

*Oregon Micro Systems, Inc.™*

*A Pro-Dex Company*

**INSTALLATION  
INSTRUCTIONS  
for  
OREGON MICRO SYSTEMS, INC.  
MODEL PMD4m  
MICROSTEP  
TRANSLATOR/DRIVE**

# TABLE OF CONTENTS

	Page
<b>THINGS TO KNOW BEFORE USING THIS EQUIPMENT.....</b>	<b>3</b>
<b>WARRANTY INFORMATION .....</b>	<b>3</b>
<b>SECTION 1: INTRODUCTION.....</b>	<b>3</b>
1.1 Using This Manual .....	3
1.2 Product Features.....	4
<b>SECTION 2: EXPRESS START UP PROCEDURE .....</b>	<b>5</b>
<b>SECTION 3: INSTALLATION GUIDELINES .....</b>	<b>6</b>
3.1 Mounting .....	6
3.2 Terminal Locations And Assignments.....	7
<b>SECTION 4: SPECIFICATIONS .....</b>	<b>10</b>
4.1 Mechanical Specifications.....	10
4.2 Electrical Specifications .....	10
4.3 Environmental Specifications .....	10
4.4 Motor Compatibility .....	11
4.5 Current Settings .....	12
4.6 Automatic Current Reduction .....	12
4.7 Step Resolution.....	12
4.8 Signal Specifications .....	13
4.9 Indicator Lights.....	15
<b>SECTION 5: TORQUE VERSUS SPEED CHARACTERISTICS.....</b>	<b>16</b>
5.1 Motor Performance .....	16
5.2 Typical Torque Vs. Speed Curves .....	17
<b>SECTION 6: TROUBLESHOOTING .....</b>	<b>21</b>
<b>APPENDIX A: TROUBLESHOOTING ELECTRICAL INTERFERENCE PROBLEMS.....</b>	<b>23</b>

# 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.

## **CAUTION:**

**This unit is designed for 24 to 40 Vdc input only (see Section 4.2, Electrical Specifications, Page 11).**

## 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 Oregon Micro Systems' PMD4m 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 Oregon Micro Systems' PMD4m 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 Oregon Micro Systems' 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 Oregon Micro Systems' PMD4m Translator/Drive is a bipolar, adjustable speed, two-phase PWM drive 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 1.0 through 3.5 amperes
- Full short circuit protection (phase-to-phase and phase-to-ground)
- Undervoltage and transient overvoltage protection
- Efficient thermal design
- Optically isolated inputs
- Windings Off capability
- Automatic Current Reduction
- Switch selectable step resolution
- Compact size
- Sturdy all-aluminum mounting base

## 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. **Heat sinking may be required to maintain case temperature below +70° C (+158° F).**
3. Select the appropriate step resolution and set the switches as described in Section 4.7.
4. Wire the motor per the "Motor Connections" description in Section 3.2.
5. Connect the power source to the DC input terminal strip. Be sure to follow the instructions for connecting the filter capacitor as described in Section 3.2, under Power Input.

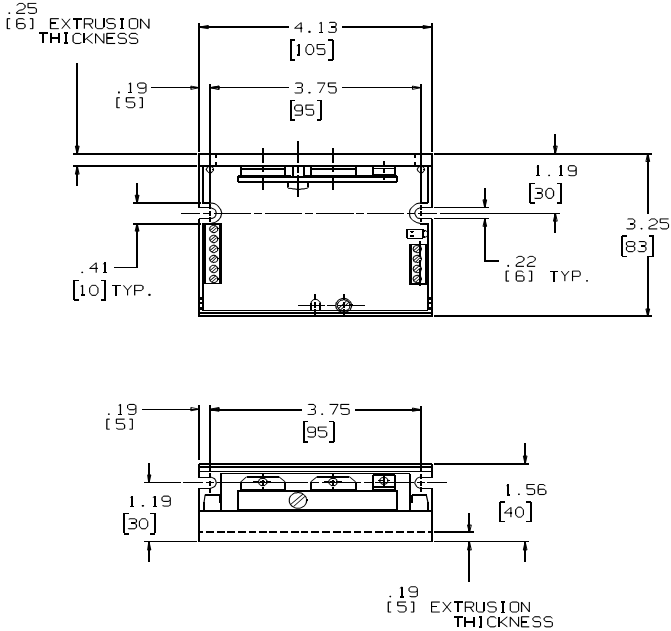
NOTES: If the motor operates erratically, refer to Section 5, "Torque Versus Speed Characteristics".

