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# Encoder Instructions

**M56/M56S THIN-LINE™**  
**INACTIVE DESIGN**  
 Replaced by Model **AV56/AV56S**

4 1/2" C-FACE MOUNT, MODULAR

## DESCRIPTION

The Avtron M56 is a modular, two piece incremental encoder (also known as a tachometer or a rotary pulse generator). It provides a two phase, A Quad B frequency (pulse) output, with complements.

Because the M56 is modular, there are no bearings or couplings required. This, combined with the latest magneto-resistive (MR) sensor technology, allows the M56 to provide superior mechanical performance and increased reliability.

An Avtron M56 can be configured with one or two independent outputs. Each output has six signals: (A, B) 90° out of phase, with complements ( $\bar{A}$ ,  $\bar{B}$ ). A marker pulse with complement ( $Z$ ,  $\bar{Z}$ ) is also provided.

## INSTALLATION

Refer to the back page of these instructions for outline and mounting dimensions. The motor must comply with 1998 NEMA MG 1, section 4, for tolerances on diameters and runout for shafts and accessory faces. Axial float or end-play must be less than  $\pm 0.050$ ".

In preparation for installing the Model M56 encoder, it is first necessary to clean both the accessory motor shaft and the mounting face. These surfaces must be inspected and any paint, burrs, or other surface imperfections removed.

Installation procedures should be performed only by qualified personnel. Safety precautions must be taken to ensure machinery cannot rotate and all sources of power are removed during installation.

## Equipment Needed for Installation

Provided	Optional	Not Provided
M56 Stator/Housing M56 Shaft Cover Socket Head Cap Screw 3/8"-16 x 0.875" (4) M56 Rotor Socket Set Screw #8-32 x 0.19" (2) or Pre-Installed Cam Screw Rotor Locator Gauge Thread Locker (blue) Anti-Seize Compound (copper)	Extended Shaft Cover w/ Screws #6-32 x 0.31" (4), lock washers Thru Shaft Cover w/ V-Ring Seal and Silicone Lubricant	Phillips Screwdriver Flat Blade (Std.) Screwdriver 5/64" Hex Wrench (T-Handle Style for Std. Thru-Shaft Rotors) 1/8" Hex Wrench (T-Handle Style for Cam Screw Rotors) 5/16" Hex Wrench (T-Handle Style for Stator/Housing)

## STANDARD THRU SHAFT ROTOR INSTALLATION

The motor shaft must project at least 0.63" from the motor face. Apply anti-seize compound to the motor shaft. Apply thread locker to the rotor set screw holes, preferably from the inside of the bore. Slide the rotor onto the shaft with the P/N marking facing out (away from the motor face). The rotor centerline must match the sensor centerline. To accomplish this, use the Rotor Locating Gauge and slide the rotor onto the shaft until it is in the proper position as shown in Figure 1. Tighten the rotor set screws to 15 in-lb using the 5/64" T-handle hex wrench.

## CAUTION

**Use only a T-handle or torque hex wrench to tighten set screws; using a right angle wrench will not provide enough holding force, and the rotor may slip.**

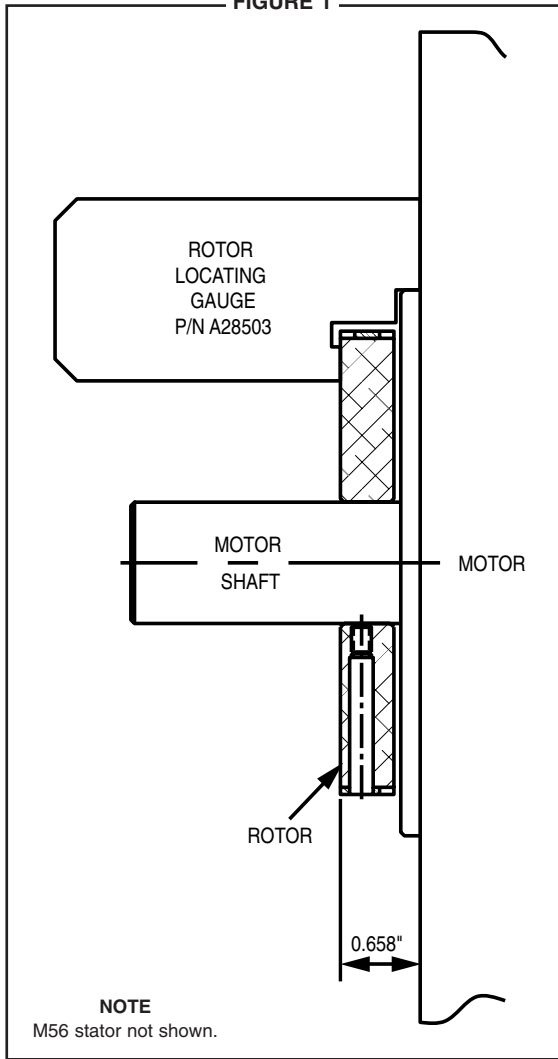
## M56/M56S PART NUMBERS AND AVAILABLE OPTIONS

