

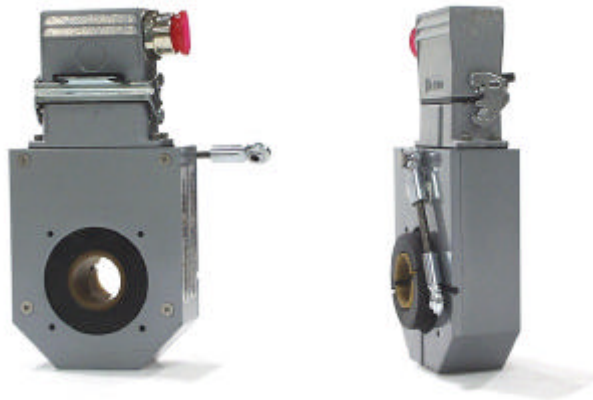


# Instruction Manual

## Magcoder<sup>®</sup> HS35 Hollow Shaft Encoder

*Designed for use in*

**0.500" - 1.125" Outer Diameter  
Hollow Shaft Applications**



**northstar**  
A Lake Shore Company

NorthStar Technologies, Inc.

A Lake Shore Company

575 McCorkle Blvd.

Westerville, Ohio 43082

Tel: (614) 818-1150

Fax: (614) 891-6909

E-mail: (sales) sales@northstar-tec.com

(service) service@northstar-tec.com

www.northstar-tec.com

**791-1011-00**

## LIMITED WARRANTY

NorthStar Technologies, Inc. (henceforth NorthStar), the manufacturer, warrants this product for a period of twelve (12) months from the date of shipment. During the warranty period, under authorized return component parts to NorthStar freight prepaid, the company will repair, or at its option replace, any part found to be defective in material or workmanship, without charge to the Owner for parts, service labor, or associated customary shipping cost. Replacement or repaired parts will be warranted for only the unused portion of the original warranty.

This warranty is limited to NorthStar products purchased and installed in the United States. This same protection will extend to any subsequent owner during the warranty period. It does not apply to damage caused by accident, misuse, fire, flood or acts of God, or from failure to properly install, operate, or maintain the product in accordance with the printed instructions provided.

THIS WARRANTY IS IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHICH ARE EXPRESSLY EXCLUDED. THE OWNER AGREES THAT NORTHSTAR'S LIABILITY WITH RESPECT TO THIS PRODUCT SHALL BE SET FORTH IN THIS WARRANTY, AND INCIDENTAL OR CONSEQUENTIAL DAMAGES ARE EXPRESSLY EXCLUDED.

## WARRANTY RETURN POLICY

If you experience any technical problems with NorthStar products, please contact our Technical Support Department at (614) 818-1150 from 8:00 A.M. to 5:00 P.M. Eastern Standard Time (EST), Monday through Friday or in writing to fax: (614) 891-6909 or e-mail: [service@northstar-tec.com](mailto:service@northstar-tec.com). Please provide your customer number, item description, serial number, invoice number, date of purchase, and the specifics of the problem.

A representative will attempt to solve your problem by running a few diagnostics. If it is determined by our representative in conjunction with the Customer that the product is required to be returned to NorthStar's factory for warranty repair, a Return Goods Authorization (RGA) number will be issued. For control purposes, only those items identified with an RGA number may be returned to NorthStar. Please make sure that the RGA number is clearly marked on the shipping label. Packages missing an RGA number cannot be accepted by our Receiving Department and must be returned to the sender freight COD. Ship returned products to NorthStar PRE-PAID and insured for its full value.

EXPRESS SERVICE IS OFFERED ON ALL WARRANTY REPAIRS WHERE AN RGA NUMBER HAS BEEN ISSUED. IF THE SAME WARRANTY PART THAT IS BEING RETURNED IS IN STOCK, NORTHSTAR WILL IMMEDIATELY SHIP OUT A NEW REPLACEMENT PART, INVOICE THE REPLACEMENT PART AND ISSUE A CREDIT INVOICE WHEN THE RGA NUMBER WARRANTY PART IS RECEIVED AT NORTHSTAR AND IS CONFIRMED TO BE A WARRANTY REPAIR. NORTHSTAR WILL EXPRESS SHIP THE PRODUCT PRE-PAID, USING THE SAME METHOD BY WHICH THE WARRANTY PART WAS SHIPPED TO NORTHSTAR, (i.e., IF THE RGA WARRANTY PART WAS SHIPPED OVERNIGHT, NORTHSTAR WILL SHIP IN THE SAME MANNER.)

