

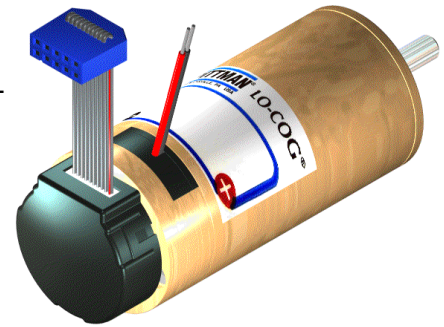
# 35mm ROSE Encoder

## Reflective Optical Sensing Encoder

✦✦✦✦ Patent Pending ✦✦✦✦

### Description

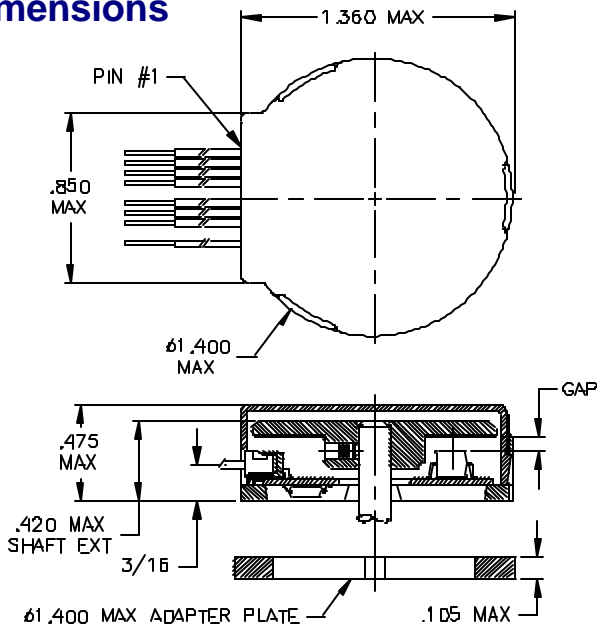
The 35mm ROSE (Reflective Optical Sensing Encoder) is an incremental, non-contacting rotary to digital feedback device. The encoder translates real-time shaft angle, speed and direction of rotation into TTL-compatible outputs. The outputs are two-channel, in quadrature with medium resolution encoding performance. The encoder is a less expensive, flexible alternative to the Agilent HEDS-9100 family of products. However, it is not intended to be a direct replacement in all applications.



The encoder's innovative PC board based design and multi-tracked code discs offers a wide range of resolutions and integral value added features. This concept achieves all the various features while using a minimum number of manufactured parts. The PC board is comprised entirely of surface mount (active and passive) components. Signal conditioning options such as an RS-422 differential line driver, pull-up resistors and additional filtering capacitor are all surface mount. The PC board also allows flexibility of low tooling costs and quick turnaround to accommodate custom control electronics.

The encoder employs a variety of proven design features such as a solid snap-together mounting base and cover that minimize weight and mounting hardware. In addition, it features a robust metal code disc hub with a set screw for simple and reliable gap setting. The reflective code disc itself is constructed of laminated photographic emulsion and Mylar. The result is a low cost, durable disc that has precise window to bar ratios.

### Dimensions



### Available Resolutions

CPR	Sensor
192	HEDR-8000
200	
250	
256	HEDR-8100
360	
400	
500	
512	

### Available Hub Bores

Æ
5/32"
4mm
5mm
6mm
1/4"
8mm

### Features

- Low cost
- Easy assembly and disassembly
- PC Board-based modular design
- Tolerant to significant gap variation ( $\pm .020$ " ) & mounting misalignment (.010")
- Mounting bolt circle range from 7/8" to 1-1/8"
- Adapter plate option available for difficult mounting conditions
- Shaft diameters from 5/32" to 8mm
- Shaft lengths from .360" to .420"
- 2 channel quadrature squarewave TTL-compatible outputs
- 192 to 512 CPR resolution
- Integral RS-422 high speed differential line driver option
- Standard pull-up resistors on all units
- Additional low cost filtering options
- Polarized locking output connector with wire & cable options
- Agilent HEDS compatible pin-out option
- Frame / motor case ground connection
- Operating temperature range -10° to 85°C
- Custom PC board design options at minimal tooling costs
- Single +5VDC supply

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## Leadwires & Connectors

### Encoder Connections (Standard)

Pin #	Function
1	Encoder Gnd
2	Vcc +5VDC
3	Encoder Gnd
4	N.C.
5	Channel A-
6	Channel A
7	Channel B-
8	Channel B
9	N.C.
10	Motor Gnd

Molex wire-to-board header 53261-1090, mates with Molex terminal housing plug 51021-1000 and 50079-8000 crimp terminals (28-32 AWG).

