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# AEDA-3200-Txx Series

Ultra Miniature, High Resolution Incremental Encoders



## Data Sheet



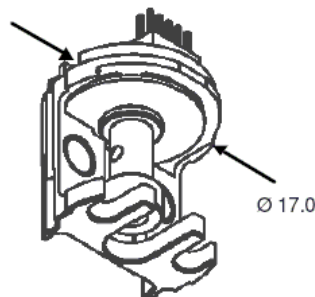
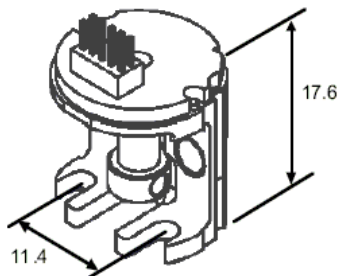
### Description

The AEDA-3200-T series (top mounting type) are high performance, cost effective, three-channel optical incremental encoder modules.

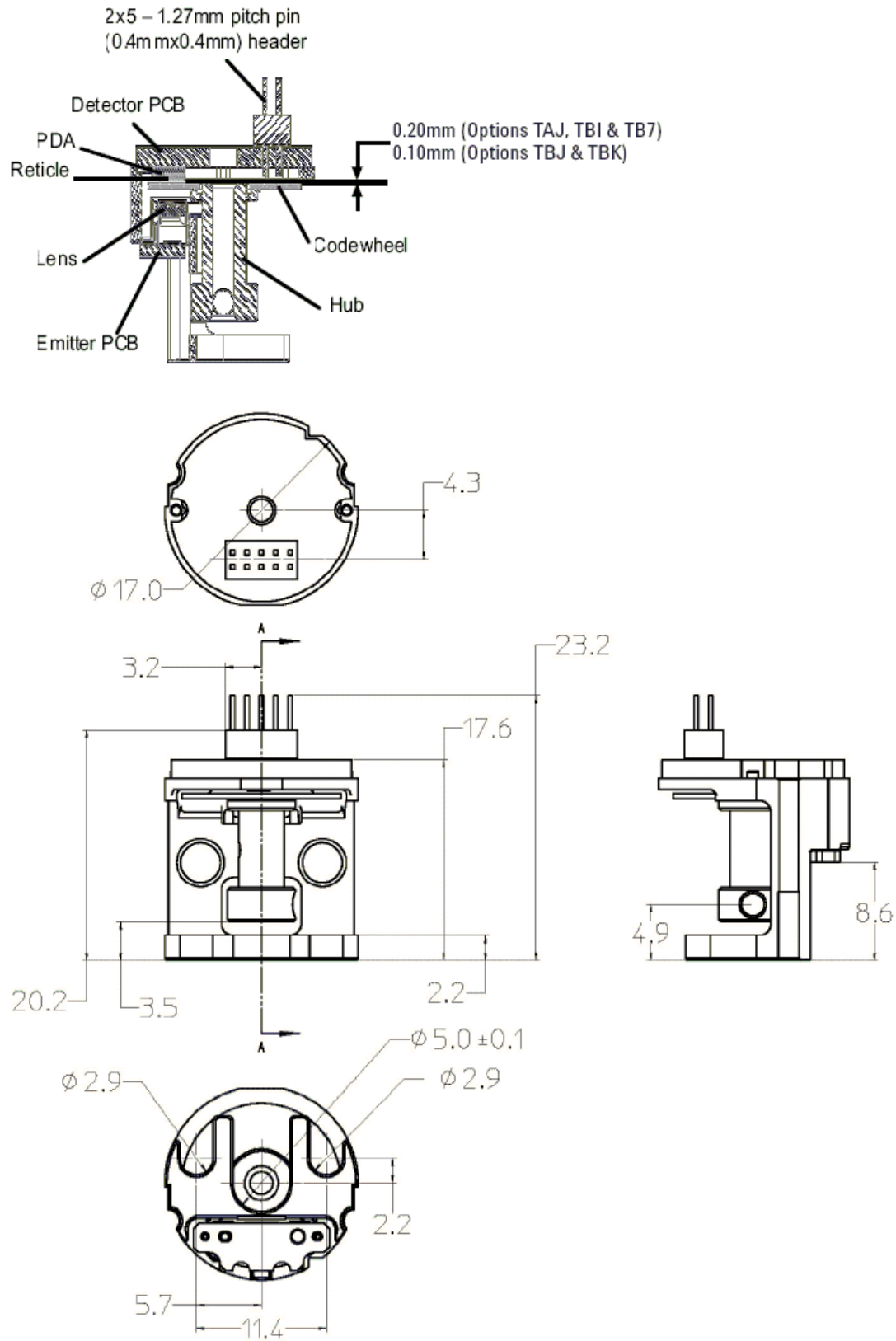
AEDA-3200-T series emphasize high reliability, high resolution and easy assembly, using transmissive encoder technology to sense rotary position. Outputs of the AEDA-3200 encoders are two channel quadrature outputs and a third channel gated index output. These encoder modules can be easily mounted to customer specific applications with the specially designed mechanical alignment tool.

