Motion Sensing and Control Products

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Your Imagination, Our Innovation

Sense • Illuminate • Connect™

Performance in Motion

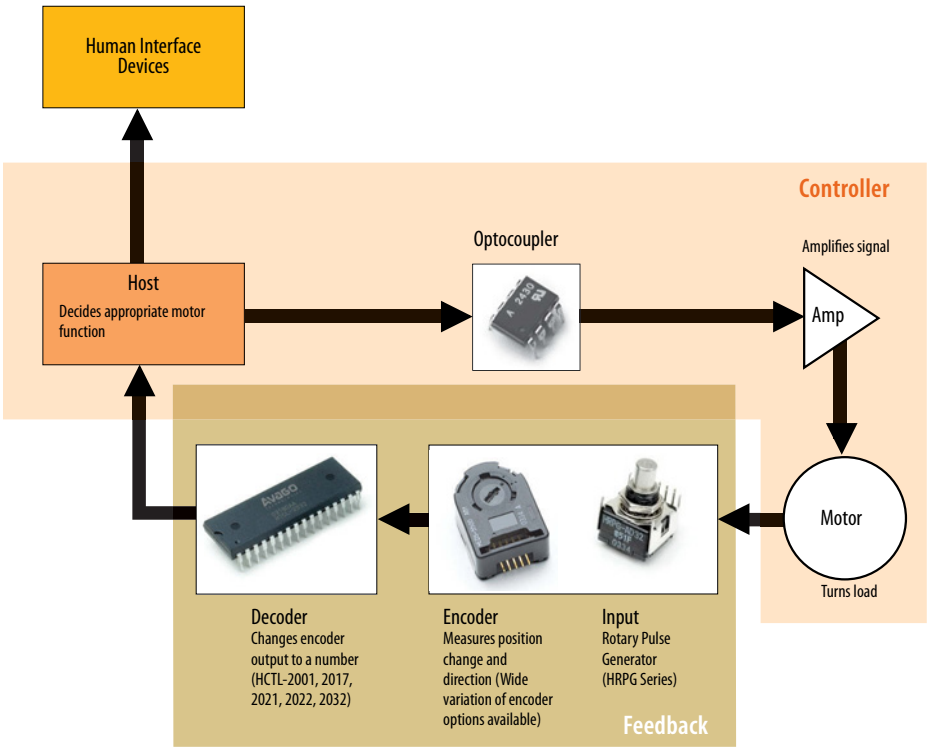
Avago Technologies is the industry-leading supplier of motion control encoders.
Avago offers "one-stop shopping" with its extensive portfolio of encoders, decoders and controllers. We offer the industry's smallest form factors, widest range of resolutions, and highest level of integration to reduce the number of components needed and shorten time-to-market.

Introduction

Motion control, in broad definition, means converting mechanical movement from codewheel/codestrip into equivalent electrical signals to move an object in an accurate and precise manner.

High accuracy, ease of use, low cost and global support…these words are rarely spoken in the same breath to describe anything. With Avago's broad range of encoders, this is now a reality.

Avago started out designing and selling classical optical encoders and has progressed to designing and manufacturing ultra miniature optical encoders and magnetic encoders. With these technologies, Avago has enabled designers to miniaturize their design with full confidence of excellent performance. Avago is changing the landscape of rotary and linear motion control.



Encoder accuracy, large range of Counts Per Revolution (CPR) options, low cost and high reliability have been key customer requirements. With Avago's range of encoders, these criteria are met and exceeded. Also, as Avago's encoders are optics based, they are immune to RF interference.

For almost all closed-loop feedback systems, the encoder's role as positioning sensor is crucial in providing the direct measurement for position and movement within the system. Avago provides a whole range of encoders capable of meeting these stringent needs.

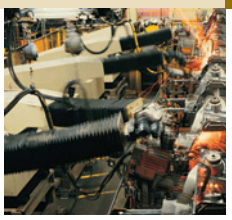
Applications

Avago's products meet the stringent requirements, in a wide range of applications from printers, copiers and scanners to servo and stepper motors, and robotic arms and wafer-handling machines.

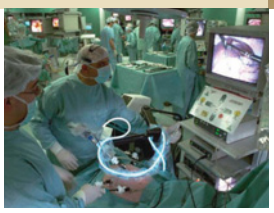
Office Automation
- Printers
- Copiers
- Tape Drives
- Plotters

Consumer
- Cameras
- Card Readers
- Motor Control

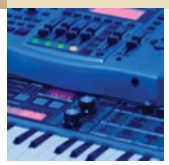
Motor Manufacturers
- DC Motors
- Stepper Motors
- Servo Motors



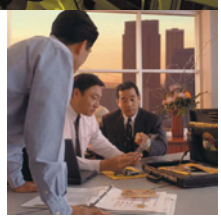
Industrial Automation
- Wafer Handling Machines
- Industrial Sewing Machines
- Robotics
- CAD/CAM Dial Boxes
- Vending Machines



Medical
- Blood Analyzers
- Lab Sample Handling Equipment
- Surgical Robotics



Instruments
- Audio & Visual Boards



Value Propositions

Customer Reach

Worldwide distribution/channels, with Technical Response Centers, supported by experienced Field Application Engineers

State-of-the-Art-Technology

Innovative designs by a vast pool of experienced software, hardware and IC designers to deliver the ultimate performance product

High Quality Services

ISO Certified, continuous process improvement, field support from all regions and quality management of supply chain

Our Commitment

Our worldwide support team will work with you to meet your requirements and put your designs in motion.

	Features	Benefits
Reliability	Longer lifespan for encoders due to elimination of mechanical parts.	Low maintenance cost.
Size	Integrated encoder solution comes in different packages (e.g. chip-size and SOIC packages vs. industrial-grade robust housing) and mountings that can be catered to customer's specific needs.	Small form factor. High performance in small package. Well suited for space-constrained applications.
Reduced Switching Glitch	Optical technology promotes quiet switching as no switching transients are generated without electrical contacts.	Accurate and precise motion sensing.
High Resolution	• Up to 80,000 counts per revolution (incremental) • Up to 65,536 positional data per revolution (absolute) • Up to 1 million or more positional data per revolution for customized solutions. Technology is not limited to quasi absolute/absolute.	Accurate and precise motion sensing.
Surface Mount	Smaller package delivers the same functionality as standard DIP.	Lower assembly cost. Easier, faster handling, improved solderability.
Cost-Effective, High Performance	Newest encoder module features reduced component and package sizes. Delivers higher performance, easier installation through patented alignment plug and play tool.	Reduced design cycles. Small form factor. Reduced cost.

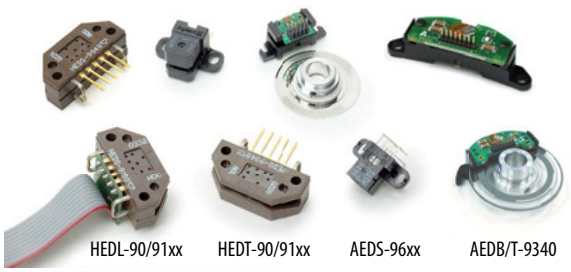
Motion Control Products Overview

Incremental

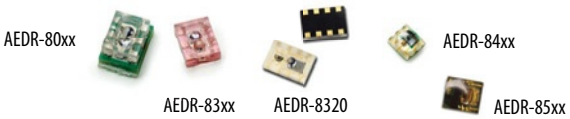
Optical Encoder

Module

Transmissive



Reflective



Housed

Transmissive

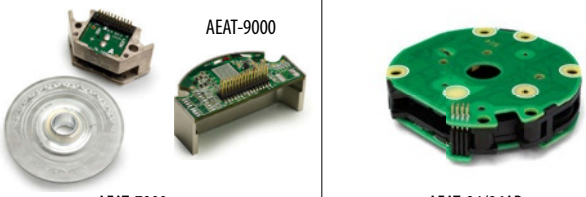
Reflective

Absolute

Opticmageal Encoder

Module

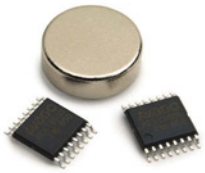
Transmissive



Magnetic

Housed

IC



Accessories

Codewheel/Codestrip

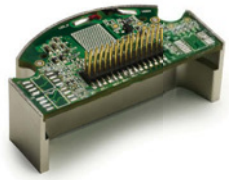
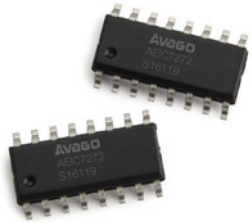
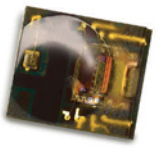
Metal/Mylar/Glass

Integrated Circuit

Decoder/Counter/Line Driver

Note: Avago Technologies encoders are not recommended for use in safety critical applications such as ABS braking systems, power steering, life support systems and critical care medical equipment. Contact your sales representative for further clarification.

What's Hot

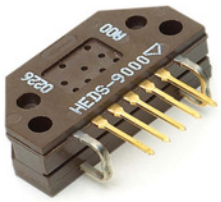
Avago's Encoders	Importance	Key Applications	Value Propositions	Benefits
Ultra-precision 17-Bit Absolute Single Turn Encoder  AEAT-9000	Designed to allow design engineers to achieve superior positioning performance in terms of speed and accuracy performance. The modular package enables the encoder to be directly integrated to the motor unlike conventional encoders. Cost savings and better performance of the overall system.	Rotary applications up to 17 bits/360° absolute position Integration into servo motors Industrial and maritime valve control High precision test and measurement machines Industrial and factory automation equipments Textile, woodworking & packaging machineries Nacelle & blades control in wind turbine	17-bit absolute single turn output (131072 absolute positions over 360°) 2 channel true differential Sine/Cosine outputs with 2048 cycles per revolution 2048 CPR A/B channel incremental analog output Interface output will be SSI (2wire SSI / 3wire SSI) with RS485 line transceiver or single ended option	Absolute encoder that consists of a read head module and a high-precision code disc. The modular design allows for better flexibility to system designers to easily design-in the encoder feedback system.
Quad Differential Line Driver  AEIC-7272-S16 AEIC-7273-S16 AEIC-2631-S16	These line drivers are pin compatible with 26LS31 in applications . Minimize standby power dissipation in high voltage applications	Encoders Industrial controls	Supply (Bias) Voltage up to 30 V Operation to 800 KHz CMOS and TTL Compatible Inputs Optional single supply operation for moderate power applications High Impedance Buffered Inputs with hysteresis Tri-State outputs	Assures highly reliable by a two-fold scheme of current limiting and thermal shutdown. Internal clamp diodes allow trouble-free operation when driving cable lengths exceeding 100m. Split supplies are provided to minimize standby power dissipation in high voltage applications.
Programmable 16-bits Magnetic Encoder AEAT-66xx	Programmable absolute output and simultaneous incremental output Flexibility in magnet range selection Meet the market standard for harsh environment, EMI application	Table/chair positioning Valve control Robotics Flow meter Industrial Actuator Amusement equipment Textile equipment	Up to 16 bits of resolution 5V or 3.3V operation Simultaneous absolute and incremental output up to 1024 CPR Incremental ABI or UVW, and PWM output modes Power-down mode to reduce	Programmable features Miniature size and low power supply All in one integrated solutions One step alignment Highest resolution up to 16bits
3 Channel Reflective Optical Encoder, up to 304LPI  AEDR-850x	World smallest 3-channel reflective encoder with build in interpolator 1x, 2x, 4x Compact size SMT encoder Meet the market demand for compact & cost effective feedback solution Proven solution based on Avago's reflective technologies	Medical devices/ & equipments Piezemotors feedback Surveillance camera Miniature motor Test & measurement equipments	3-channel (A,B,I) with build in interpolator 1x, 2x, 4x 304 LPI Miniature size Temp : -20°C to 85°C High operating frequency 56kHz Index gating	Miniature size – ability to fit the miniature motor design No need for separate component to generate index signal Based CPR resolution can be interpolated by the end user Suitable for various gating requirement Higher RPM performance with increased operating frequency

What's Hot

Avago's Encoders	Key Applications	Value Propositions	Benefits
Miniature Three Channel Housed Encoder AEDx-8xxx	Pick and place machines Servo motor, DC motor, stepper motor Factory automation Miniature motor with diameter as small as 20mm Packaging machines	Miniature size (20mm diameter) High temperature (up to 100°C) High resolution (200, 400 & 500CPR) RS-422 Line Driver Output Integrated IP 40 Low cost Easy assembly	Improves motor control High operating temperature (up to 100°C) Product robustness (IP 40) RS 422 allows long distance application Enable high precision closed-loop stepper motor Improves power efficiency for closed-loop DC Stepper Motor Control System Save assembly time and cost
Six Channel Encoders AEDT-9340 (high temperature encoder) AEDB-9340 (codewheel included) AEDS-9240 (360 CPR series)	Servo motor CNC machines Industrial sewing machines Textile machines Sewing machines	High resolution Low cost Easy assembly — alignment free housed encoder High speed > 250KHz High robustness to noise (EMI) & ESD	6-channel encoder enables single module solution for Brushless Motor Save assembly time and cost Enable miniature housed encoder for space constraint application High frequency response enables high speed application Customized housed / kits solutions available under sub-system solutions
Magnetic Encoders AEAT-6010/12 (Absolute) AEAT-601B (Incremental)	Servo motor, DC motor, stepper motor Valve & pump control Factory automation Textile machines Packaging machines	Miniature size (23mm diameter) Wide operating temperature range (-40 to 125°C) Incremental resolutions (32, 64, 128 & 256CPR) Absolute resolutions (10 & 12 bits) Easy assembly with bearing-less housing Non-contact Hall Effect sensing technology	Improves motor control High operating temperature (up to 125°C) Product robustness against contamination Cost effective feedback solution for Servo Motors Save assembly time and cost
Mid-Size 1000CPR Three Channel Housed Encoders HEDM-554x-Bxxx HEDS-8907-001 (Rubber Cover)	Servo motor, DC motor, stepper motor Valve & pump control Factory automation Textile machines Packaging machines	Retain same form & fit for easy design-in Wide operating temperature range (-40 to 85°C) Extended resolution up to 1000 CPR with Index Low cost Easy assembly with bearing-less housing Simple dust protection	Improves motor control High operating temperature (up to 85°C) Increase product robustness against contamination Cost effective feedback solution for Servo Motors Save assembly time and cost

Transmissive Module

HEDS-90xx/91xx/9200, HEDL-90xx/91xx Series, HEDT-90xx/91xx Series



Description

HEDS-9000/9040/9100/9140 Series

- High-performance two/three channel rotary encoder
- Consists of a lensed (LED) source and a detector IC enclosed in a small C-shaped plastic package
- Extremely tolerant to mounting misalignment due to a highly collimated light source and unique photodetector array
- The single 5-V output supply input are accessed through five 0.025 inch square pins located on 0.1 inch centers
- HEDS-9000 resolution: from 500 to 2048 CPR when used with appropriate codewheel
- HEDS-9040 is designed for use with a HEDx-614x codewheel which has an optical radius of 23.36 mm (0.920 inch)
- HEDS-9100 resolution: from 50 to 1024 CPR when used with appropriate codewheel
- HEDS-9140 is designed for use with the HEDS-5140 codewheel which has an optical radius of 11.00 mm (0.433 inch)

HEDS-9200 Series

- Same features as listed above
- Detects linear position when operated in conjunction with a codestrip

HEDL-90xx/91xx Series

- Differential outputs
- Utilizes an industry-standard line driver IC, 26C31, which provides complementary outputs for each encoder channel
- Offers enhanced performance when the encoders are used in noisy environments, or when required to drive long distances
- Suggested line receivers are 26C32 and 26C33
- Quadrature signals are accessed through a cable and 10-pin female connector, which is manufactured by FCI, part number: 66900-310
- Mating connectors manufactured by FCI; straight type part number: 71912-010, right angle type part number: 71913-010

HEDT-90xx/91xx Series

- High performance
- Low cost
- Operates to 125°C
- Ideal for high volume automotive applications

HEDT-9040/9140 Series

- High temperature
- Three channels (two channel quadrature output plus a third channel index output)
- Operates up to 140°C

Features

- High performance
- High resolution
- Low cost
- Easy to mount
- No signal adjustment required
- Small size
- -40°C to 100°C operating temperature (up to 140°C for high temperature version)
- Two and three channel quadrature output
- TTL compatible output
- Single 5-V supply
- Count frequency of 100 KHz

Applications

Ideal for high-volume applications:

- Printers
- Plotters
- Tape drives
- Factory automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Two Channel Linear Encoders Module – HEDS-9200 Series

HEDS-9200 Option			

Resolution (Cycles/Rev)
300 - 300 LPI
360 - 360 LPI
Q00 – 180 LPI

Two Channel Incremental Encoders – HEDS-910x series

Note: To be used with 11mm optical radius codewheel

HEDS-910	0

Lead
0 - Straight Leads
1 - Bent Leads

Option		0	0

Resolution (Cycles/Rev)	
S - 50 CPR	H - 400 CPR
K - 96 CPR	A - 500 CPR
C - 100 CPR	I - 512 CPR
E - 200 CPR	B - 1000 CPR
F - 256 CPR	J - 1024 CPR
G - 360 CPR	

Available Options														
Part Number	Options													
	A	B	C	D	E	F	G	H	I	J	K	S	T	U
HEDS-9100	•	•	•		•	•	•	•	•	•	•	•		
HEDS-9101	•		•		•		•							
Refer to codewheel ordering information for recommended usage														

