

PA05 – PROGRAMMABLE ACTUATOR USER MANUAL



Table of Contents

1.0 INTRODUCTION	
1.1 Safety Concerns	3
1.2 PA05 Overview	3
1.3 General Instructions	4
2.0 TECHNICAL SPECIFICATIONS	
2.1 Dimensions	5
2.2 Performance	6
2.3 Operational Limits	6
3.0 INSTALLATION	
3.1 Mounting Methods	8
3.2 Alignment	9
3.3 Backdriving	10
3.4 Motor Wiring	10
4.0 LIMIT SENSORS	
4.1 Sensor Installation	10
4.2 Sensor Wiring and Placement	11
5.0 OPTIONAL EQUIPMENT	
5.1 IP65 Option	11
5.2 Linear Position Sensor(LPS).....	12
6.0 PREVENTIVE MAINTENANCE	
6.1 Actuator Tube	12
6.2 Lubrication of Lifting Shaft	12
6.3 Checking Axial Lash	13
7.0 TROUBLESHOOTING	14
8.0 WARRANTY	17
9.0 APPENDIX	18

1.0 INTRODUCTION

1.1 Safety Concerns

This manual is provided to help ensure you have a safe and successful installation of your PA05 Programmable Actuator. Please heed the **Warning** and **Caution** notes throughout this manual intended to help prevent injury and/or damage to the actuator.

WARNING

The PA05 Actuators are not designed for the support of human cargo.

CAUTION

The PA05 Actuators may be self-lowering and therefore the customer must provide some means of holding the load when stationary.

CAUTION

The PA05 Actuators should not be run at speed into the internal travel stops. The rubber stops can absorb small impacts, but higher speed collisions will cause internal damage to the actuators. The same is true for externally caused impacts such as running the machine load into a hard stop.

CAUTION

Do not exceed the unit's maximum capacity. Significantly reduced life, and/or damage to the unit will result.

1.2 PA05 Overview

- Maximum load capacity = 1000 lbs. for all screw types except 0631-1000 SRT = 620 lbs.
- Rated for continuous duty (ball screw with servo motor only).
- Operates at speeds up to 25 inches per second.
- Available in Parallel and Inline motor mounting configurations.
- Standard stroke lengths: 4, 6, 8, 10, 12, 18 and 24 inches (custom lengths available).
- Both ball screw and acme screw drives available.
- Roller bearing Anti-rotation device integrated (vs. sliding type).
- Ball screws are used on high-speed applications.
- Acme screw actuators designed for lower duty cycles where self-locking is desired.
- Units with stepper motors and/or acme screws should be run at about 50% duty cycle.
- High mechanical efficiency.
- Repeatability up to +/- 0.001 inch. +/- 0.004 inch is standard.
- Synchronous (timing) belt drive (for parallel motor mounting).
- Standard motor and gear reducer flanges for simplified selection.
- Optional motors are available at customer selection when specified. Consult with Nook Engineering for more information.
- IP65 Option (motor upgrade required).
- Analog or Digital Linear Position Sensor Option for highly precise position control.

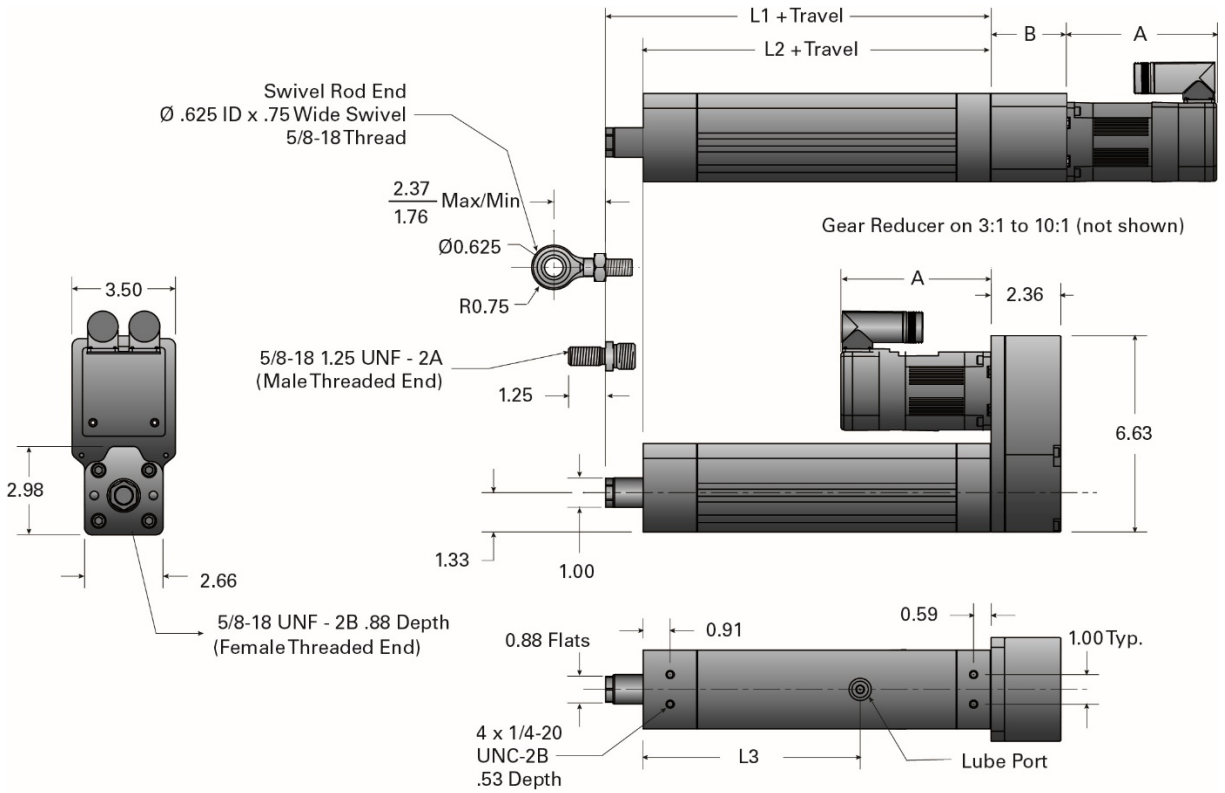
1.3 General Instructions

Your PA05 Programmable Actuator is a high quality, sturdy unit designed to give many hours of trouble-free service. However, certain precautions and procedures must be observed in handling, installing and servicing the unit in order to obtain optimum performance.

