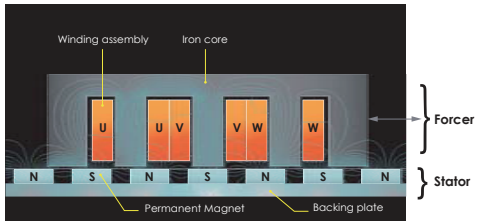
Ironcore Linear Motor

Construction & Features

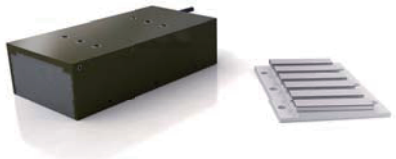
Iron core linear motors are suitable for use in high acceleration, high velocity and high load point to point linear motion applications.

Structure



- **cpc** linear motors are composed of two parts: The stator and the forcer.
- Forcer is made by combining coil windings with an iron core encapsulated by epoxy inside an aluminum outer shell.
- Stator is composed of arrays of permanent magnets on a ferromagnetic backing plate. The magnets are arranged in a N-S pole pattern, forming a closed magnetic field loop with the forcer iron core.

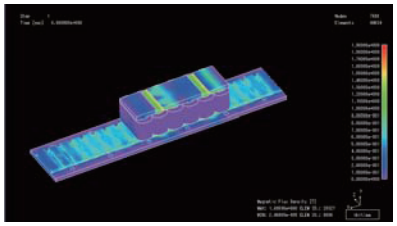
Advantages



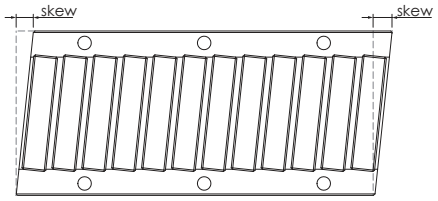
- **High Force Density**
  Due to stronger magnetic coupling between the iron core and the stator magnets. Iron core linear motors have relatively higher force output than ironless linear motors.
- **High Heat Dissipation**
  The iron core provides a dissipation path for the heat produced by the coils during operation, reducing the coil-to-ambient thermal resistance compared with ironless linear motors.
- **Easy assembly**
  For iron core linear motors the forcer and stator are directly facing and is easier to assemble.

cpc Features

- **cpc** For motor parameters, force constant refers to the amount of force produced per one ampere of current, while motor constant is the force produced per Watt and is representative of the motor's efficiency. As such the motor constant is a better metric at evaluating motor performance. cpc's linear motors have been designed with the aid of advanced simulation software. As a result, for a given dimension cpc's motor has a higher motor constant.



- **Low Cogging Force**
  Cogging force originates from the magnetic pull on the iron core during transitions across magnetic poles on the stator. By skewing the magnets the transition zone characteristics can be refined. Using advanced software analysis **cpc** arrived at a design with low cogging force

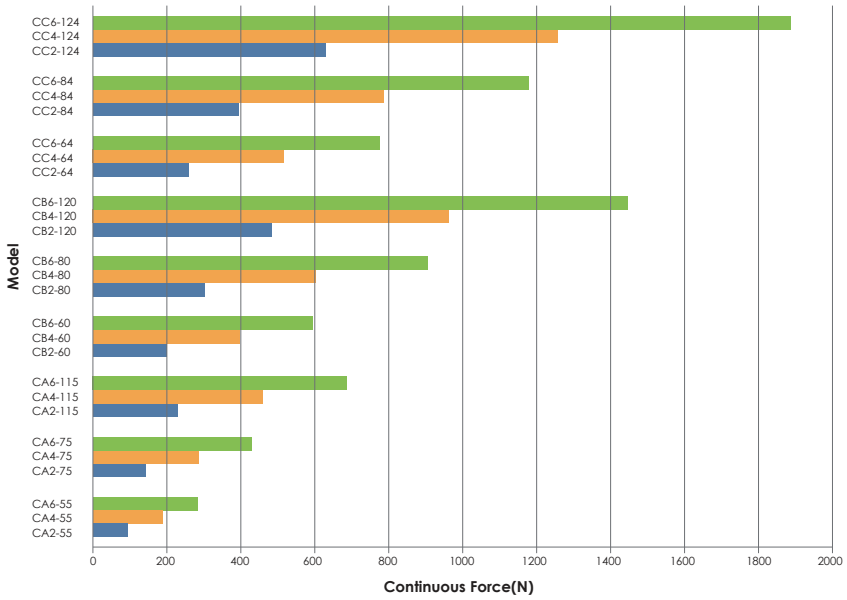


- **Heat Dissipative Case**
  In a **cpc** iron core motor the outer casing is made of aluminum, increasing heat dissipation area and lowering thermal resistance.
- **Integrated Hall Sensor and Temperature Switch**
  cpc's motor forcer fully utilizes its internal volume, integrating hall sensors and an over temperature detection switch for the user, without having to buy or install as optional extras.

