Lead Screw
Easy Assembly Design - Overview

Lead Screw Support Unit can reduce the time of assembling by 50%.

Support Unit as Standard

Lead Screw Support Units are available as standard specification.
Designing Bearing Mechanism is no longer needed.

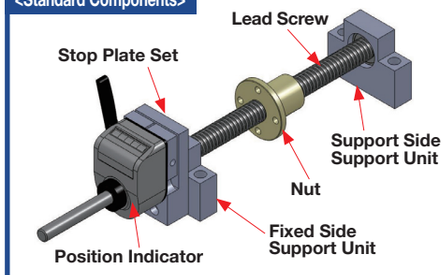
Lead screw shaft end configurations are available as standard specification.

Easy to combine with Support Units by specifying shaft dia., shaft length.
Designing Bearing Mechanism is no more required.

Design for combination with parts is no longer needed.

Easy to assemble by specifying each part dimension.
Design for combination with parts is no more required.

<Standard Components>



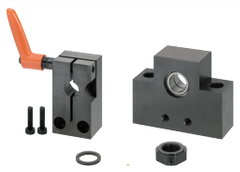
A complete lead screw unit can easily be designed by selecting standard components.

Easy Assembly Design Features of each Component

1. Lead Screw Support Units P.791~794

Features: Optimal Lead Screw Support Units use two preload-adjusted radial bearings.
Support Unit Sets combined Fixed Side Support Unit with Support Side Support Unit are available for lower prices since 2012.

Lineup : Square / Round

Fixed Side Square Support Unit	Stop Plate Set	Stop Plate Set for Position Indictor Mount	Support Side Square Support Unit
		 For Position Indicators, select from P.811	

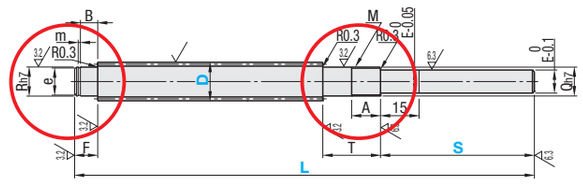
2. Lead Screws P.789

Features : Machined shaft ends based on Support Units dimensions.
Only specify **D**, **L**, and **S** dimensions.
Keyway machining and tapping etc. as an alteration are available. Mounting Handles etc. is also possible.

Lineup : Types of Threads [Right-Hand Thread / Left-Hand Thread] **Material** [SUS304 / S45C] **Surface Treatment [Black Oxide]**

Lead Screws for Support Units

Retaining Ring Groove (Support Side) Threaded (Fixed Side)



3. Nuts P.795

Features : Nuts are available in various materials and shapes. Applicable for various applications.
Lineup : See P.795~800.

Easy Assembly Design

[Selection Procedure 1] Select the optimal Lead Screw Support Unit Pattern for application.

Lead Screw Support Unit Patterns (Ex.)

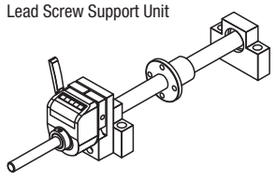
Standard Square Support Unit	Square Stop Plate Set	Stop Plate Set for Square Position Indicator Mount
		
Standard Round Support Unit	**Round Stop Plate Set**	**Stop Plate Set for Round Position Indicator Mount**
		

Without Support Side Support Unit is also selectable.

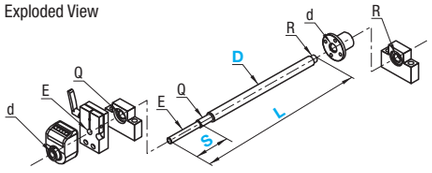
[Selection Procedure 2] Select components.

1. Specify shaft Dia. **D**, **L**, and **S** dimensions according to conditions of use.
2. Select components in the specification table based on shaft Dia. **D** specified in step 1.

