Linear Motor System

Technical Information

HIWIN®

Motion Control and System Technology

INDUSTRIE 4.0 Best Partner

Multi Axis Robot

Pick-and-place / Assembly / Grinding and Polishing / Semiconductor / Light Industry / Automotive industry / Food industry
- Articulated Robot
- Delta Robot
- Movable Delta Robot
- SCARA Robot
- Wafer Robot
- Electric Gripper

Single Axis Robot

Precision / Semiconductor / Medical / FPD
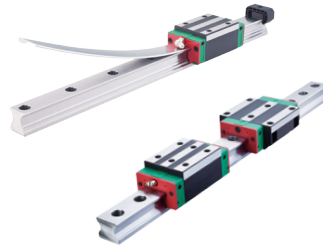- KK, SK
- KS, KA
- KU, KE, KC
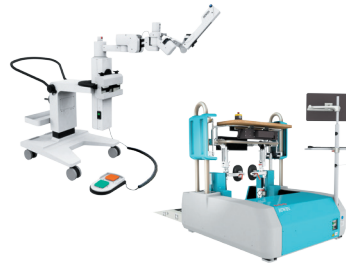
Medical Equipment

Hospital / Rehabilitation centers / Nursing homes
- Robotic Gait Training System
- Hygiene System
- Robotic Endoscope Holder

Ballscrew

Precision Ground / Rolled
- Super S series
- Super T series
- Mini Roller
- Ecological & Economical lubrication Module E2
- Rotating Nut (R1)
- Energy-Saving & Thermal-Controlling (C1)
- Heavy Load Series (RD)

Linear Guideway

Automation / Semiconductor / Medical
- Ball Type--HG, EG, WE, MG, CG
- Quiet Roller Type--QH, QE, QW, QR
- Other--RG, E2, PG, SE, RC

Direct Drive Rotary Table

Aerospace / Medical / Auto industry
- RAB Series
- RAS Series
- RCV Series
- RCH Series

Bearing

Machine tools / Robot
- Crossed Roller Bearings
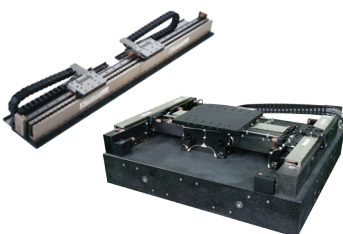- Ball Screw Bearings
- Linear Bearing
- Support Unit

AC Servo Motor & Drive

Semiconductor / Packaging machine / SMT / Food industry / LCD
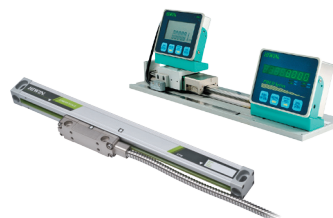- Drives-D1, D1-N, D2
- Motors-50W~2000W

Torque Motor (Direct Drive Motor)

Inspection / Testing equipment / Machine tools/ Robot
- Rotary Tables-TMS,TMY,TMN
- TMRW Series

Linear Motor

Automated transport / AOI application / Precision / Semiconductor
- Motor type-ironcore motor, ironless motor, planar servo motor, shaft motor
- Air bearing stage
- X-Y stage
- Gantry stage

Positioning Measurement System

Cutting machines / Traditional gantry milling machines / Programmable drilling machines
- High Resolution
- Signal Translator
- High-precision Enclosed
- High Efficiency Counter

Contents
Linear motor system

SA：low gravity center, high payload
Linear motor SA stages are equipped with ironcore motor(s) and well suited for applications that require point to point precision positioning and larger payload.

LMC：high-precision, high-speed stability
Linear motor LMC stages are equipped with coreless motor(s) and well suited for applications that require precision positioning and constant velocity scanning motion.

LMT：middle precision, light payloads
Linear motor LMT stages are equipped with a coreless shaft motor, which perfectly replace the combination of ball screw and AC servo motor, and improve max. speed greatly.

1 Technical Information

1.1 Glossary

Back emf constant (K_v)
This is the ratio of the back emf voltage (rms) to the motor rotational speed or linear speed (rpm or m/s). The back emf is the electromagnetic force, which is created at the movement of the coil in the magnetic field of permanent magnets, e.g. in a servo motor.

Acceleration
This is the speed change per time unit, i.e., acceleration = speed / time or a = v / t.

Acceleration time
This is defined as the time a drive requires from start until achieving maximum speed.

Vertical straightness
The measure of straightness when moving in X-axis. If there is deviation in vertical straightness, there would be positioning error in Z-axis, as the system moves along X-axis.

Torque
This is a measurement of the rotational movement in a body and consequently a vectorial direction that can be expressed in the following cross product: $\vec{M} = \vec{r} \times \vec{F_1}$
The torque is expressed in the equation Nm = kg x m²/s².

Repeatability
Repeatability should not be confused with absolute accuracy. A linear axis can have medium accuracy, but have good repeatability. Uni-directional repeatability can be measured in a way, that a target position is approached multiple times from an appropriately distance and the same approaching direction. In this way, the backlash will not have any effect. For measurement of bi-directional repeatability, the target position is approached from different directions, in which case the backlash will take effect.

Motor constant (K_m)
This designates the ratio of generated force and dissipation power, represents the efficiency of the motor.

Stiffness
This corresponds to the mechnical resistance to deformation a part or an assembly can provide under external static payload. (static stiffness) Or, it is the elastic resistance to deformation a part or an assembly can provide under external dynamic payload. (dynamic stiffness)

Horizontal straightness
The measure of straightness when moving in X-axis. If there is deviation in horizontal straightness, there would be positioning error in Y-axis, as the system moves along X-axis.

Guide deviation
This is the deviation from the axis of stroke. It depends on horizontal straightness (also straightness) and vertical straightness (also flatness).

Force, torque
Force (in linear movements) or torque (in rotational movements) is given for defined conditions, e.g., as continuous force or torque at:
○ 20 ˚C ambient temperature
○ 80 ˚C winding temperature
○ 100% rate of loading(duty cycle)
or as peak force or peak torque.

Force constant (K_f)
This is a coil specific constant. The motor output force can be calculated by multiplying the force constant of the motor by input current: F = I x K_f

Continuous torque, continuous force (F_c)
Or also nominal torque, nominal force. This is the torque or force, that rotary or linear motors can produce in continuous operation when continuous current of 100% load rate(duty cycle) is applied to the motor coil.

Continuous current (I_c)
It is a current that flows over longer time into motor. The maximum allowed current into each coil is also called nominal current. It is characterized when the generated heat results in motor warming of up to 80 ˚C.

Resolution
It is the smallest distance, that the position measuring system will detect. The reachable step size is, in principle, larger than resolution due to other additional factors.

Eccentricity
This is the deviation of the center point of rotation of rotary tables from their position during rotation. It is created by centering and bearing tolerances.

Step size
Also called resolution. It is the smallest possible movement of a system. It depends on encoder, amplifier, mechanical construction, backlash, etc.

Accuracy
This, or actually the better terminology, the inaccuracy, corresponds to the deviation between target and actual position. The accuracy along an axis is defined as the remaining difference of target and actual position, after other linear deviations are excluded. Such systematic or linear deviations can be caused by cosine error, angle deviation, ball screw error, thermal expansion, etc. For all target positions of interest in an application, it is calculated with the following formula:
Maximum of sum of systematic target-actual-difference + 2 sigma (standard deviation)
Please do not confuse accuracy with repeatablity.

Attraction force (F_a)
This is created between the primary and secondary parts of the ironcore linear motors which must be taken up by the guide.

Winding resistance R_{25}
This is the coil-specific dimension of is the winding resistance at 25˚C. At 80˚C, the winding resistance increases to approximately 1.2 x R_{25}.

Winding temperature (T)
This is the permitted winding temperature. The actual motor temperature is dependent on the installation, cooling and operating conditions and consequently can only be determined in a concrete case and cannot be calculated.

Wobbling
It is a term for rotary motor. Wobble is the angular deviation of rotating axis from theoretical axis of rotation as the motor turns. The reason for it is possibly bearing tolerances.

Peak current (I_p)
This current is applied to coils for a short time to generate peak force.The maximum time for applying peak current is 1 second. After that, motor has to cool down to nominal operating temperature, before further peak current could be applied again.

Peak torque, peak force (F_p)
The peak torque (for rotary motion) or peak force (for linear motion) is the maximum force that a motor can generate for approximately one second with peak current I_p. While applying I_p into motor, it is operating near the non-linear range of motor. This is especially useful for acceleration and braking.

2 Standard linear motor stage

2.1 Positioning stage

HIWIN offers a variety of positioning stages, such as single axis, X-Y double axis, bridge, gantry and X-Y-Z-axis Cartesian robots, to meet a variety of automation application needs. All above positioning stages use self-made key components, such as linear motors, linear slide, ball screw, direct drive motors, servo motors and drives. Therefore, HIWIN positioning stages can achieve the best performance and the most effective cost, can significantly enhance the competitiveness of our customers. HIWIN's diversified positioning stages have been widely used in various technical fields, such as optical detection, laser processing, plastic material coating, metal processing and other automated production equipment. Industrial fields cover semiconductor industry, optical elements, panel displays, medical equipment, machine tools, electronic components, MEMS and so on.

Rich specifications and quick customized ability to fully meet customers mass production, shorten product development process and strict application environment, high specification requirements.

2.1.1 Single axis positioning stage

HIWIN single axis positioning stage provides fast, accurate positioning, linear direct drive motor and can reach long stroke applications, in addition to providing metal cover, dust jacket and other optional items to achieve dust protection requirements. Choose cable chain type, horizontal or vertical wiring that uses extension cords not to scatter outside, make the machine look tidy.

Depend on different linear motors, those can be further divided into the following different types:

SA：low gravity center, high payload

Linear motor SA stages are equipped with ironcore motor(s) and well suited for applications that require point to point precision positioning and larger payload.

LMC：high-precision, high-speed stability

Linear motor LMC stages are equipped with coreless motor(s) and well suited for applications that require precision positioning and constant velocity scanning motion.

LMT：middle precision, light payload

Linear motor LMT stages are equipped with a coreless shaft motor, which perfectly replace the combination of ball screw and AC servo motor, and improve max. speed greatly.
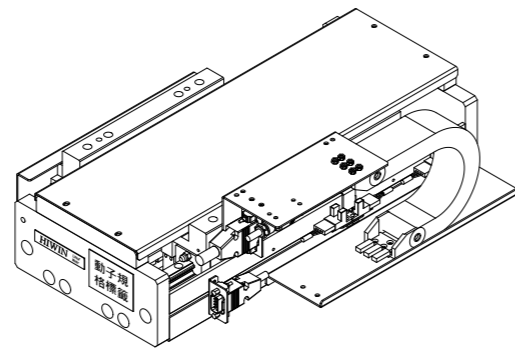
Standard

2.1.2 Measurement standards

All the precision measurement data provided by HIWIN are measured at temperature at 23 ℃±1 ℃, humidity at 55%±5% environmental, and the position feedback system of positioning stages apply 1μm resolution optical scale.

2.1.3 Cable chains: horizontal/vertical orientation
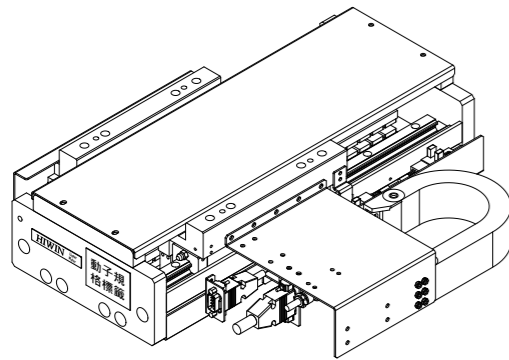
Cable chain horizontal orientation

Cable chain vertical orientation

2.2 SA low gravity center, high payload

Linear motor SA stages are equipped with ironcore motor(s) and well suited for applications that require point to point precision positioning and larger payload.

- ○ It offers larger continuous force, especially for larger force and fast applications
- ○ Stroke range up to 4m
- ○ Superior speed control characteristic
- ○ Low cost, small size, high performance
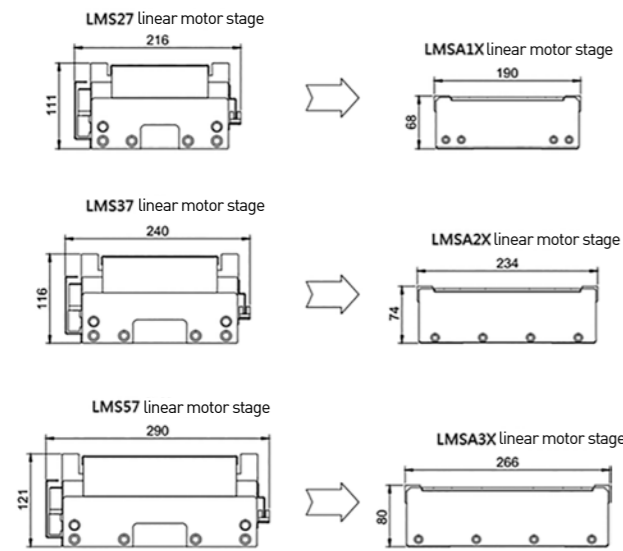- ○ Suitable for clean rooms

2.2.1 SA

LMX1A–SA11–1–800–G 1 E–V1 3–CL

Stage type

LMX1A

Motor type

SA11: LMSA11	SA21L: LMSA21L
SA12: LMSA12	SA22L: LMSA22L
SA13: LMSA13	SA23L: LMSA23L
SA21: LMSA21	SA31L: LMSA31L
SA22: LMSA22	SA32L: LMSA32L
SA23: LMSA23	SA33L: LMSA33L
SA31: LMSA31	
SA32: LMSA32	
SA33: LMSA33	

The number of slider

1: 1

Stroke

100: 100mm	600: 600mm
200: 200mm	700: 700mm
300: 300mm	800: 800mm
400: 400mm	900: 900mm
500: 500mm	1000: 1000mm

Encoder type

0:None
A:40μm analogical 1Vpp optical scale
E:TTL digital 1μm resolution magnetic scale
G:TTL digital 1μm resolution optical scale(standart)
K:TTL digital 0.1μm resolution optical scale

Limit switch

1:Inductive type，PNP，NC
2:Inductive type，NPN，NC
C:Customized

Limit switch connector type

E:Connector is mounted on edge of stage
S:Connector contains 300mm extension cord

Cable chain

N:None
V1:Vertical, chain internal space is 21x25mm
V2:Vertical, chain internal space is 21x38mm
V3:Vertical, chain internal space is 21x50mm
V4:Vertical, chain internal space is 21x68mm
H1:Horizontal, chain internal space is 21x25mm
H2:Horizontal, chain internal space is 21x38mm

Extension cable

0:None
3:3m
5:5m
7:7m
(Includes limit switch extension cable)

Additional option

None:Standard
C:Customized request
CL:Centralized lubrication
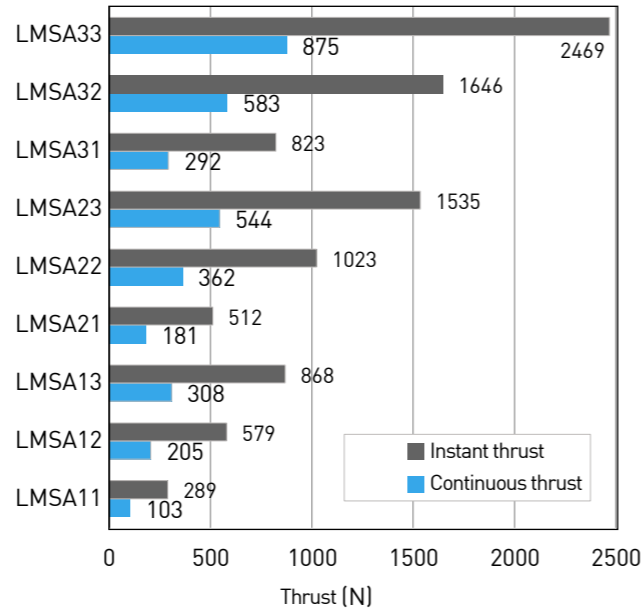
Note：Contact HIWIN for customized specification.

Standard

○Low profile
SA series stage reduced maximum 38% stage height.

○High force
SA series stage offers maximum 2469N peak force.

LMS27 linear motor stage
216
111

LMSA1X linear motor stage
190
68

LMS37 linear motor stage
240
116

LMSA2X linear motor stage
234
74

LMS57 linear motor stage
290
121

LMSA3X linear motor stage
266
80

Thrust chart

| Stage	Continuous thrust	Instant thrust
LMSA33	875	2469
LMSA32	583	1646
LMSA31	292	823
LMSA23	544	1535
LMSA22	362	1023
LMSA21	181	512
LMSA13	308	868
LMSA12	205	579
LMSA11	103	289

Thrust (N)

○High acceleration/deceleration
Acceleration / deceleration up to 140 m/s2 (14G).
Actual acceleration / deceleration might be limited by linear guideway life consideration.
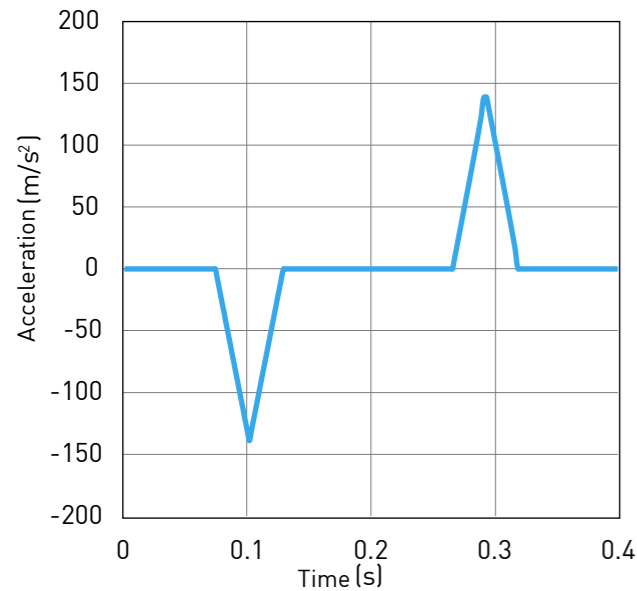
○High static stability
Position stability is within ±0.1μm (measured by laser interferometer, the result is depended on environment condition.).
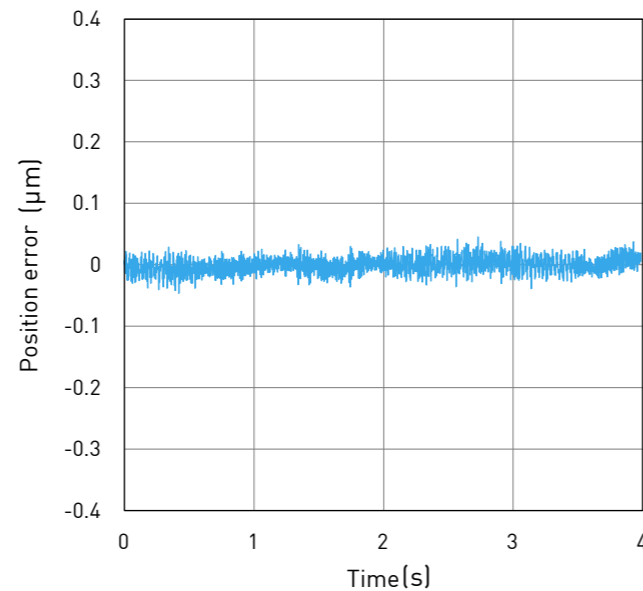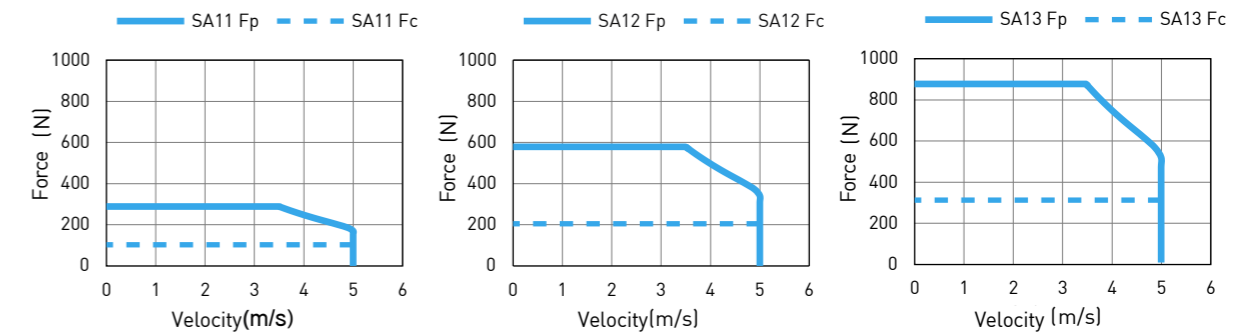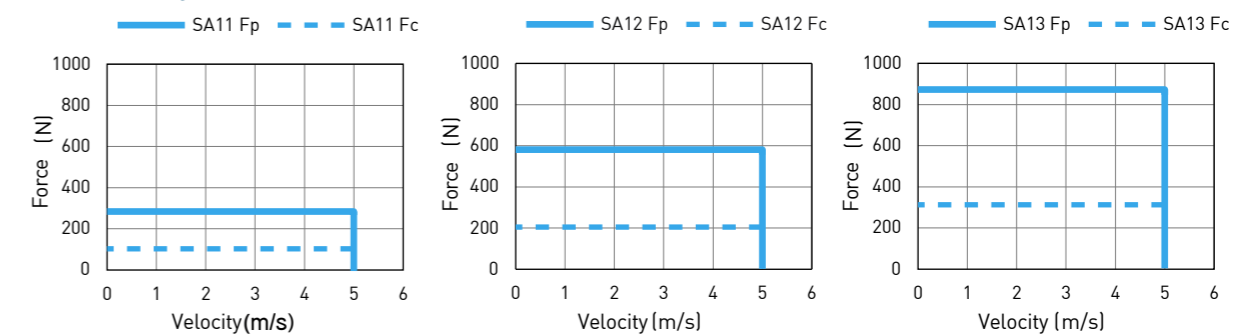
2.2.2 SA series stage
SA11,SA12,SA13

Table2-1 SA11,12,13 stage specification

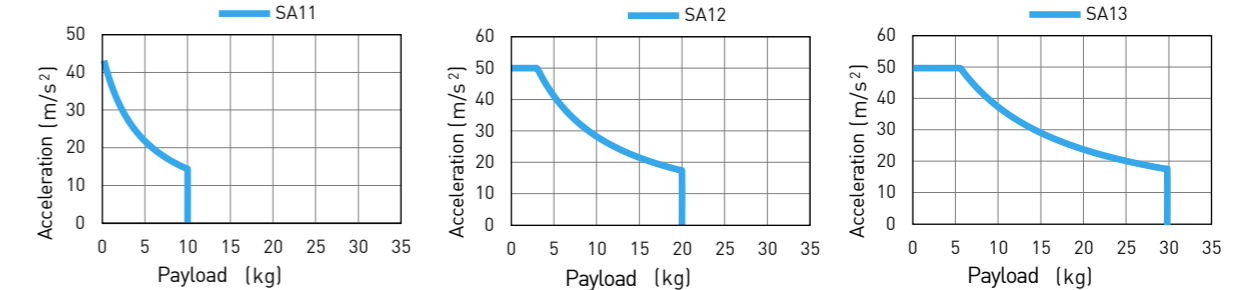| Specification	SA11	SA12	SA13
Continuous force,F_c (N)	103	205	308
Peak force,F_P (N)	289	579	868
Stroke (mm)	100~1000(mm)		
Resolution	0.1μm / 1.0μm / Analog 1Vpp		
Repeatability (μm) [2]	Digital 1μm encoder / Analog encoder: ± 1		
	Digital 0.1μm encoder: ± 0.5		
Accuracy (μm) [2,3]	Digital 1μm encoder / Analog encoder: ± 2		
	Digital 0.1μm encoder: ± 1		
Horizontal straightness (μm)	10 / 500 mm		
Vertical straightness (μm)	20 / 500 mm		
Moving mass (kg)	5	6	8
Loading capacity (kg)	10	20	30

Force-Velocity Curve(DC bus = 325V)[4]

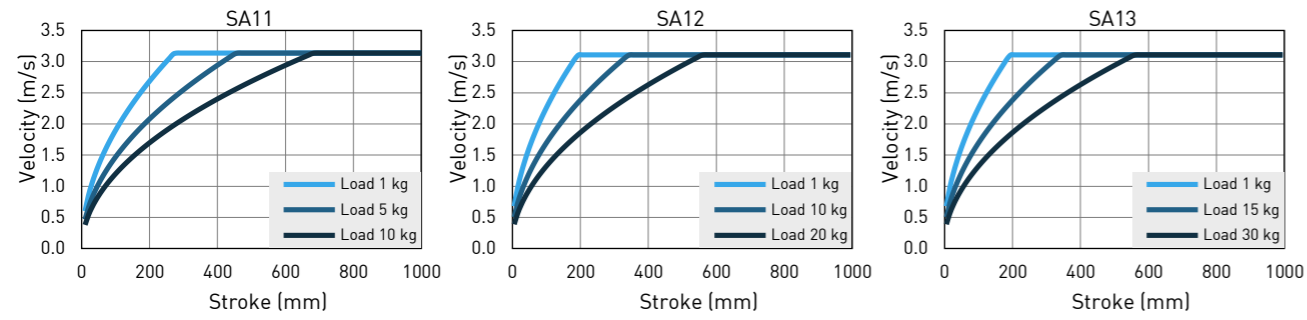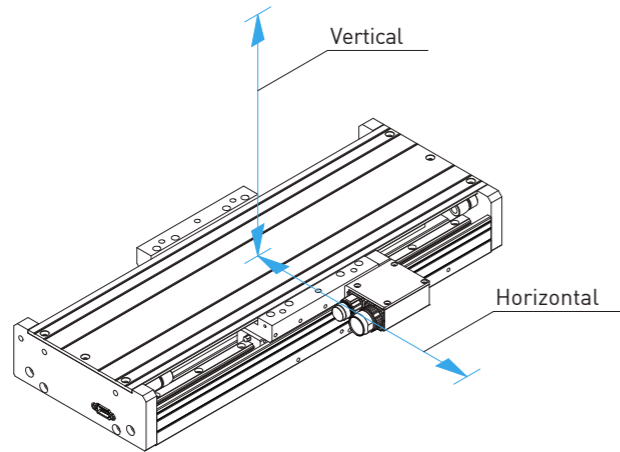**Force-Velocity Curve(DC bus = 600V)[4]**

Acceleration-Payload Curve

[1] : All values are measured on a granite table, all stage mounting holes are well fixed.
[2] : Values are measured according to HIWIN measuring standard.
[3] : After error compensation.

[4] : The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration. Please refer to the Velocity-Stroke Curve or Appendix A : Motor Sizing.
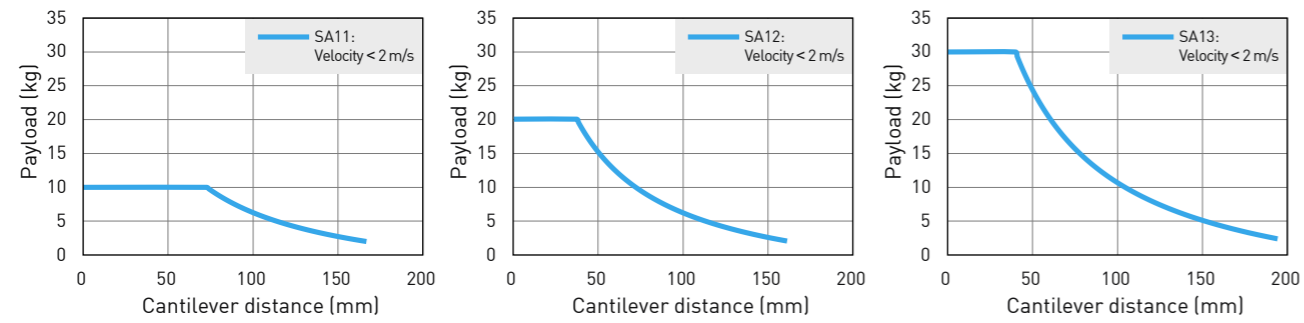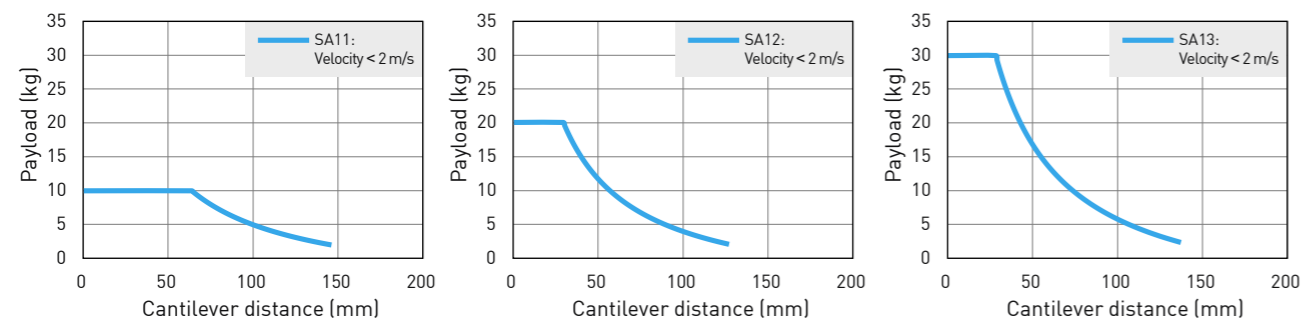[5] : All specifications above are standard, contact HIWIN for special request.

Standard

Velocity-Stroke Curve

SA11

SA12

SA13

Cantilever Load Capability*2,3

Vertical

Horizontal

Vertical

SA11: Velocity < 2 m/s

SA12: Velocity < 2 m/s

SA13: Velocity < 2 m/s

Horizontal

SA11: Velocity < 2 m/s

SA12: Velocity < 2 m/s

SA13: Velocity < 2 m/s
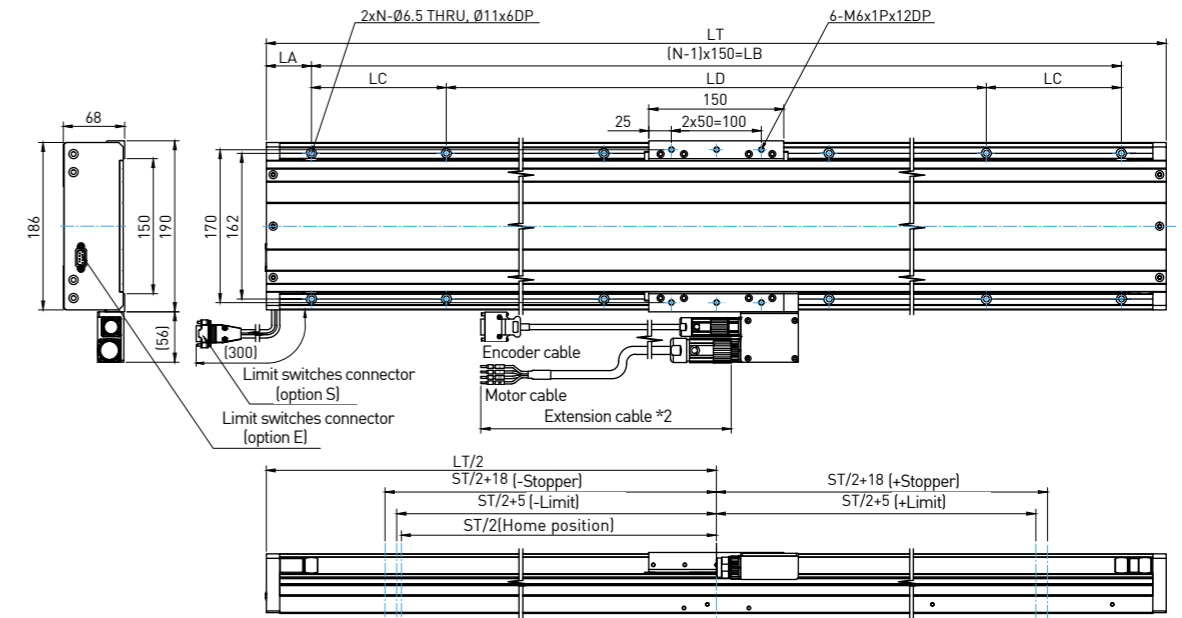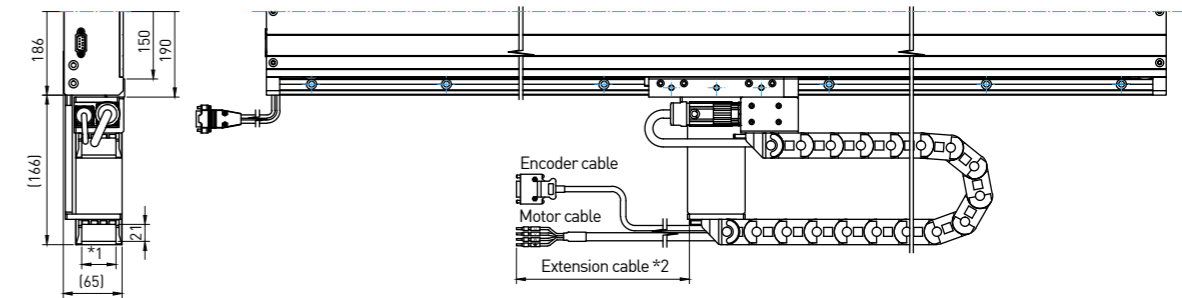
*1：All values above are standard, contact HIWIN for special request.
*2：Cantilever load capability due to different positioning stage, application rated life also vary.
*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

SA11 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

| Table2-2 SA11 | | | | | | | LC(cable chain) | |
Stroke(mm)	N	LT	LA	LB	LC	LD	V1,V2*3	V3,V4*3
100	4	400	25	-	100	150		
200	4	500	25	-	100	250		
300	4	600	65	-	100	270		
400	5	700	75	-	150	250		
500	6	800	25	750	-	-	65	95
600	6	900	75	750	-	-		
700	7	1000	50	900	-	-		
800	8	1100	25	1050	-	-		
900	8	1200	75	1050	-	-		
1000	9	1300	50	1200	-	-		

*1:Cable chain interior width is selected from ordering information.
*2:Extension cable length is selected from ordering information.
*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

Standard

SA12 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

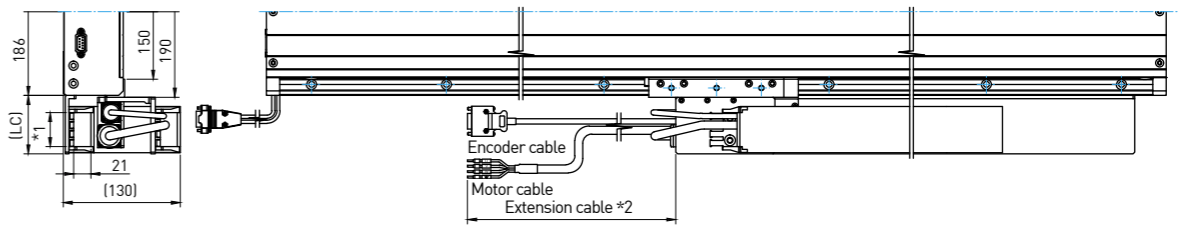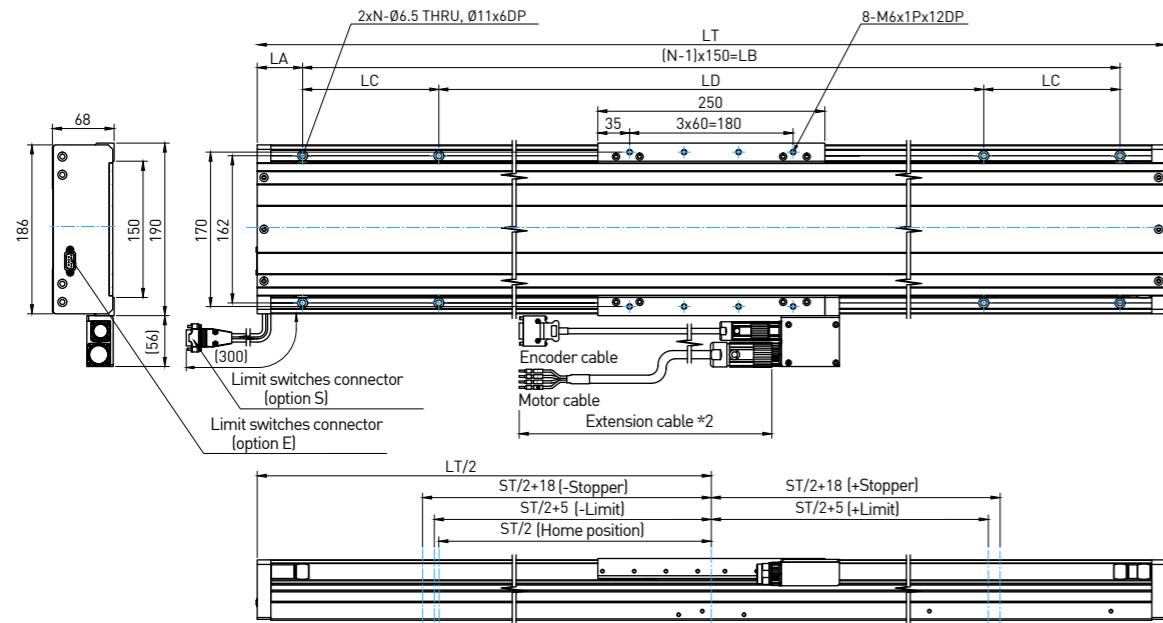### Table2-3 SA12
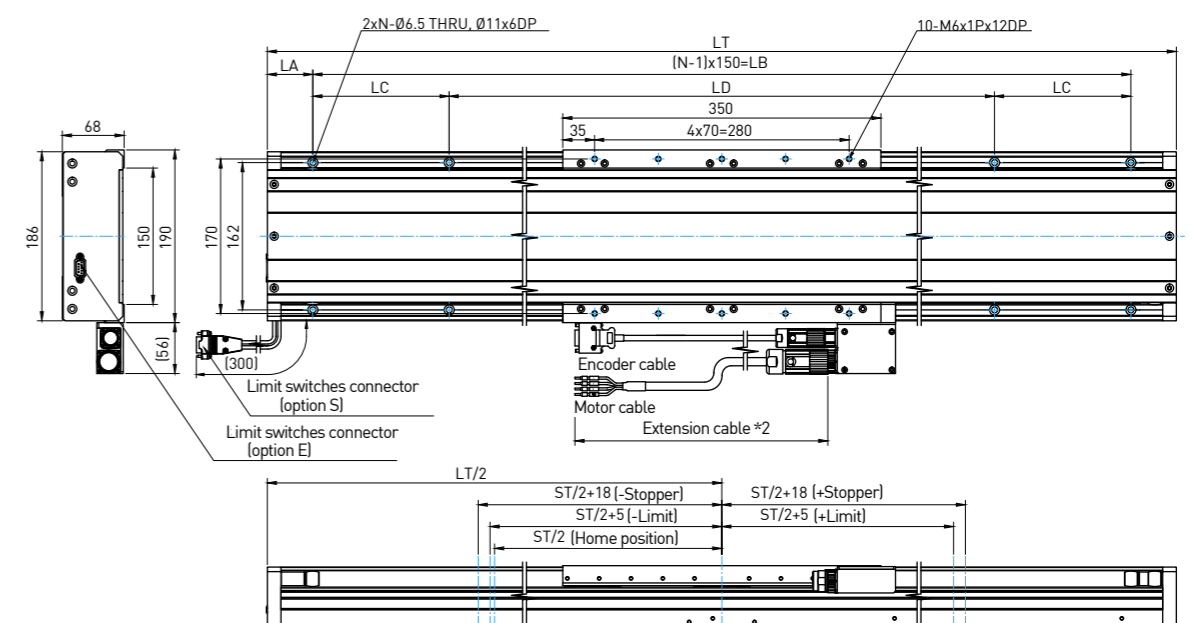
Stroke(mm)	N	LT	LA	LB	LC	LD	LC(cable chain) V1,V2*3	LC(cable chain) V3,V4*3
100	4	500	25	-	100	250		
200	4	600	65	-	100	270		
300	4	700	75	-	150	250		
400	6	800	25	750	-	-		
500	6	900	75	750	-	-	65	95
600	7	1000	50	900	-	-		
700	8	1100	25	1050	-	-		
800	8	1200	75	1050	-	-		
900	9	1300	50	1200	-	-		
1000	10	1400	25	1350	-	-		

*1:Cable chain interior width is selected from ordering information.
*2:Extension cable length is selected from ordering information.
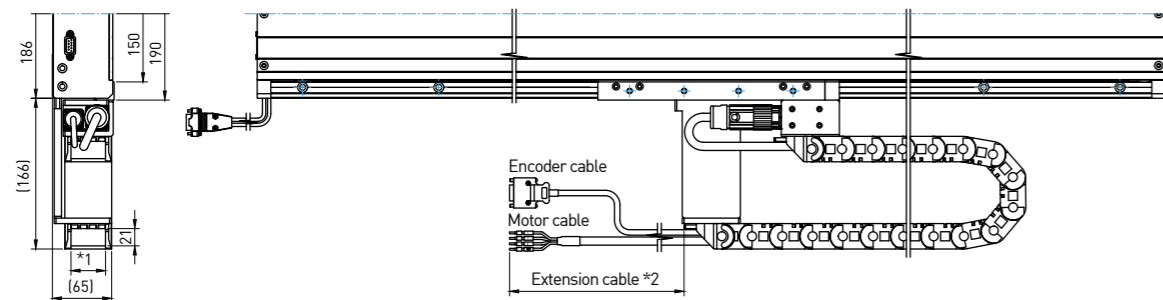*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

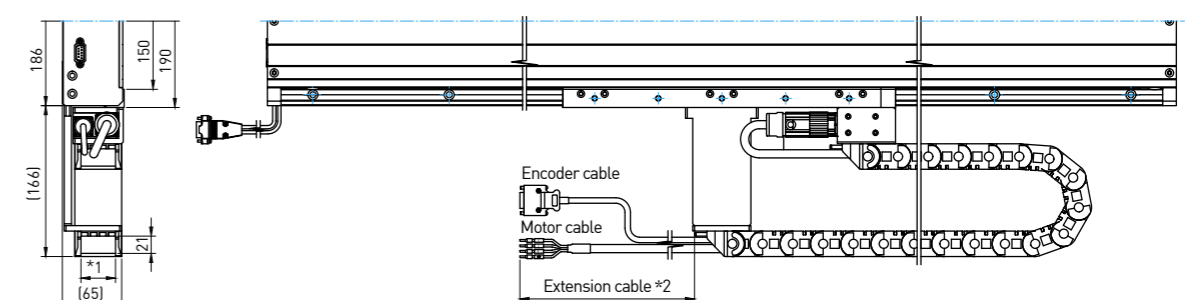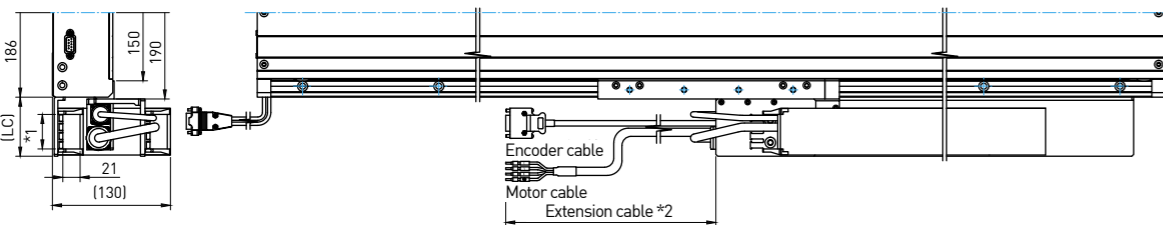## SA13 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

Table2-4 SA13

Stroke(mm)	N	LT	LA	LB	LC	LD	LC(cable chain) V1,V2*3	LC(cable chain) V3,V4*3
100	4	600	65	-	100	270		
200	4	700	75	-	150	250		
300	6	800	25	750	-	-		
400	6	900	75	750	-	-		
500	7	1000	50	900	-	-	65	95
600	8	1100	25	1050	-	-		
700	8	1200	75	1050	-	-		
800	9	1300	50	1200	-	-		
900	10	1400	25	1350	-	-		
1000	10	1500	75	1350	-	-		

*1:Cable chain interior width is selected from ordering information.
*2:Extension cable length is selected from ordering information.
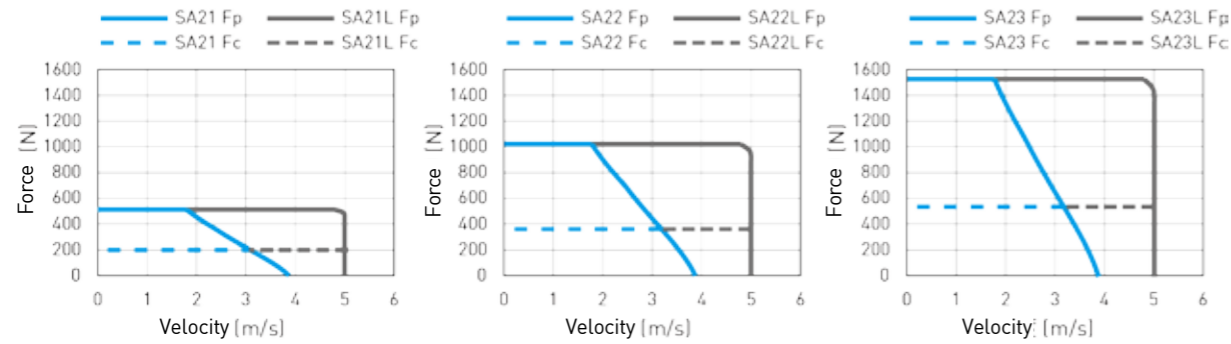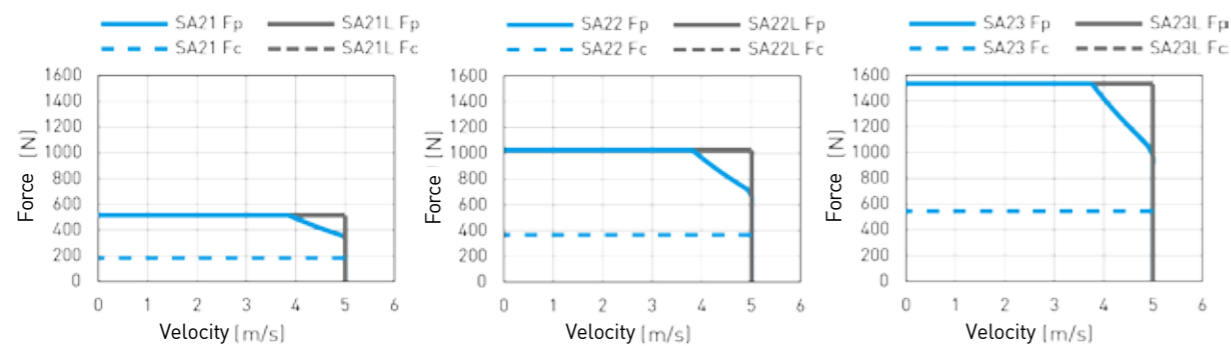*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

Standard

SA21,SA22,SA23

Table2-5 SA21,22,23 stage specification

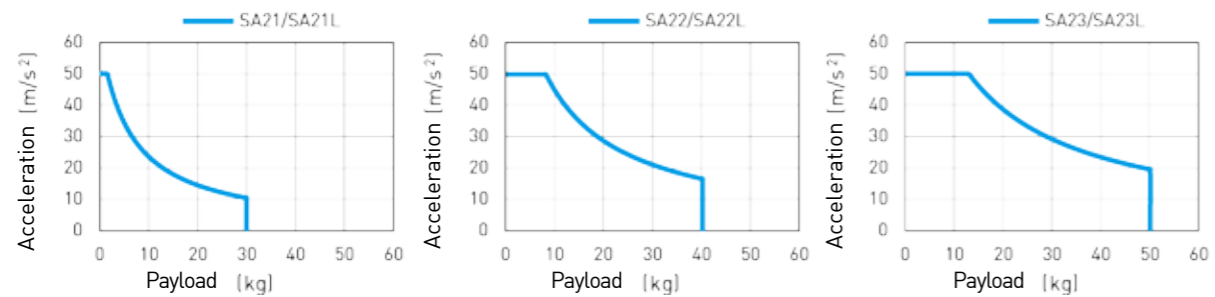| Specification	SA21	SA21L	SA22	SA22L	SA23	SA23L
Continuous force,F_c (N)	181	181	362	362	544	544
Peak force,F_p (N)	512	512	1023	1023	1535	1535
Stroke (mm)	100~1000					
Resolution	0.1μm / 1.0μm / Analog 1Vpp					
Repeatability (μm) *2	Digital 1μm encoder / Analog encoder: ± 1					
	Digital 0.1μm encoder: ± 0.5					
Accuracy (μm) *2,3	Digital 1μm encoder / Analog encoder: ± 2					
	Digital 0.1μm encoder: ±1					
Horizontal straightness (μm)	10 / 500 mm					
Vertical straightness (μm)	20 / 500 mm					
Moving mass (kg)	6		8		11	
Loading capacity (kg)	30		40		50	

Force-Velocity Curve(DC bus = 325V)*4

Force-Velocity Curve(DC bus = 600V)*4

Acceleration-Payload Curve

*1：All values are measured on a granite table, all stage mounting holes are well fixed.
*2：Values are measured according to HIWIN measuring standard.
*3：After error compensation.

