

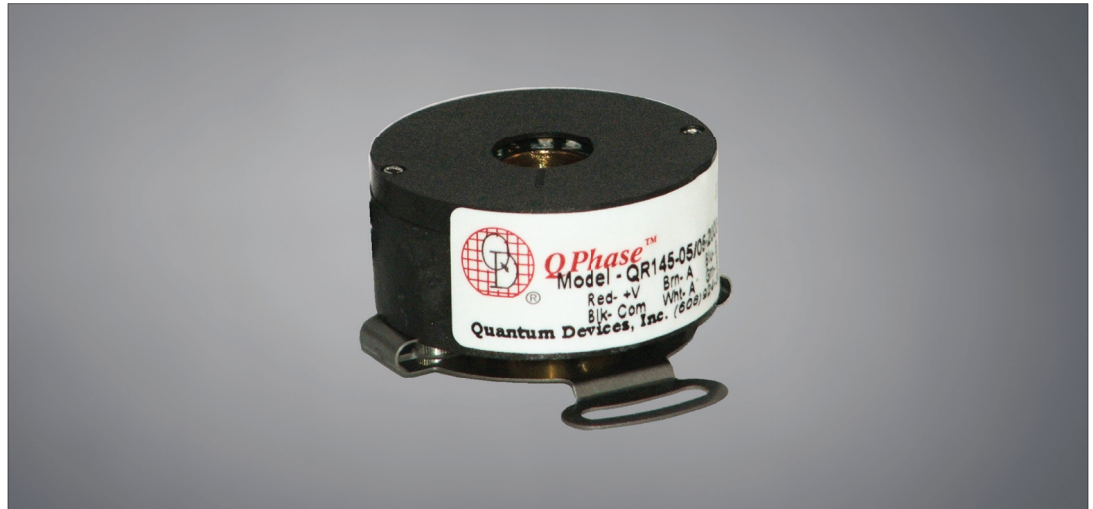
QR145

DESIGN FEATURES

- 500 kHz fundamental frequency response
- Low profile, 0.87" assembled height
- Bearing design simplifies encoder attachment
- Resolutions up to 5000 lines per revolution direct read
- 4, 6 or 8 pole commutation
- Conductive carbon fiber housing
- Standard 1.812" bolt circle mounting
- Through shaft sizes up to 0.375" diameter
- High noise immunity
- Cost competitive with modular encoders

APPLICATIONS

- Servo Motors
- Robotics
- Medical
- Packaging
- XY Gantry



Quantum Devices, Inc. Model QR145 provides an improved feedback solution in applications typically using modular encoders. With an overall height of only 0.87" and the stability of a bearing encoder design, the model QR145 can provide significant performance upgrades in applications limited by traditional modular encoder solutions. Outputs consist of a quadrature with reference pulse and three-phase commutation, which can be configured with either the industrial standard 5 volt RS422A line driver or the 5 to 26 volt OL7272 line driver. A flexible member allows for much greater tail shaft run out than can be tolerated by modular encoder designs, plus it provides 30 degrees of rotation for commutation timing. A housing constructed of conductive carbon fiber composite provides the EMI shielding of an all metal housing and the performance of a lightweight robust assembly.

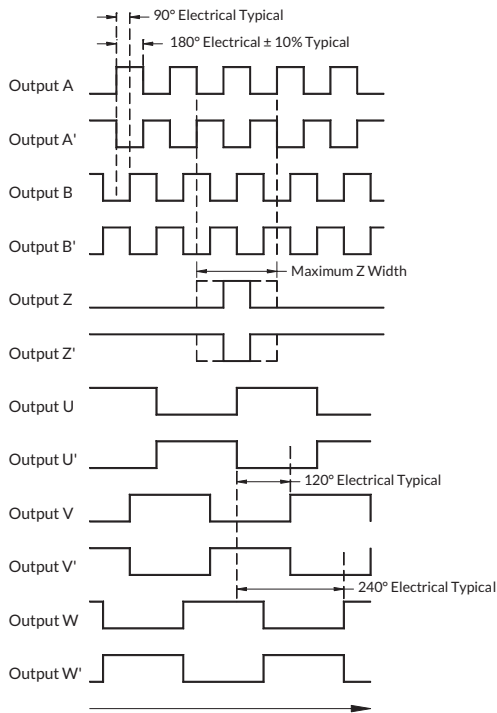
QR145 - **05/05** - **1000** - **6** - **01** - **T3** - **01** - **02**

Voltage Resolution Commutation Output Bore Mounting Index Gating

Configuration Options:

Voltage	Resolution*	Commutation	Output	Bore Size	Mounting	Index Gating
05/05 = 5VDC 05/26 = 5-26VDC	120, 200, 250, 256, 360, 500, 512, 600, 635, 800, 1000, 1024, 1250, 2000, 2048, 2500, 3000, 3600, 4096, 5000	0 = No Comm 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole	01 = Line Driver 02 = 5-26VDC Line Driver 03 = TTL 04 = Line Driver ABZ / Open Collector UVW	T1 = .25" T2 = .312" T3 = .375" T4 = 6mm T5 = 8mm T6 = 1.0mm T1 1 = 5mm T1 2 = 4mm T1 8 = .1875"	01 = 1.812" 02 = Size 15 Resolver 03 = IP66 Sealed Housing 04 = 1.575" 06 = Inverted 1.575" 07 = Inverted 1.812"	00 = Ungated 01 = 180° gated to A 02 = 90° gated to A & B

OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed
Looking at the Encoder Face
See figure below

Note: TTL Output Option consists of +VDC, Common,
Case Ground and Outputs A, B & Z wires only

QD145 WIRING DIAGRAM

Red - +VDC	Violet - Output U
Black - Common	Gray - Output U'
Brown - Output A	Brown/White - Output V
White - Output A'	Red/White - Output V'
Blue - Output B	Orange/White - Output W
Green - Output B'	Yellow/White - Output W'
Orange - Output Z	Black/White - Case Ground
Yellow - Output Z'	Drain Wire - Cable Shield

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5% or 5-26 VDC
Input Current Requirements	125mA typical @ 5VDC plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	AM26LS31 RS 422A line driver OL7272 high voltage line driver TTL output
Incremental Output Format	Quadrature with A leading B for CW rotation with index pulse centered over A for 2500 line count and below. Index pulse true over A and B high for 2500 line count and above
Frequency Response	500 kHz
Symmetry	180 degrees \pm 10% typical
Minimum Edge Separation	54 electrical degrees
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical

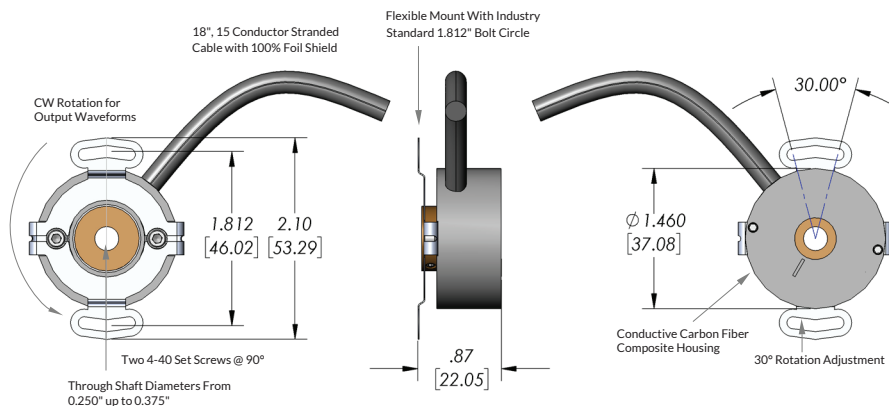
ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 100° C typical -20 to 120° C optional**
Humidity	98% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration

MECHANICAL SPECIFICATION

Maximum Shaft Speed	8000 RPM
Through Shaft Diameter	0.1875", 0.250", 0.3125", 0.375", 4mm, 6mm, 8mm, 10mm, 5mm (-0.0000, +0.0005)
Radial Shaft Movement	0.007" TIR
Axial Shaft Movement	\pm 0.030"
Housing	Carbon fiber composite (case ground via cable)
Housing Volume Resistivity	10 ⁻² ohm-cm
Termination	15 conductor cable, 28 AWG 18" long, 9 conductor cable for non-commutated and TTL outputs
Mounting	1.812" bolt circle
Moment of Inertia	1.5 x 10 ⁻⁴ oz-in-S ²
Acceleration	1x10 ⁵ radians/S ²
Accuracy	\pm 1.0 arc minute

**Contact factory for more information



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ISO 9001
CERT. NO. FM 52711

QR200

DESIGN FEATURES

- 500 kHz fundamental frequency response
- Low profile, 0.93" assembled height
- Bearing design simplifies encoder attachment
- Resolutions up to 5000 lines per revolution direct read
- 4, 6 or 8 pole commutation
- Conductive carbon fiber housing
- Standard 2.375" bolt circle mounting
- Through shaft sizes up to 0.625" diameter
- High noise immunity



Quantum Devices, Inc. Model QR200 provides an improved feedback solution in applications typically using modular encoders. With an overall height of 0.93" and the stability of a bearing encoder design, the model QR200 can provide significant performance upgrades in applications limited by traditional modular encoder solutions. Outputs consist of a quadrature with reference pulse and three-phase commutation, which can be configured with either the industrial standard 5 volt RS422A line driver or the 5 to 26 volt OL7272 line driver. A flexible spring mount allows for much greater tail shaft run out than can be tolerated by modular encoder designs, plus it provides 30 degrees of rotation for commutation timing. A housing constructed of conductive carbon fiber composite provides the EMI shielding of an all metal housing and the performance of a lightweight robust assembly.

QR200 - **05/26** - **1000** - **6** - **02** - **T3** - **01** - **02**

Voltage Resolution Commutation Output Bore Mounting Index Gating

Configuration Options:

Voltage	Resolution*	Commutation*	Output	Bore	Mounting	Index Gating
05/05 = 5VDC 05/26 = 5-26VDC	500, 512, 1000, 1024, 2000, 2048, 2500, 4096, 5000, 8192**, 10000**	0 = No Comm 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole	01 = Line Driver 02 = 5-26VDC Line Driver 03 = TTL 04 = Line Driver ABZ/ Open Collector UVW	T3 = .375" T5 = 8mm T8 = .5" T9 = .625" T10 = 12mm T14 = 14mm	01 = 2.375" 02 = Size 21 Resolver 03 = 1.812"	00 = Ungated 01 = 180° gated to A 02 = 90° gated to A & B

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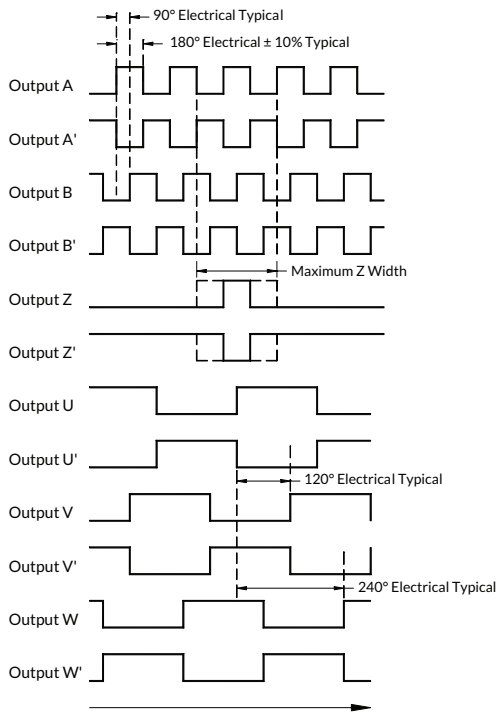
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Consult Factory for Resolution and Pole Count Availability. ** 2x Interpolated Line Counts.

ISO 9001

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OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed
Looking at the Encoder Face
See figure below

Note: TTL output option consists of +VDC, common, case ground and outputs A, B & Z wires only

QR200 WIRING DIAGRAM

Red - +VDC	Violet - Output U
Black - Common	Gray - Output U'
Brown - Output A	Brown/White - Output V
White - Output A'	Red/White - Output V'
Blue - Output B	Orange/White - Output W
Green - Output B'	Yellow/White - Output W'
Orange - Output Z	Black/White - Case Ground
Yellow - Output Z'	Drain Wire - Cable Shield

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5% or 5-26 VDC
Input Current Requirements	125mA typical @ 5VDC plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	AM26LS31 RS 422A line driver OL7272 high voltage line driver TTL output
Incremental Output Format	Quadrature with A leading B for CW rotation with index pulse centered over A for 2500 line count and below. Index pulse true over A and B high for 2500 line count and above
Frequency Response	500 kHz
Symmetry	180 degrees \pm 10% typical
Minimum Edge Separation	54 electrical degrees
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical

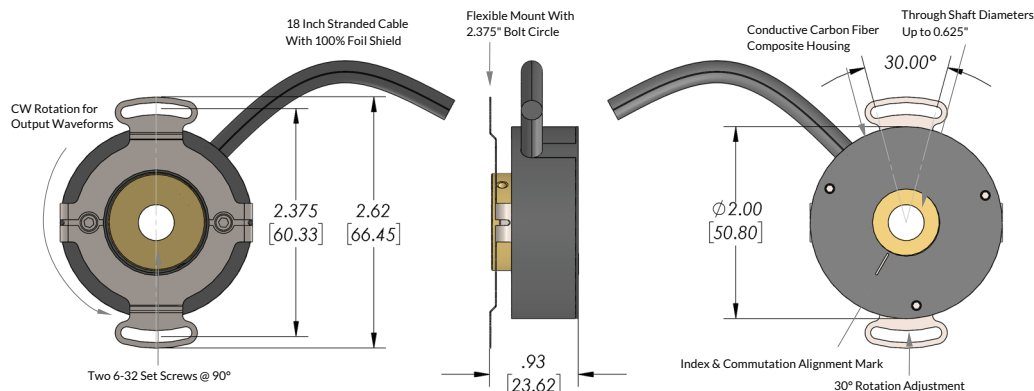
ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 100° C typical -20 to 120° C optional**
Humidity	98% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration

MECHANICAL SPECIFICATION

Maximum Shaft Speed	8000 RPM
Through Shaft Diameter	0.375", 0.500", 0.625", 8mm, 12mm (-0.0000, + 0.0005), 14mm
Radial Shaft Movement	0.007" TIR
Axial Shaft Movement	\pm 0.030"
Housing	Carbon fiber composite (case ground via cable)
Housing Volume Resistivity	10^{-2} ohm-cm
Termination	15 conductor cable, 28 AWG 18" long, 9 conductor cable for non-commutated and TTL outputs
Mounting	2.375" bolt circle
Moment of Inertia vs. Shaft \varnothing	$\varnothing 0.375$ (6.5×10^{-4} oz -in -s ²), $\varnothing 0.500$ (6.0×10^{-4} oz -in -s ²), $\varnothing 0.625$ (5.1×10^{-4} oz -in -s ²)
Acceleration	1×10^5 Radians/S ²
Accuracy	\pm 1.0 arc minute

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QR12

DESIGN FEATURES

- Low profile assembled height of 0.99"
- Bearing design simplifies encoder attachment
- Resolutions up to 20,000 lines per revolution
- SIN/COS outputs available up to 1250 LC
- 4, 6 or 8 pole commutation
- Multiple bolt circle mounting
- Through shaft sizes up to 0.375" (10mm) diameter
- High noise immunity
- Cost competitive with modular encoders
- 500 kHz frequency response
- RoHS construction



Quantum Devices, Inc. Model QR12 provides an improved feedback solution in applications traditionally using modular encoders. With an overall height of less than one inch and the stability of a bearing encoder design, the model QR12 can provide significant performance upgrades in applications limited by modular encoder solutions. Outputs consist of two incremental quadrature channels with an index pulse and three-phase commutation. A flexible spring steel mount allows for much greater tail shaft run out and TIR than can be tolerated by modular encoder designs, while also providing 30 degrees of rotation for commutation timing.

QR12 - **1000** - **4** - **A** - **B** - **L** - **C** - **A**

Resolution Commutation Output Housing Bore Mounting Index

Configuration Options:

Resolution	Commutation	Output	Housing	Bore Size	Mounting	Index
24*, 256, 360, 500, 512, 1000, 1024, 1250, 2000, 2048, 2500, 4000, 4096, 5000, 8000, 8192, 10000, 16000, 16384, 20000	0 = No Comm 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole	A = Line Driver B = Line Driver ABZ/ Open Collector UVW C = Sin/Cos/ Line Driver UVW D = Sin/Cos/Open Collector UVW	B = Through Hole Cover C = Closed Cover	A = 3mm B = 4mm C = 5mm D = 6mm E = 8mm F = 10mm G = 7mm J = .125" K = .1875" L = .25" M = .3125" N = .375"	A = 1.812" B = 1.575" C = 1.280"	A = 90° gated to A & B C = Ungated Square Wave (Sin/Cos Option Only) D = Ungated Sinusoidal (Sin/Cos Option Only)

*24 PPR only
available 0 Poles

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*Sin/Cos Limited to 1250-1250 PPR
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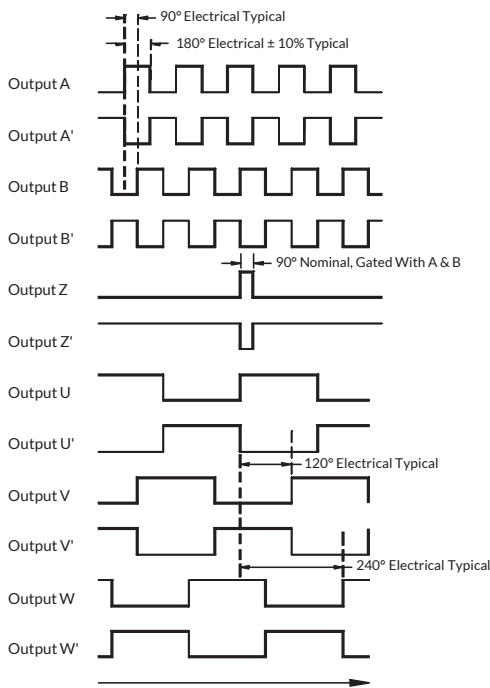
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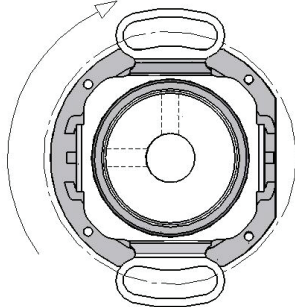
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OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed
Looking at the Encoder Face.
See figure below

CW Rotation for
Output Waveforms



Note: Relationship of Z signals to U, V, W signals is not to scale. Sin/Cos signals have no relationship to U, V, W signals.