Three Channel Incremental Encoders – HEDS-914x series

Note: To be used with 11mm optical radius codewheel

HEDS -914	0		Option		0	0

Assembly tool: HEDS-8905

Lead
0 - Straight Leads
1 - Bent Leads

Resolution (Cycles/Rev)	
S - 50 CPR	H - 400 CPR
C - 100 CPR	A - 500 CPR
E - 200 CPR	I - 512 CPR
F - 256 CPR	B - 1000 CPR
G - 360 CPR	

Available Options														
Part Number	Options													
	A	B	C	D	E	F	G	H	I	J	K	S	T	U
HEDS-9140	•	•	•		•	•	•	•	•			•		
HEDS-9141	•				•	•	•						•	
Refer to codewheel ordering information for recommended usage														

Two Channel Incremental Encoders – HEDS-900x series

Note: To be used with 23.36mm optical radius codewheel

HEDS-9000 Option		0	0

Resolution (Cycles/Rev)	
A - 500 CPR	B - 1000 CPR
J - 1024 CPR	T - 2000 CPR
U - 2048 CPR	

Available Options														
Part Number	Options													
	A	B	C	D	E	F	G	H	I	J	K	S	T	U
HEDS-9000	•	•								•			•	•
Refer to codewheel ordering information for recommended usage														

Ordering Information

Three Channel Incremental Encoders – HEDS-904x series

Note: To be used with 23.36mm optical radius codewheel

HEDS-904	0		Option		0	0

Lead
0 - Straight Leads
1 - Bent Leads

Resolution (Cycles/Rev)
B - 1000 CPR
T - 2000 CPR
J - 1024 CPR

Available Options														
Part Number	Options													
	A	B	C	D	E	F	G	H	I	J	K	S	T	U
HEDS-9040		•								•			•	
HEDS-9041		•												
Refer to codewheel ordering information for recommended usage														

High Temp 125°C Two Channel Optical Incremental Encoder Modules – HEDT-9000/9100 series

HEDT -910	0		Option		0	0

Lead
0 - Straight Leads
1 - Bent Leads

Resolution (Cycles/Rev)	
C - 100 CPR	G - 360 CPR
D - 192 CPR	A - 500 CPR
E - 200 CPR	I - 512 CPR

Available Options						
Part Number	Options					
	A	C	D	E	G	I
HEDT-9001	•					
HEDT-9100	•	•		•	•	•
HEDT-9101	•	•		•	•	•
Refer to codewheel ordering information for recommended usage						

Ordering Information

High Temp 140°C Three Channel Optical Incremental Encoder Modules – HEDT-9040/9140 series

HEDT-914	0

Lead
0 - Straight Leads
1 - Bent Leads

Option		0	0

Resolution (Cycles/Rev)
I - 512 CPR

Available Options									
Part Number	Options								
	A	B	C	D	E	F	G	H	I
HEDT-9140									•
HEDT-9141									•
Refer to codewheel ordering information for recommended usage									

HEDL-900xx/91xx Series

HEDL-90		0

Outputs
0 - 2 Channel
4 - 3 Channel

Option		0	0

Resolution (Cycles/Rev)
B - 1000 CPR
U - 2048 CPR

HEDL-91		0

Outputs
0 - 2 Channel
4 - 3 Channel

Option		0	0

Resolution (Cycles/Rev)
A - 500 CPR
H - 400 CPR
I - 512 CPR

Available Options					
Part Number	Options				
	A00	B00	H00	I00	U00
HEDL-9000					•
HEDT-9040		•			
HEDL-9100	•				
HEDL-9140	•		•	•	
Refer to codewheel ordering information of HEDS-5120, HEDS-5140, HEDM- 6120 and HEDS-6140 series for recommended codewheel usage					

Three Channel Encoder Modules and Codewheels, 11.000 Optical Radius – HEDS-9140-B00 Option

HEDS-9140 Option		0	0

Resolution (Cycles/Rev)
B - 1000 CPR

HEDM-504		Option			

Assembly tool: HEDS-8905

Artwork Orientation
0 - Artwork on hub side (use when module side B is down)
1 - Artwork opposite hub side (use when module side A is down)

Shaft Diameter	
01 - 2 mm	11 - 4 mm
02 - 3 mm	13 - 5 mm
05 - 3/16 in.	14 - 8 mm

Incremental Optical Encoders
Transmissive Module

HEDS-9700/972x/973x/978x Series

Description

- High performance
- HEDS-973x is a high-resolution version of HEDS-9700
- Detects rotary or linear position when operated in conjunction with either a codewheel or codestrip
- Consists of a lensed (LED) source and a detector IC enclosed in a small C-shaped plastic package
- Extremely tolerant to mounting misalignments due to a highly collimated light source and unique photodetector array
- Two channel digital output
- 5 V supply input
- Four solder-plated leads located on 2.54 mm (0.1 inch) centers
- Standard HEDS-9700 is designed for use with 11-mm optical radius codewheel or linear codestrip. (Other options are available - refer to factory for further details)

Features

- Small size
- Wide resolution range
- No signal adjustment required
- Two channel quadrature output
- Single 5 V supply
- -40°C to 85°C operating temperature
- Multiple mounting options
- Linear and rotary options available
- Wave solderable
- RoHS compliant
- TTL compatible output
- Count frequency 20 KHz to 80 KHz

Applications

- Printers
- Plotters
- Copiers
- Office automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

HEDS-97 | | |

0 - Rotary
2 - Linear

Lead Bend
0 - Straight Leads
1 - Bent Leads

Option | | | |

Resolution Options (11 mm optical radius,Rop)
K - 96 CPR
C - 100 CPR
D - 192 CPR
E - 200 CPR
F - 256 CPR
G - 360 CPR
H - 400 CPR
(Linear)
L - 120 LPI
P - 150 LPI
Contact Factory for Other Resolution Options

Mounting Options
50 - Standard
51 - Rounded Outline
52 - Backplane
53 - Standard w/Posts
54 - Tabless
55 - Backplane w/Posts

Ordering Information

HEDS-973 □

Lead Bend
0 - Straight Leads
1 - Bent Leads
2 - Straight Leads
3 - Bent Leads

Option □□□

Resolution Options
A - 500 CPR, 11 mm Rop
B - 1000 CPR, 11 mm Rop
J - 1024 CPR, 11 mm Rop
Q - 180 LPI, Linear
2 - 300 LPI, Linear
1 - 360 LPI, Linear
3 - 480 LPI, Linear
T - 2000 CPR, 23.36 mm Rop
U - 2048 CPR, 23.36 mm Rop

Mounting Options
50 - Standard
51 - Screwmount
52 - Backplane
53 - Standard w/Posts
54 - Tabless
55 - Backplane w/Posts

HEDS-978 □

Lead Bend
0 - Straight Leads
1 - Bent Leads

Option □□□

Resolution Options
G - 360CPR, 11mm ROP
H - 400CPR, 11mm ROP
A - 500 CPR, 11 mm Rop

Mounting Options
50 - Standard
54 - Tabless

Available Options							
Part Number		Options					
		50	51	52	53	54	55
HEDS-9780	A	•					
	G	•				•	
	H	•				•	
HEDS-9781		50	51	52	53	54	55
	A	•					
	G					•	
	H						

Note: Contact factory for codewheel and codestrip information.

Incremental Optical Encoders
Transmissive Module

HEDS-971x Series

Description

- High performance
- Detects rotary position when operates in conjunction with a codewheel
- Consists of a lensed (LED) source and a detector IC enclosed in a small C-shaped plastic package
- Extremely tolerant to mounting misalignment due to a highly collimated light source and unique photodetector array
- Two channel analog output
- 5.5V and 3.3V options available
- Four solder plated leads located on 2.54 mm (0.1 inch) centers
- Designed for use with an appropriate optical radius codewheel. (Refer to factory for further details)

Features

- Small size
- Wide resolution range
- No signal adjustment required
- Single 5 V supply
- Two channel analog output
- 15° C to 45° C operating temperature
- Multiple mounting options
- Wave solderable
- RoHS compliant

Applications

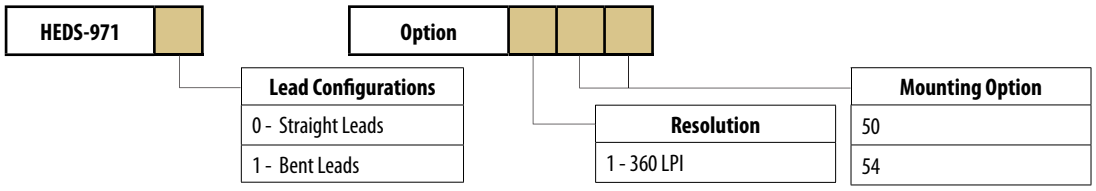
- Printers
- Plotters
- Copiers
- Office automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information



Note: Contact factory for codewheel and codestrip information.

Incremental Optical Encoders
Transmissive Module

AEDS-964x Series

Description

- High performance
- Ultra-miniature package
- Detects rotary or linear position when operated in conjunction with either a codewheel or codestrip
- Consists of lensed (LED) source and a detector IC enclosed in a small C-shaped plastic package
- Extremely tolerant to mounting misalignment due to a highly collimated light source and unique photodetector array
- Two channel digital output
- 3.3/5.0-V supply input
- Four solder plated leads located on 2.00 mm (0.1 inch) centers
- Supply input of LED rated at 16 mA, accessed through two leads located at 2.54 mm pitch
- Designed for use with an 11.00 mm optical radius codewheel or linear codestrip. (Other options are available – refer to factory for further details)

Features

- Low package height, small size
- Built-in codewheel and codestrip guide bumps
- For linear and rotary applications
- No signal adjustment required
- Insensitive to radial and axial play
- 0°C to 70°C operating temperature
- Wide resolution range
- Two channel quadrature output
- TTL, 3.3/5.0-V CMOS compatible
- Wave solderable
- RoHS compliant

Applications

- Printers
- Plotters
- Copiers
- Office automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AEDS-964		Option		1	0

Lead Configurations

0 - Straight Leads
1 - Bent Leads

Resolution

P - 150 LPI
2 - 300 LPI
1 - 360 LPI

Mounting Options

Other mounting options are available. Please refer to factory for further details.

Note: Contact factory for codewheel and codestrip information.

Incremental Optical Encoders
Transmissive Module

AEDS-965x Series

Description

- Very small, low package height and high performance incremental encoder module
- Consists of lensed (LED) source and a detector IC enclosed in a small C-shaped plastic package
- Due to the brighter LED, coupled with a photodetector array, which is less sensitive to light, the encoder is highly tolerant to aerosol environment
- This module is extremely receptive to mounting misalignment
- The two channel digital outputs and Vcc, supply voltage input, are accessed through four solder plated leads located on 2.00 mm (0.1 inch) centers
- The supply input of LED, rated at 16mA is accessed through two leads located at 2.54 mm
- Designed for use with a linear codestrip (Other options are available – refer to factory for further details)

Features

- Small size
- Built-in guide bumps for codewheel and codestrip
- Low package height
- Insensitive to radial, tangential and axial play
- 0°C to 70°C recommended operating temperature
- Two channel quadrature output
- TTL 3.3V or 5.0V CMOS compatible
- For linear and rotary application
- Wave solderable
- RoHS compliant
- Aerosol tolerant

Applications

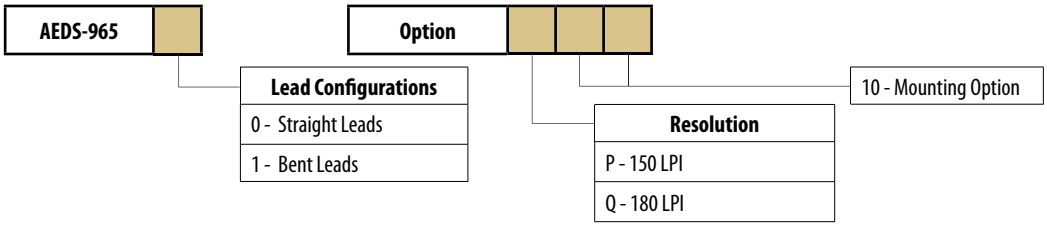
- Printers
- Copiers/Fax
- Plotters
- Office automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

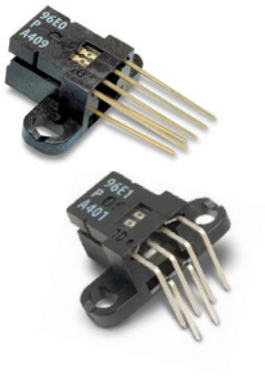
Ordering Information



Note: Contact factory for codewheel and codestrip information.

Incremental Optical Encoders
Transmissive Module

AEDS-96Ex Series



Description

- Very small, high performance, low cost optical incremental encoder module
- Consists of a lensed (LED) source and a detector IC enclosed in small C-Shaped plastic package
- Due to highly collimated light source and a unique photodetector array, the module is extremely tolerant to mounting misalignment
- The two channel analog outputs and 3.3 V supply input are accessed through four leads located on 2.00 mm centers for the detector and two leads located on 2.54 mm center for the emitter
- Designed for use with an appropriate optical radius codewheel. Contact factory for more information

Features

- Small size
- Low package height
- Resolution: 200 LPI
- 0°C to 60°C recommended operating temperature
- For linear and rotary applications
- Two channel analog output
- Single 3.3V supply*
- Wave solderable
- 1.52V LED forward voltage (IF = 16mA)*
- Built-in guide bumps for codewheel
- Tolerant to radial, tangential and axial play
- RoHS compliant

* Typical conditions

Applications

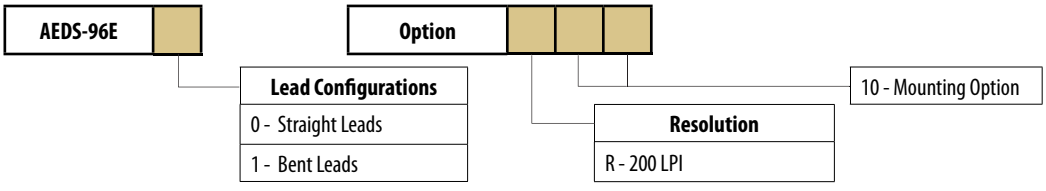
- Printers
- Copiers/Fax
- Plotters
- Office automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information



Note: Contact factory for codewheel and codestrip information.

Incremental Optical Encoders
Transmissive Module

AEDS/AEDB/AEDT-9140 Series

Description

- Three channels
- Low cost
- Detects rotary position when used with a codewheel
- Consists of a lensed (LED) source and detector IC enclosed in a small plastic package
- Extremely tolerant to mounting misalignment due to a highly collimated light source and unique photodetector array
- Two channel quadrature output, plus a third channel index output. (The index output is a 90 electrical degree high, true index pulse, which is generated once for each full rotation of the codewheel)
- Designed for use with a codewheel with an optical radius of 11.00 mm (0.433 inch)
- Quadrature signals and index pulse are accessed through five 0.46 mm square pins located on 1.27 mm (pitch) centers

Features

- Two channel quadrature output with index pulse
- Resolution from 100 CPR up to 512 CPR
- Low cost
- Easy to mount
- No signal adjustment required
- Small size
- TTL compatible output
- Single 5 V supply output

For AEDT-9140 Series:

- Same features as listed above
- -40°C to 115°C operating temperature

For AEDB-9140 Series:

- Same features as listed above
- Bundled with matching codewheel

Applications

Ideal for high-volume applications, like:

- Printers
- Plotters
- Tape drives
- Industrial equipment
- Factory automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Three Channel Encoder Modules with Codewheel, 11 mm Optical Radius

AEDB-9140 Option [ ][ ][ ]

Resolutions (Cycle/Rev)
C - 100 CPR
E - 200 CPR
F - 256 CPR
G - 360 CPR
H - 400 CPR
A - 500 CPR
B0B - 1000 CPR

Shaft Diameter*
02 - 3 mm
04 - 5/32 in
05 - 3/16 in
06 - 1/4 in
11 - 4 mm
12 - 6 mm
13 - 8 mm
14 - 5 mm
* Contact factory for other shaft diameters

Available Options									
Part Number	CPR	Shaft Diameter Options							
		02	04	05	06	11	12	13	14
AEDB-9140	C		•		•		•	•	
	E				•	•	•		
	F		•				•		•
	G				•		•		•
	H				•				•
	A	•	•	•	•	•	•	•	•

AEDS-9140 Option [ ][0][0]

Resolutions (Cycle/Rev)	
C - 100 CPR	H - 400 CPR
E - 200 CPR	A - 500 CPR
F - 256 CPR	I - 512 CPR
G - 360 CPR	B0B - 1000 CPR

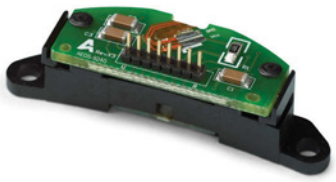
Note: B0B = 11.68 mm codewheel optical radius.