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

# SECTION 3: INSTALLATION GUIDELINES

## 3.1 MOUNTING

The Oregon Micro Systems' Drive is mounted by fastening its mounting brackets to a flat surface. Dimensions are shown in Figure 3.1. If the drive assembly is mounted against a bulkhead, be sure to apply a thin coating of thermal compound between the drive and the mounting surface before fastening the unit in place. Do not use too much thermal compound. It is better to use too little than too much.



DIMENSIONS IN BRACKETS ARE IN MILLIMETERS

**Figure 3.1, Mounting Diagram**

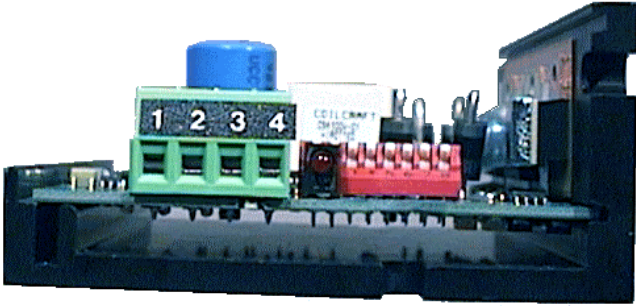
**NOTE:** Case temperature must not exceed +70° C (+158° F).

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 noise sources. If possible, locate the drive in its own metal enclosure to shield it and its wiring from electrical noise sources. If this cannot be done, keep the drive at least three feet (0.9 m) from any noise sources.

## 3.2 TERMINAL LOCATIONS AND ASSIGNMENTS

Figure 3.2 shows the terminal locations for the Oregon Micro Systems' PMD4m Translator/Drive.



**I/O Connector (J1)**



**Motor And Power Supply Connector (J2)**

**Figure 3.2, Terminal Locations**

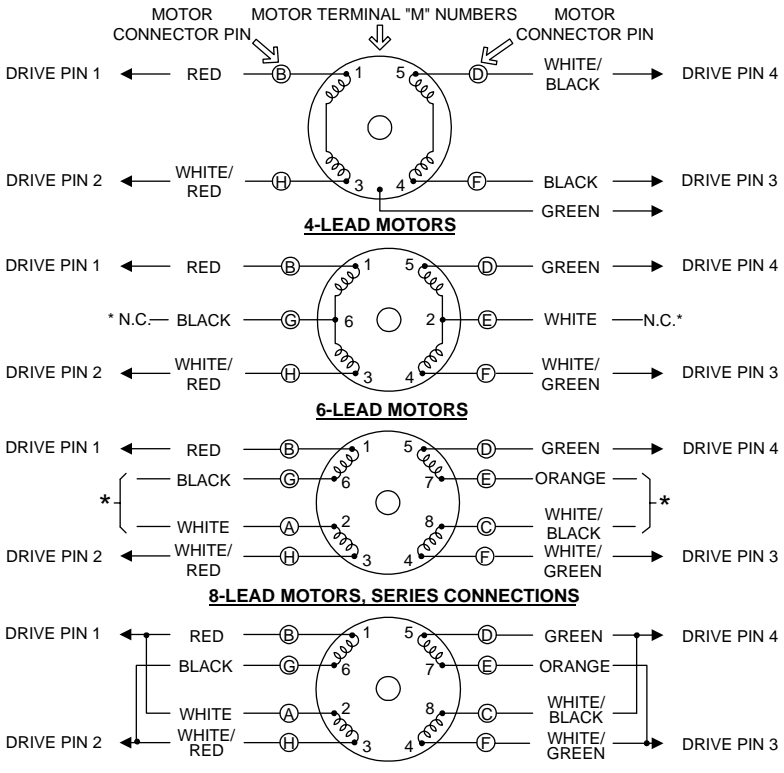
## MOTOR CONNECTIONS

All motor connections are made via the 6-terminal strip. Terminal assignments are given below. Motor connections are shown in Figure 3.3.