Model	Housing Type	Shaft Size (Thru Shaft Rotor)	Cover Style	Line Driver	Single/Left Output	Right Output	Connector	Modifications
M56 M56S~	1- Single Output, 4.500 Pilot 2- Dual Output, 4.500 Pilot**	- None J- 1.625 0- Non- K- 1.750 Standard L- 1.875 Shaft Size M- 2.000 2- 10mm N- 2.125 3- 12mm Q- 2.250 A- 0.500 8- 60mm B- 0.625 P- 2.375 5- 19mm R- 2.500 C- 0.875 S- 2.625 D- 0.938 T- 70mm* E- 1.000 U- 2.875 F- 1.125 V- 3.000* G- 1.250 4- 3.125* H- 1.375 7- 3.188* I- 1.500 6- 85mm*	X- None E- Extended Shaft Cover F- Flat Cover T- Flat Thru- Hole Cover with Shaft Seal	1- 5 to 24 VDC 2- 5 to 15 VDC 4- 5 to 24 VDC, 5v out	A- 128 PPR B- 256 PPR C- 512 PPR D- 1024 PPR E- 2048 PPR F- 120 PPR G- 240 PPR H- 480 PPR I- 960 PPR L- 600 PPR M- 1200 PPR	X- None A- 128 PPR B- 256 PPR C- 512 PPR D- 1024 PPR E- 2048 PPR F- 120 PPR G- 240 PPR H- 480 PPR I- 960 PPR L- 600 PPR M- 1200 PPR	P- 10 Pin EPIC Industrial w/ Plug Q- 18" Flex. Cable w/ Ind. Connector w/ Plug & w/ Adapter Block W- 3 Ft. Flexible Cable, Sealed Z- 3 Ft. Flexible Cable w/ EPIC Industrial	000- No Modification 004- Drain Hole (single output only) 006- Right Angle Cable Bushing 009- No Paint 010- Cam Screw Rotor* 013- Cam Screw 150°C Rotor* 9xx- Special Cable Length, xx=length in feet

~ Stainless Steel  
 \*\* Not Available on M56S

\* Cam Screw Rotors US sizes  
 only, 2.875" max., N/A M56S

FIGURE 1

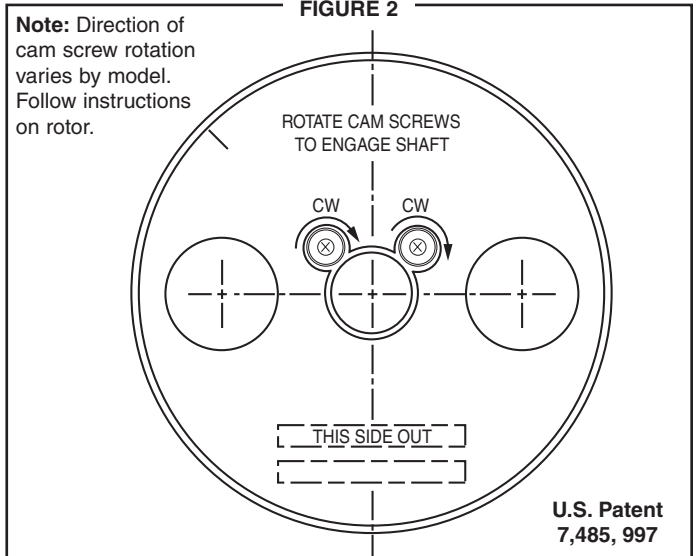


**CAM SCREW ROTOR INSTALLATION**

(Modification options 010 & 013)