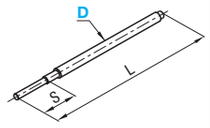
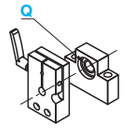
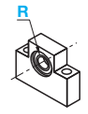
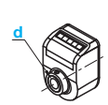
Lead Screw Support Unit



Exploded View



Lead Screw, Support Unit and Indicator Collar Size Chart

Lead Screw	Applicable Fixed Side Support Unit				Applicable Support Side Support Unit		Position Indicator Collar
							
Type	**Type**				**Type**		**Type**
MTWK		Main Body Only	Stop Plate Set	Stop Plate Set for Position Indictor Mount	Square	MTUZ	-CSE
	Square	MTWZ	MTWZ-S	MTWZ-CP-(LP)	Round	MRUZ	
	Round	MRWZ	MRWZ-S	MRWZ-CP-(LP)			
Lead Screw Shaft Dia.	**Bearing I.D.**				**Bearing I.D.**		**Collar I.D.**
D	**Q**				**R**		**d**
12	8				8		6
14	10				10		8
16	12				12		10
18	12				12		10
20	15				15		12
22	15				15		12
25	15				15		12

Position Indicator has a single I.D. size, and ordering a collar as an alteration is required. Please see Selection Chart on selecting alterations.
Select Nuts based on shaft Dia. Lead screws are available in various materials and types of threads. P.789
For Position Indicators, various types are available in terms of main body color and mounting direction. Select an appropriate type for the current application. P.811, 812

Part Number Selection Example

Components	Selection
Lead Screw	Non-plated S45C D16 L200 S20
Fixed Side Support Unit	Square Digital Position Indicators Compact Mount Set
Support Side Support Unit	Square
Position Indicator	Standard Spindle Compact

In conformance with ☐ on Size Application Table

Part Number
MTWK16-200-S20
MTWZ-CP12
MTUZ12
DPNR3-CSE10

A complete lead screw unit can be designed by ordering components with specified Part Number and assembling them.
How to Assemble P.792

When using Handles etc. please refer to P. 2 -1157

Feed Screw Comparison

Type	Slide Screw	Lead Screw	Rolled Ball Screw	Precision Ball Screw
Shape				
Features	Simple feed and adjust mechanisms, etc. Made of stainless steel shaft and plastic nut. No-grease operation is possible.	Optimal for the case where thrust loads and high loadings exist.	Can be applied at reasonable costs when precision ball screw accuracies are not required.	Optimal for the case where high positioning and velocity accuracy are required.
App. Example	Stoppers In/Out and Transfer pitch changeover	Transfer pitch changeover Jacks, Feed Screw for Lathes	Transfer Line	Measurement Instruments
Allowable Rotational Speed	Low Speed	Medium Speed	High Speed	High Speed
Accuracy	★★	★★	★★★★	★★★★★
Allowable Axial Load ( ) is for Reference.	△ (max540N)	◎ (max30000N)	○ (max9960N)	○ (max9960N)

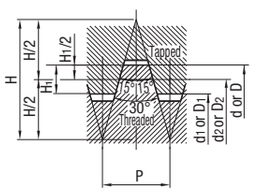
Lineup : Lead Screws

Lead Screw Type	Shape	Right-Hand Thread	Left-Hand Thread	Fine Pitch Right-Hand Thread	Right and Left-Hand Thread	Precision Right and Left-Hand Thread	Page
Both Ends Stepped		○	○	○	○	○	P.801
One End Stepped / One End Double Stepped		○	○	-	○	○	P.803
One End Stepped / One End Double Stepped		○	-	-	-	-	P.805
Both Ends Double Stepped		○	○	-	-	-	P.807
Straight		○	○	-	○	-	P.808

Lead Screw Accuracy Standards

Item	Content
Allowable Dimension and Tolerance	JISB0217 0218
Screw Accuracy	7e Grade
Nut Accuracy	7H Grade
Single Pitch Error	±0.02
Accumulated Pitch Error	±0.15/300mm
Shaft Maximum Runout	See table below
Length Tolerance	JIS B 0405 (Medium Class)