AEDT-9140 Option [ ][ ][ ]

Resolutions Option	
C - 100 CPR	H - 400 CPR
E - 200 CPR	A - 500 CPR
F - 256 CPR	I - 512 CPR
G - 360 CPR	B - 1000 CPR

Codewheels Optical Radius
00 - 11.00 mm
0B - 11.68 mm

Incremental Optical Encoders
Transmissive Module



AEDS-9240 Series

Description

- Six-channel optical incremental encoder module
- When used with a codewheel, this encoder detects rotary position
- Each module consists of a lensed LED source and a detector IC enclosed in a small plastic package
- Each module consists of a highly collimated light source and a unique photo detector array
- Modules are extremely tolerant to mounting misalignment
- Designed with integrated commutation output channels (U,V,W), two-channel quadrature outputs (A,B), plus a third channel ungated index output (I)
- Ungated index output is a positive index pulse that is generated once for each full rotation of the codewheel
- Designed for use with a codewheel that has an optical radius of 19.00 mm (0.748 inch) to obtain an optimum 360/720 CPR (count per revolution) resolution
- Quadrature, index, commutation signals and power supplied to encoder are accessed through eight 0.46mm square male connector pins located on 1.27mm pitch
- Integrated commutation outputs (U,V, and W) is equivalent to those produced by Hall Switches
- Enables motor systems to be more compact
- Optional alignment jigs enables a significantly reduced production time and ease of assembly into housed encoders
- Provides superior switching accuracy due to a much lower hysteresis when compared to Hall Switches
- Commutation signals can easily be interchanged for Brushless DC motor of different rotor pole-pairs by simply switching to matching pole-pair codewheels

Features

- Two-channel quadrature output with ungated index pulse (A,B,I)
- Three-channel integrated commutation Output (UVW)
- 360/720 Cycle Per Revolution (CPR)
- Easy assembly with alignment jig
- Design to fit into circular shaped housing
- Up to 150 kHz frequency response
- -40°C to 100°C operating temperature
- TTL Compatible
- Single 5V Supply
- Integrated feedback device for Brushless DC Motor
- RoHS Compliant

Applications

Typical applications include:

- Industrial printers
- Industrial factory automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AEDS-9240 – ☐ – 00

Alignment tool: HEDS-8953 – Alignment tool for 360/720 CPR

CPR
G - 360 CPR
Y - 720 CPR

Note: Avago Technologies encoders are not recommended for use in safety critical applications, e.g., ABS braking systems, power steering, life support systems and critical care medical equipment. Please contact sales representative if more clarification is needed.

Incremental Optical Encoders
Transmissive Module

AEDS/AEDB/AEDT-9340 Series

Description

- 6-channel optical incremental encoder modules with codewheel
- When used with a codewheel, these modules detect rotary position
- Each module consists of a collimated LED source and detector IC enclosed within a small plastic package
- Modules are extremely tolerant to mounting misalignment
- Ungated index output is a positive index pulse (360 electrical degrees high) that is generated once for each full rotation of the codewheel
- Designed for use with a codewheel that has an optical radius of:
  - i. 15 mm (0.590 inch) for 1250/2500 CPR
  - ii. 12.3 mm (0.484 inch) for 1024/2048 CPR
  - iii. 12 mm (0.472 inch) for 1000/2000 CPR
- Replaces conventional incremental encoder with Hall Switches
- The quadrature, index, commutation signals and power supplied to the encoder are accessed through eight 0.46 mm square male connector pins located on 1.27 mm (pitch)
- With our encoder, the system will be more compact, have reduced alignment time with use of alignment jig, thus making assembly process much easier for housed encoder integration
- Superior switching accuracy due to much lower hysteresis when compared to a Hall Switches
- The commutation signals can be generated for Brushless DC motor of different rotor pole-pairs by simply changing with matching pole-pair codewheel

Features

- Two-channel quadrature output with ungated index pulse (A, B, I)
- Three-channel integrated commutation output (U, V, W)
- Up to 2500 Cycles Per Revolution (CPR)
- Easy assembly with alignment jig
- Designed to fit into circular shaped housing
- Up to 200 kHz frequency response
- TTL compatible
- Single 5 V supply
- Integrated feedback device for Brushless DC Motor

For AEDT-9340 Series:

- Same features as listed above
- -40°C to 115°C operating temperature

For AEDB-9340 Series:

- Same features as listed above
- Bundled with matching codewheel

Applications

- Servo motors
- Stepper motors
- Pick and place machines
- Die bonders
- Robotics
- Machine tools
- Textiles
- Factory automation

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Six Channel Encoder Modules with Codewheel.

Encoder

AEDB-9340 – ☐ – ☐ – ☐

Pole Pair
A - 2 Pole Pairs
B - 3 Pole Pairs
C - 4 Pole Pairs

Shaft Diameter
02 - 3 mm
04 - 5/32 in
05 - 3/16 in
06 - 1/4 in
11 - 4 mm
12 - 6 mm
13 - 8 mm
14 - 5 mm
15 - 10 mm

CPR
W - 2500 CPR
U - 2048 CPR
T - 2000 CPR
L -1250 CPR
J - 1024 CPR
B -1000 CPR

Encoder

AEDT-9340 – ☐ – 00

CPR
W - 2500 CPR
U - 2048 CPR
T - 2000 CPR
L -1250 CPR
J - 1024 CPR
B -1000 CPR

Encoder

AEDS-9340 – ☐ – 00

CPR
W - 2500 CPR
U - 2048 CPR
T - 2000 CPR
L -1250 CPR
J - 1024 CPR
B -1000 CPR

Alignment Tool	
HEDS-8950	Alignment tool for 1000/2000 CPR
HEDS-8951	Alignment tool for 1024/2048 CPR
HEDS-8952	Alignment tool for 1250/2500 CPR

Incremental Optical Encoders
Transmissive Housed

AEDx-8xxx Series

Description

- Option of two-channel or three-channel optical incremental encoder kit with codewheel integrated in a protective housing
- Encoder kit consists of a collimated LED source and a detector IC enclosed within a small plastic package
- Two-channel quadrature outputs (A,B) plus a third channel index output (I)
- Designed for use with motors with shaft diameters of 2mm and up to 5mm
- Enables the servo system to be more compact
- Optional alignment jig enables easier assembly process for servo motor integration
- RoHS compliant

Features

- 3-channel differential output (A,B) with ungated, gated-90° and gated-180° index pulse (I)
- 2-channel differential output available
- Up to 500 Cycles Per Revolution (CPR)
- Up to 30000 rpm motor speed
- -40°C to 100°C operating temperature
- Single 5 V supply
- Integrated RS-422 line driver
- Quick and easy assembly

Applications

The AEDx-8xxx provides motion detection for DC servo motor and closed loop stepper motor feedback system in the following applications:

- Pick and place machines
- Semiconductor equipment
- Factory automation equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AED		8			

Option			

Operating Temperature
S - 20°C to 85°C
T - 40°C to 100°C

Index Gating
0 - Gated 90°e
1 - Gated 180°e
2 - Un-gated

Mounting Type
0 - External Ear Mounting
1 - Standard Mounting

Channels
0 - 2 Channel
1 - 3 Channel

Resolution Options (Cycle/Rev)
E - 200 CPR
H - 400 CPR
A - 500 CPR

Shaft Diameter
01 - 2 mm
02 - 3 mm
11 - 4 mm
14 - 5 mm

Connector Ordering Information

1. HEDS-8911-152 - Connector for AEDS-8xxx Series
2. HEDT-8912-152 - Connector for AEDT-8xxx Series

Alignment Tool Ordering Information

1. HEDS-8938-011 - Alignment tool for AEDx-8x11 Series (4mm shaft diameter option)
2. HEDS-8938-014 - Alignment tool for AEDx-8x14 Series (5mm shaft diameter option)

Incremental Optical Encoders
Transmissive Housed

HEDL-5xxx, HEDS-550x/554x, HEDS-560x/564x, HEDM-550x/560x Series

Description

HEDS-550X/HEDM-550X/HEDS-560X and HEDS-554X/HEDS-564X Series

- High-performance, two and three channel incremental optical encoders
- High reliability, high resolution, easy assembly
- Contains a lensed (LED) source or emitter, an integrated circuit with detectors and output circuitry, and a codewheel which rotates between the emitter and detector IC
- HEDS-550X/HEDM-550X/HEDS-560X output is two square waves in quadrature
- HEDS-554X/HEDS-564X output has a third channel index output in addition to the two channel quadrature
- The index output is a 90 electrical degree, high true index pulse which is generated once for each full rotation of the codewheel
- Features quick and easy motor mounting

HEDM-55XX/56XX Series

- Features same as listed above
- Comes with film codewheels

HEDS-56XX and HEDM-56XX Series

- Features same as listed above
- Features mounting ears HEDL-55XX Series
- Features differential output
- Utilizes an industry-standard line driver IC (26C31), which provides complementary output for each encoder channel, offering enhanced performance when the encoders are used in a noisy environment, or when required to drive long distances
- Suggested line receivers: 26C32 and 26C33
- Quadrature signals are accessed through a cable and 10-pin female connector, manufactured by FCI, part number: 66900-310. Mating connectors are made by FCI; for straight type part number: 71912-010, right angle type part number: 71913-010

Features

- Two channel quadrature output with optional index pulse
- Quick and easy assembly
- No signal adjustment required
- External mounting ears available
- Low cost
- Resolutions up to 1,024 CPR
- Small size
- Up to100°C operating temperature
- TTL compatible
- Single 5 V supply
- Count frequency of 100 KHz

Applications

Ideal for high-volume applications, including:

- Printers
- Plotters
- Tape drives
- Positioning tables and automatic handlers

Package Dimensions

- Refer to product datasheet for package dimensions

Ordering Information

Note: Please contact sales/factory to confirm up to date option availability

Mid-Sized Housed Encoders with Film Codewheels – HEDM-550x/560x series

HEDM-5		0		Option			

Mounting Type
- 5 - Standard
- 6 - External Mounting Ears

Outputs
- 0 - 2 Channel
- 4 - 3 Channel

Through Hole
- 0 - None
- 5 - 8.9 mm (0.35 in)

Resolution (Cycle/Rev)
- B - 1000
- J - 1024

Shaft Diameter

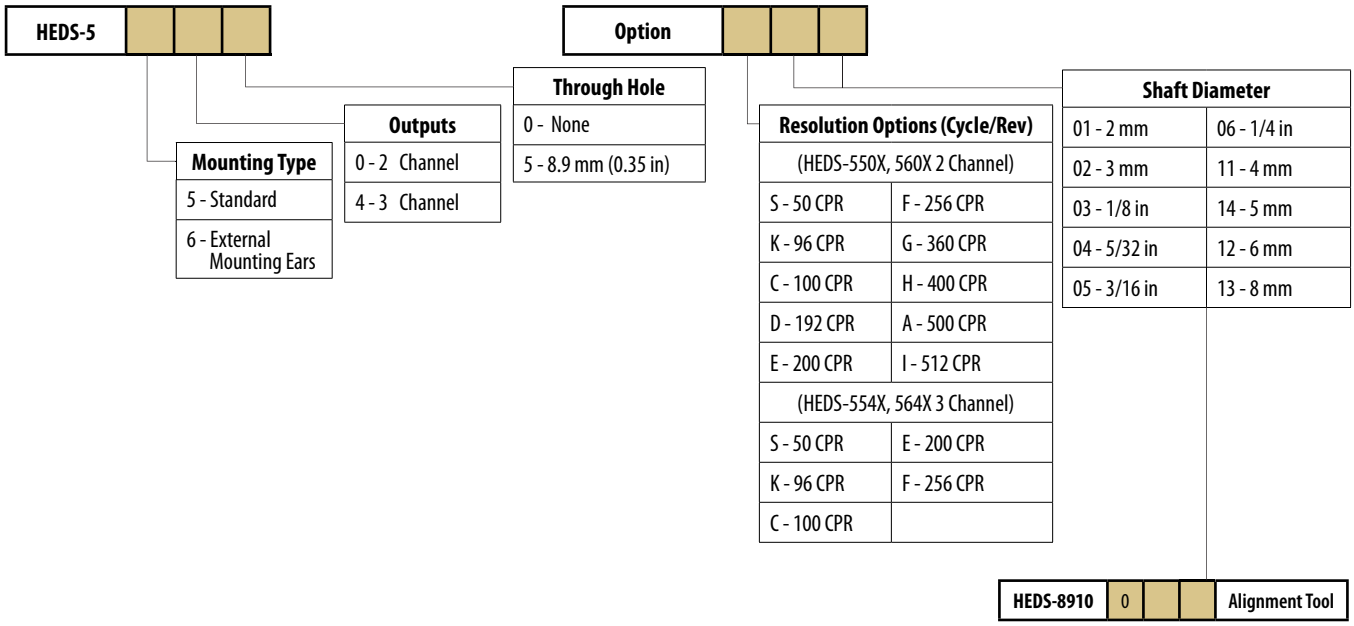
01 - 2 mm	06 - 1/4 in
02 - 3 mm	11 - 4 mm
03 - 1/8 in	14 - 5 mm
04 - 5/32 in	12 - 6 mm
05 - 3/16 in	13 - 8 mm

HEDS-8910	0			Alignment Tool

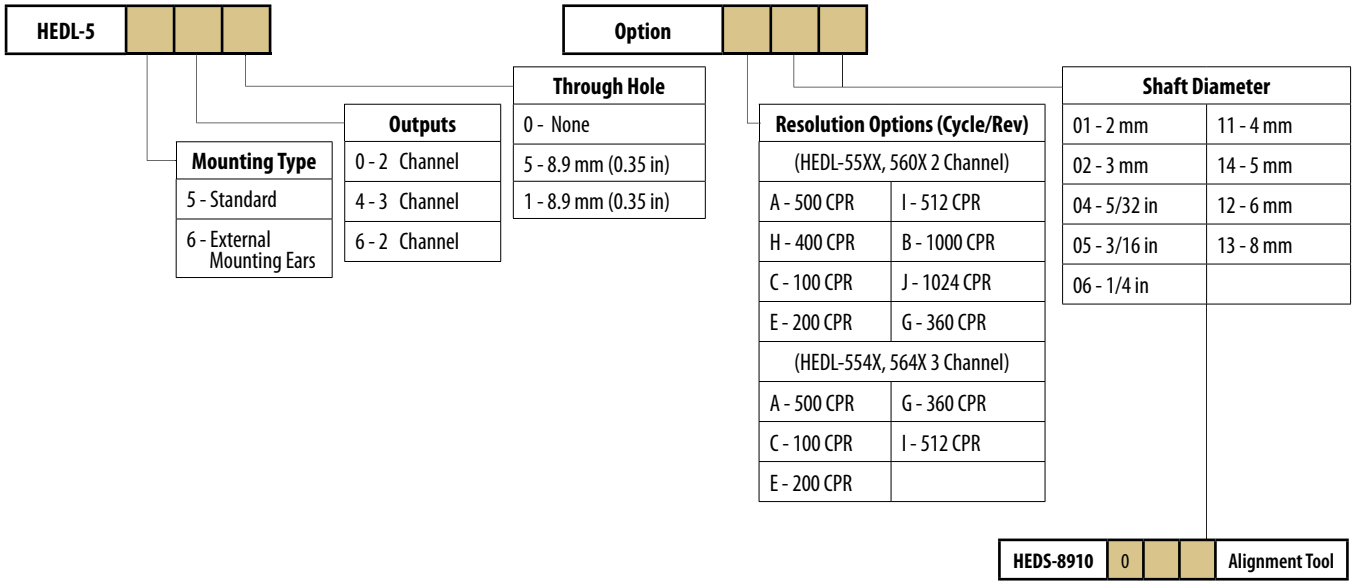
(Included with each order of HEDM-550x/560x two channel encoders and HEDM-554x three channel encoders)

Ordering Information

Mid-Sized Housed Encoders with Metal Codewheels – HEDS-550x/554x/564x Series



Mid-Sized Housed Encoders with Line Drivers – HEDL-5xxx series



Available Options

Available Options											
Part Number		Options									
		01	02	03	04	05	06	11	12	13	14
HEDL-5540	A	•	•			•	•	•	•	•	•
	C		•			•			•		
	E						•	•			
	G							•			
	I	•					•	•		•	
HEDL-5640	A						•		•	•	
HEDL-5645	A						•			•	
	G						•				
HEDL-5500	A		•				•				
	E						•				
	G					•			•		
	H						•				
	I				•						
HEDL-5505	A						•				
	I									•	
HEDL-5560	B		•					•		•	•
HEDL-5561	J						•				•
HEDL-5600	A						•				
	H						•				
HEDL-5605	A						•				
	C										•
HEDM-5500	B	•	•				•	•	•	•	•
	J		•				•		•	•	•
HEDM-5505	B				•						
	J			•			•			•	
HEDM-5540	B	•	•			•		•		•	•
HEDM-5545	B									•	
HEDM-5600	B						•			•	
	J						•				
HEDM-5605	B						•			•	
	J						•				
HEDS-5500	A	•	•	•	•	•	•	•	•		•
	C	•	•	•	•	•	•	•	•	•	•
	E		•		•	•	•	•	•		•
	F	•	•		•	•	•	•	•		•
	G		•			•	•	•	•		•
	H					•	•		•		•
	I	•	•	•	•	•	•	•	•	•	•
	K				•	•	•	•			
	S									•	

Available Options

Available Options											
Part Number		Options									
		01	02	03	04	05	06	11	12	13	14
HEDS-5505	A				•		•			•	•
	C				•		•		•		•
	E				•		•				•
	F				•		•				•
	G				•		•				
	H						•				•
	I				•		•			•	
	K				•						
HEDS-5540	A	•	•	•	•	•	•	•	•	•	•
	C	•	•				•	•	•	•	•
	E						•	•	•		
	F	•						•			•
	G						•				
	H						•				•
	I	•	•				•	•	•	•	•
HEDS-5545	A						•		•		•
	C								•		
	H						•				•
	I						•				
HEDS-5600	A						•		•	•	•
	C						•		•		•
	E						•				
	G						•			•	
	H						•		•		
	I	•						•			
HEDS-5605	A						•			•	
	C						•				
	E						•				
	F									•	
	G						•				
	H						•				•
	I						•				
HEDS-5640	A						•		•	•	
	E						•		•		
	F						•				
	H						•				
HEDS-5645	A						•		•	•	
	C									•	
	E									•	
	F									•	
	G									•	
	H						•		•		•
	I									•	

