

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 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. Single ended output can be obtained 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 Ω resistor in series with a .0047 μ 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.



Features

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

Rev. 191114131754



EC35

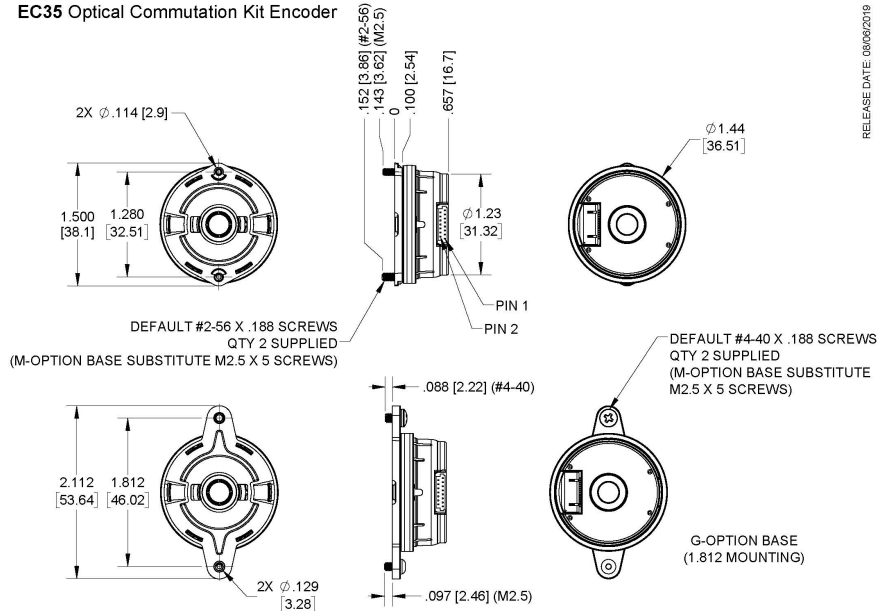
Optical Commutation Kit Encoder

Page 2 of 7



Mechanical Drawing

EC35 Optical Commutation Kit Encoder



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UNITS: INCHES (MM)
METRIC SHOWN FOR REFERENCE ONLY

Parameter	Parameter	Units
Operating Temperature	-20 to 105	C
Vibration, 10Hz to 2kHz, sinusoidal	20	G
Shock, 6 millisecond, half-sine	75	G
Electrostatic Discharge, IEC 61000-4-2	± 12	kV



Mechanical

Parameter	Min.	Max.	Units
Codewheel Moment of Inertia		6.48×10^{-5}	oz-in-s ²
Required Shaft Length (for center hole encoder cover)	0.5	0.565	in.
Shaft Axial Play	-0.003	0.003	in.
Mounting Shaft Total Runout	-	0.001	in.
Acceleration	-	250,000	rad/sec ²
Maximum RPM, CPR $\leq$ 2,500 e.x. CPR = 2,500, max. rpm = 9,600	-	24,000,000/CPR	RPM
Maximum RPM, CPR = 4,000		12,000	RPM
Maximum RPM, CPR = 10,000		6,000	RPM

Rev. 191114131754

Parameter	Min.	Max.	Units
Maximum RPM, CPR = 20,000		3,000	RPM
Maximum RPM, CPR = 40,000		1,440	RPM
Maximum RPM, CPR = 60,000		960	RPM
Base to Mounting Surface Screw Torque	-	3	in-lbs
Technical Bulletin TB1001 - Shaft and Bore Tolerances			Download

