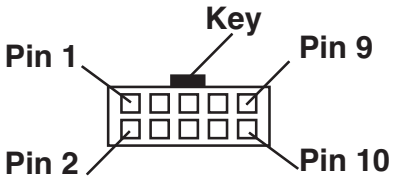
# MTR-10-10E MicroMini™ Motor (10 mm diameter, 6 Vdc, 10 position encoder)

## Linear 80 TPI/Rotary 80:1 Connection Specifications

**Motor Type: MTR-10-10E**
**Connector type: Dual row IDC**
***Mate Part# (male pin):**
**Pancon 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 female connector (front view)**

### Electrical Specifications:

| | |
|---|---|
| Supply Voltage Nom. (Volts) | 6 |
| Armature Resistance (Ohm)±12% | 20.1 |
| Maximum power output (watts)(2) | 0.42 |
| Maximum Efficiency (%)(2) | 67 |
| No Load Speed (RPM) ±12%(2) | 18,400 |
| Friction Torque (@ no load speed) (mNm) | 0.03 |
| No Load Current (mA) ±50%(3) | 10 |
| Stall Torque (mNm)(2) | 0.87 |
| Velocity Constant (RPM/Volt) | 3,173 |
| Back EMF Constant (mV/RPM) | 0.315 |
| Torque Constant (mNm/A) | 3.01 |
| Armature Inductance (mH) | 0.060 |
| Speed/Torque Gradient(RPM/mNm) | 21,185 |
| Maximum permissible speed (RPM) | 13,000 |
| Maximum continuous current (mA) | 170 |
| Maximum continuous torque (mNm) | 0.48 |

### Encoder Specifications:

| | |
|---|---|
| Supply Voltage | 5 Vdc Nom. |
| Maximum Voltage Supply | 15 Vdc |
| Operating Current | 5mA Nom. @ 5 Vdc |
| Signal Phase Shift | 90º |
| Maximum Signal Frequency | 7.2 Khz |
| Temperature Range | -30ºC to +85º 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 encoder counts |
| Output signal | CMOS and TTL compatible |

### Mechanical Specifications:

| | |
|---|---|
| Mechanical Time Constant (ms)(2) | 13 |
| Armature Inertia (g $cm^2$)(2) | 0.06 |
| Angular Acceleration (x $10^3$ $rad/sec^2$)(2) | 145 |
| Rotor Temperature Range | -30ºC to +85ºC |
| Axial Play | 0.2 mm |
| Shaft Play (measured @ bearing) | |
| Radial | Less than 0.02mm |
| Axial | Less than 0.2mm |
| Maximum Shaft Load | |
| Radial (@3,000 RPM) | |
| 1.5 mm from bearing (N) | 5 |
| Axial @ standstill (N) | 5 |
| Weight | 6.5 g |
| Planetary Gearhead recommended max continuous input speed | 5000 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.

*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.*

# 10 Position Encoder Resolution Data Sheet

## MTR-10-10E

| MM-3M-ST, -F, -FOS, -EX, MM-4M-F | | |
|---|---|---|
| 80 TPI Lead Screw (0.3175 mm/turn) | | 10 position encoder[1] |
| GH[2] Ratio | Max Travel Rate[3] (mm/sec) | Resolution (µm/count) |
| 16:1 | 6.614 | 0.4961 |
| 64:1 | 1.653 | 0.1240 |
| 256:1 | 0.413 | 0.0310 |
| 1024:1 | 0.103 | 0.0078 |

| MM-3M-ST, -F, -EX, MM-4M-F | | |
|---|---|---|
| 40 TPI Lead Screw (0.635 mm/turn) | | 10 position encoder[1] |
| GH[2] Ratio | Max Travel Rate[3] (mm/sec) | Resolution (µm/count) |
| 16:1 | 13.229 | 0.9922 |
| 64:1 | 3.307 | 0.2481 |
| 256:1 | 0.827 | 0.0620 |
| 1024:1 | 0.207 | 0.0155 |

**Notes:**

1. The 10mm motors used with both linear and rotary stages incorporate dual channel, 10 position, magnetic encoders. The quadrature output is equivalent to 40 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.

## Linear Travel

### Travel rate calculations

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

Distance per minute = (lead screw RPM) x lead; (lead = 0.3175 mm for 80 TPI screw and 0.635 mm for 40 TPI screw)

Distance per second = (distance per minute)/60

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

***Example calculation:*** with motor RPM = 20,000; GH ratio = 16:1; lead = 0.3175 mm

Distance per second = [(20000 RPM)/(16)] x (0.3175 mm) x (min/60 sec)] = 6.6145 mm/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)

***Example calculation:*** with motor GH ratio = 16:1; lead = 0.3175 mm; 40 encoder counts per motor revolution

Distance per encoder count = (0.3175 mm)/(40 x 16) = 0.4961 µm/count

# 10 Position Encoder Resolution Data Sheet (cont.)

## MTR-10-10E

| MM-3M-R | | | |
|---|---|---|---|
| 80:1 Worm Drive Ratio | | | 10 position encoder[1] |
| GH[2] Ratio | Final Output | Max Travel Rate[3] (rad/sec) | Resolution (µrad/count) |
| 16:1 | 1,280:1 | 1.636 | 122.7185 |
| 64:1 | 5,120:1 | 0.409 | 30.6796 |
| 256:1 | 20,480:1 | 0.102 | 7.6699 |
| 1024:1 | 81,920:1 | 0.025 | 1.9175 |

**Notes:**

1. The 10mm motors used with both linear and rotary stages incorporate dual channel, 10 position, magnetic encoders. The quadrature output is equivalent to 40 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.

## Rotary Travel

### Travel rate calculations

Rotor travel rate (RPM) = (motor RPM)/[gearhead ratio) x (worm drive ratio)]
Rotor travel rate (rad/sec) = [rotor travel rate (RPM)] x (min/60 sec) x (6.283185 rad/revolution)

***Example calculation:*** with motor RPM = 20,000; GH ratio = 16:1; lead = 0.3175 mm
Rotor travel rate (rad/sec) = (20000 RPM)/(16 x 80) x (min/60 sec) x (6.283185 rad/revolution) = 1.63624 rad/sec

### Encoder resolution calculations

Encoder counts per lead screw revolution = [(encoder counts per motor revolution)] x (gearhead ratio) x (worm drive ratio)
Angular resolution = (6.283185 rad/revolution)/ (encoder counts per lead screw revolution)

***Example calculation:*** with motor GH ratio = 16:1; lead = 0.3175 mm; 40 encoder counts per motor revolution
Angular resolution = (6.283185 rad per lead screw revolution)/[(40 counts per motor revolution) x (16 motor revolutions per gearhead revolution) x (80 gearhead revolutions per lead screw revolution)]
= 122.718 µrad/count

### 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