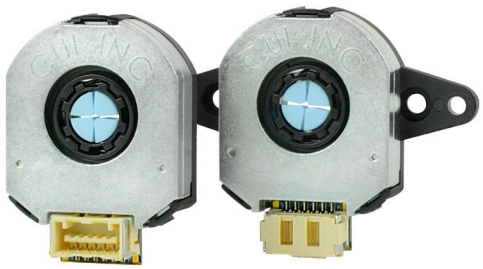
CUI INC®

SERIES: AMT21 | DESCRIPTION: MODULAR ABSOLUTE ENCODER

FEATURES

- high speed protocol for fast low latency position data
- patented capacitive ASIC technology
- low power consumption
- 12 or 14-bit absolute position with multi-turn capability
- 3.3 V half-duplex RS485
- settable zero position
- configuration and programming via AMT Viewpoint™ software
- compact modular package with locking hub for ease of installation
- radial and axial cable connections
- -40 ~ 105°C operating temperature



RoHS

ELECTRICAL

parameter	conditions/description	min	typ	max	units
power supply	VDD	3.8	5	5.5	V
start-up time			200		ms
current consumption	with unloaded output		8		mA

ABSOLUTE POSITION CHARACTERISTICS

parameter	conditions/description	min	typ	max	units
resolution	12 or 14-bit				
accuracy			0.2		degrees
absolute zero position	settable via AMT Viewpoint™ GUI or RS485				
multi-turn	multi-turn and single-turn versions available				
turns counter[1]	signed binary number		14		bits
absolute position update rate	12-bit 14-bit		25 100		µs µs

Notes: 1. Multi-turn encoders only.

MECHANICAL

parameter	conditions/description	min	typ	max	units
motor shaft length		9			mm
weight			15.7		g
axial play				±0.3	mm
rotational speed at each resolution	12-bit position resolution 14-bit position resolution			8,000 4,000	RPM RPM

ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature		-40		105	°C
humidity	non-condensing			85	%
vibration	10~500 Hz, 5 minute sweep, 2 hours on each XYZ			5	G
shock	3 pulses, 6 ms, 3 on each XYZ			200	G
RoHS	2011/65/EU				
REACH	EC 1907/2006				

RS485 INTERFACE

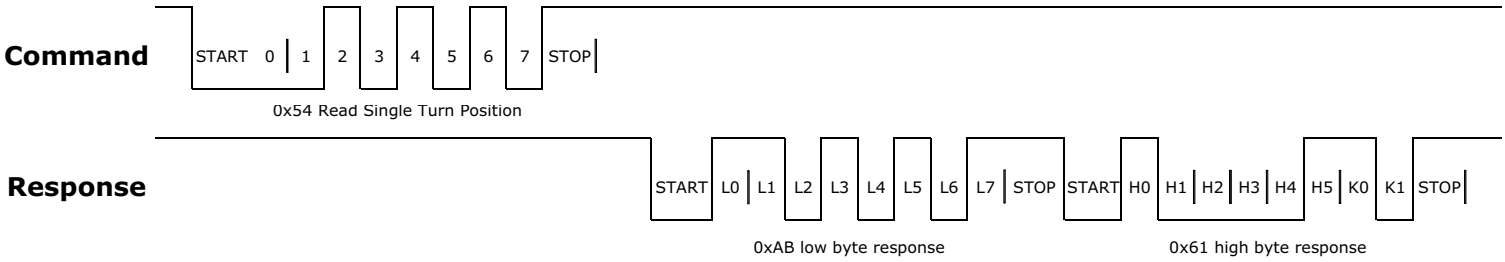
parameter	conditions/description	min	typ	max	units
protocol	RS485 balanced digital multi-port interface				
data rate	8 data bits, no parity, 1 stop bit, asynchronous		2	4	Mbps
transceiver	Texas Instruments SN65HVD75				
latency	time before encoder responds with position	18		29	µs
driver differential output voltage magnitude	load resistance = 54 Ω	1.5	2	3.3	V

AMT21 RS485 Interface
The AMT21 utilizes a half-duplex RS485 interface where the host sends a command over the differential bus at the proper baud rate (default 2 Mbps), then the encoder takes control and responds. The host sends a single character using 8 bits, 1 stop bit, and no parity. The encoder responds with 14-bit position, and 2 check bits. It sends this as two bytes also using 8 bits, 1 stop bit, and no parity. The low byte comes first. 12-bit encoders use the same format but the lowest two bits are zero.

