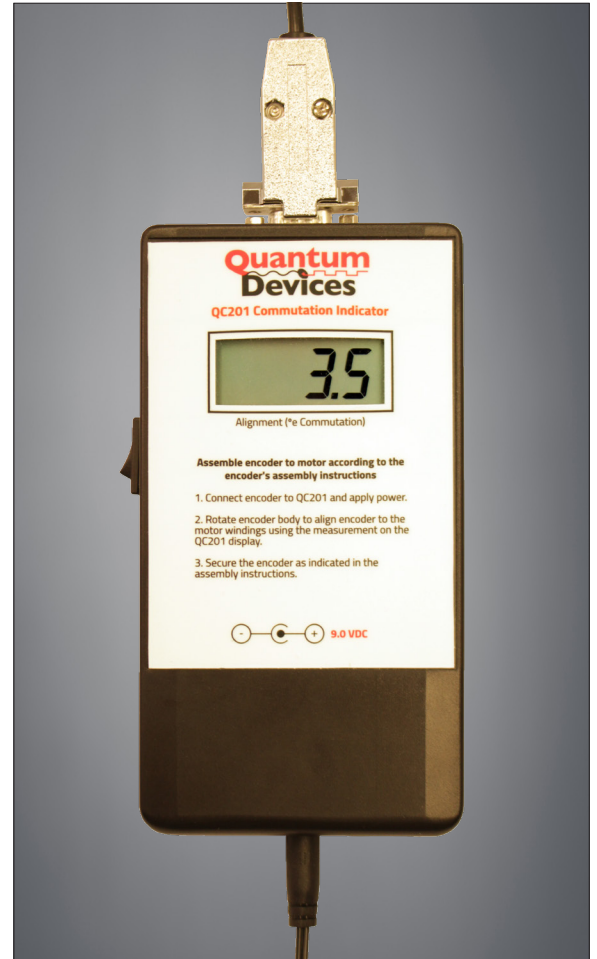# QC201 Commutation Indicator

DESIGN FEATURES

- Static Motor Shaft Assembly and Timing
- Easy to Read Indicator (Electrical Degrees)
- Reduction in Production Time
- Elimination of Production Equipment
- Oscilloscopes Not Required

The Quantum Devices QC201 Commutation Indicator allows for a quick and accurate method to time a Quantum Devices encoder's commutation channels to a BLDC motor. QC201 Commutation Indicator is an easy to use handheld indicator that measures the distance, in electrical degrees, of the rising edge of the encoder's U channel from the motor's locked winding position. By simply rotating the encoder on the locked motor shaft you can fine tune the commutation alignment with the QC201's easy to read digital indicator. QC201 Commutation Indicator simplifies and shortens the timing process, eliminates back drive equipment and oscilloscopes by providing a reliable method to statically align Quantum Devices' commutating encoders to BLDC motors.
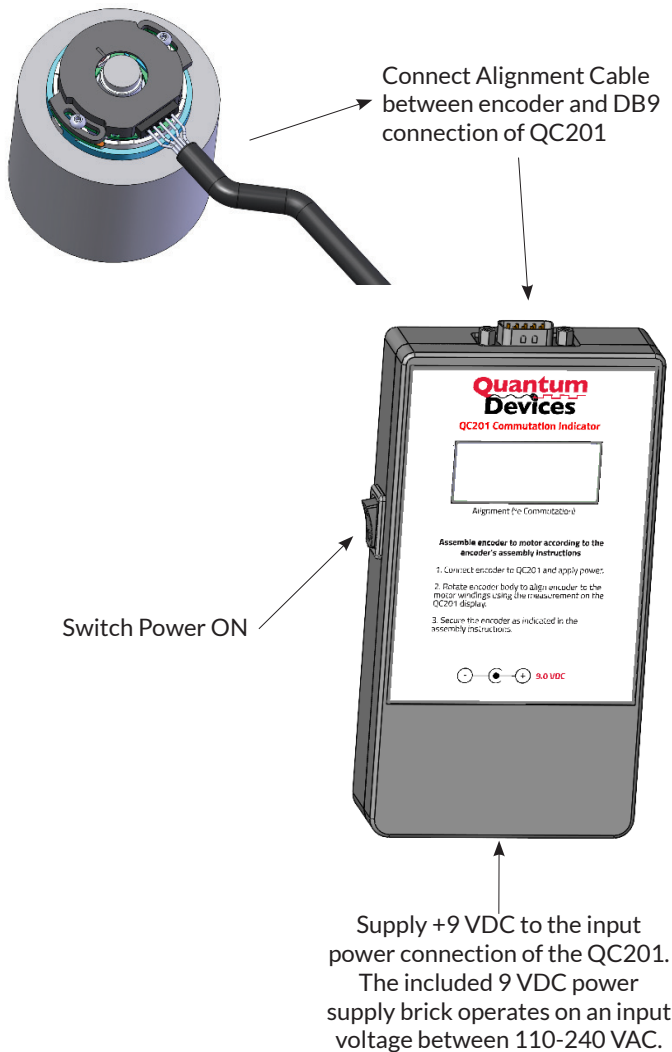

