



## HB5M Features

- Hollow bore (hollow shaft/thru-bore) bearing design
- Rugged anodized aluminum housing
- Heavy-duty ball bearings track up to 6,000 RPM
- Positive latching polarized connector
- 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)



## HB5M Product Description

The HB5M is a hollow bore (hollow shaft/thru-bore) optical encoder with a machined aluminum enclosure and an anodized protective finish. The HB5M optical incremental encoder is designed to easily mount to an existing shaft to provide digital feedback information. Typical applications include motor feedback, process control, robotics, textile machines, and elevator controls.

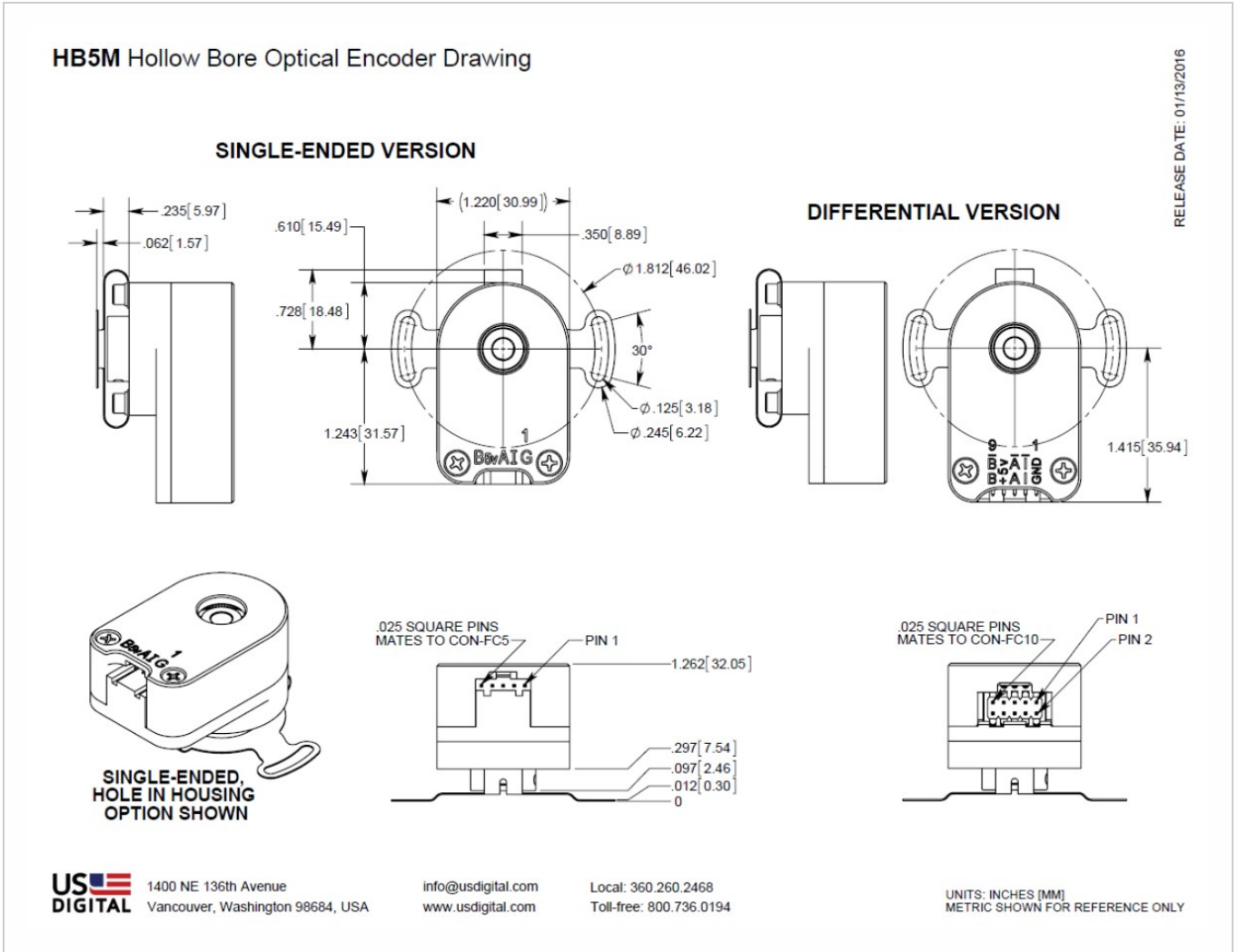


The HB5M bearing style encoder features a hollow bore that accepts shaft diameters from 5mm to 8mm in diameter. The encoder slips over the shaft and is locked into place with two 4-48 set screws. A flexible anti-rotation mount makes the encoder more tolerant of shaft runout than a standard kit encoder. The HB5M can accommodate shaft axial play up to  $\pm 0.030$  in. and shaft runout up to 0.010 in. The flexible tether provides mounting for two 4-40 machine screws on a 1.812 in. bolt circle.

The HB5M housing comes standard with a closed cover or an optional hole in the body to allow a shaft to pass completely through the encoder.

A secure connection to the HB5M 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.

## Mechanical Drawings



## 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 version), IEC 61000-4-2	± 4	
Differential (-D version), 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)	6000 rpm (1)
Max. Starting Torque	0.20 oz-in
Max. Bore Load	2 lb.
Weight	2.84 oz.
Max. Shaft Runout	0.010 in. T.I.R.
Max. Shaft Axial Play	± 0.030 in.
Required Shaft Length (From mounting surface)	Min. = 0.3 in. Max. = 1.0 in. with default cover. Max. = No limit with H-option cover.
Moment of Inertia	1.29 x 10 <sup>-4</sup> oz-in-sec <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

A leads B in a clockwise shaft rotation, and B leads A in counterclockwise shaft rotation when viewed from the rear side (opposite flexible mount) 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
		0.05		V	no load, CPR < 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 output
- 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		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-OUTS

5-PIN SINGLE-ENDED S OPTION (1)		10-PIN DIFFERENTIAL D OPTION (2)	
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/>).

(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.
- For ordering information please see the Compatible Cables / Connectors section above.

## Configuration Options

HB5M	CPR (Cycles Per Revolution)	Bore Size	Index	Output	Housing
	32	197 (5.0mm)	IE (Index)	S (Single-Ended)	D (Default)
	50	236 (6.0mm)	NE (Non-Index)	H (Single-Ended High-Voltage)	H (Hole in Cover)
	96	250 (1/4")		D (Differential)	
	100	313 (5/16")			
	120	315 (8.0mm)			
	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 HB5M product page (<https://www.usdigital.com/products/HB5M>) for pricing and additional information.