FEATURES

- **Off line 120/240 Vac 60/50 Hz**
- **Patented 4-phase Bipolar Chopper Drive for superior current regulation and low ripple current**
- **Output current adjustable from 0.625 A rms to 5 A rms with 3 position DIP switch**
- **Microstepping for smooth operation and increased resolution.**
- **Patented Digital Electronic Damping reduces instability at mid-speed ranges.**
- **Idle current reduction to reduce motor heating in many applications**
- **Output for 2nd Axis:**
  - 66 Vdc ± 2 volts available via three position plug-in connector (J6) to power additional axis (total power available for internal and external axis = 300 W)
- **Drive Fault protection:**
  - Line-to-line and line-to-neutral
- **Power supply fault protection:**
  - Over temperature
  - Short circuit
  - Under voltage
- **Optically isolated command interface:**
  - Step
  - Direction
  - Enable
  - Enabled output
- **Selectable step filter**
  - Rejection of electrical noise on step input
- **Small size** - 6.25" x 2.25" x 12.50"
- **UL and CSA recognition pending**
- **CE conformance pending**

APPLICATIONS

- **X-Y tables and slides**
- **Packaging machinery**
- **Robotics**
- **Specialty machinery**
- **Index feed of materials**
- **Labeling machines**

PRODUCT DESCRIPTION

The Pacific Scientific 6430 is a low cost, compact stepper drive converting step and direction inputs into winding currents for two-phase stepper motors.

Resolution with 1.8º motors is adjustable to 200, 400, 1000, 2000, 5000, 10,000, 25,000, or 50,000 steps per revolution with decimal step size selected, and 400, 800, 1600, 3200, 6400, 12800, 25600, or 51200 steps per revolution with binary step size selected. Higher resolution (microstepping) provides smoother operation through resonance regions as well as increased position resolution.

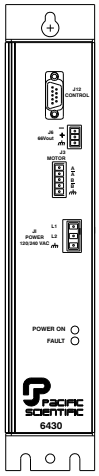
A patented Digital Electronic Damping circuit ensures the availability of full motor torque at all speed ranges. This compensation damps motor oscillations common with stepper systems. Whether in the full step or microstepping mode, full motor torque is achieved throughout the speed range.

The default output current is 5A rms. The current can be reduced in increments of 0.625 A rms using a 3 position DIP switch.

A patented 4-phase PWM (pulse width modulated) chopper electronically controls the motor winding currents at 20 KHz. This combines the best of recirculating and non-recirculating current regulation to provide high back EMF rejection with low ripple current. Benefits include reduced heat dissipation, low electrical noise and improved current control during dynamic braking.

The patented 4 phase control circuit, combined with Digital Electronic Damping, provides significantly more motor output power than from other drives.

Idle current reduction permits an automatic 50% reduction in motor winding current during motor idle conditions to minimize heating during dwell periods. If no step commands have been received for 0.1 second (0.05 and 1.0 seconds can also be selected through DIP switch settings), the current is automatically reduced. Current is restored to full amplitude upon arrival of a step command.



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SPECIFICATIONS

Input Power

Voltage	120/240 Vac (+10%, -15%) 50-60 Hz (switch selectable)
Line Current	At full (300W) load 240 Vac, 2.3 A RMS 120 Vac, 3.5 A RMS
Output motor phase current	5 A rms max. 5 A peak full step (square wave) 7.1 A peak microstepping (sine wave) Adjustable from 0.625 to 5 A rms in 0.625 A rms increments (See Figure 3)
66 Vdc Output for 2nd axis	66 ± 2 volts Total power (internal + external) = 300W
Inputs	(See Figures 1 and 2)
STEP	Optically isolated TTL compatible Minimum opto current (opto on): 5.5 ma Maximum opto current (opto on): 10 ma Minimum pulse width: 250 ns (**1 µs**) Maximum frequency: 2 MHz (**500 KHz**) Motion occurs on low-to-high transition of STEP- input **Note: BOLD** values indicate step filter enabled
DIR	Optically isolated TTL compatible For normal motor connections: Current in opto (opto on): Rotation CCW looking at motor shaft Minimum opto current (opto on): 3 ma Maximum opto current (opto on): 4.5 ma Minimum setup time: 50.0 µs Minimum hold time: zero
ENABLE	Optically isolated TTL compatible Sense of ENABLE input can be changed using ENBL_SENSE jumper: Jumper In: Current in opto (opto on) enables drive Jumper Out: Current in opto (opto on) disables drive Minimum opto current (opto on): 3 ma Maximum opto current (opto on): 4.5 ma