INCREMENTAL ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA Typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	(A) 26C31 RS 422A line driver (TTL compatible) (B) ABZ line driver, UVW open collector (No U' V' W')
Incremental Output Format	Quadrature with A leading B for CW rotation. Index pulse true over A and B high.
Frequency Response	500 kHz
Symmetry	180 Degrees \pm 10% typical
Minimum Edge Separation	<4000PPR = 54 electrical degrees \geq 4000PPR = 45 electrical degrees
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical
Z channel to U channel	\pm 1° mechanical

ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 115° C
IP Rating	40
Humidity	90% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration

MECHANICAL SPECIFICATION

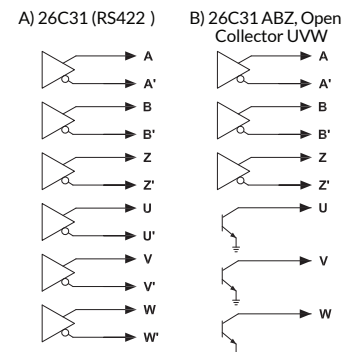
Through Shaft Diameter	0.125", 0.1875", 0.250", 0.3125", 0.375", 3mm, 4mm, 5mm, 6mm, 7mm, 8mm, 10mm tolerance: -0.0000, + 0.0006"
Recommended Shaft Engagement	.50" minimum
Radial Shaft Movement	0.007" TIR
Axial Shaft Movement	\pm 0.030"
Maximum Shaft Speed	8000 RPM, Contact Customer Service for higher RPM
Interface Connector	Connector: JAE P/N F1-W15P-HFE
Mounting	1.28", 1.575", 1.812" bolt circle
Moment of Inertia	9.1×10^{-5} oz-in-S ²
Acceleration	1×10^5 Radians/S ²
Accuracy	Instrument error 1.5 arc min. max

15 PIN CONNECTOR JAE P/N: F1-W15P-HFE

Pin Number	Function
1	A
2	A -
3	B
4	B -
5	Z
6	Z -
7	U
8	U - *
9	V
10	V - *
11	W
12	W - *
13	Vcc
14	GND
15	Open

* U-, V- and W- not present for open collector UVW Electrical Option.

ELECTRICAL OUTPUT CIRCUITS



- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.

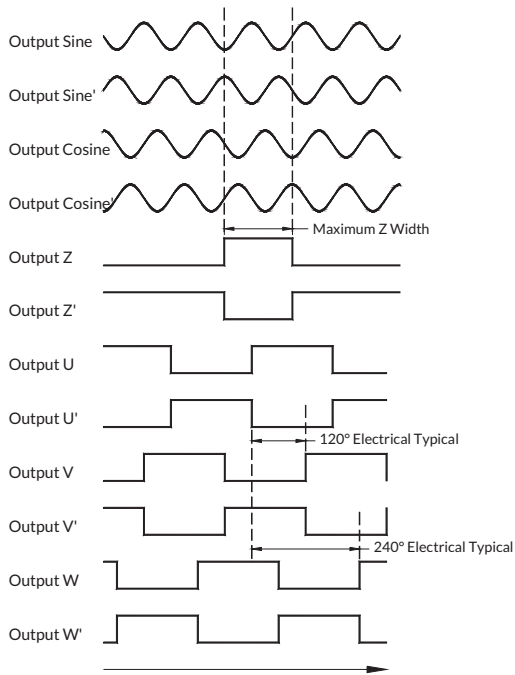
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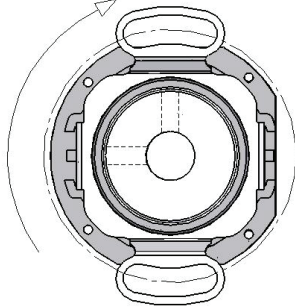
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SIN/COS OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed
Looking at the Encoder Face.
See figure below

CW Rotation for
Output Waveforms



Note: Relationship of Z signals to U, V, W signals is not to scale. A & B signals have no relationship to U, V, W signals.

SIN/COS ELECTRICAL SPECIFICATIONS

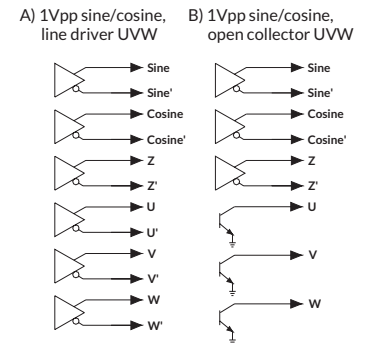
Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	(C) sine/cosine, index & RS422 UVW (TTL compatible) (D) sine/cosine, index & UVW open collector
Incremental Output Format	Quadrature sine/cosine with A leading B for CW rotation. Ungated index pulse.
Frequency Response	500 kHz
Sine/Cosine & Index Amplitude	1 Vpp \pm 5% (Measured differentially)
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical
Z Channel to U Channel	\pm 1° mechanical

15 PIN CONNECTOR JAE P/N: F1-W15P-HFE

Pin Number	Function
1	Sine
2	Sine -
3	Cosine
4	Cosine -
5	Z
6	Z -
7	U
8	U - *
9	V
10	V - *
11	W
12	W - *
13	Vcc
14	GND
15	Open

* U-, V- and W- not present for open collector UVW electrical option.

ELECTRICAL OUTPUT CIRCUITS



- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.

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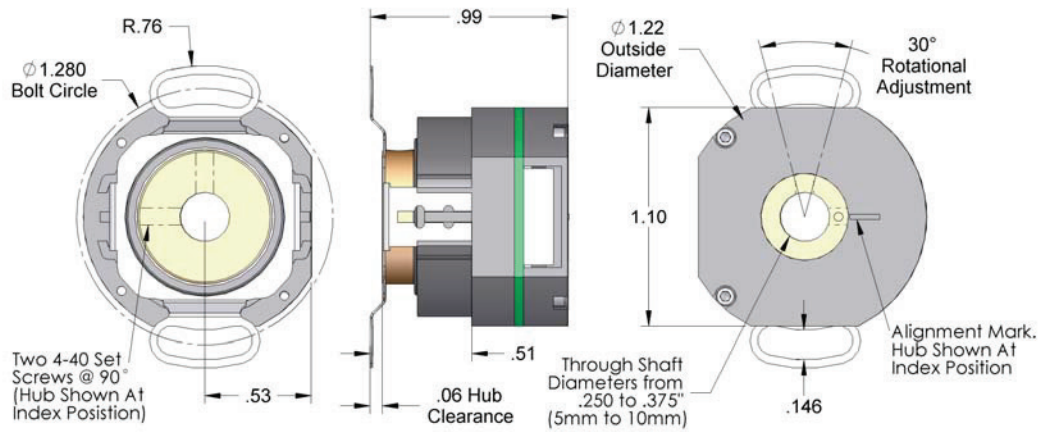
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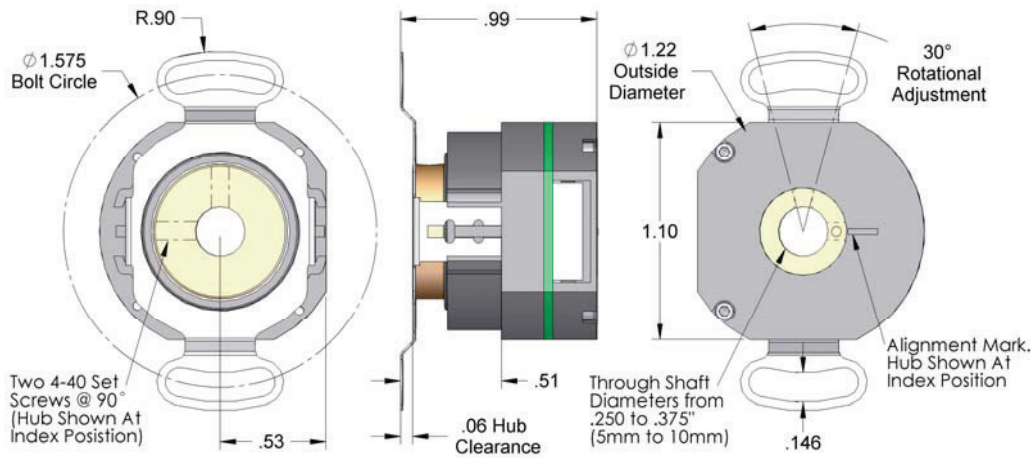
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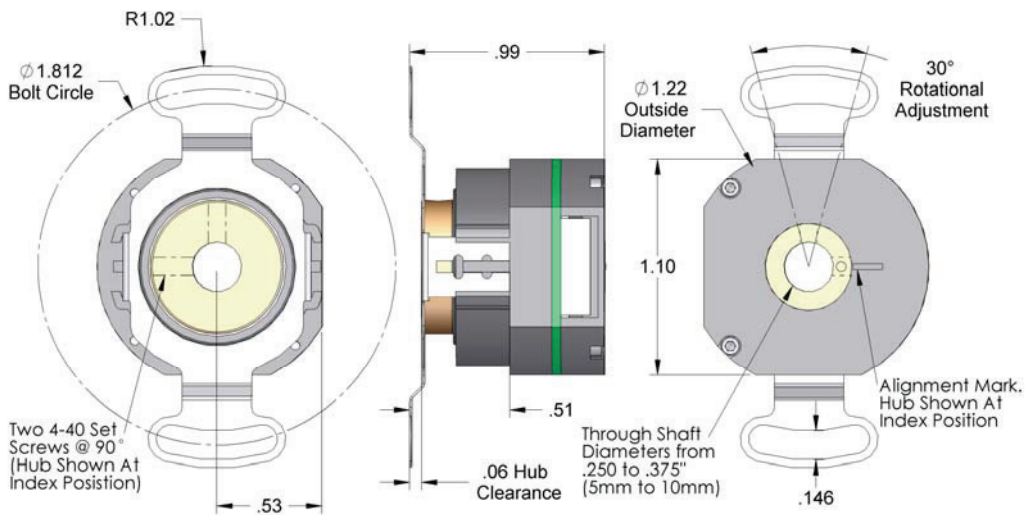
1.28 BOLT CIRCLE WITH BOTTOM MOUNT HUB



1.575 BOLT CIRCLE WITH BOTTOM MOUNT HUB



1.812 BOLT CIRCLE WITH BOTTOM MOUNT HUB



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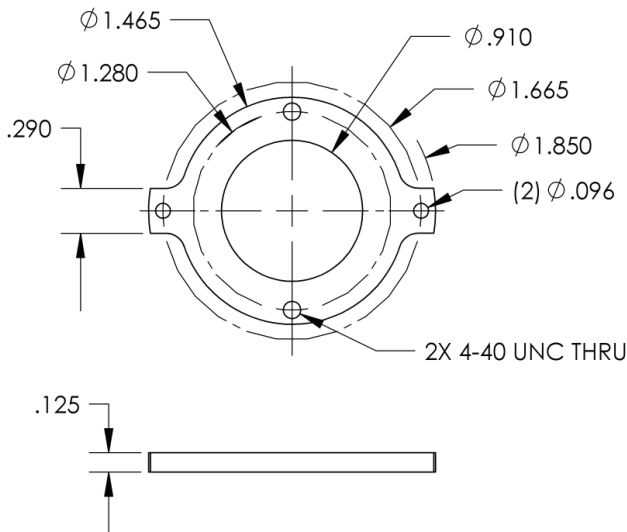
SIZE 15 RESOLVER MOUNTS

Utilize the optional resolver mount adapters to mate the QR12 - 1.280" flex mount option to Size 15 Pancake Resolver motor configurations. Eliminate the expensive mounting servo clamps by attaching either the two or three point adapters directly to the servo clamp holes. Assemble the QR12 to the adapter plate using (2) 4-40 screws. For jam nut attachment to threaded motor shafts, refer to JR12 Jam Nut Mount Optical Encoder Literature.

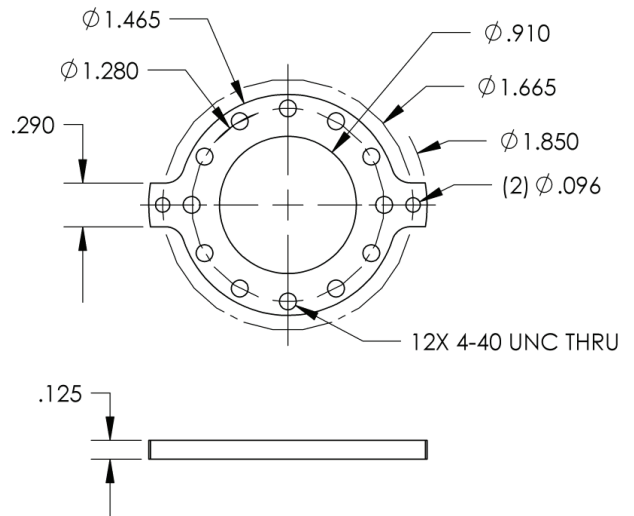
DIMENSIONS

Optional Aluminum Resolver Adapters

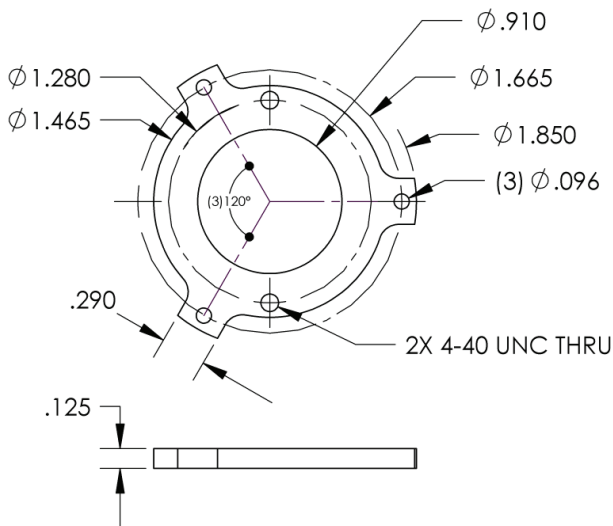
2074D024 – Two Point 30 Degree
Commutation Adjustment Range



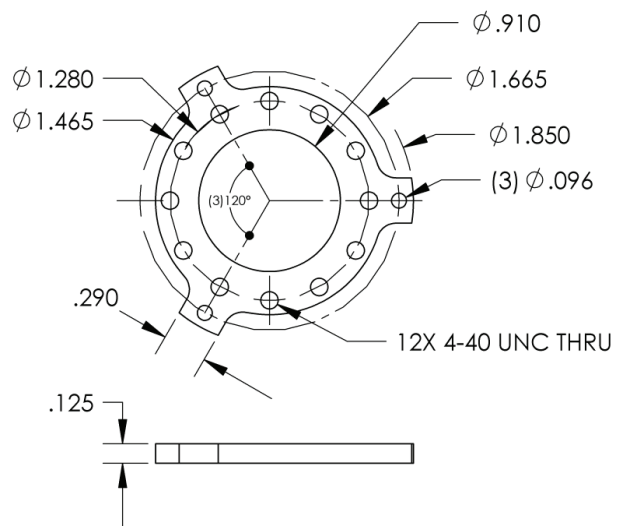
2074D025 – Two Point 360 Degree
Commutation Adjustment Range



2074D026 – Three Point 30 Degree
Commutation Adjustment Range



2074D027 – Three Point 360 Degree
Commutation Adjustment Range



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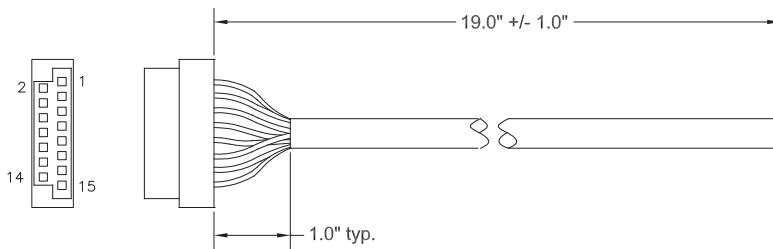
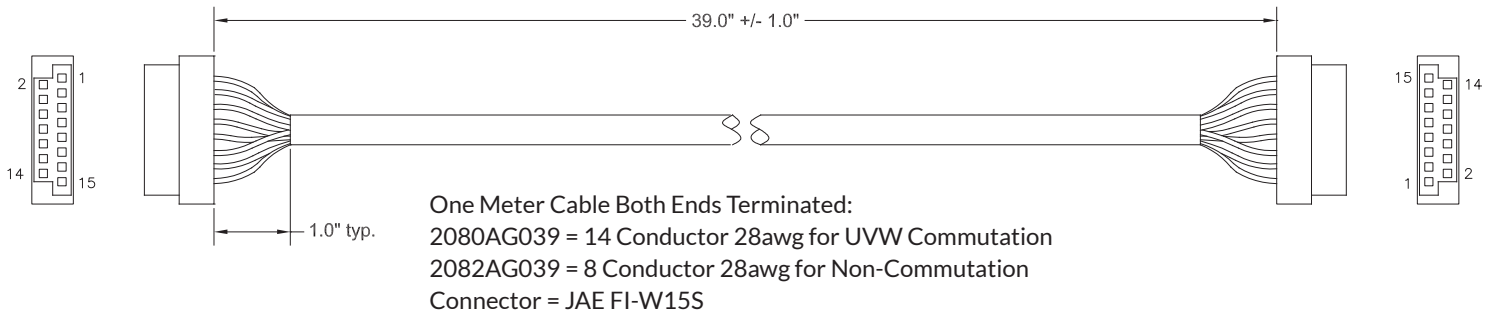
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CABLE OPTIONS

(2080AG039, 2082AG039, 2081AG019, 2083AG019)

Consult Factory for Custom Lengths



Pin Number	Signal Function	2080AG039 2081AG019 Wire Color	2082AG039 2083AG019 Wire Color
1	A	Brown	Brown
2	A -	White	White
3	B	Blue	Blue
4	B -	Green	Green
5	Z	Orange	Orange
6	Z -	Yellow	Yellow
7	U	Violet	
8	U -	Gray	
9	V	White/Brown	
10	V -	White/Red	
11	W	White/Orange	
12	W -	White/Yellow	
13	Vcc	Red	Red
14	GND	Black	Black
15	No Connect		

Note:

1. Cable has internal foil shield with 28awg 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.

ENCODER INSTALLTION INSTRUCTIONS

1. Using two fingers slide the encoder onto shaft.
2. For additional security, Loctite can be applied to the encoder hub set screws. Remove the encoder's set screws and using tip of toothpick apply appropriate amount of Loctite thread locking adhesive. A nonpermanent adhesive is recommended.
3. Insert and tighten encoder set screws using a .050" hex wrench. Typical torque range of 50 to 80 oz-in.
4. Fixture the stainless steel flex mount to the mounting surface with #6-32 button head screws.

For brushless motors requiring commutation timing:

- Encoder drawings indicate position of encoder hub to encoder body at Z (index). Rotating the hub to this position allows for known U channel transition state (prior to step one above).
- Powering appropriate motor windings allow for locking motor shaft location to match the appropriate U transition (prior to step one above).
- While mechanically back driving the motor, monitor motor winding EMF position to the powered encoder position. Rotate the encoder stainless steel flex mount to achieve accurate timing of encoder commutation feedback channels to the appropriate motor winding EMF. Tighten the screws retaining the encoder stainless steel flex mounts.

