



AVTRON INDUSTRIAL AUTOMATION, INC.

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Encoder Instructions

XT45

3/4-1 1/8" [19-30mm]
HOLLOW SHAFT

DESCRIPTION

The Avtron Model XT45 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 XT45 operates down to zero speed and can be used for both control and instrumentation applications.

CAUTION

Do not utilize XT45 in hazardous locations which require ATEX, UL, CUL, CSA, or other explosion protection certification. XT45 is not certified for hazardous locations.

When mounted to a machine shaft, the XT45 design eliminates the need for shaft couplings, adapter flanges, or accessory mounting faces. The ultra-high clamping-force collar holds the XT45 in place, even under severe vibration & shock. A high-performance composite shaft insert provides electrical isolation from motor shaft currents. The shaft insert permits models to fit a range of shaft sizes from 3/4" to 1 1/8" [19mm - 30mm]; additional sizes available upon request. An anti-rotation arm prevents housing rotation while allowing for shaft end float.

The XT45 housing features non-contacting labyrinth seals. It can withstand rough environments, shock, and vibration in any orientation.

The XT45 utilizes magnetoresistive sensors. This proven technology is ideal for rugged environments since it is immune to many contaminants that cause optical encoders to fail. All of the XT45 electronics are potted, providing full protection against liquids. The high-power outputs are protected against short circuits and wiring errors.

Each XT45 has a two-phase output (A, B) 90° out of phase, with complements (Ā, B̄), (A Quad B Output). A marker pulse with complement (Z, Z̄) is also present.

The XT45 has a diagnostic package that includes Adaptive Electronics and a Fault-Check output. With this package, the XT45 can maintain itself, and provide an alarm if there is a problem **before** the problem causes unscheduled downtime.

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 XT45 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 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.

SAFETY

The XT45 is not considered as a safety device and is not suitable for connection into a safety system.

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.

INSTALLATION

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

Equipment needed for installation

Supplied:
XT45 Encoder

Optional:
Anti-Rotation Arm Kit
Thread Locker (blue)

XT45 PART NUMBERS AND AVAILABLE OPTIONS INCLUDING AV5 SENSORS

| Model | Bore Size | | Left Output PPR | | Right Output* PPR | Line Driver | Connector Options | Tether | Channels | Modifications |
|--|---|--|---|---|-------------------|--------------------------------|--|--------------------------|----------|--|
| XT45 | Clamping Collar Mount U.S. D- 3/4" E- 7/8" F- 1" G- 1 1/8" Clamping Collar Mount Metric L- 20mm M- 25mm N- 30mm | End of Shaft: Center Bolt Mount* J- 30mm* (no stub) K- fits GE B20 | AF-60 AG-100 AH-120 AA-128 AL-240 AN-256 AE-360 AQ-500 AR-512 AS-600 AV-900 | AJ-960 AW-1000 AY-1024 AZ-1200 A3-2000 A4-2048 A5-2500 AD-4096 A8-4800 A9-5000 | XX-None | 8- 5-24V in, 5-15 out hi-power | W- 18" flex cable Y- 10 pin MS with plug on 12" cable N- Condulet with leads | X- None G- Torque arm | A- All | 000- None 001- Omit Rear Shaft Cover 9xx- Specify cable length xx=feet (use w/ Option "W") |
| * 30mm x 25mm stub shaft required for mounting + Dual output available 4Q2010 | | | | | | | | | | |

Not Supplied:

- 7/16", 3/8" Wrenches
- 3mm, 5mm, 7/16" T-handle hex wrenches or torque wrench with 3mm, 5mm, 7/16" bits (torque wrench required for Center Bolt Mounting Style).
- Dial Indicator Gauge

ELECTRICAL SPECIFICATIONS

- A. Operating Power (Vin)
 - 1. Volts..... 5-24 VDC in
 - 2. Current 100mA, each output, no load
- B. Output Format
 - 1. 2Ø & Comp A, \bar{A} , B, \bar{B} (differential line driver)
 - 2. Marker: 1/Rev Z, \bar{Z}
- 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 165,000 Hz
- G. PPR 8-5000
- H. Line Driver Specs: See table
- I. Connectors: See connector options on page 1

