## APBCLinear

# ML Series Miniature Linear Actuators 

Linear Motion Solutions


## ML Series Overview

## Rail/Housing

SIMO® process ensures precision mounting, accurate installation and lightweight composition. Ceramic Coated Body for corrosion resistance and long life.


## Nut

- Brass Inserts for system mounting and integrity.
- Built-in magnet accommodates home, limit and position sensors.
- Anti-Backlash Nut (Optional) for applications which require high bi-directional accuracy and repeatability.


## Motor

Stepper motors available in standard NEMA 11, 14, 17, 23, metric frame sizes or add your own.
Servo motors available in 40 and 60 mm motors.

## "Dovetail" Style Carriage

PTFE polymer material has fourteen plain bearing surfaces providing low friction for smooth and quiet linear motion. Notched "dovetail" carriage provides easier alignment and assembly. Features extra mounting holes for ease of installation and multi-axis assemblies.
 high stiffness and allows for increased thrust loads, rotational speed and repeatability.

## Internal Coupling

Rigid polymer insert coupling for increased smoothness and minimal backlash.

Seal Strip
Ultra-wear-resistant MDS nylon prevents particulates or contaminants from entering or exiting actuator.

## Motor Mount Adapter (MLC)

Adapter plate designed to fit any manufacturer's motor. Compensates for variations in pilot diameter, depth, shaft diameter, length and mounting screw patterns.

## ML Series Linear Actuators

## ML Advantage

- Small, Compact Profile-28 x 32 mm
- Patent Pending SIMO ${ }^{\circledR}$ Process

Ensures precision mounting, accurate installation and lightweight composition.

- Lead Screw Driven - High accuracy and precise repeatability
- Multi-Axis Configurations
- Long Travel Lengths - Up to 650 mm

MLC Series
Motor Mount Only

Specially designed motor mounts and couplings for easy mounting and extended life.


MLB Series
Motor Driven

Pre-mounted stepper or servo motors.

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Seal Strip

## Sensors



## Stepper and Servo Motors




Machine tools are built on precision machined castings or weldments. Why shouldn't your actuator be built the same?

PBC Linear has revolutionized traditional machining with the patent pending $\mathrm{SIMO}^{\text {TM }}$ (Simultaneous Integral Milling Operation).

SIMO process uses synchronized cutters, eliminating built-in extrusion variances by machining all critical edges concurrently in one pass. This ensures tight tolerances, limited variance and a remarkably straight and repeatable surface at negligible additional cost!



## Typical Aluminum Extrusion Issues

The typical aluminum extrusion process produces a natural bow, twist and variance. Costly straightening and aligning is traditionally used to combat this variance, resulting in a semi-straight aluminum extrusion that drives the cost up.


As tolerances get tighter, the cost of machining with conventional processes increases dramatically over the SIMO process.

- Patent Pending Machining Process
- High Precision Mounting Surfaces
- Tight Tolerances $\pm 0.025 \mathrm{~mm}$ ( 0.001 in )


## ML Advantage

Using the machine tooled precision and rigid surfaces sustained by the SIMO $^{\text {TM }}$ process, the ML's bridge gantry design can support 1 or 2 linear guides on the sides of the ML.


Bridge Gantry Design


4X Reference Qualified Edge


These supports work together to increase load capacities and sustain stability while utilizing recirculating caged-ball technology to provide smooth and quiet linear motion guidance.

## Technical Data

| ML SERIES - Carriage only |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Size |  | mm | $28 \times 32$ | in | $1.10 \times 1.26$ |
| MAX Load <br> - Lite Preload - anti-backlash <br> - Standard | Fx | N | $\begin{gathered} 44 \\ 267 \end{gathered}$ | lbf | $\begin{aligned} & 10 \\ & 60 \end{aligned}$ |
|  | Fy |  | 107 |  | 24 |
|  | Fz |  | 178 |  | 40 |
| MAX Moments | Mx | Nm | 1.4 | Ibf-in | 12.4 |
|  | My |  | 1.4 |  | 12.4 |
|  | Mz |  | 1.4 |  | 12.4 |
| Bending Moment of Inertia (second moment of area) | ly | cm4 | 2.4 | in ${ }^{4}$ | 0.058 |
|  | Iz |  | 4.4 |  | 0.106 |
| See page 24 for technical data on linear guide supports |  |  |  |  |  |
| Base Weight without Motor |  | Kg | 0.060 | Ibf | 0.130 |
| Add for $\mathbf{1 0 0 ~ m m ~ o f ~ s t r o k e ~}$ |  |  | 0.150 |  | 0.340 |
| Total Carriage Mass |  |  | 0.020 |  | 0.044 |
| Total Carriage Mass \& Top Plate |  |  | 0.059 |  | 0.130 |
| Coefficient of Friction |  | 0.19 |  |  |  |
| MAX Speed |  | $\mathrm{m} / \mathrm{s}$ | 1 | in/s | 75 |
| MAX Stroke Length |  | mm | 650 | in | 25.6 |
| MIN Stroke Length |  |  | 5 |  | 0.200 |
| Nominal Screw Diameter |  |  | 10.0 |  | 0.375 |
| Max RPM |  | 3000 |  |  |  |
| No Load Torque <br> Nut - Lite Preload - anti-backlash <br> - Normal Preload - anti-backlash <br> - Standard |  | Nm | $\begin{aligned} & 0.0565 \\ & 0.1060 \\ & 0.0070 \end{aligned}$ | Ibf-in | $\begin{aligned} & 0.500 \\ & 0.940 \\ & 0.062 \end{aligned}$ |
| Linear Guide Supports - Single Linear Guide <br> - Dual Linear Guides |  | Nm | $\begin{aligned} & 0.017 \\ & 0.034 \end{aligned}$ | lbf-in | $\begin{aligned} & 0.15 \\ & 0.30 \end{aligned}$ |
| Seal Strip <br> - with Seal Strip <br> - without Seal Strip |  | Nm | $\begin{gathered} 0.028 \\ 0 \end{gathered}$ | lbf-in | $\begin{gathered} 0.25 \\ 0 \end{gathered}$ |
| Screw Lead Accuracy* |  | $\begin{gathered} \mathrm{mm} / \\ \mathrm{mm} \end{gathered}$ | 0.0006 | in/in | 0.0006 |
| Normal Operating Temperature (Wider ranges available) | MIN | ${ }^{\circ} \mathrm{C}$ | 18 | ${ }^{\circ} \mathrm{F}$ | 32 |
|  | MAX |  | 98 |  | 176 |

*Higher accuracies are available to $0.0001 \mathrm{~mm} / \mathrm{mm}$ (in/in). Contact manufacturer for details.
Specifications are subject to change without notice.


