFFF	0000	Sets the internal driver parameters corresponding to the motor code. See **Appendix A** for motor codes. The driver power must be cycled to register this parameter. Power must be turned OFF then ON for this parameter to take effect.
RESOLVER CABLE LENGTH N/A FOR ENCODER	**UP-03**	1~120M	5M	Sets the driver resolver cable length compensation.
GEAR RATIO DENOMINATOR FOR THE PULSE OUTPUT	**UP-04**	1~32767	1	The driver internal feedback resolution is multiplied by the ratio of UP05/UP04 before being sent out the pulse output (APD and BPD). The driver internal command resolution is equal to the number of resolver cycles times 12000 bits/rev or the PPR of the encoder. (i.e. a motor with a 2X resolver has an internal resolution of 24000 bits/rev, see motor drawings in **Appendix A.6, A.7 & A.8**.)
GEAR RATIO NUMERATOR FOR THE PULSE OUTPUT	**UP-05**	1~32767	1	See UP-04 Above.
TORQUE LIMIT	**UP-11**	0~100.0%	100%	When the torque limit is applied the motor torque is limited to the value set in UP-11. UP-11 is % of motor peak torque. See HP-34 for torque limit method.
ABSOLUTE CLEAR MODE	**UP-15**	0~2	0	Selects the type of home 0.00 processing for absolute systems when the SET "0" POSITION input is energized or upon startup. 0: Makes current position of motor equal to 0.00. 1: Makes the current motor shaft rotation the 0 rotation while preserving the MARKER OFFSET. 2: No effect retains absolute position.
BRAKE MODE	**UP-16**	0~2	0	Select the type of Brake sequencing to be done when the drive is disabled. 0: No Brake or Dynamic Brake 1 or 2: Mechanical Holding Brake.

4.1.4 USER PARAMETER MENU LOOP (cont'd)

USER PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
AUXILIARY ENCODER INPUT PULSE TYPE	**UP-18**	00~12	0 0	Sets the type of pulse sequence and polarity of the Auxiliary Encoder Pulse inputs. 00: Pulse, Pulse decoding where FMA increments command position and FMB decrements command position. 01: Quadrature decoding of FMA and FMB with FMA leading FMB for incrementing command position. Quadrature decoding effectively multiplies the input frequency by 4 times. 02: Pulse and direction decoding where FMA is pulse train and FMB is direction. FMB OFF increments command position and ON decrements command position. 10: Pulse, Pulse decoding where FMB increments command position and FMA decrements command position. 11: Quadrature decoding of FMA and FMB with FMB leading FMA for incrementing command position. Quadrature decoding effectively multiplies the input frequency by 4 times. 12: Pulse and direction decoding where FMA is pulse train and FMB is direction. FMB ON increments command position and OFF decrements command position.
OUTPUT PULSE TYPE	**UP-19**	00~11	01	Sets the type of pulse output sequence and polarity of the PULSE OUTPUT. UP-20 must be set to xxxo for the PULSE OUTPUT to represent incremental actual position. 00: Pulse, Pulse encoding where APD pulses when the actual position increments and BPD pulses when the actual position decrements. 01: Quadrature encoding of APD and BPD with APD leading BPD for incrementing actual position. Each edge of the two pulse trains are counted as an output bit change. 10: Pulse, Pulse encoding where BPD pulses when the actual position increments and APD pulses when the actual position decrements.

4.1.4 USER PARAMETER MENU LOOP (cont'd)

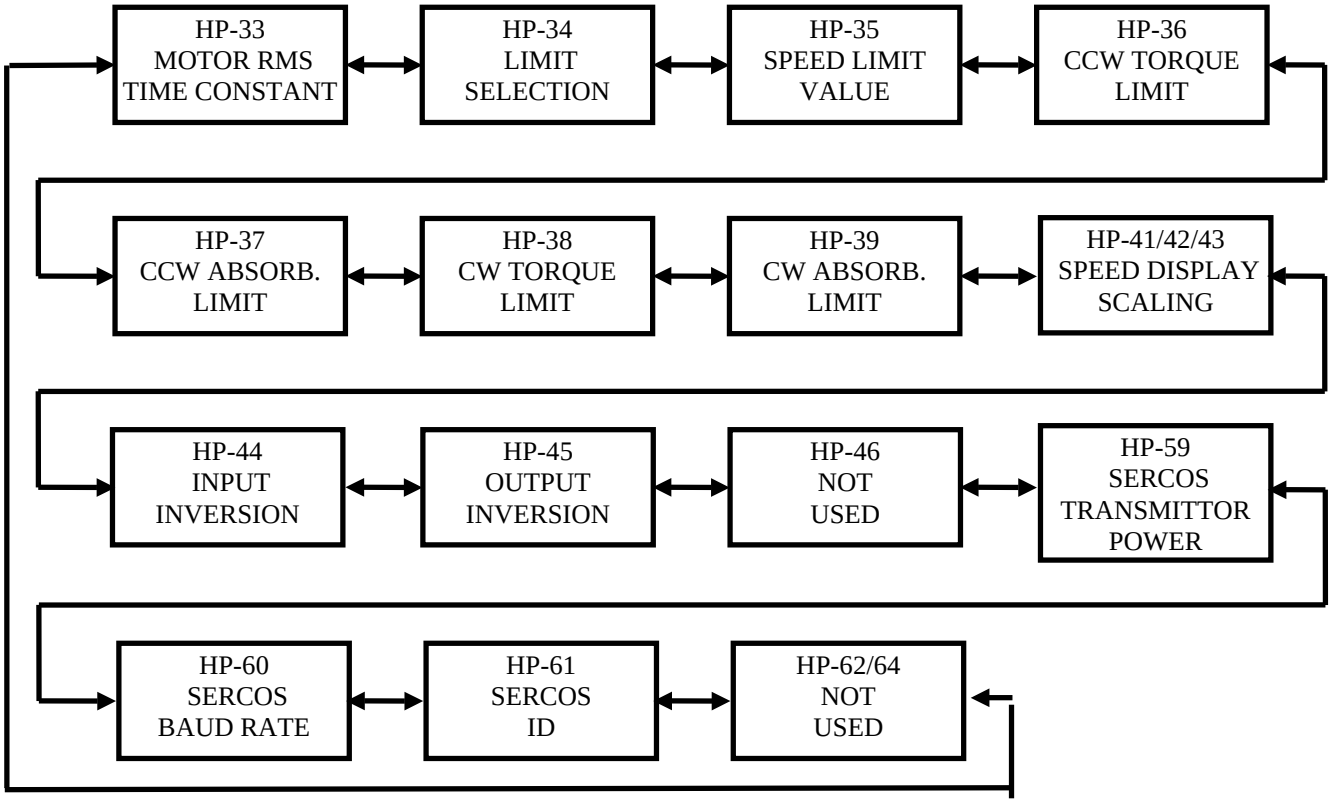
USER PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
OUTPUT PULSE TYPE (cont'd)	**UP-19**	00~11	01	11: Quadrature encoding of APD and BPD with BPD leading APD for incrementing actual position. Each edge of the two pulse trains is counted as an output bit change.
MONITOR OUTPUT FUNCTION	**UP-25**	000~111	010	Selects SPEED or TORQUE output and polarity of the MON test point. The first digit selects the MON output function. 0: TORQUE 1: SPEED The second digit selects the polarity of the MON output. 0: Normal 1: Invert
HOLDING BRAKE THRESHOLD	**UP-28**	0~100.0%	100%	When UP-16 is set to 0, UP-28 has no effect. When UP-16 is set to 1 or 2, the mechanical brake is applied when the motor speed falls below the value set in UP-28. The value in UP-28 is % of rated speed.
MOTOR TEST SPEED	**UP-29**	1~4000 r/min	50 RPM	The driver can be jogged manually by using the keypad. The jog speed is set with UP-29 in RPM.
EXTERNAL REGEN RESISTOR VALUE (Software version 10 and above)	**UP-30**	0~100.0 ohms	0.0 ohms	Value of the optional external regen resistor. When external regen resistor is used, the value of the resistor is entered to allow the driver to calculate average power into the regen resistor. When the internal regen is used, enter 0.0. See **Section 9** for details on Regen Resistor selection. This parameter is used with DSD-35 and larger drivers.
EXTERNAL REGEN RESISTOR WATTAGE (Software version 10 and above)	**UP-31**	0~327.67 Kw	0.0 Kw	Power rating of the optional external regen resistor. When external regen resistor is used, the power rating in Kw of the resistor is entered to allow the driver to calculate average power into the regen resistor. When the internal regen is used, enter 0.0. See **Section 9** for details on Regen Resistor selection. This parameter is used with DSD-35 and larger drivers.

4.1.5 HP PARAMETER MENU LOOP

The HP Parameter Menu Loop provides access to basic setup parameters that are less commonly used. Each parameter is displayed in two successive displays. The coded parameter name appears on the first display and the parameter value appears on the second display. The key will always move from the parameter-coded name to the parameter value. The key will always move from the parameter value to the coded parameter name.

Parameters can be read or written in the HP Parameter Menu Loop. The procedure to write into a parameter is found in **Section 4.2**.

The HP Parameter Menu Loop is organized as follows:



4.1.5 HP PARAMETER MENU LOOP (cont'd)

SETUP PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
MOTOR RMS TORQUE TIME CONSTANT	**HP-33**	1~60 sec	30 sec	Sets the time constant for calculating motor rms torque that is displayed as parameter bL. Time constant should be set to approximately twice as long as the machine cycle.
TORQUE LIMIT SELECTION	**HP-34**	0~1	0	First digit is torque limit method: 0: Torque Limits Disabled. 1: Limit set by parameter UP-11 or HP-36 through HP-39 when UP-11 = 0.
CCW ROTATION TORQUE LIMIT	**HP-36**	0~100.0%	100%	Limits CCW rotation torque. 100% = Peak Torque See **HP-34**
CCW ROTATION ABSORPTION TORQUE LIMIT	**HP-37**	0~100.0%	100%	Limits CCW rotation absorption (braking) torque. 100% = Peak Torque See **HP-34**
CW ROTATION TORQUE LIMIT	**HP-38**	0~100.0%	100%	Limits CW rotation torque. 100% = Peak Torque See **HP-34**
CW ROTATION ABSORPTION TORQUE LIMIT	**HP-39**	0~100.0%	100%	Limits CW rotation absorption (braking) torque. 100% = Peak Torque See **HP-34**
SPEED DISPLAY ELECTRONIC RATIO NUMERATOR	**HP-41**	1~32767	1	Parameters HP-41/HP-42 form a fraction that is used to scale the scaled Motor Speed display "F". The motor speed is multiplied by the fraction, and then put on the display. This allows a speed display that is scaled to the speed of the actual machine rather than the speed of the motor. The scaling can also allow the driver to display speed in different
SPEED DISPLAY ELECTRONIC RATIO DENOMINATOR	**HP-42**	1~32767	1	Units such as in/sec rather than the default motor RPM. Scales the driver display and optional external display if used.
SPEED DISPLAY DECIMAL POINT POSITION	**HP-43**	0~7	0	HP-43 sets the position of the decimal point in the optional external speed display. 0: No decimal point 1: Least significant digit ... 7: Most significant digit
INPUT INVERSION	**HP-44**	000~1FF	000	This parameter forms a hexadecimal bit mask that inverts the input when the bit is set to 1 and does not invert the input when the bit is 0. The LSB is for IN0 and so on. (i.e. HP-44=8C inverts inputs IN7, IN3 & IN2)

4.1.5 HP PARAMETER MENU LOOP (cont'd)

SETUP PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
OUTPUT INVERSION	**HP-45**	00~FF	00	This parameter forms a hexadecimal bit mask that inverts the output when the bit is set to 1 and does not invert the output when the bit is 0. The LSB is for OUT0 and so on. (i.e. HP-45=4A inverts outputs OUT6, OUT3 & OUT1)
SERCOS TRANSMITTER CONFIGURATION	**HP-59**	01-24	1	Sets the SERCOS Transmitter Power and mode of operation. First digit on the right defines the transmitter power. 1: High Power 2: Medium High Power 3: Medium Low Power 4: Low Power Second digit defines the mode of operation. 0: Normal Operation 1: Continuous Signal Light 2: Zero Bit Stream Power must be turned off and on for this parameter to take effect.
SERCOS BAUDRATE	**HP-60**	02, 04, 08, 10	02	Sets the SERCOS Communication Baudrate 02: 2 mbaud 04: 4 mbaud 08: 8 mbaud 10: 16 mbaud Power must be turned off and on for this parameter to take effect.
SERCOS DEVICE ID	**HP-61**	0-254	1	Sets the SERCOS Device Address on the SERCOS ring. If ID=0, then the device ignores commands and the drive acts as a repeater only. Power must be turned off and on for this parameter to take effect.

4.2 WRITING NEW VALUES IN READ/WRITE PARAMETERS

Many parameters require adjustment or modification to properly configure the Delta S driver. These parameters include AJ, UP and HP. The procedure for changing these parameters is the same and is described in this section. Although the parameter is changed in the display, pressing the ↵ key is required to log the new parameter value in the driver's non-volatile memory.

To change a parameter:

- Navigate the main menu using the ▲ ▼ MODE keys to get the parameter name to be changed in the display. See **Figure 4.2**.
- Press the ▲ key to get the parameter value in the display.
- Concurrently press the SEL and ↵ keys to prepare the parameter for change. The least significant digit in the display will now be flashing, indicating that the least significant digit can be increased or decreased with the ▲ ▼ keys.
- Use the SEL key to move the flashing digit to the left to prepare another digit in the display for change. When the flashing digit reaches the left most position one more SEL key press will return the flashing digit to the right most position.
- Repeating the above steps, change the display to the new desired value.
- Press the ↵ to log the new parameter setting in the Delta S driver's non-volatile memory.
- The ▲ ▼ MODE keys can again be used to navigate the main menu.

Changes in the AJ parameters take effect when the parameter is changed using the ▲ ▼ keys. The UP and HP parameters require pressing the ↵ key to have the parameter change take effect.

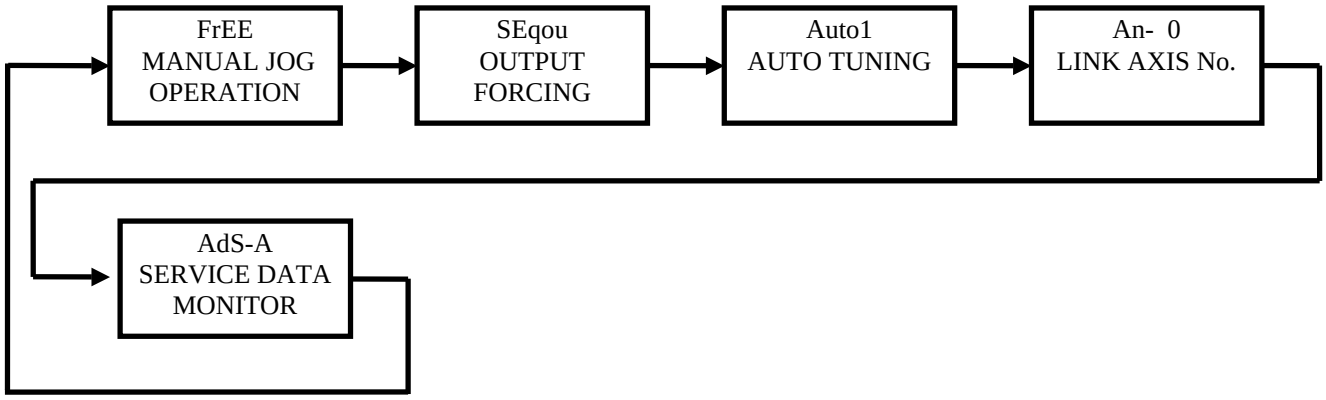
The parameter UP-02 requires a power OFF, power ON cycle to have the parameter take effect.

4.3 NAVIGATING THE SPECIAL FUNCTION MENU LOOP

The Special Function Menu Loop provides special diagnostic and setup functions. Enter the Special Function Menu by concurrently pressing the ▼ ▲ ↵ keys for 5 seconds while the Main Menu status display shows motor speed [r 0]. The special menu will appear with the display showing [FrEE]. To exit the Special Function Menu double click the MODE key.

Once in the Special Menu the SEL key is used to move around the menu loop.

The Special Menu Loop is organized as follows:



4.3.1 MANUAL JOG OPERATION

The driver can be jogged manually using the front panel keyboard switches. The jog speed is set by UP-29 and the acel/decel rate is set by UP-12, UP-13 or UP-14. The normal brake sequencing of BRAKE OUTPUT and BRAKE CONFIRM must be observed during jog operation.

Caution should be used when manually jogging the motor. Be sure all personnel are clear of moving parts and that the motor' s movement is not restricted by ancillary moving mechanisms.

- Use the SEL key to locate the FrEE menu display in the Special Menu.
- Activate the servo by pressing ↵ key. The display shows the current jog speed [L 0]
- Jog the motor CCW using the ⏫ key or CW by using the ⏬ key. The motor continues to run as long as the key is held down.
- Pressing the ⏫ SEL keys together latches the motor in jog CCW until the ⏫ or ⏬ key is momentarily pressed to unlatch the jog operation and stop the motor. The ⏬ SEL keys provide similar latched jog operation in the CW direction.
- Deactivate the servo by pressing ↵ key. The display returns to [FrEE].

4.3.2 OUTPUT FORCING FUNCTION

The Output Forcing Function is not valid with the Delta S Driver.

4.3.3 AUTO TUNING

The Delta S provides an automatic servo parameter tuning function. Auto Tuning is accessed via the Special Function Menu. **Section 8** of this manual is dedicated to auto and manual tuning of the driver parameters. See **Section 8** for Auto Tuning procedure.

4.3.4 LINK AXIS NUMBER

The Link Axis Number is not used with the Delta S Driver.

4.3.5 SERVICE DATA MONITOR

The Delta S Driver contains detailed service information. The Service Data Monitor contains detailed coded information meant for a qualified IIS Technician. There is no user serviceable information in this menu item. Contact IIS for any service related issues.

SECTION 5 - SERCOS PROGRAMMING

This section gives information on the settings needed in order to communicate to the drive over the SERCOS ring. It also details the Operation Data and Procedure Commands that can be transmitted over the SERCOS Communication ring.

5.1 SERCOS SETUP

For the Delta S driver to communicate over the SERCOS ring, the baud rate and device ID have to be configured. Refer to **Section 4** on how to set parameters using the drives Keypad.

PARAMETER	IDN	NAME	SETTINGS	DATA TYPE
HP-60	34508	SERCOS Loop Baudrate	0X02, 0X04, 0X08, 0X10	Hexadecimal
HP-61	34509	SERCOS Loop Device ID	0 - 254	Decimal

A Device ID of Zero will put the Device in repeater mode and it will not recognize commands over SERCOS.

5.2 IDENTIFICATION NUMBERS

The Delta S has an extensive list of SERCOS Identification Numbers (IDN) to access the Operation Data and Procedure Commands that can be transmitted over the SERCOS Communication ring.

5.2.1 IDN LIST

IDN	NAME
(SERCOS SPECIFIC)	
00001	Control Unit Cycle Time (t_{Ncyc})
00002	Communication Cycle Time (t_{Scyc})
00003	Shortest AT Transmission Starting Time (t_{1min})
00004	Transmit/Receive Transition Time (t_{ATMT})
00005	Minimum Feedback Processing Time (t_5)
00006	AT Transmission Starting Time (t_1)
00007	Feedback Acquisition Capture Point (t_4)
00008	Command Value Valid Time (t_3)
00009	Position of Data Record in MDT
00010	Length of MDT
00011	Class 1 diagnostic (C1D)
00012	Class 2 diagnostic (C2D)
00013	Class 3 diagnostic (C3D)
00014	Interface Status
00015	Telegram Type Parameter
00016	Configuration List of AT
00017	IDN - List of all Operation Data
00018	IDN - List of Operation Data for Phase 2
00019	IDN - List of Operation Data for Phase 3
00021	IDN - List of Invalid Operation Data for Phase 2
00022	IDN - List of Invalid Operation Data for Phase 3
00024	Configuration List of MDT

5.2.1 IDN LIST (cont'd)

IDN	NAME
(SERCOS SPECIFIC)	
00025	IDN - List of all Procedure Commands
00028	MST Error Counter
00029	MDT Error Counter
00030	Manufacturer Version
00032	Primary Operation Mode
00033	
00034	
00035	
00036	Velocity Command Value
00040	Velocity Feedback Value
00041	
00042	
00043	Velocity Polarity Parameter
00044	Velocity Data Scaling Type
00047	Position Command Value
00051	Position Feedback Value 1(Motor Feedback)
00052	
00053	Position Feedback Value 2 (Auxiliary Encoder Feedback)
00055	Position Polarity Parameters
00057	Position Window
00076	Position Data Scaling Type
00080	Torque Command Value
00082	PositiveTorque Limit
00083	Negative Torque Limit
00084	Torque Feedback Value
00085	Torque Polarity Parameter
00086	Torque/Force Data Scaling Type
00088	Receive to Receive Recovery Time (t_{MTSY})
00089	MDT Transmission Starting Time (t_2)
00090	Command Value Proceeding Time (t_{MTSG})
00091	Bipolar Velocity Limit Value
00092	Bipolar Torque Limit Value
00095	Diagnostic Message
00096	Slave Arrangment (SLKN)
00097	Mask Class 2 Diagnostics
00098	Mask Class 3 Diagnostics
00099	Reset Class 1 Diagnostics
00124	Standstill Window
00125	Velocity Threshold
00126	Torque Threshold
00127	Phase 3 Transition Check
00128	Phase 4 Transition Check
00129	Product Specific Class 1 Diagnostics
00130	Probe 1 Value Positive Edge
00131	Probe 1 Value Negative Edge
00132	Probe 2 Value Positive Edge
00133	Probe 2 Value Negative Edge
00134	Master Control Word
00135	Drive Status Word
00138	Bipolar Acceleration Limit Value
00140	Controller Type
00142	Application Type
00143	SERCOS Interface Version

5.2.1 IDN LIST (cont'd)

IDN	NAME
(SERCOS SPECIFIC)	
00147	
00148	
00157	Velocity Window
00159	Monitoring Window
00169	Probe Control Parameter
00170	Probing Cycle Procedure Command
00179	Probe Status
00185	Length of the configurable Data Record in the AT
00186	Length of the configurable Data Record in the MDT
00187	IDN -List of configurable Data Record in the AT
00188	IDN - List of configurable Data Record in the MDT
00189	Following Distance
00206	Drive On Delay Time
00207	Drive Off Delay Time
00300	Real-time Control Bit 1
00301	Allocation of Real-time Control Bit 1
00302	Real-time Control Bit 2
00303	Allocation of Real-time Control Bit 2
00304	Real-time Status Bit 1
00305	Allocation of Real-time Status Bit 1
00306	Real-time Status Bit 2
00307	Allocation of Real-time Status Bit 2
00400	
00401	Probe 1
00402	Probe 2
00403	
00405	Probe 1 Enable
00406	Probe 2 Enable
00409	Probe 1 Positive Latched
00410	Probe 1 Negative Latched
00411	Probe 2 Positive Latched
00412	Probe 2 Negative Latched
(IIS SPECIFIC)	
33000	Digital Outputs
33020	Output Function
33040	Digital Output Hardware State
33100	PLS Source
33101	Current PLS Angle
33103	PLS Cycle
33104	PLS Preset
33105	PLS Offset
33106	PLS Advance
33107	Clear PLS
33108	Set PLS Angle
33109	PLS Mask
33110	PLS Output
33111	Set PLS State
33112	Clear PLS State
33200	Probe Source
33500	Digital Inputs
33501	Digital Input 1

5.2.1 IDN LIST (cont'd)

IDN	NAME
(IIS SPECIFIC)	
33502	Digital Input 2
33503	Digital Input 3
33504	Digital Input 4
33505	Digital Input 5
33506	Digital Input 6
33507	Digital Input 7
33508	Digital Input 8
33509	Digital Input 9
33510	Digital Input 10
33511	Digital Input 11
33512	Digital Input 12
33513	Digital Input 13
33514	Digital Input 14
33515	Digital Input 15
33516	Digital Input 16
33517	Digital Input 1 Configuration
33600	Analog Input 1
33601	Analog Input 2
33700	Alarm History
33800	
34202	Load Inertia Ratio
34203	High Frequency Response
34204	Position Loop DC Gain
34207	Zero Speed Gain Reduction
34208	Feed Forward Gain
34209	Secondary Filter
34302	Motor Code
34303	Resolver Cable Length
34304	Gear Ratio Denominator For the Encoder Output
34305	Gear Ratio Numerator For the Encoder Output
34315	Absolute Position Clear
34316	Brake Mode
34318	Auxiliary Encoder Input Pulse Type
34319	Pulse Output Pulse Type
34325	Monitor Output Function
34328	Holding Brake Threshold
34330	External Regen Resistor Value
34331	External Regen Resistor Wattage
34334	Torque Limit Switchover
34337	Positive Absorption Torque Limit
34339	Negative Absorption Torque Limit
34501	Amplifier Software Number
34504	Motor Peak Current
34505	% Motor Torque
34506	% Motor Temp
34507	% Rated Absorption
34508	SERCOS Loop Baud Rate
34509	SERCOS Loop Device ID
34510	SERCOS Loop Attenuation
34511	Keyboard Lock
34601	Autotune Rotation Amount
34602	Autotune Target Response
34603	Autotune Maximum Speed

5.2.1 IDN LIST (cont'd)

IDN	NAME
(IIS SPECIFIC)	
34801	Autotune Command
34807	Drive Alarms
34808	Alarm History Details
34809	Read Motor Parameters
34810	

5.2.2 IDN BY FUNCTION

IDN	NAME
Position Control	
00032	Primary Operation Mode
00047	Position Command Value
00051	Position Feedback Value 1(Motor Feedback)
00053	Position Feedback Value 2 (Auxiliary Encoder Feedback)
00055	Position Polarity Parameters
00057	Position Window
00076	Position Data Scaling Type
00138	Bipolar Acceleration Limit Value
00159	Monitoring Window
00189	Following Distance
Velocity Control	
00032	Primary Operation Mode
00036	Velocity Command Value
00040	Velocity Feedback Value
00043	Velocity Polarity Parameter
00044	Velocity Data Scaling Type
00091	Bipolar Velocity Limit Value
00124	Standstill Window
00125	Velocity Threshold
00138	Bipolar Acceleration Limit Value
00157	Velocity Window
Torque Control	
00032	Primary Operation Mode
00080	Torque Command Value
00082	PositiveTorque Limit
00083	Negative Torque Limit
00084	Torque Feedback Value
00085	Torque Polarity Parameter
00086	Torque/Force Data Scaling Type
00092	Bipolar Torque Limit Value
00126	Torque Threshold

5.2.2 IDN BY FUNCTION (cont'd)

IDN	NAME
Communications	
00001	Control Unit Cycle Time (t_{Ncyc})
00002	Communication Cycle Time (t_{Scyc})
00003	Shortest AT Transmission Starting Time (t_{1min})
00004	Transmit/Receive Transition Time (t_{ATMT})
00005	Minimum Feedback Processing Time (t_5)
00006	AT Transmission Starting Time (t_1)
00007	Feedback Acquisition Capture Point (t_4)
00008	Command Value Valid Time (t_3)
00009	Position of Data Record in MDT
00010	Length of MDT
00014	Interface Status
00015	Telegram Type Parameter
00016	Configuration List of AT
00017	IDN - List of all Operation Data
00018	IDN - List of Operation Data for Phase 2
00019	IDN - List of Operation Data for Phase 3
00021	IDN - List of Invalid Operation Data for Phase 2
00022	IDN - List of Invalid Operation Data for Phase 3
00024	Configuration List of MDT
00025	IDN - List of all Procedure Commands
00088	Receive to Receive Recovery Time (t_{MTSY})
00089	MDT Transmission Starting Time (t_2)
00090	Command Value Proceeding Time (t_{MTSG})
00096	Slave Arrangment (SLKN)
00127	Phase 3 Transition Check
00128	Phase 4 Transition Check
00134	Master Control Word
00135	Drive Status Word
00185	Length of the configurable Data Record in the AT
00186	Length of the configurable Data Record in the MDT
00187	IDN - List of configurable Data Record in the AT
00188	IDN - List of configurable Data Record in the MDT
00206	Drive On Delay Time
00207	Drive Off Delay Time
00300	Real-time Control Bit 1
00301	Allocation of Real-time Control Bit 1
00302	Real-time Control Bit 2
00303	Allocation of Real-time Control Bit 2
00304	Real-time Status Bit 1
00305	Allocation of Real-time Status Bit 1
00306	Real-time Status Bit 2
00307	Allocation of Real-time Status Bit 2

5.2.2 IDN BY FUNCTION (cont'd)

IDN	NAME
Diagnostics	
00011	Class 1 diagnostic (C1D)
00012	Class 2 diagnostic (C2D)
00013	Class 3 diagnostic (C3D)
00028	MST Error Counter
00029	MDT Error Counter
00095	Diagnostic Message
00097	Mask Class 2 Diagnostics
00098	Mask Class 3 Diagnostics
00099	Reset Class 1 Diagnostics
00129	Product Specific Class 1 Diagnostics
33700	Alarm History
34501	Amplifier Software Number
34504	Motor Peak Current
34505	% Motor Torque
34506	% Motor Temp
34507	% Rated Absorption
34807	Drive Alarms
34808	Alarm History Details
Probes	
00130	Probe 1 Value Positive Edge
00131	Probe 1 Value Negative Edge
00132	Probe 2 Value Positive Edge
00133	Probe 2 Value Negative Edge
00169	Probe Control Parameter
00170	Probing Cycle Procedure Command
00179	Probe Status
00401	Probe 1
00402	Probe 2
00405	Probe 1 Enable
00406	Probe 2 Enable
00409	Probe 1 Positive Latched
00410	Probe 1 Negative Latched
00411	Probe 2 Positive Latched
00412	Probe 2 Negative Latched

5.2.2 IDN BY FUNCTION (cont'd)

IDN	NAME
Inputs/Outputs	
33000	Digital Outputs
33020	Output Function
33040	Digital Output Hardware State
33100	PLS Source
33101	Current PLS Angle
33102	PLS Info
33103	PLS Cycle
33104	PLS Preset
33105	PLS Offset
33106	PLS Advance
33107	Clear PLS
33108	Set PLS Angle
33109	PLS Mask
33110	PLS Output
33111	Set PLS State
33112	Clear PLS State
33200	Probe Source
33500	Digital Inputs
33501	Digital Input 1
33502	Digital Input 2
33503	Digital Input 3
33504	Digital Input 4
33505	Digital Input 5
33506	Digital Input 6
33507	Digital Input 7
33508	Digital Input 8
33509	Digital Input 9
33510	Digital Input 10
33511	Digital Input 11
33512	Digital Input 12
33513	Digital Input 13
33514	Digital Input 14
33515	Digital Input 15
33516	Digital Input 16
33517	Digital Input 1 Configuration
33600	Analog Input 1
33601	Analog Input 2
Adjust Parameters	
34202 (AJ2)	Load Inertia Ratio
34203 (AJ3)	High Frequency Response
34204 (AJ4)	Position Loop DC Gain
34207 (AJ7)	Zero Speed Gain Reduction
34208 (AJ8)	Feed Forward Gain
34209 (AJ9)	Secondary Filter

5.2.2 IDN BY FUNCTION (cont'd)

IDN	NAME
User Parameters	
00082 (HP-36)	PositiveTorque Limit
00083 (HP-38)	Negative Torque Limit
00092 (UP-11)	Torque Feedback Value
34302 (UP-02)	Motor Code
34303 (UP-03)	Resolver Cable Length
34304 (UP-04)	Gear Ratio Denominator For the Encoder Output
34305 (UP-05)	Gear Ratio Numerator For the Encoder Output
34315 (UP-15)	Absolute Position Clear
34316	Brake Mode
34318 (UP-18)	Auxiliary Encoder Input Pulse Type
34319 (UP-19)	Pulse Output Pulse Type
34325 (UP-25)	Monitor Output Function
34328 (UP-28)	Holding Brake Threshold
34330 (UP-30)	External Regen Resistor Value
34331 (UP-31)	External Regen Resistor Wattage
34334 (HP-34)	Torque Limit Switchover
34337 (HP-37)	Positive Absorption Torque Limit
34339 (HP-39)	Negative Absorption Torque Limit
Auto Tune	
34601	Autotune Rotation Amount
34602	Autotune Target Response
34603	Autotune Maximum Speed
34801	Autotune Command
Miscellaneous	
00030	Manufacturer Version
00140	Controller Type
00142	Application Type
00143	SERCOS Interface Version
34508 (HP60)	SERCOS Loop Baud Rate
34509 (HP61)	SERCOS Loop Device ID
34510 (HP59)	SERCOS Loop Attenuation
34809	Read Motor Parameters
34511	Keyboard Lock

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC

00001: CONTROL UNIT CYCLE TIME, (t_{Ncyc})

The control unit cycle time defines the cyclic interval during which the control unit makes new command values available. The control unit cycle time ($t_{Ncyc)}$ must be set equal to the communication cycle time (t_{Scyc}). This value is calculated and loaded into the drive by the Master Control Unit in Phase 2. This value becomes active in phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	500-5000	1 uSec	Phases 2, 3 and 4	Phase 2

00002: COMMUNICATION CYCLE TIME, (t_{Scyc})

The communication cycle time of the interface defines the intervals during which the cyclic data are transferred. The communication cycle can be set from 500uSec to 5000 uSec in steps of 250 uSec. This value is calculated and loaded into the drive by the Master Control Unit in Phase 2. This value becomes active in phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	500-5000	1 uSec	Phases 2, 3 and 4	Phase 2

00003: SHORTEST AT TRANSMISSION STARTING TIME, (t_{1min})

Indicates the time requirement of the drive between the end of the reception of the MST and the start of the transmission of the AT. Read by the Master Controller in Phase 2, t_{1min} is used to calculate the AT Transmission Starting Time, t_1 (IDN 00006).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	15	1 uSec	Phases 2, 3 and 4	None

00004: TRANSMIT/RECEIVE TRANSITION TIME, (t_{ATMT})

Time required by the drive to switch from transmitting the AT to receiving the MDT. Read by the Master Controller in Phase 2 and is used to determine the MDT starting time, t_2 (IDN 00089).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0	1 uSec	Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00005: MINIMUM FEEDBACK PROCESSING TIME, (t_5)

Time required by the drive between the start of feedback acquisition and the arrival of the next MST. This value is loaded by the Master Controller in Phase 2 and becomes active in Phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	150	1 uSec	Phases 2, 3 and 4	None

00006: AT TRANSMISSION STARTING TIME, (t_1)

The time the drive sends the AT after the end of the MST. This value is loaded by the Master Controller in Phase 2 and becomes active in Phase 3. ($t_1 \geq t_{1min}$)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	15-5000	1 uSec	Phases 2, 3 and 4	Phase 2

00007: FEEDBACK ACQUISITION CAPTURE POINT, (t_4)

The time the drive captures the AT Data. This value is loaded by the Master Controller in Phase 2 and becomes active in Phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0 -(tScyc - t5)	1 uSec	Phases 2, 3 and 4	Phase 2

00008: COMMAND VALUE VALID TIME, (t3)

The time the drive can start using the data sent in the MDT. Set by the Master Controller in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0-5000	1 uSec	Phases 2, 3 and 4	Phase 2

00009: POSITION OF DATA RECORD IN MDT

The position within the MDT that the drives command data can be obtained. Set by the Master Controller in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0-65535	1 byte	Phases 2, 3 and 4	Phase 2

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00010: LENGTH OF MDT

The length of the MDT, expressed in bytes, includes data records for all drives. Set by the Master Controller in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	4-65534	1 byte	Phases 2, 3 and 4	Phase 2

00011: CLASS 1 DIAGNOSTICS (C1D)

Indicates a Drive Shutdown Error.

