SLO-SYN® SS2000-DP4 TRANSLATOR/DRIVE INSTALLATION AND OPERATION INSTRUCTIONS

Superior Electric

ENGINEERING CHANGES

Superior Electric reserves the right to make engineering refinements on all its products. Such refinements may affect information given in instructions, Therefore, **USE ONLY THE INSTRUCTIONS THAT ARE PACKED WITH THE PRODUCT.**

RECORD OF REVISION		
Revision	Date	Description
A	2/9/98	Initial Release
B	8/18/00	Update corporate id.

TABLE OF CONTENTS

THINGS TO KNOW BEFORE USING THIS EQUIPMENT

Only qualified personnel should install or perform servicing procedures on this equipment.

Before performing any work on the unit, allow at least five minutes for the capacitors to discharge fully.

Voltage is present on unprotected pins when unit is operational.

Motors powered by this drive may develop extremely high torque. Be sure to disconnect power to this drive before doing any mechanical work.

WARRANTY INFORMATION

Reconfiguration of the circuit in any fashion not shown in this manual will void the Warranty.

Failure to follow the installation guidelines as described in Section 3 will void the Warranty.

SECTION 1: INTRODUCTION

1.1 USING THIS MANUAL

It is important that you understand how this SLO-SYN SS2000-DP4 Translator/Drive is installed and operated before you attempt to use it. **We strongly recommend that you read this manual completely before proceeding with the installation of this unit.**

This manual is an installation and operating guide to the SLO-SYN SS2000-DP4 Translator/Drive. Section 1 gives an overview of the Drive and its features. Section 2 describes the steps necessary to place the drive into operation. General wiring guidelines as well as the physical mounting of the unit and connections to the drive portion are covered in Section 3.

Complete specifications, listed in Section 4, provide easily referenced information concerning electrical, mechanical and environmental specifications. The procedure for setting the motor current level is also covered in this section.

Torque versus speed characteristics with all appropriate SLO-SYN Stepper Motors are given in Section 5. Section 6, Troubleshooting, gives procedures to follow if the Translator/Drive fails to operate properly.

Appendix A provides procedures for troubleshooting electrical interference problems.

1.2 PRODUCT FEATURES

The SLO-SYN SS2000-DP4 Dual Packaged drive system includes two independent stepper motor drives and their motor power supply in a single packaged unit. Each drive is a bipolar, adjustable speed, two-phase PWM circuit which uses hybrid power devices. It can be set to operate a step motor in microstep mode at up to 20,000 microsteps per revolution. The maximum running speed is 3,000 rpm. To reduce the chances of electrical noise problems, the control signals are optically isolated from the drive circuit. Features include:

- Switch selectable current levels of 0.5 through 3.5 amperes
- Choice of either Pulse/Direction or CW / CCW input capability
- Full short circuit protection (phase-to-phase and phase-to-ground)
- Undervoltage and transient overvoltage protection
- Overtemperature Protection
- Efficient thermal design
- Optically isolated inputs
- Windings Off capability
- Automatic Current Reduction (In –MM models)
- Switch selectable step resolution
- Compact size
- Sturdy cabinet with integral mounting flanges

SECTION 2: EXPRESS START UP PROCEDURE

The following instructions define the minimum steps necessary to make your **Drive** operational.

CAUTION:
Always disconnect the power to the unit before connecting or disconnecting the motor leads. FAILURE TO DO THIS WILL RESULT IN A SHOCK HAZARD AND MAY DAMAGE THE DRIVE.

Always operate the unit with the Motor and the Drive enclosure GROUNDED. Be sure to twist together the wires for each motor phase as well as those for the dc input. Six twists per foot (0.3 m) is a good guideline.

1. Check to see that the motor used is compatible with the drive. Refer to Section 4.4 for a list of compatible motors.

2. Set the correct current level for the motor being used per the instructions in Section 4.5.

3. Select the appropriate step resolution and set the switches as described in Section 4.7.

4. Wire the motor and I/O per the "Motor Connections" description in Section 3.3.

Connect the power source to the AC input terminal strip. Be sure to follow the instructions for connecting the jumpers for 115 VAC or 230 VAC as described in Section 3.3, under Power Input.

NOTES: If the motor operates erratically, refer to Section 5, "Torque Versus Speed Characteristics".

Clockwise and counterclockwise directions are properly oriented when viewing the motor from the end opposite the mounting flange.

SECTION 3: INSTALLATION GUIDELINES

3.1 GENERAL WIRING GUIDELINES

SLO-SYN 2000 drives use modern solid-state electronics to provide the features needed for advanced motion control applications. In some cases, these applications produce electromagnetic interference (EMI, or electrical "noise") that may cause inappropriate operation of the digital logic used in the drive, or in any other computer-type equipment in the user's system.

In general, any equipment that causes arcs or sparks or that switches voltage or current at high frequencies can cause interference. In addition, ac utility lines are often "polluted" with electrical noise from sources outside a user's control (such as equipment in the factory next door). Some of the more common causes of electrical interference are:

- power from the utility ac line
- relays, contactors and solenoids
- light dimmers
- arc welders
- motors and motor starters
- induction heaters
- radio controls or transmitters
- switch-mode power supplies
- computer-based equipment
- high frequency lighting equipment
- dc servo and stepper motors and drives

The following wiring practices should be used to reduce noise interference.

Solid grounding of the system is essential. Be sure that there is a solid connection to the ac system earth ground. Bond the drive case to the system enclosure. Use a single-point grounding system for all related components of a system (a "hub and spokes" arrangement). Keep the ground connection short and direct.

Keep signal and power wiring well separated. If possible, use separate conduit or ducts for each. If the wires must cross, they should do so at right angles to minimize coupling.

Note: Power wiring includes ac wiring, motor wiring, etc. and signal wiring includes inputs and outputs (I/O), serial communications (RS232 lines), etc.

Use shielded, twisted-pair cables for Indexer I/O lines. BE SURE TO GROUND SHIELDS ONLY AT ONE END, THE INDEXER/DRIVE END FOR OUTPUTS AND THE SWITCH OR SENSOR END FOR INPUTS.

Suppress all relays to prevent noise generation. Typical suppressors are capacitors or MOV's. (See manufacturer's literature for complete information). Whenever possible, use solid-state relays instead of mechanical contact types to minimize noise generation.

If you are experiencing problems with drive operation which might be related to EMI, refer to Section 6.0 for Troubleshooting pointers.

3.2 MOUNTING

The SLO-SYN Drive is mounted by fastening its mounting brackets to a flat surface as shown in Figure 3.1.

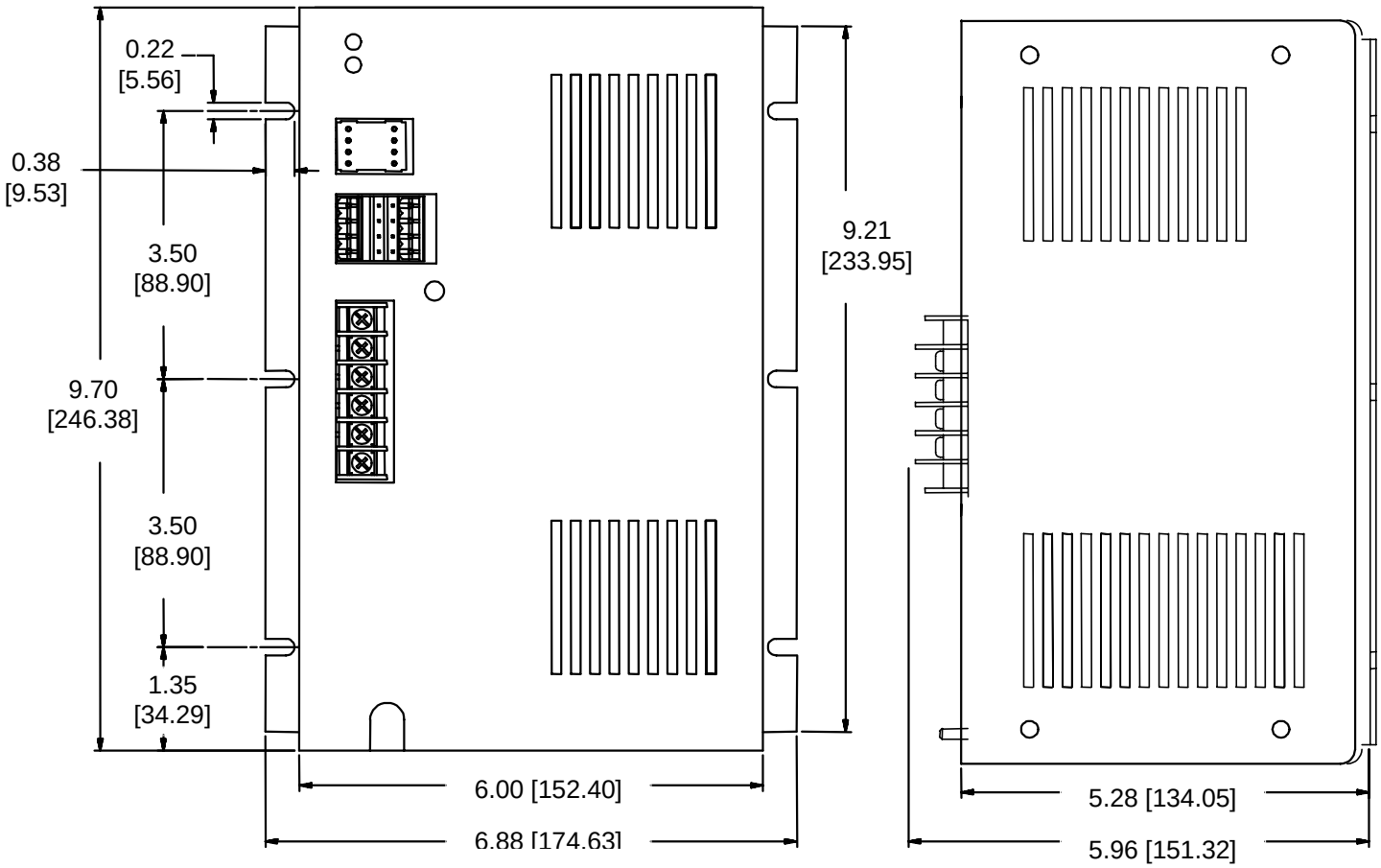


Figure 3.1, Mounting Diagram

NOTE: The unit should be mounted upright so that air flow will not be obstructed. Case temperature should not exceed +70° C (+158° F). Forced air cooling may be required to maintain temperature within the stated limits.

