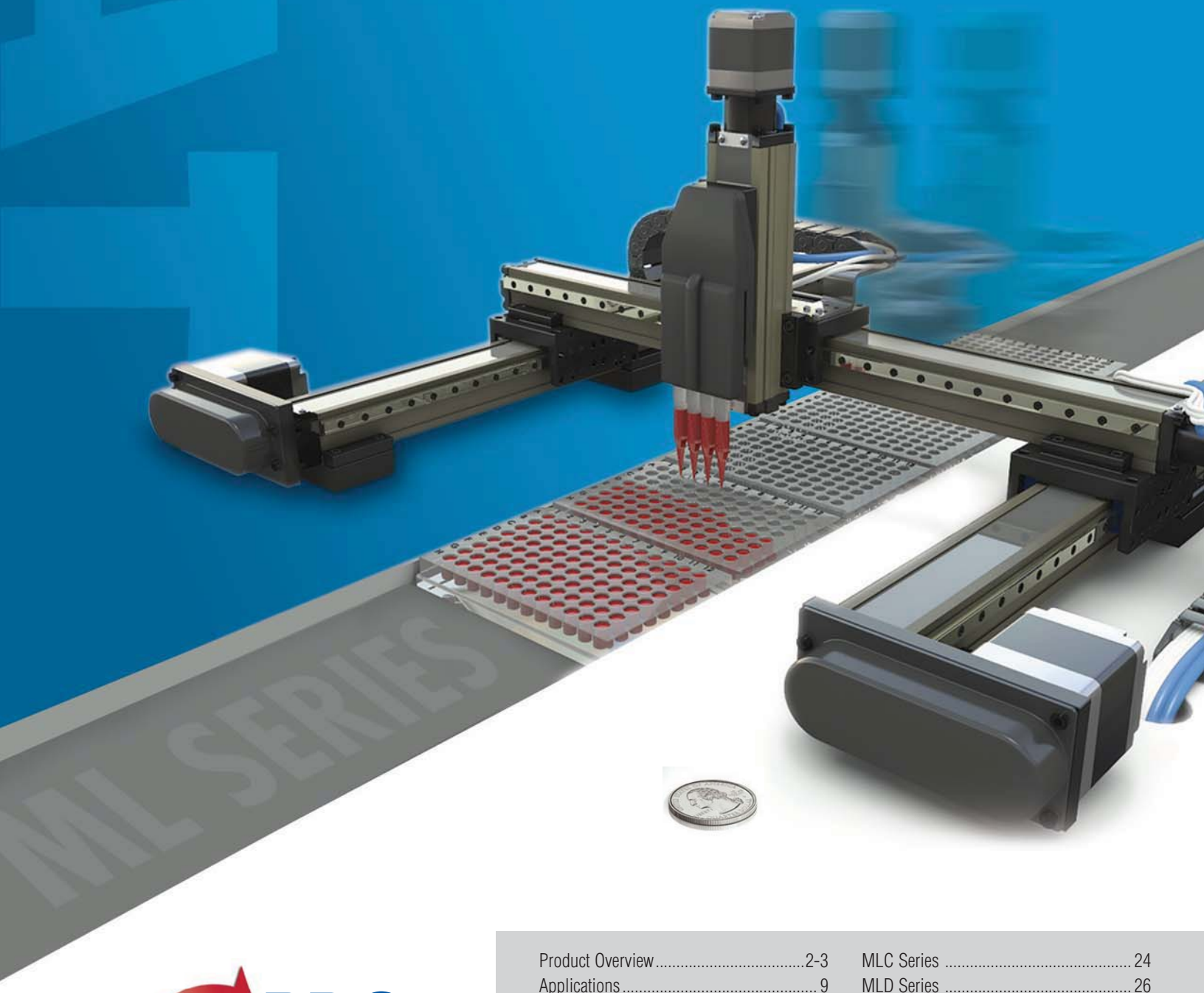
LINEAR ACTUATOR TECHNOLOGY

Precision Machined SIM

ML Series
Miniature Linear Actuator



NEW Pacific bearing PBC LINEAR
A PACIFIC BEARING CO.

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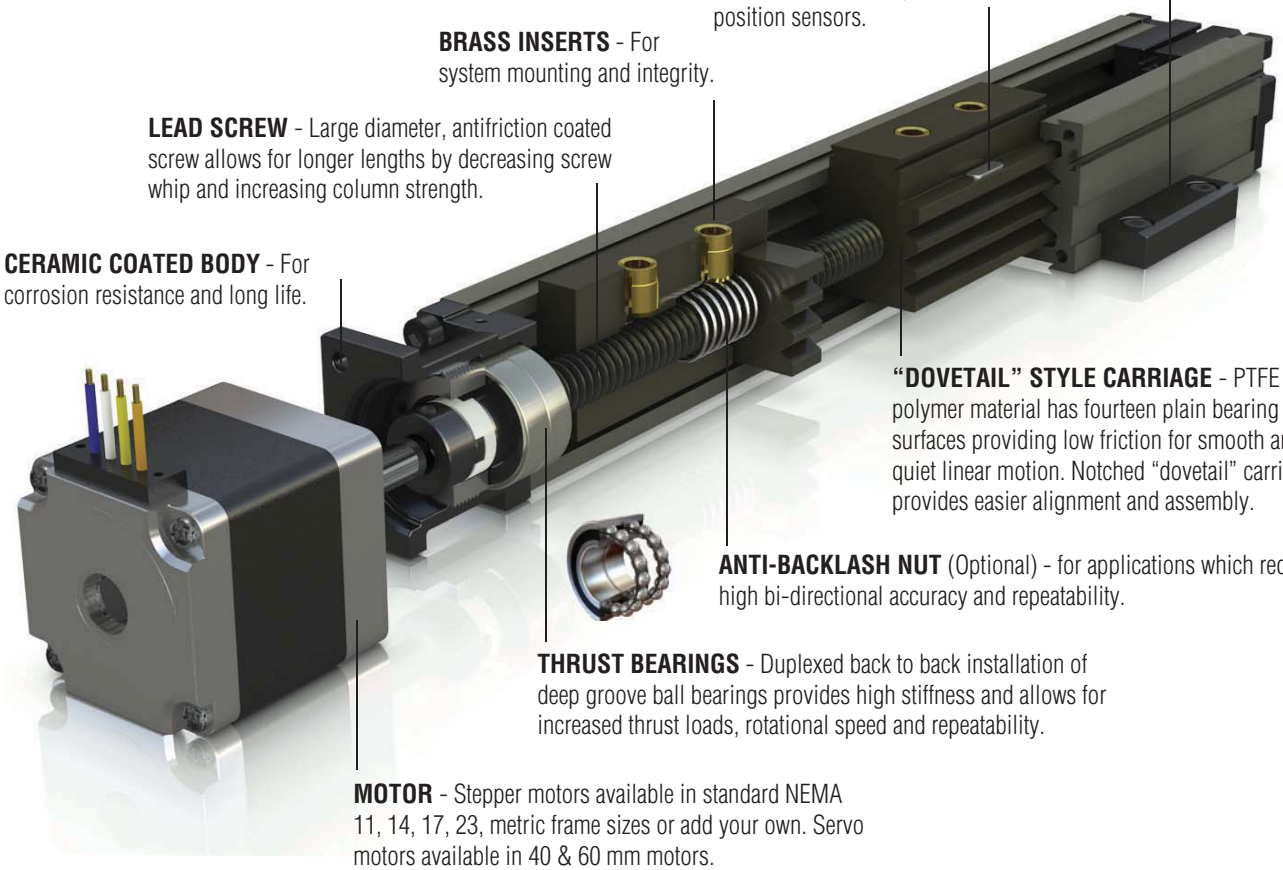
ML Series Overview



DOVETAIL CLAMPS - secure unit on all (4) surfaces. Two screw design helps ensure quick and easy alignment during installation.

MAGNET - Built-in magnet accommodates home, limit and position sensors.

BRASS INSERTS - For system mounting and integrity.

LEAD SCREW - Large diameter, antifriction coated screw allows for longer lengths by decreasing screw whip and increasing column strength.

CERAMIC COATED BODY - For corrosion resistance and long life.

"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.

ANTI-BACKLASH NUT (Optional) - for applications which require high bi-directional accuracy and repeatability.

THRUST BEARINGS - Duplexed back to back installation of deep groove ball bearings provides high stiffness and allows for increased thrust loads, rotational speed 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 & 60 mm motors.

ML ADVANTAGE

- **Small, Compact Profile** - 28 x 32mm
- **Patent Pending SIMO™ 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 650mm

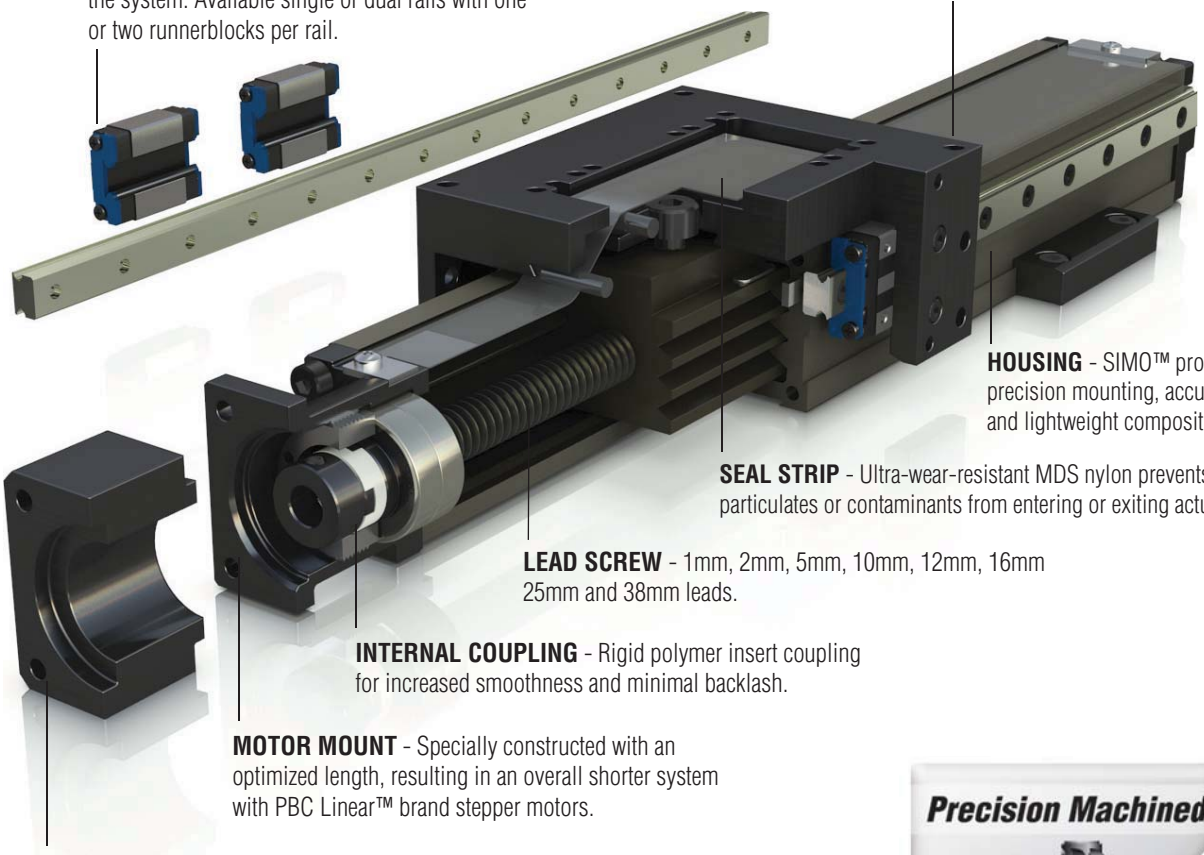
MLB SERIES - Motor Driven

Pre-mounted stepper or servo motors.
(Page 14)

PBC LINEAR A PACIFIC BEARING CO. OMRON FASTECH

LINEAR GUIDE SUPPORTS - Provide increased load and moment capacities and overall rigidity to the system. Available single or dual rails with one or two runnerblocks per rail.

MOUNTING HOLES - Carriage brackets feature extra mounting holes for ease of installation and multi-axis assemblies.



HOUSING - SIMO™ process ensures precision mounting, accurate installation and lightweight composition.

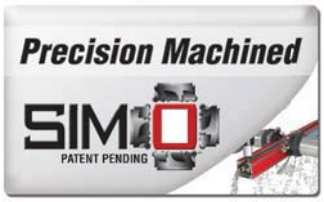
SEAL STRIP - Ultra-wear-resistant MDS nylon prevents particulates or contaminants from entering or exiting actuator.

LEAD SCREW - 1mm, 2mm, 5mm, 10mm, 12mm, 16mm 25mm and 38mm leads.

INTERNAL COUPLING - Rigid polymer insert coupling for increased smoothness and minimal backlash.

MOTOR MOUNT - Specially constructed with an optimized length, resulting in an overall shorter system with PBC Linear™ brand stepper motors.

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.



MLC SERIES - Motor Mount only

Specially designed motor mounts and couplings for easy mounting and extended life.
(Page 18)

MLD SERIES - Hand Driven (shaft or knob)

Adjustable hand operated knob and brake for precision control.
(Page 20)

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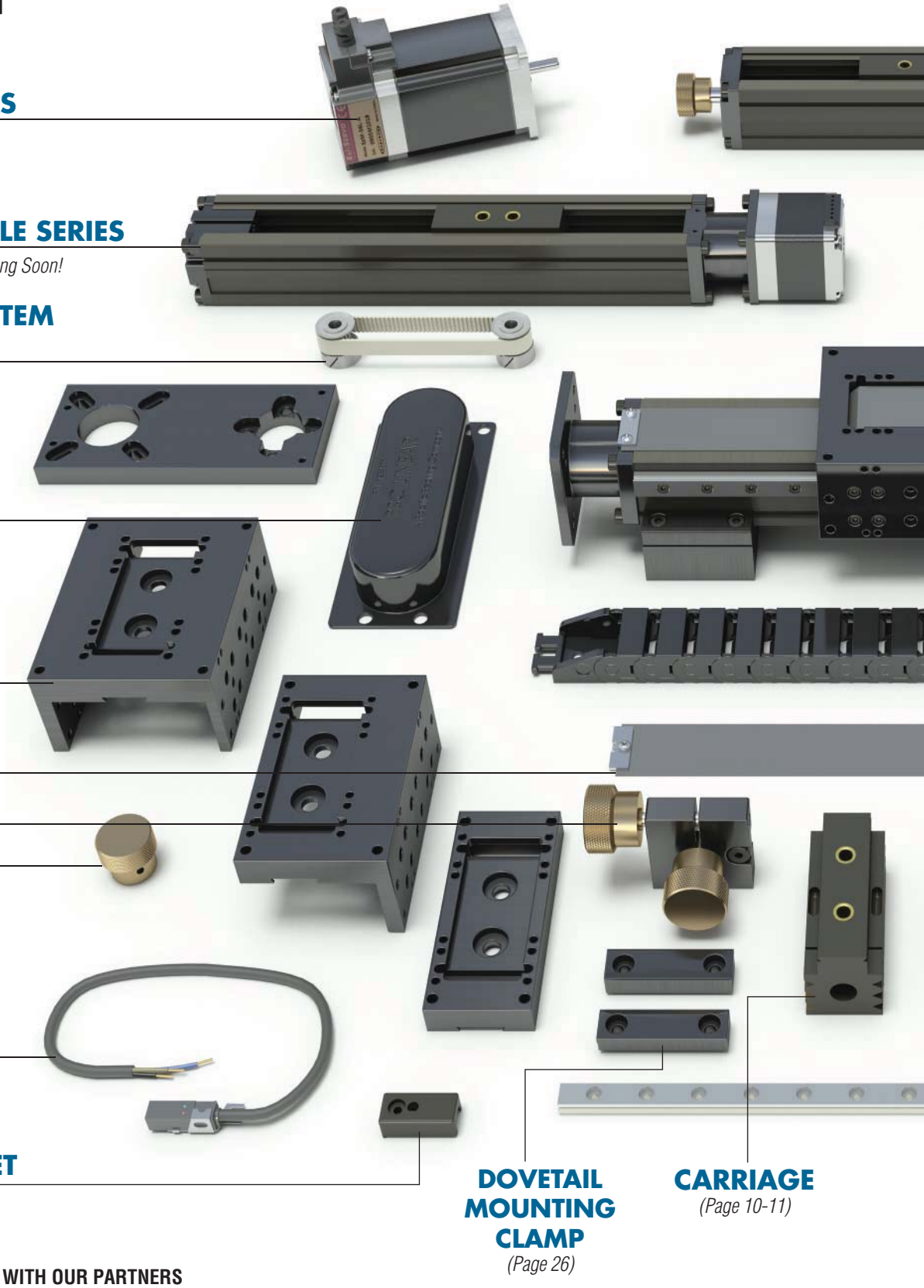
ML Components



STEPPER MOTORS
(Page 16)

MLE SERIES
Coming Soon!

PULLEY BELT SYSTEM
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SIDE MOTOR MOUNT COVER
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CARRIAGE BRACKETS *(Page 31)*

SEAL STRIP *(Page 31)*

BRAKE *(Page 21)*

HAND KNOB
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POSITION SENSOR
(Page 28)

SENSOR BRACKET
(Page 27)

DOVETAIL MOUNTING CLAMP
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CARRIAGE
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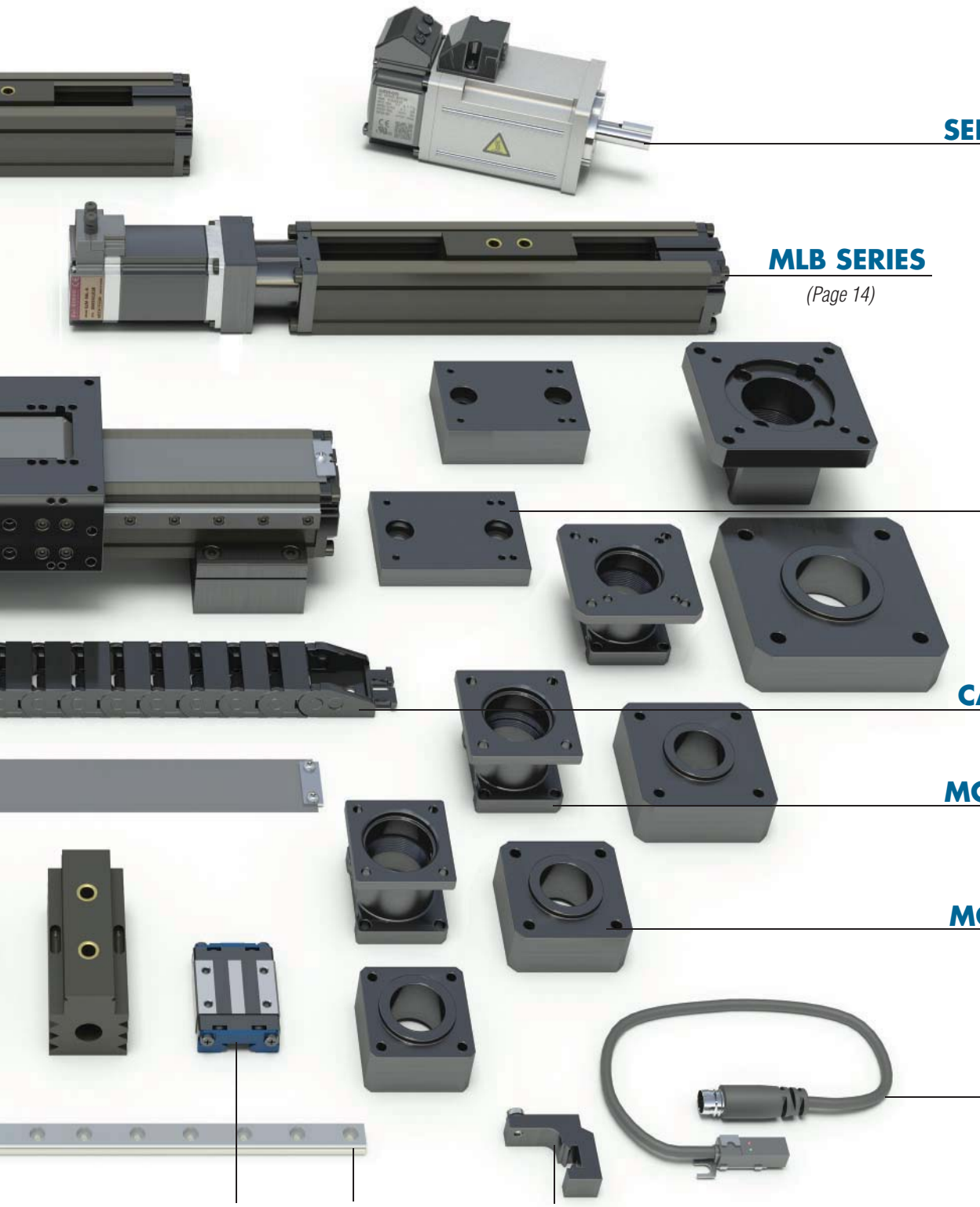
IN COOPERATION WITH OUR PARTNERS

KABELSCHLEPP OMRON FASTECH



SERVO MOTORS
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MLB SERIES
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RISER PLATES
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CABLE CARRIER
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MOTOR MOUNT
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MOTOR SPACER
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POSITION SENSOR
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RUNNER BLOCK
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LINEAR GUIDE RAIL
(Page 24 & 31)

SENSOR BRACKET
(Page 27)

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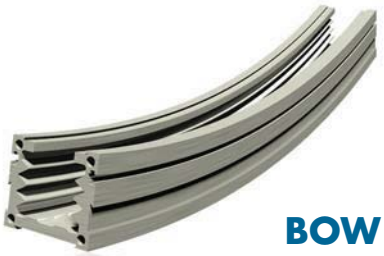
PATENT PENDING

- **Patent Pending Machining Process**
- **High Precision Mounting Surfaces**
- **Tight Tolerances ± 0.025mm (0.001 in)**

PBC Linear has revolutionized traditional machining with the patent pending SIMO™ (Simultaneous Integral Milling Operation).

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.

PBC's 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!



BOW

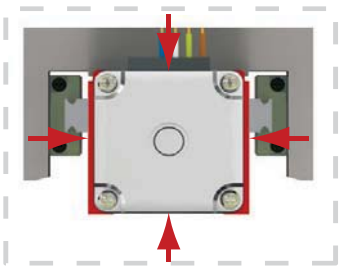
TWIST

WARP

ML Advantage

Using the machine tooled precision and rigid surfaces sustained by the SIMO™ process, the ML's bridge gantry design can support 1 or 2 linear guides on the sides of the ML. These supports work together to increase load capacities and sustain stability while utilizing re-circulating caged-ball technology to provide smooth and quiet linear motion guidance.

