MAE4 Features

- 12-bit Analog or PWM output
- -40C to +125C operating temperature
- Latching connector
- Fits shaft diameters from 0.125 in. to 0.250 in. and 3mm to 6mm
- Mounts to 0.750 in., 1.280 in. and 1.812 in. bolt circles
- Quick and easy assembly

MAE4 Product Description

The MAE4 is a magnetic absolute encoder kit that provides shaft position information over 360° of rotation with no stops or gaps. This encoder is designed to mount on an existing shaft and provides digital feedback information. The MAE4 is available with an analog or a pulse width modulated (PWM) digital output.

Analog output provides a DC voltage that is proportional to the absolute shaft position with 12-bit resolution.

PWM output provides a pulse duty cycle that is proportional to the absolute shaft position. PWM output has 12-bit resolution with 2 different output frequency options.

The MAE4 consists of three components: base, push-on magnetic hub, and encoder body. Base options for 0.750 in., 1.280 in., and 1.812 in. bolt circles are available. No tools are needed for the push-on, collet gripping hub. The hub mounts to a standard shaft in seconds and provides a simple and reliable means of securing the magnet to the shaft.
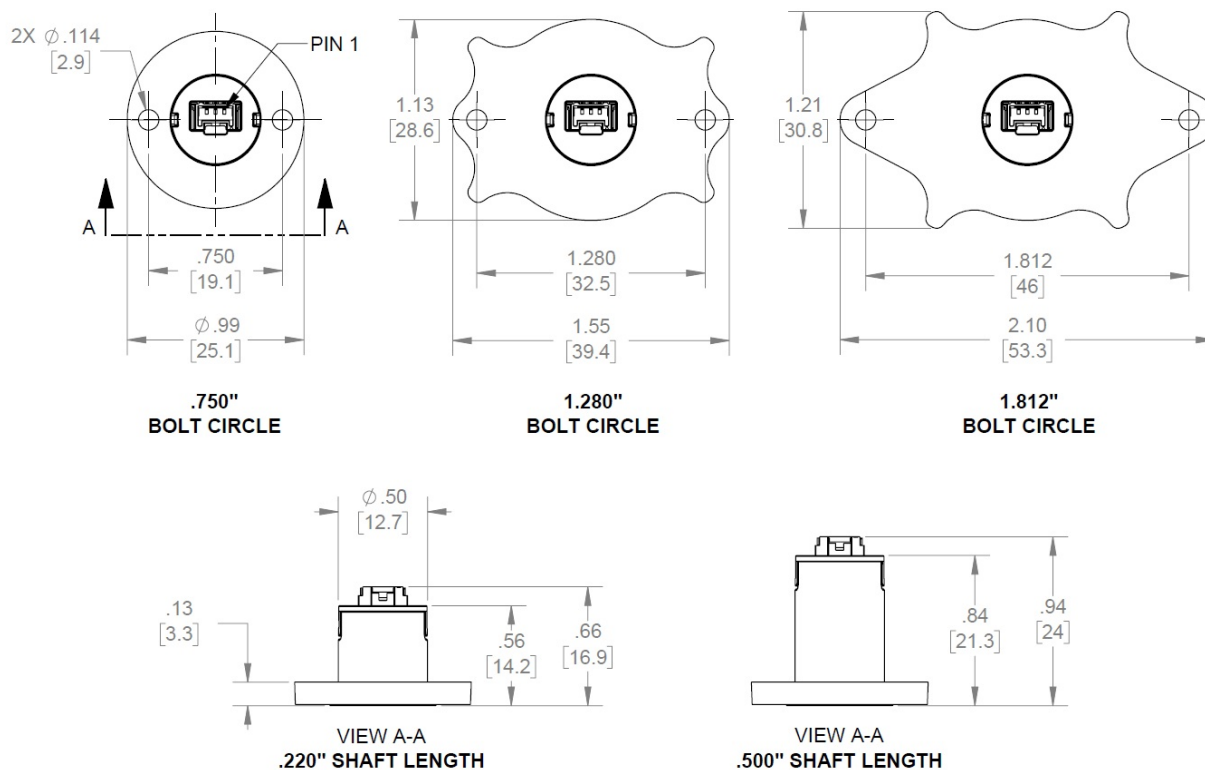
Two 4-40 pan head screws secure the base and encoder body to a flat surface. If desired, the encoder can be powered up and rotated by hand to a reference position before the screws are tightened.

The MAE4 is connected using a 3-pin latching,1.25mm pitch polarized connector.