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QM35

DESIGN FEATURES

- Bearingless modular design
- Low profile assembled height
- Resolutions up to 8192 lines per revolution
- 4, 6, 8 or 10 pole commutation
- Easy lock-n-twist assembly feature
- Through shaft sizes up to 0.375" diameter
- Up to 1Mhz 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 QM35 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 QM35's versatile electrical configurations include lines counts up to 8192 and several commutation options. The QM35's patent pending lock-n-twist mechanism simplifies installation; saving production time and money. The QM35 is the newest solution to your motion control needs.



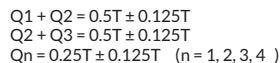
Configuration Options:

Resolution	Commutation	Output	Cover	Bore Size	Mounting	Index	Hardware
360, 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	A = Line Driver B = Line Driver (ABZ) / Open Collector (UVW) C = Dual Voltage Line Driver (ABZ) / Open Collector (UVW)	A = Hole in Cover B = Closed Cover (shaft < .512") C = Closed Cover (shaft < .450")	C = 5mm D = 6mm E = 8mm K = .1875" L = .250" N = .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

Note:

- 1.) 4 poles has four states per revolution (2 pole pair), or two 360° electrical cycles per revolution.
- 2.) RS422 is compatible with Renco options: TTL, PP, VC or LD. Open collector compatible with VO configurations.
- 3.) Mounting option A allows for resolver size 15.
- 4.) Consult factory for configurations not shown.
- 5.) 360PPR not available with 6, 8, or 10 poles.

CCW Shaft Rotation as Viewed Looking at Encoder Top.



Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA Typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	26C31 RS 422A line driver (TTL compatible) Optional UVW open collector (No U' V' W')
Incremental Output Format	Quadrature A leading B for CCW rotation viewed from encoder top.
Max Operating Frequency	<ul style="list-style-type: none"> • < 5000PPR = 500Khz or 15,000RPM • 5000PPR – 7999PPR = 675Khz • \geq 8000PPR = 1.0Mhz
Commutation Format	Three phase 4, 6, 8 or 10 poles
Commutation Accuracy (U-V-W)	\pm 2° mechanical
Interpolation Factors	1000/1024PPR = 2x 2000/2048PPR = 4x 2500PPR = 5x 4000/4096PPR = 8x 5000/5120PPR = 10x 8000/8192PPR = 16x

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

Hub Minimum Diameter	Hub size +0.0002"
Recommended Shaft Tolerance	-0.0005, + 0.0000"
Minimum Shaft Engagement	.400" [10.2mm]
Allowable Shaft Run Out	0.05mm, 0.002" TIR [+/- .0010" shaft radial play from initial shaft position of assembled encoder]
Allowable Axial Shaft Movement	± 0.25mm, ± 0.010"
Mounting	1.28", 1.812" bolt circle, resolver mount
Dynamic Commutation Adjustment Range	30° mechanical
Moment of Inertia	8.0 x 10 ⁻⁶ oz-in-S ²

	Electrical Option		
Pin Number	Option A	Option B	Option C
1	A	A	A
2	A-	A-	A-
3	B	B	B
4	B-	B-	B-
5	Z	Z	Z
6	Z-	Z-	Z-
7	U	U	U
8	U-	NC	GND2
9	V	V	V
10	V-	NC	+5v2
11	W	W	W
12	W-	NC	NC
13	Vcc	Vcc	Vcc
14	GND	GND	GND
15	NC	NC	NC

Options: GND2 is isolated from GND1. U, V and W outputs are referenced to GND2. +5v2 provides power to U, V and W. External pull up resistors (normally not installed) – call us for this configuration.

Option A) 26C31 (RS422)

Option B & C) 26C31 ABZ,
Open Collector UVW
Option C) U, V and W
referenced to GND2

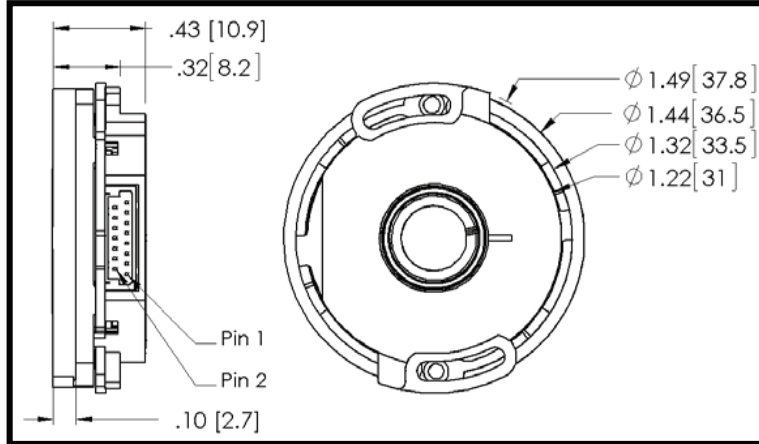
The image shows two sets of circuit diagrams. The left set, labeled 'Option A) 26C31 (RS422)', shows six differential signal pairs: A and A', B and B', Z and Z', U and U', V and V', and W and W'. Each pair is connected to a triangular driver symbol with a small circle at its base. The right set, labeled 'Option B & C) 26C31 ABZ, Open Collector UVW, Option C) U, V and W referenced to GND2', shows three single-ended signals: A, B, and Z, each connected to a triangular driver symbol. Below these are three open-collector output symbols (triangles with a horizontal line at the base) for U, V, and W. Each open-collector output is connected to a common ground symbol labeled 'GND2'.

- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.
- U, V and W are "no connect" for pole option 0.

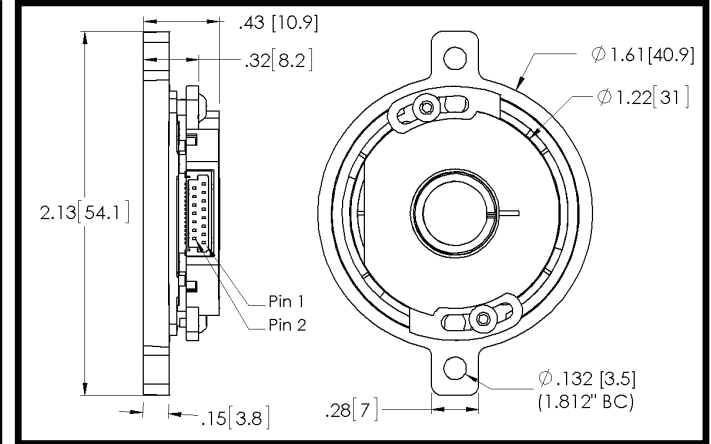
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MECHANICAL DIMENSIONS

Model QM35 – 1.280" Bolt Circle (Mounting Option A)



Model QM35 – 1.812" Bolt Circle (Mounting Option B)

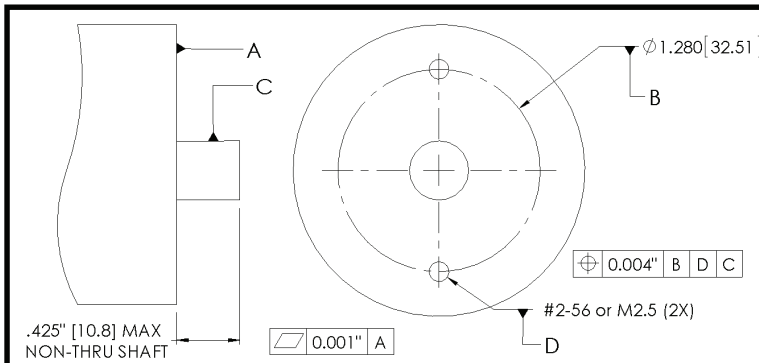


Note:

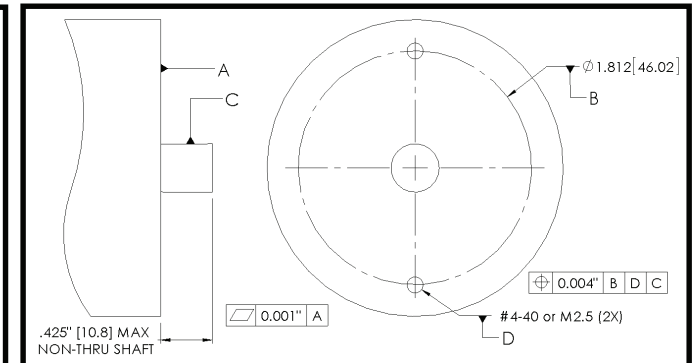
- Closed Cover Option B – Maximum shaft engagement up to .512" [13.0]. Overall height increases from .43 [10.9] to .57 [14.5]. This additional height has a cylinder diameter .56 [14.2], centered on the cover top.
- Closed Cover Option C – Maximum shaft engagement up to .450" [11.4]. Overall height increases from .43 [10.9] to .51 [13.0]. This additional height has a cylinder diameter .56 [14.2], centered on the cover top.

MOUNTING REQUIREMENTS

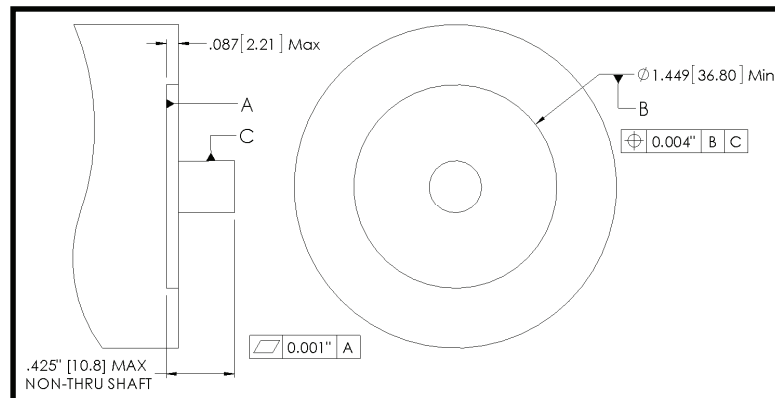
Mounting Option A (1.280" Bolt Circle)



Mounting Option B (1.812" Bolt Circle)



Servo Size 15 Mounting (Mounting Option A)



Patent Protection:

- Patent pending
- 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 required for .375" bore				3-48 x 3/32" Set Screw 3/32" set screw has deeper hex pocket to improve assembly tool life			
Mounting Screws with No Thread Lock		Mounting Screws with Thread Lock		Mounting Screws with No Thread Lock		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 required for .375" bore				3-48 x 3/32" Set Screw 3/32" set screw has deeper hex pocket to improve assembly tool life			
Mounting Screws with No Thread Lock		Mounting Screws with Thread Lock		Mounting Screws with No Thread Lock		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

Option C = No Hardware

Note:

- Options A, B, D, E, K, L, M, N are required for Hub Size = N (.375"). These options can be used with all other hub sizes.
- Options F, G, H, J, P, Q, R, S are not compatible with Hub Size = N (.375"). These kits have longer set screw 3-48 x 3/32".
- Thread lock application to 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" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 3/32" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015
Mounting Screws (Qty. 2 each)	2-56 x 1/4" Button Head, .05" Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG002	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG050	2-56 x 1/4" Button Head, .05" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG102	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG150	2-56 x 1/4" Button Head, .05" Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG002	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG050	2-56 x 1/4" Button Head, .05" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG102	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm 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" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015
Mounting Screws (Qty. 2 each)	4-40 x 5/16" Button Head, .062" Hex (Torque = 45 - 51 oz-in) Part Number 1835ZG004	M2.5 x 8mm Button Head, 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG051	4-40 x 5/16" Button Head, .062" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1835ZG104	M2.5 x 8mm Button Head, 1.5mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG151	4-40 x 5/16" Button Head, .062" Hex (Torque = 45 - 51 oz-in) Part Number 1835ZG004	M2.5 x 8mm Button Head, 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG051	4-40 x 5/16" Button Head, .062" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1835ZG104	M2.5 x 8mm Button Head, 1.5mm 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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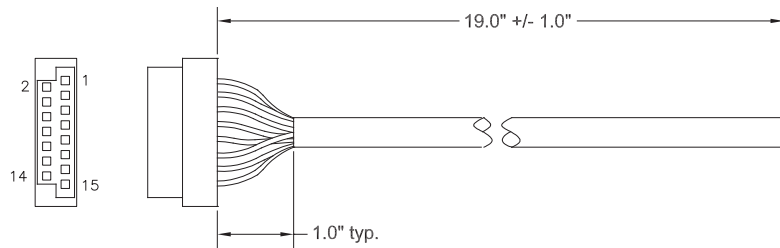
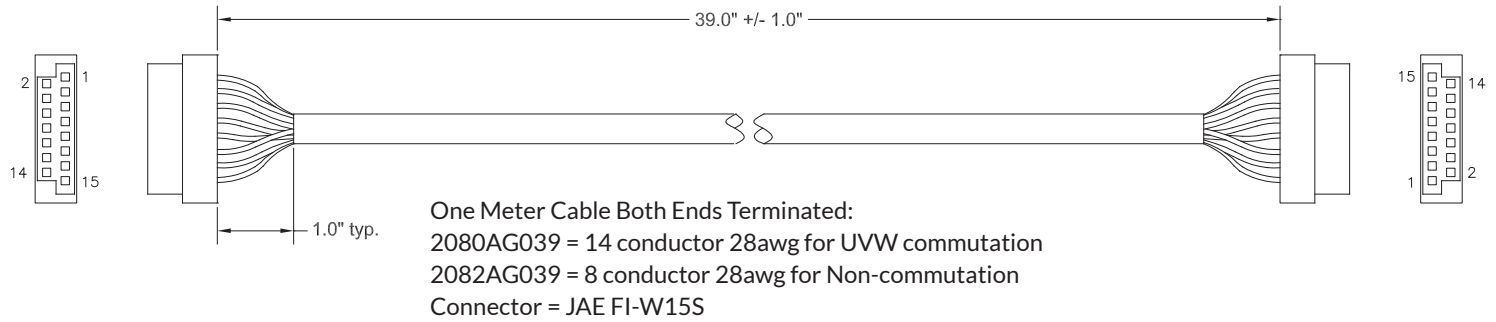
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CABLE ACCESSORIES

(2080AG039, 2082AG039, 2081AG019, 2083AG019)

Consult Factory for Custom Lengths



Pin Number	Signal Function	2080AG039 2081AG019 Wire Color	2082AG039 2083AG019 Wire Color
1	A	Brown	Brown
2	A -	White	White
3	B	Blue	Blue
4	B -	Green	Green
5	Z	Orange	Orange
6	Z -	Yellow	Yellow
7	U	Violet	
8	U -	Gray	
9	V	White/Brown	
10	V -	White/Red	
11	W	White/Orange	
12	W -	White/Yellow	
13	Vcc	Red	Red
14	GND	Black	Black
15	No Connect		

Note:

1. Cable has internal foil shield with 28awg 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.

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REV. 170627

ISO 9001
 CERT. NO. FM 52711

**Quantum
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QML35

DESIGN FEATURES

- Bearingless modular design
- Low profile assembled height
- Resolutions up to 8192 lines per revolution
- 4, 6, 8 or 10 pole commutation
- Easy lock-n-twist assembly feature
- Through shaft sizes up to 0.375" diameter
- Up to 1Mhz 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 pending lock-n-twist mechanism simplifies installation, saving production time and money. The QML35 is the newest solution to your motion control needs.

QML35 - **1000** - **4** - **A** - **A** - **L** - **A** - **A** - **A**

Resolution Commutation Voltage Cover Bore Mounting Index Hardware

Configuration Options:

Resolution	Commutation	Voltage	Cover	Bore Size	Mounting	Index	Hardware
360, 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	A = 5V (+/- 5%) B = 3.3V (+/- 5%)	A = Hole in Cover B = Closed Cover (shaft < .512") C = Closed Cover (shaft < .450")	C = 5mm D = 6mm E = 8mm K = .1875" L = .250" N = .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

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.) 360PPR not available with 6, 8 or 10 poles.

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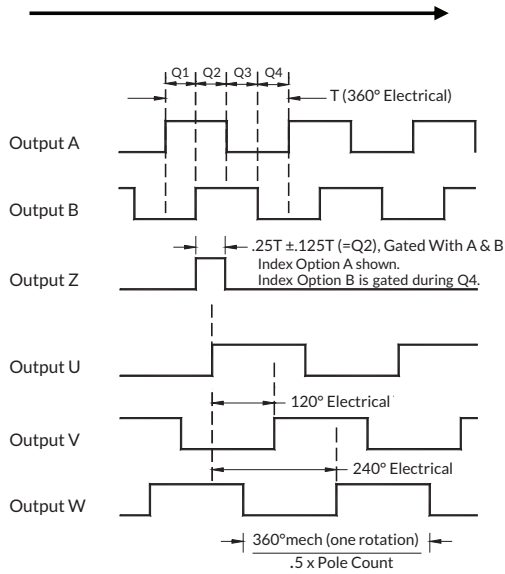
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ISO 9001
CERT. NO. FM 52711

OUTPUT WAVEFORMS

CCW Shaft Rotation as Viewed Looking at Encoder Top.



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

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

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

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5% or 3.3v \pm 5%
Input Current Requirements	65mA typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	TTL- sink or source 4ma max. Compatible with Renco PP option.
Incremental Output Format	Quadrature A leading B for CCW rotation viewed from encoder top.
Max Operating Frequency	<ul style="list-style-type: none"> < 5000PPR = 500Khz or 15,000RPM 5000PPR – 7999PPR = 675Khz \geq 8000PPR = 1.0Mhz
Commutation Format	Three phase 4, 6, 8 or 10 poles
Commutation Accuracy (U-V-W)	\pm 2° mechanical
Interpolation Factors	1000/1024PPR = 2x 2000/2048PPR = 4x 2500PPR = 5x 4000/4096PPR = 8x 5000/5120PPR = 10x 8000/8192PPR = 16x

ENVIRONMENTAL SPECIFICATIONS

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

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 pole option 0.