Materials

Part	Material
Base/Housing	20% glass filled PBT
Codewheel	Aluminum/Mylar

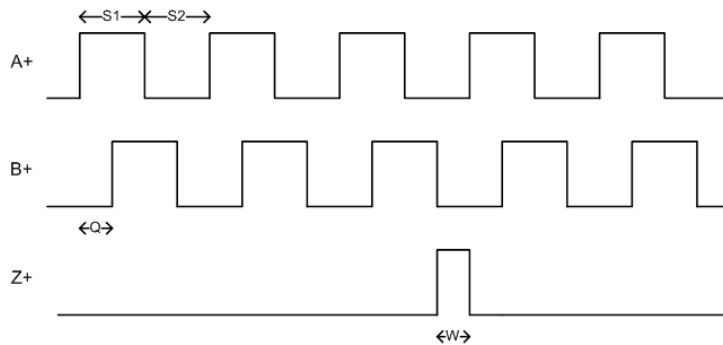
Electrical

Specifications	Min.	Typ.	Max.	Units	Notes
Supply Current					
CPR ≤ 2500		13	17	mA	no output load, max. frequency output
CPR > 2500		37	44		
Supply Voltage	4.5	5.0	5.5	V	
Differential High Level Output	2.5	3.5		V	I _{oh} = -8 mA
Differential Low Level Output			0.5	V	I _{ol} = 8 mA
Differential Rise/Fall Time		100		ns	
Open collector pullup voltage			30	V	I _{load} = 100 mA
Open collector "on" resistance		0.2		ohm	I _{load} = 100 mA
Frequency Response, CPR ≤ 2,500			400	kHz	
Frequency Response, CPR = 4,000			800	kHz	
Frequency Response, CPR = 10,000			1	MHz	
Frequency Response, CPR = 20,000 / 40,000 / 60,000			960	kHz	

Rev. 191114131754



Incremental Output Timing

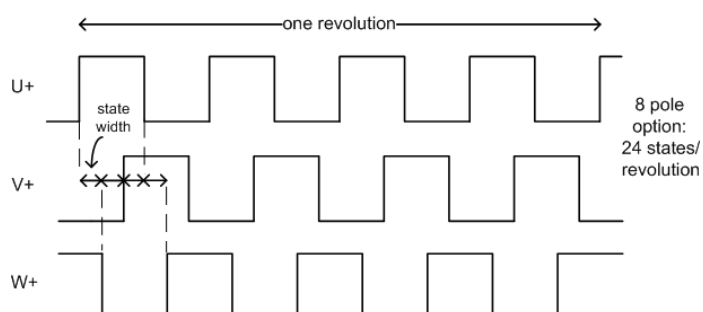
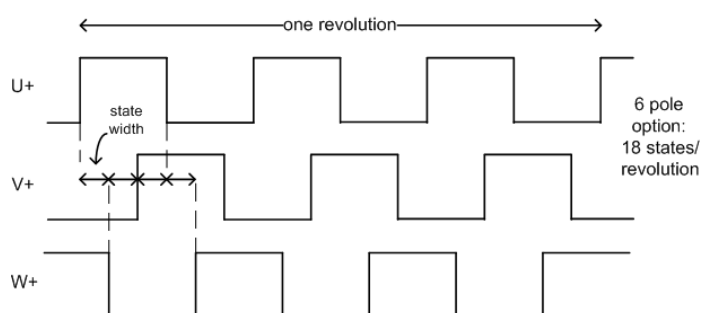
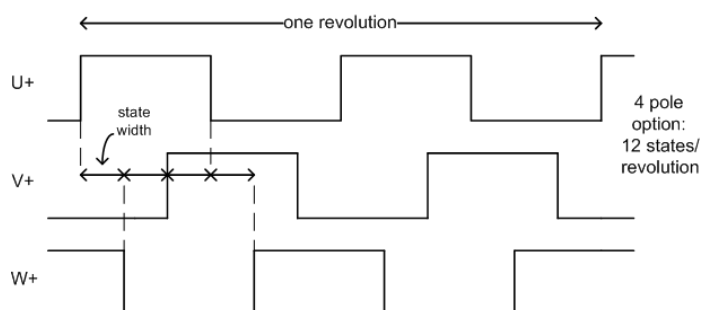


Parameter	Min.	Typ.	Max.	Units
Symmetry, S1, S2	108	180	252	elec. deg.
Quadrature Delay, Q	45	90	135	elec. deg.
Index Width, W	45	90	135	elec. deg.

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

Rev. 191114131754

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.