J2 Pin	Assignment
1	M1 (Phase A+)
2	M3 (Phase A-)
3	M4 (Phase B+)
4	M5 (Phase B-)

**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. The wires for each motor phase should be twisted together about six times per foot (0.3 m).



\*These leads must be insulated and not connected to the drive. Circled letters identify terminals for connector motors, numbers identify those for terminal box motors.

**Figure 3.3, Motor Wiring Configurations**



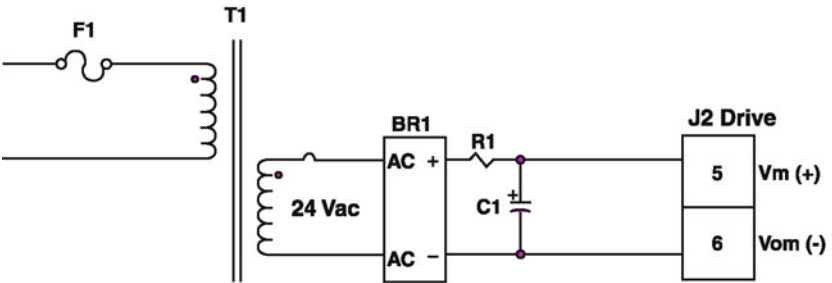
## POWER INPUT

The dc input power is connected to terminals 5 and 6 of the terminal strip. Terminal 5 [Vm(+)] is the power supply plus (+) connection and pin 6 [Vom (-)] is the power supply minus (-) connection.

**An unregulated supply similar to that shown in Figure 3.4 is preferable. If a regulated supply is used, it must be capable of operating with the added filter capacitor. A switching regulated supply may not be suitable for use with this drive. It is important that the capacitor (C1) be connected within three feet (0.9 meter) of the input terminals. The capacitor must be of the correct value and have the proper current and voltage parameters (see list of components on page 11).**

It is recommended that the power supply leads be twisted together using approximately six twists per foot (0.3 m).

NOTE: If the power supply is grounded, it must only be grounded on the negative side or the short circuit protection will not operate properly.



NOTES: The cable between the filter capacitor (C1) and the drive should be twisted using approximately six twists per foot (0.3 m). Maximum wire length is three feet.

Use #16 AWG or larger wire.

**Figure 3.4**  
**Typical Power Supply For A Single Drive Application**

**Components for circuit shown in Figure 3.4**

- F1 1.5 ampere time delay, 250 volt
- R1 5 ohm surge limiter, Dale 7SS5 or equivalent
- T1 130 VA, 24 Vac output
- BR1 General Instrument GBPC3502 or equivalent
- C1 4700 µf, 5.5 ampere 20 kHz, 63 V rated, United Chemcon  
53D472F063HS6 or equivalent

**SECTION 4: SPECIFICATIONS**

**4.1 MECHANICAL SPECIFICATIONS**

- Size
  - (Inches) ..... 1.56 H x 4.13 W x 3.25 D
  - (mm)..... 40 H x 105 W x 83 D
- Weight ..... 0.6 pounds (272 grams)

**4.2 ELECTRICAL SPECIFICATIONS**

- DC Input Range..... 24 Vdc min., 40 Vdc max.
- DC Current ..... see Motor Table
- Drive Power Dissipation  
(Worst Case) ..... 35 watts

**4.3 ENVIRONMENTAL SPECIFICATIONS**

- Temperature
  - Operating ..... +32° F to +122° F  
(0° C to +50° C) free air ambient, Natural Con-  
vection. Maximum heat sink temperature of  
158° F (70° C) must be maintained. Forced-air  
cooling may be required.
  - Storage..... -40° F to +167° F  
.....(-5° C to +75° C)
- Humidity ..... 95% max. noncondensing
- Altitude ..... 10,000 feet (3048 m) max.

