

High Performance Linear Brushless Servo Stage

# SLP Series Manual

(Preliminary)

**NPM**

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Revision History:

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## Important Notices

### **WARNING**

Please review the following precautions, and use the product correctly and safely.

1. There is a potential danger when installing, wiring, operating, maintaining and inspecting this product. Give due consideration to safety including, but not limited to, the precautions and warnings described in this manual.
2. Before working on this product, read, understand, and follow the procedures and warnings described in this manual, as well as the instructions of all devices connected to this product.
3. Please do not work on this product unless you have sufficient knowledge of this product and all connected devices, and how to operate them safely.
4. Please keep a copy of this manual for future reference and training, related to the safe handling and operation of this product.
5. This manual provides precautions and counter-measures for potential hazards, but we cannot predict all danger. Also, the laws in your area may differ. As such this manual should not be your only source of training related to the safe handling, installation, and operation of this product and all connected devices.
6. We do not assume any responsibility for damages, breakdown/repair, accidents, etc. that result from not observing the safety information described in this manual.
7. When installing and operating please follow all applicable laws and regulations related to electrical devices.
8. When disposing of this product, please dispose of it as industrial waste according to local laws and regulations.
9. The manual may be modified without notice. Please ensure you have the most current version.

## Safety Precautions

### Notes on arrival

Before installation and wiring, please confirm the model of the product, optional items, and the existence of accessories.

### Installation environment and storage precautions

#### **WARNING**

1. The moving part of this product is the slider (table), and its range of motion is from mechanical limit to mechanical limit. Please set up safeguards to prevent people and/or objects that could be damaged from entering its range of motion, as serious injury or death may occur. If connecting other objects with this product, the range of motion may expand.
2. All work should be done from outside the safeguarded area. If you need to work within the safeguarded area, ensure the product cannot be operated. This may entail removing power from the product, turning off all connected objects, removing dangerous elements and/or providing necessary safety counter-measures.
3. Since this product does not have an emergency-stop circuit, please ensure the controlling electronics are equipped with an emergency stop feature and set it appropriately according to local regulations.
4. If it is necessary to provide a guard inside the range of motion, install a guard that has sufficient strength to stop the driving force of this product.

#### **CAUTION**

1. To prevent electric shock and fire hazards, do not install this product in the following places:
  - Outdoors
  - Ambient temperature outside the range of 0° C to 40° C
  - Ambient humidity outside of the range of 20% to 80%
  - Where condensation can occur.
  - Where fine particles, mist or moisture are generated; examples include (but are not limited to): water, corrosive gas, flammable gas, chemicals, oil or oil mist, salt, cutting fluid, iron powder, etc.
  - Where unshielded electrical noise, strong magnetic fields or radiation occur.
2. To prevent damage, do not store this product in the following places:
  - Ambient temperature outside the range of -20° C to 60° C
  - Where condensation or moisture can collect or be generated; examples include (but are not limited to): water, corrosive gas, flammable gas, chemicals, oil or oil mist, salt, cutting fluid, iron powder, etc.
  - Where exposure to direct sunlight is possible.

## Notes on installation

### **DANGER**

1. This product contains strong magnets which will likely interfere with the operation of electronic medical devices such as pacemakers. We recommend not coming near the product if you have such a device. Use the product at your own risk.
2. Do not lift the product by the shaft, as it will likely bend. This can cause the equipment to malfunction, and cause damage to itself and other moving parts with which it comes in contact.

### **WARNING**

1. The shaft contains strong magnets. Ferrous and magnetic objects will be pulled towards the shaft. This may cause permanent damage to these objects, and if body parts get caught between the shaft and magnetic objects, serious injury or death may result.
2. Use non-magnetic tools when installing, inspecting and performing maintenance on or near the product.
3. The magnets within the shaft are under extreme compression. Disassembling the product will cause the magnets to come out uncontrollably and with significant force, causing grave damage.
4. When installing this product, ensure it and all connected objects are not connected to any power source. Failure to do so may result in injury or death.
5. Use appropriate safe transportation and handling practices for bulky and heavy objects when transporting and installing this product.

### **CAUTION**

1. Please mount the product on a base that meets the following conditions:
  - Has sufficient rigidity to withstand the reaction force generated during operation.
  - Has a mounting surface with at least 0.1mm / (500mm x500mm) of flatness.
  - Has equal to or greater area to the mounting surface of the product.
  - Is comprised of non-ferrous and non-magnetic materials.
2. Please mount the equipment with the appropriate hardware.
  - Please consult the Setup instructions in this manual for more information.
3. Do not put any unsecured objects on the product, as it may malfunction.
4. Do not ride on the product.
5. Do not pull on the cables or other connected parts when transporting or installing, as it may cause unseen damage.
6. When preparing a multi-axis table using this product:
  - It is recommended that you use a dedicated orthogonal fixture.
  - There may be restrictions on combining models due to issues with rigidity or payload.
  - Always ensure the bottom axis is equal to or larger than the top axis.
  - Please review the X-Y Table details in this manual for more information.

7. When using this product in a vertical orientation, please install a free-fall-prevention mechanism (for example, counterbalance) for the slider. This product is designed for use in a horizontal orientation, as such it is not equipped with a mechanism to prevent possible damage from free fall of the slider during power loss.
8. Do not place a load on the top cover of the product as it may bend, resulting in interference with the moving slider.

## Notes on wiring

### **WARNING**

1. Ensure all connections are wired correctly, including motor wires, encoder wires, and extension cables to prevent malfunctions.
2. Please review the cables provided, whether they include connectors on both ends or flying leads where requested. Please use the cables correctly (per the encoder or driver manuals) and do not attempt to alter them. Problems arising from user-altered parts are exempted from warranty.
3. Ensure that the power is off when connecting and disconnecting cables to prevent electric shock.

### **CAUTION**

1. Connect the motor extension cable and encoder extension cable securely to this product.
2. Install the motor extension and encoder extension cables as far away from each other as possible to prevent electrical interference. If cables must cross, always do so at 90-degree angles.
3. The motor and encoder extension cables are subject to warranty only when using the parts provided by Nippon Pulse. Use of other cables or incorrect parts may cause the equipment to malfunction, and will not be covered under warranty.
4. Do not damage the cable or apply excessive stress. Do not place objects on the cable or pinch it, as the cable may break and/or cause electric shock.

## Notes on operation

### **WARNING**

1. Please set up safeguards to prevent people and or other objects that could be damaged from entering this product's range of motion, as serious injury and death may occur. If connecting other objects with this product, the range of motion may expand.
2. If you must work within the operating range while this product is energized, do not work alone. Confirm that another worker can access emergency stop switches to stop the product's movement if needed and that they can see or hear a call for emergency help.
3. Shut off the power supply immediately if you notice abnormal heat generation, smoke, an abnormal odor, or fire occurring in the equipment or cable, to prevent damage or fire.
4. If abnormal noise or vibration increases during operation, stop operation immediately to prevent malfunction or breakage of the equipment.

### **CAUTION**

1. Before operation of the product, check and properly adjust the parameters of the connected servo driver to prevent unexpected behavior.
2. Make sure there are no objects in the workspace that the product can crash into before beginning operation.

## Notes on maintenance and inspection

1. Do not disassemble this product. Disassembling the product will cause the magnets to come out uncontrollably and with significant force, causing grave damage. Please contact us if repair is necessary.
2. Please perform lockout and tag-out before performing maintenance or inspecting to avoid an accident.

## Other notes

### **CAUTION**

Powerful magnets are used inside this product. Do not place any magnetic storage medium nearby, as data may be destroyed.

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## 1. Outline and Features

The SLP series is developed to be a simple and compact stage. SLP stages have a built-in Linear Shaft Motor, a high precision direct drive linear servomotor that consists of a magnet shaft and a forcer of cylindrical coils.

The major features are;

- Thrust
- High Acceleration
- High Speed
- High Precision Positioning
- Low Speed Ripple
- High Response
- Quiet Operation
- Power / Space Efficiency
- Maintenance Free

## 2. Model Numbers

SLP – Size – Stroke – Number of Slider – Motor cable Option – Encoder cable Option – Cable carrier – Jig Plate

**Example: SLP25-100-S-M3-A3-MH-XYPB**

|                      |  |
|----------------------|--|
| Size                 | 15: SLP15<br>25: SLP25<br>35: SLP35  |
| Stroke (mm)          | You can select stroke based on catalog.  |
| Number of Slider     | S: Single<br>D: Tandem   |
| Motor Cable Option   | You can select length of extension motor cable.<br>Blank: No extension motor cable<br>M3: 3m<br>M6: 6m<br>M9: 9m   |
| Encoder Cable Option | You can select length of extension encoder cable.<br>Blank: No extension encoder cable<br>A1: Double-end D-sub 1m    B1: Single-end D-sub 1m<br>A3: Double-end D-sub 3m    B3: Single-end D-sub 3m<br>A6: Double-end D-sub 6m    B6: Single-end D-sub 6m<br>A9: Double-end D-sub 9m    B9: Single-end D-sub 9m |
| Cable Carrier        | Blank: No Cable Carrier<br>SH: S-Type Horizontal Mount<br>SW: S-Type Wall Mount<br>MH: M-Type Horizontal Mount<br>MW: M-Type Wall Mount  |
| Jig Plate            | Blank: No Orthogonal Jig Plate<br>XYPA: Orthogonal Jig Plate A<br>XYPB: Orthogonal Jig Plate B<br>XZP: Z-Axis Jig Plate<br>See explanation at left.<br>(When ordering a jig plate, you get one jig plate per slider).  |

Note: Please refer each specification page for the detail of extension cable, cable carrier, and jig plate.

Note: Encoder is incidental type.

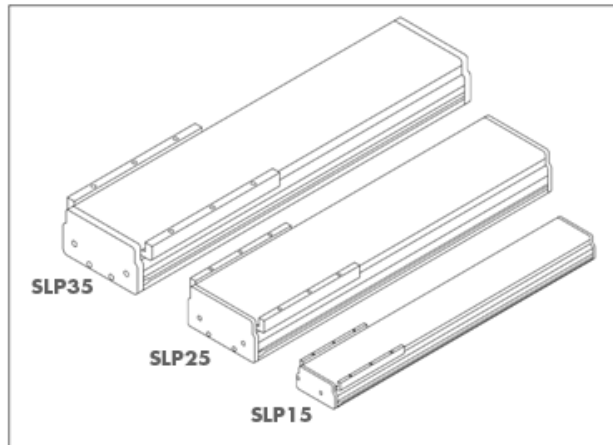
Note: Stage does not have Hall sensor. Please use driver with magnetic pole detection function. If Hall sensor required, please contact us.

Note: Requires controller and driver.

