

## FEATURES

The 6420 Microstepping Indexer/Drive provides economical microstepping control with a simple mnemonic programming interface. Operation is programmed via the serial communications port. A combination of dedicated and user-programmable I/O provides motor control, status indication, and sensor feedback.

- **Fixed Resolution microstepping.**
  - **Binary sizes:** 200 to 51,200 steps/rev.
  - Decimal sizes:** 200 to 50,000 steps/rev. Minimum and maximum step rates from 0.02 to 5700 rpm, depending on resolution.
- **Variable on-the-fly microstepping for high resolution, high speed operation: 20,000 steps/rev at 0.02 to 5700 rpm.**
- **Step and Direction outputs for independent or synchronous control of multiple axes.**
- **Single 6420 can control two independent or synchronous axes with an additional drive and no glue logic.**
- **Panel or side mounting options.**
- **Simple mnemonic command set can be executed from internal NVRAM or a more powerful host.**
- **Serial communications supporting RS-232, RS-422, and RS-485.**
- **Input/Output ports – Eight general purpose bi-directional user programmable input/output ports.**
- **Internal Memory – 1792 bytes of NVRAM available for user programs.**
- **Indexer optically isolated from drive.**
- **Single power supply.**
- **Output current adjustable from 0.625 A to 5 A<sub>RMS</sub> with 3-position DIP switch.**
- **Idle current reduction with adjustable delay to reduce motor heating.**
- **Patented mid-range instability compensation eliminates instability from the middle to high end of the operating range.**
- **Patented 4-phase Bi-polar Chopper drive for superior current regulation and low ripple current.**
- **Fault protection:**
  - Line-to-line and line-to-neutral shorts
  - Internal power supply under-voltage
  - Bus over-voltage

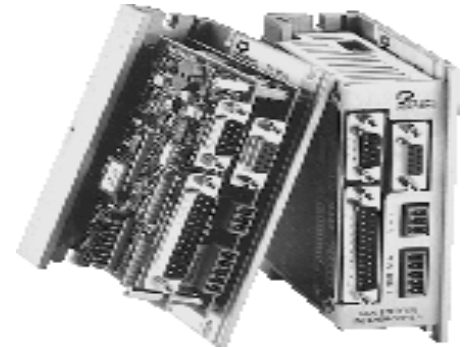
A terminal or PC can be used to program the 6420. Various motion parameters can be modified and motion executed immediately from the command line or from on-board non-volatile memory. Simple, single-letter mnemonics are used to specify a wide variety of motion commands. Many users can take advantage of the simplicity of developing programs for on-board execution. If more versatility is required, the user can write a custom program running on a host computer to control the 6420.

## PRODUCT DESCRIPTION

The 6420 can communicate with RS-232, RS-422, or RS-485 serial protocols at 9600 bps. Discrete I/O lines provide external start/stop and motor enable control, home and limit switch testing, motor jogging and step and direction outputs. The eight programmable bi-directional discrete I/O lines are individually jumper configurable for input or output. The 6420 operates in one of two modes: either Fixed Resolution mode or Variable Resolution mode. In Fixed Resolution mode with binary steps, the resolution can be set from 200 steps/rev to 51,200 steps/rev. With decimal resolution, 200 steps/rev to 50,000 steps/rev. The minimum and maximum step rates range in value from 0.08 to 19,000 steps/sec, depending on the resolution. Of course, the finer step sizes result in high shaft resolution at the expense of shaft speed. The motion profile is trapezoidal with programmable initial and final speeds. The acceleration and deceleration rates are specified by a single command in terms of acceleration and deceleration factors ranging from 5 to 255. Variable Resolution mode is beneficial where high resolution, high speed microstepping is desired. This mode allows for positioning at a resolution of 20,000 steps/rev at 0.02 to 6,000 rpm.

Power-up sign-on message returned after entry of 1 or 2 spaces.

The 6420 has special memory locations. REMOTE START at address 0. Power-up AUTOSTART program at address 1600. Fast memory 128 – 191.



