

QML35

DESIGN FEATURES

- Bearingless modular design
- Single-ended outputs
- Low profile assembled height of 0.43"
- Resolutions up to 8192 lines per revolution
- 4, 6, 8, 10, 12, 14, 16 or 18 pole commutation³
- Easy lock-n-twist assembly feature
- Through bore sizes up to 0.375" diameter
- Up to 1 MHz frequency response
- High noise immunity
- RoHS construction
- Hub to shaft uses two #3-48 set screws
- Hermetically sealed LED
- Multiple mounting options including resolver size 15



Quantum Devices, Inc. Model QML35 is a high performance, low profile modular design ideal for high volume OEM applications and priced competitively for all sizes of motion control projects. The QML35's versatile electrical configurations include line counts up to 8192 and several commutation options. The QML35's patent lock-n-twist mechanism simplifies installation, saving production time and money. The QML35 is the newest solution to your motion control needs.



Configuration Options:

Resolution ³	Commutation ³	Voltage	Cover	Bore Size	Mounting	Index	Hardware
360 ⁴ , 500, 512, 1000, 1024, 2000, 2048, 2500, 4000, 4096, 5000, 5120, 8000, 8192	0 = No Comm 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole 10 = 10 Pole 12 = 12 Pole ⁵ 14 = 14 Pole ⁵ 16 = 16 Pole ⁵ 18 = 18 Pole ⁵	A = 5V ± 5% B = 3.3V ± 5%	A = Hole in Cover B = Closed Cover (shaft < 0.512") C = Closed Cover (shaft < 0.450")	C = 5 mm D = 6 mm E = 8 mm K = 0.1875" L = 0.250" M = 0.3125" N = 0.375"	A = 1.280" B = 1.812"	A = 90° A & B High B = 90° A & B Low	Please refer to hardware options on page 4

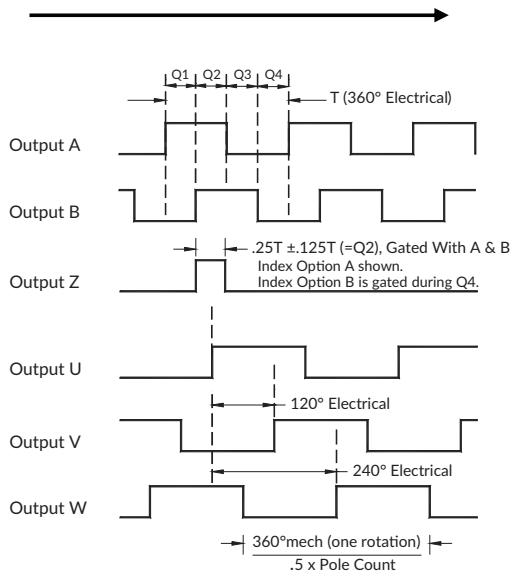
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Note:

- 1.) 4 poles has four states per revolution (2 pole pair), or two 360° electrical cycles per revolution
- 2.) Mounting option A allows for resolver size 15
- 3.) Consult factory for configurations not shown
- 4.) 360 PPR presently available only with 0 or 4 poles
- 5.) Not all Resolutions are presently available