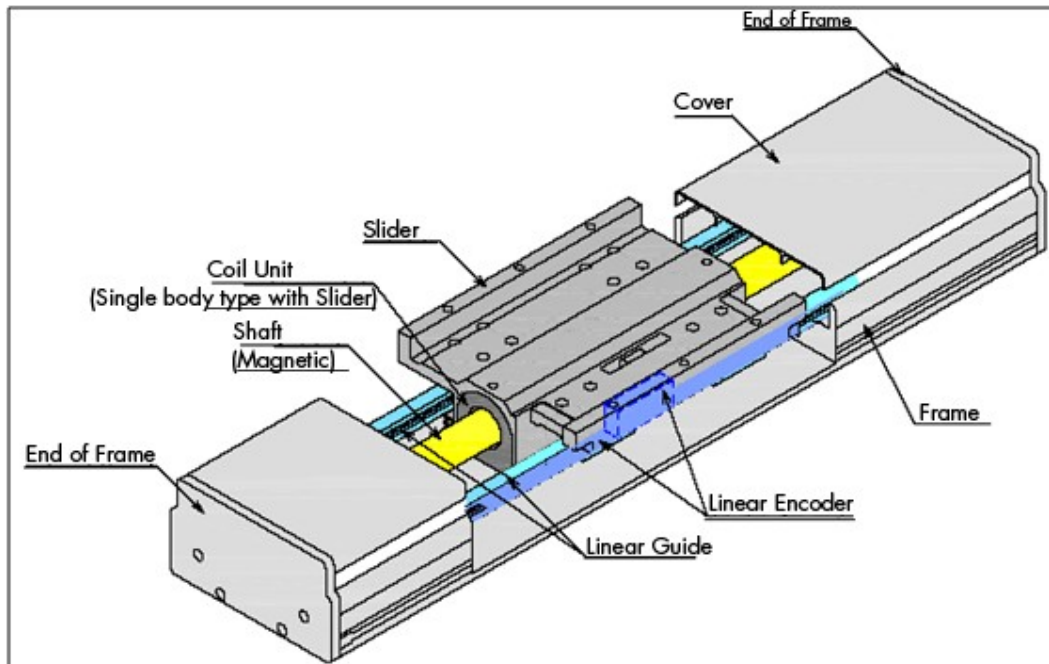
### 3. Model Types

| Model | Stroke (mm)   |             |
|-------|---------------|-------------|
| SLP15 | Single Forcer | 100 to 1300 |
|       | Double Forcer | 100 to 1200 |
| SLP25 | Single Forcer | 200 to 1200 |
|       | Double Forcer | 200 to 1000 |
| SLP35 | Single Forcer | 200 to 1200 |
|       | Double Forcer | 200 to 1000 |

Note: Stroke is selectable 100mm interval



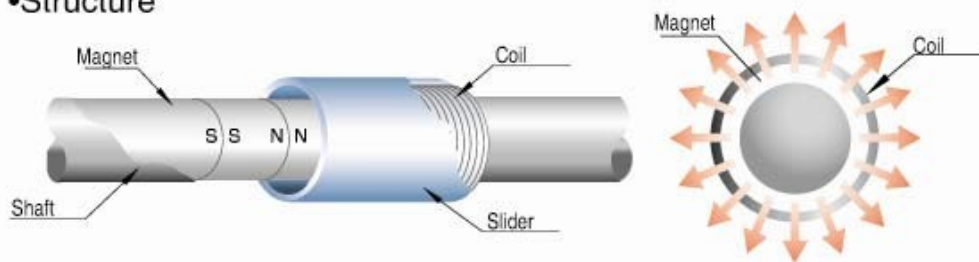
## 4. Structure



### • The Benefits of a Shaft-Type Linear Motor

This high-precision drive unit boasts high thrust (high degree of acceleration) as well as being coreless. The coil unit catches the magnetic field generated by the NS magnet arrayed inside of the shaft (magnetic) without any waste.

#### • Structure



Because it can change the outer magnetic field into force in a full 360 degrees, even with a short coil length, large force is gained.

## 5. Specifications

### 5-1. Spec.

|                                       |               | unit  | SLP15                            | SLP25                    | SLP35                    |
|---------------------------------------|---------------|-------|----------------------------------|--------------------------|--------------------------|
| Resolution                            |               | mm    | 0.001 (HEIDENHAIN, P/N: LIDA279) |                          |                          |
| Continuous Force                      |               | N     | 17                               | 80                       | 185                      |
| Peak Force ※1                         |               | N     | 90                               | 340                      | 970                      |
| Continuous Current ※2                 |               | A     | 0.51                             | 1.2                      | 2.7                      |
| Peak Current                          |               | A     | 2.7                              | 5.1                      | 14.4                     |
| Peak Constant                         |               | N/A   | 33                               | 66                       | 68                       |
| Back EMF                              |               | V/m/s | 11                               | 22                       | 22                       |
| Resistance ※3                         |               | ohm   | 56                               | 8.4                      | 7.2                      |
| Inductance ※3                         |               | mH    | 24                               | 15                       | 12                       |
| Magnetic pitch (N—N)                  |               | mm    | 60                               | 90                       | 120                      |
| Max. Acceleration ※4                  |               | G     | 3.5                              |                          |                          |
| Max. Speed ※4、※5                      |               | m/s   | 3.0                              |                          |                          |
| Repeatability                         |               | mm    | ±0.0005                          |                          |                          |
| Max Load                              | Horizontal    | kg    | 5                                | 30                       | 60                       |
|                                       | Wall          |       | 3                                | 15                       | 30                       |
| Stroke ※6                             | Single Slider | mm    | 100～1300<br>(100mm each )        | 200～1200<br>(100mm each) | 200～1200<br>(100mm each) |
|                                       | Double Slider |       | 100～1200<br>(100mm each)         | 200～1000<br>(100mm each) | 200～1000<br>(100mm each) |
| Power Supply                          |               | V     | 100, 200                         |                          |                          |
| Ambient Temperature Range (Operating) |               | °C    | 0～+40                            |                          |                          |
| Operating Humidity                    |               | %     | 20～80 (no condensation)          |                          |                          |
| Ambient Temperature Range (Storage)   |               | °C    | －20～+60                          |                          |                          |

※1 : Peak force is driven by the followings driver with 200Vac.

SLP15: Hitachi-Sanki-System ADA3-01LL2

SLP25: Hitachi-Sanki-System ADA3-02LL2

SLP35: Hitachi-Sanki-System ADA3-08LL2

※2 : Based on temp. 110K over 25deg-C ambient temp.

※3 : Averaged from U-V、U-W and V-W

※4 : Some case cannot achieve by load and/or drive condition.

※5 : Some case cannot achieve by stroke.

※6 : If you need other stroke length, please let us know.

5—2. Dimensions

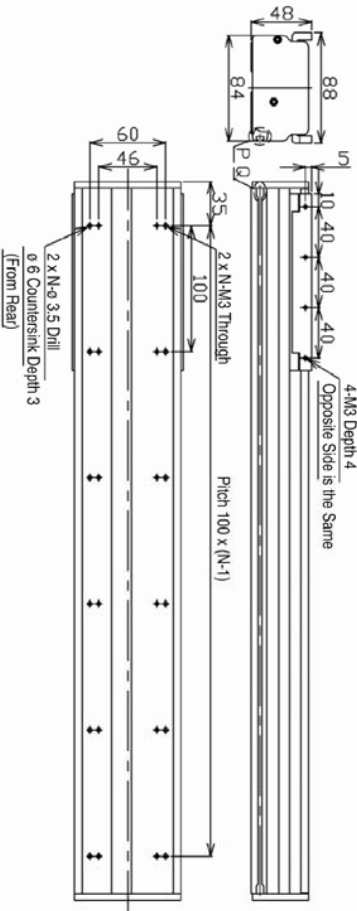
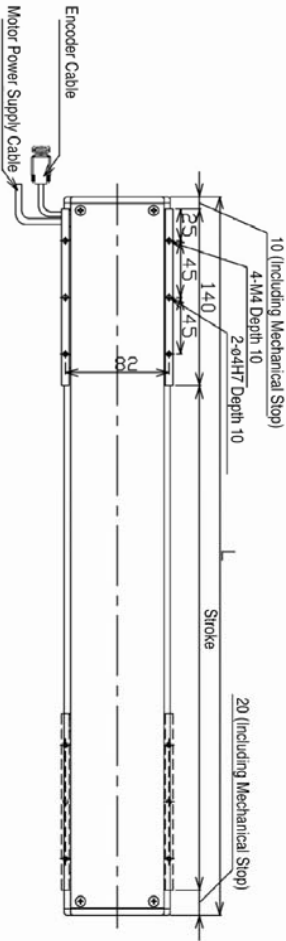
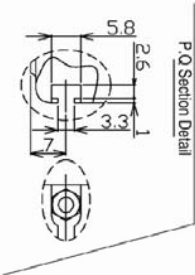
SLP15 Single Slider

Motor Power Supply Cable Specifications

Hiachi Power Supply Co. UL2464FA  
AWG 25  
Outer Diameter  $\phi$  4.3  
Length 300 mm  
No Connector  
U Phase-Red  
V Phase-White  
W Phase-Black

Encoder Cable Specifications

Outer Diameter  $\phi$  4.3  
Length 3000 mm  
Distb 15 Pin Connector (Male)



| Stroke (mm) | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900  | 1000 | 1100 | 1200 | 1300 |
|-------------|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| L (mm)      | 270 | 370 | 470 | 570 | 670 | 770 | 870 | 970 | 1070 | 1170 | 1270 | 1370 | 1470 |
| N           | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11   | 12   | 13   | 14   | 15   |
| Weight (kg) | 1.8 | 2.2 | 2.6 | 3.1 | 3.5 | 4.0 | 4.4 | 4.8 | 5.3  | 5.7  | 6.1  | 6.6  | 7.0  |

Hitachi: Power Supply Co. UL2464FA

Outer Diameter  $\varnothing 4.3$ 

| U Phase-Red | No Connector |
|-------------|--------------|
| U Phase-Red | No Connector |

