Danaher Motion Pacific Scientific

Microstep Translator Drive

6210 Installation Manual

Part Number: MA6210
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Record of Manual Revisions

ISSUE NO.	DATE	BRIEF DESCRIPTION OF REVISION
1	10/31/02	Initial release

Limited Warranty

Includes software provided by Pacific Scientific

Seller warrants that the Goods sold hereunder are free from defects in material and workmanship for the product warranty period of each item of Goods (Product Warranty Periods are listed below). Seller warrants its Good(s) only to the original purchaser (the "Customer"), and in the case of original equipment manufacturers or distributors, only to their original consumer (the "Customer"). There are no warranties whatsoever on Goods built or acquired, wholly or partially, to a buyer's designs or specifications

This express warranty is in lieu of and exclude all other warranties, express or implied, by operation or law or otherwise including THE WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (WHETHER KNOWN TO SELLER OR NOT), all other such warranties being hereby expressly disclaimed by Seller and waived by Buyer.

Written notice of claimed defects shall have been given to Seller within the period set forth in the schedule below, and within thirty (30) days from the date any such defect is first discovered.

Product Warranty Schedules

Brand	**Products**	**Warranty Period**
Pacific Scientific	All Products	24 months from date of manufacture
Superior	All Products	12 months from date of manufacture
Kollmorgen	Standard Brush-type Motors, Electronics and Accessories	12 months from date of manufacture
Kollmorgen	Standard Brushless Motors, Electronics and Accessories	24 months from date of manufacture
Kollmorgen	Standard Step Motors, Stepper Controls and Accessories	12 months from date of manufacture
Kollmorgen	Custom Motion Systems or components of any type	To be negotiated on a case-by-case basis, and set forth in the order.

The Good or parts claimed to be defective must be returned to Seller, accompanied by a Return Material Authorization (RMA) issued by Seller's facility responsible for supplying Goods, with transportation prepaid by Customer, with written specifications of the claimed defect.

If a warranty claim is valid, Seller shall pay reasonable one-way costs of transportation of the defective Goods from either the original destination or the location where defect occurred, whichever is closest to Seller's facility. Under no circumstances shall Seller be liable for removal of Seller's Goods from Buyer's equipment or re-installation into Buyer's equipment.

NO PERSON, INCLUDING ANY AGENT, DISTRIBUTOR, OR REPRESENTATIVE OF SELLER, IS AUTHORIZED TO MAKE ANY REPRESENTATION OR WARRANTY ON BEHALF OF SELLER CONCERNING ANY GOODS MANUFACTURED BY SELLER, EXCEPT TO REFER PURCHASERS TO THIS WARRANTY.

SAFETY

The equipment described herein has been developed, produced, tested and documented in accordance with the corresponding standards. During use conforming with requirements, the equipment is not dangerous for people or equipment. Use conforming with requirements means that the safety recommendations and warnings detailed in this manual are complied with and applicable regulations for safety (machine directives, etc.) and noise suppression (EMC Directives) are observed while operating the drive. At the end of its lifetime, dispose of or recycle the drive according to the applicable regulations.

Installation and wiring of the drive must be completed only by qualified personnel having a basic knowledge of electronics, installation of electronic and mechanical components, and all applicable wiring regulations.

Commissioning of the machine utilizing the drives must be done only by qualified personnel having a broad knowledge of electronics and motion control technology.

As the user or person applying this unit, you are responsible for determining the suitability of this product for the application. In no event is the Pacific Scientific Company responsible or liable for indirect or consequential damage resulting from the misuse of this product.

Read this manual completely to effectively and safely operate the 6210.

Comply with the applicable European standards and Directives.

Contents

1. INTRODUCTION

1.1. Before You Begin

- 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 fully discharge.
- Voltage is present on unprotected pins when the unit is operational.
- Motors powered by this drive may develop extremely high torque. Disconnect power to this drive before doing any mechanical work.

This unit is designed only for 24-40 VDC input (see Electrical Specifications).

- Reconfiguration of the circuit not shown in this manual voids the Warranty.
- Failure to follow the installation guidelines voids the Warranty.

1.2. 6210 Product Features

The 6210 Translator/Drive is a bipolar, adjustable speed, two-phase PWM drive that 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

1.3. Express Start-Up Procedure

The following instructions define the **minimum** steps necessary to make your Translator/Drive operational:

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

Always operate the unit with the motor and 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 (0.3m) is a good guideline.

1. Check to see that the motor used is compatible with the drive.
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 Switches for Setting Current Level and Step Resolution.
4. Wire the motor per the Motor Wiring Configurations.
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 the Power Input section.

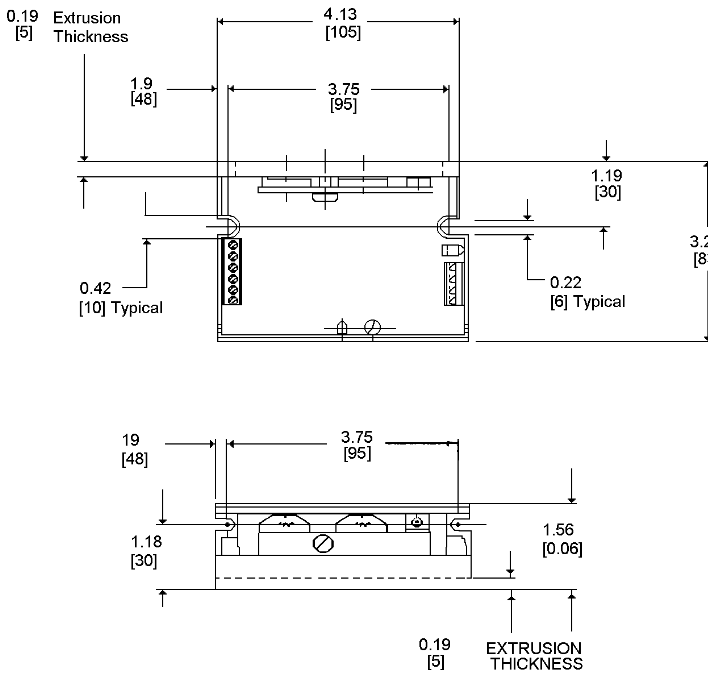
If the motor operates erratically, refer to the Torque vs. Speed section.

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

2. INSTALLATION GUIDELINES

The 6210 drive is mounted by fastening its mounting brackets to a flat surface. Dimensions are shown in the figure below. 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.



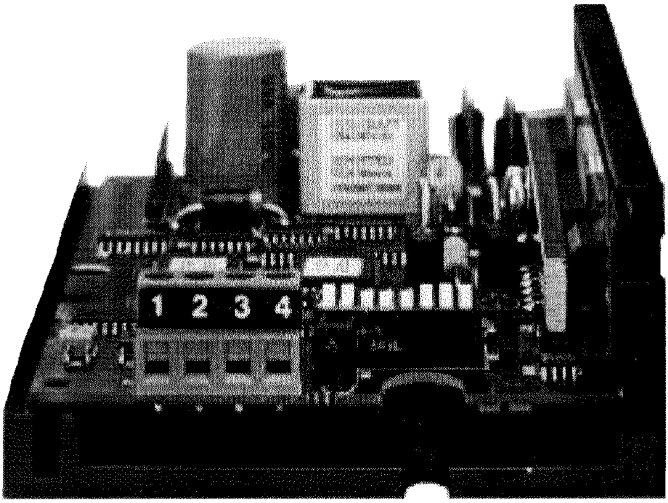
DIMENSIONS IN BRACKETS ARE IN MILLIMETERS

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

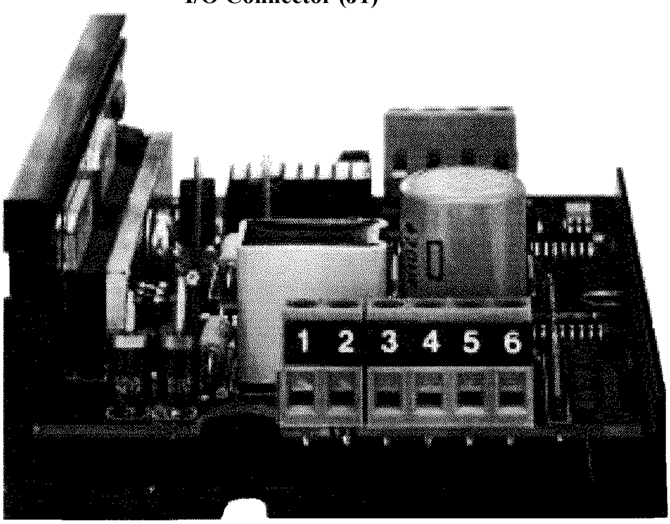
When selecting a mounting location, it is important to leave at least two inches (51 mm) of space around the top, bottom, and sides of the unit to allow proper airflow for cooling. It is also important to keep the drive away from obvious noise sources. If possible, locate the drive in its own metal enclosure the 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.