## SPECIFICATIONS

### Input Power

|                |   |
|----------------|---|
| <b>Voltage</b> | 24 VDC to 75 VDC  |
| <b>Current</b> | Motor and load dependent. Usually motor phase current.                                |
|                | Mount a 2000 µf capacitor within 3 feet of the 6420 to absorb the motor regen energy. |

### Output Motor Phase Current

|                               |   |
|-------------------------------|---|
| <b>Discrete Input Voltage</b> | 5 A <sub>RMS</sub> max.<br>5 A peak full-step<br>7.1 A peak microstepping   |
|                               | 0 – 30 VDC max. Vin = 0.8 V is a logic low and Vin = 3.7 V is a logic high. |

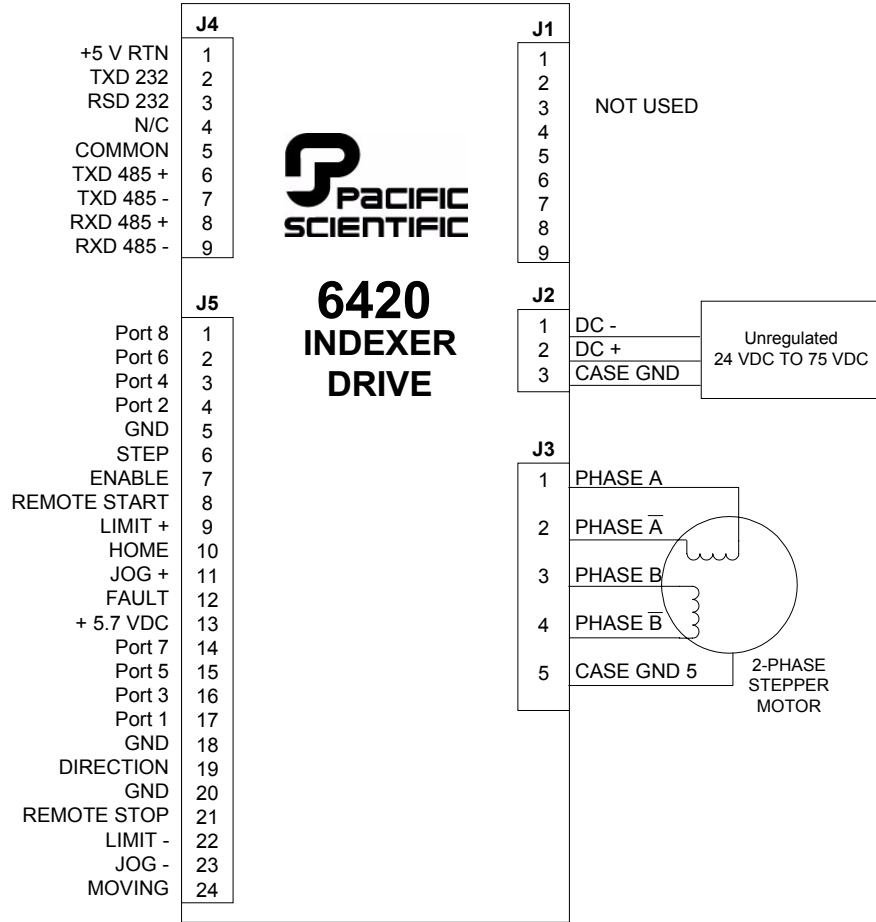
### Discrete Output Voltage

|  |   |
|--|---|
| <b>Storage Temperature</b>                   | Open collector 30 VDC, 70 mA sink, V <sub>SAT</sub> 1.0 VDC |
| <b>Operating Temperature</b>                 | - 55 °C to + 70 °C  |
| <b>Operating Temperature</b>                 | 0 °C to 50 °C ambient air                                   |
| <b>Maximum Chassis Operating Temperature</b> | 60 °C   |

