

**SERIES:** AMT30 | **DESCRIPTION:** MODULAR ENCODER

**FEATURES**

- U, V, W commutation lines
- small size 37 mm
- line count up to 1024 PPR
- optional line driver output (303LD)
- single pulse index
- capacitive ASIC technology
- modular locking hub design for ease of installation
- 2, 4, 6, 8, 10, 12, or 20 pole motors
- 6 programmable functions
- 'One Touch' commutation signal alignment


**ELECTRICAL**

| parameter                     | conditions/description                                                    | min | typ | max     | units |
|-------------------------------|---------------------------------------------------------------------------|-----|-----|---------|-------|
| power supply                  |                                                                           | 4.5 | 5   | 5.5     | V     |
| current consumption           | with unloaded outputs                                                     |     | 8   | 10      | mA    |
| commutation output signals    | U, V, W phase                                                             |     |     |         |       |
| commutation pole              | 2, 4, 6, 8, 10, 12, 20 (software programmable)                            |     |     |         |       |
| incremental output signals    | A, B, Z (AMT303)<br>A, $\bar{A}$ , B, $\bar{B}$ , Z, $\bar{Z}$ (AMT303LD) |     |     |         |       |
| incremental output waveform   | quadrature output square wave                                             |     |     |         |       |
| quadrature output resolutions | 96, 192, 200, 250, 384, 400, 500, 512, 800, 1000, 1024                    |     |     |         | PPR   |
| index                         | one pulse per 360 deg.                                                    |     |     |         |       |
| quadrature output current     | AMT303 (single ended) sink/source<br>AMT303LD (differential) sink/source  |     |     | 2<br>20 | mA    |
| position accuracy             |                                                                           |     | 0.2 |         | deg   |

**MECHANICAL**

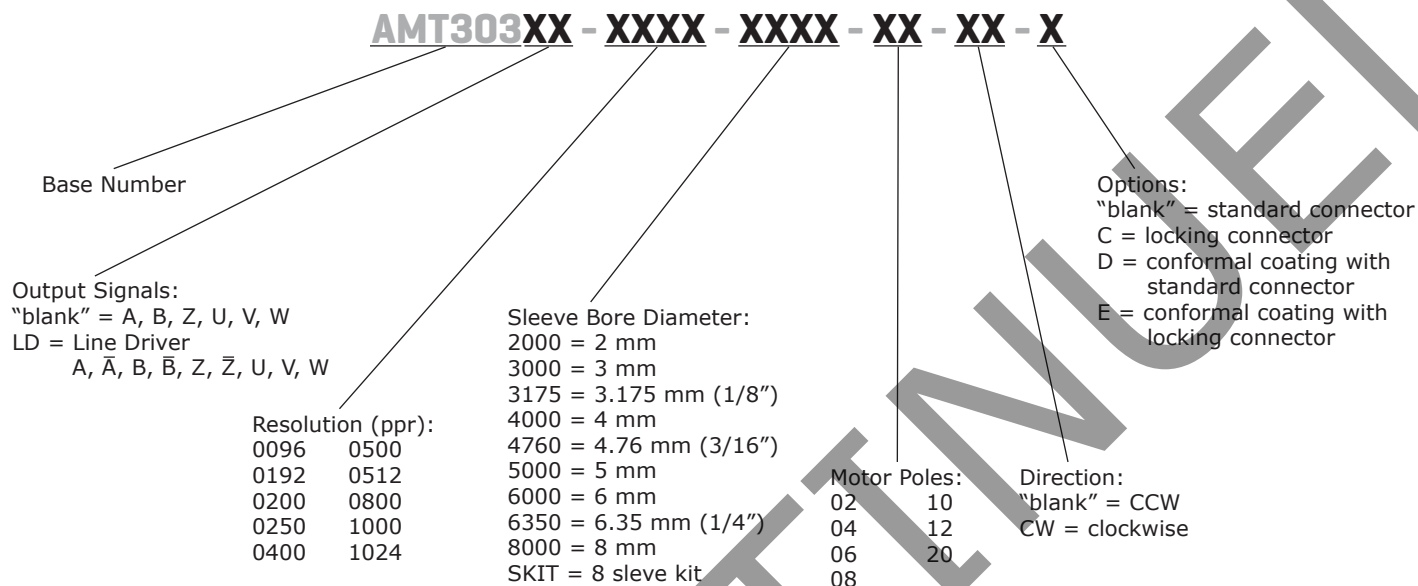
| parameter             | conditions/description                                                                                                                                                                                                                                                                                                              | min | typ | max   | units |
|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|-------|-------|
| max. rotational speed |                                                                                                                                                                                                                                                                                                                                     |     |     | 8,000 | RPM   |
| mounting options      | A) 2 x M1.6 on 16 mm (0.63") bolt circle<br>B) 2 x #4 on 19.05 mm (0.75") bolt circle<br>C) 2 x M1.6 or M2 on 20 mm (0.787") bolt circle<br>D) 3 x M1.6 or M2 on 20.9 mm (0.823") bolt circle<br>with washers in option B holes<br>E) 3 x M1.6 or M2 on 22 mm (0.866") bolt circle<br>F) 4 x M1.6 or M2 on 25.4 mm (1") bolt circle |     |     |       |       |
| axial play            |                                                                                                                                                                                                                                                                                                                                     |     |     | ±0.4  | mm    |

