# *TORQUEMASTER*®

# BRUSH
## SERVO MOTORS
# 5300 SERIES

**Series 5300, 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 48 lb.-in. —with speeds up to 3,000 RPM

- Peak torque ratings up to 350 lb.-in.

- Low cogging for smooth performance

- IP65 Sealing available

- Superior low speed performance

- Numerous custom options available

- Available with 8 standard windings

- 4.5 inch diameter motors available in three motor lengths

- Inertia ratings from .0075 Lb-in-sec$^2$ to .015 Lb-in-sec$^2$

- CE / UL

$C\,\epsilon$

## 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® 5300 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the TORQUEMASTER 5300 Series of brush servo motors to provide smooth operation throughout a full speed range. The 5300 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 5300 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 5300 Series brush servo motors are rated from 25 lb.-in. to 48 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 5300 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.

*TORQUE SYSTEMS*

*Improving Productivity Worldwide*

**CMC** *Cleveland Motion Controls*
An **IMC** Company

# 5300 SERIES

# TORQUEMASTER®

## BRUSH SERVO MOTOR CHARACTERISTICS

| | SYMBOL | | UNITS | 5330 | 5350 | 5370 |
|---|---|---|---|---|---|---|
| | $T_C$ | Cont. Torque | Lb-In | 25 | 37.5 | 48 |
| | $T_P$ | Peak Torque | Lb-In | 150 | 250 | 350 |
| | $T_F$ | Static Friction | Lb-In | .93 | 1.2 | 1.5 |
| | $F_i$ | Viscous Friction | Lb-In/KRPM | .69 | .81 | .94 |
| | $T_R$ | Cogging Torque | Lb-In | .25 | .43 | .50 |
| | $J_M$ | Inertia | Lb-In-sec$^2$ | 0.0075 | 0.0112 | 0.0150 |
| | $R_{TH}$ | Thermal Res | Deg C/watt | 1.3 | 1.1 | 0.9 |
| | $T_{TH}$ | Thermal Time | Minute | 32 | 44 | 49 |
| | $t_m$ | Mech Time | Millisec | 6.1 | 4.8 | 4.7 |
| | $t_e$ | Elect Time | Millisec | 2.5 | 2.7 | 3 |
| | $F_C$ | Commutation (41Bar) | Factor | 41000 | 66000 | 89000 |
| | Wt | Weight | Lbs | 22 | 30 | 38 |

Note: All values at 25°C Ambient.

## WINDING

| | SYMBOL | | UNITS | 5330 | 5350 | 5370 |
|---|---|---|---|---|---|---|
| **A** | $K_T$ | Torq. Sens. | Lb-In/Amp | 1.3 | 2.1 | 2.8 |
| | $R_A$ | Arm. Resis. | Ohms | 0.14 | 0.2 | 0.27 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 15.1 | 24.4 | 32.9 |
| | $F_C/K_T$ | $P_b$ | Watts | 2000 | 2000 | 2000 |
| **B** | $K_T$ | Torq. Sens. | Lb-In/Amp | 1.7 | 2.7 | 3.6 |
| | $R_A$ | Arm. Resis. | Ohms | 0.25 | 0.33 | 0.44 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 19.6 | 31.4 | 42.1 |
| | $F_C/K_T$ | $P_b$ | Watts | 1547 | 1553 | 1561 |
| **C** | $K_T$ | Torq. Sens. | Lb-In/Amp | 2.0 | 3.3 | 4.4 |
| | $R_A$ | Arm. Resis. | Ohms | 0.38 | 0.51 | 0.67 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 24.0 | 38.4 | 51.7 |
| | $F_C/K_T$ | $P_b$ | Watts | 1262 | 1269 | 1271 |
| **D** | $K_T$ | Torq. Sens. | Lb-In/Amp | 2.6 | 4.2 | 5.5 |
| | $R_A$ | Arm. Resis. | Ohms | 0.59 | 0.59 | 1.1 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 30.3 | 49.1 | 65.0 |
| | $F_C/K_T$ | $P_b$ | Watts | 1000 | 992 | 1011 |
| **E** | $K_T$ | Torq. Sens. | Lb-In/Amp | 3.3 | 5.3 | 7.2 |
| | $R_A$ | Arm. Resis. | Ohms | 0.95 | 1.3 | 1.74 |
| | $K_V$ | Back E.M.F | Volts/RPM | 39.2 | 63.2 | 85.0 |
| | $F_C/K_T$ | $P_b$ | Watts | 774 | 772 | 774 |
| **F** | $K_T$ | Torq. Sens. | Lb-In/Amp | 4.1 | 6.5 | 8.8 |
| | $R_A$ | Arm. Resis. | Ohms | 1.56 | 2 | 2.7 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 48.0 | 76.5 | 103.5 |
| | $F_C/K_T$ | $P_b$ | Watts | 631 | 638 | 636 |
| **G** | $K_T$ | Torq. Sens. | Lb-In/Amp | 5.2 | 8.3 | 11.1 |
| | $R_A$ | Arm. Resis. | Ohms | 2.35 | 3.3 | 4.3 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 61.3 | 97.5 | 131.5 |
| | $F_C/K_T$ | $P_b$ | Watts | 494 | 500 | 500 |
| **H** | $K_T$ | Torq. Sens. | Lb-In/Amp | 6.7 | 10.6 | 14.4 |
| | $R_A$ | Arm. Resis. | Ohms | 3.8 | 5.3 | 7 |
| | $K_V$ | Back E.M.F | Volts/KRPM | 79.1 | 125.6 | 170.0 |
| | $F_C/K_T$ | $P_b$ | Watts | 383 | 388 | 387 |

