

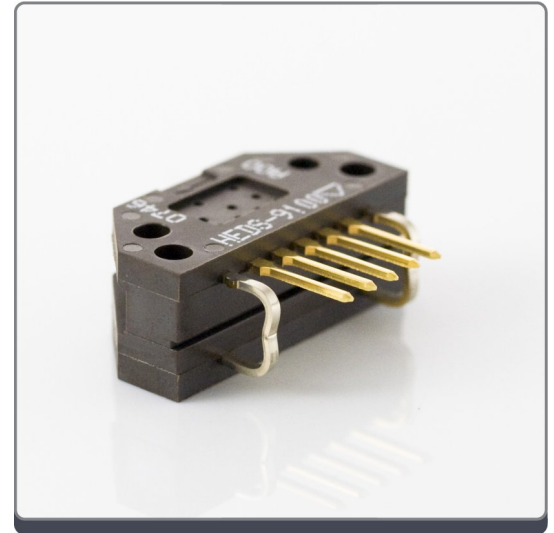
Description

HEDS is a transmissive optical encoder module. This module is designed to detect the rotary or linear position when used together with a codewheel or linear strip. The HEDS module consists of a lensed LED source and a monolithic detector IC enclosed in a small polymer package. The HEDS module uses phased array detector technology to provide superior performance and greater tolerances over traditional aperture mask type encoders.

The HEDS module provides digital quadrature outputs. It is available with a third index channel output on some resolutions. Power is supplied from a single +5Vdc source.

The resolution of the modules and encoder disks or linear strips must match. Two mounting holes are provided to accept 4-40 machine screws.

For open collector and higher voltage applications, add the PC3 cable driver, or for differential cable driver outputs, add the PC4 cable driver. Encoder disks, linear strips, quadrature decoder chips, counter chips, computer interface boards, mating connectors and cables are also available.