### Flat Ribbon Cable (Optional)

Pin #	Function
1	Encoder Gnd
2	Vcc +5VDC
3	Encoder Gnd
4	N.C.
5	Channel A-
6	Channel A
7	Channel B-
8	Channel B
9	N.C.
10	Motor Gnd

Agilent compatible pinout: 18" standard, 28 AWG, (10) position round conductor with AMP receptacle 746290-1 & strain relief 499252-5.

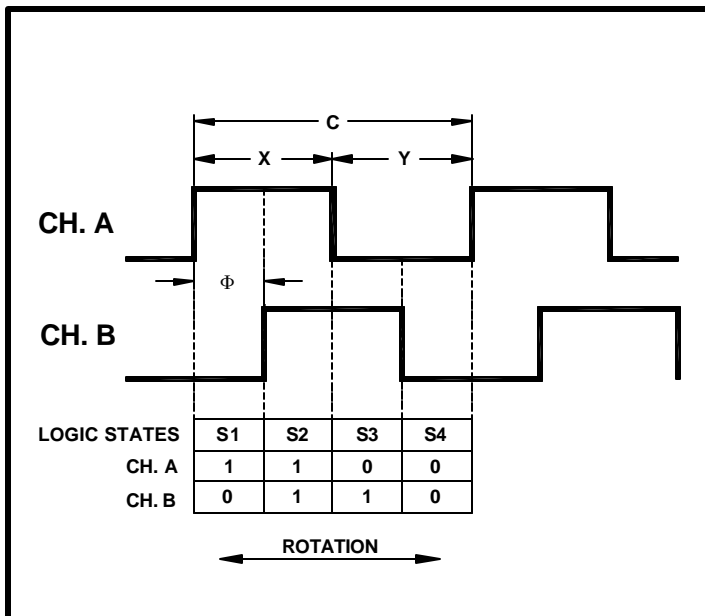
### Flying Leads (Optional)

Pin #	Wire Color	Function
1	Green	Encoder Gnd
2	White	Vcc +5VDC
3	Green	Encoder Gnd
4	N.C.	N.C.
5	Blue/White	Channel A-
6	Blue	Channel A
7	Violet/White	Channel B-
8	Violet	Channel B
9	N.C.	N.C.
10	Green/Yell	Motor Gnd

Standard leads are 18" long, 26 AWG (7 X 43) PVC insulated UL style 1061, 1/4" strip at ends.

Customer specific lead lengths, wire color and output connectors available upon request.

## Output Waveforms



## Definitions

**CPR (N):** Number of cycles per revolution.

**One Shaft Rotation:** 360 mechanical degrees, N cycles.

**One Electrical Degree (°e):** 1/360 of one cycle.

**One Cycle (C):** 360 electrical degrees (°e).

**Pulse Width:** Measure of the relationship between (X) and (Y) in electrical degrees, 180° nominal. Also known as *Duty Cycle* or *Symmetry*.

**Phase (f):** Lag or lead between channels A & B in electrical degrees, 90° nominal. Also known as *Quadrature*.

**State Width (S):** Number of electrical degrees between a transition in the output of channel A and the neighboring transition in the output of channel B. There are (4) states per cycle, each 90° nominal.

**Rotation Note:** Channel A leads B during CW code disc rotation, Channel B leads A during CCW code disc rotation (while viewing top of encoder sensor).

