

TORQUEMASTER®

BRUSH SERVO MOTORS **4000** SERIES



Performance Benefits

CMC Torque Systems specializes in the design of high performance brush servo motors that provide efficiency, flexibility of application, and a long and trouble-free service life. Our TORQUEMASTER® 4000 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the TORQUEMASTER 4000 Series of brush servo motors to provide smooth operation throughout a full speed range. The 4000 Series delivers smooth and superior low speed performance, low cogging and maximum power ratings with low thermal resistance for high speed performance. In addition, with maximum torque in a smaller package, you can count on better pricing for a better overall value.

When integrated with high performance brush amplifiers, TORQUEMASTER 4000 Series brush servo motors provide effective and highly efficient motion control solutions for a wide range of applications—including factory automation, packaging, robotics, machine tools, medical instrumentation and more.

Design Features

TORQUEMASTER 4000 Series brush servo motors are rated from 18.75 lb.-in. to 36 lb.-in. with speeds and torque stability up to 3000 RPM. They utilize the latest in high performance permanent magnet technology, and are available in eight standard windings (as well as custom windings) to meet your most demanding applications.

Each brush servo motor in the TORQUEMASTER 4000 Series is ruggedly designed and manufactured for reliable performance.

Motors can be customized to fit your exact application with tachometers, encoders, brakes and other options.

Series 4000, is a high performance, permanent magnet brush-type DC servo motor for use in various industrial direct drive or geared servo systems

- Rugged industrial construction
- Continuous torque ratings up to 36 lb.-in. —with speeds up to 3,000 RPM
- Peak torque ratings up to 200 lb.-in.
- Low cogging for smooth performance
- IP65 Sealing available
- Superior low speed performance
- Numerous custom options available
- Available with 8 standard windings
- 4.0 inch diameter motors available in three motor lengths
- Inertia ratings from .0062 Lb-in-sec² to .012 Lb-in-sec²

• CE / UL



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BRUSH SERVO MOTOR CHARACTERISTICS

SYMBOL		UNITS	4025	4037	4057
T _C	Cont. Torque	Lb-In	18.75	26.13	36
T _P	Peak Torque	Lb-In	93.75	137.5	200
T _F	Static Friction	Lb-In	0.94	0.94	0.94
F _i	Viscous Friction	Lb-In/KRPM	0.31	0.44	0.63
T _R	Cogging Torque	Lb-In	3.5	6	8
J _M	Inertia	Lb-In-sec ²	0.0062	0.0085	0.012
R _{TH}	Thermal Res	Deg C/watt	1.7	1.4	1.1
T _{TH}	Thermal Time	Minute	26	29	40
t _m	Mech Time	Millisec	7	4.9	4.7
t _e	Elect Time	Millisec	2.14	2.4	2.7
F _C	Commutation (41Bar)	Factor	17900	25500	33000
Wt	Weight	Lbs	13	15	21

Note: All values at 25°C Ambient.