V Phase-White  
W Phase-Black

Outer Diameter  $\varnothing 4.3$ 

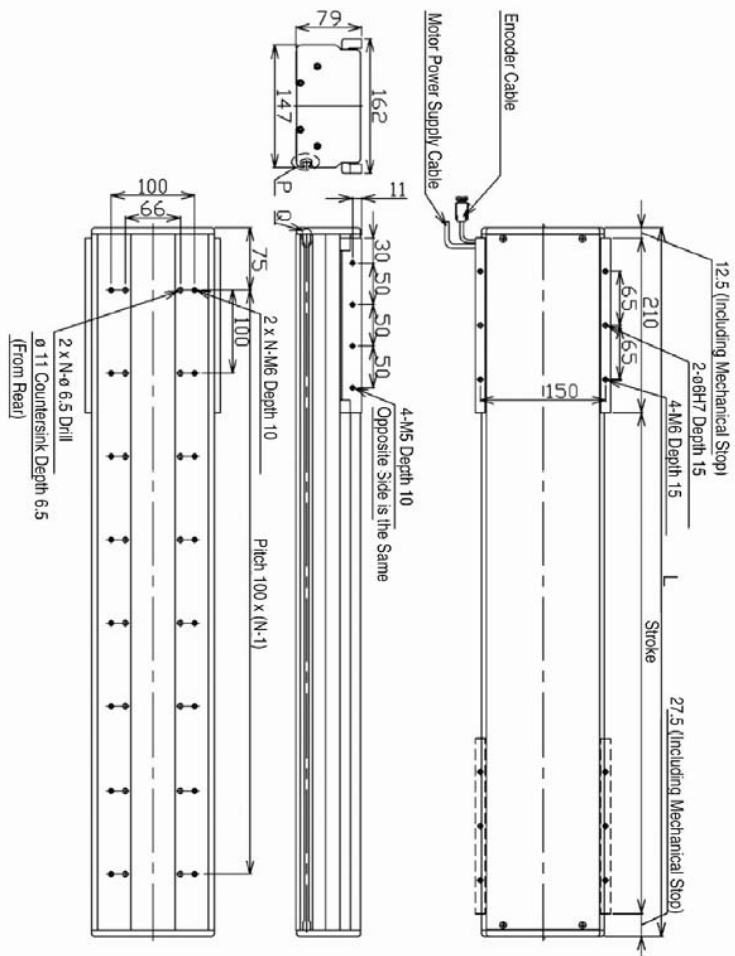
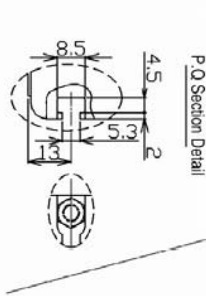
Dsub 15 Pin Connector (Male)



|             |     |     |     |     |     |     |      |      |      |      |      |      |
|-------------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| Stroke (mm) | 100 | 200 | 300 | 400 | 500 | 600 | 700  | 800  | 900  | 1000 | 1100 | 1200 |
| L (mm)      | 420 | 520 | 620 | 720 | 820 | 920 | 1020 | 1120 | 1220 | 1320 | 1420 | 1520 |
| N           | 4   | 5   | 6   | 7   | 8   | 9   | 10   | 11   | 12   | 13   | 14   | 15   |
| Weight (kg) | 3.0 | 3.5 | 3.9 | 4.3 | 4.8 | 5.2 | 5.6  | 6.1  | 6.5  | 6.9  | 7.4  | 7.8  |

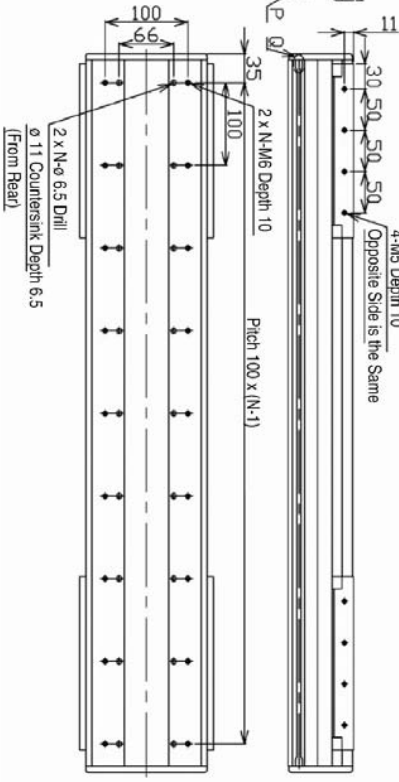
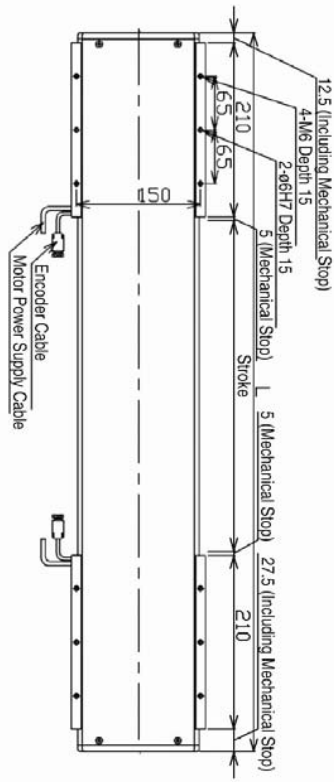
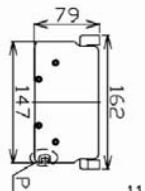


Dsub 15 Pin Connector (Male)



|             |     |     |     |     |     |     |      |      |      |      |      |
|-------------|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| Stroke (mm) | 200 | 300 | 400 | 500 | 600 | 700 | 800  | 900  | 1000 | 1100 | 1200 |
| L (mm)      | 450 | 550 | 650 | 750 | 850 | 950 | 1050 | 1150 | 1250 | 1350 | 1450 |
| N           | 4   | 5   | 6   | 7   | 8   | 9   | 10   | 11   | 12   | 13   | 14   |
| Weight (kg) | 9.7 | 11  | 12  | 14  | 15  | 16  | 18   | 19   | 20   | 22   | 23   |

Length 3000 mm  
Dsub 15 Pin Connector (Male)



|             |     |     |     |     |      |      |      |      |      |      |      |
|-------------|-----|-----|-----|-----|------|------|------|------|------|------|------|
| Stroke (mm) | 200 | 300 | 400 | 500 | 600  | 700  | 800  | 900  | 1000 | 1100 | 1200 |
| L (mm)      | 670 | 770 | 870 | 970 | 1070 | 1170 | 1270 | 1370 | 1470 | 1570 | 1670 |
| N           | 7   | 8   | 9   | 10  | 11   | 12   | 13   | 14   | 15   | 16   | 17   |
| Weight (kg) | 16  | 17  | 19  | 20  | 22   | 23   | 24   | 26   | 27   | 28   | 30   |

SLP35 Single Slider

Motor Power Supply Cable Specifications

Hiachi Power Supply Co. UL2464FA

AWG 20

Outer Diameter  $\phi$  5.3

Length 300 mm

No Connector

U Phase-Red

V Phase-White

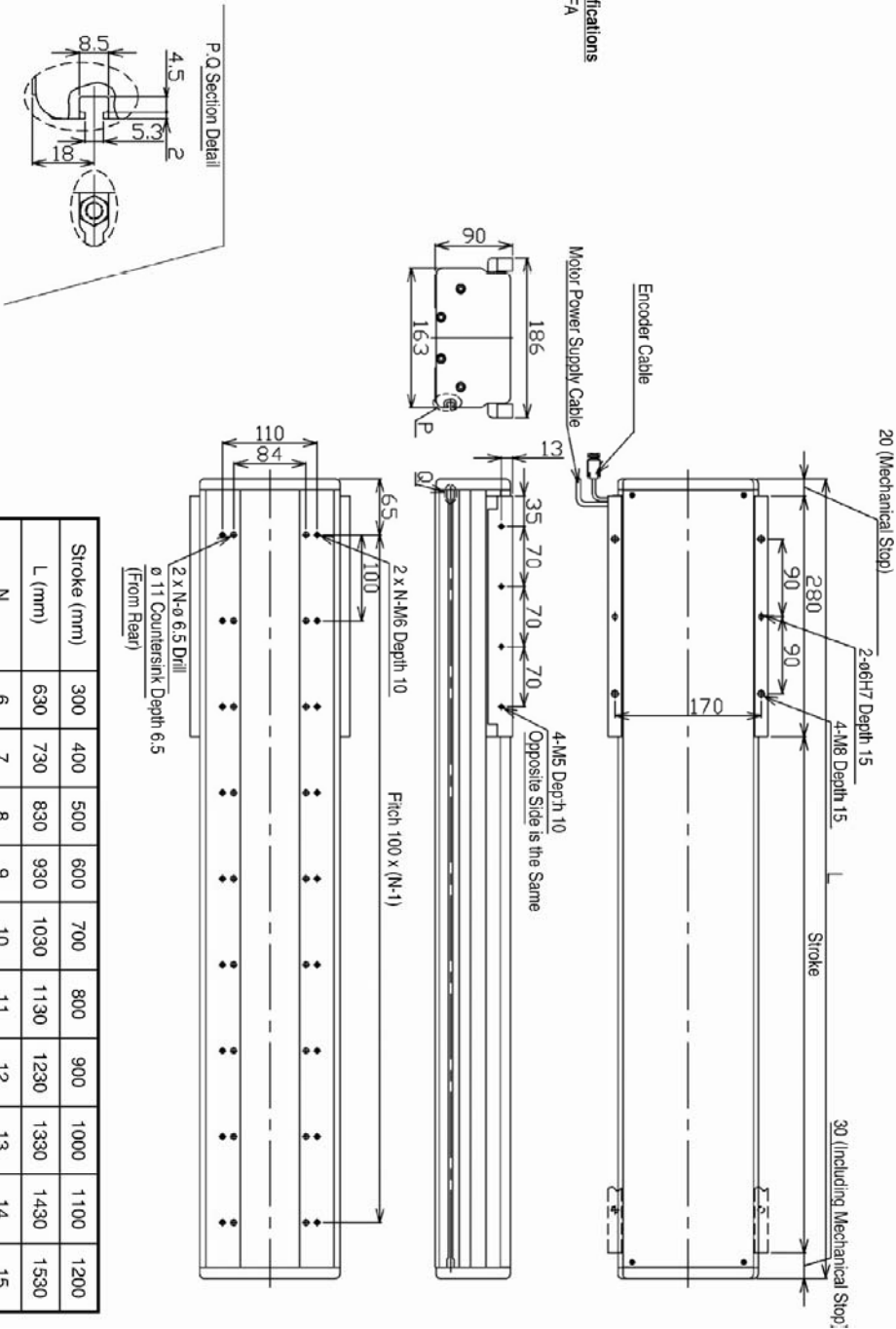
W Phase-Black

Encoder Cable Specifications

Outer Diameter  $\phi$  4.3

Length 3000 mm

Deub 15 Pin Connector (Male)



| Stroke (mm) | 300 | 400 | 500 | 600 | 700  | 800  | 900  | 1000 | 1100 | 1200 |
|-------------|-----|-----|-----|-----|------|------|------|------|------|------|
| L (mm)      | 630 | 730 | 830 | 930 | 1030 | 1130 | 1230 | 1330 | 1430 | 1530 |
| N           | 6   | 7   | 8   | 9   | 10   | 11   | 12   | 13   | 14   | 15   |
| Weight (kg) | 17  | 19  | 21  | 23  | 25   | 26   | 28   | 30   | 32   | 34   |

