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P70360
High Performance Microstepping Drive
Reference Guide

M-SD-7AC-01 Rev 1



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Record of Revisions

Date	Issue	Description
01/06/04	Rev 1	Initial release

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1. GETTING STARTED



Warning

Read this reference guide before you apply power to the drive. Miswiring of the drive may result in damage to the unit voiding the warranty. Improper grounding of the drive may cause serious injury to the operator.

Only qualified personnel are permitted to transport, assemble, commission, and maintain this equipment. Properly qualified personnel are persons who are familiar with the transport, assembly, installation, commissioning and operation of motors, and who have the appropriate qualifications for their jobs.

Read all available documentation before assembling and using. Incorrect handling of products in this manual can result in injury and damage to persons and machinery. Strictly adhere to the technical information regarding installation requirements.

- Keep all covers and cabinet doors shut during operation.
- Be aware that during operation, the product has electrically charged components and hot surfaces. Control and power cables can carry a high voltage, even when the motor is not rotating.
- Never disconnect or connect the product while the power source is energized.
- After removing the power source from the equipment, wait at least 2 minutes before touching or disconnecting sections of the equipment that normally carry electrical charges (e.g., capacitors, contacts, screw connections). To be safe, measure the electrical contact points with a meter before touching the equipment.

1.1. UNPACKING AND INSPECTING

Open the box and remove all the contents. Check to ensure there is no visible damage to any of the equipment.



Use proper procedures when handling electronic components to avoid damage to equipment.

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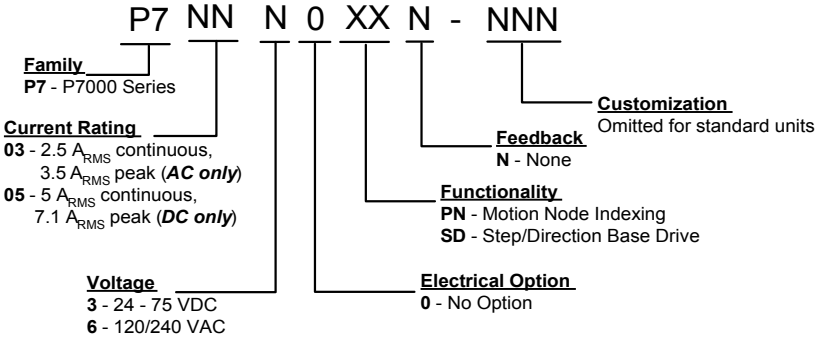


Remove all packing material and equipment from the shipping container. Be aware that some connector kits and other equipment pieces may be quite small and can be accidentally discarded. Do not dispose of shipping materials until the packing list has been checked.



Upon receipt of the equipment, inspect components to ensure that no damage has occurred in shipment. If damage is detected, notify the carrier immediately. Check all shipping material for connector kits and documentation.

1.2. PART NUMBER



1.3. ACCESSORIES

106-113020-01	Connector kit for use with AC base drive P70360-SDN or P70360-PNN
106-113023-01	Connector kit for use with AC RS485 drive P70360-R4N
768-026902-01	26-pin D-Sub connector to terminal block adapter
P7S2-232-9D	RS-232 Serial cable RJ12 to 9 pin D-Sub connector 6 feet