MECHANICAL SPECIFICATION

Hub Minimum Diameter	Hub Size +0.0002"
Recommended Shaft Tolerance	-0.0005, + 0.0000"
Minimum Shaft Engagement	.400" [10.2mm]
Allowable Shaft Run Out	0.05mm, 0.002" TIR [+/- .0010" shaft radial play from initial shaft position of assembled encoder]
Allowable Axial Shaft Movement	\pm 0.25mm, \pm 0.010"
Mounting	1.28", 1.812" bolt circle, resolver mount
Dynamic Commutation Adjustment Range	30° mechanical
Moment of Inertia	8.0 x 10 ⁻⁶ oz-in-S ²

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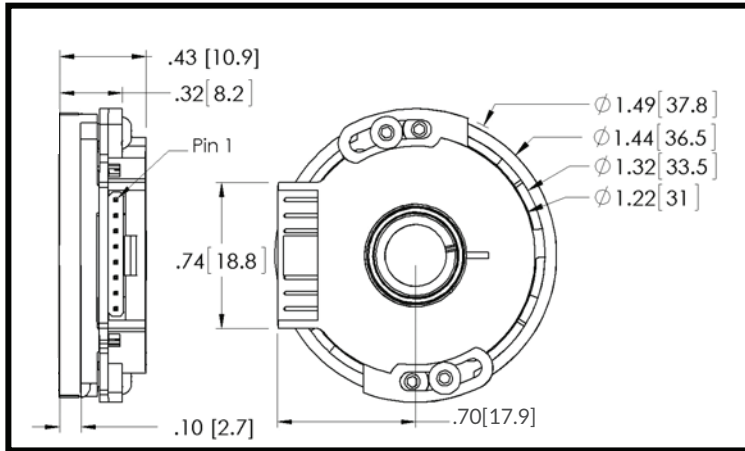
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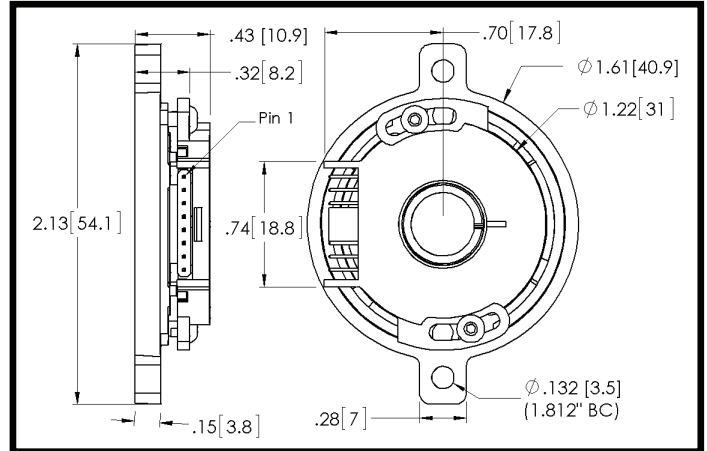
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MECHANICAL DIMENSIONS

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



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

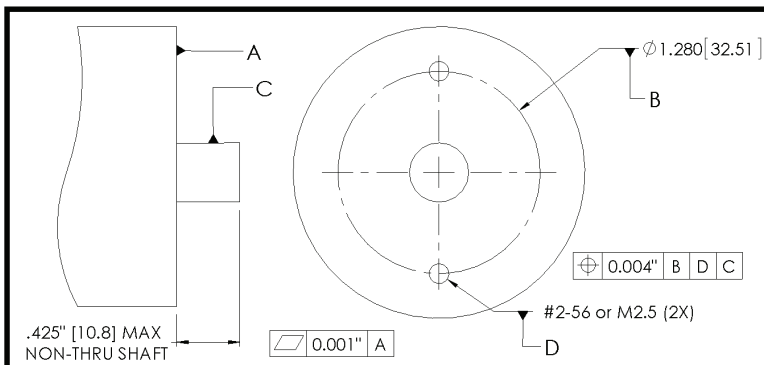


Note:

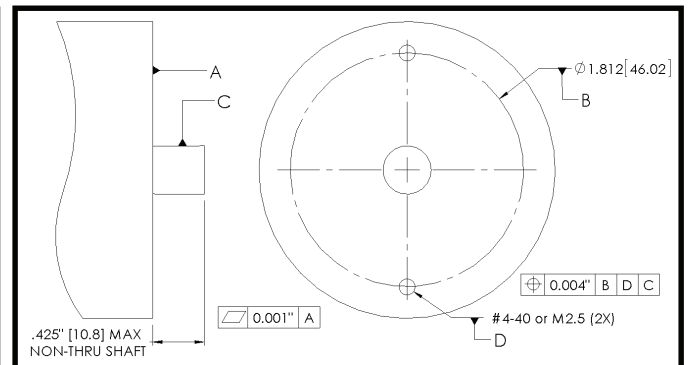
- Closed Cover Option B – Maximum shaft engagement up to .512" [13.0]. Overall height increases from .43 [10.9] to .57 [14.5]. This additional height has a cylinder diameter .56 [14.2], centered on the cover top.
- Closed Cover Option C – Maximum shaft engagement up to .450" [11.4]. Overall height increases from .43 [10.9] to .51 [13.0]. This additional height has a cylinder diameter .56 [14.2], centered on the cover top.

MOUNTING REQUIREMENTS

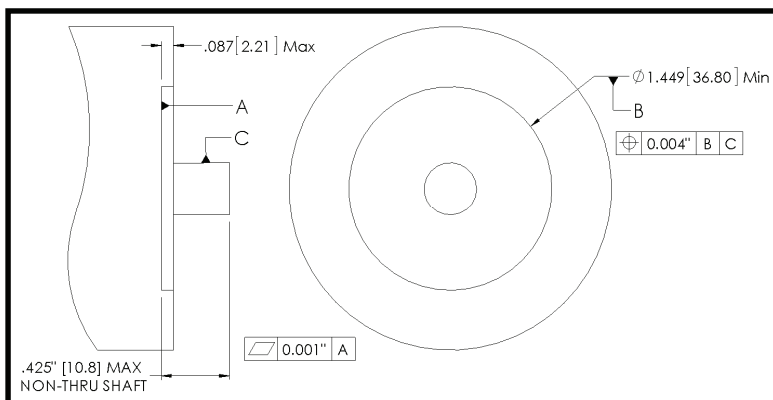
Mounting Option A (1.280" Bolt Circle)



Mounting Option B (1.812" Bolt Circle)



Servo Size 15 Mounting (Mounting Option A)



Patent Protection:

- Patent Pending
- 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 required for .375" bore				3-48 x 3/32" Set Screw 3/32" set screw has deeper hex pocket to improve assembly tool life			
Mounting Screws with No Thread Lock		Mounting Screws with Thread Lock		Mounting Screws with No Thread Lock		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 required for .375" bore				3-48 x 3/32" Set Screw 3/32" set screw has deeper hex pocket to improve assembly tool life			
Mounting Screws with No Thread Lock		Mounting Screws with Thread Lock		Mounting Screws with No Thread Lock		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

Option C = No Hardware

Note:

- Options A, B, D, E, K, L, M, N are required for Hub Size = N (.375"). These options can be used with all other hub sizes.
- Options F, G, H, J, P, Q, R, S are not compatible with Hub Size = N (.375"). These kits have longer set screw 3-48 x 3/32".
- Thread lock application to 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" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 3/32" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015
Mounting Screws (Qty. 2 each)	2-56 x 1/4" Button Head, .05" Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG002	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG050	2-56 x 1/4" Button Head, .05" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG102	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG150	2-56 x 1/4" Button Head, .05" Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG002	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG050	2-56 x 1/4" Button Head, .05" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG102	M2.5 x 6mm Button Head (max dia. 4.5mm) 1.5mm 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" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 1/16" .05" Hex (Torque = 18 - 22 oz-in) Part Number 1829ZG014	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015	Black Ox 3-48 x 3/32" .05" Hex (Torque = 28 - 32 oz-in) Part Number 1829ZG015
Mounting Screws (Qty. 2 each)	4-40 x 5/16" Button Head, .062" Hex (Torque = 45 - 51 oz-in) Part Number 1835ZG004	M2.5 x 8mm Button Head, 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG051	4-40 x 5/16" Button Head, .062" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1835ZG104	M2.5 x 8mm Button Head, 1.5mm Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1834AG151	4-40 x 5/16" Button Head, .062" Hex (Torque = 45 - 51 oz-in) Part Number 1835ZG004	M2.5 x 8mm Button Head, 1.5mm Hex (Torque = 45 - 51 oz-in) Part Number 1834ZG051	4-40 x 5/16" Button Head, .062" Hex with thread lock (Torque = 45 - 51 oz-in) Part Number 1835ZG104	M2.5 x 8mm Button Head, 1.5mm 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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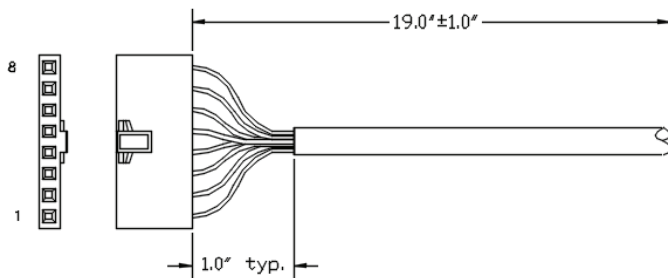
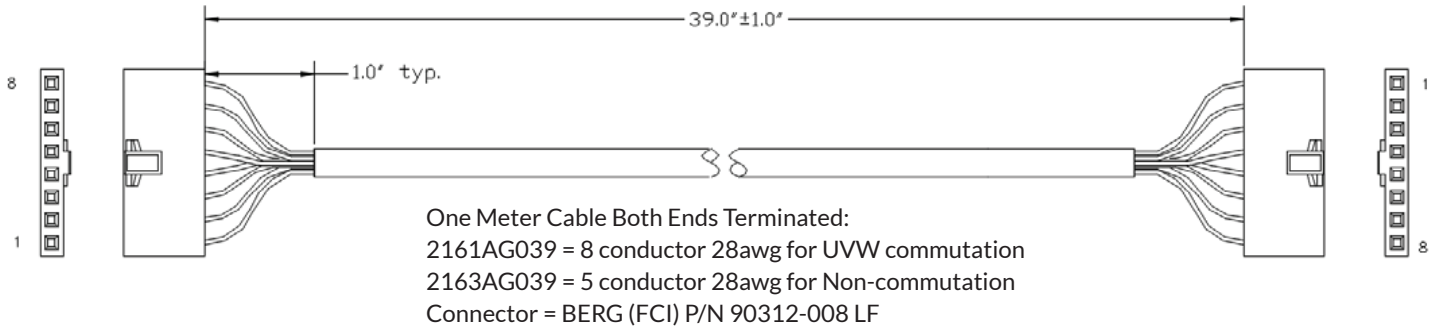
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CABLE ACCESSORIES

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

Consult Factory for Custom Lengths



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

Pin Number	Signal 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 28awg 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.

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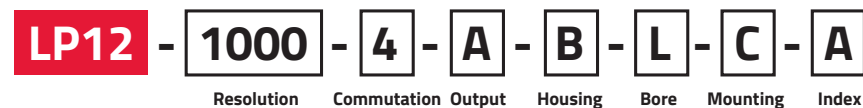
LP12

DESIGN FEATURES

- Low profile assembled height of 0.816"
- Bearing design simplifies encoder attachment
- Incremental resolutions up to 20,000 LC
- SIN/COS outputs available up to 1250 LC
- Standard 4, 6 or 8 pole commutation
- Multiple bolt circle mounting
- Through shaft sizes up to 0.3125" (8mm) diameter
- High noise immunity
- Cost competitive with modular encoders
- 500 kHz frequency response
- RoHS construction



Quantum Devices, Inc. Model LP12 provides an improved feedback solution in applications typically using modular encoders. With an overall height of less than an inch and the stability of a bearing encoder design, the model LP12 can provide significant performance upgrades in applications limited by traditional modular encoder solutions. Outputs consist of a quadrature with index pulse (incremental or sinusoidal) and three-phase commutation. A flexible member allows for much greater tail shaft run out and TIR than can be tolerated by modular encoder designs, plus it provides 30 degrees of rotation for commutation timing.



Configuration Options:

Resolution	Commutation	Output	Housing	Bore Size	Mounting	Index
24*, 256, 360, 500, 512, 1000, 1024, 1250, 2000, 2048, 2500, 4000, 4096, 5000, 8000, 8192, 10000, 16000, 16384, 20000	0 = No Comm 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole	A = Line Driver B = Line Driver ABZ/ Open Collector UVW C = Sin/Cos/ Line Driver UVW D = Sin/Cos/Open Collector UVW	B = Through Hole Cover C = Closed Cover	A = 3mm B = 4mm C = 5mm D = 6mm E = 8mm J = .125" K = .1875" L = .25" M = .3125"	A = 1.812" B = 1.575" C = 1.280"	A = 90° gated to A & B C = Ungated Square Wave (Sin/Cos Option Only) D = Ungated Sinusoidal (Sin/Cos Option Only)

*24 PPR only
available 0 poles

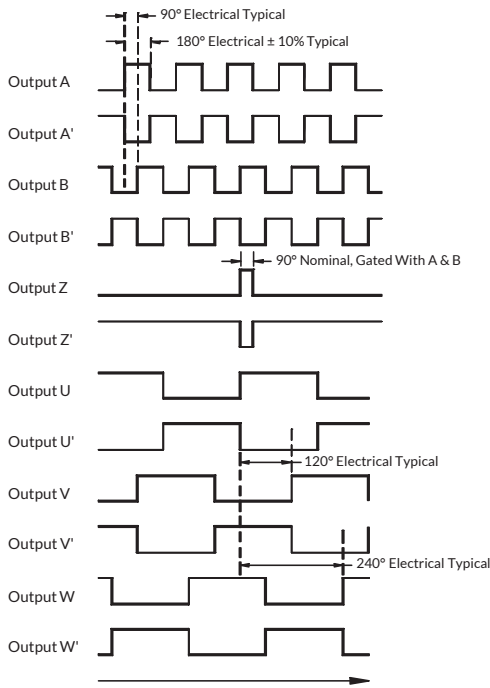
*Sin/Cos Limited to 500-1250 PPR
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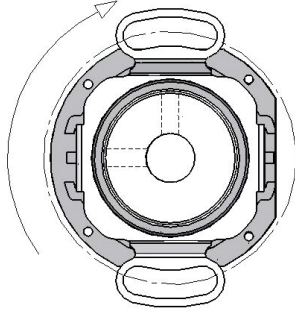
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OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed
Looking at the Encoder Face.
See figure below

CW Rotation for
Output Waveforms



Note: Relationship of Z signals to U, V, W signals is not to scale. A & B signals have no relationship to U, V, W signals.

INCREMENTAL ELECTRICAL SPECIFICATIONS

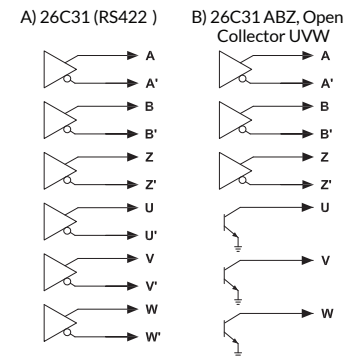
Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	(A) 26C31 RS 422A line driver (TTL compatible) (B) ABZ line driver, UVW open collector (No U' V' W')
Incremental Output Format	Quadrature with A leading B for CW rotation. Index pulse true over A and B high.
Frequency Response	500 kHz
Symmetry	180 degrees \pm 10% typical
Minimum Edge Separation	<4000PPR = 54 electrical degrees \geq 4000PPR = 45 electrical degrees
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical
Z channel to U channel	\pm 1° mechanical

15 PIN CONNECTOR JAE P/N: F1-W15P-HFE

Pin Number	Function
1	A
2	A -
3	B
4	B -
5	Z
6	Z -
7	U
8	U - *
9	V
10	V - *
11	W
12	W - *
13	Vcc
14	GND
15	Open

* U-, V- and W- not present for open collector UVW electrical option.

INCREMENTAL OUTPUT CIRCUITS



- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.

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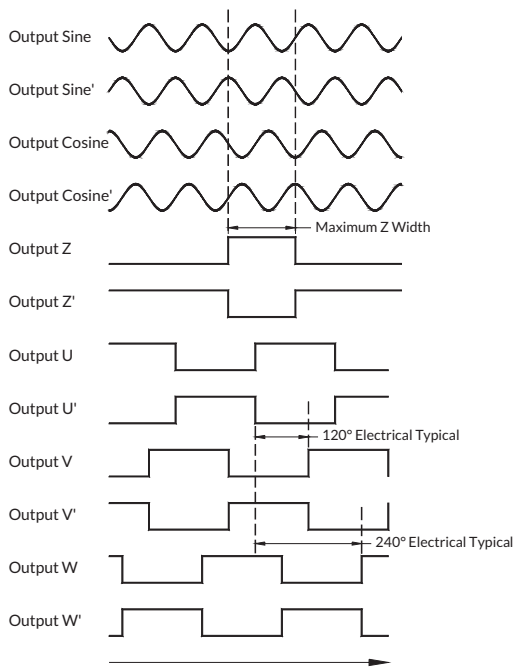
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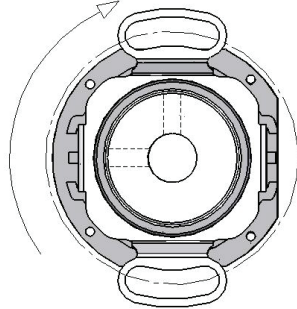
**Quantum
Devices**

SIN/COS OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed
Looking at the Encoder Face.
See figure below

CW Rotation for
Output Waveforms



Note: Relationship of Z signals to U, V, W signals is not to scale. Sin/Cos signals have no relationship to U, V, W signals.

SIN/COS ELECTRICAL SPECIFICATIONS

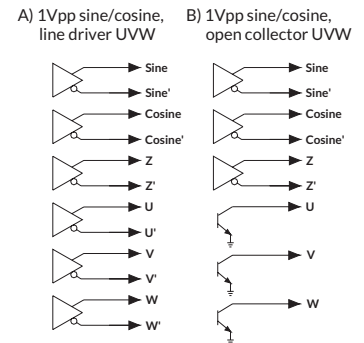
Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	(C) Sine/cosine, index & RS422 UVW (TTL compatible) (D) Sine/cosine, index & UVW open collector
Incremental Output Format	Quadrature sine/cosine with A leading B for CW rotation. Ungated index pulse.
Frequency Response	500 kHz
Sine/Cosine & Index Amplitude	1 Vpp \pm 5% (measured differentially)
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical
Z channel to U channel	\pm 1° mechanical

15 PIN CONNECTOR JAE P/N: F1-W15P-HFE

Pin Number	Function
1	Sine
2	Sine -
3	Cosine
4	Cosine -
5	Z
6	Z -
7	U
8	U - *
9	V
10	V - *
11	W
12	W - *
13	Vcc
14	GND
15	Open

* U-, V- and W- not present for open collector UVW electrical option.

ELECTRICAL OUTPUT CIRCUITS



- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.

