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Luge LM
Product Manual

Luge LM

Precision Linear Stage

Product Manual

Rev: 2.5 / 62005

P/N: 12197017

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Product Manual

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1. Introduction

Thank you for your purchase of the Luge LM Series of precision linear stages. The Luge LM is a high speed stage designed to meet the most demanding of automation applications. This manual provides installation and maintenance information for the:

LM100F Series
LM100D Series
LM150F Series
LM150D Series
LM150L Series
LM250F Series
LM250D Series

If there are any questions regarding the set up of your product, please feel free to contact Bayside Motion Group, Technical Services at (516) 484-5353 for additional support

2. Packaging

The stage is packaged in a wooden crate/carton with high density foam padding to avoid any damage during transportation. The assembly is wrapped in plastic to maintain cleanliness and should be handled with appropriate care.

Uncrating

All appropriate stage documentation (including this manual) will be found on top of the stage. The stage can be easily lifted out of the crate and placed on a secure surface.

Unlocking

Some models may arrive with a locking bracket that restrains the slide plate from moving during transportation. All locking brackets will be identified with an orange tag, and must be removed before operating the stage.

3. Specifications

3.1 General

All Luge LM Stages feature a compact, low profile, totally enclosed aluminum alloy construction for high strength in a light weight package. The stages are rugged enough for the toughest requirements, yet accurate enough for precise applications. Luge LM stages provide state-of-the-art performance and efficiency at an exceptional value.

LM100F, LM150F, LM250F Series

This Luge LM series is a ball screw driven stage with a flange mount and coupling to mount to standard motor faces. In addition the Luge LMxxxF series can be supplied with limits, a linear encoder, and a fail safe brake, all of which are integrated into the stage design. This series provides a 26pin Sub D type connection to connect to the linear encoder, limit, and brake (see Sect 4. Wiring). If a linear encoder option is ordered a second 26pin Sub D type connection is provided for this purpose.

LM100D, LM150D, LM250D Series

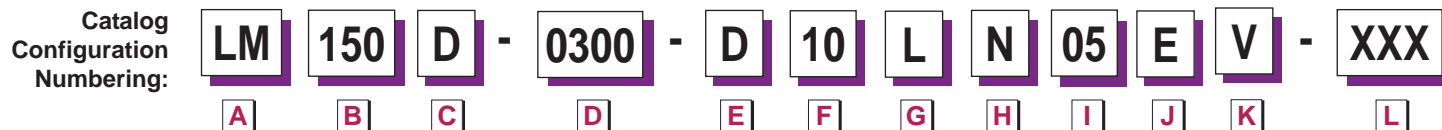
The LMxxxD series is unique because a brushless servomotor is built directly onto the ball screw. This decreases overall length, while providing superior dynamic performance over conventional mounting methods. Eliminating the motor mounting and flexible coupling increases positioning accuracy, repeatability, and provides greater reliability. A rotary encoder is also directly mounted to the ball screw, eliminating any build up of errors.

Motors in the LMxxxD are available for either 160V or 300V operation (both with Hall effects). To identify the specific winding, please refer to the catalog configuration number. In addition the Luge LMxxxD series can be supplied with limits, a linear encoder, and a fail safe brake, all of which are integrated into the stage design. This series provides a connection for motor power and one for rotary encoder/Hall/limit/brake (a separate connection is supplied for optional linear encoder). The 9 or 15pin Sub D type or 8pin DIN connection is for motor power. The 26pin Sub D type connection is for the rotary encoder, limit, and brake (see Sect 4. Wiring). If a linear Encoder option is ordered a second 26pin Sub D type connection is provided for this purpose.

LM150L, LM250L Series

The Luge LM150L series is a hybrid iron core linear motor driven stage. The motor coil is available in either single coil or double coil version for a choice of linear force capabilities. The LMxxx is controlled by a optical linear encoder and can be supplied with limits. This series is supplied with a motor power connection and a linear encoder/Hall/limit connector located at one end of the assembly. The LM150L motor power connection is a 15pin Sub D type defined in Section 4. Wiring. The LM250L power connection is a 8pin DIN type defined in Section 4. wiring. The encoder/Hall/limit connector is a 26pin Sub D type also defined in Section 4. Wiring. LM150L series (linear motor driven) - has all connectors located on the cable carrier track.