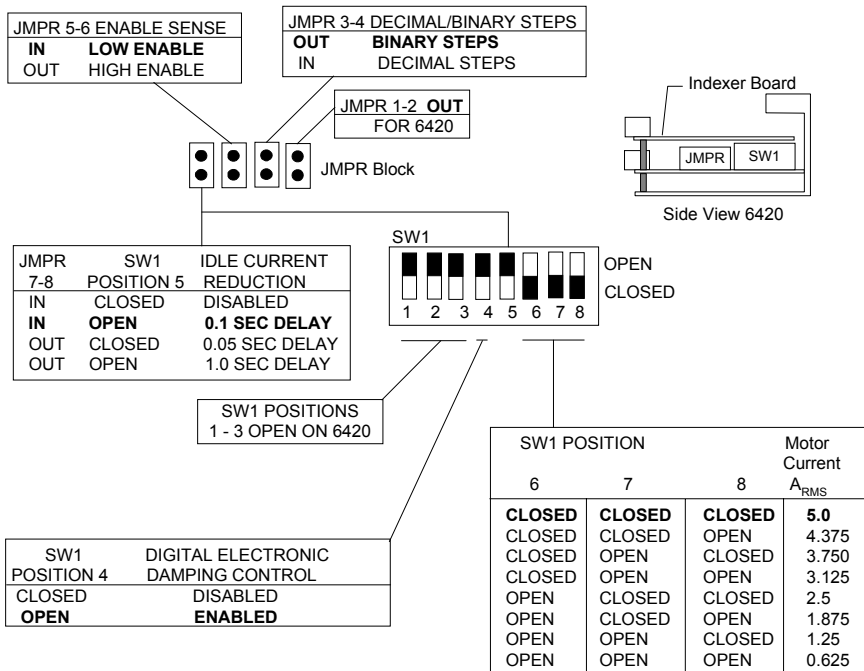
### Convection Cooling

|                            |   |
|----------------------------|---|
| <b>w/optional heatsink</b> | Full rating (5 A) at 25°C ambient<br>2.5 A max. at 45 °C ambient                            |
| <b>without heatsink</b>    | 2.5 A max at 25 °C ambient<br>1.25 A max at 45 °C ambient                                   |
| <b>Humidity Range</b>      | 10 to 90 %, non-condensing  |
|                            | Adhere to the specified bus voltage range and power ratings. Otherwise unit may be damaged. |

**Figure 1 – 6420 Connection Diagram**

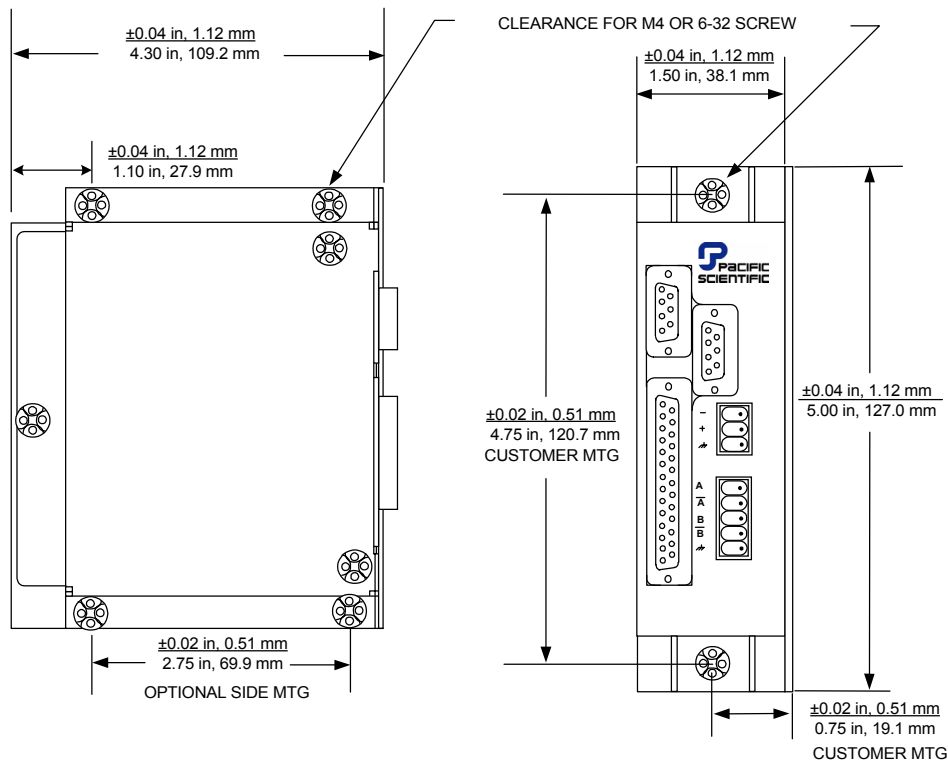


**Figure 2 - Drive Board Settings**



**INDEXER BOARD SETTINGS**

- **E1 and E2, Factory setting: E1 IN, E2 OUT. Do NOT modify.**
- **E11 IN enables RS-485 multi-unit communication, OUT for RS-232/RS-422. Factory setting: Jumper OUT enabling RS-232 and RS-422 communications.**
- **E12 and E13 control slave 6410 Drive operation. E12 IN, E13 OUT for alternating operation, E12 OUT, E13 IN for synchronous operation. Factory setting: Jumpers E12 IN, E13 OUT.**
- **E3 to E10 control discrete I/O Port 1 to 8 bit directions. Jumper IN to configure as an output, jumper OUT to configure as an input. Factory setting: All jumpers OUT configuring all lines as INPUTS. Ports are active LOW: a "1" produces a "0" and vice-versa.**



## COMMAND SUMMARY

### A (Clear and Restore), A opcode

A 0 reloads the last saved parameters from NVRAM. A 8 followed by A 9 completely initializes NVRAM to default values.