Rev. 191114131754



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

Rev. 191114131754





EC35

Optical Commutation Kit Encoder

Page 7 of 7



Ordering Information

EC35 - - - - - - -

CPR	Motor Poles	Bore	Index Gating	Output	Base	Packaging
500 =	0	197 =	H =A/B High	D =Differential	D =1.28" diam. bolt	B =Encoder components packaged in bulk - One centering tool per 10 encoders
1,000 =	4 =	5mm	L =A/B Low	A/B/Z and	circle mount, #2-56	
2,000 =	6 =	236 =		Differential U/V/W	x 3/16 screws (qty.	
2,500 =	8 =	6mm		C =Differential	2)	
4,000 =	10 =	250 =		A/B/Z and Open-	DM =1.28" diam.	
10,000 =	12 =	1/4"		collector U/V/W	bolt circle mount,	
20,000 =		315 =			M2.5 x 5 screws	
40,000 =		8mm			(qty. 2)	
60,000 =		375 =			G =1.812" diam.	
		3/8"			bolt circle mount,	
					#4-40 x 3/16	
					screws (qty. 2)	
					GM =1.812" diam.	
					bolt circle mount,	
					M2.5 x 5 screws	
					(qty. 2)	

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 for details.

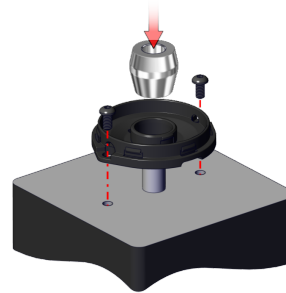
Rev. 191114131754

EC35 Assembly and Timing Instructions

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

Step 1:

Slip base and then centering tool over the shaft. Press down on the centering tool to secure the base in an aligned position on the mounting/motor surface and tighten the two mounting screws. Remove the centering tool.



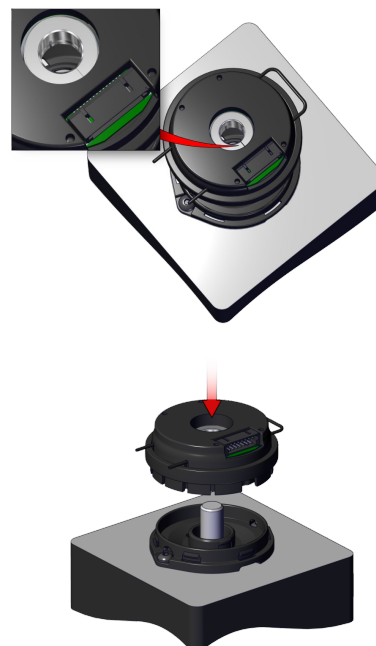
Step 2:

Energize the U phase motor winding with a positive DC voltage (relative to V or W) to lock the motor into position.

Step 3*:

Align assembled encoder over the motor shaft so that the mark on the hub is oriented in the desired direction for cable exit; this aligns the encoder's index and U signals to the motor's U winding. Note: the index marking on the disk is located ~180 deg. from the hub marking. Press the encoder onto the shaft until it snaps down on the previously mounted base. Press firmly near the cover through hole to ensure that the encoder gap is set. **Caution:** Do not press directly on the connector to avoid damaging the connector shroud.

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



Step 4:

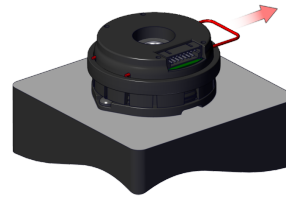
De-energize the U phase motor winding

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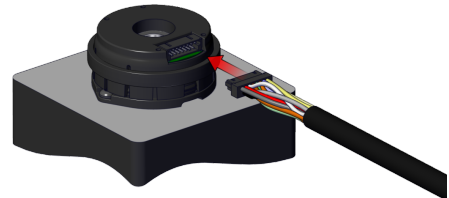
Step 5:

Remove encoder spacer tool to free hubdisk. The encoder is now properly gapped.



Step 6:

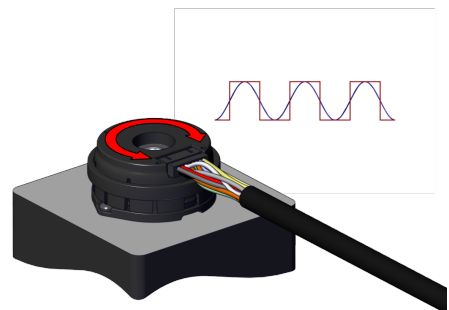
Attach the cable.



