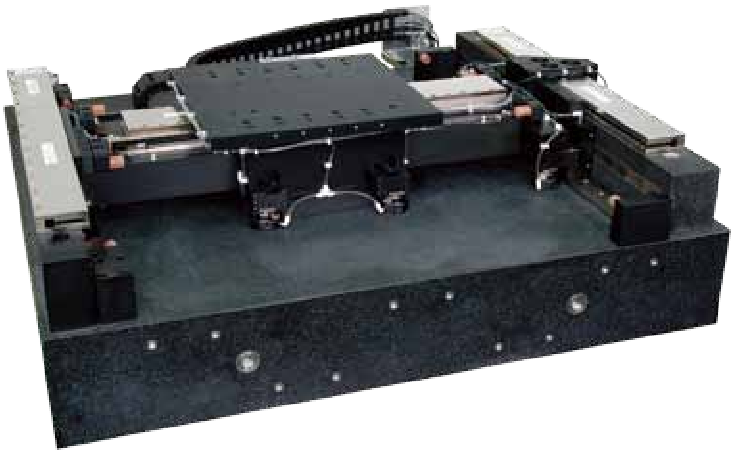
HIWIN®
Motion Control and System Technology



Linear Motor System

Technical Information

HIWIN®

Motion Control and System Technology

High speed | High precision | Multifunctional integration | Ecology first | Humanistic technology

TAIWAN EXCELLENCE
GOLD AWARD 2011, 2009, 2008
TAIWAN EXCELLENCE
SILVER AWARD 2006, 2001, 1993

Ballscrews

Ground/Rolled

- High Speed (High Dm-N Value/Super S Series)
- Heavy Load (Cool type II)
- Ecological & Economical lubrication Module E2
- Rotating Nut (R1)
- Energy-Saving & Thermal-Controlling (C1)

TAIWAN EXCELLENCE 2004

Positioning Guideway

TAIWAN EXCELLENCE
GOLD AWARD 2004

Linear Synchronous Motor

- Coreless Type (LMC)

TAIWAN EXCELLENCE 2002

Linear Actuator

- LAN for Hospital
- LAM for Industrial
- LAS Compact Size
- LAK Controller

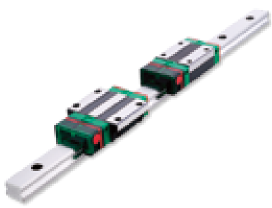
TAIWAN EXCELLENCE
GOLD AWARD 2010, 2003

Industrial Robot

- For Semiconductor & Electronic (KK Series)
- For Automation (KS, KA Series)

TAIWAN EXCELLENCE
SILVER AWARD 2009

Linear Motor Air Bearing Platform



TAIWAN EXCELLENCE
GOLD AWARD 2008
TAIWAN EXCELLENCE
SILVER AWARD 2007, 2002

Linear Guideway

HG/EG/RG/MG Type

- Ecological & Economical lubrication Module E2
- Low Noise (Q1)
- Air Jet (A1)

Positioning Measurement System

TAIWAN EXCELLENCE
GOLD AWARD 2005

Ballscrew

- For Heavy-Load Drive

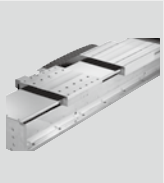
Linear Motor X-Y Robot

TAIWAN EXCELLENCE
SILVER AWARD 2006

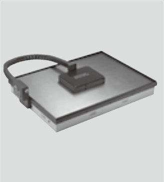
TMS Torque Motor Rotary Table

Linear Motor Gantry

Customized Positioning Systems
page 1



Linear Motor Stages
page 7



Planar Motors
page 45

Linear Motor Components
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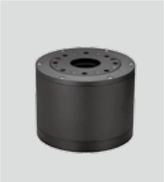

Torque Motor Rotary Tables
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Control and Drives
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Appendix
page 98

Linear Motor Inquiry Form
page 103

Positioning Systems

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 available 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.

1.1 Examples

Economical Pick & Place and Inspection

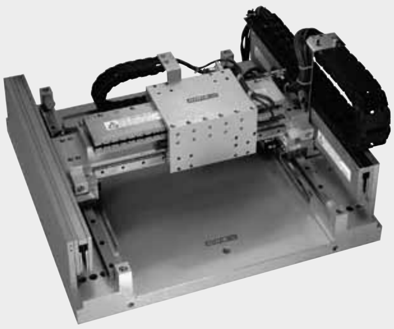
XY gantry systems are economical for many applications. Gantry axes are assembled from standard components.

- 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.

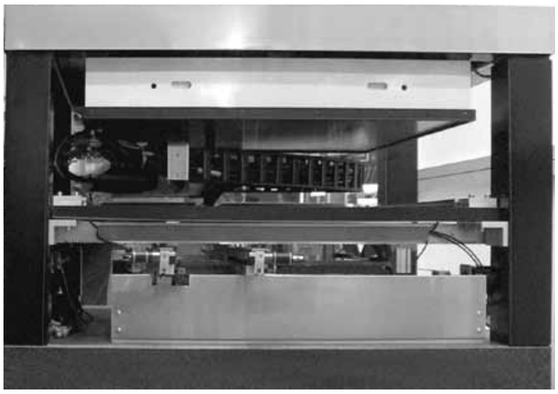
- Coreless motors LMC
- Repeatability ± 2 µm
- Technology proven through countless worldwide installations



Planar Motors

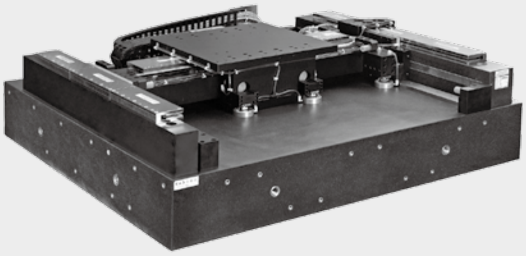
Servo-planar motors provide an excellent technological platform for inspection tasks. During inspection of circuit boards, optical sensors are integrated to completely monitor the printed conductive tracks and SMD components.

- Virtually no wear due to an air-cushion bearing
- Guaranteed levelness for the complete stroke path (up to 1000 mm x 1000 mm)
- Repeatability ± 3 µm



Positioning Systems

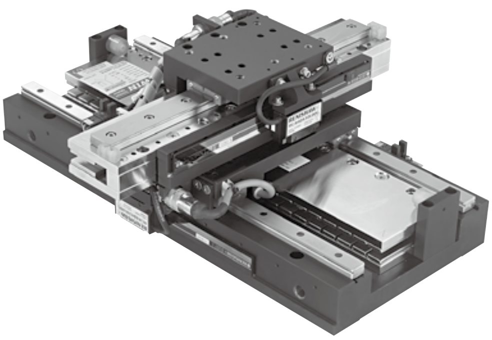
Customized Positioning Systems



Wafer Quality Control and Mask Production at the Highest Level

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.

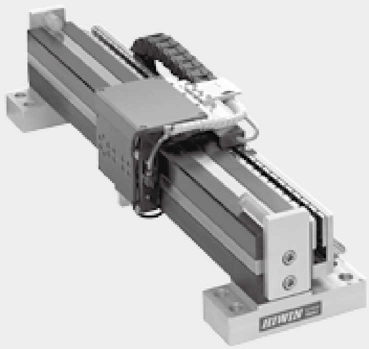
- Flatness ±2 µm
- Repeatability ±0.5 µm
- Accuracy ±1.5 µm



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.

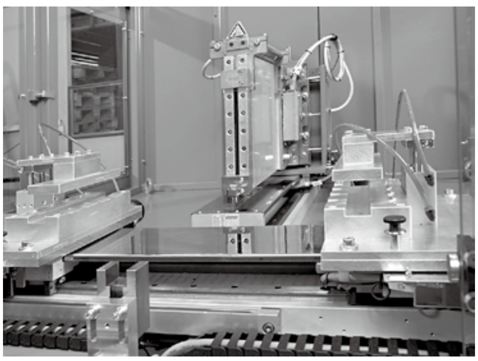
- Stroke 200 mm x 200 mm, optional 300 mm x 300 mm
- Levelness ± 4 µm across the complete stroke
- Repeatability ± 1 µm across both axes
- Accuracy ± 4 µm across both axes
- Clean room suitability class 100; optional class 10



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.

- Frictionless air cushions
- Coreless linear motors are not effected by cogging.
- Stroke up to 1,500 mm



Horizontal High-Speed Hot Weld Machine for Welding Synthetic Materials

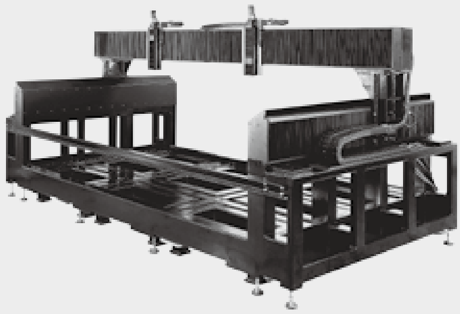
Linear motor stages of the LMX1L series with absolute position measurement offer:

- No commutation required at power up
- No "drawing" of the synthetic material when removed from the heated plate
- Welding is controlled by time, force and path
- Lower changeover times due to higher speeds

Water Jet Application

LMS double 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 thrust liner motors and run under synchronization.

- No commutation required at power up
- Large stroke
- Delivered with base frame, cover and high end motion controller



Total Solution for AOI Industry

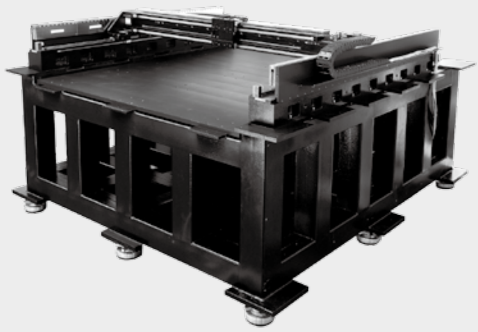
LMC linear stage provides smooth motion for the special needs in AOI applications. With the LMS linear stage mounted to the upper axis, the ballscrew driven Z-axis integrated with a CCD camera can attain high speeds.

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

Custom Made Stage for Glass Working

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

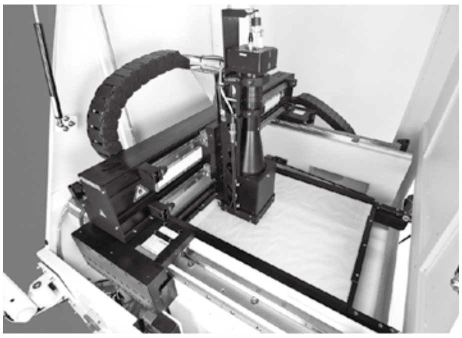
- Gantry structure linear motor positioning stage for Gen. 5 glass
- 1300 mm x 1450 mm stroke
- Smooth motion
- Sinusoidal commutation and no cogging
- LMC series motors
- Repeatablility ± 2µm
- Rigid base structure



Helping Customers with Motion Service

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

- 534 x 534 mm^2 stroke
- LMS27 and LMS13 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 +/-1.5um



Positioning Systems

Customized Positioning Systems

1.2 Glossary

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.

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 iron-core linear motors which must be taken up by the guide.

Back emf constant
(see also Chapter 1.3, 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 servomotor.

Continuous torque, continuous force
(see also Chapter 1.3, F_c)
Or also nominal torque, nominal force. This is the torque or force, that rotary or linear motors can produce in continuous operation (duty cycle = 100%).

Continuous current
(also see Chapter 1.3, 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.

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.

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% duty cycle

or as peak force or peak torque.

Force constant K_f
(see also Chapter 1.3, 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: $F = I \times K_f$

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

Horizontal straightness
It is a measure for horizontal 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.

Motor constant K_m
(see also Chapter 1.3, K_m)
This designates the ratio of generated force and dissipation power and consequently is a measure of efficiency for a motor.

Peak current I_p
(see also Chapter 1.3, I_p)
This current is applied to coils for a short time to generate peak force. HIWIN defines it to be the following: For iron core type motors, I_p is 2 times the allowed continuous current. For coreless types, it is 3 times the allowed continuous current. 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.

Repeatability
Repeatablity may 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 large enough enough 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.

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.

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

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

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 m^2/s^2.

Vertical straightness
It is a measure for vertical 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.

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_{max}
(see also Chapter 1.3, 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.

Positioning Systems

Customized Positioning Systems

1.3 Typical Dimensions

1.3.1 Coil-Independent Dimensions

F_a Relatively constant attracting force between motor primary and secondary part. The force is taken by a mechanical guide.

F_c Motor force available as continuous force in nominal operation and results in warming to 70-80 °C.

F_p Short term motor force, which is available at applying I_p to the coils and operate near the non-linear area. Without cooling means, it will cause a very strong temperature rising of coils.

K_m Motor constant, which is the ratio of generated force to dissipation power and is cosequently an index of motor efficiency.

P_v The generated power in a motor coil, which results in time dependent temperature rise according to supplied current and ambient cooling conditions. In the non-linear operating area of current (I_p), P_v is especially high due to quadratic relation to current, whereas in the linear area of current (I_c), it results in relative low warming. P_v can be calculated with motor constant K_m and force as below: $P_v = F/K_m^2$

P_{vp} Peak power at Ip

P_c Continuous power at Ic

T Permissible temperature of motor winding, which is monitored with help of sensor or thermal switch. The motor surface temparature depends on:

- The actual assembly condition (position stage size)
- Heat dissipation condition (cooling means)
- Actual operation

So the actual temperature can only be determined with the above informations.

1.3.2 Coil-Dependent Dimensions

I_c The current for generating continuous force

I_p The peak current for generationg short term peak force

K_f Coil characteristic value for calculation of force with the formula: $F = I \times K_f$

K_v Coil characteristic value, which results armature back emf dependent of velocity when motor works as generator. : $U_g = K_v \times v$

R_{25} Winding resistance at 25 °C; this increases to approx., 1.2 times the value at 80 °C.

2 Linear Motor Stages

2.1 Product Overview Page 8

2.2 Typical Properties of Linear Motor Stages Page 10

2.3 Scope of Delivery Page 11

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2.6 Linear Motor Stages LMX1E-C Page 14

2.7 Linear Motor Stages LMX1L-S Page 19

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Positioning Systems

Linear Motor Stages

2.1 Product Overview

LMX1E-C

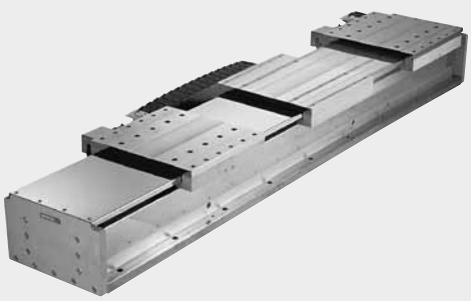
Page 14

- Complete linear stage with coreless motor, type LMC
- Excellent for applications with a high degree of synchronous operation requirements
- Also for use as cross table
- Stroke is measured via optical encoder incrementally or absolutely
- Total length to 4,000 mm

LMX1L-S

Page 19

- Complete linear stage with iron-core motor, type LMS
- Specially suited for applications with high demands on continuous power
- Also for use as cross table
- Stroke is measured via optical or magnetic encoder incrementally or absolutely depending on requirements
- Total length to 4,000 mm



LMX1L-SC

Page 26

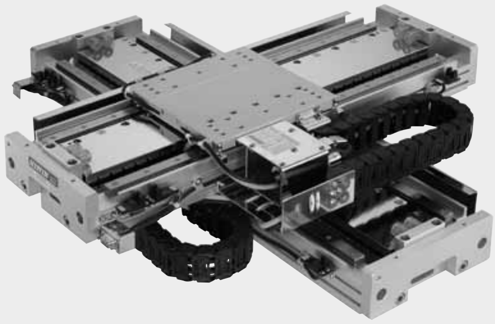
- Complete linear stage with iron-core motor, type LMSC
- Sandwich design makes high power density possible without static load of the guideways by attraction force
- Stroke is measured via optical or magnetic encoder incrementally or absolutely depending on requirements
- Total length to 4,000 mm

LMX1L-T

Page 28

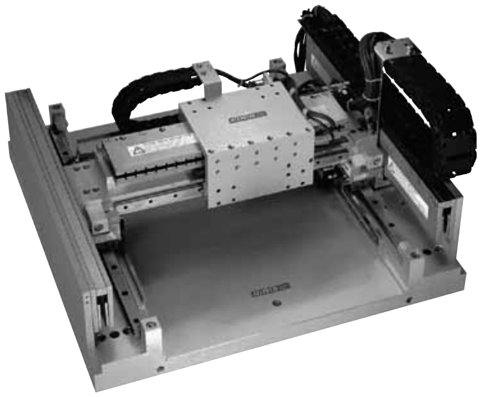
Cross Tables Page 34

- Combination of linear stages of the LMX series
- With iron-core or coreless motors



Gantry Systems Page 40

- Standardized gantry systems with iron-core or coreless motors



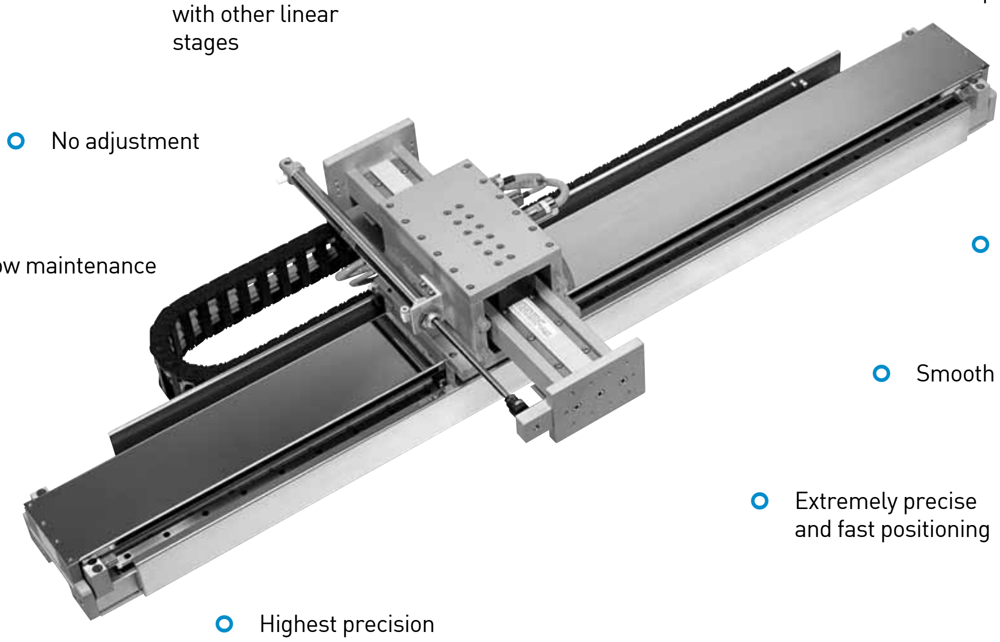
Positioning Systems

Linear Motor Stages

2.2 Typical Properties of Linear Motor Stages

HIWIN linear motor stages are directly driven axes with linear motors, which are designed as a plug and play solution. Standardized cable chains and customized cable guides are possible as an option. They are complete axes with distance measurement system, linear guide way, limit switch and optionally covers as protection against ambient influences. An arresting brake can be added as an option.

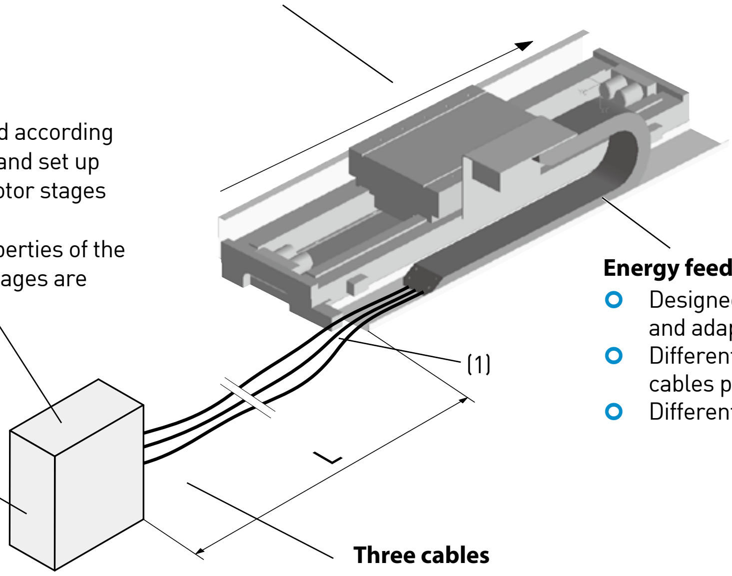
Due to the direct drive, the linear stages are backlash-free, very dynamic, low maintenance and can be equipped with several blocks.
The linear stages are provided as a complete solution including drives on request. Customers can select the drive manufacturer of their choice. We supply the required electronic parameters for adaptation of the linear motor.



2.3 Scope of Delivery

Positive (+) movement direction
The movement direction is defined via the position of the reference switch.
As a standard, it is on the opposite side as the limit switch plug (1).

Drive
(also refer to page 74)
A suitable drive is selected according to customer applications and set up according to the linear motor stages to be supplied.
The dynamic running properties of the respective linear motor stages are thus ensured.



Energy feed
- Designed to customer specifications and adapted to local conditions
- Different dimensions for additional cables possible
- Different mounting positions possible

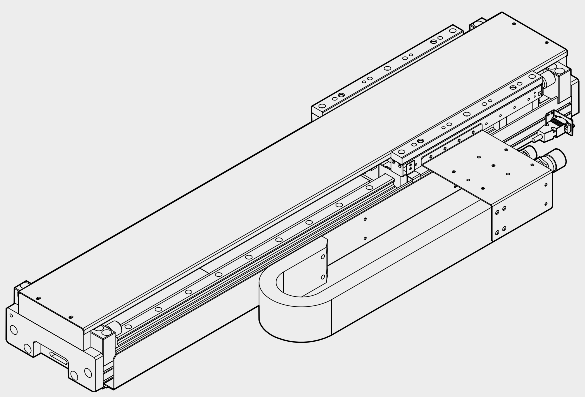
Possible interfaces
- CANopen
- Serial via RS232
- 10 V analog
- Pulse/Direction; CW/CCW
- Others on request

Three cables
- Electric power cable
- Encoder cable
- Limit switch cable

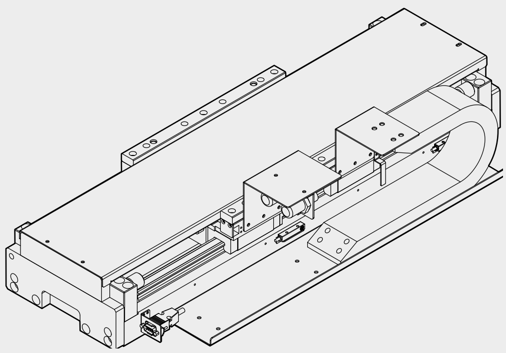
Cable length extending from forcer is 3m, 5m and 7m. the cable are certified according to CE and UL regulations.

Standard linear motor stages
Different models: see pages 14-34.

2.3.1 Cable Chain Orientation



Horizontal orientation

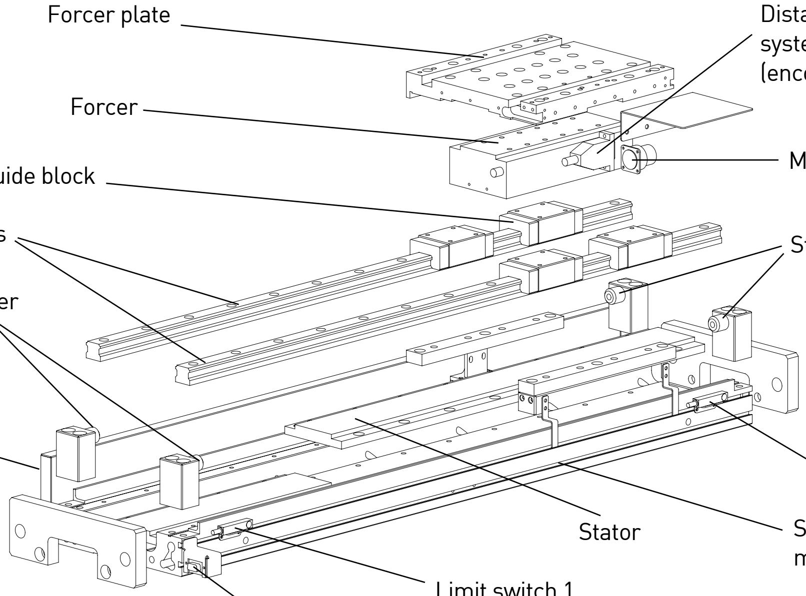


Vertical orientation

Positioning Systems

Linear Motor Stages

2.4 System Configuration



General Specifications of Linear Motor Stages

Name	Motor Type(Note1)	Repeatability(Note2) [mm]	Accuracy (Note3) [mm/300mm]	Straightness [mm/300mm]	Flatness [mm/300mm]	Page
LMX1E-C...	LMC	±0.001	±0.005	±0.005	±0.005	14
LMX1L-S...	LMS	±0.001	±0.005	±0.005	±0.005	19
LMX1L-SC...	LMSC	±0.001	±0.005	±0.005	±0.005	26
LMX1E-T...	LMT	±0.001	±0.005	±0.005	±0.005	28

Note 1 : The permissible operating voltage depends on the selected linear motor type. The max. voltage of LMS, LMC and LMT is 500VAC.
Note 2 : The data above is based on the analog type of optical positioning measurement system which is with 40μm grating period. (Stroke is below 500mm)
Note 3 : This data is according to HIWIN compensation technology.

2.5 Structure of Order Number

2.5.1 Structure of Order Number of Single-Axis Series

LMX1 L S23 - 1 - 0872 - G 2 0 0

Stage type	Motor type	Quantity of Forcer	Stroke [mm]	Encoder-Type	Limit switch	Cover	Cable chain
L– Iron-core motors E– Corelss motors C– Customized	Sxx – Iron-core linear motor Cxx – Coreless linear motor Txx – coreless of linear turbo motor SCx– Iron-core linear Linear motor in sandwich form			A– Optical, period 40 µm, analog 1Vpp sin/cos B– Optical, period 20 µm, analog 1Vpp sin/cos D– Magnetic, period 1mm, analog 1Vpp sin/cos E– Magnetic, digital TTL, resolution 1µm G– Optical, digital TTL, resolution 1 µm (standard)	0– None 1– Inductive, PNP 2– Optical, NPN (standard)	0– None (standard) A– Metal sheet B– Bellow	0– None (standard) 1– For horizontal orientation, size 15x30 2– For vertical orientation, size 15x30 C- Customized

2.5.2 Structure of Order Number of Cross Tables

LMX2 L S23 S27 - 232 - 280 G 2 0 0

Stage type	Motor type of upper axis	Motor type of lower axis	Stroke of upper axis [mm]	Stroke of lower axis [mm]	Encoder-Type	Limit switch	Cover	Cable chain
L– Iron-core motors E– Corelss motors C– Customized	Sxx – Iron-core linear motor Cxx – Coreless linear motor Txx – coreless of linear turbo motor SCx– Iron-core linear Linear motor in sandwich form	Sxx – Iron-core linear motor Cxx – Coreless linear motor Txx – coreless of linear turbo motor SCx– Iron-core linear			A– Optical, period 40 µm, analog 1Vpp sin/cos B– Optical, period 20 µm, analog 1Vpp sin/cos D– Magnetic, period 1mm, analog 1Vpp sin/cos E– Magnetic, digital TTL, resolution 1µm G– Optical, digital TTL, resolution 1 µm (standard)	0– None 1– Inductive, PNP 2– Optical, NPN (standard)	0– None (standard) A– Metal sheet B– Bellow	0– None (standard) 1– For horizontal orientation 2– For vertical orientation C- Customized

2.5.3 Structure of Order Number of Gantry Type Series

LMG2 A S13 S27 - 300 - 400 G 2 0 0

Driving of lower axis	Stage type	Motor type of upper axis	Motor type of lower axis	Stroke of upper axis [mm]	Stroke of lower axis [mm]	Encoder-Type	Limit switch	Cover	Cable chain
2- Single 3- Two sides	A– Standard C – Customized	Sxx – Iron-core linear motor Cxx – Coreless linear motor Txx – coreless of linear turbo motor SCx– Iron-core linear	Sxx – Iron-core linear motor Cxx – Coreless linear motor Txx – coreless of linear turbo motor SCx– Iron-core linear			A– Optical, period 40 µm, analog 1Vpp sin/cos B– Optical, period 20 µm, analog 1Vpp sin/cos D– Magnetic, period 1mm, analog 1Vpp sin/cos E– Magnetic, digital TTL, resolution 1µm G– Optical, digital TTL, resolution 1 µm (standard)	0– None 1– Inductive, PNP 2– Optical, NPN (standard)	0– None (standard) A– Metal sheet B– Bellow	0– None (standard) 1– For horizontal orientation 2– For vertical orientation C- Customized

Positioning Systems
Linear Motor Stages

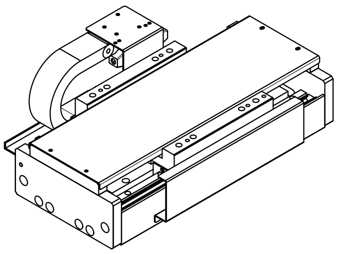
2.6 Linear Motor Stages LMX1E-C

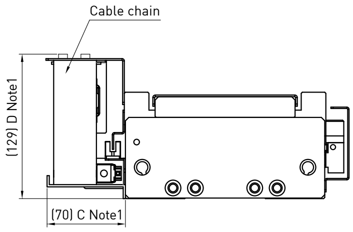
Linear motor stages LMX1E-C are equipped with a coreless motor and well suited for applications with a high degree of synchronous operation requirements. They can also be used in cross tables. They are distinguished by their low profile design. The travel is measured via optical encoder incrementally. The linear motor stages LMX1E-C have very high dynamics and are available in overall lengths up to 4,000 mm.

- Max. acceleration 100 m/s^2
- Max. speed 5 m/s
- Length up to 4,000 mm

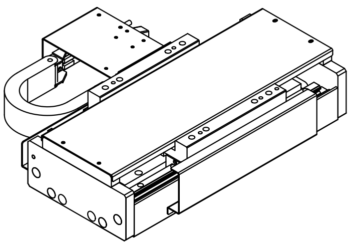
Note: The data above is in condition of no loading.

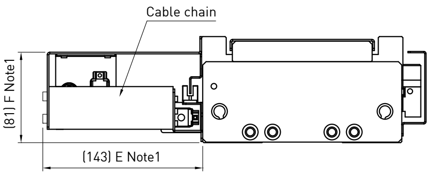
• Cable chain in Vertical orientation

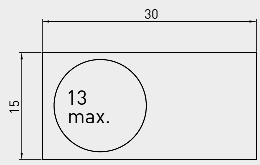




• Cable chain in Horizontal orientation





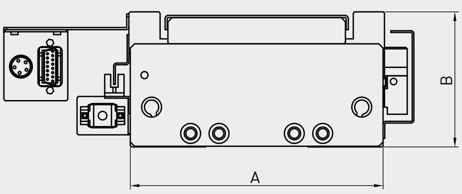


Note 1: If it's customized cable chain, the value of C, D, E, F will be changed accordingly.

Specifications for Linear Motor Stages LMX1E-C

Type (Order code) (Note 1) xxxx=Stroke [mm]	Motor Type	F_c (Note 2) [N]	F_p (Note 2) [N]	Mass of Slider [kg]	Dimension A [mm]	Dimension B (Note 3) [mm]
LMX1E-CB5-1-xxxx-G200	LMC B5	91	364	2.3	178	80
LMX1E-CB6-1-xxxx-G200	LMC B6	109	436	3.3	178	80
LMX1E-CB7-1-xxxx-G200	LMC B7	128	512	3.8	178	80
LMX1E-CB8-1-xxxx-G200	LMC B8	145	580	4.5	178	80
LMX1E-CB5-1-xxxx-G2A0	LMC B5	91	364	2.5	178	95 (105)
LMX1E-CB6-1-xxxx-G2A0	LMC B6	109	436	3.5	178	95 (105)
LMX1E-CB7-1-xxxx-G2A0	LMC B7	128	512	4.0	178	95 (105)
LMX1E-CB8-1-xxxx-G2A0	LMC B8	145	580	4.7	178	95 (105)

Note 1: If choosing special stroke, please contact with HIWINMIKRO.
Note 2: F_C = continuous force, 100% operating time
F_P = peak force [1 s]
Electric parameters for the linear motors: see page 58
Note 3: When stroke is above 1100mm, use value in () for B.

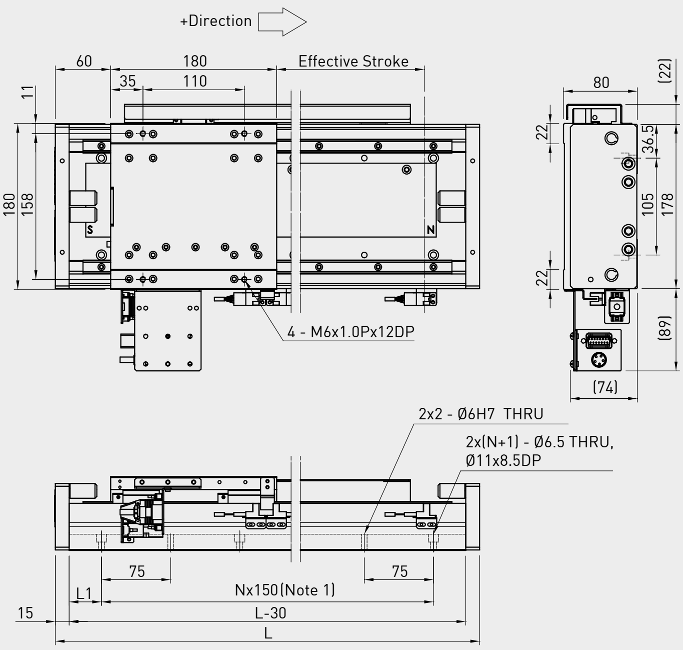


2.6.1 Linear Motor Stages LMX1E-C without Cover

Dimensions and weight of the linear motor stage LMX1E-CB5 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	400	35	1(Note 1)	18
200	500	85	2	22
300	600	60	3	26
400	700	35	4	30
500	800	85	4	34
600	900	60	5	38
700	1000	35	6	42
800	1100	85	6	46
900	1200	60	7	50
1000	1300	35	8	54
1100	1400	85	8	58
1200	1500	60	9	62

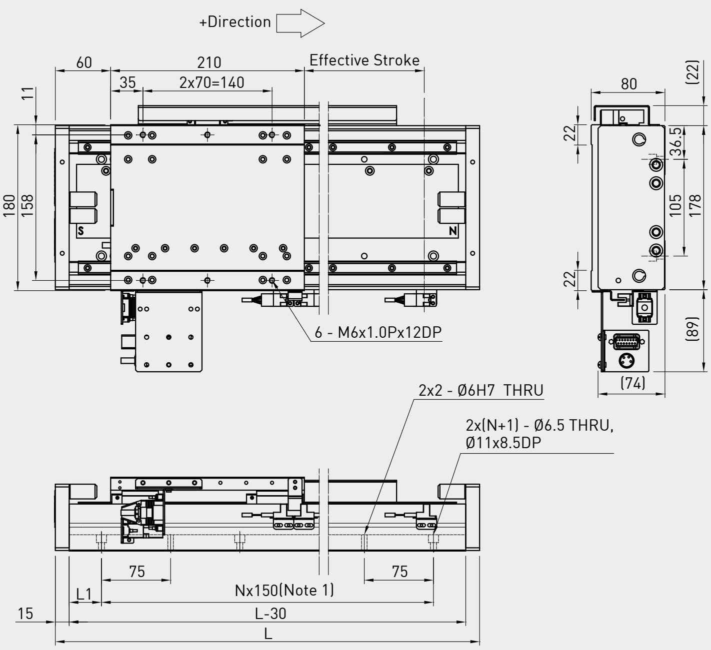
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1E-CB6 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	430	50	1(Note 1)	19
200	530	25	3	23
300	630	75	3	27
400	730	50	4	31
500	830	25	5	35
600	930	75	5	39
700	1030	50	6	43
800	1130	25	7	47
900	1230	75	7	51
1000	1330	50	8	55
1100	1430	25	9	59
1200	1530	75	9	63

Note 1：When stroke is 100mm,the pitch change to 300 mm



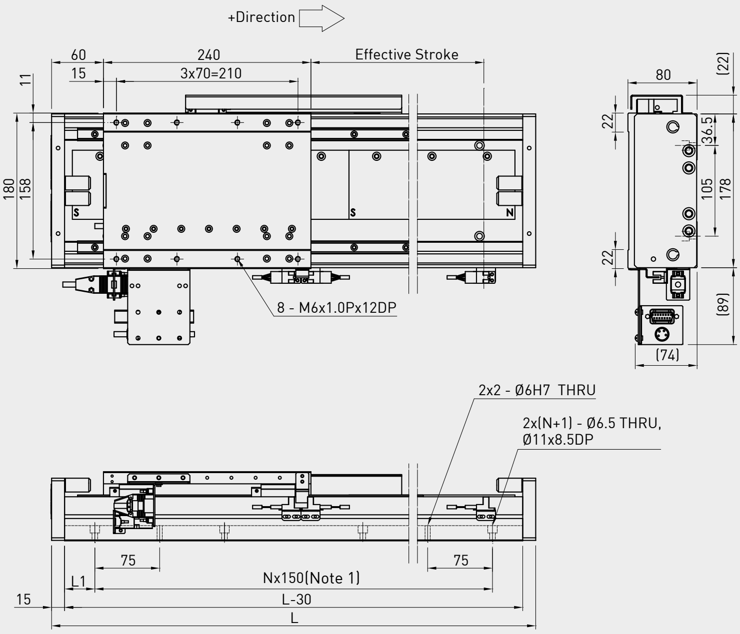
Positioning Systems

Linear Motor Stages

Dimensions and weight of the linear motor stage LMX1E-CB7-1-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	460	65	1(Note 1)	20
200	560	40	3	24
300	660	90	3	28
400	760	65	4	32
500	860	40	5	36
600	960	90	5	40
700	1060	65	6	44
800	1160	40	7	48
900	1260	90	7	52
1000	1360	65	8	56
1100	1460	40	9	60
1200	1560	90	9	64

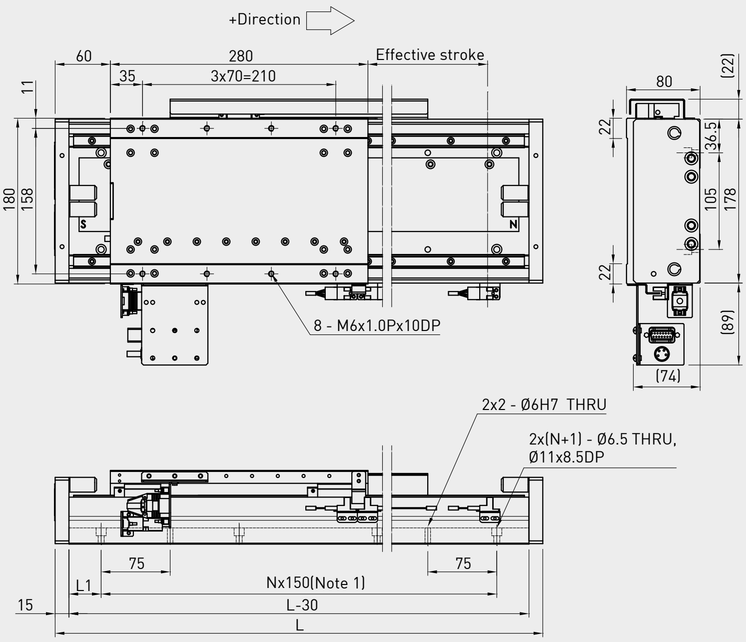
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1E-CB8-1-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	500	85	1(Note 1)	21
200	600	60	3	25
300	700	35	4	29
400	800	85	4	33
500	900	60	5	37
600	1000	35	6	41
700	1100	85	6	45
800	1200	60	7	49
900	1300	35	8	53
1000	1400	85	8	57
1100	1500	60	9	61
1200	1600	35	10	65

