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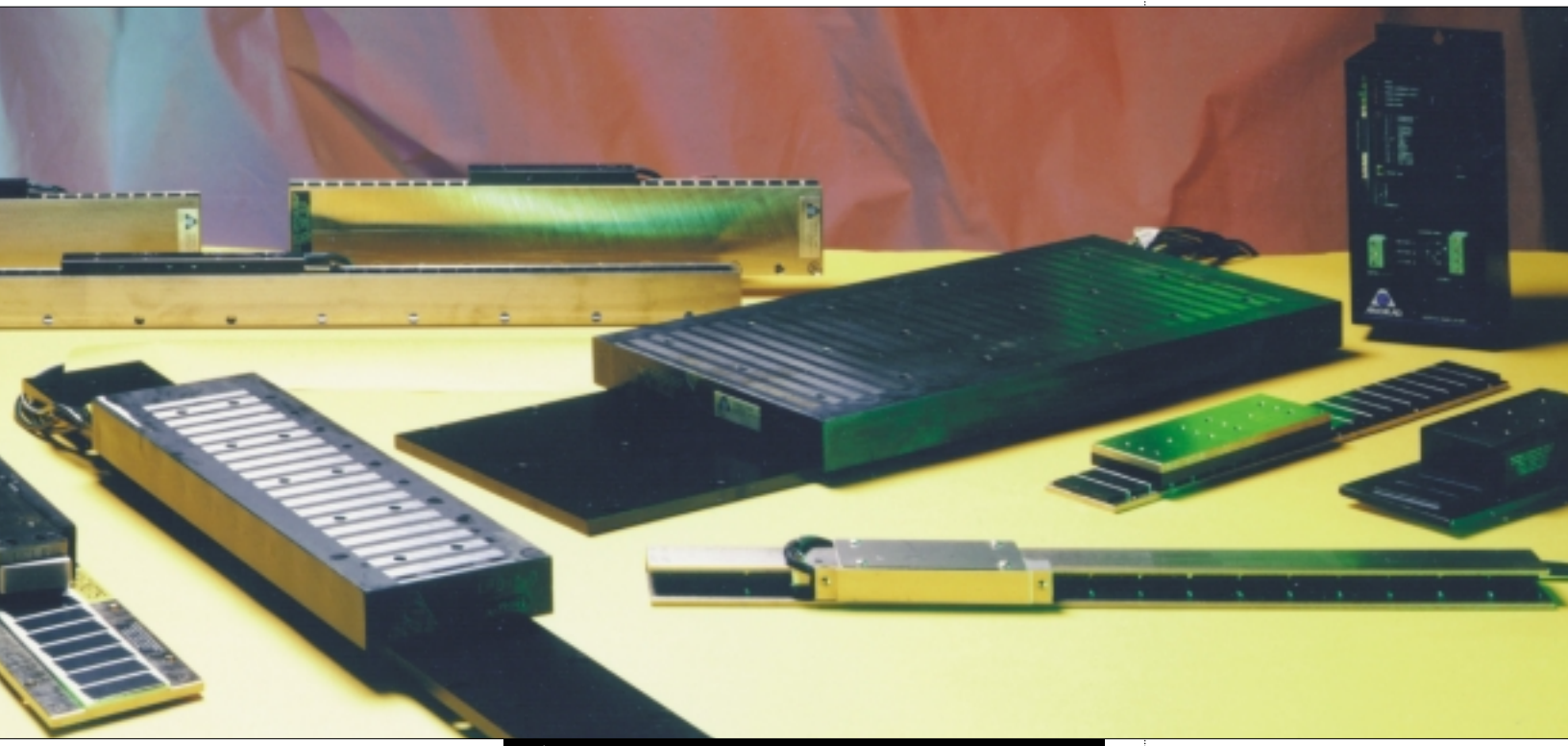
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Anorad Linear Motors

The Original Choice



Excellence in Motion

25 YEARS®

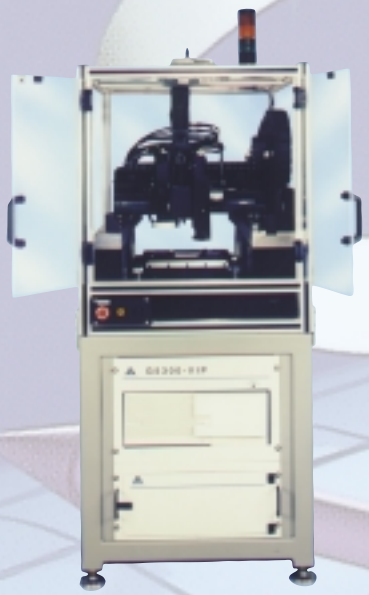
ANORAD

LINEAR MOTOR DIVISION

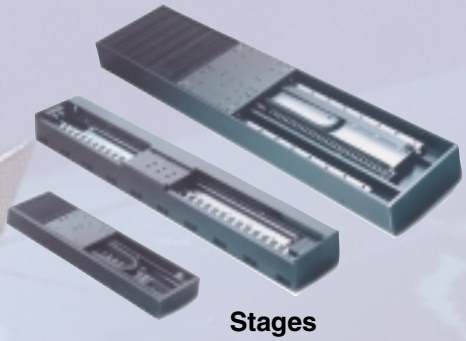
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From individual motors to complete motion systems,

Anorad gives global industries more choices to meet their needs.



Machine Vision Systems

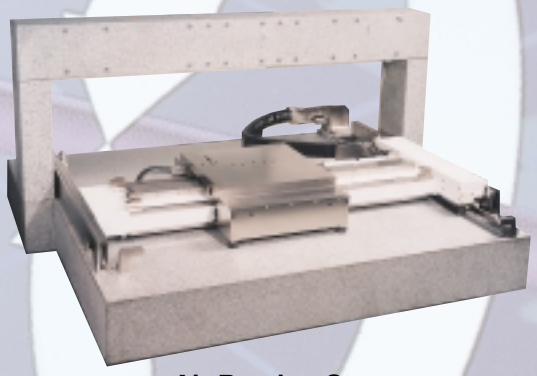


Stages

When it comes to linear motors, Anorad is the supplier of choice for companies with high performance motion requirements. Anorad offers the widest variety of motors available from a single source. Our comprehensive product offering also includes performance matched servo amplifiers, digital controls, and feedback devices, to make configuring a linear motion system easier than ever.

As the technology leader in direct drive motion, Anorad introduced the first patented brushless linear motors. Today, Anorad linear motors are the most widely used in the world, with over 30,000 motors installed. Drawing on our 25 years of experience in system design, Anorad can also provide a complete high performance motion system engineered to suit your specific application requirements.

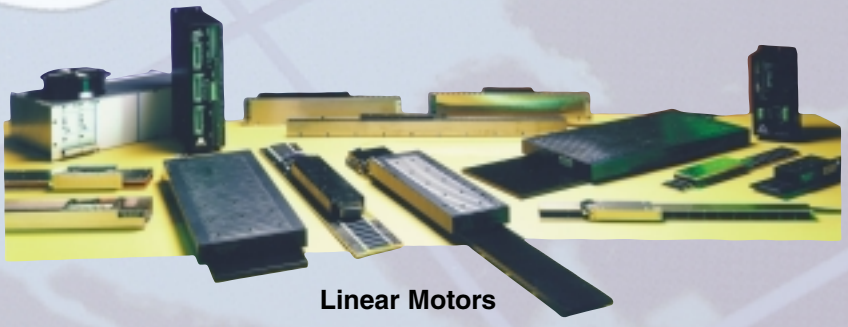
Anorad is committed to providing our customers with the widest variety of high performance direct drive motion technology. For over 25 years Anorad has been the direct drive choice. That's why linear motors are synonymous with the name Anorad.



Air Bearing Stages



Gantries



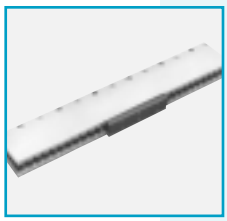
Linear Motors

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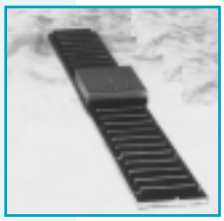
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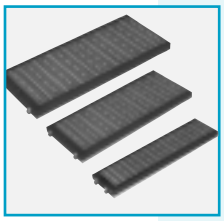
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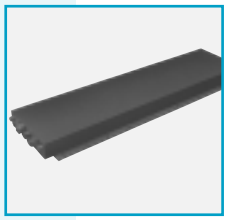
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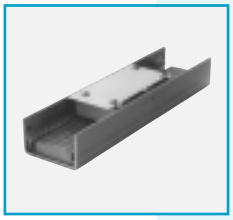
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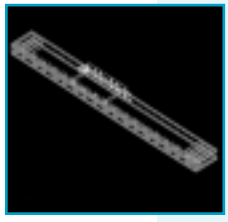
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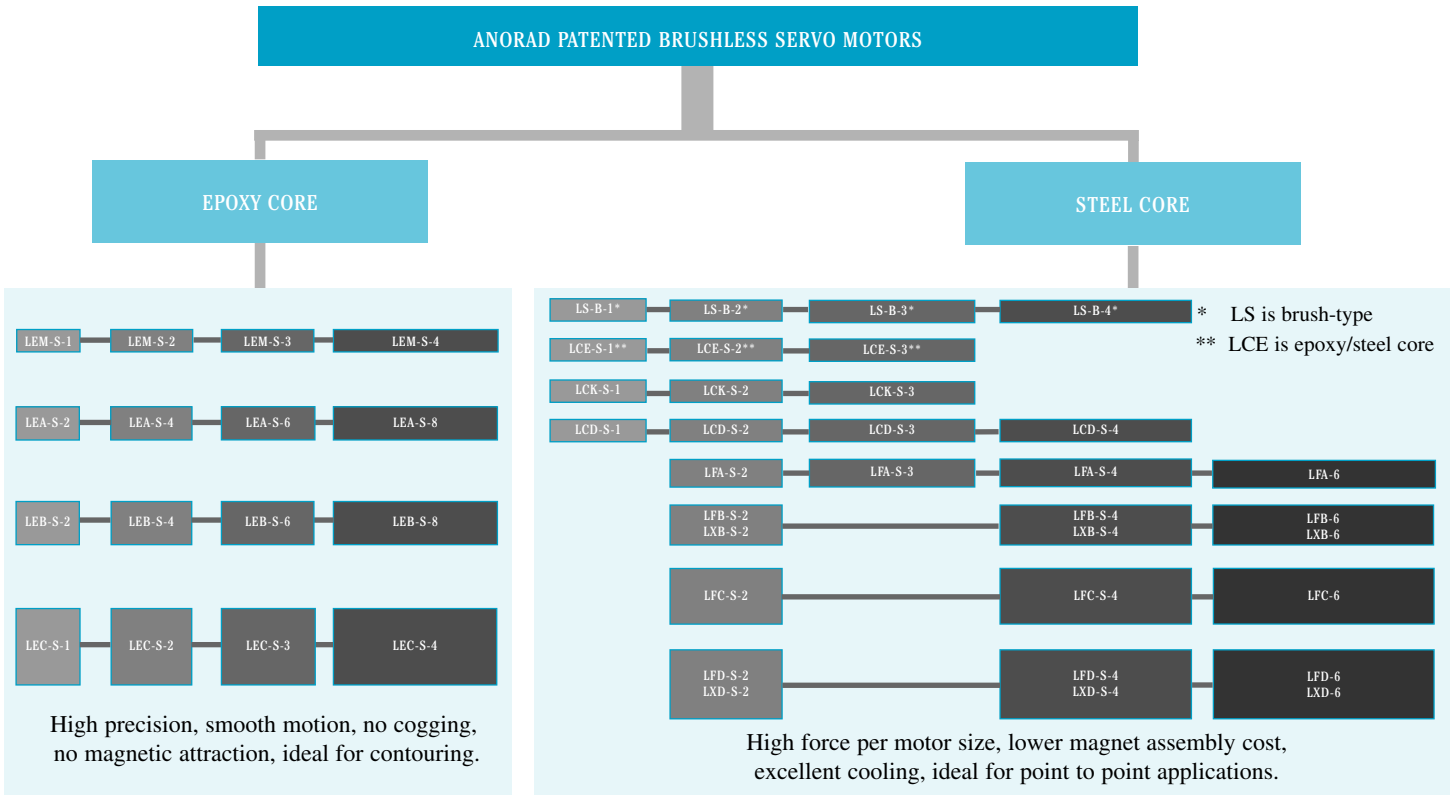
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Anorad has CE Compliant Products

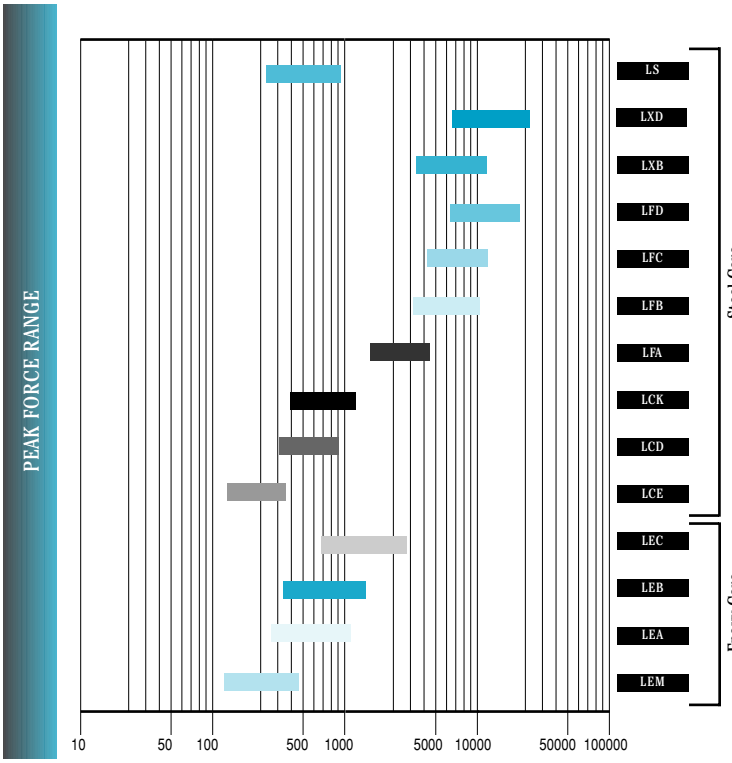
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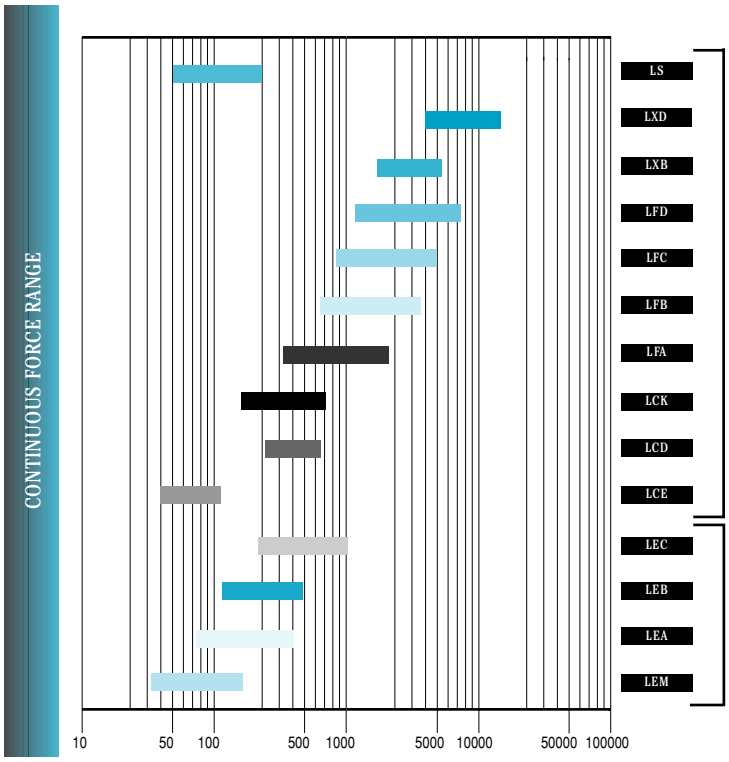
Product Overview



High precision, smooth motion, no cogging, no magnetic attraction, ideal for contouring.

High force per motor size, lower magnet assembly cost, excellent cooling, ideal for point to point applications.



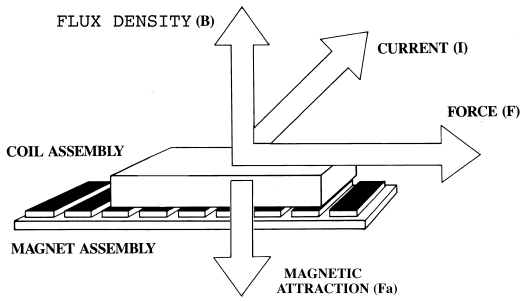


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Common Questions

How Do They Work?

Linear servo motors essentially work the same as rotary motors, only opened up and laid out flat. Each motor is made of only two parts - a coil assembly and a magnet assembly as shown below.



The coil assembly encapsulates copper windings within a core material (e.g. epoxy, steel). The copper windings conduct current (I). The magnet assembly consists of rare earth magnets, mounted in alternating polarity on a steel plate, which generate magnetic flux density (B). When the current and the flux density interact, force (F) is generated in the direction shown above, where F = I x B.

How Critical Is Mechanical Alignment?

The coil assembly is typically attached to the moving portion of the machine. The magnet channel is usually fixed to the machine base. The air gap between the two motor elements is typically 0.6mm (0.024"). The gap can vary as much as ± 0.3 mm (± 0.012") without appreciable loss of performance.

Is There Magnetic Attraction Between The Motor Parts?

There are two basic classifications of permanent magnet servo motors: epoxy core (i.e. non-ferrous, slotless) and steel core. Variation of these classifications include an epoxy/steel core. Anorad's epoxy core motors have coils wound within epoxy support. Therefore, these motors produce extremely smooth motion and have no magnetic attraction. Anorad's steel core coil assembly motors use the steel to focus the magnetic flux, thus producing very high force density. The steel in the coils is attracted to the permanent magnets in a direction perpendicular (normal) to the operated motor force. Magnetic attraction is a constant force and is present whether or not the motor is electrically energized. Depending on the motor type, the normal force of the magnetic attraction can be up to 10 times the continuous force rating of the motor.

What Is The Cogging Level In Linear Motors?

Cogging is a form of magnetic "detenting" that occurs when a coil's steel laminations cross the alternating poles of the motor's rare-earth magnets. Cogging is negligible in non-ferrous motors (LEM, LEA, LEB, LEC). Cogging in steel core motors (LCK, LCD, LFA, LFB, LFC, LFD, LXB, LXD) is typically ≤ 5% of the motor's continuous force rating.

What Is The Magnetic Flux In Linear Motors?

The magnetic flux density within the air gap of linear motors is typically several thousand gauss. The non-ferrous motors (LEM, LEA, LEB, LEC), have a closed magnetic path through the gap since two magnet plates "sandwich" the coil assembly. With these motors, very little flux exists outside the motor. Steel core motors, on the other hand, have only one magnet plate. High flux density therefore exists in the vicinity of the exposed magnets. This flux rapidly diminishes to a few gauss as the point of measure is moved a few centimeters away from the magnets. When needed, special shielding is used to further reduce the level of flux outside steel core motors.

Can A Linear Motor Be Used In A Vertical Stage?

Linear Motors are routinely used in vertical applications. To avoid motor overheating and to inhibit carriages from falling when power is removed, gravitational load offsets are typically achieved with pulleys and weights, springs, or air cylinders.

What Happens If My System Loses Power Or Feedback?

In cases of a power loss, servo control is interrupted. Stages in motion tend to stay in motion; those at rest tend to stay at rest. The stopping time and distance depend on the stage's initial velocity and the system friction. Use of the motor's back EMF for dynamic braking and positive friction brakes are often used to rapidly attenuate motion. It is also strongly advised that a system of positive stops and travel limits be built into a motion stage to prevent damage under emergency conditions (power loss, loss of feedback, and controller or servo driver failure).

Where Are The Bearings?

Anorad linear motors are frameless type motors. The motor is supplied in kit form, designed to be integrated into a customer provided structure. The motors themselves have no bearings. The machine structure in which the motors are mounted must include bearings of sufficient precision to maintain the air gap, and sufficient load rating to support the normal force of the magnetic attraction (if present).

Is Position Feedback Required?

Anorad linear motors are servo motors designed to be used in a closed loop servo positioning system. Most applications will require a linear position feedback sensor. Typical feedback sensors include linear encoders or laser interferometers. LVDT's, and linear inductosyns can also be used. The motors themselves do not have a position sensor.

Advantages

Anorad Linear Servo Motors

Unlimited Travel

Anorad motors do not have limitations on travel displacements. Since the stationary magnet assemblies can be easily joined together to form any length of motor, travel can be made as long as necessary. Since the same moving coil assembly could be used for any travel, there is no trade-off in performance as a function of travel. Screw driven systems, on the other hand, have critical speed limitations and higher inertia with added length. Speed limitations, high inertia, and low stiffness are major performance trade-offs with larger travels with other drive techniques.

Velocity

Anorad linear servo motors can be used in both very low and very high velocity applications, all with very high precision. They can precisely operate at velocities ranging from less than 1 µm/sec (0.00004"/sec) to more than 10 m/sec (400"/sec). Ball screws and lead screws have critical speed limitations. Belt drives exhibit lower stiffness. Rack-and-pinion drives typically have backlash and poor low velocity performance.

ANORAD LINEAR SERVO MOTORS VS. LINEAR SYSTEMS DRIVEN BY ROTARY MOTORS (SCREWS, BELTS, RACK-AND-PINION)

Acceleration

Anorad linear motors have a high ratio of peak force to motor inertia (about 30:1). Therefore, almost all the motor force can be used to accelerate the moving load and perform useful work. In typical screw-driven systems, a large portion of the motor torque is lost in overcoming the rotary inertia of the motor, coupling and screw.

Smoothness Of Motion

Brushless linear servo motors can provide extremely smooth motion, since they have no contacting surfaces to cause jitter. Ultimate smooth motion is achieved with Anorad's sinusoidal-commutated non-ferrous motors. By contrast, ball screws are not as smooth due to the vibrating nature of the balls entering and exiting the ball nut raceways, which is easily observed in sub-micron systems. Belt and rack-and-pinion drives also have contacting mechanisms which are susceptible to friction and backlash caused vibrations.

Accuracy and Repeatability

With Anorad linear motors, the only limit to total system accuracy and repeatability is the sensing device and the bearings of the positioning system. In rotary driven systems there are additional factors which effect these performance variables, including backlash, hysteresis, lost motion and jitter

Stiffness

Anorad linear servo motors have very high stiffness. For example, stiffness of the LF series high-force motor is 0.8 million N/mm (5 million lbs/inch). Other Anorad motors are also very stiff, typically higher than a stage's bearings and structural members. With ball screws and rack-and-pinion drives, the couplings, ball nut, and pinions are the highest contributors to low stiffness of a stage. Low stiffness reduces frequency response and increases settling times.

Maintenance and Life Expectancy

Anorad brushless linear servo motors have no contact between the two working members. Therefore, they have an extremely long, virtually maintenance-free life. The non-contact design eliminates lubrication and periodic adjustment to compensate for wear. Rotary driven mechanisms require regular lubrication and occasional replacement due to wear.

Multiple Slides On A Single Track

Several Anorad linear motor driven slides can independently share a single linear bearing track. Each slide has its own linear motor coil assembly which interfaces with the single common magnet assembly. This enables higher throughput for minimal additional cost. This configuration is difficult to achieve with most rotary driven stages.

Clean Room And Vacuum Applications

Since the coil assembly and the magnet assembly of linear servo motors do not make contact, they are ideally suited for clean room and vacuum applications. Anorad manufactures linear motors specifically for 10^{-7} torr and vacuum applications, using special material and manufacturing processes.

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Motor Performance

EFFICIENCY - Anorad motors have achieved **over 100 N/√(W)** based on 95°C winding temperature. When comparing these values with other motor designs, care must be made to assure that the same thermal conditions are being applied.

COGGING - Non-ferrous motors have negligible cogging due to their high magnetic uniformity. Steel core motors are designed with patented anti-cogging devices, such that cogging is maintained to minimal levels **(less than 5% continuous force)**.

MAGNETIC ATTRACTION - Steel core motors have magnetic attraction. This force, if properly used in positioning system design, can **help increase preload and stiffness** for improved performance.

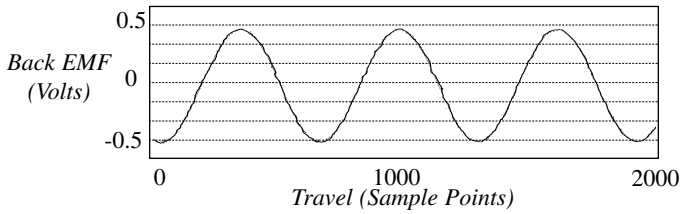
STATIC STIFFNESS - Anorad motors are designed for high static stiffness by a combination of rugged design and special vacuum molding manufacturing processes. Anorad's high force motor stiffness is over **900 N/micron**.

COOLING TECHNOLOGY - Anorad cooling design provides several advantages over common practices. 1. Epoxy core motors are cooled with internal circuits that can remove heat from the stage to an external location. 2. **Revolutionary oil cooling for high force applications.** 3. Steel core motors have cooling circuits very close to the coil itself, providing the maximum heat removal capacity.

EDDY CURRENTS - Anorad laminated steel core motors and reinforced aluminum core motors incorporate a **proprietary anti eddy current design** to reduce eddy current losses to negligible levels, resulting in higher efficiency.

MAGNETIC FLUX DENSITY - Anorad magnets are subject to the highest quality standards to assure force uniformity at any position **better than +/-5%**. (see chart below)

TYPICAL BACK EMF TEST



System Performance

SMOOTHNESS OF MOTION - Linear motors generally provide the smoothest linear motion. In particular, the epoxy core family of Anorad motors have been optimized to provide minimum velocity ripple. Advanced magnet designs, non-ferrous epoxy core, sinusoidal commutation, and linear servo amplifiers are just a few of the technology advantages Anorad employs to enable systems to achieve **velocity ripple of less than 0.01%.**

SETTLING TIME - Anorad's linear servo motors enable systems to achieve very high dynamic stiffness and closed loop bandwidth. The absence of mechanical windup, backlash and friction in the drive can often result in settling time **of a few milliseconds** in a carefully designed system.

POSITION ACCURACY - Linear motors are an essential component for achieving very high positioning accuracy. Anorad motors are employed in systems achieving **sub-micron positioning performance.** Anorad motors are also cost-effective solutions in low to moderate accuracy systems requiring the advantages of direct drive technology, such as speed or reliability.

VELOCITY - Linear motors are capable of very high velocity in excess of **10 m/s.** Anorad's proprietary anti eddy current design assures negligible eddy current losses at high speeds.

ACCELERATION - Linear motors are capable of very high acceleration **(over 10 g).** Anorad designs its motors for minimal weight per generated force such that the ratio of force to moving weight is maximized.

DYNAMIC STIFFNESS - This is the system's ability to resist displacement under time varying forces. Dynamic stiffness **depends on the overall servo system characteristics.** With system design, the highest levels of dynamic disturbance rejection can be achieved with Anorad's motors.

CLOSED LOOP BANDWIDTH - Anorad positioning systems with high force motors and third party CNC controllers have demonstrated typical linear motor closed loop position bandwidths of **100 Hz**. This is the highest known frequency to date with 9000N peak force motor.

Application Support

MOTOR VARIETY - Anorad provides the largest linear motor variety, with force ranging from a few Newton's **to over 20,000N per single coil (most powerful coil in the world).**

MANUFACTURING CAPACITY - Anorad has over **100,000 sq. ft. (9,290 m²)** of production facilities dedicated to high performance linear motion systems. We have a 16,000 sq. ft. (1,440 m²) facility dedicated exclusively to production of linear motor components. Anorad can support small users to major OEM's with products manufactured under the strictest quality standards.

APPLICATIONS ENGINEERING - Anorad has been designing high performance motion systems for over 25 years. Our **18 years of linear motor system integration expertise** is the most extensive in the world. Anorad computer-aided system design tools enable our engineers to immediately provide customers with an optimized solution. With Anorad's engineering support, specifying a linear motor has never been easier.

PROVEN RELIABILITY - An installed base of over **30,000 motors in the field** is testimony to the field proven reliability of Anorad's linear motors.

TECHNOLOGY LEADER - Anorad has **over 30 patents** and patent pending in linear motors and motion control technology. As a major user of linear motors in our own state-of-the-art motion systems, as well as being the leading manufacturer, we have the highest level of understanding the technology of linear motors.

COMPLETE SOLUTION - Anorad provides a complete solution for positioning applications. Ranging from motion components including: **motors, encoders, amplifiers, cables, and controllers** to complete positioning systems and structural elements.

ENGINEERING SUPPORT - From first rate applications engineering support, state-of-the-art computer aided engineering tools, to expert installation and field support, Anorad is **committed to the success of our customers.**

LEM-S

NEW

Brushless Linear Motor



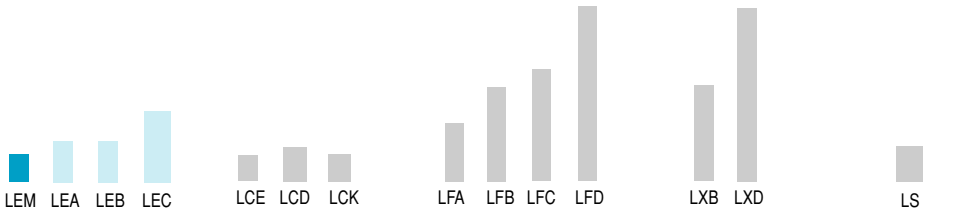
- Lowest force, epoxy core
- Enhanced cooling for high duty cycle
- No cogging, no magnetic attraction
- Miniature design
- Ideal for high precision/smooth motion

For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LEM-S Specifications

Motor Model		Symbol	Units	LEM-S-1			LEM-S-2-S			LEM-S-3-S			LEM-S-4-S		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	33	39	42	67	77	83	100	116	125	133	155	167
			lbs	7	8	9	15	17	18	22	25	28	29	34	37
Continuous Current	(coil @ 25°C)	Ic25	A rms	4.1	4.8	5.2	4.1	4.8	5.2	4.1	4.8	5.2	4.1	4.8	5.2
Continuous Force	(coil @ 125°C)	Fc125	N	28	33	35	57	66	71	85	98	106	113	131	142
			lbs	6	7	8	12	14	16	19	22	23	25	29	31
Continuous Current	(coil @ 125°C)	Ic125	A rms	3.5	4.1	4.4	3.5	4.1	4.4	3.5	4.1	4.4	3.5	4.1	4.4
Peak Force	(0.25 sec)	Fp 0.25	N	113	113	113	226	226	226	340	340	340	453	453	453
			lbs	25	25	25	50	50	50	75	75	75	100	100	100
Peak Current	(0.25 sec)	Ip 0.25	A rms	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1
Peak Force	(1 sec)	Fp1	N	80	80	80	161	161	161	241	241	241	321	321	321
			lbs	18	18	18	35	35	35	53	53	53	71	71	71
Peak Current	(1 sec)	Ip1	A rms	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	15.2	20.4	23.8	30.3	40.8	47.6	45.5	61.1	71.4	60.7	81.5	95.2
Force Constant	(All Three Phases)	Kf	N / A rms	8.04	8.04	8.04	16.08	16.08	16.08	24.12	24.12	24.12	32.17	32.17	32.17
			lbs / A rms	1.77	1.77	1.77	3.54	3.54	3.54	5.31	5.31	5.31	7.08	7.08	7.08
Back EMF	(ptn)	Ke	V rms / m / sec	2.68	2.68	2.68	5.36	5.36	5.36	8.04	8.04	8.04	10.72	10.72	10.72
			V rms / in / sec	0.07	0.07	0.07	0.13	0.13	0.13	0.20	0.20	0.20	0.27	0.27	0.27
Resistance	(ptn @ 25°C)	R25	Ω	0.9	0.9	0.9	1.8	1.8	1.8	2.7	2.7	2.7	3.5	3.5	3.5
Resistance	(ptn @ 125°C)	R125	Ω	1.2	1.2	1.2	2.4	2.4	2.4	3.7	3.7	3.7	4.9	4.9	4.9
Inductance	(ptn)	L	mH	0.5	0.5	0.5	0.9	0.9	0.9	1.4	1.4	1.4	1.8	1.8	1.8
Electrical Time Constant		Te	msec	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	4.20	4.20	4.20	5.94	5.94	5.94	7.27	7.27	7.27	8.39	8.39	8.39
			lb / √ W	0.92	0.92	0.92	1.31	1.31	1.31	1.60	1.60	1.60	1.85	1.85	1.85
Thermal Resistance		Rth	°C / W	2.20	1.64	1.40	1.10	0.82	0.70	0.73	0.55	0.47	0.55	0.41	0.35
Maximum Coil Temperature		tmax	°C	125	125	125	125	125	125	125	125	125	125	125	125
Coil Assembly Weight		W	kg	0.15	0.15	0.15	0.30	0.32	0.32	0.45	0.47	0.47	0.61	0.63	0.63
			lbs	0.3	0.3	0.3	0.7	0.7	0.7	1.0	1.0	1.0	1.3	1.4	1.4
Magnetic Attraction		Fa	N	0	0	0	0	0	0	0	0	0	0	0	0
			lbs	0	0	0	0	0	0	0	0	0	0	0	0
Cooling Flow Rate		Q	LPM	n/a	113	4	n/a	108	4	n/a	102	4	n/a	93	4
			SCFM/GPM	n/a	4	1	n/a	4	1	n/a	4	1	n/a	3	1
Cooling Supply Pressure		P	kPa	n/a	207	179	n/a	207	193	n/a	207	207	n/a	207	276
			PSIG	n/a	30	26	n/a	30	28	n/a	30	30	n/a	30	40

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LEM-S -2 -S -AC -TE -HET -(NS)**

❶ ❷ ❸ ❹ ❺

❶ Number of Coil Set	***1, 2, 3, 4***	
❷ Coil Winding Connection	***S*** —Series	***BLANK*** —Single Coil Set
❸ Cooling Type	***NC*** —No Cooling ***AC*** —Air Cooling	***WC*** —Water Cooling
❹ Thermistor	***TE*** —Thermistor	***NT*** —No Thermistor
❺ Hall Effect	***NH*** —No Hall Effect	***HET*** —Trapezoidal Hall Effect
	HES —Sinusoidal Hall Effect	***(NS)*** —Non Standard Mounting

Note: Hall effect mounted on cable side, otherwise indicate ***(NS)***.

Magnet Assembly

Example **LEM-S -225mm**

❶

❶ Magnet Assembly Length ***225, 300, 375, 450, 525, 600, 675, 750***

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function		Length
MOTOR LEADS		RED	ϕA		
(Standard)		WHT	ϕB		0.3m
		BLK	ϕC		1ft
		GRN	GND		
THERMISTORS		BLK	125°C		0.3m
(Optional)		BLK	125°C		1ft
HALL			Trap	Sine	
EFFECT		RED	V+	I+	
CONNECTOR		BLU	S2	A+	0.3m
(Optional)		WHT	S1	A -	1ft
		ORN	S3	B+	
		GRN		B -	
		BLK	VRTN	I -	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For stand still conditions multiply continuous force and continuous current by 0.9.

e) Coil mountings on either of the two narrow sides reduces continuous force by 20%.

Magnet Assembly Specifications:

a) Magnet assembly weight; 5.2 kg/m (0.28 lb/in).

b) Magnet pitch (180°) = 15 mm (0.59 in).

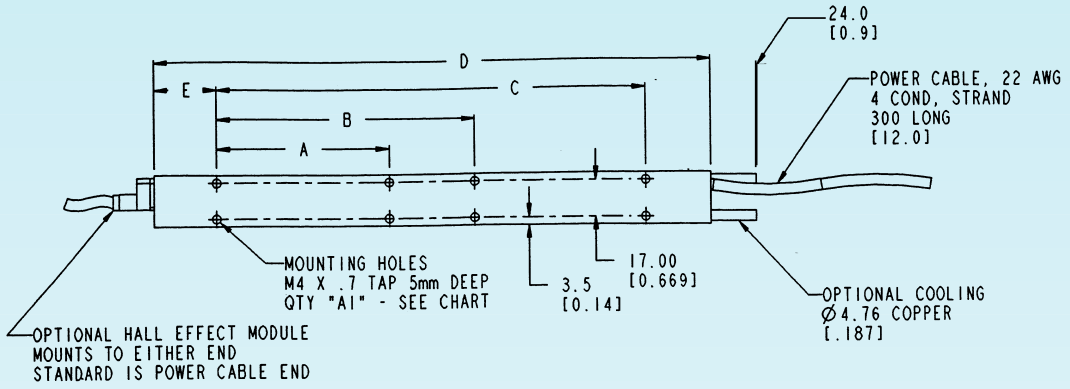
c) Magnet assy. length = travel + coil length + hall length (see example).