Lead Screw Thread Geometry Standards (JIS Tr)



H=1.866P H1=0.5P d2=d-0.5P
d1=d-P D=d D2=d2 D1=d1

Thread d: O.D . d1: Root Dia. d2: Effective Dia.
Tapped D: Root Dia. D1: I.D. d2: Effective Dia.
P: Pitch H1: Engage Height

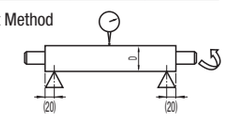
Pitch 3 of D Dimension 16, Pitch 5 of D Dimension 25 and Pitch 6 of D Dimension 40 conform to Tr Standard.

Lead Screw Specifications

Unit : mm

Shaft Dia.	Pitch	Screw Shaft Effective Dia.	Screw Shaft Minor Dia. (MIN.)	Screw Shaft Lead Angle	Screw Shaft Runout (Max.) Shaft Overall Length ~125	126~200	201~315	315~400	401~500	501~630	631~800	801~1000	1001~1250	1251~1600	1601~2000
8	1.5	7.25	(5.9)	3°46'	0.1	0.14	0.21	0.27	0.35	-	-	-	-	-	-
10	2	9	(7.2)	4°03'	0.09	0.12	0.16	0.21	0.27	0.35	0.46	0.58	-	-	-
12	2	11	(9.2)	3°19'											
14	3	12.5	(10.1)	4°22'									-	-	-
16	2	15	(13.18)	2°25'	0.09										
	3	14.5	(12.1)	3°46'		0.11	0.13	0.16	0.2	0.25	0.32	0.42	0.55	0.73	1
18	4	16	(13.1)	4°33'											
20	2	19	(17.18)	1°55'	-										
	4	18	(15.1)	4°03'											
22	5	19.5	(16.1)	4°40'											
25	5	22.5	(19)	4°03'	-	0.09	0.11	0.13	0.16	0.19	0.23	0.3	0.38	0.5	0.69
28	5	25.5	(22)	3°34'											
32	6	29	(24.5)	3°46'											
36	6	33	(28.5)	3°19'											
40	6	37	(32.5)	2°57'	-	0.11	0.11	0.11	0.13	0.15	0.17	0.22	0.27	0.34	0.46
50	8	46	(40.4)	3°10'											

• Runout Measurement Method



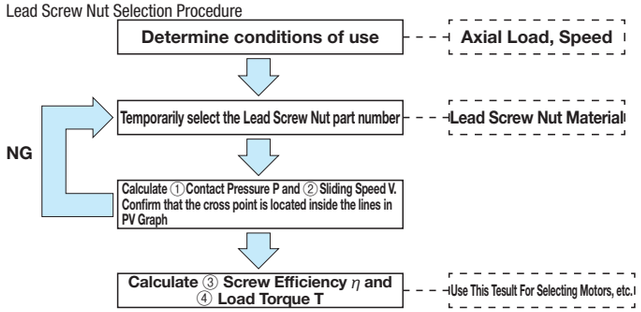
Nuts for Lead Screw Specifications

Shaft Dia.	Pitch	Part Number / Type MTS□□/ Standard	MTSP□□/ Compact	MTSJR/ Pilot	MTSQR/ Slotted Holes	MTRFR / RoHS Compliant	MTBLR/ Anti-Backlash	MTSM□□/ Lubrication-Free	MTSR□□/ High Strength Plastic	MTSF□□/ Plastic Type
										