There is a 15% restocking fee on all items returned for credit to NorthStar. This includes all items that are returned for exchange. All replacement parts must be purchased before they are sent out to the customer. If credit needs to be issued it will be issued upon the return of the product if the unit is in good condition.

## TRADEMARK ACKNOWLEDGMENT

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this manual and NorthStar was aware of a trademark claim, the designations have been printed in initial capital letters and the <sup>™</sup> or <sup>®</sup> symbol used.

Copyright © 1998 by NorthStar Technologies, Inc. All rights reserved. No portion of this manual may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the express written permission of NorthStar.

## Table of Contents

Chapter/Paragraph/Illustration	Page
<b>1 Introduction.....</b>	<b>4</b>
1.1 Safety Summary.....	4
1.2 General.....	5
<i>Figure 1: Magcoder<sup>®</sup> HS35 (view of anti-rotation arm).....</i>	<i>5</i>
1.3 Description .....	5
1.4 Specification .....	5
<b>2 Installation.....</b>	<b>6</b>
<i>Figure 2: Magcoder<sup>®</sup> HS35 Dimensional Drawing .....</i>	<i>6</i>
2.1 Inspection and Unpacking .....	6
2.2 Mounting Options.....	6
2.2.1 Mounting to a NEMA 4.5” C-face Motor .....	7
<i>Figure 3: Components for Mounting on NEMA 4.5” 56C-face Motor .....</i>	<i>7</i>
2.2.2 Mounting to a NEMA 8.5” C-face Motor .....	8
<i>Figure 4: Components for Mounting on NEMA 8.5” C-face Motor .....</i>	<i>8</i>
2.2.3 Mounting to a Motor with a Fan Shroud .....	9
<i>Figure 5: Components for Mounting to a Motor with a Fan Shroud .....</i>	<i>9</i>
<i>Figure 6: Cutaway, Side View of the Anchor Lug and Bolt Attachment .....</i>	<i>9</i>
2.3 Electrical Installation.....	10
2.3.1 Quick Release Connector Hood Wiring.....	11
<i>Figure 7: Industrial Latching Connector.....</i>	<i>11</i>
2.4 Uninstalling the MagCoder.....	11
2.5 Returning Equipment to NorthStar .....	11

Methods and apparatus disclosed and described herein have been developed solely on company funds of NorthStar Technologies, Inc. No government or other contractual support or relationship whatsoever has existed which in any way affects or mitigates proprietary rights of NorthStar Technologies, Inc. in these developments. Methods and apparatus disclosed herein may be subject to U.S. Patents existing or applied for. NorthStar Technologies, Inc. reserves the right to add, improve, modify, or withdraw functions, design modifications, or products at any time without notice. NorthStar shall not be liable for errors contained herein or for incidental or consequential damages in connection with furnishing, performance, or use of this material.

# CHAPTER 1

## INTRODUCTION

### 1.1 Safety Summary

High current, voltage, and rotating parts can cause serious or fatal injury. The use of electric machinery, like all other uses of concentrated power and rotating equipment, may be hazardous. Only qualified personnel should install, operate, or maintain electric machinery in accordance with applicable provisions of the National Electrical Code and sound local practices. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. NorthStar Technologies, Inc. assumes no liability for the customer's failure to comply with these requirements.

#### Rotating Machinery

Avoid contact with rotating parts. Avoid by-passing or rendering inoperative any safety guards or protection devices. Avoid extended exposure in close proximity to machinery with high noise levels. Use proper care and procedures in handling, lifting, installing, operating and maintaining the equipment.

#### Before Installation

Safe maintenance practices with qualified personnel is imperative. Before starting maintenance procedures, be positive that, (1) equipment connected to the shaft will not cause mechanical rotation, (2) main machine windings have been disconnected and secured from all electrical power sources, and (3) all accessory devices associated with the work area have been de-energized. If high potential insulation test is required, follow procedures and precautions outlined in NEMA standards MG-1.

#### Grounding

Improperly grounding the frame of the machine can cause serious or fatal injury to personnel. Grounding of the machine frame and structure should comply with the National Electrical Code and be consistent with sound local practices. Check wiring diagram before connecting power.

#### Do Not Operate In An Explosive Atmosphere

Do not operate the instrument in the presence of flammable gases or fumes. Operating any electrical instrument in such an environment constitutes a definite safety hazard.

#### Keep Away From Live Circuits

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified maintenance personnel. Do not replace components with power cable connected. To avoid injuries, always disconnect power and discharge circuits before touching them.