- 1.3.1** Any apparent or suspected damage sustained by equipment manufactured or furnished by Nook Industries during transport from the factory to the user should be immediately reported to both Nook Industries and to the carrier.
- 1.3.2** Upon delivery all equipment furnished should be carefully inventoried against shipping papers to determine whether any shortages exist in delivered material. Any such shortages must immediately be reported to Nook Industries and the carrier if a timely claim is to be made.
- 1.3.3** The installation of most power transmission equipment does not normally require the services of a factory engineer. These services are not included in the selling price of the equipment unless specifically agreed upon in writing between the seller and purchaser. In applications requiring a more complex arrangement of components, consideration should be given to the use of a factory engineer for construction supervision or checkout of the installation. These services are available from Nook Industries by contacting the Service Department.
- 1.3.4** The Seller's warranty applies insofar as the unit is operated within the rating and service conditions for which it was specifically sold. The purchaser must prevent the existence of any destructive external conditions which might typically include vibratory loads due to critical speeds, severe shock loading, mechanical or thermal overloads, or side loads if the seller was not fully advised of their existence at time of order.
- 1.3.5** Adequate installation, maintenance and safety instructions must be given by the user to personnel directly responsible for the installation and operation of the equipment.
- 1.3.6** In the event of malfunction within the warranty period, the manufacturer must be informed promptly or, in any event, within thirty days if it is intended that the warranty is to cover the incident.

2.0 TECHNICAL SPECIFICATONS

2.1 Dimensions



MOTOR	A (in)				B (in)	
	Without Reducer		With Reducer		Without Reducer	With Reducer
	No Brake	Brake	No Brake	Brake		
T23 STEPPER	3.03	n/a	5.49	n/a	2.36	2.61
T34 STEPPER	4.96	n/a	8.29	n/a	2.86	3.42
V200/400	5.42	6.96	8.09	9.62	2.44	2.61

NOTE: When using a linear position transducer, add 0.82 in to values L1, L2, and L3.

2.2 Performance

Ball Screw Models

Screw	PERFORMANCE SPECIFICATIONS						DIMENSIONS		
	Lead (in)	Lead Accuracy (in/ft)	Efficiency (%)	Nut Max Velocity* (in/min)	Max Capacity (lb)	Dynamic Load** (lb)	L1 (in)	L2 (in)	L3 (in)
0750-0200	0.200	0.004	>90	800	1,000	2,200	9.05	7.78	7.34
0750-0500	0.500	0.004	>90	2000	1,000	2,723	10.10	8.83	8.40
0631-1000	1.000	0.004	>90	3000	620	620	9.05	7.78	7.34

*As limited by DN Value

**Ball Screw L₁₀ life based on 1x10⁶ inches of travel life

Acme Screw Models

Screw	PERFORMANCE SPECIFICATIONS				DIMENSIONS		
	Lead (in)	Lead Accuracy (in/ft)	Efficiency (%)	Max Capacity (lb)	L1 (in)	L2 (in)	L3 (in)
3/4-6	0.166	0.0036	36	1,000	9.05	7.78	7.34
3/4-10	0.100	0.0036	25	1,000	9.05	7.78	7.34

*As limited by PV Value

2.3 Operational limits

There are several operational limits that must be observed when setting up and operating the PA05 Actuator, including the following:

2.3.1 Load Capacity

The maximum operational loads than can be moved with these units is 1000 pounds (4448 N) in direct tension or compression, with the exception of units with a 0631-1000 ball screw. These units have a max thrust of 620 pounds (2758 N). All anticipated loads should be well within the rated capacity of the actuator, which can include: static, dynamic and acceleration/deceleration loads. Severe shock loads can cause considerable damage to the unit and should be avoided.

2.3.2 Duty Cycle

In order to get the most life from the PA05, a duty cycle of 60% should not be exceeded if the unit has either an acme type screw or a stepper motor drive. Continuous operation is permitted if the unit is equipped with a ball screw and a servo motor, provided the motor is operated in the continuous output range.

2.3.3 Ambient Temperature Range

The operating temperature range for the standard PA05 Series is 0 – 104 degrees F (-18 – 40 degrees C)

2.3.4 Maximum Lift Shaft Speed (Critical Speed)

The general maximum lift shaft speeds are as follows:

Max Ball Screw RPM = 3000 Max Acme Screw RPM = 1400

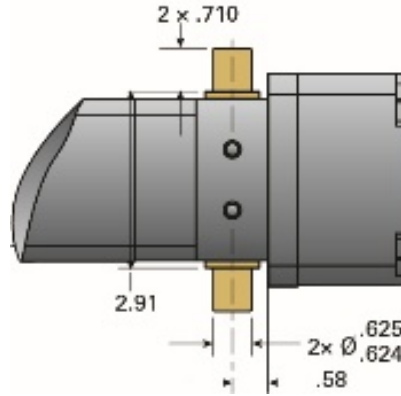
Use the following critical speed chart for better guidance as to how fast your particular unit can be safely operated. Nook recommends for the safest operation of the PA05 actuator, the operational lift shaft RPM not exceed the maximum listed values below. Please consult Nook Engineering for custom stroke lengths over 24 inches.