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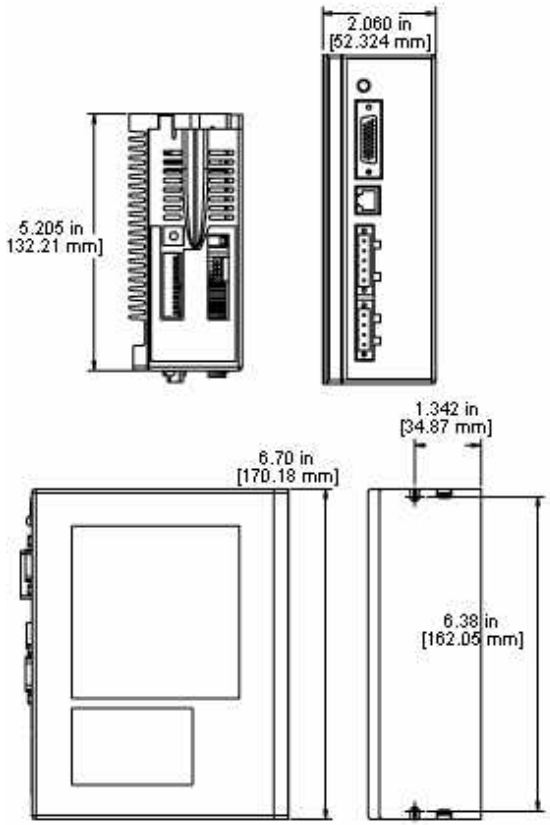
1.4. AC MOUNTING

Mount the P70360 to a cold plate using either 8x32 or M4 screws. It should be mounted upright with the heat sink fins on the left side of the drive.

1 For convection cooling allow a minimum of 1 in (25.4 mm) of space around all sides.

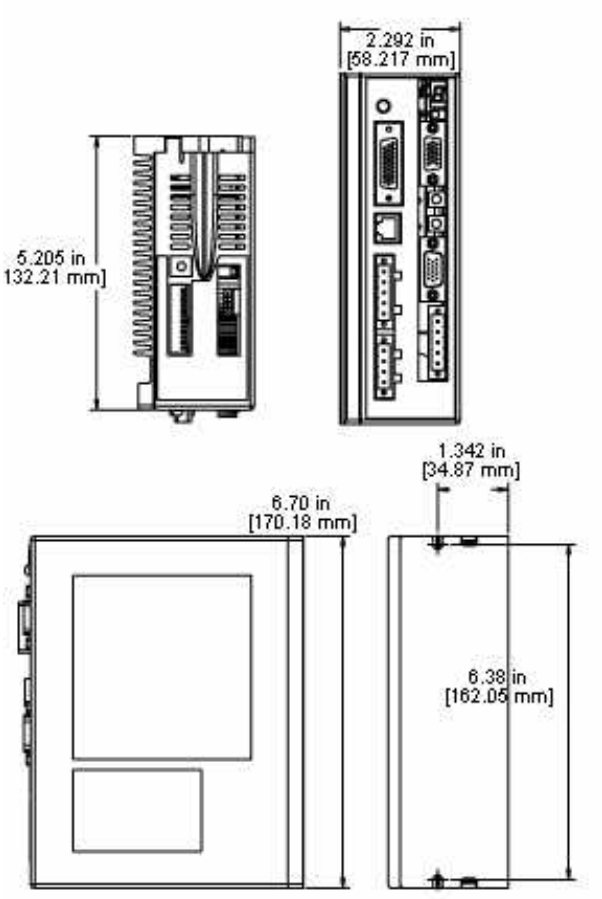
2 It the heat sink temperature exceeds 65 °C the drive shuts down due to overheating. Fan cooling or a lower ambient temperature may be required to allow the drive to run properly.

1.4.1. AC Base Drive Mounting Dimensions



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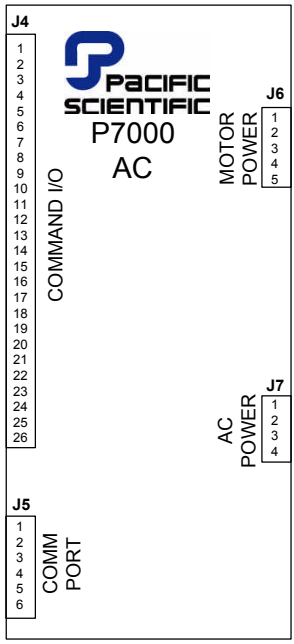
1.4.2. AC Drive with Option Card