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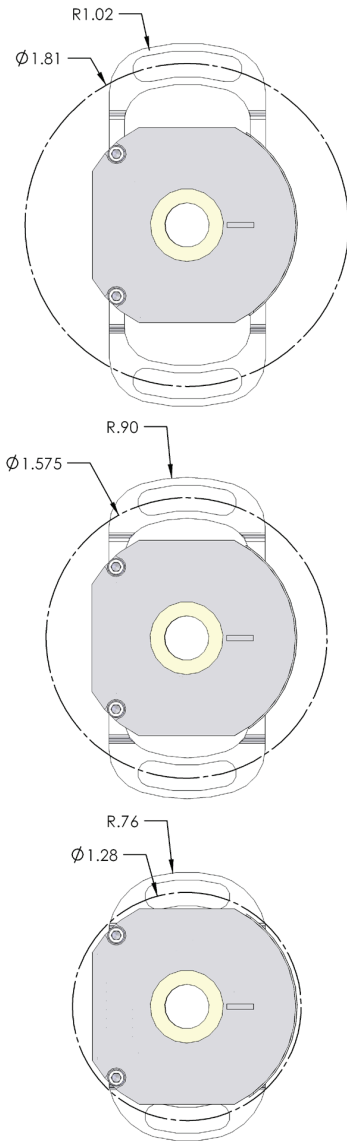
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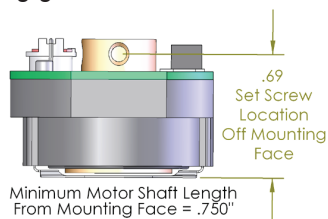
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**Quantum
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STANDARD BOLT CIRCLES



Shift Engagement



PHYSICAL SPECIFICATIONS

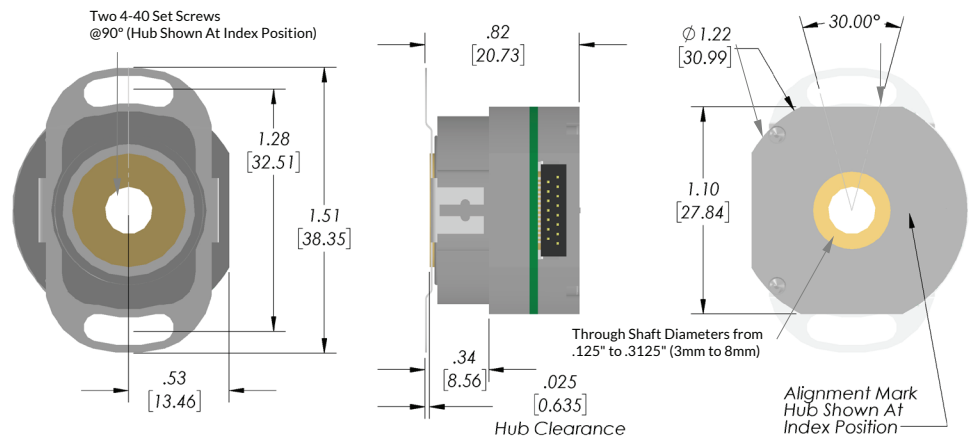
ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 115° C
IP Rating	40
Humidity	90% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration

MECHANICAL SPECIFICATION

Through Shaft Diameter	0.175", 0.1875", 0.250", 0.3125", 3mm, 4mm, 5mm, 6mm, 8mm
Tolerance	-0.0000, +0.0006
Recommended Shaft Engagement	.750" minimum
Radial Shaft Movement	0.007" TIR
Axial Shaft Movement	± 0.030"
Maximum Shaft Speed	8000 RPM, Contact Customer Service for higher RPM
Interface Connector	Connector: JAE P/N F1-W15P-HFE
Mounting	1.28", 1.575", 1.812" bolt circle
Moment of Inertia	9.1 x 10 ⁻⁵ oz-in-S ²
Acceleration	1x10 ⁵ Radians/S ²
Accuracy	Instrument error 1.5 arc min. max

PHYSICAL DIMENSIONS



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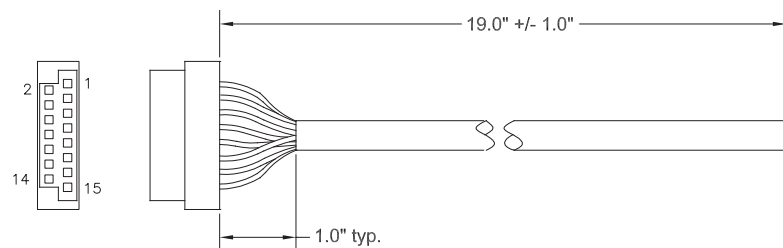
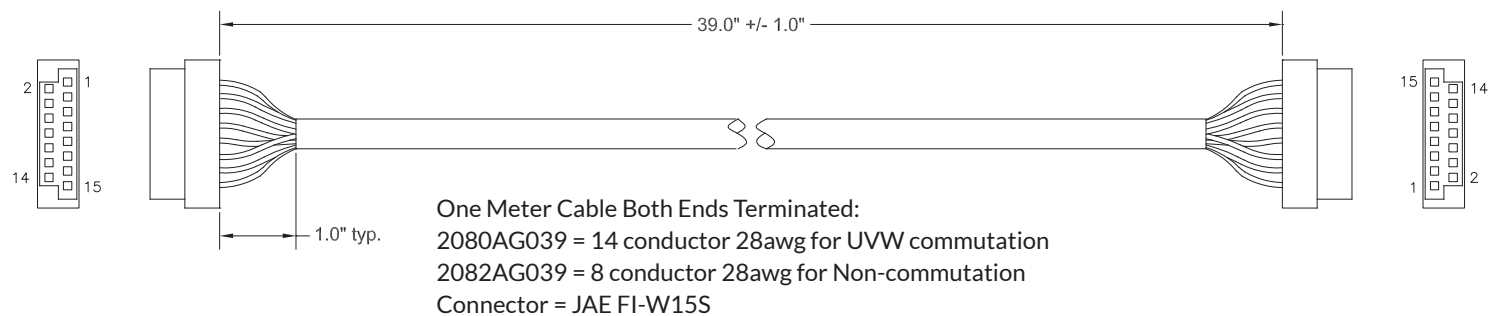
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**Quantum
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CABLE OPTIONS

(2080AG039, 2082AG039, 2081AG019, 2083AG019)

Consult Factory for Custom Lengths



Pin Number	Signal Function	2080AG039 2081AG019 Wire Color	2082AG039 2083AG019 Wire Color
1	A	Brown	Brown
2	A -	White	White
3	B	Blue	Blue
4	B -	Green	Green
5	Z	Orange	Orange
6	Z -	Yellow	Yellow
7	U	Violet	
8	U -	Gray	
9	V	White/Brown	
10	V -	White/Red	
11	W	White/Orange	
12	W -	White/Yellow	
13	Vcc	Red	Red
14	GND	Black	Black
15	No Connect		

Note:

1. Cable has internal foil shield with 28awg 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.

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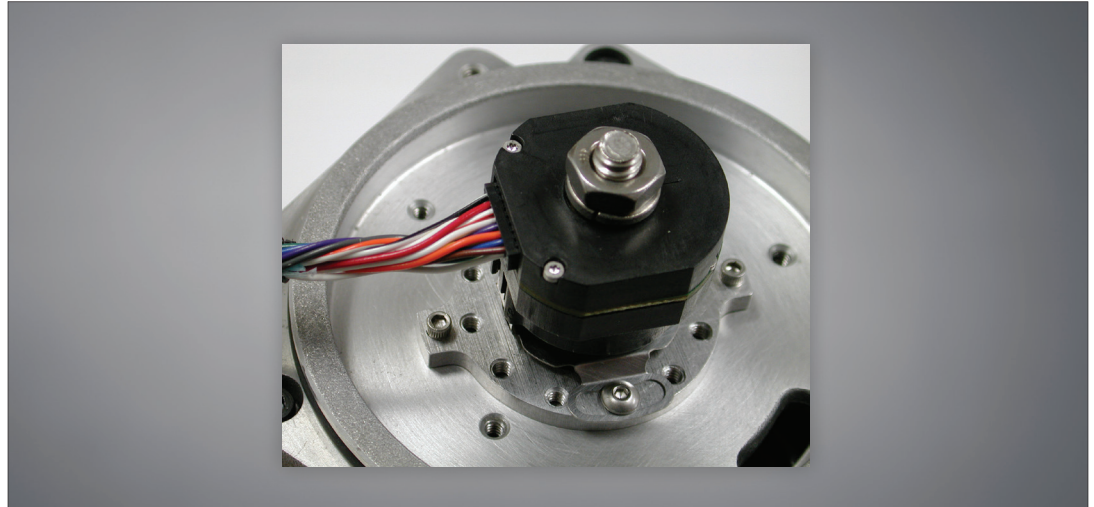
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**Quantum
 Devices**

JR12

DESIGN FEATURES

- Replaces size 15 pancake resolver
- Bearing design simplifies encoder attachment
- Resolutions up to 20,000 lines per revolution
- 4, 6 or 8 pole commutation
- Eliminates expensive mounting servo clamps
- Accommodates resolver type ¼" threaded shafts
- High noise immunity
- Cost competitive with modular encoders
- 500 kHz frequency response
- RoHS construction



Quantum Devices, Inc. Model JR12 provides an improved feedback solution in applications typically using pancake resolvers with same threaded shaft and jam nut mounting. With an overall height of less than one inch and the stability of a bearing encoder design, the model JR12 can provide significant performance upgrades in applications limited by traditional resolvers or modular encoder solutions. Output options consist of a quadrature with index pulse and three-phase commutation. A flexible member allows for much greater tail shaft run out and TIR than can be tolerated by modular encoder designs, plus the mounting flange eliminates the need for expensive servo mounting clips.

JR12 - **1000** - **4** - **A** - **B** - **R** - **C** - **A**

Resolution Commutation Output Hub Configuration Bore Mounting Index

Configuration Options:

Resolution*	Commutation	Output	Hub Configuration	Bore Size	Mounting	Index
24*, 256, 360, 500, 512, 1000, 1024, 1250, 2000, 2048, 2500, 4000, 4096, 5000, 8192, 10000, 16384, 20000	0 = 0 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole	A = RS422 (TTL) B = oc UVW	B = Hole in Cover	R = .250"	C = SS 1.280" Flex	A = Gated to AB, 90deg

*24 PPR only available 0 poles

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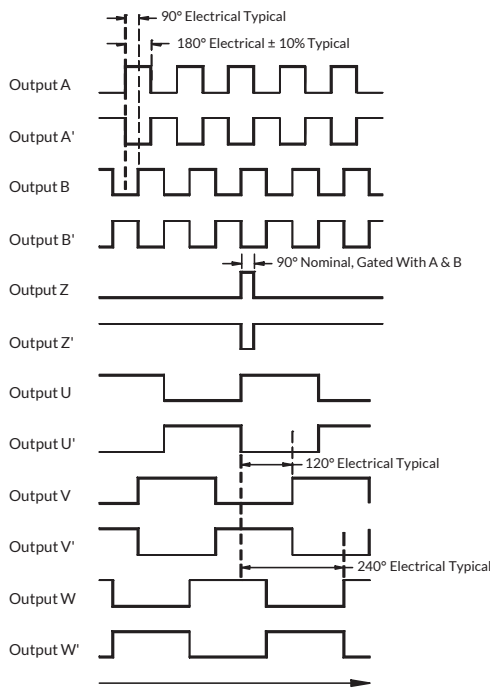
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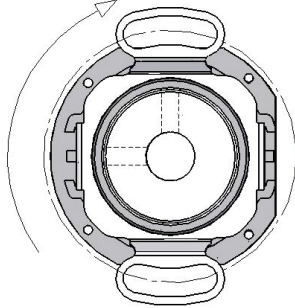
* Consult Factory for Configurations Not Shown

OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed Looking at the Encoder Face.
See figure below

CW Rotation for Output Waveforms



ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	(A) 26C31 RS 422A line driver (TTL compatible) (B) ABZ line driver, UVW open collector (No U' V' W')
Incremental Output Format	Quadrature with A leading B for CW rotation. Index pulse true over A and B high.
Frequency Response	500 kHz
Symmetry	180 Degrees \pm 10% typical
Minimum Edge Separation	<4000PPR = 54 electrical degrees \geq 4000PPR = 45 electrical degrees
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical
Z channel to U channel	\pm 1° mechanical

ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 115° C
IP Rating	40
Humidity	90% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration

MECHANICAL SPECIFICATION

Through Shaft Diameter	0.250" tolerance: -0.0000, + 0.0010"
Radial Shaft Movement	0.007" TIR
Axial Shaft Movement	\pm 0.030"
Maximum Shaft Speed	8000 RPM, Contact Customer Service for higher RPM
Interface Connector	Connector: JAE P/N F1-W15P-HFE
Mounting	Size 15 pancake resolver
Moment of Inertia	9.1×10^{-5} oz-in-S ²
Acceleration	1×10^5 Radians/S ²
Accuracy	Instrument error 1.5 arc min. max

15 PIN CONNECTOR JAE P/N: F1-W15P-HFE

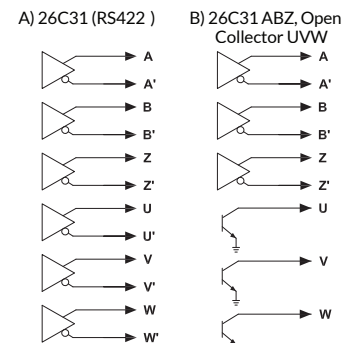
Pin Number	Function
1	A
2	A -
3	B
4	B -
5	Z
6	Z -
7	U
8	U - *
9	V
10	V - *
11	W
12	W - *
13	Vcc
14	GND
15	Open

* U-, V- and W- not present for open collector UVW electrical option.
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ELECTRICAL OUTPUT CIRCUITS



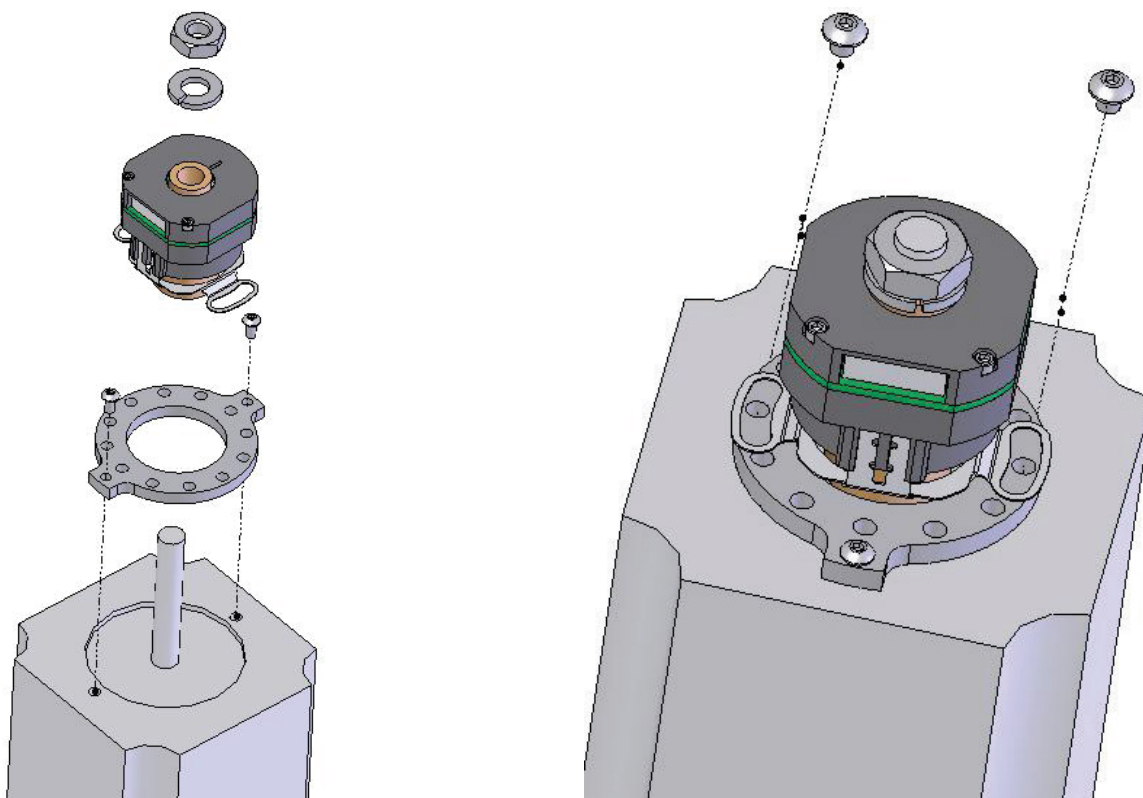
- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.

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MOUNTING

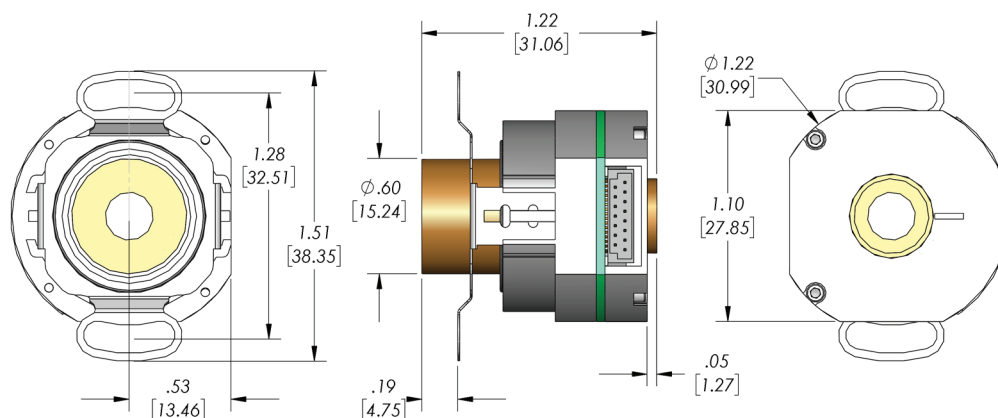
Motor resolver pocket to be same depth as motor shaft shoulder used as a mounting stop for the encoder, .062" (+/- .025") below motor rear face.



Install resolver adapter with 2-56 socket head screws. Slide encoder over 1/4" threaded shaft and secure with lock washer and jam nut to a torque of 40 – 60 in-lbs. Use thread lock or second jam nut if additional retention is required. Install (2) 4-40 button head screws to encoder flex mount to secure encoder body.