For custom designs please consult factory.          All specifications subject to change without notice.
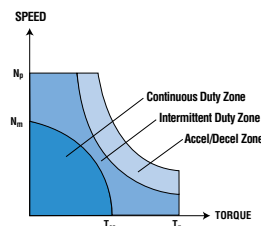
## MECHANICAL SPECIFICATIONS*

MOTOR TAB TERMINALS
.250 WIDE X .032 THICK

3/4 - 14 NPT THRU
(1) PLACE
(FOR CONDUIT FITTING)

3/8 - 16 UNC-2B THRU
(4) HOLES EQ. SP. ON A 5.875$^{\pm.010}$DBC

RED TACH TAB TERMINAL
.187 WIDE X .020 THICK

4.500
4.497
DIA.

X DIA.

.188
.190

.59 $\pm$.03

.16 $^{\pm.03}_{\pm.03}$

1.53
(FULL USABLE
KEYWAY)

2.00

L

Y
(KEYSET)

5.00
SQUARE
(AS CAST)
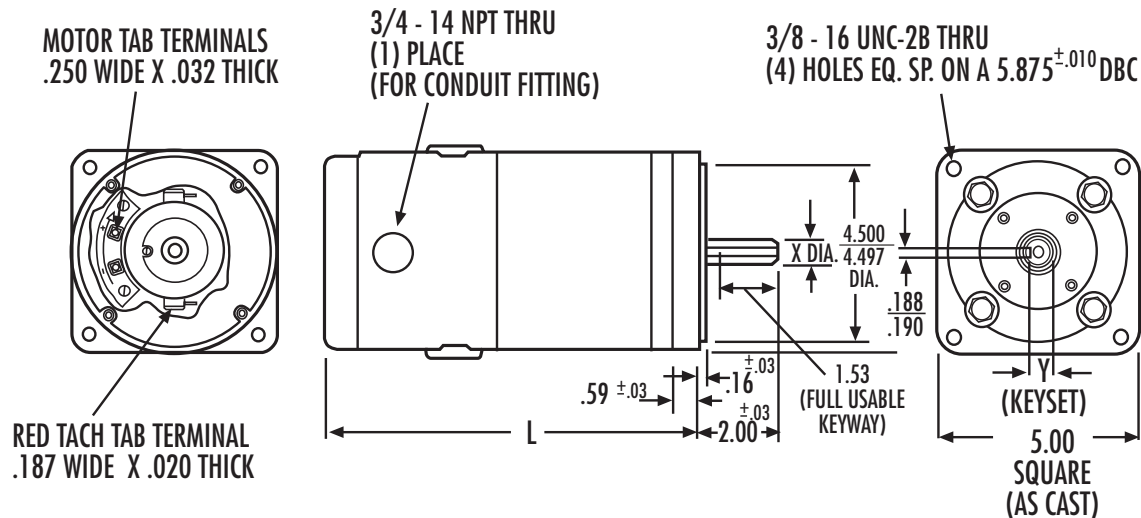
## MOTOR LENGTH (In inches)

| MOTOR | 5330 | 5350 | 5370 |
|---|---|---|---|
| Standard Motor/Tach (or Motor only) | 9.42 | 11.42 | 13.42 |
| Dimension L (with Shaft Encoder) | 12.80 | 14.80 | 16.80 |
| Dimension X | 0.625 / 0.624 | 0.625 / 0.624 | 0.875 / 0.874 |
| Dimension Y | 0.517 / 0.502 | 0.517 / 0.502 | 0.771 / 0.756 |

*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**

SPEED

$N_p$

$N_m$

Continuous Duty Zone
Intermittent Duty Zone
Accel/Decel Zone

$T_{cs}$   $T_p$   TORQUE

