

# Series M21 Modular

- *Modular, Incremental Encoder for Stepper and Small Servo Motor Feedback*
- *Phased Array Sensor Technology Provides High Temperature and Operating Frequency and Allows 0.020" (0.5 mm) of Axial Play*
- *Resolutions to 2048 PPR with Index Standard; Optional 4, 6, 8 or 12 Pole Commutation Tracks for Brushless Servo Motors*
- *Easy Installation and Removal without Special Tools or Parts*



## APPLICATION/INDUSTRY

The Dynapar brand M21 modular encoder provides high-performance, cost effective feedback for stepper and servo motor controls.

## DESCRIPTION

Using industry standard package dimensions, the M21 is easily installed onto the motor without time-consuming adjustments or special tools. Its unique mechanical design automatically centers and gaps the disc during installation.

For Brushless DC (BLDC) servo control, optional 3 phase commutation tracks replace the traditional Hall Effect sensors. These optically-generated signals provide higher accuracy and reliability, improving the performance and reliability of the servo system.

## FEATURES AND BENEFITS

- The M21 design operates up to 120°C. The high temperature plastics, phased array sensor, and low current requirements stabilize the output signals over a wide range of input voltage, ambient temperature, or output frequencies.
- The M21 provides 30 degrees of adjustment to align the signal outputs to the shaft position. Using an industry standard Size 21 modular mounting pattern, the index mark on the disc hub can be coarse aligned to the index sensor position on the housing. The housing rotates to allow further adjustment of the index or fine alignment of the commutation channels to the BLDC motor windings.
- The M21 enclosure is dirt-tight, rated NEMA 1 / IP50. The cover is gasketed to seal the disc and optics from contamination. Additionally, the base can be sealed to the motor for further environmental protection.
- The M21 outputs are protected from short circuits, and operate on 5 or 12 VDC power.

## SPECIFICATIONS

### STANDARD OPERATING CHARACTERISTICS

**Code:** Incremental  
**Resolution:** (pulses/revolution)  
 Incremental: 500 to 2048 PPR  
 Commutation: 4, 6, 8 or 12 pole  
**Accuracy:**  
 Incremental:  $\pm 5$  arc-mins. max. edge to edge;  
 Commutation:  $\pm 6$  arc-mins. max.  
**Sense:** (viewing encoder mounting surface)  
 Incremental: A leads B by 90° for CCW rotation of motor shaft;  
 Commutation: U leads V, V leads W by 120° for CW rotation of motor shaft  
**Phasing:**  
 Incremental: 90°  $\pm 18^\circ$  electrical  
 Commutation: 8 Pole: 30°; 6 Pole: 40°; 4 Pole: 60° mechanical  
 Index to U Channel:  $\pm 1^\circ$  mechanical - Index center to U channel edge  
**Symmetry:**  
 Incremental: 180°  $\pm 18^\circ$  electrical  
 Commutation: 8 Pole: 45°;  
 6 Pole: 60°; 4 Pole: 90° mechanical  
**Index Pulse Width:** 180°  $\pm 36^\circ$  electrical (Gated with B low) standard

### ELECTRICAL

**Input Power Requirements:**  
 Incremental: 5 or 12 VDC  $\pm 10\%$  at 100 mA max. (excluding output load);  
 Commutation: 5 or 12 VDC  $\pm 10\%$  at 75 mA max. (excluding output load)  
**Output Signals:**  
 7272 Line Driver: 40 mA sink/source max.;  
 Open Collector w/2.0 k $\Omega$  pull-ups: 16 mA sink max.  
**Frequency Response:** 200 kHz min.  
**Termination:**  
 Connector: PCB mounted dual row head with 0.1" x 0.1" pin spacing, 10 pins (incremental only), 16 pins (w/commutation); Cable: conductors - 28 AWG, stranded (7/36), insulation - black, PVC; Shield: aluminum/polyester foil plus tinned, copper drain wire (28 AWG, 7/36)  
**Noise Immunity:** Conforms to EN50082-1 Light Industrial for Electro-Static Discharge, Radio Frequency Interference, Electrical Fast Transients, Conducted Interference, and Magnetic Fields (for models or applications with shielded cable)

