



## BRUSHLESS SERVO MOTORS

Pacific Scientific brushless servo motors are built for a long, maintenance-free, service life. So once installed, you probably won't have to look at them again.

That's because there's more to these motors than meets the eye. Like long life bearings, in TENV, NEMA and IP65 waterproof housings. All backed by a 2 year warranty.

However you measure performance, PacSci motors have the muscle. From high torque-to-inertia rare earth to flux-focusing ferrite magnetics for matching high inertia loads. From low thermal resistance for maximum power ratings to anti-cog magnet design for smooth, low speed performance.

Whatever your control scheme, PacSci brushless motors can close the loop. From single resolver feedback to a full selection of primary and secondary feedback transducers. From mounting options to application-specific windings. All in all, PacSci offers JIT delivery on over 10,000 motor configurations.

## FEATURES

- Troublefree, brushless construction
- Rare earth magnetics provide high torque-to-inertia ratios for fast accel/decel
- Flux-focusing ferrite magnetics for matching higher inertial loads
- Low thermal resistance for maximum power rating per frame size
- High torque over wide speed range
- Location flexibility, with no need to provide brush maintenance access
- Reduced EMI through elimination of brushes and brush arcing
- Anti-cog magnet design for smooth low speed performance
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- **2 year warranty**

## PERFORMANCE

Series	Continuous stall torque—lb-in. (Nm)	Peak torque—lb-in. (Nm)
<b>R20</b>	up to 9.2 (1.04)	up to 100 (11.3)
<b>R30</b>	up to 32 (3.6)	up to 160 (18.1)
<b>F40</b>	up to 61 (6.9)	up to 155 (17.5)
<b>R40</b>	up to 64 (7.2)	up to 270 (30.5)
<b>R60</b>	up to 168 (19)	up to 555 (63)
<b>R80</b>	up to 451 (51)	up to 1757 (198)

## GENERAL SPECIFICATIONS

Magnet types	.....samarium cobalt, or ferrite (F40 Series only)
Sealed housing construction (all motors)	.....TENV, NEMA and IP65 <sup>△</sup>
Terminations	.....MS connectors
Thermal protection	.....positive-temperature-coefficient (PTC) thermistor
Frame construction	
R20 Series (2" OD)	.....round
R30 Series (3.25" width/height)	.....square
F40 Series (4.25" width/height)	.....square
R40 Series (4.25" width/height)	.....square
R60 Series (5.75" width/height)	.....square
R80 Series (7.5" width/height)	.....square

## PRIMARY FEEDBACK OPTIONS<sup>△</sup>

- Tachsyn<sup>®</sup> transducer
- Frameless resolver, transmitter type
- Hall sensors

## SECONDARY FEEDBACK OPTIONS<sup>△</sup>

- 500-, 1000-, and 1024-line optical incremental encoders

## OTHER OPTIONS

- English or metric mounting and shaft configurations
- Shaft seals
- High-speed/high-current (low torque constant) or low-speed/low-current (high torque constant) windings

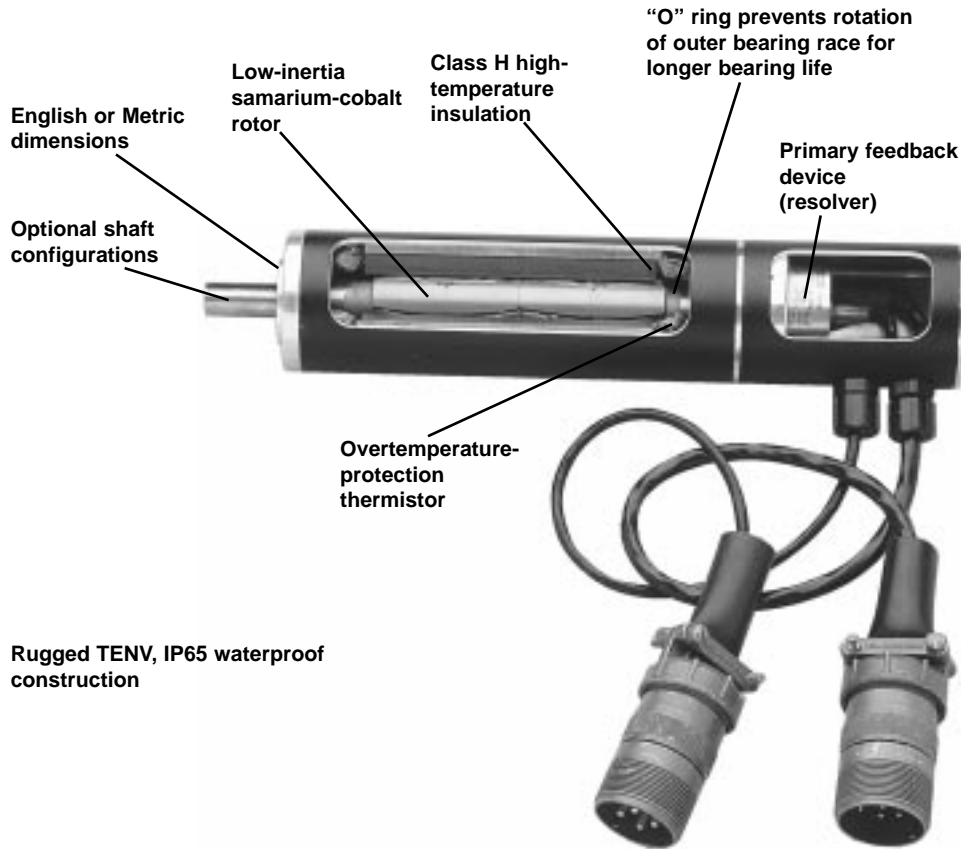
<sup>△</sup> For detailed sealing information, see individual motor specifications.

<sup>△</sup> For detailed information on primary feedback devices, see Section D.

<sup>△</sup> For detailed information on the secondary feedback device, see Section D.

# R SERIES

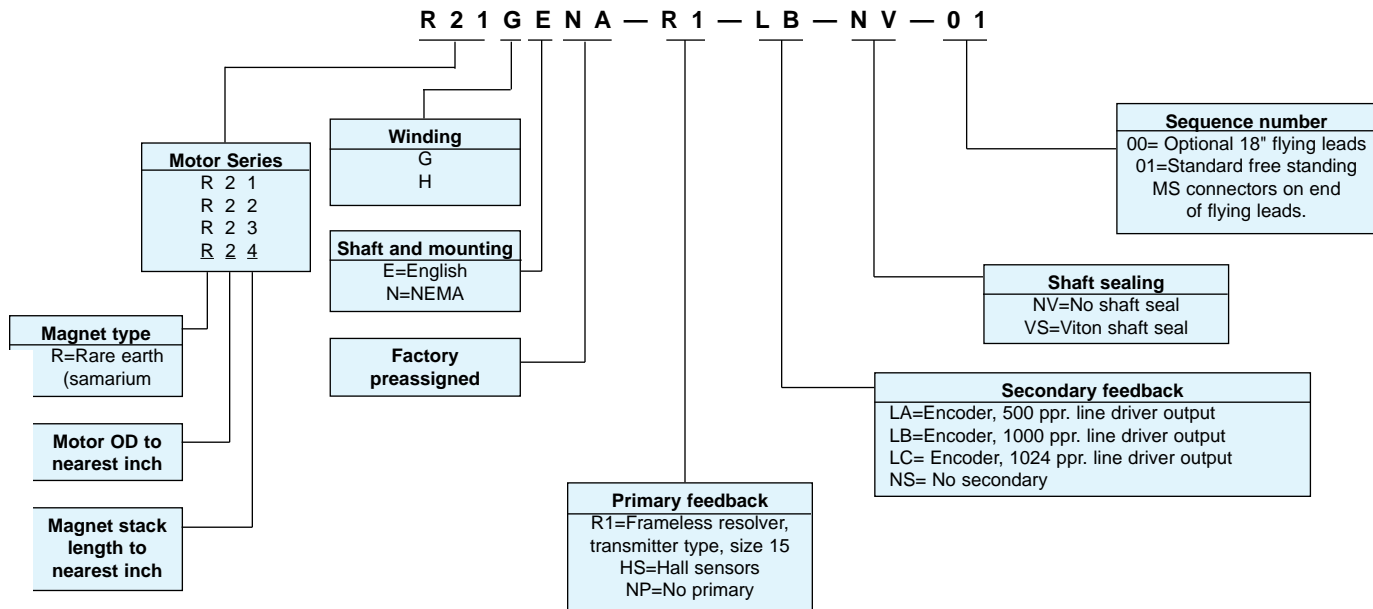
## 2" OD round-frame motor



Rugged TENV, IP65 waterproof construction

## MODEL NUMBER CODE. . .R20 Series

To construct a motor listing, select the combination of features required and put all the coded information in the proper sequence. Please account for all entries. Include the factory-preassigned "N" and "A" as noted. The model number shown is an example of a properly specified motor.