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✦✦✦✦ Patent Pending ✦✦✦✦

## Absolute Maximum Ratings

Parameter	Min.	Max.	Units
Axial Shaft Endplay <sup>1</sup>	-	± .015	in.
Mounting Misalignment <sup>2</sup>	-	.010	in.
Mounting Tilt	-	1°	Deg.
Storage Temp.	-40°	85°	°C
Storage Temp. (Line Driver)	-40°	100°	°C
Operating Temp.	-10°	85°	°C
Operating Temp. (Line Driver)	-40°	100°	°C
Relative Humidity	-	90%	%

1. See "Code Disc Gap Specifications" chart
2. PC board center thru hole to shaft alignment

## Electrical Specifications

Parameter	Min.	Typ	Max.	Units	Notes
Supply Voltage <sup>1</sup>	4.5	5.0	5.5	VDC	Ripple <100mVp-p
Supply Current <sup>2</sup>	13	15	18	mA	
Load Capacitance <sup>2</sup>	-	-	100	pF	
Count Frequency <sup>3</sup>	-	-	15+	kHz	RPM X CPR/60
High Level Output Voltage	2.4	-	-	VDC	I <sub>OH</sub> = -40 mA min.
Low Level Output Voltage	-	-	0.4	VDC	I <sub>OL</sub> = 3.86 mA
Rise Time <sup>2</sup>	-	150	200	ns	25pF
Fall Time	-	50	60	ns	

1. Standard internal 0.1µF by-pass capacitor installed between power & ground
2. Standard internal 2.7kOhm pull-up resistors on both A & B channels
3. Substantially higher count frequencies are obtainable. Contact Pittman for details.

## RS-422 (26C31) Differential Line Driver Option

Parameter	Min.	Typ	Max.	Units	Notes
Supply Voltage	4.5	-	5.5	VDC	
Supply Current	-	1	2	mA	
High Level Output Voltage	2.5	-	-	VDC	I <sub>OH</sub> = 20 mA
Low Level Output Voltage	-	-	0.8	VDC	I <sub>OL</sub> = 20 mA
Propagation Time	-	-	15	ns	

## Encoding Characteristics @ 25°C

Parameter	HEDR-8000 Sensor (192, 200, 250, 256 CPR)			HEDR-8100 Sensor (360, 400, 500, 512 CPR)			Units
	Nom.	Typ. Error	Max. Error	Nom.	Typ. Error	Max. Error	
Pulse Width	180	25	TBD	180	16	TBD	°e
Phase	90	12	TBD	90	10	TBD	°e

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## Mounting Notes

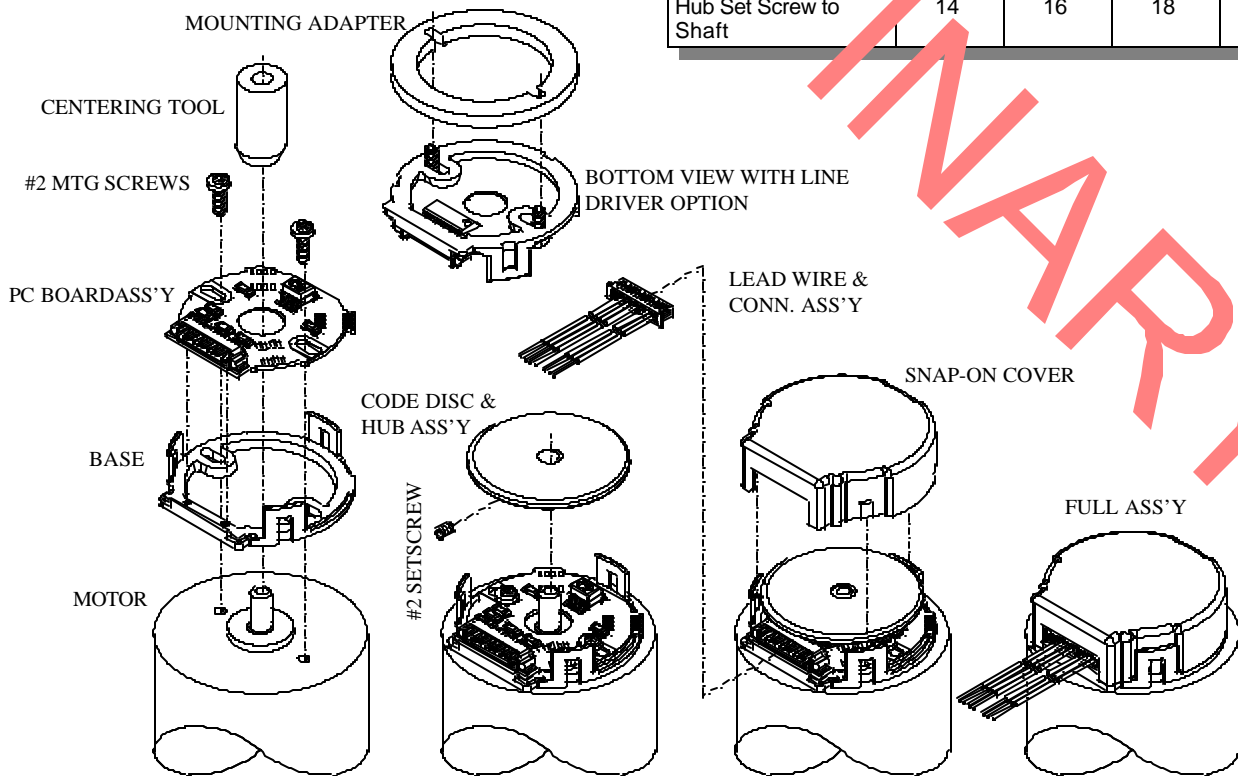
- Mounting without line driver option:  
Boss must be <math>\varnothing.594\text{''}</math> X .070" high
- Mounting with line driver option:  
Boss must be <math>\varnothing.394\text{''}</math> X .070" high
- Mounting Adapter Plate Option:  
For use with boss <math>\varnothing 1.000\text{''}</math> X .100" high  
Mounting bolt circle of adapter is <math>\varnothing 1.125\text{''}</math>