**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**

$N_m$ = Maximum speed, continuous operation

$N_p$ = Peak speed, acceleration/deceleration and intermittent duty

$T_{cs}$ = Continuous stall torque

$T_p$ = Peak torque

All specifications subject to change without notice.

## TORQUE PERFORMANCE CURVES

Motor: MH5370 - Winding: A

Motor: MH5370 - Winding: B

Motor: MH5370 - Winding: D
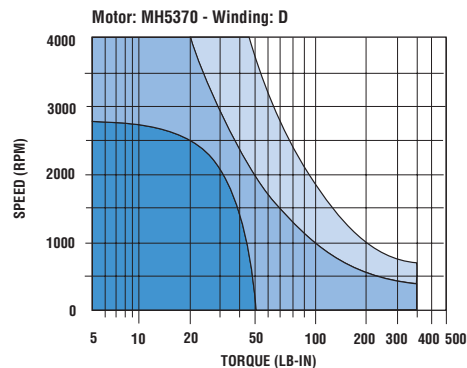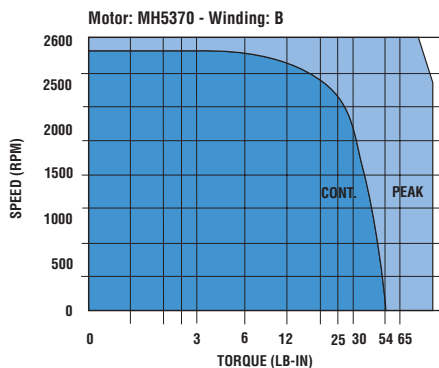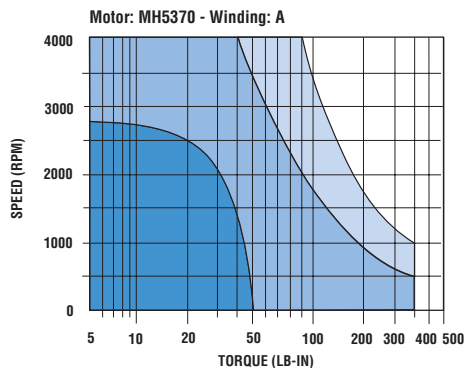


*TORQUE SPEED CURVES OF OTHER WINDINGS AVAILABLE, CONSULT FACTORY.*

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## VOLTAGE EQUATION FOR MOTORS

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

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

$T_R = .94K_T \left[ \dfrac{\dfrac{130}{R_{TH}} - \dfrac{RPM \times T_F}{1,350} - \dfrac{RPM^2 \times F_i}{1,350,000}}{1.5\,R_A} \right]^{1/2} - T_F - \dfrac{RPM \times F_i}{1000}$

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 = $\dfrac{\text{total cycle time in seconds}}{\text{thermal time constant of motors in seconds}}$