# R AND F SERIES

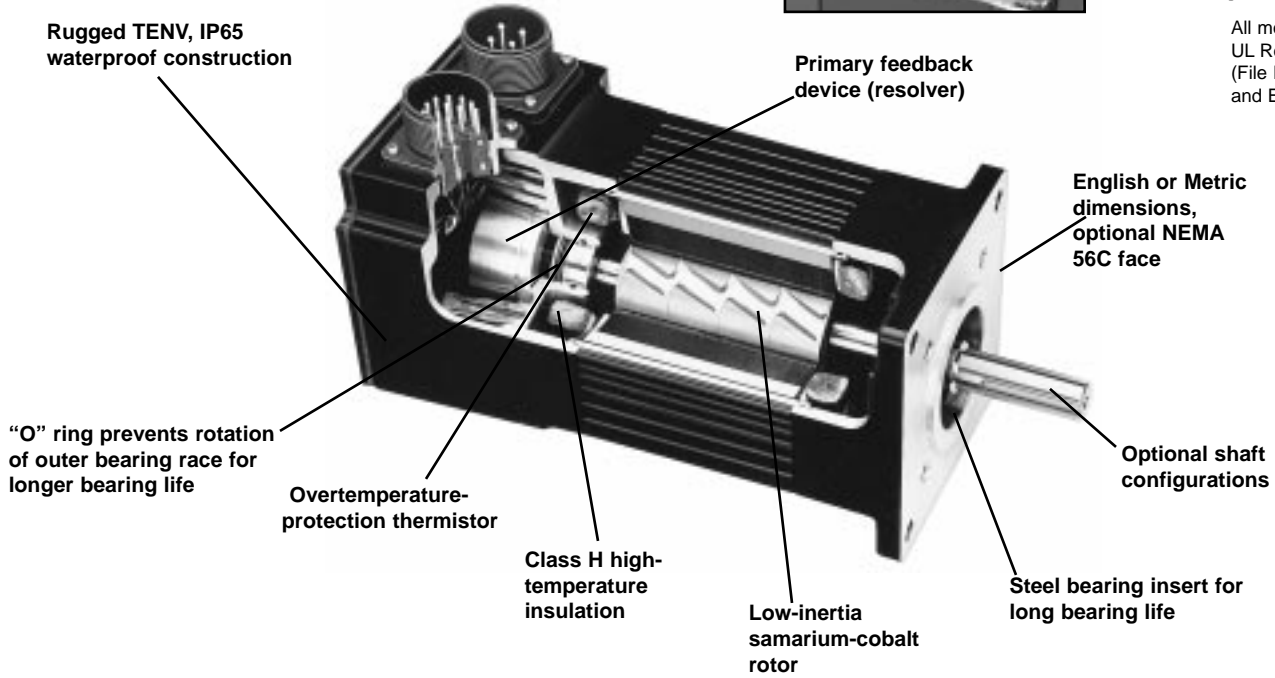
3.25", 4.25", 5.75", and 7.5" square-frame



Medium inertia ferrite rotor- F40 series only

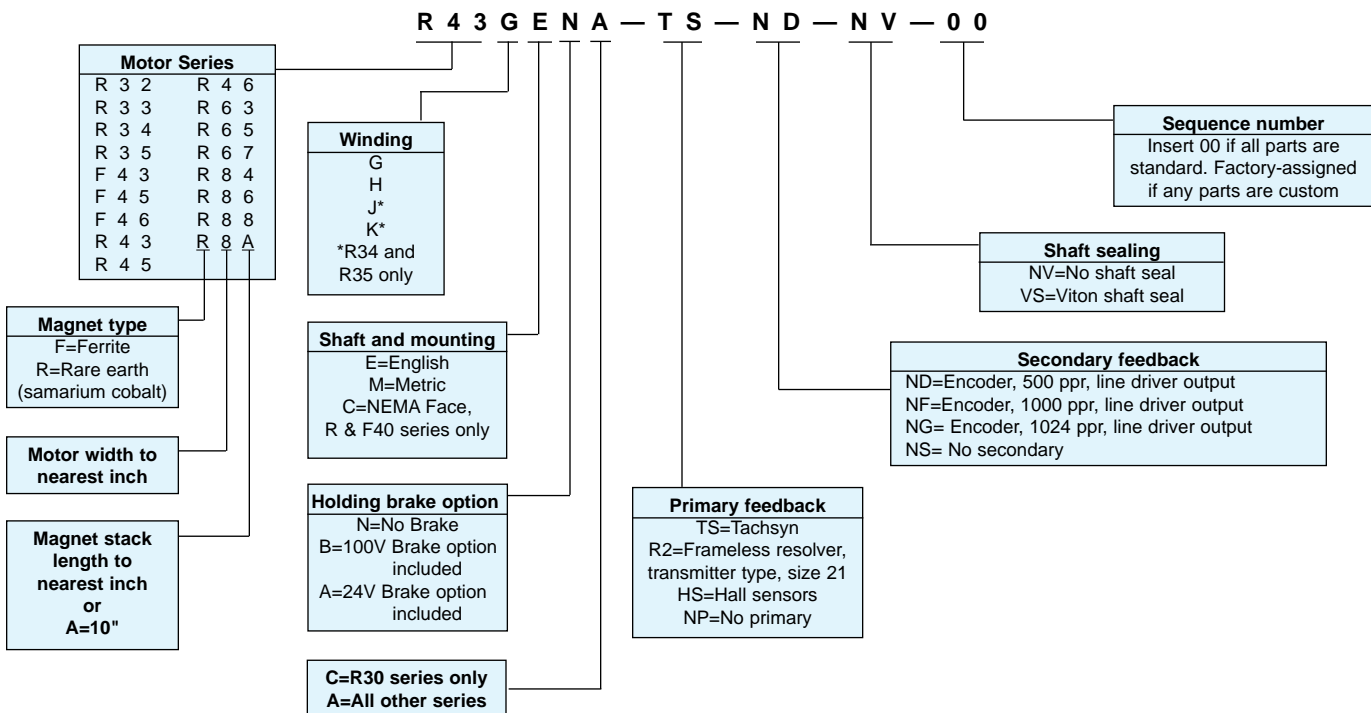


All motors are UL Recognized (File E103510 and E61960)



## MODEL NUMBER CODE. . .R30/F40/R40/R60/R80 Series

To construct a motor listing, select the combination of features required and put all the coded information in the proper sequence. Please account for all entries. The model number shown is an example of a properly specified motor.



# R20 SERIES

## 2" OD (round frame)

2.8 to 9.2 lb-in. (.32 to 1.04 Nm)  
continuous (stall) torque;  
25 to 100 lb-in. (2.8 to 11.3 Nm) peak

- Troublefree brushless construction
- Long life at high shaft speeds
- Samarium cobalt permanent magnets for maximum torque to inertia
- Low rotor inertia for rapid accel/decel
- Low thermal resistance for maximum power ratings
- Full torque over wide speed range
- Anti-cog magnet design for low speed smoothness



R20 Series brushless servo motors feature exceptionally high torque to inertia ratios for excellent acceleration and deceleration.

The samarium cobalt motors deliver high torque over a wide speed range-up to 18,000 RPM.

The R20's compact round frame design and 18" leads with MS connectors provide mounting flexibility where space is restricted.

Brushless design assures long life and low maintenance in high cycle rate applications.

### PERFORMANCE FEATURES

- Selection of primary and secondary feedback devices
- Convenient MS-type connectors on 18" leads
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- Long life bearings. Outer races won't turn. Front locked and rear held by O-ring.

### TYPICAL APPLICATIONS

- X-Y tables
- Automated fastening
- Linear actuators
- Drill spindles
- Wire bonders
- Robotics
- Tape drives
- Coil winders
- Wafer spinners
- High speed printers
- Computer equipment

### CHARACTERISTICS

Motor parameters and winding data. See system curves beginning on page B-73 for typical torque/speed performance.

English							Metric						
Parameter	Symbol	Units	R21	R22	R23	R24	Symbol	Units	R21	R22	R23	R24	
Continuous Stall Torque $\Delta$	$T_{CS}$	lb-in.	2.8	4.8	7.6	9.2	$T_{CS}$	Nm	.32	.54	.86	1.04	
Peak Torque $\Delta$	$T_{PK}$	lb-in.	25	50	75	100	$T_{PK}$	Nm	2.8	5.6	8.5	11.3	
Inertia (motor only)	$J_M$	lb-in. sec <sup>2</sup> x10 <sup>-3</sup>	.062	.098	.130	.160	$J_M$	kgm <sup>2</sup> x10 <sup>-3</sup>	.007	.011	.015	.018	
Static friction (max.)	$T_f$	lb-in.	.10	.17	.24	.31	$T_f$	Nm	.011	.019	.027	.035	
Viscous damping coefficient	$K_{DV}$	lb-in./Krpm	.03	.04	.05	.07	$K_{DV}$	Nm/Krpm	.0034	.0045	.0057	.0079	
Thermal resistance	$R_{TH}$	°C/Watt	1.65	1.43	1.27	1.14	$R_{TH}$	°C/Watt	1.65	1.43	1.27	1.14	
Thermal time constant $\Delta$	$\tau_{TH}$	min.	8	12	15	17	$\tau_{TH}$	min.	8	12	15	17	
Weight (motor only)	W	lbs	1.5	2.1	2.8	3.4	M (mass)	kg	.68	.95	1.3	1.5	

Winding data	Symbol	Units	G				H				Symbol	Units	G				H			
Torque constant $\Delta$ $\Delta$ (line-line)	$K_t$ peak	lb-in./A	3.4	1.7	3.3	1.6	4.6	2.3	5.5	2.8	$K_t$ peak	Nm/A	.38	.19	.37	.18	.52	.26	.62	.31
Voltage constant $\Delta$ (line-line)	$K_e$ peak	V/Krpm	40	20	38	19	54	27	65	33	$K_e$ peak	V/rad/sec	.38	.19	.37	.18	.52	.26	.62	.31
Continuous stall current $\Delta$	$I_{CS}$	A	.9	1.8	1.7	3.3	1.8	3.7	1.8	3.7	$I_{CS}$	A	.9	1.8	1.7	3.3	1.8	3.7	1.8	3.7
Current at peak torque $\Delta$	$I_{PK}$	A	16	32	33	65	35	70	39	77	$I_{PK}$	A	16	32	33	66	35	70	39	78
Resistance (line-line)	$R_c$ cold	Ohms	62	16	22	5.4	20	4.9	22	5.5	$R_c$ cold	Ohms	62	16	22	5.4	20	4.9	22	5.5
Resistance (line-line) $\Delta$	$R_h$ hot	Ohms	86	21	33	8.1	30	7.3	33	8.2	$R_h$ hot	Ohms	86	21	33	8.1	30	7.3	33	8.2
Inductance (line-line)	L	mH	47	12	21	5.3	26	6.5	26	6.5	L	mH	47	12	21	5.3	26	6.5	26	6.5

Note: All values at 25°C unless otherwise noted.

$\Delta$  Windings at 155°C. Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.

