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6215 Microstep Drive/Oscillator

Installation Manual
MA6215
Rev. B

Solutions by
DANAHER MOTION

Version History

Revision	Date	Description of Revision
1	10/31/02	Initial Release
B	5/17/04	Updated Corporate Identity

Warning Alerts users to potential physical danger or harm. Failure to follow warning notices could result in personal injury or death.

Caution Directs attention to general precautions, which if not followed, could result in personal injury and/or equipment damage.

Note Highlights information critical to your understanding or use of the product.

SAFETY INSTRUCTIONS

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.

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

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.

SUITABILITY AND WARRANTY

Reconfiguration of the circuit not shown in this manual voids the Warranty.

Failure to follow the installation guidelines voids the Warranty.

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 Danaher Motion 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 6215.

Comply with the applicable European standards and Directives

TABLE OF CONTENTS

1 INTRODUCTION

1. 1 Product Features

The 6215 drive/oscillator combines a bipolar, two-phase PWM drive that uses hybrid power devices and a control/oscillator in one compact package. Micro-stepping at 1/32 step resolution (6400 pulses/revolution) is used to ensure smooth low-speed operation. The maximum running speed is 3,000 rpm. Features include:

- Switch selectable current levels of 1.0 A through 3.5 A
- Microprocessor-based digital oscillator for accurate speed control
- Built-in potentiometers for acceleration, deceleration, low speed, and run speed
- Full short-circuit protection (phase-to-phase and phase-to-ground)
- Undervoltage and transient overvoltage protection
- Efficient thermal design
- Windings Off capability
- User-selectable automatic current reduction at standstill
- Compact size
- Sturdy all-aluminum mounting base
- Run speed control from built-in potentiometer or external voltage input

1. 2 Express Start-Up Procedure

The following instructions define the minimum steps necessary to make your drive/oscillator 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 (0.3 m) is a good guideline.

1. Check to see that the motor used is compatible with the drive/oscillator.
2. Set the correct current level for the motor being used per the instructions in *Current Settings*. Heat sinking may be required to maintain case temperature below +70° C (+158° F).
3. Select the desired motor current at standstill (50% or 100%) and set switch 6 as described in *Automatic Current Reduction (Switch 6).*

4. Select the appropriate run speed source (on board trim pot or external input) and set switch 7 as described in *Run Speed Source (Switch 7)*. If an external run speed voltage source is to be used, select the appropriate voltage range (0 to 5 V or 0 to 10 V) and set switch 8 as described in *External Speed Input Scaling (Switch 8).*
5. Wire the motor according to *Motor Connections*.
6. Connect the power source to the DC input terminal strip. Be sure to follow the instructions for connecting the filter capacitor as described in *Power Input Connections*.
7. Set the desired acceleration rate, deceleration rate, Low speed, and motor running speed using the appropriate potentiometers as described in Current Settings

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

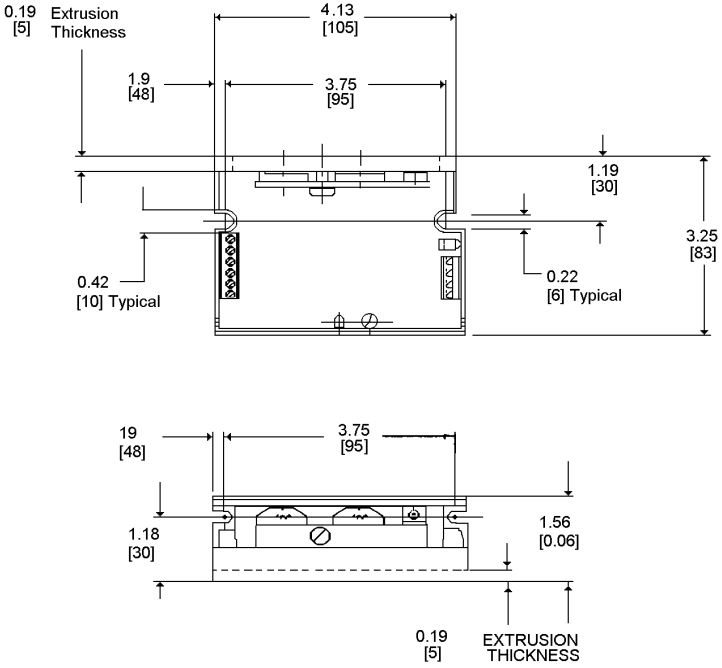
Clockwise and counter-clockwise directions are properly oriented when viewing the motor from the end opposite the mounting flange.

2 INSTALLATION GUIDELINES

The 6215 drive/oscillator is mounted by fastening its mounting brackets to a flat surface. Dimensions are shown in *Mounting Dimensions.* If the drive/oscillator 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.

2. 1 Mounting Dimensions



DIMENSIONS IN BRACKETS ARE IN MILLIMETERS

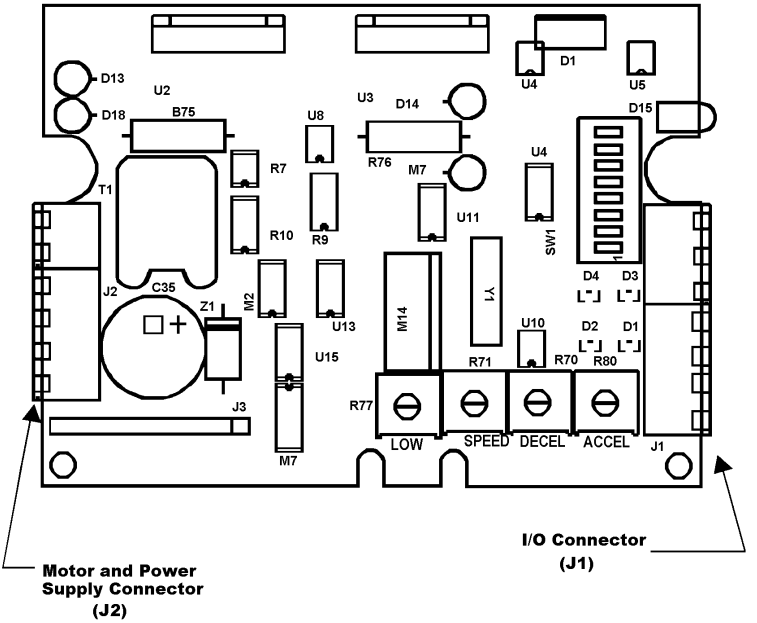
Case temperature must not exceed +70° C (+158° F).