## Dimensional Data



RECOMMENDED OVERTRAVEL PER SIDE
Knob or Hand Crank $=5 \mathrm{~mm}$
Stepper Motor $=10 \mathrm{~mm}$
Servo Motor $=20 \mathrm{~mm}$

## How to Calculate Body Length

1) Enter 19 mm
2) Select ( 5,10 or 20 mm ) for overtravel on idle end (See recommended overtravel above.)
3) Specify stroke length in mm
4) Select ( 51 or 71 mm ) for carriage length
5) Select (5, 10 or 20 mm ) for overtravel on idle end (See recommended overtravel above.)
6) Add amounts together and enter SUBTOTAL
7) Enter TOTAL BODY LENGTH (Round to nearest 10 mm )
8) When ORDERING enter TOTAL BODY LENGTH in BODY LENGTH column.

| BODY LENGTH CALCULATION TABLE |  |  |  |  | Example |
| :---: | :---: | :---: | :---: | :---: | :---: |
| IDLE END CAP = 19mm |  |  |  | 19 | 19 |
| OVERTRAVEL IDLE END (5, 10 or $\mathbf{2 0 m m}$ ) |  |  |  |  | 10 |
| STROKE LENGTH |  |  |  |  | 155 |
| CARRIAGE LENGTH ( 51 or 71mm) |  |  |  |  | 71 |
| OVERTRAVEL DRIVE END (5, 10 or $\mathbf{2 0 m m}$ ) |  |  |  |  | 10 |
| (Add Amounts 1-5) + ENTER SUBTOTAL (mm) = |  |  |  |  | 265 |
| TOTAL BODY LENGTH <br> (Round Subtotal to nearest 10 mm ) |  |  |  |  | 270 |
| (8) |  |  |  |  |  |
|  | x | x | -0270- | x | x |
|  | $\frac{\text { Seal Strip }}{\substack{0 \\ 1 \text { Wrine Seal strip }}}$ | \# of Carriages  <br> 1 1 Cariage <br> 2 2Caraiages <br> 3 3 Carriages <br> 4 4 Carriages | Body Length <br> mm <br>  | $\overline{\overline{\text { Motor Location }}}$ S Straight (in-Iine) R Right B Bottom T Top | $\begin{array}{\|l\|} \hline \text { Configuration } \\ \hline 0 \text { Standard } \\ \hline \end{array}$ |

## Performance Data

The load rating and system speed must both be accounted for when sizing a lead screw system. The nut threads and screw threads form a plane bearing system.

The PV limit of a polymer material is the point at which friction-generated heat can no longer be expelled at a rate to prevent the material from overheating. Such overheating while under stress can cause permanent deformation of the material. Ignoring how the system's speed and loading relate to the nut material's PV rating can lead to dramatically shorter thread life. The primary modes of failure for lead screw systems are wear and PV. By staying within the PV envelope of the screw and nut, one can ensure long life of the nut without premature wear.

| Torque to Raise Load |
| :---: |
| $\mathbf{T L}_{\mathbf{L}}(\mathrm{Nm})=$ |
| $\frac{\text { Load }(\mathrm{N}) \times \text { Lead (mm) }}{2 \pi \times \text { Efficiency } \times 1000}$ |
| $\mathbf{T L}$ (in-lbf) $=$ |
| $\frac{\text { Load (lbf) } \times \text { Lead (in) }}{2 \pi \times \text { Efficiency }}$ |




Distance Between Supports


## Maximum Cantilevered Length



Load on the Carriage N (Ibs.)
Maximum Travel Speeds


Body Length mm (in)
LEAD SCREW $\square 38 \mathrm{~mm}$ ( 1.50 ") $\square 10 \mathrm{~mm}$ (.400")
PITCH $\square 25 \mathrm{~mm}(1.00$ ") $\square 3 \mathrm{~mm}(.125$ ") $\square 1 \mathrm{~mm}(.039$ ")


80\% of Critical Speed


Body Length mm (in)

## Ordering Options



## Lead Screw



- Large 10 mm diameter lead screw reduces whip and increases column strength allowing longer stroke lengths
- Lead options*: 1, 2, 5, 10, 12, 16 and 25 mm . $3 \mathrm{~mm}\left(0.125^{\prime \prime}\right), 10 \mathrm{~mm}\left(0.400^{\prime \prime}\right), 25 \mathrm{~mm}\left(1^{\prime \prime}\right), 38\left(1.5^{\prime \prime}\right)$
*Contact manufacturer for other available sizes
- Nominal Lead Screw Diameter $=10 \mathrm{~mm}$ ( $0.375^{\prime \prime}$ )
- Screw Interia $=4.169 \times 10-6 \mathrm{~kg}^{-\mathrm{m}^{2} / \mathrm{m}}$
$1.5 \times 10-5$ oz.-in.sec. ${ }^{2} / \mathrm{in}$.)
- Lead Screw Length = Body Length + 32.27 mm


## ML Options Provide You with a Perfect Fit System

Nut Type

- Standard nut $\mathrm{F}_{\mathrm{x}}=262 \mathrm{~N}(60 \mathrm{lb})$ or anti-backlash nut $\mathrm{F}_{\mathrm{x}}=44 \mathrm{~N}$ ( 10 lb )
- Optional anti-backlash nut - ideal in applications requiring high bi-directional accuracy and repeatability
- Magnet is built-in for use with home and position sensors
- Anti-Backlash light pre-load Nut limits Fx linear thrust


Anti-Backlash Nut

## Seal Strip with Carriage Bracket

- Ultra wear-resistant molybdenum disulfide impregnated nylon
- Prevents debris from entering or exiting actuator
- Seal strip is 725 mm in length (Can be cut shorter using sharp pair of scissors.)