$\Delta$  Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.

$\Delta$  Peak value of a sinusoidal waveform. See Section D. Multiply given value by 0.95 to obtain hot values.

$\Delta$  For torque linearity, see Section D.

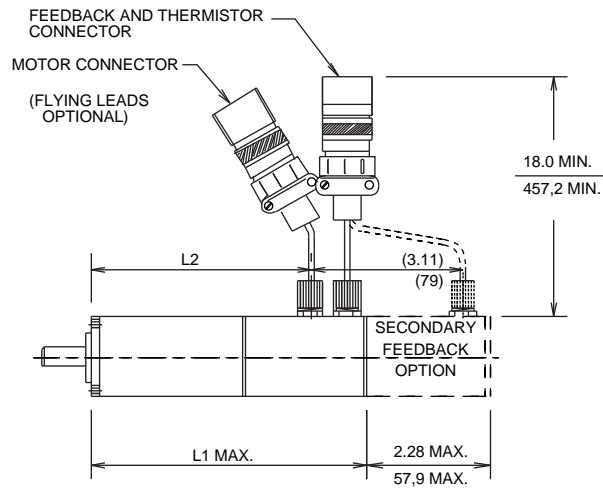
$\Delta$  Caution: For peak torques or peak currents greater than 3x the continuous rating, consult the factory for thermal considerations.

### Specifications. . .motor sealing

Motor waterproofing . . . . .in accordance with NEMA MG1-1.26, part E and IP65 with exception of shaft.  
Shaft seal . . . . .Optional, providing sealing to above specifications. Periodic lubrication required to maintain integrity of seal.

## DIMENSIONS . . R20 Series

### SIDE VIEW



### ENGLISH (INCHES)

MODEL NUMBER	L1 MAX.	L2 REF.
R21	6.38	(4.93)
R22	7.38	(5.93)
R23	8.38	(6.93)
R24	9.38	(7.93)

Note: L1 includes primary feedback device.

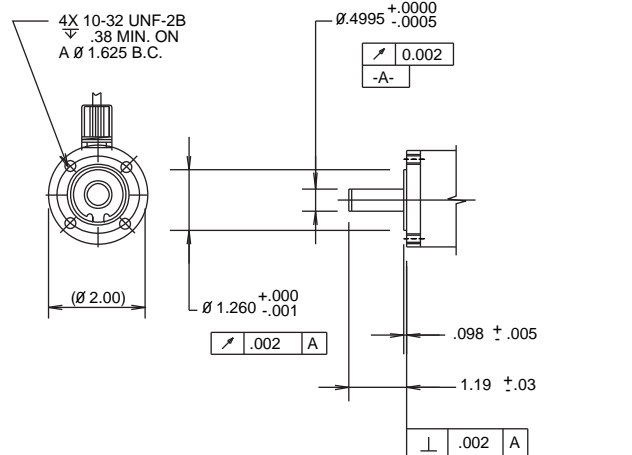
### METRIC (MILLIMETERS)

MODEL NUMBER	L1 MAX.	L2 REF.
R21	162.1	(125.2)
R22	187.5	(150.6)
R23	212.9	(176.0)
R24	238.3	(201.4)

Note: L1 includes primary feedback device.

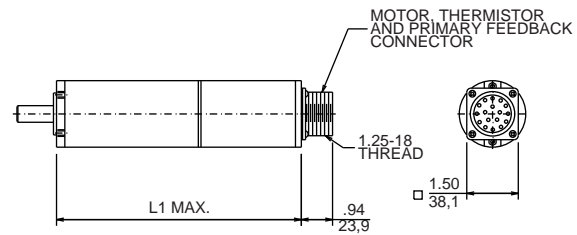
## MOUNTING AND SHAFT OPTIONS

### FRONT VIEW



### ENGLISH (INCHES)

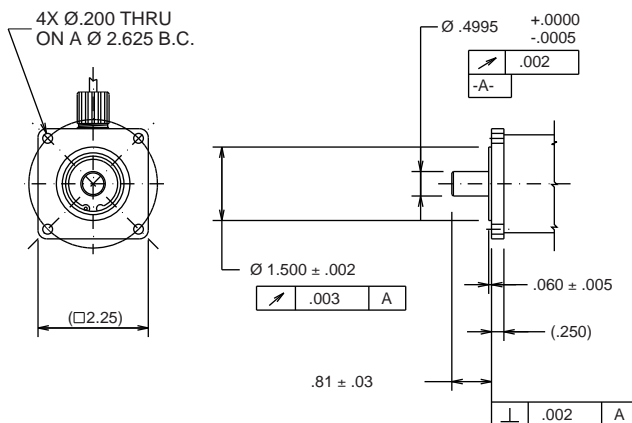
### REAR MOUNTED MS CONNECTOR OPTION



#### NOTE:

1. Available for motors with primary feedback only
2. MS connector is the same as used for the primary and secondary on square brushless motors.

### NEMA 23 (INCHES)



## CONNECTORS

#### NOTE:

Ø.2500 SHAFT OPTION IS AVAILABLE. CONSULT APPLICATION ENGINEERING.

R20 SERIES CONNECTORS	
MOTOR	MS3101A20-4P
PRIMARY FEEDBACK	MS3101A20-7P
PRIMARY PLUS SECONDARY FEEDBACK	MS3101A20-29P

# R30 SERIES

## 3.25" width/height (square frame)

14 to 32 lb-in. (1.6 to 3.6 Nm)  
continuous (stall) torque;  
66 to 160 lb-in. (7.4 to 18.1Nm) peak

- Troublefree brushless construction
- Long life bearing system
- Samarium cobalt permanent magnets for maximum torque to inertia
- Low rotor inertia for rapid accel/decel
- Low thermal resistance for maximum power ratings
- Full torque over wide speed range
- Anti-cog magnet design for low speed smoothness
- UL recognition

R30 Series brushless servo motors have samarium cobalt magnets for high torque to inertia ratios and high torque throughout a wide speed range.

The compact 3" square frame size is ideal for speed and position control applications requiring maximum performance in minimum space.

Brushless design assures long life and low maintenance in high cycle rate applications.



All motors are  
UL Recognized  
(Files E103510  
and E61960)

## PERFORMANCE FEATURES

- Selection of primary and secondary feedback devices
- Optional holding brake
- Convenient MS-type connectors
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- Long life bearings. Outer races won't turn. Front locked (in steel insert) and rear held by O-ring.

## TYPICAL APPLICATIONS

- X-Y tables
- Automated fastening
- Linear actuators
- Drill spindles
- Wire bonders
- Robotics
- Coil winders
- Wafer spinners
- Packaging machinery
- Mail handling equipment

## CHARACTERISTICS

Motor parameters and winding data. See system curves beginning on page B-73 for typical torque/speed performance.

English						Metric						
Parameter	Symbol	Units	R32	R33	R34	R35	Symbol	Units	R32	R33	R34	R35
Continuous Stall Torque <sup>△</sup>	T <sub>CS</sub>	lb-in.	14	21	27	32	T <sub>CS</sub>	Nm	1.6	2.4	3.0	3.6
Peak Torque <sup>△</sup>	T <sub>PK</sub>	lb-in.	66	98	130	160	T <sub>PK</sub>	Nm	7.4	11.0	14.7	18.1
Inertia (motor only) <sup>△</sup>	J <sub>M</sub>	lb-in. sec <sup>2</sup> x10 <sup>-3</sup>	.45	.64	.82	1.01	J <sub>M</sub>	kgm <sup>2</sup> x10 <sup>-3</sup>	.051	.072	.093	.114
Static friction (max.)	T <sub>f</sub>	lb-in.	.23	.31	.39	.47	T <sub>f</sub>	Nm	.026	.035	.044	.053
Viscous damping coefficient	K <sub>DV</sub>	lb-in./Krpm	.04	.06	.09	.11	K <sub>DV</sub>	Nm/Krpm	.0045	.0068	.010	.012
Thermal resistance	R <sub>TH</sub>	°C/Watt	.93	.84	.76	.70	R <sub>TH</sub>	°C/Watt	.93	.84	.76	.70
Thermal time constant <sup>△</sup>	τ <sub>TH</sub>	min.	20	23	26	29	τ <sub>TH</sub>	min.	20	23	26	29
Weight (motor only)	W	lbs	5.5	7.1	8.7	10.2	M (mass)	kg	2.5	3.2	3.9	4.6

Winding data	Symbol	Units	G		H		J		K		Symbol	Units	G		H		J		K	
Torque constant <sup>△</sup> <sup>△</sup> (line-line)	K <sub>t</sub> peak	lb-in./A	4.4	2.2	5.9	3.0	7.9	4.0	9.9	4.9	K <sub>t</sub> peak	Nm/A	.49	.24	.67	.33	.89	.44	1.12	.56
Voltage constant <sup>△</sup> (line-line)	K <sub>e</sub> peak	V/Krpm	52	26	70	35	93	47	117	58	K <sub>e</sub> peak	V/rad/sec	.49	.24	.67	.33	.89	.44	1.12	.56
Continuous stall current <sup>△</sup>	I <sub>CS</sub>	A	3.6	7.1	3.9	7.8	3.7	7.5	3.6	7.3	I <sub>CS</sub>	A	3.6	7.1	3.9	7.8	3.7	7.5	3.6	7.3
Current at peak torque <sup>△</sup>	I <sub>PK</sub>	A	32	64	35	70	35	71	35	71	I <sub>PK</sub>	A	32	64	35	70	35	71	35	71
Resistance (line-line)	R <sub>c</sub> cold	Ohms	7.3	1.8	6.9	1.7	8.1	2.0	9.2	2.3	R <sub>c</sub> cold	Ohms	7.3	1.8	6.9	1.7	8.1	2.0	9.2	2.3
Resistance (line-line) <sup>△</sup>	R <sub>h</sub> hot	Ohms	10.9	2.7	10.3	2.5	12.2	3.1	13.9	3.5	R <sub>h</sub> hot	Ohms	10.9	2.7	10.3	2.5	12.2	3.1	13.9	3.5
Inductance (line-line)	L	mH	23	5.8	22	5.6	30	7.5	42	10.5	L	mH	23	5.8	22	5.6	30	7.5	42	10.5

Note: All values at 25°C unless otherwise noted.