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2. WIRING

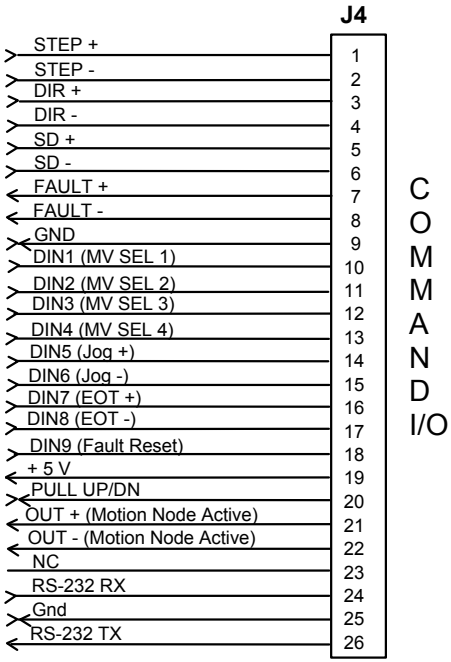
2.1. CONNECTOR LOCATIONS



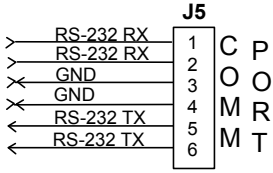
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2.2. FUNCTIONS BY CONNECTOR

2.2.1. J4 Connector – Command I/O

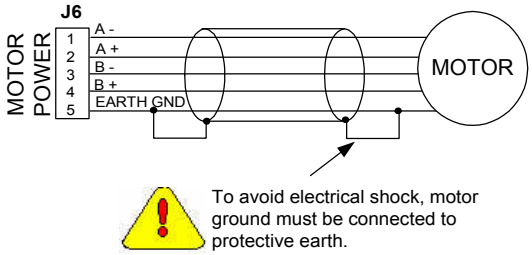


2.2.2. J5 Connector – Comm Port

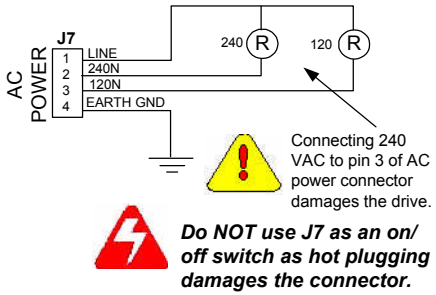


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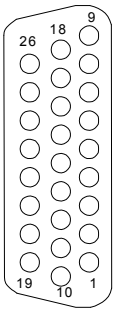
2.2.3. J6 Connector – Motor Power



2.2.4. J7 Connector – AC Power



2.3. J4 I/O COMMAND CONNECTOR



J4 is a 26-Position High Density D subminiature female connector. (Connector is shown as viewed from the front of the drive.

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Pin	Description
J4-1	STEP +
J4-2	STEP -
J4-3	DIR +
J4-4	DIR -
J4-5	SD +
J4-6	SD -
J4-7	FAULT +
J4-8	FAULT -
J4-9	Gnd
J4-10	DIN1 (MVSEL 1)
J4-11	DIN2 (MVSEL 2)
J4-12	DIN3 (MVSEL 3)
J4-13	DIN4 (MVSEL 4)

Pin	Description
J4-14	DIN5 (Jog +)
J4-15	DIN6 (Jog -)
J4-16	DIN7 (EOT +)
J4-17	DIN8 (EOT -)
J4-18	DIN9 (Fault Reset)
J4-19	+ 5 V
J4-20	Pull Up/Dn
J4-21	OUT + (Motion Node Active)
J4-22	OUT – (Motion Node Active)
J4-23	NC
J4-24	RS-232 RX
J4-25	Gnd
J4-26	RS-232 TX