Incremental Optical Encoders
Reflective Module

AEDR-83xx Series

Description

- New generation encoder
- SMT and leadless package, ideal for applications with critical space constraints
- More accurate real-time position indicator
- Single-channel and two-channel motion sensing at a very low cost
- Uses reflective technology to sense rotary or linear position
- Consists of an LED light source and a photodetector IC in a single package
- Provides either single channel or two channel square wave outputs in quadrature for count and direction information
- TTL-compatible outputs correspond to the alternating reflective/non-reflective patterns of the codewheel or codestrip
- High codewheel/strip gap tolerance & tolerant to angular misalignment
- Can be used over a range of codewheel and codestrip resolutions
- RoHS compliant
- Very low power consumption

Features

- Size: 5.12 mm (L) x 3.96 mm (W) x 1.63 mm (H)
- Resolutions of 36, 75, 150, 180 and 212 LPI
- 30 kHz, maximum operating frequency (60kHz for 212LPI)
- Rotary and linear motion sensing
- -20°C through 85°C absolute operating temperature
- One or two channel quadrature output for positioning and homing capabilities
- Single 5 V supply (3.3 V available for 212LPI)

For AEDR-8311:

- Suitable for indexing function
- -20°C to 85°C operating temperature

Applications

Ideal for high-volume applications:

- Printers
- Copiers
- Card readers
- Scanners
- Cameras
- Motor solutions
- Medical equipment
- Wafer handling machines
- Vending machines
- Low servo systems
- ATM machines
- Textile machines
- Industrial sewing machines
- Consumer product applications

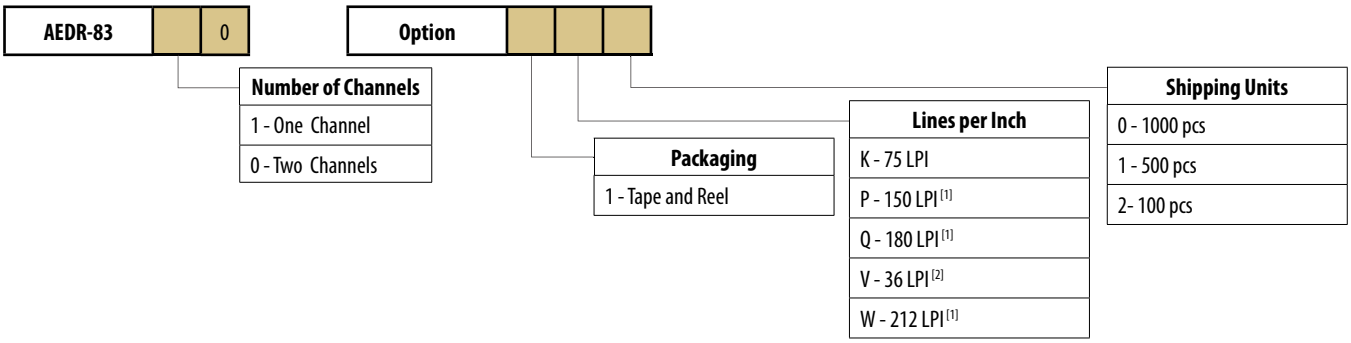
Package Dimensions

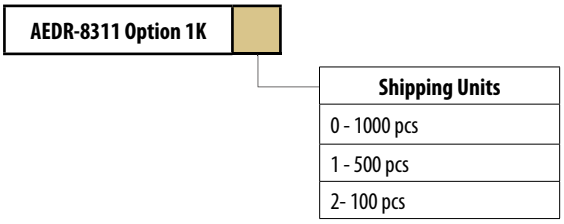
- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Pure Optical Leadless Array Optical Reflective Encoders – AEDR-8300





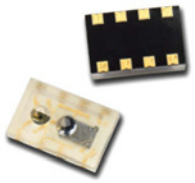
Summary of Product Availability					
Resolution Options	One Channel	Two Channel	Packaging Quantity		
			1000	500	100
36LPI	•	NA	•	•	•
75LPI	•	•	•	•	•
150LPI	NA	•	•	•	•
180LPI	NA	•	•	•	•
212LPI	NA	•	•	•	•

Note:

1. 150LPI, 180LPI and 212LPI resolutions are only available in two channel options.
2. 36LPI resolution is only available in one channel option.
3. Encoders are packed in tape quantities of 100, 500 or 1000 pieces.
4. Contact factory for matching codewheel unit or codewheel design.
5. Contact factory for higher resolution and 3 channel encoder solutions.

Incremental Optical Encoders
Reflective Module

AEDR-8320 Series



Description

- New generation encoder
- SMT and leadless package, ideal for applications with space constraints
- More accurate real-time position indicator
- Two-channel motion sensing at a very low cost
- Uses reflective technology to sense rotary or linear position
- Consist of an LED light source and a photodetector IC in a single package
- Can be used over a range of codewheel and codestrip resolutions
- Very low power consumption

Features

- Size: 6.50mm (L) x 4.20mm (W) x 1.69mm (H)
- Resolution: 180 LPI
- 30kHz, maximum operating frequency
- Rotary and linear motion sensing
- -10°C through 70°C absolute operating temperature
- Analog output
- As an example, 7840CPR can be achieved with interpolation factor of 16x where codewheel Rop is at 11mm
- Single 5V supply
- RoHS compliant

Applications

- Printers
- Copiers
- CD/DVD writers
- Card readers
- Pick and place machines
- Security cameras
- Motors
- XY table
- Housed encoders

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AEDR-8320 Option			
			Shipping Units
		Lines per Inch	0 - 1000 pcs
	Packaging	Q - 180 LPI	2- 100 pcs
	1 - Tape and Reel		

Note:
1. Encoders are packed in quantities of 1000 and 100 pieces.
2. Contact factory for matching codewheel unit or codewheel design.

Incremental Optical Encoders
Reflective Module

AEDR-8400 Series

Description

- Small optical encoder
- Houses an LED light source and a photo-detecting circuitry in a single package
- Offers two-channel quadrature digital outputs
- Outputs can be interfaced directly with most of the signal processing circuitries
- Provides great design in flexibility and easy integration into existing systems
- Very low power consumption

Features

- Size: 3.00 mm (L) x 3.28 mm (W) x 1.262 mm (H)
- Encoding resolution: 254 (lines/inch) or 10 (lines/mm)
- Reflective technology
- Surface mount leadless package
- -20°C to 85°C absolute operating temperature
- Rotary or linear motion sensing
- Two channel quadrature digital outputs for direction sensing
- TTL compatible output
- Single 2.8 V supply
- 15 KHz operating frequency
- Very low power consumption

Applications

Ideal for high volume applications:

- Printers
- Copiers
- Card readers
- Scanners
- Digital Still Cameras
- Camcorders
- Camera Phones
- Projectors
- Consumer Product Applications

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AEDR-84		0

Option			

Channels
0 - Two Channels

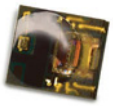
Packaging Options
1 - Tape & Reel

Resolution
3 - 254 LPI
4 - 318 LPI

Shipping Units
0 - 1000 pcs
2- 100 pcs

Note:
1. Encoders are packed in quantities of 1000 and 100 pieces.
2. Contact factory for matching codewheel unit or codewheel design.
3. Contact factory for higher resolution and 3 channel encoder solutions.

Incremental Optical Encoders
Reflective Module



AEDR-850x Series

Description

- Smallest 3 channel (A,B and I) optical reflective encoder with digital output
- Enable higher operating CPR. Example, if 1X is 1000CPR, then 2X(2000CPR) and 4X(4000 CPR)
- Enable high resolution encoding possibilities. Example, 1000 CPR @13.3mm Rop
- Fits into any application where small size and tight space is a concern
- TTL compatible
- RoHs Compliance

Features

- Surface mount leadless package - 3.95 mm (L) x 3.4 mm (W) x 0.9562 mm (H)
- 3 channels; two channel quadrature digital outputs for direction sensing and a 3rd channel, Index digital output
- -20 to 85°C operating temperature
- + 5 Vdc Operating voltage
- Encoding resolution : 304 Line per Inch (LPI)
- Interpolation factor 1X, 2X and 4X built in; selectable via external pin-outs (SEL 2x & SEL 4X).

Applications

- Close Loop Stepper Motor
- Miniature motors
- Printers
- Copiers
- Card readers
- Scanners
- Projectors
- Portable Medical Equipment (i.e. Insulin Pump)
- Optometric Equipment

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AEDR	–	8	5	0	x	–	x	0	x

Index Gating
0 - Gated 90° e
1 - Gated 180° e
2 - Ungated 360° e

Packaging
1 - Tape and Reel

Shipping Units
0 - 1000 pcs
2- 100 pcs

Incremental Optical Encoders
Reflective Housed

HEDR-542x Series

Description

- High performance
- Cost-effective
- Two channels
- High reliability, high resolution and easy assembly
- Uses reflective technology to sense rotary position
- Consists of an LED light source and photodetector IC in a single SO-8 surface mount package
- HEDR-542X output - two square waves in quadrature
- Quick and easy motor mounting

Features

- Two channel quadrature output
- Quick and easy assembly
- Cost-effective
- Ideal for small motor systems
- Resolutions at 200 CPR
- 0°C to 85°C operating temperature
- Right angle connector available
- Hub available in either a set screw configuration or a press-fit/adhesive mount configuration
- External mounting ears available

Applications

- Wafer handling machines
- Vending machines
- Motor manufacturing applications

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Mid-Sized Housed Encoders – HEDR-54XX Series

HEDR-54 [ ][ ] – [ ][ ][ ][ ][ ]

Output
2 - 2 Channel

Connector
0 - Standard/Axial
1 - Right Angle/Radial

Resolution
E - 200 CPR

Hub
S2 - Set screw with mounting ears baseplate
P1 - Pressfit without mounting ears baseplate

Shaft
01 - 2 mm
02 - 3 mm
03 - 1/8 in
11 - 4 mm
14 - 5 mm

Note: Pressfit options will only have 2 mm, 3 mm and 4 mm shaft sizes available.
For kit encoders, refer to factory.

Available Options					
Part Number	Options				
	01	02	03	11	14
HEDR-5420ES2	•	•	•	•	•
HEDR-5421EP1				•	

Incremental Optical Encoders
Reflective Housed

HRPG Series (Rotary Pulse Generators)

Description

- Family of miniature panel-mount optical encoders and digital potentiometers
- Can be mounted on a front panel and used as a rotary, data-entry device
- Multiple configuration options accommodate a variety of different applications
- Available options include: detents or smooth, multiple terminations, versatile mounting capabilities, and different shaft configurations
- Uses optical reflective technology
- Single IC detector circuit makes the part less sensitive to temperature and other environmental variations

Features

- Miniature size
- Smooth turning and detented options
- Multiple mounting bracket options
- Quadrature digital output
- Small footprint for versatile mounting
- TTL compatible output
- Up to 120CPR
- 5 V operation
- 0°C to 70°C operating temperature
- Up to 300RPM rotation speed

Applications

- Front panel instruments
- Audio/visual boards
- Other devices requiring digital output from a turning knob

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Miniature Panel Mount Optical Encoders – HRPG Series

HRPG-A [ ][ ][ ] # [ ][ ][ ]

Shaft Feel/Resolution
S16 - Smooth 16 CPR
D16 - Detented 16 CPR
S32 - Smooth 32 CPR
D32 - Detented 32 CPR
SCA - Smooth 120 CPR

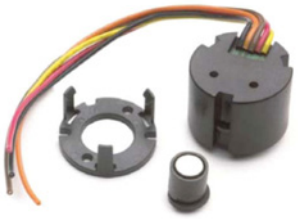
Mechanical Configuration
11 - 0.3 in. long, 0.25 in. dia.
13 - 0.3 in. long, 0.25 in. dia. D-cut
14 - 0.5 in. long, 0.25 in. dia.
15 - 0.5 in. long, 0.25 in. dia. D-cut
17 - 0.8 in. long, 0.25 in. dia.
19 - 0.8 in. long, 0.25 in. dia. D-cut
51 - 7.6 mm long, 6 mm dia.
53 - 7.6 mm long, 6 mm dia. D-cut
54 - 12.7 mm long, 6 mm dia.
56 - 12.7 mm long, 6 mm dia. D-cut
57 - 20.3 mm long, 6 mm dia.
59 - 20.3 mm long, 6 mm dia. D-cut

Termination
F - Pins Front with Bracket
R - Pins Rear with Bracket
C - Cable Connector with Strain Relief

Available Options				
Part Number		Options		
		C	F	R
HRPG-AD32	11	•		•
	13	•	•	•
	14	•	•	•
	16	•	•	•
	17	•		
	19		•	•
	51	•	•	
	53	•	•	•
	54	•		•
	56	•		•
	57		•	
	59	•	•	•
HRPG-AS16	11			•
	14	•		
	17		•	
	51	•		
	53			•
	54		•	
HRPG-AS32	11			•
	13		•	•
	14	•		•
	53	•		•
	56	•	•	
	59	•		
HRPG-ASCA	11	•	•	•
	13	•		•
	14	•	•	•
	16	•	•	•
	17	•	•	•
	19	•	•	•
	51			•
	53	•	•	
	54	•	•	•
	56	•	•	•
	57		•	
	59	•	•	
HRPG-AD16	16	•	•	•
	51			•
	54		•	•
	56	•	•	
	59		•	

Note: For kit encoders, refer to factory.

Incremental Magnetic Encoders
Magnetic Housed



AEAT-601B Series

Description

- Miniature package
- Ideal for space constraint applications
- Non-contact magnetic sensing technology
- Specifically designed to serve the industrial market with wide temperature ranges and requiring high accuracy
- Easy assemble process

Features

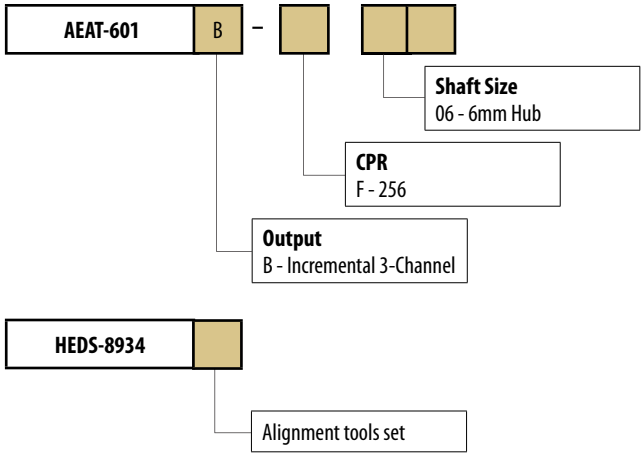
- 23mm diameter X 19mm height package
- Resolution ranges of up to 256 CPR
- Quadrature A, B and Index output (I)
- Wide operating temperature range from -40°C through 125°C
- Single +5V supply
- Bare wires output
- RoHS compliant
- Fit standard 6 mm customer solid shaft

Applications

- Stepper motor feedback
- Textiles
- Rotary positional feedback

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information



***Note:** Contact factory for customized PCB level solution or other CPR options of 32, 64, 128 or 1024CPR.

AEAT-7000 Series (Single-Turn Module)

Description

- 13-bit absolute encoder module
- Feedback device which generates a unique binary 'word' for each encoder shaft position
- Encoder design provides positional information instantly upon power up, unlike incremental encoders that require codewheel movement to obtain such information
- Ideal for space-constrained applications
- Easy alignment and installation
- Contains 13 signal photodiode channels and 1 monitor photodiode channel - each accompanied by precision amplifiers and additional circuitry
- The integrated chip, together with a highly collimated light source and precision codewheel, outputs up to 13 bits of positional information to the user via a serial synchronous interface

Features

- Miniature size, consists of 2 components only
- -40°C to 85°C standard operating temperature
- Quick and easy assembly
- Cost effective
- 11 digital tracks plus 2 sin/cos tracks to generate precise 13 bit gray code
- Ultra-fast, 1 µs cycle for serial data output word equals 16 MHz
- On-chip interpolation and code correction to compensate for mounting tolerance
- Internally built-in monitor track for tracking the light level

Applications

- Semiconductor automation machines
- Industrial sewing machine
- Robotics
- Automotive (body plant robot cells for assembly and welding)
- Machine tools

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Standard Single-Turn Encoder Module
1. AEAT-7000-1GSD0 (13-bit resolution)

Note: Contact factory for higher resolution absolute encoder solutions.

