

# **AVTRON INCREMENTAL ENCODER**

## **AV685 SMARTach™ III HAS ARRIVED!**

**Nidec Avtron is proud to upgrade your order to our latest model the AV685 SMARTach™ III**

### **WHAT'S NEW?**

#### **WIRING PROTECTION**

Now all models are protected against all short circuits and wiring errors no matter which line driver (#6, #8, #9) option you choose.

#### **IMPROVED HIGH-POWER OUTPUTS (#8 OPTION)**

Draw less current, yet make cleaner waveforms and offer full 5-24V output for improved compatibility with newer variable speed drives and PLCs.

#### **WIRING DIAGNOSTICS**

Now all models include fault indication of wiring errors—short circuits and other errors are indicated with an orange LED output.

#### **INCREASED PPR**

SMARTACH™ III models now offer up to 50,000 pulses per revolution (PPR).

### **WHAT HASN'T CHANGED?**

#### **ROTORS**

SMARTACH™ III and SMARTACH™ II rotors are 100% interchangeable.

#### **MECHANICAL FORM FACTOR**

SMARTACH™ III takes up the exact same space.

#### **CONNECTORS**

SMARTACH™ III uses the exact same connectors, same pinouts.

#### **DURABILITY**

SMARTACH™ III offers the same solid aluminum and potted electronic system that have made Avtron encoders the most reliable encoders in the world.

#### **AVTRON ENCODER'S COMMITMENT**

To making the world's most reliable encoders while backing them with our 1 year no-hassle warranty and 24x7x365 no-charge technical support.

#### **YOUR PART NUMBER TO ORDER?**

Hasn't changed.

## **HOW CAN I TELL SMARTACH™ III FROM SMARTACH™ II?**

### **SERIAL NUMBER**

SMARTACH™ III encoders will carry serial numbers beginning with 30,000

# AVTRON INCREMENTAL ENCODER

## Model: AV685 SMARTach™ III 1-1/8" Hollow Shaft

### DESCRIPTION

The Avtron Model AV685 SMARTach™ III is a severe duty incremental encoder (also known as tachometer or rotary pulse generator). Its output is directly proportional to shaft position (pulse count) or speed (pulse rate). The AV685 operates down to zero speed and can be used for both control and instrumentation applications.

When mounted to a machine shaft, the AV685 design eliminates the need for shaft couplings, adapter flanges, or accessory mounting faces. The unit employs a keyless shaft mount to lock the AV685's rotor to a 1.125" diameter shaft. An anti-rotation arm prevents housing rotation while allowing for shaft end float.

The AV685 utilizes magnetoresistive sensors. This proven technology is ideal for rugged environments since it is immune to many contaminants that cause optical encoders to fail. These factors make the AV685 ideal for demanding industries like paper, metals, and chemical processing.

An Avtron AV685 SMARTach III is equipped with one or two AV5 sensor modules. Each module has a two-phase output (A, B) 90° out of phase, with complements (A̅, B̅), (A Quad B Output). A marker pulse with complement (Z, Z̅) is also present. Output resolution on the AV685 is determined by the sensor only. Unlike older models, any PPRs can be mixed and matched. Selection of the rotor is based only on the shaft mounting requirements (and not PPR).

### NOTE

**Special option 4xx selects an alternate PPR code definition. Example: PPR Code 0, special option code 401=1270 PPR (Left) / no right output.**

The AV5 removable sensor assembly has a diagnostic package that includes Adaptive Electronics and a Fault-Check output.

### ADAPTIVE ELECTRONICS

A perfect duty cycle consists of a waveform whose "high" and "low" conditions are of the same duration (50%/50%). It is possible over time for the duty cycle and edge separation to change due to component drift, temperature changes, or mechanical wear. The Adaptive Electronics extend the life of the AV685 by constantly monitoring and correcting duty cycle and edge separation over time.

### FAULT-CHECK

If the Adaptive Electronics reach their adjustment limit, the Fault-Check alarm and LED will notify the drive and operator of an impending failure. This output can occur before a failure, allowing steps to be taken to replace the unit before it causes unscheduled downtime. Fault-Check annunciation is available as an "alarm" output through the connector or as an integrated LED.

