



## EC35 Features

- Now 500 to 60,000 CPR
- Quick, simple assembly
- A/B/Z differential outputs
- U/V/W commutation outputs (differential or open-collector)
- 2,000 to 240,000 quadrature states per rev.
- Frequency response from DC up to 1 MHz
- Fits shaft diameters from 0.197 in. (5mm) to 0.375 in. (3/8 in.)
- Single 5V supply



## EC35 Product Description

The EC35 quick assembly optical commutation encoder is designed for high volume, low cost, OEM motion control applications. The EC35 provides A/B/Z incremental outputs and U/V/W outputs for brushless motor commutation.



The EC35 is designed to be a one-time installation that mounts to the motor using 2 screws on a 1.28" or 1.812" diameter bolt circle. The precision machined encoder hubdisk pushes on when the encoder assembly is put on the motor shaft. This design securely grips the shaft without set screws. A built-in, removable spacer tool ensures that the encoder disk is automatically set to the correct gap when the encoder housing is mounted. The encoder can be "timed" by rotating a ring on the assembly and pressing the ring in with a simple tool to lock everything into place.

The EC35 is powered by a single 5V supply and comes with a 15-pin connector that provides differential outputs for A/B/Z and U/V/W. Open-collector U/V/W outputs are available as an option. The EC35 can obtain single-ended output by only using the + outputs of each differential pair. The internal 26C31 line drivers can source and sink 20 mA at TTL levels. The recommended differential 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.

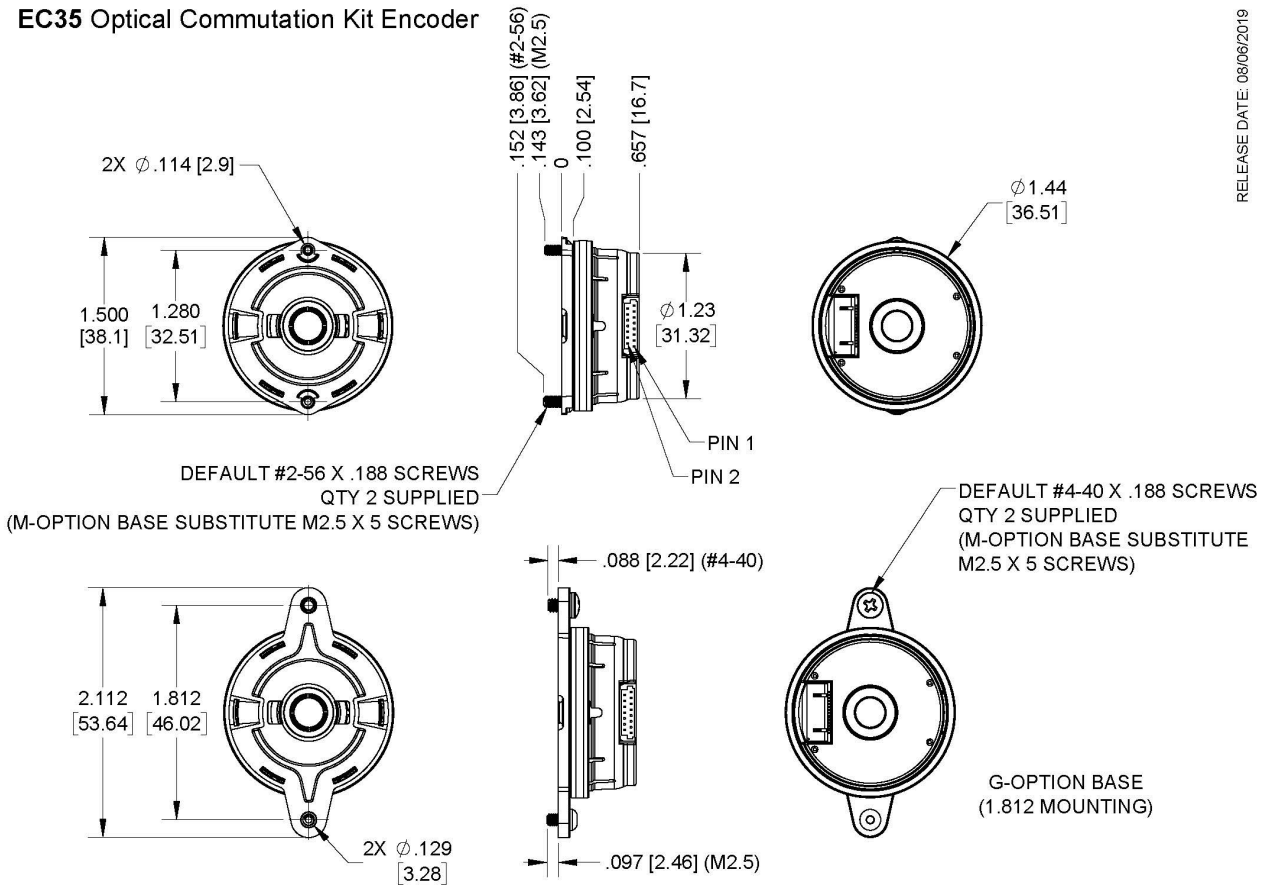
**Please Note:** Due to the EC35's push-on hub design, it is recommended for use as a one-time installation.