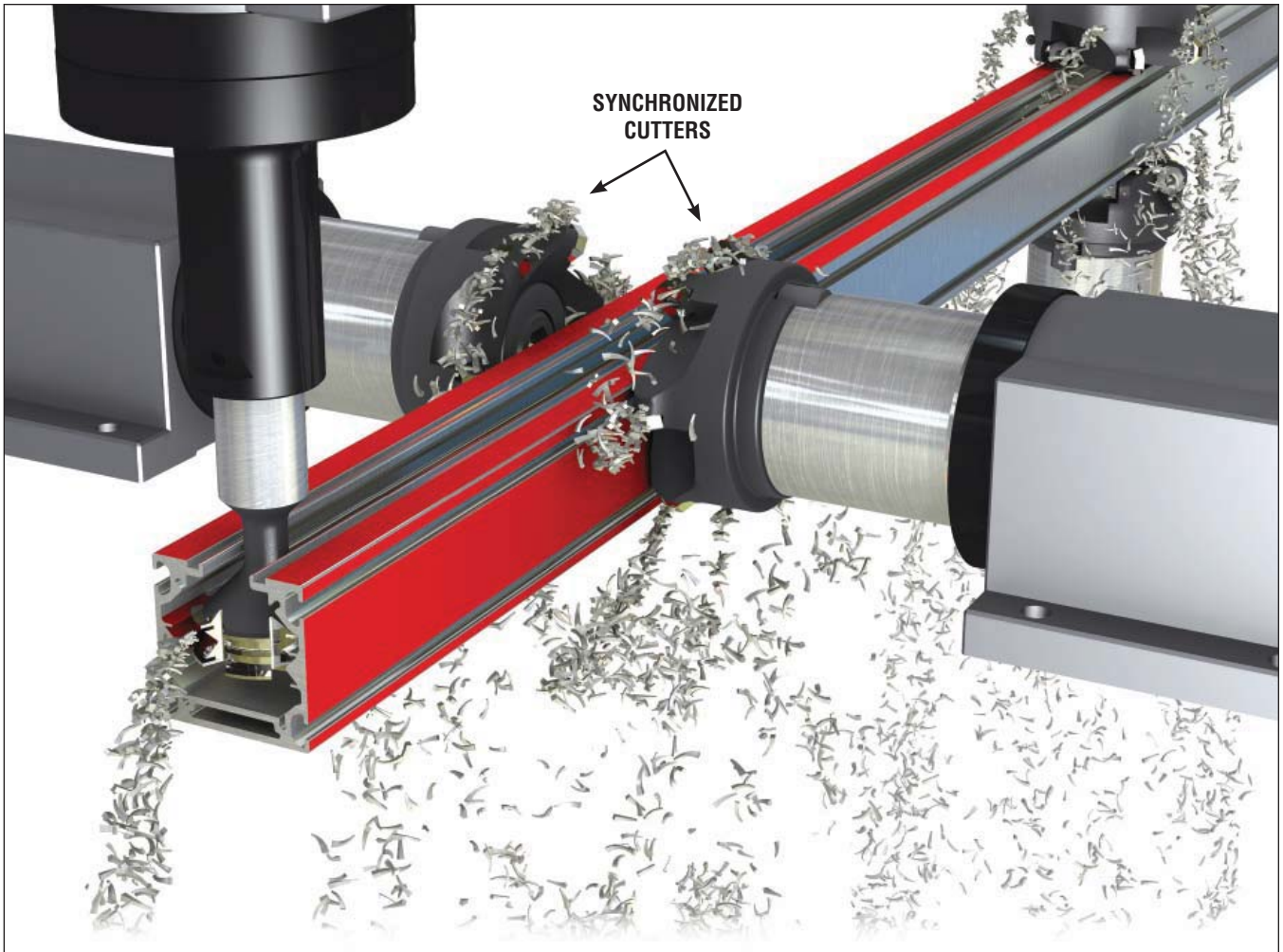
BRIDGE GANTRY DESIGN



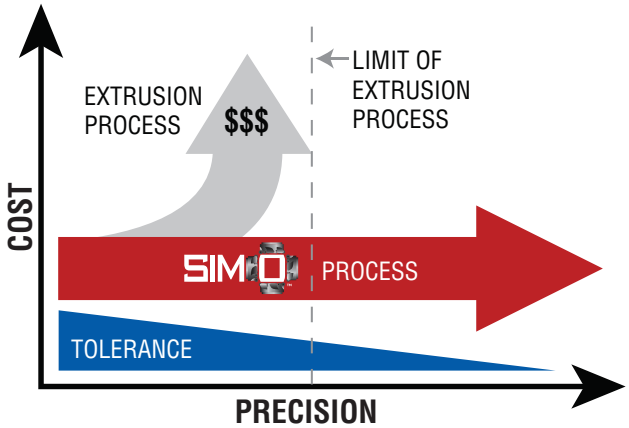
4X REFERENCE QUALIFIED EDGE

OPTIONAL SINGLE OR DUAL LINEAR GUIDE SUPPORTS

See page 24 for details.



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



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

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Multi-Axis Mounting

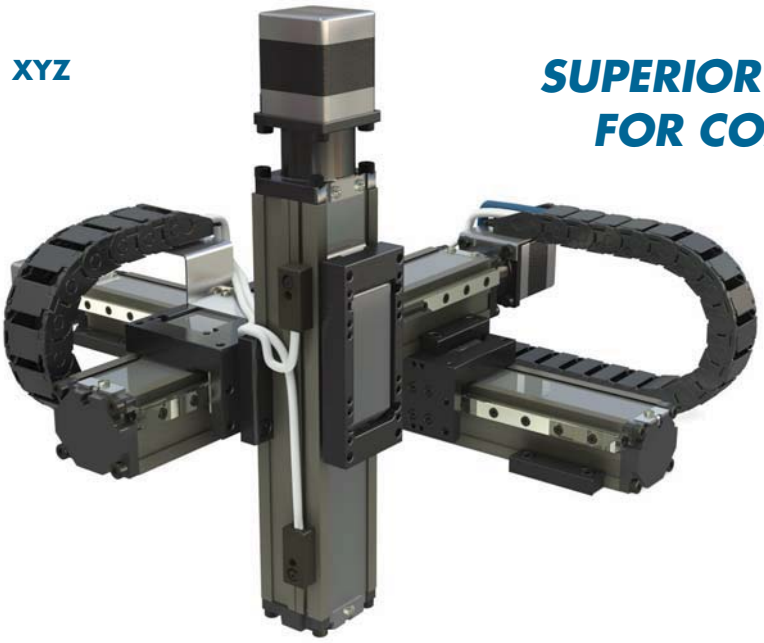
ML actuators are designed to perform well in XY and other Cartesian arrangements. The actuator body forms a strong beam with higher moment loading capacity. Special dovetail slots on all sides allow the actuators to be mounted on their bottom surface or on either side.

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 PBC's actuators such as the PL or MT Series.

XZ

XYZ



SUPERIOR MULTI-AXIS MOUNTING FOR COMPACT APPLICATIONS

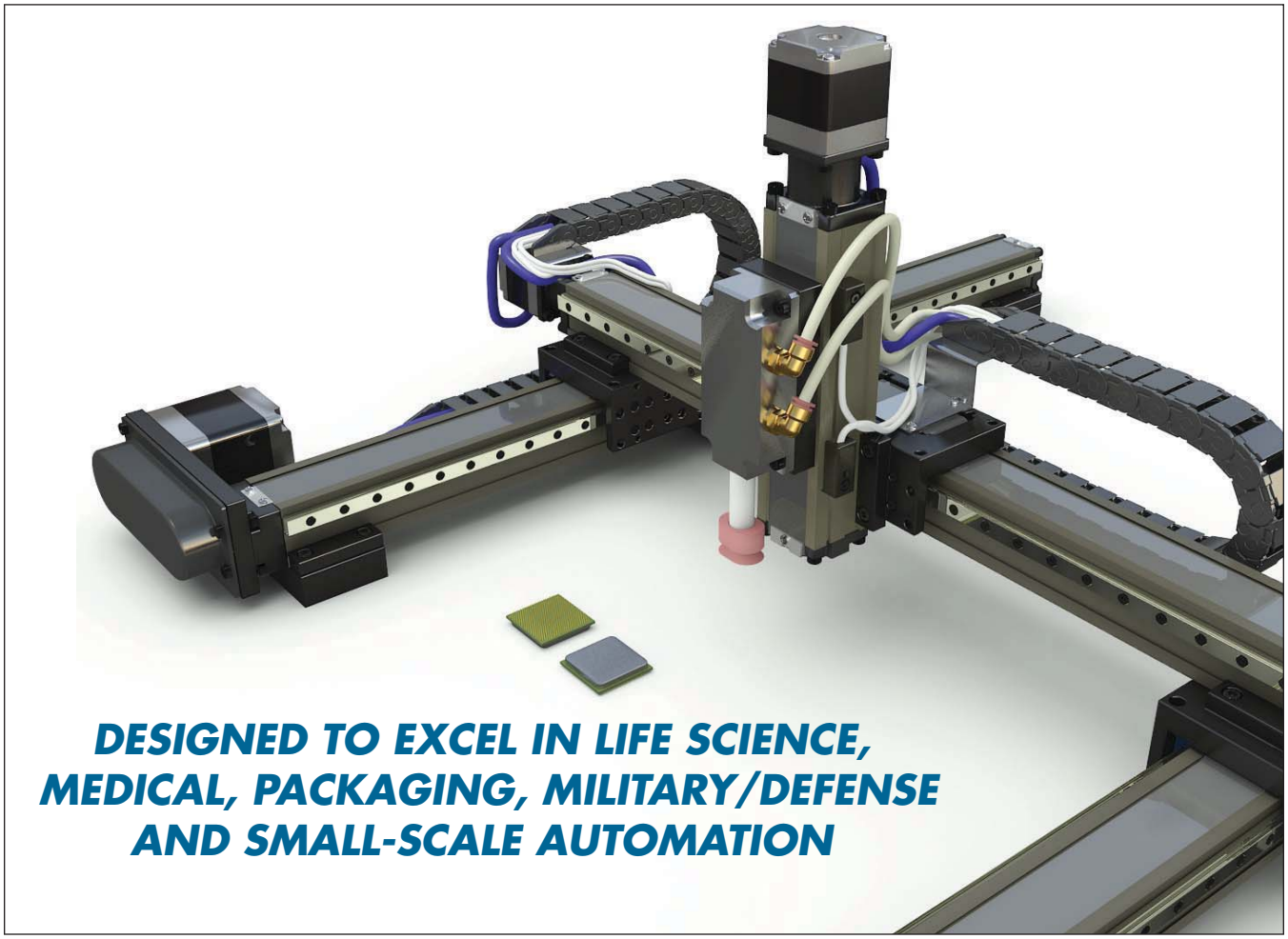
- **Medical**
- **Biotech**
- **Instrument Automation**
- **Packaging**
- **Pick and Place**
- **Semi-conductor**
- **Scanning**

XY

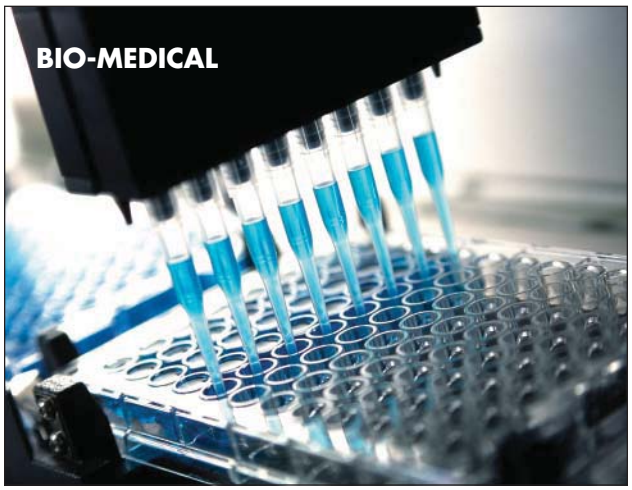
MULTI-AXIS
MTB Series with MLB

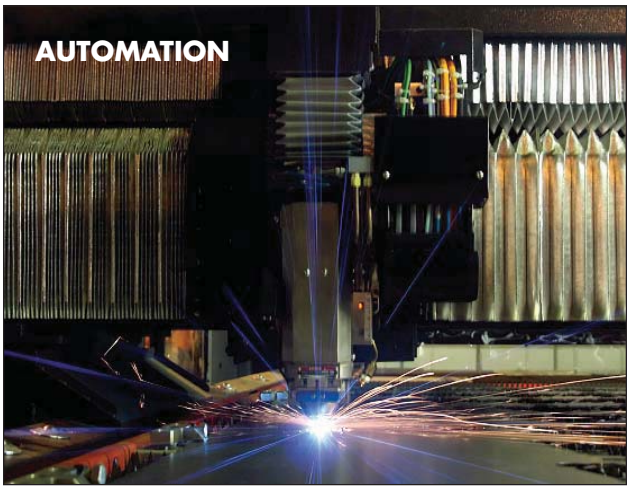
ML Applications

The ML miniature actuator has surpassed expectations and left the competition in the dust. Its 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 SIMO™ machined rail surface and zero backlash lead screw assembly ensures accuracy and precision for syringe pump and optical control applications.



DESIGNED TO EXCEL IN LIFE SCIENCE, MEDICAL, PACKAGING, MILITARY/DEFENSE AND SMALL-SCALE AUTOMATION





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Technical Data

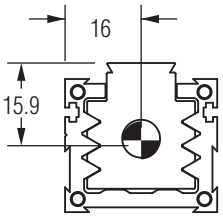
ML SERIES - Carriage only.					
Size		mm	28 x 32	in	1.10 x 1.26
Max. Load - Lite Preload - *anti-backlash* - Normal Preload - *anti-backlash* - Standard	**Fx**	N	44 89 267	lbf	10 20 60
	Fy		107		24
	Fz		178		40
Max. Moments	**Mx**	Nm	1.4	lbf-in	12.4
	My		1.4		12.4
	Mz		1.4		12.4
Bending Moment of Inertia (second moment of area)	**Iy**	cm^4	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	0.06	lbf	0.13
Add for 100 mm of stroke			0.15		0.34
Total Carriage Mass			0.020		0.044
Total Carriage Mass & Top Plate			0.059		0.130
Coefficient of Friction		0.19			
Max. Speed		m/s	1.9	in/s	75
Max. Stroke Length		mm	650	in	25.6
Min. Stroke Length			5		0.2
Nominal Screw Diameter			10.0		0.375
Max RPM		3000			
No Load Torque Nut - Lite Preload - *anti-backlash* - Normal Preload - *anti-backlash* - Standard		Nm	0.0565 0.106 0.007	lbf-in	0.50 0.94 0.062
Linear Guide Supports - Single Linear Guide - Dual Linear Guides		Nm	.017 .034	lbf-in	0.15 0.30
Seal Strip - with Seal Strip - without Seal Strip		Nm	.028 0	lbf-in	0.25 0
Screw Lead Accuracy*		mm/mm	.0006	in/in	.0006
Bi-directional Repeatability (Single Axis) - Anti-Backlash Nut - Standard Nut		+/- mm	0.02 076 -.254	+/- in	0.0008 .003 -.010
Normal Operating Temperature *(Wider ranges available)*	min	°C	98	°F	32
	max		18		176

*Higher accuracies are available to .0001 mm/mm (in/in). Contact manufacturer for details.
Specifications are subject to change without notice.

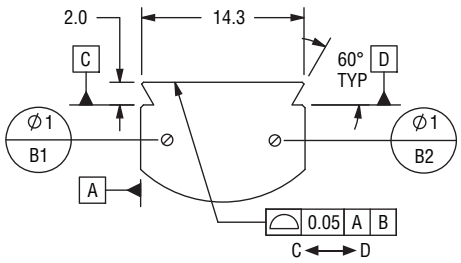
For combined loads, loading cannot exceed the following formula.

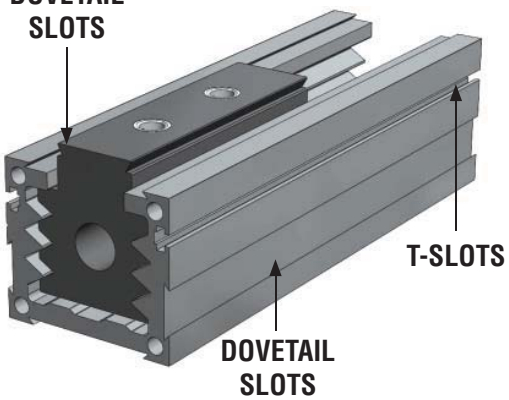
$$\frac{Fy_A}{Fy}+\frac{Fz_A}{Fz}+\frac{Mx_A}{Mx}+\frac{My_A}{My}+\frac{Mz_A}{Mz}<=1$$

CENTER OF GRAVITY FOR MOMENT CALCULATIONS

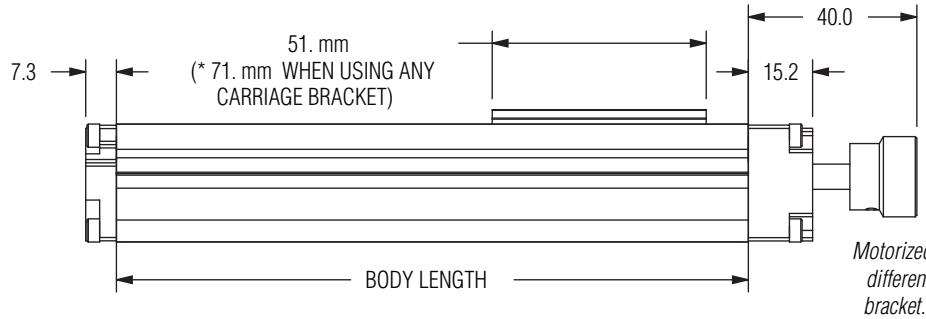


EXTERNAL DOVETAIL EASY SKETCH





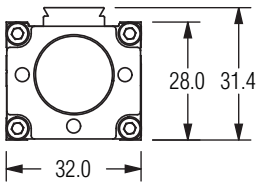
Dimensional Data

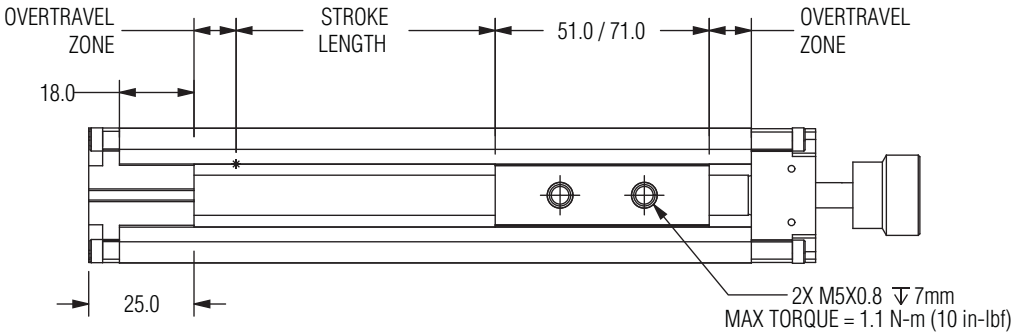


Motorized units use a different drive end bracket. See motor section for more details.

NOTE: BODY LENGTH = STROKE + *CARRIAGE LENGTH + (2X OVER TRAVEL) + 18mm

CARRIAGE WITH DOVETAIL





RECOMMENDED OVERTRAVEL PER SIDE

Knob or Hand Crank = 5mm
Stepper Motor = 10mm
Servo Motor = 20mm

HOW TO CALCULATE BODY LENGTH

1) Enter 19mm

2) Select (5, 10 or 20mm) for overtravel on idle end *(See recommended overtravel above.)*

3) Specify stroke length in mm

4) Select (51 or 71mm) for carriage length

5) Select (5, 10 or 20mm) for overtravel on idle end *(See recommended overtravel above.)*

6) Add amounts together and enter SUBTOTAL

7) Enter TOTAL BODY LENGTH *(Round to nearest 10mm)*

8) When ORDERING enter TOTAL BODY LENGTH in BODY LENGTH column.

