6000 SERIES MICROSTEPPING DRIVES

MODEL 6410

Microstepping Drive Module. 0.625 to 5 A rms, 7.1 A peak (microstepping) per phase output. 24 to 75 Vdc

- Single power supply input
- Patented 4-phase Bipolar Chopper Drive for superior current regulation and low ripple current
- Output current adjustable from 0.625 A to 5 A rms with 3 position dipswitch
- Microstepping provides smooth operation and increased resolution
- Patented Digital Electronic Damping™ reduces instability at mid-speed ranges
- Idle current reduction reduces motor heating in many applications
- Selectable step filter rejects noise on step input
- Fault protection:
  -Line-to-line and line-to-neutral shorts
  -Internal power supply under-voltage
  -Bus overvoltage
- Compact size

Model 6410 is an economical, compact stepper drive that converts step and direction inputs into winding currents for two-phase stepper motors. The 6410 can operate with a single power supply ranging from 24 to 75 Vdc. Output voltage is equal to that of the power supply. Output current is adjustable from 0.625 to 5 A rms. The default output current is 5 A rms.

Its compact size of 1.5" W x 5" H x 4.3" deep requires only 7.5 square inches of panel space!

TYPICAL APPLICATIONS

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

MICROSTEPPING

Microstepping assures smooth, low speed operation, smoother operation through resonance regions and optimum system resolution. Resolution with 1.8° motors is adjustable to 50,000 steps per revolution with decimal step size selected and to 51,200 with binary step size selected. See the Step Size table on page C-8. The 6410 switches to full step operation above 150 RPM.

FULL TORQUE AT ALL SPEEDS

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.
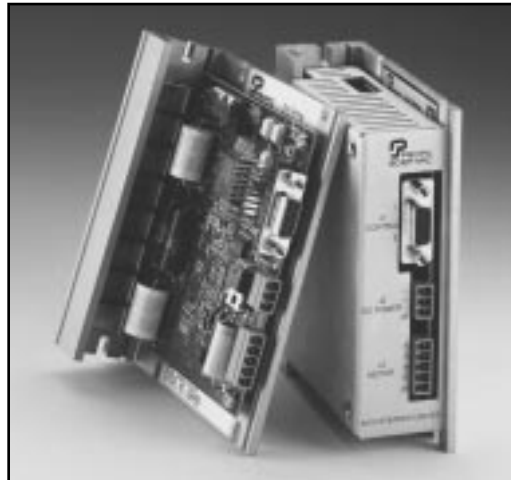
HIGH EFFICIENCY BIPOLAR CHOPPING

Patented, 4-phase PWM chopping electronically controls the motor winding currents at 20 Khz frequency. This combines the best of recirculating and nonrecirculating current regulation to provide high back EMF rejection with low ripple current. The 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

This useful function 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 - see page C-10), the current is automatically reduced. Current is restored to full amplitude upon arrival of a step command.

HEAT SINKS

Heat can be removed from the rear of the drive (cold plate mounting) or from the side with an optional side mounted heat sink. See the drawing on page C-10. Providing alternate methods for heat removal allows flexibility for system packaging.

The optional side mounted heat sink adds only 1.0 inch to the width.

FAULT PROTECTION

- Line-to-line and line-to-neutral shorts
- Internal power supply under-voltage
- Bus overvoltage

AGENCY APPROVAL

UL recognized - 508C (Type R) - file # E137798
Meets CSA Standard, C22.2 #142-M1987
Meets IEC vibration standard, #68-2-6

GENERAL. . .Model 6410

Input Power Voltage . . . . .24 Vdc to 75 Vdc
Input Power Current . . . . .Motor and load dependent. Usually < motor phase current.
Output motor phase current . . . . .See Figure C-4, page C-10
        5 A rms max.
        (5 A peak full step, 7.1 A peak microstepping)
        Adjustable from 0.625 to 5 A rms in 0.625 amp increments
Inputs   . . . . .See Figures C-2 and C-3, page C-9
    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 when step filter enabled)
        Maximum frequency: 2.0 MHz (500 KHz when step filter enabled)
        Motion occurs on low-to-high transition of STEP input (J3 Pin 6)
    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
Outputs . . . . .See Figures C-2 and C-3, page C-9
    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 . . . . .See Figure C-4, page C-10
        Set using 3 positions of DIP switch and decimal jumper
        Note: Binary values are in **Bold**.

