Bearing Options
Plain or Ball Bearing Linear Guides

Drive Type Flexibility
- Integrated Stepper Motor
- Motor Mount
- Manual

Compact
23 mm Low Profile

Configure Online at pbclinear.com
1-800-962-8979

Linear Motion Solutions
Actuators
Three Steps to Design Your Actuator

**Step 1: Bearing System**
Page 5

- Gliding Surface Technology
  - Plain Bearings

- Profile Rail Technology
  - Ball Bearings

**Step 2: Drive Options**
Page 6

- **Screw Diameters**
  - 6 mm
  - 10 mm

- **Nut**
  - Constant Force™ anti-backlash nut
  - Ball screw also available

**Step 3: Motor & Drive Type – NEMA 17 or NEMA 23**
Page 7

- **Integrated Screw & Motor**
  - Lead screw aligned and fixed directly with motor

- **Motor Mount**
  - Attach any stepper, servo, or smart motor

- **Manual Hand Knob**
  - Hand knob for manually adjusting screw driven system

If you are utilizing our digital Compact Series catalog, you can click these icons, throughout the publication, to get more information. Hyperlinks go to English language website.
**Bearing System Selection**

**Gliding Surface Technology**

**Plain Bearing**

- Low cost
- Utilizes bonded FrelonGOLD® bearing surfaces
- Self-lubricating and maintenance free
- No catastrophic failure
- No metal-to-metal contact, vibration damping
- Wide temperature range
- Resists contamination
- 510 mm maximum length

*Note:* Plain bearings should comply with the 2:1 ratio rule.

**Profile Rail Technology**

**Ball bearing linear guides**

- High precision and high speeds
- Size 15 mm bearing block
- Rigid and precise recirculating ball design
- Increased stiffness and preloaded bearing performance
- Supports cantilevered loads
- Low coefficient of friction
- 1,000 mm maximum length

System Ordering Information—Page 11

White Paper Link: Demystifying the 2:1 Ratio

Uniform dimensioning provides design flexibility.
Lead Screw and Nut Options

Lead Screw Options

- 6 mm and 10 mm diameter lead screw
- Self-lubricating PTFE coated
- 1, 2, 5, 10 mm leads most common
- Other leads available—consult factory

Nut

Constant Force™ Anti-Backlash Nut
An intuitive leap forward in nut design for lead screw applications, Constant Force Technology utilizes a constant force spring to apply a uniform pressure to the nut at all stages of the motion profile.

- Greater consistency and resistance to backlash
- Configurable for various torque requirements
- Patent pending self-adjusting anti-backlash feature
- Polymer nuts are self-lubricating and maintenance free

Video Link:
Screws, Nuts, and Hybrid Linear Actuators

Patent pending Constant Force Technology nut provides consistent anti-backlash operation
**Motor Type Selection**

**Integrated stepper motor**
- Lead screw aligned and fixed directly with motor
- Fewer components means greater accuracy, increased rigidity, and less cost
- 6 mm and 10 mm diameter lead screw driven
- NEMA 17 and NEMA 23 motors
- Single and double stack
- Standard wire connection is onboard plug—included connector plug with 12” leads
- Longer leads available, consult factory

![Motor Mount Details](Page 13)

**Motor mount**
- One-piece main frame holds shaft-to-shaft centerline
  - Extends motor and coupler life
  - Increases accuracy and repeatability
- Attach NEMA 17 or NEMA 23 stepper, servo, or smart motor
- 6 mm and 10 mm diameter lead screw driven
- Easy to assemble
- Easily attached with adapter plate and coupler
- Assembled system available with motor and motor mount, consult factory

**Manual Hand Knob**
- Hand adjustment knob is used for manually adjusting screw driven systems
Bearing System Overview

Gliding Surface Technology

Plain Bearing

Overview

- Low—23 mm—profile design
- 510 mm maximum length
- Size 15 mm bearing block
- Utilizes the bonded FrelonGOLD® self-lubricating and maintenance free bearing surfaces
- Smooth and quiet operation
- Vibration damping and shock resistant