	MAX SCREW RPM		
	0631-1000 SRT RH (RPM)	0750-0200 SRT RH (RPM)	0750-0500 SRT RH (RPM)
UP TO AND INCLUDING 18" STROKE	3000	3000	3000
24" STROKE	2400	2850	2650
LIFT SHAFT TYPE	3/4-5 RH	3/4-6 RH	3/4-10 RH
UP TO AND INCLUDING 24" STROKE	1400	1400	1400

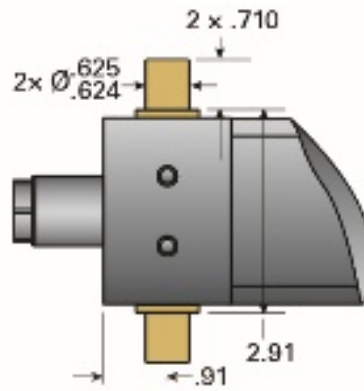
3.0 INSTALLATION

3.1 Mounting Methods

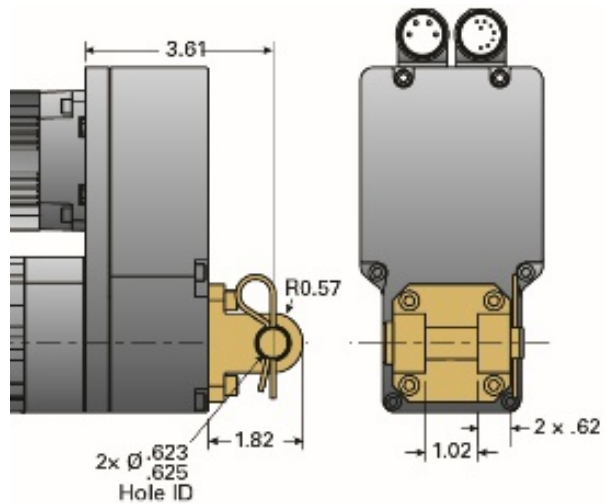
Rear Trunnion Mount



Front Trunnion Mount

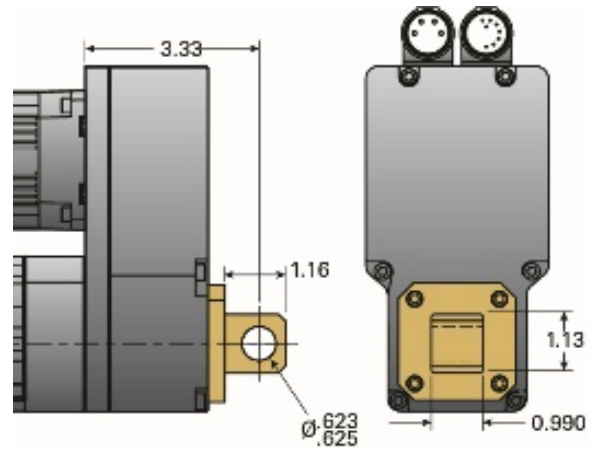


Rear Female Clevis Mount

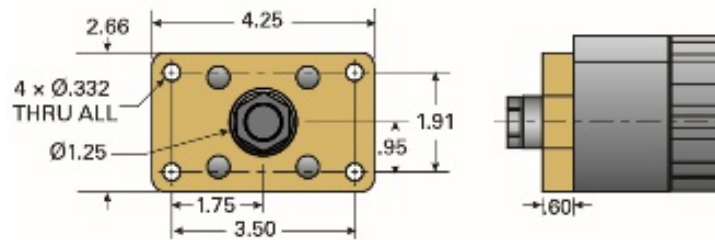


5/8" diameter clevis pin and re-usable cotter pin included.

Rear Male Clevis Mount



Front Flange Mount



Recommended for vertical/near vertical applications. Support must be provided for the motor end of actuators with stroke lengths over 12 inches for front flange mountings at or near horizontal.

3.2 Alignment

Proper alignment with the mounting of the actuator is of critical importance to both the function and longevity of the equipment. These units must be aligned so that the extension tube axis is no more than **0.010"** out of alignment with machine's load path at any point during its movement. For optimal performance and service life, the misalignment should be no more than .003" - .005" for strokes of 12 inches or less.

Caution:

Do not put any radial (side) loading on the actuator output rod or excessive wear and/or damage to the unit will result.

3.3 Backdriving

With the exception of the $\frac{3}{4}$ "-10 Acme screw, the PA actuators are not self-locking and therefore need to have some type of holding brake or device connected to prevent unintended movement of the load.

3.4 Motor Wiring

3.4.1 Allen-Bradley Servos

Four motor model choices are available with the PA05 units as follows:

MPL-A220T-EJ72AA 110/220 VAC drive input, Single-turn encoder, No Brake
MPL-A220T-EJ74AA 110/220 VAC drive input, Single-turn encoder, with Brake
MPL-B220T-EJ72AA 480 VAC 3-Ph drive input, Single-turn encoder, No Brake
MPL-B220T-EJ74AA 480 VAC 3-Ph drive input, Single-turn encoder, with Brake

Compatible drives and cables are as follows:

Drives: Kinetix 300/350, Kinetix 6200/6500, Kinetix 2000, 6000, 7000, Ultra3000
Cables: 2090-CPxM7DF-16AAxx Non-Flex Power Cable w/ Speedtec Connector
2090-CPxM7DF-16AFxx Flex Power Cable w/ Speedtec Connector
2090-CFBM7DF-CEAAxx Non-Flex Feedback Cable w/ Speedtec Connector
2090-CFBM7DF-CEAFxx Flex Feedback Cable w/ Speedtec Connector

The wiring instructions will come with the drive and should be followed carefully.

