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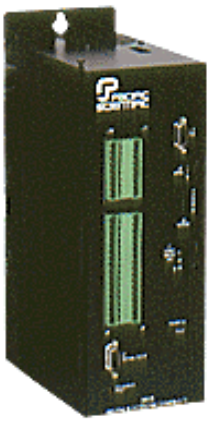
Pacific Scientific Model 6445
Indexer/Microstepping Drive Package



FEATURES

- **Powered 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.**
- **Patented Digital Electronic Damping™ reduces instability at mid-speed ranges**
- **Adjustable idle current reduction reduces motor heating in many applications.**
- **Power supply fault protection is provided for over temperature, short circuit, and under voltage.**
- **Drive fault protection is provided for line to line, line to neutral, and microprocessor faults.**
- **66 VDC output supply to power additional axis**
- **Internal cooling fan**
- **Microstepping up to 51,200 steps per revolution**
- **Master / slave, two axis control**
- **Easy programming using Danaher Motion's Stepper BASIC™**
- **Dedicated and user configurable I/O**
- **Encoder interface for position verification**
- **Single and multi-drop serial communication**
- **16 user configurable inputs**
- **12 user configurable outputs**
- **UL and CSA recognition pending**
- **CE conformance pending**

APPLICATIONS

- **Clutch brake replacement**
- **Master / slave shaft following**
- **Labeling machines**
- **Feed to length**
- **Menu prompt (MMI)**

PRODUCT DESCRIPTION

Danaher Motion's Pacific Scientific 6445 is an economical, high performance microstepping drive combined with a programmable indexer. The package uses an RS-232/485 port to allow single or multi-axis communication at 9600 baud. 16 programmable inputs and 12 programmable outputs are compatible with standard 5 to 30 VDC I/O. The 6445 features 12 k of battery-backed RAM for storage of parameters and move profiles. Motion control programming is simplified with Danaher Motion's Stepper BASIC™, an easy to learn extension of the BASIC™ protocol.

Resolution with 1.8º motors ranges from 200 to 51,200 steps-per-revolution. Step sizes are in decimal increments. Higher resolution (microstepping) provides smoother operation through low speed resonance regions. A patented Digital Electronic Damping™ circuit ensures the availability of full motor torque at all speed ranges by damping motor oscillations common with stepper systems. Full motor torque is achieved throughout the speed range whether in the full step or microstepping mode.

Adjustable 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 seconds the current is automatically reduced. Current is restored to full amplitude upon the arrival of a step command.

The 6445 accepts quadrature encoder inputs to perform position verification and correction, stall detection, and electronic gearing functions. A quadrature encoder with line driven outputs is required.

A 66 VDC output voltage is provided to power an additional axis.

Solutions by DANAHER MOTION

SPECIFICATIONS

INPUT POWER

Voltage	120/240 VAC (+10%, -15%) 60-50 Hz (switch selectable)
Line Current At Full Load (300 W)	240 VAC - 3.7 $A_{RMS,}$ 120 VAC - 4.7 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 A_{RMS} to 5 A_{RMS} in 0.625 A_{RMS} increments
66 VDC Output for 2nd Axis	66 ±3 V. Total power (internal + external) = 300 W ±10%
Discrete Inputs	5 VDC pull up. See *Connection Diagram* for discrete wiring.
Discrete Outputs	50 mA sink max. at 0.5 VDC, VCE 40 VDC max. See *Connection Diagram* for discrete wiring.

