



ITT

Cleveland Motion Controls



BRUSHLESS SERVO MOTORS BNR 3000 SERIES

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

Performance Benefits

Cleveland Motion Controls specializes in the design of high performance brushless servo motors that provide efficiency, flexibility of application, and a long and trouble-free service life. Our BNR 3000 series is no exception.

With fast response, accurate control and high torque-to-inertia ratios, you can count on the 3000 series of servo motors to provide smooth operation throughout a full speed range. The BNR 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 brushless amplifiers, BNR 3000 servo motors provide effective and highly efficient motion control solutions for a wide range of applications—including factory automation, packaging,

robotics, machine tools, semi-conductor, medical instrumentation, and more.

Design Features

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 to meet your most demanding applications.

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

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

- Trouble-free brushless construction
- Continuous torque ratings up to 34 lb-in. —with speeds up to 10,000 RPM
- IP65 Sealing available
- NEMA mounting features available
- 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



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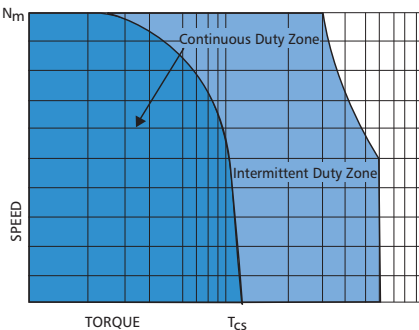


- Continuous torque range of 12 lb-in. to 34 lb-in.
- Neodymium magnet construction
- More torque per smaller frame size
- IP65 Sealing available
- Speeds to 10,000 RPM
- High torque-to-inertia ratios
- CE / UL

MOTOR SPECIFICATIONS

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 0.50" steel 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.

$$K_e = \text{Line-to-line volts-peak} / \text{Krpm}^*$$

$$K_T = \text{Pound-inches (lb-in)} / \text{peak phase amps}$$

K_e is related to K_T as follows:

$$K_T = K_e / 11.834 \text{ for 3 phase square wave current driven amplifiers}$$

$$K_T = K_e / 13.662 \text{ for 3 phase sinusoidal wave current driven amplifiers}$$

$$*\text{Krpm} = 1000 \text{ rpm}$$

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

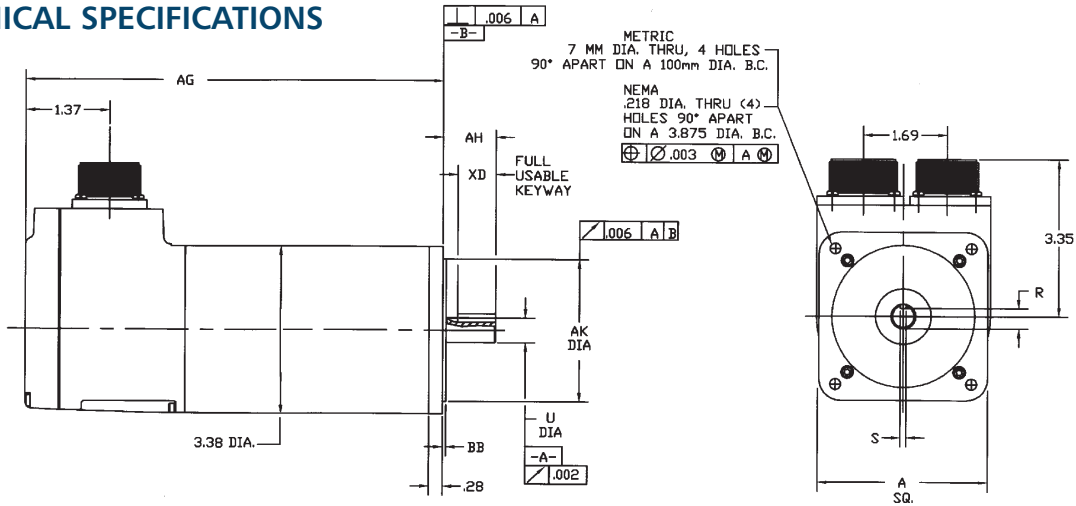
T_{cs} = Continuous stall torque

All specifications subject to change without notice.



BRUSHLESS SERVO MOTORS BNR 3000 SERIES

MECHANICAL SPECIFICATIONS



DIMENSION CHART

PART NUMBER	AG	A	AK	BB	U		AH		XD	S	R
					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

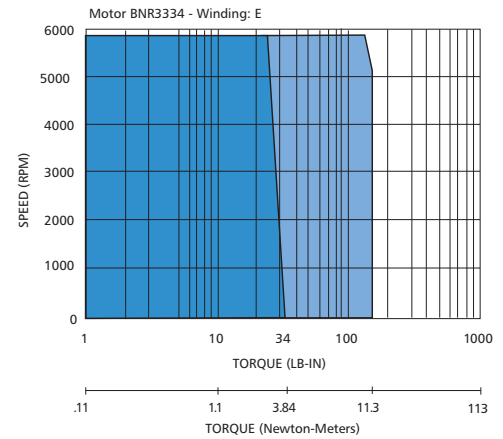
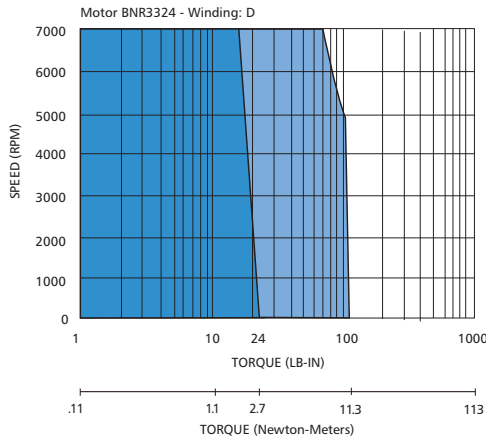
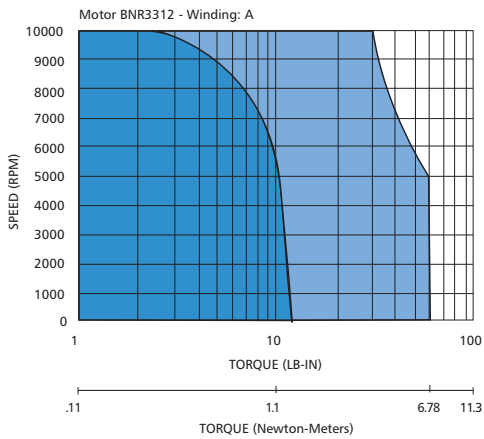
All dimensions meet NEMA 34 specifications except where indicated as standard.

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 modular encoder shown on ordering information under commutation. For internal brake add 2.0" to dimension "AG"

TORQUE PERFORMANCE CURVES



**TORQUE SPEED CURVES OF OTHER WINDINGS AVAILABLE,
CONSULT FACTORY.**



BRUSHLESS SERVO MOTORS BNR 3000 SERIES

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 \bar{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 B	-	-
S	Encoder \bar{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

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/12/16 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

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

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

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

Notes:

- Standard BMR2200 motor mounting flanges use NEMA 23 standards but allow 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 factory regarding acceptable load limits before ordering or applying this option.
- Standard encoders are dual channel line driver output with a marker pulse and complementary outputs.
- Brakes are for holding static loads and not designed to stop moving loads. Standard coils are 24 volts DC.

Customize The BNR 3000 To Your Exact Requirements

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

Cleveland Motion Controls, Inc.
7550 Hub Parkway * Cleveland, OH 44125
Tel: 216.524.8800 or 800.321.8072
Fax: 216.642.2199
cmcsales@itt.com
www.cmcccontrols.com