### C (Read Position Counter), C arg

(arg = 0, 1) Specifying arg=1 enables continuous echoing of position via the serial interface only in single-unit mode.

### E (Edit Program), E addr

Edit program at address addr.

### F (Initial Velocity), F vel

Sets the initial velocity to vel set pulses/second.  $0 \leq vel \leq 19,000$ .

### G (Go), G addr [trace]

$0 \leq addr \leq 1791$  or 2048 for indexed jump on inputs.  $0 \leq [trace] \leq 1$ .

### H (Home), H speed, dir

where  $2 \leq speed \leq 19,000$  step pulses/sec. Dir must be 0 for CW and 1 for CCW motion toward Home position.

### I (Resolution Mode), I mode

mode=0 selects Fixed Resolution Mode  
mode=1 selects Variable Resolution Mode

### J, B (Jump Loop Nested), J, B addr cnt

$0 \leq addr \leq 1791$ ,  $0 \leq cnt \leq 255$  for 1 to 256 increments.

### K (Read Input Port), K

Logic 0 input reads back as 1. Bit weightings 1-128 correspond to ports 1 to 8. Jumpers E3 to E10 control direction of I/O ports. Jumper OUT for input, IN for output.

### L (List Program), L addr

List program  $0 \leq addr \leq 1791$  returns up to 20 lines at a time.

### M (Accel/Decel Factor), M accel decel

$5 \leq accel \leq 255$ ,  $5 \leq decel \leq 255$ .

### O (Trip Point), O position vaddr

Set trip point.  $-8,388,607 \leq position \leq +8,388,607$ ,  $0 \leq addr \leq 1791$ .

### P (Store Parameters), P

Stores parameters to non-volatile memory.

### Q (Examine Parameters), Q

Displays initial, final velocity, accel/decel factors, etc.

### R (Run at constant velocity), R vel

$20 \leq vel \leq 19,000$  step pulses/second.

### S (Stop), S [arg]

Embedded in a program. S 0 ceases motion, but the program will continue. S 1 terminates the program, placing the indexer into immediate mode.

### T (Master/Slave Control) T enb

Alternating axis operation: E12 IN, E13 OUT, T 1 enables master, disables slave.

T 0 disables master, enables slave.

Synchronous operation: E12 OUT, E13 IN, T 1 enables master and slave. T 0

disables both.

### U (Loop on Port), U addr cond.

Tests a port and jumps if condition is satisfied.  $0 \leq addr \leq 1791$ . Ports 1 to 8 are HIGH 0, 2, 4, 6, 8, 10, 12, 14. Ports 1 to 8 LOW 1, 3, 5, 7, 9, 11, 13, 15.

### V (Final Velocity) V vel

Sets the final velocity of an absolute (@) or incremental ( $\pm$ ) move. Expressed as  $0 \leq vel \leq 19,000$  step pulses/second.

### W (Wait) W period

Wait.  $0 \leq period \leq 65535$ . 10 ms resolution with 0 as wait for end of motion. This command returns the status of the limit, home, and jog switches, and the drive fault status. The value of arg specifies whether the limit switch or input line information is returned.

### X (Read Limits) X arg

Specifying X 0 returns 1 for limit + active, 2 for limit - active, and 3 for both active.

Bit 7 is active high if the drive has faulted. Specifying X 1 returns a binary weighted value corresponding to the level of these signals: 1 = Home Input, 32 = Jog - Input, 64 = Jog + Input, 128 = Drive Fault.

### Y (Write Output Port) Y port

Write port.  $0 \leq port \leq 255$ . Y 0 deactivates all bits producing logic HIGHS. Y 255 activates all bits producing logic LOWs.

### Z (Zero Origin)

Zeros position counter.

### ^ (Set Jog Speed) ^ speed

Sets jog speed,  $0 \leq speed \leq 255$ . Actual speed is  $30 * speed$  step pulses/second.

**@ (Absolute Move) @ position**  
 Absolute index *Fixed Resolution*:  
 $-8,388,607 \leq position \leq +8,388,607$ .  
*Variable Resolution*:  $-8,388,607.99 \leq position \leq +8,388,607.99$ .

**+ (Positive Incremental Move), + steps**  
 Positive incremental index. *Fixed Resolution*:  $0 \leq steps \leq +8,388,607$ .  
*Variable Resolution*:  $0.00 \leq steps \leq +8,388,607.99$ .