3.4.2 Moons Stepper Motors

See Appendix 9.1

3.4.3 Anaheim Automation Stepper

See Appendix 9.2

3.4.4 Applied Motion Steppers (IP65)

See Appendix 9.3

Please see www.nookindustries.com for the Load/Speed graphs for the motor/screw combinations.

4.0 LIMIT SENSORS

4.1 Sensor Installation

When ordered with the Limit Sensor Switch Option, the PA05 units come with two Turck BIM-UNT inductive switches (can be ordered either PNP or NPN). They can be mounted in either T-slot on either side of the actuator body extrusion. Detailed mounting and wiring instructions from the manufacturer are sent with the switches and should be carefully followed to ensure proper operation and that no damage is incurred.

4.2 Sensor Placement

The activation distance (switch to magnet) can vary, so some experimenting must be done to find the proper position along the T-slot in order to have the switches activate at the right time. The goal for these switches is to keep the travel nut from crashing into the internal stops and jamming or permanently damaging the actuator or the machine load.

Caution: A high load and/or a fast moving load takes longer to stop, and therefore the switch must be placed farther inward from the ends in order to allow sufficient time to stop the movement.

Caution: If the switches are placed closer together than 2.0 inches, both switches could be activated simultaneously.

5.0 OPTIONAL EQUIPMENT

5.1 IP65 Option

The IP65 option includes an IP65 (or higher) rated motor, a bellows type protective boot for the extension tube and an adapter with tube fitting for a ¼" size air line (customer supplied). Applying 2 – 3 psi of positive pressure to the unit helps keep the contaminants on the outside when it is being used in a very dusty or wet environment. Operating the PA05 in ambient temperatures of 40° Fahrenheit (4° Celsius) or below, the use of positive airflow to eliminate internal condensation is strongly recommended.

Caution: The air supply must be clean and dry or contamination damage to the internal components will result. This type of damage will not be covered under the warranty.

5.1.1 Air Line Fitting Installation

- Remove the Lubrication Port Plug from the bottom of the actuator (Fig. 1)
- Install the ¼" barbed hose fitting in to the female ¼" NPT hole on the 9/16-18 to ¼ NPT adapter. Tighten securely.
- Install the 9/16-18 male threaded end with the o-ring on the adapter into the lube port hole.

Caution:

Do not over-tighten the adapter or damage will result.



Figure 1

Figure 2

5.2 Linear Position Sensor (LPS)

The Linear Positioning Sensor option adds a non-contact, Magneto-Restrictive linear sensor from MTS Sensors. Both Analog (0 – 10 VDC) and Digital (Pulse/Start-Stop) outputs are available. A detailed technical specification is supplied with the units, which is too extensive to reprint in this guide. A digital copy (.pdf) can be obtained by calling Nook Customer Service. A brief technical page is available in the PA05 section online as well.

Caution: PA05 units equipped with the linear positions sensor cannot be used in a damp environment or where condensation can accumulate inside the unit. The electrical connections will corrode and eventually fail, which will likely cause irreparable damage.

6.0 PREVENTIVE MAINTENANCE

6.1 Actuator Tube

The actuator extension tube must be kept as clean and dry as possible, given the operating conditions. Do not use abrasive or chemical cleaners as damage to the tube surface and/or the wiper/seal may result. A non-abrasive dish soap and a clean rag or soft bristled brush is recommended. Make sure the cleaned surfaces are dried thoroughly.

NOTE: The protective boot for the extension tube (thrust rod), which can be ordered as an option (comes with the IP65 option) does not repel liquids or fine dust particles. It is designed to keep the gross particulate matter off of the extension tube.

6.2 Lubrication of the Lifting Shaft

The PA05 units come lubricated with Mobil 28 high performance synthetic grease from the factory. It is strongly recommended that only the Mobil 28 grease be used for re-lubrication. The point at which the lift shaft (ball or acme screw) will need to be re-lubricated will depend on the following factors: screw type, loading, operating speed, duty cycle and ambient environment. This unfortunately is too many variables to give an accurate time or travel distance before re-lubrication is necessary. Here are some basic guidelines:

- Ball screws with rolling elements require less grease than Acme (lead) type screws.
- Higher loads (over 50% of the unit's capacity) need more frequent lubrication.
- Typically, slow speeds, especially when coupled with higher load situations are very demanding on the grease and rotating components.
- The higher the duty cycle (time running vs. time resting), the more frequent the re-lubrication intervals should be. Duty cycles over 50% should be treated like a high load situation.
- Using the PA05 in a moderate application in a fairly clean environment, the unit should be able to run for 1 million inches of travel before any re-lubrication is needed.

- 6.2.1 Remove the Lube Port Plug as shown in figure 1.
- 6.2.2 Extend the actuator rod until the lift nut has passed the port and the screw is visible.
- 6.2.3 Using a small grease gun, apply the grease directly on the lift shaft.
- 6.2.4 Remove the gun tip from the port and slowly retract the actuator tube all the way.
- 6.2.5 Repeat step 6.2.3 and 4 two more times.
- 6.2.6 Replace the lube port plug.

Caution:

Do not over-tighten the plug.

If the actuator is being used in a very dirty environment or the grease in the unit is visibly contaminated, the unit should be disassembled, cleaned and re-lubricated. This can be a complicated procedure and should not be attempted without first consulting with a technical representative at Nook Industries. Parallel drive models will need to be sent back to the factory for service due to the special tools required to reinstall the belt drive.