A Drive error situation leads to the following.

a) Drive safely decelerates to and releases torque when stopped.
b) The shutdown error Bit (Bit 13) is set to 1 in the drive status. IDN 99 must be issued and no Class 1 diagnostic errors exist to clear the error bit.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Overload Shutdown
Bit 1:	Reserved
Bit 2:	Motor Over-Temperature Fault
Bit 3:	Reserved
Bit 4:	Power Stage Voltage Fault
Bit 5:	Feedback Fault
Bit 6:	Reserved
Bit 7:	Over Current Fault
Bit 8:	Over Voltage Fault
Bit 9:	Under Voltage Fault
Bit 10:	Reserved
Bit 11:	Excessive Position Deviation
Bit 12:	Communication Error
Bit 13:	Reserved
Bit 14:	Reserved
Bit 15:	Manufacturer Specific Fault

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-65535	1 byte	Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00012: CLASS 2 DIAGNOSTICS (C2D)

Indicates a Drive Shutdown Warning.

The shutdown warning Bit (Bit 12) is set to 1 in the drive status.
When this IDN is read the warning bit is cleared and this IDN is reset to 0.

Currently Class 2 Diagnostics are not supported by the drive. All bits are reserved for future use.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-65535	1 byte	Phases 2, 3 and 4	None

00013: CLASS 3 DIAGNOSTICS (C3D)

Drive operation status flags.

The status flag Bit (Bit 11) is set to 1 in the drive status when a change in C3D occurs. When this IDN is read the status bit (Bit 11) in the drive status is cleared.

Bit supported by drive:

BIT NUMBER	DESCRIPTION	
Bit 0:	$n_{feedback} = n_{command}$	(See: Velocity Window IDN 00157)
Bit 1:	$n_{feedback} = 0$	(See: Standstill Window IDN 00124)
Bit 2:	$\| n_{feedback} \| < \| n_x \|$	(See: Velocity Threshold IDN 00125)
Bit 3:	$\| T \| >= \| T_x \|$	(See: Torque Threshold IDN 00126)
Bit 4:	$\| T \| >= \| T_{limit} \|$	(See: Torque Limit IDN 00082, IDN 00083, and IDN 00092)
Bit 5:	$\| n_{command} \| > \| n_{limit} \|$	(See: Velocity Limit IDN 00091)
Bit 6:	In Position	(See: Position Window IDN 00057)
Bit 7 - 15:	Reserved	

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-65535	1 byte	Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00014: INTERFACE STATUS

Status of the SERCOS Interface. When an interface error occurs, the error and the phase the error occurred is recorded. Can only be cleared by the Reset Class 1 Diagnostics (IDN 00099).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2 - 0:	Phase Error Occurred
Bit 3:	MST Failure
Bit 4:	MDT Failure
Bit 5:	Invalid Phase (Phase > 4)
Bit 6:	Error During Phase Upshift (Invalid Sequence)
Bit 7:	Error During Phase Downshift (Not To Phase 0)
Bit 8:	Phase Switching without Ready Acknowledge
Bit 9:	Switching to Unitialized Operating Mode
Bit 9 - 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-65535	1 byte	Phases 2, 3 and 4	None

00015: TELEGRAM TYPE PARAMETER

Selects the Telegram Configuration Type of the AT and the MDT cyclic data. Set by the Master Controller in Phase 2.

TYPE	CONFIGURATION
0	No AT or MDT IDNs
1	IDN 80 (Torque Command) in the MDT
2	IDN 36 (Velocity Command) in the MDT and IDN 40 (Velocity Feedback) in the AT
3	IDN 36 (Velocity Command) in the MDT and IDN 51 (Position Feedback) in the AT
4	IDN 47 (Position Command) in the MDT and IDN 51 (Position Feedback) in the AT
5	IDN 47 (Position Command) , IDN 36 (Velocity Command) in the MDT and IDN 51 (Position Feedback), IDN 40 (Velocity Feedback in the AT
6	IDN 36 (Velocity Command) in the MDT
7	User Defined At and MDT (See IDNs 16 and 24)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-7		Phases 2, 3 and 4	Phase 2

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00016: CONFIGURATION LIST OF AT

List of IDNs that are to be included in the User Defined AT Cyclic Data. Set by the Master Controller in Phase 2. Only Valid if Telegram Type 7 is selected for IDN 00015. (Refer to **IDN 00185** and **IDN 00187**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	Phase 2

00017: IDN - LIST OF ALL OPERATION DATA

Returns the list of all valid operation Data IDN's

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	None

00018: IDN - LIST OF OPERATION DATA FOR PHASE 2

Returns the list of all IDN's that must be written by the Master in Phase 2.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	None

IDN's 00001, 00002, 00006, 00007, 00008, 00009, 00010, 00015, 00032 and 00089 must be written.

00019: IDN - LIST OF OPERATION DATA FOR PHASE 3

Returns the list of all IDN's that must be written by the Master in Phase 3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	None

00021: IDN - LIST OF INVALID OPERATION DATA FOR PHASE 2

Returns the list of all operation Data IDN's for Phase 2 that is considered invalid by the drive and will need to be written before switchover to phase 3 can be made.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00022: IDN - LIST OF INVALID OPERATION DATA FOR PHASE 3

Returns the list of all operation Data IDN's for Phase 3 that is considered invalid by the drive and will need to be written before switchover to phase 4 can be made.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	None

00024: CONFIGURATION LIST OF MDT

List of IDNs that are to be included in the User Defined MDT Cyclic Data. Set by the Master Controller in Phase 2. Only Valid if Telegram Type 7 is selected for IDN 00015. (Refer to **IDN 00186** and **IDN 00188**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	Phase 2

00025: IDN - LIST OF ALL PROCEDURE COMMANDS

Returns the list of all valid Procedure Command IDN's on drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	None

00028: MST ERROR COUNTER

The MST error counter counts all invalid MST's in Communication Phase 3 and 4. In the case where more than 2 consecutive MST's are invalid, only the first two are counted. The MST error counter counts up to a maximum of 2^{16} -1. This means that if a value of 65535 is set in the counter, there may have been a noisy transmission over a long period of time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0-65535		Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00029: MDT ERROR COUNTER

The MDT error counter counts all invalid MDT's in Communication Phase 3 and 4. In the case where more than 2 consecutive MDT's are invalid, only the first two are counted. The MDT error counter counts up to a maximum of 2^{16} -1. This means that if a value of 65535 is set in the counter, there may have been a noisy transmission over a long period of time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0-65535		Phases 2, 3 and 4	Phases 2, 3 and 4

00030: MANUFACTURER VERSION

Identifies the current software version number in the drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Text	Variable			Phases 2, 3 and 4	None

00032: PRIMARY OPERATION MODE

The drive operation mode defined by this ID Number becomes active when the Primary Operation mode is set in the Control word of the MDT. Must be configured in phase 2.

VALUES	VALID MODES
0	No Command Mode
1	Torque Control Mode using Cyclic command values
2	Velocity Control Mode using Cyclic command values
3	Position Control using Cyclic command values
16385	Torque Control ignoring Cyclic command values
16386	Velocity Control ignoring Cyclic command values

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-65535		Phases 2, 3 and 4	Phases 2

00036: VELOCITY COMMAND VALUE

In the velocity control-operating mode in the drive, the control unit transfers the velocity command values to the drive. The velocity is commanded as a percent of maximum velocity.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-100.00 - +100.00	0.01%	Phases 2, 3 and 4	Phase 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00040: VELOCITY FEEDBACK VALUE

The velocity feedback value is transferred from the drive to the control unit in order to allow the control unit to periodically display the velocity.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-100.00 - +100.00	0.01%	Phases 2, 3 and 4	None

00043: VELOCITY POLARITY PARAMETER

This parameter is used to switch polarities of velocity data for specific applications. Polarities are not switched internally but externally (on the input and output) of a closed loop system. The motor shaft turns clockwise when there is a positive velocity command difference and no inversion is programmed (see **Figure 5.1**).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Velocity command value = 0 - non-inverted = 1 - inverted
Bit 1:	Reserved
Bit 2:	Velocity feedback value = 0 - non-inverted = 1 - inverted
Bit 15 - 3:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

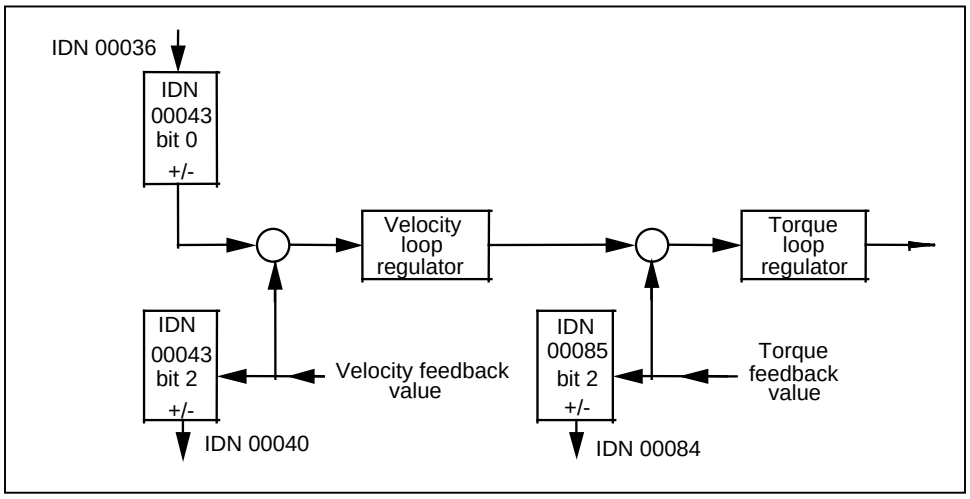


Figure 5.1 - Velocity Polarity Parameter

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00044: VELOCITY DATA SCALING TYPE

Defines the scaling option for all velocity data. Only the "No scaling Method is currently supported by the drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2-0:	Scaling method 000 - no scaling
All others:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00047: POSITION COMMAND VALUE

During the position control drive operation mode, the position command values are transferred from the control unit to the drive according to the time pattern of the control unit cycle.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1	1 bit	Phases 2, 3 and 4	Phase 4

00051: POSITION FEEDBACK VALUE 1 (MOTOR FEEDBACK)

The position feedback value 1 is transferred from the drive to the control unit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1	1 bit	Phases 2, 3 and 4	None

00053: POSITION FEEDBACK VALUE 2 (AUXILARY ENCODER FEEDBACK)

The position feedback value 2 is transferred from the drive to the control unit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1	1 bit	Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00055: POSITION POLARITY PARAMETERS

This parameter is used to switch polarities of reported position data for specific applications. Polarities are switched outside (i.e. on the input and output) of a closed loop system. The motor shaft turns clockwise (when viewed from the output shaft) when there is a positive position command difference and no inversion is programmed (see **Figure 5.2**).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Position command value 0 - Non-inverted 1 - Inverted
Bit 1:	Reserved
Bit 2:	Position feedback value 1 0 - Non-inverted 1 - Inverted
Bit 3:	Position feedback value 2 0 - Non-inverted 1 - Inverted
Bit 4-15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

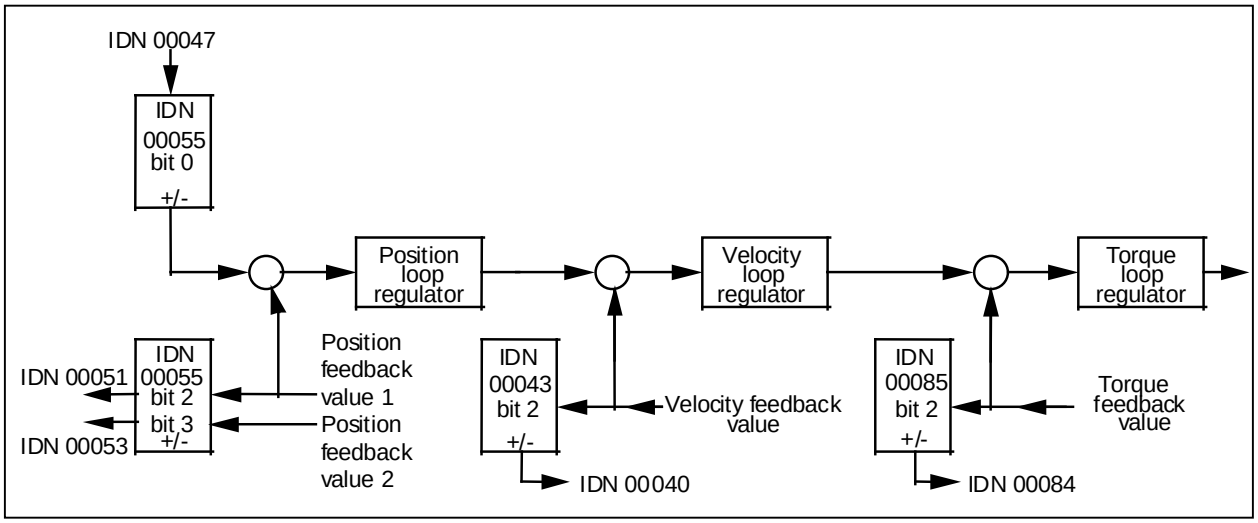


Figure 5.2 - Position Polarity Parameter

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00057: POSITION WINDOW

When the difference between the position command value and the position feedback value is within the range of the position window, then the drive sets the status "in position" in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	$0 - +2^{31} - 1$	1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4

00076: POSITION DATA SCALING TYPE

Defines the scaling option for all position data. Only the "No scaling" method is currently supported by the drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2-0:	Scaling method 000 - no scaling
All others:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00080: TORQUE COMMAND VALUE

During the torque control operation mode of the drive, torque command values are transferred from the control unit to the drive.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	-100.00 - +100.00	0.01%	Phases 2, 3 and 4	Phase 4

00082: POSITIVE TORQUE LIMIT (HP-36)

The positive torque limit value limits the maximum torque in the positive direction. If the torque limit is exceeded the drive sets the status $T >= T_{limit}$ in C3D (IDN 00013). For this limit to take effect. Torque Limits must be set active in IDN 34334 and the bipolar torque limit IDN 00092 must be set to 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	0.00 - 100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00083: NEGATIVE TORQUE LIMIT (HP-38)

The negative torque limit value limits the maximum torque in the negative direction. If the torque limit is exceeded the drive sets the status T >= T_{limit} in C3D (IDN 00013). For this limit to take effect. Torque Limits must be set active in IDN 34334 and the bipolar torque limit IDN 00092 must be set to 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	0.00 - 100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

00084: TORQUE FEEDBACK VALUE

The torque feedback value is transferred from the drive to the control unit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	-100.00 - +100.00	0.01%	Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00085: TORQUE POLARITY PARAMETER

This parameter is used to switch polarities of reported torque data for specific applications. Polarities are not switched internally but externally (on the input and output) of a closed loop system. The motor shaft turns clockwise when there is a positive torque command difference and no inversion (see **Figure 5.3**).

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Torque command value 0 - Non-inverted 1 - Inverted
Bit 1:	Reserved
Bit 2:	Torque feedback value 0 - Non-inverted 1 - Inverted
Bit 15-3:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

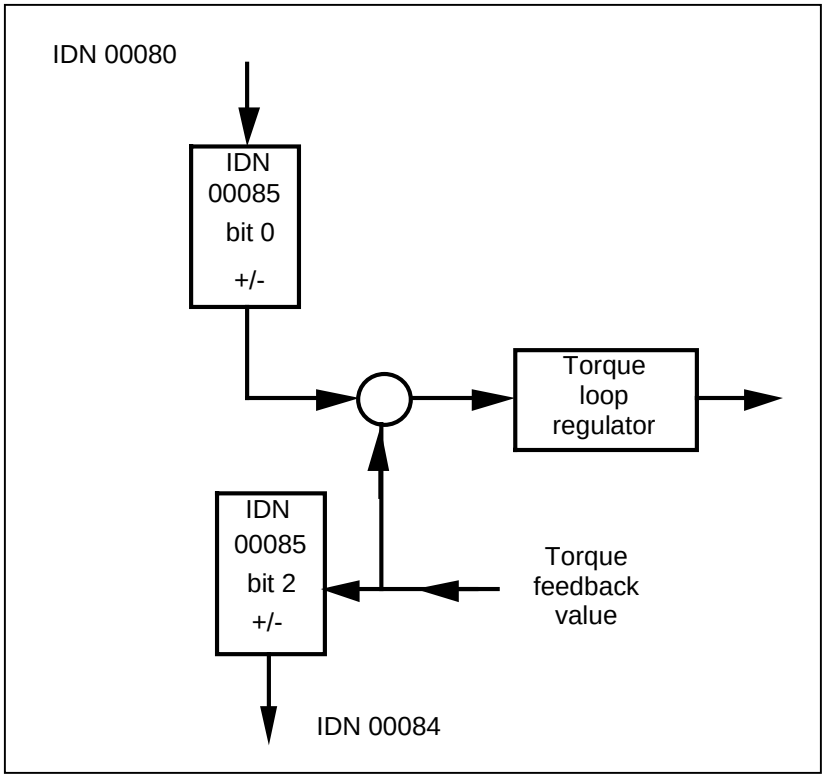


Figure 5.3 - Torque Polarity Parameter

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00086: TORQUE DATA SCALING TYPE

Defines the scaling option for all torque data. Only the "Percentage Scaling" method is currently supported by the drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 2-0:	Scaling method 000 - Percentage scaling
Bit 3-15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00088: RECEIVE TO RECEIVE RECOVERY TIME (t_{mtsy})

Recovery time of the slave after reception of a MDT to switch over to receive the next MST. The master reads this time during CP_2 to ensure that the interval will be sufficient between the end of the MDT and the beginning of the MST.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0	1 μs	Phases 2, 3 and 4	None

00089: MDT TRANSMISSION STARTING TIME (t_2)

The MDT transmission starting time determines when the master shall send its MDT during CP_3 and CP_4, following the MST. This parameter is transferred by the master to the slave during CP_2 and becomes active during CP_3.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal Number	2 bytes	1 - 5000	1 μs	Phases 2, 3 and 4	Phase 2

00090: COMMAND VALUE PROCEEDING TIME (t_{mtsg})

The time required by the slave to make command values available for a drive after receipt of a MDT. This time is read by the master during CP_2 in order to calculate correctly the command value valid time t_3 (IDN 00008).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	1	1 μs	Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00091: BIPOLAR VELOCITY LIMIT VALUE

The bipolar velocity limit value describes the maximum allowable velocity in both directions. If the velocity limit value is exceeded, the drive responds by setting the status '$n_{command} > n_{limit}$' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

00092: BIPOLAR TORQUE LIMIT VALUE (UP-11

The bipolar torque limit value limits the maximum torque symmetrically in both directions. If the torque limit value is exceeded, the drive sets the status '$T \geq T_{limit}$' in C3D (IDN 00013).
For this limit to take effect. Torque Limits must be set active in IDN 34334. If this value is set = 0, then IDN 00082, IDN 00084, IDN 34337, and IDN 34339 are valid.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

00095: DIAGNOSTIC MESSAGE

Not currently supported at this time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Text	Variable			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

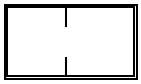
00096: SLAVE ARRANGEMENT (SLKN)

During initialization, the master needs to recognize which physical slaves and their associated drives are present in order to optimize the automatic timeslot computation. The master can request this information from the drives during CP_2. By this entry the master recognizes other drives which belong to the same physical slave. Valid drive addresses are all decimal values from 1 to 254, in accordance with hexadecimal values $(01)_H$ through $(FE)_H$.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes		1 µs	Phases 2, 3 and 4	Phases 2, 3 and 4

SLKN:

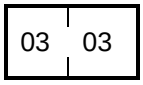
Since each Delta S is configured with one drive per slave, then "Next Drives Address" = "Drive Address".



Next Drives Address (1 through 255)
Drive Address (1 through 255)

Example:

A drive with an address of "03" has a value of:



00097: MASK CLASS 2 DIAGNOSTIC

By means of this mask, warnings in class 2 diagnostic can be masked with respect to their effect on the change bit in drive status. When changing masked warnings, the change bit for class 2 diagnostic is not set in the drive status. The mask does not affect the operation data of class 2 diagnostic (see **IDN 00012**). Setting a bit to 0 masks the effects of the correspond C2D bit on the Class 2 diagnostic change bit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00098: MASK CLASS 3 DIAGNOSTIC

By means of this mask, condition flags in C3D can be masked with respect to their effect on the change bit in drive status. When masked condition flags change, the change bit for C3D is not set in the drive status. The mask does not affect the operation data of C3D (see **IDN 00013**). Setting a bit to 0 masks the effects of the correspond C3D bit on the Class 3 diagnostic change bit.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00099: RESET CLASS 1 DIAGNOSTIC

When this procedure command is received by the drive via the service channel and no error exists, C1D, the interface status, the manufacturer's C1D, the drive shutdown error (drive status bit 13), and the drive shutdown mechanism in the drive are all reset (see **IDN 00011, IDN 00014, and IDN 00129**).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00124: STANDSTILL WINDOW

The standstill window describes the amount of the deviation of the velocity from 0. If the velocity feedback value is within the standstill window the drive sets the status $n_{feedback} = 0$ in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

00125: VELOCITY THRESHOLD (n_x)

If the velocity feedback value falls below the velocity threshold n_X, the drive sets the status '$n_{feedback} < n_X$ ' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00126: TORQUE THRESHOLD (T_X)

If the torque feedback value exceeds the torque threshold T_X, the drive sets the status '$T \geq T_X$' in C3D (IDN 00013).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

00127: CP_3 TRANSITION CHECK

The master uses this procedure command to instruct the slave to check that all necessary parameters have been transferred for CP_3. Otherwise, this procedure command results in an error (see **IDN 00021**). After the procedure command is performed correctly, the control unit has to cancel the procedure command. The control unit can then activate CP_3 in the MST.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 2

00128: CP_4 TRANSITION CHECK

The master uses this procedure command to instruct the slave to check that all necessary parameters have been transferred for CP_4. Otherwise, this procedure command results in an error (see **IDN 00022**). After the procedure command is performed correctly, the control unit has to cancel the procedure command. The control unit can then activate CP_4 in the MST.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 3

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00129: MANUFACTURER CLASS 1 DIAGNOSTIC

If an error is set in the manufacturer class 1 diagnostic, the manufacturer-specific error bit in class 1 diagnostic (see **IDN 00011**) is set as well. The drive cancels the manufacturer-specific error and resets to '0' only if the error in manufacturer class 1 diagnostic has been eliminated and on receiving the command 'reset class 1 diagnostic' (see **IDN 00099**) via the service channel.

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Regen Resistor Over-Temperature Fault
Bit 1:	Regen Resistor Open Fault
Bit 2:	Brake Sequence Fault
Bit 3:	Motor Code Invalid
Bit 4:	Cycle of Power Required
Bit 5:	Dual Port Communication Error
Bit 6:	Driver Processor Watchdog Error
Bit 7:	Absolute Home Error
Bit 8:	Battery Low
Bit 9:	Drive Hardware Error
Bit 10 - 14:	Reserved
Bit 15:	Fatal System Error

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00130: PROBE VALUE 1 POSITIVE EDGE

Based on the configure Probe Feedback Source (IDN 33100) the drive stores position feedback value in the measuring cycle in this parameter following the positive edge of the input signal of probe 1 (see **IDN 00401**). This allows the control unit to read 'probe value 1 positive edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1		Phases 2, 3 and 4	None

00131: PROBE VALUE 1 NEGATIVE EDGE

Based on the configure Probe Feedback Source (IDN 33100) the drive stores position feedback value in the measuring cycle in this parameter following the negative edge of the input signal of probe 1 (see **IDN 00401**). This allows the control unit to read 'probe value 1 negative edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1		Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00132: PROBE VALUE 2 POSITIVE EDGE

Based on the configured Probe Feedback Source (IDN 33100) the drive stores position feedback value in the measuring cycle in this parameter following the positive edge of the input signal of probe 2 (see **IDN 00402**). This allows the control unit to read 'probe value 2 positive edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1		Phases 2, 3 and 4	None

00133: PROBE VALUE 2 NEGATIVE EDGE

Based on the configured Probe Feedback Source (IDN 33100) the drive stores position feedback value in the measuring cycle in this parameter following the negative edge of the input signal of probe 2 (see **IDN 00402**). This allows the control unit to read 'probe value 2 negative edge' at a later time.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1		Phases 2, 3 and 4	None

00134: MASTER CONTROL WORD

Allows reading of the master control word on the control unit screen, via the service channel. (This can be useful during start-up and error recovery.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00135: DRIVE STATUS WORD

Allows reading of the drive status word on the control unit screen, via the service channel. (This can be useful during start-up and error recovery.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00138: BIPOLAR ACCELERATION LIMIT VALUE

The bipolar acceleration parameter limits the maximum acceleration ability of the drive symmetrically to the programmed value in both directions.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	4000	Rev/sec/sec	Phases 2, 3 and 4	Phases 2, 3 and 4

00140: CONTROLLER TYPE

The operation data of the controller type contains the name of the company and the manufacturer controller type.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Text	Variable	DELTA-S		Phases 2, 3 and 4	None

00142: APPLICATION TYPE

The operation data of the application type contains the type of the drive application (e.g., main spindle drive, round axis).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Text	Variable			Phases 2, 3 and 4	Phases 2, 3 and 4

00143: SYSTEM INTERFACE VERSION

The operation data of SYSTEM interface version contains the version of the SYSTEM Interface specification.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Text	Variable			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00157: VELOCITY WINDOW

The velocity window" relates the current velocity to the velocity command value (IDN 00036). If the current velocity feedback value falls within the calculated velocity window, the drive sets the status '*n* feedback = *n* command' in C3D (IDN 00013)·

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0-100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

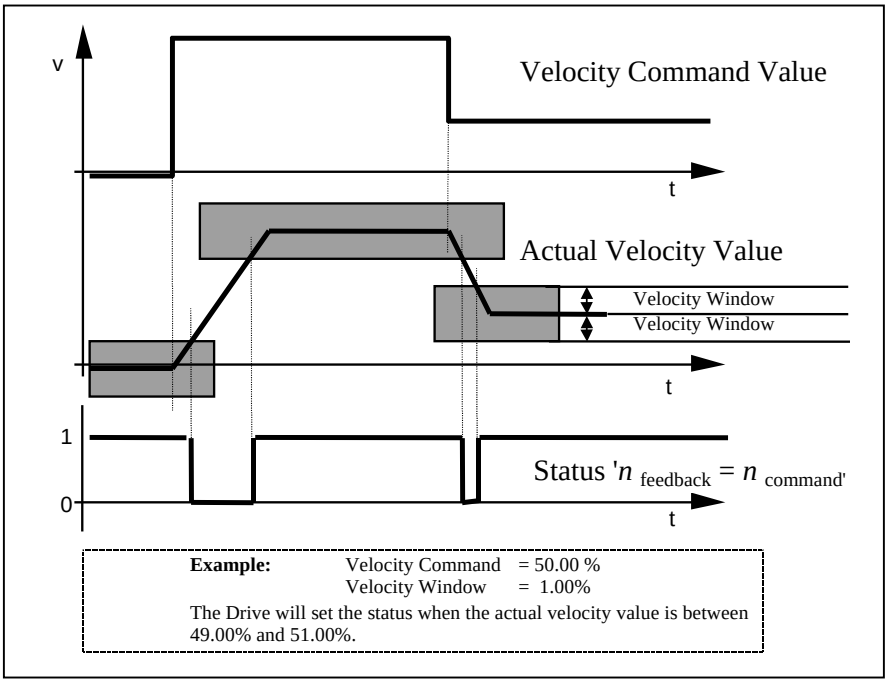


Figure 5.4 - Example of Velocity Window

00159: MONITORING WINDOW

By means of the monitoring window, the maximum position deviation, as referenced to the active actual position value, can be defined for the position feedback value. When the position error value exceeds the maximum position window value, the drive sets an error for excessive position deviation in C1D (IDN 00011).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	$0-+2^{31}-1$		Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00169: PROBE CONTROL PARAMETER

This parameter fixes which probes and which edges are activated for the probing cycle procedure command. Only 1 edge (either rising or falling) can be selected for each probe input.

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	0 - positive edge is not active 1 - positive edge is active
Bit 1:	0 - negative edge is not active 1 - negative edge is active
Bit 2:	0 - positive edge is not active 1 - positive edge is active
Bit 3:	0 - negative edge is not active 1 - negative edge is active
Bit 4 -15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00170: PROBING CYCLE PROCEDURE COMMAND

When the master sets and enables the probing cycle procedure command, the drive reacts on the following parameters:

- Probe 1/2 enable (IDN 00405/00406); and
- Probe 1/2 (IDN 00401/00402) as programmed in the probe control parameter (IDN 00169).

While the procedure command is activated the control unit can start multiple measurements.

If the control unit does not want any more measurements the control unit cancels the procedure command.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Procedure Command	Binary	2 bytes			Phases 2, 3 and 4	Phases 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00179: PROBE STATUS

Indicates the latch status of Probe1 and Probe 2

Bits supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	0 - positive edge is not latched 1 - positive edge is latched
Bit 1:	0 - negative edge is not latched 1 - negative edge is latched
Bit 2:	0 - positive edge is not latched 1 - positive edge is latched
Bit 3:	0 - negative edge is not latched 1 - negative edge is latched
Bit 4 -15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00185: LENGTH OF THE CONFIGURABLE DATA RECORD IN THE AT

This parameter indicates the maximum length, in bytes, which can be processed in the configurable data record of the AT.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes		1 Byte	Phases 2, 3 and 4	None

00186: LENGTH OF THE CONFIGURABLE DATA RECORD IN THE MDT

This parameter indicates the maximum length, in bytes, which can be processed in the configurable data record of the MDT.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes		1 Byte	Phases 2, 3 and 4	None

00187: IDN-LIST OF CONFIGURABLE DATA IN THE AT

In this list the IDNs of operation data that can be processed by the drive cyclically as feedback values.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00188: IDN-LIST OF CONFIGURABLE DATA IN THE MDT

In this list the IDNs of operation data that can be processed by the drive cyclically as command values.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	Variable			Phases 2, 3 and 4	Phases 2, 3 and 4

00189: FOLLOWING DISTANCE

The drive uses the operation data of this IDN to store the distance between position command value and the position feedback value 1. Calculation of the following distance:
following distance = position command value - position feedback value 1

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1		Phases 2, 3 and 4	None

00206: DRIVE ON DELAY TIME

When "drive on" and "drive enable" are set (bits 14 and 15 of the master control word) torque is activated at once, but the drive follows the command values after this waiting time has elapsed.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0 - 2^{16} - 1	1 ms	Phases 2, 3 and 4	Phases 2, 3 and 4

00207: DRIVE OFF DELAY TIME

After "drive off" (bit 15 of the master control word) is reset and n_{min} is reached, the torque remains activated in the drive until this waiting time is elapsed.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0 - 2^{16} - 1	1 ms	Phases 2, 3 and 4	Phases 2, 3 and 4

00300: REAL-TIME CONTROL BIT 1

Contains the state of the control signal defined in IDN 00301 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00301: ALLOCATION OF REAL-TIME CONTROL BIT 1

Assigns a control signal to the real-time control bit 1 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time control bit 1.
Valid IDN's are (IDN 00405, 00406).

Writing a value of zero disables Real Time Control Bit 1. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00302: REAL-TIME CONTROL BIT 2

Contains the state of the control signal defined in IDN 00303 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00303: ALLOCATION OF REAL-TIME CONTROL BIT 2

Assigns a control signal to the real-time control bit 2 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time control bit 2.
Valid IDN's are (IDN 00405, 00406).

Writing a value of zero disables Real Time Control Bit 2. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00304: REAL-TIME STATUS BIT 1

Contains the state of the status signal defined in IDN 00305 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00305: ALLOCATION OF REAL-TIME STATUS BIT 1

Assigns a control signal to the real-time status bit 1 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time status bit 1.
Valid IDN's are (IDN 00401, 00402, 00409, 00410, 00411, 00412, 33501 - 33516).

Writing a value of zero disables real time status bit 1. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00306: REAL-TIME STATUS BIT 2

Contains the state of the status signal defined in IDN 00307 in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00307: ALLOCATION OF REAL-TIME STATUS BIT 2

Assigns a control signal to the real-time status bit 2 by writing the IDN of the control signal to this IDN. After the allocation the assigned signal appears in the real-time status bit 2.
Valid IDN's are (IDN 00401, 00402, 00409, 00410, 00411, 00412, 33501 - 33516).

Writing a value of zero disables real time status bit 2. (Default)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	IDN	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

00401: PROBE 1

Contains the state of the Probe 1 Input in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00402: PROBE 2

Contains the state of the Probe 2 Input in Bit 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00405: PROBE 1 ENABLE

Probe 1 enable is checked by the drive only if the procedure commands "probing cycle" (IDN 00170) is active. For a new probing cycle with the same edge of probe 1 the control unit has to reset probe 1 enable to "0" and set it to "1". (For more details see IDN 00179.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 4

00406: PROBE 2 ENABLE

Probe 2 enable is checked by the drive only if the procedures command "probing cycle" (IDN 00170) is active. For a new probing cycle with the same edge of probe 2 the control unit has to reset probe 2 enable to "0" and set it to "1". (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 4

00409: PROBE 1 POSITIVE LATCHED

This parameter is used to assign an IDN to probe 1 positive latched. This allows assigning the status "probe 1 positive latched" to a real-time status bit (see **IDN 00305**). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 1 enable" (IDN 00405) is set to 1 and the positive edge of "probe 1" (IDN 00401) is announced. Simultaneously the drive stores the position feedback value in "probe 1 positive edge" (IDN 00130). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 1 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.3 IDN DESCRIPTION - SERCOS SPECIFIC (cont'd)

00410: PROBE 1 NEGATIVE LATCHED

This parameter is used to assign an IDN to probe 1 negative latched. This allows assigning the status "probe 1 negative latched" to a real-time status bit (see **IDN 00305**). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 1 enable" (IDN 00405) is set to 1 and the negative edge of "probe 1" (IDN 00401) is announced. Simultaneously the drive stores the position feedback value in "probe 1 negative edge" (IDN 00131). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 1 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00411: PROBE 2 POSITIVE LATCHED

This parameter is used to assign an IDN to probe 2 positive latched. This allows assigning the status "probe 2 positive latched" to a real-time status bit (see IDN 00305). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 2 enable" (IDN 00406) is set to 1 and the positive edge of "probe 2" (IDN 00402) is announced. Simultaneously the drive stores the position feedback value in "probe 2 positive edge" (IDN 00132). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 2 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

00412: PROBE 2 NEGATIVE LATCHED

This parameter is used to assign an IDN to probe 2 negative latched. This allows assigning the status "probe 2 negative latched" to a real-time status bit (see **IDN 00305**). Bit 0 of this parameter is set by the drive only if the procedure command "probing cycle" (IDN 00170) is active, the signal "probe 2 enable" (IDN 00406) is set to 1 and the negative edge of "probe 2" (IDN 00402) is announced. Simultaneously the drive stores the position feedback value in "probe 2 negative edge" (IDN 00133). The drive resets this bit when the control unit cancels the procedure command "probing cycle" or when probe 2 enable is reset to 0. Bit 0 is defined for operation data only. (For more details see **IDN 00179**.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.4 IDN DESCRIPTION - IIS SPECIFIC

33000: DIGITAL OUTPUTS

The state of the digital output can be set via this parameter. If the corresponding bit in the Output Function (**IDN 33020**) is set to 0 then the bit will be written to the Digital Output hardware. See **IDN 33040** for the hardware output bit structure.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary		0-65535		Phases 2, 3 and 4	Phase 4

33020: OUTPUT FUNCTION

Determines the controlling function for the Digital Output.