#### Do Not Substitute Parts Or Modify Instrument

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an authorized NorthStar Technologies, Inc. representative for service and repair to ensure that safety features are maintained.



**CAUTION!:** Crucial information, that *must* be read and followed, regarding safety and unit functioning.



**DO THIS!:** Additional procedure, that must be read and followed, without safety concerns.



**NOTE:** Useful information that should be read.



**QUESTION:** Helpful hints to answer your possible questions.

## 1.2 General

These instructions do not claim to cover all details of variation in equipment or to provide for every possible contingency or hazard to be met in connection with installation, operation, and service. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, please contact NorthStar Technologies, Inc., or one of its designated representatives.

## 1.3 Description

The Magcoder<sup>®</sup> HS35 is a high performance, reliable digital tachometer, providing velocity feedback from both AC and DC electric motors. The hollow shaft design permits easy mounting on motors without accessory mounting flanges. All critical alignments within the encoder are completed for you. The torque arm is very forgiving to any axial, or radial motions of the motor. Magnetostrictive technology allows the Magcoder<sup>®</sup> HS35 to be placed in the harshest environments. Features include an operating voltage of 5-26 VDC, short circuit protection, and EMI noise resistance. NorthStar provides a heavy duty, water-tight latching industrial connector. The connector also features 1/2 NPT pipe thread for armored electrical conduit.

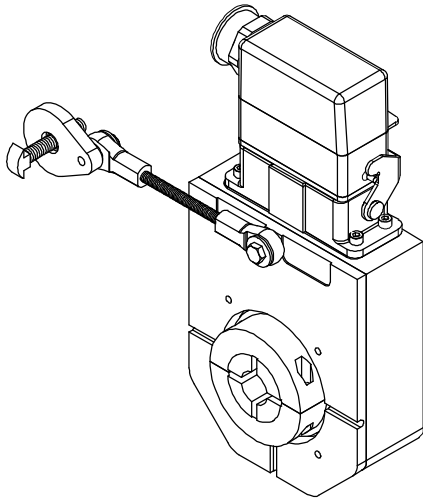


Figure 1: Magcoder<sup>®</sup> HS35 (view of anti-rotation arm)

## 1.4 Specifications (subject to change without notification)

Electrical Specifications	
Resolution	60, 100, 120, 125, 128, 150, 200, 250, 256, 300, 500, 512, 600, 1000, 1024, 1200 PPR (>1000 Z optional)
Frequency Response	0-120KHz
Pulse Code	A, B, Z (Index), and complements (A, B, Z)
Phase Duty Cycle	50% ± 15% (within defined mechanical specifications)
Quadrature Accuracy	90° ± 22° (within defined mechanical specifications)
Output Type	High speed, line driver with complements
Rise and Fall Time	Less than 1 µs at 1,000 pf typical
Internal Current Consumption	40 mA
Output current capability	40 mA
Connection Options: Connector	10 pin Epic style, NEMA 4, 12 sealed latching industrial connector
Cable	24 AWG, 8 Conductor, 0.5 m (18") shielded twisted pairs
MS Connector	MS 3102 E 18-1P
Input Voltage	+ 5.0 to +26.0 VDC reverse polarity and short circuit protected
Mechanical Specification	
Unit Weight/ Dimensions	5.00 lbs (2.27kg) / 1.25" (32mm) x 3.50" (90mm) x 5.50" (140mm)
Box Weight / Dimensions	0.60 lbs (0.30kg) / 13.25" (337mm) x 8.25" (210mm) x 3.25" (83mm)
Maximum Operational Speed	3600 RPM
Shaft Requirements	6-29 mm (.250"-1.125")
Environmental Specifications	
Operational Temperature	-20° to + 80° C
Operational Humidity Range	98% Maximum
Chemical Resistance	Salt spray, most solvents, mild acids and bases
Vibration	50 G's for 11 µs