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 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.

2. 2 Terminal Locations and Assignments

2.2.1. TERMINAL LOCATIONS DIAGRAM



2.2.2. MOTOR CONNECTIONS

All motor connections are made via the 6-terminal strip. Terminal assignments are given below. Motor connections are shown in *Motor Wiring Configurations*

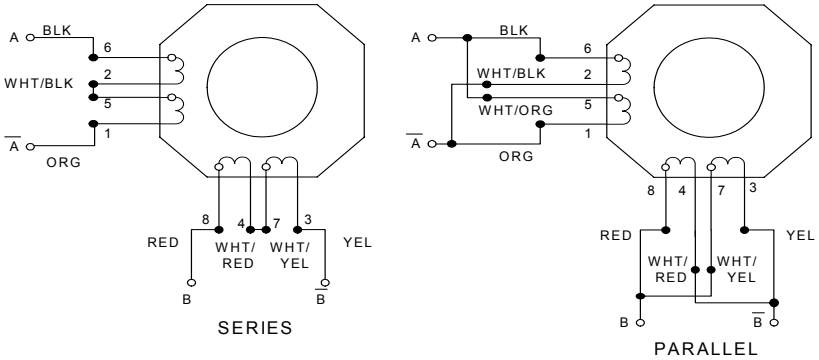
J2 Pin	Assignment
1	M1 (Phase A+)
2	M3 (Phase A-)
3	M4 (Phase B+)
4	M5 (Phase B-)

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

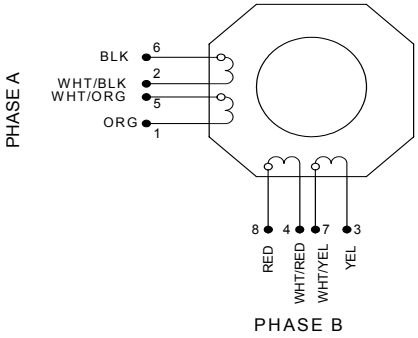
2.2.3. MOTOR WIRING CONFIGURATIONS

2.2.3.1.P2H, P21, M21, P22, M22

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



4-Lead motor (Bipolar)



8-Lead motor (reference)

	DRIVE CONNECTION				
CCW	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

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

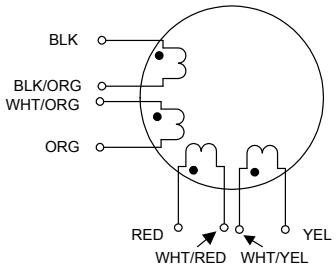
CW

O = off or open
GND = ground
+ = positive current flow
— = negative currrent flow

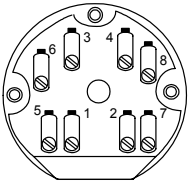
2.2.3.2. N3x / K3x / T2x

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



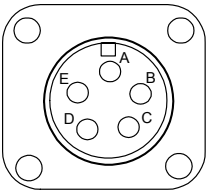
Terminal Board
N3x/K3x

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	

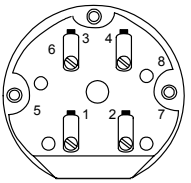
***See* Phase Sequencing Tables.**

2.2.3.3. 4 flying leads or 4 terminals or MS connector.

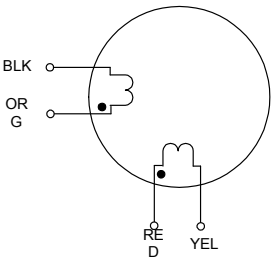
The 4-lead motor is used with bipolar drives.



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.**

2.2.4. PHASE SEQUENCING TABLES

BIPOLAR HALF STEP

CCW	DRIVE CONNECTION					
	STEP	A	$\overline{A}$	B	$\overline{B}$	
↓	1	+	—	0	0	↑
	2	+	—	+	—	
	3	0	0	+	—	
	4	—	+	+	—	CW
	5	—	+	0	0	
	6	—	+	—	+	
	7	0	0	—	+	
	8	+	—	—	+	

BIPOLAR FULL STEP

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

O = off or open
GND = ground
+ = positive current flow
–— = negative currrent flow

2.2.5. POWER INPUT CONNECTIONS

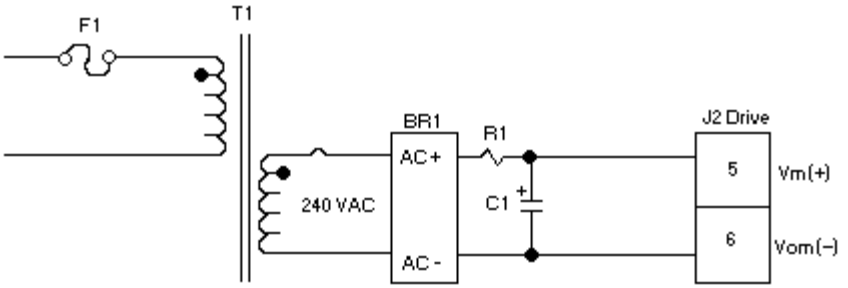
The DC input power is connected to terminals 5 and 6 of the terminal strip. Terminal 5 [V_M(+)] is the power supply plus (+) connection and pin 6 [V_{OM}(-)] is the power supply minus (-) connection.

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 below).

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

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

2.2.5.1. 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 (0.3 m). Maximum wire length is three feet. Use 16 AWG or larger wire.

