

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 codewheel pushes on when the encoder assembly is put on the motor shaft. This patent pending scheme securely grips the shaft without set screws. A built in, removable spacer tool ensures that the codewheel 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 110 Ω resistor in series with a .0047 μ F capacitor placed across each differential pair.

Download the EC35 datasheet.

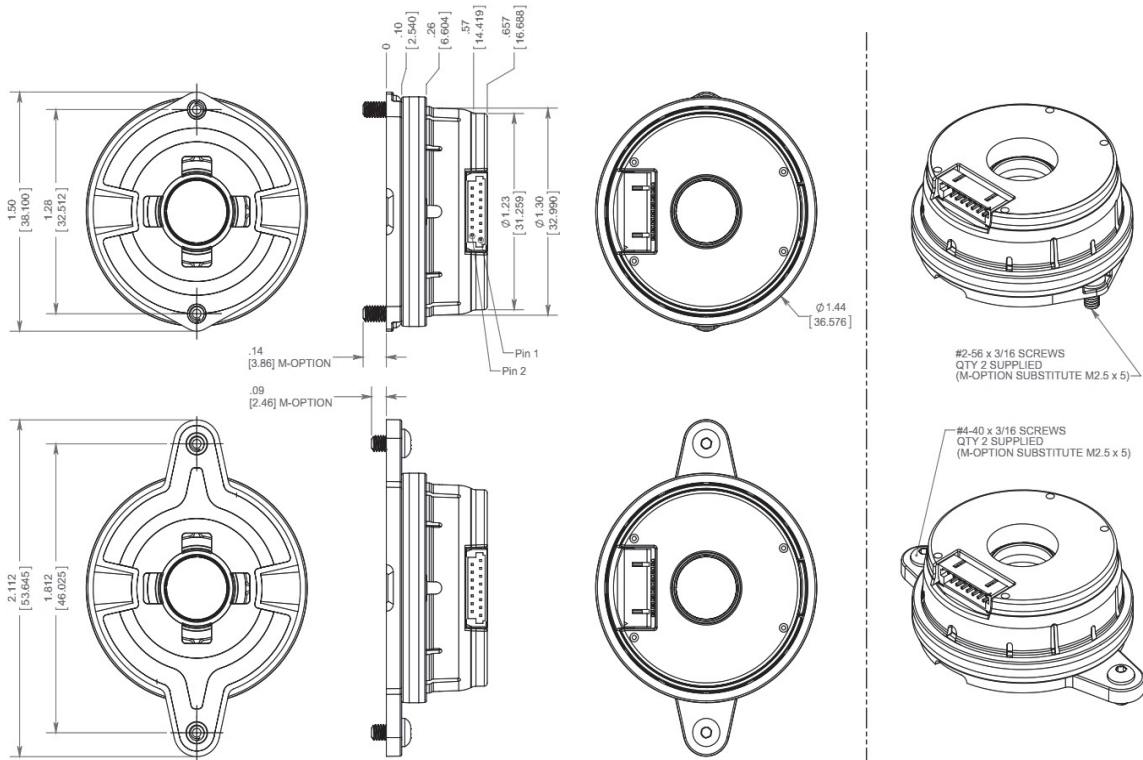
Mechanical Drawing



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 10000 cycles per rev. (CPR)
- ▶ 2000 to 40000 quadrature states per rev.
- ▶ Fits shaft diameters from 0.197" (5mm) to 0.394" (10mm)
- ▶ Single 5V supply

Rev. 120510093245



Environmental

Parameter	Parameter	Units
Relative Humidity	0 to 90	%
Storage Temperature	-40 to 105	C
Operating Temperature	-20 to 105	C
Vibration, 10Hz to 2kHz, sinusoidal	± 20	G
Shock, 6 millisecond, half-sine	± 75	G
ESD, Human Body Model, all pins	± 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	-0.005	0.005	in.
Mounting Shaft Total Runout	-	0.001	in.
Acceleration	-	250000	rad/sec ²

Rev. 120510093245

Parameter	Min.	Max.	Units
Maximum RPM, CPR \leq 2500 e.x. CPR = 1250, max. rpm = 19200 e.x. CPR = 2500, max. rpm = 9600	-	24000000/CPR	rpm
Maximum RPM, CPR = 4000		12000	rpm
Maximum RPM, CPR = 5000		9600	rpm
Maximum RPM, CPR = 10000		6000	rpm
Base to Mounting Surface Screw Torque	-	3	in-lbs

Materials

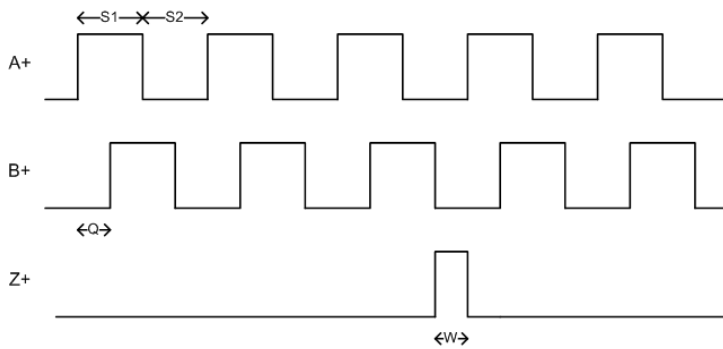
Part	Material
Base/Housing	20% glass filled PBT
Codewheel	Aluminum/Mylar