Hitachi: Power Supply Co. UL2464FA

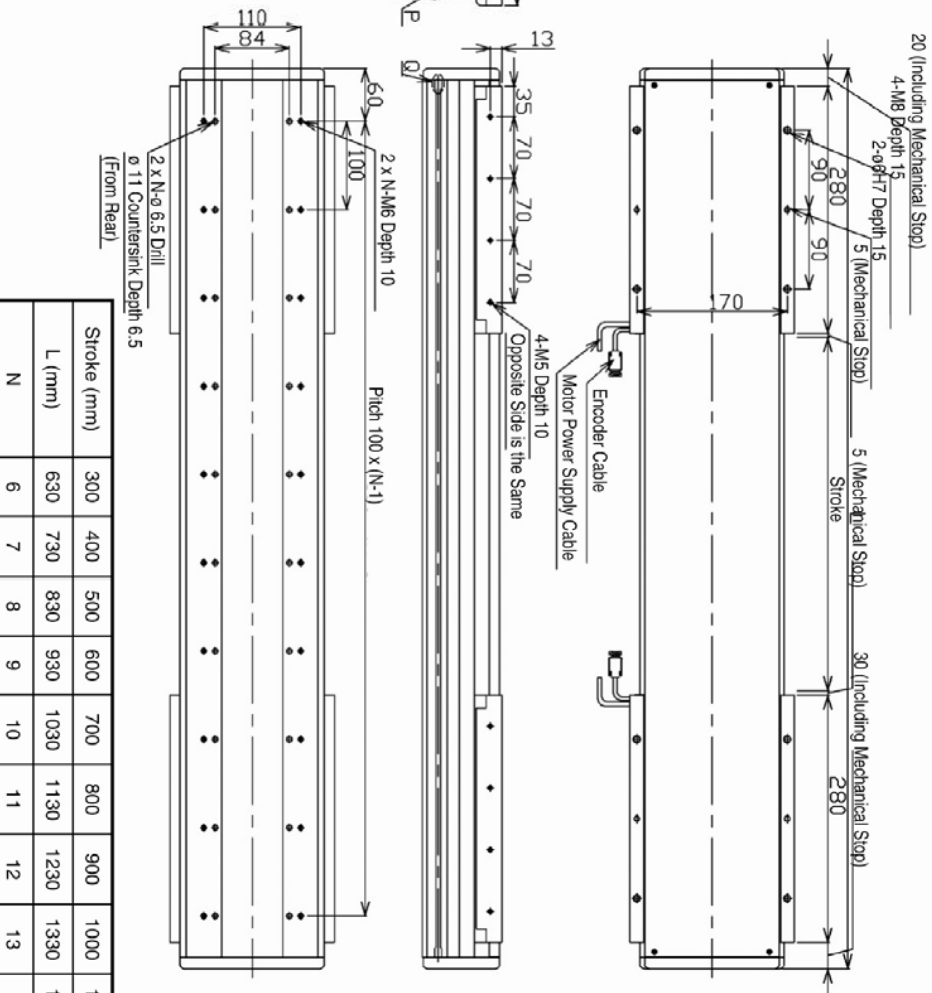
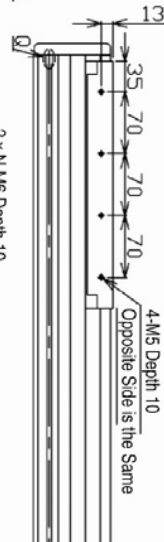
Outer Diameter  $\varnothing$  5.3

No Connector U Ph

V Phase-White  
W Phase-Black

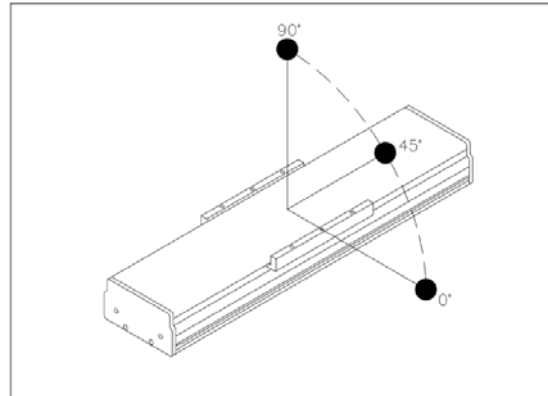
## Outer Diameter Ø 4.3

Connector (Male)



|             |     |     |     |     |      |      |      |      |      |      |
|-------------|-----|-----|-----|-----|------|------|------|------|------|------|
| Stroke (mm) | 300 | 400 | 500 | 600 | 700  | 800  | 900  | 1000 | 1100 | 1200 |
| L (mm)      | 630 | 730 | 830 | 930 | 1030 | 1130 | 1230 | 1330 | 1430 | 1530 |
| N           | 6   | 7   | 8   | 9   | 10   | 11   | 12   | 13   | 14   | 15   |
| Weight (kg) | 17  | 19  | 21  | 23  | 25   | 26   | 28   | 30   | 32   | 34   |

### 5—3. Overhang

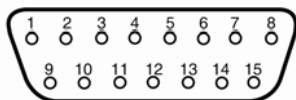


| SLP15 (mm) |      |     |     |     | SLP25 (mm) |      |      |      |      | SLP35 (mm) |      |      |      |      |
|------------|------|-----|-----|-----|------------|------|------|------|------|------------|------|------|------|------|
|            | Load | 0°  | 45° | 90° |            | Load | 0°   | 45°  | 90°  |            | Load | 0°   | 45°  | 90°  |
| Horizontal | 1kg  | 380 | 400 | 450 | Horizontal | 5kg  | 1000 | 1000 | 1000 | Horizontal | 10kg | 1000 | 1000 | 1000 |
|            | 2kg  | 220 | 250 | 270 |            | 10kg | 1000 | 800  | 1000 |            | 20kg | 1000 | 900  | 1000 |
|            | 3kg  | 160 | 190 | 200 |            | 15kg | 800  | 650  | 1000 |            | 30kg | 940  | 780  | 1000 |
|            | 4kg  | 120 | 140 | 150 |            | 20kg | 700  | 580  | 1000 |            | 40kg | 840  | 660  | 1000 |
|            | 5kg  | 100 | 110 | 130 |            | 25kg | 550  | 500  | 1000 |            | 50kg | 750  | 590  | 950  |
|            |      |     |     |     |            | 30kg | 500  | 450  | 1000 |            | 60kg | 680  | 540  | 900  |
| Wall       | 1kg  | 440 | 390 | 320 | Wall       | 3kg  | 1000 | 1000 | 580  | Wall       | 5kg  | 1000 | 1000 | 700  |
|            | 2kg  | 260 | 230 | 180 |            | 6kg  | 1000 | 800  | 450  |            | 10kg | 1000 | 900  | 600  |
|            | 3kg  | 180 | 170 | 120 |            | 9kg  | 1000 | 670  | 400  |            | 15kg | 1000 | 810  | 520  |
|            |      |     |     |     |            | 12kg | 1000 | 580  | 350  |            | 20kg | 1000 | 710  | 430  |
|            |      |     |     |     |            | 15kg | 1000 | 500  | 300  |            | 25kg | 980  | 620  | 350  |
|            |      |     |     |     |            |      |      |      |      |            | 30kg | 890  | 530  | 300  |

The numbers shown indicate what size overhang can be on the slider. For example, when using SLP15 with load 1kg at horizontal operation, the overhang will be 380mm for 0 deg, 400mm for 45 deg and 450mm for 90 deg.

**5—4. Linear Encoder Specs**

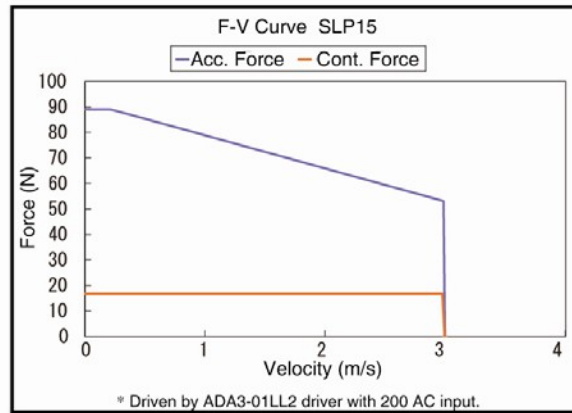
|                          |               |   |
|--------------------------|---------------|---|
| Manufacturer             |               | HEIDENHAIN  |
| Part Number              |               | LIDA279   |
| Type                     |               | Incremental   |
| Scale                    |               | Steal Scale Tape  |
| Expansion Coefficient    |               | $\alpha_{them}=10\text{ppm/K}$                            |
| Accuracy Grade           |               | $\pm 30\mu\text{m}$                                       |
| Incremental Signal       |               | TTL×50  |
| Grating Period           |               | 200 $\mu\text{m}$   |
| Integrated Interpolation |               | 50-fold   |
| Signal Period Resolution |               | 4 $\mu\text{m}$   |
| (4x Multiply)            |               | 1 $\mu\text{m}$   |
| Cutoff Frequency         |               | —   |
| Scanning Frequency       |               | $\leq 25\text{kHz}$                                       |
| Edge Separation          |               | $\geq 0.175\mu\text{s}$                                   |
| Traversing Speed         |               | $\leq 5\text{m/s}$  |
| Vibration 55 to 2000Hz   |               | $\leq 200\text{m/s}^2$ (IEC 60 068-2-6)                   |
| Shock 11ms               |               | $\leq 500\text{m/s}^2$ (IEC 60 068-2-27)                  |
| Operating Temperature    |               | 0~50°C  |
| Weight                   | Scanning Head | 20g   |
|                          | Scale Tape    | 20g/m   |
|                          | Connector     | 32g   |
|                          | Cable         | 30g   |
| Power Supply             |               | 5V±5%, <200mA(without load)                               |
| Cable                    |               | $\phi 4.3$ 3000mm<br>Dsub15-pin Connector (Male) attached |