Due to the MAE4's push-on hub design, it is recommended for use as a one-time installation.

Mechanical Drawings

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MAE4

MAE4 Miniature Absolute Magnetic Kit Encoder

RELEASE DATE: 12/19/2024

2X ⌀.114 [2.9]   PIN 1

.750 [19.1]

⌀ .99 [25.1]

.750"
BOLT CIRCLE

1.13 [28.6]

1.280 [32.5]

1.55 [39.4]

1.280"
BOLT CIRCLE

1.21 [30.8]

1.812 [46]

2.10 [53.3]

1.812"
BOLT CIRCLE

⌀ .50 [12.7]

.13 [3.3]

.56 [14.2]   .66 [16.9]

VIEW A-A
.220" SHAFT LENGTH

.84 [21.3]   .94 [24]

VIEW A-A
.500" SHAFT LENGTH

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UNITS: INCHES [MM]
METRIC SHOWN FOR REFERENCE ONLY

Specifications

ENVIRONMENTAL

PARAMETER	VALUE	UNITS
Operating Temperature	-40 to +125	C
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G
Electrostatic Discharge, IEC 61000-4-2	± 4	kV

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MECHANICAL

PARAMETER	VALUE	UNITS
Required Shaft Length, including axial play (1)		
Size 220 Shaft Length option	0.220 (+0.015 / -0.020)	in.
Size 500 Shaft Length option	0.500 (+0.015 / -0.020)	in.
Max. Shaft Runout (1)	0.004 T.I.R.	in.
Max. Acceleration	250000	rad/sec²
Max. Hub Moment of Inertia	9.42×10^{-7}	oz-in-s²
Mounting Screw Size	#4-40 x 1/4	in.
Mounting Screw Torque	4 - 6	in-lbs
Mounting Screw Spacing Tolerance	±0.005	in.

(1) For optimum accuracy, the magnetic hub must be fully seated on the shaft and the shaft play must meet the specified axial and radial limits.

(2) The chip that decodes position uses sampled data. There will be fewer readings per revolution as the speed increases. The formula for the number of readings per revolution is given by:
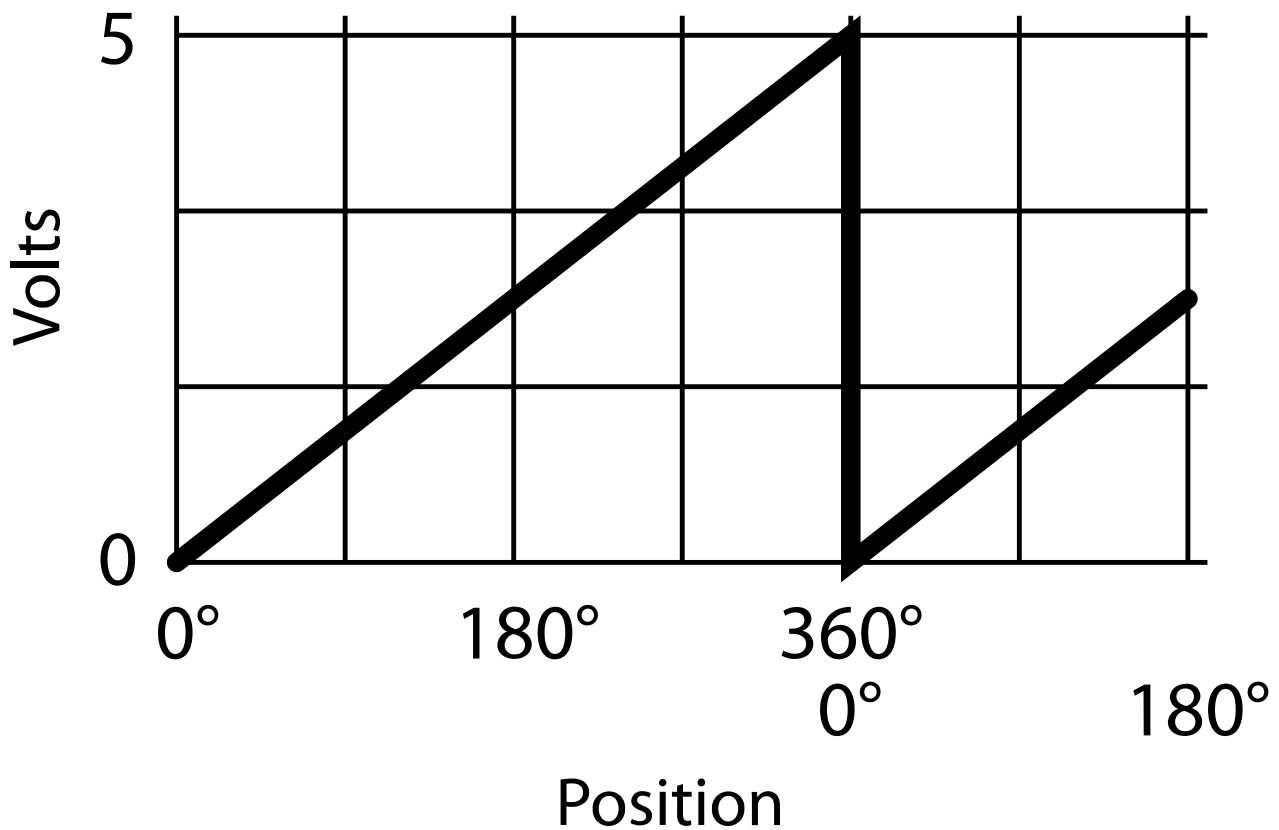
$n = 400000 / rpm$

