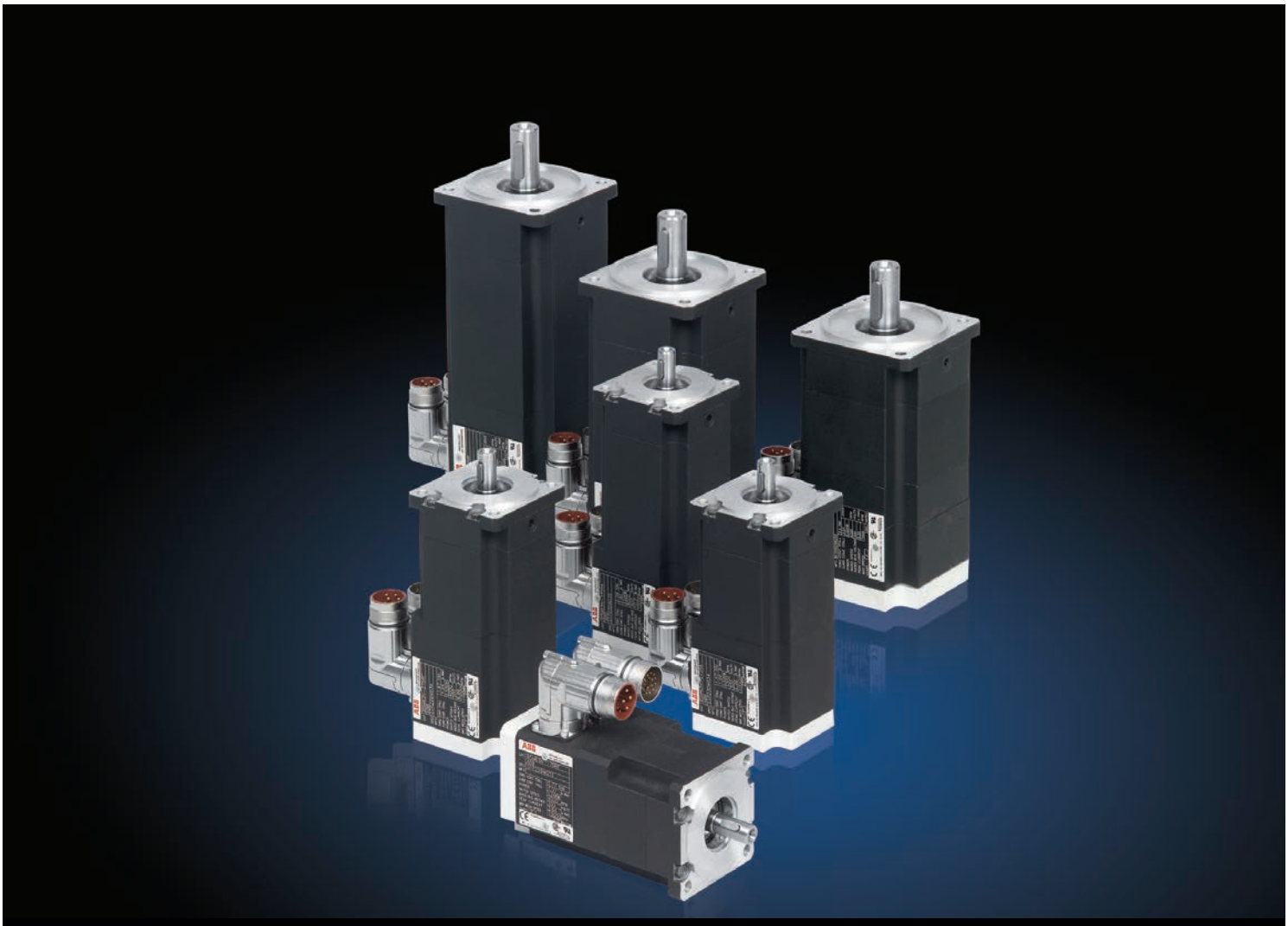


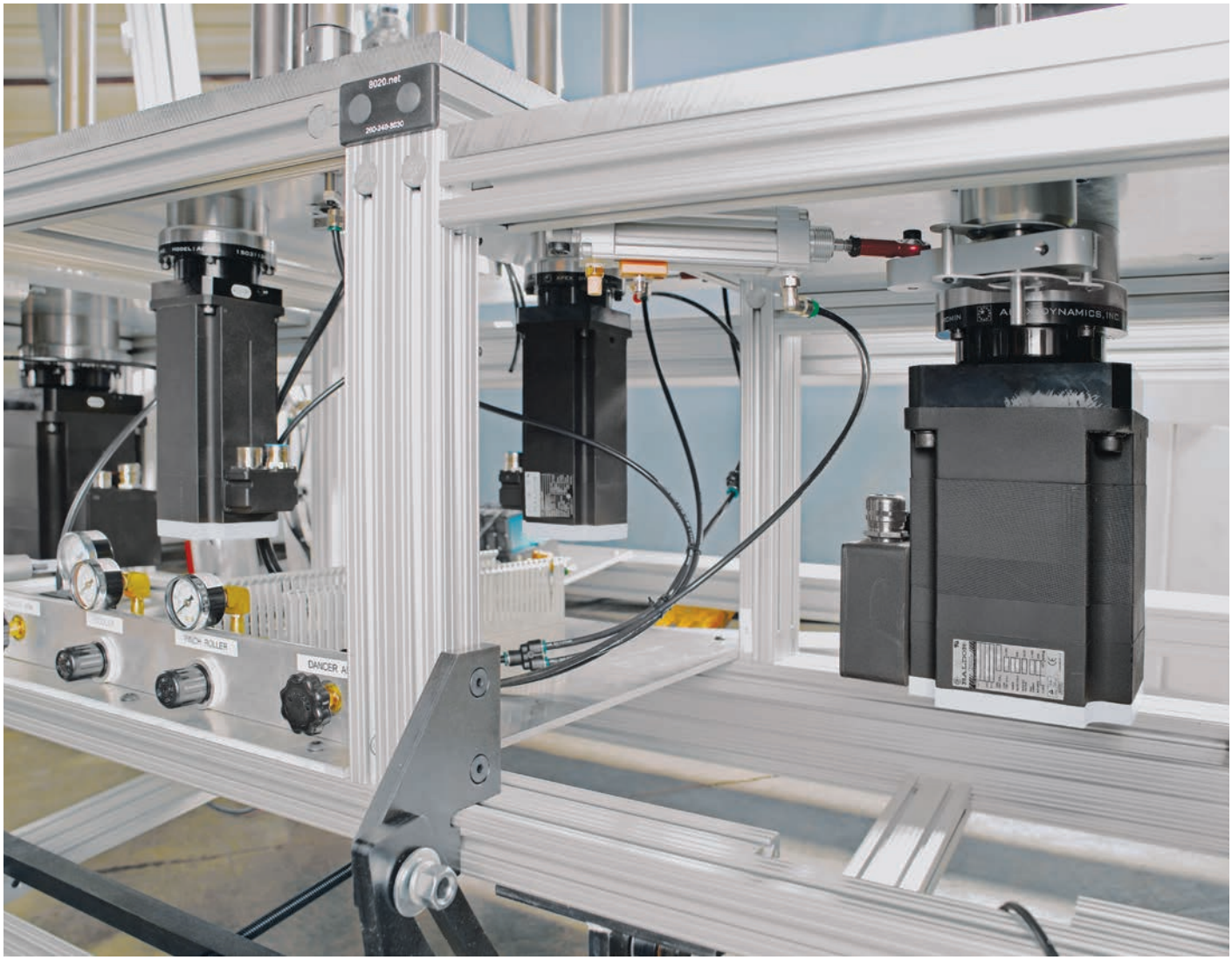
Brochure

# AC servo motors
# BSM Series

Power and productivity
for a better world™

With expertise, and a comprehensive portfolio of products and life-cycle services, we help value-minded industrial customers improve their energy efficiency and productivity.

# AC servo motors
## Table of contents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# Introduction to Motion Control and PLC products

## Solutions

ABB's comprehensive range includes multi-axis Motion Controllers, high performance Motion Control Drives, rotary servo motors, PLCs and HMI - all designed to seamlessly interface with each other to provide a complete motion solution. This allows you to optimize your design time, save development costs and minimize your time to market.

## Choice

ABB firmly believes in offering our customers a range of products to fit a variety of market needs. Whether this means delivering a product from stock, designing a product for your specific application, accessing technical data, or how you place your order, we make it easy to do business with us. Our products are designed to handle a wide range of applications.

## Quality, reliability & design

With ISO9001:2008 certification to assure conformity to customer requirements and quality standards, and by using the latest CAD tools and manufacturing techniques, ABB's engineering teams work side-by-side through design, product development, manufacture and final test to make sure that total quality and reliability is built into and stays with each product throughout its long lifetime.

## Experience

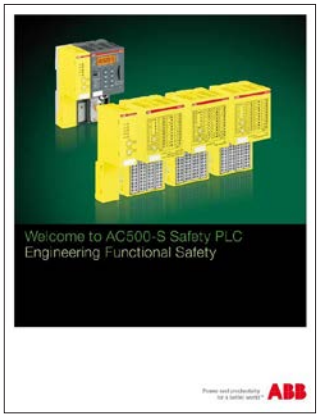
Technical knowledge is the key to solving customers' needs. Our extensive experience has been gained over many years through close customer contact from product development to field maintenance, providing invaluable feedback for our product development process - ensuring ABB Motion Control and PLC products meet the ease of use, flexibility and performance demanded by the markets we serve. Application notes reflecting our knowledge and ability are available for download on the web at www.abb.com/motion.

## Information

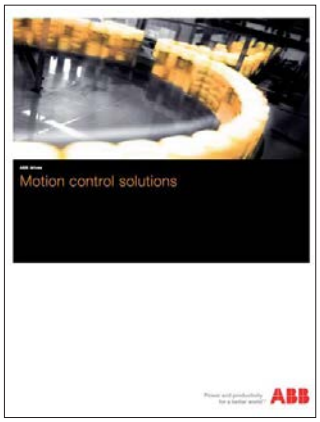
Information must be comprehensive and easily accessed. To make it easier for our customers, we provide a complete range of product literature as well as a website dedicated to Motion Control products - www.abb.com/motion. This brings together, in one location, all the information relevant to Motion Control and PLC products and includes technical information, latest news, application stories, application notes and support.


**9AKK106417**
**Servo Motor Catalog**


**3AUA0000117576**
**MicroFlex e150 Flyer**




**PLC-PHTB01U-EN**
**AC500-S Safety PLC Engineering Functional Safety Brochure**




**3AUA0000117593**
**Motion Control Solutions Brochure**


**3AUA0000168683**
**MotiFlex e180 Catalog**


**PLC-PHTC02U-EN**
**Industrial Automation Catalog**

# AC servo motors

## BSM N-Series brushless servo motors
## Low inertia - high dynamics

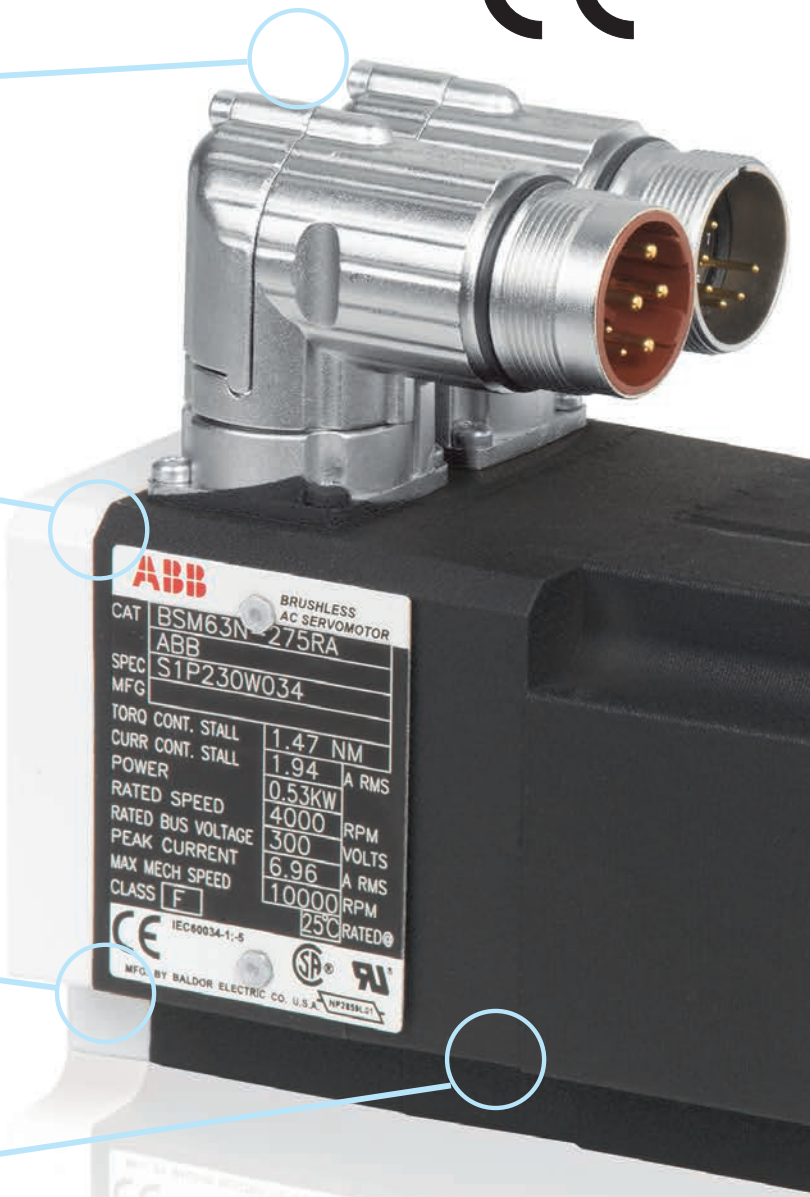
The BSM N series provides the lowest inertia and a high torque designed for excellent performance response. This series has a rugged, durable industrial design and is constructed with Neodymium Iron Boron magnetics. It is capable of peak torques equal to four times continuous, which can be used to provide high acceleration torques in applications. ABB BSM motors are available with a wide variety of feedback devices to suit application needs. IEC and NEMA configurations are available.

**Variety of feedback options:**
— Resolver
— Incremental/Absolute Encoders
— Hall sensors

**Precision wrapped rotor**
High acceleration capability - to move faster, to get the job done faster. High torque to inertia ratio - enables your machine to produce more parts per hour.

**Moisture/Dust resistant o-rings**
Environmentally rugged - for reliability and long life.

**High temperature operation**
Over temperature protection thermal switch. Heavy duty continuous operation - for dependable performance.

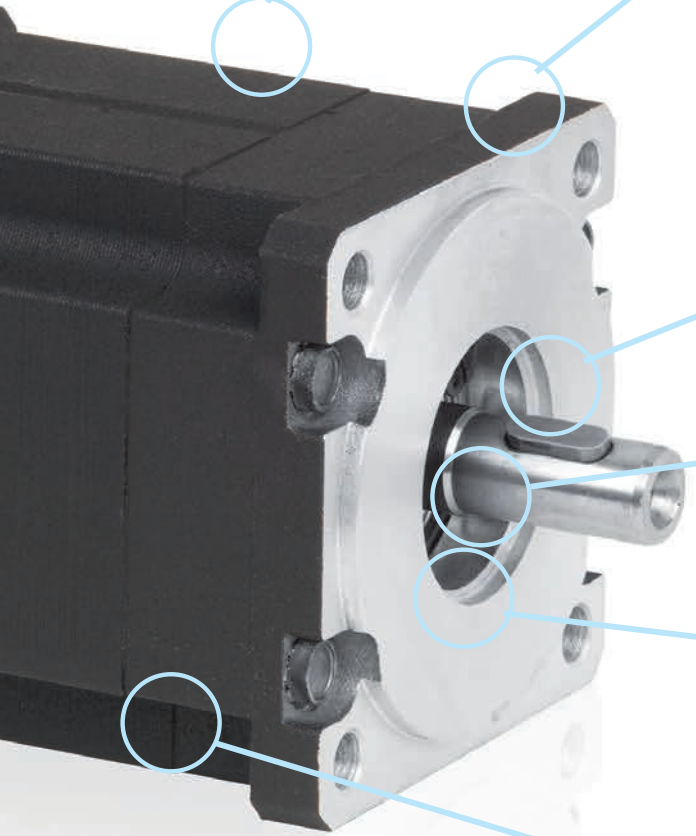



**Cooling kits available on some models - to obtain more performance and extend torque range.**
**Optional holding brakes available.**
**Typical BSM63/80 series shown**

| Motor family | Size | | Torque range | |
|---|---|---|---|---|
| | mm | in | lb-in | Nm |
| BSM50 | 55 | 2.1 | 3.9-12 | 0.45-1.36 |
| BSM63 | 67 | 2.6 | 6.8-18.5 | 0.7-2.09 |
| BSM80 | 89 | 3.5 | 14.6-40 | 1.6-4.5 |
| BSM90 | 120 | 4.7 | 53-117 | 6-13.3 |
| BSM100 | 146 | 5.7 | 123-354 | 14-40 |

**Rugged construction**
— Sealed to IP54
— With shaft oil seal sealed to IP55
— 95% RH Non-Condensing
— 1000 m (3300 Feet) without derate

**Popular shaft/mounting dimensions**
— Stock and custom
— IEC and NEMA



**Proven reliable bearings**
4 times longer bearing life.

**Optional shaft seal**

**Captured front bearing eliminates axial movement**

**High voltage insulation**
Windings potted for additional voltage protection - for improved reliability and improved heat transfer.

# AC servo motors
## BSM N-series

The BSM N-series provides applications with low inertia to attain the highest acceleration capability - to position faster - to obtain the highest machine throughput. Our motors are hard at work, increasing productivity, improving part quality, providing precision and reducing cost in many applications. This series provides continuous stall torques ranging from 3.9 lb-in (0.4 Nm) to 354 lb-in (40 Nm). Peak torques are four times continuous. This series has the lowest inertia to provide the maximum torque per package size.

### AC servo motors - N-series

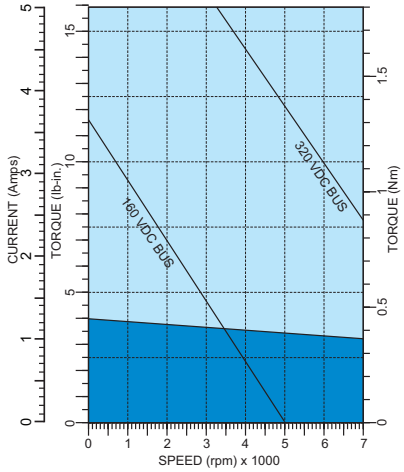
| Continuous stall torque | | Continuous stall amps | Speed RPM @ 320V[1] | Motor number[2] | Motor inertia | |
|---|---|---|---|---|---|---|
| lb-in | Nm | | | | lb-in-s$^2$ | Kg - cm$^2$ |
| 3.9 | 0.45 | 1.49 | 7500 | BSM50N-133AX | 0.00006 | 0.0677 |
| | | 0.79 | 4000 | BSM50N-175AX | | |
| 6.8 | 0.77 | 2.0 | 9000 | BSM63N-133AX | 0.00018 | 0.2031 |
| | | 1.8 | 6000 | BSM63N-150AX | | |
| | | 1.0 | 4000 | BSM63N-175AX | | |
| 7.9 | 0.9 | 2.8 | 7500 | BSM50N-233AX | 0.00011 | 0.125 |
| | | 1.4 | 3750 | BSM50N-275AX | | |
| 12 | 1.36 | 4.5 | 7500 | BSM50N-333AX | 0.00016 | 0.180 |
| | | 2.3 | 4000 | BSM50N-375AX | | |
| 13 | 1.47 | 3.9 | 9000 | BSM63N-233AX | 0.00034 | 0.384 |
| | | 2.8 | 6000 | BSM63N-250AX | | |
| | | 1.9 | 4000 | BSM63N-275AX | | |
| 14.6 | 1.65 | 4.7 | 9000 | BSM80N-133AX | 0.00091 | 1.02 |
| | | 3.0 | 6000 | BSM80N-150AX | | |
| | | 2.1 | 4000 | BSM80N-175AX | | |
| 18.5 | 2.0 | 6.0 | 9000 | BSM63N-333AX | 0.0005 | 0.564 |
| | | 4.0 | 6000 | BSM63N-350AX | | |
| | | 2.8 | 4000 | BSM63N-375AX | | |
| 28.3 | 3.2 | 8.7 | 9000 | BSM80N-233AX | 0.00162 | 1.82 |
| | | 5.6 | 6000 | BSM80N-250AX | | |
| | | 3.9 | 4000 | BSM80N-275AX | | |
| 40 | 4.52 | 12.9 | 9000 | BSM80N-333AX | 0.00223 | 2.519 |
| | | 8.6 | 6000 | BSM80N-350AX | | |
| | | 5.5 | 4000 | BSM80N-375AX | | |
| 53 | 6 | 7.8 | 4000 | BSM90N-175AX | 0.0030 | 3.389 |
| | | 4.0 | 2000 | BSM90N-1150AX | | |
| | | 2.6 | 1200 | BSM90N-1250AX | | |
| 88 | 10 | 11.6 | 4000 | BSM90N-275AX | 0.0056 | 6.327 |
| | | 6.1 | 2000 | BSM90N-2150AX | | |
| | | 4.1 | 1200 | BSM90N-2250AX | | |
| 117 | 13.3 | 19 | 4000 | BSM90N-375AX | 0.0082 | 9.264 |
| | | 8.6 | 2000 | BSM90N-3150AX | | |
| | | 5.5 | 1200 | BSM90N-3250AX | | |
| 123 | 14 | 9.4 | 2000 | BSM100N-1150AX | 0.0120 | 13.558 |
| | | 5.9 | 1200 | BSM100N-1250AX | | |
| 203 | 23 | 15.5 | 2000 | BSM100N-2150AX | 0.0196 | 22.145 |
| | | 9.9 | 1200 | BSM100N-2250AX | | |
| 300 | 34 | 21.0 | 2000 | BSM100N-3150AX | 0.0273 | 30.844 |
| | | 14.7 | 1200 | BSM100N-3250AX | | |
| 354 | 40 | 26.9 | 2000 | BSM100N-4150AX | 0.0349 | 39.431 |
| | | 16.8 | 1200 | BSM100N-4250AX | | |

**Note:** [1] Nominal rpm shown at 320 Vdc bus for convenience. For 640 Vdc double the speed. Reference motor table to verify that max speed is not exceeded.
[2] For X callout, see motor ID matrix under engineering information.

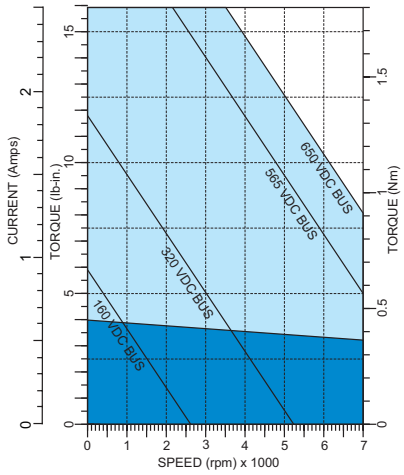
# AC servo motors
## BSM N-series performance curves



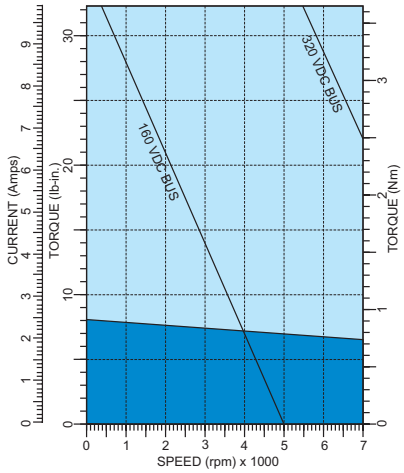
### BSM50N-133




### BSM50N-175




### BSM50N-233



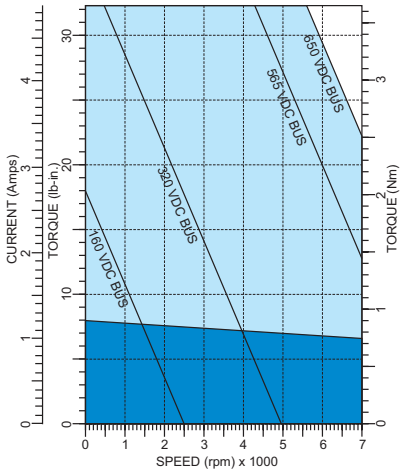

| Model number | | BSM50N-133 | BSM50N-175 | BSM50N-233 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 3.9 | 3.9 | 7.9 |
| | Nm | 0.45 | 0.45 | 0.9 |
| Continuous current | amps | 1.49 | 0.79 | 2.87 |
| Peak torque | lb-in | 15.9 | 15.9 | 32.3 |
| | Nm | 1.8 | 1.8 | 3.65 |
| Peak current | amps | 5 | 2.52 | 9.91 |
| Thermal resistance | °C/watt | 3 | 3 | 2.6 |
| Thermal time constant | Min | 7 | 7 | 11 |
| Mechanical time constant | msec | 0.6 | 0.6 | 0.38 |
| Electrical time constant | msec | 1.3 | 1.3 | 2.1 |
| Rated speed @ 300 volts | rpm | 7500 | 4000 | 7500 |
| Rated speed @ 160 volts | rpm | 4000 | 1000 | 4000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.14 | 6.31 | 3.25 |
| | Nm/amp | 0.35 | 0.71 | 0.36 |
| Voltage constant | Vpk/krpm | 30.37 | 60.94 | 32 |
| | Vrms/krpm | 21.48 | 43.1 | 22.7 |
| Resistance | ohms | 11.95 | 47.5 | 4 |
| Inductance | mH | 16.5 | 63.5 | 8.3 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00006 | 0.00006 | 0.00011 |
| | Kg-cm$^2$ | 0.0677 | 0.0677 | 0.124 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 2.4/1.1 | 2.4/1.1 | 3.4/1.6 |

(1) Maximum speed can be limited by bus volts and feedback types.

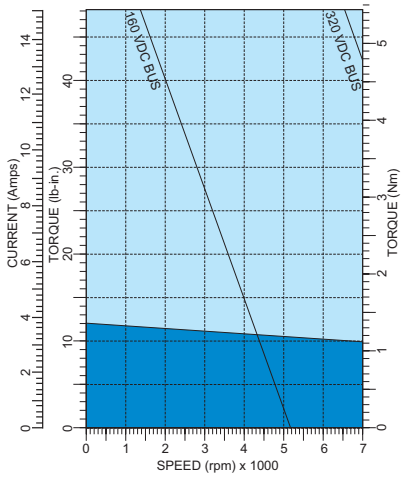
# AC servo motors
## BSM N-series performance curves

1

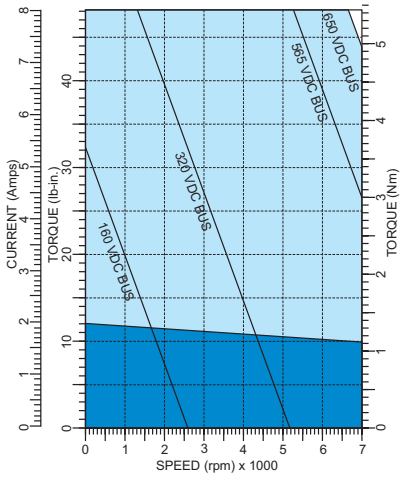
### BSM50N-275




### BSM50N-333




### BSM50N-375



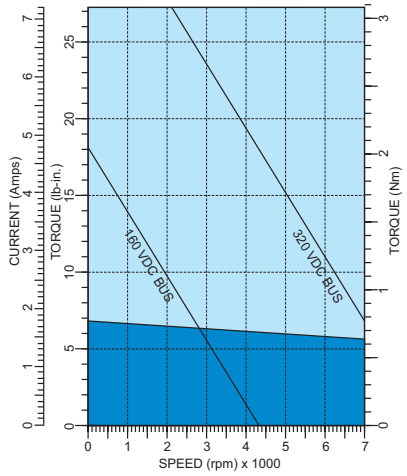

| Model number | | BSM50N-275 | BSM50N-333 | BSM50N-375 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 7.9 | 12 | 12 |
| | Nm | 0.9 | 1.36 | 1.36 |
| Continuous current | amps | 1.42 | 4.56 | 2.38 |
| Peak torque | lb-in | 32 | 48.15 | 48.15 |
| | Nm | 3.65 | 5.44 | 5.44 |
| Peak current | amps | 4.87 | 15 | 8 |
| Thermal resistance | °C/watt | 2.6 | 1.8 | 1.8 |
| Thermal time constant | Min | 11 | 15 | 15 |
| Mechanical time constant | msec | 0.35 | 0.29 | 0.3 |
| Electrical time constant | msec | 2.1 | 1.9 | 1.8 |
| Rated speed @ 300 volts | rpm | 4000 | 7500 | 4000 |
| Rated speed @ 160 volts | rpm | 2000 | 4000 | 1500 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 6.66 | 3.2 | 6.4 |
| | Nm/amp | 0.75 | 0.36 | 0.72 |
| Voltage constant | Vpk/krpm | 64.3 | 30.9 | 61.9 |
| | Vrms/krpm | 45.5 | 21.89 | 43.8 |
| Resistance | ohms | 16 | 2.1 | 8.5 |
| Inductance | mH | 33.2 | 4.1 | 16 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00011 | 0.00016 | 0.00016 |
| | Kg-cm$^2$ | 0.124 | 0.18 | 0.18 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 3.4/1.6 | 4.4/2 | 4.4/2 |

(1) Maximum speed can be limited by bus volts and feedback types.