For high slew rate applications where the motor is accelerating and/or decelerating often, Avtron offers an optional Cam Screw rotor. To install the Cam Screw rotor, apply anti-seize compound to the motor shaft, then slide the rotor onto the shaft until it is in the proper position as indicated by the Rotor Locating Gauge (Figure 1). Tighten the locking cam screws in the direction indicated next to the screw (cw/ccw) using 4-6 ft-lbs of torque using the 1/8" T-handle hex wrench (Figure 2). To ensure torque on small shafts that turn easily, two 1/8" hex wrenches may be used at the same time, or the finger-holes may be used.

FIGURE 2



**SPECIFICATIONS**

**ELECTRICAL**

- A. Operating Power (Vin) (See Line Driver Options)
  - 1. Volts.....5-24 VDC (option 1 & 4), 5-15 VDC (option 2)
  - 2. Current.....60mA, each output, no load
- B. Output Format
  - 1. 2Ø & Comp .....A,Ā, B,Ē (differential line driver)
  - 2. Marker.....1/Rev Z, Z̄
- C. Signal Type.....Incremental, Square Wave, 50 ±10% Duty Cycle.
- D. Direction Sensing.....ØA leads ØB for CW rotation as viewed from the back of the tach looking at the non-drive end of the motor.
- E. Transition Sep.....15% minimum
- F. Frequency Range:.....0 to 150,000 Hz
- G. PPR.....120-2048
- H. Line Driver Options:..... See table
- I. Connectors:..... See connector options on page 1

**MECHANICAL**

- A. Rotor Inertia: .....0.04 Oz. In. Sec.<sup>2</sup>
- B. Acceleration:.....5000 RPM/Sec. Max.
- C. Speed: .....5000 RPM Max.
- D. Weight: .....2.5 to 4 lbs. [1.13 to 1.81 kg.]
- E. Sensor to Rotor
  - Air Gap (nominal): .....0.030"
  - Tolerance:.....±0.015"

**ENVIRONMENTAL**

Solid cast aluminum stator and rotor  
 Fully potted electronics, protected against oil and water spray  
 Use "W" cable option for IP66/67 applications  
 V-Ring seals provided on though shaft covers  
 Operating Temperature: ..... -40 to 100°C (150°C rotor optional),  
 0-100% condensing humidity

**LINE DRIVER OPTIONS**

	Output Options		
	1	2	4
Voltage Input (Vin)	5-24 VDC	5-15 VDC	5-24 VDC
Output High (Volts)	(Vin) -2 (typ)	(Vin) -1 (typ)	5 VDC
Output High (milliamps)	80 (max.)	80 (avg.), 1500 (peak)	80 (max.)
Output Low (Volts)	0.5 (typ)	0.5 (typ)	0.5 (typ)
Output Low (milliamps)	80 (max.)	80 (avg.), 1500 (peak)	80 (max.)
Protection	Reverse Voltage, Transient, Short Circuit (high & low)	Reverse Voltage, Transient	Reverse Voltage, Transient, Short Circuit (high & low)
Maximum Cable Drive(Feet)	1000 ft. @ 5 V 500 ft. @ 12 V 200 ft. @ 24 V	2000 ft.	1000 ft. @ 5 V

**CAUTION**

Do not adjust the cam screws before motor shaft mounting; bottoming out the screws, or backing them out excessively, can lead to insufficient shaft holding force. Thread Locker is preapplied on the cam screws.