Note 1：When stroke is 100mm,the pitch change to 300 mm

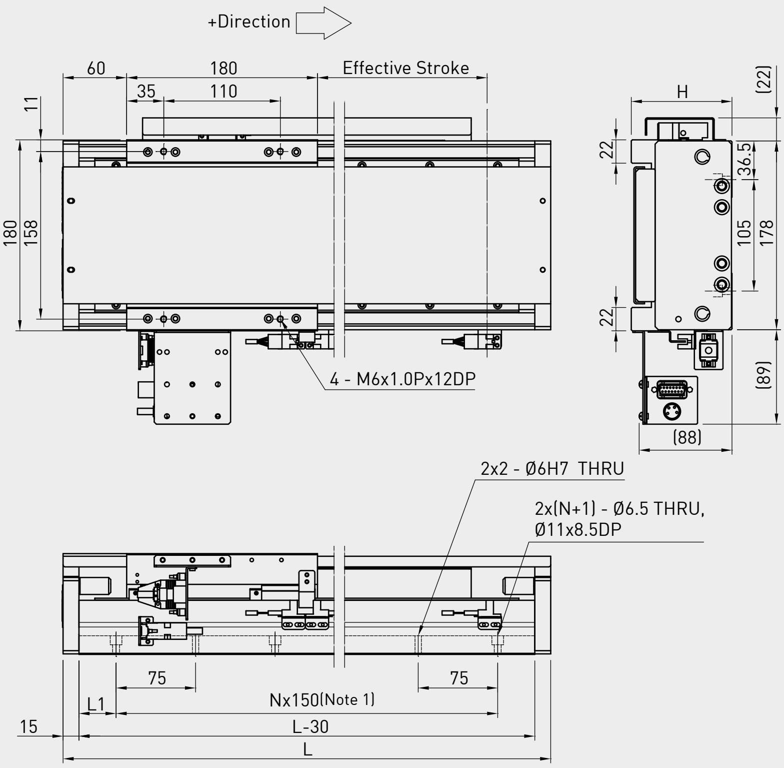


2.6.2 Linear Motor Stages LMX1E-C with Cover

Dimensions and weight of the linear motor stage LMX1E-CB5-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	400	35	1(Note 1)	19	95
200	500	85	2	23	95
300	600	60	3	27	95
400	700	35	4	31	95
500	800	85	4	35	95
600	900	60	5	39	95
700	1000	35	6	43	95
800	1100	85	6	47	95
900	1200	60	7	51	95
1000	1300	35	8	55	95
1100	1400	85	8	59	105
1200	1500	60	9	63	105

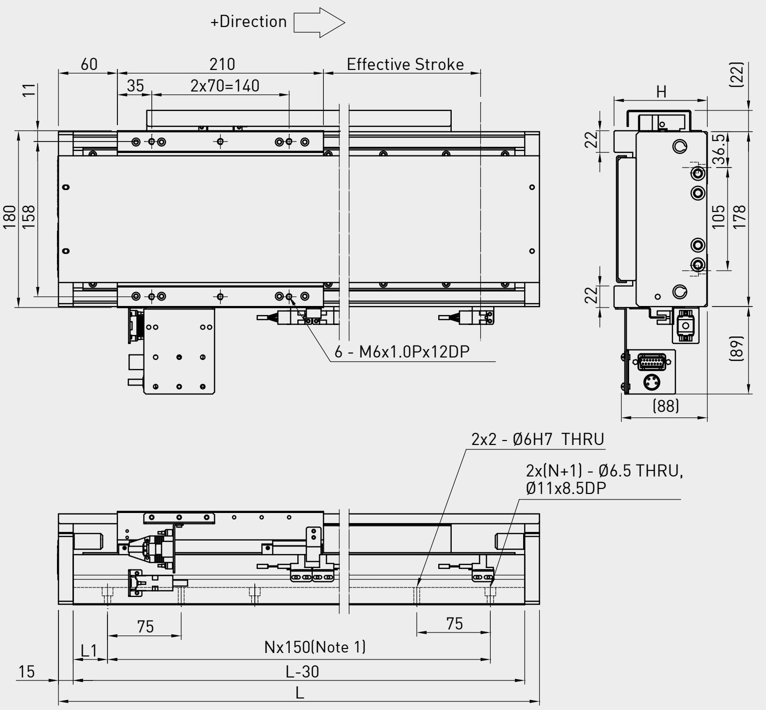
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1E-CB6-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	430	50	1(Note 1)	20	95
200	530	25	3	24	95
300	630	75	3	28	95
400	730	50	4	32	95
500	830	25	5	36	95
600	930	75	5	40	95
700	1030	50	6	44	95
800	1130	25	7	48	95
900	1230	75	7	52	95
1000	1330	50	8	56	95
1100	1430	25	9	60	105
1200	1530	75	9	64	105

Note 1：When stroke is 100mm,the pitch change to 300 mm



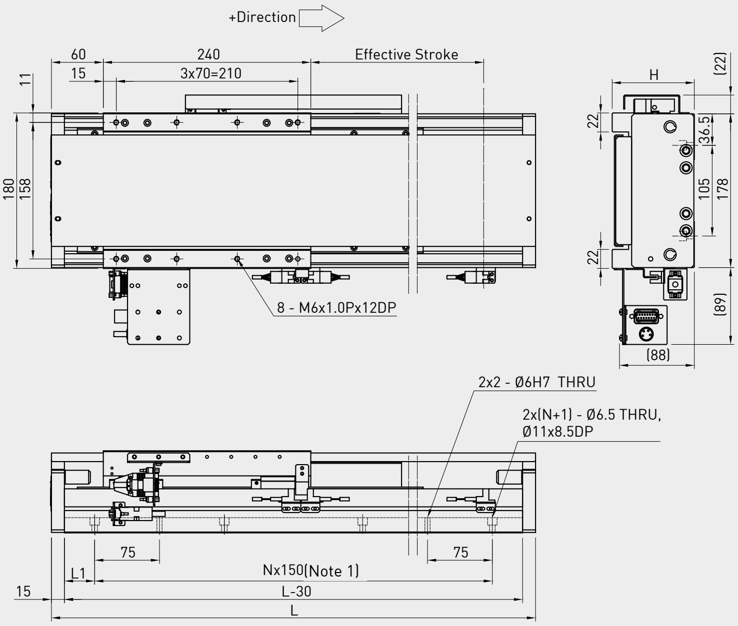
Positioning Systems

Linear Motor Stages

Dimensions and weight of the linear motor stage LMX1E-CB7-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	460	65	1(Note 1)	21	95
200	560	40	3	25	95
300	660	90	3	29	95
400	760	65	4	33	95
500	860	40	5	37	95
600	960	90	5	41	95
700	1060	65	6	45	95
800	1160	40	7	49	95
900	1260	90	7	53	95
1000	1360	65	8	57	95
1100	1460	40	9	61	105
1200	1560	90	9	65	105

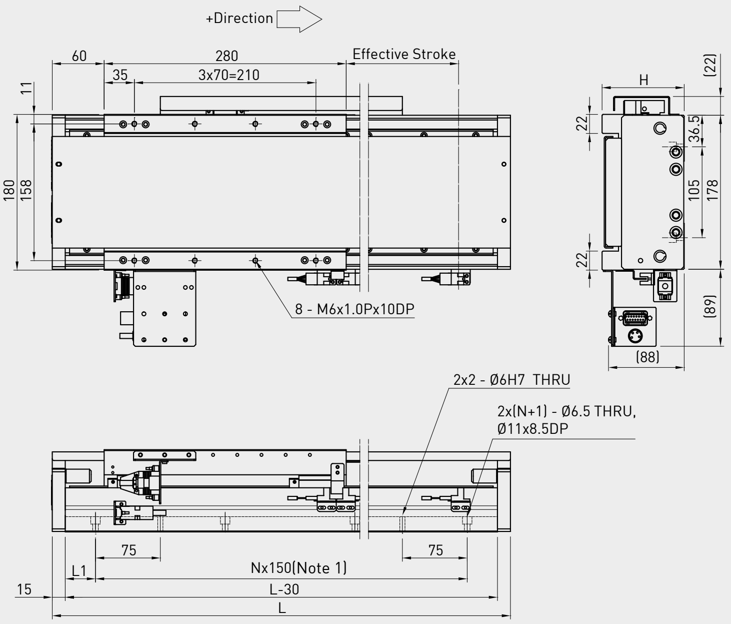
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1E-CB8-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	500	85	1(Note 1)	22	95
200	600	60	3	26	95
300	700	35	4	30	95
400	800	85	4	34	95
500	900	60	5	38	95
600	1000	35	6	42	95
700	1100	85	6	46	95
800	1200	60	7	50	95
900	1300	35	8	54	95
1000	1400	85	8	58	95
1100	1500	60	9	62	105
1200	1600	35	10	66	105

Note 1：When stroke is 100mm,the pitch change to 300 mm



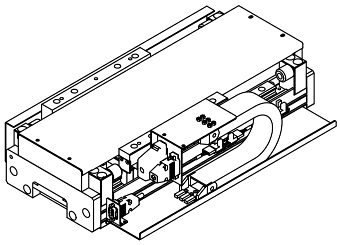
2.7 Linear Motor Stages LMX1L-S

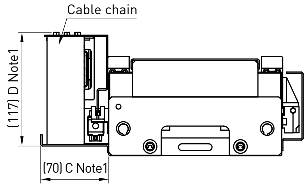
Linear motor stages LMX1L-S are equipped with an iron-core motor, which provides substantial continuous power. They can also be used in cross tables. The travel is measured via optical or magnetic encoders incrementally or absolutely. The linear motor stages LMX1L-S have a very compact design and are available in overall lengths up to 4,000 mm.

- Max. acceleration 50 m/s²
- Max. speed 4 m/s
- Length up to 4,000 mm

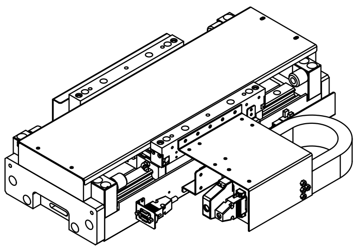
Note: The data above is in condition of no loading.

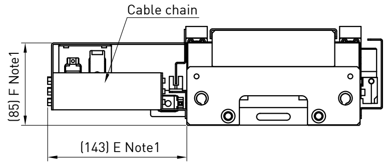
• Cable chain in Vertical orientation



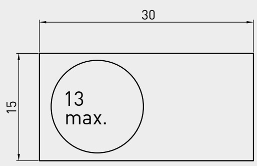


• Cable chain in Horizontal orientation





Space of cable chain

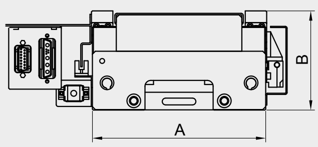


Note 1: If it's customized cable chain, the value of C, D, E, F will be changed accordingly.

Specifications for Linear Motor Stages LMX1L-S

Type (Order code) xxxx=Stroke [mm]	Motor Type	F_c [N]	F_p [N]	Mass of Slider [kg]	Dimension A [mm]	Dimension B [mm]
LMX1L-S23 -1-xxxx-G200	LMS 23	240	639	7.5	178	90
LMX1L-S27 -1-xxxx-G200	LMS 27	382	1017	9.5	178	90
LMX1L-S37 -1-xxxx-G200	LMS 37	535	1425	12	202	95
LMX1L-S37L-1-xxxx-G200	LMS 37L	535	1425	12	202	95
LMX1L-S47 -1-xxxx-G200	LMS 47	733	1953	18	232	95
LMX1L-S47L-1-xxxx-G200	LMS 47L	733	1953	18	232	95
LMX1L-S57 -1-xxxx-G200	LMS 57	879	2343	22	252	100
LMX1L-S57L-1-xxxx-G200	LMS 57L	879	2343	22	252	100
LMX1L-S67 -1-xxxx-G200	LMS 67	1069	2850	26	272	100
LMX1L-S67L-1-xxxx-G200	LMS 67L	1069	2850	26	272	100
LMX1L-S23 -1-xxxx-G2A0	LMS 23	240	639	7.8	178	102(111)
LMX1L-S27 -1-xxxx-G2A0	LMS 27	382	1017	9.9	178	102(111)
LMX1L-S37 -1-xxxx-G2A0	LMS 37	535	1425	12.5	202	107(116)
LMX1L-S37L-1-xxxx-G2A0	LMS 37L	535	1425	12.5	202	107(116)
LMX1L-S47 -1-xxxx-G2A0	LMS 47	733	1953	18.8	232	107(116)
LMX1L-S47L-1-xxxx-G2A0	LMS 47L	733	1953	18.8	232	107(116)
LMX1L-S57 -1-xxxx-G2A0	LMS 57	879	2343	23	252	112(121)
LMX1L-S57L-1-xxxx-G2A0	LMS 57L	879	2343	23	252	112(121)
LMX1L-S67 -1-xxxx-G2A0	LMS 67	1069	2850	27	272	112(121)
LMX1L-S67L-1-xxxx-G2A0	LMS 67L	1069	2850	27	272	112(121)

Note 1: If choosing special stroke, please contact with HIWINMIKRO.
Note 2: F_C = continuous force, 100% operating time
F_P = peak force [1 s]
Electric parameters for the linear motors: see page 52
Note 3: When stroke is above 1100mm, use value in () for B.



Positioning Systems

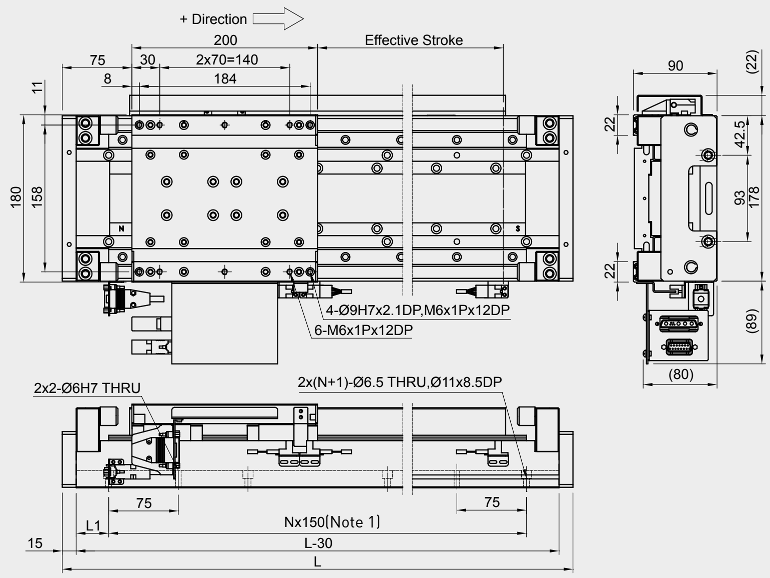
Linear Motor Stages

2.7.1 Linear Motor Stages LMX1L without Cover

Dimensions and weight of the linear motor stage LMX1L-S23-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	450	60	1(Note 1)	19
200	550	35	3	21
300	650	85	3	23
400	750	60	4	25
500	850	35	5	27
600	950	85	5	29
700	1050	60	6	31
800	1150	35	7	33
900	1250	85	7	35
1000	1350	60	8	36
1100	1450	35	9	39
1200	1550	85	9	40

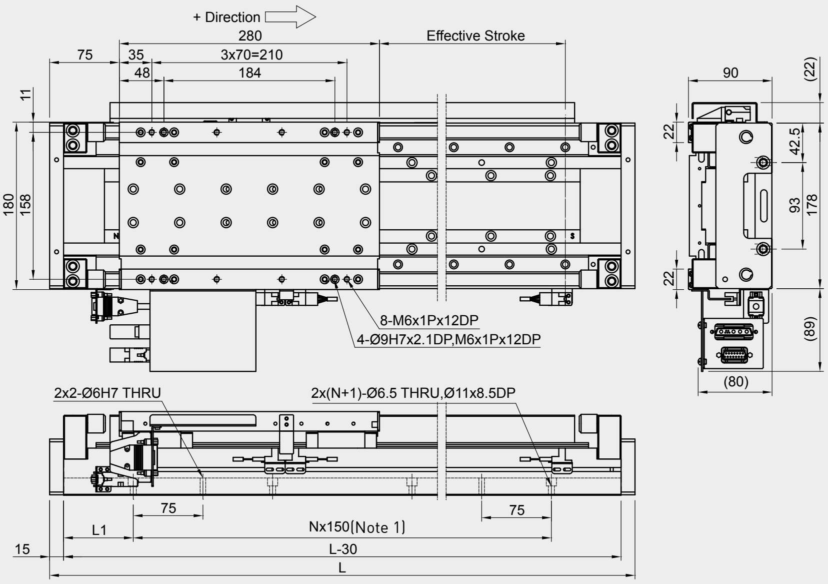
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1L-S27-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	530	100	1(Note 1)	23
200	630	75	3	26
300	730	50	4	28
400	830	25	5	29
500	930	75	5	32
600	1030	50	6	34
700	1130	25	7	36
800	1230	75	7	38
900	1330	50	8	39
1000	1430	25	9	42
1100	1530	75	9	43
1200	1630	50	10	45

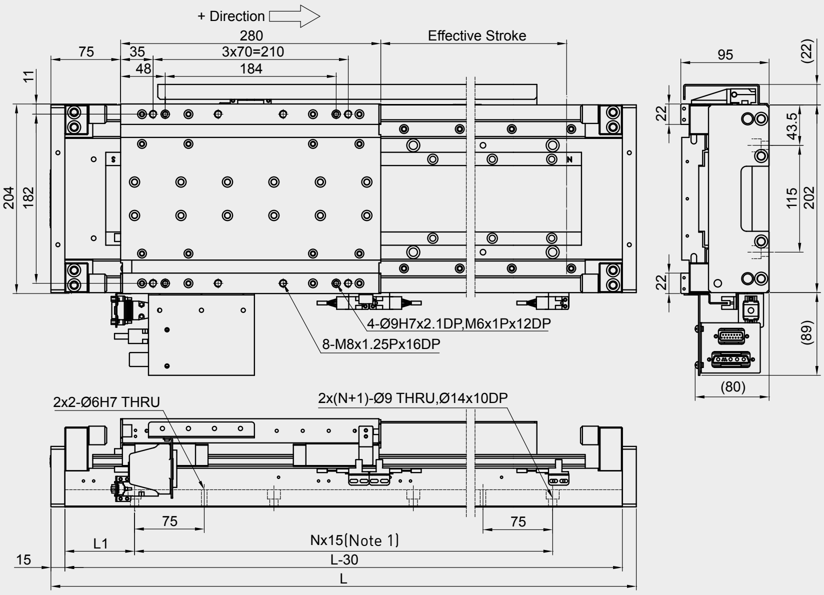
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1L-S37-1-xxxx-G200 and LMX1L-S37L-1-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	530	100	1(Note 1)	27
200	630	75	3	29
300	730	50	4	32
400	830	25	5	34
500	930	75	5	37
600	1030	50	6	39
700	1130	25	7	41
800	1230	75	7	44
900	1330	50	8	46
1000	1430	25	9	49
1100	1530	75	9	51
1200	1630	50	10	54

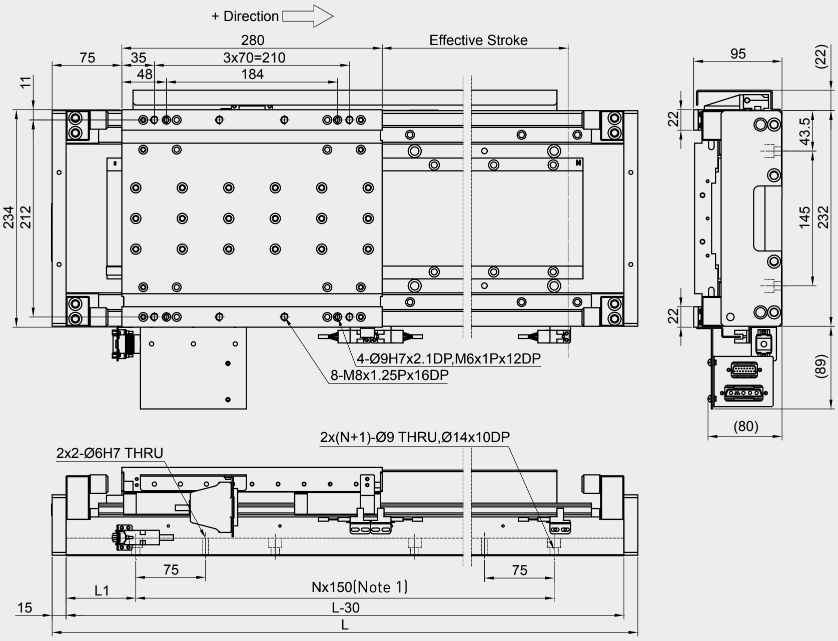
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1L-S47-1-xxxx-G200 and LMX1L-S47L-1-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	530	100	1(Note 1)	37
200	630	75	3	39
300	730	50	4	42
400	830	25	5	45
500	930	75	5	48
600	1030	50	6	51
700	1130	25	7	54
800	1230	75	7	57
900	1330	50	8	60
1000	1430	25	9	63
1100	1530	75	9	65
1200	1630	50	10	69

Note 1：When stroke is 100mm,the pitch change to 300 mm



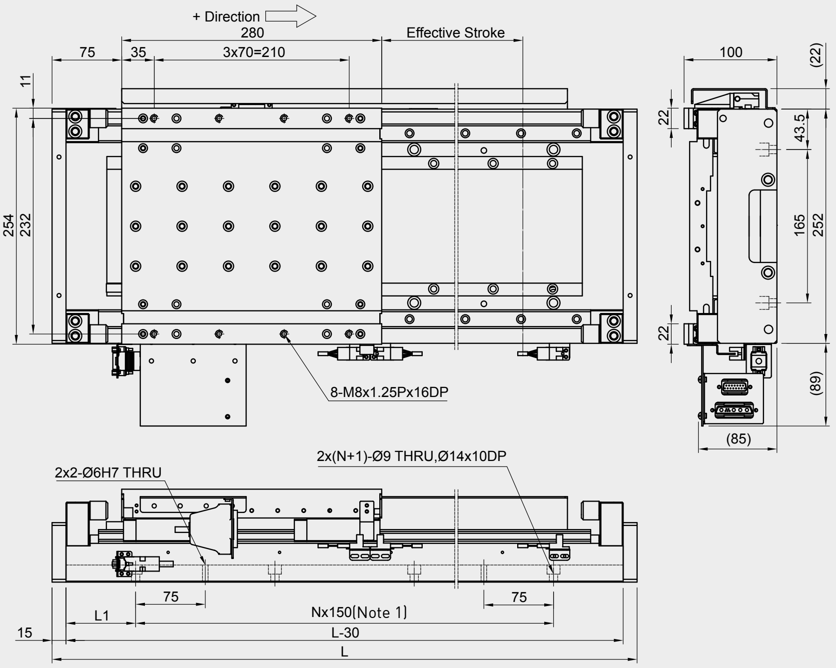
Positioning Systems

Linear Motor Stages

Dimensions and weight of the linear motor stages LMX1L-S57-1-xxxx-G200 and LMX1L-S57L-1-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	530	100	1(Note 1)	41
200	630	75	3	43
300	730	50	4	47
400	830	25	5	50
500	930	75	5	53
600	1030	50	6	57
700	1130	25	7	60
800	1230	75	7	63
900	1330	50	8	66
1000	1430	25	9	70
1100	1530	75	9	72
1200	1630	50	10	76

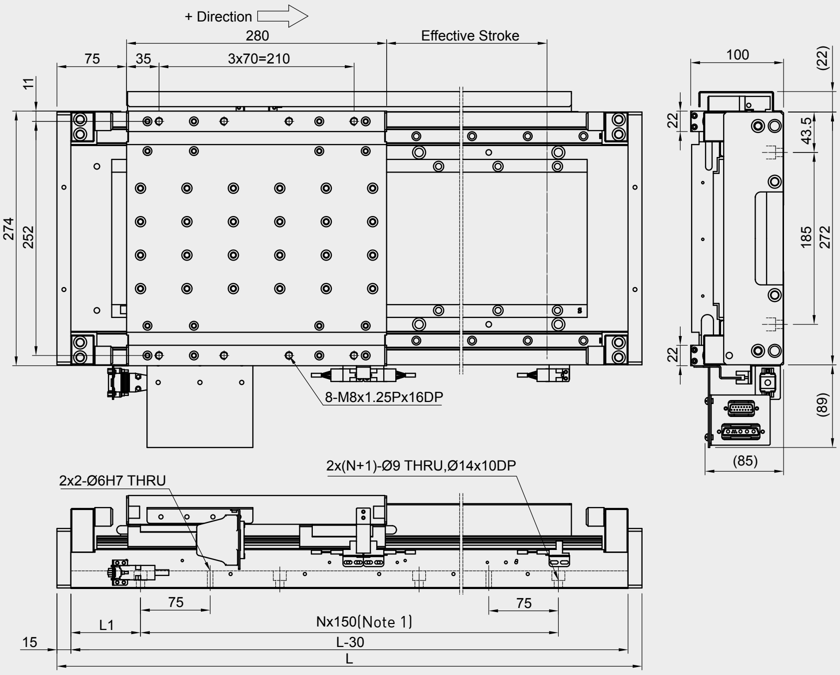
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stages LMX1L-S67-1-xxxx-G200 and LMX1L-S67L-1-xxxx-G200 without cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]
100	530	100	1(Note 1)	44
200	630	75	3	47
300	730	50	4	51
400	830	25	5	54
500	930	75	5	58
600	1030	50	6	62
700	1130	25	7	65
800	1230	75	7	69
900	1330	50	8	72
1000	1430	25	9	76
1100	1530	75	9	79
1200	1630	50	10	83

Note 1：When stroke is 100mm,the pitch change to 300 mm

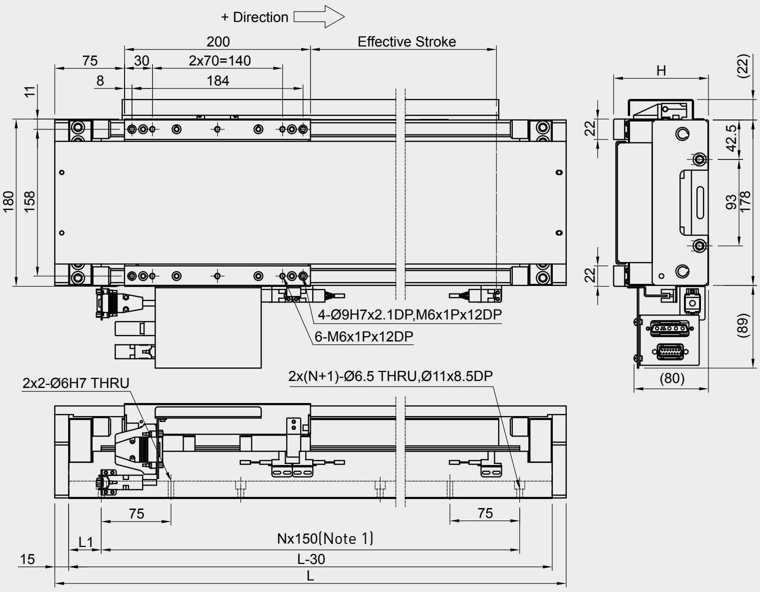


2.7.2 Linear Motor Stages LMX1L-S with Cover

Dimensions and weight of the linear motor stage LMX1L-S23-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	450	60	1(Note 1)	21	102
200	550	35	3	23	102
300	650	85	3	24	102
400	750	60	4	27	102
500	850	35	5	29	102
600	950	85	5	30	102
700	1050	60	6	33	102
800	1150	35	7	34	102
900	1250	85	7	37	102
1000	1350	60	8	38	102
1100	1450	35	9	40	111
1200	1550	85	9	42	111

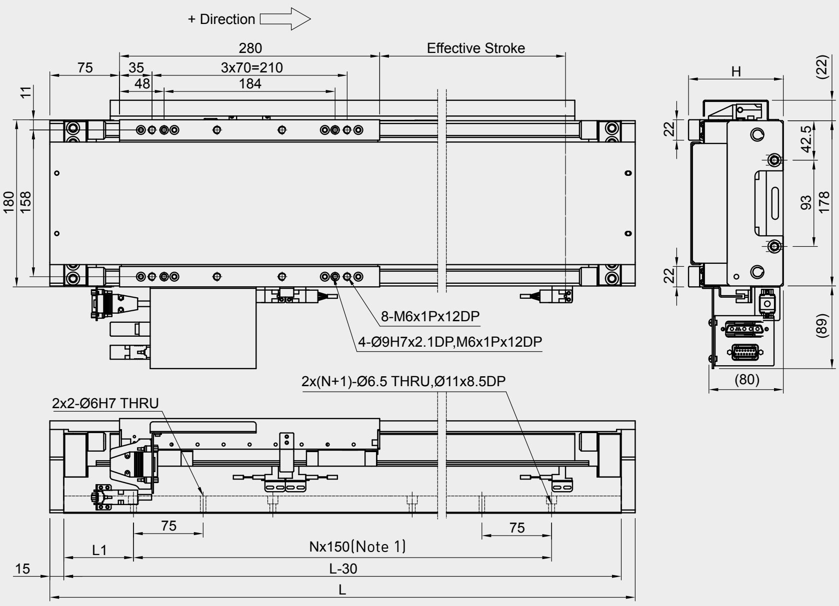
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stage LMX1L-S27-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	530	100	1(Note 1)	24	102
200	630	75	3	26	102
300	730	50	4	28	102
400	830	25	5	29	102
500	930	75	5	32	102
600	1030	50	6	34	102
700	1130	25	7	36	102
800	1230	75	7	38	102
900	1330	50	8	39	102
1000	1430	25	9	42	102
1100	1530	75	9	43	111
1200	1630	50	10	45	111

Note 1：When stroke is 100mm,the pitch change to 300 mm



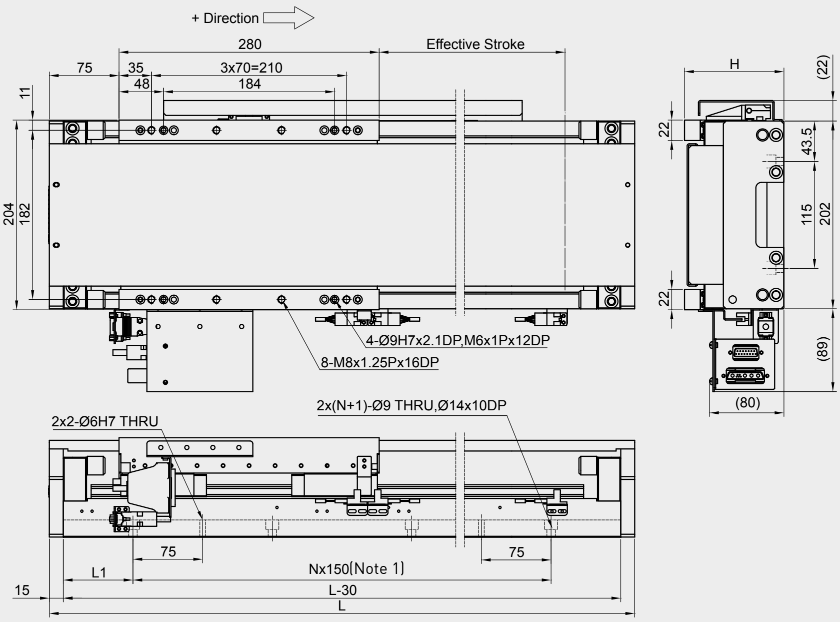
Positioning Systems

Linear Motor Stages

Dimensions and weight of the linear motor stages LMX1L-S37-1-xxxx-G2A0 and LMX1L-S37L-1-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	530	100	1(Note 1)	28	107
200	630	75	3	31	107
300	730	50	4	33	107
400	830	25	5	36	107
500	930	75	5	38	107
600	1030	50	6	41	107
700	1130	25	7	43	107
800	1230	75	7	46	107
900	1330	50	8	48	107
1000	1430	25	9	51	107
1100	1530	75	9	53	116
1200	1630	50	10	56	116

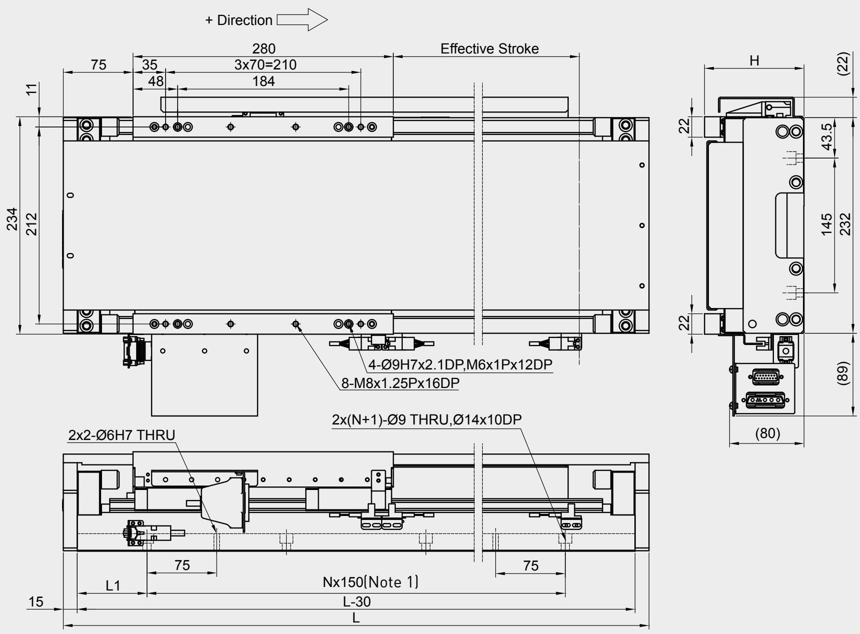
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stages LMX1L-S47-1-xxxx-G2A0 and LMX1L-S47L-1-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	530	100	1(Note 1)	38	107
200	630	75	3	41	107
300	730	50	4	44	107
400	830	25	5	47	107
500	930	75	5	50	107
600	1030	50	6	53	107
700	1130	25	7	56	107
800	1230	75	7	59	107
900	1330	50	8	62	107
1000	1430	25	9	65	107
1100	1530	75	9	68	116
1200	1630	50	10	71	116

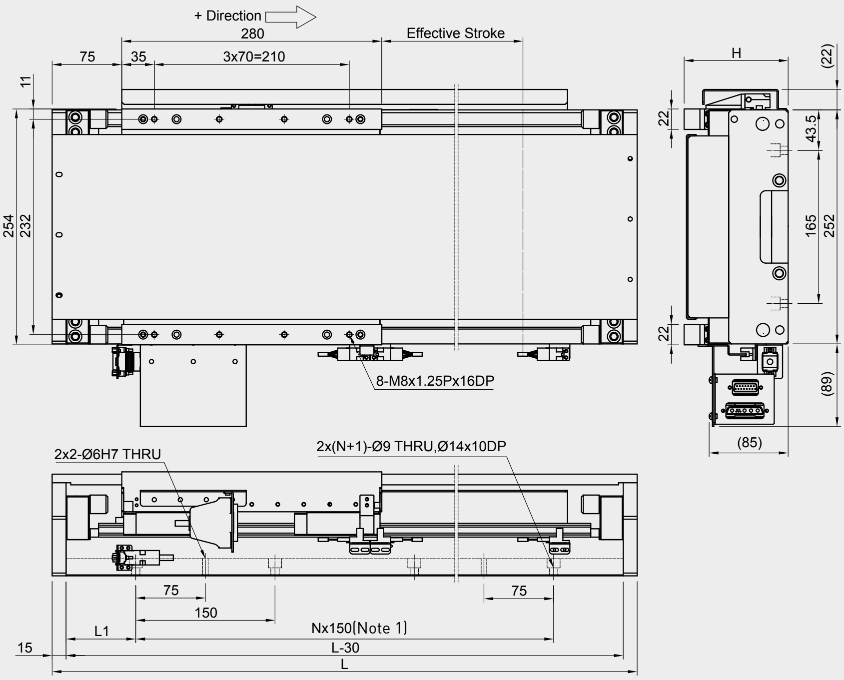
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stages LMX1L-S57-1-xxxx-G2A0 and LMX1L-S57L-1-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	530	100	1(Note 1)	42	112
200	630	75	3	45	112
300	730	50	4	49	112
400	830	25	5	51	112
500	930	75	5	55	112
600	1030	50	6	59	112
700	1130	25	7	62	112
800	1230	75	7	65	112
900	1330	50	8	68	112
1000	1430	25	9	72	112
1100	1530	75	9	75	121
1200	1630	50	10	79	121

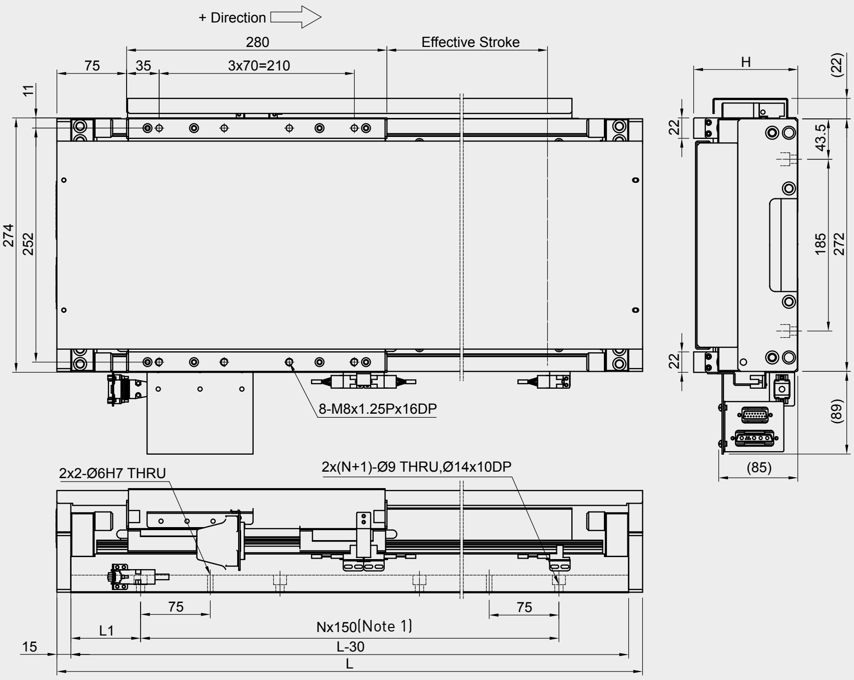
Note 1：When stroke is 100mm,the pitch change to 300 mm



Dimensions and weight of the linear motor stages LMX1L-S67-1-xxxx-G2A0 and LMX1L-S67L-1-xxxx-G2A0 with cover

Stroke [mm]	L [mm]	L1 [mm]	N	Mass [kg]	H [mm]
100	530	100	1(Note 1)	46	112
200	630	75	3	49	112
300	730	50	4	53	112
400	830	25	5	56	112
500	930	75	5	60	112
600	1030	50	6	64	112
700	1130	25	7	67	112
800	1230	75	7	71	112
900	1330	50	8	74	112
1000	1430	25	9	79	112
1100	1530	75	9	82	121
1200	1630	50	10	86	121

Note 1：When stroke is 100mm,the pitch change to 300 mm



Positioning Systems

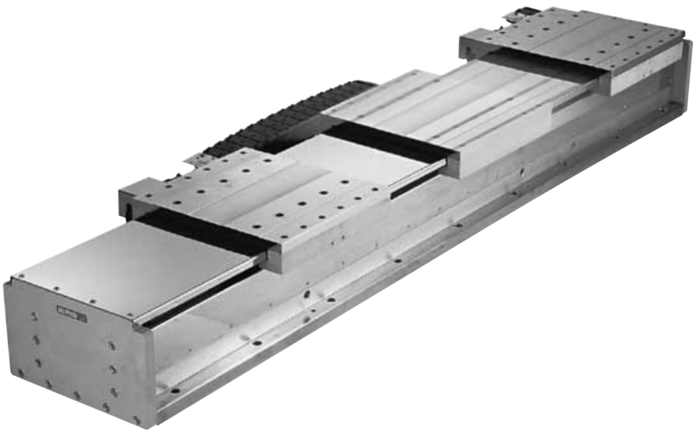
Linear Motor Stages

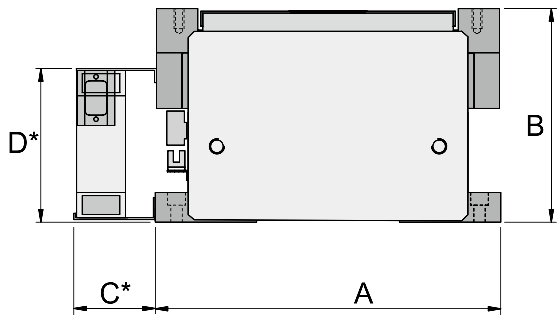
2.8 Linear Motor Stages LMX1L-SC

Linear motor stages LMX1L-SC are complete axes with iron-core motors. Due to the special design of the motor with arrangement of the forcer between two stators (sandwich construction), the attraction forces are canceled. This relieves the load especially on the guide rails.

- Very high power density
- Due to the sandwich construction of the motor, no attraction forces are created, so that the guides are not subject to static loads.
- The travel is measured via optical or magnetic encoders incrementally or absolutely.
- Total length to 4,000 mm
- Max. acceleration 50 m/s²
- Max. speed 4 m/s

Note: The data above is in condition of no loading.





