

TORQUEMASTER®

BRUSH SERVO MOTORS **2100 SERIES**



Series 2100, is a high performance, permanent magnet brush servo motor for use in various industrial direct drive or geared servo systems

- Rugged industrial construction
- Continuous torque ratings up to 53 oz.-in. —with speeds up to 6500 RPM (no load)
- Peak torque ratings up to 300 oz.-in.
- High torque-to-inertia ratio delivers maximum torque per frame size
- Superior low speed performance
- Numerous custom options available
- CE / UL



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® 2100 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the TORQUEMASTER 2100 Series of brush servo motors to provide smooth operation throughout a full speed range. The 2100 Series delivers smooth and superior low speed performance, 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 2100 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 2100 Series brush servo motors are rated from 12 oz.-in. to 53 oz.-in. with speeds and torque stability up to 6500 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 2100 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.



2100 SERIES

TORQUEMASTER®

BRUSH SERVO MOTOR CHARACTERISTICS

| SYMBOL | UNITS | 2105 | 2110 | 2115 | 2120 | 2130 |
|-----------------|------------------|------------------------|--------|--------|--------|--------|
| T _C | Cont. Torque | Oz-In | 12 | 18 | 30 | 38 |
| T _P | Peak Torque | Oz-In | 50 | 100 | 150 | 200 |
| T _F | Static Friction | Oz-In | 3 | 3 | 3 | 3 |
| F _V | Viscous Friction | Oz-In/KRPM | 0.2 | 0.3 | 0.3 | 0.4 |
| T _R | Cogging Torque | Oz-In | 0.2 | 0.3 | 0.5 | 0.5 |
| J _M | Inertia | Oz-In-sec ² | 0.0018 | 0.0031 | 0.0044 | 0.0057 |
| R _{TH} | Thermal Res | Deg C/watt | 6.9 | 6.2 | 5 | 4.5 |
| T _{TH} | Thermal Time | Minute | 10 | 10 | 15 | 15 |
| t _m | Mech Time | Millisec | 24.3 | 12.19 | 8.62 | 8.07 |
| t _e | Elect Time | Millisec | 1.6 | 1.9 | 2.1 | 2.1 |
| F _C | Commutation | Factor | 488 | 722 | 1260 | 1548 |
| Wt | Weight | Lbs | 1.9 | 2.9 | 3.1 | 3.3 |

Note: All values at 25°C Ambient.