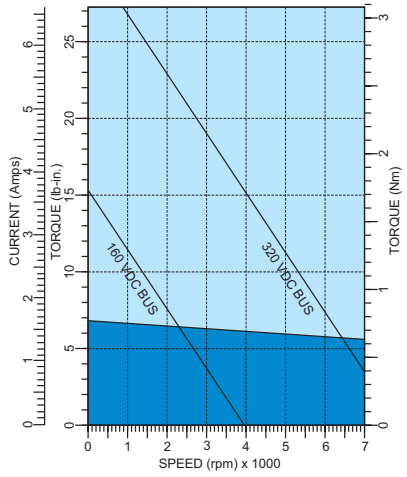
# AC servo motors
## BSM N-series performance curves



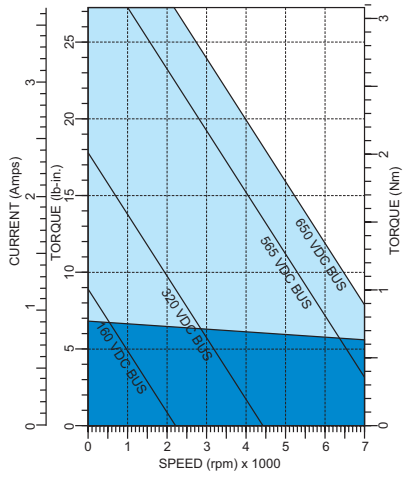
### BSM63N-133




### BSM63N-150




### BSM63N-175



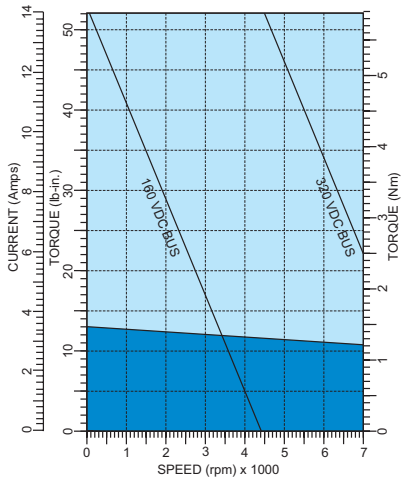

| Model number | | BSM63N-133 | BSM63N-150 | BSM63N-175 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 6.8 | 6.8 | 6.8 |
| | Nm | 0.77 | 0.77 | 0.77 |
| Continuous current | amps | 2.01 | 1.83 | 1.01 |
| Peak torque | lb-in | 27.25 | 27.25 | 27.25 |
| | Nm | 3.08 | 3.08 | 3.08 |
| Peak current | amps | 7.24 | 6.59 | 3.64 |
| Thermal resistance | °C/watt | 2.2 | 2.2 | 2.2 |
| Thermal time constant | Min | 13 | 1.3 | 13 |
| Mechanical time constant | msec | 1 | 1.1 | 1 |
| Electrical time constant | msec | 1.5 | 2 | 2.1 |
| Rated speed @ 300 volts | rpm | 9000 | 6000 | 4000 |
| Rated speed @ 160 volts | rpm | 4000 | 3200 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.75 | 4.12 | 7.46 |
| | Nm/amp | 0.425 | 0.467 | 0.844 |
| Voltage constant | Vpk/krpm | 36.3 | 39.9 | 72.1 |
| | Vrms/krpm | 25.7 | 28.2 | 51 |
| Resistance | ohms | 9.4 | 12.1 | 37.4 |
| Inductance | mH | 12.77 | 17.2 | 53.63 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00018 | 0.00018 | 0.00018 |
| | Kg-cm$^2$ | 0.2031 | 0.2031 | 0.2031 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 3.7/1.68 | 3.7/1.68 | 3.7/1.68 |

(1) Maximum speed can be limited by bus volts and feedback types.

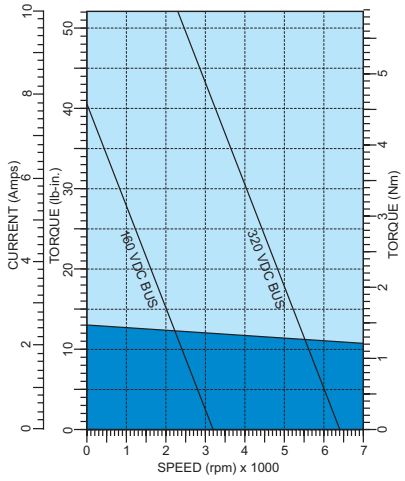
# AC servo motors
## BSM N-series performance curves

1

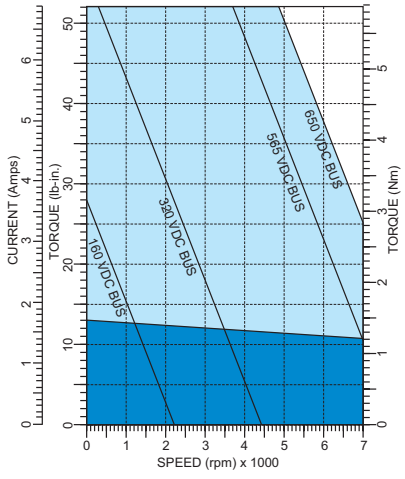
### BSM63N-233




### BSM63N-250




### BSM63N-275



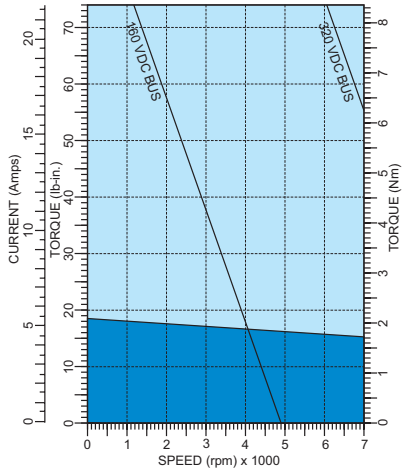

| Model number | | BSM63N-233 | BSM63N-250 | BSM63N-275 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 13 | 13 | 13 |
| | Nm | 1.47 | 1.47 | 1.47 |
| Continuous current | amps | 3.93 | 2.82 | 1.94 |
| Peak torque | lb-in | 52.04 | 52.04 | 52.04 |
| | Nm | 5.88 | 5.88 | 5.88 |
| Peak current | amps | 14.1 | 10.1 | 6.96 |
| Thermal resistance | °C/watt | 1.9 | 1.9 | 1.9 |
| Thermal time constant | Min | 19 | 19 | 19 |
| Mechanical time constant | msec | 0.69 | 0.64 | 0.62 |
| Electrical time constant | msec | 1.5 | 2 | 2.1 |
| Rated speed @ 300 volts | rpm | 9000 | 6000 | 4000 |
| Rated speed @ 160 volts | rpm | 4800 | 3200 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.67 | 5.12 | 7.47 |
| | Nm/amp | 0.415 | 0.579 | 0.844 |
| Voltage constant | Vpk/krpm | 35.4 | 49.4 | 72.1 |
| | Vrms/krpm | 25 | 34.9 | 51 |
| Resistance | ohms | 3.1 | 5.6 | 11.6 |
| Inductance | mH | 4.75 | 11.57 | 24.77 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00034 | 0.00034 | 0.00034 |
| | Kg-cm$^2$ | 0.384 | 0.384 | 0.384 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 5/2.3 | 5/2.3 | 5/2.3 |

(1) Maximum speed can be limited by bus volts and feedback types.

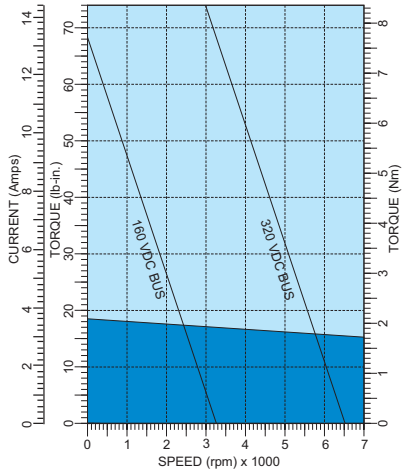
# AC servo motors
## BSM N-series performance curves



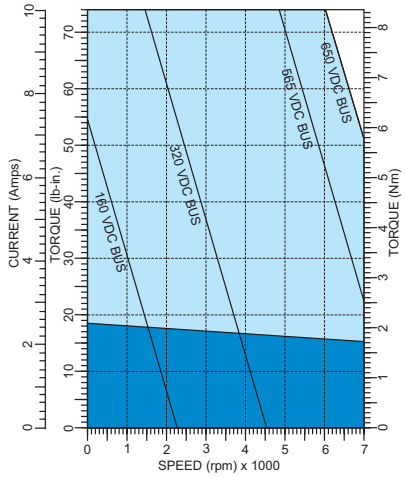
### BSM63N-333




### BSM63N-350




### BSM63N-375



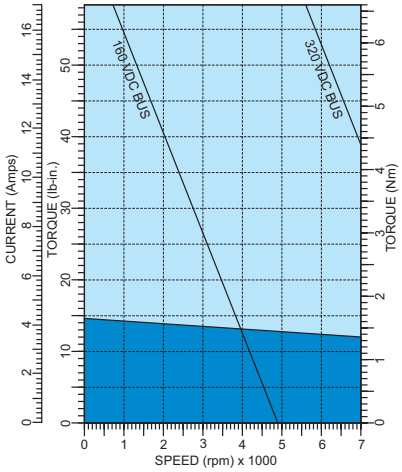

| Model number | | BSM63N-333 | BSM63N-350 | BSM63N-375 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 18.5 | 18.5 | 18.5 |
| | Nm | 2.09 | 2.09 | 2.09 |
| Continuous current | amps | 6.03 | 4.05 | 2.82 |
| Peak torque | lb-in | 73.99 | 73.99 | 73.99 |
| | Nm | 8.36 | 8.36 | 8.36 |
| Peak current | amps | 21.7 | 14.5 | 10.1 |
| Thermal resistance | °C/watt | 1.6 | 1.6 | 1.6 |
| Thermal time constant | Min | 25 | 25 | 25 |
| Mechanical time constant | msec | 0.57 | 0.57 | 0.5 |
| Electrical time constant | msec | 1.9 | 1.79 | 2.3 |
| Rated speed @ 300 volts | rpm | 9000 | 6000 | 4000 |
| Rated speed @ 160 volts | rpm | 4800 | 3200 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.41 | 5.07 | 7.28 |
| | Nm/amp | 0.385 | 0.573 | 0.823 |
| Voltage constant | Vpk/krpm | 32.8 | 49 | 70.2 |
| | Vrms/krpm | 23.25 | 34.6 | 49.7 |
| Resistance | ohms | 1.5 | 3.28 | 5.92 |
| Inductance | mH | 2.85 | 5.87 | 13.67 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0005 | 0.0005 | 0.0005 |
| | Kg-cm$^2$ | 0.564 | 0.564 | 0.564 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 6.3/2.9 | 6.3/2.9 | 6.3/2.9 |

(1) Maximum speed can be limited by bus volts and feedback types.

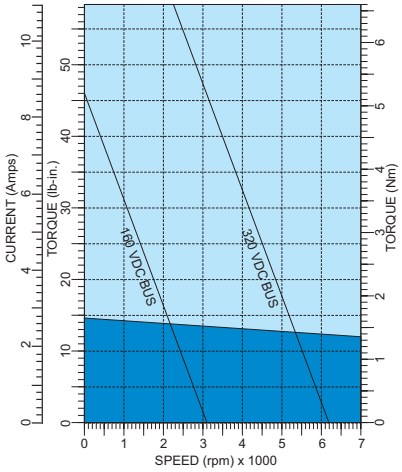
# AC servo motors
## BSM N-series performance curves

1

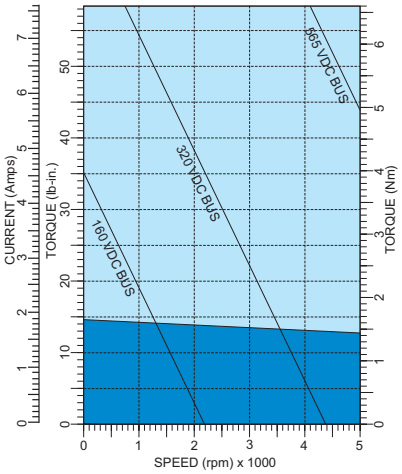
### BSM80N-133




### BSM80N-150




### BSM80N-175

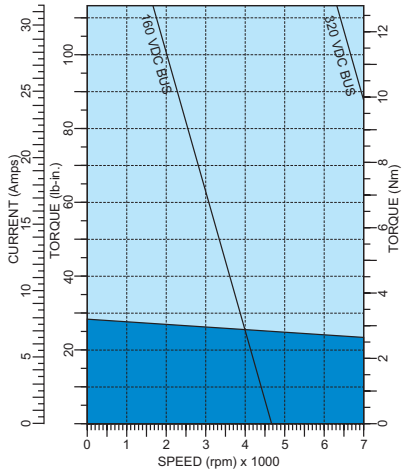



| Model number | | BSM80N-133 | BSM80N-150 | BSM80N-175 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 14.6 | 14.6 | 14.6 |
| | Nm | 1.65 | 1.65 | 1.65 |
| Continuous current | amps | 4.74 | 3.05 | 2.14 |
| Peak torque | lb-in | 58.41 | 58.41 | 58.41 |
| | Nm | 6.6 | 6.6 | 6.6 |
| Peak current | amps | 17.1 | 11 | 7.69 |
| Thermal resistance | °C/watt | 1.84 | 1.84 | 1.84 |
| Thermal time constant | Min | 23 | 23 | 23 |
| Mechanical time constant | msec | 1.5 | 1.4 | 1.3 |
| Electrical time constant | msec | 2.4 | 2.7 | 2.9 |
| Rated speed @ 300 volts | rpm | | 6000 | 4000 |
| Rated speed @ 160 volts | rpm | 4800 | 3200 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.4 | 5.3 | 7.5 |
| | Nm/amp | 0.386 | 0.6 | 0.85 |
| Voltage constant | Vpk/krpm | 33.9 | 51.3 | 73.3 |
| | Vrms/krpm | 24.2 | 36.3 | 51.8 |
| Resistance | ohms | 2.1 | 5.1 | 9.53 |
| Inductance | mH | 5.2 | 13.97 | 28 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00091 | 0.00091 | 0.00091 |
| | Kg-cm$^2$ | 1.02 | 1.02 | 1.02 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 7/3.2 | 7/3.2 | 7/3.2 |

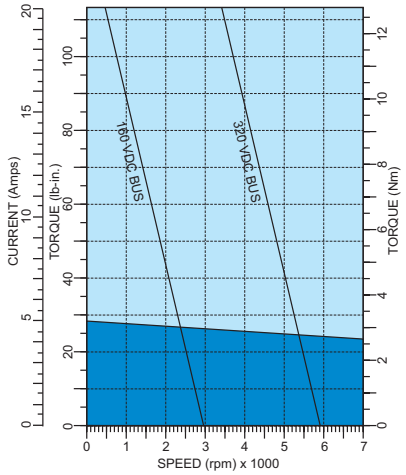
# AC servo motors
## BSM N-series performance curves



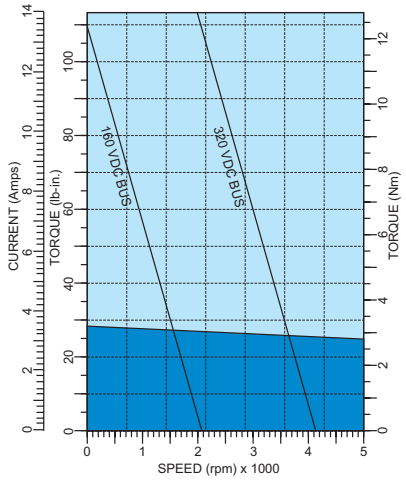
### BSM80N-233




### BSM80N-250




### BSM80N-275

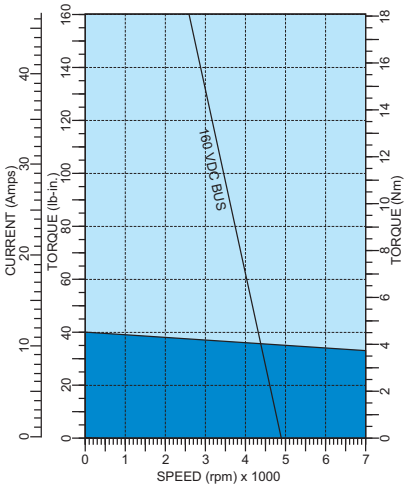



| Model number | | BSM80N-233 | BSM80N-250 | BSM80N-275 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 28.3 | 28.3 | 28.3 |
| | Nm | 3.2 | 3.2 | 3.2 |
| Continuous current | amps | 8.76 | 5.61 | 4 |
| Peak torque | lb-in | 113.28 | 113.28 | 113.28 |
| | Nm | 12.8 | 12.8 | 12.8 |
| Peak current | amps | 31.5 | 20.2 | 14 |
| Thermal resistance | °C/watt | 1.5 | 1.5 | 1.5 |
| Thermal time constant | Min | 28 | 28 | 28 |
| Mechanical time constant | msec | 0.95 | 0.84 | 0.72 |
| Electrical time constant | msec | 3.2 | 2.9 | 3.9 |
| Rated speed @ 300 volts | rpm | | 6000 | 4000 |
| Rated speed @ 160 volts | rpm | 4800 | 3200 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.59 | 5.6 | 8 |
| | Nm/amp | 0.406 | 0.633 | 0.904 |
| Voltage constant | Vpk/krpm | 34.7 | 54.1 | 77.3 |
| | Vrms/krpm | 24.6 | 38.29 | 54.7 |
| Resistance | ohms | 0.832 | 1.81 | 3.2 |
| Inductance | mH | 2.73 | 5.3 | 12.73 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00162 | 0.00162 | 0.00162 |
| | Kg-cm$^2$ | 1.82 | 1.82 | 1.82 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 10/4.6 | 10/4.6 | 10/4.6 |

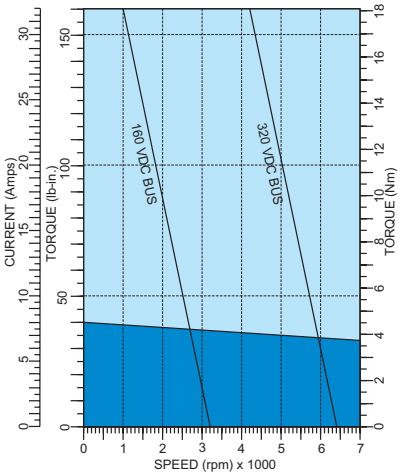
# AC servo motors
## BSM N-series performance curves

1

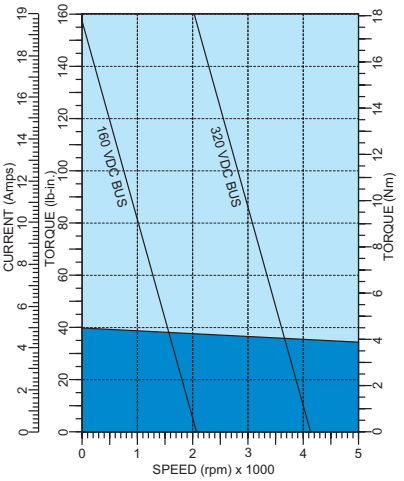
### BSM80N-333




### BSM80N-350




### BSM80N-375

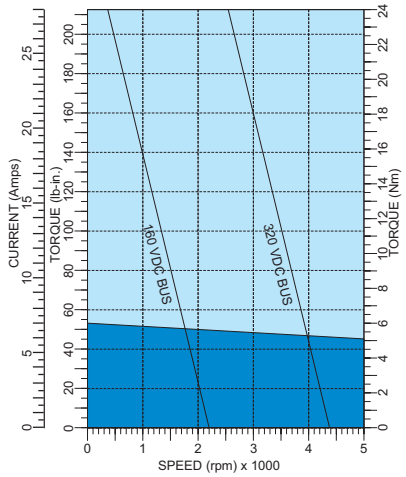



| Model number | | BSM80N-333 | BSM80N-350 | BSM80N-375 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 40 | 40 | 40 |
| | Nm | 4.52 | 4.52 | 4.52 |
| Continuous current | amps | 12.98 | 8.61 | 5.54 |
| Peak torque | lb-in | 160 | 160 | 160 |
| | Nm | 18.08 | 18.08 | 18.08 |
| Peak current | amps | 46.71 | 31.01 | 19.96 |
| Thermal resistance | °C/watt | 1.22 | 1.22 | 1.22 |
| Thermal time constant | Min | 34 | 34 | 34 |
| Mechanical time constant | msec | 0.75 | 0.7 | 0.69 |
| Electrical time constant | msec | 3.9 | 4.3 | 4.2 |
| Rated speed @ 300 volts | rpm | | 6000 | 4000 |
| Rated speed @ 160 volts | rpm | 4800 | 3200 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 3.42 | 5.15 | 8.01 |
| | Nm/amp | 0.387 | 0.583 | 0.906 |
| Voltage constant | Vpk/krpm | 33.2 | 49.7 | 77.4 |
| | Vrms/krpm | 23.41 | 35.2 | 54.7 |
| Resistance | ohms | 0.433 | 0.935 | 2.22 |
| Inductance | mH | 1.7 | 4 | 9.3 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00223 | 0.00223 | 0.00223 |
| | Kg-cm$^2$ | 2.519 | 2.519 | 2.519 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 13/6 | 13/6 | 13/6 |

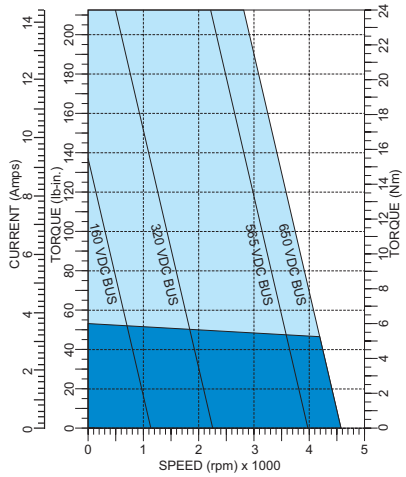
# AC servo motors
## BSM N-series performance curves



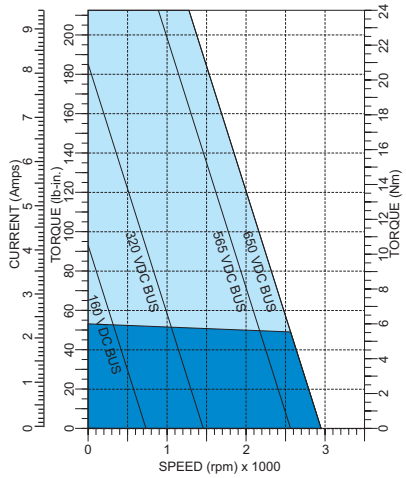
### BSM90N-175




### BSM90N-1150




### BSM90N-1250

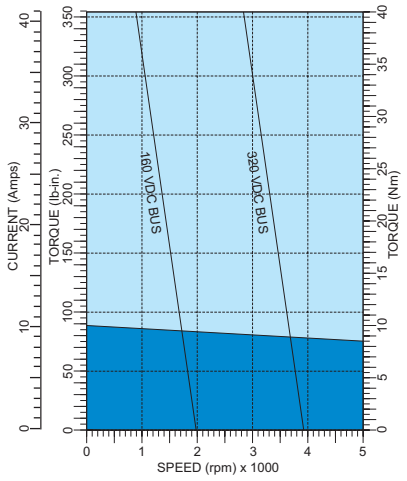



| Model number | | BSM90N-175 | BSM90N-1150 | BSM90N-1250 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 53 | 53 | 53 |
| | Nm | 6 | 6 | 6 |
| Continuous current | amps | 7.8 | 4.03 | 2.6 |
| Peak torque | lb-in | 212.41 | 212.41 | 212.41 |
| | Nm | 24 | 24 | 24 |
| Peak current | amps | 28.1 | 14.5 | 9.37 |
| Thermal resistance | °C/watt | 1.16 | 1.16 | 1.16 |
| Thermal time constant | Min | 38 | 38 | 38 |
| Mechanical time constant | msec | 0.58 | 0.54 | 0.55 |
| Electrical time constant | msec | 3.3 | 4 | 4.1 |
| Rated speed @ 300 volts | rpm | 4000 | 2000 | 1200 |
| Rated speed @ 600 volts | rpm | | 4000 | 2400 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 7.31 | 14.16 | 21.93 |
| | Nm/amp | 0.853 | 1.65 | 2.56 |
| Voltage constant | Vpk/krpm | 72.8 | 141.3 | 218.9 |
| | Vrms/krpm | 51.5 | 99.9 | 154.8 |
| Resistance | ohms | 1.24 | 4.33 | 10.66 |
| Inductance | mH | 4.15 | 17.6 | 43.5 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.003 | 0.003 | 0.003 |
| | Kg-cm$^2$ | 3.389 | 3.389 | 3.389 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 18/8.2 | 18/8.2 | 18/8.2 |

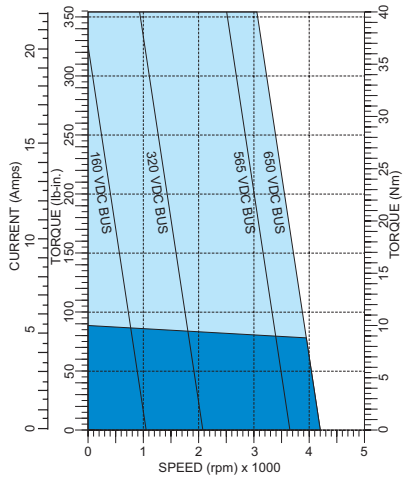
# AC servo motors
## BSM N-series performance curves

1

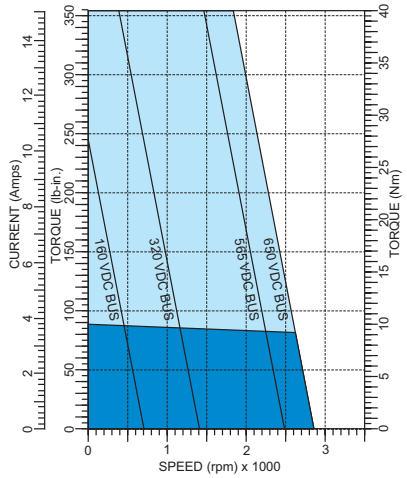
### BSM90N-275




### BSM90N-2150




### BSM90N-2250



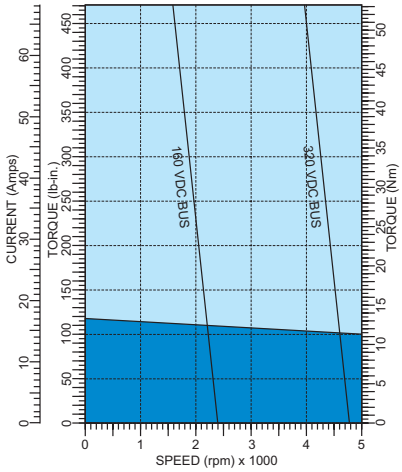

| Model number | | BSM90N-275[1] | BSM90N-2150[1] | BSM90N-2250[1] |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 88 | 88 | 88 |
| | Nm | 10 | 10 | 10 |
| Continuous current | amps | 11.6 | 6.15 | 4.19 |
| Peak torque | lb-in | 354 | 354 | 354 |
| | Nm | 40 | 40 | 40 |
| Peak current | amps | 41.8 | 22.1 | 15 |
| Thermal resistance | °C/watt | 1.15 | 1.15 | 1.15 |
| Thermal time constant | Min | 49 | 49 | 49 |
| Mechanical time constant | msec | 0.36 | 0.38 | 0.36 |
| Electrical time constant | msec | 5.1 | 5.4 | 5.7 |
| Rated speed @ 300 volts | rpm | 4000 | 2000 | 1200 |
| Rated speed @ 600 volts | rpm | | 4000 | 2400 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 8.43 | 15.9 | 23.4 |
| | Nm/amp | 0.954 | 1.8 | 2.65 |
| Voltage constant | Vpk/krpm | 81.5 | 154.5 | 226.7 |
| | Vrms/krpm | 57.6 | 109.3 | 160.3 |
| Resistance | ohms | 0.523 | 1.97 | 3.94 |
| Inductance | mH | 2.66 | 10.5 | 22.5 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0056 | 0.0056 | 0.0056 |
| | Kg-cm$^2$ | 6.327 | 6.327 | 6.327 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 28/12.7 | 28/12.7 | 28/12.7 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 80%.

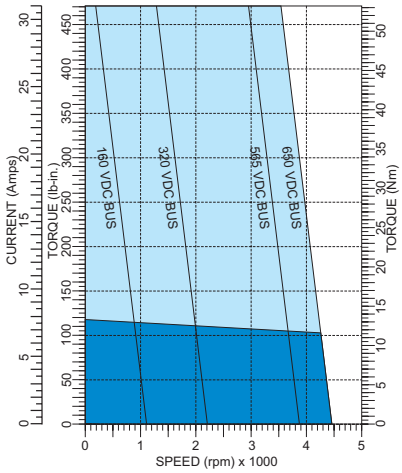
# AC servo motors
## BSM N-series performance curves



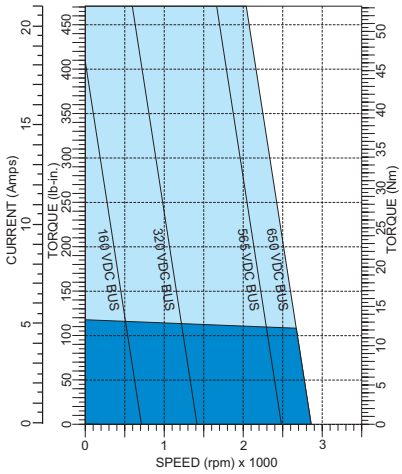
### BSM90N-375




### BSM90N-3150




### BSM90N-3250



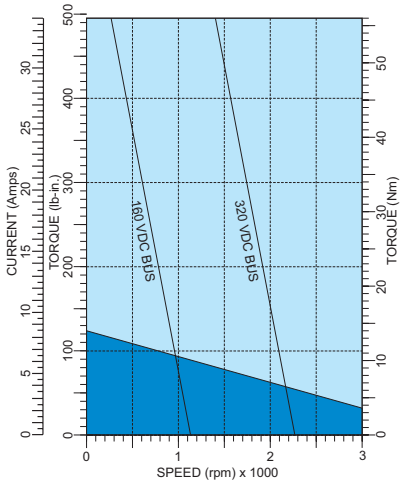

| Model number | | BSM90N-375[1] | BSM90N-3150[1] | BSM90N-3250[1] |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 117 | 117 | 117 |
| | Nm | 13.3 | 13.3 | 13.3 |
| Continuous current | amps | 19.01 | 8.64 | 5.59 |
| Peak torque | lb-in | 471 | 471 | 471 |
| | Nm | 53.2 | 53.2 | 53.2 |
| Peak current | amps | 68.47 | 31.1 | 20.1 |
| Thermal resistance | °C/watt | 1.14 | 1.14 | 1.14 |
| Thermal time constant | Min | 59 | 59 | 59 |
| Mechanical time constant | msec | 0.32 | 0.33 | 0.32 |
| Electrical time constant | msec | 2.8 | 5.4 | 5.5 |
| Rated speed @ 300 volts | rpm | 4000 | 2000 | 1200 |
| Rated speed @ 600 volts | rpm | | 4000 | 2400 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 6.8 | 15.07 | 23.4 |
| | Nm/amp | 0.77 | 1.7 | 2.64 |
| Voltage constant | Vpk/krpm | 65.7 | 145.6 | 226.3 |
| | Vrms/krpm | 46.5 | 103 | 160.1 |
| Resistance | ohms | 0.2075 | 1.02 | 2.39 |
| Inductance | mH | 1.257 | 5.53 | 13.18 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0082 | 0.0082 | 0.0082 |
| | Kg-cm$^2$ | 9.264 | 9.264 | 9.264 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 38/17.3 | 38/17.3 | 38/17.3 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 80%.