Components for Power Supply

F1	1.5 A time delay, 250 V
R1	5 Ω 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 Chemcon 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		10.3 ounces (292 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

Operating Temperature	+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 Temperature	-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 (Amps)
None (All OFF)	1.0
1	1.5
2	2.0
3	2.5
4	3.0
5	3.5

3. 5 Automatic Current Reduction (Switch 6)

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.

3. 6 Run Speed Source (Switch 7)

When switch 7 is in the OFF position, the on-board speed potentiometer is used as the run speed source. When switch 7 is in the ON position, an external voltage applied to input VIN is used as the run speed source. *External Speed Input Scaling (Switch 8)* provides information on the scaling of this input.

3. 7 External Speed Input Scaling (Switch 8)

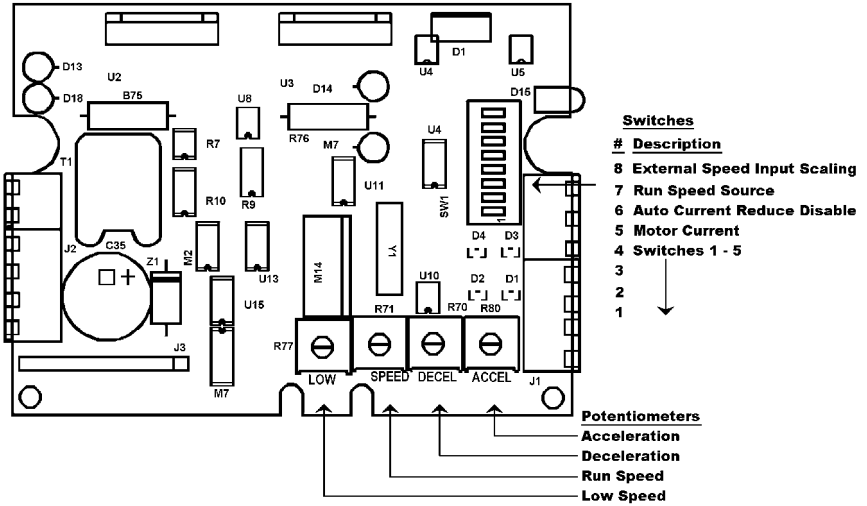
The external speed input (VIN) scaling is selected using switch 8. Placing switch 8 in the OFF position selects 0 V - 5 V as the range of the external speed input. The ON position sets the input range to 0 V - 10 V.

3. 8 Potentiometers

On-board potentiometers are provided for setting the following motion parameters: acceleration, deceleration, low speed, and run speed. Run speed can also be set via an external potentiometer (see *Run Speed Source (Switch 7)*) or an external voltage input 0 – 5 V or 0 – 10 V (see *External Speed Input Scaling (Switch 8)*).

The drive/oscillator is implemented using digital techniques. Micro-stepping at 1/32 step resolution (6400 pulses/revolution) is used to ensure smooth operation at low speeds. The settings for acceleration, deceleration, low speed and speed are analog by nature and are converted to digital form using an 8-bit A/D. This results in granularity in the resolution settings. The ranges of each parameter are specifically in full steps/sec. and full steps/sec^2.

3.8.1. SWITCH AND POTENTIOMETER LOCATIONS



Parameter	Description	Range	Resolution (8 bits)
Acceleration	Rate at which motor speed increases	4000 – 120,000	500 full steps/sec^2
Deceleration	Rate at which motor speed decreases	4000 – 120,000	500 full steps/sec^2
Low speed	Motor starting speed	0 – 1200	40 full steps/sec
Speed	Motor running speed	0 – 10,000	40 full steps/sec

3. 9 Signal Specifications

3.9.1. TERMINAL ASSIGNMENTS

All connections are made via the 7-pin terminal strip.

J1 Pin	Assignment
1	LOW SPEED
2	DIR
3	RUN
4	AWO
5	GND
6	EXT SPEED
7	+5V

3.9.2. SIGNAL DESCRIPTIONS

LOW SPEED **Low Speed Input (J1-1)**

When this input is activated (tied to GND), the RUN SPEED is set by the low speed Potentiometer.

DIR **Direction Input (J1-2)**

When this signal is high, motor rotation is clockwise. Rotation is counter-clockwise when this signal is low.

RUN **Run Input (J1-3)**

When this signal is low, the motor will run in the direction set by the DIR input at the desired set speed.

AWO **All Windings Off Input (J1-4)**

When this signal is low, AC and DC current to the motor is zero.

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

GND **Signal ground (J1-5)**
This ground point can be used for activating the discrete input signals on pins J1-1 through J1-4. It can also be used as a reference point for an external voltage input or in conjunction with the +5 V output (J1-7) to power an external speed potentiometer.

EXT SPEED **External Run Speed Input (J1-6)**
This is an optional input that can be used in place of the on-board run speed potentiometer. Input range can either be 0 – 5 V or 0 – 10 V as defined by switch 8 described in *External Speed Input Scaling (Switch 8)*.

+5V **+5 V Output (J1-7)**
This output is provided for powering an external speed potentiometer. Pin J1-5 is used as the ground reference.