ENVIRONMENTAL

Storage Temperature	-40º C to + 70º C
Operating Temperature	0º C to 50º C ambient (with internal fan)
Altitude	5000 ft (1500 m) by design
Humidity	10% to 90%, non-condensing by design
Vibration	IEC Standard 68-2-6 pending

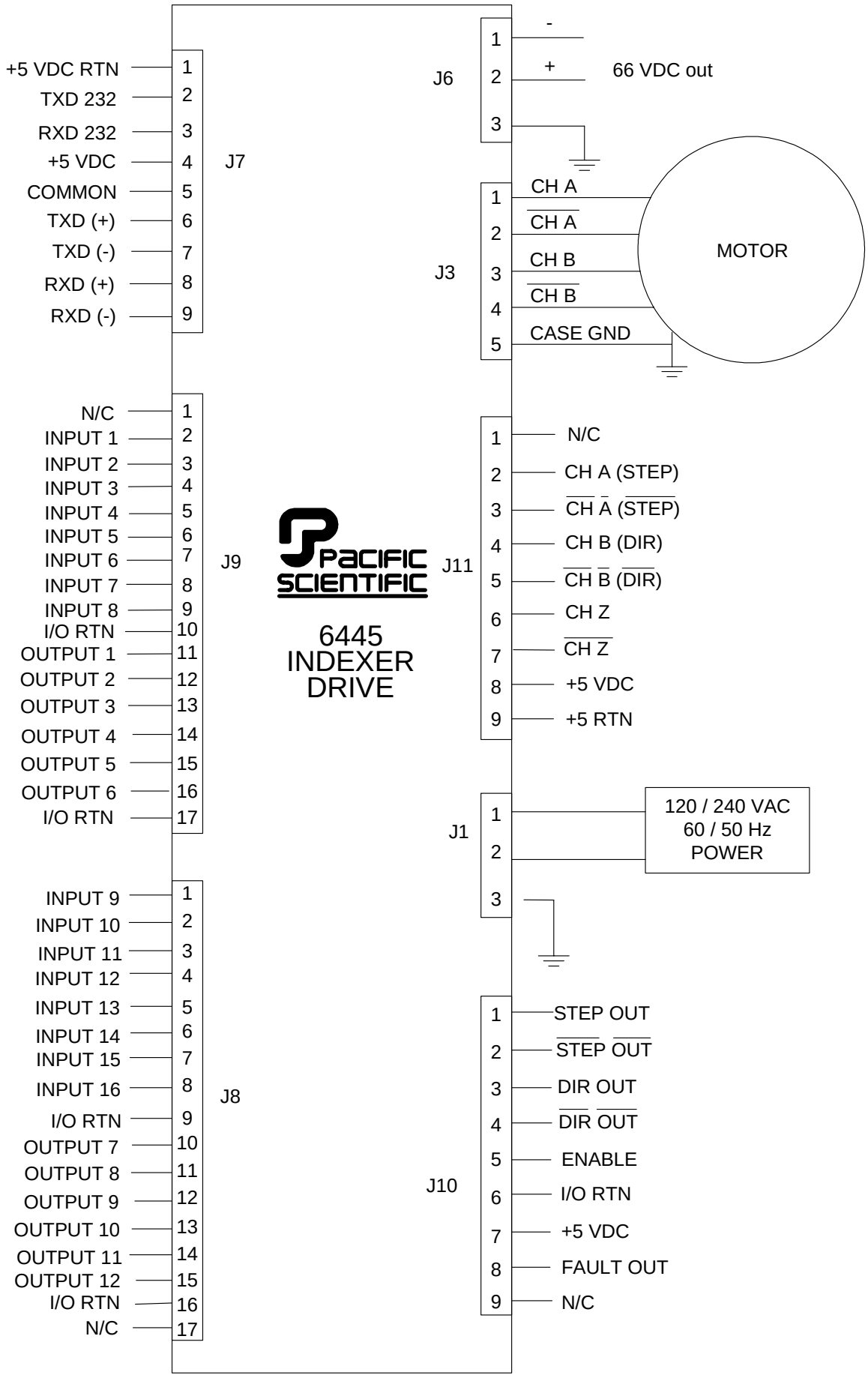
MECHANICAL

Dimensions	6.30 in x 4.25 in x 12.50 in
Weight	10 lbs. nominal

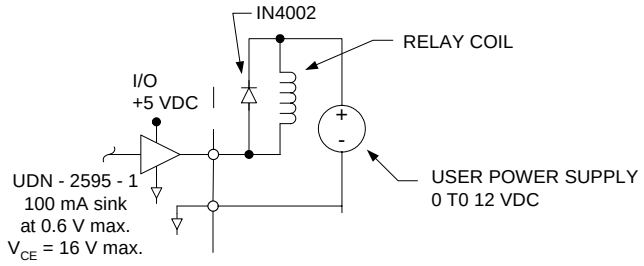
CONNECTORS

66 VDC output	PCD ELVHØ31Ø Mating connector PCD ELVPØ31ØØ
Motor	PCD ELVHØ51Ø Mating connector PCD ELVPØ51ØØ
AC Input	PCD ELFH Ø311Ø Mating connector PCD ELFPØ311Ø
Serial	9 contact female D connector. Mating connector ITT Cannon DE-9P with ITT Cannon DE110963 Hood and D20419 clamp kit.
I/O	Double height 17 position, pluggable screw terminal Phoenix connector MSTB2, 5/17-ST(x2)
Encoder input and Step/Direction	Double height 9 position, pluggable screw terminal Phoenix connector MSTB2, 5/9-ST(x2)

