# TORQUEMASTER
## BRUSH SERVO MOTORS

ITT
ENGINEERED FOR LIFE

# 3300 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® 3300 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the TORQUEMASTER 3300 Series of brush servo motors to provide smooth operation throughout a full speed range. The 3300 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 3300 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 3300 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 3300 Series is ruggedly designed and manufactured for reliable performance. To satisfy many different applications, TORQUEMASTER 3300 Series motors are manufactured to NEMA/IEC specifications. For severe duty environments, the BNR design is also available with IP65 sealing.

TORQUEMASTER BNR 3300 Series servo motors come standard with a hall sensor or resolver commutation. Encoders, brakes, gearheads and other options are available.

## Series 3300, 325 VDC brushless servo motor — provides fast response, accurate control and high torque-to-inertia ratios

- 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

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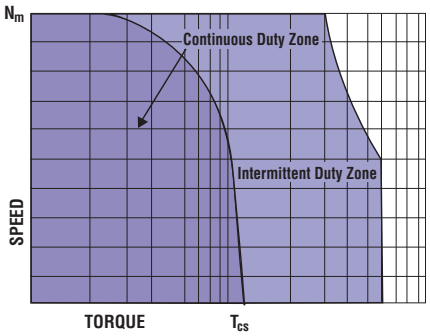
## BRUSHLESS SERVO MOTOR CHARACTERISTICS

| SYMBOL | MOTOR PARAMETER | UNITS | BNR3312A | BNR3324D | BNR3334E |
|---|---|---|---|---|---|
| $N_m$ | 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 $\sqrt{2}$

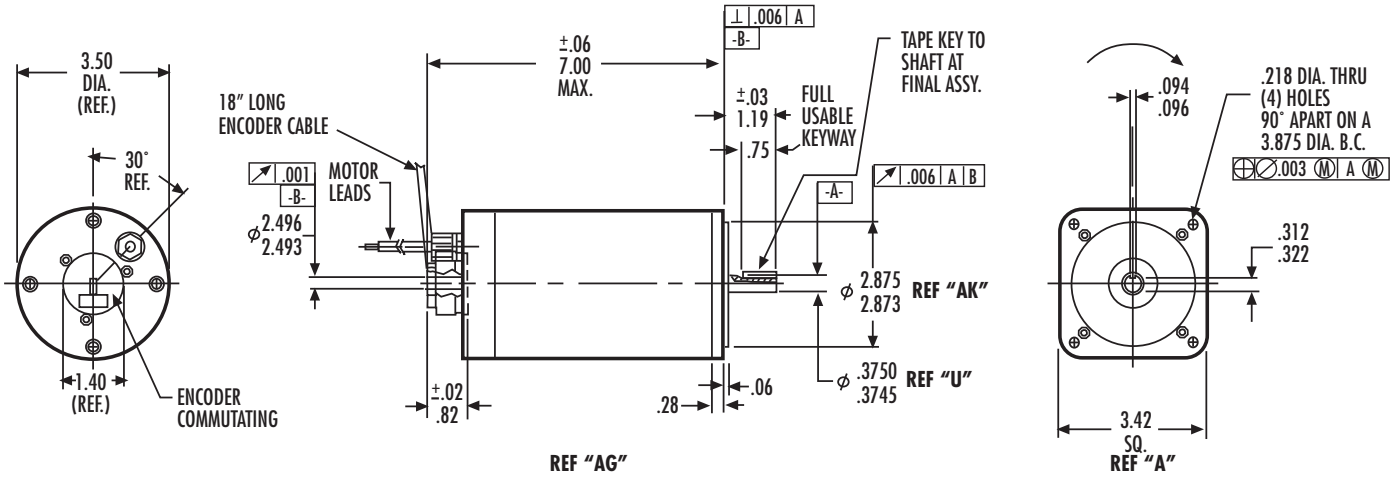
**STANDARD SPEED/TORQUE CURVE DATA FOR SIZING A SERVO MOTOR**

$N_m$ = 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)