### INSTALLATION

Equipment Needed for Installation	
Provided	Not Provided
1. AV685 Encoder	- 1-3/4" Spanner Wrench (484017)
2. Anti-Rotation Arm Kit	- 1/2" Wrench
3. Threadlocker (blue)	- 2-1/2" Spanner Wrench (484018)
4. Synthetic Grease	- Dial Indicator
5. Anti-Seize (copper)	- 7/16" Wrench

### AV685 PART NUMBERS AND AVAILABLE OPTIONS INCLUDING AV5 SENSORS

Model	Temp Rating	Tether	Style	Left Module			Right Module			Connector Options	Modifications	
				Line Driver	PPR		Line Driver	PPR				
<b>AV685</b>	<b>N-</b> -20°C to 80°C <b>C-</b> -40°C to 80°C <b>H-</b> -20°C to 120°C <sup>+</sup>	<b>X-</b> none <b>1-</b> B32809 threaded rod	<b>E-</b> standard (EOS) <b>T-</b> through shaft <b>G-</b> grounding <b>O-</b> over speed switch	<b>X-</b> none <b>6-</b> 5-24V in/out (7272) <b>8-</b> 5-24V in/out, (HX) <b>9-</b> 5-24V in, 5V out (7272)	<b>X-</b> none <b>F-</b> 60 <b>C-</b> 64 <b>G-</b> 100 <b>H-</b> 120 <b>A-</b> 128 <b>L-</b> 240 <b>N-</b> 256 <b>P-</b> 300 <b>E-</b> 360 <b>B-</b> 480 <b>Q-</b> 500 <b>R-</b> 512 <b>S-</b> 600 <b>U-</b> 720	<b>V-</b> 900 <b>J-</b> 960 <b>W-</b> 1000 <b>Y-</b> 1024 <b>Z-</b> 1200 <b>2-</b> 1500 <b>6-</b> 1800 <b>3-</b> 2000 <b>4-</b> 2048 <b>5-</b> 2500 <b>D-</b> 4096 <b>8-</b> 4800 <b>9-</b> 5000 <b>0-</b> special	<b>X-</b> none <b>6-</b> 5-24V in/out (7272) <b>8-</b> 5-24V in/out, (HX) <b>9-</b> 5-24V in, 5V out (7272)	<b>X-</b> none <b>F-</b> 60 <b>C-</b> 64 <b>G-</b> 100 <b>H-</b> 120 <b>A-</b> 128 <b>L-</b> 240 <b>N-</b> 256 <b>P-</b> 300 <b>E-</b> 360 <b>B-</b> 480 <b>Q-</b> 500 <b>R-</b> 512 <b>S-</b> 600 <b>U-</b> 720		<b>003-</b> Include analog signal converter (K661) <b>004-</b> Super magnetic shielding <b>028-</b> Include Spanner Wrenches <b>4xx-</b> Special PPR (see table below) <b>9xx-</b> Special Cable Length, XX= Length in Feet		
<b>Connector Options</b>												
<b>Mounted on Encoder Body</b>				<b>3' Cable</b>			<b>5' Flexible Conduit</b>					
<b>Industrial Connector</b>	<b>5 pin MS</b>	<b>10 pin MS</b>	<b>Other</b>	<b>Industrial Connector</b>	<b>Twist Lock</b>	<b>Other</b>						
<b>G-</b> (Northstar™ Pinout) with Plug <b>P-</b> with Plug <b>V-</b> with Plug, w/insulated adapter	<b>E-</b> (M737 Pinout) without Plug <b>F-</b> "E" with Plug <b>H-</b> (M727 Pinout) without Plug <b>J-</b> "H" with Plug	<b>A-</b> without Plug <b>B-</b> with Plug & clamp <b>C-</b> with Plug & Flex. Adapter <b>L-</b> with Right Angle Plug	<b>K-</b> Condulet <b>R-</b> Twist Lock Mini MS with Plug <b>1-</b> 10 Pin Mini Epic With Plug (M3 & M4 Replacement)	<b>Z-</b> with Plug <b>Q-</b> 18" flex cable, with Remote Base	<b>S-</b> Mini MS with Plug	<b>W-</b> Leads only	<b>D-</b> 10 pin MS w/ins. adapter <b>M-</b> w/ins. adapter <b>N-</b> In Flextight <b>T-</b> Terminal box on 5' Flextight <b>Y-</b> "T" w/ins. adapter	<b>SPECIAL PPR OPTION CODES</b> See table on page 3				

The hollow shaft AV685 design eliminates the potential for bearing and coupling failures from misalignment, however, excessive housing movement (wobble) may cause undesirable vibrations. The higher the RPM, the more severe the vibration will be from housing movement. In a typical installation, a housing movement of 0.007" TIR or less (as measured at the outside diameter of the main encoder body) will not have an adverse effect.

