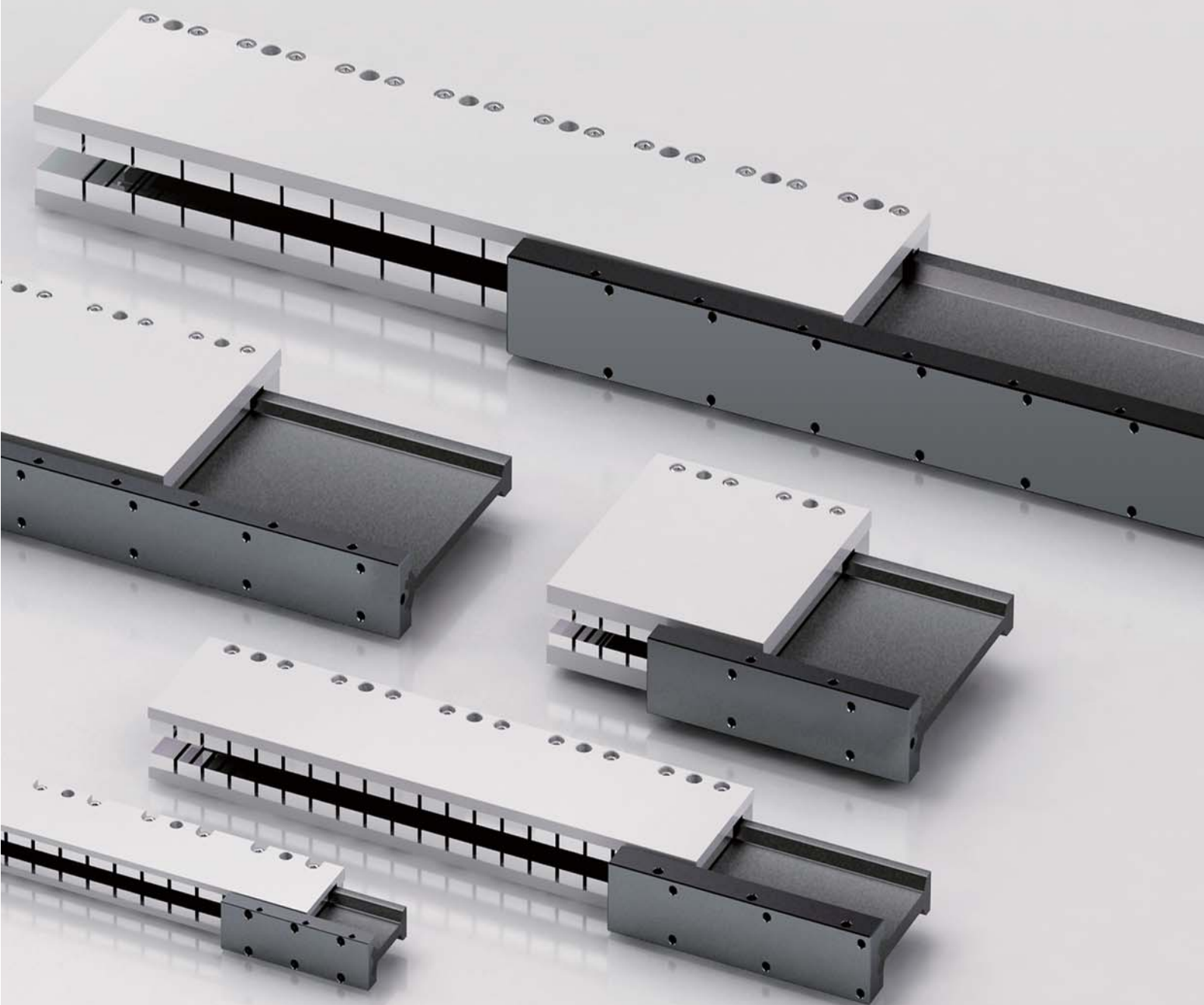




直得科技股份有限公司
CHIEFTEK PRECISION CO., LTD.

LINEAR MOTORS

NEW PRODUCT



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Move profile

Acceleration

Force

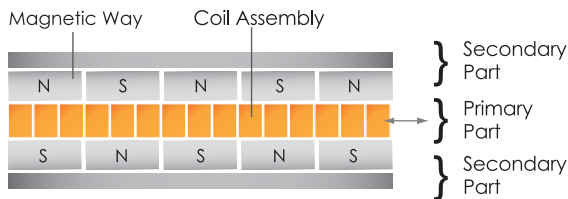
Selection guide

Ironless Linear Motors

Construction & Features

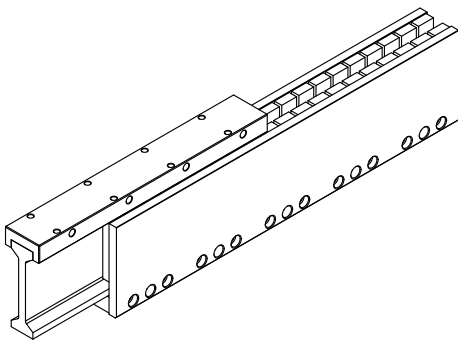
Provides fast acceleration with zero cogging for high velocities, super-smooth motion and superior position control.

Construction



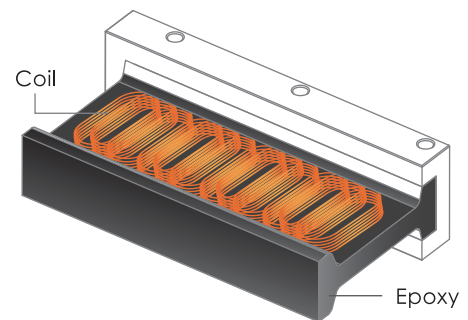
- **cpc** linear motors are composed of two pieces: a Coil Assembly (forcer) and a stationary Magnetic Way (track).
- The Coil Assembly is an ironless design, with the coils placed in a precisely molded resin shell.
- The Magnetic Way consists of two parallel steel plates with embedded rare-earth magnets facing each other. The two plates are joined at one end to create space for the Coil Assemblies to run.