ORDERING INFORMATION	
2200AG001	QC201 Commutation Indicator with 9 VDC power supply

ALIGNMENT CABLES	
2200AG011	QM22 Encoders (JAE FI-W11S connector)
2200AG012	QM35, QR12, LP12 Encoders (JAE FI-W15S connector)
2200AG013	QML35 Encoders (BERG (FCI) 90312-008 LF connector)
2200AG014	Terminal Block, for use with QR145 and QR200 Encoders

Quantum Devices, Inc.
112 Orbison St., P.O. Box 100
Barneveld, WI 53507
(608) 924-3000
qdisales@quantumdev.com

www.quantumdev.com

ISO 9001
CERT. NO. FM 52711

Connect Alignment Cable between encoder and DB9 connection of QC201

Switch Power ON

Quantum Devices
QC201 Commutation Indicator

Alignment (°e Commutation)

Assemble encoder to motor according to the encoder's assembly instructions

1. Connect encoder to QC201 and apply power.
2. Rotate encoder body to align encoder to the motor windings using the measurement on the QC201 display.
3. Secure the encoder as indicated in the assembly instructions.

9.0 VDC

Supply +9 VDC to the input power connection of the QC201. The included 9 VDC power supply brick operates on an input voltage between 110-240 VAC.

VIEW OF REAR SHOWING SWITCHES

Encoder DB9 connections:
Pin 1= Vcc   Pin 2 = A   Pin 3 = B
Pin 4 = Z (Index)   Pin 5 = GND   Pin 6 = U

Open rear cover to configure the **QC201** to the pole count and line count of the encoder.

Pole Count	Line Count
0 = 4 pole	0 = 250 to 256
1 = 6 pole	1 = 500 to 512
2 = 8 pole	2 = 1000 to 1024
3 = 10 pole	3 = 2000 to 2048
4 = 12 pole	4 = 2500
5 = 14 pole	5 = 4000 to 4096
6 = 16 pole	6 = 5000 to 5120
	7 = 8000 to 8192

Measuring Basis

U Channel   Index Channel

Pole Count

Line Count

For more information or to contact us, please visit:
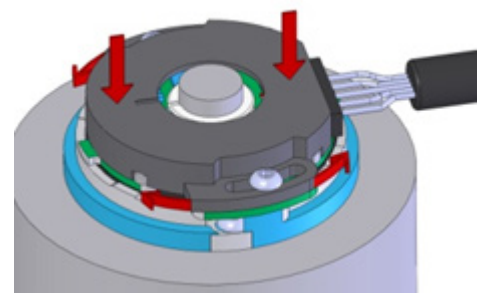**quantumdev.com**

QC201 COMMUTATION ALIGNMENT PROCEDURE

A. Energize appropriate motor windings to align shaft to U rise position.

B. Install encoder per encoder installation instructions.

C. Connect QC201 to encoder using mating QC201 Alignment Cable and switch QC201 Power ON. QC201 will display four dashes to indicate it is in Ready Mode.

D. Rotate encoder body until the Index Z mark on the body passes by the hub Z mark. QC201 display will begin to display commutation alignment.

E. Rotate encoder body to desired commutation alignment. If encoder is rotated beyond Display Range the display will revert back to dashes (Ready Mode); repeat step D to continue.

READY MODE (FOUR DASHES)

Quantum Devices
QC201 Commutation Indicator

- - - -

Alignment (°e Commutation)

STEP D - Z MARKS START ALIGNMENT DISPLAY

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ELECTRICAL SPECIFICATIONS

QC201 Input Power Requirement	9 VDC, 6 W minimum
QC201 Input Power Connection	Barrel Plug, 2 mm I.D. x 5.5 mm O.D.

DB9 PINOUT TO ENCODER

Pin 1	Vcc (+5 VDC)
Pin 2	Encoder A
Pin 3	Encoder B
Pin 4	Encoder Z (Index)
Pin 5	Ground
Pin 6	Encoder U

Note:
This is the pinout of the DB9 end of the Alignment Cables.