		P.795	P.795	P.795	P.795	P.796	P.796	P.797	P.798	P.798
		Allowable Dynamic Thrust (N)								
8	1.5	1470	-	-	-	-	-	-	-	-
10	2	2550	2020	-	-	2550	2600	2550	278	255
12	2	3920	3140	-	-	3920	3390	3920	428	392
14	3	4900	3920	4900	4900	4900	-	4900	536	490
16	2	-	-	6670	6670	6670	-	-	-	-
	3	6670	5340	-	-	6670	6290	6670	686	628
18	4	8720	-	-	-	-	-	-	954	873
20	2	-	-	-	-	10100	-	-	-	-
	4	9810	7850	9810	9810	9810	9320	9810	1071	980
22	5	12360	9890	12360	12360	-	-	12360	-	-
25	5	14220	11380	14220	14220	14220	-	14220	-	1412
28	5	17950	14420	17950	17950	17950	-	17950	-	1765
32	6	21080	16940	21080	21080	21080	-	21080	-	2050
36	6	25780	-	-	-	-	-	25780	-	-
40	6	33830	-	-	-	-	-	33830	-	-
50	8	40310	-	-	-	-	-	-	-	-

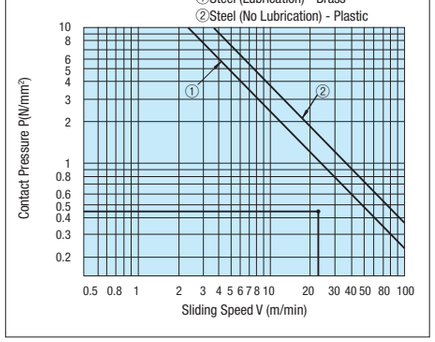
Lead Screw Technical Calculations

Calculate Contact Pressure P and Sliding Velocity V based on conditions of use to check that no abnormal wear will occur.
Calculate cross point based on the calculated P and V values in PV Graph.
When the cross point is located inside the line ① or ② in PV Value Graph, it can be stated that no abnormal wear will occur.

Lead Screw Nut Selection Procedure



PV Value Graph



①Contact Pressure P (N/mm²)

$$P=\frac{Fs}{Fo}x\alpha$$

Fs : Axial Load (N)
Fo : Allowable Dynamic Thrust (N) >> Nuts for Lead Screw Specifications
The thrust when the contact pressure acting on the screw shaft and nuts is 9.8 (0.98N)/mm²
α : 9.8 (Brass), 0.98 (Resin)

②Sliding Speed V (m/min)

$$V=\frac{\pi \cdot d_2 \cdot n}{\cos(d)}x10^{-3}$$

d2 : Screw Shaft Effective Dia. >> Nuts for Lead Screw Specifications
d : Screw Shaft Lead Angle (Degree) >> Nuts for Lead Screw Specifications
n : Screw Shaft Revolution Frequency per Minute (min⁻¹)

③Screw Efficiency η

$$\eta=\frac{1-\mu\tan(d)}{1+\mu/\tan(d)}$$

μ : Dynamic Friction Coefficient
d : Screw Shaft Lead Angle (Degree)

Dynamic Friction Coefficient Reference Value

Thread Shaft	Nut	Dynamic Friction Coefficient μ
Steel (Lubrication)	Brass	0.21
Steel (Non Lubrication)	Polyacetal / PPS Resin with Sliding Property	0.13

④Load Torque T (N · cm)

$$T=\frac{FS \cdot R}{2\pi \cdot \eta}$$

Fs : Axial Load
η : Screw Efficiency
R : Lead (cm)

Calculation Example

In case of using MTSRW16 shaft, pitch 3 and MTSFR16 brass flanged nut when the axial load is 300N as rotational speed at 500min⁻¹.

①Contact Pressure P (N/mm²)

$$P=\frac{Fs}{Fo}x\alpha=\frac{300}{6670}x9.8=0.44(N/mm^2)$$

②Sliding Speed V (m/min)

$$V=\frac{\pi \cdot d2 \cdot n}{\cos(d)}x10^{-3}=\frac{\pi x14.5x500}{\cos(3°46')}x10^{-3}=22.8(m/min)$$

When the PV Graph is viewed based on the calculated P and V values, the cross point V=22.8(m/min) when P=0.44(N/mm²) is located inside the line ① on the PV Graph, thus it can be stated that no abnormal wear will occur.