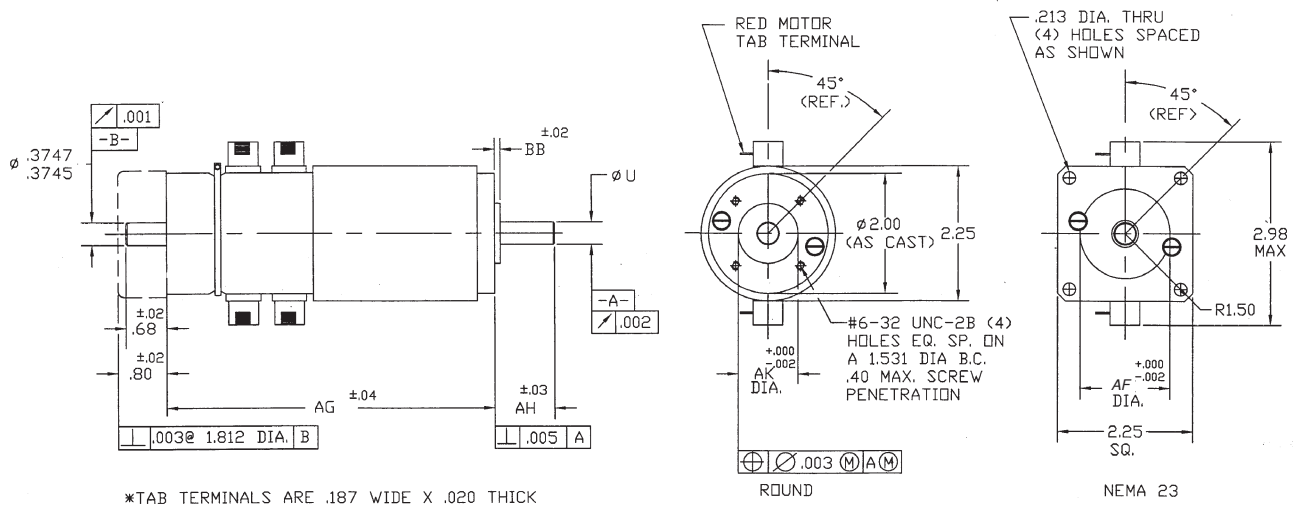
WINDING

| | | | | | | | | |
|----------|--------------------------------|----------------|------------|-------|------|-------|-------|-------|
| A | K _T | Torq. Sens. | Oz-In/Amp | 2.27 | 3.8 | 6.12 | 7.74 | 11.2 |
| | R _A | Arm. Resis. | Ohms | 0.29 | 0.40 | 0.52 | 0.60 | 0.80 |
| | K _V | Back E.M.F | Volts/KRPM | 1.7 | 2.8 | 4.5 | 5.7 | 8.3 |
| | F _C /K _T | P _b | Watts | 215 | 190 | 206 | 200 | 189 |
| B | K _T | Torq. Sens. | Oz-In/Amp | 2.77 | 4.7 | 7.48 | 9.46 | 13.6 |
| | R _A | Arm. Resis. | Ohms | 0.44 | 0.61 | 0.77 | 0.89 | 1.18 |
| | K _V | Back E.M.F | Volts/KRPM | 2 | 3.5 | 5.5 | 7.0 | 10.1 |
| | F _C /K _T | P _b | Watts | 176 | 154 | 168 | 164 | 156 |
| C | K _T | Torq. Sens. | Oz-In/Amp | 3.53 | 5.9 | 9.52 | 12 | 17.3 |
| | R _A | Arm. Resis. | Ohms | 0.70 | 0.97 | 1.25 | 1.44 | 1.92 |
| | K _V | Back E.M.F | Volts/KRPM | 2.6 | 4.4 | 7.0 | 8.9 | 12.8 |
| | F _C /K _T | P _b | Watts | 138 | 122 | 132 | 129 | 122 |
| D | K _T | Torq. Sens. | Oz-In/Amp | 4.41 | 7.4 | 11.9 | 15 | 21.7 |
| | R _A | Arm. Resis. | Ohms | 1.13 | 1.52 | 1.96 | 2.25 | 3.01 |
| | K _V | Back E.M.F | Volts/KRPM | 3.3 | 5.5 | 8.8 | 11.1 | 16.0 |
| | F _C /K _T | P _b | Watts | 111 | 98 | 106 | 103 | 98 |
| E | K _T | Torq. Sens. | Oz-In/Amp | 5.54 | 9.3 | 15 | 19 | 27 |
| | R _A | Arm. Resis. | Ohms | 1.77 | 2.40 | 3.11 | 3.61 | 4.67 |
| | K _V | Back E.M.F | Volts/KRPM | 4.1 | 6.9 | 11.1 | 14.0 | 20.0 |
| | F _C /K _T | P _b | Watts | 88 | 78 | 84 | 81 | 78 |
| F | K _T | Torq. Sens. | Oz-In/Amp | 6.93 | 11.7 | 18.7 | 23.6 | 34 |
| | R _A | Arm. Resis. | Ohms | 2.78 | 3.80 | 4.84 | 5.57 | 7.40 |
| | K _V | Back E.M.F | Volts/RPM | 5.1 | 8.6 | 13.8 | 17.4 | 25.1 |
| | F _C /K _T | P _b | Watts | 70 | 62 | 67 | 66 | 62 |
| G | K _T | Torq. Sens. | Oz-In/Amp | 8.57 | 14.4 | 23 | 29 | 42 |
| | R _A | Arm. Resis. | Ohms | 4.31 | 5.76 | 7.32 | 8.41 | 11.29 |
| | K _V | Back E.M.F | Volts/KRPM | 6.3 | 10.6 | 17.0 | 21.4 | 31.0 |
| | F _C /K _T | P _b | Watts | 57 | 50 | 55 | 53 | 50 |
| H | K _T | Torq. Sens. | Oz-In/Amp | 10.71 | 18 | 29 | 36 | 52 |
| | R _A | Arm. Resis. | Ohms | 6.84 | 9.00 | 11.64 | 12.96 | 17.31 |
| | K _V | Back E.M.F | Volts/KRPM | 7.9 | 13.3 | 21.4 | 26.6 | 38.4 |
| | F _C /K _T | P _b | Watts | 46 | 40 | 43 | 43 | 41 |