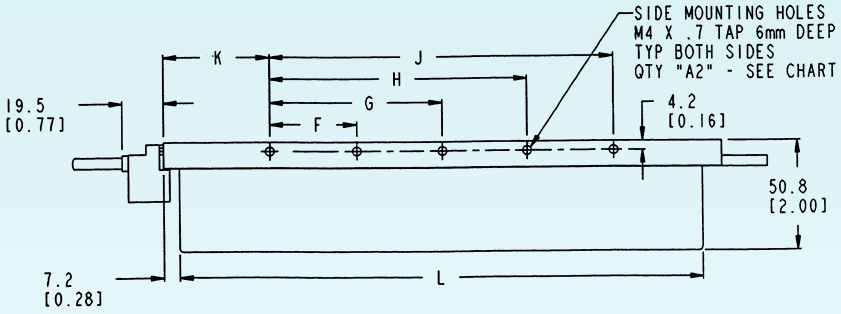
Example:

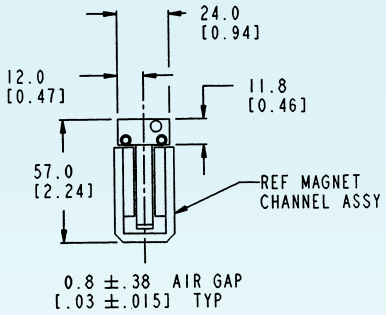
Required travel:	500 mm
Coil size:	LEM-S-2-AC-TE-HET
Magnet assembly length =	500 + 140 + 19.5 = 659.5 mm
Select:	LEM-S -675 mm magnet channel

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Coil Assembly Outline





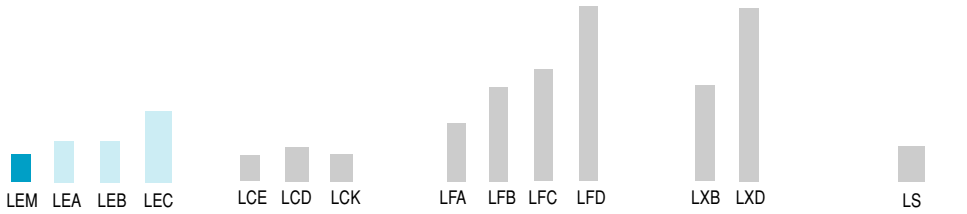


MOTOR		A	B	C	D	E	F	G	H	J	K	L	A1	A2
LEM-S-1	mm	40.00	-	-	80.0*	19.0	20.00	-	-	-	29.0	63.5	4	4
	in	1.575			3.15	.75	.787				1.14	2.5		
LEM-S-2	mm	80.00	-	-	140.0	29.0	40.00	-	-	-	49.0	123.5	4	4
	in	3.150			5.51	1.14	1.575				1.93	4.86		
LEM-S-3	mm	40.00	100.00	140.00	200.0	29.0	40.00	60.00	100.00	-	49.0	183.5	8	8
	in	1.575	3.937	5.512	7.87	1.14	1.575	2.362	3.937		1.93	7.22		
LEM-S-4	mm	80.00	120.00	200.00	260.0	29.0	40.00	80.00	120.00	160.00	49.0	243.5	8	10
	in	3.150	4.724	7.874	10.24	1.14	1.575	3.150	4.724	6.299	1.93	9.59		

*Note: A miniature size model LEM-S-1 is available. D= 67mm(2.64 in) Contact factory for details.

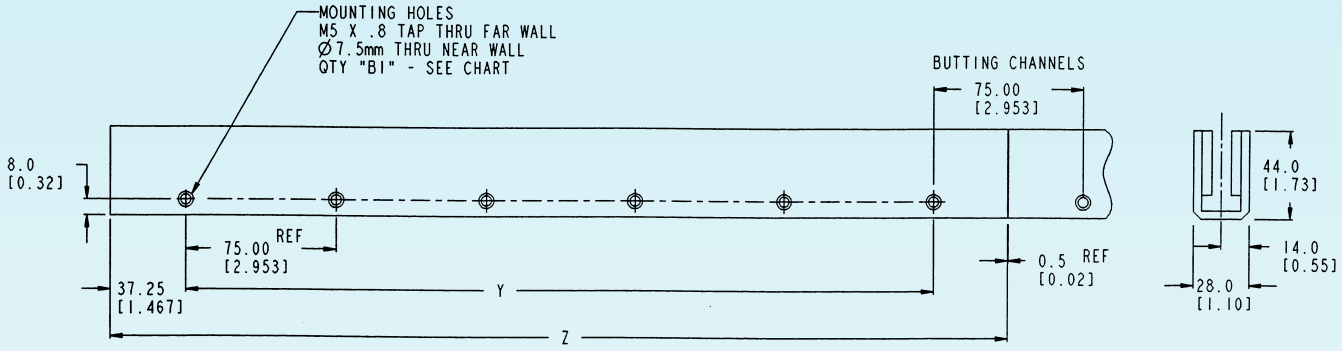


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



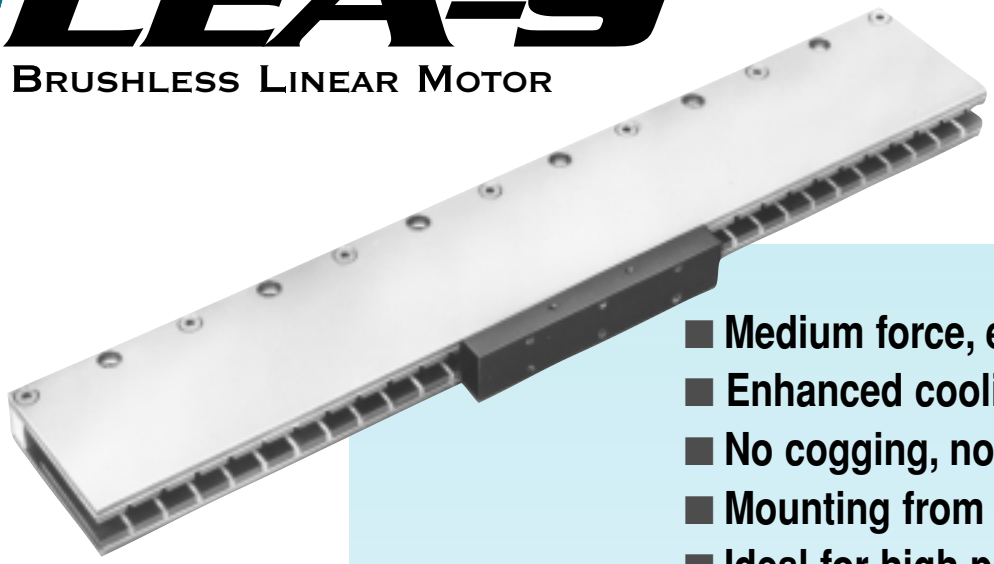
SIZE		Y	Z	B1
*225	mm	150.00	224.50	3
	in	5.906	8.839	
300	mm	225.00	299.50	4
	in	8.858	11.791	
*375	mm	300.00	374.50	5
	in	11.811	14.744	
450	mm	375.00	449.50	6
	in	14.764	17.697	
*525	mm	450.00	524.50	7
	in	17.717	20.650	
600	mm	525.00	599.50	8
	in	20.669	23.602	
*675	mm	600.00	674.50	9
	in	23.622	26.555	
750	mm	675.00	749.50	10
	in	26.575	29.508	

* These magnet channels have similar magnetic poles on each end; therefore, they can be butted to other magnet channels only from one side.

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LEA-S

Brushless Linear Motor



- Medium force, epoxy core
- Enhanced cooling for high duty cycle
- No cogging, no magnetic attraction
- Mounting from all three sides
- Ideal for high precision/smooth motion

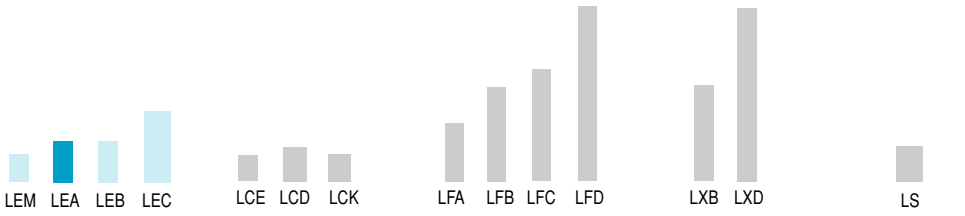
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LEA-S Specifications

Motor Model		Symbol	Units	LEA-S-2-S			LEA-S-4-S			LEA-S-6-S			LEA-S-8-SP		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	78	86	94	156	172	187	234	257	281	312	343	374
			lbs	17	19	21	34	38	41	51	57	62	69	75	82
Continuous Current	(coil @ 25°C)	Ic25	A rms	3.4	3.7	4.0	3.4	3.7	4.0	3.4	3.7	4.0	6.7	7.4	8.1
Continuous Force	(coil @ 125°C)	Fc125	N	66	73	79	132	146	159	199	219	238	265	291	318
			lbs	15	16	17	29	32	35	44	48	52	58	64	70
Continuous Current	(coil @ 125°C)	Ic125	A rms	2.9	3.1	3.4	2.9	3.1	3.4	2.9	3.1	3.4	5.7	6.3	6.9
Peak Force	(0.25 sec)	Fp 0.25	N	265	265	265	530	530	530	795	795	795	1060	1060	1060
			lbs	58	58	58	117	117	117	175	175	175	233	233	233
Peak Current	(0.25 sec)	Ip 0.25	A rms	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	22.9	22.9	22.9
Peak Force	(1 sec)	Fp1	N	191	191	191	382	382	382	573	573	573	764	764	764
			lbs	42	42	42	84	84	84	126	126	126	168	168	168
Peak Current	(1 sec)	Ip1	A rms	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	16.4	16.4	16.4
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	29.5	35.6	42.4	58.9	71.3	84.9	88.4	106.9	127.3	117.8	142.6	169.7
Force Constant	(All Three Phases)	Kf	N / A rms	23.2	23.2	23.2	46.3	46.3	46.3	69.5	69.5	69.5	46.3	46.3	46.3
			lbs / A rms	5.10	5.10	5.10	10.19	10.19	10.19	15.29	15.29	15.29	10.19	10.19	10.19
Back EMF	(ptn)	Ke	V rms / m / sec	7.72	7.72	7.72	15.44	15.44	15.44	23.16	23.16	23.16	15.44	15.44	15.44
			V rms / in / sec	0.19	0.19	0.19	0.39	0.39	0.39	0.58	0.58	0.58	0.39	0.39	0.39
Resistance	(ptn @ 25°C)	R25	Ω	2.6	2.6	2.6	5.2	5.2	5.2	7.8	7.8	7.8	2.6	2.6	2.6
Resistance	(ptn @ 125°C)	R125	Ω	3.6	3.6	3.6	7.2	7.2	7.2	10.8	10.8	10.8	3.6	3.6	3.6
Inductance	(ptn)	L	mH	1.4	1.4	1.4	2.8	2.8	2.8	4.2	4.2	4.2	1.4	1.4	1.4
Electrical Time Constant		Te	msec	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	7.05	7.05	7.05	9.96	9.96	9.96	12.20	12.20	12.20	14.09	14.09	14.09
			lb / √ W	1.55	1.55	1.55	2.19	2.19	2.19	2.68	2.68	2.68	3.10	3.10	3.10
Thermal Resistance		Rth	°C / W	1.13	0.94	0.79	0.57	0.47	0.39	0.38	0.31	0.26	0.28	0.23	0.20
Maximum Coil Temperature		tmax	°C	125	125	125	125	125	125	125	125	125	125	125	125
Coil Assembly Weight		W	kg	0.4	0.4	0.4	0.7	0.7	0.7	1.1	1.1	1.1	1.6	1.6	1.6
			lbs	0.9	0.9	0.9	1.6	1.6	1.6	2.4	2.4	2.4	3.5	3.5	3.5
Magnetic Attraction		Fa	N	0	0	0	0	0	0	0	0	0	0	0	0
			lbs	0	0	0	0	0	0	0	0	0	0	0	0
Cooling Flow Rate		Q	LPM	n/a	107.7	3.8	n/a	93.1	3.8	n/a	72.8	3.8	n/a	66.9	3.8
			SCFM/GPM	n/a	3.7	1	n/a	3.2	1	n/a	2.5	1	n/a	2.3	1
Cooling Supply Pressure		P	kPa	n/a	207	241.5	n/a	207	276	n/a	207	310.5	n/a	207	345
			PSIG	n/a	30	35	n/a	30	40	n/a	30	45	n/a	30	50

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LEA-S -2 -S -AC -TE -HET**

❶ Number of Coil Set	**2, 4, 6, 8**	
❷ Coil Winding Connection	**S** —Series	**SP** —Series Parallel
❸ Cooling Type	**NC** —No Cooling **AC** —Air Cooling	**WC** —Water Cooling
❹ Thermistor	**TE** —Thermistor	**NT** —No Thermistor
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect
	HES —Sinusoidal Hall Effect	**(NS)** —Non Standard Mounting

Note: Hall effect mounted on cable side, otherwise indicate **(NS)**.

Magnet Assembly

Example **LEA-S -225mm**

❶ Magnet Assembly Length	**225, 300, 375, 450, 525, 600, 675, 750 mm**

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function		Length
MOTOR LEADS		RED	ϕA		
(Standard)		WHT	ϕB		0.3m
		BLK	ϕC		1ft
		GRN	GND		
THERMISTORS		BLK	125ºC		0.3m
(Optional)		BLK	125ºC		1ft
HALL			Trap	Sine	
EFFECT		RED	V+	I+	
CONNECTOR		BLU	S2	A+	0.3m
(Optional)		WHT	S1	A -	1ft
		ORN	S3	B+	
		GRN		B -	
		BLK	VRTN	I -	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For stand still conditions multiply continuous force and continuous current by 0.9.

e) Coil mountings on either of the two narrow sides reduces continuous force by 20%.

Magnet Assembly Specifications:

a) Magnet assembly weight; 8.8 kg/m (0.49 lb/in).

b) Magnet pitch (180°) = 15 mm (0.59 in).

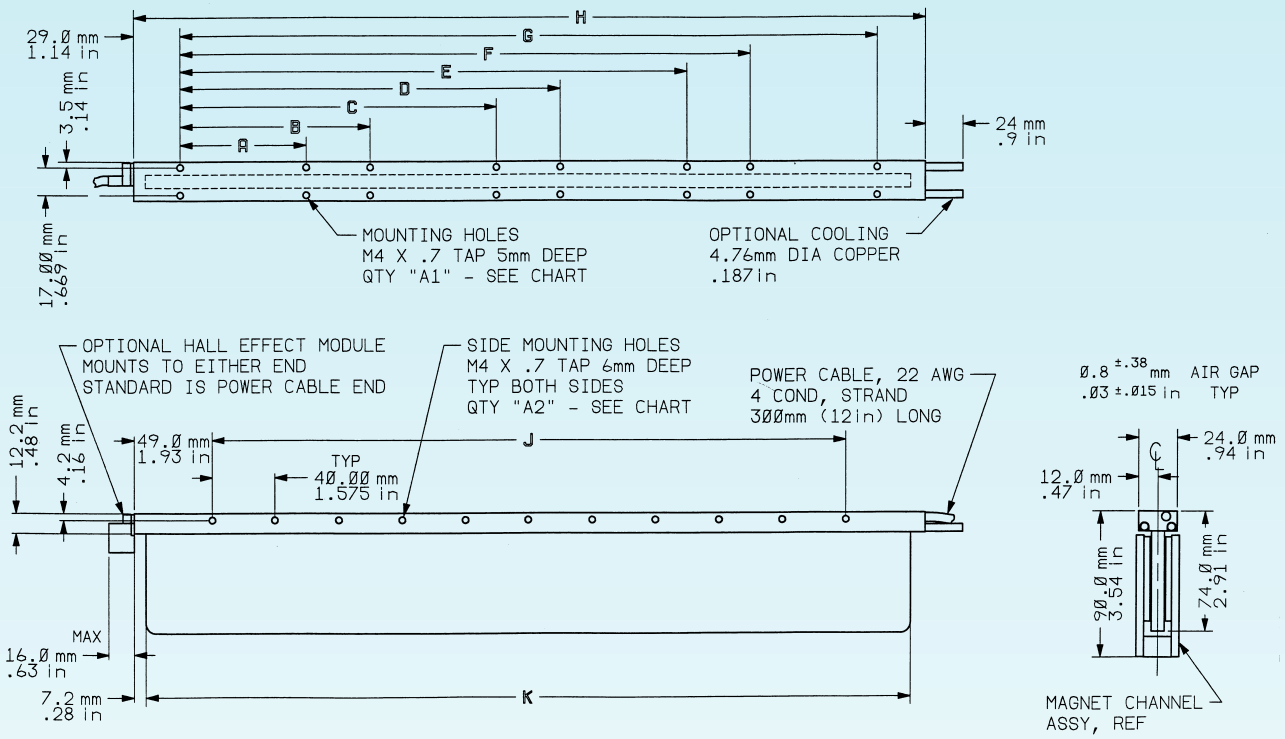
c) Magnet assy. length = travel + coil length + hall length (see example on p. 9).

d) All even lengths (e.g. 300, 450, 600, 750) can be butted on either side.

e) All odd lengths (e.g. 225, 375, 525, 675) can be butted only from one side.

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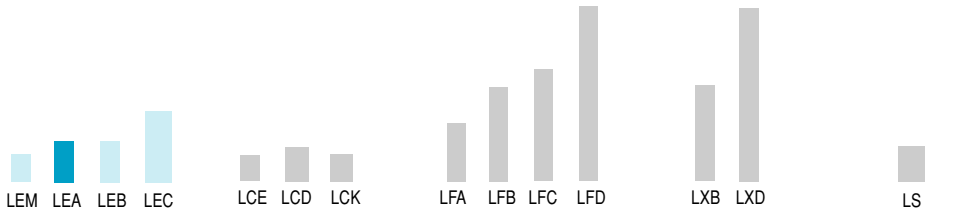
Coil Assembly Outline



MOTOR		A	B	C	D	E	F	G	H	J	K	A1	A2
LEA-S-2	mm	80.00	-	-	-	-	-	-	140.0	40.00	123.5	4	4
	in	3.150							5.51	1.575	4.86		
LEA-S-4	mm	80.00	120.00	200.00	-	-	-	-	260.0	160.00	243.5	8	10
	in	3.150	4.724	7.874					10.24	6.299	9.59		
LEA-S-6	mm	80.00	120.00	200.00	240.00	320.00	-	-	380.0	280.00	363.5	12	16
	in	3.150	4.724	7.874	9.449	12.598			14.96	11.024	14.31		
LEA-S-8	mm	80.00	120.00	200.00	240.00	320.00	360.00	440.00	499.5	400.00	483.0	16	22
	in	3.150	4.724	7.874	9.449	12.598	14.173	17.323	19.66	15.748	19.02		

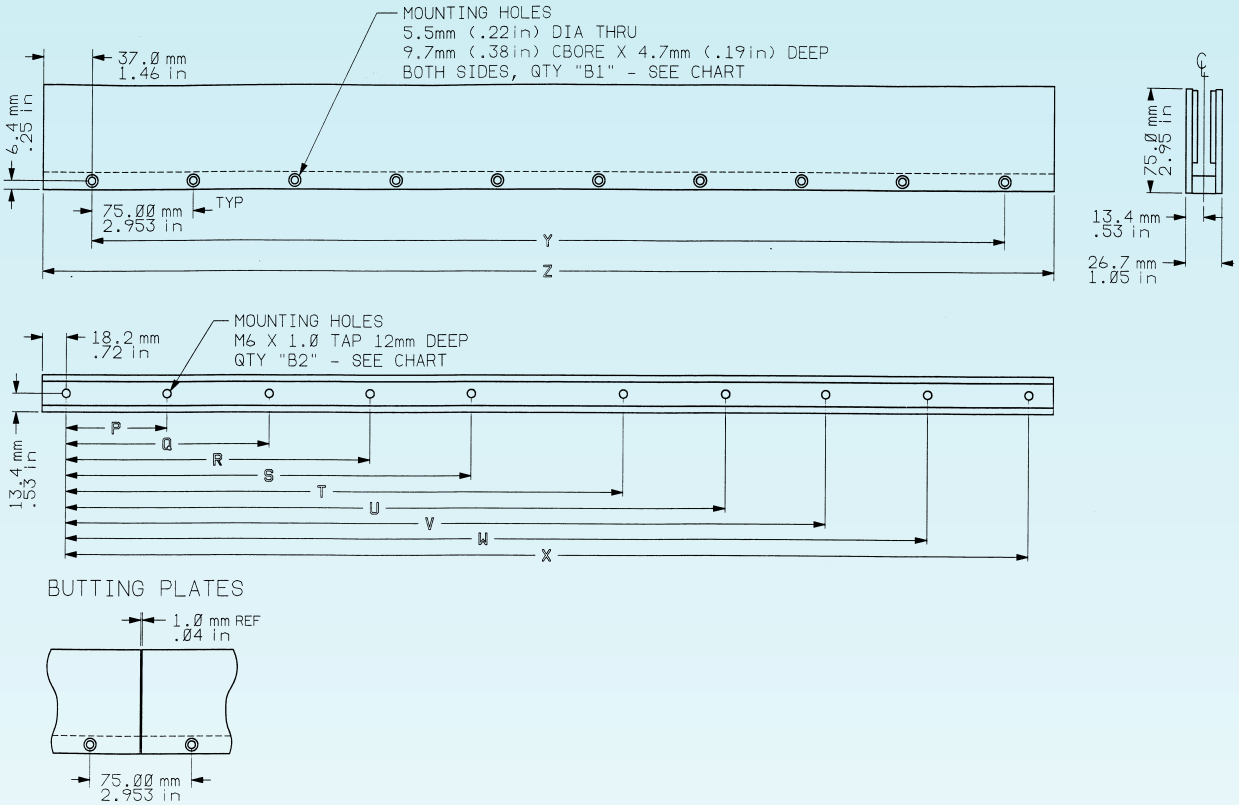


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



SIZE		p	Q	R	S	T	U	V	W	X	Y	Z	B1 QTY	B2 QTY
* 225	mm	75.00	112.50	187.50	-	-	-	-	-	-	150.00	224.00	3	4
	in	2.953	4.429	7.382							5.906	8.819		
300	mm	75.00	187.50	262.50	-	-	-	-	-	-	225.00	299.00	4	4
	in	2.953	7.382	10.335							8.858	11.772		
* 375	mm	75.00	150.00	187.50	262.50	337.50	-	-	-	-	300.00	374.00	5	6
	in	2.953	5.906	7.382	10.335	13.287					11.811	14.724		
450	mm	75.00	150.00	262.50	337.50	412.50	-	-	-	-	375.00	449.00	6	6
	in	2.953	5.906	10.335	13.287	16.240					14.764	17.677		
* 525	mm	75.00	150.00	225.00	262.50	337.50	412.50	487.50	-	-	450.00	524.00	7	8
	in	2.953	5.906	8.858	10.335	13.287	16.240	19.193			17.717	20.630		
600	mm	75.00	150.00	225.00	337.50	412.50	487.50	562.50	-	-	525.00	599.00	8	8
	in	2.953	5.906	8.858	13.287	16.240	19.193	22.146			20.669	23.583		
* 675	mm	75.00	150.00	225.00	300.00	337.50	412.50	487.50	562.50	637.50	600.00	674.00	9	10
	in	2.953	5.906	8.858	11.811	13.287	16.240	19.193	22.146	25.098	23.622	26.535		
750	mm	75.00	150.00	225.00	300.00	412.50	487.50	562.50	637.50	712.50	675.00	749.00	10	10
	in	2.953	5.906	8.858	11.811	16.240	19.193	22.146	25.098	28.051	26.575	29.488		

* These magnet channels have similar magnetic poles on each end;
therefore, they can be butted to other magnet channels only from one side.

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LEB-S

Brushless Linear Motor



- High force, epoxy core
- Enhanced cooling for high duty cycle
- No cogging, no magnetic attraction
- Mounting from all three sides
- Ideal for high precision/ smooth motion

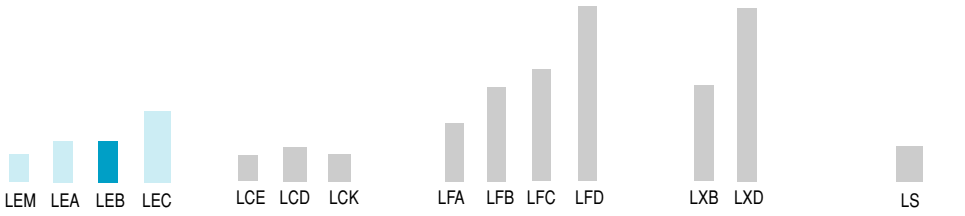
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LEB-S Specifications

Motor Model		Symbol	Units	LEB-S-2-S			LEB-S-4-S			LEB-S-6-S			LEB-S-8-SP		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	96	105	115	192	211	230	287	316	345	383	422	460
			lbs	21	23	25	42	46	51	63	70	76	84	93	101
Continuous Current	(coil @ 25°C)	Ic25	A rms	3.4	3.7	4.0	3.4	3.7	4.0	3.4	3.7	4.0	6.7	7.4	8.1
Continuous Force	(coil @ 125°C)	Fc125	N	81	90	98	163	179	195	244	269	293	326	358	391
			lbs	18	20	21	36	39	43	54	59	64	72	79	86
Continuous Current	(coil @ 125°C)	Ic125	A rms	2.9	3.1	3.4	2.9	3.1	3.4	2.9	3.1	3.4	5.7	6.3	6.9
Peak Force	(0.25 sec)	Fp 0.25	N	326	326	326	651	651	651	977	977	977	1303	1303	1303
			lbs	72	72	72	143	143	143	215	215	215	287	287	287
Peak Current	(0.25 sec)	Ip 0.25	A rms	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4
Peak Force	(1 sec)	Fp1	N	232	232	232	465	465	465	697	697	697	929	929	929
			lbs	51	51	51	102	102	102	153	153	153	204	204	204
Peak Current	(1 sec)	Ip1	A rms	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	8.2	16.4	16.4	16.4
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	29.5	35.6	42.4	58.9	71.3	84.9	88.4	106.9	127.3	117.8	142.6	169.7
Force Constant	(All Three Phases)	Kf	N / A rms	28.47	28.47	28.47	56.93	56.93	56.93	85.40	85.40	85.40	56.93	56.93	56.93
			lbs / A rms	6.26	6.26	6.26	12.53	12.53	12.53	18.79	18.79	18.79	12.53	12.53	12.53
Back EMF	(ptn)	Ke	V rms / m / sec	9.49	9.49	9.49	18.98	18.98	18.98	28.47	28.47	28.47	18.98	18.98	18.98
			V rms / in / sec	0.24	0.24	0.24	0.47	0.47	0.47	0.71	0.71	0.71	0.47	0.47	0.47
Resistance	(ptn @ 25°C)	R25	Ω	2.6	2.6	2.6	5.2	5.2	5.2	7.8	7.8	7.8	2.6	2.6	2.6
Resistance	(ptn @ 125°C)	R125	Ω	3.6	3.6	3.6	7.2	7.2	7.2	10.8	10.8	10.8	3.6	3.6	3.6
Inductance	(ptn)	L	mH	1.4	1.4	1.4	2.8	2.8	2.8	4.2	4.2	4.2	1.4	1.4	1.4
Electrical Time Constant		Te	msec	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54	0.54
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	8.66	8.66	8.66	12.25	12.25	12.25	15.00	15.00	15.00	17.32	17.32	17.32
			lb / √ W	1.91	1.91	1.91	2.69	2.69	2.69	3.30	3.30	3.30	3.81	3.81	3.81
Thermal Resistance		Rth	°C / W	1.13	0.94	0.79	0.57	0.47	0.39	0.38	0.31	0.26	0.28	0.23	0.20
Maximum Coil Temperature		tmax	°C	125	125	125	125	125	125	125	125	125	125	125	125
Coil Assembly Weight		W	kg	0.4	0.4	0.4	0.7	0.7	0.7	1.1	1.1	1.1	1.6	1.6	1.6
			lbs	0.9	0.9	0.9	1.6	1.6	1.6	2.4	2.4	2.4	3.5	3.5	3.5
Magnetic Attraction		Fa	N	0	0	0	0	0	0	0	0	0	0	0	0
			lbs	0	0	0	0	0	0	0	0	0	0	0	0
Cooling Flow Rate		Q	LPM	n/a	107.7	3.8	n/a	93.1	3.8	n/a	72.8	3.8	n/a	66.9	3.8
			SCFM/GPM	n/a	3.7	1	n/a	3.2	1	n/a	2.5	1	n/a	2.3	1
Cooling Supply Pressure		P	kPa	n/a	207	241.5	n/a	207	276	n/a	207	310.5	n/a	207	345
			PSIG	n/a	30	35	n/a	30	40	n/a	30	45	n/a	30	50

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LEB-S -8 -SP -WC2 -TE -HES**

❶ Number of Coil Set	**2, 4, 6, 8**	
❷ Coil Winding Connection	**S** —Series	**SP** —Series/Parallel
❸ Cooling Type	**NC** —No Cooling **AC** —Air Cooling **AC2** —Double Sided Air Cooling	**WC** —Water Cooling **WC2** —Double Sided Water Cooling
❹ Thermistor	**TE** —Thermistor	**NT** —No Thermistor
❺ Hall Effect	**NH** —No Hall Effect **HES** —Sinusoidal Hall Effect	**HET** —Trapezoidal Hall Effect **(NS)** —Non Standard Mounting

Note: Hall effect mounted on cable side, otherwise indicate **(NS)**.

Magnet Assembly

Example **LEB-S -525mm**

❶ Magnet Assembly Length	**225, 300, 375, 450, 525, 600, 675, 750 mm**

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function		Length
MOTOR LEADS (Standard)		RED	ϕA		0.3m 1ft
		WHT	ϕB		
		BLK	ϕC		
		GRN	GND		
THERMISTORS (Optional)		BLK	125ºC		0.3m 1ft
		BLK	125ºC		
HALL EFFECT CONNECTOR (Optional)			Trap	Sine	0.3m 1ft
		RED	V+	I+	
		BLU	S2	A+	
		WHT	S1	A -	
		ORN	S3	B+	
		GRN		B -	
		BLK	VRTN	I -	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For double-sided cooling, AC and WC, multiply continuous forces and currents of AC2 by 1.1 and of WC2 by 1.2, respectively.

e) For stand still conditions multiply continuous force and continuous current by 0.9.

f) Coil mountings on either of the two narrow sides reduces continuous force by 20%.

Magnet Assembly Specifications:

a) Magnet assembly weight; 11.4 kg/m (0.64 lb/in).

b) Magnet pitch (180°) = 15 mm (0.59 in).

c) Magnet assy. length = travel + coil length + hall length (see example on p. 9).

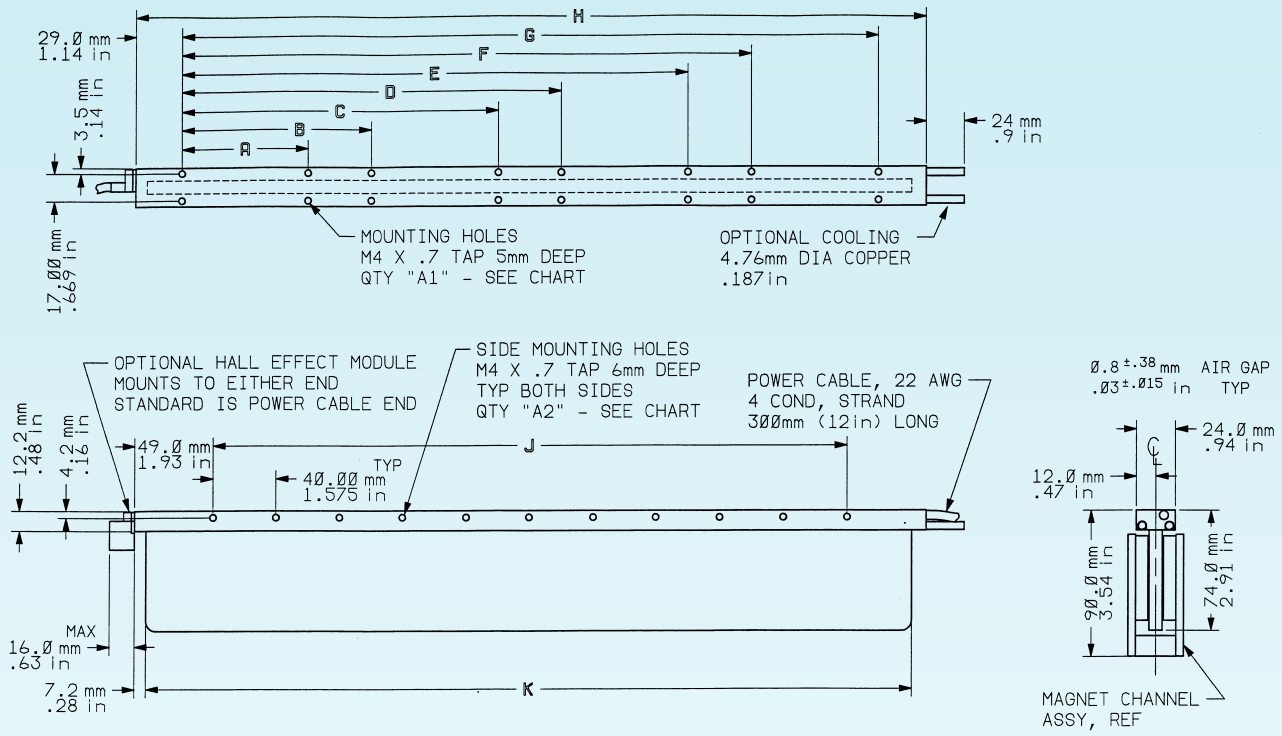
d) All even lengths (e.g. 300, 450, 600, 750) can be butted on either side.

e) All odd lengths (e.g. 225, 375, 525, 675) can be butted only from one side.

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LEB-S outline

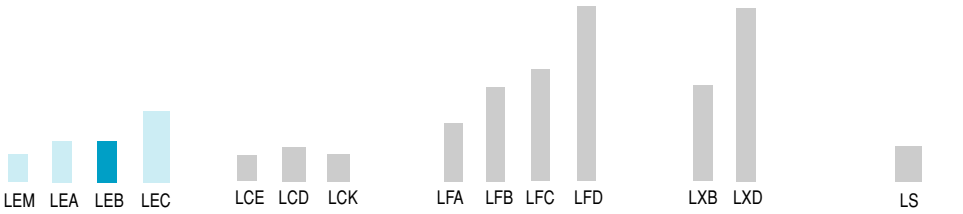
Coil Assembly Outline



MOTOR		A	B	C	D	E	F	G	H	J	K	A1	A2
LEB-S-2	mm	80.00	-	-	-	-	-	-	140.00	40.00	123.5	4	4
	in	3.150							5.51	1.575	4.86		
LEB-S-4	mm	80.00	120.00	200.00	-	-	-	-	260.00	160.00	243.5	8	10
	in	3.150	4.724	7.874					10.24	6.299	9.59		
LEB-S-6	mm	80.00	120.00	200.00	240.00	320.00	-	-	380.00	280.00	363.5	12	16
	in	3.150	4.724	7.874	9.449	12.598			14.96	11.024	14.31		
LEB-S-8	mm	80.00	120.00	200.00	240.00	320.00	360.00	440.00	500.00	400.00	483.5	16	22
	in	3.150	4.724	7.874	9.449	12.598	14.173	17.323	19.68	15.748	19.04		

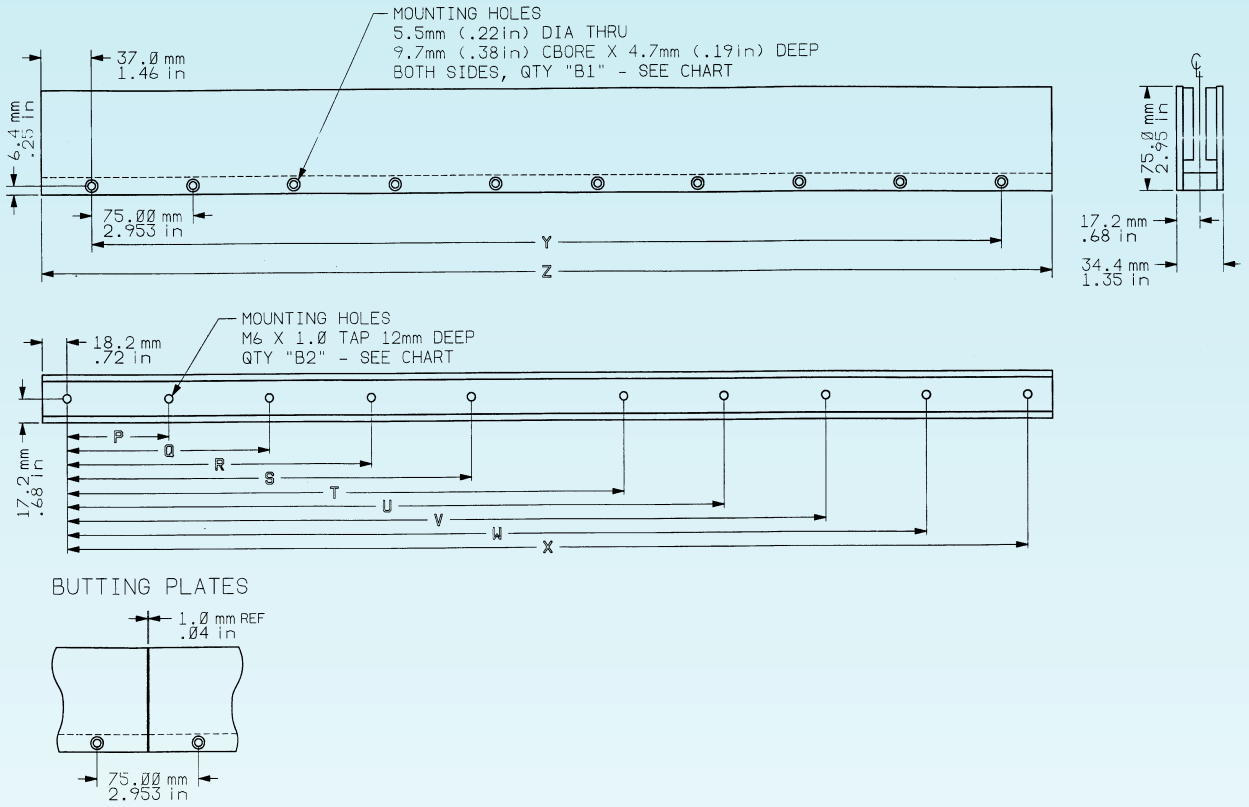


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



	SIZE		P	Q	R	S	T	U	V	W	X	Y	Z	B1 QTY	B2 QTY
*	225	mm	75.00	112.50	187.50	-	-	-	-	-	-	150.00	224.00	3	4
		in	2.953	4.429	7.382							5.906	8.819		
	300	mm	75.00	187.50	262.50	-	-	-	-	-	-	225.00	299.00	4	4
		in	2.953	7.382	10.335							8.858	11.772		
*	375	mm	75.00	150.00	187.50	262.50	337.50	-	-	-	-	300.00	374.00	5	6
		in	2.953	5.906	7.382	10.335	13.287					11.811	14.724		
	450	mm	75.00	150.00	262.50	337.50	412.50	-	-	-	-	375.00	449.00	6	6
		in	2.953	5.906	10.335	13.287	16.240					14.764	17.677		
*	525	mm	75.00	150.00	225.00	262.50	337.50	412.50	487.50	-	-	450.00	524.00	7	8
		in	2.953	5.906	8.858	10.335	13.287	16.240	19.193			17.717	20.630		
	600	mm	75.00	150.00	225.00	337.50	412.50	487.50	562.50	-	-	525.00	599.00	8	8
		in	2.953	5.906	8.858	13.287	16.240	19.193	22.146			20.669	23.583		
*	675	mm	75.00	150.00	225.00	300.00	337.50	412.50	487.50	562.50	637.50	600.00	674.00	9	10
		in	2.953	5.906	8.858	11.811	13.287	16.240	19.193	22.146	25.098	23.622	26.535		
	750	mm	75.00	150.00	225.00	300.00	412.50	487.50	562.50	637.50	712.50	675.00	749.00	10	10
		in	2.953	5.906	8.858	11.811	16.240	19.193	22.146	25.098	28.051	26.575	29.488		

* These magnet channels have similar magnetic poles on each end;
therefore, they can be butted to other magnet channels only from one side.

