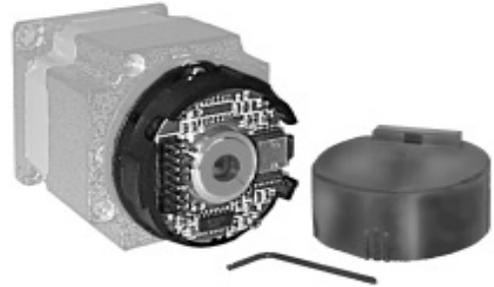


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Encoder Installation Manual

Dynapar™ brand**SERIES M21****Modular Encoder****Document No.:** 702209-0001**Revision Level:** J**October 24, 2016**

DESCRIPTION

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: 2, 3, or 4 PPR

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° ±18° electrical

Commutation: 8 Pole: 30°; 6 Pole: 40°;

4 Pole: 60° mechanical

Index to U Channel: ±1° mechanical - Index center to U channel edge

Symmetry:

Incremental: 180° ±18° electrical

Commutation: 8 Pole: 45°;

6 Pole: 60°; 4 Pole: 90° mechanical

Index Pulse Width: 180° ±36° electrical (Gated with B low) standard**Input Power Requirements:**

Incremental: 5 or 12 VDC ±10% at 100 mA max.

(excluding output load);

Commutation: 5 or 12 VDC ±10% at 75 mA max.

(excluding output load)

Output Signals:

ET7272 Line Driver: 40 mA sink/source max.;

Open Collector w/2.0 kΩ 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. with 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:** ±15° 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% noncondensing**Enclosure Rating:** NEMA 1 / IP50 dirt-tight (for models

with cover)

Getting Started

Installing your M21 is a fast, easy process. The package contents include the M21, one Allen wrench, mounting screws, and documentation. This, plus a number 0 Phillips screwdriver, is all that will be required for installations that do not use the commutation track feature.

If commutation tracks are used, a two channel oscilloscope and a fixture that can drive the target motor/encoder assembly will also be required for final alignment. Specific motor information supplied by the motor manufacturer may be required.

Note: Illustrations may differ from your specific model. Instructions provided cover all models of Dynapar Series M21 Modular Encoders.

A Package Contents

Check packaged items:

1. M21 Encoder
2. Cover (optional)
3. Mounting Screws (2)
4. Allen Wrenches (1)
5. Documentation



B Required Tools

For all installations:

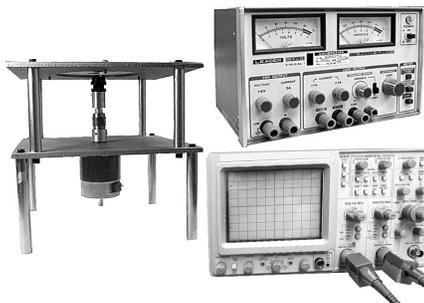
1. Number 0 Phillips Screwdriver
2. Provided Allen Wrench



C Additional Tools

For installations using commutation tracks only:

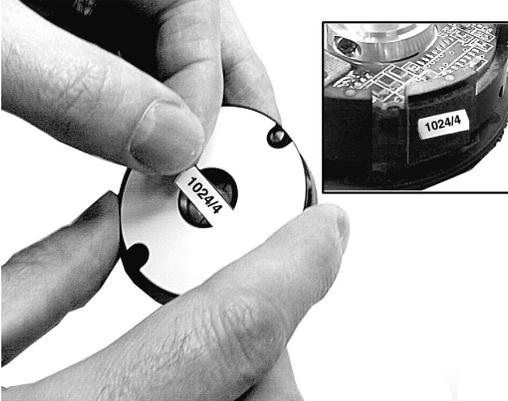
1. Motor drive fixture
2. Two channel oscilloscope
3. DC power supply



1 Preliminary Step

Remove center label:

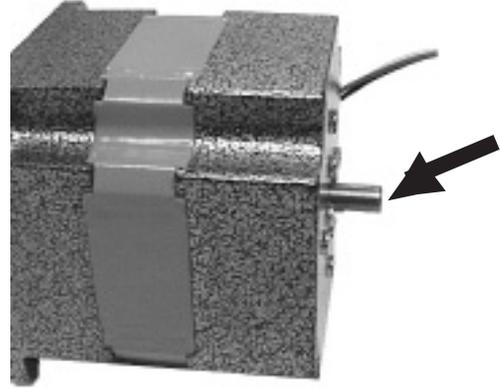
Carefully detach the center label as shown. The label contains information about the PPR of the encoder. For future reference, it should be attached to the unit's side body or cover



2 Prepare Motor

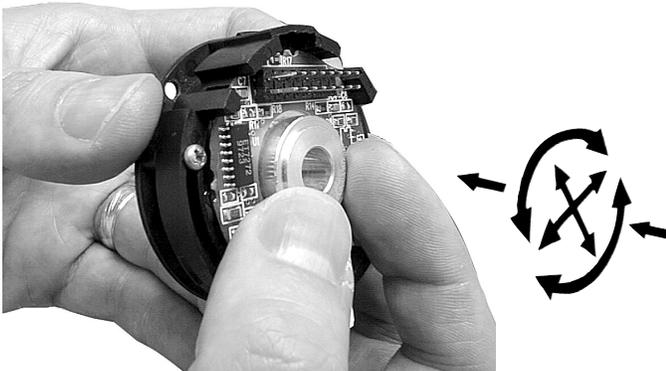
Locate mounting area:

Locate stub shaft and tapped holes where encoder is to be attached. Be sure shaft is of sufficient length to extend into hub clamping area (see specifications).



3 Center Hub

Important:



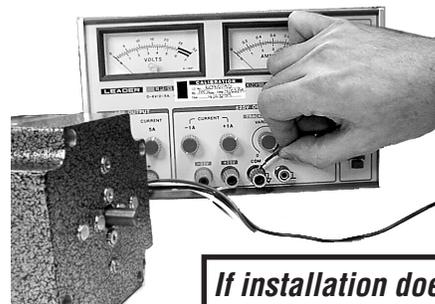
In preparation for mounting the M21 encoder on a motor, the center hub assembly must be centered properly. Press inward on the hub while moving in all directions to be sure hub is fully seated. Once centered, maintain inward pressure on the hub and proceed to the next step.

4 For Use with Commutation Tracks Only

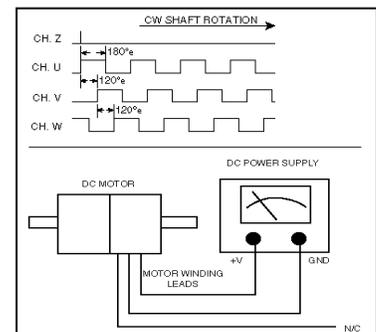
Electrically lock motor's rotor:

The manufacturer of the motor should be consulted regarding the rotor locking procedure.

Voltage should remain on through step 9a.



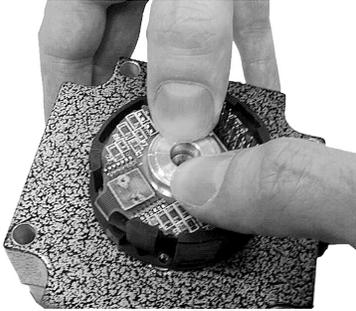
If installation does not utilize commutation tracks, skip this step



5 Mount Encoder

Set hub over motor shaft:

While holding hub in position, slide encoder over motor shaft. Confirm that encoder through-holes match tapped holes on motor.



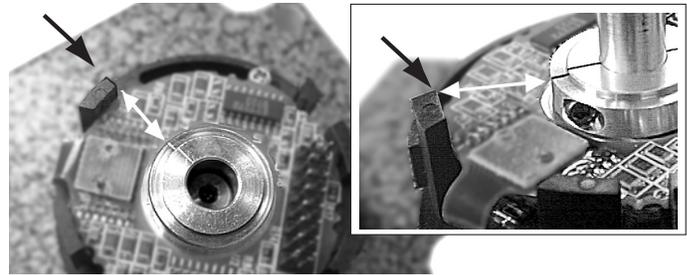
6 Index Alignment

Align index mark:

Turn hub until clamp slit or index scribe mark is in line with edge of housing post as indicated. Note difference for “*exposed hub clamp*” and “*blind hub clamp*” models.