When selecting a mounting location, it is important to leave at least two inches (51mm) of space around the top, bottom and sides of the unit to allow proper airflow for cooling.

It is also important to keep the drive away from obvious electrical noise sources. If possible, locate the drive unit in a metal enclosure to shield it and its wiring from electrical noise sources. If this cannot be done, keep the drive at least three feet from any noise sources.

3.3 CONNECTOR LOCATIONS AND PIN ASSIGNMENTS

Figure 3.2 shows the connector locations for the SS2000DP4 drive.

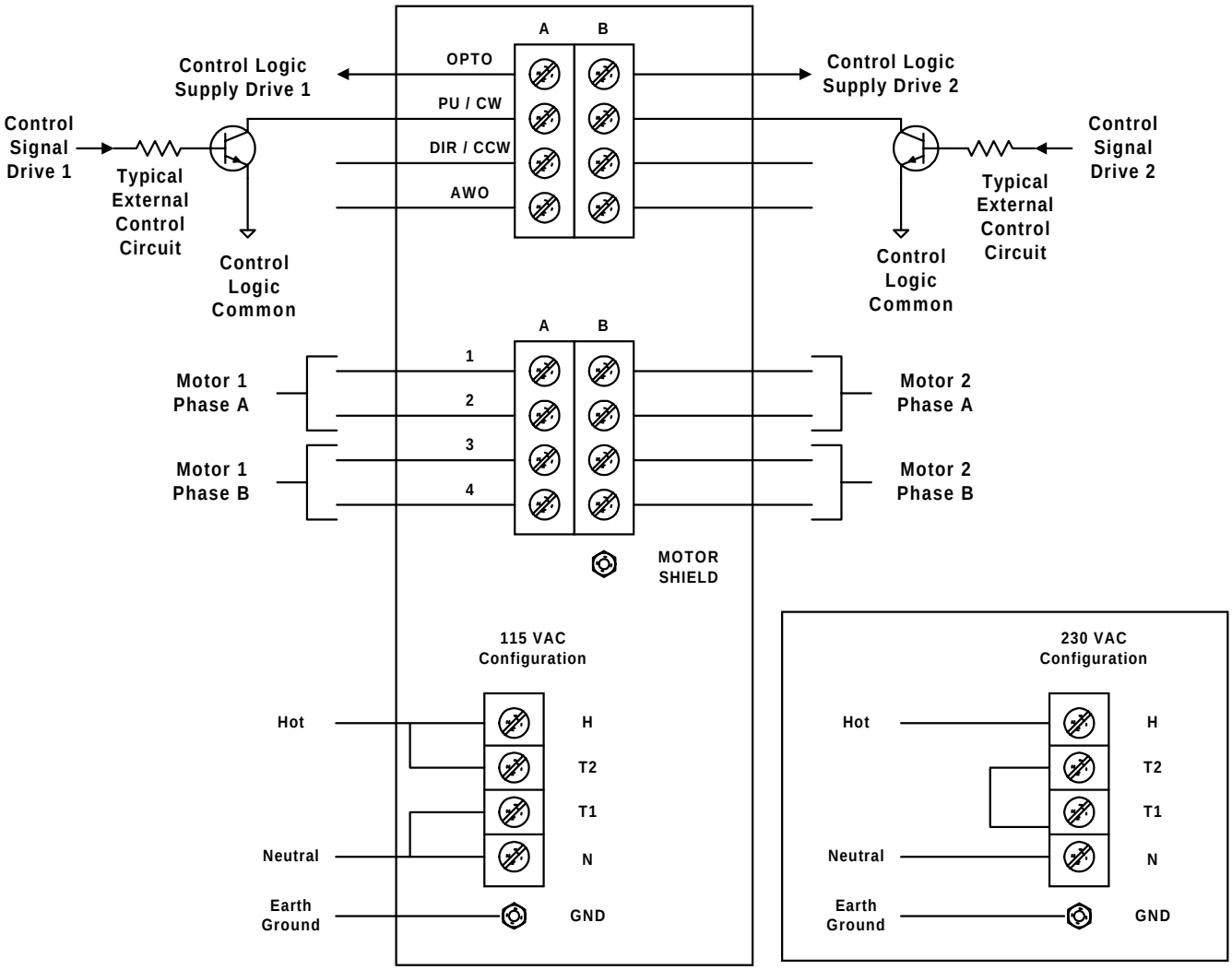


Figure 3.2, Connector Locations and Typical Wiring

MOTOR CONNECTIONS

All motor connections are made via a double row 4-pin connector and ground stud. Pin assignments for this connector are:

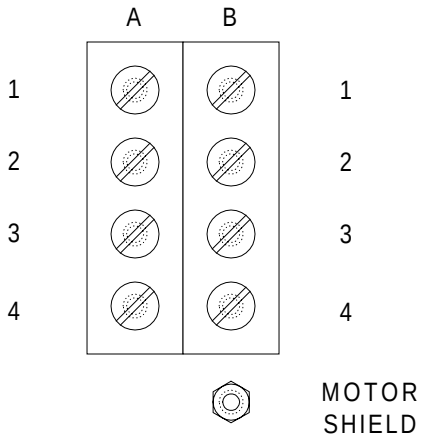


Figure 3.3, Motor Connector

Motor Connection:

Axis A Pin	Assignment	Axis B Pin	Assignment	Motor Leads	Terminals
1	M1 (Phase A)	1	M1 (Phase A)	Red	#1
2	M3 (Phase A)	2	M3 (Phase A)	White/Red	#3
3	M4 (Phase B)	3	M4 (Phase B)	Black	#4
4	M5 (Phase B)	4	M5 (Phase B)	White/Blk	#5
GND Stud	Shield	GND Stud	Shield	Shield	-

NOTE: Motor phase A is M1 and M3 and motor phase B is M4 and M5. The motor frame must be grounded.

Cabling from the drive to the motor should be done with a shielded, twisted pair cable. As a guideline, the wires for each motor phase should be twisted about six times per foot. Terminate the cable shield to the "MOTOR SHIELD" terminal on the DP4 unit case. The recommended maximum cable length is 75 feet.

Superior Electric offers the following motor cable configurations. These cables have unterminated leads on both ends.

Length	**Part Number**
10 ft (3 m)	216022-031
25 ft (7.6 m)	216022-032
50 ft (15.2 m)	216022-033
75 ft (22.8 m)	216022-034

Figure 3.4a shows typical wiring configurations to the motor output terminal block. Figure 3.4b provides motor wiring configurations for 4, 6, and 8 lead motors.

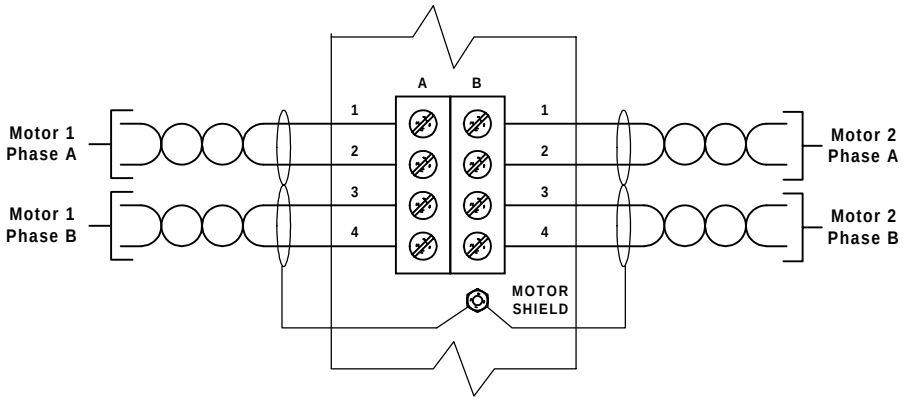
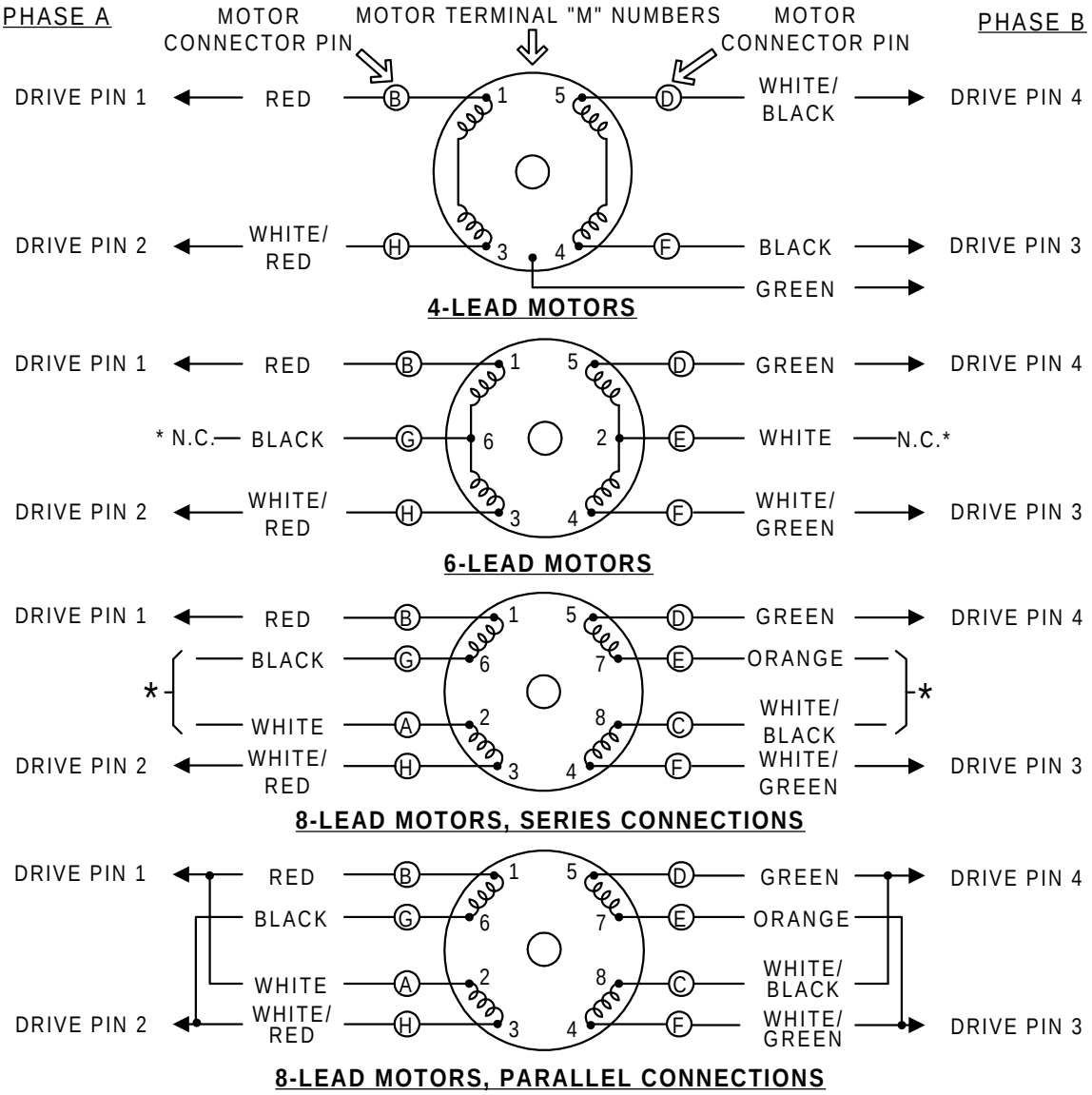