## ML Actuator Build, Mount, Use

## Build Your ML Actuator

## Step 1 <br> Configure Your System Axis <br> A. Determine if you need an external linear guide for support (p 10) <br> B. Calculate the body length (p 5)

Step 2
Choose the Drive Method
A. Motor pre-mounted and tested by PBC Linear? $\Rightarrow$ MLB ( $p$ 16)
B. Ready to mount your own motor? $\Rightarrow$ MLC ( p 12 )
C. Driven by hand? $\Rightarrow$ MLD ( $p 14$ )


## Step 3

## Choose How to Mount Axis

A. Choose dovetail clamps or riser plates (Use riser plates with NEMA 17 and 23 motors) (p 21)


## Step 4

Choose End of Travel and Home Limit Switches/Sensors
A. Determine mounting type/location (bracket type)

B. Choose from list of compatible sensors

## Repeat 1-5 for Each Axis

## Step 5

Order Your System
1-800-962-8979 or
1-815-389-5600
Questions?
Call an Application Engineer
1-888-777-0556

## Multi-Axis Mounting

ML actuators are designed to perform well in X Y and other Cartesian arrangements. The actuator body forms a strong beam with higher moment loading capacity.
Special dovetail slots on all sides allow the actuators to be mounted on their bottom surface or on either side.


Carriage brackets and special wedge mounting clamps allow for precise and rigid mounting arrangements. Linear guides can be installed on one or both sides of the actuator with one or two runner blocks on each rail for greater rigidity in gantry applications.

Multi-axis gantries can also be created by combining the ML with other actuators such as the PL or MT Series.


Superior Multi-Axis Mounting for Compact Applications

- Medical
- Biotech
- Instrument Automation
- Packaging
- Pick \& Place
- Semi-conductor
- Scanning



## ML Applications



The ML miniature actuator has a combination of compactness and ( 60 lbf ) 265 N pound thrust power gives this actuator an edge for automation applications where space is critical. Plus, the $\mathrm{SIMO}^{\circledR}$ machined rail surface and zero backlash lead screw assembly ensures accuracy and precision for syringe pumps and optical control applications.

## Linear Guide Supports

The ML series features the unique option for dual external linear guides (also available with single linear guide option). These re-circulating ball runner blocks assure high speed precision as well as enhanced load capacities and stability.


Support Options to Create Variable Levels of Performance


Note:

1. Moment arms for calculating moments should be measured from the center of the extrusion
2. Limit switches must be used in order to prevent the carriage from contacting the actuator end blocks, resulting in damage
3. Servo drive system, recommended overtravel of 20 mm
4. Stepper motors or manual hand cranks system, add 5 mm of over-travel

## Dimensional Data

## Single Linear Guide Supports



## Dual Linear Guide Supports



## MLC Series (Motor Mount Only)



- Includes motor mount with coupling
- Includes motor spacer (if required)
- Precision machined body
- Small, compact design
- Smooth and quiet operation
- High acceleration, speed and rigidity

PBC Linear stepper motors do not require a spacer due to the shorter shaft length. A spacer is required for any other manufacturer's motor. The spacer compensates for several dimensions which commonly vary amongst motor manufacturers (shaft diameter, shaft length, pilot diameter, pilot depth, bolt hole diameter, bolt type).

## MLC Ordering Guide

| MLC028D | X | XX | X | X | X |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Series | Linear Guide Supports* | Leads | Nut Type | Seal Strip | \# of Carriages |
| ML Series with motor mount $28 \times 32 \mathrm{~mm}$ | 0 No External Rail <br> 1 (1) Rail, (1) Runner Block - XY-2 Brkt (R) <br> 2 (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) <br> 3 (2) Rail, (1) Runner Block - XY-3 Brkt <br> 4 (2) Rail, (2) Runner Blocks - XY-3 Brkt <br> 5 (1) Rail, (1) Runner Block - XY-2 Brkt (L) <br> 6 (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) <br> 7 No Seal Strip - XY-1 Brkt | AH 1 mm <br> AG 2 mm <br> AX 5 mm <br> AJ 10 mm <br> BD 12 mm <br> AF 16 mm <br> AW 25 mm | 2 Standard Nut <br> 4 Anti-backlash (light preload) | 0 None <br> 1 With Seal Strip \& XY Bracket | 1 Carriage <br> 22 Carriages <br> 3 Carriages <br> 44 Carriages <br> NOTE: Contact manufacturer before ordering multiple carriages. |


| \#\#\#\# | X | X | X | X | X | 0 |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Body Length | Motor Location | Motor Frame Size | Shaft OD | Coupling Material | Spacer Config | Config. |
| mm <br> See page 11 for body length calculation table $\text { EX: } 90 \mathrm{~mm}=0090$ <br> $250 \mathrm{~mm}=0250$ | S Straight (in-line) <br> L Left <br> R Right <br> B Bottom <br> T Top | A NEMA 8 (20mm) <br> B NEMA 11 ( 28 mm ) <br> C NEMA 14 (35mm) <br> E Metric 40 <br> F NEMA 17 ( 42 mm ) <br> G NEMA 23 (56/58mm) | A 3mm <br> B 0.125 in <br> C 4 mm <br> D 0.1875 in <br> E 5 mm <br> F 6 mm <br> G 0.25 in <br> H 0.3125 in <br> J 8mm | 1 Acetal | A Standard | 0 Standard |
|  |  | At time of order, customer must declare their pilot diameter, shaft length and mounting hole pattern of the matching motor so that the proper spacer can be included. |  |  |  |  |



[^0]
## Motor Mount Assembly

$\square$ ML Series Actuator $\square$ Motor Mount \& Spacer $\square$ PBC Stepper Motor


