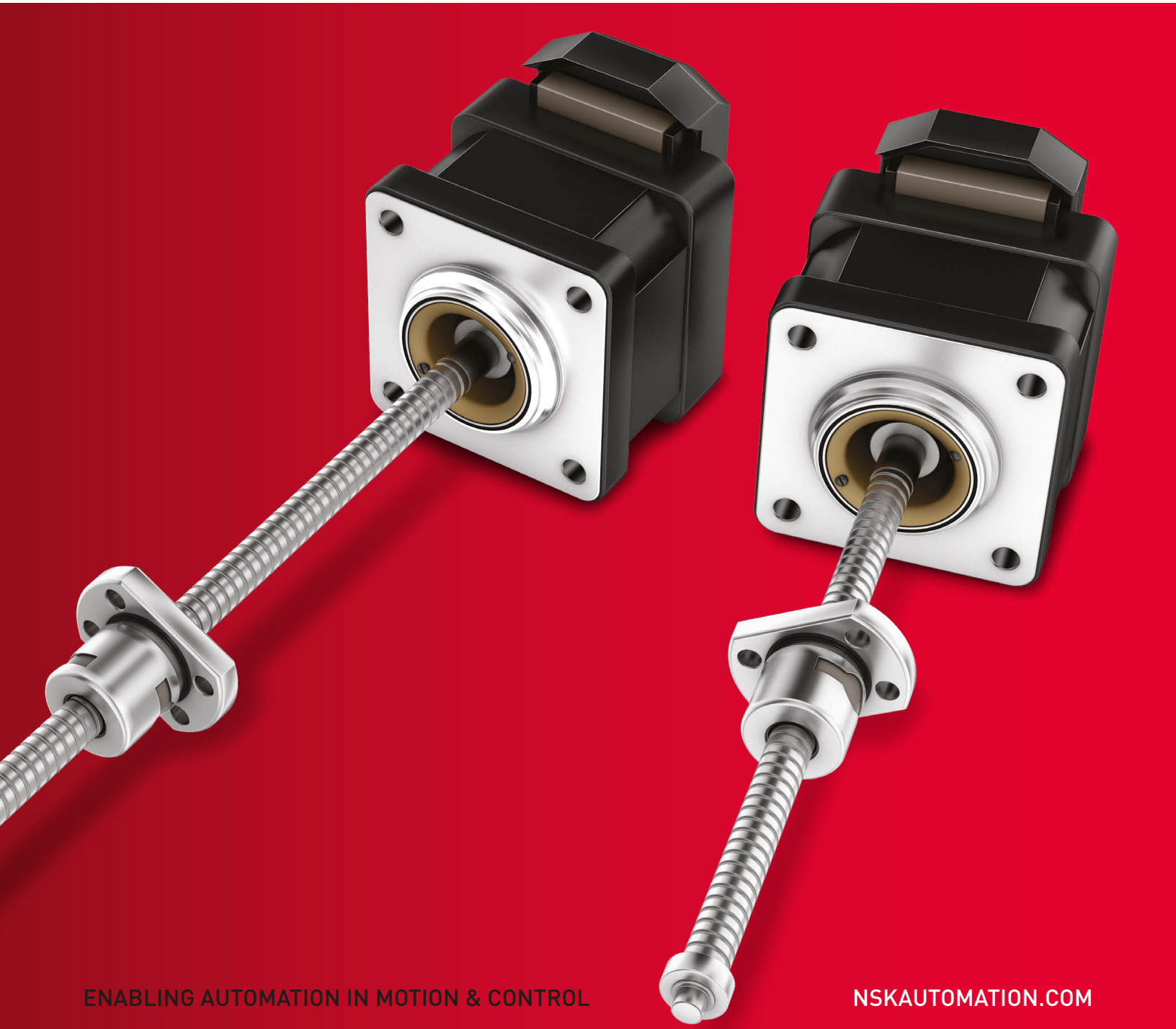
NSK

MBSA MOTORIZED BALL SCREW ACTUATOR

INTEGRATED PRECISION FOR MEDICAL DEVICES AND EQUIPMENT



ENABLING AUTOMATION IN MOTION & CONTROL

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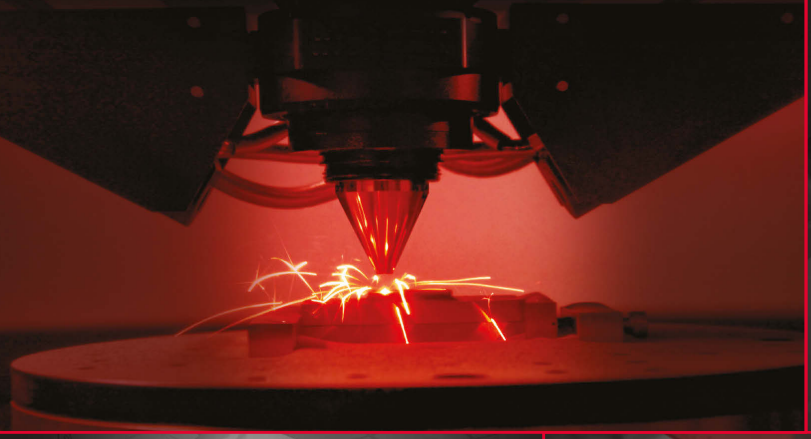
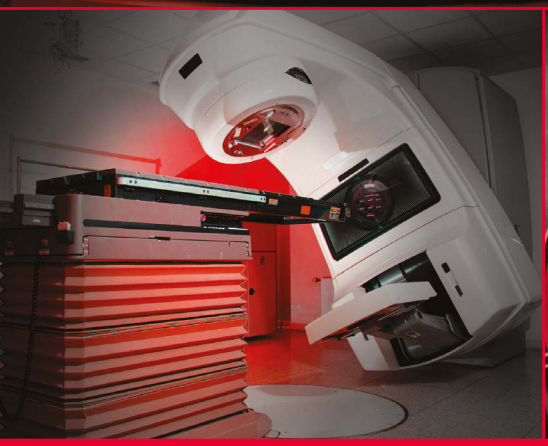
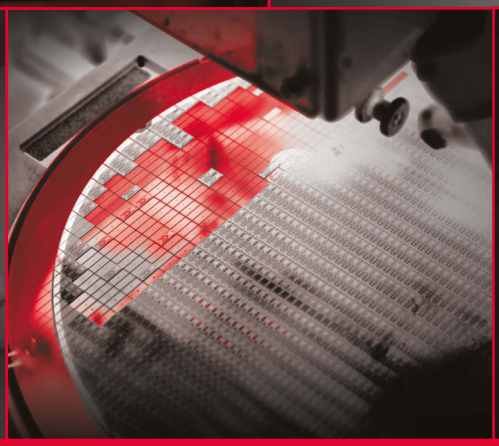



