Quantum Series
Brushless DC Motors

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Size Constants

These parameters are dependent upon the size and shape of the motor but are largely independent of the winding used. However, special designs incorporating different lamination and magnet materials as well as design modifications such as increased magnetic air gaps can change these parameters. In such instances, a specific set of design data will be provided.

Maximum Continuous Stall Torque (T_C) is the amount of torque produced at zero speed which results in a 100°C rise in temperature. Generally, the highest operating temperature that should be allowed is 150°C and is a combination of the ambient temperature and the temperature rise for a given operating condition.

Maximum Rated Torque (T_R) is the amount of torque that the motor can produce without danger of demagnetizing the rotor. This torque is only available for short durations. Also, it may not be possible to produce the Maximum Rated Torque because of limitations of voltage and current (see Peak Torque).

Motor Constant (K_M) is the ratio of the peak torque to the square root of the input power at stall with 25°C ambient temperature. This ratio is useful during the initial selection of a motor because it indicates the ability of the motor to convert electrical power into torque.

$K_M = T_P$ (Peak Torque)/$\sqrt{P_P}$ (Peak Input Power)
or
$K_M = K_T$ (Torque Constant)/ $\sqrt{R_M}$ (Terminal Resistance)

Electrical Time Constant (t_E) is the ratio of inductance L_M in Henries, to the resistance R_M in Ohms. This is the inductance and resistance as measured across any two phases in a delta or wye configuration.

$T_E = L_M/R_M$

Mechanical Time Constant (t_M) is the time required to reach 63.2% of the motors maximum speed after the application of constant DC voltage through the commutation electronics, ignoring friction, windage, and core losses.

$T_M = J_M * R_M / K_T * K_B$

Thermal Resistance (TPR) correlates winding temperature rise to the average power dissipated in the stator winding. The published TPR assumes that a housed motor is mounted to an aluminum heatsink of specific dimensions. Additional cooling from forced air, water jacketing, or increased heatsinking decreases the motor Thermal Resistance allowing higher power outputs than the published data.

Heatsink Sizes:
QB01700 Series 6 x 6 x 0.25 inches (152x152x6.3 mm)
QB02300 Series 8 x 8 x 0.25 inches (203x203x6.3 mm)
QB03400 Series 10x10x0.25 inches (254x254x6.3 mm)
QB05600 Series 12x12x0.50 inches (305x305x12.7mm)

Viscous Damping (F_0) gives an indication of the torque lost due to B.E.M.F. in the motor when the source impedance is zero. F_0 value can be represented as
$F_0 = K_T * K_B / R_M$

Maximum Cogging Torque (T_F) is principally the static friction torque felt as the motor is rotated at low speed. The published value does not include the bearing friction of a housed motor.

Mechanical Data

Rotor inertia (J_M) is the moment of inertia of the rotor about its axis of rotation.

Motor Weight (W_M) is the weight of the standard motor.

Number of Poles (N_P) is the number of permanent magnet poles of the rotor. For the QB Series this is generally a total of six (three north and three south).

Winding Constants

The winding constants are the parameters that vary with the number of wire turns per coil and the wire size. These parameters are collected under a alphabetical winding designation. A single frame size and length of motor will have several different windings. Special windings receive new designations in the sequence by which they are designed and released to production.

Design Voltage (V_P) is the nominal voltage required to

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produce the peak torque when the rotor speed is zero and the winding temperature is 25°C. As such, V_P is the product of I_P and R_M. At any temperature greater than 25°C, the required voltage to produce peak torque increases due to the increase in winding resistance. The design voltage is not a limit but a reference point for the data.

Peak Torque (T_P) is the nominal value of developed torque with the rated current I_P applied to the windings. For each winding specified the product of peak current (I_P) and nominal torque sensitivity (K_T) gives T_P unless the maximum rated torque (T_R) is reached.

Peak Current (I_P) is the rated current used to obtain the nominal peak torque from the motor with nominal torque sensitivity (K_T). I_P is generally the design voltage divided by the terminal resistance (R_M).

Torque Sensitivity (K_T) is the ratio of the developed torque to the applied current for a specific winding. K_T is related to the BEMF Constant K_B.

No Load Speed (S_{NL}) is the theoretical no load speed of the motor with the design voltage applied.

BEMF Constant (K_B) is the ratio of voltage generated in the winding to the speed of the rotor. K_B is proportional to K_T.

Terminal Resistance (R_M) is the winding resistance measured between any two leads of the winding in either a delta or wye configuration at 25°C.

Terminal Inductance (L_M) is the winding inductance measured between any two leads of the winding in either delta or wye configuration at 25°C.

Configuration Drawings

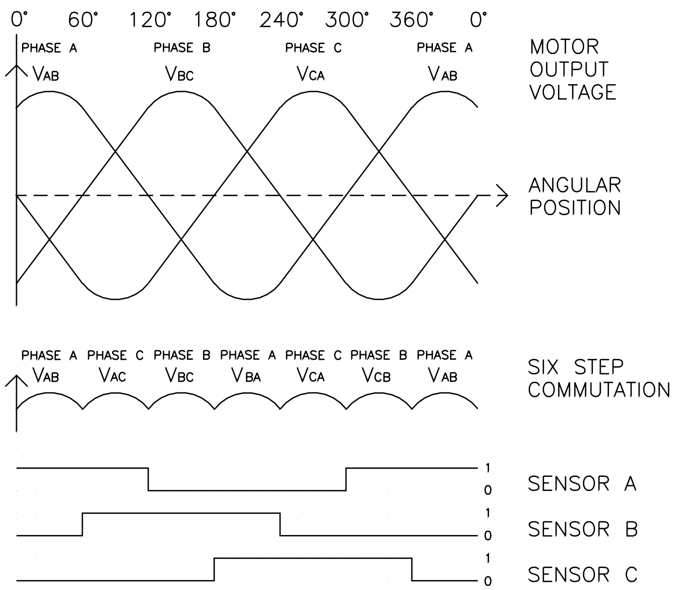
The drawings reflect the standard configurations for both the housed and frameless motors. Encoder and housing options are also detailed but customers may specify mechanical modifications such as shaft diameters and lengths as well as special mounting and cabling requirements.

Frameless motors are supplied with single stack rotor hubs for customer stacking to required rotor length. The Hall effects are integral to the stator assembly.

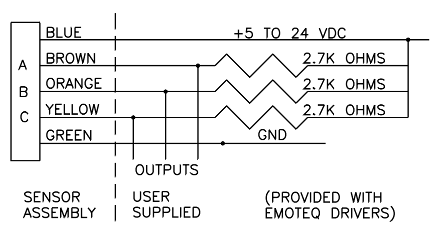
Motor Connections and Commutation Logic

MOTOR EXCITATION SEQUENCE AND SENSOR OUTPUT LOGIC FOR CW ROTATION VIEWING LEADWIRE END.

EXCITATION STEP		1	2	3	4	5	6	1
MOTOR LEADS	(RED) A	+	+		–	–		+
	(WHT) B	–		+	+		–	–
	(BLK) C		–	–		+	+	
SENSOR OUTPUTS	(BRN) A	1	1	0	0	0	1	1
	(ORG) B	0	1	1	1	0	0	0
	(YEL) C	0	0	0	1	1	1	0



HALL EFFECT CONNECTION DIAGRAM



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