Applications

1. Automated storage
2. Pick & Place
3. Industrial Automation
4. Semiconductors
5. Medical equipment
6. PCB industry
7. Printing industry

Continuous Force Overview



Ordering Information

Coil Assembly

LM	IC	CA	2	75	S	H	NC	400

- **Linear Motor**
- **Motor Type** IL - Ironless IC - Ironcore
- **Coil Assembly** CA series、CB series、CC series
- **Winding Quantity** 2 - 2 coils、4 - 4 coils、6 - 6 coils
- **Assembly width** CC-64,84,124、CA-55,75,115、CB-60,80,120
- **Winding Type** S,SP,P,D
- **Halls** N - no hall sensor, H - with hall sensor
- **Cooling** NC - no cooling, WC - water cooling
- **Cable Length** in mm (400mm Standard)

Magnetic Way

LM	IC	MA	0	75	N

- **Linear Motor**
- **Motor Type** IL - Ironless IC - Ironcore
- **Magnetic Way** MA series、MB series、MC series
- **Magnetic Way Length**
  0-MA : 120 MB : 120 MC : 114
  1-MA : 360 MB : 300 MC : 304
  2-MA : 480 MB : 480 MC : 456
- **Assembly width** CC-64,84,124 CA-55,75,115 CB-60,80,120
- **Magnet Protection**
  1. N - None
  2. S - Stainless Steel
  3. E - Epoxy

cpc also provides servo drives, optical linear scales and magnetic linear scale, for more details please contact **cpc**.

LM-CA-55 Coil Assembly Model

Coil Assembly Model	LM-CA2-55			LM-CA4-55			LM-CA6-55		
Winding code	S	P	D	SP	P	D	SP	P	D
Performance[4]									
Peak Force with heat sink(N)[1][2]	242.1			484.2			726.3		
Peak Force without heat sink(N)[2][3]	138.8			277.6			416.4		
Continuous Force with heat sink(N)[1][2]	94.2			188.3			282.5		
Continuous Force without heat sink(N)[2][3]	53.8			107.6			161.4		
Peak Force in linear range(N)	174.9			349.7			524.6		
Attraction Force(N)	350.0			700.0			1050		
Peak power(W)[1][2]	1215			2430			3645		
Continuous power(W)[1][2]	66.2			132.3			198.5		
Mechanical									
Coil assembly length(mm)	97			177			257		
Coil assembly weight(kg)[2]	0.6			1.1			1.6		
Magnetic way weight(kg/m)[2]	2.6			2.6			2.6		
Pole pitch(mm)	20			20			20		
Electrical[4]									
Continuous Current with heat sink(A_{pk})[1][2]	1.8	3.5	7.0	3.5	7.0	14.4	3.5	10.5	21.0
Continuous Current without heat sink(A_{pk})[2][3]	1.0	2.0	4.0	2.0	4.0	8.0	2.0	6.0	12.0
Peak Current with heat sink(A_{pk})[1][2]	7.5	15.0	28.0	15.0	30.0	60.0	15.0	45.0	90.0
Peak Current without heat sink(A_{pk})[2][3]	4.4	8.7	13.1	8.7	17.4	34.8	8.7	26.1	52.2
Peak Current in linear range(N)	3.3	6.5	13.2	6.6	13.2	20.0	6.6	19.8	40.0
Force Constant(N/A_{pk})[2]	53.8	26.9	13.5	53.8	26.9	13.5	80.7	26.9	13.5
Back EMF Constant(V/m/s)[2]	67.4	33.7	16.9	67.4	33.7	16.9	101.1	33.7	16.9
Resistant(Ohms)[2]	21.6	5.4	1.4	10.8	2.7	0.7	16.2	1.8	0.5
Inductance(mH)[2]	100.00	25.00	6.25	50.00	12.50	3.13	75.00	8.30	2.10
Time Constant(ms)[2]	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Thermal Resistant with heat sink(°C/W)[1][2]	1.1			0.6			0.4		
Thermal Resistant without heat sink(°C/W)[2][3]	3.4			1.7			1.1		
Motor Constant(N/√W)[2]	11.6			16.4			20.1		