Bit = 0: corresponding bit in IDN 33000 is written to output.
Bit = 1: corresponding bit in IDN 33040 is written to output.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary		0-65535		Phases 2, 3 and 4	Phases 2, 3 and 4

33040: DIGITAL OUTPUT HARDWARE STATE

The state of the Digital Output Hardware can be viewed by this parameter. The hardware state is determined by the states of IDN 33000, IDN 33020, IDN 33109 and IDN 33110.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Output 1 (Brake Output)
Bit 1:	Output 2
Bit 2:	Output 3
Bit 3:	Output 4
Bit 4:	Output 5
Bit 5:	Output 6
Bit 6:	Output 7
Bit 7:	Output 8
Bit 8:	Output 9
Bit 9:	Output 10
Bit 10:	Output 11
Bit 11:	Output 12
Bit 12:	Output 13
Bit 13:	Output 14
Bit 14:	Output 15
Bit 15:	Output 16

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

33100: PLS SOURCE

Determines which source the PLS Angle follows. Setting the PLS source initializes the PLS Angle, resets the PLS Mask (IDN 33109), PLS Preset (IDN 33109) and PLS Offset, and Clears the PLS Bit table.

Bit 0 = 0 PLS Angle follows Position Feedback 1
Bit 1 = 0 PLS Angle follows Position Feedback 2

Note: The PLS Angle will not follow any source until IDN 33100 is written to.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0-1		Phases 2, 3 and 4	Phases 2, 3 and 4

33101: CURRENT PLS ANGLE

Reads the current PLS Angle from the drive. The PLS Angle is only updated after a PLS Source has been selected.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0 - PLS Cycle	1 bit	Phases 2, 3 and 4	None

33103: PLS CYCLE

Sets the size of the PLS Cycle.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	4 to 2^{23}	1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4

33104: PLS PRESET

Sets the current PLS Angle to the PLS Preset Value.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	0 - PLS Cycle	1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

33105: PLS OFFSET

Offsets the PLS Angle by the PLS Offset value.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	4 bytes	-2^{31} - $+2^{31}$ - 1	1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4

33106: PLS ADVANCE

Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes		1 bit	Phases 2, 3 and 4	Phases 2, 3 and 4

33107: CLEAR PLS

Clears the corresponding bits in the PLS output table. See **IDN 33040** for bit definition.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

33108: SET PLS ANGLE

For all bits set in the "PLS output bits" sets corresponding bits to 1 between the On Angle and Off Angle. Of Mode = Reset then all other corresponding bits in the cycle are set to 0.

Structure:	PLS output bits	2 bytes (See **IDN 33040** for bit definition)
	Mode	2 bytes (Append: Bit 0 = 1, Reset: Bit 0 = 0)
	On Angle	4 bytes ($0 \leq$ Range < PLS CYCLE (IDN 33103))
	Off Angle	4 bytes ($0 \leq$ Range < PLS CYCLE (IDN 33103))

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Text	Variable			Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

33109: PLS MASK

Enables the corresponding bits it the PLS Output to follow the PLS Bit table.
(See **IDN 33040** for bit definition.)

Bit = 0: PLS Output bit disabled. Corresponding PLS Output Bit holds last state.
Bit = 1: PLS Output bit Enabled. Corresponding PLS Output Bit updates as PLS Angle is updated.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phases 2, 3 and 4

33110: PLS OUTPUT

The state of the PLS Outputs can be read via this parameter. (See **IDN 33040** for bit definition.)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

33111: SET PLS STATE

By definition of the PLS MASK (IDN 33109), if a PLS Output bit is disabled in the PLS Mask the bit will hold its last state. This IDN allows the last state of the bit to be forced to 1. If a bit = 1 in this operation data and its corresponding bit in the PLS Mask = 0, then the PLS Output bit will be set = 1.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phase 4

33112: CLEAR PLS STATE

By definition of the PLS MASK (IDN 33109), if a PLS Output bit is disabled in the PLS Mask the bit will hold its last state. This IDN allows the last state of the bit to be forced to 0. If a bit = 1 in this operation data and its corresponding bit in the PLS Mask = 0, then the PLS Output bit will be set = 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	Phase 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

33500: DIGITAL INPUTS

Reads the State of the Digital Inputs on the Drive.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	Input 1 (See **IDN 33517**)
Bit 1:	Input 2
Bit 2:	Input 3
Bit 3:	Input 4
Bit 4:	Input 5
Bit 5:	Input 6
Bit 6:	Input 7
Bit 7:	Input 8
Bit 8:	Input 9
Bit 9:	Input 10
Bit 10:	Input 11
Bit 11:	Input 12
Bit 12:	Input 13
Bit 13:	Input 14
Bit 14:	Input 15
Bit 15:	Input 16

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

33501 - 33516: DIGITAL INPUT0 - DIGITAL INPUT15

Read the State of the signal on the Drive into Bit 0. This IDN was created so that the digital inputs could be mapped to the Real Time Status Bits.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes			Phases 2, 3 and 4	None

33517: DIGITAL INPUT 0 CONFIGURATION

Allows mapping of the Probe bits into the Digital Input 0 Bit.

Valid Values:

0: Brake Input
1: Probe 1 State
2: Probe 2 State

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0 - 2		Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

33600: ANALOG INPUT 1

Read the counts from the Analog Input 1. The value of the A/D is shifted up to a 16-bit value so that the range is the same for either the 10-bit (standard) or the 14-bit (optional) A/D.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	-2^{15} - $+2^{15}$ - 1	10-bit or 14-bit A/D shifted up.	Phases 2, 3 and 4	None

33601: ANALOG INPUT 2

Read the counts from the Analog Input 2. The value of the A/D is shifted up to a 16bit value.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	-2^{15} - $+2^{15}$ - 1	10-bit or 14-bit A/D shifted up.	Phases 2, 3 and 4	None

33700: ALARM HISTORY

The drive maintains a list of the up to 15 Alarm Faults Codes and details about the state of the drive when the faults happened. This IDN returns only the list of up to 15 faults. See **IDN 34808** if the details of the faults are desired.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	Variable 2 byte each			Phases 2, 3 and 4	None

34202: LOAD INERTIA RATIO (AJ2)

Sets the baseline frequency response of the drive using the ratio of the load inertia/motor inertia for a rigidly coupled load. If the load is not rigidly coupled, the value entered may vary from the calculated value. If the value is set too high, the motor and the drive may become unstable and oscillate. This parameter is set automatically during auto tuning.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0~100	1 Times	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34203: HIGH FREQUENCY RESPONSE (AJ3)

Sets the high frequency response of the driver. The higher the number, the more responsive. If the value is set too high, the motor may become unstable and oscillate. The value in IDN 34203 is unit less and works in concert with IDN 34202 (AJ2). This parameter is set automatically during auto tuning.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0.1~20.0	0.1	Phases 2, 3 and 4	Phases 2, 3 and 4

34204: POSITION LOOP DC GAIN (AJ4)

Sets the DC gain of the position control loop. A higher value in IDN 34204 results in stiffer, faster response. If the value is set too high, the motor and drive may become unstable and oscillate. This parameter is set automatically during auto tuning.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	1~200	1 rad/sec	Phases 2, 3 and 4	Phases 2, 3 and 4

34207: ZERO SPEED GAIN REDUCTION (AJ7)

Set the amount of gain reduction at zero speed. The gain is reduced when the motor is below the speed set in IDN 34207 and at the set values when the speed is above IDN 34207.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	0	0~10000	1	Phases 2, 3 and 4	Phases 2, 3 and 4

34208: FEED FORWARD GAIN (AJ8)

Sets the feed forward gain in the position loop. A value of 1.0 results in 0.0 following error. Less than 1.0 will produce a lag between the actual motor position and the commanded position and greater than 1.0 produces a lead. The lead or lag will be proportion to speed at non- 1.0 setting.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0~2.0	1 Time	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34209: SECONDARY FILTER (AJ9)

Sets the notch frequency of a velocity loop anti-resonance filter. This filter can be used to cancel machine or servo resonance.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	400~20000	1 rad/s	Phases 2, 3 and 4	Phases 2, 3 and 4

34302: MOTOR CODE (UP-02)

Sets the internal driver parameters corresponding to the motor code. See **Appendix A** for motor codes. The driver power must be cycled to register a change in this parameter value. Power must be turned off then ON for this change to take effect. Writing the same value as already stored in the drive does not require the power to be cycled.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Hexidecimal	2 bytes	0000~FFFF		Phases 2, 3 and 4	Phases 2, 3 and 4

34303: RESOLVER CABLE LENGTH (UP-03)

Set the driver resolver cable length compensation.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	0~120	1 Meter	Phases 2, 3 and 4	Phases 2, 3 and 4

34304: GEAR RATIO DENOMINATOR FOR THE PULSE OUTPUT (UP-04)

The output pulse (APD and BPD) is multiplied by UP05/UP04 and then sent to the APD and BPD output pins of the encoder output. This balue is the ratio of the desired output counts of the encoder output and the internal raw processing counts of the driver.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	1~32767		Phases 2, 3 and 4	Phases 2, 3 and 4

34305: GEAR RATIO NUMERATOR FOR THE PULSE OUTPUT (UP-05)

Combined with parameter 0204H.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	1~32767		Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34315: ABSOLUTE POSITION CLEAR (UP-05)

Sets the Absolute Position based on the following type:

0: Makes current position of motor equal to 0.
1: Makes the current motor shaft rotation the 0 rotation while preserving the MARKER.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2 bytes	0 - 1		Phases 2, 3 and 4	Phases 2, 3 and 4

34316: BRAKE MODE

Selects the type of brake sequencing to be done when the drive is disabled. Also, defines the Mode of Input 0 and Output 0. Refer to **Sections 10** and **11** for more details.

0: No Brake
1: Dynamic Brake
2: Mechanical Holding Brake

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Hexidecimal	2	0~2		Phases 2, 3 and 4	Phases 2, 3 and 4

34318: AUXILIARY ENCODER INPUT PULSE TYPE (UP-18)

Sets the type of pulse sequence and polarity of the Auxiliary Encoder Pulse inputs.

00: Pulse, Pulse Decoding where FMA increments position and FMB decrements position.

01: Quadrature decoding of FMA and FMB with FMA Leading FMB for incrementing command position. Quadrature decoding effectively multiplies the input frequency by 4 times.

02: Pulse and direction decoding where FMA is pulse train and FMB is direction. FMB OFF increments the position and ON decrements the position.

10: Pulse, Pulse Decoding where FMB increments position and FMA decrements position.

11: Quadrature decoding of FMA and FMB with FMB Leading FMA for incrementing command position. Quadrature decoding effectively multiplies the input frequency by 4 times.

12: Pulse and direction decoding where FMA is pulse train and FMB is direction. FMB ON increments the position and OFF decrements the Position.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Hexidecimal	2	00 - 12		Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34319: PULSE OUTPUT PULSE TYPE (UP-19)

Sets the type of pulse output sequence and polarity of the pulse output. The pulse output pulse train is coded as the incremental position scaled by Gear Ratio parameters 0205H and 0204H.

0x00: Pulse, Pulse encoding where APD pulse when the actual position increments and BPD pulses when the actual position decrements.

0x01: Quadrature encoding of APD and BPD with APD Leading BPD for incremental actual position. Each edge of the two pulse Trains are counted as an output bit change.

0x10: Pulse, Pulse encoding where BPD pulse when the actual position increments and APD pulses when the actual position decrements.

0x11: Quadrature encoding of APD and BPD with BPD Leading APD for Incremental actual position. Each edge of the two pulse Trains are counted as an output bit change.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Hexadecimal Number	2	0x00~0x11		Phases 2, 3 and 4	Phases 2, 3 and 4

34325: MONITOR OUTPUT FUNCTION

Selects the speed and torque output and polarity of the monitor test point.

The first byte selects the MON output function.
0xX0: TORQUE
0xX1: SPEED

The second byte selects the polarity of the monitor output.
0x0X: NORMAL
0x1X: INVERT

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Hexadecimal Number	2	0x00~0x11		Phases 2, 3 and 4	Phases 2, 3 and 4

34328: HOLDING BRAKE THRESHOLD (UP-28)

When IDN34316 is set to 0, IDN 34328 has no effect. When IDN 34316 is set to 1, the mechanical break is applied when the motor speed falls below UP28. UP28 is scaled in % of rated speed.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0~100	0.1%	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34330: EXTERNAL REGEN RESISTOR VALUE (UP-30)

Value of the optional external regen resistor. When the regen resistor is used, the value is entered to allow the driver to calculate the average power into the regen resistor. When the internal regen is used, enter 0.0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0~100	0 ohm	Phases 2, 3 and 4	Phases 2, 3 and 4

34331: EXTERNAL REGEN RESISTOR WATTAGE (UP-31)

Power rating of the optional external regen resistor. When the external regen resistor is used, the power rating is Kw of the resistor is entered to allow the driver to calculate the average power into the regen resistor. When the internal regen is used, enter 0.0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0~327.67	0.01 Kwatts	Phases 2, 3 and 4	Phases 2, 3 and 4

34334: TORQUE LIMIT SELECTION (HP-34)

Determines whether torque limits are active.

Bit supported by drive:

BIT NUMBER	DESCRIPTION
Bit 0:	0: Torque Limits Disabled 1: Torque Limits Enabled (See **IDN 00082, 00083, 00092, 34337** and **34339**)
Bit 1 - 15:	Reserved

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Binary	2			Phases 2, 3 and 4	Phases 2, 3 and 4

34337: POSITIVE ABSORPTION TORQUE LIMIT (HP-37)

Limits the positive absorption torque. Torque Limits must be set active in IDN 34334 and the bipolar torque limit IDN 00092 must be set to 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34339: NEGATIVE ABSORPTION TORQUE LIMIT (HP-39)

Limits the positive absorption torque. Torque Limits must be set active in IDN 34334 and the bipolar torque limit IDN 00092 must be set to 0.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Signed Decimal	2 bytes	0-+100.00	0.01%	Phases 2, 3 and 4	Phases 2, 3 and 4

34501: AMPLIFIER SOFTWARE NUMBER

Reads the software revision number of the amplifier control board.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2			Phases 2, 3 and 4	None

34504: MOTOR PEAK CURRENT

Reads the peak value of the AC Current Output to the motor.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Decimal	2	-160.0 -160.0	0.1 %	Phases 2, 3 and 4	None

34506: % MOTOR TEMP

Reads the calculated motor temperature as a percent of maximum temperature. The electronic motor thermal limit alarm activates at 110% (AL-17).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0 - 110	1 %	Phases 2, 3 and 4	None

34507: % RATED ABSORPTION

For the drive DS-8.5 and DS-17.5, reads the value (motor absorption torque/motor rated torque)*100%. For the drive DS-35 and up the display is % rating of the regeneration resistor capacity.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0 - 100%	1 %	Phases 2, 3 and 4	None

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34508: SERCOS LOOP BAUD RATE (HP 60)

Reads the current value of the Baud Rate set in the drive keypad menu.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Hexadecimal	2	0x02, 0x04, 0x06, 0x10	Mega bits/Sec	Phases 2, 3 and 4	None

34509: SERCOS LOOP DEVICE ID (HP 61)

Reads the current value of the Device ID set in the drive keypad menu.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0-254		Phases 2, 3 and 4	None

34510: SERCOS LOOP ATTENUATION (HP 59)

Reads the current value of the SERCOS Transmitter power attenuation set in the drive keypad menu.

Defined as:

0: Low Attenuation
1: High Attenuation

(This IDN use is currently reserved. Value set to Zero)

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0-1		Phases 2, 3 and 4	None

34601: AUTOTUNE ROTATION AMOUNT

Define the amount of reciprocal rotation should be used when executing the auto tune procedure (IDN 34801).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2	0 - 300	Revs	Phases 2, 3 and 4	Phases 2, 3 and 4

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34602: AUTOTUNE TARGET RESPONSE

Define the desired frequency response desired when executing the autotune procedure (IDN 34801). If this value is set too high, unstable operation may occur.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	1 - 1000	1 Hz	Phases 2, 3 and 4	Phases 2, 3 and 4

34603: AUTOTUNE MAXIMUM SPEED

Define the speed of the reciprocal rotation when executing the autotune procedure (IDN 34801).

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	2 bytes	1 - 4000	RPM	Phases 2, 3 and 4	Phases 2, 3 and 4

34801: AUTOTUNE COMMAND

Starts the Autotune Procedure. Set IDN 34601, 34602, 34603 before executing this Procedure. See **Section 8**.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Procedure Command	2 bytes	0-3		Phases 2, 3 and 4	Phases 4

34807: DRIVE ALARMS

Returns a list of the drives current alarms.

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	Variable 2 byte each			Phases 2, 3 and 4	None

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34808: ALARM HISTORY DETAILS

Returns the list of the last 15 alarms along with details of the systems at the time of the alarm.

The structure of each alarm is:

OFFSET	PARAMETER	DATA SIZE
+0	Alarm Code	2 bytes
+2	Current Command Value	2
+4	Current Detection Value	2
+6	Machine Phase Angle	2
+8	Resolver Position	4
+12	Detection Phase	2
+14	Old Detection Phase	2
+16	Speed	2
+18	Reserved	4
+22	Power On Count	4
+26	Power On Time	4
+30	Number Of Histories	2

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Decimal	480 bytes			Phases 2, 3 and 4	None

5.2.4 IDN DESCRIPTION - IIS SPECIFIC (cont'd)

34809: MOTOR PARAMETERS

All lists of parameters are store in the drive for all valid motor codes. This IDN returns the list of Motor Parameters Specific to the current motor code in IDN 34302. If IDN 34302 is changed, the new motor parameters are not valid until after the power is cycled on the drive.

Motor Parameter List:

PARAMETER NUMBER	PARAMETER DESCRIPTION
Mot 1	Current Loop Kp
Mot 2	Current LoopTi
Mot 3	Velocity Loop Kp
Mot 4	Velocity Loop Ti
Mot 5	Motor Current Limit
Mot 6	Motor Thermal Time Constant
Mot 7	Motor Rated Current
Mot 8	Current Detection Scale Value
Mot 9	Number of Poles
Mot 10	Rated RPM
Mot 11	Motor Max RPM
Mot 12	Short Time Overload POG
Mot 13	Short Time Overload POK
Mot 14	Phase Order Selection
Mot 15	Motor Sensor
Mot 16	Upper Digits of Encoder Split Count
Mot 17	Lower Digits of Encoder Split Count
Mot 18	Encoder Shift
Mot 19	Electronic Thermal Detection
Mot 20	Spare

IDN TYPE	DATA TYPE	DATA LENGTH	SETTING RANGE	SCALING/ RESOLUTION	READ ACCESS	WRITE ACCESS
Operation Data	Unsigned Decimal	Variable 2 bytes each			Phases 2, 3 and 4	None

SECTION 6 - POWER WIRING

The Delta driver and motors have three basic power wiring configurations. Each of the configurations is shown in the following power wiring diagrams (**Figures 6.2 through 6.4**). Each of the diagrams shows recommended circuit breaker, contactor and wire gauge.

6.1 CIRCUIT BREAKER

It is recommended that each driver be provided with a circuit breaker for protection of the driver and motor. All of the drives are suitable for use on a circuit capable of delivering not more than 5000 rms symmetrical amperes, 240 vac maximum when protected by a circuit breaker having an interrupting rating not less than 5000 rms symmetrical amperes, 240 volts maximum. Each of the driver wiring diagrams contains a chart of the recommended circuit breaker for each driver size.

The breaker is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific vendor and size recommendations. Other types of circuit breakers or fuses may be used provided the continuous ratings are equivalent, the instantaneous rating is 10 to 15 times continuous and can support 3 times continuous for at least 3 seconds.

Lower rating protection devices may be used that is sized for the motor power rating. Contact the IIS factory for specific recommendations.

6.2 CONTACTOR

The DS-1.5 through DS-17.5 driver sizes have an internal power bus contactor. The DS-35 through DS-115 sizes requires an external power bus contactor. The driver-wiring diagram for the larger size drivers contains a chart of the recommended contactor for each driver size.

The contactor is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific vendor and size recommendations. Other types of contactors may be used provided the continuous ratings are equivalent and the maximum instantaneous rating is 10 to 15 times continuous. The driver is equipped with a soft start circuit to limit the contactor inrush current.

The coil voltage should be the same rating as the incoming line. The maximum current draw for the coil cannot exceed 0.25 amps. The contactor coil must be fitted with a transient voltage protection device. An RC type suppression device is preferred.

6.3 WIRE SIZES

It is required that each driver be installed with the appropriate size wire for proper operation. Each of the driver wiring diagrams contains a chart of the recommended wire gauges and terminal connection tightening torques for each driver size.

The wire is sized for the worst-case maximum power draw of the driver at the worst-case low line voltage. The charts contain specific METRIC and AWG size recommendations for stranded wire. Use only copper wire rated for 60/75 degree C or greater. The driver terminals are specifically designed to handle the recommended wire gauge with lug or ferrule terminations. See wiring diagrams for more details.

6.4 TRANSFORMERS

Isolating the driver from the facility power line with a transformer is recommended but not required. A transformer may be required to step down or step up the facility power line to meet the driver voltage specifications in **Section 3**.

If a transformer is used, select a transformer with the following characteristics:

- Isolation type.
- Load regulation less than 10%.
- Ability to provide 3 times rated current for 3 to 5 seconds without saturation.
- Ability to drive load with a power factor of 0.85.
- Primary or secondary taps to provide -10%; nominal; +10%; supply voltage.

To achieve maximum performance from the driver, the power input to the driver should be as close to nominal driver input voltage rating as possible. The facility line voltage varies through wide ranges in many parts of the world and it is recommended to match the nominal facility voltage to the nominal input voltage rating of the driver with a transformer. This gives the system the maximum operating range with facility line voltage fluctuations.

If the line voltage is too low, intermittent under voltage alarms may occur. A high line voltage will result in excessive regeneration dumping or intermittent over voltage alarms.

Buck boost transformers may be used to optimally match the facility line voltage to the driver line voltage rating. Buck boost transformers can be used with or without an isolation transformer. If buck boost transformers are used in conjunction with an isolation transformer, it is best to put the buck boost transformers on the primary side of the isolation transformer.

As a general rule the transformer rating can be calculated using the following formulas:

For single phase transformer:

$$\text{Transformer Capacity (VA)} = \frac{\text{Rated Mechanical Output (Watts)}}{0.7}$$

Where: Rated Mechanical Output is from Delta S Package rating.
0.7 = motor/drive efficiency and single phase full wave rectifier factor

Example: Select transformer for a Delta S-200HRA motor/drive package

$$\text{Transformer Capacity (VA)} = \frac{200}{0.7} = 285 \text{ VA}$$

For three phase transformer:

$$\text{Transformer Capacity (Watts)} = \frac{\text{Rated Mechanical Output (Watts)}}{0.85}$$

Where: Rated Mechanical Output is from Delta S Package rating.
0.85 is motor/drive efficiency and three phase rectifier factor

Example: Select transformer for a Delta S-6500HRA motor/drive package

$$\text{Transformer Capacity (VA)} = \frac{6500}{0.85} = 7647 \text{ VA}$$

6.4 TRANSFORMERS (cont'd)

One transformer can supply multiple motor/driver packages. Simply add the rated mechanical output of the motor/driver packages together and use the above formulas. If one transformer is used to supply multiple drivers, be sure to protect each driver with the appropriate circuit breaker or fuse.

IIS offers a full line of transformers for various line voltage and frequencies, enclosed and open frame types. Contact IIS Application Engineering Department for full details.

6.5 BRANCH CIRCUIT PROTECTION FOR CONTROL VOLTAGE R0, S0

The DS-35 through DS-115 require a separate control voltage supply (R0 S0) for proper operation. The R0 S0 circuit is fused internal to the driver and need not be externally fused except to protect the control voltage wiring external to the driver using branch circuit protection guidelines. The control voltage circuit of multiple drivers can be fed from a single branch circuit.

6.6 WIRING PRACTICES AND GROUNDING

All wiring must conform to accept standards such as NEMA and NEC codes. Signal and low voltage I/O wires must be physical separated from high voltage wires by at least 12 inches or separated by a suitable barrier such as steel conduit or wiring trough separator.

The driver must be adequately grounded for proper operation and to provide personnel safety. The proper grounding technique is shown in **Figure 6.1** below.

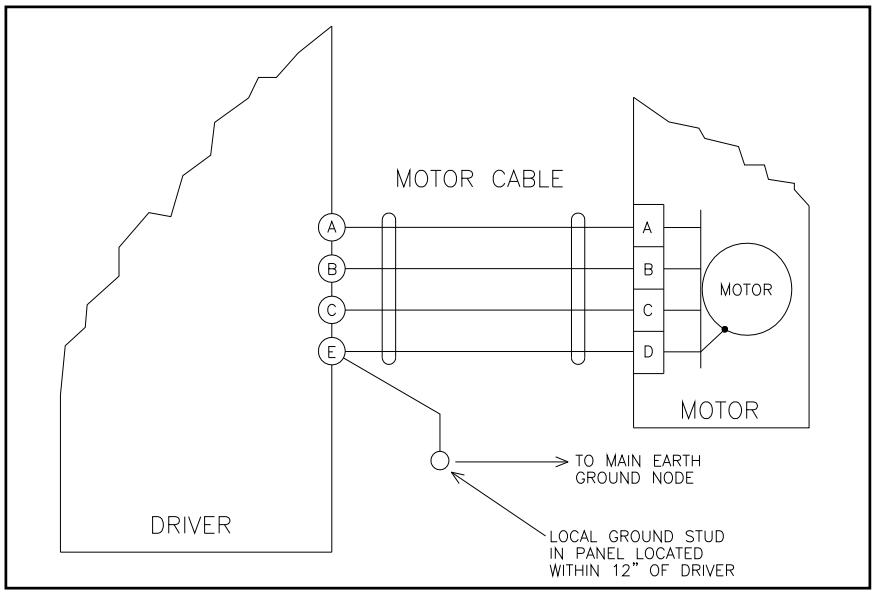
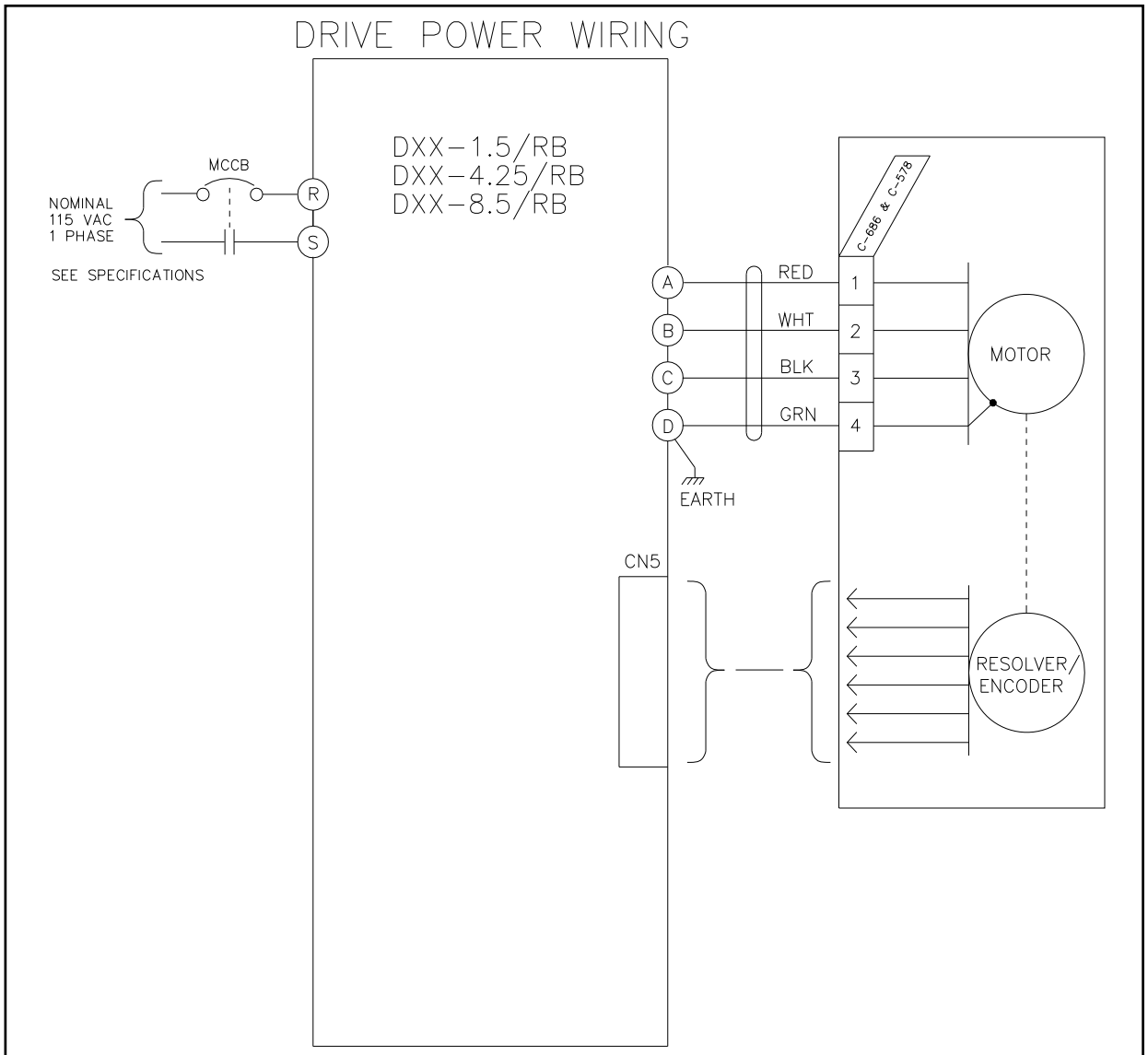


Figure 6.1 - Grounding Technique

****NOTE****

Multiple drivers can share a local ground stud if it is located within 12" of each drivers's (E) terminal. The ground symbol on each drive indicates that a connection must be made between the (E) terminal of the drive and earth ground.

6.7 POWER WIRING DIAGRAMS

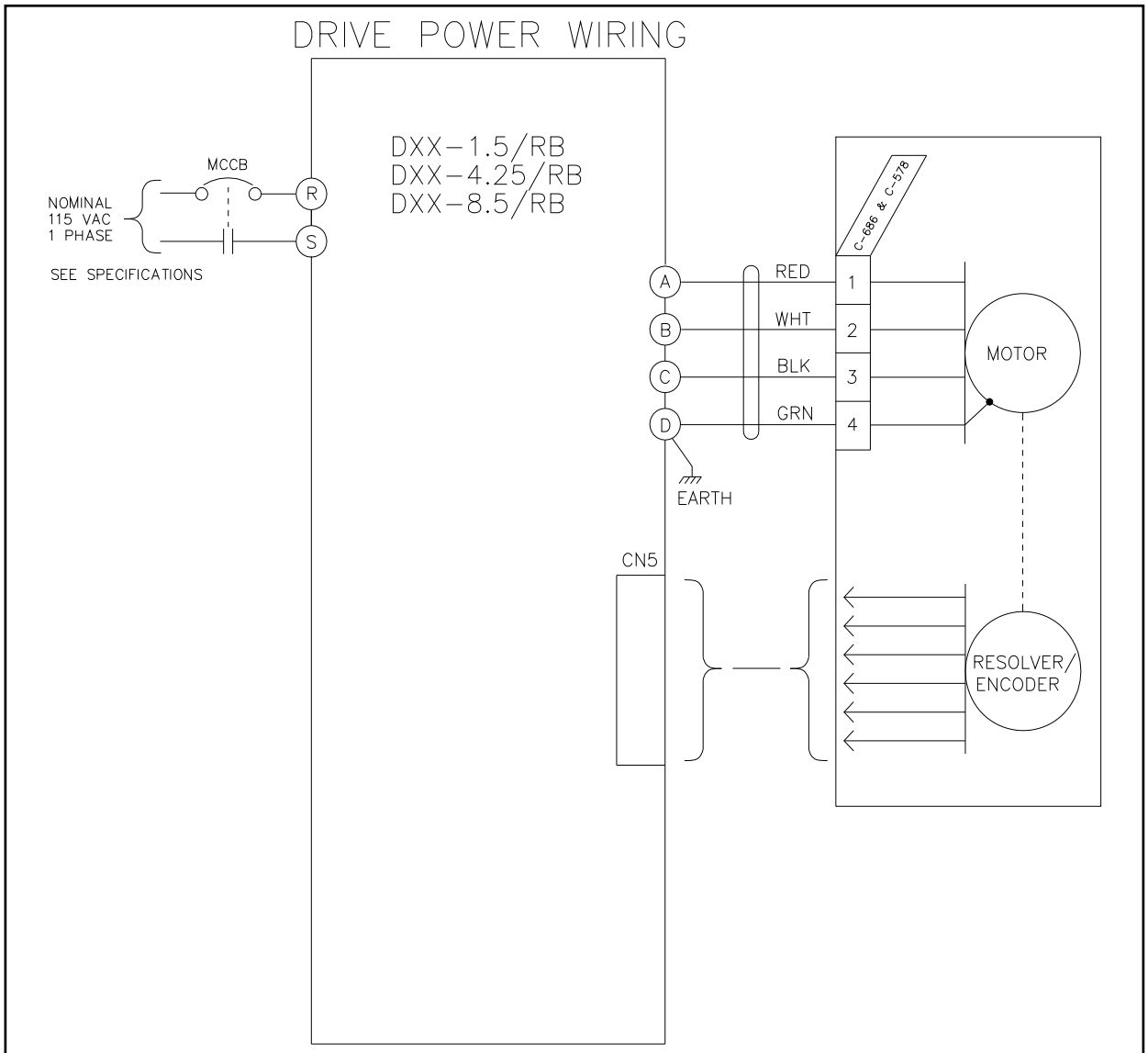


DRIVER	MCCB	R,S & EARTH CIRCUIT WIRE SIZE	REQUIRED TORQUE (LB-IN) ON POWER WIRING TERMINALS
DXX-1.5/RB DXX-4.25/RB	ABB-S271-K4NA 4 AMPS	14 AWG, 1.25 MM^2	12.00**
DXX-8.5/RB	ABB-S271-K8NA 8 AMPS	14 AWG, 1.25 MM^2	12.00**

** Field wiring connection shall be made by a UL LISTED and CSA Certified closed -loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.

