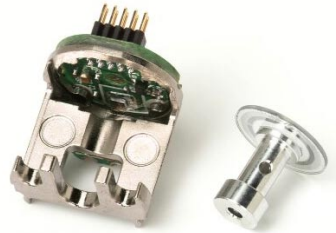# Agilent AEDA-3200-Txx Series Ultra Miniature, High Resolution Incremental Encoders

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 Plug and Play tool.
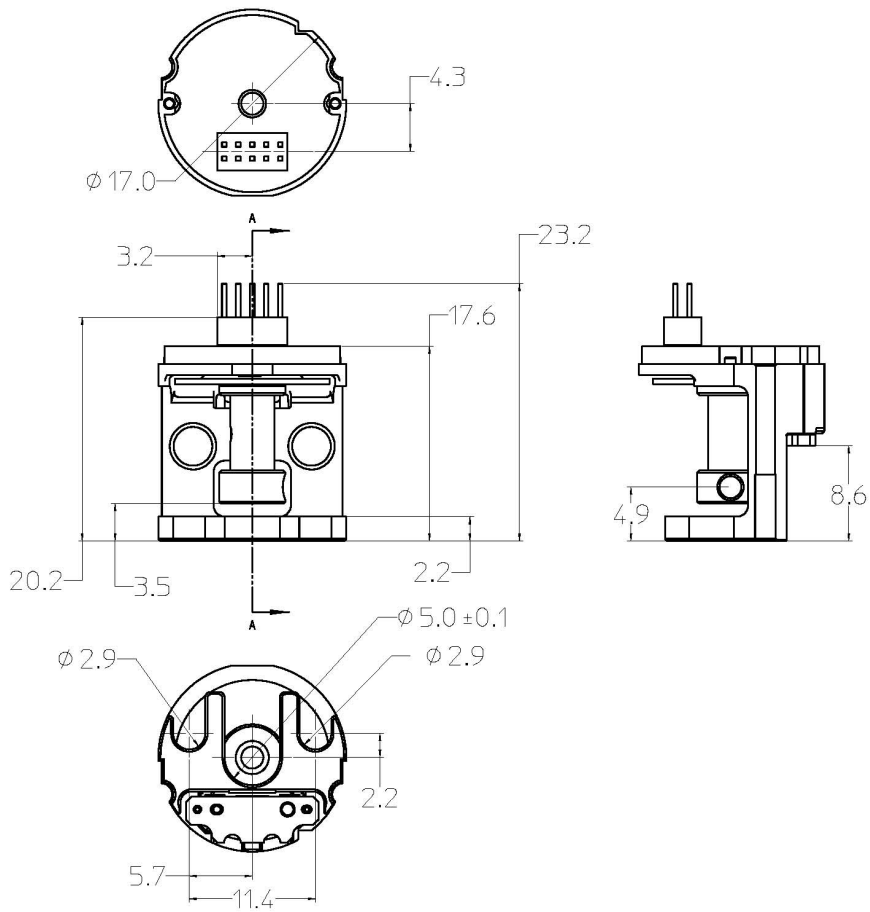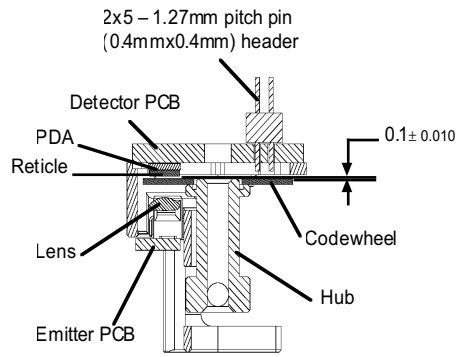

