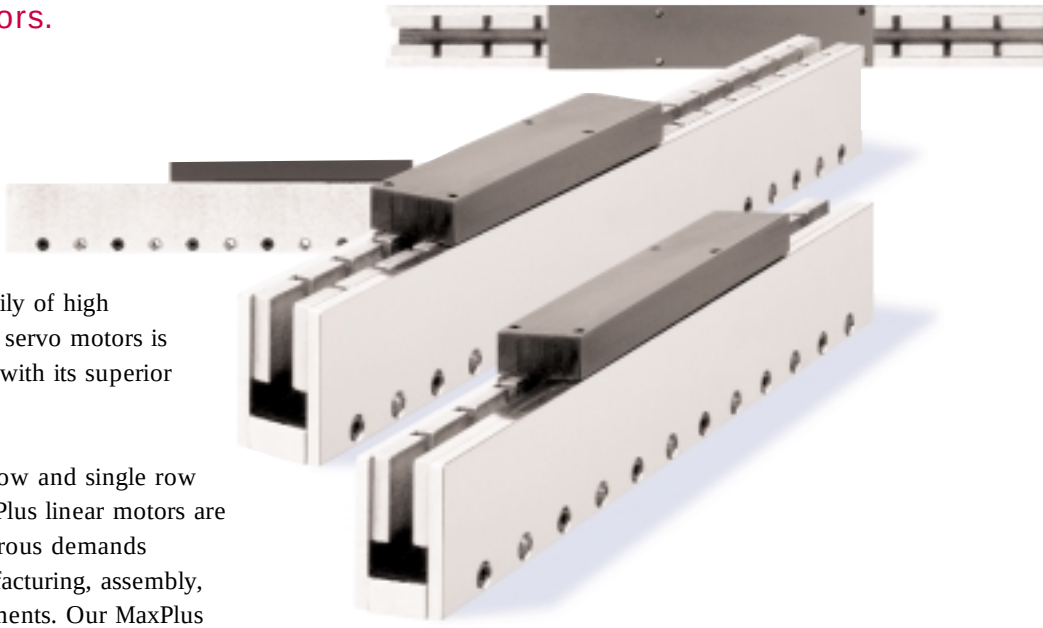
MaxPlus® Linear Servo Motors.

Redefining possibilities.

Exceeding expectations.



The MTS Automation family of high performance MaxPlus linear servo motors is revolutionizing the industry with its superior linear motion technology.

Available in both dual row and single row magnet configurations, MaxPlus linear motors are designed to exceed the rigorous demands required in advanced manufacturing, assembly, test and inspection environments. Our MaxPlus line of linear servo motors utilizes an ironless core design that provides high peak-to-continuous force ratios and extremely high acceleration in high-speed applications. MaxPlus linear motors have superior thermal properties and the highest force to coil weight available. All of which means you can expect exceptional performance, smooth motion, high accuracy, plus unparalleled acceleration and stiffness.

The difference is in performance.

Outstanding linear motion performance begins with these innovative design features:

- Continuous force up to 325 lbs./1446N
- Peak force up to 1620 lbs./7206N
- High force to coil mass ratio
- High accuracy/repeatability
- Efficient thermal performance
- Velocities > 10M/sec. Accelerations > 10G
- Zero magnetic preload
- Sinusoidal or hall effect commutation
- Thermistor
- Thermostat optional
- High-performance rare earth magnets
- Low inductance coil for fast response
- Non-contacting assemblies
- Continuous track to 72 in./1.8m*
- Configurable connections/cable options
- Fully customizable design

* 2000 Series available to 72 in./1.8m

Technological advances that produce results

We are continually working with new and emerging technologies to improve our product offering. For example, MaxPlus linear servo motors utilize a patented, automated machine winding technology that results in excellent unit-to-unit consistency at a significantly lower cost. It is the mission of MTS Automation to continually introduce our customers to breakthrough products that achieve higher levels of performance.

Custom designs to meet particular needs.

MaxPlus is not just an “off the shelf” line of servo motors. It is a line that offers unparalleled flexibility to achieve precise application requirements. What’s more, we are committed to working with our customers to custom design solutions that meet specific performance and cost criteria.

The only motor line with these performance specs:

More force to coil weight, superior performance/price. The full line of MaxPlus brushless linear servo motors outperforms competitive units in virtually every performance category. This “best of class” performance is also matched by our MaxPlus amplifiers and controllers.