Note: Continuous torque specifications obtained with motor mounted to an 10" x 10" x 0.25" alum. plate at 25 C° ambient. Typical values are within ±10% of rating.

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

MECHANICAL SPECIFICATIONS*



DIMENSION CHART*

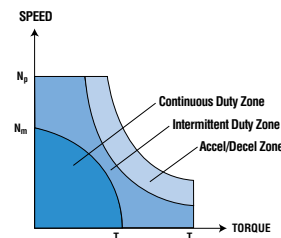
| MOTOR | AG | | U DIA. | | AH | | AK | | AF | | BB | |
|-------------|-------------------------------|-------------------------------|-------------|-------------|------|------|-------|-------|------|------|-----|------|
| | Motor Only Inches (Metric) | Motor Tach Inches (Metric) | STD | NEMA | STD | NEMA | STD | NEMA | STD | NEMA | STD | NEMA |
| 2105 | 3.13 (79.5) | 4.60 (116.8) | .3750/.3745 | .2500/.2495 | 1.00 | 0.77 | 1.000 | 1.500 | 0.10 | 0.06 | | |
| 2110 | 3.63 (92.2) | 5.10 (129.5) | .3750/.3745 | .2500/.2495 | 1.00 | 0.77 | 1.000 | 1.500 | 0.10 | 0.06 | | |
| 2115 | 4.13 (104.9) | 5.60 (142.2) | .3750/.3745 | .2500/.2495 | 1.00 | 0.77 | 1.000 | 1.500 | 0.10 | 0.06 | | |
| 2120 | 4.63 (117.6) | 6.10 (154.9) | .3750/.3745 | .2500/.2495 | 1.00 | 0.77 | 1.000 | 1.500 | 0.10 | 0.06 | | |
| 2130 | 5.63 (143.0) | 7.10 (180.3) | .3750/.3745 | .2500/.2495 | 1.00 | 0.77 | 1.000 | 1.500 | 0.10 | 0.06 | | |

METRIC (mm): DIMENSIONS ALL FRAME SIZES

| SHAFT: | DIA | 8j6 | MOUNTING: | PILOT | 25.0 |
|--------|--------|------|-----------|-----------|-------|
| | LENGTH | 25.0 | | B.C. | 38.89 |
| | | | | HOLE SIZE | M4 |

*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



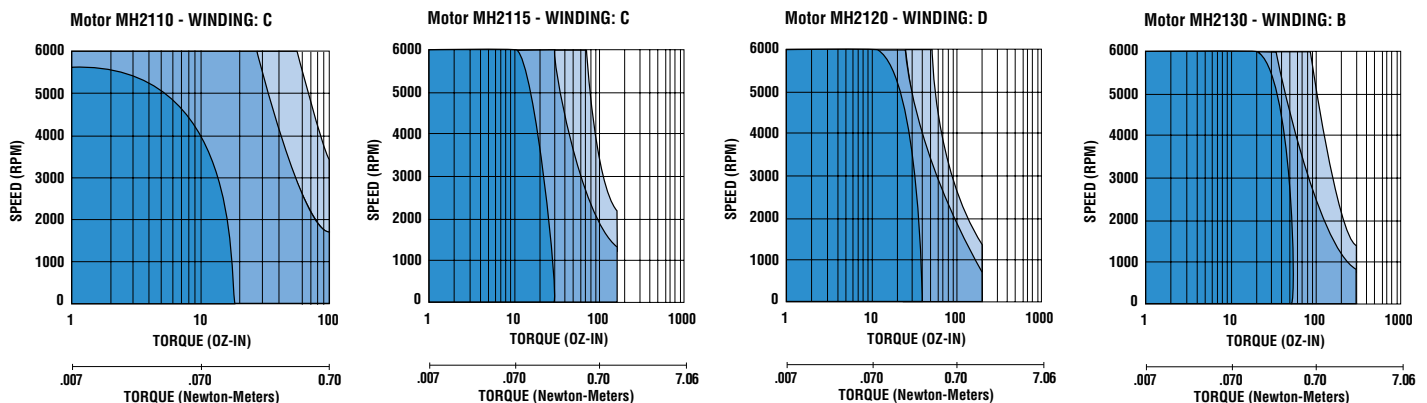
NOTE: Continuous torque specifications obtained with motor mounted to a 10"x10"x.25" aluminum plate at 25 C° ambient. Typical values are within ±10% of rating.

