50 Position Encoder Resolution Data Sheet

MTR-6-50E-4.5V

MM-1M			
80 TPI Lead Screw (0.3175 mm/turn)			50 position encoder[1]
	GH[2] Ratio (pinion gear ratio = 1.5)	Max Travel Rate[3,4] (mm/sec)	Resolution (µm/count)
	64:1	1.10	0.0165

MM-3M-G			
80 TPI Lead Screw (0.3175 mm/turn)			50 position encoder[1]
Model	GH[2] Ratio	Max Travel Rate[3,4] (rad/sec)	Resolution (µrad/count)
-25	64:1	0.044	0.6615
-42	64:1	0.026	0.3937

MM-4M-G			
80 TPI Lead Screw (0.3175 mm/turn)			50 position encoder[1]
Model	GH[2] Ratio	Max Travel Rate[3,4] (rad/sec)	Resolution (µrad/count)
-87	64:1	0.019	0.2851
-120	64:1	0.014	0.2067

Notes:

1. The 6mm motors incorporate dual channel, 50 position, optical encoders. The quadrature output is equivalent to 200 encoder counts per motor armature revolution.
2. Gearhead ratio is denoted by GH.
3. Maximum travel rate is calculated with the motor armature turning at a maximum rate of 20,000 RPM.
4. Maximum speed is measured at 4.5 VDC with 64:1 gearhead ratio.

Linear Travel

Travel rate calculations

For MM-1M and MM-3M-G[5]:

Lead screw RPM = (motor RPM)/[(gearhead ratio) x (pinion gear ratio)] = (motor RPM)/(64 x 1.5) =(motor RPM)/96

For MM-4M-G:

Lead screw RPM = (motor RPM)/(gearhead ratio) = (motor RPM)/64

Distance per minute = (lead screw RPM) x lead; (lead = 0.3175 mm for 80 TPI lead screw)

Distance per second = (distance per minute)/60

Distance in inches = (distance (mm))/(25.4)

Example calculation: with motor RPM = 20,000

For MM-1M and MM-3M-G:

Lead screw RPM = (20,000 motor RPM)/96 = 208.333 RPM

Lead screw RPS = 208.333/60 RPS = 3.4722 RPS

Distance per second = 3.4722 RPS x 0.3175 mm/revolution = 1.102 mm/sec

Encoder resolution calculations

For MM-1M and MM-3M-G:

Encoder counts per lead screw revolution = (encoder counts per motor revolution) x (gearhead ratio) x (pinion gear ratio)

For MM-4M-G:

Encoder counts per lead screw revolution = (encoder counts per motor revolution) x (gearhead ratio)

Distance per encoder count = lead/(encoder counts per lead screw revolution)

Example calculation: w/encoder counts (quadrature) per motor revolution = 200 and gearhead ratio = 64:1

For MM-1M and MM-3M-G:

Encoder counts per lead screw revolution = (200 counts per motor revolution) x (64 motor revolution per gearhead revolution) x (1.5 gearhead revolutions per pinion revolution) x (1 pinion revolution per lead screw revolution)
= 19,200 counts/(lead screw revolution)

Distance per encoder count = (0.3175 mm)/(19,200 counts) = 1.654E-5 mm/count = 1.654E-2 µm/count

For MM-4M-G:

Encoder counts per lead screw revolution = (200 counts per motor revolution) x (64 motor revolution per gearhead revolution)
= 12,800 counts

Distance per encoder count = (0.3175 mm)/(12,800 counts) = 2.48E-5 mm/count = 2.48E-2 µm/count

Note:

5. The MM-3M-G does not use a pinion gear but uses another gear train that results in an effective 96:1 composite gear ratio.

MTR-6-50E-4.5V

Goniometer Rotary Travel

Travel rate calculations

Lead screw travel rate	= (motor RPM) x [min/(60 sec)] x (lead)/(gearhead ratio)
Angular travel rate	= tan-1[(lead screw travel rate)/(stage radius)]

Example calculation: with motor RPM = 20,000; **MM-3M-G** total gear ratio = 96:1; **MM-4M-G** GH ratio = 64:1; lead = 0.3175 mm

For MM-3M-G stages:

Lead screw rate	= (20,000 RPM) x [min/(60 sec)] x (0.3175 mm)/(96) = 1.10243 mm/sec
For 25 mm radius stage:	
Angular travel rate	= tan-1[(1.10243 mm/sec)/(25 mm)] = 0.04406 rad/sec
For 42 mm radius stage:	
Angular travel rate	= tan-1[(1.10243 mm/sec)/(42 mm)] = 0.02624 rad/sec

For MM-4M-G stages:

Lead screw rate	= (20,000 RPM) x [min/(60 sec)] x (0.3175 mm)/(64) = 1.65365 mm/sec
For 87 mm radius stage:	
Angular travel rate	= tan-1[(1.65365 mm/sec)/(87 mm)] = 0.01901 rad/sec
For 120 mm radius stage	
Angular travel rate	= tan-1[(1.65365 mm/sec)/(120 mm)] = 0.01378 rad/sec

Encoder resolution calculations

Encoder counts per lead screw revolution	= (encoder counts per motor revolution) x (gearhead ratio)
Distance per encoder count	= lead/(encoder counts per lead screw revolution)
Angular resolution	= tan-1[(distance per encoder count)/(stage radius)]

Example calculation: with encoder counts (quadrature) per motor revolution = 200

For MM-3M-G stages:

Encoder counts per lead screw revolution	= [(200 counts)/(motor revolution)] x [(96 motor revolution)/(final gearhead revolution[5])] = 19,200
Distance per encoder count	= (0.3175 mm)/(19,200 counts) = 1.65365E-5 mm/count
For 25 mm radius stage:	
Angular travel rate	= tan-1[(1.65365E-5 mm/count)/(25 mm)] = 0.66146 µrad/count
For 42 mm radius stage:	
Angular travel rate	= tan-1[(1.65365E-5 mm/count)/(42 mm)] = 0.39373 µrad/count

For MM-4M-G stages:

Encoder counts per lead screw revolution	= [(200 counts)/(motor revolution)] x [(64 motor revolution)/(gearhead revolution)] = 12,800
Distance per encoder count	= (0.3175 mm)/(12,800 counts) = 2.48E-5 mm/count
For 87 mm radius stage:	
Angular resolution	= tan-1[(2.48E-5 mm/count)/(87 mm)] = 0.285057 µrad/count
For 120 mm radius stage:	
Angular resolution	= tan-1[(2.48E-5 mm/count)/(120 mm)] = 0.206667 µrad/count

Note:

5. The MM-3M-G does not use a pinion gear but uses another gear train that results in an effective 96:1 composite gear ratio.

Conversion

1 inch (in)	= 25.4 mm
1 inch	= 25,400 µm
1 millimeter (mm)	= 39.37E-3 inch
1 micron (µm)	= 39.37E-6 inch
1 deg	= 0.01745329252 rad