6.3 Checking Axial Lash (Acme screw units)

Due to the sliding, metal-on-metal nature of an acme screw/nut interface, it is expected that metal is going to be worn away, especially under heavy loads. This wearing creates additional backlash, and the screw assembly will eventually become unusable. The recommended amount of allowable backlash is 25% of the screw pitch (lead) and is measured as follows:

- 6.3.1 Make sure the nut is in an area on the screw that has the most inches of travel and the unit is securely mounted or clamped down to prevent movement.
- 6.3.2 Disconnect the actuator thrust tube from the machine (this step can be skipped if the actuator rod is solidly mounted to the machine or it is not being checked in place).
- 6.3.3 Apply pressure to the end of the actuator rod to make sure the rod is fully retracted. Using a measuring device that can measure in thousandths of an inch (0.001), measure from a solid point on the actuator body, such as the front bearing housing face, to the end of the actuator rod end. Zero the measuring device.
- 6.3.4 Pull the actuator rod out (extend) until all of the axial play has been taken up. If using calipers, re-measure the rod length the same way as in the previous step, or observe the reading on the dial indicator. This measurement is the axial lash.
- 6.3.5 Only 2 different acme screws are used in the PA05 units: $\frac{3}{4}$ "-6 and $\frac{3}{4}$ "-10. 25% of the 6 pitch screw is 0.042 inches. 25% of the 10 pitch is 0.025 inches. If the measurement from step 6.3.4 is more than these values, the screw and nut should be replaced. This repair must be done by a Nook factory technician.

7.0 TROUBLESHOOTING

The following chart is being provided to aid with general troubleshooting of an actuator system, and is by no means a complete list of problems/solutions that are possible. The vast majority of problems with these units are likely to be experienced during the initial start up. The majority of these initial issues are typically related to motor wiring and drive set up. A simple math error can end up causing the actuator to crash and cause major damage to both it and the machine. Therefore, our top recommendations are to have an experienced motion control specialist install and set up these actuators and to always carefully read and follow all instructions provided.

Problem / Symptom	Possible Cause	Suggested Solution
Unit doesn't run when commanded	Bad cable or wiring connection(s)	Remove power and check/repair all plug and wire connections.
	Incorrect wire connection(s) to the drive and/or power supply	Verify proper wiring connections per the drive/power supply wiring diagrams.
	Unit has been run too hard into an end-stop and has become jammed	Depending on how hard and/or fast the unit was run into the stop, the lift shaft can sometimes be turned manually to unjam the unit. Call Nook Customer Service for detailed instructions for this repair. If the collision was hard and/or at high speed, the unit is likely damaged and will need to be returned to Nook for repair.
	Incorrect drive and/ or control settings	Verify proper settings per the drive/controller setup instructions.
	Incorrect or incompatible motor drive	Verify compatibility of motor and drive with the manufacturer(s).
	Drive has encountered an error and has faulted out	Consult drive manual and follow the troubleshooting steps to remove the issue.
	Incorrect limit sensor placement, wiring or settings	Verify that the sensor placement is not inhibiting the drive. The 2 switches must also be at least 2 inches apart or they could both be activated simultaneously. Verify that the switch wiring is correct and the drive/controller settings are appropriate for the type of inductive switch being used (NPN / PNP).
	Internal component or motor failure due to being operated outside the allowable ambient temperature range	The ambient operating temperature must be between 0 - 104 degrees Fahrenheit.

Problem / Symptom	Possible Cause	Suggested Solution
The motor runs or tries to run but the actuator doesn't operate	Incorrect drive settings for applied load	Recalculate the torque required to properly move the load and readjust the drive settings.
	Too high of load applied for the configured motor - screw combination being used	Reduce the load to be within the unit's capacity (per the Load/Speed graph).
	A pulley (Parallel drive) or the coupler (Inline) has loosened and is slipping on the shaft	Call Nook Customer Service for detailed instructions for this repair.
	Excessive side load on the actuator rod	Remove all side forces from the actuator rod. The axis of the actuator rod must remain in line with the movement of the load at all times.
	Inadequate or contaminated lubrication	Inspect and replenish the grease on the lift shaft. (section 6.2)
Excessive vibration and/or rough operation	Misaligned or improper mounting	Check for loose or improperly sized mounting fasteners. Tighten/replace fasteners appropriately. The axis of the actuator rod must remain in line within 0.010" of the load movement for the entire stroke.
	Incorrect stepper drive resolution (too low) or improperly tuned servo motor	Increase the Steps per Revolution setting (stepper). Run or rerun the servo Auto-tuning.
	Incorrect or incompatible motor drive	Verify compatibility of motor and drive with the manufacturer(s).
	Load or critical speed maximums exceeded	Decrease load/motor speed to below 80% of rating (recommended).
	Excessive side load on the actuator rod	Remove all side forces from the actuator rod. The axis of the actuator rod must remain in line with the movement of the load at all times.
	A pulley (Parallel drive) or the coupler (Inline) has loosened and is slipping on the shaft	Call Nook Customer Service for detailed instructions for this repair.
	Inadequate or contaminated lubrication	Inspect and replenish the grease on the lift shaft. (section 6.2)
	Machine load is binding/sticking inducing vibration or rough motion in to the actuator	Disconnect the actuator rod from the load and verify smooth movement of the load. Check the actuator rod alignment with the load movement (if not done in an earlier troubleshooting step).