NEW

LEC-S

Brushless Linear Motor



- Highest force, heavy duty epoxy core
- Enhanced cooling for high duty cycle
- No cogging, no magnetic attraction
- High precision/ smooth motion
- Ideal for machine tool application

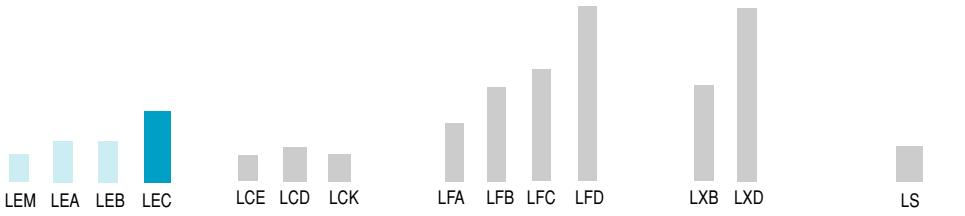
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LEC-S Specifications

Motor Model		Symbol	Units	LEC-S-1			LEC-S-2-P			LEC-S-3-P			LEC-S-4-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	206	232	275	411	464	551	617	695	826	822	927	1102
			lbs	45	51	61	90	102	121	136	153	182	181	204	242
Continuous Current	(coil @ 25°C)	Ic25	A rms	2.0	2.3	2.7	4.1	4.6	5.4	6.1	6.9	8.2	8.1	9.1	10.9
Continuous Force	(coil @ 125°C)	Fc125	N	175	197	234	349	394	468	524	591	702	698	788	936
			lbs	38	43	51	77	87	103	115	130	154	154	173	206
Continuous Current	(coil @ 125°C)	Ic125	A rms	1.7	1.9	2.3	3.4	3.9	4.6	5.2	5.8	6.9	6.9	7.8	9.2
Peak Force	(0.25 sec)	Fp 0.25	N	698	698	698	1397	1397	1397	2095	2095	2095	2794	2794	2794
			lbs	154	154	154	307	307	307	461	461	461	615	615	615
Peak Current	(0.25 sec)	Ip 0.25	A rms	6.9	6.9	6.9	13.8	13.8	13.8	20.7	20.7	20.7	27.6	27.6	27.6
Peak Force	(1 sec)	Fp1	N	508	508	508	1015	1015	1015	1523	1523	1523	2030	2030	2030
			lbs	112	112	112	223	223	223	335	335	335	447	447	447
Peak Current	(1 sec)	Ip1	A rms	5.0	5.0	5.0	10.0	10.0	10.0	15.0	15.0	15.0	20.0	20.0	20.0
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	35.2	44.7	63.2	70.4	89.5	126.4	105.5	134.2	189.6	140.7	178.9	252.8
Force Constant	(All Three Phases)	Kf	N / A rms	101.32	101.32	101.32	101.32	101.32	101.32	101.32	101.32	101.32	101.32	101.32	101.32
			lbs / A rms	22.29	22.29	22.29	22.29	22.29	22.29	22.29	22.29	22.29	22.29	22.29	22.29
Back EMF	(ptn)	Ke	V rms / m / sec	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77	33.77
			V rms / in / sec	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Resistance	(ptn @ 25°C)	R25	Ω	8.6	8.6	8.6	4.3	4.3	4.3	2.9	2.9	2.9	2.1	2.1	2.1
Resistance	(ptn @ 125°C)	R125	Ω	11.8	11.8	11.8	5.9	5.9	5.9	3.9	3.9	3.9	3.0	3.0	3.0
Inductance	(ptn)	L	mH	19.5	19.5	19.5	9.8	9.8	9.8	6.5	6.5	6.5	4.9	4.9	4.9
Electrical Time Constant		Te	msec	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28	2.28
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	17.00	17.00	17.00	24.04	24.04	24.04	29.44	29.44	29.44	33.99	33.99	33.99
			lb / √ W	3.74	3.74	3.74	5.29	5.29	5.29	6.48	6.48	6.48	7.48	7.48	7.48
Thermal Resistance		Rth	°C / W	0.95	0.75	0.53	0.47	0.37	0.26	0.32	0.25	0.18	0.24	0.19	0.13
Maximum Coil Temperature		tmax	°C	125	125	125	125	125	125	125	125	125	125	125	125
Coil Assembly Weight		W	kg	1.5	1.5	1.5	2.9	2.9	2.9	4.4	4.4	4.4	5.8	5.8	5.8
			lbs	3.2	3.2	3.2	6.4	6.4	6.4	9.6	9.6	9.6	12.8	12.8	12.8
Magnetic Attraction		Fa	N	0	0	0	0	0	0	0	0	0	0	0	0
			lbs	0	0	0	0	0	0	0	0	0	0	0	0
Cooling Flow Rate		Q	LPM	na	200.8	3.8	n/a	192.1	3.8	n/a	183.3	3.8	n/a	174.6	3.8
			SCFM/GPM	na	6.9	1	n/a	6.6	1	n/a	6.3	1	n/a	6	1
Cooling Supply Pressure		P	kPa	na	138	151.8	n/a	138	165.6	n/a	138	179.4	n/a	138	193.2
			PSIG	na	20	22	n/a	20	24	n/a	20	26	n/a	20	28

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LEC-S -4 -P -AC -TE -HES -(NS)**

❶ Number of Coil Set	***1, 2, 3, 4***		
❷ Coil Winding Connection	***P*** —Parallel	***BLANK*** —Single Coil Set	
❸ Cooling Type	***NC*** —No Cooling ***AC*** —Air Cooling	***WC*** —Water Cooling	
❹ Thermistor	***TE*** —Thermistor	***NT*** —No Thermistor	
❺ Hall Effect	***NH*** —No Hall Effect	***HET*** —Trapezoidal Hall Effect	
	HES —Sinusoidal Hall Effect	***(NS)*** —Non Standard Mounting	

Note: Hall effect mounted on cable side, otherwise indicate ***(NS)***.

Magnet Assembly

Example **LEC-S -300mm**

❶ Magnet Assembly Length	***300, 450, 600, 750 mm***

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function		Length
MOTOR LEADS		RED	ϕA		
(Standard)		WHT	ϕB		0.3m
		BLK	ϕC		1ft
		GRN	GND		
THERMISTORS		BLK	125ºC		0.3m
(Optional)		BLK	125ºC		1ft
HALL			Trap	Sine	
EFFECT		RED	V+	I+	
CONNECTOR		BLU	S2	A+	0.3m
(Optional)		WHT	S1	A -	1ft
		ORN	S3	B+	
		GRN		B -	
		BLK	VRTN	I -	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For stand still conditions multiply continuous force and continuous current by 0.9.

e) Coil mountings on either of the two narrow sides reduces continuous force by 20%.

Magnet Assembly Specifications:

a) Magnet assembly weight; 29.2 kg/m (1.6 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

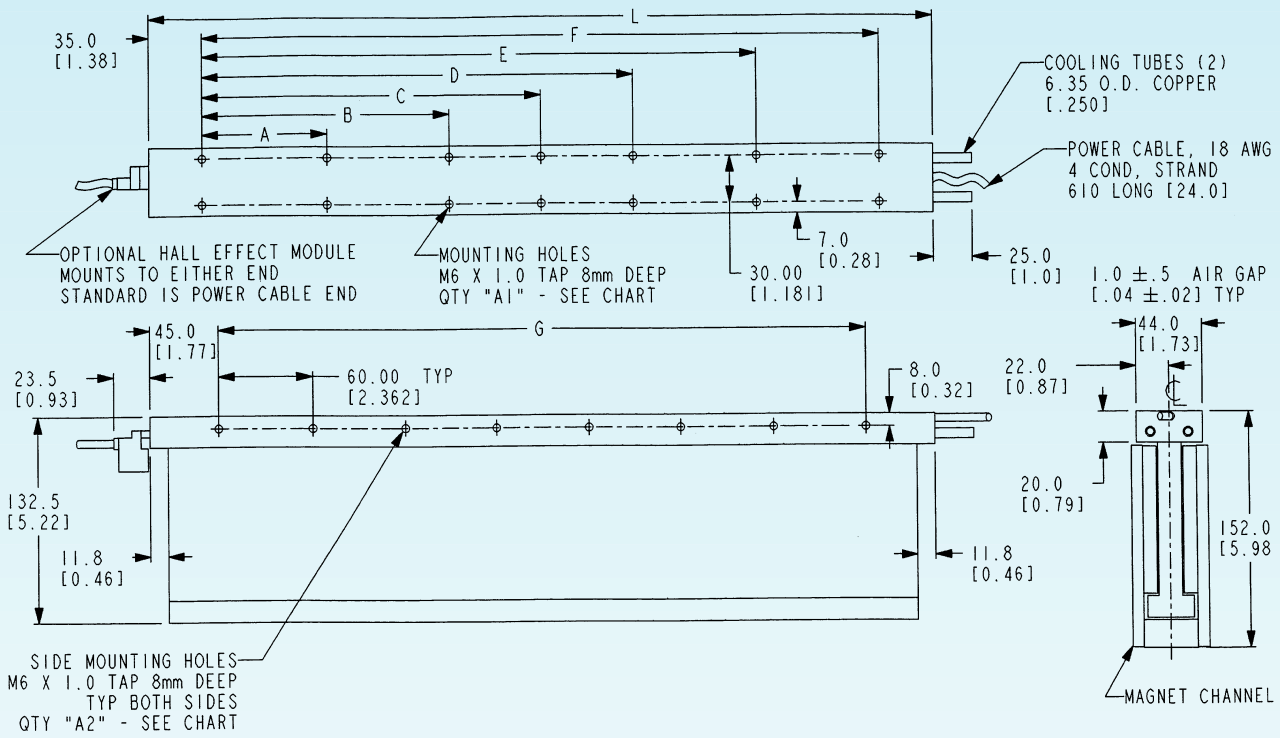
c) Magnet assy. length = travel + coil length + hall length (see example).

Example:

Required travel:	1000 mm
Coil size:	LEC-S-4-WC-TE-NH
Magnet assembly length =	1000 + 510 + 0 = 1510 mm
Select:	2x LEC-S -600 mm and 1x -450 mm

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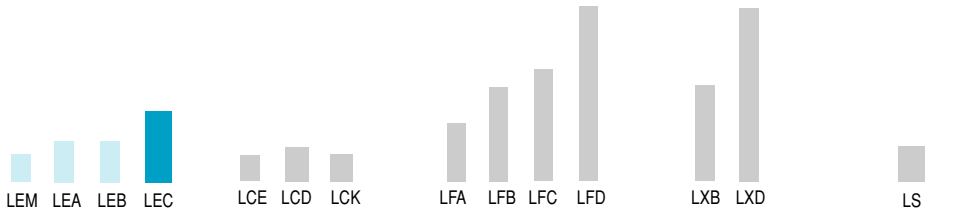
Coil Assembly Outline



MOTOR		A	B	C	D	E	F	G	L	A1	A2
LEC-S-1	mm	80.00	-	-	-	-	-	60.00	150.00	4	4
	in	3.150						2.362	5.91		
LEC-S-2	mm	60.00	140.00	200.00	-	-	-	180.00	270.00	8	8
	in	2.362	5.512	7.874				7.087	10.63		
LEC-S-3	mm	80.00	160.00	240.00	320.00	-	-	300.00	390.00	10	12
	in	3.150	6.299	9.449	12.598			11.811	15.35		
LEC-S-4	mm	80.00	160.00	220.00	280.00	360.00	440.00	420.00	510.00	14	16
	in	3.150	6.299	8.661	11.024	14.173	17.323	16.535	20.08		

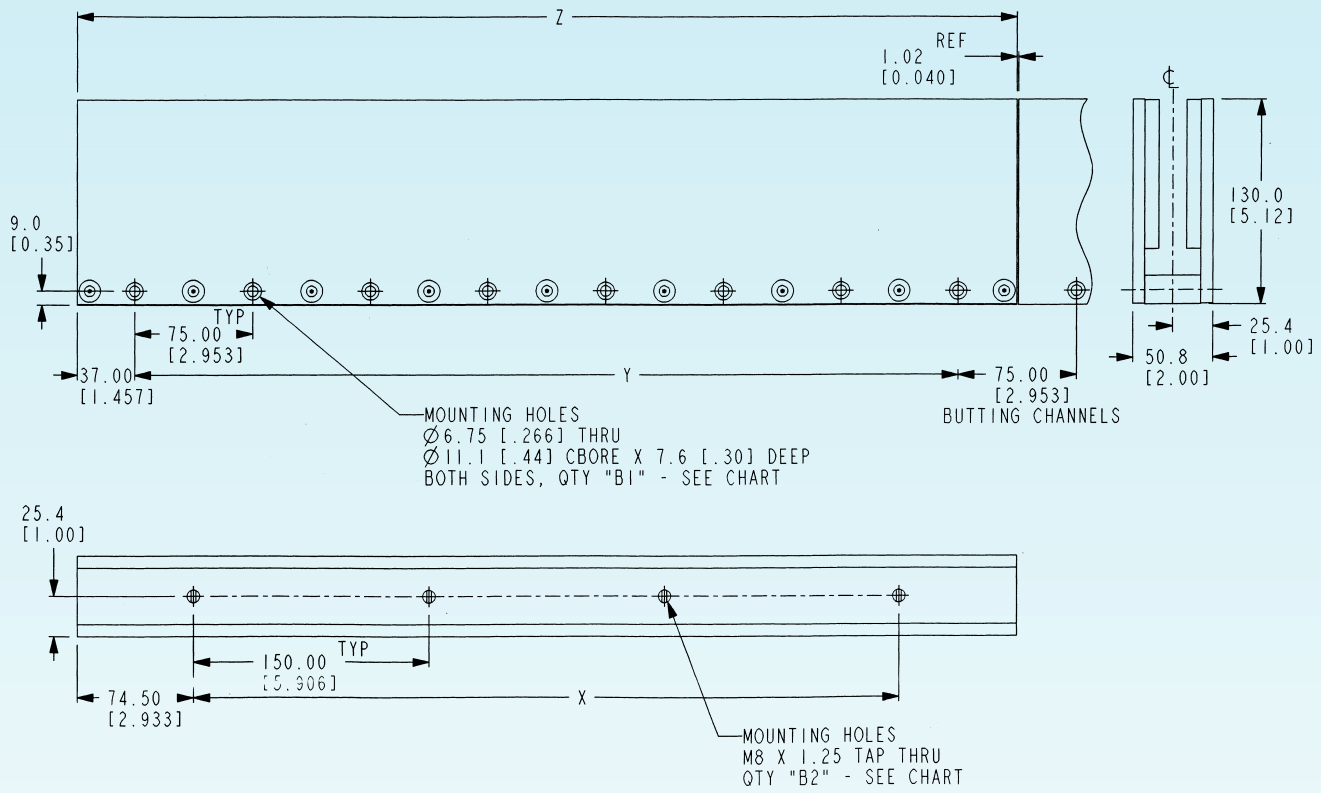


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline

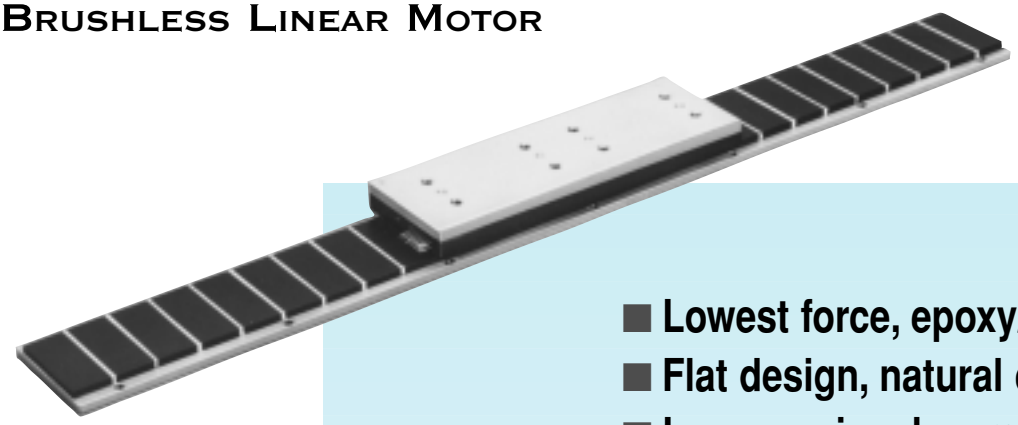


SIZE		X	Y	Z	B1	B2
300	mm	150.00	225.00	299.00	4	2
	in	5.906	8.858	11.772		
450	mm	300.00	375.00	449.00	6	3
	in	11.811	14.764	17.677		
600	mm	450.00	525.00	599.00	8	4
	in	17.717	20.669	23.583		
750	mm	600.00	675.00	749.00	10	5
	in	23.622	26.575	29.488		

LCE-S

NEW

Brushless Linear Motor



- Lowest force, epoxy/steel core
- Flat design, natural cooling
- Low cogging, low magnetic attraction
- Low profile, miniature design
- Ideal for general automation

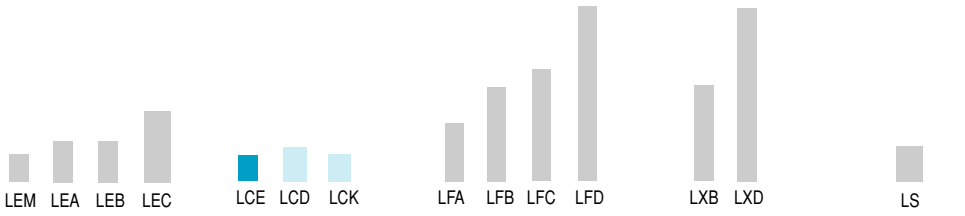
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LCE-S Specifications

Motor Model		Symbol	Units	LCE-S-1	LCE-S-2-S	LCE-S-3-S
Cooling				NC	NC	NC
Continuous Force	(coil @ 25°C)	Fc25	N	40	79	119
			lbs	9	17	26
Continuous Current	(coil @ 25°C)	Ic25	A rms	4.0	4.0	4.0
Continuous Force	(coil @ 125°C)	Fc125	N	34	67	101
			lbs	7	15	22
Continuous Current	(coil @ 125°C)	Ic125	A rms	3.4	3.4	3.4
Peak Force	(0.25 sec)	Fp 0.25	N	115	230	345
			lbs	25	51	76
Peak Current	(0.25 sec)	Ip 0.25	A rms	11.8	11.8	11.8
Peak Force	(1 sec)	Fp1	N	96	192	288
			lbs	21	42	63
Peak Current	(1 sec)	Ip1	A rms	9.7	9.7	9.7
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	27	54	81
Force Constant	(All Three Phases)	Kf	N / A rms	9.9	19.9	29.8
			lbs / A rms	2.2	4.4	6.6
Back EMF	(ptn)	Ke	V rms / m / sec	3.3	6.6	9.9
			V rms / in / sec	0.08	0.17	0.25
Resistance	(ptn @ 25°C)	R25	Ω	1.7	3.4	5.1
Resistance	(ptn @ 125°C)	R125	Ω	2.4	4.7	7.1
Inductance	(ptn)	L	mH	2.0	3.9	5.9
Electrical Time Constant		Te	msec	1.1	1.1	1.1
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	3.7	5.3	6.5
			lb / √ W	0.8	1.2	1.4
Thermal Resistance		Rth	°C / W	1.24	0.62	0.41
Maximum Coil Temperature		tmax	°C	125	125	125
Coil Assembly Weight		W	kg	0.5	1.0	1.4
			lbs	1.1	2.2	3.1
Magnetic Attraction		Fa	N	50	101	151
			lbs	11	22	33
Cooling Flow Rate		Q	LPM	n/a	n/a	n/a
			SCFM/GPM	n/a	n/a	n/a
Cooling Supply Pressure		P	kPa	n/a	n/a	n/a
			PSIG	n/a	n/a	n/a

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LCE-S -2 -S -NC -TE -HET**

❶ ❷ ❸ ❹ ❺

❶ Number of Coil Set	**1, 2, 3**	
❷ Coil Winding Connection	**S** —Series	**BLANK** —Single Coil Set
❸ Cooling Type	**NC** —No Cooling	
❹ Thermistor	**TE** —Thermistor	**NT** —No Thermistor
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect
	HES —Sinusoidal Hall Effect	

Magnet Assembly

Example **LCE-S -225mm**

❶

❶ Magnet Assembly Length	**225, 315, 405, 495, 585, 675, 765, 855 mm**

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function		Length
MOTOR LEADS	1	VIO	ϕA		
(Standard)	2	GRN	ϕA		
	3	RED	ϕB		
	4	BRN	ϕB		762 mm
	5	YEL	ϕC		30 in
	6	BLU	ϕC		
	7	WHT	GND		
THERMISTORS	8	WHT	125°C		762 mm
(Optional)	10	BLK	125°C		30 in
			Trap	Sine	
HALL	9	RED	V+	I+	
EFFECT	11	GRN	S2	A+	
CONNECTOR	12	BLU	S1	A -	762 mm
(Optional)	13	VIO	S3	B+	30 in
	14	BRN		B -	
	15	YEL	VRTN	I -	
	16		KEY	KEY	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For stand still conditions multiply continuous force and continuous current by 0.9.

Magnet Assembly Specifications:

a) Magnet assembly weight; 3.6 kg/m (0.215/in).

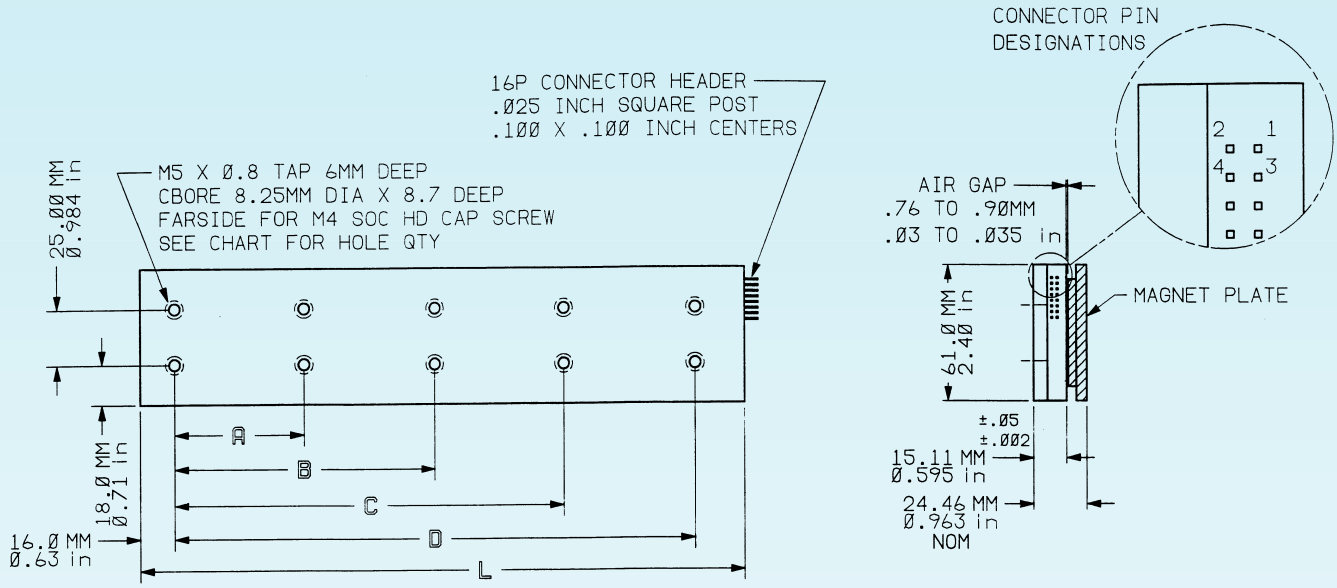
b) Magnet pitch (180°) = 22.5 mm (0.89 in).

c) Magnet assy. length = travel + coil length + hall length (see example on p. 29).

Example:

Required travel:	300 mm
Coil size:	LCE-S-2-NC-TE-HET
Magnet assembly length = 300 + 279 + 0 = 579 mm	
Select:	LCE-S -585 mm

Coil Assembly Outline

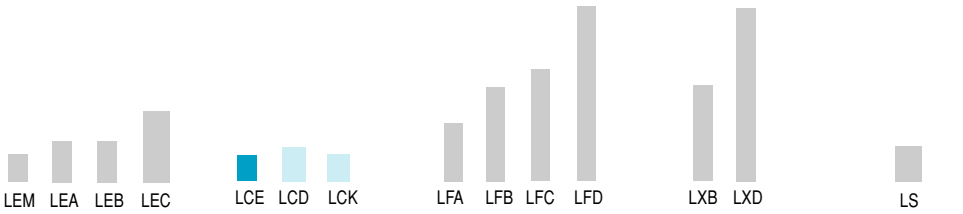


Note: Coil is provided with a cable including a connector on one end and open leads on the other end. (610 mm (24 in) long mating cable)

MOTOR		L	A	B	C	D	HOLE QTY
LCE-S-1	mm	99.0	60.00	-	-	-	4
	in	3.90	2.362				
LCE-S-2	mm	189.0	60.00	90.00	150.00	-	8
	in	7.44	2.362	3.543	5.906		
LCE-S-3	mm	279.0	60.00	120.00	180.00	240.00	10
	in	10.90	2.362	4.724	7.087	9.449	

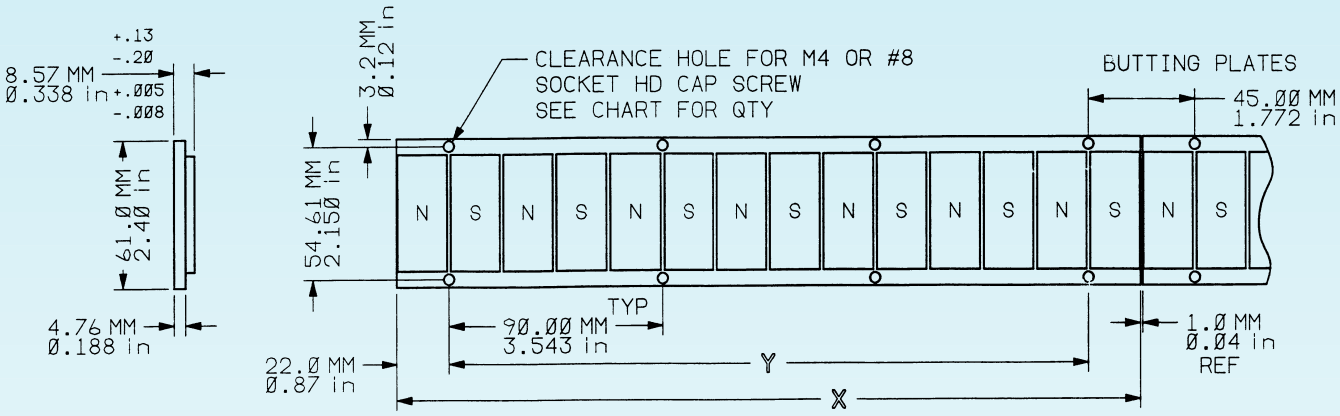


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Above chart depicts relative cross section of motors in page order.

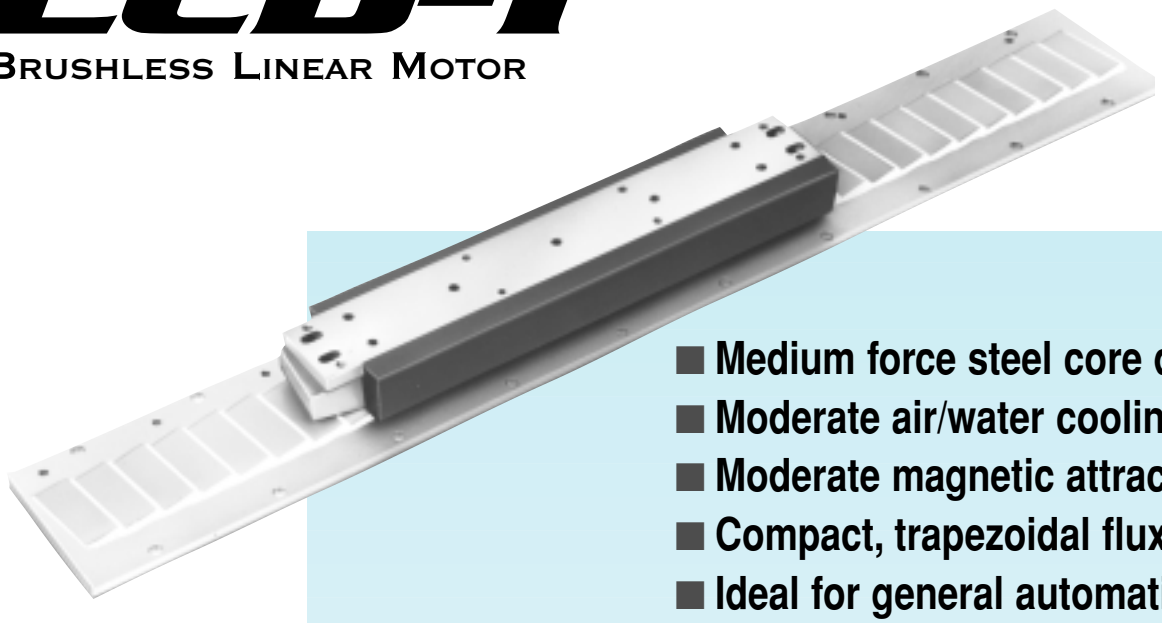
Magnet Assembly Outline



SIZE		X	Y	HOLE QTY
225	mm	224.00	180.00	6
	in	8.819	7.086	
315	mm	314.00	270.00	8
	in	12.362	10.630	
405	mm	404.00	360.00	10
	in	15.905	14.173	
495	mm	494.00	450.00	12
	in	19.449	17.716	
585	mm	584.00	540.00	14
	in	22.992	21.268	
675	mm	674.00	630.00	16
	in	26.535	24.803	
765	mm	764.00	720.00	18
	in	30.079	28.346	
855	mm	854.00	810.00	20
	in	33.622	31.090	

LCD-T

Brushless Linear Motor



- Medium force steel core design
- Moderate air/water cooling
- Moderate magnetic attraction preload
- Compact, trapezoidal flux density
- Ideal for general automation

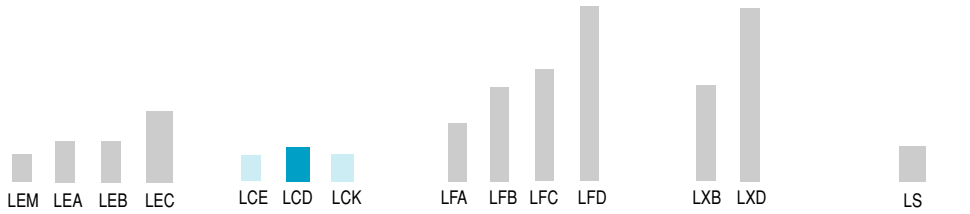
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LCD-T Specifications

Motor Model		Symbol	Units	LCD-T-1			LCD-T-2-P			LCD-T-3-P			LCD-T-4-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	163	199	250	245	299	375	327	398	500	490	598	750
			lbs	36	44	55	54	66	82	72	88	110	108	131	165
Continuous Current	(coil @ 25°C)	Ic25	A rms	4.2	5.2	6.5	6.3	7.7	9.7	8.5	10.3	12.9	12.7	15.5	19.4
Continuous Force	(coil @ 125°C)	Fc125	N	139	169	212	208	254	318	277	339	425	416	508	637
			lbs	31	37	47	46	56	70	61	74	93	92	112	140
Continuous Current	(coil @ 125°C)	Ic125	A rms	3.6	4.4	5.5	5.4	6.6	8.2	7.2	8.8	11.0	10.8	13.2	16.5
Peak Force	(0.25 sec)	Fp 0.25	N	303	303	303	455	455	455	606	606	606	909	909	909
			lbs	67	67	67	100	100	100	133	133	133	200	200	200
Peak Current	(0.25 sec)	Ip 0.25	A rms	9.2	9.2	9.2	13.8	13.8	13.8	18.4	18.4	18.4	27.6	27.6	27.6
Peak Force	(1 sec)	Fp1	N	248	248	248	373	373	373	497	497	497	745	745	745
			lbs	55	55	55	82	82	82	109	109	109	164	164	164
Peak Current	(1 sec)	Ip1	A rms	7.3	7.3	7.3	11.0	11.0	11.0	14.7	14.7	14.7	22.0	22.0	22.0
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	58	86	135	87	129	203	115	172	270	173	258	405
Force Constant	(All Three Phases)	Kf	N / A rms	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6
			lbs / A rms	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
Back EMF	(ptn)	Ke	V rms / m / sec	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9
			V rms / in / sec	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32
Resistance	(ptn @ 25°C)	R25	Ω	3.2	3.2	3.2	2.2	2.2	2.2	1.6	1.6	1.6	1.1	1.1	1.1
Resistance	(ptn @ 125°C)	R125	Ω	4.5	4.5	4.5	3.0	3.0	3.0	2.2	2.2	2.2	1.5	1.5	1.5
Inductance	(ptn)	L	mH	14.3	14.3	14.3	9.5	9.5	9.5	7.1	7.1	7.1	4.8	4.8	4.8
Electrical Time Constant		Te	msec	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	10.5	10.5	10.5	12.9	12.9	12.9	14.9	14.9	14.9	18.3	18.3	18.3
			lb / √ W	2.3	2.3	2.3	2.8	2.8	2.8	3.3	3.3	3.3	4.0	4.0	4.0
Thermal Resistance		Rth	°C / W	0.58	0.39	0.25	0.39	0.26	0.16	0.29	0.19	0.12	0.19	0.13	0.08
Maximum Coil Temperature		tmax	°C	125	125	125	125	125	125	125	125	125	125	125	125
Coil Assembly Weight		W	kg	1.8	1.8	1.8	2.4	2.4	2.4	3.6	3.6	3.6	4.8	4.8	4.8
			lbs	4.0	4.0	4.0	5.2	5.3	5.3	7.9	7.9	7.9	10.6	10.6	10.6
Magnetic Attraction		Fa	N	1036	1036	1036	1555	1555	1555	2073	2073	2073	3109	3109	3109
			lbs	228	228	228	342	342	342	456	456	456	684	684	684
Cooling Flow Rate		Q	LPM	n/a	148	4	n/a	154	4	n/a	160	4	n/a	166	4
			SCFM/GPM	n/a	5.1	1.0	n/a	5.3	1.0	n/a	5.5	1.0	n/a	5.7	1.0
Cooling Supply Pressure		P	kPa	n/a	207	72	n/a	207	76	n/a	207	79	n/a	207	97
			PSIG	n/a	30	11	n/a	30	11	n/a	30	12	n/a	30	14

Note: All specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LCD-T -3 -P -NC -TE -HET**

❶ Number of Coil Set	***1, 2, 3, 4***	
❷ Coil Winding Connection	***P*** —Parallel	***BLANK*** —Single Coil Set
❸ Cooling Type	***NC*** —No Cooling ***AC*** —Air Cooling	***WC*** —Water Cooling
❹ Thermistor	***TE*** —Thermistor	***NT*** —No Thermistor
❺ Hall Effect	***NH*** —No Hall Effect	***HET*** —Trapezoidal Hall Effect

Magnet Assembly

Example **LCD-T -375 mm**

❶ Magnet Assembly Length	***281, 375, 469, 563, 656, 750, 844, 938 mm***

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function	Length
MOTOR LEADS		BRN	ϕA	
(Standard)		BLK	ϕB	0.6m
		BLU	ϕC	2ft
		GRN	GND	
THERMISTORS		BLK	125ºC	0.6m
(Optional)		BLK	125ºC	2ft
HALL			TRAP	
EFFECT	1	RED	V+	
CONNECTOR	2	BLK	VRTN	0.6m
(Optional)	3	ORN	S3	2ft
	4	BLU	S2	
	5	WHT	S1	
	6		KEY	

Note: V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For stand still conditions multiply continuous force and continuous current by 0.9.