## Mechanical Drawings



RELEASE DATE: 08/09/2019

## EC35 Optical Commutation Kit Encoder



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UNITS: INCHES [MM]  
 METRIC SHOWN FOR REFERENCE ONLY

## Specifications

### ENVIRONMENTAL

PARAMETER	PARAMETER	UNITS
Operating Temperature	-20 to 105	C
Electrostatic Discharge, IEC 61000-4-2	$\pm$ 12	kV
Vibration (10Hz to 2kHz, sinusoidal)	20	G
Shock (6 milliseconds, half-sine)	75	G



## MECHANICAL

PARAMETER	VALUE	UNITS
Max. Shaft Axial Play	±0.003	in.
Max. Shaft Runout	0.001 T.I.R.	in.
Max. Acceleration	250000	rad/sec <sup>2</sup>
Maximum RPM, CPR ≤ 2500 e.x. CPR = 2500, max rpm = 9600	$((24 \times 10^6) / \text{CPR})$	RPM
Maximum RPM, CPR = 4000	12000	RPM
Maximum RPM, CPR = 5000	9600	RPM
Maximum RPM, CPR = 10000	6000	RPM
Maximum RPM, CPR = 20000	3000	RPM
Maximum RPM, CPR = 40000	1440	RPM
Maximum RPM, CPR = 60000	960	RPM
Codewheel Moment of Inertia	$6.48 \times 10^{-5}$	oz-in-s <sup>2</sup>
Required Shaft Length	0.500 to 0.565	in.
Mounting Screw Torque	2-3	in-lbs
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> )	

