TORQUEMASTER
BRUSH SERVO MOTORS

3500 SERIES

MTI-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, when integrated with high performance brush amplifiers, TORQUE-MASTER 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.

Performance Benefits:

- Delivers smooth and superior low speed performance, and maximum power ratings with low thermal resistance for high
speed performance.
- Maximum torque in a smaller package
- Rugged industrial construction
- Continuous torque ratings up to 10.6 in-lbs with speeds up to 4600 RPM *(no load)*
- Peak torque ratings up to 94 in-lbs
- IP65 Sealing available
- High torque-to-inertia ratio delivers maximum torque per frame size
- Numerous custom options available

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

Montevideo Technology, Inc. (MTI)®
A Motor And Control Company
TORQUE SYSTEMS

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/KRPM	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.

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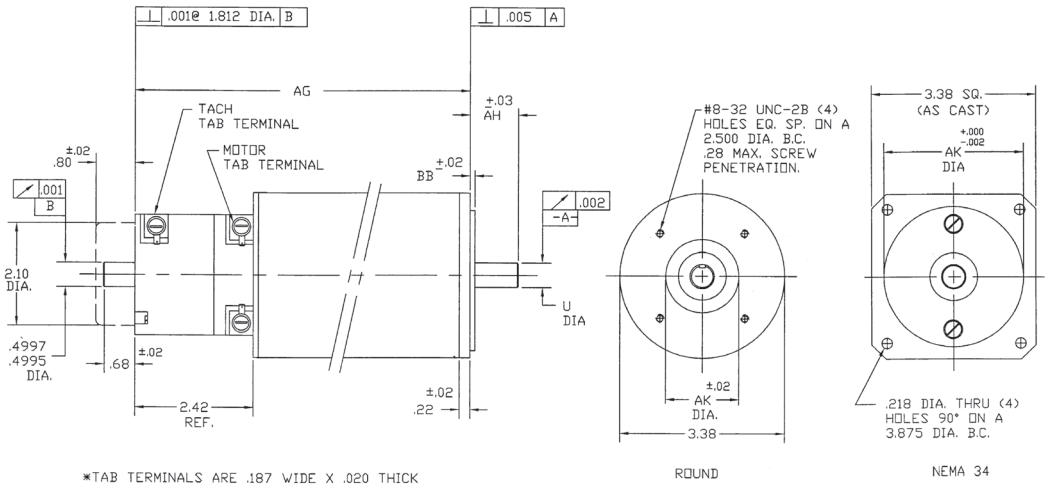
MECHANICAL SPECIFICATIONS*



DIMENSION CHART*

MOTOR	AG	AG	U DIA.		AH		AK	AF	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

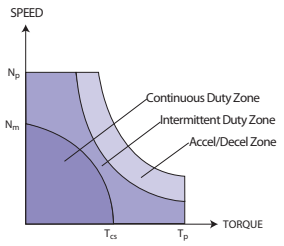
Note: Consult factory for AG length with cover option.

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

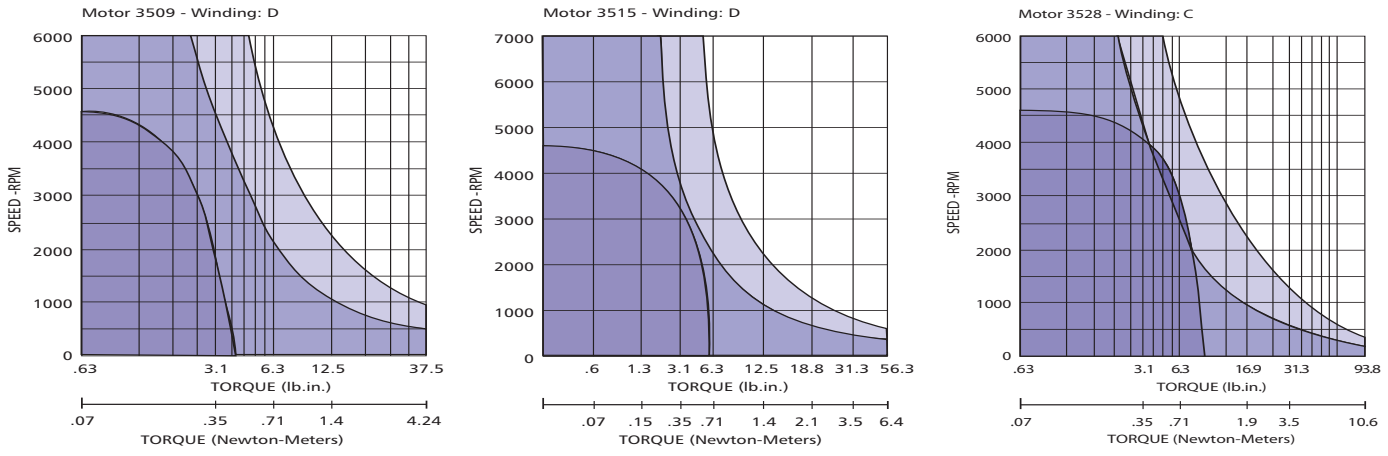
Np = Peak speed, acceleration/deceleration and intermittent duty

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

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

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

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

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)

35 XX X XX XX XX X X X X X X

SERIES
35

LAM STACK
05
09
15
28

TACH
0 = None
T = Tach

COMMUTATION/MAGNET
00 = STD

ENCODER
00= None
M0 = Mod. Enc Prep
QC = 500
QE = 1024
QD = 1000
QG = 2000
QH = 2048
QJ = 2500
QK = 5000
SX = Special

BRAKE
00 = No Brake
B1 = 15 lb-in, 24 VDC

SEALING
0 = No sealing
B = IP65 w/o shaft seal
S = IP65
} Requires "Y, C, or M" Cover Option from TERMINATION list above

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

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)
M = Metric, 12mm dia x 33mm lg. keyway
S= Special

MTG PLATE
A = 3 3/8" Round
C = 3 3/8" Square (NEMA 34)
M= Metric (85.6mm Square)
S= Special

WINDINGS MOTOR
A THRU H

WINDINGS TACH (V/KRPM)
0 = None
E = 3
F = 7
G = 15

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 MTI-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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