SPECIFICATIONS (continued)

Output (See Figures 1 and 2)

ENABLED Optically isolated open collector, open emitter

Drive Enabled: opto transistor on, V_{sat} = 0.5 V max. @ 2.0 ma

Drive Disabled: opto transistor off, V_{ce} max. = 35 V

Step Size Set using 3 positions of DIP switch and decimal jumper (See Figure 3).

Step Size	**Steps per Revolution** (1.8^o motor)
Full **(1/2)**	200 **(400)**
1/2 **(1/4)**	400 **(800)**
1/5 **(1/8)**	1000 **(1600)**
1/10 **(1/16)**	2000 **(3200)**
1/25 **(1/32)**	5000 **(6400)**
1/50 **(1/64)**	10000 **(12800)**
1/125 **(1/128)**	25000 **(25600)**
1/250 **(1/256)**	50000 **(51200)**

Note: Binary values are in **BOLD**

Idle Current Reduction Enabled or disabled with DIP switch
50% output current reduction after 0.1 second from last step command
(0.05 and 1.0 second time-outs can also be selected using a plug-on jumper. Consult factory for other current reduction options)
See Figure 3.

Digital Electronic Damping Enabled or disabled with DIP switch (See Figure 3)
Max. delay from input step to change in motor excitation:
Step frequency < 500 full steps/sec: 500 μs
Step frequency > 500 full steps/sec: 270^o of step period