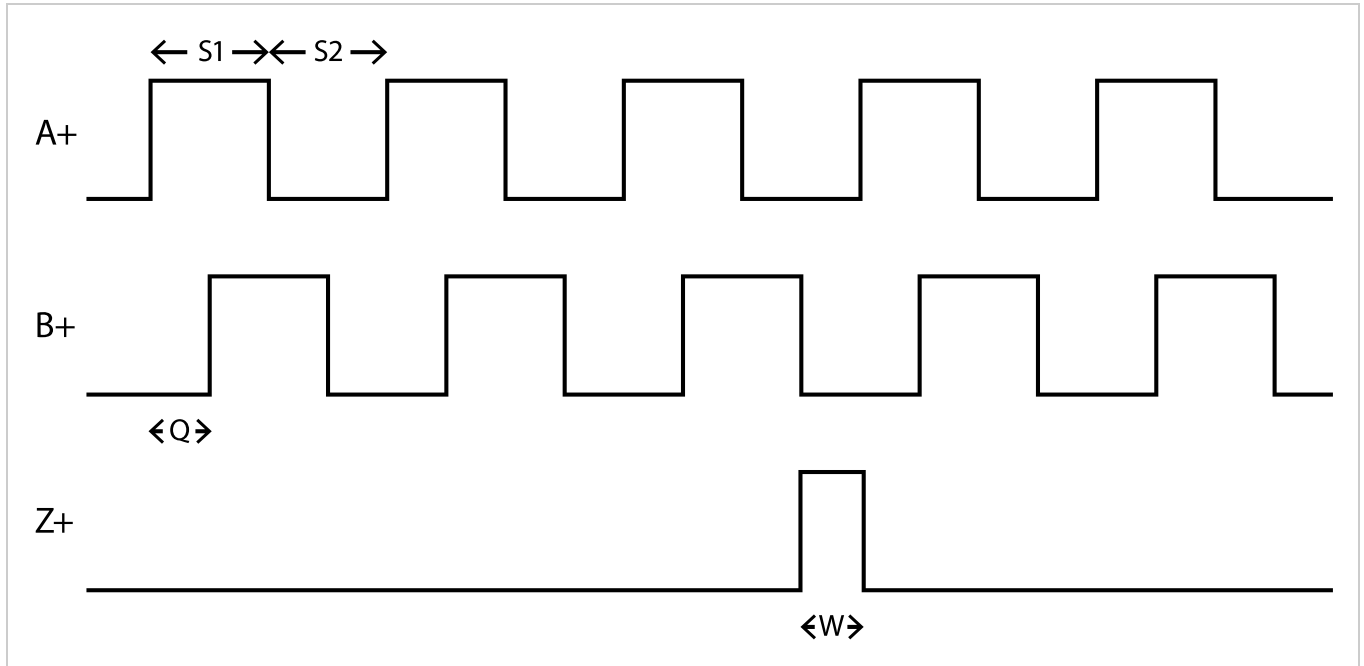


## ELECTRICAL

SPECIFICATIONS	MIN.	TYP.	MAX.	UNITS	NOTES
Supply Current CPR ≤ 2500 CPR > 2500		13 37	17 44	mA	no output load, max. frequency output
Supply Voltage	4.5	5.0	5.5	V	
Differential High Level Output	2.5	3.5		V	I <sub>oh</sub> = -8 mA
Differential Low Level Output			0.5	V	I <sub>ol</sub> = 8 mA
Differential Rise/Fall Time		100		ns	
Open collector pullup voltage			30	V	I <sub>load</sub> = 100 mA
Open collector "on" resistance		0.2		ohm	I <sub>load</sub> = 100 mA
Frequency Response, CPR ≤ 2,500			400	kHz	
Frequency Response, CPR = 4,000 & 5000			800	kHz	
Frequency Response, CPR = 10,000			1	MHz	
Frequency Response, CPR = 20,000 / 40,000 / 60,000			960	kHz	



## INCREMENTAL OUTPUT TIMING



PARAMETER	MIN.	TYP.	MAX.	UNITS
Symmetry, S1, S2	108	180	252	elec. deg.
Quadrature Delay, Q	45	90	135	elec. deg.
Index Width, W	45	90	135	elec. deg.

A leads B for CCW shaft rotation, and B leads A for CW rotation viewed from the top side of the encoder.

## ACCESSORIES

Screws:

### Part #: SCREW-256-188-SH

Description: Socket Head Cap, #2-56 UNC x 3/16"