AEAT-60xx Series (Single-Turn Housed)

Description

- 10 & 12 bit absolute encoder module
- Feedback device which generates a unique binary "word" for each encoder shaft position
- Encoder design provides positional information instantly upon power-up, unlike incremental encoders that require codewheel movement to obtain such information
- Plug and play features eliminates the need for multiple alignment adjustment, making installation very simple

Features

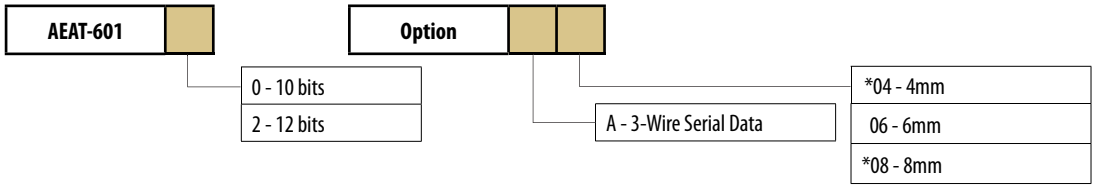
- 10 or 12 bits resolution
- Contactless sensing technologies
- Wide temperature range from -40° to 125°C
- Absolute angular position detection
- Serial Interface output for absolute position data (binary format)
- Code monotony error = ± 1 LSB
- Single 5V supply
- Easy assembly, no signal adjustment required
- RoHS compliant

Applications

- Flow meter
- Angular detection
- Knob control
- Rotary encoder

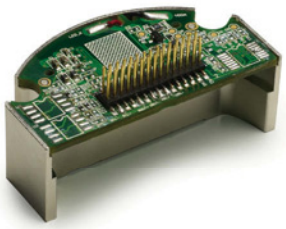
Note: Please contact sales/factory to confirm up to date option availability

Ordering Information



***Note:** Contact factory for these shaft size options.

Absolute Optical Encoders
Transmissive Module



AEAT-9000 Series

Description

- AEAT-9000 series are high resolution single turn optical absolute encoders
- The 17-bit AEAT-9000 encoder code disc consists of 13 pairs of differential absolute tracks and 2 pairs of sinusoidal tracks to perform 4 bits interpolation
- The encoder incorporates photo detectors for electrical alignment on the radial and tilt
- AEAT-9000 also comes with 2 channel incremental output with the basic of 2048 counts per rotation

Features

- 17-bit absolute single turn output (131072 absolute positions over 360°)
- 2 channel true differential Sine/ Cosine outputs with 2048 cycles per revolution
- 2048 CPR A/B channel incremental analog output
- Interface output will be SSI (2 wire SSI/3 wire SSI) with RS485 line transceiver or single ended option
- On-chip interpolation and code correction compensate for mounting tolerance
- Electrical alignment output for tilt and locate

Applications

- Rotary applications up to 17 bits/360° absolute position
- Integration into servo motors
- Industrial and maritime valve control
- High precision test and measurement machines
- Industrial and factory automation equipments
- Textile, woodworking & packaging machineries
- Nacelle & blades control in wind turbine

Package Dimensions

- Refer to product datasheet for package dimensions

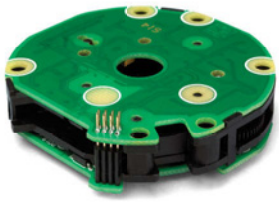
Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Part Number	Description
AEAT-9000-1GSH0	Module only, with line transceiver and OpAmp
AEAT-9000-1GSH1	Module only, without line transceiver and OpAmp
HEDS-8949	Alignment Kit
HEDG-9000-H13	Code wheel with hub
HEDG-9000-H14	Code wheel without hub

Transmissive Module

AEAT-84AD/AEAT-86AD Series (Multi-Turn Module)



Description

- Optoelectronic-mechanical unit
- Provides multiturn capabilities when used with the AEAT-7000 single-turn absolute encoder
- When used together with AEAT-7000 or AEAT-6010/6012, the designer gains a complete multiturn absolute encoder with a total resolution of up to 31 bits (contact factory for OEM integrated solution with up to 17-bit single-turn and 14-bit multi-turn)
- Enables the designer to count the number of rotations that the motor shaft has gone through
- Ideal for space constrained applications
- The plug and play feature eliminates the need for multiple alignment adjustments, making installation very simple
- Consists of an IR-LED circuit board, a phototransistor (PT) circuit board, and either 6 (12 bits) or 7 (14 bits) code wheels, arranged in between the PCBs. This construction enables AEAx-8xAD to provide absolute multiturn positioning information without battery backup

Features

- 12-bit and 14-bit resolution within small form factor
- -40°C to 125°C maximum operating temperature
- Gearing system can tolerate up to 12,000 rpm of speed, making it ideal for fast spinning applications like servo motors
- Integrator chip (built-in option available – AEAT-86AD)

Applications

- Robotics
- Machine tools
- Industrial sewing machines
- Semiconductor automation machines
- Packaging machines

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Standard Multiturn Encoder Module
1. AEAT-84AD-LBSC0 (12-bit, high temp)
2. AEAT-84AD-LBSF0 (14-bit , high temp)

Integrated Multiturn Encoder Module
1. AEAT-86AD-LASC0 (12-bit, high temp, binary code)
2. AEAT-86AD-LASF0 (14-bit, high temp, binary code)
3. AEAT-86AD-LCSC0 (12-bit, high temp, Gray code)
4. AEAT-86AD-LCSF0 (14-bit, high temp, Gray code

Integrated Circuits
Decoder

HCTL-2001/2017/2021 Series

Description

- CMOS ICs that performs the quadrature decoder, counter, and bus interface function
- Improve system performance in digital closed loop motion control systems and digital data input systems
- Consist of a quadrature decoder logic, a binary up/down state counter, and an 8-bit bus interface
- Allows reliable operation in noisy environments
- HCTL-2001 contains a 12-bit counter
- HCTL-2017/2021 contains a 16-bit counter and provides TLL/CMOS compatible tri-state output buffers
- Operation is specified for a temperature range from -40°C to 85°C at clock frequencies up to 14MHz

Features

- Interfaces encoder to microprocessor
- 14 MHz clock operation
- High noise immunity: Schmitt Trigger Inputs and digital noise filter
- 16-bit binary up/down counter
- Latched outputs
- 8-bit tri-state interface
- 8, 12 or 16-bit operating modes
- Quadrature decoder output signals, up/down and count
- Cascade output signals, up/down and count
- Substantially reduced system software
- 5V operation (VDD-VSS)
- TTL/CMOS compatible I/O
- Operating temperature: - 40°C to 85°C
- 16-Pin PDIP, 20-Pin PDIP, 20-Pin PLCC

Applications

- Interface quadrature incremental encoders to microprocessors
- Interface digital potentiometers to digital data input buses

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Part Number	Description	Package
HCTL-2001-A00	14 MHz clock operation. 12-bit counter.	PDIP-16
HCTL-2017-A00	14 MHz clock operation. 16-bit counter.	PDIP-16
HCTL-2017-PLC	14 MHz clock operation. 16-bit counter.	PLCC-20
HCTL-2021-A00	14 MHz clock operation. 16-bit counter. Quadrature decoder output signals. Cascade output signals.	PDIP-20
HCTL-2021-PLC	14 MHz clock operation. 16-bit counter. Quadrature decoder output signals. Cascade output signals.	PLCC-20

HCTL-2022/2032 Series

Description

- CMOS ICs that perform quadrature decoding, bus interfacing and counter functions
- Designed to improve system performance in digital, closed-loop motion control systems and digital data input systems. ICs interface the encoder to the microprocessor
- HCTL-2022 comes in a 20-pin PDIP (Plastic Dual In-Line Package)
- HCTL-2032 comes in a 32-pin PDIP
- HCTL-2032-SC comes in a 32-pin SOIC
- HCTL-2032/2032-SC are not pin-to-pin compatible with the HCTL-2000 series, but it is backward compatible in terms of functionality with some added enhancements
- HCTL-2032 IC supports single or dual-axis support. Cost savings realized due to decrease in on-board components
- HCTL-2022 is similar to the HCTL-2032 with only single-axis control
- Large counter allows the IC to operate without the support of extra memory, further reducing the number of supporting components needed on board and decreasing cost
- Features allow deeper penetration into the industrial automation market, such as the servo motor market
- Key advantages over competitors:
  - HCTL-2022/2032 operates at a wider range of temperatures, making it suitable for deeper penetration into the industrial automation market
  - Cascaded output signals allow design flexibility
  - A 32-bit counter size allows the product to operate without the need of external counters, reducing the component count on the PCB and therefore cost
  - Higher frequencies let the HCTL-2022/2032 operate with a wider range of encoders

Features

- Operates up to 33 MHz
- 32-bit binary up/down counter
- -40°C to 100°C operating temperature
- Programmable count modes (1x, 2x or 4x)
- Index channel support provides the ability to reset latched output when necessary
- High noise immunity. The Schmitt Trigger Input and Digital Noise Filter rejects noise on incoming quadrature signals
- Latched output, allowing stable output to microcontroller
- 8, 16, 24, or 32-bit operating modes
- Cascade-able output signals, up/down and count, trigger an external decoder or counter in case of an underflow/overflow situation
- Substantially reduced system software
- Comes with hardware built-in counters. Generally no external counters are required

Applications

- Machine tools
- Servo motors
- Sewing machines
- Robotics
- Measurement equipment
- Printers and printing machines
- Automobile service equipment

Package Dimensions

- Refer to product datasheet for package dimensions

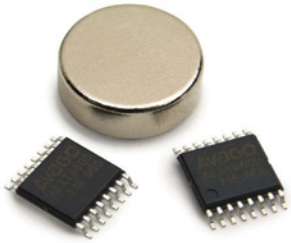
Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

HCTL-20	XX	–	XX

32	SC	32-SOIC Package
22	Blank	20-PDIP Package
32	SCT	32-SOIC Tape and Reel

Absolute (with Incremental Options) Magnetic Encoder



AEAT-6600-T16

Description

- AEAT-6600 angular magnetic encoder IC is a contact less magnetic rotary encoder for accurate angular measurement over a full turn of 360 degrees.
- It is a system-on-chip, combining integrated Hall elements, analog front end and digital signal processing in a single device.
- Absolute 10-bits to 16-bits resolution
- Incremental output resolutions 8 CPR to 1024 CPR

Features

- Absolute encoder – Programmable 10, 12, 14 to 16 bits of resolution
- Support Incremental – Programmable from 8 CPR up to 1024 CPR
- 5 V or 3.3 V operation
- 3-wire or 2-wire SSI interface mode for absolute output
- Incremental ABI or UVW, and PWM output modes
- User-programmable zero position, direction & index pulse width
- Power-down mode to reduce current consumption

Applications

- Contactless rotary position sensing
- Robotics
- Motor feedback
- Valve controls
- Front panel rotary switches
- Joystick position sensor

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

AEAT	–	6	6	0	0	–	T	1	6

Programming Kit
HEDS-8937

Line Driver

AEIC-7272/AEIC-7273/AEIC-2631 Series

Description

- Designed to meet industrial standards for encoder applications, including industrial standard line driver packaging (SOIC package), support RS422A, high temp operating range and support up to 30V operating voltage.
- Come with the current limiting and thermal shutdown features and assures highly reliable operation in harsh environments.
- Optimal solutions for the industrial encoder interface, sensor interface, PLC controllers and servo

Features

- Supply Voltage Range 4.75 V – 30 V (AEIC-2631), 3.5V – 30V (AEIC-7272/7273)
- Operation to 800 KHz
- CMOS and TTL compatible inputs
- Support RS422A
- High impedance buffered inputs with hysteresis
- Outputs short circuit protected
- Outputs Protected by Thermal Shut-Down

Applications

- Industrial encoder interfacing
- Industrial sensor interfacing
- Proximity switches
- Industrial controllers PLC
- Light barriers
- MR sensor systems

Package Dimensions

- Refer to product datasheet for package dimensions

Note: Please contact sales/factory to confirm up to date option availability

Ordering Information

Part Number	Description	Package
AEIC-7272-S16	Quad Differential, Tristate output	SOIC-16
AEIC-7273-S16	Quad Differential, open collector	SOIC-16
AEIC-2631-S16	Quad Differential	SOIC-16

Codewheels

Transmissive

HEDS-51x0/61x0, HEDG-512x/612x, HEDM-512x/61xx Series

Description

- Wide range of codewheels for use with HEDS-90XX/91XX series encoder modules
- Designed for many environments, applications and budgets
- Available in glass, film and metal
- Resolutions from 96 to 1024 CPR on an 11-mm optical radius, and 500 to 2048 CPR on a 23.36-mm optical radius
- Each of the three codewheel materials offers certain advantages

HEDS-51X0/61X0 Series

- Metal codewheels are the most versatile
- Temperature rating up to 100°C
- HEDS-51X0 offers resolution up to 512 CPR
- HEDS-61X0 offers resolution from 500 to 1024 CPR
- 2 and 3 channels output

HEDM-504X/512X/61XX Series

- Film codewheels offer higher resolution
- HEDM-504x offers resolution of 1000 CPR
- HEDM-512X offers resolutions of 1000 and 1024 CPR
- HEDM-61XX offers 2000 and 2048 CPR
- 70°C operating temperature
- 2 and 3 channels output

HEDG-512X/612X Series

- Glass codewheels combine the best of film and metal
- Operating temperature 100°C
- HEDG-512X offers resolution of 1000 and 1024 CPR
- HEDG-612X offers resolution of 2000 and 2048 CPR

Features

- Codewheels available in glass, film and metal
- Available in two standard diameters (11 mm and 23.36 mm optical radius)
- Cost effective
- For use with HEDS-90XX/91XX series two and three channel encoders

Applications

- Printers
- Plotters
- Tape drivers
- Industry automation equipment
- Factory automation equipment

Note: Please contact sales/factory to confirm up to date option availability

Reflective

Customized. Consult factory for these special parts.

Ordering Information

Metal Codewheels

HEDS-9100 Option modules		0	0

HEDS-5120 Option codewheels		
	Resolution (Cycles/Rev)	Shaft Diameter

Rop = 11 mm, 2 Channels

Resolution (Cycles/Rev)
K - 96 CPR
C - 100 CPR
D - 192 CPR
E - 200 CPR
F - 256 CPR
G - 360 CPR
H - 400 CPR
A - 500 CPR
I - 512 CPR

Shaft Diameter
01 - 2 mm
02 - 3 mm
03 - 1/8 in.
04 - 5/32 in.
05 - 3/16 in.
06 - 1/4 in.
11 - 4 mm
14 - 5 mm
12 - 6 mm
13 - 8 mm

Assembly Tools

Centering HEDS-8905	Gap-Setting HEDS-8901

		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDS-5120	A	•	•	•	•	•	•				•	•		•
	C		•				•				•	•	•	•
	D					•								
	E						•					•		
	F					•								
	G		•	•		•	•				•			•
	H		•			•	•				•	•	•	•
	I		•		•		•				•	•	•	
	K		•										•	

HEDS-9140 Option modules		0	0

HEDS-5140 Option codewheels		
	Resolution (Cycles/Rev)	Shaft Diameter

Rop = 11 mm, 3 Channels

Resolution (Cycles/Rev)
C - 100 CPR
E - 200 CPR
F - 256 CPR
G - 360 CPR
A - 500 CPR
I - 512 CPR

Shaft Diameter
02 - 3 mm
03 - 1/8 in.
04 - 5/32 in.
05 - 3/16 in.
06 - 1/4 in.
11 - 4 mm
14 - 5 mm
12 - 6 mm
13 - 8 mm

Assembly Tools

Centering HEDS-8905	Gap-Setting HEDS-8905

		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDS-5140	A		•		•	•	•				•	•	•	•
	C				•		•					•	•	
	E						•				•	•		•
	F				•							•		•
	G						•					•		•
	I		•		•		•				•	•	•	•
	H						•							•

Ordering Information

HEDS-9000 Option modules		0	0

HEDS-6100 Option codewheels		

Rop = 23.36 mm, 2 Channels

Resolution (Cycles/Rev)
A - 500 CPR
B - 1000 CPR

Shaft Diameter
06 - 1/4 in.
08 - 3/8 in.
09 - 1/2 in.
10 - 5/8 in.
11 - 4 mm
12 - 6 mm
13 - 8 mm

Assembly Tools

Centering	Gap-Setting
HEDS-8906	HEDS-8901

		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDS-6100	A								•			•	•	
	B						•	•	•	•				

HEDS-9040 Option modules		0	0

HEDS-6140 Option codewheels		

Rop = 23.36 mm, 3 Channels

Resolution (Cycles/Rev)
B - 1000 CPR
J - 1024 CPR

Shaft Diameter
06 - 1/4 in.
08 - 3/8 in.
09 - 1/2 in.
10 - 5/8 in.
11 - 4 mm
12 - 6 mm
13 - 8 mm