**ELECTRICAL\*\***

- A. Operating Power (Vin)
  - 1. Volts ..... 5-24 VDC
  - 2. Current ..... 100mA, nominal, no load
- B. Output Format
  - 1. 20/ & Comp ..... A, A, B, B (differential line driver)
  - 2. Marker ..... 1/Rev, Z, Z
- C. Signal Type ..... Incremental, Square Wave, 50 ±10% Duty Cycle.
- D. Direction Sensing ..... O/ A leads O/ B for CW rotation as viewed from the back of the tach looking at the non-drive end of the motor.
- E. Phase Sep..... 15% minimum
- F. Frequency Range ..... @5V, @1m cable, 250 kHz Max  
@24V, @300m cable, #8 output, 45 kHz Max
- G. PPR ..... 4-5000\*\*\*
- H. Line Driver Specs ..... See table
- I. Connectors..... See connector options on page 1
- J. LED Indicator ..... GREEN: power on, unit ok.  
RED: alarm on  
ORANGE: wiring fault (Thermal Overload; Under-voltage)

**MECHANICAL**

- A. Shaft Inertia..... .25 Oz. In. Sec ^2
- B. Acceleration ..... 5000 RPM/Sec. Max.
- C. Speed..... 4000 RPM Max.\*\*\*\*
- D. Weight..... 15-17 lbs [ 6-8 kg.]

**ENVIRONMENTAL**

Solid cast aluminum stator and rotor  
Fully potted electronics, protected against oil and water spray  
V-Ring seals provided.  
Operating Temperature:.....See Temp Rating on page 1.

		LINE DRIVER OPTIONS			
Electrical Specifications		6	8	9	Units
Input Voltage		5-24	5-24	5-24	VDC
Nom Output Voltage		5-24	5-24	5	VDC
Line Driver		7272	Hx	7272	
Output Resistance Typ		13	75	13	ohms
Maximum Peak Current		1500	800	1500	mA
Max Average Current		120	200	120	mA
Voh Typ	V <sub>IN</sub> -1	V <sub>IN</sub> -1	V <sub>IN</sub> -1	V <sub>IN</sub> -1	VDC
Vol Typ	0.5	0.2 @ 10mA line current	0.5	0.5	VDC
Cable Drive Capacity	1000' @ 5V 500' @ 12V 200' @ 24V	1000'	1000'	1000'	feet
Protection	Reverse Voltage	yes	yes	yes	
	Short Circuit	yes	yes	yes	
	Transient	yes	yes	yes	
	Power to A, Gnd to A/	yes	yes	yes	
Alarm	+V(out)	Output voltage equal to input voltage.			
	Alarm*	Open collector, normally off, goes low on alarm, sink 100mA max, 50VDC max			
	LED	Green=power on, Red=Alarm Orange=Wiring Error (Thermal Overload; Under-voltage)			
Marker	One per revolution. Pulse width approximately 2° (1/128 of a revolution)				

\*Alarm not available on connector option "G" (Northstar™ compatible pinout)  
\*\* Electrical specifications for SMARTach III model (rev BA or later), consult Nidec Industrial Solutions for earlier model specifications.  
\*\*\*(PPR) Standard maximum PPR is 5000. Consult Factory with your application for PPRs up to 50,000.  
\*\*\*\* (Speed) Maximum RPM may be limited for PPR > 2,500. Consult Factory with your application.

**MACHINE SHAFT PREPARATION**

Preparing the machine shaft prior to encoder installation is essential to providing an adequate barrier against environmental contamination. In some cases, a separate stub shaft (OD of 1.250" +0.0000"/-0.0005" x 4.5" long) will be installed on the motor. To prepare the machine shaft onto which the AV685 is to be installed conduct the following procedures (see figures):

- 1) Remove from the AV685 the four 1/4-20 UNC machine screws which hold the end cap on the cover plate.
- 2) Remove the end cap, O-Ring, and wave spring, noting the location of each to assist in re-assembly.