Figure 6.2 - DS-1.5/RB Through DS-8.5/RB Power Wiring

6.7 POWER WIRING DIAGRAMS (cont'd)

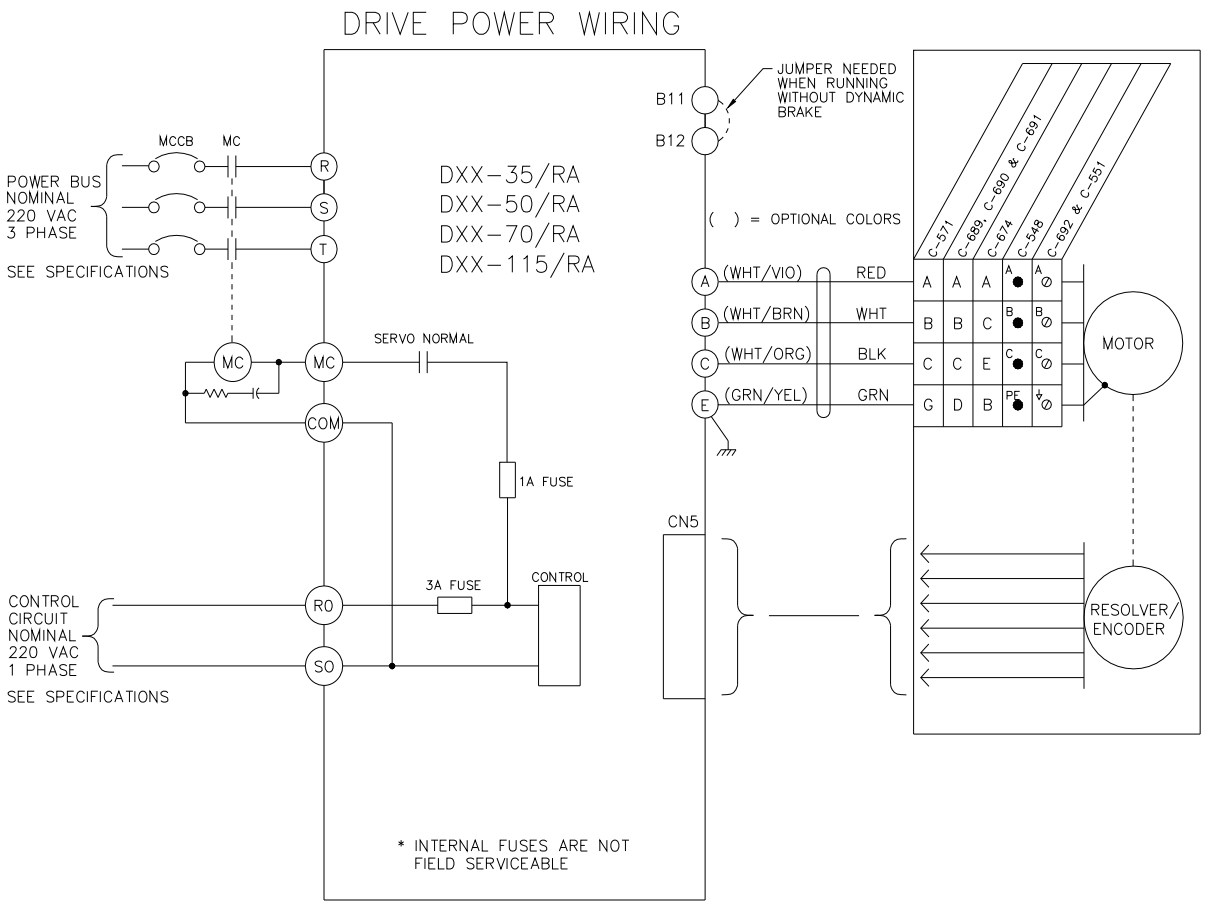


DRIVER	MCCB	R,S & EARTH CIRCUIT WIRE SIZE	REQUIRED TORQUE (LB-IN) ON POWER WIRING TERMINALS
DXX-1.5/RB DXX-4.25/RB	ABB-S271-K4NA 4 AMPS	14 AWG, 1.25 MM^2	12.00**
DXX-8.5/RB	ABB-S271-K8NA 8 AMPS	14 AWG, 1.25 MM^2	12.00**

** Field wiring connection shall be made by a UL LISTED and CSA Certified closed -loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.

Figure 6.3 - DS-1.5/RA Through DS-17.5/RA Power Wiring

6.7 POWER WIRING DIAGRAMS (cont'd)



DRIVER	MCCB	MC	R,S,T & EARTH CIRCUIT WIRE SIZE	RO, SO, MC, COM WIRE SIZE	REQUIRED TORQUE (LB-IN) ON POWER WIRING TERMINALS
DXX-35/RA	(ABB) S273-K16 (SQD) MG24468 16 AMPS	(SQD) LC1D18M7 W/ LAD4RCU	12 AWG, 2 MM^2	14 AWG, 1.25 MM^2	15.50
DXX-50/RA	(ABB) S273-K20 (SQD) MG24469 20 AMPS	(SQD) LC1D25M7 W/ LAD4RCU	12 AWG, 3.5 MM^2	14 AWG, 1.25 MM^2	15.50
DXX-70/RA	(ABB) S273-K32 (SQD) MG24471 30 AMPS	(SQD) LC1D32M7 W/ LAD4RCU	10 AWG, 5.5 MM^2	14 AWG, 1.25 MM^2	17.50**
DXX-115/RA	(ABB) S273-K63 (SQD) MG24474 63 AMPS	(SQD) LC1D65M7 W/ LA4DA2U	8 AWG, 16 MM^2	14 AWG, 1.25 MM^2	17.50**

** Field wiring connection shall be made by a UL LISTED and CSA Certified closed -loop terminal connector sized for the wire gauge involved. Connector must be fixed using the crimp tool specified by the connector manufacturer.

Figure 6.4 - DS-35/RA Through DS-115/RA Power Wiring

SECTION 7 - I/O SIGNAL WIRING

The Delta S driver offers a wide variety of input and output hardware standard, including 8 optical isolated inputs, 8 optically isolated outputs, 2 10-bit Analog inputs (14-bit optional), auxiliary encoder pulse input, and pulse output. These features give the Delta S Driver the flexibility to meet almost any application requirement for I/0.

The Delta S driver has an I/O expansion option that offers an additional 8 optically isolated inputs and 8 optically isolated outputs.

7.1 DELTA S DRIVER WITH STANDARD I/O INTERFACING TO A DINT-300

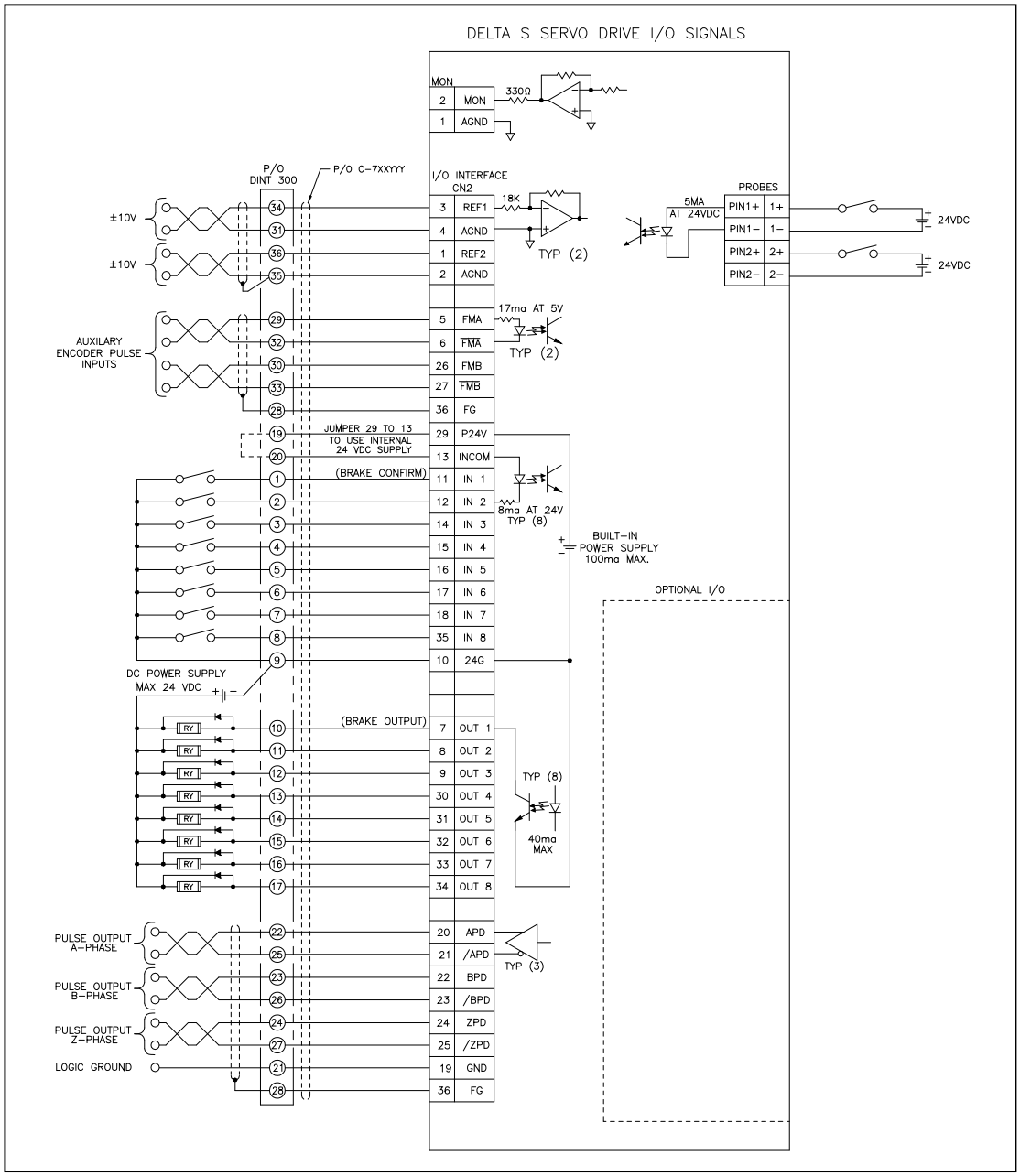


Figure 7.1 - I/O Connections To a DINT-300

7.1.1 Pin Description

Drive

REF1 - REF2 **: ±10VDC Analog Inputs**

AGND **: Analog Input Ground**

FMA/FMB **: Auxiliary Encoder Pulse Input**

APD/BPD/ZPD **: Pulse Output**

FG **: Pulse I/0 Shield**

IN 1 - IN 8 **: 24VDC Optically Isolated Inputs, high side common**

P24V **: Built-in +24VDC Supply**

INCOM **: +V IN (24 VDC) for IN 1 - IN 8**

24G **: 24VDC Ground for IN 1 - IN 8 and OUT 1 - OUT 8**

OUT 1 - OUT 8 **: 24VDC Optically Isolated Outputs, low side common**

PIN1 - PIN2 **: Optically Isolated High Speed Probe Inputs**

7.2 DELTA S DRIVER INTERFACING TO A DINT-300S

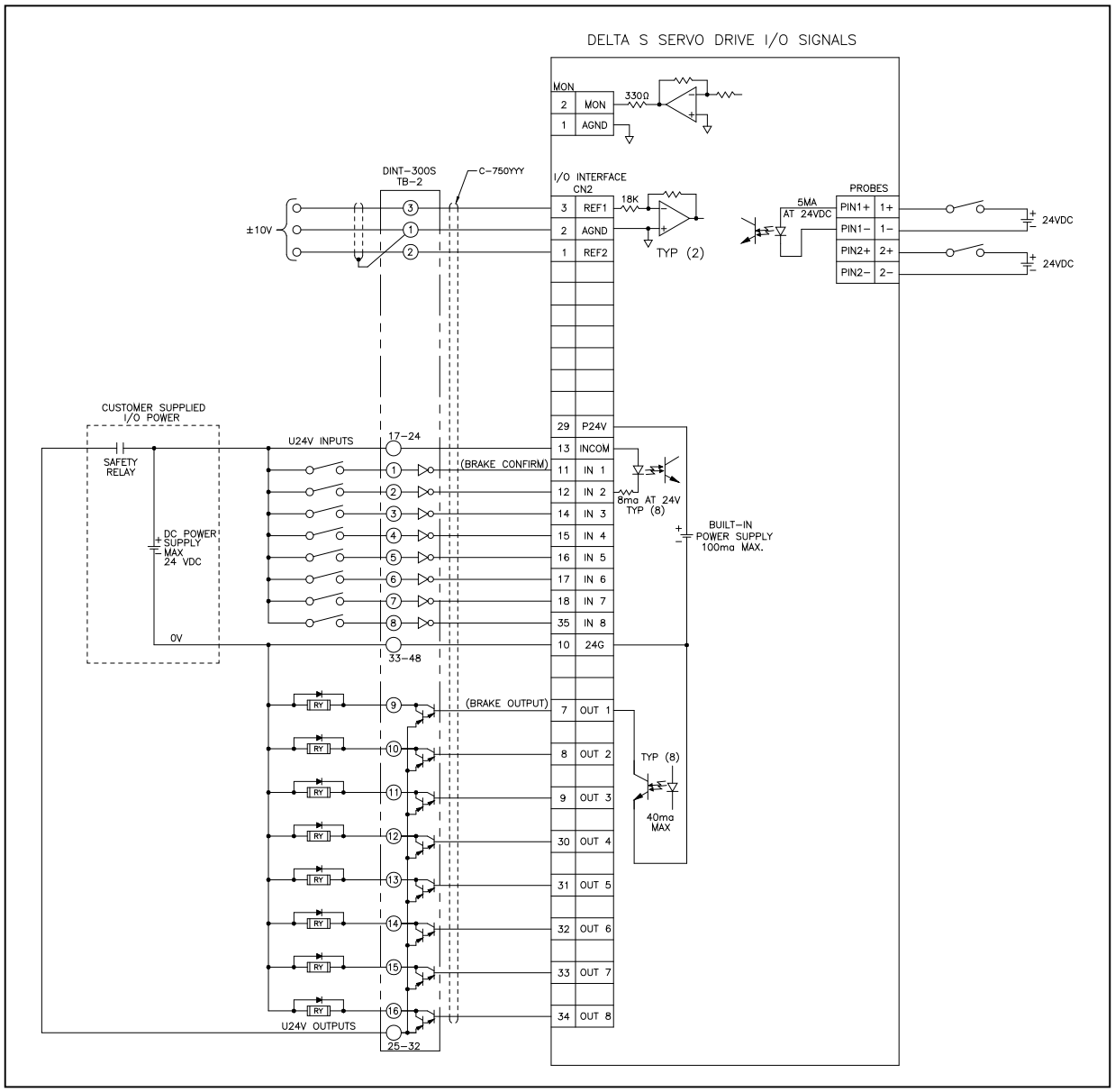


Figure 7.2 - I/O Connections To a DINT-300S

7.2.1 Pin Description

Drive

REF1 - REF2 **: ±10VDC Analog Inputs**

AGND **: Analog Input Ground**

IN 1 - IN 8 **: 24VDC Optically Isolated Inputs, high side common**

P24V **: Built-in +24VDC Supply**

INCOM **: +V IN (24 VDC) for IN 1 - IN 8**

24G **: 24VDC Ground for IN 1 - IN 8 and OUT 1 - OUT 8**

OUT 1 - OUT 8 **: 24VDC Optically Isolated Outputs, low side common**

PIN1 - PIN2 **: Optically Isolated High Speed Probe Inputs**

7.3 DELTA S DRIVER INTERFACING TO A DINT-300K

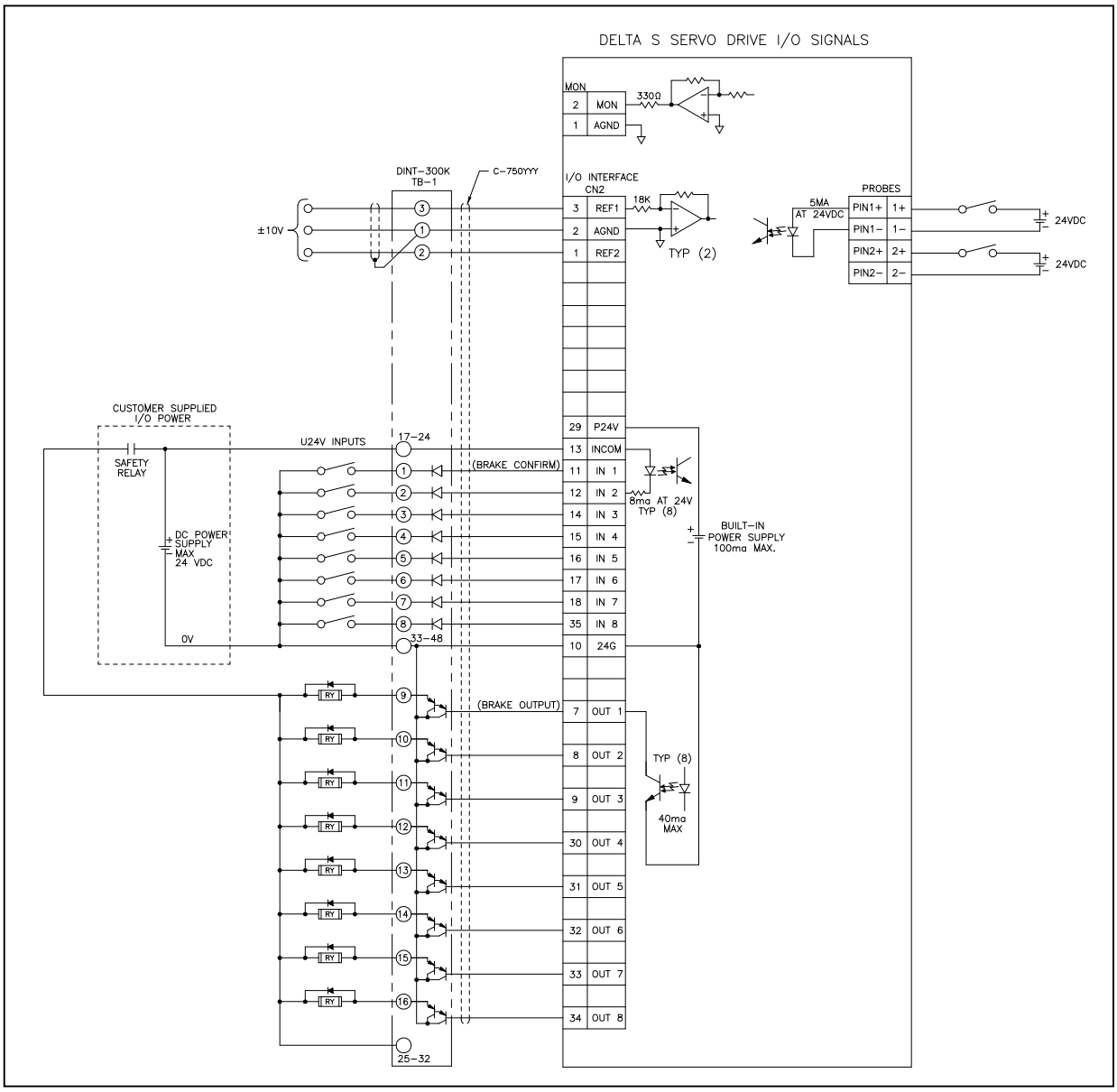


Figure 7.3 - I/O Connections To a DINT-300K

7.3.1 Pin Description

Drive

REF1 - REF2 **: ±10VDC Analog Inputs**

AGND **: Analog Input Ground**

IN 1 - IN 8 **: 24VDC Optically Isolated Inputs, high side common**

P24V **: Built-in +24VDC Supply**

INCOM **: +V IN (24 VDC) for IN 1 - IN 8**

24G **: 24VDC Ground for IN 1 - IN 8 and OUT 1 - OUT 8**

OUT 1 - OUT 8 **: 24VDC Optically Isolated Outputs, low side common**

PIN1 - PIN2 **: Optically Isolated High Speed Probe Inputs**

7.4 DELTA S OPTIONAL I/O BOARD J (SOURCING)

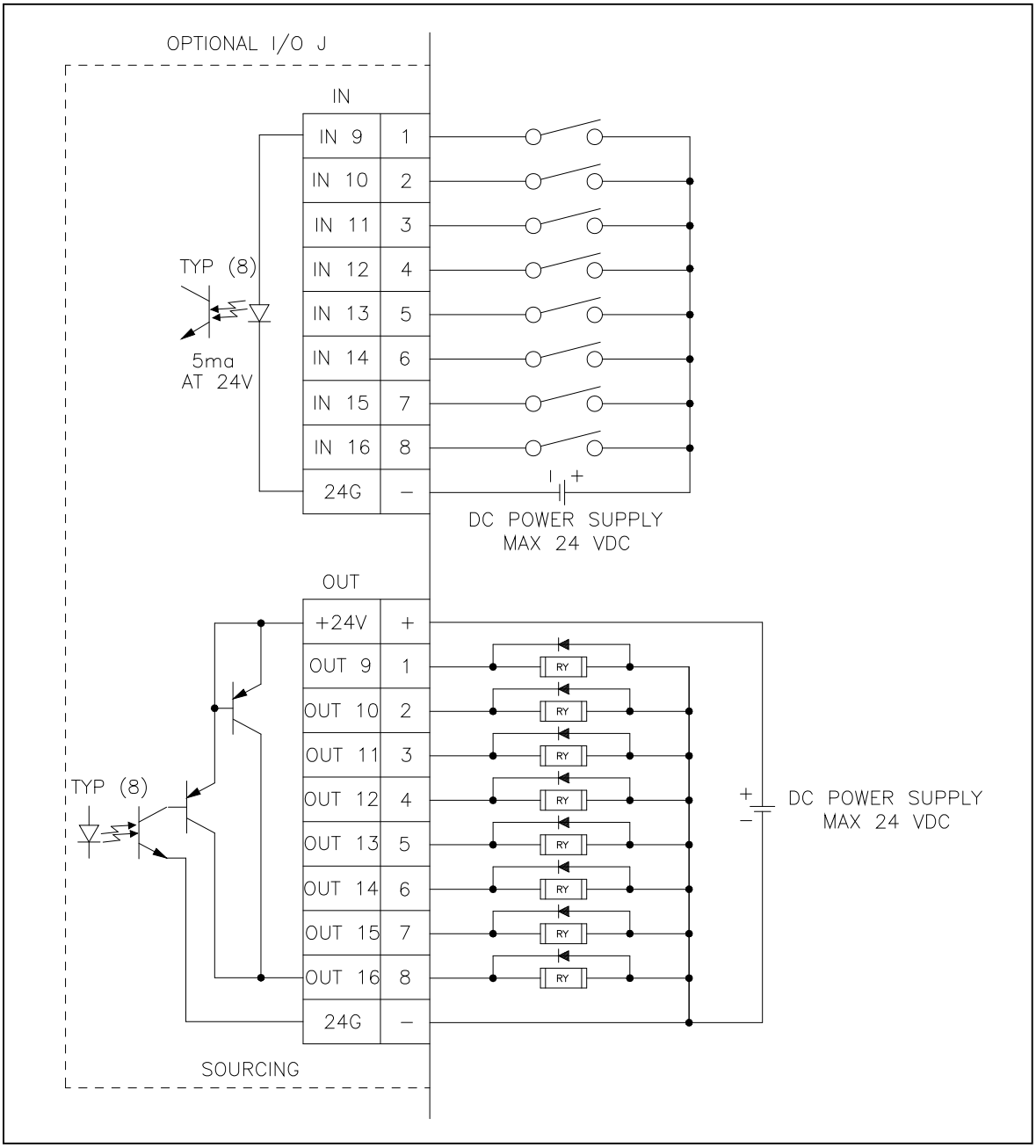


Figure 7.4 - I/O Connections For Optional J (Sourcing) Board

7.4.1 "J" OPTION SOURCING I/O

IN 9 - IN 16 **: 24VDC Optically Isolated Inputs, low side common**

24G **: 24VDC Ground for IN 9 - IN 16 and OUT 9 - OUT 16**

OUT 9 - OUT 16 **: 24VDC Optically Isolated Outputs, high side common**

+24V **: +V IN (24 VDC) for IN 9 - IN 16**

7.5 DELTA S OPTIONAL I/O BOARD K (SINKING)

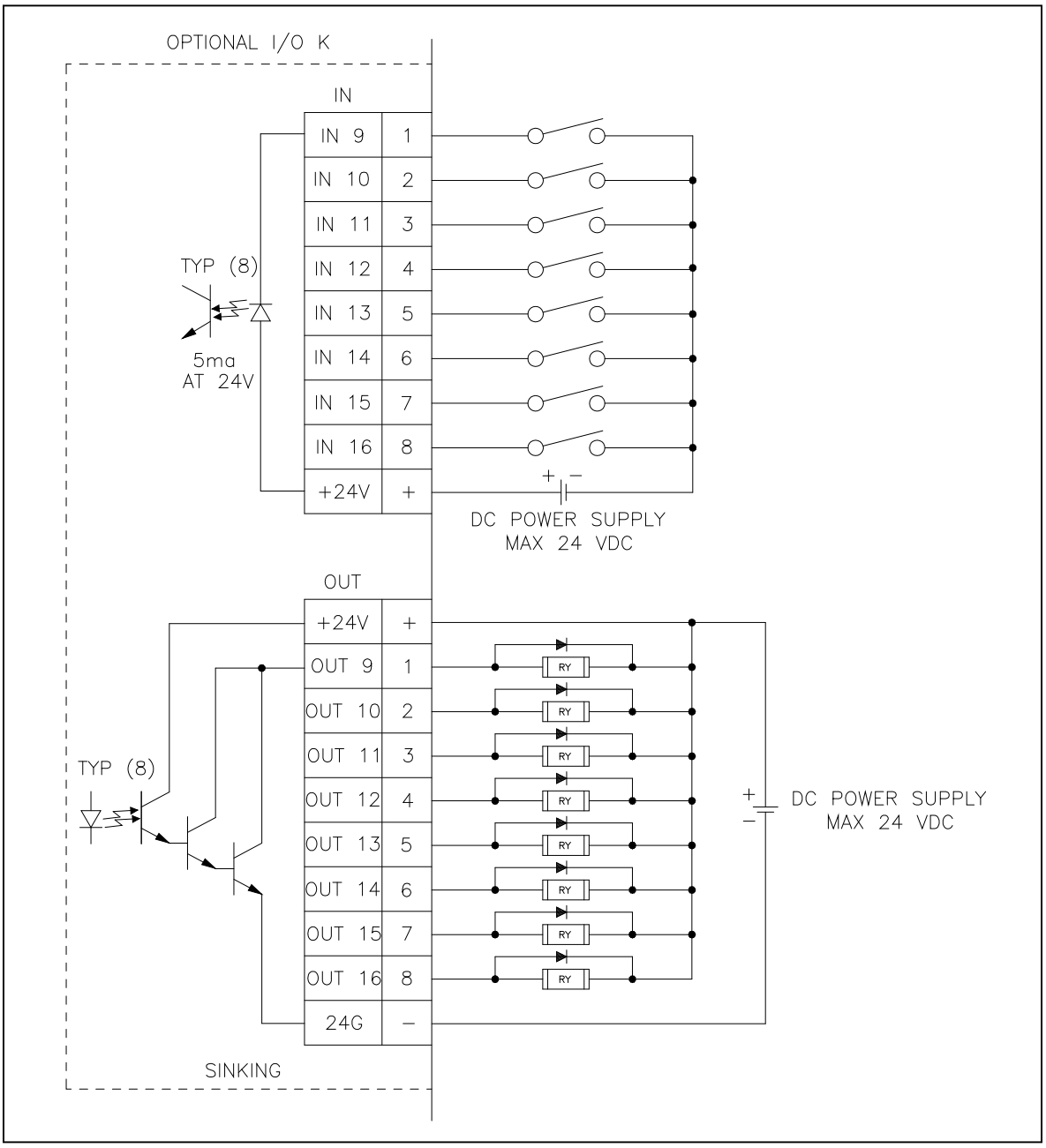


Figure 7.5 - I/O Connections For Optional K (Sinking) Board

7.5.1 "K" OPTION SINKING I/O

IN 9 - IN 16 : 24VDC Optically Isolated Inputs, high side common

+24V : +V IN (24 VDC) for IN 9 - IN 16 and OUT 9 - OUT 16

OUT 9 - OUT 16 : 24VDC Optically Isolated Outputs, low side common

24G : 24VDC Ground for OUT 9 - OUT 16

SECTION 8 - DRIVER TUNING

The Delta S driver may be tuned using a built in Automatic Tuning Sequence or manually. The keypad and display are used in both cases to accomplish the tuning. The following parameters are used to tune the driver:

- AJ2 Load Inertia Ratio
- AJ3 High Frequency Response
- AJ4 Position Loop DC Gain

It is important to note that although the driver is the focus of the tuning activity the whole system of driver, motor and mechanical components are being tuned as a system. To be successful the system must be configured complete with all components that move during normal operation.

For the purposes of this section it is assumed that the user is proficient in navigating the Special Function Menu Loop, the Adjustment Parameter Menu Loop and adjusting parameters in those loops (See **Section 4**).

8.1 AUTO TUNING SEQUENCE

Parameters AJ2, AJ3, and AJ4 are set by the auto tuning sequence.

The auto tuning sequence causes the motor to sharply rotate back and forth by an amount and at a speed set by the tuning parameters. The desired response is also set in the tuning parameters of the Special Function Menu Loop.

Auto tuning to an excessively high target response may result in unstable operation. Unstable operation will also result if the motor load is not rigidly attached or has backlash. If unstable operation results use the Adjustment Parameter menu to set AJ2, AJ3 and AJ4 back to the default settings. Try the Auto Tuning Sequence again with a lower value of target response.

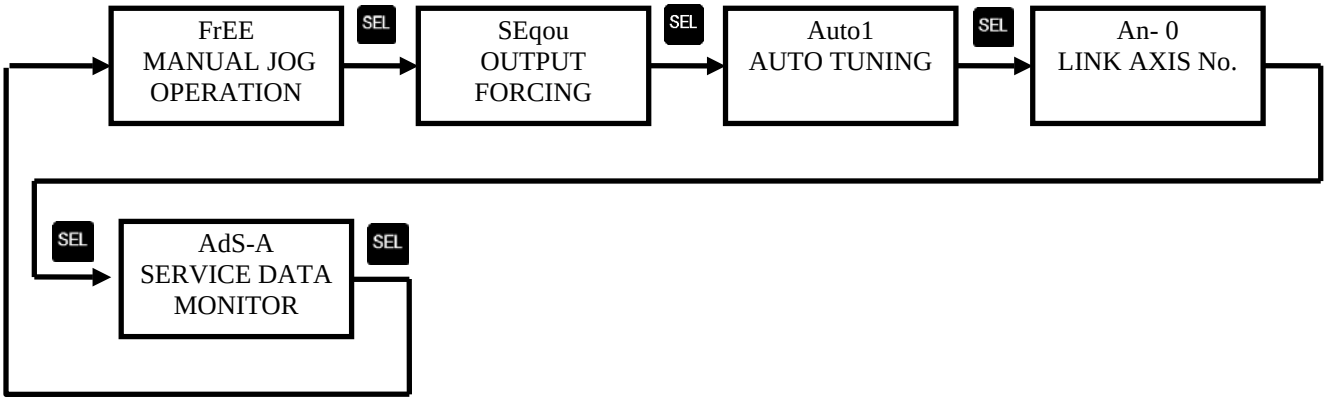
**** CAUTION ****

Must be used when executing the Auto Tuning Sequence. The motor moves through a sequence of reciprocal motions during the auto tuning. Be sure all personnel are clear of moving parts and that the mechanical systems will permit the full range of motion set in the auto tuning parameters Auto1, 2 & 3.

8.1.1 SPECIAL FUNCTION MENU LOOP

Enter the Special Function Menu Loop by concurrently pressing the keys for 5 seconds while the Main Menu status display shows motor speed [r 0]. The special menu will appear with the display showing [FrEE]. To exit the Special Function Menu double click the MODE key.

Once in the Special Function Menu Loop, use the SEL key is used to move to various menu items.



8.1.2 AUTO TUNING SETUP PARAMETERS

Verify the correct setting of the auto tuning setup parameters by using the and keys to navigate the auto menu. The menu loop will display the parameter name followed by the parameter value with successive presses of the key. Use the SEL and keys to select value to be modified. Then use and keys to adjust value, then confirm value with key.

TUNING PARAMETER	SYMBOL	SETTING RANGE	FACTORY SETTING	DESCRIPTION
ROTATION AMOUNT	**Auto1**	0~300 REV	2 REVS	Sets the amount of reciprocal rotation during the auto tuning sequence
TARGET RESPONSE	**Auto2**	1~1000 Hz	40 Hz	Sets the desired frequency response. The auto tuning software uses this value to set the desired response of the system. If the value is too high, unstable operation may result.
MAXIMUM SPEED	**Auto3**	1~4000 RPM	1000 RPM	Sets the speed of the reciprocal rotation during the auto tune sequence.

8.1.3 INITIATE AUTO TUNING

To initiate Auto Tuning use the SEL keys to get [Auto 1] in the display. With [Auto1] in the display press and hold the ↵ key followed by the ⌃⌃ key. The [Auto1] in the display will flash indicating initiation of the Auto Tuning Sequence and the motor will begin the reciprocal rotation. The driver will continuously adjust the tuning parameters while the motor is moving. When the Auto Tuning Sequence is complete the display will stop flashing. The BRAKE CONFIRM input must be functional to initiate the Auto Tuning Sequence.

Exit the Special Function Menu with a double click of the MODE key.

8.2 MANUAL TUNING PROCEDURE

The Delta S driver may be tuned manually using the Adjustment Parameter Menu Loop described in **Section 4.1.3**.

AJ2 Load inertia ratio, AJ3 High frequency response and AJ4 Position loop DC gains are the parameters that adjust the response of the driver. A qualified technician using a chart recorder or oscilloscope to view the performance of the system should do adjustment of these parameters.

1. Start the manual adjustment by setting AJ2 to the ratio of the load inertia to the motor rotor inertia. Set AJ3 and AJ4 to the default settings.

2. Connect an oscilloscope or chart recorder to the MON output on the driver front panel. Set UP-25 to 1x0 so the MON output is set to motor speed.

**** CAUTION ****

Must be used when executing the motor motion. Be sure all personnel are clear of moving parts and that the mechanical systems will permit the full range of motion.

3. Cause the system to move through the most aggressive, highest speed and highest acceleration, motion encountered in normal operation. The stimulus for this motion depends on the system configuration.

4. Adjust AJ2, AJ3 and AJ4 for the desired response using the Adjustment Parameter Loop.

Parameter AJ2 primarily provides the damping function in the system response. The larger the system inertia the larger the value of AJ2 required. If the load inertia is not rigidly attached to the motor shaft, the value of AJ2 may be smaller than the calculated value.

Parameter AJ3 sets the frequency of any small oscillations and overshoots that may be present. Too high a value can result in high frequency oscillations. AJ3 also sets the system frequency response to external stimulus.