2.1. Terminal Locations and Assignments

2.1.1. Terminal Locations



I/O Connector (J1)



Motor and Power Supply Connector (J2)

2.1.2. Motor Connections

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

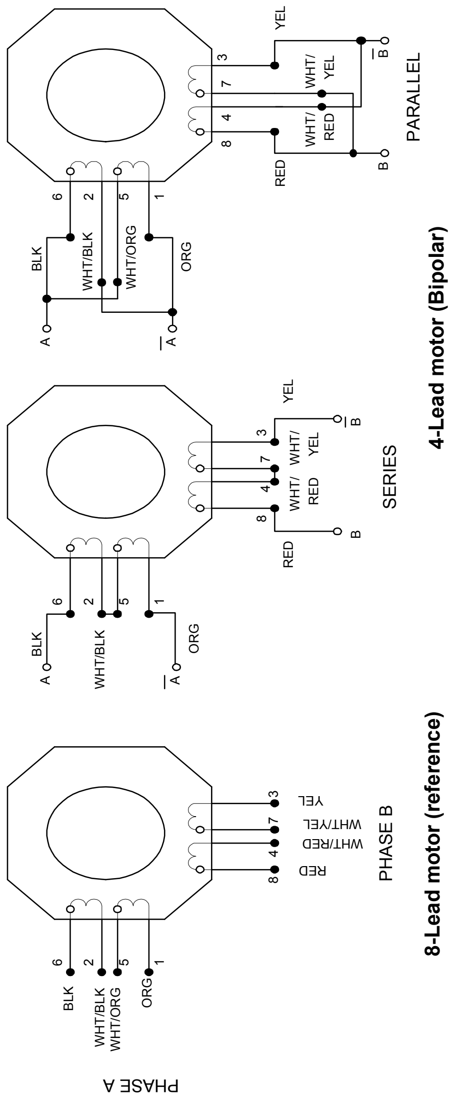
J2 Pin	Assignment
1	M1 (Phase A+)
2	M3 (Phase A-)
3	M4 (Phase B+)
4	M5 (Phase B-)

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

2.1.2.1. Motor Wiring Configurations

2.1.2.1.1. P2H, P21, M21, P22, M22

Phase sequencing direction of rotation as viewed from mounting end of motor.



CCW

DRIVE CONNECTION				
STEP	A	B	C	D
1	GND	O	GND	O
2	O	GND	GND	O
3	O	GND	O	GND
4	GND	O	O	GND
1	GND	O	GND	O

CW

CCW

DRIVE CONNECTION				
STEP	A	$\overline{A}$	B	$\overline{B}$
1	+	—	—	+
2	—	+	—	+
3	—	+	+	—
4	+	—	+	—
1	+	—	—	+

CW

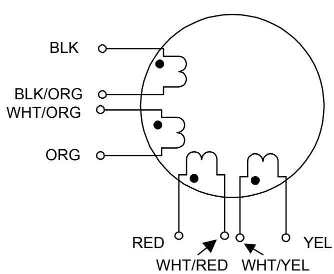
O = off or open
+ = positive current flow

GND = ground
— = negative currrent flow

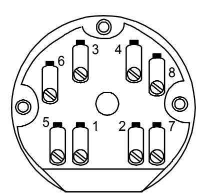
2.1.2.1.2. N3x / K3x / T2x

Power Connections: 8 flying leads or 8 terminals. The 8-lead motor is the most versatile configuration. It may be connected by you in a choice of 8-lead or 4-lead (series or parallel).

T2x is offered only with flying leads.



8-Lead Configuration

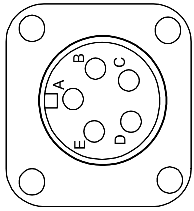


Terminal Board
N3x/K3x

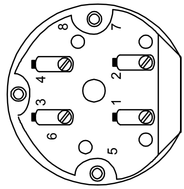
CONNECTION	DRIVER CONNECTION	LEAD COLOR	TERMINAL #
4-Lead Bipolar	A	Black (BLK)	1
Series	$\overline{A}$	Orange (ORG)	3
	B	Red (RED)	2
	$\overline{B}$	Yellow (YEL)	4
	None	WHT/BLK & WHT/ORG	6 & 5
	None	WHT/RED & WHT/YEL	8 & 7
4-Lead Bipolar	A	BLK & WHT/ORG	1 & 5
Parallel	$\overline{A}$	ORG & WHT/BLK	3 & 6
	B	RED & WHT/YEL	2 & 7
	$\overline{B}$	YEL & WHT/RED	4 & 8
8-Lead Unipolar	A	Black (BLK)	1
	B	Orange (ORG)	3
	C	Red (RED)	2
	D	Yellow (YEL)	4
	+V	WHT/ORG	5
	+V	WHT/BLK	6
	+V	WHT/YEL	7
	+V	WHT/RED	8
GND		Green/Yellow	

See Phase Sequencing Tables.

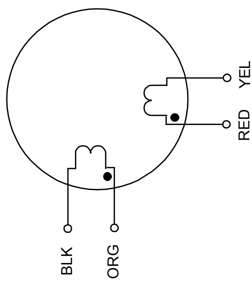
Power Connections: 4 flying leads or 4 terminals or MS connector. The 4-lead motor is used with bipolar drives.



MS Connector
N3x/K3x



Terminal Board
N3x/K3x



4-Lead Configuration

CONNECTION	DRIVER CONNECTION	LEAD COLOR	TERMINAL #	MS PIN OUT
4-Lead Bipolar	A	Black (BLK)	1	A
Series	$\overline{A}$	Orange (ORG)	3	B
	B	Red (RED)	2	C
	$\overline{B}$	Yellow (YEL)	4	D
GND		Green/Yellow		E

Terminals 7 & 8 are not used. See Phase Sequencing Tables.

Phase Sequencing Tables

BIPOLAR HALF STEP

CCW

DRIVE CONNECTION				
STEP	A	$\bar{A}$	B	$\bar{B}$
1	+	—	0	0
2	+	—	+	—
3	0	0	+	—
4	—	+	+	—
5	—	+	0	0
6	—	+	—	+
7	0	0	—	+
8	+	—	—	+

CW

BIPOLAR FULL STEP

CCW

DRIVE CONNECTION				
STEP	A	$\bar{A}$	B	$\bar{B}$
1	+	—	—	+
2	—	+	—	+
3	—	+	+	—
4	+	—	+	—
1	+	—	—	+

CW

O = off or open
+ = positive current flow

GND = ground
— = negative currrent flow

2.1.2.2. POWER INPUT

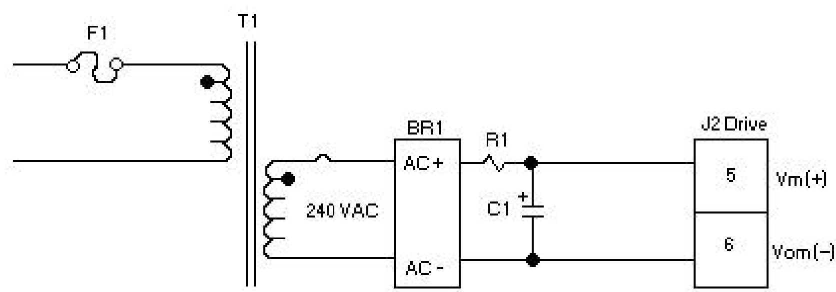
The DC input power is connected to terminals 5 and 6 of the terminal strip. Terminal 5 [Vm(+)] is the power supply plus (+) connection and pin 6 [Vom(-)] is the power supply minus (-) connection.