Ironless advantages

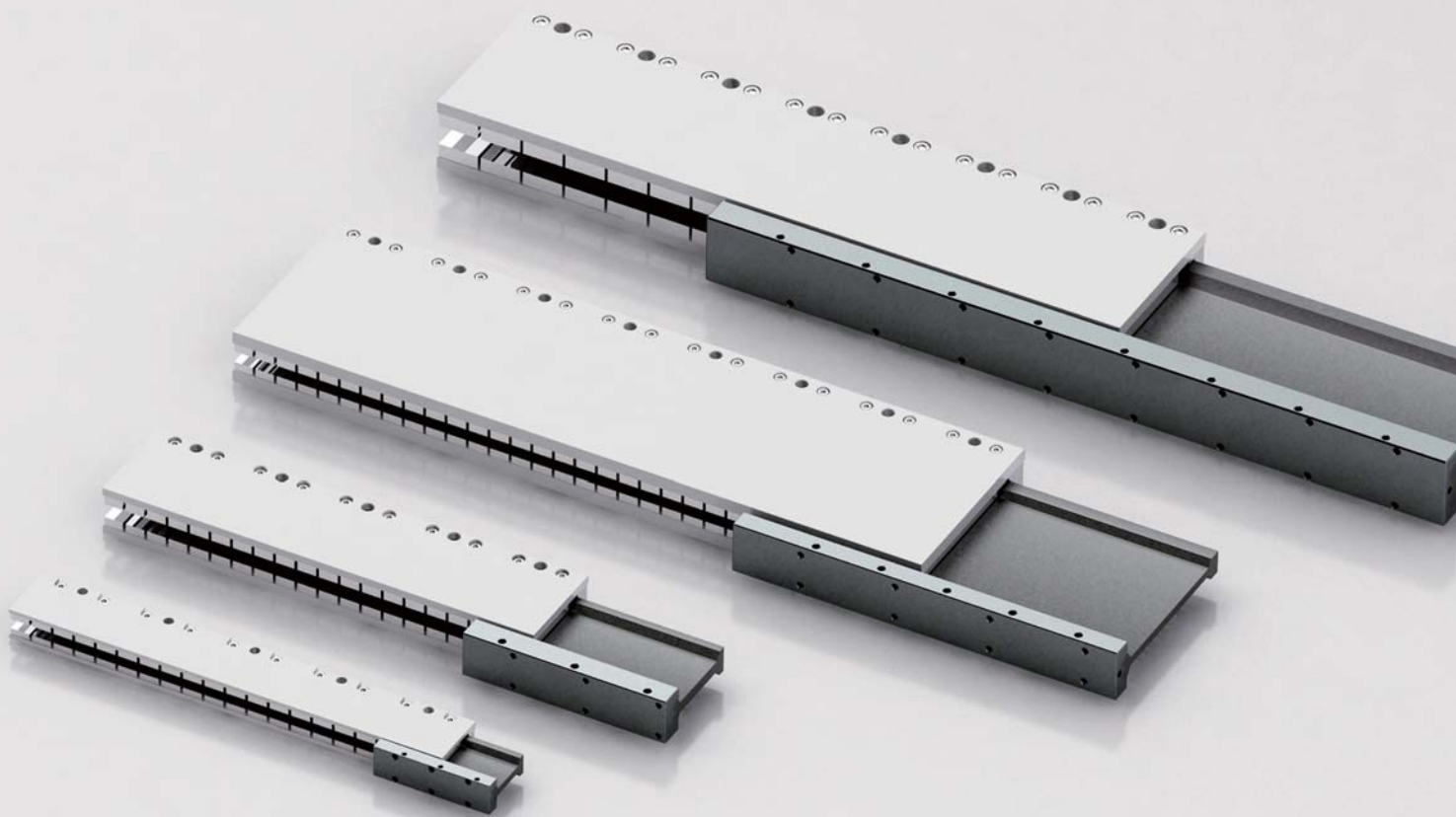


- **Magnetic Forces Contained**
Magnetic Way consists of a balanced dual-magnet track, so there are no magnetic forces to deal with during assembly.
- **No Cogging**
Ironless Coil Assembly results in zero cogging and super-smooth motion.
- **Low Weight Forcer**
Absence of iron results in higher acceleration and deceleration rates as well as a higher mechanical bandwidth.
- **Wide Air Gap**
Large air gap allows easy installation and alignment.

cpc Features



- **cpc** linear Motors are designed with overlapping coils to provide very high force density.
- **cpc** uses a vacuum-molding process to eliminate air bubbles from the finished epoxy mold. This results in a strengthened epoxy product with an enhanced lifetime.
- **cpc** linear motors are designed to have great dielectric strength, resulting in highly stable systems.
- **cpc** linear motors are very efficient at dissipating waste heat, allowing handling of larger currents for increased power.



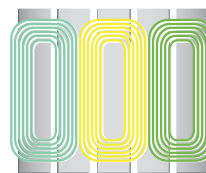
NEW PRODUCT

Linear Motion Technology

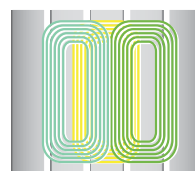
cpc Linear motor - overlapping windings for shorter overall length

- Superior thermal efficiency
- Compact package with high output
- Y-beam design for greater structural stiffness

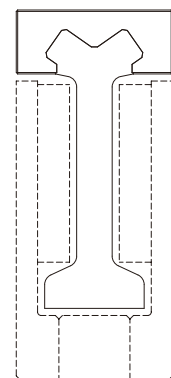
Instead of the conventional design in which the windings are arranged side by side, the **cpc** overlapping winding design creates higher power density. The result is a compact size motor with no sacrifice in performance. The Y-beam design results in an enlarged contact surface for better heat transfer and outstanding thermal efficiency.



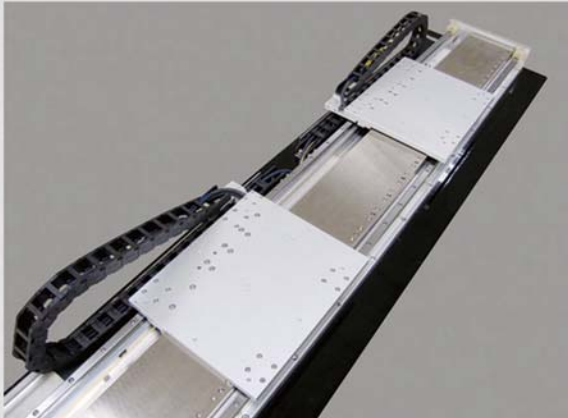
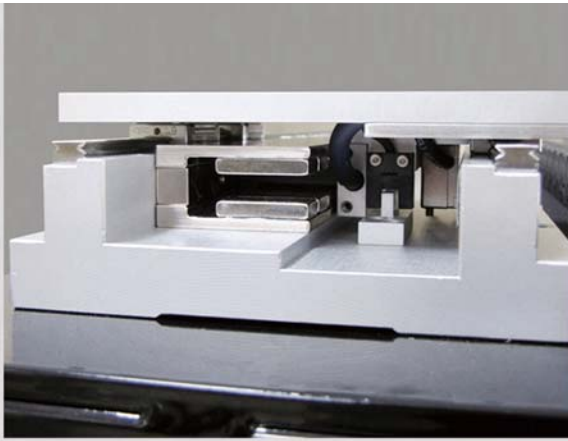
Non-overlapped windings result in longer package length



Overlapping windings for shorter overall length



Y-beam design



High Speed, High Precision

- Highly rigid, direct driven and fully closed loop system with corresponding high precision, high efficiency, and excellent high speed performance.

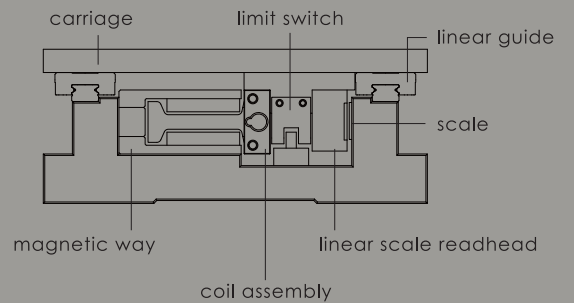
Suitable for Clean Environments

- No gear pitch error or backlash problems to cause noise. Very quiet even in high speed operation.
- No ball screw needed, no lubricant contamination issues. Suitable for clean room.

Simple Mechanism

- One Magnetic Way can operate with multiple Coil Assemblies, with each Coil Assembly driven independently.
- Multiple Magnetic Ways can be laid end to end to fit any length requirement.
- Simple and easy to use, even in applications with multiple Coil Assemblies or Magnetic Ways.

