General Explanation
IKO Precision Positioning Table should be selected taking the points related to the required conditions into careful consideration. Typical selection procedure is shown below.

1. **Check for operational condition**
   - Stroke length to be used
   - Mounting space (height, width, length)
   - Mounting direction
   - Applied load size and direction
   - Operation pattern
   - Operating environment

2. **Check for the required accuracy**
   - Positioning accuracy
   - Positioning repeatability
   - Parallelism in table motion A, B
   - Straightness
   - Squariness

3. **Temporary selection of table model**
   - Feeding mechanism of slide table
   - Size
   - Stroke length
   - Number of axes

4. **Temporary selection of motor**
   - Type and size of motor

5. **Consideration of operation patterns**
   - Marginal acceleration time
   - Effective torque
   - Inertia
   - Positioning time

6. **Consideration of maximum speed and resolution**
   - Ball screw lead
   - Maximum number of revolutions of the motor
   - Encoder specification

7. **Consideration of system**
   - Selection of controller
     - With or without sensor
     - Connection cord
     - Interface with external devices

8. **Final checking**
   - Re-check for operational condition
   - Cost and delivery
   - Additional machining
   - Special table

---

**IKO Characteristics of Precision Positioning Table**

<table>
<thead>
<tr>
<th>Series</th>
<th>Model</th>
<th>Stroke length mm</th>
<th>Positioning repeatability</th>
<th>Positioning accuracy</th>
<th>High speed</th>
<th>Rigidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision Positioning Table</td>
<td>TE</td>
<td>50 ~ 800</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table</td>
<td>TU</td>
<td>30 ~ 1400</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table L</td>
<td>TSL−M</td>
<td>50 ~ 1000</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table L</td>
<td>TSLH−M</td>
<td>100 ~ 800</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table</td>
<td>CTX−M</td>
<td>100 ~ 400</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Super Precision Positioning</td>
<td>TX−M</td>
<td>100 ~ 800</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Cleanroom Precision Positioning Table</td>
<td>TCM−EB</td>
<td>50 ~ 800</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Micro Precision Positioning</td>
<td>TM</td>
<td>10 ~ 60</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table</td>
<td>TS</td>
<td>25 ~ 250</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table</td>
<td>CT</td>
<td>15 ~ 250</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Precision Positioning Table</td>
<td>TSLB</td>
<td>300 ~ 1200</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Nano Linear NT</td>
<td>NT−V</td>
<td>10 ~ 120</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Alignment Stage SA</td>
<td>SA−DE/X</td>
<td>10 ~ 20</td>
<td>△</td>
<td>△</td>
<td>△</td>
<td>△</td>
</tr>
<tr>
<td>Linear Motor Table LT</td>
<td>LT−CE</td>
<td>200 ~ 1200</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Linear Motor Table LT</td>
<td>LT−LD</td>
<td>240 ~ 2780</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Linear Motor Table LT</td>
<td>LT−H</td>
<td>410 ~ 2670</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

**Feeding mechanism**
- Ball screw
- AC servomotor/Stepper motor

**Applied motor**
- Selection
- Provided as standard

**Linear motion rolling guide**
- U-shaped Track Rail Linear Way
- C-Lube Linear Way
- Anti-Creep Cage Crossed Roller Way

**Applications**
- Assembler, Processing machine, Measuring equipment
- Precision processing machine, Precision measuring equipment
- Precision measuring equipment, Encoder
- Encoder

**Encoder**
- U-shaped Track Rail Linear Way
- C-Lube Linear Way
- Anti-Creep Cage Crossed Roller Way

**Purpose**
- High speed conveyor, Palette changer
- Precise measuring equipment, Encoder
- Encoder
- Encoder

**AC linear servomotor**
- Provided as standard
- Parallel arrangement of 2 ways

**Applications**
- Semiconductor related device, Medical equipment
- Semiconductor related device, Medical equipment
- High speed conveyor
Selection of Precision Positioning Table

Size of Precision Positioning Table

How to see the above graph

- The values shown in the graph are for reference. For details, see the explanation of each model.

| Models and Sizes of Precision Positioning Table | TE50B | TE60B | TE86B | TU25  | TU30  | TU40  | TU50  | TU60  | TU86  | TU100 | TU130 | TSL00M | TSL120M | TSL170M | TSLH120M | TSLH220M | TSLH320M | TSLH420M | TX120M | TX220M | TX320M | TX420M | TX50EB | TX60EB | TX86EB | TM15  | TS/CT  | TSLB  | NT~V  | NT~H  | NT80XZ | NT90XZH | SA~DE | LT  | AT  | AM  | 0 | 100 | 200 | 300 | 400 | 500 |
|-----------------------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|

How to see the above graph

- The values shown in the graph are for reference. For details, see the explanation of each model.

| Stroke Length of Precision Positioning Table | TE50B | TE60B | TE86B | TU25  | TU30  | TU40  | TU50  | TU60  | TU86  | TU100 | TU130 | TSL00M | TSL120M | TSL170M | TSLH120M | TSLH220M | TSLH320M | TSLH420M | TX120M | TX220M | TX320M | TX420M | TX50EB | TX60EB | TX86EB | TM15  | TS/CT  | TSLB  | NT~V  | NT~H  | NT80XZ | NT90XZH | SA~DE | LT  | AT  | AM  | 0 | 500 | 1000 | 1500 | 2000 | 2500 | 3000 |

How to see the above graph

- The values shown in the graph are for reference. For details, see the explanation of each model.
- Length of a bar represents a standardized range of stroke length.
### Positioning Repeatability of Precision Positioning Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Positioning Repeatability (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE50B</td>
<td>±10</td>
</tr>
<tr>
<td>TE60B</td>
<td>±8</td>
</tr>
<tr>
<td>TE86B</td>
<td>±6</td>
</tr>
<tr>
<td>TU25</td>
<td>±5</td>
</tr>
<tr>
<td>TU30</td>
<td>±4</td>
</tr>
<tr>
<td>TU40</td>
<td>±3</td>
</tr>
<tr>
<td>TU50</td>
<td>±2</td>
</tr>
<tr>
<td>TU60</td>
<td>±1</td>
</tr>
<tr>
<td>TU86</td>
<td>±1</td>
</tr>
<tr>
<td>TU100</td>
<td>±1</td>
</tr>
</tbody>
</table>

How to see the above graph:
- The values shown in the graph are for reference. For details, see the explanation of each model.
- For models of ball screw drive, the value of the case selected ground ball screw is indicated.
- When two or more values are indicated for a model, this means that the applicable value depends on the stroke length.
- For TU, the value of the standard table is indicated.
- CTLH – M, CTX – M and CT are tables of two-axis specification.
- SA – DE represents value in X-axis.

