

Series M21



- **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, or 8 Pole Commutation Tracks for Brushless Servo Motors**
- **Easy Installation and Removal without Special Tools or Parts**

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

Dynapar Exclusive: 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.

Dynapar Exclusive: 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.

Dynapar Exclusive: 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.

Dynapar Exclusive: The M21 outputs are protected from short circuits, and operate on 5 or 12 VDC power.

SPECIFICATIONS

Electrical

Code: Incremental

Resolution: (pulses/revolution)
Incremental: 500 to 2048 PPR
Commutation: 4, 6 or 8 pole

Accuracy:
Incremental: ± 5 arc-mins. max. edge to edge;
Commutation: ± 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

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: 20 mA sink/source max.;
Open Collector w/2.0 k Ω 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 10⁻⁵ in-oz sec.² (4.7 gm-cm²)

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.² max.

Velocity: 12,000 RPM max.

Environmental

Operating Temperature: -40° to 120°C

Storage Temperature: -40° to 85°C

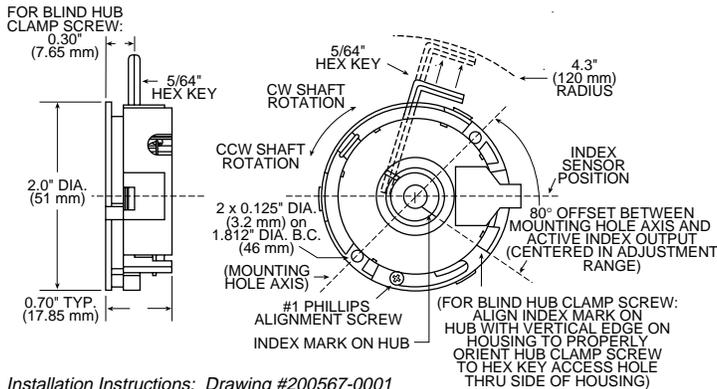
Shock: 50 G's for 11 msec duration

Vibration: 2.5 G's at 5 to 2000 Hz

Relative Humidity: 90% non-condensing

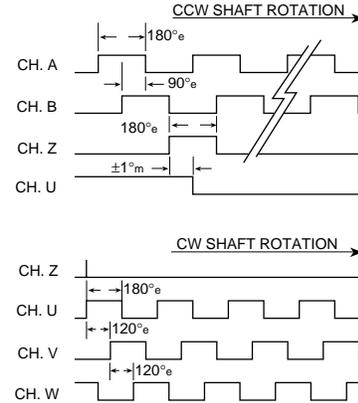
Enclosure Rating: NEMA 1 / IP50 dirt-tight (for models with cover)

Dimensions/Installation



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

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



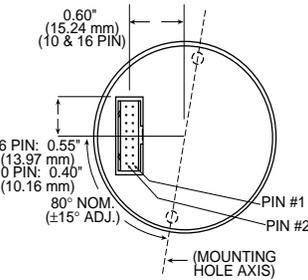
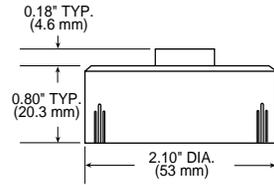
Code 6: Terminations (Not all signals present on all models)

0: Pin Header

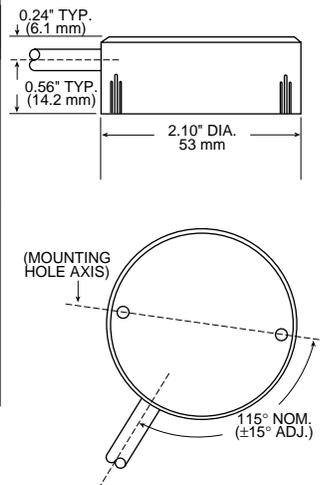
1-8: Ribbon Cable

A-H: Shielded Cable

Pin	10 Pin		16 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	Wire Color	
	Incr. Only	Incr. & Comm.
Vcc com	—	RED/WHT
Vcc Inc	RED	RED
GND Inc	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

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
M21	<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 1 Enclosed, end-of-shaft mount 2 Through shaft	0 5V in, open collector out incremental only 1 12V in, open collector out incremental only 3 5V in, line driver out incremental only Available when Code 2 is XXXX/4, XXXX/6, or XXXX/8 6 5V in, line driver out incr.; 5V in, open collector out comm. 7 5V in, line driver out incr.; 12V in, open collector out comm. 9 5V in, line driver out incr.; 5V in, line driver out comm.	Blind hub clamp screw: 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 Exposed hub clamp screw: 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	0 Pin Header
		0500/0	1024/0				0512/0
		Incremental plus Commutation channels					Available when Code 4 is 3 or higher: A-H Shielded cable; A=1 ft., B=2 ft., etc.
		0500/4	1024/4				
		0500/6	1024/6				
		0500/8	1024/8				
		0512/8	2000/4				
			2000/6				
		1000/4	2000/8				
		1000/6	2000/8				
		1000/8	2048/4				
			2048/6				
			2048/8				