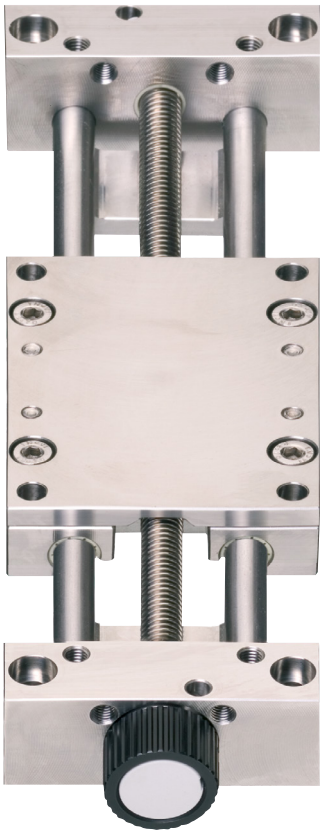
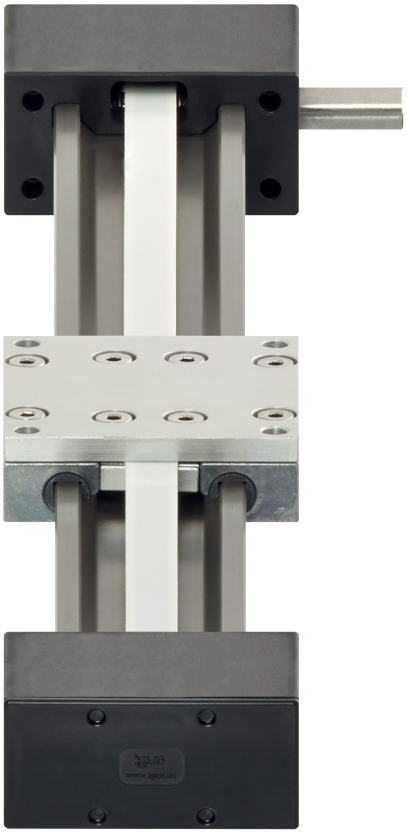
Belt-Driven Actuators vs. Lead Screw Systems

Pre-assembled linear slide tables from igus® are designed to save engineering time and resources. They are also flexible enough to meet the demands of a wide range of applications. Compared to recirculating ball bearings, self-lubricating drylin® linear bearings used in linear slide tables offer various technical advantages and significant cost savings when used in most applications.

The two most common types of actuators from igus® are lead screw driven actuators and belt-driven actuators. There are differences between the two that are important to understand before deciding which to use in a given application. In order to help facilitate the process, igus® also offers an easy to use online drive technology configurator.





Lead Screw Systems

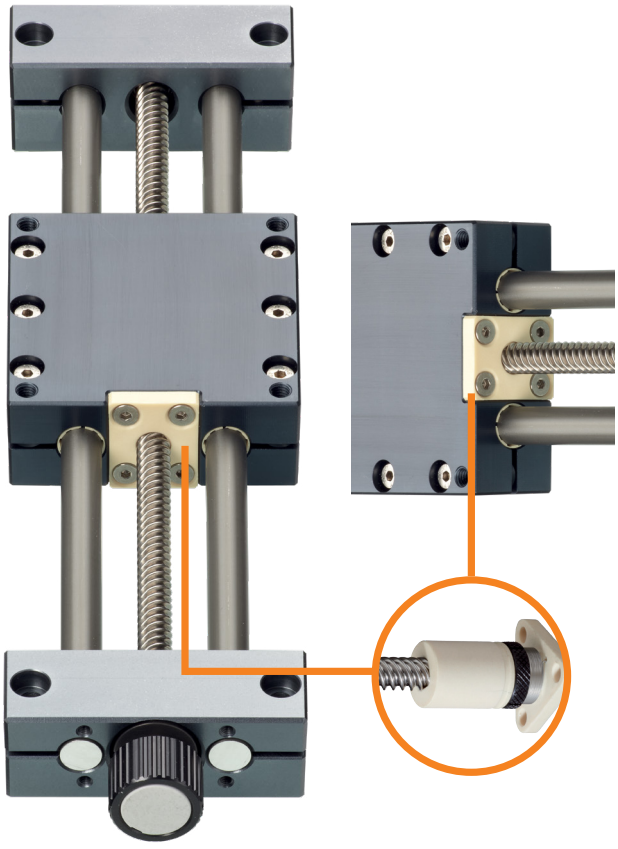
Lead screw systems use a lead screw nut to convert the rotary motion of a motor or hand wheel into the linear motion of the carriage assembly. For more information on lead screws, read this tech talk. Lead screw actuators are ideal for low-cycle positioning applications rather than applications that are constantly cycling (belt-drives are the best option for these applications). Due to the amount of torque that lead screws are able to generate, they are well-suited for moving heavy loads up to 25,000N (5,625lbf). There are many lead screw diameters, leads and materials available, as well as stepper motors, DC motors and hand wheel accessories. The limiting factor for speed is dependent on the type of lead screw bearing support used: iglide® plain bearings or sealed radial bearings. Moving a given screw at an RPM higher than its recommended length can potentially lead to resonance and noise. igus® plain bearing tables' maximum allowable RPM is 100RPM. Using the chart on the following page, the maximum length vs. RPM for tables using ball bearing supports can be found.