3.2 Catalog Configuration Number



A **STAGE SERIES**

LM	Luge LM Series
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B **METRIC WIDTH OF STAGE**

100	100 mm (4in)
150	150 mm (6in)
250	250 mm (10in)

C **DRIVE TYPE**

D	Motor, Direct Drive
F	Flange Mount
L	Motor, Linear (1)

D **TRAVEL**

	Width		
	100 (mm)	150 (mm)	250 (mm)
0050	50	—	—
0100	100	—	—
0150	150	—	—
0200	200	200	200
0250	250	—	—
0300	300	300	300
0350	350	—	—
0400	400	400	400
0450	450	—	—
0500	500	500	500
0550	550	—	—
0600	600	600	600
0700	—	700	700
0800	—	800	800
0900	—	900	900
1000	—	1,000	1,000
1200	—	1,200	1,200
1400	—	1,400	1,400
1600	—	1,600 (3)	1,600 (3)
1800	—	1,800 (3)	1,800 (3)
2000	—	2,000 (3)	2,000 (3)

E **MOTOR TYPE**

D	Motor, Rotary Direct Drive (160V, 2,000 LPR)
E	Motor, Rotary Direct Drive (300V, 2000 LPR)
I	Motor, Linear, Ironcore (3)
X	Provide Motor info. Mounting kit will be ordered separate line item

F **DRIVE VARIATIONS**

Ball Screw Options

02	2 mm Lead	(5, 7)
05	5 mm Lead	(5)
10	10 mm Lead	(5)
16	16 mm Lead	(5, 8)
20	20 mm Lead	(4, 5)
32	32 mm Lead	(4, 5)

Linear Motor Options

03	Single Coil	(1, 6)
06	Double Coil	(1, 6)

G **HOME & LIMIT**

N	None
L	NPN Normally Closed (+5VDC, Sinking 20mA Max)

Specifications are subject to change without notice.

H **BRAKE**

B	Fail Safe Brake Option
N	None

I **ENCODER, LINEAR** **Max Speed**

00	None (5)	—
01	0.1 μm	0.7m/sec
05	0.5 μm	3 m/sec
10	1 μm	3 m/sec
50	5 μm	3 m/sec

J **PROTECTION**

C	Extruded Cover
E	Fully Enclosed

K **ENVIRONMENT**

C	10,000 Class Cleanroom
S	Standard

L **SPECIAL**

XXX	Factory Issued
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- NOTES:**
- (1) Not Available on LM100 models
 - (2) For special travels please specify required travel in millimeter whole numbers For Example 0350 = 350mm travel.
 - (3) Travel greater than 1,400mm available with linear motor option only
 - (4) Not available on LM100 & 150
 - (5) Not available for choice I in section E
 - (6) Only available for choice I in section E
 - (7) Only available on LM100
 - (8) Only available on LM150

How to Order

1. Select options to create catalog configuration number, this is a Reference number
2. When placing an order, Bayside will issue the unique part number for your configuration.

Luge LM Stages are supported by a worldwide network of offices and local distributors. Call 1-800-305-4555 for application engineering assistance or for the name of your local distributor. Information can also be obtained at www.baysidemotion.com.

3.3 Electrical Specifications

3.3.1 Limits

Two end of travel limits and home switch can be ordered with all Luge LM stages. These are Hall effect type switches. (for index switch see 3.3.3 Linear Encoder). These switches have the following characteristics:

Supply Power	5-24VDC at 20mA max
Transistor Type	NPN (Current Sinking)
Operation Mode	Normally Closed
Length of Engagement	approx. 7mm
Repeatability	± 0.3mm (bidirectional)

3.3.2 Brake

A fail safe brake can ordered with ball screw driven versions of the Luge LM. The brake is a fail safe type, i.e. braking action occurs when power is removed. Therefore, for slide operation, the brake must be electrically energized. The brake is mounted to the far end of the ball screw inside the end cover, and therefore does not increase the overall length of the product. The brake has the following characteristics:

Stage	LM100	LM150	LM250
Supply Power	24 VDC at 170 mA max	24VDC at 200mA max	24VDC at 720mA max
Static Torque	0.113Nm (1in-lb)	0.34Nm (3in lb)	5.649Nm (50in-lb)
Rotating Inertia	1.194 e-3 gm cm sec ² (1.658 e-5 in oz c ²)	5.07e-3 gm cm sec ² (7.05e-5 in oz sec ²)	0.25056 gm cm sec ² (3.482 e-3 in oz sec ²)