### Positioning Accuracy of Precision Positioning Table

<table>
<thead>
<tr>
<th>Model</th>
<th>Positioning Accuracy (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE50B</td>
<td>10</td>
</tr>
<tr>
<td>TE60B</td>
<td>8</td>
</tr>
<tr>
<td>TE86B</td>
<td>6</td>
</tr>
<tr>
<td>TU25</td>
<td>5</td>
</tr>
<tr>
<td>TU30</td>
<td>4</td>
</tr>
<tr>
<td>TU40</td>
<td>3</td>
</tr>
<tr>
<td>TU50</td>
<td>2</td>
</tr>
<tr>
<td>TU60</td>
<td>1</td>
</tr>
<tr>
<td>TU86</td>
<td>1</td>
</tr>
<tr>
<td>TU100</td>
<td>1</td>
</tr>
</tbody>
</table>

How to see the above graph:
- The values shown in the graph are for reference. For details, see the explanation of each model.
- For models of ball screw drive, the value of the case selected ground ball screw is indicated.
- When two or more values are indicated for a model, this means that the applicable value depends on the stroke length.
- For TU, the value of the standard table is indicated.
- CTLH – M, CTX – M and CT are tables of two-axis specification.
Maximum Speed of Precision Positioning Table

How to see the above graph:
- The values shown in the graph are for reference. For details, see the explanation of each model.
- For models of ball screw drive, the value with the longest ball screw lead allowable is indicated.
- The upper sections indicate values of AC servomotor, whereas the lower sections indicate values of stepper motor specification.
- The ball screw drive type may sometimes be restricted by the allowable number of revolution of ball screw depending on the stroke length.

Carrying Mass of Precision Positioning Table

How to see the above graph:
- The values shown in the graph are for reference. For details, see the explanation of each model.
- The values shown in the graph are for reference. For details, see the explanation of each model.
Accuracy

Accuracy standard of precision positioning table varies depending on models and measurement methods are described below. In addition, model testing according to the use conditions such as dynamics testing may be conducted on request. Please contact IKO for details.

Precision positioning table is supplied with an inspection sheet or certificate of passing inspection regarding accuracy standard of each model.

Positioning repeatability

Repeat positioning to any one point from one direction 7 times to measure the stop position and obtain 1/2 of the maximum reading difference.

In principle, perform this measurement at the center and each end of the stroke length and take the maximum obtained value as the measurement value. Indicate the 1/2 of the maximum difference with ±.

Positioning accuracy

Perform positioning successively in the certain direction from the reference position, measure the difference between actual travel distance at each position and the theoretical travel distance, and indicate the maximum difference within the stroke length as an absolute value.

Attitude accuracy (pitching and yawing)

The tilt angles for pitching direction (Mp) and yawing direction (My) of the table within the stroke range are measured with a laser angle measurement system, and the measured value is the value of the maximum reading error.

Pitching (Mp)
Vertical angle change on table travel axis

Yawing (My)
Horizontal angle change on table travel axis

Parallelism in table motion A

Refers to parallelism (indicator fix) of the slide table motion and flat surface (precision positioning table mounting surface).

When the stroke is shorter than the slide table length
Fix the test indicator on the stool on which the precision positioning table is mounted, place the straight-edge on the slide table, and apply the test indicator at the center of the slide table. Make a measurement across almost whole area of the stroke length in X and Y directions, and take the maximum reading difference as a measurement value.

When the stroke is longer than the slide table length
Fix the test indicator on the stool on which the precision positioning table is mounted, place the straight-edge on the slide table, and apply the test indicator at the center of the slide table. Make a measurement across almost whole area of the stroke length while moving the table by the length of the table during strokes in X and Y directions, and take the maximum reading difference as a measurement value.

Accuracy standard of precision positioning table varies depending on models and measurement methods are described below. In addition, model testing according to the use conditions such as dynamics testing may be conducted on request. Please contact IKO for details.

Parallelism in table motion B

Refers to parallelism (indicator travel) of the slide table motion and flat surface (table mounting surface).

Fix the indicator at the center of the slide table, apply the test indicator on the stool on which the precision positioning table is mounted, make a measurement across almost whole area of the stroke length in X and Y directions, and take the maximum reading difference as a measurement value.

Straightness

Refers to an extent of deviation from the ideal straight line of the slide table motion, which should be linear.

Straightness in horizontal: Motion of the slide table travel axis in left and right (horizontal) direction.

Straightness in vertical: Motion of the slide table travel axis in up and down (vertical) direction.

These are measured by a test indicator or laser running straightness measurement system. The measurement value is represented by the interval between two straight lines in parallel with each other, when placed so that the interval becomes minimal.

Squareness of XY motion

Refers to squareness of X- and Y-axis motions. Fix a square scale on the slide table taking either travel direction as a reference, apply the test indicator perpendicular to the reference travel axis and take the maximum reading difference within the stroke length of the axis as a measurement value.

Backlash

Feed to the slide table and take reading of the test indicator when it is moved slightly as a reference. Then, move the slide table in the same direction with the given load from such condition without the feed gear and release the load. Obtain the difference from the reference value at this point. Perform this measurement at the center and each end of the stroke length and take the maximum obtained value as the measurement value.

Lost motion

Perform positioning in the forward direction for one position and measure the position (z1 in the figure). Then give a command to move it in the same direction and give the same command in the backward direction from the position to perform positioning in the backward direction. Measure the position (z2 in the figure). Further, give a command to move it in the backward direction and give the same command in the forward direction from the position to perform positioning in the forward direction. Measure the position (z3 in the figure). Subsequently, repeat these motions and measurements and obtain the difference between average values of stop position of the 7 positionings in forward and backward directions. Perform this measurement at the center and each end of the motion and take the maximum obtained value as the measurement value.
### Accuracy

#### Measurement of parallelism during table elevating

At the lower most step of the table \((h_{\text{in}})\), align the indicator with 0 value at the measurement point E on the table upper surface with the table mounting surface as a reference, and measure heights at the remaining 8 points \((A \text{ to } I)\) with the value as a reference.

