

TORQUEMASTER

BRUSH SERVO MOTORS



3500 SERIES

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® 00 series is no exception, when integrated with high performance brush amplifiers, TORQUE-MASTER 00 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.



Performance Benefits:

High torque in a smaller package
 Rugged industrial construction
 Continuous torque ratings up to 6 in-lbs with speeds up to 6 kRPM (no load)
 Maximum torque up to 94 in-lbs
 IP65 Sealing available
 High efficiency
 Easy integration

Design Features:

- Latest in high performance permanent magnet technology, and are available in eight standard windings as well as custom windings
- Motors can be customized to fit your exact application with tachometers, encoders, brakes and other options.
- Specialized machinery designs can install or retrofit servomotor with little or no restrictions
- Multiple configurations accommodate flexible design considerations
- Performance enhancement and feature convenience that allows Torque Systems motors to be incorporated into a broader range of applications



BRUSH SERVO MOTOR CHARACTERISTICS

SYMBOL	UNITS	3505	3509	3515	3528	
T _C	Cont. Torque	Lb-In	2.63	4.25	6.44	10.63
T _P	Peak Torque	Lb-In	21.9	37.5	56.3	93.8
T _F	Static Friction	Lb-In	0.3	0.25	0.3	0.32
F _i	Viscous Friction	Lb-In/KRPM	0.07	0.08	0.09	0.14
T _R	Cogging Torque	Lb-In	0.09	0.06	0.07	0.11
J _M	Inertia	Lb-In-sec ²	0.004	.0006	.0008	.0015
R _{TH}	Thermal Res	Deg C/watt	4.2	3.7	3.1	2.3
T _{TH}	Thermal Time	Minute	15	15	20	25
t _m	Mech Time	Millisec	8.1	5.5	3.9	3.5
t _e	Elect Time	Millisec	1.5	1.5	1.7	2
F _C	Commutation	Watts x Lb In / Amps	1475	2060	2990	4960
Wt	Weight	Lbs	3.2	3.8	5	7.5

Note: All values at 25°C Ambient.