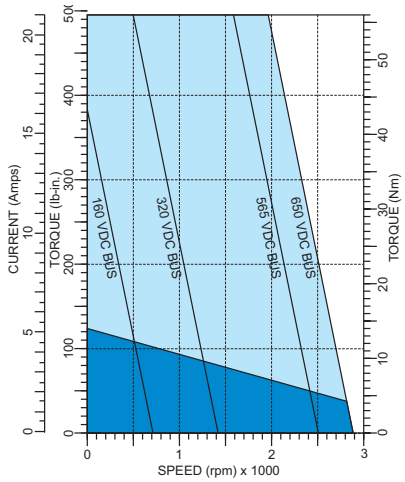
# AC servo motors
## BSM N-series performance curves

1

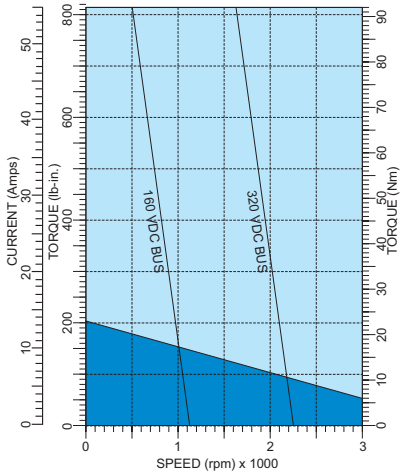
### BSM100N-1150




### BSM100N-1250




### BSM100N-2150

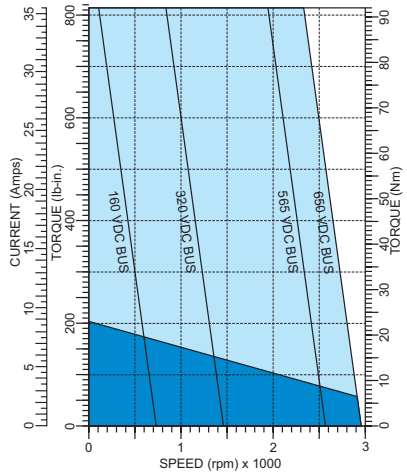



| Model number | | BSM100N-1150 | BSM100N-1250 | BSM100N-2150 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 123.9 | 123.9 | 203.5 |
| | Nm | 14 | 14 | 23 |
| Continuous current | amps | 9.4 | 5.9 | 15.5 |
| Peak torque | lb-in | 495.6 | 495.6 | 814.2 |
| | Nm | 56 | 56 | 92 |
| Peak current | amps | 34 | 21.2 | 55.8 |
| Thermal resistance | °C/watt | 1.05 | 1.05 | 1 |
| Thermal time constant | Min | 58 | 58 | 67 |
| Mechanical time constant | msec | 0.47 | 0.46 | 0.33 |
| Electrical time constant | msec | 7.2 | 7.4 | 8.3 |
| Rated speed @ 300 volts | rpm | 2000 | 1200 | 2000 |
| Rated speed @ 160 volts | rpm | 1000 | 640 | 1000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 14.5 | 23.3 | 14.5 |
| | Nm/amp | 1.64 | 2.6 | 1.64 |
| Voltage constant | Vpk/krpm | 140.4 | 225.3 | 140.8 |
| | Vrms/krpm | 99.3 | 159.4 | 99.6 |
| Resistance | ohms | 0.91 | 2.25 | 0.4 |
| Inductance | mH | 6.6 | 17.5 | 3.3 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.012 | 0.012 | 0.0196 |
| | Kg-cm$^2$ | 13.558 | 13.558 | 22.145 |
| Maximum speed | rpm | 4,000 | 4,000 | 4,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 35/16 | 35/16 | 49/22.3 |

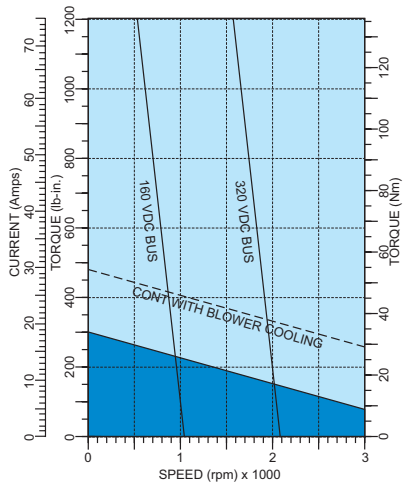
# AC servo motors
## BSM N-series performance curves



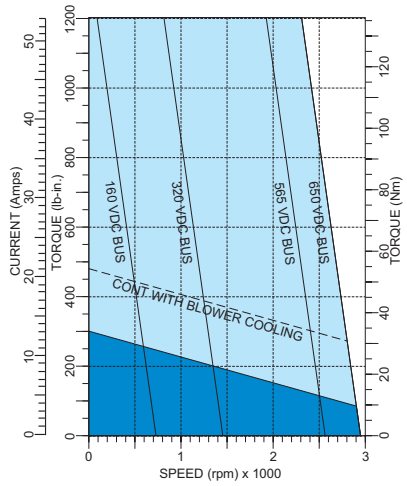
### BSM100N-2250




### BSM100N-3150




### BSM100N-3250



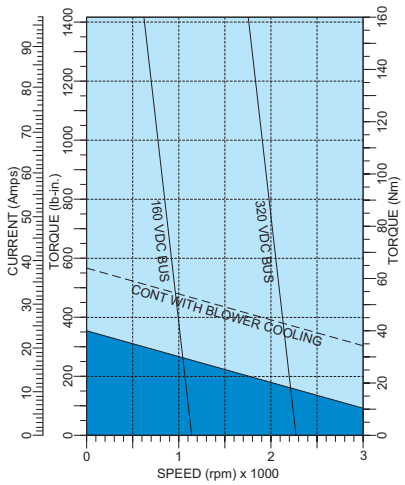

| Model number | | BSM100N-2250 | BSM100N-3150[1] | BSM100N-3250[1] |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 203.5 | 300 | 300 |
| | Nm | 23 | 34 | 34 |
| Continuous current | amps | 9.9 | 21 | 14.7 |
| Peak torque | lb-in | 814.2 | 1203.6 | 1203.6 |
| | Nm | 92 | 136 | 136 |
| Peak current | amps | 35.8 | 75.8 | 53.1 |
| Thermal resistance | °C/watt | 1 | 0.7 | 0.7 |
| Thermal time constant | Min | 67 | 76 | 76 |
| Mechanical time constant | msec | 0.3 | 0.24 | 0.29 |
| Electrical time constant | msec | 9.4 | 10.9 | 9.7 |
| Rated speed @ 300 volts | rpm | 1200 | 2000 | 1200 |
| Rated speed @ 600 volts | rpm | 2400 | | 2400 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 22.6 | 15.8 | 22.6 |
| | Nm/amp | 2.56 | 1.79 | 2.56 |
| Voltage constant | Vpk/krpm | 219 | 153.1 | 218.8 |
| | Vrms/krpm | 154.9 | 108.3 | 154.7 |
| Resistance | ohms | 0.87 | 0.25 | 0.61 |
| Inductance | mH | 8.25 | 2.7 | 5.8 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0196 | 0.0273 | 0.0273 |
| | Kg-cm$^2$ | 22.145 | 30.844 | 30.844 |
| Maximum speed | rpm | 4,000 | 4,000 | 4,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 49/22.3 | 63/28.6 | 63/28.6 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 60%.

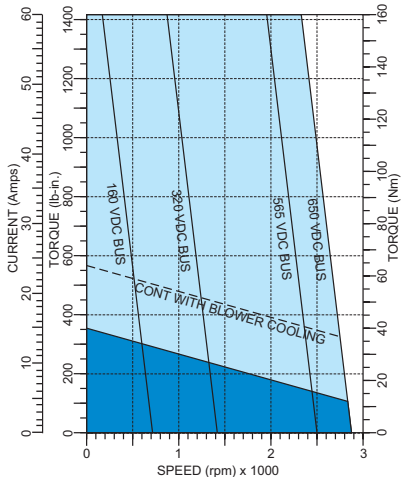
# AC servo motors
## BSM N-series performance curves

1

### BSM100N-4150




### BSM100N-4250




| Model number | | BSM100N-4150[1] | BSM100N-4250[1] |
|---|---|---|---|
| **General** | | | |
| Continuous stall torque | lb-in | 354 | 354 |
| | Nm | 40 | 40 |
| Continuous current | amps | 26.9 | 16.8 |
| Peak torque | lb-in | 1416 | 1416 |
| | Nm | 160 | 160 |
| Peak current | amps | 97.1 | 60.7 |
| Thermal resistance | °C/watt | 0.66 | 0.66 |
| Thermal time constant | Min | 85 | 85 |
| Mechanical time constant | msec | 0.26 | 0.26 |
| Electrical time constant | msec | 10.3 | 10.5 |
| Rated speed @ 300 volts | rpm | 2000 | 1200 |
| Rated speed @ 600 volts | rpm | | 2400 |
| **Electrical** | | | |
| Torque constant | lb-in/amp | 14.5 | 23.2 |
| | Nm/amp | 1.64 | 2.63 |
| Voltage constant | Vpk/krpm | 140.7 | 225.1 |
| | Vrms/krpm | 99.5 | 159.2 |
| Resistance | ohms | 0.18 | 0.46 |
| Inductance | mH | 1.867 | 4.86 |
| **Mechanical** | | | |
| Inertia | lb-in-s$^2$ | 0.0349 | 0.0349 |
| | Kg-cm$^2$ | 39.431 | 39.431 |
| Maximum speed | rpm | 4,000 | 4,000 |
| Number of motor poles | — | 8 | 8 |
| Weight | lbs/Kg | 77/35 | 77/35 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 60%.

# AC servo motors
## Brushless servo C-series

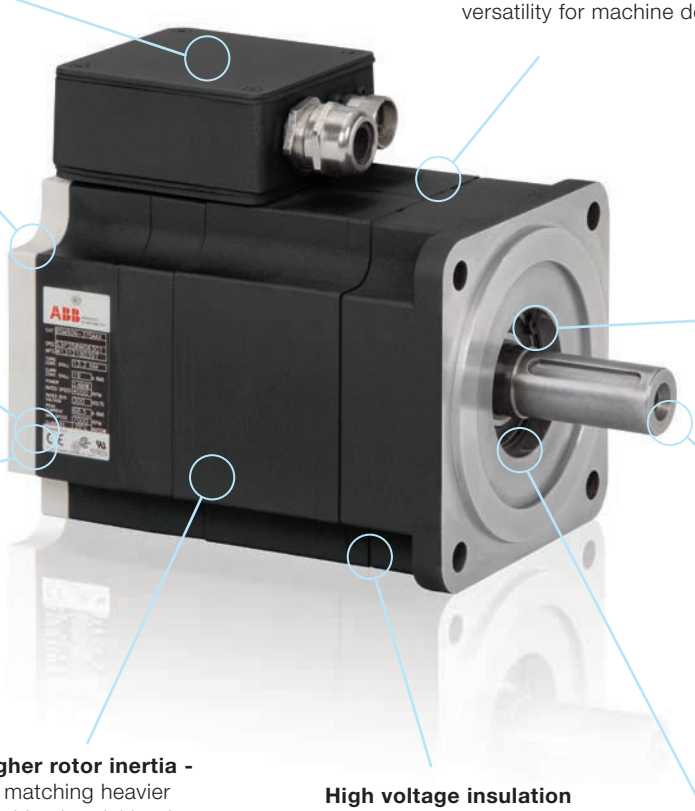


The BSM C series of servo motors provide higher inertia in an economical package. These motors have a reliable magnetic design, and are used in applications needing higher inertial matching. These rugged motors provide peak torques equal to three times continuous, thus enabling rapid acceleration for the higher inertial demanding applications. Besides a wide variety of feedback devices, other options such as brakes, cooling to extend performance, mounting, shaft, and electrical windings are available for your application needs. We also have stocked motors for immediate delivery for your application needs.

| Motor family | Size | | Torque range | |
|---|---|---|---|---|
| | mm | in | lb-in | Nm |
| BSM80 | 89 | 3.5 | 10-38 | 1.2-4.3 |
| BSM90 | 120 | 4.7 | 23-69 | 2.6-7.8 |
| BSM100 | 146 | 5.7 | 44-265 | 5-30 |
| BSM132 | 244 | 9.6 | 469-1185 | 53-134 |

**Variety of feedback options:**
– Resolver
– Incremental/Absolute Encoders
– Hall sensors

**Stock and custom shafts and mountings. Rugged industrial construction - quality in the design**
– IEC and NEMA
– Design interchangeable with N-Series - versatility for machine designs



**High continuous rated operating temperature**
Over temperature protective thermal switch

**Optional holding brakes**

**O-rings for moisture and dust resistance**
Rugged design for rugged environments - quality in the design.

**Proven reliable bearings**
4 times longer bearing life

**Rugged construction**
– Sealed to IP54
– With shaft oil seal sealed to IP55
– 95% RH Non-Condensing
– 1000 m (3300 Feet) without derate

**Higher rotor inertia -**
for matching heavier machine inertial loads.

**High voltage insulation**
Windings potted for additional voltage protection - for improved reliability and improved heat transfer

**Optional shaft seal**

Optional forced air cooling on some models - to extend torque capability for additional motor performance.
Typical BSM 90/100 series shown

# AC servo motors
## BSM C-series

The BSM C-series has as standard, a “higher” inertia - thus providing an excellent match for equipment requiring higher inertial matching for the machine. This series provides continuous stall capability ranging from 10 lb-In (1.2 Nm) to 1185 lb-In (134 Nm). Peak torques are typically three times continuous. The BSM C-series provides up to 50% more torque in a smaller size (2 inches/50 mm shorter) compared to previous models. The C-series provides an economical package best used in applications with higher load inertias.



### AC servo motors - C-series

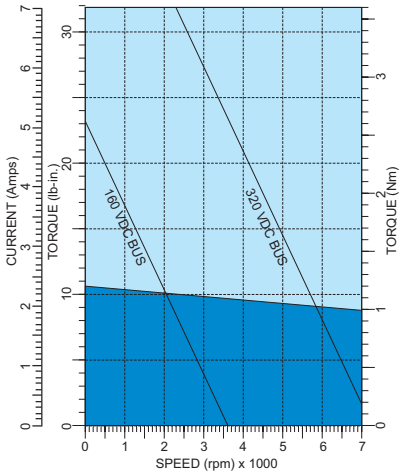
| Continuous stall torque | | Continuous stall amps | Speed RPM @ 320V[1] | Motor number[2] | Motor inertia | |
|---|---|---|---|---|---|---|
| lb-in | Nm | | | | lb-in-s$^2$ | Kg - cm$^2$ |
| 10.6 | 1.2 | 2.7 | 6000 | BSM80C-150AX | 0.0016 | 1.81 |
| | | 1.9 | 4000 | BSM80C-175AX | | |
| 21.2 | 2.4 | 5.2 | 6000 | BSM80C-250AX | 0.0033 | 3.73 |
| | | 3.2 | 4000 | BSM80C-275AX | | |
| | | 1.82 | 2000 | BSM80C-2150AX | | |
| 23.0 | 2.6 | 2.1 | 2000 | BSM90C-1150AX | 0.0039 | 4.4 |
| 31.8 | 3.6 | 7.8 | 6000 | BSM80C-350AX | 0.0049 | 5.61 |
| | | 6.3 | 4000 | BSM80C-375AX | | |
| | | 3.2 | 2000 | BSM80C-3150AX | | |
| 38.0 | 4.3 | 6.3 | 4000 | BSM80C-475AX | 0.0066 | 7.45 |
| | | 3.1 | 2000 | BSM80C-4150AX | | |
| 44.3 | 5.0 | 4.0 | 2400 | BSM100C-1150AX | 0.0149 | 16.82 |
| | | 2.3 | 1200 | BSM100C-1250AX | | |
| 46.0 | 5.2 | 9.0 | 4000 | BSM90C-275AX | 0.0078 | 8.81 |
| | | 4.7 | 2000 | BSM90C-2150AX | | |
| | | 2.5 | 1200 | BSM90C-2250AX | | |
| 69.0 | 7.8 | 12.0 | 4000 | BSM90C-375AX | 0.0117 | 13.2 |
| | | 6.0 | 2000 | BSM90C-3150AX | | |
| | | 3.4 | 1200 | BSM90C-3250AX | | |
| 88.5 | 10.0 | 8.0 | 2400 | BSM100C-2150AX | 0.0299 | 33.7 |
| | | 4.9 | 1200 | BSM100C-2250AX | | |
| 125.7 | 14.2 | 11.4 | 2400 | BSM100C-3150AX | 0.0448 | 50.6 |
| | | 6.9 | 1200 | BSM100C-3250AX | | |
| 177.0 | 20.0 | 16.8 | 2400 | BSM100C-4150AX | 0.0598 | 67.5 |
| | | 10.6 | 1200 | BSM100C-4250AX | | |
| 221.3 | 25.0 | 21.0 | 2400 | BSM100C-5150AX | 0.0747 | 84.4 |
| | | 13.0 | 1200 | BSM100C-5250AX | | |
| 265.5 | 30.0 | 24.0 | 2000 | BSM100C-6150AX | 0.0897 | 101.2 |
| | | 14.1 | 1200 | BSM100C-6250AX | | |
| 469 | 53 | 37 | 1800 | BSM132C-3200AX | 0.233 | 262 |
| 619 | 70 | 43 | 1800 | BSM132C-4200AX | 0.287 | 324 |
| 770 | 87 | 50 | 1800 | BSM132C-5200AX | 0.345 | 389 |
| 929 | 105 | 52 | 1800 | BSM132C-6200AX | 0.392 | 443 |
| 1008 | 114 | 72 | 1800 | BSM132C-7200AX | 0.448 | 506 |
| 1097 | 124 | 74 | 1800 | BSM132C-8200AX | 0.513 | 579 |
| 1185 | 134 | 79 | 1800 | BSM132C-9200AX | 0.57 | 644 |

Note: [1] Nominal rpm shown at 320 Vdc bus for convenience. For 640 Vdc double the speed. Reference motor table to verify that max speed is not exceeded.
[2] For X callouts, see motor ID matrix under engineering information.

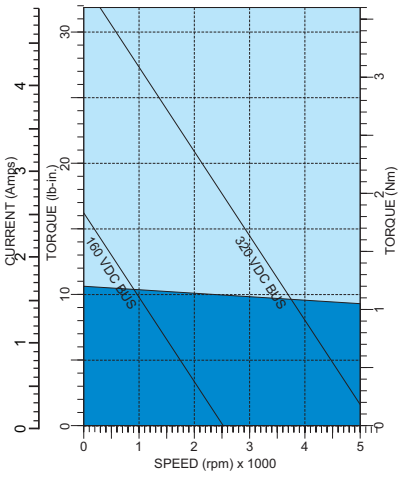
# AC servo motors
## BSM C-series performance curves



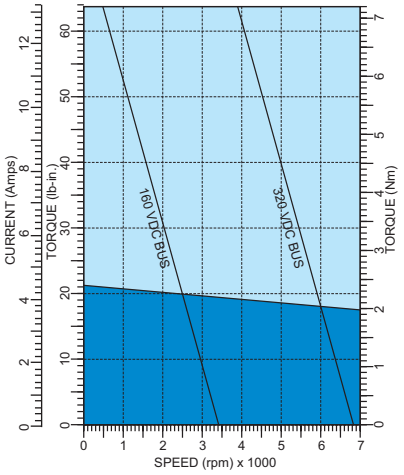
### BSM80C-150




### BSM80C-175




### BSM80C-250



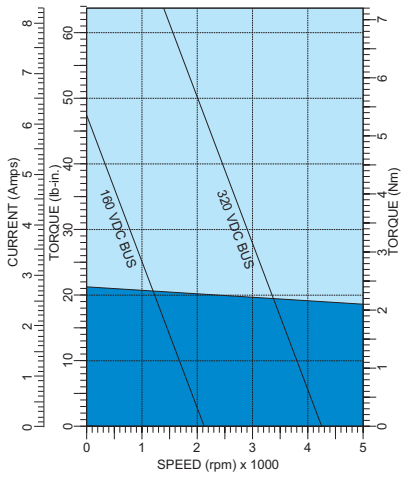

| Model number | | BSM80C-150 | BSM80C-175 | BSM80C-250 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 10.6 | 10.6 | 21.2 |
| | Nm | 1.2 | 1.2 | 2.4 |
| Continuous current | amps | 2.75 | 1.93 | 5.2 |
| Peak torque | lb-in | 31.9 | 31.9 | 63.7 |
| | Nm | 3.6 | 3.6 | 7.2 |
| Peak current | amps | 7 | 4.9 | 13.3 |
| Thermal resistance | °C/watt | 1.33 | 1.33 | 1.15 |
| Thermal time constant | Min | 19 | 19 | 23 |
| Mechanical time constant | msec | 5.95 | 5.96 | 3.59 |
| Electrical time constant | msec | 1.63 | 1.65 | 2.79 |
| Rated speed @ 300 volts | rpm | 6000 | 4000 | 6000 |
| Rated speed @160 volts | rpm | 3200 | 2130 | 3200 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 4.5 | 6.5 | 4.8 |
| | Nm/amp | 0.51 | 0.73 | 0.54 |
| Voltage constant | Vpk/krpm | 43.7 | 62.5 | 46.2 |
| | Vrms/krpm | 30.9 | 44.2 | 32.7 |
| Resistance | ohms | 8.6 | 17.6 | 2.8 |
| Inductance | mH | 14 | 29.1 | 7.8 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0016 | 0.0016 | 0.0033 |
| | Kg-cm$^2$ | 1.81 | 1.81 | 3.73 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 9/4.1 | 9/4.1 | 10/4.5 |

(1) Maximum speed can be limited by bus volts and feedback types.

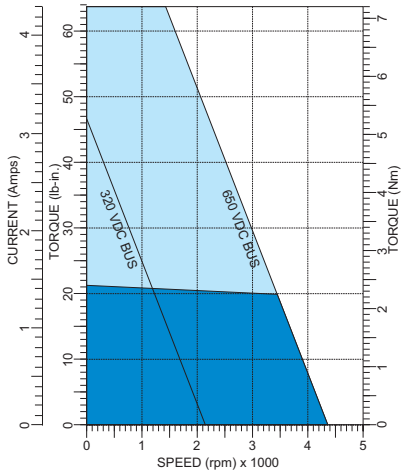
# AC servo motors
## BSM C-series performance curves



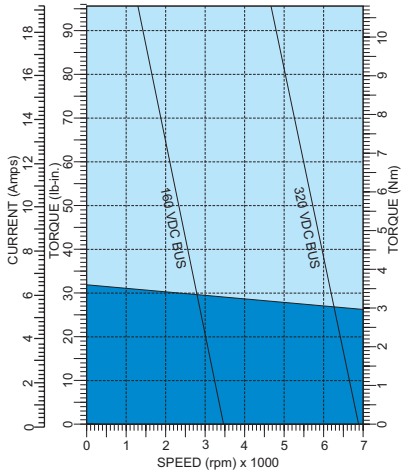
### BSM80C-275




### BSM80C-2150




### BSM80C-350



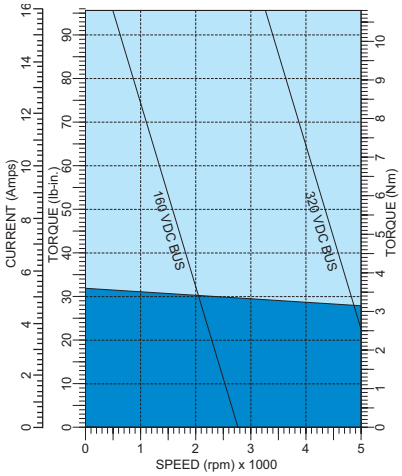

| Model number | | BSM80C-275 | BSM80C-2150 | BSM80C-350 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 21.2 | 21.2 | 31.9 |
| | Nm | 2.4 | 2.4 | 3.6 |
| Continuous current | amps | 3.24 | 1.82 | 7.8 |
| Peak torque | lb-in | 63.7 | 63.7 | 95.6 |
| | Nm | 7.2 | 7.2 | 10.8 |
| Peak current | amps | 8.3 | 4.3 | 19.3 |
| Thermal resistance | °C/watt | 1.15 | 1.15 | 1 |
| Thermal time constant | Min | 23 | 23 | 28 |
| Mechanical time constant | msec | 3.54 | 3.59 | 2.63 |
| Electrical time constant | msec | 2.63 | 2.81 | 3.02 |
| Rated speed @ 300 volts | rpm | 4000 | 2000 | 6000 |
| Rated speed @ 600 volts | rpm | 8000 | 4000 | |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 7.7 | 14.5 | 4.8 |
| | Nm/amp | 0.87 | 1.64 | 0.54 |
| Voltage constant | Vpk/krpm | 74.5 | 140.4 | 46.2 |
| | Vrms/krpm | 52.7 | 99.3 | 32.7 |
| Resistance | ohms | 7.2 | 26.6 | 1.39 |
| Inductance | mH | 18.9 | 73.3 | 4.2 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0033 | 0.0033 | 0.00497 |
| | Kg-cm$^2$ | 3.73 | 3.73 | 5.53 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 10/4.5 | 10/4.5 | 11/5.0 |

(1) Maximum speed can be limited by bus volts and feedback types.

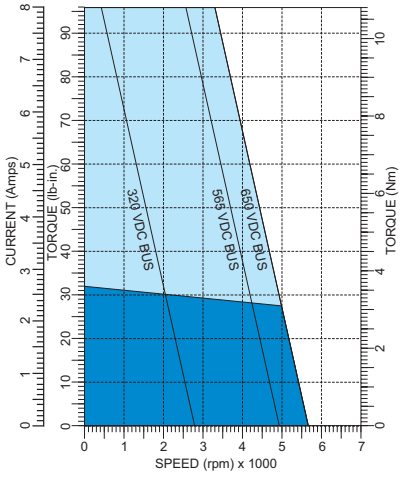
# AC servo motors
## BSM C-series performance curves



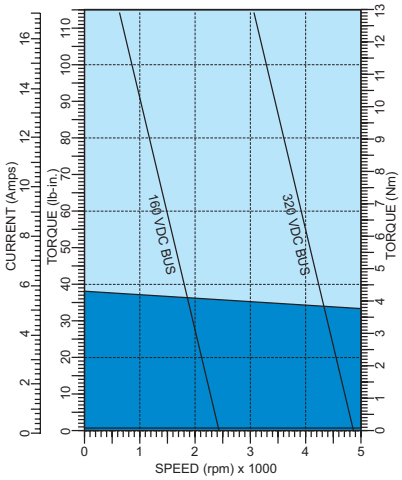
### BSM80C-375




### BSM80C-3150




### BSM80C-475



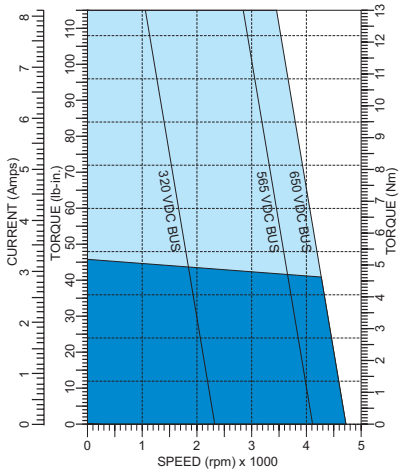

| Model number | | BSM80C-375 | BSM80C-3150 | BSM80C-475 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 31.9 | 31.9 | 38.1 |
| | Nm | 3.6 | 3.6 | 4.3 |
| Continuous current | amps | 6.29 | 3.2 | 6.3 |
| Peak torque | lb-in | 95.6 | 95.6 | 114.2 |
| | Nm | 10.8 | 10.8 | 12.9 |
| Peak current | amps | 16 | 8.1 | 17 |
| Thermal resistance | °C/watt | 1 | 1 | 1 |
| Thermal time constant | Min | 28 | 28 | 32 |
| Mechanical time constant | msec | 2.7 | 2.7 | 2.42 |
| Electrical time constant | msec | 3.73 | 3.69 | 3.16 |
| Rated speed @ 300 volts | rpm | 4000 | 2000 | 4000 |
| Rated speed @ 600 volts | rpm | 8000 | 4000 | 8000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 6 | 11.8 | 6.7 |
| | Nm/amp | 0.67 | 1.33 | 0.76 |
| Voltage constant | Vpk/krpm | 57.5 | 113.8 | 65.05 |
| | Vrms/krpm | 40.7 | 80.5 | 46 |
| Resistance | ohms | 2.2 | 8.9 | 1.95 |
| Inductance | mH | 8.2 | 32.8 | 6 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00497 | 0.00497 | 0.0066 |
| | Kg-cm$^2$ | 5.53 | 5.53 | 7.45 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 11/5.0 | 11/5.0 | 16/7.2 |

(1) Maximum speed can be limited by bus volts and feedback types.