## CHAPTER 2

### INSTALLATION

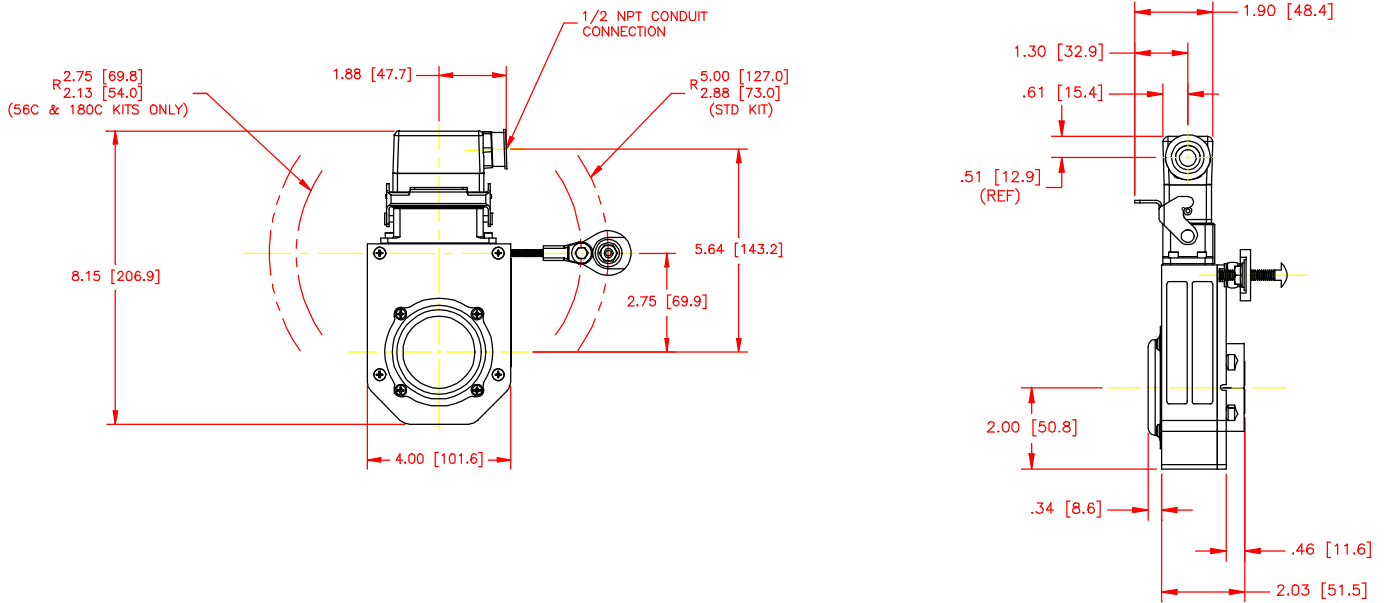


Figure 2: MagCoder<sup>0</sup> HS35 Dimensional Drawing.

### 2.1 Inspection and Unpacking

Inspect shipping container for external damage. If there is damage to any equipment in transit, be sure to file proper claims promptly with the carrier and insurance company. Please advise NorthStar Technologies of such filing. In case of parts shortages, advise NorthStar immediately. NorthStar cannot be responsible for any missing parts unless notified within 60 days of shipment. The standard NorthStar Technologies, Inc. warranty is included on page 2 of this manual.

Open shipping container and locate the packing list. The packing list is included to verify that all components, accessories, and the manual were received. Please use the packing list to check off each item as the unit is unpacked. Inspect for damage. NorthStar recommends that the shipping container be retained for future shipping, storage, or return to factory purposes.

### 2.2 Mounting Options

The unique hollow shaft design of the Magcoder HS35 allows the encoder to be mounted on all motor shaft applications. There are three typical mounting applications described in this manual.

1. **Mounting to a NEMA 4.5" C-face motor**
2. **Mounting to a NEMA 8.5" C-face motor**
3. **Mounting to a motor with a fan shroud**