Parameter AJ4 sets the basic gain of the control loop and should be set as high as practical without causing oscillations. This parameter primarily affects the stiffness of the system response or the conformance of the motor motion to the commanded motion.

8.3 NOTCH FILTER ADJUSTMENT

The Delta S driver drive contains a Notch Filter, adjusted by parameter AJ9, which can be used to eliminate system natural resonance frequency oscillations. Natural frequency resonance oscillations can occur with a belt drive, a flexible coupling or any mechanical component that causes flexing or compliance in the motor drive train.

In general, the normal tuning of the driver will not eliminate the natural resonance without lowering the system response to an unacceptable level. If the natural frequency of the system can be determined, the Notch Filter, AJ9, can be set to that frequency to notch out that particular frequency thereby allowing higher gain settings and better response.

SECTION 9 - REGEN RESISTOR SELECTION

9.1 DRIVER REGENERATION CAPACITIES

The Delta motor and driver have the ability to act as a brake for a rotating load. This condition typically occurs during the deceleration of the load or when the system is stopping a vertical load such as an elevator or lift. In both cases, the driver may have to absorb the mechanical and potential energy in the system. The driver must absorb the energy if the energy in the load exceeds to mechanical losses in the system.

The driver has 3 ways to absorb the energy from the load.

- Store the energy by charging the internal main DC bus capacitors (E_C)
- Use the energy internally to power the driver control circuitry (P_D)
- Dissipate the energy using a regeneration resistor (P_R)

The Delta S driver energy absorption capacities are as shown in **Table 9.1**.

DRIVER SIZE	INTERNAL REGEN CAPACITY (P_R)	INTERNAL POWER CONSUMPTION (P_D)	CHARGING CAPACITY (E_C)
DS-1.5/RB	0 W	13	17
DS-1.5/RA	0 W	13	17
DS-4.25/RB	0 W	13	17
DS-4.25/RA	0 W	13	17
DS-8.5/RA	0 W	24	17
DS-8.5/RB	0 W	17	17
DS-17.5/RA	0 W	37	22
DS-35/RA	80 W	80	38
DS-50/RA	80 W	100	54
DS-70/RA	100 W	200	94
DS-115/RA	180 W	300	188

Table 9.1 - Energy Absorption Capabilities

The Delta S drivers are equipped with internal circuitry to detect a rise in the main DC power bus indicating energy absorption. If the DC power bus reaches approximately 400 VDC, the regeneration circuit is turned on to prevent the main DC power bus from rising to 420 VDC which will result in an over voltage alarm AL-02.

9.2 SELECTION OF REGENERATION RESISTOR

The amount of energy stored in the moving components of the system must be calculated and compared to the energy absorption capacity of the driver to determine if an external regeneration resistor is required.

9.2 SELECTION OF REGENERATION RESISTOR (cont'd)

The stored energy is of two basic types, kinetic energy in the form of a moving mass and potential energy of a mass being held against gravity.

$E_k = 0.5 * (J_M + J_L) * (2 * \pi * N / 60)^2$

$E_P = (2 * \pi * N * T_g * t_b / 60)$

Calculate the system losses in the motor, driver and friction.

$E_L = (P_M + P_D + (\pi * N * T_f / 60)) * t_a$

Calculate the regeneration power.

$P_R = (E_k + E_P - E_L - E_C) / t_c$

If regeneration power P_R is greater than 0.0, a regeneration resistor will be needed to prevent the main DC power bus from generating an over voltage alarm AL-02.

Where:

E_k = Net kinetic energy Joules
E_P = Net Potential energy Joules
E_L = Energy loss due to friction Joules
E_C = Driver charging capacity Joules (See **Table 9.1**)
J_M = Motor rotor inertia kg-m^2
J_L = Load inertia kg-m^2
N = Motor speed in RPM
P_M = Motor loss watts (10% of motor rating)
P_D = Driver internal power consumption watts (See **Table 9.1**)
T_f = System friction torque N-m
T_g = Net torque to hold up load against gravity N-m
P_R = Regen power watts (See **Table 9.1**)
t_a = Deceleration time
t_b = Move time
t_c = Cycle time

See **Figure 9.1**

* The above equations are reasonable approximations.

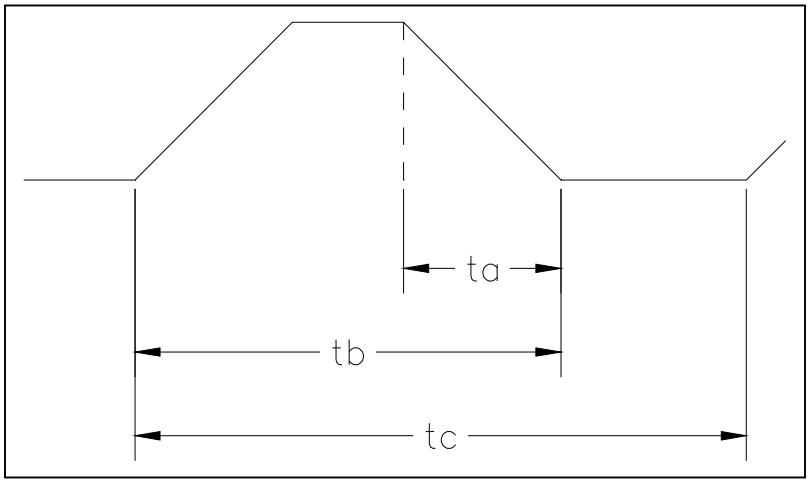


Figure 9.1

9.2 SELECTION OF REGENERATION RESISTOR (cont'd)

Drivers DS-1.5 through DS-17.5 do not contain an internal regeneration resistor. If a regeneration resistor is required, an external resistor with a power rating of at least P_R watts must be connected.

Drivers DS-35 through DS-115 contain internal regeneration resistors. If the internal regeneration resistor capacity is greater than P_R watts, no external resistor is needed. If the internal resistor is not large enough, an external resistor with a power rating of at least P_R watts must be connected. If an external regeneration resistor is needed, parameters UP-30 and UP-31 must be set to the values of the external resistor.

Table 9.2 External resistor specifications.

DRIVER SIZE	RESISTANCE	MAX WATTAGE	WIRE GAUGE
DS-1.5/RA	30~100 Ohms	300 W	14 AWG 1.25 mm²
DS-1.5/RB	30~100 Ohms	300 W	14 AWG 1.25 mm²
DS-4.25/RA	30~100 Ohms	300 W	14 AWG 1.25 mm²
DS-4.25/RB	30~100 Ohms	300 W	14 AWG 1.25 mm²
DS-8.5/RA	30~100 Ohms	300 W	14 AWG 1.25 mm²
DS-8.5/RB	30~100 Ohms	300 W	14 AWG 1.25 mm²
DS-17.5/RA	30~70 Ohms	400 W	14 AWG 1.25 mm²
DS-35/RA	12.5~25 Ohms	2.4 KW	12 AWG 3.5 mm²
DS-50/RA	12.5~25 Ohms	3 KW	12 AWG 3.5 mm²
DS-70/RA	10~15 Ohms	5.5 KW	10 AWG 5.5 mm²
DS-115/RA	6~15 Ohms	11 KW	8 AWG 16 mm²

Table 9.2 - External Resistor Specifications

Figures 9.2 and **9.3** shows how to connect an external regeneration resistor to the Delta S drivers.

9.2 SELECTION OF REGENERATION RESISTOR (cont'd)

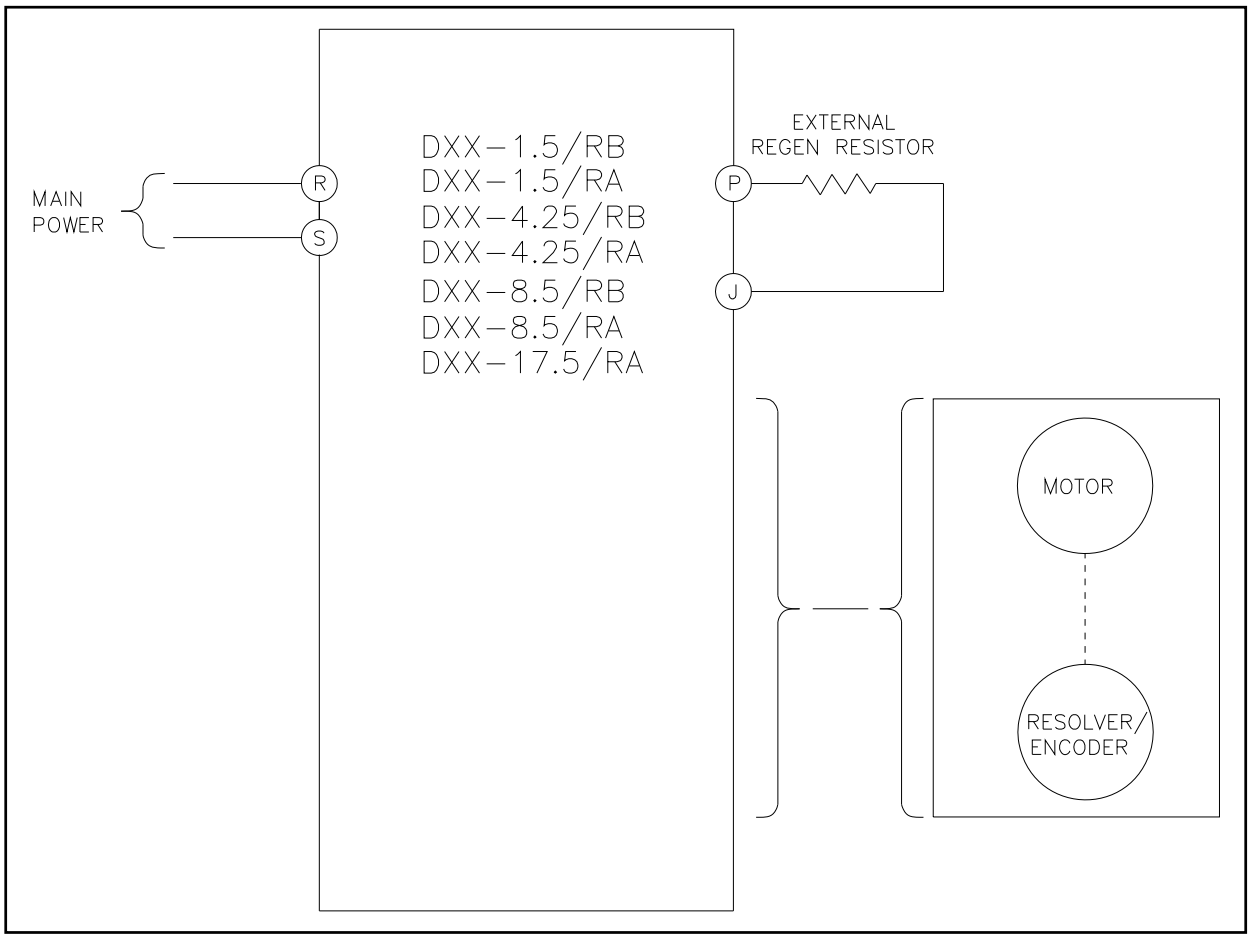


Figure 9.2 - Connection of an External Regen Resistor for Driver Sizes DS-1.5 Through DS-17.5

9.2 SELECTION OF REGENERATION RESISTOR (cont'd)

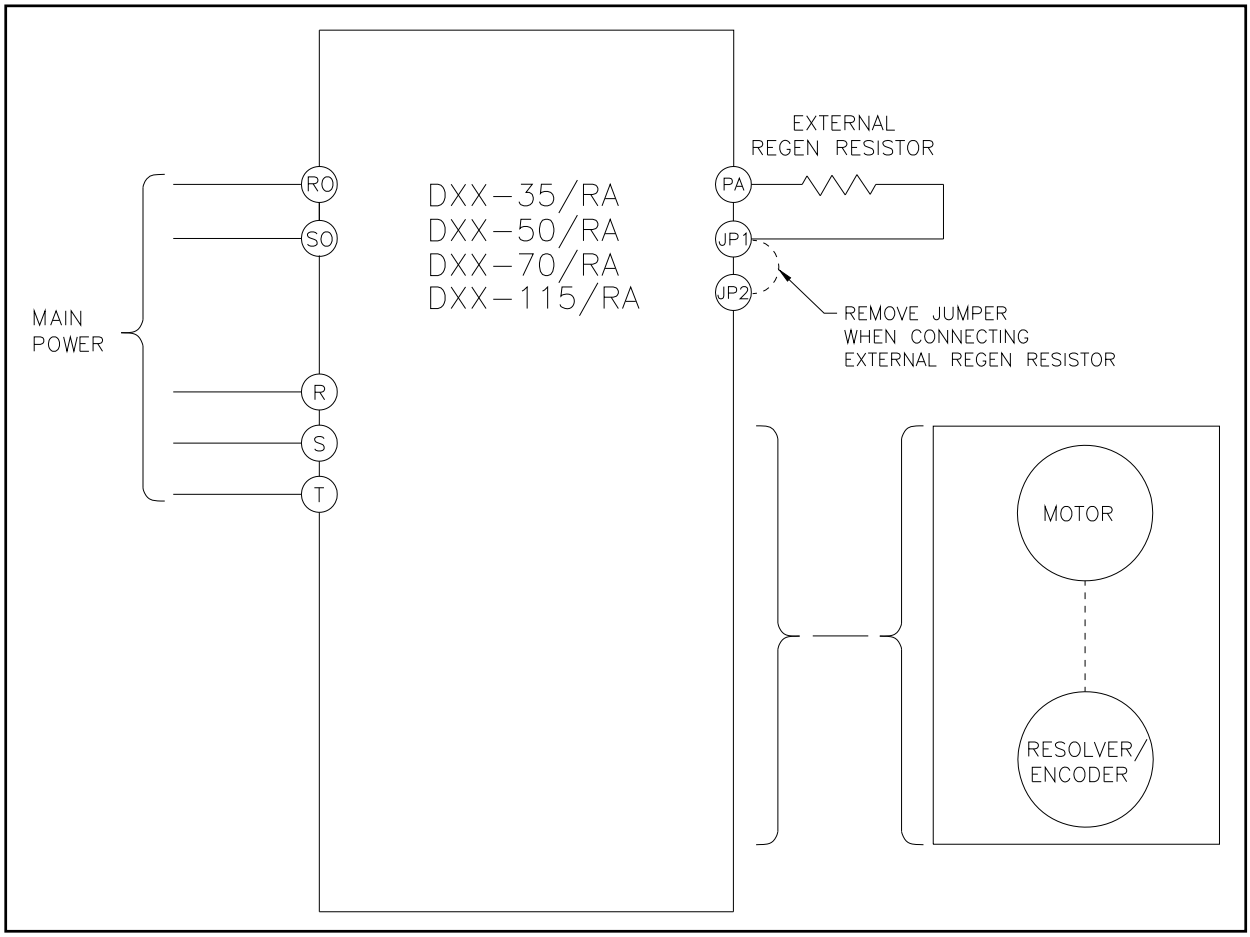


Figure 9.3 - Connection of an External Regen Resistor for Driver Sizes DS-35 and Larger

The regeneration resistor is subjected to severe peak power loads during regeneration. The driver switches the regeneration resistor across the DC power bus using PWM techniques to regulate the DC power bus voltage during regeneration dumping. When the driver's switch is on the regeneration resistor is subjected to the following peak power:

PEAK POWER = $(400\ VDC)^2$ / RESISTOR VALUE in ohms

Be sure to select a regeneration resistor that can sustain the required peak power and continuous power ratings.

9.3 STANDARD REGENERATION RESISTOR PACKAGES

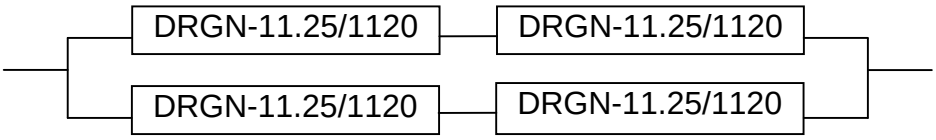
In general, wound metal ribbon resistors are recommended for this type of application. IIS offers a complete line of enclosed panel mounted regen resistor units to complement the Delta S driver. Various combinations of series and parallel connections are allowed to provide adequate regen resistor capacity.

IIS P/N	Description
MFS30A300J*	30 Ohm 30 Watts
RGH200-30*	30 Ohm 200 Watts
DRGN-20/400*	20 Ohm 400 Watts
DRGN-45/420	45 Ohm 420 Watts
DRGN-22.5/655	22.5 Ohm 655 Watts
DRGN-15/880	15 Ohm 880 Watts
DRGN-11.25/1120	11.25 Ohm 1120 Watts

*Not UL/CE approved

EXAMPLE CALCULATION:

If 4 KW of regen were needed on a DSD-115 driver, four (4) DRGN-11.25/1120 units could be connected as follows to yield 11.25 Ohms at 4480 Watts.



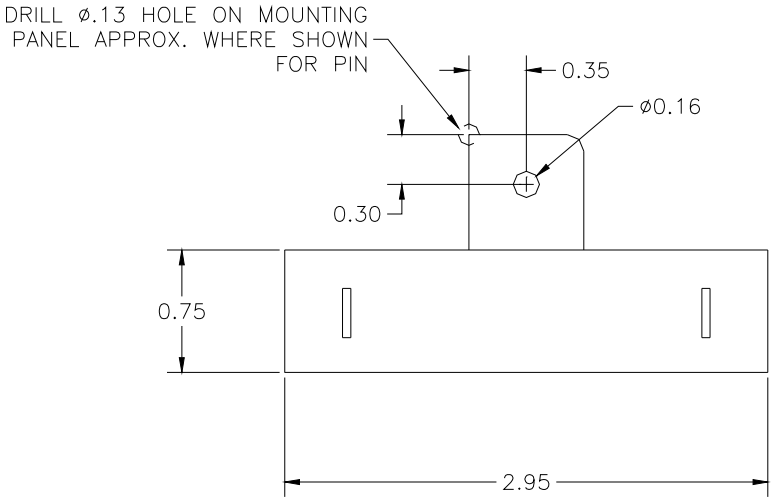
DRAWING NUMBER	DESCRIPTION
MFS30A300J	Resistor
RGH200-30	Regen Resistor
DRGN-20/400	Regen Resistor
DRGN-45/420	Regen Resistor
DRGN-45/420-2	Regen Resistor
DRGN-22.5/655	Regen Resistor
DRGN-15/880	Regen Resistor
DRGN-11.25/1120	Regen Resistor

NOTES:

1.) THIS RESISTOR IS NOT UL OR CE APPROVED.

2.) RESISTOR MUST BE SECURELY MOUNTED ON LARGE HEATSINK SUCH AS ENCLOSURE WALL OR BACKPANEL.

SPECIFICATIONS	
RESISTANCE:	30 Ohms
CONTINUOUS POWER:	30 Watts
MAXIMUM VOLTAGE:	VDC
MAXIMUM PULSE CURRENT:	15 A
MAXIMUM RMS CURRENT:	1 A
DUTY CYCLE	6 %



INDUSTRIAL INDEXING SYSTEMS, Inc.

www.iis-servo.com

TITLE: RESISTOR, 30 OHM, 30W

DRAWING NUMBER: MFS30A300J

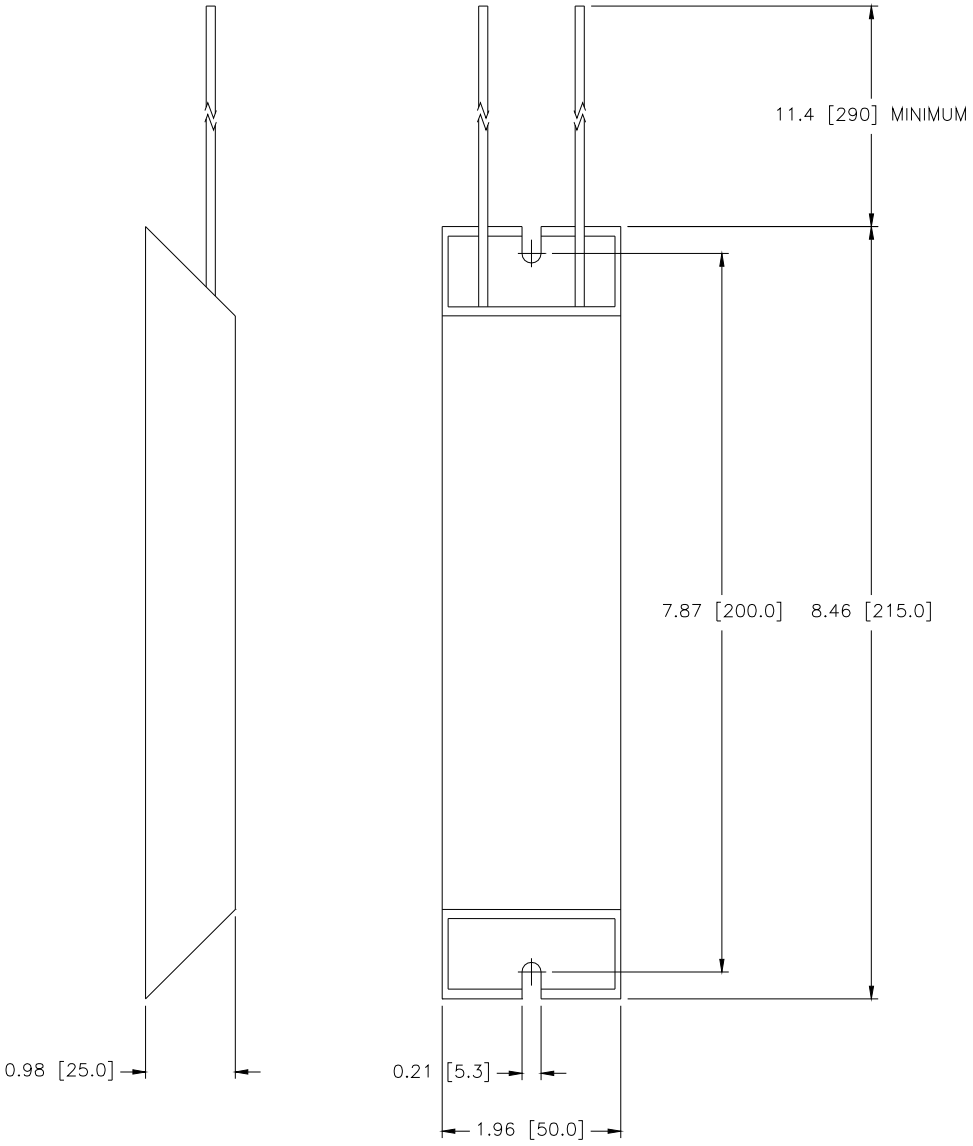
DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± --- X.XXX± --- ∠ ± ---	REV 0		ECN 03-322	DATE 16JUL03	SH. 1 OF 1

NOTES:

1.) RESISTOR MUST BE MOUNTED ON A FLAT SURFACE AT LEAST 12" X 12" IN FREE AIR TO MEET THE 200 WATT POWER DISSIPATION.

2.) THIS RESISTOR IS NOT UL OR CE APPROVED.

SPECIFICATIONS	
RESISTANCE:	30 Ohms
CONTINUOUS POWER:	200 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	14.0 A
MAXIMUM RMS CURRENT:	5.0 A
DUTY CYCLE	50%



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TITLE: REGEN RESISTOR

DRAWING NUMBER: RGH200-30

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± 0.01 X.XXX± 0.005 ∠ ± ---	REV 0		ECN 01-067	DATE 27FEB01	SH. 1 OF 1

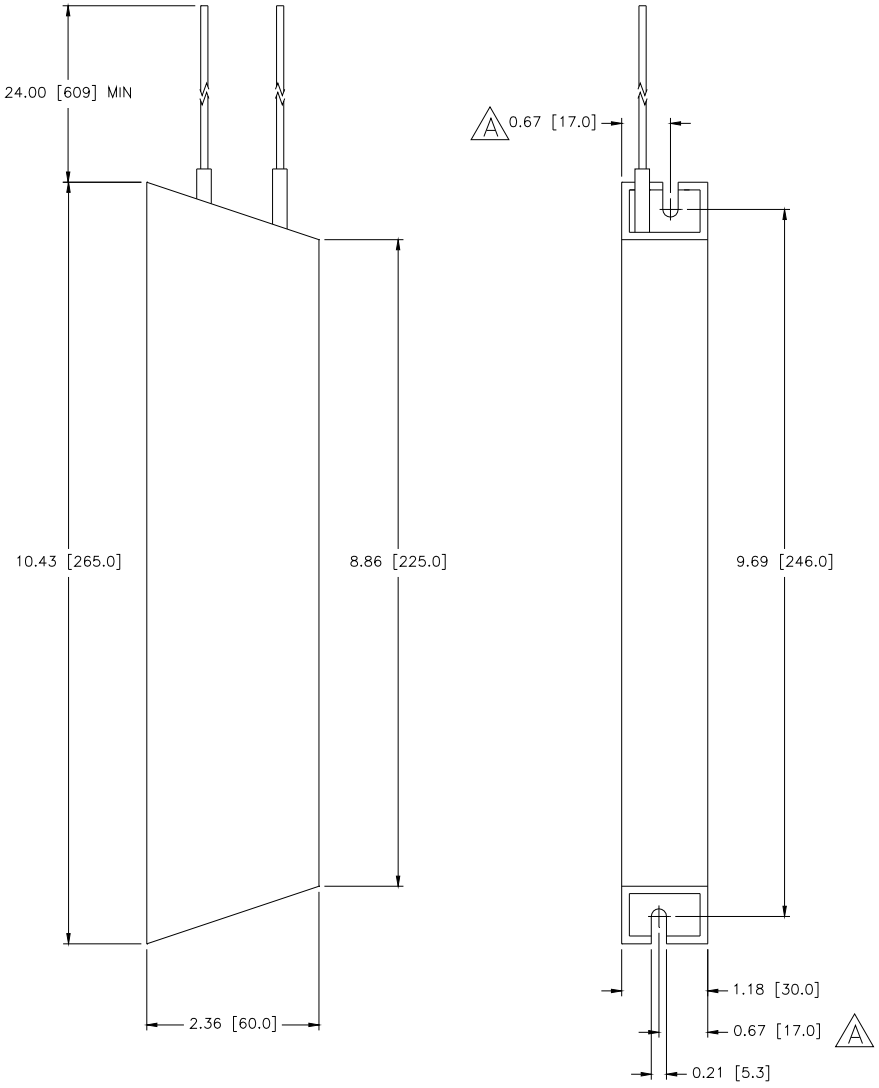
NOTES:

1.) RESISTOR MUST BE MOUNTED ON A FLAT SURFACE AT LEAST 12" X 12" IN FREE AIR TO MEET THE 200 WATT POWER DISSIPATION.

2.) THIS RESISTOR IS NOT UL OR CE APPROVED.

3.) RESISTOR MUST BE SECURELY MOUNTED ON LARGE HEATSINK SUCH AS ENCLOSURE WALL OR BACKPANEL.

SPECIFICATIONS	
RESISTANCE:	20 Ohms
CONTINUOUS POWER:	400 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	22 A
MAXIMUM RMS CURRENT:	4.5 A
DUTY CYCLE	15 %



INDUSTRIAL INDEXING SYSTEMS, Inc.

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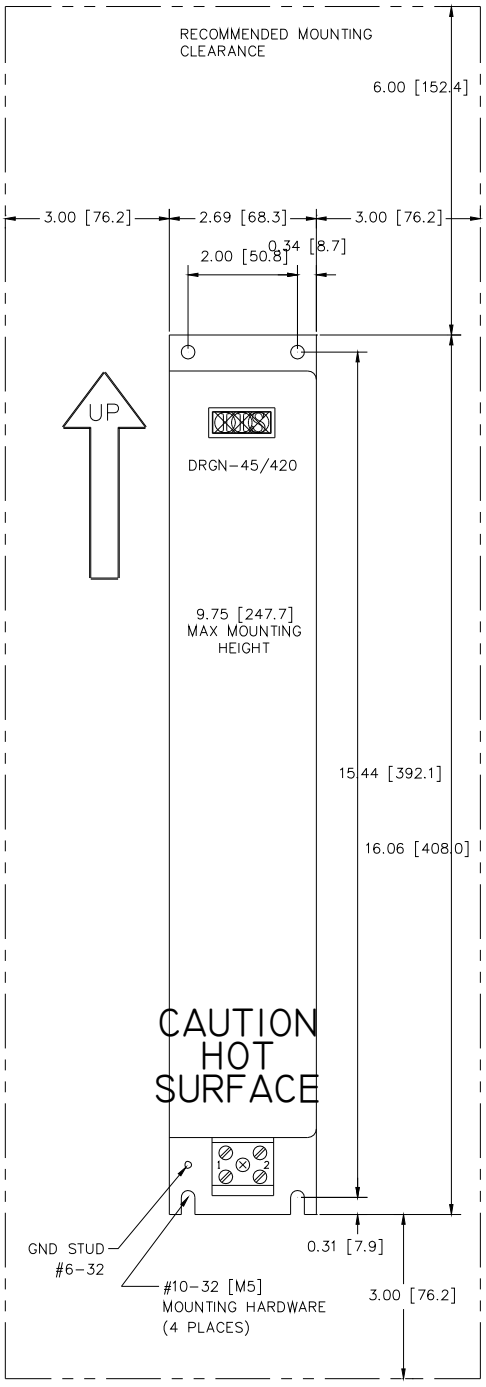
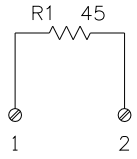
TITLE: REGEN RESISTOR

DRAWING NUMBER: DRGN-20/400

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± 0.01 X.XXX± 0.005 ∠ ± 5°	REV A		ECN 01-259	DATE 28JUN01	SH. 1 OF 1

SPECIFICATIONS	
RESISTANCE:	45 Ohms
CONTINUOUS POWER:	420 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	9.5 A
MAXIMUM RMS CURRENT:	3.1 A
DUTY CYCLE	15%





INDUSTRIAL INDEXING SYSTEMS, Inc.

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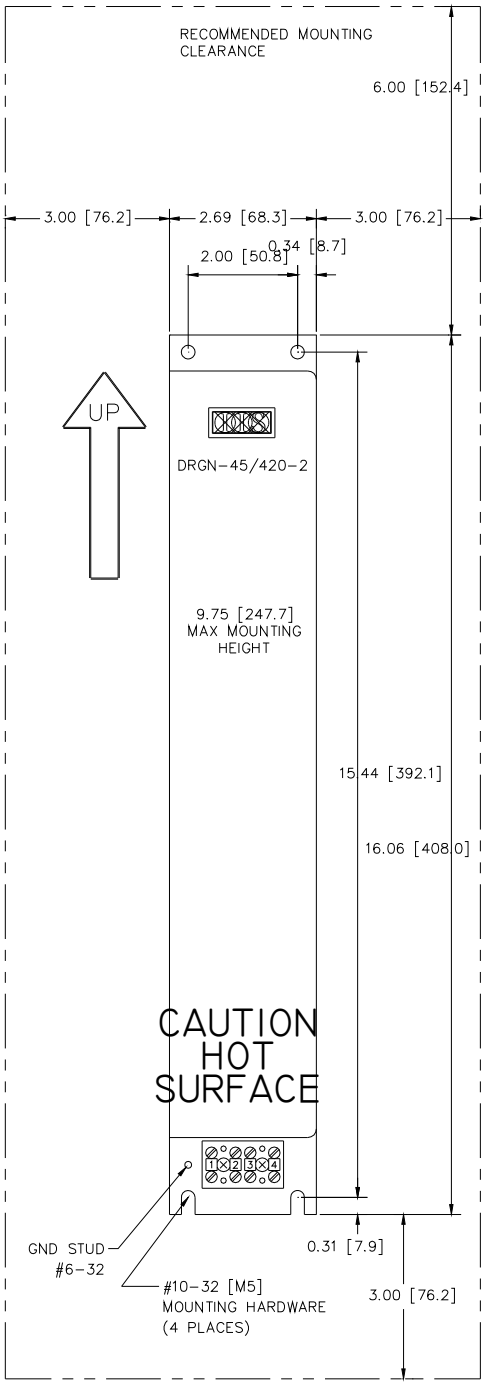
TITLE: REGEN RESISTIOR

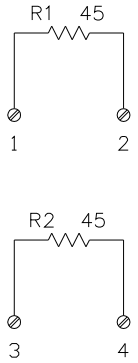
DRAWING NUMBER: DRGN-45/420

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX±.02 [0.5] X.XXX±-- ∠ ±5°	REV B		ECN 96-269	DATE 6/25/96	SH. 1 OF 1

SPECIFICATIONS	
RESISTANCE:	45 Ohms
CONTINUOUS POWER:	420 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	9.5 A
MAXIMUM RMS CURRENT:	3.1 A
DUTY CYCLE	15%

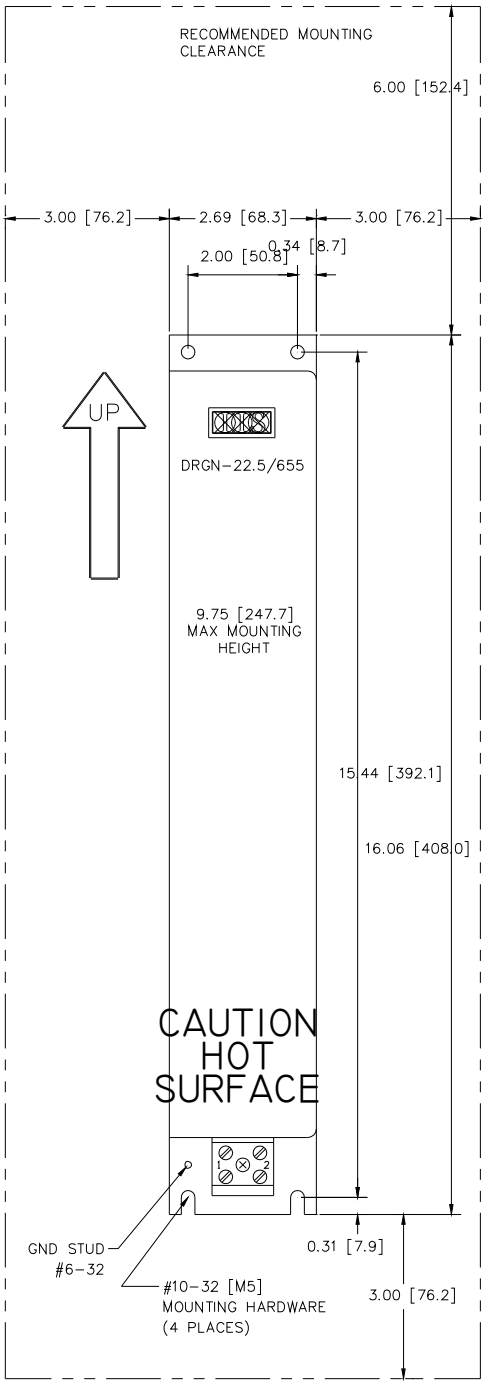


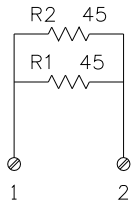
SCHEMATIC



INDUSTRIAL INDEXING SYSTEMS, Inc. www.iis-servo.com				TITLE: REGEN RESISTIOR		
				DRAWING NUMBER: DRGN-45/420-2		
DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX±.02 [0.5] X.XXX±-- ∠ ±5°	REV A		ECN 98-269	DATE 06AUG98	SH. 1 OF 1

SPECIFICATIONS	
RESISTANCE:	22.5 Ohms
CONTINUOUS POWER:	655 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	18.9 A
MAXIMUM RMS CURRENT:	5.4 A
DUTY CYCLE:	15%





INDUSTRIAL INDEXING SYSTEMS, Inc.