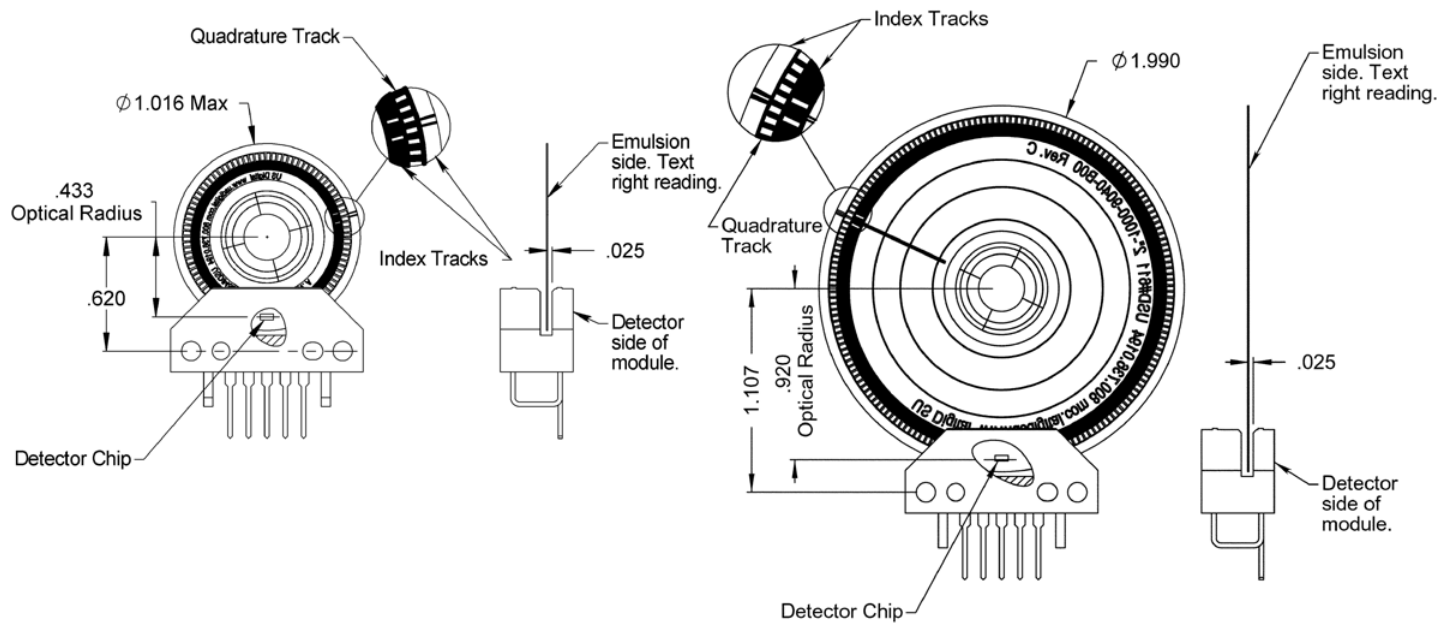
Features

- ▶ Two channel quadrature output with optional index pulse
- ▶ TTL Compatible
- ▶ Single +5V supply
- ▶ Resolutions up to 2048 CPR (8192 PPR)
- ▶ -40C to 100C operating temperature

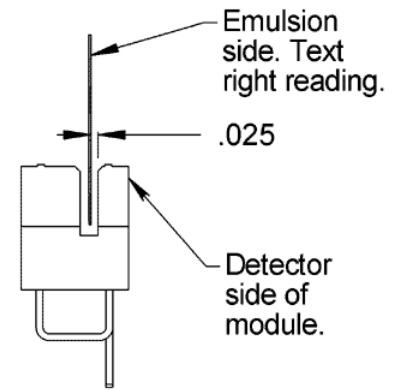
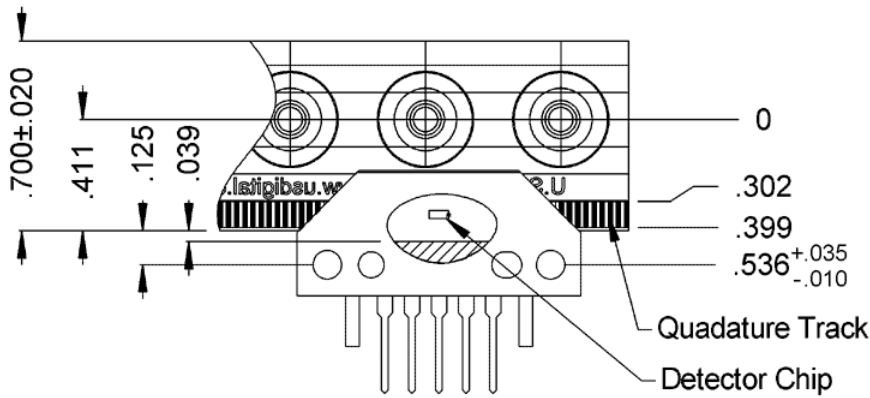
Related Products & Accessories

- ▶ CA-C5-SH-C5 5-Pin Standard / Standard Shielded Cable (Base price \$11.50)
- ▶ CA-C5-SH-FC5 5-Pin Standard / Latching Shielded Cable (Base price \$14.13)
- ▶ CA-C5-SH-NC 5-Pin Standard / Unterminated Shielded Cable (Base price \$6.25)
- ▶ CA-C5-SS-MD6 5-Pin Standard / 6-Pin Modular Silver Satin Cable (Base price \$10.48)
- ▶ CA-C5-W4-NC 5-Pin Standard / Unterminated 4-Wire Cable (Base price \$5.75)
- ▶ CA-C5-W5-NC 5-Pin Standard / Unterminated 5-Wire Discrete Cable (Base price \$5.75)
- ▶ CA-FC5-SH-LC5 5-Pin Latching / Locking Shielded Cable (Base price \$16.76)
- ▶ CA-LC5-SH-LC5 5-Pin Locking / Locking Shielded Cable (Base price \$16.76)
- ▶ CA-LC5-SH-NC 5-Pin Locking / Unterminated Shielded Cable (Base price \$8.88)
- ▶ CA-LC5-SS-MD6 5-Pin Locking / 6-Pin Modular Silver Satin Cable (Base price \$13.11)
- ▶ CA-LC5-W4-NC 5-Pin Locking / Unterminated 4-Wire Discrete Cable (Base price \$8.38)
- ▶ CA-LC5-W5-NC 5-Pin Locking / Unterminated 5-Wire Discrete Cable (Base price \$8.38)
- ▶ CON-C5 5-Pin Standard Connector (Base price \$1.05)
- ▶ CON-LC5 5-Pin Locking Connector (Base price \$3.15)
- ▶ DISK-1 1" Transmissive Rotary Disk (Base price \$8.05)
- ▶ DISK-2 2" Transmissive Rotary Disk (Base price \$10.40)
- ▶ EM1 Transmissive Optical Encoder Module (Base price \$32.35)
- ▶ HUBDISK-1 1" Transmissive Rotary Codewheel (Base price \$12.10)
- ▶ HUBDISK-2 2" Transmissive Rotary Codewheel (Base price \$18.45)
- ▶ LIN Transmissive Linear Strip (Base price \$14.70)