17.6

11.4

φ 17.0
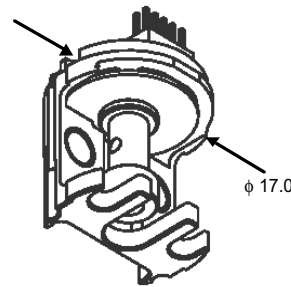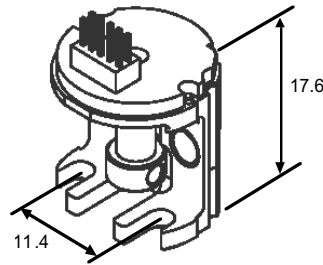
Features

- Two channel quadrature output with index pulse

- Quick and easy assembly using Plug and Play tool

- Cost-effective

- Ultra miniature size (φ17 mm)

- Resolution option before quadrature decoding from 2500 to 20000 Counts Per Revolution (CPR)

- Integrated RS 422 differential line driver

- Hub available in 2 mm shaft size

Agilent Technologies

Outline Drawing

2x5 – 1.27mm pitch pin
(0.4mmx0.4mm) header

Detector PCB

PDA

Reticle

Lens

Emitter PCB

0.1 ± 0.010

Codewheel

Hub

4.3

Ø 17.0

A

3.2

23.2

17.6

20.2

3.5

2.2

4.9

8.6

A

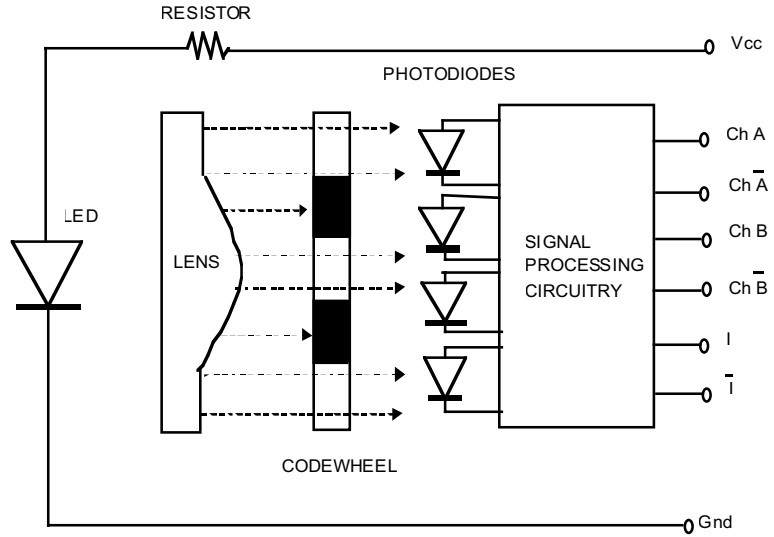Ø 5.0 ±0.1

Ø 2.9

Ø 2.9

2.2

5.7
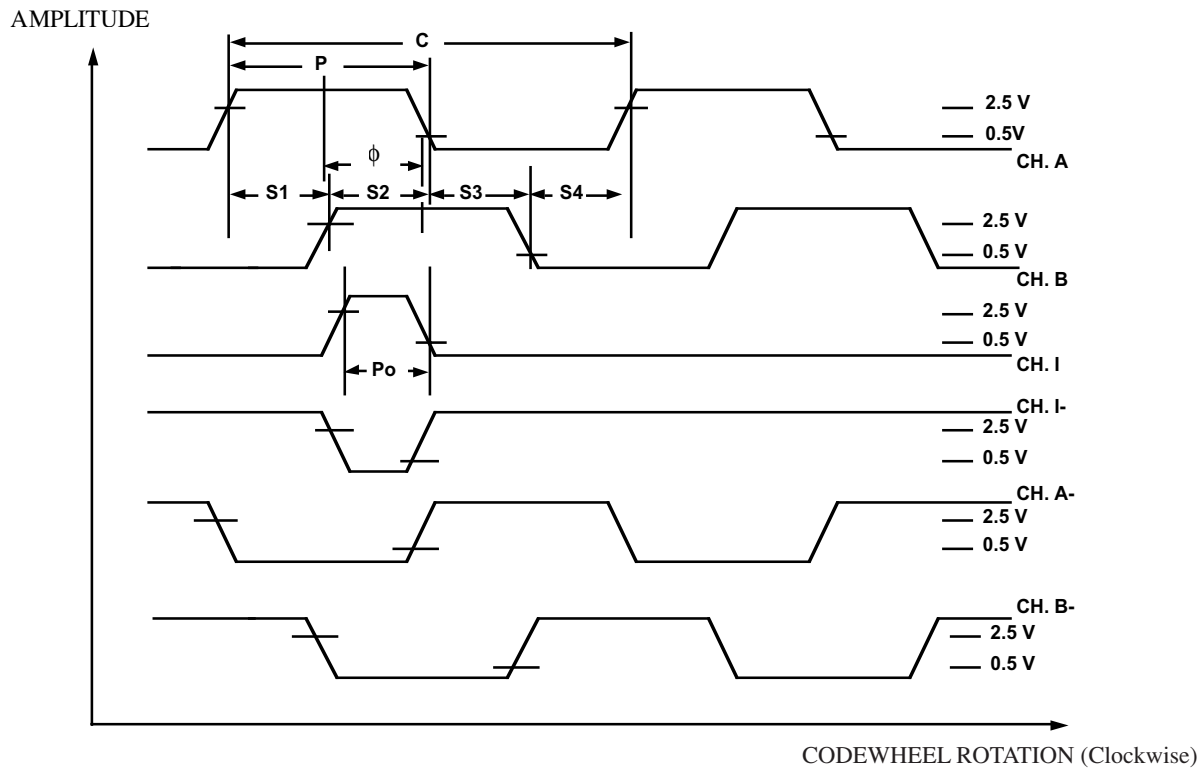
11.4

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-, and B and B-.

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.

RESISTOR

PHOTODIODES

LED

LENS

SIGNAL
PROCESSING
CIRCUITRY

Vcc

Ch A

Ch A̅

Ch B

Ch B̅

I

I̅

Gnd

CODEWHEEL

Output Waveforms

AMPLITUDE

CODEWHEEL ROTATION (Clockwise)

Definitions

Count (N): N refers to the number of bar and window pairs or counts per revolution (CPR) of the codewheel.

One Cycle (C): 360 electrical degree(°e), 1 bar and window pair.

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

Phase (ϕ): 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°e.

Pulse Width (P): The number of the electrical degrees that an output is a high-level during one cycle, nominally 180°e or 1/2 a cycle.

Pulse Width Error (ΔP): The deviation in electrical degrees of the pulse width from its ideal value of 180°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°e or _ 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°e.

State Width Error (ΔS): The deviation in electrical degrees of each state width from its ideal value of 90°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.
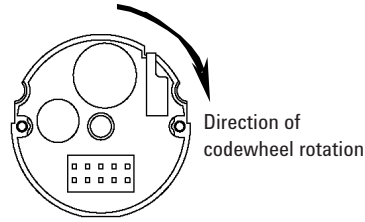

Direction of codewheel rotation

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	1 MHz

Recommended Operating Conditions

Parameter	Symbol	Min.	Typical	Max.	Units	Notes
Temperature	T_A	-40	25	125	°C	
Supply Voltage	V_{CC}	4.5	5.0	5.5	Volts	Ripple <100 mVp-p
Frequency	f		125	1000	kHz	$f = \dfrac{RPM \times CPR}{60}$