**ENVIRONMENTAL**

| parameter             | conditions/description                      | min | typ | max | units |
|-----------------------|---------------------------------------------|-----|-----|-----|-------|
| operating temperature |                                             | -40 |     | 125 | °C    |
| humidity              | non-condensing                              |     |     | 85  | %     |
| vibration             | 10 ~ 500 Hz, 5 min. sweep, 2 hours each XYZ |     |     | 5   | G     |
| shock                 | 3 pulses, 6 ms, 3 each XYZ                  |     |     | 200 | G     |

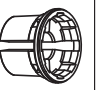
## PART NUMBER KEY

For customers that prefer a specific AMT303 configuration, please reference the custom configuration key below.



## AMT303 KITS

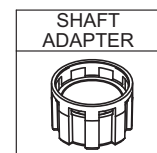
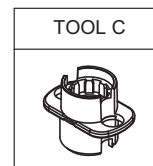
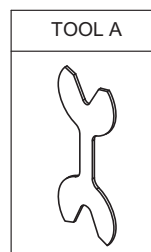
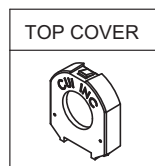
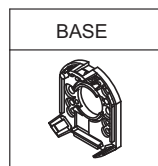
In order to provide maximum flexibility for our customers, the AMT303 series is provided in kit form standard. This allows the user to implement the encoder into a range of applications using one sku#, reducing engineering and inventory costs.

| SLEEVES                                                                             |                                                                                     |                                                                                     |                                                                                      |                                                                                       |                                                                                       |                                                                                       |                                                                                       |                                                                                       |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |  |  |  |  |  |  |  |
| 8mm                                                                                 | 1/4 inch (6.35mm)                                                                   | 6mm                                                                                 | 5mm                                                                                  | 3/16 inch (4.76mm)                                                                    | 4mm                                                                                   | 1/8 inch (3.175mm)                                                                    | 3mm                                                                                   | 2mm                                                                                   |
| Blue                                                                                | Snow                                                                                | Red1                                                                                | Green1                                                                               | Yellow1                                                                               | Gray60                                                                                | Purple1                                                                               | Orange                                                                                | Light Sky Blue                                                                        |

## ORDERING GUIDE

### AMT303XX-V

Output Signals:  
"blank" = A, B, Z, U, V, W signals  
LD = Line Driver  
A,  $\bar{A}$ , B,  $\bar{B}$ , Z,  $\bar{Z}$ , U, V, W signals