<sup>△</sup> Windings at 155°C. Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.

<sup>△</sup> Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.

<sup>△</sup> Peak value of a sinusoidal waveform. See Section D. Multiply given value by 0.95 to obtain hot values.

<sup>△</sup> For torque linearity, see Section D.

<sup>△</sup> Add holding brake inertia, if applicable.

<sup>△</sup> Caution: For peak torques or peak currents greater than 3x the continuous rating, consult the factory for thermal considerations.

## Specifications. . .optional holding brake

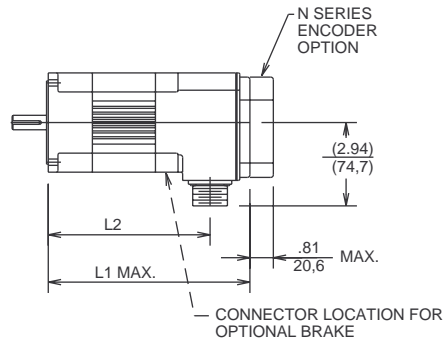
Voltage . . . . . 100, 24 Vdc  
 Current . . . . . 0.21A  
 Static holding torque (min.) . . 32 lb-in./3.6 Nm  
 Weight adder . . . . . 2.5 lbs/1.1 kg  
 Inertia . . . . . .034 lb-in-sec<sup>2</sup> x 10<sup>-3</sup>/.0039 kgm<sup>2</sup> x 10<sup>-3</sup>

## Specifications. . .motor sealing

Motor waterproofing . . . . .in accordance with NEMA MG1-1.26, part E and IP65 with exception of shaft.  
 Shaft seal . . . . .Optional, providing sealing to above specifications. Periodic lubrication required to maintain integrity of seal.

## DIMENSIONS . . R30 Series

SIDE VIEW



### ENGLISH (INCHES)

MODEL NUMBER	L1 MAX.*	L2 REF.*
R32	7.09	(5.62)
R33	8.09	(6.62)
R34	9.09	(7.62)
R35	10.09	(8.62)

Note: L1 includes primary feedback device.

### METRIC (MILLIMETERS)

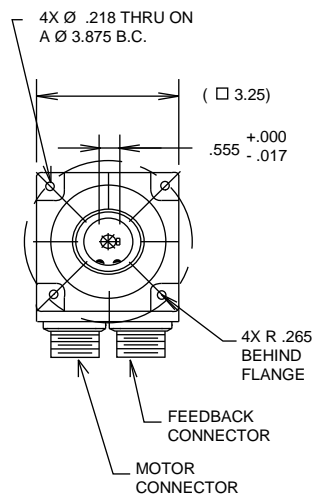
MODEL NUMBER	L1 MAX.*	L2 REF.*
R32	180.1	(142.7)
R33	205.5	(168.1)
R34	230.9	(193.5)
R35	256.3	(218.9)

Note: L1 includes primary feedback device.

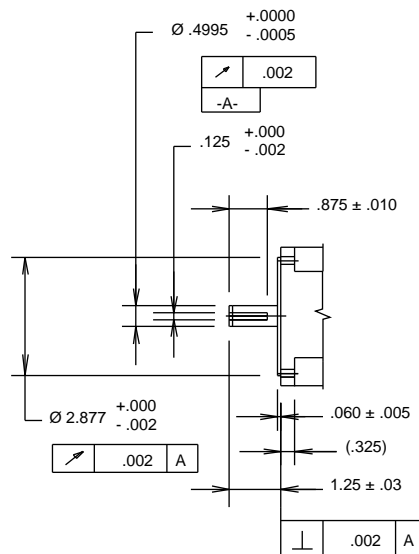
\*Add 2.22 in/56.4 mm for brake option.

## MOUNTING AND SHAFT OPTIONS

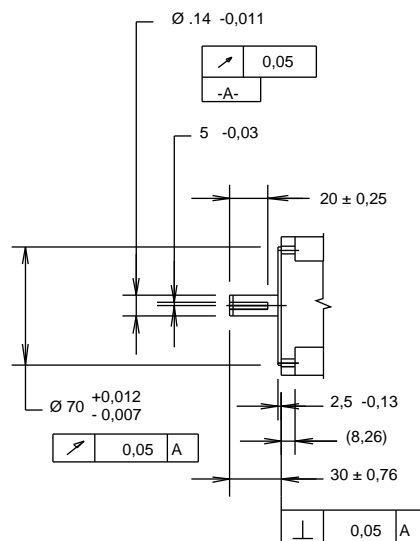
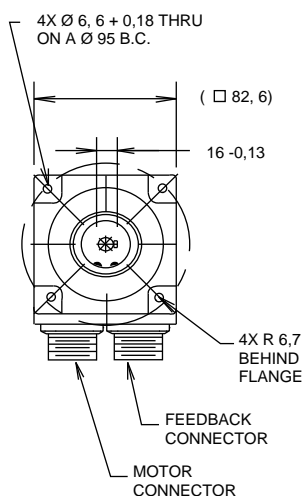
FRONT VIEW



ENGLISH (INCHES)



METRIC (MILLIMETERS)



## CONNECTORS

R30 SERIES CONNECTORS	
MOTOR	MS3102E20-4P
PRIMARY FEEDBACK	MS3102E20-7P
PRIMARY PLUS BRAKE	MS3102E14S-9P



# R40 SERIES

## 4.25" width/height (square frame)

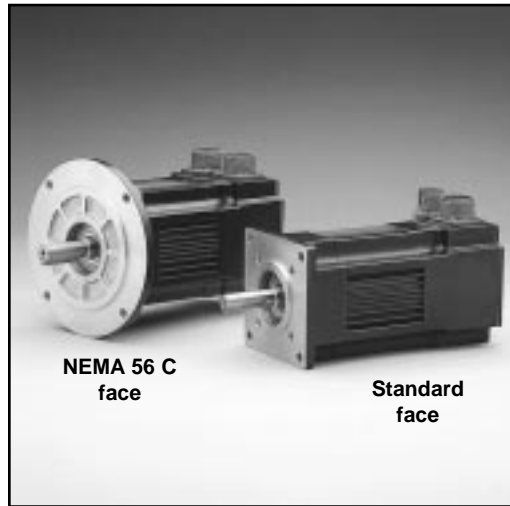
33 to 64 lb-in. (3.7 to 7.2 Nm)  
continuous (stall) torque;  
135 to 270 lb-in. (15.2 to 30.5 Nm) peak

- Troublefree brushless construction
- Long life bearing system
- Samarium cobalt permanent magnets for maximum torque to inertia
- Low rotor inertia for rapid accel/decel
- Mounting interchangeability with F40 Series ferrite magnet brushless motors
- Low thermal resistance for maximum power ratings
- Full torque over wide speed range
- Anti-cog magnet design for low speed smoothness
- UL recognition

R40 Series brushless servo motors have samarium cobalt magnets for high torque to inertia ratios. They produce excellent continuous and peak torques.

Smooth operation at low speeds, rapid acceleration and deceleration, and high torque production throughout wide speed ranges characterize these popular motors.

Brushless design assures long life and low maintenance in high cycle rate applications.



All motors are  
UL Recognized  
(Files E103510  
and E61960)

## PERFORMANCE FEATURES

- Selection of primary and secondary feedback devices
- Optional holding brake
- Convenient MS-type connectors
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- Long life bearings. Outer races won't turn. Front locked (in steel insert) and rear held by O-ring.

## TYPICAL APPLICATIONS

- Axis and spindle drives
- Press feeds
- Textile machines
- Packaging machinery
- Robotics
- Machine tools
- Coil winders
- Mail handling equipment

## CHARACTERISTICS

Motor parameters and winding data. See system curves beginning on page B-73 for typical torque/speed performance.

English				Metric						
Parameter	Symbol	Units	R43	R45	R46	Symbol	Units	R43	R45	R46
Continuous Stall Torque $\Delta$	$T_{CS}$	lb-in.	33	48	64	$T_{CS}$	Nm	3.7	5.4	7.2
Peak Torque $\Delta$	$T_{PK}$	lb-in.	135	200	270	$T_{PK}$	Nm	15.2	22.5	30.5
Inertia (motor only) $\Delta$	$J_M$	lb-in.-sec <sup>2</sup>	.0018	.0026	.0034	$J_M$	kgm <sup>2</sup> x10 <sup>-3</sup>	.20	.29	.38
Static friction (max.)	$T_f$	lb-in.	.26	.33	.39	$T_f$	Nm	.029	.037	.044
Viscous damping coefficient	$K_{DV}$	lb-in./Krpm	.10	.14	.17	$K_{DV}$	Nm/Krpm	.011	.016	.019
Thermal resistance	$R_{TH}$	°C/Watt	.72	.61	.52	$R_{TH}$	°C/Watt	.72	.61	.52
Thermal time constant $\Delta$	$\tau_{TH}$	min.	19	29	35	$\tau_{TH}$	min.	19	29	35
Weight (motor only)	W	lbs	15	20	25	M (mass)	kg	6.8	9.1	11.3

Winding data	Symbol	Units	G		H		G		H		Symbol	Units	G		H		G		H	
Torque constant $\Delta$ $\Delta$ (line-line)	$K_t$ peak	lb-in./A	10.8	5.4	8.1	4.1	10.8	5.4	8.1	4.1	$K_t$ peak	Nm/A	1.22	.61	.91	.45	1.22	.61	.91	.45
Voltage constant $\Delta$ (line-line)	$K_e$ peak	V/Krpm	128	64	96	48	128	64	96	48	$K_e$ peak	V/rad/sec	1.22	.61	.91	.45	1.22	.61	.91	.45
Continuous stall current $\Delta$	$I_{CS}$	A	3.5	6.9	6.7	13.4	6.7	13.5	6.7	13.5	$I_{CS}$	A	3.5	6.9	6.7	13.4	6.7	13.5	6.7	13.5
Current at peak torque $\Delta$	$I_{PK}$	A	27	53	53	106	53	106	53	106	$I_{PK}$	A	27	53	53	106	53	106	53	106
Resistance (line-line)	$R_c$ cold	Ohms	10.0	2.5	3.2	.81	3.7	.93	3.2	.81	$R_c$ cold	Ohms	10.0	2.5	3.2	.81	3.7	.93	3.2	.81
Resistance (line-line) $\Delta$	$R_h$ hot	Ohms	15.1	3.7	4.8	1.2	5.6	1.4	4.8	1.2	$R_h$ hot	Ohms	15.1	3.7	4.8	1.2	5.6	1.4	4.8	1.2
Inductance (line-line)	L	mH	53	13.3	20	4.9	25	6.2	20	4.9	L	mH	53	13.3	20	4.9	25	6.2	20	4.9

Note: All values at 25°C unless otherwise noted.