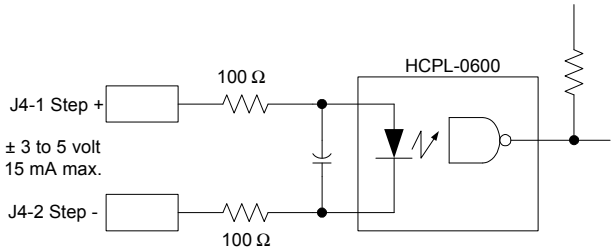
2.3.1. Step and Direction Inputs

Step Input

Pins 1 – 6 The P70360 increments its internal step counter on the ON-to-OFF transition of the LED in an opto isolator. Minimum ON and minimum OFF times are both 250 ns. This results in a maximum step input frequency of 2 MHz. Pulses that do not meet minimum times may be ignored by the drive's electronics. The input circuitry is suitable for use with 3- to 5-volt logic (single ended or differential). It is best to drive the input to both logic states rather than utilize open collector transistors

The STEP input is sensitive to high frequency noise and should be supplied through shielded cable.

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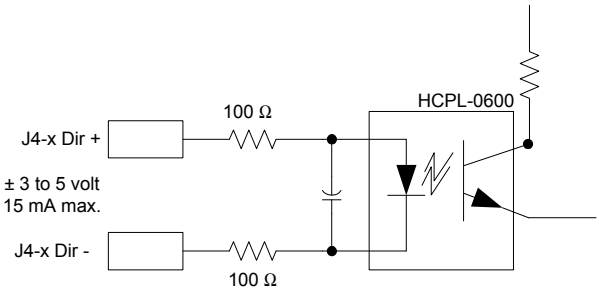


Direction and Shutdown Input

The Direction input is similar to the Step input except that it employs a slower opto isolator. Allow for a 10 µs setup time from changes at the DIR input prior to transition of the STEP input. Failure to meet setup time can result in the drive misinterpreting the intended direction of a step.

The Shutdown input removes current from the motor windings so the axis can be externally moved. The polarity of the Shutdown logic is configurable using P7000Tools. Factory default is Shutdown = ON. If the inputs are left open, the drive is enabled.
The input is enabled with 5 to 15 mA of current. It is suitable for use with 3 to 5 volt logic. The Shutdown input is digitally filtered and internally de-bounced. Do not depend on the shutdown input as a safety or E-STOP mechanism. Internal drive failure could result in motion. While in shutdown, the winding terminals are not at safe potential. The power output from the drive is electrically safe only when the drive is disconnected from the power source.

Direction and Shutdown Circuit



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Pin	Description
J4-3	Dir +
J4-4	Dir -
J4-5	SD +
J4-6	SD -

Step and Direction Input Specifications	
Voltage	3 to 5 VDC
Current	5 to 15 mA
Setup Time (Dir)	10 µs
Max. Freq. (Step)	2 MHz

2.3.2. General Purpose Inputs

There are nine configurable General Purpose Inputs (GPI's) on the P70360 drive. All the inputs share a common optically isolated bus (Pull Up/Down). The common bus simplifies the wiring allowing a common point to connect either sinking or sourcing outputs.

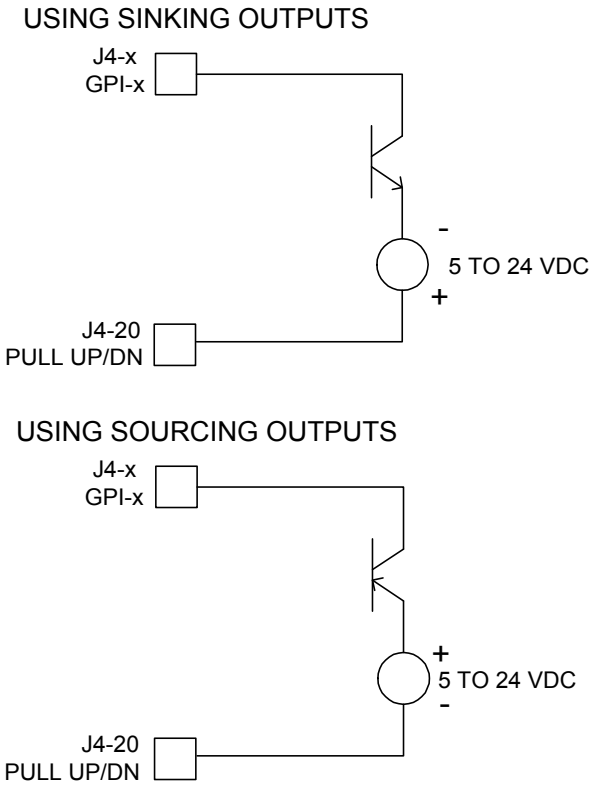
The GPI defaults for the P70360-SDN include Jog+, Jog-, EOT+, EOT- and Fault Reset. MV SEL 1, MV SEL 2, MV SEL 3 & MV SEL 4 are the additional GPI defaults when using the P70360-PNN.