Step 7:

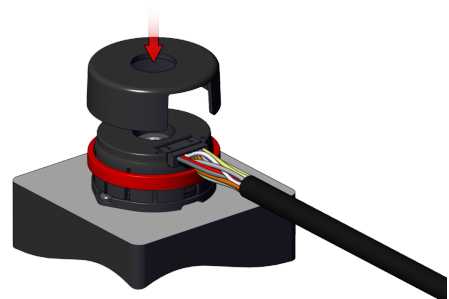
Dynamic Timing

Connect motor U winding and encoder U output to separate channels of an oscilloscope. Use a second motor to back drive the target motor and rotate the encoder until the two signals are aligned with each other. Full 360° encoder rotation allows any instance of the U winding to be located.



Step 8:

After the encoder is timed use the included tool to push the external ring all the way down, employing caution as not to rotate the encoder, until it bottoms out against the base. This will lock the encoder into its final position. Remove tool.

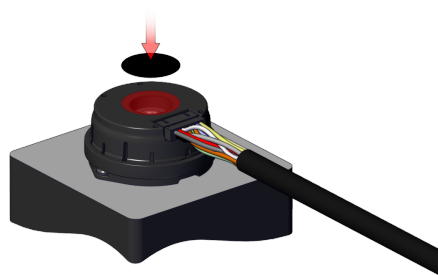


EC35 Assembly and Timing Instructions

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Step 9 (optional):

Apply the center-hole encoder cover to seal the opening.

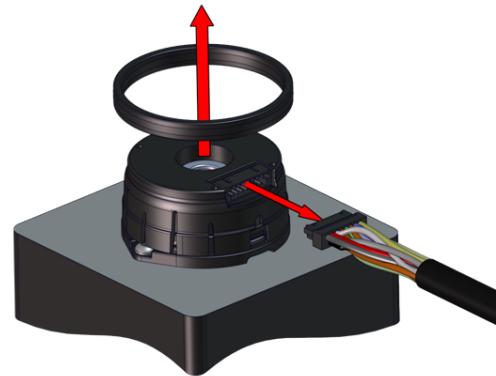


EC35 Removal Instructions

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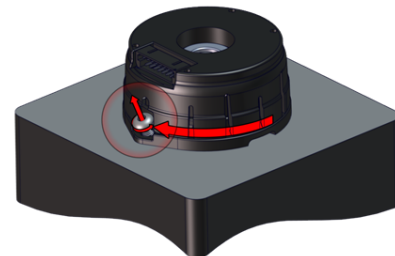
Step 1:

To remove the EC35: unplug the cable and remove the collet ring to free the rotation of the encoder module.



Step 2:

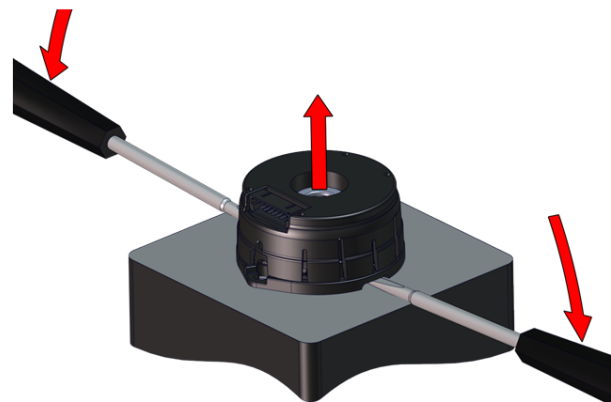
Rotate the encoder module until the screw access is aligned with one of the mounting screws. Remove the screw. Rotate the module to align the access with the remaining screw and remove.



Step 3:

Using two flat head screwdrivers apply pressure to the underside of each pry point, located 180° opposed at the bottom of the mounting plate, and remove the encoder from the motor.

*If remounting of the encoder is required continue to steps 4 and 5 for separation of the mounting plate from the encoder module.



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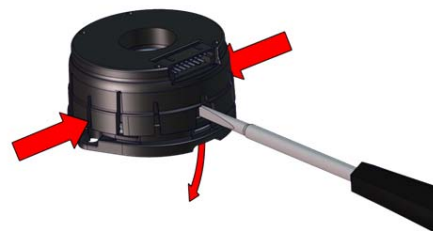
*Step 4:

Rotate the encoder module relative to the mounting plate and position the screw access above one pry point. Insert flat blade of screw driver between the mounting plate and module and turn 90° to pry the mounting plate and module apart.



*Step 5:

Pinch the sides of the encoder module and separate the mounting plate from the encoder module.



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