Step Size	Steps per Revolution (1.8° motor)	Maximum RPM*
Full (**1/2**)	200 (**400**)	12000 (**12000**)
1/2 (**1/4**)	400 (**800**)	12000 (**12000**)
1/5 (**1/8**)	1000 (**1600**)	12000 (**12000**)
1/10 (**1/16**)	2000 (**3200**)	12000 (**12000**)
1/25 (**1/32**)	5000 (**6400**)	12000 (**12000**)
1/50 (**1/64**)	10000 (**12800**)	12000 (**9000**)
1/125 (**1/128**)	25000 (**25600**)	4800 (**4600**)
1/250 (**1/256**)	50000 (**51200**)	2400 (**2300**)

        *1. Consult factory if operating motor above 3000 RPM.
         2. To determine maximum RPM when 500 KHz step filter is
            enabled multiply $\dfrac{1}{\text{steps per rev}}$ x 30 million. Note that maximum
          should not exceed 12000 RPM
Idle Current Reduction . . . . .See Figure C-4, page C-10
        Enabled or disabled with DIP switch, 50% output current reduction
        after 0.1 second from last step command (0.05 and 1.0 second timeouts
        can also be selected using a plug-on jumper. Consult factory for other
        current reduction options).
DIGITAL ELECTRONIC DAMPING . . .See Figure C-4, page C-10
        Enabled or disabled with DIP switch
        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° of step period
Protection . . . .(Any fault disables the drive and must be cleared by cycling input
        power) Line-to-line short, line to neutral, internal supply under voltage
        bus over voltage (83 Vdc)
Mechanical
    Dimensions . . . . .5" x 1.5" x 4.3"
    Weight . . . . .1 lb. nominal
Connectors . . . . .See Figure C-2, Page C-9
    Power Supply . . . . .3 contact plug-in screw terminal
    Motor . . . . .5 contact plug-in screw terminal
    Signal . . . . .9 socket D-sub miniature

ENVIRONMENTAL . . . Model 6410

Storage Temperature . . . . -55°C to +70°C
Operating Temperature . . . . Full rated current 0° to 50°C ambient air with or without cover
provide chassis properly mounted so as not to exceed 60°C
Maximum Chassis TEMPERATURE . . . .60°C
Note: For optimal thermal performance, mount the 6410 chassis (back or side) to a cooling plate or heatsink. Use a thermal pad or grease if surface is irregular. A fan or idle current reduction may be employed to keep chassis below 60°C
Convection Cooling . . . . (6410 not mounted on cooling plate)
   With optional heat sink . . . . Full rating (5A) at 25°C Ambient
2.5A max at 45°C Ambient
   Without optional heat sink . . . . .2.5A max at 25°C Ambient
1.25A max at 45°C Ambient
See Figure C-1 (below) for plot of drive power dissipation vs. output current
Humidity Range . . . . .10% to 90%, non-condensing