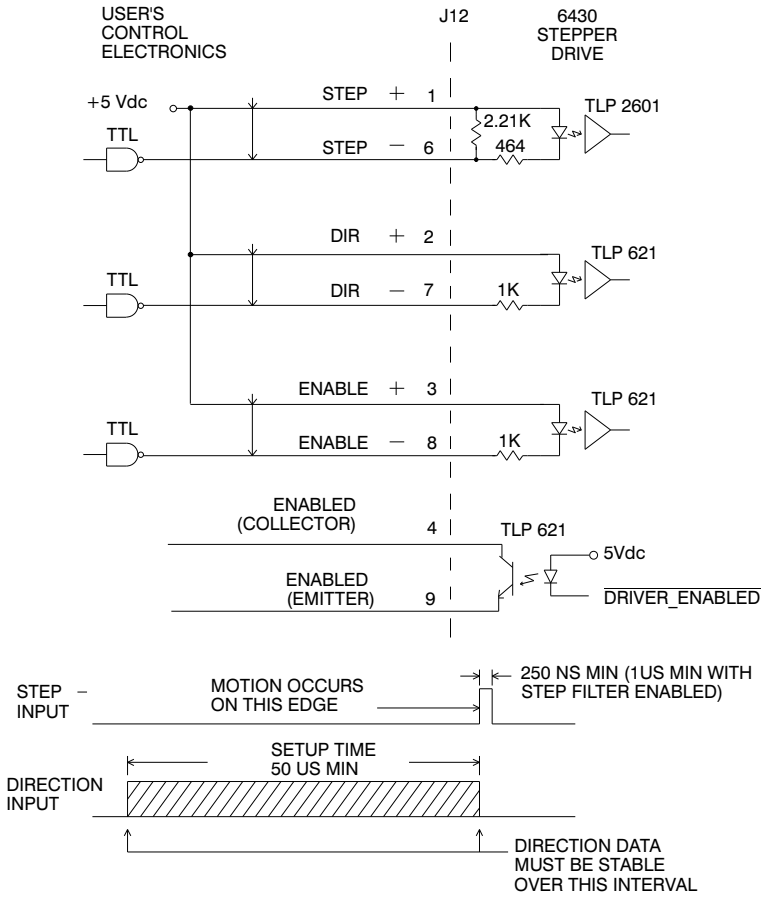


Figure 2 - Interface Circuits

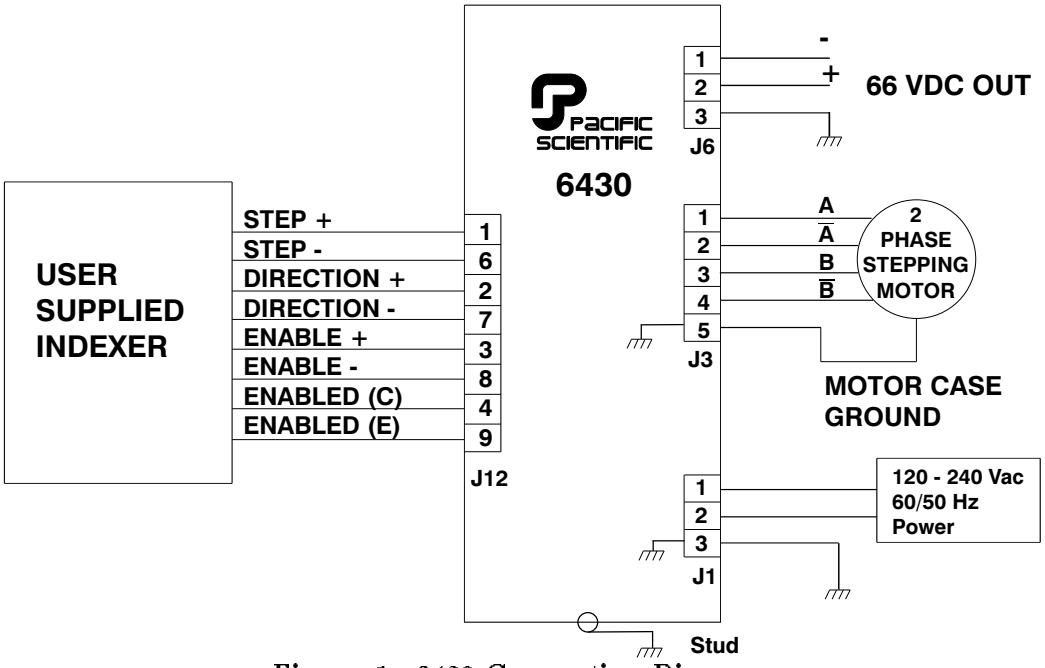


Figure 1 - 6430 Connection Diagram

Environmental Requirements

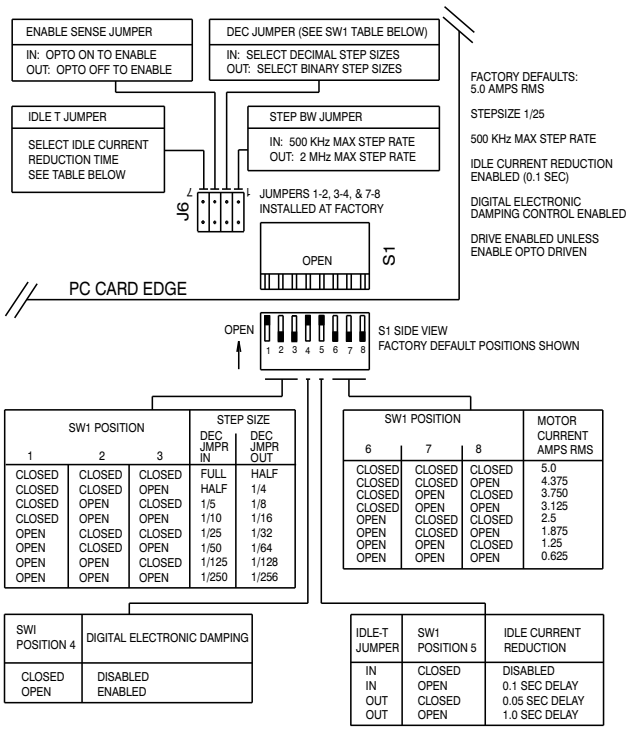
Storage temperature	-40°C to +70°C
Operating temperature	0 to 50°C ambient 50°C to 60°C (derated)
Altitude	5000 ft (1500m) by design
Humidity Range	10 to 90%, non-condensing
Vibration	IEC Standard 68-2-6 Pending