*4：The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration. Please refer to the Velocity-Stroke Curve or Appendix A：Motor Sizing.
*5：All specifications above are standard, contact HIWIN for special request.

Velocity-Stroke Curve

Cantilever Load Capability*2.3

Vertical

Horizontal

*1：All values above are standard, contact HIWIN for special request.
*2：Cantilever load capability due to different positioning stage, application rated life also vary.
*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

Standard

SA21 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

Table2-6 **SA21**

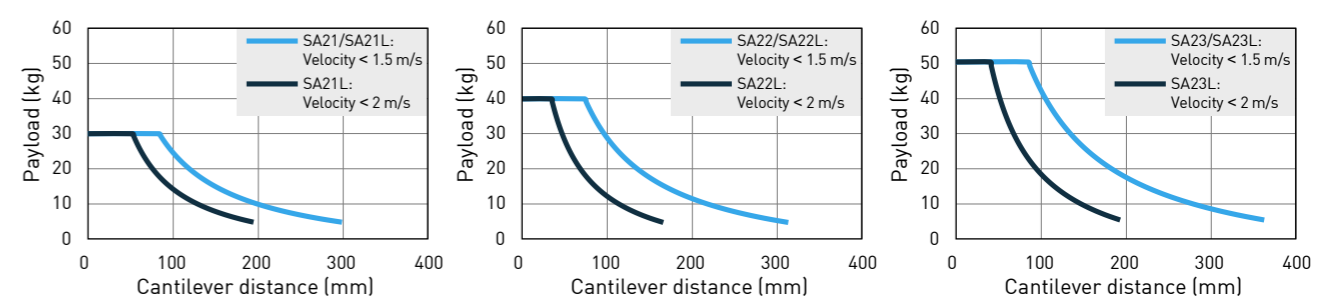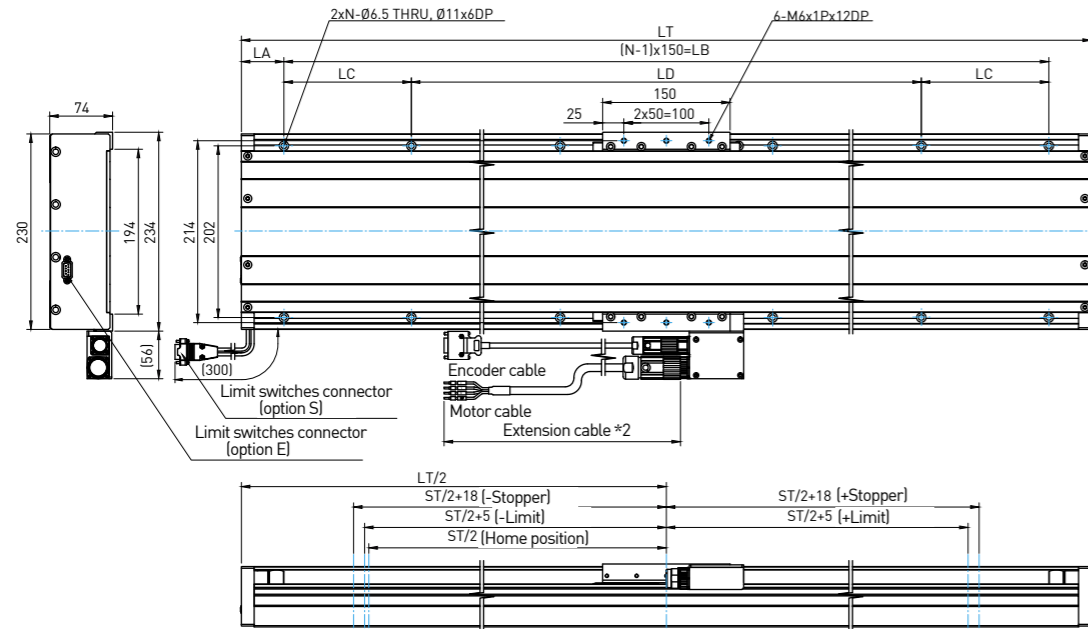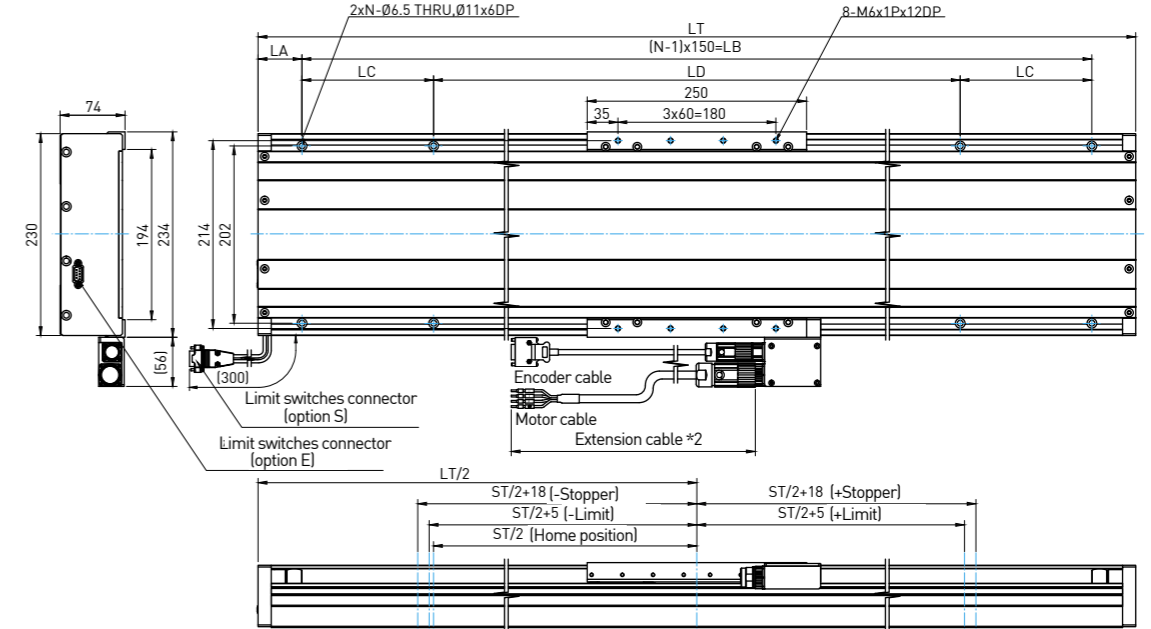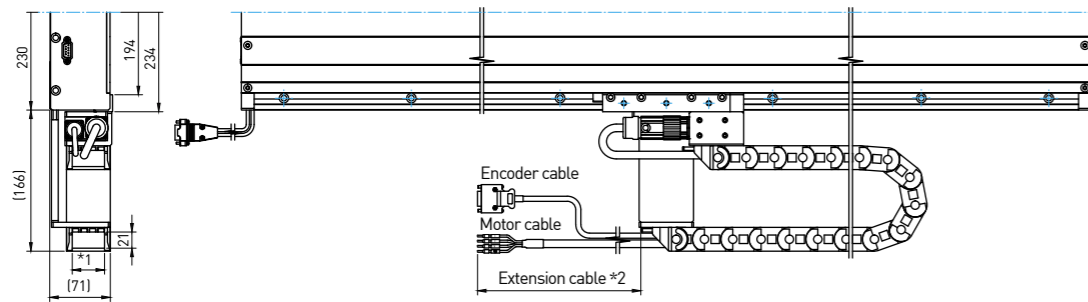| Stroke(mm)	N	LT	LA	LB	LC	LD	LC(cable chain) V1,V2*3	LC(cable chain) V3,V4*3
100	4	400	25	-	100	150		
200	4	500	25	-	100	250		
300	4	600	65	-	100	270		
400	5	700	75	-	150	250		
500	6	800	25	750	-	-	65	95
600	6	900	75	750	-	-		
700	7	1000	50	900	-	-		
800	8	1100	25	1050	-	-		
900	8	1200	75	1050	-	-		
1000	9	1300	50	1200	-	-		

*1:Cable chain interior width is selected from ordering information.
*2:Extension cable length is selected from ordering information.
*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

SA22 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

Standard

Table2-7 **SA22**

Stroke(mm)	N	LT	LA	LB	LC	LD	LC(cable chain) V1,V2*3	LC(cable chain) V3,V4*3
100	4	500	25	-	100	250		
200	4	600	65	-	100	270		
300	4	700	75	-	150	250		
400	6	800	25	750	-	-		
500	6	900	75	750	-	-	65	95
600	7	1000	50	900	-	-		
700	8	1100	25	1050	-	-		
800	8	1200	75	1050	-	-		
900	9	1300	50	1200	-	-		
1000	10	1400	25	1350	-	-		

*1:Cable chain interior width is selected from ordering information.
*2:Extension cable length is selected from ordering information.
*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

SA23 Linear motor stage dimensions

2xN-Ø6.5 THRU, Ø11x6DP
10-M6x1Px12DP

Limit switches connector (option S)
Limit switches connector (option E)
Encoder cable
Motor cable
Extension cable *2

ST/2+18 (-Stopper)
ST/2+5 (-Limit)
ST/2 (Home position)
ST/2+18 (+Stopper)
ST/2+5 (+Limit)

Linear motor stage with horizontal chain

Encoder cable
Motor cable
Extension cable *2

Linear motor stage with vertical chain

Encoder cable
Motor cable
Extension cable *2

Table2-8 **SA23**							LC(cable chain)	
Stroke(mm)	N	LT	LA	LB	LC	LD	V1,V2*3	V3,V4*3
100	4	600	65	-	100	270		
200	4	700	75	-	150	250		
300	6	800	25	750	-	-		
400	6	900	75	750	-	-		
500	7	1000	50	900	-	-	65	95
600	8	1100	25	1050	-	-		
700	8	1200	75	1050	-	-		
800	9	1300	50	1200	-	-		
900	10	1400	25	1350	-	-		
1000	10	1500	75	1350	-	-		

*1:Cable chain interior width is selected from ordering information.
*2:Extension cable length is selected from ordering information.
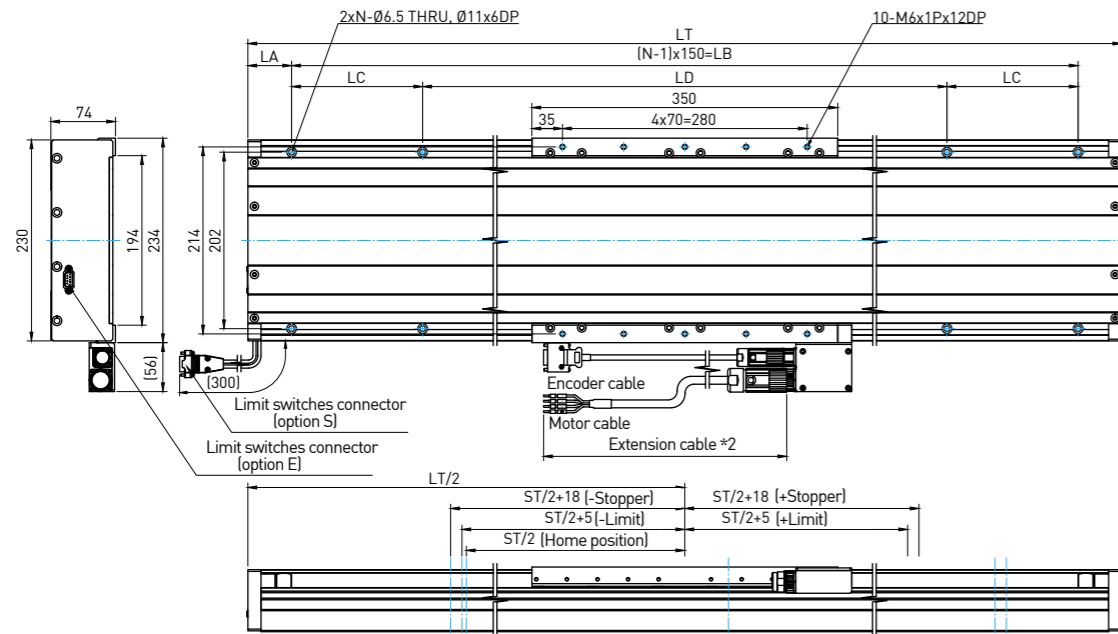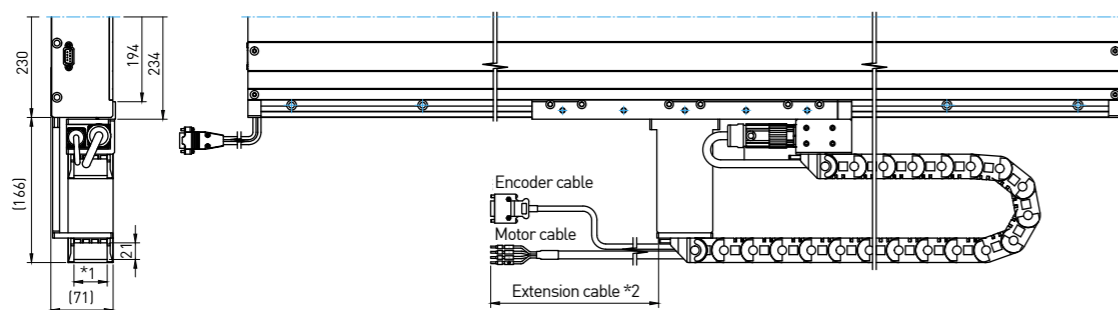*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

SA31,SA32,SA33

Table2-9 SA31,32,33 stage specification

Specification	SA31	SA31L	SA32	SA32L	SA33	SA33L
Continuous force,F_C (N)	292	292	583	583	875	875
Peak force,F_P (N)	823	823	1646	1646	2469	2469
Stroke (mm)	100~1000(mm)					
Resolution	0.1μm / 1.0μm / Analog 1Vpp					
Repeatability (μm) *2	Digital 1μm encoder / Analog encoder: ± 1					
	Digital 0.1μm encoder: ± 0.5					
Accuracy (μm) *2,3	Digital 1μm encoder / Analog encoder: ± 2					
	Digital 0.1μm encoder: ± 1					
Horizontal straightness (μm)	10 / 500 mm					
Vertical straightness (μm)	20 / 500 mm					
Moving mass (kg)	7.5		10.5		14.5	
Loading capacity (kg)	40		50		60	

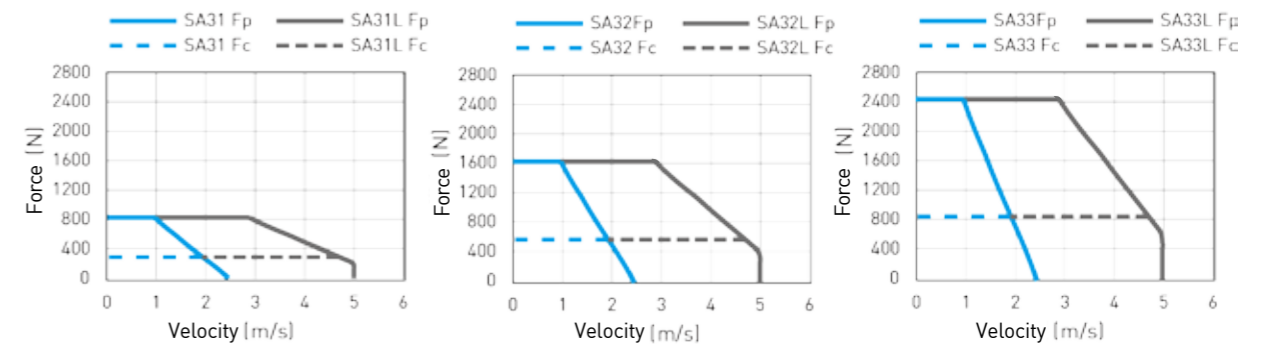### Force-Velocity Curve(DC bus = 325V)*4

Force-Velocity Curve(DC bus = 600V)*4

Acceleration-Payload Curve

*1：All values are measured on a granite table, all stage mounting holes are well fixed.
*2：Values are measured according to HIWIN measuring standard.
*3：After error compensation.

*4：The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration. Please refer to the Velocity-Stroke Curve or Appendix A：Motor Sizing.
*5：All specifications above are standard, contact HIWIN for special request.

Velocity-Stroke Curve

SA31 — Load 1 kg, Load 20 kg, Load 40 kg

SA32 — Load 1 kg, Load 25 kg, Load 50 kg

SA33 — Load 1 kg, Load 30 kg, Load 60 kg

SA31L — Load 1 kg, Load 20 kg, Load 40 kg

SA32L — Load 1 kg, Load 25 kg, Load 50 kg

SA33L — Load 1 kg, Load 30 kg, Load 60 kg

Cantilever Load Capability*2,3

Vertical

Horizontal

Vertical

SA31/SA31L: Velocity < 1 m/s; SA31L: Velocity < 2 m/s

SA32/SA32L: Velocity < 1 m/s; SA32L: Velocity < 2 m/s

SA33/SA33L: Velocity < 1 m/s; SA33L: Velocity < 2 m/s

Horizontal

SA31/SA31L: Velocity < 1 m/s; SA31L: Velocity < 2 m/s

SA32/SA32L: Velocity < 1 m/s; SA32L: Velocity < 2 m/s

SA33/SA33L: Velocity < 1 m/s; SA33L: Velocity < 2 m/s

*1：All values above are standard, contact HIWIN for special request.

*2：Cantilever load capability due to different positioning stage, application rated life also vary.

*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

SA31 Linear motor stage dimensions
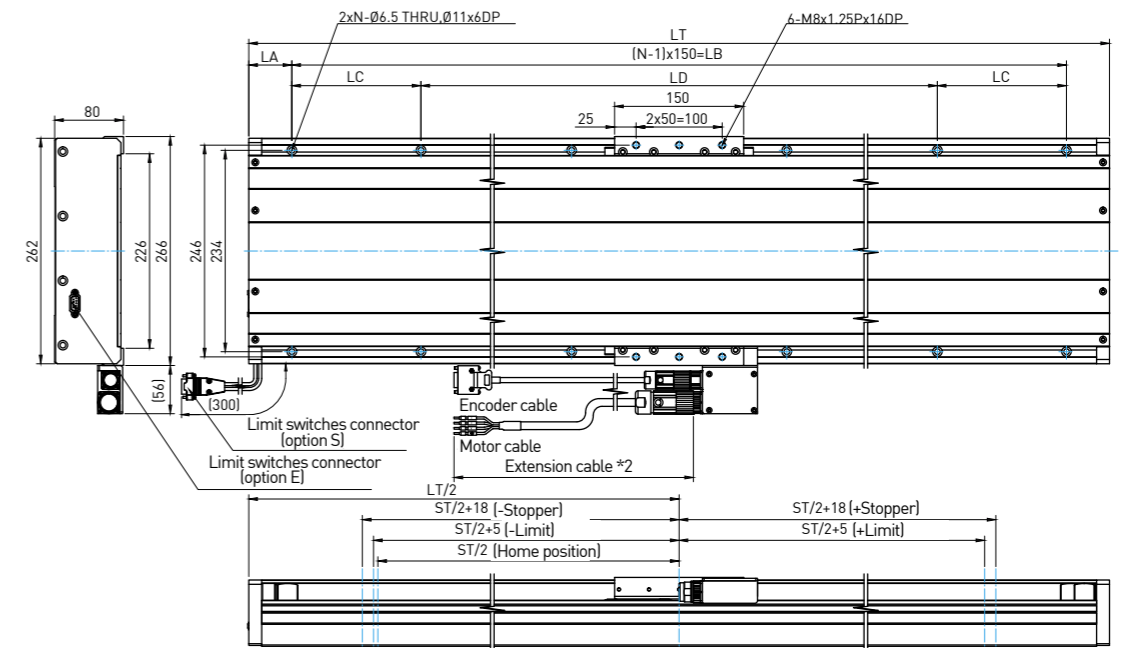
Linear motor stage with horizontal chain
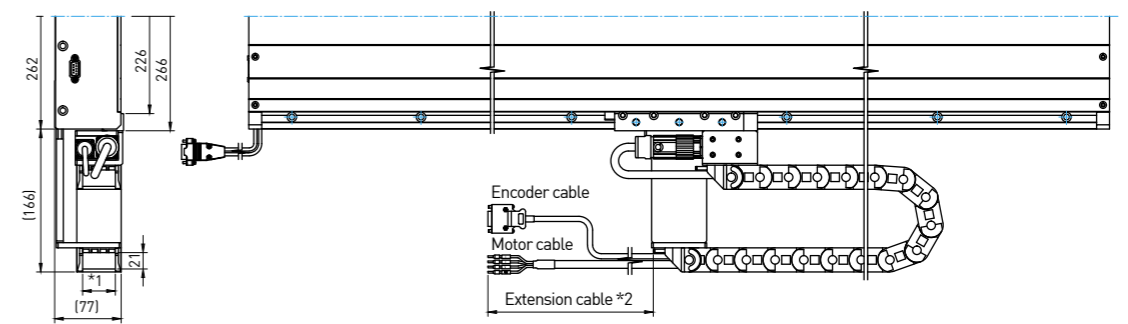
Linear motor stage with vertical chain

Table2-10 **SA31**							LC(cable chain)	
Stroke(mm)	N	LT	LA	LB	LC	LD	V1,V2*3	V3,V4*3
100	4	400	25	-	100	150		
200	4	500	25	-	100	250		
300	4	600	65	-	100	270		
400	5	700	75	-	150	250		
500	6	800	25	750	-	-	65	95
600	6	900	75	750	-	-		
700	7	1000	50	900	-	-		
800	8	1100	25	1050	-	-		
900	8	1200	75	1050	-	-		
1000	9	1300	50	1200	-	-		

*1:Cable chain interior width is selected from ordering information.

*2:Extension cable length is selected from ordering information.

*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

Standard

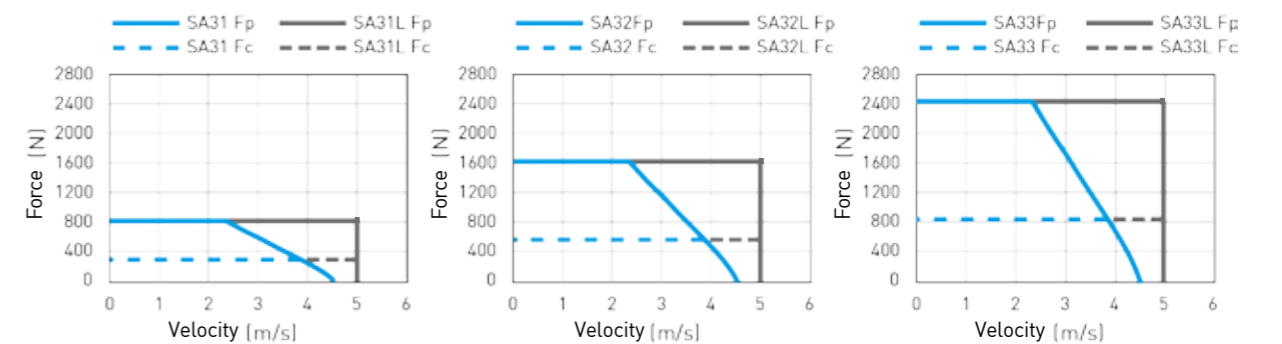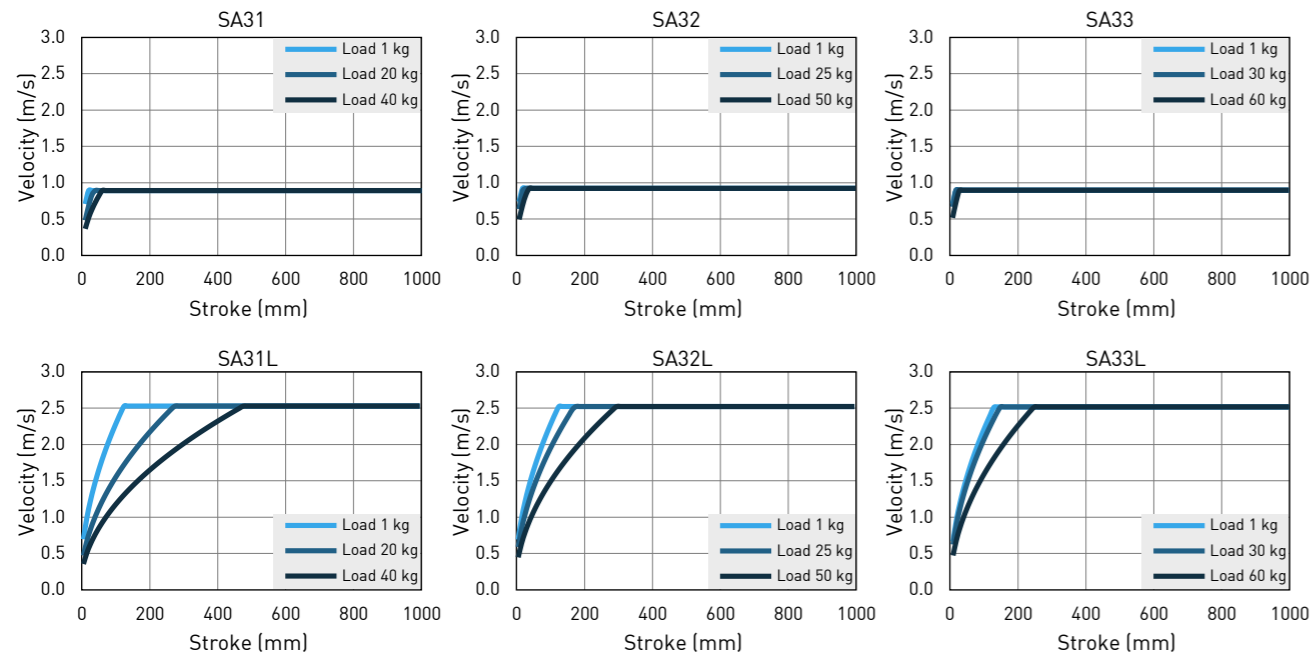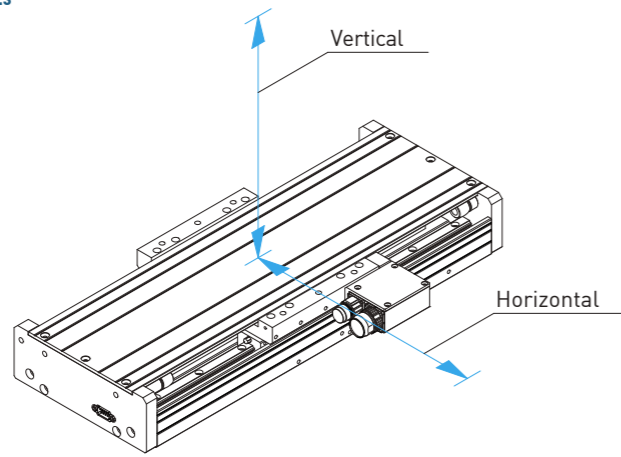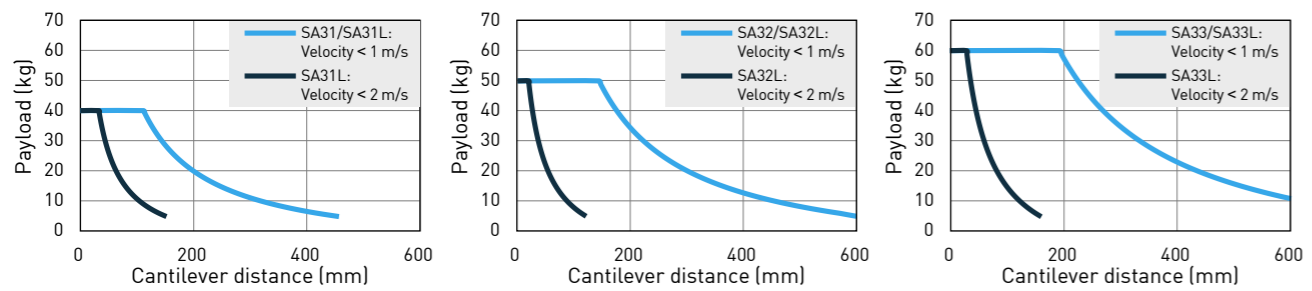## SA32 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

SA33 Linear motor stage dimensions

Linear motor stage with horizontal chain

Linear motor stage with vertical chain

Standard

Table2-11 SA32

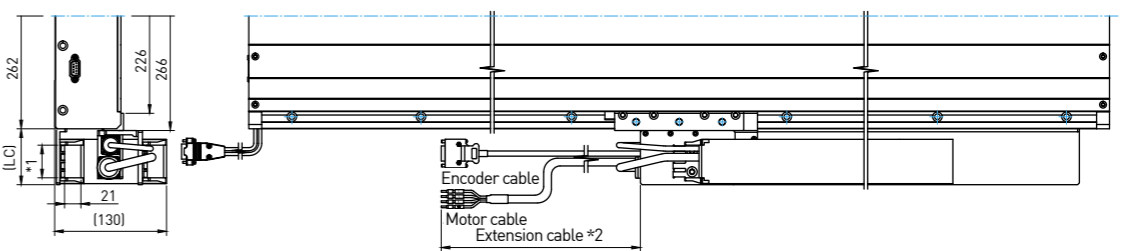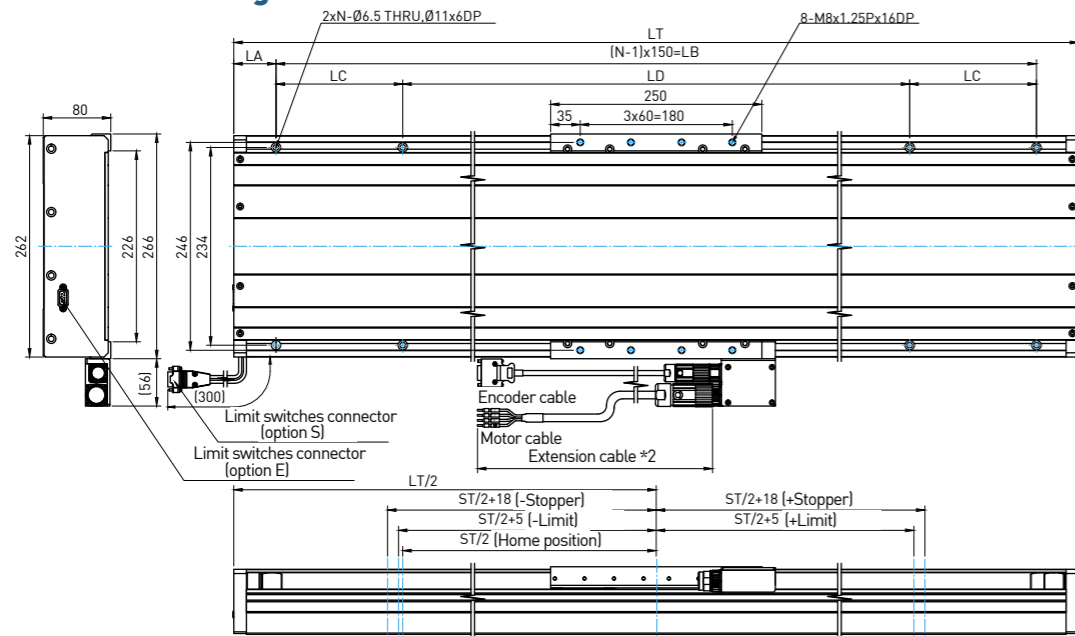| Stroke(mm)	N	LT	LA	LB	LC	LD	LC(cable chain)	
							V1,V2*3	V3,V4*3
100	4	500	25	-	100	250		
200	4	600	65	-	100	270		
300	4	700	75	-	150	250		
400	6	800	25	750	-	-		
500	6	900	75	750	-	-		
600	7	1000	50	900	-	-	65	95
700	8	1100	25	1050	-	-		
800	8	1200	75	1050	-	-		
900	9	1300	50	1200	-	-		
1000	10	1400	25	1350	-	-		

*1:Cable chain interior width is selected from ordering information.

*2:Extension cable length is selected from ordering information.

*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.

Table2-12 SA33

Stroke(mm)	N	LT	LA	LB	LC	LD	LC(cable chain)	
							V1,V2*3	V3,V4*3
100	4	600	65	-	100	270		
200	4	700	75	-	150	250		
300	6	800	25	750	-	-		
400	6	900	75	750	-	-		
500	7	1000	50	900	-	-		
600	8	1100	25	1050	-	-	65	95
700	8	1200	75	1050	-	-		
800	9	1300	50	1200	-	-		
900	10	1400	25	1350	-	-		
1000	10	1500	75	1350	-	-		

*1:Cable chain interior width is selected from ordering information.

*2:Extension cable length is selected from ordering information.

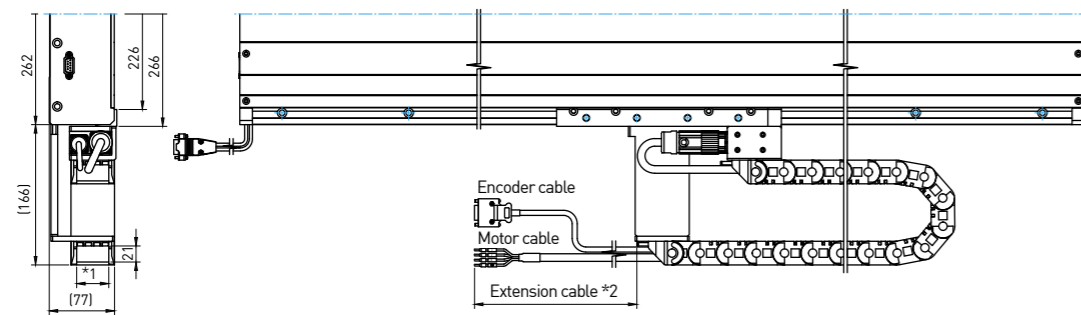*3:Dimension LC is determined by cable chain interior width V1~V4 from ordering information.
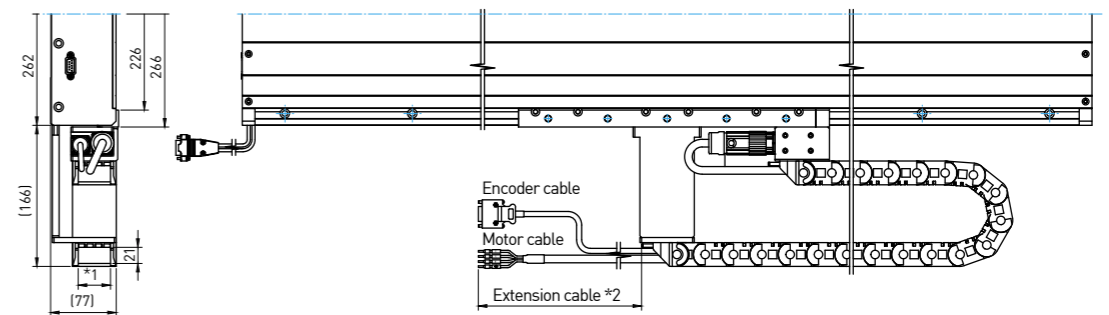
2.3 LMC high-precision, high-speed stability

Linear motor LMC stages are equipped with coreless motor(s) and well suited for applications that require precision positioning and constant velocity scanning motion.

- Linear motor direct drive, enabling ultra-precise movement
- Stroke range up to 4m
- Superior speed control characteristic
- Low cost, small size, high performance
- Suitable for clean rooms

2.3.1 Linear single axis

LMX1E – CB5 – 1 – 300 – G200

Stage type

LMX1E

Motor type

CB5:LMCB5
CB6:LMCB6
CB7:LMCB7
CB8:LMCB8

The number of slider

1:1

Stroke

100:100mm   700:700mm
200:200mm   800:800mm
300:300mm   900:900mm
400:400mm   1000:1000mm
500:200mm   1100:1100mm
600:300mm   1200:1200mm

Encoder type

0:None
A:40μm analog 1Vpp optical scale
B:20μm analog 1Vpp optical scale
D:1mm analog 1Vpp magnetic scale
E:TTL digital 1μm resolution magnetic scale
G:TTL digital 1μm resolution optical scale (standard)
H:TTL digital 0.5μm resolution optical scale
K:TTL digital 0.1μm resolution optical scale
M:TTL digital 20nm resolution optical scale
P:40μm analog glass optical scale
X:Other (please remark desired specifications, product or model)

Limit switch

0:None
1:Inductive type, PNP
2:Optical switch, NPN (standard)
3:Optical switch, PNP
4:Inductive type, NPN
C:Customized

Cover

0:None (standard)
A:Metal cover
B:Bellows
C:Customized
D:Non-woven

Cable chain

0:None (standard)
1:Horizontal direction (chain internal space 15x30mm)
2:Vertical direction (chain internal space 15x30mm)
C:Customized

Note：Contact HIWIN for customized specification.