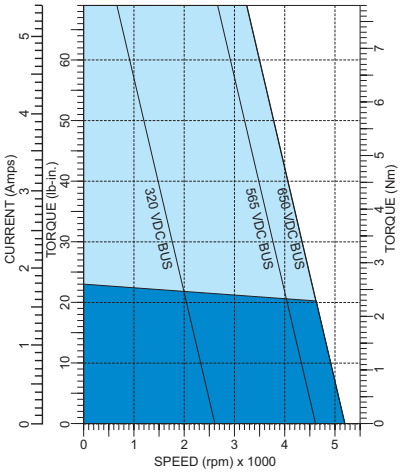
# AC servo motors
## BSM C-series performance curves



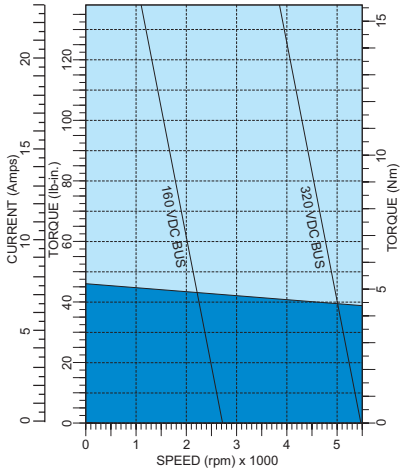
### BSM80C-4150




### BSM90C-1150




### BSM90C-275



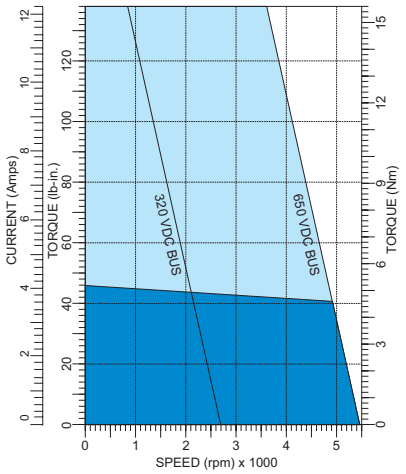

| Model number | | BSM80C-4150 | BSM90C-1150 | BSM90C-275 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 38.1 | 23 | 46 |
| | Nm | 4.3 | 2.6 | 5.2 |
| Continuous current | amps | 3.17 | 2.15 | 9 |
| Peak torque | lb-in | 114.2 | 69 | 138.1 |
| | Nm | 12.9 | 7.8 | 15.6 |
| Peak current | amps | 8.1 | 5.47 | 23 |
| Thermal resistance | °C/watt | 1 | 1.6 | 0.9 |
| Thermal time constant | Min | 32 | 35 | 45 |
| Mechanical time constant | msec | 2.03 | 2.52 | 1 |
| Electrical time constant | msec | 3.93 | 2.4 | 3.56 |
| Rated speed @ 300 volts | rpm | 2000 | 2000 | 4000 |
| Rated speed @ 600 volts | rpm | 4000 | 4000 | 8000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 14.1 | 12.6 | 6 |
| | Nm/amp | 1.59 | 1.42 | 0.68 |
| Voltage constant | Vpk/krpm | 136.5 | 121.8 | 57.9 |
| | Vrms/krpm | 96.5 | 86.1 | 41.0 |
| Resistance | ohms | 7 | 11.5 | 1.04 |
| Inductance | mH | 27.5 | 27.6 | 3.7 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0066 | 0.0039 | 0.0078 |
| | Kg-cm$^2$ | 7.45 | 4.4 | 8.81 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 8 | 8 |
| Weight | lbs/Kg | 16/7.2 | 17/7.7 | 23/10.5 |

(1) Maximum speed can be limited by bus volts and feedback types.

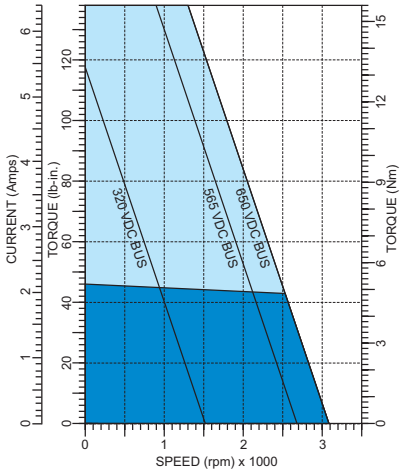
# AC servo motors
## BSM C-series performance curves



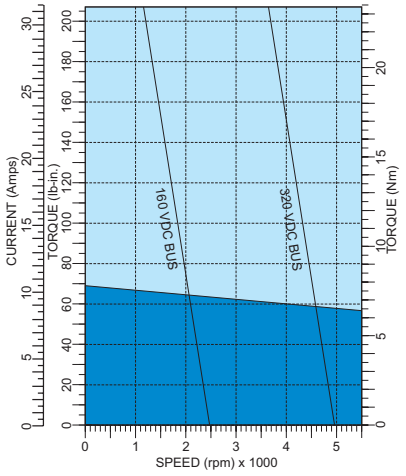
### BSM90C-2150




### BSM90C-2250




### BSM90C-375

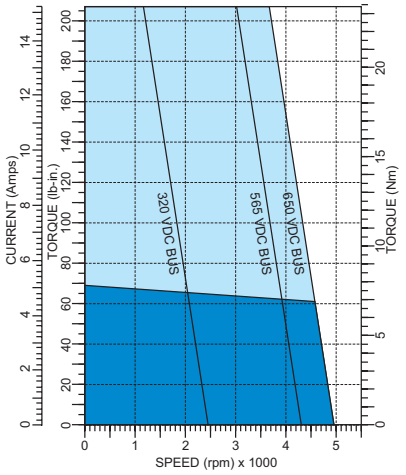



| Model number | | BSM90C-2150 | BSM90C-2250 | BSM90C-375 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 46 | 46 | 69 |
| | Nm | 5.2 | 5.2 | 7.8 |
| Continuous current | amps | 4.78 | 2.51 | 12 |
| Peak torque | lb-in | 138.1 | 138.1 | 207.1 |
| | Nm | 15.6 | 15.6 | 23.4 |
| Peak current | amps | 12.2 | 6.4 | 30.8 |
| Thermal resistance | °C/watt | 0.9 | 0.9 | 0.87 |
| Thermal time constant | Min | 45 | 45 | 55 |
| Mechanical time constant | msec | 2.32 | 2.38 | 1.59 |
| Electrical time constant | msec | 2.96 | 3.29 | 3.84 |
| Rated speed @ 300 volts | rpm | 2000 | 1200 | 4000 |
| Rated speed @ 600 volts | rpm | 4000 | 2400 | 8000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 12.2 | 21.6 | 6.7 |
| | Nm/amp | 1.38 | 2.44 | 0.76 |
| Voltage constant | Vpk/krpm | 118.8 | 208.6 | 64.9 |
| | Vrms/krpm | 84 | 147.5 | 45.9 |
| Resistance | ohms | 5 | 16 | 0.69 |
| Inductance | mH | 14.8 | 52.7 | 2.65 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0078 | 0.0078 | 0.0117 |
| | Kg-cm$^2$ | 8.81 | 8.81 | 13.21 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 23/10.5 | 23/10.5 | 30/13.6 |

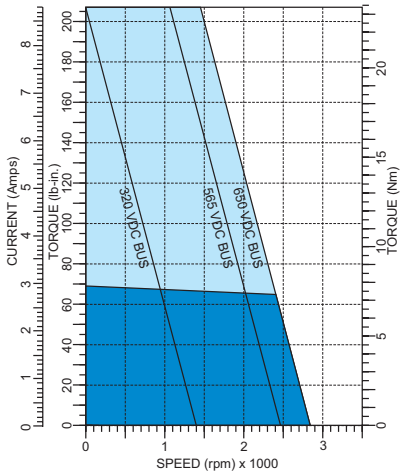
# AC servo motors
## BSM C-series performance curves



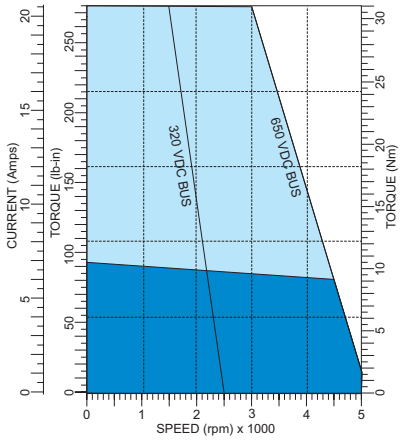
### BSM90C-3150




### BSM90C-3250




### BSM90C-4150

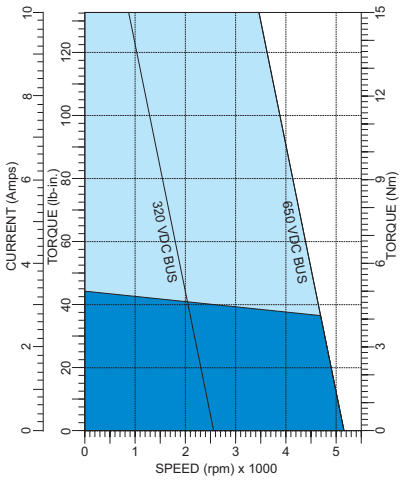



| Model number | | BSM90C-3150 | BSM90C-3250 | BSM90C-4150 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 69 | 69 | 92.0 |
| | Nm | 7.8 | 7.8 | 10.4 |
| Continuous current | amps | 6 | 3.45 | 7.69 |
| Peak torque | lb-in | 207.1 | 207.1 | 276.1 |
| | Nm | 23.4 | 23.4 | 31.2 |
| Peak current | amps | 15.4 | 8.8 | 20.8 |
| Thermal resistance | °C/watt | 0.87 | 0.87 | 0.45 |
| Thermal time constant | Min | 55 | 55 | 57 |
| Mechanical time constant | msec | 1.55 | 1.84 | 2.00 |
| Electrical time constant | msec | 4.22 | 3.32 | 4.44 |
| Rated speed @ 300 volts | rpm | 2000 | 1200 | 2000 |
| Rated speed @ 600 volts | rpm | 4000 | 2400 | 4000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 13.4 | 23.5 | 13.3 |
| | Nm/amp | 1.52 | 2.65 | 1.50 |
| Voltage constant | Vpk/krpm | 129.8 | 227.1 | 128 |
| | Vrms/krpm | 91.8 | 160.6 | 90.8 |
| Resistance | ohms | 2.7 | 9.77 | 1.5 |
| Inductance | mH | 11.4 | 32.4 | 6.6 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0117 | 0.0117 | 0.0156 |
| | Kg-cm$^2$ | 13.21 | 13.21 | 17.67 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 30/13.6 | 30/13.6 | 36/16.3 |

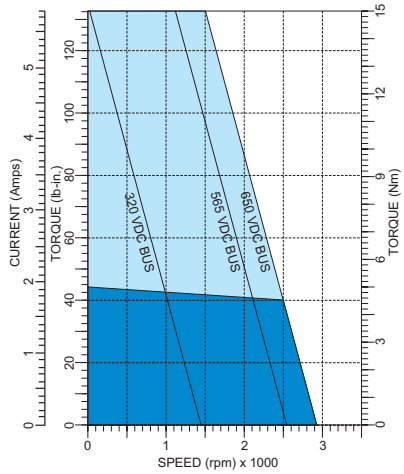
# AC servo motors
## BSM C-series performance curves



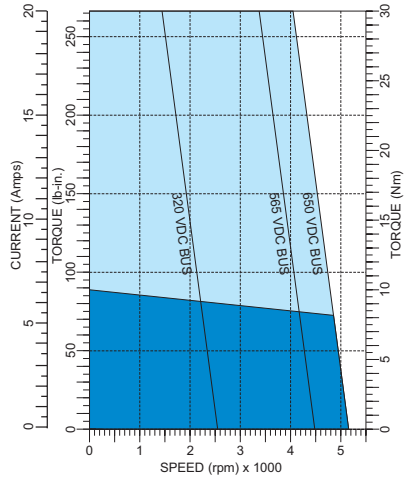
### BSM100C-1150




### BSM100C-1250




### BSM100C-2150

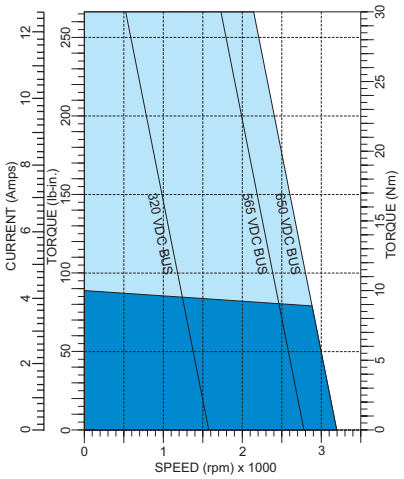



| Model number | | BSM100C-1150 | BSM100C-1250 | BSM100C-2150 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous | lb-in | 44.3 | 44.3 | 88.5 |
| stall torque | Nm | 5 | 5 | 10 |
| Continuous current | amps | 4.01 | 2.3 | 8.02 |
| Peak torque | lb-in | 132.8 | 132.8 | 265.5 |
| | Nm | 15 | 15 | 30 |
| Peak current | amps | 10.2 | 5.8 | 20.4 |
| Thermal resistance | °C/watt | 1.04 | 1.04 | 0.84 |
| Thermal time constant | Min | 47 | 47 | 54 |
| Mechanical time constant | msec | 4.12 | 3.71 | 2.54 |
| Electrical time constant | msec | 3.69 | 4.12 | 5.13 |
| Rated speed @ 300 volts | rpm | 2400 | 1200 | 2400 |
| Rated speed @ 600 volts | rpm | 4800 | 2400 | 4800 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 12.9 | 22.7 | 12.9 |
| | Nm/amp | 1.46 | 2.57 | 1.46 |
| Voltage constant | Vpk/krpm | 125 | 219.9 | 125 |
| | Vrms/krpm | 88.4 | 155.5 | 88.4 |
| Resistance | ohms | 5.2 | 14.5 | 1.6 |
| Inductance | mH | 19.2 | 59.8 | 8.2 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0149 | 0.0149 | 0.02991 |
| | Kg-cm$^2$ | 16.82 | 16.82 | 33.77 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 30/13.6 | 30/13.6 | 39/17.7 |

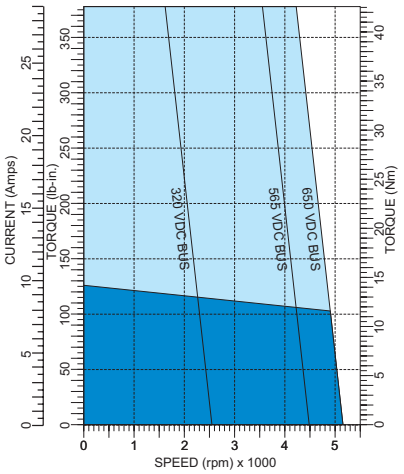
# AC servo motors
## BSM C-series performance curves



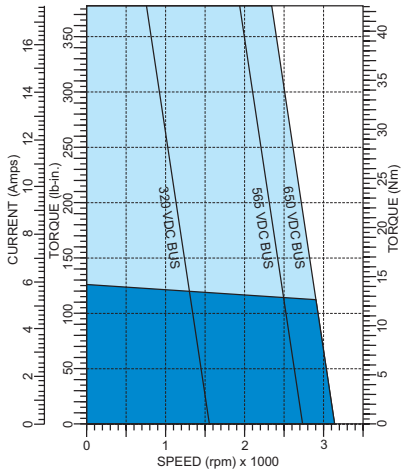
### BSM100C-2250




### BSM100C-3150




### BSM100C-3250

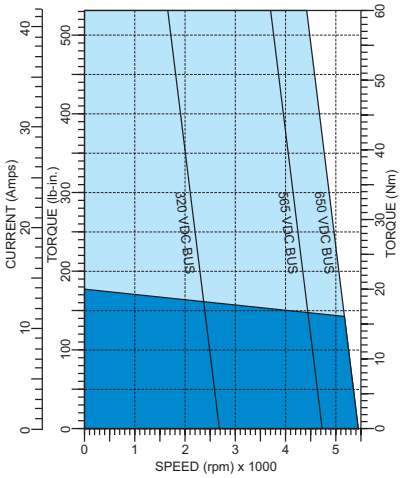



| Model number | | BSM100C-2250 | BSM100C-3150 | BSM100C-3250 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 88.5 | 125.7 | 125.7 |
| | Nm | 10 | 14.2 | 14.2 |
| Continuous current | amps | 4.97 | 11.4 | 6.9 |
| Peak torque | lb-in | 265.5 | 377 | 377 |
| | Nm | 30 | 42.6 | 42.6 |
| Peak current | amps | 12.7 | 29 | 17.7 |
| Thermal resistance | °C/watt | 0.84 | 0.8 | 0.8 |
| Thermal time constant | Min | 54 | 62 | 62 |
| Mechanical time constant | msec | 2.56 | 2 | 1.94 |
| Electrical time constant | msec | 6 | 7.62 | 7.86 |
| Rated speed @ 300 volts | rpm | 1200 | 2400 | 1200 |
| Rated speed @ 600 volts | rpm | 2400 | 4800 | 2400 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 20.9 | 12.9 | 21.2 |
| | Nm/amp | 2.36 | 1.46 | 2.4 |
| Voltage constant | Vpk/krpm | 201.9 | 125 | 205.3 |
| | Vrms/krpm | 142.8 | 88.4 | 145.2 |
| Resistance | ohms | 4.2 | 0.84 | 2.2 |
| Inductance | mH | 25.2 | 6.4 | 17.3 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.02991 | 0.04487 | 0.04487 |
| | Kg-cm$^2$ | 33.77 | 50.66 | 50.66 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 39/17.7 | 50/22.7 | 50/22.7 |

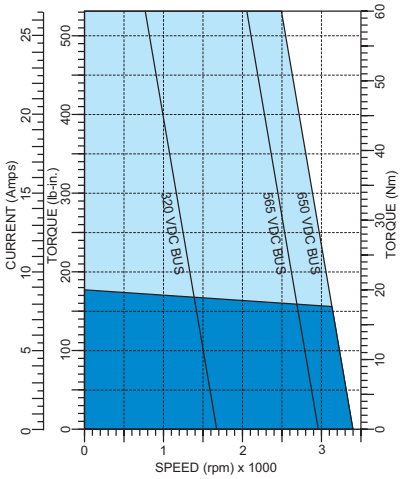
# AC servo motors
## BSM C-series performance curves



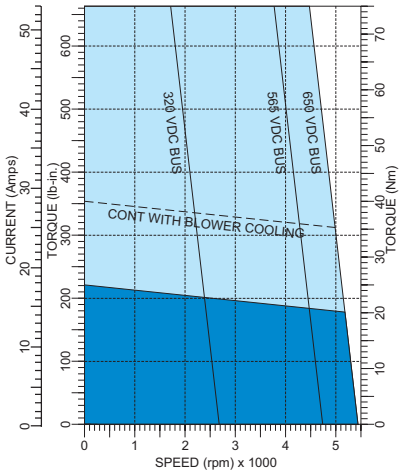
### BSM100C-4150




### BSM100C-4250




### BSM100C-5150



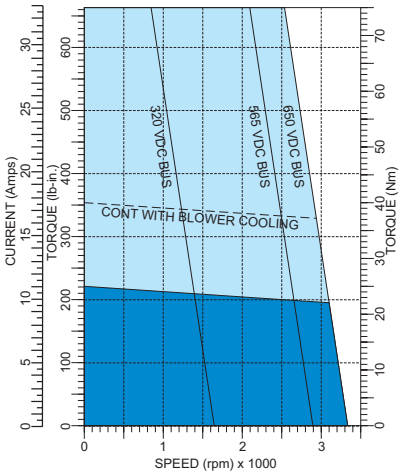

| Model number | | BSM100C-4150 | BSM100C-4250 | BSM100C-5150[1] |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 177 | 177 | 221.3 |
| | Nm | 20 | 20 | 25 |
| Continuous current | amps | 16.8 | 10.6 | 21 |
| Peak torque | lb-in | 531 | 531 | 663.8 |
| | Nm | 60 | 60 | 75 |
| Peak current | amps | 42.9 | 26.9 | 53.6 |
| Thermal resistance | °C/watt | 0.53 | 0.53 | 0.48 |
| Thermal time constant | Min | 70 | 70 | 77 |
| Mechanical time constant | msec | 2 | 2.06 | 1.8 |
| Electrical time constant | msec | 7.54 | 7.47 | 8.54 |
| Rated speed @ 300 volts | rpm | 2400 | 1200 | 2400 |
| Rated speed @ 600 volts | rpm | 4800 | 2400 | 4000 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 12.3 | 19.6 | 12.3 |
| | Nm/amp | 1.39 | 2.22 | 1.39 |
| Voltage constant | Vpk/krpm | 118.9 | 189.9 | 118.9 |
| | Vrms/krpm | 84.1 | 134.3 | 84.1 |
| Resistance | ohms | 0.57 | 1.5 | 0.41 |
| Inductance | mH | 4.3 | 11.2 | 3.5 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.05982 | 0.05982 | 0.07478 |
| | Kg-cm$^2$ | 67.54 | 67.54 | 84.43 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 59/26.8 | 59/26.8 | 70/31.8 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 60%.

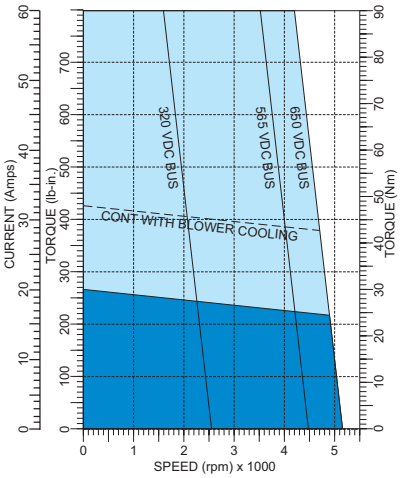
# AC servo motors
## BSM C-series performance curves



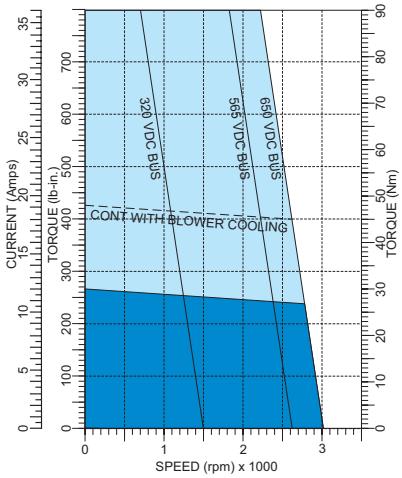
### BSM100C-5250




### BSM100C-6150




### BSM100C-6250



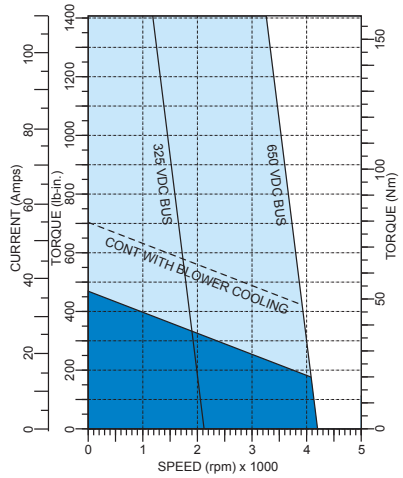

| Model number | | BSM100C-5250[1] | BSM100C-6150[1] | BSM100C-6250[1] |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 221.3 | 265.5 | 265.5 |
| | Nm | 25 | 30 | 30 |
| Continuous current | amps | 13 | 24 | 14.1 |
| Peak torque | lb-in | 663.8 | 796.5 | 796.5 |
| | Nm | 75 | 90 | 90 |
| Peak current | amps | 33.1 | 61.3 | 36 |
| Thermal resistance | °C/watt | 0.48 | 0.34 | 0.34 |
| Thermal time constant | Min | 77 | 85 | 85 |
| Mechanical time constant | msec | 1.77 | 2.15 | 1.96 |
| Electrical time constant | msec | 8.6 | 5.78 | 6 |
| Rated speed @ 300 volts | rpm | 1200 | 2000 | 1200 |
| Rated speed @ 600 volts | rpm | 2400 | 4000 | 2400 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 20 | 12.9 | 22.1 |
| | Nm/amp | 2.26 | 1.46 | 2.5 |
| Voltage constant | Vpk/krpm | 193.4 | 125 | 213.9 |
| | Vrms/krpm | 136.8 | 88.4 | 151.3 |
| Resistance | ohms | 1.07 | 0.37 | 1.2 |
| Inductance | mH | 9.2 | 2.6 | 7 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.07478 | 0.0897 | 0.0897 |
| | Kg-cm$^2$ | 84.43 | 101.27 | 101.27 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 70/31.8 | 81/36.8 | 81/36.8 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 60%.

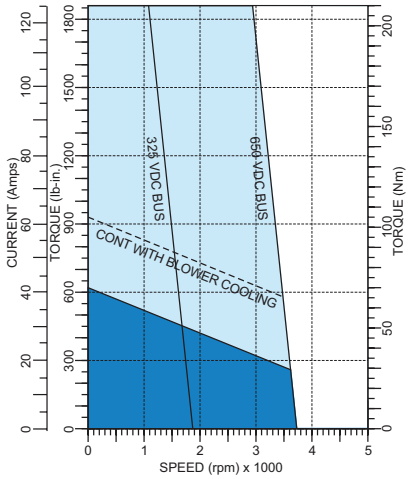
# AC servo motors
## BSM C-series performance curves



### BSM132C-3200AA




### BSM132C-4200AA



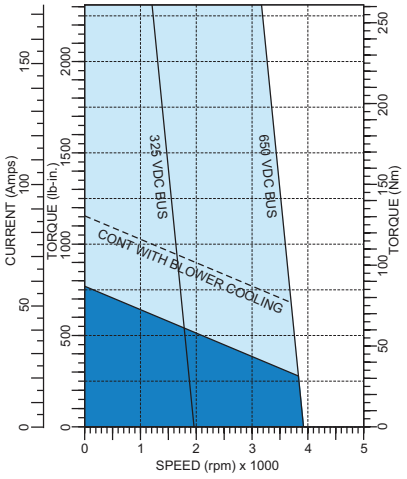

| Model number | | BSM132C-3200AA[1] | BSM132C-4200AA[1] |
|---|---|---|---|
| **General** | | | |
| Continuous stall torque | lb-in | 469.1 | 619.5 |
| | Nm | 53 | 70 |
| Continuous current | amps | 37 | 43 |
| Peak torque | lb-in | 1407 | 1859 |
| | Nm | 159 | 210 |
| Peak current | amps | 110 | 129 |
| Thermal resistance | °C/watt | 0.25 | 0.22 |
| Thermal time constant | Min | 112 | 116 |
| Mechanical time constant | msec | 1.67 | 1.66 |
| Electrical time constant | msec | 15.31 | 17.38 |
| Rated speed @ 600 volts | rpm | 3500 | 3500 |
| Rated speed @ 300 volts | rpm | 1800 | 1800 |
| **Electrical** | | | |
| Torque constant | lb-in/amp | 16 | 18 |
| | Nm/amp | 1.8 | 2.03 |
| Voltage constant | Vpk/krpm | 154.6 | 174 |
| | Vrms/krpm | 109.4 | 123 |
| Resistance | ohms | 0.26 | 0.21 |
| Inductance | mH | 3.98 | 3.65 |
| **Mechanical** | | | |
| Inertia | lb-in-s$^2$ | 0.185 | 0.287 |
| | Kg-cm$^2$ | 208.865 | 324.023 |
| Maximum speed | rpm | 5,000 | 5,000 |
| Number of motor poles | — | 8 | 8 |
| Weight | lbs/Kg | 119/54.1 | 123/55.9 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 45%.