### Features

- Two channel quadrature output with index
- Quick and easy assembly with alignment tool
- Cost-effective
- Ultra miniature size ( $\phi 17$  mm)
- Resolution options from 2500 to 7500 Cycles Per Revolution (CPR), up to 30000 counts with 4X decoding
- Integrated RS 422 differential line driver



## Outline Drawing



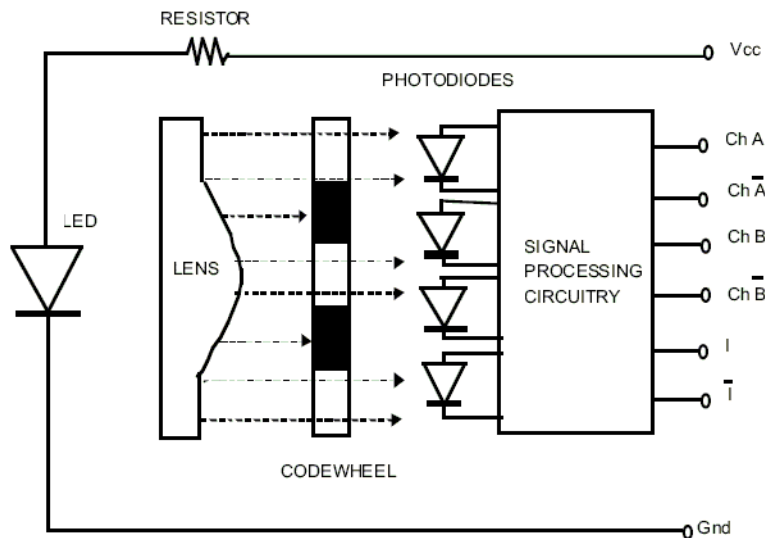
## Theory of Operation

The AEDA-3200 translates rotary motion of a shaft into a three channel digital output. The AEDA-3200 series has five key parts: a single light emitting diode (LED) light source, a photodetector IC with a set of uniquely configured photodiodes, an interpolator IC, a line driver IC and a pair of lenses.