Lead Screw & Nut

- Lead screw 6 mm
- 300 series stainless steel with PTFE coating
- 1, 2, 5, 10 mm leads most common
- Other leads available—consult factory
- Constant Force™ anti-backlash nut

Motor and Drive Type

Integrated Stepper Motor

- Integrated lead screw eliminates components and tolerance stack-ups
- Improved rigidity and performance
- Reduced system costs
- Connector with 12" flying leads included

Motor Mount

- Designed to work optimally with R+W EKL2 coupler

Manual Hand knobs

- Hand adjustment knob is used for manually adjusting screw driven systems
Profile Rail Technology

Ball Bearing Linear Guides

Overview

• Three profile choices
• 1,000 mm maximum length
• Size 15 mm bearing block
• High precision, rigidity, and speeds
• Increased stiffness and preloaded bearing performance
• Supports cantilevered loads
• Low coefficient of friction

Lead Screw and Nut

• Lead screw 6 mm and 10 mm diameter
• 300 series stainless steel with PTFE coating
• Variety of leads
• Other leads available—consult factory
• Constant Force™ anti-backlash nut
• 8 mm ball screw also available

Motor and Drive Type

Integrated Stepper Motor

• Integrated lead screw eliminates components and tolerance stack-ups
• Improved rigidity and performance
• Reduced system costs
• Connector with 12” flying leads included

Motor Mount

• Designed to work optimally with R+W EKL2 coupler

Manual Hand knobs

• Hand adjustment knob is used for manually adjusting screw driven systems
## Basic System Properties

<table>
<thead>
<tr>
<th></th>
<th>GLIDING SURFACE TECHNOLOGY</th>
<th>PROFILE RAIL TECHNOLOGY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Plain Bearing</td>
<td>Ball Bearing Linear Guides</td>
</tr>
<tr>
<td>Speed mm/s</td>
<td>4,200</td>
<td>4,200</td>
</tr>
<tr>
<td>Acceleration mm/s/s</td>
<td>50,000</td>
<td>50,000</td>
</tr>
<tr>
<td>Stroke mm</td>
<td>5–440</td>
<td>1,000</td>
</tr>
<tr>
<td>Repeatability (+/- mm)</td>
<td>0.02 Anti-Backlash</td>
<td>0.02 Anti-Backlash</td>
</tr>
<tr>
<td>MAX Drive (Input) Speed rpm</td>
<td>2,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Screw Diameter mm</td>
<td>6</td>
<td>6 or 10</td>
</tr>
<tr>
<td>Lead mm</td>
<td>1, 2, 4, 5, 6, 8, 10, 12, 16, or 25</td>
<td>1, 2, 4, 5, 6, 8, 10, 12, 16, or 25</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>333</td>
</tr>
<tr>
<td>Fy</td>
<td>240</td>
<td>2,500</td>
</tr>
<tr>
<td>Fz (Normal)</td>
<td>240</td>
<td>2,500</td>
</tr>
<tr>
<td>Fz (Inverted)</td>
<td>240</td>
<td>2,500</td>
</tr>
<tr>
<td>Max Moments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mx</td>
<td>9</td>
<td>43.6</td>
</tr>
<tr>
<td>My</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>Mz</td>
<td>15.1</td>
<td>27</td>
</tr>
</tbody>
</table>

### Buckling column load curve

6 mm diameter lead screw

Note: Based on 500 mm stroke, GST version with .125 C.O.F. and .3G acceleration. Based on 24 volt, but higher voltage amplifiers may produce higher speeds.
Profile Rail Ordering Information

**Compact Series Linear Guide Systems**

**Screw Type**
- LS: Lead Screw
- BS: Ball Screw

**Screw Diameter**
- M06: 6mm Lead Screw
- M10: 10mm Lead Screw
- M08: 8mm Ball Screw

**Screw Lead**
- AHX: 1mm (M06 & M10)
- AGX: 2mm
- ARX: 4mm (M06 & M10)
- AXX: 5mm
- B6X: 6mm (M06 & M10)
- BHX: 8mm
- AJX: 10mm (M06 & M10)
- BDX: 12mm (M06 & M10)
- AFX: 16mm (M10 only)
- AWX: 25mm