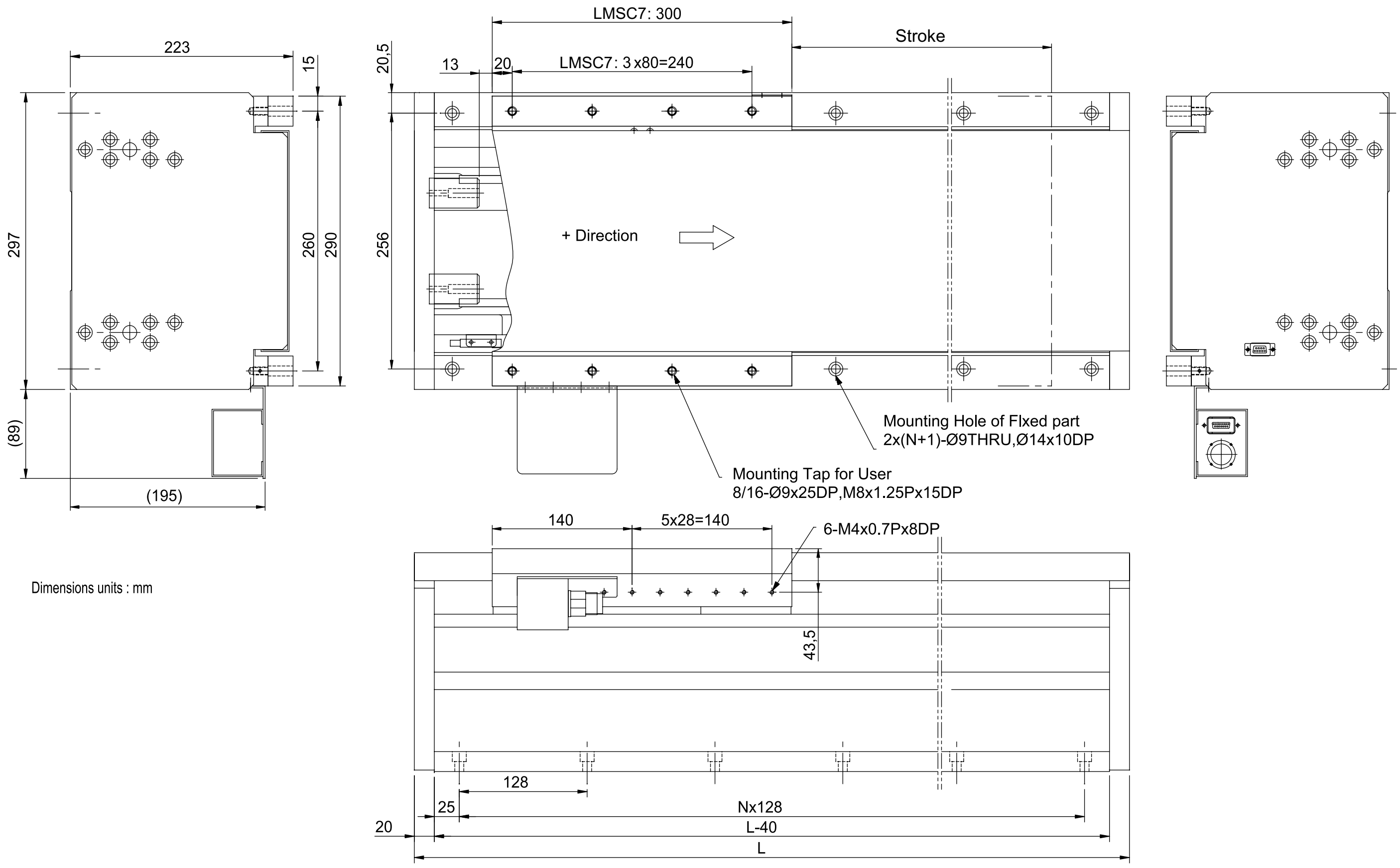
* Dimensions C and D are customer-specific

Specifications for Linear Motor Stages LMX1L-SC

Type (Order code) xxxx=Stroke [mm]	Motor Type	F_c [N]	F_p [N]	Mass of Slider [kg]	Length of forcer [mm]	v_{max} [m/s]	a_{max} [m/s²]	Dimension A [mm]	Dimension B [mm]
LMX1L-SC7 -1-xxxx-G2A0	LMSC7	1070	2850	25	300	2*	50	297	223
LMX1L-SC7L -1-xxxx-G2A0	LMSC7L	1070	2850	25	300	3	50	297	223

Note: F_C = continuous force, 100% operating time
F_P = peak force (1 s)
Electric parameters for the linear motors: see page 56
* Limited by back emf constant of the motor coil

Installation dimensions for linear motor stages LMX1L-SC



Dimensions units : mm

Dimensions and weight of the linear motor stages LMX1L-SC7 and LMX1L-SC7L, both with cover

Stroke [mm]	Total length L [mm]	N	Mass [kg]
388	858	6	120
516	986	7	135
644	1124	8	150
772	242	9	165
900	1370	10	179
1156	1626	12	208
1412	1882	14	237
1668	2138	16	267
1924	2394	18	297
2180	2650	20	327

Positioning Systems

Linear Motor Stages

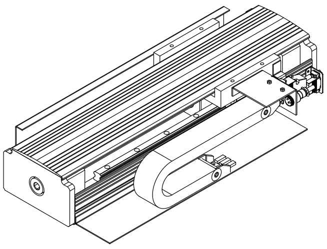
2.9 Linear Motor Stage LMX1E-T

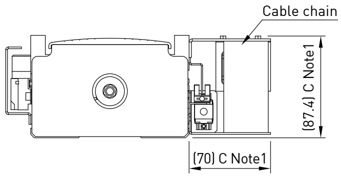
Linear motor stages LMX1E-T are equipped with a coreless motor with features as light weight, no cogging and high acceleration and deceleration.
It is well suited for applications in semiconductor industries like inspection and scanning requirements. They can also be used in cross tables. Incremental digital/analog optical encoder and magnetic encoder can be used as feedback system.

- Max. acceleration 50 m/s^2
- Max. speed 5 m/s
- Length up to 1,470 mm

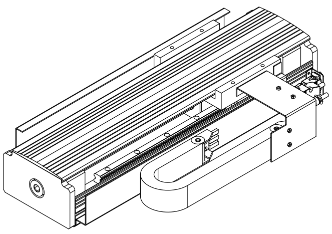
Note: The data above is in condition of no loading.

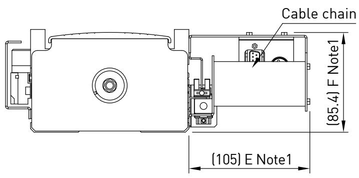
• Cable chain in Vertical orientation



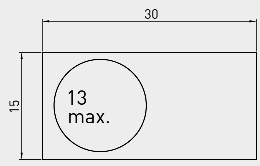


• Cable chain in Horizontal orientation





Space of cable chain

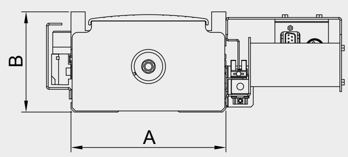


Note 1: If it's customized cable chain, the value of C, D, E, F will be changed accordingly.

Specifications for Linear Motor Stages LMX1E-T

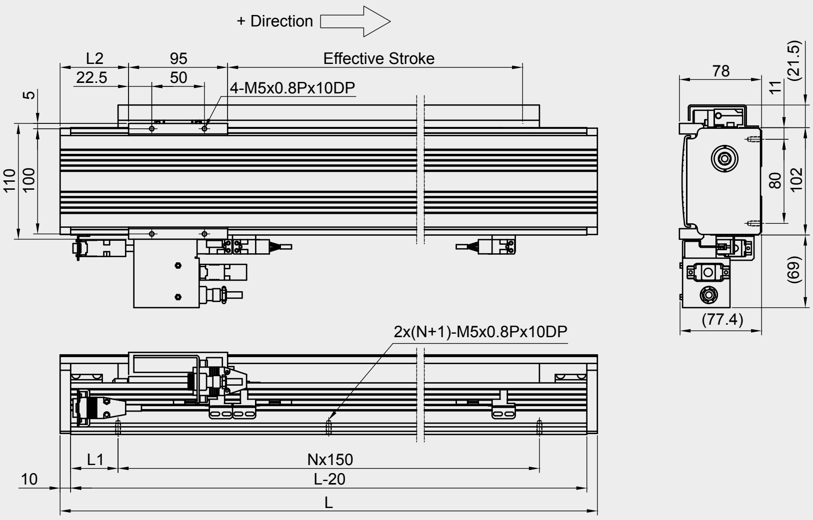
Type (Order code) (Note 1) xxxx=Stroke [mm]	Motor Type	F_c (Note 2) [N]	F_p (Note 2) [N]	Mass of Slider [kg]	Dimension A [mm]	Dimension B [mm]
LMX1E-TA2-1-xxxx-G2A0	LMTA2	27	81	1.4	102	78
LMX1E-TA3-1-xxxx-G2A0	LMTA3	42	126	2.1	102	78
LMX1E-TA4-1-xxxx-G2A0	LMTA4	55	165	2.3	102	78
LMX1E-TB2-1-xxxx-G2A0	LMTB2	48	144	2.1	136	88
LMX1E-TB3-1-xxxx-G2A0	LMTB3	72	216	2.7	136	88
LMX1E-TB4-1-xxxx-G2A0	LMTB4	96	288	3.6	136	88
LMX1E-TC2-1-xxxx-G2A0	LMTC2	92	276	4.0	168	109
LMX1E-TC3-1-xxxx-G2A0	LMTC3	138	414	5.7	168	109
LMX1E-TC4-1-xxxx-G2A0	LMTC4	184	552	6.9	168	109

Note 1: If choosing special stroke, please contact with HIWINMIKRO.
Note 2: F_C = continuous force, 100% operating time
F_P = peak force [1 s]
Electric parameters for the linear motors: see page 71



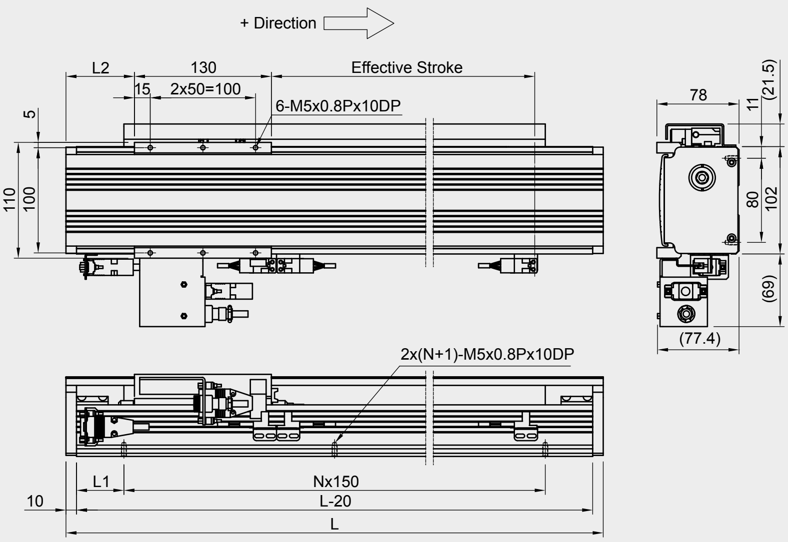
Dimensions and weight of the linear motor stage LMX1E-TA2-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	325	77.5	65	1	5.0
200	425	52.5	65	2	6.0
300	525	102.5	65	2	6.9
400	625	77.5	65	3	7.9
500	725	52.5	65	4	8.8
600	825	102.5	65	4	9.8
700	965	97.5	85	5	11.2
800	1065	72.5	85	6	12.1
900	1165	47.5	85	7	13.1
1000	1265	97.5	85	7	14.0



Dimensions and weight of the linear motor stage LMX1E-TA3-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	360	95	65	1	6.3
200	460	70	65	2	7.4
300	560	45	65	3	8.5
400	660	95	65	3	9.6
500	760	70	65	4	10.8
600	860	45	65	5	11.9
700	1000	40	85	6	13.5
800	1100	90	85	6	14.6
900	1200	65	85	7	15.8
1000	1300	40	85	8	16.9

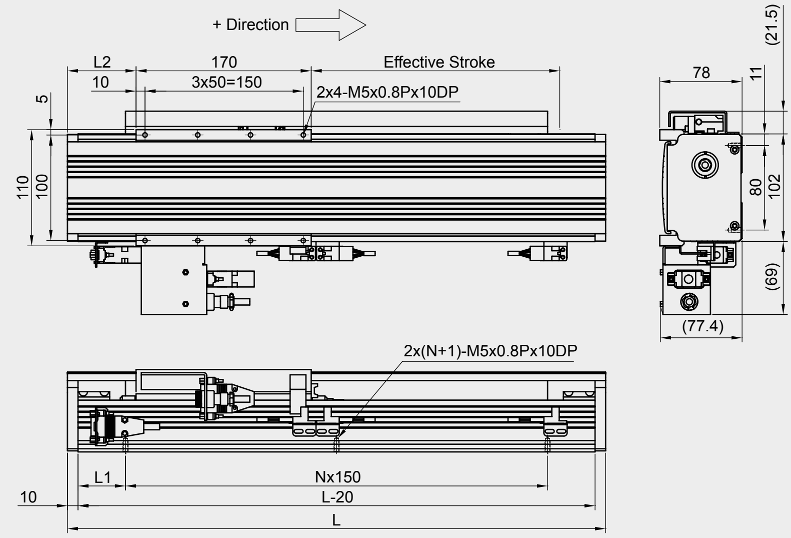


Positioning Systems

Linear Motor Stages

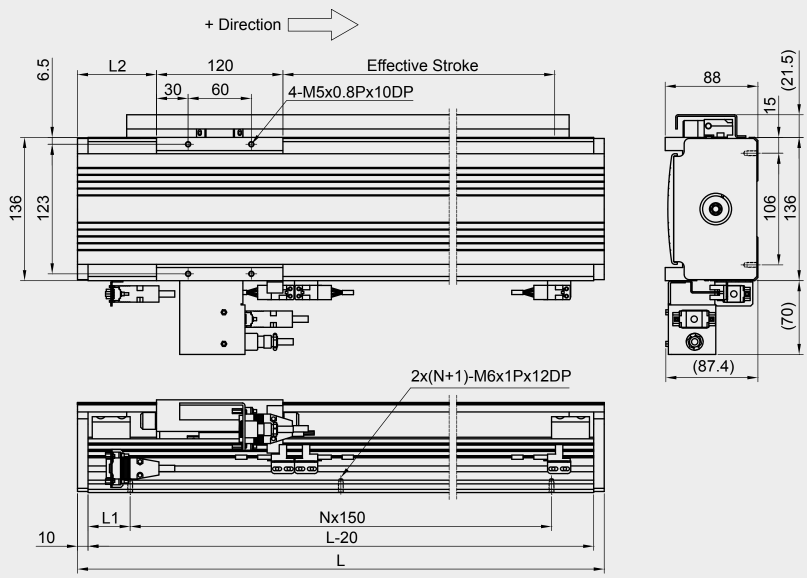
Dimensions and weight of the linear motor stage LMX1E-TA4-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	400	40	65	2	7.0
200	500	90	65	2	8.1
300	600	65	65	3	9.2
400	700	40	65	4	10.4
500	800	90	65	4	11.5
600	900	65	65	5	12.6
700	1040	60	85	6	14.2
800	1140	35	85	7	15.3
900	1240	85	85	7	16.5
1000	1340	60	85	8	17.6



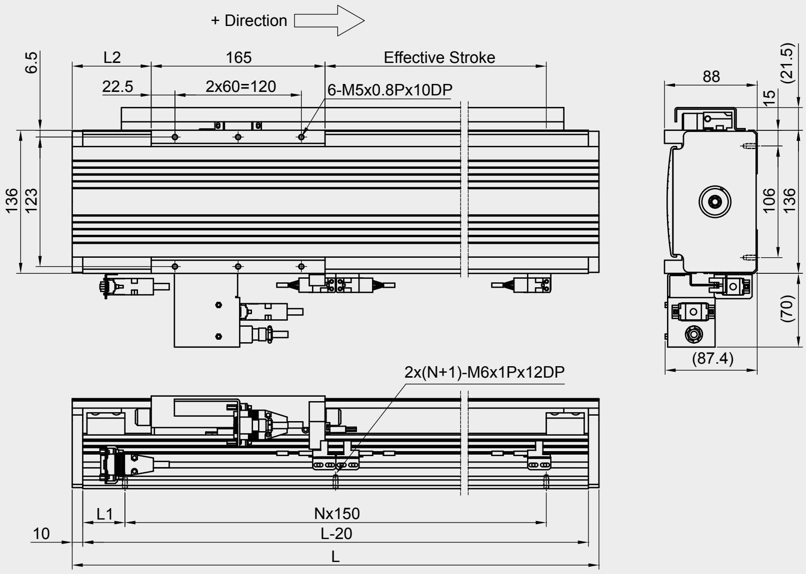
Dimensions and weight of the linear motor stage LMX1E-TB2-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	370	100	75	1	8.2
200	470	75	75	2	9.6
300	570	50	75	3	11.0
400	670	100	75	3	12.4
500	770	75	75	4	13.8
600	870	50	75	5	15.2
700	1010	45	95	6	17.1
800	1110	95	95	6	18.5
900	1210	70	95	7	19.8
1000	1310	45	95	8	21.2



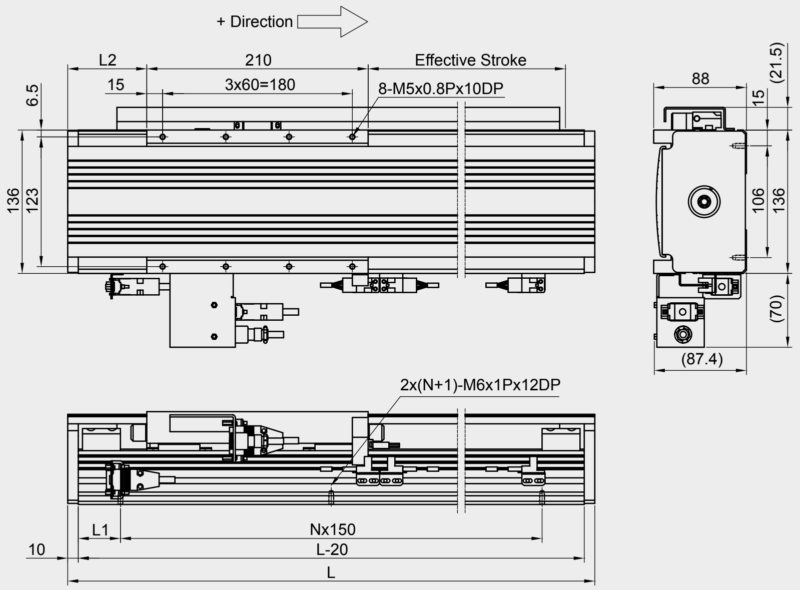
Dimensions and weight of the linear motor stage LMX1E-TB3-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	415	47.5	75	2	9.5
200	515	97.5	75	2	10.9
300	615	72.5	75	3	12.3
400	715	47.5	75	4	13.6
500	815	97.5	75	4	15.0
600	915	72.5	75	5	16.4
700	1055	67.5	95	6	18.3
800	1155	42.5	95	7	19.7
900	1255	92.5	95	7	21.1
1000	1355	67.5	95	8	22.5



Dimensions and weight of the linear motor stage LMX1E-TB4-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	460	70	75	2	11.0
200	560	45	75	3	12.4
300	660	95	75	3	13.8
400	760	70	75	4	15.2
500	860	45	75	5	16.6
600	960	95	75	5	18.0
700	1100	90	95	6	19.9
800	1200	65	95	7	21.3
900	1300	40	95	8	22.7
1000	1400	90	95	8	24.1

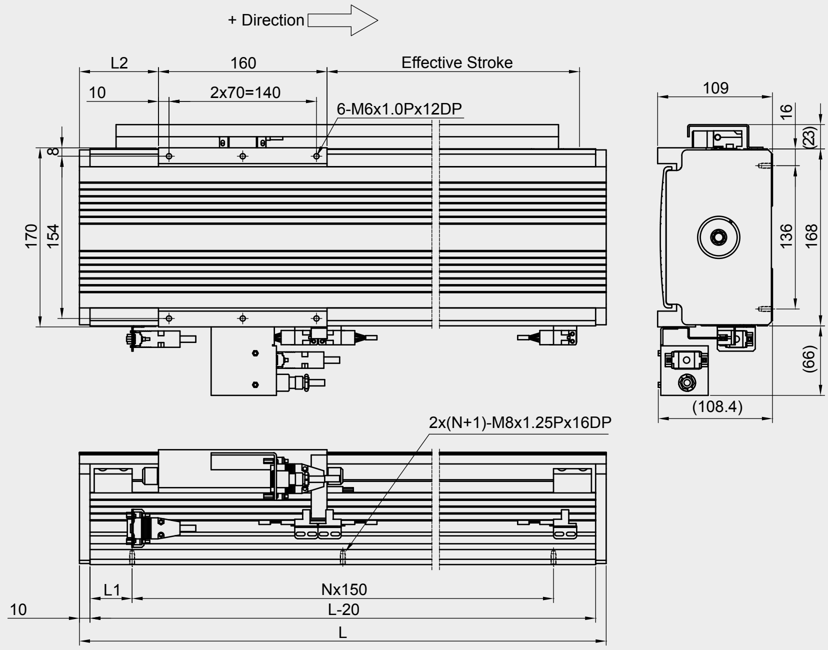


Positioning Systems

Linear Motor Stages

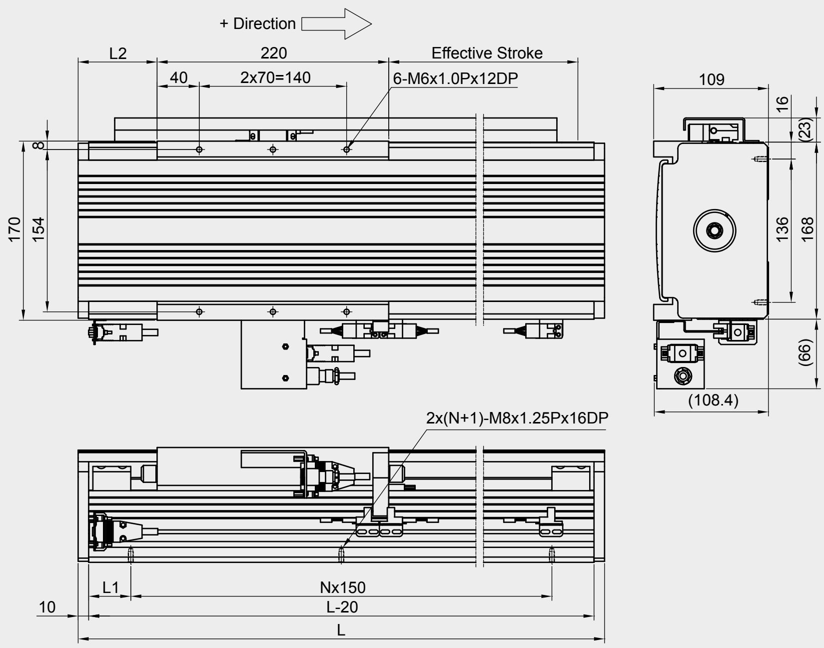
Dimensions and weight of the linear motor stage LMX1E-TC2-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	410	45	75	2	14.1
200	510	95	75	2	16.2
300	610	70	75	3	18.3
400	710	45	75	4	20.4
500	810	95	75	4	22.5
600	910	70	75	5	24.6
700	1050	45	95	6	27.5
800	1150	40	95	7	29.5
900	1250	90	95	7	31.6
1000	1350	65	95	8	33.7



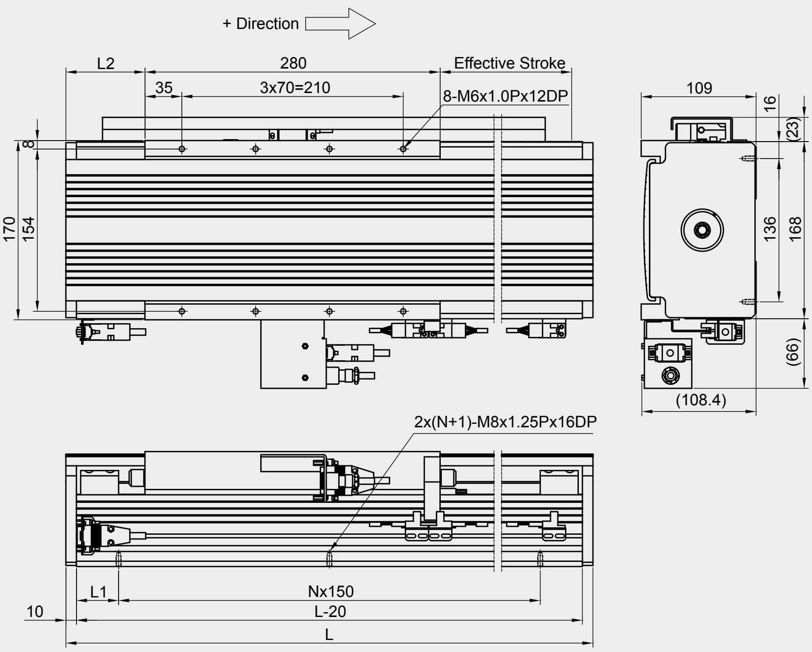
Dimensions and weight of the linear motor stage LMX1E-TC3-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	470	75	75	2	17.0
200	570	50	75	3	19.1
300	670	100	75	3	21.2
400	770	75	75	4	23.3
500	870	50	75	5	25.4
600	970	100	75	5	27.5
700	1110	75	95	6	30.4
800	1210	70	95	7	32.4
900	1310	45	95	8	34.5
1000	1410	95	95	8	36.6



Dimensions and weight of the linear motor stage LMX1E-TC4-1-xxxx-G2A0

Stroke [mm]	L [mm]	L1 [mm]	L2 [mm]	N	Mass [kg]
100	530	30	75	3	19.4
200	630	80	75	3	21.5
300	730	55	75	4	23.6
400	830	30	75	5	25.7
500	930	80	75	5	27.8
600	1030	55	75	6	29.9
700	1170	50	95	7	32.9
800	1270	100	95	7	34.9
900	1370	75	95	8	37.0
1000	1470	50	95	9	39.1



Positioning Systems

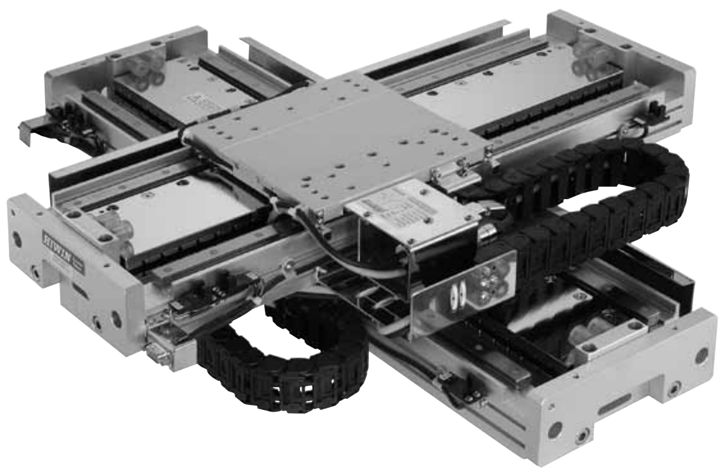
Linear Motor Stages

2.10 Cross Tables

The linear motor stages of the LMX1 series can be combined to form cross tables.
The structure of the order number shows that almost every combination of LMX1 linear motor stages is possible.
2.10.1 A cross table with LMX1E-C linear motor stage
2.10.2 A cross table with LMX1L-S linear motor stage

2.10.1 Cross Table LMX2E-CB5-CB8

- Equipped with coreless linear motors
- Slight inertia and fast acceleration
- No cogging
- Especially rigid aluminum frame with low profile
- Simple assembly

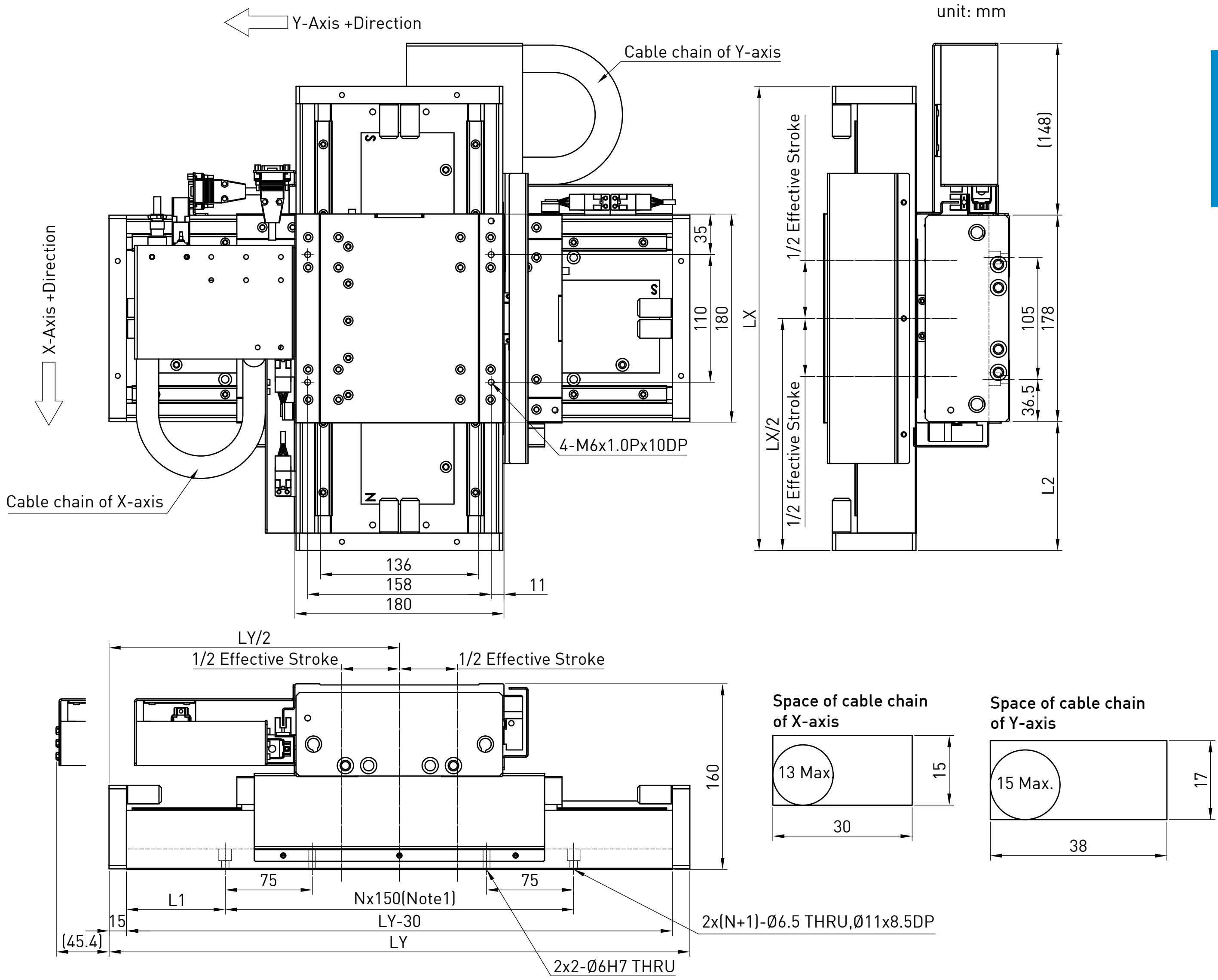


Specifications for Cross Table LMX2E-CB5-CB8

Type (Order code) xxx = X-axis effective stroke [mm] (Note 1) yyy = Y-axis effective stroke [mm] (Note 1)	Motor Type	F_c (Note 2) [N]	F_p (Note 2) [N]	Mass of Slider [kg]	Orthogo-nality [arc-sec]	Repeat-ability (Note 3) [mm]
LMX2E-CB5CB8-xxx-yyy-G20	X-axis: LMC B5	91	364	2.5	±5	±0.002
	Y-axis: LMC B8	145	580	Mass of X-axis + 4	±5	±0.002

Note 1: The permissible operating voltage depends on the selected linear motor type. The max. voltage of LMS, LMC and LMT is 500VAC.
Note 2: F_c = continuous force, 100% operating time
F_p = peak force [1 s]
Electric parameters for the linear motors: see page 58
Note 3: The data above is based on the analog type of optical positioning measurement system which is with 40μm grating period. (Stroke is below 500mm)

Dimensions of Cross Table LMX2E-CB5CB8-xxx-yyy-G20 without cover



Dimensions and weight of cross stage LMX2E-CB5CB8-xxx-yyy-G20 without cover

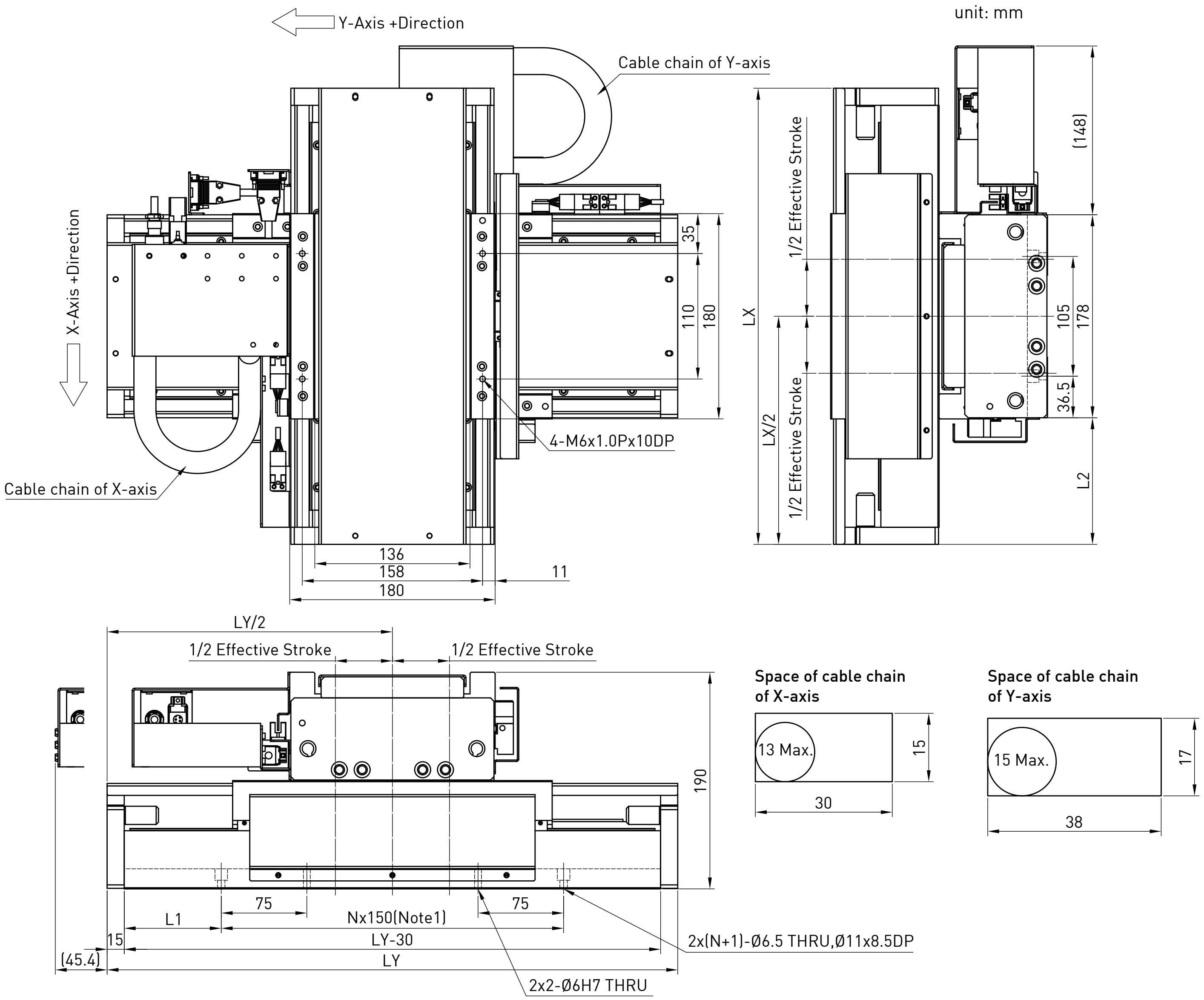
Stroke [mm]		Total length [mm]		L1	L2	N	Mass of Slider of X-axis [kg]	Mass of Slider of Y-axis [kg]	Total weight of cross table [kg]
X-axis	Y-axis	LX	LY	[mm]	[mm]				
100	100	400	500	85	111	1(Note 1)	2.5	20	44
100	200	400	600	60	111	3		20	46
200	200	500	600	60	161	3		22	48
100	300	400	700	35	111	4		20	48
200	300	500	700	35	161	4		22	50
300	300	600	700	35	211	4		24	52
100	400	400	800	85	111	4		20	50
200	400	500	800	85	161	4		22	52
300	400	600	800	85	211	4		24	54

Note 1: When stroke is 100x100mm,the pitch change to 300 mm

Positioning Systems

Linear Motor Stages

Dimensions of Cross Table LMX2E-CB5CB8-xxx-yyy-G2A with cover



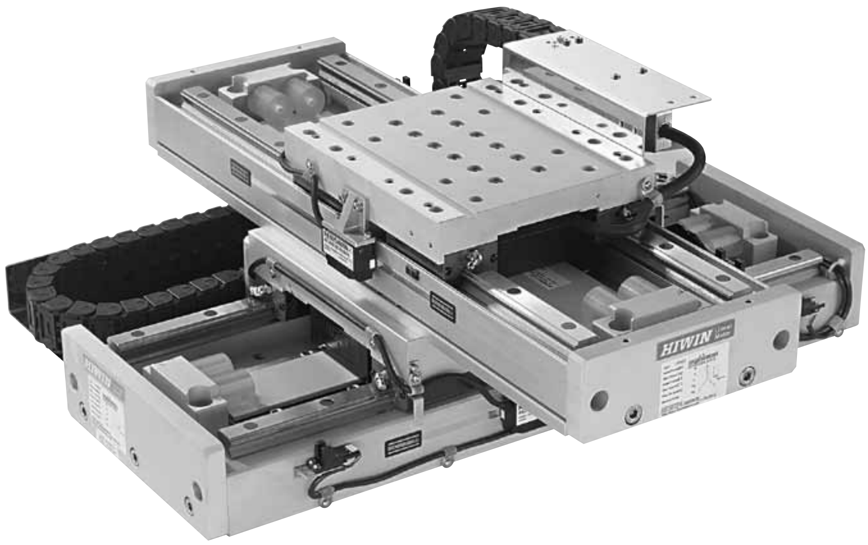
Dimensions and weight of cross stage LMX2E-CB5CB8-xxx-yyy-G20 with cover

Stroke [mm]		Total length [mm]		L1	L2	N	Mass of Slider of X-axis [kg]	Mass of Slider of Y-axis [kg]	Total weight of cross table [kg]
X-axis	Y-axis	LX	LY	[mm]	[mm]				
100	100	400	500	85	111	1(Note 1)		20	44
100	200	400	600	60	111	3		20	46
200	200	500	600	60	161	3		22	48
100	300	400	700	35	111	4		20	48
200	300	500	700	35	161	4	2.5	22	50
300	300	600	700	35	211	4		24	52
100	400	400	800	85	111	4		20	50
200	400	500	800	85	161	4		22	52
300	400	600	800	85	211	4		24	54

Note 1: When stroke is 100x100mm,the pitch change to 300 mm

2.10.2 Cross Table LMX2L-S23-S27

- Fast acceleration
- Higher thrust
- Simple assembly
- Equipped with iron-core linear motors
- Especially rigid aluminum frame with low profile
- Point to point motion



Specifications for Cross Table LMX2L-S23-S27

Type (Order code) xxx = X-axis effective stroke [mm] (Note 1) yyy = Y-axis effective stroke [mm] (Note 1)	Motor Type	F_c (Note 2) [N]	F_p (Note 2) [N]	Mass of Slider [kg]	Orthogo-nality [arc-sec]	Repeat-ability (Note 3) [mm]
LMX2L-S23S27-xxx-yyy-G20	X-axis : LMS23	240	639	7.5	±5	±0.002
	Y-axis : LMS27	382	1017	Mass of X-axis +9.5	±5	±0.002

Note 1: The permissible operating voltage depends on the selected linear motor type. The max. voltage of LMS, LMC and LMT is 500VAC.

