



Nidec-Avtron Makes the Most Reliable Encoders in the World

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# Encoder Instructions

## RAHS35M

1/2" to 1 1/8" [12mm-30mm]  
HOLLOW SHAFT

### DESCRIPTION

The Avtron Model RAHS35M Magnetic Hollow Shaft Incremental Encoder is a speed and position incremental transducer (also known as a tachometer or pulse generator). When mounted to a motor or machine, its output is directly proportional to shaft position (pulse count) or speed (pulse rate). The RAHS35M operates down to zero speed and can be used for both control and instrumentation applications.

The RAHS35M employs a hollow shaft and clamping collar to lock the encoder to the shaft. A high-performance resin housing provides electrical isolation from motor shaft currents. An anti-rotation bracket prevents rotation of the encoder while allowing for shaft end float and axial movement.

The RAHS35M encoder offers 2Ø outputs (A,B) 90° apart for direction sensing, with complements (Ā,B̄) and with marker pulse and complement (Z,Z̄).

### INSTALLATION CONSIDERATIONS

See page 3 and drawing on last page for shaft engagement rules. Shaft may include keyway, but should not be flatted.

The RAHS35M offers optional Avtron flexible anti-rotation tethers/brackets which will permit the encoder to tolerate ±0.1" of shaft end float/axial movement. For larger movement, select tether option "G" from the table below.

### CAUTION

**Be careful not to damage clamping fingers of hollow shaft during handling. Do not tighten clamping collar before installation onto motor shaft.**

### WARNING

**Installation 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
RAHS35M Encoder Clamping Collar Anti-Seize (copper)	Anti-Rotation Tether Kit Mating MS or EPIC Industrial Cable Connector/Plug Protective Basket Kit	#2 Phillips Screwdriver 3/16" T-Handle Hex Wrench Caliper Gauge Dial Indicator Gauge 7/16", 9/16", 5/8", 3/4" Wrenches (tether options)

### WARNING

**DO NOT USE ANAEROBIC THREAD LOCKER COMPOUNDS ON THE RAHS35M. Use of Loctite 222, 242 or other anaerobic thread locking compounds on the housing can cause failure of the RAHS35M housing.**

### INSTALLATION

Refer to the back page of these instructions for outline and mounting dimensions.

- 1) Use caliper gauge to verify motor shaft is proper diameter and within acceptable tolerances shown on back page.
- 2) Clean machine shaft of any dirt and remove any burrs.
- 3) Install the anti-rotation bracket to the face of the encoder using 8-32 screws and lock washers.
- 4) Loosen clamping collar screws.

### NOTE

**These screws have factory applied thread locker, no further thread locker application is required.**

RAHS35M PART NUMBERS AND AVAILABLE OPTIONS										
Model	Output PPR*		Line Driver	Bore Size	Connector Options	Mounting Style	Protection	Anti-Rotation Tether Options	Channels	Special Features
RAHS35M	A- 1 F- 60 G- 100 H- 120 K- 200 L- 240 M- 250 N- 256 P- 300 E- 360 Q- 500 R- 512 S- 600	U- 720 V- 900 W- 1000 Y- 1024 Z- 1200 1- 1250 2- 1440 B- 1500 3- 2000 4- 2048 5- 2500 0- Special	6- 5-24VDC (7272) 8- 5-15VDC (4125) 9- 5-24VDC in, 5V out (7272)	0- Non-Std. H- 5/8" F- 1" G- 1 1/8"	A- 10 pin MS w/o plug (Standard phasing) C- "A" w/ plug B- 10 pin MS w/o plug (Dynapar HS35 phasing) D- "B" w/ plug P- Industrial EPIC w/ plug V- "P" w/o plug Z- "P" on 18" cable R- Baldor Twist Lock MS w/mate S- "R" on 18" cable W- 18" flex. cable Y- 18" flex. cable w/ MS & plug (Std. phasing)	U- Universal End-of-Shaft & Thru Shaft	0- None 1- Basket	X- None A- Fan cover, 1/4-20 B- Fan cover, 5/16-18 C- Fan cover, 3/8-16 D- Fan cover, all E- 4.5" or 6.75" C-Face F- 8.5" C-Face G- Torque Arm H- Options "A" and "F"	A- A, Ā B, B̄ Z, Z̄ (All) 9- All. Enter specific cable length xx=feet under Special Features (Use with Connector Option "W").	00- None

\* up to 2500 PPR available.