OUTPUT WAVEFORMS

CCW Shaft Rotation as Viewed Looking at the Encoder Top



$$Q1 + Q2 = 0.5T \pm 0.125T$$

$$Q2 + Q3 = 0.5T \pm 0.125T$$

$$Q_n = 0.25T \pm 0.125T \quad (n = 1, 2, 3, 4)$$

ELECTRICAL PIN FUNCTIONS

Pin Number	Function
1	GND
2	Z
3	A
4	Vcc
5	B
6	U
7	V
8	W

U, V and W are "no connect" for Commutation option 0

ELECTRICAL SPECIFICATIONS

Input Voltage	A = 5 VDC \pm 5% B = 3.3 VDC \pm 5%						
Input Current Requirements	65 mA typical, 100 mA max plus interface loads						
Input Ripple	2% peak to peak @ 5 VDC						
Output Circuits	Single-ended TTL, sink or source 4 mA max (compatible with Renco PP option)						
Incremental Output Format	Quadrature with A leading B for CCW rotation viewed from the encoder top						
Max Operating Frequency	<ul style="list-style-type: none"> < 5000 PPR = 500 kHz or 15,000 RPM 5000 PPR - 7999 PPR = 675 kHz \geq 8000 PPR = 1.0 MHz 						
Commutation Format	Three phase 4, 6, 8, 10, 12, 14, 16 or 18 poles (other pole counts upon request)						
Commutation Accuracy (UVW)	\pm 2° mechanical						
Interpolation Factors	<table> <tbody> <tr> <td>1000/1024 PPR = 2x</td> <td>2000/2048 PPR = 4x</td> </tr> <tr> <td>2500PPR = 5x</td> <td>4000/4096 PPR = 8x</td> </tr> <tr> <td>5000/5120 PPR = 10x</td> <td>8000/8192 PPR = 16x</td> </tr> </tbody> </table>	1000/1024 PPR = 2x	2000/2048 PPR = 4x	2500PPR = 5x	4000/4096 PPR = 8x	5000/5120 PPR = 10x	8000/8192 PPR = 16x
1000/1024 PPR = 2x	2000/2048 PPR = 4x						
2500PPR = 5x	4000/4096 PPR = 8x						
5000/5120 PPR = 10x	8000/8192 PPR = 16x						

ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125°C
Operating Temperature	-30 to 115°C
IP Rating	IP40
Humidity	90% non-condensing
Vibration	20 g's @ 25 to 2,000 Hz
Shock	100 g's @ 6 ms duration

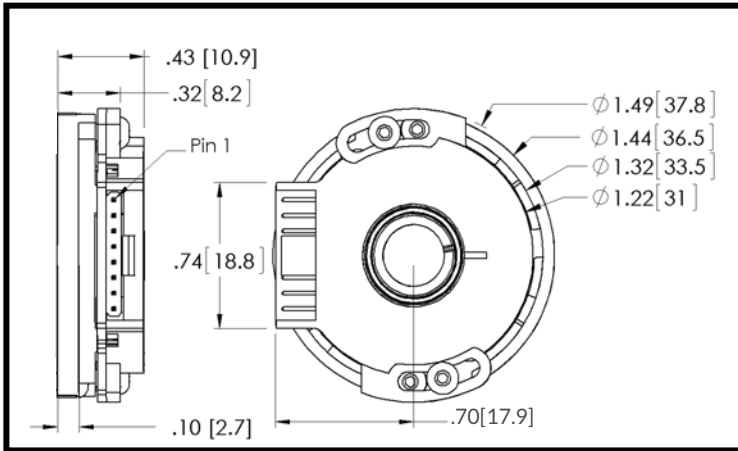
MECHANICAL SPECIFICATIONS

Bore Minimum Diameter	Bore Size +0.0002"
Recommended Shaft Tolerance	+0.0000/-0.0005"
Minimum Shaft Engagement	0.400" [10.2 mm]
Allowable Shaft Runout	0.002" [0.05 mm] TIR (\pm 0.001" shaft radial play from initial shaft position of assembled encoder)
Allowable Axial Shaft Movement	\pm 0.010" [\pm 0.25 mm]
Mounting	A = 1.280" bolt circle/size 15 resolver, B = 1.812" bolt circle
Dynamic Commutation Adjustment Range	30° mechanical
Moment of Inertia	8.0×10^{-6} oz-in-s ²

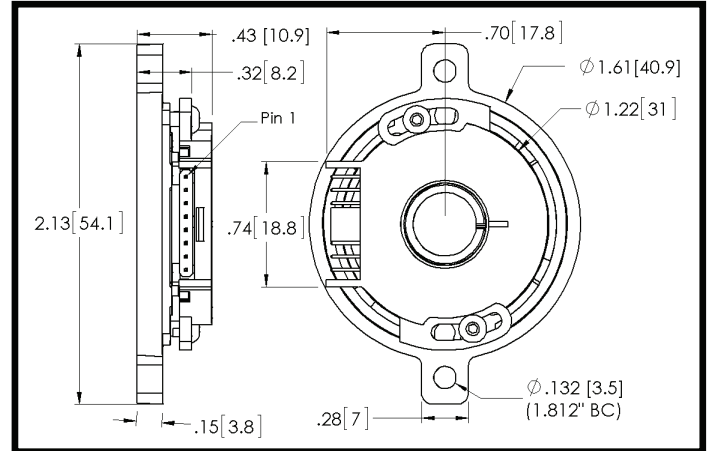
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MECHANICAL DIMENSIONS