Standard

Table2-13 LMCB5,6,7,8 stage specification

Specification	CB5	CB6	CB7	CB8
Continuous force,F_C (N)	91	109	128	145
Peak force,F_P (N)	364	436	512	580
Stroke (mm)	100-1200			
Resolution	1.0μm			
Repeatability (μm) *2	Stroke 100~1000 mm: ±1			
	Stroke 1100 / 1200 mm: ±2			
Accuracy (μm)*2,3	Stroke 100~1000 mm: ±3			
	Stroke 1100 / 1200 mm: ±8			
Horizontal straightness (μm)	10 / 500 mm			
Vertical straightness (μm)	20 / 500 mm			
Moving mass (kg)	No cover: 2.1	No cover: 3.1	3.8	4.7
	With cover: 2.3	With cover: 3.3		

Force-Velocity Curve (DC bus = 325V) *4

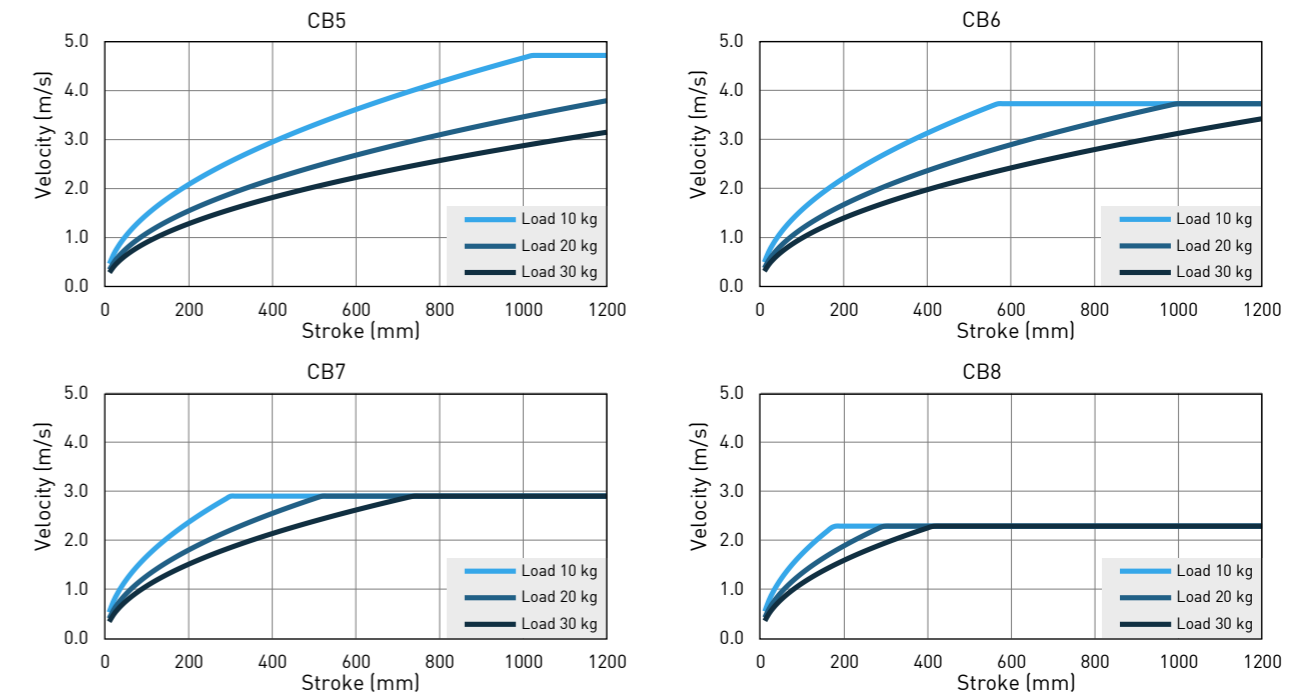CB5 Fp —— CB5 Fc —— CB6 Fp —— CB6 Fc —— CB7 Fp —— CB7 Fc —— CB8 Fp —— CB8 Fc

Acceleration-Payload Curve

*1：All values are measured on a granite table, all stage mounting holes are well fixed.
*2：Values are measured according to HIWIN measuring standard.
*3：After error compensation.
*4：The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration.
　　Please refer to the Velocity-Stroke Curve or Appendix A：Motor Sizing.
*5：All specifications above are standard, contact HIWIN for special request.

Velocity-Stroke Curve

Cantilever Load Capability*2,3

Vertical

Horizontal

*1：All values above are standard, contact HIWIN for special request.
*2：Cantilever load capability due to different positioning stage, application rated life also vary.
*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

Standard

2.2.3 LMC Series Stage

LMCB5

Table2-14 Without/with cover linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	N	Mass (kg)	H (mm)
100	400	35	1*1	18/19	95
200	500	85	2	22/23	95
300	600	60	3	26/27	95
400	700	35	4	30/31	95
500	800	85	4	34/35	95
600	900	60	5	38/39	95
700	1000	35	6	42/43	95
800	1100	85	6	46/47	95
900	1200	60	7	50/51	95
1000	1300	35	8	54/55	95
1100	1400	85	8	58/59	105
1200	1500	60	9	62/63	105

*1：When stroke is 100mm, the mounting holes spacing is 300mm.
*2: Absolute accuracy is after error mapping(with HIWIN drive).

Without cover

With cover

Standard
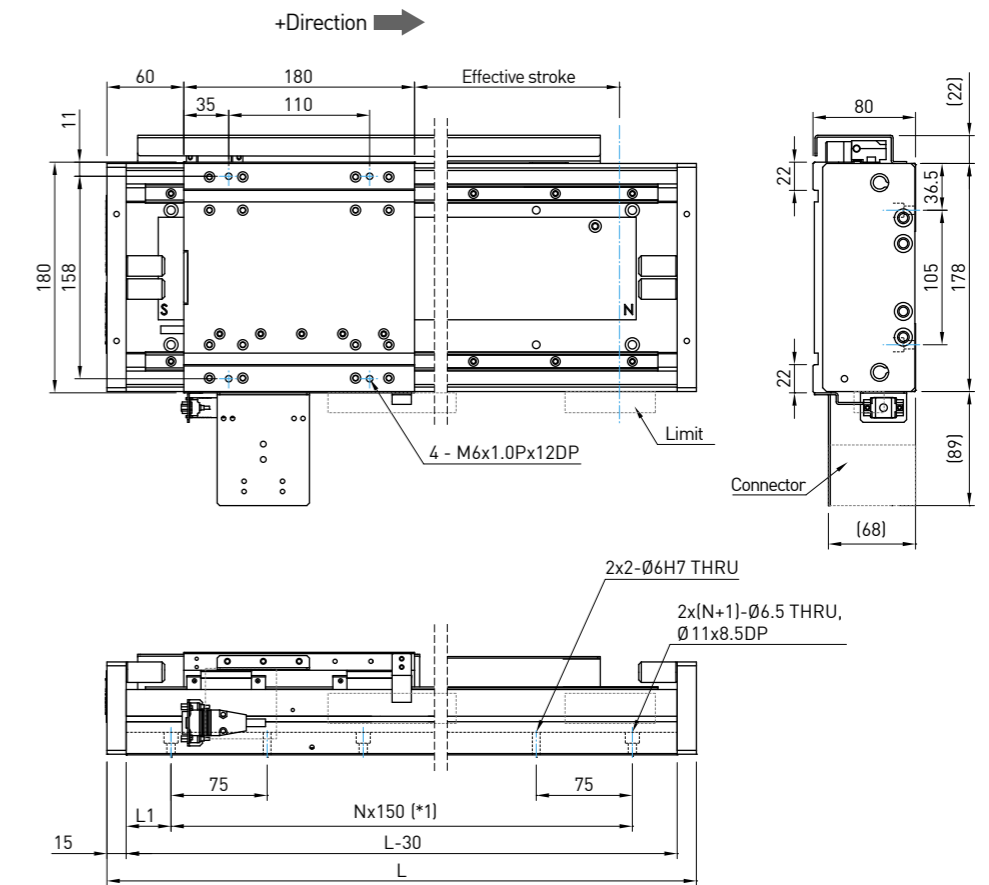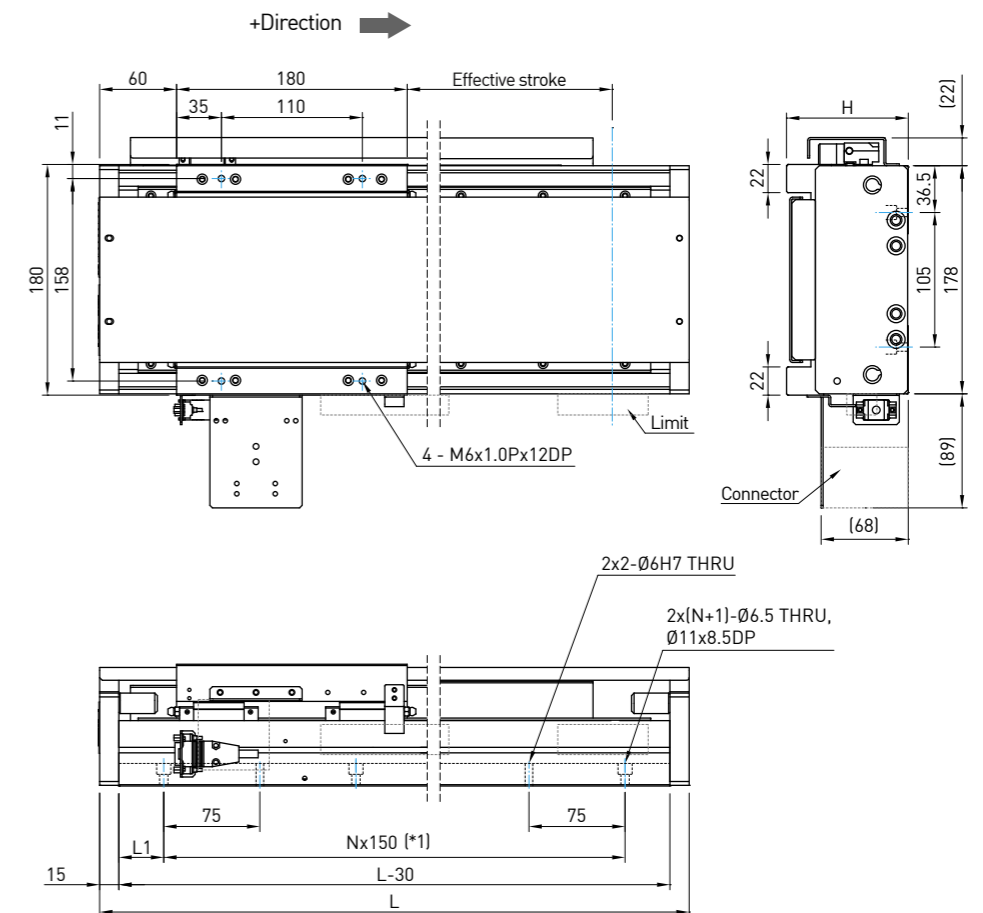
LMCB6

Table2-15 **Without/with cover linear motor stage specifications**

Stroke (mm)	L (mm)	L1 (mm)	N	Mass (kg)	H (mm)
100	430	50	1*¹	19/20	95
200	530	25	3	23/24	95
300	630	75	3	27/28	95
400	730	50	4	31/32	95
500	830	25	5	35/36	95
600	930	75	5	39/40	95
700	1030	50	6	43/44	95
800	1130	25	7	47/48	95
900	1230	75	7	51/52	95
1000	1330	50	8	55/56	95
1100	1430	25	9	59/60	105
1200	1530	75	9	63/64	105

*1：When stroke is 100mm, the mounting holes spacing is 300mm.
*2: Absolute accuracy is after error mapping(with HIWIN drive).

Without cover

With cover

Standard
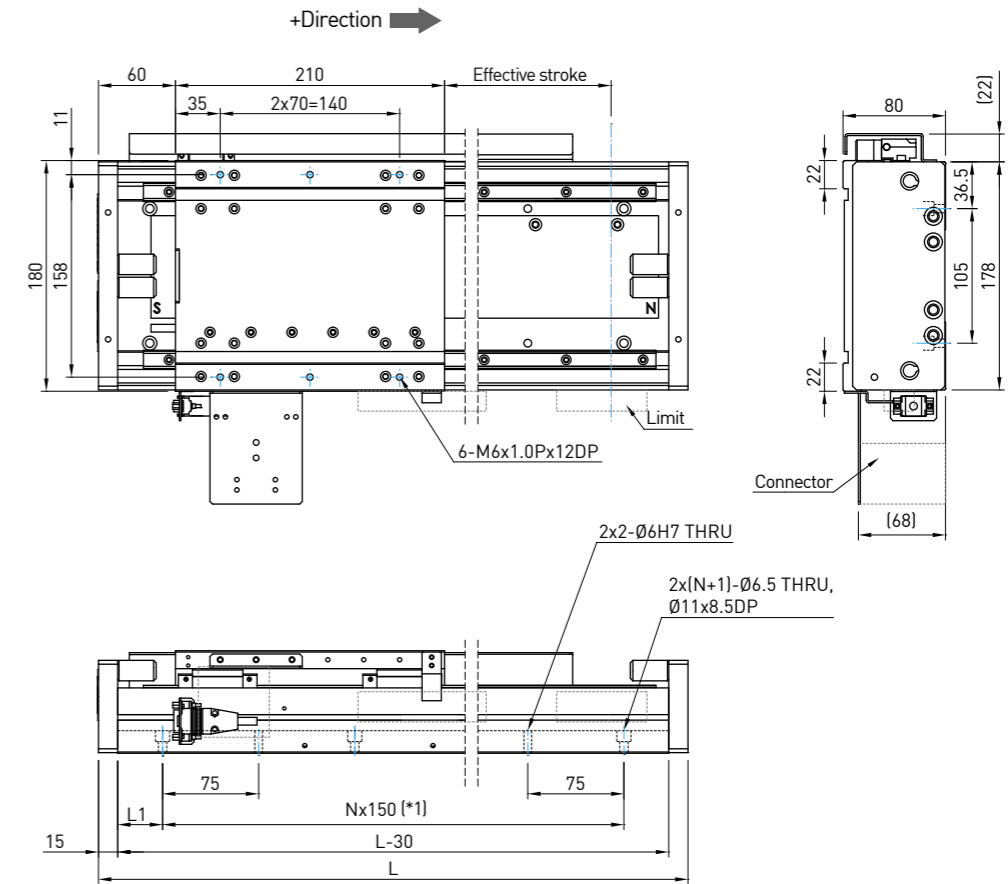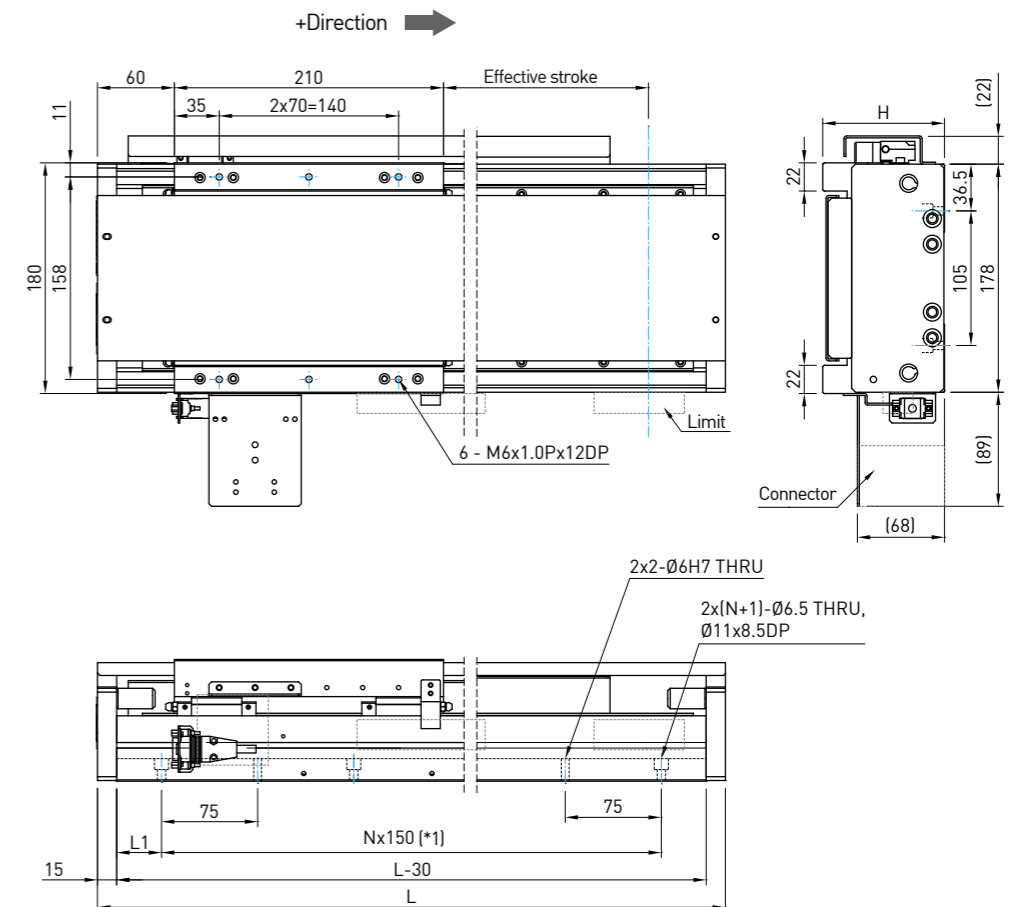
LMCB7

Table2-16 Without/with cover linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	N	Mass (kg)	H (mm)
100	460	65	1*1	20/21	95
200	560	40	3	24/25	95
300	660	90	3	28/29	95
400	760	65	4	32/33	95
500	860	40	5	36/37	95
600	960	90	5	40/41	95
700	1060	65	6	44/45	95
800	1160	40	7	48/49	95
900	1260	90	7	52/53	95
1000	1360	65	8	56/57	95
1100	1460	40	9	60/61	105
1200	1560	90	9	64/65	105

*1 : When stroke is 100mm, the mounting holes spacing is 300mm.
*2: Absolute accuracy is after error mapping(with HIWIN drive).

Without cover

With cover

Standard
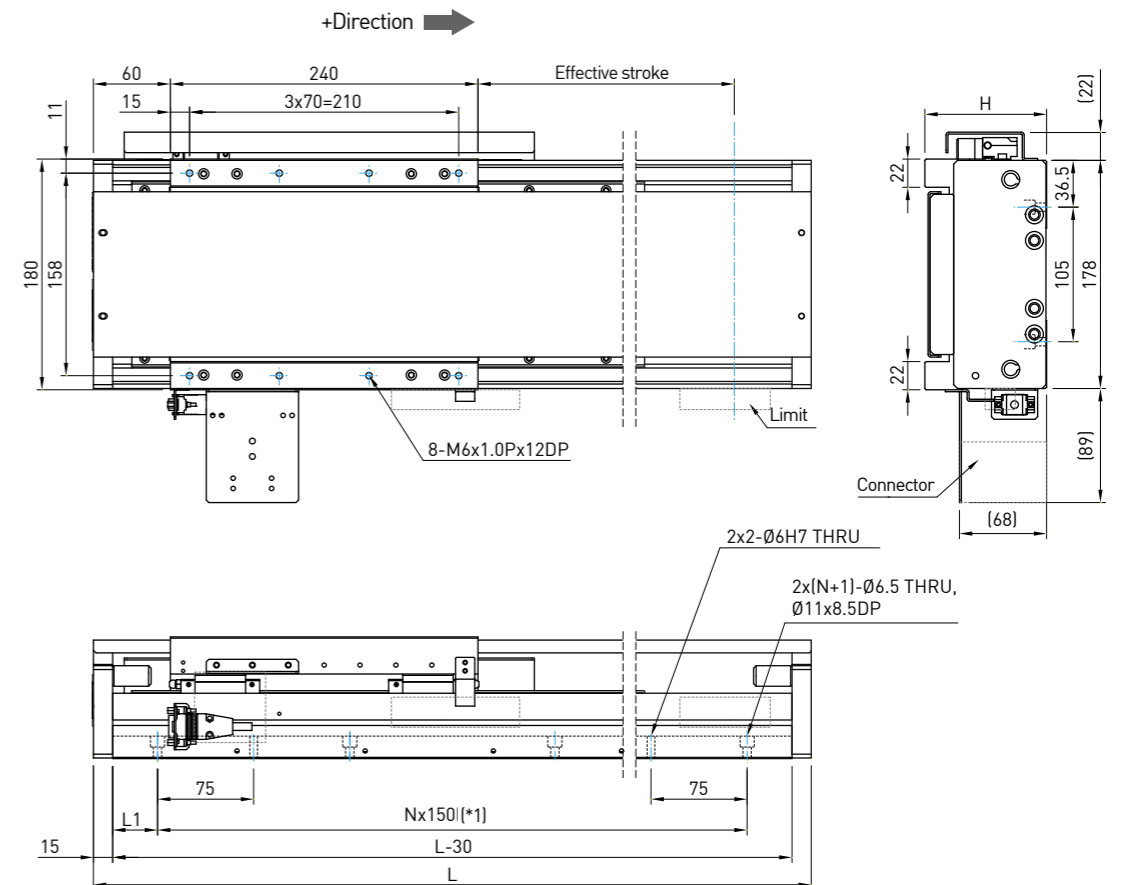
LMCB8

Table2-17 Without/with cover linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	N	Mass (kg)	H (mm)
100	500	85	1*1	21/22	95
200	600	60	3	25/26	95
300	700	35	4	29/30	95
400	800	85	4	33/34	95
500	900	60	5	37/38	95
600	1000	35	6	41/42	95
700	1100	85	6	45/46	95
800	1200	60	7	49/50	95
900	1300	35	8	53/54	95
1000	1400	85	8	57/58	95
1100	1500	60	9	61/62	105
1200	1600	35	10	65/66	105

*1 : When stroke is 100mm, the mounting holes spacing is 300mm.
*2: Absolute accuracy is after error mapping(with HIWIN drive).
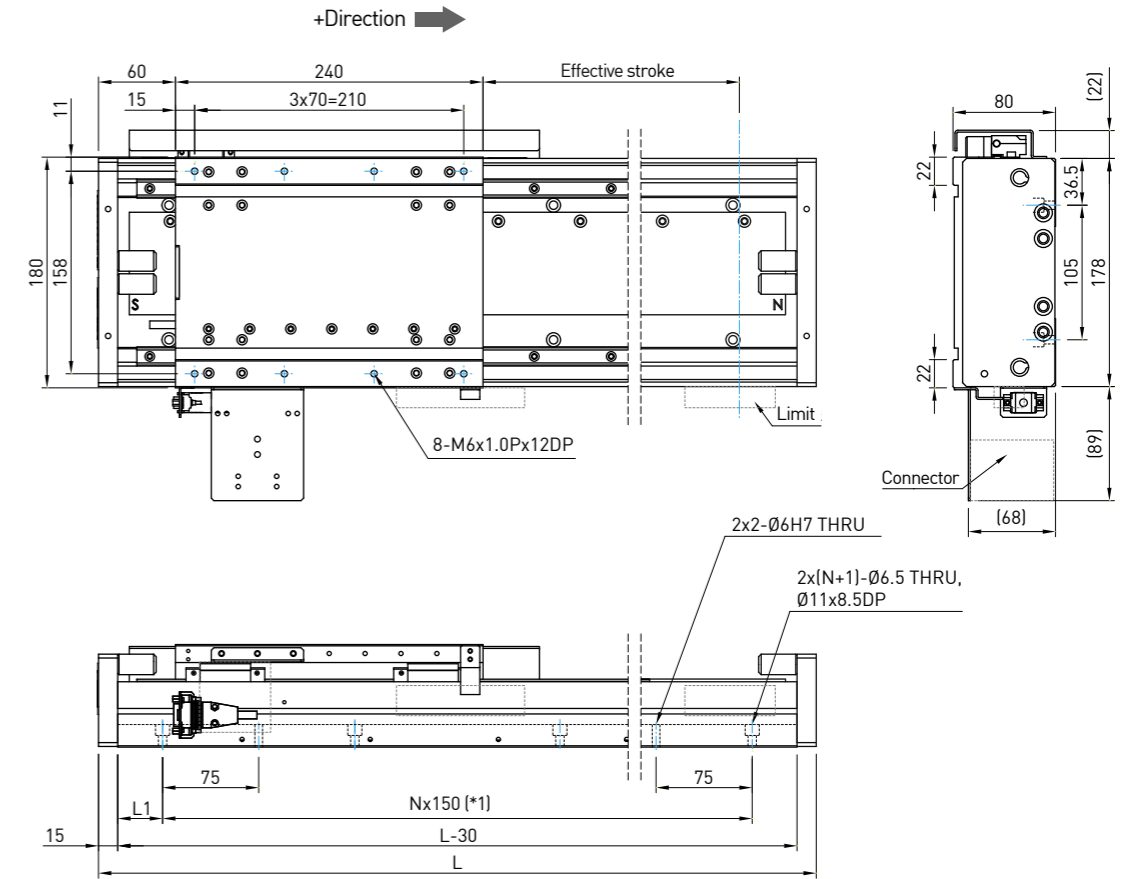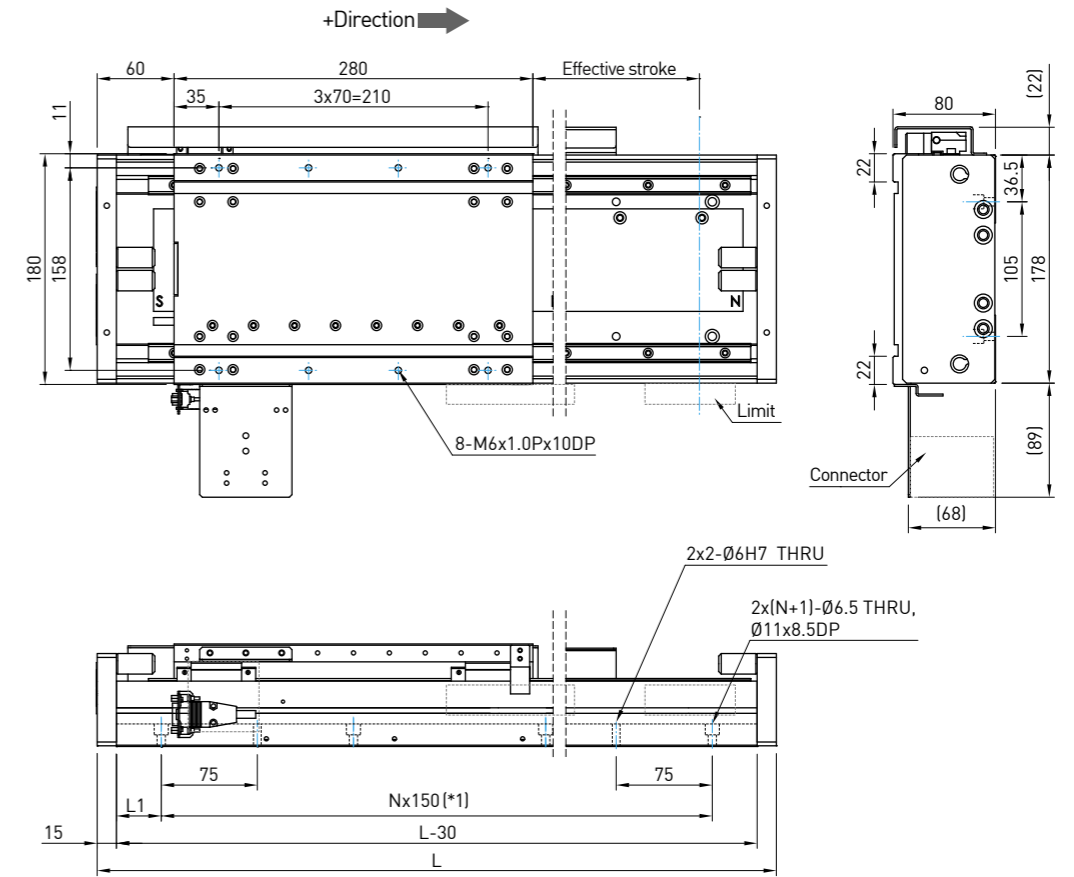
Without cover

With cover

Standard
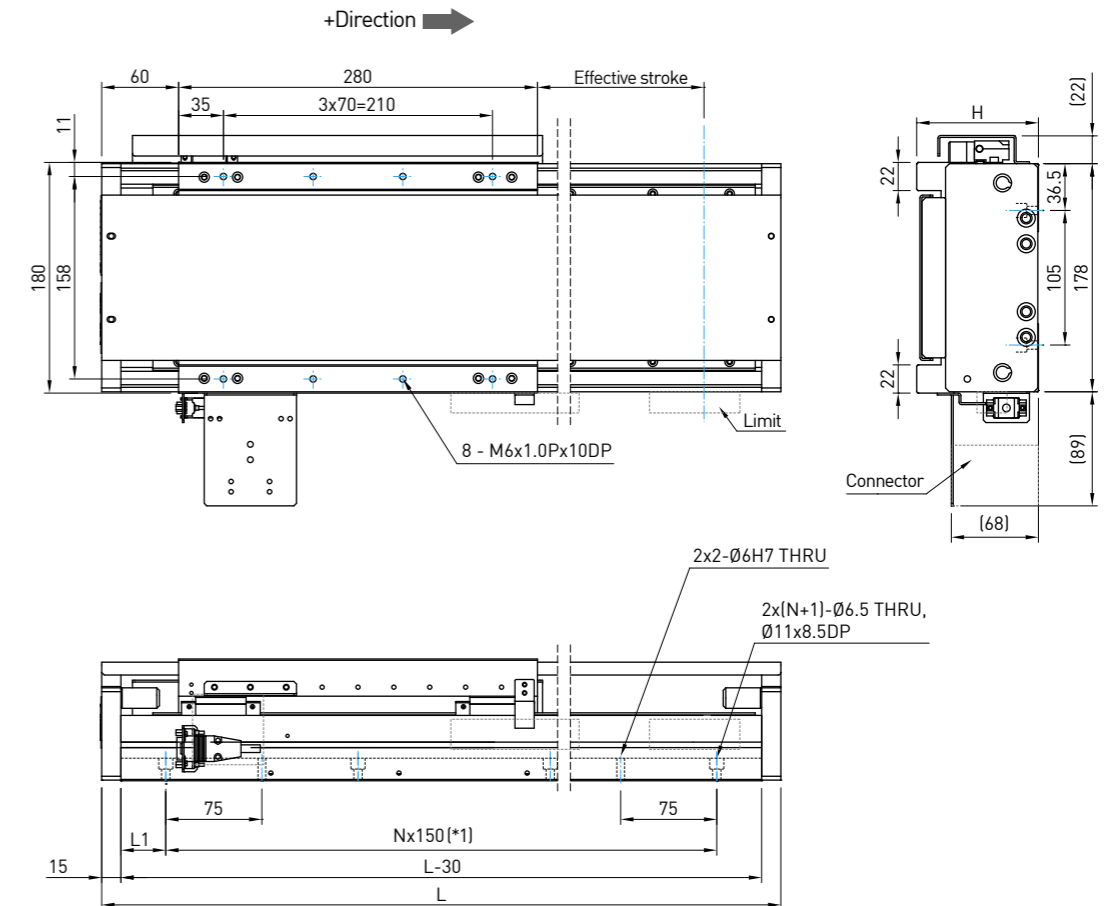
2.4 LMT light weight, high acceleration/deceleration

Shaft motor series with LMT ironless motors are suitable for inspection, scan and semiconductor industry. It can also be assembled into X-Y stage; position feedback apples incremental analog or digital optical scale and magnetic scale as position feedback are seletable.

- Lightweight
- No cogging
- Max. acceleration 50m/s^2, max. velocity 5m/s
- High acceleration and deceleration characteristics

2.4.1 Linear single axis

$$LMX1E-TA2-1-300-\ G200$$

Stage type
LMX1E

Motor type
TA2:LMTA2   TB3:LMTB3   TC4:LMTC4
TA3:LMTA3   TB4:LMTB4
TA4:LMTA4   TC2:LMTC2
TB2:LMTB2   TC3:LMTC3

The number of slider
1:1

Stroke
388:388mm   1156:1156mm
516:516mm   1412:1412mm
644:644mm   1668:1668mm
722:722mm   1924:1924mm
900:900mm   2180:2180mm

Encoder type
0:None
A:40μm analog 1Vpp optical scale
B:20μm analog 1Vpp optical scale
D:1mm analog 1Vpp magnetic scale
E:TTL digital 1μm resolution magnetic scale
G:TTL digital 1μm resolution optical scale (standard)
H:TTL digital 0.5μm resolution optical scale
K:TTL digital 0.1μm resolution optical scale
M:TTL digital 20nm resolution optical scale
P:40μm analog glass optical scale
X:Other (please remark desired specifications, product or model)

Limit switch
0:None
1:Inductive type, PNP
2:Optical switch, NPN (standard)
3:Optical switch, PNP
4:Inductive type, NPN
C:Customized

Cover
0:None (standard)
A:Metal cover
B:Bellows
C:Customized
D:Non-woven

Cable chain
0:None (standard)
1:Horizontal direction (chain internal space 15x30mm)
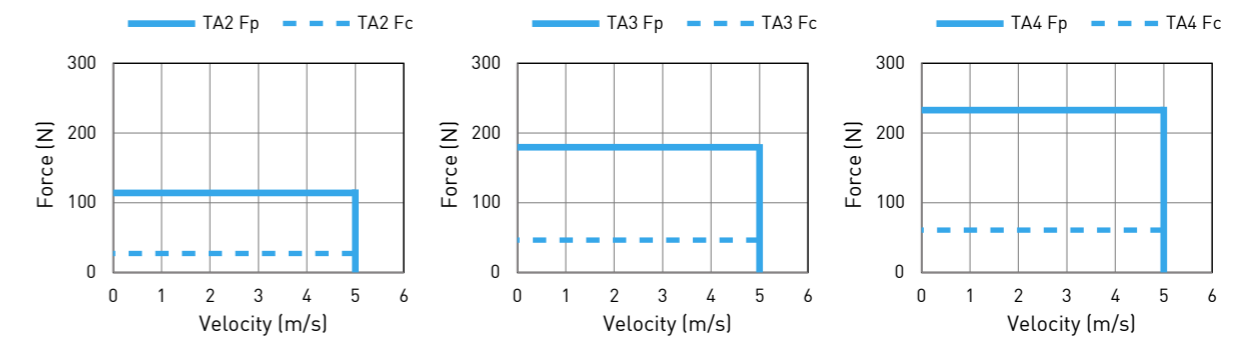2:Vertical direction (chain internal space 15x30mm)
C:Customized

Note：Contact HIWIN for customized specification.

2.4.2 LMTA2 Shaft motor stage

Table2-18 LMTA2,3,4 stage specification			
Specification	TA2	TA3	TA4
Continuous force,F_c (N)	27	42	55
Peak force,F_p (N)	108	168	220
Stroke (mm)	100-1000		
Resolution	1.0μm		
Repeatability (μm) [*2]	±1		
Accuracy (μm) [*2,3]	±3		
Horizontal straightness (μm)	10 / 500 mm		
Vertical straightness (μm)	20 / 500 mm		
Moving mass (kg)	1.4	2.1	2.3

Force-Velocity Curve (DC bus = 325V)[*4]

Acceleration-Payload Curve

*1：All values are measured on a granite table, all stage mounting holes are well fixed.
*2：Values are measured according to HIWIN measuring standard.
*3：After error compensation.
*4：The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration. Please refer to the Velocity-Stroke Curve or Appendix A：Motor Sizing.
*5：All specifications above are standard, contact HIWIN for special request.

Standard

Velocity-Stroke Curve

TA2

TA3

TA4

Cantilever Load Capability*2,3

Vertical

Horizontal

Vertical

TA2: Velocity < 2 m/s

TA3: Velocity < 2 m/s

TA4: Velocity < 2 m/s
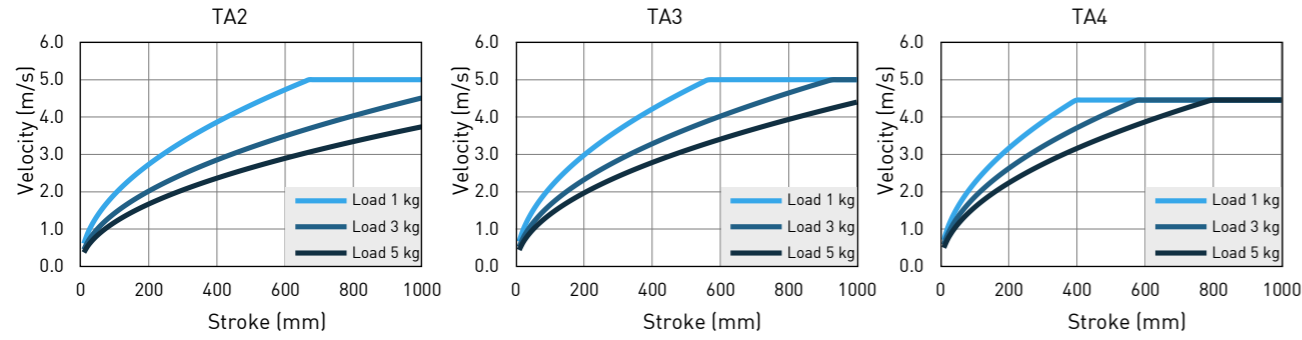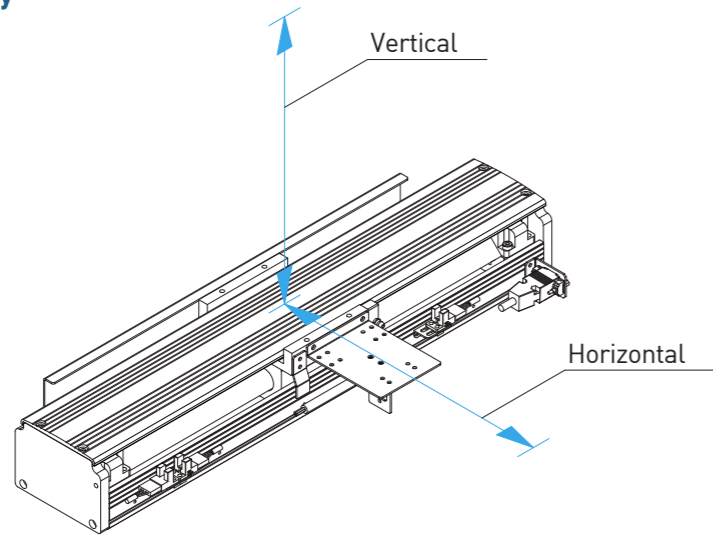
Horizontal

TA2: Velocity < 2 m/s

TA3: Velocity < 2 m/s

TA4: Velocity < 2 m/s

Table2-19 LMTA2 Shaft motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	304	67	54.5	1	5
200	404	42	54.5	2	6
300	534	32	69.5	3	6.9
400	634	82	69.5	3	7.9
500	734	57	69.5	4	8.8
600	834	32	69.5	5	9.8
700	974	27	89.5	6	11.2
800	1074	77	89.5	6	12.1
900	1174	52	89.5	7	13.1
1000	1274	27	89.5	8	14

* Absolute accuracy is after error mapping (with HIWIN drive).

■ Dimension

+Direction

L2
22.5
95
50
Effective stroke
4-M5x0.8Px10DP
78
(21.5)
11
110
100
5
80
102
(92)
Limit
2x(N+1)-M5x0.8Px10DP
Connector
(67.5)
10
L1
Nx150
L-20
L

*1：All values above are standard, contact HIWIN for special request.
*2：Cantilever load capability due to different positioning stage, application rated life also vary.
*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

Standard

Table2-20 LMTA3 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	340	85	55	1	6.3
200	440	60	55	2	7.4
300	570	50	70	3	8.5
400	670	25	70	4	9.6
500	770	75	70	4	10.8
600	870	50	70	5	11.9
700	1010	45	90	6	13.5
800	1110	20	90	7	14.6
900	1210	70	90	7	15.8
1000	1310	45	90	8	16.9

* Absolute accuracy is after error mapping (with HIWIN drive).

Table2-21 LMTA4 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	376	28	53	2	7.0
200	476	78	53	2	8.1
300	606	68	68	3	9.2
400	706	43	68	4	10.4
500	806	18	68	5	11.5
600	906	68	68	5	12.6
700	1046	63	88	6	14.2
800	1146	38	88	7	15.3
900	1246	13	88	8	16.5
1000	1346	63	88	8	17.6

* Absolute accuracy is after error mapping (with HIWIN drive).

■ Dimension

■ Dimension

Standard
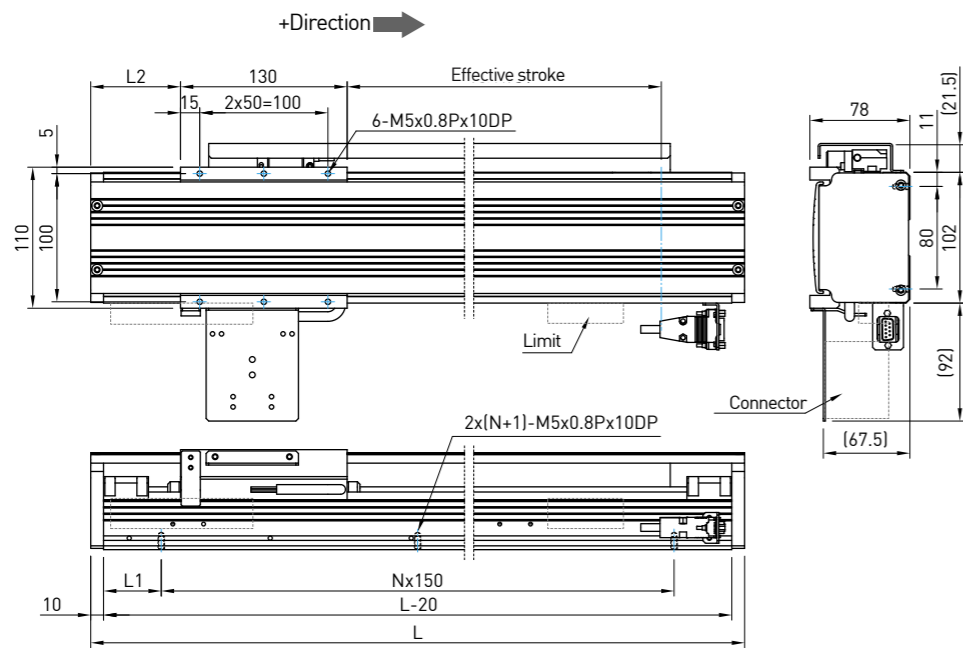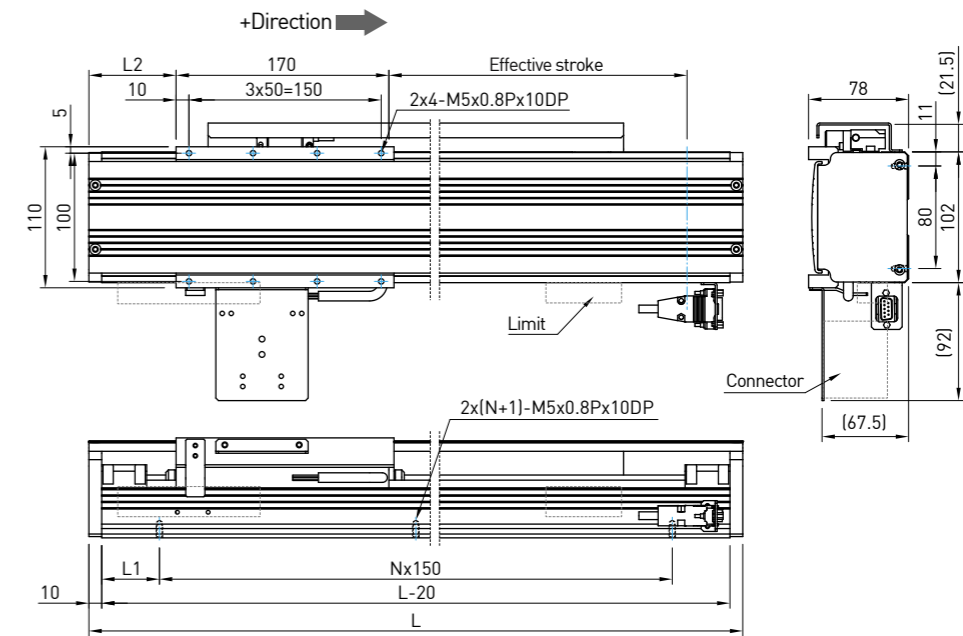
2.4.3 LMTB2 Shaft motor stage

Table2-22 **LMTB2,3,4 stage specification**

Specification	TB2	TB3	TB4
Continuous force,F_c (N)	48	72	96
Peak force,F_p (N)	192	288	384
Stroke (mm)	100-1000		
Resolution	1.0μm		
Repeatability (μm) *2	±1		
Accuracy (μm) *2,3	±3		
Horizontal straightness (μm)	10 / 500 mm		
Vertical straightness (μm)	20 / 500 mm		
Moving mass (kg)	2.1	2.7	3.6

Force-Velocity Curve (DC bus = 325V)*4

Acceleration-Payload Curve

*1：All values are measured on a granite table, all stage mounting holes are well fixed.
*2：Values are measured according to HIWIN measuring standard.
*3：After error compensation.
*4：The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration.
　　Please refer to the Velocity-Stroke Curve or Appendix A：Motor Sizing.
*5：All specifications above are standard, contact HIWIN for special request.