## 4.4 MOTOR COMPATIBILITY

Motor Types ..... Oregon Micro Systems' HT Series  
 HT series frame sizes..... HT61 (NEMA 23) through  
 HT93 (NEMA 34)

Number of Connections .. 4, 6, 8

Minimum Inductance ..... 0.5 millihenry

Maximum Resistance ..... =  $0.25 \times V_{dc} \text{ Supply/I Setting}$

Example:

$V_{dc} = 30$       I Setting = 3.5

$R \text{ max.} = 0.25 \times 30/3.5 = 2.1 \text{ ohms}$

**NOTE:** Maximum resistance is total of motor plus cable.

**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 PMD4m TRANSLATOR/DRIVE

Motor	Current Setting (Amperes)	Power Supply Current	
		Standstill (Amps. DC)	Maximum (Amps. DC)
HT60FO8	3.5	1.0	2.0
HT60F11	3.5	1.0	2.0
HT61FO5	2.5	1.2	1.5
HT61F11	3.5	1.0	3.0
HT62F07	3.0	1.0	2.5
HT62F13	3.5	1.0	4.0
HT63F07	3.0	1.5	2.0
HT63F13	3.5	1.0	4.0
HT91F07	3.0	1.0	2.0
HT91F13	3.5	1.0	4.0
HT92F07	3.0	1.5	2.5
HT92F13	3.5	1.0	4.0

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

All HT motors listed have 4 leads.

## 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. Switches 1 through 5 are used to select the current level. Select the desired operating current by setting the appropriate switch to position 1 (ON). The OFF position 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:

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

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

The number of pulses per revolution is selected using positions 7 and- 8 of the switch described in Section 4.5. The following chart shows the correct switch setting for each available step resolution.

Switch Position		Step Resolution	Pulses Per Revolution
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

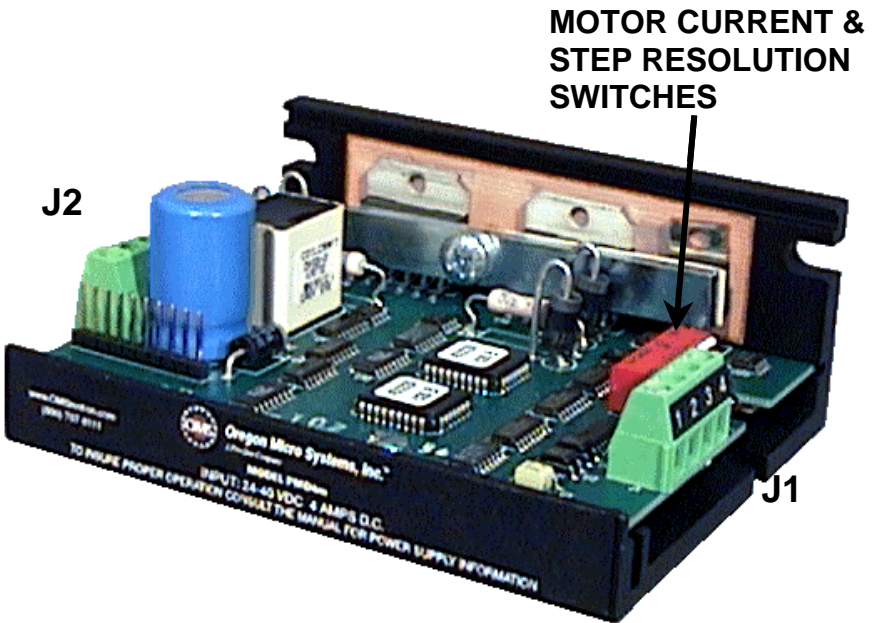


Figure 4.1  
Switches For Setting Current Level  
And Step Resolution

## 4.8 SIGNAL SPECIFICATIONS

### 4.8.1 Terminal Assignments

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

<u>J1 Pin</u>	<u>Assignment</u>
1	OPTO
2	PULSE
3	DIR
4	AWO

### 4.8.2 Signal Descriptions

OPTO      Opto-Isolator Supply  
User supplied power for the opto-isolators.

