motioncontrol catalog

manualstages

MM-1

Standard Manual MicroMini™ Stages

Constructible into **over 16 different configurations** (request 3 D Basic Construction Diagrams)

Specifications:

Wobble (max):	10 µrad (2 arc-second) (no ball bearings)
Thermal Stability:	15° to 75° C
Screw Pitch:	80 TPI
Sensitivity:	0.5µm
Backlash:	0
Load Capacity:	
Direct top or side load:	0.25 kg
Push:	0.05 kg
Retract ext-comp.:	See return force below
Tilt:	3.0 inch-ounce (210 gram-centimeter)
Twist:	1.5 inch-ounce (105 gram-centimeter)

Model No.	Travel	Runout (maximum)	Return Force (extension-compression)	Weight
MM-1	3.175mm	1.0µm	113 - 312g	3.0g
MM-1-CR	3.175mm	1.0µm	113 - 312g	4.0g
MM-1-EX	5.715mm	1.5µm	170 - 510g	2.5g
MM-1-SPR-090	3.175mm	1.0µm	227 - 510g	3.0g

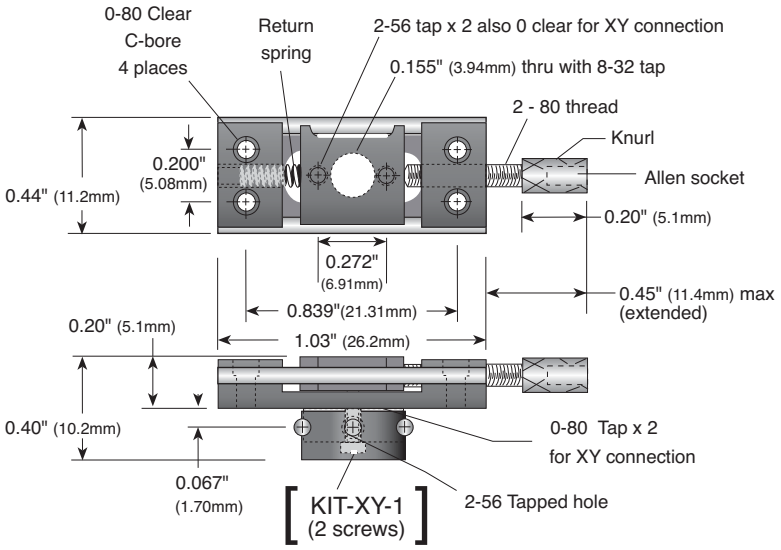
Dimensions:(L x W x H, not including lead screw extension)

Model No.	-X Single Stage	-XY (2-axis)	-XYZ (3-axis)
MM-1	26.2 x 11.2 x 5.1 (mm)	26.2 x 26.2 x 10.2 (mm)	26.2 x 26.2 x 36.3 (mm)
	1.03 x 0.44 x 0.20 (inch)	1.03 x 1.03 x 0.40 (inch)	1.03 x 1.03 x 1.43 (inch)
MM-1-CR	26.2 x 14.2 x 5.1 (mm)	26.2 x 26.2 x 10.2 (mm)	26.2 x 26.2 x 36.3 (mm)
	1.03 x 0.56 x 0.20 (inch)	1.03 x 1.03 x 0.40 (inch)	1.03 x 1.03 x 1.43 (inch)
MM-1-EX	26.2 x 11.2 x 5.1 (mm)	26.2 x 26.2 x 10.2 (mm)	
	1.03 x 0.44 x 0.20 (inch)	1.03 x 1.03 x 0.40 (inch)	
MM-1-SPR-090	26.2 x 11.2 x 5.1 (mm)	26.2 x 26.2 x 10.2 (mm)	
	1.03 x 0.44 x 0.20 (inch)	1.03 x 1.03 x 0.40 (inch)	

- XZ configurations available
- CR, -EX, and -090 versions may be combined
- Z axis must be a stage with Z connection enabled

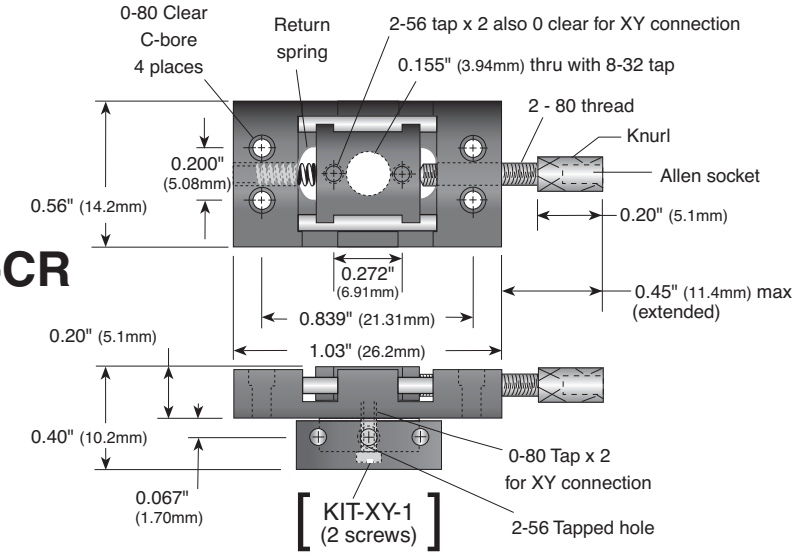
MM-1 Manual Stage
Dimensional Data

MM-1



Totally Metric/English Compatible

MM-1-CR



Totally Metric/English Compatible

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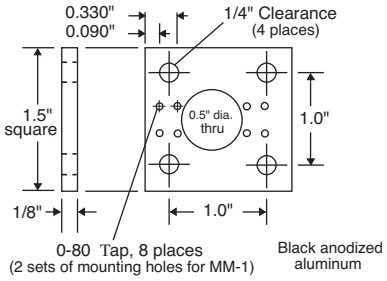
manualstages
MM-1
Accessories

Accessories

AP-1 . . . . . .Adapter Plate
KIT-XY-1 . . . . .MM-1-XY connection screw kit.
KIT-Z-1 . . . . . .MM-1-Z Connection with screws.
PA-1 . . . . . .Pinhole Adapter
SS-1 . . . . . .Headless Adjusting Screw
TG-1 . . . . . .Thumb Grip

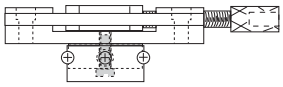


AP-1 Adapter Plate

A multi-position mounting plate to interface with standard optical tables and accessories, or to stabilize free-standing stages.

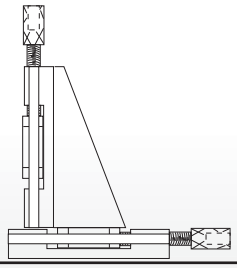
KIT-XY-1

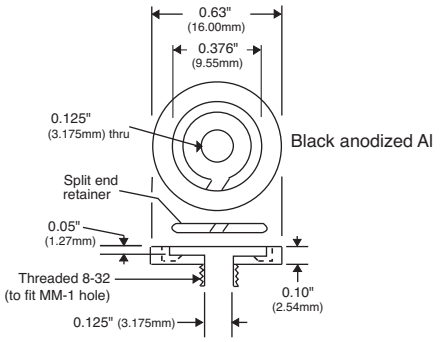
Utilizes 2 tap holes in slider as clearance for 0-80 connecting screws



KIT-Z-1

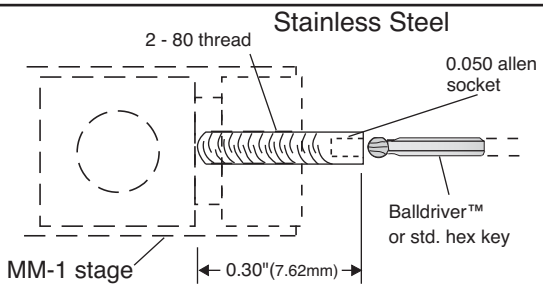
Attaches 2 MM-1 stages into an XZ configuration.





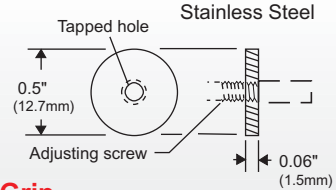
PA-1 Pinhole Adapter

With the PA-1, apertures can be changed by replacing the entire adapter or by removing it and replacing the aperture only. A soft rubber washer can be used under the adapter for slit aperture orientation. [For use with standard 0.375 inch. (9.525mm) diameter substrates, or smaller.]



SS-1 Headless Adjusting Screw

This custom designed lead screw replaces the standard thumb screw. It provides full linear travel while reducing the overall length of the stage by 0.4 inch (10.16mm).



TG-1 Thumb Grip

The knurled 0.5 inch (12.7mm) diameter adjustment ring provides increased sensitivity. The TG-1 can be added to the standard MM-1 adjusting screw and may alternately be used as a locking nut.

motioncontrol catalog

manualstages

MM-3

Standard Manual MicroMini™ Stages

Constructible into **over 16 different configurations** (request Basic Construction Diagrams)

Specifications:

Wobble (max):	0.01 mrad
Thermal Stability:	15° to 75° C
Screw Pitch:	80 TPI
Sensitivity:	0.5µm
Backlash:	0 (no ball bearings)
Load Capacity:	
Direct top or side load:	0.34 kg
Push:	1 kg
Retract ext-comp.:	See return force as specified below
Tilt:	6 inch-ounce (420 gram-centimeter)
Twist:	3 inch-ounce (210 gram-centimeter)

Model Number	Travel	Runout (maximum)	Return Force (extension-compression)	Weight
MM-3	0.5 inch (12.7mm)	1.5µm	6-20oz (170-567g)	16g
MM-3-CR	0.5 inch (12.7mm)	1.5µm	6-20oz (170-567g)	20g

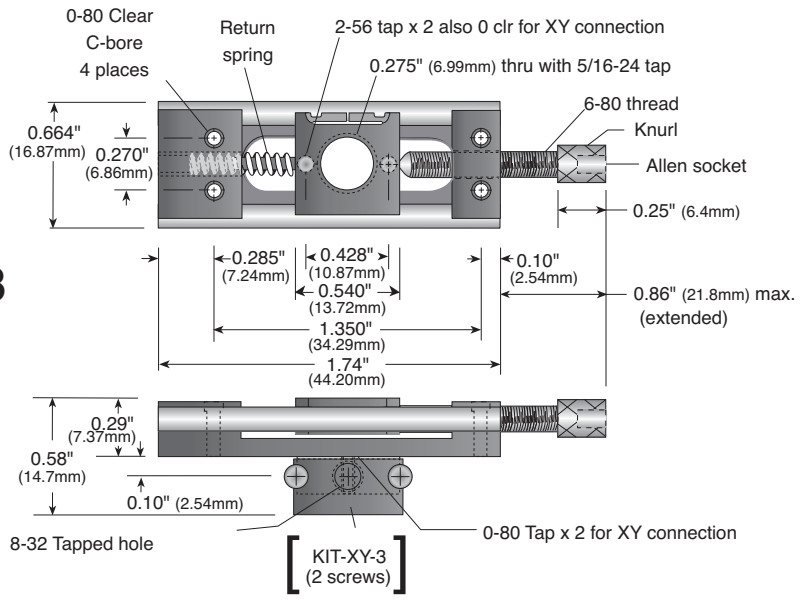
Dimensions:(L x W x H, not including lead screw extension)

Model No.	-X Single Stage	-XY (2-axis)	-XYZ (3-axis)
MM-3	44.2 x 16.8 x 7.4 (mm)	44.2 x 44.2 x 14.7 (mm)	44.2 x 44.2 x 58.9 (mm)
	1.74 x 0.66 x 0.29 (inch)	1.74 x 1.74 x 0.58 (inch)	1.74 x 1.74 x 2.32 (inch)
MM-3-CR	44.2 x 19.05 x 7.4 (mm)	44.2 x 44.2 x 14.7 (mm)	44.2 x 44.2 x 58.9 (mm)
	1.74 x 0.75 x 0.29 (inch)	1.74 x 1.74 x 0.58 (inch)	1.74 x 1.74 x 2.32 (inch)

- XZ configurations available
- Both Styles of MM-3 may be combined
- Compatible with all MM-3M motor stages
- **Fully metric compatible (all taps and clearance holes)**

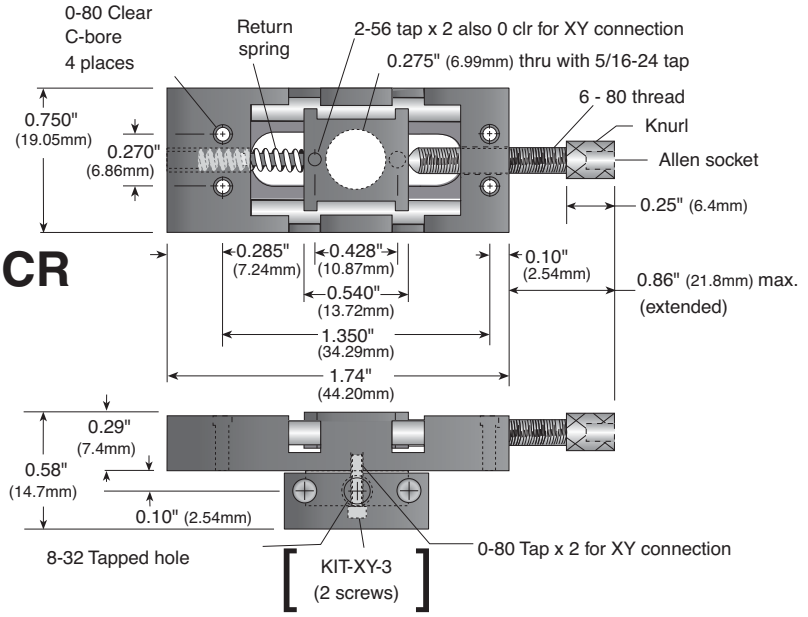
The **larger** of the manual stages, this unique micropositioner is also a dimensional breakthrough. The MM-3 manual MicroMini™ Stage is a precision instrument designed for space and weight limitations as well as higher loads and longer travel.

MM-3 Manual Stage
Dimensional Data



MM-3

Totally Metric/English Compatible



MM-3-CR

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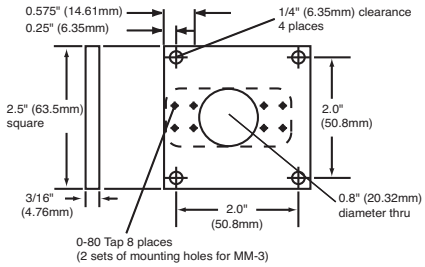
manualstages
MM-3
Accessories

Accessories

AP-3 . . . . . .Adapter Plate
KIT-XY-3 . . . . .MM-1-XY connection screw kit.
KIT-Z-3 . . . . . .MM-1-Z Connection with screws.
OA-3 . . . . . .Objective Adapter
PA-3 . . . . . .Pinhole Adapter
SS-3 . . . . . .Headless Adjusting Screw
TG-3 . . . . . .Thumb Grip



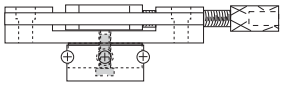
Black anodized aluminum

AP-3 Adapter Plate

A multi-position mounting plate to interface with standard optical tables and accessories, or to stabilize free-standing stages.

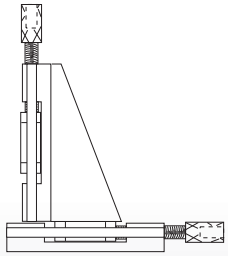
KIT-XY-3

Utilizes 2 tap holes in slider as clearance for 0-80 connecting screws



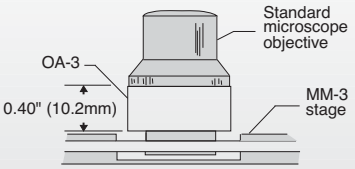
KIT-Z-3

Attaches 2 MM-3 stages into an XZ configuration.

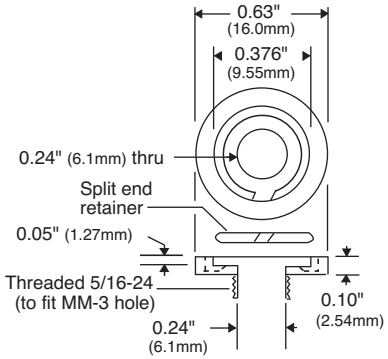


OA-3 Objective Adapter

The OA-3 holds a standard microscope objective. It is especially useful where critical alignment or tunability is necessary. (Mounting screws are included.)



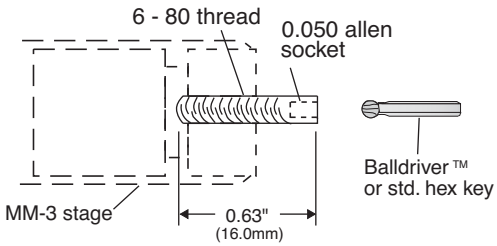
Black anodized aluminum



Black anodized aluminum

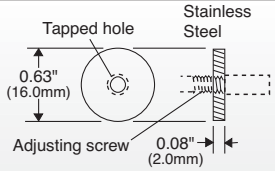
PA-3 Pinhole Adapter

With the PA-3, apertures can be changed by replacing the entire adapter or by removing it and replacing the aperture only. A soft rubber washer can be used under the adapter for slit aperture orientation. (For use with standard 0.375 inch diameter substrates, or smaller.)



SS-3 Headless Adjusting Screw

This custom designed stainless lead screw replaces the standard thumb screw, and provides full linear travel while reducing the overall length of the stage by 0.5 in.



TG-3 Thumb Grip

The knurled 5/8 in. diameter adjustment ring provides increased sensitivity. The TG-3 can be added to the standard MM-3 adjusting screw and may alternately be used as a locking nut.

motioncontrol catalog

motorizedstages

MM-3M-ST

Standard Motorized MicroMini™ Stages

Specifications:

***Repeatability:**	±2µm
***Homing Repeatability:**	±2µm
***Accuracy (linearity):**	±3µm
Speed (max.):	1.65mm/second @ 12 V with 64:1 gearhead
Slider Backlash:	0 (spring preloaded)
Encoder Conversion(resolution):	0.12406µm per count with 64:1 gearhead
	(16:1, 64:1, 256:1, 1024:1 gearheads optional)

**Encoder resolution must be added based on the gearhead: 16:1 add ±0.5µm, 64:1 add ±0.12µm*

Wobble (max.):	0.02 mrad (~4 arc-second)
Runout (max.):	0.002 mm
Gearhead Backlash:	1-2 µm equivalent; can be compensated in software without overshoot
Motor:	10 mm diameter, 6-12 VDC servo, brush type (see motor specifications)
Vacuum compatibility:	10^{-3} Torr, standard, 10^{-6} Torr available

Load Capacity:

***Direct top or side load:**	0.34 kg
***Push:**	0.50 kg
****Retract ext-comp.:**	2 ounce-24 ounce (57gram - 680 gram)
***Tilt:**	6 inch-ounce (420 gram-centimeter)
***Twist:**	3 inch-ounce (210 gram-centimeter)

**These stages may be run at twice the specified ratings without damage, but with a loss of accuracy and speed.*

**Retract is limited by the preload spring.

Travel Ranges and Dimensions:

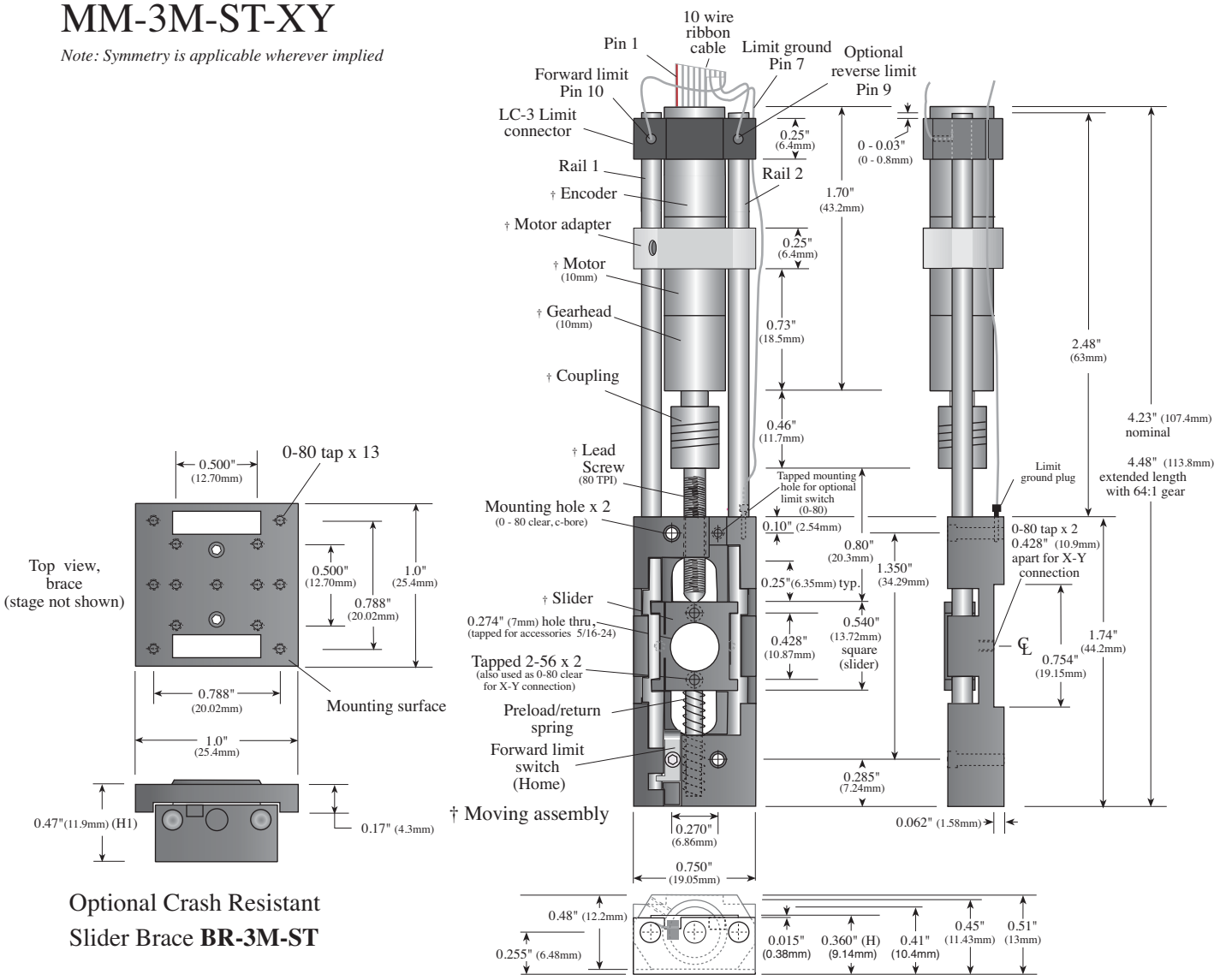
Model No.	Travel Range	Stage Body (L x W x H)	Weight
MM-3M-ST	0.5 inch	4.48 x 0.75 x 0.36 (inch)	50g
	12.7mm	113.8 x 19.05 x 9.14 (mm)	50g
MM-3M-ST-XY	0.5 inch	4.48 x 4.48 x 0.66 (inch)	100g
	12.7mm	113.8 x 113.8 x 18.28 (mm)	100g

Standard MM-3M-ST Motorized MicroMini™ Stage - 0.5 inch (12.7mm) Travel

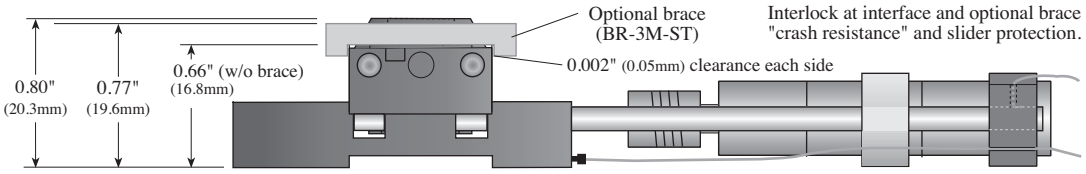
Dimensional Data

MM-3M-ST-XY

Note: Symmetry is applicable wherever implied



Optional Crash Resistant Slider Brace **BR-3M-ST**



Note: Crash resistance is in XY plane only
Z axis is not recommended on this version.

motioncontrol catalog

motorizedstages

MM-3M-F

Folded Motorized MicroMini™ Stages

Specifications:

	Standard Slider	AB Slider (anti-backlash)
***Repeatability**:	±2µm	±0.5µm
***Homing Repeatability**:	±2µm	±0.5µm
***Accuracy (linearity)**:	±3µm/inch	±1.5µm/inch
Speed (max.):	12mm/second @ 12V	1.65mm/second @ 12V
†Slider Backlash:	50µm	3µm
Encoder Conversion (resolution):	0.49609µm/count	0.12406µm/count
(See also: gearhead options)	with 16:1 gearhead	with 64:1 gearhead

*Encoder resolution must be added , based on the gearhead: 16:1 add ± 0.5µm, 64:1 add ±0.12 µm
†Slider backlash represents maximum overshoot

Runout (max.):	3µm/25.4mm
Gearhead Backlash:	1-2µm equivalent; can be compensated in software without overshoot
Motor:	10 mm diameter, 6-12 VDC servo, brush type (see motor specifications)
Vacuum compatiblity:	10^{-3} Torr, standard, 10^{-6} Torr available
Load Capacity:	
Direct top or side load:	0.5 kg
Push:	0.5 kg
Pull:	0.5 kg
Tilt:	8 inch-ounce (560 gram-centimeter)
Twist:	4 inch-ounce (280 gram-centimeter)

Note: These stages may be run at twice the specified ratings without damage, but with a loss of accuracy and *speed.*

Travel Ranges and Dimensions:

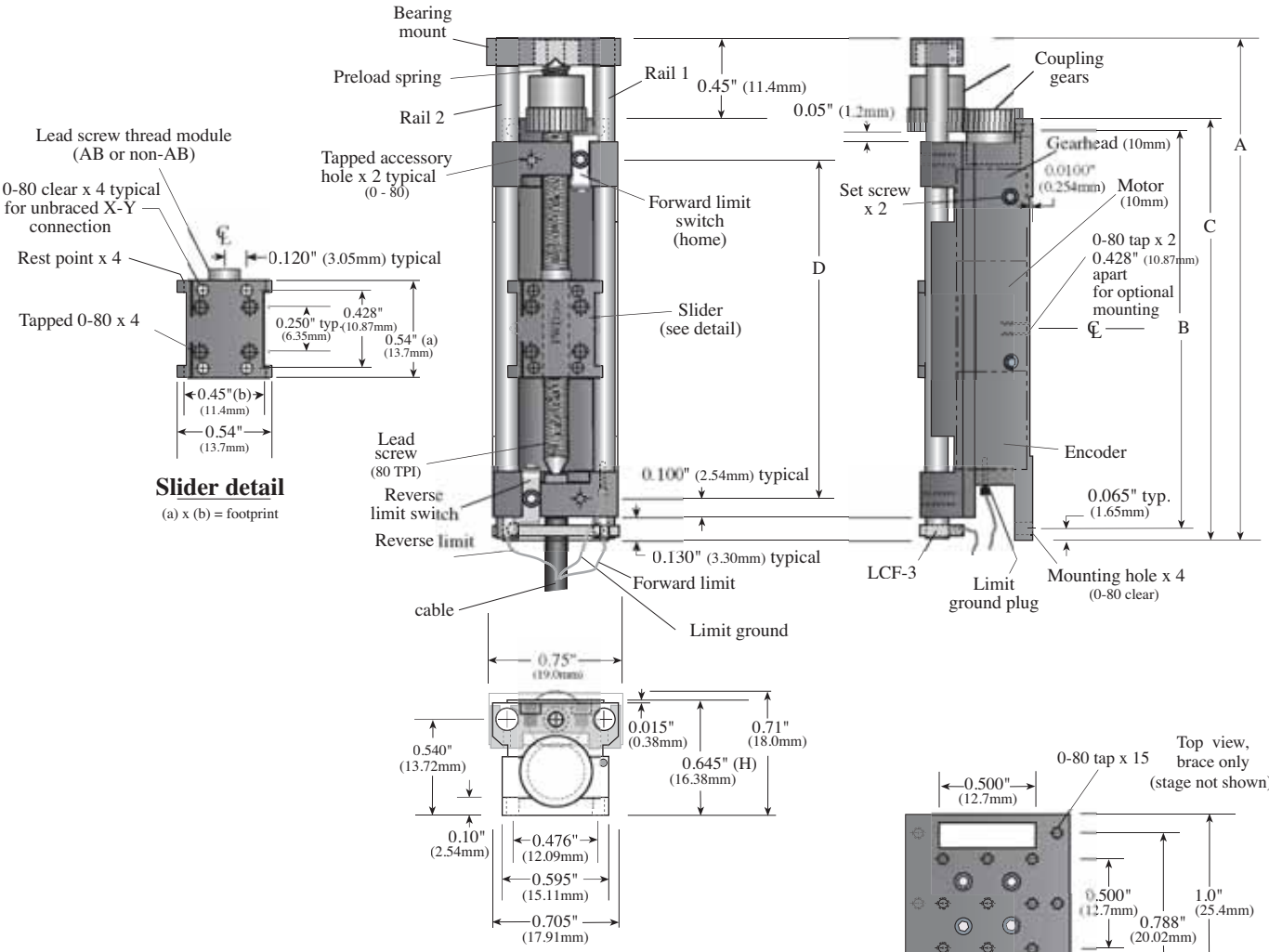
Model No.	Travel Range	Stage Body (L x W x H)	Weight
MM-3M-F-0.5	12.7mm (0.5 inch)	58.9 x 19.1 x 16.3 (mm)	53g
		2.32 x 0.75 x 0.64 (inch)	53g
MM-3M-F-1	25.4mm (1.0 inch)	71.6 x 19.1 x 16.3 (mm)	58g
		2.82 x 0.75 x 0.64 (inch)	58g
MM-3M-F-1.5	38.1mm (1.5 inch)	84.3 x 19.1 x 16.3 (mm)	63g
		3.32 x 0.75 x 0.64 (inch)	63g
MM-3M-F-2	50.8mm (2.0 inch)	97.0 x 19.1 x 16.3 (mm)	68g
		3.82 x 0.75 x 0.64 (inch)	68g
MM-3M-F-2.5	63.5mm (2.5 inch)	109.7 x 19.1 x 16.3 (mm)	73g
		4.32 x 0.75 x 0.64 (inch)	73g

x, xy, xyz, xz configurations available

Specify -AB for Anti-Backlash

Folded MM-3M-F Motorized MicroMini™ Stage - 0.5 to 2.5 inch Travel

Dimensional Data



Note: Symmetry is applicable wherever implied

	T (Travel)	A	B	C	D
MM-3M-F-0.5	0.5 inch	2.32	1.730	1.86	1.400
	12.7mm	58.9	43.94	47.2	35.56
MM-3M-F-1.0	1.0 inch	2.82	2.230	2.36	1.900
	25.4mm	71.6	56.64	59.9	48.26
MM-3M-F-1.5	1.5 inch	3.32	2.730	2.86	2.400
	38.1mm	84.3	69.34	72.6	60.96
MM-3M-F-2.0	2.0 inch	3.82	3.230	3.36	2.900
	50.8 mm	97.0	82.04	85.3	73.66
MM-3M-F-2.5	2.5 inch	4.32	3.730	3.86	3.400
	63.5 mm	109.7	94.74	98.0	86.36

Note:
Single axis brace is essential where attachments are vulnerable to crash.

BR-3M-X
Optional
Crash-resistant Slider Brace

motioncontrol catalog

motorizedstages

MM-4M-F

Folded Motorized MicroMini™ Stages
(For heavier loads)

Specifications:

***Repeatability:**	±0.5µm
***Homing Repeatability:**	±0.5µm
***Accuracy (linearity):**	±1.0µm per 25mm of travel
Straightness:	±2.0µm maximum deviation per 50mm of travel
Speed (max.):	1.65mm/second @ 12 V with 64:1 gearhead
†**Slider Backlash:**	1µm
Gearhead Backlash:	<2.54µm; can be compensated in software without overshoot
Encoder Conversion(resolution):	0.49609µm per count, with 16:1 gearhead

**Encoder resolution must be added, based on the gearhead: 16:1 add ±0.0005mm, 64:1 add ±0.00012mm*

†Slider backlash represents maximum overshoot

Motor:	10mm diameter, 6-12 VDC servo, brush type
Slide:	Cross roller bearing
Vacuum Compatibility:	10^{-3} Torr, standard, 10^{-6} Torr available
Load Capacity:	
Horizontal:	3.0 kg
Vertical:	1.0 kg
Side:	1.5 kg

Travel Ranges and Dimensions:

Model No.	Travel Range	Stage Body (L x W x H)	Weight
MM-4M-F-25	25mm	97 x 31.5 x 23 (mm)	165g
		3.82 x 1.24 x 0.905 (inch)	165g
MM-4M-F-50	50mm	162 x 31.5 x 23 (mm)	246g
		6.38 x 1.24 x 0.905 (inch)	246g

x, xy, xyz, xz configurations available

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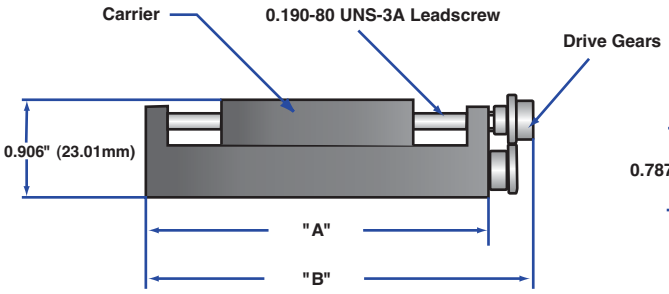
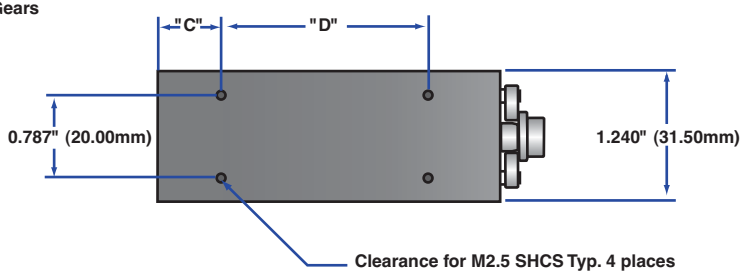
MM-4M-F Motor Stage 25mm & 50mm Travel

Dimensional Data

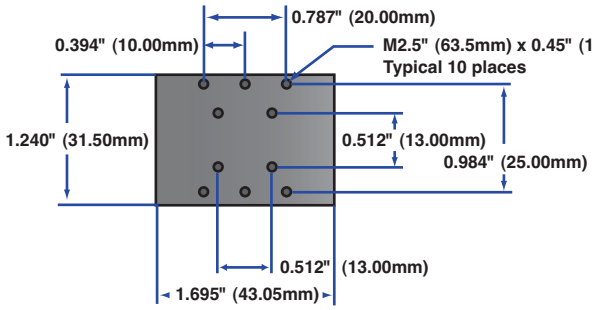
Tabulated Data for MM-4M-F Stages				
Travel	"A"	"B"	"C"	"D"
25mm	3.255" (82.68mm)	3.795" (96.39mm)	0.643" (16.34mm)	1.969" (50.00mm)
50mm	5.830" (148.02mm)	6.370" (161.80mm)	0.946" (24.04mm)	3.937" (100.00mm)



Side View

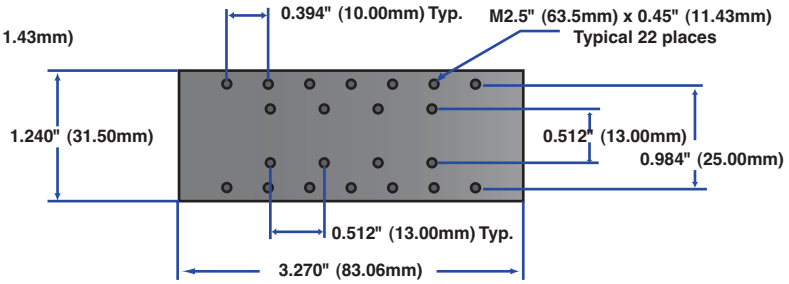


Bottom View



25mm Carrier

Top View



50mm Carrier

Top View

motioncontrol catalog

motorizedstages

MM-3M-FOS

Folded Motorized MicroMini™ Stages

Specifications:

	Standard Slider
***Repeatability**:	4µm + 1 count
***Homing Repeatability**:	4µm + 1 count
***Accuracy (linearity)**:	6µm/inch + 1 count
Speed, no load (max.):	6mm/second
†Slider Backlash:	<50µm
Encoder Conversion (resolution):	0.49609µm per count with 16:1gearhead (See also: gearheard options)

*Encoder resolution must be added based on the gearhead: 16:1 add ± 0.5µm, 64:1 add ±0.12 µm
†Slider backlash represents maximum overshoot

Runout (max.):	3µm/25.4mm (1 inch)
Gearhead Backlash:	1-2µm equivalent; can be compensated in software without overshoot
Motor:	10 mm diameter, 6-12 VDC servo, brush type (see motor specifications)
Vacuum Compatiblity:	10^{-3} Torr, standard
Load Capacity:	
Direct Top Load	17.6 ounce (0.5 kg)
Push:	8.8 ounce (0.25 kg)
Pull:	8.8 ounce (0.25 kg)
Roll:	8 inch-ounce (576 gram-centimeter)
Pitch:	4 inch-ounce (288 gram-centimeter)
Yaw:	4 inch-ounce (288 gram-centimeter)

Note: These stages may be run at twice the specified ratings without damage, but with a loss of accuracy and *speed.*

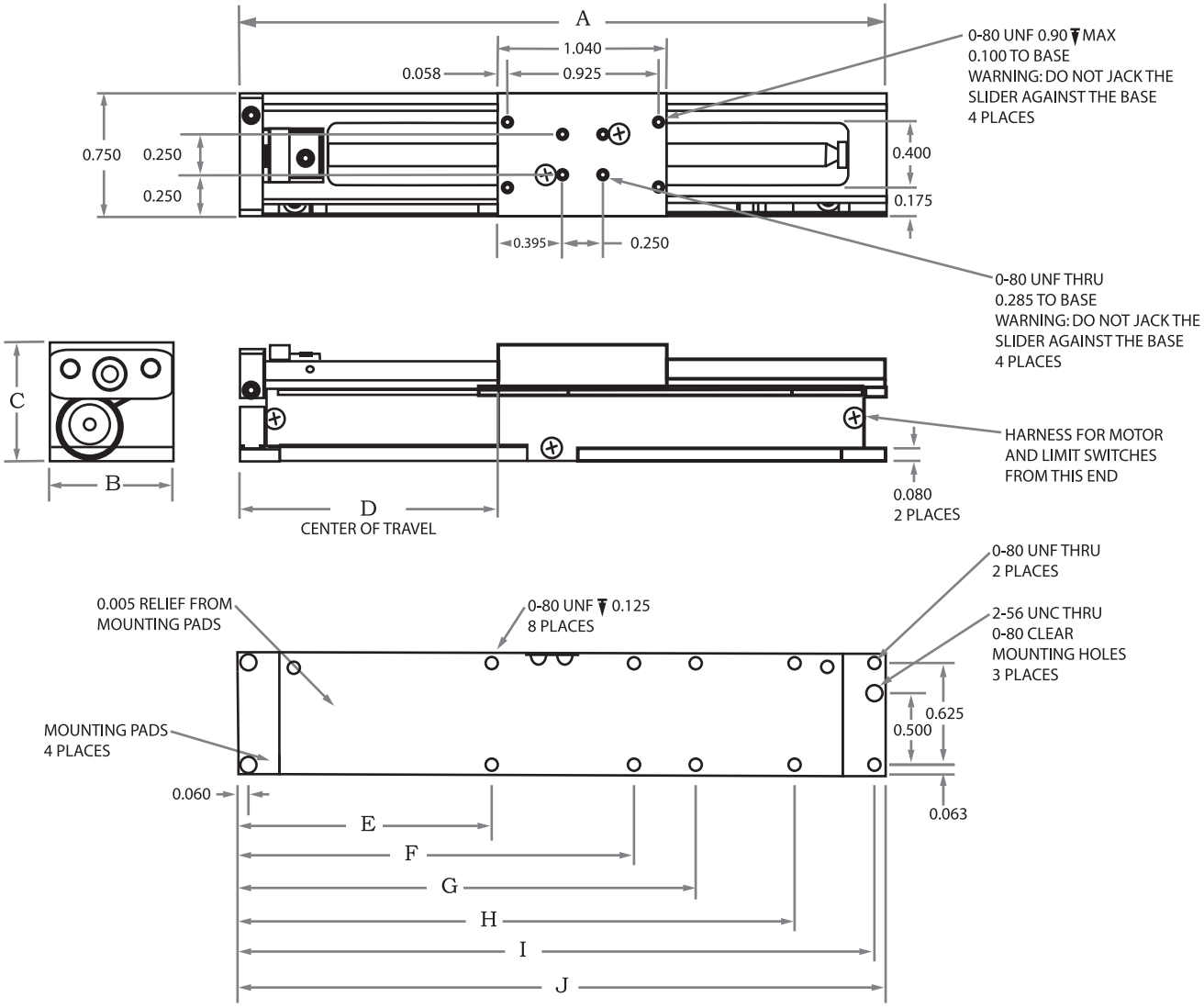
Travel Ranges and Dimensions:

Model No.	Travel Range	Stage Body (L x W x H)	Weight
MM-3M-FOS-2.0	50.8mm (2.0 inch)	136.6 x 19.1 x 18.54 (mm)	66g
		3.47 x 0.75 x 0.73 (inch)	66g
MM-3M-FOS-2.5	63.5mm (2.5 inch)	156.3 x 19.1 x 18.54 (mm)	72g
		3.97 x 0.75 x 0.73 (inch)	72g

Additional sizes ranging from 0.75 to 4.0 inches are available upon request
All sizes are available in xy configuration

Folded MM-3M-FOS Motorized MicroMini Stage™ 0.75 to 4 inch Travel

Dimensional Data



	A	B	C	D	E	F	G	H	I	J
MM-3M-FOS-2.0	3.470	0.750	0.730	1.410	1.305	1.930	2.555	2.915	3.410	3.470
MM-3M-FOS-2.5	3.970	0.750	0.730	1.594	1.555	2.430	2.805	3.415	3.910	3.970

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motorizedstages

MM-3M-EX

Extended Motorized MicroMini™ Stages
(For extended travel)

Specifications:

	Standard Slider	AB Slider (anti-backlash)
***Repeatability**:	±2µm	±0.5µm
***Homing Repeatability**:	±2µm	±0.5µm
***Accuracy (linearity)**:	±3µm	±1.5µm
Speed, no load (max.):	12mm/second @ 12V	3mm/second @ 12V
†Slider Backlash:	50µm	3µm
Encoder Conversion (resolution):	0.49609µm per count	0.12406µm per count
(See also: gearheard options)	with 16:1gearhead	with 64:1 gearhead

*Encoder resolution must be added , based on the gearhead: 16:1 add ± 0.5µm, 64:1 add ±0.12 µm

†Slider backlash represents maximum overshoot

Runout (max.):	3µm/25.4mm (1 inch)
Gearhead Backlash:	1-2µm equivalent; can be compensated in software without overshoot
Motor:	10 mm diameter, 6-12 VDC servo, brush type (see motor specifications)
Wobble (max.):	0.02 mrad (~ 4 arc-second)
Vacuum compatiblity:	10^{-3} Torr, standard, 10^{-6} Torr available
Load Capacity:	
Direct top or side load:	0.5 kg
Push:	0.5 kg
Pull:	0.5 kg
Tilt:	8 inch-ounce (560 gram-centimeter)
Twist:	4 inch-ounce (280 gram-centimeter)

Note: These stages may be run at twice the specified ratings without damage, but with a loss of accuracy and speed.

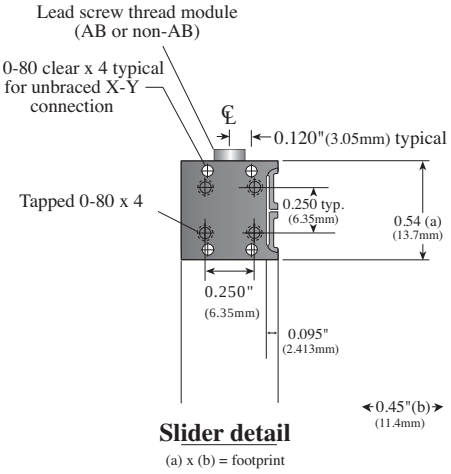
Travel Ranges and Dimensions:

Model No.	Travel Range	Stage Body (L x W x H)	Weight
MM-3M-EX-0.5	12.7mm	99.1 x 19.1 x 9.1 (mm)	53g
	0.5 inch	3.90 x 0.75 x 0.36 (inch)	53g
MM-3M-EX-1	25.4mm	111.8 x 19.1 x 9.1 (mm)	58g
	1.0 inch	4.40 x 0.75 x 0.36 (inch)	58g
MM-3M-EX-1.5	38.1mm	124.5 x 19.1 x 9.1 (mm)	63g
	1.5 inch	4.90 x 0.75 x 0.36 (inch)	63g
MM-3M-EX-2	50.8 mm	137.2 x 19.1 x 9.1 (mm)	68g
	2.0 inch	5.40 x 0.75 x 0.36 (inch)	68g

Specify -AB for Anti-Backlash

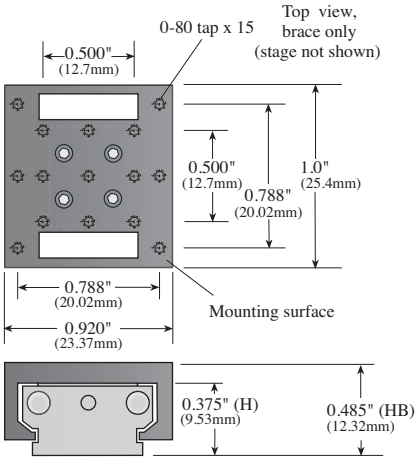
Folded MM-3M-EX Motorized MicroMini Stage™ - 0.5 to 2 inch Travel

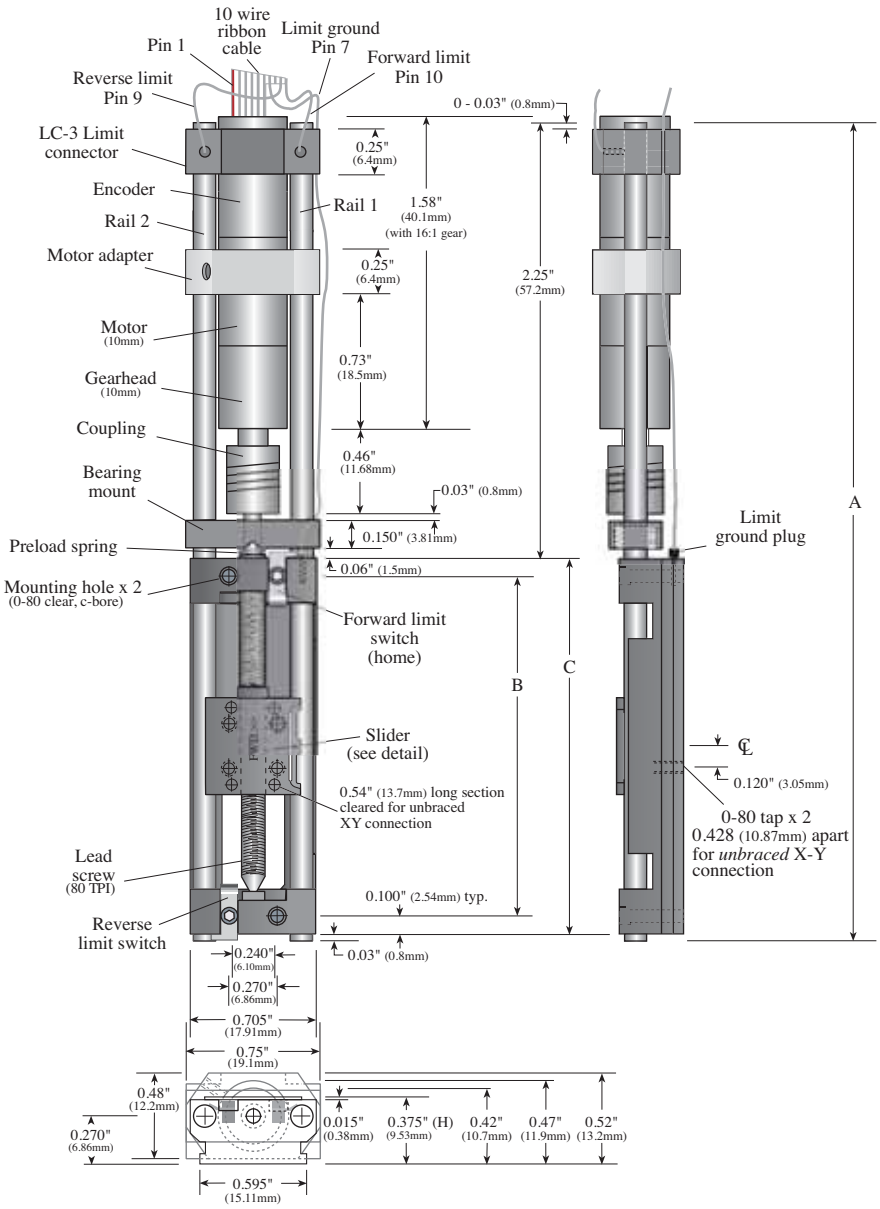
Dimensional Data



Slider detail

(a) x (b) = footprint





	T (Travel)	A	B	C
MM-3M-EX-0.5	0.5 inch	3.90	1.400	1.60
	12.7mm	99.1	35.56	40.6
MM-3M-EX-1.0	1.0 inch	4.40	1.900	2.10
	25.4mm	111.8	48.26	53.3
MM-3M-EX-1.5	1.5 inch	4.90	2.400	2.60
	38.1mm	124.5	60.96	66.0
MM-3M-EX-2.0	2.0 inch	5.40	2.900	3.10
	50.8 mm	137.2	73.66	78.7

Note:
Single axis brace is essential where attachments are vulnerable to crash.

BR-3M-X
Optional
Crash-resistant Slider Brace

motioncontrol catalog

motorizedstages

MM-4M-EX

Extended Motorized MicroMini™ Stages
(For heavier loads)

Specifications:

***Repeatability:**	±0.50 µm
***Homing Repeatability:**	±0.50 µm
***Accuracy (linearity):**	±1.00 µm per 25mm of travel
Straightness:	±2.00 µm maximum deviation per 50mm of travel
Speed, no load (max.):	7 mm/second @ 12V with 14:1 gearhead (other gearheads available)
†Slider Backlash:	1µm
Gearhead Backlash:	<2.54µm; can be compensated in software without overshoot
Encoder Conversion (resolution):	0.3595µm per count, with 14:1 gearhead

**Encoder resolution must be added, based on the gearhead: 16:1 add ±0.0005mm, 64:1 add ±0.00012mm*
†Slider backlash represents maximum overshoot

Motor:	13 mm dia., 6-12 VDC servo, brush type
Slide:	Recirculating ball bearings with four point contact, hardened stainless steel rails
Vacuum compatiblity:	10^{-3} Torr standard, 10^{-6} Torr available
Load Capacity:	
Horizontal:	3.0 kg
Vertical:	1.0 kg
Side:	1.0 kg

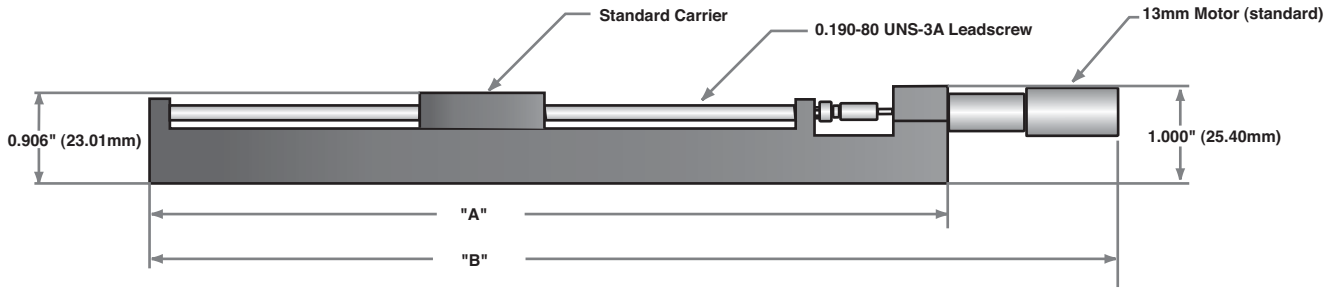
Travel Ranges and Dimensions:

Model No.	Travel Range	Stage Body (L x W x H)	Weight
MM-4M-EX-50	48 mm	138.68 x 31.5 x 25.4 (mm)	330g
	1.90 inch	5.46 x 1.24 x 1.0 (inch)	11.64oz
MM-4M-EX-80	78 mm	168.68 x 31.5 x 25.4 (mm)	345g
	3.07 inch	6.64 x 1.24 x 1.0 (inch)	12.49 oz
MM-4M-EX-110	108 mm	198.68 x 31.5 x 25.4 (mm)	360g
	4.25 inch	7.82 x 1.24 x 1.0 (inch)	12.70 oz
MM-4M-EX-140	138 mm	228.68 x 31.5 x 25.4 (mm)	375g
	5.43 inch	9.0 x 1.24 x 1.0 (inch)	13.23 oz
MM-4M-EX-170	168 mm	258.68 x 31.5 x 25.4 (mm)	390g
	6.61 inch	10.184 x 1.24 x 1.0 (inch)	13.76 oz
MM-4M-EX-200	198 mm	288.68 x 31.5 x 25.4 (mm)	405g
	7.79 inch	11.365 x 1.24 x 1.0 (inch)	14.29 oz
MM-4M-EX-230	228 mm	318.68 x 31.5 x 25.4 (mm)	420g
	8.97 inch	12.546 x 1.24 x 1.0 (inch)	14.82 oz
MM-4M-EX-260	258 mm	348.68 x 31.5 x 25.4 (mm)	435g
	10.15 inch	13.728 x 1.24 x 1.0 (inch)	15.35 oz

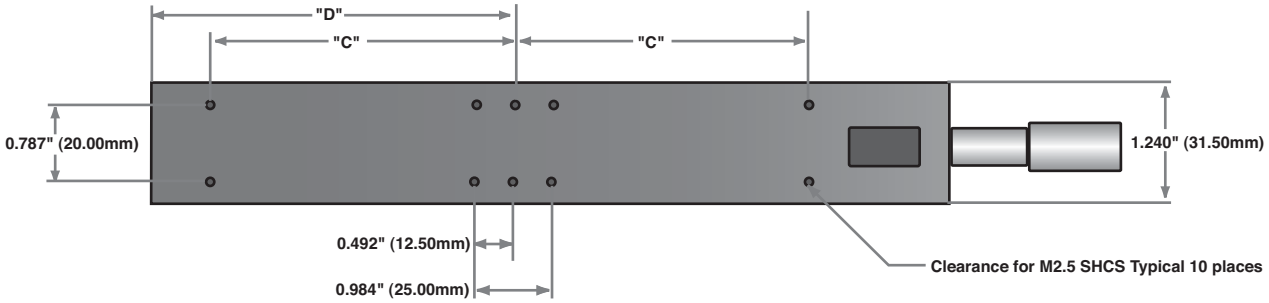
MM-4M-EX Motor Stage
Dimensional Data

Tabulated Data for MM-4M-EX Stages

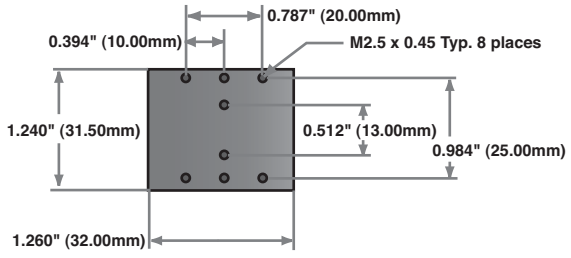
Travel	"A"	"B"	"C"	"D"
48mm	5.460" (138.68mm)	7.210" (183.13mm)	1.181" (30.00mm)	1.855" (47.12mm)
78mm	6.641" (168.68mm)	8.391" (213.13mm)	1.772" (45.00mm)	2.445" (62.12mm)
108mm	7.822" (198.68mm)	9.572" (243.13mm)	2.362" (60.00mm)	3.036" (77.12mm)
138mm	9.003" (228.68mm)	10.753" (273.13mm)	2.953" (75.00mm)	3.627" (92.12mm)
168mm	10.184" (258.68mm)	11.934 (303.13)	3.543 (90)	4.217 (107.12)
198mm	11.365" (288.68mm)	13.115" (333.13mm)	4.134" (105mm)	4.808" (122.12mm)
228mm	12.546" (318.68mm)	14.296" (363.13mm)	4.724" (120mm)	5.398" (137.12mm)
258mm	13.728" (348.68mm)	15.478" (393.13mm)	5.315" (135mm)	5.989" (152.12mm)



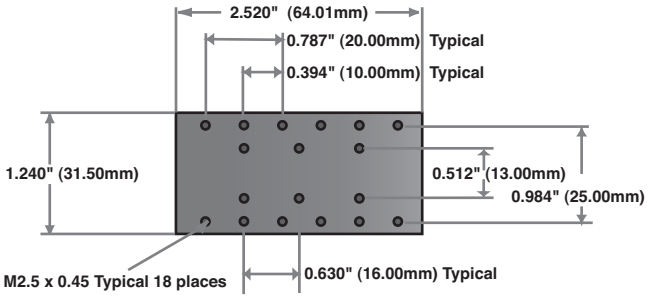
Side View



Bottom View



Standard Carrier
Top View



Extended Carrier for dual Carriage Option
Top View

MM-3M-ST, -EX, -R

Resolution Data Sheet

Linear Motion: 80 TPI Lead Screw

	Max Travel Rate[2]		Resolution[1]	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.260	6.60	19.5313	0.4960
64:1	0.064	1.65	4.8828	0.1240
256:1	0.016	0.41	1.2207	0.0310
1024:1	0.004	0.10	0.3052	0.0077

Rotary Motion: 80:1 Worm Drive Ratio

		Max Travel Rate[2]	Resolution[1]	
Gearhead Ratio	Final Output	degree per second	degree per count	arc-second per count
16:1	1,280:1	93.74	0.00703125	25.3125
64:1	5,120:1	23.44	0.00175781	6.3281
256:1	20,480:1	5.86	0.00043945	1.5820
1024:1	81,920:1	1.46	0.00010986	0.3955

Travel rate calculations:

Output Shaft RPM = RPM of motor/Gearhead Ratio

Distance per minute = Output shaft RPM x Lead (0.0125 in., 0.3175 mm)

Distance per second = Distance per minute/60

Distance in millimeter = inch/39.37 x 10^{-3}

Distance in micrometer = inch/39.37 x 10^{-6}

Encoder resolution calculations:

Encoder counts per shaft revolution = 40 encoder counts x Gearhead ratio

Minimum encoder count (inch) = Lead (0.0125 in.)/ Encoder counts per output shaft revolution

Minimum encoder count (millimeter) = Minimum encoder count (inch)/39.37 x10^{-3} in.

Minimum encoder count (micrometer) = Minimum encoder count (inch)/39.37 x 10^{-6}

Conversion:

1 inch (in) = 25.4 mm

1 inch (in) = 25,400 µm

1 millimeter (mm) = 39.37 x 10^{-3} inch

1 micrometer (µm) = 39.37 x 10^{-6} inch

1 deg (deg) = 3,600 arc-second

1 arc-sec = 0.277 x 10^{-3} degree

Notes:

1) The lead values shown above in both travel rate and resolution calculations are for 80 (1/80) threads per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.
2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.
3) The 10 mm motors used with both the rotary and linear stages incorporate dual channel, 10 position, magnetic encoders. The resultant quadrature output is equal to 40 encoder counts per motor armature revolution.

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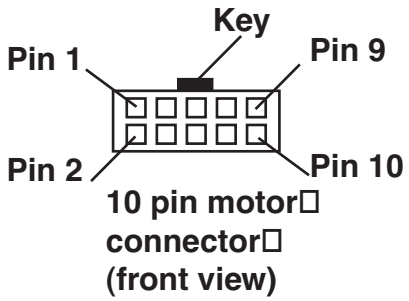
MTR-10-E MicroMini™ Motor

Connection Specifications

Motor Type: MTR-10-E
Connector type: Dual row IDC
***Mate Part# (male pin socket):**
Panduit part #057-010-115

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



10 pin motor connector (front view)

Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm)±12%	20.1
Max power output (Watts)(2)	0.42
Max. Efficiency (%)(2)	67
No Load Speed (RPM) ±12%(2)	18,400
Friction Torque (@ no load speed) (oz-in)	0.004
No Load Current (mA)±50%(3)	10
Stall Torque(oz-in)(2)	0.123
Velocity Constant (RPM/Volt)	3,173
Back EMF Constant (mV/RPM)	0.315
Torque Constant (oz-in/Amp)	0.426
Armature Inductance (mH)	0.060

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	15 VDC
Operating Current	5mA Nom. @5VDC
Signal Phase Shift	90°
Max. Signal Freq.	7.2 KHz
Temperature Range	-40°C to +85° C
Output Signal Type	Square wave
Signal Rise Time	Less than 5µs
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	10 (2 channels)
Quadrature	40

Mechanical Specifications:

Mechanical Time Constant (ms)(2)	13
Armature Inertia ($x10^{-6}$ oz-in-sec^2)(2)	0.85
Angular Acceleration (x 10^3 Rad/sec^2)(2)	145
Rotor Temperature Range	-30°C to +85°C (-22°F to +185°F)
Bearing Play (measured @ bearing)	
Radial	Less than 0.02mm (0.0008")
Axial	Less than 0.2mm (0.0079")
Thermal Resistance (°C/W)	
Rotor to Case	26
Case to Ambient	56
Maximum Shaft Load	
Radial (@3,000 RPM) 1.5mm from bearing	18 oz (510.3 gram)
Axial @ standstill	18 oz (510.3 gram)
Weight	0.23 oz (6.5 gram)

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

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MM-3M-F/MM-4M-F
Resolution Data Sheet

Linear Motion: 80 TPI Lead Screw

	Max Travel Rate[2]		Resolution[1]	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.260	6.60	19.5313	0.4960
64:1	0.064	1.65	4.8828	0.1240
256:1	0.016	0.41	1.2207	0.0310
1024:1	0.004	0.10	0.3052	0.0077

Travel rate calculations:

Output Shaft RPM = RPM of motor/Gearhead Ratio
Distance per minute = Output shaft RPM x Lead (0.0125 in., 0.3175 mm)
Distance per second = Distance per minute/60
Distance in millimeter = inch/39.37 x 10^{-3}
Distance in micrometer = inch/39.37 x 10^{-6}

Encoder resolution calculations:

Encoder counts per shaft revolution = 40 encoder counts x Gearhead ratio
Minimum encoder count (inch) = Lead (0.0125 in.)/ Encoder counts per output shaft revolution
Minimum encoder count (millimeter) = Minimum encoder count (inch)/39.37 x10^{-3} in.
Minimum encoder count (micrometer) = Minimum encoder count (inch)/39.37 x 10^{-6}

Conversion:

1 inch (in) = 25.4 mm
1 inch (in) = 25,400 µm
1 millimeter (mm) = 39.37 x 10^{-3} inch
1 micrometer (µm) = 39.37 x 10^{-6} inch
1 deg (deg) = 3,600 arc-second
1 arc-sec = 0.277 x 10^{-3} degree

Notes:

1) The lead values shown above in both travel rate and resolution calculations are for 80 (1/80) threads per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.
2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.
3) The 10 mm motors used with both the rotary and linear stages incorporate dual channel, 10 position, magnetic encoders. The resultant quadrature output is equal to 40 encoder counts per motor armature revolution.

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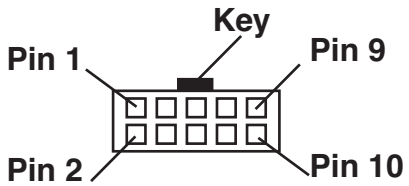
MTR-10-E MicroMini™ Motor

Connection Specifications

Motor Type: MTR-10-E
Connector type: Dual row IDC

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



10 pin motor connector (front view)

Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm)±12%	20.1
Max power output (Watts)(2)	0.42
Max. Efficiency (%)(2)	67
No Load Speed (RPM) ±12%(2)	18,400
Friction Torque (@ no load speed) (oz-in)	0.004
No Load Current (mA)±50%(3)	10
Stall Torque(oz-in)(2)	0.123
Velocity Constant (RPM/Volt)	3,173
Back EMF Constant (mV/RPM)	0.315
Torque Constant (oz-in/Amp)	0.426
Armature Inductance (mH)	0.060

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	15 VDC
Operating Current	5mA Nom. @5VDC
Signal Phase Shift	90°
Max. Signal Freq.	7.2 KHz
Temperature Range	-40°C to +85° C
Output Signal Type	Square wave
Signal Rise Time	Less than 5µs
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	10 (2 channels)
Quadrature	40

Mechanical Specifications:

Mechanical Time Constant (ms)(2)	13
Armature Inertia (x 10^{-6} oz-in-sec^2)(2)	0.85
Angular Acceleration (x 10^3 Rad/sec^2)(2)	145
Rotor Temperature Range	-30°C to +85°C (-22°F to +185°F)
Bearing Play (measured @ bearing)	
Radial	Less than 0.02mm (0.0008")
Axial	Less than 0.2mm (0.0079")
Thermal Resistance (°C/W)	
Rotor to Case	26
Case to Ambient	56
Maximum Shaft Load	
Radial (@3,000 RPM) 3 mm from bearing	18 oz (510 gram)
Axial @ standstill	18 oz (510 gram)
Weight	0.23 oz (6.5 gram)

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

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MM-3M-F/MM-4M-F

Resolution Data Sheet

Linear Motion: 80 TPI Lead Screw

	Max Travel Rate[2]		Resolution[1]	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.260	6.60	19.5313	0.4960
64:1	0.064	1.65	4.8828	0.1240
256:1	0.016	0.41	1.2207	0.0310
1024:1	0.004	0.10	0.3052	0.0077

Travel rate calculations:

Output Shaft RPM = RPM of motor/Gearhead Ratio

Distance per minute = Output shaft RPM x Lead (0.0125 in., 0.3175 mm)

Distance per second = Distance per minute/60

Distance in millimeter = inch/39.37 x 10^{-3}

Distance in micrometer = inch/39.37 x 10^{-6}

Encoder resolution calculations:

Encoder counts per shaft revolution = 40 encoder counts x Gearhead ratio

Minimum encoder count (inch) = Lead (0.0125 in.)/ Encoder counts per output shaft revolution

Minimum encoder count (millimeter) = Minimum encoder count (inch)/39.37 x10^{-3} in.

Minimum encoder count (micrometer) = Minimum encoder count (inch)/39.37 x 10^{-6}

Conversion:

1 inch (in) = 25.4mm

1 inch (in) = 25,400µm

1 millimeter (mm) = 39.37 x 10^{-3} inch

1 micrometer (µm) = 39.37 x 10^{-6} inch

1 deg (deg) = 3,600 arc-second

1 arc-sec = 0.277 x 10^{-3} degree

Notes:

1) The lead values shown above in both travel rate and resolution calculations are for 80 (1/80) threads per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.
2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.
3) The 10 mm motors used with both the rotary and linear stages incorporate dual channel, 10 position, magnetic encoders. The resultant quadrature output is equal to 40 encoder counts per motor armature revolution.

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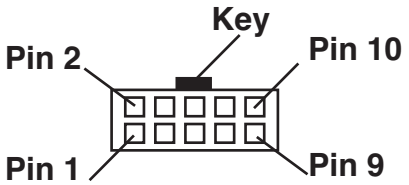
MTR-10-E-12V MicroMini™ Motor

Connection Specifications

Motor Type: MTR-10-E-12V
Connector type: Dual row IDC

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



10 pin motor connector (front view)

Electrical Specifications:

Supply Voltage Nom. (Volts)	12
Armature Resistance (Ohm)±12%	95.0
Max power output (Watts)[2]	0.36
Max. Efficiency (%)[2]	68
No Load Speed (RPM) ±12%[2]	16,500
Friction Torque (@ no load speed) (oz-in)	0.004
No Load Current (mA)±50%[3]	4
Stall Torque(oz-in)[2]	0.116
Velocity Constant (RPM/Volt)	1419
Back EMF Constant (mV/RPM)	0.705
Torque Constant (oz-in/Amp)	0.953
Armature Inductance (mH)	0.310

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	15 VDC
Operating Current	5mA Nom. @5VDC
Signal Phase Shift	90°
Max. Signal Freq.	7.2 KHz
Temperature Range	-40°C to +85° C
Output Signal Type	Square wave
Signal Rise Time	Less than 5µs
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	10 (2 channels)
Quadrature	40

Mechanical Specifications:

Mechanical Time Constant (ms)[2]	10
Armature Inertia ($x10^{-6}$ oz-in-sec^2)[2]	0.7081
Angular Acceleration (x 10^3 Rad/sec^2)[2]	165
Rotor Temperature Range	-30°C to +85°C (-22°F to +185°F)
Bearing Play (measured @ bearing)	
Radial	Less than 0.02mm (0.0008")
Axial	Less than 0.2mm (0.0079")
Thermal Resistance (°C/W)	
Rotor to Case	26
Case to Ambient	56
Maximum Shaft Load	
Radial (@3,000 RPM) 3mm from bearing	18oz (510gram)
Axial @ standstill	18oz (510gram)
Weight	0.23oz (6.5gram)

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

The information contained in this data sheet is subject to change without notice. Critical dimensions or specifications should be verified with our technical support staff.

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MM-3M-R/MM-4M-F, MM-3M-ST, MM-3M-EX, MM-3M-F

12 Position Encoder Resolution Data Sheet

Linear Motion: 80 TPI Lead Screw

	Max Travel Rate²		Resolution¹	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.2604	6.6146	16.276	0.41341

Rotary Motion: 80:1 Worm Drive Ratio

		Max Travel Rate²	Resolution¹	
Gearhead Ratio	Final Output	Degrees/Second	arc-seconds per count	degrees per count
16:1	1,280:1	93.75	21.1530	5.859375×10^{-3}

Travel rate calculations:

Output Shaft RPM = RPM of motor/Gearhead Ratio

Distance per minute = Output shaft RPM x Lead (0.0125 in., 0.3175 mm)

Distance per second = Distance per minute/60(sec/min)

Distance in millimeter = inch/39.37 x 10^{-3} (in/mm)

Distance in micrometer = inch/39.37 x 10^{-6} (in/µm)

Encoder resolution calculations:

Encoder counts per shaft revolution = 48 encoder counts x Gearhead ratio

Minimum encoder count (inch) = Lead (0.0125 in.)/ Encoder counts per output shaft revolution

Minimum encoder count (millimeter) = Minimum encoder count (inch)/39.37 x10^{-3} (in/mm)

Minimum encoder count (micrometer) = Minimum encoder count (inch)/39.37 x 10^{-6} (in/µm)

Conversion:

1 inch (in) = 25.4mm

1 inch (in) = 25,400µm

1 millimeter (mm) = 39.37 x 10^{-3} inch

1 micrometer (µm) = 39.37 x 10^{-6} inch

1 deg (deg) = 3,600 arc-second

1 arc-sec = 0.277 x 10^{-3} degree

Notes:

1) The lead values shown above in both travel rate and resolution calculations are for 80 (1/80) threads per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.
2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.
3) The 10 mm motors used with both the rotary and linear stages incorporate dual channel, 12 position, magnetic encoders. The resultant quadrature output is equal to 48 encoder counts per motor armature revolution.

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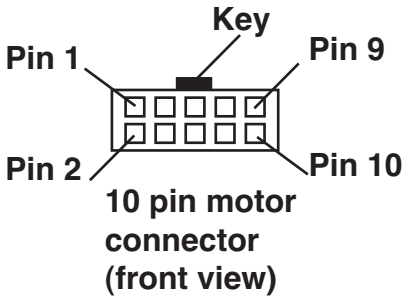
MTR-10-12E-HT MicroMini™ Motor
Connection Specifications

Motor Type: MTR-10-12E-HT with 16:1 planetary gearhead and magnetic encoder
Connector type: Dual row IDC

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm)±12%	10.8
Max power output (Watts)(2)	0.81
Max. Efficiency (%)(2)	78
No Load Speed (RPM) ±12%(2)	13,200
No Load Current (mA)±50%(3)	8
Stall Torque (mNm)(2)	2.34
Velocity Constant (RPM/Volt)	2,231
Torque Constant (oz-in/Amp)	4.28
Armature Inductance (mH)	0.100
Speed/Torque gradient (rpm/mNm)	5630
Maximum permissable speed (rpm)	12,000
Maximum continuous current (mA)	291
Maximum continuous torque (mNm)	1.21
Maximum power output at nominal voltage (mW)	0.81

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	15 VDC
Operating Current	5mA Nom. @5VDC
Signal Phase Shift	90°
Max. Signal Freq.	7.2 KHz
Temperature Range	-40°C to +85° C
Output Signal Type	Square wave
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	12 (2 channels)
Quadrature	48
Output signal TTL compatible	

Mechanical Specifications:

Mechanical Time Constant (ms)(2)	7
Armature Inertia ($x10^{-6}$ oz-in-sec^2)(2)	0.12
Maximum rotor temperature	+85°
Axial Play	0.2mm
Thermal Resistance (°C/W)	
Rotor to Case	14
Case to Ambient	41
Maximum Shaft Load (N)	
Radial 1.5mm from bearing @3000 rpm	0.5
Axial @ standstill	20
Weight	8.8 grams

Planetary Gearhead recommended input speed <8000rpm

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

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MM-3M-F/MM-4M-F
Resolution Data Sheet

Linear Motion: 40 TPI Lead Screw

	Max Travel Rate[2]		Resolution[1]	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.5208	13.229	39.0625	0.99219

Travel rate calculations:

Output Shaft RPM = RPM of motor/Gearhead Ratio
Distance per minute = Output shaft RPM x Lead (0.025 in., 0.635 mm)
Distance per second = Distance per minute/60
Distance in millimeter = inch/39.37 x 10^{-3}
Distance in micrometer = inch/39.37 x 10^{-6}

Encoder resolution calculations:

Encoder counts per shaft revolution = 40 encoder counts x Gearhead ratio
Minimum encoder count (inch) = Lead (0.025 inch)/ Encoder counts per output shaft revolution
Minimum encoder count (millimeter) = Minimum encoder count (inch)/39.37 x10^{-3} in.
Minimum encoder count (micrometer) = Minimum encoder count (inch)/39.37 x 10^{-6}

Conversion:

1 inch (in) = 25.4mm
1 inch (in) = 25,400µm
1 millimeter (mm) = 39.37 x 10^{-3} inch
1 micrometer (µm) = 39.37 x 10^{-6} inch
1 deg (deg) = 3,600 arc-second
1 arc-sec = 0.277 x 10^{-3} degree

Notes:

1) *The lead values shown above in both travel rate and resolution calculations, are for 40 (1/40) Threads per Inch (TPI) leadscrews. For an 80 TPI leadscrew, substitute 0.0125 inch lead.*
2) *Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.*
3) *The 10 mm motors used with both the rotary and linear stages incorporate dual channel, 10 position, magnetic encoders. The resultant quadrature output is equal to 40 encoder counts per motor armature revolution.*

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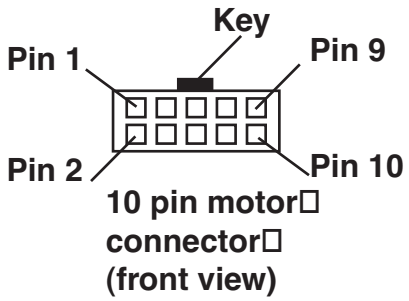
MTR-10-E MicroMini™ Motor

Connection Specifications

Motor Type: MTR-10-E
Connector type: Dual row IDC

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



10 pin motor connector (front view)

Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm)±12%	20.1
Max power output (Watts)(2)	0.42
Max. Efficiency (%)(2)	67
No Load Speed (RPM) ±12%(2)	18,400
Friction Torque (@ no load speed) (oz-in)	0.004
No Load Current (mA)±50%(3)	10
Stall Torque(oz-in)(2)	0.123
Velocity Constant (RPM/Volt)	3,173
Back EMF Constant (mV/RPM)	0.315
Torque Constant (oz-in/Amp)	0.426
Armature Inductance (mH)	0.060

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	15 VDC
Operating Current	5mA Nom. @5VDC
Signal Phase Shift	90°
Max. Signal Freq.	7.2 KHz
Temperature Range	-40°C to +85° C
Output Signal Type	Square wave
Signal Rise Time	Less than 5µs
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	10 (2 channels)
Quadrature	40

Mechanical Specifications:

Mechanical Time Constant (ms)(2)	13
Armature Inertia (x 10^{-6} oz-in-sec^2)(2)	0.85
Angular Acceleration (x 10^3 Rad/sec^2)(2)	145
Rotor Temperature Range	-30°C to +85°C (-22°F to +185°F)
Bearing Play (measured @ bearing)	
Radial	Less than 0.02mm (0.0008")
Axial	Less than 0.2mm (0.0079")
Thermal Resistance (°C/W)	
Rotor to Case	26
Case to Ambient	56
Maximum Shaft Load	
Radial (@3,000 RPM) 3 mm from bearing	18 oz (510 gram)
Axial @ standstill	18 oz (510 gram)
Weight	0.23 oz (6.5 gram)

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

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MM-3M-F/MM-4M-F
Resolution Data Sheet

Linear Motion: 80 TPI Lead Screw

	Max Travel Rate[2]		Resolution[1]	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.260	6.60	19.5313	0.4960
64:1	0.064	1.65	4.8828	0.1240
256:1	0.016	0.41	1.2207	0.0310
1024:1	0.004	0.10	0.3052	0.0077

Travel rate calculations:

Output Shaft RPM = RPM of motor/Gearhead Ratio
Distance per minute = Output shaft RPM x Lead (0.0125 in., 0.3175 mm)
Distance per second = Distance per minute/60
Distance in millimeter = inch/39.37 x 10^{-3}
Distance in micrometer = inch/39.37 x 10^{-6}

Encoder resolution calculations:

Encoder counts per shaft revolution = 40 encoder counts x Gearhead ratio
Minimum encoder count (inch) = Lead (0.0125 in.)/ Encoder counts per output shaft revolution
Minimum encoder count (millimeter) = Minimum encoder count (inch)/39.37 x10^{-3} in.
Minimum encoder count (micrometer) = Minimum encoder count (inch)/39.37 x 10^{-6}

Conversion:

1 inch (in) = 25.4mm
1 inch (in) = 25,400µm
1 millimeter (mm) = 39.37 x 10^{-3} inch
1 micrometer (µm) = 39.37 x 10^{-6} inch
1 deg (deg) = 3,600 arc-sec
1 arc-sec = 0.277 x 10^{-3} degree

Notes:

1) The lead values shown above in both travel rate and resolution calculations, are for 80 (1/80) Threads per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.
2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.
3) The 10 mm motors used with both the rotary and linear stages incorporate dual channel, 10 position, magnetic encoders. The resultant quadrature output is equal to 40 encoder counts per motor armature revolution.

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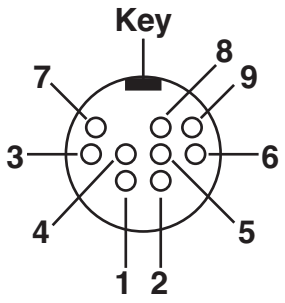
MTR-10-E MicroMini™ Motor

Connection Specifications

Motor Type: MTR-10-E
Connector type: 9 pin Mini-DIN

Pin #	Name	Pin #	Name
1	Motor+	6	Motor (-)
2	Encoder Vcc	7	Limit Ground Switch
3	Encoder Ch A	8	Forward limit
4	Encoder Ch B	9	Reverse limit
5	Encoder Ground		



9 pin Mini-Din motor connector (front view)

Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm)±12%	20.1
Max power output (Watts)(2)	0.42
Max. Efficiency (%)(2)	67
No Load Speed (RPM) ±12%(2)	18,400
Friction Torque (@ no load speed) (oz-in)	0.004
No Load Current (mA)±50%(3)	10
Stall Torque(oz-in)(2)	0.123
Velocity Constant (RPM/Volt)	3,173
Back EMF Constant (mV/RPM)	0.315
Torque Constant (oz-in/Amp)	0.426
Armature Inductance (mH)	0.060

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	15 VDC
Operating Current	5mA Nom. @5VDC
Signal Phase Shift	90°
Max. Signal Freq.	7.2 KHz
Temperature Range	-40°C to +85° C
Output Signal Type	Square wave
Signal Rise Time	Less than 5µs
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	10 (2 channels)
Quadrature	40

Mechanical Specifications:

Mechanical Time Constant (ms)(2)	13
Armature Inertia (x 10^{-6} ounce-inch-second^2)(2)	0.85
Angular Acceleration (x 10^3 Rad/second^2)(2)	145
Rotor Temperature Range	-30°C to +85°C (-22°F to +185°F)
Bearing Play (measured @ bearing)	
Radial	Less than 0.02mm (0.0008")
Axial	Less than 0.2mm (0.0079")
Thermal Resistance (°C/W)	
Rotor to Case	26
Case to Ambient	56
Maximum Shaft Load	
Radial (@3,000 RPM) 3 mm from bearing	18 oz (510 gram)
Axial @ standstill	18 oz (510 gram)
Weight	0.23 oz (6.5 gram)

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

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MM-4M-EX and MM-4M-R
Resolution Data Sheet

Linear Motion: MM-4M-EX, 80 TPI Lead Screw, 13mm mtr, 50 enc. *lines/mtr rev

		Resolution[1]		Max Travel Rate[2]	
Gearhead Ratio	**Actual Gear Ratio**	**Inch/count**	**mm/count**	**Inch/s**	**mm/s**
14:1	13.795918367:1	4.5303×10^{-6}	0.1151×10^{-3}	0.302	7.67
43:1	42.920634921:1	1.4562×10^{-6}	0.0370×10^{-3}	0.097	2.4
66:1	66.220408163:1	0.9438×10^{-6}	0.0240×10^{-3}	0.062	1.5
134:1	133.530864198:1	0.4681×10^{-6}	0.0119×10^{-3}	0.030	0.78
159:1	159.419501134:1	0.3920×10^{-6}	0.0096×10^{-3}	0.025	0.64
246:1	245.961516035:1	0.2541×10^{-6}	0.0065×10^{-3}	0.016	0.41
415:1	415.429355281:1	0.1504×10^{-6}	0.0038×10^{-3}	0.010	0.25
592:1	592.129575640:1	0.1056×10^{-6}	0.0027×10^{-3}	0.006	0.16
989:1	988.891428571:1	0.0632×10^{-6}	0.0016×10^{-3}	0.0036	0.092
1,526:1	1,525.718204082:1	0.0410×10^{-6}	0.0010×10^{-3}	0.0027	0.069
2,608:1	2,625.740771277:1	0.0238×10^{-6}	0.0006×10^{-3}	0.0015	0.039
4,365:1	4,385.142457309:1	0.0143×10^{-6}	0.0004×10^{-3}	0.0009	0.023
5,647:1	5,666.953329446:1	0.0110×10^{-6}	0.0003×10^{-3}	0.0007	0.018

Rotary Motion: MM-4M-R, 90:1 Worm Drive Ratio 13mm mtr, 50enc. *lines/mtr rev

		Resolution[1]		Max Travel Rate[2]
Gearhead Ratio	**Actual Gear Ratio**	**Degree/count**	**arc-s/count**	**Degree/s**
14:1	13.795918367:1	1.44970×10^{-3}	5.2189	96.63
43:1	42.920634921:1	0.46598×10^{-3}	1.6775	31.00
66:1	66.220408163:1	0.30202×10^{-3}	1.0873	20.09
134:1	133.530864198:1	0.14978×10^{-3}	0.5392	9.90
159:1	159.419501134:1	0.12546×10^{-3}	0.4516	8.36
246:1	245.961516035:1	0.08131×10^{-3}	0.2927	5.36
415:1	415.429355281:1	0.04814×10^{-3}	0.1733	3.18
592:1	592.129575640:1	0.03378×10^{-3}	0.1216	2.18
989:1	988.891428571:1	0.02022×10^{-3}	0.0728	1.361
1,526:1	1,525.718204082:1	0.01311×10^{-3}	0.0472	0.90
2,608:1	2,625.740771277:1	0.00762×10^{-3}	0.0274	0.54
4,365:1	4,385.142457309:1	0.00456×10^{-3}	0.0164	0.27
5,647:1	5,666.953329446:1	0.00353×10^{-3}	0.0127	0.23

Notes:

1) The lead values shown above in both travel rate and resolution calculations, are for 80 (1/80) thread per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.

2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM

**The resultant quadrature output is equal to 64 encoder counts per motor armature revolution. (mtr rev)*

Travel rate calculations:

Output Shaft RPM	= RPM of motor / Gearhead Ratio
Distance per minute	= Output shaft RPM x Lead (0.0125 inch, 0.03175mm)
Distance per second	= Distance per minute/60
Distance in millimeter	= inch/39.37 X 10^{-3}
Distance in micrometer	= inch/39.37 x 10^{-6}

Conversion:

1 inch (in.)	= 25.4 mm
1 inch (in.)	= 25,400µm
1 millimeter (mm)	= 39.37 x 10^{-3} inch
1 micrometer (µm)	= 39.37 x 10^{-6} inch
1 degree	= 3,600 arc-s
1 arc-s	= 0.277 x 10^{-3} degree

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MTR-13-E-HT MicroMini™ Motor

Connection Specifications

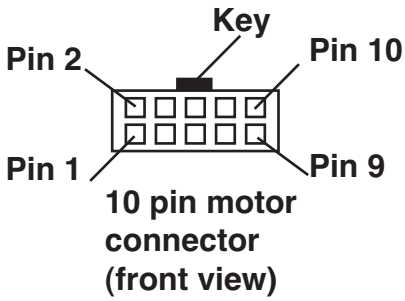
Motor Connector Pin Assignments:

Motor Type: MTR-13-E-HT
Connector Type: Dual Row IDC

Note: Mating connectors may be purchased from National Aperture, Inc.

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection*
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit

Optional: +5V with Optical Limit Switches



Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm) ±12%	2.83
Max Power Output (Watts) [1]	3.11
Max Efficiency (%)[1]	81
No-Load Speed (rpm) ±12% [1]	10,600
Friction Torque (at no-load speed)(oz-in)	0.017
No-Load Current (mA) ±50%[2]	22
Stall Torque (oz-in.)[1]	1.59
Velocity Constant (rpm/Volt)	1,790
Back EMF Constant (mV/rpm)	0.560
Torque Constant (oz-in./Amp)	0.758
Armature Inductance (mH)	0.07

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Supply Voltage	5.5 VDC
Operating Current	6 mA Nom. @ 5 VDC
Signal Phase Shift	90˚
Max Signal Frequency	20 Khz
Operating Temp. Range	-25˚C to +85˚C (-13˚F to +185˚F)
Signal Rise Time	0.1µs max.
Phase Relationship	Ch. A leads Ch. B when motor rotation is clockwise as viewed from shaft end.
Pulses Per Revolution	50 (2 channels)
Quadrature	200 encoder counts

Mechanical Specifications (Motor):

Mechanical Time Constant (ms)[1]	7
Armature Inertia	0.71g-cm^2
Angular Acceleration (x 10^3 rad/sec^2)[1]	160
Thermal Resistances (˚C/W)	
Rotor to Case	6
Case to Ambient	25
Max Shaft Load	
Radial at 3,000 rpm (3mm from bearing)	1.2 Ñ
Axial (Static)	20 N
Weight	0.71 oz (19 gram)
Max Operating Temp. Range	-30˚C to +85˚C (-22˚F to +185˚F)
Max Rotor Temp.	125˚C (257˚F)

(1) Specified at nominal supply voltage.
(2) Specified with shaft diameter = 1.5mm at no-load speed.

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MM-4M-EX and MM-4M-R
Resolution Data Sheet

Linear Motion: MM-4M-EX, 80 TPI Lead Screw, 13mm mtr, 16 enc. *lines/mtr rev

		Resolution[1]		Max Travel Rate[2]	
Gearhead Ratio	**Actual Gear Ratio**	**Inch/count**	**mm/count**	**Inch/s**	**mm/s**
14:1	13.795918367:1	14.1573×10^{-6}	0.3595×10^{-3}	0.30	7.6
43:1	42.920634921:1	4.5506×10^{-6}	0.1155×10^{-3}	0.096	2.4
66:1	66.220408163:1	2.9494×10^{-6}	0.0749×10^{-3}	0.062	1.5
134:1	133.530864198:1	1.4627×10^{-6}	0.0371×10^{-3}	0.030	0.78
159:1	159.419501134:1	1.2251×10^{-6}	0.0311×10^{-3}	0.025	0.64
246:1	245.961516035:1	0.7941×10^{-6}	0.0201×10^{-3}	0.016	0.41
415:1	415.429355281:1	0.4701×10^{-6}	0.0119×10^{-3}	0.010	0.25
592:1	592.129575640:1	0.3298×10^{-6}	0.0083×10^{-3}	0.006	0.16
989:1	988.891428571:1	0.1975×10^{-6}	0.0050×10^{-3}	0.0036	0.092
1,526:1	1,525.718204082:1	0.1280×10^{-6}	0.0032×10^{-3}	0.0027	0.069
2,608:1	2,625.740771277:1	0.0744×10^{-6}	0.0018×10^{-3}	0.0015	0.039
4,365:1	4,385.142457309:1	0.0445×10^{-6}	0.0011×10^{-3}	0.0009	0.023
5,647:1	5,666.953329446:1	0.0345×10^{-6}	0.0008×10^{-3}	0.0007	0.018

Rotary Motion: MM-4M-R, 90:1 Worm Drive Ratio 13mm mtr, 16 enc. *lines/mtr rev

		Resolution[1]		Max Travel Rate[2]
Gearhead Ratio	**Actual Gear Ratio**	**degree/count**	**arc-s/count**	**Degree/s**
14:1	13.795918367:1	4.53032×10^{-3}	16.3091	96.63
43:1	42.920634921:1	1.45617×10^{-3}	5.2422	31.00
66:1	66.220408163:1	0.94381×10^{-3}	3.3977	20.09
134:1	133.530864198:1	0.46805×10^{-3}	1.6850	9.90
159:1	159.419501134:1	0.39204×10^{-3}	1.4113	8.36
246:1	245.961516035:1	0.25410×10^{-3}	0.9147	5.36
415:1	415.429355281:1	0.15044×10^{-3}	0.5416	3.18
592:1	592.129575640:1	0.10555×10^{-3}	0.3799	2.18
989:1	988.891428571:1	0.06320×10^{-3}	0.2275	1.361
1,526:1	1,525.718204082:1	0.04096×10^{-3}	0.1474	0.90
2,608:1	2,625.740771277:1	0.02380×10^{-3}	0.0856	0.54
4,365:1	4,385.142457309:1	0.01425×10^{-3}	0.0513	0.27
5,647:1	5,666.953329446:1	0.01102×10^{-3}	0.0397	0.23

Notes:

1) The lead values shown above in both travel rate and resolution calculations, are for 80 (1/80) thread per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.

2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM

**The resultant quadrature output is equal to 64 encoder counts per motor armature revolution. (mtr rev)*

Travel rate calculations:	
Output Shaft RPM	= RPM of motor / Gearhead Ratio
Distance per minute	= Output shaft RPM x Lead (0.0125 inch, 0.03175mm)
Distance per second	= Distance per minute/60
Distance in millimeter	= inch/39.37 X 10^{-3}
Distance in micrometer	= inch/39.37 x 10^{-6}

Conversion:	
1 inch	= 25.4 mm
1 inch	= 25,400µm
1 millimeter (mm)	= 39.37 x 10^{-3} inch
1 micrometer (µm)	= 39.37 x 10^{-6} inch
1 degree	= 3,600 arc-s
1 arc-s	= 0.277 x 10^{-3} degree

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MTR-13E MicroMini™ Motor

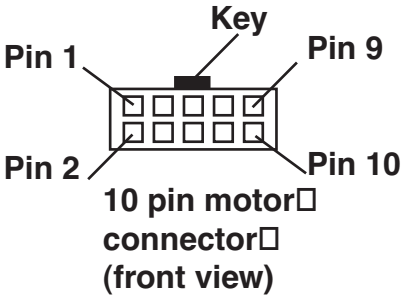
Connection Specifications

Motor Connector Pin Assignments:

Motor Type: MTR-13-E
Connector Type: Dual Row IDC
Mating Part: Panduit P/N 057-010-115S
(male pin socket with mounting flange)

Note: Mating connectors may be purchased from National Aperture, Inc.

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection*
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



10 pin motor connector (front view)

Optional: +5V with Optical Limit Switches

Electrical Specifications:	
Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm) ±12%	3.6
Max Power Output (Watts) [1]	2.43
Max Efficiency (%)[1]	78
No-Load Speed (rpm) ±12% [1]	10,900
Friction Torque (at no-load speed)(oz-in)	0.018
No-Load Current (mA) ±50%[2]	25
Stall Torque (oz-in.)[1]	1.20
Velocity Constant (rpm/Volt)	1,840
Back EMF Constant (mV/rpm)	0.542
Torque Constant (oz-in./Amp)	0.734
Armature Inductance (mH)	0.08

Encoder Specifications:	
Supply Voltage	5 VDC Nom.
Max Supply Voltage	5.5 VDC
Operating Current	5 mA Nom. @ 5VDC
Signal Phase Shift	90˚
Max Signal Frequency	20 Khz
Operating Temp. Range	-25˚C to +85˚C (-13˚F to +185˚F)
Signal Rise Time	Less than 5µs
Phase Relationship	Ch. A leads Ch. B when motor rotation is clockwise as viewed from shaft end.
Pulses Per Revolution	16 (2 channels)
Quadrature	64 encoder counts

Mechanical Specifications (Motor):	
Mechanical Time Constant (ms)[1]	9
Armature Inertia (x 10^{-4}oz-in.-sec^2)[1]	0.095
Angular Acceleration (x 10^3 rad/sec^2)[1]	130
Thermal Resistances (˚C/W)	
Rotor to Case	8
Case to Ambient	40
Max Shaft Load	
Radial at 3,000 rpm (3mm from bearing)	18 oz (510 gram)
Axial (Static)	36 oz (1021 gram)
Weight	0.71 oz (20 gram)
Max Operating Temp. Range	-30˚C to +85˚C (-22˚F to +185˚F)
Max Rotor Temp.	100˚C (212˚F)

(1) Specified at nominal supply voltage.
(2) Specified with shaft diameter = 1.5mm at no-load speed.

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MM-3M-R / MM-4M-F

12 Position Encoder Resolution Data Sheet

Linear Motion: 80 TPI Lead Screw

	Max Travel Rate[2]		Resolution[1]	
Gearhead Ratio	Inch per second	mm per second	µinch per count	µm per count
16:1	0.2604	6.6146	16.276	0.41341

Rotary Motion: 80:1 Worm Drive Ratio

		Max Travel Rate[2]	Resolution[1]	
Gearhead Ratio	Final Output	degree per second	degree per count	arc-second per count
16:1	1,280:1	93.75	5.859375×10^{-3}	21.1530

note: for 16:1 gearhead there are 61,440 counts for 360º rotation.

Travel rate calculations:	
Output Shaft RPM	=RPM of motor/Gearhead Ratio
Distance per minute	= Output shaft RPM x Lead (0.0125 inch, 0.3175 mm)
Distance per second	= Distance per minute/60
Distance in millimeter	= inch/39.37 x 10^{-3}
Distance in micrometer	= inch/39.37 x 10^{-6}

Encoder resolution calculations:	
Encoder counts per shaft revolution	= 48 encoder counts x Gearhead ratio
Minimum encoder count (inch)	= Lead (0.0125 inch)/ Encoder counts per output shaft revolution
Minimum encoder count (millimeter)	= Minimum encoder count (inch)/39.37 x10^{-3}inch
Minimum encoder count (micrometer)	= Minimum encoder count (inch)/39.37 x 10^{-6}

Conversion:	
1 inch (in.)	= 25.4 mm
1 inch (in.)	= 25,400 µm
1 millimeter (mm)	= 39.37 x 10^{-3} inch
1 micrometer (µm)	= 39.37 x 10^{-6} inch
1 deg (deg)	= 3,600 arc-second
1 arc-sec	= 0.277 x 10^{-3} degree

Notes:

1) The lead values shown above in both travel rate and resolution calculations, are for 80 (1/80) Threads per Inch (TPI) leadscrews. For a 40 TPI leadscrew, substitute 0.025 inch lead.
2) Max travel rate calculated with motor armature running at a maximum speed of 20,000 RPM.
3) The 10 mm motors used with rotary stages incorporate dual channel, 12 position, magnetic encoders. The resultant quadrature output is equal to 48 encoder counts per motor armature revolution.

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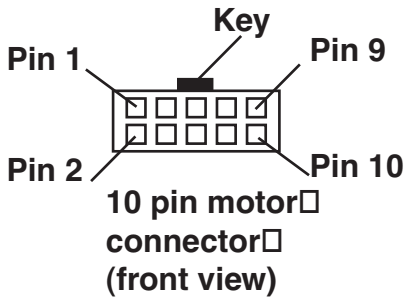
MTR-10-12E-HT MicroMini™ Motor

Connection Specifications

Motor Type: MTR-10-12E with 16:1 planetary gearhead and magnetic encoder
Connector type: Dual row IDC
*Mate Part# (male pin socket):
Panduit part #057-010-115

Pin #	Name	Pin #	Name
1	Motor+	6	Motor -
2	Encoder+V	7	Limit ground
3	Encoder Ch A	8	No connection
4	Encoder Ch B	9	Reverse limit
5	Ground (case)	10	Forward limit



Electrical Specifications:

Supply Voltage Nom. (Volts)	6
Armature Resistance (Ohm)±12%	9.09
Max. power output (Watts)(2)	0.81
Max. Efficiency (%)(2)	78
No Load Speed (RPM) ±12%(2)	13,200
No Load Current (mA) ±50%(3)	8
Stall Torque (oz-in)(2) mN	2.34
Velocity Constant (RPM/Volt)	2,231
Torque Constant (mN/A)	4.28
Armature Inductance (mH)	0.08
Speed/torque gradient (rpm/mN)	5630
Starting Current (mA)	660
Maximum permissible speed (rpm)	19,000
Maximum continuous current (mA)	291
Maximum continuous torque (mN)	1.28
Maximum power output at nominal voltage (mY)	962
Thermal time constant winding(s)	2

Encoder Specifications:

Supply Voltage	5 VDC Nom.
Max Voltage Supply	24 VDC
Operating Current	8mA Nom. @5 VDC
Signal Phase Shift	90º
Max. Signal Freq.	min. 20 KHz
Temperature Range	-20ºC to +80º C
Output Signal Type	Square wave
Phase Relationship	Ch A leads CH B when motor rotation is clockwise as seen from shaft end.
Pulses per Revolution	12 (2 channels)
Quadrature	48
Output signal TTL compatible	

Mechanical Specifications:

Mechanical Time Constant (ms)(2)	7
Armature Inertia (g - cm²)	0.098
Maximum rotor temperature	+85ºC
Axial Play	0.2mm
Thermal Resistance (K/W)	
Rotor to Case	9
Case to Ambient	38
Maximum Shaft Load (N)	
Radial 5mm from flange	0.5
Axial	2
Weight	10 gram

Planetary Gearhead recommended input speed <8000 rpm

(1) Ratings are presented independent of each other
(2) Specified at nominal supply voltage
(3) Specified with shaft diameter = 0.8mm at no load
*Mating connectors available through National Aperture, Inc.

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MicroMini™ Controller

Overview

TO THE MICRO-MOTION USER

National Aperture is the leader in micro-automation. The MicroMini™ Stages, along with our micro-motion control systems, have become the industry's best selling micro-automation tools.

The patented features of the MicroMini™ Stage provide **high-precision micropositioning** at "breakthrough" prices.

Our new constraint-free design minimizes inherent error and provides linear and rotary motion in a unique, compact configuration to give you the ultimate in accuracy, linearity, repeatability and speed in the smallest conceivable amount of space. Our miniature servo-motor has advantages that far surpass any comparable stepper motor.

Our Controllers:
Now it's easy to integrate your total motion control solution. You can begin with confidence to replace your more critical hand operations in production and laboratory. National Aperture provides "plug in and go" solutions for both PC and Macintosh™. Our motion control cards provide real-time, high speed, closed loop control without sacrificing resolution or response time. With Windows™ and the additional support of LabVIEW™ by National Instruments Corp., custom software applications become simple and hardware headaches become a thing of the past!

All of our motion control products are not only user friendly and flexible, but they offer superior compatibility with other major servo systems.

We are dedicated to bringing you into the world of motion control with the finest state of the art components.

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How The MicroMini™ Stage Works

Overview

GENERALAPPLICATION

The MM stage is designed for loads under 6 ounces (170g) and low moments below 8 in.-oz.

SLIDESYSTEM

Hardened precision dowels are preloaded against the slider. The low-load requirements of the stage allow a spring-action, preloaded, positive slider seating.

RETURNPRELOADSPRING

The standard manual stages and ST motor stages have a simple return spring and moving lead screw. Although limited in travel, there is the benefit of built in anti-backlash.

FIXEDLEADSCREW THRUSLIDER

The Folded and Extended motor stages have a fixed lead screw passing through a tapped section in the slider.

BACKLASH

Clearance between the tapped hole and the lead screw gives a degree of backlash in slider motion. It also affects linearity of motion
(in -F and -EX stages).

ANTI-BACKLASHHIGH LINEARITY

Option A radially preload-seating tapped lead hole module is provided for more stringent requirements. The effect of this system is near 0 backlash, along with maximum linearity, repeatability, and homing consistency as demanded by the submicrometer resolution.

LOADBEARINGCONSIDERATION

The amount of preload determines the load bearing capacity. When the preload is overcome by excessive load, the slider-rail seating is disturbed making overload errors easy to detect. Stage damage does not occur at this point. Simple formulae are provided for quick, or detailed load analysis. A larger MM-4 stage is provided as a base to better carry the weights of additional axes, thus improving the end load capacity by a pyramid effect.

VELOCITY

Slider velocity is determined by the torque and speed of the motor, along with the gearhead ratio. It is limited by the slider drag force, along with the lead screw drag from an anti-backlash module (if used). In order to increase speed without violating accuracy, the “drag” forces may be reduced, but with a consequent decrease in load capacity.

BRACING

A selection of optional braces (BR) offers extra rigidity and crash protection for stages in vulnerable positions, as the slide elements are not designed to withstand pressure or twist. The cushioned “ears” on one side of the slider will begin to yield, then the brace will engage before damage takes place. Braces add some weight and must be counted as load.

MULTI-AXISVERSATILITY

All similar series (MM-3) manual and motor stages and some dissimilar (MM-, MM-1) series are compatible for quick, multi-axis connection using standard English screws.

ENGLISH-METRIC

All MM- stages can be manufactured to be compatible with English or Metric threaded fasteners.

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Anti-Backlash Option For MM-3M-EX and -F Stages

overview

The AB version is not limited to just providing anti-backlash; the AB option provides many additional benefits that make it the preferred choice of users.

The following is a list of benefits that make the AB option significantly important.

- **Reduces backlash** from standard 25-50 micrometer to 2-4 micrometer.
- **Reservoir of lubrication** for even distribution and long retention.
- **Perfect thread engagement** for uniform wear and wear-in.
- **Highest possible linearity;** true to lead screw thread accuracy (50µinch).
- **Uniform radial pressure** to eliminate tight spots that may cause servo interference.
- **Self-centering;** no lateral stresses to slider resulting from normal lead screw straightness error.
- **Wiper action** keeps threads clean and clear of dust and particles.

Regular stages *cannot* be upgraded to AB version
Price: $200 for option Delivery: 4-6 weeks or less