

# MODEL M21

## Incremental Optical Rotary Encoder



- Low cost industrial encoder
- Resolutions to 2,540 cycles/revolution (10,160 counts/revolution)
- Flange or servo mount configurations
- Sealed bearings available for maximum reliability
- Frequency response up to 100KHz all channels
- Small compact size

The Model M21 series is a compact incremental, optical rotary encoder providing a multiple variety of TTL and Amplified Analog outputs at resolutions to 2,540 cycles per shaft revolution. The unit's compact diameter makes it ideal for many limited size applications. The Model M21 is available with either servo mount or flange mount configurations making it appropriate for applications where a low cost, easy to install, totally enclosed optical encoder is required.

Product  
Data  
Sheets

# SPECIFICATIONS

## ELECTRICAL

**Resolution range:**

**Light source:**

**Light sensors:**

**Excitation voltages:**

**Output format:**

**Quadrature specification:**

**Symmetry specifications:**

**Rise and fall times:**

**Frequency response:**

**Phase sense:**

**Pin connections:**

**Output specifications:**

**Wire type:**

**Zero reference angular width:**

**Zero reference alignment:**

- 50 to 2,540 cycles per revolution (10,160 counts per revolution with external 4X counting circuitry).
- Gallium aluminum arsenide LED rated for 100,000 hours MTBF (manufacturer's specification).
- Photodiodes.
- +5Vdc to +15Vdc 250ma (maximum).
- Two count channel outputs (A and B) in phase quadrature with a zero reference (ZR) output.
- $90^\circ \pm 45^\circ$  (at 10KHz output frequency).
- $180^\circ \pm 18^\circ$  (at 10KHz output frequency).
- 1  $\mu$  sec (maximum) into 1,000pf load.
- Up to 100KHz all channels.
- Channel A leads B for counterclockwise rotation of the disc as viewed from the cover side of an installed unit.
- See Table 1.
- See electronic types.
- Units with ribbon cable 28 AWG flat ribbon, units with loose wires 26 AWG, units with shielded cables 26 AWG wires with an overall shield and PVC jacket.
- $1 + \frac{1}{2}$  cycle or  $\frac{1}{2}$  cycle gated depending on electronic configuration.
- Full cycle: Approximately centered on rising edge of Channel A.
- One-half cycle: Aligns with negative transition of Channel B.

## MECHANICAL

**Outline dimensions:**

**Shaft loading:**

**Shaft radial runout:**

**Starting torque at 25°C:**

**Starting angular acceleration:**

**Moment of Inertia:**

**Bearing type:**

**Maximum operating speed:**

**Shaft material:**

**Weight:**

**Connector type:**

- See Figure.
- 10 lbs axially and radially (maximum).
- .001" T.I.R.
- Models with shielded bearings: .1 oz. in.
- Models with sealed bearings: .5 oz. in.
- $10^5$  radian/sec<sup>2</sup> (maximum).
- $4 \times 10^{-4}$  oz/in/sec<sup>2</sup>.
- R-4 sealed or shielded.
- 3,000 RPM (continuous duty) or 100KHz, whichever occurs first.
- 303 stainless steel.
- 4 oz.
- Molex 22-23-2081 or equivalent.

## ENVIRONMENTAL

**Operating temperature range:**

**Storage temperature range:**

**Shock:**

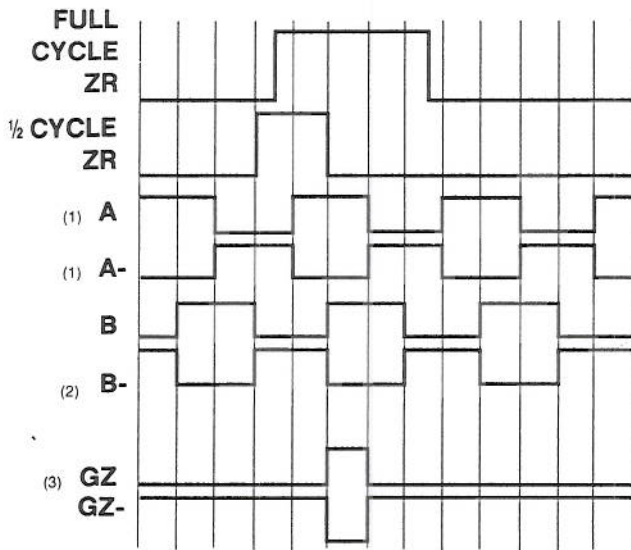
**Vibration:**

**Humidity:**

- 0°C to +70°C (+32°F to +158°F).
- -25°C to +90°C (-13°F to +194°F).
- 50G's for 11 milliseconds duration.
- 20Hz to 2,000Hz at 5G's.
- To 98% R.H. (non-condensing).

**SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE**

## TIMING DIAGRAM



### — NOTES —

- (1) Provided only with line driver, cycle interpolation, or complementary output units
- (2) Provided only with complementary output units
- (3) Provided only with line driver outputs

TABLE 1		
ELECTRICAL CONNECTIONS		
Function	Loose Wire or Cable Colors	Cover Mounted Connector
Channel A+	Orange	PIN 8
Channel A-	Green	PIN 7
Channel B+	Yellow	PIN 4
Channel B-	Blue	PIN 3
Channel ZR+	Brown	PIN 6
Channel ZR-	Grey	PIN 5
Common	Black	PIN 2
+5VDC (5%)	Red	PIN 1

## HOW TO ORDER

**M21AA**



### HOUSING TYPE:

FO = Flange  
SO = Servo



### SUPPLY VOLTAGE:

B = +5VDC  
C = +12VDC  
D = +15VDC



### ZERO REFERENCE:

0 = W/O ZR  
1 = 1/4 cycle  
2 = 1/2 cycle  
4 = Full cycle



### SPECIAL REQUIREMENTS

### CABLE TYPE/CONNECTOR:

B = Loose wires 18"  
C = Shielded cable 18"  
D = Cover/Connector

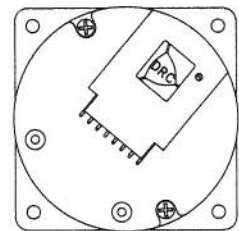
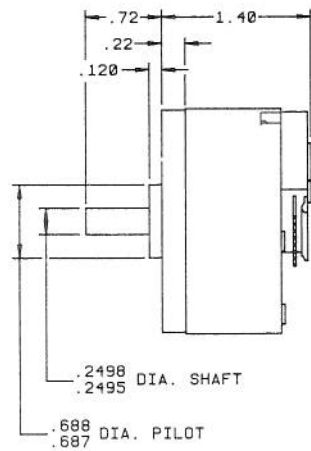
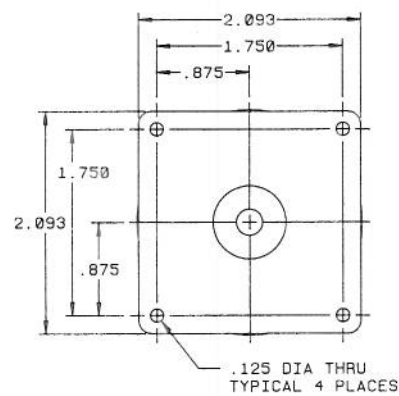
### CYCLES PER SHAFT REVOLUTION (See disc resolution listing)

### ELECTRONICS TYPE:

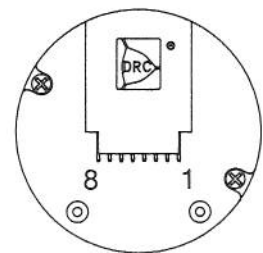
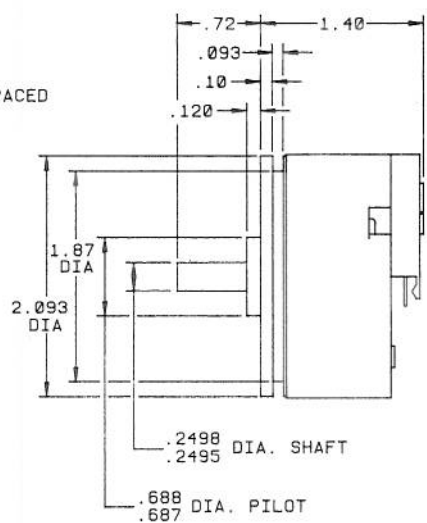
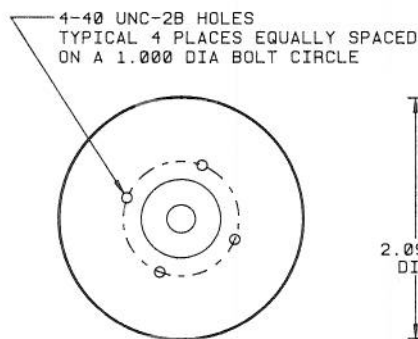
3 = Sq/wave single ended (7404)  
6 = Diff. line driver (RS422)  
7 = Comp sq/wave (7404)  
9 = Analog (see note below)  
D = Sq/wave single ended (7406)  
E = Sq/wave single ended (7406 w/pullup)  
F = Sq/wave single ended (LM339 w/pullup)  
G = Comp sq/wave (7406)  
H = Comp sq/wave (7406 w/pullup)  
NOTE: Internal pullups are 2K resistors on 5V units  
M = Sq/wave single ended (74C14)  
N = Comp sq/wave (74C14)

NOTE: Amplified analog outputs, sq/wave ZR + and - supply voltage required, limited resolutions available, consult factory.

# FLANGE MOUNT



# SERVO MOUNT



TOLERANCES	
.XXX	+.005"
.XX	+.01"