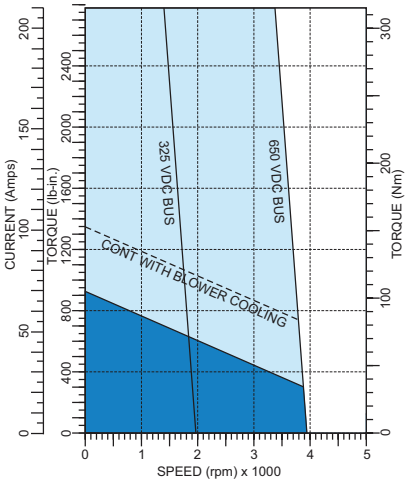
# AC servo motors
## BSM C-series performance curves



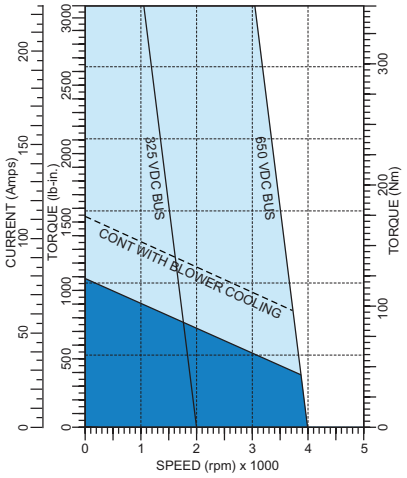
### BSM132C-5200AA




### BSM132C-6200AA




### BSM132C-7200AA



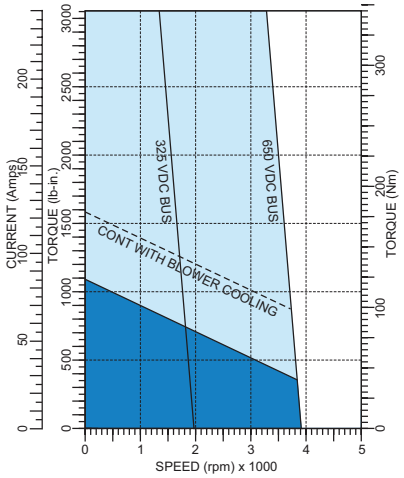

| Model number | | BSM132C-5200AA[1] | BSM132C-6200AA[1] | BSM132C-7200AA[1] |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 770 | 929.3 | 1008.9 |
| | Nm | 87 | 105 | 114 |
| Continuous current | amps | 58 | 71 | 75 |
| Peak torque | lb-in | 2310 | 2788 | 3027 |
| | Nm | 261 | 315 | 342 |
| Peak current | amps | 174 | 212 | 225 |
| Thermal resistance | °C/watt | 0.17 | 0.17 | 0.17 |
| Thermal time constant | Min | 120 | 124 | 128 |
| Mechanical time constant | msec | 2.91 | 2.03 | 1.22 |
| Electrical time constant | msec | 15.31 | 25.25 | 30.46 |
| Rated speed @ 300 volts | rpm | 1800 | 1800 | 1800 |
| Rated speed @ 600 volts | rpm | 3500 | 3500 | 3500 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 16.5 | 16.5 | 16.8 |
| | Nm/amp | 1.87 | 1.86 | 1.9 |
| Voltage constant | Vpk/krpm | 160.3 | 159.4 | 162.8 |
| | Vrms/krpm | 113.3 | 112.7 | 115.2 |
| Resistance | ohms | 0.26 | 0.16 | 0.087 |
| Inductance | mH | 3.98 | 3.99 | 2.65 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.345 | 0.392 | 0.448 |
| | Kg-cm$^2$ | 389.505 | 442.568 | 505.792 |
| Maximum speed | rpm | 5,000 | 5,000 | 5,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 148/67.3 | 172/78.2 | 191/86.8 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 45%.

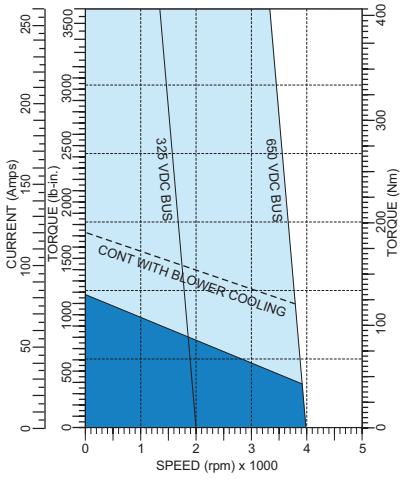
# AC servo motors
## BSM C-series performance curves



### BSM132C-8200AA




### BSM132C-9200AA



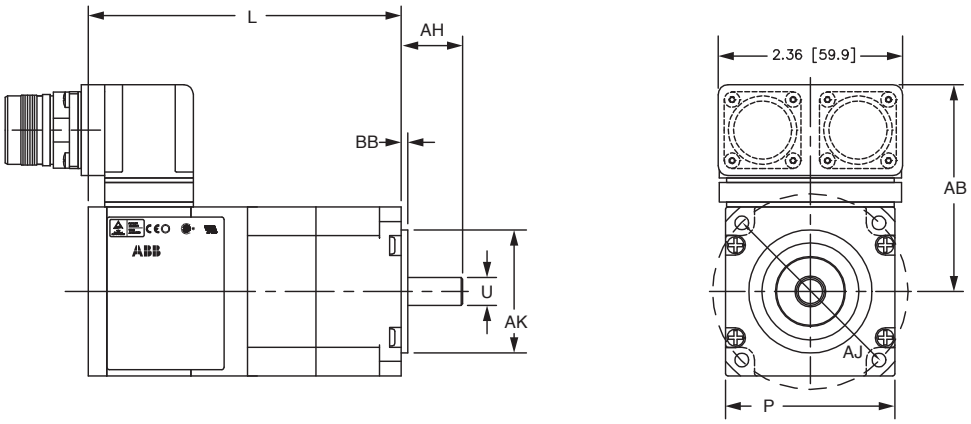

| Model number | | BSM132C-8200AA[1] | BSM132C-9200AA[1] |
|---|---|---|---|
| **General** | | | |
| Continuous stall torque | lb-in | 1097.4 | 1185.9 |
| | Nm | 124 | 134 |
| Continuous current | amps | 80 | 88 |
| Peak torque | lb-in | 3292 | 3558 |
| | Nm | 372 | 402 |
| Peak current | amps | 240 | 264 |
| Thermal resistance | °C/watt | 0.17 | 0.17 |
| Thermal time constant | Min | 132 | 136 |
| Mechanical time constant | msec | 1.08 | 1.18 |
| Electrical time constant | msec | 32.86 | 26.21 |
| Rated speed @ 300 volts | rpm | 1800 | 1800 |
| Rated speed @ 600 volts | rpm | 3500 | 3500 |
| **Electrical** | | | |
| Torque constant | lb-in/amp | 17.2 | 16.8 |
| | Nm/amp | 1.94 | 1.9 |
| Voltage constant | Vpk/krpm | 166.3 | 162.8 |
| | Vrms/krpm | 117.6 | 115.2 |
| Resistance | ohms | 0.07 | 0.066 |
| Inductance | mH | 2.3 | 1.73 |
| **Mechanical** | | | |
| Inertia | lb-in-s$^2$ | 0.513 | 0.57 |
| | Kg-cm$^2$ | 579.177 | 643.53 |
| Maximum speed | rpm | 5,000 | 5,000 |
| Number of motor poles | — | 8 | 8 |
| Weight | lbs/Kg | 210/95.5 | 229/104.1 |

[1] A blower option is available which will increase the motor's continuous stall torque by another 45%.

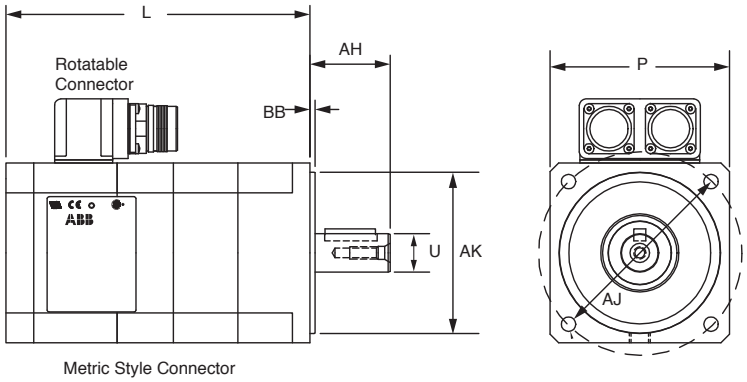
# AC servo motors
## BSM series dimensions - IEC mountings



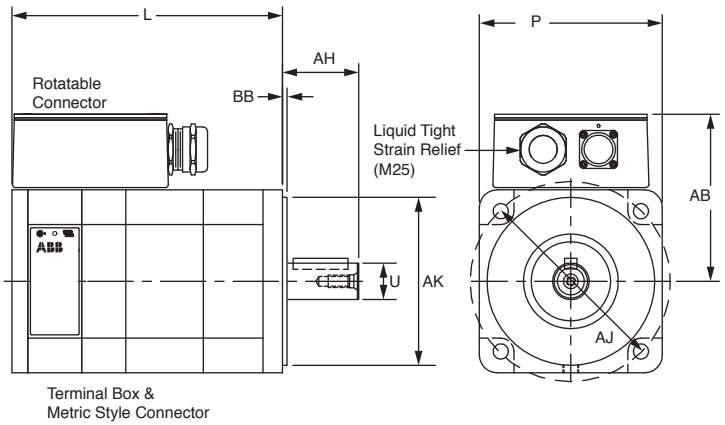
### BSM50 series



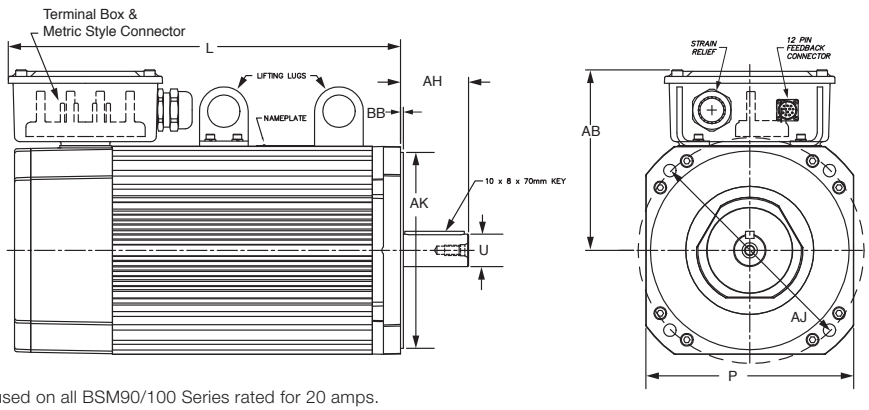

### BSM63/80 series




### BSM90/100 series




### BSM132 series




**Note:** M25 Strain Relief is used on all BSM90/100 Series rated for 20 amps.
Motors rated for greater than 20 amps should use M40 strain relief (P/N MCS-M40) and M40/M25 adaptor (P/N MCS-M40A). Shipped with cable assembly.
Rotatable connector not available on BSM50.

# AC servo motors
## BSM series dimensions - IEC mountings



### Dimensions in mm (inch)

| Motor code | P | AB | U | AH | Key | AJ | AK | BB |
|---|---|---|---|---|---|---|---|---|
| BSM50N | 55 (2.17) | 67 (2.64) | 9j6 (0.35) | 20 (0.78) | None | 4.5 (0.18) thru hole 63 (2.5) B.C. | 40j6 (1.5) | 2.5 (0.098) |
| BSM63N | 67 (2.6) | 65 (2.6) | 11j6 (0.43) | 23 (0.9) | 4x4x12 | 5.8 (0.23) thru hole 75 (3.0) B.C. | 60j6 (2.3) | 2.5 (0.098) |
| BSM80N/C | 89 (3.5) | 76 (3.0) | 19j6 (0.74) | 40 (1.5) | 6x6x25 | 7.0 (0.28) thru hole 100 (3.9) B.C. | 80j6 (3.1) | 3.0 (0.118) |
| BSM90N/C | 120 (4.7) | 109 (4.3) | 24j6 (0.94) | 50 (2.0) | 8x7x36 | 10 (0.39) thru hole 130 (5.1) B.C. | 110j6 (4.3) | 3.5 (0.138) |
| BSM100N/C | 146 (5.7) | 122 (4.8) | 28j6 (1.1) | 60 (2.3) | 8x7x50 | 12 (0.47) thru hole 165 (6.5) B.C. | 130j6 (5.1) | 3.5 (0.138) |
| BSM132C | 244 (9.6) | 212 (8.35) | 38 (1.49) | 80 (3.1) | 10x8x70 | 14.5 (0.57) thru hole 265 (10.4) B.C. | 230 (9) | 3.5 (0.138) |

| Length (without brake) | | | | | |
|---|---|---|---|---|---|
| Motor code | Resolver | Encoder | Motor code | Resolver | Encoder |
| BSM50N-1 | 101.7 (4.0) | 128.7 (5.07) | BSM80C-1 | 144.0 (5.67) | 144.0 (5.67) |
| BSM50N-2 | 127.1 (5.0) | 154.1 (6.07) | BSM80C-2 | 169.4 (6.67) | 169.4 (6.67) |
| BSM50N-3 | 152.5 (6.0) | 179.5 (7.07) | BSM80C-3 | 194.8 (7.67) | 194.8 (7.67) |
| BSM63N-1 | 115.8 (4.56) | 125.9 (4.96) | BSM80C-4 | 220.2 (8.67) | 220.2 (8.67) |
| BSM63N-2 | 141.2 (5.56) | 151.3 (5.96) | BSM90C-1 | 164.7 (6.49) | 164.7 (6.49) |
| BSM63N-3 | 166.6 (6.56) | 176.7 (6.96) | BSM90C-2 | 202.8 (7.99) | 202.8 (7.99) |
| BSM80N-1 | 150.7 (5.93) | 150.7 (5.93) | BSM90C-3 | 240.9 (9.49) | 240.9 (9.49) |
| BSM80N-2 | 182.5 (7.18) | 182.5 (7.18) | BSM90C-4 | 279.1 (10.99) | 279.1 (10.99) |
| BSM80N-3 | 214.2 (8.43) | 214.2 (8.43) | BSM100C-1 | 164.7 (6.49) | 164.7 (6.49) |
| BSM90N-1 | 177.4 (6.99) | 177.4 (6.99) | BSM100C-2 | 202.8 (7.99) | 202.8 (7.99) |
| BSM90N-2 | 228.2 (8.99) | 228.2 (8.99) | BSM100C-3 | 240.9 (9.49) | 240.9 (9.49) |
| BSM90N-3 | 279.0 (10.99) | 279.0 (10.99) | BSM100C-4 | 279.0 (10.99) | 279.0 (10.99) |
| BSM100N-1 | 203.1 (8.02) | 203.1 (8.02) | BSM100C-5 | 317.1 (12.49) | 317.1 (12.49) |
| BSM100N-2 | 253.9 (10.0) | 253.9 (10.0) | BSM100C-6 | 355.2 (13.99) | 355.2 (13.99) |
| BSM100N-3 | 304.7 (12.0) | 304.7 (12.0) | BSM132C-3 | 384 (15.12) | 384 (15.12) |
| BSM100N-4 | 355.5 (14.0) | 355.5 (14.0) | BSM132C-4 | 409.4 (16.12) | 409.4 (16.12) |
| | | | BSM132C-5 | 434.8 (17.12) | 434.8 (17.12) |
| | | | BSM132C-6 | 460.2 (18.12) | 460.2 (18.12) |
| | | | BSM132C-7 | 485.6 (19.12) | 485.6 (19.12) |
| | | | BSM132C-8 | 511 (20.12) | 511 (20.12) |
| | | | BSM132C-9 | 536.4 (21.12) | 536.4 (21.12) |

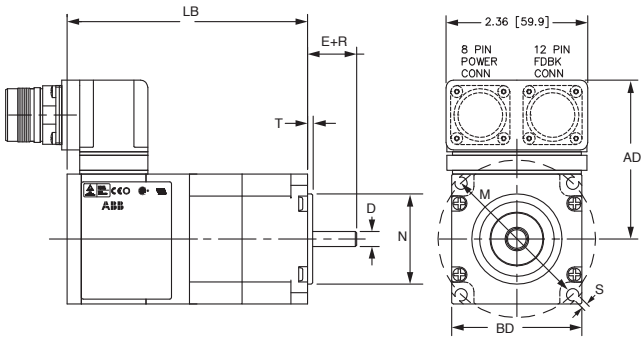
| | Brake motor length - adder | | Brake motor |
|---|---|---|---|
| Motor code | Resolver | Encoder | weight - adder |
| BSM50N | 36.1 (1.42) | 36.1 (1.42) | 0.84 lbs |
| BSM63N | 29.0 (1.14) | 43.18 (1.70) | 1.02 lbs |
| BSM80N/C | 27.2 (1.07) | 41.66 (1.64) | 2.18 lbs |
| BSM90N/C | 60.71 (2.39) | 60.71 (2.39) | 5.74 lbs |
| BSM100N/C | 40.64 (1.60) | 67.06 (2.64) | 8.77 lbs |
| BSM132C | 96.01 (3.78) | 96.01 (3.78) | 35.6 lbs |

**Note**: Standard configuration: All motors supplied with feedback device. Square mounting flange. The motors have a threaded hole on the shaft end. The BSM63 series is M4 x 0.7 threads (11mm deep). The BSM80 series is M6 x 1.0 threads (17 mm deep). The BSM90 series is M6 x 1.0 threads (17 mm deep). The BSM100 series is M10 x 1.5 threads (23 mm deep).
The BSM132 series is M12x1.5 threads (27 mm deep). Dimensions are for reference only and may change for other selected option. Detailed engineering drawings are available upon request.Contact ABB for dimensions with other feedback devices.

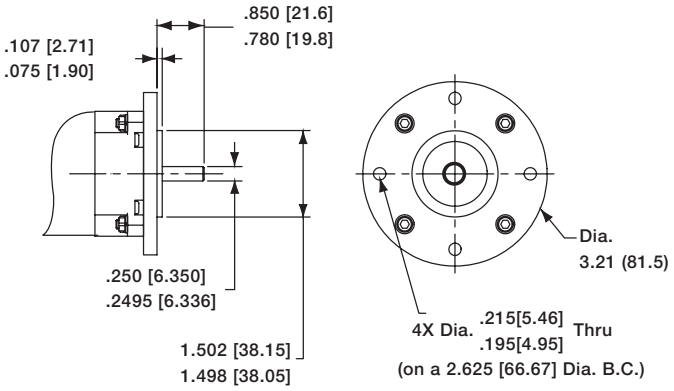
# AC servo motors
## BSM series dimensions - NEMA mountings



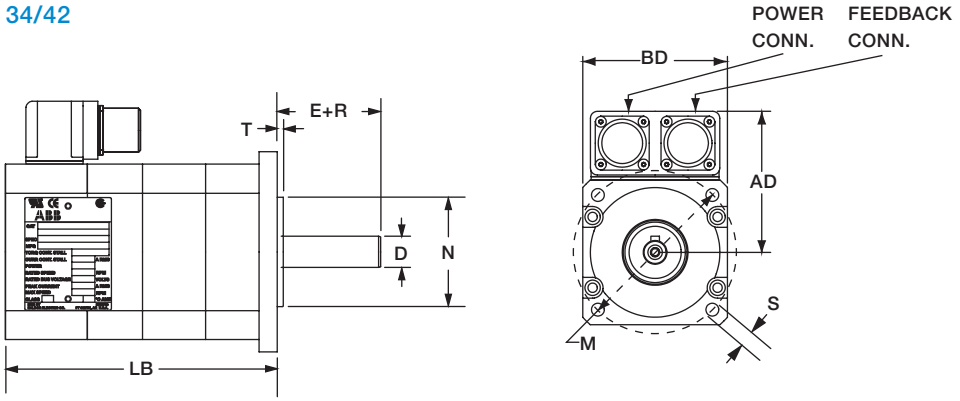
### BSM50 series NEMA 23



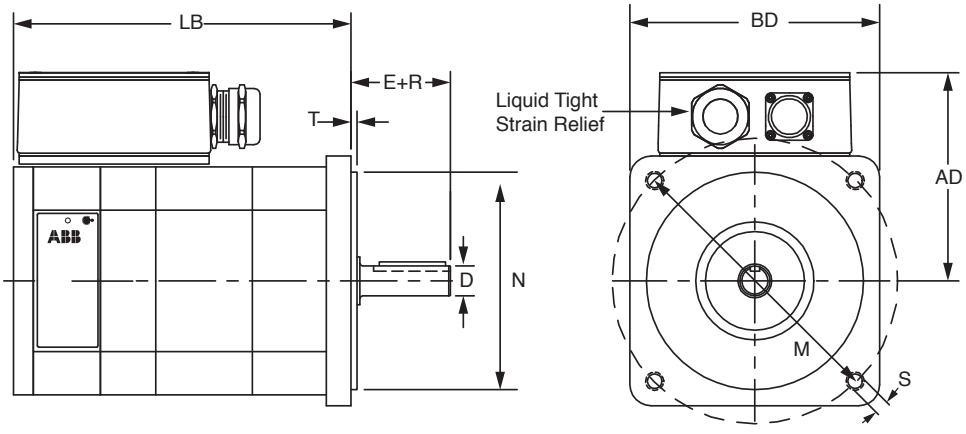

### Optional NEMA 23 mounting



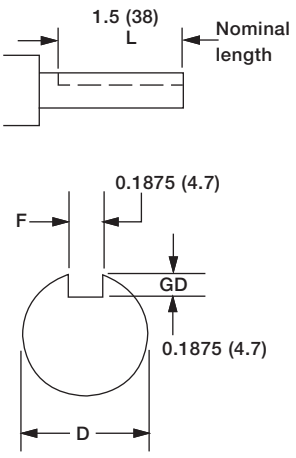

### BSM63/80 series NEMA 34/42




### BSM90/100 series NEMA 56




### NEMA key configuration




**Note:** Dimensions shown for BSM5NN, BSM6NN, BSM8NN, BSM8NC, BSM9NN, BSM9NC, 10NN, and 10NC (NEMA 23, 34,42, & 56). BSM5NN has no keyway as standard.

# AC servo motors
## BSM Series dimensions - NEMA mountings



### Dimensions in inch (mm)

| NEMA code | Motor code | BD | AD | D | E + R | M | S thru | N | T |
|---|---|---|---|---|---|---|---|---|---|
| 23 | BSM5NN | 2.2 (55) | 2.64 (67) | 0.25 (6.3) | 0.812 (20) | 2.625 (66.7) | 0.2 (5.1) Hole | 1.5 (38) | 0.10 (2.5) |
| 34 | BSM6NN | 3.14 (80) | 2.88 (73) | 0.375 (9.5) | 0.9 (22) | 3.875 (98.4) | 0.22 (5.6) Hole | 2.875 (73) | 0.10 (2.5) |
| 42 | BSM8NN | 4.0 (101) | 3.0 (76) | 0.625 (15) | 2.0 (52) | 4.95 (125.7) | 0.28 (7.1) Hole | 2.187 (55) | 0.10 (2.5) |
| 42 | BSM8NC | 4.0 (101) | 3.0 (76) | 0.625 (15) | 2.0 (52) | 4.95 (125.7) | 0.28 (7.1) Hole | 2.187 (55) | 0.10 (2.5) |
| 56 | BSM9NN | 5.17 (131) | 4.3 (108) | 0.625 (15) | 2.0 (52) | 5.875 (149.2) | 0.375-16 THD | 4.5 (114) | 0.10 (2.5) |
| 56 | BSM9NC | 5.17 (131) | 4.3 (108) | 0.625 (15) | 2.0 (52) | 5.875 (149.2) | 0.375-16 THD | 4.5 (114) | 0.13 (3.3) |
| 56 | BSM10NN | 5.75 (146) | 4.8 (122) | 0.625 (15) | 2.0 (52) | 5.875 (149.2) | 0.375-16 THD | 4.5 (114) | 0.13 (3.3) |
| 56 | BSM10NC | 5.75 (146) | 4.8 (122) | 0.625 (15) | 2.0 (52) | 5.875 (149.2) | 0.375-16 THD | 4.5 (114) | 0.13 (3.3) |

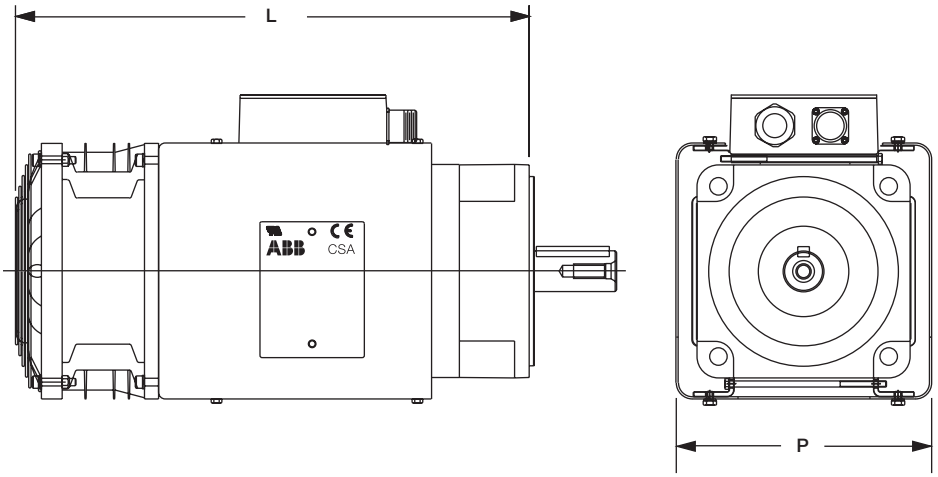
| NEMA code | Length - LB | | | Length - LB | | |
|---|---|---|---|---|---|---|
| | Motor code | Resolver | Encoder | Motor Code | Resolver | Encoder |
| 23 | BSM5NN-1 | 4.0 (101.7) | 5.07 (128.7) | — | — | — |
| | BSM5NN-2 | 5.0 (127.1) | 6.07 (154.1) | — | — | — |
| | BSM5NN-3 | 6.0 (152.5) | 7.07 (179.5 | — | — | — |
| 34 | BSM6NN-1 | 4.56 (115.8) | 5.33 (135.5) | — | — | — |
| | BSM6NN-2 | 5.56 (141.2) | 5.96 (151.3) | — | — | — |
| | BSM6NN-3 | 6.56 (166.6) | 6.96 (176.7) | — | — | — |
| 42 | BSM8NN-1 | 5.96 (151.3) | 5.96 (151.3) | BSM8NC-1 | 5.67 (144.0) | 5.69 (144.6) |
| | BSM8NN-2 | 7.21(183.0) | 7.21 (183.0) | BSM8NC-2 | 6.67 (169.0) | 6.69 (170.0) |
| | BSM8NN-3 | 8.46 (214.8) | 8.46 (214.8) | BSM8NC-3 | 7.67 (194.8) | 7.69 (195.4) |
| | - | - | - | BSM8NC-4 | 8.67 (220.2) | 8.69 (220.8) |
| 56 | BSM9NN-1 | 6.99 (177.4) | 6.99 (177.4) | BSM9NC-1 | 6.49 (164.7) | 6.49 (164.7) |
| | BSM9NN-2 | 8.99 (228.2) | 8.99 (228.2) | BSM9NC-2 | 7.99 (202.8) | 7.99 (202.8) |
| | BSM9NN-3 | 10.99 (279.0) | 10.99 (279.0) | BSM9NC-3 | 9.49 (240.9) | 9.49 (240.9) |
| | BSM10NN-1 | 8.02 (203) | 8.02 (203) | BSM10NC-1 | 6.49 (164.7) | 6.49 (164.7) |
| | BSM10NN-2 | 10.0 (253.9) | 10.0 (253.9) | BSM10NC-2 | 7.99 (202.8) | 7.99 (202.8) |
| | BSM10NN-3 | 12.0 (304.7) | 12.0 (304.7) | BSM10NC-3 | 9.49 (240.9) | 9.49 (240.9) |
| | BSM10NN-4 | 14.0 (355.5) | 14.0 (355.5) | BSM10NC-4 | 10.99 (279.0) | 10.99 (279.0) |
| | - | - | - | BSM10NC-5 | 12.49 (317.1) | 12.49 (317.1) |
| | - | - | - | BSM10NC-6 | 13.99 (355.2) | 13.99 (355.2) |

**Note**: Standard configuration: All motors are supplied with feedback device, NEMA mounting.
BSM 50/63/80 has two (2) threaded connectors for resolver and motor terminations.
BSM90/100 has one (1) threaded connector for resolver, termination of motor lead wires on terminal block.
Order mating cable assemblies/connectors as separate items.
Dimensions are for reference only. Detailed engineering drawings are available upon request.
Contact ABB for dimension with other feedback devices and configurations.
Motor identification/optional specifying information MUST include the code of “N" designating NEMA dimensions, i.e. “BSM8NN-XXX".
Contact ABB for other shaft dimensions.

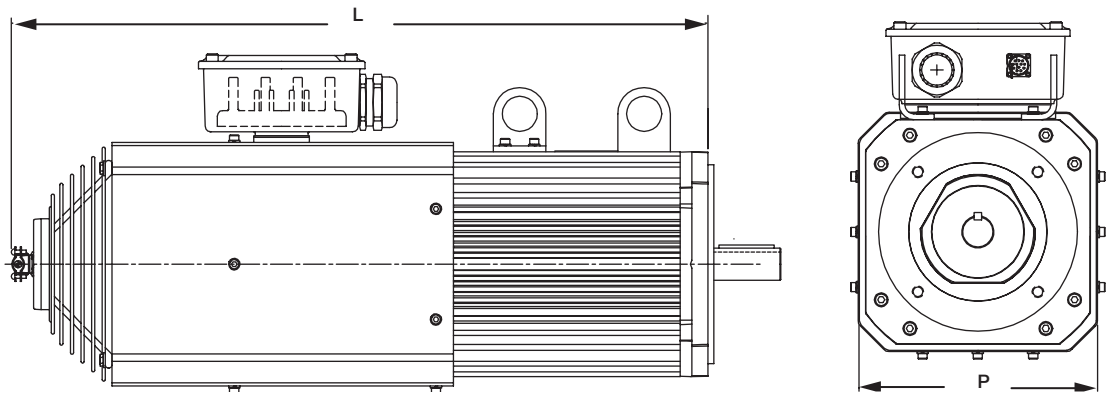
# AC servo motors



## BSM90/100 series




## BSM132 series




## Blower Volt/Amp

| Motor | Voltage | Amps | CFM |
|---|---|---|---|
| BSM90/100 | 115 VAC 1ø 50/60 Hz | 0.60 | 430 |
| | 230 VAC 1ø 50/60 Hz | 0.30 | 430 |
| | 24 Vdc | 2.10 | 470 |
| BSM132 | 230 VAC 3ø 60 Hz | 0.80 | |
| | 460 VAC 3ø 60 Hz | 0.40 | |

**Note**: Dimensions are for reference only.
Detailed engineering drawings available upon request. Order blower separately
BSM132 blower can not be installed on motor in the field. It must be specified when motor order is placed.