## 2.2.1 Mounting to a NEMA 4.5" C-Face Motor

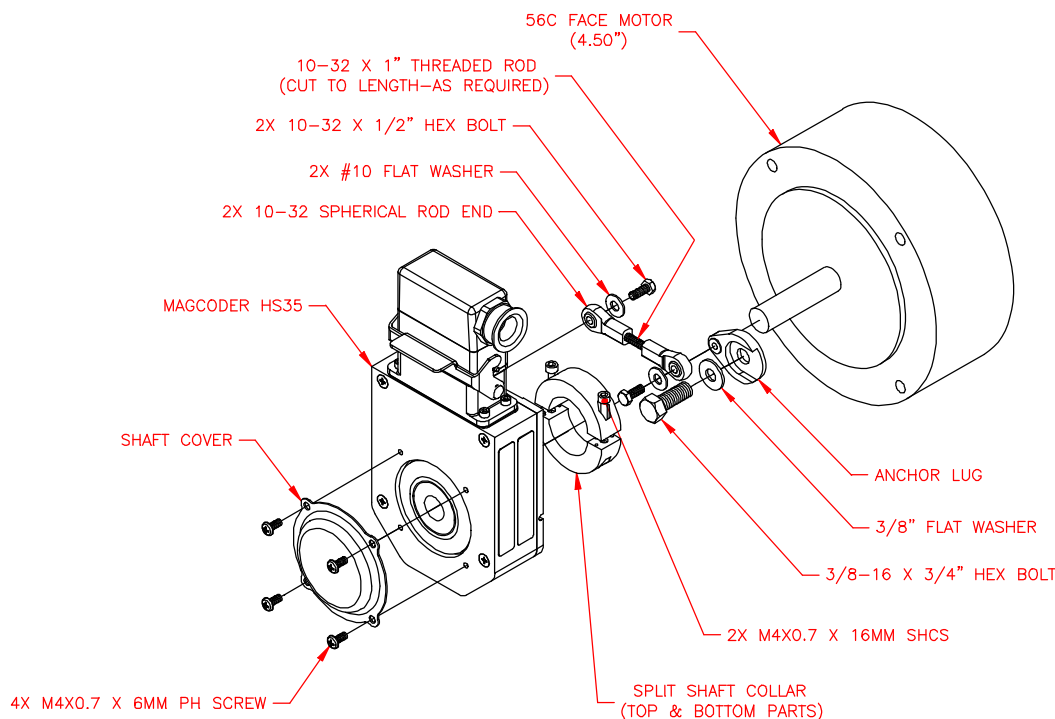


Figure 3: Components for Mounting on NEMA 4.5" 56 C-face motor.

1. Locate the torque arm mounting hole on the motor side of the Magcoder. Insert the 10-32 bolt through the rod end of the torque arm assembly. Tighten the 10-32 bolt to 30 in-lbs.
2. Mount the anchor lug to one of the four 3/8" holes on the 5.875" bolt circle of the motor C-face using the .375 16 UNC bolt. Align lug to form a straight line from motor shaft to anchor lug mounting hole (see Figure 2). Torque = 200 in-lbs.
3. Loosely attach the split shaft collar over the motor mounting sleeve of the Magcoder. Finger tighten M4 socket head cap screws in split collar so that the collar in both parts aligns with the notches in mounting sleeve.
4. Slide the Magcoder, with the split shaft collar and torque arm loosely attached, over the motor shaft. While installing the encoder, engage the torque arm by inserting the 10-32 x 1/2 hex bolt into the tapped hole in the anchor lug. Tighten to 30 in-lbs.
5. Position the encoder to produce approximately a 90° angle from the motor shaft to the torque arm motor mounting hole, in the anchor lug.
6. Without the encoder being completely tightened, set the axial alignment so that no part of the torque arm assembly touches the motor, but is perpendicular to the encoder body. Position should be as close to C-face as possible but not flush with motor (generally 0.12" - 0.15").
7. Tighten 10-32 x 1/2 bolt, in anchor lug, to 30 in-lbs.
8. Tighten M4 socket head cap screws, in split shaft collar, to 12 in-lbs. (Try maintaining the split in the shaft collar with notches in the motor mounting sleeve on the Magcoder.)



Verify installation by checking clearance between the torque arm assembly and motor C-face. The minimum motor shaft length required should be approximately 1.5".