Lift up the table and perform the same measurement at middle \((h_{\text{in}})\) and upper \((h_{\text{out}})\) steps. Then obtain each maximum difference between measurement values at the same point at lower, middle and upper steps.

Take the maximum difference value among all the 9 points as the parallelism during table elevating.

**Table 1: Sample calculation of parallelism during table elevating**

<table>
<thead>
<tr>
<th>Measuring point</th>
<th>Lower</th>
<th>Middle</th>
<th>Upper</th>
<th>Maximum difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>B</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>C</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>E</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>F</td>
<td>-1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>G</td>
<td>-2</td>
<td>3</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>H</td>
<td>-3</td>
<td>2</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>I</td>
<td>-4</td>
<td>-2</td>
<td>-4</td>
<td>2</td>
</tr>
</tbody>
</table>

If measurement values are as those indicated in the table, the maximum difference value among all points should be 6 \(\mu\)m at the point H.

As a result, the parallelism during elevating of this table is 6 \(\mu\)m.

#### Measurement of squareness during table elevating

The squareness during table elevating relative to a square scale shall be the squareness during table elevating.

At the lower step of the table \((h_{\text{in}})\), align the indicator with 0 relative to a square scale. The maximum difference in pick test deflection at the time when it is stroked from the lower step of the table \((h_{\text{in}})\) to the upper step \((h_{\text{out}})\) in the condition shall be the squareness during table elevating. (Straightness component at the time of table stroke is included.)

Place a square scale at the position 10mm away from the table edge, make a measurement for 2 directions, ball screw axial direction and direction perpendicular to the axis - and take the maximum value between the 2 values as the straightness during table elevating.

---

### Carrying Mass, Load Mass, Allowable Load

#### Maximum carrying mass

The maximum carrying mass is the mass that satisfies the following ①, ②, and ③. It is set for TE, B, TU, TSL, M, TSLH, M, TX, M, TC, EB, TM, TS/CT, TSLB, AT, AM, and TZ. The value changes by the position of the mass loaded (length \(L\), height \(H\)). It is calculated by the formula \((L, H) = (D, 0)\).

① The mass when the total rating life of the linear motion rolling guide, ball screws or bearings is 18,000 hours with continuous operation at the maximum speed for each model and size, and with an acceleration/deceleration time of 0.2s.

② The mass for which the acceleration 0.3G can be acquired in general.

③ The mass calculated based upon the basic static load rating of the linear motion rolling guide you are using.

Note that the value calculated varies depending on various conditions, such as the size, ball screw specifications, slide table length, or stroke length. The value shown at the specifications of each model was calculated based on the most severe conditions that are typical for each size. For detailed values, please contact IKO.

#### Maximum load mass

The maximum load mass refers to the maximum mass of a steel cube that ensures necessary acceleration: acceleration 0.5G for linear motion and acceleration 0.5G in outer circumferential for rotational motion. It is restricted by thrust (torque) characteristics of the motor used, and the larger the carrying mass is, the longer the marginal acceleration time becomes. For linear motor drive models (LT, NT, NT, NT, XT, NT, XZ, and NT, XZH) and direct drive models (SA, DE), the dynamic load mass representing the relation between acceleration and load mass in standard traveling models is set.
Maximum Speed and Resolution

### Maximum speed

The maximum speed of precision positioning table is defined by the following equation.

The ball screw drive type is restricted by the allowable number of ball screw revolutions which vary by the stroke length. For the timing belt drive, it is calculated with the maximum number of motor revolutions of 900/min. See the specifications of each model for details.

Each linear motor drive model has fixed maximum speed. See the specifications of each model.

<table>
<thead>
<tr>
<th>Drive Type</th>
<th>Maximum Speed Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball screw drive</td>
<td>Maximum speed (mm/s) = Ball screw lead (mm) × ( \frac{\text{Allowable number of revolutions of ball screw (min(^{-1})}}}{60} )</td>
</tr>
<tr>
<td>Timing belt drive</td>
<td>Maximum speed (mm/s) = Pulley pitch diameter × ( \pi (\text{mm}) \times \frac{\text{Maximum number of revolutions of the motor (min(^{-1})}}}{60} ) (Pulley pitch diameter × ( \pi = 100 \text{mm} ))</td>
</tr>
</tbody>
</table>

To obtain the actual positioning time, the operation pattern must be considered according to conditions such as acceleration / deceleration time and stroke length. See the section of consideration of operation patterns.

### Resolution

Resolution refers to the minimum feed rate allowed for precision positioning table and can be obtained by the following equation.

Each linear motor drive model has fixed resolution. See the specifications of each model.

<table>
<thead>
<tr>
<th>Drive Type</th>
<th>Resolution Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ball screw drive</td>
<td>Resolution (mm/pulse) = ( \frac{\text{Ball screw lead (mm)}}{\text{Number of fraction sizes per motor rotation (pulse)}} )</td>
</tr>
<tr>
<td>Timing belt drive</td>
<td>Resolution (mm/pulse) = ( \frac{\text{Pulley pitch diameter} \times \pi (\text{mm})}{\text{Number of fraction sizes per motor rotation (pulse)}} ) (Pulley pitch diameter × ( \pi = 100 \text{mm} ))</td>
</tr>
</tbody>
</table>

### Calculation of positioning time

The positioning time taken when the precision positioning table actually moves can be obtained by the following equation.

For applications requiring high precision positioning, the settling time from completion of command pulse input to full stop of the table at the positioning point and vibration damping time of the machine device must be considered in addition to the constant speed traveling time and acceleration / deceleration time.