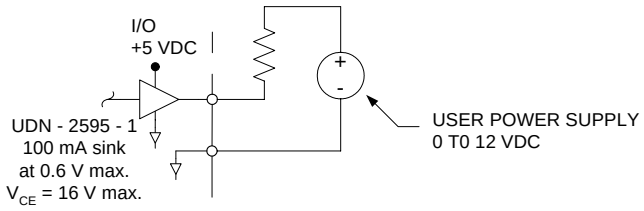
CONNECTION DIAGRAM



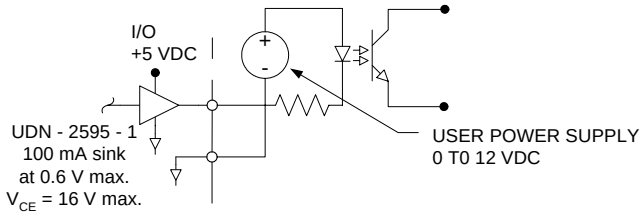
OUTPUT DIFFERENTIAL WIRING



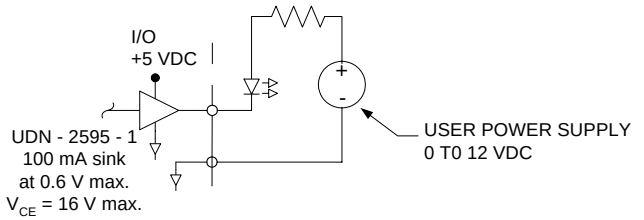
RELAY LOAD



RESISTIVE LOAD

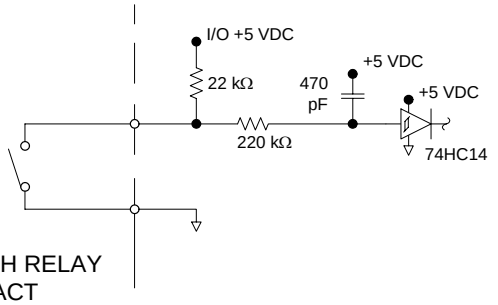


OPTO-ISOLATOR LOAD

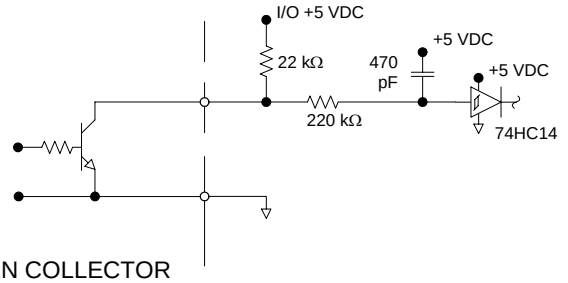


LED INDICATOR LOAD

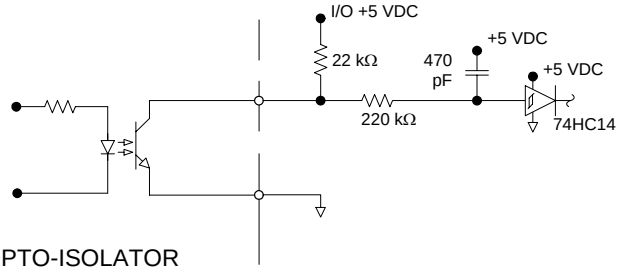
DISCRETE INPUT CONFIGURATION



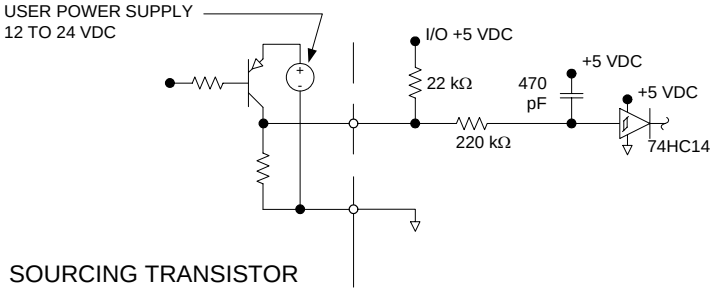
SWITCH RELAY
CONTACT



OPEN COLLECTOR

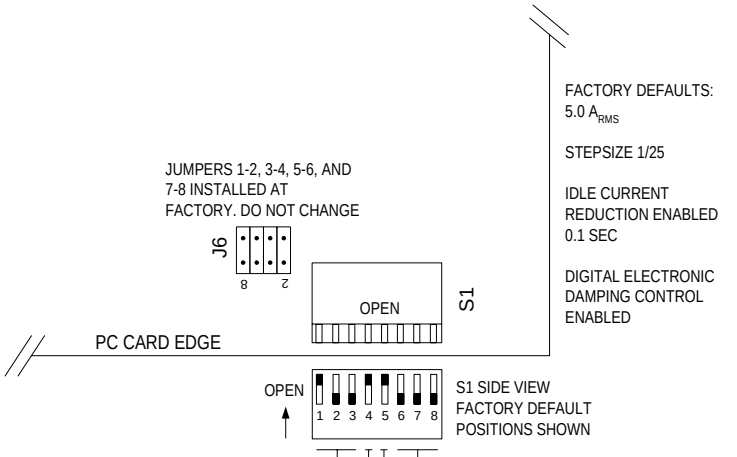


OPTO-ISOLATOR



SOURCING TRANSISTOR

DIP SWITCH (S1) SETTINGS



SW1 POSITION 1	SW1 POSITION 2	SW1 POSITION 3	STEP SIZE DEC JMPR IN
CLOSED	CLOSED	CLOSED	FULL
CLOSED	CLOSED	OPEN	HALF
CLOSED	OPEN	CLOSED	1/5
CLOSED	OPEN	OPEN	1/10
OPEN	CLOSED	CLOSED	1/25
OPEN	CLOSED	OPEN	1/50
OPEN	OPEN	CLOSED	1/125
OPEN	OPEN	OPEN	1/250

SW1 POSITION 6	SW1 POSITION 7	SW1 POSITION 8	MOTOR CURRENT A_{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 POSITION5	IDLE CURRENT REDUCTION
IN	CLOSED	DISABLED
IN	OPEN	0.1 SEC DELAY