9. For stub shaft applications, mount shaft cover using the four M4 x 6mm pan head screws.

## 2.2.2 Mounting to a NEMA 8.5" C-Face Motor

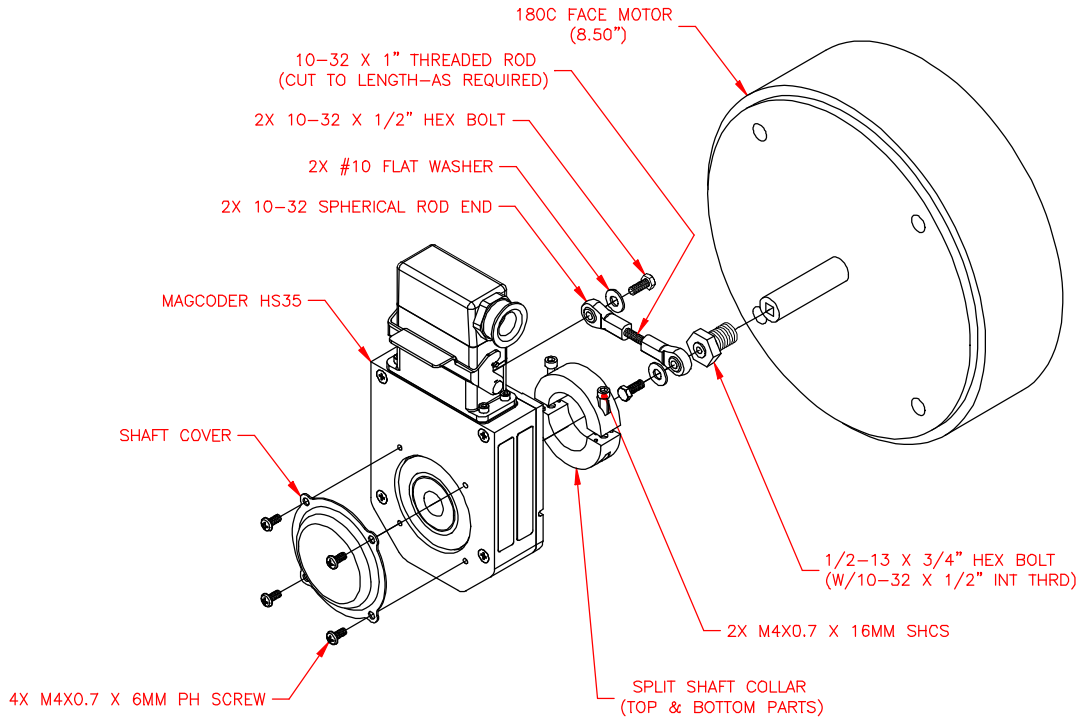


Figure 4: Components for Mounting on NEMA 8.5" 180C-face motor.

1. Locate the torque arm mounting hole on the motor side of the encoder. Insert the 10-32 bolt through the rod end of the torque arm. Tighten the 10-32 bolt to 30 in-lbs.
2. Mount the anchor bolt into one of the four  $\frac{1}{2}$  holes on the 7.25" bolt circle of the motor C-face. Torque to 500 in-lbs.
3. Loosely attach the split shaft collar the over motor mounting sleeve of the Magcoder. Finger tighten M4 socket head cap screws in split collar so that the collar in both parts aligns with the notches in mounting sleeve.
4. Slide the Magcoder, with the split shaft collar and torque arm loosely attached, over the motor shaft. While installing the encoder, engage the torque arm by inserting the 10-32 x  $\frac{1}{2}$  hex bolt into the tapped hole in the anchor lug. Tighten to 30 in-lbs.
5. Position the encoder to produce approximately a 90° angle from the motor shaft to the torque arm motor mounting hole, in the anchor lug.
6. Without the encoder being completely tightened, set the axial alignment so that no part of the torque arm assembly touches the motor, but is perpendicular to the encoder body. Position should be as close to C-face as possible but not flush with motor (generally 0.12 – 0.15").
7. Tighten 10-32 x  $\frac{1}{2}$  bolt, in anchor lug, to 30 in-lbs.
8. Tighten M4 socket head cap screws, in split shaft collar, to 12 in-lbs. (Try maintaining the split in the shaft collar with notches in the motor mounting sleeve on the Magcoder.)

Verify installation by checking clearance between the torque arm assembly and motor C-face. The minimum motor shaft length required should be approximately 1.5".