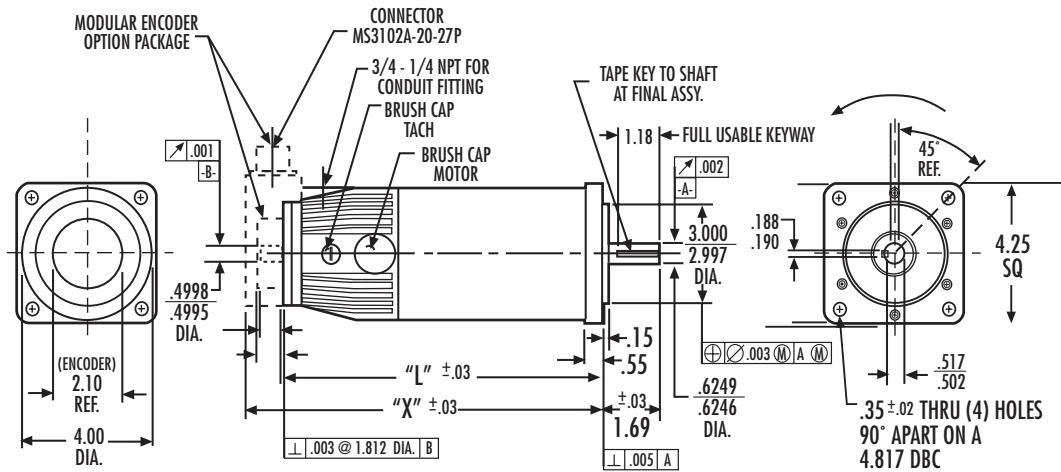
WINDING

A*	K _T	Torq. Sens.	Lb-In/Amp	1.0	1.5	2.1
	R _A	Arm. Resis.	Ohms	0.14	0.17	0.22
	K _V	Back E.M.F	Volts/KRPM	12.0	17.7	24.6
	F _C /K _T	P _b	Watts	1098	1067	991
B*	K _T	Torq. Sens.	Lb-In/Amp	1.3	1.9	2.7
	R _A	Arm. Resis.	Ohms	0.23	0.27	31.7
	K _V	Back E.M.F	Volts/KRPM	15.4	22.7	31.7
	F _C /K _T	P _b	Watts	856	831	769
C*	K _T	Torq. Sens.	Lb-In/Amp	1.6	2.3	3.3
	R _A	Arm. Resis.	Ohms	0.35	0.42	0.56
	K _V	Back E.M.F	Volts/KRPM	18.9	27.7	38.7
	F _C /K _T	P _b	Watts	699	680	630
D	K _T	Torq. Sens.	Lb-In/Amp	2.0	3.0	4.2
	R _A	Arm. Resis.	Ohms	0.57	0.68	0.90
	K _V	Back E.M.F	Volts/KRPM	24.1	35.3	49.3
	F _C /K _T	P _b	Watts	549	533	495
E	K _T	Torq. Sens.	Lb-In/Amp	2.6	3.8	5.4
	R _A	Arm. Resis.	Ohms	0.92	1.10	1.45
	K _V	Back E.M.F	Volts/RPM	31.0	45.4	63.3
	F _C /K _T	P _b	Watts	427	415	385
F	K _T	Torq. Sens.	Lb-In/Amp	3.2	4.7	6.6
	R _A	Arm. Resis.	Ohms	1.41	1.69	2.24
	K _V	Back E.M.F	Volts/KRPM	37.8	55.4	77.4
	F _C /K _T	P _b	Watts	350	340	315
G	K _T	Torq. Sens.	Lb-In/Amp	4.1	6.0	8.3
	R _A	Arm. Resis.	Ohms	2.26	2.72	3.59
	K _V	Back E.M.F	Volts/KRPM	48.2	70.6	98.6
	F _C /K _T	P _b	Watts	275	267	247
H	K _T	Torq. Sens.	Lb-In/Amp	5.2	7.7	10.7
	R _A	Arm. Resis.	Ohms	3.66	4.40	5.82
	K _V	Back E.M.F	Volts/KRPM	61.9	90.7	126.7
	F _C /K _T	P _b	Watts	214	208	192

* A, B and C windings are designed for a 42 bar commutator only.
All other windings are designed for 21 or 42 bar commutators.

For custom designs please consult factory.
All specifications subject to change without notice.

MECHANICAL SPECIFICATIONS*



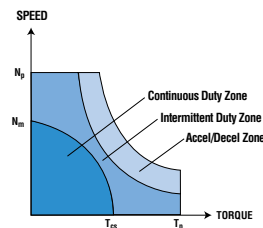
MOTOR LENGTH (In inches)

MOTOR	4025	4037	4057
Length (L) (Motor Only)	8.00	9.55	11.31
Length (X) with Optical Modular Encoder or Tachometer	8.45	9.70	11.70
Length (X) with Shaft Encoder	11.70	13.25	15.01

*All specifications are for reference only. Please consult the factory for certified dimension drawings.

Standard Direction of Rotation: CCW rotation viewed from shaft end with red motor terminal positive with respect to black motor terminal.

TORQUE PERFORMANCE CURVES



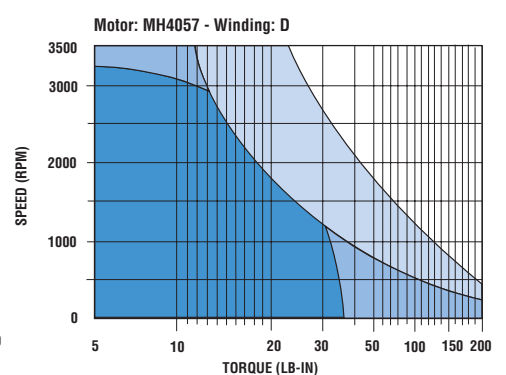
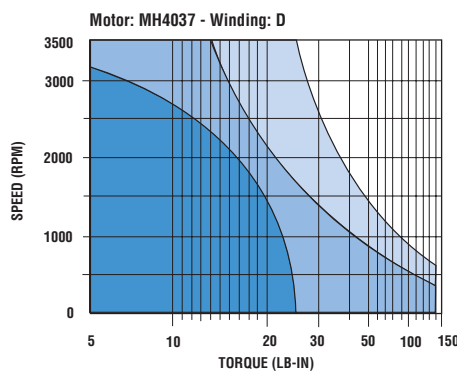
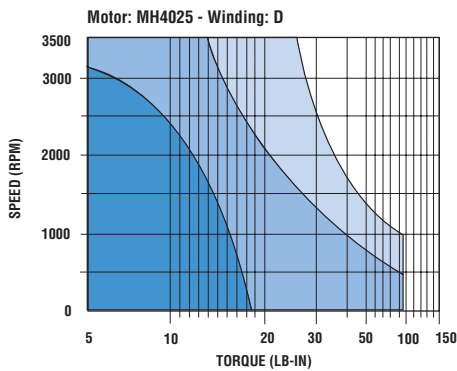
NOTE: Continuous torque specifications obtained with motor mounted to an 8.5"x12"x 0.5" aluminum plate at 25 C° ambient. Typical values are within ±10% of rating.