Note 2: F_c = continuous force, 100% operating time

F_p = peak force [1 s]

Electric parameters for the linear motors: see page 52

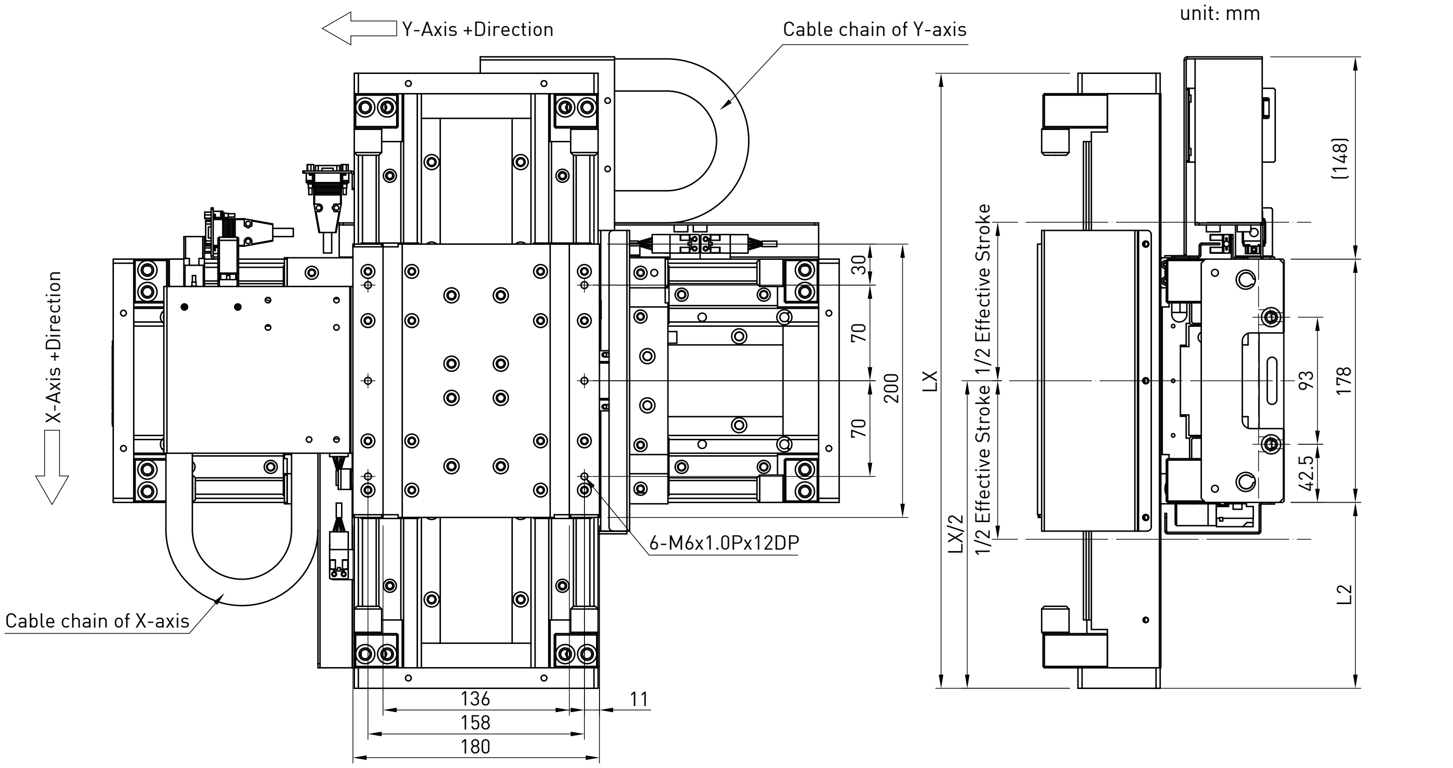
Note 3: The data above is based on the analog type of optical positioning measurement system which is with 40μm grating period. (Stroke is below 500mm)

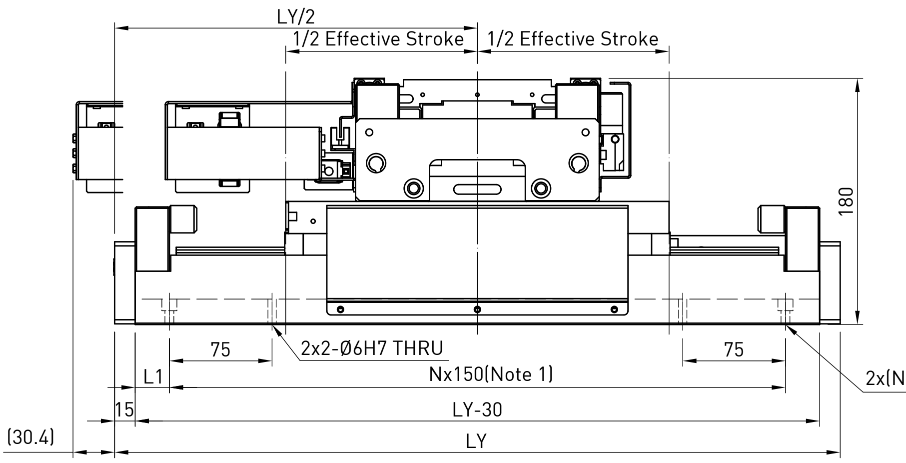
Positioning Systems

Linear Motor Stages

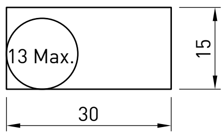
Dimensions and weight of cross stage LMX2L-S23S27-xxx-yyy-G20 without cover

unit: mm

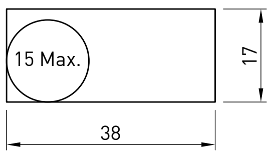




Space of cable chain of X-axis



Space of cable chain of Y-axis

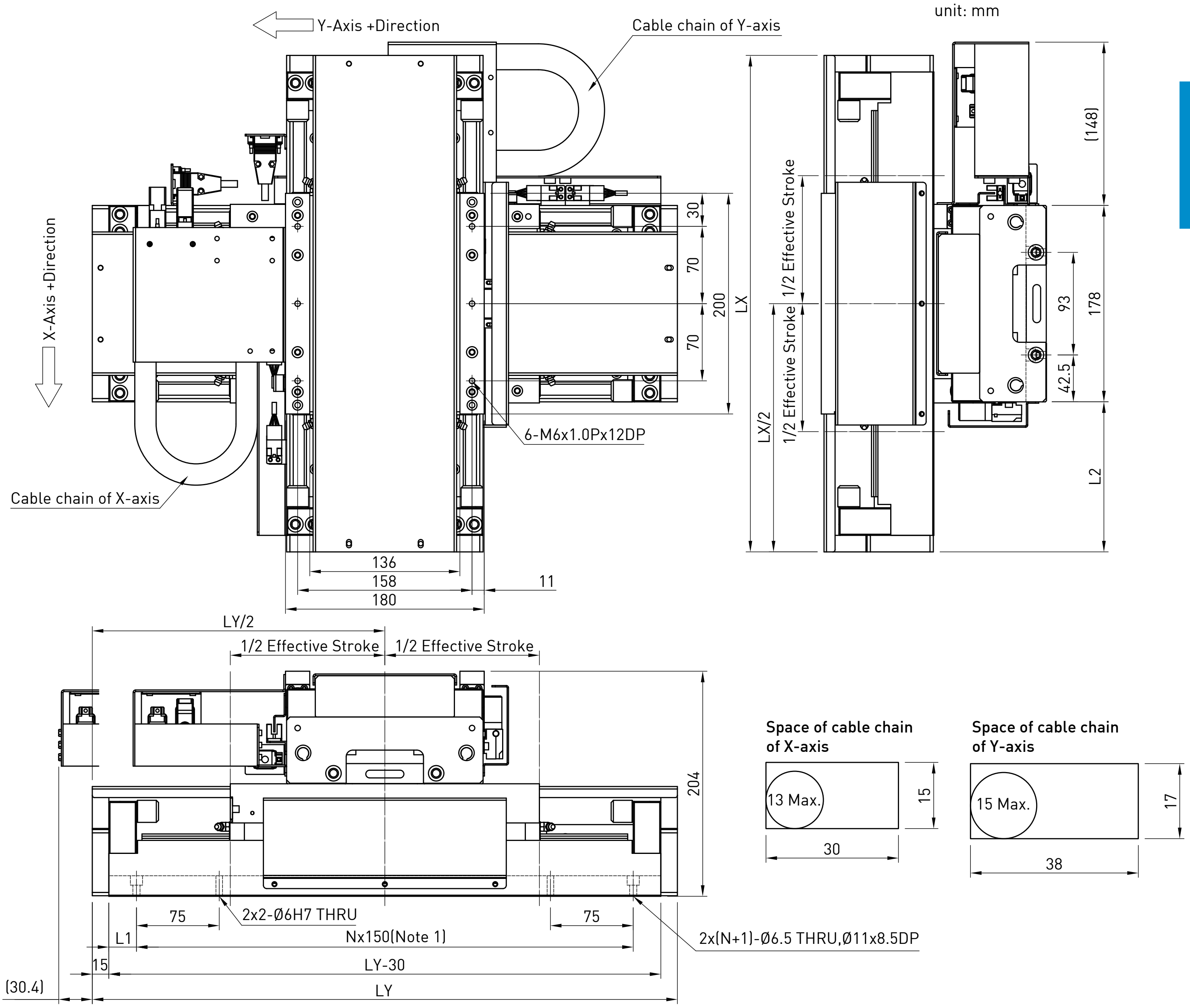


Dimensions and weight of cross stage LMX2L-S23S27-xxx-yyy-G20 without cover

Stroke [mm]		Total length [mm]		L1	L2	N	Mass of Slider of X-axis [kg]	Mass of Slider of Y-axis [kg]	Total weight of cross table [kg]
X-axis	Y-axis	LX	LY	[mm]	[mm]				
100	100	450	530	25	136	1(Note 1)		22	48
100	200	450	630	75	136	3		22	50
200	200	550	630	75	186	3		24	52
100	300	450	730	50	136	4		22	52
200	300	550	730	50	186	4	7.5	24	54
300	300	650	730	50	236	4		26	56
100	400	450	830	25	136	5		22	54
200	400	550	830	25	186	5		24	56
300	400	650	830	25	236	5		26	58

Note 1: When stroke is 100x100mm,the pitch change to 300 mm

Dimensions and weight of cross stage LMX2L-S23S27-xxx-yyy-G2A with cover



Dimensions and weight of cross stage LMX2L-S23S27-xxx-yyy-G2A with cover

Stroke [mm]		Total length [mm]		L1	L2	N	Mass of Slider of X-axis [kg]	Mass of Slider of Y-axis [kg]	Total weight of cross table [kg]
X-axis	Y-axis	LX	LY	[mm]	[mm]				
100	100	450	530	25	136	1(Note 1)		22	48
100	200	450	630	75	136	3		22	50
200	200	550	630	75	186	3		24	52
100	300	450	730	50	136	4		22	52
200	300	550	730	50	186	4	7.5	24	54
300	300	650	730	50	236	4		26	56
100	400	450	830	25	136	5		22	54
200	400	550	830	25	186	5		24	56
300	400	650	830	25	236	5		26	58

Note 1: When stroke is 100x100mm,the pitch change to 300 mm

Positioning Systems

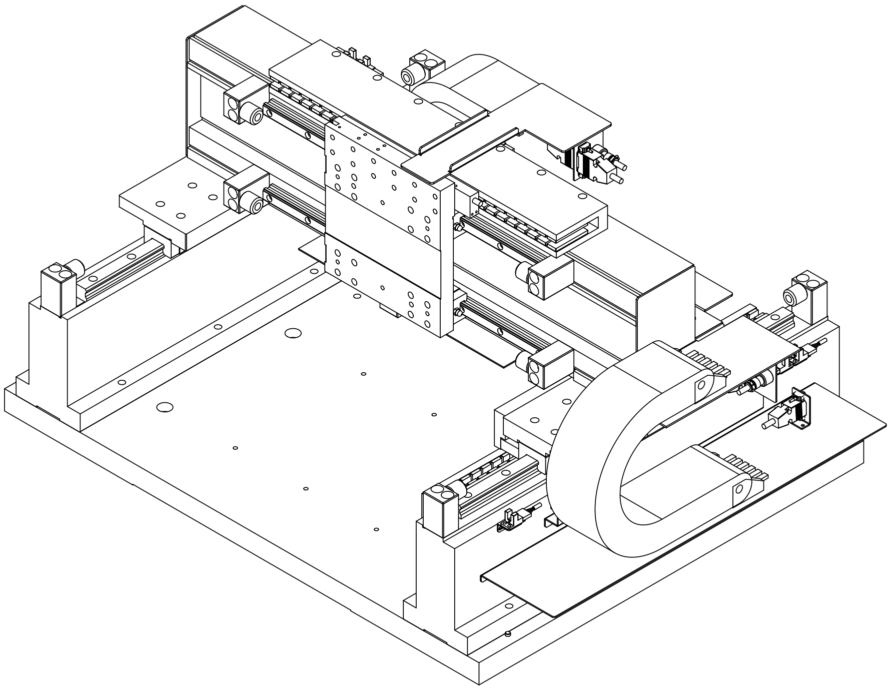
Linear Motor Stages

2.11 Gantry Systems

The standardized gantry system of the LMG2A series are systems with one-sided supporting guide rail.
The type LMG2A-C is equipped with coreless linear motors. The type LMG2A-S is driven by iron-core linear motors.

2.11.1 Gantry-System LMG2A-CB6 CC8

- Slight inertia
- No cogging
- Fast acceleration
- Simple assembly
- Rigid aluminum bridge
- Equipped with coreless linear motors



Specifications for Gantry System LMG2A-CB6CC8-xxx-yyy-G2

Type (Order code) xxx = X-axis effective stroke [mm] (Note 1) yyy = Y-axis effective stroke [mm] (Note 1)	Motor Type	F_c (Note 2) [N]	F_p (Note 2) [N]	Repeat-ability (Note 3) [mm]	Orthogo-nality [arc-sec]
LMG2A-CB6CC8-xxx-yyy-G2	X-axis(upper axis):CB6	109	436	±0.002	±5
	Y-axis(lower axis):CC8	145	580	±0.004(Note 4)	±5

Note 1: The permissible operating voltage depends on the selected linear motor type. The max. voltage of LMS, LMC and LMT is 500VAC.

Note 2: F_c = continuous force, 100% operating time

F_p = peak force [1 s]

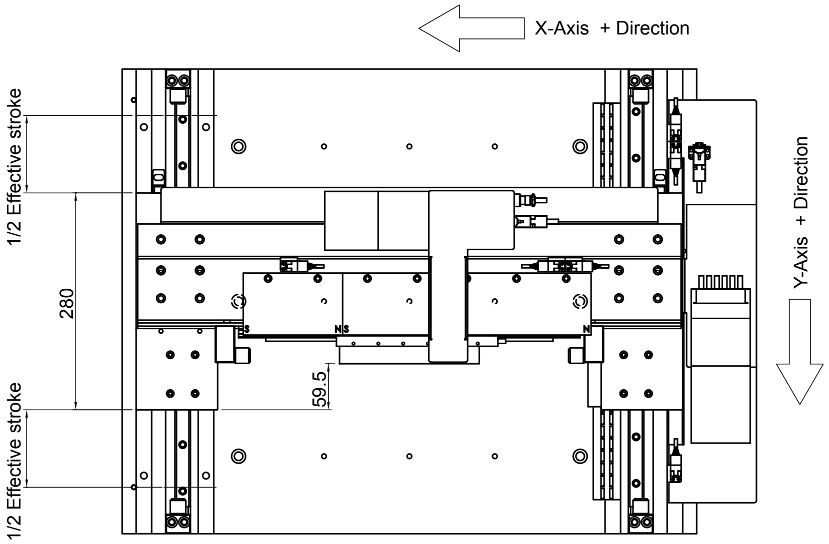
Electric parameters for the linear motors: see page 58

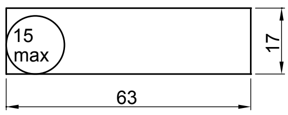
Note 3: The data above is based on the analog type of optical positioning measurement system which is with 40μm grating period.

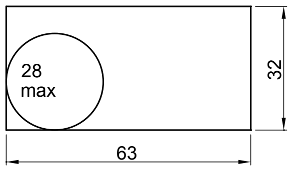
Note 4: While measuring the Y-axis, the movable part of X-axis is in the middle of the stroke.

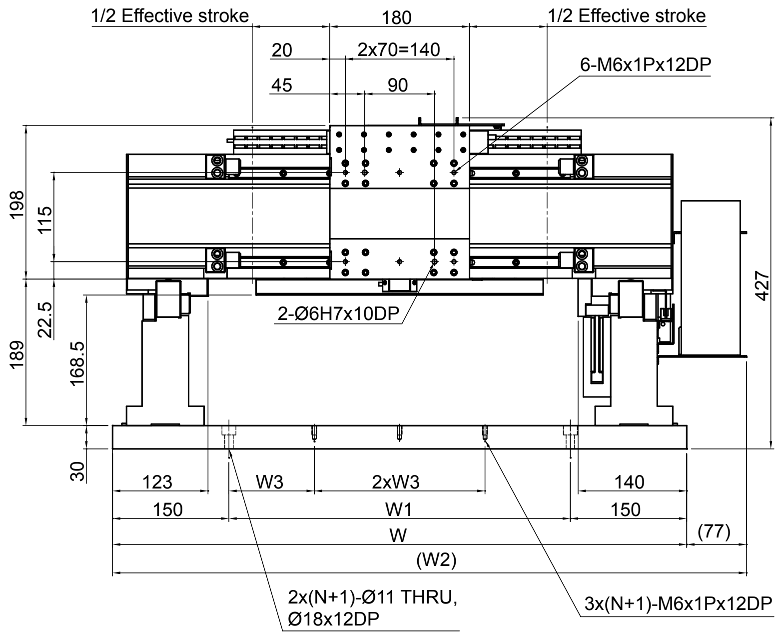
Dimensions of Gantry System LMG2A-CB6CC8-xxx-yyy-G2

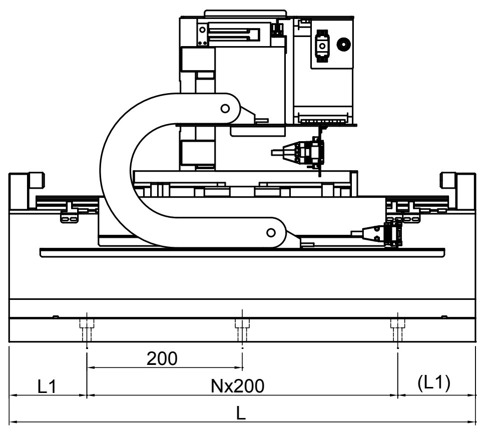
unit: mm











Dimensions of Gantry System LMG2A-CB6CC8-xxx-yyy-G2

	Stroke(Note1) [mm]	W [mm]	W1 [mm]	W2 [mm]	W3 [mm]	Mass of Slider [kg]	Total weight of X-axis [kg]
X-axis (upper)	200	740	440	817	110	5	25
	300	840	540	917	135		29
	400	940	640	1017	160		33
	500	1040	740	1117	185		37
	600	1140	840	1217	210		41

	Stroke(Note1) [mm]	N	L [mm]	L1 [mm]	Mass of Slider [kg]
Y-axis (lower)	200	2	600	100	Total weight of X-axis+6
	300	3	700	50	
	400	3	800	100	
	500	4	900	50	
	600	4	1000	100	

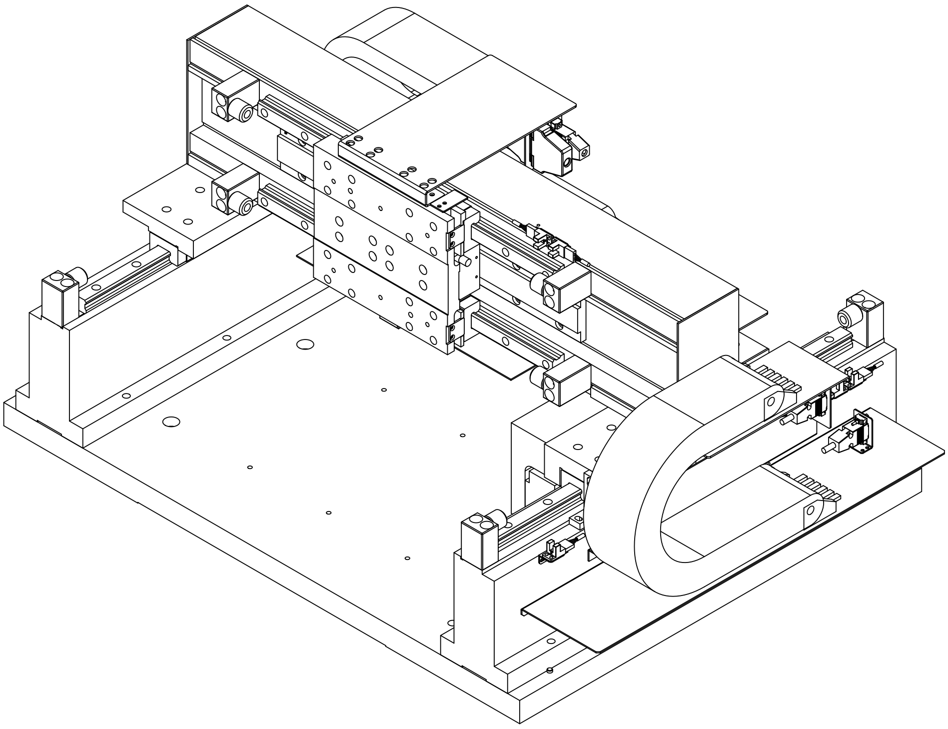
Note 1: The standard stroke of X, Y axis could be chosen by request.

Positioning Systems

Linear Motor Stages

2.11.2 Gantry System LMG2A-S13 S27

- Higher thrust
- Fast acceleration
- Simple assembly
- Less cogging
- Equipped with iron-core linear motors
- Rigid aluminum bridge



Specifications for Gantry System LMG2A-S13S27-xxx-yyy-G2

Type (Order code) xxx = X-axis effective stroke [mm] (Note 1) yyy = Y-axis effective stroke [mm] (Note 1)	Motor Type	F_c (Note 2) [N]	F_p (Note 2) [N]	Repeat-ability (Note 3) [mm]	Orthogo-nality [arc-sec]
LMG2A-S13S27-xxx-yyy-G2	X-axis(upper axis):S13	203	540	±0.002	±5
	Y-axis(lower axis):S27	382	1017	±0.004(Note 4)	±5

Note 1: The permissible operating voltage depends on the selected linear motor type. The max. voltage of LMS, LMC and LMT is 500VAC.

Note 2: F_c = continuous force, 100% operating time

F_p = peak force [1 s]

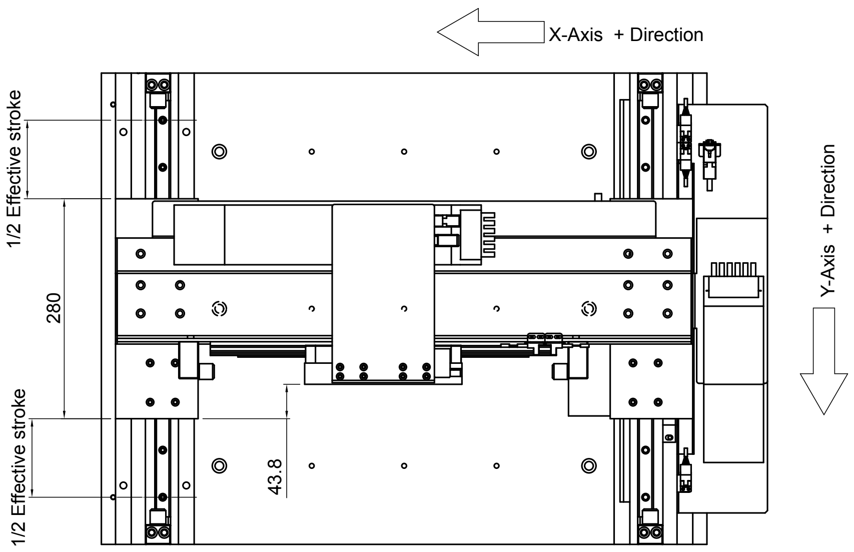
Electric parameters for the linear motors: see page 52

Note 3: The data above is based on the analog type of optical positioning measurement system which is with 40μm grating period.

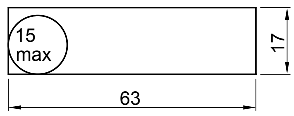
Note 4: While measuring the Y-axis, the movable part of X-axis is in the middle of the stroke.

Specifications for Gantry System LMG2A-S13S27-xxx-yyy-G2

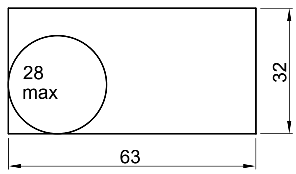
unit: mm

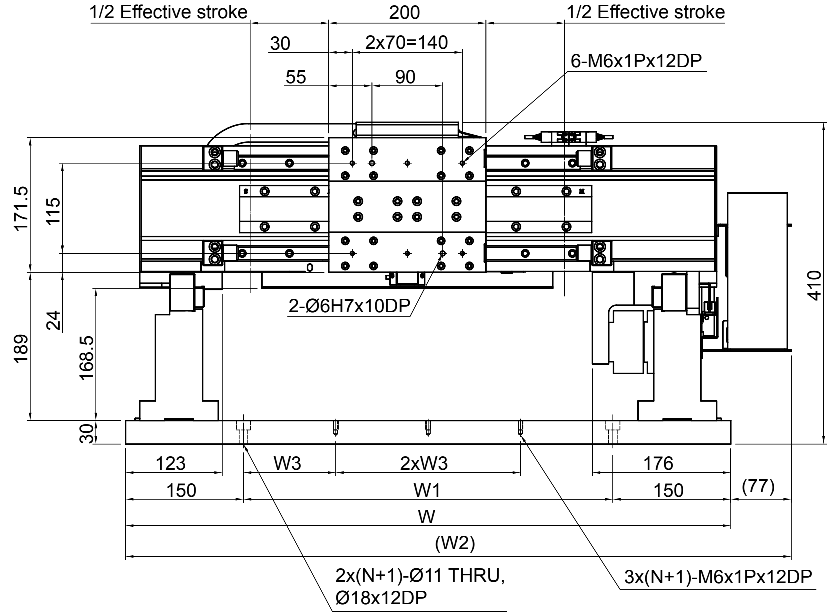


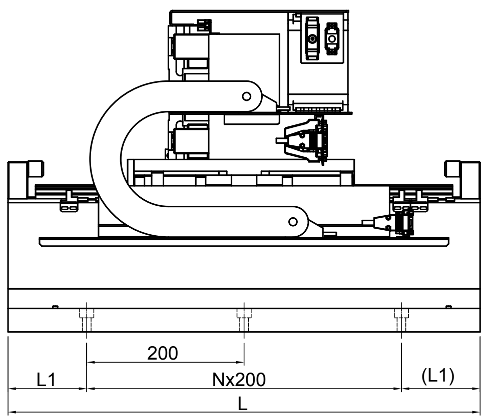
Space of cable chain of X-axis



Space of cable chain of Y-axis







Specifications for Gantry System LMG2A-S13S27-xxx-yyy-G2

	Stroke(Note1) [mm]	W [mm]	W1 [mm]	W2 [mm]	W3 [mm]	Mass of Slider [kg]	Total weight of X-axis [kg]
X-axis (upper)	200	770	470	847	117.5	7	24
	300	870	570	947	142.5		27
	400	970	670	1047	167.5		30
	500	1070	770	1147	192.5		33
	600	1170	870	1247	217.5		36

	Stroke(Note1) [mm]	N	L [mm]	L1 [mm]	Mass of Slider [kg]
Y-axis (lower)	200	2	600	100	Total weight of X-axis+8
	300	3	700	50	
	400	3	800	100	
	500	4	900	50	
	600	4	1000	100	

Note 1: The standard stroke of X, Y axis could be chosen by request.

3 Planar Motor

3.1 Planar Servo Motor LMSP  Page 46

3.2 Servo Drive LMDX  Page 49

Positioning Systems

Planar Motor

3 Planar Motor

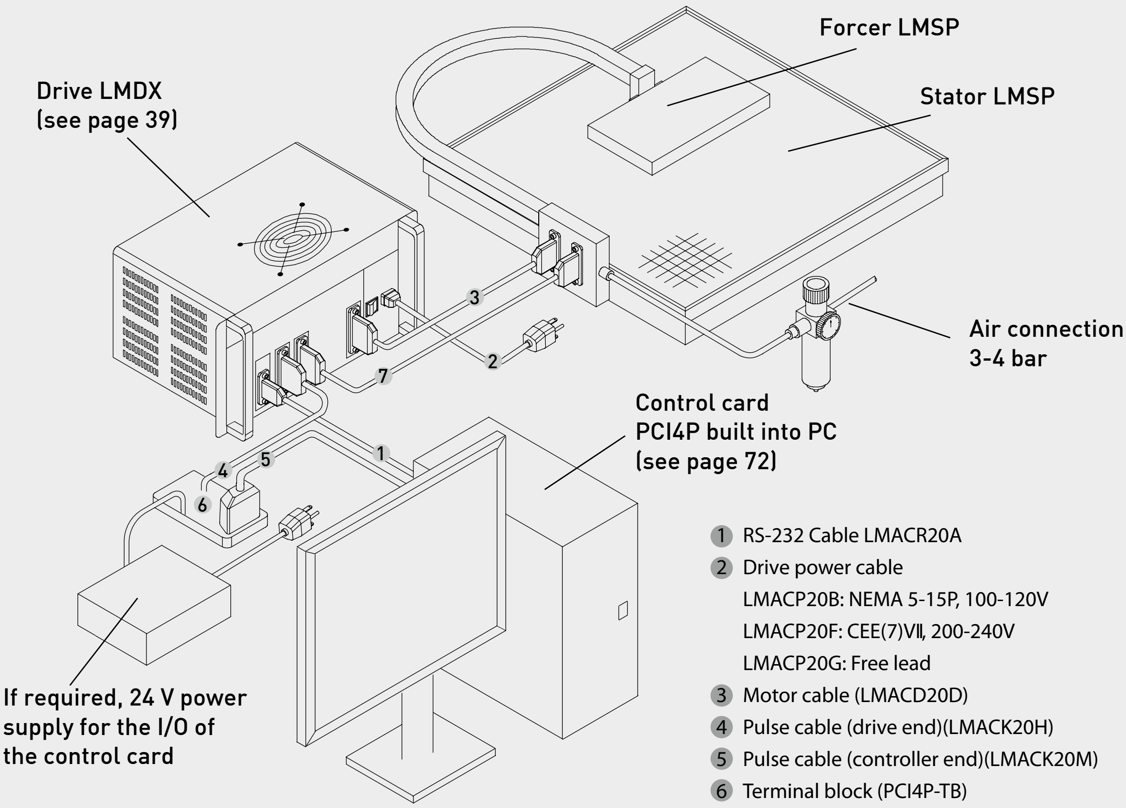
XY movements on an air bearing through a planar-servo motor with integrated distance measurement. Can be operated upside down.

3.1 Planar Servo Motor LMSP

The planar motor LMSP has integrated distance measurement sensors and works with position control (closed loop).

- XY table
- Closed loop thanks to integrated distance measurement
- Air bearing free of wear
- No externally measurable magnetic fields
- Very low heat generation
- Can be mounted upside down
- Stator area up to 1000 x 1000 mm

Configuration of LMSP with servo drive LMDX



1. RS-232 Cable LMACR20A
2. Drive power cable
   LMACP20B: NEMA 5-15P, 100-120V
   LMACP20F: CEE(7)VII, 200-240V
   LMACP20G: Free lead
3. Motor cable (LMACD20D)
4. Pulse cable (drive end)(LMACK20H)
5. Pulse cable (controller end)(LMACK20M)
6. Terminal block (PCI4P-TB)
7. Encoder cable (LMACE20C)

Dimensions of Planar Servo Motor LMSP

(Values X_f see Table 3.1, values X_s see Table 3.2)

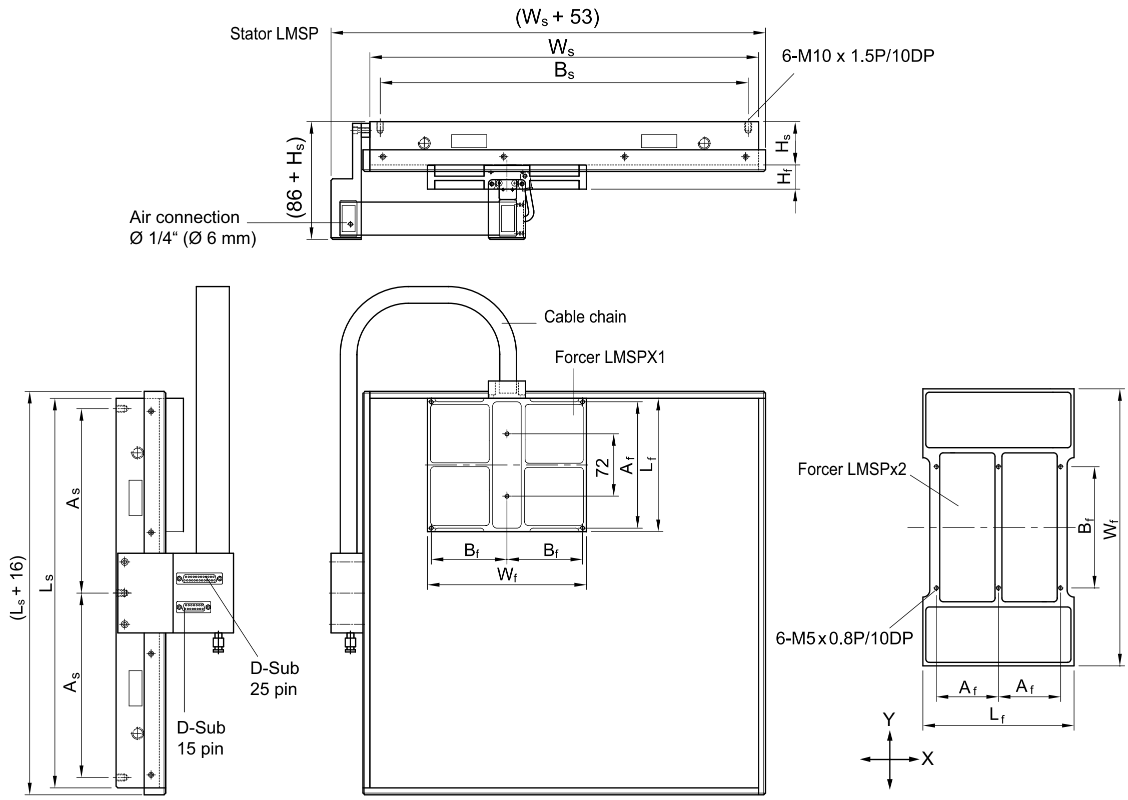


Table 3.1 Specifications for Planar Servo Motor LMSP

		Symbol	Unit	LMSPX1	LMSPX2
Performance	**Max. thrust**	T_m	N	75	140
	Resolution	R_s	mm	0.001	0.001
	Repeatability (unidirectional)	R_p	mm	0.002	0.002
	Accuracy (every 300mm)	A_c	mm	±0.015	±0.015
	Max. speed	V	m/s	0.9	0.8
	Max. load	-	kg	12.2	24.3
Forcer	**Length**	L_f	mm	154	175
	Width	W_f	mm	184	320
	Height	H_f	mm	28	30
	Air pressure	P_a	kg/cm^2	3-4	3-4
	Air flow rate	F_a	l/min	6.4	11
	Mass	M_f	kg	1.8	3.7
	Fixing distance	A_f x B_f	mm x mm	146 x 87.5	72 x 140

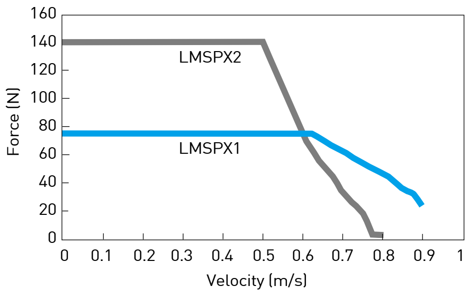
Positioning Systems

Planar Motor

Table 3.2 Dimensions and weight of the stators LMSP-P1 to LMSP-P6

		Unit	P1	P2	P3	P4	P5	P6
Stator dimensions	**L_s x W_s**	mm	350 x 330	450 x 450	600 x 450	600 x600	1000 x 600	850 x 850
Max. Stroke	**LMSPX1**	mm	190 x 140	290 x 260	440 x 260	440 x 410	840 x 410	690 x 660
(one Forcer)	**LMSPX2**	mm		270 x 125	420 x 125	420 x 275	820 x 275	670 x 525
Stator height	**H_s**	mm	50	50	70	70	100	120
Mass of Stator		kg	27	36	52	66	120	250
Fixing Distance	**A_s x B_s**	mm	165 x 310	213 x 426	288 x 426	288 x 576	(318-324-318) x 280	400 x 400
No. of mounting holes			6	6	6	6	10	9

LMSP series F-V Curve



Structure of Order Number

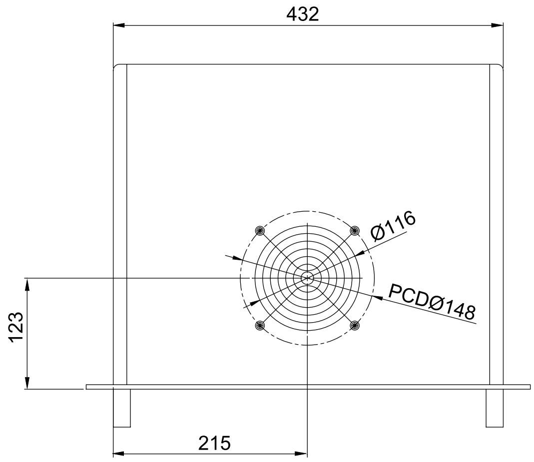
LMSPX 1 1 P1

Series	Forcer	Number of forcers	Stator
	1		P1
	2		P2
			P3
			P4
			P5
			P6

3.2 Servo Drive LMDX

The servor drive LMDX for the planar servo motor LMSP is available in two different voltage versions and with an optional digital I/O interface card.

Dimensions of Servo Drive LMDX



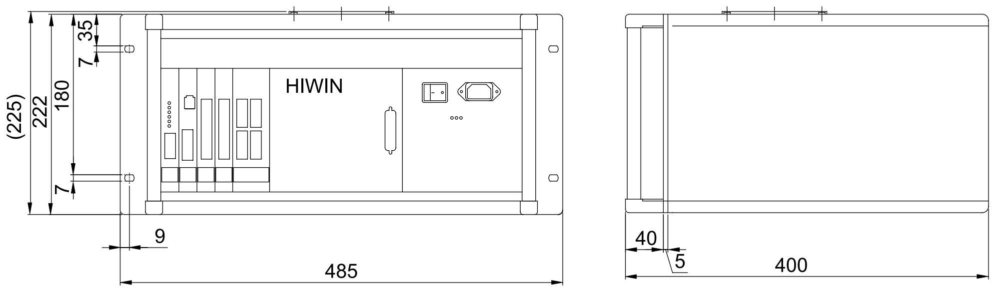


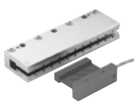
Table 3.3 Specifications for Servo Drive LMDX

		Unit	Value
Power supply	**Voltage**	V_{AC}	95-125 (LMDX1) 200-240 (LMDX2)
	Frequency **Output**	Hz VA	50/60 500 (max.)
Output current		A	3 (max.)
Interface	**Parameter setting: RS-232**		9600 Baud, 8 data bits, 2 stop bits, odd parity
	Digital I/O signal		DXIO plug-in card: 8 inputs: including HOME and RESET 6 outputs: including IN-POSITION, ALARM, SVON DXIO16 plug-in card (option): 16 inputs, 16 outputs
	Pulse command	Pulse	STEP/DIR
Resolution		µm/pulse	min. 1 (set by parameter)
Mass		kg	13.3
Max. operation temperature		°C	50

4 Linear Motor Components

4.1 Linear Motors, LMS Series Page 52


4.2 Linear Motors, LMSC Series Page 56


4.3 Linear Motors, LMC Series Page 58
4.3.1 Linear Motors, LMCA, LMCB, LMCC Series Page 58
4.3.2 Linear Motors, LMCD, LMCE Series Page 60
4.3.3 Linear Motors, LMCF Series Page 62


4.4 Linear Motors, LMF Series Page 64


4.5 Linear Motors, LMT Series Page 71


Positioning Systems

Linear Motor Components

4.1 Linear Motors, LMS Series

HIWIN synchronous linear motors LMS are the power packs of linear drives.
They are especially distinguished by very high power density and minimum cogging force.
The three-phase motors are composed of a primary part (forcer) with a coiled stack of sheets and a secondary part with permanent magnets (stators). With the combination of several stators, many stroke combinations are possible.