- 5) Optional: for resizing RAHS35M 1" bore to fit smaller diameter shafts: Insert shaft sizing insert into encoder. **DO NOT FORCE.**
- 6) Test Fitting: carefully slide the encoder onto the shaft to verify fit. Ensure a minimum of 1/8" between encoder and mounting surface. **DO NOT FORCE.** Encoder should slide on easily. If the encoder does not fit easily, remove it, verify shaft size, and check for burrs and shaft damage.
- 7) Remove encoder, apply anti-seize compound to shaft and reinstall encoder, leaving a minimum of 1/8" between motor face and encoder (see "Shaft Engagement").
- 8) Firmly tighten screws on clamping collar evenly until snug, then firmly tighten each screw. **DO NOT USE A STANDARD RIGHT ANGLE WRENCH.** Use only a T-handle hex wrench or torque wrench with hex bit.
- 9) For all motor mount options other than 8.5" C-face: Snap the plastic washer pair together in the mounting slot of the anti-rotation arm. (See assembly diagram on page 4 for full details)
- 10) Secure free end of the anti-rotation bracket to frame using bolt or T-bolt provided. Use additional washers as needed to install the bracket without a large deflection or bend.
- 11) Turn shaft by hand and verify the shaft turns freely and does not produce excessive runout/wobble of the encoder (<0.005" TIR, Total Indicator Reading).
- 12) Optional: Attach Avtron Encoder/Tachometer Tester unit (B27609) using factory-provided cable. Follow tester instructions to check direction of rotation, proper output, PPR, and signal quality.
- 13) Connect cable as shown in wiring diagram.
- 14) Apply power to the encoder.
- 15) Rotate the shaft by hand, or using jog mode of the speed controller and verify proper direction.
- 16) Optional: Install Protective Basket using either T-bolts (Fan Cover) or bolt to 4.5" C-Face (bolts provided). Be certain to pivot the basket over the encoder connector when installing. **DO NOT FORCE.**  
To mount the basket on an 8.5" C-face, thread the 1/2"-13 bolts into the motor face, through each clip (provided with options "F" and "H") but do not tighten fully. Pivot the basket over the encoder, and pivot each clip over each respective basket bolt hole. **DO NOT FORCE.** Tighten each

bolt to secure the basket and clip.

**Adjusting the Encoder to Eliminate Excess Runout/Wobble:**

In a typical installation, a housing movement of 0.005" TIR or less (as measured at the outside diameter of the main encoder body) will not have an adverse effect. If excessive housing movement is detected in the installation:

- 1) Check the shaft the RAHS35A is mounted on for excessive shaft runout using a dial gauge. NEMA MG1 calls for 0.002" TIR or less.
- 2) Verify that the mounting shaft meets minimum and maximum diameter tolerances.
- 3) Maximize the shaft insertion into the encoder (retaining the minimum of 1/8" between mounting face and encoder)
- 4) Loosen the clamping collar and rotate the motor shaft 180° within the encoder hollow shaft sleeve. Retighten the clamping collar.
- 5) Loosen the clamping collar; move the split in the clamping collar over a solid portion of the encoder shaft, retighten the clamping collar.

If excessive housing movement still exists after the above steps, the shaft or the encoder may be damaged and should be checked by the manufacturer.

**Shaft Sizes:**

RAHS35M: 5/8", 1", 1 1/8"

Consult factory for other shaft sizes not shown.