**CAUTION**

**SPANNER WRENCHES MUST BE USED DURING THE FOLLOWING PROCEDURES. Using a substitute can distort the 1-3/4" nut and damage the unit. Do not try to remove the 2-1/2" bearing locknut at any time. This locknut is factory adjusted for optimum AV685 performance.**

**NOTE**

**Two spanner wrenches, which are required for AV685 installation, accommodate the 1-3/4" and 2-1/2" nuts found under the cap.**

- 3) Holding the 2-1/2" bearing locknut, remove the 1-3/4" dia. clamping nut and slide out the internal compression sleeve.
- 4) Verify that the compression sleeve can be installed by hand on the shaft where the unit is to be installed. File any burrs that obstruct sleeve installation and lightly oil the shaft.
- 5) If a keyway or flat exists on the shaft, provide a sealing medium, or true the shaft back to round using metal putty or equal.
- 6) Return the compression sleeve to the AV685 hub.
- 7) Thread the 1-3/4" clamping nut onto the AV685 by hand until resistance is felt. DO NOT TIGHTEN at this time.

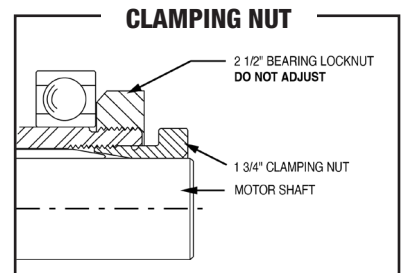
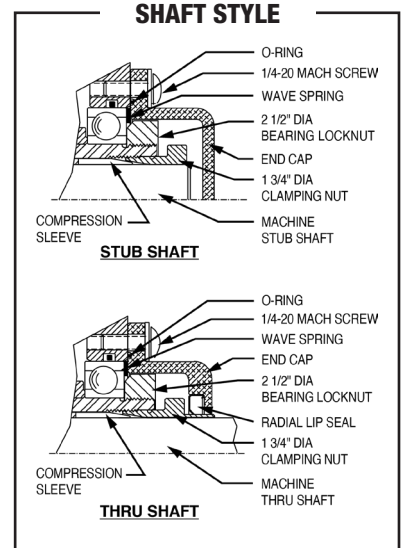
**ENCODER INSTALLATION**

Installing the AV685 and Anti-Rotation Arm:

- 1) The free end of the anti-rotation arm must be secured by the customer to a stationary member such as the floor or machine frame. Refer to "Anti-Rotation Arm Mounting Guidelines" on the last page for general requirements.

- 2) Based on the location of the stationary point and the guidelines on page 6, attach the 1/4" thick mounting board to one of two places on the AV685. Use two 1/4-20 UNC by 3/4" long machine screws provided.

- 3) Apply anti-seize (copper), provided, to machine shaft. A packet of silicone grease is provided to lubricate the following shaft seals: First, ALL AV685 types have an O-Ring inside their hollow shafts at the motor end. In addition, in THRU-SHAFT types, the clamping nut has an O-Ring on the inside, plus the outside of the clamping nut requires lubrication for the radial lip seal per step 8b. Slide the AV685 onto the machine shaft, mounting the board first. Ideally, the AV685 housing will be 1/2" to 1" from the motor or machine housing, but this may vary depending on the machine profile and the anti-rotation arm clearance requirements. Consider shaft end float when positioning the AV685.