QC201 DISPLAY RANGE (± °E-COMMUTATION)

Line Count	4 Pole	6 Pole	8 Pole	10 Pole	12 Pole	14 Pole	16 Pole
250-256	90.4	99.0	99.0	99.0	99.0	99.0	99.0
500-512	45.2	67.8	90.4	99.0	99.0	99.0	99.0
1000-1024	22.6	33.9	45.2	56.5	67.8	79.1	90.4
2000-2048	22.6	33.9	22.6	28.2	33.9	39.5	45.2
2500	36.6	27.4	36.6	22.9	27.4	32.0	36.6
4000-4096	22.6	33.9	22.6	28.2	33.9	19.8	22.6
5000	18.3	27.4	36.6	22.9	27.4	32.0	36.6
8000-8192	11.3	16.9	22.6	28.2	33.9	19.8	22.6

QC201 DISPLAY RESOLUTION (°E-COMMUTATION)

Line Count	4 Pole	6 Pole	8 Pole	10 Pole	12 Pole	14 Pole	16 Pole
250-256	0.7	1.1	1.4	1.8	2.1	2.5	2.8
500-512	0.4	0.5	0.7	0.9	1.1	1.2	1.4
1000-1024	0.2	0.3	0.4	0.4	0.5	0.6	0.7
2000-2048	0.2	0.3	0.2	0.2	0.3	0.3	0.4
2500	0.3	0.2	0.3	0.2	0.2	0.3	0.3
4000-4096	0.2	0.3	0.2	0.2	0.3	0.2	0.2
5000	0.1	0.2	0.3	0.2	0.2	0.3	0.3
8000-8192	0.1	0.1	0.2	0.2	0.3	0.2	0.2

QM22/QM35/QML35/QR12 INSTRUMENT ACCURACY (°E-COMMUTATION) USING QC201

Line Count	4 Pole	6 Pole	8 Pole	10 Pole	12 Pole	14 Pole	16 Pole
250-256	3.0	4.5	6.0	7.5	9.0	10.5	12.0
500-512	2.8	4.2	5.6	7.0	8.5	9.9	11.3
1000-1024	2.7	4.1	5.5	6.8	8.2	9.6	10.9
2000-2048	2.7	4.1	5.4	6.7	8.1	9.4	10.7
2500	2.8	4.1	5.4	6.7	8.0	9.4	10.7
4000-4096	2.7	4.1	5.4	6.7	8.1	9.3	10.6
5000	2.7	4.1	5.4	6.7	8.0	9.4	10.7
8000-8192	2.7	4.0	5.4	6.7	8.1	9.3	10.6

QR145 INSTRUMENT ACCURACY (°E-COMMUTATION) USING QC201

Line Count	4 Pole	6 Pole	8 Pole	10 Pole	12 Pole	14 Pole	16 Pole
250-256	1.6	2.3	3.1	3.9	4.7	5.4	6.2
500-512	1.4	2.1	2.8	3.4	4.1	4.8	5.5
1000-1024	1.3	1.9	2.6	3.2	3.9	4.5	5.2
2000-2048	1.3	1.9	2.5	3.1	3.7	4.4	5.0
2500	1.3	1.9	2.5	3.1	3.7	4.3	4.9
4000-4096	1.3	1.9	2.5	3.1	3.7	4.3	4.9
5000	1.3	1.9	2.5	3.1	3.7	4.3	4.9

QR200 INSTRUMENT ACCURACY (°E-COMMUTATION) USING QC201

Line Count	4 Pole	6 Pole	8 Pole	10 Pole	12 Pole	14 Pole	16 Pole
250-256	1.3	2.0	2.6	3.3	3.9	4.6	5.3
500-512	1.1	1.7	2.3	2.8	3.4	4.0	4.6
1000-1024	1.0	1.6	2.1	2.6	3.1	3.7	4.2
2000-2048	1.0	1.6	2.0	2.5	3.0	3.5	4.0
2500	1.1	1.5	2.1	2.5	3.0	3.5	4.0
4000-4096	1.0	1.6	2.0	2.5	3.0	3.4	3.9
5000	1.0	1.5	2.1	2.5	3.0	3.5	4.0
8000-8192	1.0	1.5	2.0	2.5	3.0	3.4	3.9

Note: Instrument Accuracy specifications do not include motor winding pole pair position and magnetizing inaccuracies

ISO 9001

REV. 230925   **CERT. NO. FM 52711**

INSTALLATION INSTRUCTIONS FOR QM35 & QML35 WITH 1.280" BOLT CIRCLE
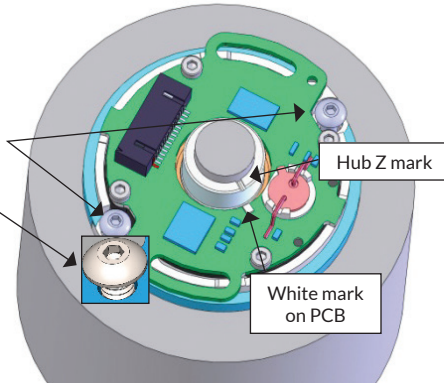
QM35 Connector shown in illustrations

STEP 1

A. Rotate printed circuit board (PCB) to expose the mounting holes. This is the Lock position. Mounting/motor surface must be clean and flat.