Figure 3.4a, Motor Wiring Configurations



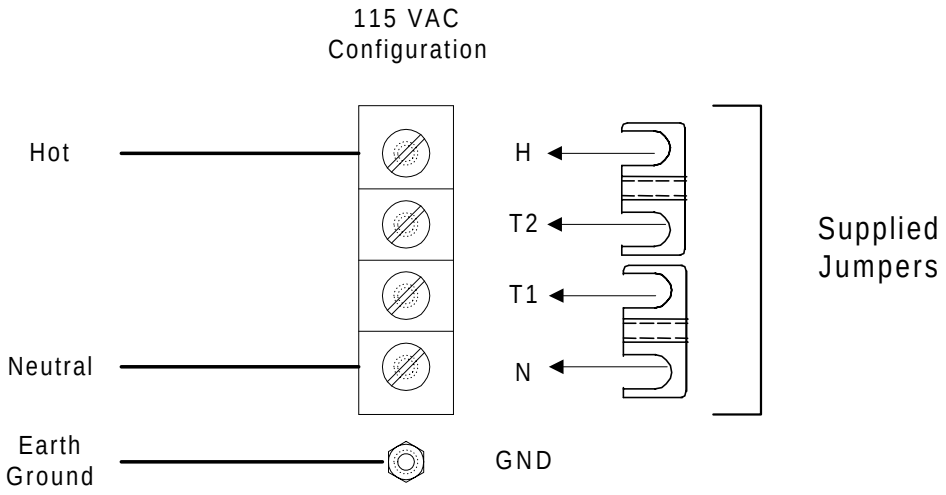
* These leads are NOT connected to drive or ground. These leads must be insulated and isolated or damage to the drive may occur.

Figure 3.4a, Motor Wiring Configurations

POWER INPUT

The ac input power is connected to a 4-screw terminal strip. The terminals are labeled as follows:

Terminal	Lead Color, North American Standard
"H" for Line or "Hot"	Black
"N" for Common or Neutral	White
" " for Ground	Green



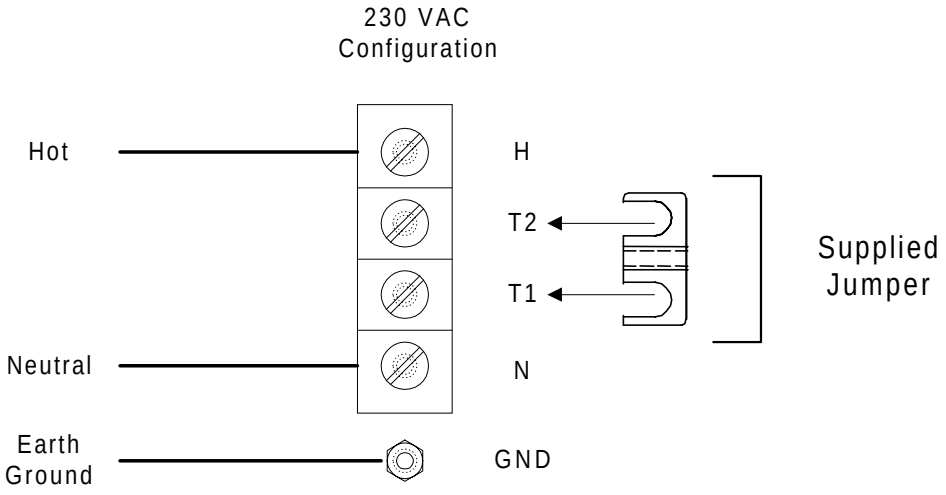


Figure 3.5, AC Input Power Connections

SECTION 4: SPECIFICATIONS

4.1 MECHANICAL SPECIFICATIONS

Size	
(Inches)	9.7 H x 6.875 W x 5.96 D
(mm)	246.38 H x 174.63 W x 151.38 D
Weight	15 pounds (6.8 kg)

4.2 ELECTRICAL SPECIFICATIONS

AC Input Range	115 VAC / 230 VAC ± 10 %
AC Current	2.5 Amps @115 VAC / 1.25 @230 VAC
Drive Power Dissipation	
(Worst Case)	70 watts

4.3 ENVIRONMENTAL SPECIFICATIONS

Temperature:	
Operating	+32° F to +122° F (0° C to +50° C) free air ambient,
Storage	-40° F to +167° F (-40° C to +75° C)
Humidity	95% max. noncondensing
Altitude	10,000 feet (3048 m) max.

4.4 MOTOR COMPATIBILITY

Motor Types	Superior Electric M and KM Series
Frame Sizes	M061 (NEMA 23D) through M092 (NEMA 34)
	KML060 (NEMA 23D mounting)
	through KML092 (NEMA 34 mounting)
Number of Connections	4, 6, 8
Minimum Inductance	0.5 millihenry
Maximum Resistance	= 0.25 x 32/I Setting

NOTE: Maximum resistance is total of motor plus cable. I Setting = drives current setting in amperes (see Section 4.5)

CAUTION: Do not use larger frame size motor than those listed, or the drive may be damaged. If a larger frame size motor must be used, consult the factory for recommendations.

MOTORS FOR USE WITH THE SS2000DP4 DUAL PACKAGED DRIVE SYSTEM

Motor	Winding	Connection	Current Setting* (Amperes)	Power Supply Current	
				Standstill (Amps. DC)	Maximum (Amps. DC)
M061	08	Series	2.5	1.0	2.0
M061	08	Parallel	3.5	1.0	2.0
M062	09	Series	3.0	1.0	2.5
M062	09	Parallel	3.5	1.0	3.5
M063**	09	Series	3.0	1.5	2.0
M063**	09	Parallel	3.5	1.0	3.5
M091	09	Series	3.0	1.0	1.5
M091	09	Parallel	3.5	1.0	3.0
M092	09	Series	3.0	1.5	2.0
M092	09	Parallel	3.5	1.0	3.0
KML061F05	-	-	2.5	1.2	1.5
KML061F11	-	-	3.5	1.0	3.0
KML062F07	-	-	3.0	1.0	2.5
KML062F13	-	-	3.5	1.0	4.0
KML063F07	-	-	3.0	1.5	2.0
KML063F13	-	-	3.5	1.0	4.0
KML091F07	-	-	3.0	1.0	2.0
KML091F13	-	-	3.5	1.0	4.0
KML092F07	-	-	3.0	1.5	2.5
KML092F13	-	-	3.5	1.0	4.0
KML093F07	-	-	3.5	1.8	2.5

* See Section 4.5 for instructions on setting drive current.

** M063 motors are discontinued and should not be incorporated into new designs. They can be provided to support existing systems.

Power supply currents shown are measured at the output of the rectifier bridge in Figure 3.4a.

Figures 3.4a and 3.4b in Section 3.3 provide motor connection information for the motors listed above.

M061, M062 and M063 motors listed include LS, LE, CS, FC and FD versions. M091 and M092 motors include FC and FD versions with 6 or 8 leads. All KML motors listed have 4 leads. Motors with windings other than those listed can be used as long as the current ratings listed on the motors are not exceeded.

4.5 CURRENT SETTINGS

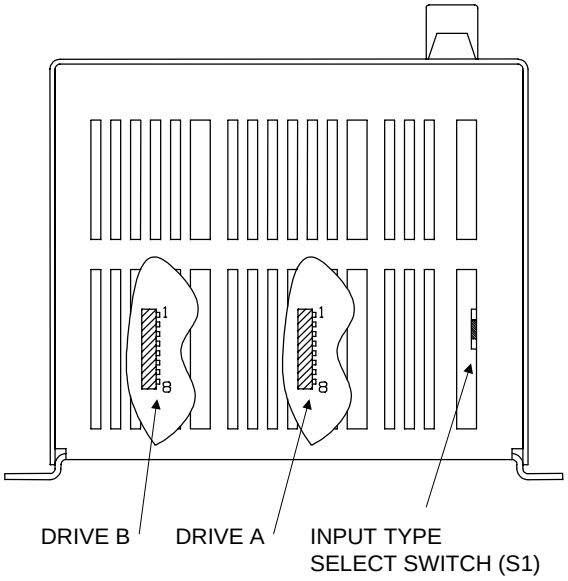
The proper current setting for each motor is shown on the individual torque vs. speed curves. Use this current level to obtain the torque shown. The current setting dip switch for each drive is located on the top of the unit. (See figure below) Be sure to set each according to the motor table in section 4.4 Dip switch positions 1 through 7 are used to select the current level. Select the desired operating current by setting the appropriate switch to 1 (ON). The OFF setting is labeled "0". Only one switch should be ON. If two or more switches are ON, the one which selects the highest current level will be the active switch. The switch settings are as follows:

4.5.1 CURRENT SETTINGS for F Drive

Position	Current (amperes)
None	0.5
1	0.75
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5

4.5.2 CURRENT SETTINGS for M Drive

Position	Current (amperes)
None	1.0
1	1.5
2	2.0
3	2.5
4	3.0
5	3.5



4.6 AUTOMATIC CURRENT REDUCTION on M Drives only

When switch #6 is in the OFF position, the current at standstill goes to 50% of the selected level. This occurs between 1 and 2 seconds after the last pulse is received. When switch #6 is in the ON position, the current at standstill remains at full value.