ENABLING AUTOMATION

NSK MECHATRONIC SYSTEM SOLUTIONS

For decades, NSK has specialized in developing electromechanical solutions – integrating our precision machine components with control technology – to deliver advanced, reliable and precise motion and control.

Robotic surgery. Medical imaging. Biomedicine. Semiconductor. 3D printing. Factory automation. Our customers are vast and diverse, united by precision-critical applications and NSK's ability to achieve coherent mechatronic solutions that offer:

› Augmented machine function and accuracy

› Optimized system performance, space and life

› Reduced costs and complexity

From complex systems to single-axis solutions, NSK delivers innovative and ideal integrated motion solutions to enable automation and accuracy in machine function, for a competitive edge to our customers.

EFFICIENT, PRECISE LINEAR MOTION – MBSA

Nowhere is the stringent need for smooth, precise, repeatable and reliable motion more critical than with medical devices and equipment. In applications ranging from diagnostics and dispensing to imaging and scanning, a common challenge emerges: to translate the rotary motion of a motor into highly accurate and smoothly controlled linear motion within increasingly compact spaces.

Enter NSK, and the MBSA Series Motorized Ball Screw Actuator.

Compact and fully integrated, the MBSA delivers exponentially superior accuracy and efficiency. It's the result of our global expertise in precision ball screws and mechatronic integration, and reflects the unwavering commitment behind all NSK automation initiatives:

- Streamline - consolidating multiple components into a single, compact and coherent solution
- Simplify - reducing installation complexity and eliminating potential alignment errors
- Support - dedicated collaboration, project management and technical expertise

DESIGN AND OPERATIONAL BENEFITS

NSK's MBSA Series Motorized Ball Screw Actuator is a fully integrated, highly compact and high-performing solution for precision-critical medical devices and laboratory equipment. With smooth friction-free motion, high-accuracy positioning and high operating efficiencies, it offers considerable advantages versus conventional solutions.

DESIGN FEATURES

- Precision C3 accuracy ball screw directly integrated into a NEMA stepper motor
- Available with ball screw shaft diameters of 6 and 8 mm, with leads of 1 and 2 mm
- Screw shaft thread lengths range from 50 to 200 mm
- Available with NEMA 14 and 17 size motors
- A configurable encoder can be preassembled to the motor, allowing communication with a variety of controllers / drivers
- Additional ball screw and motor frames are available upon request

RANGE OF AVAILABILITY

MBSA SCREW SHAFT / MOTOR MODEL COMBINATIONS									
SHAFT DIAMETER		06		08				10	12
STEPPER MOTOR		NEMA 14		NEMA 14		NEMA 17		NEMA 23	
SHAFT LEAD		1	2	1	2	1	2	TBD	
THREADED SHAFT LENGTH	50	■	■	■	■	■	■	Series Availability 2021	
	100	■	■	■	■	■	■		
	125	■	■	■	■	■	■		
	150			■	■	■	■		
	200				■		■		

MBSA motorized ball screw actuators are standardly available from stock in the combinations shown in the table above.

For additional combinations of screw shaft and/or motor sizes, please consult NSK.

■ shaft diameter / stepper motor / shaft lead combinations available

PROVEN ADVANTAGES

- Integrated design eliminates alignment errors that can occur when the motor and ball screw are separately mounted
- Compact, space-saving solution with the elimination of a motor coupling
- High accuracy positioning with zero backlash for precision-critical medical devices and equipment
- Longer life than conventional lead screw designs due to reduced friction, reduced wear and dramatically higher efficiency - as high as 95%
- Energy efficient with reduced motor size and lower energy consumption
- Smooth and quiet operation with improved rigidity
- Easy installation, simplifying field replacement

DESIGN AND OPERATIONAL BENEFITS

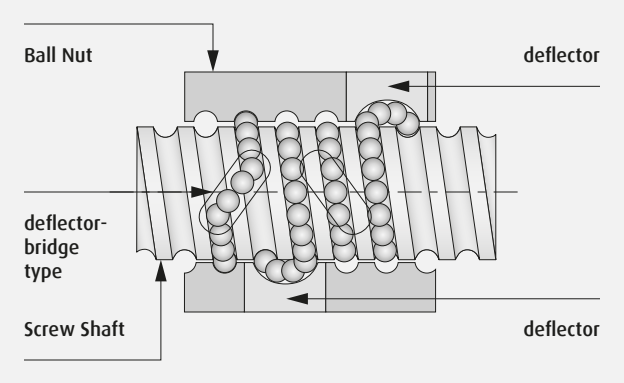
ENGINEERED FOR EXTREME ACCURACY AND EFFICIENCY

