HEDS Optical Encoder Module

Description:

This optical encoder incremental module is used to detect a linear or rotary position when used together with a codewheel. Each module consists of a lensed LED source and a monolithic detector IC enclosed in a small plastic package. They are available in 2 channel or 3 channel versions. The resolution and index version of the modules and codewheels must match. They can easily be mounted by using 4-40 screws through the mounting holes. These devices are very reliable when connected properly. Improper connections are the most common cause of failure. For maximum noise immunity or cables longer than 6 feet, add a cable driver option (**PC4, EA-D8**). For open collector or higher voltage applications, add the **PC3** device. The suggested mating connector can be found on each encoder's product data sheet, or on the **Cables & Connectors** data sheet. Codewheels, quadrature decoder chips, counter chips, computer interface boards, mating connectors and mating cables are also available.

Agilent announced recently that they will discontinue a number of their optical encoder module resolutions and associated encoders. Some of these discontinued resolutions, plus additional resolutions, will be readily available from US Digital. For further information on our own incremental optical encoder module, please see the **EM1** data sheet.

Features:

- Two channel quadrature output with optional index pulse.
- Resolution up to 2048 CPR.
- No signal adjustment required.
- Small size.
- -40°C to 100°C operating temperature.
- TTL compatible.
- Single +5V supply.

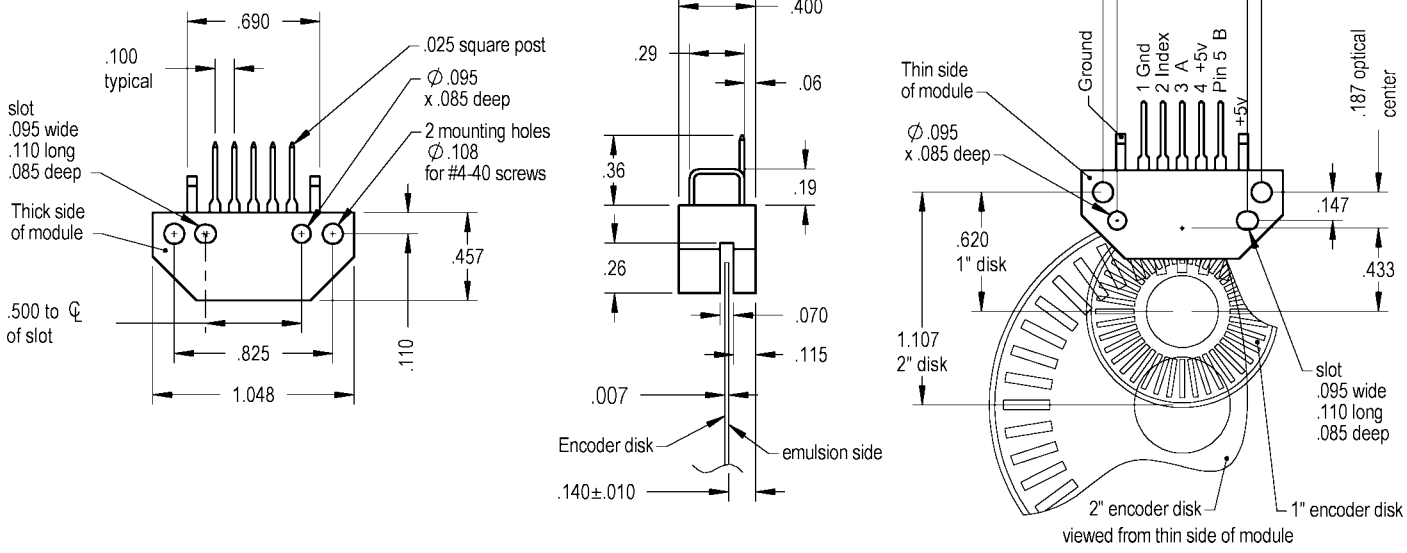
Mechanical Notes:

Parameter	Min.	Max.	Units
Storage temperature	-40	100	℃
Supply voltage, Vcc	-0.5	7.0	Volts
Output voltage	-0.5	Vcc	Volts
Output current per channel	-1.0	5.0	mA

Recommended Operating Conditions:

Parameter	Min.	Max.	Units	Notes
Temperature	-40	100	°C	
Supply voltage	4.5	5.5	Volts	Ripple<100V_{P-P}
Load capacitance	-	100	pF	
Count frequency	-	100	kHz	rpm/60 x cycles/rev.

Mechanical Specifications:



Electrical Characteristics:

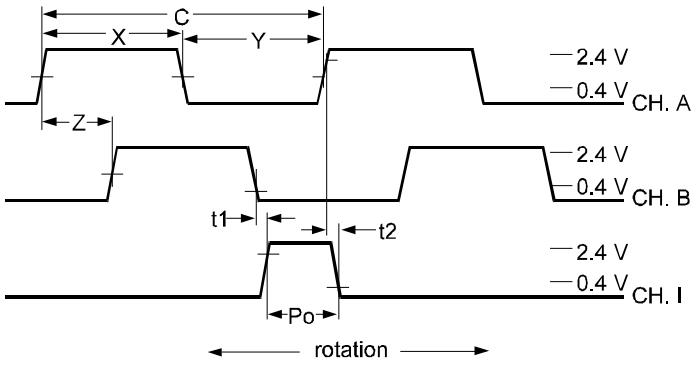
	Non-Index (2-channel) or 1" disk < 1000 CPR or 2" disk < 2000 CPR				With Index Option (3-channel) or 1" disk >= 1000 CPR or 2" disk >= 2000 CPR				
Parameter	**Min.**	**Typ.**	**Max.**	**Notes**	**Min.**	**Typ.**	**Max.**	**Units**	**Notes**
Supply current	-	17	40		30	57	85	mA	
High level output voltage	2.4	-	-	I_{OH} = -40 µA max.[1]	2.4	-	-	Volts	I_{OH} = -200 µA max.
Low level output voltage	-	-	0.4	I_{OL} = 3.2 mA max.	-	-	0.4	Volts	I_{OL} = 3.86 mA max.
Rise time	-	200	-	25pF, 11KOhm pullup	-	180[2]	-	ns	25pF, 2.7KOhm pullup
Fall time	-	50	-	25pF, 11KOhm pullup	-	49[2]	-	ns	25pF, 2.7KOhm pullup

- Over recommended operating range. Typical values are specified at Vcc= 5.0V and 25°C.

1. Unloaded high level output voltage is 4.80v typically, 4.2v minimum.
2. 80 nSec for HEDS-9040 #T00 (2000 CPR With Index).

US Digital™ Corporation
phone: 360.260.2468 • sales: 800.736.0194 • fax: 360.260.2469
email: sales@usdigital.com • website: www.usdigital.com
11100 ne 34th circle • vancouver, washington 98682 USA

Timing Diagram:



CPR (N): The number of Cycles Per Revolution.
One Shaft Rotation: 360 mechanical degrees, N cycles.
One Electrical Degree (°e): 1/360 of one cycle.
One Cycle (C): 360 electrical degrees (°e). 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.

Shaft Rotation for Shaft Encoders:

- View the encoder so the shaft/bushing side is facing up.

H1:
A leads B in a clockwise rotation; B leads A in a counterclockwise rotation.
H3, **H5D, H5S**, **H25**, **S1**, **S2**, **S5D**, **S5S** and **SP-16:**
B leads A in a clockwise rotation; A leads B in a counterclockwse rotation.

Shaft Rotation for Kit Encoders:

- View the encoder so the cover side is facing up.

E3, **E5D**, **E5M**, **E5S** and **E6M:**
A leads B in a clockwise rotation; B leads A in a counterclockwise rotation.
E2:
B leads A in a clockwise rotation; A leads B in a counterclockwise rotation.

Encoder Characteristics:

Parameter	Symbol	Min.	Typ.	Max	Units
Cycle Error			3	5.5	°e
Symmetry		150	180	210	°e
Quadrature		60	90	120	°e
Index Pulse width	Po	60	90	120	°e
CH. I rise after CH. B or CH. A fall	t1	-300	100	250	ns
CH. I fall after CH. A or CH. B rise	t2	70	150	1000	ns

Over recommended operating range. Values are for the worst error over a full rotation.

Encoder Characteristics for HEDS-9040#T00 (2000-I, 2048-I):

Parameter	Symbol	Min.	Typ.	Max	Units
Cycle Error			3	7.5	°e
Symmetry		130	180	230	°e
Quadrature		40	90	140	°e
Index Pulse width	Po	40	90	140	°e
CH. I rise after CH. B or CH. A fall	t1	10	450	1500	ns
CH. I fall after CH. A or CH. B rise	t2	10	250	1500	ns

Over recommended operating range. Values are for the worst error over a full rotation.

Ordering Information:

HEDS–9□□0–□□□□

- **0** = 2 inch disk*
- **1** = 1 inch disk*
- **2** = linear strip*

see disk optic box to the right.

- **0** = non-index
- **4** = index (3rd channel)

* These are normally used with disk sizes indicated, but exceptions are made. Please contact our Sales department to confirm disk and module compatibility.

Module Pricing:

	Low Resolution	High Resolution
HEDS-9000	$25 (<=1000 CPR)	$28
HEDS-9040	$28	$28
HEDS-9100	$25 (<=500 CPR)	$28
HEDS-9140	$28	$28
HEDS-9200	$25	$25

Linear Strip Optics:

CPI	Optics
125	HEDS-9200-M00
127	HEDS-9200-M00
150	HEDS-9200-P00
180	HEDS-9200-Q00
200	HEDS-9200-R00
300	HEDS-9200-300
360	HEDS-9200-360

Unavailable Modules:

A number of Agilent optical encoder modules are being discontinued. The following resolutions are no longer offerered by Agilent, but are available through US Digital's own module, the **EM1**:

200 CPR w/ Index, HEDS-9140-E00
120 CPI, HEDS-9200-L00

For further information on our own incremental optical encoder module, please see the **EM1** data sheet.

Disk Optics:

CPR	1"	2"
50	S00	-
96	C00	-
100	C00	S00
110	C00*	-
120	C00*	-
192	D00*	-
200	E00*	C00
250	F00	-
256	F00	-
360	G00	-
400	H00	D00*
500	A00	A00**
512	I00	A00*
540	R00***	-
1000	B00*	B00
1016	J00*	-
1024	J00*	J00
2000	-	T00
2048	-	U00**

* Index option not available.
** **Index Exceptions (1" & 2"):**
500-I uses 9140-F00 module.
2048-I uses 9040-T00 module.
*** **Non-index Exceptions (1" & 2"):**
540 uses 9200-R00 module (no index).

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