

## H5 Features

- Ball-bearing option tracks to 10,000 RPM
- 2-channel quadrature with optional index
- Multiple Output Drive Options
- 32 to 5,000 cycles per revolution (CPR)
- 128 to 20,000 pulses per revolution (PPR)
- Wide operating temperature



## H5 Product Description

The H5 series ball-bearing optical shaft encoder has a molded polycarbonate housing and utilizes either a 5-pin or 10-pin latching connector. This non-contacting rotary to digital converter is designed to provide digital feedback information.



The H5 is fully assembled with a brass shaft, two 1/4 in. ID by 1/2 in. OD heavy-duty ball bearings and a mounting plate. The mounting plate comes with 2 mounting holes for #4 size screws.

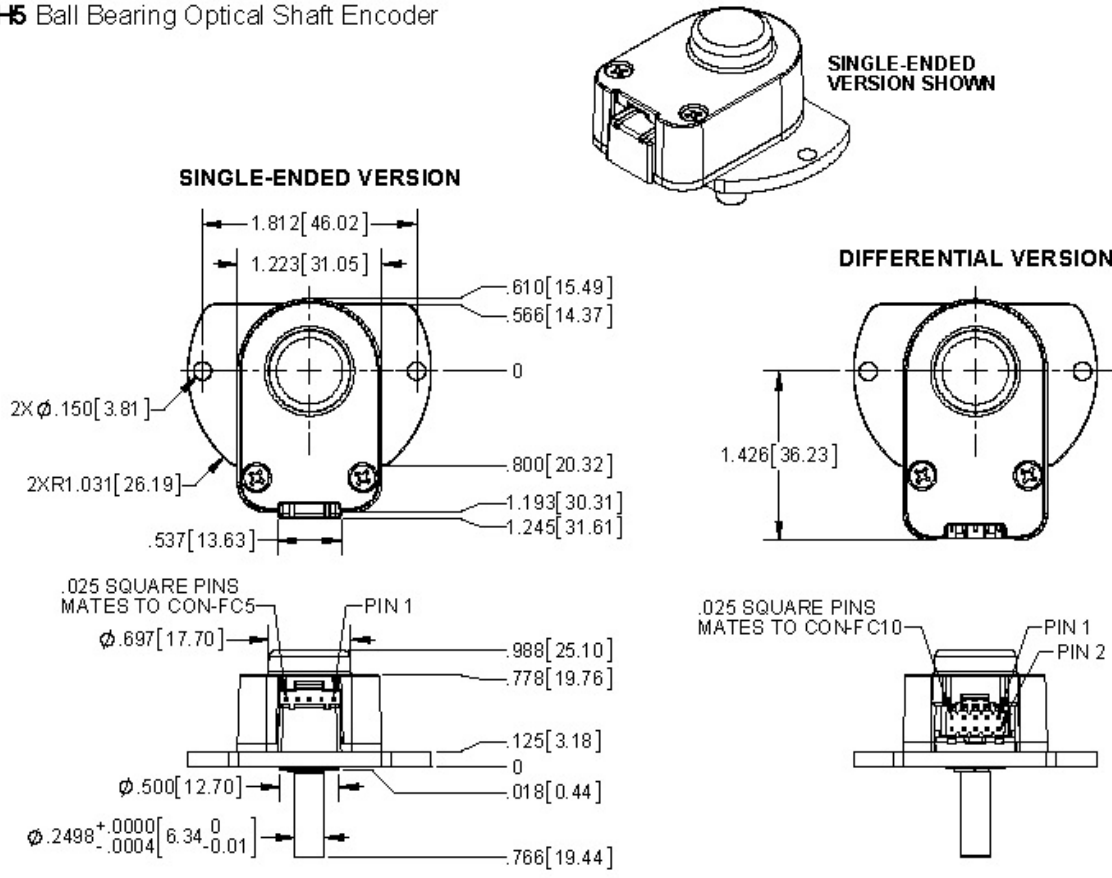
A secure connection to the H5 Series encoder is made through a 5-pin (single-ended versions) or 10-pin (differential or high-voltage versions) latching connector. The mating connectors are available from US Digital with several cable options and lengths.

The internal differential line driver (26C31) can source and sink 20mA at TTL levels for differential versions. The recommended receiver is the industry-standard 26C32. Maximum noise immunity is achieved when the differential receiver is terminated with a 150  $\Omega$  resistor in series with a .0047  $\mu$ F capacitor placed across each differential pair. The capacitor conserves power; otherwise, power consumption would increase by approximately 20mA per pair or 60mA for 3 pairs.

## Mechanical Drawings

## H5 Ball Bearing Optical Shaft Encoder

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UNITS: INCHES (MM)  
METRIC SHOWN FOR REFERENCE ONLY

## Specifications

### ENVIRONMENTAL

Parameter	Value	Units
Operating Temperature, CPR < 2000	-40 to 100	C
Operating Temperature, CPR ≥ 2000	-25 to 100	C
Electrostatic Discharge		kV
Single-ended (S option), IEC 61000-4-2	± 4	
Differential (D, L option), Human Body Model	± 2	
High-Voltage, Open-collector (H, C option), IEC 61000-4-2	± 4	
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G



## MECHANICAL

PARAMETER	VALUE
Max. Acceleration	100000 rad/sec <sup>2</sup>
Max. Shaft Speed (mechanical)	10000 rpm (1)
Max. Shaft Torque	0.05 in-oz
Max. Shaft Loading	2 lbs.
Bearing Life	life in millions of revs. = $(90/P)^3$ where P = radial load in pounds.
Weight	
Single-ended (S option)	1.79 oz.
Differential (D option)	1.89 oz.
High-Voltage, Open-Collector (H, C option)	1.89 oz.
Max. Shaft Runout	0.006 in. T.I.R.
Mounting Plate Screw Torque	(#4-40) 4-6
Moment of Inertia	0.001 oz-in-s <sup>2</sup>
Technical Bulletin TB1001 - Shaft and Bore Tolerances	Download ( <a href="https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/">https://www.usdigital.com/support/resources/reference/technical-docs/technical-bulletins/shaft-and-bore-tolerances-tb1001/</a> )

(1) The maximum speed due to electrical considerations is dependent on the CPR. See the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) and EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages.