SMOOTH ROTARY TO LINEAR MOTION

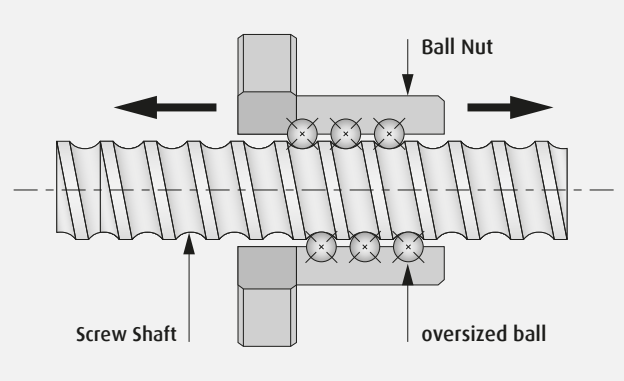
With the MBSA motorized ball screw actuator, NSK achieves superior performance by utilizing a C3 accuracy precision ball screw and rolling contact with precision balls, rather than the sliding contact of conventional lead screw solutions. The ball nut thread profile acts as an outer raceway and the screw shaft grooves act as an inner raceway with the balls travelling between.

The balls provide a rolling contact point between the nut and the shaft that dramatically lowers the coefficient of friction compared to a conventional lead screw solution. The result is a highly efficient (90% to 95%) mechanism that requires considerably less torque to convert rotary motion into linear motion. That translates into smooth, energy efficient and long-lasting performance.

With size constraints in mind, MBSA ball nuts utilize bridge-type deflector recirculation to guide the balls between raceways, providing the essential recirculation in a compact space. Since the deflectors sit below the surface of the nut body outside diameter, this area can be used as a pilot surface for instruments or components attached to the nut.



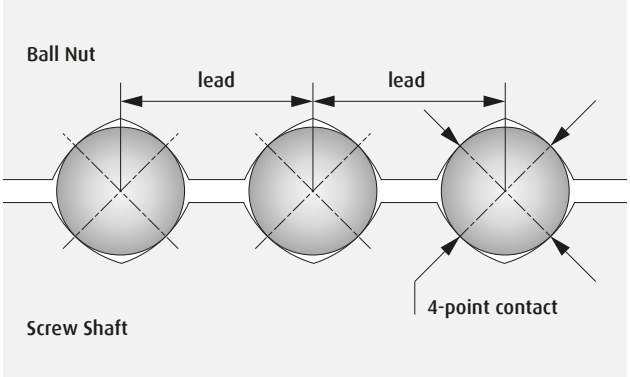
Illustrated above: deflector-type recirculation within the ball screw nut, including bridge-type deflection used in the MBSA motorized ball screw actuator



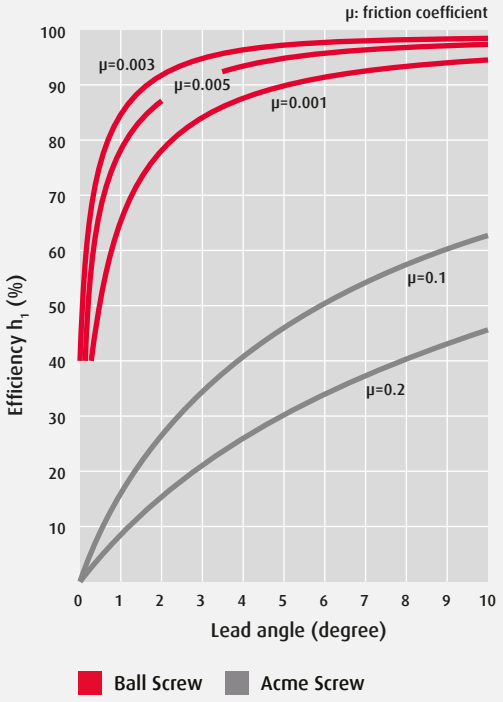
Illustrated above and below: by using slightly oversized balls resulting in 4 points of contact, NSK creates a light preload to eliminate clearance and possibility of backlash

POSITIONING ACCURACY WITH ZERO BACKLASH

The inaccuracy created by backlash inherent to conventional lead screw solutions is completely eliminated with the MBSA. NSK uses slightly oversized balls to create a light preload, eliminating any axial play between the screw shaft and the nut. The elastic deformation of the balls creates an internal force between the nut and the screw shaft to eliminate clearance. The result is precise linear movement of the object attached to the ball screw nut, with zero backlash between shaft rotation and nut linear movement. This preload enables the high positioning accuracy and control that is ideal for highly precise medical devices and laboratory equipment with multi-directional axial loads.