BODY LENGTH CALCULATION TABLE		Example	
IDLE END CAP = 19mm	19	19	1
OVERTRAVEL IDLE END (5, 10 or 20mm)		10	2
STROKE LENGTH		155	3
CARRIAGE LENGTH (51 or 71mm)		71	4
OVERTRAVEL DRIVE END (5, 10 or 20mm)		10	5
(Add Amounts 1-5) + ENTER SUBTOTAL (mm) =		265	6
TOTAL BODY LENGTH *(Round Subtotal to nearest 10mm)*		270	7

8

ORDERING GUIDE

MLC028D	-	X	XX	X	X	X	-	0270	-	X	X

Series	Linear Guide Supports	Leads	Nut Type	Seal Strip	# of Carriages	Body Length mm	Motor Location	Configuration
ML Series with motor lead screw driven 28 x 32 mm	0 No external Rail 1 1 Rail + 1 Runner Block* 2 1 Rail + 2 Runner Block* 3 2 Rail + 1 Runner Block/rail 4 2 Rail + 2 Runner Block/rail	AH 1 MM AG 2 MM AX 5 MM AJ 10 MM BD 12 MM	2 Standard Nut 4 Anti-backlash (light preload) 6 Anti-backlash (normal preload)	0 None 1 With Seal strip	1 1 Carriage 2 2 Carriages 3 3 Carriages 4 4 Carriages		S Straight (in-line) L Left R Right B Bottom T Top	0 Standard

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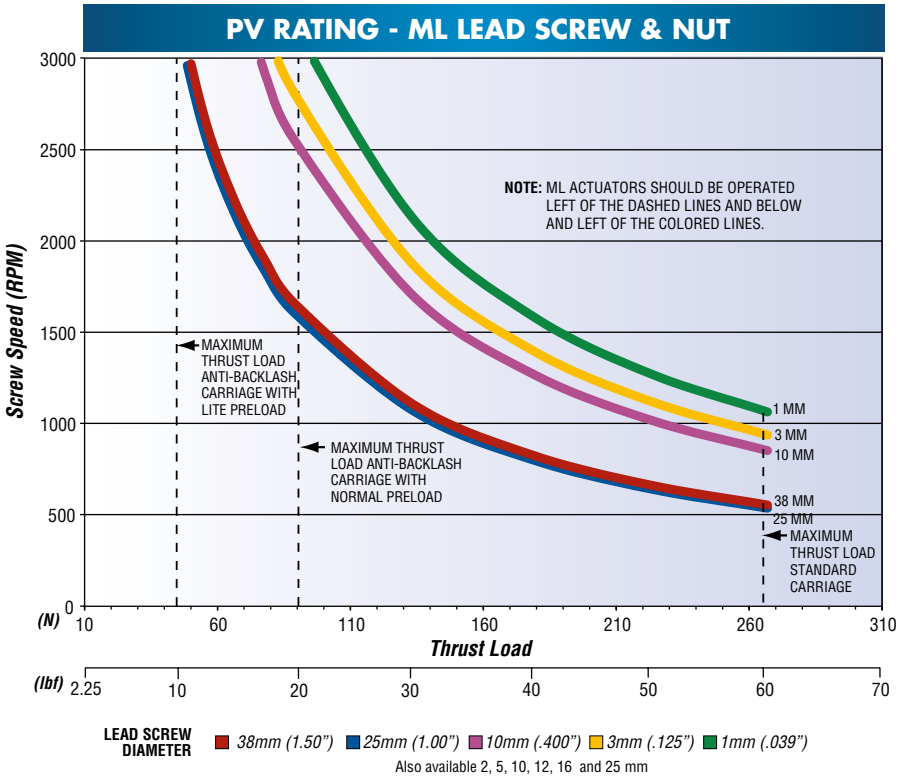
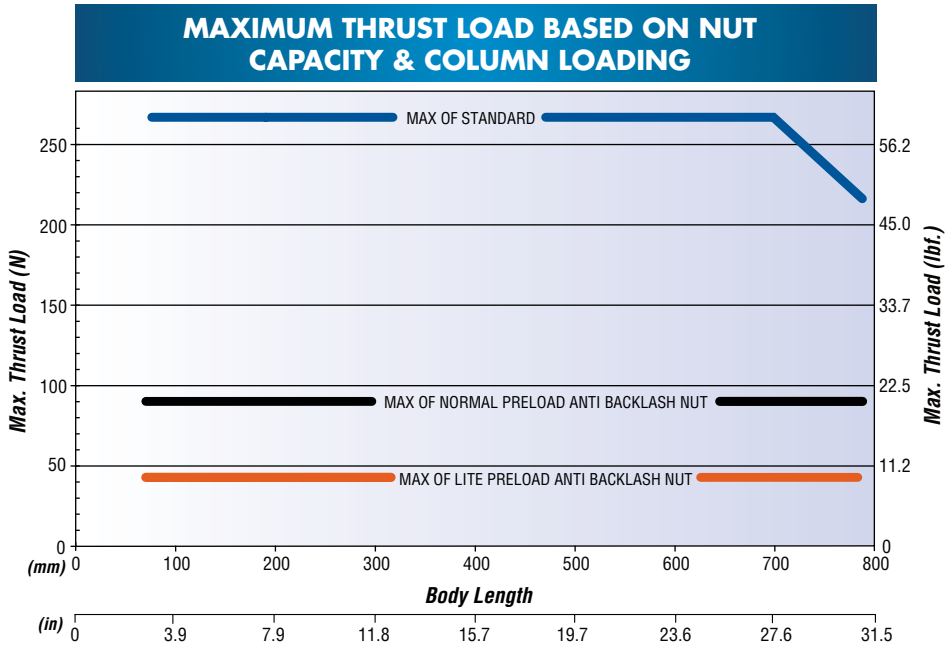
Performance Data

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.





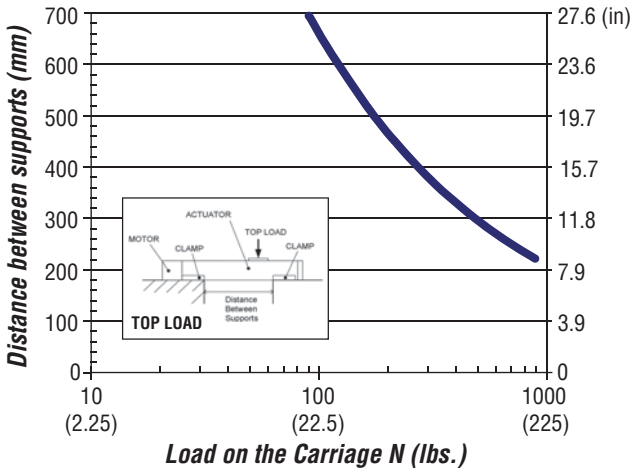
Torque to Raise Load

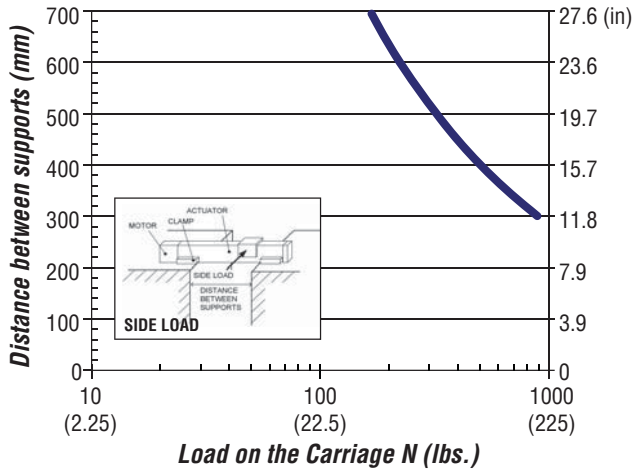
$$T_L \text{ (Nm)} = \frac{\text{Load (N) x Lead (mm)}}{2\pi \text{ x Efficiency x } 1000}$$

$$T_L \text{ (in-lbf)} = \frac{\text{Load (lbf) x Lead (in)}}{2\pi \text{ x Efficiency}}$$

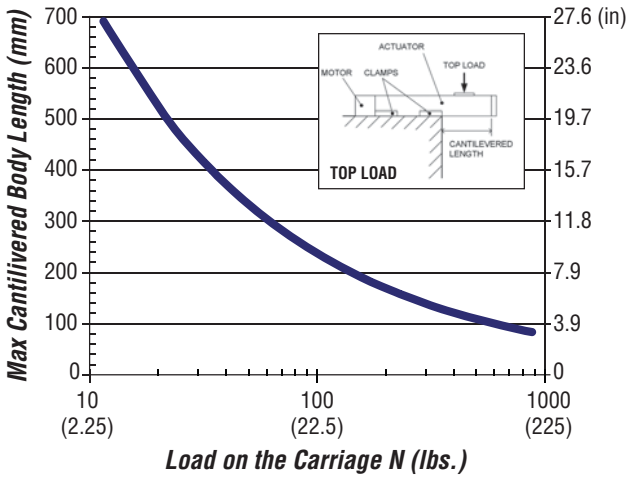
PERFORMANCE CHARACTERISTICS		LEAD SCREW mm *(in)*				
		38 (1.50)	**25 (1.00)**	**10 (.400)**	**3 (.125)**	**1 (.039)**
Max, Travel Speed	mm/s (in/s)	1905 (75)	1270 (50)	508 (20)	159 (6.25)	50 (1.95)
Screw Diameter	mm (in)	10 (0.375)	10 (0.375)	10 (0.375)	10 (0.375)	10 (0.375)
Screw Efficiency (See formula to left)		81%	82%	77%	57%	26%

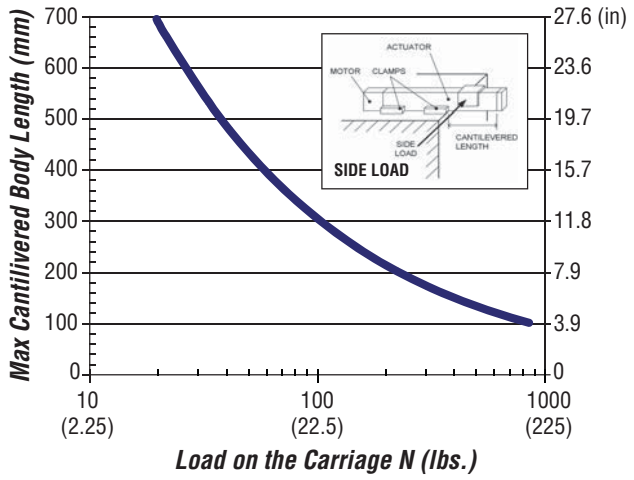
DISTANCE BETWEEN SUPPORTS



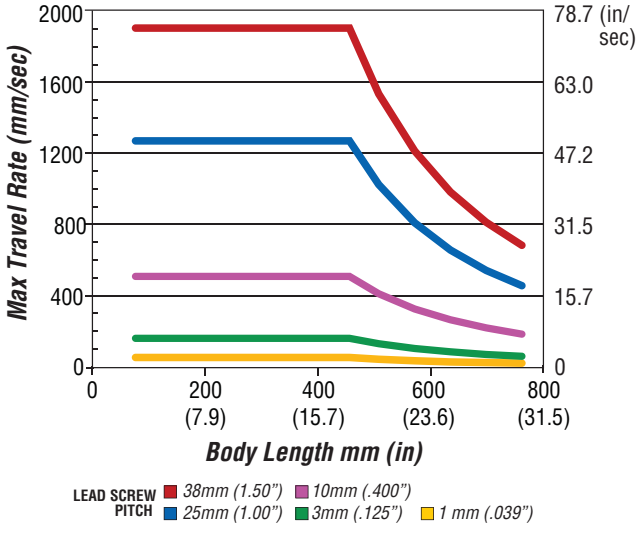


MAXIMUM CANTILEVERED LENGTH

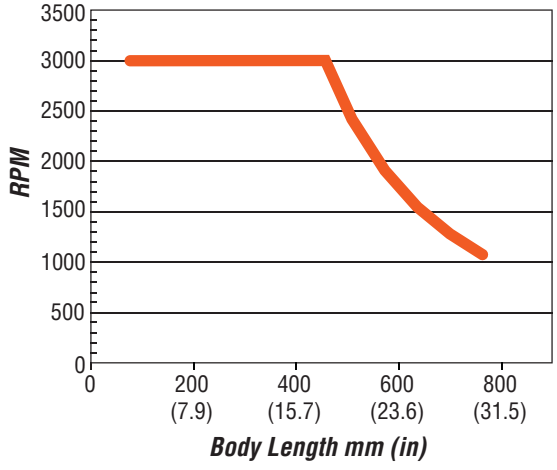




MAXIMUM TRAVEL SPEEDS



80% OF CRITICAL SPEED



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MLB Series (Integrated Motor)

- **Includes motor, coupling and motor assembly**
- **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

MLB028D –	X	XX	X	X	X	–	####

Series
Motor or Lead Screw Driven 28 x 32 mm

Linear Guide Supports*
- **0** No External Rail
- **1** (1) Rail, (1) Runner Block - XY-2 Brkt (R)
- **2** (1) Rail, (2) Runner Blocks - XY-2 Brkt (R)
- **3** (2) Rail, (1) Runner Block - XY-3 Brkt
- **4** (2) Rail, (2) Runner Blocks - XY-3 Brkt
- **5** (1) Rail, (1) Runner Block - XY-2 Brkt (L)
- **6** (1) Rail, (2) Runner Blocks - XY-2 Brkt (L)
- **7** No Seal Strip - XY-1 Brkt

*(L) = Left (R) = Right

Lead
- **AH** 1mm
- **AG** 2mm
- **AX** 5mm
- **AJ** 10mm
- **BD** 12mm
- **AF** 16mm
- **AW** 25mm
- **AS** 1.5 in

Nut Type
- **2** **Standard Nut**
- **4** Anti-backlash (light preload)
- **6** Anti-backlash (normal preload)

Seal Strip
- **0** **None**
- **1** With Seal Strip & XY Bracket

of Carriages
- **1** **1 Carriage**
- **2** 2 Carriages
- **3** 3 Carriages
- **4** 4 Carriages

NOTE: Contact manufacturer before ordering multiple carriages.

Body Length
(mm)

See page 11 for body length calculation table

EX: 90mm = 0090
250mm = 0250

X	X	X	X	XX	0

Motor Location
- **S** Straight
- **L** Left
- **R** Right
- **B** Bottom
- **T** Top

Motor Make
- **1** PBC Linear™ Open loop stepper motor
- **3** FASTech® EZI-Step BT with integral drive. Open loop stepper motor
- **4** FASTech® EZI-Servo Closed loop stepper motor
- **5** Omron® A/C, brushless servo motor

Motor Frame Size
- **B** NEMA 11 (28mm)
- **C** NEMA 14 (35mm)
- **F** NEMA 17 (42mm)
- **G** NEMA 23 (56mm)
- **E** Metric 40mm

Motor Power
- **B** Single Stack
- **C** Double Stack*
- **D** Triple Stack

* not available with NEMA 14

- **A** 1/2 Stack
- **B** Single Stack
- **C** Double Stack
- **D** Triple Stack
- **F** 50W
- **G** 100W

Motor Features
- **00** Hybrid wiring (8 wires), flying leads, no encoders [hybrid wiring can be bi-polar or uni-polar]
- **00** Bi-polar wiring, flying leads, no encoder
- **01** 2,000 resolution (pulse/rev) encoder (std)
- **03** 16,000 resolution (pulse/rev) encoder
- **02** 10,000 resolution (pulse/rev) encoder (std)
- **04** 20,000 resolution (pulse/rev) encoder
- **05** 32,000 resolution (pulse/rev) encoder
- **01** 120V input, INC encoder, NO brake
- **02** 120V input, INC encoder, with brake
- **03** 120V input, ABS encoder, NO brake
- **04** 120V input, ABS encoder, with brake
- **05** 240V input, INC encoder, NO brake
- **06** 240V input, INC encoder, with brake
- **07** 240V input, ABS encoder, NO brake
- **08** 240V input, ABS encoder, with brake

Configuration
- **0** Standard

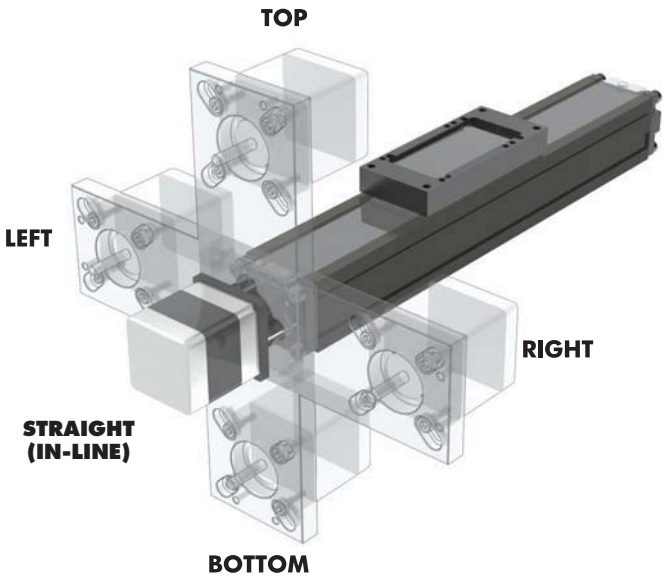
FINAL PART #

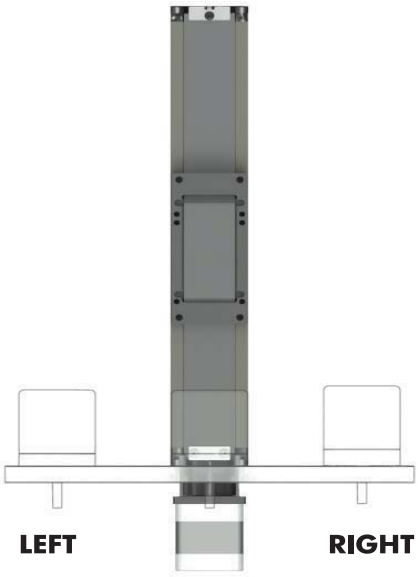
MLB028D -	X	XX	X	X	X	-	XXXX	-	X	X	X	X	XX	0

NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1mm increments up to 701mm. Standard lengths are multiples of 10mm. When possible round up to nearest multiple of 10mm. 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.

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.





Motor Options

STEPPER MOTORS	
PBC Linear™ brand stepper motors are designed to reduce length in the ML actuator. Other stepper motor brands have a longer shaft and require a spacer to ensure all motors will be compatible. Single, double and triple stack motors are available in each size. See page 16 for dimensional data.	
FASTech® applies state-of-the-art monitoring and drive advancements into their EZi-Step™ motor for precision, speed and power. Built with an internal unique algorithm and sensorless stall detection, these stepper motors assure faultless control. The EZi-Step also employs digital signal processors to guarantee high precision and high speed drive. Available in open or closed loop designs. Contact PBC Linear's for FASTech motor options and availability.	
SERVO MOTORS	
OMRON servo motors provide a large variety of functions featuring high-precision positioning with improved response and vibration control, making it suitable for a wide range of application. Contact PBC Linear's Application Engineers for Omron motor options and availability.	

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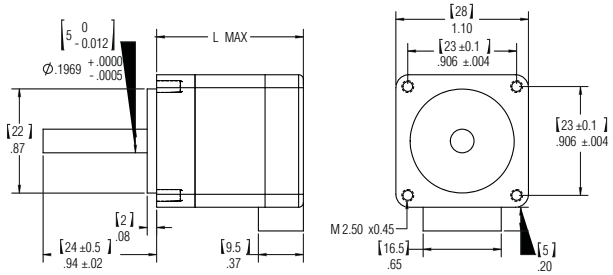
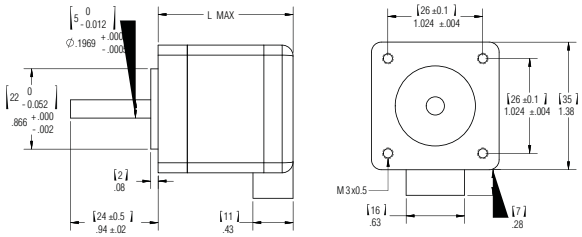
Stepper Motor

PBC LINEAR
A PACIFIC BEARING CO.

NEMA 11 (28mm)

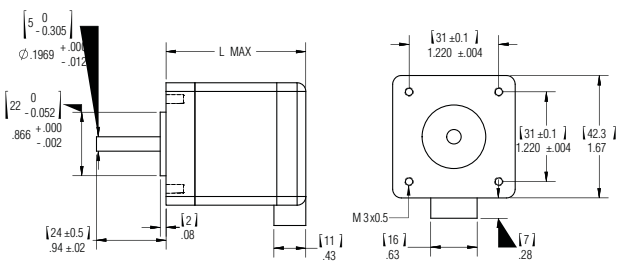


NEMA 14 (35mm)

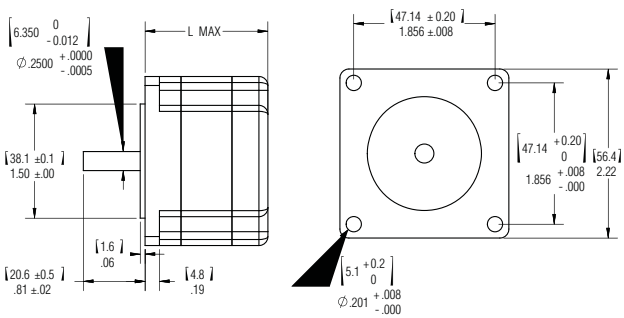


NEMA Rating	Motor Power	Current per Phase	Holding Torque		Detent Torque		Rotor Intertia		Length mm (in)	Weights kg (lb)	Model P/N #
		A	mN • m	oz-in	mN • m	oz-in	g-cm²	oz-in²			
NEMA 11	Single	1	50	7.08	5	0.71	9	0.05	31 (1.21)	0.10 (0.22)	**6200297**
NEMA 11	Double	0.67	90	12.75	6	0.85	12	0.07	40 (1.56)	0.15 (0.33)	**6200298**
NEMA 11	Triple	1	100	14.16	8	1.13	18	0.1	51 (2.01)	0.20 (0.44)	**6200299**
NEMA 14	Single	0.4	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	1.5	360	50.99	15	2.12	57	0.31	39.8 (1.57)	0.28 (0.62)	**6200303**
NEMA 17	Double	1.5	490	69.41	25	3.54	82	0.45	48.3 (1.90)	0.36 (0.79)	**6200304**
NEMA 17	Triple	1.5	630	89.24	30	4.25	123	0.68	62.8 (2.47)	0.60 (1.32)	**6200305**
NEMA 23	Single	1.5	500	70.82	22	3.12	135	0.74	41 (1.61)	0.42 (0.93)	**6200306**
NEMA 23	Double	1.5	1000	141.64	40	5.66	260	1.43	54 (2.13)	0.60 (1.32)	**6200307**
NEMA 23	Triple	1.4	1650	233.71	70	9.91	460	2.53	76 (2.99)	1.00 (2.20)	**6200308**

NEMA 17 (42mm)



NEMA 23 (56mm)



Stepper Motor

FASTECH

FASTech applies state-of-the-art monitoring and drive advancements into their Ezi-SERVO® motor for precision, speed and power. Built with an internal unique algorithm, no hunting and sensorless stall detection, these stepper motors assure faultless control. The Ezi-SERVO® also employs digital signal processors to guarantee high precision and high speed drive. Available in closed or open loop designs (Ezi-STEP®).

Ezi-SERVO® Closed Loop Stepping System

***Ezi-SERVO* - Closed Loop Stepping System**
- High Resolution Optical Encode
- No Gain Tuning or Hunting
- High Speed Operation using Internal DC-DC Converter (24VDC - 40VDC)
- Short Settling Time (Fast in-position) signal
- Software Dampening (Smooth Operation)

Ezi-SERVO® Plus-R Closed Loop Stepping System with Network based Motion Controller

***Ezi-SERVO Plus-R* - Closed Loop Stepping System with Network based Motion Controller**
- Integrated Motion Controller
- Powerful and Various motion control functions
- No Gain Tuning or Hunting
- High Resolution
- Short Settling Time (Fast in-position) signal
- Software Dampening (Smooth Operation)

Ezi-STEP® BT Integrated Drive

Ezi-STEP BT
- Integrated Drive
- Sensorless Stall Detection (400 rpm)
- Software Dampening
- Run/Stop Signal Output

Ezi-STEP® ST Micro Stepping System

Ezi-STEP ST
- High Precision Microstep Operation
- Sensorless Stall Detection (400 rpm)
- Software Dampening
- Run/Stop Signal Output
- Drive sold separately

Ezi-STEP® Plus-R Micro Stepping Drive

***Ezi-STEP Plus-R* with Network based Motion Controller**
- Integrated Micro-stepping (50,000 step/rev.)
- Sensorless Stall Detection (400 rpm)
- Software Dampening
- Run/Stop Signal Output
- Motor sold separately *(MLB excluded.)*

CHOOSING THE RIGHT STEPPER MOTOR

DO YOU NEED AN ENCODER?