3.9.3. LEVEL REQUIREMENTS

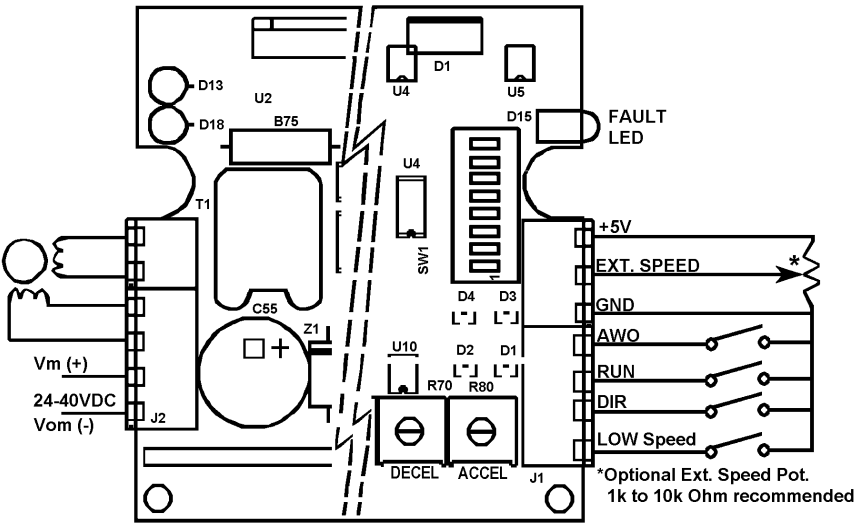
External Speed Input (EXT SPEED)

Voltage	0 - 10 VDC
Input Impedance	100 k Ω

I/O Signals

Voltage	
Low	≤2.0 VDC ≥0.0 VDC
High	≥3.0 VDC
Open Circuit Input Voltage	5 VDC Typical
Current	
Logic 0 sink current	≤1 mA

3.9.3.1. Suggested Methods for Control Interface



3.9.4. TIMING CONSIDERATIONS

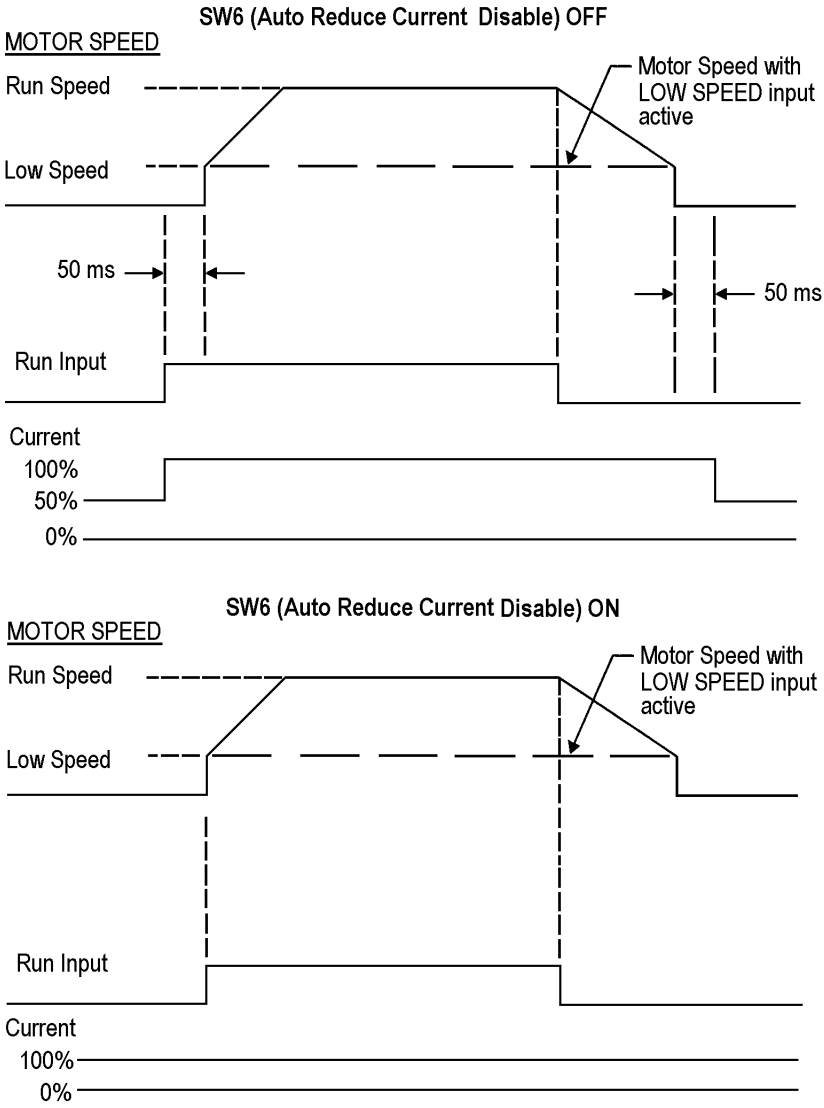
***Refer to* Timing Considerations Diagram**

When the RUN input is activated, the motor goes from 0 speed to Low speed either immediately or after a 50 ms delay. If the Low speed input is active, the motor speed stays at Low speed. Otherwise, the speed is increased to the Run speed at the acceleration rate set via the ACCEL potentiometer. When the RUN input is removed, the motor speed is decreased to Low speed at the deceleration rate via the DECEL potentiometer. Upon reaching Low speed, the motor stops.

If selected, Auto Reduce Current takes effect 50 ms after the motor stops. The DIR input, which determines the motor rotation direction, is sampled when the RUN input goes active (Low tied to GND).

All of the switch settings, potentiometer settings, and input signals can be changed on-the-fly with the new settings (except DIR), effective immediately. The *Timing Considerations Diagram* depicts the timing relationships between the RUN input, motor speed, and motor current.

3.9.4.1. Timing Considerations Diagram



3. 10 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 over current condition requires removing and then reapplying the power.

4 TORQUE VS. SPEED

4. 1 Motor Compatibility

Motor Types	Danaher Motion
T, PSeries Frame Sizes	TBD
N, K Series Frame Sizes	TBD
Number of Connections	4, 6, 8
Minimum Inductance	0.5 mH
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 Ω

Do not use larger frame size motor than those listed or the drive/oscillator may be damaged. If a larger frame size motor must be used, consult Danaher Motion for recommendation.

Maximum resistance is total of motor plus cable.

4.1.1. MOTORS FOR USE WITH THE 6215 DRIVE/OSCILLATOR

4.1.1.1. Specifications

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
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

Motor Type	STD. LTR. WINDING	Connection S= Series P=Parallel	Drive Amps I (rms)	Rated Motor Current Ic (Amps)	Phase Resistance Ohms @25C
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

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

Motor Type	Phase Inductance Lp (mH)	Holding Totque Th (OZ*IN)	Rotor Inertia Jm (OZ*IN*S^2)	Detent Torque Td (OZ*IN)
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
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. Danaher Motion 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 Danaher Motion 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 aids 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.

