

LNX Series Motor and Drives

Operator's Manual
PN 04-01808 x

PRECISION MOTION CONTROLS

2530 Berryessa Rd. #209

San Jose, CA 95132

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INTRODUCTION

Description

The LNIIX Drive is a microstepping drive with a linear amplifier for the output stage. It is intended for stepping motor applications where motor vibration must be minimized and EMI noise can't be tolerated. The LNX drive eliminates EMI generated noise in the steady state condition and minimizes EMI noise while running. The drives dual voltage supply design, allows this unit to have speed vs torque curves superior to most pulsewidth modulated drives; while minimizing the stress on the power amplifier. Extremely smooth movement is provided with a microstepping resolution of up to 25600 steps/revolution; this makes this product suitable in application with precision equipment where vibration must be minimized.

The LNIIX Drive can be bought with a wide range of motors, with torque ranging from 60 to 600 in-oz. The drive has two dip switches for easy access to current selection, step size, auto-shutdown, 3rd harmonic correction, and a test mode. Each function is described in detail further on in the manual.

A standard 25 pin D connector with TX, RX Gnd, L+, and L- inputs make this drive easy to interface with existing terminals on the market.

Features

The LNX is a high performance linear Microstepping drive designed for low noise applications. The systems dual supply allows cool operation at idle and low speed operation yet still enables the drive to obtain high speeds.

- * Wave shape correction of 3%, 6% third harmonic distortion
- * 115/220 VAC line voltage operation
- * Auto-standby reduces motor current to 1/2 after 2 seconds if no input is received.
- * Short circuit current protection
- * Low voltage sense

Warranty

PMC's linear drives have a one year warranty against manufacturing defects from the date of purchase. If your unit should ever fail, and you wish to send it back for repairs; you should do the following:

1. Get the serial number from the defective unit.

2. Check purchase date to see if the unit is under warranty. If not, obtain a purchase order number for repair costs.
3. Call Precision Motion Controls for a return authorization (408) 298-0898.
4. Ship to :

Precision Motion Controls
2530 Berryessa Rd. #209
San Jose, CA. 95132

Attention RMA # _____

INSTALLATION

Unpacking

When unpacking your unit verify that the unit was not damaged during shipping. Report any damage found to the shipper. Check the box contents against the packing slip. The box will contain the driver, an AC line cord and manual. If a complete system was bought a motor will also be included.

Connect the motor to the driver box and then plug in the AC line cord. Feel the shaft of the motor and verify that the motor is producing torque. If you are able to move the motor shaft the motor does not have torque; unplug the line cord. Check if any of the motor wires have come out of the connector or if the fuse is blown. Contact the factory for a return authorization if the above checks prove negative. IF the above test works turn off the drive and put the unit into the test mode by placing dip-switch 2 position 7 to the on position. Plug the AC cord in; the motor will rotate at about 0.5 rev/second in the counter clockwise direction.

CAUTION, always disconnect the AC power prior to connecting or disconnecting the motor to the drive.

Mounting

The LN Drive comes with built in mounting brackets to facilitate mounting. The unit may be mounted in any direction. Our built-in fan eliminates the need for the user to be concerned about cooling. It is recommend that 3 inches be allowed above the box for air flow into the system. See appendix B for a detailed drawing of the driver box and motors.

Cooling

The drive has a fan cooled enclosure; the surrounding temperature of the environment should not exceed 40 degrees centigrade. If the driver needs to be in a warmer environment, consult the factory for recommendations. The temperature of the transistor cases should not exceed 80 degrees centigrade.

Wiring

Motor Connections

The drive has three connectors on the box; a standard AC inlet, a 25 pin "D" connector for the indexer, and a 5 pin Phoenix connector for the motor.

IF a motor is purchased with the drive, the motor will have the connector attached to it; otherwise a connector with screw mountings will be supplied. The center pin of the connector is for connection of the motor cable shield. The center pin (shield) is connected to the motor case on PMC supplied motors. The

system normally comes configured with the center pin jumped to motor ground and the supply floating. The motor connections are listed below.