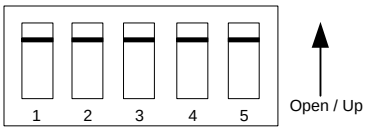
SERIAL ADDRESSES

Address	1	2	3	4	5
0	On	On	On	On	On
1	Off	On	On	On	On
2	On	Off	On	On	On
3	Off	Off	On	On	On
4	On	On	Off	On	On
5	Off	On	Off	On	On
6	On	Off	Off	On	On
7	Off	Off	Off	On	On
8	On	On	On	Off	On
9	Off	On	On	Off	On
10	On	Off	On	Off	On
11	Off	Off	On	Off	On
12	On	On	Off	Off	On
13	Off	On	Off	Off	On
14	On	Off	Off	Off	On
15	Off	Off	Off	Off	On
16	On	On	On	On	Off
17	Off	On	On	On	Off
18	On	Off	On	On	Off
19	Off	Off	On	On	Off
20	On	On	Off	On	Off
21	Off	On	Off	On	Off
22	On	Off	Off	On	Off
23	Off	Off	Off	On	Off
24	On	On	On	Off	Off
25	Off	On	On	Off	Off
26	On	Off	On	Off	Off
27	Off	Off	On	Off	Off
28	On	On	Off	Off	Off
29	Off	On	Off	Off	Off
30	On	Off	Off	Off	Off
31	Off	Off	Off	Off	Off

Switch settings must be made when the unit is unpowered.

Address 31 is for RS-232 operation, all others are for RS-422/485. RS-232 operation is the factory default setting.

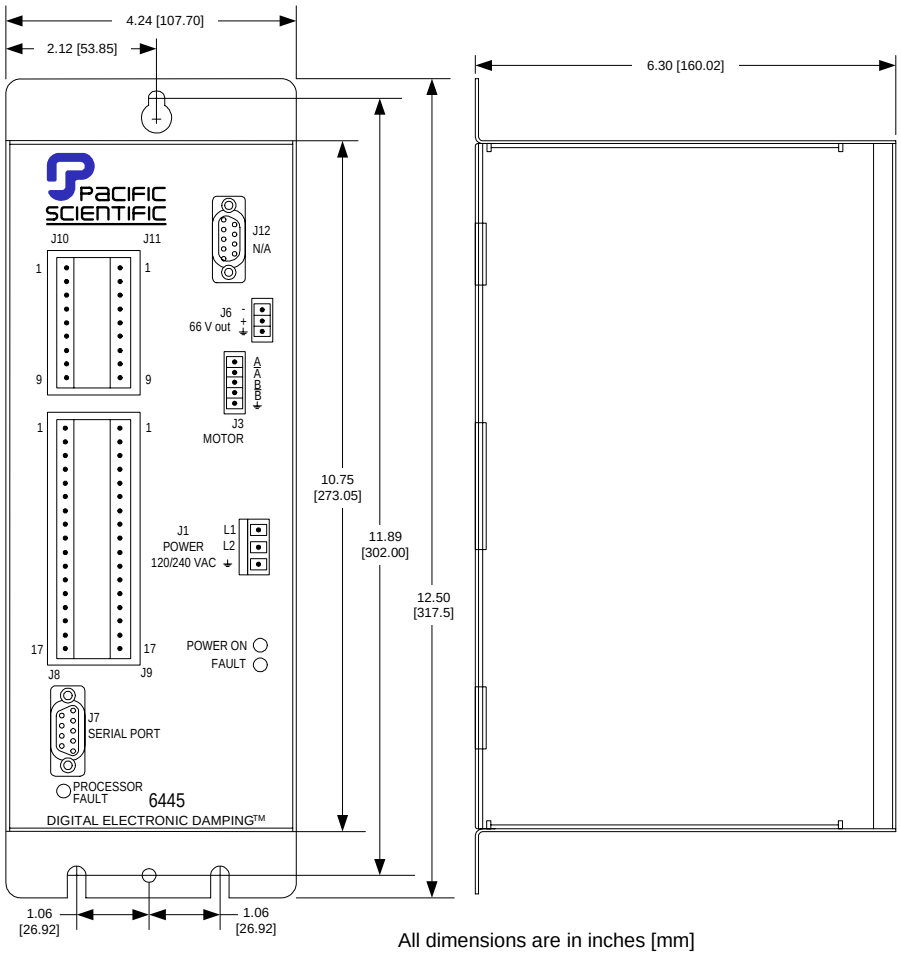
S2 SWITCH SETTINGS



On = Closed / Down Position
Off = Open / Up Position

Switches S1 and S2 are easily accessed without removing the cover.