$\Delta$  Windings at 155°C. Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.

$\Delta$  Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.

$\Delta$  Peak value of a sinusoidal waveform. See Section D. Multiply given value by 0.95 to obtain hot values.

$\Delta$  For torque linearity, see Section D.

$\Delta$  Add holding brake inertia, if applicable.

$\Delta$  Caution: For peak torques or peak currents greater than 3x the continuous rating, consult the factory for thermal considerations.

### Specifications. . .optional holding brake

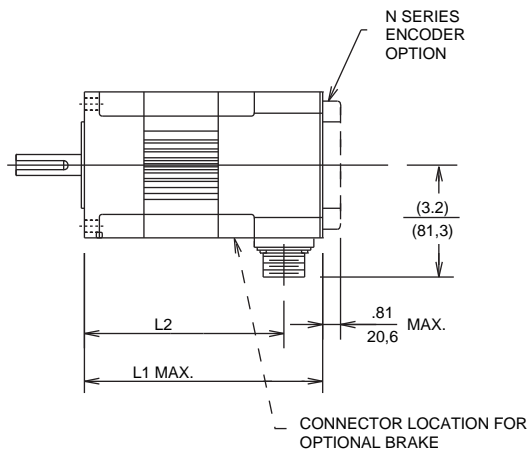
Voltage . . . . . 100, 24 Vdc  
 Current . . . . . 0.22A  
 Static holding torque (min.) . . . . . 72 lb-in./8.1 Nm  
 Weight adder . . . . . 4 lbs/1.8 kg  
 Inertia . . . . . .0005 lb-in sec<sup>2</sup>/.056 kgm<sup>2</sup> x 10<sup>-3</sup>

### Specifications. . .motor sealing

Motor waterproofing . . . . .in accordance with NEMA MG1-1.26, part E and IP65 with exception of shaft.  
 Shaft seal . . . . .Optional, providing sealing to above specifications. Periodic lubrication required to maintain integrity of seal.

## DIMENSIONS . . R40 Series

### SIDE VIEW



### ENGLISH (INCHES)

MODEL NUMBER	L1 MAX.*	L2 REF.*
R43	8.4	(7.01)
R45	9.9	(8.51)
R46	11.4	(10.01)

Note: L1 includes primary feedback device.

### METRIC (MILLIMETERS)

MODEL NUMBER	L1 MAX.*	L2 REF.*
R43	213.4	(178.1)
R45	251.5	(216.2)
R46	289.6	(254.3)

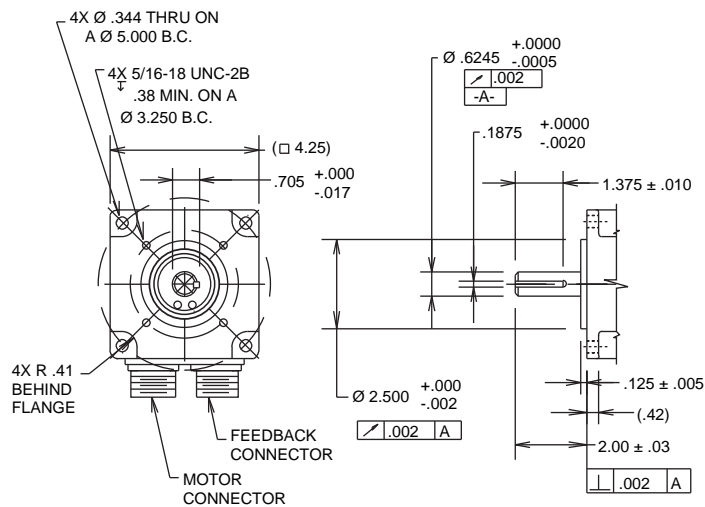
Note: L1 includes primary feedback device.

\*Add 2.44 in./62.0 mm for brake option.

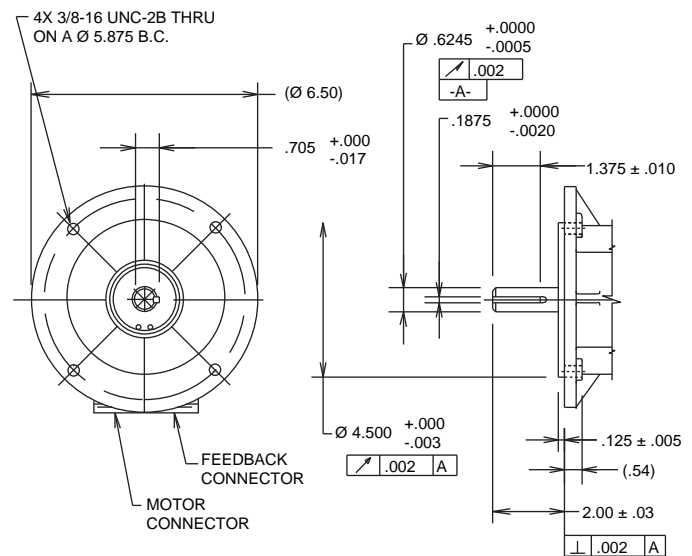
## MOUNTING AND SHAFT OPTIONS

### FRONT VIEW

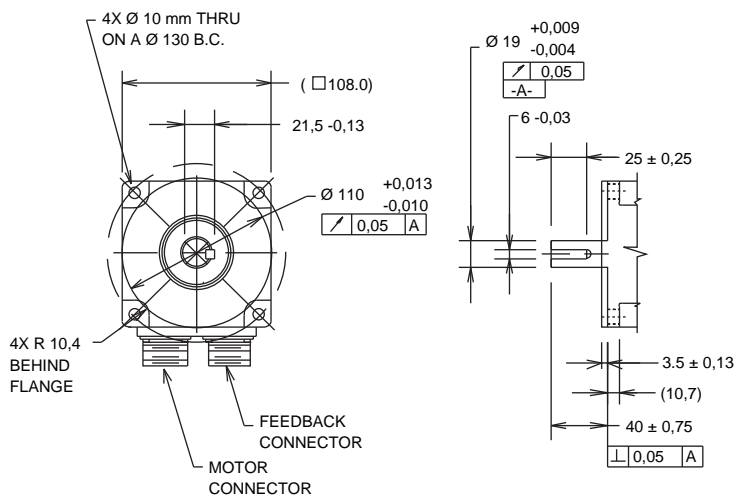
### ENGLISH (INCHES)



### NEMA 56C (INCHES)



### METRIC (MILLIMETERS)



## CONNECTORS

R40 SERIES CONNECTORS	
MOTOR	MS3102E20-4P
PRIMARY FEEDBACK	MS3102E20-7P
PRIMARY PLUS SECONDARY FEEDBACK	MS3102E20-29P
BRAKE	MS3102E14S-9P

# F40 SERIES

4.25" width/height (square frame)

32 to 61 lb-in. (3.6 to 6.9Nm)  
continuous (stall) torque;  
81 to 155 lb-in. (9.2 to 17.5 Nm) peak

- Troublefree brushless construction
- Extended range of motor inertias for better high inertia load matching
- Mounting interchangeability with R40 Series rare earth magnet servo motors
- Long life bearing system
- Low thermal resistance for maximum power ratings
- High torque over wide speed range
- Anti-cog magnet design for low speed smoothness
- UL recognition

F40 Series brushless servo motors utilize ferrite magnetics to improve system response by closely matching motor inertia to load inertia.

These motors are more easily compensated in applications with higher inertial loads than low inertia motors. F40 Series motors are suitable for direct drive applications and can eliminate costly gearing.

## EFFICIENT MAGNET DESIGN

A unique flux-focusing rotor design optimizes ferrite magnet characteristics to achieve good torque production. The resulting continuous torques are equivalent to rare earth motors of the same physical size. Cogging torque is virtually eliminated.

Compared to conventional ferrite magnet rotors, the F40 Series exhibits a high tolerance to demagnetization.

No demagnetization occurs at 3 times continuous stall current, and less than 3% reduction in  $K_t$  is experienced at 4 times continuous stall current.

## CHARACTERISTICS

Motor parameters and winding data. See system curves beginning on page B-73 for typical torque/speed performance.