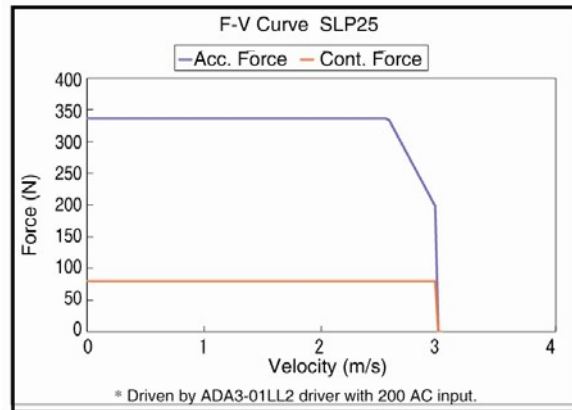
D-sub Pin Connector

## 6. Characteristics

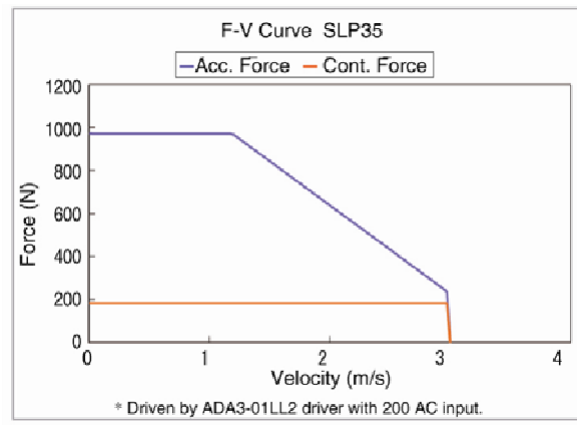
### 6 - 1 . F-V



SLP15



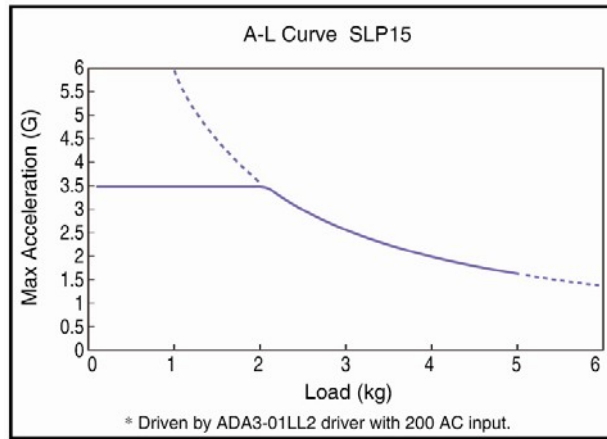
SLP25



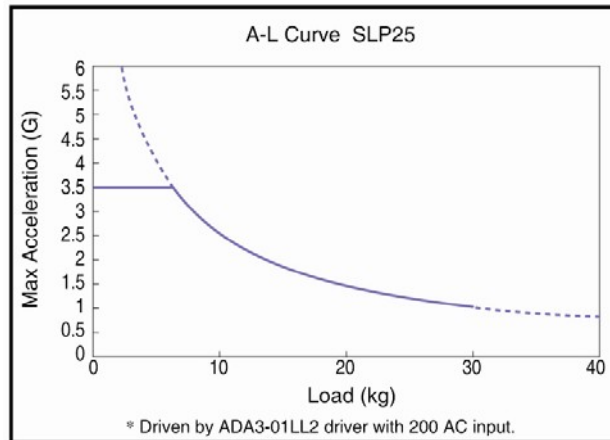
SLP35

※ Be aware that control speed is less than 3m/sec. Over 3m/sec speed operation causes performance issues or can damage the part.

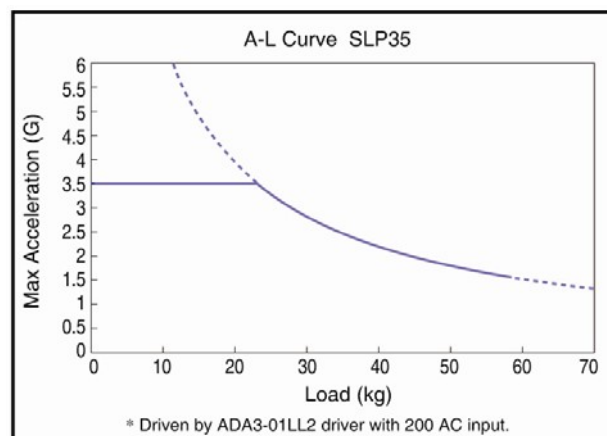
## 6-2. Acceleration



SLP15



SLP25



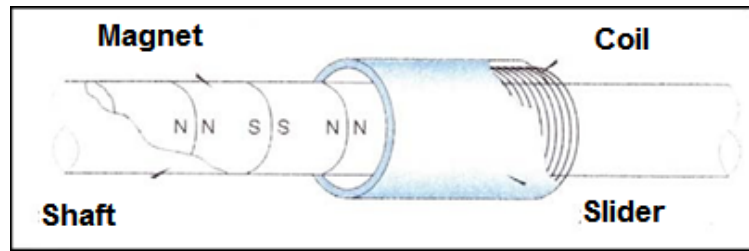
SLP35

※ Be aware that control speed is less than 3m/sec. Over 3m/sec speed operation causes performance issues or can damage the part.



### 6—3. Magnetic Flux at Peripheral of Shaft

Strong magnets are built into the shaft. It is showing the magnetic field.



## 6—4. Speed Ripple

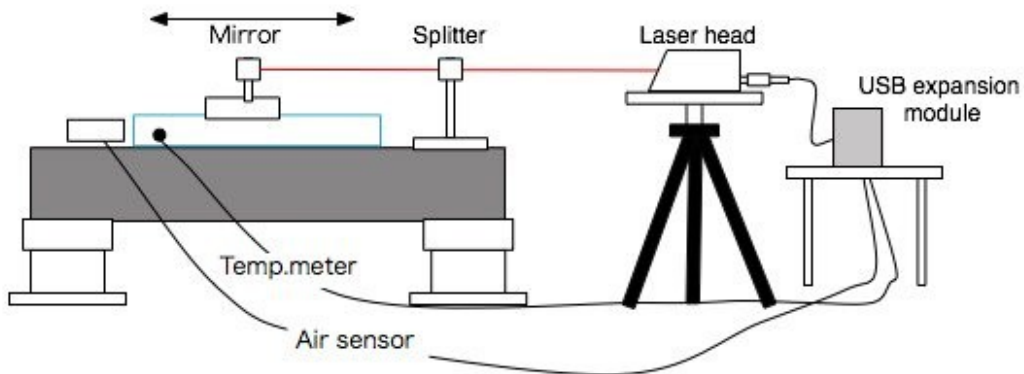
### 6—4—1. Measurement method for speed ripple

Measurements settled target system on the granite table. Slider is operated in whole stroke range with continuous speed, peak to peak speed and then calculated average speed.

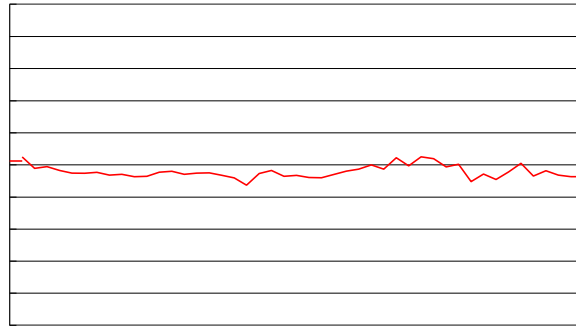
$(\text{Plus peak Speed} - \text{Minimum peak Speed}) / \text{Average Speed} \times 1/2 = \pm \text{Speed Ripple}$

Conditions (Three models are common);

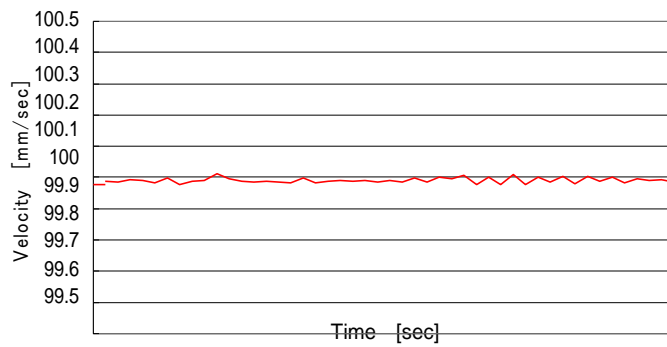
- Stroke: 600mm
- Speed: 100mm/sec
- Driver: Servoland (P/N:SVF)
- Laser Displacement Meter : Agilent Technologies (P/N:55292A)
- Load: 1.2Kg
- Sampling: 10Hz



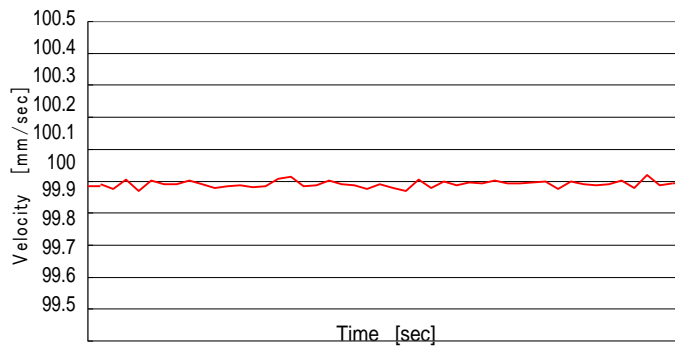
6-4-2. Result for Speed Ripple



SLP15:  $\pm 0.05\%$



SLP25:  $\pm 0.02\%$



SLP35:  $\pm 0.03\%$

## 6—5. Position Repeatability

### 6—5—1. Measurement Method for Position Repeatability

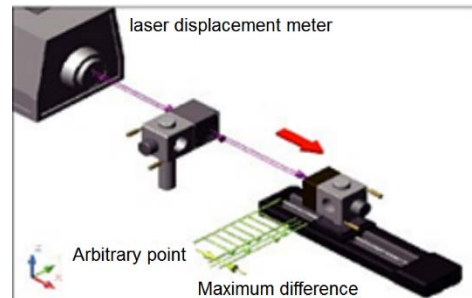
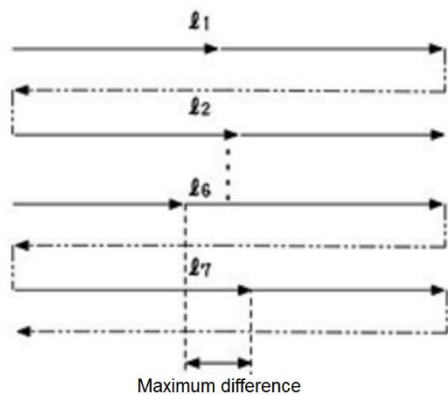
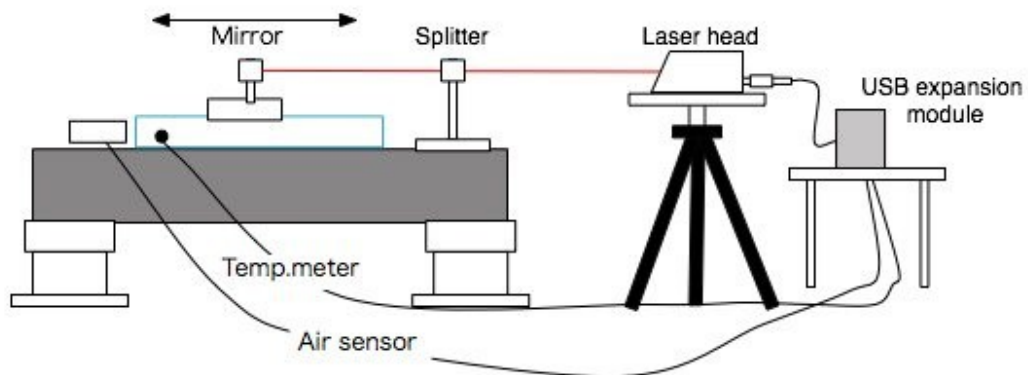
SLP settled target system on the granite table. Slider for measurement is operated for one arbitrary position to seven times from the same direction. The formula is following;

$$\pm \text{Repeatability} = (\text{difference of maximum} - \text{difference of minimum}) \times 1/2$$

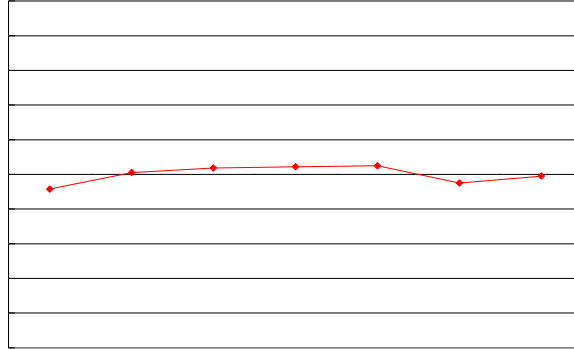
$$(\text{Difference of Maximum} - \text{Difference of Minimum}) \times 1/2 = \pm \text{Position Repeatability}$$

Conditions (Same for all three models);

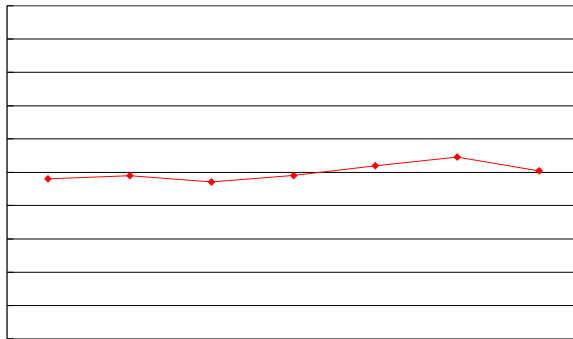
- Stroke: 600mm
- Speed: 300mm/sec
- Driver: Servoland (P/N:SVF)
- Laser Displacement Meter : Agilent Technologies (P/N:55292A)
- Load: 1.2Kg



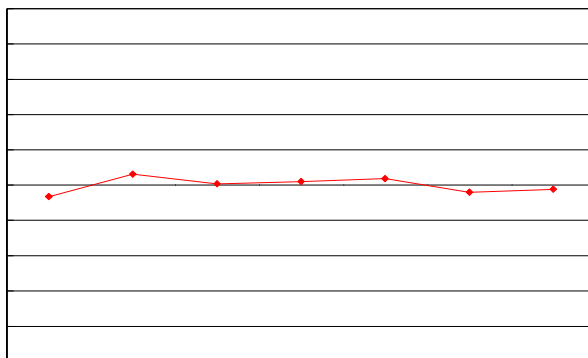
**6—5—2. Result for Position Repeatability**



SLP15:  $\pm 0.32 \mu\text{m}$



SLP25:  $\pm 0.34 \mu\text{m}$



SLP35:  $\pm 0.38 \mu\text{m}$

## 7. Driver

### 7—1. Recommendation

| Manufacture | Model     |
|-------------|-----------|
| Panasonic   | MINAS     |
| ELMO        | BAS, CEL  |
| Hitachi     | AD Series |
| Yasukawa    | Sigma V   |
| Technosoft  |           |

## 8. Set-up

### 8—1. Attachment Requirements

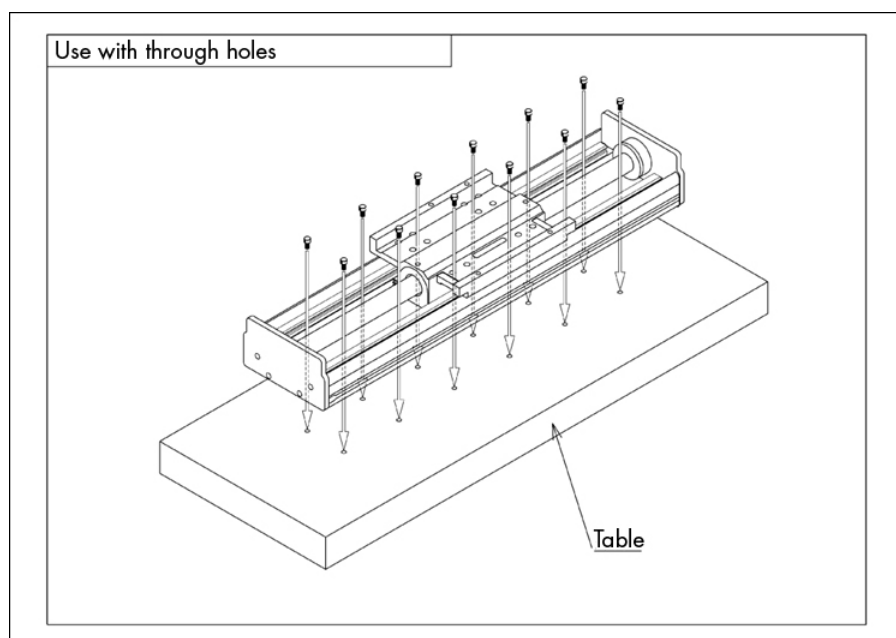
- For attachment the SLP stage needs a sturdy frame/table to withstand the reaction of the stage.
- Flatness 0.1mm or less to surface (500mm x 500mm)
- There should be adequate space on the table for the attached stage.
- A table or frame must be non-magnetic. Please do not use magnetic parts.

### 8—2. Attachment

#### 8—2—1. Use with thru holes

Make the thread holes to the table and fasten with bolts from top. Remove the cover to fasten the bolts. Please make sure the proper torque is used when tightening the screws (see below). Please use non-magnetic tools to fasten the stage to the table because the shaft of the stage contains a very strong magnet.

|       | Screw                                  | Torque                 |
|-------|--|------------------------|
| SLP15 | M3 x 8mm or more<br>Material: SUS304   | 12 kgf-cm to 16 kgf-cm |
| SLP25 | M6 x 15mm or more<br>Material: SUS304  | 100kgf-cm to 130kgf-cm |
| SLP35 | M6 x 15mm or more<br>Material : SUS304 | 100kgf-cm to 130kgf-cm |

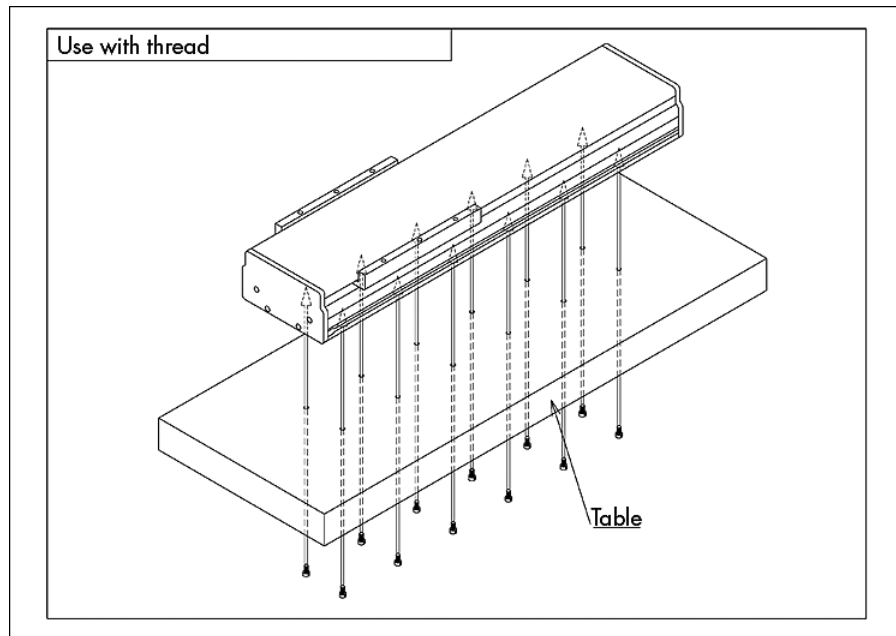


#### 8—2—2. Use with Thread

Make through holes to table and set the stage with bolts from under the table.  
Please use the proper torque for tightening the bolts. See below.

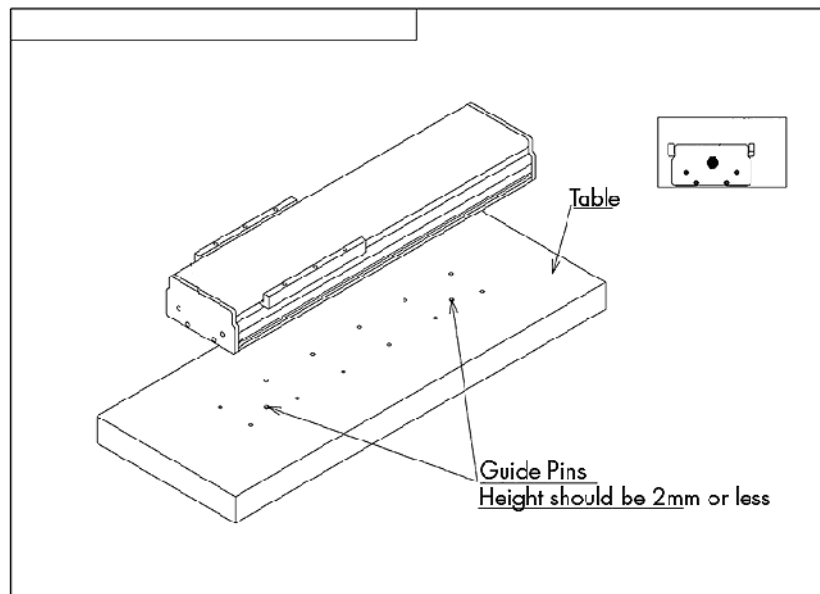
|       | Screw  | Torque                 |
|-------|--|------------------------|
| SLP15 | M3, Thickness of table 5mm or more<br>Material: SUS304   | 12 kgf-cm to 16 kgf-cm |
| SLP25 | M6, Thickness of table 10mm or more,<br>Material: SUS304 | 100kgf-cm to 130kgf-cm |
| SLP35 | M6, Thickness of table 10mm or more<br>Material: SUS304  | 100kgf-cm~130kgf-cm    |

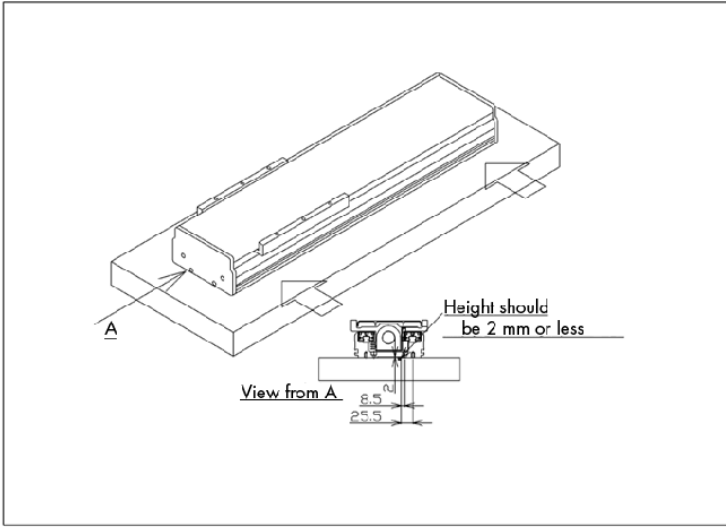




### 8—2—3. Other Axis, Parallel or Straight

By using two guide pins, you can set the stage for other axes, and parallel or straight operations. The guide pins need to hit for accuracy. Please follow the above procedures 8-2-1 or 8-2-2.





