

LN3 Series Motor and Drives

Operator's Manual
PN 04-01906 D

PRECISION MOTION CONTROLS

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LN3 Manual

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Introduction

Description

The LN3 Drive is a microstepping drive with a linear amplifier output stage. It is intended for stepping motor applications where motor vibration must be minimized and EMI noise cannot be tolerated. The LN3 drive eliminates EMI noise in the steady state condition and minimizes EMI noise while running. The drive's dual voltage supply design allows this unit to have speed vs torque curves superior to most pulse width modulated drives while minimizing the stress on the power amplifier. The drive provides extremely smooth movement with a microstepping resolution of up to 51200 steps/revolution; this makes this product suitable in applications involving precision equipment where vibration must be minimized. The LN3 drive is the next generation of LN drives superseding the LNII drive.

The LN3 drive can be purchased with a wide range of motors, with torque ranging between 60 and 400 in-oz. The drive has two dip switches for easy access to current selection, step size, auto-standby, 3rd harmonic correction, and a test mode. Each function is described in further detail in the manual.

A standard 25 pin D connector with step, direction, and remote disable inputs make this drive easy to interface with existing indexers on the market. The remote disable input removes power from the drive so the motor can be turned by hand. This may also be used as a safety limit since it overrides the other drive signals.

The two fault indicators indicate various motor conditions. Fault1 indicates that an over-current, over-temperature, has occurred; this is a fatal error and power must be turned off and then back on for the drive to continue operation. Fault 2 indicates that current is not on the motor (i.e. the shutdown signal is active).

Features

The LN3 is a high performance linear microstepping drive designed for low noise applications. The system's 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%, 5% 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.
- * 2 MHz step input rate (0.25 usec minimum width high or low)
- * 8 selectable step sizes
- * Short circuit current protection
- * Low voltage sense
- * Current configurable through dip switches
- * External fault indicators

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 or Precision Motion Controls or email to service@premotn.com for a return authorization
4. Ship to:

Precision Motion Controls
5273 Prospect Rd. #209
San Jose, CA. 95129

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, check the AC line voltage switch is set to the proper voltage and the correct motor current is set correctly, 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 is not producing torque. Check if the fault LED is on; and unplug the line cord. Check if any of the motor wires have come out of the connector or a blown fuse. 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 0.7 rev/second.

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

Mounting

The LN3 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 recommended that 3 inches be allowed around the box for air flow into the system. See appendix for a detailed drawing of the driver box

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.

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 the shield connection of the motor cable. The center pin (shield) is connected to the motor case on PMC supplied motors. The motor connections are listed below.

Phoenix 5 pin connector

A+	(Red)
A-	(Black)
Shield	(Earth ground)
B+	(White)
B-	(Green)

You can change motor rotation direction by swapping A+ with A- or B+ with B-.

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 VAC line voltage position. The correct line cord is supplied for connection of 115 VAC power. Make sure AC line voltage is selected correctly and that the unit is plugged into a wall socket with earth ground before turning the power on.

It is very important to select the line voltage correctly before turning on the drive

Indexer Connections

The STEP+, STEP-, DIRECTION+, and DIRECTION- signals are required for operation of the motor. These signals are photo-coupled to eliminate ground loops. The direction signal must not change 50 usec prior to the step signal changing. A remote shutdown input is provided to remove power from the drive without removing AC power from the box.

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 cycled to reactivate the drive.

The Fault 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 Step +
- 14 Step -
- 2 Direction +
- 15 Direction -
- 16 Shutdown +
- 17 Shutdown -
- 9 Fault + (collector)
- 21 Fault - (emitter)

Typical inputs, output connections

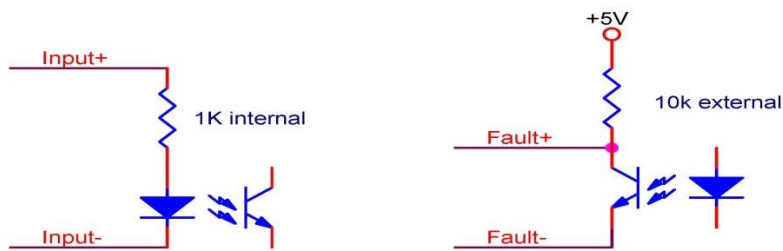


Figure 1: indexer connection

Switch Settings

Disconnect AC power from the unit prior to attempting to change any switch settings. The switch settings control the maximum winding current, step size of the motor\driver, 3rd harmonic correction, auto-standby and test mode.

The two dip switches are accessible from the bottom of the box. Figure 2 shows the location of 2 switches. Switch 1(SW1) is on the left hand side in the graph.