3.3.3 Linear Encoder

A linear encoder can be ordered with any Luge LM product (standard on the LM150L Series). The encoder is an incremental non-contact optical design. It uses a reflective tape scale scanned by a moving readhead to produce a digital square wave output. The encoder has been designed to fit inside the stage to protect it from possible damage and give the best possible accuracy results. When a linear encoder option is ordered it automatically comes with a reference mark that can be used as a very accurate and repeatable index location. The index pulse can be read from the encoder Z channel (see Section 4 Cabling & Wiring for pin location). The reference mark is always placed near the end of travel limit closest to the stage's connectors. The encoder can be ordered in a range of resolutions (see 3.2 Catalog Configuration for more info) and all have the following characteristics:

Supply Power	5VDC ± 5% at 150mA max
Output Signal	Square wave differential line driver.
Reference Mark	Hall effect type synchronized to encoder. Length of engagement equal to resolution of encoder.

Additionally stage velocity and the motion controller/amplifier must be considered when choosing an encoder resolution. Please observe the following chart to ensure proper operation:

Resolution (um)	Maximum speed (m/s)	Minimum recommended controller clock frequency (MHz)
5	10	(encoder velocity (m/s) / resolution (um)) x 4
1	5	
0.5	3	
0.1	0.7	40

3.3.4 Direct Drive

3.3.4.1 Rotary Servo Motor

The direct drive servo motor in the LMxxxD series has the following specifications:

		LM100		LM150		LM250	
PARAMETERS	UNITS						
General							
Torque Constant K_t	Nm/amps	0.155	0.363	0.222	0.443	0.654	1.062
Back Emf Constant K_e	V/kRPM	11.47	23.15	23.5	46.9	56.28	91.46
Number of Poles		4	4	6	6	12	12
Inertia		← Motor&Ball Screw. See www.baysidemotion.com , Performance Specifications →					
Electrical Resistance (L-L)	ohms	16.5	66	7.7	30.8	0.73	1.89
Inductance	mH	8.11	33	8	32	2.23	5.89
Rated Voltage	Volts	160	300	160	300	160	300
Peak Current (RMS)	Amps	2.77	1.37	7	4	42.4	26
Continuous Current (RMS)	Amps	0.92	0.46	2.3	1.37	14	8.7
Thermal Resistance	°C/watt	1.82		2.36		0.4	

Temperature Note:

All motor speed/torque curves are based on 25 °C ambient with a winding temperature of 155 °C, at stall. Ambient temperatures above 25 °C will require derating. Consult Bayside Motion Group, Technical Services at (516) 484-5353 for application assistance.

3.3.4.2 Rotary Encoder

A rotary encoder is supplied with LMxxxD series (direct drive) ball screw driven stages. It is mounted just behind the motor and is self contained. Therefore in case of failure this encoder (and motor stator) is field replaceable. The encoder is a 2000 line rotary encoder, providing 8,000 counts per revolution, post quadrature. The encoder has the following specifications:

Power	5VDC +/- 5% at 125 mA Max
Output Format	Square wave differential line driver. Dual channel quadrature plus index
Resolution	2,000 lines (8,000 counts per revolution, post quadrature)
Frequency response	500kHz
Operating Temperature	-20 to 100 deg C
Storage Temperature	-40 to 125 deg C

3.3.4.3 Motor Commutation

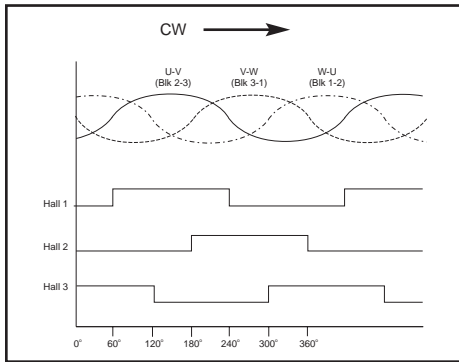
The commutation signals, developed by Hall sensors, are available for proper control of the motor by an amplifier. The Hall effects are located on a board fixed to the back end of the motor's stator. The Hall effect are pre-aligned at the factory and are not adjustable. The commutation board has the following specifications:

Power	5VDC +/- 5% at 100mA max
Output Format	TTL (internal pull-up resistor provided)