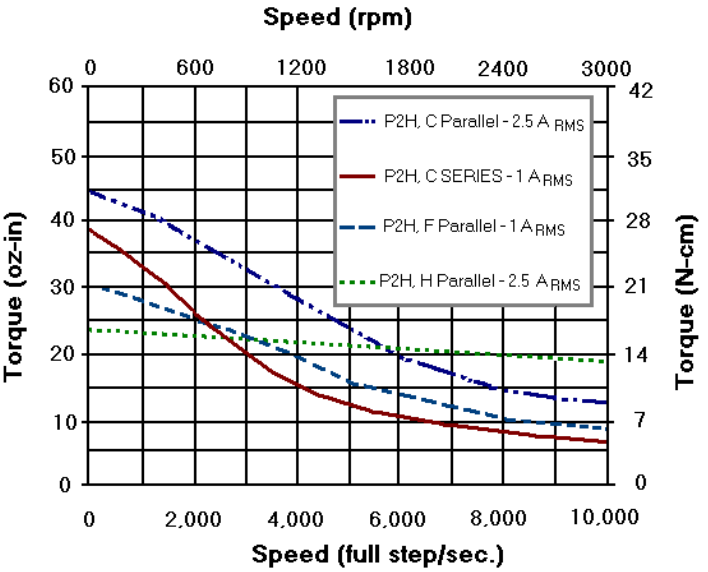
Avoid constant speed operation at the motor's unstable frequencies. Select a base speed above the motor's resonant frequencies and adjust acceleration and deceleration to move the motor through unstable regions quickly.

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.