ELECTRICAL

PARAMETER	MIN.	TYP.	MAX.	UNITS
Power Supply	4.5	5.0	5.5	Volts
Supply Current		6.5		mA
Power-up Time			10	mS

ANALOG OUTPUT OPERATION

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Vcc = 5V

Analog output has 12-bit resolution. The analog output voltage is ratiometric to the power supply voltage, which is typically 5.0V

PARAMETER	MIN.	TYP.	MAX.	UNITS
Position Sampling Rate		6.667		kHz
Propagation Delay		286		µS
Output Noise (1-σ)		0.043		Deg. RMS

Max Output Voltage
  no load
  5k load to GND
  2k load to GND
		
		4.99
		4.97
		4.92
				V

Min Output Voltage
  no load
  5k load to Vcc
  2k load to Vcc
		
		0.010
		0.030
		0.075
				V

Capacitive Load			1000	pF

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PWM OUTPUT OPERATION

To measure the angular position accurately, calculate the position from the duty cycle (t_{on} / (t_{on} + t_{off})) instead of just measuring t_{on} . This will cancel out the effect of the PWM frequency tolerance.

PARAMETER	MIN.	TYP.	MAX.	UNITS
PWM Frequency				Hz
-L option	218	230	242	
-H option	874	920	966	
PWM Duty Cycle	2.9		97.1	%
Position Sampling Rate		6.667		kHz
Propagation Delay		286		µS
Output Noise (1-σ)		0.043		Deg. RMS
Output High Voltage				V
10k load to GND		4.72		
5k load to GND		4.44		
Output Low Voltage				V
10k load to Vcc		0.16		
5k load to Vcc		0.36		
Capacitive Load			1000	pF

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PIN-OUTS

ANALOG OUTPUT (MAE4-A):

PIN	NAME	DESCRIPTION
1	5	+5VDC power
2	A	Analog output
3	G	Ground

PWM OUTPUT (MAE4-H, MAE3-L):

PIN	NAME	DESCRIPTION
1	5	+5VDC power
2	P	PWM output
3	G	Ground

ACCESSORIES

MOUNTING SCREWS

Part #:	SCREW-440-250-PH
Description	4-40 x 1/4" Pan head screw
Quantity Required	2 per encoder

Notes

- Cables and connectors are not included and must be ordered separately.
- US Digital® warrants its products against defects in materials and workmanship for two years. See complete warranty *(https://www.usdigital.com/company/warranty)* for details.

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Configuration Options

MAE4	-	Output	-	Bore Size	-	Shaft Length	-	Bolt Circle	-	Packaging
		A (*Analog*)		118 (*3.0mm*)		220 (*.220″*)		7 (*0.750″*)		B (*Encoders packaged in bulk.*)
		L (*PWM Low*)		125 (*1/8″*)		500 (*.500″*)		12 (*1.280″*)		1 (*Encoders packaged individually.*)
		H (*PWM High*)		157 (*4.0mm*)				18 (*1.812″*)		
				188 (*3/16″*)						
				197 (*5.0mm*)						
				236 (*6.0mm*)						
				250 (*1/4″*)						

PLEASE NOTE: This chart is for informational use only. Certain product configuration combinations are not available. Visit the MAE4 product page *(https://www.usdigital.com/products/MAE4)* for pricing and additional information.