DO YOU NEED A NETWORK CONTROLLER?	**YES- CLOSED LOOP**	**NO - OPEN LOOP**
YES	Ezi-SERVO® Plus-R Closed Loop Stepping System with Network based Motion Controller	PBC LINEAR MOTORS + Ezi-STEP® Plus-R Micro Stepping Drive
NO	Ezi-SERVO® Closed Loop Stepping System	PBC LINEAR MOTORS + Ezi-STEP® ST Micro Stepping System
		Ezi-STEP® BT Integrated Drive

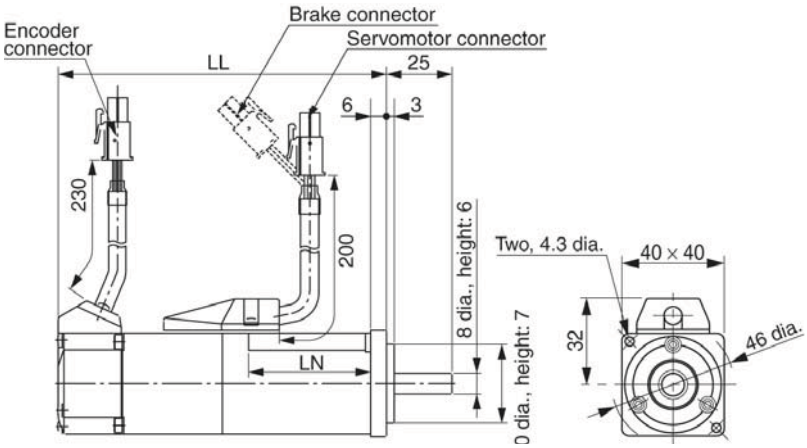
Servo Motors - OM-R88M-G

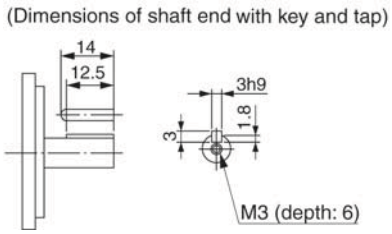
Omron Servo Motors deliver smooth performance for accurate positioning combined with Servo Drivers OM-R7D-B and OM-R88D-G. They meet international standards for use in machinery worldwide. All models have a shaft key and top.

OM-R88M-G Servo Motors

SERVO MOTOR DATA							
Voltage	**Rated Power**	**RPM**	**Encoder**	**Brake**	**LL**	**LN**	**Drive Compatibility**
100V/200V	50W	3000	Incremental	Yes	102	26.5	OM-R7D-B, OM-R88D-G
100V/200V	50W	3000	Incremental	No	72	26.5	OM-R7D-B, OM-R88D-G
100V/200V	50W	3000	Absolute	Yes	102	26.5	OM-R88D-G
100V/200V	50W	3000	Absolute	No	72	26.5	OM-R88D-G
100V	100W	3000	Incremental	Yes	122	46.5	OM-R7D-B, OM-R88D-G
100V	100W	3000	Incremental	No	92	46.5	OM-R7D-B, OM-R88D-G
100V	100W	3000	Absolute	Yes	122	46.5	OM-R88D-G
100V	100W	3000	Absolute	No	92	46.5	OM-R88D-G
200V	100W	3000	Incremental	Yes	122	46.5	OM-R7D-B, OM-R88D-G
200V	100W	3000	Incremental	No	92	46.5	OM-R7D-B, OM-R88D-G
100V	100W	3000	Absolute	Yes	122	46.5	OM-R88D-G
100V	100W	3000	Absolute	No	92	46.5	OM-R88D-G

Dimensional Data



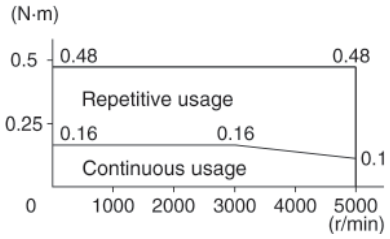


KEY SPECIFICATIONS	
Part #	**OM-R88M-G**
Structure	Totally enclosed, self-cooling; rated IP 65
Operating Position	All Directions
Insulation G	Type B
Ambient operating temperature and humidity	0 to 40°C, 85% RH max.
Vibration Resistance	10 to 2,500 Hz and acceleration of 49 m/s^2 max. in the X, Y, and Z directions
Impact Resistance	Acceleration of 98 m/s^2 max. 3 times each in the X, Y, and Z directions
International Standards	EMC Directive: EN 55011 class A group 1, EN 61000-6-2, IEC 61000-4-2/-3/-4/-5/-6/-11 Low voltage Directive: IEC 60034-1/-5 UL standards: UL 508C cUL standards: CSA 22.2 No.100

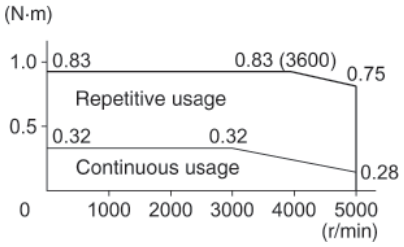
Speed - Torque Performance - 3,000-r/min Cylindrical Servomotors

(OM-R88D-G DRIVES) - 100-VAC POWER INPUT

OM-R88M-G05030H/T (50 W)

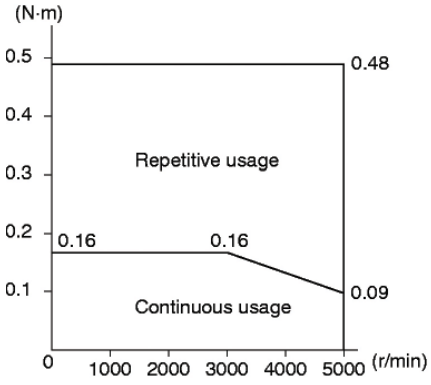


OM-R88M-G10030L/S (100 W)

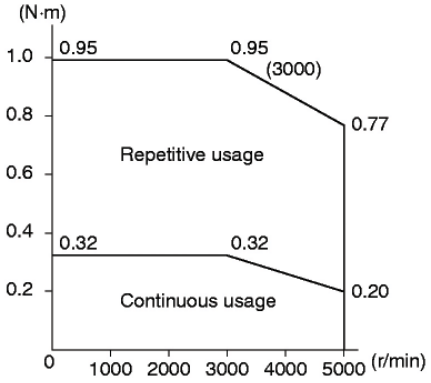


(OM-R7D-B DRIVES) - 100-VAC POWER INPUT

OM-R88M-G05030H

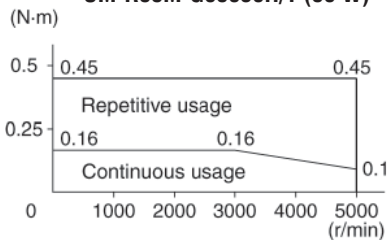


OM-R88M-G10030L

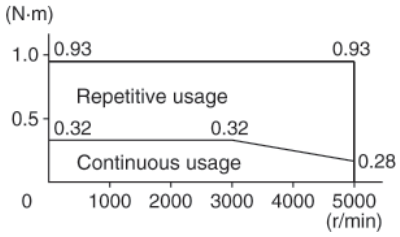


(OM-R88D-G DRIVES) - 200-VAC POWER INPUT

OM-R88M-G05030H/T (50 W)

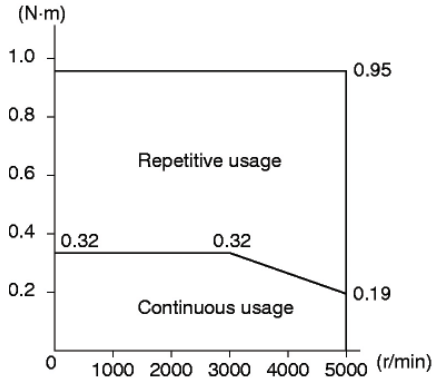


OM-R88M-G10030H/T (100 W)



(OM-R7D-B DRIVES) - 200-VAC POWER INPUT

OM-R88M-G10030H



FOR MORE INFORMATION CONTACT AN APPLICATION ENGINEER AT 888-777-0556

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Servo Drives - OM-R7D

Omron's OM-R7D-B provides high-speed pulse train output to OM-R88M-G servomotors for straightforward control applications. Simple real-time auto-tuning continuously sets optimum gain and eliminates the need for complicated adjustments. Vibration caused by resonance is suppressed to improve positioning accuracy even in systems with low mechanical rigidity.

In addition to conventional CW/CCW inputs (2 pulses) and SIGN/PULS inputs (1 pulse), the OM-R7D-B servo drive supports 90° phase difference input. This makes it possible to input encoder output signals directly into the Servo Drive for simplified synchronization control.

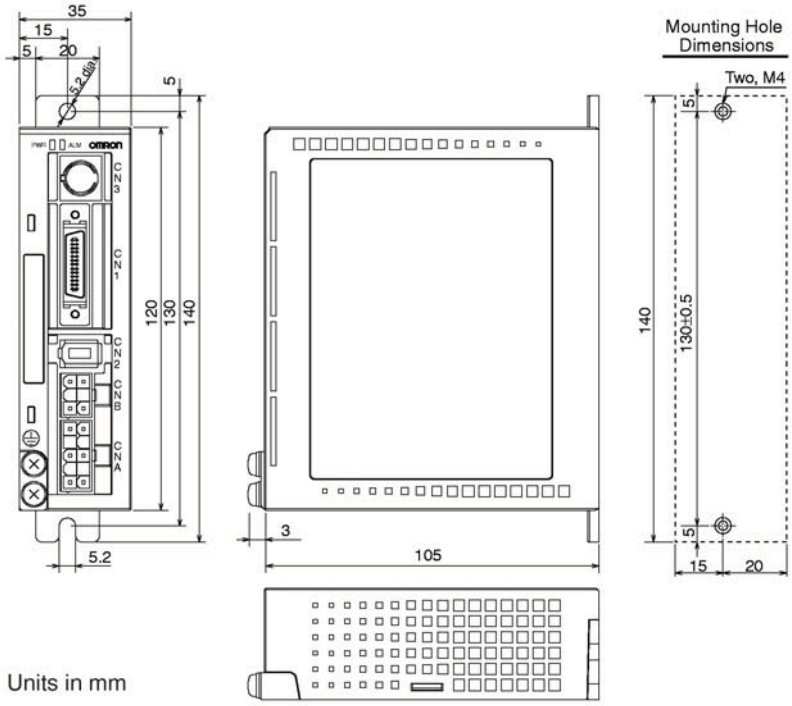
OM-R7D Servo Drive

SERVO DRIVE			
Part #	**Voltage**	**Servomotor Capacity**	**Motor Compatibility**
OM-R7D-BPA5L	100V, single-phase	50W	OM-R88M-G05030H
OM-R7D-BP01L	100V, single-phase	100W	OM-R88M-G10030L
OM-R7D-BP01H	200V, single-phase /three-phase	100W	OM-R88M-G10030H

POWER SUPPLY CABLES		
Part #	**Voltage**	**Length**
OM-R7A-CLB002S2	Single-phase	2m
OM-R7A-CLB002S3	Three-phase	2m

MOTOR TO DRIVE CABLES		
Part #	**Motor Brake**	**Length**
OM-R7A-CAB003S	Power cable	3m
OM-R7A-CAB005S	Power cable	5m
OM-R7A-CAB010S	Power cable	10m
OM-R7A-CAB015S	Power cable	15m
OM-R7A-CAB020S	Power cable	20m
OM-R88A-CAGA003B	Power and Brake cable	3m
OM-R88A-CAGA005B	Power and Brake cable	5m
OM-R88A-CAGA010B	Power and Brake cable	10m
OM-R88A-CAGA015B	Power and Brake cable	15m
OM-R88A-CAGA020B	Power and Brake cable	20m
OM-R88A-CRGB003C	Encoder cable	3m
OM-R88A-CRGB005C	Encoder cable	5m
OM-R88A-CRGB010C	Encoder cable	10m
OM-R88A-CRGB015C	Encoder cable	15m
OM-R88A-CRGB020C	Encoder cable	20m

Dimensional Data



SERVO DRIVE SPECIFICATIONS			
Part #	**OM-R7D-BPA5L**	**OM-R7D-BP01L**	**OM-R7D-BP01H**
Input power supply voltage	Single-phase 100 to 115 VAC(85 to 127 V), 50/60 Hz		Both single-phase and three-phase 200 to 240 VAC (170 to 264 V), 50/60 Hz
Maximum response frequency	Command pulses: Line drive: 500 kpps, Open collector: 200 kpps		
Operating ambient	0 to 55°C, 90% RH max.		
Vibration resistance	10 to 60 Hz; acceleration: 5.9 m/s2 (0.6 G) max.		
Impact resistance	Acceleration of 19.6 m/s2 max. 3 times each in X, Y, and Z directions.		
International standards	EMC Directive: EN 55011 class A group 1, EN 61000-6-2 Low Voltage Directive: EN 50178 UL/cUL standards: UL 508C, cUL C22.2 No.14		

Terminal Blocks & Cables - OM-R7D

Select the Servo Terminal Block (Relay Unit) and cable according to the part number of the Position Control Unit being used.

SYSMAC CJ-series
Programmable Controller

CJ1W-NCF71
Position Control Unit

Servo Relay Units

OM-R7D-B
Servo Drive

Use With OM-R7D Servo Drives

TERMINAL BLOCK (RELAY UNITS) & CABLES			
Position Control Unit	**Position Control Unit Cable**	**Servo Terminal Block (Relay Unit)**	**Servo Drive Cable***
OM-CJ1W-NC133	OM-XW2Z-050J-A18 OM-XW2Z-100J-A18	OM-XW2B-20J6-1B	OM-XW2Z-100J-B29 OM-XW2Z-200J-B29
OM-CJ1W-NC233	OM-XW2Z-050J-A19 OM-XW2Z-100J-A19	OM-XW2B-40J6-2B	
OM-CJ1W-NC433			
OM-CS1W-NC133	OM-XW2Z-050J-A10 OM-XW2Z-100J-A10	OM-XW2B-20J6-1B	
OM-CS1W-NC233	OM-XW2Z-050J-A11 OM-XW2Z-100J-A11	OM-XW2B-40J6-2B	
OM-CS1W-NC433			
OM-CJ1W-NC113	OM-XW2Z-050J-A14 OM-XW2Z-100J-A14	OM-XW2B-20J6-1B	
OM-CJ1W-NC213	OM-XW2Z-050J-A15 OM-XW2Z-100J-A15	OM-XW2B-40J6-2B	
OM-CJ1W-NC413			
OM-CS1W-NC113	OM-XW2Z-050J-A6 OM-XW2Z-100J-A6	OM-XW2B-20J6-1B	
OM-C200HW-NC113			
OM-CS1W-NC213	OM-XW2Z-050J-A7 OM-XW2Z-100J-A7	OM-XW2B-40J6-2B	
OM-CS1W-NC413			
OM-C200HW-NC213			
OM-C200HW-NC413			
OM-CJ1M-CPU21	OM-XW2Z-050J-A33 OM-XW2Z-100J-A33	OM-XW2B-20J6-8A OM-XW2B-40J6-9A (for 2 axes)*	OM-XW2Z-100J-B32 OM-XW2Z-200J-B32
OM-CJ1M-CPU22			
OM-CJ1M-CPU23			
OM-CQM1H-PLB21	OM-XW2Z-050J-A3 OM-XW2Z-100J-A3	OM-XW2B-20J6-3B	OM-XW2Z-100J-B29 OM-XW2Z-200J-B29

***NOTE:** Two (2) servo drive cables are required if 2-axis control is performed.
Cable Length (050 = 0.5 m 100 = 1 m 200 = 2 m)

FOR CP1H/CP1L OR GENERAL PURPOSE CONTROLLERS		
Specifications		**Part #**
Connector Terminal Block Cables	1 m	OM-XW2Z-100J-B28
	2 m	OM-XW2Z-200J-B28
General-Purpose Control Cables	1 m	OM-R7A-CPB001S
	2 m	OM-R7A-CPB002S
Connector Terminal Block	M3 screw type	OM-XW2B-34G4
	M3.5 screw type	OM-XW2B-34G5

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Servo Drives - G-Series

Omron's OM-R88D-GT drives offer pulse/analog output for reliable position control. Integrate multiple axes easily with OM-R88D-GN drives with high-speed Mechatrolink-II motion network.

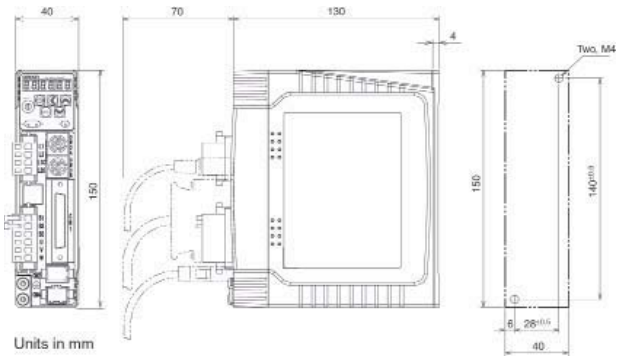
Eight internal speed settings allow you to change the speed easily by using external signals. Command Control Mode lets you switch operations between two of the following control modes for multi-phase processes: Position control, speed control (including internal speed) and torque control. Simple real-time auto-tuning continuously sets optimum gain and eliminates the need for complicated adjustments.

Vibration caused by resonance is suppressed to improve positioning accuracy.

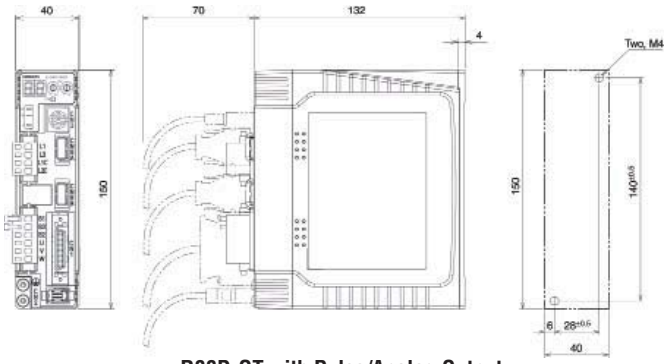
G-Series Servo Drive

SERVO DRIVES				
Part #	**Voltage**	**Servomotor Capacity**	**Output**	**Motor Compatibility**
OM-R88D-GTA5L	120V, single-phase	50W	Pulse/Analog	OM-R88M-G05030H, OM-R88M-G05030T
OM-R88D-GT01L	120V, single-phase	100W	Pulse/Analog	OM-R88M-G10030L, OM-R88M-G10030S
OM-R88D-GT01H	240V, single-phase	100W	Pulse/Analog	OM-R88M-G10030H, OM-R88M-G10030T
OM-R88D-GNA5L-ML2	120V, single-phase	50W	Mechatrolink-II	OM-R88M-G05030H, OM-R88M-G05030T
OM-R88D-GN01L-ML2	120V, single-phase	100W	Mechatrolink-II	OM-R88M-G10030L, OM-R88M-G10030S
OM-R88D-GN01H-ML2	240V, single-phase	100W	Mechatrolink-II	OM-R88M-G10030H, OM-R88M-G10030T

Dimensional Data



R88D-GT with Pulse/Analog Output



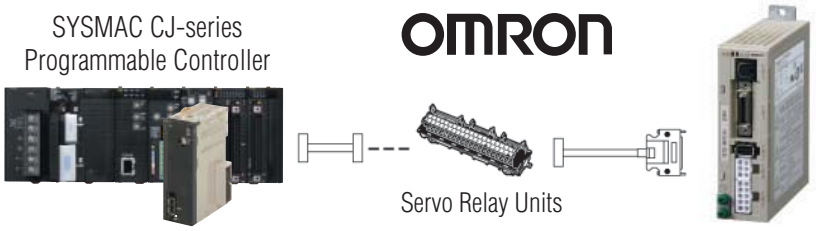
R88D-GT with Pulse/Analog Output

MOTOR TO DRIVE CABLES		
Part #	**Motor Brake**	**Length**
OM-R88A-CAGA003S	Power cable	3m
OM-R88A-CAGA005S	Power cable	5m
OM-R88A-CAGA010S	Power cable	10m
OM-R88A-CAGA015S	Power cable	15m
OM-R88A-CAGA020S	Power cable	20m
OM-R88A-CAGA003B	Power and Brake cable	3m
OM-R88A-CAGA005B	Power and Brake cable	5m
OM-R88A-CAGA010B	Power and Brake cable	10m
OM-R88A-CAGA015B	Power and Brake cable	15m
OM-R88A-CAGA020B	Power and Brake cable	20m

ENCODER CABLES		
Part #	**Cable Type**	**Length**
OM-R88A-CRGB003C	Incremental Encoder cable	3m
OM-R88A-CRGB005C	Incremental Encoder cable	5m
OM-R88A-CRGB010C	Incremental Encoder cable	10m
OM-R88A-CRGB015C	Incremental Encoder cable	15m
OM-R88A-CRGB020C	Incremental Encoder cable	20m
OM-R88A-CRGA003C	Absolute Encoder cable	3m
OM-R88A-CRGA005C	Absolute Encoder cable	5m
OM-R88A-CRGA010C	Absolute Encoder cable	10m
OM-R88A-CRGA015C	Absolute Encoder cable	15m
OM-R88A-CRGA020C	Absolute Encoder cable	20m

Terminal Blocks & Cables - G-Series

Select the Servo Terminal Block (Relay Unit) and cable according to the part number of the Position Control Unit being used.



