

TORQUEMASTER

BRUSH SERVO MOTORS



3500 SERIES

Performance Benefits

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® 3500 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the TORQUEMASTER 3500 Series of brush servo motors to provide smooth operation throughout a full speed range. The 3500 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 3500 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 3500 Series brush servo motors are rated from 2.63 lb.-in. to 10.60 lb.-in. with speeds and torque stability up to 4600 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 3500 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 3500, 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 10.6 lb.-in. — with speeds up to 4600 RPM (no load)
- Peak torque ratings up to 94 lb.-in.
- IP65 Sealing available
- High torque-to-inertia ratio delivers maximum torque per frame size
- Superior low speed performance
- Numerous custom options available



Sold & Serviced By:



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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

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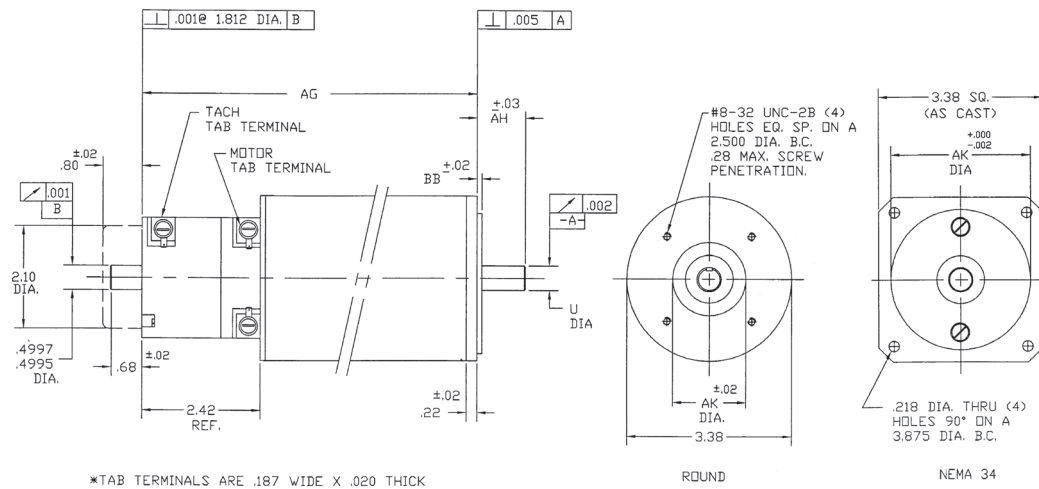
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Note: Continuous torque specifications obtained with motor mounted to an 10" x 10" x 0.25" alum. plate at 25°C ambient. Typical values are within ±10% of rating.

For custom designs please consult factory.

All specifications subject to change without notice.

MECHANICAL SPECIFICATIONS*



DIMENSION CHART*

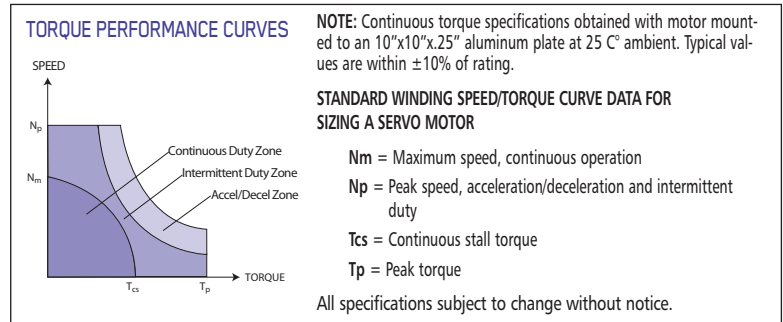
MOTOR	AG		U DIA.		AH		AK		BB	
	Motor Only Inches (Metric)	Motor Tach Inches (Metric)	STD	NEMA	STD	NEMA	STD	NEMA	STD	NEMA
3505	2.49 (63.2)	4.00 (101.6)	.5000/.4995	.3750/.3745	1.00	1.19	1.500	2.875	0.10	0.06
3509	3.24 (82.3)	4.75 (120.7)	.5000/.4995	.3750/.3745	1.00	1.19	1.500	2.875	0.10	0.06
3515	3.99 (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.