Pin	Description
J4-10	DIN1 (MV SEL 1) *
J4-11	DIN2 (MV SEL 2) *
J4-12	DIN3 (MV SEL 3) *
J4-13	DIN4 (MV SEL 4) *
J4-14	DIN5 Jog +
J4-15	DIN6 Jog -
J4-16	DIN7 EOT +
J4-17	DIN8 EOT-
J4-18	DIN9 Fault Reset
J4-20	Pull Up/Dn

*Availble with Motion Node Only

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General Purpose Input Load Wiring



2.4. OUTPUTS

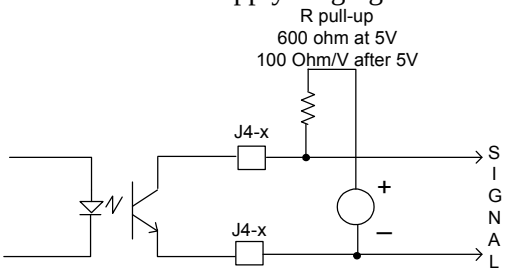
2.4.1. Fault Output

The P70360 has an optically isolated fault output which latches when a drive fault occurs. The fault can be cleared by cycling power, resetting through P7000Tools or by toggling the fault reset GPI. The input may be powered by the on-board 5 VDC logic supply (J4-19) or from a remote supply ranging from 5-24 VDC.

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2.4.2. General Purpose Output

The P70360 includes one optically isolated output that can be configured to indicate when the motion node is active or an end of travel limit has been reached. The input may be powered by the on-board 5 VDC logic supply (J4-19) or from a remote supply ranging from 5 - 24 VDC.



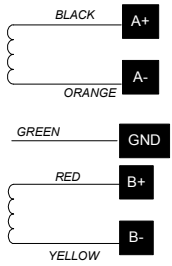
Pin	Description
J4-7	Fault +
J4-8	Fault -
J4-21	Out +
J4-22	Out -

1.5 CONNECTING A MOTOR

Danaher Motion offers a number of standard stepper motors designed to provide optimum performance when matched with the P70360. The motors are offered with a 4-flying lead configuration. If your motor has 6 or 8 leads, you should consult your distributor or the factory for assistance. If you are using a motor other than a Danaher Motion brand, make certain that the insulation material is rated for 240 VAC operation.



Danaher Motion's Pacific Scientific
Flying Lead Motor Wiring
For T20, N30, K30, N40, and K40 Series Motors.

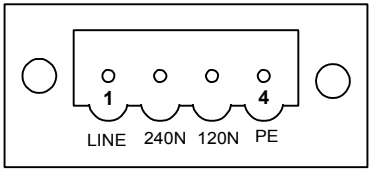


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Do not hot-plug the motor connector.

1.6 POWERING THE DRIVE

J7 AC Power



(Connector view from front of drive).

The P70360 AC power can be connected to either a 120 VAC or 240 VAC single-phase power source. If using 240 VAC, connect to pins 1, 2, and 4.

Connecting 240 VAC to pin 3 damages the drive!