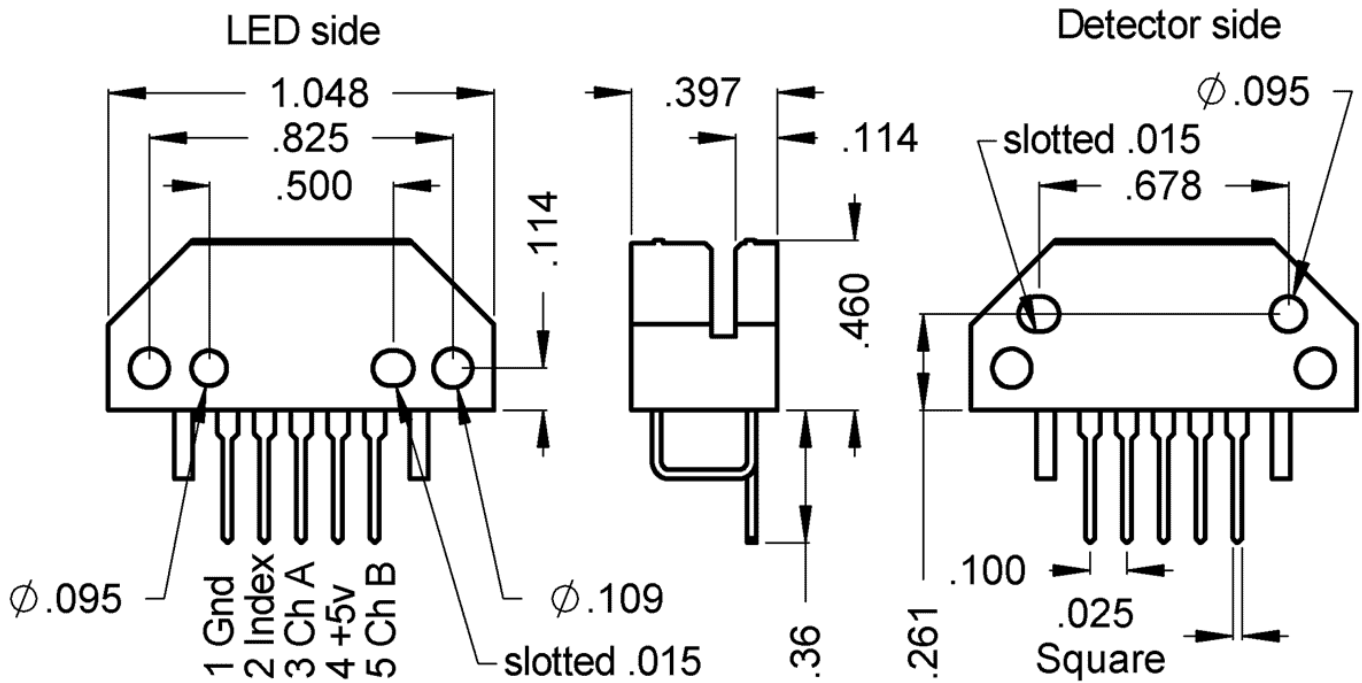
Module & Disk Mechanical Alignment



Module & Linear Strip Mechanical Alignment



Mechanical Drawing



Available Resolutions

CPI-CPR	1" Disk Non-index	1" Disk With Index	2" Disk Non-index	2" Disk With Index	Linear Strip Non-index
50	HEDS-9100-S00	HEDS-9140-S00	-	-	-
96	HEDS-9100-C00*	HEDS-9140-C00*	-	-	-
100	HEDS-9100-C00	HEDS-9140-C00	HEDS-9100-S00*	HEDS-9140-S00*	-
110	HEDS-9100-C00*	-	-	-	-
120	HEDS-9100-C00*	-	-	-	-
180	-	-	-	-	HEDS-9200-Q00
192	HEDS-9100-E00*	HEDS-9140-E00*	-	-	-
200	HEDS-9100-E00	HEDS-9140-E00	HEDS-9100-C00*	HEDS-9140-C00*	-
250	HEDS-9100-F00*	HEDS-9140-F00*	-	-	-
256	HEDS-9100-F00*	HEDS-9140-F00	-	-	-
300	-	-	-	-	HEDS-9200-300
360	HEDS-9100-G00	HEDS-9140-G00	-	-	HEDS-9200-360
400	HEDS-9100-H00	HEDS-9140-H00	HEDS-9100-E00*	HEDS-9140-E00*	-
500	HEDS-9100-A00	HEDS-9140-A00	HEDS-9000-A00	HEDS-9140-F00*	-
512	HEDS-9100-I00	HEDS-9140-I00	HEDS-9000-A00*	-	-

CPI- CPR	1" Disk Non-index	1" Disk With Index	2" Disk Non-index	2" Disk With Index	Linear Strip Non-index
540	HEDS-9100-I00*	-	-	-	-
1000	HEDS-9100-B00	-	HEDS-9000-B00	HEDS-9040-B00	-
1016	HEDS-9100-J00*	-	-	-	-
1024	HEDS-9100-J00	-	HEDS-9000-J00	HEDS-9040-J00	-
2000	-	-	HEDS-9000-T00	HEDS-9040-T00	-
2048	-	-	HEDS-9000-U00	HEDS-9040-T00	-