Velocity-Stroke Curve

Cantilever Load Capability*2.3

Vertical

Horizontal

*1：All values above are standard, contact HIWIN for special request.
*2：Cantilever load capability due to different positioning stage, application rated life also vary.
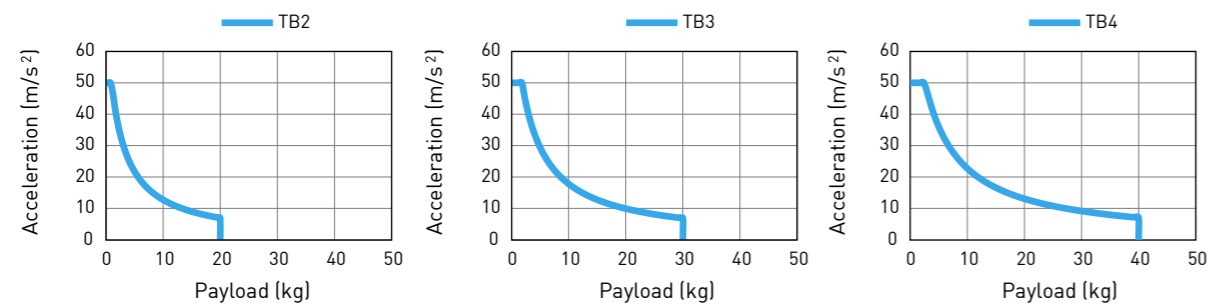*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

Standard

Table2-23 LMTB2 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	380	30	80	2	8.2
200	480	80	80	2	9.6
300	580	55	80	3	11.0
400	680	30	80	4	12.4
500	780	80	80	4	13.8
600	880	55	80	5	15.2
700	1020	50	100	6	17.1
800	1120	25	100	7	18.5
900	1220	75	100	7	19.8
1000	1320	50	100	8	21.2

* Absolute accuracy is after error mapping (with HIWIN drive).
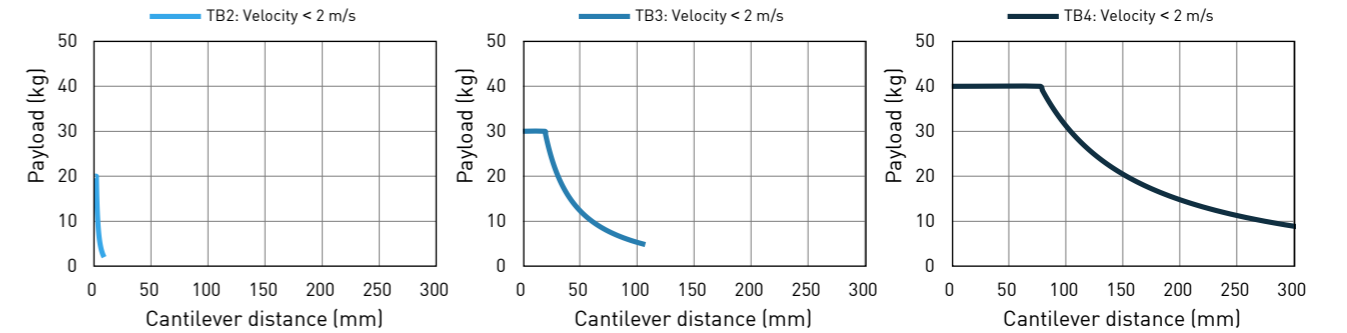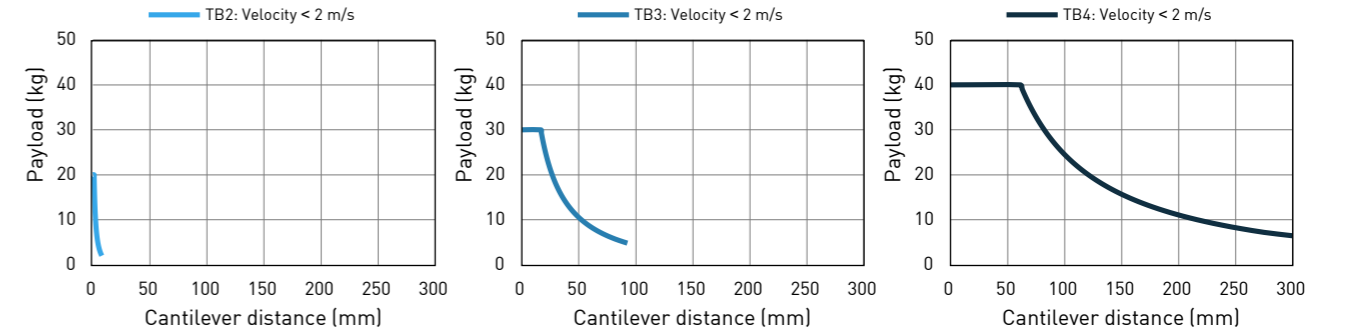
Table2-24 LMTB3 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	425	52.5	80	2	9.5
200	525	27.5	80	3	10.9
300	625	77.5	80	3	12.3
400	725	52.5	80	4	13.6
500	825	27.5	80	5	15.0
600	925	77.5	80	5	16.4
700	1055	72.5	100	6	18.3
800	1165	47.5	100	7	19.7
900	1265	22.5	100	8	21.1
1000	1365	72.5	100	8	22.5

* Absolute accuracy is after error mapping (with HIWIN drive).
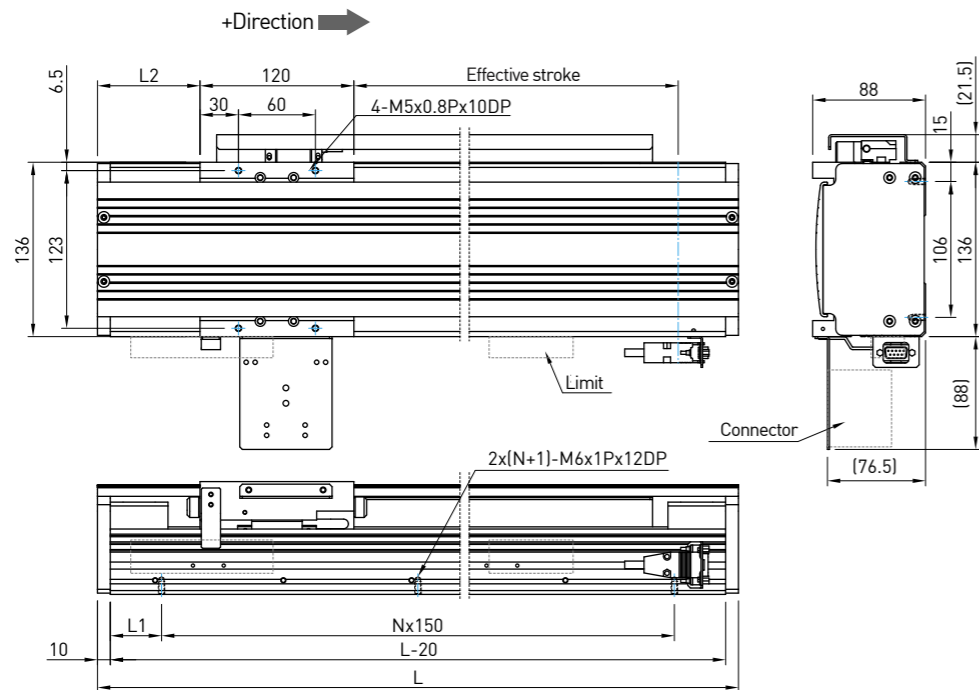
■ Dimension

■ Dimension
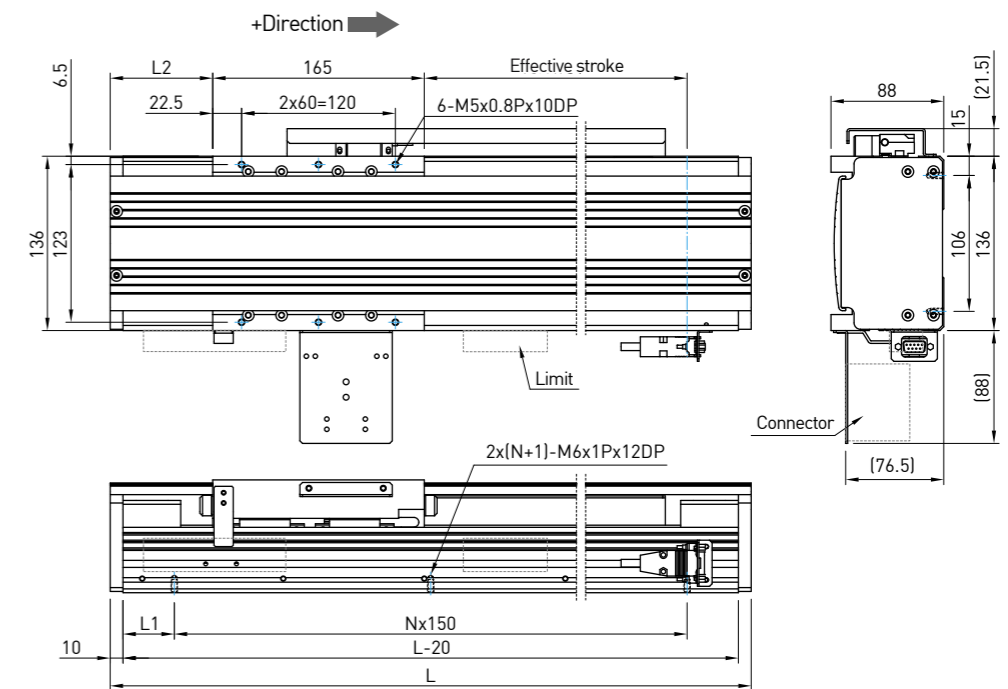
Table2-25 LMTB4 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	470	75	80	2	11
200	570	50	80	3	12.4
300	670	25	80	4	13.8
400	770	75	80	4	15.2
500	870	50	80	5	16.6
600	970	25	80	6	18
700	1110	20	100	7	19.9
800	1210	70	100	7	21.3
900	1310	45	100	8	22.7
1000	1410	20	100	9	24.1

* Absolute accuracy is after error mapping (with HIWIN drive).

■ Dimension
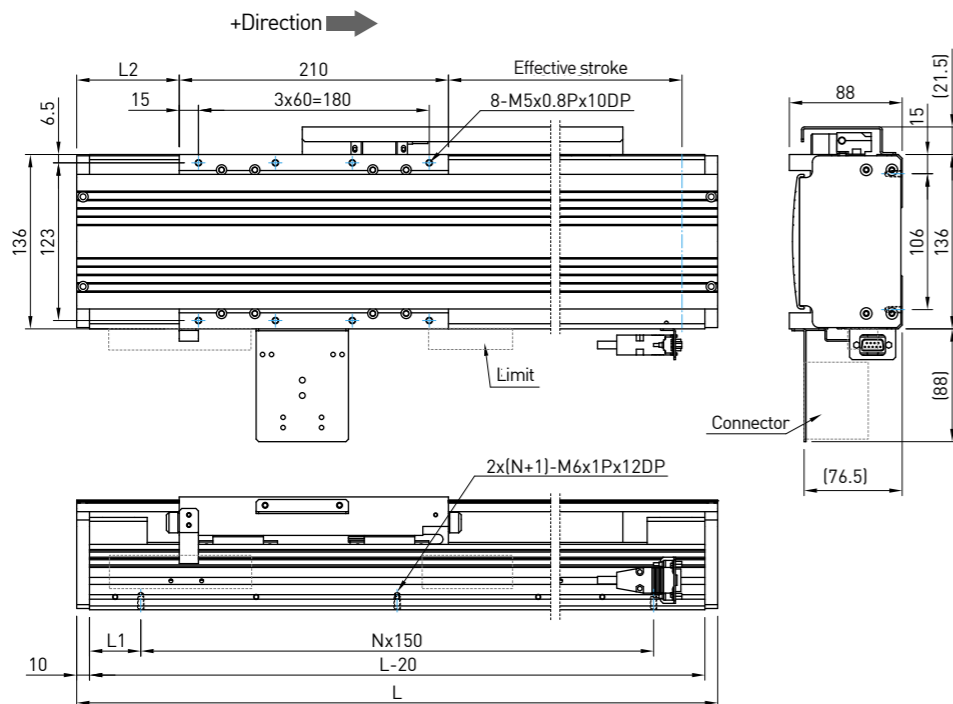
2.4.4 LMTC2 Shaft motor stage

Table2-26 LMTC2,3,4 stage specification

Specification	TC2	TC3	TC4
Continuous force,F_c (N)	92	138	184
Peak force,F_p (N)	368	552	736
Stroke (mm)	100-1000		
Resolution	1.0μm		
Repeatability (μm) *2	±1		
Accuracy (μm) *2,3	±3		
Horizontal straightness (μm)	10 / 500 mm		
Vertical straightness (μm)	20 / 500 mm		
Moving mass (kg)	4.0	5.7	6.9

Force-Velocity Curve (DC bus = 325V) *4

Acceleration-Payload Curve

*1：All values are measured on a granite table, all stage mounting holes are well fixed.
*2：Values are measured according to HIWIN measuring standard.
*3：After error compensation.
*4：The Force-Velocity Curve is the characteristic curve of the motor. The actual velocity will change with stroke, payload and acceleration.
    Please refer to the Velocity-Stroke Curve or Appendix A：Motor Sizing.
*5：All specifications above are standard, contact HIWIN for special request.

Standard

Velocity-Stroke Curve

TC2

TC3

TC4

Cantilever Load Capability*2.3

Vertical

Horizontal

Vertical

Horizontal

Table2-27 LMTC2 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	420	50	80	2	14.1
200	520	25	80	3	16.2
300	620	75	80	3	18.3
400	720	50	80	4	20.4
500	820	25	80	5	22.5
600	920	75	80	5	24.6
700	1020	50	80	6	27.5
800	1160	45	100	7	29.5
900	1260	20	100	8	31.6
1000	1360	70	100	8	33.7

* Absolute accuracy is after error mapping (with HIWIN drive).

■ Dimension

*1：All values above are standard, contact HIWIN for special request.
*2：Cantilever load capability due to different positioning stage, application rated life also vary.
*3：The main reason for lifetime derives from linear guideway. For more details, please refer to HIWIN linear guideway catalog.

Standard

Table2-28 LMTC3 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	480	80	80	2	17
200	580	55	80	3	19.1
300	680	30	80	4	21.2
400	780	80	80	4	23.3
500	880	55	80	5	25.4
600	980	30	80	6	27.5
700	1080	80	80	6	30.4
800	1220	75	100	7	32.4
900	1320	50	100	8	34.5
1000	1420	25	100	9	36.6

* Absolute accuracy is after error mapping (with HIWIN drive).

Table2-29 LMTC4 Shaft type linear motor stage specifications

Stroke (mm)	L (mm)	L1 (mm)	L2 (mm)	N	Mass (kg)
100	540	35	80	3	19.4
200	640	10	80	4	21.5
300	740	60	80	4	23.6
400	840	35	80	5	25.7
500	940	10	80	6	27.8
600	1040	60	80	6	29.9
700	1140	35	80	7	32.9
800	1280	30	100	8	34.9
900	1380	80	100	8	37
1000	1480	55	100	9	39.1

* Absolute accuracy is after error mapping (with HIWIN drive).

■ Dimension

■ Dimension

Standard

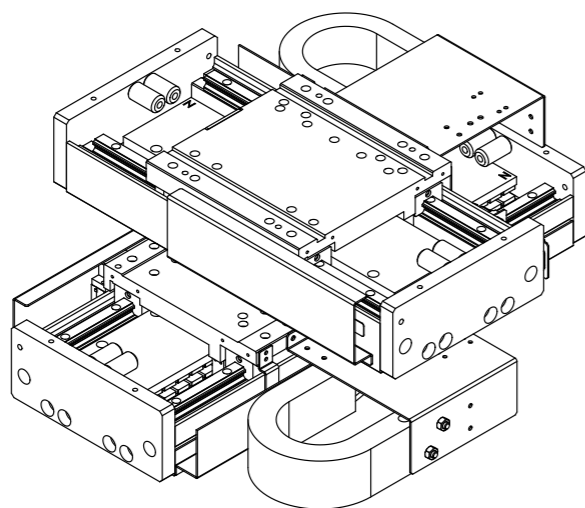# 2.5 X-Y stage

LMX1 series linear motor stages can be assembled into an X-Y stage and configured for a variety of different X and Y strokes.
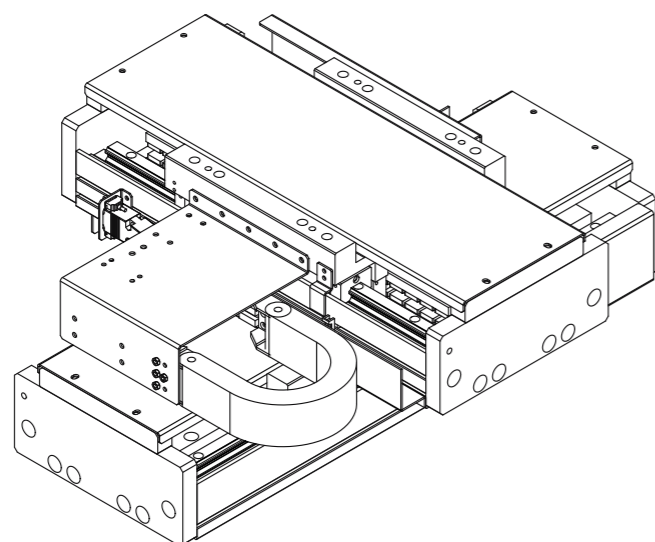
2.5.1 LMX2E-CB5-CB8 X-Y stage

- ○ High speed
- ○ No cogging
- ○ High precision
- ○ Easy to assemble
- ○ High stiffness aluminum structure
- ○ Ironless linear motor
- ○ Optical inspection

Without cover

With cover

2.5.2 X-Y stage

$$\text{LMX2E-CB5-CB8-200-300-G200}$$

Stage type
LMX2E

Upper axis motor type
CB5

Lower axis motor model
CB8

Upper axis stroke
100:100mm
200:200mm
300:300mm

Lower axis stroke
100:100mm
200:200mm
300:300mm
400:400mm

Encoder type
0:none
A:40μm analog 1Vpp optical scale
B:20μm analog 1Vpp optical scale
D:1mm analog 1Vpp magnetic scale
E:TTL digital 1μm resolution magnetic scale
G:TTL digital 1μm resolution optical scale (standard)
H:TTL digital 0.5μm resolution optical scale
K:TTL digital 0.1μm resolution optical scale
M:TTL digital 20nm resolution optical scale
P:40μm glass optical analog scale
X:Other (please remark desired specifications or product model)

Limit switch
0:None
1:Metal cover
2:Optical switch, NPN (standard)
3:Optical switch, PNP
4:Inductive type, NPN
C:Customized

Cover
0:None (standard)
A:Metal cover
B:Bellows
B:Customized
D:Non-woven

Cable chain
0:None (standard)
1:Horizontal direction (chain internal space 15x30mm)
2:Vertical direction (chain internal space 15x30mm)
C:Customized

Note：Contact HIWIN for customized specification.

Standard

Without cover

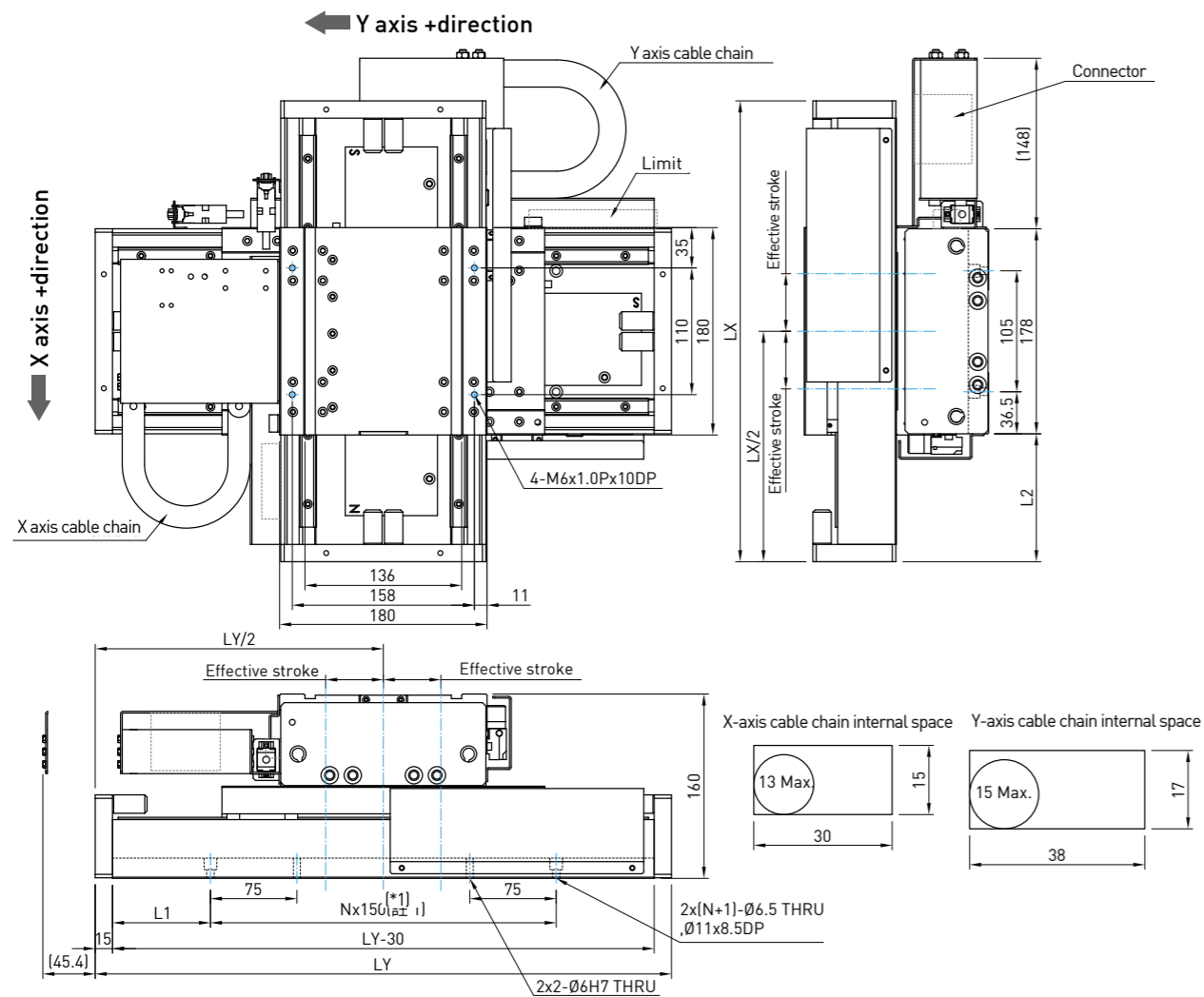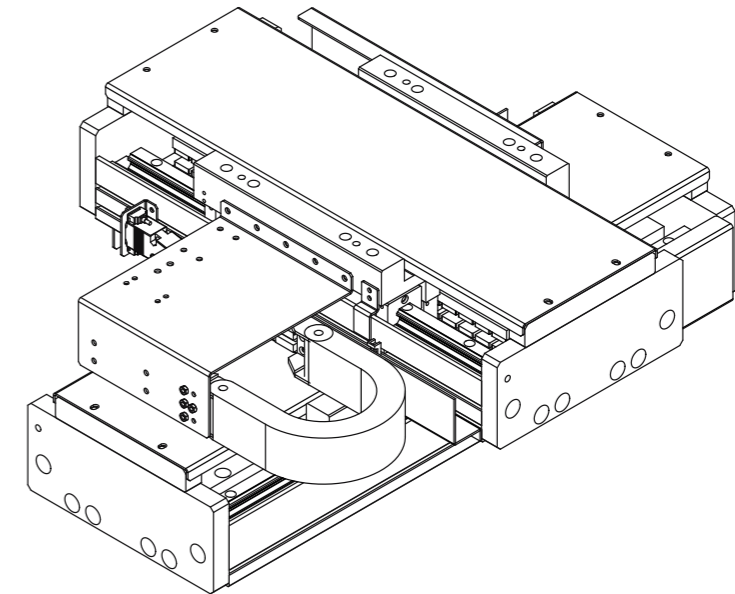**Table2-30 Without cover X-Y stage product specifications**

X-Stroke [mm]	Y-Stroke [mm]	LX [mm]	LY [mm]	L1 [mm]	L2 [mm]	N	Absolute accuracy [μm]	Resolution [μm]	Repeatability [μm]	Orthogonality [arc-sec]	X moving unit mass [Kg]	Y moving unit mass [Kg]	Mass [kg]
100	100	400	500	85	111	1*1	±3		±1	±5	2.5	20	44
100	200	400	600	60	111	3	±3		±1	±5	2.5	20	46
200	200	500	600	60	161	4	±3		±1	±5	2.5	22	48
100	300	400	700	35	111	5	±3		±1	±5	2.5	20	48
200	300	500	700	35	161	5	±3	1	±1	±5	2.5	22	50
300	300	600	700	35	211	6	±3		±1	±5	2.5	24	52
100	400	400	800	85	111	7	±3		±1	±5	2.5	20	50
200	400	500	800	85	161	7	±3		±1	±5	2.5	22	52
300	400	600	800	85	211	8	±3		±1	±5	2.5	24	54

* 1: When the stroke is 100mm, the mounting holes spacing is 300mm.
* 2: Absolute accuracy is after error mapping (with HIWIN drive).
* 3: Except resolution magnetic scale.
* 4: For higher resolution, please contact HIWIN MIKROSYSTEM.

2.5.3 LMX2E-CB5CB8 X-Ystage-cover type

Different stroke and function of dual axes stages consist of various standard single axes. This will shortens the development and mass production lead time. It can be applied in machine tool and semiconductor industry.

○ High speed
○ No cogging
○ High precision
○ Easy to assemble
○ Optical detection application
○ High rigid aluminum structure
○ Ironless linear motor

Standard

With cover type

Table2-31 With cover X-Y stage product specifications

X-Stroke (mm)	Y-Stroke (mm)	LX (mm)	LY (mm)	L1 (mm)	L2 (mm)	N	Absolute accuracy (μm)	Resolution (μm)	Repeatability (μm)	Orthogonality (arc-sec)	X moving unit mass (Kg)	Y moving unit mass (Kg)	Mass (kg)
100	100	400	500	85	111	1*1	±3		±1	±5	3	21	46
100	200	400	600	60	111	3	±3		±1	±5	3	21	48
200	200	500	600	60	161	4	±3		±1	±5	3	23	50
100	300	400	700	35	111	5	±3		±1	±5	3	21	50
200	300	500	700	35	161	5	±3	1	±1	±5	3	23	52
300	300	600	700	35	211	6	±3		±1	±5	3	25	54
100	400	400	800	85	111	7	±3		±1	±5	3	21	52
200	400	500	800	85	161	7	±3		±1	±5	3	23	54
300	400	600	800	85	211	8	±3		±1	±5	3	25	56

* 1: When the stroke is 100mm, the mounting holes spacing is 300mm.
* 2: Absolute accuracy is after error mapping (with HIWIN drive).
* 3: Except resolution magnetic scale.
* 4: For higher resolution, please contact HIWIN MIKROSYSTEM.
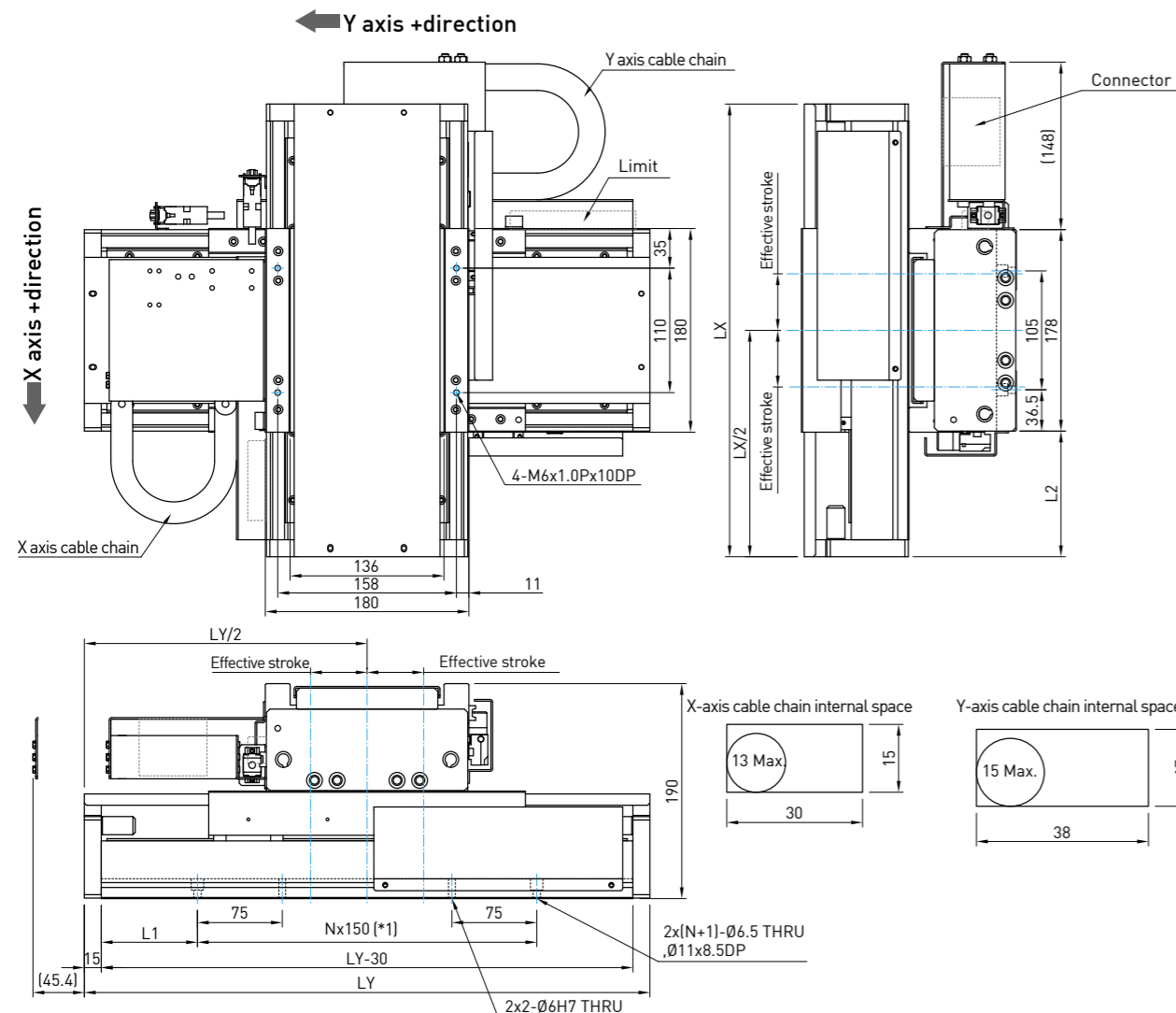
2.6 Gantry Stage

LMG2A series standardized gantry system is a unilateral drive system.
LMG2A-C applies to ironless linear motor, and LMG2A-S applies to iron core linear motor.

2.6.1 Gantry stage LMG2A-CB6-CC8

- High acceleration
- No cogging
- Low inertia
- Easy to assemble
- High stiffness aluminum gantry structure
- Equipped with ironless linear motor
- Optical detection application

Standard
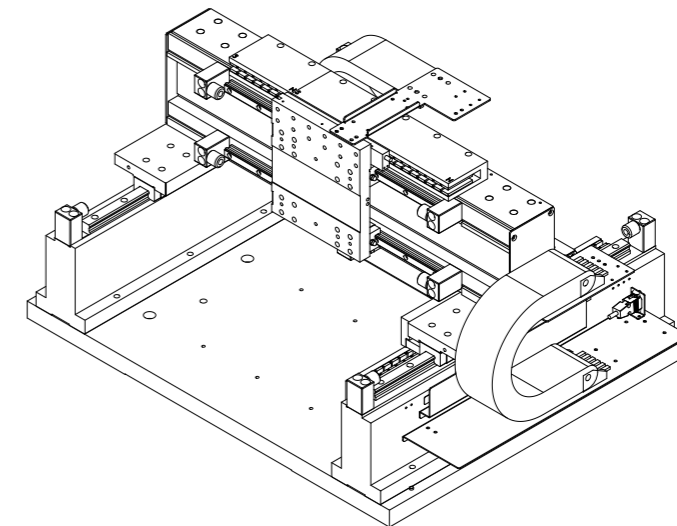
2.6.2 Gantry stage

LMG2A-CB6-CC8-300-400-G200

Stage type
LMG2A

Upper axis motor type
CB6

Lower axis motor model
CC8

Upper axis stroke
200:200mm   500:500mm
300:300mm   600:600mm
400:400mm

Lower axis stroke
100:100mm   500:500mm
200:200mm   600:600mm
300:300mm
400:400mm

Encoder type
0:none
A:40μm analog 1Vpp optical scale
B:20μm analog 1Vpp optical scale
D:1mm analog 1Vpp magnetic scale
E:TTL digital 1μm resolution magnetic scale
G:TTL digital 1μm resolution optical scale (standard)
H:TTL digital 0.5μm resolution optical scale
K:TTL digital 0.1μm resolution optical scale
M:TTL digital 20nm resolution optical scale
P:40μm glass optical analog scale
X:Other (please remark desired specifications or product model)

Limit switch
0:None
1:Metal cover
2:Optical switch, NPN (standard)
3:Optical switch, PNP
4:Inductive type, NPN
C:Customized

Cover
0:None (standard)
A:Metal cover
B:Bellows
B:Customized
D:Non-woven

Cable chain
0:None (standard)
1:Horizontal direction (chain internal space 15x30mm)
2:Vertical direction (chain internal space 15x30mm)
C:Customized

Note：Contact HIWIN for customized specification.

Table2-31 Gantry stage LMG2A product specifications

X-Stroke [mm]	Y-Stroke [mm]	W [mm]	W1 [mm]	W2 [mm]	W3 [mm]	N	L [mm]	L1 [mm]	Absolute accuracy [μm]	Resolution [μm]	Repeatability [μm]	Orthogonality [arc-sec]	X moving unit mass [Kg]	X moving unit mass [Kg]	Mass [kg]
200	200	740	440	817	110	2	600	100	±9		±3	±5	5	31	50
300	300	840	540	917	135	3	700	50	±9		±3	±5	5	35	52
400	400	940	640	1017	160	3	800	100	±12	1μm	±4	±5	5	39	54
500	500	1040	740	1117	185	4	900	50	±12		±4	±5	5	43	54
600	600	1140	840	1217	210	4	1000	100	±12		±4	±5	5	47	56

* 1: Absolute accuracy is after error mapping (with HIWIN drive).
* 2: Except resolution magnetic scale.
* 3: For higher resolution, please contact HIWIN MIKROSYSTEM.

Standard
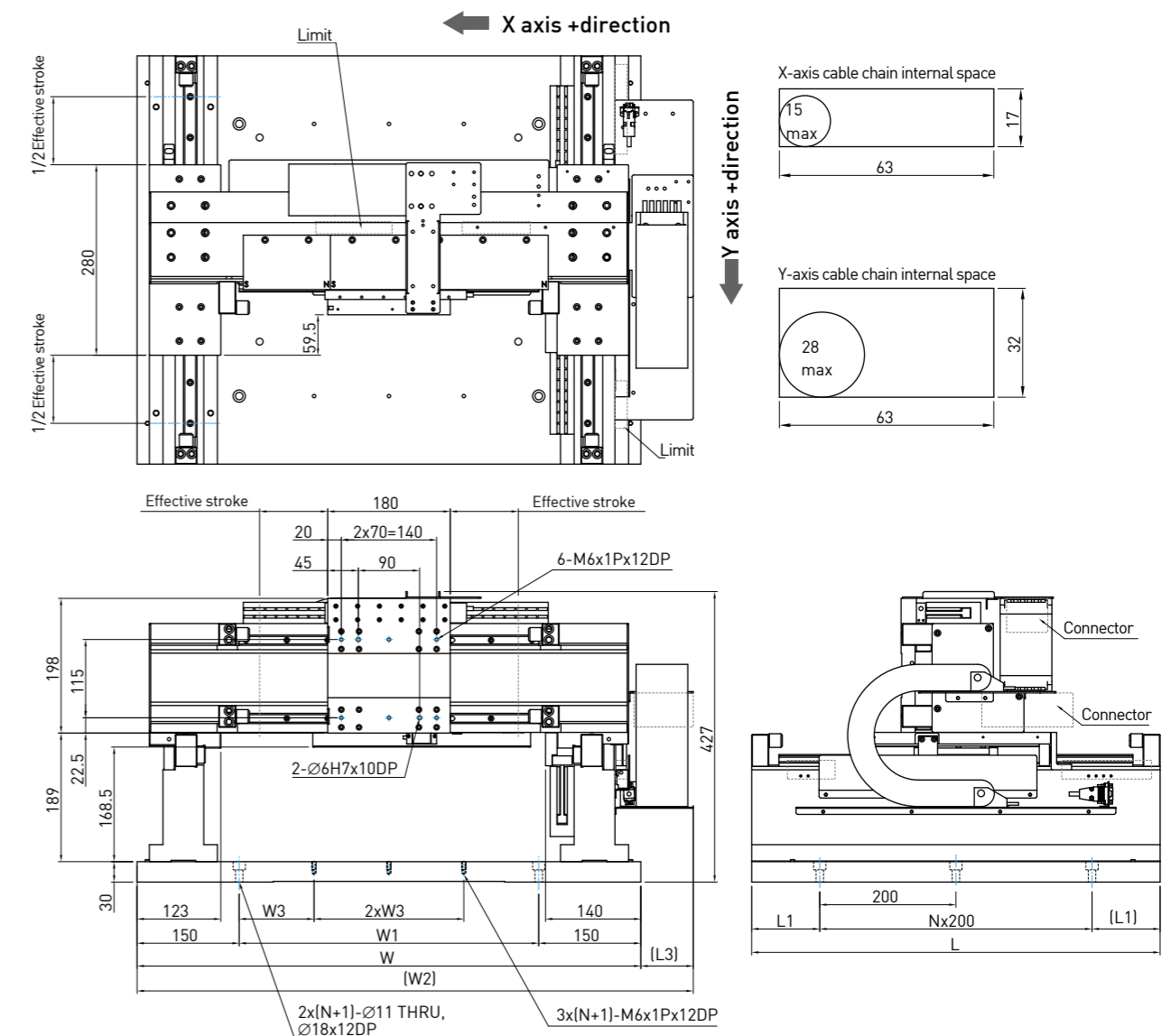
2.7 Air bearing stage

2.7.1 Non-contact air bearing stage LMAS

- Non-contact air bearing provides better positioning accuracy
- Embedded magnetic preloading design, enhance stability
- Provide extremely smooth motion and rapid settling time
- Equipped with ironless linear motor, no cogging
- High resolution feedback with linear optical encoder
- Equipped with high flexible cable
- For clean room, no need to lubricate and easy to maintain
- Low velocity ripple
- Available for precision positioning, calibration systems, scanning applications, wafer inspection

Table2-33 LMAS product specifications
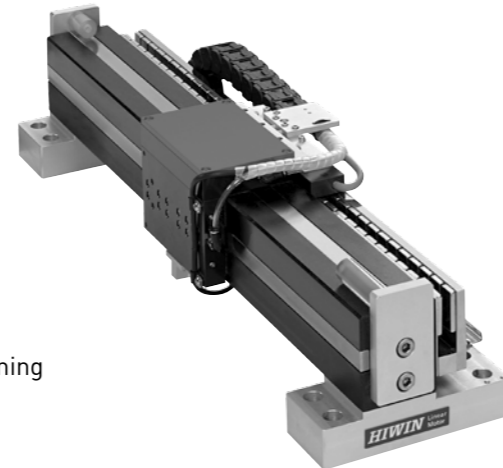
Specifications	Unit	AS200	AS400	AS600	AS800	AS1000
Stroke	mm	200	400	600	800	1000
Motor type	-	LMCB8				
Bus voltage	V	Up to 325 VDC				
Instant current	A(pk)	6				
Continuous current	A(rms)	2.0				
Feedback system	-	Optical Linear Encoder: Analog period 20μm				
Resolution*1	μm	4				
Repeatability	μm	±0.3	±0.4	±0.4	±0.5	±0.5
Positioning accuracy*2	μm	±3.0	±4.0	±4.0	±5.0	±5.0
Horizontal straightness*3	μm	±1.0	±1.0	±1.5	±2.0	±2.5
Vertical straightness*3	μm	±1.0	±1.0	±1.5	±2.0	±2.5
Pitch*3	arc-sec	±2.0	±2.5	±3	±3.5	±4
Yaw*3	arc-sec	±2.0	±2.5	±3	±3.5	±4
Roll*3	arc-sec	TBD				
Allowable payload	kg	10				
Max. speed*4*5	m/s	1	1.2	1.4	1.6	2
Max. acceleration*5	m/s²	10	11	12	13	14
Working pressure*6	N/m²	4×10^5 N/m² ± 2×10^4 N/m²				
Moving unit mass*7	kg	8				
Moving unit material	-	Aluminum (hardened anodized)				
Base	-	Granite				

*1: The maximum resolution is up to 4096 times, resolution accuracy is about 4 nm
*2: Absolute accuracy is after error mapping.
*3: Required specification is restricted by load, this specification is based on empty load
*4: Must comply with the resolution of encoder and the number of mass transfer rate
*5: Based on the limitations of motor instantly force, only allow moving unit mass about 8Kg (center load)
*6: It is recommended to link pressure switch on the emergency stop devices to protect air bearing from overloading
*7: Free of load
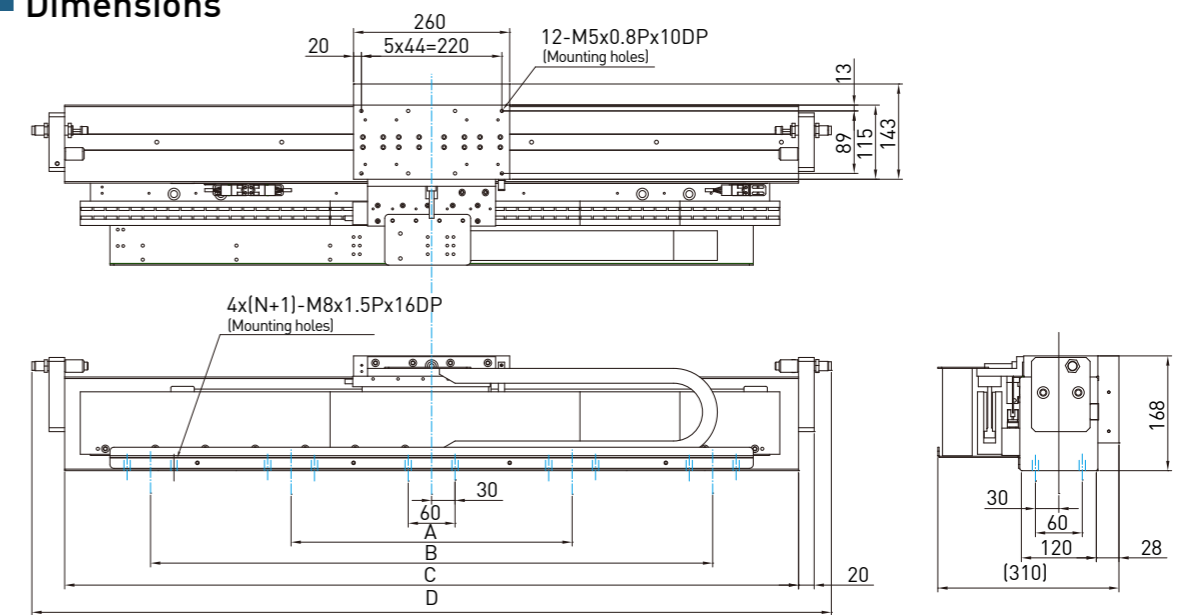
Dimensions

Type	Stroke	Dimensions				
		A	B	C	D	N
AS200	200	280	-	526	619	2
AS400	400	480	-	726	819	2
AS600	600	580	-	926	1019	2
AS800	800	440	880	1126	1219	4
AS1000	1000	540	1080	1326	1419	4

Standard

2.7.2 Air bearing stage LMAP series

Low profile, XY symmetric structure design, with high stiffness granite base magnetic preload designed to enhance stability, with excellent geometrical property; applies ironless linear motor, no cogging to parid setting time, that provides excellent smooth motion and positioning accuracy; strong beam design uses high stiffness lightweight aluminum, reduces weight of moving unit; gantry dual-drive structure and use of two sets of optical linear encoder for feedback compensation, offers dynamic control and error mapping; for clean room, no lubrication for easy maintenance and provides high flexible cable management.