Electrical

Specifications	Min.	Typ.	Max.	Units	Notes
Supply Current CPR \leq 2500 CPR > 2500		13 32	17	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 _{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 \leq 2500			400	kHz	
Frequency Response, CPR = 4000 or 5000			800	kHz	
Frequency Response, CPR = 10000			1	MHz	

Rev. 120510093245

Incremental Output Timing

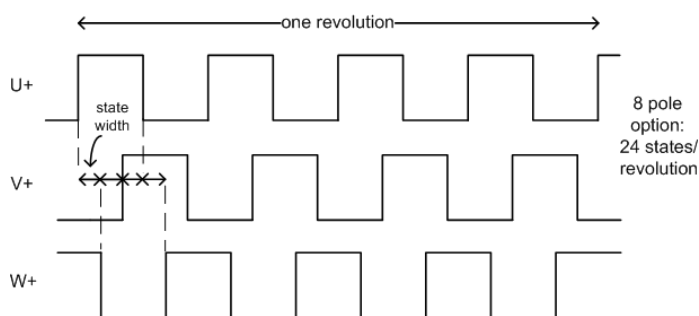
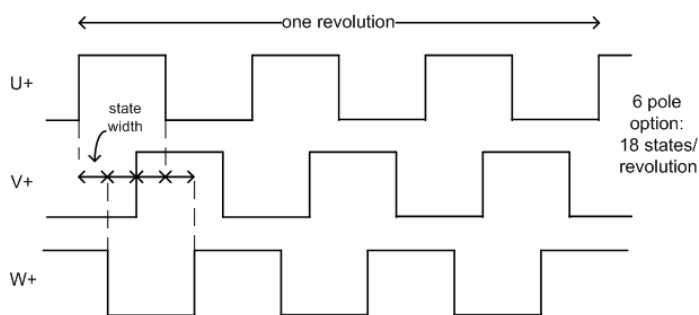
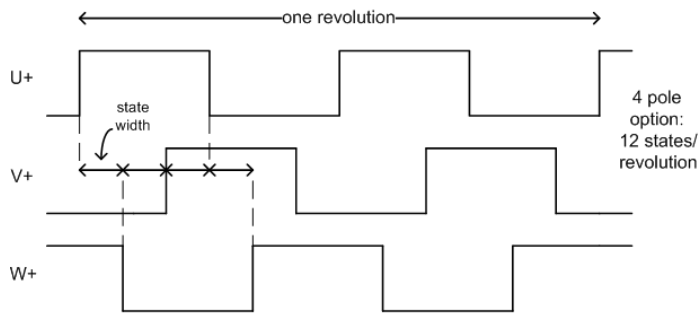


Parameter	Min.	Typ.	Max.	Units
Symmetry, S1, S2	135	180	225	elec. deg.
Quadrature Delay, Q	45	90	135	elec. deg.
Index Width, W	45	90	135	elec. deg.

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

Rev. 120510093245

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.

Rev. 120510093245

 **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

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Rev. 120510093245

Ordering Information

EC35							
	CPR	Motor Poles	Bore	Index Gating	Output	Base	Packaging
	500	0	197 = 5mm	H = A/B High L = A/B Low	D = Differential A/B/Z and Differential U/V/W	D = 1.28" diam. bolt circle mount, #2-56 x 3/16 screws (qty. 2)	B = Encoder components packaged in bulk - One centering tool per 10 encoders
	1000	4	236 = 6mm		C = Differential A/B/Z and Open- collector U/V/W	DM = 1.28" diam. bolt circle mount, M2.5 x 5 screws (qty. 2)	
	1250	6	250 = 1/4"			G = 1.812" diam. bolt circle mount, #4-40 x 3/16 screws (qty. 2)	
	2000	8	315 = 8mm			GM = 1.812" diam. bolt circle mount, M2.5 x 5 screws (qty. 2)	
	2500		375 = 3/8"				
			394 = 10mm				

Rules

- ▶ Output must be equal to D when Motor Poles is equal to 0

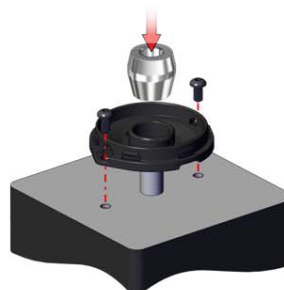
Notes

- ▶ Cables and connectors are not included and must be ordered separately.
- ▶

EC35 Assembly Instructions

Step 1:

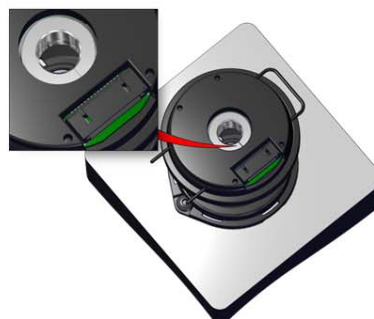
Slip base and then centering tool over the shaft. Press down on the centering tool to secure the base in an aligned position on the mounting/motor surface and tighten the two mounting screws. Remove the centering tool.