- 4a) FOR END-of-SHAFT APPLICATIONS, place the AV685 3-3/8" to 4-1/8" onto the shaft. The end of the machine shaft must extend completely through the AV685 compression sleeve and be approximately flush with the end of the 1-3/4" clamping nut.
- 4b) FOR THRU SHAFT APPLICATIONS, position the AV685 as required.
- 5) Attach free end of the anti-rotation arm to the 1/4" mounting board using the shoulder bolt provided.
- 6) Remove 1-3/4" clamping nut and apply liquid threadlocker to the threads. (Loctite™ grade 242, supplied, should be used in most applications.)
- 7) Replace 1-3/4" clamping nut and tighten as shown in CLAMPING NUT sketch (approx. 15-20 ft.-lbs.), holding the 2-1/2" bearing locknut in place. Spanner wrenches are required for this operation.
- 8a) FOR END-of-SHAFT INSTALLATIONS, replace the end cap with the wave spring (loading spring) against the bearing and the O-ring located in the cap groove. Secure the end cap with the four 1/4-20 UNC machine screws previously removed. Apply the threadlocker to the screws when assembling.
- 8b) FOR THRU SHAFT APPLICATIONS, prior to replacing the end cap per step 8a, apply a small amount of silicone grease (provided) to the seal surface on the 1-3/4" clamping nut. The radial lip seal in the end cap will seal on this surface.

## ENVIRONMENTAL CONSIDERATIONS

Special attention is to be given to conduit runs, interconnection wiring and NEMA type enclosure mounting. In those applications where ambient temperatures are controlled within 20° C and high humidity/washdown are not present, position the flexible conduit with a slight sag to prevent any condensation from entering the encoder via conduit.

In harsh environments, which include temperature extremes, high humidity, equipment washdown or atmosphere contamination, extra care is required. Follow these steps to reduce potential problems:

- 1) Always mount connection points, conduit couplings, junction boxes, etc., lower than actual encoder.
- 2) For washdown areas, shroud or otherwise cover the encoder to prevent direct water spray. Do not attach the shroud directly to the encoder.
- 3) Keep conduit outputs and axis of rotation horizontal.
- 4) Avtron recommends sealed and/or remote connector styles for these applications. These include options (A-J, M-N, R-T, W, Y).

## ANTI-ROTATION ARM MOUNTING GUIDELINES

The anti-rotation arm stabilizes the encoder and keeps it from rotating as the machine shaft rotates. To get the best performance, minimize encoder movement by following these anti-rotation arm mounting guidelines as closely as possible.

- 1) Mount AV685 with conduit entry ports positioned horizontally.
- 2) Fasten the 1/4" thick mounting board to the inboard side of the AV685 in one of the two positions shown. Use the two 1/4-20 UNC x 3/4" long fasteners.
- 3) Mount anti-rotation arm perpendicular to motor shaft axis of rotation. Arm mounting bolts and associated rod bearings should be parallel to motor shaft also (top view).
- 4) Mount anti-rotation arm approx. 90° to a line established between the mounting board mounting hole and shaft centerline (viewed from end).
- 5) Mount AV685 as close as possible to the motor with the mounting board closest to the motor.
- 6) Establish a stationary (static) mounting point for the free end of the anti-rotation arm, using the guidelines above. Use the bolt provided to fasten arm to stationary point.
- 7) The anti-rotation arm is fully threaded and can be adjusted in length. The recommended length is 8 to 12".

## WIRING INSTRUCTIONS

### CAUTION

**Remove power before wiring.**

For bidirectional operation of the 2-phase SMARTach III, proper phasing of the two output channels is important. Phase A channel leads Phase B channel for clockwise shaft rotation as viewed from the anti-drive or accessory end of the motor (AV685 mounting end).

Wiring option "G" provides a pinout compatible with Northstar encoders, with a cable shield connection on pin 10. Note that this option does not ground the shield; Avtron still recommends grounding the shield at the drive end of the cable for all wiring options.

## 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.

## AV5 Maintenance and Replacement Part Numbers

AV5 Sensor								
Model	Line Driver	PPR					Connector Options	Modifications
AV5	6- 5-24V in/out (7272)	X- none	L- 240	R- 512	Y- 1024	5- 2500		000- none
	8- 5-24V in/out (HX)	F- 60	N- 256	S- 600	Z- 1200	D- 4096		004- Super magnetic shielding
	9- 5-24V in, 5V out (7272)	C- 64	P- 300	U- 720	2- 1500	8- 4800		4xx- Special PPR (see table)
		G- 100	E- 360	V- 900	6- 1800	9- 5000		
		H- 120	B- 480	J- 960	3- 2000	0-special		
		A- 128	Q- 500	W- 1000	4- 2048			