- 3-phase
- High thrust
- Excellent acceleration
- Low cogging
- Many stroke lengths
- Several forcers possible on one stator

Force Chart for Linear Motors, LMS Series

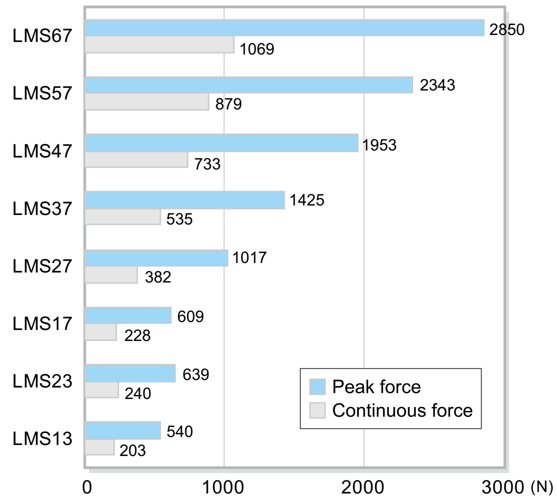


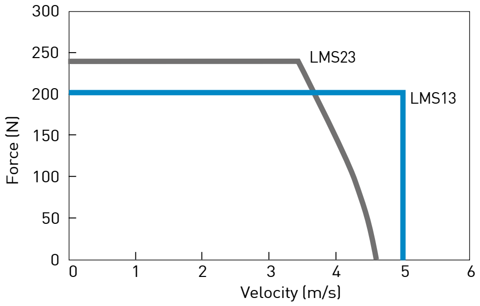
Table 4.1 Specifications for Linear Motors, LMS Series

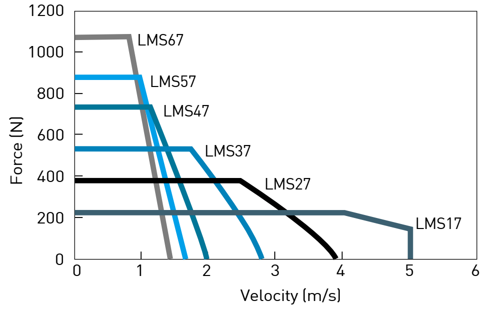
	Symbol	Unit	LMS13	LMS23	LMS17	LMS27	LMS27L	LMS37	LMS37L	LMS47	LMS47L	LMS57	LMS57L	LMS67	LMS67L
Continuous force	F_c	N	203	240	228	382	382	535	535	733	733	879	879	1069	1069
Continuous current	I_c	A (rms)	4.6	3.9	3.9	3.9	7.9	3.9	7.9	3.9	7.9	3.9	7.9	3.9	7.9
Peak force for 1 sec.	F_p	N	540	639	609	1017	1017	1425	1425	1953	1953	2343	2343	2850	2850
Peak current for 1 sec.	I_p	A (rms)	24.6	21.0	21.0	21.0	42.0	21.0	42.0	21.0	42.0	21.0	42.0	21.0	42.0
Force constant	K_f	N/A (rms)	44	61	58	97	46	136	68	186	93	223	112	271	136
Attraction force	F_a	N	805	1350	1221	2036	2036	2850	2850	4071	4071	4885	4885	5700	5700
Max. winding temp.	T_{max}	°C	120	120	120	120	120	120	120	120	120	120	120	120	120
Electrical time constant	K_e	ms	10.4	10.5	10.6	11.3	8.9	11.6	11.0	13.0	12.2	12.4	12.0	12.4	12.6
Resistance (line to line at 25 °C)	R_{25}	Ω	3.1	4.6	4.8	6.8	1.6	8.9	2.1	11.9	2.7	13.8	3.1	15.4	3.4
Inductance (line to line)	L	mH	32.2	48.4	50.8	76.8	14	103.4	23.1	154.4	33	170.8	37.3	190.7	43
Pole pair pitch	2τ	mm	32	32	32	32	32	32	32	32	32	32	32	32	32
Bend radius of motor cable	R_{bend}	mm	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Back emf constant (line to line)	K_v	Vrms/(m/s)	26	43	31	51	24	71	36	101	51	121	61	141	71
Motor constant (at 25 °C)	K_m	N/√W	20.4	23.2	21.6	30.3	31.4	37.1	38.2	44.0	46.2	49.0	51.7	56.5	60.1
Thermal resistance	R_{th}	°C/W	0.7	0.7	0.6	0.5	0.5	0.3	0.4	0.3	0.3	0.2	0.2	0.2	0.2
Thermal switch			3 PTC SNM120 In Series												
Max. DC bus voltage		V	500												
Mass of forcer	M_f	kg	1.8	2.7	2.7	4.1	4.1	5.9	5.9	8.0	8.0	9.4	9.4	10.8	10.8
Unit mass of stator	M_s	kg/m	4.2	6.2	4.2	6.2	6.2	8.2	8.2	11.5	11.5	13.7	13.7	15.9	15.9
Width of stator	W_s	mm	60	80	60	80	80	100	100	130	130	150	150	170	170
Length of stator / Dimension N	L_s	mm	128mm/N=1, 192mm/N=2, 320mm/N=4												
Stator mounting distance	A_s	mm	45	65	45	65	65	85	85	115	115	135	135	155	155
Total height	H	mm	55.2	55.2	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4

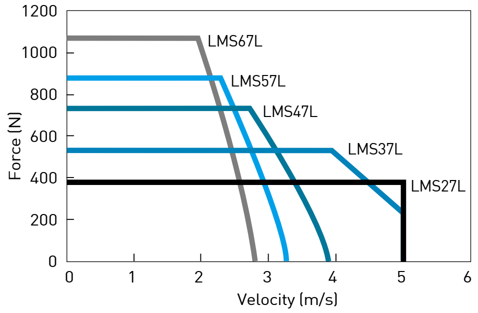
Note: Values in the table refer to operation without forced cooling
Except dimensions, all the specifications in the table are in ± 10% of tolerance.

LMS series F-V curves

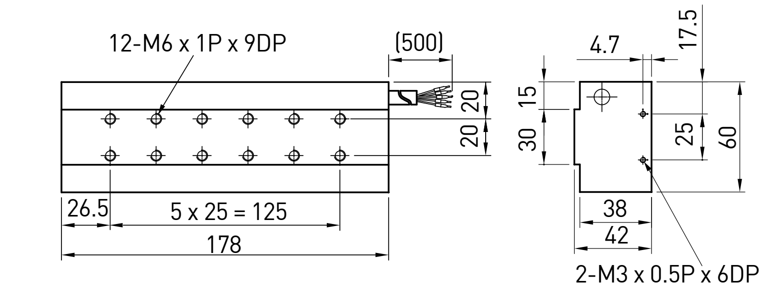
Force vs. Velocity curves are calculated with DC bus voltage=300 VDC



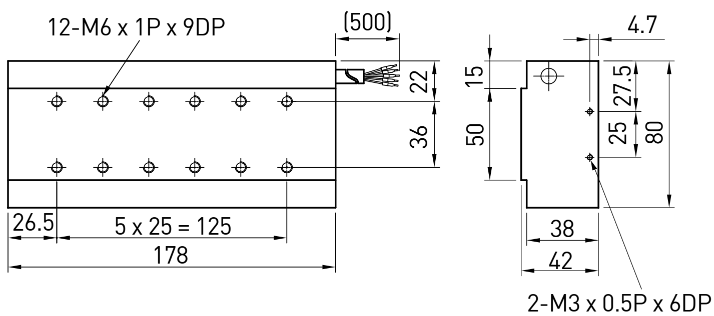




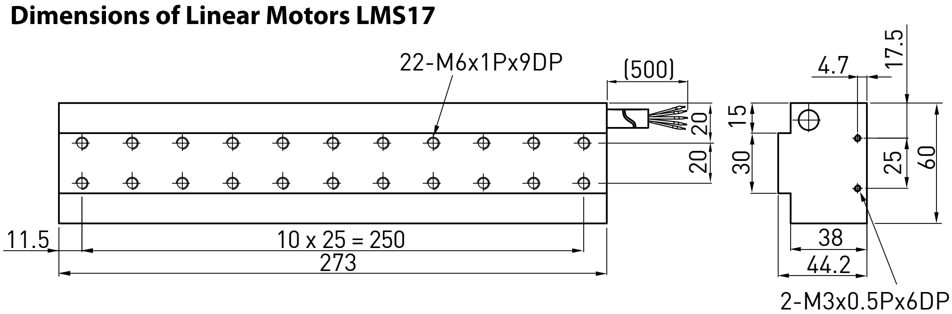
Dimensions of Linear Motors LMS13



Dimensions of Linear Motors LMS23



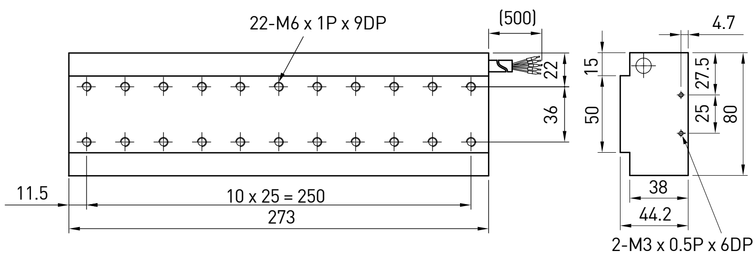
Dimensions of Linear Motors LMS17



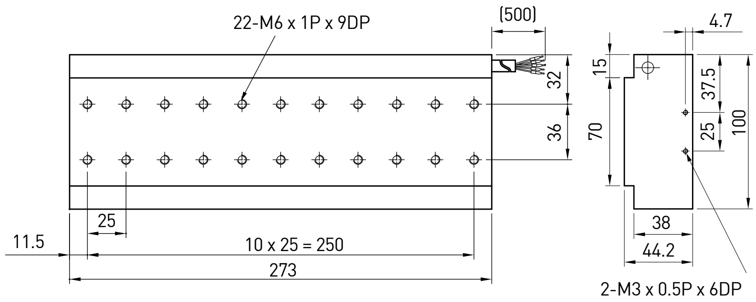
Positioning Systems

Linear Motor Components

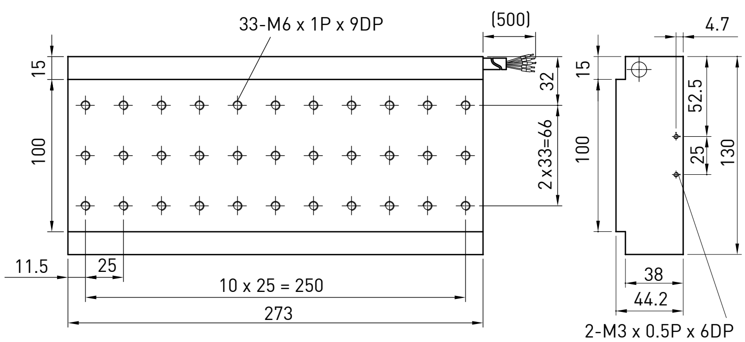
Dimensions of Linear Motors LMS27



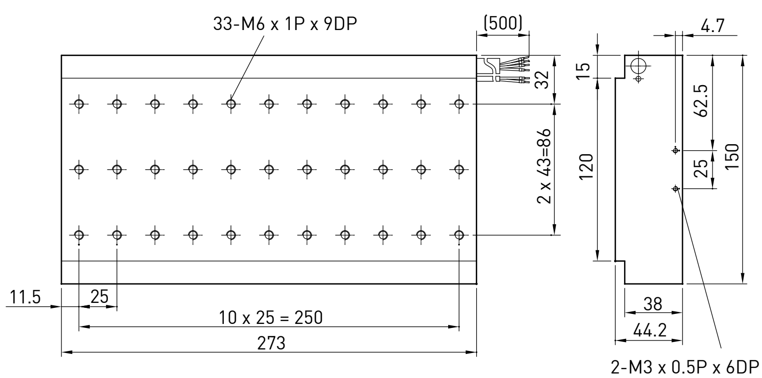
Dimensions of Linear Motors LMS37 (L)



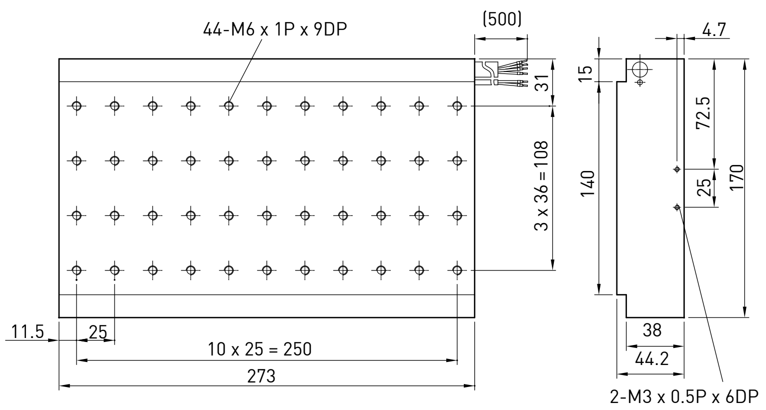
Dimensions of Linear Motors LMS47 (L)



Dimensions of Linear Motors LMS57 (L)

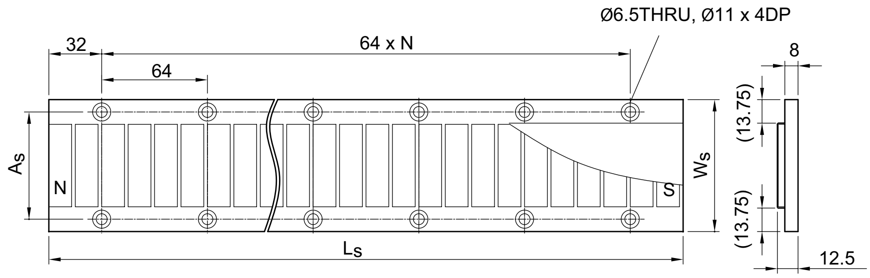


Dimensions of Linear Motors LMS67 (L)

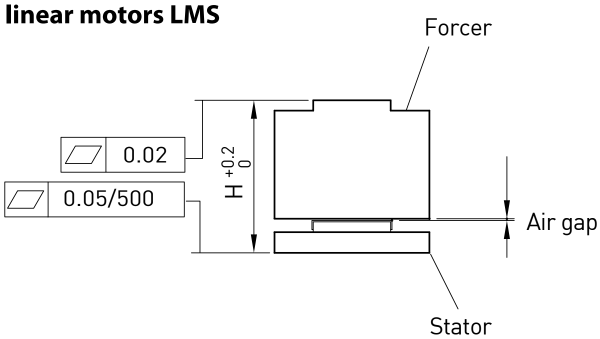


Dimensions of stators for linear motors LMS

(Values for L_S, A_S, W_S and H see Table 4.1)



Installing linear motors LMS



Structure of the order number of linear motors LMS, stators

LMS 1 S 3

Series	Width of stator	Stator model	Length of stator
	1: for linear motors, LMS13 and LMS17 series 2: for linear motors, LMS23 and LMS27 series 3: for linear motors, LMS37 (L) and LMSC7 (L) series 4: for linear motors, LMS47 (L) series 5: for linear motors, LMS57 (L) series 6: for linear motors, LMS67 (L) series	S: Standard C: Customized	0: 128 mm (N=1) 1: 192 mm (N=2) 3: 320 mm (N=4)

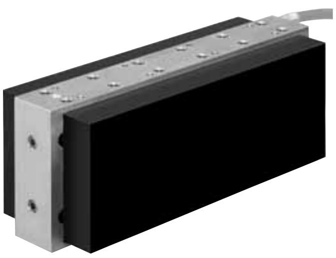
Positioning Systems

Linear Motor Components

4.2 Linear Motors, LMSC Series

HIWIN synchronous linear motors LMSC are iron-core motors with similar properties to the motors of the LMS series. Due to the special arrangement of the forcer between two stators, the attraction force in the LMSC motors is canceled. As a result, the guide rails are relieved of loads and a high power density is achieved with relatively short sliders.

- Large force constant
- Water cooling possible
- Attraction force compensation
- No attraction force introduction into the guide elements
- Several forcers possible on one stator
- Any stroke length



Force Chart for Linear Motors, LMSC Series

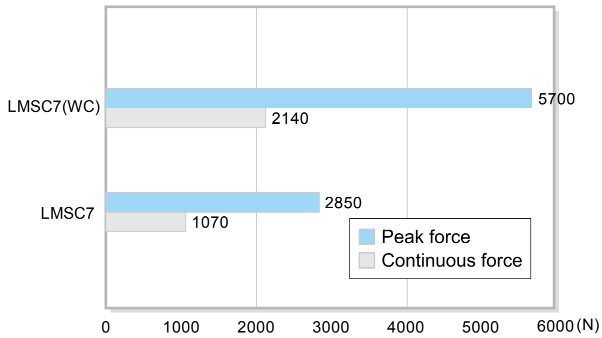


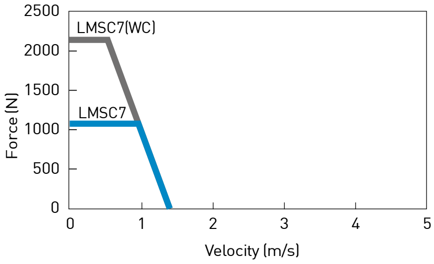
Table 4.2 **Specifications for Linear Motors, LMSC Series**

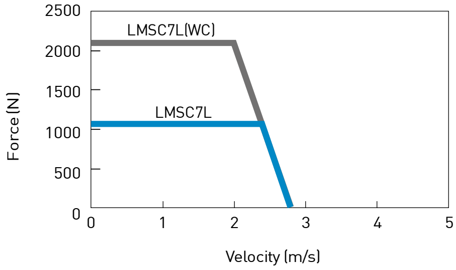
	Symbol	Unit	LMSC7	LMSC7(WC)[2]	LMSC7L	LMSC7L (WC)[2]
Continuous force	F_c	N	1070	2140	1070	2140
Continuous current	I_c	A(rms)	3.9	7.9	7.9	15.7
Peak force (for 1 s)	F_p	N	2850	5700	2850	5700
Peak current (for 1 s)	I_p	A(rms)	21.0	42.0	42.0	84.0
Force constant	K_f	N/A (rms)	271	271	136	136
Attraction force	F_a	N	0[1]	0[1]	0[1]	0[1]
Max. winding temp.	T_{max}	°C	120	120	120	120
Electrical time constant	K_e	ms	10.5	10.5	10.0	10.0
Resistance (line to line at 25 °C)	R_{25}	Ω	17.8	17.8	4.2	4.2
Inductance (line to line)	L	mH	206.8	206.8	46.2	46.2
Pole pair pitch	2τ	mm	32	32	32	32
Bend radius of motor cable	R_{bend}	mm	37.5	37.5	37.5	37.5
Back emf constant (line to line)	K_v	Vrms/(m/s)	141	141	71	71
Motor constant (at 25 °C)	K_m	$N/\sqrt{W}$	45.7	45.7	47.2	47.2
Thermal resistance	R_{th}	°C/W	0.17	0.04	0.18	0.05
Thermal switch			3 PTC SNM120 In Series			
Max. DC bus voltage		V	500			
Mass of forcer	M_f	kg	14.0	14.0	14.0	14.0
Unit mass of stator	M_s	kg/m	16.4	16.4	16.4	16.4
Width of stator	W_s	mm	100	100	100	100
Length of stator/Dimension N	L_s	mm	128mm/N=1, 192mm/N=2, 320mm/N=4			
Stator mounting distance	A_s	mm	85	85	85	85
Total height	H	mm	131.5	131.5	131.5	131.5

Note: 1) 0: Counter balanced by equal attraction force
2) WC: with water cooling
Values in the table are according to no forced cooling except labelled with WC (Water Cooling).
Except dimensions, all the specifications in the table are in ± 10% of tolerance.

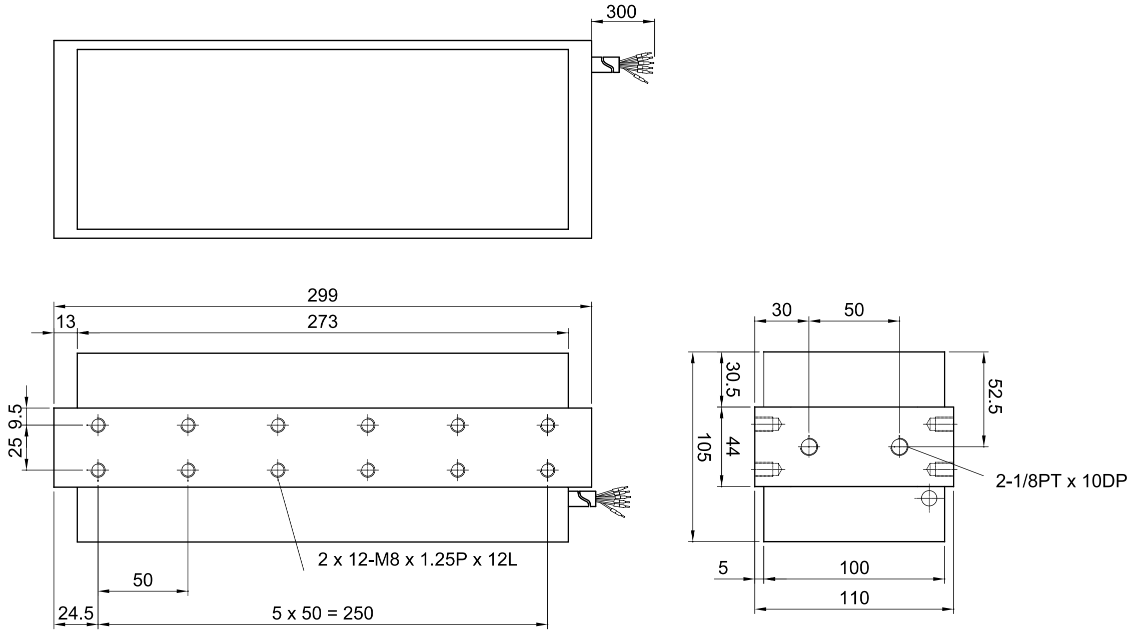
LMSC series F-V Curve

Force vs. Velocity curves are calculated with DC bus voltage=300 VDC

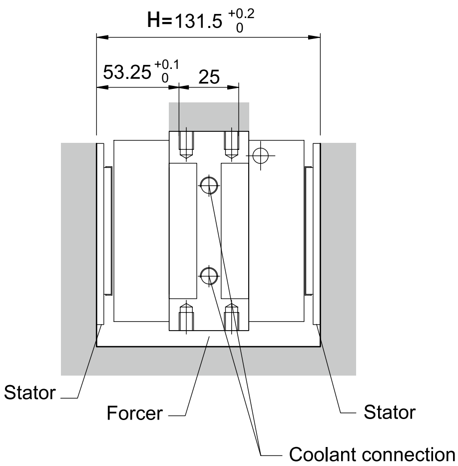




Dimensions for linear motor LMSC7 (L) forcer



Installing linear motors LMSC7 (L)



Positioning Systems

Linear Motor Components

4.3 Linear Motors, LMC Series

4.3.1 Linear Motors, LMCA, LMCB, LMCC Series

HIWIN synchronous linear motors LMC are the born sprinters. They are light, extremely dynamic. This is due to their coreless primary part (forcer) with epoxy cast coils, it needs to move very little of its own weight. The secondary part is composed of an U-shaped stator made of permanent magnets.

- 3-phase
- Extremely dynamic
- Good synchronization and high speed consistency
- Low inertia and high acceleration
- Low profile
- No cogging
- Several forcers possible on one stator

Force Chart for Linear Motors, LMCA,LMCB,LMCC Series

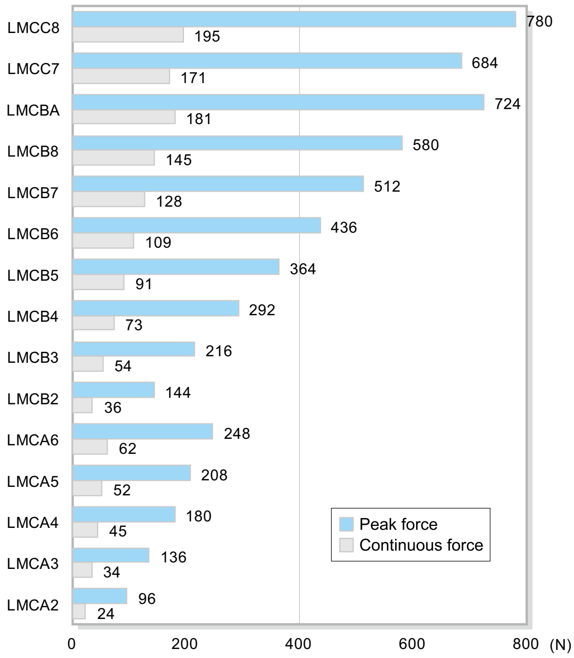


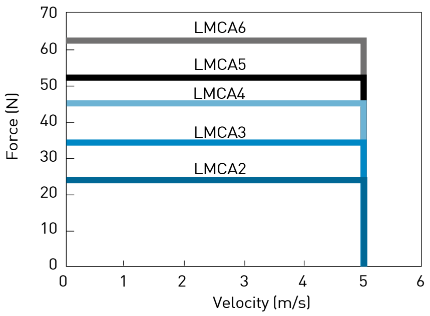
Table 4.3 **Specifications for Linear Motors, LMCA, LMCB, LMCC Series**

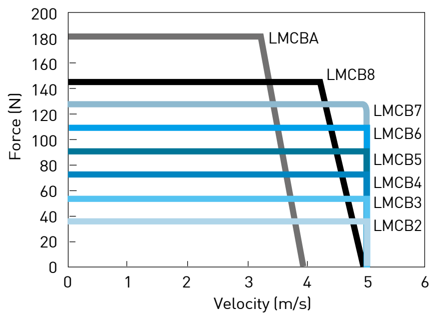
	Symbol	Unit	LMCA2	LMCA3	LMCA4	LMCA5	LMCA6	LMCB2	LMCB3	LMCB4	LMCB5	LMCB6	LMCB7	LMCB8	LMCBA	LMCC7	LMCC8
Continuous force	F_c	N	24	34	45	52	62	36	54	73	91	109	128	145	181	171	195
Continuous current	I_c	A (rms)	2.3	2.1	2.1	1.8	1.8	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Peak force (for 1 s)	F_p	N	96	136	180	208	248	144	216	292	364	436	512	580	724	684	780
Peak current (for 1 s)	I_p	A (rms)	9.2	8.4	8.4	7.2	7.2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Force constant	K_f	N/A (rms)	10.6	15.8	21.2	28.2	33.8	18.1	27.2	36.3	45.4	54.5	63.5	72.5	90.6	85.4	97.5
Max. winding temp.	T_{max}	°C	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Electrical time constant	K_e	ms	0.4	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3
Resistance (line to line at 25 °C)	R_{25}	Ω	2.7	4.1	5.4	6.7	8.2	3.6	5.4	7.1	9.0	10.7	12.6	14.6	17.9	15.8	18.2
Inductance (line to line)	L	mH	1.0	1.4	1.9	2.3	2.8	1.4	1.9	2.6	3.2	3.8	4.4	5.0	6.2	5.5	6.3
Pole pair pitch	2 τ	mm	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32
Bend radius of motor cable	R_{bend}	mm	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Back emf constant (line to line)	K_v	Vrms/(m/s)	5.9	8.8	11.9	14.5	17.4	10.1	15.2	20.0	24.8	29.3	34.7	40.0	50.0	45.4	51.9
Motor constant (at 25 °C)	K_m	N/√W	5.2	6.5	7.5	9.1	9.8	7.7	9.5	11.2	12.4	13.6	14.7	15.5	17.5	17.6	18.7
Thermal resistance	R_{th}	°C/W	2.80	2.21	1.68	1.84	1.50	2.77	1.85	1.41	1.11	0.93	0.79	0.68	0.56	0.63	0.55
Thermal switch			3 PTC SNM100 In Series														
Max. DC bus voltage		V	500														
Mass of forcer	M_f	kg	0.15	0.23	0.31	0.38	0.45	0.2	0.29	0.38	0.48	0.58	0.68	0.72	0.88	0.74	0.76
Unit mass of stator	M_s	kg/m	7	7	7	7	7	12	12	12	12	12	12	12	12	21	21
Length of forcer/ Dimension n	L_f	mm	66/2	98/3	130/4	162/5	194/6	66/2	98/3	130/4	162/5	194/6	226/7	258/8	322/10	226/7	258/8
Height of forcer	h	mm	59	59	59	59	59	79	79	79	79	79	79	79	79	99	99
Height of stator	H_s	mm	60	60	60	60	60	80	80	80	80	80	80	80	80	103	103
Width of stator	W_s	mm	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	35.2	35.2
Length of stator / Dimension N	L_s	mm	128mm/N=2, 192mm/N=3, 320mm/N=5														
Total height	H	mm	74.5	74.5	74.5	74.5	74.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	94.5	117.5	117.5

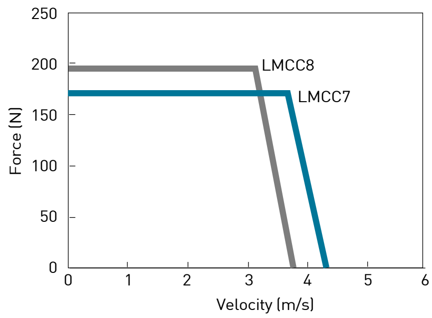
Note: Except dimensions, all the specifications in the table are in ±10% of tolerance.

LMCA, LMCB, LMCC Series F-V Curve

Force vs. Velocity curves are calculated with DC bus voltage=300 VDC

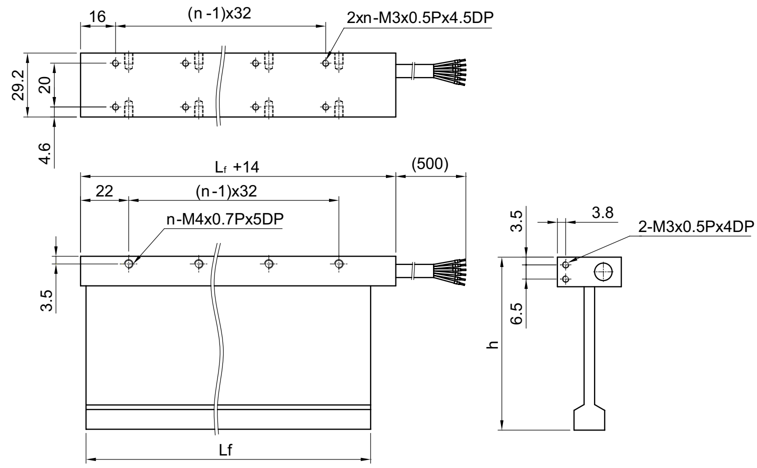






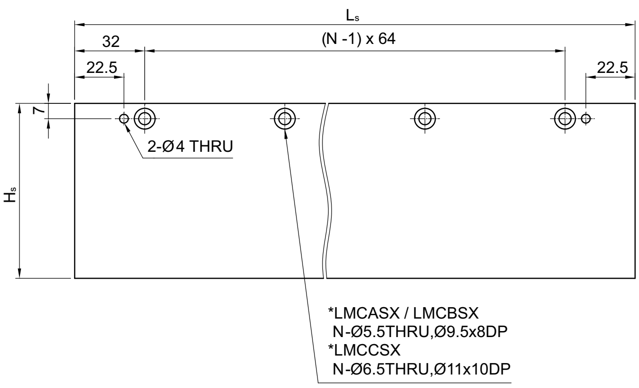
Dimensions for linear motors LMCA,LMCB,LMCC forcers

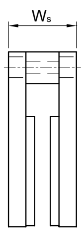
(Values for L_f, h and n: see Table 4.3)



Dimensions for linear motors LMCA,LMCB,LMCC stators

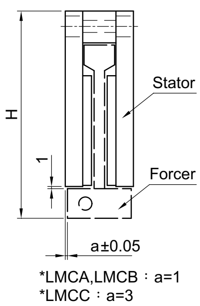
(Values for Ls, Hs, Ws and N:see Table 4.3)





Installing linear motors LMCA,LMCB,LMCC Series

(Values for H:see Table 4.3)



Structure of the order number of linear motors LMCA, LMCB, and LMCC stators

LMC A S 3

Series	Stator height	Stator model	Length of stator
	A: 60 mm B: 80 mm C: 103 mm	S: Standard	0: 128 mm (N=2) 1: 192 mm (N=3) 3: 320 mm (N=5)

Positioning Systems

Linear Motor Components

4.3.2 Linear Motors, LMCD, LMCE Series

HIWIN synchronous linear motors LMCD and LMCE are the born sprinters. They are light, extremely dynamic. This is due to their coreless primary part (forcer) with epoxy cast coils, it needs to move very little of its own weight. The secondary part is composed of an U-shaped stator made of permanent magnets.

- 3 phase
- Extremely dynamic
- Good synchronization and high speed consistency
- Low inertia and high acceleration
- Low profile
- No cogging
- Several forcers possible on one stator

Force Chart for Linear Motors, LMCD,LMCE Series

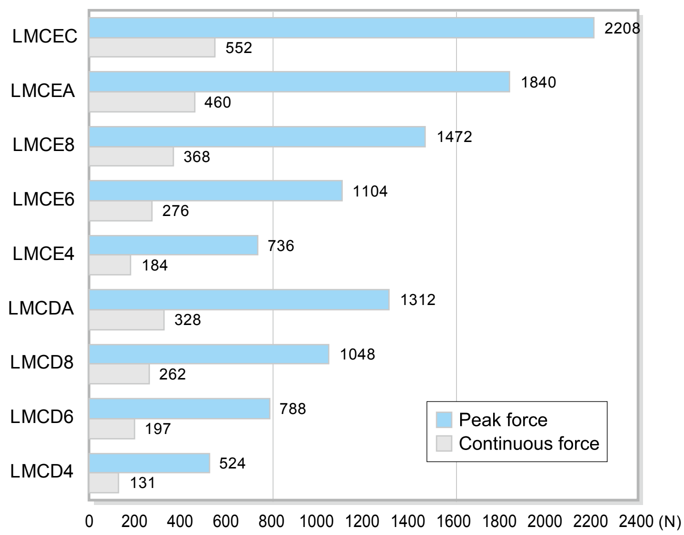


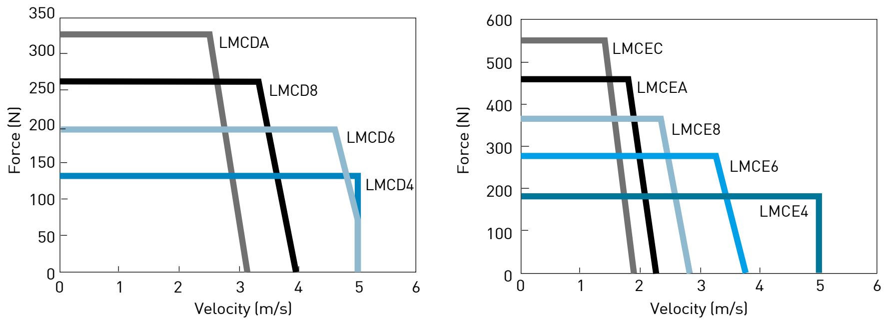
Table 4.4 **Specifications for Linear Motors, LMCD and LMCE Series**

	Symbol	Unit	LMCD4	LMCD6	LMCD8	LMCDA	LMCE4	LMCE6	LMCE8	LMCEA	LMCEC
Continuous force	F_c	N	131	197	262	328	184	276	368	460	552
Continuous current	I_c	A (rms)	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25	3.25
Peak force (for 1 s)	F_p	N	524	788	1048	1312	736	1104	1472	1840	2208
Peak current (for 1 s)	I_p	A (rms)	13	13	13	13	13	13	13	13	13
Force constant	K_f	N/A (rms)	40.3	60.6	80.6	100.9	56.6	84.9	113.2	141.5	169.8
Max. winding temp.	T_{max}	°C	100	100	100	100	100	100	100	100	100
Electrical time constant	K_e	ms	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Resistance (line to line at 25°C)	R_{25}	Ω	4.6	7.1	9.0	11.6	5.6	8.4	11.0	13.8	16.7
Inductance (line to line)	L	mH	2.3	3.5	4.7	5.8	2.9	4.4	5.9	7.3	8.8
Pole pair pitch	2τ	mm	60	60	60	60	60	60	60	60	60
Bend radius of motor cable	R_{bend}	mm	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Back emf constant (line to line)	K_v	Vrms/(m/s)	25	38	50	63	35	53	70	88	106
Motor constant (at 25 °C)	K_m	$N/\sqrt{W}$	14.6	17.8	20.0	22.2	19.1	23.4	27.0	30.2	33.2
Thermal resistance	R_{th}	°C/W	0.82	0.53	0.42	0.33	0.68	0.45	0.34	0.27	0.23
Thermal switch			3 PTC SNM100 In Series								
Max. DC bus voltage		V	500								
Mass of forcer	M_f	kg	0.88	1.32	1.76	2.20	1.23	1.84	2.46	3.08	3.70
Unit mass of stator	M_s	kg/m	16	16	16	16	20	20	20	20	20
Length of forcer/ Dimension n	L_f	mm	260/7	380/10	500/13	620/16	260/7	380/10	500/13	620/16	740/19
Height of forcer	h	mm	87.5	87.5	87.5	87.5	107.5	107.5	107.5	107.5	107.5
Height of stator	H_s	mm	86.8	86.8	86.8	86.8	106.8	106.8	106.8	106.8	106.8
Width of stator	W_s	mm	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
Length of stator/ Dimension N	L_s	mm	120mm/N=2, 180mm/N=3, 300mm/N=5								
Total height	H	mm	105	105	105	105	125	125	125	125	125

Note: Except dimensions, all the specifications in the table are in ±10% of tolerance.

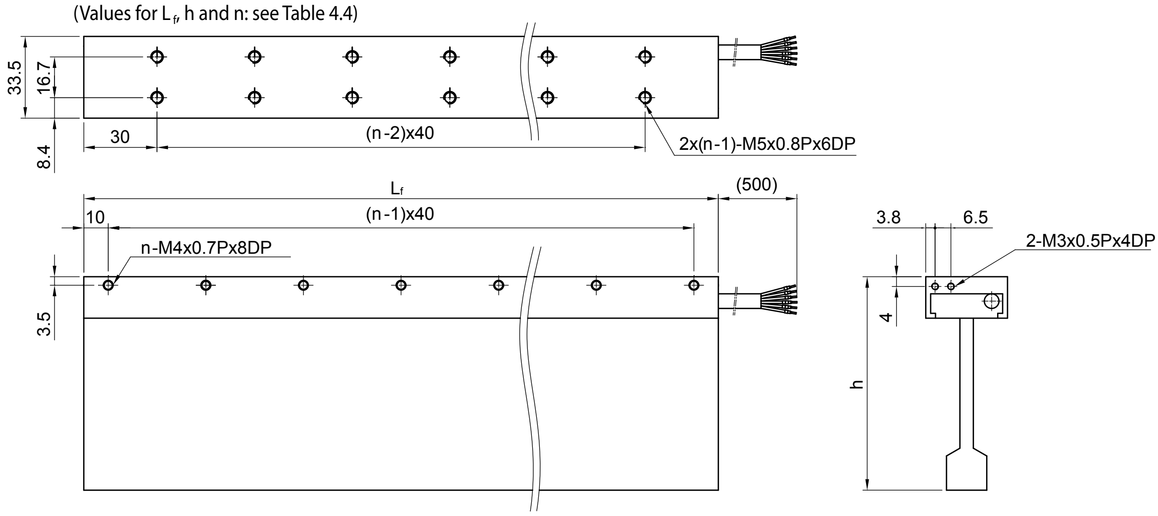
LMCD and LMCE series F-V Curve

Force vs. Velocity curves are calculated with DC bus voltage=300 VDC



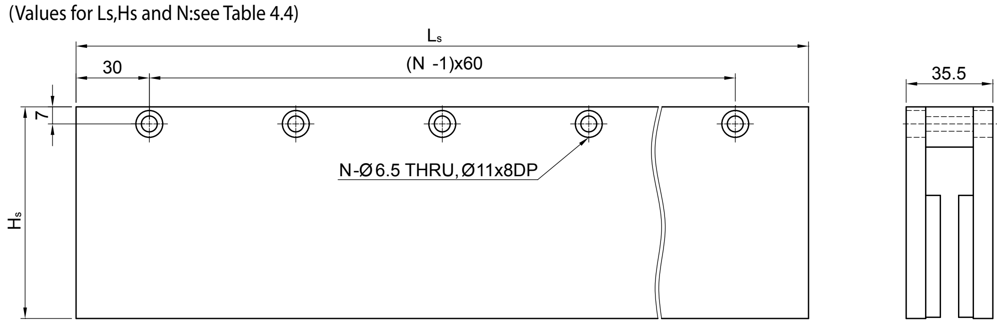
Dimensions for linear motors LMCD and LMCE forcers

(Values for L_f, h and n: see Table 4.4)



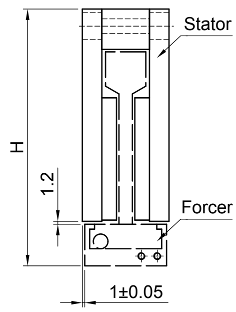
Dimensions for linear motors LMCD,LMCE stators

(Values for Ls,Hs and N:see Table 4.4)



Installing linear motors LMCD,LMCE Series

(Values for H:see Table 4.4)



Structure of the order number of linear motors LMCD and LMCE stators

LMC D S 1

Series	Stator height	Stator model	Length of stator
	D: 86.8 mm E: 106.8 mm	S: Standard	1: 120 mm (N=2) B: 180 mm (N=3) 2: 300 mm (N=5)

Positioning Systems

4.3.3 Linear Motors, LMCF Series

HIWIN synchronous linear motors LMCF are the born sprinters. They are light, extremely dynamic. This is due to their coreless primary part (forcer) with epoxy cast coils, it needs to move very little of its own weight. The secondary part is composed of an U-shaped stator made of permanent magnets.

