# ENC-A2I Single-Ended Encoder with Index Channel

## FEATURES

- 50 to 5,000 Cycles Per Revolution (CPR)
- Tracks 0 to 300,000 Cycles Per Second
- Powered From a Single +5VDC Power Supply
- 2-Channel Quadrature TTL Squarewave Outputs
- Third Channel Index
- Operating Temperature of -40° to +100° C
- Powered from a Single +5VDC Power Supply
- Allows for +/- .010" Axial Shaft Play

## DESCRIPTION

The ENC-A2I is a single-ended encoder with an optional third index channel. This encoder requires a minimum shaft length of .445" and maximum shaft length of .575", and can be attached to shaft sizes ranging from .079" to .394" in diameter. The ENC-A2I provides digital feedback information for motion control applications that require position, speed and/or direction control. This line of encoders is RoHS Compliant and REACH Certified.

### Optical Encoder Module Update:

This new transmissive optical encoder module is designed to be an improved replacement for the Avago HEDS-9000 series encoder module. This module is designed to detect rotary position when used with a code wheel. The new module consists of a lensed LED source and a monolithic detector IC enclosed in a small polymer package. The new module uses phased array detector technology to provide superior performance and greater tolerances over traditional aperture mask type encoders. The new module provides digital A & B quadrature outputs with an optional third output index channel. Each module is resolution specific and is matched to the resolution of a code wheel. All standard resolutions offered by the HEDS-9000 series encoder module, as well as additional resolutions, are now supported by the new module. The new module operates with a single 5V supply and provides single ended outputs which are capable of both sinking and sourcing 8mA at TTL levels. An internal 0.1 uF decoupling capacitor is designed into the new module to provide enhanced noise immunity over the HEDS-9000 series encoder modules. Physically, the new module has no external wire loops which can interfere when mounting. The connector pins are 0.051" shorter than HEDS modules, while still providing .30" insertion depth.
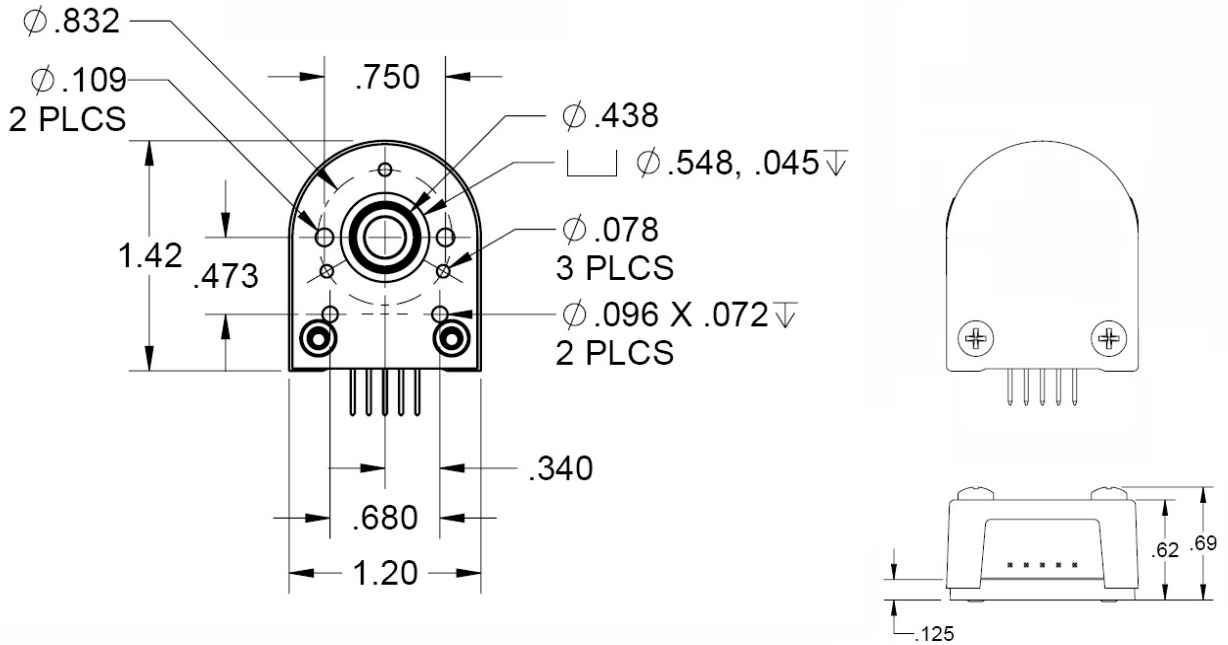
## ORDERING INFORMATION