Problem / Symptom	Possible Cause	Suggested Solution
Actuator is not reaching desired speed / position	Motor RPM not calculated correctly	Verify that the screw lead and time units being used for the calculation are correct.
	Insufficient time to reach commanded speed	Reduce speed and/or increase time / acceleration. CAUTION: Do not set the accel/decel too high for the system inertia.
	The load inertia is greater than 10X than the motor inertia (Inertia Mismatch)	Reduce the load and/or the load's resistance to change. Adjust the drive gain settings. Remove some flexibility (compliance) from the machine load path.
	Load or critical speed maximums exceeded	Decrease load/motor speed to below 80% of rating (recommended).
	Incorrect position commanded	Verify proper number of motor turns needed to reach the desired location or verify proper switch location.
	Unit is binding due to improper alignment / excessive side loading	Remove all side forces from the actuator rod. The axis of the actuator rod must remain in line within 0.010" of the load movement for the entire stroke.
	Inadequate or contaminated lubrication	Inspect and replenish the grease on the lift shaft. (section 6.2)
	A pulley (Parallel drive) or the coupler (Inline) has loosened and is slipping on the shaft	Call Nook Customer Service for detailed instructions for this repair.
	Unit is being operated outside the published temperature range	The ambient operating temperature must be between 0 - 104 degrees Fahrenheit.
	Ball screw is being back driven by the load	Reduce the load to be within the unit's holding capacity (per the motor/brake specifications). If the load is within the motor capacity, check and increase the drive output (up to maximum).
Motor is overheating	Too high of load applied for the configured motor - screw combination being used	Reduce the load to be within the unit's capacity (per the Load/Speed graph).
	Too high of a duty cycle for the configured motor - screw combination being used	Increase the dwell (resting) time to reduce the duty cycle. Provide some air flow across the motor if possible.
	Incorrect drive settings for applied load	Recalculate the torque required to properly move the load and readjust the drive settings. Reduce drive current output (stepper) / gain setting (servo).
	Bad cable or wiring connection(s)	Remove power and check/repair all plug and wire connections.
	Unit is being operated outside the published temperature range	The ambient operating temperature must be between 0 - 104 degrees Fahrenheit.
	Unit is binding due to improper alignment / excessive side loading	Remove all side forces from the actuator rod. The axis of the actuator rod must remain in line within 0.010" of the load movement for the entire stroke.
	Inadequate or contaminated lubrication	Inspect and replenish the grease on the lift shaft. (section 6.2)

8.0 WARRANTY

8.1 STATEMENT OF ASSURANCE

Thank you for purchasing another quality product from Nook Industries, Inc. Every effort has been taken to assure this product was manufactured to the highest industry standards of quality, precision and performance.

8.2 WARRANTY

Unless otherwise stated herein, Seller will repair or replace, without charge, f.o.b. point of shipment, any parts proven to Seller's satisfaction and upon Seller's examination to have been defective in material or workmanship when furnished, provided claim is made within one year after date of shipment. Deterioration or wear occasioned by abuse, severe eccentric loading, overloading, chemical or abrasive action or excessive heat shall not constitute defects. Equipment and accessories not of the Seller's manufacture are warranted only to the extent that they are warranted by the manufacturers, and this warranty is applicable only if the defect was the result of normal use, application and service, and is void if the product or any part hereof was tampered with, repaired or altered by any person other than the factory or authorized repair station. THERE ARE NO OTHER WARRANTIES, EXPRESS, STATUTORY, OR IMPLIED, INCLUDING THAT OF MERCHANTABILITY AND OF FITNESS.

Authorization for return must be received from Nook Industries before returning any equipment for inspection or warranty repair.

8.3 WARNING

The equipment shown in this bulletin is intended for industrial use only and should not be used to lift, support, or otherwise transport human cargo, unless you have a written statement from Nook Industries, Inc. that the Jac unit as used in your application is suitable for lifting human cargo.

9.0 APPENDIX

9.1 Moons Stepper Motor Wiring and Torque/Speed Curves

Wiring Diagram



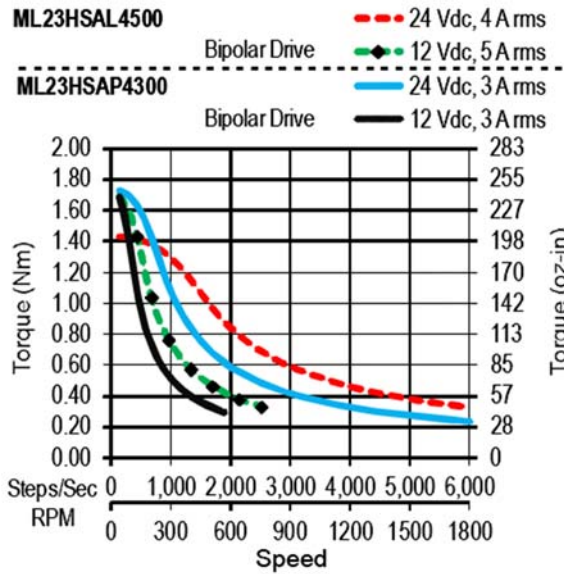
励磁顺序 vs. 旋转方向

Exciting Sequence vs. Direction of Rotation

STEP	A	B	C	D	
1	+	+	-	-	ccw
2	-	+	+	-	
3	-	-	+	+	
4	+	-	-	+	

从安装面看为顺时针方向

Clockwise view from mounting side



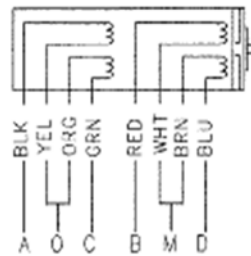
Nema 23 Stepper (ML23HSAL4500)