MOUNTING DIMENSIONS

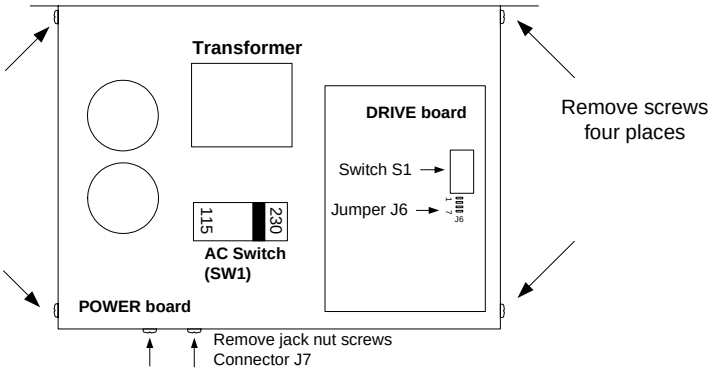


All dimensions are in inches [mm]

AC SWITCH SETTINGS

The AC switch is accessible by opening the cover and is preset at the factory to the 230 VAC position. First, make certain the power connections have been removed and rest the unit on its side as shown. Unscrew four screws and two jack screws as shown to remove cover. *Cautiously remove cover, being careful not to put a strain on the ribbon cable or power supply cable.* Select appropriate setting. **DO NOT** over tighten the mounting screws. (5.0 in-lbs max.)

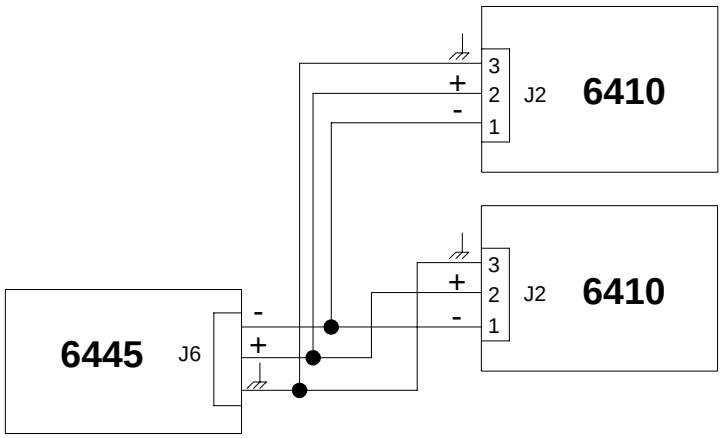
Connecting 240 (230) VAC with the switch in 120 (115) VAC position will permanently damage the drive.



66 VDC OUTPUT CONNECTOR J6

The 6445 package has a connector J6, 66 VDC, designed to power an additional drive. The total power available for both the internal and external drives is 66 VDC at 4.6 A or approximately 300 W. If the two drives are running simultaneously and require more than 4.6 A, the voltage will begin to cut back. 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 grounding cable using 16, 18, or 20 gauge wire is recommended to connect the remote connector to the external drive. An aluminum electrolytic capacitor (maximum 1000 µF, 100 VDC) rated for 2 A ripple current or greater must be installed at the additional drive if the cable length is over 3 feet.



TROUBLESHOOTING

Fault LED on – 6445 Disable Fault

Symptom	Possible Cause	Corrective Action
Motor does not turn. LEDs on (green and/or red)	120 / 240 VAC switch in 240 position with 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 voltage is 66 V ±3 V. 1. If voltage output > 70 VDC and < 78 VDC add a load and ensure VDC is approximately 66 VDC 2. If output voltage > 78 VDC, return the 6445 to factory for service.
	Internal Failure	Return to factory for service.
Motor does not turn, LEDs off.	Check AC input	Use proper input.
	240 VAC applied and switch in 120 VAC position	Return to factory for service
Motor 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.
Motor turns on and off on its own (although no such commands are given) and red LED keeps flashing	120 VAC applied and switch in 240 VAC position	Turn power off, correct switch position
	Over load	Reduce load
	AC input line low	Check input AC line voltage for low line.
Red LED turns on when motor tries to accelerate, motor does not turn.	Load is too high, AND/OR accel/decel is too high AND/OR run speed is too high.	Reduce the load, accel/decel, and/or run speed.