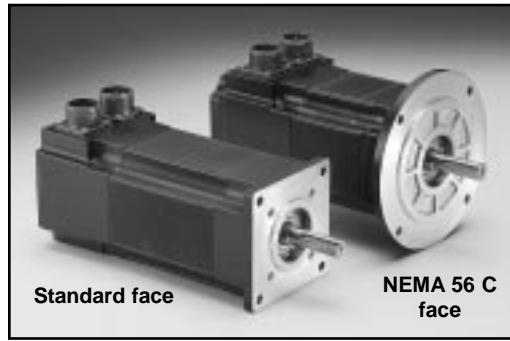
English				Metric						
Parameter	Symbol	Units	F43	F45	F46	Symbol	Units	F43	F45	F46
Continuous stall torque $\Delta$	$T_{CS}$	lb-in.	32	46	61	$T_{CS}$	Nm	3.6	5.2	6.9
Peak torque $\Delta$	$T_{PK}$	lb-in.	81	117	155	$T_{PK}$	Nm	9.2	13.2	17.5
Inertia (motor only) $\Delta$	$J_M$	lb-in.-sec <sup>2</sup>	.00936	.0137	.0179	$J_M$	kgm <sup>2</sup> x10 <sup>-3</sup>	1.06	1.55	2.02
Static friction (max.)	$T_f$	lb-in.	.70	1.0	1.3	$T_f$	Nm	.08	.11	.15
Viscous damping coefficient	$K_{DV}$	lb-in./Krpm	.18	.26	.30	$K_{DV}$	Nm/Krpm	.020	.030	.034
Thermal resistance	$R_{TH}$	°C/Watt	.84	.73	.61	$R_{TH}$	°C/Watt	.84	.73	.61
Thermal time constant $\Delta$	$\tau_{TH}$	min.	30	34	42	$\tau_{TH}$	min.	30	34	42
Weight (motor only)	W	lbs	16.6	22	27.4	M (mass)	kg	7.5	10	12.5

Winding data	Symbol	Units	G	H	F	G	G	H	Symbol	Units	G	H	F	G	G	H
Torque constant $\Delta$ $\Delta$ (line-line)	$K_t$ peak	lb-in./A	10.8	5.4	16.3	8.1	11.0	5.5	$K_t$ peak	Nm/A	1.22	.61	1.84	.92	1.24	.62
Voltage constant $\Delta$ (line-line)	$K_e$ peak	V/Krpm	128	64	193	96	130	65	$K_e$ peak	V/rad/sec	1.22	.61	1.84	.92	1.24	.62
Continuous stall current $\Delta$	$I_{CS}$	A	3.6	7.2	3.4	6.8	6.8	13.6	$I_{CS}$	A	3.6	7.2	3.4	6.8	6.8	13.6
Current at peak torque $\Delta$	$I_{PK}$	A	10.8	21.6	10.2	20.4	20.4	40.8	$I_{PK}$	A	10.8	21.6	10.2	20.4	20.4	40.8
Resistance (line-line)	$R_c$ cold	Ohms	7.7	1.9	10.1	2.5	3.1	.78	$R_c$ cold	Ohms	7.7	1.9	10.1	2.5	3.1	.78
Resistance (line-line) $\Delta$	$R_h$ hot	Ohms	11.6	2.9	15.2	3.8	4.7	1.18	$R_h$ hot	Ohms	11.6	2.9	15.2	3.8	4.7	1.18
Inductance (line-line)	L	mH	49	12	69	17	24	6	L	mH	49	12	69	17	24	6

Note: All values at 25°C unless otherwise noted.

- $\Delta$  Windings at 155°C. Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.
- $\Delta$  Motor in 25°C ambient and mounted to a 10" x 10" x 1/4" aluminum sink.
- $\Delta$  Peak value of a sinusoidal waveform. See Section D. Multiply given value by 0.86 to obtain hot values.
- $\Delta$  For torque linearity, see Section D.
- $\Delta$  Add holding brake inertia, if applicable.
- $\Delta$  Caution: For peak torques or peak currents greater than 3x the continuous rating, consult the factory for thermal considerations.



All motors are  
UL Recognized  
(Files E103510  
and E61960)

## PERFORMANCE FEATURES

- Selection of primary and secondary feedback devices
- Optional holding brake
- Convenient MS-type connectors
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- Long life bearings. Outer races won't turn. Front locked (in steel insert) and rear held by O-ring.

## TYPICAL APPLICATIONS

- Axis and spindle drives
- Press feeds
- Textile machines
- Packaging machinery
- Material handling systems
- Assembly equipment
- Machine tools
- Coil winders

## Specifications...optional holding brake

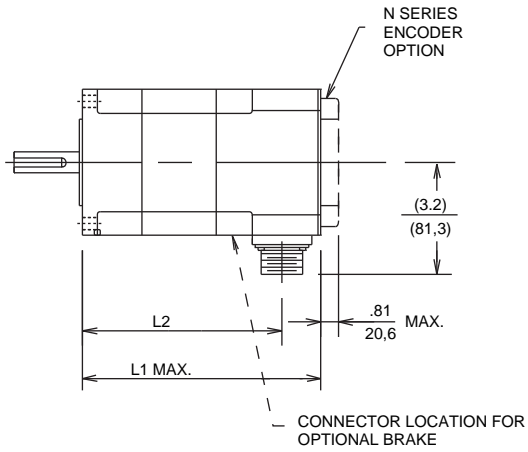
Voltage	100, 24 Vdc
Current	0.22A
Static holding torque (min.)	72 lb-in./8.1 Nm
Weight adder	4 lbs./1.8 kg
Inertia	.0005 lb-in sec <sup>2</sup> /.056 kgm <sup>2</sup> x 10 <sup>-3</sup>

## Specifications...motor sealing

Motor waterproofing	in accordance with NEMA MG1-1.26, part E and IP65 with exception of shaft.
Shaft seal	Optional, providing sealing to above specifications. Periodic lubrication required to maintain integrity of seal.

## DIMENSIONS . . F40 Series

### SIDE VIEW



### ENGLISH (INCHES)

MODEL NUMBER	L1 MAX.*	L2 REF.*
F43	8.4	(7.01)
F45	9.9	(8.51)
F46	11.4	(10.01)

Note: L1 includes primary feedback device.

### METRIC (MILLIMETERS)

MODEL NUMBER	L1 MAX.*	L2 REF.*
F43	213.4	(178.1)
F45	251.5	(216.2)
F46	289.6	(254.3)

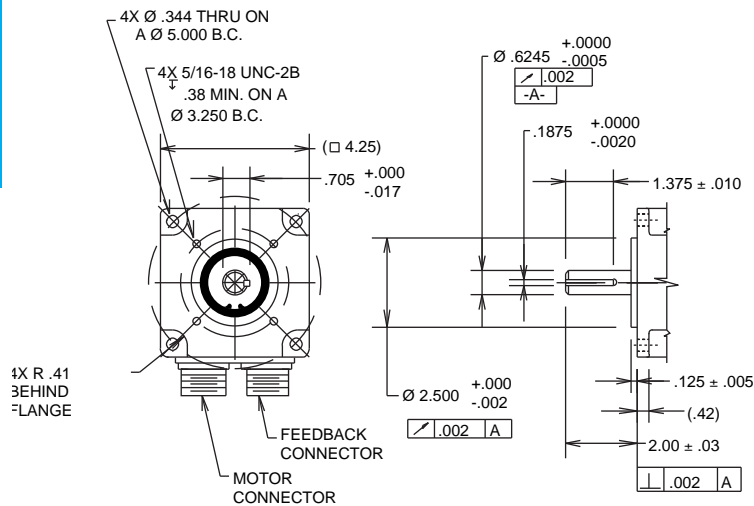
Note: L1 includes primary feedback device.

\*Add 2.44 in./62.0 mm for brake option.

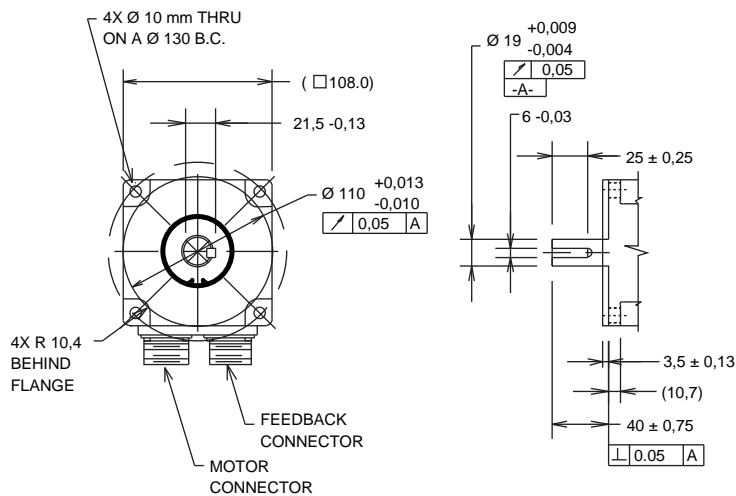
## MOUNTING AND SHAFT OPTIONS

### FRONT VIEW

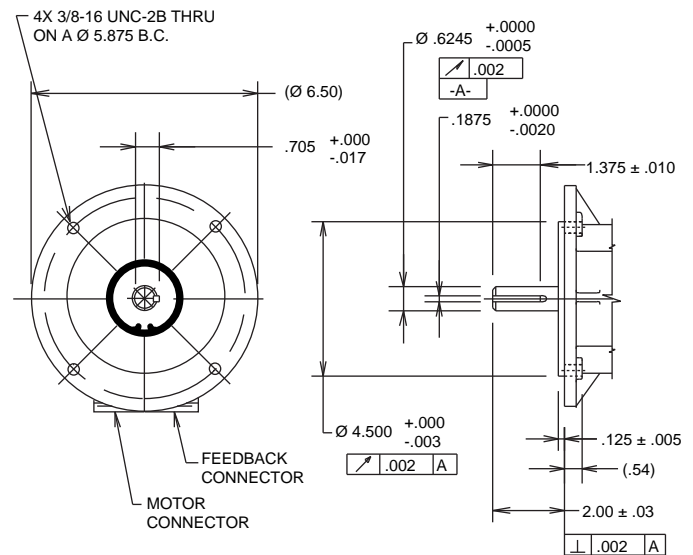
### ENGLISH (INCHES)



### METRIC (MILLIMETERS)



### NEMA 56C (INCHES)



## CONNECTORS

F40 SERIES CONNECTORS	
MOTOR	MS3102E20-4P
PRIMARY FEEDBACK	MS3102E20-7P
PRIMARY PLUS SECONDARY FEEDBACK	MS3102E20-29P
BRAKE	MS3102E14S-9P

# R60 SERIES

5.75" width/height (square frame)

70 to 168 lb-in. (8 to 19 Nm)  
continuous (stall) torque;  
230 to 555 lb-in. (26 to 63 Nm) peak

- Troublefree brushless construction
- Long life bearing system
- Samarium cobalt permanent magnets for maximum torque to inertia
- Low rotor inertia for rapid accel/decel
- Low thermal resistance for maximum power ratings
- High torque over wide speed range
- Anti-cog magnet design for low speed smoothness
- UL recognition

Built for heavy duty applications, R60 Series brushless servo motors exhibit excellent torque, speed and/or velocity characteristics.