Shaft Engagement:

RAHS35M: For end of shaft applications, shaft insertion/engagement should be 1.25" to 2.06" [32mm to 52mm] with a minimum of 1/8" [3mm] between encoder and mounting surface.

For shaft lengths greater than the maximum engagement allowed, end of shaft mounting may still be employed by using a spacer between the mounting surface and anti-rotation bracket.

The RAHS35M may also be used for thru shaft applications by removing the end of shaft cover.

**SPECIFICATIONS**

**ELECTRICAL**

- A. Operating Power (Vin)
  - 1. Volts ..... See Line Driver Options
  - 2. Current ..... 80mA, no load
- B. Output Format ..... A Quad B with marker (A,  $\bar{A}$ , B,  $\bar{B}$ , Z,  $\bar{Z}$ )
- C. Signal Type ..... Incremental, Square Wave, 50% ±10% Duty Cycle
- D. Direction Sensing ..... Phasing with respect to rotation as viewed from the back of the encoder.
  - Connector options "A", "C", "P", "V", "W", & "Y" .....  $\emptyset A$  leads  $\emptyset B$  for CW rotation.
  - Connector options "B" & "D" .....  $\emptyset A$  leads  $\emptyset B$  for CCW rotation.
- E. Transition Separation .... 15% minimum
- F. Frequency Range ..... 0 to 165 kHz.
- G. PPR ..... 1 - 2500 standard (for other PPR needs, Consult Factory)
- H. Output ..... See table for Line Driver Options

**MECHANICAL**

- A. Acceleration ..... 4,700 RPM/Sec.
- B. Speed ..... 4,700 RPM max. (for higher RPM needs, Consult Factory)
- C. Shaft Diameter ..... 0.500" to 1.125" [12mm to 30mm]
- D. Shaft Engagement ..... 1.250" to 2.060" [32mm to 52mm]
- E. Weight ..... 1.4 lbs. [635 g] approx.

**ENVIRONMENTAL**

- A. Enclosure Rating ..... NEMA 4, 13, IP65 (dust and water tight, not for immersion)
- B. Operating Temp. .... -20° to +85°C
- C. Humidity ..... 98% Non-condensing
- D. Shock ..... 50G, 11 ms Duration
- E. Vibration ..... 5-2000Hz @ 20G

**LINE DRIVER OPTIONS**

		Output Options		
		6	8	9
Output Type		Differential Line Driver	High Current Line Driver	Differential Line Driver 5V output
Line Driver		7272	4125	7272
Voltage Input (Vin)		5-24VDC	5-15VDC	5-24VDC
Protection	Reverse Voltage	Yes	Yes	Yes
	Transient	Yes	Yes	Yes
	Short Circuit	Yes	Yes	Yes

# WIRING INSTRUCTIONS

## CAUTION

Be sure to remove power before wiring the encoder.

## CAUTION

When wiring for differential applications (A,  $\bar{A}$ , B,  $\bar{B}$ , Z,  $\bar{Z}$ ), A and  $\bar{A}$  should be wired using one twisted, shielded pair; B and  $\bar{B}$  should be in a second pair, etc. Failure to use complementary pairs (say, using A and B in a twisted pair) will reduce noise immunity significantly.

For encoder output that correctly reflects the direction of rotation, proper phasing of the two output channels is important. Phase A channel leads phase B channel for clockwise shaft rotation as viewed from the back (non-mounting side) of the encoder for standard phasing options ("A", "C", "P", "V", & "W"). Follow instructions under corrective installation as needed to reverse the direction of output or purchase RAHS35M with reverse (Dynapar HS35) phasing (options "B", "D").

## CORRECTIVE ACTION FOR PHASE REVERSAL

If Encoder Direction is Reversed:

(Note: Avtron offers reverse phasing options for former Dynapar HS35 customers – select wiring option "B" or "D").

- 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 below) Exchange A and B at the user end of the wires.
  - b.) Differential 2 Phase Wiring (see wiring diagram below) 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.

