TORQUEMASTER
BRUSH SERVO MOTORS

ITT
ENGINEERED FOR LIFE

3000 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® 3000 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the TORQUEMASTER 3000 Series of brush servo motors to provide smooth operation throughout a full speed range. The 3000 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, TORQUE-MASTER 3000 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 BNR 3000 Series servo motors are rated from 12 lb.-in. to 34 lb.-in. with speeds and torque stability up to 10,000 RPM— accommodating DC bus voltages up to 325 volts. They utilize the latest in high performance Neodymium, permanent magnet technology, and are available in several standard windings (as well as custom windings) to meet your most demanding applications.

Each servo motor in the TORQUE-MASTER 3000 Series is ruggedly designed and manufactured for reliable performance. To satisfy many different applications, TORQUEMASTER 3000 Series motors are manufactured to NEMA/IEC specifications. For severe duty environments, the BNR design is also available with IP65 sealing.

TORQUEMASTER BNR 3000 Series servo motors come standard with a hall sensor or resolver commutation. Encoders, brakes, gearheads and other options are available.

Series 3000, 325 VDC brushless servo motor — provides fast response, accurate control and high torque-to-inertia ratios

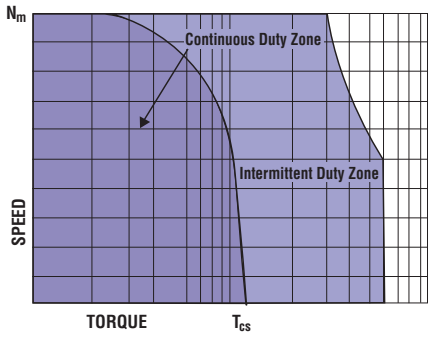
- 8 pole brushless design
- Continuous torque ratings up to 34 lb.-in.—with speeds up to 10,000 RPM
- IP65 Sealing available
- NEMA 23 mounting features standard
- IEC 72 Metric specifications available
- Maximum torque per frame size with high performance Neodymium magnets
- Superior low speed performance
- Numerous custom options available

CE UL®

BRUSHLESS SERVO MOTOR CHARACTERISTICS

SYMBOL	MOTOR PARAMETER	UNITS	BNR3012A	BNR3024D	BNR3034E
N_m	Max Operating Speed	RPM	10,000	7000	5800
T_C	Max Stall Torque	lb.-in.(Nm)	12 (1.4)	24 (2.7)	34 (3.8)
T_{Pk}	Peak Torque	lb.-in.(Nm)	60 (6.78)	110 (12.4)	150 (16.95)
K_T	Torque Sensitivity	lb.-in./AMP(Nm/Amp)	1.69 (.19)	4.22 (.47)	5.07 (.57)
K_e	Back E.M.F.	Volts/Krpm	20	50	60
R_a	Resistance Line to Line	Ohms	1.24	2.6	2.1
L	Inductance Line to Line	Millihenry	2	5.1	4.7
J_m	Rotor Inertia	lb.-in.-sec^2 (Kg-m^2)	0.0008 (0.00009)	0.0015 (0.00017)	0.00196 (0.0011)
T_F	Static Friction	lb.-in.(Nm)	0.10 (.011)	0.10 (.011)	.125 (.014)
F_i	Viscous Friction	Lb-In/Krpm	.075	0.094	0.156
R_{th}	Thermal Resistance	Deg C/Watt	1.2	0.92	0.8
T_m	Mechanical Time Const.	Millisec.	3.2	1.98	1.41
T_e	Electrical Time Const.	Millisec.	1.5	2.0	3.6
W_T	Motor Weight	Lbs(Kg)	6 (2.71)	8 (3.62)	9.5 (4.30)

TORQUE PERFORMANCE CURVES



NOTE: Continuous torque specifications obtained with motor mounted to an 8.5"x12"x 0.25" aluminum plate at 25°C ambient. Typical values are within ±10% of rating.