4.7 STEP RESOLUTION

4.7.1 STEP RESOLUTION – F Drive

The number of pulses per revolution is selected using position 8 of the switch described in Section 4.5.1. The following chart shows the correct switch setting for each available step resolution.

Switch Position 8	Step Resolution	Pulses Per Revolution
0 (off)	Full-Step	200
1 (on)	Half-Step	400

4.7.2 STEP RESOLUTION – M Drive

The number of pulses per revolution is selected using positions 7 and- 8 of the switch described in Section 4.5.2. The following chart shows the correct switch setting for each available step resolution.

Switch Position		Step Resolution	Pulses PerRevolution
7	8		
0 (OFF)	0 (OFF)	1/2	400
1 (ON)	0 (OFF)	1/10	2,000
0 (OFF	1 (ON)	1/25	5,000
1 (ON)	1 (ON)	1/100	20,000

4.8 SIGNAL SPECIFICATIONS

4.8.1 Terminal Assignments

All connections are made via the 4-pin terminal strip.

Pin	Assignment
1	OPTO
2	PULSE/CW
3	DIR/CCW
4	AWO

4.8.2 Signal Descriptions

OPTO Opto-Isolator Supply
User supplied power for the opto-isolators. (See Section 4.8.3 for level requirements)

PULSE / CW Direction, Pulse Input
In Pulse/Direction mode a low to high transition on this terminal advances the motor one step. The step size is determined by the Step Resolution switch setting. In CW/CCW mode a pulse on this input will cause the motor to move one step clockwise.

DIR / CCW Direction, Pulse Input
When this signal is high, in Pulse/Direction mode , motor rotation will be clockwise. Rotation will be counterclockwise when this signal is low. In the CW/CCW mode a pulse on this input will cause the motor to move one step counter-clockwise.

Note: Clockwise and counterclockwise directions are properly oriented when viewing the motor from the end opposite the mounting flange.

AWO All Windings Off Input
When this signal is low, AC and DC current to the motor will be zero. **Caution: There will be no holding torque when the AWO signal is low.**

NOTE: If you are using the drive with an SS2000I or SS2000I-V control, the READY input and the OPTO input on the control must be jumpered together.

4.8.3 Level Requirements

OPTO
- Voltage ..... 4.5 to 6.0 volts dc
- Current ..... 16 mA per signal used

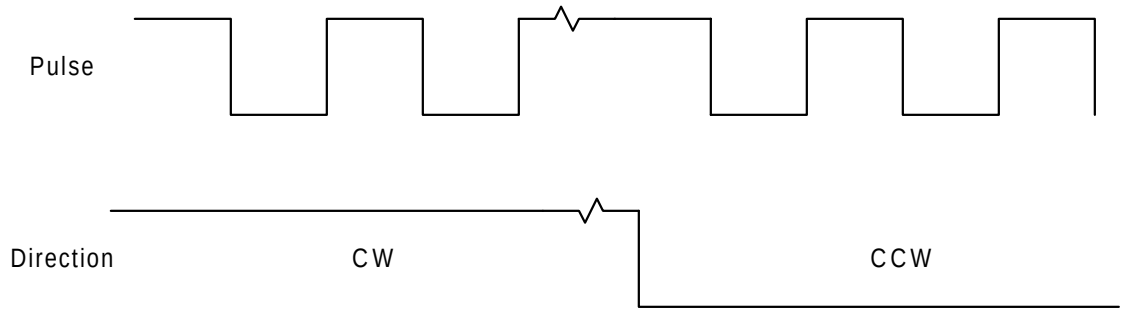
Other Signals
- Voltage ..... Low 0.8 Vdc 0.0 Vdc
  High OPTO - 1 volt
- Current ..... Low 16 mA
  High 0.2 mA

4.8.4 Timing Requirements

PULSE	F Drive	M Drive
Max. Frequency	20 kHz	500 kHz
Max. Rise And Fall Times	1 microsecond	1 microsecond
Min. Pulse Width	25 microseconds	1 microsecond
Other Signals:.....Response Time	25 microseconds	50 microseconds

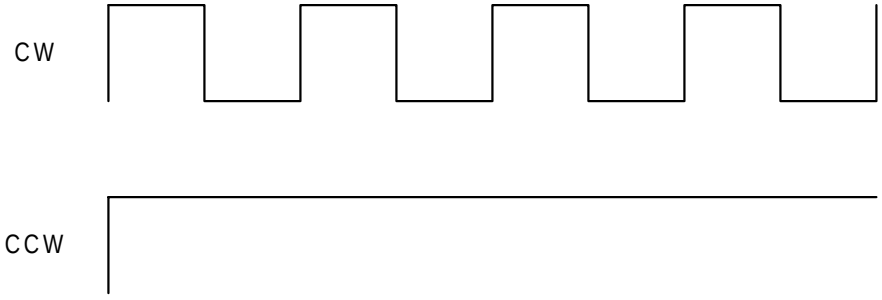
4.8.5 Pulse and Direction / CW - CCW Option

Switch S1 on the top of the unit allows the selection of either a pulse and direction signal into the drives or a CW / CCW input. If a pulse and direction signal is to be used, the switch should be placed into the PU / DIR position. A diagram of this type of control signal is shown below where the signals are seen at the pins of the drive. If the direction signal is high the motor will rotate clockwise as seen from the end of the motor away from the mounting flange. If the direction line is low the drive will rotate in the counter-clockwise direction as seen from the end away from the motor flange.

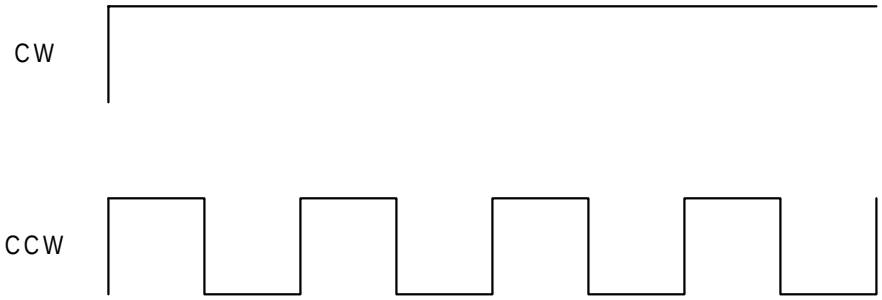


If a CW / CCW signal is being fed into the drive, **the inputs must be high during power up** to ensure proper operation. A diagram of this type of control signal is shown below where the signals are seen at the pins of the drive. For the motor to rotate in the clockwise direction, pulses a placed on the CW input and the CCW input is held high. If counter-clockwise rotation is desired, pulses are applied to the CCW input and the CW input is held high. **Max. input frequency for the CW / CCW mode of operation is 100kHz, all other timing requirements are the same as in section 4.8.4.**

Clockwise Rotation



Counter-clockwise Rotation



4.9 INDICATOR LIGHTS

“POWER” LED, Red
Indicates that AC power has been applied to the drives.

"FAULT" LED's, Red
Lights to indicate over current condition. This condition is caused by motor wiring errors or a ground fault. Recovery from over current condition requires removing and then reapplying the power. These LED's are located on the individual drive boards and are visible through the top of the unit.

“OVER TEMP” LED, Red
Shows that the internal heatsink temperature is ≥ 75 °C.
This is a latched function, therefore to reset the drive power must be cycled and internal heatsink temperature must be < 75 °C.

SECTION 5: TORQUE VERSUS SPEED CHARACTERISTICS

5.1 MOTOR PERFORMANCE

All stepper motors exhibit instability at their natural frequency and harmonics of that frequency. Typically, this instability will occur at speeds between 50 and 1000 full steps per second and, depending on the dynamic motor load parameters, can cause excessive velocity modulation or improper positioning. This type of instability is represented by the open area at the low end of each Torque vs. Speed curve.

There are also other instabilities which may cause a loss of torque at stepping rates outside the range of natural resonance frequencies. One such instability is broadly defined as mid-range instability. Usually, the damping of the system and acceleration/deceleration through the resonance areas aid in reducing instability to a level that provides smooth shaft velocity and accurate positioning. If instability does cause unacceptable performance under actual operating conditions, the following techniques can be used to reduce velocity modulation.

1) Avoid constant speed operation at the motor's unstable frequencies. Select a base speed that is above the motor's resonant frequencies and adjust acceleration and deceleration to move the motor through unstable regions quickly.

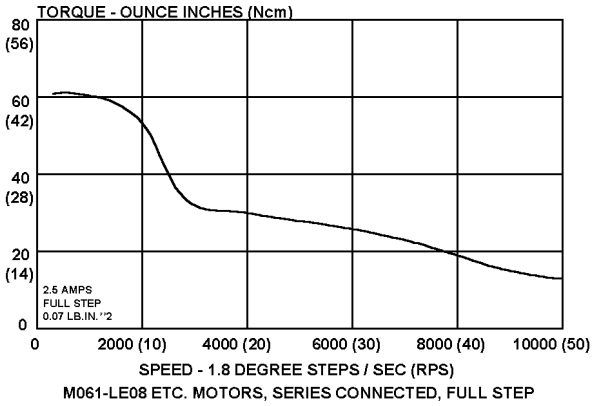
2) The motor winding current can be reduced as described in Section 4.5. Lowering the current will reduce torque proportionally. The reduced energy delivered to the motor can decrease velocity modulation.