DIMENSIONS

JR12 JAM NUT MOUNT .250" BORE



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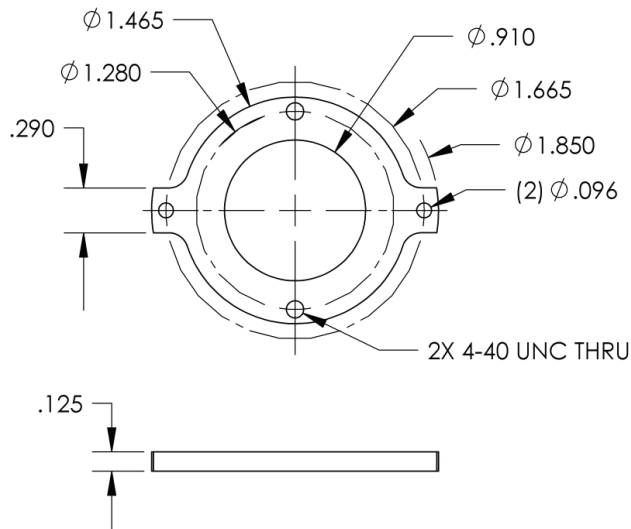
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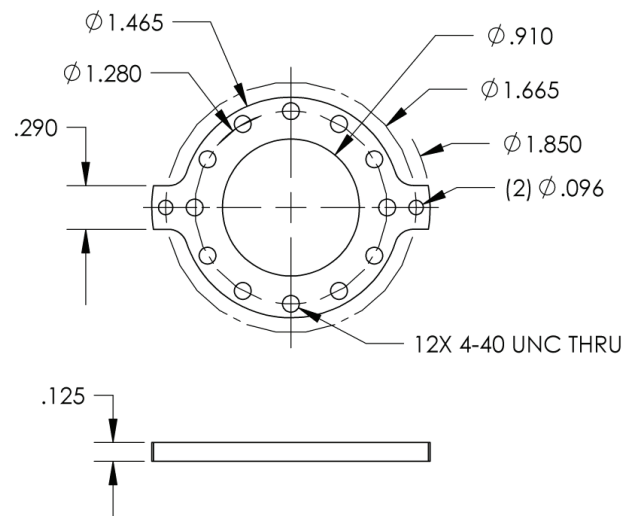
DIMENSIONS

Optional Aluminum Resolver Adapters

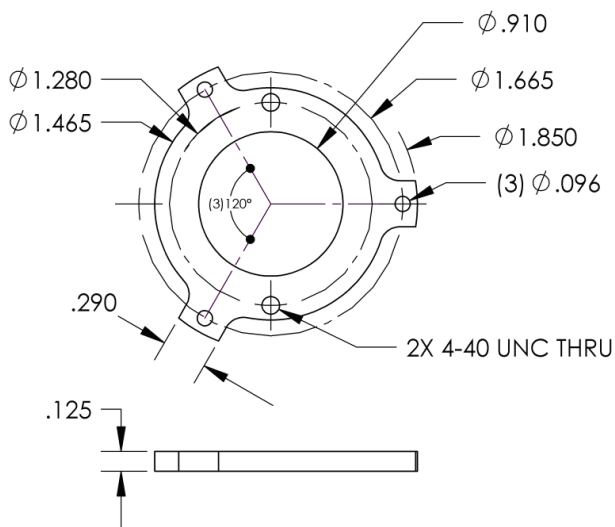
2074D024 – Two Point 30 Degree
Commutation Adjustment Range



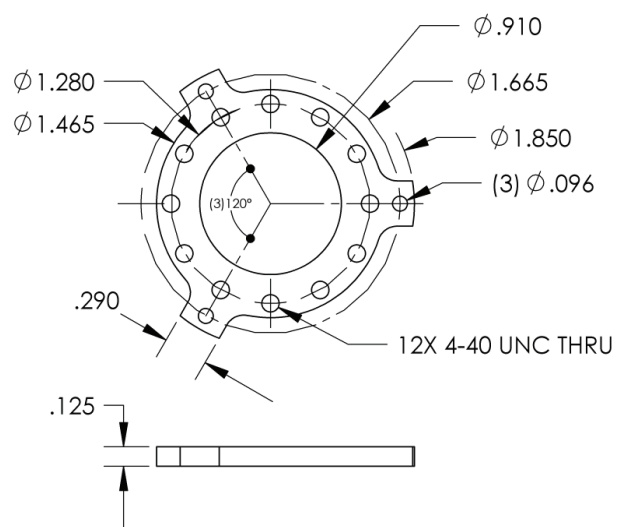
2074D025 – Two Point 360 Degree
Commutation Adjustment Range



2074D026 – Three Point 30 Degree
Commutation Adjustment Range



2074D027 – Three Point 360 Degree
Commutation Adjustment Range



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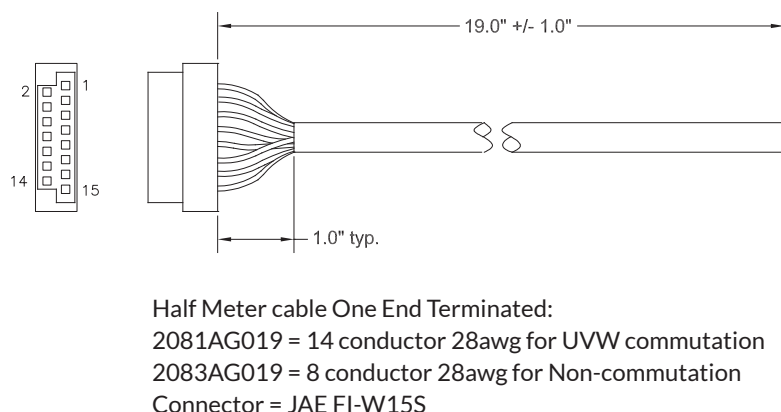
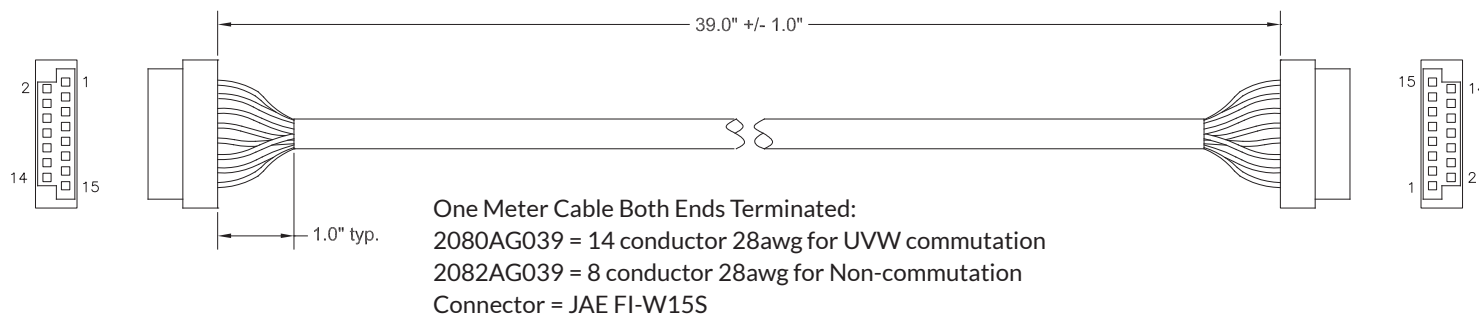
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CABLE OPTIONS

(2080AG039, 2082AG039, 2081AG019, 2083AG019)

Consult Factory for Custom Lengths



Pin Number	Signal Function	2080AG039 2081AG019 Wire Color	2082AG039 2083AG019 Wire Color
1	A	Brown	Brown
2	A -	White	White
3	B	Blue	Blue
4	B -	Green	Green
5	Z	Orange	Orange
6	Z -	Yellow	Yellow
7	U	Violet	
8	U -	Gray	
9	V	White/Brown	
10	V -	White/Red	
11	W	White/Orange	
12	W -	White/Yellow	
13	Vcc	Red	Red
14	GND	Black	Black
15	No Connect		

Note:

1. Cable has internal foil shield with 28awg 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.

For brushless motors requiring commutation timing:

- Encoder drawings indicate position of encoder hub to encoder body at Z (index). Rotating the hub to this position allows for known U channel transition state, prior to assembling to motor shaft.
- Power appropriate motor windings to lock motor shaft location to match the appropriate U transition, prior to assembly to motor shaft.
- Flex mount screws can be loosened to allow rotation of encoder body. While mechanically back driving the motor, monitor motor winding EMF position to the powered encoder commutation position. Rotate the encoder body to achieve accurate timing of encoder commutation feedback channels to the appropriate motor winding EMF. Mounting slots in encoder flex mount allow for 30 mechanical degrees of rotation. Retighten the flex mount screws.

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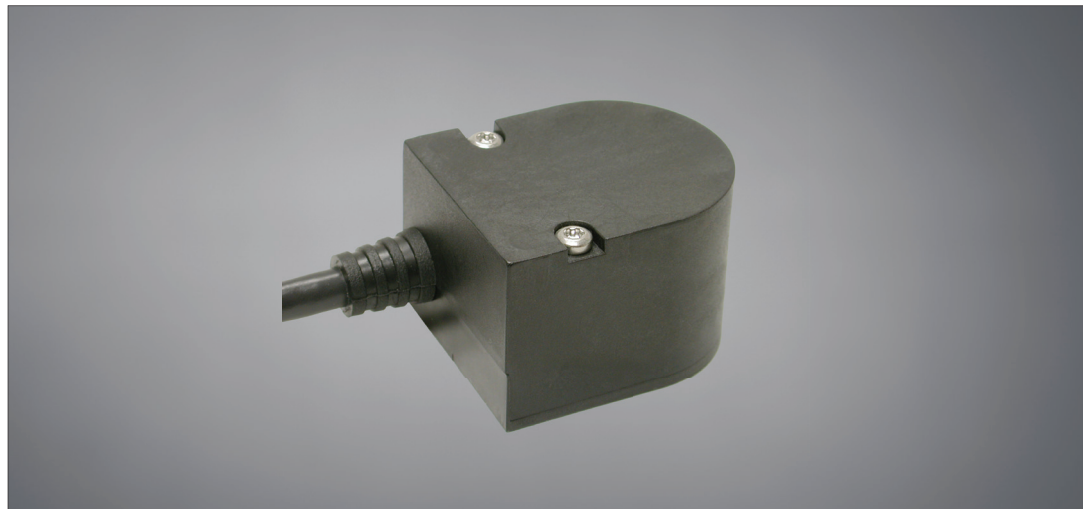
ISO 9001
 CERT. NO. FM 52711

**Quantum
 Devices**

HR12

DESIGN FEATURES

- Mount compatible with HEDS encoders
- Bearing design simplifies encoder attachment
- Resolutions up to 20,000 lines per revolution
- 4, 6 or 8 pole commutation
- Differential line drivers
- Protective enclosure
- Multiple bolt circle mounting
- Through shaft sizes up to 0.375" (10mm) diameter
- High noise immunity
- Cost competitive with modular encoders
- 500 kHz frequency response
- RoHS construction
- No centering tools required for easy assembly



Quantum Devices, Inc. Model HR12 provides an improved feedback solution in applications typically using modular encoders. The HR12 provides feedback capabilities where the others leave off – high line count resolution, high temperature operation, rugged bearing construction, large tolerance to radial and axial shaft play, commutation for brushless motor control, with a strain relieved cable. Quadrature output with index pulse and three-phase commutation provided with industrial 26C31 differential drivers. A flexible member allows for much greater tail shaft run out and TIR than can be tolerated by modular encoder designs, plus it provides 30 degrees of rotation for commutation timing.

HR12 - **1000** - **4** - **A** - **H** - **L** - **H** - **A**

Resolution Commutation Output Hub Bore Mounting Index

Configuration

Configuration Options:

Resolution*	Commutation	Output	Hub Configuration	Bore Size	Mounting	Index
24*, 256, 360, 500, 512, 1000, 1024, 1250, 2000, 2048, 2500, 4000, 4096, 5000, 8192, 10000, 16384, 20000	0 = 0 4 = 4 Pole 6 = 6 Pole 8 = 8 Pole	A = RS422 (TTL) B = oc UVW	H = HEDS Compatible Configuration	C = 5mm D = 6mm E = 8mm F = 10mm L = .25" M = .3125" N = .375"	H = HEDS	A = Gated to AB, 90deg

*24 PPR only available 0 poles

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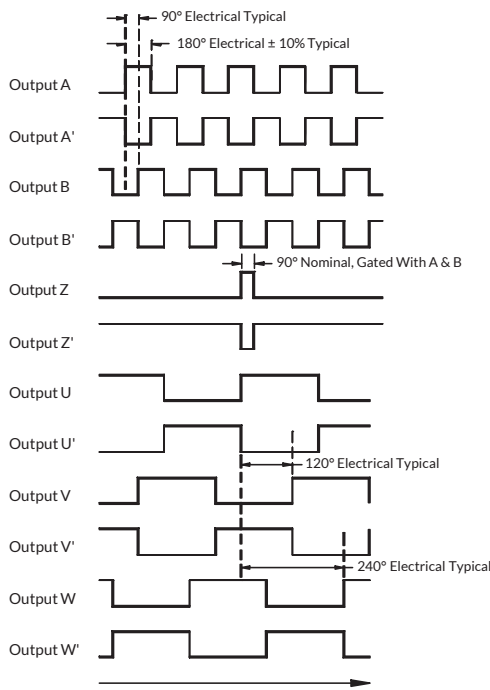
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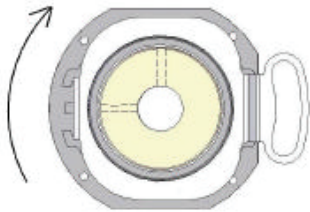
* Consult Factory for Configurations Not Shown

OUTPUT WAVEFORMS



Clockwise Shaft Rotation as Viewed Looking at the Encoder Face.
See figure below

CW Rotation for Output Waveforms



Hub set screw location at Z index position

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5%
Input Current Requirements	65mA typ., 100mA max plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	(A) 26C31 RS 422A line driver (TTL compatible) (B) ABZ line driver, UVW open collector (No U' V' W')
Incremental Output Format	Quadrature with A leading B for CW rotation. Index pulse true over A and B high.
Frequency Response	500 kHz
Symmetry	180 Degrees \pm 10% typical
Minimum Edge Separation	<4000PPR = 54 electrical degrees \geq 4000PPR = 45 electrical degrees
Commutation Format	Three phase 4, 6 or 8 poles
Commutation Accuracy	\pm 1° mechanical
Z channel to U channel	\pm 1° mechanical

ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 115° C
IP Rating	52
Humidity	90% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration

MECHANICAL SPECIFICATION

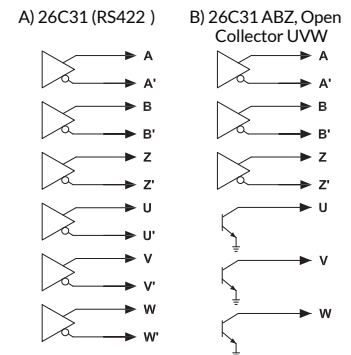
Through Shaft Diameter	0.250", 0.3125", 0.375", 5mm, 6mm, 8mm, 10mm Tolerance: -0.0000", + 0.0006"
Recommended Shaft Engagement	.50" minimum
Radial Shaft Movement Max	0.007" TIR (shaft eccentricity plus radial play)
Axial Shaft Movement	\pm 0.030"
Maximum Shaft Speed	8000 RPM
Interface Connector	Connector: JAE P/N F1-W15P-HFE
Mounting	HEDS Compatible: 0-80 screw 3 places on .823" circle 2-56 screw 2 places on .750" circle
Moment of Inertia	9.1×10^{-5} oz-in-S ²
Acceleration	1×10^5 Radians/S ²
Accuracy	Instrument error 1.5 arc min. max

15 PIN CONNECTOR JAE P/N: F1-W15P-HFE

Pin Number	Function
1	A
2	A -
3	B
4	B -
5	Z
6	Z -
7	U
8	U - *
9	V
10	V - *
11	W
12	W - *
13	Vcc
14	GND
15	Open

* U-, V- and W- not present for open collector UVW electrical option.

ELECTRICAL OUTPUT CIRCUITS



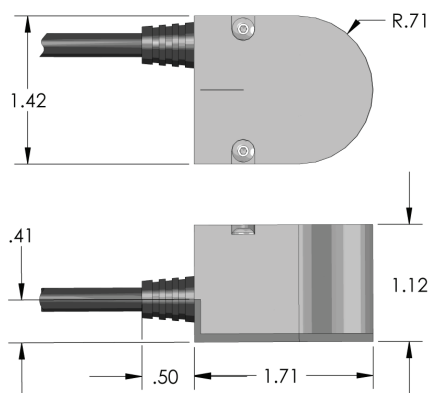
- 26C31 sink/source current (max) = 20ma (meets RS-422 at 5vdc supply).
- Open collector sink current (max) = 30ma.
- Open collector pull up voltage (max) = 30vdc.

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DIMENSIONS



Motor Mounting Considerations

3 SCREW MOUNTING 0-80
3 PLCS-EQUALLY SPACED
ON .823 DIAMETER CIRCLE

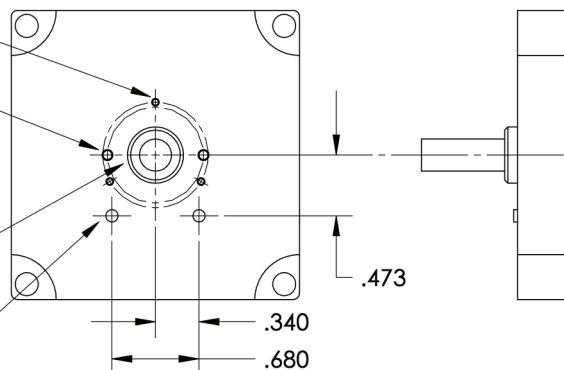
2 SCREW MOUNTING 2-56
2 PLCS-EQUALLY SPACED
ON .750 DIAMETER CIRCLE

$\pm .010$ " Motor Shaft Center

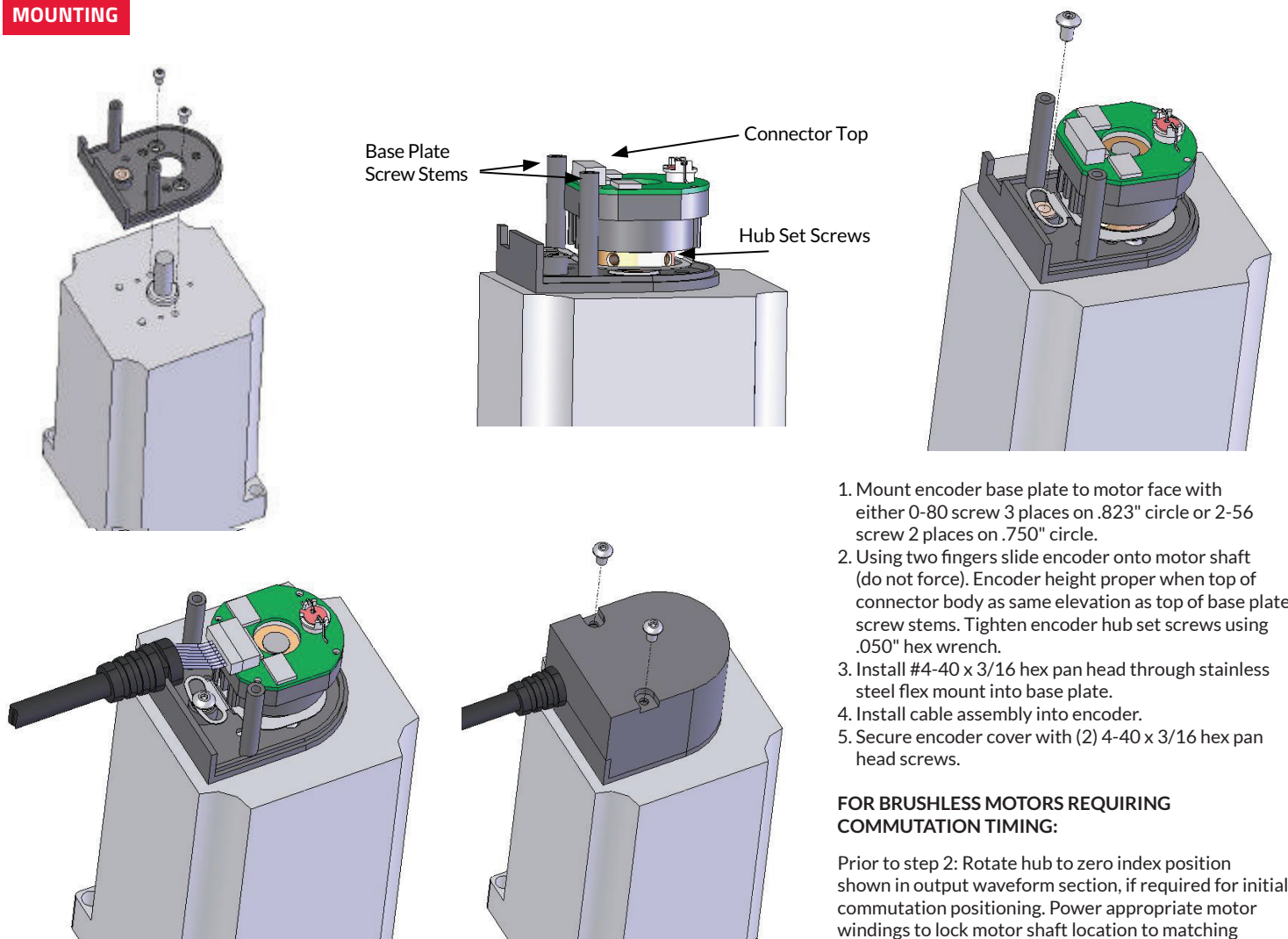
OPTIONAL MOUNTING AIDS

MOTOR BOSS:
DIAMETER = 0.431" - 0.438"
HEIGHT = 0.10"
CHAMFER = 0.03" X 45°

ALIGNING PINS:
DIAMETER = 0.092" - 0.096"
HEIGHT = 0.30"
CHAMFER = 0.01" X 45°



MOUNTING



1. Mount encoder base plate to motor face with either 0-80 screw 3 places on .823" circle or 2-56 screw 2 places on .750" circle.
2. Using two fingers slide encoder onto motor shaft (do not force). Encoder height proper when top of connector body as same elevation as top of base plate screw stems. Tighten encoder hub set screws using .050" hex wrench.
3. Install #4-40 x 3/16 hex pan head through stainless steel flex mount into base plate.
4. Install cable assembly into encoder.
5. Secure encoder cover with (2) 4-40 x 3/16 hex pan head screws.