# ENC - A2I - 0050 - 394 - H - G

| Index | CPR | | | Bore Size | | Cover Options |
|-------|-----|-----|-----|-----------|-----------|---------------|
| I = Index (3rd Channel) | 0050 | 0360 | 1024 | 079 = 2mm | 236 = 6mm | E = Cover Extension |
| | 0096 | 0400 | 1250 | 118 = 3mm | 250 = 1/4" | H = Hole in Cover |
| | 0100 | 0500 | 2000 | 125 = 1/8" | 276 = 7mm | Blank = Default |
| | 0192 | 0512 | 2048 | 156 = 5/32" | 313 = 5/16" | |
| | 0200 | 0540 | 2500 | 157 = 4mm | 315 = 8mm | |
| | 0250 | 0720 | 4000 | 188 = 3/16" | 375 = 3/8" | |
| | 0256 | 0900 | 4096 | 197 = 5mm | 394 = 10mm | |
| | 0360 | 1000 | 5000 | | | |

### Base Options

3 = Base Mounting Holes Become 0.125"

A = Adds Self-Aligning Shoulder to Base

G = Adds 1.812" Mounting Ears to Base

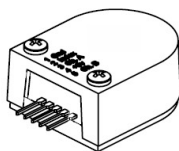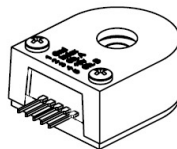R = Adds 3-Slot Adapter to Bottom of Base

Blank = Default

L010720

## DIMENSIONS

### DEFAULT OPTION:

∅ .832
∅ .109
2 PLCS

.750

∅ .438

□ ∅ .548, .045 ▽

∅ .078
3 PLCS

1.42
.473

∅ .096 X .072 ▽
2 PLCS

.340

.680

1.20

.62  .69

.125

Note: All dimensions are in inches

## COVER OPTIONS

Default Option:

H-Option:

E-Option:

∅ .500

.25
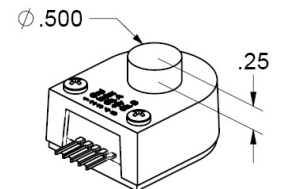
Note: Dimensions are in inches

| Cover Options: | Description |
|---|---|
| E - Option | E-Option provides a cylindrical extension cover for larger shafts. The required shaft length is .445" to .795". Note: E-option + R-Option the required shaft length is .570" to .920". |
| H - Option | Shaft < .375 - a .375" diameter hole is used Shaft ≥ .375" or larger - a .500" diameter hole is used Minimum Shaft Length: greater than .445" Note: H-Option + R-Option the required shaft length is > .570" |
| Default | The required length is .445" to .570" Note: Default Option + R-Option the required shaft length is .570" to .695" |

**3-OPTION:**

⌀.125
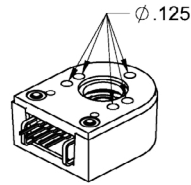
3-Option: Makes all five hole diameters .125"

**G-OPTION:**

2.062
1.812
⌀.109 2 PLCS
.125 THICK
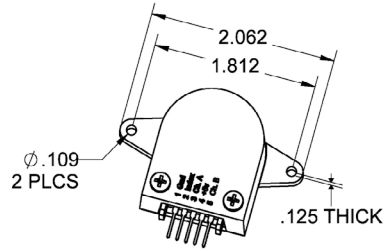
G-Option: Includes molded ears which enables it to be mounted to a 1.812" diameter bolt circle. Mounting holes are designed to fit 4-40 screws. Will work with shaft lengths of .445" to .570" and does not add to the required shaft length.