Magnet Assembly Specifications:

a) Magnet assembly weight; 6.4 kg/m (0.35 lb/in).

b) Magnet pitch (180°) = 23.45 mm (0.98 in).

c) Magnet assy. length = travel + coil length + hall length (see example).

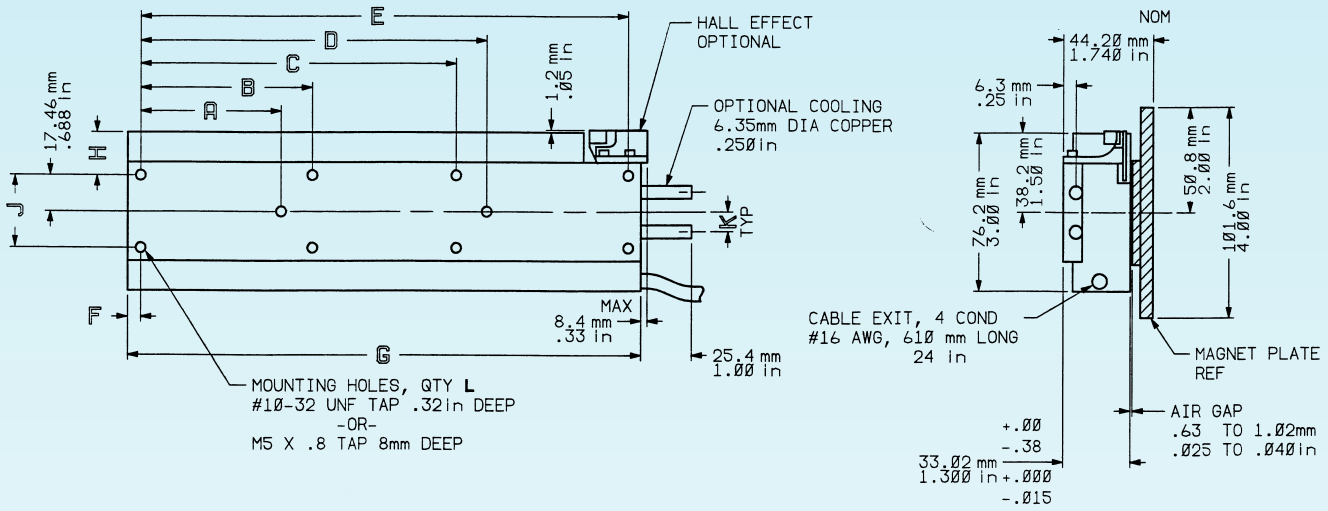
Example:

Required travel:	500 mm
Coil size:	LCD-T-2-NC-NT-HET
Magnet assembly length =	500 + 203.2 + 8.4 = 711.6 mm
Select:	LCD-T -750 mm

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LCD-T outline

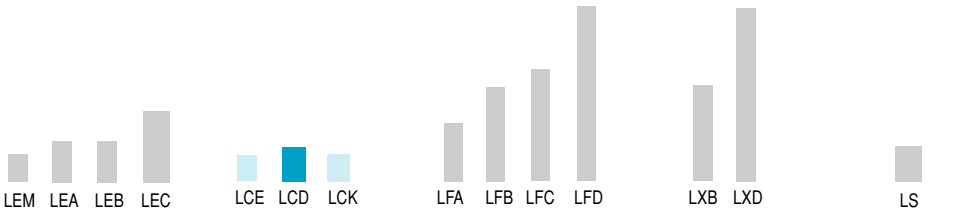
Coil Assembly Outline



MOTOR		VERSION	A	B	C	D	E	F	G	H	J	K	L
LCD-T-1	mm	ALL	44.45	-	-	88.90	133.35	6.4	146.0	20.6	34.93	9.5	6
	in		1.750			3.500	5.250	.25	5.75	.81	1.375	.37	
LCD-T-2	mm	ALL	57.94	-	-	126.21	184.15	6.4	203.2	20.6	34.93	9.5	6
	in		2.281			4.969	7.250	.25	8.00	.81	1.375	.37	
LCD-T-3	mm	ALL	69.85	-	-	171.45	241.30	6.4	254.0	20.6	34.93	9.5	6
	in		2.750			6.750	9.500	.25	10.00	.81	1.375	.37	
LCD-T-4	mm	WITHOUT COOLING	-	106.38	215.90	-	322.28	19.8	362.0	20.6	34.93	6.4	8
	in			4.188	8.500		12.688	.78	14.25	.81	1.375	.25	
LCD-T-4	mm	WITH OPTIONAL COOLING	-	106.38	215.90	-	307.19	19.8	362.0	25.4	25.4	6.4	8
	in			4.188	8.500		12.094	.78	14.25	1.00	1.000	.25	

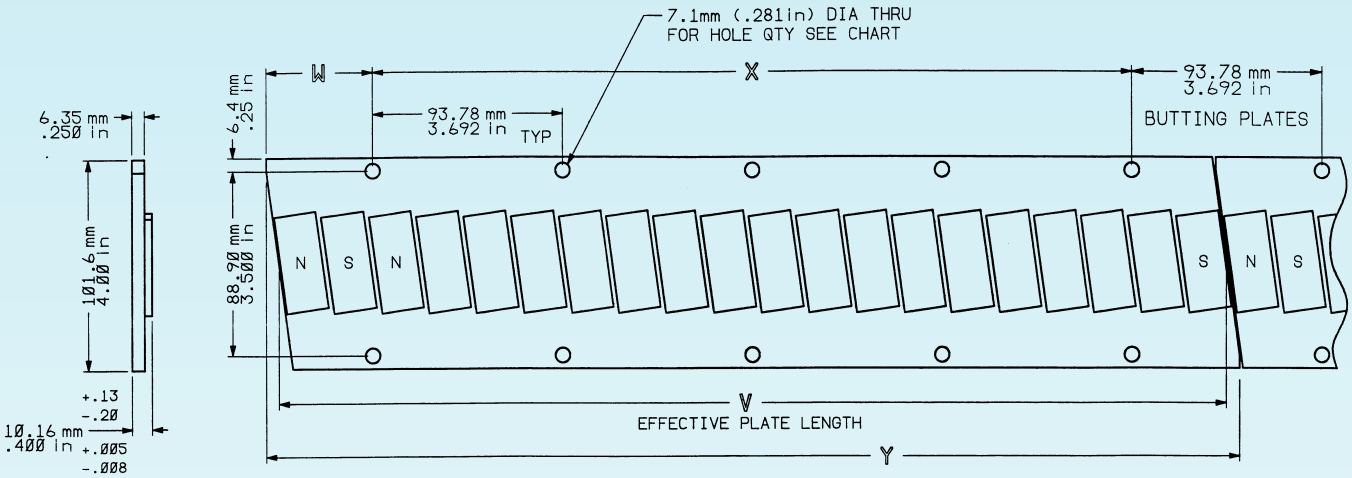


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Magnet Assembly Outline



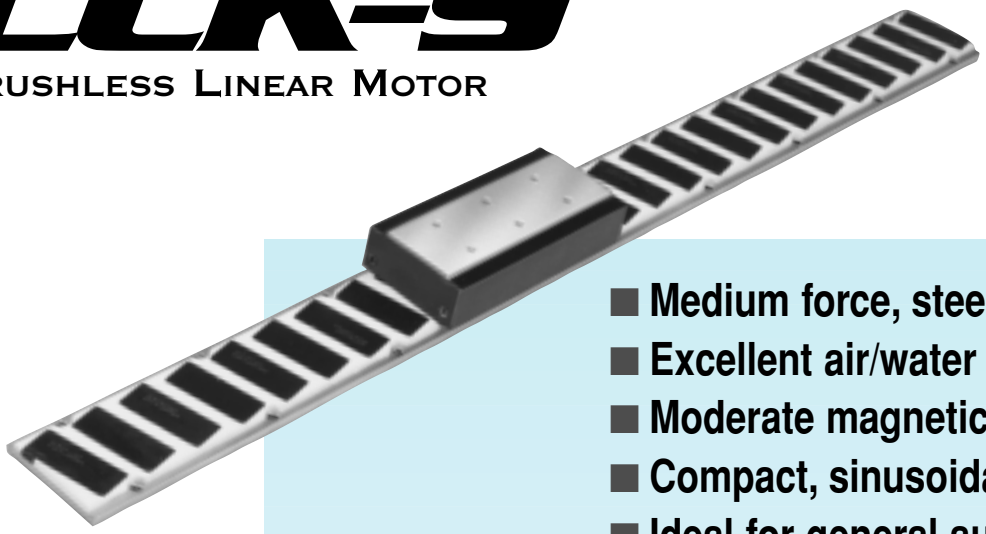
SIZE		V	W	X	Y	HOLE QTY
281	mm	281.3	52.68	187.55	293.01	6
	in	11.07	2.074	7.384	11.536	
375	mm	375.01	52.68	281.33	386.82	8
	in	14.77	2.074	11.076	15.229	
469	mm	468.9	52.68	375.11	480.59	10
	in	18.46	2.074	14.768	18.921	
563	mm	562.7	52.68	468.88	574.37	12
	in	22.15	2.074	18.460	22.613	
656	mm	656.4	52.68	562.66	668.15	14
	in	25.84	2.074	22.152	26.305	
750	mm	750.2	52.68	656.44	761.92	16
	in	29.53	2.074	25.844	29.997	
844	mm	844.0	52.68	750.21	855.70	18
	in	33.23	2.074	29.536	33.689	
938	mm	937.8	52.68	843.99	949.48	20
	in	36.92	2.074	33.228	37.381	

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NEW

LCK-S

Brushless Linear Motor



- Medium force, steel core
- Excellent air/water cooling
- Moderate magnetic attraction preload
- Compact, sinusoidal flux density
- Ideal for general automation

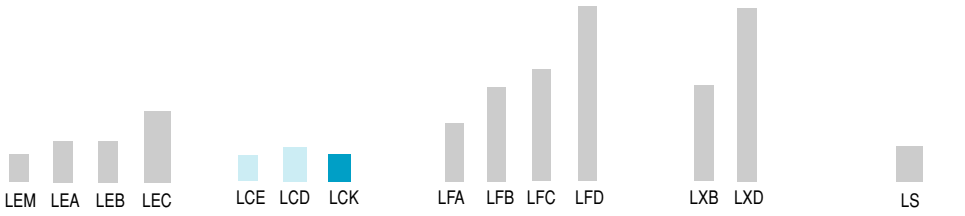
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LCK-S Specifications

Motor Model		Symbol	Units	LCK-S-1			LCK-S-2-P			LCK-S-3-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	184	241	279	368	483	558	552	724	836
			lbs	40	53	61	81	106	123	121	159	184
Continuous Current	(coil @ 25°C)	Ic25	A rms	3.3	4.4	5.0	6.6	8.7	10.1	9.9	13.1	15.1
Continuous Force	(coil @ 125°C)	Fc125	N	156	205	237	312	410	474	469	615	711
			lbs	34	45	52	69	90	104	103	135	156
Continuous Current	(coil @ 125°C)	Ic125	A rms	2.8	3.7	4.3	5.6	7.4	8.5	8.4	11.1	12.8
Peak Force	(0.25 sec)	Fp 0.25	N	395	395	395	791	791	791	1186	1186	1186
			lbs	87	87	87	174	174	174	261	261	261
Peak Current	(0.25 sec)	Ip 0.25	A rms	10.0	10.0	10.0	20.0	20.0	20.0	30.0	30.0	30.0
Peak Force	(1 sec)	Fp1	N	345	345	345	691	691	691	1036	1036	1036
			lbs	76	76	76	152	152	152	228	228	228
Peak Current	(1 sec)	Ip1	A rms	8.1	8.1	8.1	16.2	16.2	16.2	24.3	24.3	24.3
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	42.3	72.9	97.2	84.6	145.8	194.4	126.9	218.7	291.7
Force Constant	(All Three Phases)	Kf	N / A rms	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5	55.5
			lbs / A rms	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
Back EMF	(ptn)	Ke	V rms / m / sec	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5	18.5
			V rms / in / sec	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Resistance	(ptn @ 25°C)	R25	Ω	3.9	3.9	3.9	1.9	1.9	1.9	1.3	1.3	1.3
Resistance	(ptn @ 125°C)	R125	Ω	5.3	5.3	5.3	2.7	2.7	2.7	1.8	1.8	1.8
Inductance	(ptn)	L	mH	30.0	30.0	30.0	15.0	15.0	15.0	10.0	10.0	10.0
Electrical Time Constant		Te	msec	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	13.9	13.9	13.9	19.6	19.6	19.6	24.0	24.0	24.0
			lb / √ W	3.1	3.1	3.1	4.3	4.3	4.3	5.3	5.3	5.3
Thermal Resistance		Rth	°C / W	0.79	0.46	0.34	0.39	0.23	0.17	0.26	0.15	0.11
Maximum Coil Temperature		tmax	°C	125	125	125	125	125	125	125	125	125
Coil Assembly Weight		W	kg	1.3	1.5	1.5	2.6	3.0	3.0	4.0	4.5	4.5
			lbs	2.9	3.3	3.3	5.8	6.6	6.6	8.7	9.9	9.9
Magnetic Attraction		Fa	N	1164	1164	1164	2327	2327	2327	3491	3491	3491
			lbs	256	256	256	512	512	512	768	768	768
Cooling Flow Rate		Q	LPM	n/a	183	4	n/a	169	4	n/a	151	4
			SCFM/GPM	n/a	6	1	n/a	6	1	n/a	5	1
Cooling Supply Pressure		P	kPa	n/a	207	55	n/a	207	69	n/a	207	69
			PSIG	n/a	30	8	n/a	30	10	n/a	30	10

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LCK-S -2 -P -AC -TE -HET**

❶ ❷ ❸ ❹ ❺

❶ Number of Coil Set	**1, 2, 3**		
❷ Coil Winding Connection	**S** —Series	**P** —Parallel	**BLANK** —Single Coil Set
❸ Cooling Type	**NC** —No Cooling **AC** —Air Cooling		**WC** —Water Cooling
❹ Thermistor	**TE** —Thermistor		**NT** —No Thermistor
❺ Hall Effect	**NH** —No Hall Effect		**HET** —Trapezoidal Hall Effect
	HES —Sinusoidal Hall Effect (120°)		**HER** —Sinusoidal Hall Effect (90°)
	RES —Resolver Hall Effect		

Magnet Assembly

Example **LCK-S -780 mm**

❶

❶ Magnet Assembly Length	**240, 420, 600, 780 mm**

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Color	Function			Length
MOTOR LEADS	RED	ϕA			
(Standard)	WHT	ϕB			0.3m
	BLK	ϕC			1ft
	GRN	GND			
THERMISTORS	BLK	125°C			0.3m
(Optional)	BLK	125°C			1ft
		Trap	Sine	Resolver	
HALL	RED	V+	I+	R1	
EFFECT	BLU	S2	A+	S1	0.3m
CONNECTOR	WHT	S1	A-	S2	1ft
(Optional)	ORN	S3	B+	S3	
	GRN		B-	S4	
	BLK	VRTN	I-	R2	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil moving with all phases sharing the same load in sinusoidal commutation.

b) Coil attached to aluminum heat sink 254 x 254 x 25.4 mm (10" x 10" x 1").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

d) For stand still conditions multiply continuous force and continuous current by 0.9.

Options:

a) Low voltage windings. Contact factory for details.

Magnet Assembly Specifications:

a) Magnet assembly weight; 3.4 kg/m (0.19 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

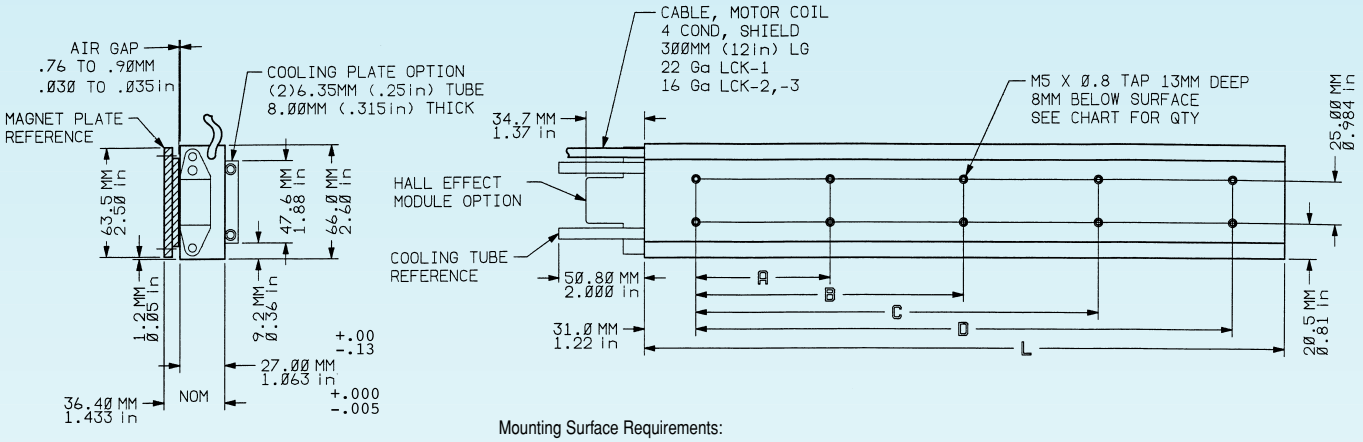
c) Magnet assy. length = travel + coil length + hall length (see example).

Example:

Required travel:	500 mm
Coil size:	LCK-S-3-NC-NT-HES
Magnet assembly length =	500 + 382 + 34.7 = 916.7 mm
Select:	LCK-S -600 mm and 420 mm

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Coil Assembly Outline

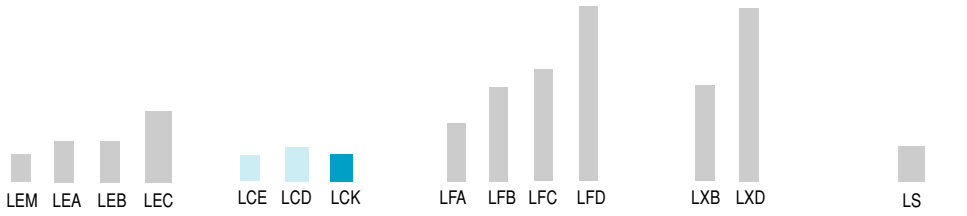


Mounting Surface Requirements:
1. Coil Mounting Surface:
   (with and without cooling) Flat within .13 mm (.005 in)
2. Magnet Plate Mounting Surface:
   Flat within .13 mm (.005 in)
   Parallel to coil .13 mm (.005 in)

MOTOR		L	A	B	C	D	HOLE QTY
LCK-S-1	mm	142.0	40.00	80.00	-	-	6
	in	5.59	1.575	3.150			
LCK-S-2	mm	262.0	80.00	120.00	200.00	-	8
	in	10.31	3.150	4.724	7.874		
LCK-S-3	mm	382.0	80.00	160.00	240.00	320.00	10
	in	15.04	3.150	6.299	9.449	12.598	

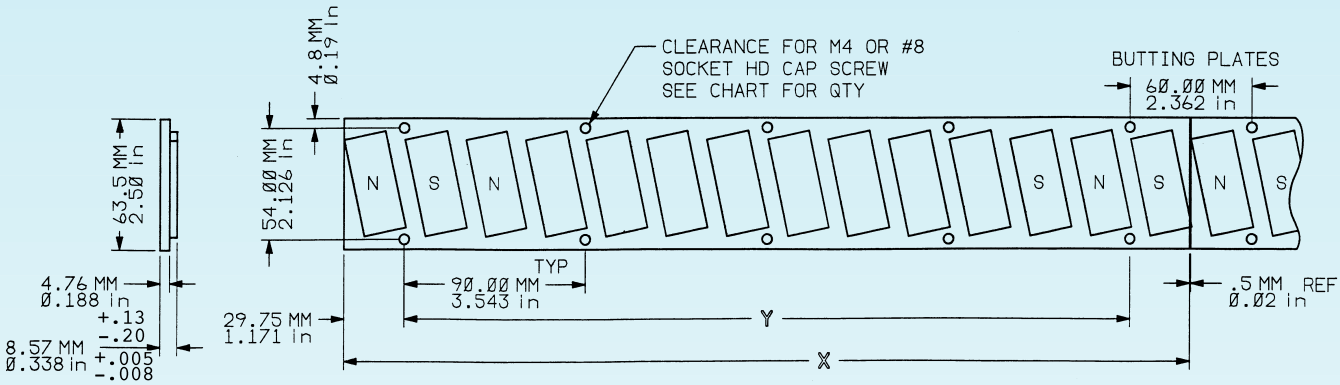


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline

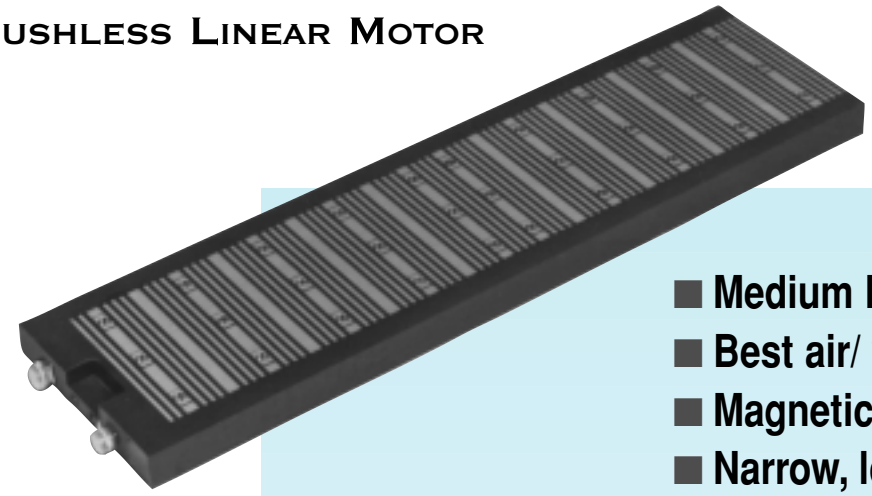


SIZE		X	Y	HOLE QTY
240	mm	239.50	180.00	6
	in	9.429	7.086	
420	mm	419.50	360.00	10
	in	16.516	14.173	
600	mm	599.50	540.00	14
	in	23.602	21.260	
780	mm	779.50	720.00	18
	in	30.689	28.346	

NEW

LFA-S

Brushless Linear Motor



- Medium high force, steel core
- Best air/ water cooling
- Magnetic attraction preload
- Narrow, low cost for long travel
- Ideal for heavy duty applications

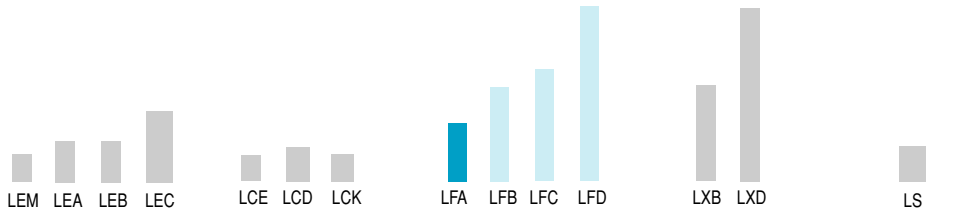
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LFA-S Specifications

Motor Model		Symbol	Units	LFA-S-2-P			LFA-S-3-P			LFA-S-4-P			LFA-S-6-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	357	426	710	535	639	1065	713	852	1420	1070	1279	2130
			lbs	78	94	156	118	141	234	157	188	312	235	281	468
Continuous Current	(coil @ 25°C)	Ic25	A rms	3.1	3.7	6.1	4.6	5.5	9.2	6.2	7.4	12.3	9.2	11.0	18.4
Continuous Force	(coil @ 95°C)	Fc95	N	317	378	630	475	567	945	633	757	1260	950	1135	1890
			lbs	70	83	139	104	125	208	139	166	277	209	250	416
Continuous Current	(coil @ 95°C)	Ic95	A rms	2.7	3.3	5.4	4.1	4.9	8.2	5.5	6.5	10.9	8.2	9.8	16.3
Peak Force	(0.25 sec)	Fp 0.25	N	1568	1568	1568	2352	2352	2352	3136	3136	3136	4705	4705	4705
			lbs	345	345	345	518	518	518	690	690	690	1035	1035	1035
Peak Current	(0.25 sec)	Ip 0.25	A rms	15.5	15.5	15.5	23.3	23.3	23.3	31.0	31.0	31.0	46.5	46.5	46.5
Peak Force	(1 sec)	Fp1	N	1364	1364	1364	2045	2045	2045	2727	2727	2727	4091	4091	4091
			lbs	300	300	300	450	450	450	600	600	600	900	900	900
Peak Current	(1 sec)	Ip1	A rms	13.6	13.6	13.6	20.4	20.4	20.4	27.2	27.2	27.2	40.8	40.8	40.8
Continuous Power Loss	(ptn @ 95°C)	Pc95	W	45.5	65.0	180.4	68.3	97.6	270.6	91.1	130.1	360.7	136.6	195.1	541.1
Force Constant	(All Three Phases)	Kf	N / A rms	115.8	115.8	115.8	115.8	115.8	115.8	115.8	115.8	115.8	115.8	115.8	115.8
			lbs / A rms	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5	25.5
Back EMF	(ptn)	Ke	V rms / m / sec	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6	38.6
			V rms / in / sec	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Resistance	(ptn @ 25°C)	R25	Ω	4.8	4.8	4.8	3.2	3.2	3.2	2.4	2.4	2.4	1.6	1.6	1.6
Resistance	(ptn @ 95°C)	R95	Ω	6.1	6.1	6.1	4.1	4.1	4.1	3.0	3.0	3.0	2.0	2.0	2.0
Inductance	(ptn)	L	mH	37.5	37.5	37.5	25.0	25.0	25.0	18.8	18.8	18.8	12.5	12.5	12.5
Electrical Time Constant		Te	msec	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8	7.8
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	27.1	27.1	27.1	33.2	33.2	33.2	38.3	38.3	38.3	46.9	46.9	46.9
			lb / √ W	6.0	6.0	6.0	7.3	7.3	7.3	8.4	8.4	8.4	10.3	10.3	10.3
Thermal Resistance		Rth	°C / W	0.51	0.36	0.13	0.34	0.24	0.09	0.26	0.18	0.06	0.17	0.12	0.04
Maximum Coil Temperature		tmax	°C	95	95	95	95	95	95	95	95	95	95	95	95
Coil Assembly Weight		W	kg	6.1	6.1	6.1	9.1	9.1	9.1	12.1	12.1	12.1	18.2	18.2	18.2
			lbs	13.3	13.3	13.3	20.0	20.0	20.0	26.7	26.7	26.7	40.0	40.0	40.0
Magnetic Attraction		Fa	N	4545	4545	4545	6818	6818	6818	9091	9091	9091	13636	13636	13636
			lbs	1000	1000	1000	1500	1500	1500	2000	2000	2000	3000	3000	3000
Cooling Flow Rate		Q	LPM	n/a	189.2	5.7	n/a	171.7	5.7	n/a	154.2	5.7	n/a	125.1	5.7
			SCFM/GPM	n/a	6.5	1.5	n/a	5.9	1.5	n/a	5.3	1.5	n/a	4.3	1.5
Cooling Supply Pressure		P	kPa	n/a	138.0	241.5	n/a	138.0	276.0	n/a	138.0	310.5	n/a	138.0	414.0
			PSIG	n/a	20.0	35.0	n/a	20.0	40.0	n/a	20.0	45.0	n/a	20.0	60.0

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LFA-S -2 -P -AC -TE -HET -M**

❶ Number of Coil Set	**2, 3, 4, 6**		
❷ Coil Winding Connection	**P** —Parallel		
❸ Cooling Type	**NC** —No Cooling	**WC** —Water Cooling	
	AC —Air Cooling		
❹ Thermistor	**TE** —Thermistor		
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect	
	HES —Sinusoidal Hall Effect (120°)	**HER** —Sinusoidal Hall Effect (90°)	
	RES —Resolver Hall Effect	**HESNA** —Sinusoidal Hall Effect No Amp	
❻ Cooling Fitting	**BLANK** —English	**M** —Metric	

Magnet Assembly

Example **LFA-S -240 mm**

❶ Magnet Thickness	**S**—Standard	**SH**—Thick
❷ Magnet Assembly Length	**240, 420, 600, 960 mm**	

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Color	Function					Length
MOTOR LEADS	BLK/RED	ϕA					
(Standard)	BLK/WHT	ϕB					5 m
	BLK/GRN	ϕC					15 ft
	GRN/YEL	GND					
THERMISTORS	BLK	75°C					
(Standard)	WHT	75°C					5 m
	RED	95°C					15 ft
	GRN	95°C					
		Sine	Sine	Resolver	Trap		
		Amp	No Amp		Color	Function	
HALL	BRN	I+	I+		RED	V+	
EFFECT	BLK/BRN	COM	I -		BLK	VRTN	
	RED	+15V		R1	ORN	S1	
(see note c	BLK/RED	- 15V		R2	WHT	S2	5 m
in options)	YEL	A+	A+	S1	BLU	S3	15 ft
	BLK/YEL	A -	A -	S3	GRN		
	ORN	B+	B+	S2			
	BLK/ORN	B -	B -	S4			

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil in stand still conditions.

b) Coil attached to aluminum heat sink 609 x 762 x 51 mm (24" x 30" x 2").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

Options:

a) Low voltage windings. Contact factory for details.

b) Thick magnets (-SH) for 20% increased force. Contact factory for details.

c) Use hall effect "Amp" option with high power amplifier (15 - 28 Kw), use "No Amp" option with low power amplifier (0.15 - 2 Kw).

Magnet Assembly Specifications:

a) Magnet assembly weight; 10.0 kg/m (0.55 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

c) Magnet assy. length = travel + coil length + hall length (see example).

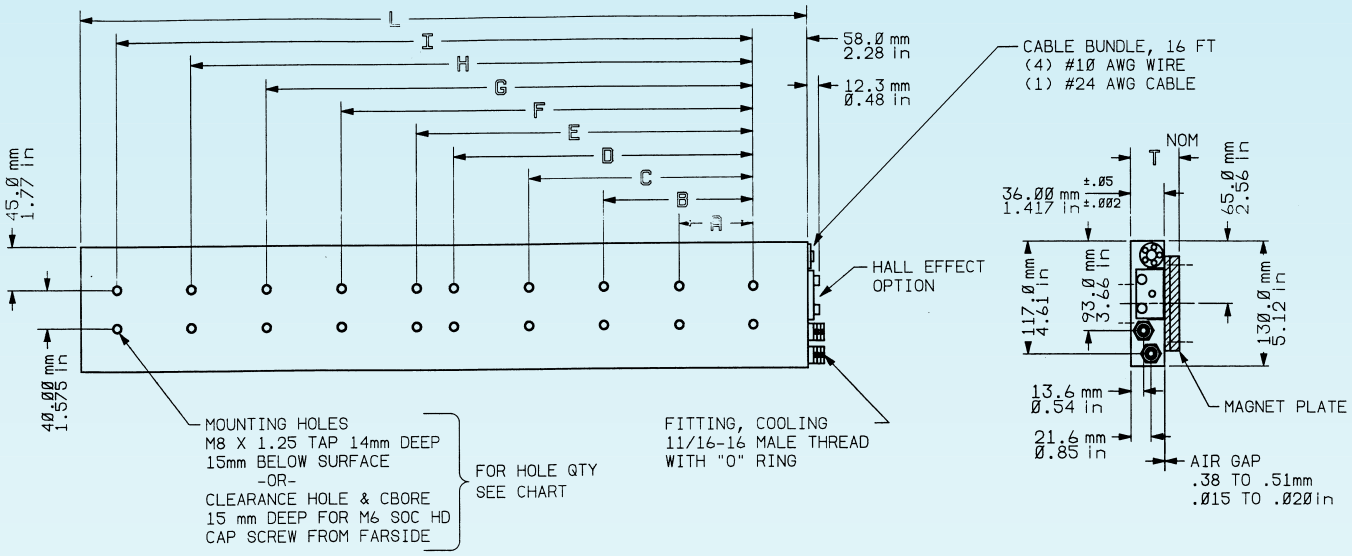
Example:

Required travel:	500 mm
Coil size:	LFA-S-6-WC-TE-HES
Magnet assembly length =	500 + 777 + 12.3 = 1289.3 mm
Select:	LFA-S -960 mm and 420 mm

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LFA-S outline

Coil Assembly Outline



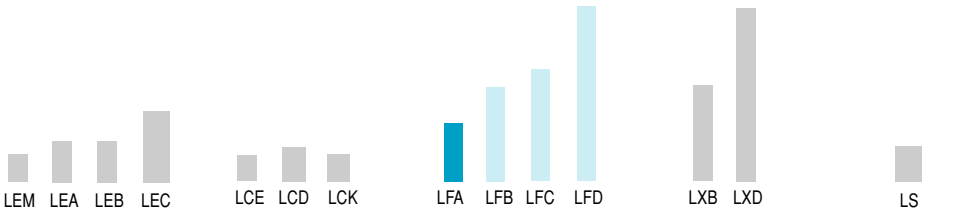
Metric Fitting = M16 x 1.5 parallel thread

MOTOR		L	A	B	C	D	E	F	G	H	I	HOLE QTY
LFA-S-2	mm	297.0	80.00	120.00	200.00	-	-	-	-	-	-	8
	in	11.69	3.150	4.724	7.874							
LFA-S-3	mm	417.0	80.00	160.00	240.00	320.00	-	-	-	-	-	10
	in	16.42	3.150	6.299	9.449	12.598						
LFA-S-4	mm	537.0	80.00	160.00	280.00	360.0	440.00	-	-	-	-	12
	in	21.14	3.150	6.299	11.024	14.173	17.323					
LFA-S-6	mm	777.0	80.00	160.00	240.00	320.00	360.00	440.00	520.00	600.00	600.00	20
	in	30.59	3.150	6.299	9.449	12.598	14.173	17.323	20.472	23.622	26.772	

SERIES		T
LFA-S	mm	51.88
	in	2.043
LFA-SH	mm	54.88
	in	2.160

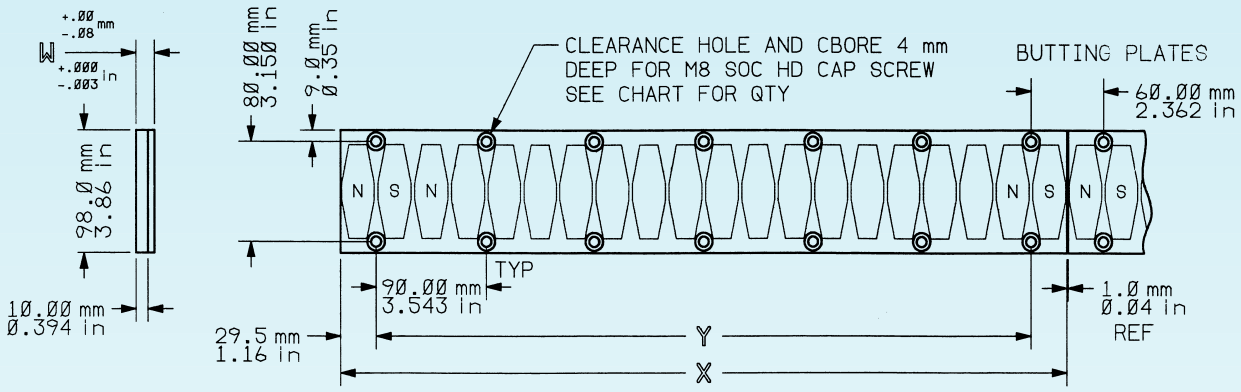


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Magnet Assembly Outline



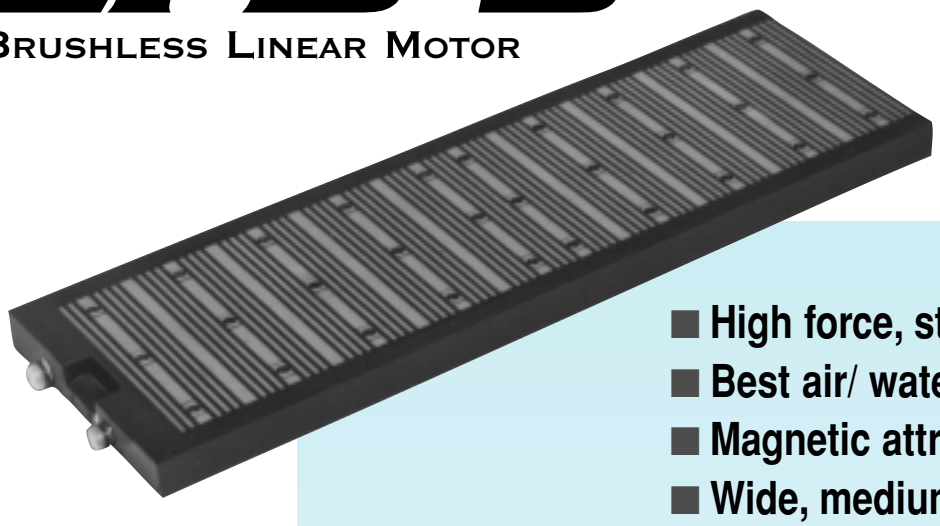
SIZE		X	Y	HOLE QTY
240	mm	239.00	180.00	6
	in	9.409	7.086	
420	mm	419.00	360.00	10
	in	16.496	14.173	
600	mm	599.00	540.00	14
	in	23.583	21.260	
960	mm	959.00	900.00	22
	in	37.756	35.433	

