

Description:

This incremental optical encoder 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 6FT, add a cable driver option (see our cable driver products). For open collector or higher voltage applications, add a high voltage cable driver (see the PC3, EA-D5HV, EA-D10HV data sheets).

Agilent announced that they will discontinue a number of their optical encoder module resolutions and associated encoders. Some of these discontinued resolutions, plus additional resolutions, are readily available from US Digital. For further information on our own incremental optical encoder module (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

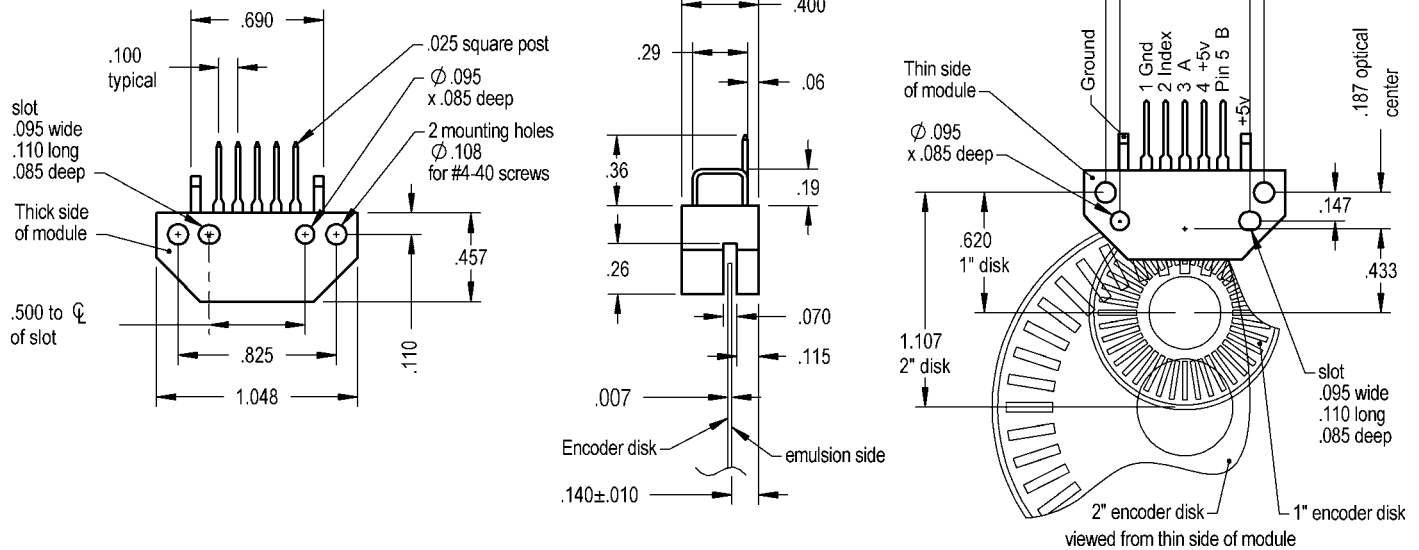
Absolute Maximum Ratings:

Parameter	Min.	Max.	Units
Storage Temperature	-40	100	°C
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 < 100mV _{P-P}
Load Capacitance	-	100	pF	
Count Frequency	-	100	kHz	rpm/60 x cycles/rev.

Mechanical Specifications:



Electrical Characteristics:

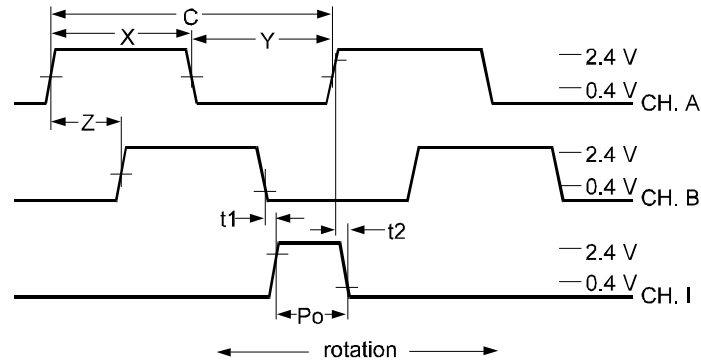
Parameter	Non-Index (2-channel) or 1" disk < 1000 CPR or 2" disk < 2000 CPR				With Index Option (3-channel) or 1" disk => 1000 CPR or 2" disk => 2000 CPR				
	Min.	Typ.	Max.	Notes	Min.	Typ.	Max.	Units	Notes
Supply Current	-	17	40		30	57	85	mA	
High Level Output Voltage	2.4	-	-	I _{OH} = -40 µA max. ^[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

> Specifications apply over entire operating temperature 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).