RPM	Ø8mm, for part numbers:	Ø10mm, for part numbers:	Ø14mm, for part numbers:	Ø18mm, for part numbers:	Ø24mm, for part numbers:
	SLW-BB-0630	HTS-BB-12 and SLW/SAW-BB-1040	SAW and SLW-BB-16	HTS-BB-20 and SAW/SLW-BB-2080	HTS-BB-30 and SLW-BB-25
100	1000mm	1500mm	1500mm	1500mm	1200mm
200	550mm	1000mm	1000mm	1250mm	1000mm
300	150mm	750mm	750mm	1000mm	850mm
400	N/R	550mm	550mm	800mm	700mm
500	N/R	400mm	400mm	600mm	600mm
600	N/R	250mm	250mm	400mm	500mm
700	N/R	100mm	100mm	300mm	400mm
800	N/R	N/R	N/R	200mm	300mm
900	N/R	N/R	N/R	100mm	200mm
1000	N/R	N/R	N/R	N/R	100mm

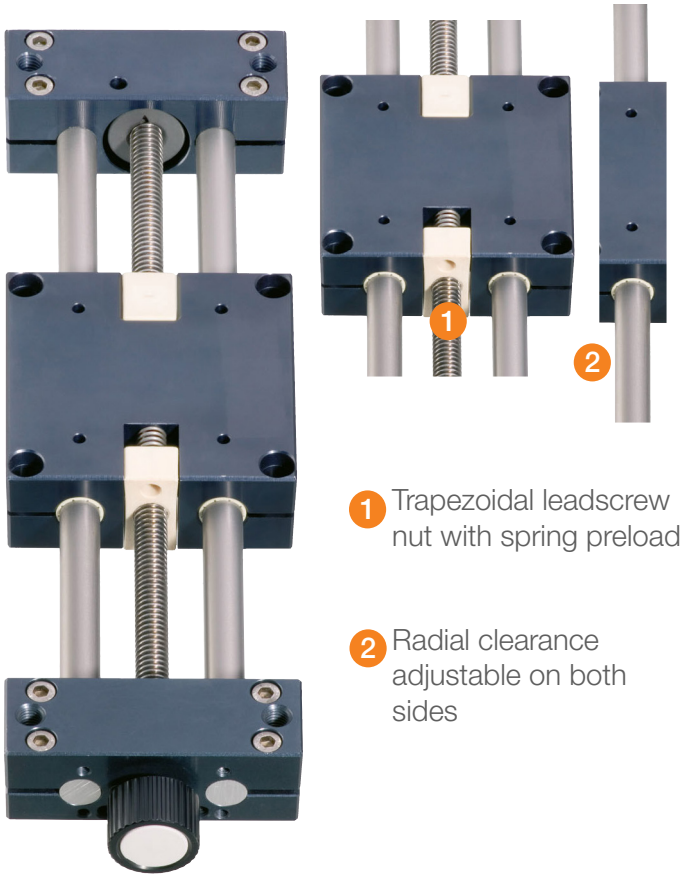
* N/R = Not Recommended at that length

Linear Positioning Tolerance

As a general rule, igus® lead screw tables allow a +/-0.1mm linear positioning tolerance when they are new. Wear in the nut for high-cycle requirements must be considered, in which case a zero-backlash or preloaded nut is recommended. This tolerance for lead screw tables is less than belt-driven actuators, which can be between +/-0.2mm and +/-0.35mm (+/-0.4mm for some low-cost “eco” versions).