■ Applications

- Wafer inspection system
- Micromachining system
- Laser lithography
- Semiconductor inspection system
- Exposure system
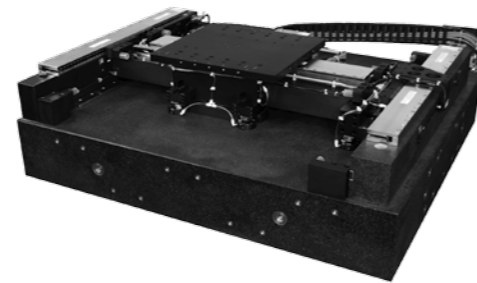
Tabke2-34 LMAP series product specification

Basic model		Unit	AP250	AP450	AP650
Stroke		mm	250x250	450x450	650x650
Motor specification		-	Beam axis: LMCC8 Gantry axes: LMCB8 x 2		
Bus Voltage		V	Up to 325 VDC		
Instant current		A(pk)	6.0		
Continuous current		A(rms)	2.0		
Feedback system		-	Optical Linear Encoder: Analog period 40µm glass scale		
Resolution*1		µm	10		
Repeatability		µm	±0.5	±0.5	±0.5
Positioning accuracy*2		µm	±1.5	±1.5	±1.5
Horizontal straightness*3		µm	±1.5	±2	±2.5
Vertical straightness*3		µm	±1.5	±2	±2.5
Orthogonality		arc-sec	±2.5	±2.5	±3.5
Pitch*3		arc-sec	±6	±8	±12
Yaw*3		arc-sec	±1.5	±2	±2.5
Roll*3		arc-sec	TBD		
Allowable load		kg	30		
Max. speed*4*5		m/s	0.6	0.8	1
Max. acceleration*5		m/s^2	4	4.5	5
Working pressure*6		N/m^2	$4x10^5$ N/m^2 ± $2x10^4$ N/m^2		
Moving unit mass*7	Bridge	kg	30		
	Gantry	kg	75	85	95
Moving unit material		-	Aluminum (hardened anodized)		
Base		-	Granite		

*1: The maximum resolution is up to 4096 times, resolution accuracy is about 4 nm
*2: Error after compensation
*3: Required specification is restricted by load, this specification is based on empty load
*4: Must comply with the resolution of encoder and the number of mass transfer rate
*5: Based on the limitations of motor instantly force, only allow moving unit mass about 8Kg (center load)
*6: It is recommended to link pressure switch on the emergency stop devices to protect air bearing from overloading
*7: Free of load
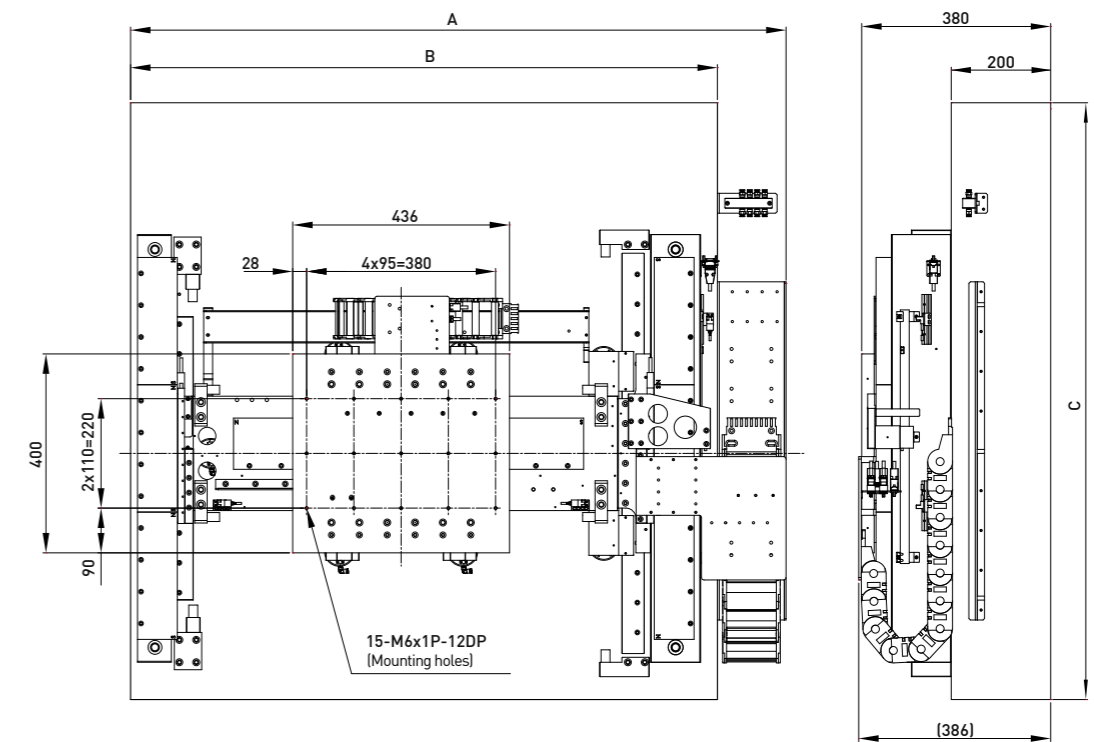
■ Dimensions

Type	Stroke	Dimensions		
		A	B	C
AP250	250x250	1168	1030	1100
AP450	450x450	1368	1230	1300
AP650	650x650	1568	1430	1500

Standard

3 Customized Positioning Systems

The standardized positioning axes presented in this catalogue make it possible to handle many kinds of positioning tasks.For positioning tasks, that cannot be solved using standard axes, HIWIN engineers are able to work out an optimized solution for customers. The inquiry form at the end of this catalogue serves to help our application engineers make a preliminary design.

A sampling of customized solutions is shown here. In several examples, mechanics are not the only parts customized. For instance, with the planar motors, special software is developed in order to obtain optimal integration of the positioning system to the production process.

3.1 Examples

Economical Pick & Place and Inspection
XY gantry systems are economical for many applications. Gantry axes are assembled from standard components.

- Standard axes of the LMX1L series
- Repeatability ± 2 μm
- Delivery with base frame

Microshapes and Macroshapes
Milling of microstructures with cutting tools and lasers are application areas in which gantry systems excel. They are also very economical to implement.

- Ironless motors LMC
- Repeatability ± 2 μm
- Technology proven through countless worldwide installations
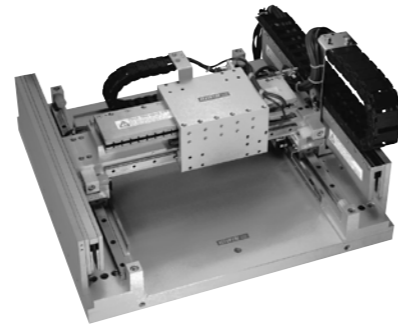
Planar Motors
Servo-planar motors provide an excellent technological stage for inspection tasks. During inspection of circuit boards, optical sensors are integrated to completely monitor the printed conductive tracks and SMD components.

- Virtually no wear due to an air bearing
- Guaranteed levelness for the complete stroke path (up to 1000 mm x 1000 mm)
- Repeatability ± 3 μm
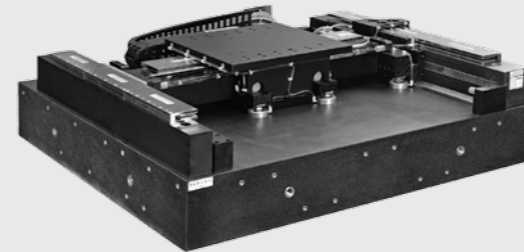
Semiconductor inspection and exposure
High precision cross stages with air-bearings are the prerequisites for surface monitoring and mask production, to find even the smallest errors, to produce precision masks, in wafer production for the electronics, chip and flat panel industries.

- Stroke 500 mm x 500 mm
- Vertical straightness
- Repeatability ±0.5 μm
- Accuracy ±1.5 μm
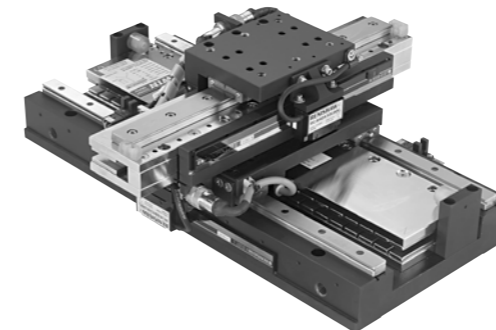
Microsystem Technology and Wafer Processing
Absolute precision and suitability for clean room conditions are the prerequisites for every drive in microsystem technology and wafer processing. Linear motor cross stages meet these requirements.

- Stroke 200 mm x 200 mm, optional 300 mm x 300 mm
- Levelness ± 4 μm across the complete stroke
- Repeatability ± 1 μm across both axes
- Accuracy ± 4 μm across both axes
- Clean room suitability class 100; optional class 10

Laser Scanners
Extremely smooth motion and long operating life are a must for optical inspection systems such as laser scanners. Linear motor stages with air bearings fulfill these requirements.

- Air bearing system without friction
- Ironless linear motors are not effected by cogging.
- Stroke up to 1,500 mm

Horizontal High-Speed Hot Weld Machine for Welding Synthetic Materials
Linear motor stages of the LMX1L series with absolute position measurement offer:

- Rapid initialization phase
- material when removed from the heated plate
- Welding is controlled by time, force and path
- Rapid load/unload system

Water Jet Application

LMSA multi-forcer linear stage provides 2.5m stroke and carries two HIWIN KK stages on the Z-axis. The lower 2 axes are also equipped with LMS high force liner motors and run under synchronization.

- No commutation required at power up
- Long stroke
- Delivered with base frame, cover and precision motion controller
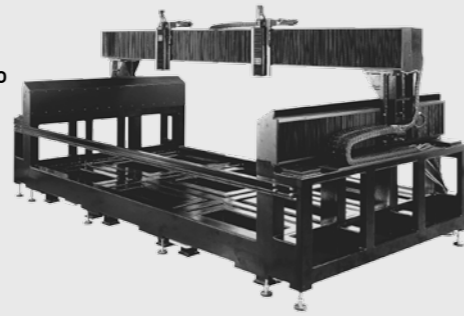
Total Solution for AOI Industry

LMC linear stage provides smooth motion for the special requirement in AOI applications. With the LMS linear stage mounted to the upper axis, the ballscrew driven Z-axis integrated with a CCD camera can attain high speeds.

- Repeatability ±1 μm
- Velocity ripple below 1.5 %
- Delivery with base frame and cover

Customized for Glass Working

The linear motor stage is designed to carry a working head to move above the flat table. The customer's laser head is for cutting double layer glasses.

- Gantry structure linear motor positioning stage for Gen. 5 glass
- 1300 mm x 1450 mm stroke
- Smooth motion
- Sinusoidal commutation and no cogging
- LMC series motors
- Repeatablility ±2 μm
- Rigid base structure

Provide motion plan for customer

This is another AOI application, where customer needed high cost–performance ratio.

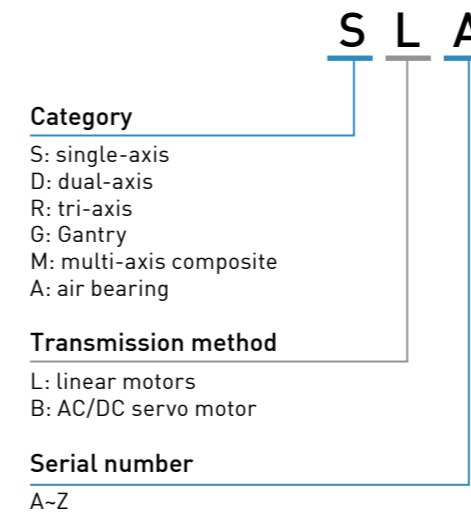- Stroke 534mm x 534mm
- LMSA type gantry
- Special synchrnous control for gantry
- Steel base frame
- Integrating PCB conveyor, PLC, IPC for customers
- Sub-micron repeatability
- Promising move and settle time 40mm within 200ms to ±1.5 μm
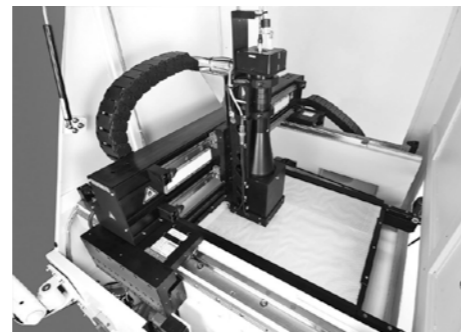
3.2 General type positioning stage

HIWIN offers a variety of customized positioning stages to satisfy customer requirements in a variety of technical fields, such as optical inspection, laser processing, plastic material coating, metal processing and other automated production equipment. Application industries include semiconductor industry, Optical elements, panel displays, medical equipment, machine tools, electronic components, MEMS and so on. Specifications diversification and the ability for rapid customization are combined to fully meet customer needs for mass production, a shorted product development process and strict environmental requirements.

■ Model code description

S L A

Category

S: single-axis
D: dual-axis
R: tri-axis
G: Gantry
M: multi-axis composite
A: air bearing

Transmission method

L: linear motors
B: AC/DC servo motor

Serial number

A~Z

Note1：Contact HIWIN for customized specification.

Note2: Starting from April 2016, users of LMS series linear motor positioning stage products, will be fully converted to LMSA series motors.

Customized

3.2 SLA series

- Max. velocity 5 m/s (no load).
- Max. stroke up to 6,000 mm or more.
- High stiffness structure.
- Suitable for point-to-point motion.
- Can be equipped with ironcore motor.
- With a special chain design, it can be installed upside down.
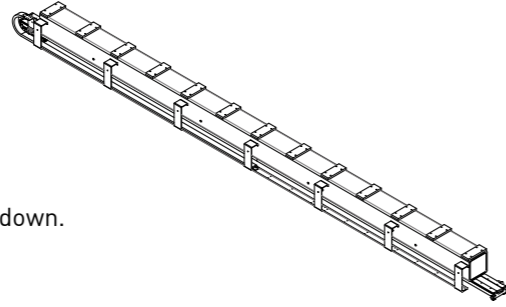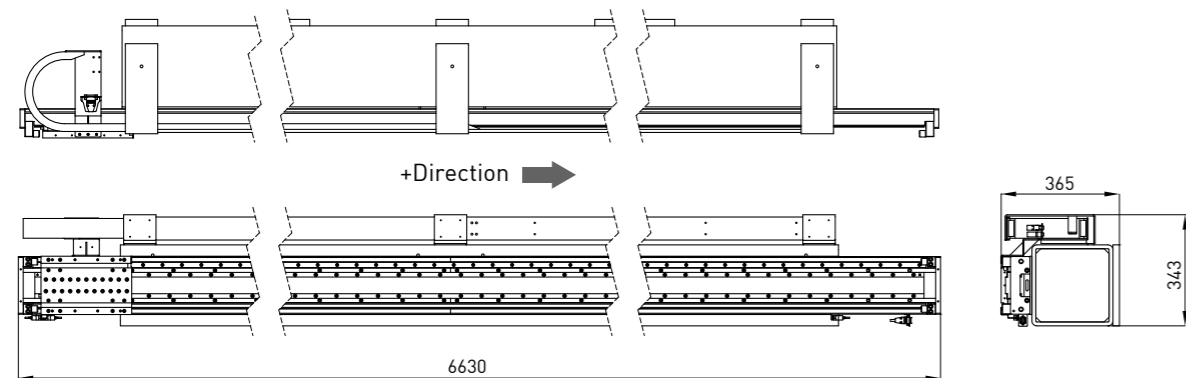
3.2.1 Industry applications

Automation equipment, glass substrate moving equipment

3.2.2 Performance specifications

| Table3-1 **LMX1L-S27-6200-X202 product specification**	
Stage type	**LMX1L-S27-6200-X202**
Motor specifications	Ironcore motor (can select ironless motor)
Stroke (mm)	6200
Max. force (N)/Continuous force(N)	1017/382
Repeatability (μm)	±15 (apply HIWIN measurements)
Max. acceleration (m/s²)	10 (with Payload)
Max. speed (m/s)	2 (with Payload)
Payload (kg)	5
Stage orientation	Upside down

Note：All specifications can be designed according to customer demand.

+Direction

365
343
6630

3.3 SLB series

- High stiffness design of base.
- Milt-forcer design.
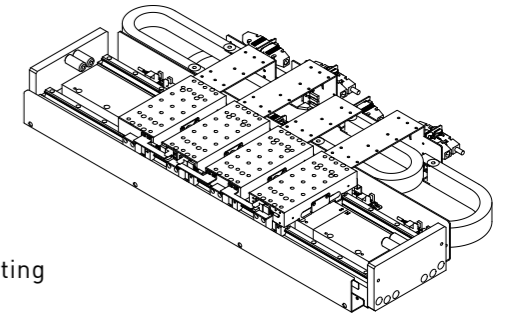
3.3.1 Industry applications

Large-scale inkjet printer, glass substrate/PCB board testing equipment, glass substrate exposure equipment

3.3.2 Performance specifications
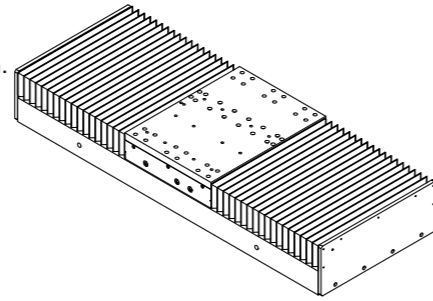
Table3-2 **LMX1C-CB2-4-290 product specification**	
Stage type	**LMX1C-CB2-4-290**
Motor Type	Ironless(/Ironcore) motor
Stroke(mm)	290
Peak Force(N)/Continuous Force(N)	144/36
Repeatability(μm)	±1(with HIWIN solution)
Accuracy(μm)	±3(after error mapping)
Max. Acceleration(m/s²)	0.05(with payload)
Max. Velocity(m/s)	0.05(with payload)
Payload(kg)	25
Stage orientation	Side-Mount

Note：All specifications can be designed according to customer demand.

+Direction

94.5
790
(800.5)
412.5

Customized
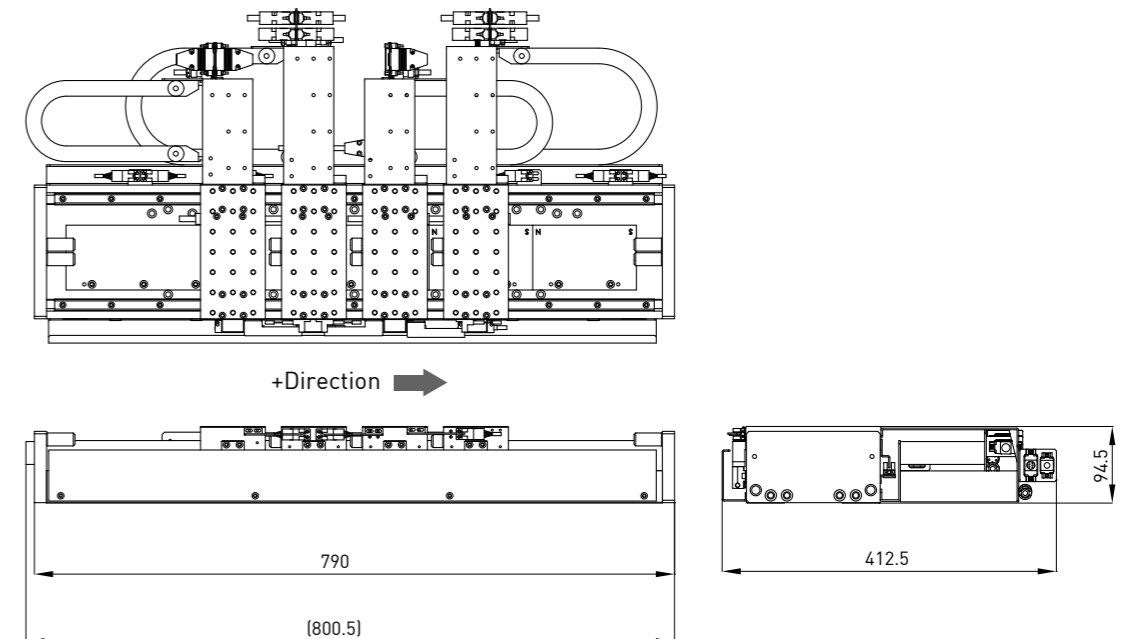
3.4 SLC series

- Uses dust-proof design.
- Uses granite base, high stiffness.
- Not easily influenced by environmental temperature.
- Can be equipped with ironless or ironcore motor.
- Horizontal straightness and vertical straightness up to ±3 μm/m.
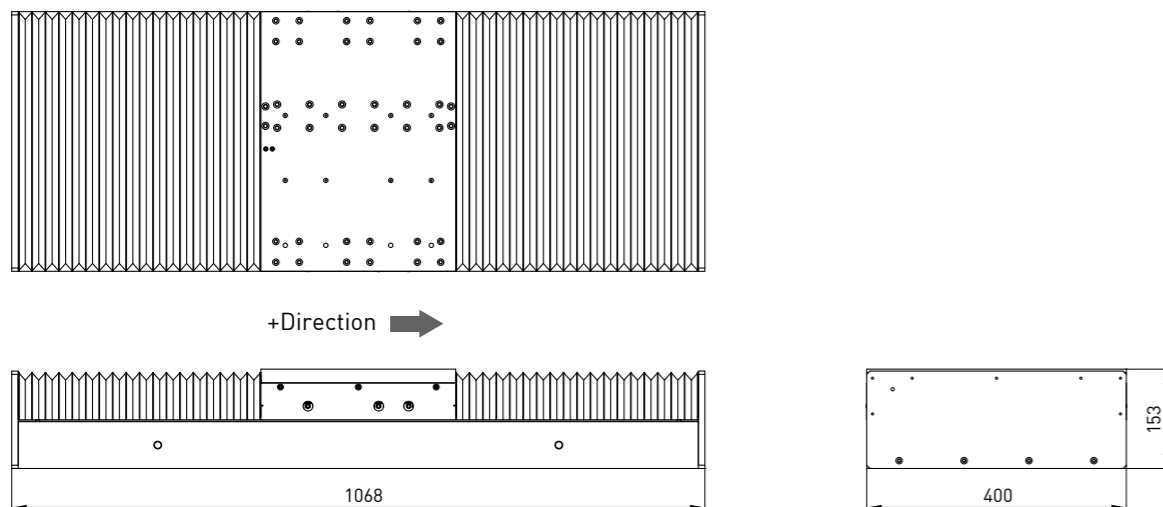- Design with hidden cable chain.

3.4.1 Industry applications

Automation equipment, laser cutting applications

3.4.2 Performance specifications
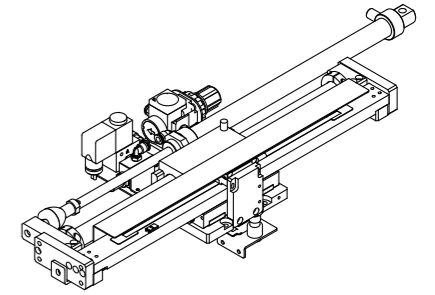
Table3-3 LMX1C-S27-1-460 product specification

Stage type	LMX1C-S27-1-460
Motor Type	Ironcore(/Ironless) motor
Stroke(mm)	460
Peak Force(N)/Continuous Force(N)	1017/382
Repeatability(μm)	±1(with HIWIN solution)
Accuracy(μm)	±3(after error mapping)
Max. Acceleration(m/s²)	5(with payload)
Max. Velocity(m/s)	1(with payload)
Horizontal Straightness(μm)	±3
Vertical Straightness(μm)	±3
Payload(kg)	30
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

+Direction

1068

153

400

3.5 SLD series

- Vertical Applications.
- Integrate adjustable pneumatic counterweight module.
- Equipped with ironless motor.
- In line with the smaller space requirements.
- High-speed, lightweight design.

3.5.1 Industry applications

Automation equipment, high-speed pick and place feeding equipment, electronic component assembly equipment

3.5.2 Performance specifications

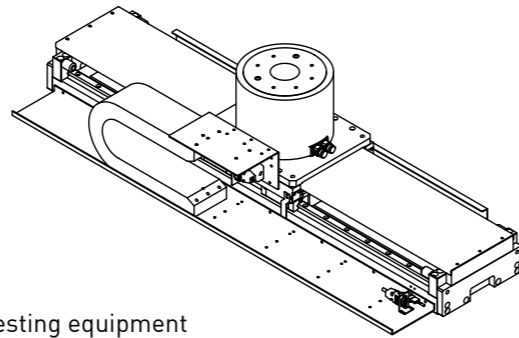**Table3-4 LMX1C-TA2-1-260 product specification**

Stage type	LMX1C-TA2-1-260
Motor Type	Ironless motor
Stroke(mm)	260
Peak Force(N)/Continuous Force(N)	108/27
Repeatability(μm)	±2(with HIWIN solution)
Accuracy(μm)	±6(after error mapping)
Max. Acceleration(m/s²)	10(with payload)
Max. Velocity(m/s)	1(with payload)
Payload(kg)	0.5
Stage orientation	Vertical

Note：All specifications can be designed according to customer demand.

(580.2) +Direction

(180.5)

(183.4)

Customized
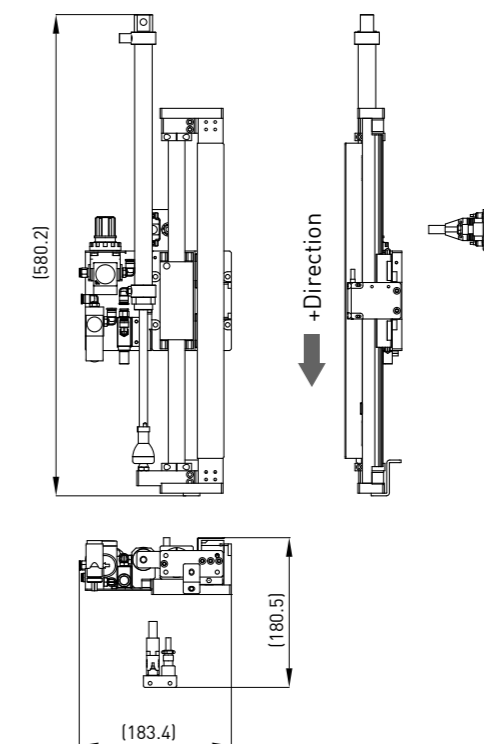
3.6 SLE series

- Integration of high-precision torque motor.
- Precision compensation and angular positioning.
- Simple structure, wide range of applications
- High stiffness extruded aluminum structure.
- High-speed, point-to-point motion.
- Can be equipped with ironless or ironcore motor.
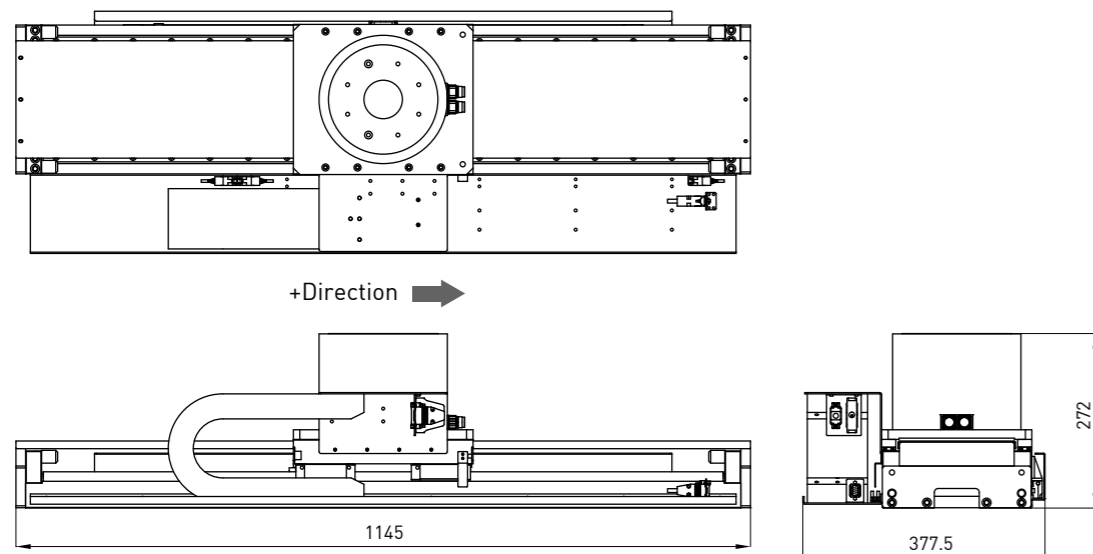
3.6.1 Industry applications

Automation equipment, touch panel coating equipment, AOI testing equipment

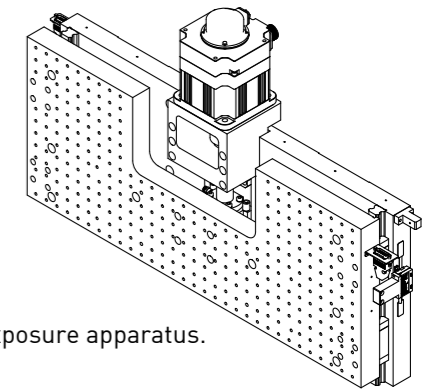### 3.6.2 Performance specifications

Table3-5 **LMX1C-S47-1-700+TMS34 product specification**

Stage type	LMX1C-S47-1-700+TMS34
Motor Type	Ironcore(/Ironless) motor
Stroke(mm)	700
Peak Force(N)/Continuous Force(N)	1953/733
Repeatability(μm)	±1(with HIWIN solution)
Accuracy(μm)	±3(after error mapping)
Max. Acceleration(m/s²)	10(with payload)
Max. Velocity(m/s)	1(with payload)
Payload(kg)	15
Stage orientation	Horizontal
Torque Motor Type	TMS34
Peak Torque(Nm)/Continuous Torque(Nm)	60/20
Max. Velocity(rpm)	500(220V)
Repeatability(arc-sec)	±2.5
Accuracy(arc-sec)	±25
Inertia of rotation parts(kgm²)	0.02

Note：All specifications can be designed according to customer demand.

+Direction

1145

272

377.5

3.7 SBF series

- Vertical applications.
- High load capacity of up to 200 kg.
- Linear feedback system can be applied,high positioning accuracy, zero backlash.
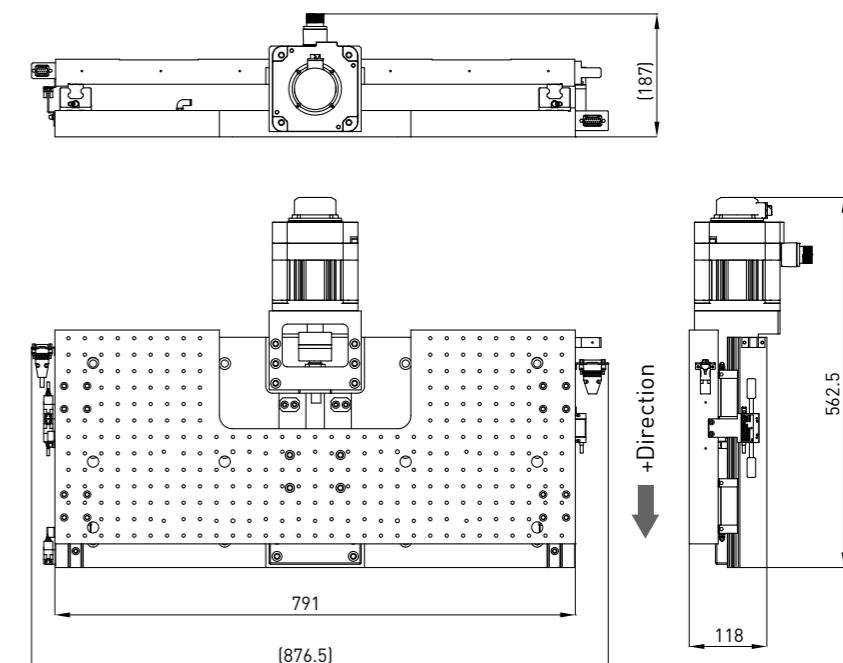
3.7.1 Industry applications

Automation equipment, touch panel coating equipment, AOI testing, exposure apparatus.

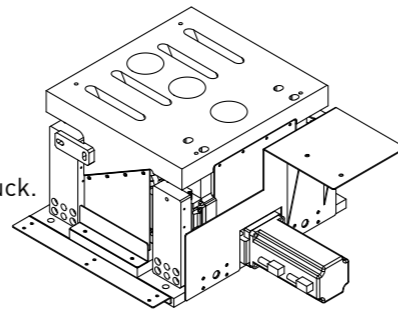### 3.7.2 Performance specifications

Table3-6 **BS-2-50 product specification**

Stage type	BS-2-50
Motor Type	HIWIN AC Servo motor
Stroke(mm)	50
Ball screw lead(mm)	2
Repeatability(μm)	±1(with HIWIN solution)
Accuracy(μm)	±3(after error mapping)
Max. Acceleration(m/s²)	2(with payload)
Max. Velocity(m/s)	0.05(with payload)
Horizontal Straightness(μm)	±2
Vertical Straightness(μm)	±10
Payload(kg)	200
Stage orientation	Vertical

Note：All specifications can be designed according to customer demand.

[187]

+Direction

562.5

791

[876.5]

118

Customized

3.8 SBH series

- High stiffness oblique wedge structure.
- Vertically precision positioning.
- High load capacity.
- Large installation area,can be equipped with large-size vacuum chuck.

3.8.1 Industry applications

Exposure apparatus, the touch panel lamination equipment, laser cutting, AOI testing equipment.

3.8.2 Performance specifications

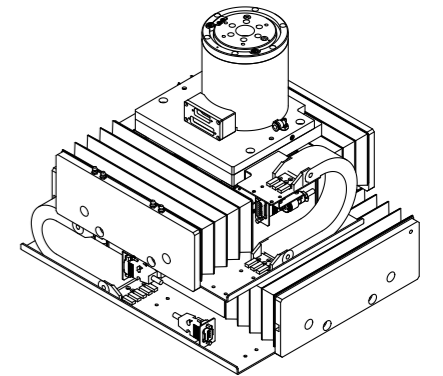**Table3-7 BS-2-12 product specification**

Stage type	BS-2-12
Motor Type	HIWIN AC Servo motor
Stroke(mm)	12
Ball screw lead(mm)	2
Repeatability(μm)	±2.5(uni-direction, with HIWIN solution)
Accuracy(μm)	±10(uni-direction,after error mapping)
Max. Acceleration(m/s²)	Vertical：0.5, Horizontal：0.87(with payload)
Max. Velocity(m/s)	Vertical：0.02, Horizontal：0.035(with payload)
Payload(kg)	35
Stage orientation	Horizontal
Note：All specifications can be designed according to customer demand.	
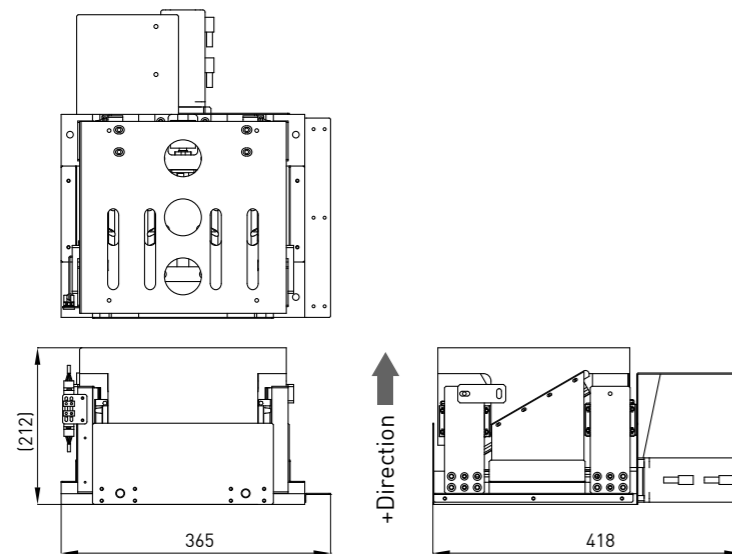
3.9 DLA series

- Integration of high-precision torque motor.
- XY positioning with high precision angular compensation.
- Use dust-proof design.
- High stiffness extruded aluminum structure.
- Can be equipped with ironless or ironcore motor.
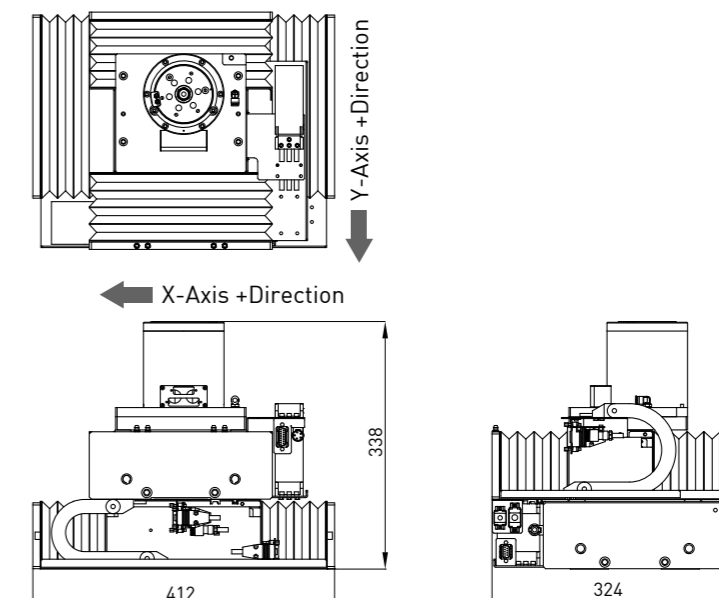
3.9.1 Industry applications

3D measuring equipment, glass substrate chamfering devices, glass substrate/PCB testing equipment.

3.9.2 Performance specifications

**Table3-8 LMX2C-CB4CB7-50-50+TMS03 product specification**

Stage type	LMX2C-CB4CB7-50-50+TMS03
Motor Type	Ironless(/Ironcore) motor
Stroke(mm)	50
Peak Force(N)/Continuous Force(N)	X-axis：512/128, Y-axis：292/73
Repeatability(μm)	±1(with HIWIN solution)
Accuracy(μm)	±5(after error mapping)
Max. Acceleration(m/s²)	X-axis：5, Y-axis：5(with payload)
Max. Velocity(m/s)	X-axis：0.4, Y-axis：0.2(with payload)
Payload(kg)	5
Stage orientation	Horizontal
Torque Motor Type	TMS03
Peak Torque(Nm)/Continuous Torque(Nm)	9.3/3.1
Max. Velocity(rpm)	500(220V)
Repeatability(arc-sec)	±3
Accuracy(arc-sec)	±45
Inertia of rotation parts(kgm²)	0.003

Note：All specifications can be designed according to customer demand.

Customized

(212)

365

+Direction

418

Y-Axis +Direction

X-Axis +Direction

338

412

324

3.10 DLB series

- Upside down applications.
- Suitable for point-to-point motion.
- High stiffness extruded aluminum structure.
- Can be equipped with ironless or ironcore motor.
- Wide range of applications.
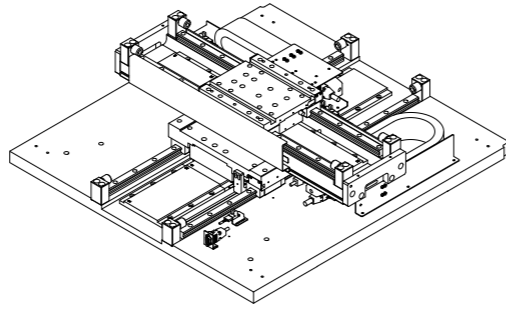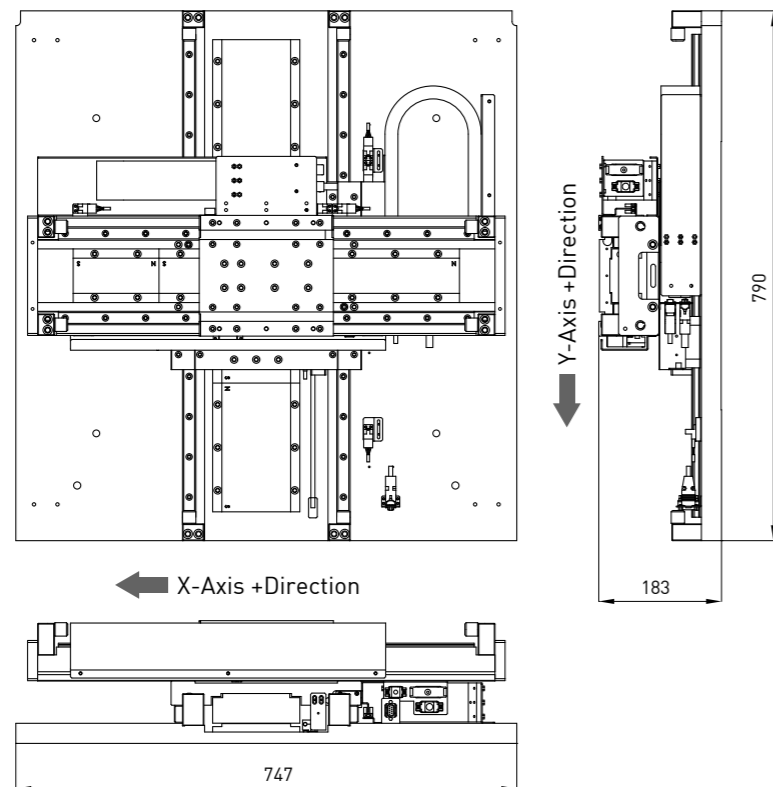
3.10.1 Industry applications

Automation equipment, AOI inspection applications, Wafer cutting applications.ations, Wafer cutting applications.

3.10.2 Performance specifications

Table3-9 LMX2C-S23S47L-362-390 product specification

Stage type	LMX2C-S23S47L-362-390
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：362, Y-axis：390
Peak Force(N)/Continuous Force(N)	X-axis：639/240, Y-axis：1953/733
Repeatability(μm)	±2(with HIWIN solution)
Accuracy(μm)	±4(after error mapping)
Max. Acceleration(m/s²)	10(with payload)
Max. Velocity(m/s)	1(with payload)
Payload(kg)	10
Stage orientation	Upside down

Note：All specifications can be designed according to customer demand.