Use With OM-R88D-GT Servo Drives

TERMINAL BLOCK (RELAY UNITS) & CABLES			
Position Control Unit	**Position Control Unit Cable**	**Servo Terminal Block (Relay Unit)**	**Servo Drive Cable**
OM-CQM1H-PLB21	0.5m = OM-XW2Z-050J-A3 1m = OM-XW2Z-100J-A3	OM-XW2B-20J6-3B	1m = OM-XW2Z-100J-B25 2m = OM-XW2Z-200J-B25
OM-CS1W-NC113	0.5m = OM-XW2Z-050J-A6 1m = OM-XW2Z-100J-A6	OM-XW2B-20J6-1B	
OM-C200HW-NC113			
OM-CS1W-NC213	0.5m = OM-XW2Z-050J-A7 1m = OM-XW2Z-100J-A7	OM-XW2B-40J6-2B	
OM-CS1W-NC413			
OM-C200HW-NC213			
OM-C200HW-NC413			
OM-CS1W-NC133	0.5m = OM-XW2Z-050J-A10 1m = OM-XW2Z-100J-A10	OM-XW2B-20J6-1B	
OM-CS1W-NC233	0.5m = OM-XW2Z-050J-A11 1m = OM-XW2Z-100J-A11	OM-XW2B-40J6-2B	
OM-CS1W-NC433			
OM-CJ1W-NC113	0.5m = OM-XW2Z-050J-A14 1m = OM-XW2Z-100J-A14	OM-XW2B-20J6-1B	
OM0CJ1W-NC213	0.5m = OM-XW2Z-050J-A15 1m = OM-XW2Z-100J-A15	OM-XW2B-40J6-2B	
OM-CJ1W-NC413			
OM-CJ1W-NC133	0.5m = OM-XW2Z-050J-A18 1m = OM-XW2Z-100J-A18	OM-XW2B-20J6-1B	
OM-CJ1W-NC233	0.5m = OM-XW2Z-050J-A19 1m = OM-XW2Z-100J-A19	OM-XW2B-40J6-2B	
OM-CJ1W-NC433			
OM-CJ1M-CPU21	0.5m = OM-XW2Z-050J-A33 1m = OM-XW2Z-100J-A33	OM-XW2B-20J6-8A (for 1 axes) OM-XW2B-20J6-8A (for 1 axes)	1m = OM-XW2Z-100J-B31 2m = OM-XW2Z-200J-B31
OM-CJ1M-CPU22			
OM-CJ1M-CPU23			

Use With OM-R88D-GT/GN Servo Drives

CP1H1/CP1L OR GENERAL PURPOSE CONTROLLERS			
Specification		**Part #**	
Connector Terminal Block Cables	1 m	R88A-CPG001S	OM-XW2Z-100J-B33
	2 m	R88A-CPG002S	OM-XW2Z-200J-B33
Control Cables with Connector on One End	1 m	XW2Z-100J-B24	-
	2 m	XW2Z-200J-B24	-
Connector Terminal Block	M3 screw type	XW2B-50G4	OM-XW2B-20G4
	M3.5 screw type	XW2B-50G5	OM-XW2B-20G5
	M3 screw type	XW2D-50G6	OM-XW2D-20G6

MOTION CONTROL UNIT CABLE		
There are special cables for 1-axis and 2-axis Motion Control Unit operation. Select the appropriate cable for the number of axes to be connected.		
Motion Control Unit	**Cable Part #**	
OM-CS1W-MC221-V1/421-V1	For 1 axis	OM-R88A-CPG☐☐☐ M1
	For 2 axes	OM-R88A-CPG☐☐☐ M2
The ☐☐☐ digits in the model number indicate the cable length. Motion Control Unit Cables come in four lengths: 1 m, 2 m. 3 m, and 5 m EXAMPLE Part#: for 2-m 1-axis cable: OM-R88A-CPG002M1.		

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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's 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 x 32mm	**0** No External Rail **1** (1) Rail, (1) Runner Block - XY-2 Brkt (R) **2** (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) **3** (2) Rail, (1) Runner Block - XY-3 Brkt **4** (2) Rail, (2) Runner Blocks - XY-3 Brkt **5** (1) Rail, (1) Runner Block - XY-2 Brkt (L) **6** (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) **7** No Seal Strip - XY-1 Brkt	**AH** 1mm **AG** 2mm **AX** 5mm **AJ** 10mm **BD** 12mm **AF** 16mm **AW** 25mm **AS** 1.5in	**2** **Standard Nut** **4** Anti-backlash (light preload) **6** Anti-backlash (normal preload)	**0** **None** **1** With Seal Strip & XY Bracket	**1** **1 Carriage** **2** 2 Carriages **3** 3 Carriages **4** 4 Carriages NOTE: Contact manufacturer before ordering multiple carriages.

*(L) = Left (R) = Right

#### –	X	X	X	X	X	0

Body Length	Motor Location	Motor Frame Size	Shaft OD	Coupling Material	Spacer Config	Config.
mm See page 11 for body length calculation table EX: 90mm = 0090 250mm = 0250	**S** Straight (in-line) **L** Left **R** Right **B** Bottom **T** Top	**A** NEMA 8 (20mm) **B** NEMA 11 (28mm) **C** NEMA 14 (35mm) **E** Metric 40 **F** NEMA 17 (42mm) **G** NEMA 23 (56/58mm)	**A** 3mm **B** 0.125 in **C** 4mm **D** 0.1875 in **E** 5mm **F** 6mm **G** 0.25 in **H** 0.3125 in **J** 8mm	**1** Acetal	**A** Standard **B** **C** **D** Contact PBC application engineer to specify spacer before ordering	**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.

FINAL PART #	MLC028D	-	X	XX	X	X	X	-	XXXX	-	X	X	X	X	X	0

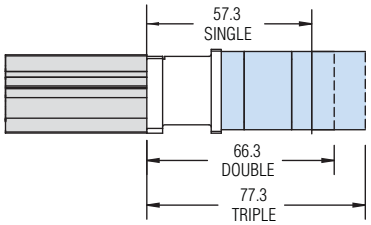
NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1mm increments up to 701mm. Standard lengths are multiples of 10mm. When possible round up to nearest multiple of 10mm. NEMA 11 stepper motors typically do not have enough torque to 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.

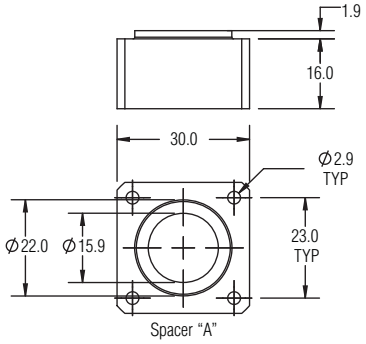
Motor Mount Assembly

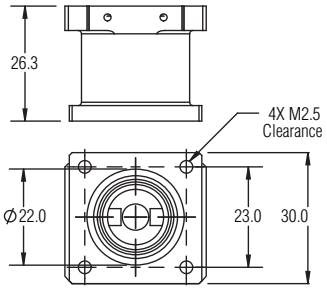
ML Series Actuator | Motor Mount & Spacer | PBC Stepper Motor

ASSEMBLY DIMENSIONS	SPACER	MOTOR FRAME SIZE

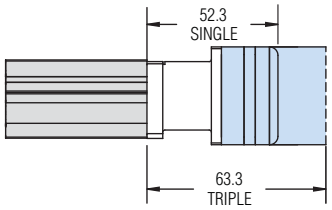
Recommended for **NEMA 11** Stepper Motor

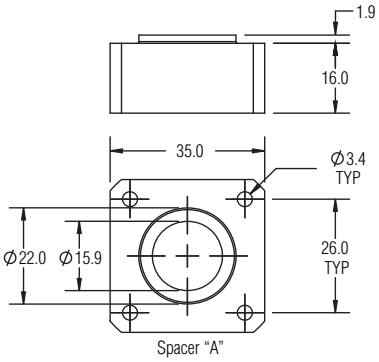


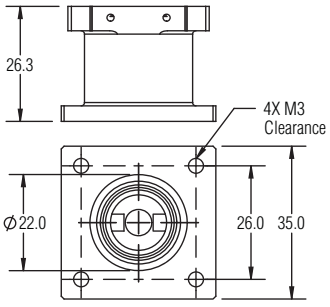




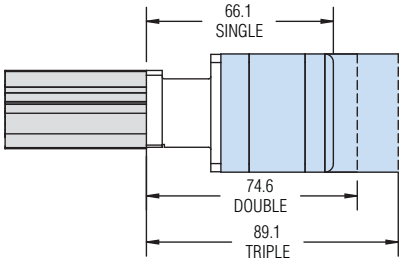
Recommended for **NEMA 14** Stepper Motor

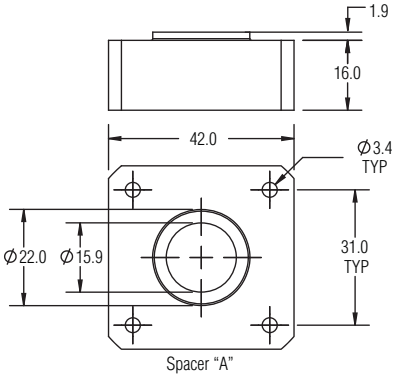


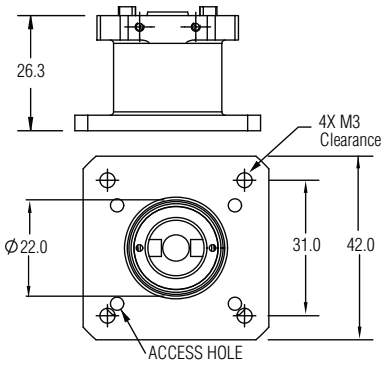




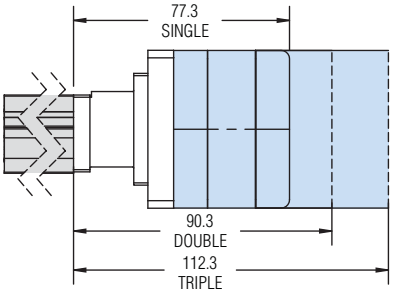
Recommended for **NEMA 17** Stepper Motor

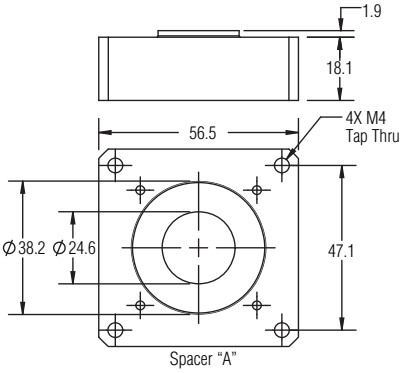


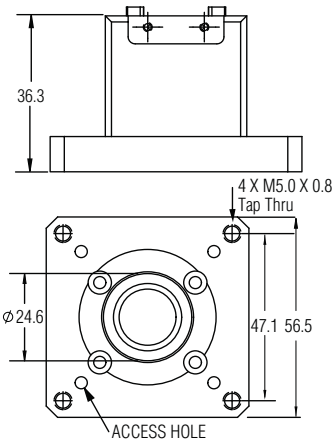




Recommended for **NEMA 23** Stepper Motor







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**

MLD ORDERING GUIDE

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 x 32 mm	**0** No External Rail **1** (1) Rail, (1) Runner Block - XY-2 Brkt (R) **2** (1) Rail, (2) Runner Blocks - XY-2 Brkt (R) **3** (2) Rail, (1) Runner Block - XY-3 Brkt **4** (2) Rail, (2) Runner Blocks - XY-3 Brkt **5** (1) Rail, (1) Runner Block - XY-2 Brkt (L) **6** (1) Rail, (2) Runner Blocks - XY-2 Brkt (L) **7** No Seal Strip - XY-1 Brkt	**AH** 1mm **AG** 2mm **AX** 5mm **AJ** 10mm **BD** 12mm **AF** 16mm **AW** 25mm **AS** 1.5 in	**2** **Standard Nut** **4** Anti-backlash (light preload) **6** Anti-backlash (normal preload)	**0** **None** **1** With Seal Strip & XY Bracket	**1** **1 Carriage** **2** 2 Carriages **3** 3 Carriages **4** 4 Carriages NOTE: Contact manufacturer before ordering multiple carriages.

*(L) = Left (R) = Right

####	-	X	X	0

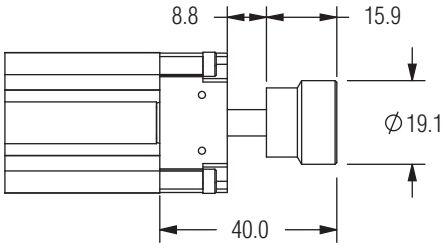
Body Length	-	(Drive) Knob	Brake	Configuration
mm See page 11 for body length calculation table EX: 90mm = 0090 250mm = 0250		**0** No - shaft only **1** Yes - with knob	**0** No **1** Yes (at drive end)	**0** Standard

FINAL PART #	MLD028D	-	X	XX	X	X	X	-	XXXX	-	X	X	0

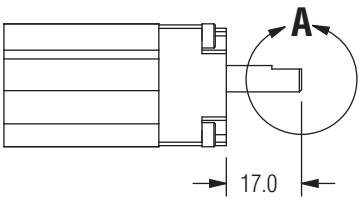
NOTE: Not all combinations are possible. Contact manufacturer for available combinations. Body lengths are available in 1mm increments up to 701mm. Standard lengths are multiples of 10mm. When possible round up to nearest multiple of 10mm. Specifications are subject to change without notice.

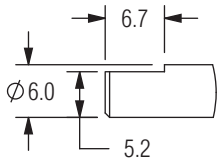
Dimensional Data

KNOB

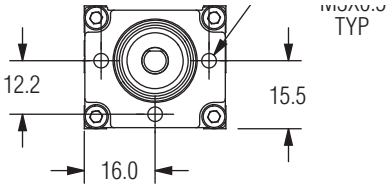


SHAFT ONLY.

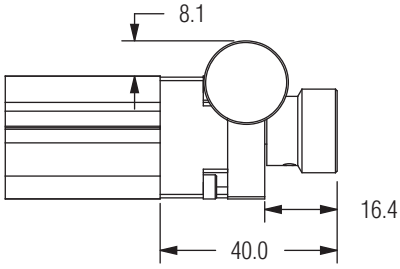


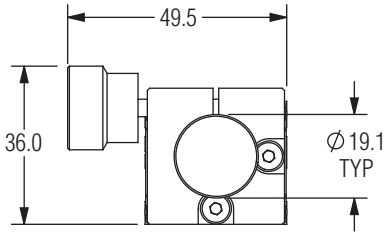


DETAIL A



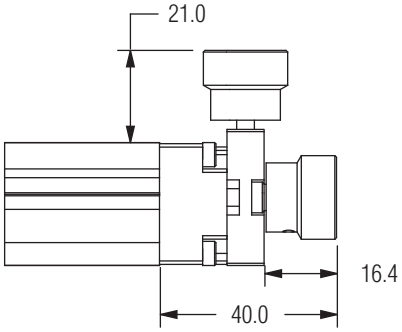
HAND BRAKE SIDE MOUNT

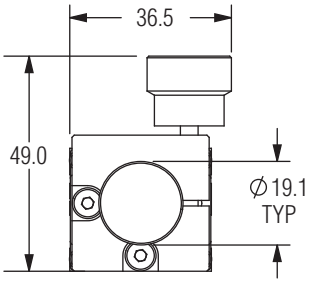




NOTE: Brake installed on side as default and can easily be changed to the top by the customer.

HAND BRAKE TOP MOUNT





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Build Your ML Actuator

6 Easy Steps

Follow these easy-to-follow steps to build your ML Series Actuator

STEP 1

Configure Your System Axis

a. Determine if you need an external linear guide for support *(pg. 10 and 24)*
b. Calculate the body length *(pg. 11)*

STEP 2

Choose The Drive Method

a. Motor pre-mounted and tested by PBC? ➡ MLB *(Page 14)*
b. Ready to mount your own motor? ➡ MLC *(Page 18)*
c. Driven by hand? ➡ MLD *(Page 20)*

STEP 3

Choose How To Mount The Axis

a. Choose dovetail clamps or riser plates
(Use riser plates with NEMA 17 and 23 motors) *(Page 27)*

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

STEP 5

Choose The Cable Carrier

a. List all cables to run through carrier
b. Complete selection calculation
c. Choose mounting type/location (bracket type)

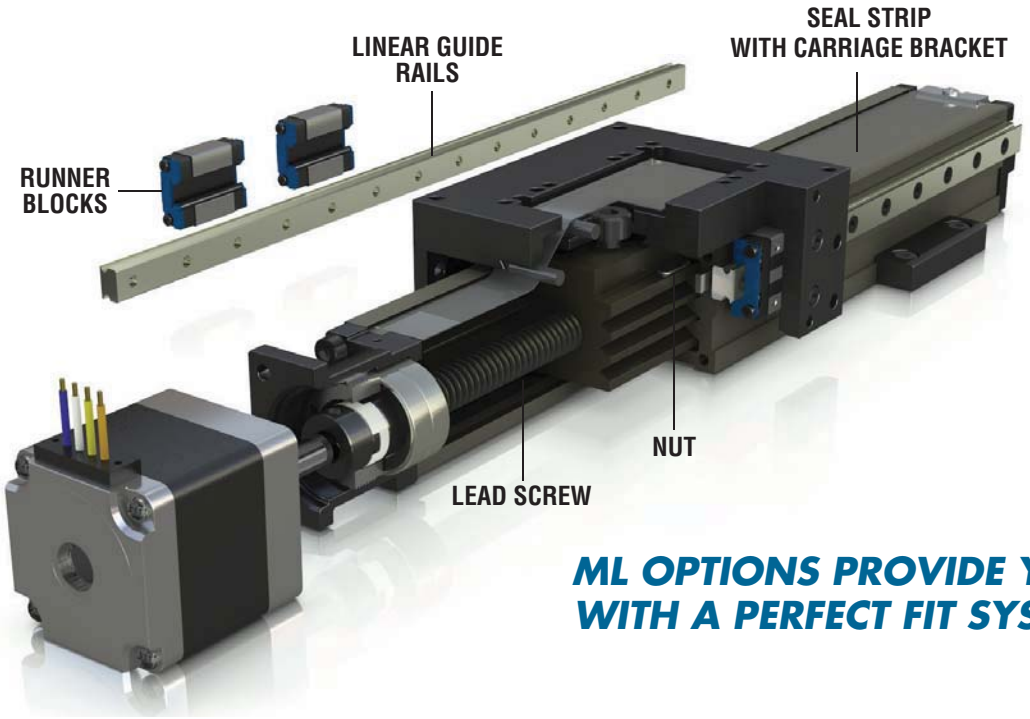
Repeat 1-5 for each axis

STEP 6

Order Your System
1-800-962-8979 or 1-815-389-5600

Questions? Call an Application Engineer 1-888-777-0556

Ordering Options



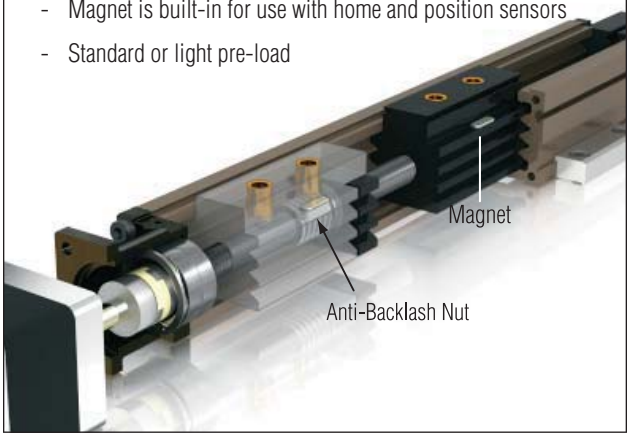
ML OPTIONS PROVIDE YOU WITH A PERFECT FIT SYSTEM

LEAD SCREW

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

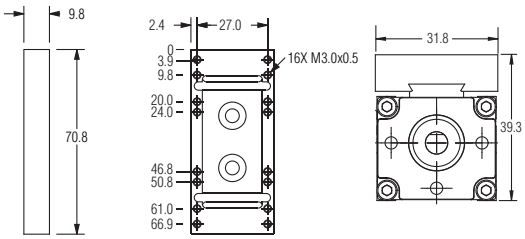
NUT TYPE

- Standard nut or anti-backlash nut
- 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
- Standard or light pre-load



SEAL STRIP WITH CARRIAGE BRACKET

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



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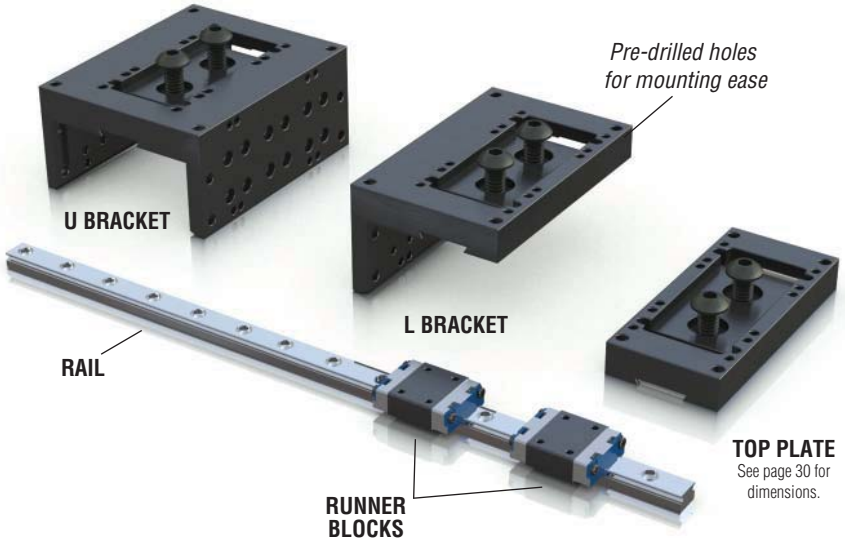
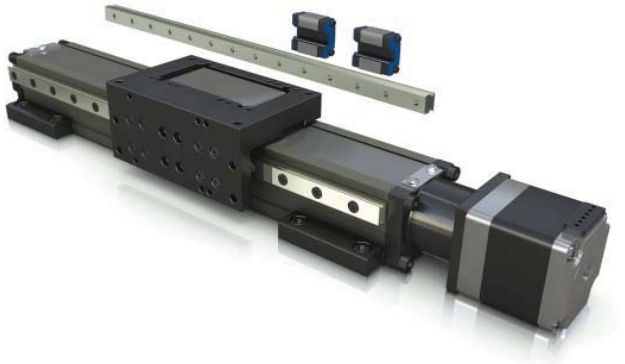
Linear Guide Supports

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.