Typical linear motor application



Coil Assembly

Ordering Information:

LM	IL	PA	1	W1	N	NC	400				
								Cable Length in mm (400 mm Standard)			
								Cooling NC- no cooling AC- air cooling LC - liquid cooling			
								Halls N- no hall sensor H- with hall sensor			
								Winding Type W1- winding 1 W3- winding 3 W2- winding 2 W4- winding 4			
								Coil Assembly Length			
								PA type: 1-50mm 2-80mm		3-110mm 4-140mm 5-170mm	
								PB type: 2-80mm 3-110mm		4-140mm 5-170mm 6-200mm 8-260mm	
								PC type: 4-144mm 6-204mm		8-264mm	
								PD type: 2-154mm 4-274mm		6-394mm 8-514mm 10-634mm	
								Coil Assembly PA series PB series PC series PD series			
								Motor Type IL - ironless IC - ironcore			
Linear Motor											

Magnetic Way

Ordering Information:

LM	IL	SA	0								
				Magnetic Way Length 0 - 120 mm 1 - 300 mm 2 - 480 mm							
				Magnetic Way SA series SB series SC series SD series							
				Motor Type IL- ironless IC- ironcore							
Linear Motor											

LM-PA SERIES

Linear Motion Technology



LM-PA Coil Assembly Model

Coil Assembly Model	LM-PA1		LM-PA2		LM-PA3		LM-PA4			LM-PA5		
Winding code	W1	W1	W2	W1	W2	W1	W2	W3	W1	W2	W3	
Performance												
Peak force (N)	72	144		216		288			360			
Continuous force (N)	18	36		54		72			90			
Peak power (W)	505	1011		1516		1600			2525			
Continuous power (W)	31	63		94		100			155			
Mechanical												
Coil assembly length (mm)	50	80		110		140			170			
Coil assembly weight (kg)	0.08	0.12		0.19		0.23			0.40			
Magnetic way weight (kg/m)	4.2	4.2		4.2		4.2			4.2			
Electrical cycle length (mm)	30	30		30		30			30			
Electrical												
Continuous current (Arms)	2.0	2.0	4.0	2.0	4.0	2.0	4.0	8.0	2.0	4.0	8.0	
Peak current (Arms)	8.0	8.0	16.0	8.0	16.0	8	16	32	8	16	32	
Force constant (N/A)	9	18	9	27	13.5	36	18	9	45	22.5	11	
Back EMF constant (V/m/s)	8	16	8	24	12	32	16	8	40	20	10	
Ph-Ph resistance @25°C(Ω)	7.3	14.6	3.7	21.9	5.5	25	6.0	1.5	36	9	2.3	
Ph-Ph inductance @25°C(mH)	1.25	2.5	0.63	3.75	0.94	5	1.25	0.31	7.25	1.81	0.45	
Motor constant (N/√ W)	3.2	4.5	4.5	5.5	5.5	7.2	7.2	7.2	7.5	7.5	7.5	
Ph-PE dielectric strength	≥ 5KV (AC)		≥ 5KV (AC)		≥ 5KV (AC)		≥ 5KV (AC)			≥ 5KV (AC)		
Ph-PE insulation resistance	≥ 1KV (DC)		≥ 1KV (DC)		≥ 1KV (DC)		≥ 1KV (DC)			≥ 1KV (DC)		