2.4.3. P70360 Power Pin Out

Pin	Description
J7-1	120/240 VAC line
J7-2	240 VAC neutral
J7-3	120 VAC neutral
J7-4	PE (Protective Earth)

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2.5. SERIAL PORT CONNECTION



RJ12/RJ11 Phone Style	
Pin	***Description***
J5-1	No Connection
J5-2	RX232
J5-3	I/O RTN
J5-4	I/O RTN
J5-5	TX232
J5-6	No Connection

RJ12/RJ11 PHONE STYLE

Standard RJ12/RJ11 Plug

J5-1, J5-6
No Connection — These terminals are not used or connected to the drive.

J5-2
RX232 — RS-232 receiver input to the drive. This terminal connects to the user's RS-232 transmitter output.

J5-3, J5-4
I/O RTN — This terminal is the common/ground connection for the RS-232 serial port. The ground from the user's RS-232 needs to connect to this terminal. Cable shielding is also connected to this point.

J5-5
TX232 — RS-232 Transmitter output from the drive. This terminal connects to the user's RS-232 receiver input.

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3. CONFIGURING THE DRIVE

3.1. MOTOR SELECTION

Configure the drive for a motor type via switch settings on the top of the drive. If you are not certain how much current to supply to your motor, contact technical support. Valid settings are:

MOTOR	S1	S2
USE GUI	0	OFF
T21NRLC	1	OFF
T22NRLC	2	OFF
T23NRLC	3	OFF
N31HRLG	4	OFF
N32HRLG	5	OFF
N33HRLG	6	OFF
N34HRLG	7	OFF

MOTOR	S1	S2
K31HRLG	8	OFF
K32HRLG	9	OFF
K33HRLG	A	OFF
K34HRLG	B	OFF
N41HRLG	C	OFF
N42HRLK	D	OFF
K41HRLG	E	OFF
K42HRLK	F	OFF



For non-system motors, configure the drive with the P7000Tools GUI Wizard.

Motor type zero is used for non-system motors.

Motor types 16-31 (not Shown) are reserved for factory- configurations.

Using incorrect settings results in zero current (motor will not operate).

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3.2. STEP RESOLUTION

Step Resolution			
Resolution	**S2-2**	**S2-3**	**S2-4**
200	ON	ON	ON
400	OFF	ON	ON
5,000	ON	OFF	ON
10,000	OFF	OFF	ON
18,000	ON	ON	OFF
25,000	OFF	OFF	OFF
25,400	OFF	ON	OFF
50,000	ON	OFF	OFF

3.3. LOAD INERTIA

The P7000 eliminates resonance, typical of step motors, with high-speed, digital processing of motor electrical activity. To use this feature, you must set three switches based on the load-to-rotor inertia ratio. These switches select the gain parameter for the drive to use to stabilize the motor.

Load Inertia Ratio			
Load-Rotor	**S2-5**	**S2-6**	**S2-7**
0-1	OFF	OFF	OFF
1-1.5	ON	OFF	OFF
1.5-2.5	OFF	ON	OFF
2.5-5.0	ON	ON	OFF
5.0-7.0	OFF	OFF	ON
7.0-12.0	ON	OFF	ON
12.0-20.0	OFF	ON	ON
20.0-32.0	ON	ON	ON

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3.4. DYNAMIC SMOOTHING™

Dynamic Smoothing is a temporal filter (2nd- Order, Low-pass) applied to the command sequence to reduce jerk. It helps reduce overshoot and lessens the excitation of mechanical resonance in the system. It filters from slightly below the resonant frequency up to well above resonance to remove spectral content would be misrepresented in the motor output and may also excite other parts of the machine.

Dynamic Smoothing		
Smoothing	S2-8	S2-9
Minimal	OFF	OFF
Moderate	ON	OFF
Heavy	OFF	ON
Aggressive	ON	ON

3.5. CURRENT REDUCTION

Reduces Drive and Motor heating by invoking Standby Current Reduction via Switch S2-10. When enabled, the reduction mode cuts motor current to 75% of its commanded value 100 ms after receipt of the last step pulse or the end of a stored move. The reduction proportion and the delay can be set to other values using P7000Tools.