Phoenix 5 pin connector

A+	(Red)
A-	(Black)
Shield	(earth gnd)
B+	(White)
B-	(Green)

An internal connector JP4 allows for optional connections of the shield and motor ground. Jumping JP4 connects motor shield to AC ground. Jumping JP5 connects the motor shield to motor ground on the board. Standard factory setting is for jumper JP5 is shorted.

Line Power

The drive has an AC line voltage (115 or 220 VAC) selection switch on the side of the unit. All units are shipped with the selection switch in the 115 line voltage position. The correct line cord is supplied for connection of 115 VAC power. Make sure that the unit is plugged into a wall socket with earth ground.

Indexer Connections

The drive has RS232 compatible signals for TX, RX and Communications ground. Inputs for limit CW, CCW and home are provided; these signals are photo-coupled to eliminate ground loops.

If an over-current, under-voltage, or over-temperature condition is detected the photo-transistor across the Fault+ and Fault- output is turned on. If the Fault signal is active, the drive's AC power needs to be recycled to reactivate the drive.

The Error condition is satisfied if the drive current exceeds 7 Amps, line voltage drops below 90 VAC, or if the internal temperature exceeds 50 degree C.

25 pin "D" connector

1	Limit + Pwr
14	Limit + ret
2	Limit - Pwr
15	Limit - ret
16	Home Pwr
17	Home ret
9	Fault + (collector)
21	Fault - (emitter)
11	RXD(option)
24	TXD(option)
12	RS232 ret

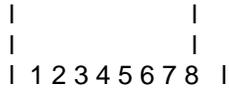
Switch Settings

Disconnect AC power from the unit prior to attempting to change any switch settings. The switch settings control the maximum winding current, 3rd harmonic correction, and test mode.

The two dip switches are accessible from the bottom of the box. The following diagrams and tables lists the dip switch settings for various motor currents. Resolutions not listed may be ordered as specials.

DIP SWITCH 2

ON



OFF

TABLE 1

Switch 2	1	2	3	4	5	6	7	8
PMC - 60 MTR	on	on	off	off	off	off	X	X
PMC - 90 MTR	on	on	off	off	off	off	X	X
PMC - 130 MTR	off	off	off	off	off	off	X	X
PMC - 160 MTR	on	off	off	off	off	off	X	X
PMC - 260 MTR	on	off	off	off	off	off	X	X
PMC - 320 MTR	on	off	off	off	off	off	X	X
PMC - 420 MTR	on	off	off	off	off	off	X	X
PMC - 600 MTR	on	on	on	off	off	off	X	X
Test Mode	X	X	X	X	X	X	on	X

The first 6 switches of dip switch 2 are the current settings and are approximately 40 ma per bit. The off position of the switch selects the current; switch 6 is the most significant bit. The PMC supplied motors run at approximately 2.25 amps/phase.

Test

This is a mode that is entered upon power up if switch 2-7 is in the on position. The motor will rotate in the CCW direction at 0.5 rev/sec . Power must be turned off and switch 2-7 put in the off position to leave this mode.

	Switch 1							
	1	2	3	4	5	6	7	8
waveshape								
0%	X	X	X	on	on	on	X	X
+2%	X	X	X	off	on	on	X	X
-2%	X	X	X	on	off	on	X	X
0%	X	X	X	off	off	on	X	X
0%	X	X	X	on	on	off	X	X

enable DN	on	X	X	X	X	X	X	X
enable echo	X	on	X	X	X	X	X	X
enable CR	X	X	off	X	X	X	X	X

The user has the ability to select the motor current wave shape. This will help provide even steps and minimize motor vibrations for various motors. If you use motors that have a large detent torque compared to the motor torque you may need to select a wave form other than sine. The wave shape corrections are based on a percentage of third harmonic distortion.

Switch 1-1 enables and disables the characters from being echoed from the drive. It is best to have the echo enabled while debugging.

Switch 1-2 enables or disables the drive from sending a DN response when a move stops. This can be used as an indication that the drive has reached the desired position without polling the position status.

Switch 1-3 can be set to put out a "CR" carriage return after status

Switches 7 and 8 set the system ID so that the units can be daisy chained.