SPECIAL PPR OPTION CODES		
4xx Code	PPR (Left)	PPR (Right)
401*	1270	None
402*	150	None
403*	50	None
404	None	16
405	16	None
406	6000	None
407	2800	None
408	1400	None
409*	30	None
410	None	6000
411	12000	None
412	200	None
413*	30	30
414	1500	None
415	3000	None
416	3600	None
417	1250	None
418	2400	2400
419	160	160
420	450	None

Connector Options							
Mounted on Encoder Body				3' Cable			5' Flexible Conduit
Industrial Connector	5 pin MS	10 pin MS	Other	Industrial Connector	Twist Lock	Other	
G- (Northstar™ Pinout) with Plug P- with Plug V- with Plug, w/insulated adapter	E- (M737 Pinout) without Plug F- "E" with Plug H- (M727 Pinout) without Plug J- "H" with Plug	A- without Plug B- with Plug & clamp C- with Plug & Flex. Adapter L- with Right Angle Plug	K- Condulet R- Twist Lock Mini MS with Plug 1- 10 Pin Mini Epic With Plug (M3 & M4 Replacement)	Z- with Plug Q- 18" flex cable, with Remote Base	S- Mini MS with Plug	W- Leads only	D- 10 pin MS w/ins. adapter M- w/ins. adapter N- In Flextight T- Terminal box on 5' Flextight Y- "T" w/ins. adapter

- 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 below are based on typical applications. Refer to the system drawing for specific cable requirements where applicable.

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 thru 16 gauge (Industrial EPIC options can use 14-20 AWG), each wire pair individually shielded with braid or foil with drain wire, 0.05 uF maximum total mutual or direct capacitance, outer sheath insulator, 1,000 ft. max. See Wire Selection Chart below for some suggested cables.

**NOTE**

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

**MAINTENANCE**

**GENERAL**

This section describes routine maintenance for the Avtron AV685 Encoder. For support, contact Avtron’s field service department at 216-642-1230. For emergency after hours service contact us at 216-641-8317.

The AV685 SMARTach III circuitry includes a diagnostic package that includes Adaptive Electronics and a Fault-Check output.

**ADAPTIVE ELECTRONICS**

A perfect duty cycle consists of a waveform whose “high” and “low” conditions are of the same duration (50%/50%). It is possible, over time, for duty cycle to change due to component drift, temperature changes, and mechanical wear. The AV5 adaptive electronics extends the life of the AV685 by constantly monitoring and correcting duty cycle over time.

**FAULT-CHECK**

After power-up and the internal rotor position is checked by the sensor, the Fault-Check LED will turn GREEN. If the adaptive electronics reach their adjustment limit for any reason, the Fault-Check alarm and LED will notify the drive and operator of an impending failure. The LED will turn RED if the Adaptive Electronics reach their adjustment limit. This output occurs before an actual failure, allowing steps to be taken to replace the unit before it causes unscheduled downtime. Fault-Check annunciation is available as an “alarm” output through the connector and as an integrated LED.

**TROUBLESHOOTING:**

If the drive indicates a loss of encoder/tach fault and the AV685 fault-check LED is not illuminated, check the encoder power supply. If power is present, check polarity: one indicator of reversed power supply is that all outputs will be high at the same time. If the drive indicates encoder fault, but the LED shows GREEN, then check the wiring between the drive and the encoder. If the wiring appears correct and in good shape, test the wiring by replacing the AV5 sensor module. If the new module shows GREEN, and the drive still shows encoder loss/tach fault, then the wiring is faulty and should be repaired or replaced.

**If the alarm output and/or LED indicate a fault (RED):**

1. Remove an end sensor plate or the second sensor, and use the built-in gauge to check the location of the rotor (see Figure 1).
2. Remove the AV5 sensor from the housing. Clean the housing mounting surface for the AV5 sensor and the AV685 housing.

**If the alarm output and/or LED indicate a fault (RED) on a properly mounted AV5 sensor and the rotor is properly located, replace the AV5 sensor.**

An oscilloscope can also be used to verify proper output of the AV5 encoder at the encoder connector itself and at the drive/controller cabinet. If the outputs show large variations in the signals at steady speed (jitter or “accordion effect”, figure 1), check rotor position. If the rotor position is correct, the motor or shaft may be highly magnetized. Replace any magnetized shafts with non-magnetic material (stainless/aluminum). Consider replacing the sensors with super-shielded models, option -004.