MECHANICAL

- A. Shaft Inertia..... 1.59 lb-in-sec²
- B. Acceleration..... 5000 RPM/Sec. Max.
- C. Speed: 5000 RPM Max.
- D. Weight: 5-6 lbs [2.2-2.7 kg.]
- E. Vibration 20 Gs, 5-2000 Hz (any orientation)
- F. Shock 300 Gs, any orientation

ENVIRONMENTAL

Solid cast aluminum stator and rotor
 Fully potted electronics, protected against oil and water spray
 Non-contacting labyrinth seal provided.
 Operating Temperature:.....-40°C to +100°C.

| | | LINE DRIVER OPTIONS | | | |
|---------------------------|-----------------|--|--------------------|-------|-------|
| Electrical Specifications | | 6 | 8 | 9 | Units |
| Input Voltage | | 5-24 | 5-24 | 5-24 | VDC |
| Nom Output Voltage | | 5-24 | 5-15 | 5 | VDC |
| Line Driver | | 7272 | 4125 | 7272 | |
| Output Resistance Typ | | 13 | 3 | 13 | ohms |
| Maximum Peak Current | | 1500 | 3000 | 1500 | mA |
| Maximum Average Current | | 120 | 350 | 120 | mA |
| Voh Typ | | VIN-1 | VIN-1, max 15V out | VIN-1 | VDC |
| Vol Typ | | 0.5 | 0.4 | 0.5 | VDC |
| Cable Drive Capacity | | 1000' @ 5V 500' @ 12V 200' @ 24V | 1000' | 1000' | feet |
| Protection | Reverse Voltage | yes | yes | yes | |
| | Short Circuit | yes | yes | yes | |
| | Transient | 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 | | | |
| Marker | | One per revolution. Pulse width approximately 1/128 of a revolution | | | |

The hollow shaft XT45 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.

- 1) Disconnect power from equipment and encoder cable.
- 2) Use caliper gauge to verify motor shaft is proper diameter and within allowable tolerances: +0.000", -0.0005" [+0.00, -0.013mm].
- 3) Clean machine shaft of any dirt and remove any burrs.
- 4) Use dial indicator gauge to verify the motor shaft: Total Indicated Runout (TIR) <0.002" [0.05mm].
- 5) Install the anti-rotation bracket tether to the face of the encoder using M5 Hex screws and lock washers, included with the tether.
- 5a) (optional) For non-through-shaft (end of shaft) applications, the optional rear cover may be installed for optimum performance against dirt, liquid sprays and impacts.

FOR CLAMP COLLAR MOUNTING STYLE:

- 6) Loosen clamping collar screws.

NOTE

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

- 7) Insert shaft sizing insert into encoder. DO NOT FORCE.
- 8) Test Fitting: carefully slide the encoder onto the shaft to verify fit. Ensure a minimum of 1/8" [2mm] 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.
- 8a) For end of shaft applications using the clamping collar system, place the XT45 2.75-3.31" [70-84mm] onto the shaft. Ensure the stub shaft does not contact the optional rear cover.
- 8b) For thru-shaft applications using the clamping collar system, remove the rear shaft cover, retain the (4x) M4 socket head screw, and position the XT45 as required.
- 9) Tighten screws on clamping collar evenly until snug, then tighten each screw to 95 in-lb [10.7 Nm]. DO NOT USE A STANDARD RIGHT ANGLE WRENCH. Use only a T-handle hex wrench or torque wrench with hex bit.

NOTE

To verify proper collar installation: check to ensure the clamping collar compression washers are completely flattened. For clamping collar installation, proceed to step 10.

OR FOR END OF SHAFT CENTER BOLT MOUNT STYLE:

6. Using the bolt(s) and thread locker provided, mount the 30mm diameter stub shaft on the motor. Use dial indicator to verify the stub shaft TIR <0.002" [0.05mm]
7. Remove the sealing plug from the XT45.
8. Carefully slide the encoder onto the shaft to verify fit. Ensure a minimum of 0.050" [1mm] between encoder and stub shaft 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.
9. Insert center mounting screw (M8x1.0x35 with Belleville washers provided) through the body of the encoder into the stub shaft tapped hole and tighten to 424 in-lbs [48n-m]
- 9a. Replace rear sealing plug into XT45. Tighten to 150 in-lbs [17n-m]