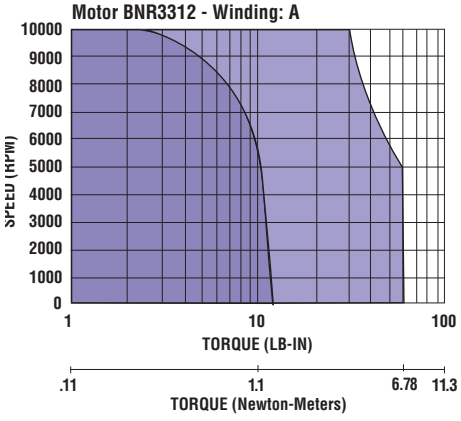
| PART NUMBER | AG | A | AK | BB | U | | AH | | XD | S | R |
|---|---|---|---|---|---|---|---|---|---|---|---|
| STD (inch) | | | | | STD | NEMA 34 | STD | NEMA 34 | | | |
| BNR3312 | 6.40 | 3.42 | 2.875 | .06 | .500 | .375 | 1.00 | 1.19 | .62 | .125 | .420/.413 |
| BNR3324 | 7.40 | 3.42 | 2.875 | .06 | .500 | .375 | 1.00 | 1.19 | .62 | .125 | .420/.413 |
| BNR3334 | 8.40 | 3.42 | 2.875 | .06 | .500 | .375 | 1.00 | 1.19 | .62 | .125 | .420/.413 |

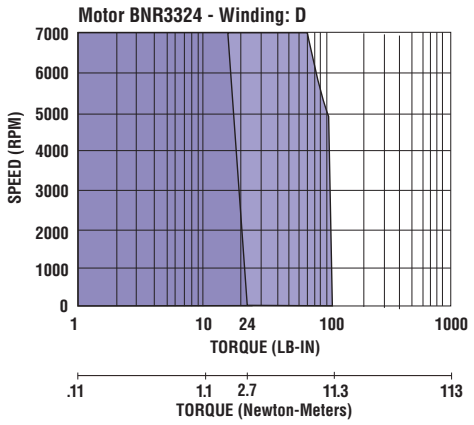
All dimensions meet NEMA 34 specifications except where indicated as standard.

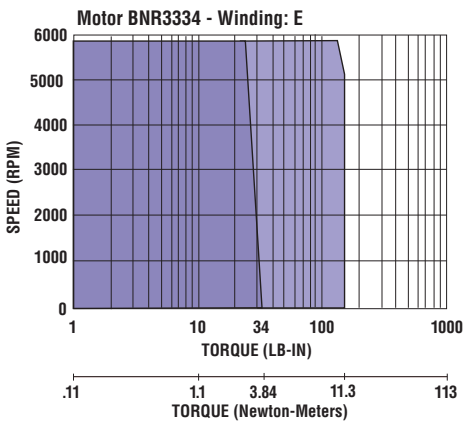
| Metric IEC 72 (mm) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BNR3312 | 162.6 | 86.9 | 60j6 | 2.5 | 15j6 | 30 | 23 | 5.0 | 12 |
| BNR3324 | 187.9 | 86.9 | 60j6 | 2.5 | 15j6 | 30 | 23 | 5.0 | 12 |
| BNR3334 | 213.4 | 86.9 | 60j6 | 2.5 | 15j6 | 30 | 23 | 5.0 | 12 |

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

### MOTOR/CABLE CODE

| Function | Wire Color |
|---|---|
| Motor M1 | White |
| Motor M2 | Black |
| Motor M3 | Red |
| **HALL CONNECTIONS** | |
| +5-24V | Red |
| Common | Black |
| H1 | Yellow |
| H2 | Orange |
| H3 | Green |

**Note:** Separate drain wires for motor power and halls

### ENCODER WIRING CONNECTION CODE

| Function | Wire Color |
|---|---|
| Encoder Output A | Green |
| Encoder Output $\bar{A}$ | Brown |
| Encoder Output B | Orange |
| Encoder Output $\bar{B}$ | Yellow |
| Encoder Output M | White |
| Encoder Output $\bar{M}$ | Blue |
| Encoder +5 VDC | Red |
| Encoder Common | Black |
| Case Ground | Drain |

**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

## 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**
312 = 12 lb-in
324 = 24 lb-in
334 = 34 lb-in

**WINDINGS**
A = 20 V/Krpm
D = 50 V/Krpm
E = 60 V/Krpm

**COMMUTATION/FEEDBACK** (see note 3)
HA = Hall Sensor only
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

**MATING CONNECTORS**
0 = None

**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

**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

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

**ENGINEERING MODIFICATIONS**

**EXAMPLE:** BNR 3 324 A RA B 0 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 BNR3300 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 3300 SERIES TO YOUR EXACT REQUIREMENTS

To satisfy various applications with cost-effective solutions, 3300 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.