Efficiency of Normal Operation: Converting Rotary Motion to Linear Motion



Illustrated above: comparative efficiencies of precision ground ball screws and lead screws

PRECISION MOTION AND CONTROL

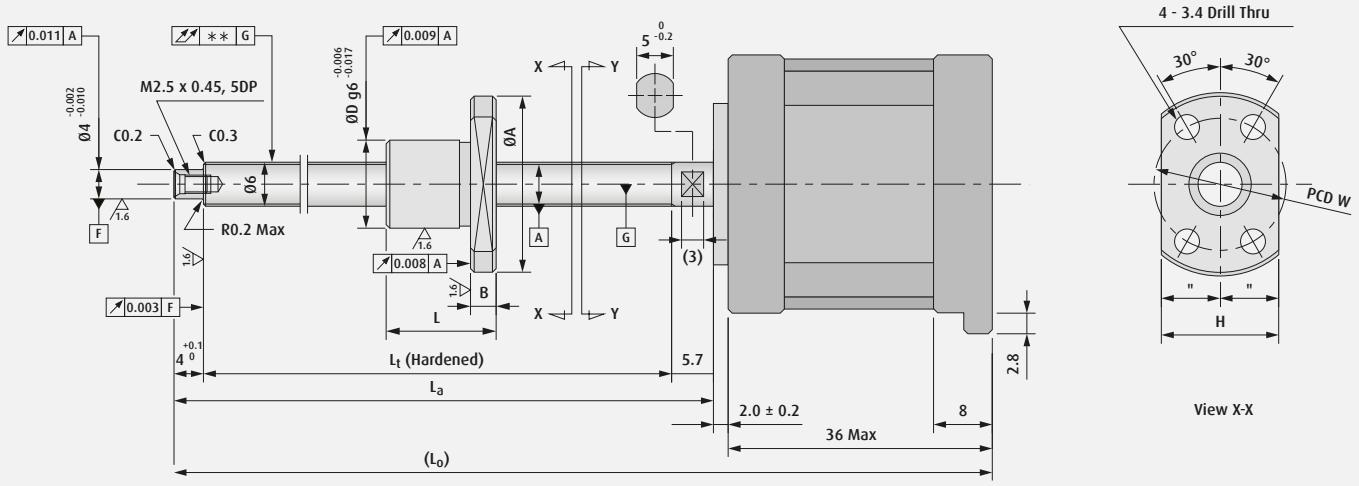
NSK C3 accuracy ball screws have a lead accuracy of 0.006 mm per shaft revolution. Over 300 mm of travel, the actual nut position deviation from the theoretical nut position is a maximum of 0.008 mm. Comparatively a lead screw can have a deviation as large as 0.250 mm, more than 30 times greater.

Using an NSK MBSA motorized ball screw actuator results in lower operating temperatures, smoother motion, reduced motor size and energy consumption, less wear and longer life compared to conventional lead screw solutions.

Ready to configure an MBSA motorized ball screw actuator? Visit **www.nskautomation.com**

MBS06 WITH NEMA 14 STEPPER MOTOR

DIMENSIONS AND OPERATING VALUES

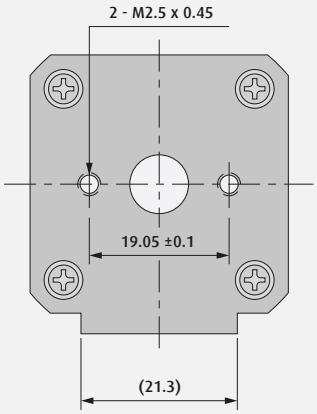


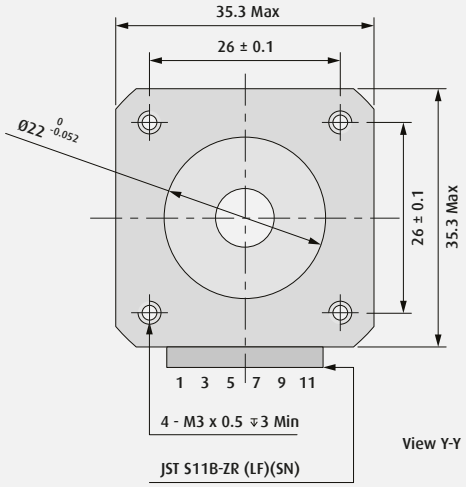
MODEL NO.	BALL SCREW		STROKE		SCREW SHAFT LENGTH			
	Diameter	Lead	Nominal	Maximum[1]	L_t	L_a	L_o	ØD
MBS0601050	6	1	30	35	50	59.7	97.7	12
MBS0601100	6	1	80	85	100	109.7	147.7	12
MBS0601125	6	1	105	110	125	134.7	172.7	12
MBS0602050	6	2	28	33	50	59.7	97.7	13
MBS0602100	6	2	78	83	100	109.7	147.7	13
MBS0602125	6	2	103	108	125	134.7	172.7	13

1) The value for maximum stroke is calculated as screw shaft dimension L_t minus ball nut length dimension L

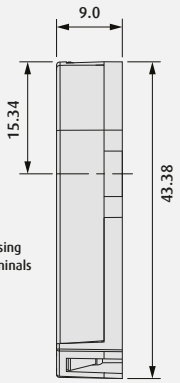
NEMA 14 MOTOR SPECIFICATIONS			
Number Of Phases	2	Phase Resistance	1.62 OHM +/-10% (20° C)
Step Angle	1.8°	Phase Inductance	2.2mH +/- 20% (1kHz 1V rms)
Rated Voltage	2.43 V DC		
Rated Current	1.5 AMP	Rotor Inertia	20 gcm^2
Holding Torque	0.23 Nm TYP (2 phase on / rated current)	Motor Weight	210 g
		Insulation Class	B (130° C)

The permissible rotational speed for this ball screw and NEMA 14 motor is 1800 rpm or less.