An unregulated supply is similar to that shown below and 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 m) 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 (0.3m).

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

2.1.2.3. TYPICAL POWER SUPPLY FOR A SINGLE DRIVE APPLICATION



The cable between the filter capacitor (C1) and the drive should be twisted using approximately six twists per foot (0.3m). Maximum wire length is three feet. Use #16 AWG or larger wire.

Components for Power Supply

F1	1.5 A 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 A, 20 kHz, 63 V rated, United Chemicon 53D472F063HS6 or equivalent

3. SPECIFICATIONS

3.1. Mechanical

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)

3.2. Electrical

DC Input Range	24 VDC min., 40 VDC max.
DC Current	see Motor Table
Drive Power Dissipation (worse case)	35 watts

3.3. Environmental

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

3.4. 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:

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

3.5. Automatic Current Reduction

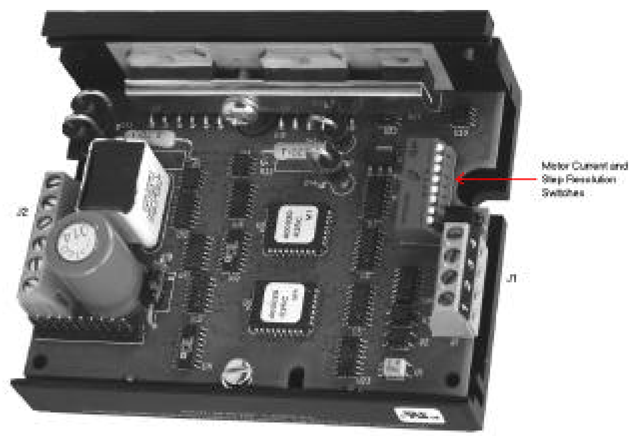
When switch 6 is in the OFFposition, the current at standstill goes to 50% of the selected level. This occurs between 1 and 2 seconds after the last pulse is received. When switch 6 is in the ON position, the current at standstill remains at full value.

3.6. Step Resolution

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

Switch Position			
7	**8**	**Step Resolution**	**Pulses-Per-Revolution**
0 (OFF)	0 (OFF)	½	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

3.6.1. Switches for Setting Current Level and Step Resolution



3.7. Signal Specifications

3.7.1. Terminal Assignments

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

J1 Pin	**Assignment**
1	OPTO
2	PULSE
3	DIR
4	AWO

3.7.2. 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 is clockwise. Rotation is counter-clockwise when this signal is low.

Clockwise and counter-clockwise 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 is zero.

There will be no holding torque when the AWO signal is low.

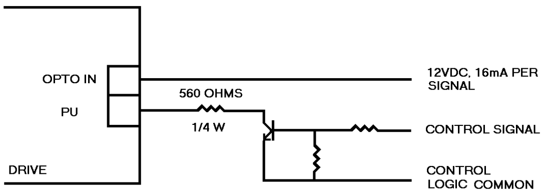
3.7.3. Level Requirements

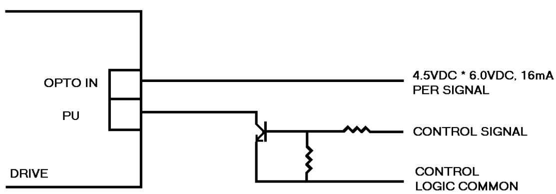
OPTO		
	Voltage	4.5 VDC – 6.0 VDC
	Current	16mA per signal used
Other Signals		
	Voltage	
	Low	□0.8VDC □0.0VDC
	High	□OPTO □OPTO – 1V
	Current	
	Low	□16 mA
	High	□0.2 mA

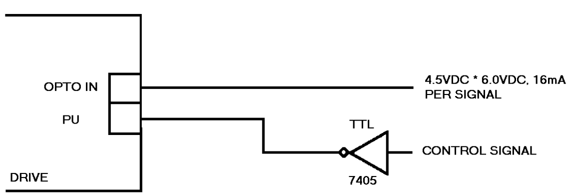
3.7.4. Timing Requirements

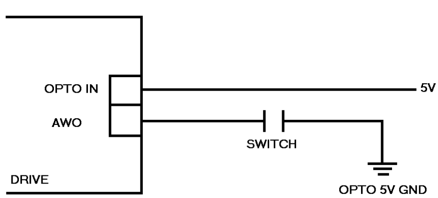
PULSE		
	Max. Frequency	500 kHz
	Max. Rise and Fall Times	1 µ second
	Min. Pulse Width	1 µ second
Other Signals		
	Response Time	□50 µ second

3.8. Suggested Methods for Control Interface









3.9. Indicator Lights

"Fault" LED, Red Lights to indicate over current condition. This condition is caused by motor winding errors or a ground fault.

Recovery from overcurrent condition requires removing and then reapplying the power.

4. TORQUE VS. SPEED

4.1. Motor Compatibility

Motor Types	Pacific Scientific
T,P, M Series Frame Sizes	Pacific Scientific T & Power Max
T,K , N Series Frame Sizes	Pacific Scientific T & Powerpac
Number of Connections	4 or 8
Minimum Inductance	0.5 millihenry
Maximum Resistance	0.25 x VDC Supply/I Setting

Example:

VDC = 30 I Setting = 3.5
R max. = 0.25 x 30/3.5 = 2.1 Ohms

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 Pacific Scientific for recommendation.

Maximum resistance is total of motor plus cable.

4.1.1. Motors for Use with the 6210 Translator/Drive

4.1.1.1. Std. Ltr. Winding, Connection, Drive Amps, Rated Motor Current, Phase Resistance by Motor Type

Motor Type	STD. LTR. WINDING	Connection S= Series P=Parallel	Drive Amps I (rms)	Rated Motor Current Ic (Amps)	Phase Resistance OHMS @25C
P2H	C	Series	1.0	1.2	3.35
P2H	C	Parallel	2.5	2.5	0.84
P2H	F	Parallel	1.0	1.6	1.92
P2H	H	Parallel	2.5	5.2	0.22
P21	A	Series	2.5	2.8	0.91
P21	B	Parallel	2.5	4.6	0.32
P21	C	Parallel	3.5	3.5	0.53
P21	D	Parallel	1.0	1.5	2.61
M21	C	Parallel	3.5	3.5	0.53
P22	A	Series	2.5	3.3	0.85
P22	B	Parallel	3.5	4.6	0.38
P22	C	Series	1.0	1.6	3.1
P22	D	Parallel	2.5	2.5	1.22
P22	G	Parrallel	1.0	1.0	7.35
M22	D	Parallel	2.5	2.5	1.22
M22	G	Parallel	1.0	1.0	7.35
T2H	D	Parallel	1	1.220	3.540
T2H	G	Parallel	2.5	3.000	0.580
T2H	H	Parallel	3.5	4.700	0.250
T21	E	Parallel	1	1.540	2.930

Motor Type	STD. LTR. WINDING	Connection S= Series P=Parallel	Drive Amps I (rms)	Rated Motor Current Ic (Amps)	Phase Resistance OHMS @25C
T21	G	Parallel	2.5	3.000	0.800
T21	H	Parallel	3.5	4.800	0.320
T22	E	Parallel	1	1.740	2.880
T22	G	Parallel	2.5	2.700	1.210
T22	H	Parallel	2.5	3.600	0.680
T22	J	Parallel	3.5	4.400	0.460
T23	E	Parallel	1	1.670	3.820
T23	H	Parallel	3	3.300	0.970
T23	K	Parallel	3.5	6.700	0.260
N31	K	Series	2.5	3.3	1.16
N31	J	Series	2.5	2.7	1.69
N31	J	Parallel	3.5	5.5	0.42
K31	L	Series	3.5	4.3	0.72
N32	L	Series	2.5	4.1	1.03
N32	L	Series	3.5	4.1	1.03
N32	M	Series	3.5	5.0	0.7
K32	L	Series	3.5	4.1	1.03

4.1.1.2. PHASE INDUCTANCE, HOLDING TORQUE, ROTOR INERTIA, AND DETENT TORQUE BY MOTOR TYPE

Motor Type	Phase Inductance Lp (mH)	Holding Totque Th (OZ*IN)	Rotor Inertia Jm (OZ*IN*S^2)	Detent Torque Td (OZ*IN)
P2H	9.1	61	0.00096	2.5
P2H	2.3	61	0.00096	2.5
P2H	5.1	60	0.00096	2.5
P2H	0.5	59	0.00096	2.5
P21	3.4	114	0.00168	4
P21	1.1	111	0.00168	4
P21	2.3	116	0.00168	4
P21	10.3	109	0.00168	4
M21	2	144	0.00168	9.4
P22	3.3	197	0.00357	7
P22	2.1	214	0.00357	7
P22	15.4	203	0.00357	7
P22	6.2	203	0.00357	7
P22	37.4	200	0.00357	7
M22	5	238	0.00357	17
M22	30	235	0.00357	17
T2H	13.600	78.852	0.002	2.000
T2H	2.200	78.901	0.002	2.000
T2H	1.000	80.123	0.002	2.000
T21	15.500	189.532	0.003	3.000
T21	4.500	194.501	0.003	3.000
T21	1.700	192.945	0.003	3.000
T22	16.400	304.536	0.006	6.000

Motor Type	Phase Inductance Lp (mH)	Holding Totque Th (OZ*IN)	Rotor Inertia Jm (OZ*IN*S^2)	Detent Torque Td (OZ*IN)
T22	7.100	309.160	0.006	6.000
T22	3.500	297.244	0.006	6.000
T22	2.500	304.015	0.006	6.000
T23	23.100	413.562	0.008	7.000
T23	5.800	413.562	0.008	7.000
T23	1.400	414.092	0.008	7.000
N31	10.3	661	0.0202	18
N31	14	643	0.0202	18
N31	3.5	643	0.0202	18
K31	4.7	829	0.0202	25
N32	4.7	1199	.03798	36
N32	10.3	1199	0.03798	36
N32	7	1213	0.03798	36
K32	8.1	1512	0.03798	50

Power supply currents shown are measured at the output of the rectifier bridge. Pacific Scientific motor reference. Motors with windings other than those listed can be used as long as the current ratings listed on the motors are not exceeded. All Pacific Scientific motors listed have 8 leads.

4.2. Motor Performance

All stepper motors exhibit instability at their natural frequency and harmonics of that frequency. Typically, this instability occurs 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 that 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 the 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.

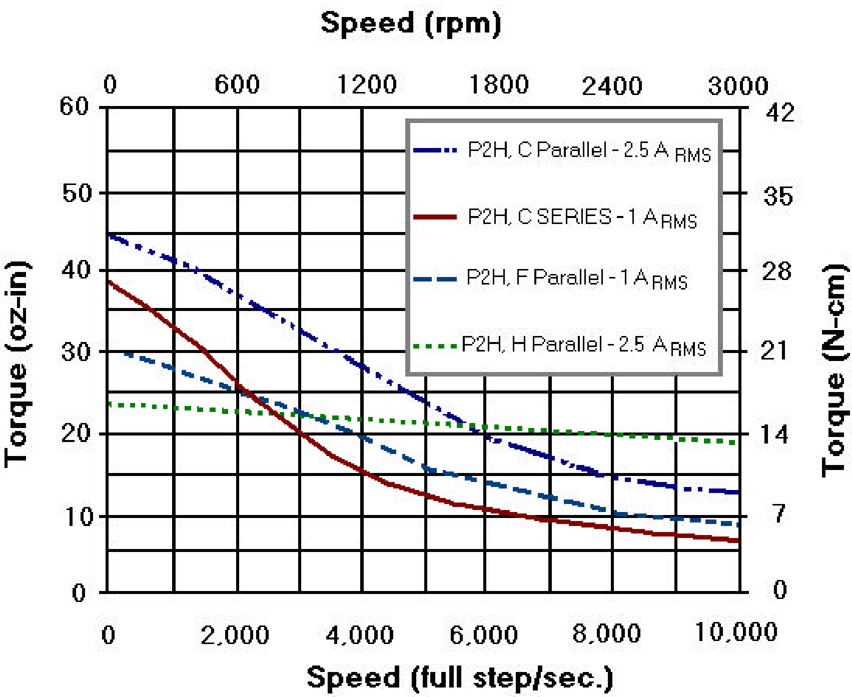
1. Avoid constant speed operation at the motor's unstable frequencies. Select a base speed above the motor's resonant frequencies and adjust acceleration and deceleration to move the motor through unstable regions quickly.
2. The motor winding current can be reduced as described in Current Settings.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

Microstepping changes the shaft speed for a given pulse input rate.

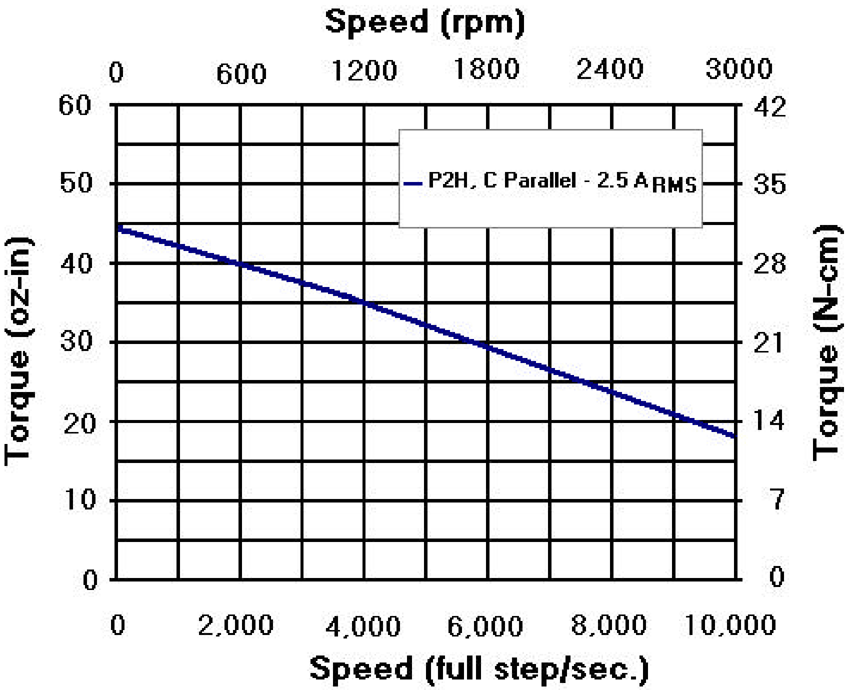
4.3. Typical Torque Vs. Speed Curves

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

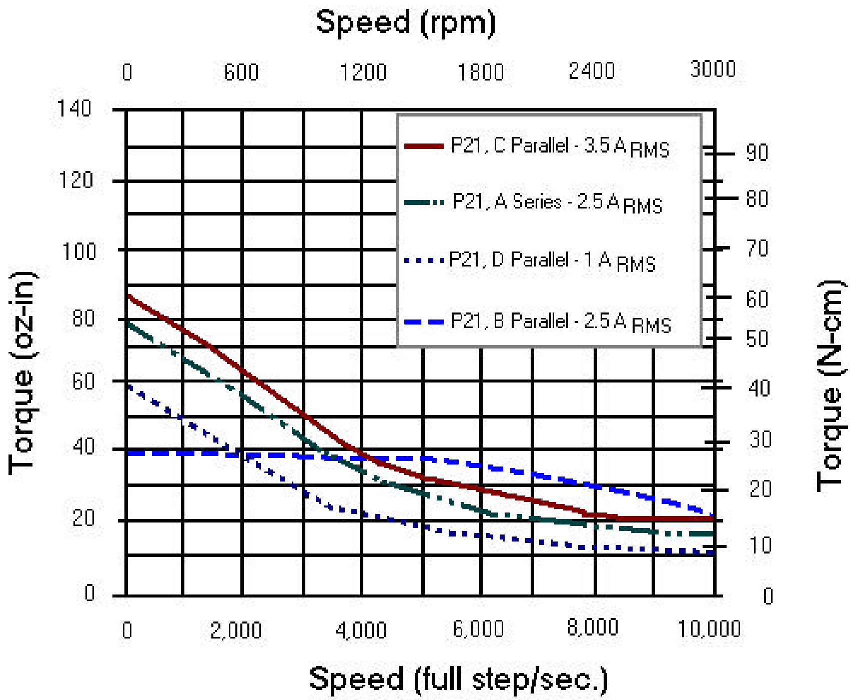
4.3.1. P2H, 24 V



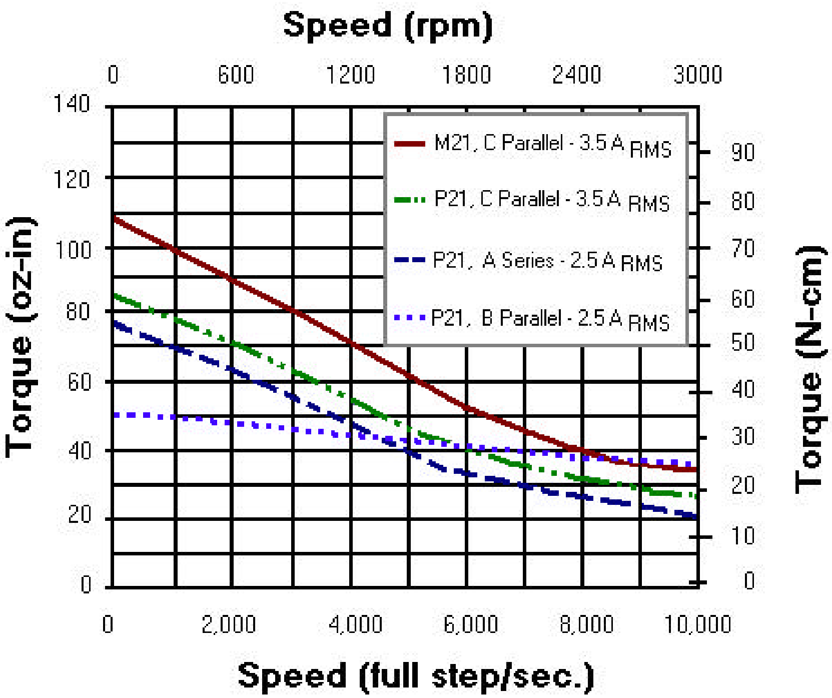
4.3.2. P2H, 36 V


Speed (rpm)
0
600
1200
1800
2400
3000
60
50
40
30
20
10
0
Torque (oz-in)
42
35
28
21
14
7
0
Torque (N-cm)
P2H, C Parallel - 2.5 A RMS
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

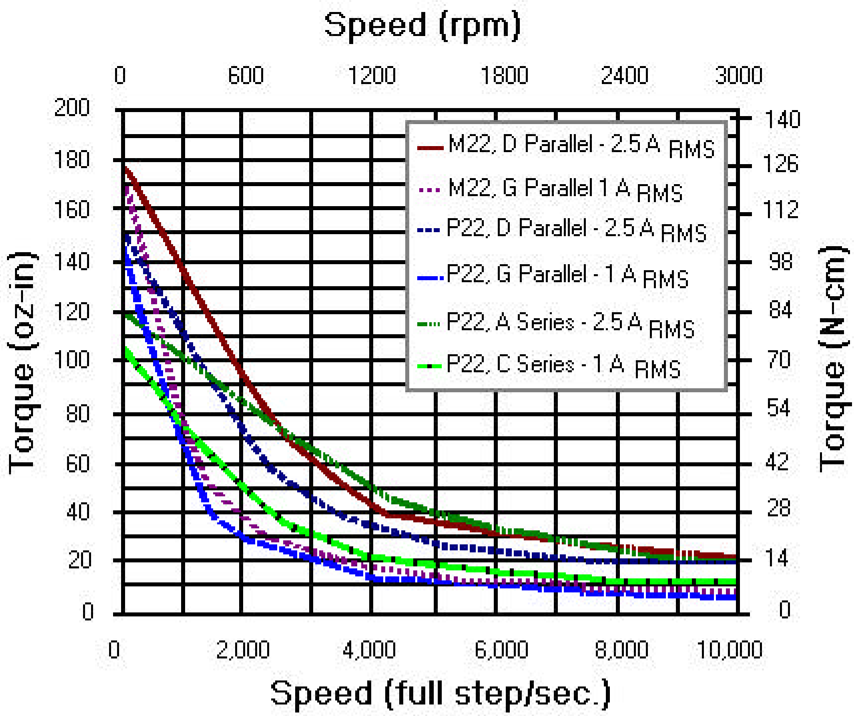
4.3.3. P21, 24 V


Speed (rpm)
0
600
1200
1800
2400
3000
140
120
100
80
60
40
20
0
Torque (oz-in)
P21, C Parallel - 3.5 A RMS
P21, A Series - 2.5 A RMS
P21, D Parallel - 1 A RMS
P21, B Parallel - 2.5 A RMS
90
80
70
60
50
40
30
20
10
0
Torque (N-cm)
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