Calculation Example

Required Torque when using MTSRW16 shaft , pitch 3, and MTSFR16 brass (flanged nut.)

③Screw Efficiency η

$$\eta=\frac{1-\mu\tan(d)}{1+\mu/\tan(d)}=\frac{1-0.21x\tan(3°46')}{1+0.21/\tan(3°46')}=0.24$$

Also, in a case of calculating for the Load Torque T (N · cm) when the axial load is 300N.

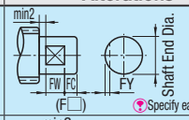
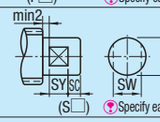
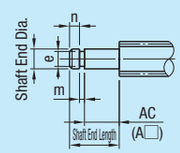
④Load Torque T (N · cm)

$$T=\frac{FS \cdot R}{2\pi \cdot \eta}=\frac{300x0.3}{2\pi x0.24}=59.7(N \cdot cm)$$

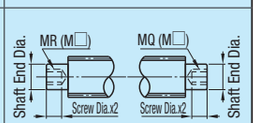
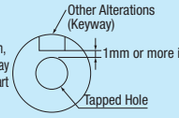
Lead Screw Shaft End Machining - Overview

Orders can be placed without drawings by adding the Alteration Specifications listed below to the standard lead screw product part numbers. Procurement is quick with short lead time.

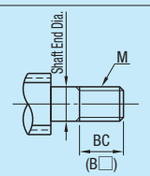
On the table below, the "□" portion of F□ and so on will contain the V, Q, R, E or C code which indicates which shaft part to add alterations to.

Alteration Items	Alterations	Code	Spec.
Flat Machining		F□ FV FQ FR FE FC	Adds a flat on a shaft end. Usage: Used for a set screw flat when mounting a handle. Ordering Code: FC5-FW10-FY1 0.5mm Increment When shaft end diameter ≤25, FY≤1.0 When shaft end diameter ≥26, FY≤2.0 3≤FW≤20 F□=0, or F□≥2 Only one end of the shaft is machined
2 Flats Machining		S□ SC SQ SE SR SV	2 flats (wrench flats) are machined on one end of the shaft Usage: For wrench use Ordering Code: SC5-SW10-SY8 1mm Increment When shaft end O.D. <15, SW≥ end O.D. -2 When 15≤ shaft end O.D. ≤25, SW ≥ end O.D. -3 When 30≤ shaft end O.D., SW≥ end O.D. -5 3≤SY≤20 Only one end of the shaft is machined S□=0, or S□≥2
Retaining Ring Groove		A□ AC AQ AR AE	Adds a retaining ring groove on a shaft end. Usage: For bearing mounting, etc. Ordering Code: AC13.3 0.1mm increment AC (AQ, AR, AE) ≤ Shaft End Length-**m-n** For the m,n value, see the table on the right. (For the m value, consider the tolerance.)

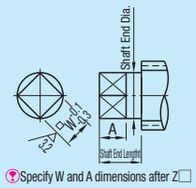
Shaft End Dia.	e Tolerance		m+0.14 0	n Machining Limit	Retaining Ring
6	4	+0.075 0	0.7	n≥1.2	E-Shaped Retaining Ring
7					
8	5				
9	6		0.9		
10	9.6	0 -0.09	1.15	n≥1.5	C-Shaped Retaining Ring
12	11.5				
14	13.4	0 -0.11			
15	14.3				
16	15.2				
17	16.2				
20	19	0 -0.21	1.35		
25	23.9				
30	28.6		1.65		
35	33				
40	38	0 -0.25	1.9	n≥2	

Coarse Tapping		M□ MC MQ MR ME MV	Adds a coarse threaded tapped hole on the shaft end. Usage: Used for mounting threaded item (knobs, etc.) Ordering Code: MC24 Select from table on the right. Not applicable to 4mm dia. shafts When combined with an other alteratuion, do not specify this alteration in such a way that the shaft thickness on the tapped part becomes less than 1mm. 