9. For stub shaft applications, mount shaft cover using the four M4 x 6mm pan head screws.



### 2.2.3 Mounting to a Motor with a Fan Shroud

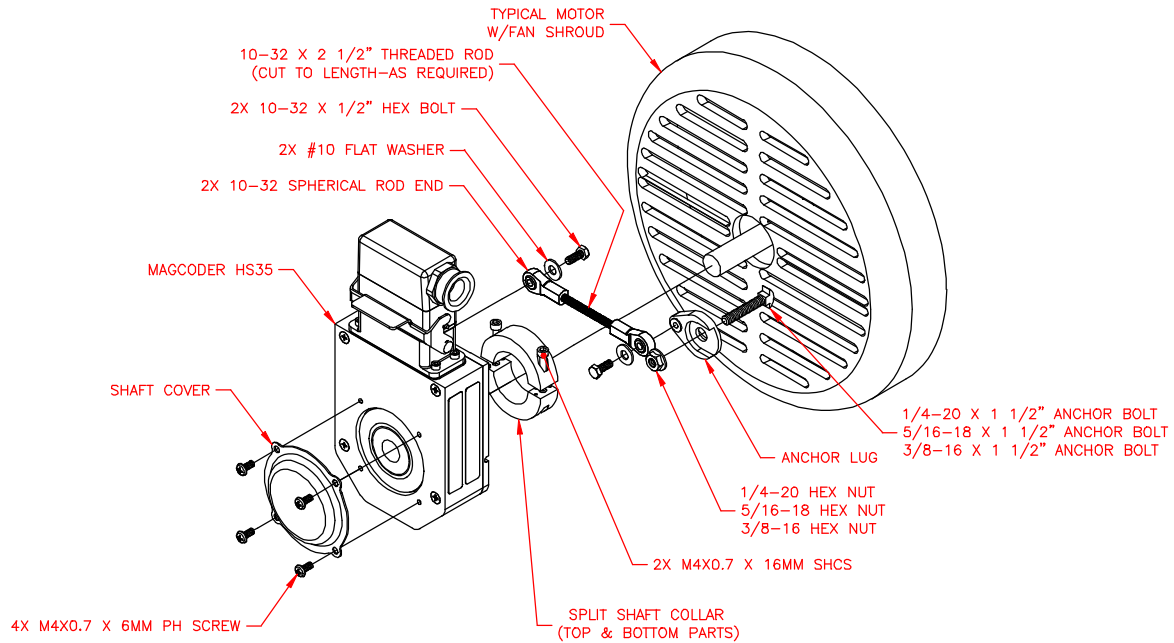


Figure 5: Components for Mounting on Fan Shroud Motor.



If only the opposite drive end of the motor is available and has a fan shroud, you must use the special anchor bolt and lug on the end of the torque arm. Figure 6 shows the anchor lug and bolt attached to the fan shroud.

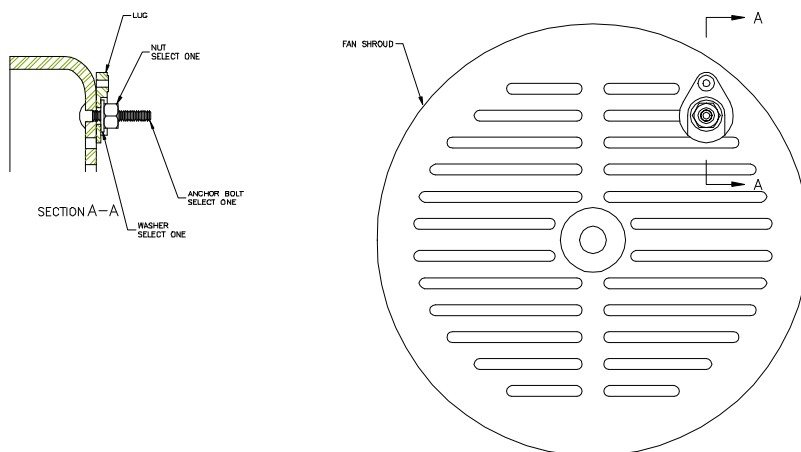


Figure 6: Cutaway, Side View of the Anchor Lug and Bolt Attachment.

1. Locate the torque arm mounting hole on the motor side of the encoder. Insert the 10-32 bolt through the rod end of the torque arm. Tighten the 10-32 bolt to 30 in-lbs.

2. Arrange the anchor bolt (1/4, 5/16 or 3/8" bolts) and lug. Slide the anchor bolt head into the fan shroud through an available vent slot.
3. Rotate the bolt 90° so that the anchor bolt catches to the inside of the fan shroud. Align lug to form a straight line from shaft to anchor. Once positioned, tighten the hex nut with approximately (1/4-20 = 25in-lbs, 5/16 =45in-lbs, 3/8-16 = 95 in-lbs) torque.
4. Loosely attach the split shaft collar the over motor mounting sleeve of the Magcoder. Finger tighten M4 socket head cap screws in split collar so that the collar in both parts aligns with the notches in mounting sleeve.
5. Slide the Magcoder, with the split shaft collar and torque arm loosely attached, over the motor shaft. While installing the encoder, engage the torque arm by inserting the 10-32 x 1/2hex bolt into the tapped hole in the anchor lug. Tighten to 30 in-lbs.
6. Position the encoder to produce approximately a 90° angle from the motor shaft to the torque arm motor mounting hole, in the anchor lug.
7. Without the encoder being completely tightened, set the axial alignment so that no part of the torque arm assembly touches the motor, but is perpendicular to the encoder body. Position should be as close to C-face as possible but not flush with motor (generally 0.12-0.15").
8. Tighten 10-32 x 1/2bolt, in anchor lug, to 30 in-lbs.
9. Tighten M4 socket head cap screws, in split shaft collar, to 12 in-lbs. (Try maintaining the split in the shaft collar with notches in the motor mounting sleeve on the Magcoder.)