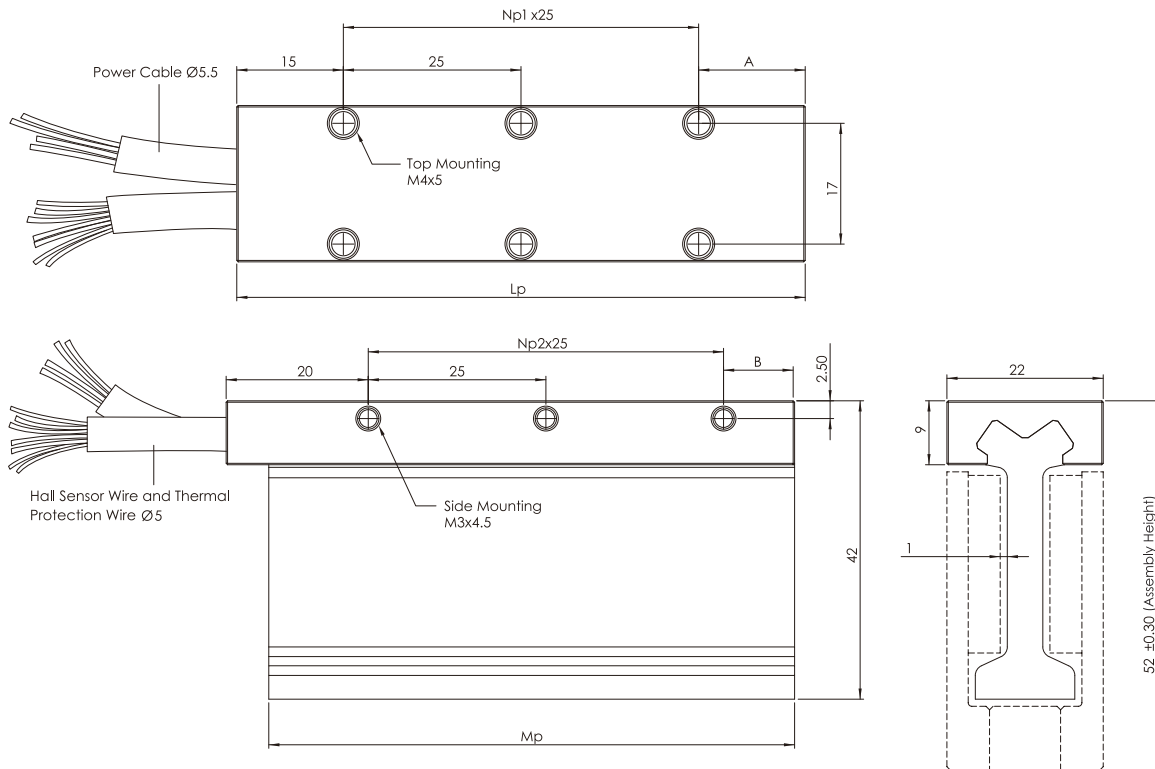
LM-PA Coil Assembly

	Np1	Np2	Lp	Mp
LM-PA 1	1	1	50	44
LM-PA 2	2	2	80	74
LM-PA 3	3	3	110	104
LM-PA 4	4	4	140	134
LM-PA 5	5	5	170	164

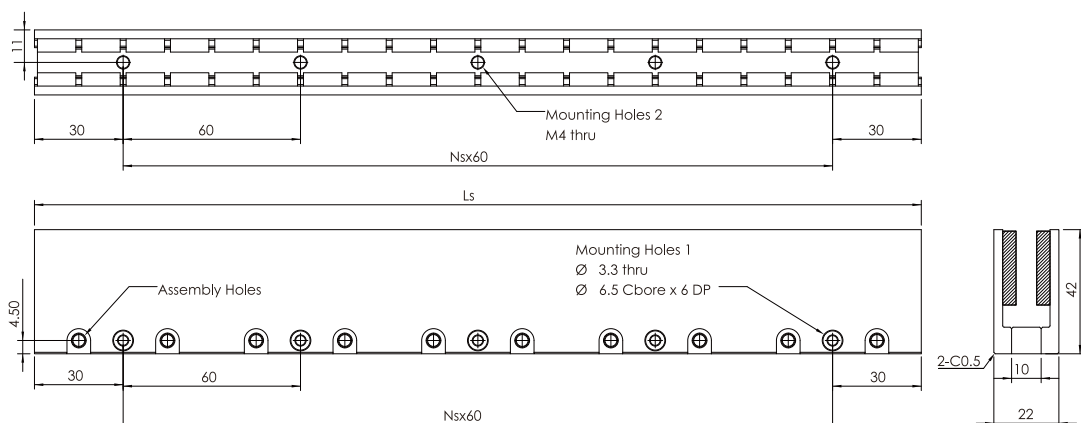
LM-SA Magnetic Way

	Ns	Ls
LM-SA0	1	120
LM-SA1	4	300
LM-SA2	7	480

LM-PA Coil Assembly

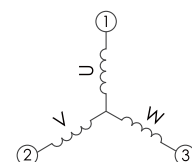


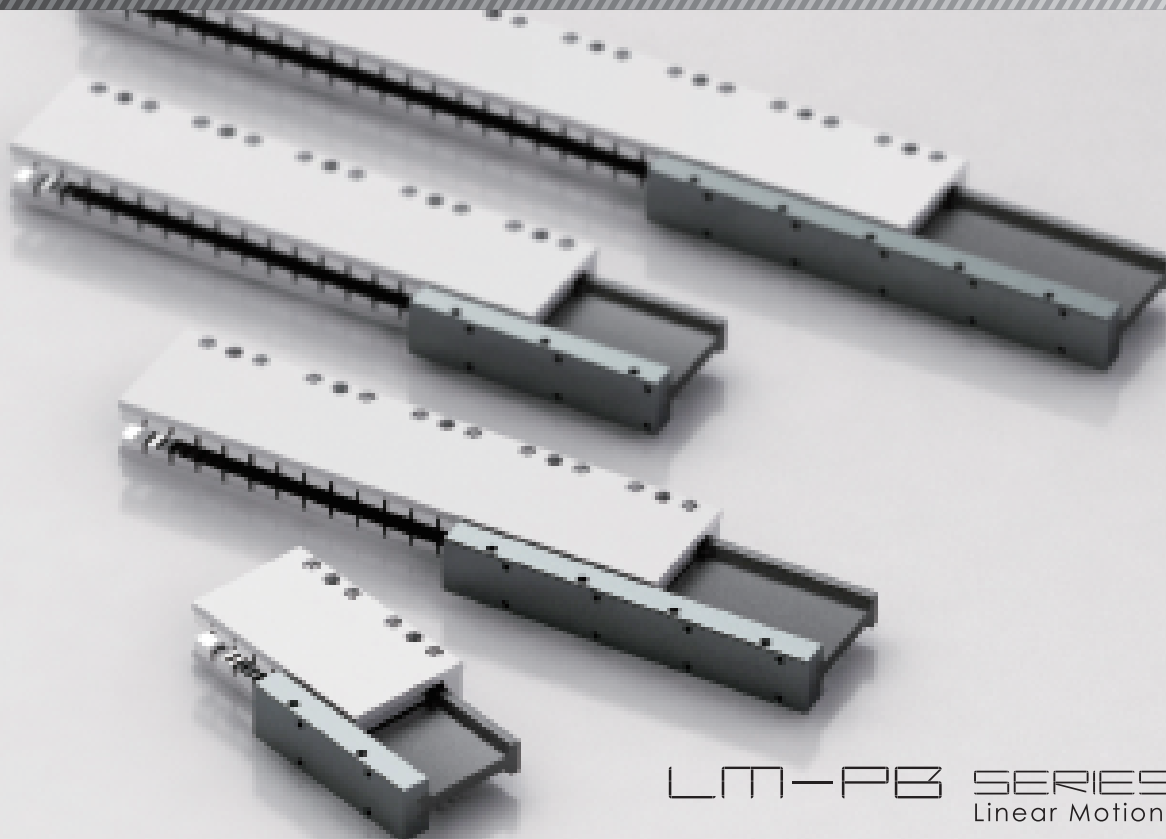
LM-SA Magnetic Way



OUTPUT CABLE (Cable standard length 400mm)

Motor Wire Table			Hall Sensor Wire Table and Thermal Protection Wire Table					
Pin Number	Function	Cross section	Color	Function	Cable Dia.	Color	Function	Cable Dia.
White	U phase	0.25mm ²	Pink	Hall A U phase	0.14 mm ²	Brown/Blue	Thermal sensor	0.14 mm ²
Yellow	V phase	0.25mm ²	Yellow	Hall B V phase	0.14 mm ²			
Brown	W phase	0.25mm ²	Green	Hall C W phase	0.14 mm ²			
Green	PE	0.25mm ²	Grey	Hall IC + 5V	0.14 mm ²			
			White	GND	0.14 mm ²			





LM-PB SERIES

Linear Motion Technology

LM-PB Coil Assembly Model

Coil Assembly Model	LM-PB2		LM-PB3		LM-PB4			LM-PB5			LM-PB6			LM-PB8			
	W1	W2	W1	W2	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3	W4
Performance																	
Peak force (N)	150		224		300			368			450			600			
Continuous force (N)	37.5		56.2		75			92			112.5			150			
Peak power (W)	684		1030		1517			1759			2073			1548			
Continuous power (W)	42		64		94			105			129			189			
Mechanical																	
Coil assembly length (mm)	80		110		140			170			200			260			
Coil assembly weight (kg)	0.17		0.26		0.31			0.39			0.46			0.58			
Magnet track weight (kg/m)	8.4		8.4		8.4			8.4			8.4			8.4			
Electrical cycle length (mm)	30		30		30			30			30			30			
Electrical																	
Continuous current (Arms)	2.0	4.0	2.0	4.0	2.1	4.2	8.4	2.0	4.0	8.0	2.0	4.0	8.0	2.1	4.2	8.4	16.0
Peak current (Arms)	8	16	8	16	8.4	16.8	33.6	8.0	16	32.0	8	16	32	8	16	32	64
Force constant (N/A)	18.7	9.3	28.1	14	35.7	17.8	8.9	45.9	23	11.5	56.2	28.1	14	75	37.5	18	9.3
Back EMF constant (V/m/s)	20.6	10.3	30.9	7.7	41.2	20.58	10.3	51.4	25.7	12.9	61.8	30.9	15.4	82.3	41.2	20.58	10.3
Ph-Ph resistance @25°C(Ω)	10.7	2.7	16.1	4	21.5	5	1.25	26.4	6.6	1.68	32.4	8.1	2.1	43.0	10	2.5	0.7
Ph-Ph inductance @25°C(mH)	6.52	1.63	9.78	2.44	13.04	3.26	0.82	26.08	6.52	1.63	39.12	9.78	2.44	26.08	6.52	1.63	0.4
Motor constant (N/√W)	5.78	5.78	7.02	7.02	7.73	7.73	7.73	8.8	8.8	8.8	9.9	9.9	9.9	10.91	10.91	10.91	10.91
Ph-PE dielectric strength	≥ 5KV (AC)		≥ 5KV (AC)		≥ 5KV (AC)			≥ 5KV (AC)			≥ 5KV (AC)			≥ 5KV (AC)			
Ph-PE insulation resistance	≥ 1KV (DC)		≥ 1KV (DC)		≥ 1KV (DC)			≥ 1KV (DC)			≥ 1KV (DC)			≥ 1KV (DC)			