### Rail Length
- Lengths from 80 mm to 1,000 mm (Consult maximum speed data)

### Drive End Option
- 00: None-Stub Shaft
- 02: Motor Mount Adapter Plate
- 04: 40 mm Motor Mount
- 06: NEMA17 Motor Mount
- 08: NEMA23 Motor Mount
- 10: Blank Plate (Customer Machined)

### Motor Option
- 00: NEMA17 Single Stack
- A1: NEMA17 Single Stack
- A2: NEMA17 Double Stack
- A3: NEMA17 Triple Stack
- B4: NEMA23 Single Stack
- B5: NEMA23 Double Stack
- B6: NEMA23 Power Plus

### Carriage
- S: Short (6 mm only)
- L: Long (10 mm and 8 mm only)

### Cover
- N: No
- L: Low
- T: Tail

### Nut
- 1: Standard (Ball screw only)
- 2: Anti-Backlash (Lead screw only)

### Quantity of Carriages
- 0: 1 driven carriage
- 1: 2 carriages, 1st from drive end driven
- 2: 2 carriages, 2nd from drive end driven
- 3: 3 carriages, 1st from drive end driven
- 4: 3 carriages, 2nd from drive end driven
- 5: 3 carriages, 3rd from drive end driven

**Configure Online**

### Gliding Surface Rail Ordering Information

**Rail Length**
- Lengths from 80 mm to 510 mm (Consult maximum speed data)

### Drive Type
- 100: None-Stub Shaft
- 200: Hand Knob
- 3A1: NEMA17 Single Stack
- 1ZE: 40 mm Motor Mount
- 1ZF: NEMA17 Motor Mount
- 1ZG: NEMA23 Motor Mount
- 1ZH: 60 mm Motor Mount
- 1ZO: Blank Plate

**Screw (6 mm lead screw)**
- AHX: 1 mm
- AGX: 2 mm
- AXX: 5 mm
- AJX: 10 mm

### Quantity of Carriages
- 0: 1 driven carriage
- 1: 2 carriages, 1st from drive end driven
- 2: 2 carriages, 2nd from drive end driven
- 3: 3 carriages, 1st from drive end driven
- 4: 3 carriages, 2nd from drive end driven
- 5: 3 carriages, 3rd from drive end driven

**Configure Online**

**Ordering example:**
- CSBSM08AXXR10Z-1:M-0300-5
- CSMR15D-000-0425-3A1-AXXR2-2

**Email an Application Engineer**

www.pbclinear.com | LINEAR MOTION SOLUTIONS 9
Motor Mount Option Benefits

**PBC LINEAR’S DESIGN WITH PRE-ENGINEERED ALIGNMENT**
- One-piece main frame holds shaft-to-shaft centerline
- Extends motor and coupler life
- Increases accuracy and repeatability
- Easy to assemble

**PROBLEMATIC DESIGNS CAUSE MIS-ALIGNMENT**
- Mis-alignment between motor shaft, coupler, and screw shortens life and affects motion quality
- Mis-alignment results in camming or lobbing motion that translates to inconsistent linear movement
- Difficult to align and prone to deflection
- Over-torque of coupler causes accuracy loss

**PROBLEM #1: DEFLECTION**

**PROBLEM #2: TWIST**

**PROBLEM #3: OFF CENTERLINE**
### Ordering Motor Mount Option

<table>
<thead>
<tr>
<th>Compact Series System</th>
<th>Motor Size</th>
<th>Part Number</th>
<th>Recommended Coupler Ordered Separately or Customer Supplied</th>
<th>Included with Motor Mount Purchase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gliding Surface Technology – Plain Bearing</td>
<td>NEMA 17 42 mm</td>
<td>UGA040A-3PMM-HF</td>
<td>R + W EKL2 Maximum coupler dimensions: 25 mm O.D. x 26 mm length</td>
<td>(1) Main frame with 4 SBHCS (Socket Button Head Cap Screw) (1) Motor plate with 3 SBHCS for attaching to frame* (1) Cover (plastic)</td>
</tr>
<tr>
<td>Profile Rail Technology – Ball Bearings</td>
<td>NEMA 23 56 mm</td>
<td>UGA040A-3PMM-HG</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blank Plate (customer machined)</td>
<td>UGA040A-3PMM-H0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### STUB SHAFT DIMENSIONS

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Stub Shaft Diameter</td>
<td>3.5 mm</td>
</tr>
<tr>
<td>Overall Stub Shaft Length</td>
<td>20 mm</td>
</tr>
<tr>
<td>Stub Shaft Length for Coupler Engagement</td>
<td>6 mm</td>
</tr>
</tbody>
</table>

### MOTOR MOUNT LENGTH (X)

<table>
<thead>
<tr>
<th>Compact Series System</th>
<th>NEMA 17 42 mm</th>
<th>NEMA 23 56 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>53.7 mm</td>
<td>54.3 mm</td>
</tr>
</tbody>
</table>

* Customer supplies motor screws
Applications

Medical and Laboratory Equipment:
The self-lubricating FrelonGOLD® bearing liner, in the plain bearing option of the Compact Series, is ideal for environments where no grease or lubrication can be present.

Well Plate Handling:
Compact Series installed in an intricate well plate handler—providing accurate and reliable linear motion.

Automated Conveyor:
Material handling conveyor systems utilize the Compact Series linear guide system for maintenance free, repeatable linear motion.

Integrated stepper motor reduces the number of components and improves rigidity in the system.
**Scanning Equipment:**
High precision and smooth operation are required when designing linear motion for laboratory scanning equipment. The plain bearing system utilizes FrelonGOLD®—a self-lubricating, maintenance free surface that does not require oil.

**CNC Router:**
The plain bearing version of the Compact Series is ideal for harsh, dirty environments such as a CNC router. The carriage acts as a wiper as it clears away contamination such as dust and debris from the rail.

**Bottling:**
The Compact Series is ideal in bottling and food service applications that require repeatable motion and involve various load capacities.

Plain bearings utilize the bonded FrelonGold® self-lubricating maintenance-free surface.
Motor Mount Plate Dimensions

MOTOR SIZE: NEMA 17 (42 MM)
• Material: Anodized aluminum

![Diagram of Motor Mount Plate Dimensions for NEMA 17 (42 MM)]

MOTOR SIZE: NEMA 23 (56 MM)
• Material: Anodized aluminum

![Diagram of Motor Mount Plate Dimensions for NEMA 23 (56 MM)]
Blank Plate and Main Frame Dimensions

**BLANK PLATE**
- Intended use: To give customers the ability to machine the plate to match non-standard motor configurations
- Material: Anodized aluminum
- Tip: It is best to locate from the center hole when machining hole pattern for motor attachment.

**MAIN FRAME**
- Material: Die cast aluminum, clear chromate
User Manual

Table of Contents

Safety
Tips for Safe Installation and Operation ................................ 18

Motor Mount Option
Coupler .............................................................................. 19
Assembly .. ........................................................................ 20

Maintenance
Lubrication ........................................................................ 21