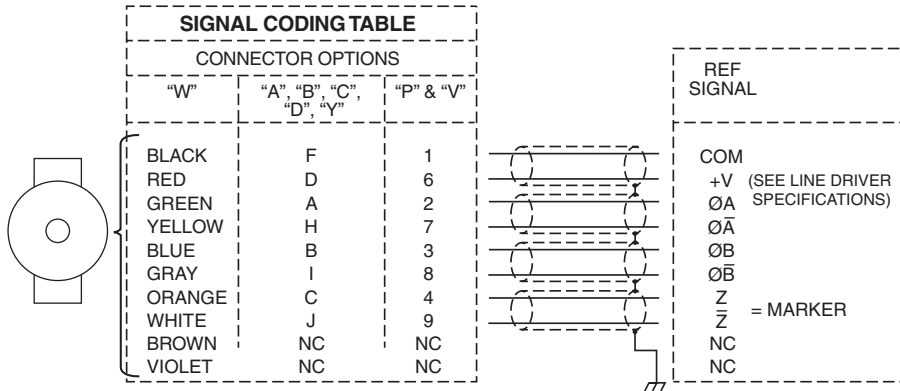
Interconnecting cables specified in the wire selection chart are based on typical applications. Refer to the "Wiring Diagrams" below for suggested cable types. General electrical requirements are: stranded copper, 22 thru 16 gauge, each wire pair individually shielded with braid or foil with drain wire, 0.05 uF maximum total mutual or direct capacitance with outer sheath insulator.

## NOTE

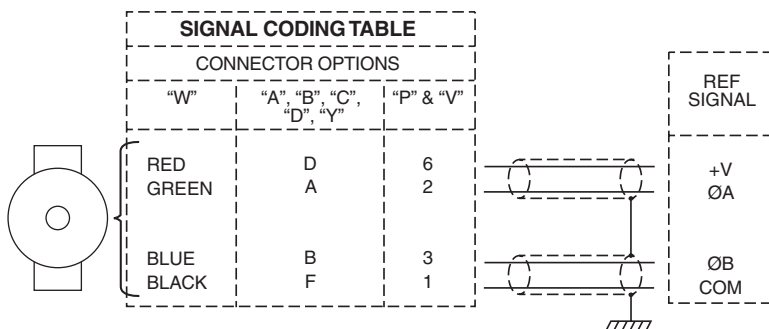
When using the industrial connector ("P", "V", or "Z" options), the minimum wire size is 20 gage, and 20 gage (only) wire ends must be tinned with solder before connection at the screw terminals.