Commands:

Read Single-Turn Position
Command char: T
Hex value: 0x54

Figure 1
Read Single-Turn Configuration



Values K1 and K0 in the response are checkbits. The checkbits are odd parity over the odd and even bits in the position response shown in the equation below. The checkbits are not part of the position, but are used to verify its validity. The lower 14 bits are the encoder position.

Full response: 0x61AB
14-bit position: 0x21AB (8619 decimal)

Checkbit Formula
Odd: K1 = !(H5^H3^H1^L7^L5^L3^L1)
Even: K0 = !(H4^H2^H0^L6^L4^L2^L0)

From the above response 0x61AB:
Odd: 0 = !(1^0^0^1^1^1^1) = correct
Even: 1 = !(0^0^1^0^0^0^1) = correct

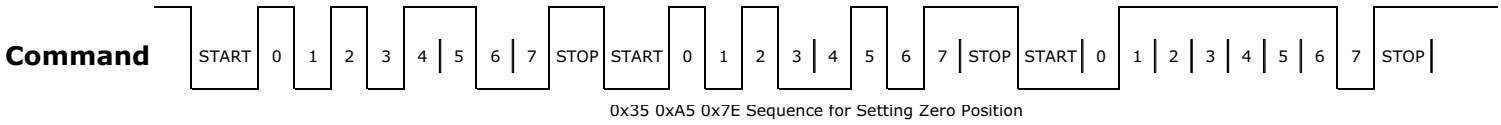
For 12-bit applications L0 and L1 are always 0. Because the low two bits are 0, 12-bit data will need right-shifted two bits. The checkbit calculation remains the same and unaffected.

RS485 INTERFACE (CONTINUED)

Set Zero Position (Single-Turn Encoders Only)

Hex command sequence: 0x35 0xA5 0x7E

Figure 2
Set Zero Position



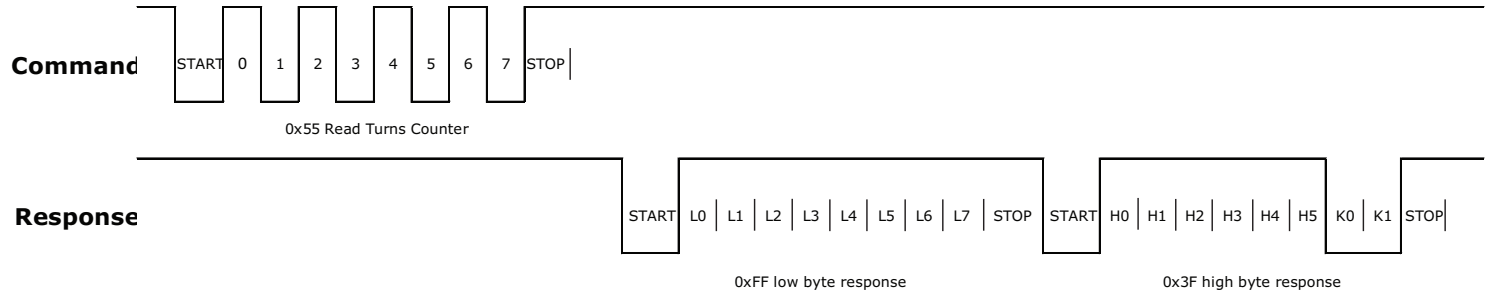
The encoder will not give a response but will store the zero position, and then restart. This operation takes approximately 200 ms.