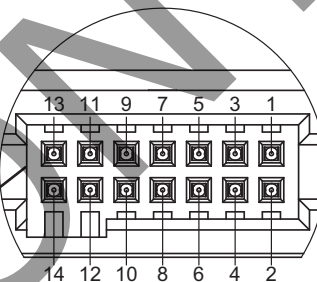
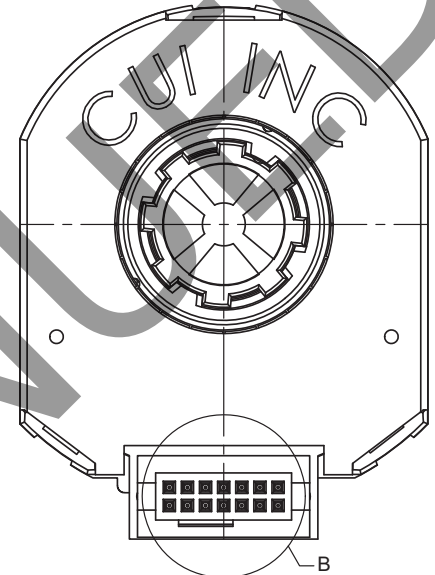
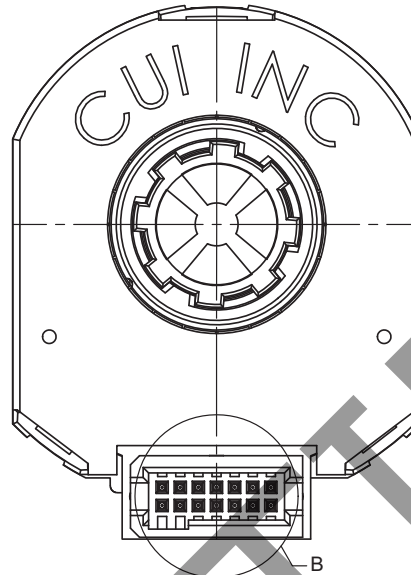
## ENCODER INTERFACE

### Standard Connector Option

### Locking Connector Option

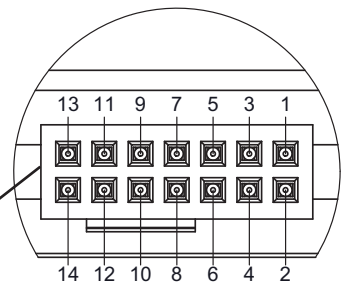
| PINOUT CONNECTOR 1 |                    |                    |
|--------------------|--------------------|--------------------|
| #                  | Function           |                    |
|                    | AMT303             | AMT303LD           |
| 14                 | GND_C <sup>1</sup> | GND_C <sup>1</sup> |
| 13                 | N/A                | -Z                 |
| 12                 | Z                  | Z                  |
| 11                 | N/A                | -A                 |
| 10                 | A                  | A                  |
| 9                  | N/A                | -B                 |
| 8                  | B                  | B                  |
| 7                  | V                  | V                  |
| 6                  | 5 V+               | 5 V+               |
| 5                  | W                  | W                  |
| 4                  | GND                | GND                |
| 3                  | U                  | U                  |
| 2                  | zero set           | zero set           |
| 1                  | N/A                | N/A                |

Notes: 1. GND\_C is mode selection line used at startup to determine encoder mode:  
 VCC/Floating: SPI Communication Mode  
 Ground: Normal Operation Mode  
 Standard use requires attaching GND\_C  
 Pin# 14 to GND in order to get Commutation output.  
 SPI Communication mode allows the user to write parameters to the encoder via SPI link, contact CUI Inc. for more details.