3) Using another step resolution may provide smoother operation and reduce the effects of mid range instability. Note that microstepping changes the shaft speed for a given pulse input rate.

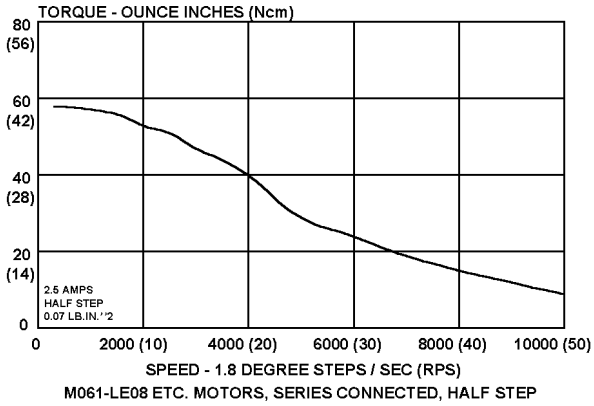
5.2 TYPICAL TORQUE VERSUS SPEED CURVES

NOTE: The test conditions used when obtaining the torque versus speed data are listed in the lower left-hand corner of each curve.

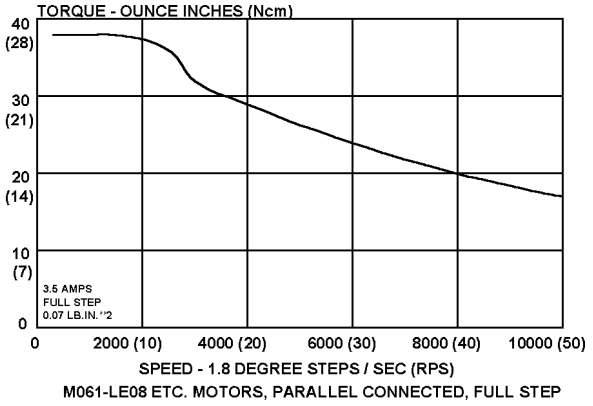
F DRIVE TORQUE Vs. SPEED CURVES



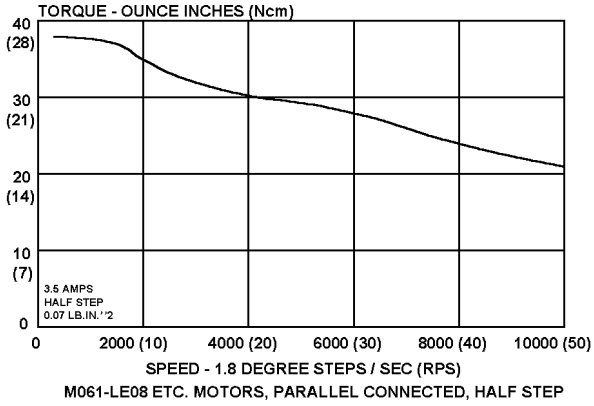
M061-LE08 ETC. MOTORS, SERIES CONNECTED, FULL STEP



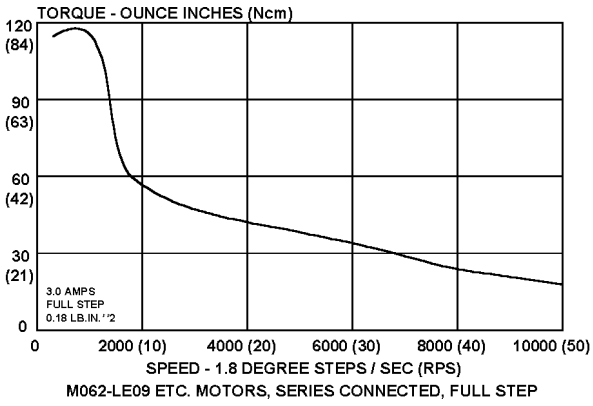
M061-LE08 ETC. MOTORS, SERIES CONNECTED, HALF STEP



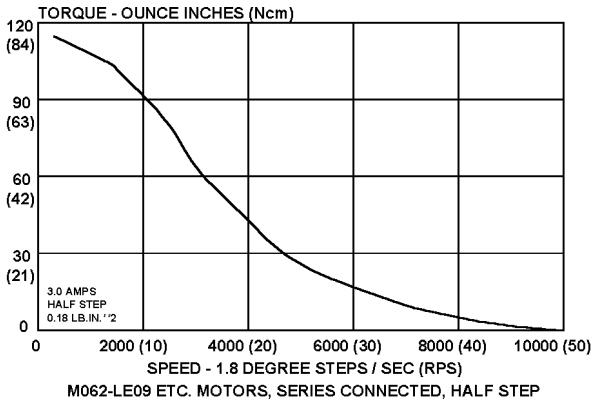
M061-LE08 ETC. MOTORS, PARALLEL CONNECTED, FULL STEP



M061-LE08 ETC. MOTORS, PARALLEL CONNECTED, HALF STEP

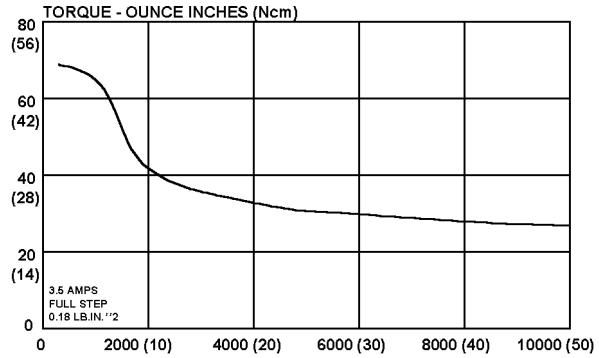


M062-LE09 ETC. MOTORS, SERIES CONNECTED, FULL STEP

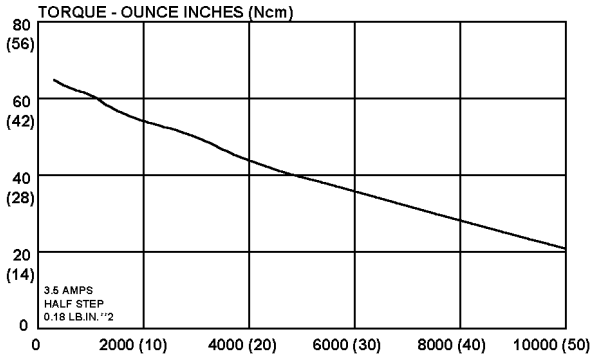


M062-LE09 ETC. MOTORS, SERIES CONNECTED, HALF STEP

F DRIVE TORQUE Vs. SPEED CURVES (cont.)



M062-LE09 ETC. MOTORS, PARALLEL CONNECTED, FULL STEP



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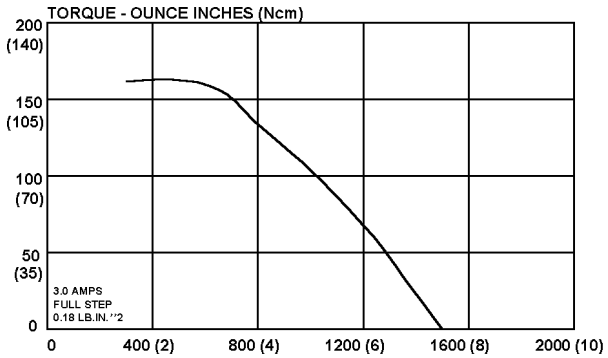

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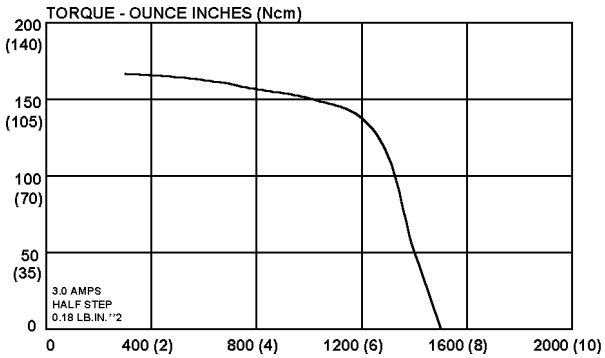

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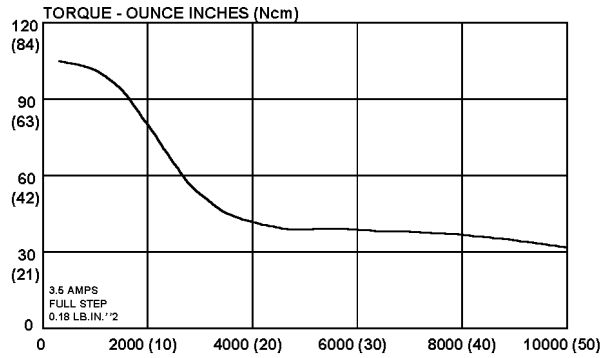

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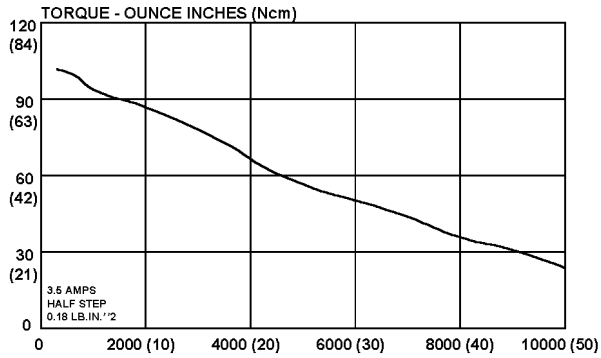
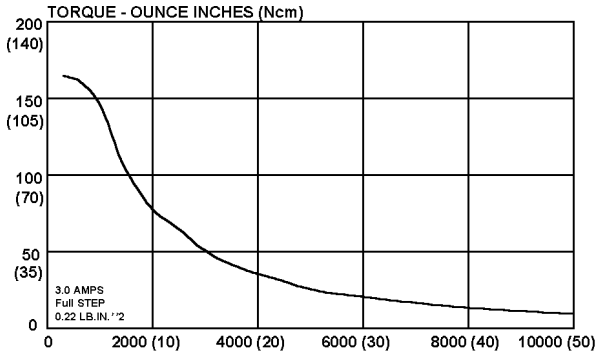


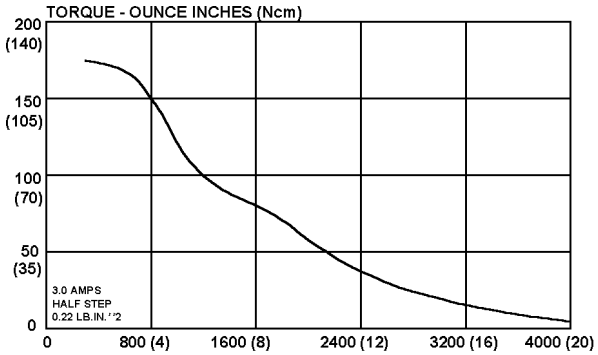
M063-LE09 ETC. MOTORS, PARALLEL CONNECTED, HALF STEP *

* M063 motors are discontinued and should not be incorporated into new designs. They can be provided to support existing systems.