BEMF Constant

The BEMF constant is multiplied by the maximum motor speed to determine how much voltage is generated by the motor. The amplifier must be able to produce more voltage than the generated voltage to cause current to flow in the motor. The following formula is a good rule of thumb to determine the needed amplifier voltage:

Bus Voltage = 1.25 * ((BEMF * Max Speed) + (DC Resistance (hot) * Current))
Remember to express speed in inches per second.

Continuous Force

Continuous force is the largest force that the motor can exert on the system for an extended period of time. To use the motor at this power level, a suitable heat sink must be provided for all the power dissipated by the motor (see Heat Management).

Force Constant

The force constant is the force produced by applying 1 amp DC to the motor. MTS Automation specifies the force constant in LBS/AMP (N/AMP).

Peak Force

Peak force is the largest force that the motor can exert on the system for a short period of time. It is specified for a 10% or shorter duty cycle. To use the motor at peak force, a suitable heat sink must be provided for all the power dissipated by the motor (see Heat Management).

Electrical Time Constant

The electrical time constant is the motor inductance divided by the motor resistance. It is a measure of how quickly the motor current can be changed. The stated value is the time it takes for the current to arrive at the 63% point of the applied current. The MaxPlus Linear Motor is ironless and has a low inductance. This allows the motor response to be very quick.

HED (Hall Effect Device)

All servo amplifiers will require some type of commutation device. A Hall Device is available for commutation of trapezoidal type drives and for initial positioning for Sine type drives. The HED is positioned deep within the magnet track to prevent picking up external disturbances. It is built in to the coil as an option to minimize added length.

Heat Management

All motor coils contain resistance. As current is driven through this resistance, heat is produced. The power lost (heat) is equal to the current squared times the resistance ($P=I^2R$). The MTS Automation linear motor has been optimized such that resistance is minimized and the thermal path to remove heat from the motor is as efficient as possible. Heat management is the principal design criteria when applying this style of motor. Failure to observe and control heat can result in motor failure. The MTS Automation motor comes with a thermistor to measure the motor temperature, and provides complete thermal protection, insuring a long life for both the motor and the system. A thermostat type switch is available as an option to shut the system down if the motor temperature rating is exceeded.

When applications of the MTS Automation linear motor approach performance extremes, heat dissipation will be the principal-limiting factor. Heat is removed from the motor by conduction into the attached mass (motor load), convection and radiation into the surrounding environment. Of these, conduction is the primary contributor. The motor load (stage, work-piece, table...) must behave as a heat sink to conduct heat away from the motor. Heat must be conducted away fast enough to maintain a temperature below the maximum rating during motor “STALL” conditions. The motor temperature MUST NEVER be allowed to go higher than the maximum 125˚C rating.

The power (P) into the motor during static conditions is determined by the equation $P=I^2R$ where I is the current being supplied to the motor and R is the resistance of the motor coils.

A current of 4 amps through the resistance of 8 ohms will cause the motor to draw 128 watts. A rated motor resistance of 8 ohms at room temperature will become 11.3 ohms at 125˚C. At this resistance the power draw becomes 180 watts. Heat must be withdrawn fast enough such that the motor does not exceed its maximum rated temperature.

The user must be aware of the system thermal dynamics, the heat removal process and the responsibility to design with one of the thermal protection devices active. Contact the factory for more information about the use of these devices in your system, or additional cooling options to extend the operating range of the motor.

Coil Length

The coil length is actually the length of the coil, excluding the mounting bracket. It does not include the bend radius of cable attached to the end of the motor bracket. The length of travel is normally described as the magnet track length minus the coil length. Remember to account for the length of the HED module when required.

Coil Weight

The specified weight of the coil assembly includes approximately one foot of cable. This weight should be added to the stage and load weights to calculate the total moving mass.

Inductance

The inductance of the winding and the resistance of the winding determine the electrical time constant of the motor. Lower inductance is desired for faster motor response but the amplifier may require a minimum inductance to drive the motor successfully. The option of coil connections in parallel reduces inductance, back EMF and resistance, but requires double the current to produce the same force.