*Some modules can be used with other-than-native OD and/or CPI/CPR while maintaining specified tolerances.

Recommended Operating Conditions

Parameter	Min.	Max.	Units	Notes
Temperature	-40	100	C	
Supply Voltage	4.5	5.5	Volts	Ripple (<100mV P-P)
Load Capacitance	-	100	pF	
Count Frequency	-	100	kHz	(rpm/60) x cycles/rev.

Electrical Specifications

- Specifications apply over entire operating temperature range.
- Typical values are specified at Vcc = 5.0Vdc and 25 ° C.

Parameter	Min.	Typ.	Max.	Units	Notes
Output Voltage	-0.5	-	Vcc	Vdc	
Supply Current (Index or 1" >=1000 CPR or 2" >=2000 CPR only)	30	57	85	mA	
Supply Current (All Other Resolutions)	-	17	40	mA	
Low-level Output (Index or 1" >=1000 CPR or 2" >=2000 CPR only)	-	-	0.5	Vdc	IOL = 8.0mA max.
Low-level Output (All Other Resolutions)	-	-	0.4	Vdc	IOL = 3.2mA max.
High-level Output (Index or 1" >=1000 CPR or 2" >=2000 CPR only)	2.4	-	-	Vdc	IOH = -200uA max.
High-level Output (All Other Resolutions)	2.4	-	-	Vdc	IOH = -40 uA max.
Output Current Per Channel	-1.0	-	5.0	mA	

Timing Characteristics

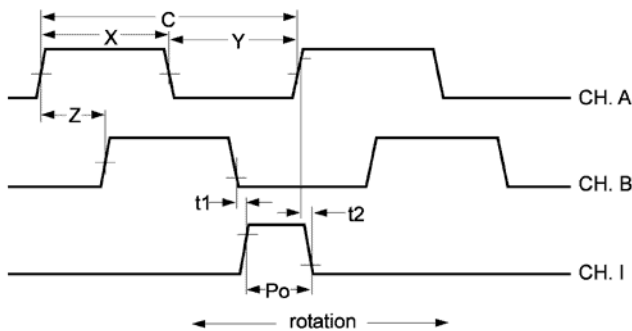
Encoding Characteristics:

- Specifications apply over entire operating temperature range.
- Values are for the worst error over full rotation.
- Refer to Timing Diagram below.