F DRIVE TORQUE Vs. SPEED CURVES (cont.)



M091-FD8109 MOTOR, SERIES CONNECTED, FULL STEP



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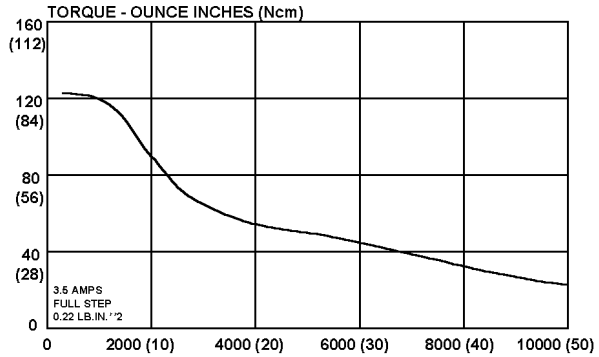

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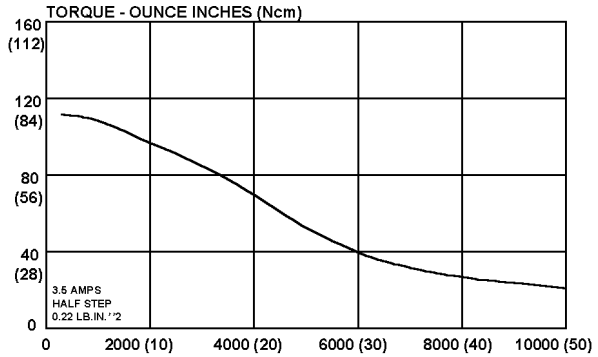

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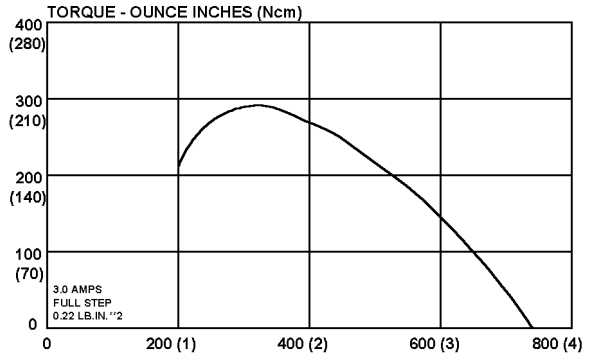

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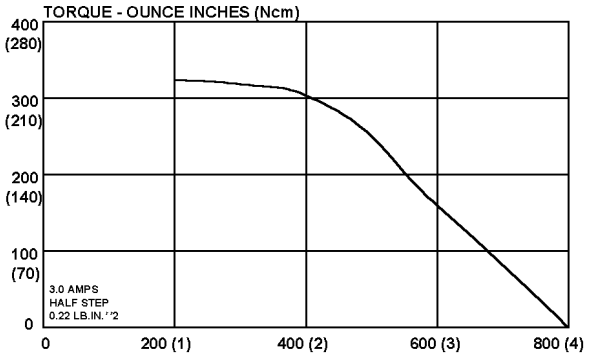
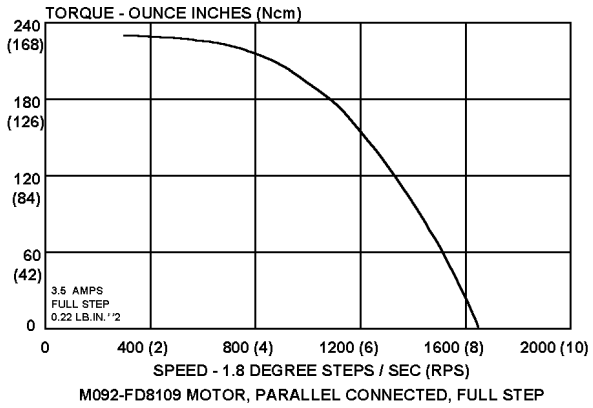


M092-FD8109 MOTOR, SERIES CONNECTED, HALF STEP

F DRIVE TORQUE Vs. SPEED CURVES (cont.)



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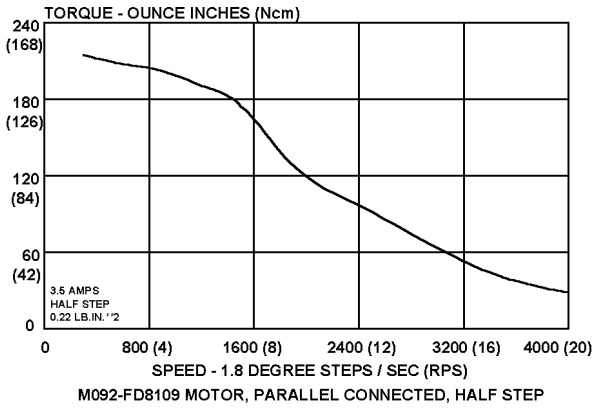

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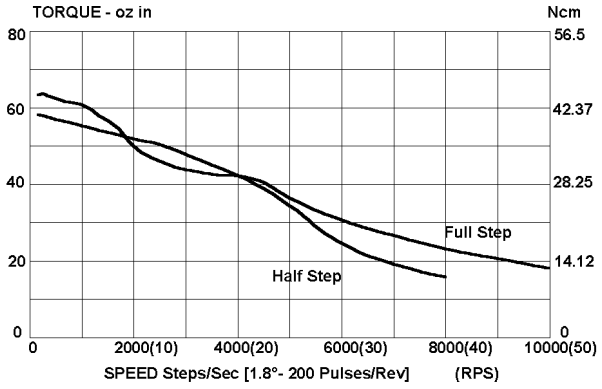

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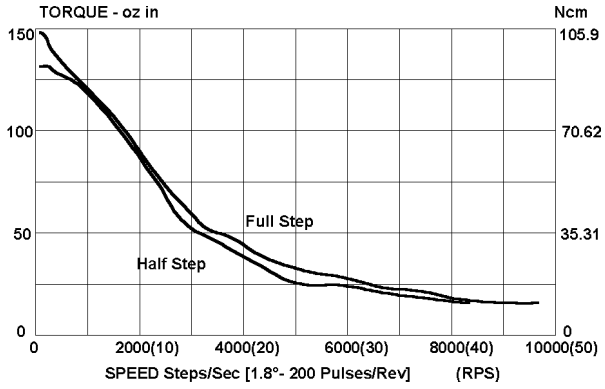

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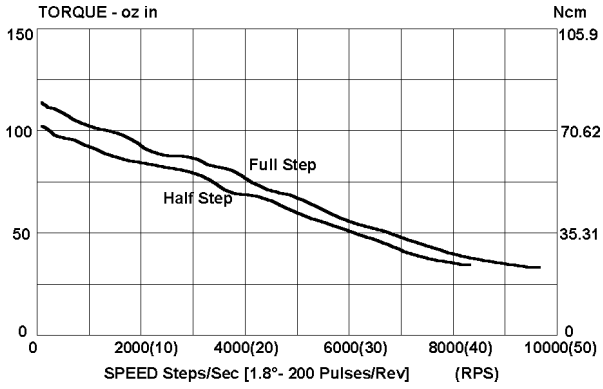

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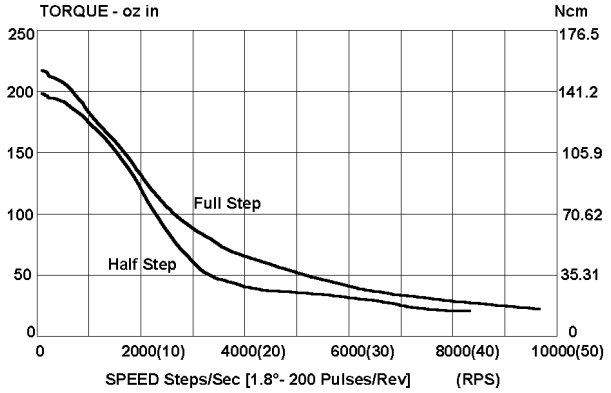

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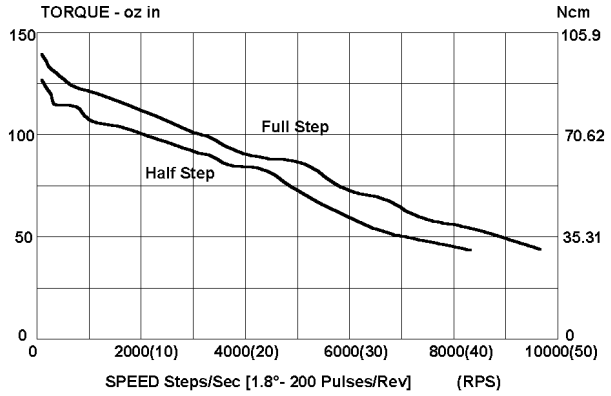
F DRIVE TORQUE Vs. SPEED CURVES (cont.)