View Y-Y



AMT CUI 102:

Molex 50-57-9405 Housing
Molex 16-02-0086 Terminals

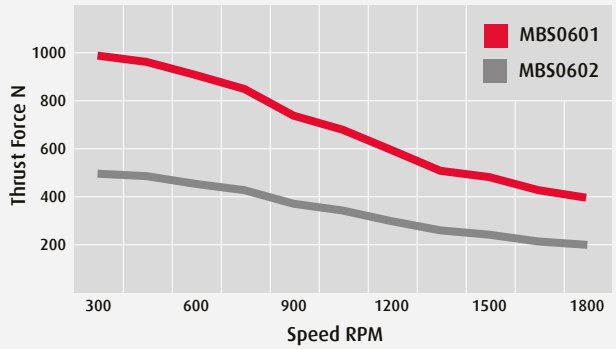
www.cuidevices.com

Encoder

Note: Encoder adds 9 mm to overall length

BALL NUT DIMENSIONS					LEAD ACCURACY			SHAFT RUN-OUT **
L	B	ØA	W	H	T	*ep*	*vu*	
15	3.5	24	18	16	0	0.008	0.008	0.020
15	3.5	24	18	16	0	0.008	0.008	0.020
15	3.5	24	18	16	0	0.010	0.008	0.025
17	4	25	19	17	0	0.008	0.008	0.020
17	4	25	19	17	0	0.008	0.008	0.020
17	4	25	19	17	0	0.010	0.008	0.025

BALL SCREW THRUST / SPEED CURVE - 6 MM BALL SCREW, 24 VDC, 1.5 A RMS



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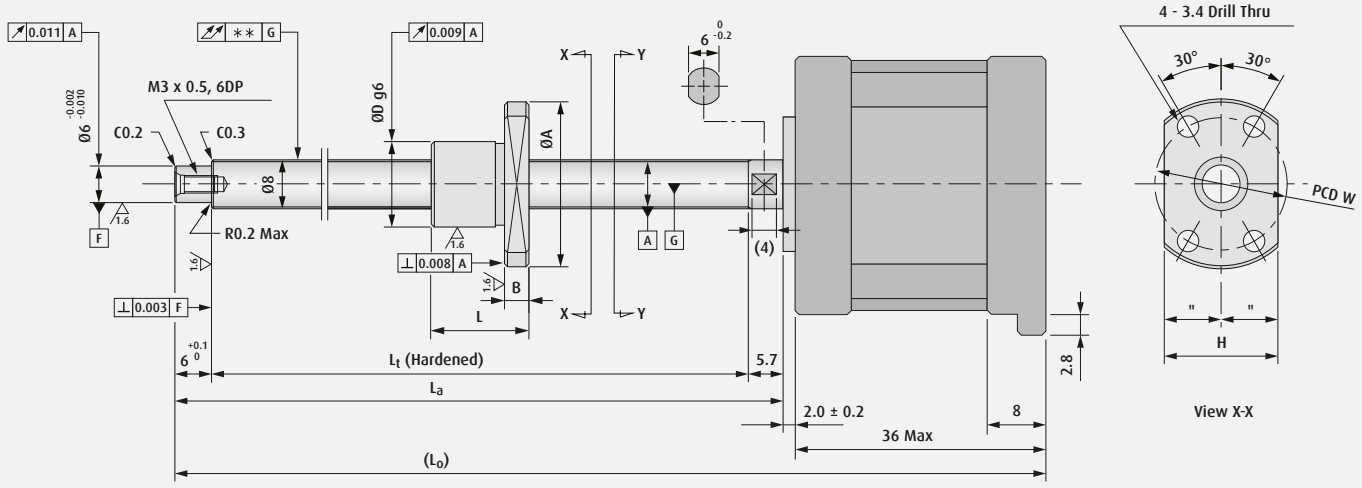
MBS08 WITH NEMA 14 STEPPER MOTOR

DIMENSIONS AND OPERATING VALUES

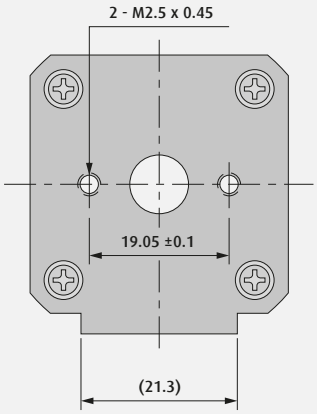


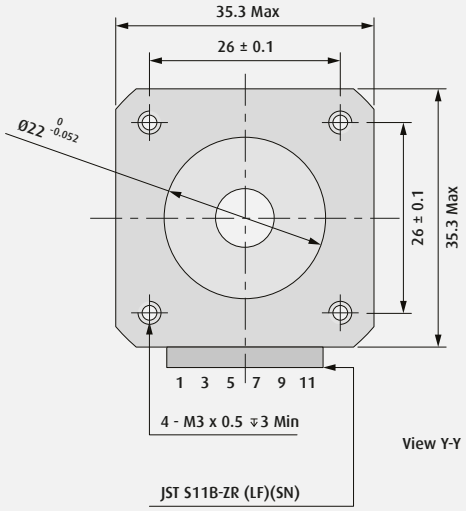
MODEL NO.	BALL SCREW		STROKE		SCREW SHAFT LENGTH			
	Diameter	Lead	Nominal	Maximum[1]	L_t	L_a	L_o	ØD
MBS0801050	8	1	29	34	50	61.7	99.7	14
MBS0801100	8	1	79	84	100	111.7	149.7	14
MBS0801125	8	1	104	109	125	136.7	174.7	14
MBS0801150	8	1	129	134	150	161.7	199.7	14
MBS0802050	8	2	19	24	50	61.7	99.7	16
MBS0802100	8	2	69	74	100	111.7	149.7	16
MBS0802125	8	2	94	99	125	136.7	174.7	16
MBS0802150	8	2	119	124	150	161.7	199.7	16
MBS0802200	8	2	169	174	200	211.7	249.7	16