HTS-zero-backlash threaded nut in linear axis



1 Trapezoidal leadscrew nut with spring preload

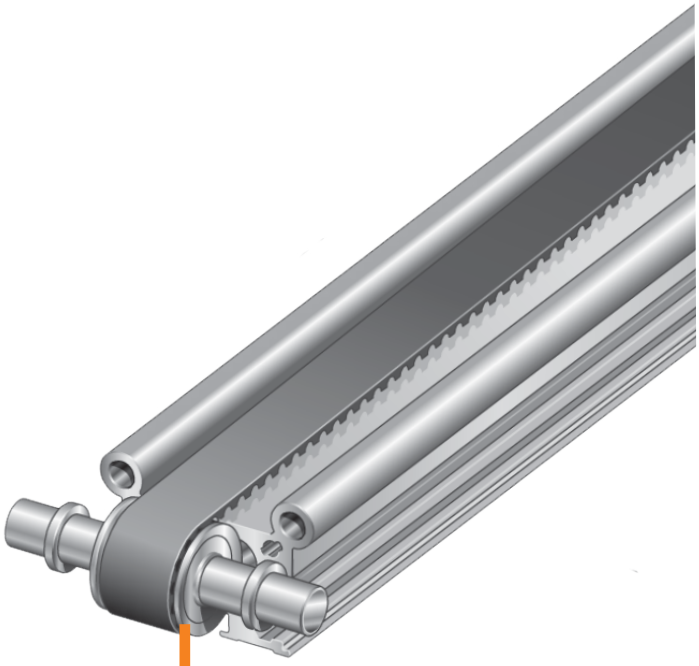
2 Radial clearance adjustable on both sides

HTS-preload-manual clearance adjustment

Belt-Driven Actuators

The primary benefit of the belt drive system, which is sometimes referred to as a timing-belt or a toothed-belt actuator, is its ability to achieve high speeds. drylin® ZLW belt-drives, for instance, are rated for speeds up to 5m/s. Due to the fact that they use a belt guided by a pulley system that has deep-grooved radial ball bearings, they avoid frictional heat issues that can occur in lead screws.

The maximum allowable load is determined by the belt tension. For example, the drylin® ZLW-20 system has a belt tension of 750N and is therefore capable of axial loads up to 75kg (1N=10kg) or 168lbf. When this loading has exceeded, it is possible for the belt to skip over the pulley and therefore is not recommended.



Belt guided by a pulley system using a deep-grooved radial ball bearing

Belt-driven tables are also more ideal than lead screw-driven tables in applications that require long stroke lengths. Lead screw nuts are prone to deflection and vibration on the inside of the nut, as well as friction. While a lead screw system using a Ø20mm diameter linear bearing is limited to stroke lengths of 1,000mm, a Ø20mm belt drive system is able to achieve max standard catalog strokes of 3,000mm. Strokes of 20 feet (6 meters) have also been achieved after review by drylin® engineering.

drylin® ZLW belt-driven actuator:

- End supports with grooved ball bearing
- Self-lubricating linear guide system with polymer plain bearings
- Various carriage lengths
- Hard-anodized aluminum profile
- Polyurethane or neoprene toothed belts

General Guidelines for Selecting a Lead Screw or Belt Drive:

	Lead Screw Systems	Belt-Driven Systems
Low Speed Positioning/Hand Powered	Ideal	Suitable
Maximum Speed	0.1m/min. - 20m/min.	1m/s - 5m/s
Maximum Stroke Length	300mm - 1250mm	500mm - 3,000mm
Maxmimum Static Radial Loads	Up to 25,000N	Up to 3,000N
Linear Position Tolerance	Up to +/-0.1mm	From +/-0.2mm to +/-0.4mm

Conversion Chart	
1N (Newton)	0.225lbf
1kg	2.2lbf
1mm	0.4"
1 meter/minute	0.17FPM
1 meter/second	3.3FPS

- drylin® drive technical data
- Toothed-belt drive technical data

Find the right drylin® linear system in just a few clicks with the drylin® drive configurator: