LTROBOT

Motion The Future

LTROBOT

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Single Axis Robot

1.1 Features

The LTROBOT Single-Axis Robot module utilizes professional standard manufacturing technology developed over the years, with the ballscrew and magnetic slide design module developed and produced by ourselves, LTROBOT itis applicable to all types of automation equipment due to its features of easy installation, small size, high-precision and various specifications.

◎Complete selection of single-axis robots and accessories.
Drive type: ballscrew, toothed belt
AC motor output: 30W~750W servo motor or stepping motor
Motor connection type (depends on available space): direct, bottom, internal, left, right
Max stroke:100～2000mm (Dependant on screw speed limit.)

◎Easy installation and maintenance.

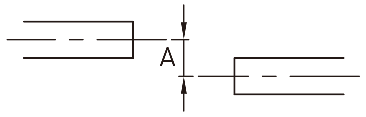
◎Customized designs available.

◎Easy transformation into a multi-axis robot.

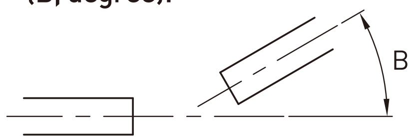
1.2 Installation guide for motor flange, motor and coupling

◎Three types of displacement may exist while installing the ballscrew with motor axis, which are shown as below.

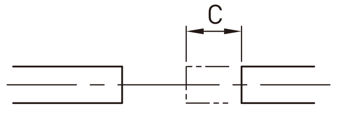
1. Radial displacement (A):



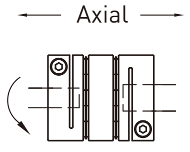
2. Angular displacement (B, degree):



3.Axial displacement(C):

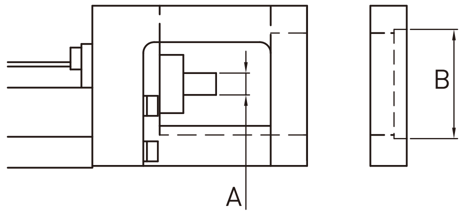


◎Confirmation of axial alignment:



When the ballscrew shaft and motor are connected by a coupling, turn the coupling to confirm if it is capable of rotating without restrictions. This will ensure the concentricity of both axes. The illustration is shown as left.

◎The use of a motor mounting jig might be necessary to make sure the ballscrew spindle end (A) and the positioning hole of the motor flange (B) are concentric. The illustration is shown below.

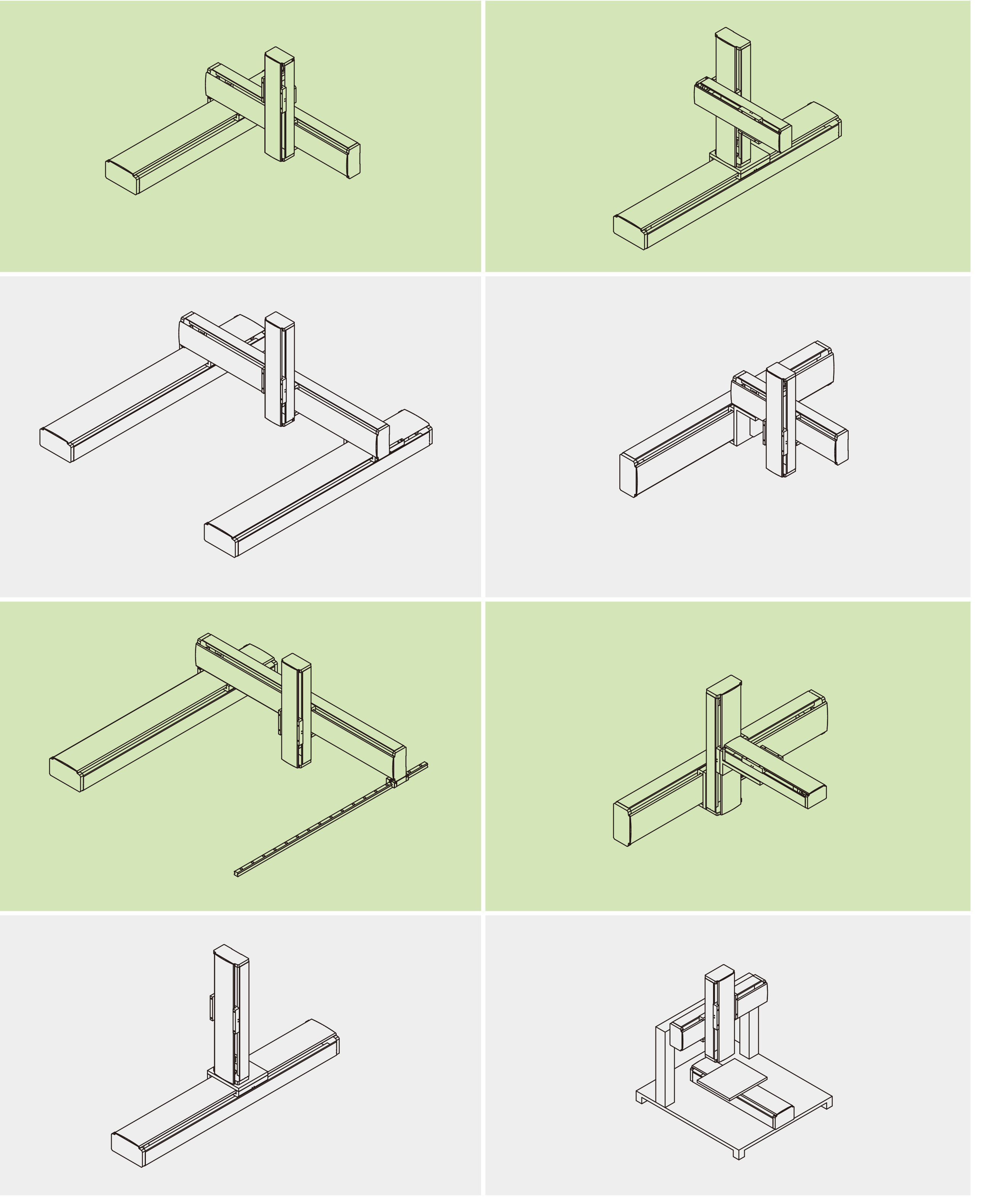


◎Precaution:

1. During motor flange mounting, the displacement between ballscrew spindle end and the positioning hole of the motor flange should be controlled and also within the allowable displacement range of the chosen coupling.

2. The ballscrew spindle end could break if the displacement is beyond the allowable range limit or the coupling is mounted incorrectly.

3. Make sure the allowable displacement of the coupling is sufficient for your application, LTROBOT recommends a Disk Type coupling. Please contact LTROBOT with any questions regarding coupling installation or selection.



1.3 Applications

Single-axis robots can be used in a wide range of applications. The following are examples of applicable systems: Automatic soldering system, screw feeding machine, adhesive laminating machine, CCD lens shifting, automatic paint spray machine, cutting machine, semiconductor manufacturing equipment, assembly equipment, press machine, spot welding machine, surface processing automation, self adhesive labeling machine, packaging machine, marking press machine, conveying equipment, and more.

1.4 Selection Process

When choosing an single-axis robot based on different conditions and restrictions, you may refer to the following selection process:

1. User requirements	5. Motor load calculation
● Effective stroke ● Location restrictions (width, height, length) ● Installation (horizontal, vertical, side mount) ● Position of gravity, center of loading ● Operating conditions (lead, speed, acceleration and deceleration, duty cycle) ● Environment (high temperature, vibration, oil, water, corrosion)	● Maximum speed ● Motor resolution ● Motor torque calculation
2. Demand for precision	**6. Operation analysis**
● Position accuracy ● Repeatability ● Running parallelism	● Acceleration ● Actual operation mode (V-T diagram)
3. Configuration	**7. Other accessories**
● Single axis ● Double axis ● Multi axis ● Special combination	● The use of related accessories (limit switches, adapter plate, retractable sheath, the slip ring protection tube)
4. Motor selection	**8. Final confirmation**
● AC servo motor ● Stepper motor ● With or without brake (included, plug-in)	● Conditions of use should be confirmed ● Price, deadline ● Alteration ● Special requirements

1.5 Precision

1. Positioning accuracy

The maximum difference (absolute value) between the actual arrival distance and the reaching distance based on the original setting.

2. Repeatability of round-trip position (precision)

The maximum difference in the entire cycle. The difference in the positioning value measured from a setting position during the round trip movement of the single-axis robot's slider.

3. Running parallelism

(1) The parallelism between single-axis robot module platform plane and module installation plane. Position the scale at the center of the slider, and then put the pointer on the installation plane. Finally, take the maximum deviation value measured in the full stroke as the result.

(2) The parallelism between single-axis robot module platform and the installation datum. Position the scale at the center of the slider, and put the pointer on the installation datum. Finally, take the maximum derviation value measured in the full stroke as the result.

1.6 Speed

1. Maximum linear velocity

The single-axis robot's maximum linear velocity (V) is calculated from the ballscrew speed (S) multiplied by the lead (L).

V(mm/sec)=S(rpm)÷ 60× L(mm)

2. Maximum rotational speed

The maximum allowable rotational speed of the ballscrew is decided by it's critical rotational speed. If the ballscrew speed exceeds it's critical speed it may result in resonance. Hence, the critical speed is related to the ballscrew length, the critical speed can help to determine the ballscrews effective stroke and total length.

The maximum allowable rotational speed of the ballscrew is calculated as follows:

$$Np = 0.8 \times 2.71 \times 10^8 \times \frac{M_f d_r}{L_t^2}$$

Np = the maximum allowable rotation speed (rpm)
Mf = breakdown of the assembly mounting type; KA uses fixed-support type; Mf=0.689
dr = screw root diameter (mm)
Lt = screw span between bearings (mm)

3. Acceleration/Deceleration

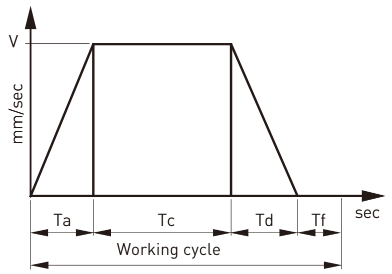
Speed is specified as the working speed of the sliding table. The sliding table must accelerate to the designated speed as it moves to it's target position, in opposite, it must decelerate before it comes to a stop.

Acceleration/deceleration is programmed by the operator according to the needed conditions. The acceleraton on a KA system is set at 0.15G calculated for lead = 5, 0.3G is calculated for all other leads. 1G = 9.8m/s^2, therefore 0.15G = 1470mm/s^2, 0.3G = 2940mm/s^2. The maximum load shown in the catalog is based on this acceleration/deceleration.

Attention Acceleration/deceleration will generate an inertia force on the load. For higher acceleration/deceleration, load will increase accordingly. In addition, higher acceleration/deceleration could generate a possible impact and should be noted.

4. Working cycle

The SR system's working cycle is determined by the operator. The below diagram illustrates how the working cycle is generally calculated. The variables include acceleration time Ta, constant speed time Tc, deceleration time Td, and idling time Tf.



Accelerating Speed=V/Ta
Decelerating Speed=V/Td
Working cycle(sec)= Ta + Tc + Td + Tf
Working time=working cycle × frequency
Operating ratio=working time / (working time+off time)
Operating ratio is closely related to the load of the motor. Normally, the operating ratio is not recommended to exceed 0.5 for long, continuous work.

1.7 Motor Loading Calculation

1. Confirm the moving conditions required by the loading mechanism, including acceleration, deceleration, the weight of the mechanism and it's movement.

2. Momentum loading calculation:
   Momentum calculation for loads moving along a straight line

$$J_L = W \times \left(\frac{V}{2 \times \pi \times N \times 10}\right)^2 = W \times \left(\frac{\Delta S}{20 \times \pi}\right)^2$$

J_L : Momentum of load, calculated to the motors axial output (kg.cm^2)
V : Velocity of load along a straight line(mm/min)
ΔS : Displacement of load per motor rotation(mm)
W : Weight of load (kg)
N : Rotational speed of motor[r/min]

3. Select suitable specification of motor with the proportional principle per the momentums between load and motor.

4. Calculate the acceleration and deceleration torques per the momentum of the selected motor combined with the momentum of the load.

Acceleration torque: $$T_a = \frac{(J_L + J_M) \times N}{9.55 \times 10^4 \times T_{psa}}$$

Deceleration torque: $$T_d = \frac{(J_L + J_M) \times N}{9.55 \times 10^4 \times T_{psd}}$$

J_L : Momentum of load, calculated to the motors axial output (kg.cm^2)
J_M : Momentum of motor (kg.cm^2)
N : Rotational speed of motor (r/min)
T_{psa} : Acceleration/deceleration time(s)
T_{psd} : time (s)

5. Per the loads, installation methods, friction coefficients, and motor efficiency, calculate the torque at uniform motion.

$$T_L = \frac{F \times V}{2 \times 10^3 \times \pi \times \eta \times N} = \frac{F \times \Delta S}{2 \times 10^3 \times \pi \times \eta}$$

F : Axial force moving along a straight line
F=Fc + μx (Wxg + Fo)
T_L : Load torque (N.m)
F_C : External force exerted in the axial direction (N)
F_O : External positive pressure exerted by the load onto the single-axis robot (N)
W : Load (including sliding platform) (kg)
μ : Friction coefficient
η : Mechanical efficiency
V : Velocity of load in a straight line (mm/min)
N : Rotational speed of motor (r/min)
g : Gravity (9.8m/s^2)
ΔS : Displacement of load per motor rotation (mm)

6. The maximum output torque of the selected motor should be larger than the sum of the acceleration torque and load torque; if this condition is not met, the model number needs to be changed and calculated until the requirement is satisfied.

7. Obtain the continuous effective torque per the load torque, acceleration torque, deceleration torque, and continuous torque.

$$T_{RMS} = \sqrt{\frac{T_a^2 \times T_{psa} + T_L^2 \times t_c + T_d^2 \times T_{psd} + T_{LH}^2 \times t_h}{T_f}}$$

T_{psa} : Acceleration time t_c : Constant speed time
T_{psd} : Deceleration time t_h : Stop time
T_f : Cycle time T_a : Acceleration torque
T_L : Load torque T_d : Deceleration torque
T_{LH} : Continuous torque (horizontal movement, T_{LH}=0)

8. The rated output torque of the selected motor should be larger than the continuous effective torque; if this condition is not met, the model number needs to be changed and calculated until the requirement is compliant.

1.8 Installation

If the ballscrew is used in the vertical direction (Z axis), the load should be within the maximum value indicated for vertical loading. Vertical installation using timing belts is forbidden.

* Attention: To prevent the load from slipping off, a brake system is recommended on the motor when the KA module is installed vertically.

1.9 Service life

For horizontal, side or slope (less than 30 degrees) orientation, the service life is dependent on the guideway, as for vertical orientation, the service life is dependent on the ballscrew or fixed bearing which ever one is shorter.

The listed dynamic load (Fy, Fz, Mx, My, Mz) is based on a service life of 10,000km of travel. If the load is less than the loading condition (Fy/Fyd + Fz/Fzd + Mx/Mxd + My/Myd + Mz/Mzd)≦ 1), the service life could be extended. If the load is over, the service life will be less than 10,000km. To ensure long term use, it is recommended that the loading be within the listed range.

1.10 Maintenance

All the related accessories, ballscrew and guideway need to be maintained. After every 3 months or 100km travel distance, it is recommended to add grease to the ballscrew and guideway. Clean any dust or debris from the system. Replace the grease if there is any color change. If you have any further questions, please contact HIWIN.

Single Axis Robot

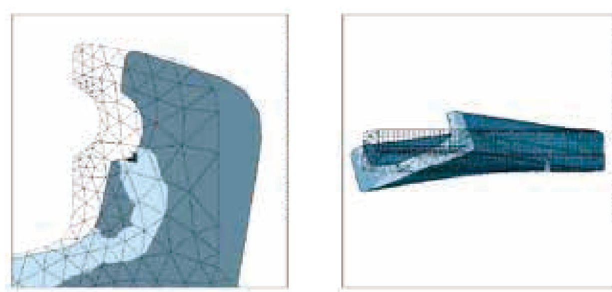
2. SLMK Series

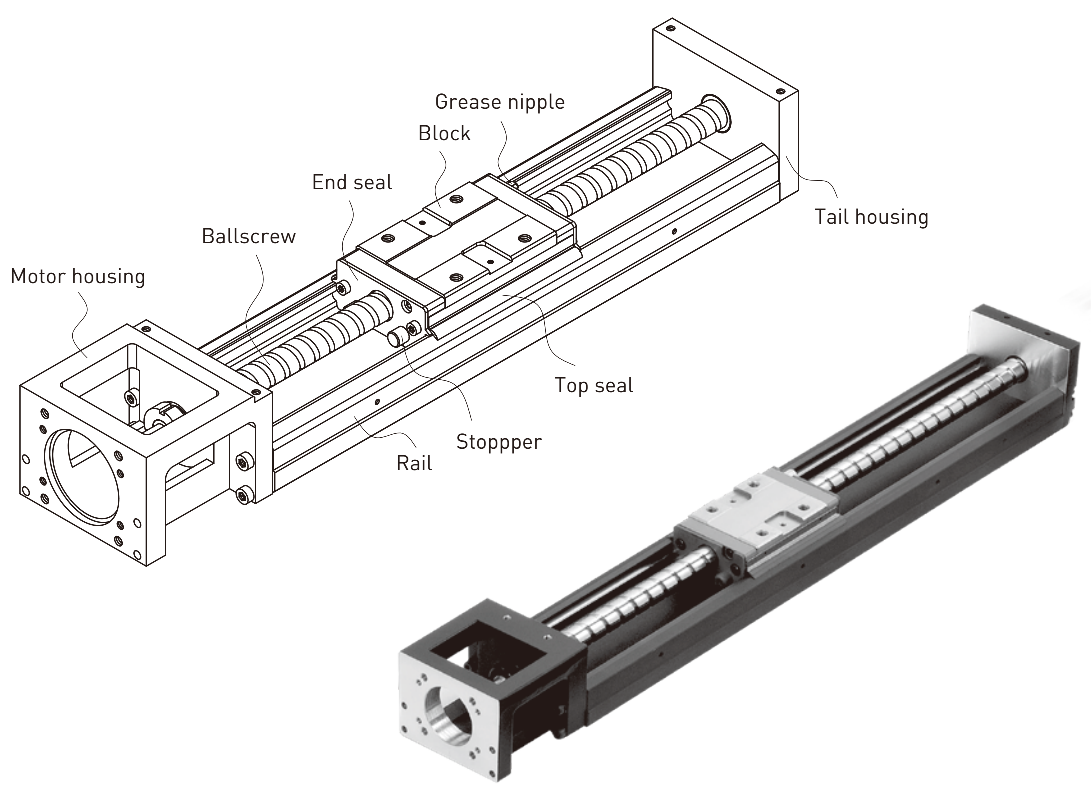
The LTROBOT SLMK single-axis robot is driven by a ballscrew while a guideway slides on an optimized U-rail to achieve higher accuracy and greater stiffness.

2.1 Features

◎ An integrated system
◎ Easy installation and maintenance
◎ Compact and lightweight
◎ High accuracy
◎ High stiffness
◎ Complete line of accessories

The structure of rail is analyzed by FEA to get the best rigidity and weight. The analysis results are shown as the right figures.



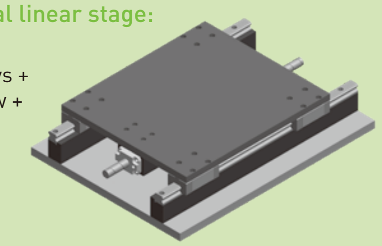


LTROBOT® Linear Modules

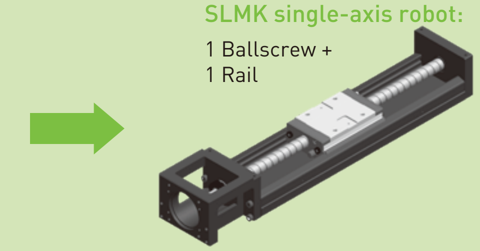
2.1.1 Modulization

The SLMK single-axis robot integrating a ballscrew and guideway forms a modularized product. The modularized design can help customers save time, cost and system inspection. Therefore, installation efficiency and a space-saving design are also promoted.

Traditional linear stage:
1 Table +
2 Guideways +
1 Ballscrew +
1 Base

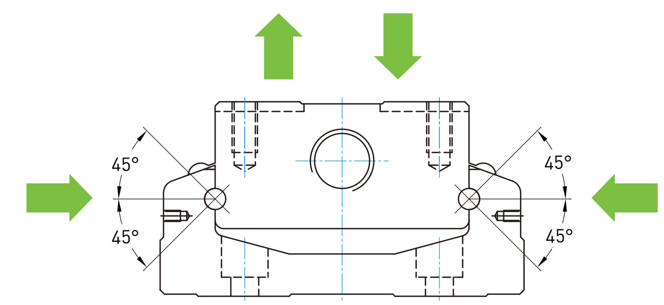


SLMK single-axis robot:
1 Ballscrew +
1 Rail



2.1.2 Equivalent Load

The gothic arch contact design sustains load from all directions and offers high rigidity and accuracy.

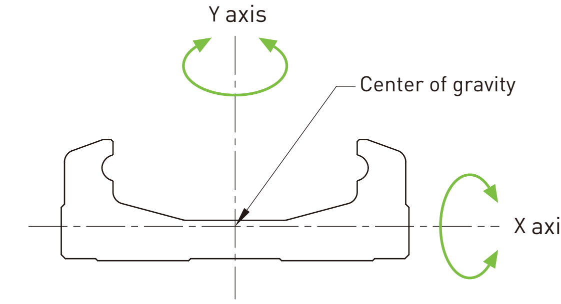


2.1.3 High Stiffness

Using finite element analysis on the U-shaped cross section allows the volume and rigidity to be made balanced, therefore, a high rigidity rail, compact design and a light weight design are also accomplished simultaneously.

Moment of inertia Unit:mm⁴

Model no.	I_x	I_y
SLMK50	9.6×10^3	1.34×10^5
SLMK60	2.056×10^4	2.802×10^5
SLMK86	7.445×10^4	1.134×10^6
SLMK100	1.296×10^5	2.035×10^6

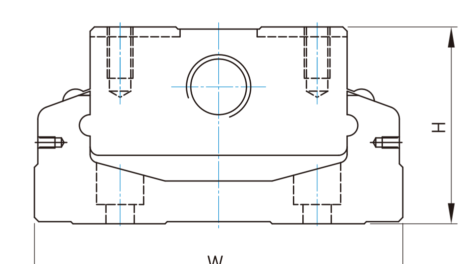


I_x : Moment of inertia computed about X axis
I_y : Moment of inertia computed about Y axis

2.1.4 Various Specification

SLMK single-axis robots of various specifications are developed, providing customers with different choices relating to space and loading conditions.

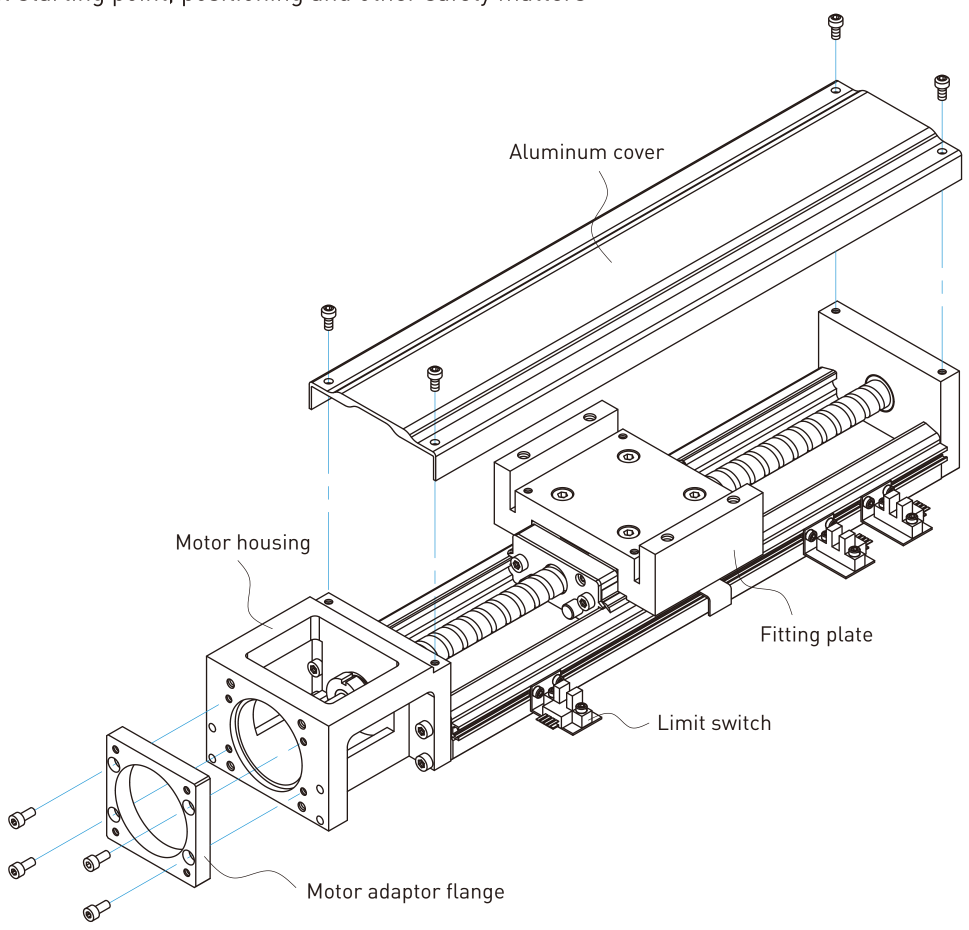
Model no.	W	H
SLMK50	50	26
SLMK60	60	33
SLMK86	86	46
SLMK100	100	55



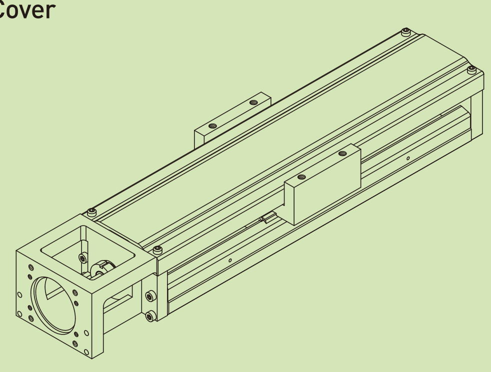
2.2 Accessories

Accessories of SLMK single-axis robot are also supported for specific demands, such as an aluminum cover, bellows, motor adaptor flange and limit switches.

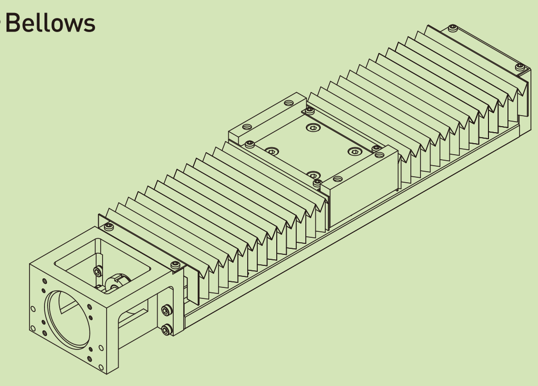
◎ Aluminum cover and bellow: contamination protection
◎ Motor adaptor flange: connection for different types of motors
◎ Limit switchs: starting point, positioning and other safety matters



•Cover



•Bellows

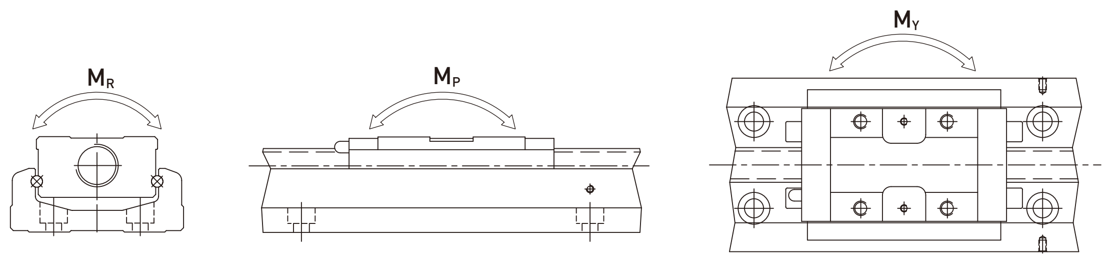


2.3 Model Number of SLMK Series

SLMK 60D 10 P E - 400 E A 2 E - FO C S0 M

- SLMK Series
- Nominal Width: 50, 60, 86, 100
- Ballscrew Lead: SLMK50: 2; SLMK60: 5, 10; SLMK86: 10, 20; SLMK100: 20
- Accuracy Grade: P: Precision, C: Normal
- E: Ballscrew Special Order; None: Normal Type
- Rail Length (mm): SLMK50: 150, 200, 250, 300; SLMK60: 150, 200, 300, 400, 500, 600; SLMK86: 340, 440, 540, 640, 740, 940; SLMK100: 980, 1080, 1180, 1280, 1380
- E: Rail Special Order; None: Normal Type
- Block Type: A: Normal; S: Short
- Number of Blocks: 1, 2
- E: Block Special Order; None: Normal Type
- Motor Adaptor Flange: ref. catalog P.25-26; FE: Flange Special Order
- C: Aluminum Cover; B: Bellows (ref.catlog P.27); None: Normal Type
- Limit Switch: ref.catlog P.27-28; S0: Switch Rail Only; S1: Omron EE-SX671; S2: Omron EE-SX674; S3: Panasonic GX-F12A; S4: Panasonic GX-F12A-P; SE: Sensor Special Order; None: No Limit Switch and Switch Rail
- M: customer specified; None: Without Motor

2.4 Specifications



Model No.		Ballscrew				Guideway															
		Nominal Diameter (mm)	Lead (mm)	Basic Dynamic Load (N)	Basic Static Load (N)	Basic Dynamic Load Rating (N)		Basic Static Load Rating (N)		Static Rated Moment											
										Allowable Static Moment M_P (N-m) (pitching)				Allowable Static Moment M_Y (N-m) (yawing)				Allowable Static Moment M_R(N-m) (rolling)			
						Block A	Block S	Block A	Block S	Block A1	Block A2	Block S1	Block S2	Block A1	Block A2	Block S1	Block S2	Block A1	Block A2	Block S1	Block S2
SLMK5002	Precision	8	2	2136	3489	8007	-	12916	-	116	545	-	-	116	545	-	-	222	444	-	-
	Normal			1813	2910																
SLMK6005	Precision	12	5	3744	6243	13230	7173	21462	11574	152	760	72	367	152	760	72	367	419	838	241	482
	Normal			3377	5625																
SLMK6010	Precision	12	10	2410	3743	13230	7173	21462	11574	152	760	72	367	152	760	72	367	419	838	241	482
	Normal			2107	3234																
SLMK8610	Precision	15	10	7144	12642	31458	21051	50764	29475	622	3050	228	1309	622	3050	228	1309	1507	3014	847	1694
	Normal			6429	11387																
SLMK8620	Precision	15	20	4645	7655	31458	21051	50764	29475	622	3050	228	1309	622	3050	228	1309	1507	3014	847	1694
	Normal			4175	6889																
SLMK10020	Precision	20	20	7046	12544	39200	-	63406	-	960	4763	-	-	960	4763	-	-	2205	4410	-	-
	Normal			4782	9163																

2.5 Accuracy Grade

Unit : mm

Model	Rail Length	Repeatability		Accuracy		Running Parallelism		Starting Torque(N-cm)	
		Precision	Normal	Precision	Normal	Precision	Normal	Precision	Normal
SLMK50	150	± 0.003	± 0.005	0.020	-	0.010	-	4	2
	200								
	250								
	300								
SLMK60	150	± 0.003	± 0.005	0.020	-	0.010	-	15	7
	200								
	300								
	400								
	500	± 0.003	± 0.005	0.025	-	0.015	-	15	7
	600								
SLMK86	340	± 0.003	± 0.005	0.025	-	0.015	-	15	10
	440								
	540								
	640								
	740	± 0.003	± 0.005	0.030	-	0.020	-	17	10
	940	± 0.003	± 0.005	0.040	-	0.030	-	25	10
SLMK100	980	± 0.005	± 0.01	0.035	-	0.025	-	17	12
	1080								
	1180	± 0.005	± 0.01	0.040	-	0.03	-	20	12
	1280	± 0.005	± 0.01	0.045	-	0.035	-	23	15
	1380			0.05		0.04		25	

2.6 Maximum Speed Limit

Model	Ballscrew Lead (mm)	Rail Length L2 (mm)	Speed (mm/sec)	
			Precision	Normal
SLMK50	02	150	270	270
		200	270	270
		250	270	270
		300	270	270
SLMK60	05	150	550	390
		200	550	390
		300	550	390
		400	550	390
		500	550	390
		600	340	340
	10	150	1100	790
		200	1100	790
		300	1100	790
		400	1100	790
		500	1100	790
		600	670	670
SLMK86	10	340	740	520
		440	740	520
		540	740	520
		640	740	520
		740	740	520
		940	610	430
	20	340	1480	1050
		440	1480	1050
		540	1480	1050
		640	1480	1050
		740	1480	1050
		940	1220	870
SLMK100	20	980	1120	800
		1080	980	800
		1180	750	750
		1280	630	630
		1380	530	530

2.7 Life Calculations

2.7.1 Service Life

Under repeated stress between the raceway and the rolling elements, pitting and flaking will occur as it reaches fatigue failure. The service life of the SLMK single-axis robot is defined as the distanced traveled before any failure of the raceway or rolling elements appear.

2.7.2 Nominal Life (L)

The service life varies greatly even when the SLMK units are manufactured in the same way or operated under the same conditions. For this reason, nominal life is used as the criteria for predicting the service life of a SLMK unit.

2.7.3 Nominal Life Calculation

The calculating formulas are divided into two parts, guideway and ballscrew. The smaller value of the two would be the recommended nominal life of the SLMK unit.

Nominal life formulas for both the guideway and ballscrew depend on several parameters and are shown below.

◎ Guideway

$$L = \left(\frac{f_t}{f_w} \cdot \frac{C}{P_n}\right)^3 \text{ x } 50 \text{ km}$$

L :Life Rating (km)
f_t : Contact Coefficient (ref. Table 1)
f_w : Loading Coefficient (ref. Table 2)
C : Basic Dynamic Load Rating (N)
P_n : Calculated Loading (N)

Table 1

Block Type	Contact Coefficient f_t
A1, S1	1.0
A2, S2	0.81

Table 2

Operating Condition		Loading Coefficient f_w
Thrust and Vibration	Velocity (V)	
No Thrust	V≤ 15m/min	1.0 ~ 1.5
Low Vibration	15m/min< V≤ 60m/min	1.5 ~ 2.0
High Vibration	V> 60m/min	2.0 ~ 3.5

◎ Ballscrew and Bearing

$$L = \left(\frac{1}{f_w} \cdot \frac{C_a}{P_{a,n}}\right)^3 \text{ x } 10^6 \text{ rev}$$

L : Life Rating (rev.)
f_w : Loading Coefficient (ref. Table 2)
C_a : Basic Dynamic Load Rating (N)
$P_{a,n}$: Axial Loading (N)

2.8 Lubrication

Insufficient lubrication of the guideway would lead to a reduction of the service life.

The lubricant provides the following functions:

◎ Reducing rolling friction and avoiding abrasion

◎ Providing a lubricating film and extending the service life

◎ Anti-rusting

2.8.1 Lubricating Grease

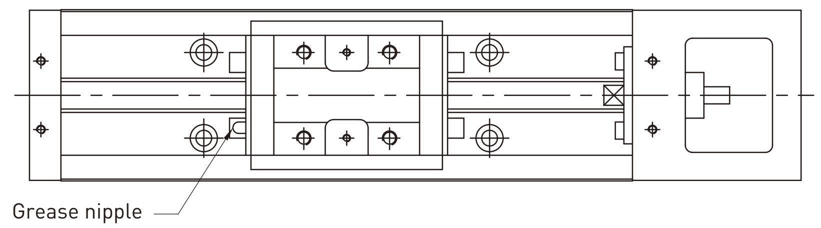
Re-lubricating the SLMK single-axis robot every 100km is recommened. Generally, grease is applied for speeds under 60 m/min. For operating speeds over 60 m/min, a grease with a higher viscosity should be used.

$$T = \frac{100 \times 1000}{V_e \times 60}$$

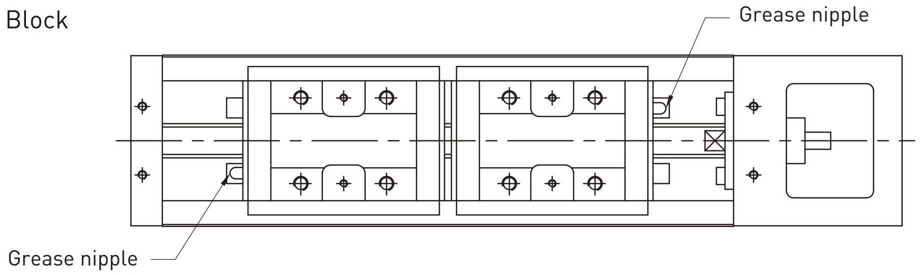
T : Lubricating frequency (hrs)
Ve : Speed (m/min)

2.8.2 Grease Nipple

◎ 1 Block

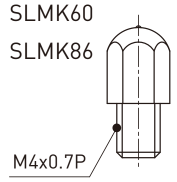


◎ 2 Block



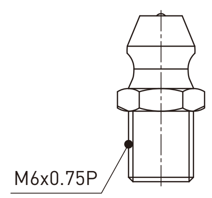
Types of grease nipple

SLMK50
SLMK60
SLMK86



NO. 34310002

SLMK100

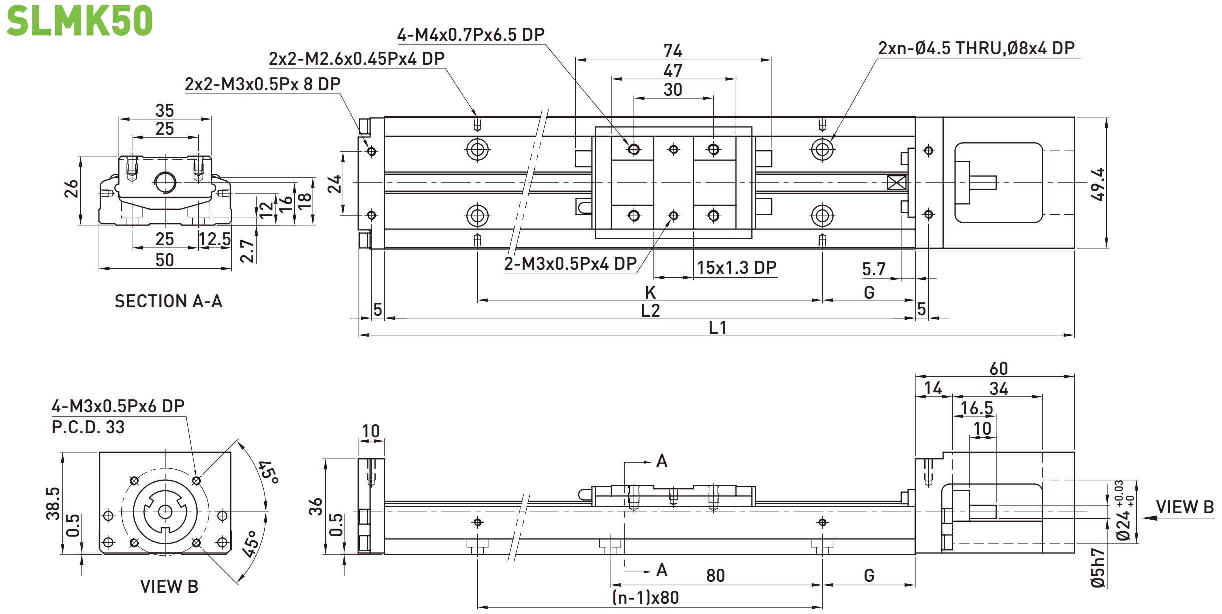


NO. 34310008

2.9 SLMK Series

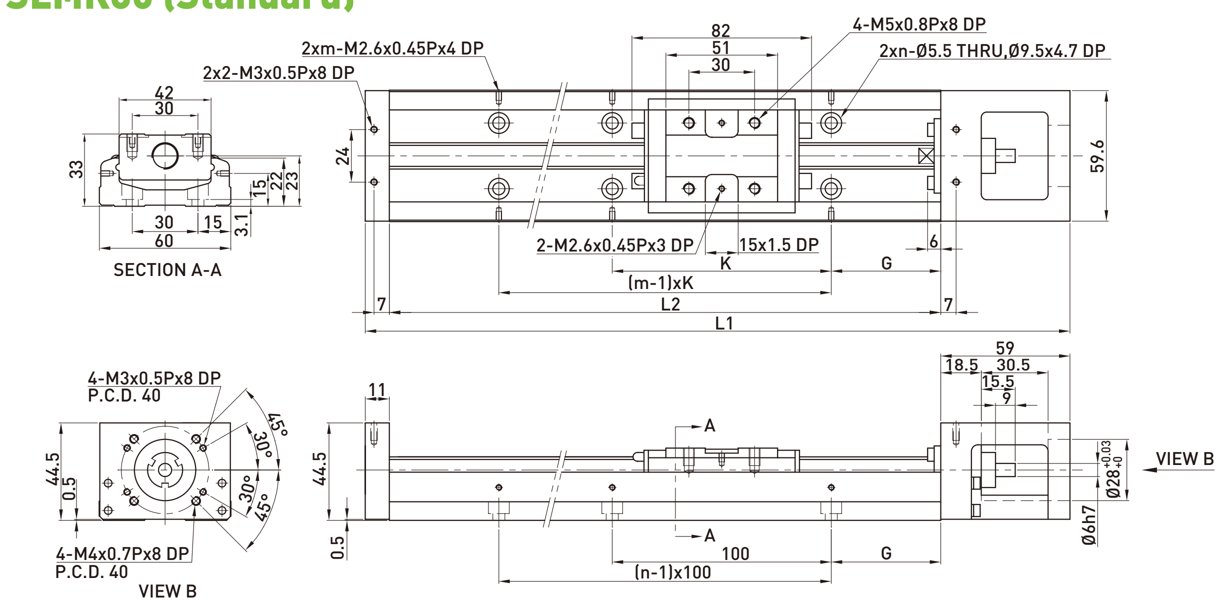
2.9.1 Without cover

SLMK50



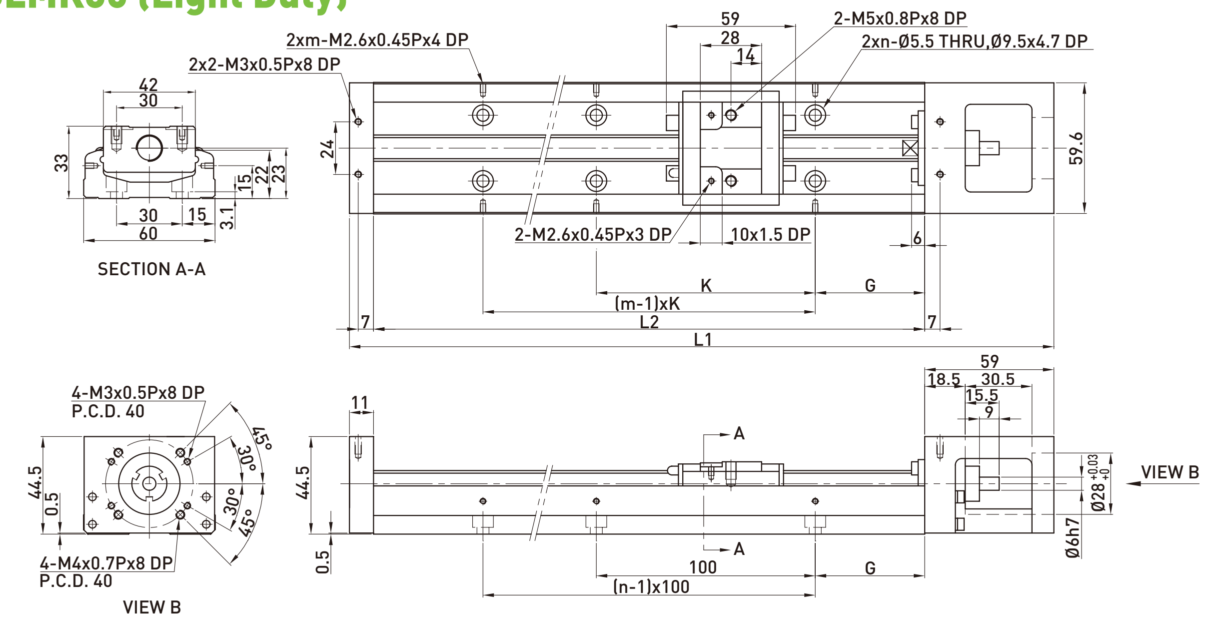
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	K (mm)	n	Mass (kg)	
		A1 Block	A2 Block				A1 Block	A2 Block
150	220	70	-	35	80	2	1	-
200	270	120	55	20	160	3	1.2	1.4
250	320	170	105	45	160	3	1.4	1.6
300	370	220	155	30	240	4	1.6	1.8

SLMK60 (Standard)



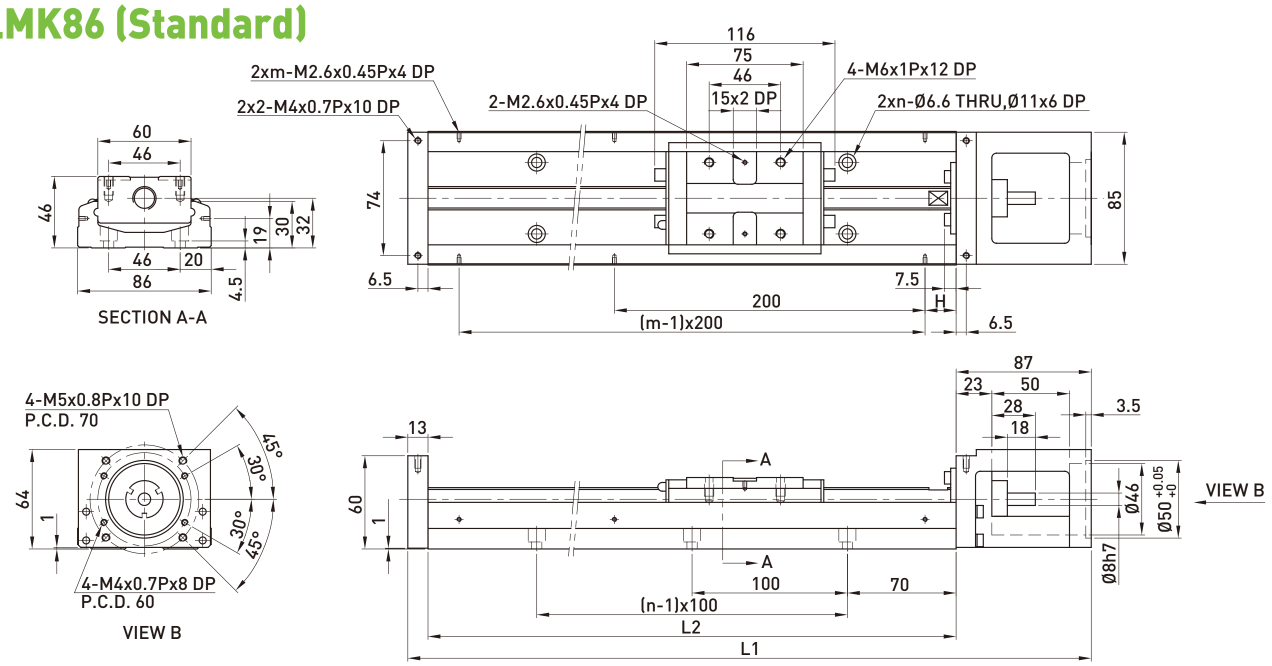
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	K (mm)	n	m	Mass (kg)	
		A1 Block	A2 Block					A1 Block	A2 Block
150	220	60	-	25	100	2	2	1.5	-
200	270	110	-	50	100	2	2	1.8	-
300	370	210	135	50	200	3	2	2.4	2.7
400	470	310	235	50	100	4	4	3	3.3
500	570	410	335	50	200	5	3	3.6	3.9
600	670	510	435	50	100	6	6	4.2	4.6

SLMK60 (Light Duty)



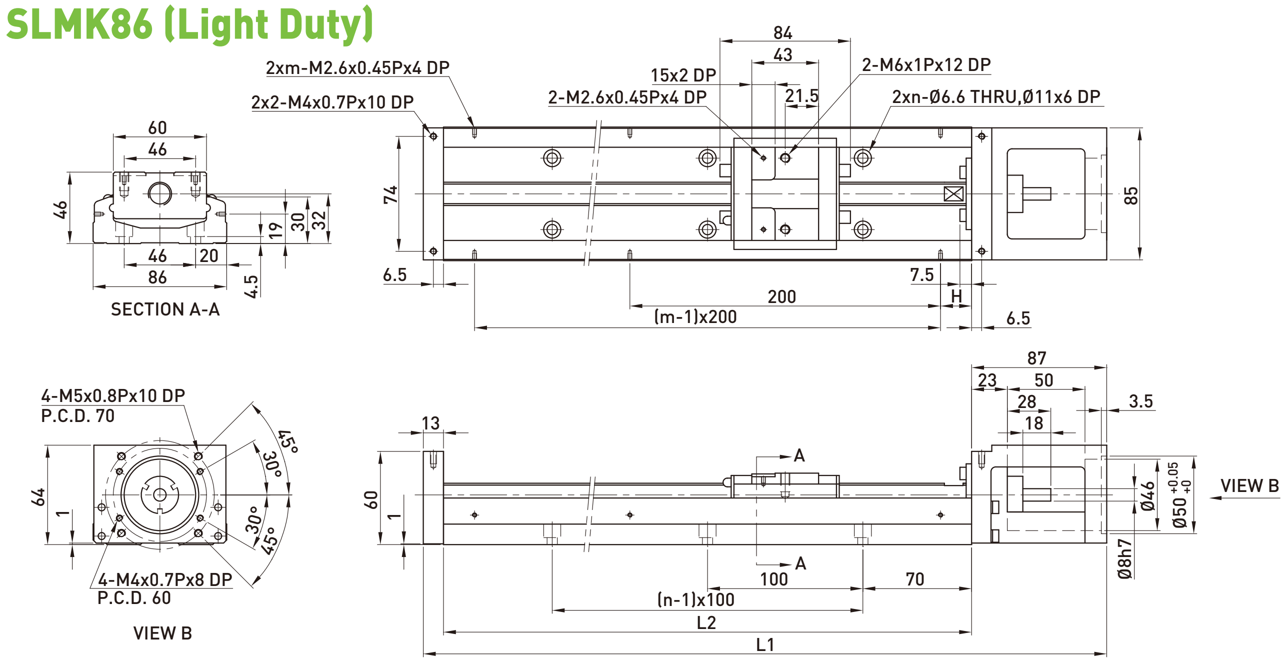
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	K (mm)	n	m	Mass (kg)	
		S1 Block	S2 Block					S1 Block	S2 Block
150	220	85	34	25	100	2	2	1.4	1.6
200	270	135	84	50	100	2	2	1.7	1.9
300	370	235	184	50	200	3	2	2.3	2.5
400	470	335	284	50	100	4	4	2.9	3.1
500	570	435	384	50	200	5	3	3.5	3.7
600	670	535	484	50	100	6	6	4.1	4.3

SLMK86 (Standard)



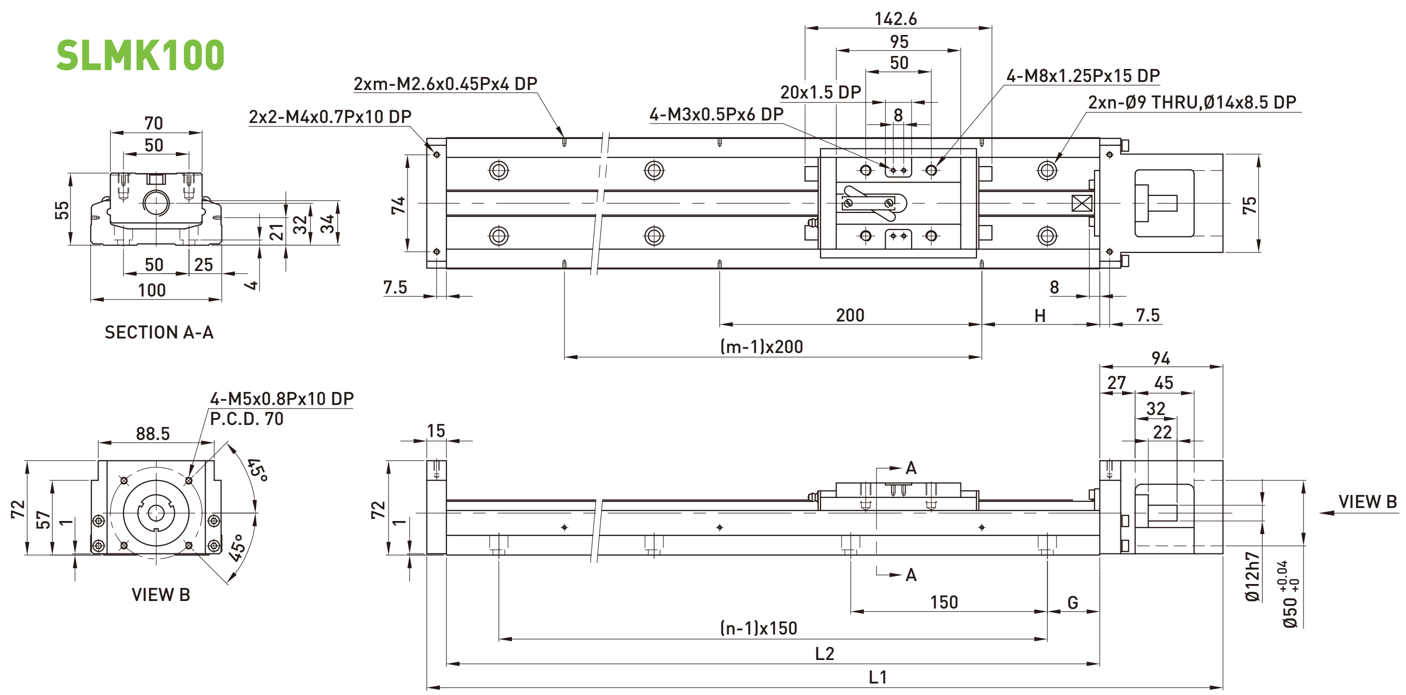
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		H (mm)	n	m	Mass (kg)	
		A1 Block	A2 Block				A1 Block	A2 Block
340	440	216.5	108.5	70	3	2	5.7	6.5
440	540	316.5	208.5	20	4	3	6.9	7.7
540	640	416.5	308.5	70	5	3	8.0	8.8
640	740	516.5	408.5	20	6	4	9.2	10.0
740	840	616.5	508.5	70	7	4	10.4	11.2
940	1040	816.5	708.5	70	9	5	11.6	12.4

SLMK86 (Light Duty)



Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		H (mm)	n	m	Mass (kg)	
		S1 Block	S2 Block				S1 Block	S2 Block
340	440	248.5	172.5	70	3	2	5.4	5.9
440	540	348.5	272.5	20	4	3	6.6	7.1
540	640	448.5	372.5	70	5	3	7.7	8.2
640	740	548.5	472.5	20	6	4	8.9	9.4
740	840	648.5	572.5	70	7	4	10.1	10.6
940	1040	848.5	772.5	70	9	5	11.3	11.8

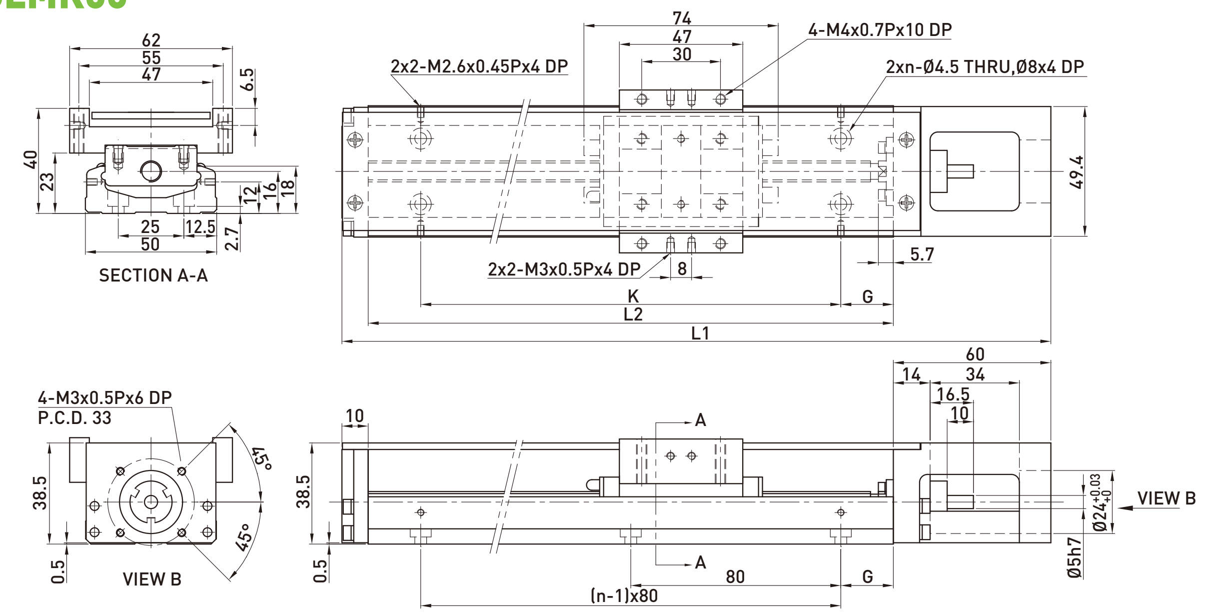
SLMK100



Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	H (mm)	n	m	Mass (kg)	
		A1 Block	A2 Block					A1 Block	A2 Block
980	1089	828	700	40	90	7	5	18.6	20.3
1080	1189	928	800	15	40	8	6	20.3	22.0
1180	1289	1028	900	65	90	8	6	22.0	23.7
1280	1389	1128	1000	40	40	9	7	23.6	25.3
1380	1489	1228	1100	15	90	10	7	25.3	27.0

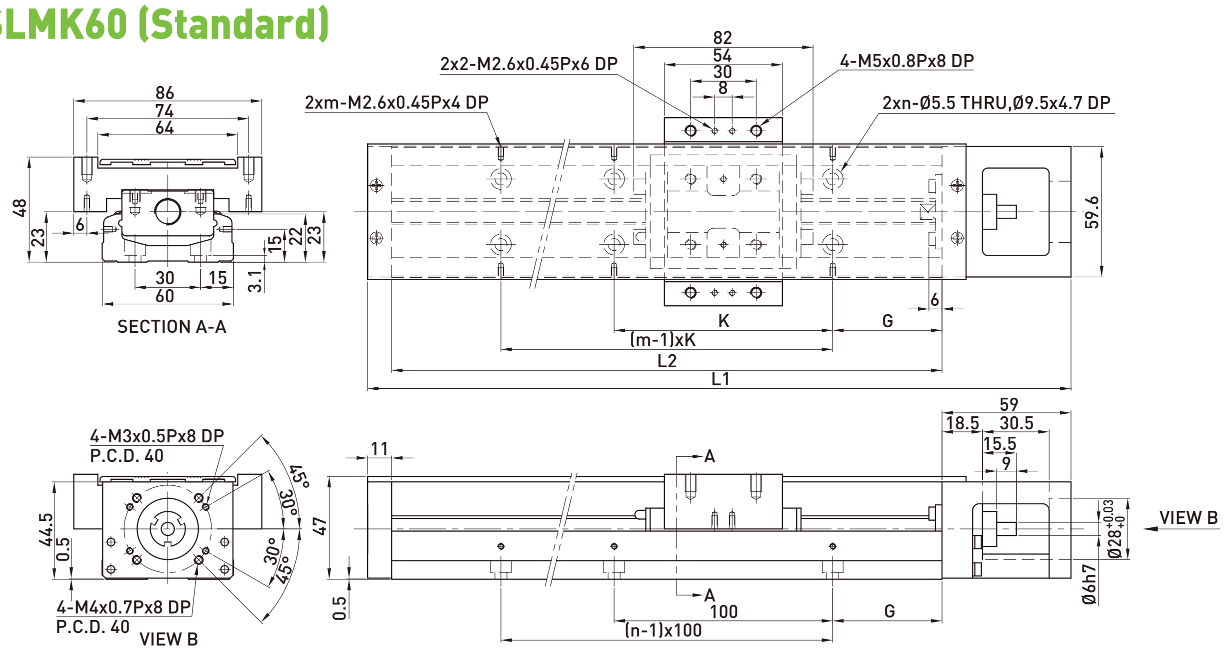
2.9.2 With cover

SLMK50



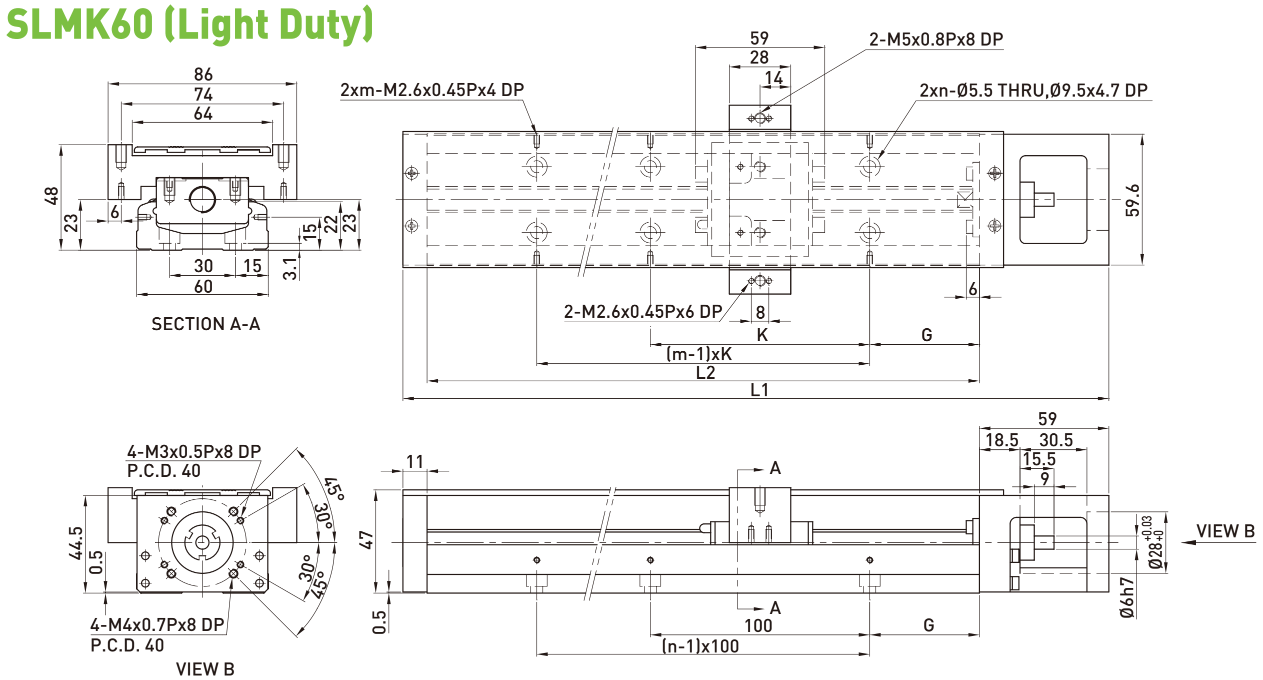
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	K (mm)	n	Mass (kg)	
		A1 Block	A2 Block				A1 Block	A2 Block
150	220	70	-	35	80	2	1.1	-
200	270	120	55	20	160	3	1.3	1.5
250	320	170	105	45	160	3	1.6	1.8
300	370	220	155	30	240	4	1.8	2.0

SLMK60 (Standard)



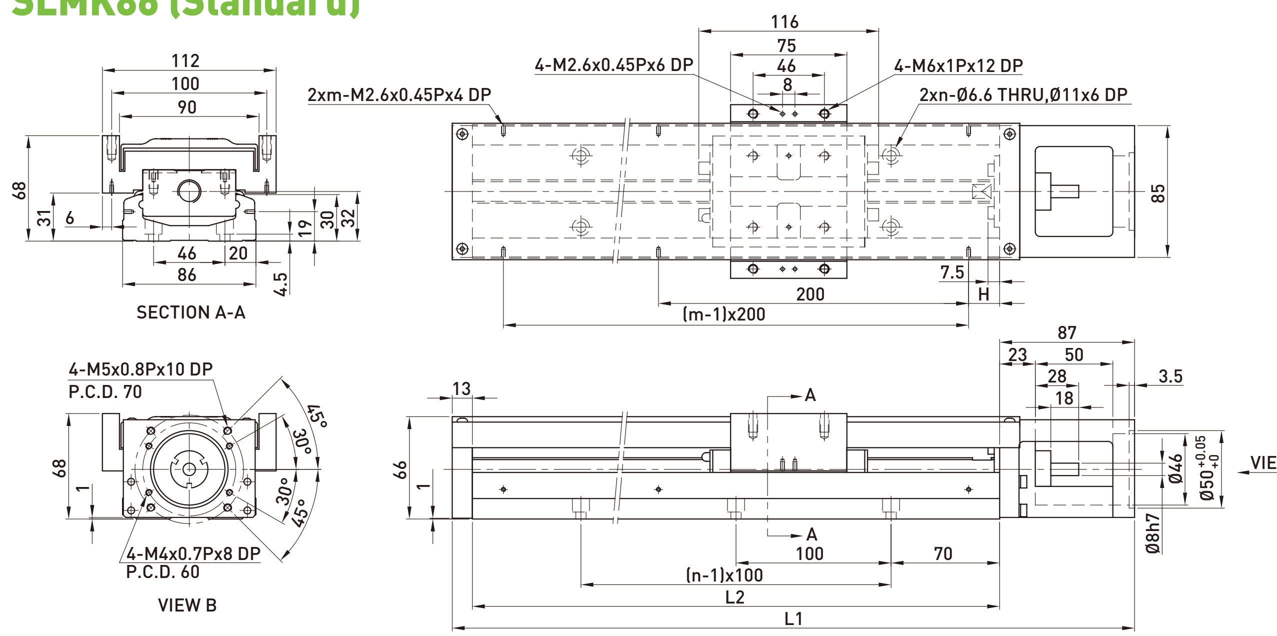
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	K (mm)	n	m	Mass (kg)	
		A1 Block	A2 Block					A1 Block	A2 Block
150	220	60	-	25	100	2	2	1.7	-
200	270	110	-	50	100	2	2	2.1	-
300	370	210	135	50	200	3	2	2.7	3.0
400	470	310	235	50	100	4	4	3.3	3.6
500	570	410	335	50	200	5	3	3.9	4.2
600	670	510	435	50	100	6	6	4.6	5.0

SLMK60 (Light Duty)



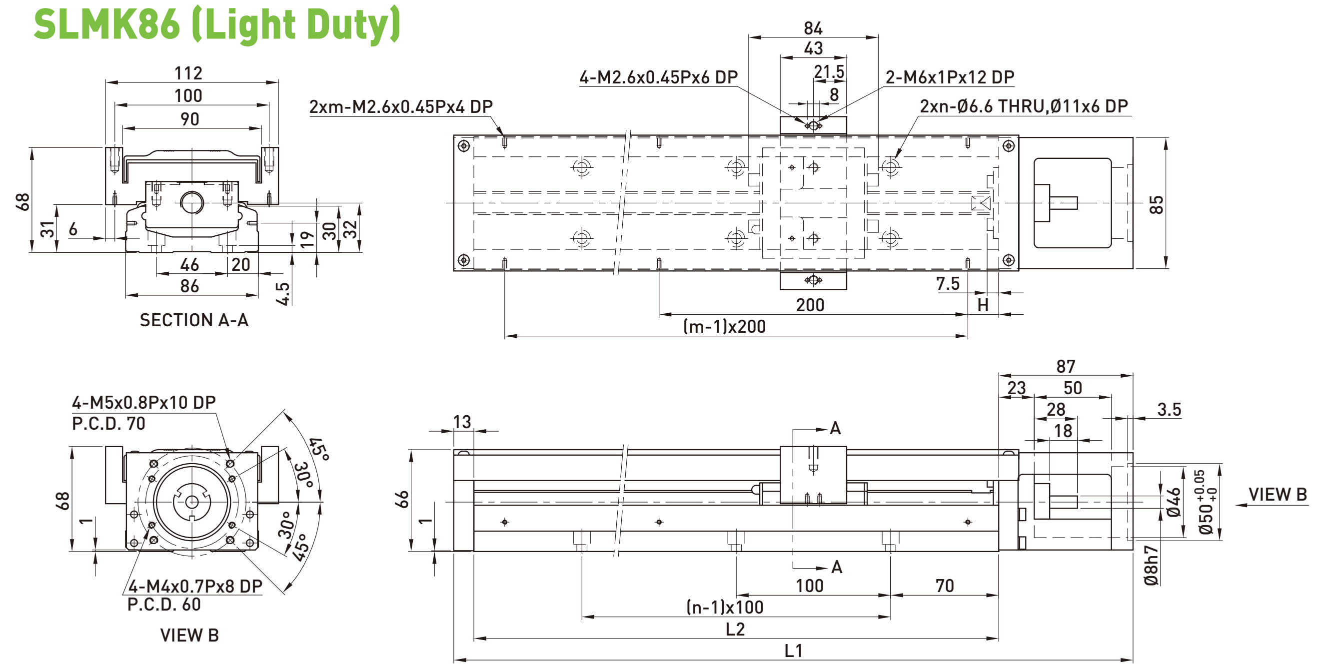
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	K (mm)	n	m	Mass (kg)	
		S1 Block	S2 Block					S1 Block	S2 Block
150	220	85	34	25	100	2	2	1.6	1.8
200	270	135	84	50	100	2	2	1.9	2.1
300	370	235	184	50	200	3	2	2.5	2.7
400	470	335	284	50	100	4	4	3.1	3.3
500	570	435	384	50	200	5	3	3.7	3.9
600	670	535	484	50	100	6	6	4.4	4.6

SLMK86 (Standard)



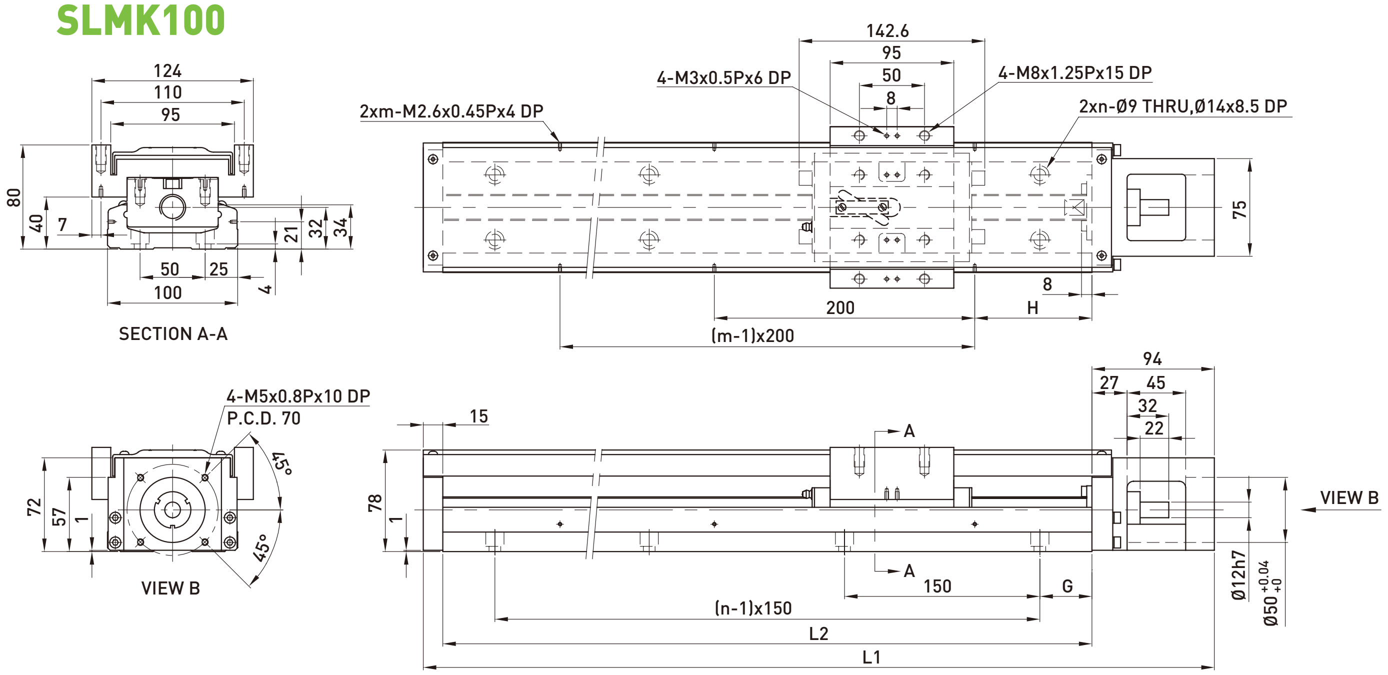
Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		H (mm)	n	m	Mass (kg)	
		A1 Block	A2 Block				A1 Block	A2 Block
340	440	216.5	108.5	70	3	2	6.5	7.3
440	540	316.5	208.5	20	4	3	7.8	8.6
540	640	416.5	308.5	70	5	3	9.0	9.8
640	740	516.5	408.5	20	6	4	10.3	11.3
740	840	616.5	508.5	70	7	4	11.6	12.4
940	1040	816.5	708.5	70	9	5	13.0	13.8

SLMK86 (Light Duty)



Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		H (mm)	n	m	Mass (kg)	
		S1 Block	S2 Block				S1 Block	S2 Block
340	440	248.5	172.5	70	3	2	6.3	7.1
440	540	348.5	272.5	20	4	3	7.6	8.4
540	640	448.5	372.5	70	5	3	8.8	9.6
640	740	548.5	472.5	20	6	4	10.1	11.1
740	840	648.5	572.5	70	7	4	11.4	12.2
940	1040	848.5	772.5	70	9	5	12.8	13.6

SLMK100



Rail Length L2 (mm)	Total Length L1 (mm)	Maximum Stroke (mm)		G (mm)	H (mm)	n	m	Mass (kg)	
		A1 Block	A2 Block					A1 Block	A2 Block
980	1089	828	700	40	90	7	5	20.4	22.1
1080	1189	928	800	15	40	8	6	22.2	23.9
1180	1289	1028	900	65	90	8	6	24.0	25.7
1280	1389	1128	1000	40	40	9	7	25.7	27.4
1380	1489	1228	1100	15	90	10	7	27.5	29.2

2.10 Motor Housing and Motor Adaptor Flange

2.10.1 Motor Selection

Mikrosystem Servo Motor

Motor Output	Motor	Weight (kg)	Flange Selection				+Brake Weight (kg)	Drive	Weight (kg)	Remarks
			SLMK50	SLMK60	SLMK86	SLMK100				
50W	FRLS052□□A4□	0.45	F2	F2	F3	-	0.58	D2T	1.25	220V
100W	FRLS102□□A4□	0.6	F2	F2	F3	-	0.76			220V
200W	FRLS202□□06□	1	-	-	F0	F0	1.5			220V
400W	FRLS402□□06□	1.45	-	-	F0	F0	1.86			220V
750W	FRMS752□□08□	2.66	-	-	-	F1	3.32			220V

Mitsubishi Servo Motor

Motor Output	Motor	Weight (kg)	Flange Selection				+Brake Weight (kg)	Drive	Weight (kg)	Remarks
			SLMK50	SLMK60	SLMK86	SLMK100				
10W	HC-AQ0135D	0.19	-	-	-	-	0.29	M2-JR-03A5	0.2	
20W	HC-AQ0235D	0.22	-	-	-	-	0.32	M2-JR-03A5	0.2	
50W	HF-KP053	0.35	F1	F1	F2	-	0.75	MR-J3S-10A	0.8	220V
100W	HF-KP13	0.56	F1	F1	F2	-	0.89	MR-J3S-10A	0.8	220V
200W	HF-KP23	0.94	-	-	F0	F0	1.6	MR-J3S-20A	0.8	220V
400W	HF-KP43	1.5	-	-	F0	F0	2.1	MR-J3S-40A	1	220V
750W	HF-KP73	2.9	-	-	-	F1	4	MR-J3S-70A	1.4	220V

Panasonic Servo Motor

Motor Output	Motor	Weight (kg)	Flange Selection				+Brake Weight (kg)	Drive	Weight (kg)	Remarks
			SLMK50	SLMK60	SLMK86	SLMK100				
50W	MSMD5AZP1	0.32	F2	F2	F3	-	0.53	MADDT1105	0.8	110V
50W	MSMD5AZP1	0.32	F2	F2	F3	-	0.53	MADDT1205	0.8	220V
100W	MSMD011P1	0.47	F2	F2	F3	-	0.68	MADDT1107	0.8	110V
100W	MSMD012P1	0.47	F2	F2	F3	-	0.68	MADDT1205	0.8	220V
200W	MSMD021P1	0.82	-	-	F1	-	1.3	MADDT2110	1.1	110V
200W	MSMD022P1	0.82	-	-	F1	-	1.3	MADDT1207	0.8	220V
400W	MSMD041P1	1.2	-	-	F1	-	1.7	MADDT3120	1.5	110V
400W	MSMD042P1	1.2	-	-	F1	-	1.7	MADDT2210	1.1	220V
750W	MSMD082S1	2.3	-	-	F4	F2	3.1	MADDT3520	1.5	220V

Yasukawa Servo Motor

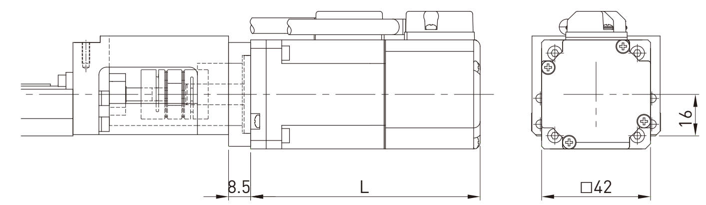
Motor Output	Motor	Weight (kg)	Flange Selection				+Brake Weight (kg)	Drive	Weight (kg)	Remarks
			SLMK50	SLMK60	SLMK86	SLMK100				
10W	SGMMV-A1A2A21	0.13	-	-	-	-	0.215	SGDV-R90A01A	0.9	220V
20W	SGMMV-A2A2A21	0.17	-	-	-	-	0.27	SGDV-R90A01A	0.9	220V
50W	SGMAV-A5ADA61	0.3	F1	F1	F2	-		SGDV-R70A01A	0.9	with key
50W	SGMAV-A5ADA2C	0.3	F1	F1	F2	-		SGDV-R70A01A	0.9	no key
50W	SGMAV-A5ADA21	0.3	F1	F1	F2	-	0.75	SGDV-R70A01A	0.9	Mid inertia
100W	SGMAV-01ADA64	0.4	F1	F1	F2	-	0.89	SGDV-R90A01A	0.9	
200W	SGMAV-02ADA65	0.9	-	-	F0	F0	1.6	SGDV-1R6A01A	0.9	
400W	SGMAV-04ADA66	1.2	-	-	F0	F0	2.1	SGDV-2R8A01A	1	
750W	SGMAV-08ADA67	2.6	-	-		F1	4	SGDV-5R5A01A	1.5	