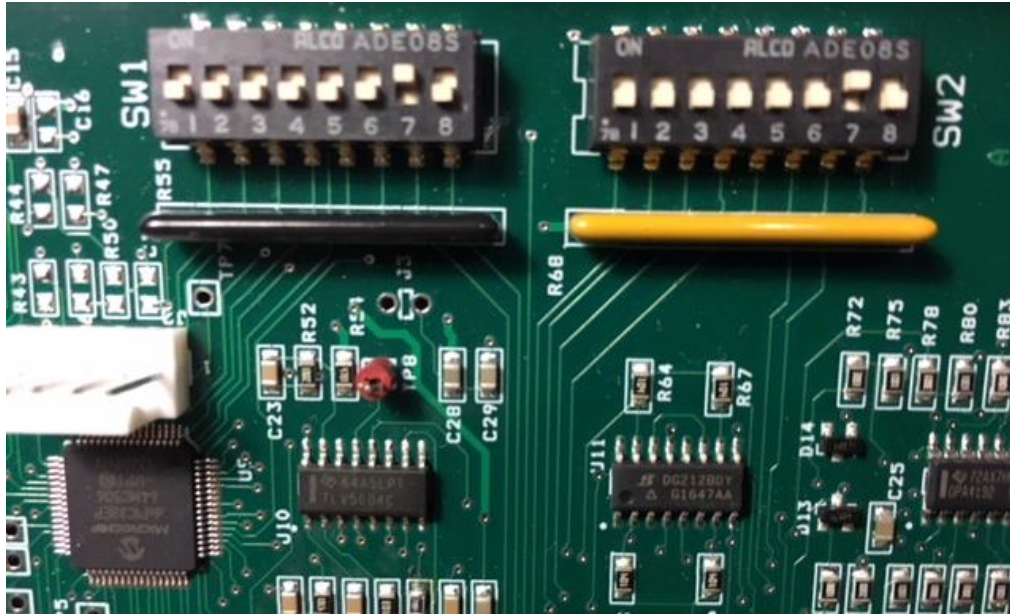


Figure 2: switch location

Table 1 lists the dip switch settings for various motor currents, motor waveform and micro-stepping resolution.

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 2.5 amps/phase peak current.

Test

This is a mode that is entered upon power up if switch 2-7 is in the on position. The motor will rotate at 0.7 rev/sec. Power must be turned off and switch 2-7 put in the off position to leave this mode.

The step sizes are set with switch 1, positions 1 to 3. The selections are illustrated in the following table.

	Switch 1							
	1	2	3	4	5	6	7	8
Steps/rev								
50000	off	off	off	X	X	X	X	X
25000	on	off	off	X	X	X	X	X
10000	off	on	off	X	X	X	X	X
2000	on	on	off	X	X	X	X	X
51200	off	off	on	X	X	X	X	X
25600	on	off	on	X	X	X	X	X
6400	off	on	on	X	X	X	X	X
400	on	on	on	X	X	X	X	X
Waveshape								
0%	X	X	X	on	on	on	X	X
+3%	X	X	X	off	on	on	X	X
-3%	X	X	X	on	off	on	X	X
+5%	X	X	X	off	off	on	X	X
-5%	X	X	X	on	on	off	X	X
autostandby	X	X	X	X	X	X	off	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 0% wave shape. The wave shape corrections are based on a percentage of third harmonic distortion.

Auto-Standby

In the auto-standby mode the drive reduces the current to 1/2 the rated current after approximately 2 seconds if no input pulses are received. This can be used to minimize motor heating and heat dissipation by the drive. This will have some effect on the motor

position and should not be used if a slight change in your stop position cannot be tolerated. The position shift due to current reduction is about 5% of a motor cardinal step (8 usteps for a system with 50000 step resolution). This mode is activated by putting switch 1-7 in the off position.

Fault indicators

There are two LED indicators adjacent to the motor terminal.

Fault1 LED is on when Over-current or Over-temperature conditions occur.

Fault1 LED is flashing when under voltage condition occurs. Check AC voltage is selected correctly.

Fault2 LED is on when the motor power is removed.

Power has to be recycled to remove the faults.

Electrical

Input Power: 95 to 132 VAC 50/60 Hz, 190 to 270 VAC 50/60 .switch selectable.

Fuse: 2 3.5 Amp 250V (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 minimum inductance of 1mH requirement. However a motor inductance greater than 20 mH will reduce the top motor speed and may cause stability problems.

Indexer Inputs

Input signals: Step signals have a maximum of 2 MHz rate and a 250 nsec minimum width.

Direction signal applied at least 50 usec prior to a step pulse.

Shutdown requires 1 msec to respond (the application of this signal will cause the motor to lose sync if the step signal is applied at the same time).

Fault (Fault+, Fault-) 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 current limiting resistor in series. A driving source of 5 volts will meet this requirement.

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 midrange (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.

Drive Specification

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 VDC, TTL typical

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

Output (optically isolated): 30VDC, 5ma max.

Environmental – Operating

- Driver: 0 to 60 °C measured at the heatsink
- Motor: 80 °C measured at motor case
- Ambient: 10 to 40 °C, 0 to 95% humidity, non-conducting

Environmental- Storage

- Motor + Driver: 0 to 60 °C, 0 to 95% humidity, non-conducting

Power: 95-130/190-260 VAC 50/60 Hz, 1.2A

Weight: 15 Lbs

Motor Specifications

Model	LN3-60	LN3-90	LN3-120	LN3-160	LN3-240	LN3-400
Static Torque (oz-in)	60	90	110	150	240	400
Motor size	23	23	23	34	34	34

Double shaft motors are standard, add –s suffix for single shaft

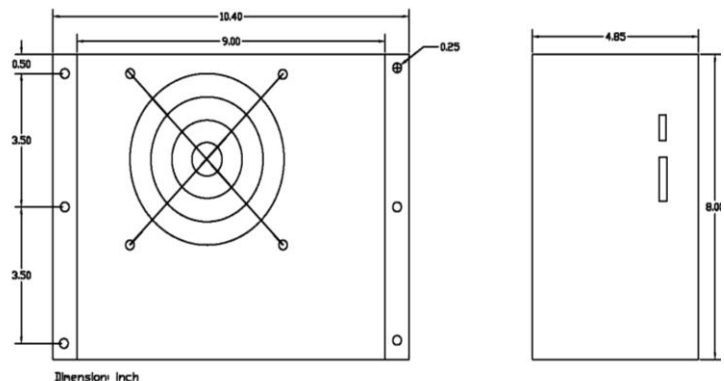
Indexer connector: 25 pin D

LN3 dimension: inch

1. Step+
2. Direction+
9. Fault+
- 14 Step-
- 15 Direction-
- 16 Shutdown+
- 17 Shutdown-
- 21 Fault-

Motor connector: 5 pin terminal block

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



Precision Motion Controls

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