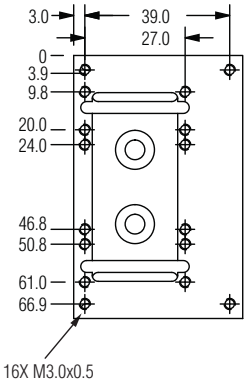
SUPPORT OPTIONS TO CREATE VARIABLE LEVELS OF PERFORMANCE

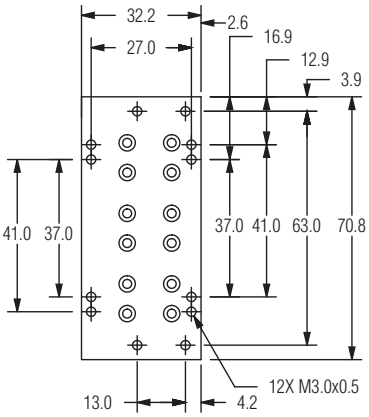
Technical Data Linear Guide Supports			(1) Single		(2) Dual			(1) Single		(2) Dual	
			# of runner blocks on each guide					# of runner blocks on each guide			
			1	2	1	2		1	2	1	2
Max. Load Anti-Backlash - Lite Preload	**Fx**	N	44	44	44	44	lbf	10	10	10	10
- Normal Preload			89	89	89	89		20	20	20	20
Standard Nut			267	267	267	267		60	60	60	60
	Fy		180	250	445	890		40	56	100	200
	Fz		267	356	445	890		60	80	100	200
Max. Moments	**Mx**	Nm	1.8	3.6	8.6	18	lbf-in	16	32	76	160
	My		1.8	5	3.6	10		16	44	32	88
	Mz		1.8	5	3.6	10		16	44	32	88
Bending Moment of Inertia (Second moment of area)	**Iy**	cm^4	2.4	2.4	2.4	2.4	in^4	0.058	0.058	0.058	0.058
	Iz		4.4	4.4	4.4	4.4		0.106	0.106	0.106	0.106
Base Weight without Motor		Kg	0.127	0.136	0.195	0.205	lbf	0.28	0.30	0.43	0.45
Add for 100mm of Stroke			0.18	0.18	0.21	0.21		0.40	0.40	0.46	0.46
Total Carriage Mass		Kg	.109	.117	.159	.175	lbm	.240	.257	.350	.385
Coefficent of Friction			0.19		0.01			0.19		0.01	

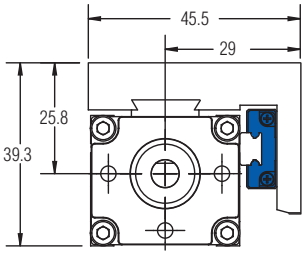
NOTE:
1. Moment arms for calculating moments should be measured from the center of the extrusion.
2. Limit switches must be used in order to prevent the carriage from contacting the actuator end blocks, resulting in damage.
3. Servo drive system - Recommended overtravel of 20mm
4. Stepper motors or manual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

Dimensional Data

SINGLE LINEAR GUIDE SUPPORTS







LEFT **RIGHT**

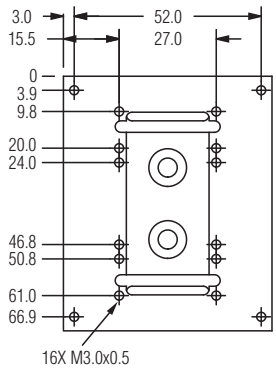
INCLUDES:

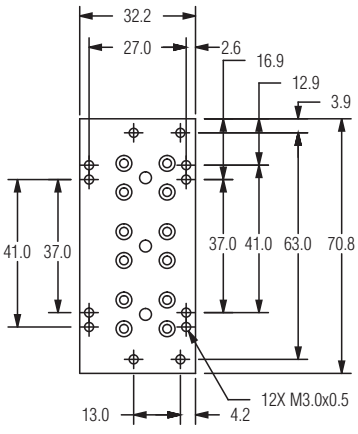
(1) rail, (1) runner block & aluminum alloy L shaped carriage bracket

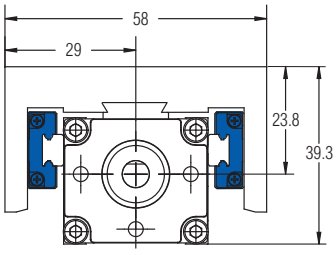
- or -

(1) rail, (2) runner blocks & aluminum alloy L shaped carriage bracket

DUAL LINEAR GUIDE SUPPORTS







INCLUDES:

2) rails, (1) runner block & aluminum alloy U shaped carriage bracket

- or -

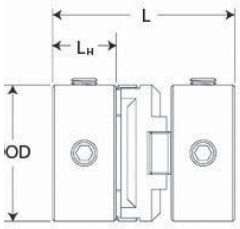
(2) rails, (2) runner blocks & aluminum alloy U shaped carriage bracket

Motor Couplings

MOTOR COUPLING (HUB & DISK)

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

HUB



DISK

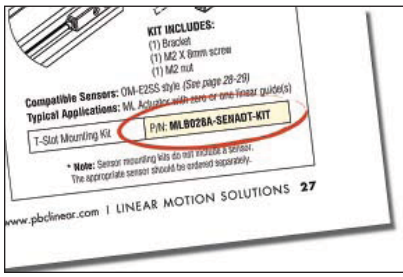
FOR USE WITH NEMA 11, 14, 17 MOTORS								
HUBS P/N #	BORE*	OD	HUB LENGTH (LH)	COUPLING LENGTH (L)	SHAFT PENETRATION	SET SCREW	MOMENT OF INERTIA (lb-in^2)	MOMENT OF INERTIA (kg x m^2)
6200129	3mm	12.7mm	5.6mm	15.9mm	5.6mm	M3	0.0056"	1.64E-06
6200286	5mm	12.7mm	5.6mm	15.9mm	5.6mm	M3	0.0050"	1.47E-06
6200350	6mm	12.7mm	5.6mm	15.9mm	5.6mm	M3	0.0047"	1.37E-06
6200113	.125"	0.500"	.222"	.625"	.222"	M3	0.0056"	1.64E-06
6200349	.250"	0.500"	.222"	.625"	.222"	M3	0.0045"	1.32E-06

FOR USE WITH NEMA 23 MOTORS ONLY.								
HUBS P/N #	BORE*	OD	HUB LENGTH (LH)	COUPLING LENGTH (L)	SHAFT PENETRATION	SET SCREW	MOMENT OF INERTIA (lb-in^2)	MOMENT OF INERTIA (kg x m^2)
6200130	4mm	19.1mm	7.6mm	22.2mm	7.6mm	M3	0.0069	2.02E-06
6200131	5mm	19.1mm	7.6mm	22.2mm	7.6mm	M3	0.0068	1.99E-06
6200132	6mm	19.1mm	7.6mm	22.2mm	7.6mm	M3	0.0066	1.94E-06
6200133	8mm	19.1mm	7.6mm	22.2mm	7.6mm	M3	0.0061	1.79E-06
6200114	.1875"	.750"	.300"	.875"	.300"	M3	0.0068	1.99E-06
6200115	.250"	.750"	.300"	.875"	.300"	M3	0.0065	1.91E-06
6200116	.3125"	.750"	.300"	.875"	.300"	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 (kg x m^2)
		(mm)	(in)	(Deg/ Nm)	(Deg /lb-in)	(Nm)	(lb-in	(Nm)	(lb-in	(mm)	(in)	(mm)	(in)	
6200148	Acetal	12.7	0.5	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	0.1	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

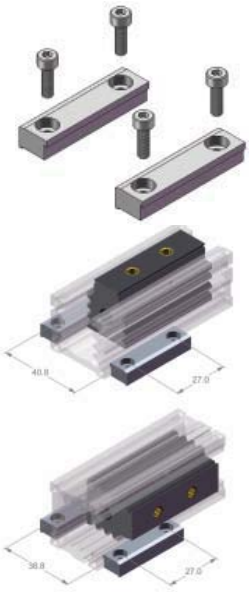


Ordering Accessories

When ordering ML accessories the part number (P/N) can be located in a yellow box next to the item. The item part number can be given separately when placing your ML actuator order. If you have technical question contact a PBC Application Engineer at at **1-800-962-8979.**

Mounting Hardware (Clamps, Plates & Sensor Kits)

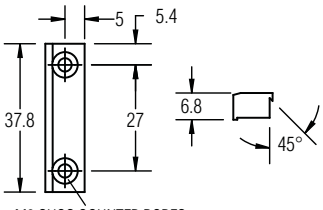
ACTUATOR MOUNTING



DOVETAIL CLAMPS

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

KIT INCLUDES:
(2) M3 Dovetail Clamp
(4) M3 x 10mm SHCS

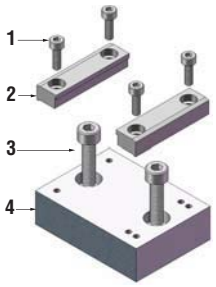


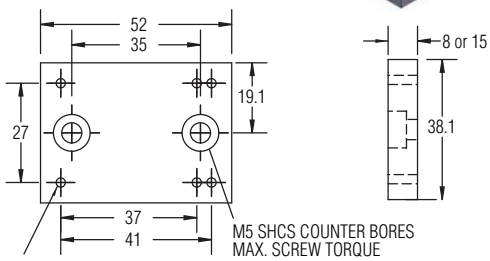
M3 SHCS COUNTER BORES
MAX. SCREW TORQUE = .8 N-m (7 in-lbf)

Single Dovetail Clamp only.	P/N: **MLA028A-HDC-M3**
Dovetail Clamp Kit	P/N: **MLA028A-HDC-M3-KIT**

RISER PLATES

INCLUDES:
1. (4) M3 x 10mm SHCS
2. (2) M3 Dovetail Clamp
3. (2) M5 x 16mm SHCS
4. (1) 8mm or 15mm Riser Plate





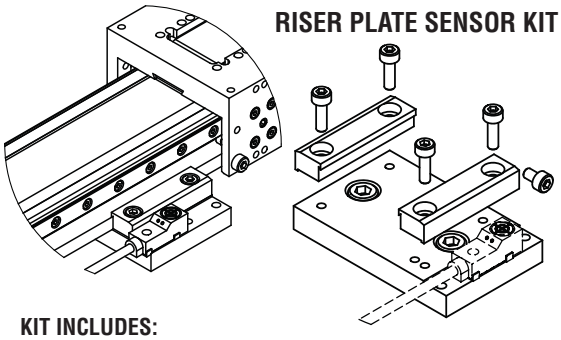
M5 SHCS COUNTER BORES
MAX. SCREW TORQUE
= 1.1 N-m (10 in-lbf)

6X M3 X0.5 - 6H ↧ 6.5
MAX. SCREW TORQUE = .8 N-m (7 in-lbf)

RECOMMENDED FOR NEMA 14 & 17 MOTOR	
8mm Riser Plate only	P/N: **MLA028A-RSRPLT-08**
8mm Riser Plate Kit	P/N: **MLA028A-RSRPLT-08 -KIT**
RECOMMENDED FOR NEMA 23 MOTOR	
15mm Riser Plate only	P/N: **MLA028A-RSRPLT-15**
15mm Riser Plate Kit	P/N: **MLA028A-RSRPLT-15-KIT**

SENSOR MOUNTING KITS

RISER PLATE SENSOR KIT

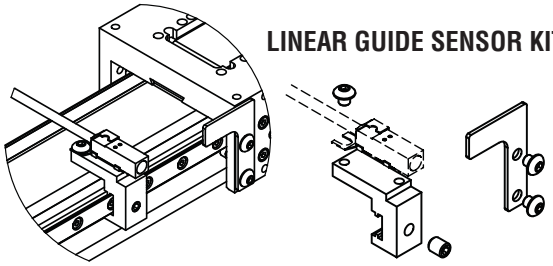


KIT INCLUDES:
(1) Riser plate (8 or 15mm)
(4) M3 x 10mm screws
(1) M3 x 6mm screw
(2) Dovetail clamps
(1) M3 x 12mm screw
(2) M5 x 16mm screw (optional)

Compatible Sensors: OM-E2S-W2 style *(See page 28-29)*
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

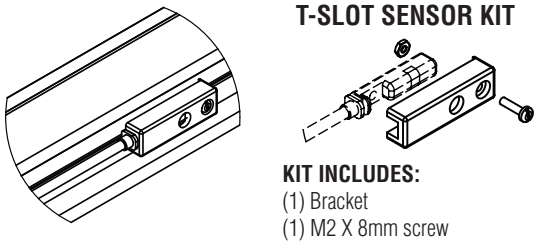


KIT INCLUDES:
(1) Bracket
(3) M3 X 4mm screws
(1) Flag, 5mm sensing distance
(1) OM-Y92E-C1R6 Bracket
(1) M4 X 5mm set screw

Compatible Sensors: OM-E2S-Q1 style *(See page 28-29)*
Typical Applications: ML Actuators with one or two linear guide(s)

Linear Guide Sensor Kit	P/N: **MLB028A-BRKTA-KIT**

T-SLOT SENSOR KIT



KIT INCLUDES:
(1) Bracket
(1) M2 X 8mm screw
(1) M2 nut

Compatible Sensors: OM-E2SS style *(See page 28-29)*
Typical Applications: ML Actuator with zero or one linear guide(s)

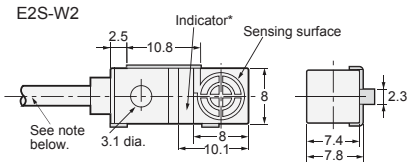
T-Slot Sensor Kit	P/N: **MLB028A-SENADT-KIT**

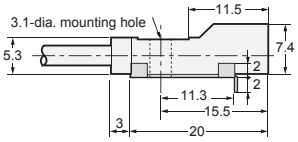
*** Note:** Sensor mounting kits do not include a sensor. The appropriate sensor should be ordered separately.

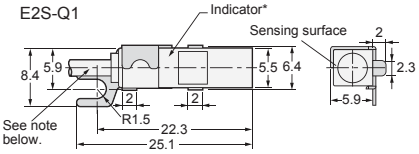
Proximity Sensors

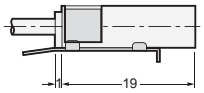
SUPER COMPACT PROXIMITY SENSORS

OM-E2S-W2
OM-E2S-Q1



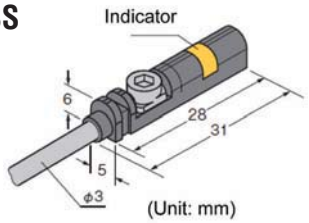


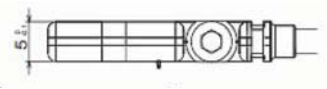


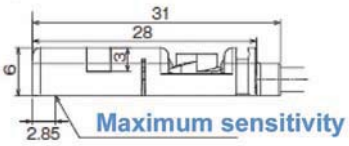


NOTE: 2.9-dia. vinyl-insulated round cable with 2/3 conductors. (Conductor cross section: 0.14 mm^2, Insulator diameter: 0.9 mm), Standard length: 1m

OM-E2SS

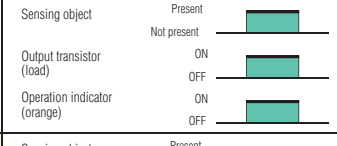
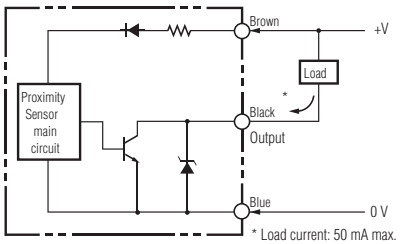
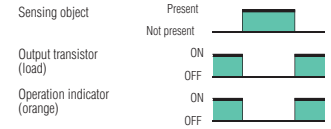
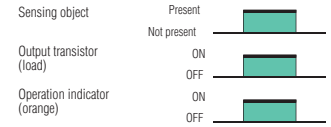
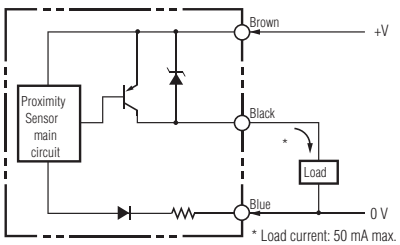
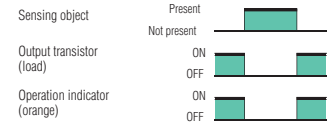






Sensing Surface	Sensing Distance	Sensor Series	Output Configuration	Cable: 5m Flying Lead		Cable: 275mm M8 Quick Disconnect	
				Normally Open (NO)	Normally Closed (NC)	Normally Open (NO)	Normally Closed (NC)
End	1.6mm	**OM-E2S-Q**	NPN	OM-E2S-Q13-☐	**OM-E2S-Q14-5M**	OM-E2S-Q13-U2	**OM-E2S-Q14-U2**
			PNP	OM-E2S-Q15-☐	OM-E2S-Q16-5M	OM-E2S-Q15-U2	OM-E2S-Q16-U2
Front/Top	2.5mm	**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	**OM-E2SS**	NPN	Contact manufacturer to order.			
			PNP	Contact manufacturer to order.			

NOTE: Omron and FASTtech drives require NPN sensors. Omron drives require NC sensors. If in doubt, order one of the sensors highlighted above in **yellow.**
☐ = length of cable 5M" = 5 meters with flying lead; U2 = 275mm with quick disconnect

Operation Status	Output Configuration	P/N #	Timing Chart	Output Circuits
NO	NPN	OM-E2S-W23-☐ OM-E2S-Q13-☐		
NC	NPN	OM-E2S-W24-☐ OM-E2S-Q14-☐		
NO	PNP	OM-E2S-W25-☐ OM-E2S-Q15-☐		
NC	PNP	OM-E2S-W26-☐ OM-E2S-Q16-☐		

Model P/N:		OM-E2S-W13 OM-E2S-W14	OM-E2S-W23 OM-E2S-W24	OM-E2S-Q15 OM-E2S-Q16	OM-E2S-W25 OM-E2S-W26	OM-E2SS
Sensing surface		Front	Top	Front	Top	N/A
Sensing distance		1.6mm ± 15%	2.5mm ± 15%	1.6mm ± 15%	2.5 mm ± 15%	N/A
Set distance		0 to 1.2mm	0 to 1.9mm	0 to 1.2mm	0 to 1.9mm	N/A
Differential travel		10% max of sensing distance				N/A
Detectable object type		Ferrous metal				N/A
Standard target object		Iron, 12 x 12 x 1 mm	Iron, 15 x 15 x 1 mm	Iron, 12 x 12 x 1 mm	Iron, 15 x 15 x 1 mm	N/A
Response frequency (see note)		1 kHz min.				1 kHz max.
Power supply voltage (operating voltage range)		12 to 24V DC, ripple (p-p): 10% max., (10 to 30V DC)				10 to 30V DC ripple 10% max
Current Consumption		13 mA max. at 24 VDC (no-load)				15mA max
Operation Mode (with sensing object approaching)		OM-E2S-_ _ 3 models: NO OM-E2S-_ _ 4 models NC				N/A
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.)		150mA max.
	Residual voltage	1.0 V max. with a load current of 50 mA and a cable length of 1 m				2V max. (at 150mA load current 2m cable)
Indicator		Operation indicator (orange)				(yellow)
Protection Circuits		Reverse polarity connection and surge absorber				Output short-circuit, Output reverse polarity, Power supply reverse polarity
Ambient temperature	Operating	-25°C to 70°C (-13°F to 158°F) with no icing or condensation				
	Storage	-40°C to 85°C (-40°F to 185° F) with no icing or condensation				-25 to 70°C (No Freezing)
Ambient humidity	Operating	35% to 90% (with no condensation)				35 to 95%RH
	Storage	35% to 95% (with no condensation)				35 to 95%RH
Temperature influence		± 15% max. of sensing distance at 23° in the temperature range of -25 to 70° C				N/A
Voltage Influence		± 2.5% max. of sensing distance in rated voltage range ± 10%				N/A
Insulation resistance		50 M min. (500V VDC) between current carry parts and case				
Dielectric strength		1,000 VAC, 50/60 Hz for 1 min between current carry parts and case				500 VAC, 50/60 Hz
Vibration resistance		Destruction: 10 to 55 Hz, 1.0 mm double amplitude for 2 hours each in X, Y and Z directions				
Shock resistance		Destruction: 500 m/s² (1640 ft/s²) 3 times each in X, Y and Z directions				Mechanical durability; 300m/s2
Connection Method		Pre-wired standard length 1 m (39.37 in)				Normal: Pre-wire (standard 2m) -M`J:M12 Connector with Cable (Cable: 0.3m)
Weight (packed state)		Approx. 10 g (0.35 oz)				N/A
Material/Case		Polyarylate resin				Case: PP, Code: PUR

Magnetic sensitivity	2.8mT max.
Hysteresis	1mm max.
Repeatability	±0.1mm max.
Pass speed	10 m/s

SENSOR IO CONNECTOR

- Extension cables for M8 quick disconnect sensor.
- Simplifies maintenance and reduces downtime.

- Single-end I/O connector with female socket with attached cable.