XT45

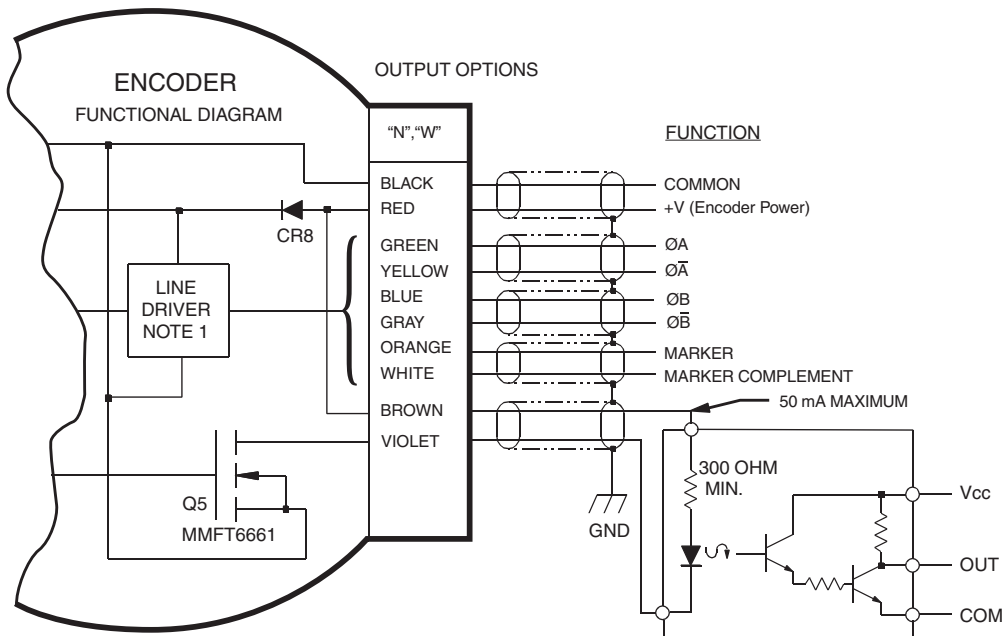
Application Examples

Applies to all Model XT45 Encoders except connector style "Y".

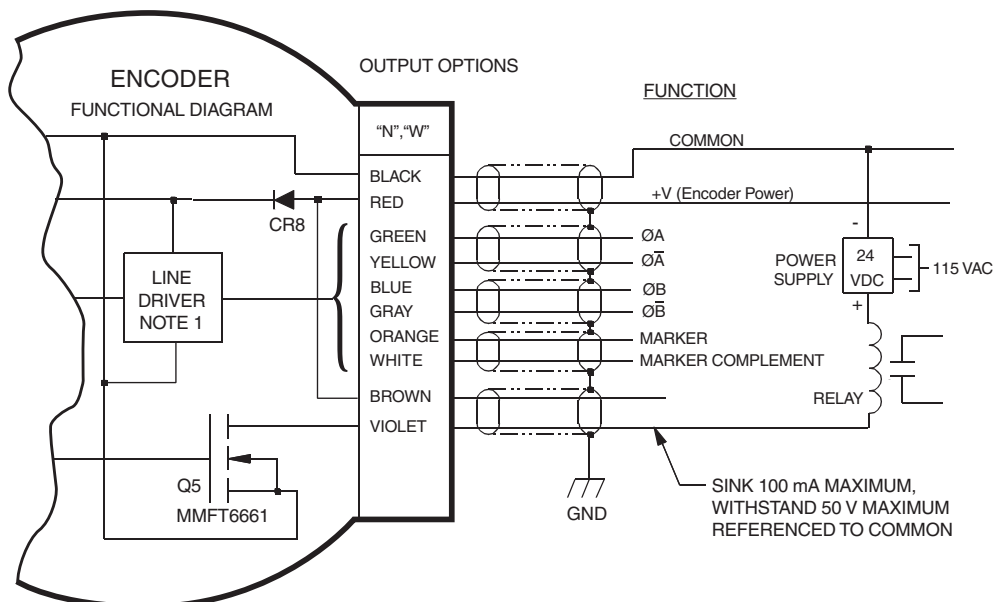
ALARM OUTPUT CONNECTION

Avtron XT45 encoders provide an alarm signal if maintenance is required under specific circumstances. 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.