Samarium cobolt rotors, long life bearings and brushless construction assure maximum performance and service life.



All motors are  
UL Recognized  
(Files E103510  
and E61960)

## PERFORMANCE FEATURES

- Selection of primary and secondary feedback devices
- Optional holding brake
- Convenient MS-type connectors
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- Long life bearings. Outer races won't turn. Front locked (in steel insert) and rear held by O-ring.

## TYPICAL APPLICATIONS

- Axis and spindle drives
- Press feeds
- Textile machines
- Packaging machinery
- Robotics
- Transfer lines
- Machine tools
- Mail handling equipment

## CHARACTERISTICS

Motor parameters and winding data. See system curves beginning on page B-73 for typical torque/speed performance.

English				Metric						
Parameter	Symbol	Units	R63	R65	R67	Symbol	Units	R63	R65	R67
Continuous stall torque $\Delta$	$T_{CS}$	lb-in.	70	115	168	$T_{CS}$	Nm	8	13	19
Peak torque $\Delta$	$T_{PK}$	lb-in.	230	400	555	$T_{PK}$	Nm	26	45	63
Inertia (motor only) $\Delta$	$J_M$	lb-in.-sec <sup>2</sup>	.007	.011	.015	$J_M$	kgm <sup>2</sup> x10 <sup>-3</sup>	.79	1.24	1.69
Static friction (max.)	$T_f$	lb-in.	1.4	2.3	3.2	$T_f$	Nm	.16	.26	.36
Viscous damping coefficient	$K_{DV}$	lb-in./Krpm	.41	.66	.92	$K_{DV}$	Nm/Krpm	.046	.075	.104
Thermal resistance	$R_{TH}$	°C/Watt	.51	.42	.30	$R_{TH}$	°C/Watt	.51	.42	.30
Thermal time constant $\Delta$	$\tau_{TH}$	min.	19	36	72	$\tau_{TH}$	min.	19	36	72
Weight (motor only)	W	lbs	29	39	49	M (mass)	kg	13	18	22

Winding data	Symbol	Units	G		H		G		H		Symbol	Units	G		H		G		H	
Torque constant $\Delta$ $\Delta$ (line-line)	$K_t$ peak	lb-in./A	5.9	2.9	9.9	5.0	13.8	6.9			$K_t$ peak	Nm/A	.66	.33	1.12	.56	1.56	.78		
Voltage constant $\Delta$ (line-line)	$K_e$ peak	V/Krpm	70	35	117	59	164	82			$K_e$ peak	V/rad/sec	.66	.33	1.12	.56	1.56	.78		
Continuous stall current $\Delta$	$I_{CS}$	A	13.5	27.0	13.1	26.2	13.8	27.6			$I_{CS}$	A	13.5	27.0	13.1	26.2	13.8	27.6		
Current at peak torque $\Delta$	$I_{PK}$	A	82	164	82	164	82	164			$I_{PK}$	A	82	164	82	164	82	164		
Resistance (line-line)	$R_c$ cold	Ohms	.93	.23	1.20	.34	1.50	.37			$R_c$ cold	Ohms	.93	.23	1.2	.34	1.5	.37		
Resistance (line-line) $\Delta$	$R_h$ hot	Ohms	1.4	.34	1.8	.51	2.3	.55			$R_h$ hot	Ohms	1.4	.34	1.81	.51	2.3	.55		
Inductance (line-line)	L	mH	8.9	2.2	13.7	3.4	18.2	4.6			L	mH	8.9	2.2	13.7	3.4	18.2	4.6		

Note: All values at 25°C unless otherwise noted.

$\Delta$  Windings at 155°C. Motor in 25°C ambient and mounted to a 18" x 18" x 1/2" aluminum sink.

$\Delta$  Motor in 25°C ambient and mounted to a 18" x 18" x 1/2" aluminum sink.

$\Delta$  Peak value of a sinusoidal waveform. See Section D. Multiply given value by 0.95 to obtain hot values.

$\Delta$  For torque linearity, see Section D.

$\Delta$  Add holding brake inertia, if applicable.

$\Delta$  Caution: For peak torques or peak currents greater than 3x the continuous rating, consult the factory for thermal considerations.

### Specifications...optional holding brake

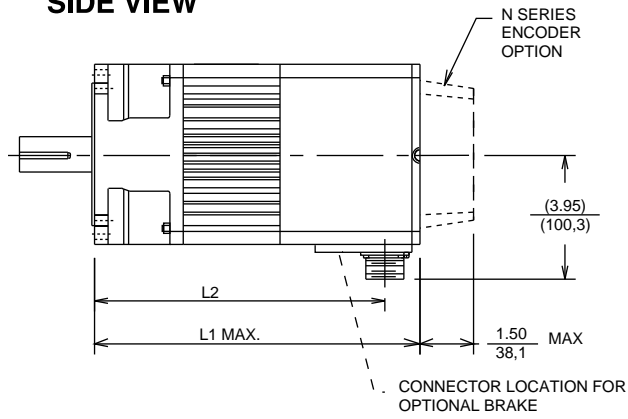
Voltage . . . . . 100, 24 Vdc  
 Current . . . . . 0.262A  
 Static holding torque (min.) . . 180 lb-in./20.3 Nm  
 Weight adder . . . . . 9 lbs./4.2 kg  
 Inertia . . . . . .00037 lb-in sec<sup>2</sup>/.042 kgm<sup>2</sup> x 10<sup>-3</sup>

### Specifications...motor sealing

Motor waterproofing . . . . .in accordance with NEMA MG1-1.26, part E and IP65 with exception of shaft.  
 Shaft seal . . . . .Optional, providing sealing to above specifications. Periodic lubrication required to maintain integrity of seal.

## DIMENSIONS . . R60 SERIES

### SIDE VIEW



### ENGLISH (INCHES)

MODEL NUMBER	L1 MAX.*	L2 REF.*
R63	9.36	(8.12)
R65	11.36	(10.12)
R67	13.36	(12.12)

Note: L1 includes primary feedback device.

### METRIC (MILLIMETERS)

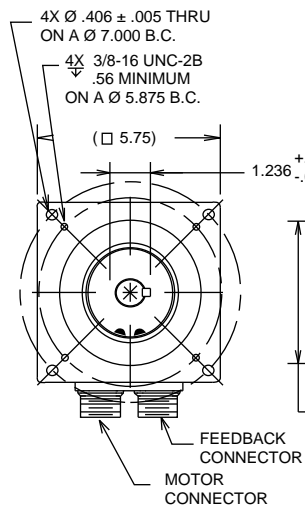
MODEL NUMBER	L1 MAX.*	L2 REF.*
R63	237.7	(206.2)
R65	288.5	(257.0)
R67	339.3	(307.8)

Note: L1 includes primary feedback device.

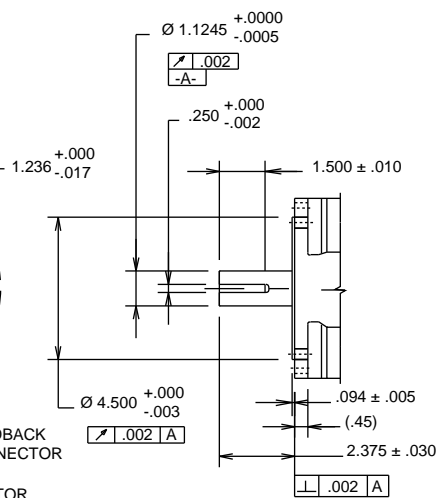
\*Add 2.66 in./67.6 mm for brake option.

## MOUNTING AND SHAFT OPTIONS

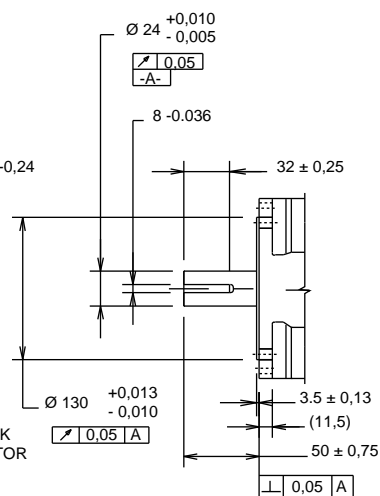
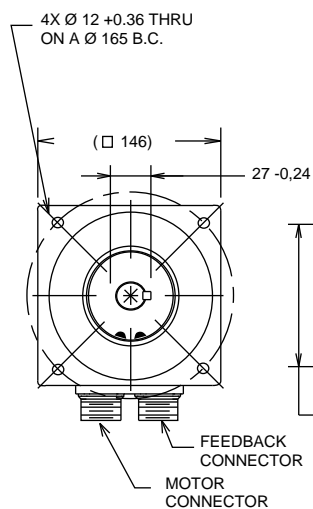
### FRONT VIEW



### ENGLISH (INCHES)



### METRIC (MILLIMETERS)



## CONNECTORS

R60 SERIES CONNECTORS	
MOTOR	MS3102E20-4P
PRIMARY FEEDBACK	MS3102E20-7P
PRIMARY PLUS SECONDARY FEEDBACK	MS3102E20-29P
BRAKE	MS3102E14S-9P

# R80 SERIES

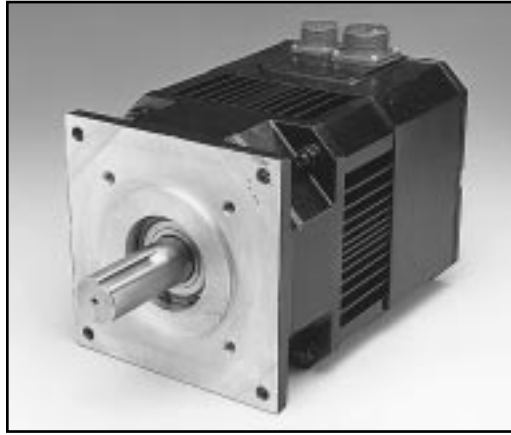
## 7.5" width/height (square frame)

190 to 451 lb-in. (21 to 50 Nm)  
continuous (stall) torque;  
710 to 1757 lb-in. (80 to 198 Nm) peak

- Troublefree brushless construction
- Long life bearing system
- Samarium cobalt permanent magnets for maximum torque to inertia
- Low rotor inertia for rapid accel/decel
- Low thermal resistance for maximum power ratings
- High torque over wide speed range
- Anti-cog magnet design for low speed smoothness
- UL recognition

R80 Series brushless servo motors are built for extremely high torque, and power applications. They exhibit excellent torque, speed and/or velocity characteristics.