Y-Axis +Direction

790

183

X-Axis +Direction

747

3.11 DLC series

- Suitable for High-speed scanning and rapid positioning motion.
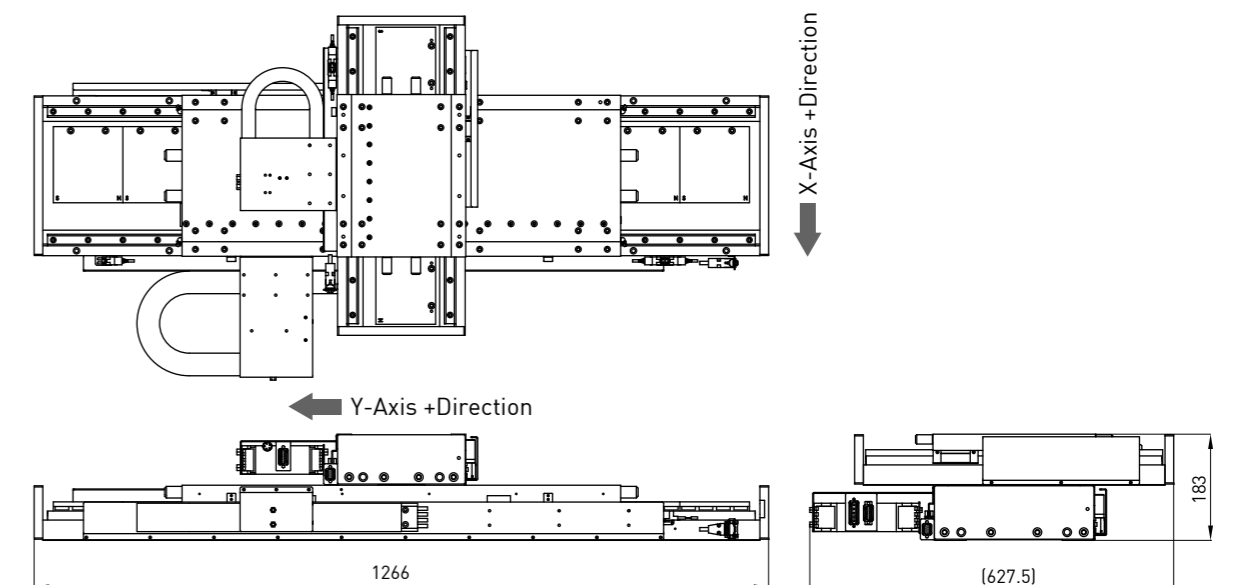- Simple structure and wide range of applications.
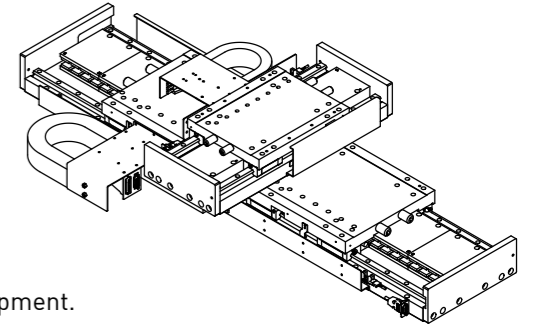
3.11.1 Industry applications

Biomedical testing equipment, electronic components plug-in equipment.

3.11.2 Performance specifications

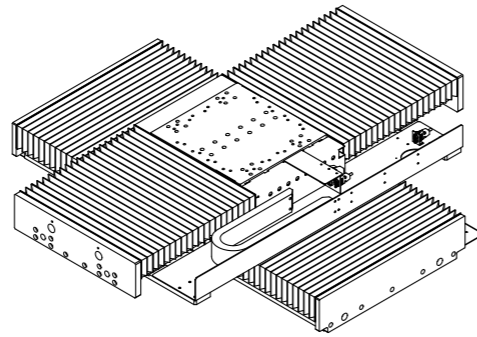**Table3-10 LMX2C-CC8CFC-150-400 product specification**

Stage type	LMX2C-CC8CFC-150-400
Motor Type	Ironless(/Ironcore) motor
Stroke(mm)	X-axis：150, Y-axis：400
Peak Force(N)/Continuous Force(N)	X-axis：780/195, Y-axis：2736/684
Repeatability(μm)	±2(with HIWIN solution)
Accuracy(μm)	±5(after error mapping)
Max. Acceleration(m/s²)	X-axis：10, Y-axis：10(with payload)
Max. Velocity(m/s)	X-axis：1, Y-axis：1(with payload)
Payload(kg)	10
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

X-Axis +Direction

Y-Axis +Direction

1266

183

(627.5)

Customized

3.12 DLD series

- Suitable for point-to-point motion.
- Vertical straightness up to ±4 μm.
- Use dust-proof design.
- High load capacity.
- Simple structure and wide range of applications.
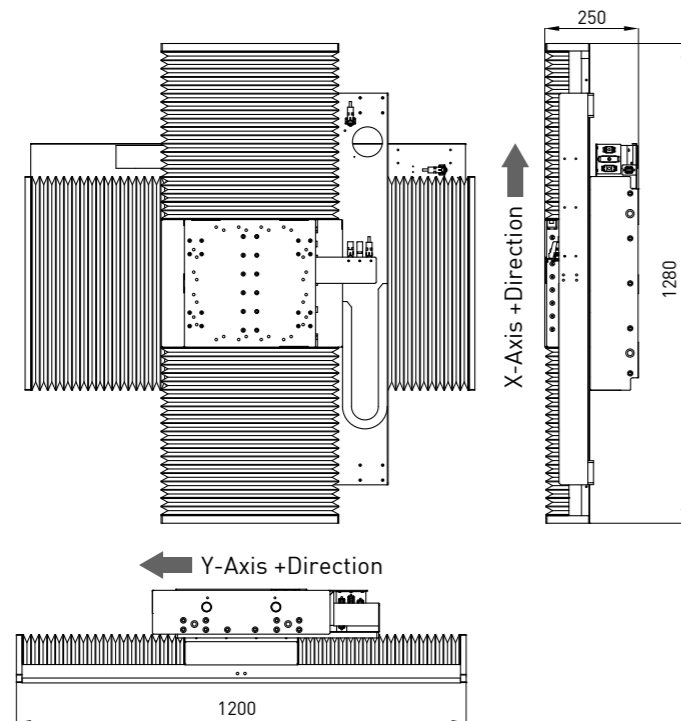
3.12.1 Industry applications

PCB/steel plate laser cutting applications, automation equipment, and 3D engraving machine applications.

3.12.2 Performance specifications

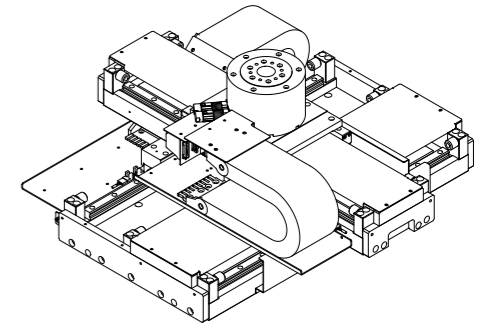Table3-11 **LMX2C-S37S67L-600-600 product specification**

Stage type	LMX2C-S37S67L-600-600
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：600, Y-axis：600
Peak Force(N)/Continuous Force(N)	X-axis：1425/535, Y-axis：2850/1069
Repeatability(μm)	±2(with HIWIN solution)
Accuracy(μm)	±3(after error mapping)
Max. Acceleration(m/s^2)	X-axis：10, Y-axis：7(with payload)
Max. Velocity(m/s)	0.7(with payload)
Vertical Straightness(μm)	X-axis：±4, Y-axis：±5
Orthogonality(arc-sec)	±5
Payload(kg)	35
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

3.13 DLE series

- Integration of high-precision torque motor.
- X-Y positioning with high precision angular compensation.
- High stiffness extruded aluminum structure.
- Best guideway supporting structure design.
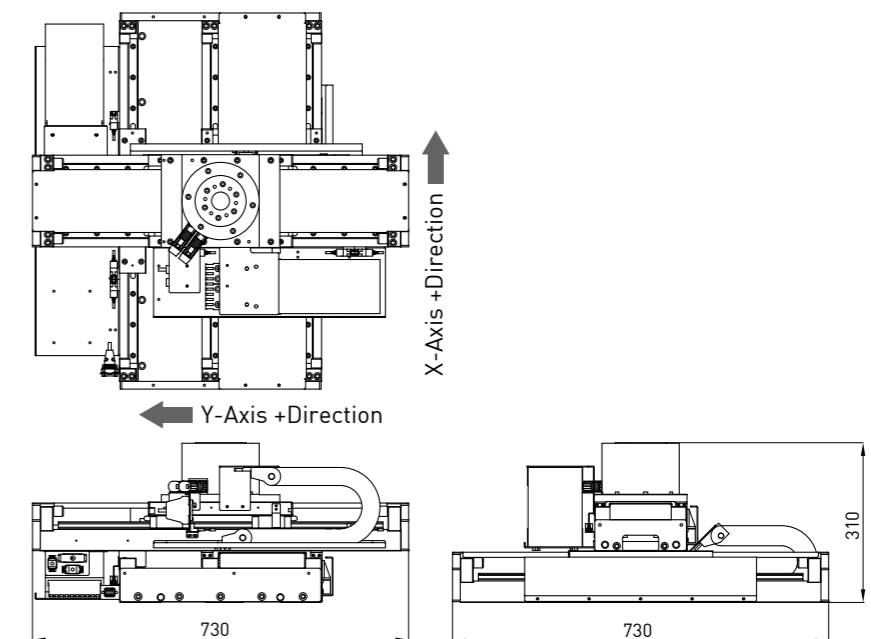
3.13.1 Industry applications

Automation equipment, AOI testing equipment, laser cutting applications, appearance grinding trimming equipment.

3.13.2 Performance specifications

Table3-12 **LMX2C-S27S47-300-300+TMS12 product specification**

Stage type	LMX2C-S27S47-300-300+TMS12
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：300, Y-axis：300
Peak Force(N)/Continuous Force(N)	X-axis：1953/733, Y-axis：1017/382
Repeatability(μm)	±0.5(with HIWIN solution)
Accuracy(μm)	±1(after error mapping)
Max. Acceleration(m/s^2)	5(with payload)
Max. Velocity(m/s)	0.8(with payload)
Orthogonality(arc-sec)	±5
Payload(kg)	40
Stage orientation	Horizontal
Torque Motor Type	TMS12
Peak Torque(Nm)/Continuous Torque(Nm)	15/5
Max. Velocity(rpm)	700(220V)
Repeatability(arc-sec)	±3
Accuracy(arc-sec)	±45
Inertia of rotation parts(kgm^2)	0.006

Note：All specifications can be designed according to customer demand.

Customized

3.14 DLF series

- Stainless steel cover, can withstand Instantaneous high temperature.
- Maze dust-proof design.
- With short setting time.
- Low center of gravity design.
- Equipped with ironless motor.
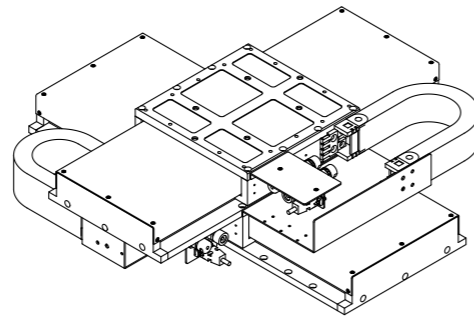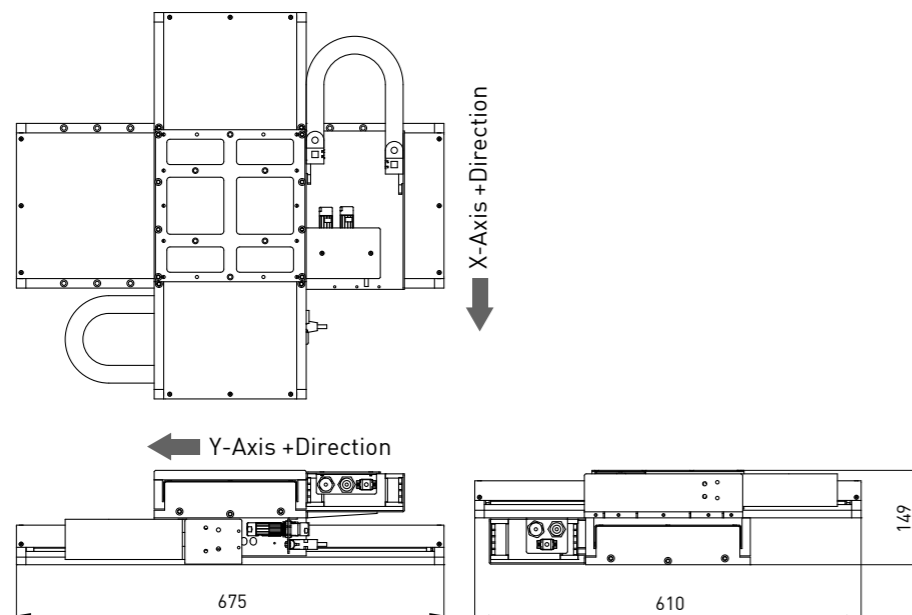
3.14.1 Industry applications

Automation equipment, laser cutting equipment.

3.14.2 Performance specifications

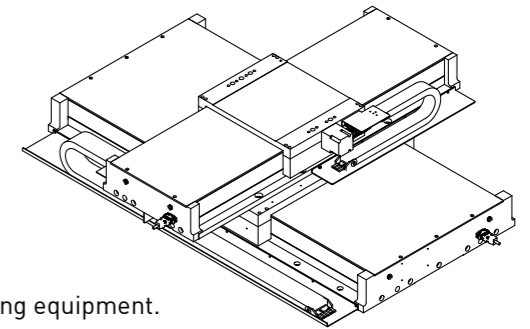Table3-13 **LMX2C-CB7CC7-280-340 product specification**

Stage type	LMX2C-CB7CC7-280-340
Motor Type	Ironless motor
Stroke(mm)	X-axis：280, Y-axis：340
Peak Force(N)/Continuous Force(N)	X-axis：512/128, Y-axis：684/171
Repeatability(μm)	±3(with HIWIN solution)
Accuracy(μm)	±5(after error mapping)
Max. Acceleration(m/s^2)	X-axis：10, Y-axis：5(with payload)
Max. Velocity(m/s)	X-axis：0.7, Y-axis：0.5(with payload)
Orthogonality(arc-sec)	±5
Payload(kg)	35
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

3.15 DLG series

- Sealed architecture.
- Suitable for the high dust environment.
- Low center of gravity design.
- With short setting time.
- Equipped with ironless motor.
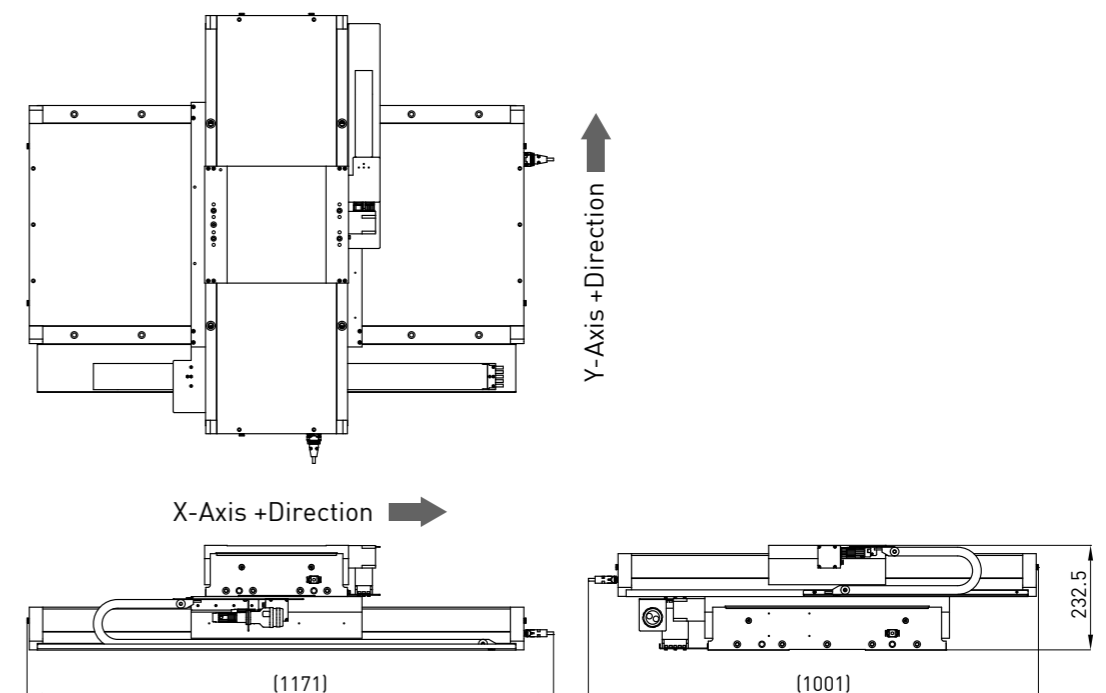
3.15.1 Industry applications

Automation equipment, laser cutting equipment, PCB drilling equipment.

3.15.2 Performance specifications

Table3-14 **LMX2C-CE4CE6-2-450-500 product specification**

Stage type	LMX2C-CE4CE6-2-450-500
Motor Type	Ironless motor
Stroke(mm)	X-axis：500, Y-axis：450
Peak Force(N)/Continuous Force(N)	X-axis：1104/276, Y-axis：736/184
Repeatability(μm)	±1(with HIWIN solution)
Accuracy(μm)	±1.5(after error mapping)
Max. Acceleration(m/s^2)	5(with payload)
Max. Velocity(m/s)	0.22(with payload)
Payload(kg)	35
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

Customized

3.16 DLH series

- Suitable for vacuum environment, 1x10^{-6} Torr.
- Vacuum flat cable.
- Integration of high-precision torque motor.
- X-Y positioning with high precision angular compensation.
- Can be equipped with ironless or ironcore motor.
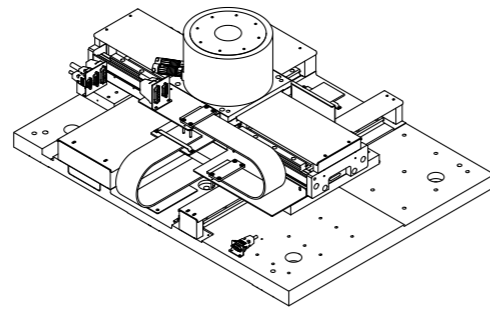
3.16.1 Industry applications

Automation equipment, plasma repair equipment, electron beam scanning applications.

3.16.2 Performance specifications

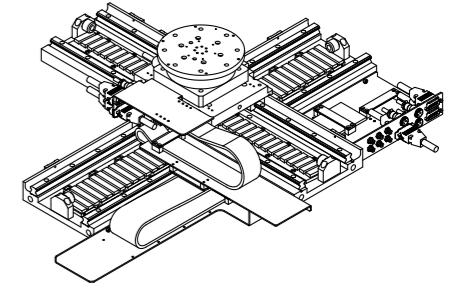**Table3-15 LMX2C-S23S27-360-240+TMS32 product specification**

Stage type	LMX2C-S23S27-360-240+TMS32
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：240, Y-axis：360
Peak Force(N)/Continuous Force(N)	X-axis：1017/382, Y-axis：639/240
Repeatability(μm)	X-axis：±2, Y-axis：±1(with HIWIN solution)
Accuracy(μm)	X-axis：±5, Y-axis：±3(after error mapping)
Max. Acceleration(m/s^2)	X-axis：5, Y-axis：5(with payload)
Max. Velocity(m/s)	X-axis：0.7, Y-axis：1(with payload)
Payload(kg)	5
Stage orientation	Horizontal
Torque Motor Type	TMS32
Peak Torque(Nm)/Continuous Torque(Nm)	30/10
Max. Velocity(rpm)	700(220V)
Repeatability(arc-sec)	±3
Accuracy(arc-sec)	±15
Inertia of rotation parts(kgm^2)	0.014

Note：All specifications can be designed according to customer demand.
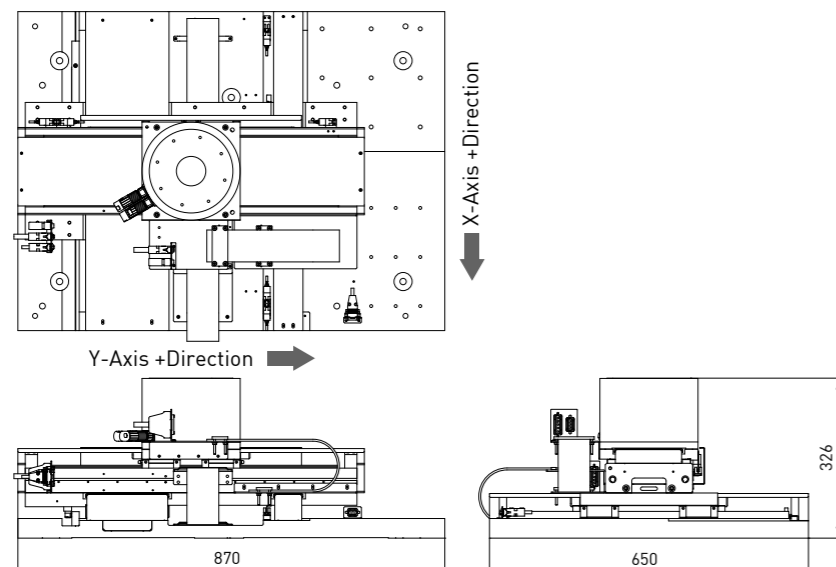
3.17 DLJ series

- Integration of high-precision torque motor.
- XY positioning with high precision angular compensation.
- Low center of gravity design.
- With short setting time.
- Excellent servo stability.
- Use low dust flat cable(class 1).
- Can be equipped with ironless or ironcore motor.

3.17.1 Industry applications

The semiconductor wafer inspection equipment, AOI equipment.

3.17.2 Performance specifications

**Table3-16 LMX2C-SA11LSA21L-420-490+TMF42 product specification**

Stage type	LMX2C-SA11LSA21L-420-490+TMF42
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：420, Y-axis：490
Peak Force(N)/Continuous Force(N)	X-axis：254/90, Y-axis：462/149
Repeatability(μm)	±0.5(with HIWIN solution)
Accuracy(μm)	±2(after error mapping)
Max. Acceleration(m/s^2)	6.5(with payload)
Max. Velocity(m/s)	0.5(with payload)
Vertical Straightness(μm)	±10
Orthogonality(arc-sec)	±5
Payload(kg)	10
Stage orientation	Horizontal
Torque Motor Type	TMF42
Peak Torque(Nm)/Continuous Torque(Nm)	3.6/1.2
Max. Velocity(rpm)	120(220V)
Repeatability(arc-sec)	±2.5
Accuracy(arc-sec)	±25
Inertia of rotation parts(kgm^2)	0.0005

Note：All specifications can be designed according to customer demand.

Customized
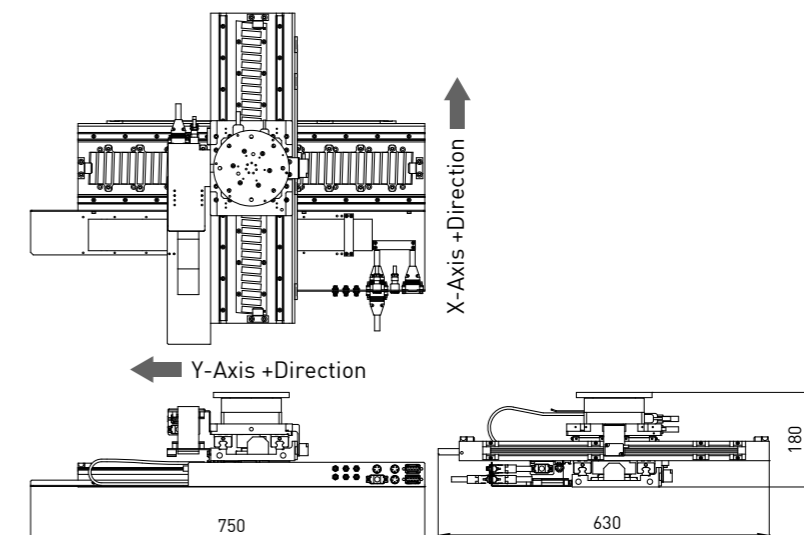
3.18 DLK series

○ Multi-forcer simultaneously motion.
○ Suitable for laterally applications.
○ For high-speed reciprocating motion.
○ Z-axis using a linear motor with a pneumatic counterweight design.
○ With high speed and high accuracy.
○ Can be equipped with ironless or ironcore motor.
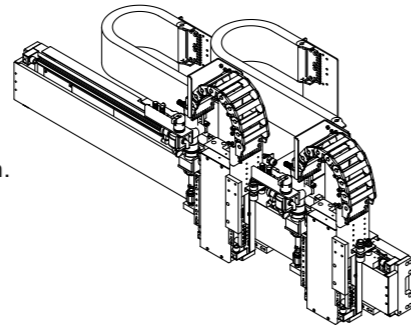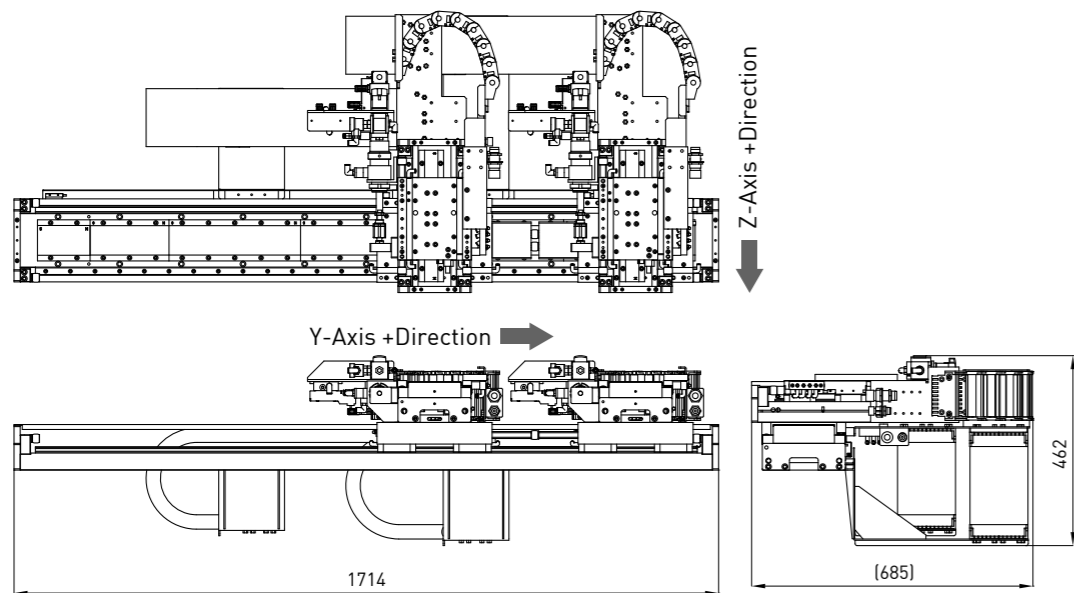
3.18.1 Industry applications

Solar automation equipment, high-speed pick and place feeding equipment, electronic components assembly equipment.

3.18.2 Performance specifications

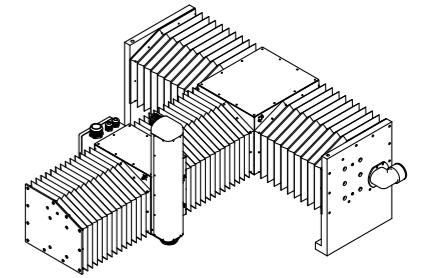**Table3-17 LMX4C-S13S37-2-32-750 product specification**

Stage type	LMX4C-S13S37-2-32-750
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	Z-axis：32, Y-axis：750
Peak Force(N)/Continuous Force(N)	Z-axis：540/203, Y-axis：1425/535
Repeatability(μm)	±2(with HIWIN solution)
Accuracy(μm)	±5(after error mapping)
Max. Acceleration(m/s²)	Z-axis：10, Y-axis：10(with payload)
Max. Velocity(m/s)	Z-axis：0.5, Y-axis：1.3(with payload)
Payload(kg)	10
Stage orientation	Laterally

Note：All specifications can be designed according to customer demand.

Z-Axis +Direction

Y-Axis +Direction

1714

462

(685)

3.19 RLA series

○ Fully enclosed waterproof design.
○ Using non-contact air bearing.
○ XY cantilever structure.
○ Space saving.
○ Lightweight and high-stiffness design.
○ Can be equipped with ironless or ironcore motor.
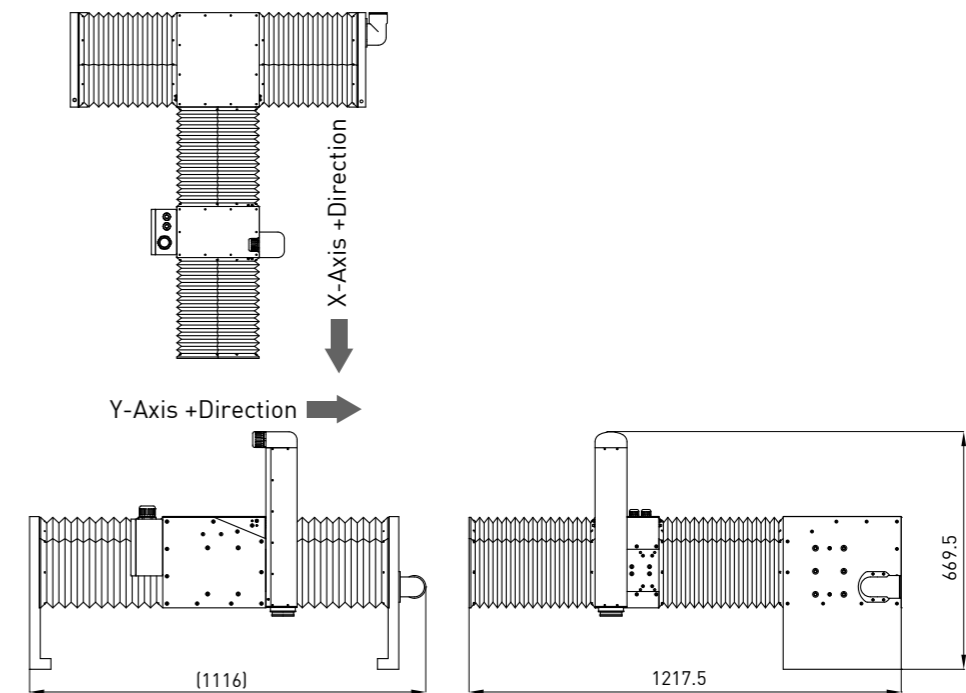
3.19.1 Industry applications

Waterjet equipment, laser cutting equipment, automation equipment.

3.19.2 Performance specifications

Table3-18 LMX2C-S13S17-510-510 product specification

Stage type	LMX2C-S13S17-510-510
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：510, Y-axis：510
Peak Force(N)/Continuous Force(N)	X-axis：540/203, Y-axis：609/228
Repeatability(μm)	X-axis：±2, Y-axis：±2(with HIWIN solution)
Accuracy(μm)	X-axis：±5, Y-axis：±5(after error mapping)
Max. Acceleration(m/s²)	X-axis：10, Y-axis：5(with payload)
Max. Velocity(m/s)	X-axis：0.8, Y-axis：0.5(with payload)
Payload(kg)	10
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

X-Axis +Direction

Y-Axis +Direction

(1116)

1217.5

669.5

Customized

3.20 RLB series

- Z-axis counterweight design.
- Excellent low speed velocity stability ±1 %@10 mm/s.
- Fully enclosed waterproof design.
- High positioning accuracy up to ±1 μm.
- Can be equipped with ironless or ironcore motor.

3.20.1 Industry applications

Micromachining equipment, 3D measurement equipment, 3D engraving equipment.
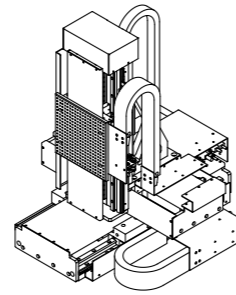
3.20.2 Performance specifications

Table3-19 LMX3C-CB5CB5CB8-200-200-200 product specification

Stage type	LMX3C-CB5CB5CB8-200-200-200
Motor Type	Ironless(/Ironcore) motor
Stroke(mm)	X-axis：200, Y-axis：200, Z-axis：200
Peak Force(N)/Continuous Force(N)	X-axis：580/145, Y-axis：364/91, Z-axis：364/91
Repeatability(μm)	±0.5(with HIWIN solution)
Accuracy(μm)	±1(after error mapping)
Max. Acceleration(m/s²)	X-axis：0.5, Y-axis：0.5, Z-axis：0.5(with payload)
Max. Velocity(m/s)	X-axis：0.2, Y-axis：0.2, Z-axis：0.05(with payload)
Orthogonality(arc-sec)	X-Y：±4, Y-Z：±2, X-Z：±3
Speed ripple	X-axis：1.35, Y-axis：0.93, Z-axis：1.57(when V=5mm/s)
Payload(kg)	5
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

X-Axis +Direction

Y-Axis +Direction

Z-Axis +Direction

682.5

568.5

613.5
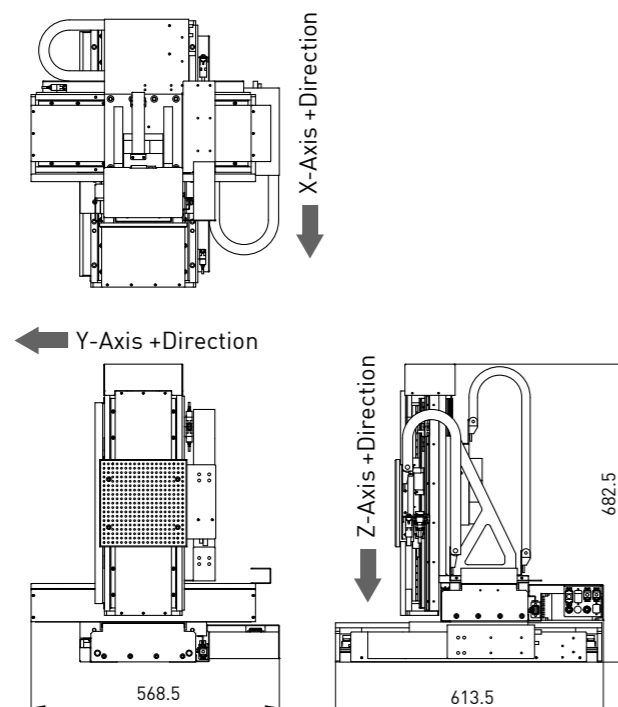
3.21 RBC series

- Z-axis designed with KK series ballscrew driven stage module significantly reduces system cost.
- Use dust-proof design.
- Three-dimensional motion.
- Simple structure design.
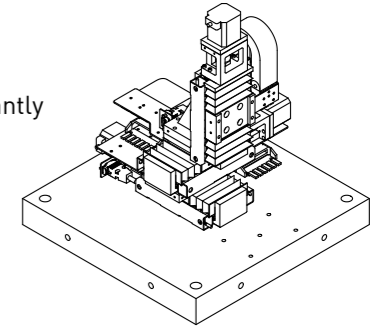
3.21.1 Industry applications

Mechanical component testing equipment, automation equipment, 3D engraving equipment.

3.21.2 Performance specifications

**Table3-20 KK6010-KK6010-KK6005-150-150-150 product specification**

Stage type	KK6010-KK6010-KK6005-150-150-150
Motor Type	HIWIN AC Servo motor
Stroke(mm)	X-axis：55, Y-axis：55, Z-axis：55
Ball screw lead(mm)	X-axis：10, Y-axis：10, Z-axis：5
Repeatability(μm)	±2(uni-direction, with HIWIN solution)
Accuracy grade	C
Max. Acceleration(m/s²)	X-axis：5, Y-axis：5, Z-axis：5(HIWIN 100W, with payload)
Max. Velocity(m/s)	X-axis：0.5, Y-axis：0.5, Z-axis：0.2(HIWIN 100W, with payload)
Payload(kg)	1
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

X-Axis +Direction

Y-Axis +Direction

Z-Axis +Direction

441

385

385

Customized
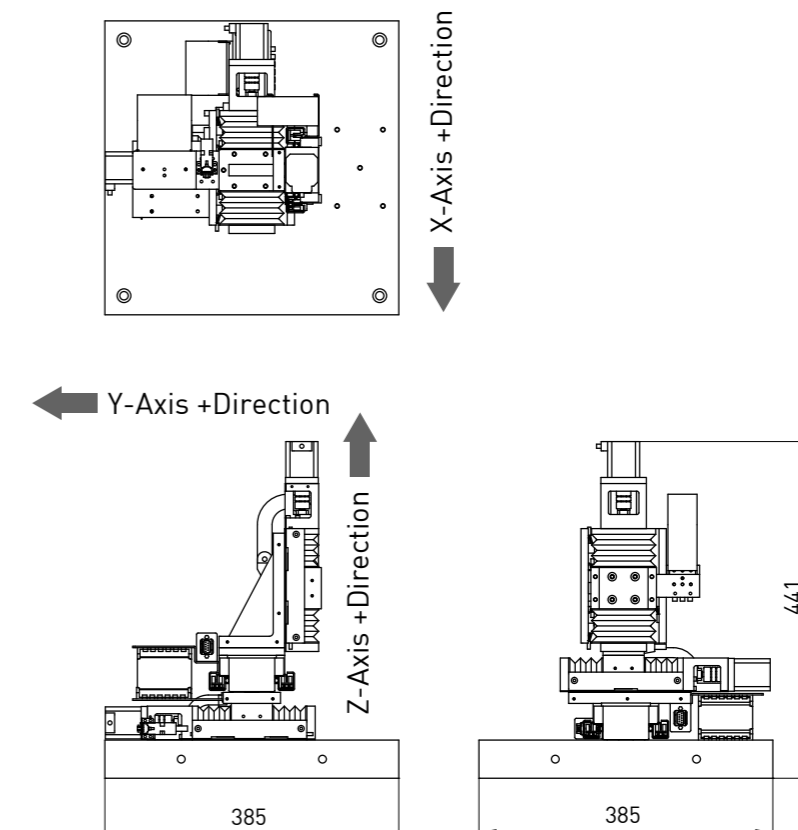
3.22 GLA series

○ Micro gantry structure.
○ Space saving.
○ Lightweight beam design.
○ High dynamic response.
○ Can be equipped with ironless or ironcore motor.
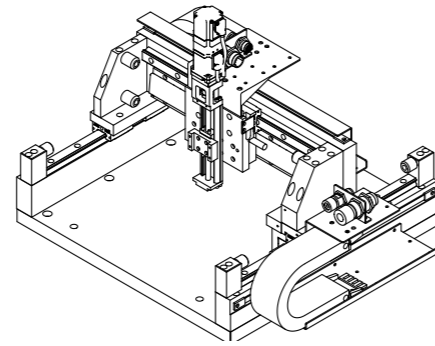
3.22.1 Industry applications

Electronic components assembly equipment, biomedical equipment industries, AOI testing equipment.
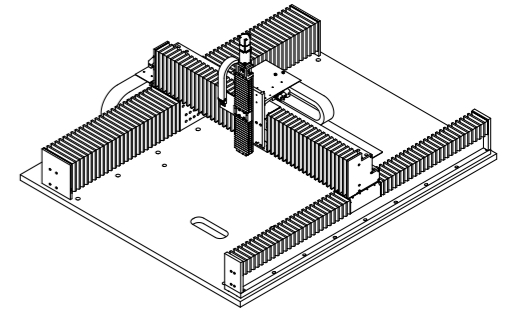
3.22.2 Performance specifications

Table3-21 LMG2C-S11S11-200-200+KK4005C-150A1-F2M product specification

Stage type	LMG2C-S11S11-200-200+KK4005C-150A1-F2M
Motor Type	Ironcore (/Ironless) motor & HIWIN AC Servo motor
Stroke(mm)	X-axis：200, Y-axis：200, Z-axis：50
Peak Force(N)/Continuous Force(N)	X-axis：254/92, Y-axis：254/92, Z-axis：HIWIN 50W(220V)
Ball screw lead(mm)	Z-axis：5
Repeatability(μm)	X-axis：±2, Y-axis：±3, Z-axis：±2(uni-direction, with HIWIN solution)
Accuracy(μm)	X-axis：±5, Y-axis：±10, Z-axis：±10(uni-direction, after error mapping)
Max. Acceleration(m/s²)	X-axis：5, Y-axis：5, Z-axis：5(with payload)
Max. Velocity(m/s)	X-axis：1, Y-axis：0.5, Z-axis：0.04(with payload)
Payload(kg)	1
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.
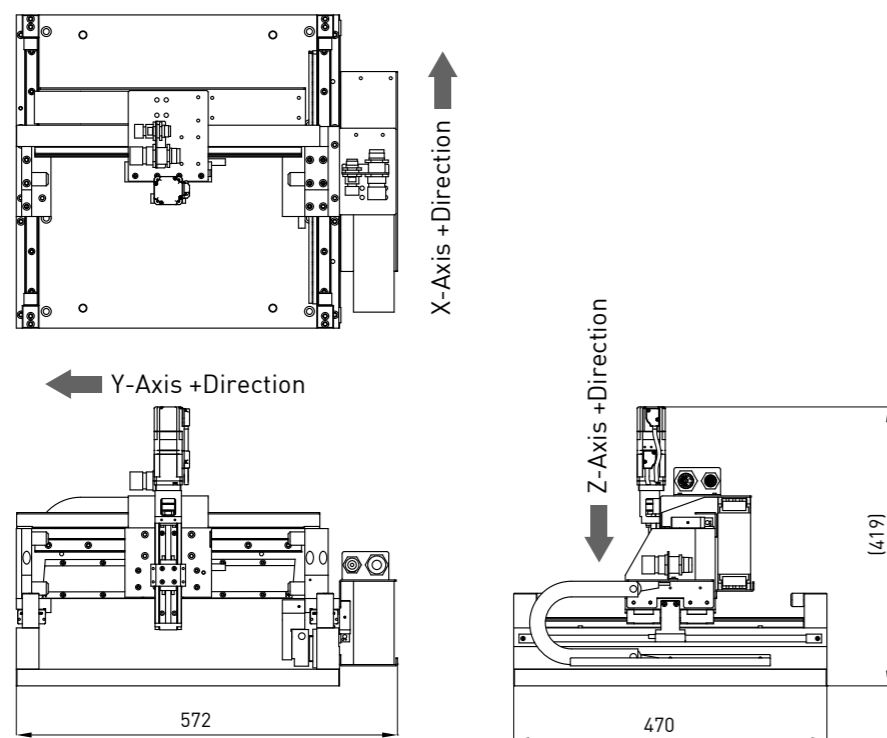
3.23 GLB series

○ High stiffness aluminum gantry structure.
○ Use dust-proof design.
○ Z-axis designed with KK series ballscrew driven stage module.
○ Unilateral or bilateral drive structure are seletable according to the precision requirement.
○ Can be equipped with ironless or ironcore motor.