Commands

The following are a list of commands that are accepted over the RS232 input. The small x's after a command stand for numbers that can be entered. The alpha characters must be capital. See examples.

Axxxx

Acceleration

This is in rev/sec/sec the least significant digit is in 0.1 rev. The drive does not accept a period to locate the decimal point. Thus accelerations from 999.9 to .1 rev/sec² are represented by the 4 integers. The least significant bit represents 0.1 multiples of acceleration.

Example A255 sets the acceleration to 25.5 rev/sec²; A3 sets the acceleration to 0.3 rev/sec². The acceleration should be set after each move is completed. In the distance mode the acceleration should not be changed while the motor is moving.

CF

COMMAND CURRENT OFF

Removes power from the motor and turns LED 2 on. This removes motor torque so the load can be moved by hand.

CN

COMMAND CURRENT ON

Puts power back on the motor. If the CF command is issued this command should be issued prior to doing a move.

Dxxxxxxxx

Distance

The distance is in motor steps (25600 per revolution. Valid numbers are +12000000. The distance is a 24 bit number internally. Putting in larger numbers will cause incorrect moves. The distance command is only applicable in the position mode (MI). The distance is in reference to the current position.

Example

D256000 will set the move to 10 revolution CW; a D-256000 is 10 rev CCW. The distance must be entered before each move. There is not a default distance and it is destroyed after each move. Do not enter a distance while the motor is moving.

G

GO

This tells the unit to start the move. It calculates the ramp distances at this time for incremental moves and enables the limit in the direction of travel.

Example see MA, MI and MC commands

GH

GO HOME

Seeks the CW edge of the home limit at the previously specified velocity, acceleration, and direction. Always specify the CW direction to ensure full travel search. If H- (CCW) direction specified the sequence is terminated if the CCW limit is found.

Example

H+ A50 V200 GH

The unit uses an acceleration of 5rev/sec² and a velocity of 2rev/sec and moves in the CW direction looking for the HOME sensor. If the sensor is reached it stops and then continues in the CW direction at 0.1 rev/sec until the limit sensor is cleared. If the unit senses the limit before the home sensor on the initial move the drive stops and then drives CCW until the home sensor is reached. It then stoops and moves CW at 0.1rev/sec until the home sensor is cleared. If the drive finds the CW limit and then CCW limit without finding the home sensor the sequence is terminated.

Hx

Set direction

H is followed by a "+" or "-" to indicated CW and CCW motor rotation respectively. This is used mainly in the MC mode to set the motor ration direction. The H must be followed by a + or - to be valid.

MA

MODE ABSOLUTE

This puts the drive in the Absolute position mode. All distances entered are respect to the systems absolute position counter. Thus if a PZ command is issued the Internal counter is zero. Entering a distance off D2000 would cause the drive to move CW 2000 counts. Then entering a Distance of D4000 would cause the drive to move 2000 steps again or move from the 2000 to 4000 absolute counter position. A distance of D-20000 would now cause a move of 6000 counts in the CCW direction.

PZ MA A50 V200 D2000 G

D4000 G

D-2000 G

MC

Mode continuous

This puts the unit in the velocity mode. The unit will accelerate to the velocity entered. New velocity values may be entered while the motor is running. As soon as entered this becomes the target velocity whether the previous velocity has been reached. The acceleration may also be changed while running.

Example

MC A100 V500 G ; After the G is entered the motor accelerates to 5 rev/sec at 10 rev/sec². A new acceleration and velocity or just velocity may now be entered and it will accelerate to the new value. Entering A20 V100 would cause the motor to decelerate from 5 to 1 rev/sec at 2 rev/sec².

MI

MODE INCREMENTAL

This puts the drive in the incremental distance mode. The drive performs a trapezoidal move based on the acceleration, velocity and distance parameters entered. If the distance entered is not great enough to allow the motor to reach velocity with the acceleration given the velocity profile will be triangular and accelerate for 1/2 the distance and decelerate for the other half.