## Mechanical Notes

Parameter	Dimension	Units
Mounting Screw Size	(2) #2-56 X 1/4	in.
Mounting Pattern Range	7/8 to 1-1/8 Dia. B.C.	in.
Shaft Extension	.390 +/- .030	in.
Hub Set Screw Size	(1) #2-56 X 3/32	in.
Hex Wrench Size	.035 (across flats)	in.

## Mounting Torque Specifications

Parameter	Min.	Typ	Max.	Torque
Base & PC Board to Mounting Surface	18	20	22	oz-in
Hub Set Screw to Shaft	14	16	18	oz-in



## Code Disc Gap Specifications

Sensor	Min.	Typ	Max.	Units
HEDR-8000 (192, 200, 250, 256 CPR)	.050	.070	.090	in.
HEDR-8100 (360, 400, 500, 512 CPR)	.030	.050	.070	in.

1. Gap tolerance is a combined total of  $\pm 0.015$  axial shaft endplay and  $\pm 0.005$  tolerance of actual setting of gap
2. Setting gap on shafts with endplay (.015 max.): during code disc gapping, slack endplay should be reduced towards encoder mounting surface to create min. shaft extension

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### Recommendations on Use

- Channel A is intended to gather count information and channel B is intended to gather direction information.
- The above can be achieved while using (1X) or (2X) decoding.
- Full (4X) quadrature decoding is not recommended.
- ESD Warning: Normal handling precautions should be taken to avoid static discharge damage to the sensor.
- Exposure to high intensity light sources: High intensity light sources such as photographic flashes and spotlights can damage the encoder's sensor. Normal light sources will not cause damage.
- Encoder is not recommended for use in safety critical applications.

### Additional Documentation

- Agilent Technologies HEDR-8000 Reflective Optical Surface Mount Encoder Technical Datasheet (PDF)  
<http://literature.agilent.com/litweb/pdf/5988-5310EN.pdf>
- Agilent Technologies Application Note 1079, Design & performance Considerations with the Agilent -HE DR-8000 (PDF)  
<http://literature.agilent.com/litweb/pdf/5965-5973E.pdf>
- National Semiconductor, DS26LS31/DS26LS31M Quad High Speed Differential Line Driver (PDF)  
<http://www.national.com/ads-cgi/viewer.pl/ds/DS/DS26LS31C.pdf>
- Molex Wire-to-Board, 1.25mm (.049") Vertical Housing – Right Angle SMT Header & Mating Components  
[Molex 50079/50058,51021:53261 Data Sheets](#)

### Pittman Specifications and Assembly Documentation (AutoCAD .DWG) *Internal Use Only*

- [Pittman 35mm ROSE Encoder Assembly Drawing: 153-210-1](#)
- [Pittman Encoder Screw Torque: Specification P-103-ENC, sheet 2](#)
- [Pittman Reflective Optical Code disc Gap Specification: P-139](#)
- [Pittman Reflective Optical Encoder Test Limits Specification: P-140](#)