Length	Regular Flex P/N:	High/Robotic Flex P/N:
2m	OM-XS3F-M421-402-A	OM-XS3F-M421-402-R
5m	OM-XS3F-M421-405-A	OM-XS3F-M421-405-R
10m	OM-XS3F-M421-410-A	OM-XS3F-M421-410-R

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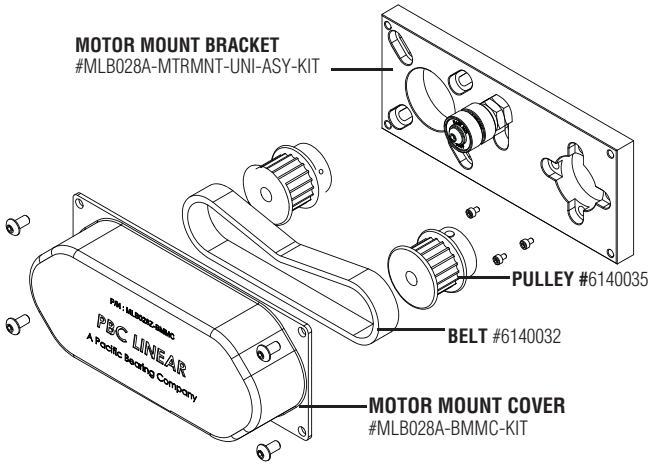
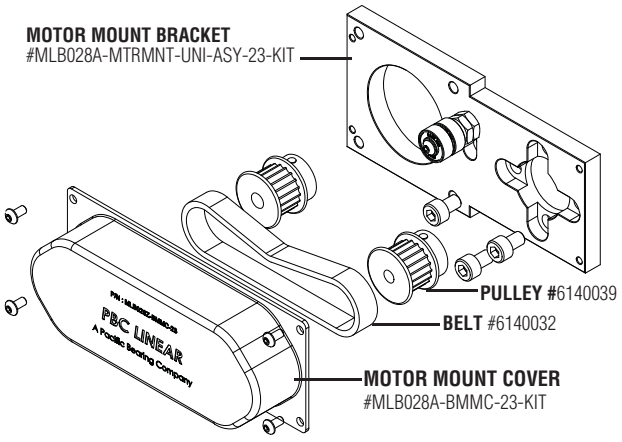
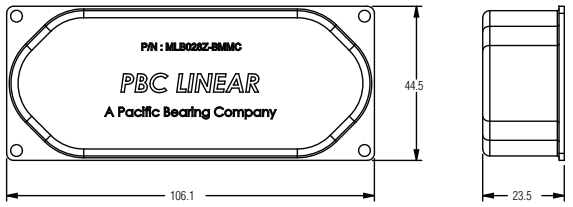
Motor Mount Assembly - Replacement Parts



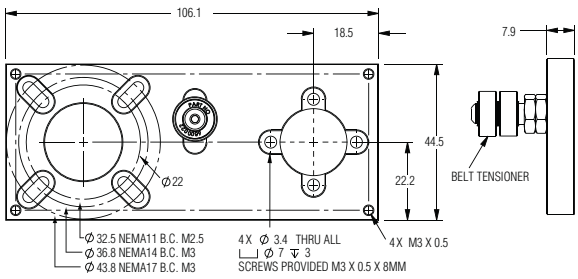


MOTOR MOUNT ASSEMBLY - NEMA 11/14/17



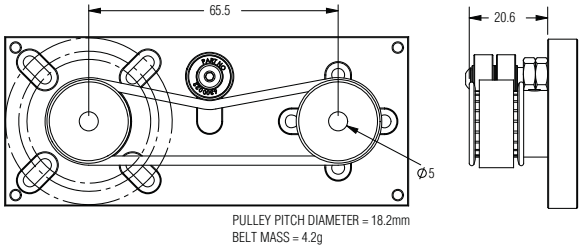
INCLUDES:

(1) Motor Mount Cover (4) BHCS M3 x 0.5 x 6mm	P/N: **MLB028A-BMMC-KIT**



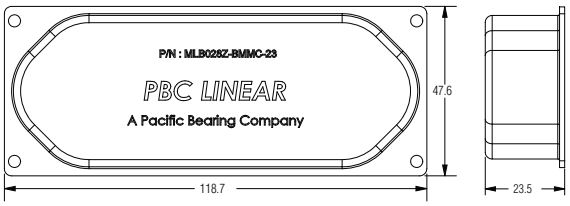
INCLUDES:

(1) Motor Mount Bracket (3) SHCS M3 x 0.5 x 8mm	P/N: **MLB028A-MTRMNT-UNI-ASY-KIT**



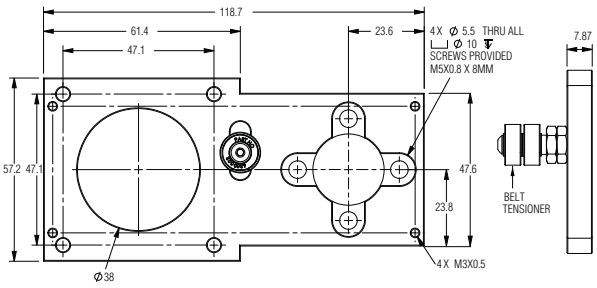
(1) Pulley Belt (3mm pitch)	P/N: **6140032**
(2) Timing Pulley, 9mm x 5mm	P/N: **6140035**

MOTOR MOUNT ASSEMBLY - NEMA 23



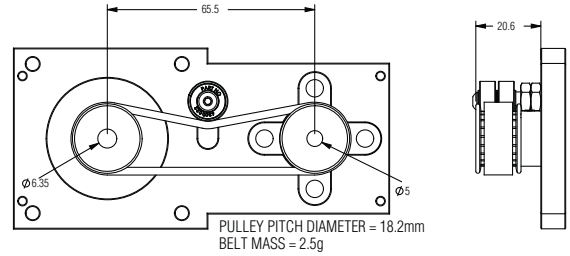
INCLUDES:

(1) Motor Mount Cover (4) BHCS M3 x 0.5 x 8mm	P/N: **MLB028A-BMMC-23-KIT**



INCLUDES:

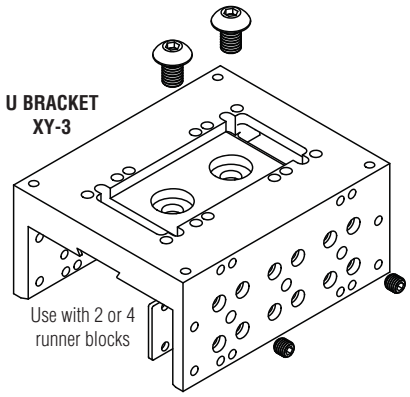
(1) Motor Mount Bracket (3) SHCS M5 x 0.8 x 8mm	P/N: **MLB028A-MTRMNT-UNI-ASY-23-KIT**

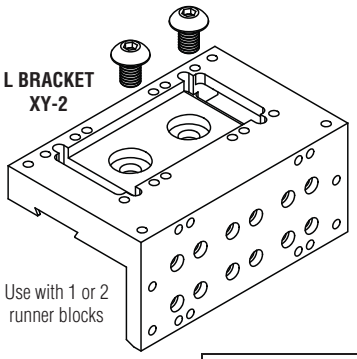


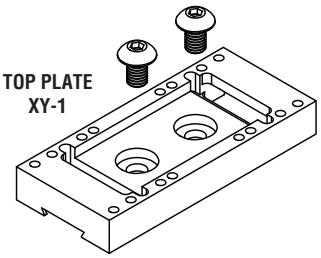
(1) Pulley Belt (3mm pitch)	P/N: **6140032**
(1) Timing Pulley, 9mm x 6.35mm	P/N: **6140039**
(1) Timing Pulley, 9mm x 5mm	P/N: **6140035**

Upgrade System Parts

CARRIAGE BRACKET KIT (For use with linear guide supports or seal strip)



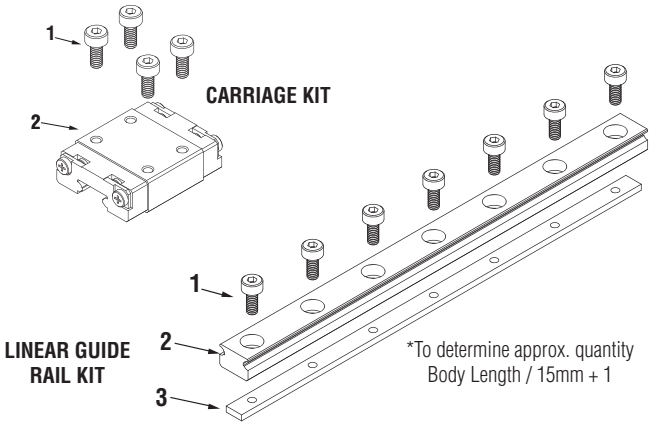




INCLUDES: Bracket & (2) BHCS M5 x 0.8 x 8mm LG
Linear guide supports sold separately.

U Bracket (XY-3)	P/N: **MLB028A-XY-3BRKT-KIT**
L Bracket (XY-2)	P/N: **MLB028A-XY-2BRKT-KIT**
Top Bracket (XY-1)	P/N: **MLB028A-XY-1BRKT-KIT**

LINEAR GUIDE KITS



CARRIAGE KIT INCLUDES: *(rail sold separately.)*
1. (4) SHCS M2 x 0.4 x 5mm
2. (1) Runner Block

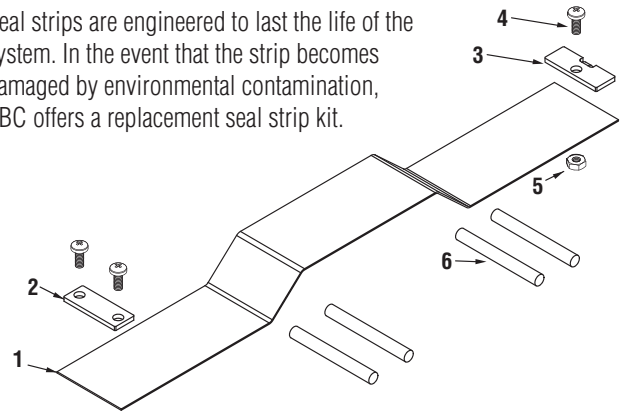
LINEAR GUIDE RAIL KIT INCLUDES: *(Carriage sold separately.)*
1. (##)* SHCS M2 x 0.4 x 5mm
2. (1) Rail
3. (1) Mounting Bar

Linear Carriage Kit	P/N: **MLA028A-NBC-KIT**
Linear Guide Rail Kit	P/N: **MLA028A-NBR-XXXX-KIT**

XXXX = Body Length of Actuator - 1mm

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 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 M2 x 0.4 x 5mm
5. (1) Hexagon Nut, M2 x 0.4
6. (4) Bearings

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

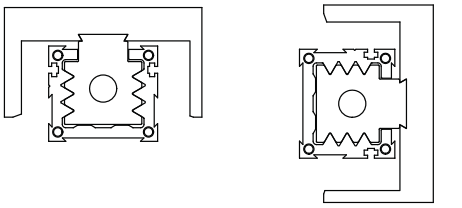
Seal strip is 725mm in length and can be cut shorter using sharp pair of scissors.

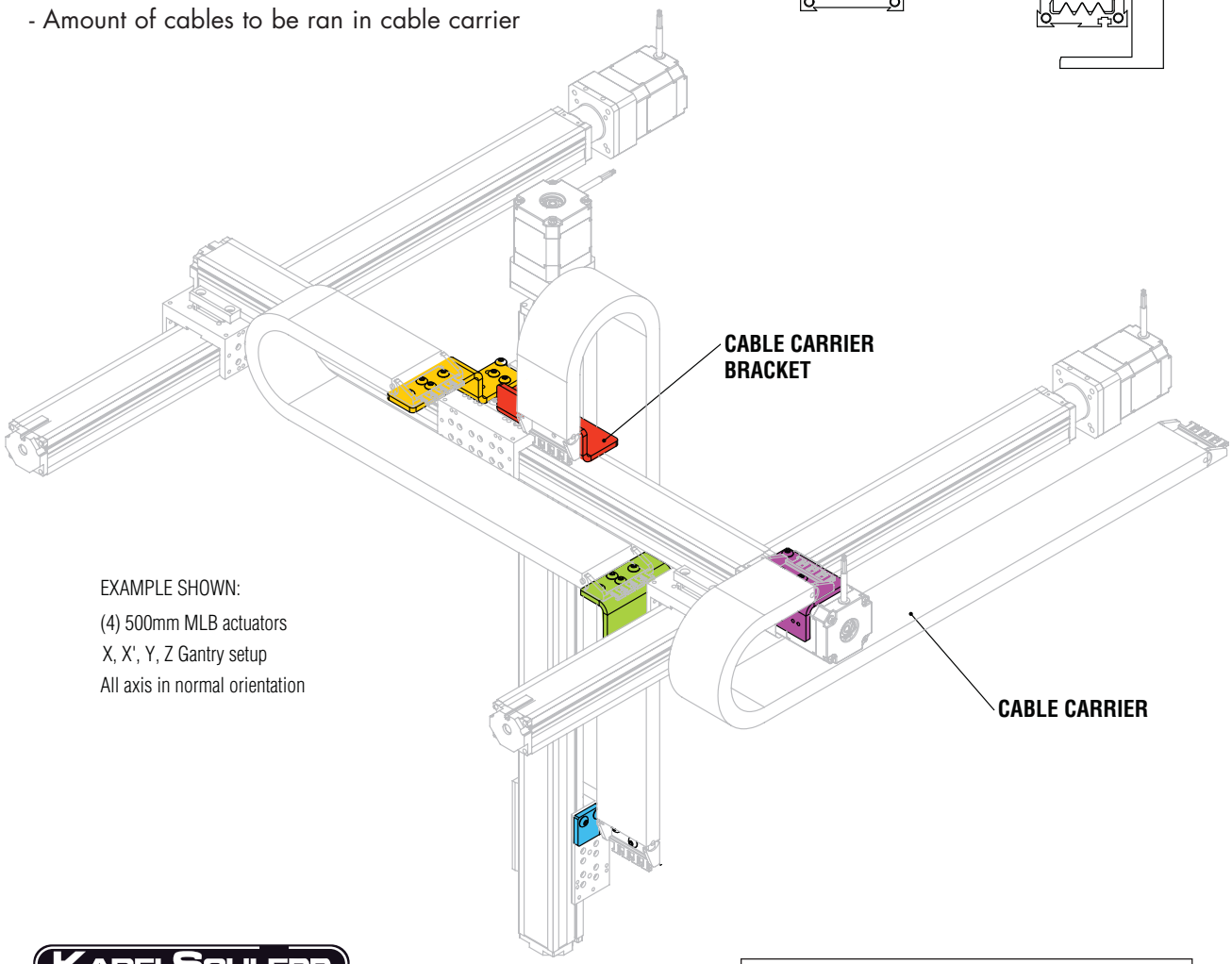
Cable Carrier Brackets

Cable carrier brackets vary depending on actuator orientations. Contact Application Engineering for assistance with selection of brackets.

Please provide as much of the following as possible:

- Actuator part number
- Gantry Layout (X, Y, Z)
- Axis orientation (normal or lateral) for each axis
- Largest diameter cable to be used in cable carrier
- Amount of cables to be ran in cable carrier





EXAMPLE SHOWN:
(4) 500mm MLB actuators
X, X', Y, Z Gantry setup
All axis in normal orientation

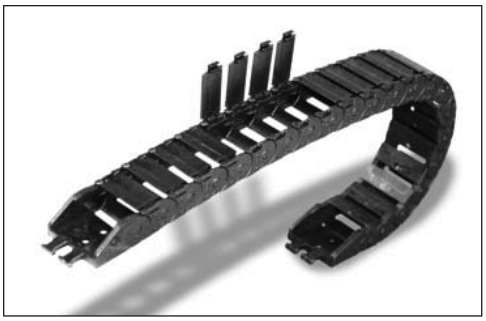
KABELSCHLEPP

Cable Carriers

Recommended cable carrier sizes for ML actuators:

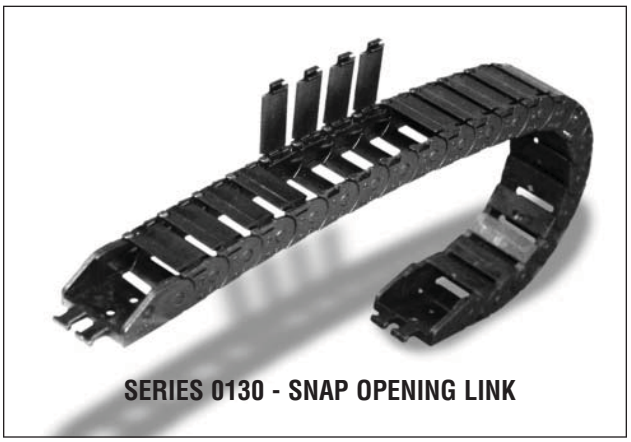
- 0130.10/0132.10
- 0130.15/0132.15
- 0130.20/0132.20
- 0130.30/0132.30

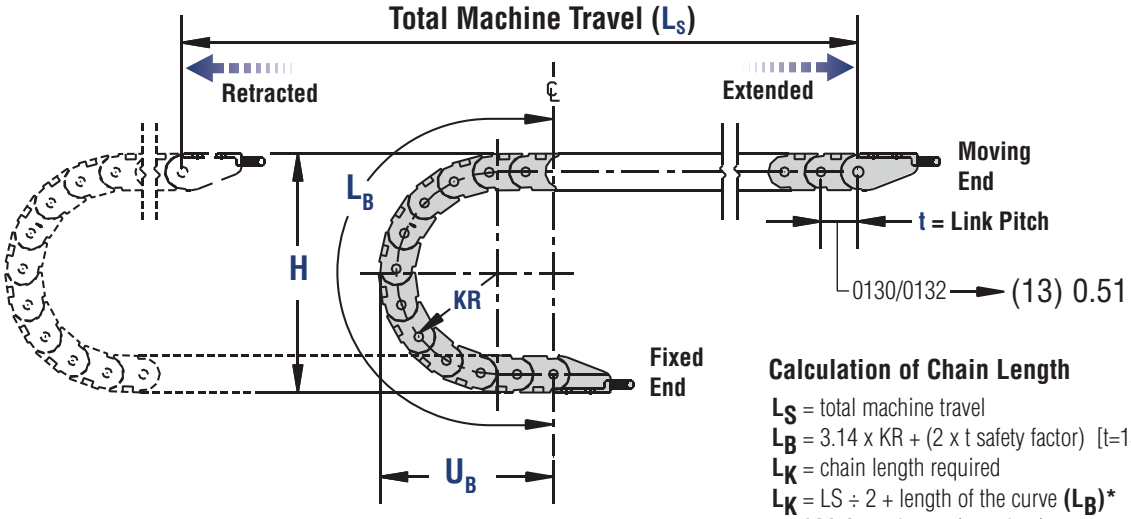
See page 33 for cable carrier ordering information.



KabelSchlepp Cable Carriers

- Smallest cable carriers for smooth and quiet operation in tight spaces
- End brackets with integral strain relief
- Light-weight and rugged fiber-reinforced nylon material
- Simple snap-together links make assembly and modifications to chain length effortless
- Links available with hinged-opening cavity lids for quick and simple installation of cables and hoses





Calculation of Chain Length

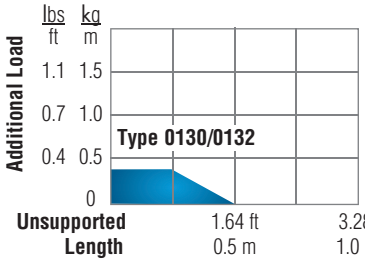
L_S = total machine travel
L_B = 3.14 x KR + (2 x t safety factor) [t=13mm]
L_K = chain length required
L_K = LS ÷ 2 + length of the curve **(L_B)***
# of Links = L_K ÷ t (round up)

** Assumes the Fixed Point is located at the Center of the Total Machine Travel.*

Series 0130/0132	Mounting Height	Bend Radius	Depot	Loop Length
	H	KR	U_B	L_B
Option A*	52.5 (2.07)	20 (0.79)	40 (1.57)	89 (3.50)
Option B	68.5 (2.70)	28 (1.10)	48 (1.89)	114 (4.49)
Option C (Std)	**86.5 (3.41)**	**37 (1.46)**	**57 (2.24)**	**142 (5.59)**

**0130.40 is only available in bend radius KR20. Dimensions in mm (in).*

Self-Supporting Lengths



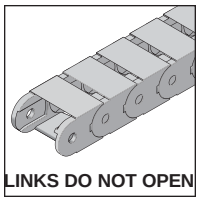
Extended Travel: When application travel exceeds the self-supporting length of the carrier, MICROTRAK™ carrier systems are designed to glide on themselves in a guide channel.

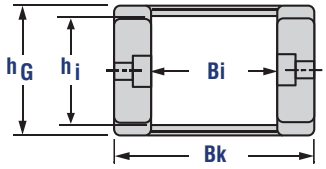
ORDERING GUIDE

EX: 4-KS0132-06KR20-1000+FI/MA

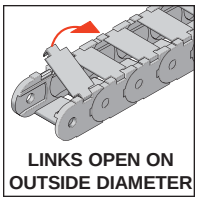
4	-	KS	XXXX	-	XX	KR	XX	-	XXXX	+	FI/MA
# of Systems Required		Kabel Schlepp®	Carrier ype		Inner Width (B_i)		Bend Radius (KR)		# of Links Length		Type of Position Brackets

KABELSCHLEPP Links


LINKS DO NOT OPEN

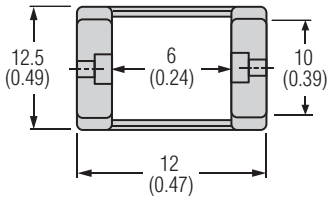


B_k = Outer Width
B_i = Inner Width
h_G = Outer Height
h_i = Inner Height

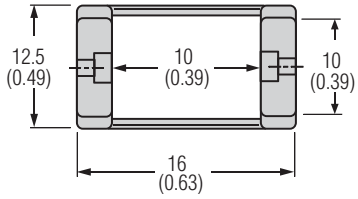

LINKS OPEN ON OUTSIDE DIAMETER

NON-OPENING LINKS

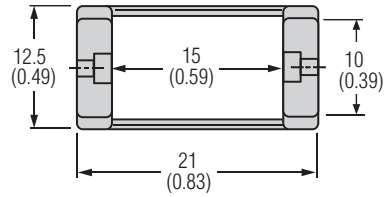
0132.06
Chain Weight:
0.09 lbs/ft
(0.13 kg/m)



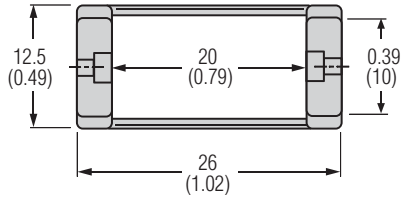
0132.10
Chain Weight:
0.09 lbs/ft
(0.14 kg/m)



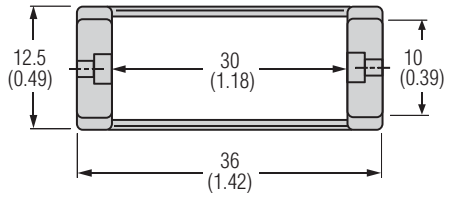
0132.15
Chain Weight:
0.10 lbs/ft
(0.15 kg/m)



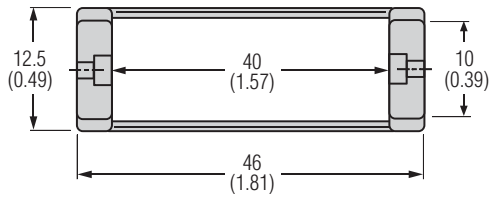
0132.20
Chain Weight:
0.11 lbs/ft
(0.16 kg/m)



0132.30
Chain Weight:
0.12 lbs/ft
(0.18 kg/m)

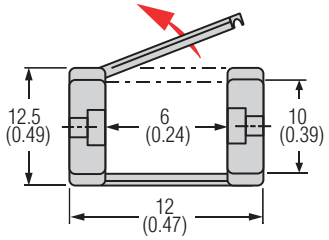


0132.40
Chain Weight:
0.13 lbs/ft
(0.20 kg/m)

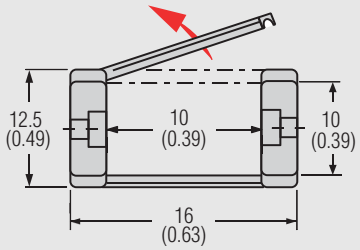


SNAP OPENING LINKS

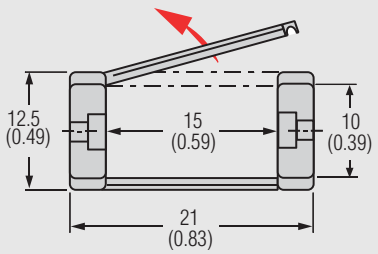
0130.06
Chain Weight:
0.09 lbs/ft
(0.13 kg/m)



