PBC Linear Compact Series Actuators

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Linear Motion Solutions

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Bearing Options Plain or Ball Bearing Linear Guides

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Drive Type Flexibility

Integrated Stepper Motor
 Motor Mount
 Manual

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Compact

23 mm Low Profile 31 mm Low Cover 39 mm Tall Cover



Configure Online at pbclinear.com

1-800-962-8979





*Note: Plain bearings should comply with the 2:1 ratio rule. Cover option NOT available for plain bearing rail.



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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*.



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Compact Features

Linear Stepper Motors

The Compact Series drive systems feature NEMA 17 and NEMA 23 open loop stepper motors and integrated lead screws. Together,

10

they provide better torsional rigidity and save additional space by eliminating couplings and additional journal bearings. (Motor is not field replaceable)

Motor Mounting

Engineers have the option to attach any stepper, servo, or smart motor using the Compact Series motor mount option. Its universal design accommodates R+W EKL2 couplers for 6 mm lead screws, or R+W EKL5 couplers for 8 mm ball screws and 10 mm lead screws. (Motor is field replaceable)

Profile Rail Bearings

Recommended for higher

precision guidance and

offset cantilevered

applications.

loading, but not well suited for short stroke

Ball Screws

Better suited for the combination of high-thrust loads and high-duty cycle applications. Not suitable for short strokes or dirty environments.

-1116

Lead Screws

Better suited for short-stroke applications and dirty environments. They are quieter with less backlash than a ball screw.

Constant Force[™] Anti-Backlash Nut

Constant Force Technology utilizes a patented constant force spring to apply uniform pressure to a polymer nut at all stages of the motion profile. Advantages include an overall greater consistency and resistance to backlash, along with these additional features:

- Self-adjusting and self-lubricating, maintenance-free design.
- Configurable for various torque requirements.
- Quieter with less backlash than standard ball screw nuts.

Gliding Surface Technology

Simplicity[®] plain bearing systems fulfill many of the demands of high precision applications where smooth operations are required. The patented FrelonGOLD[®] liners create maintenance-free, self-lubricating surfaces that are quieter than their profile rail recirculating ball bearing counterparts. In addition, they are best suited for short-stroke applications and dirty contaminated environments except for those with sticky liquids. Note: Plain bearings should comply with the 2:1 ratio rule.

Applications

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.





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.

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.

Medical & Laboratory Equipment

The self-lubricating FrelonGOLD lined plain bearing 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.



Compact System Overview

Designed for Tight Spaces

The Compact Series boasts a low profile standard system height of 23 mm, making it an ideal solution for applications such as medical and lab automation, automated delivery systems, robotic dispensing systems, and electronics manufacturing. These compact systems provide smooth, accurate, and repeatable linear motion that ensure dependable performance for your application.

Compact Series can be configured with standard options to fit the demands of your application. There are two bearing options to choose from: profile rail (ball bearing) and gliding surface technology (plain bearing).

- Profile Rail systems (available in all sizes) provide higher rigidity and precision, as well as support cantilevered loads. Recirculating ball bearings operate at < 0.010 dynamic coefficient of friction (Approx. 0.020/0.025 static coefficient of friction).
- Gliding Surface Technology systems (available in 6 mm diameter Lead Screws) utilize plain bearing rails and carriages that boast our FrelonGOLD® liners. This patented technology provides smooth, quite operation with maintenance-free performance. Additional benefits include vibration damping, wide temperature range, and resistance to catastrophic failure. Keep in mind that plain bearings must comply with the 2:1 ratio rule and operate at < 0.125 dynamic coefficient of friction (Approx. 0.150/0.200 static coefficient of friction).

All carriage dimensions conform to industry standards, providing flexibility in design. Carriages can be driven by either lead screws or ball screws. Lead screw sizes are available in 6, 8, and 10 mm, while ball screws are limited to 8 mm with various leads.

Lead screws are CNC precision rolled, conforming to a lead accuracy of 0.003"/ft (76 µm/300 mm). They are constructed with 300 series stainless steel with an additional PTFE coating applied.