Mechanical

Dimensions	6.25" x 2.25" x 12.50"
Weight	6 lbs. nominal

Connectors

66 VDC Output	PCD ELVH0310 connector. Mating connector: PCD ELVP03100.
Motor	PCD ELVH0510 connector. Mating connector: PCD ELVP05100.
AC Input	Phoenix MSTBA 2,5/3-G connector. Mating connector: Phoenix MSTB 2,5/3-ST.
Signal	9 contact female D connector, Mating connector: ITT Cannon DE-9P with ITT Cannon DE110963 Hood and D20419 Clamp Kit.



SW1 POSITION 1	2	3	STEP SIZE DEC JMPR IN	DEC JMPR OUT
CLOSED	CLOSED	CLOSED	FULL	HALF
CLOSED	CLOSED	OPEN	HALF	1/4
CLOSED	OPEN	CLOSED	1/5	1/8
CLOSED	OPEN	OPEN	1/10	1/16
OPEN	CLOSED	CLOSED	1/25	1/32
OPEN	CLOSED	OPEN	1/50	1/64
OPEN	OPEN	CLOSED	1/125	1/128
OPEN	OPEN	OPEN	1/250	1/256

SW1 POSITION 6	7	8	MOTOR CURRENT AMPS RMS
CLOSED	CLOSED	CLOSED	5.0
CLOSED	CLOSED	OPEN	4.375
CLOSED	OPEN	CLOSED	3.750
CLOSED	OPEN	OPEN	3.125
OPEN	CLOSED	CLOSED	2.5
OPEN	CLOSED	OPEN	1.875
OPEN	OPEN	CLOSED	1.25
OPEN	OPEN	OPEN	0.625

SWI POSITION 4	DIGITAL ELECTRONIC DAMPING
CLOSED	DISABLED
OPEN	ENABLED

IDLE-T JUMPER	SW1 POSITION 5	IDLE CURRENT REDUCTION
IN	CLOSED	DISABLED
IN	OPEN	0.1 SEC DELAY
OUT	CLOSED	0.05 SEC DELAY
OUT	OPEN	1.0 SEC DELAY