POWER DISSIPATION VS. OUTPUT CURRENT
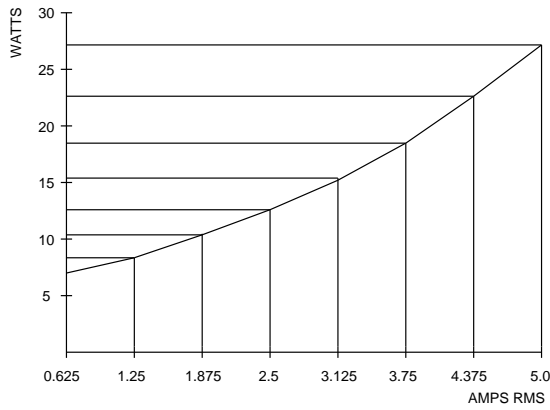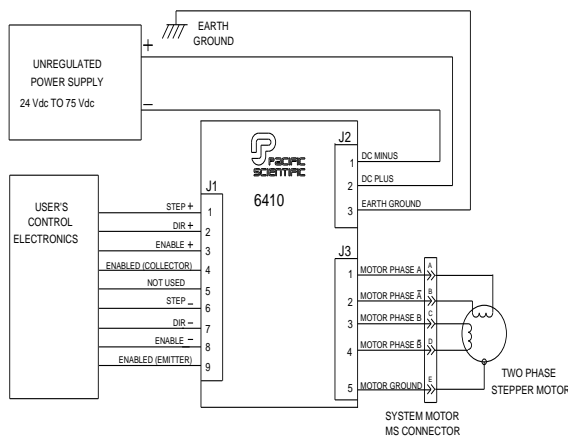

Figure C-1. Power Dissipation vs. Output Current

INTERFACE CIRCUITS

Figure C-3. Interface Circuits
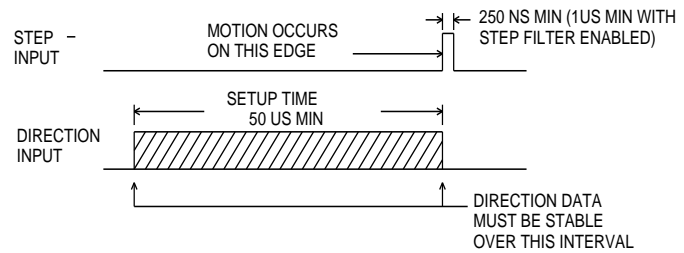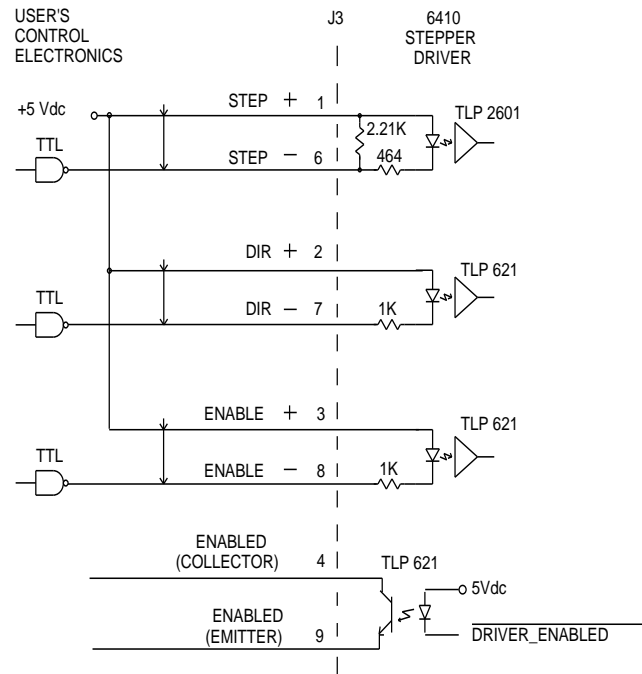
CONNECTION DIAGRAM

Figure C-2. Connection Diagram

DIP SWITCH (S1) SETTINGS (FIG. 4). . .Model 6410

- Output motor phase current
- Step size and rate
- Idle current reduction

ENABLE SENSE JUMPER
IN: OPTO ON TO ENABLE
OUT: OPTO OFF TO ENABLE

DEC JUMPER (SEE SW1 TABLE BELOW)
IN: SELECT DECIMAL STEP SIZES
OUT: SELECT BINARY STEP SIZES

IDLE T JUMPER
SELECT IDLE CURRENT
REDUCTION TIME
SEE TABLE BELOW

STEP BW JUMPER
IN: 500 KHz MAX STEP RATE
OUT: 2 MHz MAX STEP RATE

JUMPERS 1-2, 3-4, & 7-8
INSTALLED AT FACTORY

J6

8   2

FACTORY DEFAULTS:
5.0 AMPS RMS

STEPSIZE 1/25

500 KHz MAX STEP RATE

IDLE CURRENT REDUCTION
ENABLED (0.1 SEC)