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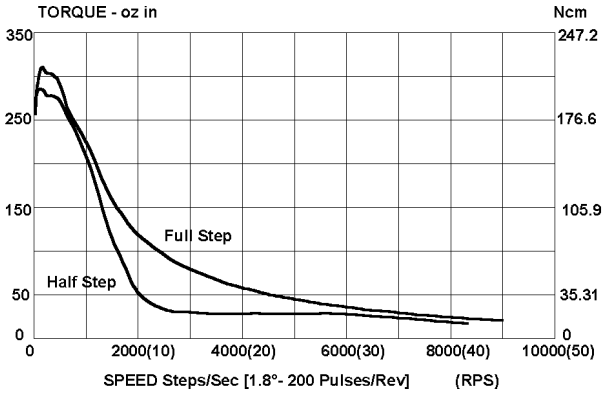

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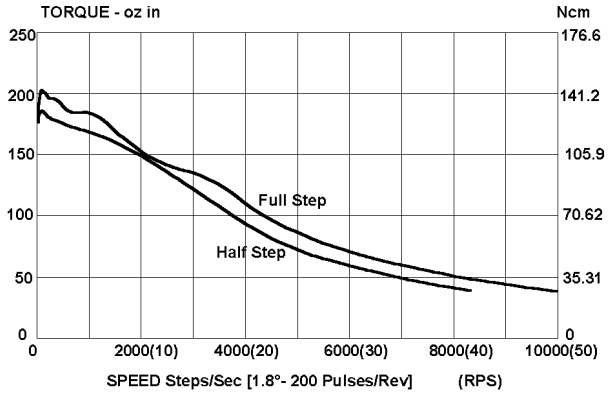

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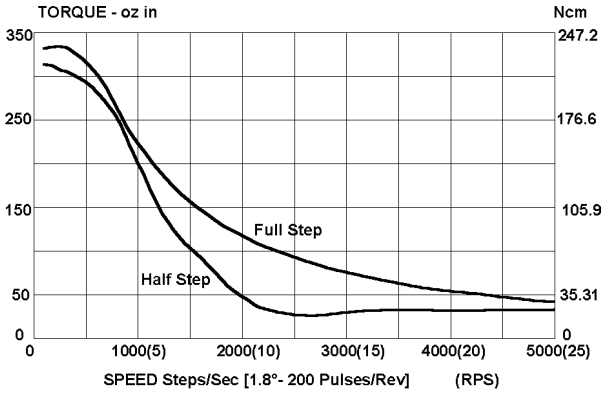

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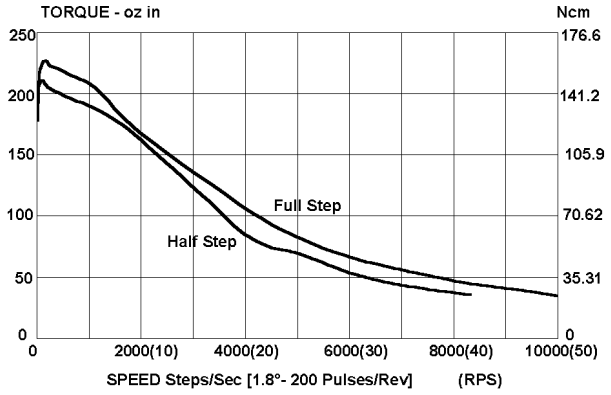

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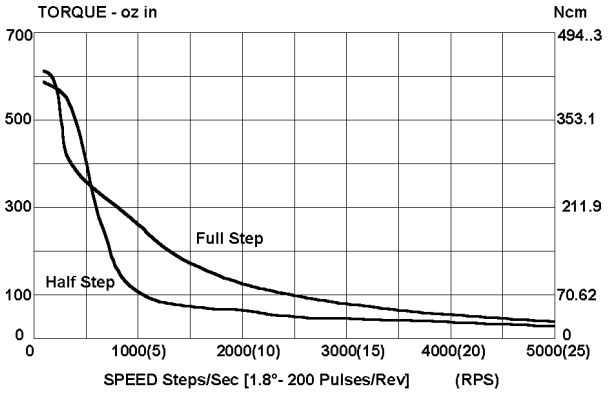

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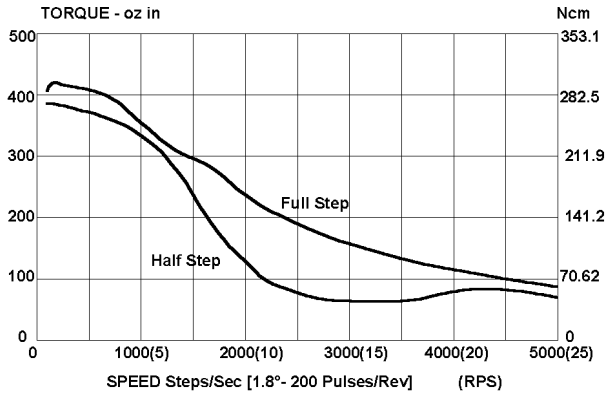
F DRIVE TORQUE Vs. SPEED CURVES (cont.)



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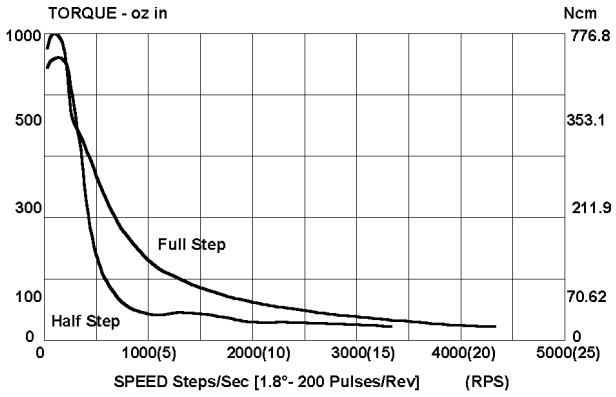

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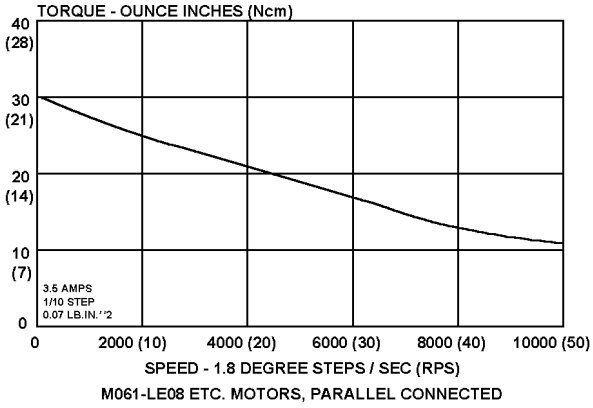
M DRIVE TORQUE Vs. SPEED CURVES



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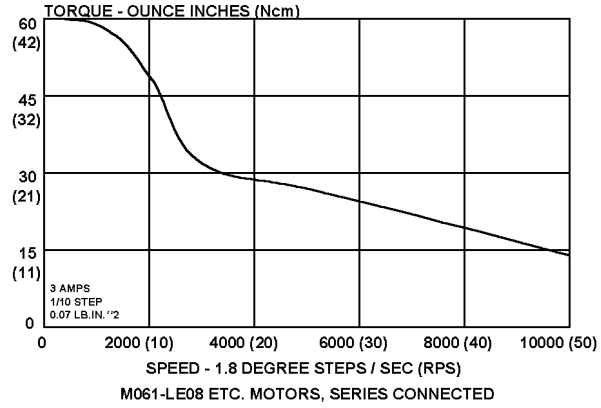
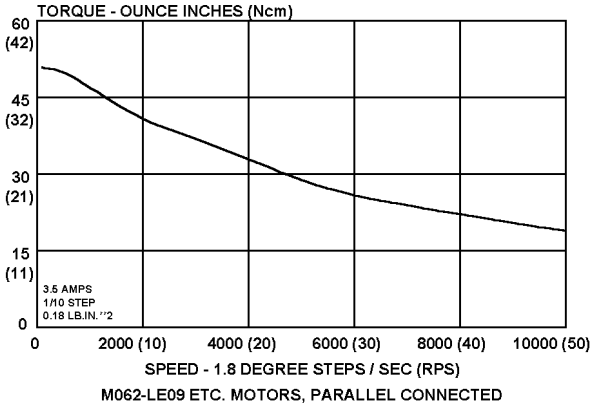


M061-LE08 ETC. MOTORS, SERIES CONNECTED



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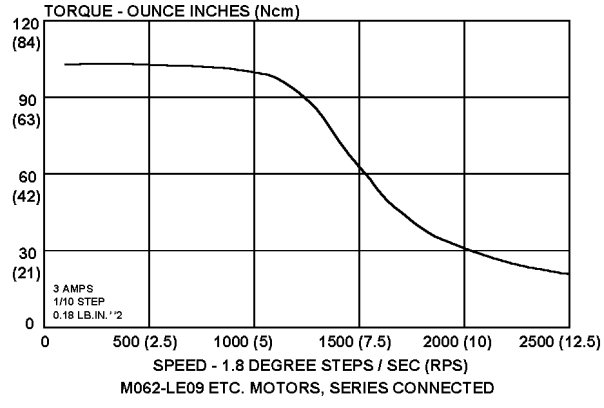
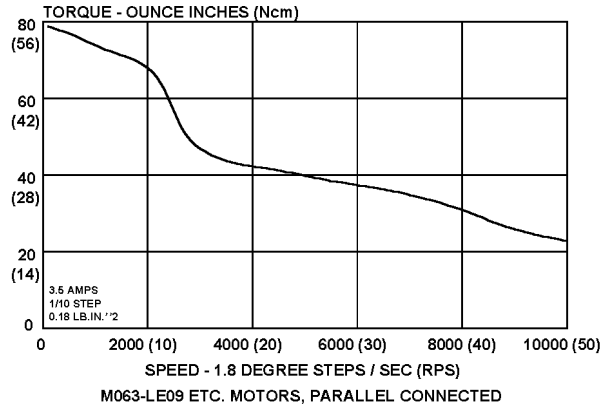


M062-LE09 ETC. MOTORS, SERIES CONNECTED

M DRIVE TORQUE Vs. SPEED CURVES (cont.)