Parameter	Symbol	Min.	Typ.	Max.	Units
Cycle Error (2000 or 2048 CPR only)		-	3.0	7.5	° e

Parameter	Symbol	Min.	Typ.	Max.	Units
Cycle Error (All Other Resolutions)		-	3.0	5.5	° e
Symmetry (2000 or 2048 CPR only)		130	180	230	° e
Symmetry (All Other Resolutions)		150	180	210	° e
Quadrature (2000 or 2048 CPR only)		40	90	140	° e
Quadrature (All Other Resolutions)		60	90	120	° e
Index Pulse Width (2000 or 2048 CPR only)	Po	40	90	140	° e
Index Pulse Width (All Other Resolutions)	Po	60	90	120	° e
Ch. I Rise After Ch. B or Ch. A Fall (2000 & 2048 CPR only)	t1	10	450	1500	ns
Ch. I Rise After Ch. B or Ch. A Fall (All Other Resolutions)	t1	-300	100	250	ns
Ch. I Fall After Ch. B or Ch. A Rise (2000 & 2048 CPR only)	t2	10	250	1500	ns
Ch. I Fall After Ch. B or Ch. A Rise (All Other Resolutions)	t2	70	150	1000	ns

Timing Diagram:



CPR (N): The number of Cycles Per Revolution.

One Shaft Rotation: 360 mechanical degrees, N cycles.

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

One Cycle (C):

360 electrical degrees (° e). Each cycle can be decoded into 1 or 4 codes, referred to as X1 or X4 resolution multiplication.

Symmetry: A measure of the relationship between (X) and (Y) in electrical degrees, nominally 180 ° e.

Quadrature (Z): The phase lag or lead between channels A and B in electrical degrees, nominally 90 ° e.

Index (CH I.): The index output goes high once per revolution, coincident with the low states of channels A and B, nominally 1/4 of one cycle (90 ° e).

Position Error: The difference between the actual shaft position and the position indicated by the encoder cycle count.

Cycle Error: An indication of cycle uniformity. The difference between an observed shaft angle which gives rise to one electrical cycle, and the nominal angular increment of 1/N of a revolution.

Installation Torque

Parameter	Torque
Mounting Screws	3.5 in.-lbs

EM1 / HEDS Comparison

US Digital is the designer and manufacturer of the **EM1** transmissive optical encoder module. The design of the **EM1** provides electrical and mechanical compatibility with the Agilent **HEDS-9000**, **HEDS-9100**, **HEDS-9200**, **HEDS-9040**, and **HEDS-9140** series modules.

The process of switching from the **HEDS** to the **EM1** module should not require any mechanical or electrical changes. Simply use the **EM1** and matching codewheel in place of the **HEDS** module and codewheel. The **EM1** has a built-in index channel available on all resolutions, for both rotary disks and linear strips. The **EM1** uses a US Digital designed codewheel with 2 tracks rather than 3 tracks for index versions. Non-index codewheels are interchangeable between the **EM1** and **HEDS** modules. The **EM1** offers improved output drive capability and will source and sink 8mA at TTL levels.

Physically, the **EM1** has no external wire loops which can interfere when mounting. The connector pins are 0.051" shorter than **HEDS** modules, while still providing .30" insertion depth. US Digital's **EM1** offers custom and special resolutions.

Ordering Information

HEDS -

Model

- 9100-A00
- 9100-B00
- 9100-C00
- 9100-E00
- 9100-F00
- 9100-G00
- 9100-H00
- 9100-I00
- 9100-J00
- 9100-S00
- 9140-A00
- 9140-C00
- 9140-E00
- 9140-F00
- 9140-G00
- 9140-H00
- 9140-I00
- 9140-S00
- 9000-A00
- 9000-B00
- 9000-J00
- 9000-T00
- 9000-U00
- 9040-B00
- 9040-J00
- 9040-T00
- 9200-Q00
- 9200-300
- 9200-360

Notes

- US Digital warrants its products against defects in materials and workmanship for two years. See complete warranty for details.

Base Pricing

Quantity	Price
1	\$28.85
10	\$25.69
50	\$21.91
100	\$19.42

► Add 12% per unit for **Model** of 9100-B00 , 9100-J00 , 9140-A00 , 9140-C00 , 9140-E00 , 9140-F00 , 9140-G00 , 9140-H00 , 9140-I00 , 9140-S00 , 9000-T00 , 9000-U00 , 9040-B00 , 9040-J00 , 9040-T00 , 9200-Q00 , 9200-300 or 9200-360