Model QML35 - 1.280" Bolt Circle (Mounting Option A)



Model QML35 - 1.812" Bolt Circle (Mounting Option B)

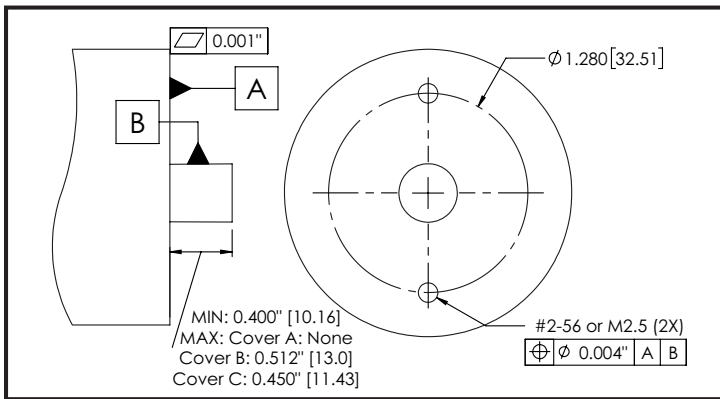


Note:

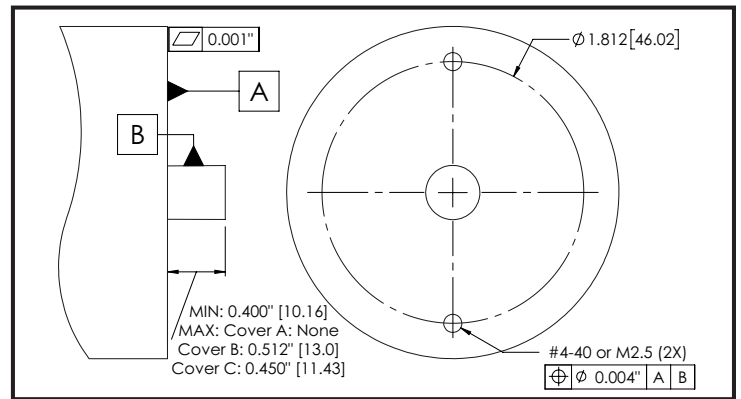
- Shown with Cover option A (hole in cover).
- Cover option B (closed) - Maximum shaft length up to 0.512" [13.0 mm]. Overall height increases from 0.43" [10.9 mm] to 0.57" [14.5 mm]. This additional height has a cylinder diameter 0.56" [14.2 mm], centered on the cover top.
- Cover option C (closed) - Maximum shaft length up to 0.450" [11.4 mm]. Overall height increases from 0.43" [10.9 mm] to 0.51" [13.0 mm]. This additional height has a cylinder diameter 0.56" [14.2 mm], centered on the cover top.

MOUNTING REQUIREMENTS

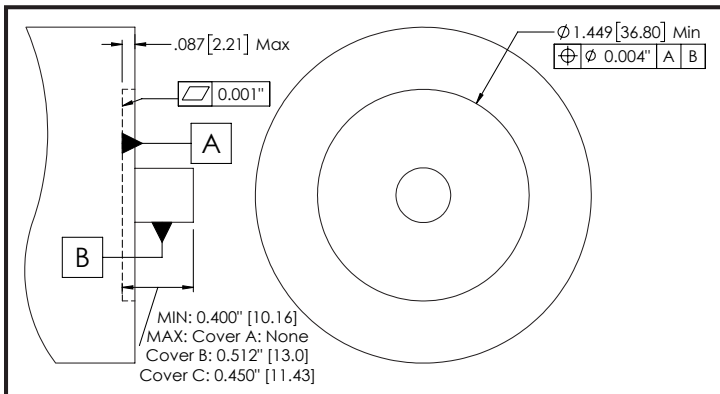
Mounting Option A (1.280" Bolt Circle)