Resistance

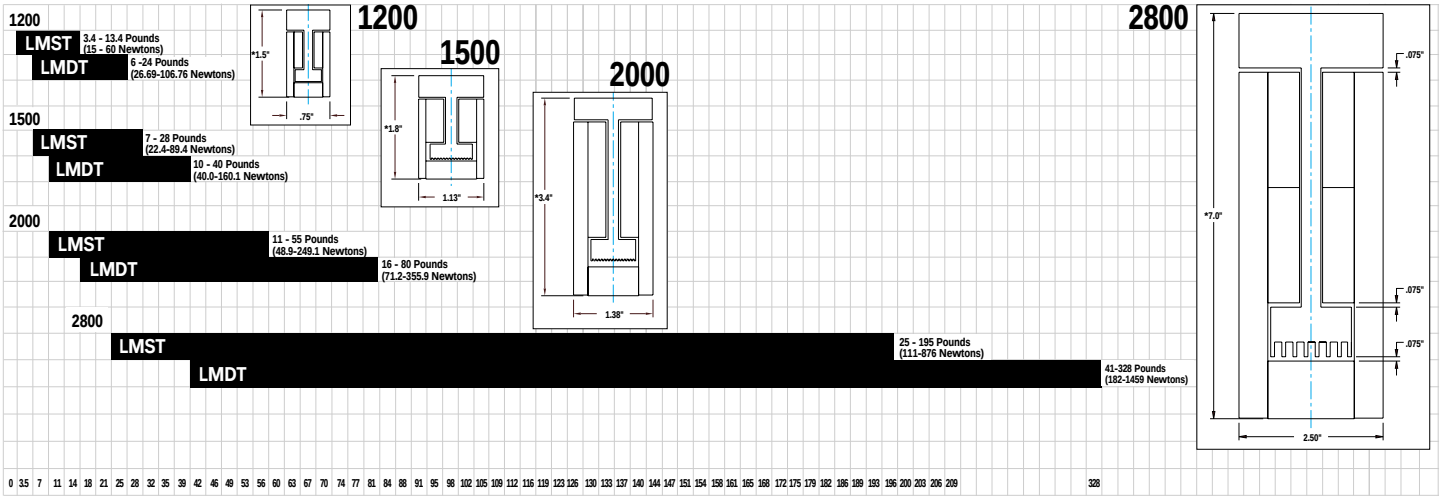
Understanding the motor resistance is important to proper motor application. Motor resistance increases with temperature by 0.393% per degree C. Motor power is defined by the equation:

$P=I^2 * R$

Where: I=Current
P=Power
R=Resistance

As the motor warms up (keeping the current a constant) the power dissipated by the motor increases. This increase causes the motor to warm up even faster. The temperature reached by the winding is above the ambient temperature as a result of the power being dissipated by the motor.

Linear Motor Series Force Ratings



* = Dimension includes .030" air gap, which is nominal all the way around the coil assembly.

Coil Ordering Chart

LMC	12	4	1	S	072	X
LINEAR MOTOR COIL	FRAME SIZE	COIL STATOR LENGTH	COIL TYPE	CONFIG	CABLE LENGTH	THERMAL DEVICE
					STANDARD	
	12=1200 SERIES	1	1=COIL ONLY	S=SERIES	072=72"	L=NORMALLY CLOSED
	15=1500 SERIES	2	3=COIL/120HED	P=PARALLEL	180=180"	F=NORMALLY OPEN
	20=2000 SERIES	3				
	28=2800 SERIES	4			*SPECIAL LENGTH CONSULT FACTORY	X=NEGATIVE TEMP. COEF. THERMISTOR
		5* ONLY WITH 2000 and 2800 SERIES				
		6, 7, and 8** ONLY WITH 2800 SERIES				

The jacket strip length is 2.0" Standard. The lead strip length is .25" Standard.

If product cannot fall under this system, it will be processed as special. The special part number system will follow as the above example except after coil there will be a "-" and a 5 digit number, i.e.: LMC1241-20000 (Thru 49999)

Magnet Track Ordering Chart

LM	D	T	12	25.2	F	S	S
LINEAR MOTOR	OPTION	TRACK	SIZE	TRACK LENGTH	MAGNET	PROFILE	STANDARD
	D=DOUBLE ROW		12=1200 SERIES	25.2=25.2"	F=1200, 1500 and 2800 (STANDARD)	S=STANDARD	S=STANDARD
	S=SINGLE ROW		15=1500 SERIES	*1200 and 1500 SERIES SOLD IN 1.2" INCREMENTS	B=2000 (STANDARD)		
			20=2000 SERIES	*2000 and 2800 SERIES SOLD IN 2.4" INCREMENTS			
			28=2800 SERIES				

If product cannot fall under this system, it will be processed as special. The special part number system will follow as the above example except after track length there will be a "–" and a 5 digit number, i.e.: LMD1225.2-50000 (thru 99999)

Note: For Metric Mounting, Consult Factory.

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Automation Division

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