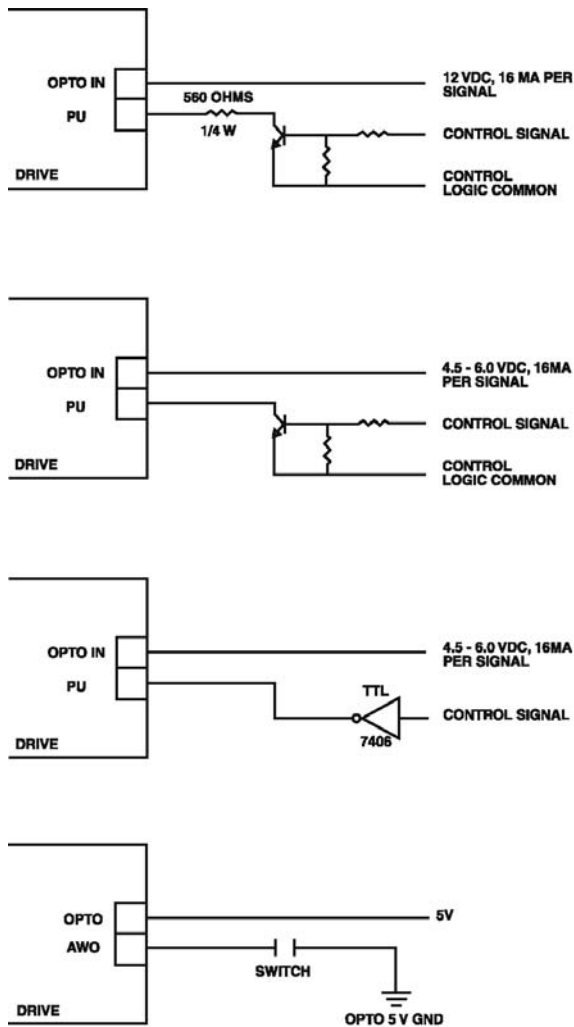
- PULSE Pulse Input  
A low to high transition on this terminal advances the motor one step. The step size is determined by the Step Resolution switch setting.
  
- DIR Direction Input  
When this signal is high, motor rotation will be clockwise. Rotation will be counterclockwise when this signal is low.  
  
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.**

**4.8.3 Level Requirements**

- OPTO
  - Voltage..... 4.5 to 6.0 volts dc
  - Current..... 16 mA per signal used
- Other Signals
  - Voltage
    - Low.....  $\leq 0.8$  Vdc
    - $\geq 0.0$  Vdc
    - High.....  $\leq$ OPTO
    - $\geq$ OPTO - 1 volt
  - Current
    - Low.....  $\leq 16$  mA
    - High.....  $\leq 0.2$  mA

**4.8.4 Timing Requirements**

- PULSE
  - Max. Frequency .... 500 kHz
  - Max. Rise And
  - Fall Times ..... 1 microsecond
  - Min. Pulse Width... 1 microsecond
- Other Signals
  - Response Time..... 50 microseconds



**Suggested Methods For Control Interface**  
**Figure 4.2**

## 4.9 INDICATOR LIGHTS

### "FAULT" LED, 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.

# SECTION 5: TORQUE VERSUS SPEED CHARACTERISTICS

## 5.1 MOTOR PERFORMANCE

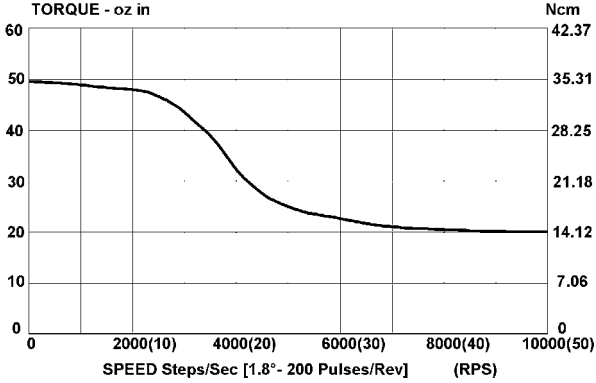
All stepper motors exhibit instability at their natural frequency and harmonics of that frequency. Typically, this instability will occur at speeds between 50 and 1000 full steps per second and, depending on the dynamic motor load parameters, can cause excessive velocity modulation or improper positioning. 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.