Assembly Tools

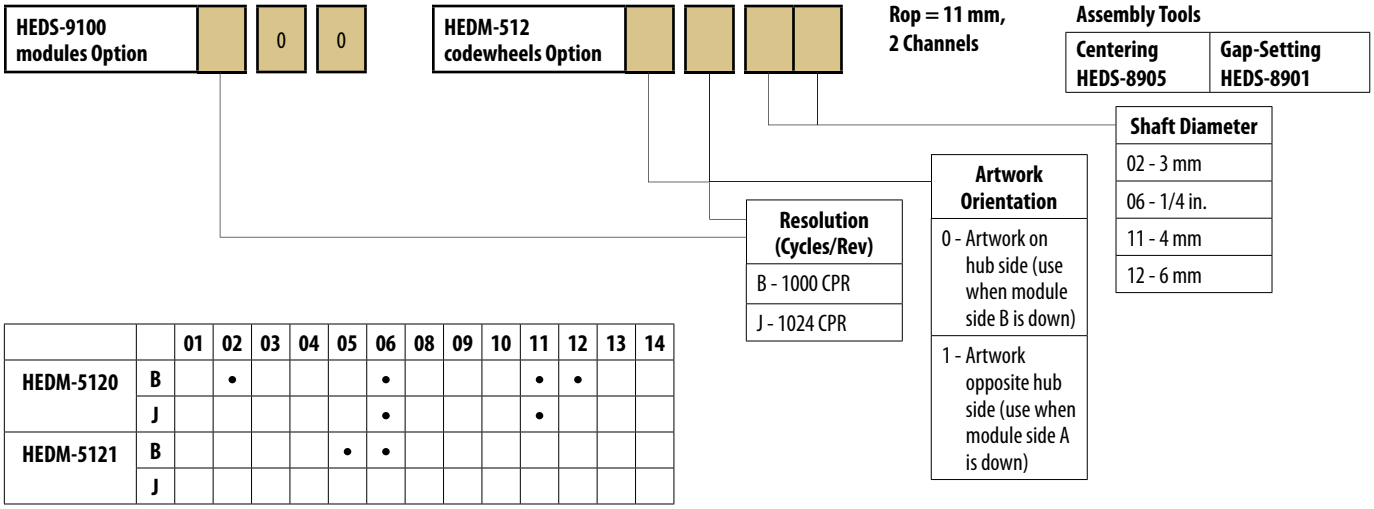
Centering	Gap-Setting
HEDS-8906	HEDS-8906

		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDS-6140	B						•	•	•	•	•	•	•	
	J						•		•			•	•	

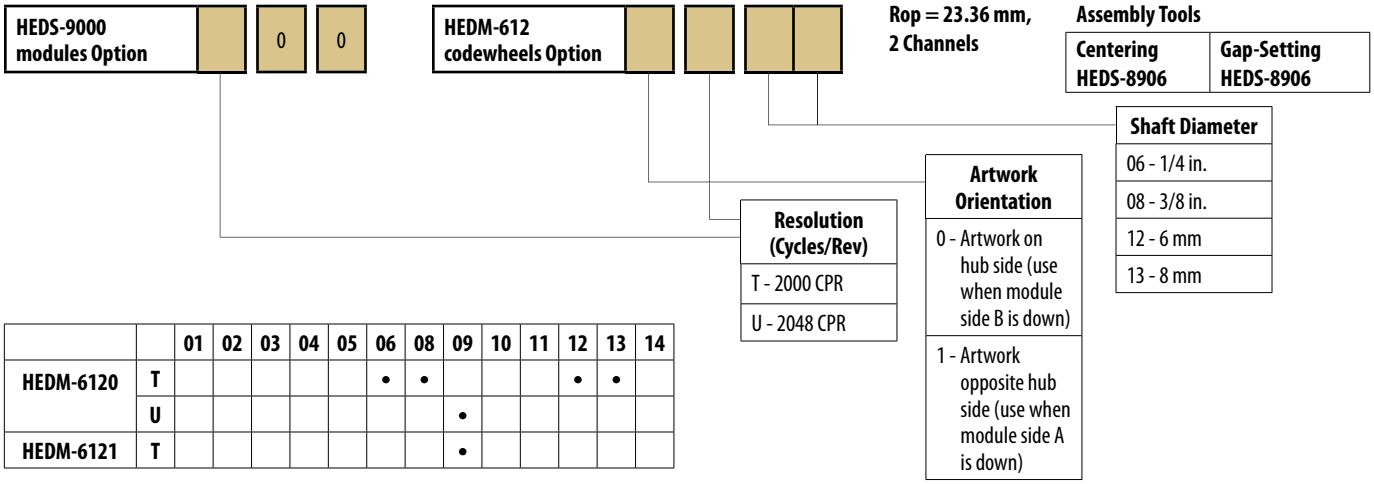
Note: For the lower resolution, two channel encoders, (11 mm ≤ 512 CPR; 23.36 mm ≤ 1024 CPR) the centering tool and gap-setting shim are not necessary, but sometimes helpful in an assembly process.

Ordering Information

Film Codewheels



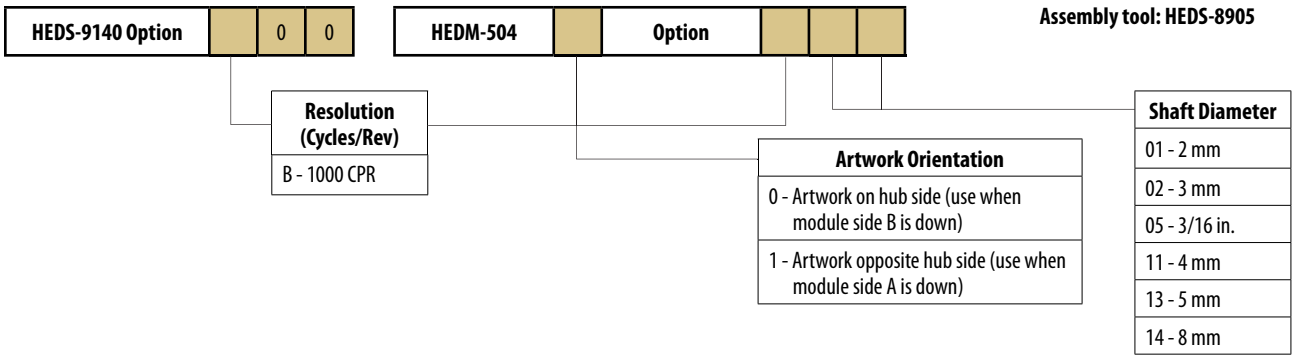
		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDM-5120	B		•				•				•	•		
	J						•				•			
HEDM-5121	B					•	•							
	J													

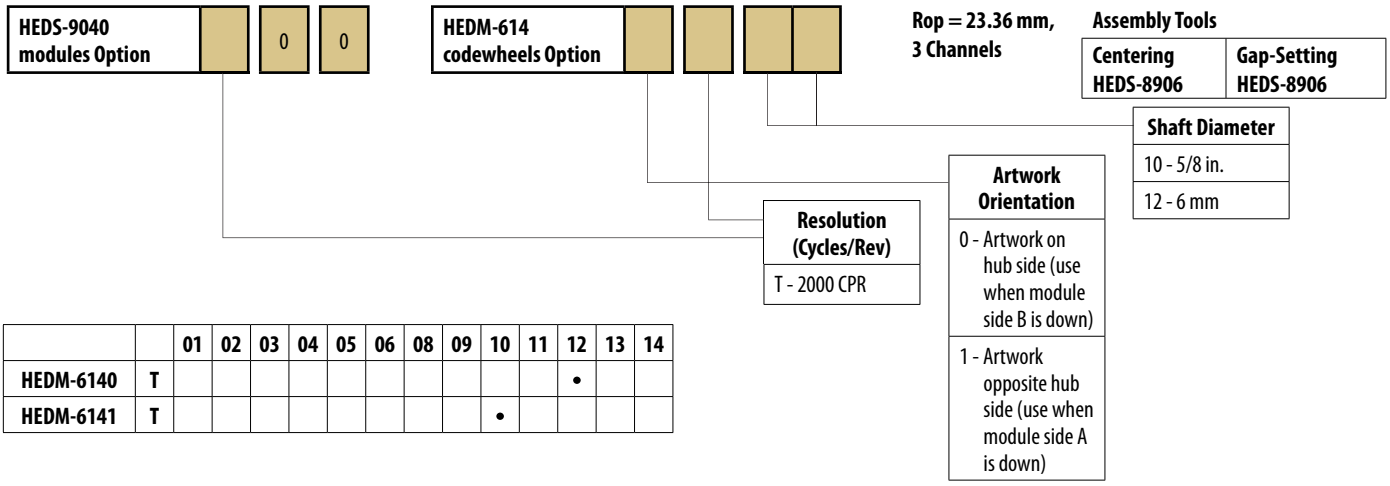


		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDM-6120	T						•	•				•	•	
	U								•					
HEDM-6121	T								•					

Ordering Information

Three Channel Encoder Modules and Codewheels, 11.000 Optical Radius

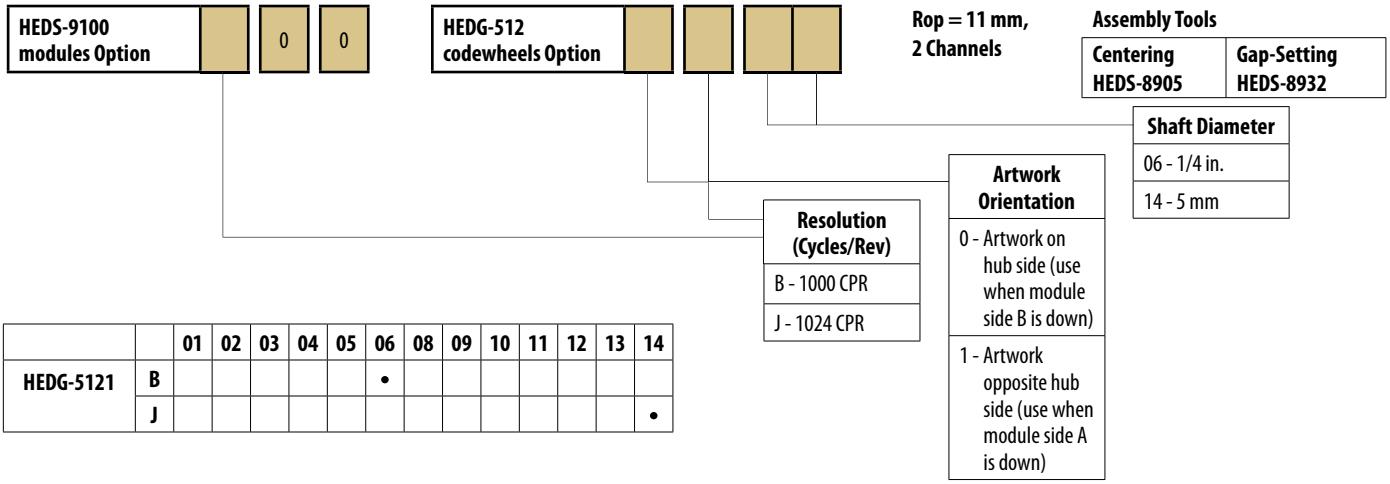




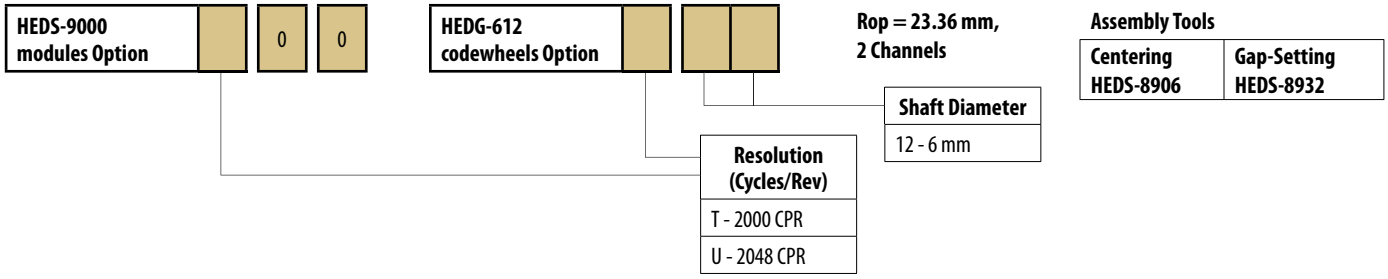
		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDM-6140	**T**											•		
HEDM-6141	**T**									•				

Ordering Information

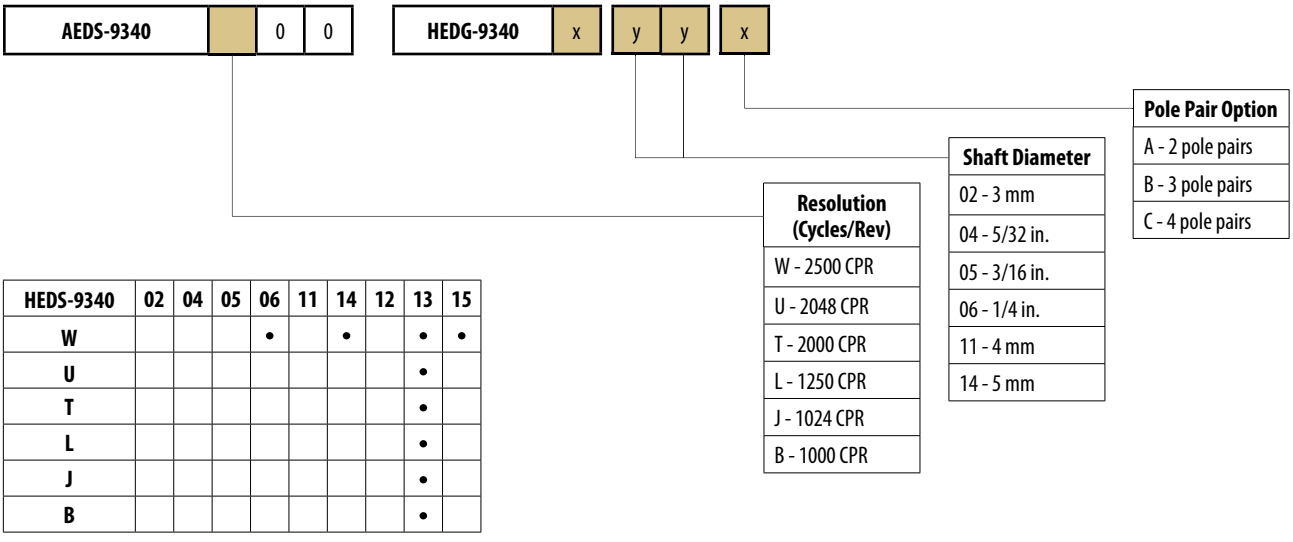
Glass Codewheels



		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDG-5121	B						•							
	J													•



		01	02	03	04	05	06	08	09	10	11	12	13	14
HEDG-6120	U											•		



HEDS-9340	02	04	05	06	11	14	12	13	15
W				•		•		•	•
U								•	
T								•	
L								•	
J								•	
B								•	

Customized Solutions

Avago Technologies can provide you with the right solution for your applications. If you don't see the exact encoder you need, visit our website and use our "Request Customization" form to tell us exactly what you need.

Our technical experts will contact you shortly to discuss your requirements.

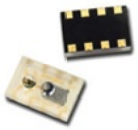
Applications Reference

	Incremental Optical Encoders				
	Transmissive Modules				
Products	HEDS-9xxx	HEDS-97xx	AEDS-96xx	AEDA-3xxx	AEDx-9140
Office Automation					
Printers/All-in-One Machines	•	•	•		•
Copiers	•	•	•		•
Tape Drives	•	•	•		•
Plotters	•	•	•		•
Scanners		•	•		
CD/DVD Writers					
Fax Machines		•	•		
Consumer					
Card Readers	•	•	•		
Appliance Front Panels					
Camera Phones					
Set-top Boxes					
TV Projectors					
Industrial Automation					
Wafer Handling Machines	•	•	•	•	•
Industrial Sewing Machines	•		•	•	•
Robotics	•			•	•
CAD/CAM Dial Boxes					
Wire Bonders				•	
Vending Machines		•	•	•	•
Seat Control and Alignment	•				•
Industrial Fans				•	
A/C Ventilation Blades				•	
Tool Changer (Machine Tools)		•		•	•
Robotics (Automotive)				•	
Dispensing Pump		•			
Elevator	•				
Pump & Valve					
Medical					
Blood Analyzers	•	•	•	•	•
Lab Sample Handling Equip.				•	
Surgical Robotics				•	
CAT Scan Machines				•	
Sport & Healthcare Equipments					
Motor Manufacturers	•		•		•
Elevators					
Instrumentation					
Audio Video					
Front Panel Combo Knobs					
Other					
ATM Machines		•	•		•

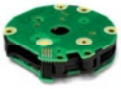
Applications Reference

	Incremental Optical Encoders			
	Transmissive Modules		Transmissive Housed	
Products	AEDS-9240	AEDx-9340	AEDx-8xxx	HEDx -5xxx
Office Automation				
Printers/All-in-One Machines				
Copiers				•
Tape Drives				
Plotters				•
Scanners		•		
CD/DVD Writers				
Fax Machines				
Consumer				
Card Readers				
Appliance Front Panels				
Camera Phones				
Set-top Boxes				
TV Projectors				
Industrial Automation				
Wafer Handling Machines		•		•
Industrial Sewing Machines		•		•
Robotics		•		•
CAD/CAM Dial Boxes				•
Wire Bonders				•
Vending Machines				•
Seat Control and Alignment				•
Industrial Fans		•		•
A/C Ventilation Blades				
Tool Changer (Machine Tools)		•		
Robotics (Automotive)		•		
Dispensing Pump				
Elevator		•		
Pump & Valve				
Medical				
Blood Analyzers				•
Lab Sample Handling Equip.				
Surgical Robotics				•
CAT Scan Machines				
Sport & Healthcare Equipments		•		•
Motor Manufacturers		•		•
Elevators				
Instrumentation				
Audio Video				
Front Panel Combo Knobs				
Other				
ATM Machines				

Applications Reference

	Incremental Optical Encoders					
	Reflective Modules				Reflective Housed	
						Rotary Pulse Generators
						