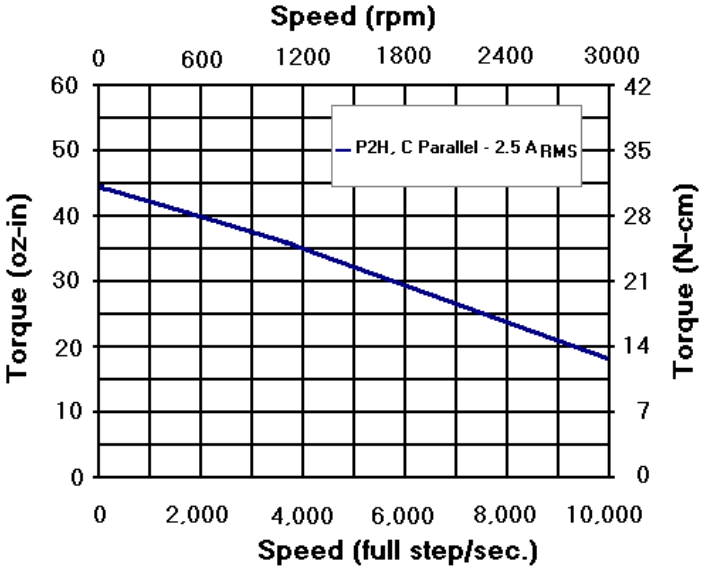
4. 3 Typical Torque Vs. Speed Curves

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

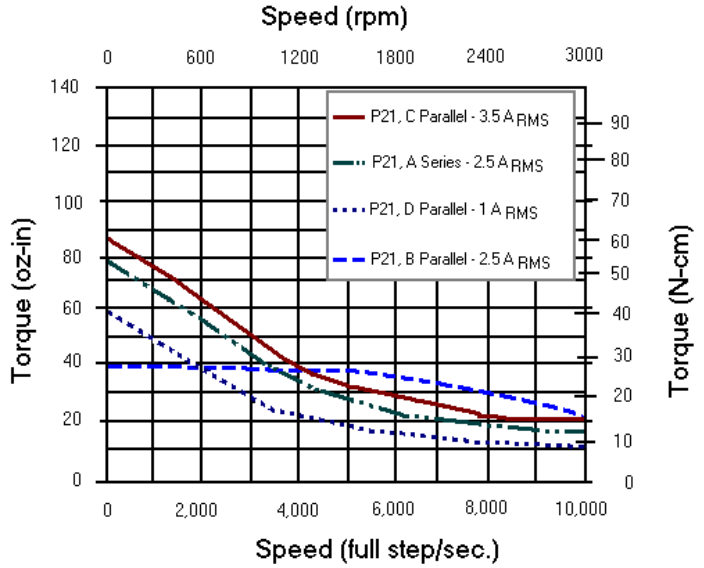
4.3.1. P2H, 24 V



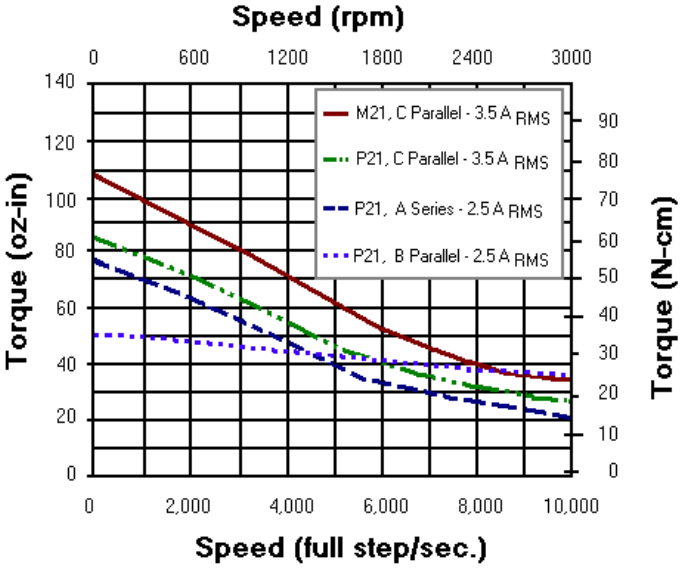
4.3.2. P2H, 36 V



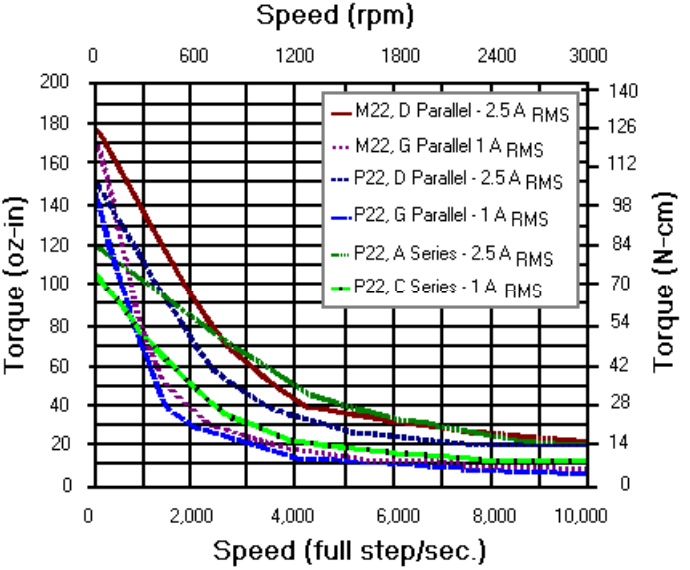
4.3.3. P21, 24 V



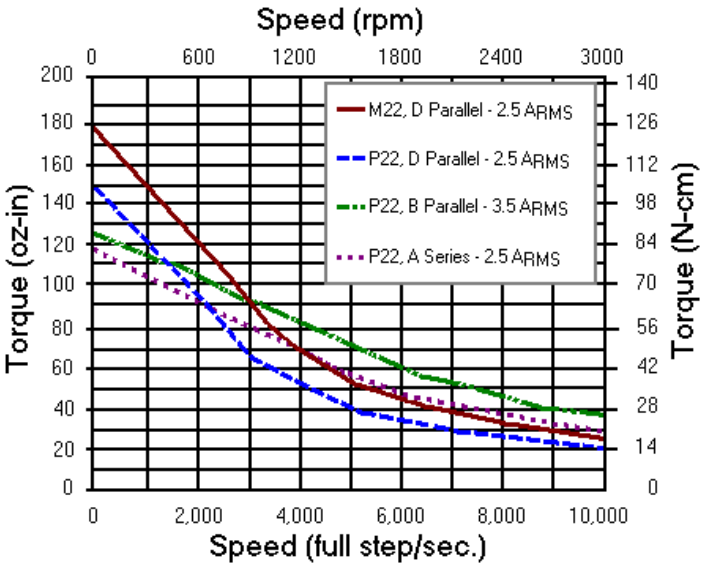
4.3.4. P21/M21, 36 V



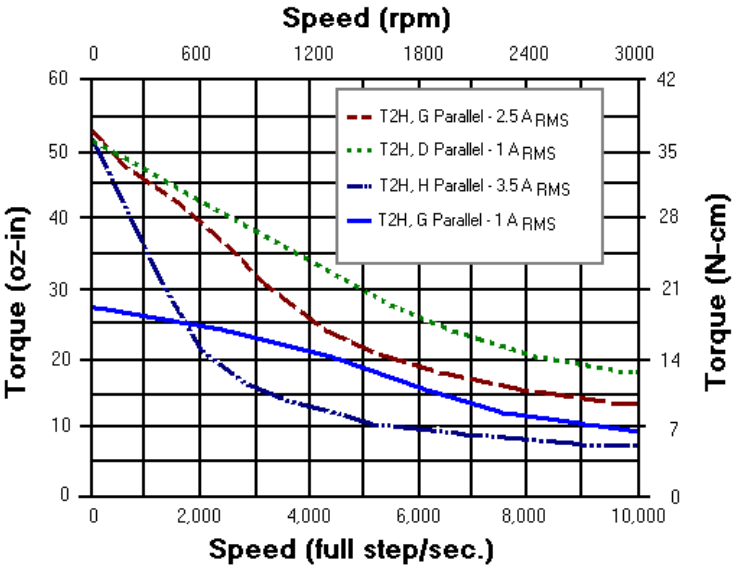
4.3.5. P22/M22, 24 V



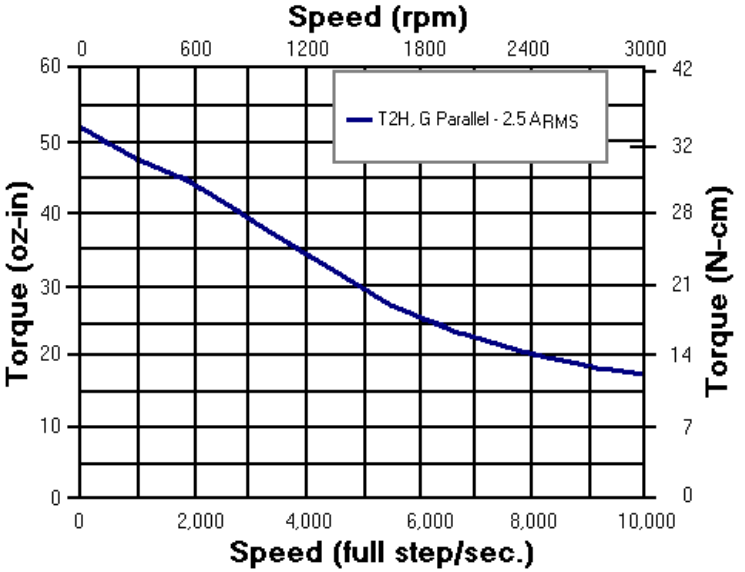
4.3.6. P22/M22, 36 V



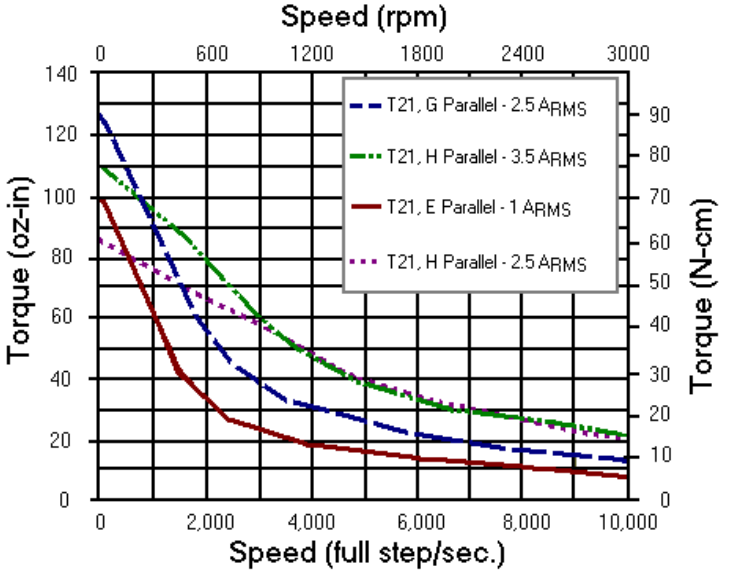
4.3.7. T2H, 24 V



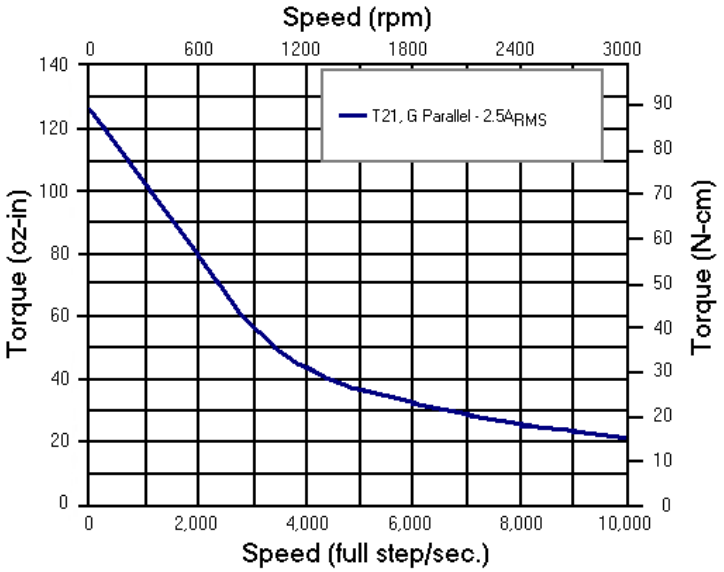
4.3.8. T20, 36 V



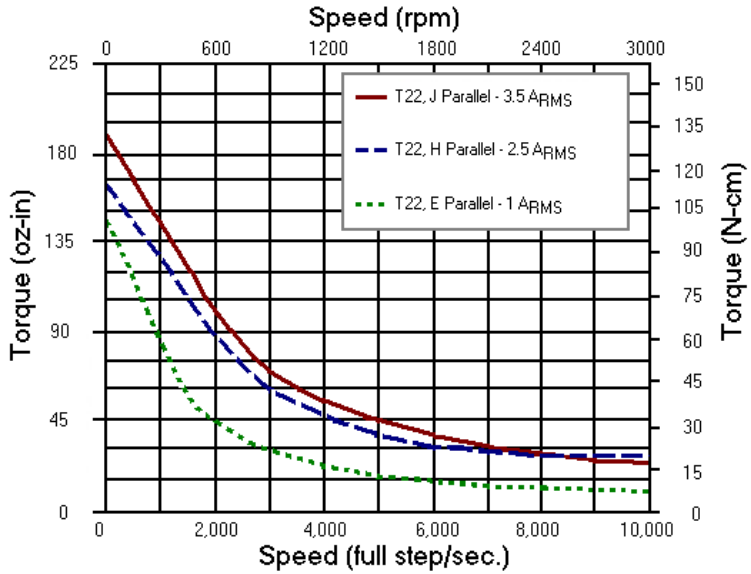