WINDING

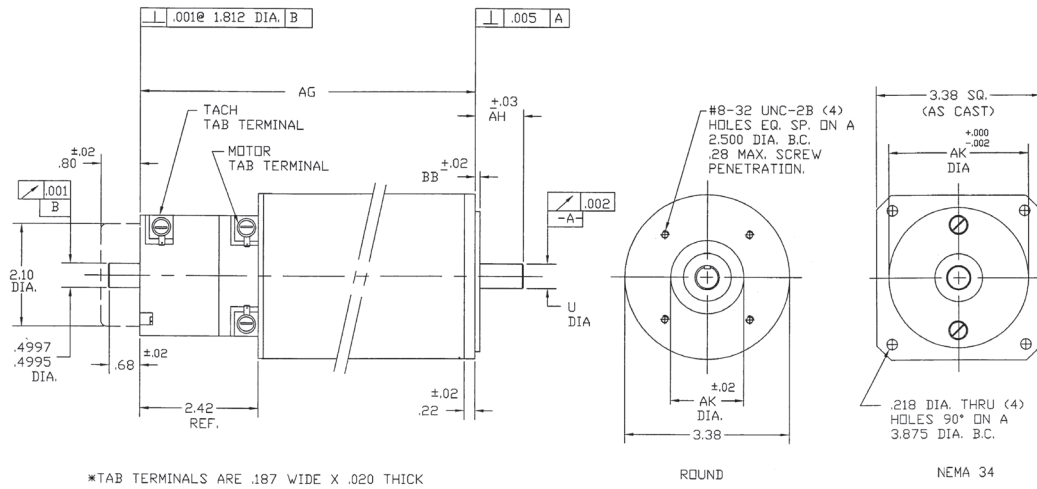
A	K _T	Torq. Sens.	Lb-In/Amp	0.24	0.39	0.59	1.05
	R _A	Arm. Resis.	Ohms	0.13	0.16	0.2	0.3
	K _V	Back E.M.F	Volts/KRPM	2.8	4.6	7.0	12.4
	F _C /K _T	P _b	Watts	388	332	315	295
B	K _T	Torq. Sens.	Lb-In/Amp	0.31	0.52	0.79	1.4
	R _A	Arm. Resis.	Ohms	0.22	0.27	0.34	0.51
	K _V	Back E.M.F	Volts/KRPM	3.7	6.1	9.4	16.6
	F _C /K _T	P _b	Watts	295	248	235	221
C	K _T	Torq. Sens.	Lb-In/Amp	0.39	0.65	0.99	1.74
	R _A	Arm. Resis.	Ohms	0.44	0.53	0.67	1.01
	K _V	Back E.M.F	Volts/KRPM	4.7	7.7	11.8	20.6
	F _C /K _T	P _b	Watts	234	198	188	178
D	K _T	Torq. Sens.	Lb-In/Amp	.5	.82	1.26	2.21
	R _A	Arm. Resis.	Ohms	0.55	0.67	0.84	1.3
	K _V	Back E.M.F	Volts/KRPM	5.9	9.7	14.9	26.2
	F _C /K _T	P _b	Watts	184	157	148	140
E	K _T	Torq. Sens.	Lb-In/Amp	.63	1.04	1.59	2.79
	R _A	Arm. Resis.	Ohms	0.88	1.05	1.34	2.04
	K _V	Back E.M.F	Volts/KRPM	7.5	12.3	18.8	33.0
	F _C /K _T	P _b	Watts	146	124	117	111
F	K _T	Torq. Sens.	Lb-In/Amp	.79	1.29	1.99	3.5
	R _A	Arm. Resis.	Ohms	1.4	1.7	2.12	3.2
	K _V	Back E.M.F	Volts/RPM	9.3	15.3	23.5	41.3
	F _C /K _T	P _b	Watts	117	100	94	89
G	K _T	Torq. Sens.	Lb-In/Amp	1.0	1.64	2.52	4.43
	R _A	Arm. Resis.	Ohms	2.2	2.7	3.4	5.12
	K _V	Back E.M.F	Volts/KRPM	11.8	19.4	29.8	52.3
	F _C /K _T	P _b	Watts	92	78	74	70
H	K _T	Torq. Sens.	Lb-In/Amp	1.26	2.08	3.18	5.59
	R _A	Arm. Resis.	Ohms	3.52	4.3	5.4	8.14
	K _V	Back E.M.F	Volts/KRPM	14.9	24.5	37.6	66.1
	F _C /K _T	P _b	Watts	73	62	59	55

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		BB	
	Motor Only Inches (Metric)	Motor Tach Inches (Metric)	STD	NEMA	STD	NEMA	STD	NEMA	STD	NEMA
3505	2.49 (63.2)	4.00 (101.6)	.5000/.4995	.3750/.3745	1.00	1.19	1.500	2.875	0.10	0.06
3509	3.24 (82.3)	4.75 (120.7)	.5000/.4995	.3750/.3745	1.00	1.19	1.500	2.875	0.10	0.06
3515	3.99 (101.3)	5.50 (139.7)	.5000/.4995	.3750/.3745	1.00	1.19	1.500	2.875	0.10	0.06
3528	5.24 (133.1)	6.75 (171.5)	.5000/.4995	.3750/.3745	1.00	1.19	1.500	2.875	0.10	0.06

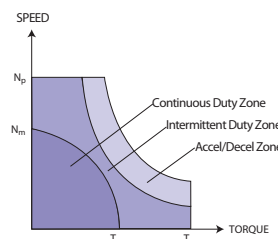
Note: Consult factory for AG length with cover option.