Recommended for NEMA 17 Stepper Motor


Recommended for NEMA 23 Stepper Motor


## MLD Series (Hand Driven shaft or knob)



- Perfect for hand-operated
precision control
- Manual brake optional
- Textured knob for both positioning and braking
- Precision machined body
- Small, compact design
- Great repeatability

| MLD028D | - | X | XX | X | X | X |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| Series |  | Linear Guide Supports | Leads | Nut Type | Seal Strip | \# of Carriages |
| ML Series with knob/drive lead screw driven $28 \times 32 \mathrm{~mm}$ |  | 0 No External Rail <br> (1) Rail, (1) Runner Block - XY-2 Brkt (R) <br> (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) <br> (2) Rail, (1) Runner Block - XY-3 Brkt <br> (2) Rail, (2) Runner Blocks - XY-3 Brkt <br> (1) Rail, (1) Runner Block - XY-2 Brkt (L) <br> (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) <br> 7 No Seal Strip - XY-1 Brkt | AH 1 mm <br> AG 2 mm <br> AX 5 mm <br> AJ 10 mm <br> BD 12 mm <br> AF 16 mm <br> AW 25mm | 2 Standard Nut <br> 4 Anti-backlash (light preload) | 0 None <br> 1 With Seal Strip \& XY Bracket | 11 Carriage <br> 22 Carriages <br> 3 Carriages <br> 44 Carriages <br> NOTE: Contact manufacturer before ordering multiple carriages. |

* (L) $=$ Left ( R ) $=$ Right


NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1 mm increments up to 701 mm . Standard lengths are multiples of 10 mm . When possible round up to nearest multiple of 10 mm . Specifications are subject to change without notice.

## Dimensional Data



NOTE: Brake installed on side as default and can easily be changed to the top by the customer.


## MLB Series (Integrated Motor)



- Full stock of open and closed loop stepper motors and servo motors
- Available in NEMA 11,14,17, 23
- Precision machined body
- Small compact design
- High acceleration, speed, and rigidity
- Pre-engineered and assembled for easy installation


## MLB Ordering Guide



NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1 mm increments up to 701 mm . Standard lengths are multiples of 10 mm . When possible round up to nearest multiple of 10 mm . Longer lead times apply to non-standard lengths. NEMA 11 stepper motors typically do not have enough torque to drive the anti-backlash nuts. Customers are responsible for doing torque calculations to ensure the motor is properly sized. Specifications are subject to change without notice.

## Stepper Motor Options

PBC Linear brand stepper motors are designed to reduce length in the ML actuator. Single, double and triple stack motors are available in each size. See page 18 for dimensional data.


## Motor Locations

Using universal motor mounts, PBC Linear's ML series mini-actuators give our customers the freedom for limitless mounting options. Straight (in-line), top, bottom or side motor mounting allows the ML series to fit seamlessly into any specified application.


Wiring Harnesses Plug Connector included with all Stepper Motor Equipped MLB Series Actuators


NEMA 11 Series
4 Lead Part Number 6200727


NEMA 17 Series
4 Lead Part Number 6200490


Wiring Diagram



## NEMA 14 Series

4 Lead Part Number 6200728


NEMA 23 Series
4 Lead Part Number 6200491


## Stepper Motor



NEMA 11 (28mm)
NEMA 14 (35mm)


| NEMA <br> Rating | Motor Power | Current per Phase <br> A | Holding Torque |  | Detent Torque |  | Rotor Intertia |  | Length mm (in) | Weights kg ( lb ) | Model <br> P/N\# |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | $\mathrm{mN} \cdot \mathrm{m}$ | 0z-in | $\mathrm{mN} \cdot \mathrm{m}$ | 0z-in | $\mathrm{g}-\mathrm{cm}^{2}$ | 0z-in ${ }^{2}$ |  |  |  |
| NEMA 11 | Single | 1 | 50 | 7.08 | 5 | 0.71 | 9 | 0.05 | 31 (1.21) | 0.10 (0.22) | 6200297 |
| NEMA 11 | Double | 0.67 | 90 | 12.75 | 6 | 0.85 | 12 | 0.07 | 40 (1.56) | 0.15 (0.33) | 6200298 |
| NEMA 11 | Triple | 1 | 100 | 14.16 | 8 | 1.13 | 18 | 0.10 | 51 (2.01) | 0.20 (0.44) | 6200299 |
| NEMA 14 | Single | 0.40 | 60 | 8.5 | 10 | 1.42 | 12 | 0.07 | 26 (1.01) | 0.15 (0.33) | 6200300 |
| NEMA 14 | Triple | 0.85 | 100 | 14.16 | 15 | 2.12 | 20 | 0.11 | 37 (1.44) | 0.21 (0.46) | 6200302 |
| NEMA 17 | Single | 1.50 | 360 | 50.99 | 15 | 2.12 | 57 | 0.31 | 39.8 (1.57) | 0.28 (0.62) | 6200303 |
| NEMA 17 | Double | 1.50 | 490 | 69.41 | 25 | 3.54 | 82 | 0.45 | 48.3 (1.90) | 0.36 (0.79) | 6200304 |
| NEMA 17 | Triple | 1.50 | 630 | 89.24 | 30 | 4.25 | 123 | 0.68 | 62.8 (2.47) | 0.60 (1.32) | 6200305 |
| NEMA 23 | Single | 1.50 | 500 | 70.82 | 22 | 3.12 | 135 | 0.74 | 41 (1.61) | 0.42 (0.93) | 6200306 |
| NEMA 23 | Double | 1.50 | 1000 | 141.64 | 40 | 5.66 | 260 | 1.43 | 54 (2.13) | 0.60 (1.32) | 6200307 |
| NEMA 23 | Triple | 1.40 | 1650 | 233.71 | 70 | 9.91 | 460 | 2.53 | 76 (2.99) | 1.00 (2.20) | 6200308 |

NEMA 17 (42mm)
NEMA 23 (56mm)