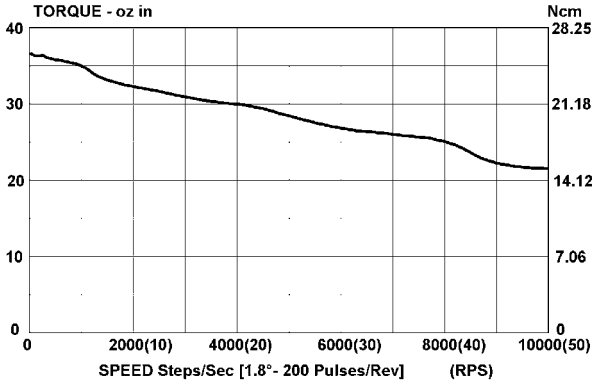
- 1) Avoid constant speed operation at the motor's unstable frequencies. Select a base speed that is above the motor's resonant frequencies and adjust acceleration and deceleration to move the motor through unstable regions quickly.
- 2) The motor winding current can be reduced as described in Section 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.



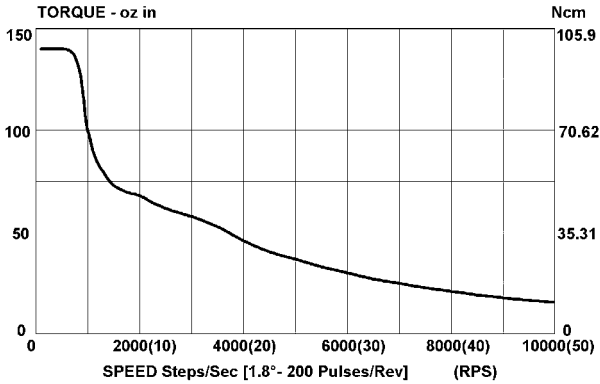
# 5.2 TYPICAL TORQUE VERSUS SPEED CURVES