Use: Base Mounting

Quantity Required: 2

Screws are included

### Part #: SCREW-M25-5MM-PH

Description: Pan Head, Phillips M2.5 x 0.45 x 5mm

Use: Base Mounting

Quantity Required: 2

### Part #: SCREW-M25-5MM-BH

Description: Button Head Cap, M2.5 x 0.45 x 5mm

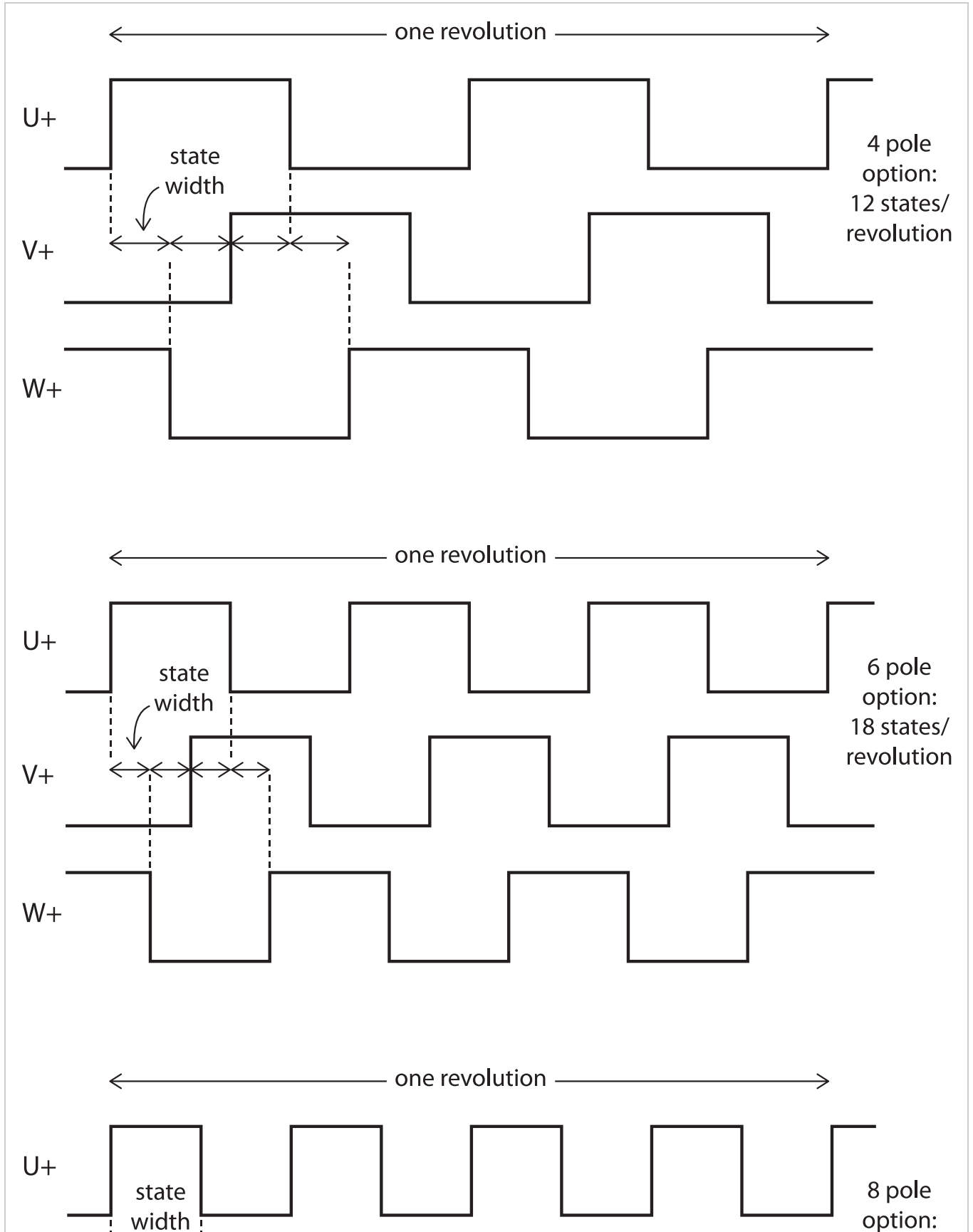
Use: Base Mounting

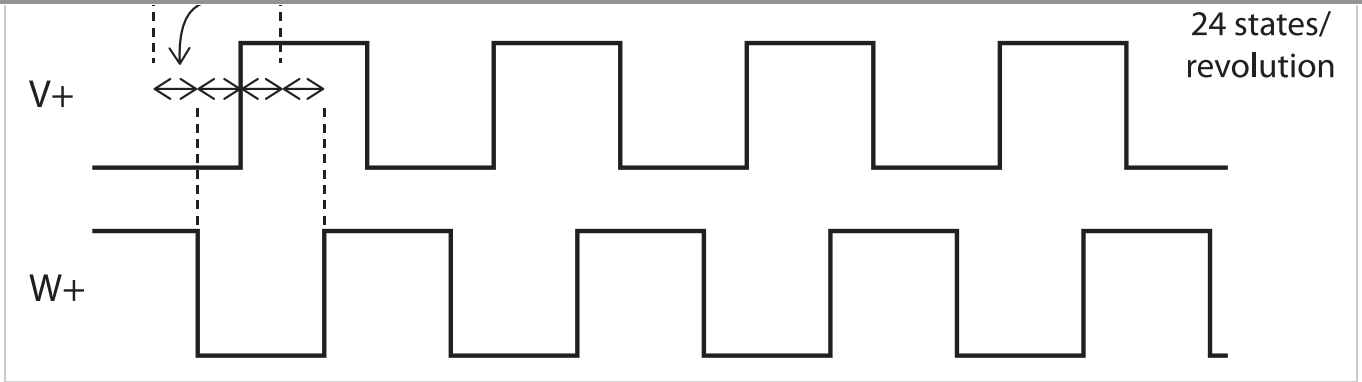
Quantity Required: 2

Screws are included



## COMMUTATION OUTPUT TIMING





PARAMETER	MIN.	TYP.	MAX.	UNITS
State width, 4 pole	27	30	33	angular deg.
State width, 6 pole	17	20	23	angular deg.
State width, 8 pole	12	15	18	angular deg.
State width, 10 pole	9	12	15	angular deg.
State width, 12 pole	7	10	13	angular deg.



## PIN-OUTS

Pin	"D" Output Option	"C" Output Option	"0" pole Option
1	A+ (A Quadrature)	A+ (A Quadrature)	A+ (A Quadrature)
2	A-	A-	A-
3	B+ (B Quadrature)	B+ (B Quadrature)	B+ (B Quadrature)
4	B-	B-	B-
5	Z+ (Index)	Z+ (Index)	Z+ (Index)
6	Z-	Z-	Z-
7	U+ (U Commutation)	U (Open collector)	no connection
8	U-	no connection	no connection
9	V+ (V Commutation)	V (Open collector)	no connection
10	V-	no connection	no connection
11	W+ (W Commutation)	W (Open collector)	no connection
12	W-	no connection	no connection
13	+5V power	+5V power	+5V power
14	GND	GND	GND
15	no connection	no connection	no connection

## 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

EC35	CPR (Cycles Per Revolution)	Motor Poles	Bore Size	Index Gating	Output	Base	Packaging