FOR BRUSHLESS MOTORS REQUIRING COMMUTATION TIMING:

Prior to step 2: Rotate hub to zero index position shown in output waveform section, if required for initial commutation positioning. Power appropriate motor windings to lock motor shaft location to matching U transition.

Prior to step 5: Flex mount screw can be loosened to allow final commutation timing adjustment. Rotate encoder to match commutation signals to back driven EMF motor windings. Retighten flex mount screw.

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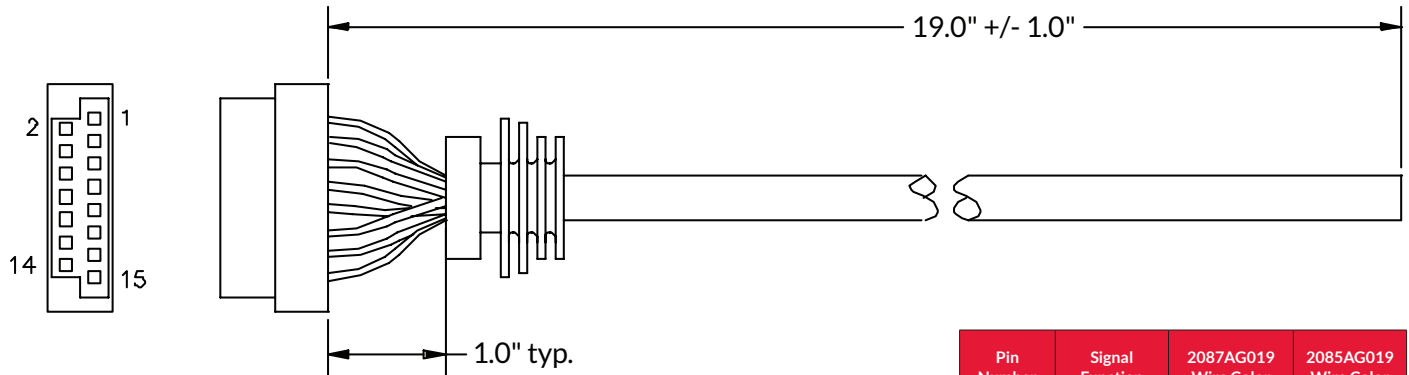
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CABLE OPTIONS

(2085AG019, 2087AG019)

Consult Factory for Custom Lengths



Half Meter Cable One End Terminated:

2085AG019 = 14 conductor 28awg for UVW commutation

2087AG019 = 8 conductor 28awg for Non-commutation

Connector = JAE FI-W15S

Pin Number	Signal Function	2087AG019 Wire Color	2085AG019 Wire Color
1	A	Brown	Brown
2	A -	White	White
3	B	Blue	Blue
4	B -	Green	Green
5	Z	Orange	Orange
6	Z -	Yellow	Yellow
7	U	Violet	
8	U -	Gray	
9	V	White/Brown	
10	V -	White/Red	
11	W	White/Orange	
12	W -	White/Yellow	
13	Vcc	Red	Red
14	GND	Black	Black
15	No Connect		

Note:

1. Cable has internal foil shield with 28awg 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.

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REV. 170627

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**Quantum
Devices**

QR110

DESIGN FEATURES

- Standard size 11 encoder mounting
- Compatible with size 11 resolver mounting
- Resolutions up to 2048 line per revolution direct read
- Unique optical sensing system
- Differential and single ended outputs
- Nickel coated carbon fiber composite housing
- IP 50 sealing
- High noise immunity
- Low supply current requirements



Quantum Devices, Inc. Model QR110 is designed to provide high resolution digital feedback in an industrial standard size 11 mounting format. Quadrature with reference pulse output format, resolutions up to 2048 lines per revolution (direct read) and a variety of electrical options are easily capable of satisfying the most demanding feedback application. The QR110 provides the user digital position information, directly from the feedback device, without the external R to D converters that are typically used with resolver feedback. Converting from size 11 resolver to encoder feedback is easily accomplished with the QR110 without the need for costly mounting modification to existing designs. QDI's unique optical sensing system embodies a much simplified encoder design, which ultimately results in longer service life and less downtime due to feedback device failure. A nickel coated carbon fiber composite housing provides the EMI shielding of an all-metal housing and the high performance of a lightweight assembly.

QR110 - **05/05** - **0500** - **01** - **01** - **S1**

Voltage Resolution Output I/O Termination Solid Shaft

Configuration Options:

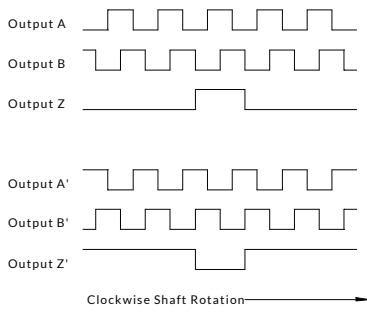
Voltage	Resolution	Output	I/O Termination	Solid Shaft
05/05 = 5VDC 05/26 = 5-26VDC	500, 512, 1000, 1024, 2000, 2048	01 = TTL 02 = Line Driver 03 = 5-26VDC Line Driver	01 = Straight Pins 02 = 8" Ribbon Cable w/Connector	S1 = .125"

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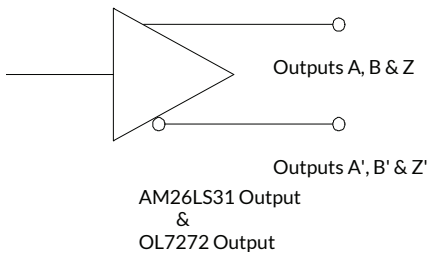
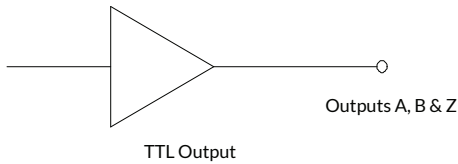
ISO 9001
CERT. NO. FM 52711

OUTPUT WAVEFORMS



Viewed From Shaft End

OUTPUT CIRCUITS



QR110 WIRING INFORMATION

Pin 1 - Common
Pin 2 - +VDC
Pin 3 - Z
Pin 4 - Z'
Pin 5 - B
Pin 6 - B'
Pin 7 - A
Pin 8 - A'
Pin 9 - N/C
Pin 10 - Case

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5% or 5-26 VDC
Input Current Requirements	80 mA max. Output option 01 & 02, 35mA max output option 03; plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	AM26LS31 RS 422A line driver TTL output OL7272 line driver
Output Format	Quadrature with A leading B for CW rotation. Index centered over A
Frequency Response	200 kHz
Symmetry	180 degrees \pm 10%
Minimum Edge Separation	54 electrical degrees max

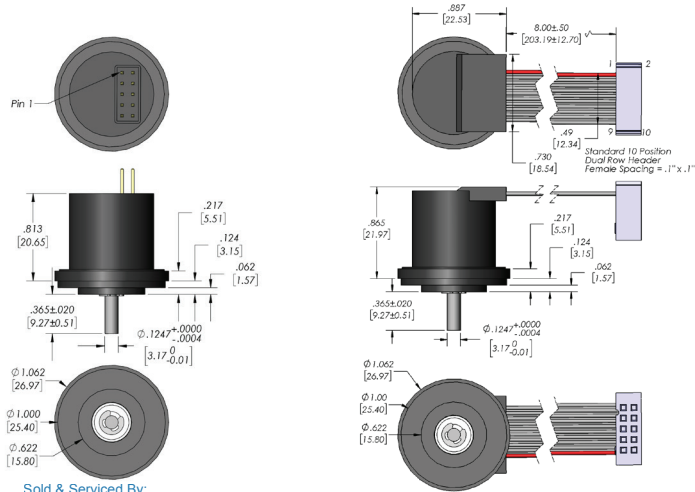
ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	0 to 70° C typical -20 to 100° C optional**
Humidity	98% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11ms duration

MECHANICAL SPECIFICATION

Maximum Shaft Speed	8000 RPM
Shaft Diameter	0.125"
Shaft Material	Stainless steel
Bearings	Radial ball bearing, R2 type
Radial Shaft Load	2 lbs. maximum
Axial Shaft Load	1 lb. maximum
Housing	Carbon fiber composite (case ground via connector)
Housing Volume Resistivity	10^{-2} ohm-cm
Termination	Two rows of 5 pins on 0.100" centers. 8" ten conductor ribbon cable with 2x5 connector
Mounting	Servo
Moment of Inertia	9.5×10^{-6} oz-in-sec ²
Acceleration	1×10^5 radians per second ²

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QR787 w/Blind Bore

DESIGN FEATURES

- Miniature size, 20mm (0.787") diameter
- Resolutions up to 2048 lines per revolution direct read
- Blind hollow shaft bores
- Long service life
- Conductive carbon fiber housing
- IP 50 sealing
- High noise immunity
- Low supply current requirements



Quantum Devices, Inc. Model QR787 blind hollow shaft version provides a high performance, high resolution digital feedback solution for small motor applications. The QR787 model provides the resolution of larger encoder packages, but in a package only 20mm (0.787") in diameter. Outputs can be configured in either single ended, 5 volt RS422A differential or with high voltage differential line driver. QDI's patent pending sensing scheme embodies a much simplified encoder design, which ultimately results in longer service life and less downtime due to feedback device failure. The encoder housing is constructed of a carbon fiber composite that provides the EMI shielding of an all-metal housing and performance of a lightweight robust assembly.

QR787 - **05/05** - **0500** - **01** - **01** - **H1**

Voltage Resolution Output I/O Hollow Bore
Termination

Configuration Options:

Voltage	Resolution	Output	I/O Termination	Hollow Bore
05/05 = 5VDC 05/26 = 5-26VDC	500, 512, 1000, 1024, 2000, 2048	01 = TTL 02 = Line Driver 03 = 5-26VDC Line Driver	01 = Straight Pins 02 = 8" Ribbon Cable w/Connector	H1 = 2.5mm H2 = 2mm H3 = .125" H4 = 3mm H5 = 4mm

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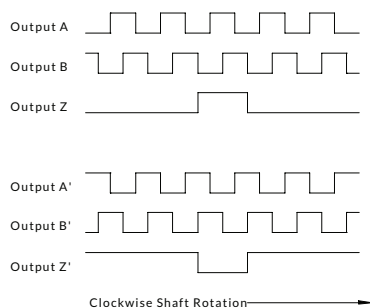
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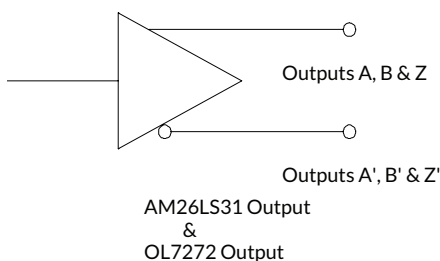
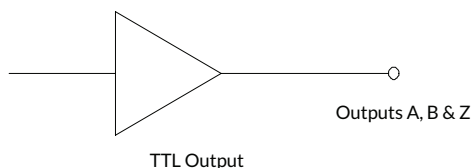
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OUTPUT WAVEFORMS



Viewed From Shaft End

OUTPUT CIRCUITS



QR787 WIRING INFORMATION

Pin 1 – Common
Pin 2 – +VDC
Pin 3 – Z
Pin 4 – Z'
Pin 5 – B
Pin 6 – B'
Pin 7 – A
Pin 8 – A'
Pin 9 – N/C
Pin 10 – Case

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5% or 5-26 VDC
Input Current Requirements	80 mA Max. output option 01 & 02, 35mA max output option 03; plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Currents	AM26LS31 RS 422A line driver TTL output, OL7272 line driver
Output Format	Quadrature with A leading B for CW rotation. Ungated Z index pulse true over A and B high
Frequency Response	200 kHz
Symmetry	180 degrees \pm 10% typical
Minimum Edge Separation	54 electrical degrees

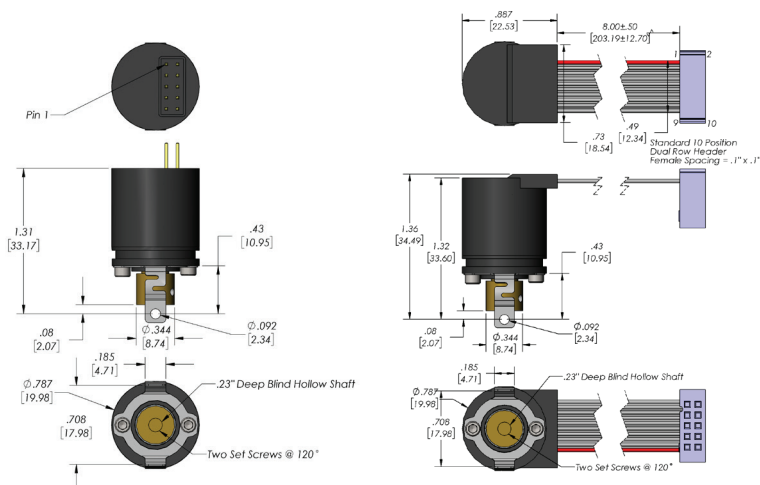
ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	0 to 70° C typical -20 to 100° C optional**
Humidity	98% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11ms duration

MECHANICAL SPECIFICATION

Maximum Shaft Speed	8000 RPM
Hollow Shaft Bores	0.125", 2.5mm, 2mm, 3mm, 4mm
Shaft Material	360 brass
Bearings	Radial ball bearing, R2 type
Radial Shaft Load	2 lbs. maximum
Axial Shaft Load	1 lb. maximum
Housing	Carbon fiber composite (case ground via connector)
Housing Volume Resistivity	10 ⁻² ohm-cm
Termination	Two rows of 5 pins on 0.100" centers. 8" ten conductor ribbon cable with 2x5 connector
Mounting	Servo
Moment of Inertia	9.5 x 10 ⁻⁶ oz-in-sec ²
Acceleration	1x10 ⁵ radians per second ²

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QR787 w/Shaft

DESIGN FEATURES

- Miniature size, 20mm (0.787") diameter
- Resolutions up to 2048 lines per revolution direct read
- Single ended and differential outputs
- Long service life
- Conductive carbon fiber housing
- IP 50 sealing
- High noise immunity
- Low supply current requirements



Quantum Devices, Inc. Model QR787 is intended for applications requiring high performance, high-resolution digital feedback in a very small package. The model QR787 provides the resolution of larger encoder packages but in a package only 20mm (0.787") in diameter. Outputs can be configured in either single ended, open collector or internal pull up resistor, or with an industrial standard RS 422A differential line driver. QDI's patent pending sensing scheme embodies a much simplified encoder design, which ultimately results in longer service life and less downtime due to feedback device failure. The encoder housing is constructed of a conductive carbon fiber composite that provides the EMI shielding of an all-metal housing and performance of a lightweight robust assembly.