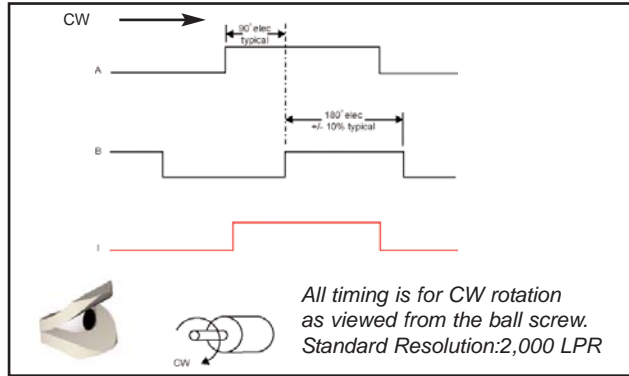
3.3.4.4 Signal Timing

The following chart shows the timing of the commutation and encoder signals in relation to the motor back EMF. Section Section 4. Cabling & Wiring, for signal pin designations. Note timing is for

Motor Signal Timing



Rotary Encoder Timing



For Luge LM D timing is for CW rotation as viewed from the ball screw.

Clockwise rotation as viewed from the ball screw.

3.3.5 Flange Mount

The are specific electronics related to the flange mount stage. Please see the above sections for information on limits,linear encoder or the brake options that can be ordered with this stage.

3.3.6 Linear Motor

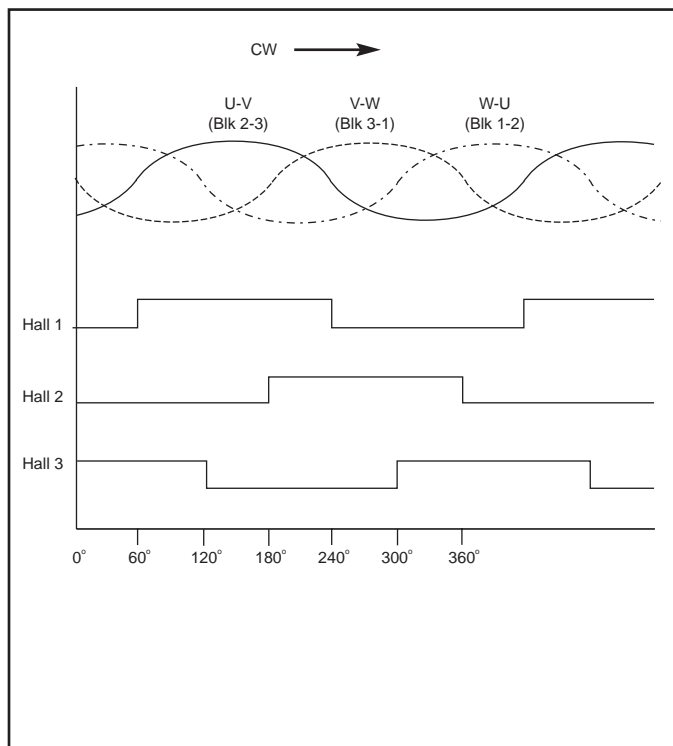
Both versions (single and double coil) come complete with Hall effect sensors for commutation and a thermistor for heat protection. The linear motor stage has the following specifications:

Parameter	Units	LM150X	LM150	LM250	LM250
		Single Coil (03)	Double Coil (06)	Single Coil (03)	Double Coil (06)
Peak Force	N (lbf)	170 (38)	340 (76)	940 (211)	1875 (421.5)
Continuous Force	N (lbf)	57 (13)	104 (23)	435 (89)	864 (194)
Peak Current	A -rms	13.7	13.7	11.3	11.0
Continuous Current	A -rms	3.7	3.4	4.6	4.6
Electrical Resistance*	Ohms L-L	1.1	2.1	3.5	7.1
Electrical Inductance ±20%	mH L-L	3.0	6.1	39.4	78.9
Back EMF constant*	Vpeak/m/s (Vpeak/in/s) L-L	12.6 (0.32)	25.2 (0.64)	77.1	154
Force Constant*	N/A-rms (lbf/A-rms)	15.4 (3.5)	30.9 (6.9)	94.4(21.2)	189(42.5)
Coil Mass ±15%	kg (lbs)	0.62 (1.4)	1.1 (2.5)	5.0(11)	9.6(21.2)
Magnet Pole Pitch	mm (electrical deg)	32 (360)	32 (360)	32(360)	32(360)