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	ΔP	5	85	°e
State Width Error	ΔS	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 *	+0/-.01 (+0/-.0005)	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.
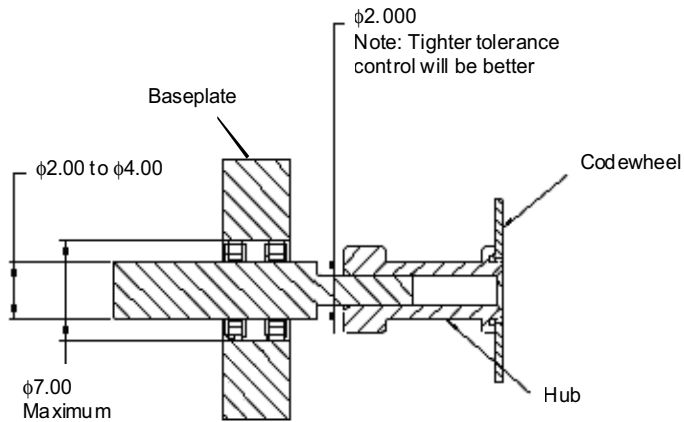
Pin Assignments

| Pin	Signal	Description
Pin 1	B+	Digital Output
Pin 2	B-	Digital Output
Pin 3	Gnd	Ground Pin
Pin 4	Gnd	Ground Pin
Pin 5	A+	Digital Output
Pin 6	A-	Digital Output
Pin 7	Vcc	Input Voltage
Pin 8	Vcc	Input Voltage
Pin 9	I+	Digital Output
Pin 10	I-	Digital Output
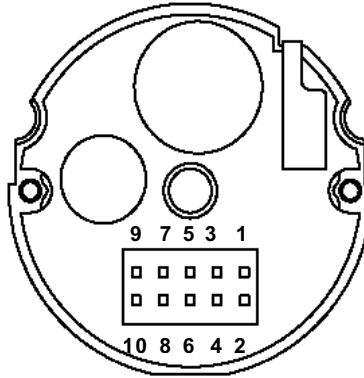
Notes:
1. Both Pin 7 and Pin 8 must be connected to Vcc.
2. Either Pin 3 or Pin 4 must be connected to Gnd.

Mating Connector

AEDA-3200 requires a 5 x 2 (1.27 mm x 1.27 mm) female IDC Connector. The cable used is 0.635 mm pitch flat ribbon cable.

Electrical Interface

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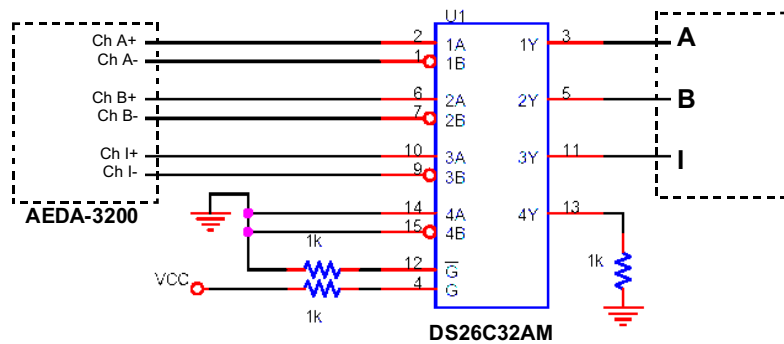
Alignment Considerations

The Plug and Play tool is intended to absorb normal installation misalignment and runouts. To achieve the optimum performance, user should mini-mize misalignment.

Complete instruction for AEDA-3200 Plug and Play installation can be found in the AEDA-3200 application note. AEDA-3200 Plug and Play tool part number is HEDS-8940.

Plug and Play tool.

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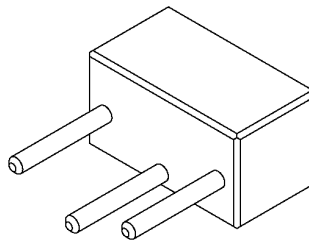
Ordering Information

A E D A - 3 2 0 0 - T _ _ _

Resolution Options (cpr)	
A J	2,500
B 1	5,000
B 7	6,000
B J	7,200
B K	7,500
B M	8,000
C 1	10,000
C 2	10,160
C 3	10,240
C H	12,000
C J	12,500
C M	13,000
C N	13,500
C Q	14,000
C X	14,400
D 1	15,000
D M	18,000
E 1	20,000

Mounting Options	
T	Top-down mounting

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