Our Constant Force[™] anti-backlash nut applies uniform radial pressure along the full length of the lead screw and has consistent preload over the life of the nut. This combination of screw and nut provides a self-lubricated and maintenance-free system. The system can be driven with a NEMA 17 or NEMA 23 motor that's either integrated or contains a motor mount. Manual hand knobs or stub shafts are available for applications not requiring a motor.

ew and Demystifying the 2:1 Ratio

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

WARNING: Profile rail requires a flat mounting surface. It is recommended to have a mounting surface within a flatness error of 0.060/200 mm.

Questions, contact an Applications Engineer at +1.800.962.8979.

Email an Application Engineer

Gliding Surface Technology Plain Bearing

Profile Rail - Ball Bearing

Profile Rail Actuator Dimensions



* First number pertains to 6 mm Compact version and second number pertains to 8 mm and 10 mm Compact version.

Plain Bearing Actuator Dimensions



Units of Measurement mm



Gliding Surface Rail System Ordering Information

Comp	act - es	Гуре			Rail Length	Dr	ive Option	Lead	N	ut	QTY of Carriages	ŝ		
CS	S MF	R15D	- 0	00 -	XXXX	- 1	100	-AWX	XR	2	x		\bigcirc	
Rail Lengt	:h ——		_	_								1	Configu	ire
Lengths from 80 (Consult maxiur) mm to 510 num speed c	mm lata)		Drive	Туре				Anti-B	acklas	h		Unline	
			100	None-St	ub Shaft		M06 (6 mi	m lead screw)			<u> </u>			
			200	Hand Kr	iob		АНХ	1 mm			Qua	antity of (Carriages	
			3A1	NEMA17	7 Single Stack		AGX	2 mm		0	1 driven	carriage		
			1ZE	40 mm I	Motor Mount		ARX	4 mm		1	2 carria	ges, 1st fr	om drive er	nd driven
Ordering example:			1ZF	NEMA17	7 Motor Mount		ΔΧΧ	5 mm		2	2 carria	ges, 2nd f	rom drive e	nd driven
CSMR15D-000-0425-3	BA1-AXXR	2-2	17G	NFMA23	8 Motor Mount		RCY	6 mm		3	3 carria	ges, 1st fr	om drive er	nd driven
			174	60 mm l	Motor Mount		DUX	0 mm		4	3 carria	ges, 2nd f	rom drive e	nd driven
			170					0 11111		5	3 carria	iges, 3rd f	rom drive e	nd driven
			120	BIANK PI	ate		AJX	10 mm				•		
							BDX	12 mm						

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	System Properties						
Fy My My Mx		Gliding Surface Technology Plain Bearing	H Ba	Profile Rail to	echnology hear Guides		
Email a Applic	an ation Enginee	er	Lead Screw	Lead	Screw	Ball Screw	
Speed mm/s		4,200	4,2	200	5,500		
Acceleration m/sec2		50	5	0	250		
Stroke mm		445 MAX Plus. 10 mm End Over Travel	920 MAX F End Ove	Plus. 10 mm er Travel	920 MAX Plus. 10 mm End Over Travel		
Repeatablility (+	-/- mm)		= 0.02 Anti-Backlash</th <th><!--= 0.02 Ar</th--><th>nti-Backlash</th><th><!--= 0.03</th--></th></th>	= 0.02 Ar</th <th>nti-Backlash</th> <th><!--= 0.03</th--></th>	nti-Backlash	= 0.03</th	
MAX Drive (Inpu	it) Speed rpm		2,000	3,000		3,000	
Screw Diameter	mm		6 mm Lead Screw	6 mm LS 10 mm LS		8 mm Ball Screw	
Lead mm			1, 2, 4, 5, 6, 8, 10, or 12	1, 2, 4, 5, 6, 8, 10, or 12	1, 2, 4, 5, 6, 8, 10, 12, 16, or 25	2, 5 or 8	
	Fx		25	25	222	386	
MAX Bearing	Fy	NI	200	950		1,425	
Loads	Fz (Normal)	IN	200	950		1,425	
	Fz (Inverted)		200	950		1,425	
	Mx		9	20.2		30.4	
Bearing	Му	Nm	9	13.1		29.8	
Moment Loads	Mz		15.1	13.1		29.8	

Note: See PV Derate Chart on the next page. Plain bearings should comply with the 2:1 ratio rule. **WARNING:** Profile rail requires a flat mounting surface. It is recommended to have a mounting surface within a flatness error of 0.060/200 mm. For questions, contact an Applications Engineer at +1.800.962.8979.

White Paper Demystifying the 2:1 Ratio

MAX Nut Load = Cf x Nut Dynamic Load Rating

Please note that the PV limit of the nut is dependent on the duty of the application and other factors so these curves are a guideline. If your application will operate near or beyond the shown curves, please contact PBC Linear for support.

Screw	Drag Tor	que** (Nm)	Dynami	c Load (N)
Diameter	Standard	Constant Force	Standard	Constant Force
6 mm	Free Wheeling	0.0134-0.0164	334 N	302 N
10 mm	Free Wheeling	0.0197-0.0240	445 N	400 N

** Standard drag torque is factory set to the median number shown. For custom drag torque please contact a PBC Linear Applications Engineer.

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6 mm Lead Screw Gliding Surface Load Curves

Note: Based on 500 mm stroke, GST version with 0.125 C.O.F. and 0.3G acceleration. Based on 24 volt, but higher voltage amplifiers may produce higher speeds.

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6 mm Lead Screw Profile Rail Load Curves

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8 mm Ball Screw Profile Rail Load Curves

Horizontal Loads

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Lead 2

Lead 5

Lead 8

10 mm Lead Screw Profile Rail Load Curves

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Cover Component Dimensions

Covered Compact Actuators

- Material: Aluminum
- Low profile cover with thru rail mount or tall profile cover that provides a more modular mounting with toe clamps
- 6 mm diameter lead screw,
 10 mm diameter lead screws, or
 8 mm diameter ball screw drives
- 15 PRT profile rail (standard recirculating ball brg block)
- 45 mm long carriage for 6 mm dia. lead screw
 60 mm long carriage for 8 mm dia. ball screw & 10 mm dia. lead screw

31 mm

6 mm System Carriage

8 & 10 mm System Carriage

Units of Measurement mm

39 mm

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Drive End Options/ Motor Mount Benefits

Manual Hand Knob

Hand adjustment knob is used for manually adjusting screw driven systems

Integrated **Stepper Motor**

Lead screw aligned and fixed directly with motor

- Fewer components means greater accuracy, increased rigidity, and less cost
- 6 mm & 10 mm dia. lead screw driven or 8 mm dia. ball screw driven
- Attach NEMA 17 and NEMA 23 motors
- Single and double stack
- Standard wire connection is onboard plug. included connector plug with 12" leads

Stub Shaft

6 mm screw = 3.5 mm dia. stub 8 & 10 mm screw = 4 mm dia. stub

Motor Mount

One-piece main frame holds shaft-to-shaft center line

- · Extends motor and coupler life
- · Increases accuracy and repeatability
- Attach NEMA 17 or NEMA 23 stepper, servo, or smart motor
- 6 mm, 10 mm diameter lead screw or 8 mm diameter ball screw driven
- Motor easily attached with adapter plate and coupler (Motor mount kit excludes coupler)
- · Assembled system available with motor, coupling, and motor mount. Consult factory
- · Easy to assemble and motor field replaceable

Problematic Designs Cause Misalignment

Misalignment 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

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PBC Linear Design with Pre-Engineered Alignment

One-piece main frame holds shaft-to-shaft center line

- · Extends motor and coupler life
- Increases accuracy and repeatability Easy to assemble

Ordering Motor Mount Kit Separately

Motor Size	Part Number	Recommended Coupler Ordered Separately or Customer Supplied	Included with Motor Mount Purchase
40 mm	UGA040A-3PMM-HE		(1) Main frame
NEMA 17 - 42 mm	UGA040A-3PMM-HF	R + W EKL2 for 6 mm R + W EKL5 for 8 mm & 10 mm Maximum coupler dimensions:	with 4 SBHCS (Socket Button Head Cap Screw)
NEMA 23 - 56 mm	UGA040A-3PMM-HG		(1) Motor plate with 3 SBHCS for attaching to frame*
60 mm	UGA040A-3PMM-HH	25 mm O.D. x 26 mm length	(1) Cover (plastic) * Customer supplies motor screws
Blank Plate (customer machined)	UGA040A-3PMM-H0		

Motor Mount Main Frame

Stub Shaft Dimensions

Stub Shaft Diameter (6 mm dia. Lead Screw)	3.5 mm
Stub Shaft Diameter (8 mm dia. BS & 10 mm dia. LS)	4 mm
Overall Stub Shaft Length	20 mm
Stub Shaft Length for Coupler Engagement	6 mm

Motor Mount Length

NEMA 17 - 42 mm	53.7 mm
NEMA 23 - 56 mm	54.3 mm

Units of Measurement mm

Motor Mount Plates

Units of Measurement mm

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4X Ø 4.20 Thru M5 X 0.8 - 6H Thru 8

Motor Mount Plates

Motor Size: 60 mm

UGA040Z-3PMM-60A Material: Anodized aluminum

Blank Plate

UGA040Z-3PMM-BKA

- 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.

Units of Measurement mm

Sensor Bracket & Sensors

CS-SB-01

Use with:

Covered Low & Tall

Units of Measurement mm

Inductive Proximity Sensor Switches

Home sensor or position sensor with rectangular shape and only 11 mm width. DC 3-wire (10-30V DC)

Specifications

Sensor Model	6200418	6200699	
Detecting Distance	4 mm		
Sensing Direction	Flat	Pack	
Connection	Cable Type (DC 3	Cores Dia. 4 mm)	
Supply Voltage	10-3	OVDC	
Output Mode	NPN	PNP	
Output Type	Normal Open	Normal Open	
Output Current (MAX)	200	ImA	
Current Consumption	8mA		
Leakage Current	< 0.1mA		
Residual Voltage	e < 1.5VDC		
Response Frequency	500) Hz	
Reverse Polarity Protection	Stan	dard	
Short Circuit Protection	Not Av	ailable	
Hysteresis	10)%	
Ambient Temp/Humidity	-25°C to 55°C / 25% to 90% RH		
IP Protection Category	IP67		
Size (L/W/H)	L/W/H 30	/11/8 mm	

Output Circuit & Wiring

Attention

- Keep sufficient distance from nearby objects
- Do not confuse the wire connections as wrong connections may damage product

- · Do not use in the presence of flammable or volatile gas
- Proximity switch may malfunction if used near cellular phones or other transceivers

Units of Measurement mm

User Manual

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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

Motor Mount & Coupler Information

Coupler

- Compact Series motor mounts are designed to work optimally with the R+W EKL2 or R+W EKL5 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

Stub Shaft Diameter (6 mm dia. Lead Screw)	3.5 mm
Stub Shaft Diameter (8 mm dia. BS & 10 mm dia. LS)	4 mm
Overall Stub Shaft Length	20 mm
Stub Shaft Length for Coupler Engagement	6 mm

Motor Mount Length

NEMA 17 - 42 mm	53.7 mm
NEMA 23 - 56 mm	54.3 mm

ONBOARD connector PLUG

With 12" Leads Included with Purchase

User Manual Motor Mount Assembly

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) Motor fasteners (customer supplied) (See Table 2)

Tools Required:

Hex Key (See Table 1)

Suggested Thread Locker:

Blue Loctite® 242 or equivalent

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).

Table 1

Hex Key Size Needed:

M3 SHCS = 2.5 mm Driver M4 SBHCS = 2.5 mm Driver M5 SHCS = 4 mm Driver

Table 2

Customer Supplie	ed Motor Fasteners:
NEMA 17 Motor	= M3 x 0.5 SHCS
NEMA 23 Motor	= M5 x 0.8 SHCS
60 mm Servo Motor	

Table 3

 Fastener Torque Values:

 M3 SHCS
 = 8-10 in/lb [1.0-1.2 Nm]

 M4 SBHCS
 = 17-21 in/lb [2.0-2.4 Nm]

 M5 SHCS
 = 37-45 in/lb [4.2-5.1 Nm]

Lubrication User Manual

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)

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