- 3 phase
- Extremely dynamic
- Good synchronization and high speed consistency
- Low inertia and high acceleration
- Low profile
- No cogging
- Several forcers possible on one stator

Force Chart for Linear Motors,LMCF Series

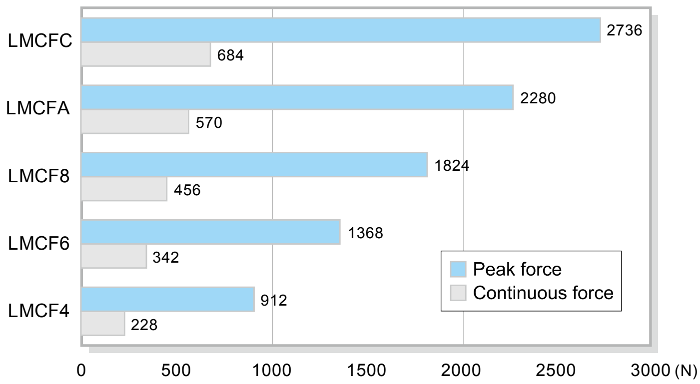


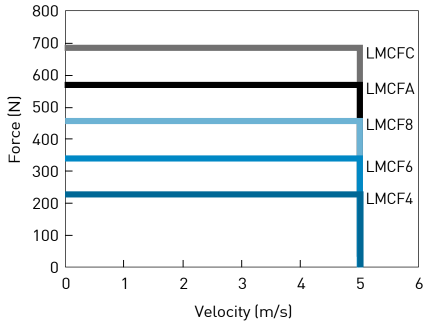
Table 4.5 **Specifications for Linear Motors, LMCF Series**

	Symbol	Unit	LMCF4	LMCF6	LMCF8	LMCFA	LMCFC
Continuous force	F_c	N	228	342	456	570	684
Continuous current	I_c	A (rms)	3.8	5.7	7.6	9.5	11.4
Peak force (for 1 s)	F_p	N	912	1368	1824	2280	2736
Peak current (for 1 s)	I_p	A (rms)	15.2	22.8	30.4	38.0	45.6
Force constant	K_f	N/A (rms)	60	60	60	60	60
Max. winding temp.	T_{max}	°C	100	100	100	100	100
Electrical time constant	K_e	ms	1	1	1	1	1
Resistance (line to line at 25°C)	R_{25}	Ω	3.4	2.3	1.7	1.4	1.1
Inductance (line to line)	L	mH	3.4	2.3	1.7	1.4	1.1
Pole pair pitch	2τ	mm	60	60	60	60	60
Bend radius of motor cable	R_{bend}	mm	57.5	57.5	57.5	57.5	57.5
Back emf constant (line to line)	K_v	Vrms/(m/s)	34.4	34.4	34.4	34.4	34.4
Motor constant (at 25 °C)	K_m	N/√W	26.7	32.7	37.7	42.2	46.2
Thermal resistance	R_{th}	°C/W	0.82	0.55	0.41	0.33	0.27
Thermal switch			3 PTC SNM100 In Series				
Max. DC bus voltage		V	500				
Mass of forcer	M_f	kg	2.5	3.75	5	6.25	7.5
Unit mass of stator	M_s	kg/m	25.6	25.6	25.6	25.6	25.6
Length of forcer/ Dimension n	L_f	mm	260/7	380/10	500/13	620/16	740/19
Height of forcer	h	mm	152.5	152.5	152.5	152.5	152.5
Height of stator	H_s	mm	131.3	131.3	131.3	131.3	131.3
Width of stator	W_s	mm	41.1	41.1	41.1	41.1	41.1
Length of stator/ Dimension N	L_s	mm	120mm/N=2, 180mm/N=3, 300mm/N=5				
Total height	H	mm	172	172	172	172	172

Note: Except dimensions, all the specifications in the table are in ±10% of tolerance.

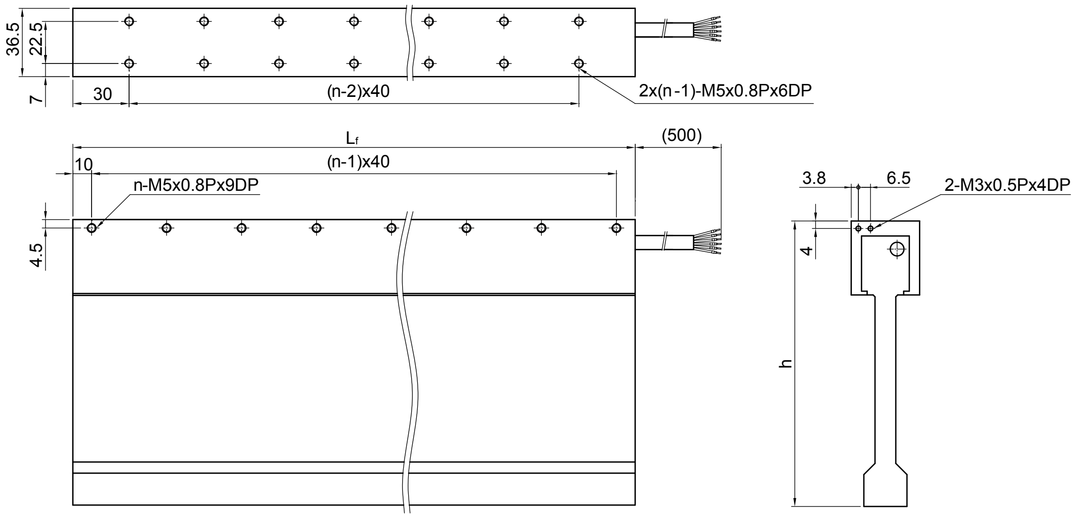
LMCF Series F-V Curve

Force vs. Velocity curves are calculated with DC bus voltage=300 VDC



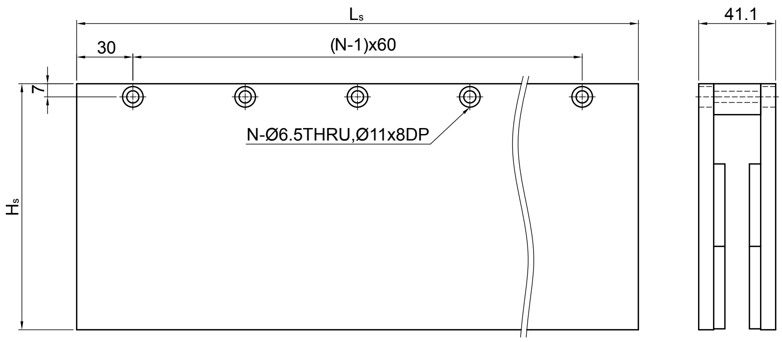
Dimensions for linear motors LMCF forcers

(Values for L_f, h and n: see Table 4.5)



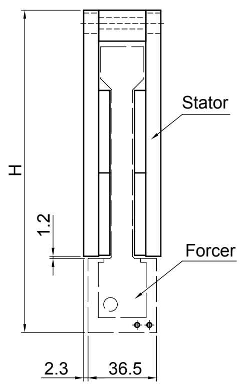
Dimensions for linear motors LMCF stators

(Values for Ls,Hs and N:see Table 4.5)



Installing linear motors LMCF Series

(Values for H:see Table 4.5)



Structure of the order number of linear motors LMCF stators

LMC F S 1

Series	Stator height	Stator model	Length of stator
	F : 131.3mm	S: Standard	1: 120 mm (N=2) B: 180 mm (N=3) 2: 300 mm (N=5)

Positioning Systems

Linear Motor Components

4.4 Linear Motors, LMF Series

HIWIN synchronous linear motors LMF are coiled stack of sheets with water-cooling loop. They are especially distinguished by very high power density and minimum cogging force. This three-phase motor is composed of a primary part (forcer) with iron core and secondary part (stator) with permanent magnets. With the combination of several stators, many stroke combinations are possible.

- 3 phase
- Water-cooling
- UL certification
- Low cogging
- Unlimited stroke

Table 4.6 Specifications for Linear Motors, LMF Series

	Symbol	Unit	LMF01	LMF01L	LMF02	LMF02L	LMF03	LMF03L	LMF11	LMF11L	LMF12	LMF12L	LMF13	LMF13L	LMF14	LMF14L
Continuous force	F_c	N	94	94	187	187	281	281	170	170	340	340	510	510	680	680
Continuous current	I_c	A(rms)	2.0	4.7	4.0	9.4	5.9	14.1	2.0	4.7	4.0	9.4	5.9	14.1	7.9	18.7
Continuous force (WC)	F_c	N	140	140	281	281	421	421	255	255	510	510	764	764	1019	1019
Continuous current (WC)	I_c	A(rms)	3.0	7.0	5.9	14.1	8.9	21.1	3.0	7.0	5.9	14.1	8.9	21.1	11.9	28.1
Peak force (for 1 s)	F_p	N	254	254	508	508	762	762	462	462	924	924	1386	1386	1848	1848
Peak current (for 1 s)	I_p	A(rms)	5.4	12.7	10.8	25.4	16.2	38.1	5.4	12.7	10.8	25.5	16.2	38.2	21.6	51.0
Force constant	K_f	N/A (rms)	47.3	20.0	47.3	20.0	47.3	20.0	85.8	36.3	85.8	36.3	85.8	36.3	85.8	36.3
Attraction force	F_a	N	570	570	1140	1140	1710	1710	954	954	1909	1909	2863	2863	3818	3818
Max. winding temp.	T_{max}	°C	120	120	120	120	120	120	120	120	120	120	120	120	120	120
Electrical time constant	K_e	ms	4.3	3.2	4.4	3.2	4.3	3.3	4.9	3.6	4.9	3.6	4.8	3.7	4.9	3.7
Resistance (line to line at 25 °C)	R_{25}	Ω	9.0	2.1	4.4	1.1	3.0	0.7	12.4	3.0	6.2	1.5	4.4	1.0	3.1	0.7
Inductance (line to line)	L	mH	39.0	7.0	19.3	3.4	12.9	2.3	60.7	10.8	30.4	5.4	21.0	3.8	15.2	2.7
Pole pair pitch	2τ	mm	30	30	30	30	30	30	30	30	30	30	30	30	30	30
Back emf constant (line to line)	K_v	Vrms/(m/s)	27	11	27	11	27	11	49	21	49	21	49	21	49	21
Motor constant (at 25 °C)	K_m	$N/\sqrt{W}$	12.8	11.1	18.2	15.8	22.5	19.6	19.7	17.2	27.9	24.3	33.6	29.3	39.9	34.8
Thermal resistance	R_{th}	°C/W	1.33	1.33	0.68	0.68	0.46	0.46	0.97	0.97	0.48	0.48	0.31	0.31	0.25	0.25
Thermal resistance(WC)	R_{th}	°C/W	0.59	0.59	0.31	0.31	0.20	0.20	0.43	0.43	0.22	0.22	0.14	0.14	0.11	0.11
Thermal switch			1 x KTY84-130+ 1 x (3 PTC SNM120 In Series)													
Max. DC bus voltage		V	600													
Mass of forcer	M_f	kg	1.5	1.5	2.3	2.3	3.1	3.1	2.4	2.4	4	4	5.6	5.6	7.6	7.6
Unit mass of stator	M_s	kg/m	3.7	3.7	3.7	3.7	3.7	3.7	5.8	5.8	5.8	5.8	5.8	5.8	5.8	5.8
Width of stator	W_s	mm	58	58	58	58	58	58	88	88	88	88	88	88	88	88
Length of stator/Dimension N	L_s	mm	120mm/N=2, 180mm/N=3, 300mm/N=5													
Stator mounting distance	W_{s1}	mm	48	48	48	48	48	48	74	74	74	74	74	74	74	74
Total height	H	mm	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5	48.5

Note: WC: with water cooling
Except dimensions, all the specifications in the table are in ±10% of tolerance.

Force Chart for Linear Motors, LMF Series

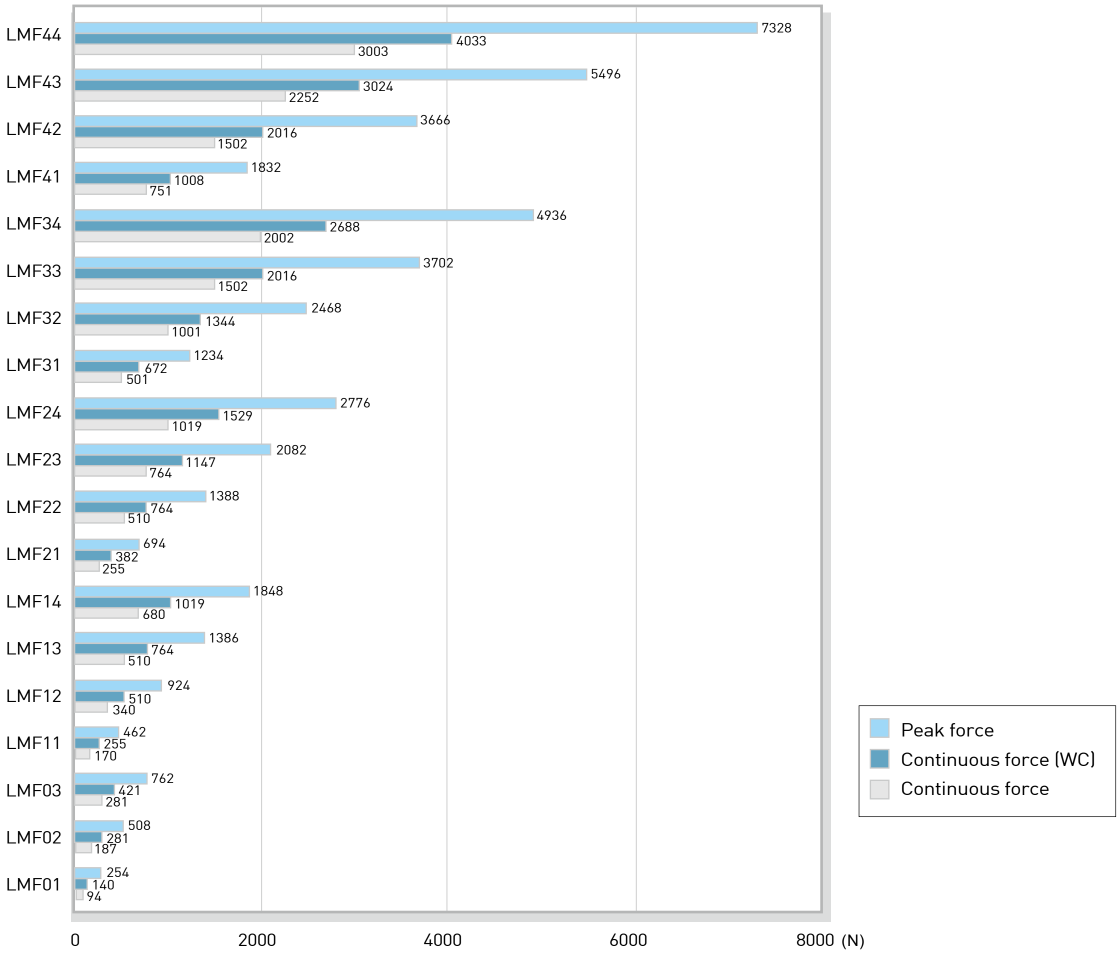


Table 4.7 Specifications for Linear Motors, LMF Series

	Symbol	Unit	LMF21	LMF21L	LMF22	LMF22L	LMF23	LMF23L	LMF24	LMF24L	LMF31	LMF31L	LMF32	LMF32L
Continuous force	F_c	N	255	255	510	510	764	764	1019	1019	501	501	1001	1001
Continuous current	I_c	A(rms)	2.0	4.7	4.0	9.4	5.9	14.0	7.9	18.7	3.9	8.5	7.7	17.0
Continuous force (WC)	F_c	N	382	382	764	764	1147	1147	1529	1529	672	672	1344	1344
Continuous current (WC)	I_c	A(rms)	3.0	7.0	5.9	14.0	8.9	21.1	11.9	28.1	5.2	11.4	10.3	22.8
Peak force (for 1 s)	F_p	N	694	694	1388	1388	2082	2082	2776	2776	1234	1234	2468	2468
Peak current (for 1 s)	I_p	A(rms)	5.4	12.8	10.8	25.5	16.2	38.3	21.6	51.0	9.4	20.9	18.8	41.8
Force constant	K_f	N/A (rms)	128.7	54.4	128.7	54.4	128.7	54.4	128.7	54.4	130.0	59.0	130.0	59.0
Attraction force	F_a	N	1431	1431	2863	2863	4294	4294	5727	5727	3430	3430	6860	6860
Max. winding temp.	T_{max}	°C	120	120	120	120	120	120	120	120	120	120	120	120
Electrical time constant	K_e	ms	5.0	3.7	5.2	3.8	5.1	3.9	5.3	4.0	4.4	3.3	7.8	5.9
Resistance (line to line at 25 °C)	R_{25}	Ω	17.2	4.1	8.6	2.1	5.8	1.4	4.3	1.0	6.0	1.7	3.0	0.8
Inductance (line to line)	L	mH	85.6	15.3	44.3	7.9	29.7	5.3	22.6	4.0	26.6	5.5	23.3	4.8
Pole pair pitch	2τ	mm	30	30	30	30	30	30	30	30	46	46	46	46
Back emf constant (line to line)	K_v	Vrms/(m/s)	73.5	31	73.5	31	73.5	31	73.5	31	59.1	27	59.1	27
Motor constant (at 25 °C)	K_m	$N/\sqrt{W}$	25.1	21.9	35.5	30.9	43.9	38.2	50.8	44.2	42.8	37.3	61.3	53.4
Thermal resistance	R_{th}	°C/W	0.70	0.70	0.35	0.35	0.24	0.24	0.18	0.18	0.53	0.53	0.27	0.27
Thermal resistance(WC)	R_{th}	°C/W	0.31	0.31	0.16	0.16	0.10	0.10	0.08	0.08	0.30	0.30	0.15	0.15
Thermal switch			1 x KTY84-130+ 1 x (3 PTC SNM120 In Series)											
Max. DC bus voltage		V	600											
Mass of forcer	M_f	kg	3.2	3.2	5.5	5.5	8	8	10.4	10.4	6.4	6.4	11.7	11.7
Unit mass of stator	M_s	kg/m	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	16.2	16.2	16.2	16.2
Width of stator	W_s	mm	118	118	118	118	118	118	118	118	134	134	134	134
Length of stator/Dimension N	L_s	mm	120mm/N=2, 180mm/N=3, 300mm/N=5							184mm/N=2, 276mm/N=3, 460mm/N=5				
Stator mounting distance	W_{s1}	mm	104	104	104	104	104	104	104	104	115	115	115	115
Total height	H	mm	50.5	50.5	50.5	50.5	50.5	50.5	50.5	50.5	64.1	64.1	64.1	64.1

Note: WC: with water cooling
Except dimensions, all the specifications in the table are in ±10% of tolerance.

Positioning Systems

Linear Motor Components

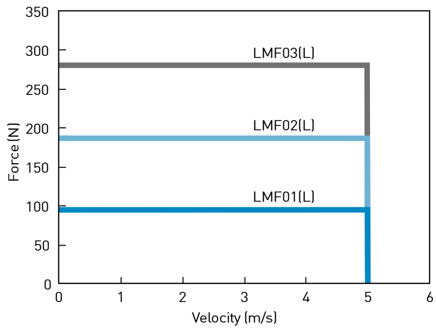
Table 4.8 Specifications for Linear Motors, LMF Series

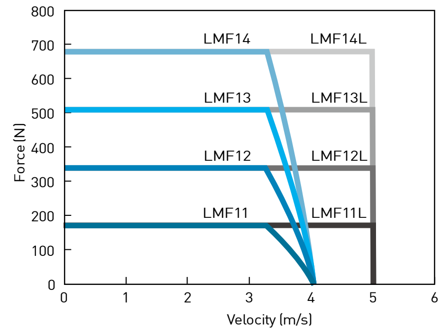
	Symbol	Unit	LMF33	LMF33L	LMF34	LMF34L	LMF41	LMF41L	LMF42	LMF42L	LMF43	LMF43L	LMF44	LMF44L
Continuous force	F_c	N	1502	1502	2002	2002	751	751	1502	1502	2252	2252	3003	3003
Continuous current	I_c	A(rms)	11.6	25.5	15.4	33.9	3.9	8.5	7.7	17.0	11.6	25.4	15.4	33.9
Continuous force (WC)	F_c	N	2016	2016	2688	2688	1008	1008	2016	2016	3024	3024	4033	4033
Continuous current (WC)	I_c	A(rms)	15.5	34.2	20.7	45.6	5.2	11.4	10.3	22.8	15.5	34.2	20.7	45.6
Peak force (for 1 s)	F_p	N	3702	3702	4936	4936	1832	1832	3666	3666	5496	5496	7328	7328
Peak current (for 1 s)	I_p	A(rms)	28.2	62.7	37.6	83.7	9.4	20.7	18.8	41.4	28.2	62.1	37.6	82.8
Force constant	K_f	N/A (rms)	130.0	59.0	130.0	59.0	195.0	88.5	195.0	88.5	195.0	88.5	195.0	88.5
Attraction force	F_a	N	10290	10290	13720	13720	5145	5145	10290	10290	15435	15435	20580	20580
Max. winding temp.	T_{max}	°C	120	120	120	120	120	120	120	120	120	120	120	120
Electrical time constant	K_e	ms	8.2	6.2	8.4	6.4	8.6	6.4	8.6	6.5	8.7	6.5	8.5	6.4
Resistance (line to line at 25 °C)	R_{25}	Ω	1.9	0.5	1.4	0.4	7.8	2.2	3.9	1.1	2.6	0.7	2.0	0.5
Inductance (line to line)	L	mH	15.6	3.2	11.8	2.4	67.0	13.8	33.5	6.9	22.5	4.6	17.0	3.5
Pole pair pitch	2τ	mm	46	46	46	46	46	46	46	46	46	46	46	46
Back emf constant (line to line)	K_v	Vrms/(m/s)	59.1	27	59.1	27	88.7	40	88.7	40	88.7	40	88.7	40
Motor constant (at 25 °C)	K_m	$N/\sqrt{W}$	76.7	66.8	89.7	78.1	56.3	49.0	80.6	70.2	98.3	85.6	112.6	98.0
Thermal resistance	R_{th}	°C/W	0.19	0.19	0.14	0.14	0.40	0.40	0.21	0.21	0.14	0.14	0.10	0.10
Thermal resistance(WC)	R_{th}	°C/W	0.11	0.11	0.08	0.08	0.23	0.23	0.12	0.12	0.08	0.08	0.06	0.06
Thermal switch			1 x KTY84-130+ 1 x (3 PTC SNM120 In Series)											
Max. DC bus voltage		V	600											
Mass of forcer	M_f	kg	17.3	17.3	22.5	22.5	9.5	9.5	16.2	16.2	23	23	29	29
Unit mass of stator	M_s	kg/m	16.2	16.2	16.2	16.2	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3
Width of stator	W_s	mm	134	134	134	134	180	180	180	180	180	180	180	180
Length of stator/Dimension N	L_s	mm	184mm/N=2, 276mm/N=3, 460mm/N=5											
Stator mounting distance	W_{s1}	mm	115	115	115	115	161	161	161	161	161	161	161	161
Total height	H	mm	64.1	64.1	64.1	64.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1	66.1

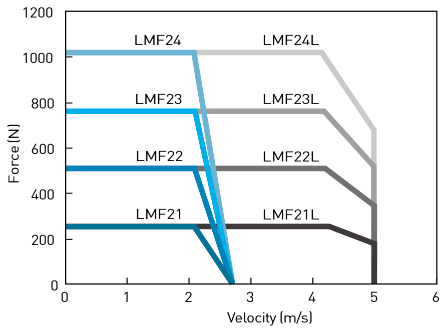
Note: WC: with water cooling
Except dimensions, all the specifications in the table are in ±10% of tolerance.

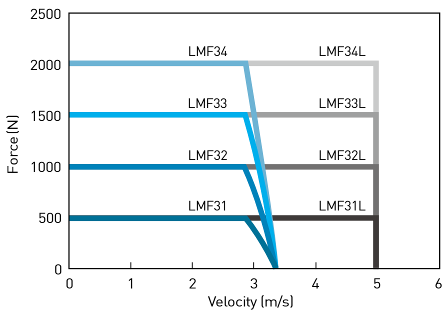
LMF series F-V Curve (no water cooling)

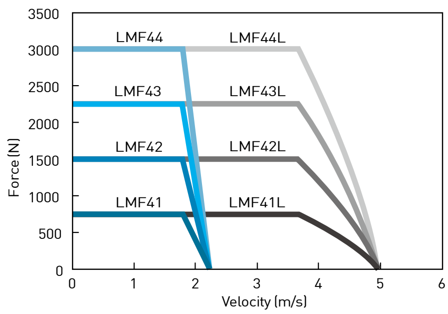
Force vs. Velocity curves are calculated with DC bus voltage=300 VDC





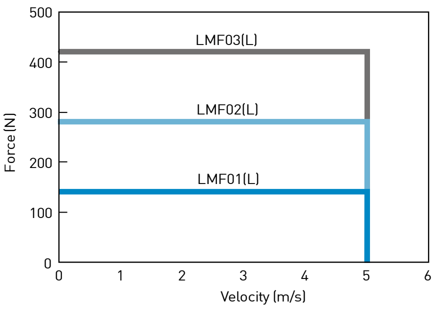


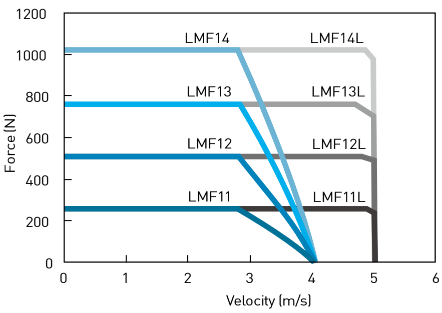


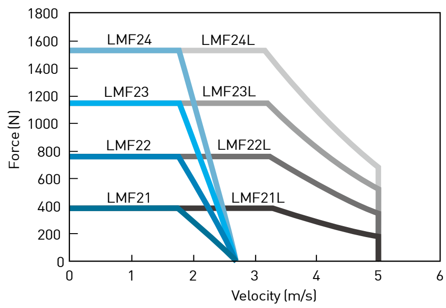


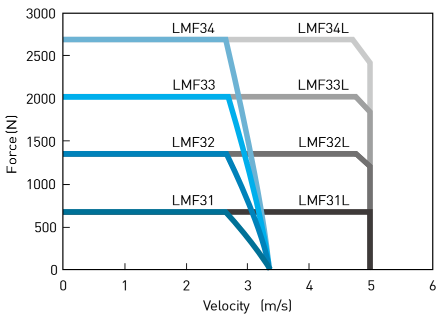
LMF series F-V Curve (water cooling)

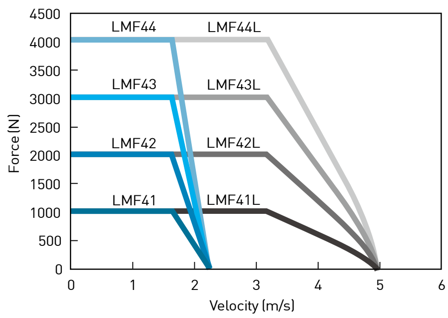
Force vs. Velocity curves are calculated with DC bus voltage=300 VDC







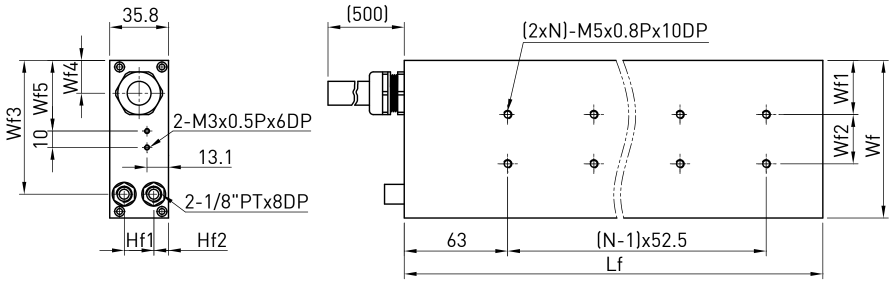




Positioning Systems

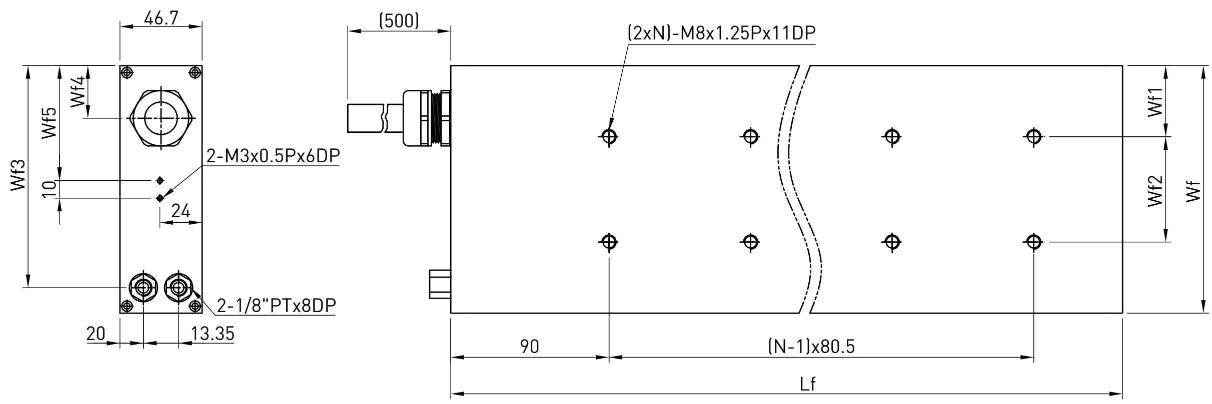
Linear Motor Components

Dimensions for linear motor LMF 0 , 1 , 2 forcer



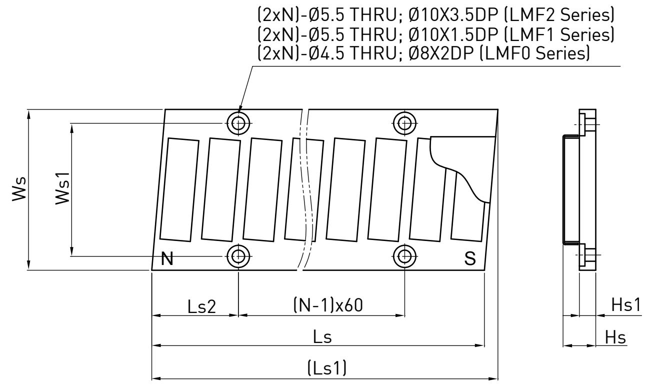
Type	Lf	Wf	Wf1	Wf2	Wf3	Wf4	Wf5	N	Hf1	Hf2
LMF01	150	67	18.5	30	55	33.5	33.75	2	15	10.5
LMF02	255	67	18.5	30	55	33.5	33.75	4	15	10.5
LMF03	360	67	18.5	30	55	33.5	33.75	6	15	10.5
LMF11	150	96	33	30	81.5	48	43	2	18	8.9
LMF12	255	96	33	30	81.5	48	43	4	18	8.9
LMF13	360	96	33	30	81.5	48	43	6	18	8.9
LMF14	465	96	33	30	81.5	48	43	8	18	8.9
LMF21	150	126	40.5	45	111.5	63	58	2	18	8.9
LMF22	255	126	40.5	45	111.5	63	58	4	18	8.9
LMF23	360	126	40.5	45	111.5	63	58	6	18	8.9
LMF24	465	126	40.5	45	111.5	63	58	8	18	8.9

Dimensions for linear motor LMF 3, 4 forcer



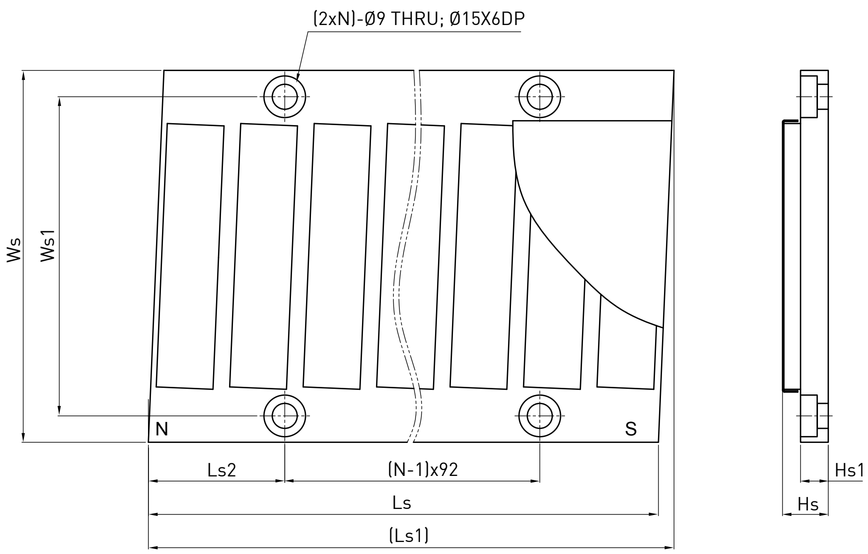
Type	Lf	Wf	Wf1	Wf2	Wf3	Wf4	Wf5	N
LMF31	221	141	40.5	60	126.5	70.5	65.5	2
LMF32	382	141	40.5	60	126.5	70.5	65.5	4
LMF33	543	141	40.5	60	126.5	70.5	65.5	6
LMF34	704	141	40.5	60	126.5	70.5	65.5	8
LMF41	221	188	54	80	173.5	94	89	2
LMF42	382	188	54	80	173.5	94	89	4
LMF43	543	188	54	80	173.5	94	89	6
LMF44	704	188	54	80	173.5	94	89	8

Dimensions for linear motor LMF 0, 1, 2 Stator



Type	Ls	(Ls1)	N	Ls2	Hs	Hs1	Ws	Ws1
LMF0S1	120	124.87	2	31.25	11.8	5.9	58	48
LMF0S2	180	184.87	3	31.25	11.8	5.9	58	48
LMF0S3	300	304.87	5	31.25	11.8	5.9	58	48
LMF1S1	120	122.77	2	30.6	11.8	5.9	88	74
LMF1S2	180	182.77	3	30.6	11.8	5.9	88	74
LMF1S3	300	302.77	5	30.6	11.8	5.9	88	74
LMF2S1	120	123.09	2	30.4	13.8	7.9	118	104
LMF2S2	180	183.09	3	30.4	13.8	7.9	118	104
LMF2S3	300	303.09	5	30.4	13.8	7.9	118	104

Dimensions for linear motor LMF 3, 4 Stator

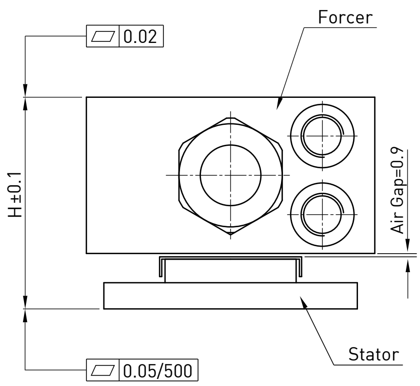


Type	Ls	(Ls1)	N	Ls2	Hs	Hs1	Ws	Ws1
LMF3S1	184	189.6	2	49.2	16.5	10	134	115
LMF3S2	276	281.6	3	49.2	16.5	10	134	115
LMF3S3	460	465.6	5	49.2	16.5	10	134	115
LMF4S1	184	189.03	2	48.9	18.5	12	180	161
LMF4S2	276	281.03	3	48.9	18.5	12	180	161
LMF4S3	460	465.03	5	48.9	18.5	12	180	161

Positioning Systems

Linear Motor Components

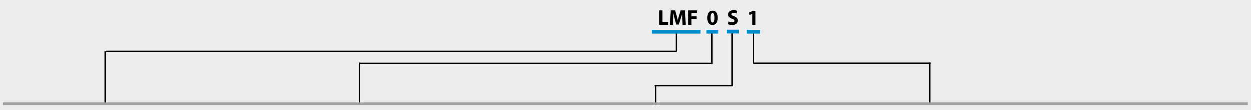
Linear Motor Assembly



Type	H
LMF01	48.5
LMF02	48.5
LMF03	48.5
LMF11	48.5
LMF12	48.5
LMF13	48.5
LMF14	48.5
LMF21	50.5
LMF22	50.5
LMF23	50.5
LMF24	50.5

Type	H
LMF31	64.1
LMF32	64.1
LMF33	64.1
LMF34	64.1
LMF41	66.1
LMF42	66.1
LMF43	66.1
LMF44	66.1

Structure of the order number of linear motors LMF stator



Series	Width of stator	Stator model	Length of stator
	0: 58 mm 1: 88 mm 2: 118 mm 3: 134 mm 4: 180 mm	S: Standard C: Customized	for 0~2 series 1: 120 mm 2: 180 mm 3: 300 mm for 3~4 series 1: 184 mm 2: 276 mm 3: 460 mm

4.5 Linear Motors, LMT Series

HIWIN Linear turbo LMT series are linear motors with the unique shape by arranging cylindrically permanent magnets. Due to the coreless forcer, the LMT Turbo motors are very light and extremely dynamic. They are also good substitutes for ballscrew applications, because of the same installation interface.