Oriental Step Motor

Series	Model	Flange Selection				Built in Motor	Weight (kg)	Built in Drive	Weight (kg)
		SLMK50	SLMK60	SLMK86	SLMK100				
CSK 2 phase	CSK243-AP	F3	F5	-	-	PK243-01A	0.21	CSD2109-P	0.12
	CSK244-AP	F3	F5	-	-	PK244-01A	0.27	CSD2112-P	0.12
	CSK245-AP	F3	F5	-	-	PK245-01A	0.35	CSD2112-P	0.12
	CSK264-AP	-	F4	F6	-	PK264-02A	0.45	CSD2120-P	0.12
	CSK266-AP	-	F4	F6	-	PK266-02A	0.7	CSD2120-P	0.12
	CSK268-AP	-	F4	F6	-	PK268-02A	1	CSD2120-P	0.12
	CSK296-AP	-	-	-	F4	PK296-03A	1.7	CSD2145P	0.2
	CSK299-AP	-	-	-	F4	PK299-03A	2.8	CSD2145P	0.2
	CSK2913-AP	-	-	-	F4	PK2913-02A	3.8	CSD2140P	0.2
CSK 2 phase	CSK523-AP	-	-	-	-	PK523A	0.1	SD5103P3	0.04
CFKII 5 phase micro stepping	CFK543AP2	F3	F5	-	-	PK543NAW	0.21	DFC5107P	0.2
	CFK544AP2	F3	F5	-	-	PK544NAW	0.27	DFC5107P	0.2
	CFK545AP2	F3	F5	-	-	PK545NAW	0.35	DFC5107P	0.2
	CFK564AP2	-	-	F5	-	PK564NAW	0.6	DFC5114P	0.2
	CFK566AP2	-	-	F5	-	PK566NAW	0.8	DFC5114P	0.2
	CFK569AP2	-	-	F5	-	PK569NAW	1.3	DFC5114P	0.2
	CFK566HAP2	-	-	F5	-	PK566HNAW	0.8	DFC5128P	0.22
	CKF569HAP2	-	-	F5	-	PK569HNAW	1.3	DFC5128P	0.22
	CFK596HAP2	-	-	-	F3	PK596HNAW	1.7	DFC5128P	0.22
	CFK599HAP2	-	-	-	F3	PK599HNAW	2.8	DFC5128P	0.22
	CFK5913HAP2	-	-	-	F3	PK5913HNAW	3.8	DFC5128P	0.22
UMK 2 phase	UMK243A	F3	F5	-	-	PK243-01	0.21	UDK2109	0.47
	UMK244A	F3	F5	-	-	PK244-01	0.27	UDK2112	0.47
	UMK245A	F3	F5	-	-	PK245-01	0.35	UDK2112	0.47
	UMK264A	-	F4	F6	-	PK264-02	0.45	UDK2120	0.47
	UMK266A	-	F4	F6	-	PK266-02	0.7	UDK2120	0.47
	UMK268A	-	F4	F6	-	PK268-02	1	UDK2120	0.47
RK 5 phase	RK543AA	F3	F5	-	-	PK543W	0.25	RKD507-A	0.4
	RK544AA	F3	F5	-	-	PK544W	0.3	RKD507-A	0.4
	RK545AA	F3	F5	-	-	PK545W	0.4	RKD507-A	0.4
	RK566AA	-	-	F5	-	PK566W	0.8	RKD514L-A	0.85
	RK569AA	-	-	F5	-	PK569W	1.3	RKD514L-A	0.85
	RK596AA	-	-	-	F3	PK596W	1.7	RKD514H-A	0.85
	RK599AA	-	-	-	F3	PK599W	2.8	RKD514H-A	0.85
	RK5913AA	-	-	-	F3	PK5913W	3.8	RKD514H-A	0.85
ASC α-step	ASC34AK	-	-	-	-	ASM34AK	0.15	ASD10A-K	0.25

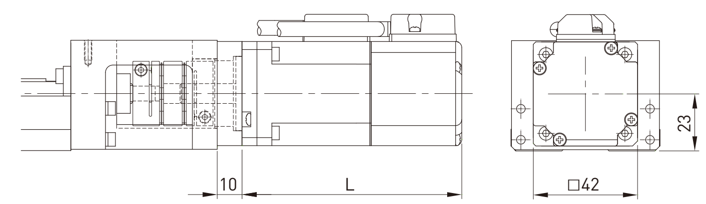
2.10.2 AC Servo Motor & Drive Selection Model Comparison Table

SLMK50



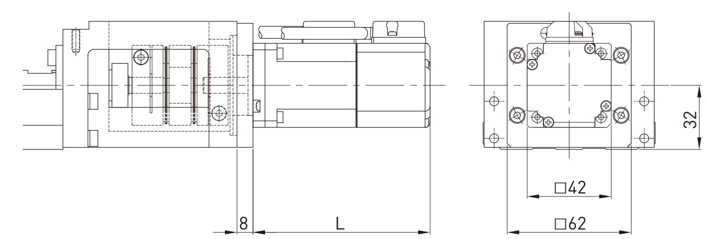
Model selection	Rated Output	Brakes	Flange	L(mm)	Weight (kg)*
M05□	50W	NO	F2	88.5	0.49
K05□		YES		117	0.62
M10□	100W	NO		110.5	0.64
K10□		YES		139	0.80

SLMK60

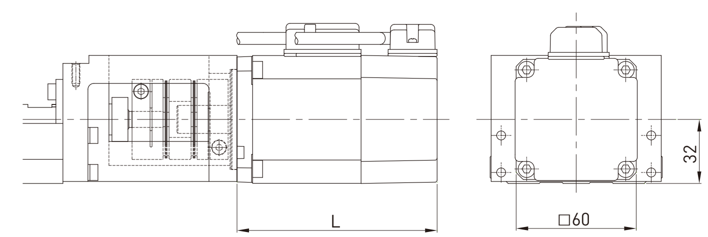


Model selection	Rated Output	Brakes	Flange	L(mm)	Weight (kg)*
M05□	50W	NO	F2	88.5	0.51
K05□		YES		117	0.64
M10□	100W	NO		110.5	0.66
K10□		YES		139	0.82

SLMK86

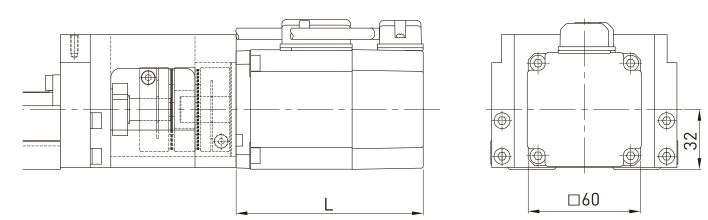


Model selection	Rated Output	Brakes	Flange	L(mm)	Weight (kg)*
M05□	50W	NO	F3	88.5	0.65
K05□		YES		117	0.78
M10□	100W	NO		110.5	0.80
K10□		YES		139	0.96

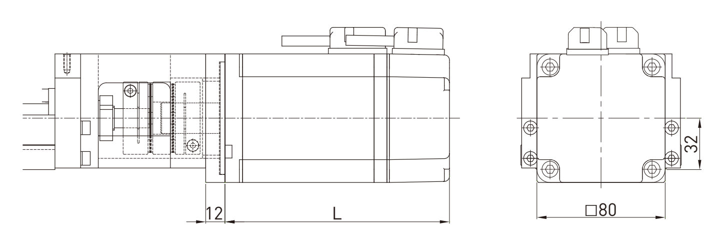


Model selection	Rated Output	Brakes	Flange	L(mm)	Weight (kg)*
M20□	200W	NO	F0	100	1.13
K20□		YES		133	1.63
M40□	400W	NO		121.5	1.58
K40□		YES		154.5	1.99

SLMK100



Model selection	Rated Output	Brakes	Flange	L(mm)	Weight (kg)*
M20□	200W	NO	F0	100	1.14
K20□		YES		133	1.64
M40□	400W	NO		121.5	1.59
K40□		YES		154.5	2.00



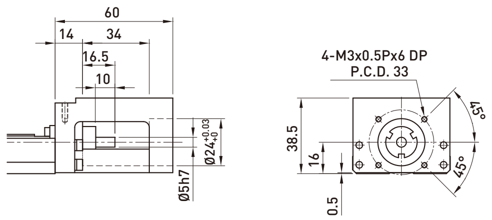
Model selection	Rated Output	Brakes	Flange	L(mm)	Weight (kg)*
M75□	750W	NO	F1	140	2.93
K75□		YES		176	3.59

*The weight is the total weight of the motor, flange and coupling. It does not include the weight of the single-axis robot.

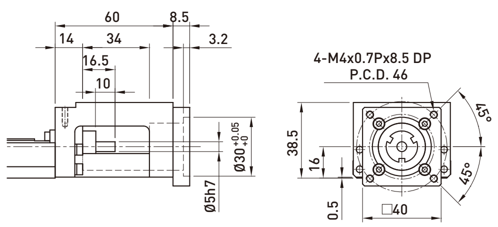
2.10.3 Motor Housing and Motor Adaptor Flange

