

1.3. Accuracy Averaging Effect by Absorbing Mounting Surface Error

The LM Guide contains highly spherical balls and has a constrained structure with no clearance. In addition, it uses LM rails in parallel on multiple axes to form a guide structure with multiple-axis configuration. Thus, the LM Guide is capable of absorbing misalignment in straightness, flatness or parallelism that would occur in the machining of the base to which the LM Guide is to be mounted or in the installation of the LM Guide by averaging these errors. The magnitude of the averaging effect varies according to the length or size of the misalignment, the preload applied on the LM Guide and the number of axes in the multiple-axis configuration. When misalignment is given to one of the LM rails of the table as shown in Fig. 1, the magnitude of misalignment and the actual dynamic accuracy of the table (straightness in the horizontal direction) are as shown in Fig. 2. By applying such characteristics obtained with the averaging effect, you can easily establish a guide structure with high dynamic accuracy.

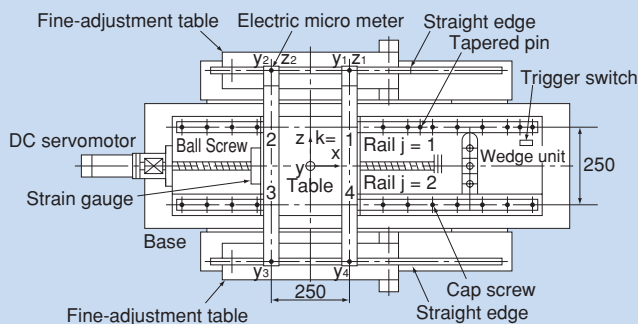


Fig. 1

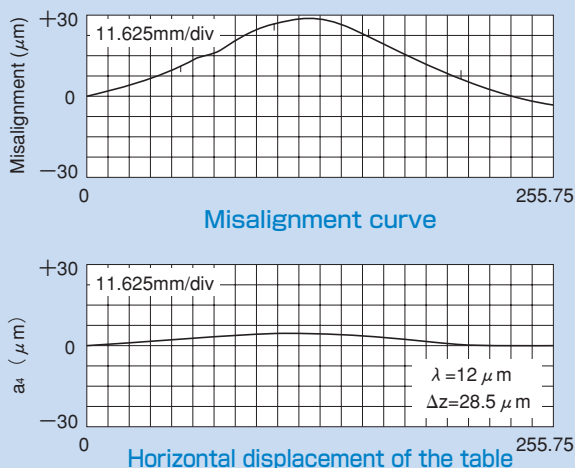


Fig. 2

Dr. Shigeo Shimizu: Study on the accuracy averaging effect of an LM ball guide system, from a collection of papers (1990) at an academic lecture of the Spring Conference of the Precision Manufacturers Association 1990

Even on a roughly milled mounting surface, the LM Guide drastically increases running accuracy of the top face of the table.

Example of installation

When comparing the mounting surface accuracy (a) and the table running accuracy (b), the results are:

$$\begin{aligned} \text{Vertical} & \quad 92.5 \mu\text{m} \rightarrow 15 \mu\text{m} = 1/6 \\ \text{Horizontal} & \quad 28 \mu\text{m} \rightarrow 4 \mu\text{m} = 1/7 \end{aligned}$$

Table 1 Actual Measurement of Mounting Surface Accuracy
Unit: μm

Direction	Mounting surface	Straightness	Average (a)
Vertical	Horizontal	A 80	92.5
	Horizontal	B 105	
Bottom surface	Side surface	C 40	28
	Side surface	D 16	

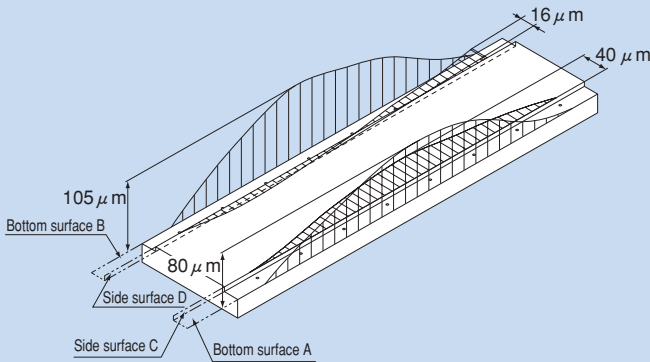


Fig.3 Surface Accuracy of the LM Guide Mounting Base (Milled Surface Only)

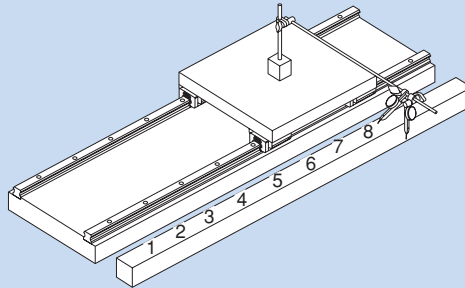


Fig. 4 Running Accuracy After the LM Guide Is Mounted

Table 2 Actual Measurement of Running Accuracy on the Table (Based on Measurement in the Figure Above)
Unit: μm

Direction	Measurement point	1	2	3	4	5	6	7	8	Straightness (b)
Vertical		0	+2	+8	+13	+15	+9	+5	0	15
Horizontal		0	+1	+2	+3	+2	+2	-1	0	4