**STATOR HOUSING INSTALLATION**

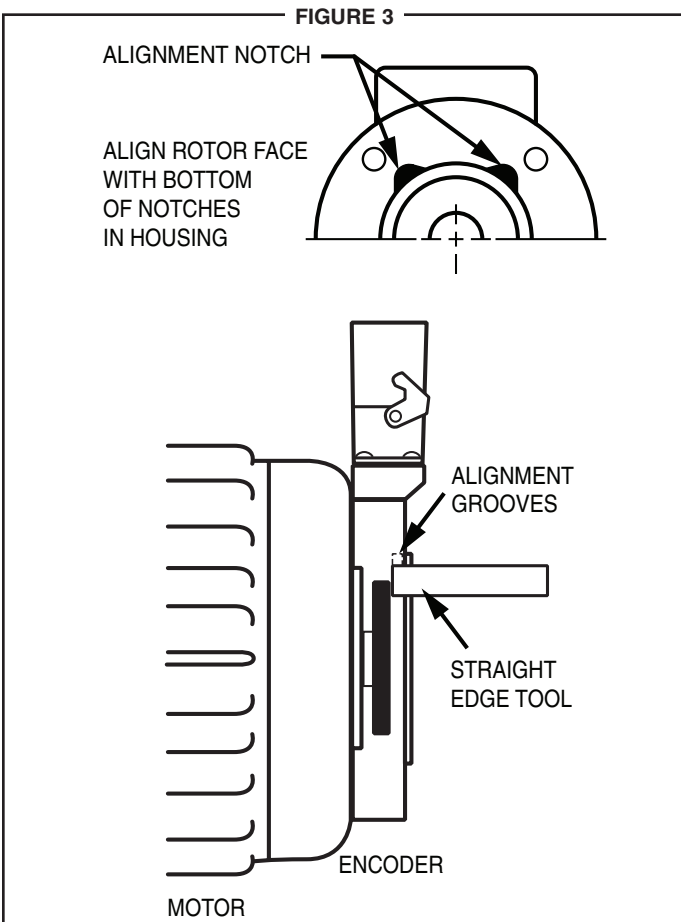
The stator housing is attached to the motor using four socket head cap screws 3/8-16 x 1" long, locating on a 5.875" bolt circle. Longer bolts, (not included), are required for sandwich installation between a motor and a brake. Install the four mounting bolts using thread locker and torque to approximately 20 to 30 foot pounds using the 5/16" T-handle hex wrench.

**VERIFY ROTOR LOCATION**

To ensure the rotor is properly located on the shaft: remove the back cover if factory-preinstalled, and verify that the outer face of the rotor is at the same depth as the alignment grooves, using a straight edge tool. (Figure 3)

**CAUTION**

Do not use silicone sealants or caulk of any kind on the motor or encoder face; these can cause misalignment or sensor scraping damage. The M56 electronics are fully sealed; water may enter and leave the rotor area as needed. A drain hole option is available if frequent moisture buildup is expected.



**COVER INSTALLATION**

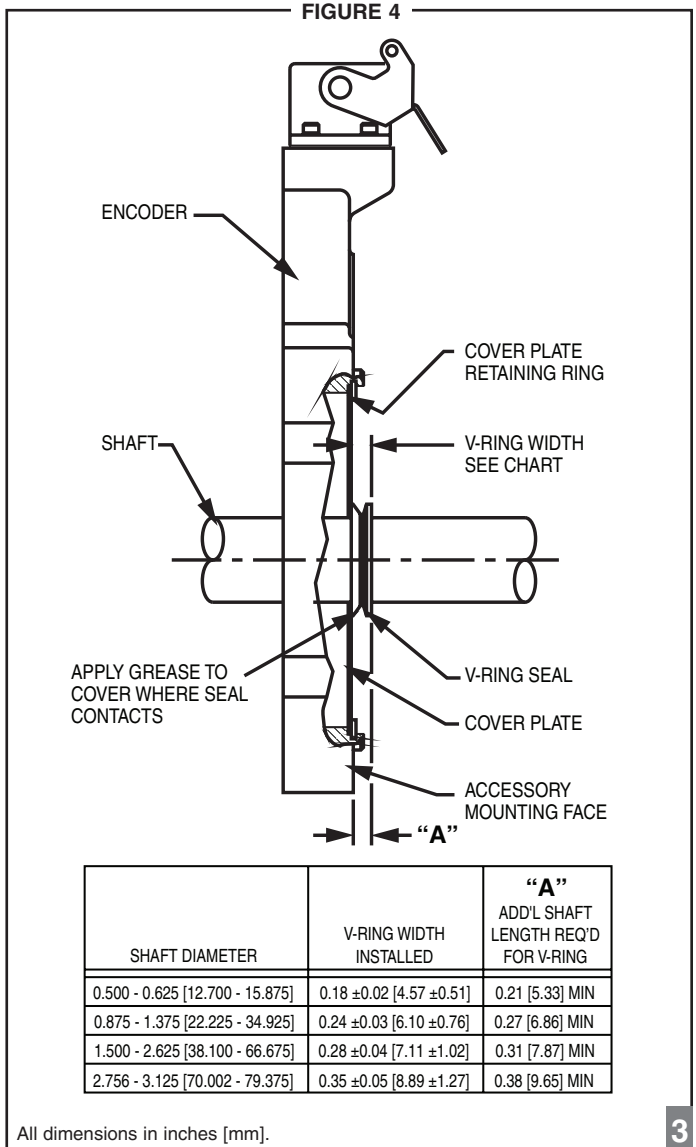
Covers must not interfere with the motor shaft or rotor. The longest shaft that can be used without interfering is 0.69" with a standard flat cover (Cover Style option "F") and 2.5" with an extended "pie pan" cover (Cover Style option "E"). Through shaft covers with seals are available for "sandwich" style applications (Cover Style option "T").