SERIES		W
LFA-S	mm	15.40
	in	.606
LFA-SH	mm	18.40
	in	.725

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LFB-S

Brushless Linear Motor



- High force, steel core
- Best air/ water cooling
- Magnetic attraction preload
- Wide, medium cost for medium travel
- Ideal for heavy duty applications

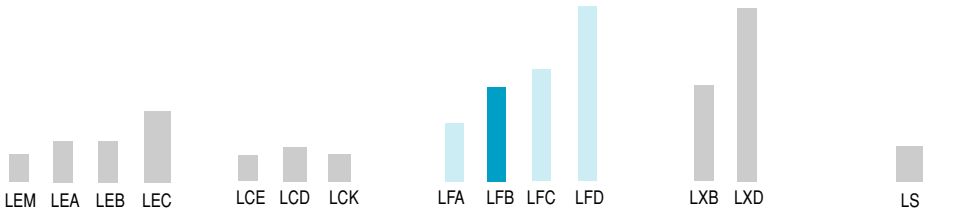
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LFB-S Specifications

Motor Model		Symbol	Units	LFB-S-2-P			LFB-S-4-P			LFB-S-6-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	713	856	1427	1427	1712	2853	2140	2568	4280
			lbs	157	188	314	314	377	628	471	565	942
Continuous Current	(coil @ 25°C)	Ic25	A rms	3.1	3.7	6.2	6.2	7.4	12.3	9.2	11.1	18.5
Continuous Force	(coil @ 95°C)	Fc95	N	633	760	1266	1266	1519	2532	1899	2279	3798
			lbs	139	167	279	279	334	557	418	501	836
Continuous Current	(coil @ 95°C)	Ic95	A rms	2.7	3.3	5.5	5.5	6.6	10.9	8.2	9.8	16.4
Peak Force	(0.25 sec)	Fp 0.25	N	3106	3106	3106	6212	6212	6212	9318	9318	9318
			lbs	683	683	683	1367	1367	1367	2050	2050	2050
Peak Current	(0.25 sec)	Ip 0.25	A rms	15.5	15.5	15.5	31.0	31.0	31.0	46.5	46.5	46.5
Peak Force	(1 sec)	Fp1	N	2727	2727	2727	5455	5455	5455	8182	8182	8182
			lbs	600	600	600	1200	1200	1200	1800	1800	1800
Peak Current	(1 sec)	Ip1	A rms	13.6	13.6	13.6	27.2	27.2	27.2	40.8	40.8	40.8
Continuous Power Loss	(ptn @ 95°C)	Pc95	W	74.0	106.6	296.0	148.0	213.1	592.0	222.0	319.7	887.9
Force Constant	(All Three Phases)	Kf	N / A rms	231.6	231.6	231.6	231.6	231.6	231.6	231.6	231.6	231.6
			lbs / A rms	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Back EMF	(ptn)	Ke	V rms / m / sec	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
			V rms / in / sec	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Resistance	(ptn @ 25°C)	R25	Ω	7.8	7.8	7.8	3.9	3.9	3.9	2.6	2.6	2.6
Resistance	(ptn @ 95°C)	R95	Ω	9.9	9.9	9.9	5.0	5.0	5.0	3.3	3.3	3.3
Inductance	(ptn)	L	mH	75.0	75.0	75.0	37.5	37.5	37.5	25.0	25.0	25.0
Electrical Time Constant		Te	msec	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	42.5	42.5	42.5	60.1	60.1	60.1	73.6	73.6	73.6
			lb / √ W	9.3	9.3	9.3	13.2	13.2	13.2	16.2	16.2	16.2
Thermal Resistance		Rth	°C / W	0.32	0.22	0.08	0.16	0.11	0.04	0.11	0.07	0.03
Maximum Coil Temperature		tmax	°C	95	95	95	95	95	95	95	95	95
Coil Assembly Weight		W	kg	11	11	11	23	23	23	34	34	34
			lbs	25	25	25	50	50	50	75	75	75
Magnetic Attraction		Fa	N	9091	9091	9091	18182	18182	18182	27273	27273	27273
			lbs	2000	2000	2000	4000	4000	4000	6000	6000	6000
Cooling Flow Rate		Q	LPM	n/a	145.5	5.7	n/a	116.4	5.7	n/a	87.3	5.7
			SCFM/GPM	n/a	5.0	1.5	n/a	4.0	1.5	n/a	3.0	1.5
Cooling Supply Pressure		P	kPa	n/a	138.0	138.0	n/a	138.0	276.0	n/a	138.0	414.0
			PSIG	n/a	20.0	20.0	n/a	20.0	40.0	n/a	20.0	60.0

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LFB-S -6 -P -WC -TE -HES -M**

❶ Number of Coil Set	**2, 4, 6**		
❷ Coil Winding Connection	**P** —Parallel		
❸ Cooling Type	**NC** —No Cooling	**WC** —Water Cooling	
	AC —Air Cooling		
❹ Thermistor	**TE** —Thermistor		
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect	
	HES —Sinusoidal Hall Effect (120°)	**HER** —Sinusoidal Hall Effect (90°)	
	RES —Resolver Hall Effect	**HESNA** —Sinusoidal Hall Effect No Amp	
❻ Cooling Fitting	**BLANK** —English	**M** —Metric	

Magnet Assembly

Example **LFB-S -420 mm**

❶ Magnet Thickness	**S**—Standard	**SH**—Thick
❷ Magnet Assembly Length	**240, 420, 600, 960 mm**	

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Color	Function					Length
MOTOR LEADS	BLK/RED	ϕA					
(Standard)	BLK/WHT	ϕB					5 m
	BLK/GRN	ϕC					15 ft
	GRN/YEL	GND					
THERMISTORS	BLK	75°C					
(Standard)	WHT	75°C					5 m
	RED	95°C					15 ft
	GRN	95°C					
		Sine	Sine	Resolver	Trap		
		Amp	No Amp		Color	Function	
HALL	BRN	I+	I+		RED	V+	
EFFECT	BLK/BRN	COM	I -		BLK	VRTN	
	RED	+15V		R1	ORN	S1	
(see note c	BLK/RED	- 15V		R2	WHT	S2	5 m
in options)	YEL	A+	A+	S1	BLU	S3	15 ft
	BLK/YEL	A -	A -	S3	GRN		
	ORN	B+	B+	S2			
	BLK/ORN	B -	B -	S4			

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil in stand still conditions.

b) Coil attached to aluminum heat sink 609 x 762 x 51 mm (24" x 30" x 2").

c) Care must be taken to remove heat from the coil mounting plate and from the magnets plate.

Options:

a) Low voltage windings. Contact factory for details.

b) Thick magnets (-SH) for 20% increased force. Contact factory for details.

c) Use hall effect "Amp" option with high power amplifier (15 - 28 Kw), use "No Amp" option with low power amplifier (0.15 - 2 Kw).

Magnet Assembly Specifications:

a) Magnet assembly weight; 19.6 kg/m (1.09 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

c) Magnet assy. length = travel + coil length + hall length (see example).

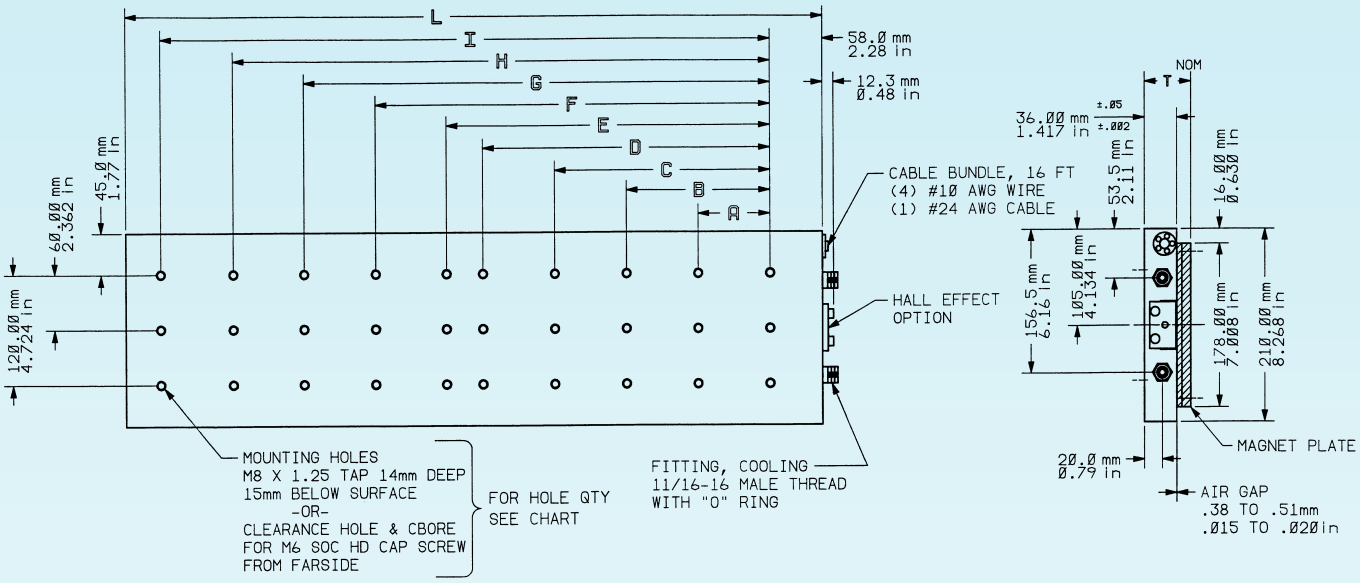
Example:

Required travel:	500 mm
Coil size:	LFB-S-6-WC-TE-HES
Magnet assembly length =	500 + 777 + 12.3 = 1289.3 mm
Select:	LFB-S -960 mm and 420 mm

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LFB-S outline

Coil Assembly Outline



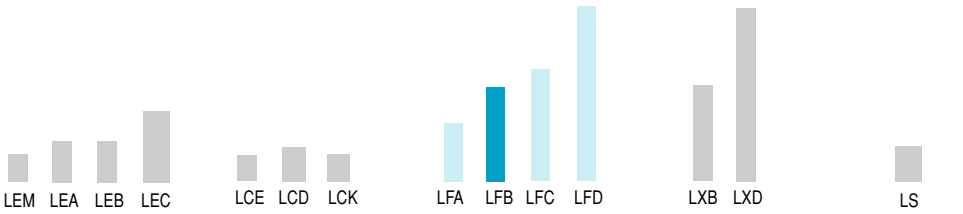
Metric Fitting = M16 x 1.5 parallel thread

MOTOR		L	A	B	C	D	E	F	G	H	I	HOLE QTY
LFB-S-2	mm	297.0	80.00	120.00	200.00	-	-	-	-	-	-	12
	in	11.69	3.150	4.724	7.874							
LFB-S-4	mm	537.0	80.00	160.00	280.00	360.00	440.00	-	-	-	-	18
	in	21.14	3.150	6.299	11.024	14.173	17.323					
LFB-S-6	mm	777.0	80.00	160.00	240.00	320.00	360.00	440.00	520.00	600.00	680.00	30
	in	30.59	3.150	6.299	9.449	12.598	14.173	17.323	20.472	23.622	26.772	

SERIES		T
LFB-S	mm	51.88
	in	2.043
LFB-SH	mm	54.88
	in	2.160

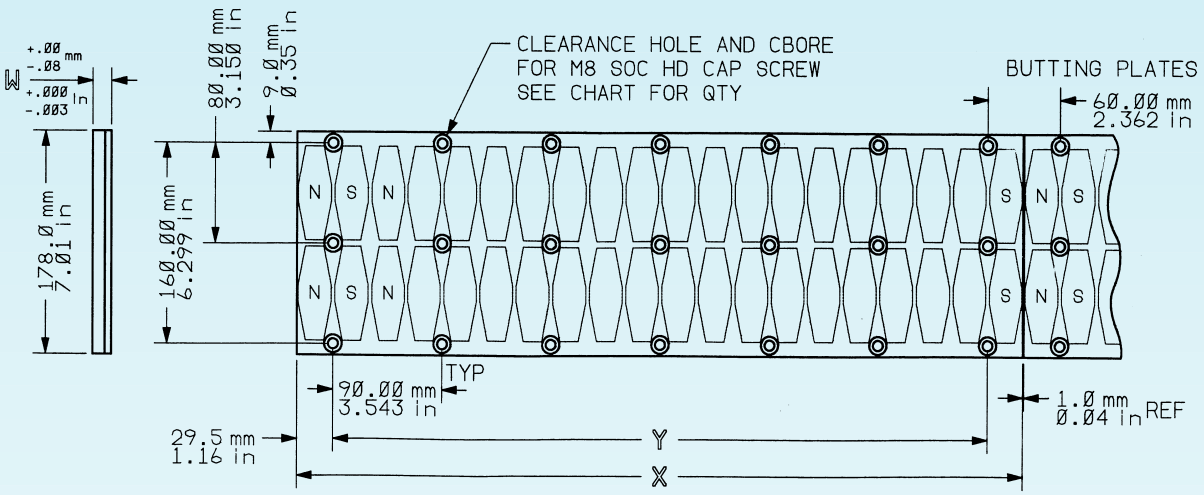


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



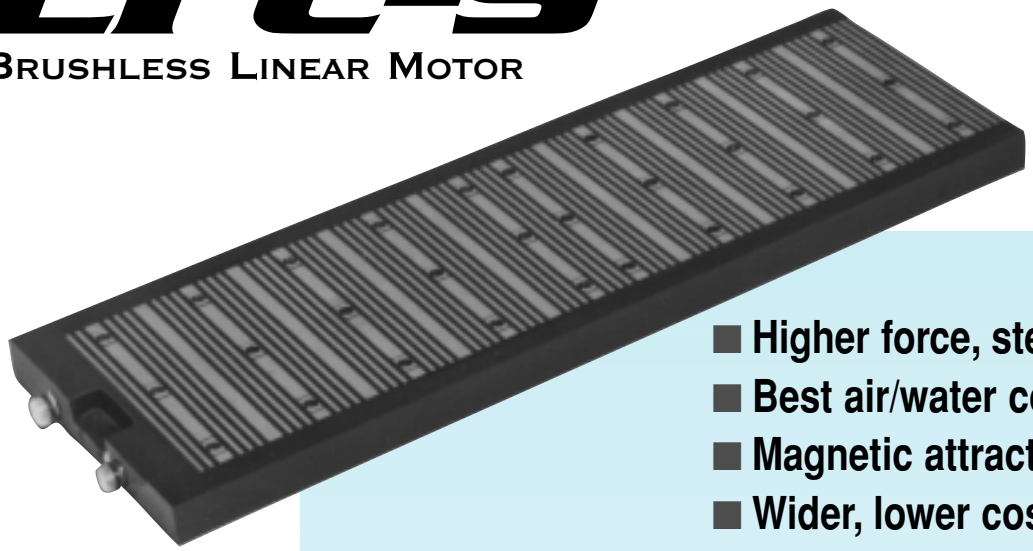
SIZE		X	Y	HOLE QTY
240	mm	239.00	180.00	9
	in	9.409	7.086	
420	mm	419.00	360.00	15
	in	16.496	14.173	
600	mm	599.00	540.00	21
	in	23.583	21.260	
960	mm	959.00	900.00	33
	in	37.756	35.433	

SERIES		W
LFB-S	mm	15.40
	in	.606
LFB-SH	mm	18.40
	in	.725

NEW

LFC-S

Brushless Linear Motor



- Higher force, steel core
- Best air/water cooling
- Magnetic attraction preload
- Wider, lower cost for short travel
- Ideal for heavy-duty application

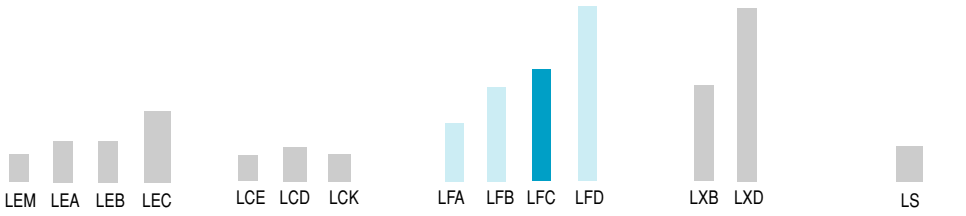
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LFC-S Specifications

Motor Model		Symbol	Units	LFC-S-2-P			LFC-S-4-P			LFC-S-6-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	936	1119	1863	1872	2238	3727	2809	3357	5590
			lbs	206	246	410	412	492	820	618	738	1230
Continuous Current	(coil @ 25°C)	Ic25	A rms	3.1	3.7	6.1	6.2	7.4	12.3	9.2	11.0	18.4
Continuous Force	(coil @ 95°C)	Fc95	N	831	993	1654	1662	1986	3307	2493	2979	4961
			lbs	183	218	364	366	437	728	548	655	1091
Continuous Current	(coil @ 95°C)	Ic95	A rms	2.7	3.3	5.4	5.5	6.5	10.9	8.2	9.8	16.3
Peak Force	(0.25 sec)	Fp 0.25	N	4318	4318	4318	8636	8636	8636	12955	12955	12955
			lbs	950	950	950	1900	1900	1900	2850	2850	2850
Peak Current	(0.25 sec)	Ip 0.25	A rms	15.5	15.5	15.5	31.0	31.0	31.0	46.5	46.5	46.5
Peak Force	(1 sec)	Fp1	N	3788	3788	3788	7576	7576	7576	11364	11364	11364
			lbs	833	833	833	1667	1667	1667	2500	2500	2500
Peak Current	(1 sec)	Ip1	A rms	13.6	13.6	13.6	27.2	27.2	27.2	40.8	40.8	40.8
Continuous Power Loss	(ptn @ 95°C)	Pc95	W	92.5	132.1	366.4	185.0	264.2	732.7	277.5	396.3	1099.1
Force Constant	(All Three Phases)	Kf	N / A rms	304.0	304.0	304.0	304.0	304.0	304.0	304.0	304.0	304.0
			lbs / A rms	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9	66.9
Back EMF	(ptn)	Ke	V rms / m / sec	101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.3	101.3
			V rms / in / sec	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Resistance	(ptn @ 25°C)	R25	Ω	9.8	9.8	9.8	4.9	4.9	4.9	3.3	3.3	3.3
Resistance	(ptn @ 95°C)	R95	Ω	12.4	12.4	12.4	6.2	6.2	6.2	4.1	4.1	4.1
Inductance	(ptn)	L	mH	99.0	99.0	99.0	49.5	49.5	49.5	33.0	33.0	33.0
Electrical Time Constant		Te	msec	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	49.9	49.9	49.9	70.5	70.5	70.5	86.4	86.4	86.4
			lb / √ W	11.0	11.0	11.0	15.5	15.5	15.5	19.0	19.0	19.0
Thermal Resistance		Rth	°C / W	0.25	0.18	0.06	0.13	0.09	0.03	0.08	0.06	0.02
Maximum Coil Temperature		tmax	°C	95	95	95	95	95	95	95	95	95
Coil Assembly Weight		W	kg	14	14	14	29	29	29	43	43	43
			lbs	32	32	32	63	63	63	95	95	95
Magnetic Attraction		Fa	N	11818	11818	11818	23636	23636	23636	35455	35455	35455
			lbs	2600	2600	2600	5200	5200	5200	7800	7800	7800
Cooling Flow Rate		Q	LPM	n/a	146	6	n/a	116	6	n/a	87	6
			SCFM/GPM	n/a	5	2	n/a	4	2	n/a	3	2
Cooling Supply Pressure		P	kPa	n/a	138	138	n/a	138	276	n/a	138	414
			PSIG	n/a	20	20	n/a	20	40	n/a	20	60

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LFC-S -2 -P -AC -TE -HET -M**

❶ Number of Coil Set	**2, 4, 6**	
❷ Coil Winding Connection	**P** —Parallel	
❸ Cooling Type	**NC** —No Cooling	**WC** —Water Cooling
	AC —Air Cooling	
❹ Thermistor	**TE** —Thermistor	
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect
	HES —Sinusoidal Hall Effect (120°)	**HER** —Sinusoidal Hall Effect (90°)
	RES —Resolver Hall Effect	**HESNA** —Sinusoidal Hall Effect No Amp
❻ Cooling Fitting	**BLANK** —English	**M** —Metric

Magnet Assembly

Example **LFC-S -240 mm**

❶ Magnet Thickness	**S**—Standard	**SH**—Thick
❷ Magnet Assembly Length	**240, 420, 600, 960 mm**	

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Color	Function					Length
MOTOR LEADS	BLK/RED	ϕA					
(Standard)	BLK/WHT	ϕB					5 m
	BLK/GRN	ϕC					15 ft
	GRN/YEL	GND					
THERMISTORS	BLK	75°C					
(Standard)	WHT	75°C					5 m
	RED	95°C					15 ft
	GRN	95°C					
		Sine	Sine	Resolver	Trap		
		Amp	No Amp		Color	Function	
HALL	BRN	I+	I+		RED	V+	
EFFECT	BLK/BRN	COM	I -		BLK	VRTN	
	RED	+15V		R1	ORN	S1	
(see note c	BLK/RED	- 15V		R2	WHT	S2	5 m
in options)	YEL	A+	A+	S1	BLU	S3	15 ft
	BLK/YEL	A -	A -	S3	GRN		
	ORN	B+	B+	S2			
	BLK/ORN	B -	B -	S4			

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil in stand still conditions.

b) Coil attached to aluminum heat sink 609 x 762 x 51 mm (24" x 30" x 2").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

Options:

a) Low voltage windings. Contact factory for details.

b) Thick magnets (-SH) for 20% increased force. Contact factory for details.

c) Use hall effect “Amp” option with high power amplifier (15 - 28 Kw), use “No Amp” option with low power amplifier (0.15 - 2 Kw).

Magnet Assembly Specifications:

a) Magnet assembly weight; 25.2 kg/m (1.38 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

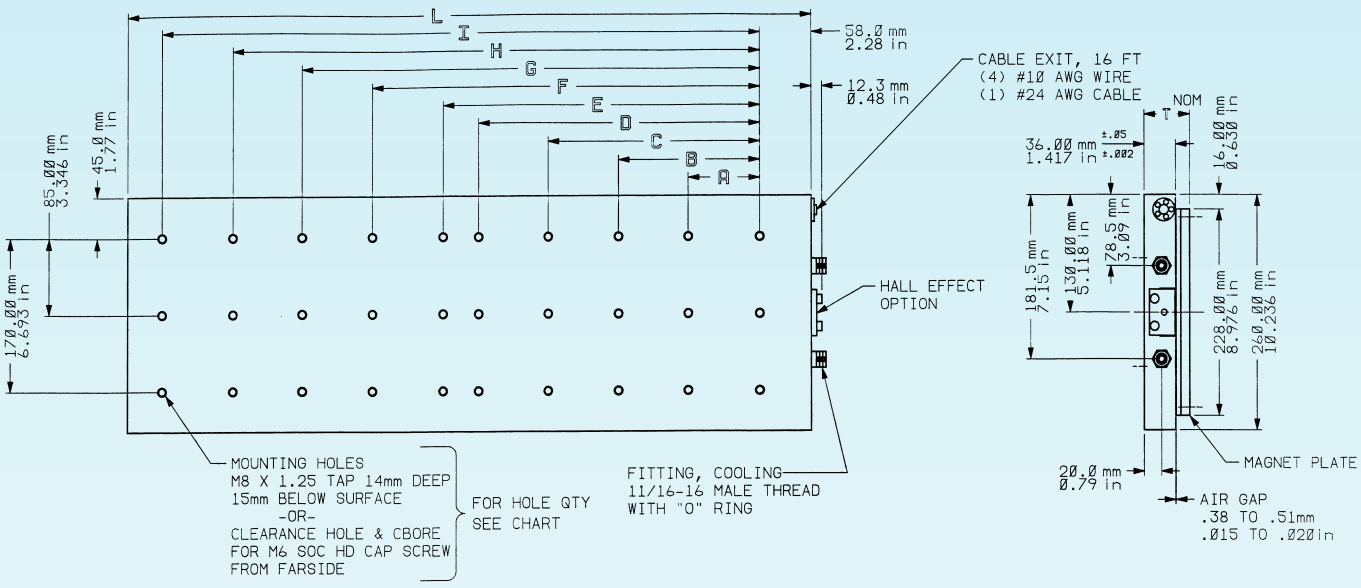
c) Magnet assy. length = travel + coil length + hall length (see example).

Example:

Required travel:	500 mm
Coil size:	LFC-S-6-WC-TE-HES
Magnet assembly length =	500 + 777 + 12.3 = 1289.3 mm
Select:	LFC-S -960 mm and 420 mm

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Coil Assembly Outline



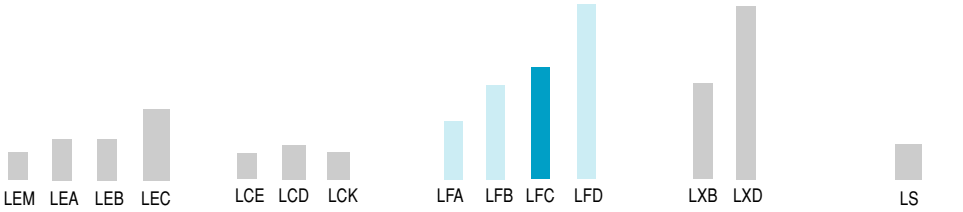
Metric Fitting = M16 x 1.5 parallel thread

MOTOR		L	A	B	C	D	E	F	G	H	I	HOLE QTY
LFC-S-4	mm	537.0	80.00	160.00	280.00	360.00	440.00	-	-	-	-	18
	in	21.14	3.150	6.299	11.024	14.173	17.323					
LFC-S-6	mm	777.0	80.00	160.00	240.00	320.00	360.00	440.00	520.00	600.00	680.00	30
	in	30.59	3.150	6.299	9.449	12.598	14.173	17.323	20.472	23.622	26.772	

SERIES		T
LFC-S	mm	51.88
	in	2.043
LFC-SH	mm	54.88
	in	2.160

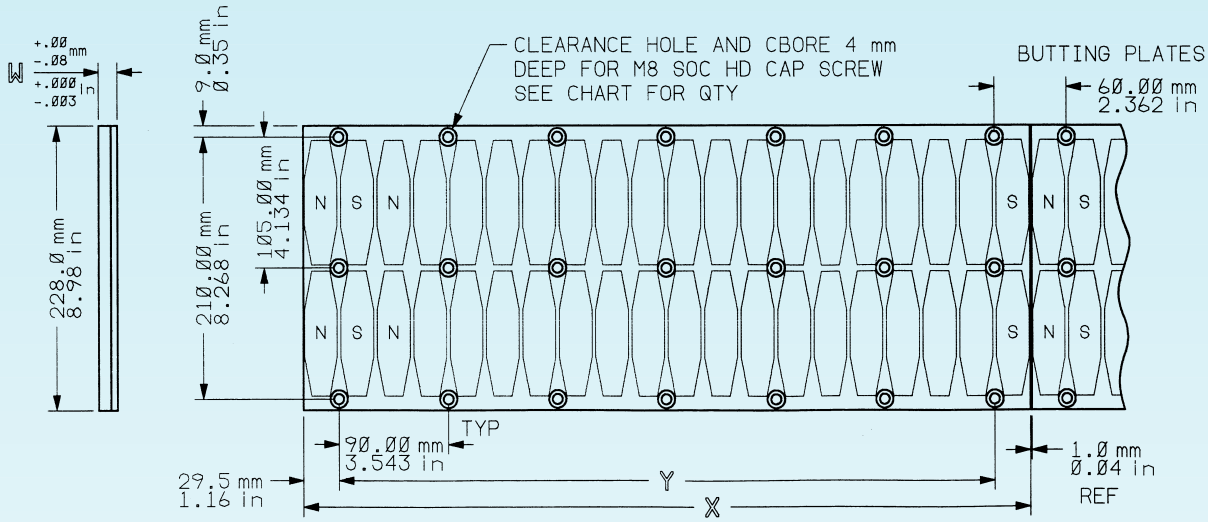


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Magnet Assembly Outline



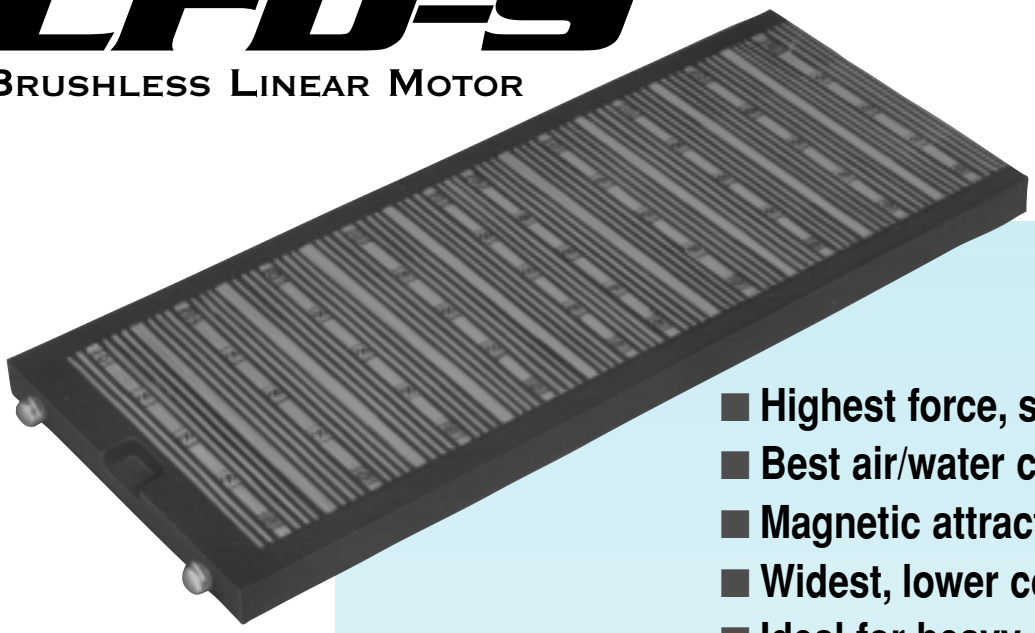
SIZE		X	Y	HOLE QTY
240	mm	239.00	180.00	9
	in	9.409	7.086	
420	mm	419.00	360.00	15
	in	16.496	14.173	
600	mm	599.00	540.00	21
	in	23.583	21.260	
960	mm	959.00	900.00	33
	in	37.756	35.433	

SERIES		W
LFC-S	mm	15.40
	in	.606
LFC-SH	mm	18.40
	in	.725

LFD-S

NEW

Brushless Linear Motor



- Highest force, steel core
- Best air/water cooling
- Magnetic attraction preload
- Widest, lower cost for shorter travel
- Ideal for heavy-duty application

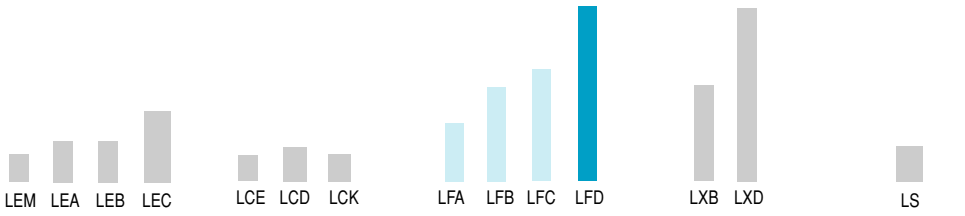
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LFDLV-S Specifications

Motor Model		Symbol	Units	LFDLV-S-2-P			LFDLV-S-4-P			LFDLV-S-6-P		
Cooling				NC	AC	WC	NC	AC	WC	NC	AC	WC
Continuous Force	(coil @ 25°C)	Fc25	N	1427	1705	2839	2853	3410	5679	4280	5115	8518
			lbs	314	375	625	628	750	1249	942	1125	1874
Continuous Current	(coil @ 25°C)	Ic25	A rms	6.2	7.4	12.3	12.3	14.7	24.5	18.5	22.1	36.8
Continuous Force	(coil @ 95°C)	Fc95	N	1266	1513	2520	2532	3026	5040	3798	4539	7559
			lbs	279	333	554	557	666	1109	836	999	1663
Continuous Current	(coil @ 95°C)	Ic95	A rms	5.5	6.5	10.9	10.9	13.1	21.8	16.4	19.6	32.6
Peak Force	(0.25 sec)	Fp 0.25	N	6288	6288	6288	12576	12576	12576	18864	18864	18864
			lbs	1383	1383	1383	2767	2767	2767	4150	4150	4150
Peak Current	(0.25 sec)	Ip 0.25	A rms	31.0	31.0	31.0	62.0	62.0	62.0	93.0	93.0	93.0
Peak Force	(1 sec)	Fp1	N	5455	5455	5455	10909	10909	10909	16364	16364	16364
			lbs	1200	1200	1200	2400	2400	2400	3600	3600	3600
Peak Current	(1 sec)	Ip1	A rms	27.2	27.2	27.2	54.4	65.0	54.4	81.6	81.6	81.6
Continuous Power Loss	(ptn @ 95°C)	Pc95	W	148	211	586	296	423	1172	444	634	1759
Force Constant	(All Three Phases)	Kf	N / A rms	232	232	232	232	232	232	232	232	232
			lbs / A rms	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0
Back EMF	(ptn)	Ke	V rms / m / sec	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2	77.2
			V rms / in / sec	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93
Resistance	(ptn @ 25°C)	R25	Ω	3.9	3.9	3.9	1.95	1.95	1.95	1.3	1.3	1.3
Resistance	(ptn @ 95°C)	R95	Ω	5.0	5.0	5.0	2.5	2.5	2.5	1.7	1.7	1.7
Inductance	(ptn)	L	mH	37.5	37.5	37.5	18.8	18.8	18.8	12.5	12.5	12.5
Electrical Time Constant		Te	msec	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	60.09	60.09	60.09	84.98	84.98	84.98	104.07	104.07	104.07
			lb / √ W	13.22	13.22	13.22	18.69	18.69	18.69	22.90	22.90	22.90
Thermal Resistance		Rth	°C / W	0.16	0.11	0.04	0.08	0.06	0.02	0.05	0.04	0.01
Maximum Coil Temperature		tmax	°C	95	95	95	95	95	95	95	95	95
Coil Assembly Weight		W	kg	21.2	21.6	21.6	40.7	40.7	40.7	63.6	63.6	63.6
			lbs	46.7	47.5	47.5	89.5	89.5	89.5	140.0	140.0	140.0
Magnetic Attraction		Fa	N	18182	18182	18182	36400	36400	36400	54545	54545	54545
			lbs	4000	4000	4000	8008	8008	8008	12000	12000	12000
Cooling Flow Rate		Q	LPM	n/a	145.5	5.7	n/a	116.4	5.7	n/a	87.3	5.7
			SCFM/GPM	n/a	5	1.5	n/a	4	1.5	n/a	3	1.5
Cooling Supply Pressure		P	kPa	n/a	138	138	n/a	138	276	n/a	138	552
			PSIG	n/a	20	20	n/a	20	40	n/a	20	80

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Coil Assembly

Example **LFDLV-S -2 -P -AC -TE -HET -M**

❶ Number of Coil Set	**2, 4, 6**		
❷ Coil Winding Connection	**P** —Parallel		
❸ Cooling Type	**NC** —No Cooling	**WC** —Water Cooling	
	AC —Air Cooling		
❹ Thermistor	**TE** —Thermistor		
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect	
	HES —Sinusoidal Hall Effect (120°)	**HER** —Sinusoidal Hall Effect (90°)	
	RES —Resolver Hall Effect	**HESNA** —Sinusoidal Hall Effect No Amp	
❻ Cooling Fitting	**BLANK** —English	**M** —Metric	

Magnet Assembly

Example **LFDLV-S -240 mm**

❶ Magnet Thickness	**S**—Standard	**SH**—Thick
❷ Magnet Assembly Length	**240, 420, 600, 960 mm**	

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Color	Function					Length
MOTOR LEADS	BLK/RED	ϕA					
(Standard)	BLK/WHT	ϕB					5 m
	BLK/GRN	ϕC					15 ft
	GRN/YEL	GND					
THERMISTORS	BLK	75°C					
(Standard)	WHT	75°C					5 m
	RED	95°C					15 ft
	GRN	95°C					
		Sine	Sine	Resolver	Trap		
		Amp	No Amp		Color	Function	
HALL	BRN	I+	I+		RED	V+	
EFFECT	BLK/BRN	COM	I -		BLK	VRTN	
	RED	+15V		R1	ORN	S1	
(see note b	BLK/RED	- 15V		R2	WHT	S2	5 m
in options)	YEL	A+	A+	S1	BLU	S3	15 ft
	BLK/YEL	A -	A -	S3	GRN		
	ORN	B+	B+	S2			
	BLK/ORN	B -	B -	S4			

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil in stand still conditions.

b) Coil attached to aluminum heat sink 609 x 762 x 51 mm (24" x 30" x 2").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plates.

Options:

a) Thick magnets (-SH) for 20% increased force. Contact factory for details.

b) Use hall effect “Amp” option with high power amplifier (15 - 28 Kw), use “No Amp” option with low power amplifier (0.15 - 2 Kw).

Magnet Assembly Specifications:

a) Magnet assembly weight; 39.2 kg/m (2.2 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

c) Magnet assy. length = travel + coil length + hall length (see example).