1) The value for maximum stroke is calculated as screw shaft dimension L_t minus ball nut length dimension L

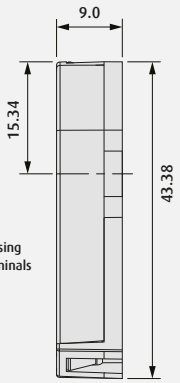
NEMA 14 MOTOR SPECIFICATIONS			
Number Of Phases	2	Phase Resistance	1.62 OHM +/-10% (20° C)
Step Angle	1.8°	Phase Inductance	2.2mH +/- 20% (1kHz 1V rms)
Rated Voltage	2.43 V DC		
Rated Current	1.5 AMP	Rotor Inertia	20 gcm^2
Holding Torque	0.23 Nm TYP (2 phase on / rated current)	Motor Weight	210 g
		Insulation Class	B (130° C)

The permissible rotational speed for this ball screw and NEMA 14 motor is 1800 rpm or less.





View Y-Y



AMT CUI 102:

Molex 50-57-9405 Housing
Molex 16-02-0086 Terminals

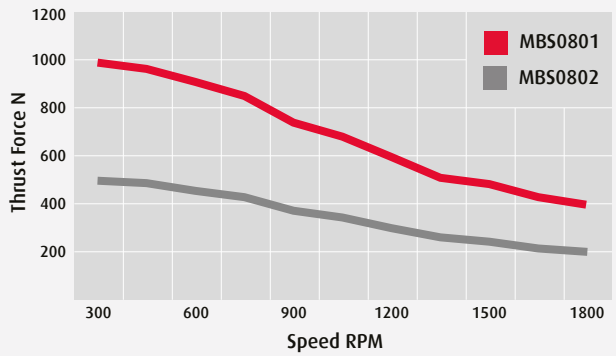
www.cuidevices.com

Encoder

Note: Encoder adds 9 mm to overall length

BALL NUT DIMENSIONS					LEAD ACCURACY			SHAFT RUN-OUT **
L	B	ØA	W	H	T	*ep*	*vu*	
16	4	27	21	18	0	0.008	0.008	0.025
16	4	27	21	18	0	0.008	0.008	0.025
16	4	27	21	18	0	0.010	0.008	0.030
16	4	27	21	18	0	0.010	0.008	0.030
26	4	29	23	20	0	0.008	0.008	0.025
26	4	29	23	20	0	0.008	0.008	0.025
26	4	29	23	20	0	0.010	0.008	0.030
26	4	29	23	20	0	0.010	0.008	0.030
26	4	29	23	20	0	0.010	0.008	0.030

BALL SCREW THRUST / SPEED CURVE - 8 MM BALL SCREW, 24 VDC, 1.5 A RMS



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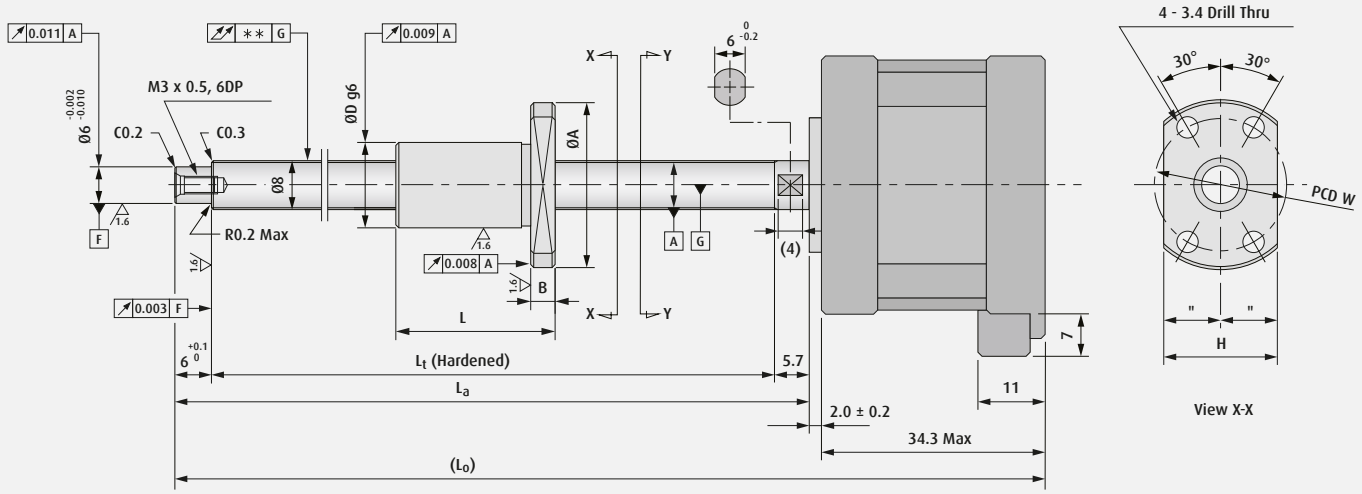
MBS08 WITH NEMA 17 STEPPER MOTOR