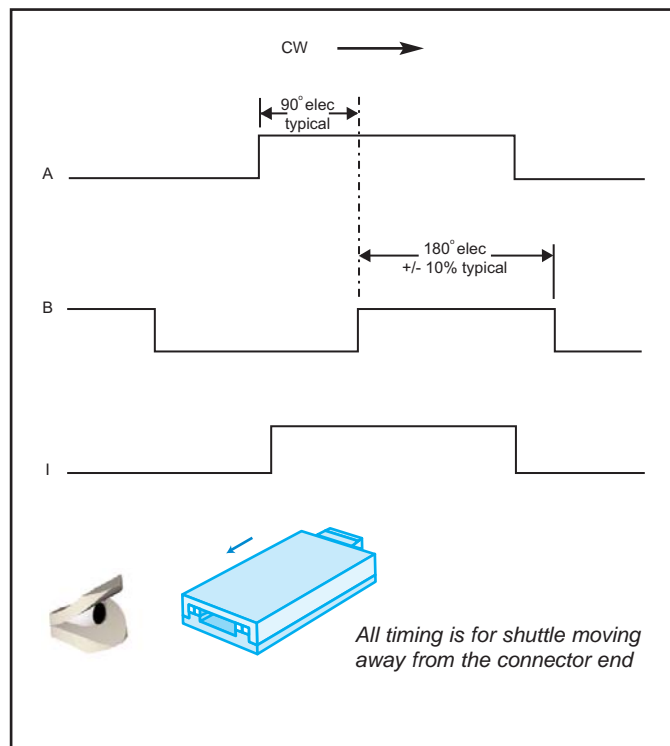
* @25C ±10%

Please observe the following chart for proper Motor/Signal timing. Note that positive travel is in the direction away from the power/signal connector side of the stage.

Linear Motor Signal Timing



Linear Encoder Timing



3.3 Mechanical Specifications

See www.baysidemotion.com for dimensional information.

3.4 Performance Specifications

See www.baysidemotion.com for performance information.

Motor Output and Signal Phasing

4.0 Cabling & Wiring

4.1.2 LMxxx Motor Power Connection

Motor Power Signals and Connector

LM150D, LM150L (15pin)

Pin	Function
1	Motor Phase U
2	Motor Phase U
9	Motor Phase U
10	Motor Phase U
3	Motor Phase V
4	Motor Phase V
11	Motor Phase V
12	Motor Phase V
5	Motor Phase W
6	Motor Phase W
13	Motor Phase W
14	Motor Phase W
7	Motor Ground
8	Motor Ground
15	Motor Ground

LM100 (9pin)

Pin	Function
1	Motor Phase U
3	Motor Phase V
5	Motor Phase W
7	Motor Ground

LM250D, LM250L (8pin)

Pin	Function
3	Motor Phase U
1	Motor Phase V
4	Motor Phase W
2	Motor Ground

Mating Connector (Female)

LM150D, LM150L

Part Numbers:		
	Amp	Bayside
Body	205205-1	10379010
Crimp Socket	1-66504-0	10966005

LM100D

Part Numbers:		
	Amp	Bayside
Body		10379017
Crimp Socket		10966074

LM250D, LM250L

Part Numbers:		
	Amp	Bayside
Body w/ Connectors		12097005

Motor Power Cable Option

The following mating power cable is available to enable connecting the slide to your controller. The cable has a mating connector at the slide end and flying leads at the controller end.

Flying Leads for LM150

Pin	Signal	Wire Color Rev (A)
1, 2, 9, 10	Phase U	Black #1
3, 4, 11, 12	Phase V	Black #2
5, 6, 13, 14	Phase W	Black #3
7, 8, 15	Chassis	Green/Yellow

Power Cable Part Number	
LM150	10963280
LM150	10963018
Cable Length: 3 meter	
Wire Termination to user: Flying Leads	

4.2 Sensor Connection

All three models of Luge LM stages come with a 26pin Sub D type connector for supplying power and receiving signals from various parts of the stage as shown below. The Luge LMxxxD and LMxxxF Series has the connector located on the main body of the stage. If a linear encoder option is ordered, then a second 26pin Sub D type connector will be located on the supplied cable carrier. This second 26pin connector is used only to connect to the linear encoder power and signals, with the pin locations being the same as the call out on the main connector.