#### Long-distance positioning

Long distance in this context refers to distance for which there is enough constant speed traveling time even taking into account the acceleration / deceleration time.

\[
\begin{align*}
T &= t_a + t_c + t_d \\
&= \frac{L_1}{V_1} + \frac{V_1 + a}{2} + t_s \\
&= \frac{L_1}{V_1} + \frac{V_1 + a}{2} + t_s
\end{align*}
\]

where:
- \( t_a \): Positioning time (s)
- \( t_b \): Acceleration/deceleration time (s)
- \( t_c \): Constant speed traveling time (s)
- \( t_d \): Settling time (s)
- \( L_1 \): Traveling distance (mm)
- \( V_1 \): Traveling speed (set speed) (mm/s)

#### Short-distance positioning

Short distance in this context refers to distance for which there is no constant speed traveling time because deceleration occurs before reaching to constant speed traveling.

\[
\begin{align*}
T &= t_a + t_b + t_d \\
&= \frac{L_2}{V_1} + \frac{a}{2} + t_s
\end{align*}
\]

where:
- \( t_b \): Acceleration/deceleration time (s)
- \( t_c \): Constant speed traveling time (s)
- \( t_d \): Settling time (s)
- \( L_2 \): Traveling distance (mm)
- \( V_1 \): Set speed (mm/s)
- \( V_2 \): Traveling speed (mm/s)
Calculation of marginal acceleration time

For driving of precision positioning table comes to the highest during acceleration. Torque required for this acceleration is limited by motor output torque (linear motor thrust force). Therefore, the marginal acceleration time with table used horizontally is calculated by the following equation.

\[ T_e = \frac{W}{\mu \cdot W_{rot} \cdot \tan \lambda} \]

\[ \lambda = \frac{\theta_c - \theta_l}{2 \cdot \pi / \theta_{rot}} \]

For calculating the required estimation time for the above equation, it is necessary to the following equation.

\[ T_a = \frac{\mu \cdot W_{rot} \cdot \tan \lambda}{2 \cdot \pi / \theta_{rot}} \]

In case of linear motor drive

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

Friction coefficient of rolling guide \( \mu \) should be as follows.

\[ \mu = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of ball screw drive and timing belt drive

\[ T_e = \frac{W}{\mu \cdot W_{rot} \cdot \tan \lambda} \]

For ball screw drive and timing belt drive

\[ \lambda = \frac{\theta_c - \theta_l}{2 \cdot \pi / \theta_{rot}} \]

For the stepper motor, it is the output torque at the number of motor revolutions \( N \).

\[ \lambda = \frac{\theta_c - \theta_l}{2 \cdot \pi / \theta_{rot}} \]

\[ T_a = \frac{\mu \cdot W_{rot} \cdot \tan \lambda}{2 \cdot \pi / \theta_{rot}} \]

For the stepper motor, it is the output torque at the number of motor revolutions \( N \).

\[ T_e = \frac{W}{\mu \cdot W_{rot} \cdot \tan \lambda} \]

\[ \lambda = \frac{\theta_c - \theta_l}{2 \cdot \pi / \theta_{rot}} \]

In case of LT - CE, LT - LD

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

However, minimum value of \( F_L \) shall be as follows.

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of LT100CE: 2.5N

For LT150CE: 5.0N

For LT100LD: 6.0N

For LT170LD: 6.0N

In case of LT - H

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

Running resistance \( F_L \) LT170H: 40N

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of NT55V/NT80V

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of LT170H: 40N

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of LT100CE: 2.5N

For LT150CE: 5.0N

For LT100LD: 6.0N

For LT170LD: 6.0N

In case of NT38V

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of NT55V/NT80V

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of NT800X2Z

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of NT800X2H

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

In case of NT88H

\[ F_L = \mu \cdot \frac{(W_m + W_{rot})}{W_{rot}} \cdot \tan \lambda \]

Note (1) It is the resistance value for the stroke of ±5mm from the equilibrium point in the center area of the stroke range, assuming the spring system balance mechanism of the vertical axis. The value changes depending on the spring mounting position or the stroke width in the actual calculation. Please verify using the actual machine.
Consideration of Operation Patterns

**In case of direct drive (SA-DE/DE)**

- **Friction resistance of rolling guide** $F_f$
  - $F_f$ value shall be as follows:
    - In case of SA65DE/DE 0.5N
    - In case of SA120DE/DE 3.0N
- **Force from running resistance** $F_r$
  - $F_r = F_f + F_s$ [N]
- **Force from acceleration** $F_a$
  - $F_a = (W + W_f) \frac{a}{c}$ [N]
- **Thrust force required for acceleration** $F_T$
  - $F_T = F_a + F_r$ [N]
- **Marginal acceleration time** $t_a$
  - $t_a = (W + W_f) \frac{V}{L} + V \cdot \frac{k}{a}$ [s]

**In case of DE-ES**

- **Friction resistance of rolling guide** $M_f$
  - $M_f$ value shall be as follows:
    - In case of SA65DE/ES 0.03N-m
    - In case of SA120DE/ES 0.1N-m
    - In case of SA200DE/ES 0.2N-m
- **Torque from rotation resistance** $M_r$
  - $M_r = (J + J_r) \frac{t}{2}$ [N-m]
- **Torque from acceleration** $M_a$
  - $M_a = (J + J_r) \frac{a}{c}$ [N-m]
- **Torque required for acceleration** $M_T$
  - $M_T = M_r + M_a$ [N-m]
- **Marginal acceleration time** $t_a$
  - $t_a = (J + J_r) \frac{V}{L} + V \cdot \frac{k}{a}$ [s]

**Calculation of inertia moment**

<table>
<thead>
<tr>
<th>Cylinder</th>
<th>Quadrangular prism</th>
<th>Offset rotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>$J_c = \frac{1}{2} \pi r^4$</td>
<td>$J_q = \frac{1}{3} l (a^2 + b^2)$</td>
<td>$J_o = J_c + m \cdot r^2$</td>
</tr>
<tr>
<td>$J_c = \frac{1}{2} \pi r^2$</td>
<td>$J_q = \frac{1}{12} l (a^2 + b^2)$</td>
<td>$J_o' = J_c + m \cdot r^2$</td>
</tr>
<tr>
<td>$J_c' = \frac{1}{2} \pi r^2$</td>
<td>$J_q' = \frac{1}{12} l (a^2 + b^2)$</td>
<td>$J_o' = \text{Inertia moment from rotation center}$</td>
</tr>
<tr>
<td>$J_c'' = \text{Inertia moment when rotating around the center of gravity}$</td>
<td>$J_q'' = \text{Inertia moment when rotating around the center of gravity}$</td>
<td>$J_o'' = \text{Inertia moment when rotating around the center of gravity}$</td>
</tr>
</tbody>
</table>

---

**Calculation of effective torque and effective thrust force**

As a large torque (thrust force) is required for acceleration / deceleration when the precision positioning table is driven, the effective torque (effective thrust force) may become larger than the motor’s rated torque (rated thrust) depending on the operation rate of each pattern in case the AC servomotor or linear motor drive is used. Continuing the operation in this condition may cause overheating and seize of the motor. So ensure that the effective torque (effective thrust force) is smaller than motor’s rated torque (rated thrust). The effective torque (effective thrust force) by the operation pattern of table is calculated by the following equation.