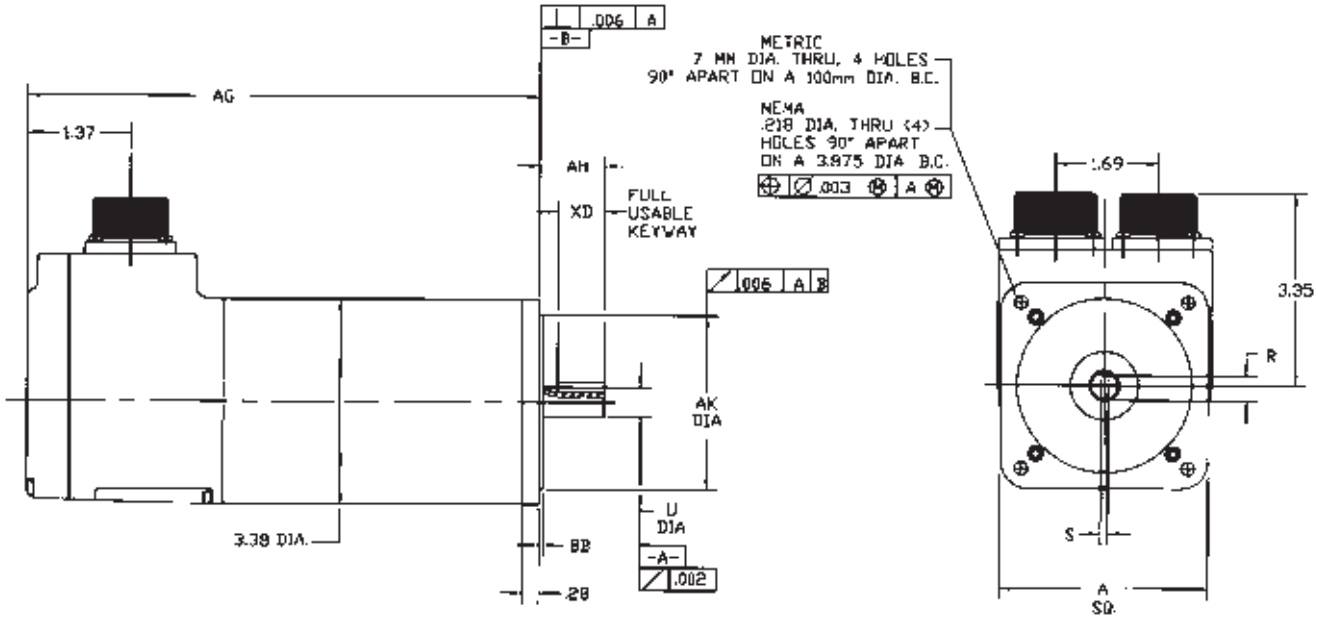
Relationship Between K_e & K_T
Torque Systems uses the following important motor performance parameters for the 3 phase square wave and 3 phase sine wave brushless motors in order to properly account for the British Imperial unit system currently used in the US.

K_e = Line-to-line volts-peak / Krpm*
K_T = Pound-inches (lb-in) / peak phase amps
K_e is related to Kt as follows:
$K_T = K_e/11.834$ for 3 phase square wave current driven amplifiers
$K_T = K_e/13.662$ for 3 phase sinusoidal wave current driven amplifiers
*Krpm = 1000 rpm
For "RMS" values, divide peak values by $\sqrt{2}$

STANDARD SPEED/TORQUE CURVE DATA FOR SIZING A SERVO MOTOR
N_m = Maximum speed, continuous operation
T_{cs} = Continuous stall torque

All specifications subject to change without notice.

MECHANICAL SPECIFICATIONS*



DIMENSION CHART* (Dimensions may change depending upon options)

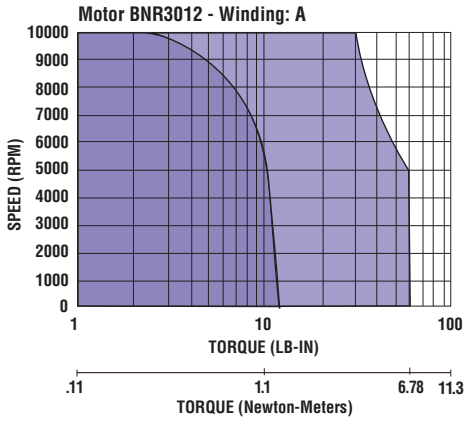
PART NUMBER	AG	A	AK	BB	U		AH		XD	S	R
STD (inch)					STD	NEMA 34	STD	NEMA 34			
BNR3012	6.40	3.42	2.875	.06	.500	.375	1.00	1.19	.62	.125	.420/.413
BNR3024	7.40	3.42	2.875	.06	.500	.375	1.00	1.19	.62	.125	.420/.413
BNR3034	8.40	3.42	2.875	.06	.500	.375	1.00	1.19	.62	.125	.420/.413

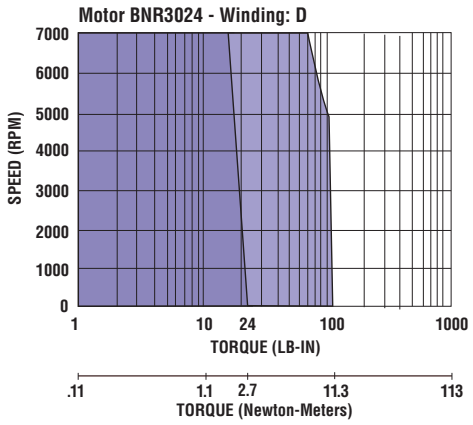
All dimensions meet NEMA 34 specifications except where indicated as standard.

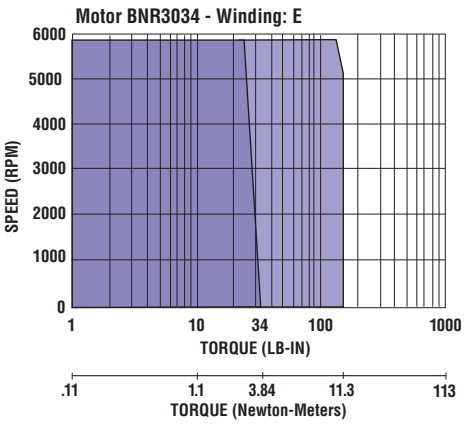
Metric IEC 72 (mm)									
BNR3012	162.6	86.9	60j6	2.5	15j6	30	23	5.0	12
BNR3024	187.9	86.9	60j6	2.5	15j6	30	23	5.0	12
BNR3034	213.4	86.9	60j6	2.5	15j6	30	23	5.0	12

NOTE: Dimension AG includes commutation feedback device and/or a secondary feedback device as shown on ordering information.
With internal brake option add 2.0" to dimension "AG"

TORQUE PERFORMANCE CURVES







TORQUE SPEED CURVES OF OTHER WINDINGS AVAILABLE, CONSULT FACTORY.