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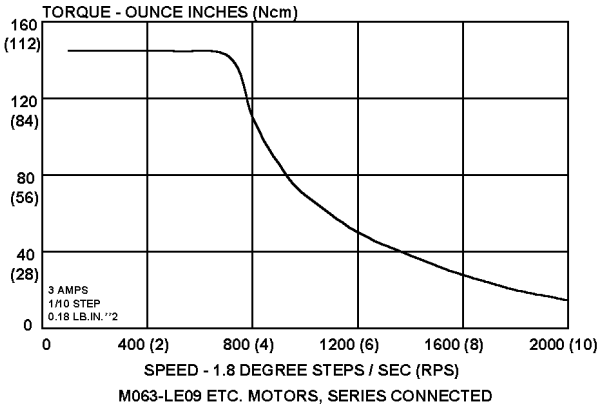

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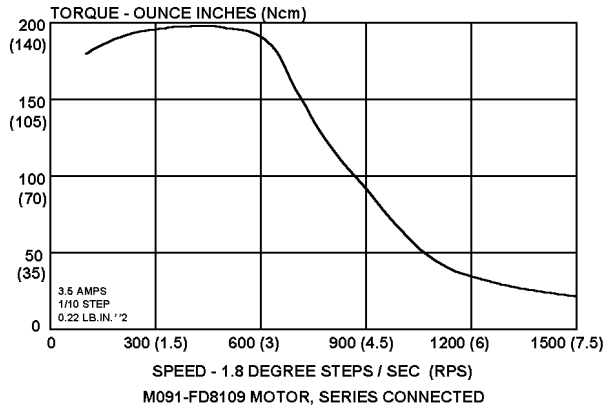
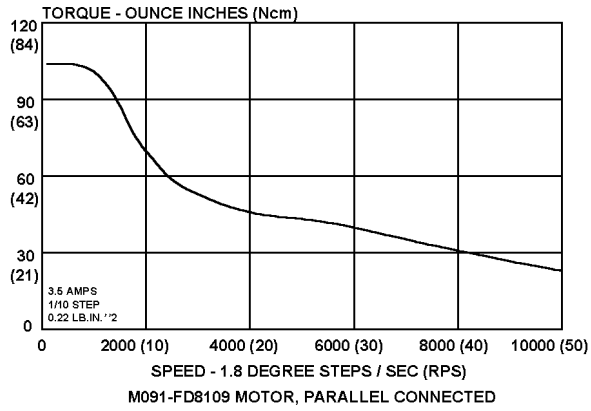
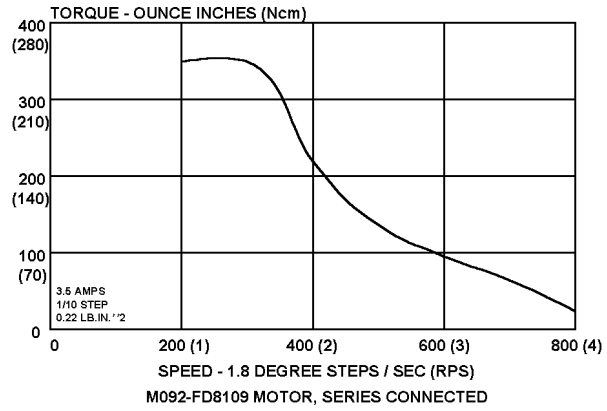


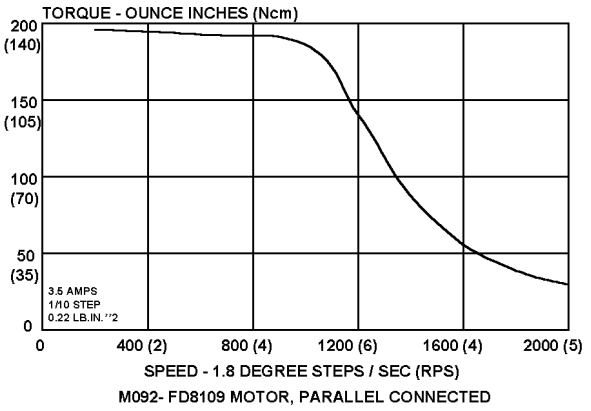
M091-FD8109 MOTOR, SERIES CONNECTED



M091-FD8109 MOTOR, PARALLEL CONNECTED



M092-FD8109 MOTOR, SERIES CONNECTED



M092- FD8109 MOTOR, PARALLEL CONNECTED

SECTION 6: TROUBLESHOOTING

WARNING:

Motors connected to this drive can develop high torque and large amounts of mechanical energy.

Keep clear of the motor shaft and all parts mechanically linked to the motor shaft.

Turn off all power to the drive before performing work on parts mechanically coupled to the motor.

If installation and operating instructions have been followed carefully, this unit should operate correctly. If the motor fails to step properly, the following checklist will be help locate and correct the problem.

In General:

Check all installation wiring carefully for wiring errors or poor connections.

Check to see that the proper voltage levels are being supplied to the unit.

Be sure that the motor is a correct model for use with this unit.

Check that the controller supplying PULSE and DIR or CW/CCW signals is operating correctly and that its output specifications are compatible with the DP4's input requirements.

Specifically:

IF MOTOR DIRECTION IS REVERSED, Check For:

Reversed connections to the Motor Connector. Reversing the phase A **or** the phase B connections will reverse the direction of motor rotation.

IF THE MOTOR MOTION IS ERRATIC, Check For:

Supply voltage out of tolerance.

Improper motion parameters (low speed, acceleration/deceleration, jog speed, home speed and feed rate). Set parameters on controller supplying pulse input to drive.

Bad PULSE/DIR or CW/CCW input signals.

IF TORQUE IS LOW, Check For:

All Windings Off active.

Correct current setting.

Improper supply voltage.

IF "FAULT" INDICATOR IS LIT, Check For:

Improper motor wiring

Grounded or shorted wiring to the motor or shorted motor

Improper motor type or incorrect Current Select switch setting

If a malfunction occurs that cannot be corrected by making the preceding checks, contact Superior Electric.

APPENDIX A: TROUBLESHOOTING ELECTRICAL INTERFERENCE PROBLEMS

Electrical interference problems are common with today's computer based controls, and such problems are often difficult to diagnose and cure. If such a problem occurs with your system, the following checks should be made to locate the cause of the problem.

1. Check the quality of the ac line voltage using an oscilloscope and a line monitor, such as the Superior Electric VMS series. If line voltage problems exist, use appropriate line conditioning, such as line filters or isolation transformers.

2. Be certain proper wiring practices are followed for location, grounding, wiring and relay suppression. Refer to Section 3.1.

3. Double check the grounding connections to be sure they are good electrical connections and are as short and direct as possible.

4. Try operating the drive with all suspected noise sources switched off. If the drive functions properly, switch the noise sources on again, one at a time, and isolate which ones are causing the interference problems. When a noise source is located, try rerouting wiring, suppressing relays or other measures to eliminate the problem.

APPENDIX B: SS2000DP4 MODEL NUMBERS

SS2000DP4-__ __

FF	-	2 Full-step drives
MM	-	2 Micro-step drives
FM	-	1 Full-step drive (Drive A) and 1 Micro-step drive (Drive B)

WARRANTY AND LIMITATION OF LIABILITY

Superior Electric (the "Company"), Bristol, Connecticut, warrants to the first end user purchaser (the "purchaser") of equipment manufactured by the Company that such equipment, if new, unused and in original unopened cartons at the time of purchase, will be free from defects in material and workmanship under normal use and service for a period of one year from date of shipment from the Company's factory or a warehouse of the Company in the event that the equipment is purchased from the Company or for a period of one year from the date of shipment from the business establishment of an authorized distributor of the Company in the event that the equipment is purchased from an authorized distributor.

THE COMPANY'S OBLIGATION UNDER THIS WARRANTY SHALL BE STRICTLY AND EXCLUSIVELY LIMITED TO REPAIRING OR REPLACING, AT THE FACTORY OR A SERVICE CENTER OF THE COMPANY, ANY SUCH EQUIPMENT OR PARTS THEREOF WHICH AN AUTHORIZED REPRESENTATIVE OF THE COMPANY FINDS TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP UNDER NORMAL USE AND SERVICE WITHIN SUCH PERIOD OF ONE YEAR. THE COMPANY RESERVES THE RIGHT TO SATISFY SUCH OBLIGATION IN FULL BY REFUNDING THE FULL PURCHASE PRICE OF ANY SUCH DEFECTIVE EQUIPMENT. This warranty does not apply to any equipment which has been tampered with or altered in any way, which has been improperly installed or which has been subject to misuse, neglect or accident.

THE FOREGOING WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, and of any other obligations or liabilities on the part of the Company; and no person is authorized to assume for the Company any other liability with respect to equipment manufactured by the Company. The Company shall have no liability with respect to equipment not of its manufacture. **THE COMPANY SHALL HAVE NO LIABILITY WHATSOEVER IN ANY EVENT FOR PAYMENT OF ANY INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCLUDING, WITHOUT LIMITATION, DAMAGES FOR INJURY TO ANY PERSON OR PROPERTY.**

Written authorization to return any equipment or parts thereof must be obtained from the Company. The Company shall not be responsible for any transportation charges.

IF FOR ANY REASON ANY OF THE FOREGOING PROVISIONS SHALL BE INEFFECTIVE, THE COMPANY'S LIABILITY FOR DAMAGES ARISING OUT OF ITS MANUFACTURE OR SALE OF EQUIPMENT, OR USE THEREOF, WHETHER SUCH LIABILITY IS BASED ON WARRANTY, CONTRACT, NEGLIGENCE, STRICT LIABILITY IN TORT OR OTHERWISE, SHALL NOT IN ANY EVENT EXCEED THE FULL PURCHASE PRICE OF SUCH EQUIPMENT.

Any action against the Company based upon any liability or obligation arising hereunder or under any law applicable to the sale of equipment, or the use thereof, must be commenced within one year after the cause of such action arises.

Distribution Coast-To-Coast and International

Superior Electric motion control products are available worldwide through an extensive authorized distributor network. These distributors offer literature, technical assistance and a wide range of models off the shelf for fastest possible delivery and service.
In addition, Superior Electric sales engineers are conveniently located to provide prompt attention to customers' needs. Call the nearest office listed for ordering and application information or for the address of the closest authorized distributor.

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