Products	AEDR-83xx	AEDR-8320	AEDR-8400	AEDR-850x	HEDR-542x	HRPG-Axxx
Office Automation						
Printers/All-in-One Machines	•	•	•	•		
Copiers	•	•	•	•		•
Tape Drives	•		•	•		
Plotters	•	•	•	•	•	•
Scanners	•		•	•		
CD/DVD Writers	•		•	•		
Fax Machines	•	•	•	•		
Industrial Automation						
Wafer Handling Machines						
Industrial Sewing Machines	•	•	•	•		
Robotics					•	
CAD/CAM Dial Boxes						
Wire Bonders						
Vending Machines	•	•	•	•	•	
Seat Control and Alignment	•	•	•	•		
Industrial Fans	•	•	•	•	•	
A/C Ventilation Blades	•	•	•	•	•	
Tool Changer (Machine Tools)						
Robotics (Automotive)						
Dispensing Pump						
Elevator						
Pump & Valve						
Medical						
Blood Analyzers						•
Lab Sample Handling Equip.						
Surgical Robotics						
CAT Scan Machines						
Sport & Healthcare Equipments						
Motor Manufacturers	•	•	•	•		•
Elevators						
Consumer						
Card Readers	•	•	•	•		•
Appliance Front Panels		•				•
Camera Phones	•		•	•		
Set-top Boxes	•	•	•	•		
TV Projectors	•		•	•		
Instrumentation						
Audio Video		•				•
Front Panel Combo Knobs		•				•
Other						
ATM Machines	•	•	•	•		

Applications Reference

	Absolute Encoders					Integrated Circuits	
	Transmissive Modules					Decoders	
		Magnetic Encoders					
							
Products	AEAT-7000	AEAT-60xx	AEAT-6600-T16	AEAT-9000	AEAx-8xAD	HTCL-20xx	AEIC-7272/7273/2631-S16
Office Automation							
Printers/All-in-One Machines						•	
Copiers						•	
Tape Drives						•	
Plotters						•	
Scanners						•	
CD/DVD Writers						•	
Fax Machines						•	
Industrial Automation							
Wafer Handling Machines	•	•	•	•	•	•	•
Industrial Sewing Machines	•	•	•	•	•		•
Robotics	•			•	•		
CAD/CAM Dial Boxes		•	•				•
Wire Bonders	•	•	•	•	•	•	•
Vending Machines		•	•				•
Seat Control and Alignment	•	•	•	•	•	•	•
Industrial Fans		•	•				•
A/C Ventilation Blades		•	•				•
Tool Changer (Machine Tools)	•	•	•	•	•	•	•
Robotics (Automotive)	•	•	•	•	•	•	•
Dispensing Pump		•	•				•
Elevator							
Pump & Valve	•	•	•	•	•		•
Medical							
Blood Analyzers	•			•			
Lab Sample Handling Equip.	•			•			
Surgical Robotics	•			•	•		
CAT Scan Machines	•	•	•	•	•		•
Sport & Healthcare Equipments		•	•				•
Motor Manufacturers	•	•		•	•	•	•
Elevators		•					•
Consumer							
Card Readers							
Appliance Front Panels							
Camera Phones							
Set-top Boxes							
TV Projectors							
Instrumentation							
Audio Video	•	•	•	•			•
Front Panel Combo Knobs	•	•	•	•		•	•
Other							
ATM Machines		•	•				•

Definition of Key Terms

Product Technology	Description
Absolute Encoder	A type of encoder which generates a unique code for each position, unlike an incremental encoder, which only generate pulses proportional to position. An absolute encoder has the distinctive feature of being able to provide positional information instantly upon power up.
Absolute Multi-Turn Encoder	In addition to the Absolute Single-Turn Encoder, this type of Absolute Multi-Turn Encoder provides shaft revolution detection, usually through means of an integrated gear, in which the code representation for each revolution is unique. Combined with Absolute Single-Turn Encoder, it provides unique positional information beyond one revolution.
Absolute Single-Turn Encoder	A type of absolute encoder whereby each measurable angular position provides unique positional information, within one revolution, without the need of counter and homing operation, upon power up.
Codewheel and Codestrip	Codewheel and codestrip are patterned discs or strips that translate a mechanical position into a representative electrical signal when used with an optical encoder. A codewheel is used for rotary motion while a codestrip is used for side-to-side motion. In a transmissive encoder, the bars block light and the windows allow light to pass through. In a reflective encoder, the bars absorb light while the windows reflect light.
Controller IC	A PID Motor Controller IC commands the motor operation by taking the feedback signal from the encoder output. It frees the host processor for other tasks by performing all the time intensive functions of digital motion control.
Decoder/Counter IC	Interfaces the encoder to the microprocessor. A decoder and counter IC converts the incremental signal from the encoder to a binary number.
Housed Encoder	An enclosed encoder with protective housing that normally has a defined IP rating.
Incremental Encoder	A type of encoder that provides relative position, whereby the feedback signal is always referenced to a start or home position. On an incremental encoder, each mechanical position is not uniquely defined. The current position sensed is only incremental from the last position sensed.
Linear Encoder	A type of incremental encoder that provides high resolution linear incremental positioning information. The linear encoder is a good alternative to designers who need to measure linear movement in high resolution.
Module Encoder	A basic encoder unit that integrates the detector and emitter in a single unit.
Optical Encoder	Sensors that use light to sense the speed, angle and direction of a rotary shaft.
Reflective Encoder	Consists of an emitter and detector, each positioned on the same side of the codewheel/codestrip.
Rotary Encoder	Also known as a shaft encoder. A type of incremental encoder that converts angular position of a shaft or axle to a digital code. Rotary encoders can also be used to measure linear motion, with the use of a ballscrew systems, to translate linear motion into rotary motion.
Transmissive Encoder	Consists of an emitter and detector, each positioned at opposite sides of the codewheel/codestrip.
Magnetic Encoder	Contactless magnetic sensing absolute rotary encoders suitable for dusty and high temperature environment.

Definition of Key Terms

Detector sets

Single Detector

- It looks at only the window or bar
- Defects at individual windows or bars cause error

Multiple Photodetectors

- It looks at many windows or bars
- Minimizes error due to defects at individual windows or bars
- Increases detected signal strength

Avago encoders employ multiple detector sets. Each set consists of differential outputs with push/pull circuitry. See diagram 2 below. An explanation on the operation of the differential signaling is described in the next item.

Diagram 1: Single and Multiple detector elements

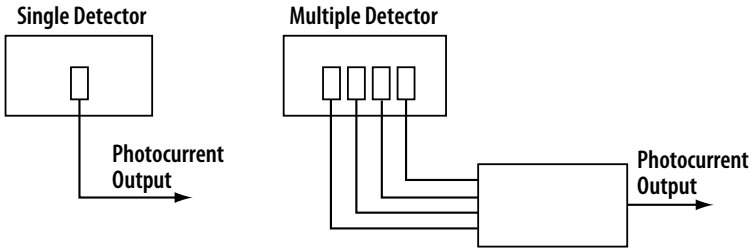
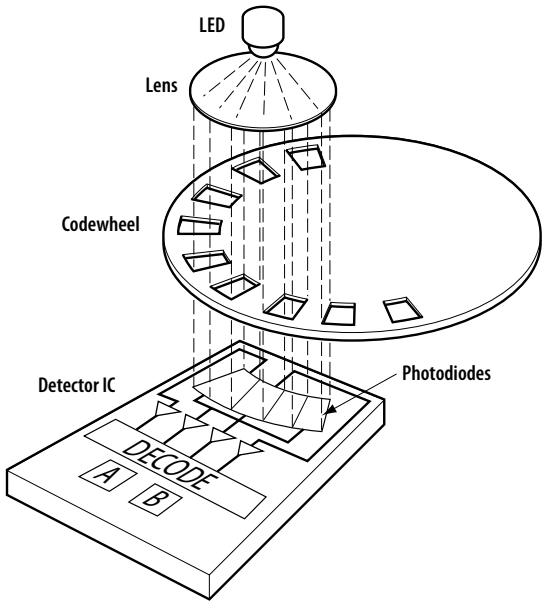


Diagram 2: Multiple detector elements



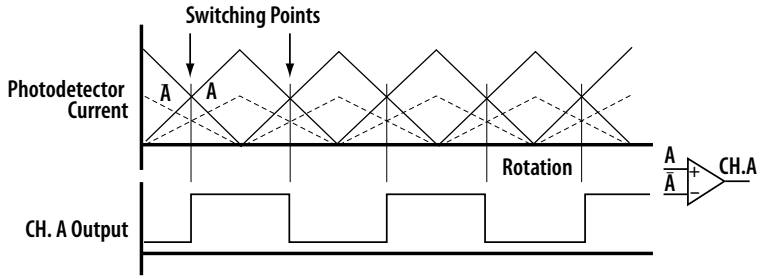
Definition of Key Terms

Differential Signaling

Why use differential signaling?

- Insensitive to variations in light
- Hysteresis in comparators prevents oscillation
- Switching points remain the same, independent of light level
- Negates effect of light level variation

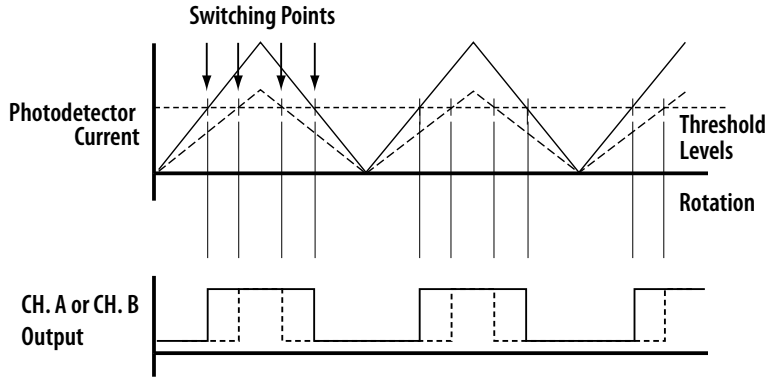
Diagram 3: Differential Detector output



How does differential signaling work?

- Signals for A and its complement A(bar) are sent to comparator
- When A receives more light than A(bar), then Ch. A is high
- Otherwise, if A(bar) receives more light than A, then Ch. A is low

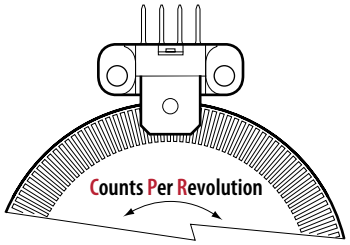
Diagram 4: Single channel detector output



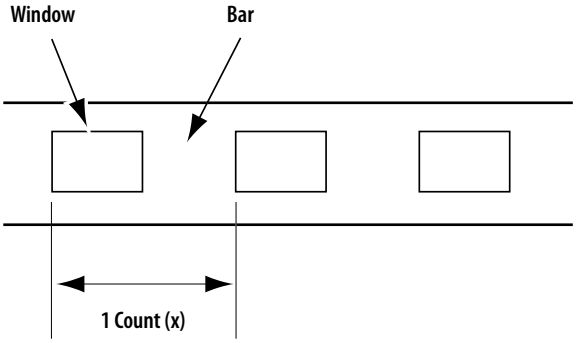
Definition of Key Terms

LPI:

CPR:



LPI Formula



LPmm can be used instead of LPI (Lines Per Inch). LPmm means the number of 'Lines Per mm'. The method of calculation for LPmm is the same as LPI. The only difference is that the 'mm' replaces 'Inch' as the standard measurement of length.

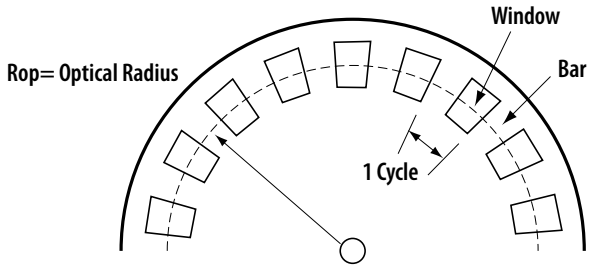
The formula for LPI and LPmm is as follows:

$$LPI = \frac{1}{x\ (Inch)} \qquad LPmm = \frac{1}{x\ (mm)}$$

Where x = length of Window and Bar pair length

Definition of Key Terms

CPR Formula



1 Cycle = the mechanical rotation that corresponds to one pair of Window and Bar.

CPR = Number of Window and Bar pairs over full rotation

Converting CPR to LPI and LPmm

$$\text{Count Density} = \frac{\text{Number of Window and Bar pair}}{\text{Arc Length}} = \frac{\text{CPR (count over full rotation)}}{\text{2πRop (Arc length over full rotation)}}$$

$$\text{LPI} = \frac{\text{CPR}}{\text{2πRop(Inch)}} \qquad \text{LPImm} = \frac{\text{CPR}}{\text{2πRop(mm)}}$$

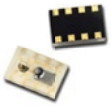
Calculation for Customized Resolution

Assuming you would like to use an Encoder with a known CPR and Rop for a custom CPR resolution, the LPI or LPmm must match for the encoder to operate properly.

The formulas described on the previous page can be used to calculate the new codewheel dimension. To retain the same LPI or LPmm, increase the CPR, then the Rop will increase accordingly. If the CPR is decreased, the Rop will also decrease accordingly.

For example, for the case of HEDS-9000-Txx. This is a 2000CPR at 23.36mm Rop encoder. Assuming we want to use a customized codewheel with a CPR of 4000CPR with this 2000CPR encoder.

Quick Guide - Encoder Module[1,2]

Product Type	Symbol								
General									
Encoder Type									
Form		Reflective							
Function									
Type/Size									
Product Part Number		AEDR-8000 AEDR-8010 AEDR-8100	AEDR-83xx	AEDR-8300-1Wx	AEDR-8320 (Analog Output)	AEDR-8400	AEDR-850x	HEDS-90xx HEDS-91xx HEDS-92xx	HEDB-9xxx
Product Picture									
Fit									
Bore / Shaft Diameter[3] (mm)		-	-	-	-	-		up to 8	
SMT		SO-6	SO-6	SO-6	SO-8	SO-6		-	
Modular		Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Overall Dimension[5] (mm)		6.2x4.4x3.2/2.7[11] (WxLxH)	4x5.1x1.6[11] (WxLxH)				3.4x3.95x0.9562 (WxLxH)	26.7x20.8x10.2[11] (WxLxH)	
Lead free		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Resolution									
Ranges: (Cycle per Revolution)[6,7]		-	-	-		-		up to 2048	up to 1024
(Line per Inch)		75, 150, 180	36 to 180	212	180	254, 318	304	up to 360	-
Currently available option (Cycle per Revolution)[2]		-	-			-		50, 96, 100, 200, 256, 360, 400, 500, 512, 1000, 1024, 2000, 2048	96,100, 200, 256, 360, 400, 500, 512, 1000,1024
(Line per Inch)[8]		75, 150, 180	36, 75, 150, 180	212	180	254, 318	304	180, 300,360	-
Codewheel / Codestrip[9]	CW								
Optical Radius(mm)	Rop	11	11	11	11	11		11, 23.36	11, 23.36
Part number[10]		HEDR-5120	HEDR-5120	HEDR-5120		HEDR-5120		HEDS-51xx/61xx HEDG-51xx/61xx HEDM-51xx/61xx	Codewheel included
Enclosure Type									
Ingress Protection Rating		-	-	-	-	-		-	-
Output									
TTL Compatible		Yes	Yes	Yes	-	Yes	Yes	Yes	Yes
Transmission		-	-	-	-	-		-	-
No of Channels		2	2	2	2	2	3	3	3
Absolute Maximum Ratings									
Storage Temperature (°C)[13]	T_S	-40 to 85	-40 to 85	-40 to 85	-40 to 85	-40 to 85	-20 to 85	-40 to 100	-40 to 100
Operating Temperature (°C)[13]	T_A	-20 to 85	-20 to 85	-20 to 85	-10 to 70	-20 to 85	-20 to 85	-40 to 100	-40 to 100
Supply Voltage (V)	Vcc	-0.5 to 7	-0.5 to 7	-0.5 to 7	-0.5 to 7	-0.5 to 7	4.5 to 5.5	-0.5 to 7V	-0.5 to 7V
Output Voltage (V)	V_O	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	Vcc + 0.4	-0.5 to Vcc	0 to Vcc	-0.5 to Vcc	-0.5 to Vcc
Recommended Operating Condition									
Temperature (°C)[13]	T	0 to 80	0 to 85	-20 to 85	-10 to 70	-20 to 85	-20 to 85	-40 to 100	-40 to 100
Supply Voltage (V)	Vcc	5.0	5.0	3.3 / 5.0	5.0	2.8	5.0	5.0	5.0
Count Frequency (kHz)[14]	f	30	15 / 30	60	20	15	55	100	100
Accessories and Tools									
Alignment Tools		-	-	-	-	-		HEDS-8905 HEDS-8906	-
Gapping Tools		-	-	-	-	-		HEDS-8901 HEDS-8910 HEDS-8932	-

Definition of Key Terms

The table below simplifies the problem statement. The encoder and custom codewheel LPI must match in order for the encoder to operate properly. The new CPR is known and the only unknown is the Rop of the custom Codewheel to ensure that the new codewheel, LPmm matches that of the encoder specifications. We have to identify what is the new Codewheel Rop.