TERMINATION CHART

FEEDBACK OPTIONS

(B STANDARD) MS3102R-22-14P

PIN	Com. Encoder	Resolver	Hall (Note 1)
A	Brake+	Brake+	Brake+
B	Brake-	Brake-	Brake-
C	–	S2 (Sine+)	–
D	–	S4 (Sine-)	–
E	Encoder A	–	–
F	Encoder A	–	–
G	Hall U	S1 (Cosine+)	H1
H	Hall V	S3 (Cosine-)	H2
J	Hall W	–	H3
K	Encoder 5V	R1 (Excit.+)	+5V to +24V
L	Encoder Com	R2 (Excit.-)	Common
M	–	–	–
N	Thermostat	Thermostat	Thermostat
P	Thermostat	Thermostat	Thermostat
R	Encoder $\bar{B}$	–	–
S	Encoder B	–	–
T	Encoder M	–	–
V	Encoder $\bar{M}$	–	–

PIN	Modular Encoder	PIN	Modular Encoder
M	5 Volt	S	B
U	Common	R	$\bar{B}$
F	A	T	M
E	$\bar{A}$	V	$\bar{M}$

Note 1. Hall Sensor Specifications

Voltage = 5V to 24V
Current = 10 ma typical, 25 ma max.
Output = Open collector

Note 2. Com. Encoder

Current = 250 ma

MOTOR POWER CONNECTIONS

(B STANDARD) MS3102R-20-4P

PIN	Motor Winding
A	M1
B	M2
C	M3
D	CASE

BNR ORDERING INFORMATION – (For Standard Options)

BNR 3 012 A HA B A P A A 000

FRAME SIZE
3 = 3.38" Dia.

STALL TORQUE
012 = 12 lb-in
024 = 24 lb-in
034 = 34 lb-in

WINDINGS
A = 20 V/Krpm (K_T = 1.69 lb. in./Amp)
D = 50 V/Krpm (K_T = 4.22 lb. in./Amp)
E = 60 V/Krpm (K_T = 5.07 lb. in./Amp)

COMMUTATION/FEEDBACK (see note 3)
HA = Hall Sensor only
MO = Enc. Mtg. Provisions
RA = Resolver, 12 Arc Min
PA = Resolver, 7 Arc Min
SP = Special

Commutating Encoders		Line Count		Modular Encoders*
CB	=	250	=	MB
CC	=	500	=	MC
CD	=	1000	=	MD
CE	=	1024	=	ME
CF	=	2500	=	MF
SC	=	Special	=	MS

*Modular Encoder selection includes Hall Sensor Commutation

BRAKE (Internal) (see note 4)
0 = None
B = 30 lb-in brake

ENGINEERING MODIFICATIONS

SEALING
0 = None
A = per IP65 w/o shaft seal
B = per IP65 w/shaft seal

MOUNTING (see note 1)
A = 3.42" Sq. Flange with .500" Dia. x 1.00" long shaft
D = NEMA 34 Flange with 0.375" Dia. x 1.19" long shaft
M = Metric IEC72 Flange w/12J6 Dia. shaft
S = Special Flange and shaft

TERMINATIONS
C = Connector, MS3102A-20-4P Motor
MS3102A-22-14P Feedback
H = Heyco seal-tite w/1.5 ft shielded cable
P = Pipe Tap (NPT) w/1.5 ft shielded cable

MATING CONNECTORS (see note 2)
0 = None
A = Straight
B = Rt. Angle
S = Special

EXAMPLE: BNR 3 024 A RA B A C A A 000

- MODEL/FRAME
- 24 LB-IN STALL TORQUE
- WINDING
- COMMUTATION
- BRAKE
- MATING CONNECTORS
- TERMINATIONS
- MOUNTING FEATURES
- SEALING
- ENGINEERING MODIFICATIONS

Notes:

1. Standard BNR3000 motor mounting flanges use NEMA 34 standards but have oversized shaft diameters to carry the rated torque load. Standard NEMA shaft diameters are typically undersized for most servo ratings and are not recommended. Consult CMC regarding acceptable load limits before ordering or applying this option.
2. The above motors include standard MS connectors. Connector mates or cables must be ordered separately.
3. Standard encoders are dual channel line driver output with a marker pulse and complementary outputs.
4. Brakes are for holding static loads and not designed to stop moving loads. Standard coils are 24 volts DC.

CUSTOMIZE THE 3000 SERIES TO YOUR EXACT REQUIREMENTS

To satisfy various applications with cost-effective solutions, 3000 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.