## PHASE RELATIONSHIP

B leads A for clockwise shaft rotation, and A leads B for counterclockwise rotation when viewed from the shaft side of the encoder.

## SINGLE-ENDED OPTION

- S option provides 5V TTL compatible outputs
- Specifications apply over the entire operating temperature range
- Typical values are specified at  $V_{cc} = 5.0V_{dc}$  and  $25^{\circ}C$
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		27	33	mA	CPR < 500, no load
		54	62	mA	CPR $\geq$ 500 and < 2000, no load
		72	85	mA	CPR $\geq$ 2000, no load
Low-level Output			0.5	V	$I_{OL} = 8mA$ max., CPR < 2000
			0.5	V	$I_{OL} = 5mA$ max., CPR $\geq$ 2000
		0.25		V	no load, CPR $\geq$ 2000
High-level Output	2.0			V	$I_{OH} = -8mA$ max. and CPR < 2000
	2.0			V	$I_{OH} = -5mA$ max. and CPR $\geq$ 2000
		4.8		V	no load and CPR < 2000
		3.5		V	no load and CPR $\geq$ 2000
Output Current Per Channel	-8		8	mA	CPR < 2000
	-5		5	mA	CPR $\geq$ 2000
Output Rise Time		110		nS	CPR < 2000
		50		nS	CPR $\geq$ 2000, $\pm 5mA$ load
Output Fall Time		100		nS	CPR < 2000
		50		nS	CPR $\geq$ 2000, $\pm 5mA$ load



## DIFFERENTIAL OPTION

- D Option provides differential line driver outputs
- Specifications apply over the entire operating temperature range
- Typical values are specified at  $V_{cc} = 5.0V_{dc}$  and  $25^{\circ}C$
- For complete details, see the EM1 (<https://www.usdigital.com/products/em1>) and EM2 (<https://www.usdigital.com/products/em2>) product pages

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	4.5	5.0	5.5	V	
Supply Current		29	36	mA	CPR < 500, no load
		56	65	mA	CPR $\geq$ 500 and < 2000, no load
		74	88	mA	CPR $\geq$ 2000, no load
Low-level Output		0.2	0.4	V	$I_{OL} = 20mA$ max.
High-level Output	2.4	3.4		V	$I_{OH} = -20mA$ max.
Differential Output Rise/Fall Time			15	nS	

## HIGH-VOLTAGE OPTION

- H option uses a higher supply voltage and provides both single-ended and open-collector outputs
- Single-ended outputs are 5V TTL compatible (same as S option). See Pin-out.
- Specifications apply over the entire operating temperature range
- For complete details, see the EM1 (<https://www.usdigital.com/products/encoders/incremental/modules/em1/>) or EM2 (<https://www.usdigital.com/products/encoders/incremental/modules/em2/>) product pages

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Supply Voltage	7.5		30.0	V	
Supply Current, 24V power		8	10	mA	CPR < 500, no load
		16	19	mA	CPR $\geq$ 500 and < 2000, no load
		22	25	mA	CPR $\geq$ 2000, no load
Open Collector "On" Resistance		2		ohms	
Open Collector Sink Current			200	mA	
Output Low Voltage			0.4	V	200 mA sink current
Open Collector Pullup Voltage			50	V	



## PIN-OUT

5-PIN SINGLE-ENDED S OPTION		10-PIN DIFFERENTIAL D OPTION	
Pin	Description	Pin	Description
1	Ground	1	Ground
2	Index	2	Ground
3	A channel	3	Index-
4	+5VDC power	4	Index+
5	B channel	5	A- channel
		6	A+ channel
		7	+5VDC power
		8	+5VDC power
		9	B- channel
		10	B+ channel

10-PIN HIGH-VOLTAGE H OPTION (2)	
Pin	Description
1	Ground
2	Ground
3	Index- (open collector)
4	Index+ (single-ended)
5	A- channel (open collector)
6	A+ channel (single-ended)
7	7.5-30V power
8	7.5-30V power
9	B- channel (open collector)
10	B+ channel (single-ended)

(1) 5-pin single-ended mating connector is CON-FC5 (<https://www.usdigital.com/products/accessories/connectors/con-fc5/>).



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(2) 10-pin differential mating connector is CON-FC10 (<https://www.usdigital.com/products/accessories/connectors/con-fc10/>).

## Notes

- Cables and connectors are not included and must be ordered separately.
- US Digital® warrants its products against defects in materials and workmanship for two years. See complete warranty (<https://www.usdigital.com/company/warranty>) for details.

## Configuration Options

H5	CPR (Cycles Per Revolution)	Index	Output
	32	IE ( <i>Index</i> )	S ( <i>Single-Ended</i> )
	50	NE ( <i>Non-Index</i> )	H ( <i>Single-Ended High-Voltage</i> )
	96		D ( <i>Differential</i> )
	100		
	192		
	200		
	250		
	256		
	360		
	400		
	500		
	512		
	540		
	720		
	800		
	900		
	1000		
	1024		
	1250		
	2000		
	2048		
	2500		
	4000		
	4096		
	5000		

**PLEASE NOTE: This chart is for informational use only.** Certain product configuration combinations are not available. Visit the H5 product page (<https://www.usdigital.com/products/H5>) for pricing and additional information.