Current Reduction	S2-10	ON=Disabled
Multi-Step	S2-11	ON=Enabled
Stall Detection	S2-12	ON=Enabled

3.6. MULTI-STEPPING™

MultiStepping™ is similar to Dynamic Smoothing™ except that it is a much more agressive use of the filter. Typically, it results in a filter that begins to roll off a couple octaves below the resonant frequency. This is intended for use with course resolution (full/half step input pulses) to smooth out the big steps into a continuous train of microsteps.

Multi-Stepping	S2-11	ON=Enabled

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3.7. ENCODERLESS STALL DETECTION™

The P70360 drive is uniquely designed to sense the motor shaft position at all times. The drive monitors the commanded position and compares it to the actual position. As with any 2 phase step motor, when the shaft position and commanded position are greater than two full steps apart a stall will be detected and the drive will fault.

Stall Detection	S2-12	ON=Enabled

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4. USING P7000TOOLS

4.1. SET UP WIZARD

Start **P7000Tools Wizard**. Follow the **Setup Wizard.** You will go through a series of screens to set up the motor, drive I/O, command structure and mechanical configuration.

When you Finish this set up, the front panel **LED** indicator will be **Solid Green**. The motor should have holding torque.



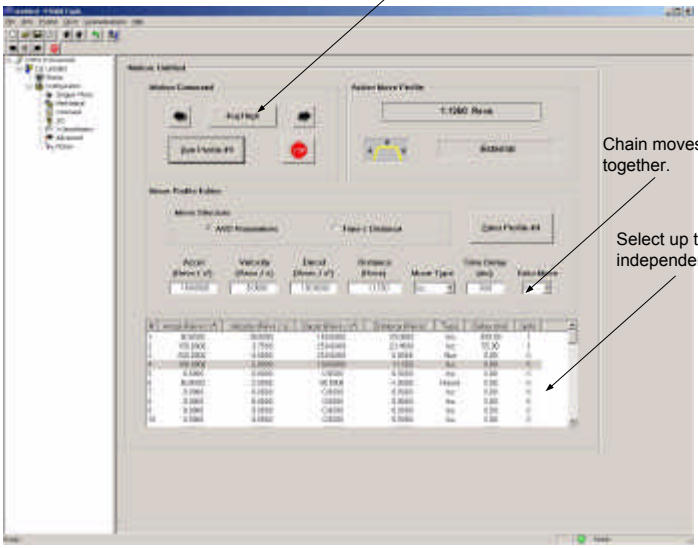
4.2. P7000TOOLS MOTION PROFILE GENERATOR

Once the system is configured you can select the Motion wizard by double clicking on the motion folder. You can immediately generate motion by selecting the ± jog arrows. When using the P70360-PNN you can also select up to 63 moves. These may be chained together with a time delay between moves.

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Motion Node

Jog your motor with a click of the mouse.



Chain moves together.

Select up to 63 motions, with independent accel and decel.

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5. TROUBLE SHOOTING

5.1. COMMON PROBLEMS

Problem	Possible Fixes
Motor spins in wrong Direction	Reverse wires on one phase. Change direction polarity using P7000Tools
Drive Overheats	Lower ambient temperature. Provide fan cooling. Reduce system throughput

5.2. STATUS DISPLAY

There are 7 faults that may occur with the P7000 drive. The fault output latches when they occur. Determine the type of fault by viewing the front panel or through the serial port. The front panel LED turns red and blinks according to the table below.

	Blink Code
Stall	1
Over Current	2
Over Voltage	3
Drive Over Temp	4
System Error	5
Under Voltage	6
EPROM Checksum	7

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The blinking continues until the drive is reset by one of the following methods:

1) Power Cycle
2) GUI Control
3) Fault Reset (Configurable General Purpose Input)

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