Shaft End Dia.	MC (M□): Tap Dia. Selection Range
5	3
6	3
7, 8	3, 4
9, 10	3, 4, 5
11, 12	3, 4, 5, 6
13~15	3, 4, 5, 6, 8
16~18	3, 4, 5, 6, 8, 10
19~24	3, 4, 5, 6, 8, 10, 12
25~30	3, 4, 5, 6, 8, 10, 12, 16
31~39	3, 4, 5, 6, 8, 10, 12, 16, 20
40, 50	3, 4, 5, 6, 8, 10, 12, 16, 20, 24, 30

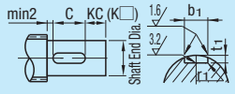
For Bearing Nut Threaded for Bearing Nuts		B□ BV BC BQ BR	Cuts a thread on the shaft end. Usage: For locking bearing nuts Ordering Code: BC20 Select from table on the right. Nut Detail **P.1036** Shaft end diameters applicable to 7, 9, 16 are not available. B□ (Tap Length) ≤ Shaft End Dia. x 3 B□ (Tap Length) ≥ Pitch x 3 B□ (Tap Length) ≤ Shaft End Length - Pitch x 3

Shaft End Dia.	MxPitch
6	M 6x0.75
8	M8x1.0
10	M10x1.0
12	M12x1.0
14	M14x1.0
15	M15x1.0
17	M17x1.0
20	M20x1.0
25	M25x1.5
30	M30x1.5
35	M35x1.5
40	M40x1.5

Square Machining		Z□ ZC ZQ ZE ZR ZV	Adds square chamfering on a shaft end. Usage: For mounting handles, etc. Ordering Code: ZC12-W10-A8 Specify ZC (Z□) as same as the end diameter W=Select from the table on the right, or specify in 1mm increment A=1mm Increment 5≤A≤20 Only one end of the shaft is machined

Shaft End Dia.	W 1mm Increment
6, 7	5
8	6
9	7
10	8
12	9 10
14, 15	10 11 12
16	11 12 13
17	12 13 14
20	14 15 16
25	17~20
30	21~24
35	25~28
40	29~30

Shaft End Dia.	W 1mm Increment
6~10	5~8
11~14	8~10
15~19	10~14
20~25	14~20
26~30	19~24
31~35	22~28
36~40	26~30

Keyway		K□ KC KQ KV KE KR	Adds a keyway on a shaft end. Usage: For handle mounting keyway use Ordering Code: KC8-C10 KC (K□) and C: Specify in 1mm increment Only one end of the shaft is machined C≤60, C≥t1 KC (K□)≥2, or KC (K□)=0 When KC (K□)=0, keyway R will be eliminated on the end side. 

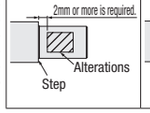
Applicable Shaft End Dia.	Keyway Dimension b1 Reference Dimension	b1 Tolerance (N9)	t1 Reference Dimension	t1 Tolerance	r1
6~7	2	-0.004 -0.029	1.2	+0.1 0	0.08 ~0.16
8~10	3		1.8		
11~12	4	0 -0.030	2.5		0.16 ~0.25
13~17	5		3		
18~22	6		3.5		
23~30	8	0 -0.036	4	+0.2 0	0.25 ~0.40
31~38	10		5		
39, 40	12	0 -0.043	5		

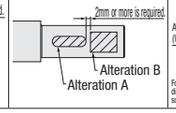
Notes on Selecting Alterations

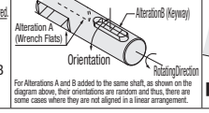
① Specify an alteration position to be 2mm or more away from the stepped part. (See Diagram Note ①.)
② When adding multiple alterations, there must be 2mm or more clearance between each feature. (See Diagram Note ②.)
③ When flat machining, wrench flats, square chamfering and keyway alterations are combined with each other, their orientations will be random. (See Diagram Note ③.)
④ When two or more features are specified on a shaft, some alterations may not be possible due to their correlations.
⑤ Do not specify multiple alterations in such a way that they overlap with each other in the rotating direction on the same shaft. (See Diagram Note ⑤.)