QR787 - **05/05** - **0500** - **01** - **01** - **S1**

Voltage Resolution Output I/O Termination Solid Shaft

Configuration Options:

Voltage	Resolution	Output	I/O Termination	Solid Shaft
05/05 = 5VDC 05/26 = 5-26VDC	500, 512, 1000, 1024, 2000, 2048	01 = TTL 02 = Line Driver 03 = 5-26VDC Line Driver	01 = Straight Pins 02 = 8" Ribbon Cable w/ Connector	S1 = .125"

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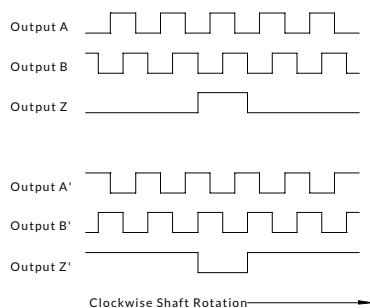
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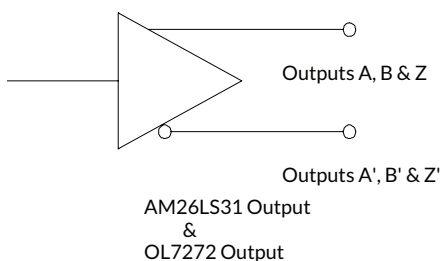
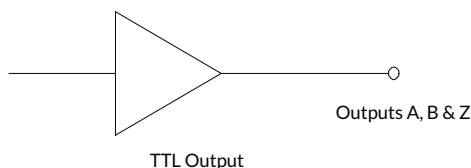
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OUTPUT WAVEFORMS



Viewed From Shaft End

OUTPUT CIRCUITS



QR787 WIRING INFORMATION

Pin 1 – Common
Pin 2 – +VDC
Pin 3 – Z
Pin 4 – Z'
Pin 5 – B
Pin 6 – B'
Pin 7 – A
Pin 8 – A'
Pin 9 – N/C
Pin 10 – Case

ELECTRICAL SPECIFICATIONS

Input Voltage	5 VDC \pm 5% or 5-26 VDC
Input Current Requirements	100 mA Max. output option 01 & 02, 50mA max output option 03; plus interface loads
Input Ripple	2% peak to peak @ 5 VDC
Output Circuits	AM26LS31 RS 422A line driver TTL output, OL7272 line driver
Output Format	Quadrature with A leading B for CW rotation. Ungated Z index pulse true over A and B high
Frequency Response	200 kHz
Symmetry	180 degrees \pm 10% typical
Minimum Edge Separation	54 electrical degrees

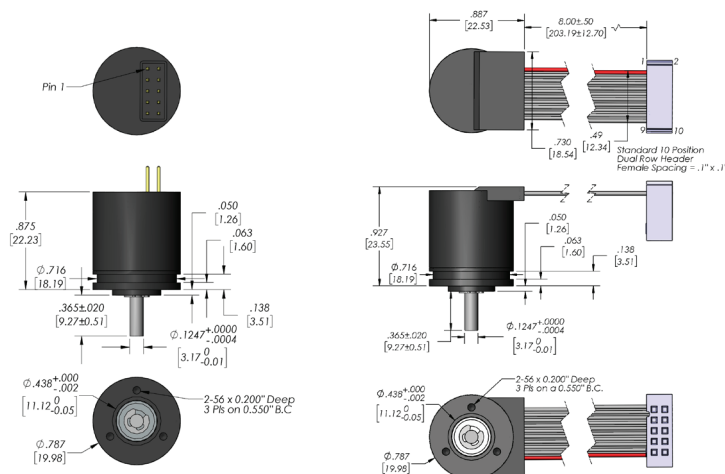
ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	0 to 70° C typical -20 to 100° C optional**
Humidity	98% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11ms duration

MECHANICAL SPECIFICATION

Maximum Shaft Speed	8000 RPM
Shaft Diameter	0.125"
Shaft Material	Stainless steel
Bearings	Radial ball bearing, R2 type
Radial Shaft Load	2 lbs. maximum
Axial Shaft Load	1 lb. maximum
Housing	Carbon fiber composite (case ground via connector)
Housing Volume Resistivity	10 ⁻² ohm-cm
Termination	Two rows of 5 pins on 0.100" centers. 8" ten conductor ribbon cable with 2x5 connector
Mounting	Servo
Moment of Inertia	9.5 x 10 ⁻⁶ oz-in-sec ²
Acceleration	1x10 ⁵ radians per second ²

**Contact factory for more information



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ISO 9001
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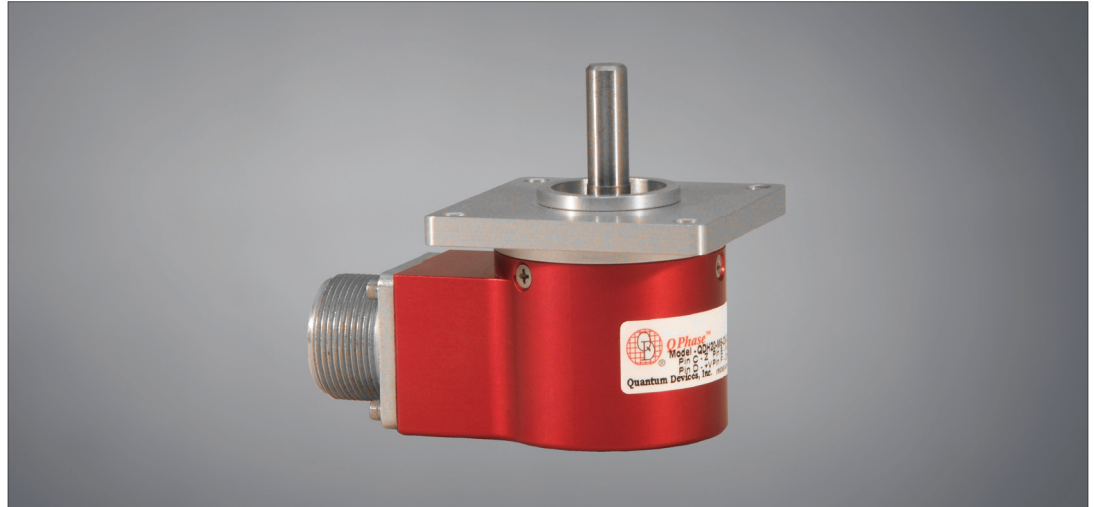
QDH20

DESIGN FEATURES

- 500 kHz fundamental frequency response
- High operating temperature (100°C)
- Resolutions up to 5000 lines per revolution direct read
- Flange and servo mount options
- Solid shaft sizes up to 10mm
- Hollow shaft sizes up to 0.625" diameter
- High noise immunity

APPLICATIONS

- Motion control feedback
- Machine control
- Process control
- Elevator controls
- Agricultural machinery
- Textile equipment
- Robotics
- Food processing
- Conveyors
- Material handling



Quantum Devices, Inc. Model QDH20 provides an improved feedback solution in applications typically using a standard size 20 package. The QDH20 provides encoder feedback in standard industrial mounting configurations with superb mechanical and environmental protection. Outputs consist of a quadrature A & B with reference pulse Z as a standard feature. The output can be configured with either the 5 to 26 volt OL7272 line driver or open collector outputs. The QDH20 features two heavy-duty bearings holding the output shaft, and two more bearings along with an integral flexible spring mount to isolate the working pieces of the encoder from mechanical stresses.

QDH20	-	M1	-	C1	-	S2	-	N	-	5000	-	02	-	06	-	04	-	SS
		Mounting		Housing		Solid Shaft		Shaft Seal		Resolution		Output		Channels		Output Waveform		Special Features

Configuration Options:

Mounting	Housing	Solid Shaft	Resolution	Output	Channels	Output Waveform
M1 = Size 20 Flng w/ 1.181" F Pilot M2 = Size 20 Flng w/ 1.250" M Pilot M3 = Size 20 Servo w/ 1.181" F Pilot M4 = Size 20 Servo w/ 1.250" M Pilot M5 = Size 25 Flng w/ M Pilot M6 = Size 25 Servo w/ M Pilot F1 = Hollow Shaft 2.25" F Mount	C1 = Radial 10 Pin C2 = Radial 7 Pin C3 = Radial 6 Pin C4 = Radial Wire Gland C5 = Axial 10 Pin C6 = Axial 7 Pin C7 = Axial 6 pin C8 = Axial Wire Gland	S2 = .375" S3 = 10mm S4 = .25" Hollow Bore H5 = .375" H6 = .5" H7 = .625"	120, 200, 250, 256, 360, 500, 512, 600, 635, 800, 1000, 1024, 1250, 2000, 2048, 2500, 3000, 3600, 4096, 5000	02 = Line Driver 04 = Open Collector	01 = Single A 02 = Dual AB 03 = Dual AB w/Z 04 = Single A w/ A' 05 = Dual AB w/ Comp. A'B' 06 = Full Comp. AA' BB' ZZ'	01 = LD Out, Z gated to B' 02 = OC Out, Ungated Z 03 = LD Out, Z gated to A 04 = OC Out, Ungated Z

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ELECTRICAL SPECIFICATIONS

Input Voltage	4.75 to 26 VDC
Input Current Requirements	70mA typical @ 5VDC plus interface loads
Input Ripple	2% peak to peak @ 5VDC
Output Circuits	OL7272 high voltage line driver: VOL = .5V max @ 20mA sink VOH = Vcc-.8V @ 20mA source RS422 compatible @ 20mA source
Open Collector Output	Sink up to 100mA
Incremental Output Format	Quadrature outputs with index pulse. See waveform reference chart for timing and gating options.
Accuracy	±1.0 arc minute
Frequency Response	500 kHz
Symmetry	180° ± 10% typical
Minimum Edge Separation	67 electrical degrees at 100 kHz
Code	Incremental
Rise Time	Less than 1 uS
Electrical Protection	Reverse protected to .6 A Cont. 4 amp for 1 uS. OL7272 outputs over voltage and short circuit protected.

ENVIRONMENTAL SPECIFICATIONS

Storage Temperature	-40 to 125° C
Operating Temperature	-20 to 100° C typical
Humidity	98% Non-condensing
Vibration	20 g's @ 50 to 500 CPS
Shock	50 g's @ 11mS duration
Sealing Option	IP 66 solid shaft, IP 64 hollow shaft

MECHANICAL SPECIFICATION

Maximum Shaft Speed	8000 RPM (see factory for higher shaft speed)
Hollow Shaft Diameter Tolerance	0.375", 0.500", 0.625" (+.0006" to -.0000")
Solid Shaft Diameter Tolerance	0.250", 0.375", 10mm (+.0000" to -.0004")
Shaft Runout	.001 T.I.R. (max)
Bearings	Precision ABEC double shielded
Shaft Material	303 stainless steel
Bearing Life	1.5 X 10 ⁹ at rated load
Moment of Inertia	3.4 X 10 ⁻⁴ oz-in-S ²
Acceleration	1x10 ⁵ Radians/Sec ²
Starting Torque	1.0 in-oz max
Radial Shaft Loading	40 lbs (80 lbs max)
Axial Shaft Loading	40 lbs (80 lbs max)
Housing	Anodized aluminum
Weight	13 oz. typical
Termination	Radial Exit: 10, 7 & 6 pin MS, wire gland w 24" cable Axial Exit: 10, 7 & 6 pin MS, wire gland w 24" cable
Mounting	Flange w/1.181" Female Pilot Flange w/1.250" Male Pilot Servo w/1.181" Female Pilot Servo w/1.250" Male Pilot Size 25 Flange and Pilot Size 25 Servo and Pilot 2.250" bolt circle flex mount

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INCREMENTAL OUTPUT TERMINATIONS

HOUSING OPTION		NO. OF CHANNELS IN MODEL NUMBER				
6 Pin	7 Pin		A	AB	ABZ	$\overline{A}\overline{A}$
E	A	→	Ch. A	Ch. A	Ch. A	Ch. A
D	B	→		Ch. B	Ch. B	
C	C	→			Ch. Z	Ch. \overline{A}
B	D	→	+V	+V	+V	+V
F	E	→				Ch. B
A	F	→	Ground	Ground	Ground	Ground
	G	→	Case Ground	Case Ground	Case Ground	Case Ground

10 Pin	Wire Gland		$\overline{A}\overline{A}\overline{B}\overline{B}\overline{Z}\overline{Z}$
A	Brown	→	Ch. A
B	Blue	→	Ch. B
C	Orange	→	Ch. Z
D	Red	→	+V
E		→	
F	Black	→	Ground
G	White/Black	→	Case Ground
H	White	→	Ch. \overline{A}
I	Green	→	Ch. \overline{B}
J	Yellow	→	Ch. \overline{Z}
	Drain	→	Cable Shield

Note: The housing option and number of channels will determine output terminations.

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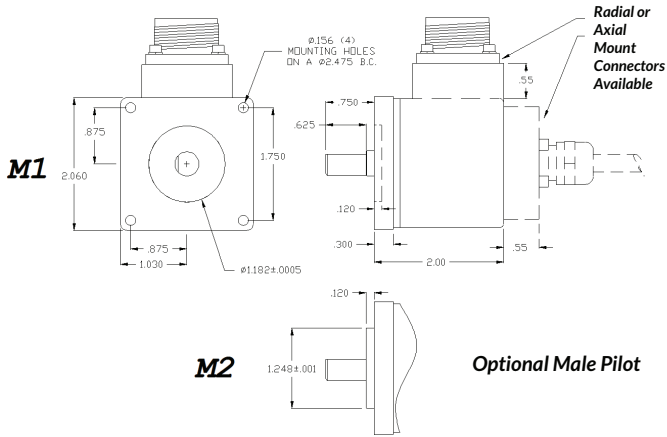
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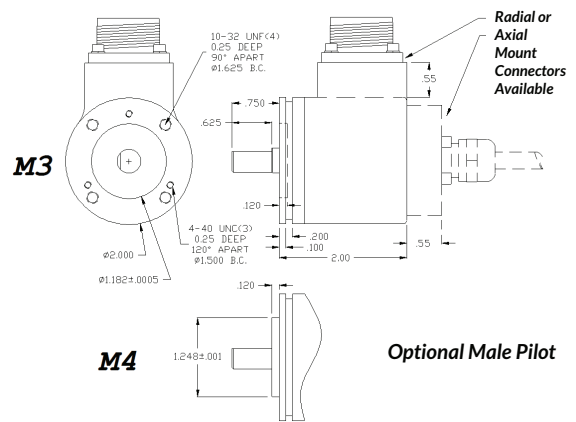
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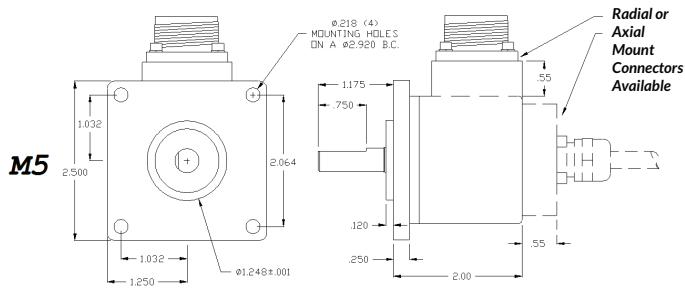
Size 20 Flange



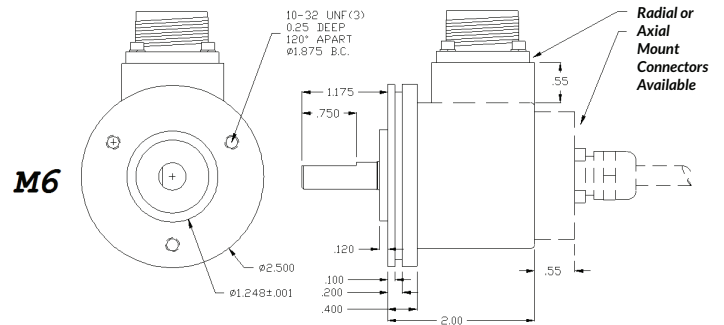
Size 20 Servo



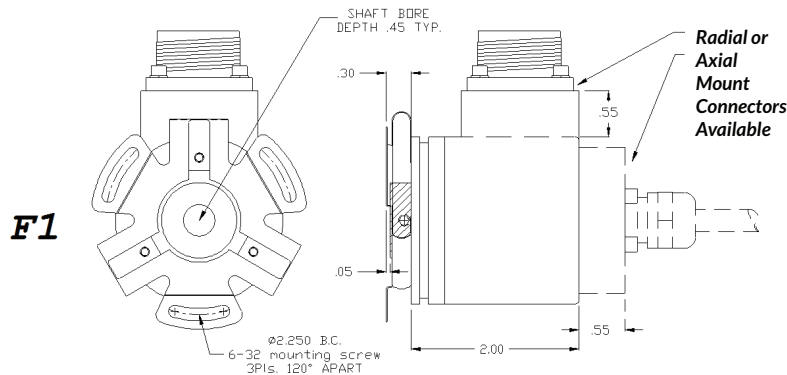
Size 25 Flange



Size 25 Servo



Flex Mount Hollow Shaft



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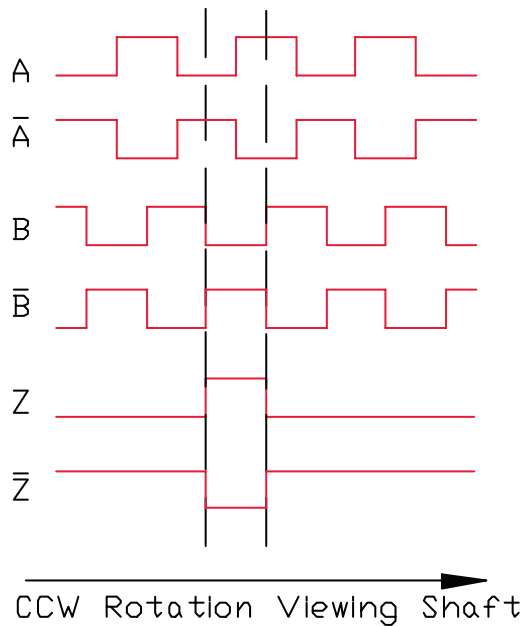
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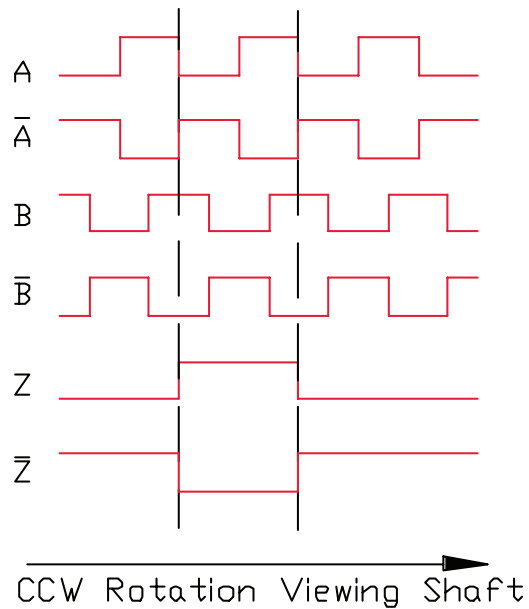
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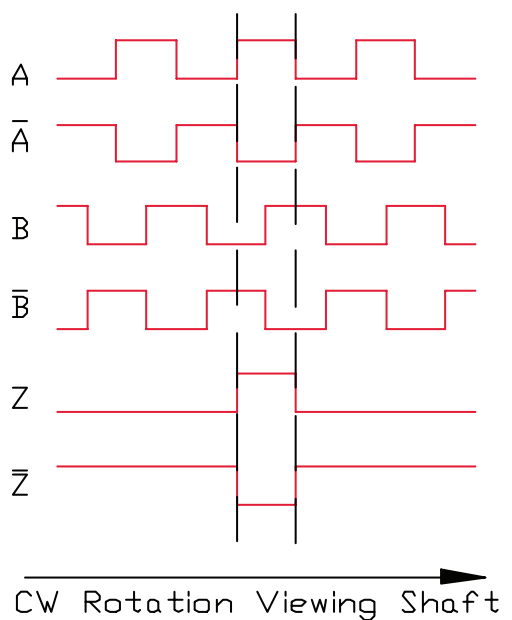
OUTPUT WAVEFORMS



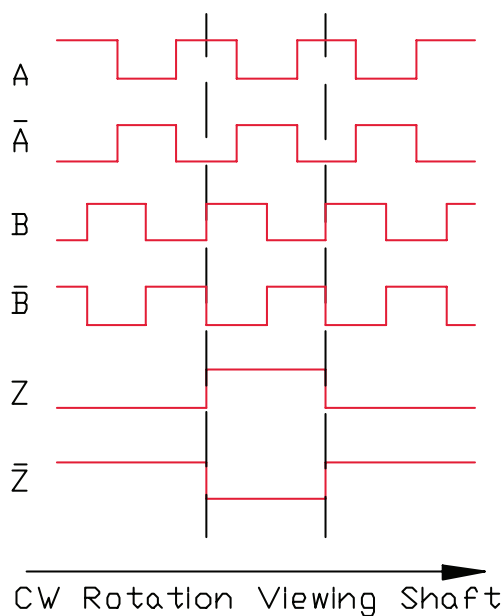
01 (OL7272 Output with Z Gated to B')
See Waveform Above



02 (Open Collector Output with Ungated Z
Centered on B') See Waveform Above



03 (OL7272 Output with Z Gated Z to A)
See Waveform Above



04 (Open Collector Output with Ungated Z
Centered on A') See Waveform Above

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