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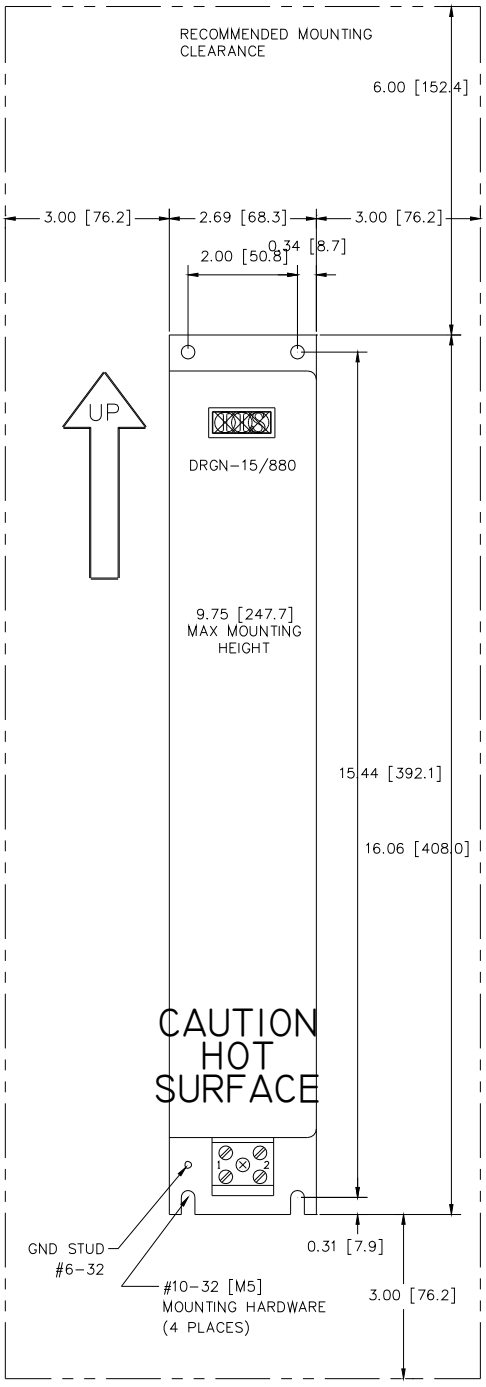
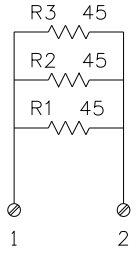
TITLE: REGEN RESISTIOR

DRAWING NUMBER: DRGN-22.5/655

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX±.02 [0.5] X.XXX±--	△ ± 5°	REV B		ECN 96-269	DATE 6/25/96	SH. 1 OF 1

SPECIFICATIONS	
RESISTANCE:	15 Ohms
CONTINUOUS POWER:	880 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	28.4 A
MAXIMUM RMS CURRENT:	7.6 A
DUTY CYCLE	15%





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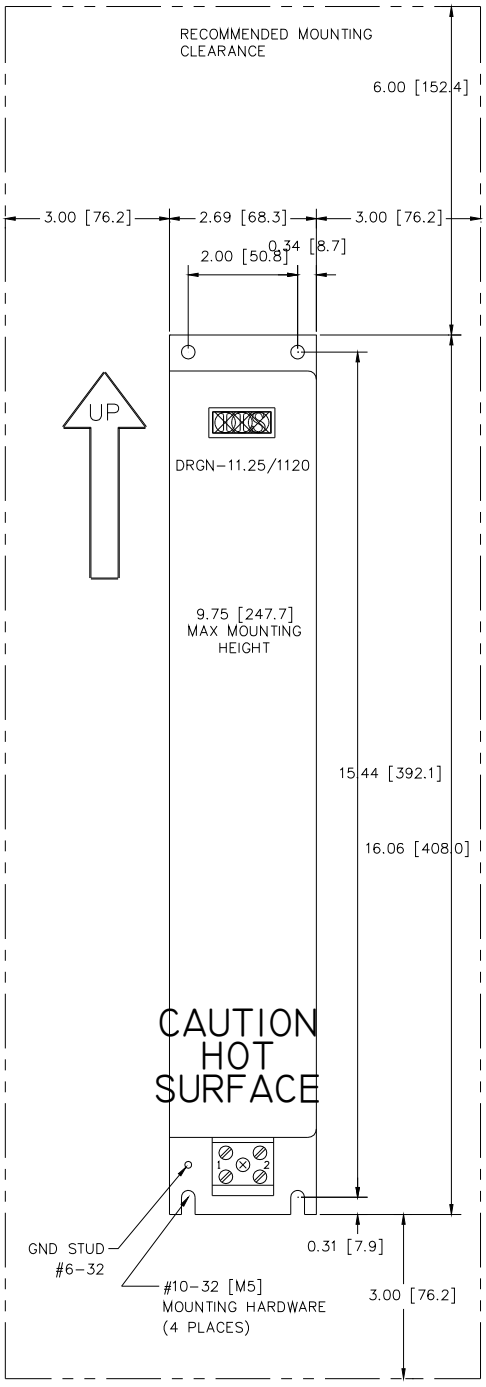
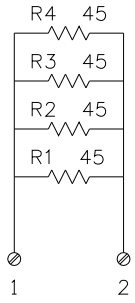
TITLE: REGEN RESISTIOR

DRAWING NUMBER: DRGN-15/880

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX±.02 [0.5] X.XXX±-- ∠ ± 5°	REV B		ECN 96-269	DATE 6/25/96	SH. 1 OF 1

SPECIFICATIONS	
RESISTANCE:	11.25 Ohms
CONTINUOUS POWER:	1120 Watts
MAXIMUM VOLTAGE:	425 VDC
MAXIMUM PULSE CURRENT:	38.7 A
MAXIMUM RMS CURRENT:	10 A
DUTY CYCLE	15%





INDUSTRIAL INDEXING SYSTEMS, Inc.

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TITLE: REGEN RESISTIOR

DRAWING NUMBER: DRGN-11.25/1120

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX±.02 [0.5] X.XXX± --	∠ ± 5°	REV B		ECN 96-269	DATE 6/25/96	SH. 1 OF 1

SECTION 10 - DYNAMIC BRAKES

The Delta S driver is equipped with special circuitry and software to sequence a dynamic braking relay connected across the motor windings. It is very important for proper operation that the dynamic breaking relay contacts are open before the driver circuitry is turned on and that the driver is off before the dynamic braking relay contacts close. The driver in conjunction with external braking relays provides the proper sequencing to prevent driver damage.

If dynamic braking is not used, the BRAKE CONFIRM input must be satisfied. This can be handled by 1 of 2 methods. Method 1 is to Tie input BRAKE CONFIRM ON for the DS-1.5 through DS-17.5 driver sizes. For DS-35 and larger drivers, a jumper must be provided between B11 and B12. A B11 to B12 jumper is installed by the factory and must be removed if dynamic braking is to be used. Method 2 is to invert the BRAKE CONFIRM input in the Parameter HP-44 "Input Inversion". Refer to **Section 4.1.5** for details.

Parameter UP-16 should be set to the default value of 0 for dynamic braking or no brake connections.

If configuring the Brake Mode over SERCOS, parameter 34316 must be set to 1 for dynamic braking and 0 for no brake. Also, by setting the brake mode over SERCOS the drive will also properly handle the BRAKE CONFIRM input by inverting the input in HP-44 if Brake Mode 0 is selected.

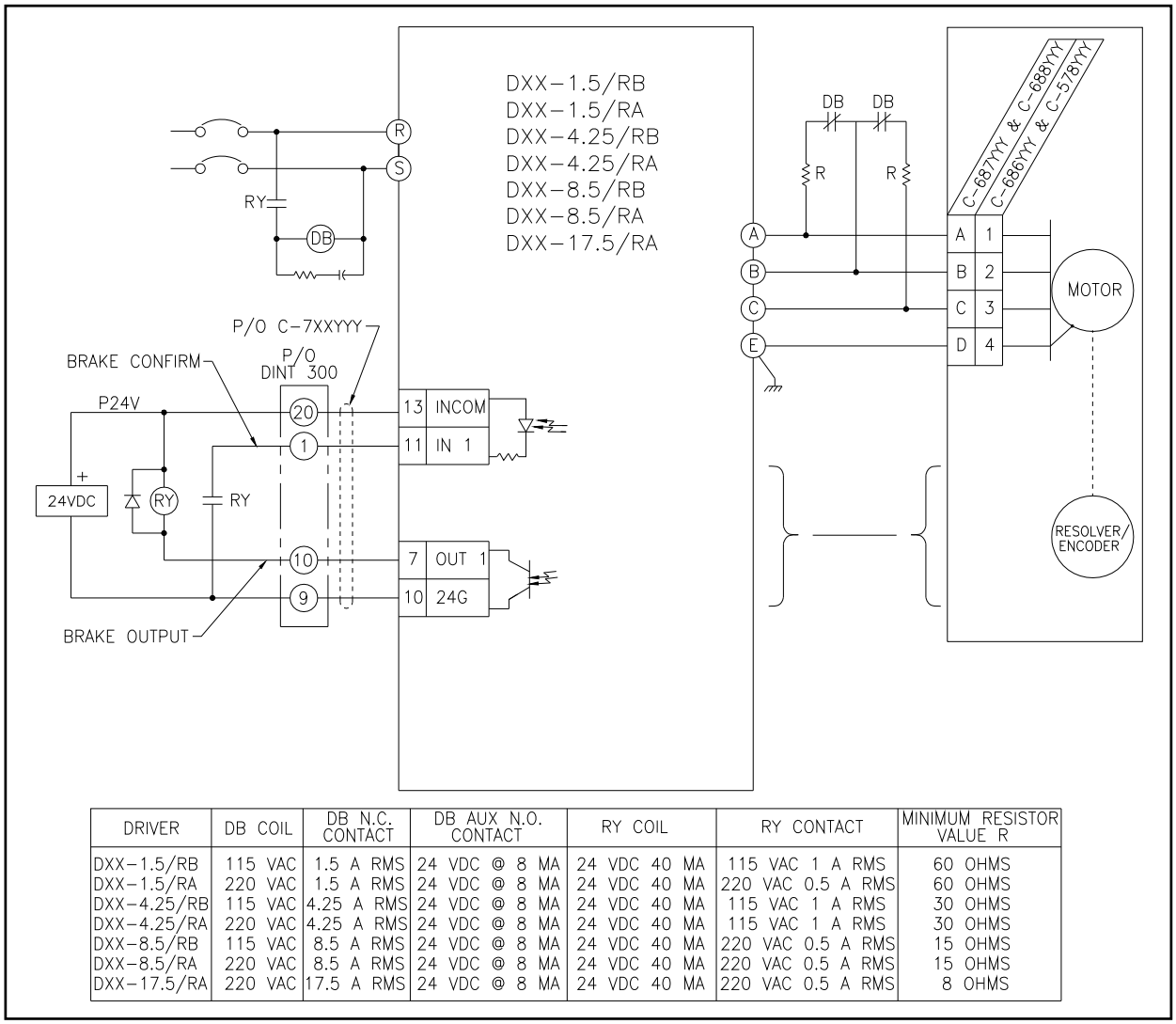
Be sure to select a dynamic braking resistor with a sufficient peak power rating.

$$\text{Resistor Peak Power} = \frac{150 * V^2}{R}$$

Where V = maximum motor voltage when dynamic braking is applied.

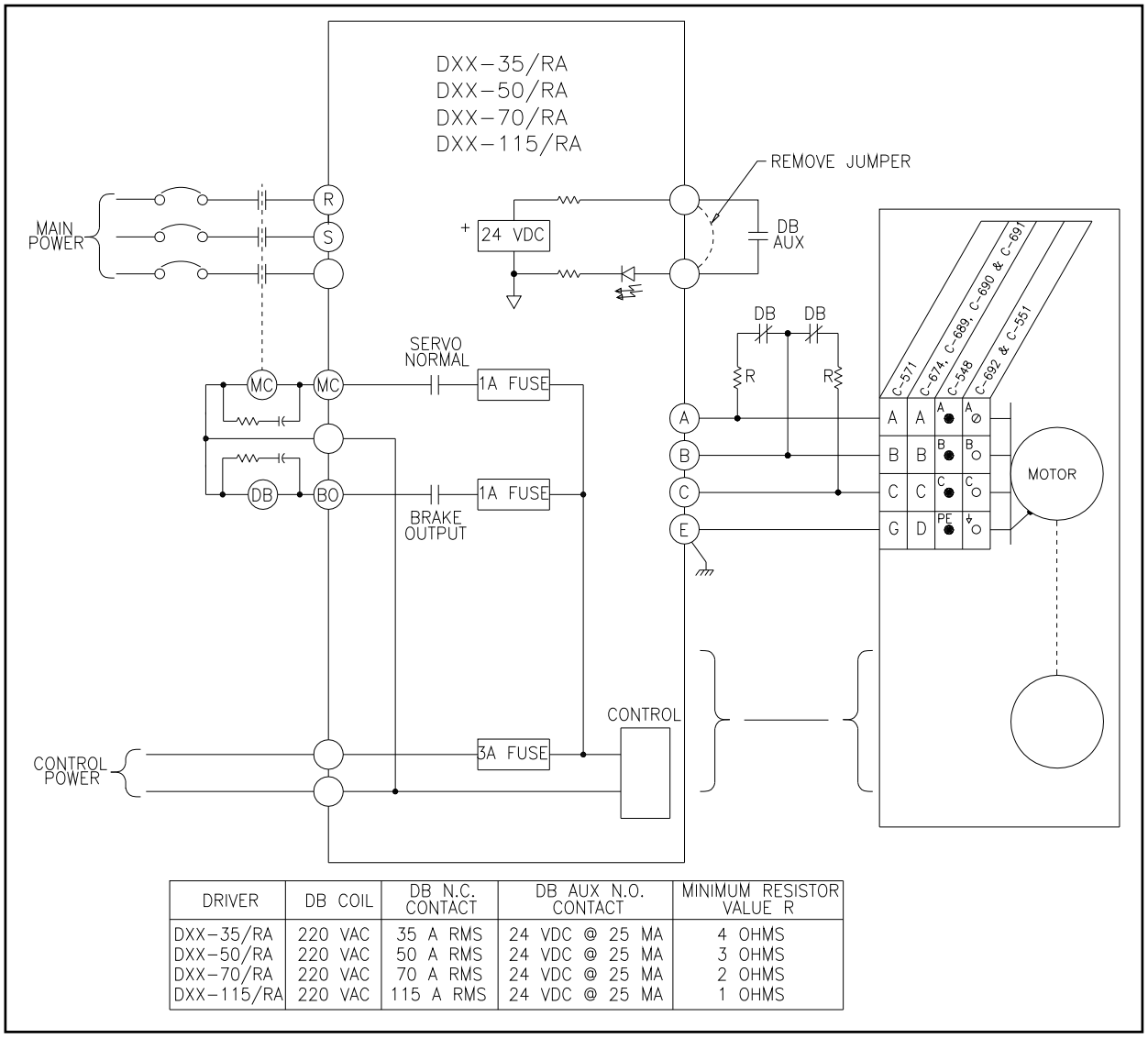
General rule: V = 300 * (motor speed @ braking) / (motor maximum speed rating)

Figures 10.1 and 10.2 show the connections for dynamic braking.



DRIVER	DB COIL	DB N.C. CONTACT	DB AUX N.O. CONTACT	RY COIL	RY CONTACT	MINIMUM RESISTOR VALUE R
DXX-1.5/RB	115 VAC	1.5 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	115 VAC 1 A RMS	60 OHMS
DXX-1.5/RA	220 VAC	1.5 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	220 VAC 0.5 A RMS	60 OHMS
DXX-4.25/RB	115 VAC	4.25 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	115 VAC 1 A RMS	30 OHMS
DXX-4.25/RA	220 VAC	4.25 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	115 VAC 1 A RMS	30 OHMS
DXX-8.5/RB	115 VAC	8.5 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	220 VAC 0.5 A RMS	15 OHMS
DXX-8.5/RA	220 VAC	8.5 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	220 VAC 0.5 A RMS	15 OHMS
DXX-17.5/RA	220 VAC	17.5 A RMS	24 VDC @ 8 MA	24 VDC 40 MA	220 VAC 0.5 A RMS	8 OHMS

Figure 10.1 - Dynamic Brake Connection for the DS-1.5 Through DS-17.5 Drivers



DRIVER	DB COIL	DB N.C. CONTACT	DB AUX N.O. CONTACT	MINIMUM RESISTOR VALUE R
DXX-35/RA	220 VAC	35 A RMS	24 VDC @ 25 MA	4 OHMS
DXX-50/RA	220 VAC	50 A RMS	24 VDC @ 25 MA	3 OHMS
DXX-70/RA	220 VAC	70 A RMS	24 VDC @ 25 MA	2 OHMS
DXX-115/RA	220 VAC	115 A RMS	24 VDC @ 25 MA	1 OHMS

Figure 10.2 - Dynamic Brake Connection for the DS-35 Through DS-115 Drivers

SECTION 11 - MECHANICAL BRAKES

The Delta S driver is equipped with special circuitry and software to sequence an electrically released mechanical brake. The full line of Delta motors are available with mechanical brakes to provide mechanical fail safe braking in the case of power loss and driver disable.

It is very important for proper operation to sequence the driver servo lock and mechanical brake to avoid loss of holding torque during the transition. The driver in conjunction with an external relay and brake power supply provide for the optimum sequencing to prevent loss of holding torque or driver damage.

11.1 NO MECHANICAL BRAKING

If a mechanical brake is not used, the BRAKE CONFIRM input must be satisfied. This can be handled by 1 of 2 methods. Method 1 is to tie the BRAKE CONFIRM input ON for the DS-1.5 through DS-17.5 driver sizes. For the DS-35 and larger drivers, a jumper must be provided between B11 and B12. The factory installs a B11 to B12 jumper. Method 2 is to invert the BRAKE CONFIRM input in the Parameter HP-44 "Input Inversion. Refer to **Section 4.1.5** for details.

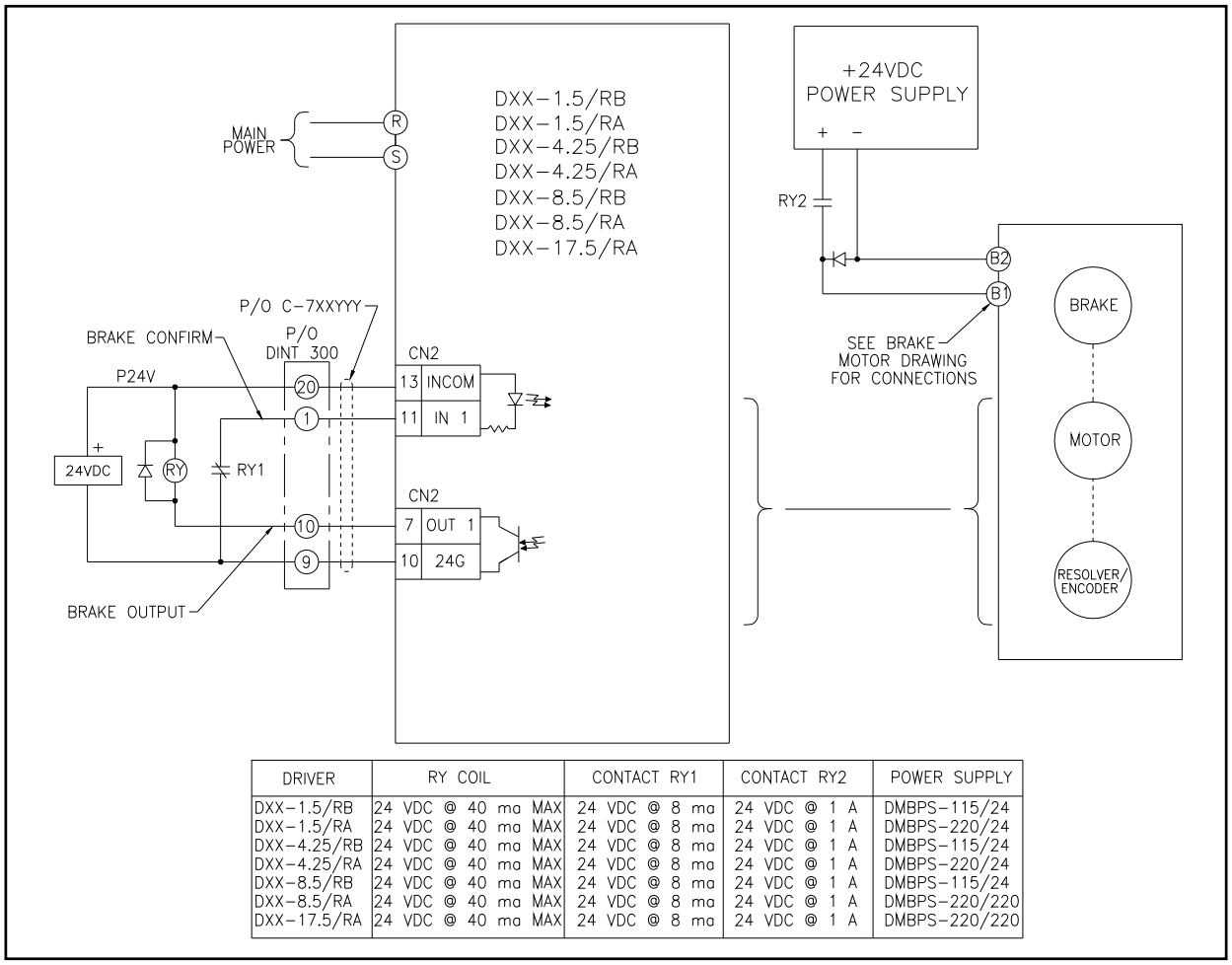
Set UP-16 to the default value of 0.

If configuring the Brake Mode over SERCOS, parameter 34316 must be set to a value of 0 for no mechanical braking. Also, by setting the brake mode to a value of 0 over SERCOS, the drive will also properly handle the BRAKE CONFIRM input by inverting the input in HP-44.

11.2 MECHANICAL BRAKING

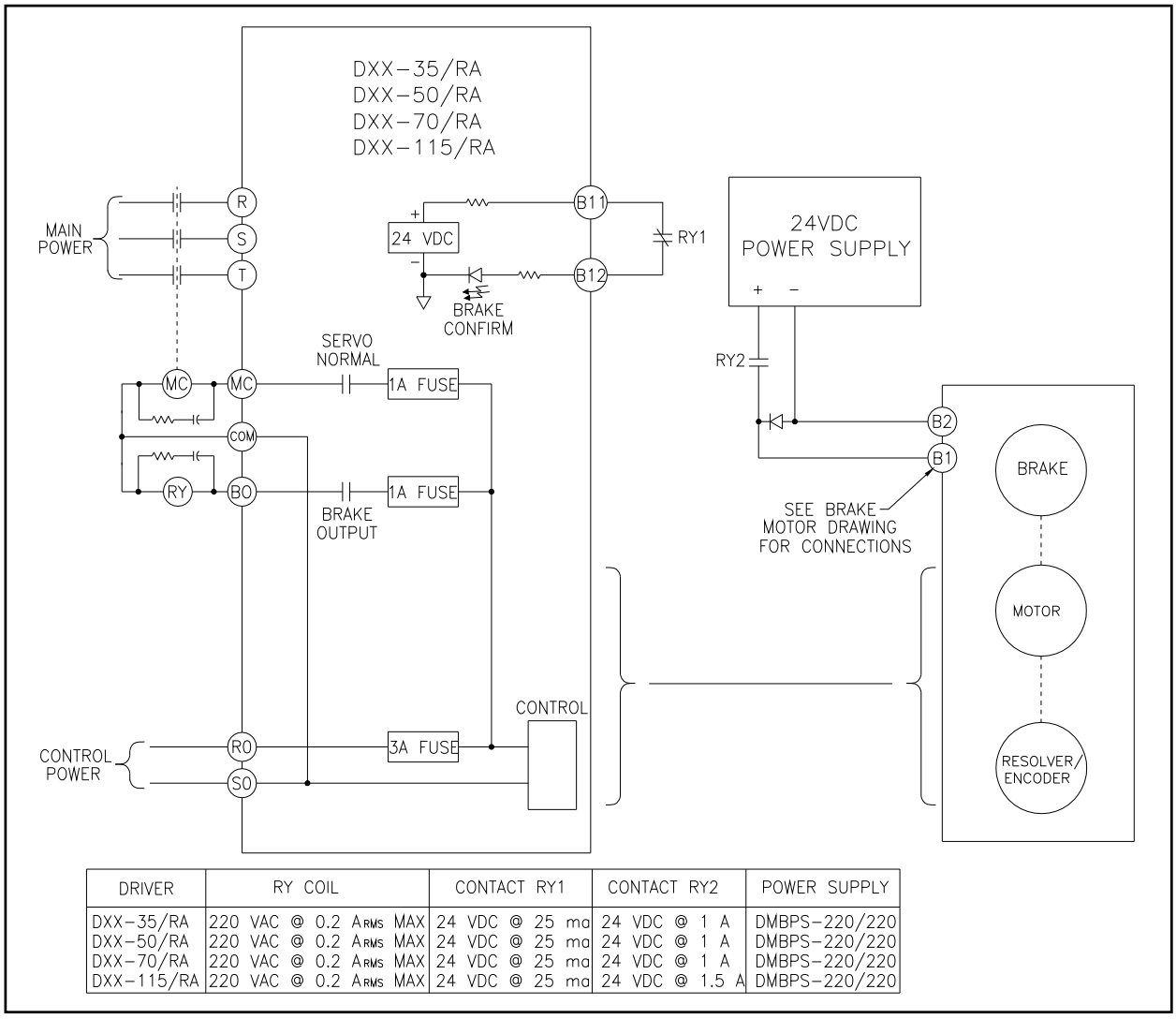
The driver sequencing can be set to apply the mechanical brake immediately upon driver disable. Since the mechanical brake is applied immediately upon driver disable the deceleration of the motor will be abrupt and limited only by the brake torque and mechanical system.

Connect the braking relay and power supplies as shown in **Figures 11.1 or 11.2** and set UP-16 to a value of 02. Over SERCOS, parameter 34316 must be set to a value of 2.



DRIVER	RY COIL	CONTACT RY1	CONTACT RY2	POWER SUPPLY
DXX-1.5/RB	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-115/24
DXX-1.5/RA	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-220/24
DXX-4.25/RB	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-115/24
DXX-4.25/RA	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-220/24
DXX-8.5/RB	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-115/24
DXX-8.5/RA	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-220/220
DXX-17.5/RA	24 VDC @ 40 ma MAX	24 VDC @ 8 ma	24 VDC @ 1 A	DMBPS-220/220

Figure 11.1 - Mechanical Brake Connection for the DS-1.5 Through DS-17.5 Drivers



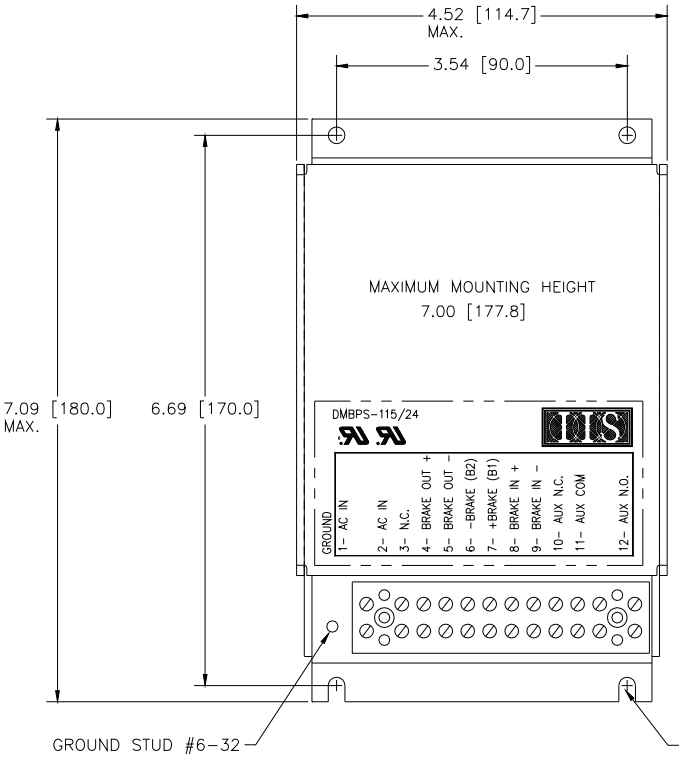
DRIVER	RY COIL	CONTACT RY1	CONTACT RY2	POWER SUPPLY
DXX-35/RA	220 VAC @ 0.2 A_{RMS} MAX	24 VDC @ 25 ma	24 VDC @ 1 A	DMBPS-220/220
DXX-50/RA	220 VAC @ 0.2 A_{RMS} MAX	24 VDC @ 25 ma	24 VDC @ 1 A	DMBPS-220/220
DXX-70/RA	220 VAC @ 0.2 A_{RMS} MAX	24 VDC @ 25 ma	24 VDC @ 1 A	DMBPS-220/220
DXX-115/RA	220 VAC @ 0.2 A_{RMS} MAX	24 VDC @ 25 ma	24 VDC @ 1.5 A	DMBPS-220/220

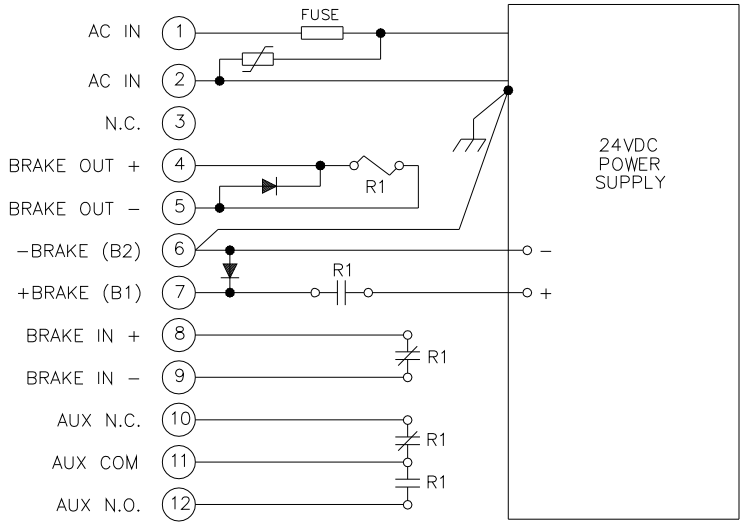
Figure 11.2 - Mechanical Brake Connection for the DS-35 Through DS-115 Drivers

11.3 MECHANICAL BRAKE POWER SUPPLY

DRAWING NUMBER	DESCRIPTION
DMBPS-115/24	Mechanical Brake Power Supply
DMBPS-220/24	Mechanical Brake Power Supply
DMBPS-220/220	Mechanical Brake Power Supply

SPECIFICATIONS:	
INPUT POWER: AC IN	100–120VAC 50/60Hz 500ma max
BRAKE:	26 VDC at 1.0 A max.
R1 AUX CONTACT:	24 VDC at 1 A max./ 120 VAC at 1 A max.
R1 (BRAKE IN):	24 VDC at 1 A max.
R1 COIL: (BRAKE OUT)	24 VDC at 0.9 watts
FUSE:	GDC–0.500A





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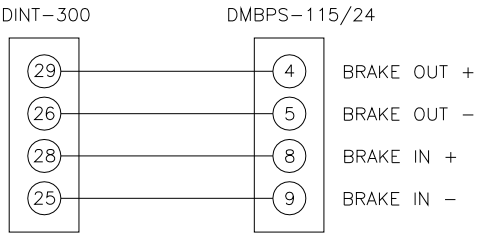
TITLE
MECHANICAL BRAKE POWER SUPPLY

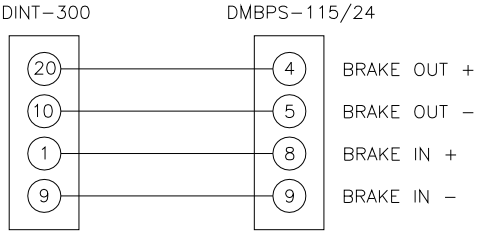
DRAWING NUMBER
DMBPS–115/24

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± 0.02 X.XXX± --- ∠ ± --	REV F		ECN 00–399	DATE 00–339	SH. 1 OF 2

FOR DELTAMAX AND DELTAPRO SOURCING I/O CONTROLLERS WITH DSD-8.5 AND DSD-17.5 DRIVES:

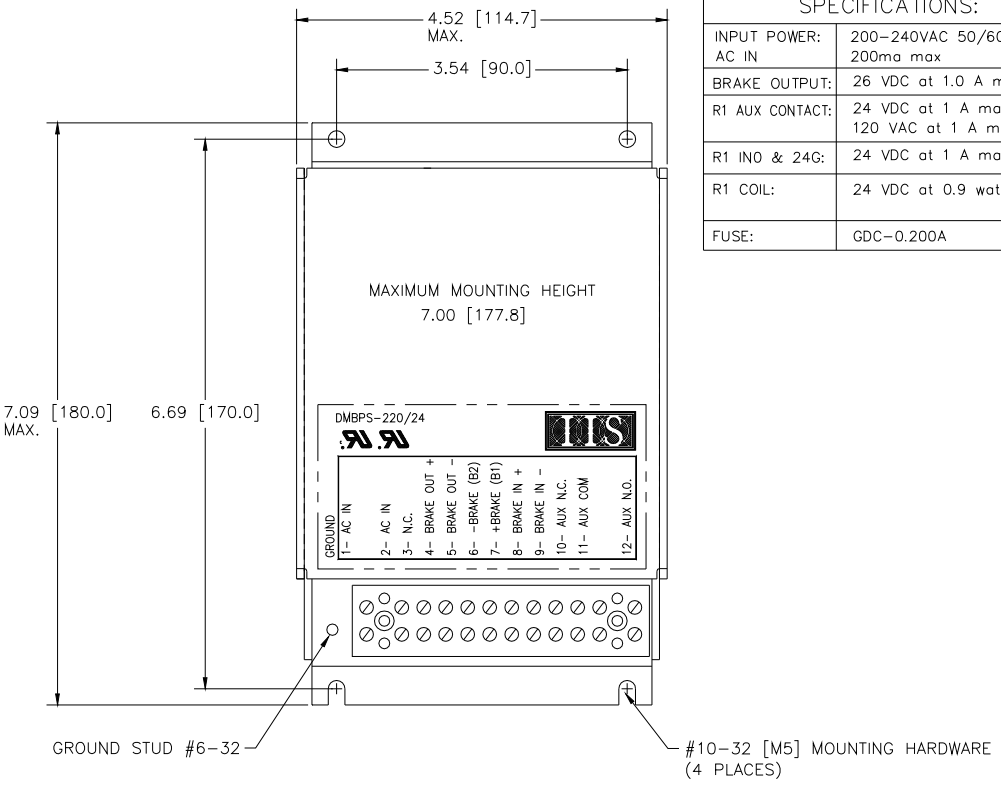


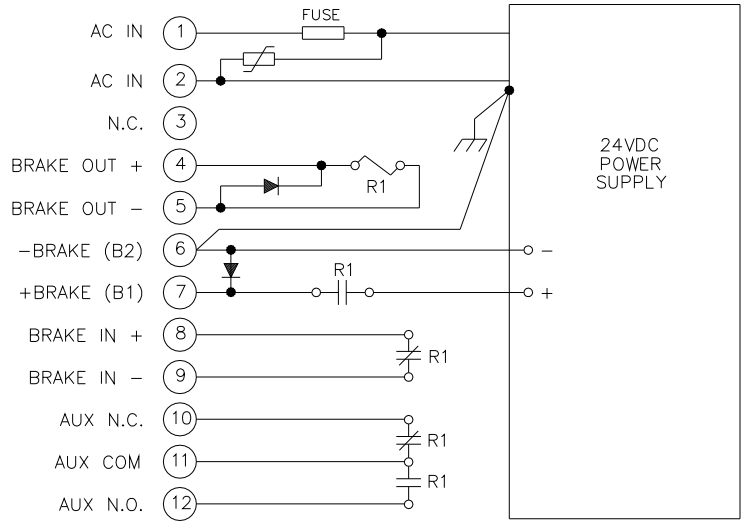
FOR DELTA DSD-8.5 AND DSD-17.5 DRIVES:



INDUSTRIAL INDEXING SYSTEMS, Inc. www.iis-servo.com				TITLE MECHANICAL BRAKE POWER SUPPLY				
				DRAWING NUMBER DMBPS-115/24				
DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± 0.02	X.XXX± --	△ ± --	REV F		ECN 00-399	DATE 00-399	SH. 2 OF 2

SPECIFICATIONS:	
INPUT POWER: AC IN	200–240VAC 50/60Hz 200ma max
BRAKE OUTPUT:	26 VDC at 1.0 A max.
R1 AUX CONTACT:	24 VDC at 1 A max./ 120 VAC at 1 A max.
R1 INO & 24G:	24 VDC at 1 A max.
R1 COIL:	24 VDC at 0.9 watts
FUSE:	GDC–0.200A





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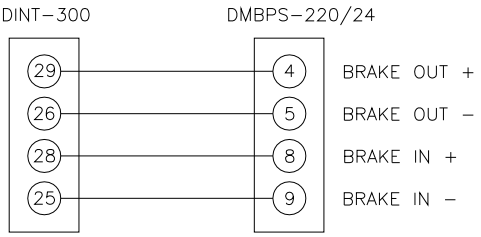
TITLE: MECHANICAL BRAKE POWER SUPPLY

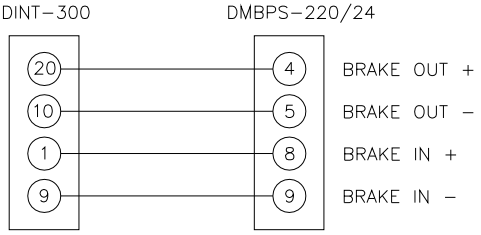
DRAWING NUMBER: DMBPS–220/24

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± 0.02 X.XXX± –– ∠ ± ––	REV J		ECN 02–186	DATE 19JUN96	SH. 1 OF 2

FOR DELTAMAX AND DELTAPRO SOURCING I/O CONTROLLERS WITH DSD-8.5 AND DSD-17.5 DRIVES:

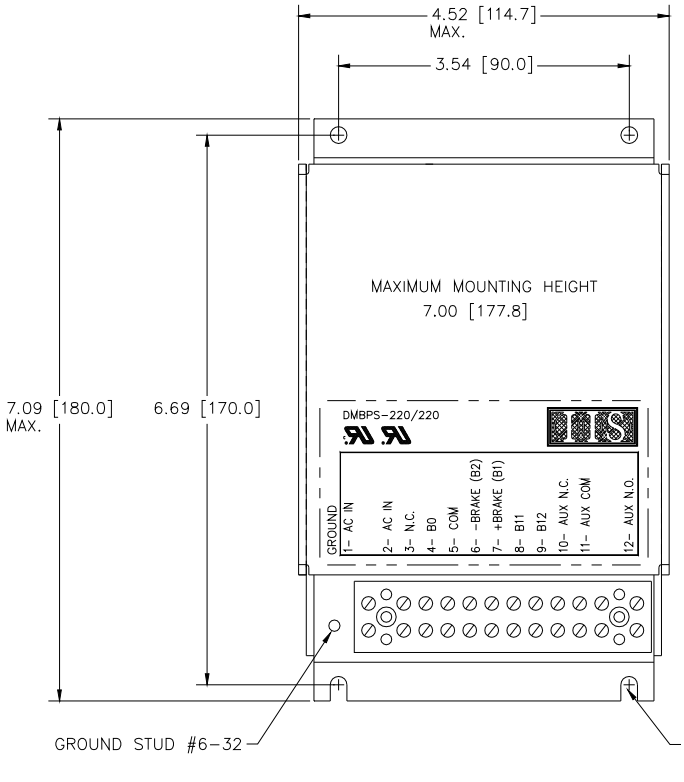


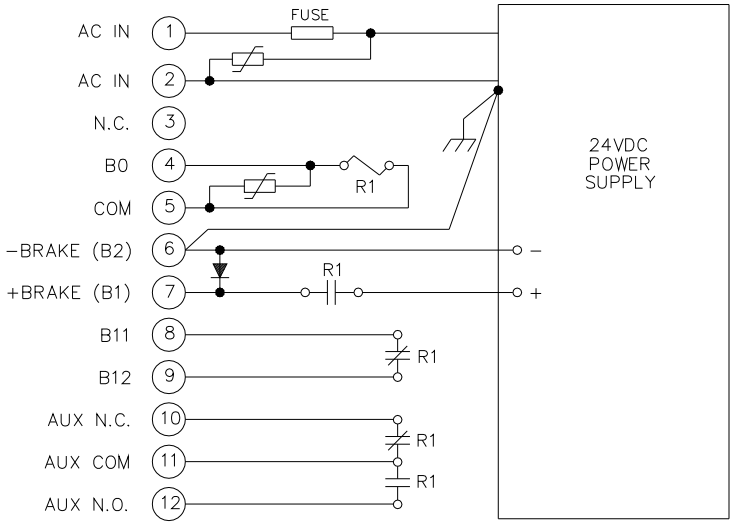
FOR DELTA DSD-8.5 AND DSD-17.5 DRIVES:



INDUSTRIAL INDEXING SYSTEMS, Inc. www.iis-servo.com				TITLE MECHANICAL BRAKE POWER SUPPLY				
				DRAWING NUMBER DMBPS-220/24				
DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX± 0.02	X.XXX± --	△ ± --	REV J		ECN 02-186	DATE 19JUN96	SH. 2 OF 2

SPECIFICATIONS:	
INPUT POWER: AC-IN	200-240VAC 50/60Hz 200ma max
BRAKE:	26 VDC at 1.5 A max.
R1 AUX CONTACT:	24 VDC at 1 A max./ 120 VAC at 1 A max.
R1 B11 & B12:	24 VDC at 1 A max.
R1 COIL: B0 & COM	220 VAC at 3.5 VA Inrush 1.2 VA Sealed
FUSE:	GDC-0.200A





INDUSTRIAL INDEXING SYSTEMS, Inc.

www.iis-servo.com

TITLE: MECHANICAL BRAKE POWER SUPPLY

DRAWING NUMBER: DMBPS-220/220

DIMENSIONS ARE INCHES [mm]	TOLERANCES X.XX±0.02 X.XXX± --- ∠ ± --	REV H		ECN 00-399	DATE 19JUN96	SH. 1 OF 1

SECTION 12 - ALARM CODES / STATUS

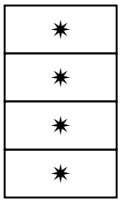
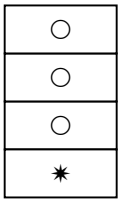
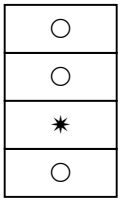
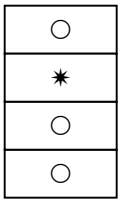
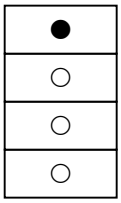
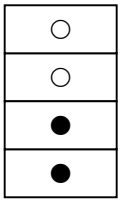
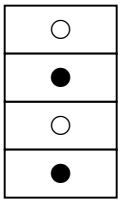
ALARM CODE	DESCRIPTION	REMEDY
HALt	Driver fatal fault	Replace driver.
AL -01 Internal Power Module Error	Driver has detected the following: • Overcurrent • Overheat • Gate voltage drop	Check if the motor wire (A/B/C) is shorted or grounded. Ambient temperature over 55° C. Indicates a fatal fault in the driver power stage. If motor wires are not shorted and temperature is below 55° C, contact IIS factory.
AL -02 Overvoltage	DC power bus exceeds 420 VDC.	Power line voltage fluctuation above 264 VAC for "A" model drivers or 126 VAC for "B" model drivers. Excessive regeneration energy. Check line voltage fluctuations. Add additional external regeneration resistor.
AL -03 Under Voltage	DC power bus below 200 VDC.	Power line voltage fluctuation below 170 VAC for "A" model drivers or 85 VAC for "B" model drivers. Check line voltage fluctuations. Check for missing phase of AC line power for 3 phase models DS-35 and above.
AL -06 Resolver Open	Resolver feedback signal (R1, R2) drops below 0.34 VAC.	Check for broken resolver wire or loose connection. Voltage between R1-R2 must be above 0.34VAC.
AL -07 Power Stage Error	Main control unit identifies a fault in the power stage of the driver.	Indicates a fatal fault in the driver power stage. Contact IIS factory.
AL -09 Regen Resistor Over Temperature	Excessive regen energy being dissipated by the internal or external regeneration resistor.	The frequency or rate of acceleration/deceleration may be too high. Excessive power line voltage. Add additional regen resistor capacity.
AL -10 Regen Resistor Open (DS-35 and above only)	Regen transistor is ON for more than 50ms.	**WITH POWER OFF:** If an internal regen resistor is used, check that the resistance from P to JP2 is less than 20-30 ohms and that a jumper is installed from JP1 to JP2. If an external regen resistor is used, verify the regen resistor is the proper value and that all wiring to the resistor is secure.
AL -12 Watchdog timer	Internal CPU clock has stopped.	Unit is damaged. Contact IIS factory.
AL -14 Brake Alarm	Sequencing of the static or dynamic brake is faulty.	Check wiring connections of the static or dynamic brake. Verify that the external braking relay is functional.
AL -15 Excessive Current	Motor current exceeds the rating by 120%.	Check if the motor wire (A/B/C) is shorted or grounded. Verify that motor shaft or machine system is not jammed. Check motor code UP-02 is set for the proper motor.
AL -16 Speed amp Saturated	Internal speed loop is saturated and max.torque is applied for more than 3 sec.	Verify that motor shaft or machine system is not jammed. Check motor code UP-02 is set for the proper motor. Acel/decel rate is too large for the inertia load on the motor causing maximum torque during acel/decel.

ALARM CODE	DESCRIPTION	REMEDY
AL -17 Motor overload	Calculated motor temperature exceeds rating 110%.	Verify that the average torque required to drive the load does not exceed the motor/driver continuous rating. Check if the duty cycle of the machine is too high. Check motor code UP-02 is set for the proper motor. $t = -Tm \left(1 - \frac{1.05^2}{\left(\frac{I}{IR}\right)^2}\right)$ Where: t = time in minutes I = motor current I_R = motor rated current T_M = thermal time constant of motor Status display oL is $\frac{I}{IR} \times 100$ See **Section 3**.
AL -18 Driver Overload	Motor current exceeds intermittent rating of driver or motor whichever is less.	Verify that motor shaft or machine system is not jammed. Check motor code UP-02 is set for the proper motor. Acel/decel rate is too large for the inertia load on the motor causing maximum torque during acel/decel. $t = \frac{K}{\left(\frac{I}{IR*1.2} - 1\right)}$ Where: t = time in seconds I = motor current I_R = motor rated current K = 2 for Delta S-120HRA 2.5 for Delta S-200HRA 3.5 for Delta S-400HRA 6 for all others See Overload Protection Characteristic Curve in **Section 3**.
AL -19 Resolver Error	Resolver feedback error.	Check resolver cable and connectors. Check if resolver is loose on motor shaft. Verify that resolver cable is separated from power wiring to prevent noise coupling to resolver signals.
AL -20 Overspeed	Motor speed exceeds maximum rating by 120%.	Check resolver cable and connectors. Check if resolver is loose on motor shaft. Verify that resolver cable is separated from power wiring to prevent noise coupling to resolver signals. Overshoot is generated due to improper setting of AJ2, AJ3 & AJ4 parameters.
AL -21 Deviation counter overflow	Motor is unable to follow the commanded profile. Deviation counter exceed $\pm 2^{21}$.	Excessive load. Load inertia is too large for acceleration/deceleration rate. Position gain (AJ4) is too high. Torque limit is too low.

ALARM CODE	DESCRIPTION	REMEDY
AL-22 Absolute encoder phase error	Absolute encoder CHA and CHB have been detected out of phase.	Replace motor.
AL-23 Absolute encoder disconnected	Absolute encoder connection is broken.	Check absolute encoder/resolver cable. If cable is OK, replace motor.
AL-25 Option	Self-diagnostic checks of options failed.	14-bit A/D converter not functioning to specification. Return to factory.
AL-26 Parameter setting error	UP-02 (motor code) is not set or is set improperly.	Motor code must be set to operate. Set UP-02 then cycle power to have the parameters take effect.
AL-27 Absolute encoder fault	CHA or CHB of absolute encoder is non-functional.	Check absolute encoder/resolver cable, C-253YYY. If cable is OK, replace motor.
AL-32 Absolute Home Position not set	Absolute Home Position has not been established. Also set with AL-6, 19, 22, 23.	Check for cause of fault in the case of AL-6, 19, 22, 23.
AL-33 Absolute Home Position setting error	Absolute Home setting procedure is not correctly completed. Also set with AL-6, 19, 22, 23, 27.	Check for cause of fault in the case of AL-6, 19, 22, 23, 27. Correct fault and set Absolute Home Position.
AL-36 Battery Missing	Battery has been disconnected when the power was OFF.	Check for detached battery or cable short.
AL-40 Encoder Signal Short	A, B, Z, U, W or V phases of encoder not functional.	Check encoder cable and connections.
AL-41 Encoder Communication Error	Communication problem with absolute encoder.	Check encoder cable, replace driver, motor.
AL-42 Encoder Power	Absolute encoder backup power low.	Replace battery.
AL-43 Encoder Checksum	Encoder communication checksum error at power up.	Replace motor/encoder.
AL-44 Battery Low	Absolute battery voltage has fallen below 2.8V.	Replace absolute battery.
AL-45 Absolute encoder error	Signal sequencing problem in the absolute encoder.	Replace motor.
AL-50 Sercos Adaptor Com_error	Driver to Sercos Adaptor Dual Port Memory Error	Contact IIS factory
AL-70 Following Error	Motor is not following Sercos command	Check following error window. Check for binding in mechanical travel of motor.
AL-80 SERCOS MST Error	Drive has detected unacceptable errors in the Master Sync Telegrams of the SERCOS Communication	Check fiber optic connections on the SERCOS Ring. Replace fiber optic cable.

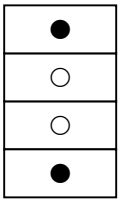
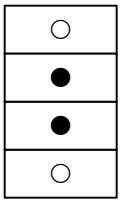
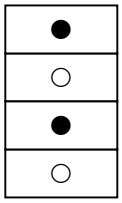
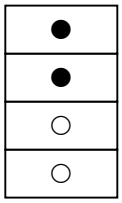
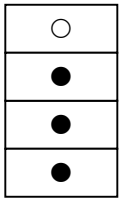
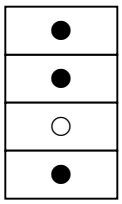
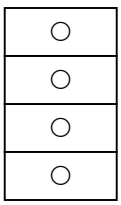
ALARM CODE	DESCRIPTION	REMEDY
AL-81 SERCOS MDT Error	Drive has detected unacceptable errors in the Master Data telegram	Check fiber optic connections on the SERCOS Ring. Replace fiber optic cable.
AL-82 Invalid SERCOS Phase	Drive has detected an invalid phase in the initialization of the SERCOS Ring	Contact IIS Factory.
AL-83 SERCOS Phase UP_SHIFT Error	Invalid sequence of the SERCOS Ring Initialization Phases	Re-initialize the SERCOS Ring at the controller.
AL-84 SERCOS Phase DOWN_SHIFT Error	Invalid sequence of the SERCOS Ring Initialization Phases	Re-initialize the SERCOS Ring at the controller.
AL-85 SERCOS Phase Switching Error	Attempt to switch phase with out satisfying the requirements of the previous phase.	Verify that all required parameters are written in Phase 2 (See IDN 00018) and that Command 127 and 128 execute successfully.

SERCOS ADAPTER STATUS DISPLAYS

DISPLAY	STATUS	ACTION/REMEDY
	SERCOS Phase 0	Ring is open. The baud rate and device id need to be set the same on drive and controller to go beyond this phase. Also verify that all fiber optic cables are connected correctly.
	SERCOS Phase 1	Ring is closed, master is checking if drive is communicating on ring. If device gets to this status, then the master has identified the drive correctly on the ring.
	SERCOS Phase 2	Master is configuring drive to run in phase 4.
	SERCOS Phase 3	Master/drive switching to configuration sent in phase 2. If the drive successfully obtains this status then all parameters sent in phase 2 are valid.
	SERCOS Phase 4	SERCOS ring is up, and drive is ready to run. If the drive reaches this phase then all parameters sent in phase 3 are valid.
	No firmware, system ready for download	Download new firmware to drives SERCOS adapter. Replace drive if this does not correct problem.
	Flash memory erase in progress	Displayed as part of firmware download.

SERCOS ADAPTER STATUS DISPLAYS

○ OFF ✷ FLASHING ● ON

DISPLAY	STATUS	ACTION/REMEDY
	Flash memory error	Replace drive.
	Drive communication error	Replace drive.
	SERCOS communication error	Checks drives fiber optic rings, transmitter on previous device in ring, fiber optic cables, and master.
	Watch dog overflow	Replace drive.
	CPU fault	Replace drive.
	Motor id changed, must cycle power	Cycle control power off then back on.
	Processor failure	Replace drive.

SECTION 13 - EMC INSTALLATION GUIDELINES FOR DELTA S SERIES MOTORS AND DRIVERS

13.1 INTRODUCTION TO EMC GUIDELINES

This chapter provides guidance and requirements when installing IIS Delta S Series motors and drivers into industrial control machinery required to be CE marked. These guidelines are intended to provide the machine builder with the necessary EMC information, including parts and wiring techniques to comply with the European Community Standards for industrial control equipment. The final conformance to the standards for the overall machine remains the sole responsibility of the machine builder.

13.2 EMC REQUIREMENTS

In 1996, the European Community enacted standards concerning conducted and radiated emissions and immunity to various types of interference for industrial control equipment. The EMC Directive 89/336/EEC and harmonized standards define specific EMC levels and test procedures to gain conformance.

Emission Standards provide maximum levels of noise permitted to be generated by the equipment. Immunity Standards subject the equipment to various types of disturbances and verifies that the equipment continues to perform in a safe manner.

The IIS Delta S Series motors and drivers have been tested and have been shown to comply with the following standards when installed per the guidelines in this section.

EMISSIONS STANDARDS:

EN55011 Class A	Power line conducted noise
EN55011 Class A	Radiated noise

IMMUNITY STANDARDS:

EN61000-4-2	Static discharge
ENV50140 & ENV50204	Electromagnetic irradiation
EN61000-4-4	Burst noise injected into power and signal wiring
EN61000-4-5	Lightning surge into power line
ENV50141	RF frequency injection into power and signal wiring
EN61000-4-8	Power frequency magnetic field
EN61000-4-11	Power line fluctuation and drop out

13.3 CONTROL ENCLOSURE

The Delta S Series drivers must be installed in a suitable control enclosure that provides a good quality ground system and tight construction. The cabinets can be of welded construction, metal to metal conductive joints or have overlapping EMC gasketed joints. All joints and removable panels must have metal-to-metal ground contact. All hinged panels or doors must have a bonded ground wire from the hinged panel to the main body of the enclosure.

13.4 ENCLOSURE MOUNTING PANEL

It is highly recommended that a galvanized panel be used. Galvanized panels provide a continuous conductive surface that provides a low impedance ground plane for mounting the servo components.

The mounting panel must be grounded to the control enclosure with metal to metal joints, bolted together with external tooth lock washers or have multiple short ground jumper wires between the panel and the enclosure.

Painted panels can be used if the mounting area for the servo components and all grounding points have been masked off or have the paint removed.

All servo components that require grounding must use fasteners with external tooth lock washers.

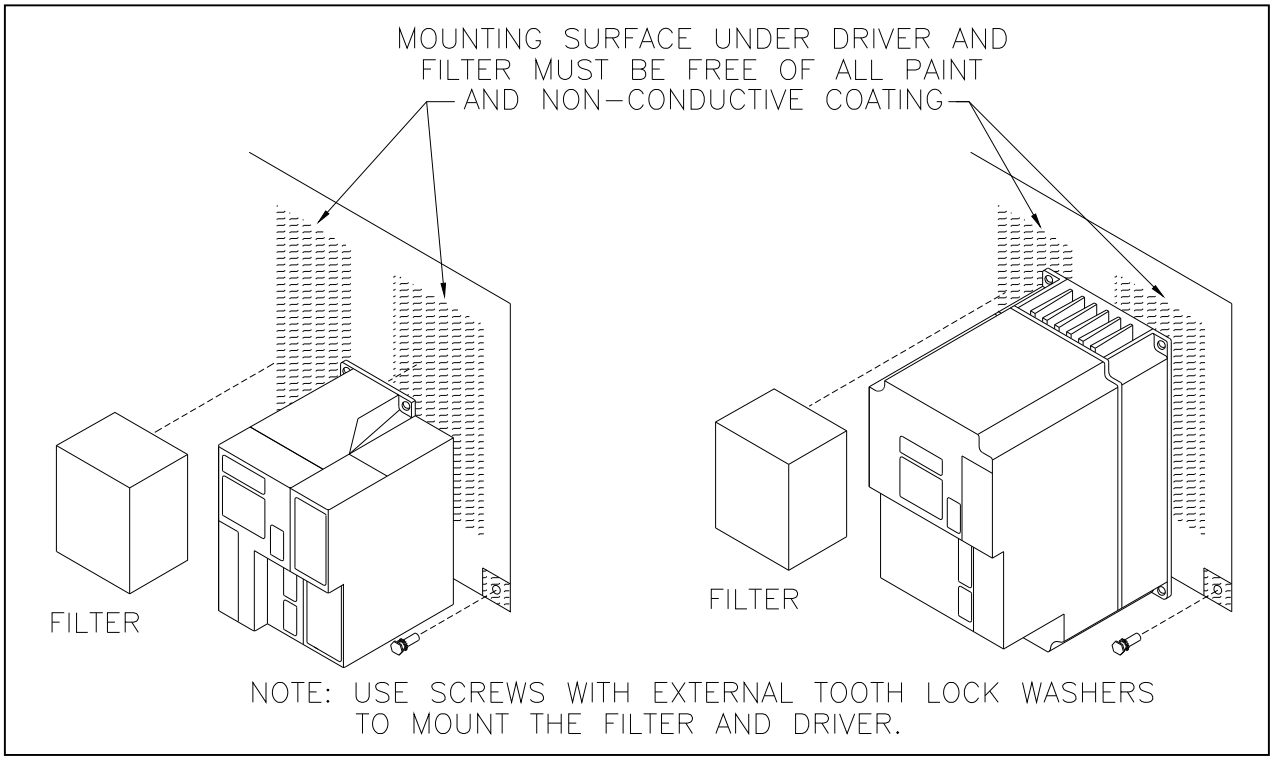


Figure 13.1 - Enclosure Mounting Panel

13.5 POWER LINE FILTER

A filter must be installed between the Delta S Series Driver and the incoming power line to prevent conducted noise for getting onto the power line. It is recommended that a separate filter be used for each driver but it is possible to use a single larger filter to supply multiple drivers if the wiring between the filter and drivers is kept as short as possible.

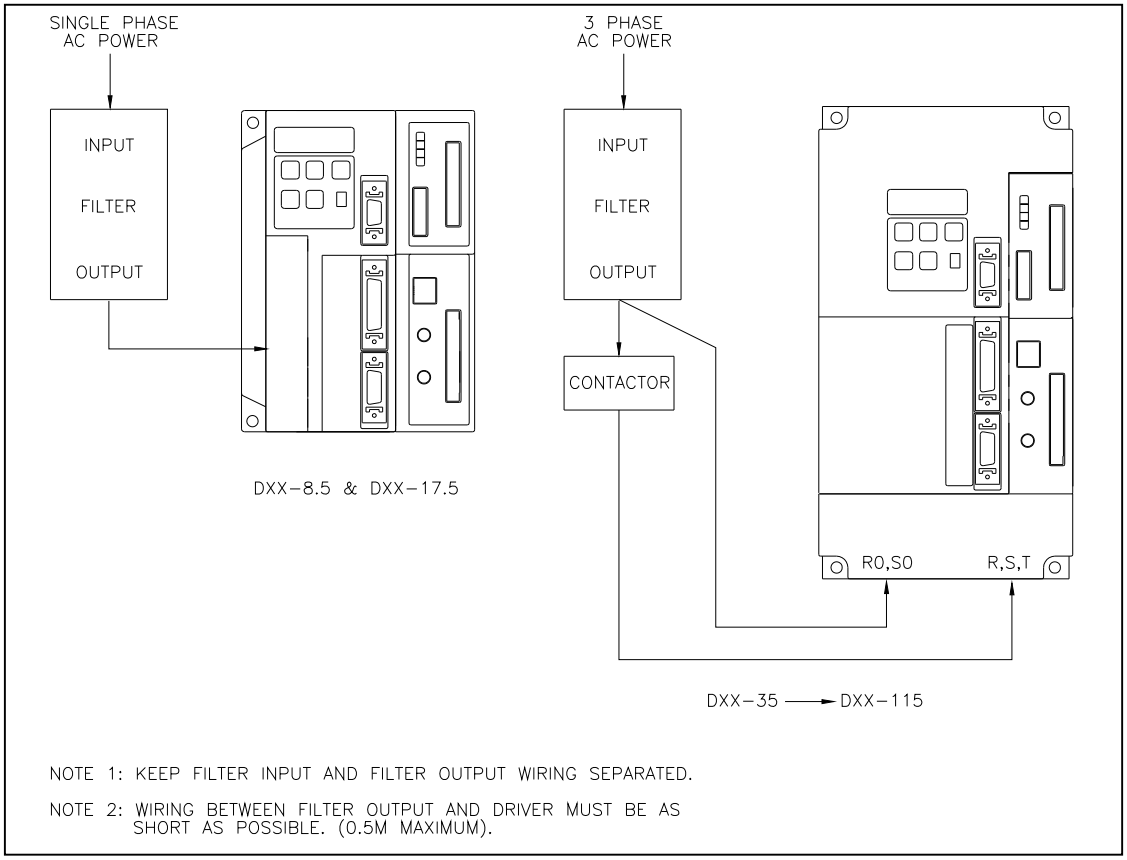


Figure 13.2 - Power Line Filter

The following power line filters are recommended for use with the Delta S Series motors and drivers:

Total Motor Capacity	Phase	SOSHIN ELECTRONICS
500W max.	1	HF2010A-PI
500W -> 1000W	1	HF2015A-PI
1000W ->1800W	3	HF3010A-PI
1800W -> 2600W	3	HF3020A-PI
2600W -> 3700W	3	HF3030A-PI
3700W -> 6500W	3	HF3040A-PI
6500W -> 11000W	3	HF3060A-TMA

Total Motor Capacity	Phase	SCHAFFNER ELECTRONIC AG
500W max.	1	FN 2070-3
500W -> 1000W	1	FN 2070-6
1000W ->2200W	3	FN 258-16
2200W -> 3700W	3	FN 258-30
3700W -> 6500W	3	FN 258-42
6500W -> 11000W	3	FN 258-55

13.6 DRIVER OUTPUT (MOTOR ARMATURE) FILTER

The Delta S Series Driver uses pulse width modulation (PWM) control of the motor windings. The PWM switching of the motor output generates transient voltages that must be suppressed before exiting the control enclosure. A simple ferrite core can be used as shown below.

The following ferrite core filters are recommended for use with the Delta S Series motors and drivers:

Drive Size	Manufacturer	Part Number
DS-1.5 -> DS-70	TDK Corp.	ZCAT3035-1330
DS-115	TOKIN Corp.	ESD-R-47DB

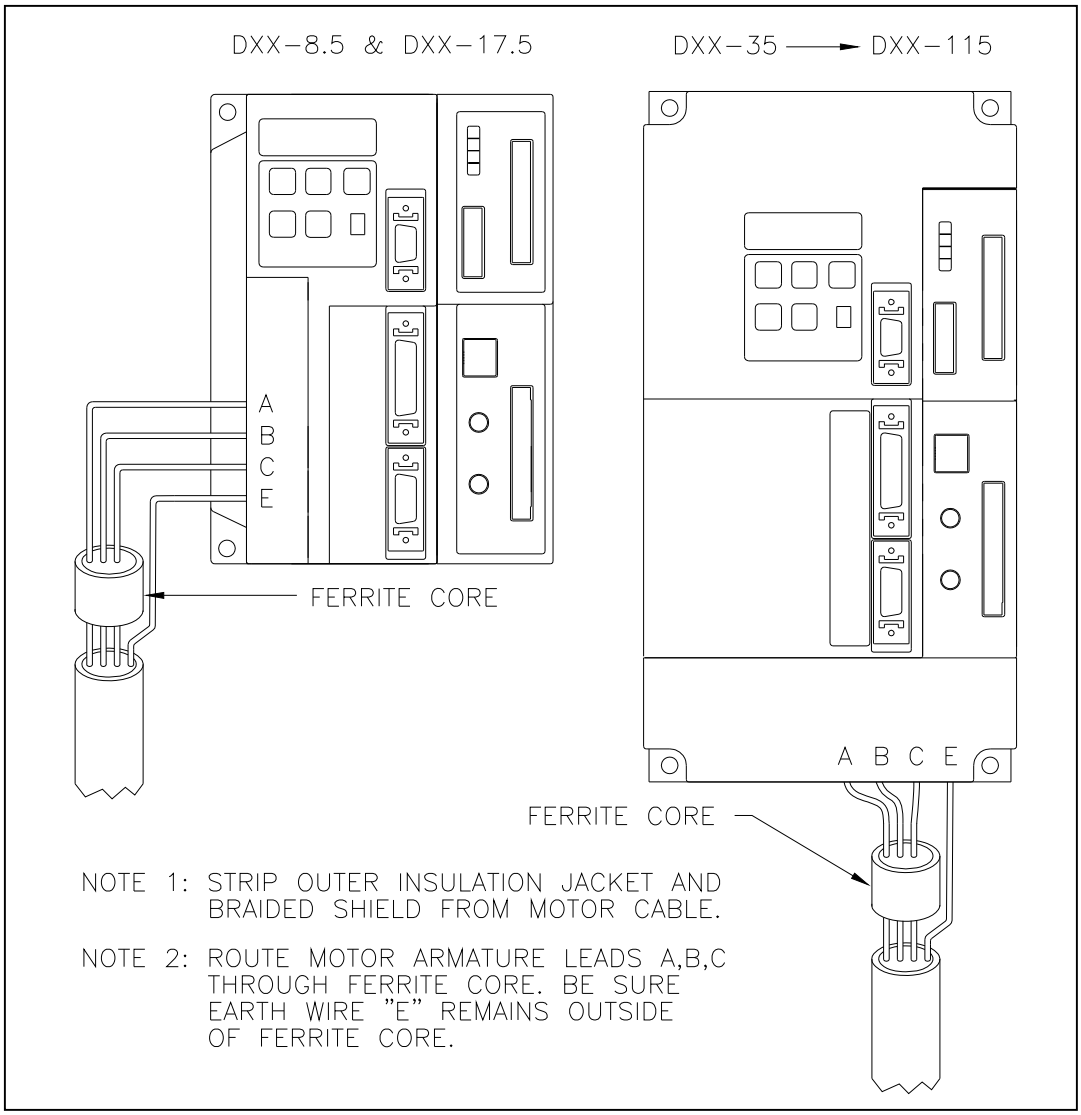


Figure 13.3 - Driver Output (Motor Armature) Filter

13.7 SHIELDED MOTOR CABLE

The motor armature cable between the driver and motor must be shielded and grounded at both the driver and motor end. The motor armature cable length between the control enclosure and motor must be less than 50 meters or additional shield is necessary. The following shielded motor armature wire is recommended.

Motor Capacity	TAIYO Electric	OFLEX	BELDEN
500W max.	VCT-SB0.75SQ4C	891804CY	7411AS
500W -> 1000W	VCT-SB1.25SQ4C	891604CY	7423AS
1000W ->1800W	VCT-SB2.0SQ4C	891404CY	7436AS
1800W -> 2600W	VCT-SB3.5SQ4C	891204CY	7445AS
2600W -> 3700W	VCT-SB5.5SQ4C	891004CY	7447AS
3700W -> 11000W	VCT-SB14SQ4C	N/A	7450AS

Figures 13.4 and 13.5 show the recommended technique for grounding the motor armature cable.