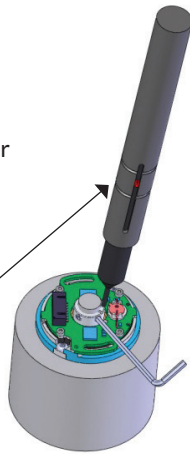B. Energize appropriate motor windings to align shaft to U rise position.

STEP 2

A. Install mounting screws through encoder into mounting/motor surface. Insert 1-2 turns. **DO NOT tighten screws.**

B. Align Z mark on hub to White mark on PCB.

Hub Z mark

White mark on PCB

STEP 3

A. Press down on the hub with a force between 150 g (0.33 lb) and 700 g (1.5 lb). This will center the encoder assembly to the motor shaft.

B. Using slight forefinger and thumb force, verify no radial (side-to-side) movement of the encoder occurs.

Illustrated is accessory Q-Scale p/n 2160AG276. Proper downward force is indicated when pin is between the force lines.

STEP 4

A. Tighten hub set screws to motor shaft.
#3-48 x 1/16" screw = 18-22 oz·in
#3-48 x 3/32" screw = 28-32 oz·in

B. The downward force on the hub can be removed.

C. Tighten mounting screws to 45-51 oz·in

TIP: Place Q-Scale point within the Z mark of hub.

STEP 5

Place cover on encoder. Observe the cover dowel pins positioned into mating PCB holes.

STEP 6

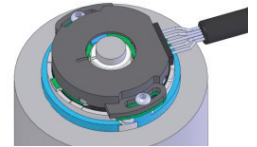A. Twist cover/PCB to expose screw holes for cover screws.

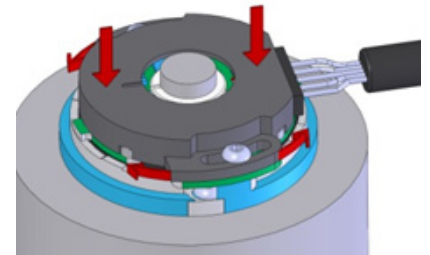B. Install cover screws and tighten to 37-43 oz·in.

STEP 7

A. Connect encoder to QC201 using mating QC201 Alignment Cable.

B. Switch QC201 Power ON. QC201 will display four dashes to indicate it is in Ready Mode.

STEP 8

A. Loosen the cover screws slightly, to allow the encoder body to be rotated.

B. Maintain a slight downward pressure on the cover.

C. Rotate encoder body until the Index Z mark on the body passes by the hub Z mark. QC201 display will begin to display commutation alignment.

D. Rotate encoder body to desired commutation alignment. If encoder is rotated beyond Display Range the display will revert back to dashes (Ready Mode); repeat step C to continue.

E. Tighten cover screws to 37-43 oz·in.

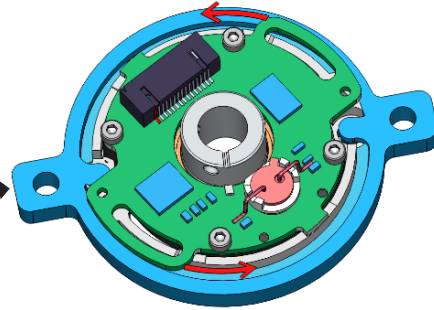*Note:* Refer to Hardware Selection Breakout chart for driver sizes.

Quantum Devices, Inc. reserves the right to make changes in design, specifications and other information at any time without prior notice.