Blind Hub
Clamp Models

Exposed Hub
Clamp Models



7 Tighten Hub Clamp

Determine hub clamp type:

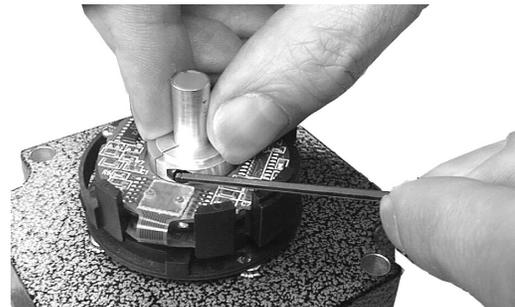
M21 encoders are available with exposed (step 7a) or blind (step 7b) hub clamp screws.

For exposed hub clamp screw, go to step 7a.
For blind hub clamp screw, go to step 7b.

7a Exposed Hub Clamp

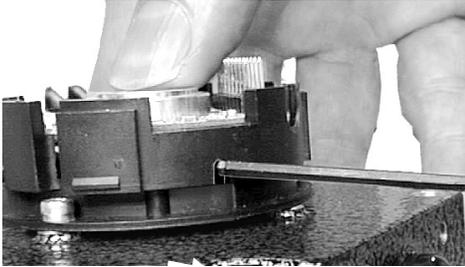
Use provided Allen wrench:

Hold the hub seated in the base and tighten the clamp screw to 3 lb – in (34 N – cm). Take care not to rotate hub from aligned position.

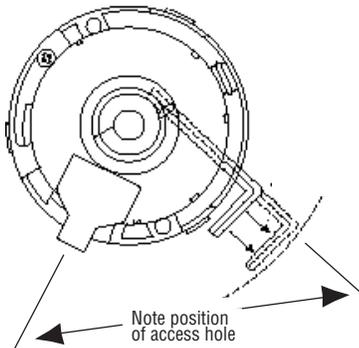


7b Blind Hub Clamp

Use provided Allen wrench:
Hold the hub seated in the base. Place wrench through hole at angle indicated and tighten the clamp screw to 3 lb – in (34 N – cm). Take care not to rotate hub from aligned position.



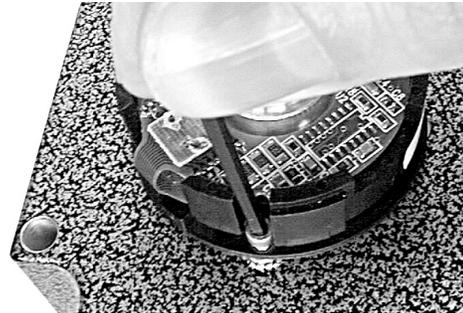
Important



Insert wrench at angle shown above and keep wrench parallel with base

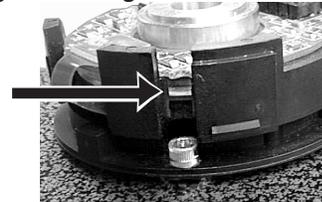
8 Insert Mounting Screws

Insert screws and tighten with Phillips screwdriver to 2 lb-in (23 N-cm).



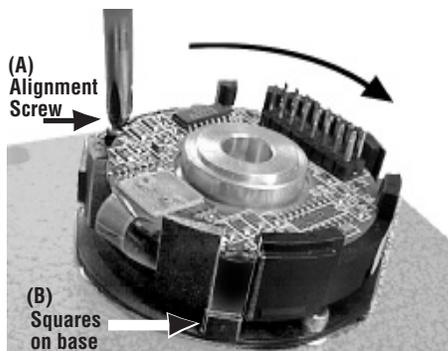
CAUTION

Take care not to contact the edge of the internal disk while inserting and tightening mounting screws.



9 Unlock Hub

Use Phillips screwdriver:
Loosen the alignment screw (A) (1/4 turn CCW). Rotate encoder housing clockwise 30° until housing slots are aligned with squares on base (B).