	Encoder Specification	Custom CW Specification
CPR	2000	4000
Rop	23.36 mm	Unknown (x)
LPmm	13.6245	

First, calculate the LPmm of the encoder:

$$LPmm = \frac{CPR}{2\pi Rop(mm)}$$

$$LPmm = (2000)/(2\pi*23.36) \qquad \pi = 3.142$$

$$LPmm = 13.6245$$

The new 4000CPR codewheel must also match this 13.6245LPmm. Next, find the appropriate Rop for 4000CPR:

$$LPmm = \frac{CPR}{2\pi Rop(mm)}$$

$$13.6245 = 4000/(2\pi*x)$$

$$Rop(mm) = 46.72\ mm$$

The new Codewheel for 4000CPR must have a Rop of 46.72mm to be used with a 2000CPR 23.36mm encoder.

	Encoder Specification	Custom CW Specification
CPR	2000	4000
Rop	23.36 mm	46.72 mm
LPmm	13.6245	

Important: The LPI or LPmm for the codewheel and the encoder must match for the encoder to operate properly.

Encoder - Module[1,2]

Rotary Encoder

Optical Incremental

Transmissive

Digital Output

HEDT-900x HEDT-910x	HEDT-904x HEDT-914x	AEDB-9140	AEDT-9140	AEDS-9240	AEDB-9340	AEDT-9340	HEDL-90xx HEDL-91xx	HEDS-97xx HEDS-973x HEDS-974x HEDS-978x	AEDS-964x AEDS-965x	AEDA-32xx	HEDS-9202
up to 8	up to 8	up to 8	up to 8	up to 12	up to 12	up to 12	up to 8	Refer to factory	-	2	up to 8
-	-	-	-	-			-		-	-	-
Yes	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes	Yes
26.7x20.8x10.2 [11] (WxLxH)	26.7x20.8x10.2 [11] (WxLxH)	22x10x15 [11] (WxLxH)	22x10x15 [11] (WxLxH)	(WxLxH)		(WxLxH)	26.7x20.8x10.2 [11] (WxLxH)	20.2x12.6x10.8 [11] (WxLxH)	18x15x7 [11] (WxLxH)	17x18 (ØxH)	26.7x20.8x10.2 [11] (WxLxH)
Yes	Yes	Yes	Yes	Yes	Yes	Yes	-	-	-	Yes	Yes
up to 1024	up to 512	up to 500	up to 1000	up to 720	up to 2500	up to 2500	up to 2048	96 to 2048	-	2500 to 7500	-
	-	-	-	-			-	120 to 480	150, 180, 200,300,360	-	200
100, 200, 360, 400, 500,1000, 1024	512	100, 200, 256, 360, 400, 500	100, 200, 256, 360, 400, 500, 1000	360, 720	1000, 1024, 1250, 2000, 2048, 2500	1000, 1024, 1250, 2000, 2048, 2500	500, 512, 1000, 2048	96, 100, 192, 200, 256, 360, 400, 500, 1000, 1024, 2000, 2048	150, 300, 360, 150, 180 for 965x	2500, 5000, 6000, 7200, 7500	-
-	-	-	-		-	-	346[8]	120, 127, 150, 180, 300, 360		-	200
11, 23.36	11, 23.36	11	11	19	15, 12.3, 12	15, 12.3, 12	11, 23.36	-	-	5	-
HEDS-5120/6100 HEDG-5120/6100	HEDS-5140/5145 HEDS-6140/6145	Codewheel included			Codewheel included		HEDS-51xx/61xx HEDG-51xx/61xx HEDM-51xx/61xx	Refer to factory	Refer to factory	Codewheel included	Refer to factory
-	-	-	-	-	-	-	-	-	-	-	-
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
-	-	-	-	-	-	-	-	-	-	-	-
2	3	3	3	6	6	6	3	2	2	3	2
-40 to 125	-40 to 140	-10 to 85	-40 to 115	-40 to 100	-40 to 105	-40 to 115	-40 to 70 or 100	-40 to 70 or 85	-40 to 85	-40 to 125	-40 to 100
-40 to 125	-40 to 140	-10 to 85	-40 to 115	-40 to 100	-40 to 105	-40 to 115	0 to70 or 100	-40 to 70 or 85	0 to 70	-40 to 125	-10 to 100
-0.5 to 7V	-0.5 to 7V	-0.5 to 7V	-0.5 to 7V	-0.5 to 7V	-0.5 to 7V	-0.5 to 7V	-0.5 to 7V	-0.5 to 7	Refer to datasheet	4.5 to 5.5	-0.5 to 7
-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-
-40 to 125	-40 to 140	-10 to 85	-40 to 115	-40 to 100	-10 to 85	-40 to 115	0 to 70 or 100	25	0 to 70	25	25
5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	3.3 / 5.0	5.0	5
100	50	100	100	150	150	200	100	20, 40, 80	50,60	750	120
-	HEDS-8905	-		HEDS-8953	HEDS-8950 HEDS-8951	HEDS-8950 HEDS-8951	-	-	-	HEDS-8940	-
-	-	-		-	HEDS-8952	HEDS-8952	-	-	-	-	-

		Absolute				
		Single-Turn				
Analog Output						
HEDS-971x	AEDS-96Ex	AEAT-7000	AEAT-9000	AEAT-60xx	AEAT-84AD	AEAT-86AD
Refer to factory		8		6	Pineon Gear Module 0.3[4]	Pineon Gear Module 0.3[4]
-		-		-	-	-
Yes		Yes	Yes	Yes	Yes	Yes
20.2x12.6x10.8 [11] (WxLxH)		56x23 (ØxH)		23x23 (ØxH)	55x12.2 (ØxH)	55x13.3 (ØxH)
Yes	Yes	Yes	Yes	Yes	-	-
-	-	up to 13 bits	up to 17 bits	10, 12 bits	12, 14 bits	12, 14 bits
200, 360	200	-			-	-
-	-	13 bits	17 bits	10, 12 bits Binary/ Gray Serial	12, 14 bits Multiplexed	12, 14 bits Binary/ Gray Serial
200, 360	200	-		-	-	-
-	-	Ø43 mm[5]		-	-	-
Refer to factory	Refer to factory	Codewheel included	HEDG-9000-H13 HEDG-9000-H14 Refer to factory for more information	-	-	-
-	-	-		-	-	-
			Refer to datasheet	Refer to datasheet	Refer to datasheet	Refer to datasheet
Yes	Yes	-		-	-	-
-	-	Serial		Serial	-	-
2	2	2		-		
-40 to 85	-40 to 85	-40 to 100	-40 to 85	-40 to 125	-40 to 125	-40 to 125
0 to 85	0 to 70	-40 to 100	-40 to 115	-40 to 125	-40 to 125	-40 to 125
-0.5 to 7	-0.5 to 7	-0.3 to +6.0	4.5 to 5.5	5.0	-0.3 to +6.0	-0.3 to +6.0
-	-	-0.3 to VD+0.3	-0.3 to VD+0.3	-	-0.5 to + Vcc +0.5	-0.5 to + Vcc +0.5
15 to 45	0 to 60	-40 to 85	-40 to 115	-40 to 125	-40 to 125	-40 to 125
5.0	3.3	5.0	5.0	+4.5 / +5.5	5.0	5.0
40	50	16MHz[15]		-	-	-
-	-	HEDS-8933 Refer to factory	HEDS-8949	HEDS-8934	-	-
-	-	-			-	-

Notes:

1. This is an overview of product range and specifications. For further product details and a complete list of distributors, please visit our web site at http://www.avagotech.com/motioncontrol
2. Data subject to change. Please refer to the latest datasheets available in our website.
3. Refer to factory for different product shaft or bore diameter sizes (this refers to the inner diameter of the bore, unless specified otherwise).
4. AEAT-8xAD series uses mechanical pinion gear for its mechanical linkage. Please refer to factory for further details.
5. Data shown is an approximation of the actual dimensions. (W = width, L=length, H= height, Æ = diameter).
6. All given resolution is *before* full 4X multiplication or quadrature decode. For example, 2048 CPR (cycle per revolution) can be further decoded to 8192 PPR (pulse per revolution).
7. The resolution shown is typically based on CPR (Cycle Per Revolution), unless specified otherwise .
8. For linear encoder option.
9. As some modular encoders can be used as both rotary and linear encoder, these encoders may be coupled with codewheel or codestrip dependent on application.
10. As there are diversified design of matching codewheels or codestrips, please refer to factory for further details. General information can be found in HEDS-51X0/61X0 series two and three channel codewheels.
11. Dimensions shown are referring to encoder module size only, excluding the codewheel size.
12. Two channels of analog / digital output are available.
13. The temperature range shown may vary as it is dependent on selected options and type of codewheels.
14. The count frequency may vary according to different part numbers and options. The specified value indicates the maximum count frequency allowed.
15. This refers to the response frequency of the encoder.

Quick Guide - Encoder Housed[1,2]

Product Type	Symbol	Encoder - Housed[1,2]			
General		Optical Rotary Encoder			
Encoder Type		Incremental			
Form		Mid Size	Miniature Size		Panel Mount
Function					Digital Potentiometer
Type/Size					
Product Part Number		HEDL-55xx HEDM-55xx HEDS-55xx HEDL-56xx HEDM-56xx HEDS-56xx	AEDS-8xxx AEDT-8xxx	HEDR-54xx	HRPG-Axxx
Product Picture					
Fit					
Bore / Shaft Diameter[3] (mm)		up to 8	up to 5mm	2,3,4,5 &1/8"	0.25"/ 6 mm
SMT		-	-	-	-
Modular		-	-	-	-
Overall Dimension[5] (mm)		41.7x52.1x18.3 (WxLxH)	20mmx18mm (OD x H)	23x17.9 (ØxH)	21x17.5 (WxH)
Resolution					
Ranges: (Cycle per Revolution)[6,7]		up to 1024	up to 500	200	up to 120
(Line per Inch)		-		-	-
Currently available option (Cycle per Revolution)[2]		50, 96, 100, 192, 200 256, 360, 400, 500, 512 1000, 1024	200, 400, 500	200	16, 32, 120
(Line per Inch)[8]		-		-	-
Enclosure Type					
Ingress Protection Rating		IP20	IP40	IP20	IP20
Output					
TTL Compatible			RS-422 line driver		
Transmission		-	-	-	-
No of Channels			3		
Absolute Maximum Ratings					
Storage Temperature (°C)[13]	T_S	-40 to 70 or 100	-20 to 85 or -40 to 100	-40 to 85	-40 to 85
Operating Temperature (°C)[13]	T_A	-40 to 70 or 100	-20 to 85 or -40 to 100	-10 to 85	0 to 70
Supply Voltage (V)	V_{CC}	-0.5 to 7	-0.5 to 7	-0.5 to 7	-0.5 to 7
Output Voltage (V)	V_O	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc	-0.5 to Vcc
Recommended Operating Condition					
Temperature (°C)[13]	T	-40 to 70 or 100	-20 to 85 or -40 to 100	-10 to 85	0 to 70
Supply Voltage (V)	Vcc	5.0	4.5 to 5.5	5.0	4.5 to 5.5
Count Frequency (kHz)[14]	f	100	up to 200	16	
Accessories and Tools					
Alignment Tools		HEDS-8910	HEDS-8938	HEDR-5900	-
Gapping Tools		-		-	-

Discover More

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For additional product information, visit www.avagotech.com/motioncontrol.

ed Circuits[1,2]

Integrated Circuits[1,2]		
Decoder		
Quadrature Decoder / Counter Interface IC		
HCTL-2032 - SC HCTL - 2022	HCTL-2001-A00 HCTL-2017-A00/PLC HCTL-2021-A00/PLC	AEIC-7272/7273/2631-S16
32 pin - PDIP 32 pin - SOICC 20 pin - PDIP	16 pin - PDIP 20 pin - PDIP 20 pin - PLCC	16pin - SOIC
1, 2	1	
-	-	
-	-	
8-bit, 16-bit, 24-bit, 32-bit	8-bit, 12-bit, 16-bit	
Quadrature Output Incremental Frequency 5.5 MHz (Max)[3]	Quadrature Output Incremental Frequency 2.3 MHz (Max)[3]	Quadrature Output 800KHz
- 33 MHz clock operation - Programmable count mode / (1x,2x or 4x decode) - High noise immunity - Substantially reduced system software - Cascade output signal - Schmitt Trigger inputs and digital noise filter - TTL compatible I/O - Latched outputs - Index channel support - Single or dual axis support	- 14 MHz clock operation - 4x Decoding - High noise immunity - Substantially reduced system software - Cascade output signal (HCTL-2021 Only) - Schmitt Trigger inputs and digital noise filter - TTL compatible I/O - Latched outputs - Index channel support - Single axis	- Operation to 800 KHz - CMOS and TTL Compatible Inputs - Optional single supply operation for moderate power applications - High Impedance Buffered Inputs with hysteresis - Tri-State outputs
-55 to 150	-55 to 150	
-40 to 100	-40 to 85	-55 to 125 (AEIC-7272/7273-S16) -40 to 125 (AEIC-2631-S16)
-0.3 to 6.0	-0.3 to 6.0	4.75 to 30 (AEIC-2631-S16) 3.5 to 30 (AEIC-7272/7273-S16)
-0.3 to V_{DD} +0.3	-0.3 to V_{DD} +0.3	
33 MHz	14 MHz	800kHz
25	25	25
4.5 to 5.5	4.5 to 5.5	4.75 to 30 (AEIC-2631-S16) 3.5 to 30 (AEIC-7272/7273-S16)
1µA	1µA	

Notes:

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3. This refers to count frequency of the encoder output.

Quick Guide - Integrate

AEAT-601B-F06	AEAT-6600-T16
6	
-	
-	
23	5x4.4 (WxH)
256	up to 1024
32, 64, 128, 256, 1024	8, 16, 32, 64, 128, 256, 512, 1024
256	
IP20	
-	
-	
3	3
-40 to 125	-40 to 125
-40 to 125	-40 to 125
-0.3 to 7	3.3 or 5
-0.3 to Vcc +0.3	
-40 to 125	-40 to 125
4.5 to 5.5	3.3 or 5
30	120KHz
HEDS-8934	HEDS-8937
HEDS-8934	

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5. Data shown is an approximation of the actual dimensions. (W = width, L=length, H= height, Æ = diameter).
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7. The resolution shown is typically based on CPR (Cycle Per Revolution), unless specified otherwise.
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9. As some modular encoders can be used as both rotary and linear encoder, these encoders may be coupled with codewheel or codestrip dependent on application.
10. As there are diversified design of matching codewheels or codestrips, please refer to factory for further details. General information can be found in HEDS-51X0/61X0 series two and three channel codewheels.
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13. The temperature range shown may vary as it is dependent on selected options and type of codewheels.
14. The count frequency may vary according to different part numbers and options. The specified value indicates the maximum count frequency allowed.
15. This refers to the response frequency of the encoder.

	Symbol
Product Part Number	
Product Picture	
Package Type	
Number of Axes	
Coordination between multiple HTCL-1100	
Power Dissipation (mw)	PD
Binary Counter	
Motor Type/Encoder Input Type	
Functions	
Features	
Absolute Maximum Rating	
Storage Temperature (°C)	T_S
Operating Temperature (°C)	T_A
Supply Voltage (V)	V_{DD}
Input Voltage (V)	V_{IN}
Maximum Operating Clock Frequency	f_{CLK}
Recommended Operating Condition	
Temperature (°C)	T
Supply Voltage (V)	V_{DD}
Supply Current	I_{DD}

Your Imagination. Our Innovation

From the smartphone that keeps you in touch, to the fiber optic network that keeps a $10-billion corporation connected, we get our information these days through an ever-increasing array of sophisticated device technologies. And behind it all, are semiconductors that sense, illuminate, and connect the signals in order to process that digital data.

Avago Technologies is a leading supplier in III-V compound and silicon semiconductors providing an extensive range of analog, mixed signal and optoelectronics components that are backed by over 5,000 patents to approximately 40,000 end customers.

Our heritage of technical innovation dates back 45 years, and includes over 1,000 talented design and product engineers. We believe in strong customer service support and intense collaboration to create leading-edge proprietary technologies to solve customers' technical bottlenecks. In that way - Our innovation helps bring your imagination to market.

Avago products serve four diverse end markets

Wireless Communications serving the smartphone/handset and Base Station infrastructure markets with over 250 patents and leading-edge products that include:

- Power Amplifiers
- Front End Modules
- Film Bulk Acoustic Resonator (FBAR) Filters
- GPS LNAs
- Optical Finger Navigation
- LED Backlighting, Screen Illumination
- Ambient Light and Proximity Sensors

Wired Infrastructure for switches/routers, data centers, supercomputers and storage/servers with over 200 patents in parallel optics alone and products that include:

- 120Gb Parallel Optic Arrays
- 20Gb SerDes ASICs in 40nm
- Storage Fibre Channel Transceivers
- QSFP/SFP Sonet Transceivers

Industrial and Automotive Electronics for alternative energy power generation, electronic sign and signals, automated manufacturing, automotive lighting, GPS navigation, motor inverter system, battery charging and management, infotainment systems and vehicle safety systems with products that include:

- Inverters
- Isolation and Digital Optocouplers
- Optical Encoders
- Polymer Optical Fiber
- PLCC-2/4 LEDs, 0.5W LEDs

Consumer and Computing peripherals for Optical/Laser mice, printers, white goods, DVD players, netbooks, Tablet PCs and laptops with over 100 patents and products that include:

- Optical and Laser Mouse Sensors
- Motion Control Optical Encoders
- Paper Level/Edge Proximity Sensors
- Display LEDs
- Status Indicator and Backlighting LEDs
- Ambient Light Photo Sensors
- Auto Focus Auxiliary Flash LED

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www.avagotech.com

www.avagotech.com/motioncontrol

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