Red LED Flashing With No Fault

If the power supply is on the verge of an under-voltage fault, you will notice the following during normal operation.

Symptom	Possible Cause	Corrective Action
Motor runs fine, red LED flashes	Load is too high, AND/OR accel/decel is too high AND/OR run speed is too high.	Although no action is required, the symptom may be reduced by reducing the load, accel/decel, and/or run speed.

Processor Fault LED On

Symptom	Possible Cause	Corrective Action
Drive faults when enabled	Motor output over-current	Disconnect the AC power. Disconnect motor cable and cycle the J1 120/240 VAC 60-50 Hz power off and on. If the processor fault LED is off, check motor cable and shorts across the windings or between the windings and the motor case.
Drive faults while decelerating	Drive internal bus over voltage	Measure drive internal bus voltage at J6-1 and J6-2 (66 VDC out) with a storage oscilloscope during deceleration. If regeneration causes the bus voltage to exceed 84 V, verify the total load inertia to insure that the 66 VDC out limit is never exceeded.
Processor Fault LED on when power is applied	Indexer external +5 V logic supply out of tolerance	Measure the +5 V logic supply from J7-4 to J7-1 and J10-7 to J10-6 within +5 V (±5%). The total 5 VDC current from pins J7-4, J11-8, and J10-7 must be less than 450 mA.
	Indexer processor watchdog timer failed	Internal failure. Return to factory for service.

Communication Interface Fault

Symptom	Corrective Action
6445 will not respond to commands over serial link	Verify that baud rate and COM port are set correctly in PacCom
	Check that terminal transmit and receive lines from the computer go to receive and transmit lines on the 6445
	Verify that the serial cable is functioning properly 1. Disconnect serial cable 2. Short pins 2 and 3 3. Type a character on the keyboard 4. Verify that character entered echoes back to screen
	Verify that the serial cable is connected to J7. *J12 is not used on the 6445*
	Internal Failure. Return to factory for service
6445 will not respond during RS-422/ RS-485 operation	Verify that each unit has a unique serial address using switch S2

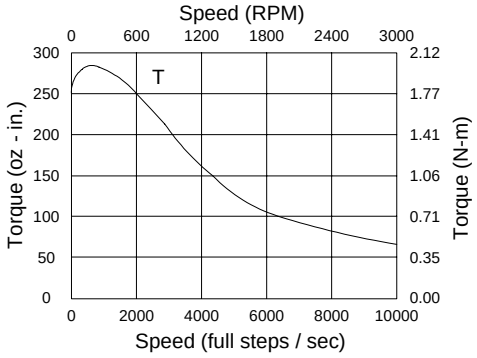
PERFORMANCE

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

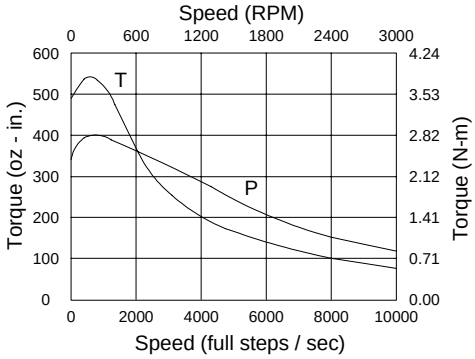
In addition to those shown, Danaher Motion offers a wide range of other motor windings to meet specific performance requirements.

RECOMMENDED MOTORS FOR 5.0 A OPERATION

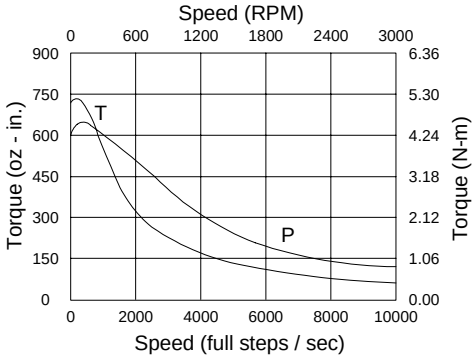
3 in. Motor - One Rotor Stack
E31NX-HTLNN-NS50
5.0 A / 65 V per phase