Samarium cobalt rotors, long life bearings and brushless construction assure maximum performance and service life.



All motors are  
UL Recognized  
(Files E103510  
and E61960)

### PERFORMANCE FEATURES

- Selection of primary and secondary feedback devices
- Optional holding brake
- Convenient MS-type connectors
- Rugged TENV, NEMA and IP65 waterproof construction for washdown requirements
- Long life bearings. Outer races won't turn. Front locked (in steel insert) and rear held by O-ring.

### TYPICAL APPLICATIONS

- Axis and spindle drives
- Press feeds
- Textile machines
- Robotics
- Machine tools
- Packaging machinery
- Transfer lines

### CHARACTERISTICS

Motor parameters and winding data. See system curves beginning on page B-73 for typical torque/speed performance.

English					Metric							
Parameter	Symbol	Units	R84	R86	R88	R8A	Symbol	Units	R84	R86	R88	R8A
Continuous stall torque $\Delta$	$T_{CS}$	lb-in.	190	276	357	451	$T_{CS}$	Nm	21	31	40	50
Peak torque $\Delta$	$T_{PK}$	lb-in.	710	1060	1410	1757	$T_{PK}$	Nm	80	120	159	198
Inertia (motor only) $\Delta$	$J_M$	lb-in.-sec <sup>2</sup>	.039	.058	.076	.095	$J_M$	kgm <sup>2</sup> x10 <sup>-3</sup>	4.4	6.6	8.6	10.7
Static friction (max.)	$T_f$	lb-in.	2.5	3.7	5.0	6.3	$T_f$	Nm	.28	.42	.56	.70
Viscous damping coefficient	$K_{DV}$	lb-in./Krpm	.96	1.4	1.8	2.2	$K_{DV}$	Nm/Krpm	.11	.16	.20	.25
Thermal resistance	$R_{TH}$	°C/Watt	.30	.25	.23	.21	$R_{TH}$	°C/Watt	.30	.25	.23	.21
Thermal time constant $\Delta$	$\tau_{TH}$	min.	40	54	59	63	$\tau_{TH}$	min.	40	54	59	63
Weight (motor only)	W	lbs	60	77	94	111	M (mass)	kg	27	35	43	49

Winding data	Symbol	Units	G		H		G		H		Symbol	Units	G		H		G		H	
Torque constant $\Delta$ $\Delta$ (line-line)	$K_t$ peak	lb-in./A	6.7	3.3	8.8	4.4	11.7	5.8	17.7	8.85	$K_t$ peak	Nm/A	.76	.38	.99	.49	1.32	.66	.20	1.0
Voltage constant $\Delta$ (line-line)	$K_E$ peak	V/Krpm	79	39	104	52	138	69	210	105	$K_E$ peak	V/rad/sec	.76	.38	.99	.49	1.32	.66	2.0	1.0
Continuous stall current $\Delta$	$I_{CS}$	A	33	66	37	74	36	73	30	60	$I_{CS}$	A	33	66	37	74	36	73	30	60
Current at peak torque $\Delta$	$I_{PK}$	A	225	450	255	510	255	510	209	418	$I_{PK}$	A	255	450	255	510	255	510	209	418
Resistance (line-line)	$R_c$ cold	Ohms	.26	.07	.25	.06	.28	.07	.46	.12	$R_c$ cold	Ohms	.26	.07	.25	.06	.28	.07	.46	.12
Resistance (line-line) $\Delta$	$R_h$ hot	Ohms	.39	.10	.37	.09	.42	.10	.69	.17	$R_h$ hot	Ohms	.39	.10	.37	.09	.42	.10	.69	.17
Inductance (line-line)	L	mH	3.2	0.8	3.6	0.9	4.0	1.0	7.4	1.9	L	mH	3.2	0.8	3.6	0.9	4.0	1.0	7.4	1.9

Note: All values at 25°C unless otherwise noted.

$\Delta$  Windings at 155°C. Motor in 25°C ambient and mounted to a 18" x 18" x 1/2" aluminum sink.

$\Delta$  Motor in 25°C ambient and mounted to a 18" x 18" x 1/2" aluminum sink.

$\Delta$  Peak value of a sinusoidal waveform. See Section D. Multiply given value by 0.95 to obtain hot values.

$\Delta$  For torque linearity, see Section D.

$\Delta$  Add holding brake inertia, if applicable.

$\Delta$  Caution: For peak torques or peak currents greater than 3x the continuous rating, consult the factory for thermal considerations.

### Specifications...optional holding brake

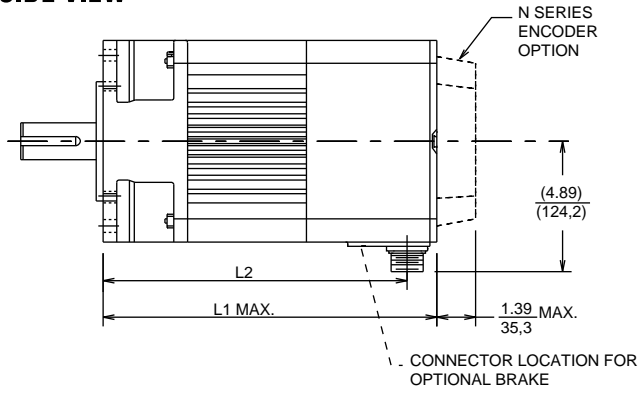
Voltage ..... 100, 24 Vdc  
 Current ..... .314A  
 Static holding torque (min.) .. 408 lb-in./46.1 Nm  
 Weight adder ..... 15 lbs./8.6 kg  
 Inertia ..... .00149 lb-in sec<sup>2</sup>/.168 kgm<sup>2</sup> x 10<sup>-3</sup>

### Specifications...motor sealing

Motor waterproofing ..... in accordance with NEMA MG1-1.26, part E and IP65 with exception of shaft.  
 Shaft seal ..... Optional, providing sealing to above specifications. Periodic lubrication required to maintain integrity of seal.

## DIMENSIONS . . R80 Series

### SIDE VIEW



### ENGLISH (INCHES)

MODEL NUMBER	L1 MAX.*	L2 REF.*
R84	10.93	(9.56)
R86	12.93	(11.56)
R88	14.93	(13.56)
R8A	16.93	(15.56)

Note: L1 includes primary feedback device.

### METRIC (MILLIMETERS)

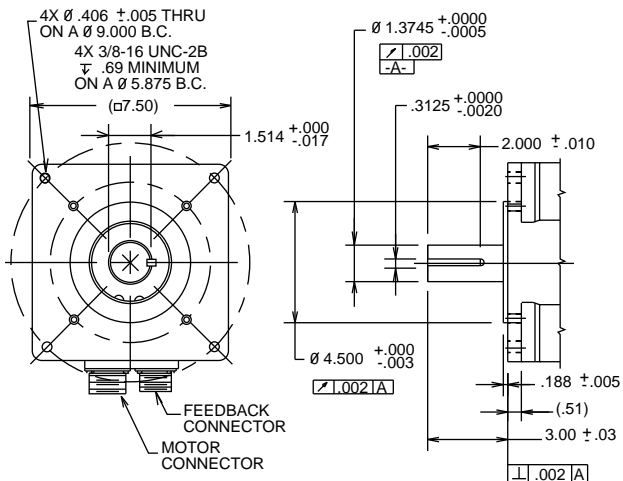
MODEL NUMBER	L1 MAX.*	L2 REF.*
R84	277.6	(242.8)
R86	328.4	(293.6)
R88	379.2	(344.4)
R8A	430.0	(395.2)

Note: L1 includes primary feedback device.

\*Add 2.88 in/73.1 mm for brake option.

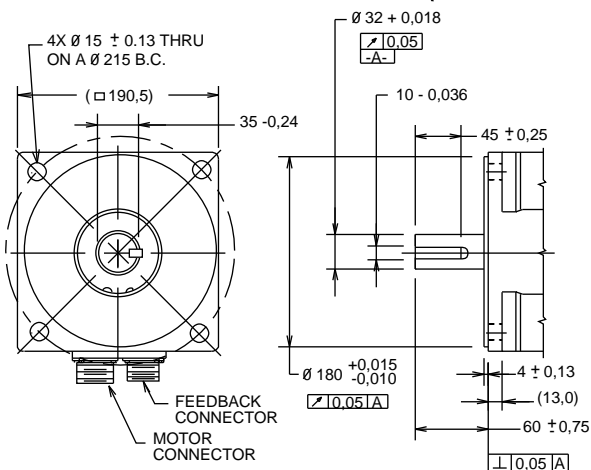
## MOUNTING AND SHAFT OPTIONS

### FRONT VIEW



### ENGLISH (INCHES)

### METRIC (MILLIMETERS)



## CONNECTORS

R80 SERIES CONNECTORS	
MOTOR	MS3102E24-22P
PRIMARY FEEDBACK	MS3102E20-7P
PRIMARY PLUS SECONDARY FEEDBACK	MS3102E20-29P
BRAKE	MS3102E14S-9P