**A-OPTION:**

⌀.438 I.D.
.030
⌀.497 O.D.
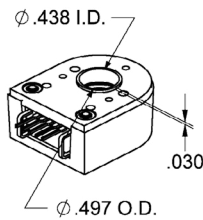
A-Option: Adds a .497" diameter alignment shoulder designed to slip into a .500" diameter recess in the mounting surface centered around the shaft.

**R-OPTION:**

⌀.111
⌀1.812
30°
.125 THICK G10
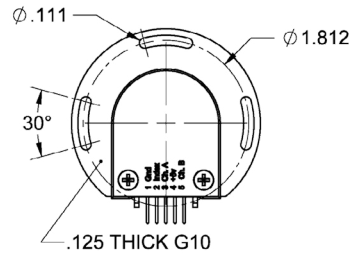
R-Option: Adapter is an 1/8" thick fiberglass adapter which is pre-mounted to the base of the encoder. It allows the encoder to rotate +/- 15 degrees.
*This option adds 1/8" to the required shaft length.

Note: All dimensions are in inches

**(Note: Base Mounting Screws are NOT included. #2-56 or #4-40 screws can be used to mount the base to your mounting surface.)**

| Timing Characteristics | Symbol | Min | Typ | Max | Units |
|---|---|---|---|---|---|
| Cycle Error | C | - | 3.0 | 5.5 | °e |
| Symmetry | X,Y | 150 | 180 | 210 | °e |
| Quadrature | Z | 60 | 90 | 120 | °e |
| Index Pulse Width | Po | 60 | 90 | 120 | °e |
| Ch. I Rise After Ch. B or Ch. A Fall | t1 | 10 | 100 | 250 | ns |
| Ch. I Fall After Ch. B or Ch. A Rise | t2 | 70 | 150 | 300 | ns |

### SINGLE-ENDED ENCODER PINOUT
**TOP OF ENCODER FACING PLUG**

| Pin # | Function |
|---|---|
| 1 | Ground |
| 2 | Index |
| 3 | Channel A |
| 4 | +5VDC Input |
| 5 | Channel B |

SINGLE-END ENCODER TIMING DIAGRAMS

C
X
Y
Z
2.4V
0.4V CHANNEL A
2.4V
0.4V CHANNEL B
t1
t2
2.4V
0.4V INDEX
Po
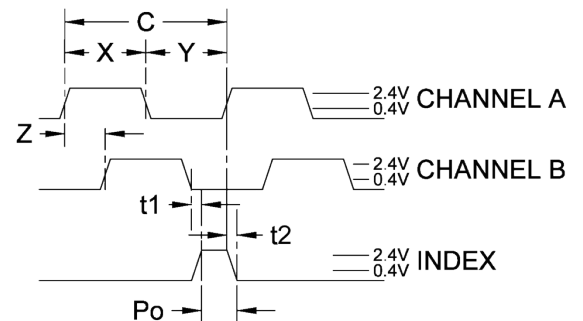
ROTATION:
CW - A LEADS B, CCW - B LEADS A