If the rated torque (rated thrust) of the motor is larger than the effective torque (effective thrust force), continuous operation according to the operation pattern is possible.

---

**If AC servomotor is used**

- **Effective torque** $T_{es}$
  - $T_{es} = \sqrt{F_{th}^2 + (F_{th} - 2F_L)^2 + F_{th}L \cdot I_{rms}}$ [N-m]

**In case of linear motor drive**

- **Effective thrust force** $F_{es}$
  - $F_{es} = \sqrt{F_{th}^2 + (F_{th} - 2F_L)^2 + F_{th}L \cdot I_{rms}}$ [N]

**In case of direct drive (SA-DE/DE)**

- **Effective thrust force (applicable to SA-DE/DE) $F_{es}$**
  - $F_{es} = \sqrt{F_{th}^2 + (F_{th} - 2F_L)^2 + F_{th}L \cdot I_{rms}}$ [N]

- **Effective thrust force (applicable to SA-DE/ES) $F_{es}$**
  - $F_{es} = \sqrt{J + J_r + M_r + M_a}$ [N]
Consideration of Operation Patterns

### Consideration example of operation pattern

If AC servomotor is used

- **Usage conditions**
  - Mounting direction: W
  - Carrying mass: 30kg
  - Stroke length: 300mm
  - Traveling speed (set speed): 300mm/s
  - Acceleration/deceleration time: 0.2s
  - Constant speed traveling time: 0.8s
  - 1 cycle time: 2.0s

- **Basic specification**
  - Acceleration/deceleration time: 0.08N-s
  - Effective thrust force: 103N

#### Consideration example of operation pattern

- **Calculation of torque required for acceleration**
  - Applied torque: \( T_a = \frac{W \cdot \alpha}{2 \pi} \)
  - \( W = 30 \times 0.01 \times 30 + 0.3 \times 2 \times 9.8 \times 0.8 \times 0.95 \times 0.8 \times 2 \times 10^{-5} \times 0.3 \times 0.23 = 0.09N-m \)

- **Acceleration torque**
  - \( T_a = W \cdot \alpha \)
  - \( T_a = 30 \times 0.01 \times 30 + 0.3 \times 2 \times 9.8 \times 0.8 \times 0.95 \times 0.8 \times 2 \times 10^{-5} \times 0.3 \times 0.23 = 0.09N-m \)

- **Torque required for acceleration**
  - \( T_a = T_c + T_r = 0.09 + 0.09 = 0.18N-m \)

- **Consideration of effective torque**
  - **Effective torque** \( T_{eff} = \sqrt{2 \times T_a + \sqrt{2 \times T_a + 2 \times T_a}} \)
  - \( T_{eff} = \sqrt{2 \times 0.23 + 0.23} = 0.95N-m \)

- **Effective thrust force**
  - \( F_{eff} \approx 117N \) (rated thrust)

- **In case of linear motor drive**

  **STEP1** Calculation of thrust force required for acceleration
  
  \[ F_a = \sqrt{F_L + F_T} = \sqrt{550N + 0.3(261 - 91)} = 103N \]

- **STEP2** Consideration of effective thrust force
  
  \[ F_{eff} = \frac{F_L + F_T}{2} = \frac{550N + 0.3(261 - 91)}{2} = 103N \]

The effective thrust force may exceed the rated thrust depending on the operation rate of Linear Motor Table, and the effective thrust force is below the rated thrust. Below is an example calculation of operation pattern with LT1704S. Temporarily set the operation pattern as indicated below considering the carrying mass and acceleration from the dynamic load mass chart in page II-294.
In case of Alignment Stage SA

The effective thrust force may exceed the rated thrust (or the effective torque exceeds the rated torque) depending on the operation rate of Alignment Stage SA, leading to motor overheating and seizure that may cause breakage and human injury. Before operations, ensure that the effective thrust force is below the rated thrust (or the effective torque is below the rated torque).

Described below is an example of consideration of operation pattern with Alignment Stage SA120DE/XYS.

Temporarily set an operation pattern as indicated below considering the marginal acceleration time.

<table>
<thead>
<tr>
<th>Setting items</th>
<th>Table model</th>
<th>SA120DE/XYS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load mass</td>
<td>W</td>
<td>5.0kg</td>
</tr>
<tr>
<td>Inertia moment of load</td>
<td>J</td>
<td>1.0×10⁻¹⁰kg·m²</td>
</tr>
<tr>
<td>Mass of moving table</td>
<td>M</td>
<td>3.46kg</td>
</tr>
<tr>
<td>Acceleration / deceleration</td>
<td>t</td>
<td>0.05s</td>
</tr>
<tr>
<td>Constant speed traveling time</td>
<td>t</td>
<td>0.05s</td>
</tr>
<tr>
<td>Cycle time</td>
<td>t</td>
<td>0.4s</td>
</tr>
<tr>
<td>Cord pull-resistance</td>
<td>F</td>
<td>1.0N</td>
</tr>
<tr>
<td>Mass of moving table</td>
<td>M</td>
<td>3.46kg</td>
</tr>
<tr>
<td>Acceleration / deceleration</td>
<td>t</td>
<td>0.05s</td>
</tr>
<tr>
<td>Constant speed traveling time</td>
<td>t</td>
<td>0.05s</td>
</tr>
<tr>
<td>Cycle time</td>
<td>t</td>
<td>0.4s</td>
</tr>
<tr>
<td>Cord pull-resistance</td>
<td>F</td>
<td>1.0N</td>
</tr>
<tr>
<td>Inertia moment of moving table</td>
<td>J</td>
<td>2.0×10⁻¹⁰kg·m²</td>
</tr>
<tr>
<td>Maximum speed</td>
<td>V</td>
<td>0.1m/s</td>
</tr>
<tr>
<td>Maximum stroke</td>
<td>L</td>
<td>5.0m</td>
</tr>
</tbody>
</table>