### MECHANICAL

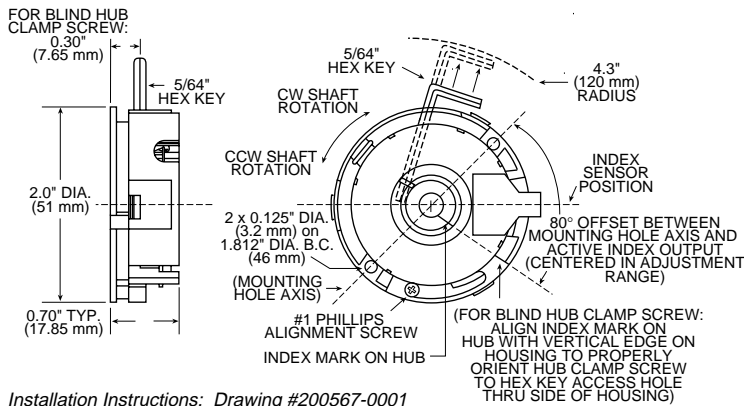
**Weight:**  
 Connector: 1 oz. (28 gm) typ.  
 Connector w/cover: 1.5 oz. (43 gm) typ.  
 Cable: 2.5 oz (71 gm) typ.  
 Cable w/cover: 3 oz. (85 gm) typ.  
**Dimensions:**  
 Outside Diameter: 2.1" (53 mm) max. w/cover, 2.0" (51 mm) max. without cover; Height: 0.8" (20.3 mm) max. (w/cover, excluding connector);  
 Emitter to Detector Gap: 0.070" (1.8 mm) min.  
**Material:**  
 Base, Housing, & Cover: high temperature, glass filled polymer;  
 Hub: Aluminum; Disk: 0.030" thick glass  
**Finish:**  
 Base & Housing: black;  
 Cover: RAL 7010 (dark grey)  
**Moment of Inertia:** 6.64 x 10<sup>-5</sup> in-oz sec.<sup>2</sup> (4.7 gm-cm<sup>2</sup>)  
**Hub Diameters:** 1/4", 3/8", 7/16", 1/2", 6 mm, 8 mm, 10 mm, 12 mm nominal  
**Hub Dia. Tolerance:** +0.001"/-0.000" (+0.026 mm/-0.000 mm)  
**Mating Shaft Length:** 0.45" (12 mm) min. blind hub clamp screw, 0.65" (16.5 mm) exposed hub clamp screw; 0.75" (19 mm) max. inside cover  
**Mating Shaft Runout:** 0.002" (0.05 mm) max. (Includes shaft perpendicularity to mounting surface)  
**Mating Shaft Endplay:** +0.005"/-0.015" (+0.13 mm/-0.38 mm) nominal ("+" indicates away from mounting face)  
**Mounting:**  
 Base: (2) #4-40 (M2.5) #1 Phillips fillister head cap screw on 1.812" (46 mm) B.C., 0.01" (0.254 mm) true position to shaft; Shaft: split hub w/ collar clamp, #2-56 hex socket cap screw (5/64" hex wrench included)  
**Electrical/Mechanical Alignment Range:**  $\pm 15^\circ$  mechanical  
**Acceleration:** 100,000 rad/sec.<sup>2</sup> max.  
**Velocity:** 12,000 RPM max.

### ENVIRONMENTAL

**Operating Temperature:** -40° to 120°C  
**Storage Temperature:** -40° to 85°C  
**Shock:** 50 G's for 11 msec duration  
**Vibration:** 2.5 G's at 5 to 2000 Hz  
**Relative Humidity:** 90% non-condensing  
**Enclosure Rating:** NEMA 1 / IP50 dirt-tight (for models with cover)

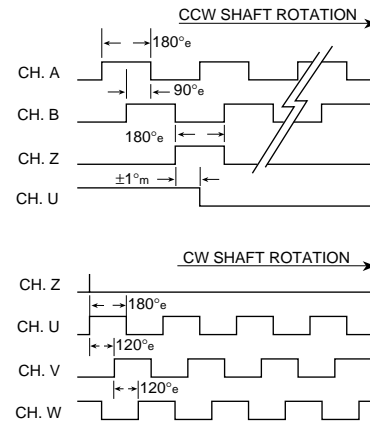
# Series M21 Modular

## Dimensions/Installation



Installation Instructions: Drawing #200567-0001  
Alignment Instructions: Drawing #200567-0002