Tips for Safe Installation and Operation

• Only qualified personnel should transport, assemble, operate, and maintain this equipment.
• Always wear appropriate personal protection equipment, such as safety glasses and hearing protection.
• Read and observe the installation, operating, and safety instructions provided by the manufacturer. Incorrect handling and operation may result in damage to equipment and personal injury.
• Comply with all installation specifications and requirements to ensure proper setup.
• Provide a flat and stable mounting surface.
• Be sure sufficient space is provided to permit full carriage travel with no hard stops.
• Be sure power is OFF before performing actuator maintenance.
• The unit should be checked regularly for worn or damaged components. Follow recommended service intervals and replace defective parts immediately. Always replace parts with the same make and model as the original.
• Be aware that most actuator configurations are not self-braking. A load can move if the drive force is disconnected, or if drive train components are detached. This is particularly true for vertical applications. The load should be secured prior to service. Consider installing an electromechanical power-off brake in vertical configurations to prevent potential damage or personal injury.
• Actuators should be wiped down occasionally to keep them clean. Use fluids sparingly and be sure none seeps inside. Do not use strong or harsh cleaning agents.
• Always test run actuators after maintenance work is completed.
• Do not back-drive the lead screw by moving the carriage by hand.

Mounting tips

• Mount the Compact Series through the holes in the rail
• Counter bores accommodate M3 SHCS
• The number of counter bores varies with the length of rail
COUPLER
• Compact Series motor mounts are designed to work optimally with the R+W EKL2 coupler
• Other couplers can be used under the following conditions:
  • Maximum O.D. = 25 mm
  • Maximum length = 26 mm
• Coupler should be sized per the Compact Series actuator.

VERIFY coupler bore diameters and depths will accept both actuator stub shaft and motor shaft.

STUB SHAFT DIMENSIONS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stub Shaft Diameter</td>
<td>3.5 mm</td>
</tr>
<tr>
<td>Overall Stub Shaft Length</td>
<td>15.5 mm</td>
</tr>
<tr>
<td>Stub Shaft Length for Coupler Engagement</td>
<td>6 mm</td>
</tr>
</tbody>
</table>

MOTOR MOUNT LENGTH (X)

<table>
<thead>
<tr>
<th>Compact Series System</th>
<th>NEMA 17</th>
<th>NEMA 23</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Mount Length</td>
<td>53.7 mm</td>
<td>54.3 mm</td>
</tr>
</tbody>
</table>

ONBOARD connector PLUG
With 12" Leads Included with Purchase

NEMA 17 Connector
PBC Part Number: 6200490
Housing: JST PHR-6
Terminal: JST SPH-002T-PD.5

NEMA 23 Connector
PBC Part Number: 6200491
Housing: JST XHP-6
Terminal: JST SXH-001T-PD.6
MOTOR MOUNT ASSEMBLY

Components:
• Base actuator unit
• Motor (customer supplied)
• Motor Mount Kit
  • Motor Plate
  • Main Frame
  • Cover
• Coupler (customer supplied) R + W EKL2 recommended

Fasteners: (9) M4 x 12 mm SBHCS (supplied by PBC Linear),
(4) Customer supplied motor fasteners (See Table 2)

Tools Required: Hex Key (See Table 1)

Suggested Thread Locker: Blue Loctite® 242 or equivalent

### TABLE 1

<table>
<thead>
<tr>
<th>Hex Key Size Needed:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3 SHCS = 2.5 mm Driver</td>
</tr>
<tr>
<td>M4 SBHCS = 2.5 mm Driver</td>
</tr>
<tr>
<td>M5 SHCS = 4 mm Driver</td>
</tr>
</tbody>
</table>

### TABLE 2

<table>
<thead>
<tr>
<th>Customer Supplied Fasteners:</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEMA 17 Motor = M3 x 0.5 SHCS</td>
</tr>
<tr>
<td>NEMA 23 Motor = M5 x 0.8 SHCS</td>
</tr>
<tr>
<td>60 mm Servo Motor = M5 x 0.8 SHCS</td>
</tr>
</tbody>
</table>

### TABLE 3

<table>
<thead>
<tr>
<th>Fastener Torque Values:</th>
</tr>
</thead>
<tbody>
<tr>
<td>M3 SHCS = 8-10 in/lb [1.0-1.2 Nm]</td>
</tr>
<tr>
<td>M4 SBHCS = 17-21 in/lb [2.0-2.4 Nm]</td>
</tr>
<tr>
<td>M5 SHCS = 37-45 in/lb [4.2-5.1 Nm]</td>
</tr>
</tbody>
</table>