STEP1 Calculation of thrust force required for X-axis acceleration

1. Force from running resistance \( F_{r} = 0.1×10² \times 1.3 = 2.6 \text{N} \)

2. Force from acceleration \( F_{a} = 0.1×10² \times 4.0 = 4.0 \text{N} \)

At this point, check that the \( F_{a} \times t \) (factor of safety is below the maximum thrust in page 2-270. If this value is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time.

You can see in the example pattern that it is below the maximum thrust.

The maximum thrust \( F_{u} \) of SA120DE/X=70N

\[ F_{u} = 25.8\times1.3 = 33.54N < F_{u} \]

STEP2 Consideration of effective thrust force

- Effective thrust force \( F_{w} \) can be obtained as follows.

\[ F_{w} = \sqrt{F_{r}^{2} + F_{a}^{2} + F_{c}^{2} + F_{l}^{2}} \]

At this point, check that \( F_{w} \) is below the rated thrust. If the rated thrust is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time.

| Factor of safety | 1.3 |

STEP3 Consideration of thrust force and effective thrust force required for Y-axis acceleration

Perform the same calculation as X-axis. If the operation pattern is the same, the condition is lighter for Y-axis as its mass of moving table is smaller. So that is omitted in this example.

| Factor of safety | 1.0 |

STEP4 Consideration of torque required for \( \theta \)-axis acceleration

1. Torque from rotation resistance \( M_{r} = M_{s} + M_{r} = 0.1 + 0.0 = 0.1N·m \)

At this point, check that the \( M_{r} \times t \) (factor of safety is below the maximum torque in page 2-270. If this value is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time.

At this point, check that \( M_{r} \times t \) is below the rated torque. If the rated torque is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time. In the example pattern, it can be judged that continuous operation is possible.

Caution If the load is offset from the rotation center, \( \theta \)-axis acceleration / deceleration generates torque load on the \( \theta \)-axis. So extra care must be exercised.

STEP5 Consideration of effective torque

- Effective torque \( M_{w} \) can be obtained as follows.

\[ M_{w} = \sqrt{M_{r}^{2} + (M_{s} + 2\times M_{r})^{2} + M_{w}^{2}} \]

At this point, check that \( M_{w} \) is below the rated torque. If the rated torque is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time. In the example pattern, it can be judged that continuous operation is possible.

\[ M_{w} = \sqrt{0.38^{2} + 0.038^{2} + 0.38^{2} + 0.038^{2} + 0.38^{2} + 0.038^{2}} = 0.854N·m \]

At this point, check that \( M_{w} \) is below the rated torque. If the rated torque is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time. In the example pattern, it can be judged that continuous operation is possible.

Caution If the load is offset from the rotation center, \( \theta \)-axis acceleration / deceleration generates torque load on the \( \theta \)-axis. So extra care must be exercised.

\[ M_{w} = \sqrt{0.754^{2} + 0.754^{2} + 0.754^{2} + 0.754^{2} + 0.754^{2} + 0.754^{2}} = 0.854N·m \]

At this point, check that \( M_{w} \) is below the rated torque. If the rated torque is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time. In the example pattern, it can be judged that continuous operation is possible.

Caution If the load is offset from the rotation center, \( \theta \)-axis acceleration / deceleration generates torque load on the \( \theta \)-axis. So extra care must be exercised.

\[ M_{w} = \sqrt{0.754^{2} + 0.754^{2} + 0.754^{2} + 0.754^{2} + 0.754^{2} + 0.754^{2}} = 0.854N·m \]

At this point, check that \( M_{w} \) is below the rated torque. If the rated torque is exceeded, review the maximum speed for operating pattern and acceleration / deceleration time. In the example pattern, it can be judged that continuous operation is possible.
Sensor Specification

Precision positioning table is equipped with CW and CCW limit sensors for overrun prevention and pre-origin and origin sensors for machine origin detection. For some table models, these sensors are provided as standard equipment, and for the other models, mounting is specified by identification numbers.

Types of sensors used for Precision positioning table are listed in Table 1 and specifications of each sensor in Table 2 to 4. For connector specifications for NT- V, SA200/DE/S, LT and TM, see Table 5.1 to 5.2. For other tables, wires are unbound, so that the sensor output connector and mating side must be prepared separately by customer.

For sensor timing chart, please see section of sensor specifications of each model. In addition, unless otherwise stated, sensor positions can be fine-adjusted. Please make adjustment on your own.

### Table 1 Sensor types

<table>
<thead>
<tr>
<th>Table model</th>
<th>Sensor</th>
<th>CW limit</th>
<th>Pre-origin (PORG)</th>
<th>Origin (ORG)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TE B(1)</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
</tr>
<tr>
<td>TU(1)</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
</tr>
<tr>
<td>TSL-M</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Photo sensor (6)</td>
</tr>
<tr>
<td>TSLB-M/CTX M</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
</tr>
<tr>
<td>TX-M/CTX M</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
</tr>
<tr>
<td>TC EB(1)</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
<td>Proximity sensor</td>
</tr>
<tr>
<td>TM(1)(1)</td>
<td>Magnetic sensor(1)</td>
<td>Magnetic sensor(1)</td>
<td>Magnetic sensor(1)</td>
<td>Magnetic sensor(1)</td>
</tr>
<tr>
<td>TS755/755 - CT755/755</td>
<td>Micro switch(1)</td>
<td>Micro switch(1)</td>
<td>Proximity sensor</td>
<td>Photo sensor 8</td>
</tr>
<tr>
<td>TS75/75</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
</tr>
<tr>
<td>CT75/75</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
</tr>
<tr>
<td>Other than listed above</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
<td>Photo sensor 3</td>
</tr>
</tbody>
</table>

A mark tube with engraved signal name (ORG, PORG, CW or CCW) is inserted into the unbound-wire specification sheath.