#### 8-2-4. Load Attachment

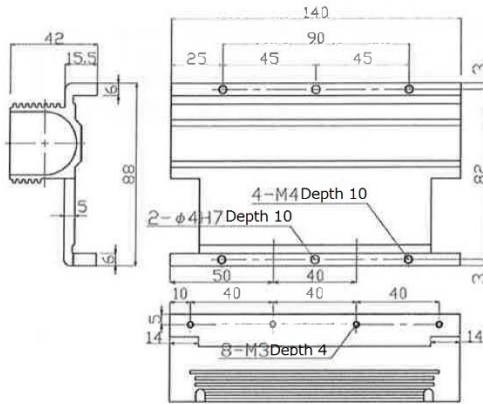
Please fix the load to the tapped hole in the slider.

The slider has two holes for positioning pins.

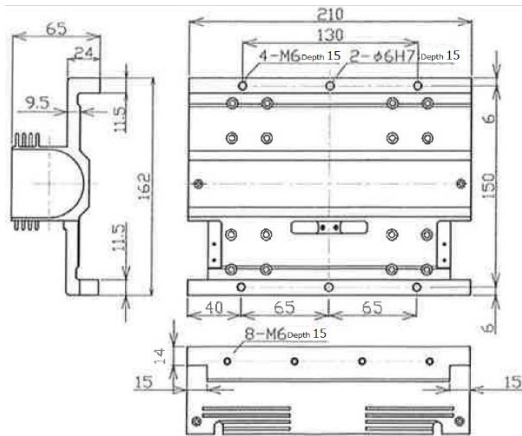
You need to arrange the positioning pins yourself.

Please refer to the slider drawing below for the shape of the hole.

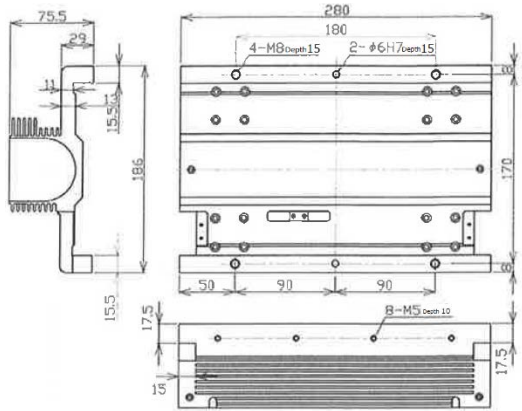
## SLP15



SLP25



SLP35



### 8—3. Wiring

Please be careful of incorrect wiring. Damage due to faulty wiring is not covered by warranty.

#### Motor

| Pin # | Name    | Color |
|-------|---------|-------|
| 1     | U-Phase | Red   |
| 2     | V-Phase | White |
| 3     | W-Phase | Black |

|       | Motor cable                       | Connector   |
|-------|-----------------------------------|-------------|
| SLP15 | UL2464 AWG25 Ø4.3mm Hitachi cable | JST XM male |
| SLP25 | UL2570 AWG18 Ø6.1mm Hitachi cable | JST HL male |
| SLP35 | UL2570 AWG18 Ø6.1mm Hitachi cable | JST HL male |

Note: This is the case for a standard coil. 1S coils may be different.  
Please contact us.

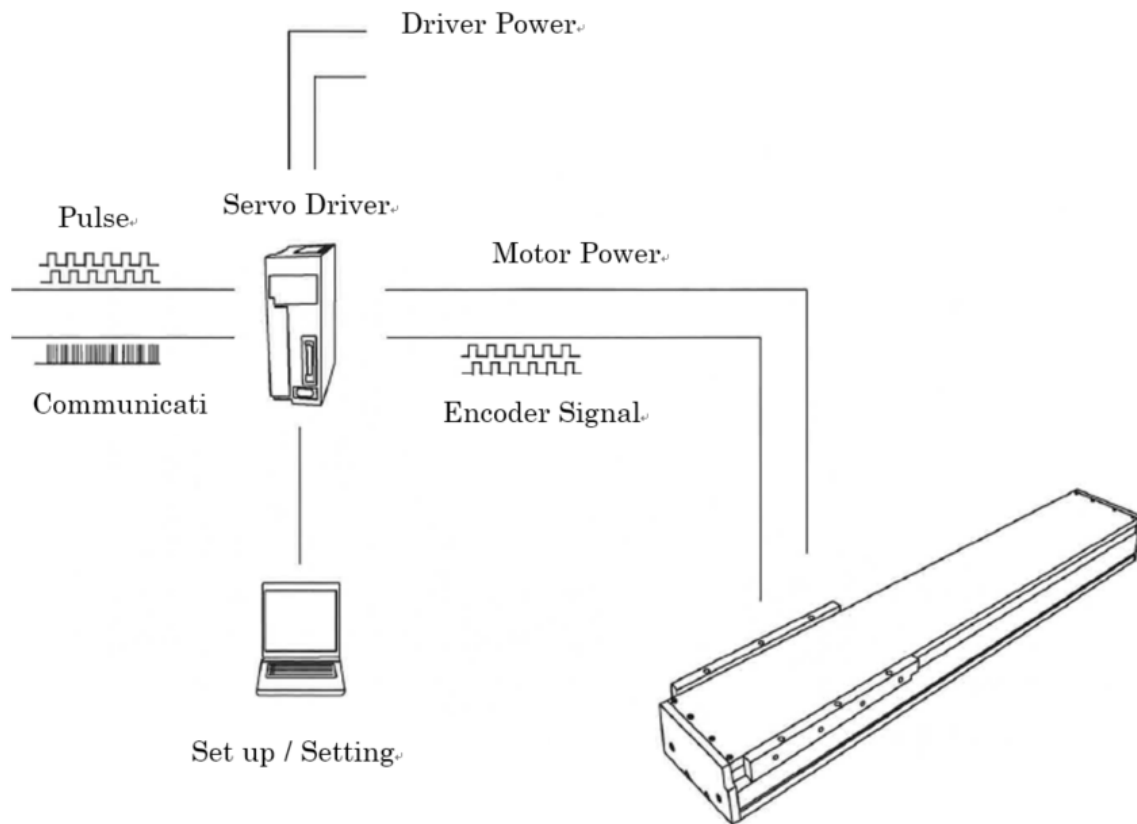
#### Encoder

##### Omron D-sub15 connector male

| Pin# | Signal | Color        |
|------|--------|--------------|
| 1    | A+     | White        |
| 2    | 0V     | Black/Red    |
| 3    | B+     | Green        |
| 4    | 5V     | Red          |
| 7    | Z-     | Black/Yellow |
| 9    | A-     | Black/White  |
| 11   | B-     | Black/Green  |
| 14   | Z+     | Yellow       |

Note: If a pin number is not called out, it is not connected.  
Shield is connected to connector housing.

## 8—4. System Constructions



## 9. Basic Components

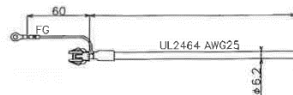
- Main Stage Unit (including Linear Encoder)
- Connector (male/female) for Flexible Motor Cable
  - SLP15 : XMR—03V (JST)
  - SLP25 : HLR—03V (JST)
  - SLP35 : HLR—03V (JST)

It does not include drivers or other type of connectors.

## 10. Options

### 10—1. Motor cable For SLP15

| Pin | Name    | Wire Color   |
|-----|---------|--------------|
| 1   | U-phase | Red          |
| 2   | V-phase | White        |
| 3   | W-phase | Black        |
| -   | FG      | Green/Yellow |

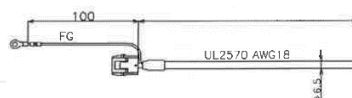


Hitachi-Densen: 3-conductor robot cable + FG wire

Cable length: 1m, 3m, 6m and 9m

### For SLP25 and SLP35

| Pin | Name    | Wire Color   |
|-----|---------|--------------|
| 1   | U-phase | Red          |
| 2   | V-phase | White        |
| 3   | W-phase | Black        |
| -   | FG      | Green/Yellow |

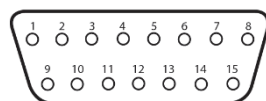


Hitachi-Densen: 4-conductor robot cable

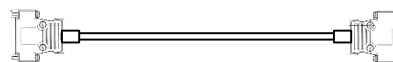
Cable length: 1m, 3m, 6m and 9m

### 10—2. Encoder cable

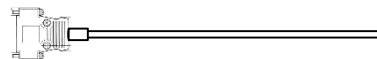
D-sub connector is available. Please see the chart below.



A type



B type



Length: 1m, 3m, 6m, 9m

A type: Double-end D-sub

B type: Single-end D-sub

Cable Spec.: UL2464 AWG28

φ8.2mm Dia.

65.6mm minimum bend radius

| Pin | Signal | Wire Color   | Function           |
|-----|--------|--------------|--------------------|
| 1   | A+     | White        | Incremental Signal |
| 2   | 0      | Black/Red    | Ground             |
| 3   | B+     | Green        | Incremental Signal |
| 4   | 5V     | Red          | Power              |
| 7   | Z-     | Black/Yellow | Reference Mark     |
| 9   | A-     | Black/White  | Incremental Signal |
| 11  | B-     | Black/Green  | Incremental Signal |
| 14  | Z+     | Yellow       | Reference Mark     |

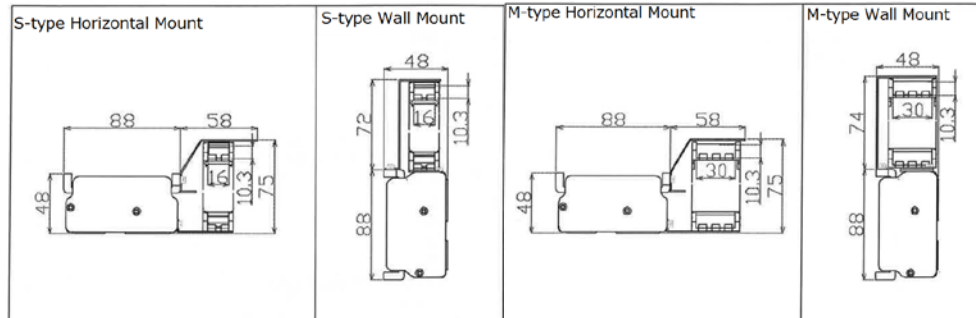
## SLP Series Manual

SH and SW: Igus, P/N: 07.16.028.0

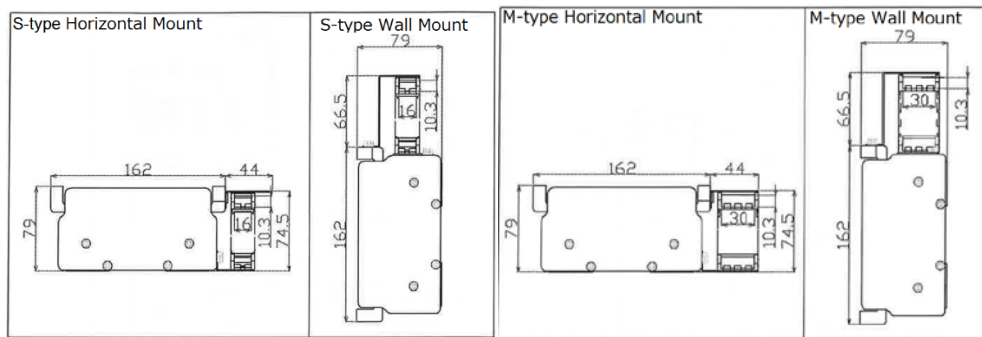
MH and MW: Igus, P/N: 07.30.028.0

When ordering, please let us know if you need a horizontal or wall mounting type.