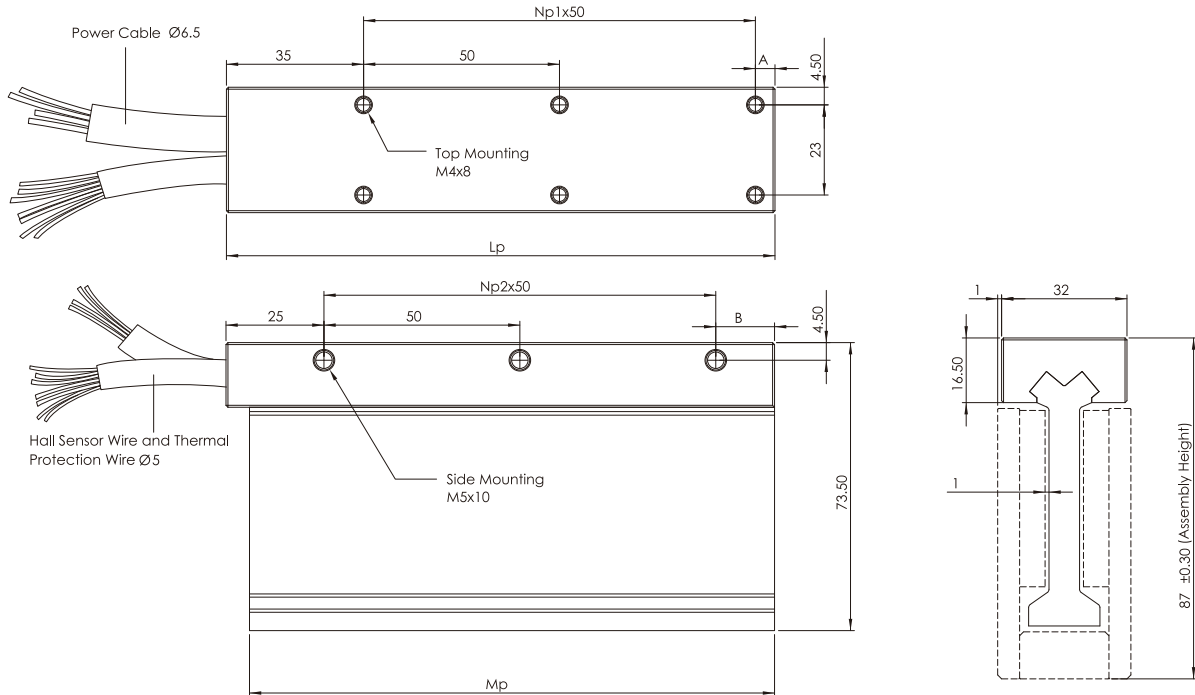
LM-PB Coil Assembly

	Np1	Np2	Lp	Mp
LM-PB2	1	1	80	74
LM-PB3	2	2	110	104
LM-PB4	2	2	140	134
LM-PB5	2	2	170	164
LM-PB6	3	3	200	194
LM-PB8	4	4	260	254

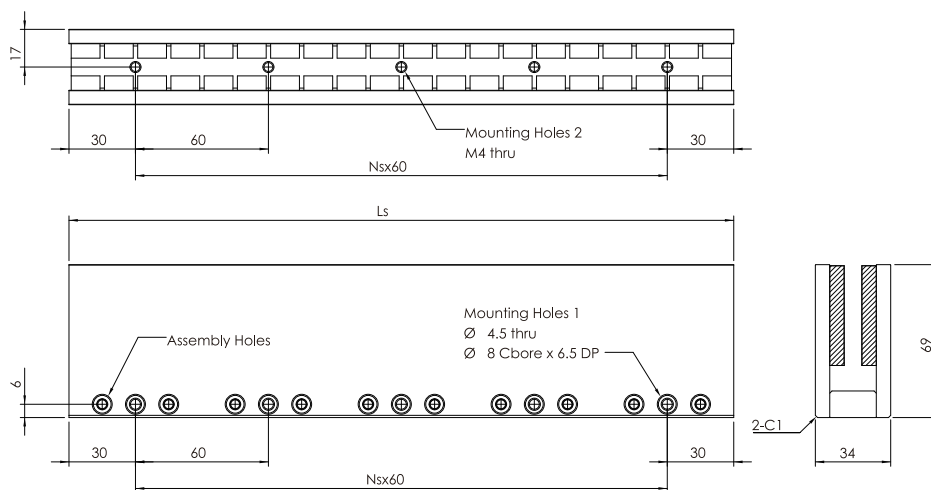
LM-SB Magnetic Way

	Ns	Ls
LM-SB0	1	120
LM-SB1	4	300
LM-SB2	7	480

LM-PB Coil Assembly

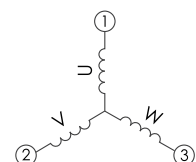


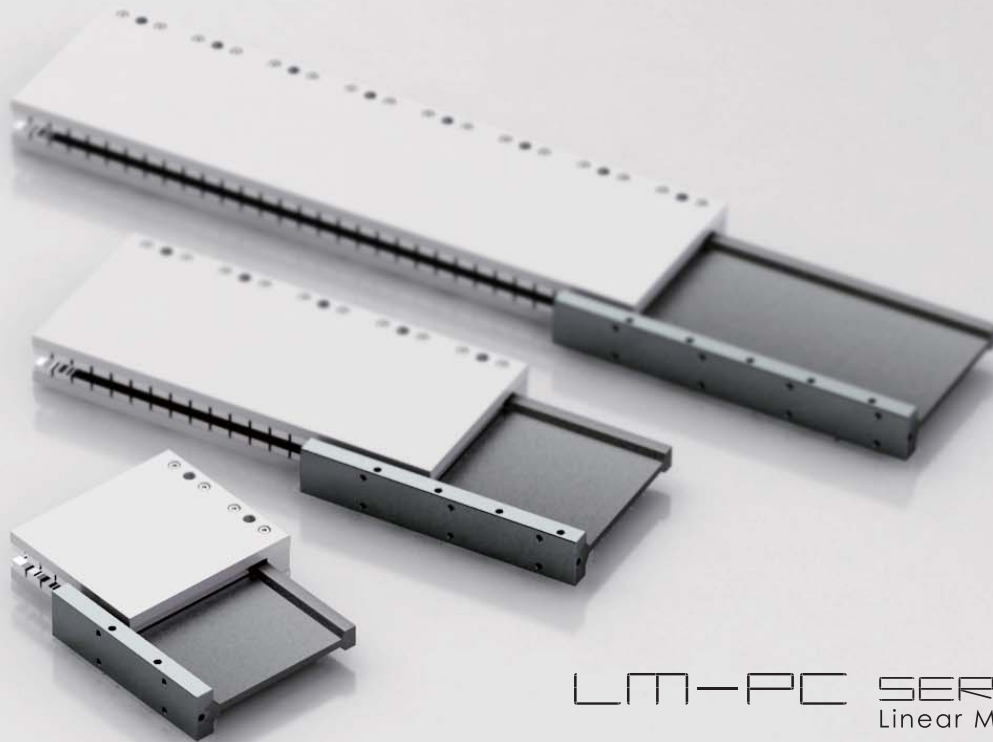
LM-SB Magnetic Way



OUTPUT CABLE (All cable standard length 400 mm)

Motor Wire Table			Hall Sensor Wire Table and Thermal Protection Wire Table						
Pin Number	Function	Cross section	Color	Function	Cable Dia.	Color	Function	Cable Dia.	
	White	U phase	0.5 mm ²	Pink	Hall A U phase	0.14 mm ²	Brown/Blue	Thermal sensor	0.14 mm ²
	Yellow	V phase	0.5 mm ²	Yellow	Hall B V phase	0.14 mm ²			
	Brown	W phase	0.5 mm ²	Green	Hall C W phase	0.14 mm ²			
	Green	PE	0.5 mm ²	Grey	Hall IC + 5V	0.14 mm ²			
				White	GND	0.14 mm ²			