## Motor Couplings

## Motor Coupling (HUB \& Disk)

- Compensates for motor and screw misalignment
- Electrically isolating
- Balanced design


FOR USE WITH NEMA 11, 14, 17 MOTORS

| HUBS P/N \# | Bore* | OD | $\begin{gathered} \text { HUB } \\ \text { Length (LH) } \end{gathered}$ | Coupling <br> Length (L) | Shaft Penetration | Set Screw | Moment of Inertia (lb-in^2) | Moment of Inertia ( $\mathrm{kg} \mathrm{x} \mathrm{m}^{\wedge}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| 6200129 | 3 mm | 12.7 mm | 5.6 mm | 15.9 mm | 5.6 mm | M3 | $0.0056^{\prime \prime}$ | 1.64E-06 |
| 6200286 | 5 mm | 12.7 mm | 5.6 mm | 15.9 mm | 5.6 mm | M3 | 0.0050 " | $1.47 \mathrm{E}-06$ |
| 6200350 | 6 mm | 12.7 mm | 5.6 mm | 15.9 mm | 5.6 mm | M3 | $0.0047{ }^{\prime \prime}$ | 1.37E-06 |
| 6200113 | 0.125" | $0.500^{\prime \prime}$ | $0.222^{\prime \prime}$ | $0.625^{\prime \prime}$ | $0.222^{\prime \prime}$ | M3 | $0.0056 "$ | 1.64E-06 |
| 6200349 | 0.250" | $0.500^{\prime \prime}$ | $0.222^{\prime \prime}$ | $0.625^{\prime \prime}$ | $0.222^{\prime \prime}$ | M3 | $0.0045^{\prime \prime}$ | $1.32 \mathrm{E}-06$ |


| For Use with NEMA 23 Motors Only |  |  |  |  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| HUBS P/N \# | Bore* | OD | $\begin{gathered} \text { HUB } \\ \text { Length }(\mathrm{LH}) \end{gathered}$ | Coupling Length (L) | Shaft Penetration | Set Screw | Moment of Inertia ( $\mathrm{lb}-\mathrm{in}^{\wedge} 2$ ) | Moment of Inertia ( $\mathrm{kg} \mathrm{x} \mathrm{m}^{\wedge}$ ) |
| 6200130 | 4 mm | 19.1 mm | 7.6 mm | 22.2 mm | 7.6 mm | M3 | 0.0069 | 2.02E-06 |
| 6200131 | 5 mm | 19.1 mm | 7.6 mm | 22.2 mm | 7.6 mm | M3 | 0.0068 | 1.99E-06 |
| 6200132 | 6 mm | 19.1 mm | 7.6 mm | 22.2 mm | 7.6 mm | M3 | 0.0066 | 1.94E-06 |
| 6200133 | 8 mm | 19.1 mm | 7.6 mm | 22.2 mm | 7.6 mm | M3 | 0.0061 | 1.79E-06 |
| 6200114 | $0.1875{ }^{\prime \prime}$ | 0.750 " | $0.300 "$ | $0.875^{\prime \prime}$ | $0.300^{\prime \prime}$ | M3 | 0.0068 | 1.99E-06 |
| 6200115 | 0.2500 " | 0.750 " | $0.300^{\prime \prime}$ | 0.875" | $0.300^{\prime \prime}$ | M3 | 0.0065 | $1.91 \mathrm{E}-06$ |
| 6200116 | 0.3125" | 0.750 " | $0.300 "$ | 0.875" | $0.300^{\prime \prime}$ | M3 | 0.0062 | 1.82E-06 |

*Contact PBC linear if required bore is not listed.

| Disk P/N \# | Material | OD |  | Torsional Stiffness |  | Rated Torque |  | Brake Torque |  | Parallel Misalignment |  | Axial Motion |  | Moment of Inertia ( $\mathrm{kg} \times \mathrm{m}^{\wedge}$ ) |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | (mm) | (in) | $\begin{gathered} (\mathrm{Deg} / \\ \mathrm{Nm}) \\ \hline \end{gathered}$ | $\begin{aligned} & (\mathrm{Deg} \\ & / \mathrm{lb-in}) \end{aligned}$ | ( Nm ) | (lb-in) | (Nm) | (lb-in) |  | (in) | (mm) | (in) |  |
| 6200148 | Acetal | 12.7 | 0.50 | 0.636 | 0.072 | 0.69 | 6 | 3.9 | 34 | 0.1 | 0.004 | 0.05 | 0.002 | 2.93E-08 |
| 6200149 | Acetal | 19.1 | 0.75 | 0.38 | 0.043 | 2.25 | 20 | 10.5 | 93 | 0.2 | 0.008 | 0.10 | 0.004 | 5.87E-08 |

NOTE: Motor coupling assembly (hubs \& disk) are included in MLB \& MLC Series actuators. One hub of the coupling is integral to the lead screw drive system. Alternate coupling styles are not available

## Ordering Accessories

When ordering ML accessories, use the part number ( $\mathrm{P} / \mathrm{N}$ ) to specify which accessory you want when placing your ML actuator order. If you have technical question contact a PBC Linear Application Engineer at at 1-800-962-8979.