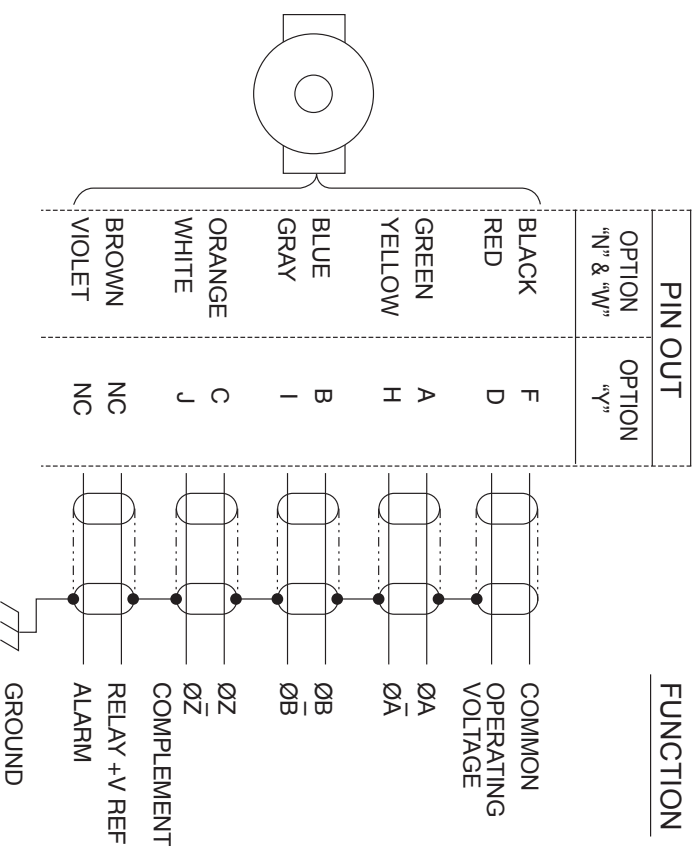


Example 2. Alarm Output Using Separate 24 VDC Power Supply and Relay.

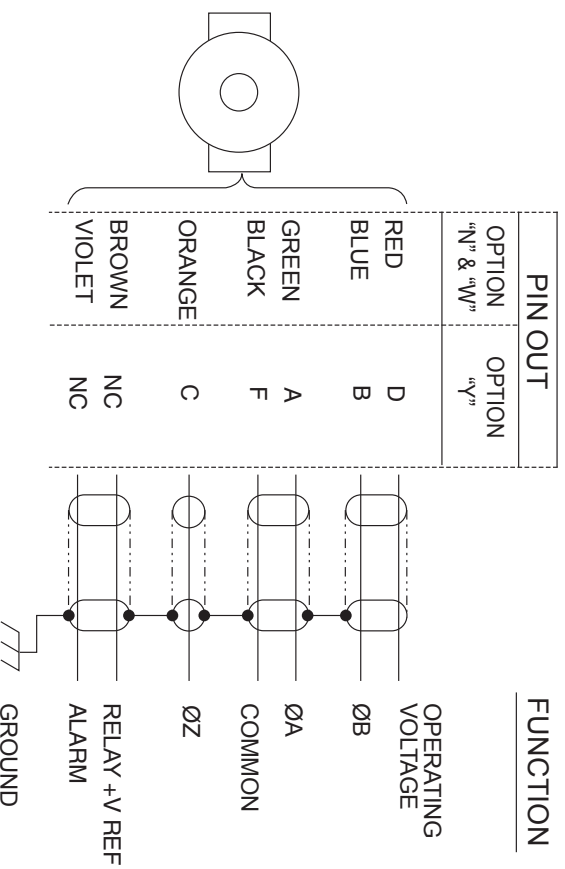


WIRING DIAGRAMS

FOR DIFFERENTIAL APPLICATIONS



FOR SINGLE ENDED APPLICATIONS



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

- 10) Attach free end of the anti-rotation arm to the bracket tether using the shoulder bolt provided.
- 11) 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. The bracket should be parallel to the encoder face, 90 degrees to the shaft to avoid encoder bearing damage.
- 12) Turn shaft by hand and verify the shaft turns freely and does not produce excessive runout/wobble of the encoder (<0.007" TIR [0.18mm], Total Indicated Runout.)
- 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.