- 3-phase
- Low mass and high acceleration
- Extremely dynamic
- Wide air gap and easy assembly
- No cogging and no contact
- No wearing
- Multiple forcers

Force Chart for Linear Motors

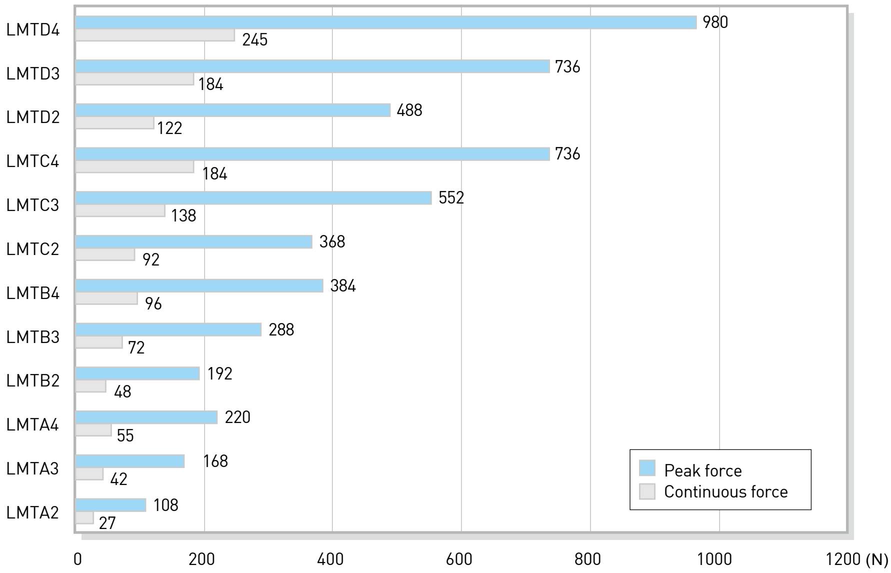


Table 4.9 **Specifications for Linear Motors, LMT Series**

	Symbol	Unit	LMTA2	LMTA3	LMTA4	LMTB2	LMTB3	LMTB4	LMTC2	LMTC3	LMTC4	LMTD2	LMTD3	LMTD4
Continuous force	F_c	N	27	42	55	48	72	96	92	138	184	122	184	245
Continuous current	I_c	A (rms)	1.5	1.5	1.5	1.2	1.2	1.2	2.4	2.4	2.4	1.7	1.7	1.7
Peak force for 1 sec.	F_p	N	108	168	220	192	288	384	368	552	736	488	736	980
Peak current for 1 sec.	I_p	A (rms)	6	6	6	4.8	4.8	4.8	9.6	9.6	9.6	6.8	6.8	6.8
Force constant	K_f	N/A (rms)	18	28	37	40	60	80	38	58	77	72	108	144
Max. winding temp.	T_{max}	°C	100	100	100	100	100	100	100	100	100	100	100	100
Electrical time constant	K_e	ms	0.6	0.6	0.6	0.9	0.9	0.9	1	1	1	3.4	3.4	3.4
Resistance (line to line at 25 °C)	R_{25}	Ω	7.4	11.1	14.8	16	24	32.4	6.2	9.3	12.4	18.5	27.8	37.0
Inductance (line to line)	L	mH	4.5	6.7	8.9	14.2	21.3	28.4	6.1	9.2	12.2	62.0	93.0	124.0
Pole pair pitch	2τ	mm	72	72	72	90	90	90	120	120	120	180	180	180
Bend radius of motor cable	R_{bend}	mm	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5	37.5
Back emf constant (line to line)	K_v	Vrms/(m/s)	11.7	17.5	23.3	22	33	44	24.6	36.9	49.2	44	66	88
Motor constant (at 25 °C)	K_m	$N/\sqrt{W}$	5.4	6.9	7.9	8.2	10	11.6	12.6	15.4	17.8	19.6	23.0	26.6
Thermal resistance	R_{th}	°C/W	2.4	1.6	1.2	1.7	1.2	0.9	1.1	0.7	0.6	0.73	0.52	0.4
Thermal switch		°C	B59100M1090A070 PTC Thermistor											
DC bus		V	500											
Mass of forcer	M_f	kg	0.62	0.78	0.94	0.99	1.32	1.65	1.60	2.20	2.80	3.9	5.85	7.8
Unit mass of stator	M_s	kg/m	2.0	2.0	2.0	3.2	3.2	3.2	6.4	6.4	6.4	7.4	7.4	7.4
Air gap	G	mm	0.75			0.55			1			1.65		

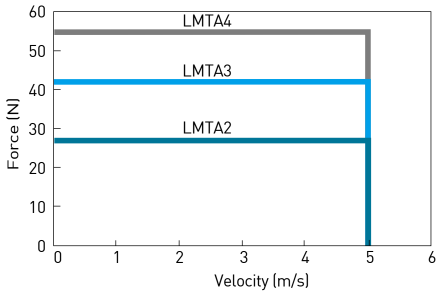
Note: Except dimensions, all the specifications in the table are in ± 10% of tolerance.

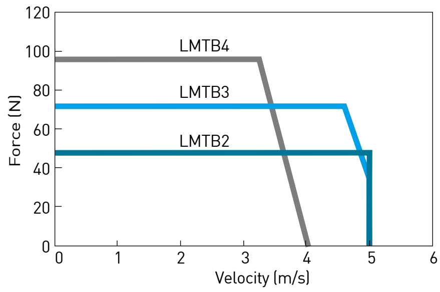
Positioning Systems

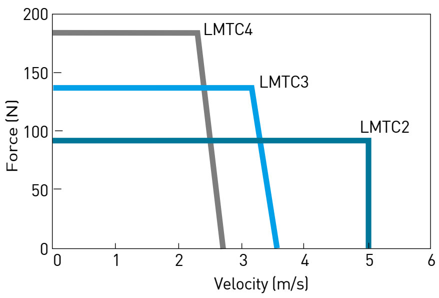
Linear Motor Components

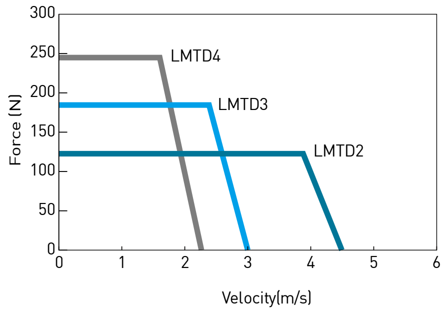
LMT series F-V curves

Force vs. Velocity curves are calculated with DC bus voltage=300 VDC

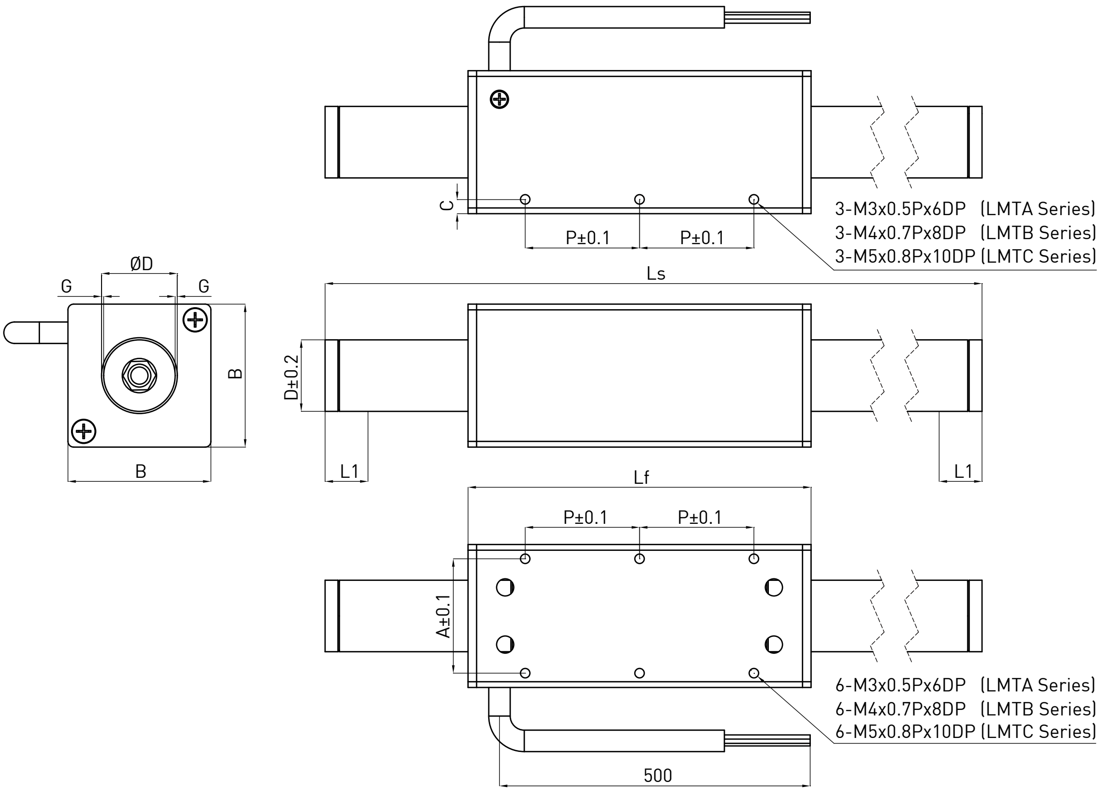




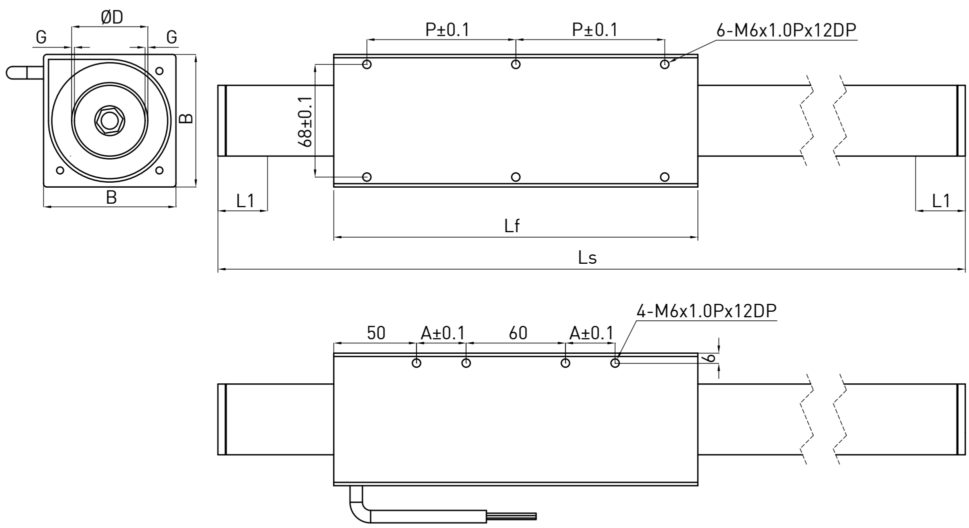




Dimensions for linear motor LMTA/LMTB/LMTC



Dimensions for linear motor LMTD



Positioning Systems

Linear Motor Components

Ls(Total Length of Stator)= S (Stroke) + Lf (Length of forcer) +2*L_1 (Supporting distance)

Table 4.10 **Forcer Setup Dimensions for Linear Motor, LMT Series**

Linear Motor Type	LMTA2	LMTA3	LMTA4	LMTB2	LMTB3	LMTB4	LMTC2	LMTC3	LMTC4	LMTD2	LMTD3	LMTD4
Length of forcer Lf (mm)	94	130	166	120	165	210	160	220	280	220	310	400
Width of forcer B (mm)	40	40	40	50	50	50	60	60	60	80	80	80
Diameter of Stator D (mm)	20	20	20	25	25	25	35	35	35	42.7	42.7	42.7
Fixing pitch PxA (mm)	30x30	48x30	66x30	40x40	62.5x40	85x40	60x48	90x48	120x48	90x30	135x75	180x120
Fixing pitch PxC(mm)	30x5	48x5	66x5	40x5	62.5x5	85x5	60x6	90x6	120x6			
LMTA & LMTB series Stroke S (mm)	100~1550(increase the travel based on 50mm)											
LMTC series Stroke S (mm)	100~2000(increase the travel based on 50mm)											
LMTD series stroke S(mm)	100~3000(increase the travel based on 50mm)											

The supporting distance for the same motor stator model varies depending on strokes (see below:)

Linear Motor Type	LMTA2/A3/A4			LMTB2/B3/B4			LMTC2/C3/C4			LMTD2/D3/D4		
Stroke (mm)	100~300	350~700	750~1550	100~700	750~1300	1350~1550	100~750	800~1500	1550~2000	100~550	600~1000	1050~3000
Supporting distance L_1(mm)	25	40	60	50	70	100	50	70	100	60	80	100

Structure of the order number of linear turbo LMT stators

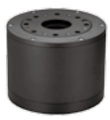
LMT A S - xxxx

Series	Diameter of stator	Option	Length of stator(L_S) [mm]
Linear Turbo Motor	A: 20 mm B: 25.4 mm C: 35 mm D: 42.7 mm	S: Standard C: Customized	

5 Torque Motor Rotary Tables

5.1 Product Overview and Application Areas Page 76

5.2 TMS Rotary Tables Page 77



5.3 TMX Rotary Tables Page 82

Positioning Systems

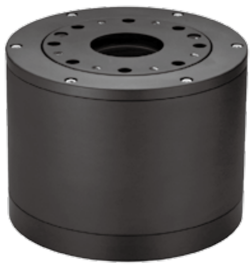
Torque Motor Rotary Tables

5.1 Product Overview and Application Areas

The extremely rigid connection between motor and load, and a servo-drive regulation ensures excellent acceleration capabilities and good uniformity of movement. HIWIN rotary tables and torque motors are especially well suited for tasks in automation due to the hollow shaft design. Media, cable systems or mechanical parts can be fed through without problems.

HIWIN Rotary Tables:
TMS series utilize cross roller bearing.

- Drive free of clearance
- Hollow shaft
- No gear transmission losses
- Maintenance free and compact
- Drive can be selected freely
- Brush-free drive
- Extremely rigid support with cross-roller
- Meet IP65 enclosure standards as an option
- Integrated brake is available as an option



Short and compact:
HIWIN rotary tables are optimized for high torques and robust dynamics.

Table 5.1 Application Areas of Rotary Tables

Classification	Application	Features and main reasons for use					
		Accuracy	Speed	Rigidity	Compactness	Clearliness	Freedom from maintenance
Production equipment	CVD, wafer cleaning, ion implantation	○			○	○	○
	Semi-conductor transport, inspection/processing	○			○	○	○
Assembly machines	Assembly machines for electric components	○	○		○	○	○
	High-speed assembly machines for electronic components	○	○		○	○	○
	Various assembly machines	○	○		○		○
Machine tools	Tool changers		○		○		○
	C axes	○		○	○		○
Inspection/ testing equipment	Machine part inspection	○			○		○
	Inspection of electric components	○			○		○
	Inspection of optical components	○			○		○
	Chemical analysis of liquids		○			○	○
	Various Inspection/testing equipment	○			○		○
Robots	Various assembly robots	○	○	○	○		○
	Various transport robots	○	○		○		○
	Inspection/transport robots in clean rooms	○	○		○	○	○

5.2 TMS Rotary Tables

5.2.1 TMS0x Rotary Tables

Dimensions of TMS0x rotary tables
(Values see Table 5.2)

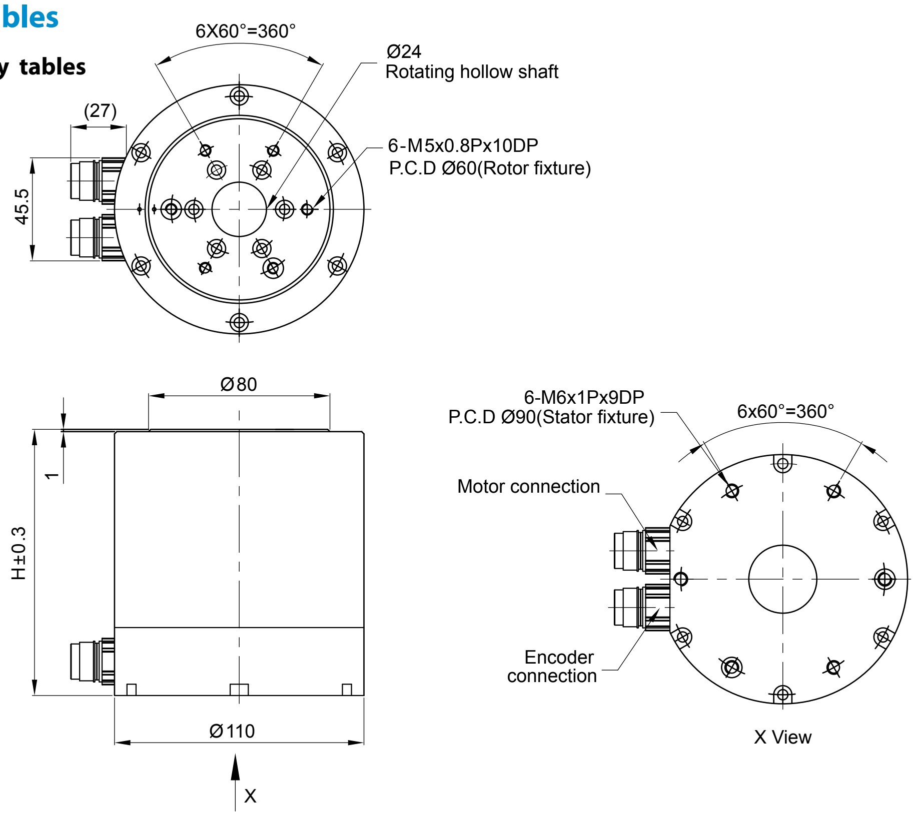


Table 5.2 **Specifications for TMS0x rotary table**

	Symbol	Unit	TMS03	TMS07
Continuous torque	T_c	Nm	3.1	6.2
Continuous current	I_c	A (rms)	2	2
Peak torque for 1 sec.	T_p	Nm	9.3	18.6
Peak current for 1 sec.	I_p	A (rms)	6	6
Torque constant	K_t	Nm/A (rms)	1.55	3.1
Electrical time constant	K_e	ms	2.1	2.5
Resistance (line to line, 25 °C)	R_{25}	Ω	7.1	12.4
Inductance (line to line)	L	mH	15.2	30.4
Number of poles	2p		10	10
Back emf constant (line to line)	K_v	Vrms/(rad/s)	0.82	1.7
Motor constant (25 °C)	K_m	Nm/√W	0.5	0.7
Thermal resistance	R_{th}	°C/W	1.8	1.0
Thermal switch			3 PTC SNM100 in series	
Max. DC bus voltage		V	500	
Inertia of rotating parts	J	kg m²	0.003	0.006
Mass of motor	M_m	kg	4	7
Max. axial load	F_a	N	3700	3700
Max. radial load	F_r	N	820	820
Max. speed	n	rpm	700	700
Repeatability		Arc sec	± 3	
Accuracy*		Arc sec	± 45 / ±10[1)]	
Height	H	mm	117.5	150

Note : [1)]±10arcsec as an option (with HIWIN solution)
Except dimensions, all the specifications in the table are in ±10% of tolerance.

Positioning Systems

Torque Motor Rotary Tables

5.2.2 TMS1x Rotary Tables

Dimensions of TMS1x rotary tables
(Values see Table 5.3)

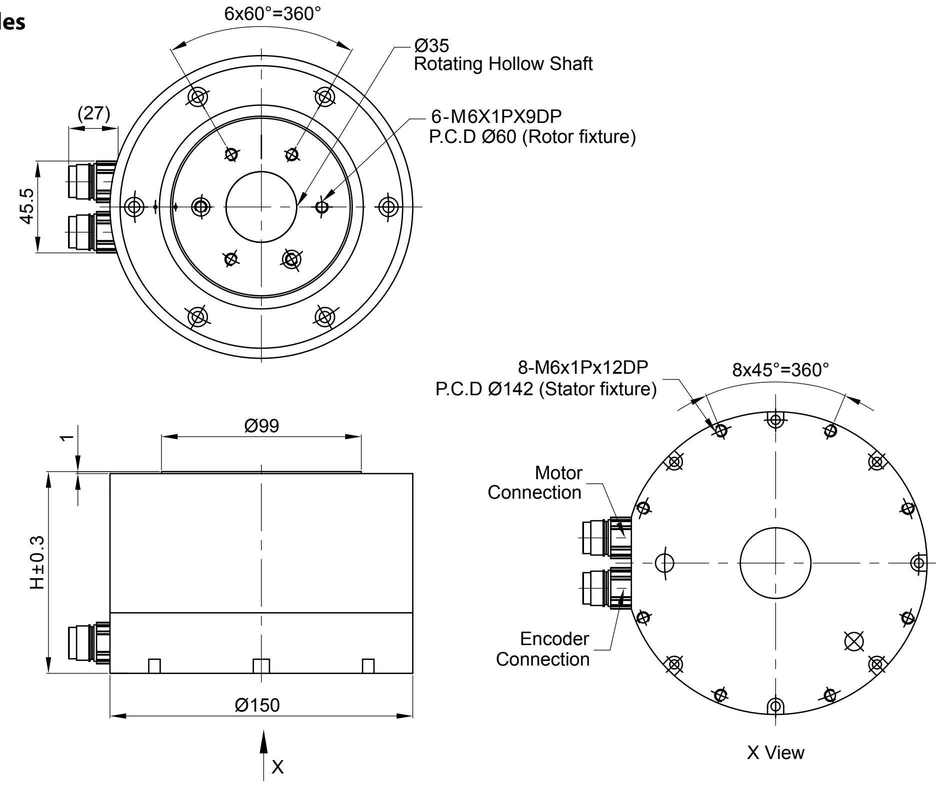


Table 5.3 **Specifications for TMS1x rotary table**

	Symbol	Unit	TMS12	TMS14	TMS16	TMS18
Continuous torque	T_c	Nm	5	10	15	20
Continuous current	I_c	A (rms)	4	4	4	4
Peak torque for 1 sec.	T_p	Nm	15	30	45	60
Peak current for 1 sec.	I_p	A (rms)	12	12	12	12
Torque constant	K_t	Nm/A (rms)	1.25	2.50	3.75	5.00
Electrical time constant	K_e	ms	3.2	3.6	3.8	4.0
Resistance (line to line, 25 °C)	R_{25}	Ω	2.6	3.9	5.2	6.5
Inductance (line to line)	L	mH	8.2	14	20	26
Number of poles	2p		22	22	22	22
Back emf constant (line to line)	K_v	Vrms/(rad/s)	0.6	1.2	1.8	2.4
Motor constant (25 °C)	K_m	Nm/√W	0.6	1.0	1.3	1.6
Thermal resistance	R_{th}	°C/W	1.2	0.8	0.6	0.5
Thermal switch			3 PTC SNM100 in series			
Max. DC bus voltage		V	500			
Inertia of rotating parts	J	kg m²	0.006	0.0065	0.007	0.0075
Mass of motor	M_m	kg	5.7	7	8.3	9.5
Max. axial load	F_a	N	3700	3700	3700	3700
Max. radial load	F_r	N	1700	1700	1700	1700
Max. speed	n	rpm	700	700	700	700
Repeatability		Arc sec	± 3			
Accuracy*		Arc sec	± 45 / ±10[1)]			
Height	H	mm	100	120	140	160

Note : [1)]±10 arcsec as an option (with HIWIN solution)
Except dimensions, all the specifications in the table are in ±10% of tolerance.

5.2.3 TMS3x Rotary Tables

Dimensions of TMS3x rotary tables

(Values see Table 5.4)

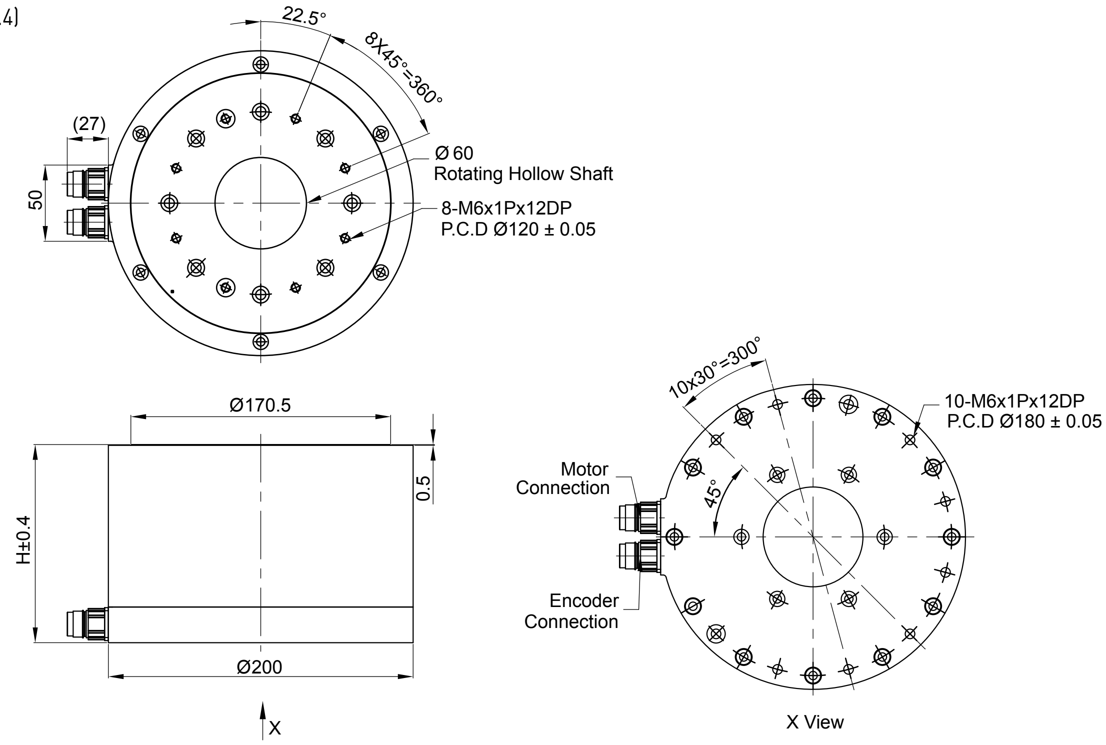


Table 5.4 Specifications for TMS3x rotary table

	Symbol	Unit	TMS32	TMS34	TMS38	TMS3C
Continuous torque	T_c	Nm	10	20	40	60
Continuous current	I_c	A (rms)	3	3	3	3
Peak torque for 1 sec.	T_p	Nm	30	60	120	180
Peak current for 1 sec.	I_p	A (rms)	9	9	9	9
Torque constant	K_t	Nm/A (rms)	3.3	6.6	13.3	20.0
Electrical time constant	K_e	ms	4.7	5.4	5.7	5.9
Resistance (line to line, 25 °C)	R_{25}	Ω	5.8	8.4	13.6	18.8
Inductance (line to line)	L	mH	27	45	78	111
Number of poles	2p		22	22	22	22
Back emf constant (line to line)	K_v	Vrms/(rad/s)	1.6	3.2	6.4	9.6
Motor constant (25 °C)	K_m	$Nm/\sqrt{W}$	1.1	1.9	3.0	3.8
Thermal resistance	R_{th}	°C/W	1.0	0.7	0.4	0.3
Thermal switch			3 PTC SNM100 in series			
Max. DC bus voltage		V	500			
Inertia of rotating parts	J	kg m^2	0.014	0.02	0.026	0.035
Mass of motor	M_m	kg	15	21	26	32
Max. axial load	F_a	N	8000	8000	8000	8000
Max. radial load	F_r	N	6500	6500	6500	6500
Max. speed	n	rpm	700	500	240	120
Repeatability		Arc sec	± 2.5			
Accuracy*		Arc sec	± 25 / ±10[1)]			
Height	H	mm	130	150	190	230

Note : [1)] ±10 arcsec as an option (with HIWIN solution)
Except dimensions, all the specifications in the table are in ±10% of tolerance.

Positioning Systems

Torque Motor Rotary Tables

5.2.4 TMS7x Rotary Tables

Dimensions of TMS7x rotary tables
(Values see Table 5.5)

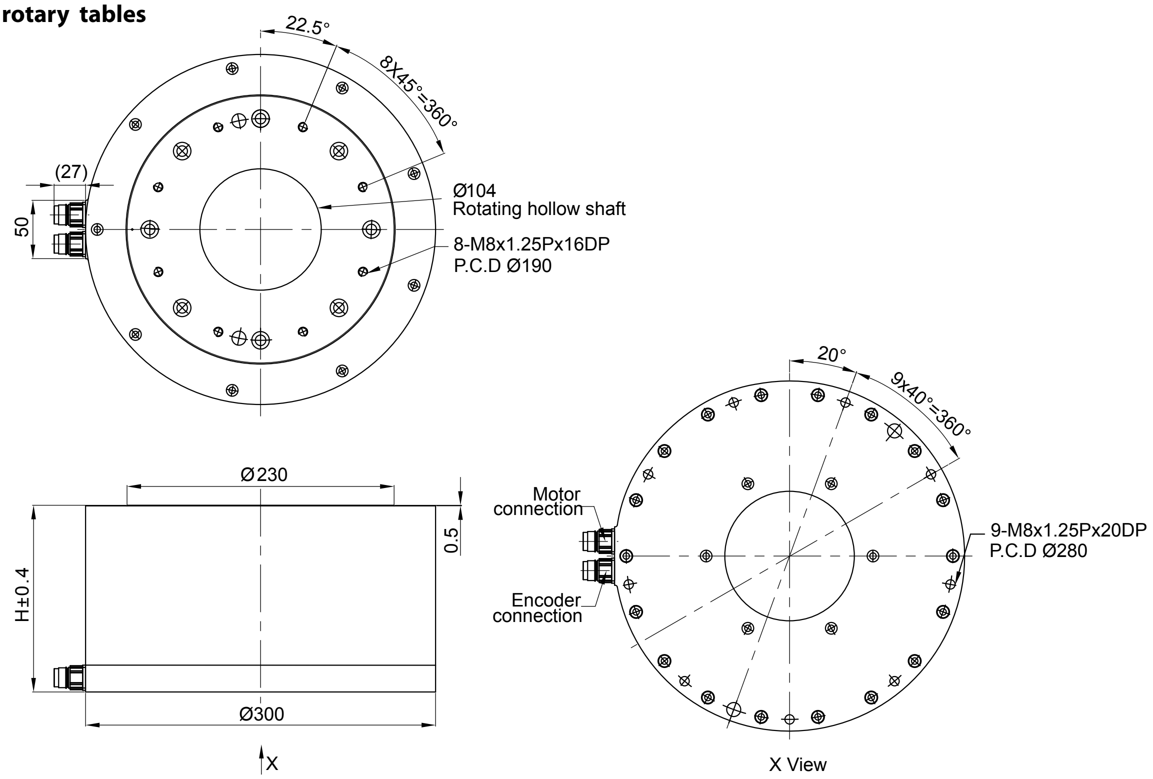


Table 5.5 **Specifications for TMS7x rotary table**

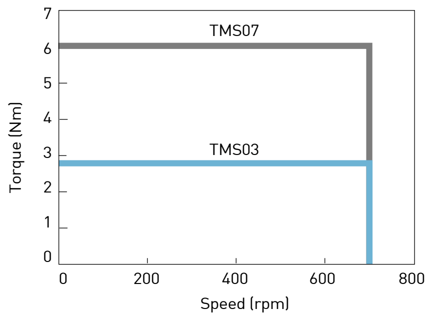
	Symbol	Unit	TMS74	TMS76	TMS7C
Continuous torque	T_c	Nm	50	75	150
Continuous current	I_c	A (rms)	3	3	3
Peak torque for 1 sec.	T_p	Nm	150	225	450
Peak current for 1 sec.	I_p	A (rms)	9	9	9
Torque constant	K_t	Nm/A (rms)	16.7	25.0	50.0
Electrical time constant	K_e	ms	5.0	5.1	5.4
Resistance (line to line, 25 °C)	R_{25}	Ω	14.0	19.0	32.5
Inductance (line to line)	L	mH	70.0	96.5	176.0
Number of poles	2p		44	44	44
Back emf constant (line to line)	K_v	Vrms/(rad/s)	10.8	16.2	32.4
Motor constant (25 °C)	K_m	Nm/$\sqrt{W}$	3.6	4.7	7.2
Thermal resistance	R_{th}	°C/W	0.4	0.3	0.2
Thermal switch			3 PTC SNM100 in series		
Max. DC bus voltage		V	500		
Inertia of rotating parts	J	kg m²	0.152	0.174	0.241
Mass of motor	M_m	kg	39	44.5	61.5
Max. axial load	F_a	N	8000	8000	8000
Max. radial load	F_r	N	6500	6500	6500
Max. speed	n	rpm	180	120	48
Repeatability		Arc sec	± 2.5		
Accuracy*		Arc sec	± 25 / ±10[1)]		
Height	H	mm	160	180	240

Note : [1)]±10 arcsec as an option (with HIWIN solution)
Except dimensions, all the specifications in the table are in ±10% of tolerance.

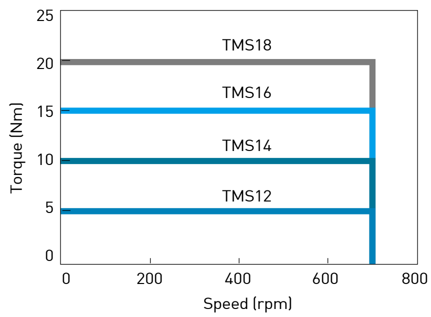
TMS series T-N curves

Torque vs. Velocity curves are calculated with DC bus voltage=300 VDC

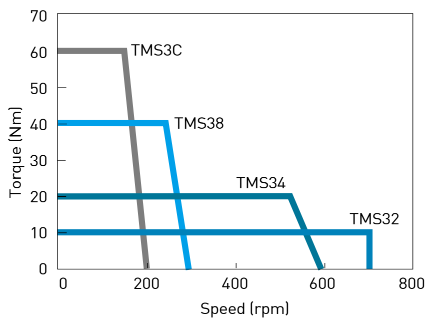
TMS0x Series



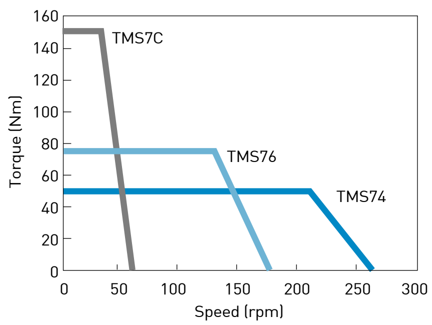
TMS1x Series



TMS3x Series



TMS7x Series



Structure of the order number of TMS rotary tables

TM S 3 4

Series	Type	Size	Rotor height
TM	S: Complete rotary table	0: External diameter 110 mm 1: External diameter 150 mm 3: External diameter 200 mm 7: External diameter 300 mm	2: 20 mm 4: 40 mm 6: 60 mm 8: 80 mm C: 120 mm

Positioning Systems

Torque Motor Rotary Tables

5.3 TMX Rotary Tables

- High resolution resolver integrated, full servo loop control.
- Outer ratating structure

5.3.1 TMX4 Rotary Tables

Dimensions of TMX4 rotary tables

(Values see Table 5.6)

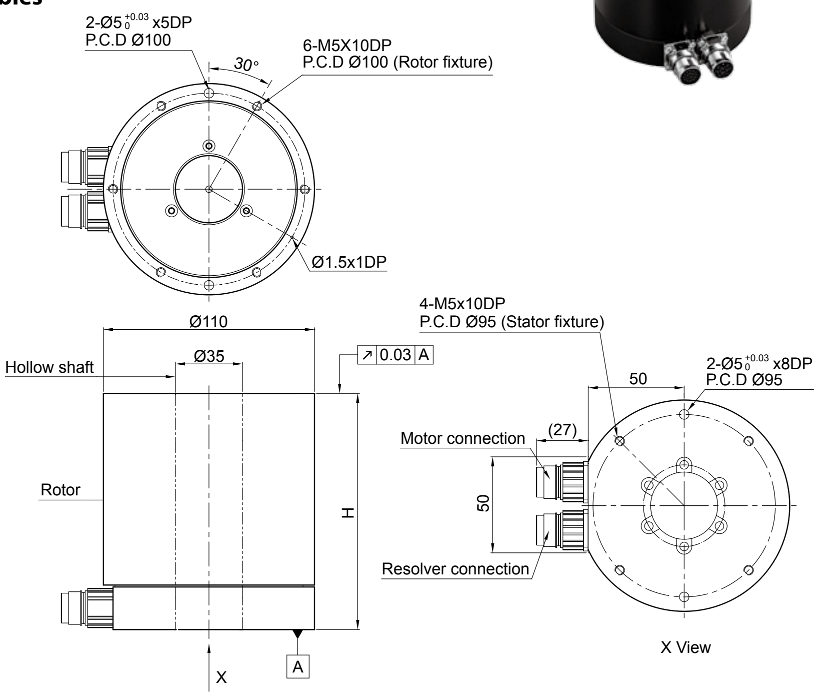


Table 5.6 **Specifications for TMX4 rotary tables**

	Symbol	Unit	TMX44	TMX48
Continuous torque	T_c	Nm	4	8
Continuous current	I_c	A (rms)	2.6	2.6
Peak torque for 1 sec.	T_p	Nm	12	24
Peak current for 1 sec.	I_p	A (rms)	7.8	7.8
Torque constant	K_t	Nm/A (rms)	1.56	3.12
Electrical time constant	K_e	ms	5	5.8
Resistance (line to line, 25 °C)	R_{25}	Ω	2.3	3.9
Inductance (line to line)	L	mH	11.6	22.4
Number of poles	2p		14	14
Back emf constant (line to line)	K_v	Vrms/(rad/s)	0.9	1.8
Motor constant (25 °C)	K_m	$Nm/\sqrt{W}$	0.8	1.3
Thermal resistance	R_{th}	°C/W	3.2	1.9
Thermal switch			3 PTC SNM100 in series	
Max. DC bus voltage		V	500	
Inertia of rotating parts	J	kg m^2	0.0065	0.0085
Mass of motor	M_m	kg	4.5	7
Max. axial load	F_a	N	1000	1000
Max. speed	n	rpm	300	
Repeatability		Arc sec	± 3	
Accuracy		Arc sec	± 50 / ± 25[1]	
Height	H	mm	123	163

Note : [1]±25 arcsec as an option (with HIWIN solution)
Except dimensions, all the specifications in the table are in ±10% of tolerance.

5.3.2 TMX6 Rotary Tables

Dimensions of TMX6 rotary tables

(Values see Table 5.7)

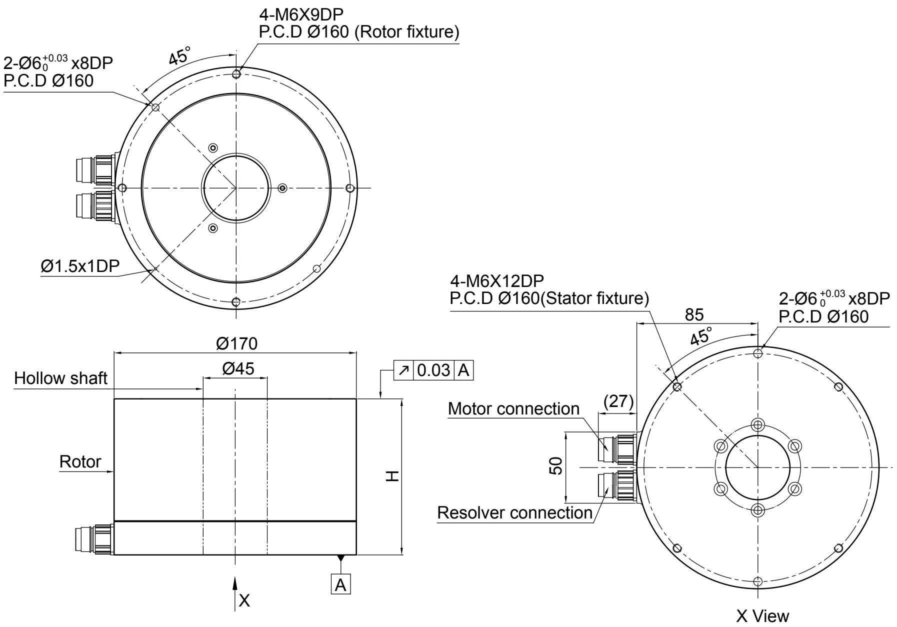


Table 5.7 Specifications for TMX6 rotary tables

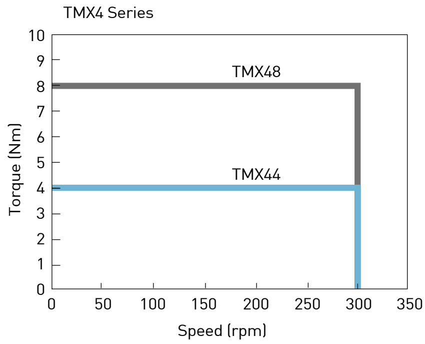
	Symbol	Unit	TMX63	TMX65	TMX68
Continuous torque	T_c	Nm	8	16	24
Continuous current	I_c	A (rms)	3.8	3.8	3.8
Peak torque for 1 sec.	T_p	Nm	24	48	72
Peak current for 1 sec.	I_p	A (rms)	12	12	12
Torque constant	K_t	Nm/A (rms)	2.13	4.26	6.39
Electrical time constant	K_e	ms	5.6	5.8	5.9
Resistance (line to line, 25 °C)	R_{25}	Ω	2	3.5	5
Inductance (line to line)	L	mH	11.4	20.5	29.6
Number of poles	2p		16	16	16
Back emf constant (line to line)	K_v	Vrms/(rad/s)	1.2	2.5	3.7
Motor constant (25 °C)	K_m	$Nm/\sqrt{W}$	1.2	1.8	2.3
Thermal resistance	R_{th}	°C/W	1.7	1.0	0.7
Thermal switch			3 PTC SNM100 in series		
Max. DC bus voltage		V	500		
Inertia of rotating parts	J	kg m²	0.019	0.026	0.033
Mass of motor	M_m	kg	8	11	15
Max. axial load	F_a	N	3700	3700	3700
Max. speed	n	rpm	300		
Repeatability		Arc sec	± 3		
Accuracy		Arc sec	± 50 / ± 25[1)]		
Height	H	mm	109.5	134.5	159.5

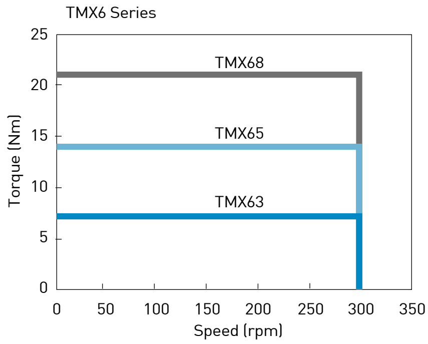
Note : [1)]±25 arcsec as an option (with HIWIN solution)
Except dimensions, all the specifications in the table are in ±10% of tolerance.