DIMENSIONS AND OPERATING VALUES

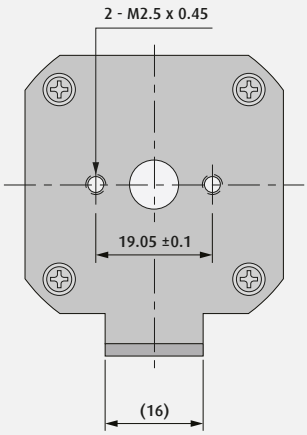


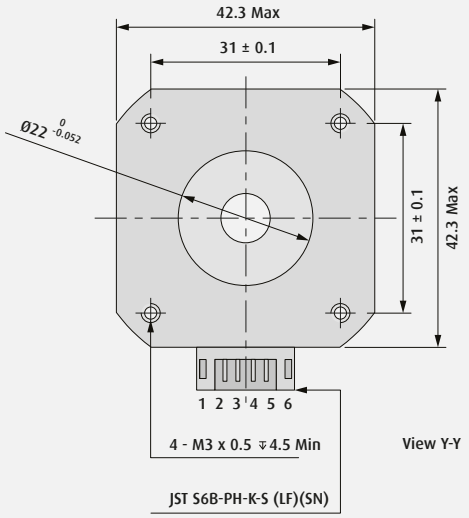
MODEL NO.	BALL SCREW		STROKE		SCREW SHAFT LENGTH			
	Diameter	Lead	Nominal	Maximum[1]	L_t	L_a	L_o	ØD
MBS0801050	8	1	29	34	50	61.7	98	14
MBS0801100	8	1	79	84	100	111.7	148	14
MBS0801125	8	1	104	109	125	136.7	173	14
MBS0801150	8	1	129	134	150	161.7	198	14
MBS0802050	8	2	19	24	50	61.7	98	16
MBS0802100	8	2	69	74	100	111.7	148	16
MBS0802125	8	2	94	99	125	136.7	173	16
MBS0802150	8	2	119	124	150	161.7	198	16
MBS0802200	8	2	169	174	200	211.7	248	16

1) The value for maximum stroke is calculated as screw shaft dimension L_t minus ball nut length dimension L

NEMA 17 MOTOR SPECIFICATIONS			
Number Of Phases	2	Phase Resistance	1.7 OHM +/-10% (20° C)
Step Angle	1.8°	Phase Inductance	2.9mH +/- 20% (1kHz 1V rms)
Rated Voltage	2.55 V DC		
Rated Current	1.5 AMP	Rotor Inertia	38 gcm^2
Holding Torque	0.32 Nm TYP (2 phase on / rated current)	Motor Weight	210 g
		Insulation Class	B (130° C)

The permissible rotational speed for this ball screw and NEMA 17 motor is 1800 rpm or less.





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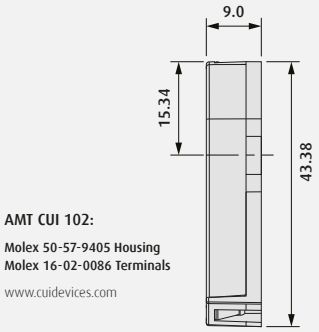


AMT CUI 102:

Molex 50-57-9405 Housing
Molex 16-02-0086 Terminals

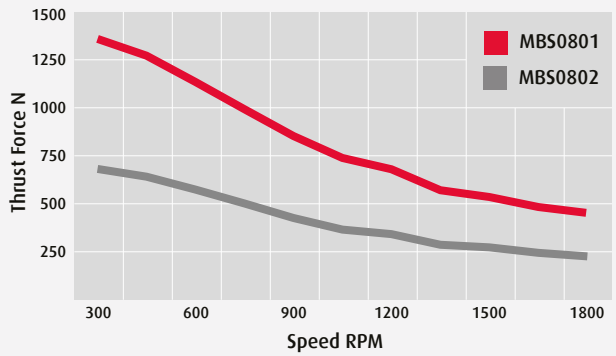
www.cuidevices.com

Encoder

Note: Encoder adds 9 mm to overall length

BALL NUT DIMENSIONS					LEAD ACCURACY			SHAFT RUN-OUT **
L	B	ØA	W	H	T	*ep*	*vu*	
16	4	27	21	18	0	0.008	0.008	0.025
16	4	27	21	18	0	0.008	0.008	0.025
16	4	27	21	18	0	0.010	0.008	0.030
16	4	27	21	18	0	0.010	0.008	0.030
26	4	29	23	20	0	0.008	0.008	0.025
26	4	29	23	20	0	0.008	0.008	0.025
26	4	29	23	20	0	0.010	0.008	0.030
26	4	29	23	20	0	0.010	0.008	0.030
26	4	29	23	20	0	0.010	0.008	0.030