## Motor Mount Assembly - Replacement Parts



Motor Mount Assembly - NEMA 11/14/17


Includes:
(1) Motor Mount Cover
(4) BHCS M $3 \times 0.5 \times 6 \mathrm{~mm}$

P/N: MLB028A-BMMC-KIT


Includes:
(1) Motor Mount Bracket
(3) SHCS M3 $\times 0.5 \times 8 \mathrm{~mm}$ P/N: MLBO28A-MTRMNT-UNI-ASY-KIT

(1) Pulley Belt ( 3 mm pitch)
P/N: $\mathbf{6 1 4 0 0 3 2}$
(2) Timing Pulley, $9 \mathrm{~mm} \times 5 \mathrm{~mm}$
P/N: $\mathbf{6 1 4 0 0 3 5}$


Motor Mount Assembly - NEMA 23


Includes:
(1) Motor Mount Cover
(4) BHCS M3 $\times 0.5 \times 8 \mathrm{~mm} \quad$ P/N: MLB028A-BMMC-23-KIT


Includes:
(1) Motor Mount Bracket
(3) SHCS M $5 \times 0.8 \times 8 \mathrm{~mm}$ P/N: MLB028A-MTRMNT-UNI-ASY-23-KIT


| (1) Pulley Belt (3 mm pitch) | P/N: $\mathbf{6 1 4 0 0 3 2}$ |
| :--- | :--- |
| (1) Timing Pulley, $9 \mathrm{~mm} \times 6.35 \mathrm{~mm}$ | $\mathrm{P} / \mathrm{N}: \mathbf{6 1 4 0 0 3 9}$ |
| (1) Timing Pulley, $9 \mathrm{~mm} \times 5 \mathrm{~mm}$ | $\mathrm{P} / \mathrm{N}: \mathbf{6 1 4 0 0 3 5}$ |

## Mounting Hardware (Clamps, Plates \& Sensor Kits)



## Dovetail Clamps

Two screw design helps ensure quick and easy alignment during installation.

## Kit Includes:

(2) M3 Dovetail Clamp
(4) M3 $\times 10 \mathrm{~mm}$ SHCS


M3 SHCS COUNTER BORES
MAX. SCREW TORQUE $=.8 \mathrm{~N}-\mathrm{m}$ ( $7 \mathrm{in}-\mathrm{lbf})$

| Single Dovetail Clamp Only | P/N: MLA028A-HDC-M3 |
| :--- | :--- |
| Dovetail Clamp Kit | P/N: MLA028A-HDC-M3-KIT |

## Riser Plates

## Includes:

1. (4) $\mathrm{M} 3 \times 10 \mathrm{~mm}$ SHCS
2. (2) M3 Dovetail Clamp
3. (2) M5 $\times 16 \mathrm{~mm}$ SHCS
4. (1) 8 mm or 15 mm Riser Plate


MAX. SCREW TORQUE $=.8 \mathrm{~N}-\mathrm{m}(7 \mathrm{in}-\mathrm{lbf})$

| Recommended for NEMA 14 \& 17 Motor |  |
| :--- | :--- |
| 8 mm Riser Plate only | P/N: MLA028A-RSRPLT-08 |
| $\mathbf{8} \mathrm{mm}$ Riser Plate Kit | P/N: MLA028A-RSRPLT-08 -KIT |

Recommended for NEMA 23 Motor

| 15 mm Riser Plate only | P/N: MLA028A-RSRPLT-15 |
| :--- | :--- |
| $\mathbf{1 5} \mathrm{mm}$ Riser Plate Kit | P/N: MLA028A-RSRPLT-15-KIT |



Kit Includes:
(1) Riser plate (8 or 15 mm )
(2) Dovetail clamps
(4) M3 $\times 10 \mathrm{~mm}$ screws
(1) M3 $\times 12 \mathrm{~mm}$ screw
(1) M3 $\times 6 \mathrm{~mm}$ screw
(2) M5 $\times 16 \mathrm{~mm}$ screw (optional)

Compatible Sensors: OM-E2S-W2 style)
Typical Applications: ML Actuator gantry's with (2) linear guides

| Riser Plate Sensor Kit | P/N: MLA028A-RSRPLT-08A-KIT |
| :--- | :--- |
| Riser Plate Sensor Kit | P/N: MLA028A-RSRPLT-15A-KIT |



Linear Guide Sensor Kit


Kit Includes:
(1) Bracket
(1) OM-Y92E-C1R6 Bracket
(3) M3 X 4mm screws
(1) M4 X 5mm set screw
(1) Flag, 5 mm sensing distance

Compatible Sensors: OM-E2S-Q1 style
Typical Applications: ML Actuators with one or two linear guide(s)


T-Slot Sensor Kit


Kit Includes:
(1) Bracket
(1) M2 $\times 8 \mathrm{~mm}$ screw
(1) M2 nut

Compatible Sensors: PBC Linear 6200XXX Series Sensors Typical Applications: ML Actuator with zero or one linear guide(s)
T-Slot Sensor Kit P/N: MLA028A-SENADT-KIT

* Note: Sensor mounting kits do not include a sensor.

The appropriate sensor should be ordered separately.

## Proximity Sensors

## Super Compact Proximity Sensors



| Sensing Surface | Sensing Distance | Sensor Series | Output Configuration | Cable: 5 m Flying Lead |  | Cable: 275 mm M8 Quick Disconnect |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  | Normally Open (NO) | Normally Closed (NC) | Normally Open (NO) | Normally Closed (NC) |
| End | 1.6 mm | OM-E2S-Q | NPN | OM-E2S-Q13-■ | OM-E2S-Q14-5M | OM-E2S-Q13-U2 | OM-E2S-Q14-U2 |
|  |  |  | PNP | OM-E2S-Q15-■ | OM-E2S-Q16-5M | OM-E2S-Q15-U2 | OM-E2S-Q16-U2 |
| Front/Top | 2.5 mm | OM-E2S-W | NPN | OM-E2S-W23-■ | OM-E2S-W24-5M | OM-E2S-W23-U2 | OM-E2S-W24-U2 |
|  |  |  | PNP | OM-E2S-W25-■ | OM-E2S-W26-5M | OM-E2S-W25-U2 | OM-E2S-W26-U2 |
| Bottom | n/a | PBC Linear 6200XXX | NPN |  |  |  |  |
|  |  |  | PNP |  |  |  |  |

$=$ length of cable $5 \mathrm{M}^{\prime \prime}=5$ meters with flying lead; U2 $=275 \mathrm{~mm}$ with quick disconnect

| Operation Status | Output Configuration | P/N \# | Timing Chart | Output Circuits |
| :---: | :---: | :---: | :---: | :---: |
| NO | NPN | $\begin{aligned} & \text { OM-E2S-W23-- } \\ & \text { OM-E2S-Q13-ए } \end{aligned}$ | Sensing Object Present  <br>  Not present  <br> Output Transistor ON  <br> (Load) OFF  <br> Operation Indicator ON  <br> (Orange) OFF  |  |
| NC | NPN | OM-E2S-W24- <br> OM-E2S-Q14- |  |  |
| NO | PNP | $\begin{aligned} & \text { OM-E2S-W25-[ } \\ & \text { OM-E2S-Q15-C } \end{aligned}$ | Sensing Object Present  <br>  Not present  <br>  ON  <br> Output Transistor OFF  <br> (Load) ON  <br> Operation Indicator ON $\square$ <br> (Orange) OFF  |  |
| NC | PNP | OM-E2S-W26- <br> OM-E2S-Q16- $\square$ | Sensing Object Present  <br>  Not present  <br> Output Transistor ON  <br> (Load) OFF  <br> Operation Indicator ON  <br> (Orange) OFF  |  |

## Magnetic Sensor Switch Specifications

Dimensional:


Schematics:


NPN (Current Sinking)


PNP (Current Sourcing)


Pinout

| Type | $\begin{aligned} & \text { 이 } \\ & \text { ì } \\ & \text { on } \end{aligned}$ | $\begin{aligned} & \text { N} \\ & \text { O} \\ & \text { On } \end{aligned}$ | $\begin{aligned} & \text { N్ర్ర } \\ & \text { M } \end{aligned}$ | $\begin{aligned} & \text { N} \\ & \text { O } \\ & \text { ज } \end{aligned}$ | N 0 0 0 | $\begin{aligned} & \text { N} \\ & \text { N్ర } \\ & \text { O} \end{aligned}$ | О - N - | О - N N |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
| End Connector | Quick Disconnect |  |  |  | Wire |  |  |  |
| Wire Length | 300 mm |  |  |  | 5 m |  |  |  |
| Sensor Type | NPN |  | PNP |  | NPN |  | PNP |  |
| Switching Logic (Solid State Output) | NC | NO | NC | NO | NC | NO | NC | NO |
| Operative Voltage | 10-30V DC |  |  |  |  |  |  |  |
| Switching Current | 200 mA MAX |  |  |  |  |  |  |  |
| Contact Rating | 6 W MAX |  |  |  |  |  |  |  |
| Current Consumption | 20 ma @ 24V DC MAX |  |  |  |  |  |  |  |
| Voltage Drop | 1.5V MAX |  |  |  |  |  |  |  |
| Leakage Current | 0.05 mA MAX |  |  |  |  |  |  |  |
| Cable | $\emptyset 3 \mathrm{~mm}, 3$ wire, polyurethane |  |  |  |  |  |  |  |
| Indicator | Red | Yellow | Yellow | Yellow | Red | Yellow | Yellow | Yellow |
| Operating Frequency | 1000 Hz |  |  |  |  |  |  |  |
| Magnet Requirement (Note 1) | 50 | 65 | 50 | 65 | 50 | 65 | 50 | 65 |
| Temperature Range | $-10-70^{\circ} \mathrm{C}\left(+14-158^{\circ} \mathrm{F}\right)$ |  |  |  |  |  |  |  |
| Shock (Note 2) | 50 g |  |  |  |  |  |  |  |
| Vibratin (Note 3) | 9 g |  |  |  |  |  |  |  |
| Enclosure Classification | IEC 529 IP 67 (NEMA 6) |  |  |  |  |  |  |  |
| Protection Circuit | Reverse polarity, Short-circuit |  |  |  |  |  |  |  |

Notes: 1. Units: Gauss Parallel. Measuring standard target: $\varnothing 15.5 \times \emptyset 8 \times 5 t$ (Anisotrophy rubber magnet)
2. Sine wave $\cdot X Y Z$ three directions $\cdot$ three times each direction $\cdot 11 \mathrm{~ms}$ each time
3. Double amplitude $1.5 \mathrm{~mm} \cdot 10 \mathrm{~Hz}-55 \mathrm{~Hz}-10 \mathrm{~Hz}$ (Sweep 1 min .) $\cdot \mathrm{X} \mathrm{Y} \mathrm{Z} \mathrm{three} \mathrm{directions} \cdot 1$ hour each time