Figure 3 - Dip Switch Settings

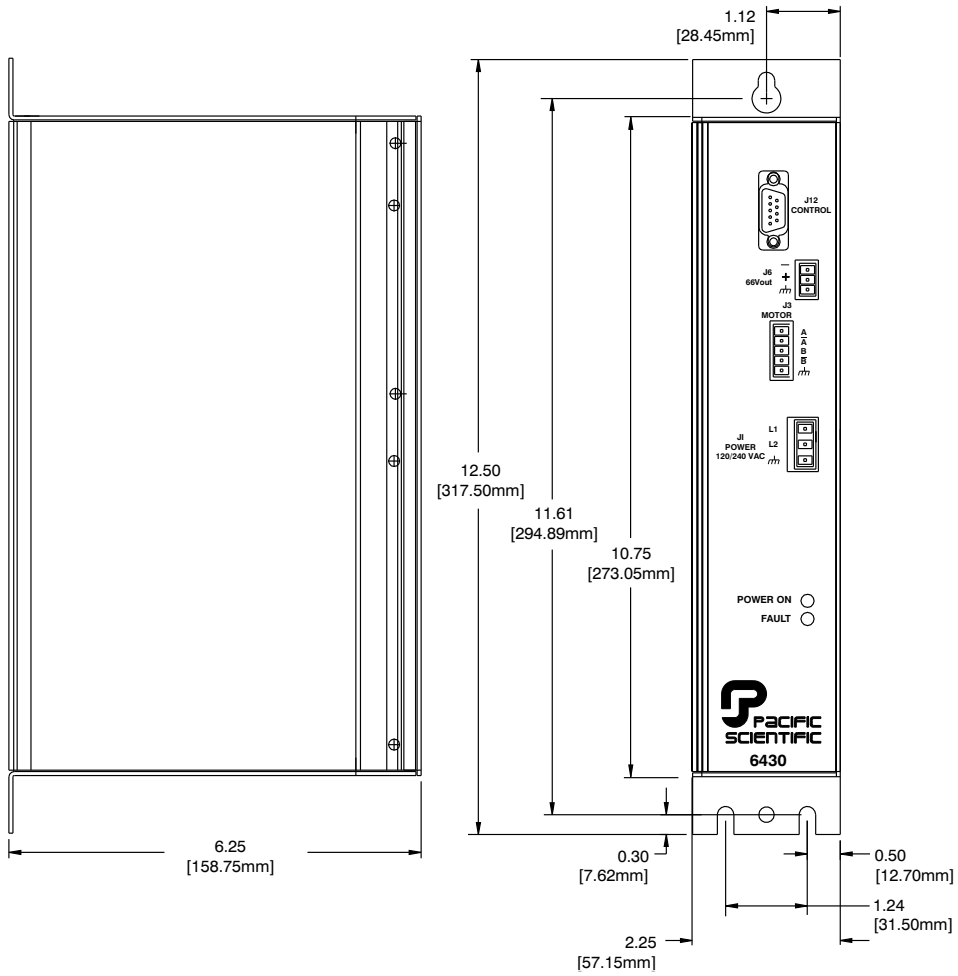
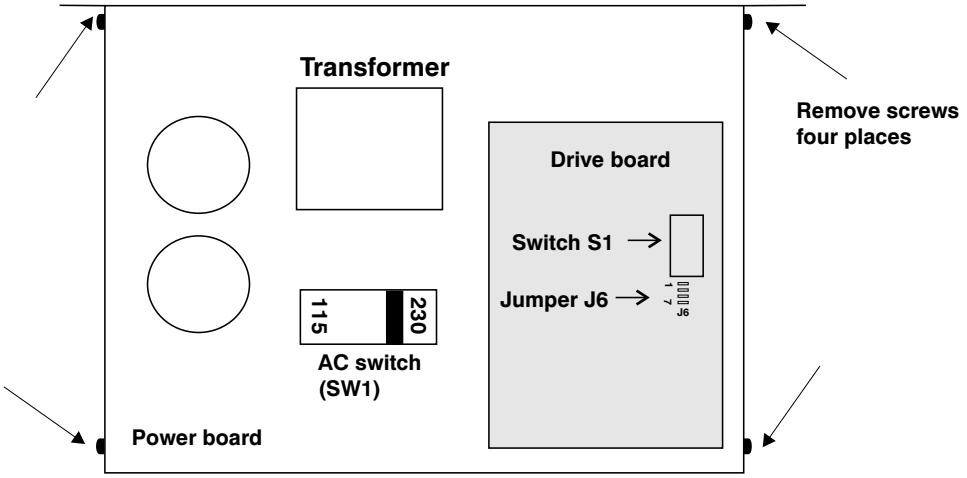