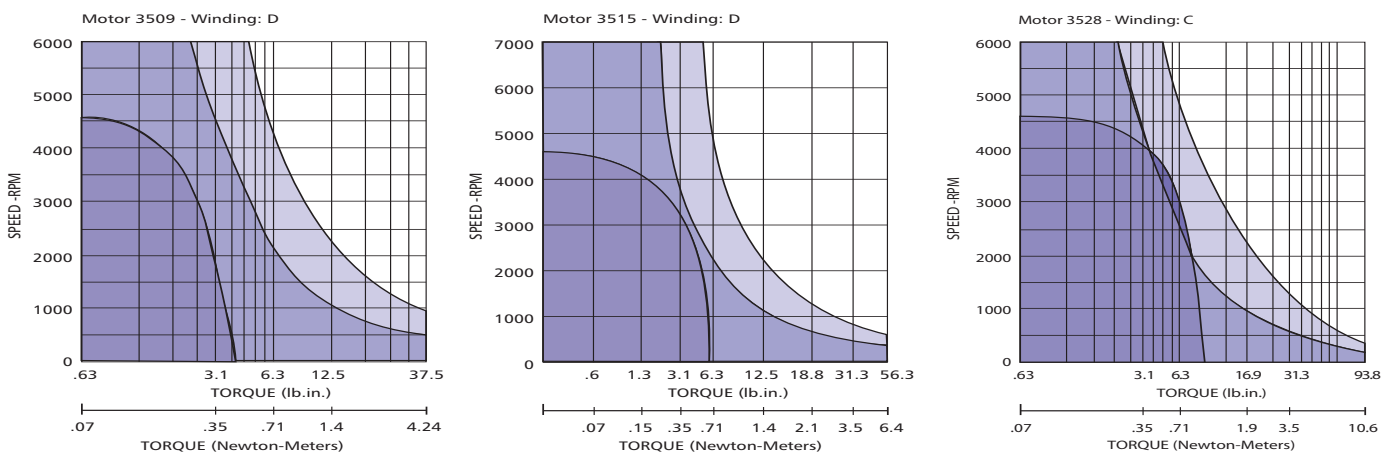
METRIC (mm): DIMENSIONS ALL FRAME SIZES

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



Torque Speed Curves of other windings available, consult factory.

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

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

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

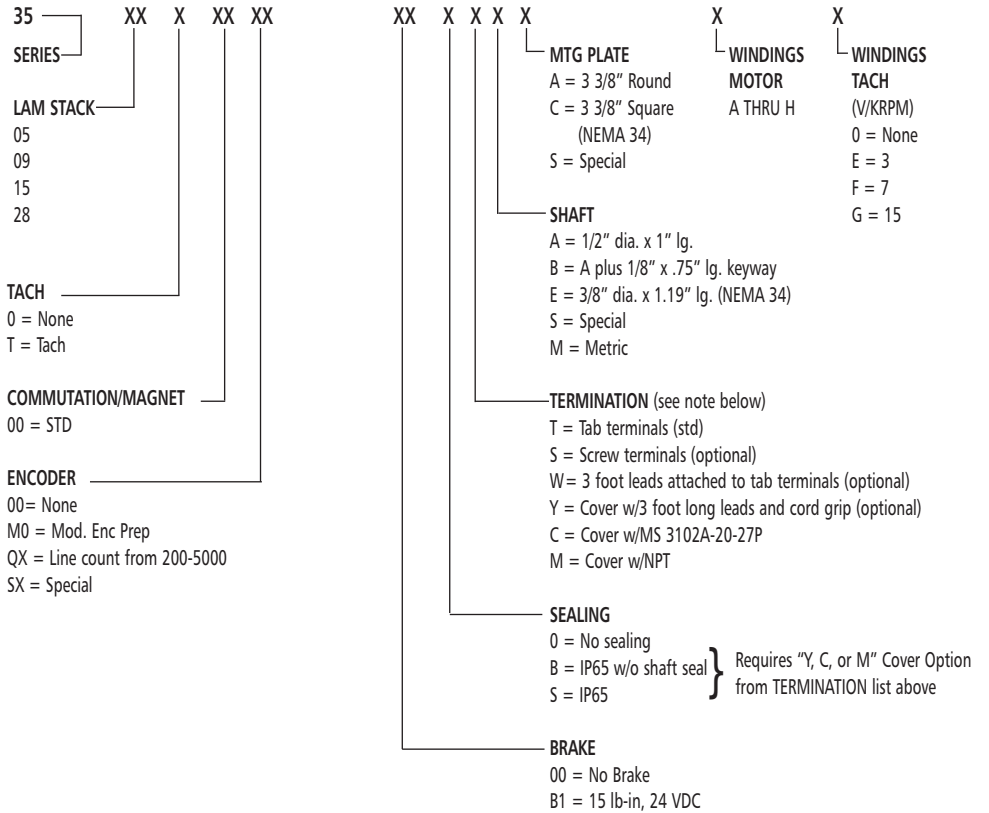
$$\text{Let } A = \frac{\text{total cycle time in seconds}}{\text{thermal time constant of motors in seconds}}$$

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

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

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

ORDERING INFORMATION (For Standard Options)



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

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