LM-PC SERIES

Linear Motion Technology

LM-PC Coil Assembly Model

Coil Assembly Model	LM-PC4			LM-PC6			LM-PC8			
	W1	W2	W3	W1	W2	W3	W1	W2	W3	W4
Performance										
Peak force (N)	520			776			1048			
Continuous force (N)	130			194			259			
Peak power (W)	684			1368			2925			
Continuous power (W)	42			85			171			
Mechanical										
Coil assembly length (mm)	144			204			264			
Coil assembly weight (kg)	0.6			0.9			1.1			
Magnetic way weight (kg/m)	29.3			29.3			29.3			
Electrical cycle length (mm)	30			30			30			
Electrical										
Continuous current (Arms)	1.5	3.0	6.0	1.5	3.0	6.0	1.5	3.0	5.9	12.0
Peak current (Arms)	6.0	12.0	24.0	6.0	12.0	24.0	6.2	12.5	24.3	48
Force constant (N/A)	86.6	43.3	21.6	129	64.6	32.3	172	86	44	22
Back EMF constant (V/m/s)	45.5	22.8	11.4	91	45.5	22.8	182	91	45.5	22.7
Ph-Ph resistance @25°C(Ω)	19	4.8	1.2	38	9.5	2.4	76.1	19.2	4.8	12
Ph-Ph inductance @25°C(mH)	26.4	13.2	6.6	39.6	9.9	2.4	52.8	13.2	6.6	1.6
Motor constant (N/√ W)	20	20	20	21	21	21	19.7	19.7	19.7	19.7
Ph-PE dielectric strength	≥ 5KV (AC)			≥ 5KV (AC)			≥ 5KV (AC)			
Ph-PE insulation resistance	≥ 1KV (DC)			≥ 1KV (DC)			≥ 1KV (DC)			

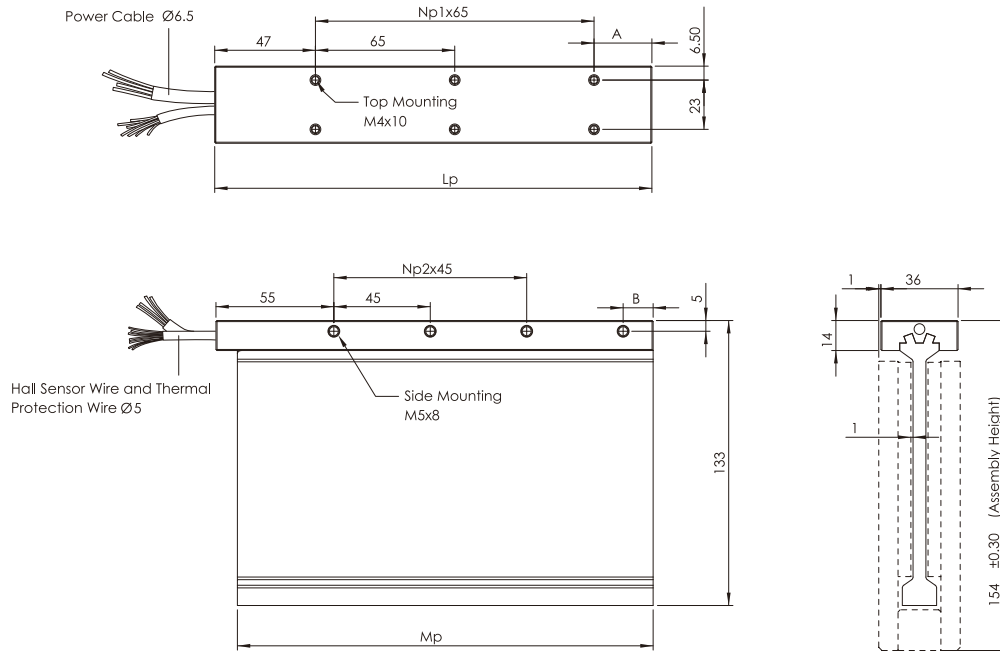
LM-PC Coil Assembly

	Np1	Np2	Lp	Mp
LM-PC4	1	1	144	134
LM-PC6	2	3	204	194
LM-PC8	4	4	264	254

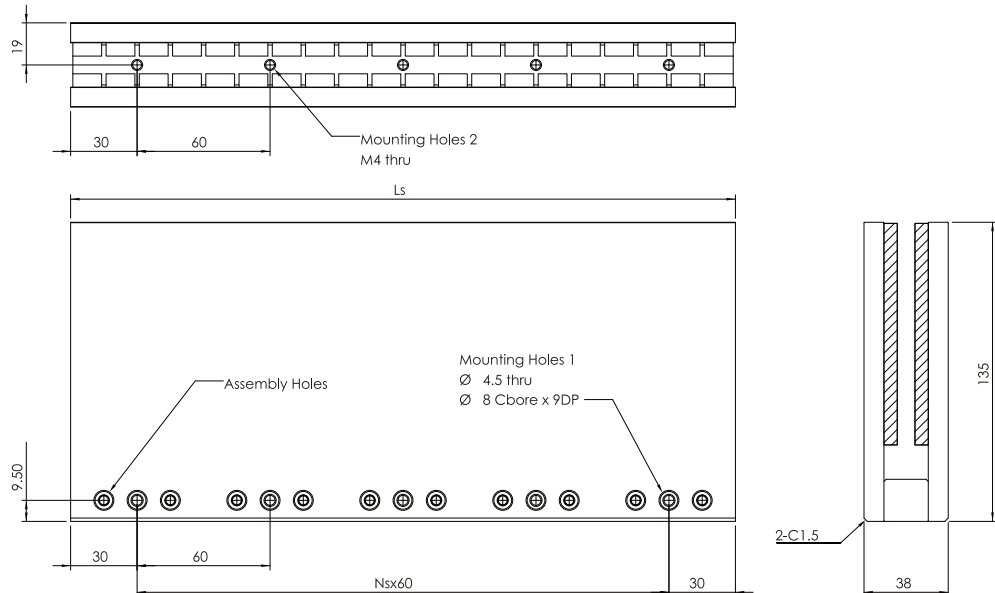
LM-SC Magnetic Way

	Ns	Ls
LM-SC0	1	120
LM-SC1	4	300
LM-SC2	7	480

LM-PC Coil Assembly

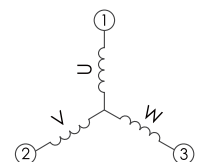


LM-SC Magnetic Way



OUTPUT CABLE (Cable standard length 400mm)

Motor Wire Table			Hall Sensor Wire Table and Thermal Protection Wire Table					
Pin Number	Function	Cross section	Color	Function	Cable Dia.	Color	Function	Cable Dia.
White	U phase	0.5 mm ²	Pink	Hall A U phase	0.14 mm ²	Brown/Blue	Thermal sensor	0.14 mm ²
Yellow	V phase	0.5 mm ²	Yellow	Hall B V phase	0.14 mm ²			
Brown	W phase	0.5 mm ²	Green	Hall C W phase	0.14 mm ²			
Green	PE	0.5 mm ²	Grey	Hall IC + 5V	0.14 mm ²			
			White	GND	0.14 mm ²			