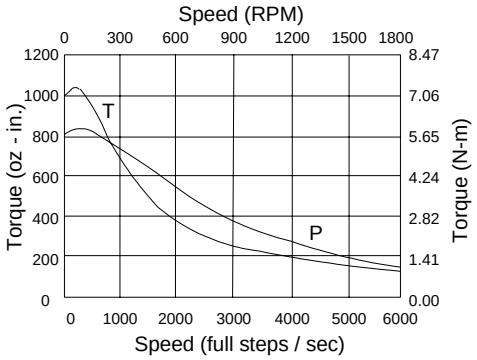
3 in. Motor - Two Rotor Stacks
E32NX-HTLNN-NS50
E32NX-HPLNN-NS50
5.0 A / 65 V per phase



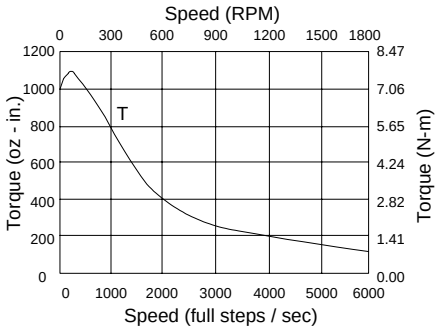
3 in. Motor - Three Rotor Stacks
E33NX-HTLNK-NS50
E33NX-HPLNK-NS50
5.0 A / 65 V per phase



3 in. Motor - Four Rotor Stacks
E34HX-HTLNK-NS50
E32HX-HPLNK-NS50
5.0 A / 65 V per phase

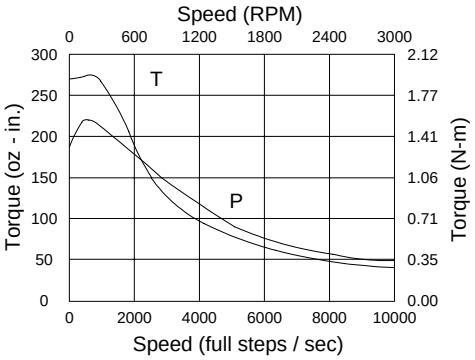


4 in. Motor - One Rotor Stack
E41HX-HTLNK-NS50
5.0 A / 65 V per phase

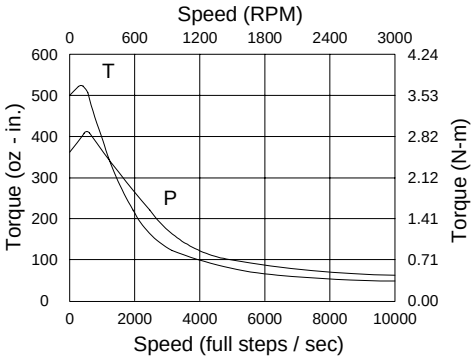


RECOMMENDED MOTORS FOR 2.5 A OPERATION

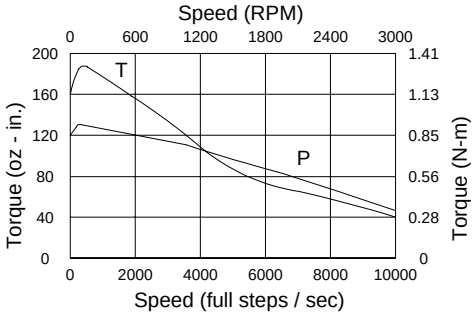
3 in. Motor - One Rotor Stack
E31NX-LTLNN-NS50
E31NX-LPLNN-NS50
2.5 A / 65 V per phase



3 in. Motor - Two Rotor Stacks
E32NX-LTLNN-NS50
E32NX-LPLNN-NS50
2.5 A / 65 V per phase



2 in. Motor - Two Rotor Stacks
E22NX-LTLNN-NS50
E22NX-LPLNN-NS50
2.5 A / 65 V per phase



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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