METRIC (mm): DIMENSIONS ALL FRAME SIZES

SHAFT: DIA	12h6	MOUNTING: PILOT	38
LENGTH	25.0	B.C.	63.5
		HOLE SIZE	6.6

*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



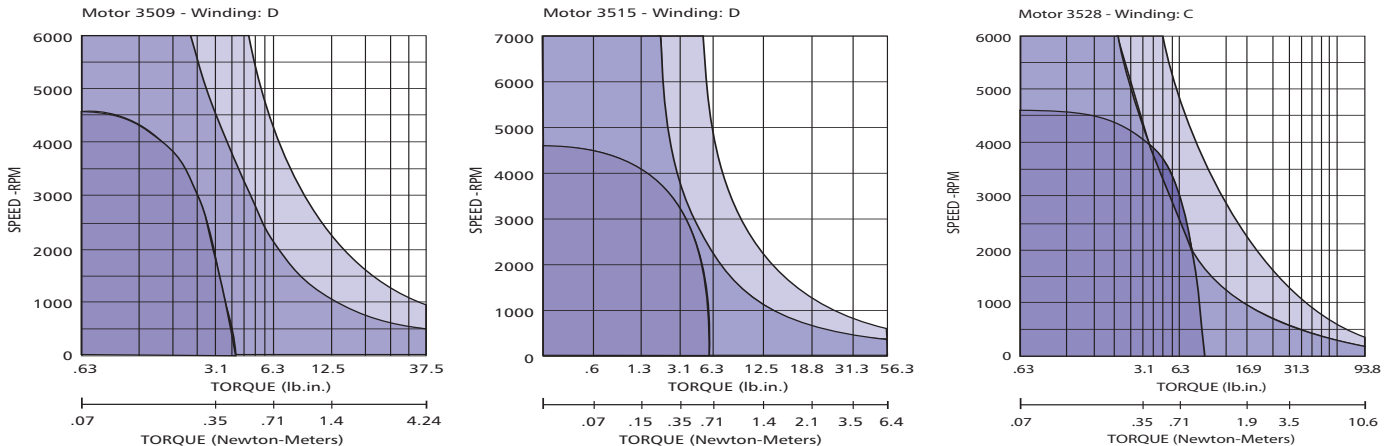
NOTE: Continuous torque specifications obtained with motor mounted to an 10"x10"x.25" aluminum plate at 25°C ambient. Typical values are within ±10% of rating.

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.



VOLTAGE EQUATION FOR MOTORS

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

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

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

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

ORDERING INFORMATION (For Standard Options)

<p>35 SERIES</p> <p>LAM STACK 05 09 15 28</p> <p>TACH 0 = None T = Tach</p> <p>COMMUTATION/MAGNET 00 = STD</p> <p>ENCODER 00 = None MO = Mod. Enc Prep QX = Line count from 200-5000 SX = Special</p>	<p>XX X XX XX</p> <p>XX X X X X</p>	<p>MTG PLATE A = 3 3/8" Round C = 3 3/8" Square (NEMA 34) S = Special M = Metric (85.6mm)</p> <p>SHAFT A = 1/2" dia. x 1" lg. B = A plus 1/8" x .75" lg. keyway E = 3/8" dia. x 1.19" lg. (NEMA 34) S = Special M = Metric</p> <p>TERMINATION (see note below) T = Tab terminals (std) S = Screw terminals (optional) W = 3 foot leads attached to tab terminals (optional) Y = Cover w/3 foot long leads and cord grip (optional) C = Cover w/MS 3102A-20-27P M = Cover w/NPT</p> <p>SEALING 0 = No sealing B = IP65 w/o shaft seal S = IP65</p> <p>BRAKE 00 = No Brake B1 = 15 lb-in, 24 VDC</p>	<p>X X</p> <p>WINDINGS MOTOR A THRU H</p> <p>WINDINGS TACH (V/KRPM) 0 = None E = 3 F = 7 G = 15</p> <p>} Requires "Y, C, or M" Cover Option from TERMINATION list above</p>
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NOTE:
Cover Option – consult factory for overall motor length.

CUSTOMIZE THE 3500 SERIES TO YOUR EXACT REQUIREMENTS

To satisfy various applications with cost-effective solutions, 3500 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 Torque Systems. For assistance, call your local distributor or Torque Systems direct. We look forward to meeting your custom requirements.

ASK ABOUT OTHER MOTION CONTROL SOLUTIONS & CAPABILITIES FROM TORQUE SYSTEMS

- Brushless TorqueMaster® Servo Motor
- Gearboxes/Brakes
- Expert application engineering
- Complete repair & refurbishing services



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