## WIRING DIAGRAMS

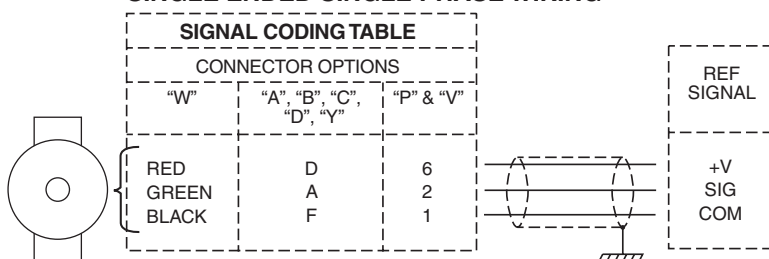
### DIFFERENTIAL TWO PHASE WIRING



### SINGLE ENDED TWO PHASE WIRING



### SINGLE ENDED SINGLE PHASE WIRING

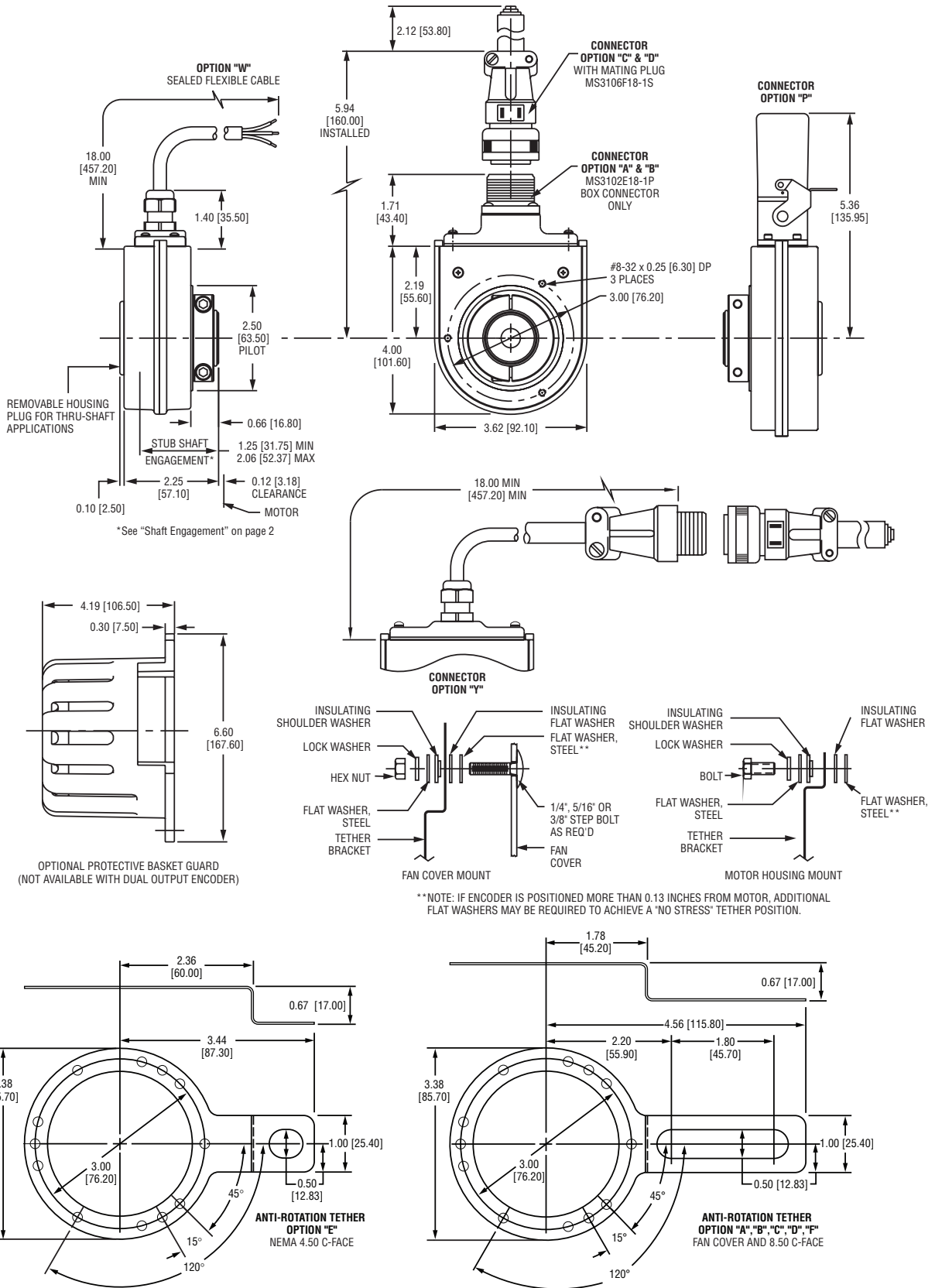


TYPICAL WIRE SELECTION CHART for 18 AWG, multiple pair, individually shielded

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

For Connector Option "W", unused connections must be insulated to prevent accidental contact.

# OUTLINE DRAWINGS



Motor Shaft Tolerance to be  $+0.0000/-0.0005$  [ $+0.0000/-0.0127$ ] per NEMA Std. MG1.  
All dimensions are in inches [millimeters] approx.

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Avtron standard warranty applies. Copies available upon request.  
Specifications subject to change without notice.

CE Pending

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