9a Unlock Hub

Next Step:

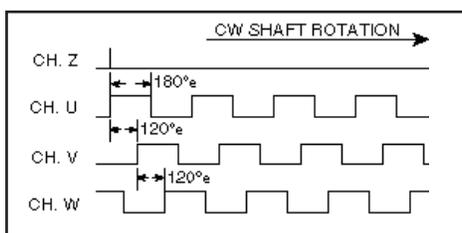
If commutation tracks are used, do not tighten alignment screw, remove power connection from the motor and proceed to step 10

If commutation tracks are not used, tighten alignment screw to 2 lb – in (23 N – cm) and proceed to step 13.

10 For Use with Commutation Tracks Only

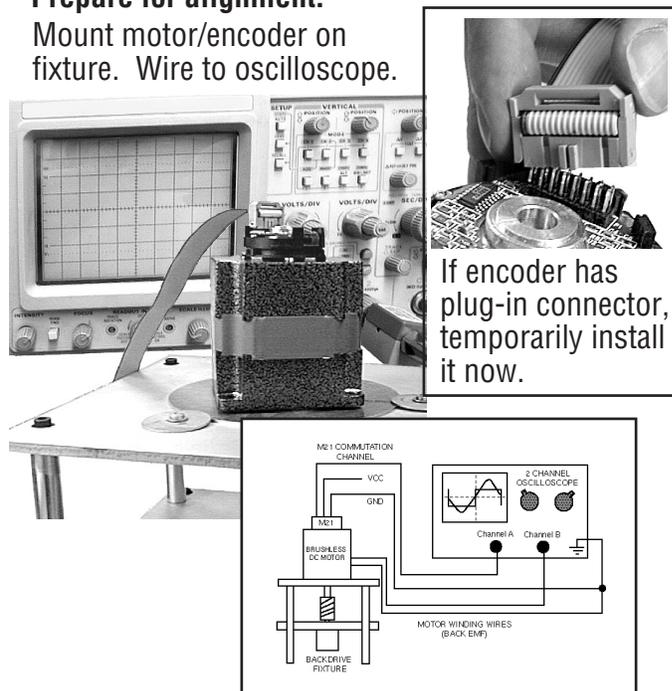
Alignment Theory: In Step 6, the physical position of the encoder's index was set to provide an approximate electrical output as shown in the figure below. Note that the rising edge of Channel U will occur simultaneously with the index output, Channel Z.

Step 11 details the fixture and oscilloscope procedure which allows final precise alignment to be made. It is important that the motor phase that requires synchronization with Channel U is connected to the scope. The specific wire identification varies among motor types.



11 For Use with Commutation Tracks Only

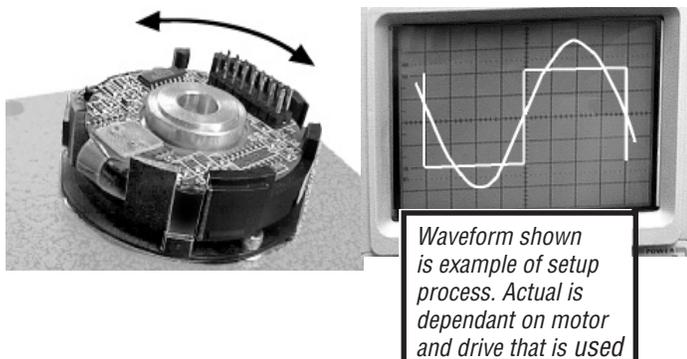
Prepare for alignment:
Mount motor/encoder on fixture. Wire to oscilloscope.



12 Scope Alignment of Commutation Tracks

Calibrate waveform:

With fixture spinning motor and the encoder powered up, rotate the encoder housing to achieve the waveforms as indicated on scope photo. The sinewave is from the motor winding back-EMF, the squarewave is from encoder's commutation channel. When completed, tighten alignment screw to 2 lb – in (23 N – cm), remove all connections and proceed to step 13.