# AC servo motors
## BSM series - blower cooling option



### Blower Kits for use with BSM90/100 motors

| Motor code | | Blower kit number | | | P dimension | | L dimension | |
|---|---|---|---|---|---|---|---|---|
| | | 115 VAC 1Ø | 230 VAC 1Ø | 24 Vdc | mm | inch | mm | inch |
| BSM90N-2 | Motor | BSM90N-2FN-1 | BSM90N-2FN-8 | BSM90N-2FN-D | 175.5 | 6.91 | 381.8 | 15.03 |
| | Motor-brake | BSM90N-2FNB-1 | BSM90N-2FNB-8 | BSM90N-2FNB-D | 175.5 | 6.91 | 442.5 | 17.42 |
| BSM90N-3 | Motor | BSM90N-3FN-1 | BSM90N-3FN-8 | BSM90N-3FN-D | 175.5 | 6.91 | 432.6 | 17.03 |
| | Motor-brake | BSM90N-3FNB-1 | BSM90N-3FNB-8 | BSM90N-3FNB-D | 175.5 | 6.91 | 493.3 | 19.42 |
| BSM100N-3 | Motor | BSM100N-3FN-1 | BSM100N-3FN-8 | BSM100N-3FN-D | 175.5 | 6.91 | 453.5 | 17.85 |
| | Motor-brake | BSM100N-3FNB-1 | BSM100N-3FNB-8 | BSM100N-3FNB-D | 175.5 | 6.91 | 475.3 | 18.71 |
| BSM100N-4 | Motor | BSM100N-4FN-1 | BSM100N-4FN-8 | BSM100N-4FN-D | 175.5 | 6.91 | 504.3 | 19.85 |
| | Motor-brake | BSM100N-4FNB-1 | BSM100N-4FNB-8 | BSM100N-4FNB-D | 175.5 | 6.91 | 526.1 | 20.71 |
| BSM90C-2 | Motor | BSM90C-2FN-1 | BSM90C-2FN-8 | BSM90C-2FN-D | 175.5 | 6.91 | 356.4 | 14.03 |
| | Motor-brake | BSM90C-2FNB-1 | BSM90C-2FNB-8 | BSM90C-2FNB-D | 175.5 | 6.91 | 417.1 | 16.42 |
| BSM90C-3 | Motor | BSM90C-3FN-1 | BSM90C-3FN-8 | BSM90C-3FN-D | 175.5 | 6.91 | 394.5 | 15.53 |
| | Motor-brake | BSM90C-3FNB-1 | BSM90C-3FNB-8 | BSM90C-3FNB-D | 175.5 | 6.91 | 455.2 | 17.92 |
| BSM100C-3 | Motor | BSM100C-3FN-1 | BSM100C-3FN-8 | BSM100C-3FN-D | 175.5 | 6.91 | 391.1 | 15.4 |
| | Motor-brake | BSM100C-3FNB-1 | BSM100C-3FNB-8 | BSM100C-3FNB-D | 175.5 | 6.91 | 437.8 | 17.24 |
| BSM100C-4 | Motor | BSM100C-4FN-1 | BSM100C-4FN-8 | BSM100C-4FN-D | 175.5 | 6.91 | 429.2 | 16.9 |
| | Motor-brake | BSM100C-4FNB-1 | BSM100C-4FNB-8 | BSM100C-4FNB-D | 175.5 | 6.91 | 475.9 | 18.74 |
| BSM100C-5 | Motor | BSM100C-5FN-1 | BSM100C-5FN-8 | BSM100C-5FN-D | 175.5 | 6.91 | 467.3 | 18.4 |
| | Motor-brake | BSM100C-5FNB-1 | BSM100C-5FNB-8 | BSM100C-5FNB-D | 175.5 | 6.91 | 514 | 20.24 |
| BSM100C-6 | Motor | BSM100C-6FN-1 | BSM100C-6FN-8 | BSM100C-6FN-D | 175.5 | 6.91 | 505.4 | 19.9 |
| | Motor-brake | BSM100C-6FNB-1 | BSM100C-6FNB-8 | BSM100C-6FNB-D | 175.5 | 6.91 | 590.2 | 23.24 |

### Blower Kits for use with BSM132C motors

| Motor code | | Kit must be ordered with motor | P dimension | | L dimension | |
|---|---|---|---|---|---|---|
| | | 230/460 VAC 3Ø | mm | inch | mm | inch |
| BSM132C-3 | Motor | Factory fit option only. | 260.1 | 10.24 | 587.0 | 23.11 |
| | Motor-brake | | 260.1 | 10.24 | 683.0 | 26.89 |
| BSM132C-4 | Motor | | 260.1 | 10.24 | 612.4 | 24.11 |
| | Motor-brake | | 260.1 | 10.24 | 708.4 | 27.89 |
| BSM132C-5 | Motor | | 260.1 | 10.24 | 637.8 | 25.11 |
| | Motor-brake | | 260.1 | 10.24 | 733.8 | 28.89 |
| BSM132C-6 | Motor | | 260.1 | 10.24 | 663.2 | 26.11 |
| | Motor-brake | | 260.1 | 10.24 | 759.2 | 29.89 |
| BSM132C-7 | Motor | | 260.1 | 10.24 | 688.6 | 27.11 |
| | Motor-brake | | 260.1 | 10.24 | 784.6 | 30.89 |
| BSM132C-8 | Motor | | 260.1 | 10.24 | 714.0 | 28.11 |
| | Motor-brake | | 260.1 | 10.24 | 810.0 | 31.89 |
| BSM132C-9 | Motor | | 260.1 | 10.24 | 739.4 | 29.11 |
| | Motor-brake | | 260.1 | 10.24 | 835.4 | 32.89 |

# AC servo motors
## Stainless steel brushless servo



Our totally stainless steel SSBSM series of motors are designed for food, liquid, washdown, hygiene and harsh, corrosive environments. These motors are designed to handle IP67 and withstand 1500 psi (103 bar) washdown conditions. Offered in standard and low inertia designs for best machine inertial matching. Included in this quality design are Teflon stainless steel double-sealed bearings with Viton O-rings, environmental protected stator with premium moisture resistant wire, and internal thermal over temperature protection. The SSBSM products are designed to be durable - they are BISSC, UL, cUL and CE approved.

### Torque range low inertia models
- SSBSM50N 3.9-12 lb-in (0.45-1.3 Nm)
- SSBSM63N 13-18.5 lb-in (1.4-2 Nm)
- SSBSM80N 23-32 lb-in (2.5-3.6 Nm)

### Torque range standard inertia models
- SSBSM80C 8-30 lb-in (0.9-3.4 Nm)

**Construction -** All stainless steel provides protection in harsh environments and washdown conditions - 304 housing, 416 shaft

**Stator -** Reliable potted design provides environmental protection, high current spike protection and high voltage protection.

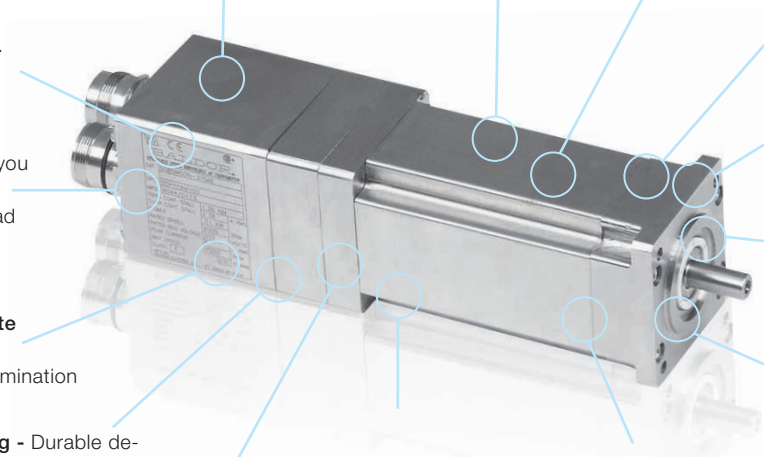
**Wire -** Premium 200°C moisture resistant, multi-coated copper wire - to improve your reliability

**Insulation -** UL rated for 130°C rise, and potted - to provide you with extra high insulation/safety

**BISSC/UL/CSA/CE -** Agency approvals - proven design, proven quality, proven reliability.

**Grease -** Exxon Polyrex EX Polyurea - proven to provide 4 times greater life - H1 bearing grease for incidental food contact.

**Internal Thermal protection -** to supply you with safeguards against overheating and overload conditions.



**FDA approved shaft seal**

**Laser etched nameplate**
- easy to clean
- protects against contamination

**Bearings -** Quality grade ball bearings - to provide you with dependability and long trouble free life.

**Motor housing -** Durable design to handle IP67 and harsh 1500 psi (103 bar) washdown conditions.

**Armature -** proven quality design - to supply superior performance for your application.

**Magnets -** High energy - provides very high resistance to demagnetization, so the motor always performs.

**Feedback -** Variety available: resolver, encoder, absolute encoder - choices for your application.

Stock and custom designs available. Optional holding brakes available. Typical BSM63/80 series shown.

# AC servo motors
## SSBSM-series

Our totally stainless steel SSBSM series of motors are designed for food, liquid, hygiene or corrosive environments. These motors are designed to handle IP67 applications and withstand 1500 psi washdown conditions. Included in this quality design are double sealed bearings and O-rings, environmentally protected stator design with premium moisture resistant wire, and internal thermal over temperature protection. The SSBSM products are designed to be durable - they are BISSC, UL, cUL and CE approved.



### Stainless steel brushless servo motors

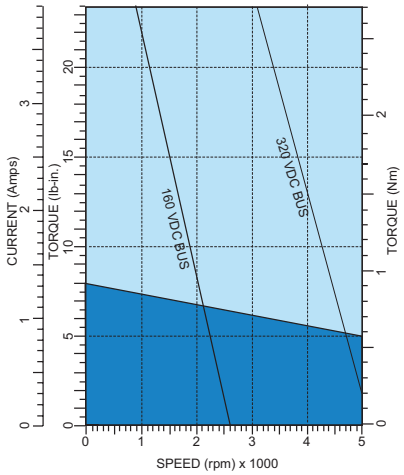
| Continuous stall torque | | Continuous stall amps | Speed RPM @ 320V | Motor catalog number | Motor inertia | |
|---|---|---|---|---|---|---|
| lb-in | Nm | | | | lb-in-s² | Kg-cm² |
| **Standard inertia stainless steel brushless servo motors - SSBSM C-series** | | | | | | |
| 8 | 0.9 | 1.5 | 4000 | SSBSM80C-175CX | 0.0016 | 1.81 |
| 17 | 1.9 | 2.6 | 4000 | SSBSM80C-275CX | 0.0033 | 3.73 |
| 25 | 2.8 | 5 | 4000 | SSBSM80C-375CX | 0.0049 | 5.54 |
| 30 | 3.4 | 5.3 | 4000 | SSBSM80C-475CX | 0.0066 | 7.45 |
| **Low inertia stainless steel brushless servo motors - SSBSM N-series** | | | | | | |
| 3.9 | 0.45 | 0.8 | 4000 | SSBSM50N-175CX | 0.00006 | 0.0677 |
| 7.9 | 0.9 | 1.4 | 4000 | SSBSM50N-275CX | 0.00011 | 0.124 |
| 12 | 1.3 | 2.4 | 4000 | SSBSM50N-375CX | 0.00016 | 0.18 |
| 13 | 1.4 | 1.9 | 4000 | SSBSM63N-275CX | 0.00034 | 0.384 |
| 18.5 | 2.0 | 2.8 | 4000 | SSBSM63N-375CX | 0.00050 | 0.564 |
| 23 | 2.5 | 3.1 | 4000 | SSBSM80N-275CX | 0.00162 | 1.82 |
| 32 | 3.6 | 4.28 | 4000 | SSBSM80N-375CX | 0.00223 | 2.51 |

**Note:** [1] Nominal rpm shown at 320 Vdc bus for convenience. For 640 Vdc double the speed. Reference motor table to verify that max speed is not exceeded.
[2] Stainless steel connectors rated for 20 amps. 3 For X callout, see motor ID matrix.

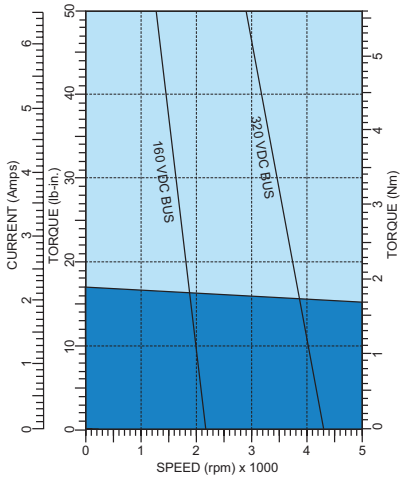
# AC servo motors
## SSBSM stainless series performance curves



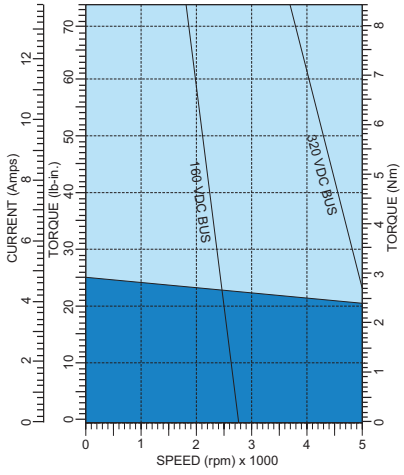
### SSBSM80C-175




### SSBSM80C-275




### SSBSM80C-375



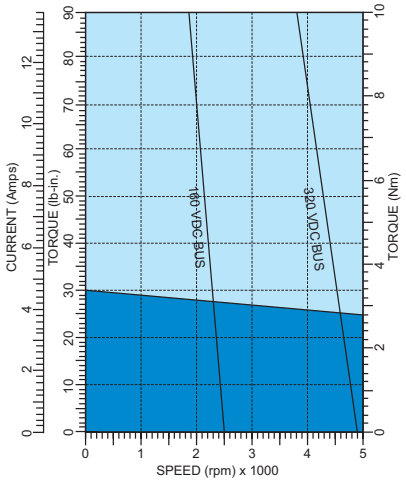

| Model number | | SSBSM80C-175 | SSBSM80C-275 | SSBSM80C-375 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 8 | 16.8 | 24.8 |
| | Nm | 0.9 | 1.9 | 2.8 |
| Continuous current | amps | 1.5 | 2.6 | 5 |
| Peak torque | lb-in | 23.9 | 50.4 | 74.3 |
| | Nm | 2.7 | 5.7 | 8.4 |
| Peak current | amps | 3.9 | 6.6 | 13.9 |
| Thermal resistance | °C/watt | 2.08 | 1.78 | 1.58 |
| Thermal time constant | Min | 19 | 23 | 28 |
| Mechanical time constant | msec | 5.96 | 3.54 | 2.7 |
| Electrical time constant | msec | 1.65 | 2.63 | 3.73 |
| Rated speed @ 300 volts | rpm | 4000 | 4000 | 4000 |
| Rated speed @ 160 volts | rpm | 2130 | 2130 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 6.5 | 7.7 | 6 |
| | Nm/amp | 0.73 | 0.87 | 0.67 |
| Voltage constant | Vpk/krpm | 62.5 | 74.5 | 57.5 |
| | Vrms/krpm | 44.2 | 52.7 | 40.7 |
| Resistance | ohms | 17.6 | 7.2 | 2.2 |
| Inductance | mH | 29.1 | 18.9 | 8.2 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0016 | 0.0033 | 0.0049 |
| | Kg-cm$^2$ | 1.81 | 3.73 | 5.53 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 12/5.5 | 15/6.8 | 18/8.2 |

(1) Maximum speed can be limited by bus volts and feedback types.

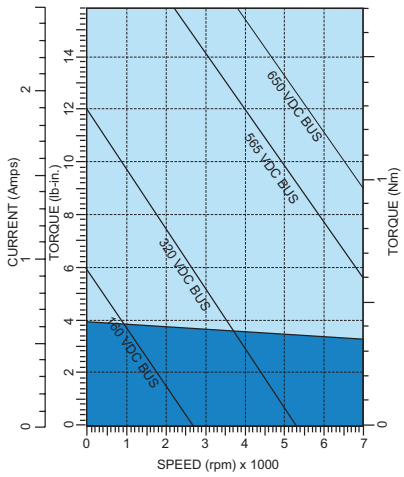
# AC servo motors
## SSBSM stainless series performance curves



### SSBSM80C-475




### SSBSM50N-175



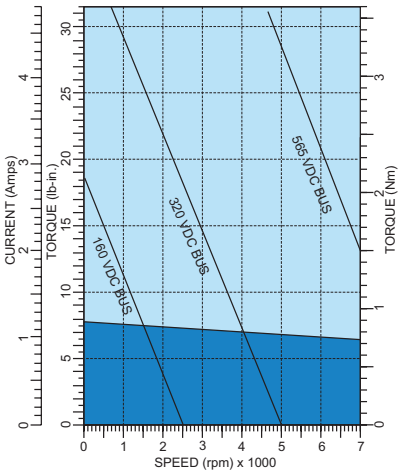

| Model number | | SSBSM80C-475 | SSBSM50N-175 |
|---|---|---|---|
| **General** | | | |
| Continuous stall torque | lb-in | 30.1 | 3.9 |
| | Nm | 3.4 | 0.45 |
| Continuous current | amps | 5.3 | 0.79 |
| Peak torque | lb-in | 90.3 | 15.9 |
| | Nm | 10.2 | 1.8 |
| Peak current | amps | 13.6 | 2.5 |
| Thermal resistance | °C/watt | 1.82 | 2.85 |
| Thermal time constant | Min | 32 | 7 |
| Mechanical time constant | msec | 2.42 | 0.6 |
| Electrical time constant | msec | 3.16 | 1.3 |
| Rated speed @ 300 volts | rpm | 4000 | 4000 |
| Rated speed @ 160 volts | rpm | 2130 | 2130 |
| **Electrical** | | | |
| Torque constant | lb-in/amp | 6.7 | 6.31 |
| | Nm/amp | 0.76 | 0.71 |
| Voltage constant | Vpk/krpm | 65.2 | 60.94 |
| | Vrms/krpm | 46 | 43.1 |
| Resistance | ohms | 1.9 | 47.5 |
| Inductance | mH | 6.2 | 63.5 |
| **Mechanical** | | | |
| Inertia | lb-in-s$^2$ | 0.0066 | 0.00006 |
| | Kg-cm$^2$ | 7.45 | 0.0677 |
| Maximum speed (1) | rpm | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 |
| Weight | lbs/Kg | 21/9.5 | 5/2.3 |

(1) Maximum speed can be limited by bus volts and feedback types.

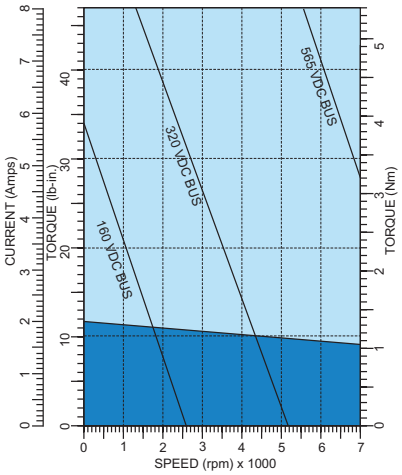
# AC servo motors
## SSBSM stainless series performance curves



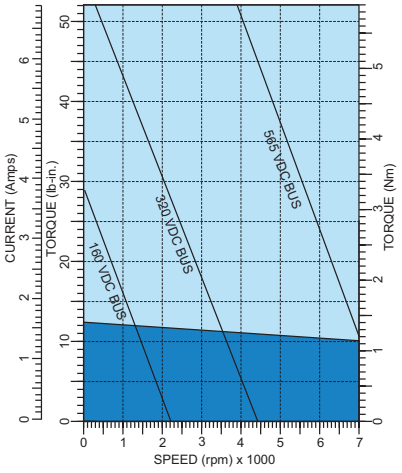
### SSBSM50N-275




### SSBSM50N-375




### SSBSM63N-275



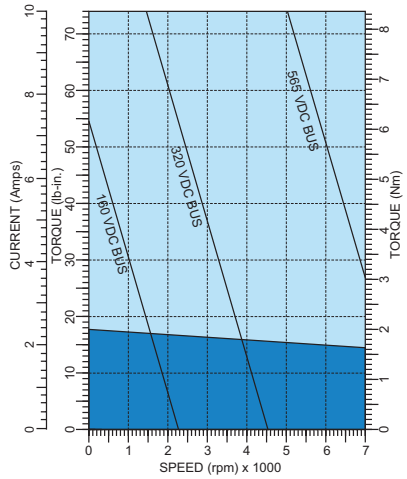

| Model number | | SSBSM50N-275 | SSBSM50N-375 | SSBSM63N-275 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 7.9 | 12 | 13 |
| | Nm | 0.9 | 1.3 | 1.4 |
| Continuous current | amps | 1.4 | 2.4 | 1.9 |
| Peak torque | lb-in | 32 | 48 | 52 |
| | Nm | 3.6 | 5.4 | 5.9 |
| Peak current | amps | 4.8 | 8 | 6.9 |
| Thermal resistance | °C/watt | 2.76 | 1.77 | 2.08 |
| Thermal time constant | Min | 11 | 19 | 19 |
| Mechanical time constant | msec | 0.35 | 0.29 | 0.62 |
| Electrical time constant | msec | 2.1 | 1.8 | 2.1 |
| Rated speed @ 300 volts | rpm | 4000 | 4000 | 4000 |
| Rated speed @ 160 volts | rpm | 2130 | 2130 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 6.6 | 6.4 | 7.47 |
| | Nm/amp | 0.75 | 0.72 | 0.84 |
| Voltage constant | Vpk/krpm | 64.34 | 61.9 | 72.1 |
| | Vrms/krpm | 45.5 | 43.8 | 51 |
| Resistance | ohms | 16 | 8.5 | 11.6 |
| Inductance | mH | 33.2 | 16 | 24.7 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00011 | 0.00016 | 0.00034 |
| | Kg-cm$^2$ | 0.124 | 0.18 | 0.384 |
| Maximum speed (1) | rpm | 10,000 | 10,000 | 10,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 5.75/2.6 | 6.5/2.9 | 8/3.6 |

(1) Maximum speed can be limited by bus volts and feedback types.

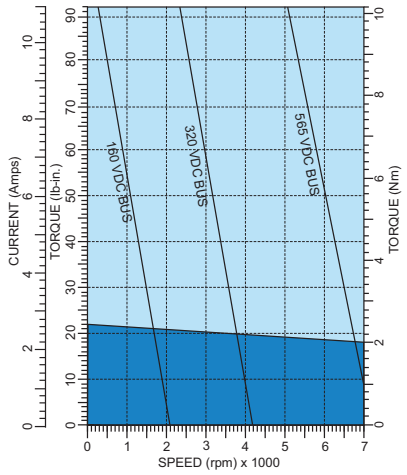
# AC servo motors
## SSBSM stainless series performance curves



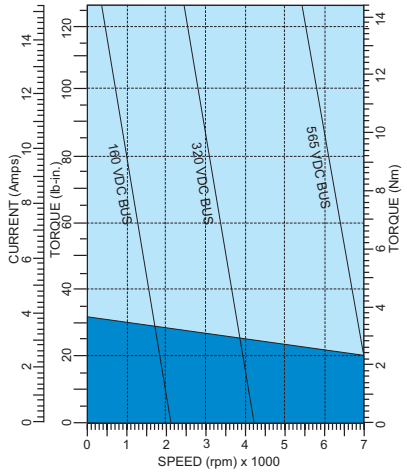
### SSBSM63N-375




### SSBSM80N-275




### SSBSM80N-375



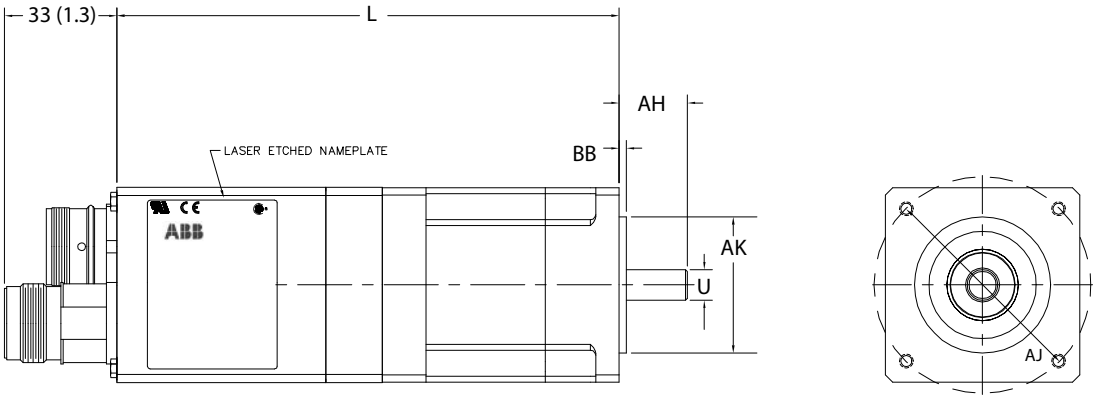

| Model number | | SSBSM63N-375 | SSBSM80N-275 | SSBSM80N-375 |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 18.5 | 23 | 32 |
| | Nm | 2 | 2.5 | 3.6 |
| Continuous current | amps | 2.8 | 3.1 | 4.3 |
| Peak torque | lb-in | 74 | 92 | 128 |
| | Nm | 8.4 | 10.4 | 14.5 |
| Peak current | amps | 10 | 11.2 | 15.4 |
| Thermal resistance | °C/watt | 1.87 | 2.82 | 2.02 |
| Thermal time constant | Min | 23 | 28 | 34 |
| Mechanical time constant | msec | 0.5 | 0.72 | 0.69 |
| Electrical time constant | msec | 2.3 | 3.9 | 4.2 |
| Rated speed @ 300 volts | rpm | 4000 | 4000 | 4000 |
| Rated speed @ 160 volts | rpm | 2130 | 2130 | 2130 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 7.2 | 8 | 8 |
| | Nm/amp | 0.82 | 0.9 | 0.9 |
| Voltage constant | Vpk/krpm | 70.2 | 77.3 | 77.4 |
| | Vrms/krpm | 49.7 | 54.7 | 54.7 |
| Resistance | ohms | 5.92 | 3.2 | 2.22 |
| Inductance | mH | 13.65 | 12.73 | 9.3 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.0005 | 0.00162 | 0.00223 |
| | Kg-cm$^2$ | 0.564 | 1.82 | 2.51 |
| Maximum speed (1) | rpm | 10,000 | 7,000 | 7,000 |
| Number of motor poles | — | 4 | 4 | 4 |
| Weight | lbs/Kg | 9/4.0 | 15.5/7 | 18.5/8.4 |

(1) Maximum speed can be limited by bus volts and feedback types.

# AC servo motors
## Stainless steel brushless servo motors
## SSBSM series dimensions - IEC mountings

3

### SSBSM50/63/80 series




### Dimensions in mm (inch)

| Motor code | P | U | AH | Key | AJ | AK | BB |
|---|---|---|---|---|---|---|---|
| SSBSM50N | 57 (2.25) | 9 (0.35) | 20 (0.78) | NONE | 4.5 (0.18) thru hole 63 (2.5) B.C. | 40 (1.5) | 2.5 (0.098) |
| SSBSM63N | 69 (2.72) | 11 (0.43) | 23 (0.9) | 4x4x12 | 5.8 (0.23) thru hole 75 (3.0) B.C. | 60 (2.3) | 2.5 (0.098) |
| SSBSM80C/N | 91.3 (3.59) | 19 (0.74) | 40 (1.5) | 6x6x25 | 7.0 (0.28) thru hole 100 (3.9) B.C. | 80 (3.1) | 3.0 (0.118) |

| | Length - L | | | Length - L | |
|---|---|---|---|---|---|
| Motor code | Resolver | Encoder | Motor code | Resolver | Encoder |
| SSBSM50N-1 | 147.4 (5.80) | 147.4 (5.80) | SSBSM80C-1 | 156.2 (6.15) | 156.2 (6.15) |
| SSBSM50N-2 | 172.8 (6.80) | 172.8 (6.80) | SSBSM80C-2 | 181.6 (7.15) | 181.6 (7.15) |
| SSBSM50N-3 | 198.2 (7.80) | 198.2 (7.80) | SSBSM80C-3 | 207.0 (8.15) | 207.0 (8.15) |
| SSBSM63N-2 | 180.9 (7.12) | 180.9 (7.12) | SSBSM80C-4 | 232.4 (9.15) | 232.4 (9.15) |
| SSBSM63N-3 | 206.3 (8.12) | 206.3 (8.12) | | | |
| SSBSM80N-2 | 194.3 (7.65) | 194.3 (7.65) | | | |
| SSBSM80N-3 | 226.1 (8.90) | 226.1 (8.90) | | | |

| | Brake motor length - adder | | Brake motor |
|---|---|---|---|
| Motor code | Resolver | Encoder | weight - adder |
| SSBSM50N | 37.3 (1.47) | 37.3 (1.47) | 0.84 lbs |
| SSBSM63N | 46.2 (1.82) | 46.2 (1.82) | 1.02 lbs |
| SSBSM80N/C | 44.7 (1.76) | 44.7 (1.76) | 2.18 lbs |

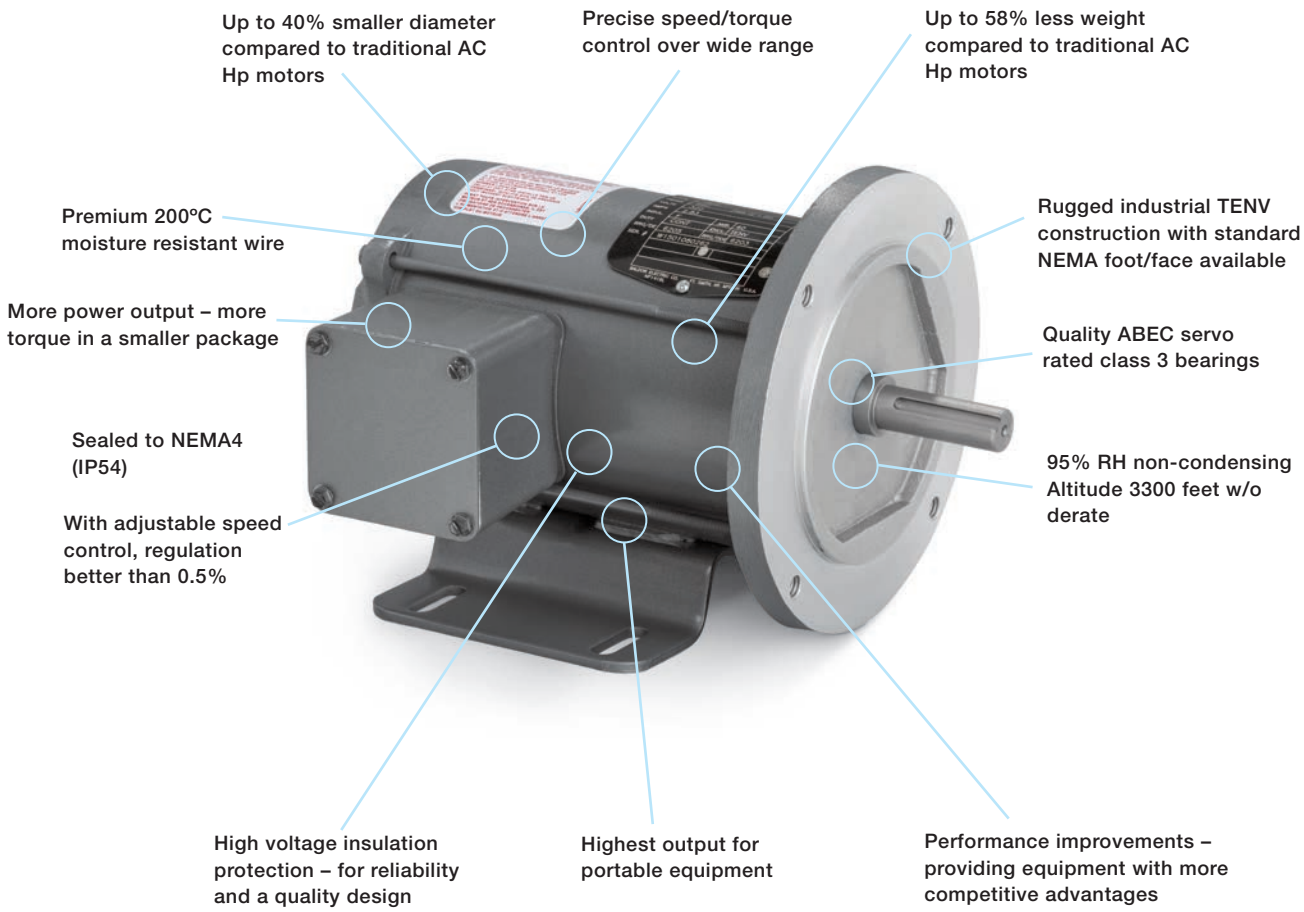
**Note:** Standard configuration: All motors supplied with feedback device. Square mounting flange.
SSBSM 50/63/80 has two (2) threaded connectors for feedback and motor terminations.
Order mating cable assemblies/connectors as separate items.
The motors have a threaded hole on the shaft end. The SSBSM63 series is M4 x 0.7 threads (11mm deep). The SSBSM80 series is M6 x 1.0 threads (17 mm deep).
Contact ABB for dimensions with other feedback devices.