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, H6D, H6S, HD25, S1, S2, S5D, S5S, S6D, S6S and SP-16:

B leads A in a clockwise rotation; A leads B in a counterclockwise rotation.

Shaft Rotation for Kit Encoders:

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

E3, E5D, E5M, E5S, E6D, E6M and E6S:

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

Specifications apply over entire operating temperature 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

Specifications apply over entire operating temperature range. Values are for the worst error over a full rotation.

Ordering Information:

1" Disk Resolutions & Matching Modules:

CPR	Standard	With Index
32*	EM1-1-32	EM1-1-32
50	HEDS-9100-S00	HEDS-9140-S00
96	HEDS-9100-C00	HEDS-9140-C00
100	HEDS-9100-C00	HEDS-9140-C00
110	HEDS-9100-C00	Unavailable
120	HEDS-9100-C00	Unavailable
192	HEDS-9100-E00	HEDS-9140-E00
200	HEDS-9100-E00	HEDS-9140-E00
250	HEDS-9100-F00	HEDS-9140-F00
256	HEDS-9100-F00	HEDS-9140-F00
360	HEDS-9100-G00	HEDS-9140-G00
400	HEDS-9100-H00	HEDS-9140-H00
500	HEDS-9100-A00	HEDS-9140-A00
512	HEDS-9100-I00	HEDS-9140-I00
540	HEDS-9100-I00	Unavailable
1000	HEDS-9100-B00	Unavailable
1016	HEDS-9100-J00	Unavailable
1024	HEDS-9100-J00	Unavailable

* Only available in EM1.

2" Disk Resolutions & Matching Modules:

CPR	Standard	With Index
64*	EM1-1-32	EM1-1-32
100	HEDS-9100-S00	HEDS-9140-S00
200	HEDS-9100-C00	HEDS-9140-C00
400	HEDS-9100-E00	Unavailable
500	HEDS-9000-A00	HEDS-9140-F00
512	HEDS-9000-A00	Unavailable
1000	HEDS-9000-B00	HEDS-9040-B00
1024	HEDS-9000-J00	HEDS-9040-J00
2000	HEDS-9000-T00	HEDS-9040-T00
2048	HEDS-9000-U00	HEDS-9040-T00

* Only available in EM1, 64 CPR uses the EM1-1-32 module.

Standard Price:

\$25.00 / 1
 \$22.00 / 10
 \$20.00 / 50
 \$18.50 / 100
 \$17.50 / 500
 \$17.00 / 1K

Index/Linear/HiRes/Price:

HiRes: =>540 CPR (1"), =>1016 CPR (2")
 \$28.00 / 1
 \$24.64 / 10
 \$22.40 / 50
 \$20.72 / 100
 \$19.60 / 500
 \$19.04 / 1K

Linear Strip Resolutions & Matching Modules:

CPR	Standard	With Index
120*	EM1-0-120	EM1-0-120
125	EM1-0-127	EM1-0-127
127	EM1-0-127	EM1-0-127
150	EM1-0-150	EM1-0-150
180	HEDS-9200-Q00	Unavailable
200	EM1-0-200	EM1-0-200
250	EM1-0-250	EM1-0250
300	HEDS-9200-300	Unavailable
360	HEDS-9200-360	Unavailable

* Only available in EM1, 125 CPI uses the EM1-0-127 module.

EM1 Pricing:

For EM1 pricing and ordering information, please see the EM1 Data Sheet.

Discontinued Modules:

A number of Agilent optical encoder modules are being discontinued. The following modules are no longer offered by Agilent:

> HEDS-9200-L00	120 CPI
> HEDS-9200-M00	127 CPI
> HEDS-9200-P00	150 CPI
> HEDS-9200-R00	540 CPR
	200 CPI
> HEDS-9100-D00	192 CPR

Technical Data, Rev. 03.19.03, March 2003
 All information subject to change without notice.