接线图 Wiring Diagram

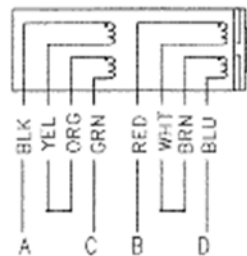


接线顺序图 Connection Diagram

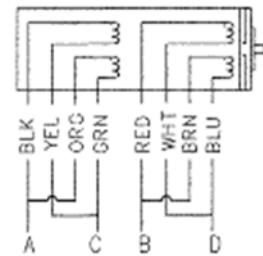
单极性 Uni-polar



双极性串联 Bi-polar series



双极性并联 Bi-polar parallel



励磁顺序 vs. 旋转方向 Exciting Sequence vs. Direction of Rotation

单极性整步

Uni-polar full step

STEP	A	B	C	D	O	M	
1	-	-			+	+	ccw
2		-	-		+	+	
3			-	-	+	+	
4	-			-	+	+	

从安装面看为顺时针方向

Clockwise view from mounting side

双极性整步

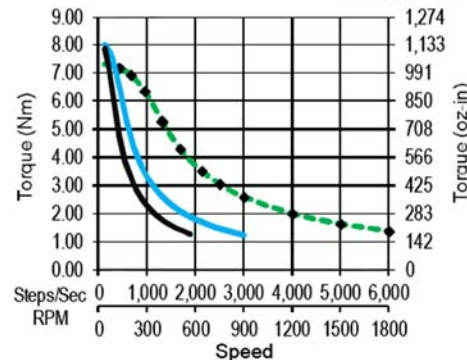
Bi-polar full step

STEP	A	B	C	D	
1	+	+	-	-	ccw
2	-	+	+	-	
3	-	-	+	+	
4	+	-	-	+	



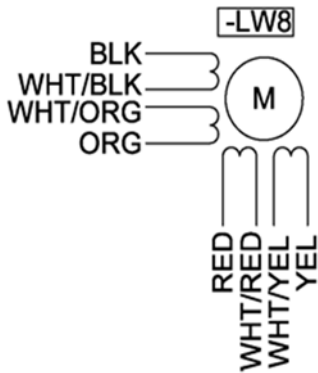
ML34HD2L4350 & ML34HD2L8350 Bipolar Drive

160 Vdc, 3 Arms; 72 Vdc, 3.5 Arms; 48 Vdc, 3.5 Arms



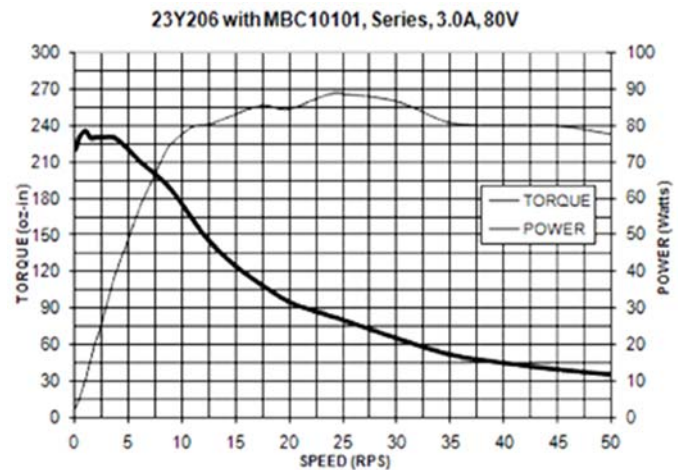
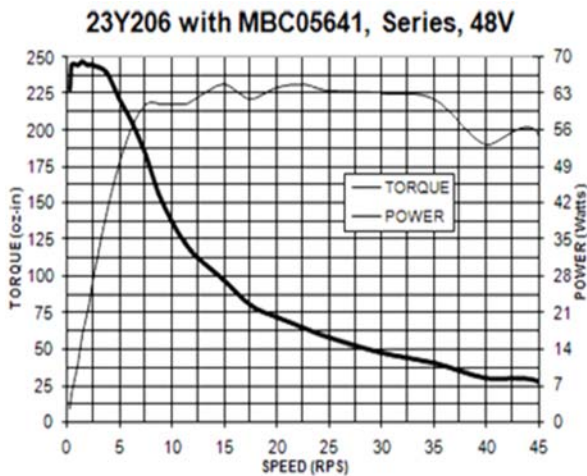
Nema 34 Stepper (ML34HD2L8350)

9.2 Anaheim Automation Stepper Motor Wiring and Torque/Speed Curves

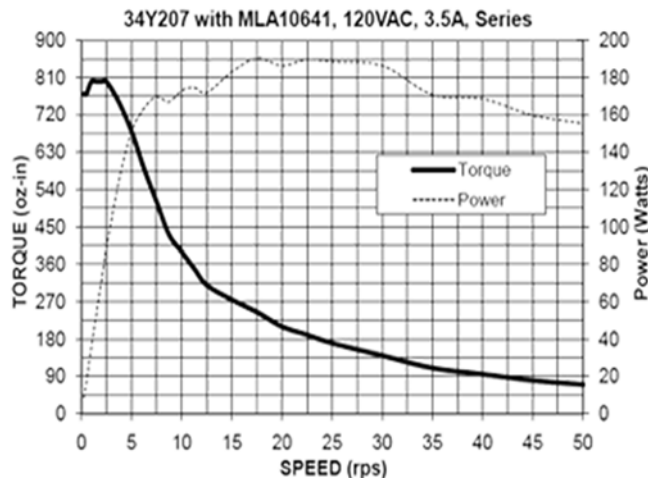


Connection	Lead Wire Connection	Lead Wire Color
4 - Lead Bipolar Series MBC Series	Phase 1 (A)	Black
	Phase 3 (A)	Orange
	Phase 2 (B)	Red
	Phase 4 (B)	Yellow
	Connect Wires with Wire Nut	White/Black & White/Orange
	Connect Wires with Wire Nut	White/Red & White/Yellow
4 - Lead Bipolar Parallel MBC Series	Phase 1 (A)	Black & White/Orange
	Phase 3 (A)	Orange & White/Black
	Phase 2 (B)	Red & White/Yellow
	Phase 4 (B)	Yellow & White/Red
6 - Lead Unipolar BLD, TM Series	Phase 1	Black
	Phase 3	Orange
	Phase 2	Red
	Phase 4	Yellow
	Common Phase 1 & 3	White/Black & White/Orange
	Common Phase 2 & 4	White/Red & White/Yellow

NOTE: Wiring applies to both the Nema 23 and Nema 34 sizes.