**EXTENDED COVER MOUNT (Cover Style option "E")**

The extended cover mounts to the encoder housing using quantity 4 #6-32 x 0.31" screws, lock washers, and thread locker.

**THRU SHAFT AND FLAT COVER INSTALLATION (Cover Style options "T" and "F")**

The housing has a machined step in the outboard face to accept the cover and a recessed groove for the retaining ring. Insert the cover, smooth side facing out, fully into the machined step until it seats against shoulder. Using a spiral assembly method, install the retaining ring by first inserting the squared off end into the machined groove. Flex the ring and insert it into the groove walking it around the perimeter (A flat blade screwdriver can be used). Final position should have the ring fully seated into groove. Remove the cover by reversing above procedure, starting with the tang end.



All dimensions in inches [mm].

M56S ROTOR ASSY		
ROTOR CODE	BASE PPR 120	BASE PPR 128
A	B30740-21	B30741-21
B	B30740-1	B30741-1
C	B30740-2	B30741-2
D	B30740-3	B30741-3
E	B30740-4	B30741-4
F	B30740-5	B30741-5
G	B30740-6	B30741-6
H	B30740-7	B30741-7
I	B30740-8	B30741-8
J	B30740-9	B30741-9
K	B30740-10	B30741-10
L	B30740-11	B30741-11
M	B30740-12	B30741-12
N	B30740-13	B30741-13
Q	B30740-14	B30741-14
P	B30740-15	B30741-15
R	B30740-16	B30741-16
S	B30740-17	B30741-17
T	B30740-18	B30741-18
U	B30740-19	B30741-19
V	B30740-20	B30741-20
2	B30740-22	B30741-22
3	B30740-23	B30741-23

**CAUTION**

For through shaft applications, apply a small amount of adhesive (not supplied) to the cover and retaining ring to prevent rotation from seal contact.

CONNECTOR SPARE PARTS					
STYLE	OPTION CODE	ENCODER SIDE		CABLE SIDE PLUG	
Industrial EPIC on Encoder	P	315233	Base	315231	Hood
		315229	Terminal	315230	Terminal
Industrial EPIC w/ Adapter Block	Q			401112	Adapter
Industrial EPIC on 3' Cable	Z	315232	Surface	315231	Hood
		315229	Terminal	315230	Terminal
		471819	Bushing	401112	Adapter