Sensor Signals and Connector

CONNECTOR	
Pin	Function
1	Encoder Channel A'
2	Encoder Channel A
3	Encoder Channel B'
4	Encoder Channel B
5	Encoder Channel Z'
6	Encoder Channel Z
7	+5 to +24V (1)
8	Limit (COM) (1)
9	Shield
10	Connector End Limit (N.C.) (3)
11	Not Used
12	Not Used
13	Far End Limit (N.C.) (3)
14	Not Used
15	Not Used
16	Home Limit (N.C.) (3)
17	Not Used
18	Brake (+)
19	Motor Hall 1
20	Motor Hall 2
21	Motor Hall 3
22	+5V (2)
23	Ground (2)
24	T2 (Thermistor)
25	T1 (Thermistor)
26	Brake (-)

CABLE (Optional)	
Color	Cable
Pink	Encoder
Green	Encoder
Yellow	Encoder
Blue	Encoder
Red	Encoder
Violet	Encoder
White / 20g	Limits
Brown / 20g	Limits
Shield	Limits/Encoder
Green	Limits
N/A	N/A
N/A	N/A
Violet	Limits
N/A	N/A
N/A	N/A
White	Limits
N/A	N/A
Orange	Limits
Grey	Encoder
Black	Encoder
Orange	Encoder
White / 20g	Encoder
Brown /20g	Encoder
White	Encoder
Clear	Encoder
Blue	Limits

Note:

- (1) Pins 7 & 8 are used for limit switch only.
- (2) Pins 22 & 23 are used for encoder and Hall effects.
- (3) Switches are open collector with output logic 0 for normal operation.
On limit condition the switch output will go to logic 1

Stage Connector (Male)

Part Numbers:

Amp	Body	748365-1
	Crimp Pin	748333-7
Amphenol		17HD026PAA000

Mating Connector (Female)

Part Numbers:

Amp	Body	748566-1
	Crimp Pin	748610-7
	Hood	745172-1
Amphenol		17HD026PAA000

Sensor Cable Part Number: 10963194

Cable Length: 3 meter

Wire Termination to user: Flying Leads

5.0 Installation

5.1 Home & Limit Adjustment

In order to adjust the home and limit switches follow these steps:

1. Remove the top cover (4 screws).
Note: If performing this procedure on a the LM150L series (linear motor driven) be careful to keep any metal components away from the magnet channel. The magnet channel is highly magnetic and may cause injury if you come between the channel and a metal object.
2. LM150/LM250 Only: Remove the side cover opposite side of the power and signal connectors. The cover is removed by removing three flat head screws (one at each end and one in the middle).
3. Underneath the cover on the side of the base plate are screws set in slots. These screws control the location of the end of travel limits and home switch. Loosen the appropriate screw and slide the screw forward or backward to adjust the limit location (total travel is approximately 25mm).
Note: After location is set check to ensure that the limit switch wiring has not moved into the path of the shuttle plate
4. Replace the side cover and ensure the blue belt (used to enclosed the stage if ordered) is sitting in the "U" channel in the side cover.

5. Replace the top cover.

6.0 Maintance & Lubrication

The only periodic maintenance required is lubrication of the bearings and the ball screws. As the frequency of lubrication varies based on the specific application, parameters, and environmental conditions, it is recommended that each axis be analyzed and lubricated after the first 50,000 meters of travel. Based on this evaluation, future lubrication frequency should be developed. It is expected, that a three to six month lubrication frequency will be adequate to assure reliable service life of the bearing and ball screw structure.

6.1 Lubrication Type

For both recirculating guides and ball screws

Lithium soap based grease #2 or equivalent

Acceptable products:

Nye Lubricants: Rheolube 716B

Kluber Lubrication: Isoflex NBU 15

Exxon Mobil: RONEX MP

6.2 Re-Lubrication Procedure

1. Remove top cover of the stage
2. Wipe down the ball screw and rails with a clean lint free cloth.
3. Liberally apply grease to ball screw and rails.
4. Operate the stage at low speeds to allow the grease to work into the recirculating pucks and ball screw nut.
5. Repeat steps 2 & 3 several times to make sure grease is worked into the components
6. Clean excess grease from rails and ball screw using a clean lint free cloth.
7. Install top cover.

Note: If performing this procedure on a the LM150L series (linear motor driven) be careful to keep any metal components away from the magnet channel. The magnet channel is highly magnetic and may cause injury if you come between the channel and a metal object.

Note: take care not to get grease onto the linear encoder readhead or tape scale (if ordered). If the tape scale does become contaminated with grease, clean with a cloth damp with isopropal alcohol.