Read Turns Counter (Multi-Turn Encoders Only)

Command char: U

Hex command sequence: 0x55

Figure 3
Read Turns Counter



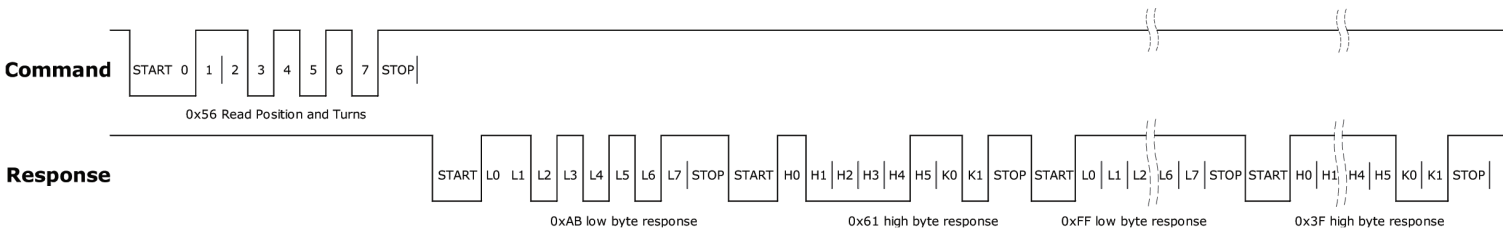
The turns counter is stored as a 14-bit signed number. The encoder responds with two bytes using the same checkbit formula as is used for position. After removing the check bits K0 and K1 the resulting value is still 0x3FFF. Since this is a signed number the resulting turns counter value is -1. The turns counter is always zero at startup, a battery backup may be required to prevent loss of turns count.

Read Position and Turns (Multi-Turn Encoders Only)

Command char: V

Hex command sequence: 0x56

Figure 4
Read Position and Turns



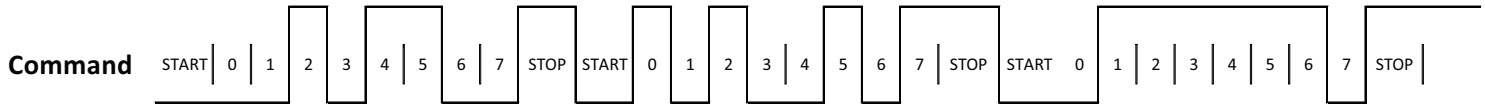
The encoder responds with the position response in the same format as is received by the 0x54 position command, immediately followed by the turns counter in the same format as the 0x56 turns command.

RS485 INTERFACE (CONTINUED)

Reset Encoder

Hex command sequence: 0x34 0xA5 0x7E

Figure 5
Reset Encoder



0x34 0xA5 0x7E Sequence for Resetting Encoder

This command resets the device. Note that for multi-turn encoders this command will result in a zero'ing of the turns counter as the encoder always starts with the turns counter at zero.

PART NUMBER KEY

For customers that prefer a specific AMT21 configuration, please reference the custom configuration key below.

AMT21 X X - XXXX - X

- Base Number
- Orientation:
  2 = Radial
  3 = Axial
- Absolute Resolution:
  A = 12-bit single-turn
  B = 14-bit single-turn
  C = 12-bit multi-turn
  D = 14-bit multi-turn
- Sleeve Bore Diameter:
  2000 = 2 mm
  3000 = 3 mm
  3175 = 3.175 mm (1/8")
  4000 = 4 mm
  4760 = 4.76 mm (3/16")
  5000 = 5 mm
  6000 = 6 mm
  6350 = 6.35 mm (1/4")
  8000 = 8 mm
  SKIT = 9 sleeve kit
- Mounting Base:
  S = Standard
  W= Wide

AMT21-V KITS

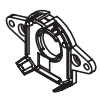
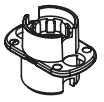
In order to provide maximum flexibility for our customers, the AMT21 series is provided in kit form standard. This allows the user to implement the encoder into a range of applications using one sku#, reducing engineering and inventory costs.

ORDERING GUIDE

AMT21XX-V

- Orientation:
  2 = Radial
  3 = Axial
- Absolute Resolution:
  A = 12-bit single-turn
  B = 14-bit single-turn
  C = 12-bit multi-turn
  D = 14-bit multi-turn