Mating Connector:  
Samtec ISDF-07-D

DETAIL B  
SCALE 4 : 1

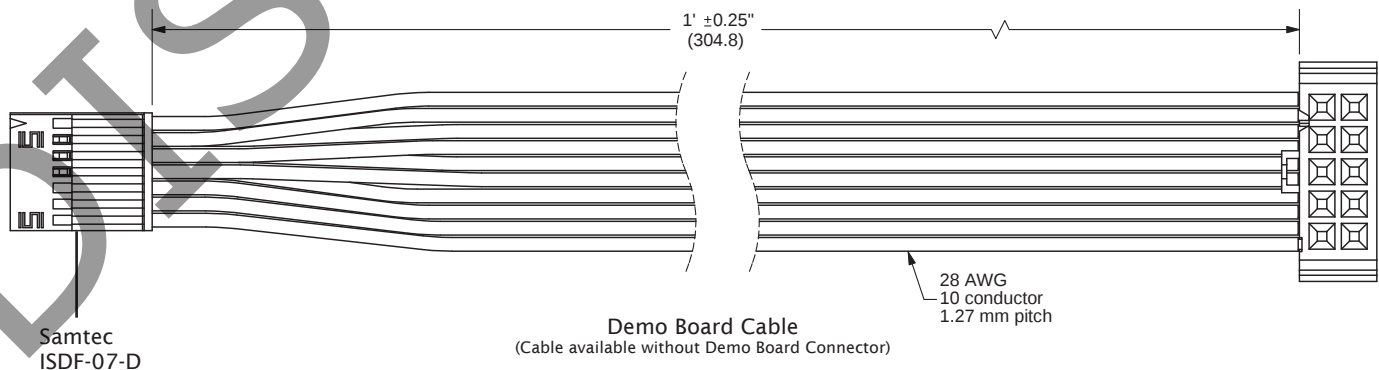


Mating Connector:  
Samtec ISDF-07-D-L

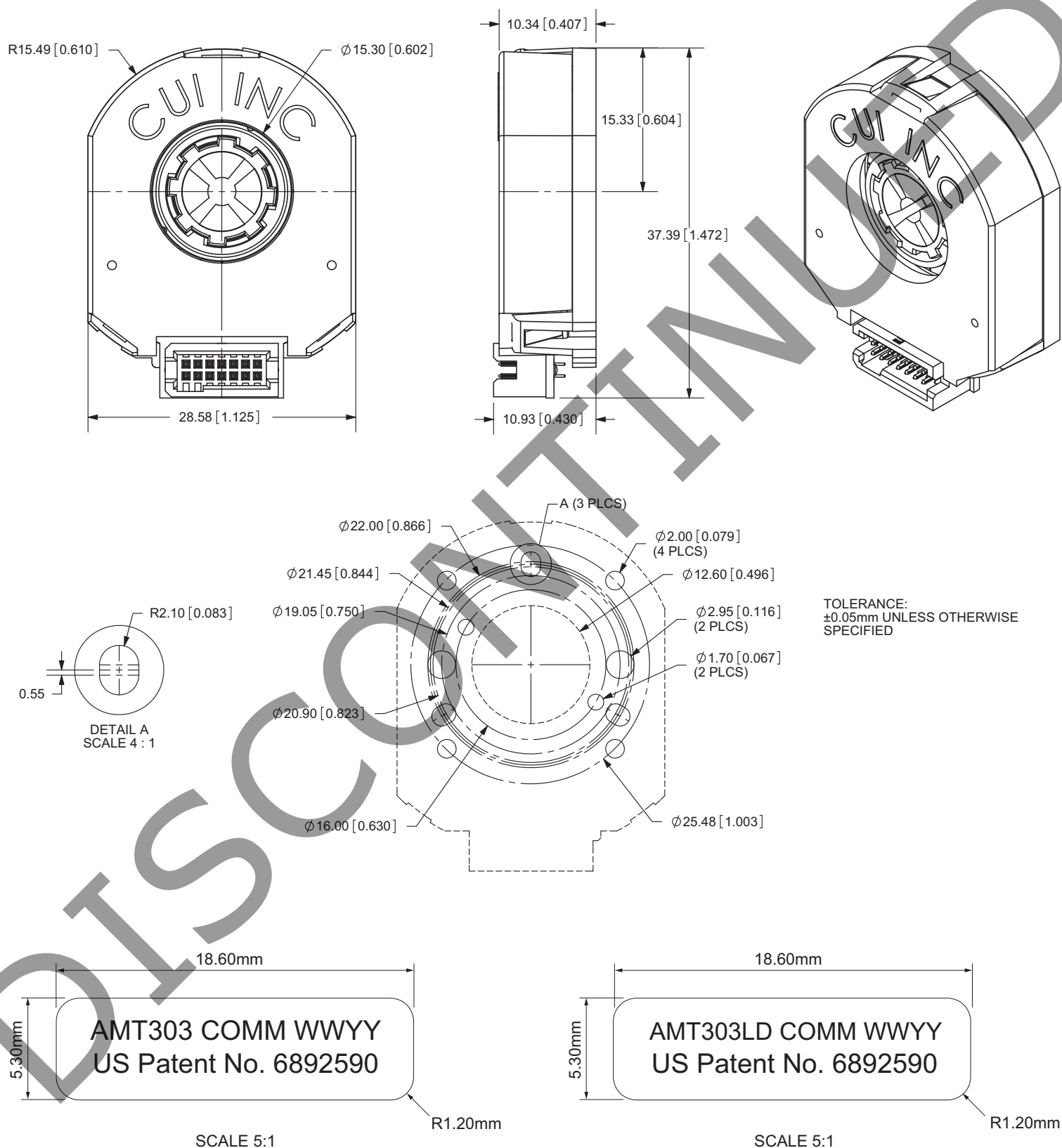
DETAIL B  
SCALE 4 : 1

### Encoder Side

### Demo Board Side



## MECHANICAL DRAWING



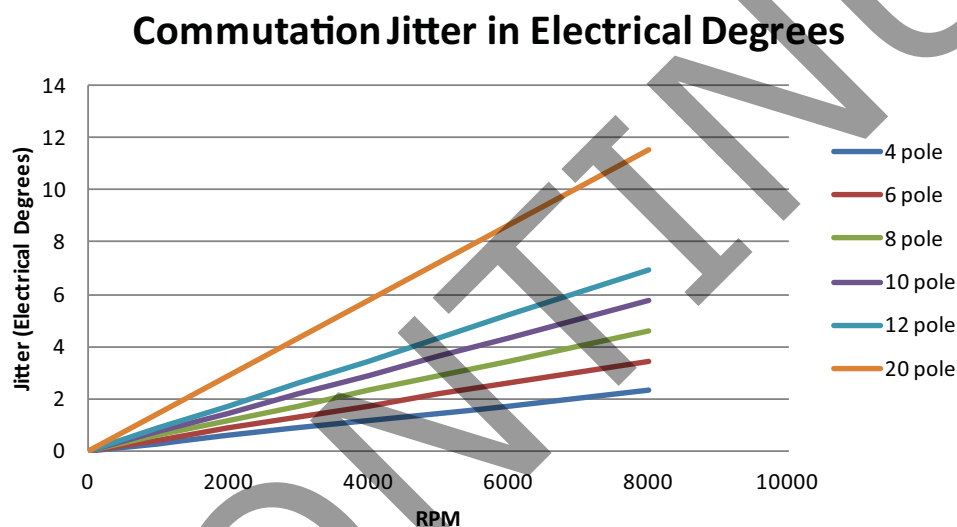
## ENCODER OPERATIONAL MODE

### Initialization mode:

- At power up the encoder goes through an initiation and stabilization procedure. This includes microprocessor stabilization and the program for combining Coarse and Fine channel of the encoder for getting the absolute start position. This takes less than 0.1 seconds.

### Tracking mode:

- MCU 12 bit position register is updated from Fine Asic every 48  $\mu$ s.
- The commutation program in the MCU has a compensation for the average delay caused by the update rate, leaving a remaining jitter of less than 24  $\mu$ s RMS.
  - The communication jitter expressed in electrical degrees will be proportional speed and does not reach 6 deg RMS until the speed reaches the following values:



## COMMUTATION ALIGNMENT AND SETTING THE ZERO POINT

We strongly recommend the use of the AMT303 series demo board to set commutation zero. It greatly simplifies and expedites the process. The demo board also allows setting of resolution, # of motor poles, direction of quadrature increment, and commutation angle offset (when required). If you do not have or cannot obtain a demo board, use the following procedure to align the AMT303XX commutation angle with your motor:

- Mount the AMT303 series encoder to the motor.
- Put the motor in a 'locked rotor' condition. Consult your motor manufacturer if you are not certain how to lock the rotor for commutation alignment.
- With the motor in a locked rotor position, pull pin# 2 (zero set) low, tie Pin 2 to Ground, to write the rotor position into non-volatile memory in the encoder.
- Power cycle the encoder, i.e., remove power from it. The commutation position is now permanently aligned with the motor rotor zero position and will use this offset at initialization every time at startup.

Note: The procedure is based on the standard "WYE" motor phase connection configuration. If your motor uses other than the "WYE" phase connection, you must acquire the AMT303 series demo board to program the required offset to align encoder commutation signal zero with motor zero position.

## REVISION HISTORY

| rev. | description                                                                                     | date       |
|------|-------------------------------------------------------------------------------------------------|------------|
| 1.0  | initial release                                                                                 | 05/04/2011 |
| 1.01 | updated electrical specifications                                                               | 06/10/2011 |
| 1.02 | updated pin-out and speed specification                                                         | 09/21/2011 |
| 1.03 | addition of commutation jitter, shock, speed, and position accuracy,<br>updated part number key | 09/30/2011 |
| 1.04 | updated Part Number Key                                                                         | 03/09/2012 |
| 1.05 | clarification notes                                                                             | 08/17/2012 |
| 1.06 | added locking connector drawing                                                                 | 03/29/2013 |
| 1.07 | updated spec                                                                                    | 01/30/2014 |
| 1.08 | added axial play specification                                                                  | 03/25/2014 |

The revision history provided is for informational purposes only and is believed to be accurate.

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CUI offers a one (1) year limited warranty. Complete warranty information is listed on our website.

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