Conditions Applied to Lead Screws with Alterations for Combination of Square Chamfering and Tapping. Applied to Lead Screws on **P.803~807**.

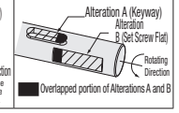
Square Chamfering		Coarse Tapping
Shaft End Dia.	Square Machining	Tap Dia.
6~10	5~8	3
11~14	8~10	3, 4
15~19	10~14	3, 4, 5
20~25	14~20	3, 4, 5, 6, 8
26~30	19~24	3, 4, 5, 6, 8, 10
31~35	22~28	3, 4, 5, 6, 8, 10, 12
36~40	26~30	3, 4, 5, 6, 8, 10, 12, 16

Note① Specify an alteration portion to be 2mm or more away from the stepped part.


Note② 2mm or more is required for the clearance between multiple alterations.


Note③ When the multiple alterations are combined each other, their orientations are random and thus, are not always aligned in a linear arrangement. (One example of this is shown on the diagram below.)


For Alterations A and B added to the same shaft, as shown on the diagram above, their orientations are random and thus, there are some cases where they are not aligned in a linear arrangement.

Note⑤ Do not specify multiple alterations in such a way that they overlap with each other on the same shaft. (Any diagram as shown bellow is not acceptable.)


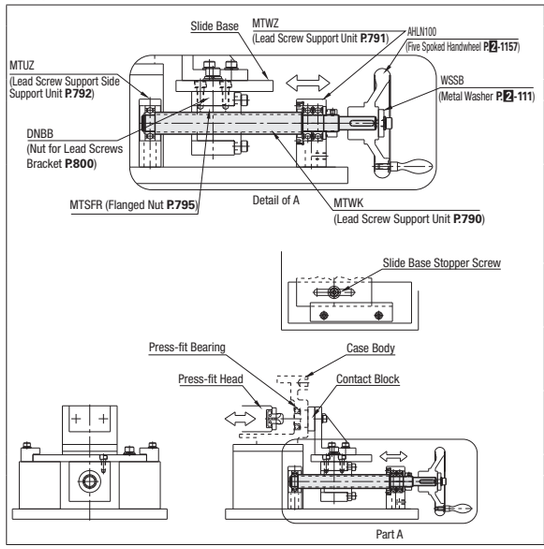
Overlapped portion of Alterations A and B

Lead Screw Application Examples

Lead Screw Application Examples

App. Example 1 Machine Name Slide Base Feed Mechanism for Reference Shoulder Adjusting

Configuration comprised of Shaft Support Unit for Lead Screws, Lead Screw Shaft, and a Position Indicator.



• Applications

Used for transfer feeding, locating stoppers, and guiding of various workpieces.
Adjustments are relatively small, but shock loads in axial direction are considered.
In addition, the lead screw scheme is chosen for its low price.

• Selection Criteria

Lead Screw Shaft
A lead screw shaft configured specifically for MISUMI Shaft Supports with a Keyway is selected.
The configuration supports each end of the shaft with a bearing.

Lead Screw Support Units
Lead Screw Support Unit is selected for the fixed side of the shaft.
Selected support unit has two radial bearings in preloaded arrangement.
Selected since thrust loads can be supported.

Lead Screw Support Units
A Shaft Support Unit for Lead Screws is selected for the shaft support side.
Comes with two radial bearings in the set, and used as is.