| Model P/N: |  | OM-E2S-W13 <br> OM-E2S-W14 | $\begin{aligned} & \text { OM-E2S-W23 } \\ & \text { OM-E2S-W24 } \end{aligned}$ | $\begin{aligned} & \text { OM-E2S-Q15 } \\ & \text { OM-E2S-Q16 } \end{aligned}$ | $\begin{aligned} & \text { OM-E2S-W25 } \\ & \text { OM-E2S-W26 } \end{aligned}$ |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Sensing surface |  | Front | Top | Front | Top |
| Sensing distance |  | $1.6 \mathrm{~mm} \pm 15 \%$ | $2.5 \mathrm{~mm} \pm 15 \%$ | $1.6 \mathrm{~mm} \pm 15 \%$ | $2.5 \mathrm{~mm} \pm 15 \%$ |
| Set distance |  | 0 to 1.2 mm | 0 to 1.9 mm | 0 to 1.2 mm | 0 to 1.9 mm |
| Differential travel |  | 10\% MAX of sensing distance |  |  |  |
| Detectable object type |  | Ferrous metal |  |  |  |
| Standard target object |  | Iron, $12 \times 12 \times 1 \mathrm{~mm}$ | Iron, $15 \times 15 \times 1 \mathrm{~mm}$ | Iron, $12 \times 12 \times 1 \mathrm{~mm}$ | Iron, $15 \times 15 \times 1 \mathrm{~mm}$ |
| Response frequency (see note) |  | 1 kHz min. |  |  |  |
| Power supply voltage (operating voltage range) |  | 12 to 24 V DC, ripple (p-p): $10 \%$ max., ( 10 to 30 V DC) |  |  |  |
| Current Consumption |  | 13 mA max . at 24 VDC (no-load) |  |  |  |
| Operation Mode (with sensing object approaching) |  | $\begin{aligned} & \text { OM-E2S-_ } 3 \text { models: NO } \\ & \text { OM-E2S-_ } 4 \text { models NC } \end{aligned}$ |  |  |  |
| Control Output | Load Current | NPN open collector output 50 mA max. (30 V DC max) |  | PNP open collector output 50 mA max. (30 V DC max.) |  |
|  | Residual voltage | 1.0 V max. with a load current of 50 mA and a cable length of 1 m |  |  |  |
| Indicator |  | Operation indicator (orange) |  |  |  |
| Protection Circuits |  | Reverse polarity connection and surge absorber |  |  |  |
| Ambient temperature | Operating | $-25^{\circ} \mathrm{C}$ to $70^{\circ} \mathrm{C}\left(-13^{\circ} \mathrm{F}\right.$ to $\left.158^{\circ} \mathrm{F}\right)$ with no icing or condensation |  |  |  |
|  | Storage | $-40^{\circ} \mathrm{C}$ to $85^{\circ} \mathrm{C}\left(-40^{\circ} \mathrm{F}\right.$ to $\left.185^{\circ} \mathrm{F}\right)$ with no icing or condensation |  |  |  |
| Ambient humidity | Operating | $35 \%$ to $90 \%$ (with no condensation) |  |  |  |
|  | Storage | $35 \%$ to 95\% (with no condensation) |  |  |  |
| Temperature influence |  | $\pm 15 \%$ max. of sensing distance at $23^{\circ}$ in the temperature range of -25 to $70^{\circ} \mathrm{C}$ |  |  |  |
| Voltage Influence |  | $\pm 2.5 \%$ MAX of sensing distance in rated voltage range $\pm 10 \%$ |  |  |  |
| Insulation resistance |  | $50 \mathrm{M} \mathrm{MIN} \mathrm{( } 500 \mathrm{~V}$ VDC) between current carry parts and case |  |  |  |
| Dielectric strength |  | 1,000 VAC, $50 / 60 \mathrm{~Hz}$ for 1 min between current carry parts and case |  |  |  |
| Vibration resistance |  | Destruction: 10 to $55 \mathrm{~Hz}, 1.0 \mathrm{~mm}$ double amplitude for 2 hours each in $X, Y$ and $Z$ directions |  |  |  |
| Shock resistance |  | Destruction: $500 \mathrm{~m} / \mathrm{s}^{2}\left(1640 \mathrm{ft} / \mathrm{s}^{2}\right) 3$ times each in $X, Y$ and $Z$ directions |  |  |  |
| Connection Method |  | Pre-wired standard length 1 m (39.37 in) |  |  |  |
| Weight (packed state) |  | Approx. $10 \mathrm{~g}(0.35 \mathrm{oz})$ |  |  |  |
| Material/Case |  | Polyarylate resin |  |  |  |

## Maintenance Kit System Parts • Seal Strip Kit

Seal strips are engineered to last the life of the system. In the event that the strip becomes damaged by environmental contamination, PBC Linear offers a replacement seal strip kit.


Kit Includes: (Carriage bracket sold separately.)

1. (1) Seal Strip - Ultra-wear resistant MDS nylon
2. (1) Retainer Bracket
3. (1) Adjuster Bracket
4. (3) PHC M $2 \times 0.4 \times 5 \mathrm{~mm}$
5. (1) Hexagon Nut, M2 $\times 0.4$
6. (4) Bearings

## Seal Strip Kit P/N: MLA028A-SSAR-KIT

Seal strip is 725 mm in length and can be cut shorter using sharp pair of scissors.

## Application Data Sheet

FAX COMPLETE FORMS TO:
RFQ: $\qquad$ 1(815) 389-5790

Date: $\qquad$
Company: $\qquad$
Contact: $\qquad$
Address: $\qquad$

Phone: $\qquad$
E-mail: $\qquad$


APPLICATION DESCRIPTION - Sketch if available.

Project Name: $\qquad$ Project Status: Concept

- Design - Prototype - Existing

Project Description: $\qquad$
Project Timing: $\qquad$ Target Pricing: $\qquad$
Quantity: $\qquad$ Components

- Actuator Only - Actuator/Motor - Accessories $\qquad$
Environment:Clean Room General Shop Heavy Industrial
- Food/Washdown
- High Vibration $\square$ Other $\qquad$


## SYSTEM TYPE

Single Axis



Axi $\frac{F y_{A}}{F y}+\frac{F z_{A}}{F z}+\frac{M x_{A}}{M x}+\frac{M y_{A}}{M y}+\frac{M z_{A}}{M z}<=1$ s Orientation: Vertical $\square$ Horizontal Inverted angled

|  | AXIS |  |  |
| :--- | :---: | :---: | :---: |
|  | $\mathbf{X}$ | $\mathbf{Y}$ | $\mathbf{Z}$ |
| Load N (lbf) |  |  |  |
| Moment $\mathrm{Nm}(\mathrm{lbf-in})$ |  |  |  |
| Stroke $\mathrm{mm}(\mathrm{in})$ |  |  |  |
| Velocity $\mathrm{mm} / \mathrm{s}(\mathrm{in} / \mathrm{s})$ |  |  |  |
| Acceleration $\mathrm{m} / \mathrm{s}^{2}\left(\mathrm{ft} / \mathrm{s}^{2}\right)$ |  |  |  |
| Deceleration $\mathrm{m} / \mathrm{s}^{2}\left(\mathrm{ft} / \mathrm{s}^{2}\right)$ |  |  |  | Comments:

$\qquad$
$\qquad$
$\qquad$
$\qquad$

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## Distributed by

PBC Linear has a global network of distributors with thousands of locations worldwide.

Visit pbclinear.com to find a distributor near you.

[^1]
[^0]:    NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1 mm increments up to 701 mm . Standard lengths are multiples of 10 mm . When possible round up to nearest multiple of 10 mm . NEMA 11 stepper motors typically do not have enough torque to drive the anti-backlash nuts. Customers are responsible for doing torque calculations to ensure the motor is properly sized. Specifications are subject to change without notice.

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