(1) The value applies to static sinusoidal drive, specific heat sink (a 25mm aluminum heat sink whose area equals 11x the coil mounting area) and temperature from 25°C up to 110°C. The actual performance is dependent to heat sink configuration, system cooling condition and ambient temperature.
(2) The tolerance of all performance and electrical specification is ±10%
(3) The value applies to static sinusoidal drive and temperature from 25°C up to 110°C, without heat sink.
(4) Above "withoutheatsink" figure assumes a working condition of 1atm, 25°Cambient temperature, with the linear motor stationary and not in contact with any other objects, thus relying only on free air convection for cooling. As all heat conductive objects in direct contact with the linear motor, including slide plate, linear guide and base etc.can be considered as a kind of heat sink, the "with heat sink" figure should be taken as the primaryreference in actual application design.

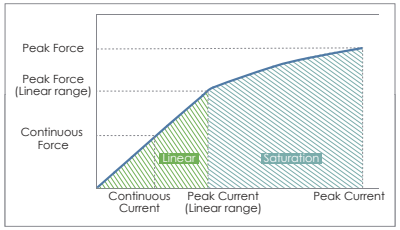
LM-CA-55 Coil Assembly

	Np1	Lp
LM-CA2-55	1	97
LM-CA4-55	3	177
LM-CA6-55	5	257

LM-MA-55 Magnetic Way

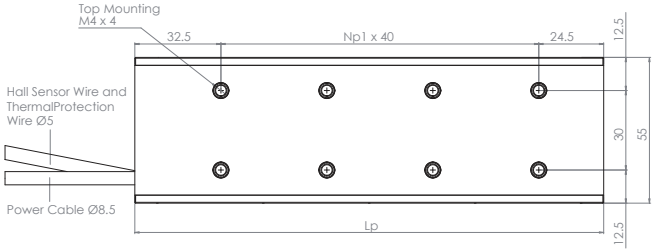
	Ns	Lt	Ls	Ls1
LM-MA0-55	2	126	120	110
LM-MA1-55	8	366	360	350
LM-MA2-55	11	486	480	470

Current VS Force.

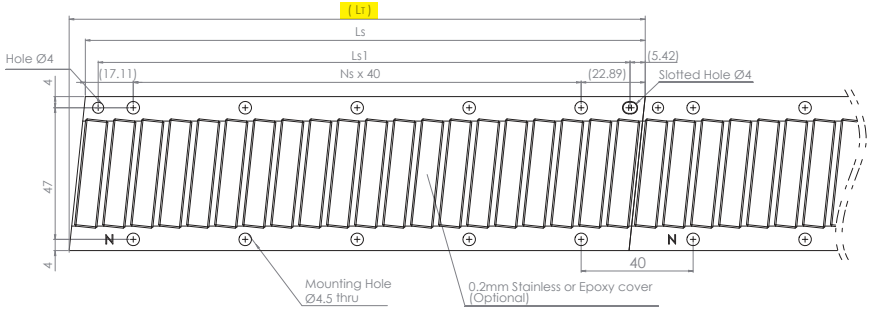


When the motor its operating in its linear regin, its thrust output is directly proportional to input current and the force constant is fixed.
When operating in the saturation regin,output thrust is not linearly proportional due to magnetic saturation,resulting in less thrust increase than expected.