BALL SCREW THRUST / SPEED CURVE - 8 MM BALL SCREW, 24 VDC, 1.5 A RMS



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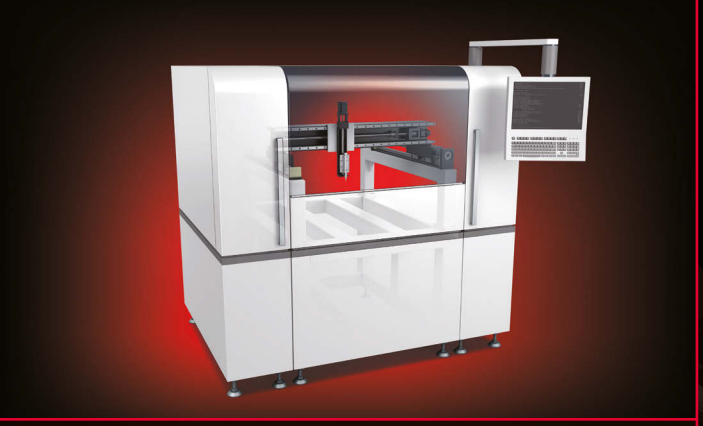
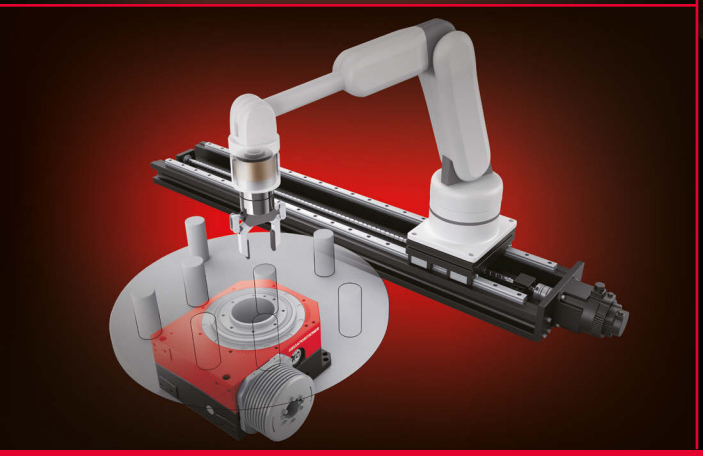
DESIGNATION SYSTEM

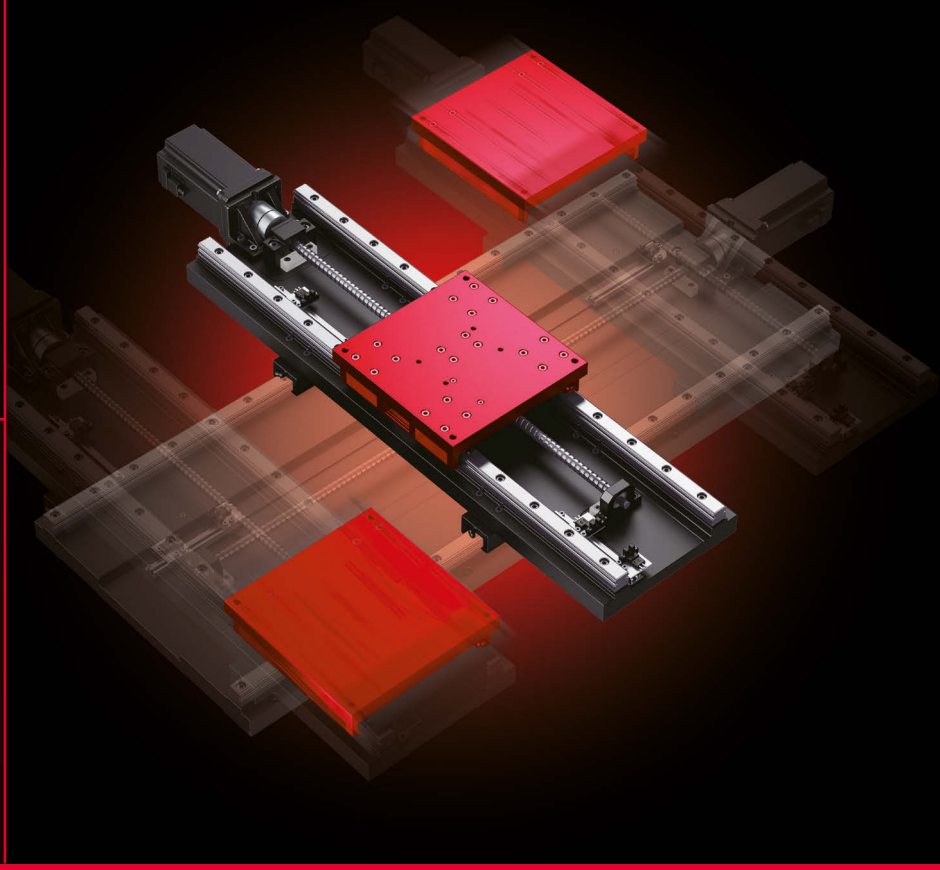
MBSA MOTORIZED BALL SCREW ACTUATORS

DESIGNATION		ATTRIBUTE
Product Series	MBS	Motorized Ball Screw Actuator
Screw Shaft Diameter	06	diameter = 6 millimeters
	08	diameter = 8 millimeters
Shaft Lead	01	lead = 1 millimeter
	02	lead = 2 millimeters
Screw Shaft Length		in millimeters, ranging from 50 to 200

DESIGNATION		ATTRIBUTE
Design Control No.		assigned by NSK
Stepper Motor Frame Size	N14	Nema 14 Motor
	N17	Nema 17 Motor
Encoder	E1	AMT CUI 102 Encoder Dip Switch
	E*	assigned by NSK







ACCUMULATED EXPERTISE, OPTIMAL SUPPORT

For your precision machine component and integrated system requirements, you can rely on the optimum interaction of NSK design solutions, comprehensive engineering support, domestic manufacturing capabilities and access to our global technology network. Our local automation experts will collaborate closely with you through all aspects of design, provide intensive project management and extend comprehensive technical support. We aim to deliver to our customers the ideal motion and control solution and experience.

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Latin America
NSK Latin America Inc.
1.305.477.0605

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