13 Install Cover

**Snap On -
No Tools Required:**

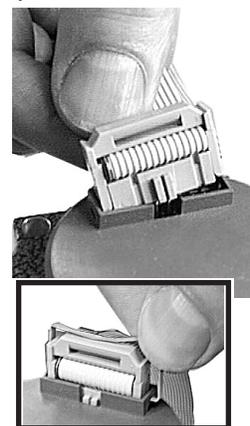
Position cover in line with cable or connector egress. Line up molded rails with body channels. Press down firmly until 3 snaps engage. May be removed by squeezing ribbed area and pulling up.



14 Cable Plug

For models so equipped:

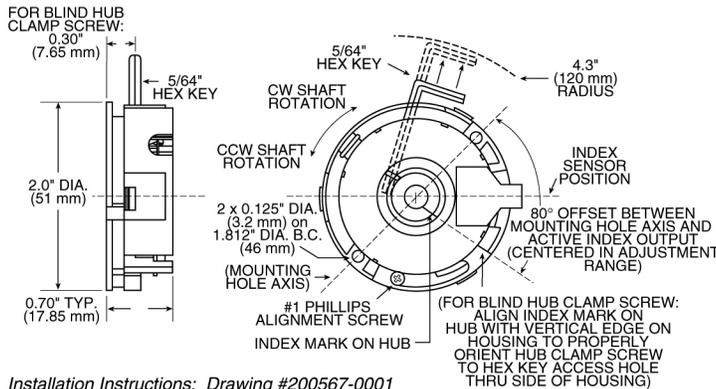
Carefully line up pins and guides and press firmly into place. Secure with clip provided.



Note: Illustrations may differ from your specific model. Instructions provided cover all models of Dynapar Series M21 Modular Encoders.

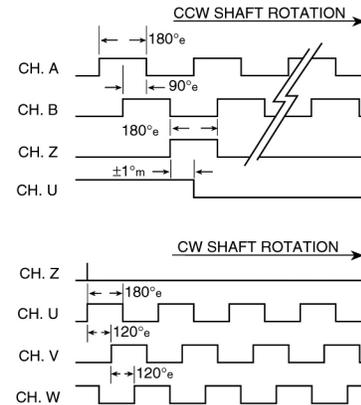
Series M21 Modular

Dimensions/Installation



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

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



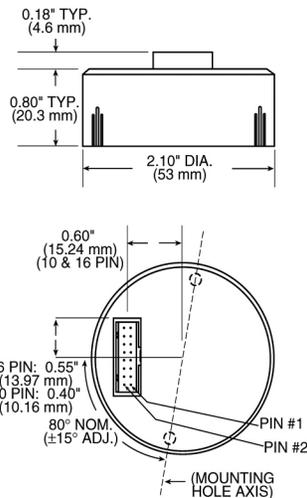
Code 6: Terminations (Not all signals present on all models)

0: Pin Header

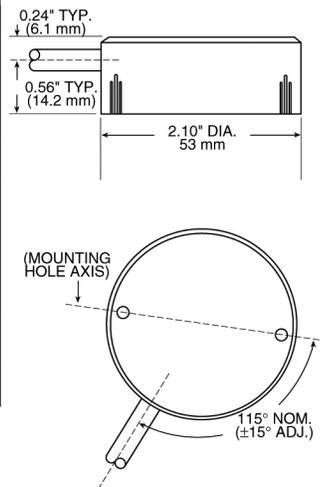
1-8: Ribbon Cable

A-H: Shielded Cable

Pin	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="text"/>				

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	1 3/8 in.	1-8 Mating ribbon cable included; 1=1 ft., 2=2 ft., etc.
		Incremental plus Commutation channels 0500/† 2000/† 1000/† 2048/† 1024/†	2 Through shaft	3 5V in, line driver out incremental only	2 7/16 in.	Available when Code 4 is 3 or higher:
		† 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		Available when Code 2 is XXXX/4, XXXX/6, XXXX/8, XXXX/C	3 1/2 in.	A-H Shielded cable; A=1 ft., B=2 ft., etc.
				6 5V in, line driver out incr.; 5V in, open collector out comm.	4 6 mm	
				7 5V in, line driver out incr.; 12V in, open collector out comm.	5 8 mm	
				9 5V in, line driver out incr.; 5V in, line driver out comm.	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	