Mounting Option B (1.812" Bolt Circle)



Servo Size 15 Mounting (Mounting Option A)



Patent Protection:

- US Patent 9,857,205
- US Patent 6,563,108

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SELECTION CHARTS

MOUNTING OPTION A (1.280" BOLT CIRCLE)							
#3-48 x 1/16" Set Screw 1/16" set screw is required for Bore Size options E (8 mm), M (0.3125") and N (0.375")				#3-48 x 3/32" Set Screw 3/32" set screw has deeper hex pocket to improve assembly tool life			
Mounting Screws		Mounting Screws with Thread Lock		Mounting Screws		Mounting Screws with Thread Lock	
English	Metric	English	Metric	English	Metric	English	Metric
Option A	Option B	Option D	Option E	Option F	Option G	Option H	Option J

MOUNTING OPTION B (1.812" BOLT CIRCLE)							
#3-48 x 1/16" Set Screw 1/16" set screw is required for Bore Size options E (8 mm), M (0.3125") and N (0.375")				#3-48 x 3/32" Set Screw 3/32" set screw has deeper hex pocket to improve assembly tool life			
Mounting Screws		Mounting Screws with Thread Lock		Mounting Screws		Mounting Screws with Thread Lock	
English	Metric	English	Metric	English	Metric	English	Metric
Option K	Option L	Option M	Option N	Option P	Option Q	Option R	Option S

Note:

- 1.) Bore Size options E (8 mm), M (0.3125") and N (0.375") are limited to Hardware options A, B, D, E, K, L, M or N. These Hardware options can optionally be used with all other standard Bore Size options.
- 2.) Hardware options F, G, H, J, P, Q, R and S have longer #3-48 set screws (3/32") with a deeper hex pocket to improve assembly tool life. These Hardware options are not compatible with Bore Size options E (8 mm), M (0.3125") or N (0.375").
- 3.) Hardware options D, E, H, J, M, N, R and S contain a thread lock which is applied to the mounting screws only. This preapplied thread locking product contains a microencapsulated epoxy resin that is suspended in a hardener. The force of thread engagement crushes the microscopic capsules of epoxy resin, mixing the reactant components, and initiating a chemical reaction which locks the parts together. This product series provides consistent and predictable torque values and requires no heat or primers for curing. Product - ND Industries 593S.