3.23.1 Industry applications

Automation industrial equipment, laser cutting applications, spraying equipment
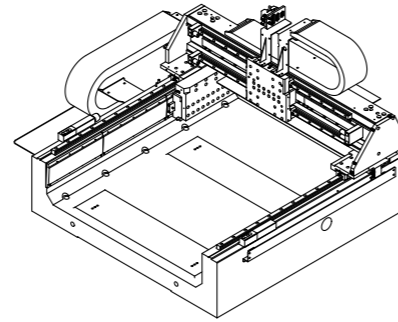
3.23.2 Performance specifications

Table3-22 LMG2A-S13S23-600-900+KK6005C-400A1-F2BS2M product specification

Stage type	LMG2A-S13S23-600-900+KK6005C-400A1-F2BS2M
Motor Type	Ironcore (/Ironless) motor & HIWIN AC Servo motor
Stroke(mm)	X-axis：600, Y-axis：900, Z-axis：234
Peak Force(N)/Continuous Force(N)	X-axis：540/203, Y-axis：639/240, Z-axis：HIWIN 100W(220V)
Ball screw lead(mm)	Z-axis：5
Repeatability(μm)	X-axis：±5, Y-axis：±5, Z-axis：±2(uni-direction, with HIWIN solution)
Accuracy(μm)	X-axis：±15, Y-axis：±15, Z-axis：C(uni-direction, after error mapping)
Max. Acceleration(m/s²)	5(with payload)
Max. Velocity(m/s)	0.2(with payload)
Payload(kg)	5
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

Customized
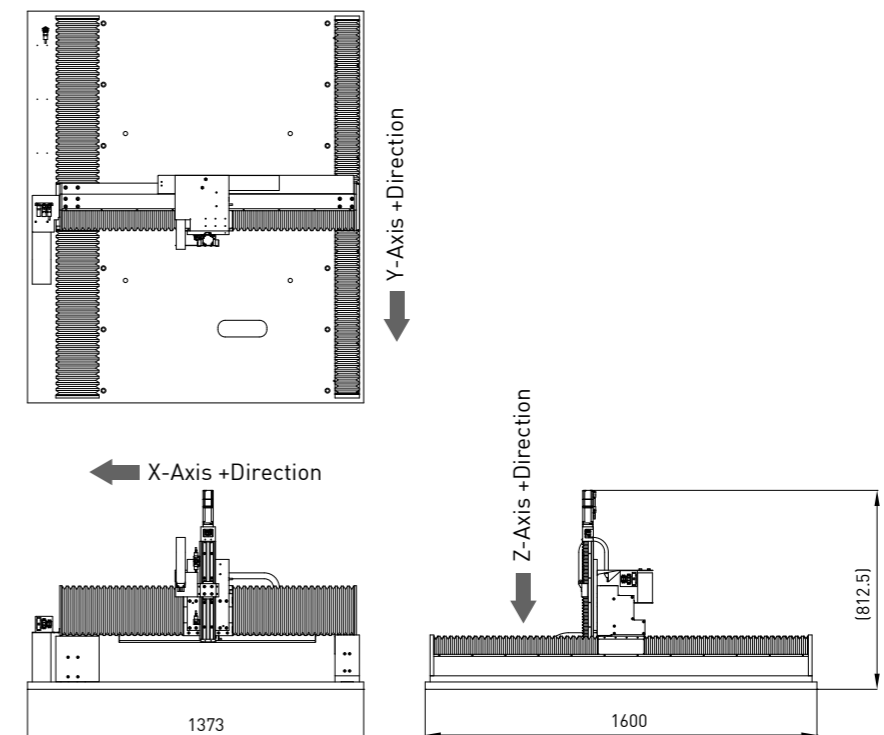
3.24 GLD series

- High stiffness cast iron base.
- With excellent vibration suppression capability.
- Suitable for high acceleration and deceleration applications.
- With excellent positioning accuracy.
- Unilateral or bilateral drive structure are seletable according to the precision requirement.
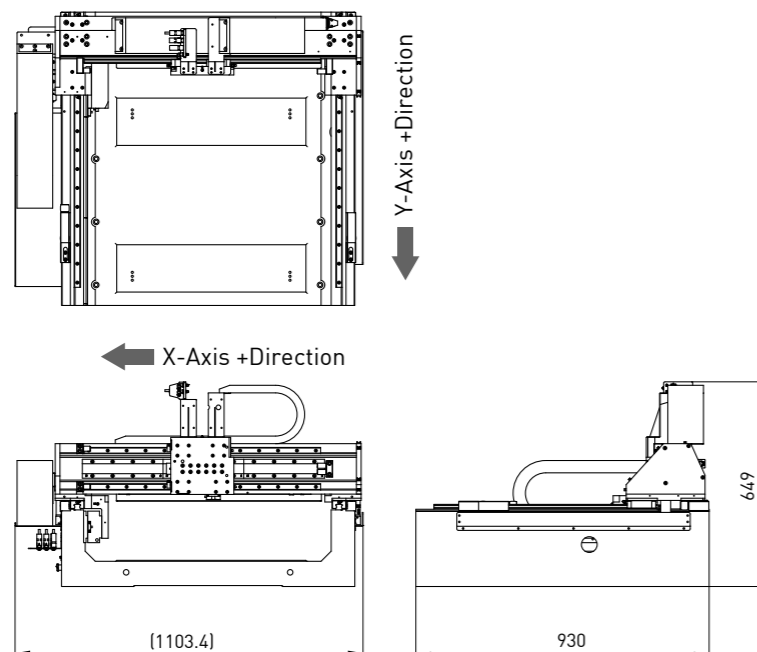
3.24.1 Industry applications

Automation equipment, PCB AOI inspection applications.
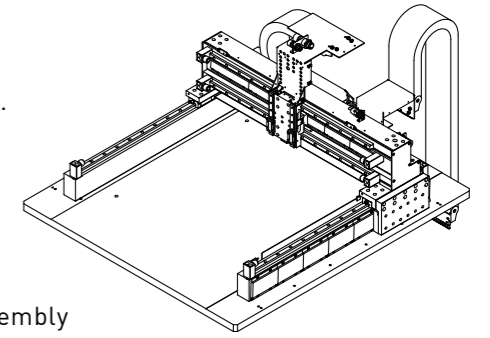
3.24.2 Performance specifications

Table3-23 LMG2C-S13S37L-515-540 product specification	
Stage type	LMG2C-S13S37L-515-540
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：515, Y-axis：540
Peak Force(N)/Continuous Force(N)	X-axis：540/203, Y-axis：1425/535
Repeatability(μm)	±1(uni-direction, with HIWIN solution)
Accuracy(μm)	±2(after error mapping)
Max. Acceleration(m/s²)	X-axis：15, Y-axis：10(with payload)
Max. Velocity(m/s)	X-axis：1.5, Y-axis：1.5(with payload)
Vertical Straightness(μm)	10
Horizontal Straightness(μm)	10
Pitch(arc-sec)	25
Yaw(arc-sec)	X-axis：20, Y-axis：15
Orthogonality(arc-sec)	±5
Payload(kg)	12
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

Y-Axis +Direction

X-Axis +Direction

(1103.4)   930   649

3.25 GLE series

- High stiffness aluminum gantry structure.
- Suitable for high acceleration and deceleration applications.
- Maximize the working area.
- Space saving.
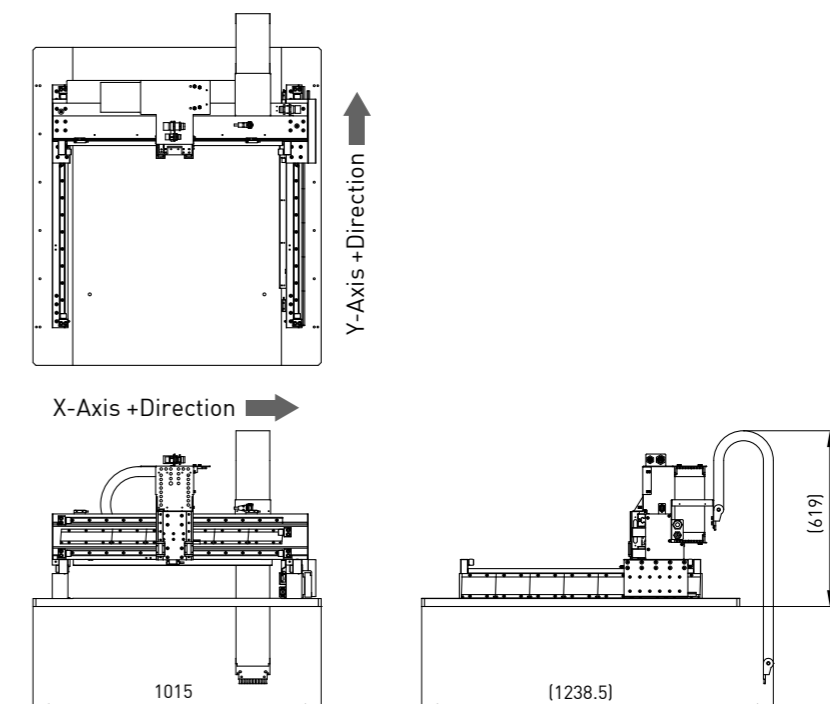- Can be equipped with ironless or ironcore motor.

3.25.1 Industry applications

Automation equipment, electronic components plug-in assembly equipment, AOI equipment, automatic coating equipment
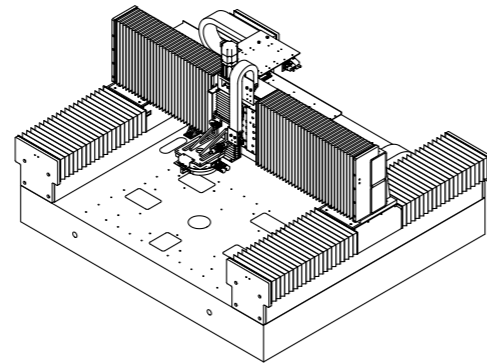
3.25.2 Performance specifications

Table3-24 LMG2C-SA11SA22-580-500 product specification	
Stage type	LMG2C-SA11SA22-580-500
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：580, Y-axis：500
Peak Force(N)/Continuous Force(N)	X-axis：289/121, Y-axis：1023/426
Repeatability(μm)	±2.5(uni-direction, with HIWIN solution)
Accuracy(μm)	±5(after error mapping)
Max. Acceleration(m/s²)	X-axis：10, Y-axis：10(with payload)
Max. Velocity(m/s)	X-axis：0.5, Y-axis：0.5(with payload)
Vertical Straightness(μm)	±5
Horizontal Straightness(μm)	±5
Payload(kg)	5
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

Y-Axis +Direction

X-Axis +Direction

1015   (1238.5)   (619)

Customized

3.26 GLF series

- Use dust-proof design.
- Granite base, Steel beams.
- Modular Z-axis with a high-precision torque motor.
- Can be equipped with ironless or ironcore motor.
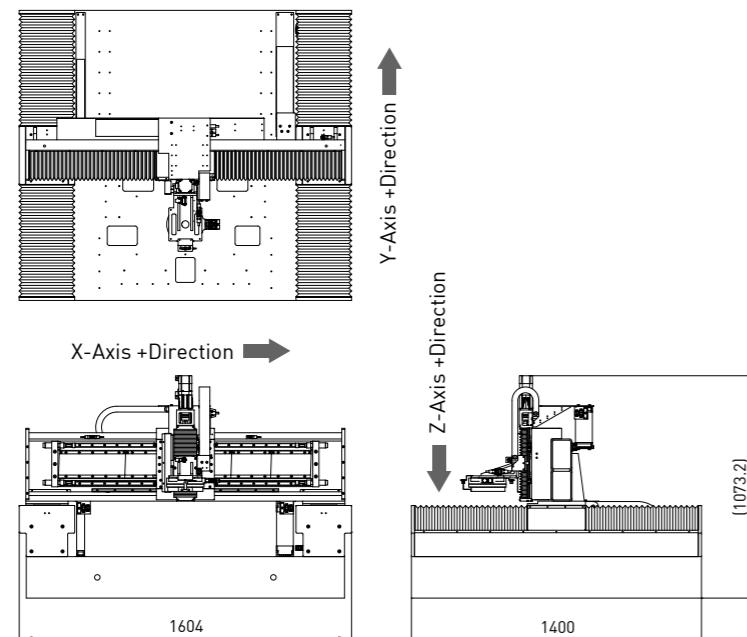
3.26.1 Industry applications

Optical detection applications, 3D measurement system

3.26.2 Performance specifications

**Table3-25 LMG3C-S47LS37L-750-550 +KK8610P-340A1-F0BS2M+TMN71EH product specification**

Stage type	LMG3C-S47LS37L-750-550 +KK8610P-340A1-F0BS2M+TMN71EH
Motor Type	Ironcore (/Ironless) motor & HIWIN AC Servo motor
Stroke(mm)	X-axis：750, Y-axis：550, Z-axis：170
Peak Force(N)/Continuous Force(N)	X-axis：1953/733, Y-axis：1425/535, Z-axis：HIWIN 400W
Repeatability(μm)	X-axis：±1, Y-axis：±1, Z-axis：±2(with HIWIN solution)
Accuracy(μm)	±3(after error mapping)
Max. Acceleration(m/s^2)	X-axis：20, Y-axis：4, Z-axis：2.5(with payload)
Max. Velocity(m/s)	X-axis：1, Y-axis：1, Z-axis：0.5(with payload)
Payload(kg)	5
Stage orientation	Horizontal
Torque Motor Type	TMN71EH
Peak Torque(Nm)/Continuous Torque(Nm)	11.1/3.7
Max. Velocity(rpm)	600(220V)
Repeatability(arc-sec)	±2.5
Accuracy(arc-sec)	±10
Inertia of rotation parts(kgm^2)	0.008

Note：All specifications can be designed according to customer demand.

Y-Axis +Direction

X-Axis +Direction

Z-Axis +Direction

(1073.21)

1604

1400

3.27 GBC series

- Ballscrew structure.
- High acceleration and deceleration motion.
- Can be equipped with linear scale to enhance the positioning accuracy and reproducibility.
- Simple structure.
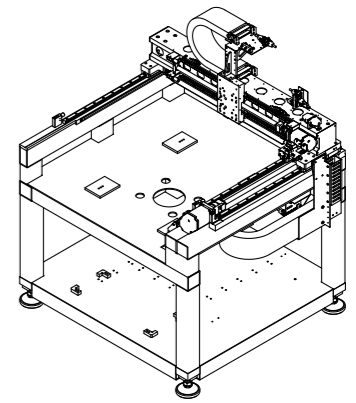
3.27.1 Industry applications

Automation equipment, AOI inspection applications.

3.27.2 Performance specifications

**Table3-26 BS-20-540+BS-20-515 product specification**

Stage type	BS-20-540+BS-20-515
Motor Type	HIWIN AC Servo motor
Stroke(mm)	X-axis：515, Y-axis：540
Ball screw lead(mm)	20
Repeatability(μm)	±2.5(uni-direction, with HIWIN solution)
Accuracy(μm)	±6(after error mapping)
Max. Acceleration(m/s^2)	X-axis：12, Y-axis：17(with payload)
Max. Velocity(m/s)	X-axis：1, Y-axis：1(with payload)
Vertical Straightness(μm)	20
Horizontal Straightness(μm)	20
Pitch(arc-sec)	30
Yaw(arc-sec)	X-axis：20, Y-axis：25
Orthogonality(arc-sec)	±10
Payload(kg)	9
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

Y-Axis +Direction

X-Axis +Direction

1110

1040

(1351)

Customized
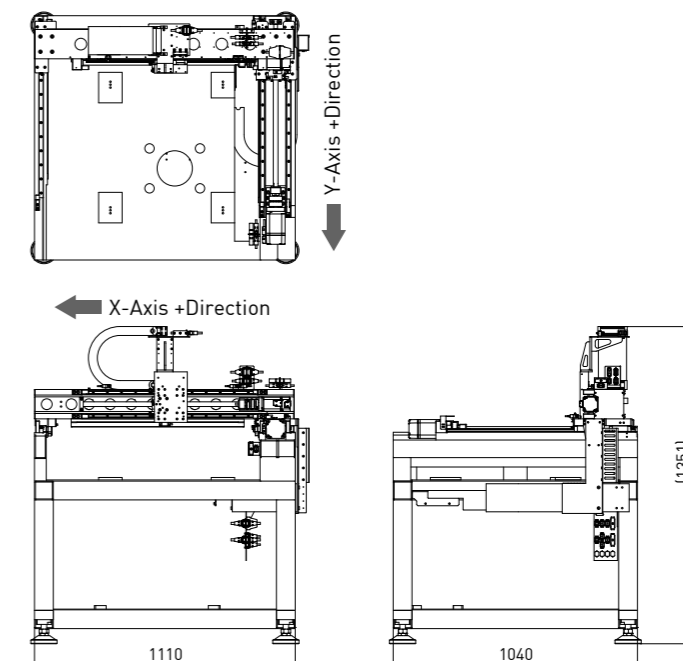
3.28 MLA series

- Integration of high-precision TMN torque motor.
- With excellent flatness(X-Y-theta 0.01 mm).
- Water cooling design, reduce thermal deformation.
- XY Stage low center of gravity design.
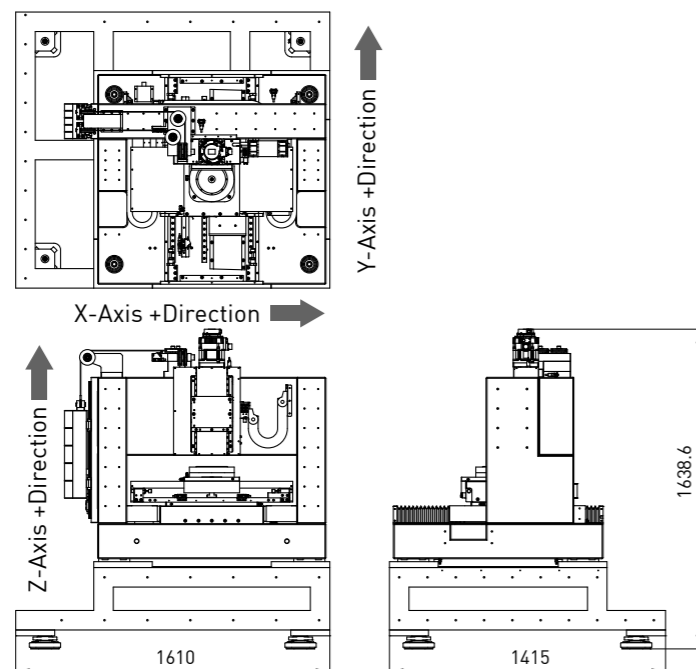- Can be equipped with ironless or ironcore motor.
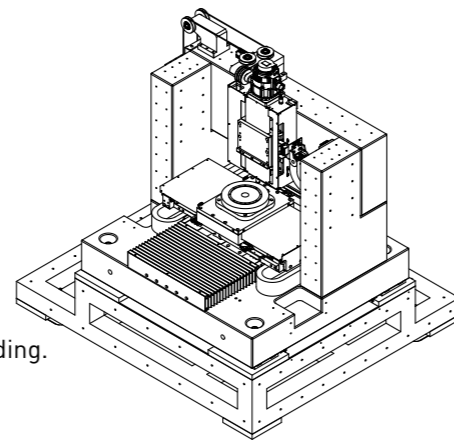
3.28.1 Industry applications

Wafer cutting, the glass substrate testing equipment, wafer bonding.

3.28.2 Performance specifications

| Table3-27 LMX2C-F23F43-300-300+BS-5-170+TMN93EH product specification	
Stage type	**LMX2C-F23F43-300-300+BS-5-170+TMN93EH**
Motor Type	Ironcore (/Ironless) motor & HIWIN AC Servo motor
Stroke(mm)	X-axis：362, Y-axis：390
Peak Force(N)/Continuous Force(N)	X-axis：2082/764, Y-axis：5496/2252
Repeatability(μm)	±0.5(with HIWIN solution)
Accuracy(μm)	±1(after error mapping)
Max. Acceleration(m/s²)	10(with payload)
Max. Velocity(m/s)	1(with payload)
Payload(kg)	Z-axis：50, A-axis：30
Stage orientation	Horizontal
Torque Motor Type	TMN93EH
Peak Torque(Nm)/Continuous Torque(Nm)	45/15
Max. Velocity(rpm)	300(220V)
Repeatability(arc-sec)	±2.5
Accuracy(arc-sec)	±25
Inertia of rotation parts(kgm²)	0.052

Note：All specifications can be designed according to customer demand.

3.29 MLB series

- Multi-axis simultaneously motion.
- Good working efficiency.
- High stiffness honeycomb beam design.
- High acceleration and deceleration motion.
- With excellent settling time.
- Can be used with automated pick and place conveying mechanism.
- Can be equipped with ironless or ironcore motor.
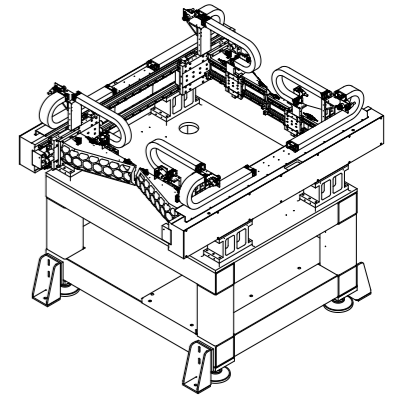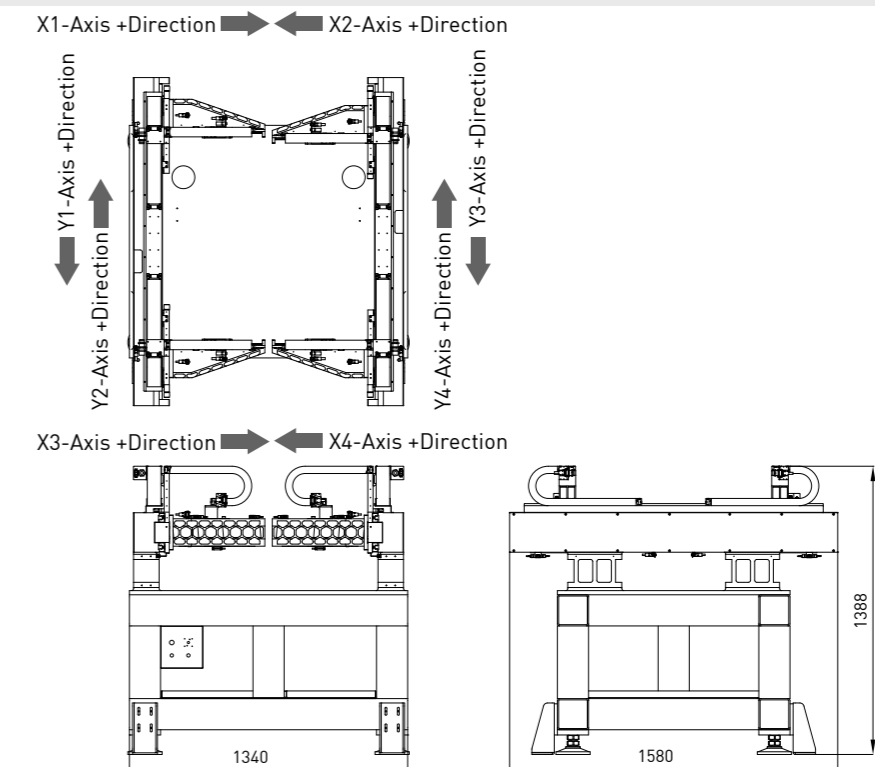
3.29.1 Industry applications

Precision component assembly applications, electronic components plug-in equipment.

3.29.2 Performance specifications

| Table3-28 LMX8C-SA11F13-264-632 product specification	
Stage type	**LMX8C-SA11F13-264-632**
Motor Type	Ironcore (/Ironless) motor
Stroke(mm)	X-axis：264, Y-axis：632
Peak Force(N)/Continuous Force(N)	X-axis：289/121, Y-axis：1380/510
Repeatability(μm)	X-axis：±1, Y-axis：±2(with HIWIN solution)
Accuracy(μm)	X-axis：±3, Y-axis：±5(after error mapping)
Max. Acceleration(m/s²)	X-axis：20, Y-axis：30(with payload)
Max. Velocity(m/s)	X-axis：1, Y-axis：1(with payload)
Horizontal Straightness(μm)	±10
Orthogonality(arc-sec)	±10
Payload(kg)	1
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

X1-Axis +Direction ← X2-Axis +Direction
X3-Axis +Direction ← X4-Axis +Direction
Y1-Axis +Direction Y3-Axis +Direction
Y2-Axis +Direction Y4-Axis +Direction

1340   1580   1388

Y-Axis +Direction
X-Axis +Direction
Z-Axis +Direction

1638.6   1610   1415

Customized

3.30 ALA series

- Using non-contact air bearing.
- Without maintenance.
- High positioning accuracy.
- Not easily influenced by environmental temperature.
- With high-precision and large-size vacuum chuck.
- With passive vibration suppressing system.
- Integrated electronic control system.
- Equipped with ironless motor.
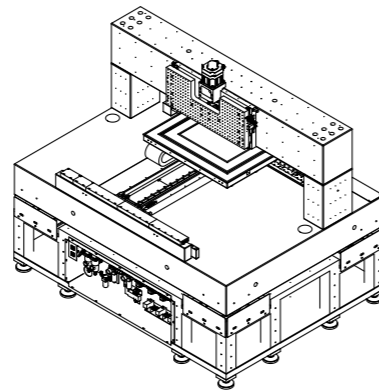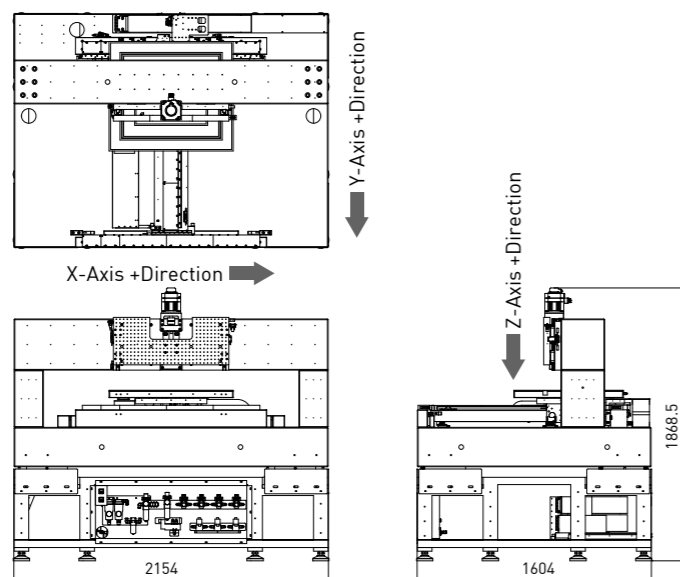
3.30.1 Industry applications

Glass substrate exposure Application, white testing equipment, wafer defect detection equipment.

3.30.2 Performance specifications

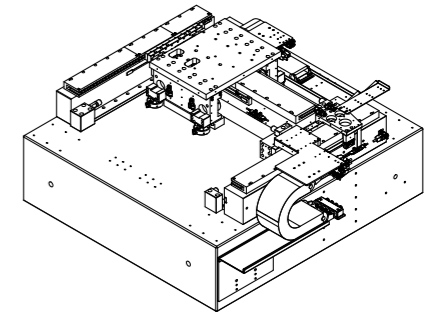| Table3-29 **LMAP-CC8CB8-700-800+BS-2-50 product specification**	
Stage type	**LMAP-CC8CB8-700-800+BS-2-50**
Motor Type	Ironless motor
Stroke(mm)	X-axis：700, Y-axis：800, Z-axis：50
Peak Force(N)/Continuous Force(N)	X-axis：580/145, Y-axis：780/195, Z-axis：HIWIN 1KW(220V)
Repeatability(μm)	X-axis：±0.5, Y-axis：±0.5, Z-axis：±2(with HIWIN solution)
Accuracy(μm)	X-axis：±1.5, Y-axis：±1.5, Z-axis：±6(after error mapping)
Max. Acceleration(m/s²)	X-axis：2.5, Y-axis：4(with payload 10 kg), Z-axis：2(with payload 200 kg)
Max. Velocity(m/s)	X-axis：0.3, Y-axis：0.3(with payload 10 kg) , Z-axis：0.05(with payload 200 kg)
Vertical Straightness(μm)	X-axis：±2, Y-axis：±2, Z-axis：±10
Horizontal Straightness(μm)	X-axis：±1, Y-axis：±1, Z-axis：±2
Orthogonality(arc-sec)	XY-axis：±5
Payload(kg)	XY-axis：10, Z-axis：200
Stage orientation	Horizontal
Note：All specifications can be designed according to customer demand.	

3.31 ALB series

- Using non-contact air bearing.
- Without maintenance.
- High positioning accuracy.
- Not easily influenced by environmental temperature.
- With high-precision and large-size vacuum chuck.
- Z direction jitter 100 nm.
- Vertical straightness up to ±1 μm.
- Equipped with ironless motor.
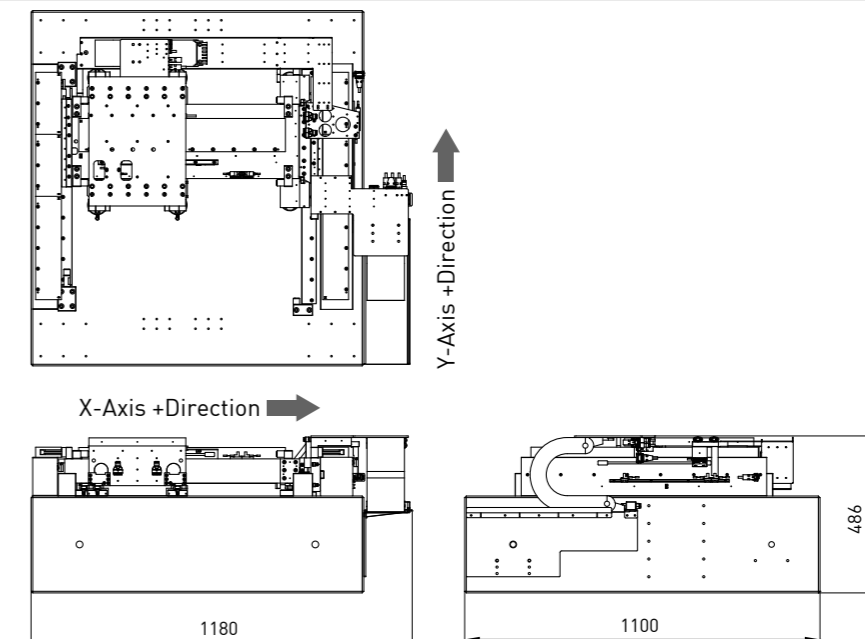
3.31.1 Industry applications

Glass substrate exposure Application, white testing equipment, wafer defect detection equipment.

3.31.2 Performance specifications
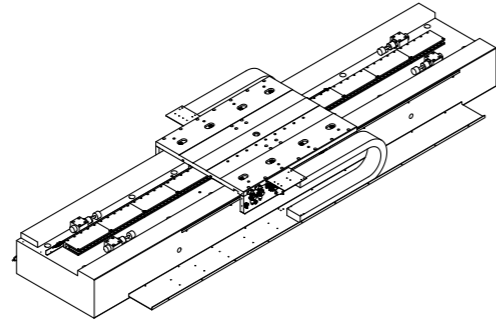
Table3-30 **LMAP-CC8CB8-250-250 product specification**	
Stage type	**LMAP-CC8CB8-250-250**
Motor Type	Ironless motor
Stroke(mm)	X-axis：250, Y-axis：250
Peak Force(N)/Continuous Force(N)	X-axis：780/195, Y-axis：580/145
Repeatability(μm)	±0.75(with HIWIN solution)
Accuracy(μm)	±1.5(after error mapping)
Max. Acceleration(m/s²)	2(with payload)
Max. Velocity(m/s)	0.25(with payload)
Vertical Straightness(μm)	±1
Horizontal Straightness(μm)	±2
Orthogonality(arc-sec)	±3
Payload(kg)	15
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

Customized

3.32 ALC series

- Using non-contact air bearing.
- Without maintenance.
- High positioning accuracy.
- High load capacity of up to 680 kg.
- Vertical straightness up to ±3 μm.
- Equipped with ironless motor.

3.32.1 Industry applications

Large-size glass substrate detection equipment

3.32.2 Performance specifications

Table3-31 LMAP-CFC-1-2350 product specification

Stage type	LMAP-CFC-1-2350
Motor Type	Ironless motor
Stroke(mm)	2320
Peak Force(N)/Continuous Force(N)	2736/684
Repeatability(μm)	±0.5 (with HIWIN solution)
Accuracy(μm)	±2(after error mapping)
Max. Acceleration(m/s²)	2(with payload)
Max. Velocity(m/s)	0.7(with payload)
Vertical Straightness(μm)	±4
Horizontal Straightness(μm)	±3
Payload(kg)	680
Stage orientation	Horizontal

Note：All specifications can be designed according to customer demand.

+Direction

3620

1118.5

357.5
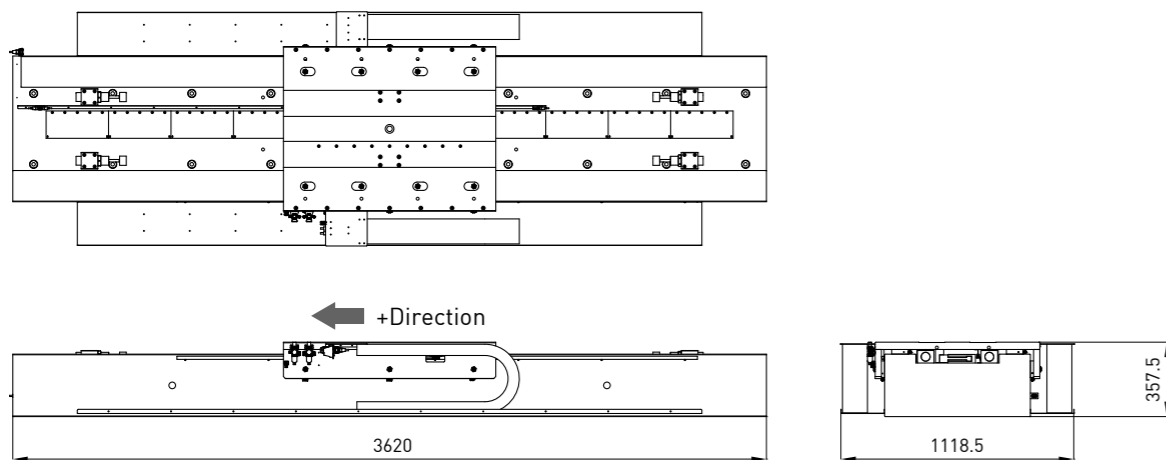
4 Drive

4.1 HIWIN D1 servo motor drive

- Digital drive
- Vector control
- Lightening human, machine interface
- 100-240Vac power input
- Support various pulse wave formats
- Support analog or digital optical scales

DC24V

Option

Main Power

LM STAGE

Drive

CN3

CN2

CN3 CN2 CN4

CN1

Limit signals

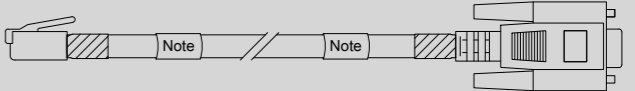Pulse signal etc.

PC

Motion Controller
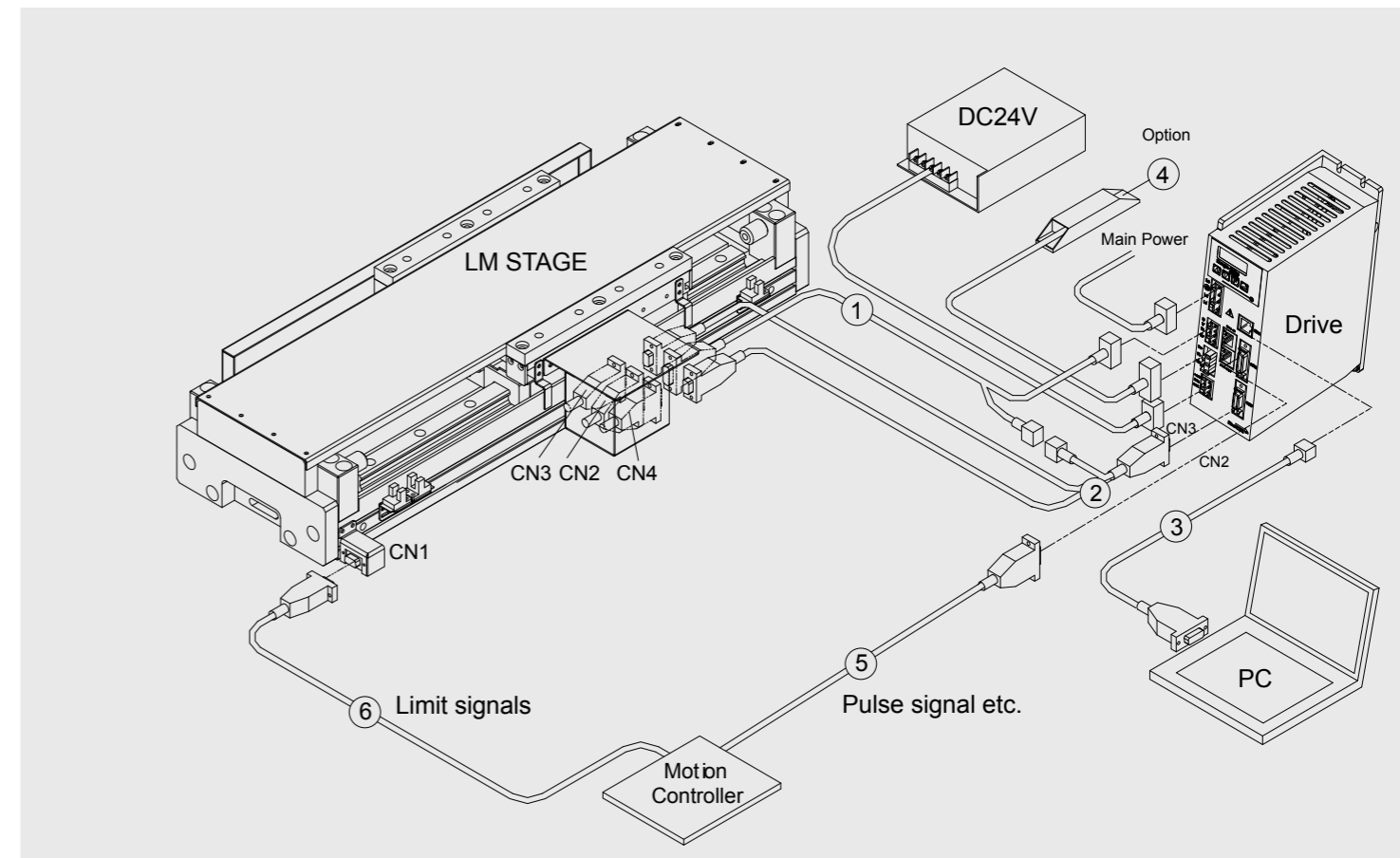
4.2 HIWIN D1-N servo motor drive

- Current vector control
- Best for driving linear motors, shaft motors and torque motors
- 100-240VAC power input
- Supports STP / DIR, CW / CCW, A / B pulse formats (differential / single ended interace)
- upports ±10V voltage or digital commands for velocity or force/ torque modes
- PDL general motion language
- Supports analog and digital encoder and resolver

4.3 D1 related accessories

Table4-1 Drive peripheral accessories

	Name	Specification	Connector	Description
③	RS-232communication cable	LMACR21D	D-sub connector and CN1	D-Sub9PIN to RJ-11
④ ⑩	Regenerative resistor	050100700001		Rated power 100W, instant power 500W
	D1 Drive connector accessories kit bag	D1-CK1		All connectors (not included CN3)
				All connectors (also included CN3)
	EMC accessories kit bag	D1-EMC1		Single phase power
		D1-EMC2		Three phase power
	Heat sink	D1-H1		Standard
		D1-H2		Small type
	Digital Hall sensor	LMAHS		Suitable for LMS series, single-ended signal
		LMAHC		Suitable for LMCA,LMCB and LMCC series, single-ended signal
		LMAHC2		Suitable for LMCD and LMCE series, single-ended signal
	Analog Hall sensor	LMAHSA-D		Suitable for LMS series, differential signal
		LMAHCA-D		Suitable for LMCA,LMCB and LMCC series, differential signal

Note：Please contact us for hall sensor.