Figure 4 - Mounting Dimensions

JUMPER & AC SWITCH SETTINGS

The AC switch is preset at the factory in the 230 Vac position. The J6 Jumper and AC switch settings are easily accessible by opening the cover. **First, make certain the power connections have been removed**. Rest the unit on its side as shown. Remove the four screws. Select appropriate settings. Replace cover and mounting screws. Do NOT over tighten mounting screws. (5.0 in-lbs max)

Note: *Connecting 240 (230) Vac with switch in 120 (115) Vac position will permanently damage the drive.*

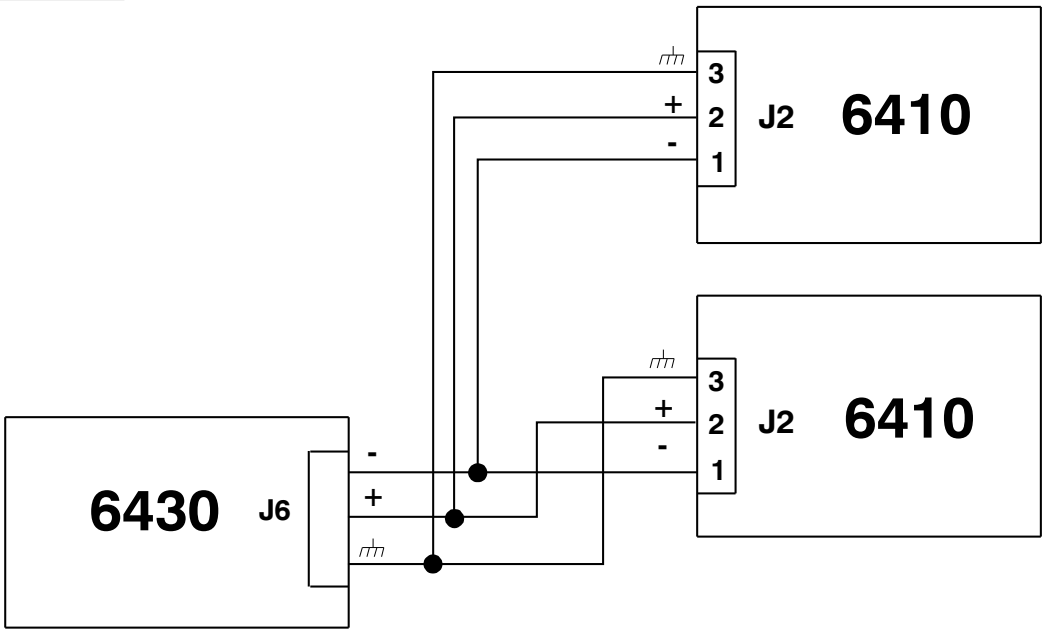


66 VDC OUTPUT CONNECTOR J6

The 6430 package has an external 66 Vdc connector designed to power an additional drive. The total power available for both the internal and external drives is 66 Vdc @ 4.6 Amps or approximately 300 Watts. If the two drives are running simultaneously and require more than 4.6 Amps, the voltage will drop. The power supply has a low voltage protection circuit that will fault the drive if the voltage is less than 55 Vdc.

A twisted pair plus ground cable utilizing 16, 18, or 20 gauge wire, is recommended to connect the remote connector to the external drive. A 470 μF 100 Vdc aluminum electrolytic capacitor, rated for 2A ripple current or greater, must be installed at the additional drive if the cable length is over 3 feet.