### Table 2 Photo sensor specifications

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Limit, pre-origin and origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM-L25</td>
<td>CN-14A-C1 (lead length: 1 m) or CN-14A-C3 (lead length: 3 m)</td>
</tr>
<tr>
<td>PM-K65</td>
<td>DCS–24V ±10%</td>
</tr>
<tr>
<td>PM-T65</td>
<td>15mA or less</td>
</tr>
<tr>
<td>PM-L65</td>
<td></td>
</tr>
</tbody>
</table>

#### Output connection models (1)

- Maximum input current : 50mA
- Applied voltage : 30VDC or less
- Residual voltage : 2V or less at input current of 50mA
- 1V or less at 16mA

#### Output operation

ON/OFF upon light entrance; selective (1)

#### Operation indication

Orange LED (ON upon light entrance)

**Circuit diagram**

- Red: OUT1 (black) for CW limit and CCW limit and OUT2 (white) for pre-origin and origin. For the other models, use OUT1 (black) for all.

#### Notes

- Mounting a sensor is specified using the corresponding identification number. For the other models, sensors are equipped as standard equipment.
- No origin sensor is provided if an attachment for AC servomotor or linear encoder is selected. Use C phase or Z phase signal of AC servomotor or linear encoder to be installed on your own. For AM, only AC servomotor is selected.
- Each signal is output from applicable dedicated programmable control unit or dedicated driver.
- Sensors are built in the table and each signal is output from a dedicated sensor amplifier. When the AC servomotor is used, use encoder’s C phase for origin signals.
- Sensor (encoder) positions cannot be fine-adjusted.
- This is built in the substrate.

---

1mm=0.03937inch
### Table 3 Specifications of proximity sensor

<table>
<thead>
<tr>
<th>Item</th>
<th>Target model</th>
<th>Other models</th>
<th>TZO20H and TZZ20X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>ABE Corporation</td>
<td>DFHLN Corporation</td>
<td>AUH Corporation</td>
</tr>
<tr>
<td>Model(1)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-origin</td>
<td>APM-D3A1F-S</td>
<td>APM-D3A1-S</td>
<td>APM-D3A1F-S</td>
</tr>
<tr>
<td>E2S W14 1M</td>
<td>E2S W14 1M</td>
<td>E2S W14 1M</td>
<td></td>
</tr>
<tr>
<td>C/CW limit</td>
<td>APM-D3B1F-S</td>
<td>APM-D3B1F-S</td>
<td>APM-D3B1F-S</td>
</tr>
<tr>
<td>E2S W14 1M</td>
<td>E2S W14 1M</td>
<td>E2S W14 1M</td>
<td></td>
</tr>
<tr>
<td>E2S W14 1M</td>
<td>E2S W14 1M</td>
<td>E2S W14 1M</td>
<td></td>
</tr>
<tr>
<td>Shape mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply voltage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current consumption</td>
<td>DC12 -24V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum input current</td>
<td>TE10A or less</td>
<td>EN50056A or less</td>
<td>EN50056A</td>
</tr>
<tr>
<td>Applied voltage</td>
<td>DC30V or less</td>
<td>EN50056A or less</td>
<td>EN50056A</td>
</tr>
<tr>
<td>Residual voltage</td>
<td>1V or less at input current of 4mA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Circuit diagram</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Remarks:</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Wire the sensor cords on your own (except for NT, Y/B/G).
2. Lead runs off by at least 200mm from the table end. Actual length varies depending on stroke length.
3. For information about PNP sensor options, please contact K.O.

### Table 4 Specifications of magnetic sensor

<table>
<thead>
<tr>
<th>Item</th>
<th>TM</th>
<th>SA65DE, SA120DE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power supply voltage</td>
<td>DC12 to 24V</td>
<td>DC5 to 24V</td>
</tr>
<tr>
<td>Current consumption</td>
<td>10mA or less</td>
<td>10mA or less</td>
</tr>
<tr>
<td>Output(1)</td>
<td>NPN open collector</td>
<td>NPN open collector</td>
</tr>
<tr>
<td>Operation</td>
<td>Pre-origin</td>
<td>Off in proximity</td>
</tr>
<tr>
<td>Origin</td>
<td>ON in proximity</td>
<td>Off in proximity</td>
</tr>
<tr>
<td>Operation</td>
<td>Pre-origin</td>
<td>Yellow LED (ON upon detection)</td>
</tr>
<tr>
<td>Limit</td>
<td>CCW (+) limit</td>
<td>Yellow LED (ON upon detection)</td>
</tr>
<tr>
<td>Operation</td>
<td>Pre-origin</td>
<td>Red LED (ON upon detection)</td>
</tr>
<tr>
<td>Limit</td>
<td>CCW (-) limit</td>
<td>Red LED (ON upon detection)</td>
</tr>
<tr>
<td>Circuit diagram</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. Current consumption of the whole system including sensor amplifier.
2. Output per circuit.

### Table 5.1 Connector specifications (NT59V/SC, NT80V/SC, SA200DE/S and LT)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Connector used (Product of Molex Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pre-origin(1)</td>
<td>Housing 1625-12R1</td>
</tr>
<tr>
<td>2</td>
<td>Pre-origin</td>
<td>Housing 1625-12P1</td>
</tr>
<tr>
<td>3</td>
<td>+ direction limit</td>
<td>Terminal 1854TL</td>
</tr>
<tr>
<td>4</td>
<td>- direction limit</td>
<td>Terminal 1854TL</td>
</tr>
<tr>
<td>5</td>
<td>Power input (for pre-origin)(1)</td>
<td>Housing 43020-0600</td>
</tr>
<tr>
<td>6</td>
<td>GND (for pre-origin)(1)</td>
<td>Housing 43025-0600</td>
</tr>
<tr>
<td>7</td>
<td>Power input (for + direction limit)</td>
<td>Terminal 43091-0010</td>
</tr>
<tr>
<td>8</td>
<td>GND (for + direction limit)</td>
<td>Terminal 43090-0007</td>
</tr>
<tr>
<td>9</td>
<td>Power input (for - direction limit)</td>
<td>Terminal 43091-0010</td>
</tr>
<tr>
<td>10</td>
<td>GND (for - direction limit)</td>
<td>Terminal 43090-0007</td>
</tr>
</tbody>
</table>

Notes:
1. For B-table of LT, T2.