**If the alarm output and/or LED indicate a wiring fault (ORANGE):**

Remove all output wires/connections (A,  $\bar{A}$ , B,  $\bar{B}$ , Z,  $\bar{Z}$ ). The LED should turn GREEN. If the LED does not turn GREEN, the encoder is not receiving enough voltage at +V to properly operate. Correct input voltage problem at power supply or cabling.

If the LED turns GREEN once all outputs are disconnected, reconnect each output, one at a time, monitoring for ORANGE LED. For partial/resistive short circuits, the LED may take a few minutes to turn ORANGE. To speed the troubleshooting process, if possible, spin the encoder while replacing individual output connections. This will make the ORANGE LED condition occur faster. Once the shorted output(s) are located, correct the shorting condition, and the encoder LED should remain GREEN.

If the LED is OFF, but power is being applied to the encoder, check the output voltage level at A,  $\bar{A}$ , B,  $\bar{B}$ . If all outputs are ON ( $\approx$ +V), the connections to +V and COM are reversed. Swap connections between +V and COM; the LED should turn GREEN.

**WIRING DIAGRAMS**

**FOR DIFFERENTIAL APPLICATIONS**

PIN OUT					FUNCTION
OPTION "N", "M", "W"	OPTION "C", "D", & "L"	OPTION "P", "Q", "V", "X", "Z"	OPTION "S" & "T"	OPTION "G"	
BLACK	A	1	COM	1	COMMON OPERATING VOLTAGE
RED	B	6	+V	6	
GREEN	D	2	A	2	$\bar{O}A$ $\bar{O}\bar{A}$
YELLOW	G	7	$\bar{A}$	7	
BLUE	E	3	B	3	$\bar{O}B$ $\bar{O}\bar{B}$
GRAY	H	8	$\bar{B}$	8	
ORANGE	C	4	Z	4	MARKER MARKER COMPLEMENT
WHITE	I	9	$\bar{Z}$	9	
BROWN	F	5	+V (OUT)	NC*	RELAY +V REF* ALARM*
VIOLET	J	10	ALM	NC*	

\* FOR OPTION "G" Pin 5 is not used and Pin 10 is cable shield.  
Twisted pair cable required

**FOR SINGLE ENDED APPLICATIONS**

PIN OUT					FUNCTION
OPTION "N", "M", "W"	OPTION "C", "D", & "L"	OPTION "P", "Q", "V", "X", "Z"	OPTION "S" & "T"	OPTION "G"	
RED	B	6	+V	6	OPERATING VOLTAGE
BLUE	E	3	B	3	
GREEN	D	2	A	2	$\bar{O}A$ COMMON
BLACK	A	1	COM	1	
ORANGE	C	4	Z	4	MARKER RELAY +V REF* ALARM*
BROWN	F	5	+V (OUT)	NC*	
VIOLET	J	10	ALM	NC*	

\* FOR OPTION "G" Pin 5 is not used and Pin 10 is cable shield.