QM35 Connector shown in illustrations

STEP 1

A. Rotate printed circuit board (PCB). This is the Lock position.
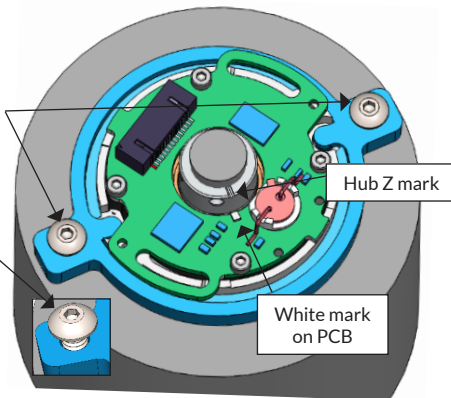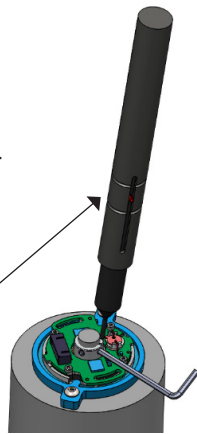   Note - The outside ring with 1.812" bolt holes may be loose. Mounting/motor surface must be clean and flat.

B. Energize appropriate motor windings to align shaft to U rise position.

STEP 2

A. Install mounting screws through encoder into mounting/motor surface. Insert 1-2 turns. **DO NOT tighten screws.**

B. Align Z mark on hub to White mark on PCB.

Hub Z mark

White mark on PCB

STEP 3

A. Press down on the hub with a force between 150 g (0.33 lb) and 700 g (1.5 lb). This will center the encoder assembly to the motor shaft.

B. Using slight forefinger and thumb force, verify no radial (side-to-side) movement of the encoder occurs.

Illustrated is accessory Q-Scale p/n 2160AG276. Proper downward force is indicated when pin is between the force lines.
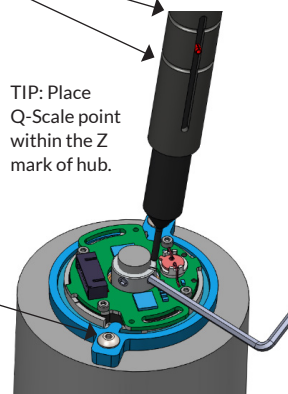
STEP 4

A. Tighten hub set screws to motor shaft.
   #3-48 x 1/16" screw = 18-22 oz·in
   #3-48 x 3/32" screw = 28-32 oz·in
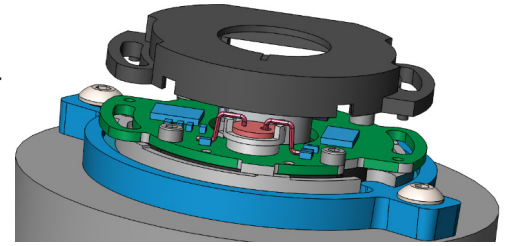
B. The downward force on the hub can be removed.

C. Tighten mounting screws to 45-51 oz·in
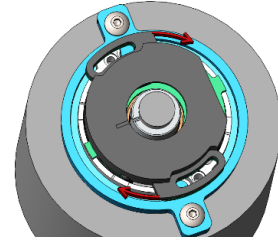
TIP: Place Q-Scale point within the Z mark of hub.

STEP 5

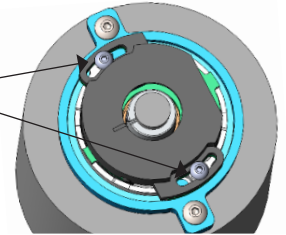Place cover on encoder. Observe the cover dowel pins positioned into mating PCB holes.

STEP 6
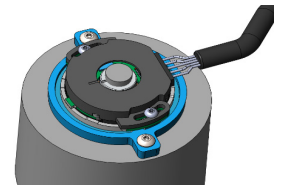
A. Twist cover/PCB to expose screw holes for cover screws.

B. Install cover screws and tighten to 37-43 oz·in.

STEP 7

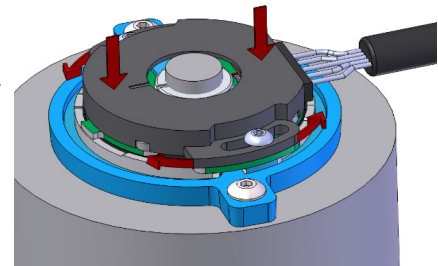A. Connect encoder to QC201 using mating QC201 Alignment Cable.

B. Switch QC201 Power ON. QC201 will display four dashes to indicate it is in Ready Mode.

STEP 8

A. Loosen the cover screws slightly, to allow the encoder body to be rotated.

B. Maintain a slight downward pressure on the cover.

C. Rotate encoder body until the Index Z mark on the body passes by the hub Z mark. QC201 display will begin to display commutation alignment.

D. Rotate encoder body to desired commutation alignment. If encoder is rotated beyond Display Range the display will revert back to dashes (Ready Mode); repeat step C to continue.

E. Tighten cover screws to 37-43 oz·in.

Note: Refer to Hardware Selection Breakout chart for driver sizes.