SPARE PARTS								
SHAFT SIZE	OPTION CODE	ROTOR P/N				SHAFT COVERS		
		128/256/512/1024/2048 PPR PPR OPTION A,B,C,D,E		120/240/480/600/960/1200 PPR PPR OPTION F,G,H,I,L,M		THRU SHAFT	EXTENDED	FLAT
		SET SCREW	CAM SCREW*	SET SCREW	CAM SCREW**			
0.5000/0.4995	A	B27584-21	B31068-21	B29228-21	B31066-21	N/A	P/N A26777	P/N B27600
0.6250/0.6245	B	B27584-1	B31068-1	B29228-1	B31066-1	A28763-1		
0.8750/0.8745	C	B27584-2	B31068-2	B29228-2	B31066-2	A28763-2		
0.9375/0.9370	D	B27584-3	B31068-3	B29228-3	B31066-3	A28763-3		
1.0000/0.9995	E	B27584-4	B31068-4	B29228-4	B31066-4	A28763-4		
1.1250/1.1245	F	B27584-5	B31068-5	B29228-5	B31066-5	A28763-5		
1.2500/1.2495	G	B27584-6	B31068-6	B29228-6	B31066-6	A28763-6		
1.3750/1.3745	H	B27584-7	B31068-7	B29228-7	B31066-7	A28763-7		
1.5000/1.4995	I	B27584-8	B31068-8	B29228-8	B31066-8	A28763-8		
1.6250/1.6245	J	B27584-9	B31068-9	B29228-9	B31066-9	A28763-9		
1.7500/1.7495	K	B27584-10	B31068-10	B29228-10	B31066-10	A28763-10		
1.8750/1.8745	L	B27584-11	B31068-11	B29228-11	B31066-11	A28763-11		
2.0000/1.9995	M	B27584-12	B31068-12	B29228-12	B31066-12	A28763-12		
2.1250/2.1245	N	B27584-13	B31068-13	B29228-13	B31066-13	A28763-13		
2.2500/2.2495	Q	B27584-14	B31068-14	B29228-14	B31066-14	A28763-14		
2.3639/2.3646	X	B27584-22	B31068-22	B29228-22	B31066-22	A28763-22		
2.3750/2.3745	P	B27584-15	B31068-15	B29228-15	B31066-15	A28763-15		
2.5000/2.4995	R	B27584-16	B31068-16	B29228-16	B31066-16	A28763-16		
2.6250/2.6245	S	B27584-17	B31068-17	B29228-17	B31066-17	A28763-17		
2.7559/2.7554	T	B27584-18	B31068-18	B29228-18	B31066-18	A28763-18		
2.8750/2.8745	U	B27584-19	B31068-19	B29228-19	B31066-19	A28763-19		
3.0000/2.9995A	V	B27584-20	N/A	B29228-20	N/A	A28763-20		
0.3937/0.3934	2	B27584-22	N/A	B29228-22	N/A	N/A		
0.4727/0.4723	3	B27584-23	N/A	B29228-23	N/A	N/A		
0.7480/0.7475	5	B29530-4	N/A	B29329-4	N/A	N/A		
3.1250/3.1245	4	B30741-24	N/A	B30740-24	N/A	N/A		
3.3478/3.3469	6	B29530-15	N/A	B29329-15	N/A	N/A		
3.1875/3.1870	7	B30741-26	N/A	B30740-26	N/A	N/A		
<b>HARDWARE</b>		#8-32 x 0.19" (2)	N/A	#8-32 x 0.19" (2)	N/A	4.13" Ring 467368	#6-32 x 0.31" (4)	4.13" Ring 467368

4 M56 shaft length requirements: 0.63" long minimum, 0.69" long maximum for flat cover, and 2.5" long maximum for extended cover.  
 \* Also replaces B30199-XX. \*\* Also replaces B30197-XX.

## V-RING INSTALLATION FOR THRU SHAFT COVERS (Cover Style option "T")

For thru shaft covers, verify that the shaft passes completely through the hole in the cover. Apply a small amount of silicone lubricant to the cover plate around the thru shaft hole. The V-ring seal should compress axially when it is pressed against the clean, smooth face of the cover plate. See Figure 4 for proper installation and V-Ring compression.

## WIRING INSTRUCTIONS

### CAUTION

**Be sure to remove power before wiring the encoder.**

**Be sure to ground the cable shield: It can be connected to case ground at the encoder, or grounded at the receiving device, but should not be grounded on both ends.**

Refer to the wiring diagrams for specific information on each option.

The M56 can be wired for single phase or two phase, either with or without complements, with or without markers. For bidirectional operation, Phase A channel leads phase B channel for clockwise shaft rotation as viewed from the anti-drive or accessory end of the motor (M56 mounting end).