Nuts for Lead Screws
Commonly used Round Flanged Lead Screw Nut is selected.

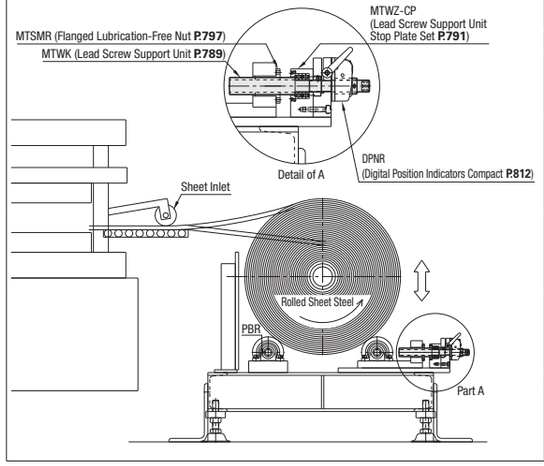
Nut Brackets
A Nut Bracket compatible with a lead screw nut is selected.

• Conditions of Use

①Applied Load 200N Material Mass : 300N
②Setup Change-over Frequency Once a day for rod changes, etc.
③Positioning Accuracy ±0.5mm
④Stroke 150mm

App. Example 2 Machine Name Sheet Steel Roll Base with Adjustment Mechanism

Configuration comprised of Shaft Support Unit for Lead Screws, Stop Plate Set, Lead Screw Shaft, and a Position Indicator.

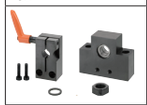


• Applications

Sheet steel roll's remaining O.D. is measured at set intervals, and the roll is raised accordingly with a lead screw.
The lead screw feed amount is measured by a position indicator, instead of using a conversion table.

• Selection Criteria

Lead Screw Shaft
A lead screw shaft configured specifically for MISUMI Shaft Supports with no R machining on the support side (Alteration RC) is selected.



Lead Screw Support Units
Lead Screw Support Unit is selected for the fixed side of the shaft.
Selected since thrust loads can be supported, and a Digital Position Indicators Compact can be directly mounted.

Nuts for Lead Screws
Round Flanged Lubrication-Free Lead Screw Nut is selected.
Selected because the lubrication maintenance can be reduced to only once a year.

Position Indicators
A Digital Position Indicators Compact is selected for lead screw feed distance measurements.

• Conditions of Use

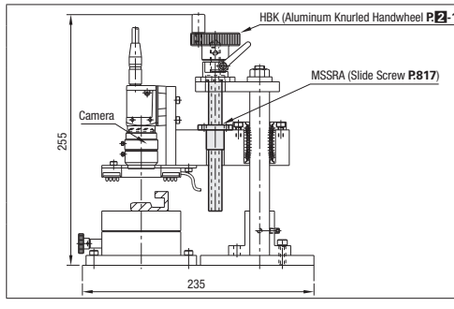
①Applied Load 20kN
②Maintenance Once a year
③Positioning Accuracy 1~2mm
④Stroke 150mm

Slide Screw Application Example

With a stainless steel thread shaft and a plastic nut, slide screws can be used without grease and are suitable for use with the screw feed mechanism in clean environments.
Slide screws are low cost and offer smooth movements due to their excellent tribological properties.

App. Example 1 Machine Name Camera Inspection Unit

A slide screw is utilized as the Z axis.



• Applications

A slide screw is chosen for fine adjustability, and can be used without lubrication maintenance.

• Selection Criteria

Slide Screw Shaft
One End Stepped Type in SUS304 is selected.
Nut
Tribological resin nut is selected for zero grease requirement and good corrosion resistance.

• Conditions of Use

①Applied Load 50N
②Setup Change-over Frequency Once a day for rod changes, etc.
③Positioning Accuracy ±0.5mm
④Stroke 100mm