Drives
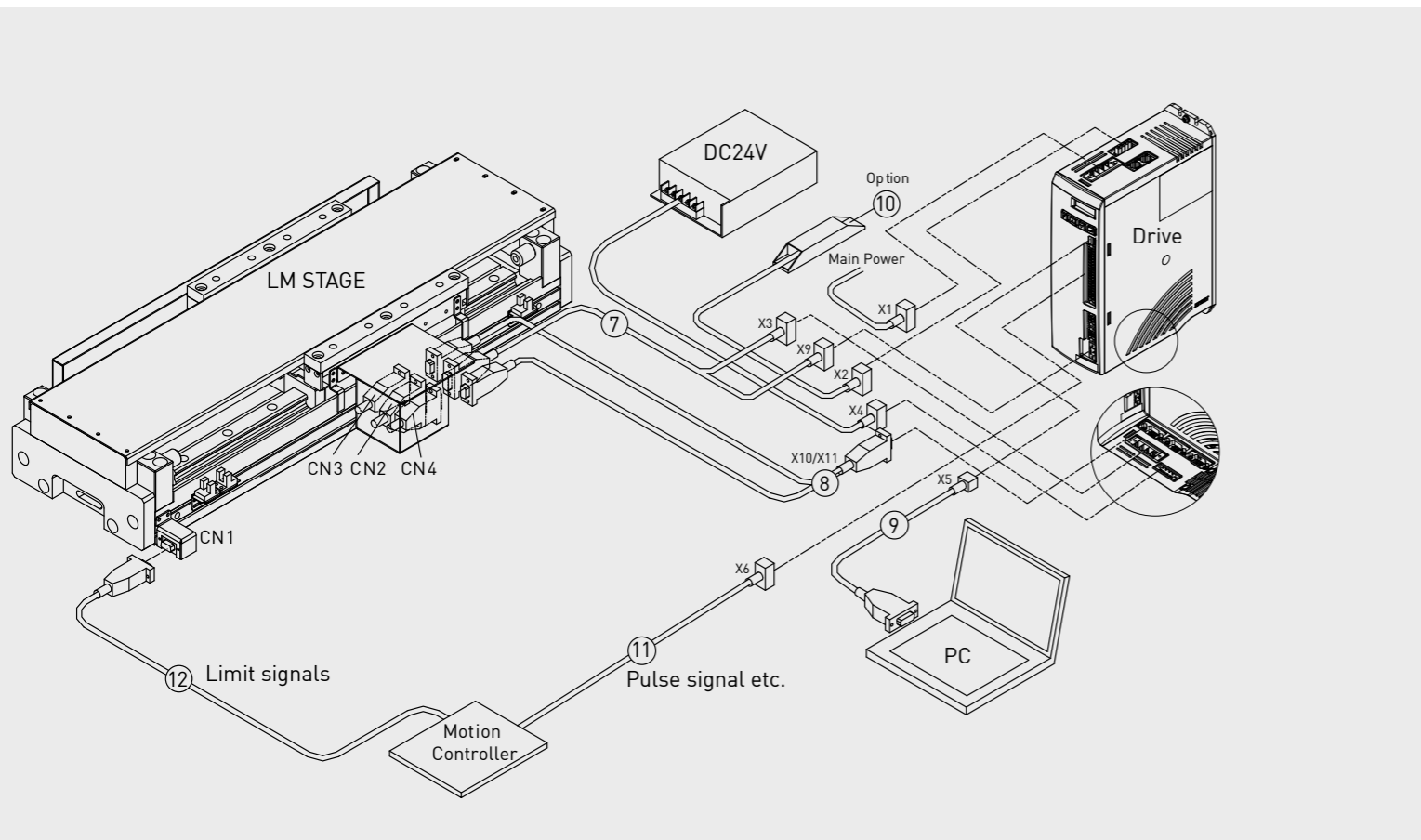
4.4 Cables and connectors

4.4.1 D1 related cables

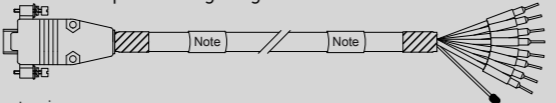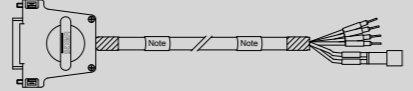**Table4-2 Control signals, limit signals, motor power cables**
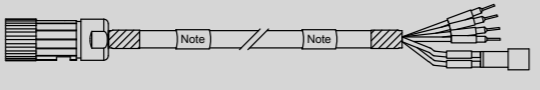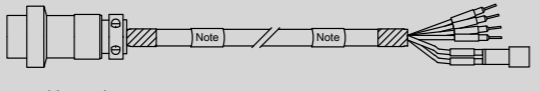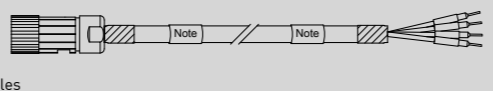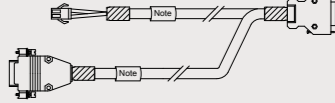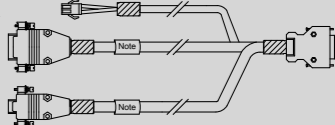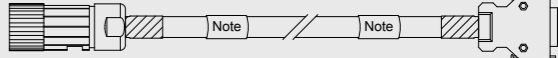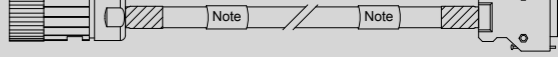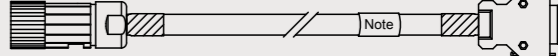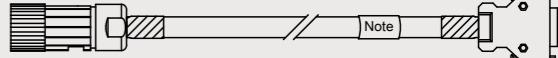
Name	Specification	Connector	Description
⑤ Control signal cables	LMACK30R	CN2	To motion controller (about 3 meters long) Drive connectors (3M) Model: 10126-3000VE
⑥ ⑫ Limit switch extension cord	LMACK□□S		Suitable for linear motor positioning stages D-Sub9 Pin to discrete wires
① Motor power supply cables and over-temperature signal cables	LMACS□□D	Motor power connector (U.V.W)	Suitable for LMS series linear motors，LMC series linear motors: LMC-EFE、LMC-EFF 9W4S to discrete cables and over-temperature connector
	LMACS□□L		Suitable for LMCF motors 9W4S to discrete cables and over-temperature connector
	LMACS□□T		Suitable for LMSA series linear motors 9W4S to discrete cables and over-temperature connector
	LMACS□□K		Suitable for LMC series linear motors: A, B, C, D, E, EFC LMT series linear motors: A, B, C Interconnect to discrete cables and over-temperature connector
	LMACS□□F		Suitable for TMS、TMN、TMY series torque motors (not include over-temperature signal) Intercontec to discrete cables

Table4-3 Position feedback cables

Drive	Specification	Connector	Description
② HIWIN D1-XX-S2 series	LMACE□□Y		For Renishaw digital optical scale, motor over-temperature signal. For position feedback D-SUB 15 female connector Motor over-temperature connector Drive connector (3M) Model no.：10120-3000VE
	LMACE□□Z		Renishaw digital optical scale, motor over-temperature signal, digital Hall component signals. For position feedback D-SUB 15 female connector Motor over-temperature connector Digital Hall component D-SUB 9 female connector Drive connector (3M) Model no.：10120-3000VE
	LMACE□□C		Renishaw digital optical scale, motor over-temperature signal. Motor over-temperature connector Drive connector (3M) Model no.：10120-3000VE
	LMACE□□J		Renishaw analog optical scale, motor over-temperature signal, digital Hall component signals. Motor over-temperature connector Digital Hall component D-SUB 9 female connector Drive connector (3M) Model no.：10120-3000VE
HIWIN D1-XX-S3 series	LMACE□□AW	CN3	Renishaw digital optical scale, motor over-temperature signal.
	LMACE□□AV		Renishaw digital optical scale, motor over-temperature signal, digital Hall component signals.
HIWIN D1-XX-S8 series	LMACE□□AA		Jena for analog encoder, motor over-temperature signal, suitable for TMS series torque motors. Intercontec Model no.：ASTA876NN0085200A000 Drive connector (3M) Model no.：10120-3000VE
	LMACE□□AM		Jena for analog encoder, motor over-temperature signal, Hall component signals. Intercontec Model no.：ASTA876NN0085200A000
HIWIN D1-XX-SR series	LMACE□□AD		Single Resolver extension cable, includes over-temperature signal. Intercontec Model no.：ASTA876NN0085200A000
HIWIN D1-XX-DR series	LMACE□□AU		Dual Resolver extension cable, includes over-temperature signal. Intercontec Model no.：ASTA876NN0085200A000

□□	03	04	05	06	07	08	09	10
Cable length (m)	3	4	5	6	7	8	9	10

Drives

4.4.2 Pin assignments of D1

LMACE□□Z
LMACE□□Y (No Hall component)

Signal	D-SUB 15Pin female connector	Color (051400300063)	D-SUB 20Pin male connector
5V	7	Brown	3
0V	2	White	2
A+	14	Green	4
A-	6	Yellow	5
B+	13	Blue	6
B-	5	Red	7
Z+	12	Violet	8
Z-	4	Grey	9
Inner Shield	15	Inner shield	20
Case	-	Outer shield	1

Signal	2Pin female connector	Color (051400300133)	
T+	1	Brown	14
T-	2	Blue	15

Signal	D-SUB 9Pin female connector	Color (051400100075)	
5V	1	Brown	3
Hall A	2	White	11
Hall B	3	Grey	12
Hall C	4	Yellow	13
0V	5	Green	10
Shield	Case	Shield	1

LMACE□□AV
LMACE□□AW (No Hall component)

Signal	D-SUB 15Pin female connector	Color (051400300069)	D-SUB 20Pin male connector
5V	7	Brown	3
0V	2	White	2
A+	14	Green	4
A-	6	Yellow	5
B+	13	Blue	6
B-	5	Red	7
Z+	12	Violet	8
Z-	4	Gray	9
Encoder Alarm	3	Pink	18
Inner	15	Inner shield	20
Outer	Case	Outer shield	1

Signal	2Pin female connector	Color (051400100133)	
T+	1	Brown	14
T-	2	Blue	15

Signal	D-SUB 9Pin female connector	Color	
5V	1	Brown	3
Hall A	2	White	11
Hall B	3	Grey	12
Hall C	4	Yellow	13
0V	5	Green	10
Shield	Case	Shield	1

LMACE□□AM
LMACE□□AA (No Hall component)

Function	8-10-0090 (Female)	JENA Signal	Color (051400300069)	SCSI 20 (Male)	mega-fabs D1 Signal
Power	4	5V	Blue	3	+5Vdc
	5	5V	Blue	-	-
	6	0V	White	2	Signal Gnd
Incremental signals	2	U_2-	Red	19	Cos(-)
	3	U_1-	Brown	17	Sin(-)
	9	U_2+	Black	18	Cos(+)
	10	U_1+	Green	16	Sin(+)
Origin signal	1	U_0-	Pink	9	/X
	8	U_0+	Grey	8	X
	6	0V	Inner shield	20	Signal Gnd
	Case	Shield	Outer shield	1	Frame Gnd
Temperature	11	T+	Violet	14	[IN5] Motemp
	12	T-	Yellow	15	Signal Gnd
Hall sensor	13	Vcc	Blue	3	+5Vdc
	14	HallA	Brown/Green	11	HA
	15	HallB	White/Yellow	12	HB
	16	HallC	White/Green	13	HC
	17	GND	White	10	Signal Gnd

LMACE□□J
LMACE□□C (No Hall component)

Signal	D-SUB 15Pin female connector	Color (051400300063)	D-SUB 20Pin male connector
5V	4	Brown	3
0V	12	White	2
Sin(+)	9	Green	16
Sin(-)	1	Yellow	17
Cos(+)	10	Blue	18
Cos(-)	2	Red	19
Z+	3	Violet	8
Z-	11	Grey	9
Inner Shield	15	Inner shield	20
Case	-	Outer shield	1

Signal	2Pin female connector	Color (051400100133)	
T+	1	Brown	14
T-	2	Blue	15

Signal	D-SUB 9Pin female connector	Color (051400100075)	
5V	1	Brown	3
Hall A	2	White	11
Hall B	3	Grey	12
Hall C	4	Yellow	13
0V	5	Green	10
Shield	Case	Shield	1

LMACE□□AD

Signal	Round connector 17Pin 8-10-0090 Female connector	Color (051400300069)	SCSI 20Pin Male connector
Z+	13	Grey	12
Z-	14	Pink	13
Sin1+	2	Green	16
Sin1-	3	Yellow	17
COS1+	9	Blue	18
COS1-	10	Red	19
VREF+	1	Brown	11
VREF-	8	White	3
Inner	12	Inner shield	15
Outer	Metal housing	Outer shield	1/Case
T+	11	White/Green	14
T-	12	Brown/Green	15
+5V	5	Violet	9
0V	6	Black	10

LMACE□□AU

Function	Signal	Round connector 17Pin 8-10-0090 Female connector	Color (051400300069)	SCSI 20Pin Male connector
Resolver1 (20/115)	Vref+	1	Brown	11
		4	White/Yellow	
	Vref-	7	White	3
		8	Yellow/Brown	
	SIN+	2	Green	16
	SIN-	3	Yellow	17
	COS+	9	Blue	18
	COS-	10	Red	19
Resolver2 (24/114)	SIN+	13	Black	4
	SIN-	14	Violet	5
	COS+	15	Grey	6
	COS-	16	Pink	7
	Inner Shield	12	Inner shield	15
	Outer Shield	Case	Outer shield	1/Case
Temperature	T+	11	Brown/Green	14
	T-	12	White/Green	15

Drives

LMACK30R

Signal	Pin	Color	Wire pair		Color	Pin	Signal
Frame Ground	1	Brown	1a	8a	Blue	14	[Out2]
Signal Ground	2	Brown/White	1b	8b	Blue/White	15	[Out3]
Enable [IN1]	3	Red	2a	9a	Light blue	16	Encoder A In/Out
GP Input [IN2]	4	Red/Black	2b	9b	Light blue /Black	17	Encoder /A In/Out
GP Input [IN3]	5	Orange	3a	10a	Purple	18	Encoder B In/Out
GP Input [IN4]	6	Orange/Black	3b	10b	Purple /White	19	Encoder /B In/Out
HS Input [IN6]	7	Green	6a	11a	Grey	20	Encoder X In/Out
HS Input [IN7]	8	Pink	4a	11b	Grey /Black	21	Encoder /X In/Out
HS Input [IN8]	9	Yellow	5a	12a	White/Red	22	+5 Vdc @ 400mA
HS Input [IN9]	10	Pink/Black	4b	12b	White/Blue	23	Siganl Ground
HS Input [IN10]	11	Yellow/Black	5b	13a	White	24	Analog Ref In (+)
GP Input [IN11]	12	Green/Black	6b	13b	White /Black	25	Analog Ref In (-)
[Out1]	13	Light green	7a	7b	Light green/Black	26	[IN12] GP Input
Shield	Case						
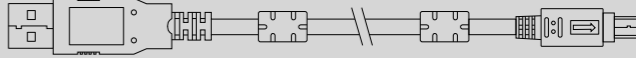
NOTE: Wire pair 1a and 1b represent diagonal.

LMACK□□S

Signal	Pin	Color	Wire set
Vcc	1	Yellow	+
GNb	9	Green	-
Negative limit signal output	3	Grey	1-OUT
* Reference notes	2	White	1-L
Positive limit signal output	5	Pink	2-OUT
* Reference notes	4	Brown	2-L
Origin signal output	7	Red	3-OUT
* Reference notes	6	Blue	3-L

NOTE: If connect wire set "L" to "+", can change wire set "OUT" output contact patterns.

4.5 D1-N related accessories

Table4-4 **Drive peripheral accessories**

Name	Specification	Connector	Description
⑨ USB 2.0A to Mini-B Cable (5m)			051700800514
Regenerative resistor	050100700001		Rated power 100W, instant power 500W
D1-N Drive connector accessories kit bag	D1-CK		All connectors
EMC accessories kit bag	D1-N EMC2		Single phase power
	D1-N EMC1		Three phase power

Drives

4.5.1 D1-N related cables

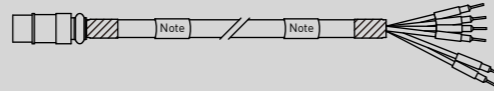**Table4-5 Control signals, limit signals, motor power cables**
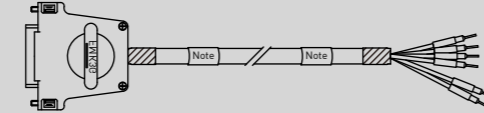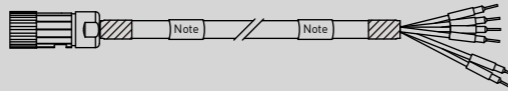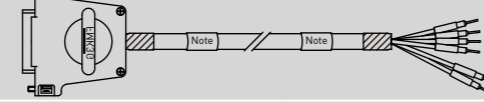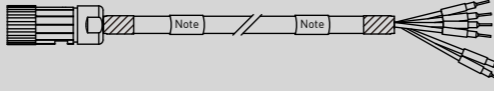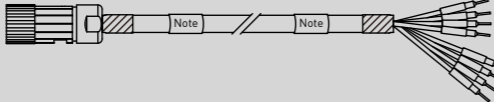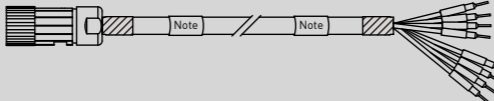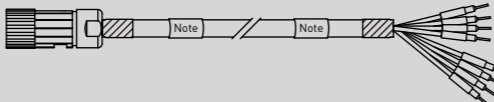
Name	Specification	Connector	Description
⑪ **Control signal cables**	LMACK□□F	X6	Both ends are scattered lines,suitable for HIWIN D1-N drive series.
⑦ **Motor power supply cables and over-temperature signal cables**	LMACS□□U	X3	Suitable for LMC series linear motors: LMC-EFE、LMC-EFF
	LMACS□□V		Suitable for LMSA motors
	LMACS□□M		Suitable for LMC series linear motors: A, B, C, D, E, EFC LMT series linear motors: A, B, C, D
	LMACS□□N		Suitable for LMC series linear motors:F
	LMACT□□D		Suitable for LMT series linear motors:E
	LMACS□□Z		Suitable for LMFA series linear motors: LMFA0□□、LMFA1□□、 LMFA2□□、 LMFA31、LMFA31L、LMFA32、LMFA32L、LMFA41、LMFA41L、LMFA42、LMFA42L、LMFA52、LMFA52L、LMFA62(round metal connector, wire diameter 1.5mm²)
	LMACT□□A		Suitable for LMFA series linear motors: LMFA33、LMFA33L、LMFA34、LMFA43 、LMFA43L、LMFA44、LMFA53、LMFA53L、LMFA54、LMFA62L 、LMFA63、LMFA64,includes KTY and PTC two sets of over-temperature signals.(round metal connector, wire diameter 2.5mm²)
	LMACT□□B		Suitable for LMFA series linear motors: LMFA34L、LMFA44L、 LMFA54L、 LMFA63L,includes KTY and PTC two sets of over-temperature signals.(round metal connector, wire diameter 4.0mm²)

Table4-5 Control signals, limit signals, motor power cables
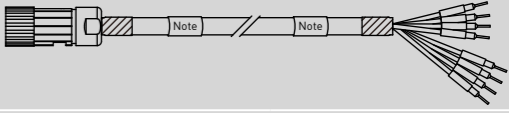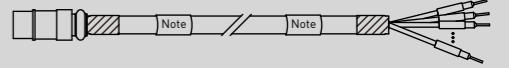
Name	Specification	Connector	Description
Motor power supply cables and over-temperature signal cables	LMACS□□C	X3	Suitable for LMFA series linear motors:LMFA64L,includes KTY and PTC two sets of over-temperature signals.(round metal connector, wire diameter 6.0mm²)
	LMACS□□R		Suitable for DD series direct drive motors: TMS、 TMN、 TMY,(not include over-temperature signal)

Drives

Table4-6 Position feedback cables

Drive	Specification	Connector	Description
Suitable for linear motors ⑧ ⑧	LMACF□□C	X10	For Renishaw digital optical scale,connector is the D-type connector,doesn't include Hall sensor signal.
	LMACF□□D		For Renishaw digital optical scale,connector is the D-type connector, include Hall sensor signal.
	LMACF□□A		For Renishaw analog optical scale,connector is the D-type connector,doesn't include Hall sensor signal.
	LMACF□□H		For Renishaw analog optical scale,connector is the D-type connector, include Hall sensor signal.
	LMACF□□L	X11	Jena for analog encoder, motor over-temperature signal, suitable for TMS、TMN□□E motors.
	LMACF□□G		Jena for analog encoder, motor over-temperature signal, hall sensor signals,suitable for TMN□□EH motors.
Suitable for direct drive motors	LMACF□□E	X12	Single Resolver encoder,with motor over-temperature signal,suitable for TMN motors.
	LMACF□□J		Dual Resolveruencoder,with motor over-temperature signal,suitable for TMY、TMN□□A motors.

4.5.2 Pin assignments of D1-N

LMACF□□D
LMACF□□C (No Hall component)

Signal	D-SUB 15Pin female connector	Color (051400300069)	X10HD-SUB 15Pin male connector
5V	7	Brown	5
	8	Brown/Yellow	
0V	2	White	15
	9	White/Yellow	
A+	14	Green	1
A-	6	Yellow	6
B+	13	Blue	2
B-	5	Red	7
Z+	12	Violet	3
Z-	4	Grey	8
Inner Shield	15	Inner shielding	15
Outer	Case	Outer shielding	Case

Signal	9Pin female connector	Color (051400100075)	
5V	1	Brown	5
Hall A	2	White	9
Hall B	3	Grey	10
Hall C	4	Yellow	11
0V	5	Green	15
Shield	Case	Shield	Case

LMACE□□H
LMACE□□A (No Hall component)

Signal	D-SUB 15Pin female connector	Color (051400300069)	X11HD-SUB 15Pin male connector
5V	4	Brown	5
	5	Brown/Yellow	
0V	12	White	15
	13	White/Yellow	
Sin(+)	9	Green	1
Sin(-)	1	Yellow	6
Cos(+)	10	Blue	2
Cos(-)	2	Red	7
Z+	3	Violet	3
Z-	11	Grey	8
Inner Shield	15	Inner shielding	15
Outer	Case	Outer shielding	Case

Signal	D-SUB 9Pin female connector	Color (051400100075)	
5V	1	Brown	5
Hall A	2	White	9
Hall B	3	Grey	10
Hall C	4	Yellow	11
0V	5	Green	15
Shield	Case	Shield	Case

LMACF□□G
LMACF□□L (No Hall component)

Function	JENA Signal	17Pin female connector	Color (051400300069)	X12 HD-SUB 15Pin female connector
Power	5V	4	Blue	5
	5V	5	Blue	5
	0V	6	White	15
Incremental signals	U_2-	2	Red	7
	U_1-	3	Brown	6
	U_2+	9	Black	2
	U_1+	10	Green	1
Origin signal	U_0-	1	Pink	8
	U_0+	8	Grey	3
	Shield	Case	Inner shield	15
Temperature	T+	11	Purple	
	T-	12	Yellow	

	Color (051400100133)	Line number casung
	Brown	T+
	Blue	T-

Function	JENA Signal	17Pin	Color (051400300069)	Color (051400300063)	X10 HD-SUB 15Pin male connector
Hall sensor	Vcc	13	Blue	Blue	5
	HallA	14	Brown/Green	Brown	9
	HallB	15	White/Yellow	Yellow	10
	HallC	16	White/Green	Green	11
	GND	17	White	White	15

Drives

LMACF□□E

Signal	Round connector 17Pin 8-10-0090 Female connector	Color (051400300108)	X12HD-SUB 15Pin female connector
5V	5	Brown / Brown/Green	5
0V	6	White / White/Green	4
Sin1+	2	Green	1
Sin1-	3	Yellow	6
COS1+	9	Blue	2
COS1-	10	Red	7
VREF+	1	Gray	11
VREF-	8	Pink	12
Z+	13	Black	13
Z-	14	Violet	14
T+	11	Gray/Pink	
T-	12	Red/Blue	
Shield	Case	Shield	15

Color (051400300138)	Line number casing
Brown	T+
White	T-

LMACF□□J

Signal	Round connector 17Pin 8-10-0090 Female connector	Color (051400300108)	X12HD-SUB 15Pin female connector
Sin1+	2	Green	1
Sin1-	3	Yellow	6
COS1+	9	Brown	2
COS1-	10	White	7
Sin2+	13	Blue	3
Sin2-	14	Red	8
COS2+	15	Gray	9
COS2-	16	Pink	10
VREF+	1/4	Black	11
VREF-	7/8	Violet	12
T+	11	Brown/Green	
T-	12	White/Green	
Shield	Case	Outer shielding	Case

Color (051400300138)	Line number casing
Brown	T+
White	T-

LMACK□□F

Signal	Pin	Color	Signal	Pin	Color
CWL	1	White	FG	21	Light blue
CCWL	2	White/Black	GND	22	Light blue/Black
CW+	3	Red	01+	23	Light green
CW-	4	Red/Black	01-	24	Light green /Black
CCW+	5	Yellow	02+	25	White/Red
CCW-	6	Yellow/Black	02-	26	White/Blue
I1	7	Green	03+	27	Red/White
I2	8	Green/Black	03-	28	Red/Blue
I3	9	Blue	PT+	29	Yellow/Red
I4	10	Blue/White	PT-	30	Yellow/Blue
I5	11	Brown	N/A	31	Green/White
I6	12	Brown/White	N/A	32	Light green /Blue
I7	13	Orange	A	33	Gray/Red
I8	14	Orange/Black	/A	34	Gray/Blue
I9	15	Gray	B	35	Pink/Red
I10	16	Gray/Black	/B	36	Pink/Blue
COM	17	Purple	Z	37	Light blue/Red
REF+	18	Pink	/Z	38	Light blue/Blue
REF-	19	Pink/Black	CZ	39	Light green /Red
DSF+	20	Violet/White	DSF-	40	Green/Blue

Appendix A: Motor Sizing

Start Motor Sizing

The following contents describe how to choose proper motor according to speed, moving distance, and Payloading inertia. The basic process for sizing a motor is:

- Decide motion profile and required parameters
- Calculate peak and continuous force
- Select motor

Symbols

X : move distance (mm)
T : move time (sec)
a : acceleration (mm/s^2)
V : velocity (mm/s)
M_L: Payloading (kg)
g : gravitation acceleration (mm/s^2)
F_p : peak force (N)
F_c : continuous force (N)
F_a : attraction force between stator and forcer (applicable for LMS, LMF series) (N)
F_i : inertia force (N)
K_p : force constant (N/Arms)
I_p : peak current (Arms)
I_e : effective current (Arms)
I_c : continuous current (Arms)
V_0 : starting velocity (mm/s)

STEP 1 Decide motion velocity profile and required parameters

In order to determine the correct motor for a particular application it is necessary to be familiar with the motion equation.

Motion equation
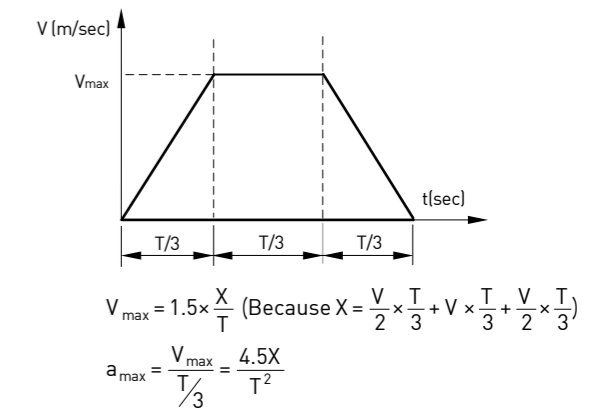
Basic kinematics equations are described as follows:

$$V = V_0 + aT$$

$$X = V_0T + \frac{1}{2}aT^2$$

Where V is velocity, a is acceleration, T is move time and X is move distance.
You can choose two of the four parameters (V, a, T and X) as your designed parameters, then the last two parameters can be calculated by above equations.
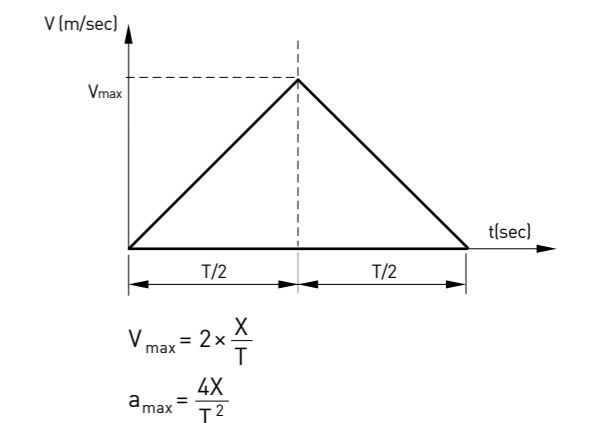
Motion velocity profile

1. 1/3-1/3-1/3 trapezoid profile

If the distance (X) and move time (T) have been given, the most common and efficient velocity profile for point-to-point motion is the "1/3-1/3-1/3" trapezoid curve because it provides the optimal move by minimizing the power required to complete the move. It breaks the time of the acceleration, Strokeing, and deceleration into three segments as shown below.

$$V_{max} = 1.5 \times \frac{X}{T} \quad \left(\text{Because } X = \frac{V}{2} \times \frac{T}{3} + V \times \frac{T}{3} + \frac{V}{2} \times \frac{T}{3} \right)$$

$$a_{max} = \frac{V_{max}}{T/3} = \frac{4.5X}{T^2}$$

Herein the parameters are described as motion equation.

2. 1/2-1/2 triangle profile

If X and T are given, another common motion profile is the 1/2-1/2 triangle profile. The motion is divided into two parts, namely acceleration and deceleration. The second motion velocity profile is shown as follows.

$$V_{max} = 2 \times \frac{X}{T}$$

$$a_{max} = \frac{4X}{T^2}$$

3. Some useful equations

	1/3 -1/3-1/3 Trapezoid profile	Triangle profile
V	$1.5 \times \dfrac{X}{T}$	$2 \times \dfrac{X}{T}$, or $\sqrt{a \times X}$
a	$\dfrac{4.5X}{T^2}$	$\dfrac{4X}{T^2}$
t	$\dfrac{X}{V_{max}} + \dfrac{V_{max}}{a}$ (if $\dfrac{X}{V_{max}} \geq \dfrac{V_{max}}{a}$)	

The acceleration required in the first motion velocity profile is bigger than that in the second motion velocity profile; therefore, the required motor size is bigger. When choosing second motion velocity profile, the chosen motor size is smaller, however, we need to verify the DC bus of driver is bigger enough, due to the higher velocity (V_{max}).

STEP 2 Determine peak force and effective force
The peak force can be calculated by the follow equation

$$F_p = M_L \times a_{max} + (M_L \times g + F_a) \times \mu = F_i + F_f$$

Where F_i is inertia force while F_f is friction force, and μ is friction factor.
In most cases, motions are cyclic point-to-point movements. Assuming a cyclic motion shown in the following profile with a pause time of t_4 second, the effective force can be calculated as following formula:

$$F_e = \sqrt{\dfrac{(F_i + F_f)^2 t_1 + F_f^2 t_2 + (F_i - F_f)^2 t_3}{t_1 + t_2 + t_3 + t_4}}$$
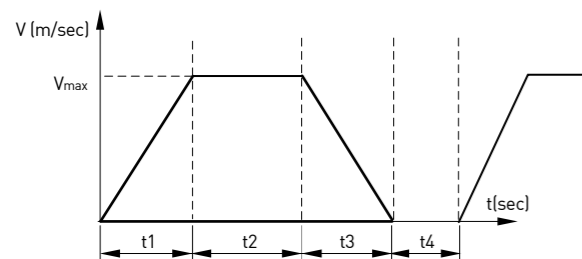
The peak current I_p and effective current I_e can be calculated by using motor force constant K_f.

$$I_p = \dfrac{F_p}{K_f}$$

$$I_e = \dfrac{F_e}{K_f}$$

STEP 3 Select motor by peak force and verify the current supply of motor

From the HIWIN catalog, you can check the specifications of motor and choose an applicable motor by peak force, and then you can verify the current supply if it is fitted the specification as follows.

$$I_p = \dfrac{F_p}{K_f} < I_p \text{ (from specification of chosen motor)}$$

$$I_e = \dfrac{F_e}{K_f} < I_c \text{ (from specification of chosen motor)}$$

Regarding effective and continuous current, the ratio of I_e/I_c had better be less than 0.7 to attain some margin.

Linear Motor Sizing Example
For example, if Payload is 5 kg (moving mass of mechanism is 1 kg and payPayload is 4 kg), friction factor μ is 0.01 ,distance is 500 mm, move time is 400 ms and dwell time is 350 ms.
At first, we can calculate the V_{max}, a_{max}, F_p and F_e by the formulas described above (choose the first motion velocity profile and LMC series)

$$V_{max} = 1.5 \times \dfrac{X}{T} = 1.5 \times \dfrac{0.5}{0.4} = 1.875 \text{ (m/sec)}$$

$$a_{max} = \dfrac{4.5 \times X}{T^2} = \dfrac{4.5 \times 0.5}{(0.4)^2} = 14.06 \text{ (m/sec}^2)$$

$$F_p = M_L \times a_{max} + (M_L \times g + F_a) \times \mu$$

$$= 5 \times 14.06 + 5 \times 9.81 \times 0.01 = 70.3 + 0.49 = 70.79 \text{ (N)}$$

$$F_e = \sqrt{\dfrac{[(70.3 + 0.49)^2 + 0.49^2 + (70.3 - 0.49)^2] \times 0.1333}{0.4 + 0.35}}$$

$$= 41.92 \text{ (N)}$$

In this case, we can choose motor of type LMCA6 (p.48) which can provide up to 187(N)of peak force and continuous force 62(N), and the force constant is 33.8 N/A(rms). Then the current supply of motor can be determined as follows

$$I_p = \dfrac{F_p}{K_f} = \dfrac{70.79}{33.8} = 2.09 \text{ (Arms)} < 5.4 \text{ (Arms)}$$

$$I_p = \dfrac{F_e}{K_f} = \dfrac{41.92}{33.8} = 1.24 \text{ (Arms)} < 1.8 \text{ (Arms)}$$

$$I_e/I_c = \dfrac{1.24}{1.8} \times 100\% = 68.89\% < 70\%$$

Appendix B: Sizing a Regen Resistor

1. Gather required information
To calculate the power and resistance of the regen resistor requires information about the amplifier and the motor.
For all applications, gather the following information:

- Detail of motion profile, including acceleration and velocity
- Amplifier model number
- Applied line voltage to amplifier
- Toque/force constant of the motor
- Resistance (line-to-line) of the motor windings

For rotary motor applications, gather additional information
- Payload inertia seen by the motor
- Inertia of the motor

For linear motor applications, gather additional information
- Moving mass

2. Observe the properties of each deceleration during a complete cycle of operation
For each deceleration during the motion cycle, determine:
- Speed at the start of the deceleration
- Speed at the end of the deceleration
- Time over which the deceleration takes place

3. Calculate energy returned for each deceleration
The energy returned during each deceleration can be calculated by the following formulas.
Rotary motor:

$$E_{dec} = \frac{1}{2}J_t(\omega_1^2 - \omega_2^2)$$

E_{dec} (joules): Energy returned by the deceleration
J_t (kg m^2): Payload inertia on the motor shaft plus the motor inertia
   (radians /sec): Shaft speed at the start of deceleration
   (radians /sec): Shaft speed at the end of deceleration
I_e : effective current (Arms)

Linear motor:

$$E_{dec} = \frac{1}{2}M_t(V_1^2 - V_2^2)$$

E_{dec} (joules): Energy returned by the deceleration
M_t (kg): Moving mass
V_1 (meters /sec): Velocity at the start of deceleration
V_2 (meters /sec): Velocity at the end of deceleration

4. Determine the amount of energy dissipated by the motor
Calculate the amount of energy dissipated by the motor due to current flow through the motor winding resistance using the following formula.

$$P_{motor} = \frac{3}{4}R_{winding}(\frac{F}{K_t})^2$$

P_{power} (watts): Power dissipated in the motor
$R_{winding}$ (ohm): Line to Line resistance of the motor coil
F : Force need to decelerate the motor
   Nm for rotary applications

N for linear applications
K_t: Torque constant for the motor
   Nm/Amp for rotary applications
   N/Amp for linear applications
$E_{motor} = P_{motor}T_{decel}$
E_{motor} (joules): Energy dissipated in the motor
T_{decel} (seconds): Time of deceleration

5. Determine the amount of energy returned to the amplifier
Calculate the amount of energy that will be returned to the amplifier for each deceleration using the following formula

$E_{returned} = E_{dec} - E_{motor}$
$E_{returned}$ (joules): Energy returned to the amplifier
E_{dec} (joules): Energy returned by the deceleration
E_{motor} (joules): Energy dissipated by the motor

6. Determine if energy returned exceeds amplifier capacity
Compare the amount of energy returned to the amplifier in each deceleration with the amplifier's absorption capacity. The following formula is used to determine the energy that can be absorbed by the amplifier.

$$W_{capacity} = \frac{1}{2}C(V_{regen}^2 - (1.414V_{mains})^2)$$

$W_{capacity}$ (joules): The energy that can be absorbed by the bus capacitor
C (farads): Bus capacitance
V_{regen} (volts): Voltage at which the regen circuit turns on
V_{mains} (volts): Mains voltage (AC) applied to the amplifier

7. Calculated energy to be dissipated for each deceleration
For each deceleration where the energy exceeds the amplifier's capacity, using the following formula to calculate the energy that must be dissipated by the regen resistor.

$E_{regen} = E_{returned} - E_{amp}$
E_{regen} (joules): Energy that must be dissipated in the regen resistor
$E_{returned}$ (joules): Energy delivered back to the amplifier from the motor
E_{amp} (joules): Energy that the amplifier will absorb

8. Calculate pulse power of each deceleration that exceeds amplifier capacity
For each deceleration where energy must be dissipated by the regen resistor, use the following formula to calculate the pulse power that will be dissipated by the regen resistor

$P_{pulse} = E_{regen} / T_{decel}$
P_{pulse} (watts): Pulse power
E_{regen} (joules): Energy that must be dissipated in the regen resistor
T_{decel} (seconds): Time of deceleration

9. Calculate resistance needed to dissipate the pulse power
 Using the maximum pulse power from the previous calculation, calculate the resistance value of the regen resistor required to dissipate the maximum pulse power.

$R = V_{regen}^2 / P_{pulse\ max}$
R(ohms):Resistance
$P_{pulse\ max}$:The maximum pulse power
V_{regen} :The voltage at which the regen circuit turns on

Choose a standard value of resistance less than the calculated value. The value must also be greater than the minimum regen resistor value specified by the amplifier supplier.

10. Regen resistor sizing example
Gather required information
LM ROBOTS type:LMXL1L-S37L-1200-G200
Amplifier: mega-fabs D1
   DC bus capacitance: 1880uF
   Regen circuit turn on voltage: 390V
   Minimum resistance:15 Ω
Moving mass: 86Kg (include payPayload 74 Kg)
V_{max}: 2 m/s
Acceleration, deceleration: 5 m/s^2
Power supply (AC) of driver: 220VAC
Motor type:LMS37L
Force constant (Kf): 68N/A(rms)
$R_{winding}$: 2 ohms(line-to-line)

Calculate regen resistor as following step:

$$F = ma = 86 \times 5 = 430\,(N)$$

$$E_{dec} = \frac{1}{2}m_tV^2 = \frac{1}{2} \times 86 \times 2^2 = 172\,(joule)$$

$$P_{motor} = \frac{3}{4} \times R_{winding} \times (\frac{F}{K_f} \times \sqrt{2})^2 = \frac{3}{4} \times 2 \times (\frac{430}{68} \times \sqrt{2})^2$$
$$= 120\,(Watt)$$

$$E_{motor} = P_{motor} \times T_{decel} = 120 \times (\frac{2}{5}) = 48\,(joule)$$

$$E_{returned} = E_{dec} - E_{motor} = 172 - 48 = 124\,(joule)$$

$$W_{capacity} = \frac{1}{2} \times C \times (V_{regen}^2 - (1.414V_{mains})^2)$$
$$= \frac{1}{2} \times 1880 \times 10^{-6} \times (390^2 - (1.414 \times 220)^2)$$
$$= 51.98\,(joule)$$

$$\because E_{returned} > W_{capacity}$$

$$E_{regen} = E_{returned} - E_{amp} = 124 - 51.98 = 72.02\,(joule)$$

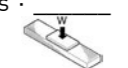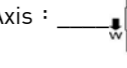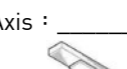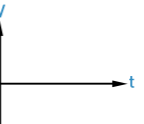$$P_{pulse} = E_{regen} / T_{decel} = 72.02 / 0.4 = 180.05\,(Watt)$$

Because the total value of selected resistance must be less than 844.77 ohms and the power capacity must be more than 180.05 watts, we choose two resistors and connect them in series, in each resistor the resistance is 68 ohms and power capacity is 100W. The total resistance value is 136 ohms and power capacity is 200W. The resistance order number is 050100700001.

Appendix C:Inquiry form,Mechanical System

Fields marked with asterisk (*) are required.   Date:

Customer name：_____   Contact HIWIN：_____

Email：_____   Inquiry No.：_____

Tel.：_____ Fax.：_____   Business owners：_____

*Industry/Application	_____	Multi-forcers	☐Yes,quantity：_____pcs ☐No
*Operational environment	☐Indoor, general 25℃ ☐Cleaning room, class：_____ ☐Vacuum ,_____ ☐Others	Required measurement protocol	☐Straightness(H)_____μm ☐Straightness(V)_____μm ☐Pitch_____arc-sec ☐Yaw_____arc-sec
*Stage type	☐Single ☐Dual axis Bridge ☐Gantry (single-driven) ☐Gantry (dual-driven) ☐Others _____	*Cover	☐No ☐Metal cover ☐Bellows
		Cable chain	☐No ☐Horizontal ☐Vertical
*Payload	☐Mass：___kg ☐Dimensions：___ mm ☐Offset, X：___ mm,Y：___ mm, Z：___ mm	*Movement	☐Point to point movement ☐Scanning

		Drive	Firmware version	☐Latest version ☐Specific version：_____
External force (N)	X-axis___ Y-axis___ Z-axis___		Voltage	☐110V ☐220V ☐Other,_____ V
*Max. speed(m/s)	X-axis___ Y-axis___ Z-axis___		command	☐Pulse formet ☐STEP/DIR ☐CW/CCW ☐A/B ☐Analog voltage command ☐Bus ☐mega-ulink ☐EtherCAT ☐Modbus
*Max. acceleration(m/s²)	X-axis___ Y-axis___ Z-axis___			
*Stroke(mm)	X-axis___ Y-axis___ Z-axis___	Wiring board included	☐Yes (Please fill out appendix D) ☐No
Repeatability(μm)	☐Uni-dir.：___ ☐Bi-dir.：___	Software requirements	☐Yes (Please fill in the remarks column) ☐No
Accuracy(μm)	_____	Upper controller	☐Specify ☐Motion board ☐Controller ☐IPC ☐PLC ☐Customer provide
Encoder type(μm)	☐Analog ☐Digital ☐Absolute：_____ Resolution：_____		☐HIWIN Design ☐No
		Position trigger function	☐Yes ☐No
*Stage installation	☐Horizon Axis： ☐Vertical Axis：	Distance	_____mm
		Travel time	_____sec
		Dwelling time	_____sec
	☐Hang Axis： ☐Upside-down Axis：	Motion profile	

Others

The information below is to be filled out by HIWIN or authorized agents.
Recommended specification:

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Appendix D:Inquiry form,Electric Control System

Fields marked with asterisk (*) are required.   Date:
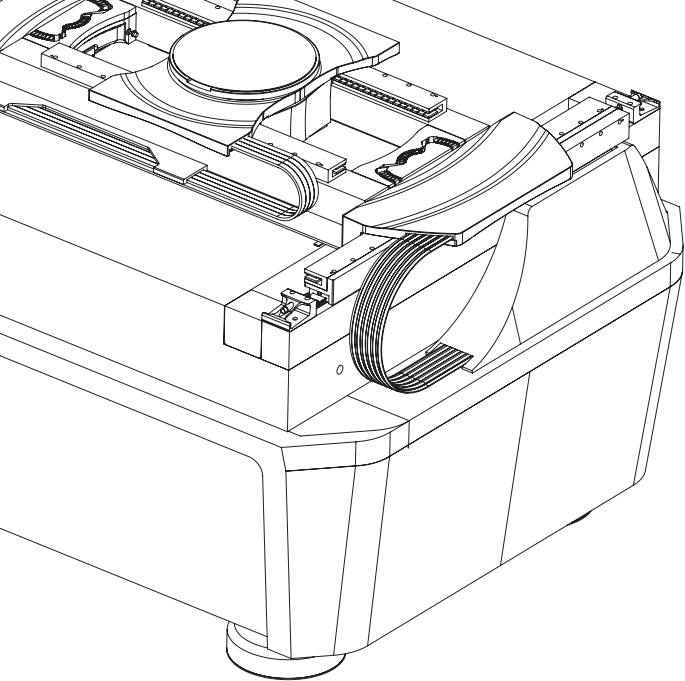
*Power system	Input Voltage	☐110V ☐220V(Single phase) ☐220V(Three-phase) ☐Other: _____V ☐HIWIN design	Optional parts	☐Socket	Input Voltage: _____V Quantity: _____
	Connector type	☐H Type(Input current< 15A.) ☐T Type(Input current< 15A.) ☐Bare Wire ☐Other: _____		☐I/O terminal	Input quantity_____: ☐NPN ☐PNP ☐Dry contact Output quantity_____: ☐NPN ☐PNP ☐Dry Contact Output current :_____mA
	UPS	☐Yes___KVA ☐No		☐No	
*Control panel	☐Wiring Panel	Installation method ☐Vertical ☐Horizontal ☐Drawer-Type Dimension(Unit: inch): L:_____W:_____H:_____	HIWIN document	☐Spare parts list(.pdf) ☐N/A
			Screen	☐Touchscreen Quantity: _____ Size: _____ inches ☐Non-touchscreen Quantity: _____ Size:_____ inches ☐No
	☐Electric Cabinet	Material type and Surface processing: ☐Stainless Steel ☐Aluminum ☐Coated ☐Non-Coated Dimension(Unit: inch): ☐8U: L: 26" W: 19" H: 14" ☐8U: L: 48" W: 19" H: 14" ☐Other:_____	Industrial specification	☐Required safety approval: _____ Customer wiring method: ☐Customer wiring method ☐HIWIN Standard
	☐HIWIN Design		Designated parts	☐List of designated parts(.PDF)(.xls) ☐List of designated parts (Customer-supplied)(.PDF)(.xls)
*Emergency stop mode	☐Keep Motor power-off (Control power retains.) ☐Keep Drive disable (Control power retains.) ☐HIWIN design		Alarm	☐Stack light ☐Buzzer ☐Safety Light Curtains ☐Other: _____ ☐N/A (Multiple choice are acceptable.)
Special requirements:				

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MEMO

MEMO

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Motion Control and System Technology

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The specifications in this catalog are subject to change without notification.