**- (Negative Incremental Move), - steps**  
 Negative incremental index. *Fixed Resolution*:  $0 \leq steps \leq +8,388,607$ .  
*Variable Resolution*:  $0.00 \leq steps \leq +8,388,607.99$ .

**^C or ESC (Software Reset)**  
 Stops all activity. Indexer waits for the space bar sign-on or external Remote Start or Jog pulse inputs.

**\ (Step Size, VelScale), \arg**  
 Sets the step size in *Fixed Resolution* mode, binary and decimal step sizes. In *Velocity Resolution* mode, scales the step pulse rates for  $0 \leq arg \leq 8$ :

| Fixed Binary | Fixed Decimal | VR Speed   |
|--------------|---------------|------------|
| 0=FULL       | Not Allowed   | Full Speed |
| 1=1/2        | Full          | 1/2        |
| 2 = 1/4      | 1/2           | 1/4        |
| 3=1/8        | 1/5           | 1/8        |
| 4=1/16       | 1/10          | 1/16       |
| 5=1/32       | 1/25          | 1/32       |
| 6=1/64       | 1/50          | 1/64       |
| 7=1/128      | 1/125         | 1/128      |
| 8=1/256      | 1/250         | 1/256      |

**> (Read Memory), >addr size**  
 $0 \leq addr \leq 2047$ ,  $0 \leq size \leq 255$  bytes.  
 Displays a block of memory starting at *addr* in decimal format, returning a total of *size* bytes.

**< (Write Memory), < addr data**  
 $0 \leq addr \leq 2047$ ,  $0 \leq data \leq 255$ . Writes a *data* byte to an address specified by *addr* in memory.

**] (Read Moving Status)**  
 Returns a decimal number representing the current move status. Bit weights:  
 1=indexing; 2=constant, 128=drive fault.

**' (Trip and Output), 'nextpos port**  
 $0 \leq nextpos \leq +8,388,607$ ,  $0 \leq port \leq 255$ .  
 Used within a Trip Point Service Routine (TPSR) and provides the capability of setting or clearing user I/O lines as a function of current position. *Port* is written to the I/O ports when the previously set position is reached. Next trip point set to position is *nextpos*.

**= (Limit Switch Polarity), = polarity**  
 0 = active LOW limit input (default)  
 1 = active HIGH limit input

**: (Selective Termination), : axis**  
 Aborts operations on a particular axis when configured for RS-485 communications mode.

| Step Size   | Min. Speed rpm (full steps/sec) | Max. Speed rpm (full steps/sec) | Resolution Pulses/rev. |
|---|---------------------------------|---------------------------------|------------------------|
| <b>Fixed Resolution - Binary Steps</b>  |                                 |                                 |                        |
| Full  | 6 (20)                          | 5700 (19,000)                   | 200                    |
| 1/2   | 3 (10)                          | 3000 (10,000)                   | 400                    |
| 1/4   | 1.5 (5)                         | 1500 (5000)                     | 800                    |
| 1/8   | 0.75 (2.5)                      | 750 (2500)                      | 1600                   |
| 1/16  | 0.37 (1.25)                     | 375 (1250)                      | 3200                   |
| 1/32  | 0.19 (0.625)                    | 188 (635)                       | 6400                   |
| 1/64  | 0.09 (0.312)                    | 93.75 (312)                     | 12,800                 |
| 1/128   | 0.05 (0.156)                    | 46.87 (156)                     | 25,600                 |
| 1/256   | 0.02 (0.078)                    | 23.42 (78)                      | 51,200                 |
| <b>Fixed Resolution - Decimal Steps</b>   |                                 |                                 |                        |
| Full  | 6 (20)                          | 5700 (19,000)                   | 200                    |
| 1/2   | 3 (10)                          | 3000 (10,000)                   | 400                    |
| 1/5   | 1.2 (4)                         | 1200 (4000)                     | 1000                   |
| 1/10  | 0.60 (2)                        | 600 (2000)                      | 2000                   |
| 1/25  | 0.24 (0.8)                      | 240 (800)                       | 5000                   |
| 1/50  | 0.12 (0.4)                      | 120 (400)                       | 10,000                 |
| 1/125   | 0.048 (0.16)                    | 48 (160)                        | 25,000                 |
| 1/250   | 0.024 (0.08)                    | 24 (80)                         | 50,000                 |
| <b>Variable Resolution</b>  |                                 |                                 |                        |
| Step sizes automatically chosen. User Specifies position to within 1/100 of a step. | 0.02 (0.078)                    | 5700 (19,000)                   | 20,000                 |