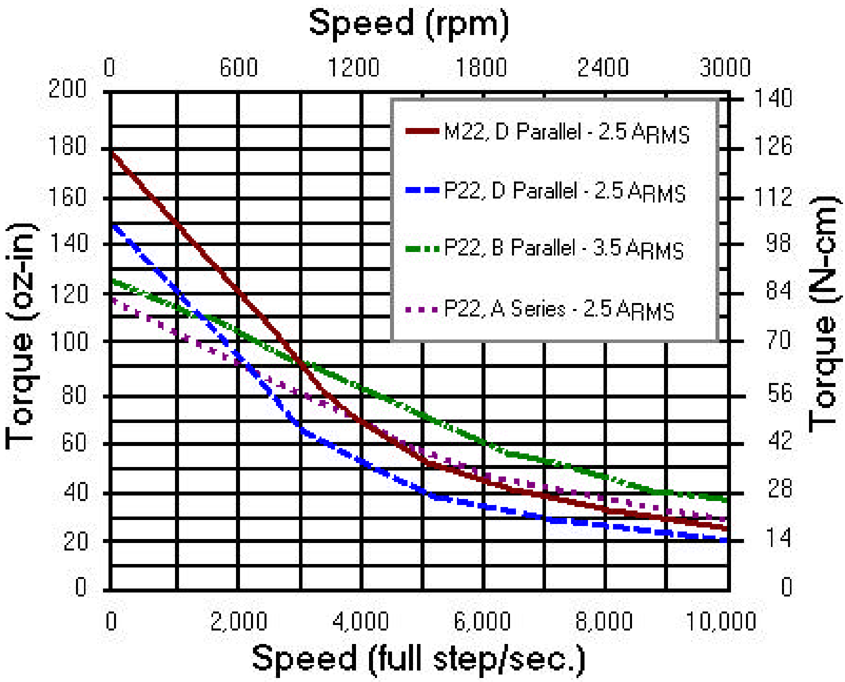
4.3.4. P21/M21, 36 V



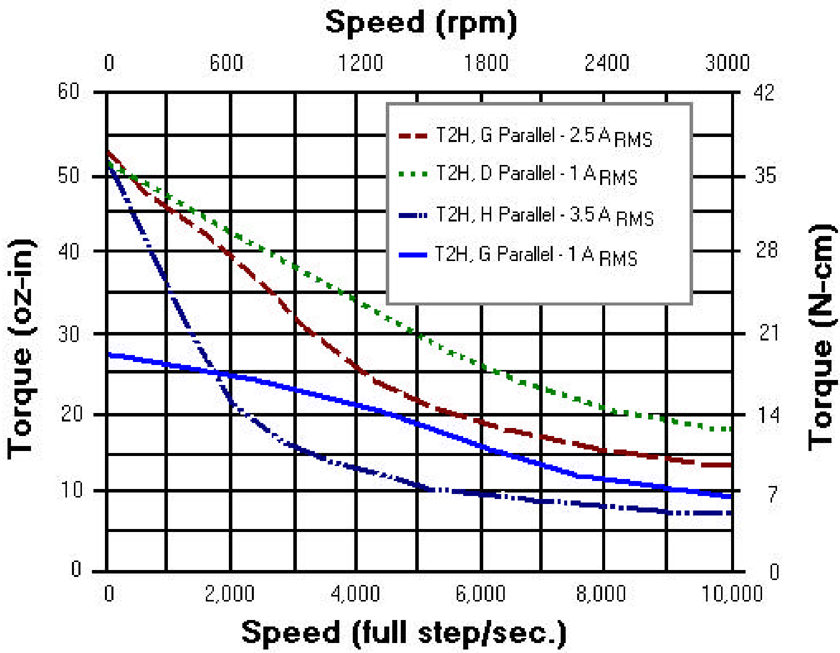
4.3.5. P22/M22, 24 V



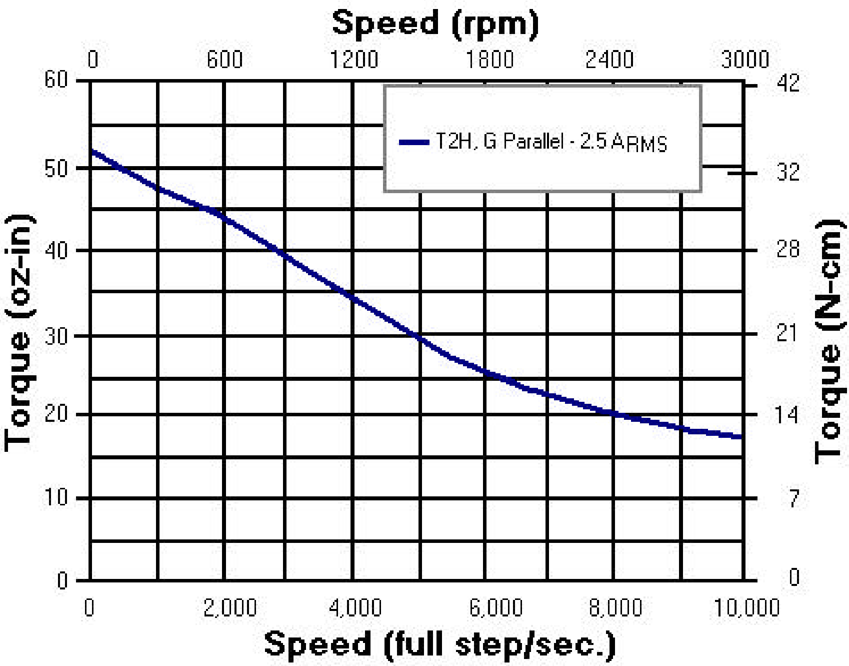
4.3.6. P22/M22, 36 V



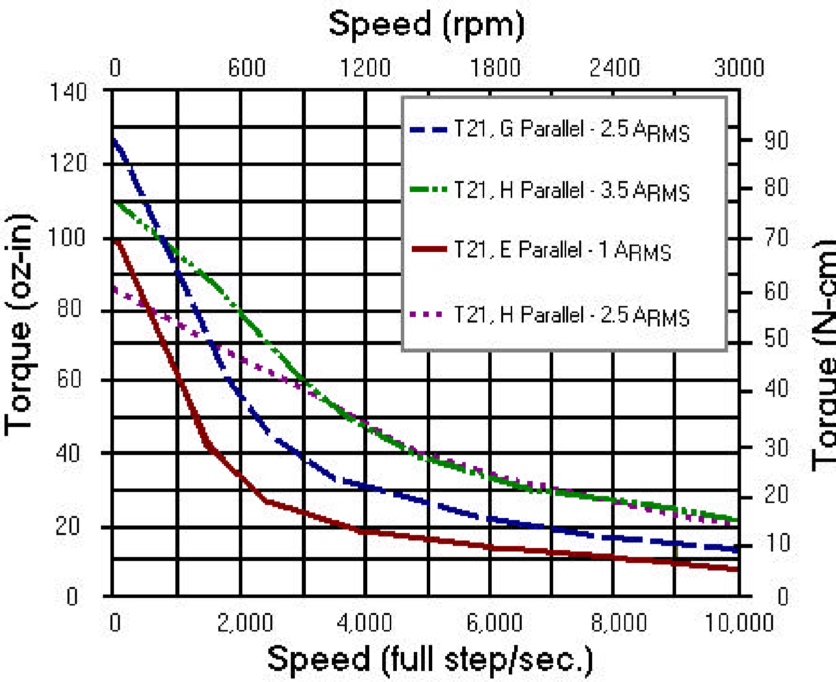
4.3.7. T2H, 24 V


Speed (rpm)
0
600
1200
1800
2400
3000
T2H, G Parallel - 2.5 A RMS
T2H, D Parallel - 1 A RMS
T2H, H Parallel - 3.5 A RMS
T2H, G Parallel - 1 A RMS
Torque (oz-in)
60
50
40
30
20
10
0
Torque (N-cm)
42
35
28
21
14
7
0
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

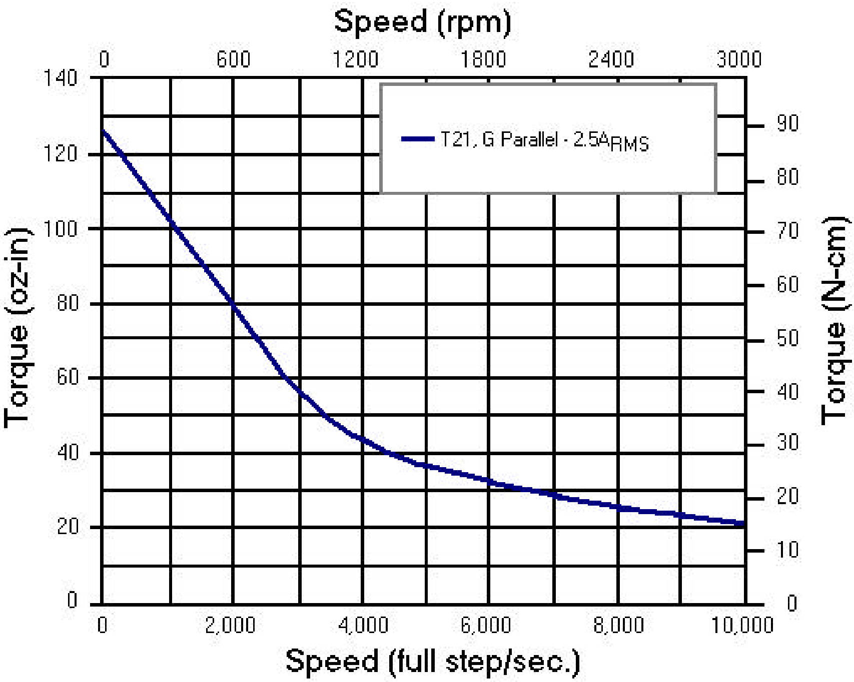
4.3.8. T20, 36 V


Speed (rpm)
0
600
1200
1800
2400
3000
T2H, G Parallel - 2.5 ARMS
Torque (oz-in)
60
50
40
30
20
10
0
Torque (N-cm)
42
32
28
21
14
7
0
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