Connection diagram



TROUBLESHOOTING

Power Board

SYMPTOM	POSSIBLE CAUSE	ACTION
Unit does not start LEDs ON (green and/or red)	120/240 Vac switch in 240 position, input from 120 Vac	Turn power off, correct switch position.
	AC Input line low	Increase Input AC to spec.
	Dead short or overload across external 66 Vdc output connector (J6).	Remove short or reduce load.
	Over temperature	Check ambient temperature or internal fan malfunction/blockage.
	Bad load connection	Check load connection. Check J6 Vdc output with a voltmeter and ensure output voltage is 66V ±2%. 1. If output voltage > 70 Vdc and < 78 Vdc add a load and ensure Vdc is ≈ 66Vdc. 2. If output voltage > 78 Vdc, return 6430 to factory for service.
	Drive board fault	See table below.
Unit does not start, LEDs OFF	Check AC input	Use proper input.
	240 Vac applied and switch in 120 Vac position.	Return to factory for service.
Unit runs for a while and stops, both LEDs come on	Over temperature.	Reduce load. Check for excessive ambient temperature. Check for internal fan malfunction/blockage.
Unit turns on and off on its own and red LED keeps flashing **OR** Unit stops after running once.	120 Vac applied and switch in 240 Vac position	Correct switch position.
	Over load.	Reduce load.
	AC input line low.	Check input AC line voltage for low line.
	Drive Board Fault.	See table below.
	Internal failure.	Return to factory for service.

Drive Board

SYMPTOM	CORRECTIVE ACTION
Motor produces no torque, Meter at J12-4 and J12-9 reads high.	Ensure that the J6 5-6 jumper is out, or if in, that the enable input opto is driven with at least 3 mA. **Disconnect AC power** then disconnect the motor cable and cycle the J1 power supply Off and On. If the meter reads low, check motor cable and motor for shorts across the windings or between the windings and the motor case.
Motor produces no torque, Meter at J12-4 and J12-9 reads low.	Verify that DIP Switch S1 position 6, 7, and 8 (current select) are set correctly. Re-check that the motor cable is wired correctly and properly plugged into the drive.
Motor produces torque but does not turn.	Make sure that the STEP input is switching and meets specified electrical and timing requirements.
Motor rotates in the wrong direction	Check polarity of the DIRECTION input. Also, check that the DIRECTION input satisfies the specified electrical and timing requirements. Reverse the A and $\overline{A}$ motor phases.

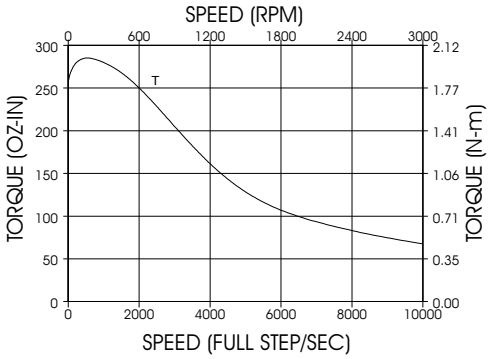
PERFORMANCE - 6400 SERIES CONTROLS

Motors will perform as shown without the winding temperature exceeding a rise of 90°C. When the motor is operated unmounted (without heat sink) in an ambient temperature of up to 40°C. The curves do not reflect systems resonance points, which will vary with motor coupling and systems parameters.

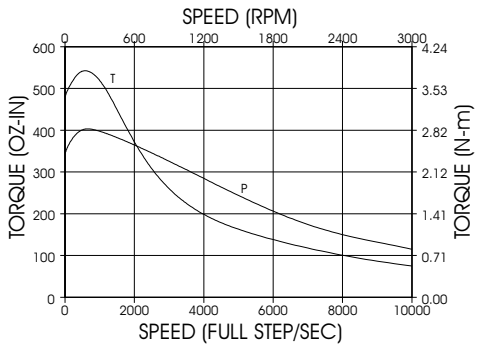
In addition to those shown below, Pacific Scientific offers a wide range of other motor windings to meet specific performance requirements.