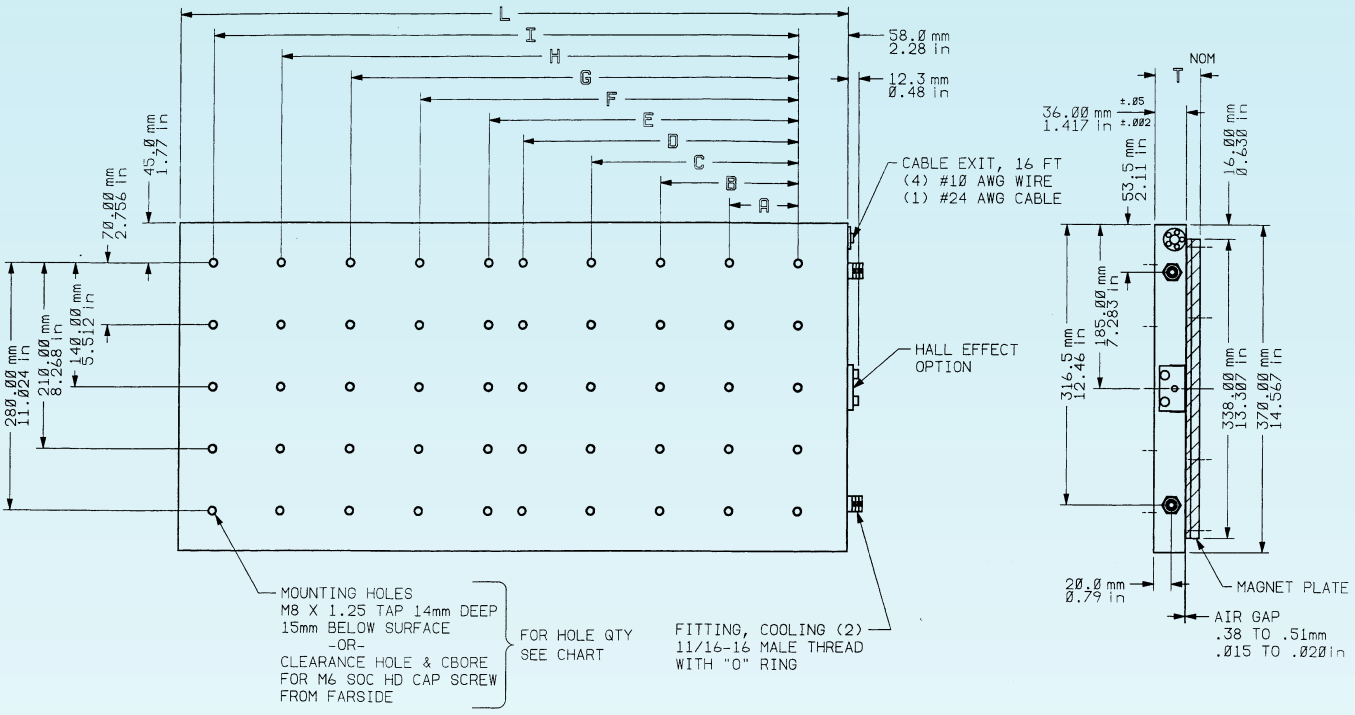
Example:

Required travel:	500 mm
Coil size:	LFDLV-S-6-WC-TE-HES
Magnet assembly length =	500 + 777 + 12.3 = 1289.3 mm
Select:	LFDLV-S -960 mm and 420 mm

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LFD-S outline

Coil Assembly Outline



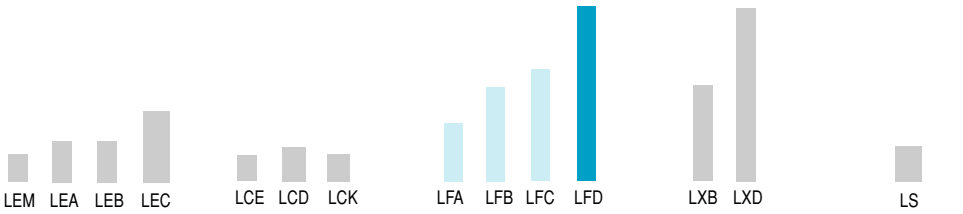
Metric Fitting = M16 x 1.5 parallel thread

MOTOR		L	A	B	C	D	E	F	G	H	I	HOLE QTY
LFDLV-S-2	mm	297.0	80.00	120.00	200.00	-	-	-	-	-	-	20
	in	11.69	3.150	4.724	7.874							
LFDLV-S-4	mm	537.0	80.00	160.00	280.00	360.00	440.00	-	-	-	-	30
	in	21.14	3.150	6.299	11.024	14.173	17.323					
LFDLV-S-6	mm	777.0	80.00	160.00	240.00	320.00	360.00	440.00	520.00	600.00	680.00	50
	in	30.59	3.150	6.299	9.449	12.598	14.173	17.323	20.472	23.622	26.772	

SERIES		T
LFDLV-S	mm	51.88
	in	2.043
LFDLV-SH	mm	54.88
	in	2.160

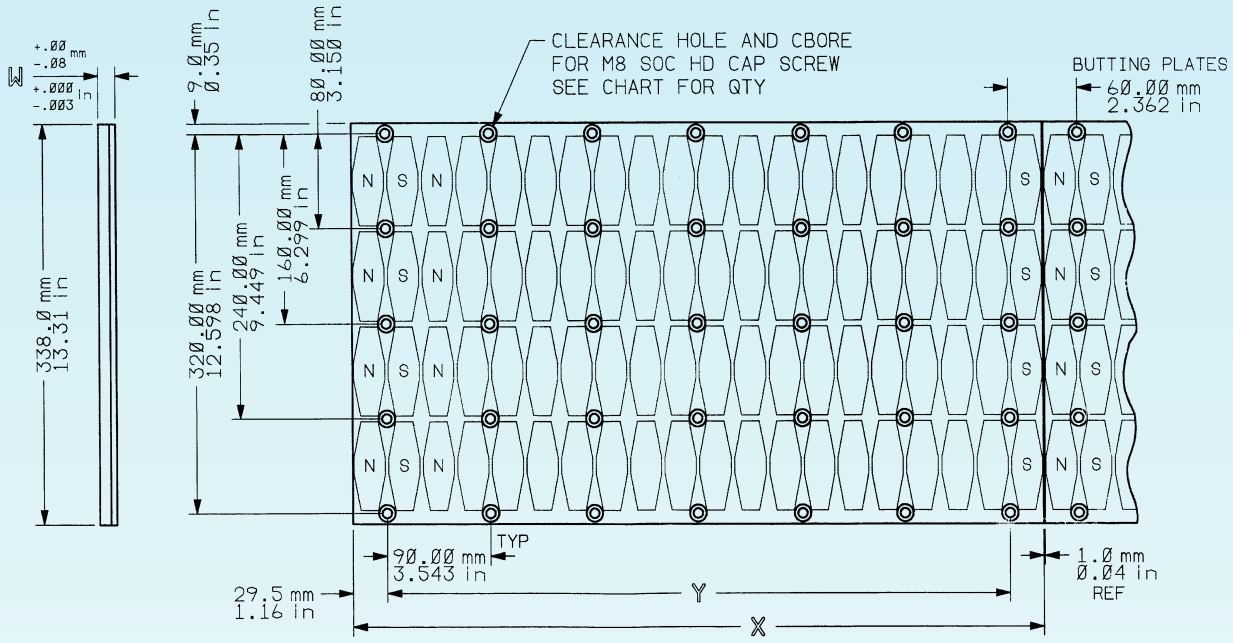


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



SIZE		X	Y	HOLE QTY
240	mm	239.00	180.00	15
	in	9.409	7.086	
420	mm	419.00	360.00	25
	in	16.496	14.173	
600	mm	599.00	540.00	35
	in	23.583	21.260	
960	mm	959.00	900.00	55
	in	37.756	35.433	

SERIES		W
LFDLV-S	mm	15.40
	in	.606
LFDLV-SH	mm	18.40
	in	.725

LXB-S

NEW

Brushless Linear Motor



Manufactured under several patents, including additional patent pending.

- **Extreme force**
- **Revolutionary oil cooling**
- **High magnetic attraction preload**
- **Encapsulated, built-in connectors**
- **Ideal for machine tool applications**

(Interchangeable with LFB-S*)

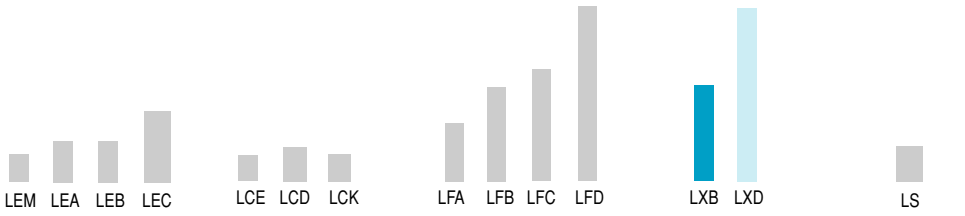
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LXB-S Specifications

Motor Model		Symbol	Units	LXB-S-2-P	LXB-S-4-P	LXB-S-6-P
Cooling				OC	OC	OC
Continuous Force	(coil @ 25°C)	Fc25	N	2090	4180	6270
			lbs	460	920	1379
Continuous Current	(coil @ 25°C)	Ic25	A rms	9.0	18.0	27.1
Continuous Force	(coil @ 125°C)	Fc125	N	1776	3551	5327
			lbs	391	781	1172
Continuous Current	(coil @ 125°C)	Ic125	A rms	7.7	15.3	23.0
Peak Force	(0.25 sec)	Fp 0.25	N	3485	6970	10455
			lbs	767	1533	2300
Peak Current	(0.25 sec)	Ip 0.25	A rms	15.5	31	46.5
Peak Force	(1 sec)	Fp1	N	3030	6061	9091
			lbs	667	1333	2000
Peak Current	(1 sec)	Ip1	A rms	13.6	27.2	40.8
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	635	1270	1905
Force Constant	(All Three Phases)	Kf	N / A rms	232	232	232
			lbs / A rms	51.0	51.0	51.0
Back EMF	(ptn)	Ke	V rms / m / sec	77.2	77.2	77.2
			V rms / in / sec	1.9	1.9	1.9
Resistance	(ptn @ 25°C)	R25	Ω	7.8	3.9	2.6
Resistance	(ptn @ 125°C)	R125	Ω	10.8	5.4	3.6
Inductance	(ptn)	L	mH	75.0	37.5	25.0
Electrical Time Constant		Te	msec	9.6	9.6	9.6
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	40.7	57.5	70.5
			lb / √ W	8.9	12.7	15.5
Thermal Resistance		Rth	°C / W	0.052	0.026	0.017
Maximum Coil Temperature		tmax	°C	125	125	125
Coil Assembly Weight		W	kg	11	23	34
			lbs	25	50	75
Magnetic Attraction		Fa	N	9091	18182	27273
			lbs	2000	4000	6000
Cooling Flow Rate		Q	LPM	5.7	5.7	5.7
			SCFM/GPM	1.5	1.5	1.5
Cooling Supply Pressure		P	kPa	138	276	414
			PSIG	20	40	60

Note: Additional models available, all specifications are ± 10%.
*Except for motor height, which is an additional 6 mm. Slide face mounting hole is same as LFB. Optional flange mount is available for magnet face installation.

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Above chart depicts relative cross section of motors in page order.

Ordering Information (Available in 1998. Contact factory for details.)

Coil Assembly

Example **LXB-S -2- P- OC- TE -NH -M**

❶ ❷ ❸ ❹ ❺ ❻

❶ Number of Coil Set	**2, 4, 6**		
❷ Coil Winding Connection	**P** —Parallel		
❸ Cooling Type	**OC** —Oil Cooling		
❹ Thermistor	**TE** —Thermistor		
❺ Hall Effect	**NH** —No Hall Effect	**HET** —Trapezoidal Hall Effect	
	HES —Sinusoidal Hall Effect (120°)	**HER** —Sinusoidal Hall Effect (90°)	
	RES —Resolver Hall Effect	**HESNA** —Sinusoidal Hall Effect No Amp	
❻ Cooling Fitting	**BLANK** —English	**M** —Metric	

Magnet Assembly

Example **LXB-S -240 mm**

❶ ❷

❶ Magnet Thickness	**S**—Standard	**SH**—Thick
❷ Magnet Assembly Length	**240, 420, 600, 960 mm**	

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function			Length
MOTOR LEADS	A		ϕA			
M53102R-18-10P	B		ϕB			
Receptacle	C		ϕC			
	D		GND			
	A		105ºC			
THERMISTORS	B		105ºC			
M53102R-145-6P	C		125ºC			
Receptacle	D		125ºC			
	E		Linear			
	F		Linear			
			Trap	Sine	Resolver	
HALL		RED	V+	I+	R1	
EFFECT		BLU	S2	A+	S1	0.3m
CONNECTOR		WHT	S1	A-	S2	1ft
(Optional)		ORN	S3	B+	S3	
		GRN		B-	S4	
		BLK	VRTN	I-	R2	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil in stand still conditions.

b) Coil attached to aluminum heat sink 609 x 762 x 51 mm (24" x 30" x 2").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

Options:

a) Low voltage windings. Contact factory for details.

b) Thick magnets (-SH) for 20% increased force. Contact factory for details.

Magnet Assembly Specifications:

a) Magnet assembly weight; 19.6 kg/m (1.09 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

c) Magnet assy. length = travel + coil length + hall length (see example).

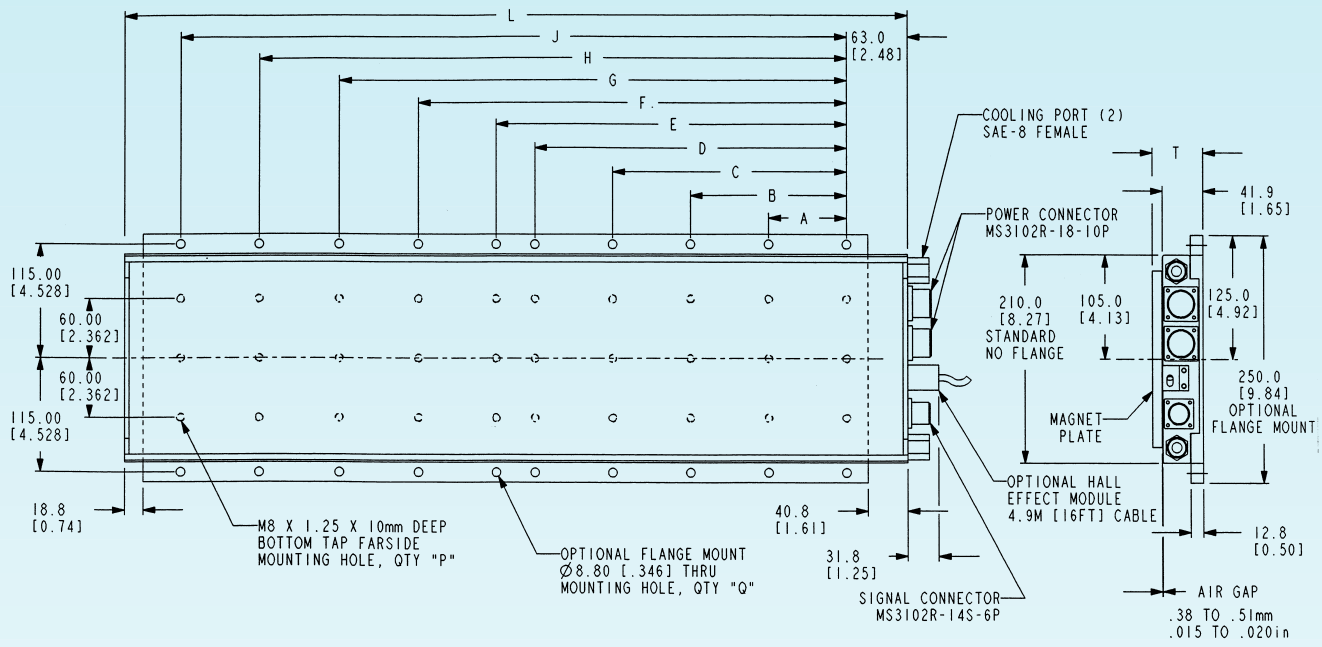
Example:

Required travel:	500 mm
Coil size:	LXB-S-4-OC-TE-HES
Magnet assembly length =	500 + 552 + 31.8 = 1083.8 mm
Select:	2x LXB-S -600 mm

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LXB-S outline

Coil Assembly Outline



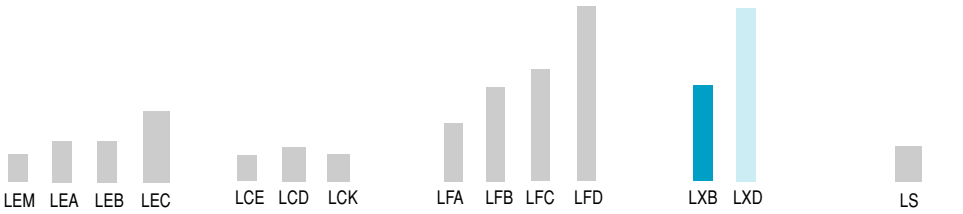
Metric Fitting = M16 x 1.5 parallel thread

MOTOR		L	A	B	C	D	E	F	G	H	J	P	Q
LXB-S-2	mm	312.00	80.00	120.00	200.00	-	-	-	-	-	-	12	8
	in	12.28	3.150	4.724	7.874								
LXB-S-4	mm	552.00	80.00	160.00	280.00	360.00	440.00	-	-	-	-	18	12
	in	21.73	3.150	6.299	11.024	14.173	17.323						
LXB-S-6	mm	792.00	80.00	160.00	240.00	320.00	360.00	440.00	520.00	600.00	680.00	30	20
	in	31.18	3.150	6.299	9.449	12.598	14.173	17.323	20.472	23.622	26.772		

SERIES		T
LXB-S	mm	57.88
	in	2.28
LXB-SH	mm	60.88
	in	2.40

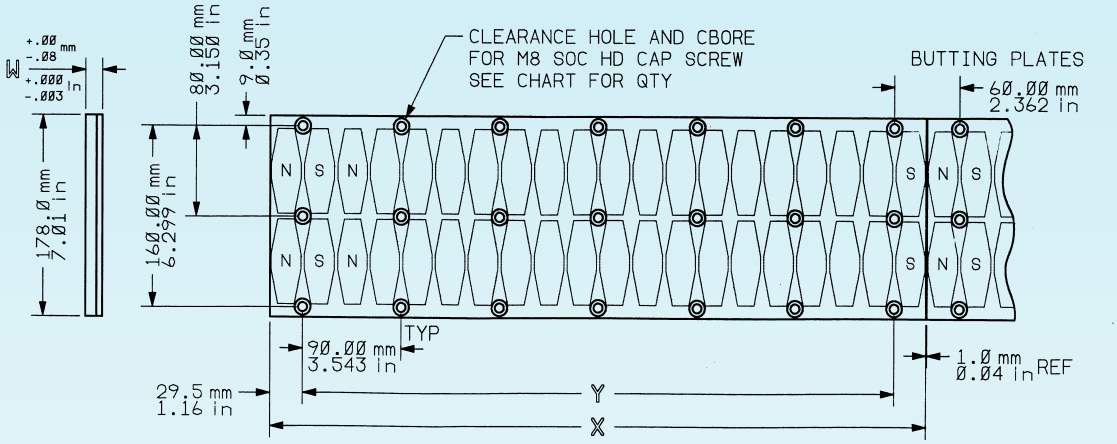


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



SIZE		X	Y	HOLE QTY
240	mm	239.00	180.00	9
	in	9.409	7.086	
420	mm	419.00	360.00	15
	in	16.496	14.173	
600	mm	599.00	540.00	21
	in	25.583	21.260	
960	mm	959.00	900.00	33
	in	37.756	35.433	

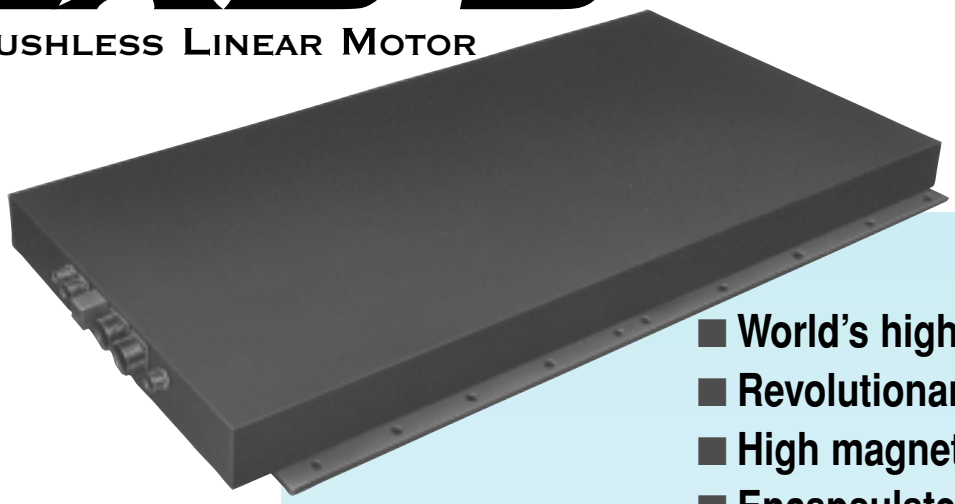
SERIES		W
LXB-S	mm	15.40
	in	.606
LXB-SH	mm	18.40
	in	.725

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LXD-S

NEW

Brushless Linear Motor



Manufactured under several patents, including additional patent pending.

- **World's highest force**
- **Revolutionary oil cooling**
- **High magnetic attraction preload**
- **Encapsulated, built-in connectors**
- **Ideal for machine tool applications**

(Interchangeable with LFD-S*)

For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

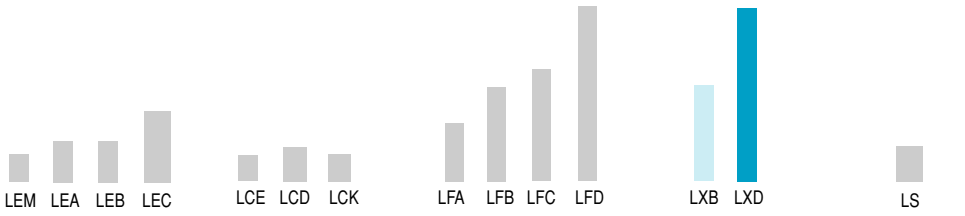
LXDLV-S Specifications

Motor Model		Symbol	Units	LXDLV-S-2-P	LXDLV-S-4-P	LXDLV-S-6-P
Cooling				OC	OC	OC
Continuous Force	(coil @ 25°C)	Fc25	N	4361	8723	13084
			lbs	960	1919	2879
Continuous Current	(coil @ 25°C)	Ic25	A rms	18.8	37.7	56.5
Continuous Force	(coil @ 125°C)	Fc125	N	3706	7411	11117
			lbs	815	1630	2446
Continuous Current	(coil @ 125°C)	Ic125	A rms	16.0	32.0	48.0
Peak Force	(0.25 sec)	Fp 0.25	N	6894	13788	20682
			lbs	1517	3033	4550
Peak Current	(0.25 sec)	Ip 0.25	A rms	31	62	93
Peak Force	(1 sec)	Fp1	N	6000	12000	18000
			lbs	1320	2640	3960
Peak Current	(1 sec)	Ip1	A rms	27.2	54.4	81.6
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	1383	2766	4149
Force Constant	(All Three Phases)	Kf	N / A rms	232	232	232
			lbs / A rms	51	51	51
Back EMF	(ptn)	Ke	V rms / m / sec	77.20	77.20	77.20
			V rms / in / sec	1.93	1.93	1.93
Resistance	(ptn @ 25°C)	R25	Ω	3.9	1.95	1.3
Resistance	(ptn @ 125°C)	R125	Ω	5.4	2.7	1.8
Inductance	(ptn)	L	mH	37.5	18.8	12.5
Electrical Time Constant		Te	msec	9.6	9.6	9.6
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	57.5	81.4	99.6
			lb / √ W	12.7	17.9	21.9
Thermal Resistance		Rth	°C / W	0.024	0.012	0.008
Maximum Coil Temperature		tmax	°C	125	125	125
Coil Assembly Weight		W	kg	21	42	64
			lbs	47	93	140
Magnetic Attraction		Fa	N	18182	36364	54545
			lbs	4000	8000	12000
Cooling Flow Rate		Q	LPM	5.7	5.7	5.7
			SCFM/GPM	1.5	1.5	1.5
Cooling Supply Pressure		P	kPa	276	414	552
			PSIG	40	60	80

Note: Additional models available, all specifications are ± 10%.

*Except for motor height, which is an additional 6 mm. Slide face mounting hole is same as LFD. Optional flange mount is available for magnet face installation.

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Above chart depicts relative cross section of motors in page order.

Ordering Information (Available in 1998. Contact factory for details.)

Coil Assembly

Example **LXDLV-S -6 -P -OC -TE -HES -M**

❶ Number of Coil Set	***2, 4, 6***	
❷ Coil Winding Connection	***P*** —Parallel	
❸ Cooling Type	***OC*** —Oil Cooling	
❹ Thermistor	***TE*** —Thermistor	
❺ Hall Effect	***NH*** —No Hall Effect	***HET*** —Trapezoidal Hall Effect
	HES —Sinusoidal Hall Effect (120°)	***HER*** —Sinusoidal Hall Effect (90°)
	RES —Resolver Hall Effect	
❻ Cooling Fitting	***BLANK*** —English	***M*** —Metric

Magnet Assembly

Example **LXDLV-S -240mm**

❶ Magnet Thickness	***S***—Standard	***SH***—Thick
❷ Magnet Assembly Length	***240, 420, 600, 960 mm***	

Note: Magnet assemblies can be butted together to provide longer length.

Cable Pinout

	Pin	Color	Function			Length
MOTOR LEADS	A		ϕA			
M53102R-18-10P	B		ϕB			
Receptacle	C		ϕC			
	D		GND			
	A		105°C			
THERMISTORS	B		105°C			
M53102R-145-6P	C		125°C			
Receptacle	D		125°C			
	E		Linear			
	F		Linear			
			Trap	Sine	Resolver	
HALL		RED	V+	I+	R1	
EFFECT		BLU	S2	A+	S1	0.3m
CONNECTOR		WHT	S1	A-	S2	1ft
(Optional)		ORN	S3	B+	S3	
		GRN		B-	S4	
		BLK	VRTN	I-	R2	

Note: I+ 5 mA Nominal; V+ 5 - 24 vdc

Force Rating:

a) Continuous forces and currents are based on coil in stand still conditions.

b) Coil attached to aluminum heat sink 609 x 762 x 51 mm (24" x 30" x 2").

c) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

Options:

a) Thick magnets (-SH) for 20% increased force. Contact factory for details.

Magnet Assembly Specifications:

a) Magnet assembly weight; 39.2 kg/m (2.2 lb/in).

b) Magnet pitch (180°) = 30 mm (1.18 in).

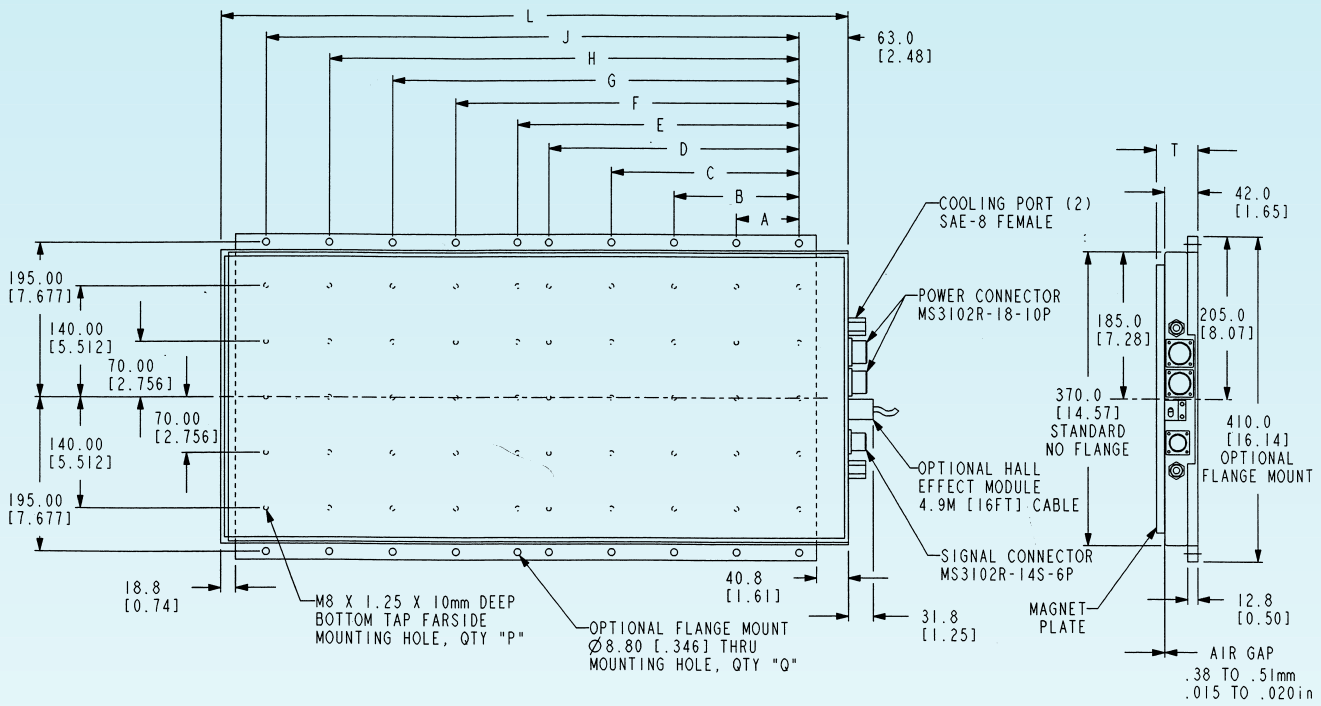
c) Magnet assy. length = travel + coil length + hall length (see example).

Example:

Required travel:	500 mm
Coil size:	LXDLV-S-4-OC-TE-HES
Magnet assembly length =	500 + 552 + 31.8 = 1083.8 mm
Select:	2x LXDLV-S -600 mm

LXD-S outline

Coil Assembly Outline



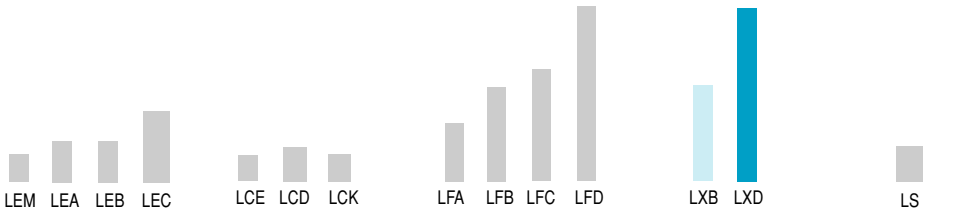
Metric Fitting = M16 x 1.5 parallel thread

MOTOR		L	A	B	C	D	E	F	G	H	J	P	Q
LXDLV-S-2	mm	312.00	80.00	120.00	200.00	-	-	-	-	-	-	20	8
	in	12.28	3.150	4.724	7.874								
LXDLV-S-4	mm	552.00	80.00	160.00	280.00	360.00	440.00	-	-	-	-	30	12
	in	21.73	3.150	6.299	11.024	14.173	17.323						
LXDLV-S-6	mm	792.00	80.00	160.00	240.00	320.00	360.00	440.00	520.00	600.00	680.00	50	20
	in	31.18	3.150	6.299	9.449	12.598	14.173	17.323	20.472	23.622	26.772		

SERIES		T
LXDLV-S	mm	57.88
	in	2.28
LXDLV-SH	mm	60.88
	in	2.40

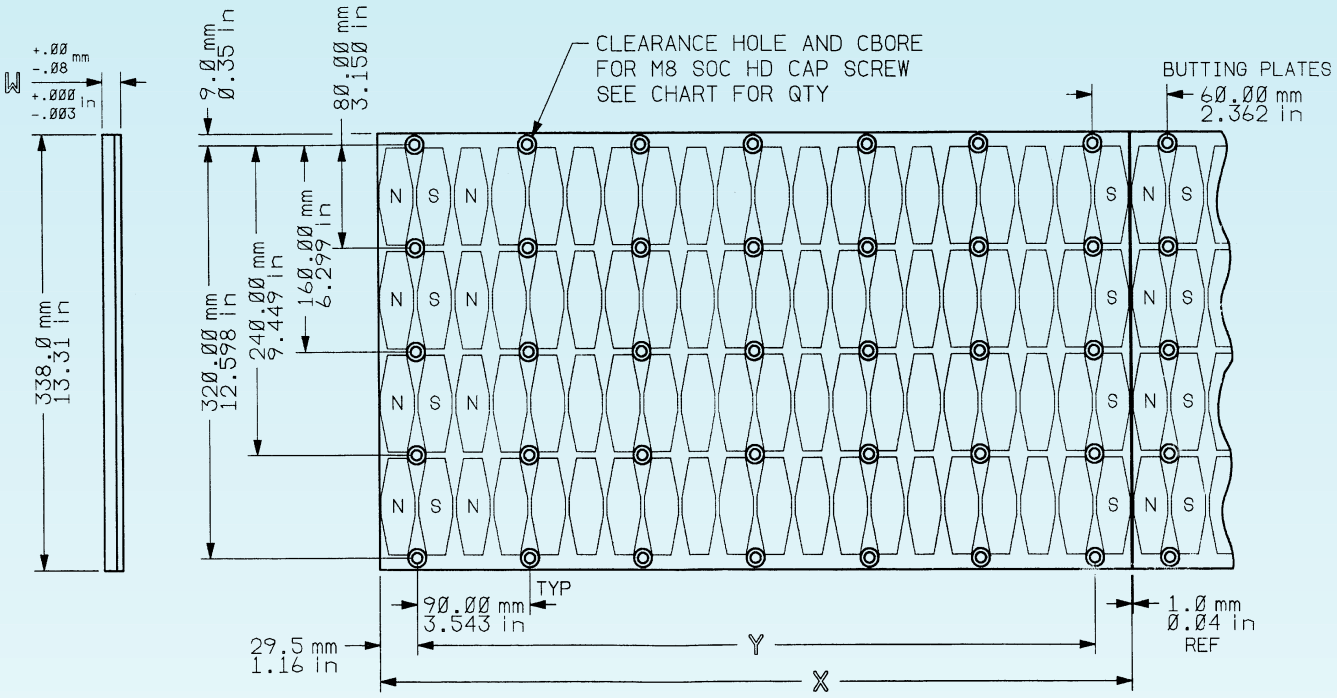


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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline



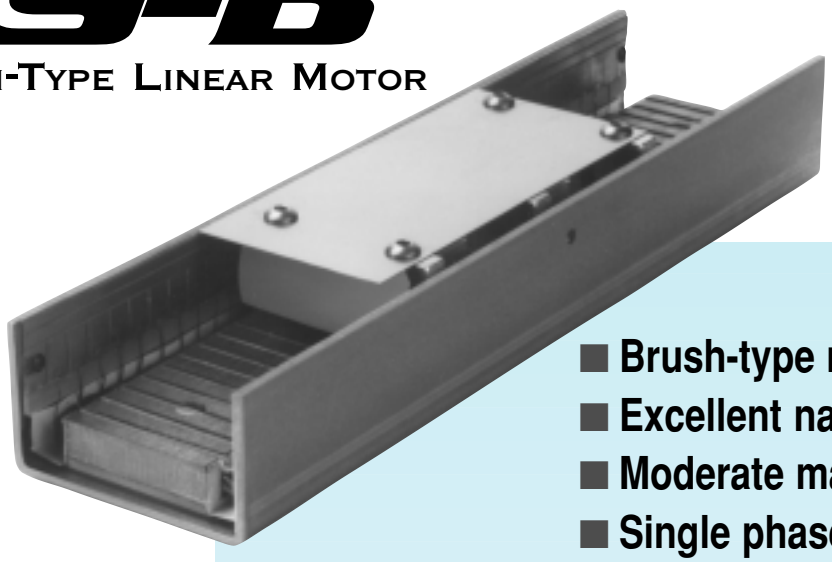
SIZE		X	Y	HOLE QTY
240	mm	239.00	180.00	15
	in	9.409	7.086	
420	mm	419.00	360.00	25
	in	16.496	14.173	
600	mm	599.00	540.00	35
	in	23.583	21.260	
960	mm	959.00	900.00	55
	in	37.756	35.433	

SERIES		W
LXDLV-S	mm	15.40
	in	.606
LXDLV-SH	mm	18.40
	in	.725

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LS-B

Brush-Type Linear Motor



- Brush-type motor
- Excellent natural cooling
- Moderate magnetic attraction preload
- Single phase, no moving cable
- Ideal for low velocity applications

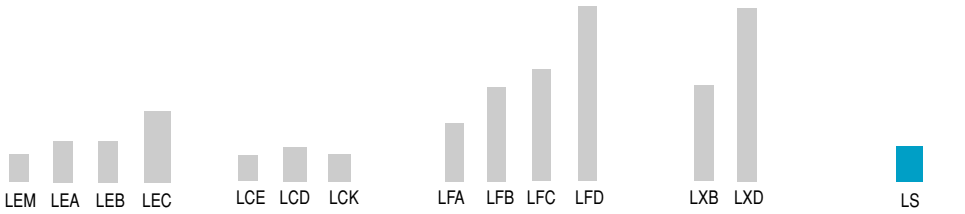
For required force select motor type on p. 4. For required velocity select matching amplifier on p. 65.