# AC servo motors
## Brushless motors BSM 25 & 33 series

The BSM 25 and 33 series provide a durable round housing design that has the capability of a foot mounting. Using our standard reliable Neodymium magnet design, many applications, especially adjustable speed applications, can now make use of brushless technology benefits – less maintenance, quieter operation, faster acceleration, higher torque and power output. Although introduced with Hall sensor feedback for adjustable speed applications, the BSM25 and BSM33 series are available with a wide variety of feedback devices to suit demanding servo application needs.



### Torque range
- BSM25 1/4 - 1/2 HP – 18-23 lb-in (2-2.6 Nm)
- BSM33 1/2 - 3 HP – 27 - 138 lb-in (3-15.6 Nm)




Typical BSM33 series shown

# AC servo motors
## BSM 25 & 33 series

The BSM 25/33 series allows many applications to make use of the advantages of brushless technology, including higher torque in smaller packages, quieter operation, and less maintenance. They have a continous stall torque range from 18.6 lb-in (2Nm) to 138 lb-in (15.6 Nm) with available peak torques of 3 times continuous. This series will increase productivity while providing reliability and durability. It provides equipment with more competitive advantages in your market.



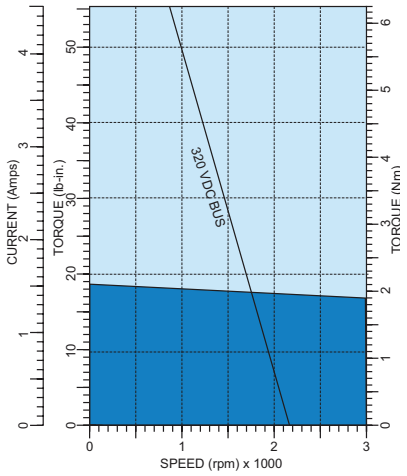
### Brushless motors – BSM 25 & 33 series

| Continuous stall torque | | Continuous stall amps | Speed RPM @ 320V[1] | HP @ 1800 RPM | Motor number[2] | Motor inertia | |
|---|---|---|---|---|---|---|---|
| lb-in | Nm | | | | | lb-in-s$^2$ | Kg - cm$^2$ |
| 18.6 | 2.1 | 1.5 | 1800 | 1/4 HP | BSM25C-1177MHC | 0.00241 | 2.72 |
| 23.0 | 2.6 | 1.90 | 1800 | 1/2 HP | BSM25C-2177MHC | 0.0028 | 3.16 |
| 27.4 | 3.1 | 2.55 | 1800 | 1/2 HP | BSM33C-2177MHQ | 0.00374 | 4.22 |
| 35.4 | 4 | 3.16 | 1800 | 1 HP | BSM33C-3177MHQ | 0.00536 | 6.05 |
| 79.7 | 9 | 6.47 | 1800 | 1.5 | BSM33C-4177MHQ | 0.01033 | 11.66 |
| 99.1 | 11.2 | 9.15 | 1800 | 2 HP | BSM33C-5177MHQ | 0.01212 | 13.68 |
| 138.1 | 15.6 | 14.23 | 1800 | 3 HP | BSM33C-6177MHQ | 0.01859 | 20.99 |

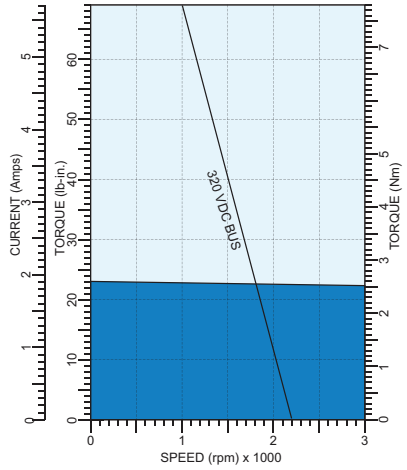
**Note**: [1] Nominal rpm shown at 320 Vdc bus for convenience. For 640 Vdc double the speed. Reference motor table to verify that max speed is not exceeded.
[2] Moters shown with these options for convenience: H = Hall Sensor, C = Round face only, Q = Foot & Round Face.
For other options see BSM25/33 ID matrix under engineering information.

# AC servo motors
## BSM 25 & 33 series performance curves

### BSM25C-1177MHC




### BSM25C-2177MHC



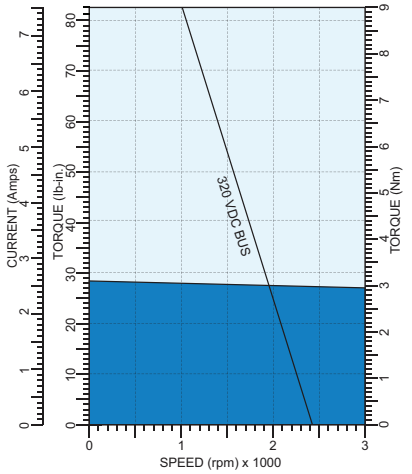

| Model number | | BSM25C-1177MHC | BSM25C-2177MHC |
|---|---|---|---|
| **General** | | | |
| Continuous stall torque | lb-in | 18.6 | 23 |
| | Nm | 2.1 | 2.6 |
| Continuous current | amps | 1.5 | 1.9 |
| Peak torque | lb-in | 55.8 | 69 |
| | Nm | 6.3 | 7.8 |
| Peak current | amps | 4.5 | 5.7 |
| Thermal resistance | °C/watt | 1.44 | 1.24 |
| Thermal time constant | Min | 24 | 26.2 |
| Mechanical time constant | msec | 2.38 | 2.1 |
| Electrical time constant | msec | 3.98 | 3.73 |
| Rated speed @ 300 volts | rpm | 1800 | 1800 |
| Rated speed @ 160 volts | rpm | 900 | 900 |
| **Electrical** | | | |
| Torque constant | lb-in/amp | 15.5 | 15.1 |
| | Nm/amp | 1.75 | 1.71 |
| Voltage constant | Vpk/krpm | 150 | 146.5 |
| | Vrms/krpm | 106.1 | 103.6 |
| Resistance | ohms | 26.7 | 19.4 |
| Inductance | mH | 106.3 | 72.3 |
| **Mechanical** | | | |
| Inertia | lb-in-s$^2$ | 0.00241 | 0.0028 |
| | Kg-cm$^2$ | 2.72 | 3.16 |
| Maximum speed | rpm | 7,000 | 7,000 |
| Number of motor poles | — | 4 | 4 |
| Weight | lbs/Kg | 11.1/5.0 | 14.4/6.5 |

# AC servo motors

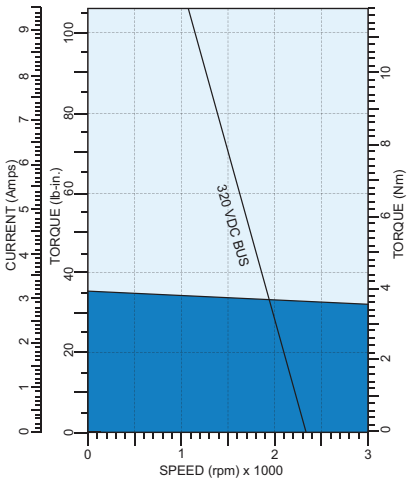
## BSM 25 & 33 series performance curves



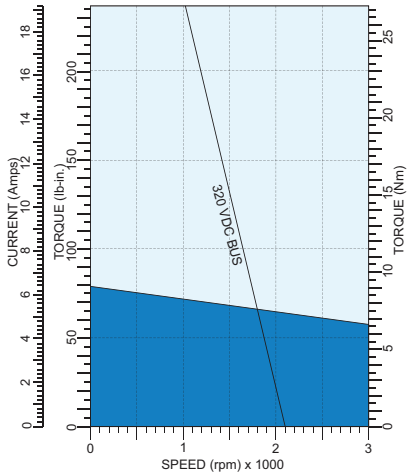
### BSM33C-2177MHQ




### BSM33C-3177MHQ



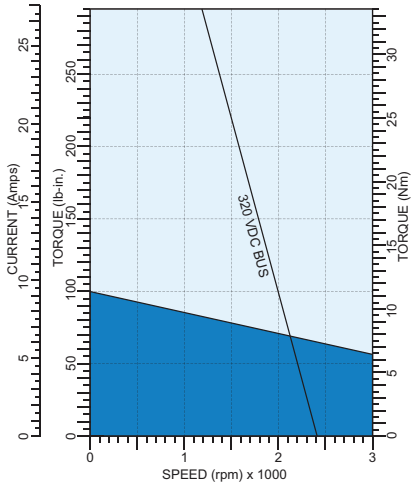

### BSM33C-4177MHQ



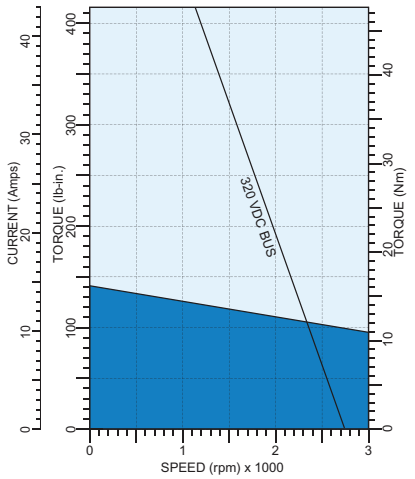

| Model number | | BSM33C-2177MHQ | BSM33C-3177MHQ | BSM33C-4177MHQ |
|---|---|---|---|---|
| **General** | | | | |
| Continuous stall torque | lb-in | 27.4 | 35.4 | 79.7 |
| | Nm | 3.1 | 4 | 9 |
| Continuous current | amps | 2.55 | 3.16 | 6.47 |
| Peak torque | lb-in | 82.3 | 106.2 | 239 |
| | Nm | 9.3 | 12 | 27 |
| Peak current | amps | 7.6 | 9.5 | 19.4 |
| Thermal resistance | °C/watt | 1.17 | 1.1 | 0.69 |
| Thermal time constant | Min | 27.8 | 29.5 | 33.9 |
| Mechanical time constant | msec | 2.09 | 1.92 | 1.16 |
| Electrical time constant | msec | 3.81 | 4.37 | 5.75 |
| Rated speed @ 300 volts | rpm | 1800 | 1800 | 1800 |
| Rated speed @ 160 volts | rpm | 900 | 900 | 900 |
| **Electrical** | | | | |
| Torque constant | lb-in/amp | 13.5 | 14 | 15.4 |
| | Nm/amp | 1.52 | 1.58 | 1.74 |
| Voltage constant | Vpk/krpm | 131.5 | 136.3 | 151.3 |
| | Vrms/krpm | 93 | 96.4 | 107 |
| Resistance | ohms | 11.4 | 7.88 | 3.37 |
| Inductance | mH | 45.7 | 34.4 | 17.2 |
| **Mechanical** | | | | |
| Inertia | lb-in-s$^2$ | 0.00374 | 0.00536 | 0.01033 |
| | Kg-cm$^2$ | 4.22 | 6.05 | 11.66 |
| Maximum speed | rpm | 7,000 | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 | 8 |
| Weight | lbs/Kg | 14.9/6.8 | 17.3/7.9 | 25.3/11.5 |

# AC servo motors
## BSM 25 & 33 series performance curves

### BSM33C-5177MHQ




### BSM33C-6177MHQ

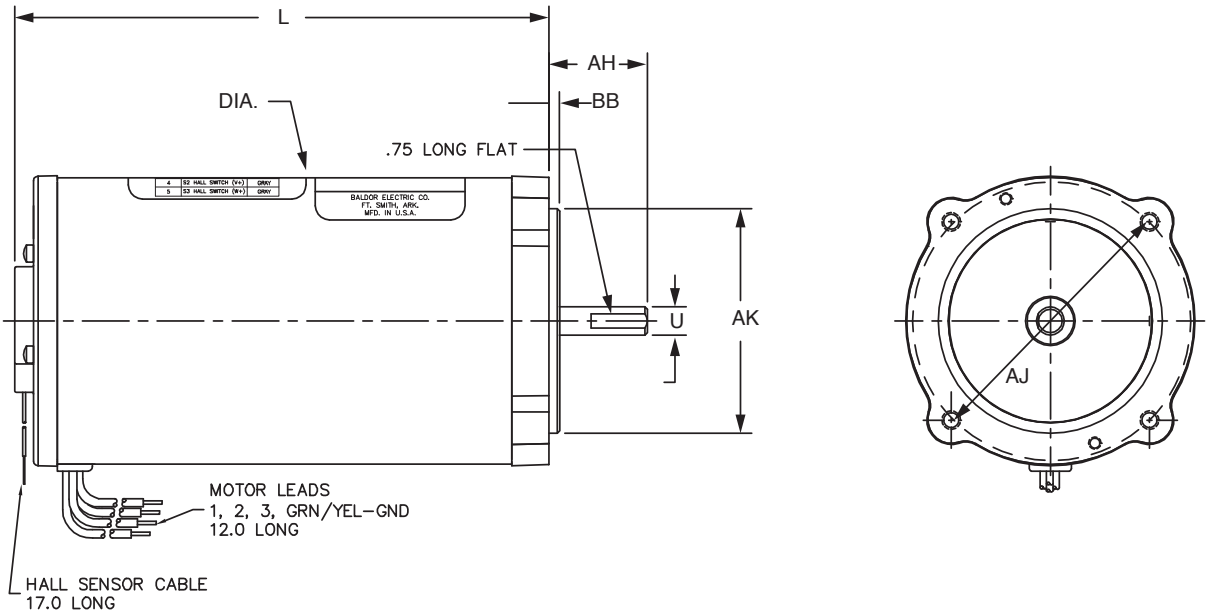



| Model number | | BSM33C-5177MHQ | BSM33C-6177MHQ |
|---|---|---|---|
| **General** | | | |
| Continuous stall torque | lb-in | 99.1 | 138.1 |
| | Nm | 11.2 | 15.6 |
| Continuous current | amps | 9.15 | 14.23 |
| Peak torque | lb-in | 297.4 | 414.2 |
| | Nm | 33.6 | 46.8 |
| Peak current | amps | 27.5 | 42.7 |
| Thermal resistance | °C/watt | 0.52 | 0.52 |
| Thermal time constant | Min | 39.8 | 59.5 |
| Mechanical time constant | msec | 1.2 | 0.9 |
| Electrical time constant | msec | 5.83 | 6.8 |
| Rated speed @ 300 volts | rpm | 1800 | 1800 |
| Rated speed @ 160 volts | rpm | 900 | 900 |
| **Electrical** | | | |
| Torque constant | lb-in/amp | 13.5 | 12.1 |
| | Nm/amp | 1.53 | 1.37 |
| Voltage constant | Vpk/krpm | 131.1 | 117.4 |
| | Vrms/krpm | 92.7 | 83 |
| Resistance | ohms | 2.04 | 1.0 |
| Inductance | mH | 11.9 | 5.2 |
| **Mechanical** | | | |
| Inertia | lb-in-s$^2$ | 0.01212 | 0.01859 |
| | Kg-cm$^2$ | 13.68 | 20.99 |
| Maximum speed | rpm | 7,000 | 7,000 |
| Number of motor poles | — | 8 | 8 |
| Weight | lbs/Kg | 30.4/13.8 | 40.2/18.3 |

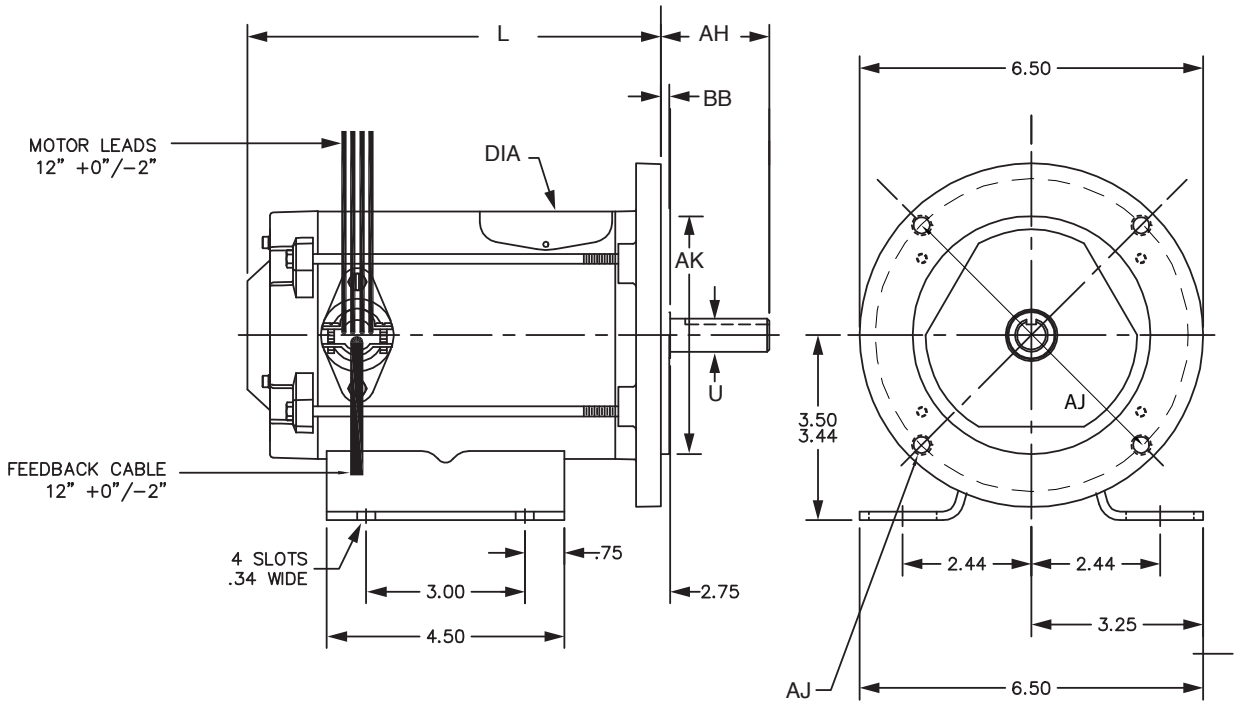
# AC servo motors
## BSM25 & 33 motors dimensions - NEMA mountings



### BSM25 series




### BSM33 series



# AC servo motors
## BSM25/33 series dimensions - NEMA dimensions

### Dimensions in inch (mm)

| Motor code | Configuration | Body dia | U | AH | Key | AJ | AK | BB |
|---|---|---|---|---|---|---|---|---|
| BSM25C | 42C face | 3.88 (98.5) | 0.375 (9.5) | 1.31 (33.2) | 0.75 | 4x 1/4-20 UNC-2B on a 3.75 B.C. | 3 (76.2) | 0.14 (3.5) |
| BSM33C | 56C face | 4.66 (118) | 0.625 (15.8) | 2.05 (52.07) | 0.19 x 1.38 | 4x 0.38-16 tap on 5.875 B.C. | 4.5 (114) | 0.13 (3.3) |

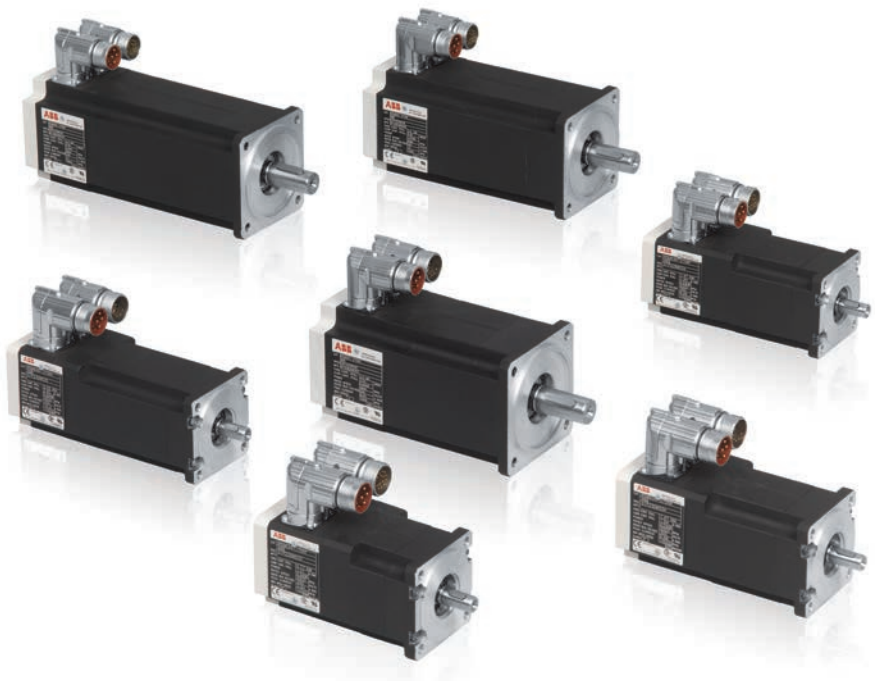
| Motor code | Length - L | | |
|---|---|---|---|
| | Hall | Encoder | Resolver |
| BSM25C–1 | 6.64 (169) | – | – |
| BSM25C–2 | 7.1 (180) | – | – |
| BSM33C–2 | 7.8 (198) | 8.56 (217) | 7.8 (198) |
| BSM33C–3 | 7.8 (198) | 8.56 (217) | 7.8 (198) |
| BSM33C–4 | 10.1 (257) | 10.81 (275) | 10.1 (257) |
| BSM33C–5 | 13.1 (333) | 13.81 (351) | 13.1 (333) |
| BSM33C–6 | 13.1 (333) | 13.81 (351) | 13.1 (333) |



**Note:** Standard configuration: All motors supplied with Hall sensors and flying leads..
BSM25 has NEMA 42C face; power leads 12" (304mm); Hall sensor leads 17" (431mm)
BSM33 has NEMA 56C face/foot; power leads 12" (304mm); Hall sensor leads 12" (304)
Dimensions are for reference only and may change for other selected options. Detailed engineering drawings available upon request

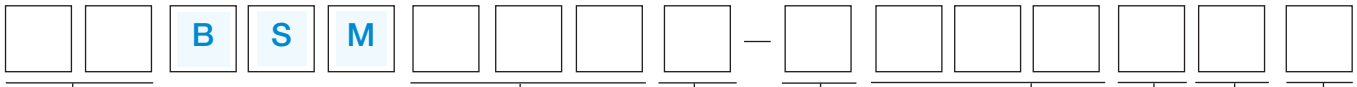
# AC servo motors
## Engineering information





# AC servo motors

## Brushless servo motor identification matrix N and C series




Blank = Std
SS = Stainless steel

Note: Not all options are available on all motors. Contact your local District Office.

**Frame**

| IEC | NEMA |
|---|---|
| 50 | 5N |
| 63 | 6N |
| 80 | 8N |
| 90 | 9N |
| 100 | 10 N |
| 132 | |

**Series**

N
C

**Motor size**

1
2
3
4

**Winding code**

50
75
etc.



### Motor options

| Description | Connections | | | | |
|---|---|---|---|---|---|
| | Standard (metric) threaded style | Cables[6] | Optional (inch) quick connect | Flying leads[6] | Rotate-able (metric) threaded[9] |
| Motor (no shaft seal) | A | E | I | M | R |
| Motor and brake | B | F | J | N | S |
| Motor with shaft oil seal | C | G | K | O | T |
| Motor with brake & shaft oil seal | D | H | L | P | U |

### Feedback options

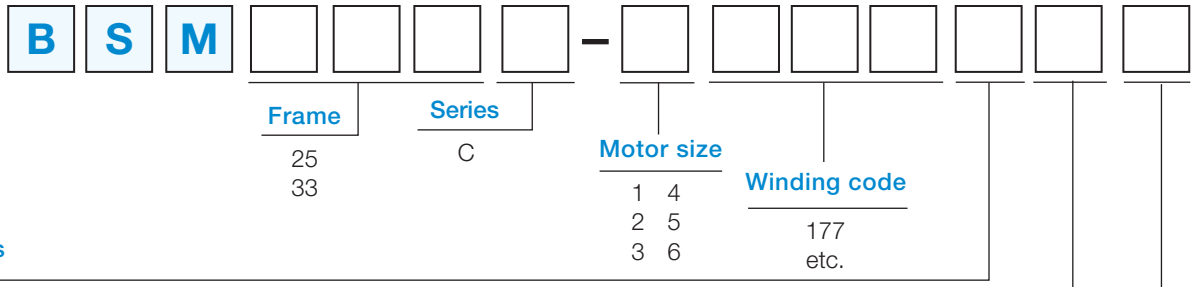
- A = Resolver
- B = Absolute encoder – single-turn (BiSS)
- B2 = Absolute encoder – multi-turn (BiSS)
- D = Absolute encoder – multi-turn (EnDat)
- D2 = Absolute encoder – single-turn (EnDat)
- D3 = Absolute encoder – single-turn (Hiperface)
- D4 = Absolute encoder – multi-turn (Hiperface)
- S1 = Absolute encoder – single-turn (SSI)
- S2 = Absolute encoder – multi-turn (SSI)
- E = Incremental encoder w/ commutation (1000 ppr)
- F = Incremental encoder w/ commutation (2500 ppr)
- H = Halls only
- V = Encoder mounting only
- Y = Resolver mounting only

### Accessory options

- Blank = No option
- M = No keyway
- N = DIN 42955-R
- O = DIN 42955-R & no keyway
- P = Optional motor connector on BSM 90/100 (Note: This option available only if current less than 28 amps)
- X = Special option (order by spec no. only)
- Z1 = Blower (115 VAC) (not available on all motors)
- Z2 = Blower (230 VAC) (not available on all motors)
- Z3 = Blower (24 Vdc)
- Z4 = Blower (230/460 VAC) for BSM132 only.

**Note:** [1] The standard BSM50/63/80 series includes feedback, two threaded connectors for feedback and motor terminations, square mounting flange.
[2] The standard BSM90/100 series includes, one threaded connector for feedback termination, termination of motor lead wires on terminal block, square mounting flange.
[3] BSM motors do not have shaft seal as standard. BSM motors are IP54. Motors will meet IP55 with shaft oil seal.
[4] SSBSM motors available with IEC mounting and include as standard a shaft seal. SSBSM motors are IP67.
[5] The standard BSM50 series has as standard no keyway.
[6] Shielded cables and flying leads are one meter long as standard. Flying leads option is composed of individual wires with no armored protection.
[7] Order motor power and feedback cable assemblies as separate items.
[8] Motors may be used with 115/230/400/460 volt controls. Verify that maximum speed is not exceeded.
[9] Rotatable connectors not available on BSM50-series. Standard rotatable on models up to BSM100 available (only if current is less than 28 amps). BSM132 requires a larger connector.
[10] Pricing for NEMA versions 5N, 6N, 8N, 9N, and 10N is the same as IEC versions 50, 63, 80, 90, and 100.
[11] Contact your local ABB district office for special options.

# AC servo motors
## Brushless motors




### Motor options

| Description | Connections | | |
|---|---|---|---|
| | Flying leads | Rotatable feedback connector and motor terminal box | Conduit Box |
| Motor (no shaft seal) | M | R | A |
| Motor and brake | N | S | B |
| Motor with shaft oil seal | O | T | C |
| Motor with brake and shaft oil seal | P | U | D |

### Feedback options

H = Halls
A = Resolver
E = Incremental encoder w/ commutation (1000 ppr)
F = Incremental encoder w/ commutation (2500 ppr)
N = No feedback

### Accessory options

Q = Foot and round face
C = Round face only
F = Foot mount
C1 = 33 frame only IEC flange MTG
C2 = 33 frame only IEC face MTG

# AC servo motors

## Speed – torque curves how to read motor performance curves

We have provided the following curves in order to simplify the process of selecting both a motor and control for a specific application. The following paragraphs explain how the information in these curves should be interpreted.