ENVIRONMENTAL CONSIDERATIONS

Special attention is to be given to conduit runs, interconnection wiring and NEMA type enclosure mounting.

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.

REPAIRS

REMOVAL INSTRUCTIONS:

FOR CLAMPING COLLAR MOUNTING STYLE:

1. Unbolt tether arm from mounting point on motor.
2. Loosen both clamping collar screws.
3. Slide the encoder off the motor.

OR FOR END OF SHAFT CENTER BOLT MOUNTING STYLE:

1. Unbolt tether arm from mounting point on motor.
2. Unscrew & remove the sealing plug from the XT45.
3. Unscrew & remove the center mounting bolt.
4. Slide the encoder off the shaft.
5. (optional) If the encoder does not remove easily, do NOT force. Instead, use the center bolt lifter method, detailed below:

Center Bolt Lifter Method (optional)

- 5a. Reinsert and loosely tighten the bolt through the encoder body into the stub shaft.
- 5b. Loosen the reinserted bolt by approximately 5 turns. This will leave the screw head approximately even with the bottom of the seal plug hole threads.
- 5c. Reinsert and tighten the sealing plug cap. This will lift the encoder by pushing on the head of the center mounting bolt. The encoder should move axially ~0.2" [5mm]
- 5d. Check to see if the encoder can now be moved axially on the shaft. If it can, remove the seal cap and center bolt and remove the encoder.
- 5e. If the encoder cannot yet be moved by hand, repeat the lifting cycle as needed: remove the cap, loosen the bolt an additional ~5 turns, replace and retighten the cap, and the encoder will move an additional 0.2" [5mm] for each repetition.

There are no field replaceable parts in an XT45. The unit should be returned to the factory for all repairs.

WIRING INSTRUCTIONS

CAUTION

Remove power before wiring.

For bidirectional operation of the XT45, 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 (XT45 mounting end).

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 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, 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.

OUTLINE DIMENSIONS AND OPTION DETAILS

SHAFT ENGAGEMENT:
 Minimum: 2.75 [70mm]
 Maximum (With Cover): 3.31[84mm]

ANTI-ROTATION ARM

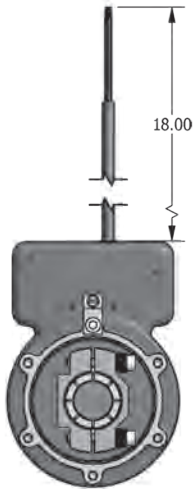
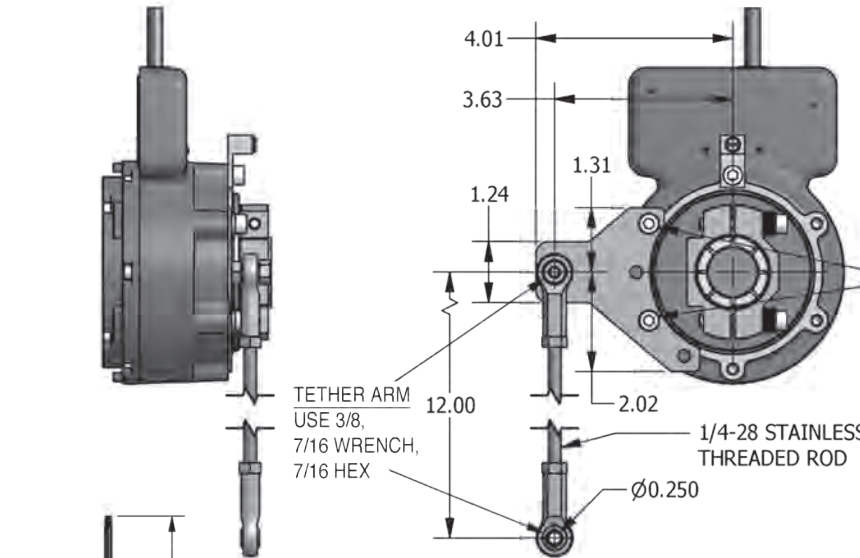
TETHER ARM
 USE M5 HEX
 FOR M6 SHCS X2
 TORQUE
 95 IN-LB
 (10.7 N-M)