LM-CA-55 Coil Assembly

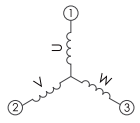


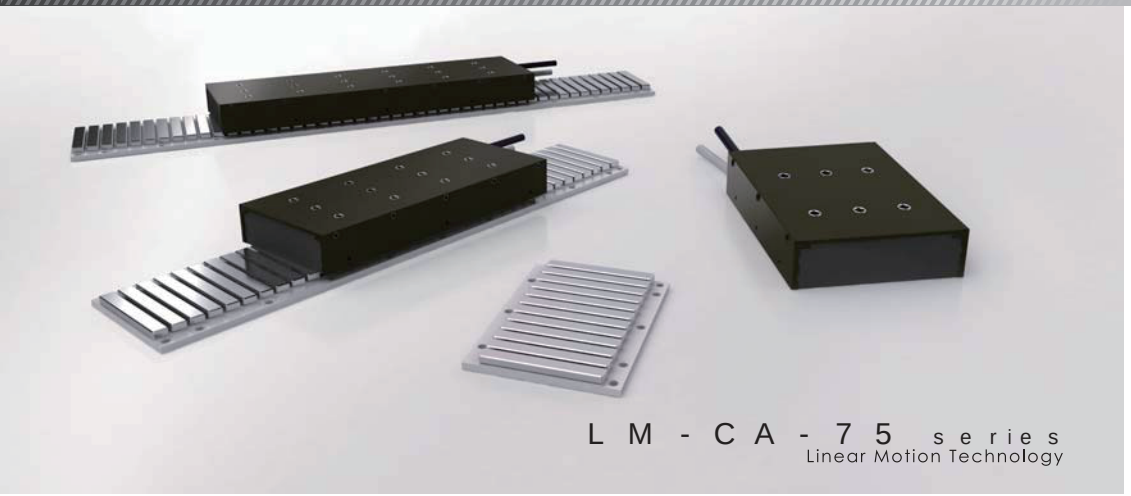
LM-MA-55 Magnetic Way



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	1.5mm²	Pink	Hall A U phase	0.14 mm²	Brown/Blue	Thermal sensor	0.14 mm²
Yellow	V phase	1.5mm²	Yellow	Hall B V phase	0.14 mm²			
Brown	W phase	1.5mm²	Green	Hall C W phase	0.14 mm²			
Green	PE	1.5mm²	Grey	HallIC + 5V	0.14 mm²			
			White	GND	0.14 mm²			





LM-CA-75 Coil Assembly Model

Coil Assembly Model	LM-CA2-75			LM-CA4-75			LM-CA6-75	
Winding code	S	P	D	SP	P	D	P	D
Performance[4]								
Peak Force with heat sink(N)[1][2]	368.0			736.0			1104.0	
Peak Force without heat sink(N)[2][3]	213.4			426.9			640.3	
Continuous Force with heat sink(N)[1][2]	143.1			286.2			429.3	
Continuous Force without heat sink(N)[2][3]	81.8			163.6			245.3	
Peak Force in linear range(N)	265.8			531.5			797.3	
Attraction Force(N)	505			1009			1514	
Peak power(W)[1][2]	1665			3330			4995	
Continuous power(W)[1][2]	90.7			181.3			272.0	
Mechanical								
Coil assembly length(mm)	97			177			257	
Coil assembly weight(kg)[2]	0.8			1.5			2.2	
Magnetic way weight(kg/m)[2]	3.5			3.5			3.5	
Pole pitch(mm)	20			20			20	
Electrical[4]								
Continuous Current with heat sink(A_{pk})[1][2]	1.8	3.5	7.0	3.5	7.0	14.0	10.5	21.0
Continuous Current without heat sink(A_{pk})[2][3]	1.0	2.0	4.0	2.0	4.0	8.0	6.0	12.0
Peak Current with heat sink(A_{pk})[1][2]	7.5	15.0	28.0	15.0	30.0	60.0	45.0	60.0
Peak Current without heat sink(A_{pk})[2][3]	4.4	8.7	13.1	8.7	17.4	34.8	26.1	52.2
Peak Current in linear range(N)	3.3	6.5	13.2	6.6	13.2	20.0	19.8	39.6
Force Constant(N/A_{pk})[2]	81.8	40.9	20.4	81.8	40.9	20.4	40.9	20.4
Back EMF Constant(V/m/s)[2]	102.4	51.2	25.6	102.4	51.2	25.6	51.2	25.6
Resistant(Ohms)[2]	29.6	7.4	1.9	14.8	3.7	0.9	2.5	0.6
Inductance(mH)[2]	137.03	34.26	8.57	68.52	17.13	4.28	11.4	2.9
Time Constant(ms)[2]	4.6	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Thermal Resistant with heat sink(°C/W)[1][2]	0.8			0.4			0.3	
Thermal Resistant without heat sink(°C/W)[2][3]	2.5			1.2			0.8	
Motor Constant(N/√W)[2]	15.0			21.3			26.0	