LM-PD SERIES

Linear Motion Technology

LM-PD Coil Assembly Model

Coil Assembly Model	LM-PD2		LM-PD4			LM-PD6			LM-PD8			LM-PD10		
	W1	W2	W1	W2	W3	W1	W2	W3	W1	W2	W3	W1	W2	W3
Performance														
Peak force (N)	1240		2480			3720			4960			6200		
Continuous force (N)	310		620			930			1240			1550		
Peak power (W)	2600		5200			7800			10400			13000		
Continuous power (W)	162.5		325			487.5			650			812.5		
Mechanical														
Coil assembly length (mm)	154		274			394			514			634		
Coil assembly weight (kg)	1.3		2.23			3.14			4.11			5.1		
Magnetic way weight (kg/m)	29.8		29.8			29.8			29.8			29.8		
Electrical cycle length (mm)	60		60			60			60			60		
Electrical														
Continuous current (Arms)	2.5	5	2.5	5	10	2.5	5	10	2.5	5	10	2.5	5	10
Peak current (Arms)	10	20	10	20	40	10	20	40	10	20	40	10	20	40
Force constant (N/A)	124	62	248	124	62	372	186	93	496	248	122	620	310	155
Back EMF constant (V/m/s)	58	29	116	58	29	174	87	43.5	232	116	58	290	145	36.3
Ph-Ph resistance @25°C(Ω)	26	6.5	52	13	3.3	78	19.5	4.9	104	26	6.6	130	32.5	8.1
Ph-Ph inductance @25°C(mH)	26.4	6.6	52.8	13.2	3.3	79.2	59.8	5	105.6	26.4	6.6	132	33	8.3
Motor constant (N/A/W)	20.9	20.9	29.6	29.6	29.6	36.2	36.2	36.2	41.9	41.9	41.9	46.8	46.8	46.8
Ph-PE dielectric strength	≥ 5KV (AC)		≥ 5KV (AC)			≥ 5KV (AC)			≥ 5KV (AC)			≥ 5KV (AC)		
Ph-PE insulation resistance	≥ 1KV (DC)		≥ 1KV (DC)			≥ 1KV (DC)			≥ 1KV (DC)			≥ 1KV (DC)		

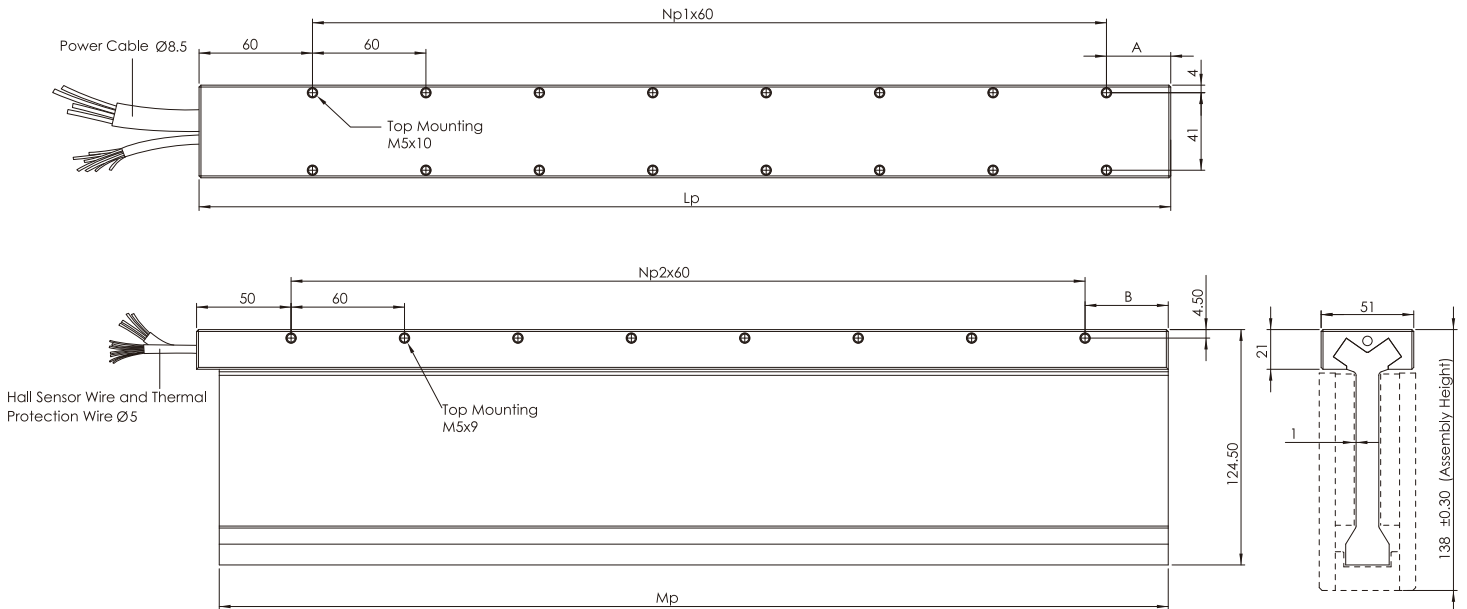
LM-PD Coil Assembly

	Np1	Np2	Lp	Mp
LM-PD2	1	1	154	144
LM-PD4	3	3	274	264
LM-PD6	5	5	394	384
LM-PD8	7	7	514	504
LM-PD10	9	9	634	624

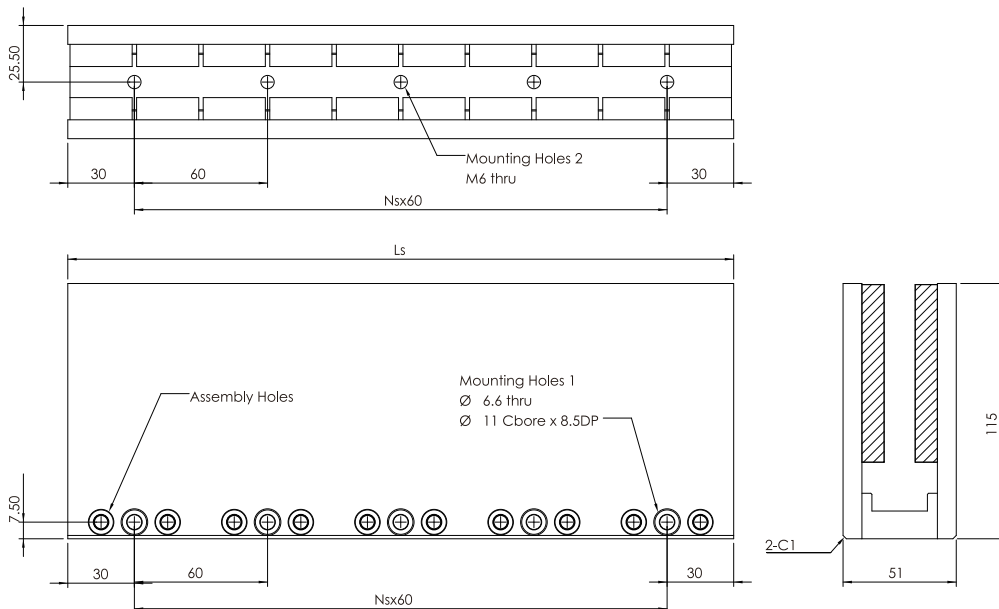
LM-SD Magnetic Way

	Ns	Ls
LM-SD0	1	120
LM-SD1	4	300
LM-SD2	7	480

LM-PD Coil Assembly

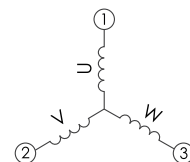


LM-SD Magnetic Way



OUTPUT CABLE (Cable standard length 400mm)