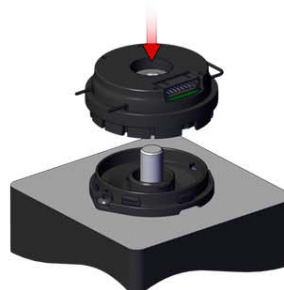
Note: If you require the encoder cable exit to be located more precisely than $\pm 90^\circ$ for a 4 pole motor, $\pm 60^\circ$ for a 6 pole motor or $\pm 45^\circ$ for an 8 pole motor then contact US Digital for information on how to do so.

Step 2:

Align assembled encoder over the motor shaft so that the mark on the hub is oriented in the desired direction for cable exit. Press the encoder onto the shaft until it snaps down on the previously mounted base.

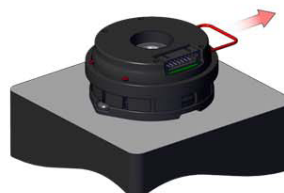


Caution: Do not press directly on the connector to avoid damaging the connector shroud.



Step 3:

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



EC35 Assembly Instructions

Step 4:

Attach the cable.

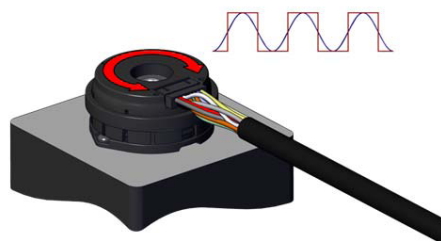


Step 5:

Dynamic Timing

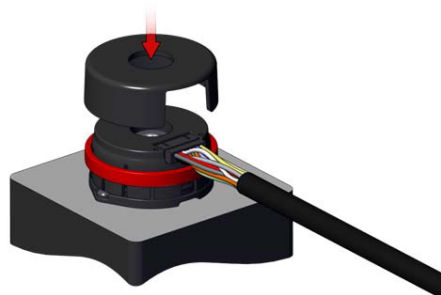
Connect motor U winding and encoder U output to separate channels of an oscilloscope*. Use a second motor to back drive the target motor and rotate the encoder until the two signals are aligned with each other. Full 360° encoder rotation allows any instance of the U winding to be located.

*Our QSB product may be used in place of an oscilloscope to complete the timing process. Please contact US Digital for additional details.



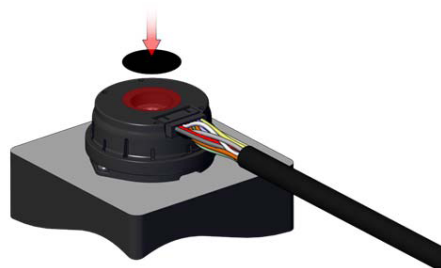
Step 6:

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.



Step 7 (optional):

Apply the center hole encoder cover to seal the opening.



We are here for you. Addresses and Contacts

Sales Switzerland

Matthias Rüegg
Ruhbergstrasse 32
CH-9230 Flawil

Phone +41 44 877 35 18
Mobile+41 76 491 66 66
Fax +41 44 877 35 19

matthias.rueegg@pewatron.com

Sales Germany

Baden-Württemberg Region
(Postcode 60000–79999)

Dieter Hirthe
Mühlweg 23
D-71554 Weissach i.T.

Phone +49 71 91 49 60 58
Mobile+49 163 76 27 430
Fax +49 71 91 93 31 88

dieter.hirthe@pewatron.com

Rest of Germany

Kurt Stritzelberger
Neumarkter Str. 86a
D-81673 Munich

Phone +49 89 260 38 47
Mobile+49 17 18 03 41 35
Fax +49 89 43 10 91 91

kurt.stritzelberger@pewatron.com

Sales Austria

Kurt Stritzelberger
Neumarkter Str. 86a
D-81673 Munich

Phone +49 89 260 38 47
Mobile+49 17 18 03 41 35
Fax +49 89 43 10 91 91

kurt.stritzelberger@pewatron.com

Sales Other Countries

PEWATRON AG
Thurgauerstrasse 66
CH-8052 Zurich

Phone +41 44 877 35 00
Fax +41 44 877 35 25

info@pewatron.com
www.pewatron.com

Sensors

Physical Sensors
Data Acquisition
Peter Felder
Phone +41 44 877 35 05
peter.felder@pewatron.com

Geometrical Sensors
Eric Letsch
Phone +41 44 877 35 14
eric.letsch@pewatron.com

Power Supplies

DC-DC Converters
Switching Power Supplies
DC-AC Inverters
Sebastiano Leggio
Phone +41 44 877 35 06
sebastiano.leggio@pewatron.com

E-Components

Current Converters
Man Machine Interface
Measurement Probes
Sebastiano Leggio
Phone +41 44 877 35 06
sebastiano.leggio@pewatron.com