0130.10
Chain Weight:
0.09 lbs/ft
(0.14 kg/m)

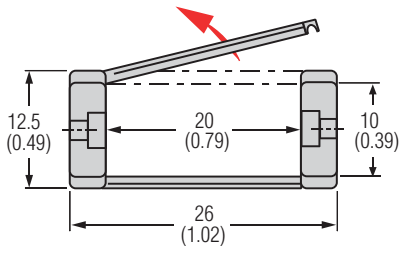


0130.15
Chain Weight:
0.10 lbs/ft
(0.15 kg/m)



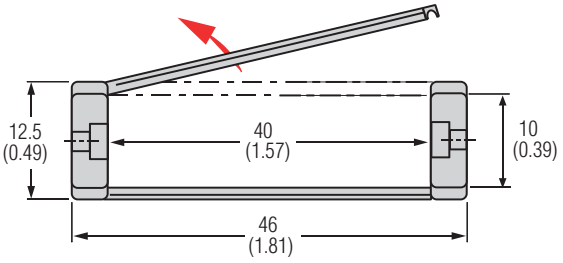
RECOMMENDED FOR ML SERIES

0130.20
Chain Weight:
0.11 lbs/ft
(0.16 kg/m)



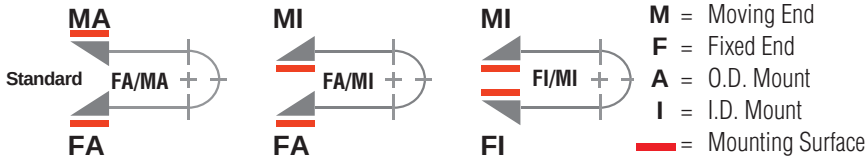
0130.40
Chain Weight:
0.13 lbs/ft
(0.20 kg/m)

Note: 0130.40 is only available in bend radius KR20



KABELSCHLEPP End Bracket

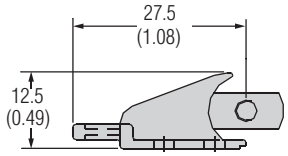
MALE



FEMALE

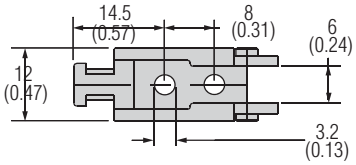
FIXED END BRACKET - WITH PIN

0130/0132 FIXED END



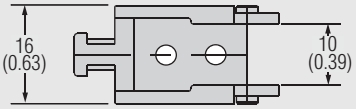
0130/32.06

PN: KS52301



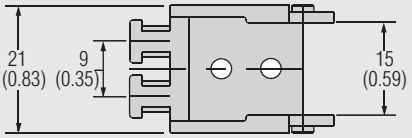
0130/32.10

PN: KS52303



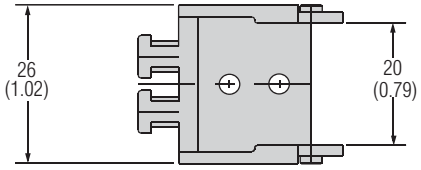
0130/32.15

PN: KS52305



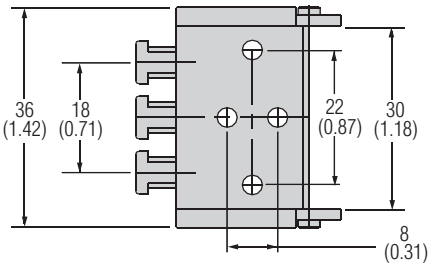
0130/32.20

PN: KS52307



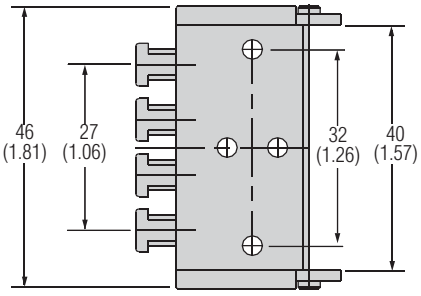
0132.30

PN: KS53376



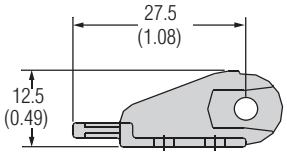
0130/32.40

PN: KS53378



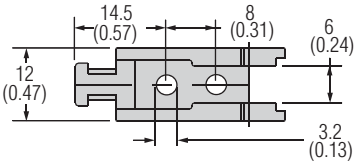
MOVING END BRACKET - WITH HOLE

0130/0132 MOVING END



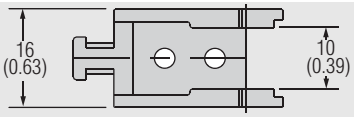
0130/32.06

PN: KS52300



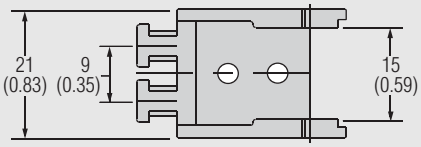
0130/32.10

PN: KS52302



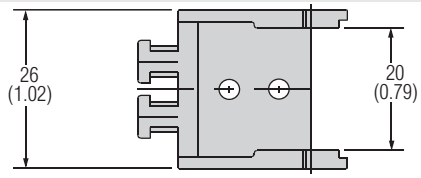
0130/32.15

PN: KS52304



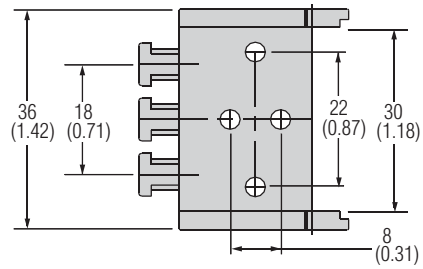
0130/32.20

PN: KS52306



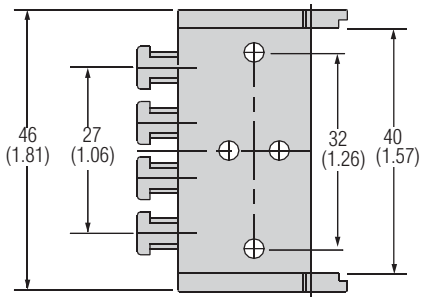
0132.30

PN: KS53377



0130/32.40

PN: KS53379



RECOMMENDED FOR ML

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Technical Selection Guide

Before the selection process can begin, a few preliminary steps must be completed:

1. **Define the payload and end effector (including wires, cables, hoses, etc)**

2. **Determine required Stroke for each axis**

   Stroke – X = _____ mm or in (if mm is chosen, convert to meters = _____m)
   Stroke – Y = _____ mm or in (if mm is chosen, convert to meters = _____m)
   Stroke – Z = _____mm or in (if mm is chosen, convert to meters = _____m)

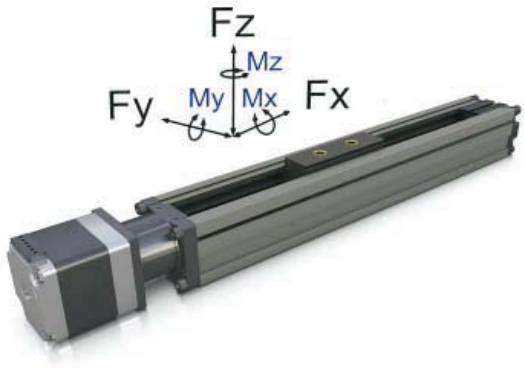
3. **Determine the basic system shape**

   With the MLA, any configuration is possible. Choose a basic style which will meet your needs. Some samples are shown here:

Now that the basic system information has been established, the configuration process begins. The following steps should be repeated for each axis. Start with the Z-Axis (aka the top axis or the axis which is farthest away from the fixed axis). Once the Z-Axis is finalized, move on to the Y-Axis (middle axis) and then the X-Axis.

1. **Complete a Force Diagram for Your System's <u>Static</u> Loads**

   A force diagram should be completed for each axis. Assume the system is statically loaded. The system will encounter additional forces as a result of acceleration/deceleration and these will be accounted for in a later step. If the actuator must support a cantilevered load, do not forget to include moment as a result of acceleration/deceleration.



Fx = _____ N or lbf

Fy = _____ N or lbf

Fz = _____ N or lbf

Mx = _____ Nm or lbf-in

My = _____ Nm or lbf-in

Mz = _____ Nm or lbf-in

For each moment (Mx, My, Mz), write down the moment arm distance (meters or inches) in the spaces below. Be sure to measure from the <u>center of the screw</u>.

Dx = _____ m *or* in Dy = _____ m *or* in Dz = _____ m *or* in

2. Determine if External Linear Guides are Necessary

Compare your results with the Load chart shown on page 24 to determine if external linear guide supports are necessary. It's important to remember that it is not possible to maximize the loads and moments in all directions and that the applied forces and moments should conform to the formula shown below.

Equation 1. :
$$\frac{F_{y,applied}}{F_{y,max}} + \frac{F_{z,applied}}{F_{z,max}} + \frac{M_{x,applied}}{M_{x,max}} + \frac{M_{y,applied}}{M_{y,max}} + \frac{M_{z,applied}}{M_{z,max}} \leq 1$$

TIP: IF the axis being designed is in the middle or at the bottom of a multi-axis assembly, choose at least 1 external linear guide, even if the force diagram says that it is not necessary. Without the linear guides, the system may not have the necessary rigidity for your application.

3. Determine the Velocity/Acceleration Needed.

Equation 2. $n = number\ of\ equal\ time\ segments$

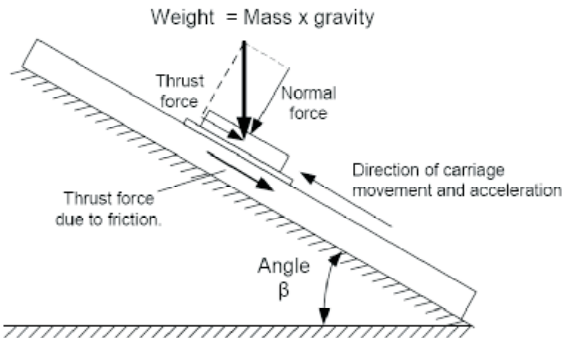
Equation 3. $$V_{MAX} = \frac{n}{n-1} * \frac{\Delta x}{\Delta t} = \frac{n}{n-1} * \frac{(distance)}{(move\ time)}$$

Equation 4. $$A_{ACCEL} = A_{DECEL} = \frac{\Delta v}{\Delta t} = \frac{(V_{MAX})}{\frac{(move\ time)}{n}} = n * \frac{(V_{MAX})}{(move\ time)}$$

V_{MAX} = _____ m/s or in/s **A_{ACCEL} = _____ m/s² or in/s²**

Start with n=2, which is the triangular motion profile. The triangular motion profile is generally the most efficient and has the highest velocity, but the lowest acceleration. If you want a trapezoidal with three equal time segments, use n=3. With this profile, the system will spend 1/3 of the time accelerating, 1/3 of the time at a constant velocity and 1/3 of the time decelerating. The trapezoidal profile will lower the maximum velocity by 25% and increase the acceleration by only 12.5%. For now, ignore any trajectory smoothing algorithms (i.e. S-curves, jerk reduction, etc) and consider only the "theoretical" values calculated here. If you need to account for the extra time necessary for the S-curves, reduce the move time by 10% and re-calculate.

Once the maximum velocity has been calculated, double check that V_{MAX} falls within the allowable travel speed shown in the chart on page 13 (*Maximum Travel Speeds*, lower left-hand corner)



4. Calculate the Applied Thrust Load (see diagram on previous page)

Equation 5. $F_{Thrust,total} = \sum F_{external} + \sum F_{weight\ and\ friction} + \sum F_{Accel}$

Equation 6. $F_{Thrust,total} = \sum F_{external} + \sum F_{mass\ (gravity)} + \sum F_{Thrust\ (friction)} + \sum F_{Accel}$

Equation 7. $\sum F_{external} = Sum\ of\ all\ other\ external\ forces\ (except\ load)$

Equation 8. $\sum F_{mass\ (gravity)} = \sum mass \times gravity \times \sin\beta$

Equation 9. $\sum F_{Thrust\ (friction)} = \sum mass \times gravity \times \cos\beta \times \mu$

Per the chart on page 10, μ = 0.19 for 0 or 1 external linear guide; μ = 0.01 for 2 external linear guides

Equation 10. $\sum F_{Accel} = \sum mass \times acceleration$

Equation 11. $Weight = W = mass \times gravity = m \times g$ (mass = kg or lbm)

Equation 12. $Gravity = g \cong 9.81 \frac{m}{s^2} \cong 32.174 \frac{ft}{s^2}$

Equation 13. $\beta = angle\ of\ incline\ from\ horizontal\ (degrees)$

After the thrust load has been calculated, compare this to the *Maximum Column Loading* chart on page13. Be sure that the calculated value is within the acceptable range.

* Don't forget to include the weight of the carriage in the total mass of the system!
* Unit for mass is "lbm" or "kg", not to be confused with "lbf" or "kgf"!
* **BE SURE TO DOUBLE CHECK THE UNITS OF MEASURE!**

5. Compare to PV Rating Chart & Critical Speed (whip) Chart (Page 12-13)

The next step is to calculate the actual rotations per minute (RPM) of the screw and to verify that the PV Value and thrust capacity of the nut have not been exceeded. To do this, use one of the formulas in Equation 15, below, to calculate the RPM of the screw. Once the RPM has been calculated, plot the location on the *PV Rating* chart (page 12). Once the point has been plotted, ensure that the selected lead's colored line is above and to the right of the plotted point. If it is not, the Thrust Load or the Maximum Velocity must be reduced or the lead must be increased so that the RPM can be reduced.

Equation 14. $RPM = \frac{rotations}{minute} = \left[V_{max}\left(\frac{m}{s}\right)\right] \times \left[\frac{60}{1}\left(\frac{s}{min}\right)\right] \times \left[\frac{1000}{1}\left(\frac{mm}{m}\right)\right] \times \left[\frac{1}{(LEAD)}\left(\frac{rot}{mm}\right)\right]$

Equation 15. $RPM = \frac{rotations}{minute} = (metric)\frac{\left[V_{max}\left(\frac{m}{s}\right)\right] \times 60{,}000}{screw\ lead\ \left(\frac{mm}{rot}\right)} = (imperial)\frac{\left[V_{max}\left(\frac{in}{s}\right)\right] \times 60}{screw\ lead\ \left(\frac{in}{rot}\right)}$

Optional leads: Units = mm (in): **38.1**(1.50), **25.4** (1.00), **10.16**(0.40), **3.18**(0.125), **1**(0.039)

** Additional leads are available, contact factory for more information*

6. Double Check All Values

Double check all charts and graphs on page 12-13 to ensure the selected system will perform as needed.

7. Determine the Required Motor

In order to determine the required motor, the maximum torque must be calculated.

Equation 16. $$Torque_{total} = \sum torque_{load} + \sum torque_{actuator\ components}$$

Equation 17. $$\sum torque_{load}\ (Nm) = \frac{\sum F_{Thrust\ (friction)}\ (N) \times lead\ (m)}{2 \times \pi \times Efficiency\ (\%)}$$

Equation 18. $$\sum torque_{actuator\ components} = No\ Load\ Torque\ (Nm) + Torque_{rot.inertia}$$

Equation 19. $$No\ Load\ Torque\ (Nm) = Nut\ Torque + Seal\ Strip\ Torque + Linear\ Guide\ Torque$$

Nut torque:
standard nut = .007 Nm (0.06 in-lbf)
light preload nut = .057 Nm (.50 in-lbf)
normal preload nut = .106 Nm (0.94 in-lbf)

Seal strip torque:
without seal strip = 0 Nm (0 in-lbf)
with seal strip = .028 Nm (0.25 in-lbf)

Linear guide torque:
Single linear guide = .017 Nm (0.15 in-lbf)
Dual Linear guides = .034 Nm (0.30 in-lbf)

Equation 20. $$Torque_{rot.inertia}(Nm) = screw\ rot.intertia\ x\ angular\ acceleration$$

Equation 21. $$screw\ rot.intertia = 4.169\ x\ 10^{-9}\ \frac{(kg\ x\ m^2)}{mm}\ x\ (body\ length\ (mm) + 32mm)$$

Equation 22. $$angular\ acceleration = \frac{A_{accel}\left(\frac{m}{s^2}\right)}{(screw\ lead\ (mm))\ x\ \left(\frac{1\ m}{1000\ mm}\right)}$$

Once you have calculated the required torque, a comparison must be made to the speed-torque curves for each specific motor. Don't forget to include a safety margin of at least 30%, i.e. the required toque must be at least 30% below the plotted torque curve.

A gear box may be required if the total inertia of the system is too far mismatched from the inertia of the motor. Each motor manufacturer will publish the maximum mismatch allowed for their motor. A general guideline is that stepper motors will allow up to a 10:1 mismatch. Servo's are capable of handling a much higher mismatch; however, the higher the mismatch, the more time will be spent tuning the servo during installation. Manufacturers will typically recommend staying under 6:1 mismatch and definitely under 10:1 mismatch[1]. Please contact a PBC Application Engineer for assistance with selecting a gearbox.

For Torque charts, refer to the "Stepper Motor" section of the main LAT Catalog or www.pbclinear.com
For servo motor driven applications, please contact our Applications Engineers at 1-800-962-8979.

1. LEGAL DISCLAIMER: The ratios presented on this page should be used as a GUIDELINE ONLY. Users should refer to the specifications published by each motor manufacturer as the numbers listed herein are likely to change and will vary from manufacturer to manufacturer.

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8. Choose Dovetail Clamps (Mounting Type)

The mounting feet kits are listed on page 33. IF this axis will be mounted to another MLA axis underneath it, one (1) MLA028A-HDC-M3-KIT is necessary. If this is a single axis, or a bottom axis of a multiple axis gantry, then there are 3 choices. The basic kit is the MLA028A-HDC-M3-KIT and a minimum of (2) two kits are necessary. Use the *Distance Between Supports* chart on page 13 to determine the minimum number of supports based upon the body length and load of the specified system. (Extra supports can always be added to increase the rigidity of the system)

If a NEMA17 or NEMA23 motor are specified, the design may call for a Riser Plate to be used. The Riser Plate will raise the actuator off the mounting surface, which allows for the larger motor size to not interfere with the mounting surface. The 8 mm Riser Plate should be used with NEMA17 (or equivalent metric frame sizes) motors and the 15 mm Riser Plate should be used with NEMA23 (or equivalent metric frame sizes) motors. Multiple Riser Plate kits may be necessary.

9. Choose Sensors/Limit Switches

Now that the axis has been specified, choose the switches/sensors which will be mounted along the axis. PBC recommends that a minimum of two (2) sensors are used (one at each end of the axis) in order to prevent overtravel. Additional sensors may be necessary, depending upon the application. The most common reason for the additional sensors is to set a “home” and/or “target” positions.

10. Choose Cable Carrier

The last step in completing the system is to specify the cable carrier. This can only be done once all of the cables which will run through it have been defined. For most applications, this means a minimum of a power cable for the motor, 2 sensor cables and whatever cables/hoses are required for the payload. Servo and closed loop stepper motors will have a sensor cable and motors with a brake will also have a cable for the brake. Once a list of all of the cables has been compiled, visit the Cable Carrier section of the main LAT Catalog (or visit www.pbclinear.com) to complete the step by step selection guide for the cable carriers.

11. Place order

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Application Data Sheet

RFQ:_____

Date:_____

Company:_____

Contact:_____

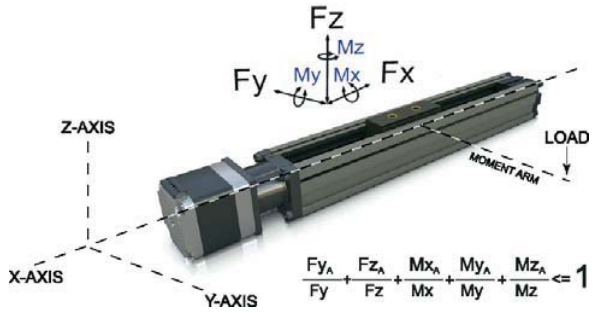
Address:_____

_____

Phone:_____

E-mail:_____

FAX COMPLETE FORMS TO:
1(815) 389-5790



APPLICATION DESCRIPTION – *Sketch if available.*

Project Name:_____Project Status: ❑ Concept ❑ Design ❑ Prototype ❑ Existing

Project Description: _____

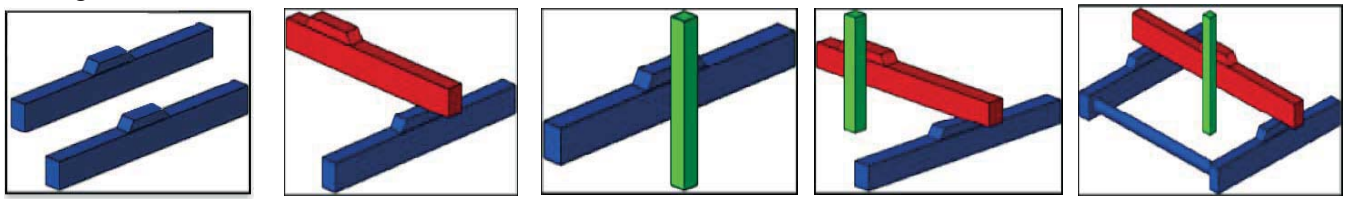
Project Timing:_____Target Pricing:_____

Quantity:_____Components: ❑ Actuator Only ❑ Actuator/Motor ❑ Accessories_____

Environment: ❑ Clean Room ❑ General Shop ❑ Heavy Industrial ❑ Food/Washdown ❑ High Vibration ❑ Other_____

SYSTEM TYPE

❑ Single Axis ❑ X-Y Axis ❑ Y-Z Axis ❑ X-Y-Z Axis ❑ X1/X2-Y-Z Axis



Axis $\frac{Fy_A}{Fy}+\frac{Fz_A}{Fz}+\frac{Mx_A}{Mx}+\frac{My_A}{My}+\frac{Mz_A}{Mz}<=1$ s Orientation: ❑ Vertical ❑ Horizontal ❑ Inverted ❑ Angled

	AXIS		
	X	Y	Z
Load N (lbf)			
Moment Nm (lbf-in)			
Stroke mm (in)			
Velocity mm/s (in/s)			
Acceleration m/s^2 (ft/s^2)			
Deceleration m/s^2 (ft/s^2)			

Comments:

_____

_____

_____

_____

_____

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