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

2100 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

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

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

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

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

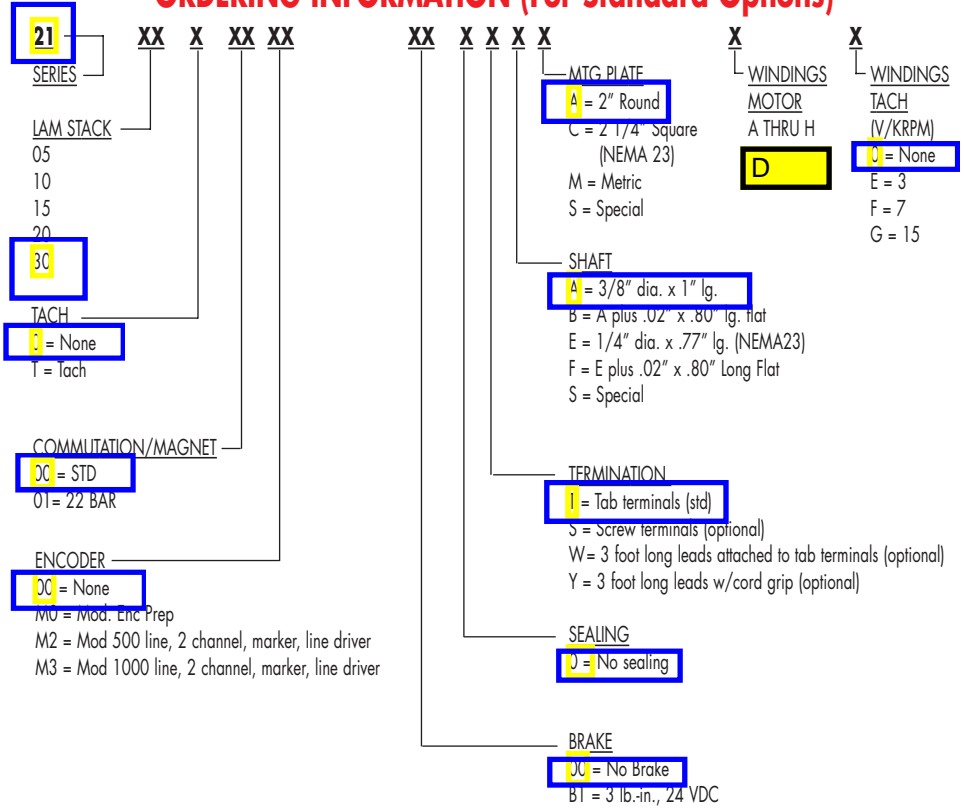
$$T_{MAX} = T_R \times \left[\frac{1 - e^{-A}}{1 - e^{-B}} \right]^{1/2}$$

Customize The 2100 Series To Your Exact Requirements

To satisfy various applications with cost-effective solutions, 2100 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



6 Enterprise Road, Billerica, MA 01821-5734
 Call: 800-669-5112 or 978-667-5100
 Fax: 888-295-5550 or 978-667-4989

Visit Us: www.torquesystems.com