## SPECIFICATIONS

| Terminology | Definition |
|---|---|
| CPR(N): | The Number of Cycles Per Revolution |
| One Shaft Rotation: | 360 mechanical degrees, N cycles |
| One Electrical Degree (°e): | 1/360th of one cycle |
| One Cycle (C): | 360 electrical degrees (°e). Each cycle can be decoded into 1 or 4 codes, referred to as X1 or X4 resolution multiplication |
| Symmetry: | A measure of the relationship between (X) and (Y) in electrical degrees, nominally 180 °e |
| Quadrature (Z): | The phase lag or lead between channels A and B in electrical degrees, nominally 90 °e |
| Index (CH I): | The index output goes high once per revolution, coincident with the low states of channels A and B, nominally 1/4 of one cycle (90 °e) |

| Recommended Operating Conditions | Min | Max | Units |
|---|---|---|---|
| Temperature (CPR < 2000) | -40 | 100 | °C |
| Temperature (CPR ≥ 2000) | -25 | 100 | °C |
| Load Capacitance | - | 100 | pF |
| Count Frequency (CPR ≤ 1250) | - | 300 | kHz |
| Count Frequency (CPR 2000-2500) | - | 360 | kHz |
| Count Frequency (CPR 4000+) | - | 720 | kHz |

| Parameter | Max | Units |
|---|---|---|
| Vibration (5 to 2kHz) | 20 | g |
| Shaft Axial Play | +/- 0.01 | in. |
| Shaft Eccentricity Plus Radial Play | 0.004 | in. |
| Acceleration | 250,000 | rad/sec$^2$ |

| Parameter | Min | Typ | Max | Units |
|---|---|---|---|---|
| Supply Voltage | 4.5 | 5.0 | 5.5 | Volts |
| **Supply Current** CPR < 500, no load | - | 27 | 30 | mA |
| CPR ≥ 500 and < 2000, no load | - | 55 | 57 | mA |
| CPR ≥ 2000, no load | - | 72 | 85 | mA |
| **Low-Level Output** $I_{OL}$ = 8mA max (CPR < 2000) | - | - | 0.5 | V |
| $I_{OL}$ = 5mA max (CPR ≥ 2000) | - | - | 0.5 | V |
| no load (CPR ≥ 2000) | - | 0.25 | - | V |
| **High-Level Output** $I_{OL}$ = 8mA max (CPR < 2000) | 2.0 | - | - | V |
| $I_{OL}$ = 5mA max (CPR ≥ 2000) | 2.0 | - | - | V |
| no load (CPR < 2000) | - | 4.8 | - | V |
| no load (CPR ≥ 2000) | - | 3.5 | - | V |
| **Output Current Per Channel (CPR < 2000)** | -8.0 | - | 8.0 | mA |
| **Output Current Per Channel (CPR ≥ 2000)** | -5 | - | 5 | mA |
| **Output Rise Time (CPR < 2000)** | - | 110 | - | nS |
| **Output Rise Time (CPR ≥ 2000)** | - | 50 | - | nS |
| **Output Fall Time (CPR < 2000)** | - | 100 | - | nS |
| **Output Fall Time (CPR ≥ 2000)** | - | 50 | - | nS |

\* Unloaded high level output voltage is 4.80V typically, 4.2V minimum.

| Speed Calculation | | Units |
|---|---|---|
| CPR ≤ 1250 | 18x10$^6$ / CPR | RPM |
| CPR 2000-2500 | 21.6x10$^6$ / CPR | RPM |
| CPR 4000+ | 43.2x10$^6$ / CPR | RPM |

\*60,000 RPM is the maximum RPM due to mechanical limitations.

## ACCESSORIES

### Cables:

The following cables are compatible with Anaheim Automation's A2I series encoder. Select a cable length from the table below:

| Cable Part Number | Length |
|---|---|
| ENC-CBL-AA4032 | 1 ft. |
| ENC-CBL-AA4032-04 | 4 ft. |
| ENC-CBL-AA4032-10 | 10 ft. |

*NOTE: For pricing and other information on cables and centering tools, please visit Accessories on our website.*

### Centering Tools:

Centering tools are optional, but recommended for a more precise installation.

# ENC-CTOOL - 250

| Bore Size | |
|---|---|
| 079=2mm | 236=6mm |
| 118=3mm | 250=1/4" |
| 125=1/8" | 276=7mm |
| 157=4mm | 313=5/15" |
| 188=3/16" | 375=3/8" |
| 197=5mm | 394=10mm |