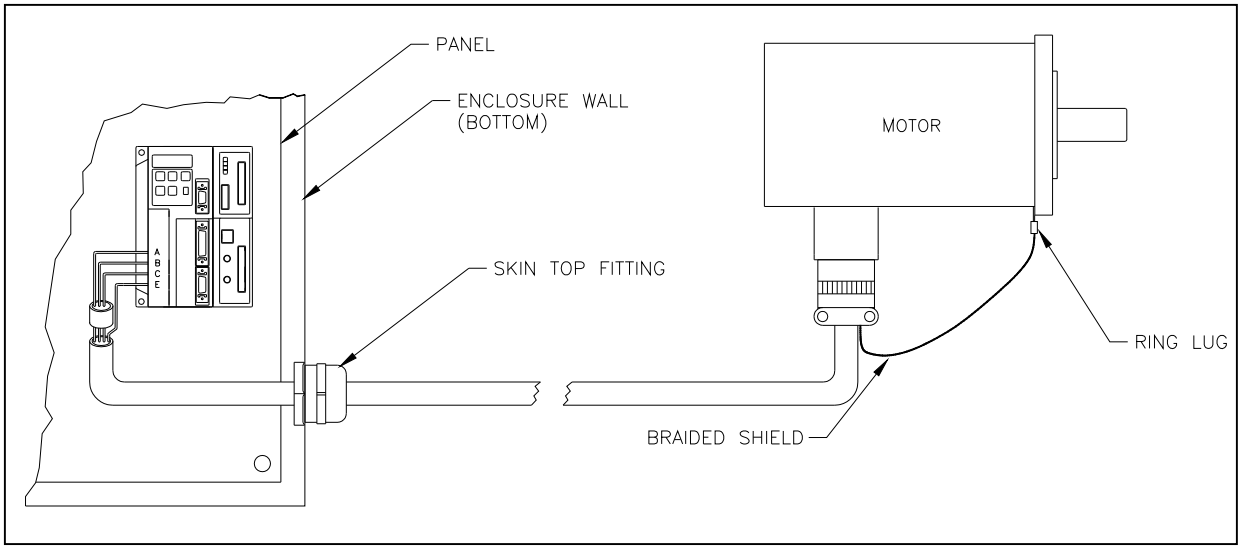


Figure 13.4 - Grounding Motor Armature Cable

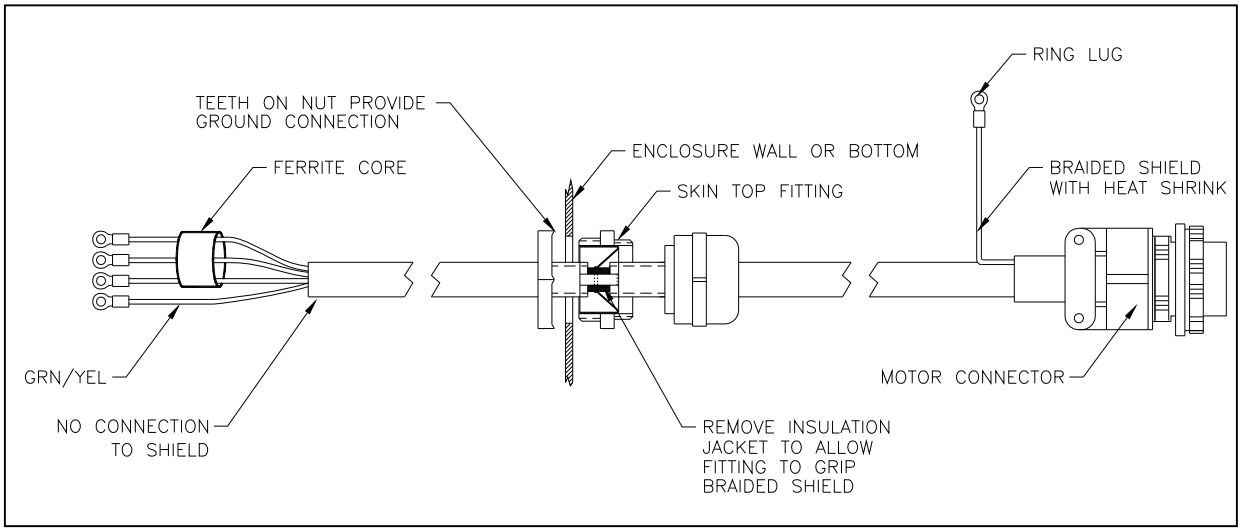


Figure 13.5 - Grounding Motor Armature Cable

13.7 SHIELDED MOTOR CABLE (cont'd)

The ground fittings shown in the figures above are made by OFLEX. The fittings are OFLEX SKINTOP MS-SC series P/N 5311-22x0; where x is a code for the wire diameter.

Figures 13.6 and 13.7 show an alternate method to ground the motor armature cable shield using saddle clamps.

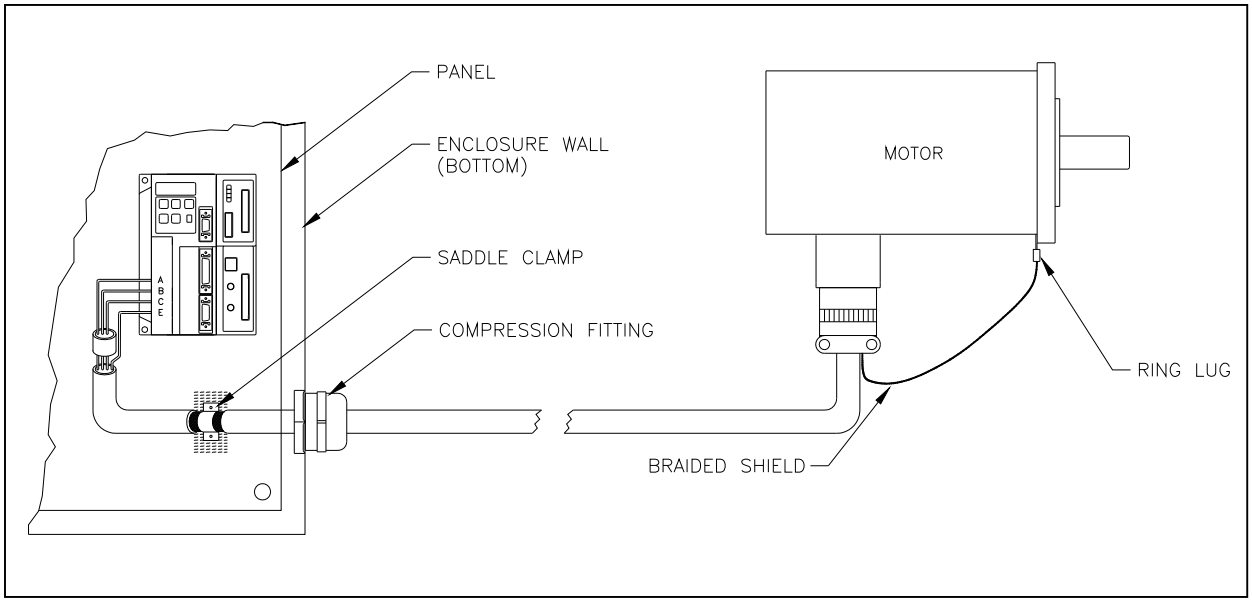


Figure 13.6 - Alternate Method to Ground the Motor Armature Cable

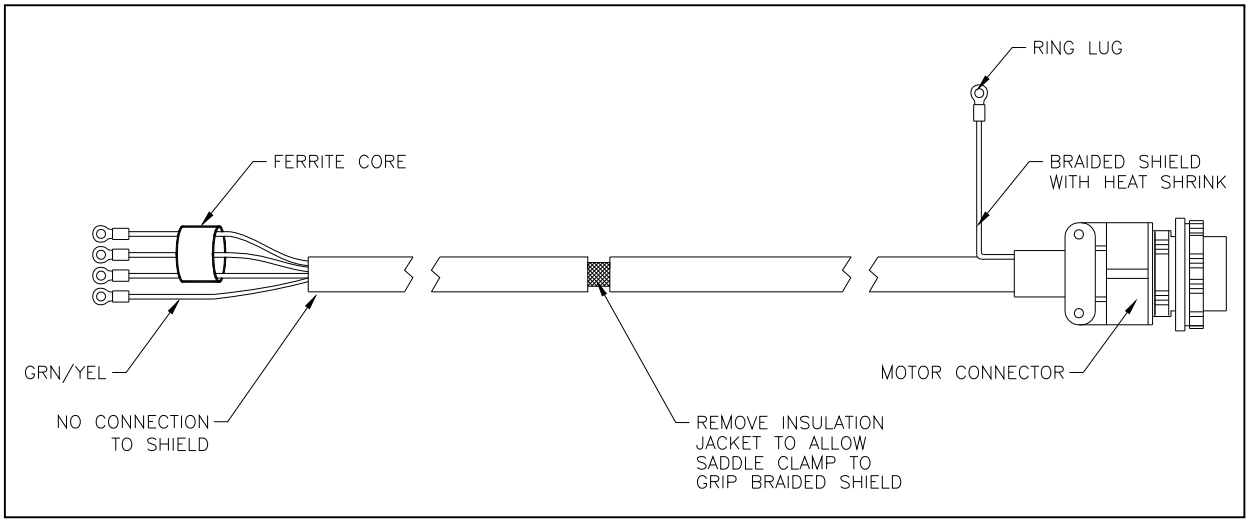


Figure 13.7 - Alternate Method to Ground the Motor Armature Cable

13.8 REGENERATION RESISTOR WIRING (OPTION)

If the regeneration resistor is located in the same enclosure as the driver, shielded wire is not necessary if the wiring is kept as short as possible. If the regeneration resistor is located in another enclosure, the regeneration resistor wire must be shielded and grounded in both enclosures. The SKINTOP ground fittings are shown in **Figure 13.8** but the saddle clamp method of grounding can also be used as shown in **Figure 13.9**.

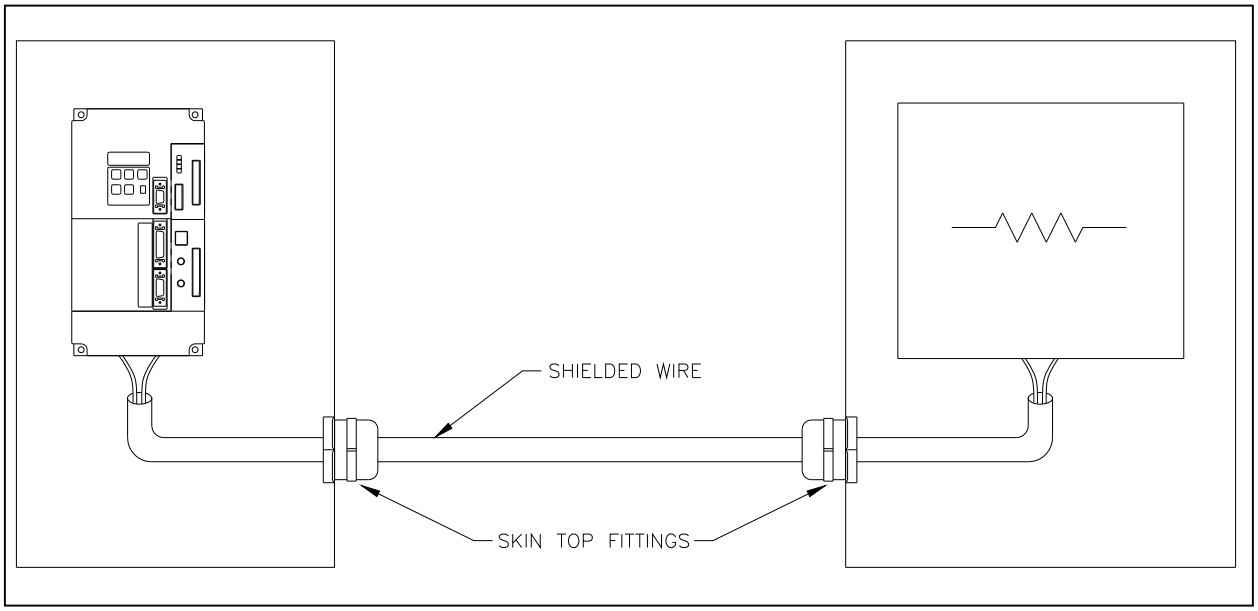


Figure 13.8 - SKINTOP Ground Fittings

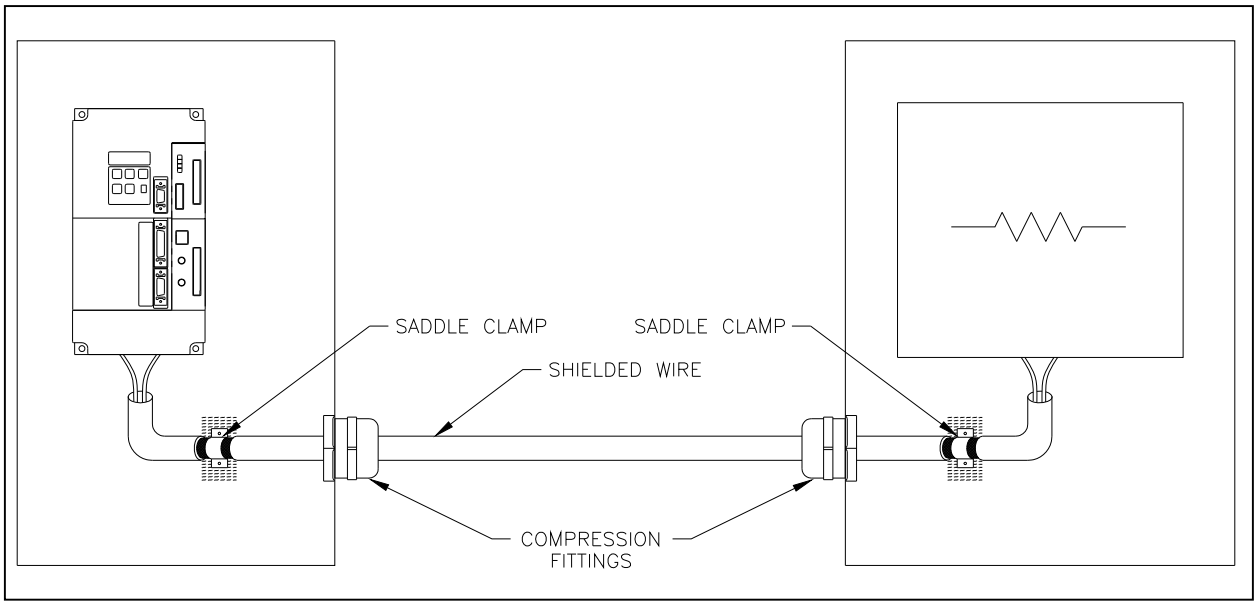


Figure 13.9 - Saddle Clamp Method of Grounding

13.9 DIGITAL CONTROL SIGNALS

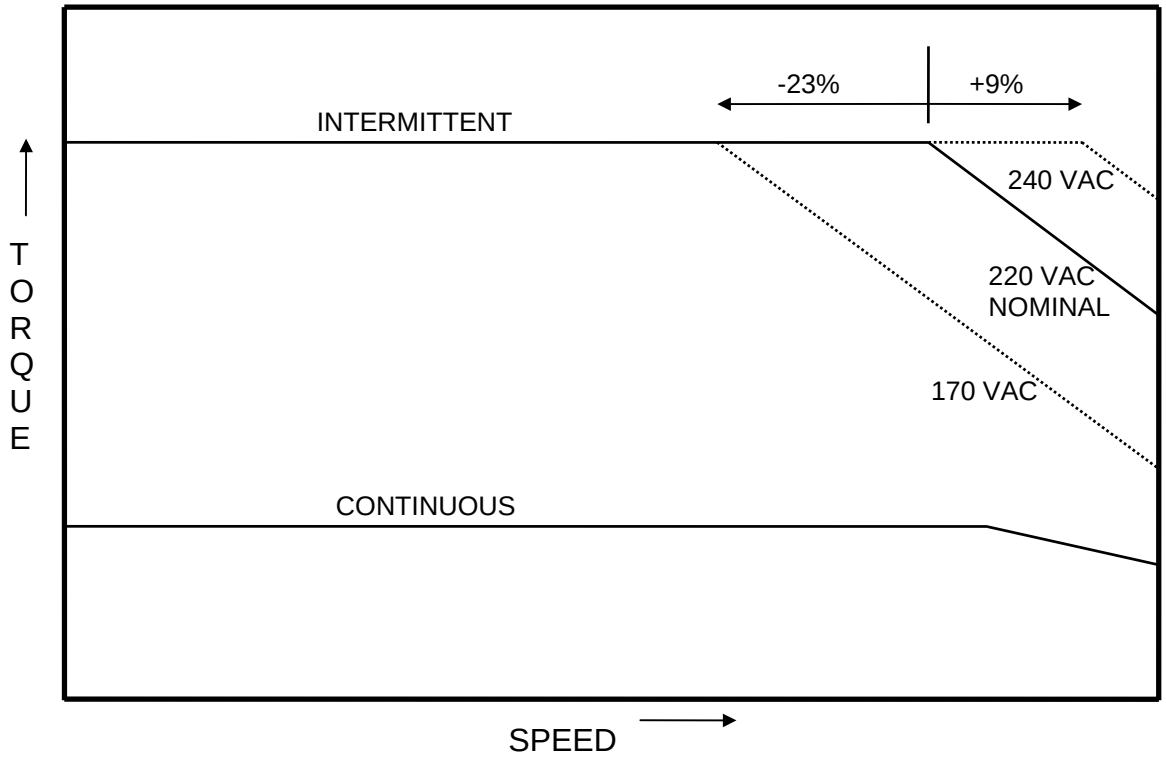
High speed, fast rise time signals used with the Delta S driver, such as encoder inputs or pulse outputs, radiate high frequency noise. This noise must be suppressed to prevent excessive EMC radiation.

If the positioning controller and Delta S driver are in the same control enclosure, the cable between the two must be shielded and grounded at both ends. If the positioning controller is located in a separate control enclosure, the cable between enclosures must be a braided shielded cable with both enclosure entries grounded with SKINTOP fittings or saddle clamps.

SECTION 14 - APPLICATION NOTES

14.1 SPEED TORQUE CURVES

The Delta S Driver speed/torque curves are shown with a nominal 115 VAC and 220 VAC, 50/60Hz incoming line voltage. The Delta S Drivers however are rated at 85-126 VAC for the "B" models and 170-264 VAC for the "A" models. The intermittent torque rating at the high speed is nearly linearly related to the line voltage. Motor winding resistance, winding inductance and motor losses also play a role in rolling off the peak torque and higher speeds.



As the servo motor speed goes up, the counter EMF or generator action of the motor increases the voltage across the motor windings. The driver must provide a voltage greater than the motor voltage to produce current in the winding and therefore torque at the motor shaft. The intermittent torque curve rolls off when the motor voltage reaches the driver's internal DC bus voltage. The internal DC bus voltage is directly related to the incoming line voltage.

The roll off in the continuous torque curve is caused by motor heating due to internal losses in the motor, not line voltage.

Note that the speed/torque curves shown in the specifications represent the speed and torque being applied in the same direction, as is the case when the motor is driving the load.

When the speed and torque are in opposite directions, as is the case when the motor is braking the load, the motor is putting the load's mechanical energy back into the driver in the form of electrical energy. The result is that the driver internal voltage DC bus is pumped up rather than drained down, as is the case when the motor is driving the load. The driver has a higher bus voltage in this braking mode; therefore the intermittent zone of speed/torque curve is higher. This means that there is more high-speed torque available for braking/deceleration than there is for accelerating a load.

14.1 SPEED TORQUE CURVES (cont'd)

When the driver is braking the load it is absorbing the mechanical energy of the load and pumping up the internal voltage bus. If the energy absorption is great enough, the driver switches in a regeneration resistor to dump some of the energy as heat. Repetitive or excessive absorption can overheat the regeneration resistor resulting in a fault condition. Absorption energy and the use of an internal or external regeneration resistor are discussed in detail in the Delta S Driver Technical manual Section 10.

When reviewing a particular application, consideration of the line voltage fluctuation can be an important issue. Generally speaking, applications in the more developed countries in the world can be more aggressively sized because a stable 220 VAC line is readily available. In emerging countries the line voltage is not likely to be stable, so more conservative sizing is necessary. It may even be necessary to move up a size rating to be sure the application will run properly when the line voltage dips. This could be of particular concern for Original Equipment Manufacturers that ship machines around the globe.

**** CAUTION ****

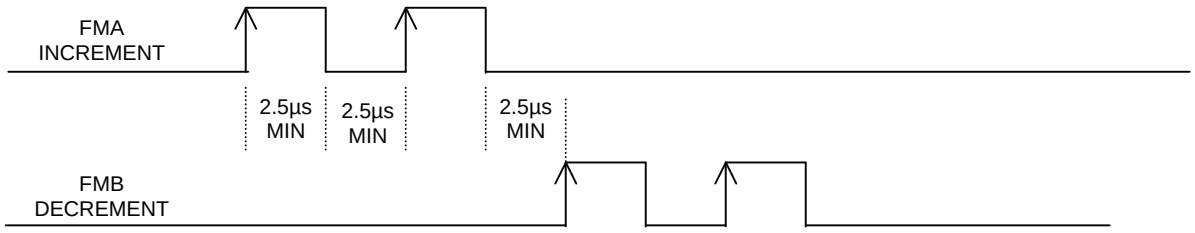
It might appear tempting to simply use a transformer to raise the nominal line voltage to 240-250 VAC to avoid the low line problem. Raising the nominal line voltage poses the risk of overheating the driver's regeneration resistor in the case of heavy motor braking or in the case of a rise in the line voltage.

14.2 PULSE INPUT & OUTPUT

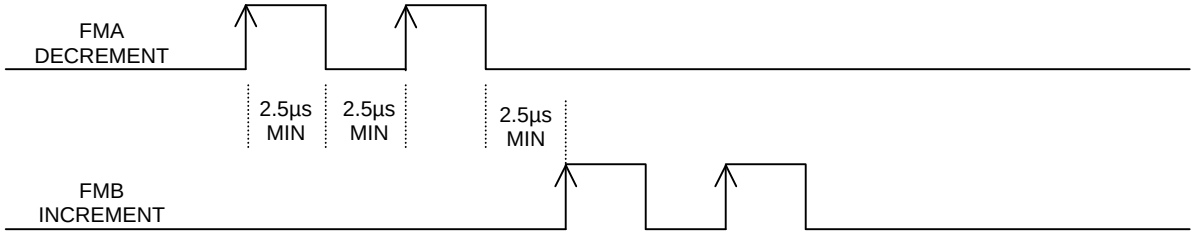
14.2.1 AUXILIARY ENCODER PULSE INPUTS FMA & FMB

An auxiliary position feedback to the Delta S driver is provided by pulse inputs from an external source. The Delta S driver, depending on the settings in UP-18, can configure the pulse inputs, FMA and FMB, in one of six ways. In the following descriptions an up arrow ↑ and down arrow ↓ indicates a pulse.

PULSE-PULSE DECODING (UP-18 = 00) where FMA increments the command position and FMB decrements the encoder position. Maximum frequency of FMA and FMB is 200 KHZ.

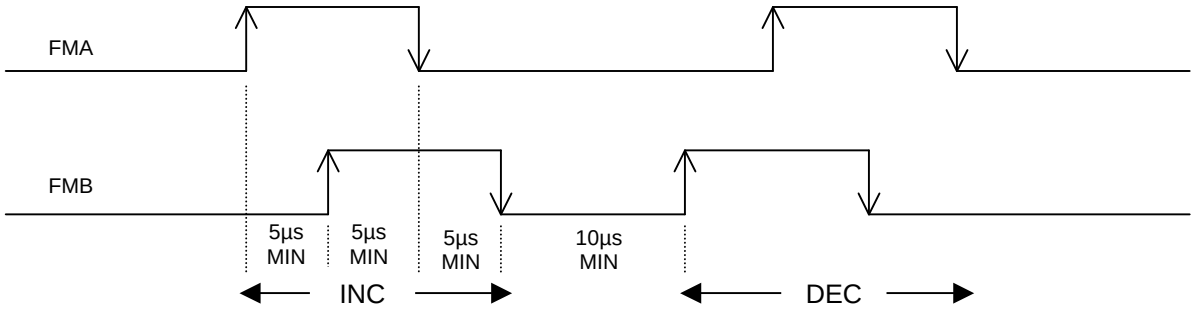


PULSE-PULSE DECODING (UP-18 = 10) where FMA decrements the command position and FMB increments the encoder position. Maximum frequency of FMA and FMB is 200 KHZ.

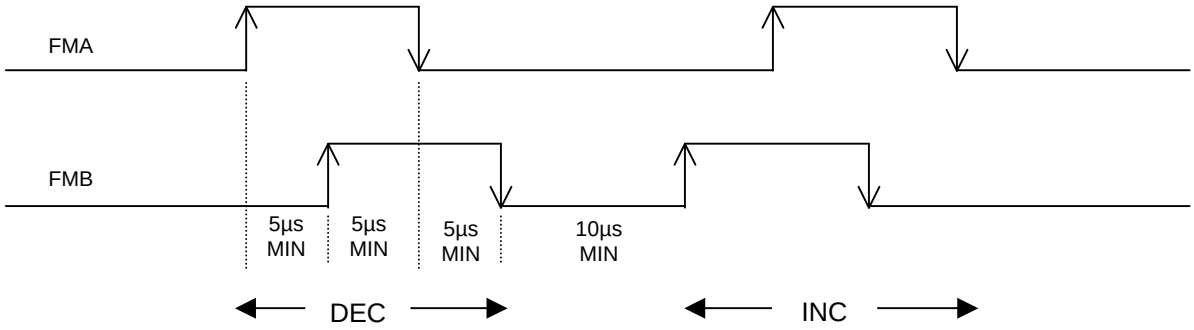


14.2.1 AUXILIARY ENCODER PULSE INPUTS FMA & FMB (cont'd)

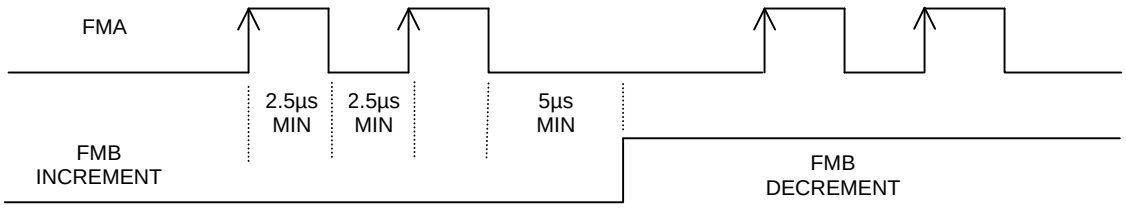
AB QUADRATURE DECODING (UP-18 = 01) where FMA leading FMB increments the command position, FMB leading FMA decrements the encoder position. Maximum frequency of FMA and FMB is 50 KHZ.



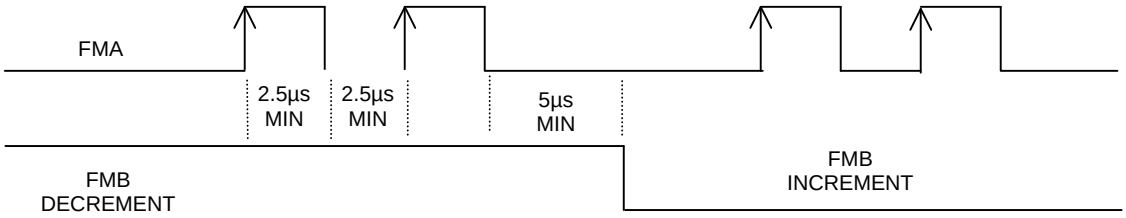
AB QUADRATURE DECODING (UP-18 = 11) where FMB leading FMA increments the command position, FMA leading FMB decrements the encoder position. Maximum frequency of FMA and FMB is 50 KHZ.



PULSE AND DIRECTION DECODING (UP-18 = 02) where FMA is pulse count and FMB is direction. Maximum frequency of FMA is 200 KHZ.



PULSE AND DIRECTION DECODING (UP-18 = 12) where FMA is pulse count and FMB is direction. Maximum frequency of FMA is 200 KHZ.

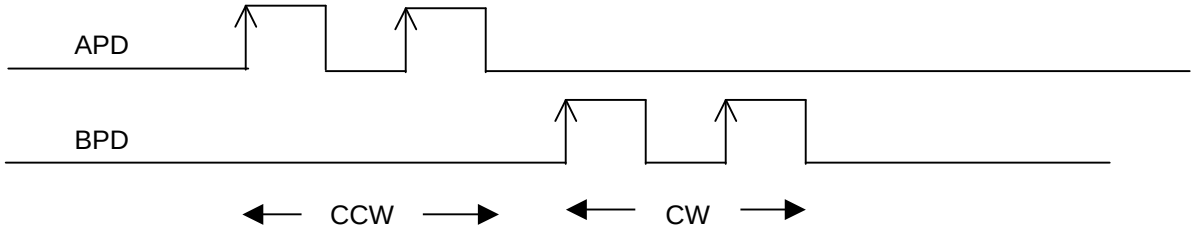


14.2.2 PULSE OUTPUTS APD, BPD & ZPD

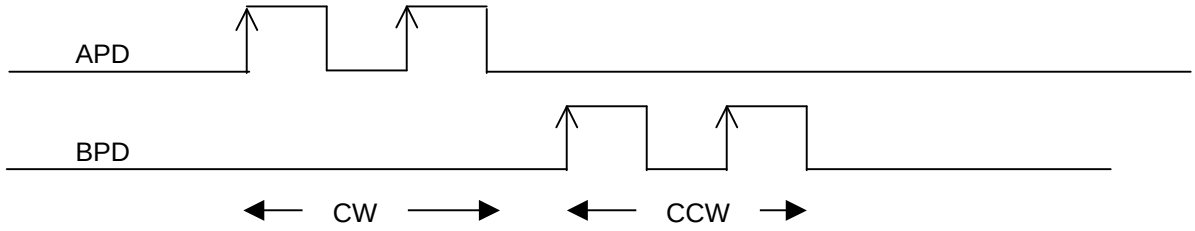
The pulse outputs of the Delta S driver, APD, BPD & ZPD, are used primarily to provide motor position to an external controller. The APD, BPD & ZPD outputs are RS422 compatible and are driven by a 26LS31 driver or equivalent. The width of the pulses is dependant on motor speed, resolver resolution and the setting of UP-04 and UP-05.

The ZPD pulse occurs when the motor's resolver is at 0 degrees. The Delta motors have various configurations of resolvers that provide 1, 2 or 3 electrical cycles per rotation of the motor shaft. Each resolver electrical cycle causes a 0 degree position and therefore a ZPD pulse. See individual motor data sheets for details. The ZPD pulse spacing will be (360º of motor rotation / # of resolver cycles) and the ZPD pulse width will be a multiple of 400µsec.

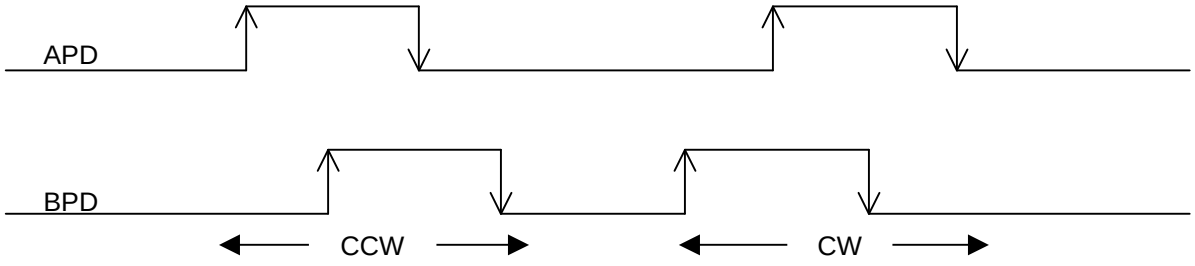
PULSE-PULSE DECODING (UP-19 = 00) where APD pulses when the motor actual position moves CCW and BDP pulses when the motor actual position moves CW. Maximum frequency of FMA and FMB is 400 KHZ.



PULSE-PULSE DECODING (UP-19 = 10) where APD pulses when the motor actual position moves CW and BDP pulses when the motor actual position moves CCW. Maximum frequency of FMA and FMB is 400 KHZ.

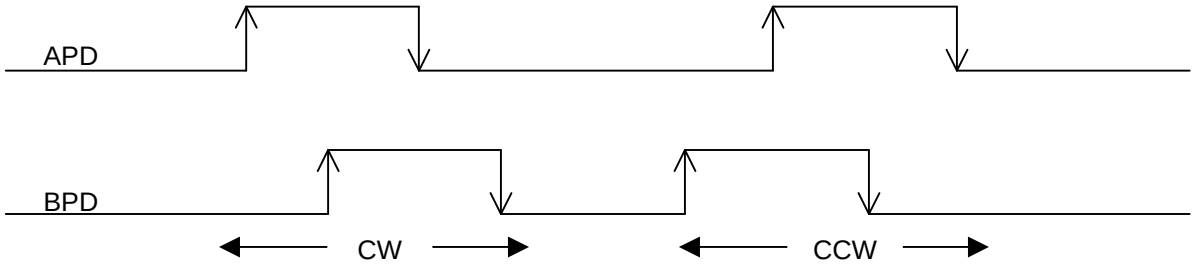


AB QUADRATURE DECODING (UP-19 = 01) where APD leads BPD for CCW motor rotation. Maximum frequency of APD and BPD is 100 KHZ. This mode simulates an encoder output being read as 4X.



14.2.2 PULSE OUTPUTS APD, BPD & ZPD (cont'd)

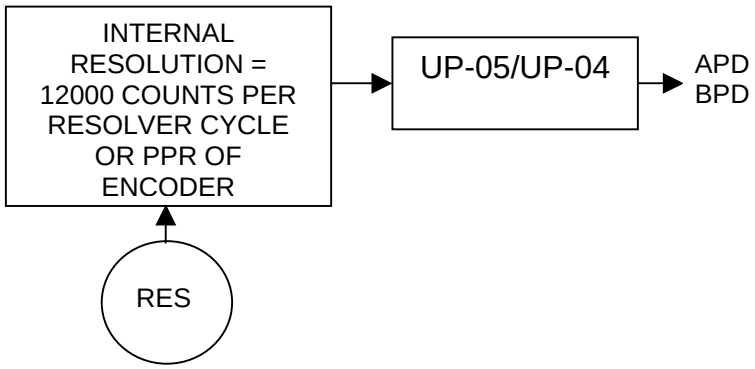
AB QUADRATURE DECODING (UP-19 = 11) where BPD leads APD for CCW motor rotation. Maximum frequency of APD and BPD is 100 KHZ. This mode simulates an encoder output being read as 4X.



14.2.3 SETTING THE RESOLUTION OF THE PULSE OUTPUTS

The feedback resolver in the motor determines the internal resolution of the Delta S driver. The driver resolution is 12000 counts per resolver electrical cycle. The Delta motors have one cycle (1X), two cycle (2X) or three cycle (3X) resolvers. (i.e. a 2X resolver has 2 electrical cycles per 1 rotation of the motor shaft). Delta driver can also have various encoder options with a different number of pulses per motor revolution (PPR).

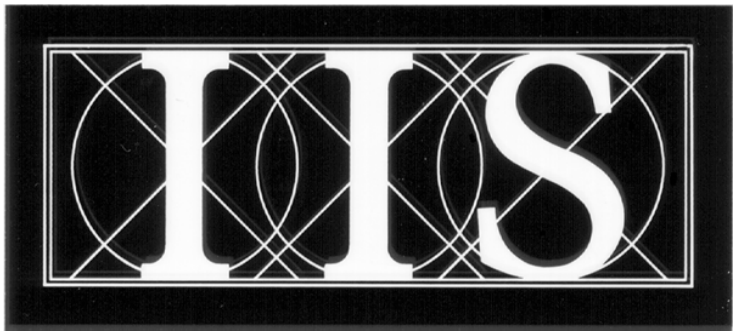
The resolution of the pulse outputs is set by parameters UP-04 and UP-05.



Example: It is desired to output 8192 pulses/revolution of the motor shaft. A motor with a 2x resolver would have an internal resolution of 2 x 12000 = 24000 counts/rev of the motor. The internal driver resolution must be multiplied by 8192/24000. Set UP-04 to 24000 and UP-05 to 8192. Any ratio equivalent to 8192/24000 will also work like 4096/12000, 128/375, etc.

APPENDIX A (MOTOR/DRIVER SPECIFICATIONS) AND **APPENDIX B** (CABLES AND ACCESSORIES) DOCUMENTS ARE SAVED UNDER **IB-19B001**.

IB-19B007



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