(1) The value applies to static sinusoidal drive, specific heat sink (a 25mm aluminum heat sink whose area equals 11x the coil mounting area) and temperature from 25°C up to 110°C. The actual performance is dependent to heat sink configuration, system cooling condition and ambient temperature.
(2) The tolerance of all performance and electrical specification is ±10%
(3) The value applies to static sinusoidal drive and temperature from 25°C up to 110°C, without heat sink.
(4) Above "withoutheatsink" figure assumes a working condition of 1atm, 25°Cambient temperature, with the linear motor stationary and not in contact with any other objects, thus relying only on free air convection for cooling. As all heat conductive objects in direct contact with the linear motor, including slide plate, linear guide and base etc.can be considered as a kind of heat sink, the "with heat sink" figure should be taken as the primaryreference in actual application design.

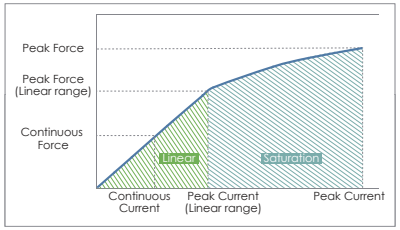
LM-CA-75 Coil Assembly

	Np1	Lp
LM-CA2-75	1	97
LM-CA4-75	3	177
LM-CA6-75	5	257

LM-MA-75 Magnetic Way

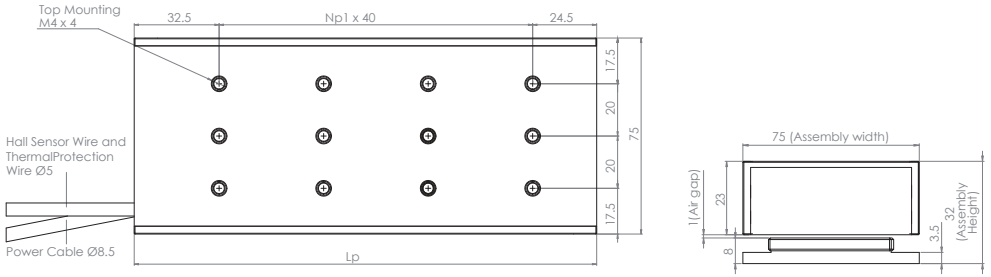
	Ns	Lt	Ls	Ls1
LM-MA0-75	2	126	120	110
LM-MA1-75	8	366	360	350
LM-MA2-75	11	486	480	470

Current VS Force.

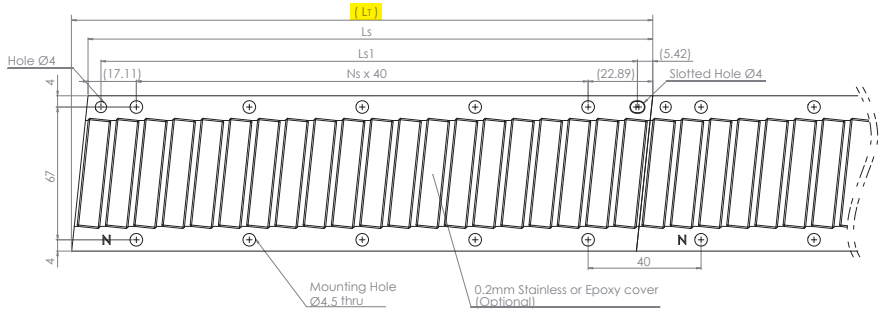


When the motor its operating in its linear regin, its thrust output is directly proportional to input current and the force constant is fixed.
When operating in the saturation regin,output thrust is not linearly proportional due to magnetic saturation,resulting in less thrust increase than expected.