Motor Wire Table			Hall Sensor Wire Table and Thermal Protection Wire Table						
Pin Number	Function	Cross section	Color	Function	Cable Dia.	Color	Function	Cable Dia.	
	White	U phase	1.5 mm ²	Pink	Hall A U phase	0.14 mm ²	Brown/Blue	Thermal sensor	0.14 mm ²
	Yellow	V phase	1.5 mm ²	Yellow	Hall B V phase	0.14 mm ²			
	Brown	W phase	1.5 mm ²	Green	Hall C W phase	0.14 mm ²			
	Green	PE	1.5 mm ²	Grey	Hall IC + 5V	0.14 mm ²			
				White	GND	0.14 mm ²			



Selection Example: How to size a linear motor

Example:

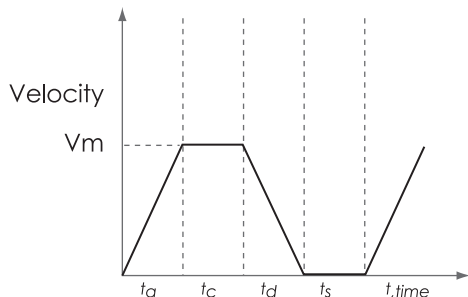
Load: $M1 = 5\text{kg}$

Stroke: $S_{\text{total}} = 300\text{mm}$

Cycle time: 100 cycle/min

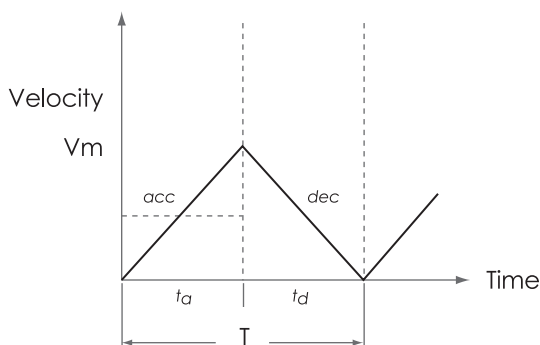
Number of Motors: $n = 1$

1. Move profile



Symbol	Meaning	SI	English
t_a	Acceleration time	m	in
t_c	Time at constant move	S	S
t_d	Deceleration time	S	S
t_s	Stop time	S	S
V_m	Max velocity	m/S	in/S

Assuming $t_a = t_d$ and $t_s = t_c = 0$
move profile is triangular.



2. Acceleration

Moving weight:

Table + coil + block + + load = $1.5 + 5 = 6.5\text{ kg}$

$$T = \frac{60}{100} \frac{\text{sec}}{\text{cycle}} = 0.6 \text{ sec}$$

$$\left(\frac{1}{2} S_{\text{total}} \right) = \frac{1}{2} \times a \times \left(\frac{1}{2} T \right)^2$$

$$150 = \frac{1}{2} \times a \times (0.3)^2 \quad a = 3.3 \text{ m/s}^2$$

3. Force

$$F = ma = 6.5 \times 3.3 = 21.45\text{N} \quad \text{①}$$

Therefore, we select a motor delivering a continuous force higher than F.

From ①, select LM-PA2 with continuous force of 36N.

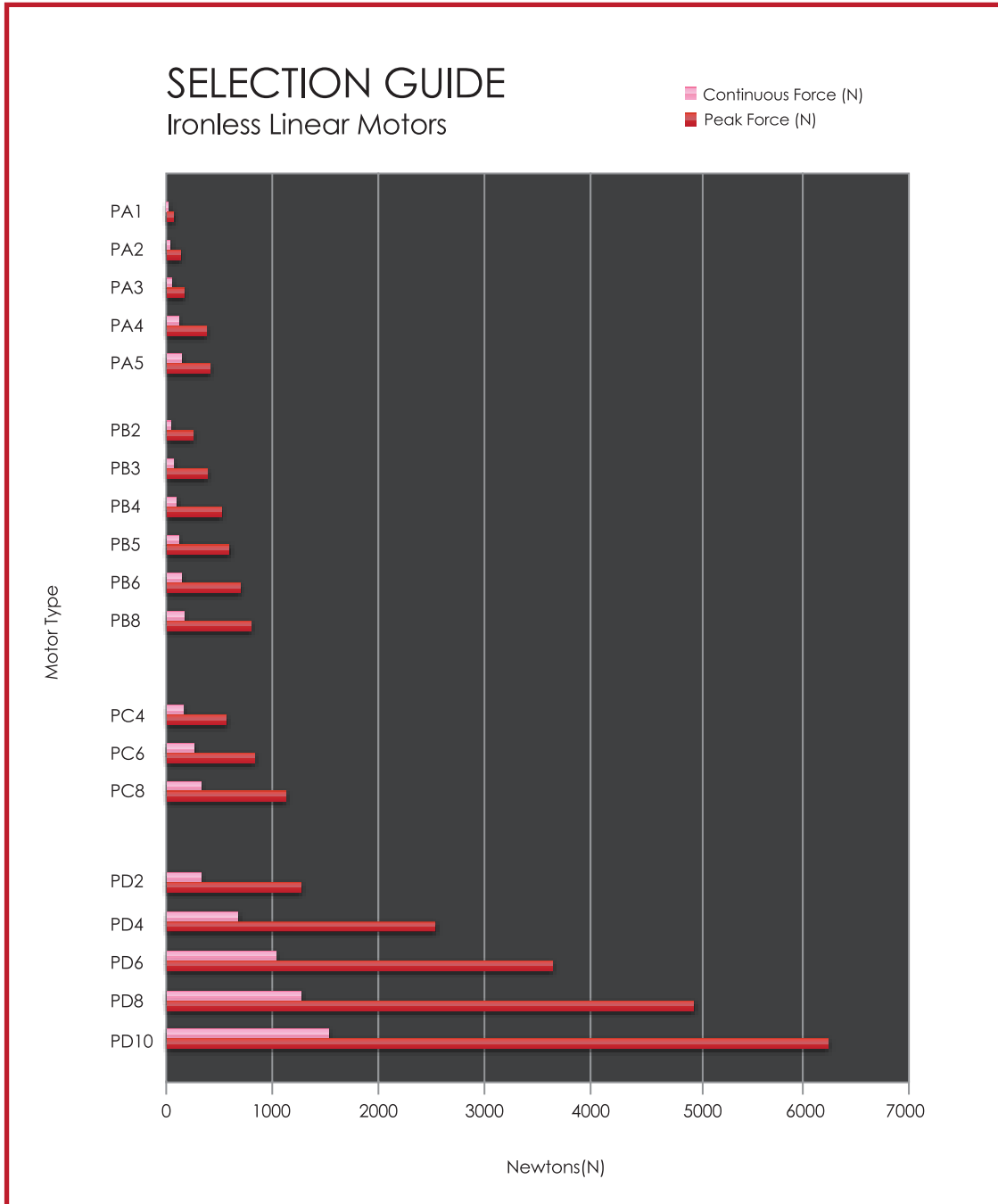
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Specifications of LM-PA2

Continuous force : 36N, Peak force : 144N

4. Checking

$$F = ma = (6.5 + 0.12) \times 3.3 = 21.84\text{N} < 36\text{N (applicable)}$$



Type	PA1	PA2	PA3	PA4	PA5	PB2	PB3	PB4	PB5	PB6	PB8	PC4	PC6	PC8	PD2	PD4	PD6	PD8	PD10
Continuous force(N)	18	36	54	72	90	37.5	56.2	75	92	112.5	150	130	194	259	310	620	930	1240	1550
Peak force(N)	72	144	216	288	360	150	224	300	368	450	600	520	776	1048	1240	2480	3720	4960	6200
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* Please note that the specifications are subject to change without notice due to product improvements.



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