Example

MI A100 V1000 D1000000 G

The motor will accelerate for 128000 steps (5 rev) ; run at 10 rev/sec until the motor has traveled 872000 steps and then start decelerating. If the distance in the above move is changed to 200000. A100 V1000 D200000 the motor would accelerate until the motor reached 100000 steps and then decelerate.

PZ

Zero position counter

Set the position counter to 0 (800000 hex). This allows the user to establish the zero position. This should be done after a home command.

RD

REPORT POSITION

The content of the 24 bit position counter are sent back in hex format. A 800000 is the power up zero position, 800001 is one step positive and 7FFFFFFF is 1 step negative. This counter will roll over at FFFFFFFF to 000000 and the other direction. The counter can be read while the motor is moving but no guarantees are made on data integrity since the count could change during the reading and conversion to ASCII.

RL

Report Limits

The contents of the limit status register is sent. in two hex values. these are located in bits, 0,1, and 2. If the bit is 0 then it is active.
bit 0 = limit -

bit 1 = home sensor
bit 2 = Limit+

RS

Report Motor status

Sends out the motor status in hex. Tells whether last movement was acceleration or deceleration., whether motor is running, mode (velocity or incremental).

b0	motor direction 1 = positive
b1	
b2	continuous mode = 1
b3	incremental mode = 1
b4	absolute mode = 1
b5	accelerate = 1
b6	running = 1
b7	

S

STOP

This causes the motor to decelerate to a stop in either the velocity or position mode.

Vxxx

Velocity

The velocity is in rev/sec. The acceptable range is from 50 to 0.01 rev/sec. Since decimals are not accepted this equates to a range of 5000 to 1.

Example V1002 represents a velocity of 10.02 rev/sec. The velocity "must" be set before each move. In the velocity mode (MC) entering a new velocity while the unit is running will cause the drive to accelerate to that velocity at the last acceleration rate entered. A velocity of 0 will cause the motor to come to a stop.

MC A50 V500 H+ G

The motor accelerates at 5 rec/sec² to 5rev/sec in the clockwise direction. Entering V1000 after the drive has reached speed will cause it to accelerate from the present speed to 10 rev/sec.

DN

Movement Done

This is sent by the drive when the motor stops. This can be used by the host as a notice of move completed.

Electrical

Input Power: 90 to 132 VAC 50/60 Hz ,185 to 270 VAC 50/60 .switch selectable.

Fuse : 2 Amp (located on PC board by voltage select switch).

Output Power: 0 to 2.5 Amps at 40 VDC through an H bridge liner driver.

Motor Compatibility

Motor inductance - approximately 4 mh for a PMC supplied motor. The drive has no minimum inductance requirement however a motor inductance greater than 20 mh will degrade the top motor speed and may cause stability problems.

Indexer Inputs

Input signals:

Fault (error+, error-) is a npn transistor photo-coupled output. The transistor is on when an over-current, over-temperature or under-voltage condition is detected.

All input signal are optically isolated and have a 330 ohm current limiting resistor in series. A current of 8 to 15 ma should be applied to the opto-couplers. A driving source of 5 volts will meet this requirement.

The drive also has a RS232 input. These signals are not isolated from the driver unit. This is an option for OEM application to remotely change parameters. The shutdown input and fault output can be programmed for a different function for OEM customers. Consult factory if you have a need for this option.

PMC drives come pre tested and adjusted for the motor that is supplied with the unit. No further adjustments are necessary.

"DO Not" connect or disconnect the motor with power applied to the box.

Resonances

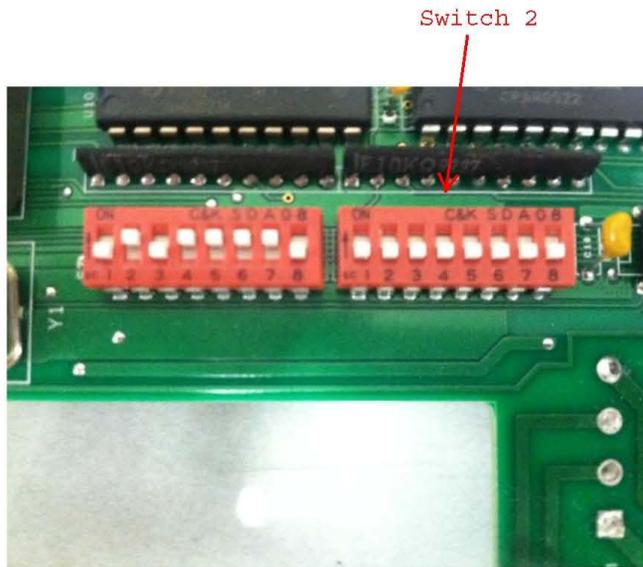
All stepper motor drives are subject to two oscillation regions; low speed (approximately 1 rev/sec) and mid range (approximately 10 to 15 rev/sec).

