LS100 Series Positioning Tables

User's Guide

ANAHEIM AUTOMATION
4985 East Landon Drive Anaheim, CA 92807 (714) 992-6990 fax: (714) 992-0471
e-mail: info@anaheimautomation.com website: www.anaheimautomation.com

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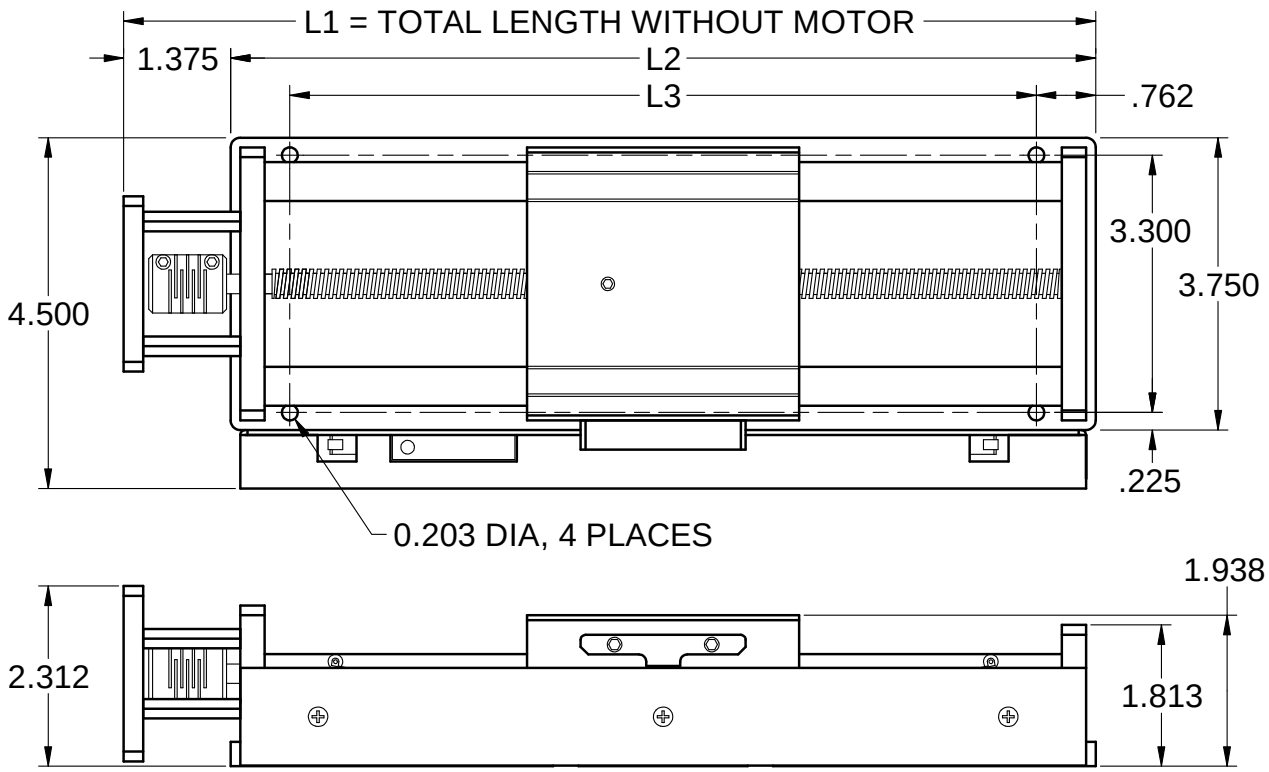
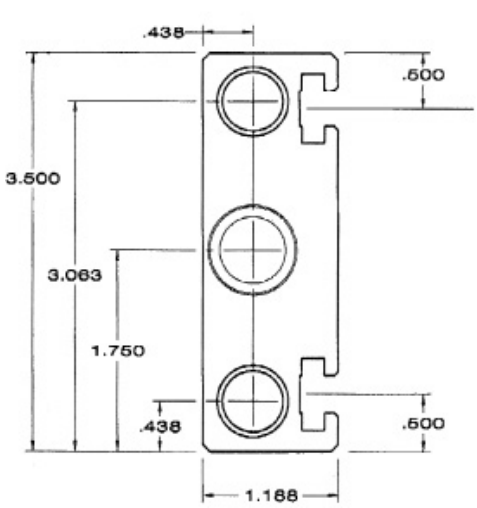
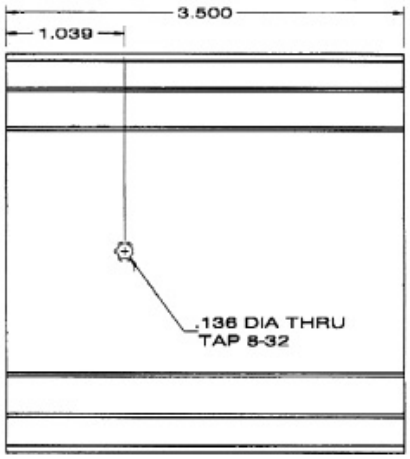
Dimensions







*All units are in inches

	Length (Inches)		
	L1	L2	L3
6”	12.500	11.125	9.600
12”	18.500	17.125	15.600
18”	24.500	23.125	21.500

Ordering Information:

LS100 - 06 - A - N - 3A - N

Series

Travel Options	
6	6”
12	12”
18	18”

Screw Options	
A	.0625”
D	.200”
H	.500”

Limit Options	
N	No Limits
S	End of Travel
B	End of Travel & Home Prox.