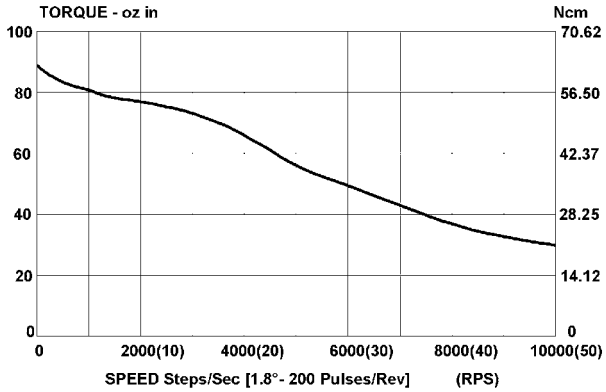
HT60F08, 3.5 Amp, 36V Bus



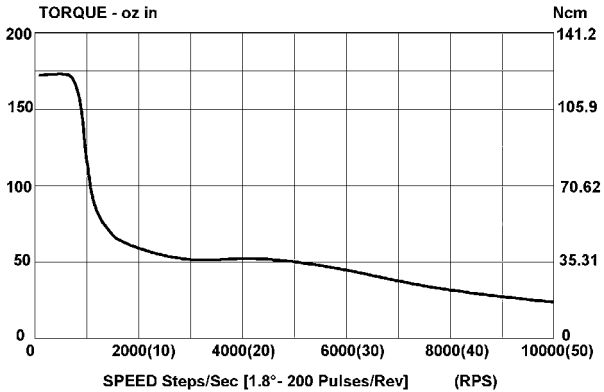
HT60F11, 3.5 Amp, 36V Bus



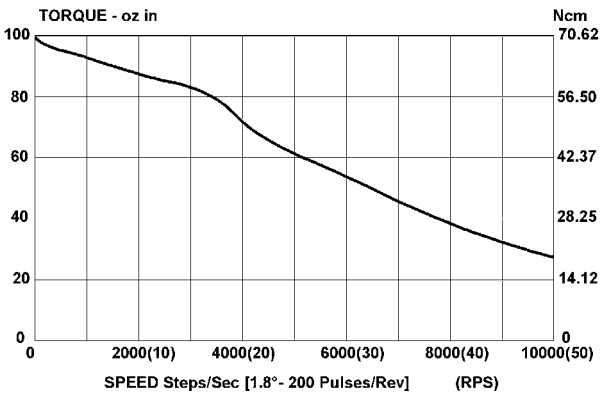
HT61F05, 3.0 Amp, 36V Bus



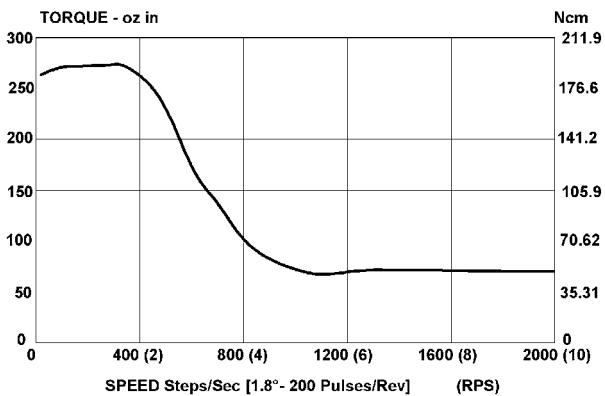
**HT61F11, 3.5 Amp, 36V Bus**



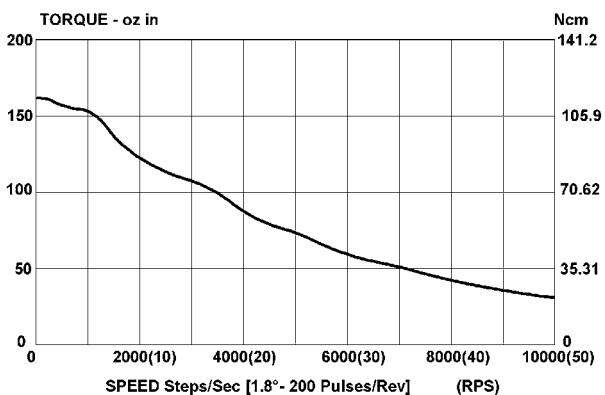
**HT62F07, 3.0 Amp, 36V Bus**



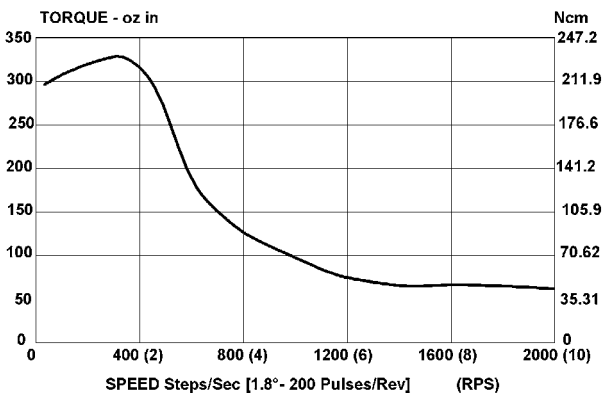
**HT62F13, 3.5 Amp, 36V Bus**



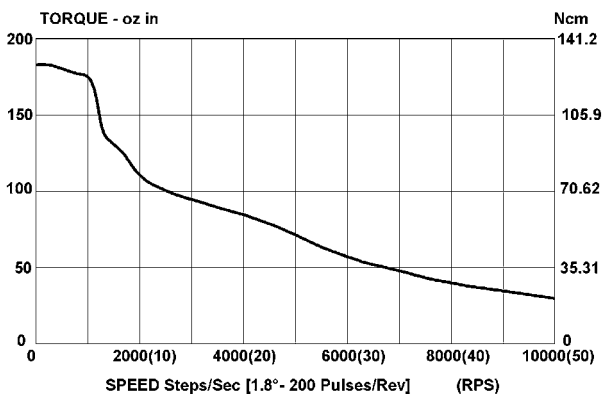
**HT63F07, 3.0 Amp, 36V Bus**



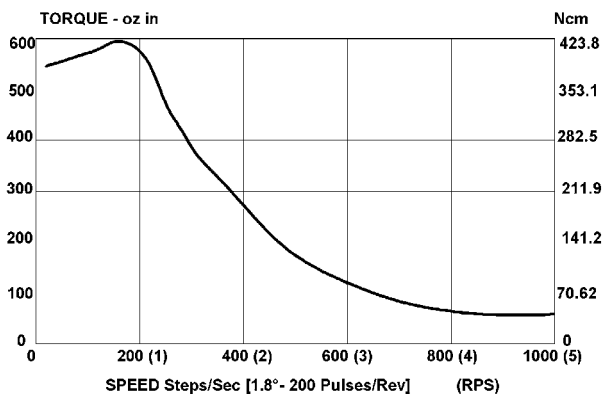
**HT63F13, 3.5 Amp, 36V Bus**



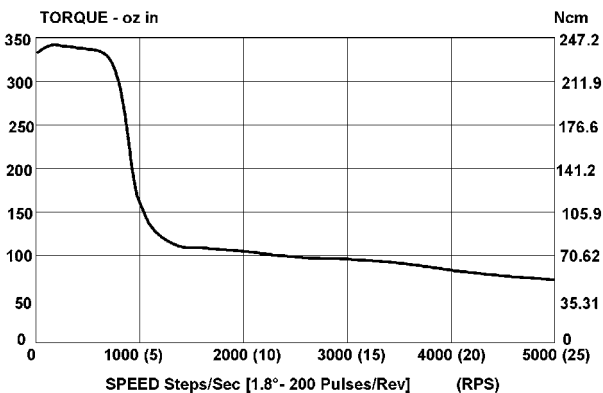
**HT91F07, 3.5 Amp, 36V Bus**



HT91F13, 3.5 Amp, 36V Bus



HT92F07, 3.5 Amp, 36V Bus



HT92F13, 3.5 Amp, 36V Bus

## 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 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.

### **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.

Filter capacitor missing or too low in value.

**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 Oregon Micro Systems.

# **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/or line monitor. 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.
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.