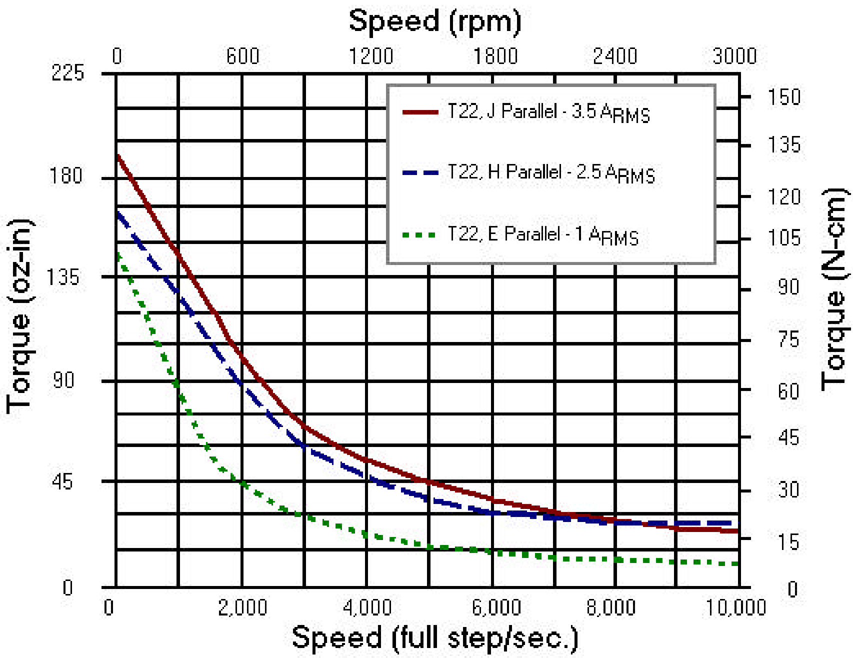
4.3.9. T21, 24 V


Speed (rpm)
0
600
1200
1800
2400
3000
140
120
100
80
60
40
20
0
Torque (oz-in)
T21, G Parallel - 2.5 ARMS
T21, H Parallel - 3.5 ARMS
T21, E Parallel - 1 ARMS
T21, H Parallel - 2.5 ARMS
90
80
70
60
50
40
30
20
10
0
Torque (N-cm)
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

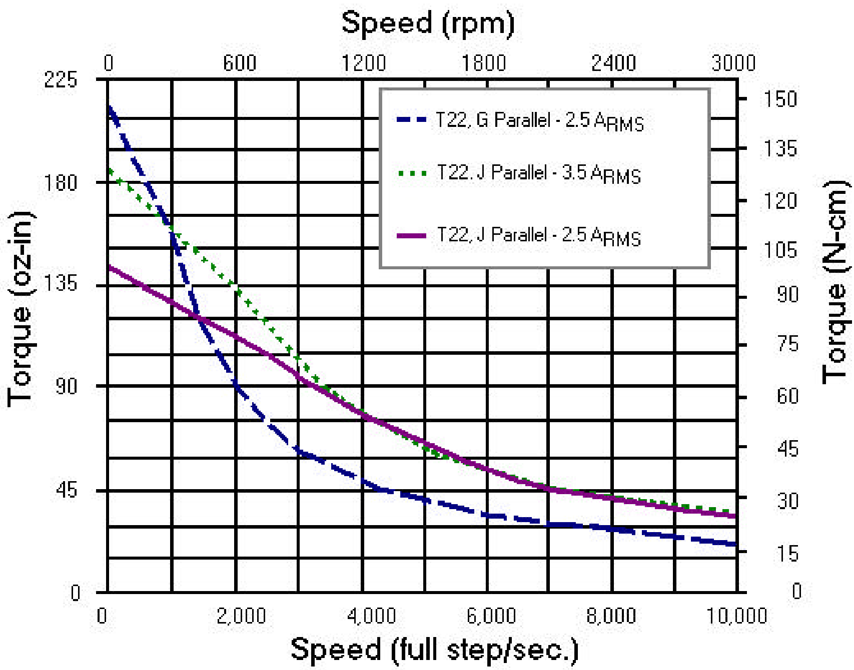
4.3.10. T21, 36 V


Speed (rpm)
0
600
1200
1800
2400
3000
T21, G Parallel - 2.5A RMS
Torque (oz-in)
140
120
100
80
60
40
20
0
Torque (N-cm)
90
80
70
60
50
40
30
20
10
0
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

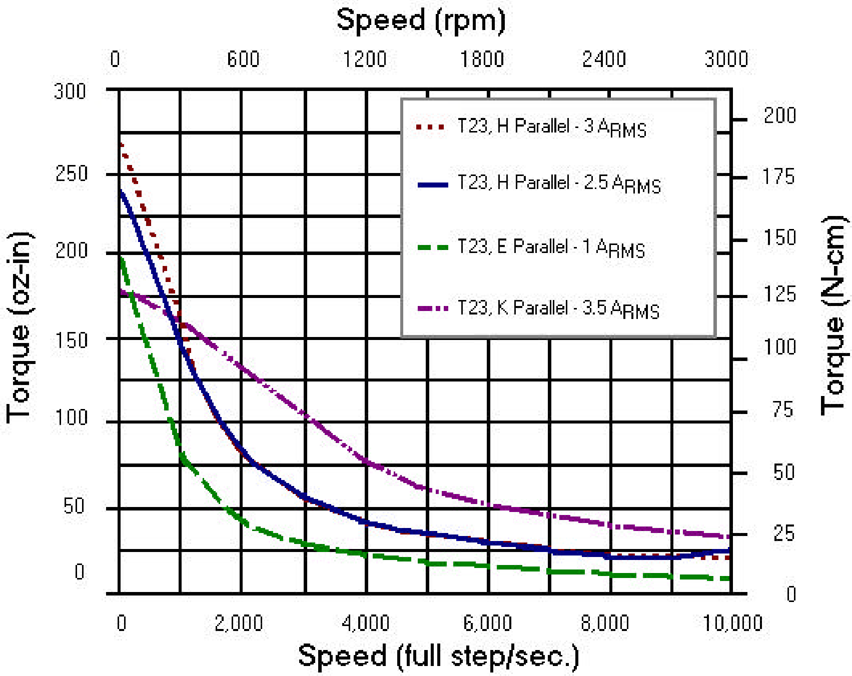
4.3.11. T22, 24 V


Speed (rpm)
0
600
1200
1800
2400
3000
225
180
135
90
45
0
Torque (oz-in)
150
135
120
105
90
75
60
45
30
15
0
Torque (N-cm)
T22, J Parallel - 3.5 A_{RMS}
T22, H Parallel - 2.5 A_{RMS}
T22, E Parallel - 1 A_{RMS}
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