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

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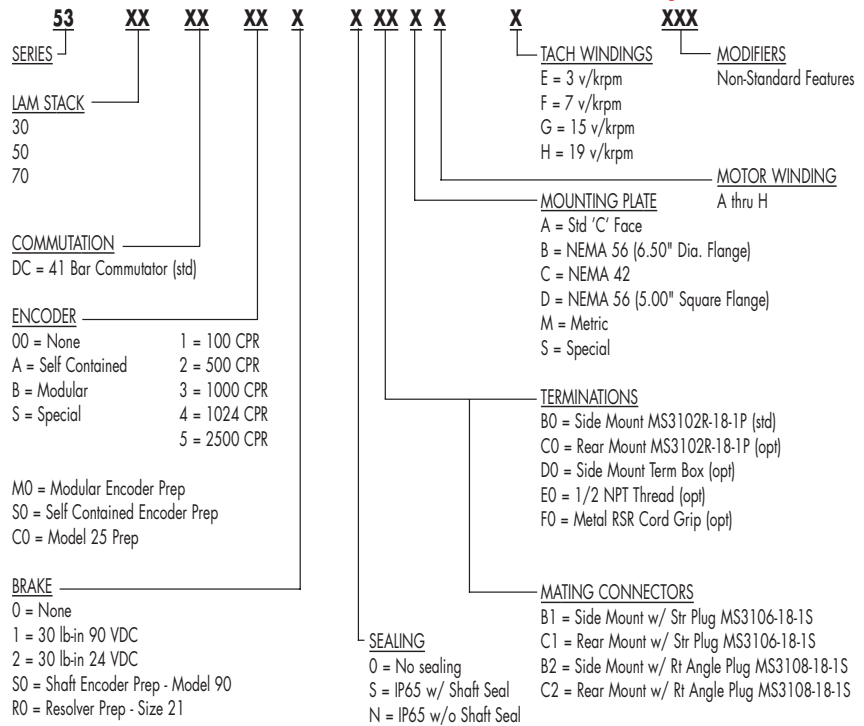and $T_{MAX}$ = Rated torque for intermittent duty

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

## ORDERING INFORMATION (For Standard Options)

53  XX  XX  XX  X    X  XX  X  X    X    XXX

**SERIES**

**LAM STACK**
30
50
70

**COMMUTATION**
DC = 41 Bar Commutator (std)

**ENCODER**
| | |
|---|---|
| 00 = None | 1 = 100 CPR |
| A = Self Contained | 2 = 500 CPR |
| B = Modular | 3 = 1000 CPR |
| S = Special | 4 = 1024 CPR |
| | 5 = 2500 CPR |

M0 = Modular Encoder Prep
S0 = Self Contained Encoder Prep
C0 = Model 25 Prep

**BRAKE**
0 = None
1 = 30 lb-in 90 VDC
2 = 30 lb-in 24 VDC
S0 = Shaft Encoder Prep - Model 90
R0 = Resolver Prep - Size 21

**SEALING**
0 = No sealing
S = IP65 w/ Shaft Seal
N = IP65 w/o Shaft Seal

**MATING CONNECTORS**
B1 = Side Mount w/ Str Plug MS3106-18-1S
C1 = Rear Mount w/ Str Plug MS3106-18-1S
B2 = Side Mount w/ Rt Angle Plug MS3108-18-1S
C2 = Rear Mount w/ Rt Angle Plug MS3108-18-1S

**TERMINATIONS**
B0 = Side Mount MS3102R-18-1P (std)
C0 = Rear Mount MS3102R-18-1P (opt)
D0 = Side Mount Term Box (opt)
E0 = 1/2 NPT Thread (opt)
F0 = Metal RSR Cord Grip (opt)

**MOUNTING PLATE**
A = Std 'C' Face
B = NEMA 56 (6.50" Dia. Flange)
C = NEMA 42
D = NEMA 56 (5.00" Square Flange)
M = Metric
S = Special

**MOTOR WINDING**
A thru H

**TACH WINDINGS**
E = 3 v/krpm
F = 7 v/krpm
G = 15 v/krpm
H = 19 v/krpm

**MODIFIERS**
Non-Standard Features

## Customize The 5300 Series To Your Exact Requirements

To satisfy various applications with cost-effective solutions, 5300 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.

## 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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