Torque/Speed Curves - Recommended Motors for 5.0 A operation

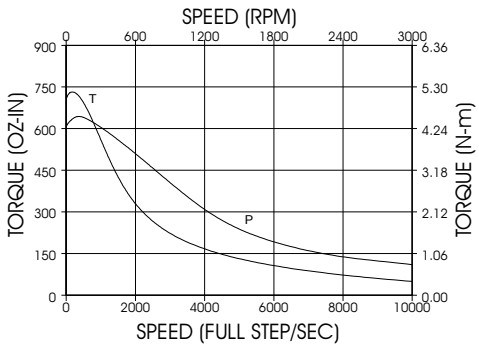
(3"MOTOR-ONE ROTOR STACK)
E31NX-HTLNN-NS50
5.0A/65V PER PHASE



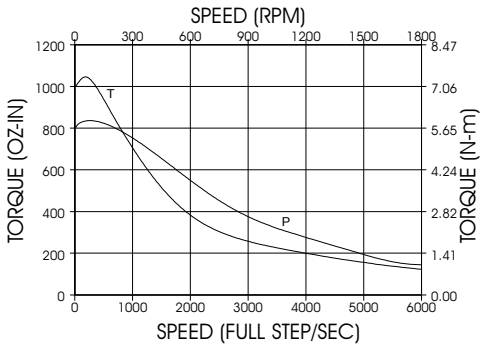
(3"MOTOR-TWO ROTOR STACK)
E32NX-HTLNN-NS50
E32NX-HPLNN-NS50
5.0A/65V PER PHASE



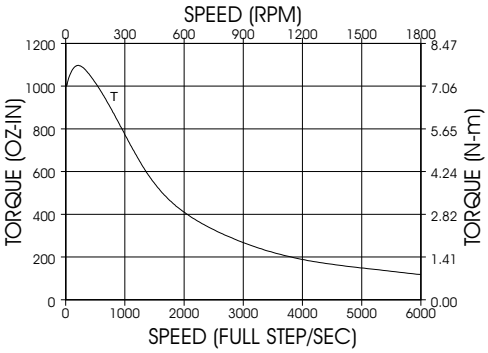
(3"MOTOR-THREE ROTOR STACKS)
E33NX-HTLNK-NS50
E33NX-HPLNK-NS50
5.0A/65V PER PHASE



(3"MOTOR-FOUR ROTOR STACKS)
E34HX-HTLNK-NS50
E32HX-HPLNK-NS50
5.0A/65V PER PHASE

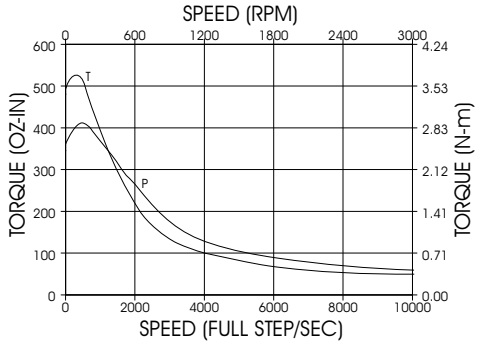


(4" MOTOR-ONE ROTOR STACK)
E41HX-HTLNK-NS50
5.0A/65V PER PHASE

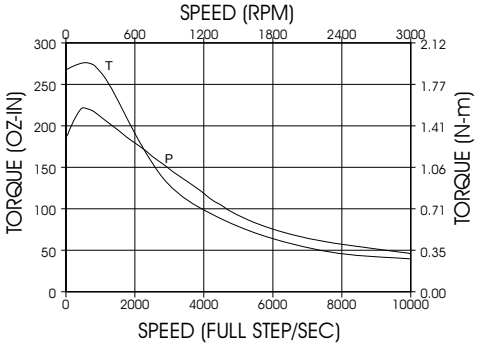


Torque/Speed Curves - Recommended Motors for 2.5 A operation

(3"MOTOR-TWO ROTOR STACK)
E32NX-LTLNN-NS50
E32NX-LPLNN-NS50
2.5A/65V PER PHASE



(3"MOTOR-ONE ROTOR STACK)
E31NX-LTLNN-NS50
E31NX-LPLNN-NS50
2.5A/65V PER PHASE



(2"MOTOR-TWO ROTOR STACKS)
E22NX-LTLNN-NS50
E22NX-LPLNN-NS50
2.5A/65V PER PHASE