Positioning Systems

Torque Motor Rotary Tables

TMX series T-N curves





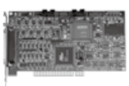
Structure of the order number of TMX rotary tables

TM X 4 4

Series	Type	Motor Outer Diameter	Length of stack
Torque Motor	X: Resolver type	4: 110 mm 6: 170 mm	3: 30 mm 4: 40 mm 5: 50 mm 8: 80 mm

6 Control and Drives

6.1 Control Card PCI4P Page 84



6.2 Drives Page 86
6.2.1 Drives for Linear Motor Stages Page 86
6.2.2 Drives for Rotary Tables Page 88
6.2.3 Drives Accessories Page 90
6.2.4 For mega-fabs D1 Amplifiers Page 92
6.2.5 For XTL Amplifiers Page 93
6.2.6 Pin Assignment Page 94

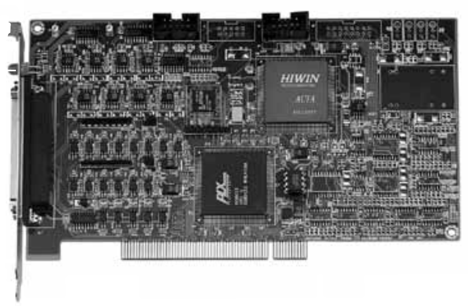
Positioning Systems

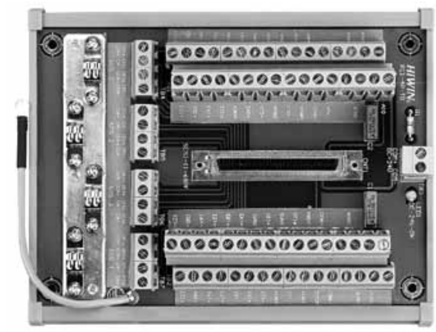
Control and Drives

6.1 Control Card PCI4P

The HIWIN control card PCI4P controls up to four axes. It can be used for stepping motors and for pulse-controlled servo motors.

- 32 bit PCI card, Plug-and-Play
- Pulse train generation for 4 axes
- 13 digital inputs, 5 digital outputs
- Supports STEP/DIR, CW/CCW and A/B phase pulse format
- Differential pulse output reduces noise interference
- Linear interpolation for three axes
- Circular interpolation for two axes
- Supports speed profile T and S
- 4 x 32 bit counter for digital incremental encoder (Max. 1.76MHz after 4x evaluation)
- Encoder latch function
- DLL library for Windows, MCCL Motion Library for VC++/VB programming under Windows XP with 98 functions
- Referencing, limit switch, jog function
- Supports stepping motors, AC servo motors and linear motors
- MotionMaker™ user interface for convenient operation
- Power supply slot
  +5 V DC +/–5 %, max. 900 mA via PCI-Bus in PC
- External power supply (input)
  +24 V DC +/–5 %, max. 500 mA, prepared by user



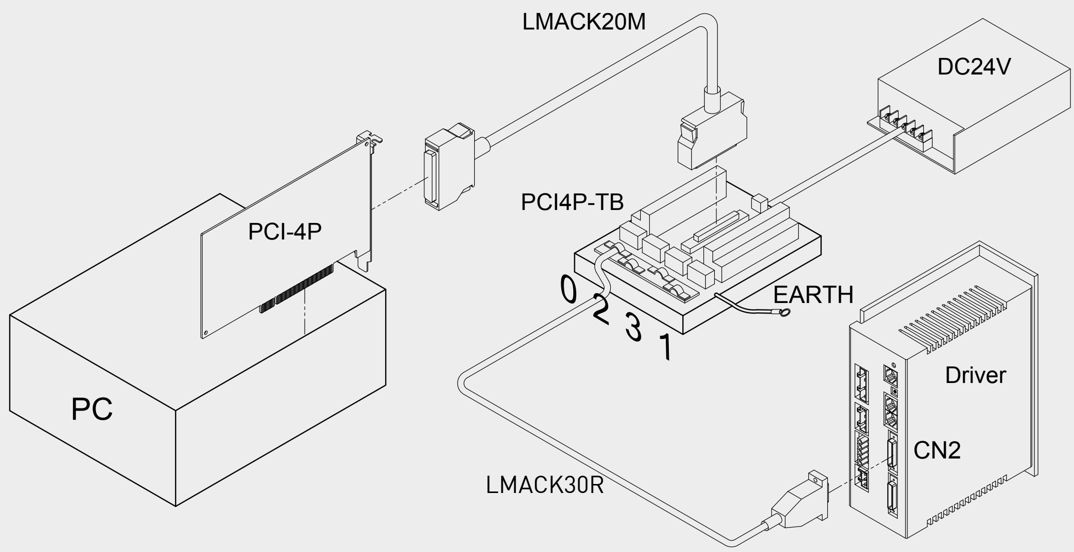


6.1.1 Terminal Block PCI4P-TB

The terminal block PCI4P-TB provides clear connection for pulse and all inputs and outputs of the control card.

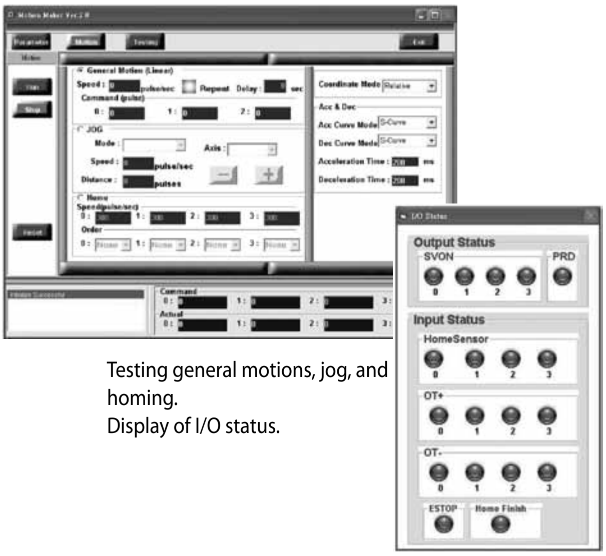
Applicable for stepping motor,
AC servo motors and linear servo motors etc.

Connection example

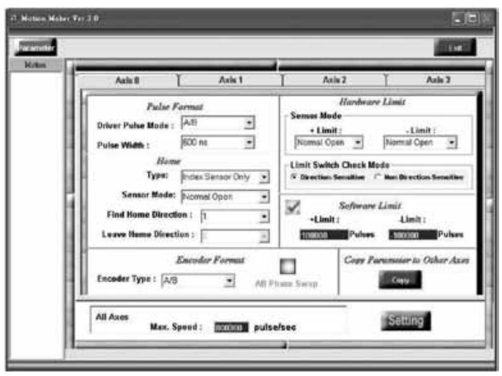


HIWIN Motion Maker

HIWIN Motion Maker tool software is easy to use for the first step of building a motion system with PCI-4P. With its help, a user can check if the wiring and logic of switches are in order and make test runs.



Testing general motions, jog, and homing.
Display of I/O status.



Pulse formats, Homing,
Hardware and software limits.

Positioning Systems

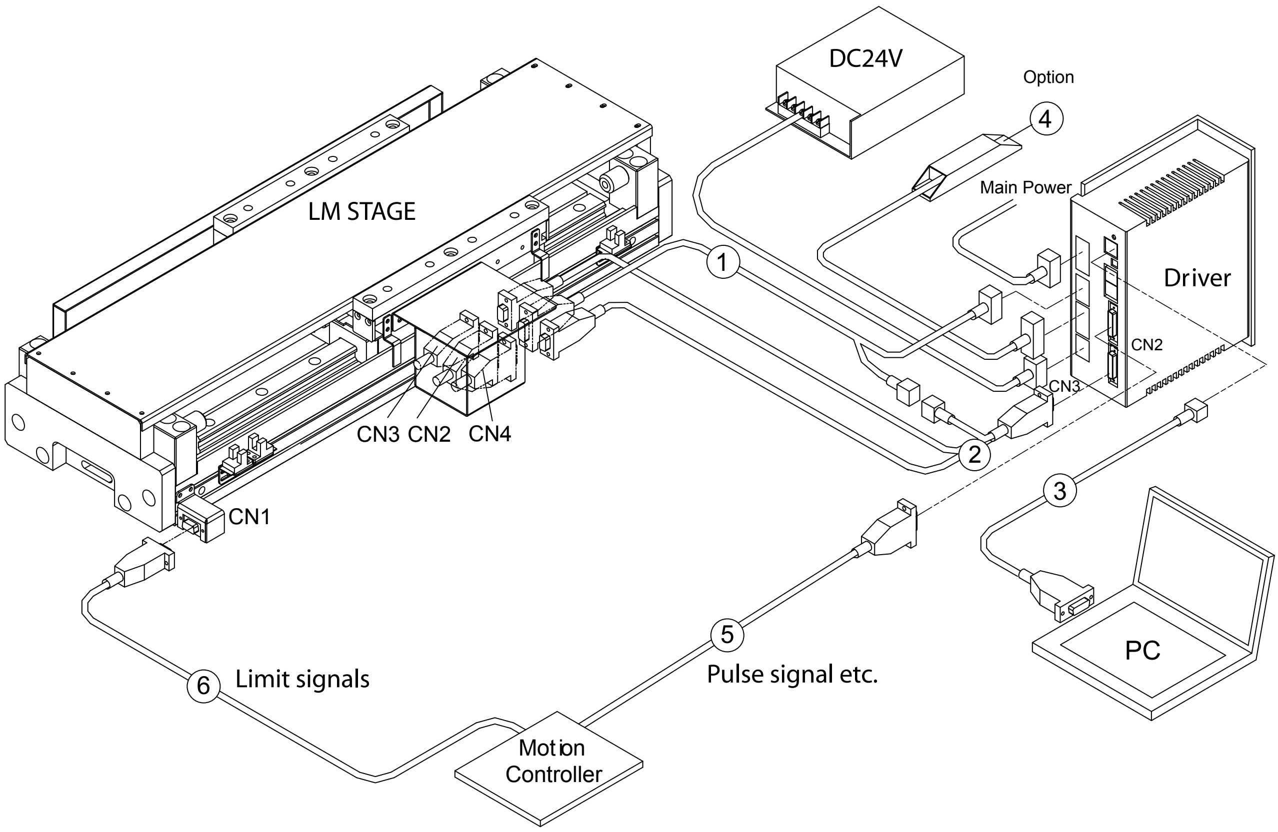
Control and Drives

6.2 Drives

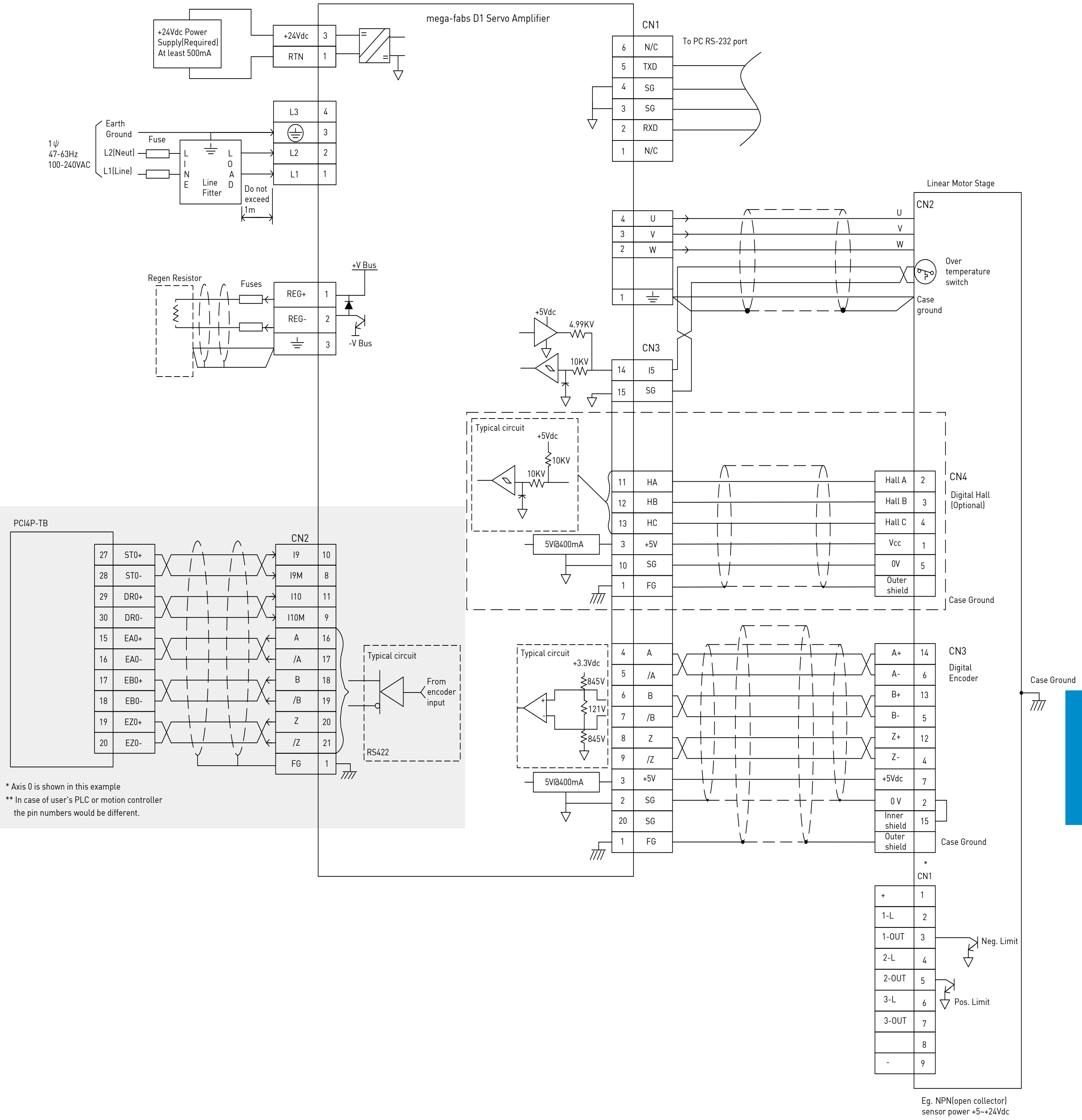
6.2.1 Drives for Linear Motor Stages

mega-fabs D1 Servo Drive

- Digital amplifier
- Field oriented control
- Intuitive Lightening interface
- 100-240VAC input power
- Supports Step/Direction, CW/CCW and A/B phase pulse format
- Supports analog and digital encoder



Wiring examples



* Axis 0 is shown in this example
** In case of user's PLC or motion controller the pin numbers would be different.

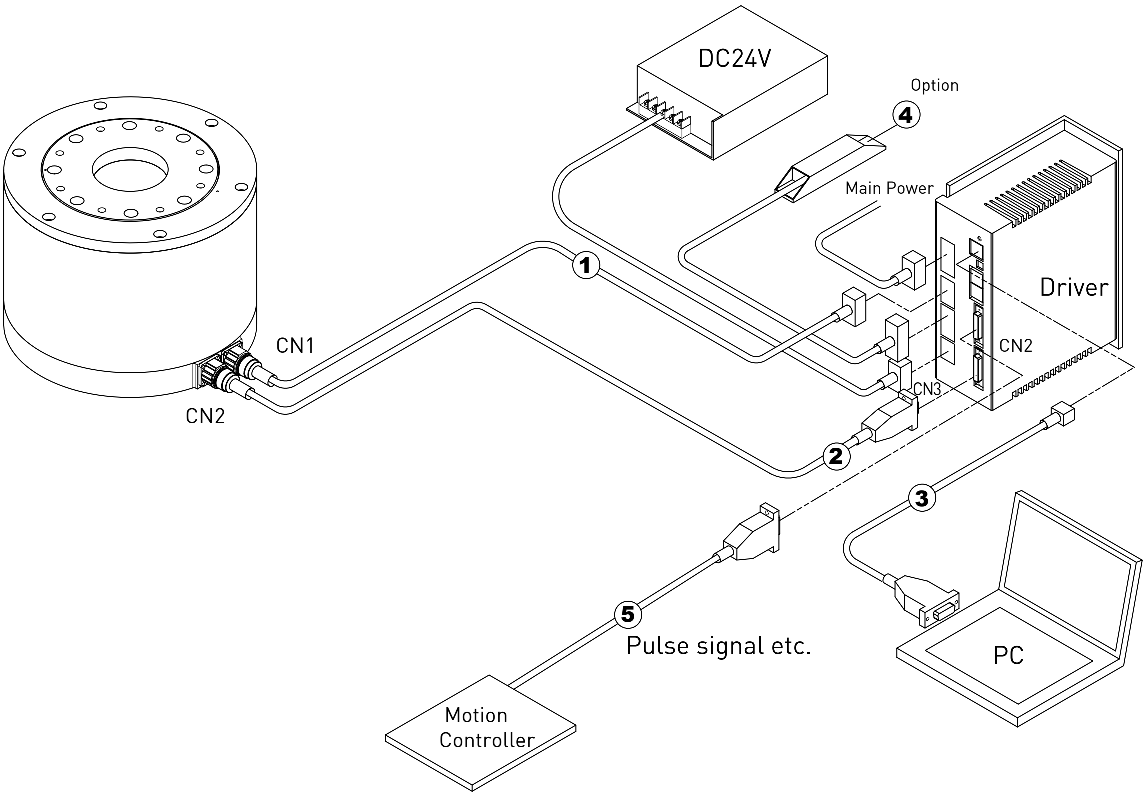
Positioning Systems

Control and Drives

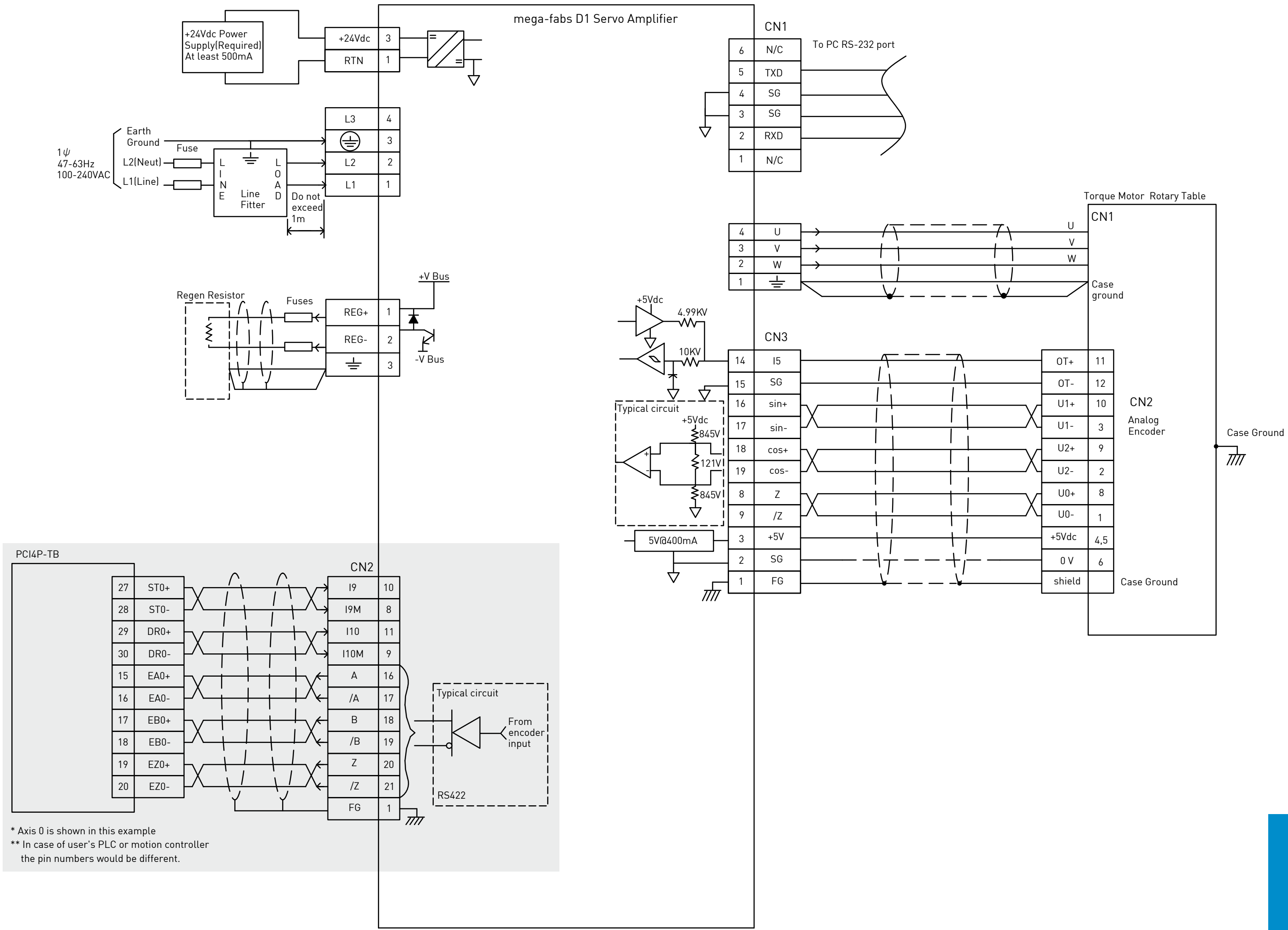
6.2.2 Drives for Rotary Tables

mega-fabs D1 Servo Drive

- Digital amplifier
- Field oriented control
- Intuitive Lightening interface
- 100-240VAC input power
- Supports Step/Direction, CW/CCW, A/B phase pulse format
- Supports analog and digital encoder



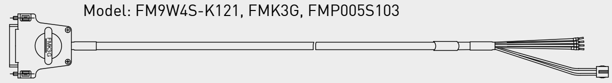
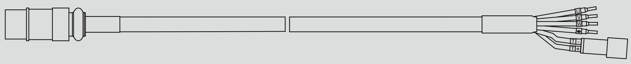
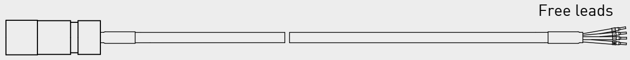
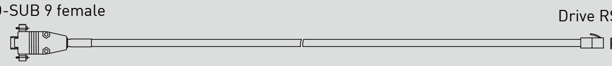
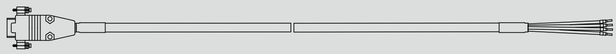
Wiring examples



Positioning Systems

Control and Drives

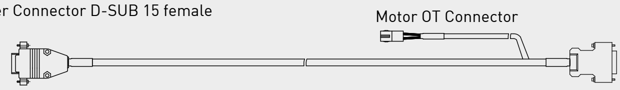
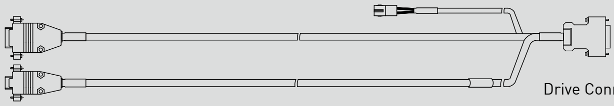
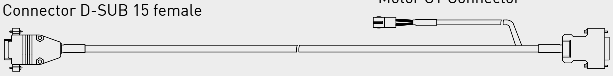
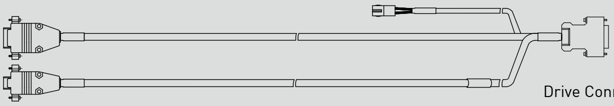
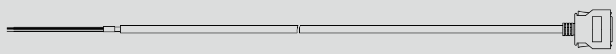
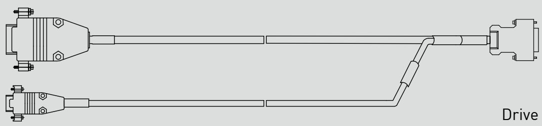
6.2.3 Drive Accessories

Part name	Model	Connector	Description
① Motor Power Cable UVW and Over Temp. Signal Cable	LMACS□□D	Motor Connects (U,V,W) and CN3	For LMS 
	LMACS□□K		For LMC 
	LMACS□□F		For TMS 
③ RS-232 Cable	LMACR21D		To PC (about 2m long For mega-fabs D1 and XTL.) 
④ Regen Resistor	050100700001		68Ω, Rated 100W, Peak 500W
⑥ Limit Switch Cable	LMACK□□S		For Linear Motor Positioning Stage 
D1 Drive Accessory	D1-CK1		All Connector(Not Include CN3)
	D1-EMC2		All Connector(Include CN3)
EMC Accessory	D1-H1		Used in Single Phase AC Power
	D1-H2		Used in Three Phase AC Power
Heat Sink	D1-H1		Standard
	D1-H2		Low profile
Digital Hall Sensor	LMAHS		For LMS series, single ended signal
	LMAHC		For LMCA, LMCB and LMCC series, single ended signal
	LMAHC2		For LMCD and LMCE series, single ended signal
Analog Hall Sensor	LMAHSA-D		For LMS series, differential signal
	LMAHCA-D		For LMCA, LMCB and LMCC series, differential signal

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

Note: User must prepare one 24Vdc power supply for each drive.

6.2.4 mega-fabs D1 Amplifier

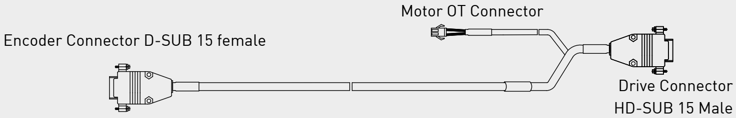
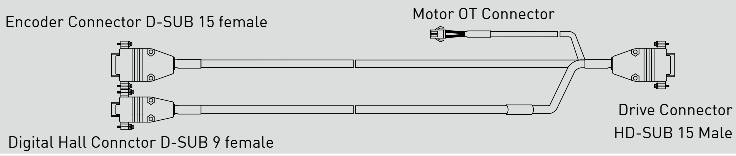
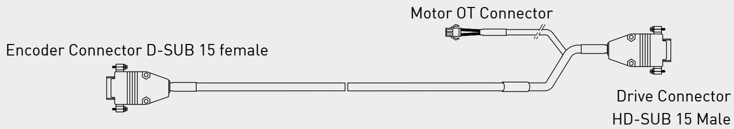
Part name	Model	Connector	Description
② Encoder Cable	LMACE□□Y	CN3	For Renishaw Digital Encoder, motor OT 
	LMACE□□Z		For Renishaw Digital Encoder, motor OT, and digital hall sensors 
	LMACE□□C		For Renishaw Analog Encoder, motor OT 
	LMACE□□J		For Renishaw Analog Encoder, motor OT, and digital hall sensors. 
	LMACE□□AA		For Jena analog encoder and motor OT. For TMS 
⑤ Controller Pulse Cable	LMACK30R	CN2	To motion controller (about 3m long) 
	LMACK□□A		For ACS SPiiPlus SA 

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

Positioning Systems

Control and Drives

6.2.5 For XTL Amplifiers

<table>
<tr><th>Part name</th><th>Model</th><th>Connector</th><th>Description</th></tr>
<tr><td rowspan="5">② Encoder Cable</td><td>LMACE□□L</td><td rowspan="5"></td><td>For Renishaw Digital Encoder, motor OT (XTL)

</td></tr>
<tr><td>LMACE□□P</td><td>For Renishaw Digital Encoder, motor OT, and digital hall sensors (XTL)

</td></tr>
<tr><td>LMACE□□M</td><td>For Renishaw Analog Encoder, motor OT (XTL)

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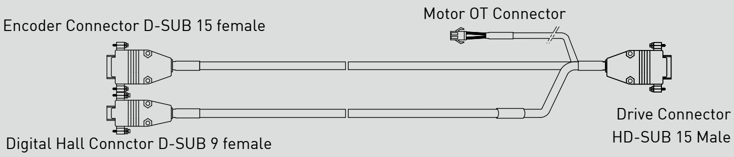
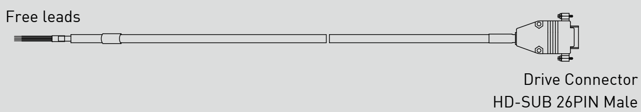
<tr><td>LMACE□□N</td><td>For Renishaw Analog Encoder, motor OT, and digital hall sensors (XTL)

</td></tr>
<tr><td>LMACE□□R</td><td>For Jena analog encoder and motor OT. For TMS (XTL)

</td></tr>
<tr><td>⑤ Controller Pulse Cable</td><td>LMACK30U</td><td></td><td>For motion controller(about 3m long) (XTL)

</td></tr>
</table>

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

6.2.6 Pin Assignment

LMACE□□Z
LMACE□□Y (Without Hall Sensor)

Signal	D-Sub 15Pin Female	Color (051400300063)	SCSI 20Pin Male
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	Purple	8
Z-	4	Grey	9
Inner Shield	15	Inner Shield	20
Case	-	Outer Shield	1
Signal	**2Pin Female**	**Color (051400100133)**	
T+	1	Brown	14
T-	2	Blue	15
Signal	**D-Sub 9Pin Female**	**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□□P
LMACE□□L (Without Hall Sensor)

Signal	D-Sub 15Pin Female	Color (051400300063)	HD-Sub 15Pin Male
5V	7	Brown	4
0V	2	White	5
A+	14	Green	14
A-	6	Yellow	13
B+	13	Blue	12
B-	5	Red	11
Z+	12	Purple	8
Z-	4	Grey	7
Inner Shield	15	Inner Shield	15
Case	-	Outer Shield	1
Signal	**2Pin Female**	**Color (051400100133)**	
T+	1	Brown	10
T-	2	Blue	15
Signal	**D-Sub 9Pin Female**	**Color (051400100075)**	
5V	1	Brown	2
Hall A	2	White	3
Hall B	3	Grey	6
Hall C	4	Yellow	9
0V	5	Green	15
Shield	Case	Shield	1

LMACE□□J
LMACE□□C (Without Hall Sensor)

Signal	D-Sub 15Pin Female	Color (051400300063)	SCSI 20Pin Male
5V	4	Brown	3
0V	12	White	2
Sin(+)	9	Red	16
Sin(-)	1	Blue	17
Cos(+)	10	Yellow	18
Cos(-)	2	Green	19
Z+	3	Purple	8
Z-	11	Grey	9
Inner Shield	15	Inner Shield	20
Case	-	Outer Shield	1
Signal	**2Pin Female**	**Color (051400100133)**	
T+	1	Brown	14
T-	2	Blue	15
Signal	**D-Sub 9Pin Female**	**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□□N
LMACE□□M (Without Hall Sensor)

Signal	D-Sub 15Pin Female	Color (051400300063)	HD-Sub 15Pin Male
5V	4	Brown	4
0V	12	White	5
Sin(+)	9	Red	14
Sin(-)	1	Blue	13
Cos(+)	10	Yellow	12
Cos(-)	2	Green	11
Z+	3	Purple	8
Z-	11	Grey	7
Inner Shield	15	Inner Shield	15
Case	-	Outer Shield	1
Signal	**2Pin Female**	**Color (051400100133)**	
T+	1	Brown	10
T-	2	Blue	15
Signal	**D-Sub 9Pin Female**	**Color (051400100075)**	
5V	1	Brown	2
Hall A	2	White	3
Hall B	3	Grey	6
Hall C	4	Yellow	9
0V	5	Green	15
Shield	Case	Shield	1

Positioning Systems

Control and Drives

LMACE□□AA

Function	8-10-0090 (Female)	JENA Signal	Color (051400300069)	SCSI 20Pin (Male)	800-151x 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(+)
Reference mark	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+	Purple	14	[IN5] Motemp
	12	T-	Yellow	15	Signal Gnd

LMACE□□R

Function	8-10-0090 (Female)	JENA Signal	Color (051400300069)	HD-Sub 15Pin(Male)	XTL Signal
Power	4	5V	Blue	4	+5Vdc
	5	5V	Blue	-	-
	6	0V	White	5	Signal Gnd
Incremental signals	2	U_2-	Red	11	Cos(-)
	3	U_1-	Brown	13	Sin(-)
	9	U_2+	Black	12	Cos(+)
	10	U_1+	Green	14	Sin(+)
Reference mark	1	U_0-	Pink	7	/X
	8	U_0+	Grey	8	X
	6	0V	Inner Shield	15	Signal Gnd
	Case	Shield	Outer Shield	1	Frame Gnd
Temperature	11	T+	Purple	10	[IN5] Motemp
	12	T-	Yellow	15	Signal Gnd

LMACK30R

Signal	Pin	Color	Pair		Color	Pin	Signal
Frame Ground	1	Brown	1a	8a	Blue	14	[Out2]
Signal Ground	2	Brown/Black	1b	8b	Blue/Black	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/Black	19	Encoder /B In/Out
HS Input [IN6]	7	Green	6a	11a	Gray	20	Encoder X In/Out
HS Input [IN7]	8	Pink	4a	11b	Gray/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	Black	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						

LMACK30U

Signal	Pin	Color	Pair		Color	Pin	Signal
Frame Ground	1	Brown	1a	5b	Yellow/Black	14	[In10] HS
Ref (-)	2	White/Black	13b	1b	Brown/Black	15	Signal Gnd
Ref (+)	3	White	13a	7a	Light Green	16	[Out1]
[IN1] Enable	4	Red	2a	8a	Blue	17	[Out2]
[IN2] GP	5	Red/Black	2b	8b	Blue/Black	18	[Out3]
[IN3] GP	6	Orange	3a	12b	Black	19	Signal Gnd
[IN4] GP	7	Orange/Black	3b	12a	White/Red	20	+5 Vdc
[IN11] GP	8	Green/Black	6b	11b	Gray/Black	21	Multi Encoder/X
[IN12] GP	9	Light Green/Black	7b	11a	Gray	22	Multi Encoder X
[IN6] HS	10	Green	6a	10b	Purple/Black	23	Multi Encoder/B
[IN7] HS	11	Pink	4a	10a	Purple	24	Multi Encoder B
[IN8] HS	12	Yellow	5a	9b	Light Blue/Black	25	Multi Encoder/A
[IN9] HS	13	Pink/Black	4b	9a	Light Blue	26	Multi Encoder A
Shield	Case						

Positioning Systems

Appendix A: Motor Sizing

Start Motor Sizing

The following contents describe how to choose proper motor according to speed, moving distance, and loading 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: loading (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:

$$V = V_0 + aT$$

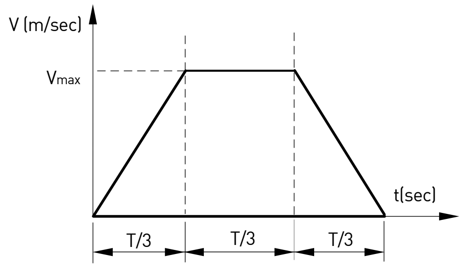
$$X = V_0T + \frac{1}{2}aT^2$$

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, traveling, and deceleration into three segments as shown below.



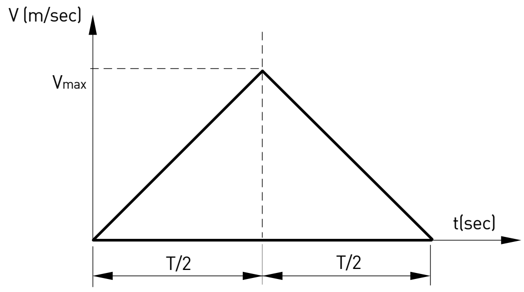
$$V_{max} = 1.5 \times \frac{X}{T} \quad (\text{Because } X = \frac{V}{2} \times \frac{T}{3} + V \times \frac{T}{3} + \frac{V}{2} \times \frac{T}{3})$$

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

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.

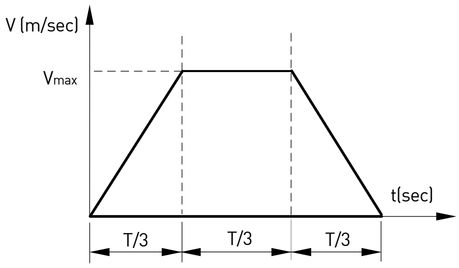
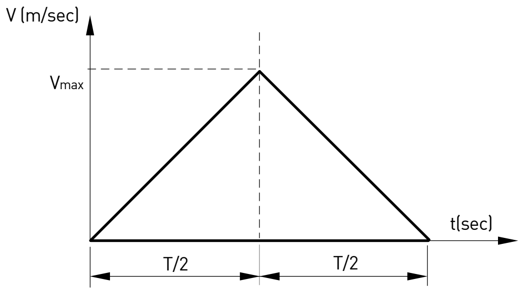


$$V_{max} = 2 \times \frac{X}{T}$$

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

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 drive is bigger enough, due to the higher velocity (V_{max}).

3. Some useful equations

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

STEP 2 Determine peak force and effective force

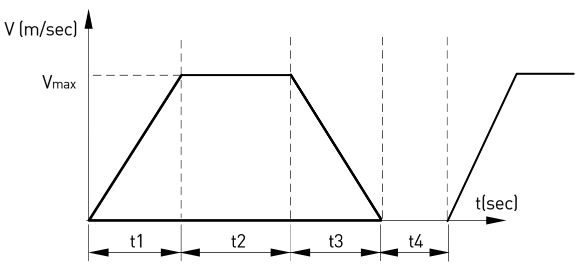
The peak force can be calculated by the follow equation

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

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:

$$F_e = \sqrt{\frac{(F_i + F_f)^2 t_1 + F_f^2 t_2 + (F_i - F_f)^2 t_3}{t_1 + t_2 + t_3 + t_4}}$$



The peak current I_p and effective current I_e can be calculated by using motor force constant K_f.

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

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

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

From the catalog of HIWIN, 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.

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

$I_e = \frac{F_e}{K_f} < I_c$ (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.

Positioning Systems

Linear Motor Sizing Example

For example, if load is 5 kg (moving mass of mechanism is 1 kg and payload 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)

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

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

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

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

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

$$= 41.92\ (N)$$

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

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

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

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

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
- Load 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): Load inertia on the motor shaft plus the motor inertia
ω_1 (radians /sec): Shaft speed at the start of deceleration
ω_2 (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.

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

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.

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

$W_{capacity}$ (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.

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

Positioning Systems

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:15Ω

Moving mass: 86Kg (include payload 74 Kg)

V_{max}: 2 m/s

Acceleration, deceleration: 5 m/s^2

Power supply (AC) of drive: 220VAC

Motor type:LMS37L

Force constant (Kf): 68N/A(rms)

$R_{winding}$: 2 ohms(line-to-line)

Calculate regen resistor as following step:

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

$$E_{dec} = \frac{1}{2} m_t V^2 = \frac{1}{2} \times 86 \times 2^2 = 172(\text{joule})$$

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

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

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

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

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

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

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

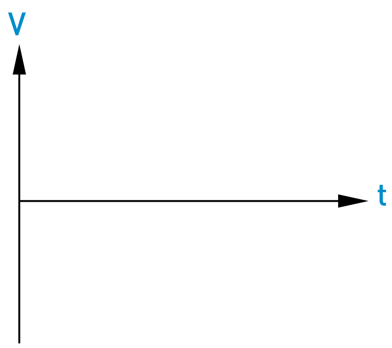
$$R = \frac{V_{regen}^2}{P_{pulse}} = \frac{390^2}{180.05} = 844.77(\text{ohms})$$

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: Linear Motor Inquiry form

Date :

Company name : Email Tel : Fax :		Contact person : Title :
Industrial		Notes :
Environment	☐Normal environment ☐Clean room,class ☐Other _____	
Stage type	☐Single axis ☐XY axis ☐Bridge type ☐Gantry(Single drive) ☐Gantry (Dual drive) ☐Other _____	
Load(kg)or Moment of inertia(kg-m2)		
Max. Velocity(m/s) or (rad/s)		
Max. Acceleration(m/s^2)or(rad/s^2)		
Stroke(mm)		
Repeatability(μm)or(deg)		
Accuracy(μm)or(deg)		
Encoder type	☐Analog ☐Pitch _____ μm ☐Digital ☐resolution ____ μm	
Orientation of Stage	☐Horizontal ☐Vertical ☐Laterally ☐Upside-down	
Multiple forcer	☐Yes, Number : _____ ☐No	
Dust-proof device	☐No ☐Cover ☐Bellow	
Cable Chain	☐No ☐Horizontal ☐Vertical	
Drive voltage	☐110V ☐220V ☐Other _____ V	
Pulse format	☐CW/CCW ☐A/B ☐STEP/DIR	
Application	☐Point to point ☐Scan	
Special measurement requirement		



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

Manager : Engineer : Salesperson :

FME001-08

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