### NOTE

**Avtron's convention for A and B wiring, as well as clockwise rotation, are EXACTLY REVERSED from Northstar (Danaher) Slimline™. This means the Avtron THIN-LINE™ M56 can be installed to an existing connection for Slimline RL56, and it will produce rotation in the expected direction without rewiring.**

## CORRECTIVE ACTION FOR PHASE REVERSAL

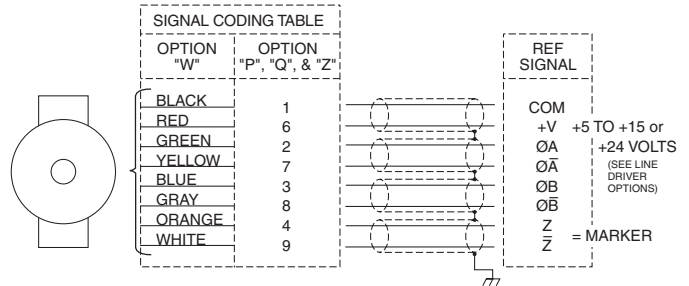
- 1) Remove Power.
- 2) Exchange wires on cable, either at encoder cable end, or at speed controller end (but not both).
  - a) **Single Ended 2 Phase Wiring** (see wiring diagram) Exchange A and B at the use end of the wires.
  - b) **Differential 2 Phase Wiring** (see wiring diagram) Exchange **either** A with  $\bar{A}$  in the phase A pair **OR** B with  $\bar{B}$  in the phase B pair but **NOT** both.

- 3) Apply Power.
- 4) Verify encoder feedback is correct, using hand rotation of shaft, or jog mode of the speed controller.

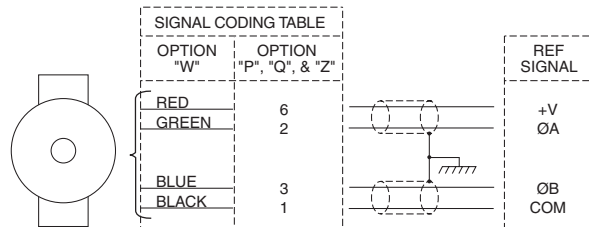
Interconnecting cables specified in the wire selection chart are based on typical applications. Physical properties of cable such as abrasion, temperature, tensile strength, solvents, etc., are dictated by the specific application. General electrical requirements are: stranded copper, 22 through 16 AWG (Industrial EPIC Connector type options can use 14 AWG), each wire pair individually shielded with braid or foil with drain wire, .05 uf of maximum total mutual or direct capacitance, outer sheath insulator. See specifications for maximum cable length. Stranded 22 AWG wire should not be used for cable runs greater than 200 feet. If 22 AWG is used with EPIC type connector options the wire ends should be tinned.