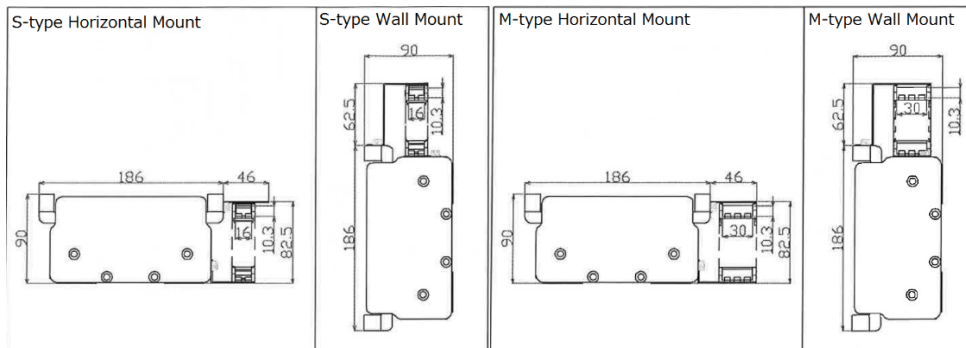
### SLP15



### SLP25



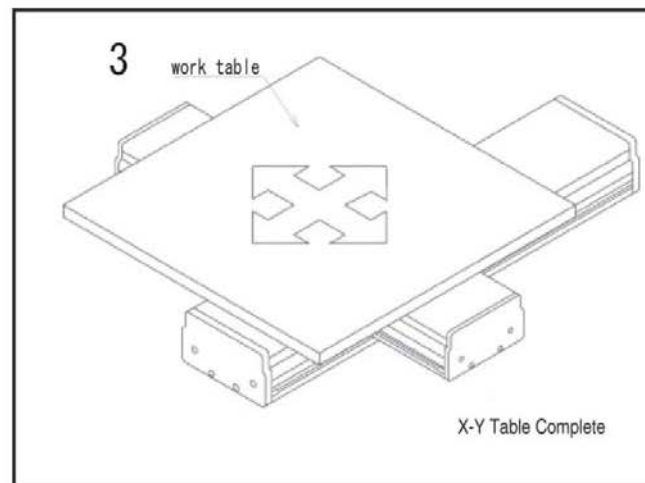
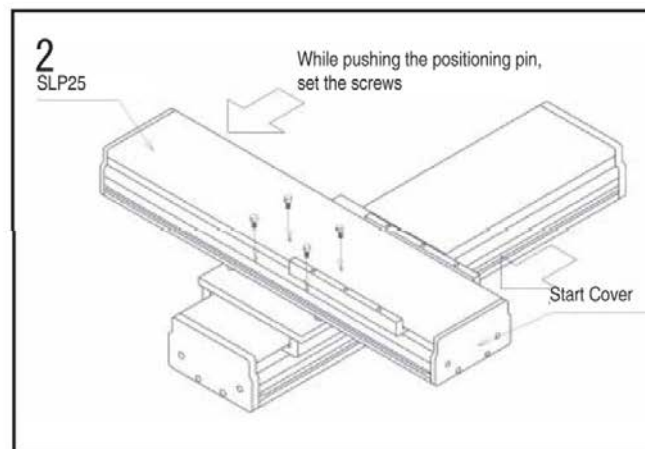
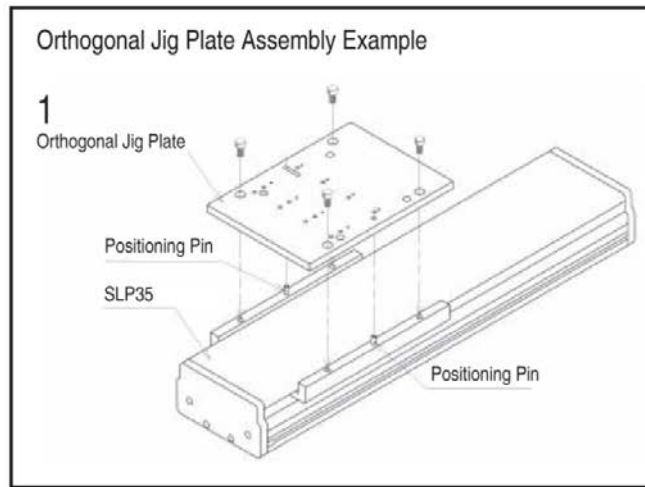
### SLP35





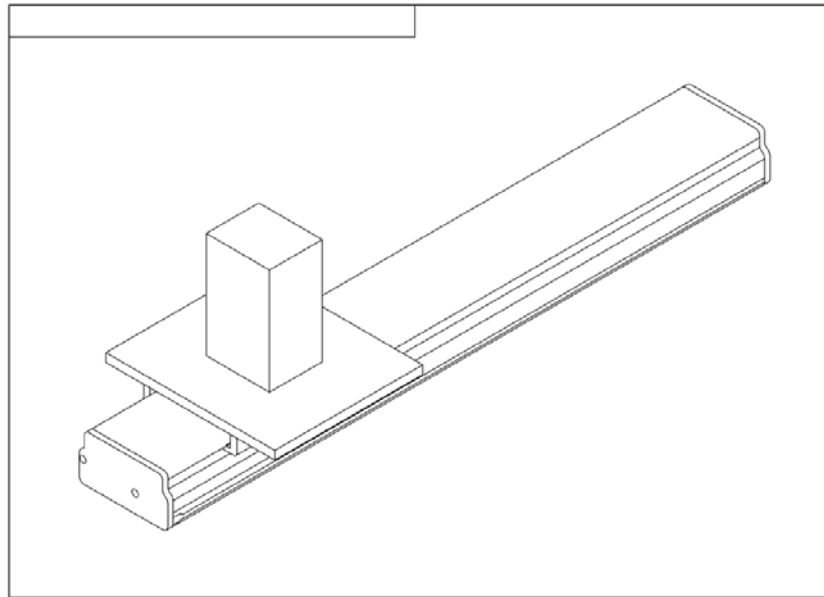


★Orthogonal Jig Plate Usage

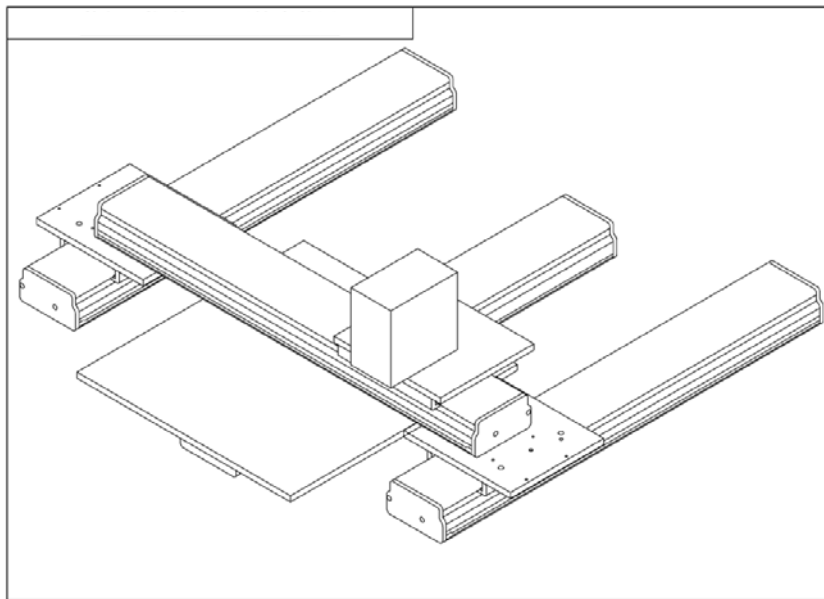


## 11.SLP Series Applications

### ■ 1 axis



### ■ Multi Axis



## 12. Handling

### PRECAUTION

- When operating the stage, make sure others around you are aware that it is moving.
- To avoid accidents, make sure there is nothing near the slider.
- Please make sure the power supply is shut OFF prior to anyone working on or near the stage.
- Please keep electronics at least 1 meter away from the shaft. The magnet will affect the proper operation of electronics devices, including pacemakers.
- Do not disassemble or attempt to service the stage. If you experience problems with the stage, please contact Nippon Pulse America, Inc.

### HANDLING AND CARE

- Use proper care and safety procedures during handling, lifting, installation, operation, and maintenance operations. Failure to follow care and safety procedures can result in muscle strain or serious injury.
- The magnetic attraction between the magnet shaft and other magnetic or ferrous materials are extremely high. Keep fingers and other body parts away from these objects to avoid injury.

### UNPACKING

- Check packaging for signs of damage.
- Material surfaces may be hot or cold following prolonged storage.
- Remove packaging. Do not discard. In the event that items need to be returned to NPA, it is recommended that the original packaging be used.
- Ensure that the packing slip correctly reflects your order and the items delivered.
- Check equipment for signs of damage. Never use the equipment if it appears damaged in any way.
- Read and make sure you understand this manual before installing and using this equipment.

## 13. Maintenance

Please check the stage for basic maintenance according to the schedule below.

This recommendation is based on usage in which the stage is operated 8 hours a day. Please adjust the maintenance schedule according to your usage.

| Check for:                      | Recommended Maintenance |         |         |        |
|---------------------------------|-------------------------|---------|---------|--------|
|                                 | Before Operating        | 1 month | 6 month | 1 year |
| Looseness of stage fixing bolt  | ●                       | ●       | ●       | ●      |
| Cable damage                    | ●                       | ●       | ●       | ●      |
| Cable bear damage               | ●                       | ●       | ●       | ●      |
| Connector connection            | ●                       | ●       | ●       | ●      |
| Grease of the linear guide part |                         |         |         | ●      |
| Abnormal vibration              | ●                       | ●       | ●       | ●      |

Note: Please contact Nippon Pulse America, Inc. about grease of guide.

## 14. Service

The SLP series is not designed to be serviced in the field. If you experience any issues or malfunctions, please contact NPA for return authorization.

Nippon Pulse America, Inc. 4

Corporate Drive

Radford, VA 24141, U.S.A.

Tel: 540-633-1677

E-mail: [info@nipponpulse.com](mailto:info@nipponpulse.com)

Web: [nipponpulse.com](http://nipponpulse.com)