ASSEMBLY STEPS

1. Slide coupling onto shaft and leave loose.
2. Install main frame to actuator end block using (4) M4 x 12 mm SBHCS. Snug fasteners, but do not tighten.
3. Install motor plate to main frame using (3) M4 x 12 mm SBHCS. Apply blue Loctite® 242 or equivalent threadlocker and torque to 17-21 in/lb [2.0-2.4 Nm] (See Table 3).
4. Install motor to motor plate with customer supplied fasteners (See Table 2) and install shaft into coupling. Snug fasteners, but do not tighten.
5. Check for proper shaft engagement on both sides (per coupler manufacturer specs).
6. Once system is aligned, final torque all fasteners appropriately (See Table 3).
7. Install cover on pins in casting (snaps in place).
Initial Lubrication During Installation

Some PBC Linear systems are shipped with a preservative lubrication applied to the raceways. If so, additional lubrication should be applied during installation. Proper lubrication dissipates heat, increases service life, and reduces friction, wear, and corrosion. Recommended lubricants are listed where applicable, but there are some lubricants which SHOULD NOT be used on any configuration.

**DO NOT USE:** WD40; motor oil; oils with additives; moly or other filled greases; PTFE sprays, oils, or greases; or sprays containing fluorocarbons or silicone.

**Recommended Lubricants**

**Plain Bearing (GST - Gliding Surface Technology)**
Recommended Lubricants: way lube oils, lightweight oils, 3-IN-ONE® oils, and lightweight petroleum-based greases. The PTFE coated lead screw and polymer nut require no lubrication during normal operation, but should be routinely inspected for damage and wear. In certain applications, however, an external lubricant may be desirable. Contact a PBC Linear applications engineer for guidance regarding additional lubrication.

**Profile Rail (PRT - Profile Rail Technology)**
Recommended Grease: Synthetic oil based lithium-soap grease with an ISO VG32-100 viscosity.
Recommended Oil: Synthetic oil CLP or CGLP based on DIN 51517, or HLP based on DIN51524.
Viscosity range should be ISO VG32-100.

**Relubrication**

Linear guide raceways should be relubricated periodically with oil or grease. Recommended lubricants are listed where applicable, but there are some lubricants which SHOULD NOT be used on any Compact Series configuration.

**DO NOT USE:** WD40; motor oil; oils with additives; moly or other filled greases; PTFE sprays, oils, or greases; or sprays containing fluorocarbons or silicone.

The relubrication interval is dependent on many operating and environmental conditions, such as load, stroke, velocity, acceleration, lubrication type, mounting position/orientation, UV exposure, temperature, and humidity. The actual lubrication interval should be determined by tests conducted under actual application conditions.

While the actual relubrication intervals are application specific and determined only through testing, the following “first check” guidelines can typically be used as a starting reference point under “normal” conditions:

* Relubrication every 1000 km; 50000 cycles; or six months (whichever occurs first)

**Extended Lubrication Interval**

* Relubrication every 2500 km; 100000 cycles; or one year (whichever comes first)
Global Footprint

Range of Offerings

Components

Mechatronics

Request a FREE Product Sample

Mini-Rail Linear Guide
MR15, 97 mm Rail

PTFE Coated Leadscrew
Anti-Backlash Nut, 12 mm

6402 E. Rockton Road, Roscoe, Illinois 61073 USA
Tel: +1.815.389.5600 • Toll-Free: +1.800.962.8979
Fax: +1.815.389.5790
sales@pbclinear.com • pbclinear.com

Bonner Straße 363, 40589 Duesseldorf, Germany
Tel: +49 211 545590 20 • Fax: +49 211 545590 39
info@pbclinear.eu • pbclinear.eu

168 Mingjia Road, Minhang District, Shanghai 201107, P.R. China
Tel: +86 21 52634688 • Fax: +86 21 52634098
info@moons.com.cn • www.moons.com.cn

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

Visit pbclinear.com to find a distributor near you.