DIGITAL ELECTRONIC
DAMPING CONTROL ENABLED

DRIVER ENABLED UNLESS
ENABLE OPTO DRIVEN

OPEN   S1

PC CARD EDGE

OPEN   1 2 3 4 5 6 7 8

S1 SIDE VIEW
FACTORY DEFAULT POSITIONS SHOWN

SW1 POSITION			STEP SIZE	
1	2	3	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			MOTOR CURRENT AMPS RMS
6	7	8	
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 C-4. DIP Switch (S1) Settings

DIMENSIONS. . .Model 6410 [mm—dimensions for ref.

±0.04"
4.30" [109.2mm]

±0.04"
1.10" [27.9mm]

CLEARANCE FOR M4
or 6-32 SCREW

±0.04"
1.50" [38.1mm]

COMP'S NOT SHOWN

±0.02"
4.75" [120.7mm]
CUSTOMER MTG

±0.04"
5.00" [127.0mm]

6410
STEPPER DRIVER

OPTIONAL
HEAT SINK

±0.02"
2.75" [69.9mm]
OPTIONAL SIDE MTG

±0.02"
0.75" [19.1mm]
CUSTOMER MTG
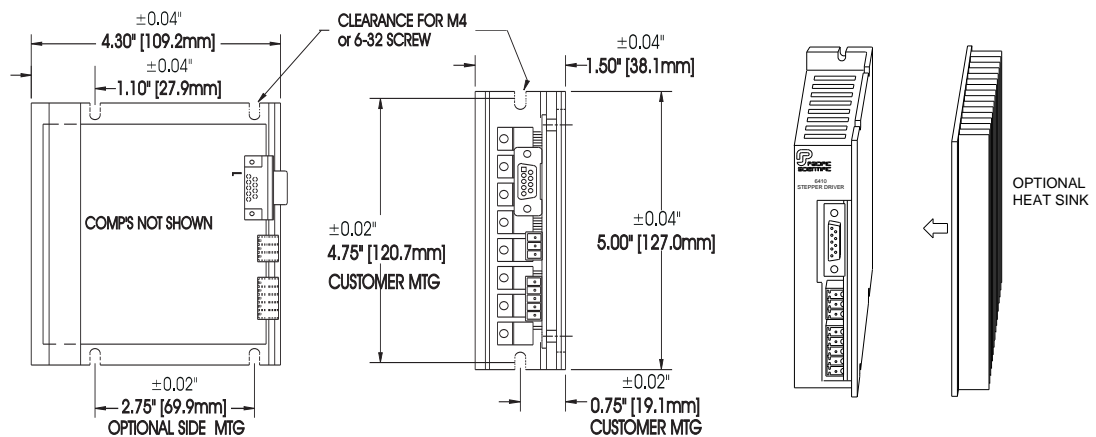
FUNCTIONAL ENHANCEMENT