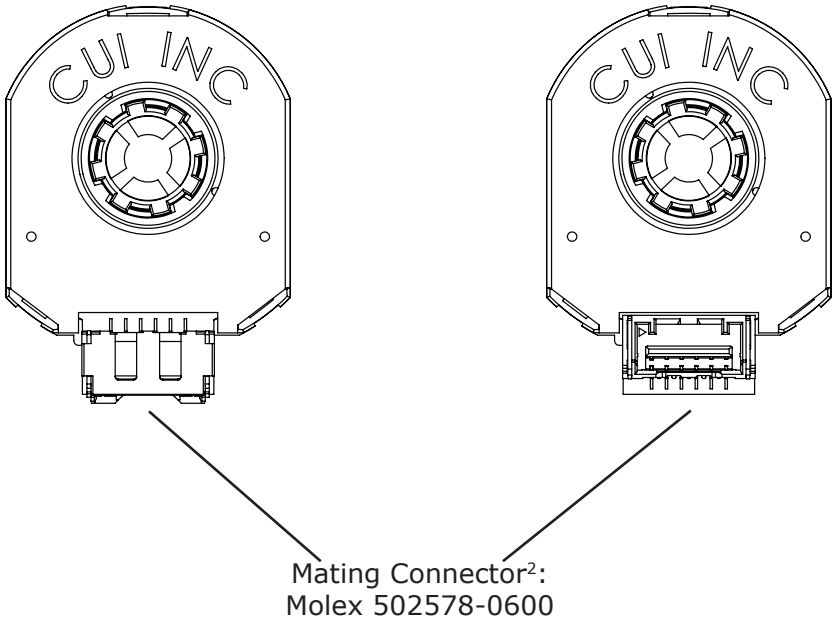
SLEEVES								
2mm	3mm	1/8 inch (3.175mm)	4mm	3/16 inch (4.76mm)	5mm	6mm	1/4 inch (6.35mm)	8mm
Light Sky Blue	Orange	Purple	Gray	Yellow	Green	Red	Snow	Blue