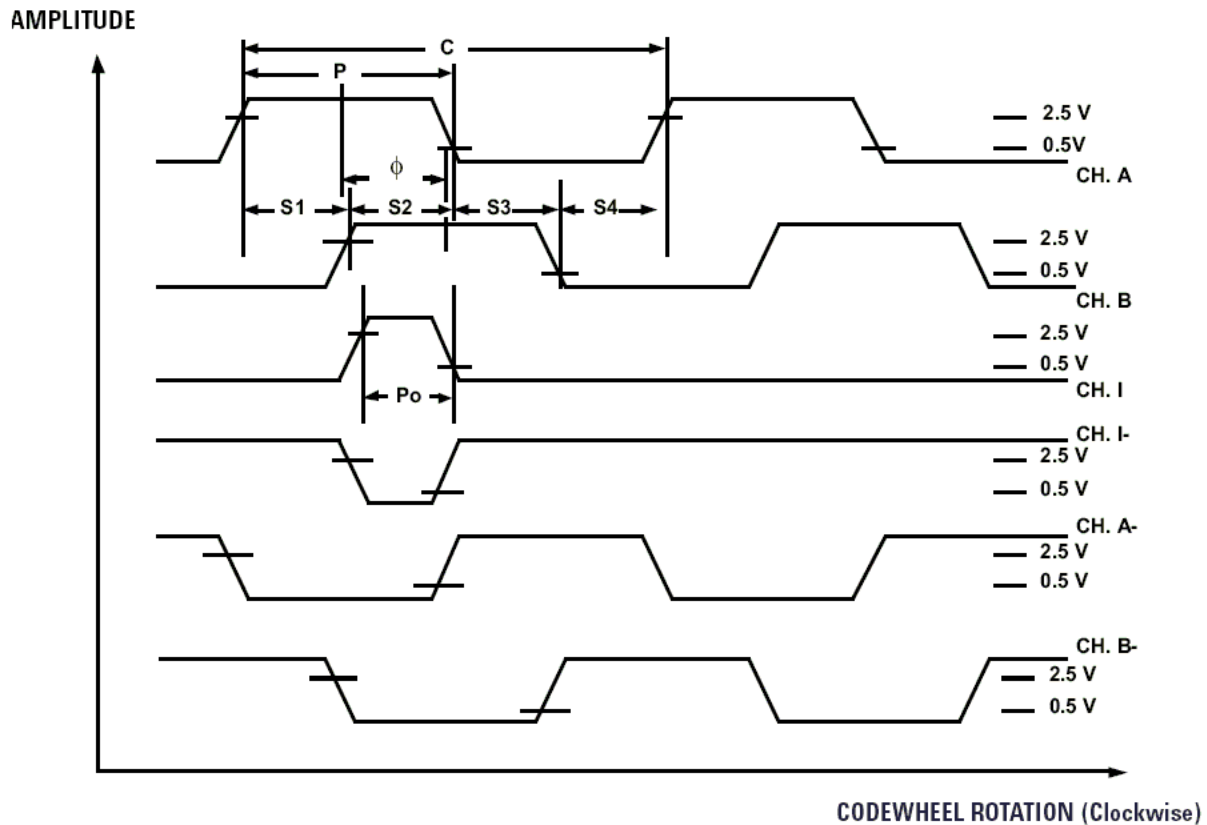
This light is used to produce internal signals A and A<sup>-</sup>, and B and B<sup>-</sup>.

As part of the “push-pull” detector system, these signals are fed through comparators and line driver that are part of the signal processing circuitry to produce the final outputs for channels A.

The AEDA-3200 is available for cycles per revolution (CPR) of 2500 to 7500. This translates to a maximum resolution of 30000 counts after quadrature decode (4X).



## Output Waveforms



## Definitions

**Count (N):** N refers to the cycles per revolution (CPR) of the encoder output.

**One Cycle (C):** 360 electrical degrees ( $^{\circ}\text{e}$ ).

**One Shaft Rotation:** 360 mechanical degrees, N cycles (rotary motion only).

**Phase ( $\phi$ ):** The number of electrical degrees between the center of the high state on the channel A and the center of the high state of channel B. This value is nominally  $90^{\circ}\text{e}$ .

**Pulse Width (P):** The number of the electrical degrees that an output is a high-level during one cycle, nominally  $180^{\circ}\text{e}$  or  $1/2$  a cycle.

**Pulse Width Error ( $\Delta P$ ):** The deviation in electrical degrees of the pulse width from its ideal value of  $180^{\circ}\text{e}$ .