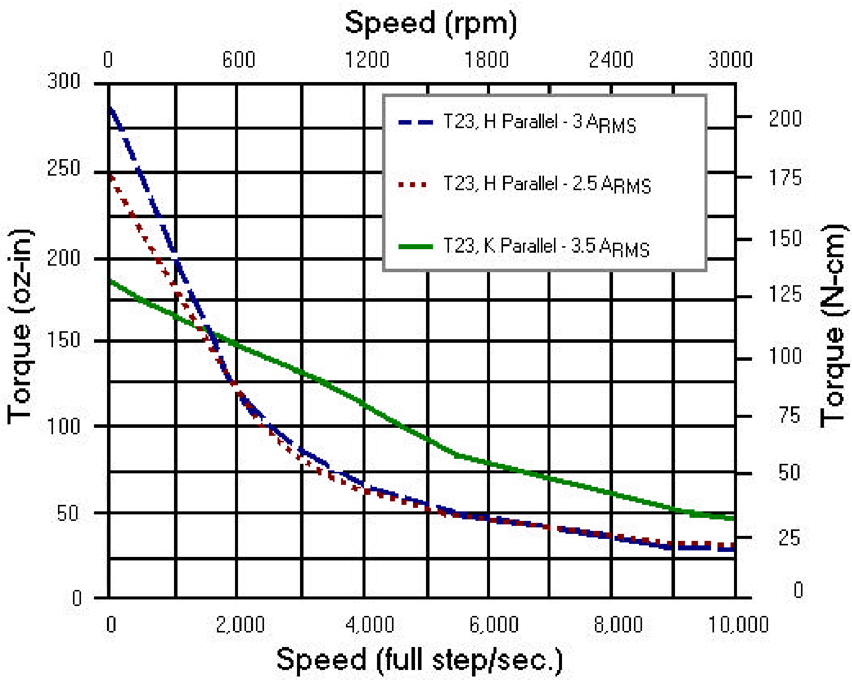
4.3.12. T22, 36 V


Speed (rpm)
0
600
1200
1800
2400
3000
225
180
135
90
45
0
Torque (oz-in)
150
135
120
105
90
75
60
45
30
15
0
Torque (N-cm)
T22, G Parallel - 2.5 ARMS
T22, J Parallel - 3.5 ARMS
T22, J Parallel - 2.5 ARMS
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

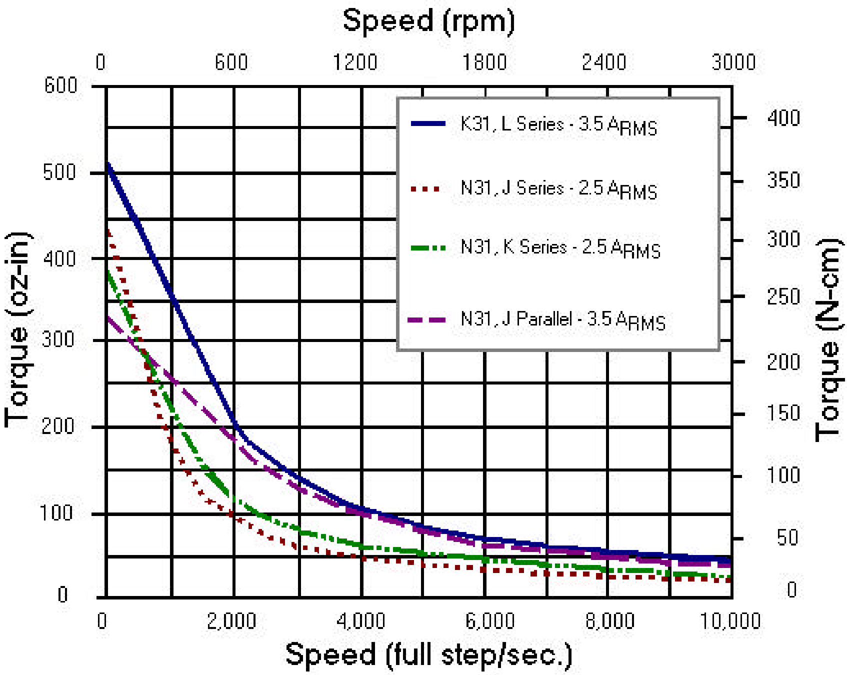
4.3.13. T23, 24 V


Speed (rpm)
0
600
1200
1800
2400
3000
300
250
200
150
100
50
0
Torque (oz-in)
200
175
150
125
100
75
50
25
0
Torque (N-cm)
T23, H Parallel - 3 ARMS
T23, H Parallel - 2.5 ARMS
T23, E Parallel - 1 ARMS
T23, K Parallel - 3.5 ARMS
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

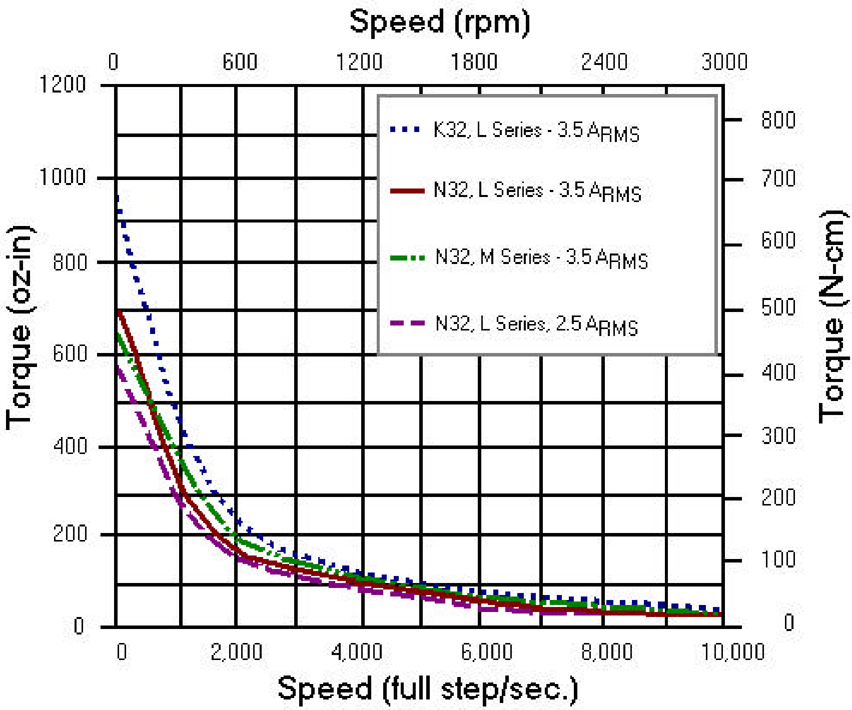
4.3.14. T23, 36 V


Speed (rpm)
0
600
1200
1800
2400
3000
300
250
200
150
100
50
0
Torque (oz-in)
T23, H Parallel - 3 ARMS
T23, H Parallel - 2.5 ARMS
T23, K Parallel - 3.5 ARMS
200
175
150
125
100
75
50
25
0
Torque (N-cm)
0
2,000
4,000
6,000
8,000
10,000
Speed (full step/sec.)

4.3.15. N31/K31, 36 V



4.3.16. N32/K32, 36 V



5. TROUBLESHOOTING

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.

5.1. 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.

5.2. Specifically

If MOTOR DIRECTION is reversed, check for:

Reversed connection to the Motor Connector. Reversing the phase A or the phase B connections will reverse the direction of the 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 winding

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 Danaher Motion Customer Support.

5.3. Electrical Interference Problems

Electrical interference problems are common with today's computer-based controls. 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. 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 the one(s) causing the interference problems. When a noise source is located, try rerouting wiring, suppressing relays or other measures to eliminate the problem.

5.4. Customer Support/Contact Information

Danaher Motion Pacific Scientific technical documentation is updated periodically and may be changed without notice. The latest documentation can be found on our website.

For information on this product or where to purchase near you, contact: your local distributor.

Danaher Motion Customer Support
Phone: (815) 226-2222
Fax: (815) 226-3080
Email: customer.service@danahermotion.com
Website: www.danahermotion.com