## Output Waveforms (For clarity, compliments are not shown.)



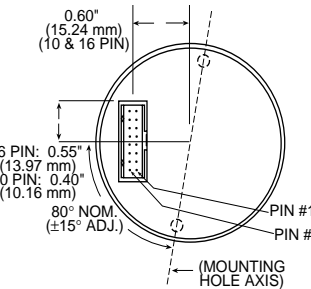
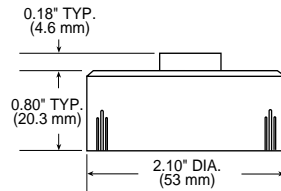
## Code 6: Terminations (Not all signals present on all models)

### 0: Pin Header

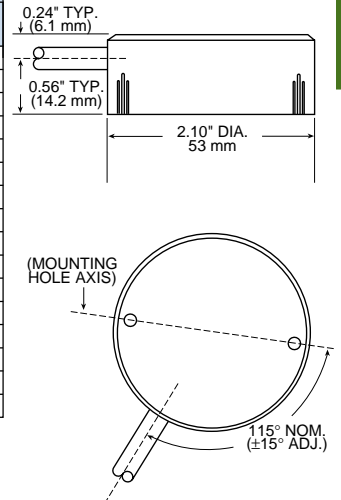
### 1-8: Ribbon Cable

### A-H: Shielded Cable

Pin	O.C.	L.D.	
1	A	—	Vcc com
2	Vcc	Vcc	Vcc Inc
3	GND	GND	GND Inc
4	—	—	GND com
5	—	A'	A'
6	—	A	A
7	—	B'	B'
8	B	B	B
9	—	Z'	Z'
10	Z	Z	Z
11	—	—	U'
12	—	—	U
13	—	—	V'
14	—	—	V
15	—	—	W'
16	—	—	W



Function	Incr. Only	Incr. & Comm.
*Vcc com	—	RED/WHT
Vcc	RED	RED
GND	BLK	BLK
*GND com	—	BLK/WHT
A'	RED/BLK	BLU/BLK
A	GRN	BLU
B'	WHT/BLK	GRN/BLK
B	ORN	GRN
Z'	BLU	VIO/BLK
Z	WHT	VIO
U'	—	BRN/BLK
U	—	BRN
V'	—	GRY/BLK
V	—	GRY
W'	—	WHT/BLK
W	—	WHT



Mating Cable Assembly:  
10 pin, 109524-000x  
16 pin, 109523-000x  
x= length in feet

\*Connection is only available when "Code 4: Electrical" of the model number is equal to "7". See Ordering Information.

## Ordering Information

To order, complete the model number with code numbers from the table below:

Code 1: Model	Code 2: PPR, Poles	Code 3: Cover	Code 4: Electrical	Code 5: Hub	Code 6: Termination
<b>M21</b>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> / <input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

### Ordering Information

M21	Size 20 Commutating Modular	Incremental channels only	0 No cover	0 5V in, open collector out incremental only	Blind hub clamp screw:	0 Pin Header
		0500/0 1024/0 0512/0 2000/0 1000/0 2048/0	1 Enclosed, end-of-shaft mount	1 12V in, open collector out incremental only	0 1/4 in. 1 3/8 in. 2 7/16 in. 3 1/2 in. 4 6 mm 5 8 mm 6 10 mm 7 12 mm	1-8 Mating ribbon cable included; 1=1 ft., 2=2 ft., etc.
		Incremental plus Commutation channels	2 Through shaft	3 5V in, line driver out incremental only	Exposed hub clamp screw:	Available when Code 4 is 3 or higher:
		0500/† 2000/† 1000/† 2048/† 1024/†		Available when Code 2 is XXXX/4, XXXX/6, XXXX/8, XXXX/C	A 1/4 in. B 3/8 in. C 7/16 in. D 1/2 in. E 6 mm F 8 mm G 10 mm H 12 mm	A-H Shielded cable; A=1 ft., B=2 ft., etc.
		† Available with 4, 6, 8 or 12* pole (12 pole is designated by character "C") Examples: 1024/8 is 1024PPR, 8 pole; 2000/C is 2000PPR, 12 pole		6 5V in, line driver out incr.; 5V in, open collector out comm. 7 5V in, line driver out incr.; 5-12V in, open collector out comm. 9 5V in, line driver out incr.; 5V in, line driver out comm.		