LS-B Specifications

Motor Model		Symbol	Units	LS-B-1	LS-B-2-S	LS-B-3-S	LS-B-3-P	LS-B-SP
Cooling				NC	NC	NC	NC	NC
Continuous Force	(coil @ 25°C)	Fc25	N	62	124	185	185	247
			lbs	14	27	41	41	54
Continuous Current	(coil @ 25°C)	Ic25	A rms	5.9	5.9	5.9	17.7	11.8
Continuous Force	(coil @ 125°C)	Fc125	N	53	105	158	158	210
			lbs	12	23	35	35	46
Continuous Current	(coil @ 125°C)	Ic125	A rms	5.0	5.0	5.0	15.0	10.0
Peak Force	(0.25 sec)	Fp 0.25	N	231	462	693	693	924
			lbs	51	102	152	152	203
Peak Current	(0.25 sec)	Ip 0.25	A rms	22.0	22.0	22.0	66.0	44.0
Peak Force	(1 sec)	Fp1	N	210	420	630	630	840
			lbs	46	92	139	139	185
Peak Current	(1 sec)	Ip1	A rms	20.0	20.0	20.0	60.0	40.0
Continuous Power Loss	(ptn @ 125°C)	Pc125	W	52.0	103.9	155.9	155.9	207.8
Force Constant	(All Three Phases)	Kf	N / A rms	10.5	21.0	31.5	10.5	21.0
			lbs / A rms	2.3	4.6	6.9	2.3	4.6
Back EMF	(ptn)	Ke	V rms / m / sec	10.5	21.0	31.5	10.5	21.0
			V rms / in / sec	0.3	0.5	0.8	0.3	0.5
Resistance	(ptn @ 25°C)	R25	Ω	1.5	3.0	4.5	0.5	1.5
Resistance	(ptn @ 125°C)	R125	Ω	2.1	4.2	6.2	0.7	2.1
Inductance	(ptn)	L	mH	2.2	4.4	6.6	0.7	2.2
Electrical Time Constant		Te	msec	1.5	1.5	1.5	1.5	1.5
Motor Constant	(Km=Fc/√ Pc)	Km	N / √ W	7.3	10.3	12.6	7.3	8.4
			lb / √ W	1.6	2.3	2.8	1.6	1.9
Thermal Resistance		Rth	°C / W	1.92	0.96	0.64	0.21	0.16
Maximum Coil Temperature		tmax	°C	125	125	125	125	125
Coil Assembly Weight		W	kg	0.6	1.05	3.58	3.58	4.6
			lbs	1.3	2.3	7.9	7.9	10.1
Magnetic Attraction		Fa	N	730	1455	2180	2180	2910
			lbs	161	320	480	480	640
Cooling Flow Rate		Q	LPM	n/a	n/a	n/a	n/a	n/a
			SCFM/GPM	n/a	n/a	n/a	n/a	n/a
Cooling Supply Pressure		P	kPa	n/a	n/a	n/a	n/a	n/a
			PSIG	n/a	n/a	n/a	n/a	n/a

Note: Additional models available, all specifications are ± 10%.

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Above chart depicts relative cross section of motors in page order.

Ordering Information

Magnet/ Coil Assembly

Example **LS-B -2-S -NC -NT -NH**

❶ ❷ ❸ ❹ ❺

❶ Number of Magnet Set	***1, 2, 3, 4***			
❷ Coil Winding Connection	***S*** —Series	***P*** —Parallel	***SP*** —Series/Parallel	
❸ Cooling Type	***NC*** —No Cooling			
❹ Thermistor	***NT*** —No Thermistor			
❺ Hall Effect	***NH*** —No Hall Effect			

Coil Assembly

Example **LS-B -231.1mm**

❶

❶ Coil Assembly Length	***231.1, 285.8, 332.7, 387.4, 434.3, 535.9, 637.5, 739.1, 895.4, 1043.9 mm***

Note: Coil assemblies can be butted together to provide longer length (Contact factory for details).

Cable Pinout

	Pin	Color	Function	Length
MOTOR LEADS		GRN	+	0.15 m
(Standard)		BLU	-	6 in

Force Rating:

a) Continuous forces and currents are based on stand still conditions.

b) Care must be taken to remove heat from the coil mounting plate and from the magnet plate.

Options:

a) High lamination model (LH-B) is available at a 20% higher peak and continuous force.Contact factory for details.

Magnet/Coil Assembly Specifications:

a) Coil assembly weight; 7.6 kg/m (0.42lb/in).

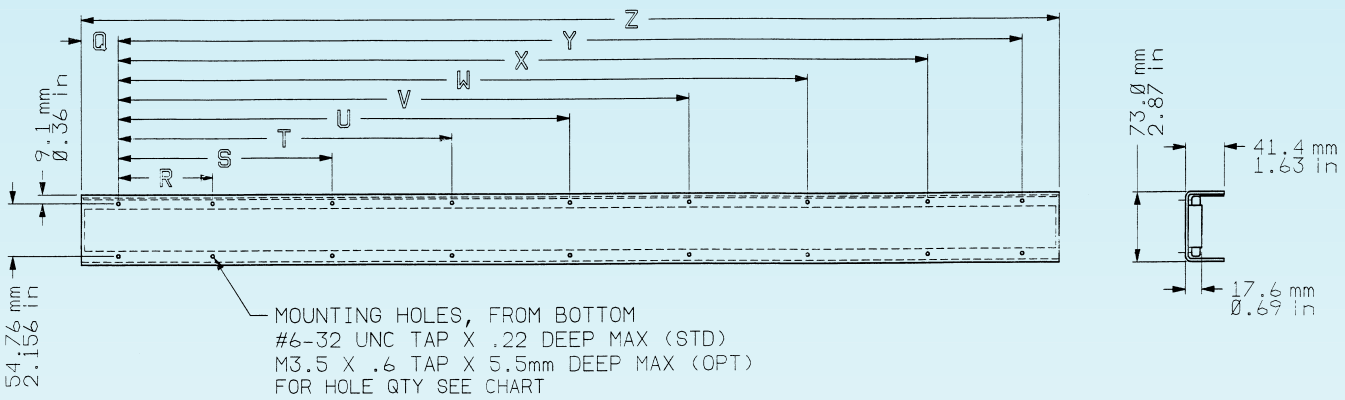
b) Magnet pitch (180°) = 16.25 mm (0.64 in).

c) Coil assy. length = travel + magnet length + hall length (see example).

Example:

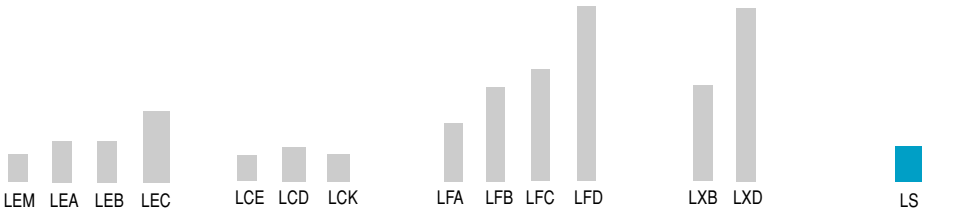
Required travel:	500 mm
Magnet size:	LS-B-2-NC-NT-NH
Coil assembly length =	500 + 214.4 + 0 = 714.4 mm
Select:	LS-B -739.10 mm

Coil Assembly Outline



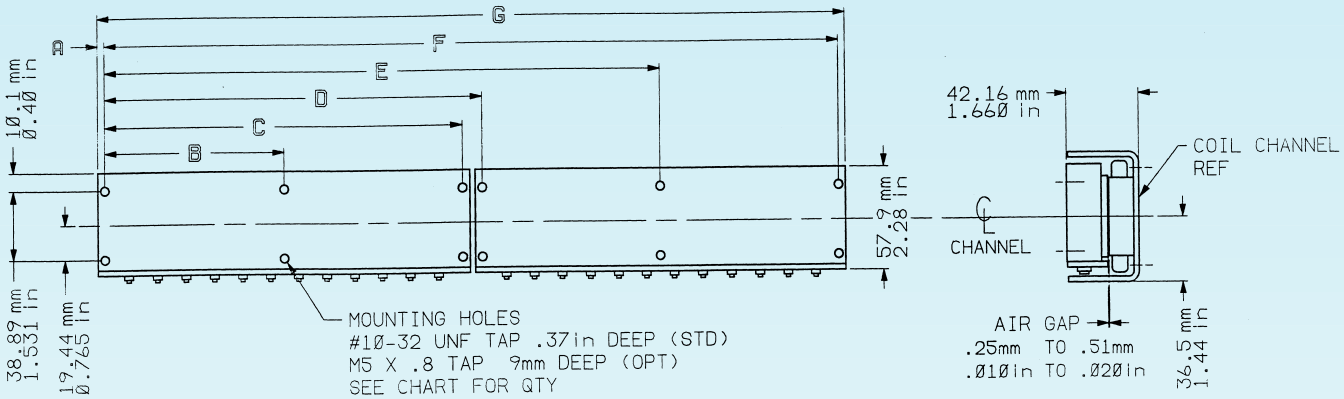
SIZE		Q	R	S	T	U	V	W	X	Y	Z	HOLE QTY
231.1	mm	39.4	76.20	152.40	-	-	-	-	-	-	231.1	6
	in	1.55	3.000	6.000							9.10	
285.8	mm	41.4	101.60	203.20	-	-	-	-	-	-	285.8	6
	in	1.63	4.000	8.000							11.25	
332.7	mm	52.1	114.30	228.60	-	-	-	-	-	-	332.7	6
	in	2.05	4.500	9.000							13.10	
387.4	mm	41.4	101.60	203.20	304.80	-	-	-	-	-	387.4	8
	in	1.63	4.000	8.000	12.000						15.25	
434.3	mm	45.7	114.30	228.60	342.90	-	-	-	-	-	434.3	8
	in	1.80	4.500	9.000	13.500						17.10	
535.9	mm	39.4	114.30	228.60	342.90	457.20	-	-	-	-	535.9	10
	in	1.55	4.500	9.000	13.500	18.000					21.10	
637.5	mm	33.0	114.30	228.60	342.90	457.20	571.50	-	-	-	637.5	12
	in	1.30	4.500	9.000	13.500	18.000	22.500				25.10	
739.10	mm	52.1	127.00	254.00	381.00	508.00	635.00	-	-	-	739.10	12
	in	2.05	5.000	10.00	15.000	20.00	25.00				29.10	
895.4	mm	47.6	114.30	228.60	342.90	457.20	571.50	685.80	800.10	-	895.4	16
	in	1.88	4.500	9.000	13.500	18.000	22.500	27.00	31.500		35.25	
1043.9	mm	39.4	101.60	228.60	355.60	482.60	609.60	736.60	863.60	965.20	1043.9	18
	in	1.55	4.000	9.000	14.000	19.000	24.000	29.000	34.000	38.000	41.10	

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Above chart depicts relative cross section of motors in page order.

Magnet Assembly Outline

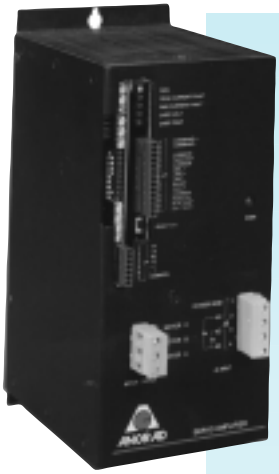


MOTOR		A	B	C	D	E	F	G	HOLE QTY
LS-B-1	mm	4.1	103.12	-	-	-	-	111.3	4
	in	.16	4.060					4.38	
LS-B-2	mm	4.1	103.12	206.25	-	-	-	214.4	6
	in	.16	4.060	8.120				8.44	
LS-B-3	mm	4.1	103.12	206.25	217.42	320.55	-	328.7	10
	in	.16	4.060	8.120	8.560	12.620		12.94	
LS-B-4	mm	4.1	103.12	206.25	217.42	320.55	423.67	431.8	12
	in	.16	4.060	8.120	8.560	12.620	16.680	17.00	



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AMPLIFIERS



- Rack mount (150 W - 2 kw)
- Panel mount (2 kw - 28 kw)
- Bus voltage range (40V - 650V)
- Current loop response > 1 kHz
- Hall, software, or resolver commutation
- PWM or linear, sinusoidal or trapezoidal



Amplifier Types

Anorad offers a wide selection of servo amplifier products to integrate with its diverse line of linear servo motors. Options include brushed and brushless with both PWM (pulse width modulated) and linear amplification. The brushless models provide commutation by trapezoidal or sinusoidal hall effect, resolver or software (encoder) commutation. The high powered panel mounted models include an onboard micro-processor to set software configurable current loop gains through an RS-232 serial link or front panel inputs, and programmable optically isolated logic inputs. Selection between velocity or force (torque) mode is jumper selectable. The power levels range from 2 - 28 kW continuous, with either a 110, 220, or 380 - 460 VAC input supply range.

The PWM amplifiers employ a high efficiency switch mode power scheme, thus minimizing EMI for noise sensitive applications. The 20-25 kHz inaudible switching frequency allows for a wider control bandwidth in the current feedback loop. The higher voltage amplifiers employ surface mount technology for high reliability.

PWM amplifiers are best suited for applications where higher continuous power is required. Linear amplifiers are recommended for applications where smooth motion is critical, and electrical noise cannot be tolerated.

Packaging Options

Two packaging options are available: a 1-4 axis, rack mountable amplifier chassis, or a panel mount single axis version. Both packages possess an ergonomic design with easy access to connections, adjustments, and test points. The rack mount chassis is configured specifically for the application. It accommodates up to four industry standard Eurocard 3U high x 19 inch wide format amplifier cards, and universal backplanes with high quality DIN type connectors, a power supply, and a 110 CFM fan to maximize drive efficiency. The panel mount is a stand alone unit with built-in power supply in a modular construction for ease of installation and service.

Additional Noteworthy Features

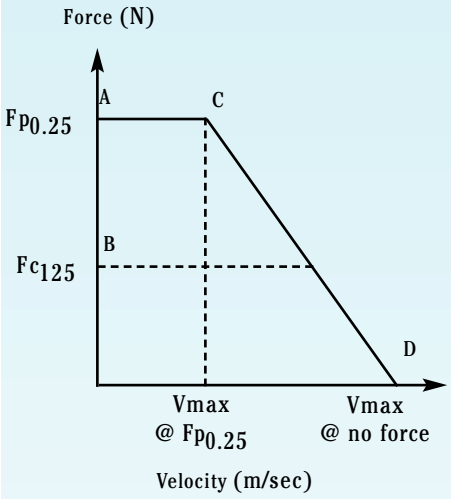
- Fault protection circuits for over temperature, overspeed, overvoltage, current overload and motor stall, protect the amplifier and the motion control system from damage
- Signals such as travel limits, breakfault, current limit, and motor velocity simplify set-up and trouble shooting
- Front panel LED's indicate all operating and fault conditions
- Differential amplifier for command and velocity feedback inputs, for noise immunity
- Brushless trapezoidal units accept three-phase commutation sensors with 60 or 120 degree spacing
- Fault outputs are optically isolated on the panel mount series and buffered on Euro series
- Digital inputs for amplifier enable/disable, brake and forward/reverse travel limits

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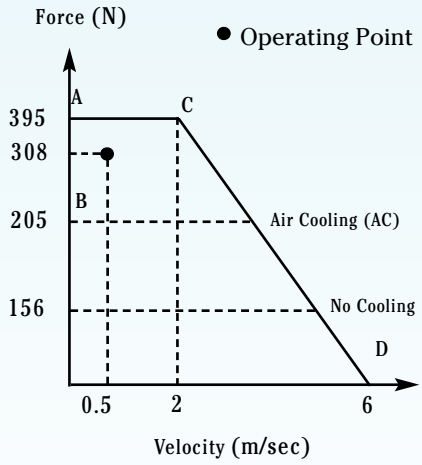
Motor-Amplifier Force / Velocity Curves

Explanations:
The data for a motor-amplifier combination, as shown in the table on the right, can be used to construct a force / velocity curve as follows:

1- Select a motor model.
2- Use values of motor peak force and continuous force* to construct points A,B respectively.
3- Use values of maximum motor velocity at peak force and at no force for the selected amplifier to construct points C and D respectively.
4- Construct the chart as shown.



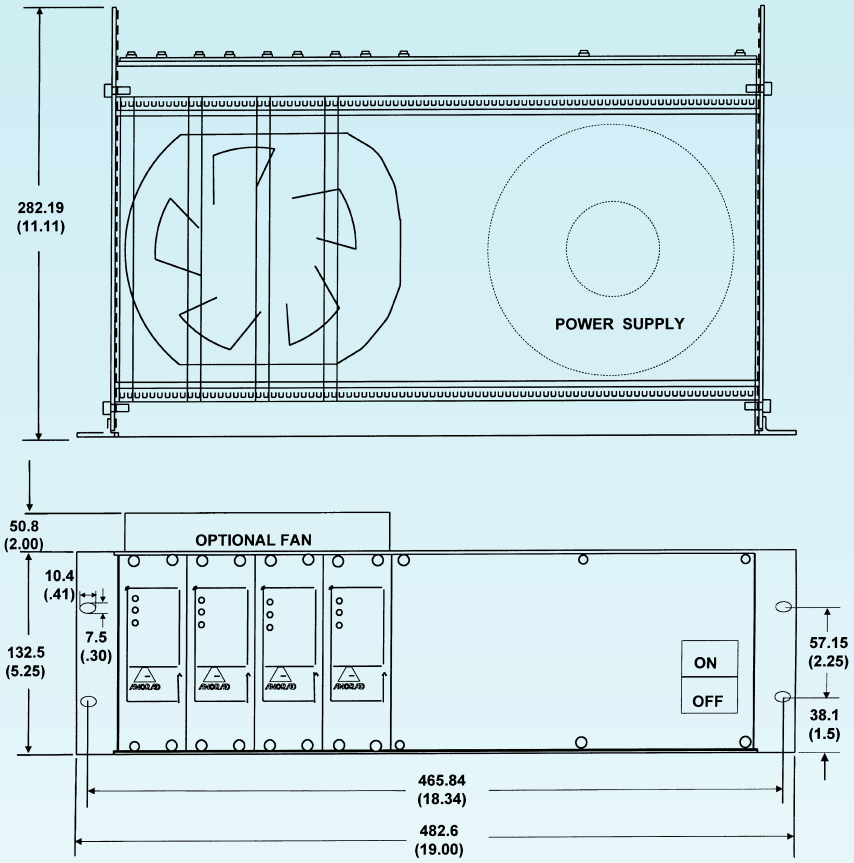
Example: (LCK-S-1-AC) (see p. 76)



*Note: Continuous force for models LE and LC are shown with no cooling, and for LF/LX with water/oil cooling respectively.

AMPLIFIER TYPES											
	Cont. Current (A) RMS			10.0		10.0		39.0		68.0	
	Peak Current (A) RMS			18.0		18.0		78.0		137.0	
	Bus Voltage (V)			160.0		320.0		650.0		650.0	
	Avail. Voltage (V)			135.0		270.0		575.0		575.0	
		Fp; Peak Force (N) 0.25 sec.	*Fc; Continuous Force (N)	Max Velocity (m/s) @ Peak Force	Max Velocity (m/s) @ No Force	Max Velocity (m/s) @ Peak Force	Max Velocity (m/s) @ No Force	Max Velocity (m/s) @ Peak Force	Max Velocity (m/s) @ No Force	Max Velocity (m/s) @ Peak Force	Max Velocity (m/s) @ No Force
EPOXY CORE MOTORS	LEM-S-1	113	28	10.0	15.0						
	LEM-S-2	226	57	3.7	10.3						
	LEM-S-3	340	85	0.4	6.9	6.9	13.7				
	LEM-S-4	453	113			3.7	10.3				
	LEA-S-2	265	66	1.8	7.1	8.5	14.3				
	LEA-S-4	530	132			1.8	7.1				
	LEA-S-6	795	199			0.0	4.8				
	LEA-SP-8	1060	265	0.0	3.6	1.8	7.1				
	LEB-S-2	326	81	1.4	5.8	7.0	11.6				
	LEB-S-4	651	163			1.4	5.8				
	LEB-S-6	977	244			0.0	3.9				
	LEB-SP-8	1303	326	0.7	2.9	3.6	5.8				
	LEC-S-1	698	175			0.8	3.3				
	LEC-S-2	1397	349			0.8	3.3				
	LEC-S-3	2095	524			0.8	3.3				
	LEC-S-4	2794	698			0.8	3.3				
STEEL CORE MOTORS	LCE-S-1	115	34	6.9	15.0						
	LCE-S-2	230	67			6.9	15.0				
	LCE-S-3	345	101			2.4	11.1				
	LCK-S-1	395	156			2.0	6.0				
	LCK-S-2	791	312			2.0	6.0				
	LCK-S-3	1186	469			2.0	6.0				
	LCD-T-1	303	139	0.9	4.3	3.7	8.6				
	LCD-T-2	455	209	0.9	4.3	3.7	8.6				
	LCD-T-3	606	277	0.9	4.3	3.7	8.6				
	LCD-T-4	909	416	0.9	4.3	3.7	8.6				
	LFA-S-2	1568	630			0.4	2.9	2.4	6.1		
	LFA-S-3	2352	945			0.4	2.9	2.4	6.1		
	LFA-S-4	3136	1260					2.4	6.1		
	LFA-S-6	4705	1890					2.4	6.1		
	LFB-S-2	3106	1266					0.8	3.0		
	LFB-S-4	6212	2532					0.8	3.0		
	LFB-S-6	9318	3798					0.8	3.0		
	LFC-S-2	4318	1654					0.4	2.3		
	LFC-S-4	8636	3307					0.4	2.3		
	LFC-S-6	12955	4961					0.4	2.3		
	LFDLV-S-2	6288	2520					0.8	3.0		
	LFDLV-S-4	12576	5040					0.8	3.0		
	LFDLV-S-6	18864	7559							0.8	3.0
	LXB-S-2	3485	1776					0.7	3.0		
	LXB-S-4	6970	3551					0.7	3.0		
	LXB-S-6	10455	5327					0.7	3.0		
	LXDLV-S-2	6894	3706					0.7	3.0		
	LXDLV-S-4	13788	7411					0.7	3.0		
	LXDLV-S-6	20682	11117							0.7	3.0

Euro Outline (Rack Mount Enclosure)



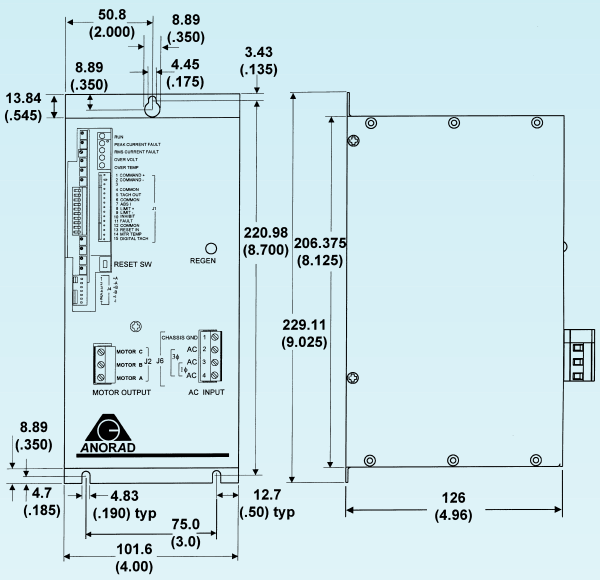
Type	Commutation (1)			Continuous Output Power (Watts)	Power Supply AC Voltage ±10% (Volt)	Nominal Bus Voltage (Volt)	Continuous Current (Amp) (RMS)	Peak Current (Amp) (RMS)	Output Voltage (2) (Volt)	Order Number
Euro Amplifiers	brush		PWM	480	115/220	40-55	10	18	48 (52)	62286
	brushless	trap	PWM HE	480	115/220	40-55	10	18	48 (52)	62663
				2000	115/220	55-330	5	10	135 (165)	67192-LP
							15	25	270 (330)	67192-SP
	brushless	sin	PWM HE	2000	115/220	55-330	5	7	135 (135)	69080-LP
							15	18	270 (330)	69080-SP
	brushless	sin	PWM SW	2000	115/220	55-330	5	18	135 (135)	69350-LP
							15	18	270 (330)	69350-SP
	brushless	sin	linear HE	150	115/220	40-55	3	13	46 (52)	69812
		sin	linear SW				3	6	46 (52)	69532

Notes:
1. Trap = trapezoidal, sin = sinusoidal, PWM = pulse width modulated, HE = Hall Effect, SW = Software.
2. Voltage output is nominal, defined at nominal bus voltage as shown in parentheses.
3. Compensation of RC network is done at factory by plug-in component carrier.

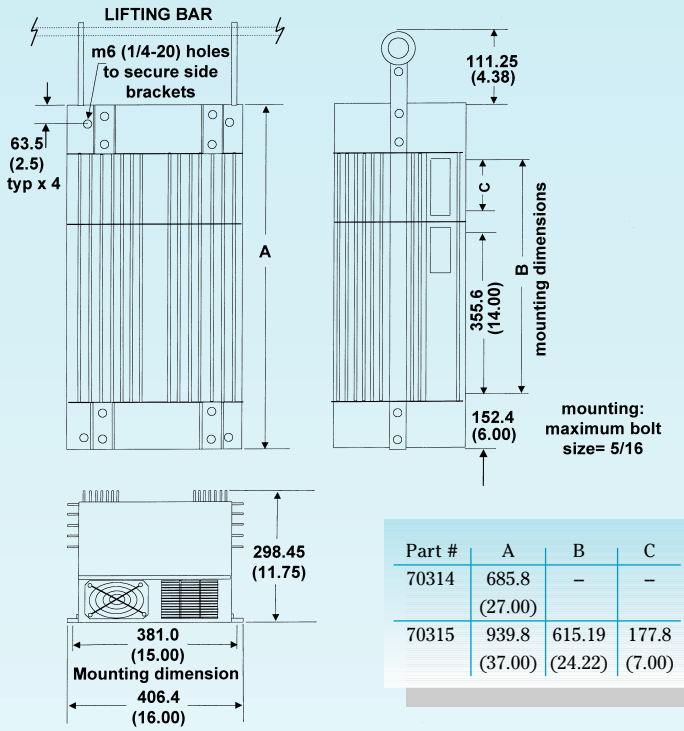
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Panel Mount Outline

2 Kw Amplifiers



15/28 Kw Amplifiers



Part #	A	B	C
70314	685.8 (27.00)	–	–
70315	939.8 (37.00)	615.19 (24.22)	177.8 (7.00)

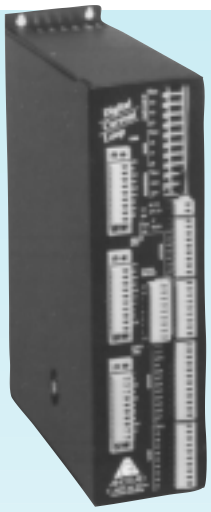
Type	Commutation (1)			Inductance (2)	Continuous Output Power (Watts)	Power Supply AC ±10% Voltage (Volt)	Nominal Bus Voltage (Volt)	Continuous Current (Amp) (RMS)	Peak Current (Amp) (RMS)	Nominal Voltage Output (3) (Volts)	Order Number
Panel Mount Amplifiers	brushless	trap	PWM HE	low	2000	115	160	10	25	135	73771
				low		220	320			270	73779
				high		115	160			135	73772
				high		220	320			270	73780
	brushless	sin	PWM HE	low	2000	115	160	10	18	135	73769
				low		220	320			270	73777
				high		115	160			135	73770
				high		220	320			270	73778
	brushless	sin	PWM SW	low	2000	115	160	10	18	135	73773
				low		220	320			270	73781
				high		115	160			135	73775
				high		220	320			270	73782
	brushless	resolver	PWM RES	low	2000	115	160	10	18	135	73775
				low		220	320			270	73783
				high		115	160			135	73776
				high		220	320			270	73784
	brushless	sin	PWM SW RES	high	35000	380-460	650	39	78	575	70314
				high	60000	380-460	650	68	137	575	70315

Notes:
1. Trap = trapezoidal, sin = sinusoidal, PWM = pulse width modulated, HE = Hall Effect, SW = Software, RES = Resolver.
2. High inductance amplifiers are suitable for the iron core type motors (LCD/LCK/LFA/LFB/LFC/LFD/LXB/LXD). Low inductance amplifiers are suitable for the epoxy and steel/epoxy type motors (LEM/LEA/LEB/LEC/LCE).
3. Nominal voltage output is defined at nominal bus voltage and continuous current.

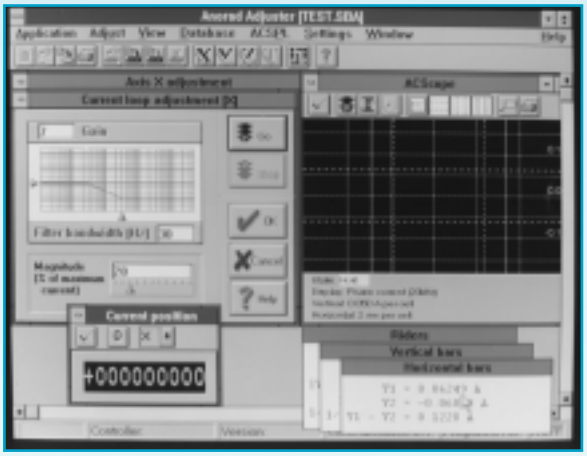
Digital Servo Controllers

D-Serv/ M-Serv





- Matched to all Anorad linear motors
- 1-3 axis digital servo controllers
- Integral digital amplifier and power supply
- Sinusoidal software commutation
- Graphical User Interface with Softscope
- 20 kHz servo update rate, per axis



Many other Anorad servo controllers are available, including bus based (PC & VME) and C-programmable. Anorad linear motors also work with many third party controls. Contact factory for details.

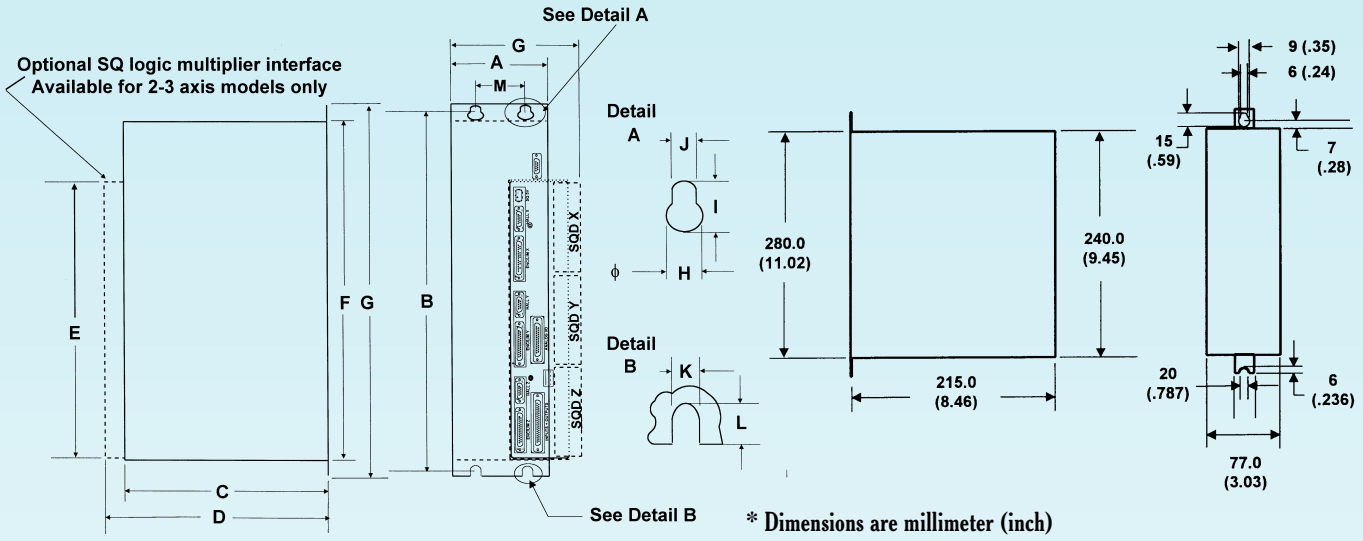
Specifications

Number of Axes	1			2	3
Model Number	M-Serv-MLH-1	D-Serv-DLM-1	D-Serv-DLH-1	D-Serv-DLM-2	D-Serv-DLM-3
Order Number	70641-A	70782-A	70642-A	71028-A	70855-A
Continuous Output Current (RMS)	2.1 A	7.1 A	10.6 A	4.6 A	4.6 A
Peak Output Current (RMS)	4.3 A	14 A	21 A	9.2 A	9.2 A
AC Input Voltage	85 Vac - 240 Vac	115 or 230 VAC			
	47-63 Hz Single Phase	47-63 Hz Single or 3 Phase			
Bus Voltage @ 230 VAC	320 Vdc				
Bus Voltage @ 115 VAC	170 Vdc				
Continuous Power	25 W	100 W			
Peak Power	1K W	1.5 KW			
Update Period	50 µs (20kHz)				
Current Resolution @ 2 kHz	14 BITS				
Velocity Resolution	14 BITS				
Current Loop Bandwidth	2.5 kHz				

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D-SERV

M-SERV



* Dimensions are millimeter (inch)
* All dimensions are ± .5 mm

ORDER NO.	Controller	# axes	A	B	C	D	E	F	G	H	I	J	K	L	M
70782-A, 70642-A	D-Serv	1	80 (3.15)	338.5 (13.33)	230 (9.06)	n/a	n/a	302 (11.89)	348 (13.70)	8 (.32)	11 (.43)	5 (.20)	5 (.20)	8 (.32)	50 (1.97)
71028-A, 70855-A	D-Serv	2 or 3	154 (6.06)	429 (16.89)	258 (10.16)	281.94 (11.10)	330.2 (13.00)	404 (15.91)	450 (17.72)	12 (.47)	18 (.71)	7 (.28)	7 (.20)	18 (.71)	100 (3.94)
70641-A	M-Serv	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Controller

- Servo update rate: 20 kHz
- Servo algorithm: Second order filter, acceleration and velocity feedforward
- Position range: ± 999,999,999 counts
- Velocity range: ± 1 to 20,000,000 counts/sec (D-Serv)
  ± 1 to 10,000,000 counts/sec (M-Serv)
- Acceleration range: 1,000 to 127,000,000 counts/s^2

Software Attributes

- Error-mapping, Real-time data collection, Position event generator (optional)
- Built-in motion modules: linear and repetitive point-to-point move, search for contact , jogging, master-slave, electronic cam, registration mark moves, index searching at any speed
- Conditional statements, special states and variables which reflect motion, arrays, variables, counters, nested subroutines, arithmetic and logical expressions
- Automatic execution routines, interactive data entry

Communication/Inputs/Outputs

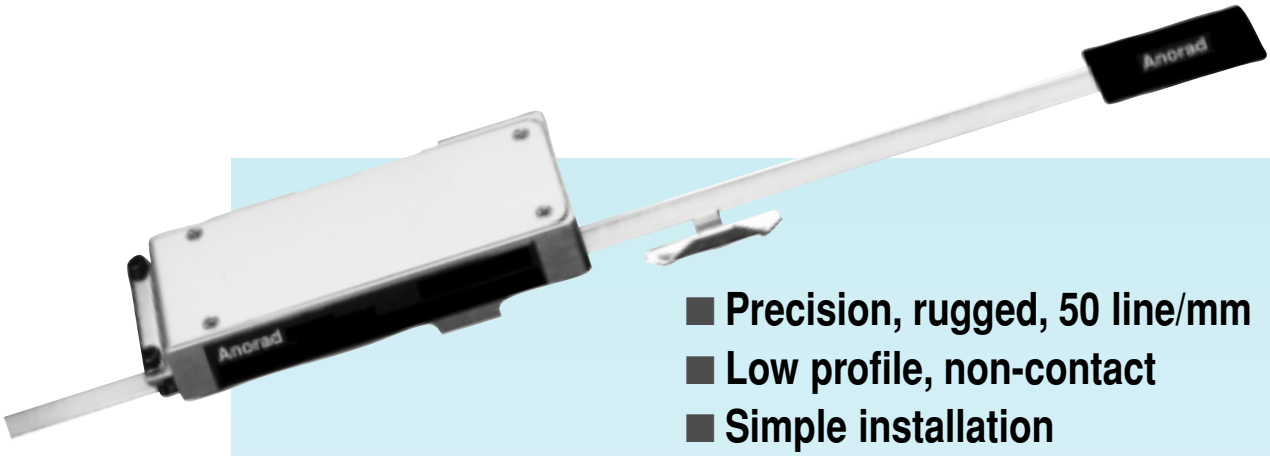
- Communication: RS232, RS422, up to 9,600 baud
- Encoder input: 3 channel differential line receiver
- Analog inputs: ± 10 V, 12 bit resolution
  (2) /axis D-Serv, (1) /axis M-Serv
- Analog outputs: (1) /axis ± 10V, 10 bit resolution
- Dedicated inputs: (2) limits, opto-isolated, 5V /axis, (1) drive fault
- Digital inputs: (8) single, (16) multi axis, opto-isolated D-Serv;
  (6) opto-isolated M-Serv
- Digital outputs: (8) single, (16) multi-axis, opto-isolated
  Supported by a built-in 24V isolated supply
  50 mA output sink capability D-Serv
  (2) opto isolated, CE floating M-Serv
- Brake driver: Built in 24V (0.75A) for brake/clutch control/axis (single axis D-Serv only)

Protection, Diagnostics and Error Handling

- All errors handled by automatic routines
- Programmable software limits, stall and dynamic force limits
- Automatic drive shutdown when: emergency stop is activated, position feedback signal is lost, user-defined position error is exceeded, five volt overvoltage, and overheating
- Automatic warning if the axis moves away from its target by more than a pre-defined distance
- Host communication with check-sum validation
- Immediate status response to “begin motion” commands indicating either a successful execution or a reason for failure
- Immediate detailed error message for abnormal motion termination
- I/O status and memory integrity
- Built-in hardware watch-dog timer

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ENCODERS



- **Precision, rugged, 50 line/mm**
- **Low profile, non-contact**
- **Simple installation**
- **Resolution 5 µ to 0.5 µ**
- **Choice of 1x, 5x and 10x output**

The MER-50 linear encoder system compliments the linear motor product line by offering a unique combination of accuracy, high speed reliability and fast installation. While all components are ordered separately, a complete package consists of a precision cut-to-length, rugged 50 line/mm metal tape scale, low profile analog readhead with integral home index vane, and two magnetic limit actuators. A choice of several digital encoder multipliers is available as indicated based on the speed and resolution requirements.