**Index Pulse Width (Po):** The number of electrical degrees that an index is high during one full shaft rotation. This value is nominally  $90^{\circ}\text{e}$  or  $1/4$  cycle.

**State Width (S):** The number of the electrical degrees between a transition in the output of the channel B. There are 4 states per cycle, each nominally  $90^{\circ}\text{e}$ .

**State Width Error ( $\Delta S$ ):** The deviation in electrical degrees of each state width from its ideal value of  $90^{\circ}\text{e}$ .

## Direction of Motor Rotation

When the codewheel rotates in a clockwise direction, channel A will lead channel B (Figure 1 illustrates the definition of clockwise direction of codewheel rotation). When the codewheel rotates in a counter-clockwise direction, channel B will lead channel A.

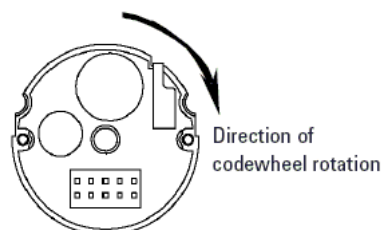


Figure 1. Viewed from the PCB encoder end.

## Absolute Maximum Ratings

Storage Temperature	-40°C to 125°C
Operating Temperature	-40°C to 125°C
Supply Voltage	4.5 V to 5.5 V
Output Voltage	-0.5 V to $V_{cc}$
Output Current per Channel	20 mA
Frequency	750 kHz

## Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Units	Notes
Temperature	$T_A$	-40	25	125	$^{\circ}\text{C}$	
Supply Voltage	$V_{cc}$	4.5	5.0	5.5	Volts	Ripple < 100 mVp-p
Frequency	f		125	750	kHz	$f = \frac{\text{RPM} \times \text{CPR}}{60}$

## Maximum Frequency and RPM

CPR	Maximum Frequency (kHz)	Maximum RPM <sup>2</sup>
2500	750 <sup>1</sup>	12000
5000	750	9000
6000	750	7500
7200	750	6250
7500	750	6000

Note:

1. Maximum frequency will be lower due to limitation in maximum RPM.
2. Maximum mechanical limit is 12000 RPM, operating limit is dependent on the maximum operating frequency.

## Electrical Characteristics

Electrical characteristics over recommended operating conditions. Typical values at 25°C.

Parameter	Symbol	Min.	Typical	Max.	Units
Supply Current	$I_{CC}$		55	80	mA
High level Output Voltage	$V_{OH}$	2.5	3.4		V
Low level Output Voltage	$V_{OL}$	0.3	0.5		V

## Encoding Characteristics

Encoding characteristics over recommended operating conditions. Typical values at 25°C.

Parameter	Symbol	Typical	Max.	Units
Pulse Width Error	$\Delta P$	5	85	°e
State Width Error	$\Delta S$	5	60	°e
Phase Error	$\Delta \phi$	1	40	°e

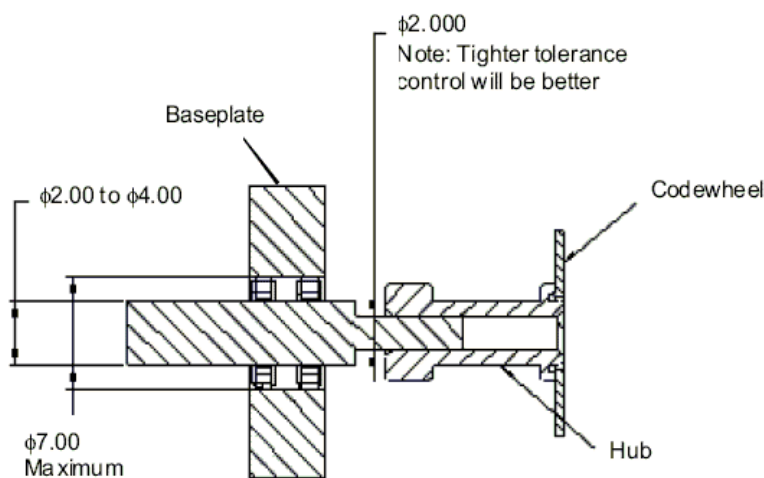
## Mechanical Characteristics

(Refer to page 2 for details.)