LM-CA-75 Coil Assembly

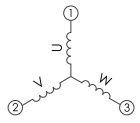


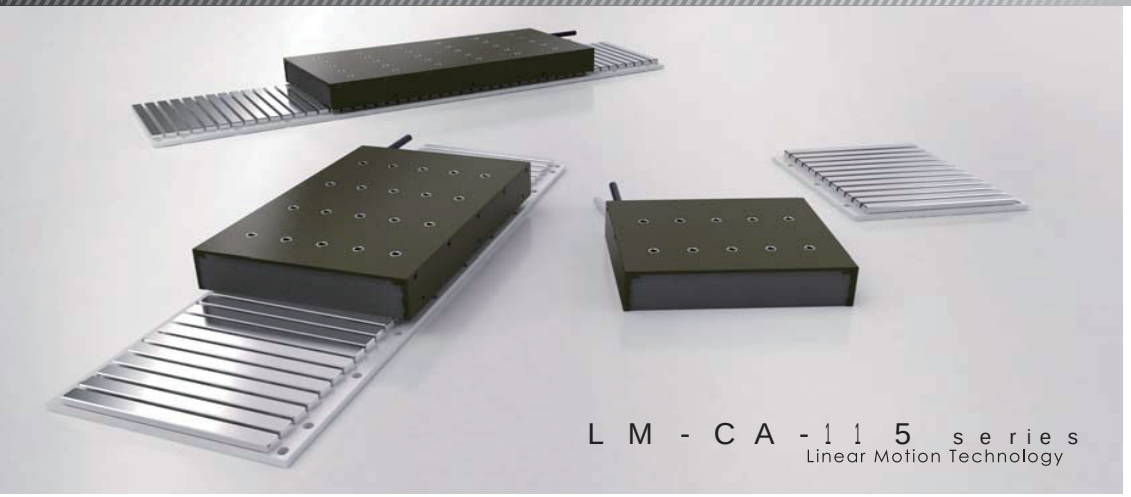
LM-MA-75 Magnetic Way



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	1.5mm²	Pink	Hall A U phase	0.14 mm²	Brown/Blue	Thermal sensor	0.14 mm²
Yellow	V phase	1.5mm²	Yellow	Hall B V phase	0.14 mm²			
Brown	W phase	1.5mm²	Green	Hall C W phase	0.14 mm²			
Green	PE	1.5mm²	Grey	Hall IC + 5V	0.14 mm²			
			White	GND	0.14 mm²			





LM-CA-115 Coil Assembly Model

Coil Assembly Model	LM-CA2-115		LM-CA4-115		LM-CA6-115	
Winding code	P	D	P	D	P	D
Performance[4]						
Peak Force with heat sink(N)[1][2]	588.8		1177.6		1766.4	
Peak Force without heat sink(N)[2][3]	341.5		683.0		1024.5	
Continuous Force with heat sink(N)[1][2]	229.0		457.9		686.9	
Continuous Force without heat sink(N)[2][3]	130.8		261.7		392.5	
Peak Force in linear range(N)	454.5		909.0		1363.5	
Attraction Force(N)	896		1792		2688	
Peak power(W)[1][2]	2295		4589		6884	
Continuous power(W)[1][2]	124.9		249.9		374.8	
Mechanical						
Coil assembly length(mm)	97		177		257	
Coil assembly weight(kg)[2]	1.5		2.8		4.1	
Magnetic way weight(kg/m)[2]	6.7		6.7		6.7	
Pole pitch(mm)	20		20		20	
Electrical[4]						
Continuous Current with heat sink(A_{pk})[1][2]	3.3	6.7	6.7	13.3	10.0	20.0
Continuous Current without heat sink(A_{pk})[2][3]	1.9	3.8	3.8	7.6	5.7	11.4
Peak Current with heat sink(A_{pk})[1][2]	14.3	27.5	28.5	57.0	42.8	85.5
Peak Current without heat sink(A_{pk})[2][3]	8.3	13.1	13.1	33.1	24.8	49.6
Peak Current in linear range(N)	6.6	13.2	13.2	26.4	16.5	39.6
Force Constant(N/A_{pk})[2]	68.9	34.4	68.9	34.4	68.9	34.4
Back EMF Constant(V/m/s)[2]	86.3	43.1	86.3	43.1	86.3	43.1
Resistant(Ohms)[2]	11.3	2.8	5.65	1.41	3.8	0.9
Inductance(mH)[2]	52.31	13.08	26.16	6.54	17.4	4.4
Time Constant(ms)[2]	4.6	4.6	4.6	4.6	4.6	4.6
Thermal Resistant with heat sink(°C/W)[1][2]	0.6		0.3		0.2	
Thermal Resistant without heat sink(°C/W)[2][3]	1.8		0.9		0.6	
Motor Constant(N/√W)[2]	20.5		29.0		35.5	