Encoder/Brake Options	
N	No Brake or Encoder
B	400 Line Encoder
C	1000 Line Encoder
K	80 oz-in Brake

- All Tables Assembled with a Zero Backlash Nut
- All Steppers and Integrated Drivers Include a 10ft Motor Cable (5E, 5I, 5K and 5O not included)
- All Tables with Limits Include a 10ft Limit Cable
- All Tables with Encoders Include a 10ft Encoder Cable

Accessories	
LS100-TNUT-01	T Nuts for Mounting External Materials to Carriage (4 Per Set)
LS100-TNUT-2	T Nuts for Mounting LS100 Tables Together to Create Multiple Axes Systems (2 Per Set)

Motor Options		
00		**No Motor**
01		**Coupling, No Motor**
Motors Only		
SS	**DS**	Motor Type
3A	**3E**	Size 23, 1/2 Stack, 3A
3B	**3F**	Size 23, 1 Stack, 3A
3C	**3G**	Size 23, 2 Stack, 3A
Motors with Integrated Driver (All Motor/Drives are Size 23)		
SS	**DS**	Motor Type
4G	**4M**	1/2 Stack, Sinking
4H	**4N**	1/2 Stack, Sourcing
4E	**4K**	1 Stack, Sinking
4F	**4L**	1Stack, Sourcing
4I	**4O**	2 Stack, Sinking
4J	**4P**	2 Stack, Sourcing
Motors with Integrated Controller and Driver (All Motor/Driver/Controllers are Size 23)		
5E	**5K**	1 Stack
5I	**5O**	2 Stack
***SS=Single Shaft, DS=Dual Shaft**		

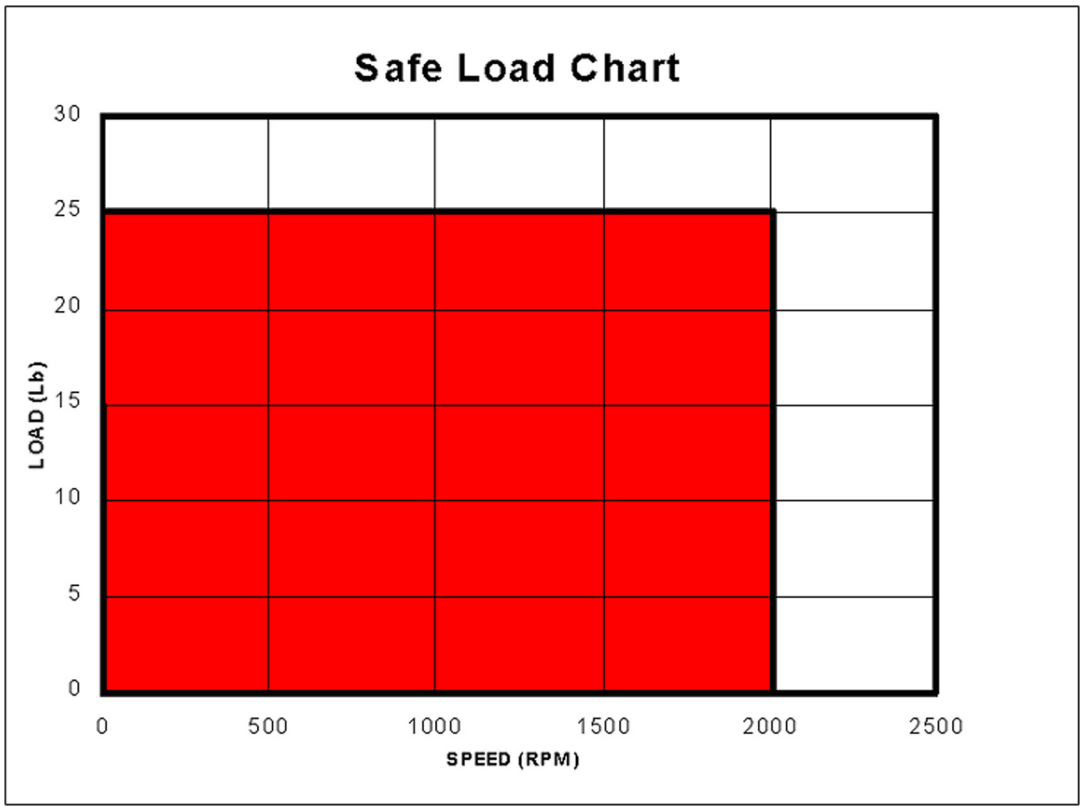
Cables will be supplied based on the table part number selected. All cables have a mating connector to the table assembly and have flying leads on the opposite end to connect to Driver/ Controller/ Power Supply Terminals.

Cable P/N	Function
CBL-AA4101-10	10ft Limits/Home Sensor Cable with 6 Pin Mating Connector
CBL-AA4102-10	10ft Motor Cable with 8 Pin Mating Connector
CBL-AA4175-10	10ft Encoder Cable with 5 Pin Mating Connector
CBL-AA4266	10ft 23MD Series Motor/Driver with 7 Pin Mating Connector

Actuator Specifications:

Travel		6	12	18
Maximum Deflection (Center Point)	5 Lbs (2.27kg)	0.0005” (12.7µm)	0.002” (50.8µm)	0.003” (76.2µm)
	10 Lbs (4.53kg)	0.001” (25.4µm)	0.003” (76.2µm)	0.015” ($0.18x10^{-3}$µm)
	20 Lbs (9.07kg)	0.0025” (63.5µm)	0.007” ($0.18x10^{-3}$m)	0.015” ($0.381x10^{-3}$m)
Stage Weight (Without Motor)	---	4.5lb (2.0kg)	6.0lb (2.7kg)	7.5lb (3.4kg)
	With Limit Switches	x.xxlb (x.xkg)	x.xxlb (x.xkg)	x.xxlb (x.xkg)
Resolution with Divide-by-64	0.0625 in/rev lead (0.0016 m/rev)	4.88 x 10-6 Inches (0.12µm) @ 12,800 steps/rev Resolution		
	0.2 in/rev lead (0.0051 m/rev)	15.6 x 10-6 Inches (0.39µm) @ 12,800 steps/rev Resolution		
	0.5 in/rev lead (0.0127 m/rev)	39.1 x 10-6 Inches (0.99µm) @ 12,800 steps/rev Resolution		
Resolution with 400 Line Encoder	0.0625 in/rev lead (0.0016 m/rev)	0.39 x 10-4 Inches (0.9µm) @ 1,600 steps/rev Resolution		
	0.2 in/rev lead (0.0051 m/rev)	1.25 x 10-4 Inches (3.18µm) @ 1,600 steps/rev Resolution		
	0.5 in/rev lead (0.0127 m/rev)	3.12 x 10-4 Inches (7.93µm) @ 1,600 steps/rev Resolution		
Resolution with 1000 Line Encoder	0.0625 in/rev lead (0.0016 m/rev)	0.156 x 10-4 Inches (0.4µm) @ 4,000 steps/rev Resolution		
	0.2 in/rev lead (0.0051 m/rev)	0.50 x 10-4 Inches (1.27µm) @ 12,800 steps/rev Resolution		
	0.5 in/rev lead (0.0127 m/rev)	1.25 x 10-4 Inches (3.8µm) @ 4,000 steps/rev Resolution		
Encoder Outputs	---	TTL Square Wave, Two Channel A & B		
Maximum Travel Speed	5 Lbs (2.27kg)	0.5 Inches/Second (0.013 m/sec)		
	10 Lbs (4.53kg)	2 Inches/Second (0.051 m/sec)		
	20 Lbs (9.07kg)	10 Inches/Second (0.254 m/sec)		
Rated Maximum Dynamic Load Capacity of Carriage	Horizontal (Orientation)	20 Lbs (11.34kg)		
	Vertical (Orientation)	15 Lbs (6.80kg)		
	Side (Orienation)	20 Lbs (9.07kg)		
Repeatability Bidirectional	Leadscrew	<0.001 Inches (25.4µm)		
Material	---	Aluminum		
Finish	---	Blake Anodize		
Flatness, Straightness, & Orthogonality	---	<0.001 [Inch/Inch] (<25.4µm/µm)		
Screw Material	---	Stainless Steel		
Nut Efficiency	---	36% for 0.0625” Lead 65% for 0.2” Lead 79% for 0.5” Lead		
Nut Temperature	---	32°F-180°F (0°C-82°C)		
Nut-Screw Friction Coefficient	---	0.08-0.14		
Duty Cycle	---	Low to Mid (<50%)		

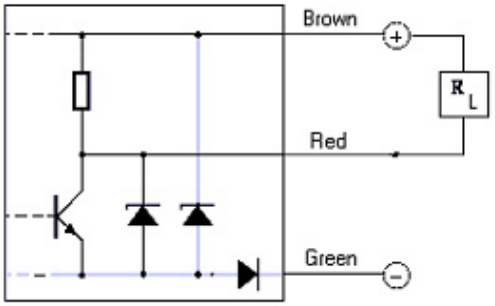
The area below 25 pounds and less than 2000RPM is the recommended load region.



Limits

Note: All models with limit switches come with a 6 conductor cable and a mating Mini-Fit Jr. connector.

Limits/Sensor Cable - CBL-AA4101-10		
Connector PIN#	Color	Function
1	Brown	Home Switch Power In (10-30VDC 200mA)
2	Red	Home Switch
3	Green	0VDC, Common
4	Blue	Limit Switch Hard -
5	White	Limit Switch Hard +
6	Black	No Connection



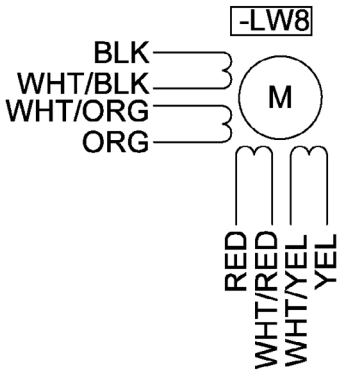
Motors Only (23Y) Specifications:

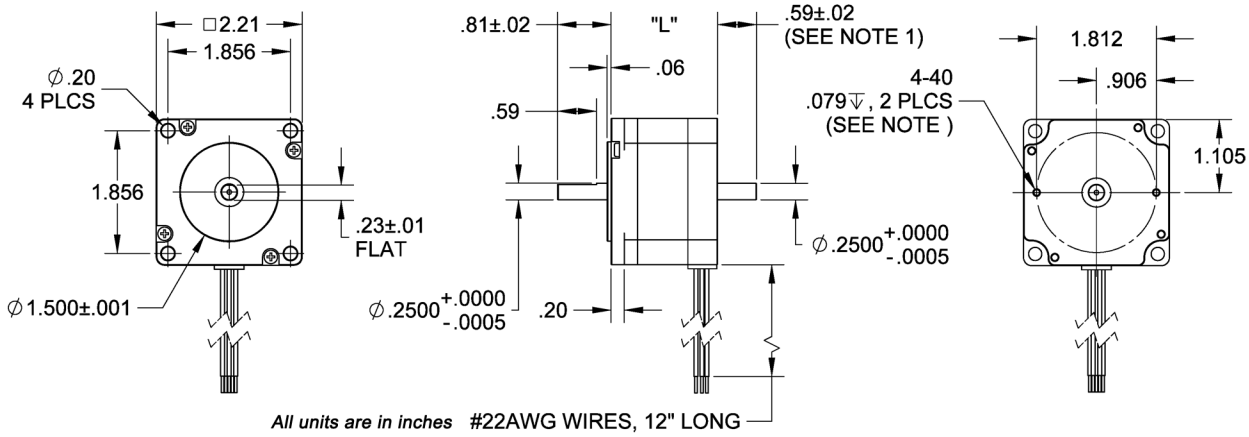
Note: All Motors Only options come with an 8 Pin Molex Mini-Fit Jr. connector and a 10ft, 8 conductor cable with mating Molex Mini-Fit Jr. connector.

Motor Option	Motor Part Number	Bipolar Torque (oz-in)	Series Current (A)	Unipolar Current (A)	Parallel Current (A)	Unipolar Inductance (mH)	Rotor Inertia (oz-in-sec^2)	Weight (lbs)	"L" Length (in)
3A	23Y006S-LW8	76	2.10	3.0	4.2	0.6	0.0017	1.00	1.62
3B	23Y106S-LW8	175	2.10	3.0	4.2	1.1	0.0042	1.55	2.21
3C	23Y206S-LW8	262	2.10	3.0	4.2	1.6	0.0068	2.21	3.00
3E	23Y006D-LW8	76	2.10	3.0	4.2	0.6	0.0017	1.00	1.62
3F	23Y106D-LW8	175	2.10	3.0	4.2	1.1	0.0042	1.55	2.21
3G	23Y206D-LW8	262	2.10	3.0	4.2	1.6	0.0068	2.21	3.00

Step Angle Accuracy:	± 5% (Full Step, No Load)	Insulation Resistance:	100M Ohm Min, 500VDC
Resistance Accuracy:	± 10%	Dielectric Strength:	500VAC for 1 minute
Inductance Accuracy:	± 20%	Shaft Radial Play:	0.02" Max (1.0 lbs)
Temperature Rise:	80°C Max (2 Phases On)	End Play:	0.08" Max (1.0 lbs)
Ambient Temperature:	-20° to +50° C	Max Radial Force:	16.9 lbs (0.79" from Flange)
Insulation Type:	Class B	Max Axial Force:	3.4 lbs-Force

Motor Cable - CBL-AA4102-10		
Connector Pin #	Color	Function
1	Black	Phase A
2	Black/White	Phase A\
3	Orange/White	Phase B\
4	Orange	Phase B
5	Red	Phase C
6	Red/White	Phase C\
7	Yellow/White	Phase D\
8	Yellow	Phase D





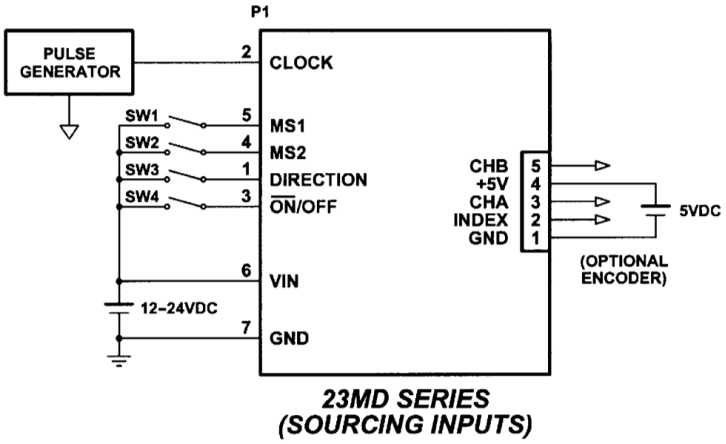
NOTE 1: 23YxxxD-LW8 Models Only

Motors with Integrated Drivers (23MD) Specifications:

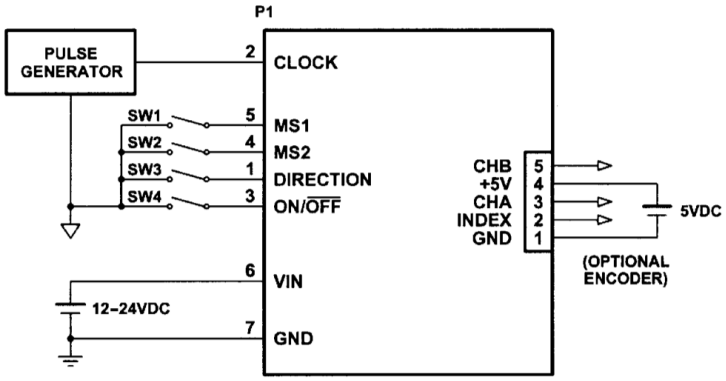
Note: All Motors with Integrated Drivers options come with a 10ft, 7 PIN Molex Mini-Fit Jr. connector and a 10ft, 8 conductor cable with mating MTA connector.

Motor Option	Motor Part Number	Bipolar Torque (oz-in)	Rotor Inertia (oz-in-sec^2)	Weight (lbs)	"L" Length (in)	Active Input
4G	23MD006S-00	76	0.0017	1.20	2.98	Sinking
4E	23MD106S-00	175	0.0042	1.75	4.03	Sinking
4I	23MD206S-00	262	0.0068	2.41	4.94	Sinking
4M	23MD006D-00	76	0.0017	1.20	2.98	Sinking
4K	23MD106D-00	175	0.0042	1.75	4.03	Sinking
4O	23MD206D-00	262	0.0068	2.41	4.94	Sinking

Power Requirements:	12-24VDC	Microstepping Res.	1600 Steps/Rev (Div-by 8)
Input Voltage (Inputs):	3.5 - 24VDC	Driver Type:	Bipolar Series
Step Angle Accuracy:	+/- 5% (Full Step, No Load)	Insulation Resistance:	100M Ohm Min, 500VDC
Temperature Rise:	80°C Max (2 Phases On)	Dielectric Strength:	500VDC for 1 Minute
Ambient Temperature:	-20° to +50° C	Radial Play:	0.02" at *(1.0 lbs)
Insulation Type:	Class B	End Play:	0.08" at (1.0 lbs)
Max Axial Force:	3.4 lbs-Force	Max Radial Force:	16.9 lbs (0.79" from Flange)



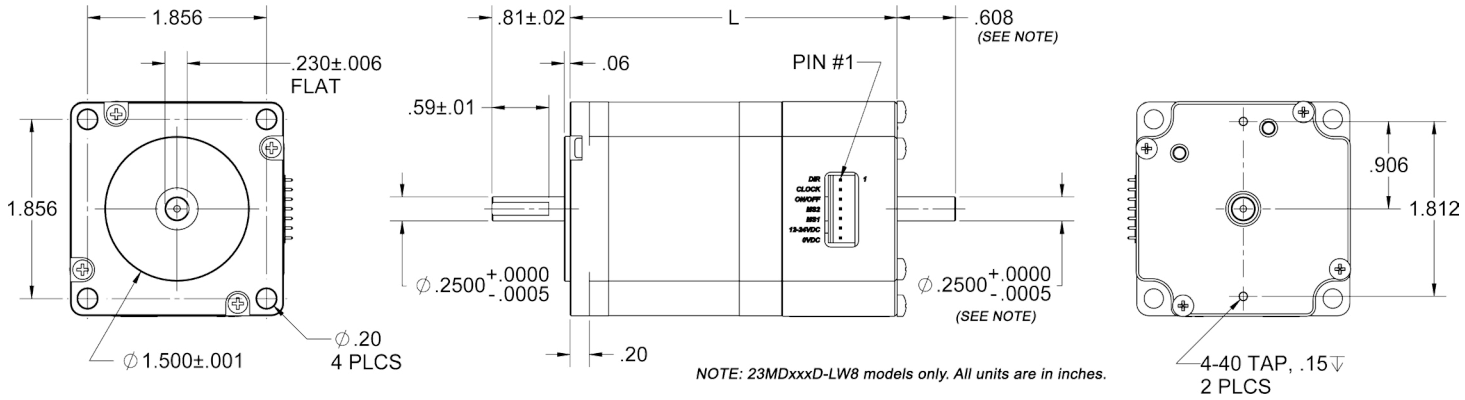
23MD SERIES (SOURCING INPUTS)



23MD SERIES (SINKING INPUTS)

23MD Input Cable - CBL-AA4266		
Connector Pin #	Color	Function
1	Brown	Direction
2	Red	Clock
3	Orange	On/Off
4	Yellow	MS2
5	Green	MS1
6	Blue	12VDC-24VDC
7	Violet	0VDC (Gnd)

Motors with Integrated Drivers (23MD) Specifications: (Cont.)



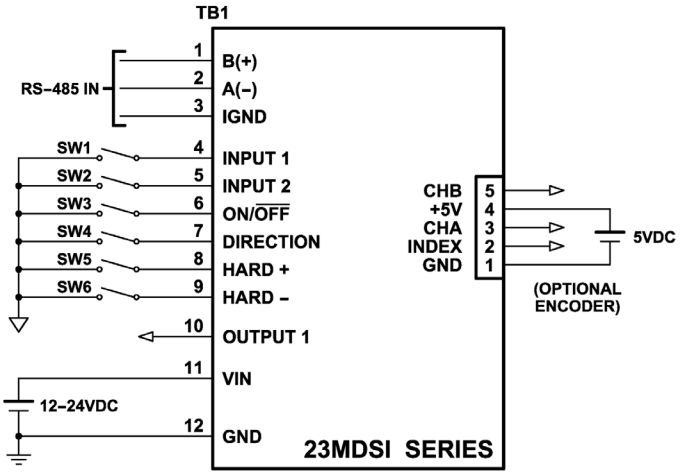
NOTE: 23MDxxxD-LW8 models only. All units are in inches.

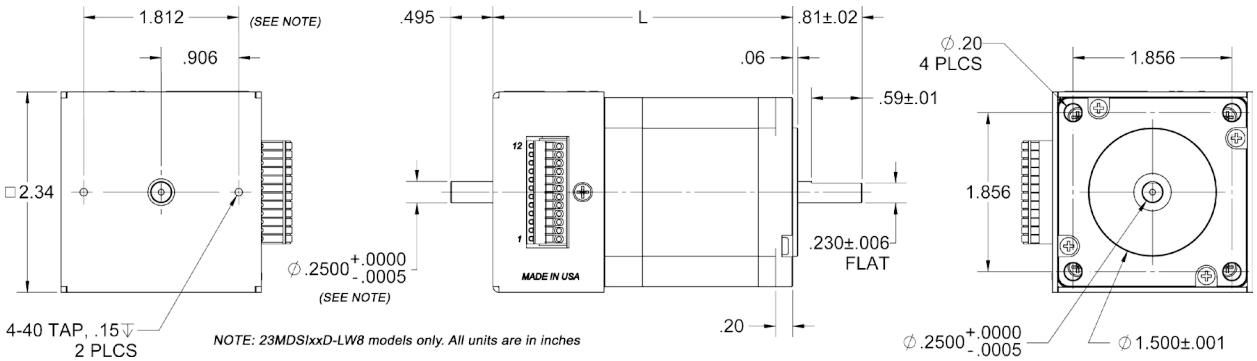
Motors with Integrated Controllers and Drivers (23MDSI) Specifications:

Note: No cable is provided with the Motors with Integrated Controllers and Drivers option.

Motor Option	Motor Part Number	Bipolar Torque (oz-in)	Rotor Inertia (oz-in-sec^2)	Weight (lbs)	L Length (in)
5E	23MDSI106S-00-00	175	0.0042	1.73	3.504
5I	23MDSI206S-00-00	262	0.0068	2.39	4.292
5K	23MDSI106D-00-00	175	0.0042	1.73	3.504
5O	23MDSI206D-00-00	262	0.0068	2.39	4.292

Power Requirements:	12-24VDC	Microstepping Res.	1600 steps/rev (Div-by 8)
Input Voltage (Inputs):	3.5 - 24VDC	Driver Type:	Bipolar Series
Step Angle Accuracy:	+/- 5% (Full Step, No Load)	Insulation Resistance:	100M Ohm Min, 500VDC
Temperature Rise:	80°C Max (2 Phases On)	Dielectric Strength:	500VDC for 1 Minute
Ambient Temperature:	-20° to +50° C	Radial Play:	0.02” at (1.0 lbs)
Insulation Type:	Class B	End Play:	0.08” at (1.0 lbs)
Max Axial Force:	3.4 lbs-Force	Max Radial Force:	16.9 lbs (0.79” from Flange)





Note: 23MDSIxxxD-LW8 models only. All units are in inches.

Encoder Cable Connection

Note: All models with encoders come with a 10 ft, 4 conducor cable and a mating MTA connector.

Encoder Cable - CBL-AA4175-10		
Connector PIN #	Color	Function
1	Black	0VDC
2	N/C	Index
3	Orange	CH A
4	Red	+5Vdc
5	Yellow	CH B

Parameter	Min	Typ	Max	Units
Supply Current CPR < 500, no load CPR ≥ 500, no load	 - -	 27 55	 30 57	 mA mA
Output Low (I_{OL} = 8mA max)	-	-	0.5	Volts
Output High* I_{OL} = -8mA max no load	 2.0 4.2	 - 4.8	 - -	 Volts Volts
Output Current Per Channel	-8.0	-	8.0	mA
Output Rise Time		110		nS
Output Fall Time		35		nS

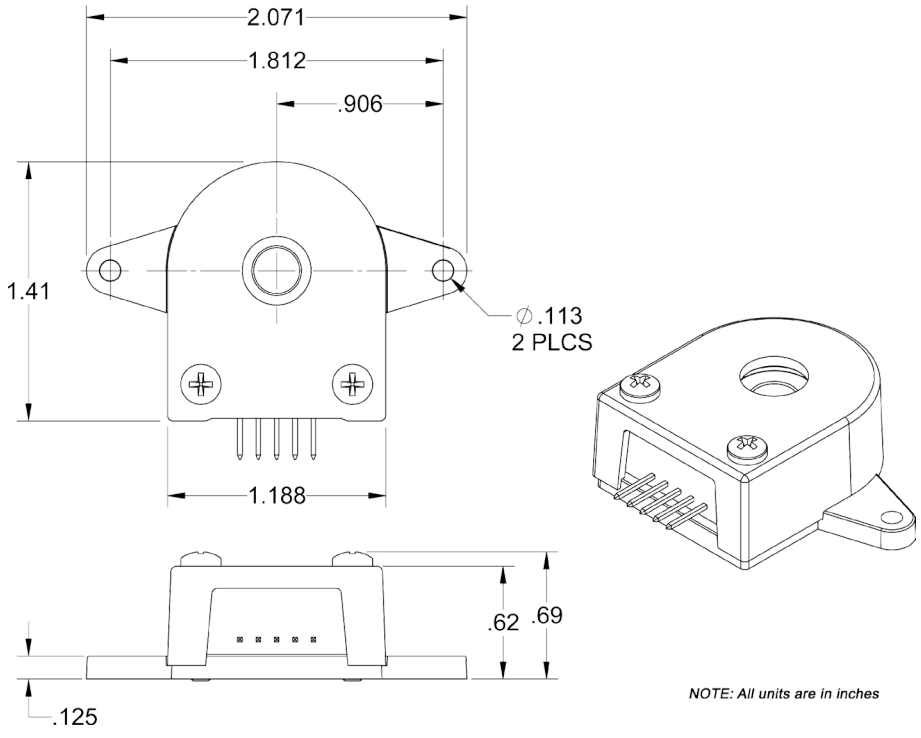
* Unloaded high level output voltage is 4.80V typically, 4.2V minimum.

Recommended Operating Conditions	Min	Max	Units
Temperature	-40	100	°C
Supply Voltage	4.5	5.5	Volts
Load Capacitance	-	100	pF
Count Frequency	-	100	kHz

Parameter	Description
CPR(N):	The Number of Cycles Per Revolution
One Shaft Rotation:	360 mechanical degrees, N cycles
One Electrical Degree (°e):	1/360th of one cycle
One Cycle (C):	360 electrical degrees (°e). Each cycle can be decoded into 1 or 4 codes, referred to as X1 or X4 resolution multiplication
Symmetry:	A measure of the relationship between (X) and (Y) in electrical degrees, nominally 180 °e
Quadrature (Z):	The phase lag or lead between channels A and B in electrical degrees, nominally 90 °e
Index (CH I):	The Index Output goes high once per revolution, coincident with the low states of channels A and B, nominally 1/4 of one cycle (90°e)

Parameter	Max	Units
Vibration (5 to 2kHz)	20	g
Shaft Axial Play	+/- 0.01	in.
Shaft Eccentricity Plus Radial Play	0.004	in.
Acceleration	250,000	rad/sec^2

Timing Characteristics	Symbol	Min	Typ	Max	Units
Cycle Error	C	-	3.0	5.5	°e
Symmetry	X,Y	150	180	210	°e
Quadrature	Z	60	90	120	°e
Index Pulse Width	Po	60	90	120	°e
Ch. I Rise After Ch. B or Ch. A Fall	t1	10	100	250	ns
Ch. I Fall After Ch. B or Ch. A Rise	t2	70	150	300	ns



LS100 Series Positioning Table Features and Applications

- Lab Automation
- Biotech Automation
- Inspection Stations
- Part Scanning
- Pick & Place
- Liquid Dispensing
- Part Insertion

Construction

The LS100 Series Positioning Tables are designed to provide accurate positioning while minimizing physical size and cost. These tables use a low friction, preloaded stainless steel ACME lead screw, and twin railed linear system. The linear rails are mounted to rigid supports on opposite ends of the precision-machined aluminum endplates. The load is mounted to a precision machined aluminum carriage, which has T-Slots for inserts that are designed to fit T-Nuts. The T-Nuts are threaded for high strength and wear. All Anaheim Automation Standard tables are built with ACME Lead Screws that offer the needed resolutions and precision. The tables are designed to accommodate a variety of options, including End of Travel (EOT) & HOME Switches, rotary encoders, motor cables, switches, encoders, and more. An integrated motor/driver(23MD Series) is also an option that combines the needed driver to a step motor, simplifying the need for STEP & DIRECTION signals from an external controller. T-Nuts are available for assembling multiple stages together of creating multiple axis (XY) tables.

ACME Screws

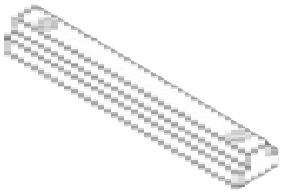
Three different types of acme screws can be selected for the LS100 Series Tables, providing solutions for typical industrial applications. We offer high, mid an d low resolution lead screws to allow for a wide range of solutions.

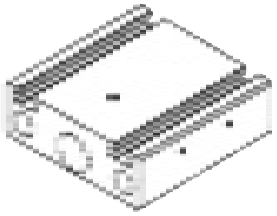
Screw Option	Screw Type and Size	Lead per Revolution (Inches)	Travel Accuracy (in/in)	Travel Accuracy (in/ft)	Resolution per 1/2 Step (Inches)	Torque to Raise 1 Lb	Bidirectional Repeatability (Inches)
A	3/8-16 ACME	0.0625	0.0003	0.003	0.000156	0.58 oz-in	0.001
D	3/8-10, 2 Start ACME	0.2	0.0003	0.003	0.0005	0.92 oz-in	0.001
H	3/8-10, 4 Start Stub ACME	0.5	0.0003	0.003	0.00125	1.80 oz-in	0.001

(Refer to the Specification Section for more details.)

Carriage T-NUTS (Optional)

Two different types of optional T-Nuts can be slotted directly into the carriages of the tables. The long type (LS100-TNUT-02) is used for mounting multiple tables together to create XY tables. The short type (LS100-TNUT-01) is used for mounting external loads to the carriage. Also known as tapped-thru nuts or T-Slot Nuts, these nuts are threaded all the way through so studs can extend beyond the bottom of the nut for increased take-up. These nuts are made of case-hardened C1018 steal with a black-oxide finish which is comparable to low strength steel. Each table carriage has T-Slots for mounting the user supplied load. A load adapter plate should be used between the load and the arriage surface if your load requires additional base mounting holes to properly securing the load.

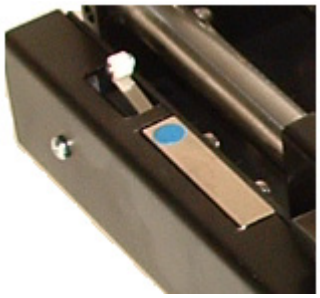




T-NUTS P/N	Description/ Function
LS100-TNUT-01	Small T-Nut, ¼”-20 thread, ¼” Height, 0.5625” long accommodates the ability to mount additional mounting plates or load. Qty 4 included.
LS100-TNUT-02	Long T-Nut, 10-32 thread, ¼” height, 3.5” long accommodates the ability to mount additional LS100 tables. Qty 2 included, Qty 4 10-32 Screws included.

End of Travel and Home Switches(Optional)

The LS100 series tables can be provided with end of travel (EOT) and home proximity switches, which are assembled / wired onto the table assembly. Most position controllers can utilize the EOT switches to stop the carriage motion when exceeding table travel has been reached in either direction. The home switch provides a known datum location or zero position on the table that establishes a known HOME position for the positioning controller used.



Rotary Encoders (Optional)

Single Ended Incremental encoders can be mounted to the step motors in order to provide positional feedback data to a motion controller. Anaheim Automation offers standard encoder resolutions of 400 and 1,000 lines.

Motor Adapter Brackets

The NEMA 23 is the Standard motor mount for all LS100 Series Tables. Each Table comes with a flexible coupling and four 10-32 mounting screws.

Special NUT with Rolled ACME Screw

A solid polymer nut has no rolling elements in it providing smoother motion and less audible noise than most ball nuts, and is ideal for clean and harsh environments.

Maximum Carriage Speed

The maximum speed of the carriage is determined by the screw lead, screw length, screw diameter and bearing support system. *Refer to Specifications for more details.*

Backlash
The drive nut offered is a pre-loaded, zero backlash nut offering zero backlash operation that automatically adjusts for wear to ensure zero backlash for the life of the positioning table.

Linear Guide Rods
The linear guides used are 60 CASE Hard Ground Rods designed to provide smooth operation and reduce wear on rod bearings.

Connections to Table Assembly
Separate cables with mating connectors for the step motor, EOT/ Home Limit Switches and Encoder are provided for ease of operation. *Additional information on wiring can be found later in this manual.*

Lubrication
The type of lubrication recommended is Lithium Grease or Synthetic Teflon Grease. It is recommended that the linear rails and screw assembly be lubricated depending on the application duty, speed, and environment installed. Insufficient lubrication can result in excessive wear which may cause scoring of the rails, rough table operation, corrosion, and even failure of the positioning system. WARNING: Avoid the use of WD-40, or cleaning solvents, as they can cause damage to the screw assembly and linear rails. ACME screws & polymer nut screw driven positioning tables have a solid surface contacting a solid surface, therefore sufficient lubrication is required. Apply lubrication directly onto the entire length of the screw and linear rails on a regular basis. The critical factor in the life of a plastic nut is the heat build up in the nut. Each application has different heat conditions and each application has differences in lubrication requirements. These have dramatic effect on the nut life. There is no formula that can account universally for these variations.

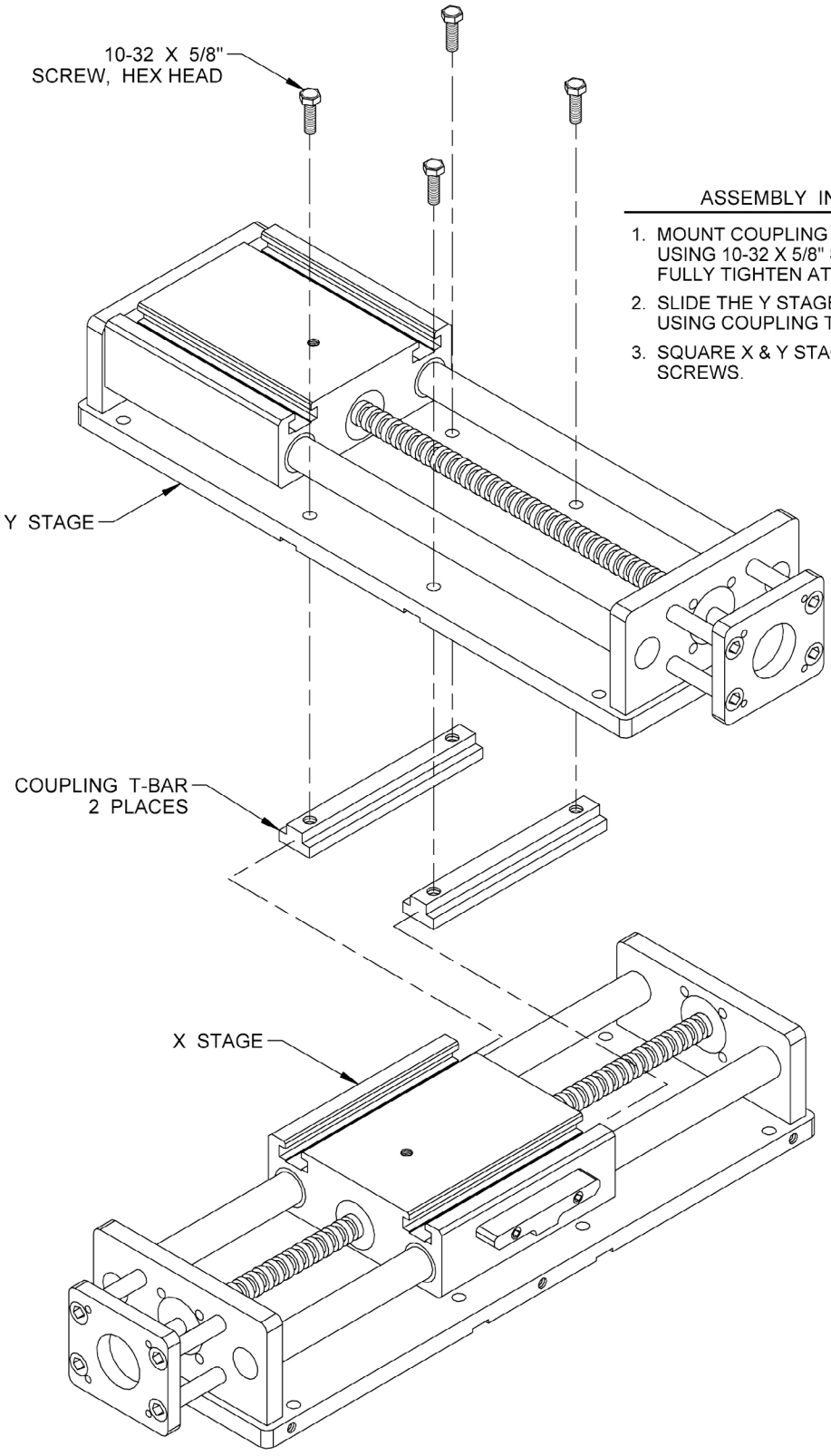
Mounting Requirements

In order to achieve the published accuracy & repeatability of an LS100 Series Positioning Table, care must be taken when mounting the table to your surface. The mounting surface of the positioning table must be as flat, or flatter than the positioning table itself. If the surface is not flat, shimming may be required. Proper table mounting is essential and highly recommended so that the table can be supported over its entire length and that all table base mounting holes are used. This will prevent the table from deflecting over unsupported regions when the load travels over that area. It also maintains the systems rigidity, and prevents shortened positioning table life from structural fatigue.

Recommended Base Mounting Screws: English mount #10-32
Base Mounting screws are not provided by Anaheim Automation

Cantilever Load
It is recommended that a 1:1 ratio be used when loading the carriage of the LS100 Series Tables.
The 3.5” Carriage Length predetermines the attached MAX Length that the extended load should rest from.

X-Y Assembly Instructions



ANAHEIM AUTOMATION

4985 East Landon Drive Anaheim, CA 92807 (714) 992-6990 fax: (714) 992-0471
e-mail: info@anaheimautomation.com website: www.anaheimautomation.com