The 6410 microstepping drive is the core component utilized in a full family of products adding enhanced functionality.
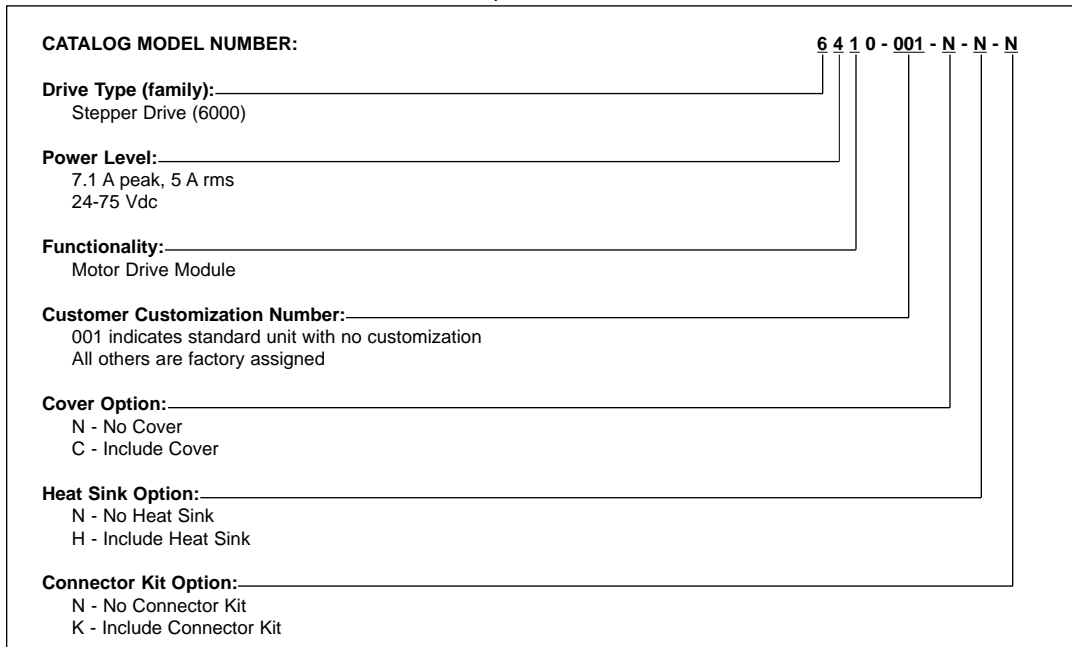
ADDITIONAL PRODUCTS
24-75 Vdc Input:
      6415 Oscillator/Drive . . . .± 0-10 Vdc input or on board potentiometers
      6420 Indexer/Drive . . . . .RS232/RS485 programmable package, mnemonic language, 8 BDIO
120/240 VAC 50-60HZ INPUT:
      6430 Package . . . . .6410 drive with AC input
      6435 Package . . . . .6415 oscillator/drive with AC input
      6440 Package . . . . .6420 indexer/drive with AC input
      6445 Package . . . . .6410 drive with Stepper Basic indexer with AC input

HOW TO ORDER. . .Model 6410 recommended systems

Order the 6410, accessories and motor as separate model numbers.

```
CATALOG MODEL NUMBER:                                6 4 1 0 - 001 - N - N - N

Drive Type (family):
    Stepper Drive (6000)

Power Level:
    7.1 A peak, 5 A rms
    24-75 Vdc

Functionality:
    Motor Drive Module

Customer Customization Number:
    001 indicates standard unit with no customization
    All others are factory assigned

Cover Option:
    N - No Cover
    C - Include Cover

Heat Sink Option:
    N - No Heat Sink
    H - Include Heat Sink

Connector Kit Option:
    N - No Connector Kit
    K - Include Connector Kit
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NOTE: Standard drive includes Data Sheet. Manual/Design Guide ordered separately.

6410 Accessories: Order in accordance with the following model number codes:

Part No.	Description
CV6410	Cover (includes fastening screws)
HS6410	Heat Sink (includes fastening screws)
CK6410	Connector Kit (includes all mating connectors) 9-pin D-shell and Phoneix Connectors for J3-motor: Phoneix p/n: MC 1.5/5-ST-3.81 and J2-DC input: MC 1.5/3-ST-3.81
MA6410	User Manual / Design Guide
SPC-XXX-6410	With control connector and motor MS connector. Four conductor shielded wire plus ground. In place of XXX, specify length in even one foot increments from 001 to 050 feet. Consult factory for longer lengths.
SPC-CO-XXX	Motor Power Cable Only. Four conductor shielded wire plus ground. In place of XXX, specify length in even one foot increments.