### Table 5.2 Connector specifications (for TM)

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Signal name</th>
<th>Connector used (Product of Molex Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Origin</td>
<td>Housing 43020-0600</td>
</tr>
<tr>
<td>2</td>
<td>Pre-origin</td>
<td>Housing 43025-0600</td>
</tr>
<tr>
<td>3</td>
<td>G/W limit</td>
<td>Terminal 43091-0010</td>
</tr>
<tr>
<td>4</td>
<td>C/W limit</td>
<td>Terminal 43090-0007</td>
</tr>
<tr>
<td>5</td>
<td>Power input</td>
<td>Terminal 43091-0010</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Terminal 43090-0007</td>
</tr>
</tbody>
</table>

Remark: When the AC Servomotor is used, use encoder’s C phase for origin signals.
### Mounting

#### Processing accuracy of mounting surface
Accuracy and performance of Precision positioning table are affected by accuracy of mating mounting surface. Therefore, processing accuracy of the mounting surface must be considered according to usage conditions such as required motion performance and positioning accuracy.

Reference flatness of the mating mounting surface under general usage conditions is indicated in Table 6.

In addition, the base on which a table is mounted receives a large reactive force, so take enough care about the rigidity of the base.

**Table 6 Accuracy of mounting surface**

<table>
<thead>
<tr>
<th>Model</th>
<th>Flatness of the mounting surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSL/CT</td>
<td>5</td>
</tr>
<tr>
<td>NT-V</td>
<td>8</td>
</tr>
<tr>
<td>NT-XZ</td>
<td>10</td>
</tr>
<tr>
<td>NT-XZH</td>
<td>10</td>
</tr>
<tr>
<td>SA-DE</td>
<td>10</td>
</tr>
<tr>
<td>TSLH-M</td>
<td>15</td>
</tr>
<tr>
<td>TE-B</td>
<td>30</td>
</tr>
<tr>
<td>TU</td>
<td></td>
</tr>
<tr>
<td>TSL-M</td>
<td>30</td>
</tr>
<tr>
<td>TC-EB</td>
<td></td>
</tr>
<tr>
<td>LT</td>
<td></td>
</tr>
<tr>
<td>AM</td>
<td></td>
</tr>
<tr>
<td>TSLB</td>
<td>50</td>
</tr>
</tbody>
</table>

#### Tightening torque for fixing screw

Typical tightening torque to fix the Precision positioning table is indicated in Table 7. If sudden acceleration / deceleration occurs frequently or moment is applied, it is recommended to tighten them to 1.3 times higher torque than that indicated in the table. In addition, when high accuracy is required with no vibration and shock, it is recommended to tighten the screws to torque smaller than that indicated in the table and use adhesive agent to prevent looseness of screws.

**Table 7 Screw tightening torque**

<table>
<thead>
<tr>
<th>Bolt size</th>
<th>Female thread component</th>
<th>Steel</th>
<th>Aluminum alloy</th>
<th>Screw insert</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2 × 0.4</td>
<td>0.31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M3 × 0.5</td>
<td>0.71</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M4 × 0.7</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M5 × 0.8</td>
<td>1.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M6 × 1.0</td>
<td>1.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M8 × 1.25</td>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M10×1.5</td>
<td>6.2</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note (*) As tightening torque for NT-V, 1.1N·m is recommended. (When using a steel base)

### Precaution for Use

#### Safety precautions
- Be sure to earth the ground terminal (The grounding resistance is 100Ω or less.). It may lead to electric shock and fire.
- Use only the power voltage indicated on the device. Otherwise, it may lead to fire and malfunction.
- Do not touch any electrical component with wet hand. It may lead to electric shock.
- Do not bend forcibly, twist, pull, heat or apply heavy load on the cord. It may lead to electric shock and fire.
- Do not put your finger into any opening during table operations. It may lead to injury.
- Do not touch any moving part during table operations. It may lead to injury.
- When removing the electrical component cover, be sure to turn the power off and disconnect the power plug. It may lead to electric shock.
- Do not touch the terminal for 5 minutes after shutting down the power. Otherwise, electric shock due to residual voltage may occur.
- When installing / removing the connection terminal, be sure to turn the power off and disconnect the power plug in advance. Otherwise, it may lead to electric shock and fire.

#### Precaution for Use
- As precision positioning table is a precision machine, excessive load or shock may impair accuracy and damage the parts. Take extra care when handling it.
- Check that the table mounting surface is free from dust and harmful projection.
- Use it in a clean environment where it is not exposed to water, oil and dust particles.
- As grease is applied to the linear motion rolling guide integrated with precision positioning table and ball screws, take dust protection measures to prevent dust and other foreign matters from entering into the unit. If foreign matters get mixed, thoroughly eliminate the contaminated grease and apply clean grease again.
- Though lubrication frequency for precision positioning table varies depending on usage conditions, wipe off old grease and apply clean grease again biannually for normal cases or every three months for applications with constant reciprocating motions in long distance. In addition, the Precision Positioning Table in which C-Lube is built delivers long-term maintenance free performance. This reduces the need for the lubrication mechanism and workload which used to be necessary for linear motion rolling guides and ball screws, allowing large-scale reduction of maintenance cost.
- As precision positioning table is assembled through precise processing and adjustments, do not disassemble or alter it.
- Linear motor drive products have strong magnets inside. Note that any magnetic object around such product may be attracted. For use around any device vulnerable to magnetism, please contact IKO.
- Linear motor drive products require parameter settings of programmable control unit or driver for driving. Securely configure parameter settings suitable for the drive motor.
- For Linear Motor Table LT series, motor cord, etc. is connected to moving table, so a space for wiring of cord must be ensured in addition to the installation space for the main body. In addition, arrange cord wiring with sufficient curvature so that the running resistance does not increase or no excessive force is applied.

◎ The external appearance / specifications of this product can be modified for improvements without notices.