SLMK50

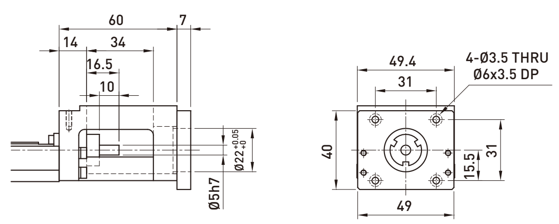
Motor Housing F0



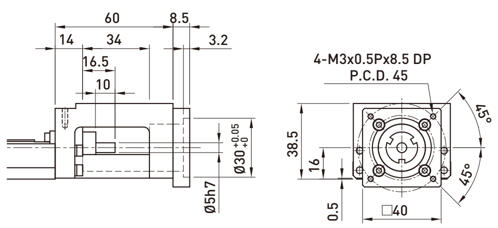
Motor Adaptor Flange F1



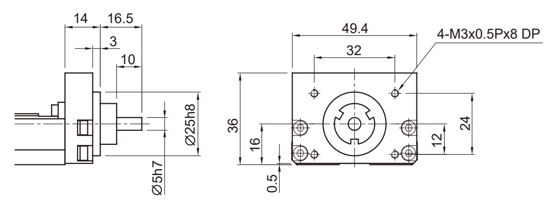
Motor Adaptor Flange F3



Motor Adaptor Flange F2

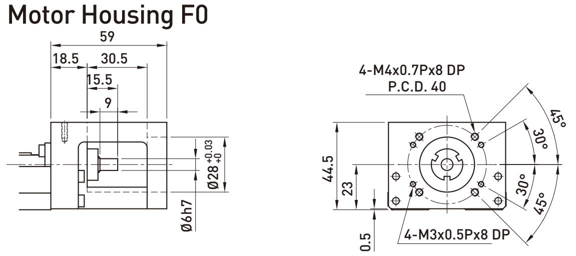


Mount Housing H0

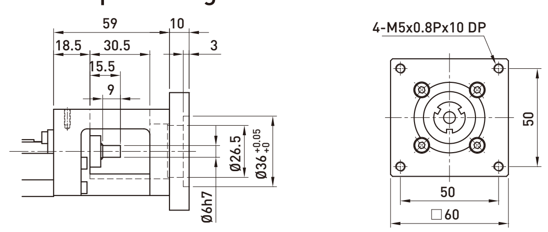


SLMK60

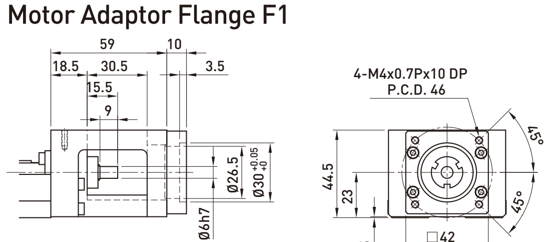
Motor Housing F0



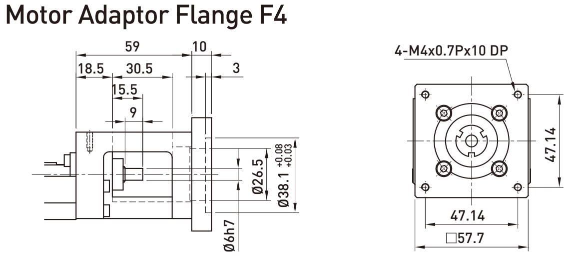
Motor Adaptor Flange F3



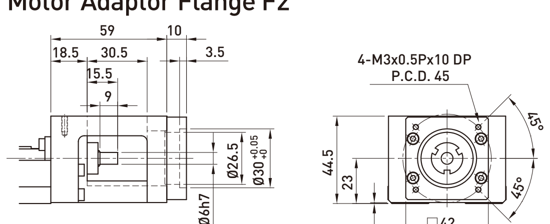
Motor Adaptor Flange F1



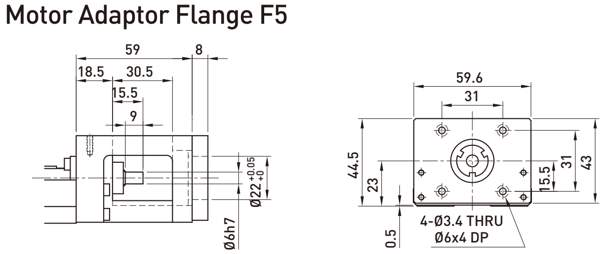
Motor Adaptor Flange F4



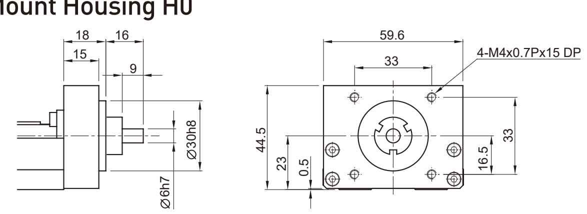
Motor Adaptor Flange F2



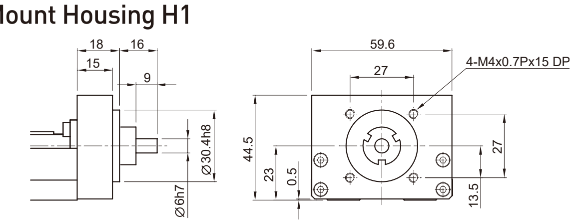
Motor Adaptor Flange F5



Mount Housing H0

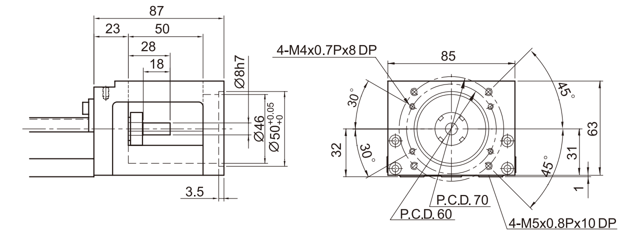


Mount Housing H1

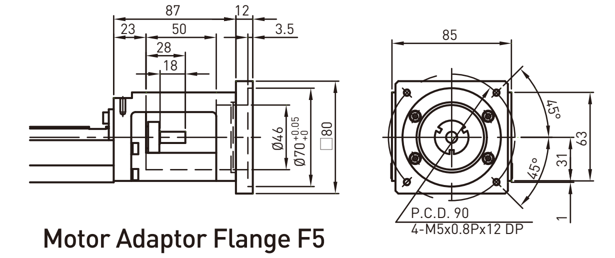


SLMK86

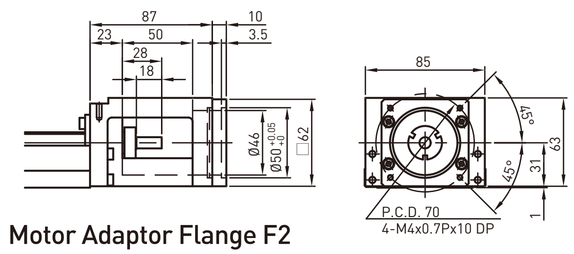
Motor Housing F0



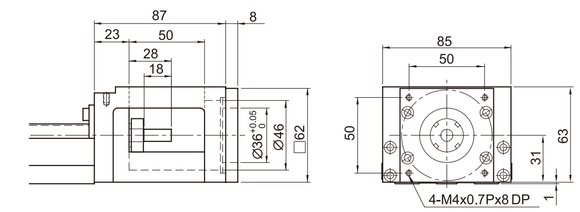
Motor Adaptor Flange F4



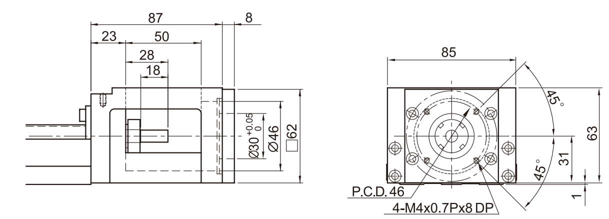
Motor Adaptor Flange F1



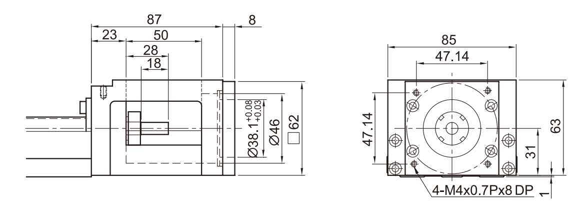
Motor Adaptor Flange F5



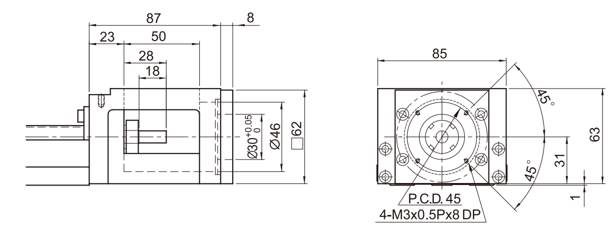
Motor Adaptor Flange F2



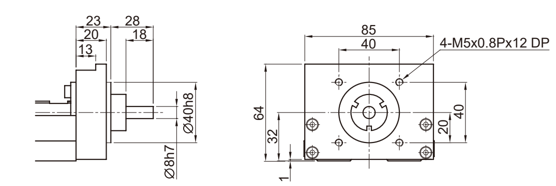
Motor Adaptor Flange F6



Motor Adaptor Flange F3

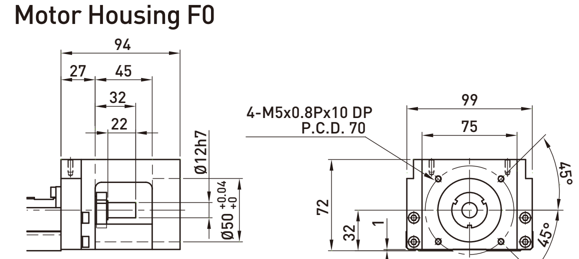


Mount Housing H0

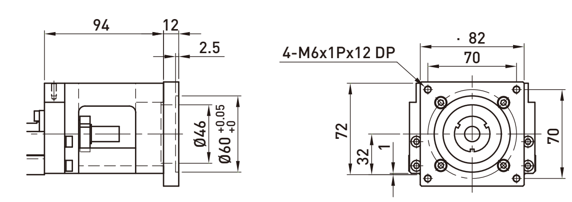


SLMK100

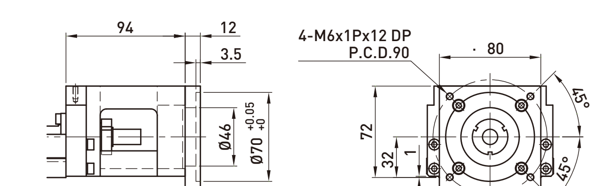
Motor Housing F0



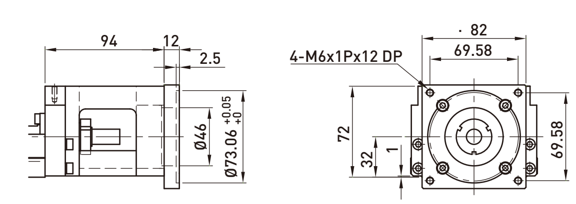
Motor Adaptor Flange F3



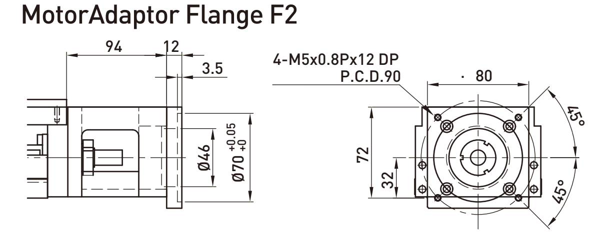
Motor Adaptor Flange F1



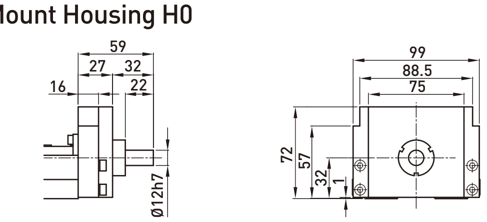
Motor Adaptor Flange F4



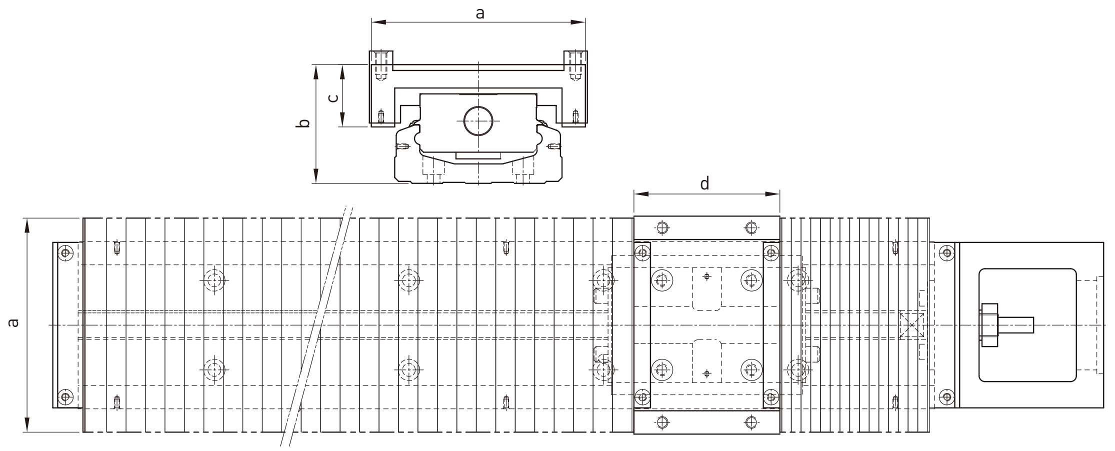
MotorAdaptor Flange F2



Mount Housing H0



2.11 Optional Accessories

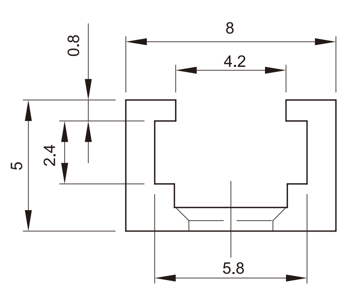


Unit : mm

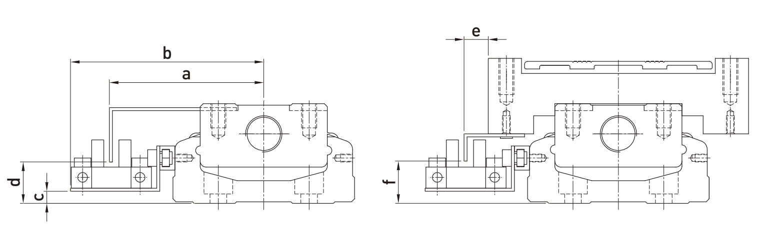
Nominal Width	Rail Length	Stroke	Min.	Max.	a	b	c	d
SLMK50	150	60	21.5	81.5	62	37	19	47
	200	95	29	124				
	250	130	36.5	166.5				
	300	160	46.5	206.5				
SLMK60	150	56	16	80	84	45.5	24	54
	200	106	20	126				
	300	166	40	206				
	400	234	56	290				
	500	306	70	376				
	600	366	90	456				
SLMK86	340	188	36	224	110	61	32	75
	440	260	50	310				
	540	336	62	398				
	640	408	76	484				
	740	480	90	570				
	940	640	110	750				
SLMK100	980	769	58	827	150	73	41	95
	1080	855	65	920				
	1180	945	70	1015				
	1280	1029	78	1107				
	1380	1115	85	1200				

2.12 Switch

Switch rail

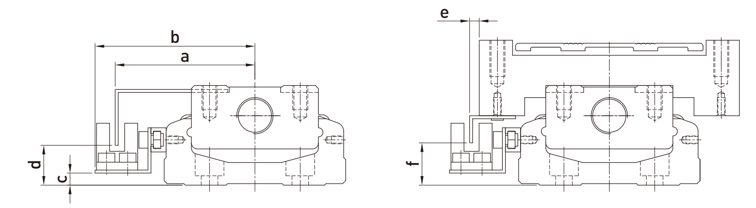


Switch



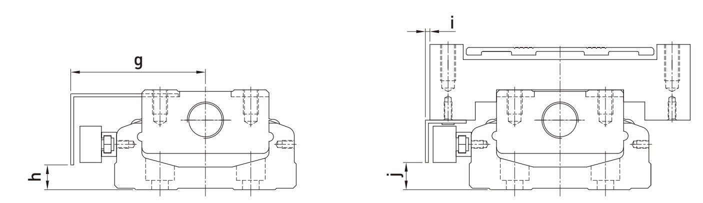
Nominal Width	a	b	c	d	e	f
SLMK50	45.5	59	1	10	15	11
SLMK60	51	63.8	4	14.5	8	13
SLMK86	63.5	76.7	8	18	8	18
SLMK100	71	84	10	20	9	20

Switch 1 : Omron EE-SX671



Nominal Width	a	b	c	d	e	f
SLMK50	41.3	48	1	10.5	10.2	11
SLMK60	46.2	52.8	4	14	3.2	13
SLMK86	59	65.7	8	18	3	18
SLMK100	66	73	10	20	4.2	20

Switch 2 : Omron EE-SX674



Nominal Width	g	h	i	j
SLMK50	39.5	5.7	7	19.5
SLMK60	44.5	9	2	9
SLMK86	57	13	1	13
SLMK100	64.5	15	2.5	15

Switch 3: PANASONIC GX-F12A

Switch 4 : PANASONIC GX-F12A-P