(1) The value applies to static sinusoidal drive, specific heat sink (a 25mm aluminum heat sink whose area equals 11x the coil mounting area) and temperature from 25°C up to 110°C. The actual performance is dependent to heat sink configuration, system cooling condition and ambient temperature.
(2) The tolerance of all performance and electrical specification is ±10%
(3) The value applies to static sinusoidal drive and temperature from 25°C up to 110°C, without heat sink.
(4) Above "withoutheatsink" figure assumes a working condition of 1atm, 25°Cambient temperature, with the linear motor stationary and not in contact with any other objects, thus relying only on free air convection for cooling. As all heat conductive objects in direct contact with the linear motor, including slide plate, linear guide and base etc.can be considered as a kind of heat sink, the "with heat sink" figure should be taken as the primaryreference in actual application design.

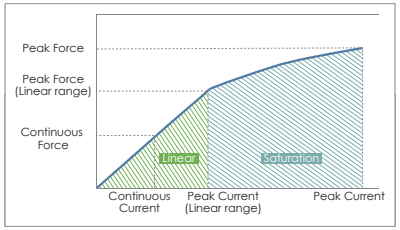
LM-CA-115 Coil Assembly

	Np1	Lp
LM-CA2-115	1	97
LM-CA4-115	3	177
LM-CA6-115	5	257

LM-MA-115 Magnetic Way

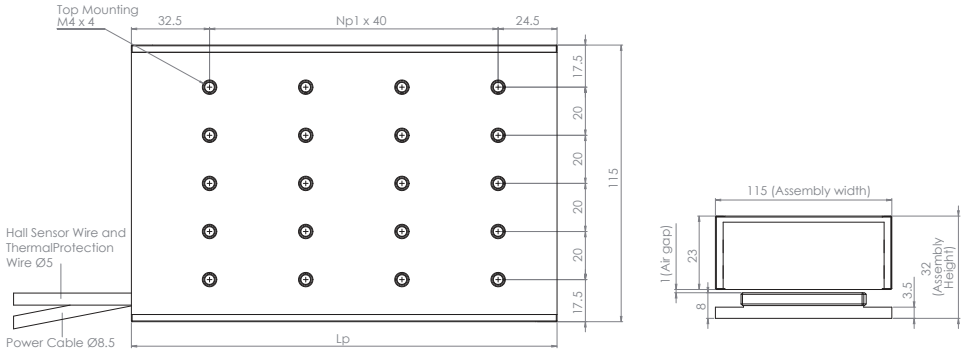
	Ns	Lt	Ls	Ls1
LM-MA0-115	2	126	120	110
LM-MA1-115	8	366	360	350
LM-MA2-115	11	486	480	470

Current VS Force.

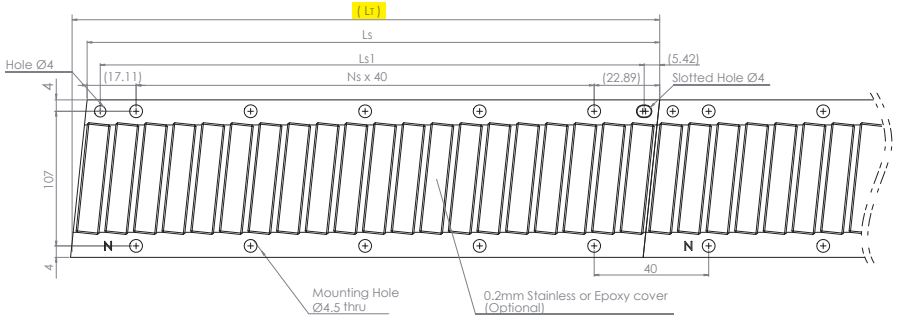


When the motor its operating in its linear regin, its thrust output is directly proportional to input current and the force constant is fixed.
When operating in the saturation regin,output thrust is not linearly proportional due to magnetic saturation,resulting in less thrust increase than expected.

LM-CA-115 Coil Assembly



LM-MA-115 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	1.5mm²	Pink	Hall A U phase	0.14 mm²	Brown/Blue	Thermal sensor	0.14 mm²
Yellow	V phase	1.5mm²	Yellow	Hall B V phase	0.14 mm²			
Brown	W phase	1.5mm²	Green	Hall C W phase	0.14 mm²			
Green	PE	1.5mm²	Grey	HallIC + 5V	0.14 mm²			
			White	GND	0.14 mm²