## WIRING DIAGRAMS

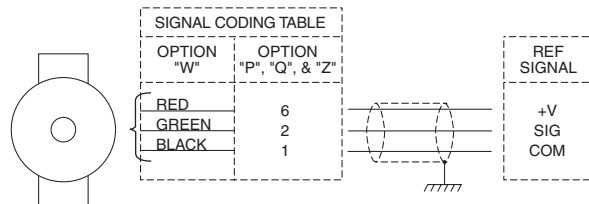
### FOR DIFFERENTIAL APPLICATIONS



### FOR SINGLE ENDED TWO PHASE APPLICATIONS



### FOR SINGLE ENDED SINGLE PHASE APPLICATIONS



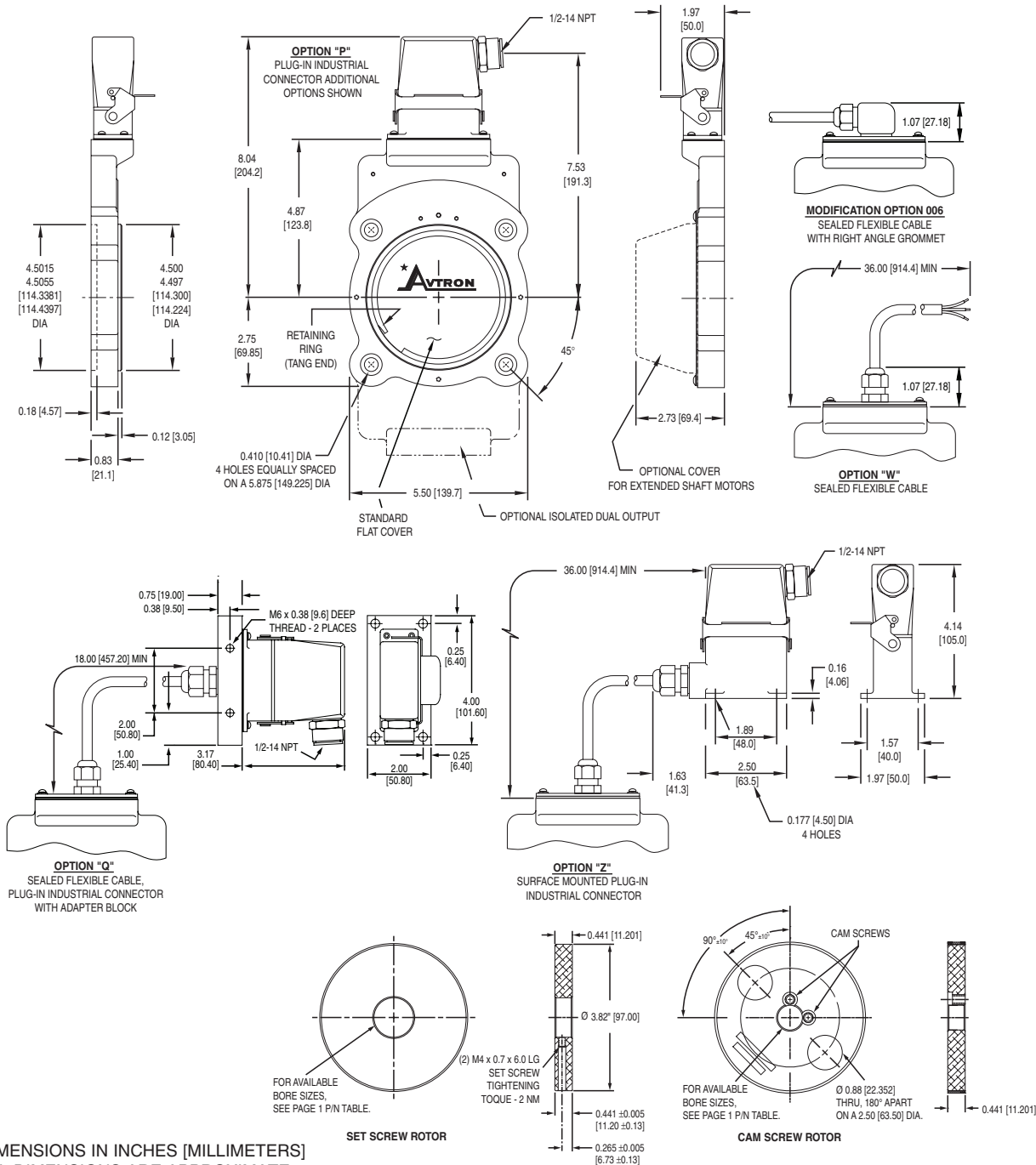
**TYPICAL WIRE SELECTION CHART**  
for 18 AWG, multiple pair, individually shielded

	BELDEN	ALPHA
2 PAIR	9368	5620B1802
3 PAIR	9773 or 9369	6445
4 PAIR	9388	6444
3 CONDUCTOR	9365	5640B1801

For option "W", unused outputs must be insulated to prevent accidental contact.

**NOTE:** Avtron standard 3 year warranty applies. Copies available upon request. Specifications subject to change without notice.

# OUTLINE DRAWING



## EU DECLARATION OF CONFORMITY

The Model M56 Encoder has been assessed and type tested against the following Harmonized European Standards: BS EN 61000-6-1: 2001, BS EN 61000-6-2: 2001, BS EN 61000-6-3: 2001, BS EN 61000-6-4: 2001. The Model M56 has been found to be compliant with the requirements of EU Directive 89/336/EEC as Amended by EU Directive 93/68/EEC "EMC Directive" provided the following conditions are met: The electrical supply to the M56 must be within specified limits. The electrical supply must offer suitable protection from voltage surges unless the application does not require such protection. On behalf of Avtron: Stephen L D'Henin, Certification Manager, Epsilon Certification Service.

Features and specifications subject to change without notice. Avtron standard warranty applies. All dimensions are in inches [mm] approx.