STANDARD WINDING SPEED/TORQUE CURVE DATA FOR SIZING A SERVO MOTOR

- Nm** = Maximum speed, continuous operation
- Np** = Peak speed, acceleration/deceleration and intermittent duty
- Tcs** = Continuous stall torque
- Tp** = Peak torque

All specifications subject to change without notice.

TORQUE PERFORMANCE CURVES



TORQUE SPEED CURVES OF OTHER WINDINGS AVAILABLE, CONSULT FACTORY.

BRUSH SERVO MOTORS

4000 SERIES

VOLTAGE EQUATION FOR MOTORS

$$\text{Volts} = \frac{K_T \times \text{RPM}}{1,350} + \frac{T \times R_A}{K_T} + V_B$$

Where:

K_T = torque constant, oz.-in. per amp

T = load torque plus motor friction torque-oz.-in.

R_A = armature resistance + brush resistance

V_B = brush voltage drop = 2 volts

Note: For armature resistance at maximum temperature rating, multiply catalog value of R by 1.5

MOTOR TORQUE RATING VS. SPEED

$$T_R = .94K_T \left[\frac{130 \cdot \text{RPM} \times T_F - \text{RPM}^2 \times F_i}{R_{TH} \cdot 1,350 \cdot 1,350,000} \right]^{1/2} \cdot T_F \cdot \left[\frac{\text{RPM} \times F_i}{1000} \right]$$

Where:

T_R = rated torque (25°C ambient)-oz.-in.

K_T = torque sensitivity-oz.-in./amp

R_A = armature resistance

RPM = revolutions per minute

T_F = static friction torque-oz.-in.

F_i = viscous friction-oz.-in.

R_{TH} = thermal resistance

To Find: Higher Torque Rating for Intermittent Duty

$$\text{Let } A = \frac{\text{total cycle time in seconds}}{\text{thermal time constant of motors in seconds}}$$

$$\text{Let } B = \frac{\text{"on" time in seconds per cycle}}{\text{thermal time constant of motor in seconds}}$$

then with T_R = Rated torque for 100% duty
and T_{MAX} = Rated torque for intermittent duty

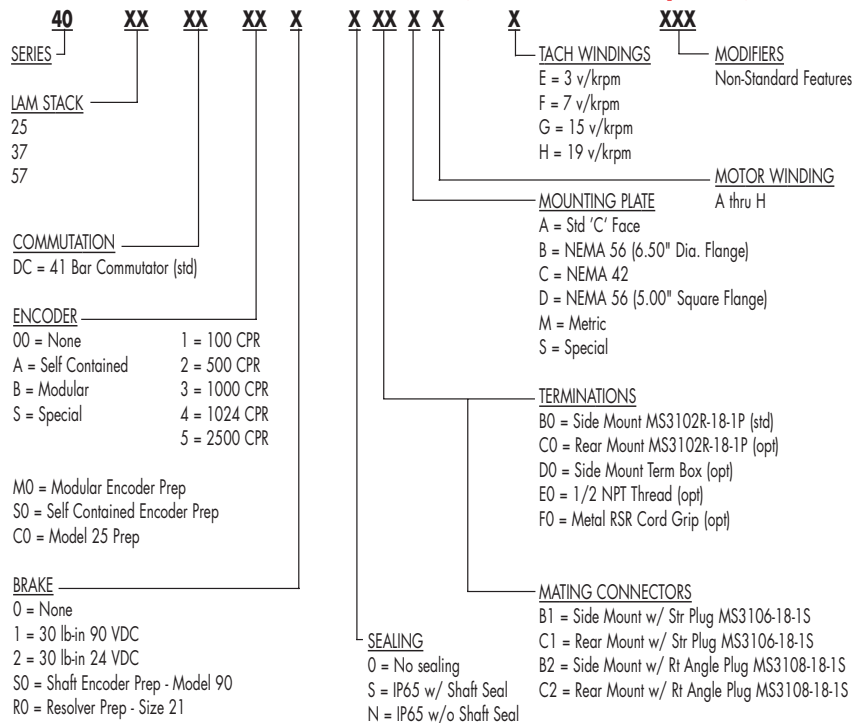
$$T_{MAX} = T_R \times \left[\frac{1 - e^{-A}}{1 - e^{-B}} \right]^{1/2}$$

Customize The 4000 Series To Your Exact Requirements

To satisfy various applications with cost-effective solutions, 4000 Series motors are readily available with a wide range of standard capabilities. Final designs are often the result of cooperative efforts between the customer's engineering department and CMC. For assistance, call your local CMC distributor or CMC direct. We look forward to meeting your custom requirements.

TORQUEMASTER®

ORDERING INFORMATION (For Standard Options)



Ask About Other Motion Control Solutions & Capabilities From Torque Systems

- Brushless TorqueMaster® Servo Motors
- PowerMaster® Amplifiers
- Shaft-mounted DataTorque™ Encoders
- Gearboxes/Brakes
- Expert application engineering
- Complete repair & refurbishing services



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