HARDWARE SELECTION BREAKOUT

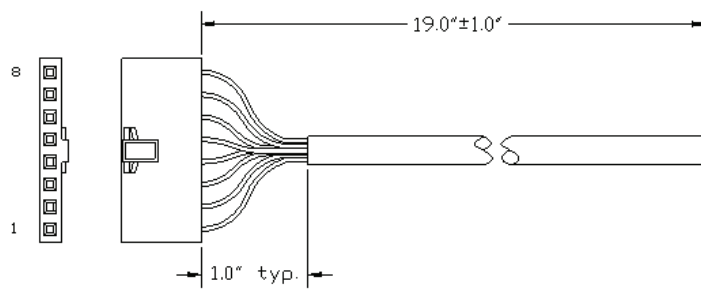
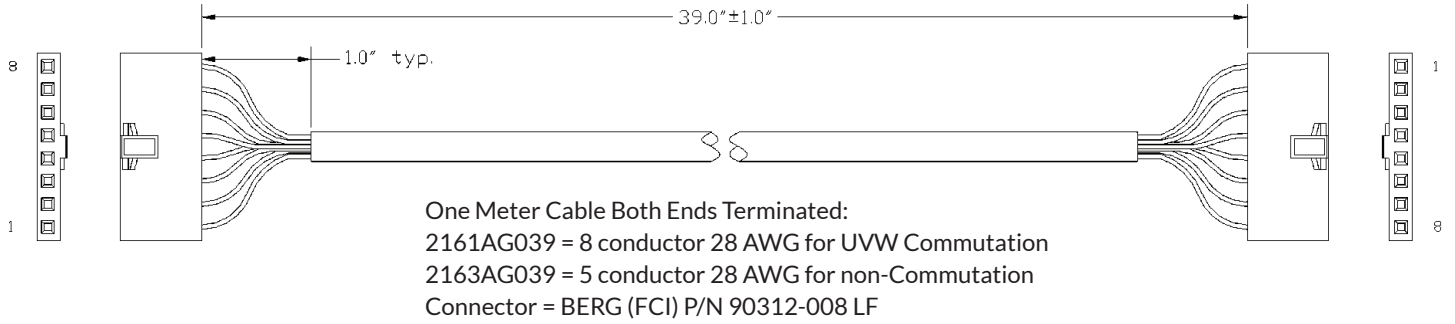
	Option A	Option B	Option D	Option E	Option F	Option G	Option H	Option J
Set Screws (Qty. 2 each)	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG015	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015
Mounting Screws (Qty. 2 each)	#2-56 x 1/4" Button Head, 0.050" Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG002	M2.5 x 6 mm Button Head (max dia. 4.5 mm) 1.5 mm Hex (Torque = 45 to 51 oz-in) Part Number 1834ZG050	#2-56 x 1/4" Button Head, 0.050" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG102	M2.5 x 6 mm Button Head (max dia. 4.5 mm) 1.5 mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG150	#2-56 x 1/4" Button Head, 0.050" Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG002	M2.5 x 6 mm Button Head (max dia. 4.5 mm) 1.5 mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG050	#2-56 x 1/4" Button Head, 0.050" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG102	M2.5 x 6 mm Button Head (max dia. 4.5 mm) 1.5 mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG150
Cover Screws (Qty. 2 each)	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002
	Option K	Option L	Option M	Option N	Option P	Option Q	Option R	Option S
Set Screws (Qty. 2 each)	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 1/16" 0.050" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox #3-48 x 3/32" 0.050" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015
Mounting Screws (Qty. 2 each)	#4-40 x 5/16" Button Head, 0.062" Hex (Torque = 45 - 52 oz-in) Part Number 1835ZG004	M2.5 x 8 mm Button Head, 1.5 mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG051	#4-40 x 5/16" Button Head, 0.062" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1835ZG104	M2.5 x 8 mm Button Head, 1.5 mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG151	#4-40 x 5/16" Button Head, 0.062" Hex (Torque = 45 - 51 oz-in) Part Number 1835ZG004	M2.5 x 8 mm Button Head, 1.5 mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG051	#4-40 x 5/16" Button Head, 0.062" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1835ZG104	M2.5 x 8 mm Button Head, 1.5 mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG151
Cover Screws (Qty. 2 each)	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002	Plastite 48-2, thread 2-28, length 1/4", Torx Plus IP7 (Torque = 37 - 43 oz-in) Part Number 1826ZG002

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CABLE ACCESSORIES

(2161AG039, 2163AG039, 2162AG019, 2164AG019)

Consult Factory for Custom Lengths



Half Meter Cable One End Terminated:
 2162AG019 = 8 conductor 28 AWG for UVW Commutation
 2164AG019 = 5 conductor 28 AWG for non-Commutation
 Connector = BERG (FCI) P/N 90312-008 LF

Pin Number	Encoder Pin Function	2161AG039 2162AG019 Wire Color	2163AG039 2164AG019 Wire Color
1	GND	Black	Black
2	Z	Orange	Orange
3	A	Yellow	Yellow
4	Vcc	Red	Red
5	B	Blue	Blue
6	U	Green	-
7	V	Brown	-
8	W	White	-

Note:

1. Cable has internal foil shield with 28 AWG drain wire trimmed to jacket edge
2. Unused wires to be locally isolated from adjacent signal wires, Vcc and GND to prevent damage to encoder signals

Note: BERG (FCI) P/N 90312-008 LF connector using 77138-001LF pins is compatible with 26-30 AWG wire.