The encoders are highly resistant to contamination due to their unique manner of operation, using scattered light and spatial filtering to reject optical noise and distortion.

The MER-50 encoder system requires minimal machine preparation for installation. A special applicator is available to mount the self adhesive scale, and the readhead provides for generous mounting tolerances with a unique built in set-up indicator. Anorad can provide installation services or custom encoder mounting to motors.

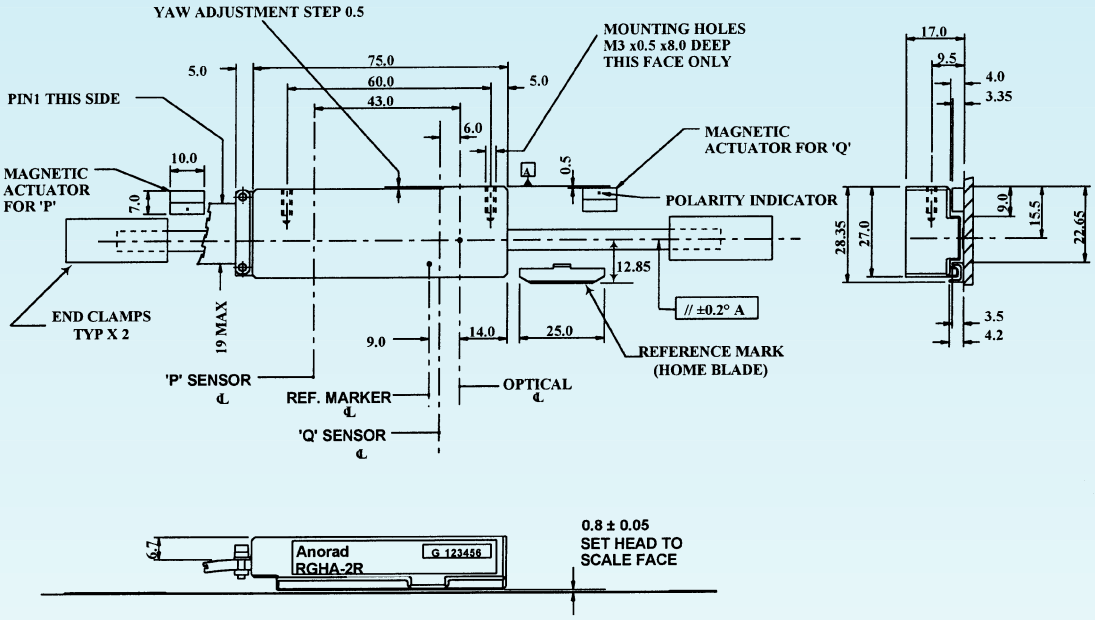
MER 50 Specifications

Description	Specification	Order #
Self adhesive scale, 50 line/mm	Maximum non-linear error ± 3 µm/m Maximum non-linear error per 60 mm ± 1 µm	69868-(x mm) x = length
Readerhead, with integral magnetic limits and photoelectric home sensor	5 m/s maximum velocity Output incremental channel, sin/cos, sinusoidal analog in quadrature, period 20 µm, 1V pk-pk nominal Tolerance on signal amplitude + 10, -20%	69981
1x external encoder multiplier	5 m/s maximum velocity 5 µm resolution after quadrature	69982
5x external encoder multiplier	1.5 m/s maximum velocity 1 µm resolution after quadrature	69983
10x external encoder multiplier	0.75 m/s maximum velocity 0.5 µm resolution after quadrature	69984
Index marker	Better than 1 µm signal repeatability differential CMOS logic output Logic low on mark, high off mark, actuates low to high	47941
Magnetic limits	Better than 200 µm signal repeatability Output open collector, operates in background magnetic field up to 25 Gauss	47940
End Clamps	Adhesive type	69869
Epoxy adhesive kit	Bulk quantity, two part	70947
Scale applicator		70944
Setting location tool	For readerhead, index, and limits	70948
Mating Connector Cables	Amp Micro-Match Refer to pages 72-73, Cable type EL	70853
Mer 50 Manual		72128

Note: Contact factory for ordering information.

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Encoder Installation Outline



Signal Information

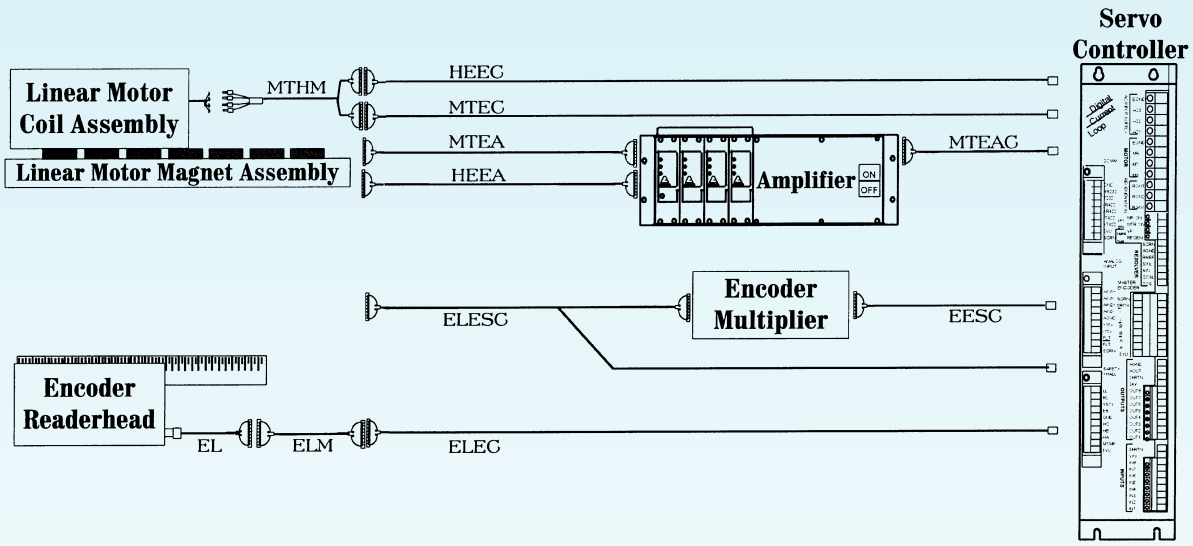
15 pin amp micro connector	Description
1	Case/ screen connection
2	“P” sensor open collector output
3	Reference mark (+)
4	Reference mark (-)
5	“Q” sensor open collector output
6	-5 volts out of head to power interface
7	+5 volt power supply
8	+5 volt return power supply
9	Sinewave output (+)
10	Sinewave output (-)
11	+5 volt return power supply
12	Cosinewave output (+)
13	Cosinewave output (-)
14	+5 volt power supply

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Cables



- Ultra high flex machine cables
- High quality, standard D connectors
- All gold plated contacts
- Shielded twisted pair for noise immunity
- 100% inspected



Notes:
1. Cables can be ordered as components for connectivity between all Anorad products.
2. The system cable layout shown above represents cabling scenarios for various linear motor motion control systems.
3. All cables are fully tested and shipped with schematics.

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Cable Types

Motor/Thermistor/Hall Effect Cables:

Types	Description	Connecting	Function
MTHM -HF -LF	Motor Thermistor Hall Effect Moving	Motor to bulkhead connector	Moving machine cable. Specify High Flex -HF or Low Flex -LF. Splits out the hall effect and motor/thermistor cable.
MTEC	Motor Thermistor Extender	Bulkhead connector to controller	Connects the moving machine cable to the D-Serv or M-Serv integrated controller/amplifier products.
MTEA	Motor Thermistor Extender	Bulkhead connector to amplifier	Connects the moving machine cable to the 3U rack or panel mount amplifier chassis.
MTEAC	Motor Thermistor Extender	Amplifier to controller	Connects the motor command signal and thermistor signal from the 3U rack or panel mount amplifiers to a stand alone controller.
HEEC	Hall Effect Extender	Bulkhead connector to controller	Connects the moving machine cable to the D-Serv or M-Serv integrated controller/amplifier products.
HEEA	Hall Effect Extender	Bulkhead connector to amplifier	Connects the moving machine cable to the 3U or panel mount amplifier chassis.

Encoder/Limit Cables:

Types	Description	Connecting	Function
EL	Encoder Limit	Encoder and limits to moving cable	152 mm (6") standard length.
ELM -HF -LF	Encoder Limit Moving	Encoder/limits to bulkhead connector	Moving machine cable. Specify High Flex -HF or Low Flex -LF.
ELEC	Encoder Limit Extender	Bulkhead connector to controller	Connects the moving machine cable to the D-Serv or M-Serv integrated controller/amplifier products.
ELESC	Encoder Limit Extender	Bulkhead connector to controller and SQ box	Connects the encoder moving machine cable to the MER 50 1x, 5x, or 10x encoder logic multipliers. Splits out the limit signals and routes them directly to the D-Serv or M-Serv integrated controller/amplifier products.
EESC	Encoder Extender	SQ logic to controller	Connects the encoder logic multiplier to the D-Serv or M-Serv, integrated controller/amplifier products.

Ordering information:

Specify related components as shown in example.

Cable Type - Length[1] - Units - (Motor, Amplifier[2], Controller, Multiplier)

Example ***MTHM-HF-10-FT (LCK-S-1, None, D-Serv, 10X)***

Notes:

1) Standard extender cable lengths total 250 mm (10").

2) Controller type can represent a controller only, or an integrated controller with amplifier(s) and power supplies.

Engineering Notes

Useful Formulas

Nomenclature

Variable	Units		Symbol
Positioning			
Displacement	mm	(in)	X
Velocity	mm/sec	(in/sec)	V
Maximum Velocity	mm/sec	(in/sec)	Vmax
Acceleration	mm/sec^2	(in/sec^2)	A
Moving Mass	kg	(lbm)	M
Moving Weight	N	(lb)	Wt
Duty Cycle	%		d/c
Time	sec		T
Cycle Time	sec		Tc
Force			
Resistance Force	N	(lb)	Fr
Inertial Force	N	(lb)	Fi
Friction Force	N	(lb)	Ff
Damping Force	N	(lb)	Fd
Spring Force	N	(lb)	Fs
Spring Coefficient	N/mm	(lb/in)	Ks
Damping Coefficient	N/mm/sec	(lb/in/sec)	Kv
Friction Coefficient	--		μ
Total Force	N	(lb)	Ft

Variable	Measured	Units		Symbol
Amplifier				
Amplifier Peak Current	rms	Amp		Ipa
Amplifier Continuous Current	rms	Amp		Ica
Amplifier Buss Voltage		Volts		vdc
Environment				
Ambient Temperature		° C		tamb
Coil Temperature		° C		tp
Motor				
Motor Peak Current	rms	Amp		Ip
Motor Continuous Current (Coil @ t°c)	rms	Amp		Ic (t)
Motor Resistance (Coil @ t°c)	ptn	Ohm		R (t)
Motor Inductance	ptn	mH		L
Motor Magnet Pitch		mm	(in)	τ
Motor BEMF Constant	ptn (rms)	V/m/sec	(V/in/sec)	Ke
Motor Force Constant	3 phases (rms)	N/amp	(lb amp)	Kf
Motor Constant	3 phases	N/√w	lb/√w	km
Motor Magnetic Attraction		N	(lb)	Fa
Motor Thermal Resistance		° C/w		Rth
Motor Peak Force	3 phases	N	(lb)	Fp
Motor Continuous Force (Coil @ t°c)	3 phases	N	(lb)	Fc (t)
Motor Continuous Power Loss	ptn	Watt		Pc
Motor Weight		kg	(lb)	W
Motor Coil Maximum Temperature		° C		tmax

Force Equations

Force Type	Units		Symbol	Equation	
Friction Force	N	(lb)	Ff	- (M * g + Fa) * μ * (V/ |V|)	[kg (lbm) * 9.8 m/sec^2 (386 in/sec^2) + N (lb)] * μ
Inertial Force	N	(lb)	Fi	- M * A	[$N/mm/sec^2$ ($lb/in/sec^2$) * mm/sec^2 (in/sec^2)]
Damping Force	N	(lb)	Fd	- Kv * V	[N/mm/sec (lb/in/sec)] * [mm/sec (in/sec)]
Spring Force	N	(lb)	Fs	- Ks * X	[N/mm (lb/in)] * [mm (in)]
Total Force	N	(lb)	Ft	Fr + Ff + Fi + Fd + Fs	[N (lb)]

Note: g = gravity acceleration = 9.8 m/sec^2 (386 in/sec^2).
Note: (V/|V|) = Vector direction of velocity.

Kinematic Equations
(for acceleration/deceleration phases)

Given	A,X	A,V	A,T	V,T	V,X	X,T
Solve for						
A				V/T	$V^2/2X$	$2X/T^2$
V	$\sqrt{2AX}$		AT			2X/T
X		$V^2/2A$	$AT^2/2$	VT/2		
T	$\sqrt{2X/A}$	V/A			2X/V	

Motor Sizing Equations

Variable	Symbol	Equation
Required Motor Peak Force	$\overline{Fp}$	Max [Ft_1, Ft_2...Ft_n]
Required Duty Cycle	$\overline{d/c}$	$(Fc/Fp)^2 * 100\%$
Required Motor Continuous Force	$\overline{Fc}$	$\sqrt{\frac{Ft_1^2 * T_1 + Ft_2^2 * T_2 + \ldots Ft_n^2 * T_n}{\sum_{i=1}^{n} Ti}}$

Note: Tc = T1 + T2 + ... Tn
Fti = Total force for positioning phase i (i = 1, 2...n)
Note: Bar above symbol indicates required value, e.g. Fc = required Motor Continuous Force

Thermal Equations

Variable	Symbol	Equation
Motor Resistance @ t°C	$R_{(t)}$	$\frac{R_{(25)} * (234.5 + t)}{234.5 + 25}$
Motor Power @ t°C (Per Phase)	$P_{c(t)}$	$I^2_{(t)} * R_{(t)}$
Motor Temperature	t°C	$tamb + P_{c(t)} * Rth * 3$

Amplifier Sizing Equations

Variable	Symbol	Equation
Required Continuous Current	$\overline{Ica}$	$\overline{Fc/Kf}$
Required Peak Current	$\overline{Ipa}$	$\overline{Fp/Kf_{0.25}}$ $\left(Kf_{0.25} = \frac{Fp_{0.25}}{Ip_{0.25}}\right)$
Required Amplifier Voltage	$\overline{Vdc}$	$Va * \sqrt{6} * 1.1$
Voltage RMS ptn	Va	$\sqrt{\left(\frac{\Pi * V * L * Ip}{\tau}\right)^2 + (R_{125} * Ip + V * K_e)^2}$

Note: For steel core motors calculate the value of non-linear Kf at 0.25 sec ($kf_{0.25}$) from the specification table. Value of 1.1 accounts for 10% safety margin.

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Continuous Force @ 25°C - (Fc25)

The force the motor generates continuously when all three phases are equally sharing the load, provided the time of operation is shorter than the thermal time constant of the motor. The coil is attached to an aluminum heat sink 250 x 250 x 25 mm (610 x 762 x 50 mm for the LF series) and the coil temperature is close to 25°C.

Continuous Force @ 125°C or 95°C - (Fc125 or Fc95)

The force the motor generates continuously when all three phases are equally sharing the load, provided the time of operation is longer than the long thermal time constant of the motor. The coil is attached to an aluminum heat sink 250 x 250 x 25 mm (610 x 762 x 50 mm for the LF series) and the coil temperature is close to 125°C or 95°C (LF series motors are rated at 95°C).

Peak Force - (Fp)

The force the motor (all three phases) is capable of generating, during a specified length of time (1 sec, 0.25 sec).

Continuous RMS Current @ 25°C - (Ic25)

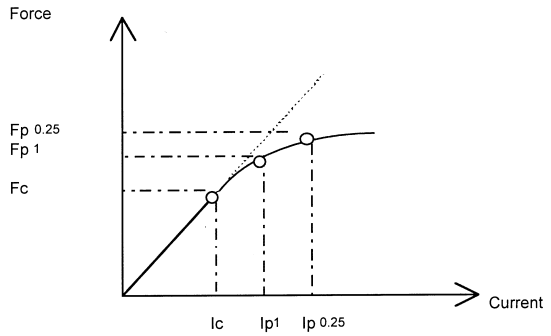
The RMS current (for all phases) which results in a continuous force of Fc25.

Continuous RMS Current @ 125°C or 95°C - (Ic125 or Ic95)

The RMS current (for all phases) which results in a coil temperature of 125°C or 95°C and a continuous force of Fc125 or Fc95 (LF series motors are rated at 95°C).

Peak Current - (Ip)

The RMS current (for all phases) which corresponds to the peak force, on the non-linear force current curve.



Force Constant - (Kf)

The ratio between motor force (all three phases) and RMS current. For balanced, epoxy core motors the force constant is linear from 0 to $Fp_{0.25}$, as shown by the dotted line in the above chart. For steel core motors the force constant is non-linear, as shown by the solid line in the above chart. The non-linear force constant curve can be generated using 4 points (i.e. 0, Fc/Ic, Fp_1/Ip_1 and $Fp_{0.25}/Ip_{0.25}$). These values are given in the specification table of each motor. The linear value of Kf in the specification table equals Fc/Ic. The non-linear approximations of Kf are $Kf_1 = Fp_1/Ip_1$ and $Kf_{0.25} = Fp_{0.25}/Ip_{0.25}$.

Power Loss at 125°C or 95°C - (Pc125 or Pc95)

The continuous (Phase to Neutral) power loss of the motor when the RMS current in the coil is Ic125 or Ic95. The total motor power loss equals 3 * Pc125 or Pc95 (LF series motors are rated at 95°C).

Back EMF Constant- (Ke)

The ratio between the Back EMF voltage RMS (Phase to Neutral) and the motor speed.

Coil Resistance at 25°C - (R25)

Phase to Neutral electrical coil resistance at 25°C coil temperature.

Coil Resistance at 125°C or 95°C - (R125 or R95)

Phase to Neutral electrical coil resistance at 125°C or 95°C coil temperature. (LF series motors are rated at 95°C).

Inductance - (L)

Phase to Neutral Inductance.

Electrical Time Constant - (τe)

The time it takes for a step current input to the coil to reach 63% of its value by overcoming the resistance and the inductance of the coil.

Motor Constant - (Km)

This constant is a figure of merit for motor efficiency. It is the ratio of motor continuous force (three phases) Fc125 or Fc95 to the square root of the total motor power loss (3 phases).

Thermal Resistance - (Rth)

The equivalent thermal resistance of the motor, determined by the ratio of coil temperature rise (100°C for LE, LC, LX and 70°C for LF) and the total power loss of the motor (3 * Pc125 or Pc95).

Maximum Coil Temperature - (Tmax)

The temperature above which coil failure is expected due to excessive thermal expansion or wire insulation failure. Note: insulation failure typically occurs between 150°C and 170°C. For motor sizing the recommended coil temperature is 25°C below the Tmax, or less.

Coil or Magnet Assembly (Slide) Weight - (W)

The weight of the coil assembly for brushless motors. The weight of the magnet assembly for brush-type motors.

Magnetic Attraction - (Fa)

The total force between the coil assembly and the magnet assembly at the nominal air gap.

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Motor Sizing Example

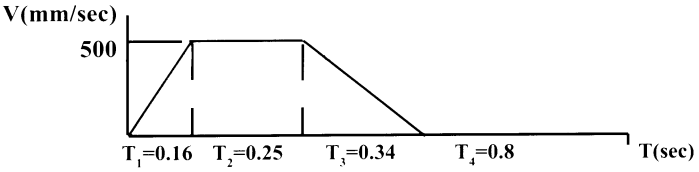
1 Step: Positioning Specifications

Specify your positioning system requirements on a copy of the RFQ Questionnaire (p. 78). Fax the copy of the RFQ to your nearest Anorad representative (see back cover of this brochure) for computer-aided analysis and price quotation based on the following steps:

2 Step: Kinematic Analysis

Use the formula given in the Kinematic Equations table (p. 74) to completely define the positioning requirements for your application, as shown below.
For example, consider a positioning application with a total travel of 250 mm which starts with a forward acceleration to velocity of 500 mm/sec within 40 mm (Phase 1), then a travel for 125 mm at 500 mm/sec (Phase 2), followed by a deceleration to rest within the remaining travel of 85 mm (Phase 3) and a dwell for 0.8 seconds (Phase 4).

Positioning Phase Variable	Units	1	2	3	4
X (displacement)	mm	40	125	85	0
V (velocity)	mm/sec	0-500	500	500-0	0
A (acceleration)	mm/sec2	3125	0	1471	0
T (time)	sec	0.16	0.25	0.34	0.8



3 Step: Force Analysis

In the above example assume a machining force of 130 N in Phase 2, a coefficient of friction 0.08, and a moving mass of 23 kg (20 kg slide and customer load and 3 kg assumed mass for motor coil). Finally, assume magnetic attraction of 2000 N. Using the force equations (p. 74), we get the resulting forces in this example as shown in the following table:

Positioning Phase			1	2	3	4
Force	Units	Symbol				
Friction	N	Ff	-178	-178	-178	0
Inertia	N	Fi	-71.9	0	33.8	0
Resistance	N	Fr	0	-130	0	0
Total	N	Ft	-250	-308	-144.2	0

Note: (-) sign indicates direction of the force is opposite to the direction of motion. The motor has to provide a force equal in magnitude and opposite in direction to Ft.

4 Step: Motor Sizing

Using the formula for motor sizing (p. 74), we get the following requirements:

Peak Force: $\bar{F}p = \max.(250,308,144.2) = 308$ N

Continuous Force: $\bar{F}c = \sqrt{\frac{250^2 * 0.16 + 308^2 * 0.25 + 144.2^2 * 0.34}{0.16 + 0.25 + 0.34 + 0.8}} = 162$ N

Duty Cycle: $\overline{d/c} = \left(\frac{162}{308}\right)^2 * 100\% = 28\%$

To select motor type use the Product Overview (p. 4). From the performance tables select model LCK-S, and from (p. 32) choose size LCK-S-1-AC. Note: Check from the charts that assumed coil weight and magnetic attraction match with that of the motor and modify steps 3 and 4 accordingly.

5 Step: Coil Temperature Check

Using the formula for thermal equations (p.74) and motor properties (p.32), solve for coil temperature (t) by iterations as follows:

First iteration:

Assume $t = 125°C$

$R_{125} = 3.9 * \frac{234.5 + 125}{234.5 + 25} = 5.4$ ohms

$\overline{Ic} = \bar{F}c/Kf = 162/55.5 = 2.92$ Amps.

$Pt = \bar{I}c^2 * R = (2.92)^2 * 5.4 = 46.04$ W

$t = tamb + Pt * Rth * 3$

$t = 25 + 46.04 * 0.46 * 3 = 88.5°C$

Second Iteration:

Assume $t = 88.5°C$

$R_{88.5} = 3.9 * \frac{234.5 + 88.5}{259.5} = 4.85$ ohms

$Pt = (Ic)^2 * R = (2.92)^2 * 4.85 = 41.35W$

$t = tamb + Pt * Rth * 3$

$t = 25 + 41.3 * 0.46 * 3 = 81.9°C$

Third Iteration:

Assume $t = 81.9°C$

$R_{81.9} = 3.9 * \frac{234.5 + 81.9}{259.5} = 4.75$ ohms

$Pt = Ic^2 * R = (2.92)^2 * 4.75 = 40.5W$

$t = tamb + Pt * Rth * 3$

$t = 25 + 40.5 * 0.46 * 3 = 80.9°C$

6 Step: Amplifier Sizing

Using the amplifier sizing formula, we get the following:

Continuous Current: $\overline{Ic} = \bar{F}c/kf = \frac{162}{55.5} = 2.92$ Amps

Peak Current: $\overline{Ipa} = \bar{F}p/kf_{0.25} = \frac{308}{39.5} = 7.2$ Amps (kf @ $Ip1_{0.25} = 395/10 = 39.5$)

Bus Voltage: $Va = \sqrt{6} * 1.1 * \sqrt{\left(\frac{\pi * 0.5 * 30}{30} * 7.2\right)^2 + (7.2 * 4.35 + 0.5 * 18.5)^2} = 113$

7 Step: Amplifier/Controller Option Selection

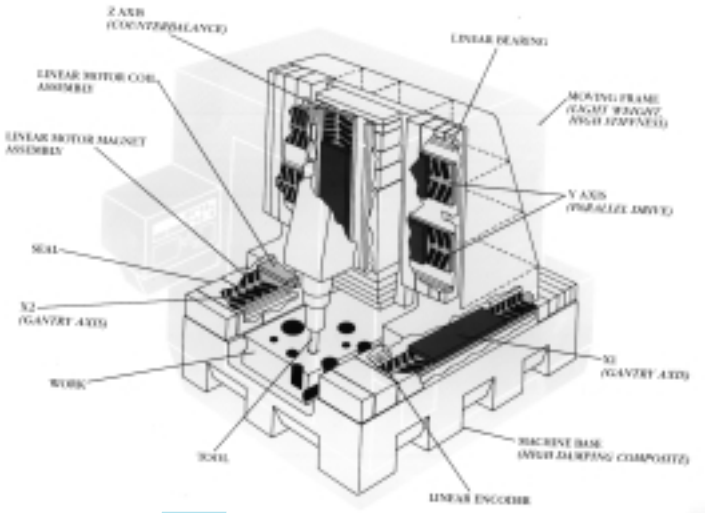
Consider amplifier and controller specifications. Select D-SERV-DLM-1 controller (p. 68) or 73775 amplifier (p.67). For force velocity curve see example (p. 65).

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System Considerations

To achieve the highest performance in positioning systems, the entire machine structure must be optimized to result in the highest possible natural frequency, and the entire servo system design must be optimized to achieve the highest possible closed loop bandwidth. The designer of a linear motor machine should therefore be aware of various design considerations, which are somewhat different than traditional servo system practices.

A typical concept of a linear motor machine.



1 Very high magnetic attraction (up to 10 times drive force) can exist between the motor parts. This requires careful handling of the magnetic plates, before and during installation, proper installation tools, and design for ease of disassembly in the field.

2 Linear bearings must be selected to support both the moving load and the magnetic attraction force. Desirable bearing characteristics include high stiffness (for increased natural frequency) and low friction. Because linear motors can provide higher velocities, the speed and acceleration limitations of the bearings need to be considered.

3 Machine chips must be kept outside the magnet assembly by proper sealing and bellows. This is needed to prevent machine chips from penetrating the small air gap between the motor parts.

4 The motor air gap must be maintained within specified tolerance for proper motor functioning. The machine bearings and guideway must be of sufficient precision to maintain the air gap.

5 Brushless linear motors typically have moving cables. Provision must be provided in the machine to carry the cables. Motors with cooled coils will also have moving air or liquid coolant lines.

6 If a liquid cooled motor is selected, the coolant should include a rust inhibitor additive. The motor thermistor should be connected to a safety interlock circuit in the machine control system to prevent overheating.

7 When used in a vertical application, linear motors typically require a counterbalance mechanism to prevent the load from dropping in the event of a power interruption. The counter balance can also reduce the motor duty cycle by supporting the load against gravity. Typical counterbalance techniques include pneumatic cylinder, springs, or counterweight.

8 The motor should be mounted as close as possible to the center of mass of the moving load. The position feedback (e.g. linear encoder) should be mounted as close as possible to the working point of the machine. If the motor and feedback are far apart, the machine structure and bearings must be of sufficient stiffness to minimize dynamic deflections of the structure.

9 Cables should be made in a twisted pair configuration, shielded and grounded properly to the machine base, servo amplifier and motor to reduce RFI. Cables should be selected for proper flex life at the designed bend radius.

10 Brushless motors require commutation for proper operation. Anorad motors can be provided with a variety of commutation options. Select a commutation method that matches the requirements of the servo controller. Specify the commutation option when ordering the motor.

11 Take advantage of Anorad's linear motor and system design expertise. Anorad's skilled application engineers will help you scale the linear motor learning curve. Anorad provides one stop shopping for linear motors and all accessories, including servo amplifiers, digital controls and feedback devices. For over 25 years, Anorad is the world leader in linear positioning systems.

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LINEAR MOTORS

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Fax to: (See Back Cover)
Please use a black pen when filling out our fax RFQ form.

Company Information

Name: _____ Title: _____ Date: _____

Company: _____

Address: _____

City: _____ State: _____ Zip: _____

Telephone: ( ) _____ Fax: ( ) _____ E-mail: _____

Motion Requirements

AXIS	UNITS	X	Y	Z	Comments
Travel:	mm (in)				
Typical Move:	mm (in)				
Max Velocity:	mm/s (in/s)				
Max Acceleration:	mm/s² (in/s²)				
Dwell:	sec				
Moving Load:	kg (lb)				
Resistance Force:	kg (lb)				
Settling/ Move Time:	sec				
Friction Coefficient:	(0-1)				

Fill in known values in above boxes.

System Characteristics

Move Type:	Point-to-Point	Interpolation	Scanning	Flying Shear	Master/Slave	Other
System Configuration:	Single Axis	Stacked	Split Axis	Gantry	Vertical	
No. Axes in Machine:	1	2	3	4	5	
Constant Velocity (%):	0.01 or less	0.1	1	5	10	
System Accuracy (µm):	0.01 or less	0.1	1	10	100	
Feedback Type:	Encoder	Laser	Resolver	LVDT	Limit Sensors	
Controller Type:	Analog	Digital	CNC	PC bus	VME bus	
Servo Amplifier Type:	Linear	PWM	Hall Effect	Software (encoder)	Resolver	
Motor Type:	Brush	Brushless	Ironless	Voice Coil	Stepper	
Maximum Quantity:	1	25	50	100	500	
Drive Used Today:	Ballscrew	Belt	Rack & Pinion	Pneumatic Hydraulic	Linear Motor	
Project Schedule:	Immediate	1 Month	3 Months	6 Months	1 Year	

Circle appropriate features or indicate other values.

System Consideration

Description Of Application

Attach sketch if necessary

I Am Interested In Receiving A Quotation For:
(check all that apply)

- ❑ Linear Servo Motors
- ❑ Servo Drives/Amplifiers
- ❑ Servo Controllers
- ❑ Feedback Devices
- ❑ Cables
- ❑ Engineering Support
- ❑ A Complete Motion Control Solution
- ❑ A Complete Anorad Positioning System

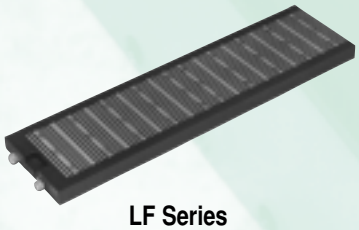
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Anorad's Linear Motor Application Examples

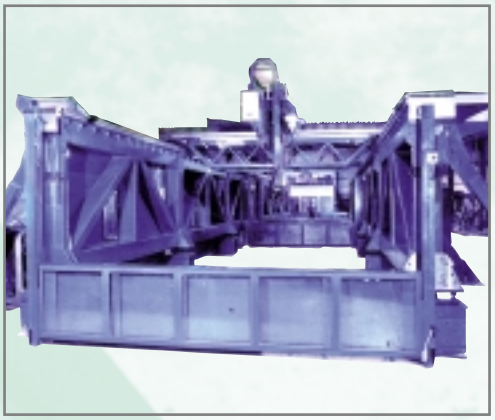


INGERSOLL
High Velocity Machine Tool (HVM)

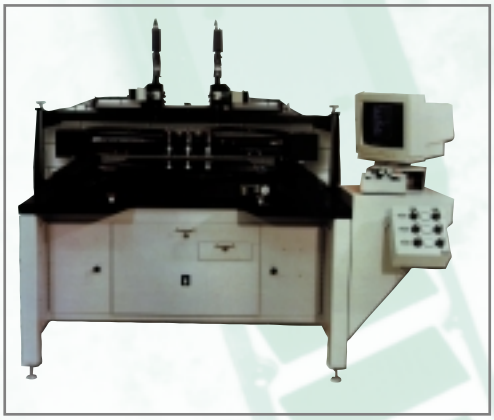
MACHINE TOOL



LF Series



BOEING
Laser Machining

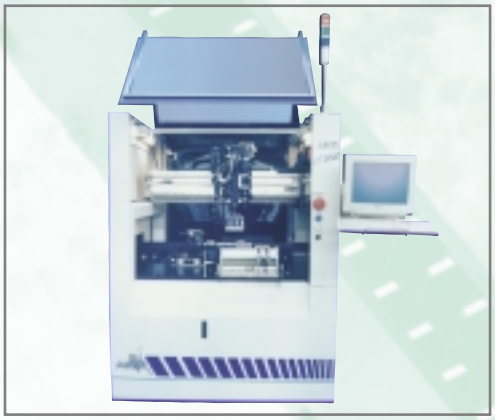


VPI
Glass Scriber

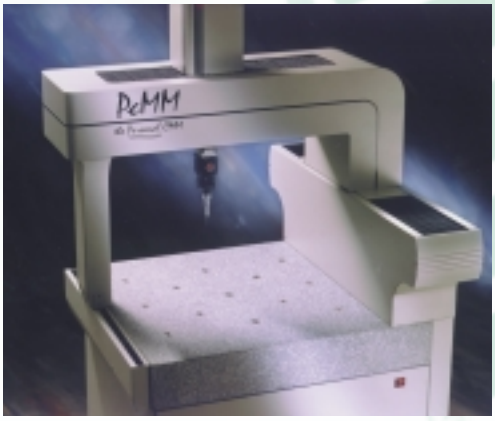
GENERAL AUTOMATION



LC Series

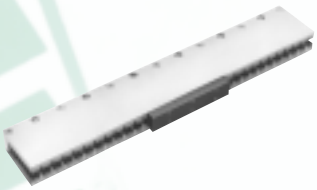


AMTI
SMT Assembly System



HELMEL
Coordinate Measuring Machine (CMM)

PRECISION



LE Series



OPTRONICS
Laser Color Imaging

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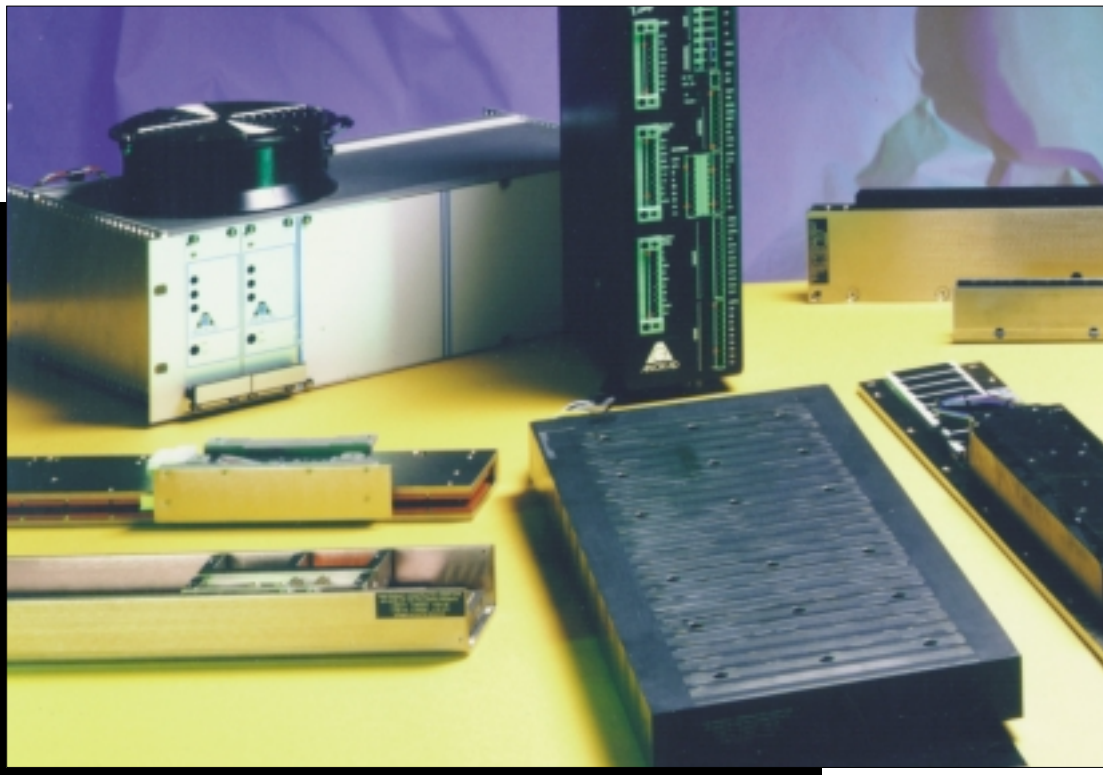
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Coherent General	IBM	Siemens
Digital Equipment Corp	Ingersoll	Sonoco
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Eastman Kodak	Lucent	Tektronix
EG&G	Lumonics	Texas Instruments
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