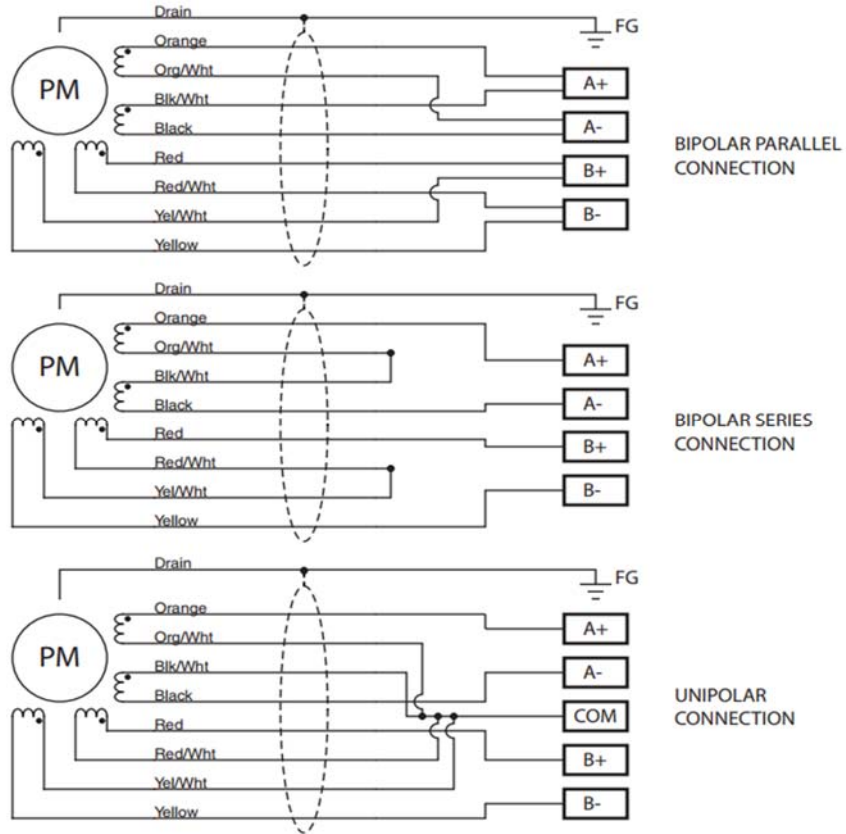


Nema 23 Stepper w/Brake (23Y210D-LW8-12AE)



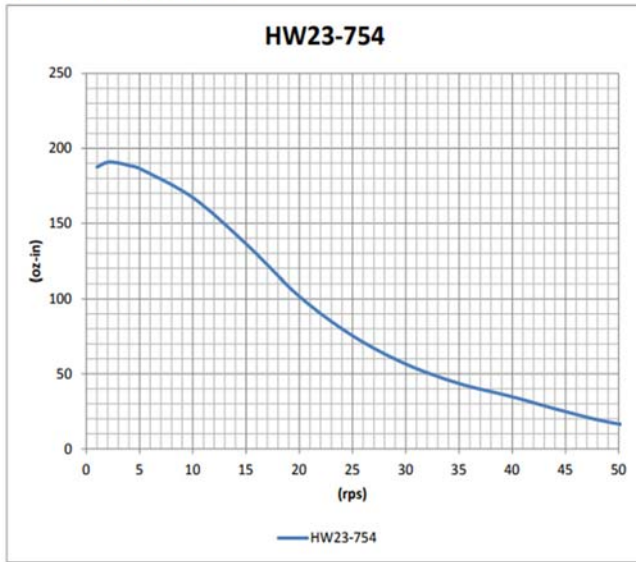
Nema 34 Stepper w/Brake (34Y214D-LW8-18CE)

9.3 Applied Motion Products Stepper Motor Wiring and Torque/Speed Curves



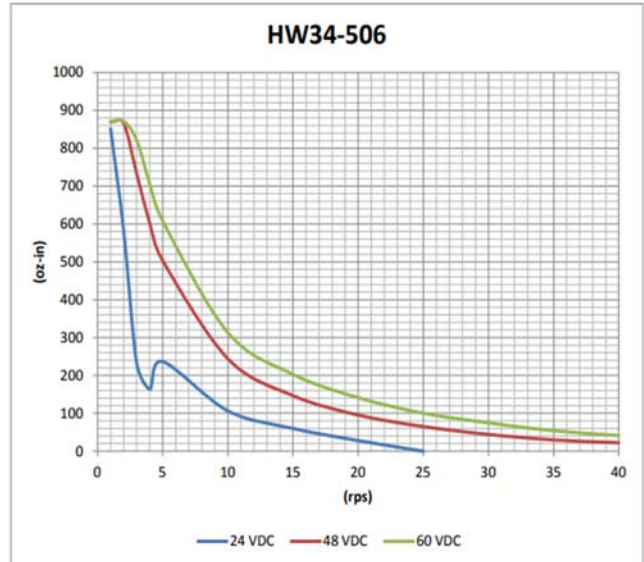
NOTE: Wiring applies to both the Nema 23 and Nema 34 sizes.

Speed vs. Torque Curves



Recommended drives: STAC5 or STAC6 Series

Speed vs. Torque Curves



Recommended drives: STR8, ST10