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

	BELDEN	ALPHA
2 PAIR	9368	6062
3 PAIR	9369	6063
4 PAIR	9388	6064
6 PAIR	9389	6066

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

# SMARTach™ III

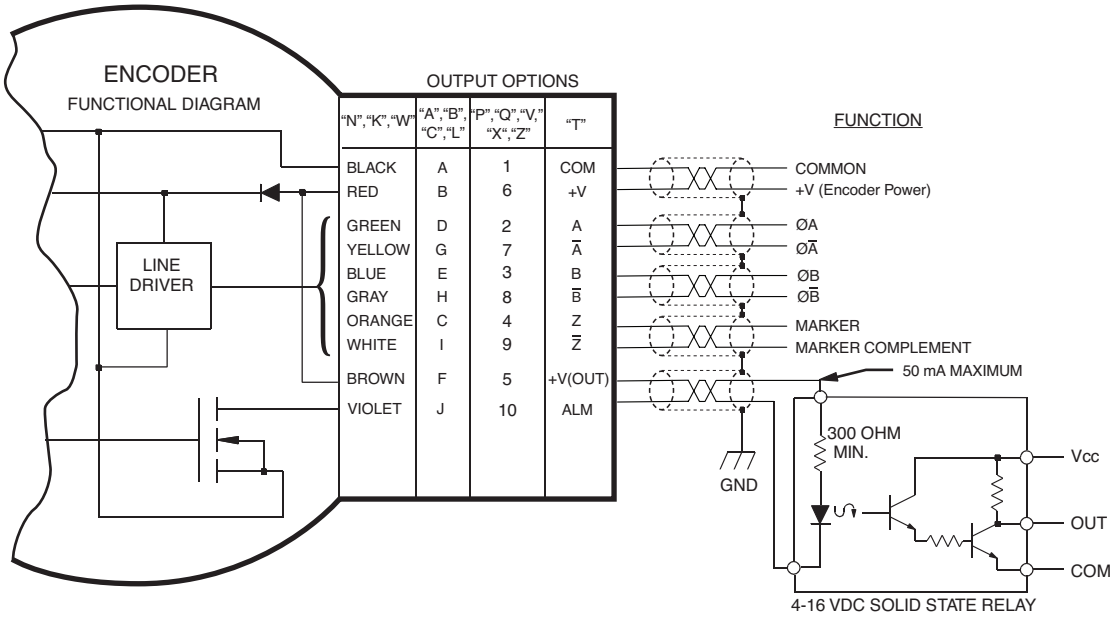
## Application Examples

Applies to all Model AV685 Encoders except connector styles E, F, G, H, J, R, 3.

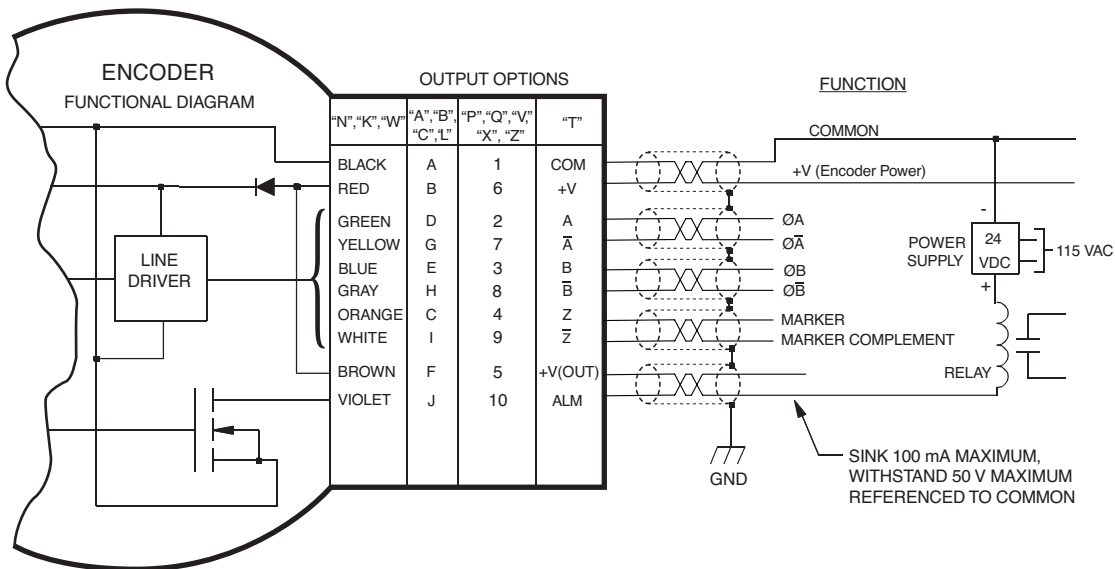
### ALARM OUTPUT CONNECTION

Avtron SMARTach III encoders provide an alarm signal if maintenance is required under specific circumstances. The LED indicator is green when the encoder is properly powered and there are no faults; red indicates alarm on. Green indicates power on, red indicates alarm on. Following are application examples provided to help install the alarm output.

Example 1. Alarm output using +V(OUT). +V(OUT) is equal to +V, the encoder power supply.



Example 2. Alarm Output Using Separate 24 VDC Power Supply and Relay.



Note: Alarm output is "low true"; i.e. it goes to 0V when activated

Figure 1  
Excessive Signal Variation  
("Jitter")