BASE	WIDE BASE	TOP COVER	SHAFT ADAPTER	TOOL A	TOOL C
					

ENCODER INTERFACE

PINOUT CONNECTOR	
#	**Function**
1	+5 V
2	B
3	A
4	GND
5[1]	MODE
6	MCLR

AMT212 **AMT213**

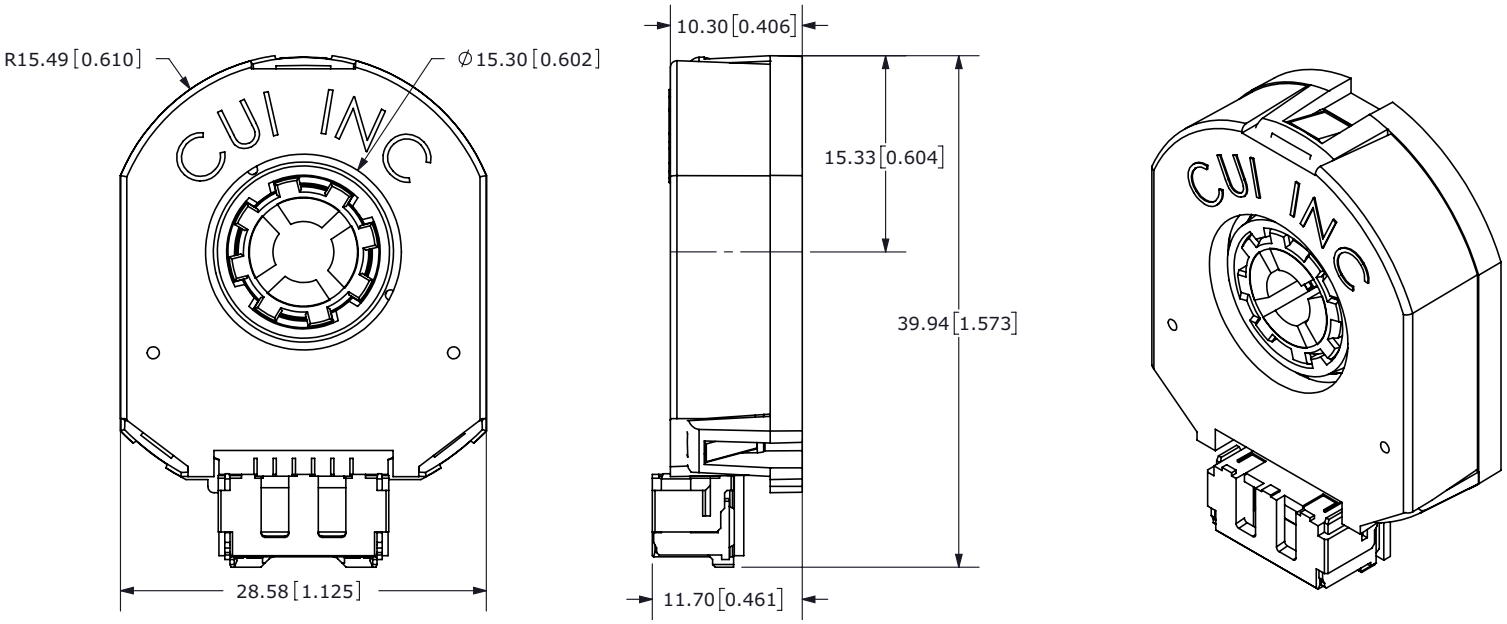


Notes: 1. Mode pin is used by AMT Viewpoint for configuring the encoder and should be left disconnected during normal operation.
2. Compatible with prototype cable AMT-06C-1-036 and programming cable AMT-06C-1-036-USB.

MECHANICAL DRAWING

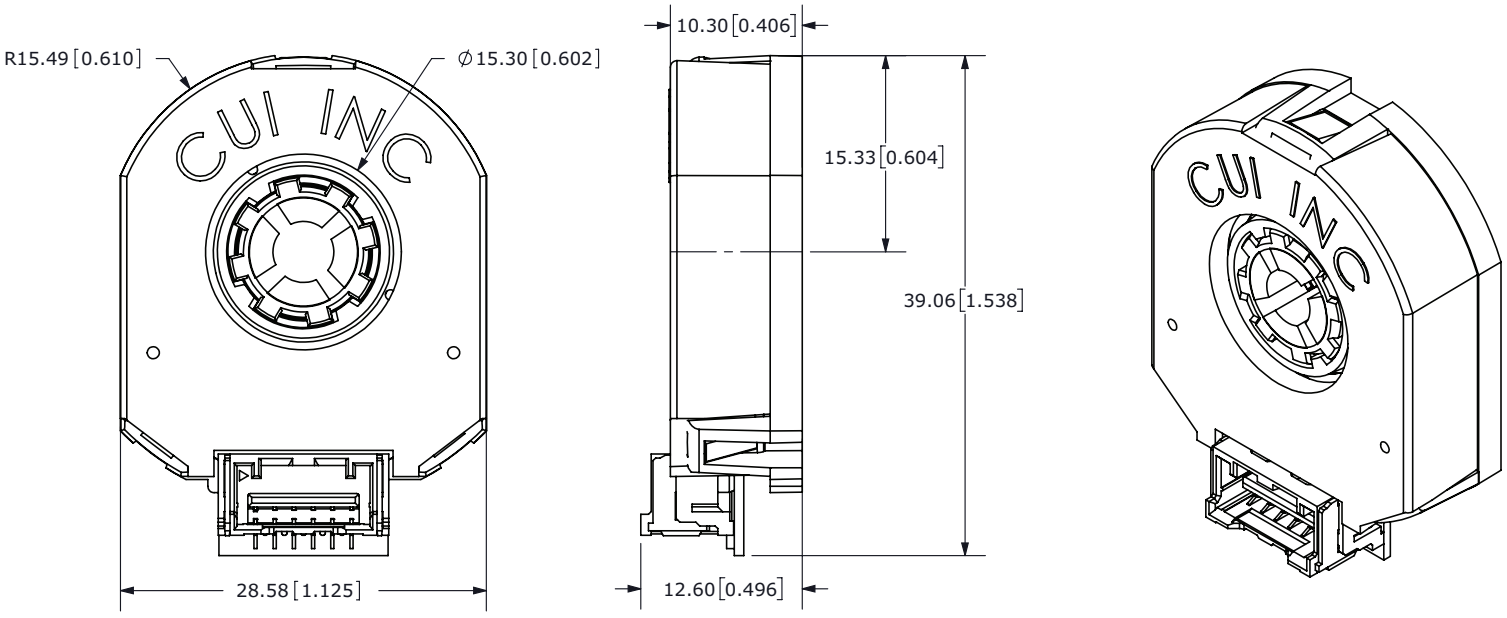
AMT212

units: mm
tolerance: ±0.1



AMT213

units: mm
tolerance: ±0.1

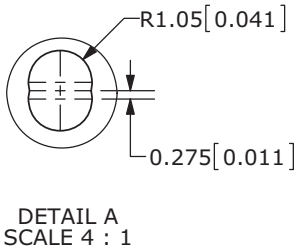


MECHANICAL DRAWING (CONTINUED)