		0	197 (5.0mm)	H (A/B High)	C (Open-Collector U/V/W)	D (1.28" Diameter Bolt Circle, #2-56 x 3/16" Screws)	B (Encoders packaged in bulk.)
	500	4	236 (6.0mm)	H (A/B High)	C (Open-Collector U/V/W)	D (1.28" Diameter Bolt Circle, #2-56 x 3/16" Screws)	B (Encoders packaged in bulk.)
	1000	6	250 (1/4")	L (A/B Low)	D (Differential U/V/W)	DM (1.28" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	1250	8	315 (8.0mm)	L (A/B Low)	D (Differential U/V/W)	DM (1.28" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	2000	10	375 (3/8")	L (A/B Low)	D (Differential U/V/W)	DM (1.28" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	2500	12				DM (1.28" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	4000					GM (1.812" Diameter Bolt Circle, #4-40 x 3/16" Screws)	B (Encoders packaged in bulk.)
	5000					GM (1.812" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	10000					GM (1.812" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	20000					GM (1.812" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	40000					GM (1.812" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)
	60000					GM (1.812" Diameter Bolt Circle, M2.5 x 5 Screws)	B (Encoders packaged in bulk.)

**PLEASE NOTE: This chart is for informational use only.** Certain product configuration combinations are not available. Visit the EC35 product page (<https://www.usdigital.com/products/EC35>) for pricing and additional information.