Microstepping minimizes low speed oscillation. If your load has a high Q and resonates around 200 Hz, adding extra inertia to the motor shaft may eliminate the problem. Changing the current wave shape may help tune the motor driver to your motor load combination.

PMC motors and drives have been matched to eliminate most mid-range instability problems.

LN2 DIP switch

Switch 1 is the one on the left hand side. It is used for waveshape selection and some RS232 features. Switch 2 is on the right hand side, used for current selection and test mode.



Drive Specifications

Performance (unloaded motor)

Repeatability: ± 5 arc-seconds (unidirectional)
 Accuracy: ± 5 arc-minutes (bidirectional)
 Step-to-Step Accuracy: ± 20 arc-seconds (unidirectional)

Inputs (optically isolated) 5 to 6.0 VDC, 20 ma.

Step : 250 nanosecond min.
 Direction: 100 usec setup and hold
 Shutdown: 10 msec min.

Output 25 Vdc, 5ma. max

Fault : optically isolated

Optional RS232

Environmental-Operating

Driver: 0 to 60 °C measured at the heat sink
 Motor: 110 °C measured at the motor case
 Ambient: 10 to 40 °C, 0 to 95% humidity,
 non-condensing

Environmental-Storage

Motor+Driver: -40 to +80 °C, 0 to 95% humidity,
 non-condensing

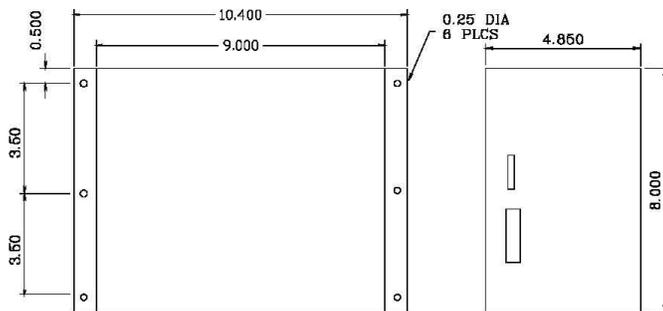
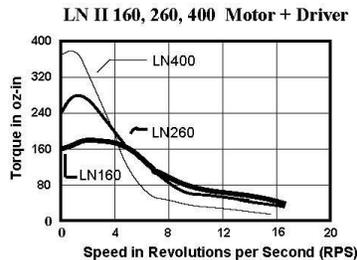
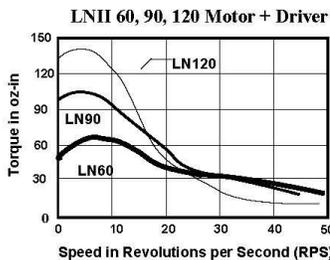
Power 95-130/185-270 VAC 50/60Hz, 1.2A

Weight 14 Lb.

Motor Specifications

Model	LNII-60	LNII-90	LNII-120	LNII-160	LNII-260	LNII-400
Static Torque (oz-in):	60	90	120	150	240	400
Motor size	23	23	23	34	34	34

Double shaft motors are standard add -s suffix for single shaft



Indexer connector:

25 pin D

1. Step+
2. Direction+
9. Fault+
11. Rx/D
12. RS232Ret
14. Step-
15. Direction-
16. Shutdown+
17. Shutdown-
21. Fault-
24. Tx/D

Motor connector:

5 pin terminal block

1. A+
2. A-
3. Gnd
4. B+
5. B-

Precision Motion Controls

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