Parameter	Dimension/Details	Tolerance	Units
Standard Shaft Diameters	2 mm diameter maximum *	-.002/- .007 (-.0001/- .0003)	mm (in)
Mounting Screw Size:	M2.5 x 0.45 (Recommended Length 6 mm)		mm

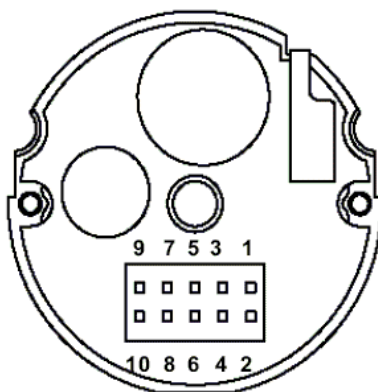
\* Note:

1. Using a step shaft, maximum shaft diameter is 4 mm.



## Pin Assignments

Pin	Signal	Description
Pin 1	A+	Digital Output
Pin 2	A-	Digital Output
Pin 3	Gnd	Ground Pin
Pin 4	Gnd	Ground Pin
Pin 5	B+	Digital Output
Pin 6	B-	Digital Output
Pin 7	Vcc	Input Voltage
Pin 8	Vcc	Input Voltage
Pin 9	I+	Digital Output
Pin 10	I-	Digital Output



### Notes:

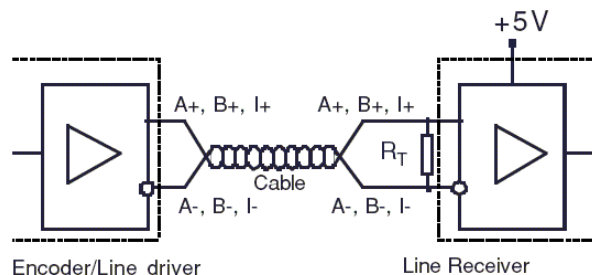
- Both Pin 7 and Pin 8 must be connected to Vcc.
- Either Pin 3 or Pin 4 must be connected to Gnd.

## Mating Connector

AEDA-3200 requires a 5 x 2 (1.27 mm x 1.27 mm) female IDC Connector. An example of the suggested mating connectors is Samtec ([www.samtec.com](http://www.samtec.com)) part number: FFSD-05-D-x-01-N. The cable used is 0.635 mm pitch flat ribbon cable.

## Electrical Interface

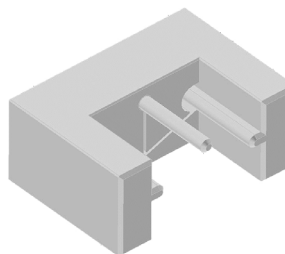
Avago recommends National Semiconductor DS26C32AM Quad Differential Line Receiver or compatible as line receiver. Unused pin should be grounded for noise reduction.



## Alignment Considerations

The mechanical alignment tool is intended to absorb normal installation misalignment and runouts. To achieve the optimum performance, user should minimize misalignment.

Complete instructions for AEDA-3200 installation can be found in Application Note 5080, Avago AEDA-3200-T Mechanical Mounting and Installation Consideration. AEDA-3200 Mechanical Alignment tool part number is HEDS-8940.



HEDS-8940 Mechanical Alignment Tool.

## Ordering Information

A E D A - 3 2 0 0 - T



Resolution Options (CPR)		Counts After 4x Decoding
A J	2,500	10,000
B 1	5,000	20,000
B 7	6,000	24,000
B J	7,200	28,800
B K	7,500	30,000

Alignment Tool	Remark
HEDS-8940	Mechanical Alignment Tool

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