Verify installation by checking clearance between the torque arm assembly and motor C-face. The minimum motor shaft length required should be approximately 1.5".

10. For stub shaft applications, mount shaft cover using the four M4 x 6mm pan head screws.

### 2.3 Electrical Installation

Electrical connections are through a standard 1/2 inch NPT liquid tight fitting (PG16 optional).

Interconnection cable recommendations are as follows: stranded copper, 24 through 16 gage, braided or foil with drain wire shielding of 0.05 µF maximum total mutual or direct capacitance and outer sheath insulated. Shrink tubing may be placed over any non-insulated wires. If shielded twisted pair wire is used, do not cross channels. Keep together each pair of complementary channel outputs in a single twisted pair (e.g., A and A). An example of this type of cable is Belden 9730 or Belden 9728. Note: NorthStar offers a general purpose encoder cable (Part # RIM DB1).



Reversing power and common should not damage the unit. However, applying power to any of the sensor outputs may cause damage.

The encoder requires 5 to 26 volts DC on pin 6 and common on pin 1. Other electrical connections are as listed in Table 1.



We recommend a liquid tight termination if the application involves contaminants.

Table 1.

Signal	Industrial Connector	Pigtail Wire Color	Optional MS Connector
VCC (5-26 VDC)	6	Red	D
Common	1	Black	F
A	3	Blue	A
A	8	Gray	H
B	2	Green	B
B	7	Yellow	I
Z*	4	Violet	C
Z*	9	Orange	J
Case (optional)	5	Brown	G
No Connection	10	----	E

\*Applies only to units with index pulse capability.

### 2.3.1 Quick Release Connector Hood Wiring

To install the Quick Release Connector, perform the following steps:

1. Remove the four screws that hold the terminal block in place from mating connector hood. Remove the terminal block from the hood.
2. Insert wiring through the liquid tight flexible seal and the mating connector hood. Enough wire should be left exposed to comfortably reach the terminal block.
3. Wire to terminal block according to the wire code in Table 1. A similar wiring list is attached to the enclosure.
4. Replace the terminal block in the connector hood. Insert and tighten the four mounting screws.
5. Tighten the liquid tight fitting on the housing.
6. **OPTIONAL:** In some hostile environments, seal between connector body and sensor module can be improved by applying a sealant (silicone grease, etc.) on the neoprene seal of the connector.
7. Place the connector on the sensor mounting and snap the latch into place.

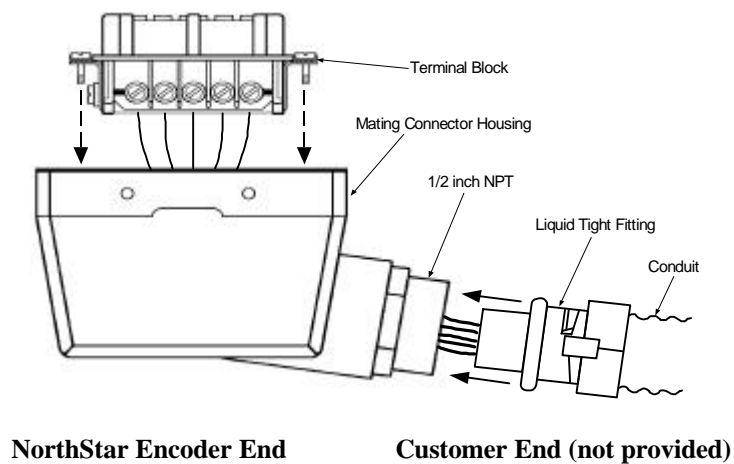


Figure 7: Industrial Latching Connector

### 2.4 Uninstalling the MagCoder

1. Loosen the M4 socket head cap screws in split shaft collar. Loosen 10-32 x 1/4 hex bolt attached to the anchor lug or bolt on the motor. Carefully remove the Magcoder and torque arm assembly.
2. Perform the installation steps in reverse order.

### 2.5 Returning Equipment to NorthStar

If it is necessary to return the unit for repair or replacement, a **Return Goods Authorization (RGA)** number must be obtained from a factory representative before returning the equipment to our service department. When returning an instrument for service, the following information must be provided before NorthStar can attempt any repair.

1. Instrument model and serial number.
2. User's name, company, address, and phone number.
3. Malfunction symptoms.
4. Description of system.
5. Returned Goods Authorization number.

Please consult the factory for shipping instructions.