WITH COVER

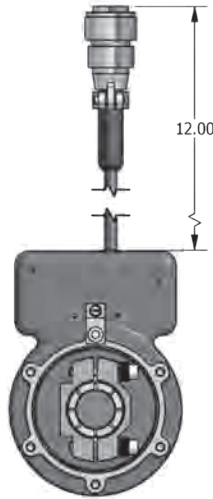
COVER SCREWS
 USE M3 HEX
 FOR M4 SHCS X4
 TORQUE
 25 IN-LBS
 (2.8 N-M)

TETHER ARM
 USE 3/8,
 7/16 WRENCH,
 7/16 HEX

1/4-28 STAINLESS
 THREADED ROD
 Ø0.250

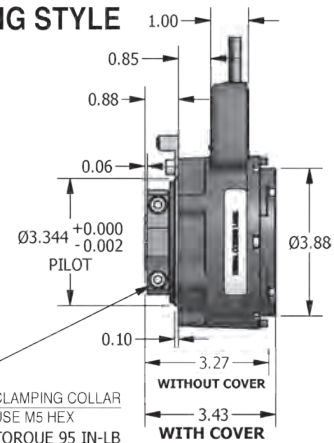
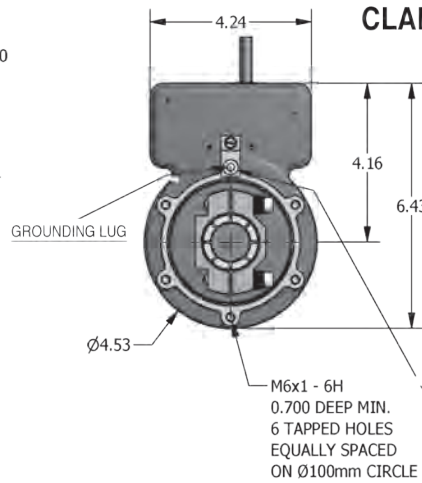


OPTION "W"
 18 IN. FLEX
 CABLE



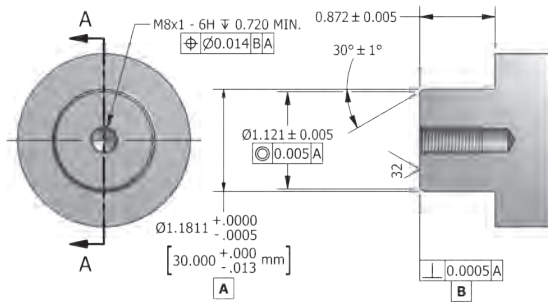
OPTION "Y"
 10 PIN MS
 CONNECTOR

CLAMPING STYLE

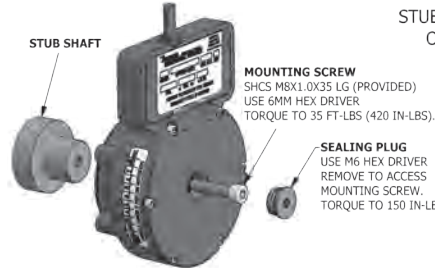


CLAMPING COLLAR
 USE M5 HEX
 TORQUE 95 IN-LB
 (10.7 N-M)

CENTER BOLT MOUNTING STYLE



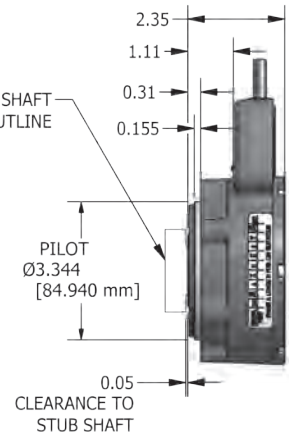
STUB SHAFT
 REQUIRED DIMENSIONS TO
 MATE WITH ENCODER
 MATERIAL: 303 STAINLESS STEEL



ASSEMBLE TO SHAFT

MOUNTING SCREW
 SHCS M8X1.0X35 LG. (PROVIDED)
 USE 6MM HEX DRIVER
 TORQUE TO 35 FT-LBS (420 IN-LBS).

SEALING PLUG
 USE M6 HEX DRIVER
 REMOVE TO ACCESS
 MOUNTING SCREW.
 TORQUE TO 150 IN-LB



Features and specifications subject to change without notice.
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