## LIMITED WARRANTY

The Seller warrants that the articles furnished are free from defect in material and workmanship and perform to applicable, published Oregon Micro Systems, Inc. specifications for one year from date of shipment. This warranty is in lieu of any other warranty express or implied. In no event will Seller be liable for incidental or consequential damages as a result of an alleged breach of the warranty. The liability of Seller hereunder shall be limited to replacing or repairing, at its option, any defective units which are returned f.o.b. Seller's plant. Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect or unauthorized repair are not covered by warranty. Seller shall have the right of final determination as to the existence and cause of defect. As to items repaired or replaced, the warranty shall continue in effect for the remainder of the warranty period, or for 90 days following date of shipment by Seller of the repaired or replaced part whichever period is longer. No liability is assumed for expendable items such as lamps and fuses. No warranty is made with respect to custom equipment or products produced to Buyer's specifications except as specifically stated in writing by Seller and contained in the contract.



***Oregon Micro Systems, Inc.***<sup>TM</sup>

*A Pro-Dex Company*

1800 NW 169th Place • Suite C100

Beaverton, Oregon 97006

(503) 629-8081

Fax (503) 629-0688

Email: [sales@OMSmotion.com](mailto:sales@OMSmotion.com)

Web Site: <http://www.OMSmotion.com>

©Oregon Micro Systems, Inc. 1999, All rights Reserved