4.3.9. T21, 24 V



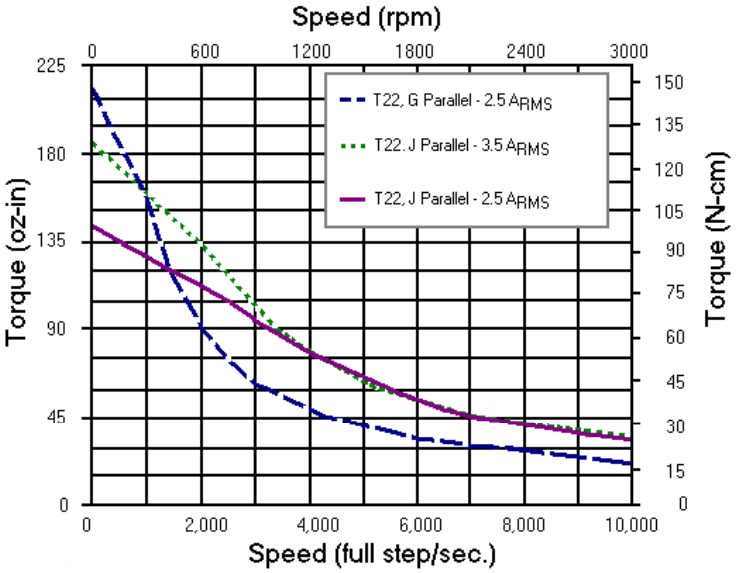
4.3.10. T21, 36 V



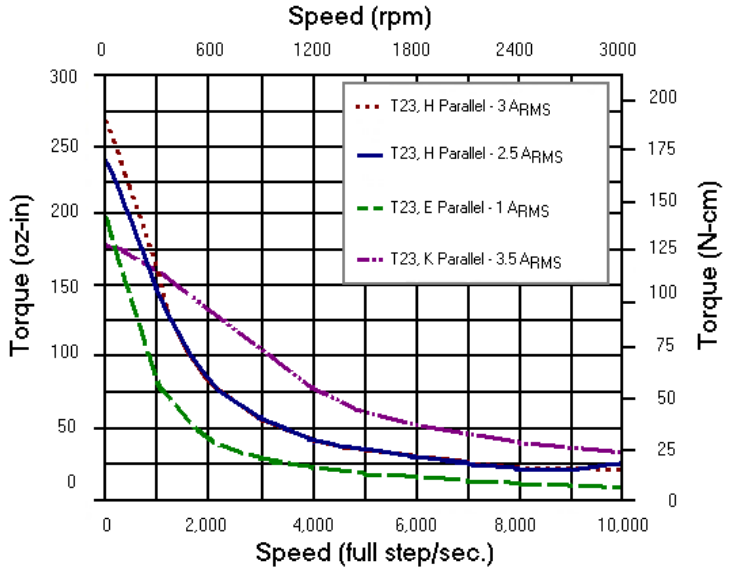
4.3.11. T22, 24 V



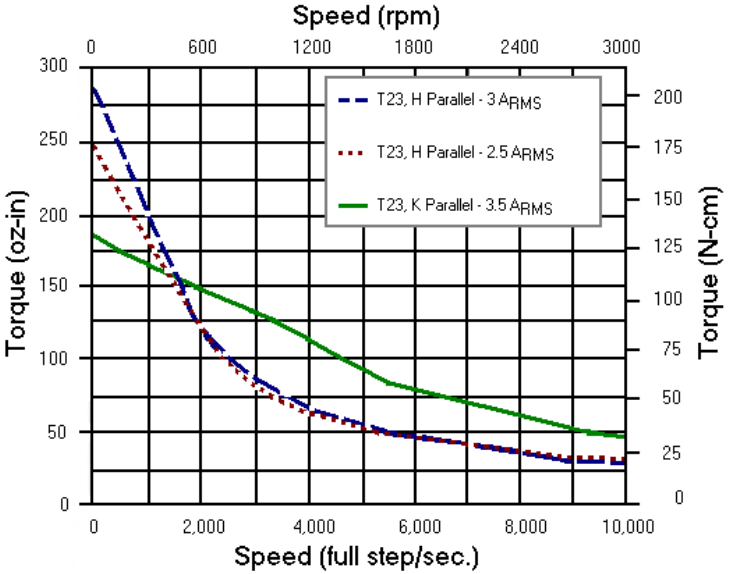
4.3.12. T22, 36 V



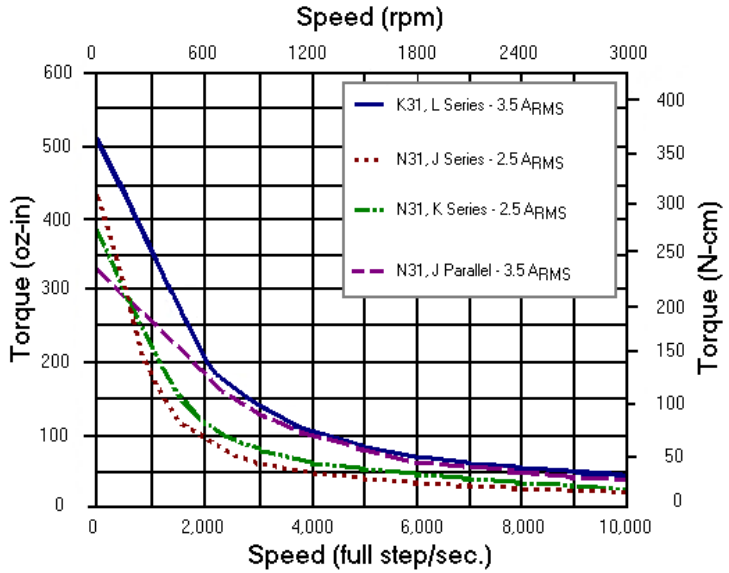
4.3.13. T23, 24 V



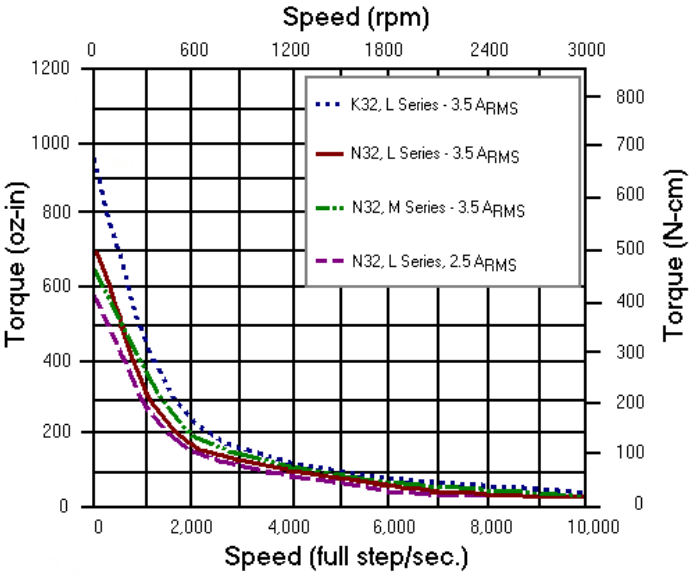
4.3.14. T23, 36 V



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.

- 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.
- Be certain proper wiring practices are followed for location, grounding, wiring, and relay suppression.
- Double-check the grounding connections to be sure they are good electrical connections and are as short and direct as possible.
- 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

Danaher Motion products are available world-wide through an extensive authorized distributor network. These distributors offer literature, technical assistance, and a wide range of models off the shelf for the fastest possible delivery. Danaher Motion sales engineers are conveniently located to provide prompt attention to customer needs. Call the nearest office for ordering and application information and assistance or for the address of the closest authorized distributor. If you do not know who your sales representative is, contact us at:

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