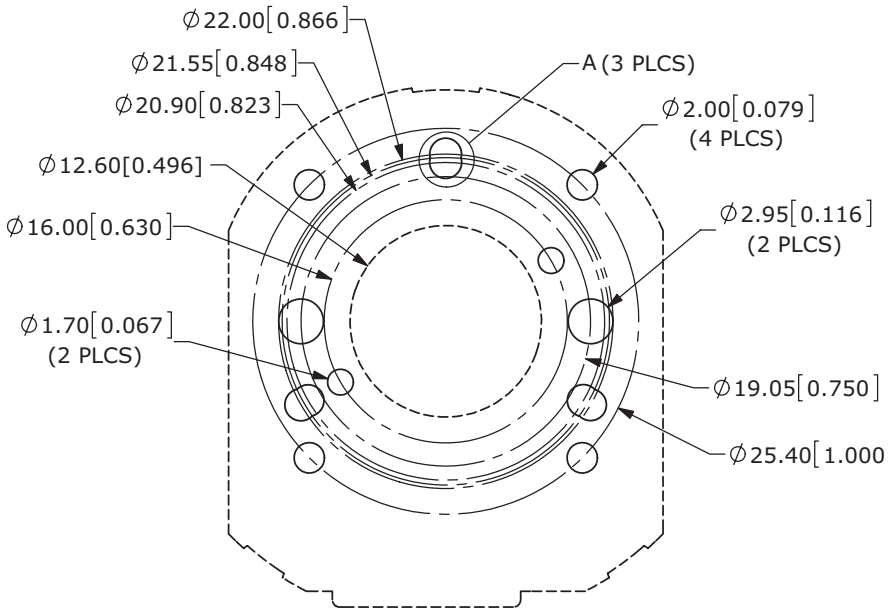
MOUNTING HOLE PATTERNS

STANDARD BASE

units: mm[inch]
tolerance: ±0.1

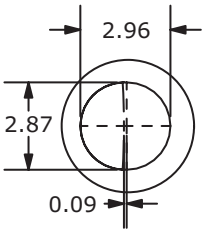


DETAIL A
SCALE 4 : 1

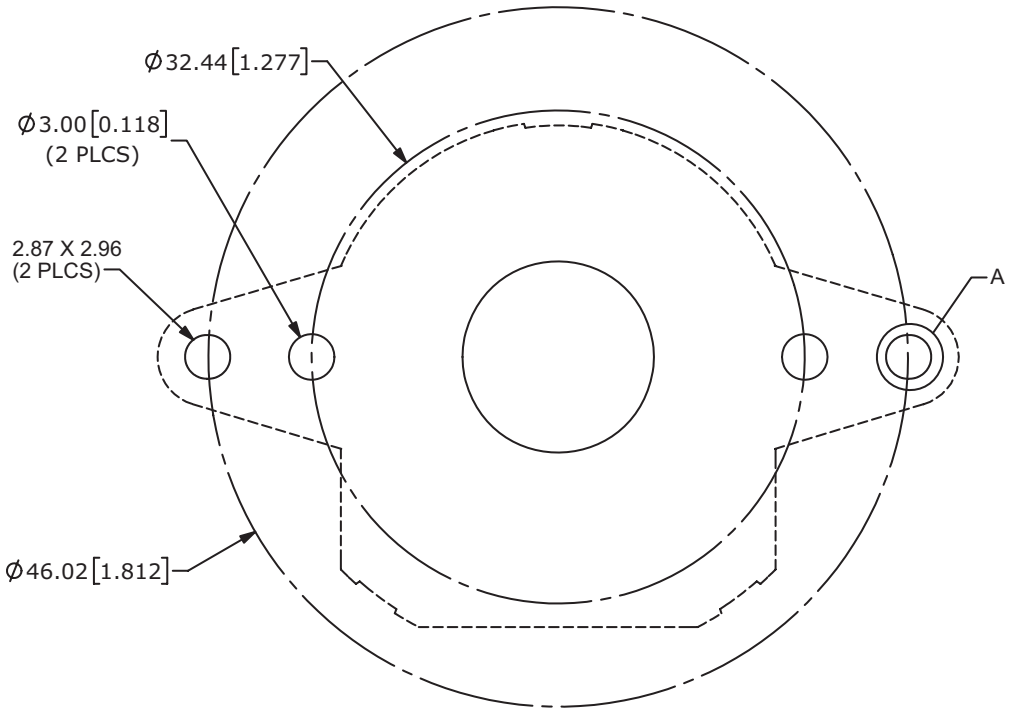


WIDE BASE

units: mm[inch]
tolerance: ±0.1

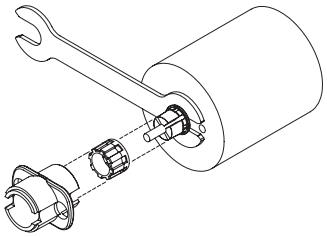


DETAIL A
SCALE 4 : 1



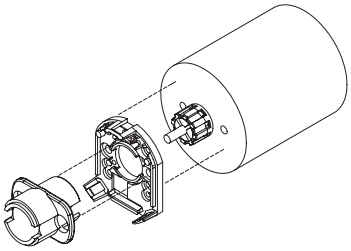
ASSEMBLY PROCEDURE

STEP 1



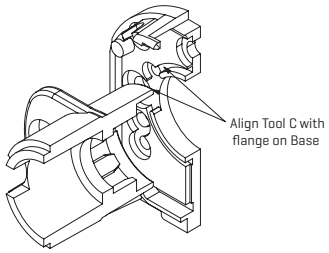
1. Insert Tool A as a spacer that defines the distance to the mounting surface.
2. Slide appropriate sized Sleeve over shaft all the way down to Tool A.
3. Slide Shaft Adaptor over Sleeve.
4. Use Tool C to press Shaft Adaptor over Sleeve (ensure Shaft Adapter and Tool C spline alignment) until flush with Tool A.

STEP 2



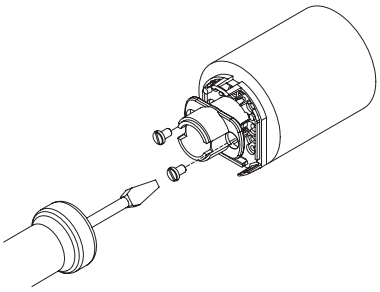
1. Remove Tools A and C.
2. Place Base on motor, with Tool C used as a centering tool.

STEP 3



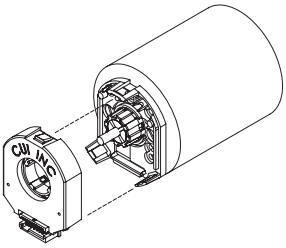
1. Align Tool C with flange on Base.
2. Slide Base and Tool C onto motor, centering onto the Shaft Adapter.

STEP 4



1. Fasten the Base on the motor (Tool C may need to be rotated to allow for some mounting configurations).
2. Remove Tool C.

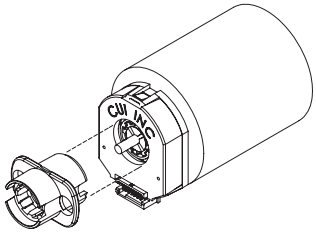
STEP 5



1. Snap the Top Cover onto the Base, carefully observing that the teeth of the Shaft Adaptor align with the grooves in the hub. *

* *We recommend no more than three cycles of mounting and removal of the AMT top cover base. Multiple cycles of mounting and removing the top cover can cause base fatigue over time and affect encoder performance.*

STEP 6



1. Make sure the snaps are fully engaged by pressing on the Hub with the reverse side of Tool C.
2. When assembly is finished, the Shaft Adaptor, Sleeve and Rotor Hub should all be flush with the Motor Shaft rotating freely.

REVISION HISTORY

rev.	description	date
1.0	initial release	02/20/2018
1.01	added serial interface details	05/15/2018
1.02	added multi-turn serial interface details	06/29/2018

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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CUI products are not authorized or warranted for use as critical components in equipment that requires an extremely high level of reliability. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.