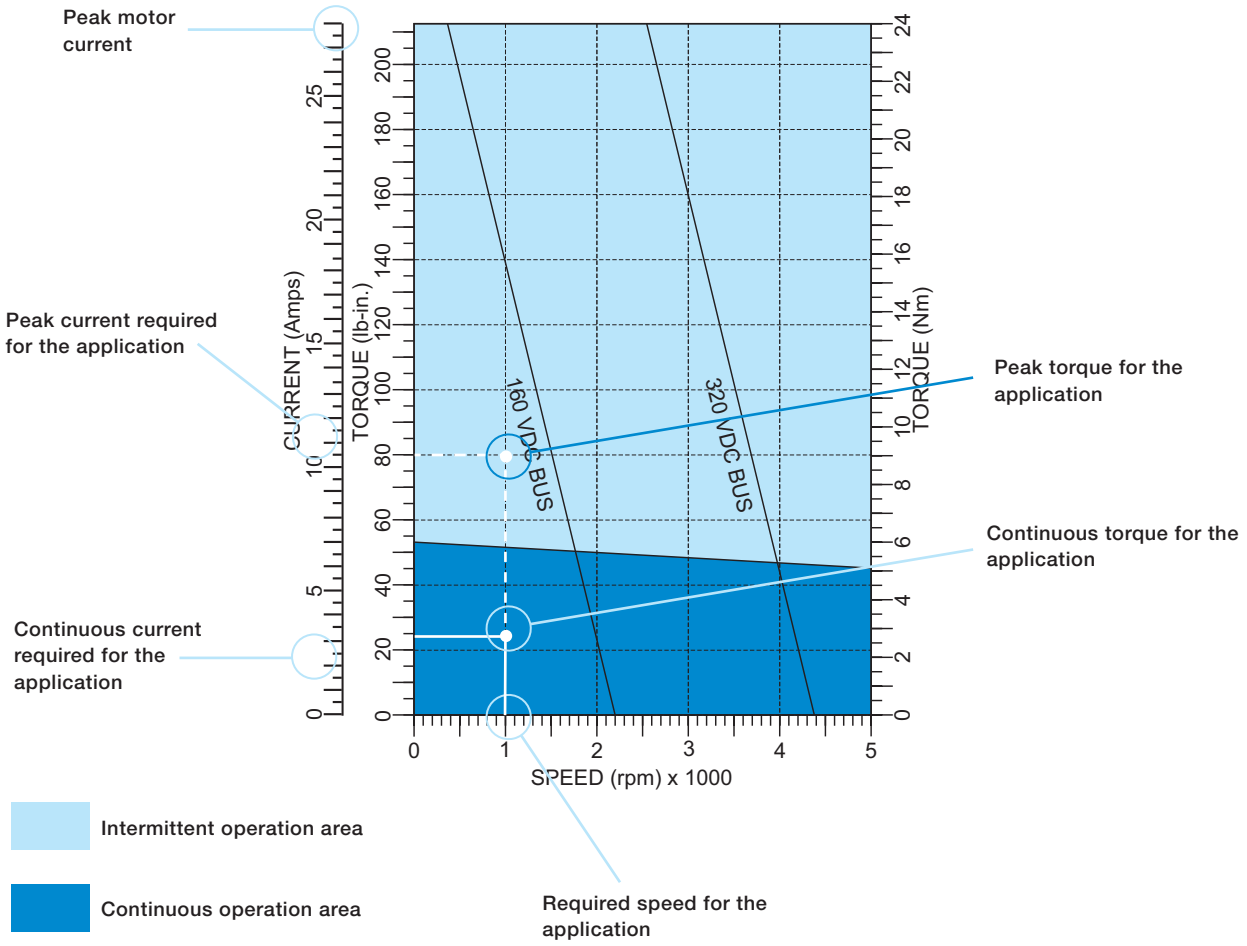
In constant speed applications, motors are defined in terms of horsepower or kilowatts (which is torque at a base speed). Servo motors normally operate over a wide speed range. The curves show continuous torque (defined as torque which will not overheat the motor), and peak torque (defined as intermittent acceleration torque).

It is also necessary to know the current and voltage required for the motor to operate. The curves have a scale that shows current required for any torque, and voltage required for any speed.

As an example, an application requires a continuous torque of 25 lb-in (2.8 Nm) at a speed of 1000 RPM. The peak torque required for acceleration is 80 lb-in (9 Nm).

This curve shows that the motor will work in this application. The bus voltage required is 160Vdc. The continuous and peak currents required is 3.5 and 12 amps.





# AC servo motors
## How to interpret motor information

### "Rated" voltage/speed
"Rated" conditions refer to measurement points, and are selected as an easy and convenient "reference" or "measurement" point. Manufacturers select a "rated voltage", operate with a "rated torque", to verify that "rated speed" is reached.

Note that any voltage may be applied to the BSM series of brushless servo motors so either 160 Vdc, 300 Vdc, or 650 Vdc may be applied. However the design limits must be observed. And those are: 1) maximum speed (rpm) limit, 2) demagnetization (max torque/current) limit, and 3) 650 Vdc maximum.

### Motor data
All BSM motors are 3-phase WYE connected. Connection is important because the motor/feedback is phase sensitive. All motor parameters are expressed as phase to phase (line-to-line) figures. This includes voltage constant, resistance and inductance.



The phase to phase voltage constant (back-emf) is a sinusoidal wave, which is measured while driving the motor (as a generator) at 1000 rpm, and measuring the output voltage. The peak of this measured output voltage is shown in the literature as Vpk/krpm; the RMS of the output voltage is Vrms/krpm.

Some data in the motor tables are expressed as "cold" figures (25°C), while others are "hot" (155°C) values. The cold figures are: voltage constant, torque constant, resistance, inductance, peak torque and peak current. The hot figures are: continuous stall torque continuous stall current.

The temperature coefficient between cold and hot voltage constant (and torque constant) is 0.90 for N-series, 0.80 for C-series and 0.85 for BSM132 series. Motor resistance changes by a factor of 1.5 from 25°C to 155°C.

### Motor temperature
The BSM series of servo motors are rated for a maximum continuous winding temperature of 155°C. These conditions are ploted in a 25°C ambient on the motor speed-torque curves. For operation at 40°C ambient derate by 6%.

The temperature rise of the motor windings depends upon the amount of torque which is being delivered to the load. In this brochure, the thermal limit line (line dividing dark and light shaded areas on the speed-torque curves) indicates the 155°C limit.

Temperature range - normal operating range of bearing grease is - 29°C to 155°C.

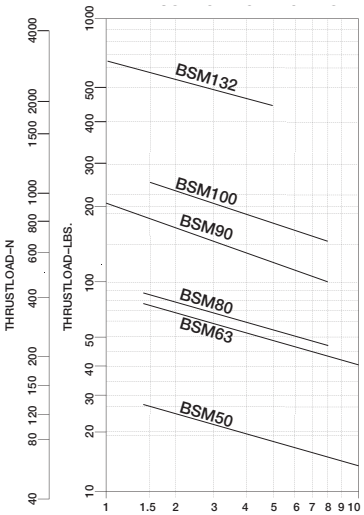
Altitude - the motors are rated for operation at 1000m or lower; derate 10% per 1000m.

The BSM motors include an internal thermal switch (bi-metallic) which is normally closed. It opens at 155°C ±5°. This switch may be connected to the input of a motion controller, programmable logic device, or other type of machine control via an isolating relay. Any of these devices could then sense this switch and shut power down when the thermal switch opens.

# AC servo motors

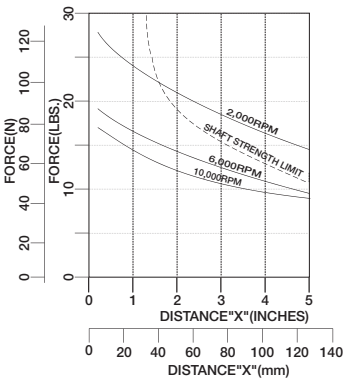
## Thrust load capacity

Brushless servo motors
Thrust load capacities

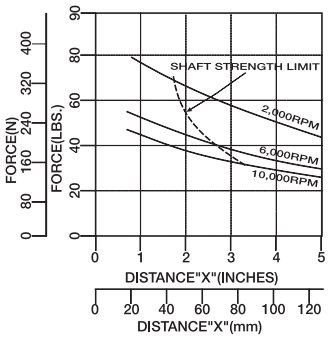



## Radial load capacity

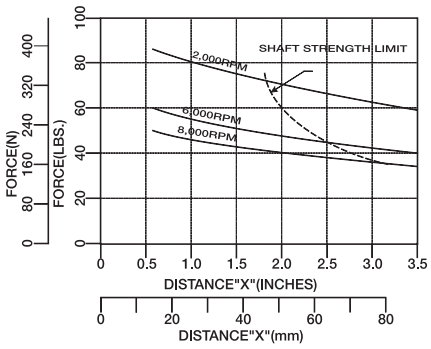
BSM50



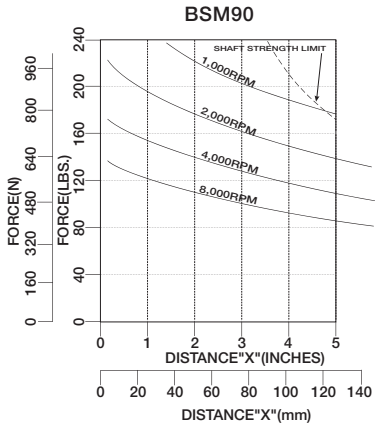

BSM63



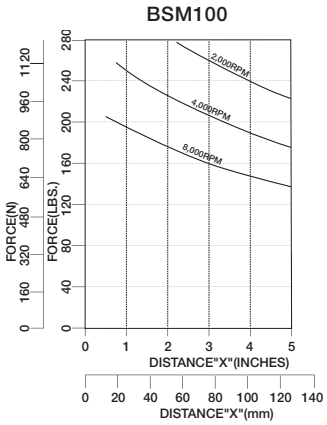

BSM80



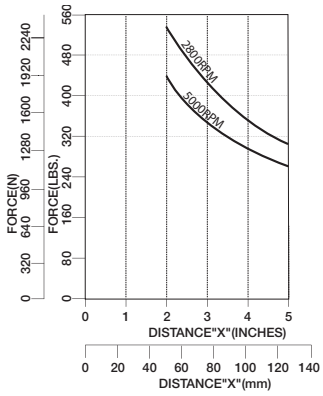

BSM90

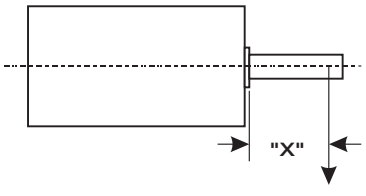



BSM100




BSM132



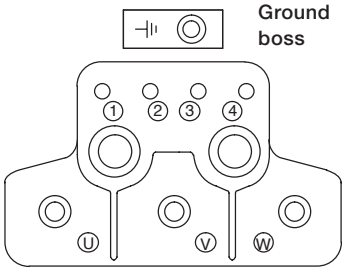

**Notes :** 1) Solid lines are based on L10 = 20,000 hours.
2) Dashed line is based on 104 load peaks @ 110% of rated torque.
3) L10 is a failure rate measure given in time period before 10% failure.

# AC servo motors
## Motor connection diagrams

5

## Motor-Resolver
## BSMxxx-xxxxA

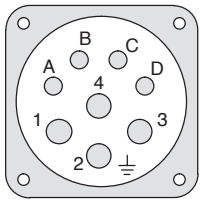
### Terminal block




### Power connections BSM 90/100

| Post | Function |
|---|---|
| 1 | Thermal switch |
| 2 | Thermal switch |
| 3 | Brake (optional) |
| 4 | Brake (optional) |
| U1 | Motor lead U |
| V2 | Motor lead V |
| W3 | Motor lead W |
| Screw | Ground |

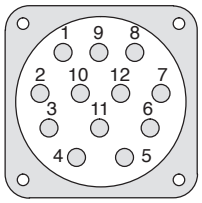
### Standard and rotatable connectors




### Power connections BSM 50/63/80 and SSBSM

| Post | Function |
|---|---|
| A | Thermal switch |
| B | Thermal switch |
| C | Brake (optional) |
| D | Brake (optional) |
| 1 | Motor lead U |
| 2 | Ground |
| 3 | Motor lead W |
| 4 | Motor lead V |

### Standard and rotatable connectors
**12 Pin**

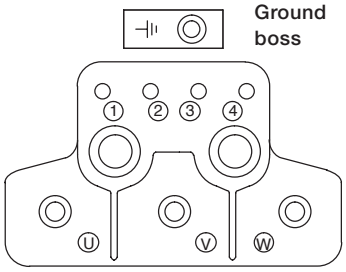



### Resolver connections BSM and SSBSM

| Post | Function |
|---|---|
| 1 | REF HI R1 |
| 2 | REF LO R2 |
| 3 | COS+ S1 |
| 4 | COS- S3 |
| 5 | SINE- S4 |
| 6 | SINE+ S2 |
| 7-12 | No connection |

## Motor-Incremental encoder
## BSMxxx-xxxxF or E

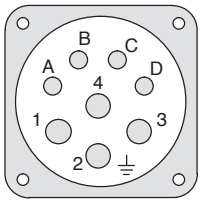
### Terminal block




### Power connections BSM 90/100

| Post | Function |
|---|---|
| 1 | Thermal switch |
| 2 | Thermal switch |
| 3 | Brake (optional) |
| 4 | Brake (optional) |
| U1 | Motor lead U |
| V2 | Motor lead V |
| W3 | Motor lead W |
| Screw | Ground |

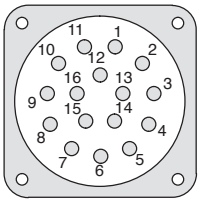
### Standard motor connector




### Power connections BSM 50/63/80 and SSBSM

| Post | Function |
|---|---|
| A | Thermal switch |
| B | Thermal switch |
| C | Brake (optional) |
| D | Brake (optional) |
| 1 | Motor lead U |
| 2 | Ground |
| 3 | Motor lead W |
| 4 | Motor lead V |

### Standard encoder connector
**16 pin**




### Encoder connections BSM and SSBSM

| Post | Function |
|---|---|
| 1 | DC + 5V |
| 2 | Ground |
| 3 | Channel A |
| 4 | Channel $\underline{A}$ |
| 5 | Channel B |
| 6 | Channel $\underline{B}$ |
| 7 | Channel Z |
| 8 | Channel $\underline{Z}$ |
| 9 | Open |
| 10 | Channel U |
| 11 | Channel $\underline{U}$ |
| 12 | Channel V |
| 13 | Channel $\underline{V}$ |
| 14 | Channel W |
| 15 | Channel $\underline{W}$ |
| 16 | No connection |

**Note:** For BSM 50/63/80 (and option on BSM90/100), the standard and rotatable power connector is rated at 28 amps.
BSM brakes are not polarity sensitive.

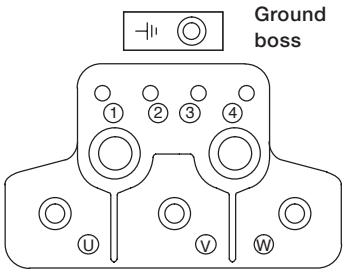
# AC servo motors
## Motor connection diagrams



## Motor-BiSS

## BSMxxx-xxxxB or B2

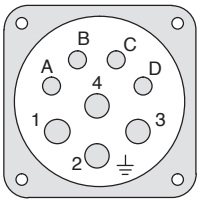
### Terminal block




### Power connections BSM 90/100

| Post | Function |
|---|---|
| 1 | Thermal switch |
| 2 | Thermal switch |
| 3 | Brake (optional) |
| 4 | Brake (optional) |
| U1 | Motor lead U |
| V2 | Motor lead V |
| W3 | Motor lead W |
| Screw | Ground |

### Standard motor connector

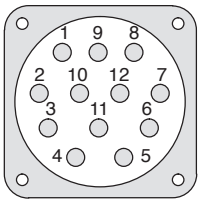



### Power connections BSM 50/63/80 and SSBSM

| Post | Function |
|---|---|
| A | Thermal switch |
| B | Thermal switch |
| C | Brake (optional) |
| D | Brake (optional) |
| 1 | Motor lead U |
| 2 | Ground |
| 3 | Motor lead W |
| 4 | Motor lead V |

### Standard BiSS connector

12 Pin



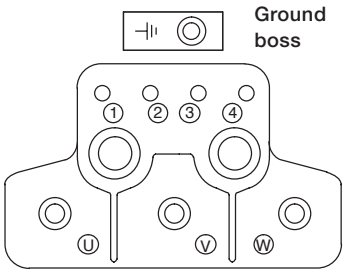

### BiSS connections BSM and SSBSM

| Post | Function |
|---|---|
| 1 | DATA- |
| 2 | A+ (SIN+) |
| 3 | 0V sensor |
| 4 | B+ (COS+) |
| 5 | Clock- |
| 6 | — |
| 7 | Clock+ |
| 8 | B- (COS-) |
| 9 | 5V & up sense |
| 10 | 0V DGND |
| 11 | A- (SIN-) |
| 12 | DATA+ |

## Motor-EnDat

## BSMxxx-xxxxD2 or D

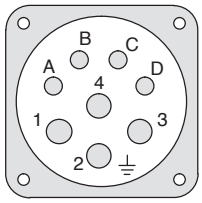
### Terminal block




### Power connections BSM 90/100

| Post | Function |
|---|---|
| 1 | Thermal switch |
| 2 | Thermal switch |
| 3 | Brake (optional) |
| 4 | Brake (optional) |
| U1 | Motor lead U |
| V2 | Motor lead V |
| W3 | Motor lead W |
| Screw | Ground |

### Standard motor connector

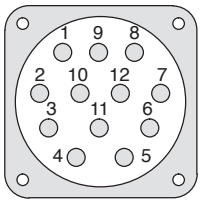



### Power connections BSM 50/63/80 and SSBSM

| Post | Function |
|---|---|
| A | Thermal switch |
| B | Thermal switch |
| C | Brake (optional) |
| D | Brake (optional) |
| 1 | Motor lead U |
| 2 | Ground |
| 3 | Motor lead W |
| 4 | Motor lead V |

### Standard EnDat connector

12 Pin




### EnDat connections BSM and SSBSM

| Post | Function |
|---|---|
| 1 | DATA- |
| 2 | SIN A+ |
| 3 | 0V sensor |
| 4 | COS B+ |
| 5 | Clock – |
| 6 | 5V sensor |
| 7 | Clock + |
| 8 | COS B- |
| 9 | +5V |
| 10 | DGND |
| 11 | SIN A- |
| 12 | DATA+ |

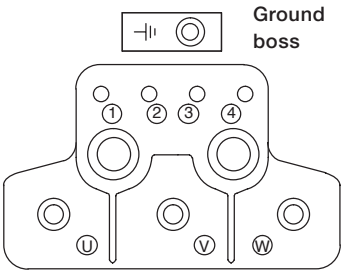
**Note:** For BSM 50/63/80 (and option on BSM90/100), the power connector is rated at 28 amps.
BSM brakes are not polarity sensitive.

# AC servo motors
## Motor connection diagrams



## Motor-SSi
## BSMxxx-xxxxS1 or S2

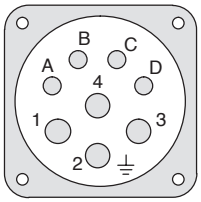
### Terminal block




### Power connections BSM 90/100

| Post | Function |
|---|---|
| 1 | Thermal switch |
| 2 | Thermal switch |
| 3 | Brake (optional) |
| 4 | Brake (optional) |
| U1 | Motor lead U |
| V2 | Motor lead V |
| W3 | Motor lead W |
| Screw | Ground |

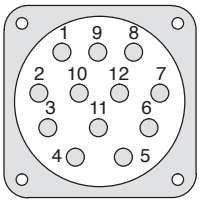
### Standard motor connector




### Power connections BSM 50/63/80 and SSBSM

| Post | Function |
|---|---|
| A | Thermal switch |
| B | Thermal switch |
| C | Brake (optional) |
| D | Brake (optional) |
| 1 | Motor lead U |
| 2 | Ground |
| 3 | Motor lead W |
| 4 | Motor lead V |

### Standard SSI connector
12 Pin

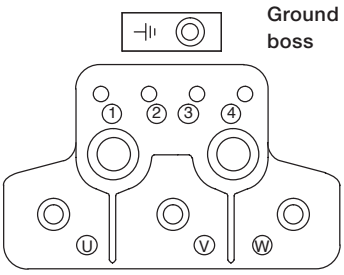



### SSI connections BSM and SSBSM

| Post | Function |
|---|---|
| 1 | +Vs (5Vdc) |
| 2 | 0V |
| 3 | SSI clock |
| 4 | SSI clock |
| 5 | SSI DATA |
| 6 | SSI DATA |
| 7 | – |
| 8 | – |
| 9 | Connected to pin 1 |
| 10 | – |
| 11 | – |
| 12 | – |

## Motor-Hiperface
## BSMxxx-xxxxD3 or D4

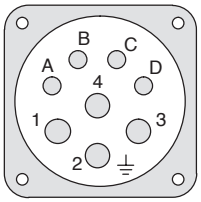
### Terminal block




### Power connections BSM 90/100

| Post | Function |
|---|---|
| 1 | Thermal switch |
| 2 | Thermal switch |
| 3 | Brake (optional) |
| 4 | Brake (optional) |
| U1 | Motor lead U |
| V2 | Motor lead V |
| W3 | Motor lead W |
| Screw | Ground |

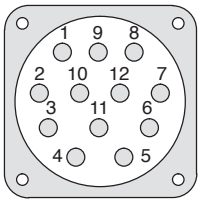
### Standard motor connector




### Power connections BSM 50/63/80 and SSBSM

| Post | Function |
|---|---|
| A | Thermal switch |
| B | Thermal switch |
| C | Brake (optional) |
| D | Brake (optional) |
| 1 | Motor lead U |
| 2 | Ground |
| 3 | Motor lead W |
| 4 | Motor lead V |

### Standard hyperface connector
12 Pin




### Hyperface connections BSM and SSBSM

| Post | Function |
|---|---|
| 1 | DATA- |
| 2 | +SIN |
| 3 | Open |
| 4 | +COS |
| 5 | OPEN |
| 6 | OPEN |
| 7 | OPEN |
| 8 | REF COS |
| 9 | US 7-12V |
| 10 | GND |
| 11 | REF SIN |
| 12 | DATA+ |

**Note:** For BSM 50/63/80 (and option on BSM90/100), the power connector is rated at 28 amps.
BSM brakes are not polarity sensitive.

# AC servo motors
## Motor connection diagrams

### Motor – Halls
### BSM25C–xxxxMHx

#### Flying leads
#### Power connections BSM25C

| Wire color | Function |
|---|---|
| 1 (T1) | U |
| 2 (T2) | V |
| 3 (T3) | W |
| Green/yellow | Ground |

#### Flying leads
#### Hall connections BSM25C

| Wire color | Function |
|---|---|
| White | S1 hall switch |
| Yellow | S2 hall switch |
| Orange | S3 hall switch |
| Red | VCC+ |
| Black | Ground |

### Motor – Halls
### BSM33C–xxxxMHx

#### Flying leads
#### Power connections BSM33C

| Wire color | Function |
|---|---|
| Yellow or blue | Thermal switch* |
| Yellow or blue | Thermal switch* |
| Black | U |
| Red | V |
| Blue | W |
| Green/yellow | Ground |

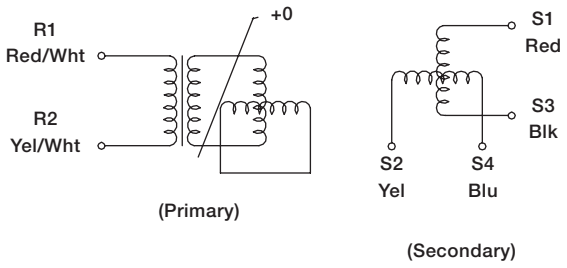
*When required

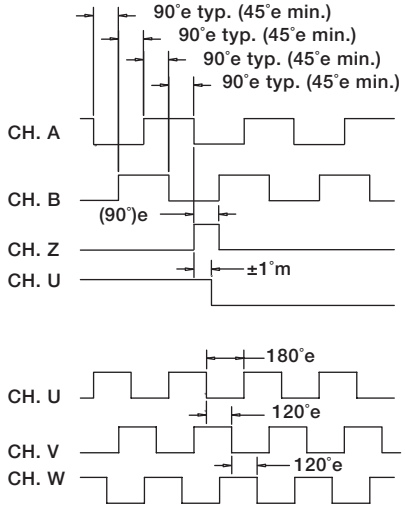
#### Flying leads
#### Hall connections BSM33C

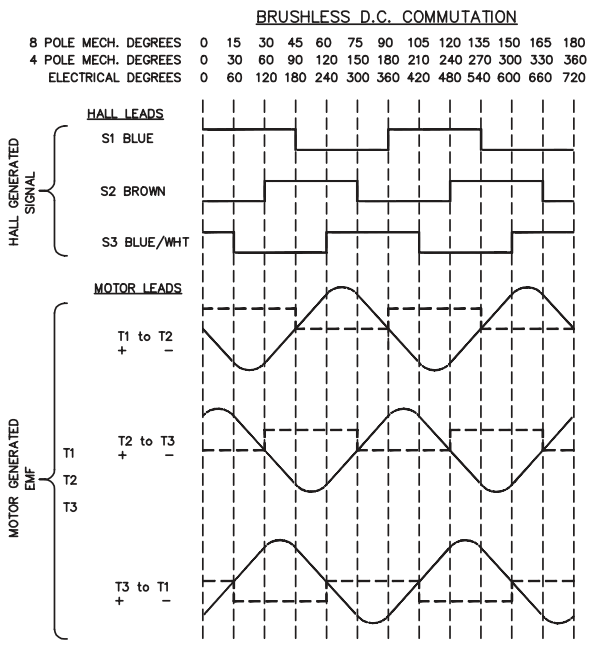
| Wire color | Function |
|---|---|
| Blue | S1 hall switch (U+) |
| Brown | S2 hall switch (V+) |
| Blue/white | S3 hall switch (W+) |
| Red | VCC+ |
| Black | Ground |

**Note**: BSM/SSBSM 50/63/80 series require both power and feedback cables. Refer to BR1202-H for cable assemblies.

# AC servo motors
## Feedback specifications




## Resolver specifications

| Power source | | AC 10Vrms / 4.5 kHz |
|---|---|---|
| Primary element | | Rotor |
| Electrical error | | ±7 |
| Resolver speed | | 1 |
| Transformation ratio | | 0.5±10% |
| Phase shift | | + 8° Nominal |
| Accuracy spread | | 12 Arc Minutes |
| Input impedance | ZRO | 90 + ¡180 Nominal |
| Output impedance | ZSO | 220 + ¡350 Nominal at 0° (S1-S3) |
| | ZSS | 210 + ¡300 Nominal at 0° (S1-S3) |
| D.C. resistance | ROTOR | 46 Ref |
| | STATOR | 120 Ref |
| Dielectric strength | | AC500 Volts 1 Minute 60 (50) Hz |
| Insulation resistance | | 100 M Min DC 500 Volts |
| Weight | | 0.18 kg Max |
| Max operating speed | | 10,000 Min |
| Operating temperature range | | -55° C to +150° C |
| Output equation | | ES1 - S3 KE R1-R2 COS |
| | | ES2 - S4 KE R1-R2 SIN |

## Encoder specifications

| Power in | 5V |
|---|---|
| Output | Line driver |
| | Incremental 2 channel |
| | Index |
| | Hall output (4 or 8 pole) |
| PPR | STD 2500 ppr |
| | Contact ABB for other options |
| Maximum Electrical Frequency | 1000/2500 ppr |
| | 200 kHZ/300kHZ |
| Hall output | BSM/SSBSM 50/63/80 series use 4 pole Hall output. 90/100 series use 8 pole Hall output. |
| Operating temperature range | -20˚ C to +120˚ C |

## Hall sensor specifications

| Power In | 3.8–30 Vdc |
|---|---|
| Output | Hall output (4 or 8 pole) |

# AC servo motors
## Motor mating connectors

| Termination | Motor type | Description | Number |
|---|---|---|---|
| Motor power | BSM50/63/80/90/100 | Mate assy power CE threaded connector (28 amp) (8 pin) | MCSPOW-08 |
| | BSM132 | Mate assy rotatable power (70 amp) | C/F |
| | SSBSM | Mate assy power stainless steel threaded conn (28 amp) | MCSPOW-08S |
| Strain relief | BSM90/100 | PG21 strain relief | MCS-PG21 |
| | | PG29 strain relief | ASR24661 |
| | | Adaptor (PG29 to PG21) | ASR24662 |
| | | M40 strain relief | MCS-M40 |
| | | Adaptor (M40 to M25) | MCS-M40A |
| Resolver, BiSS, SSI, hyperface, EnDat | BSM50/63/80/90/100/132 | Mate assy feedback CE threaded connector (12 pin) | MCSRES-12 |
| | SSBSM | Mate assy feedback threaded conn stainless steel | MCSRES-12S |
| | BSM - F-series | F-series resolver mate assy (14 pin) | MSCN |
| Encoder | BSM50/63/80/90/100/132 | Mate assy encoder CE threaded connector (16 pin) | MCSENC-16 |
| | SSBSM | Mate assy encoder threaded conn stainless steel | MCSENC-16S |

**Note:** BSM/SSBSM 50/63/80 series require both power and feedback cables. Refer to BR1202-H for cable assemblies.

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### Flange adaptor kits

| Order number | Description |
|---|---|
| 2R-BSM63 | Kit for BSM63 to convert to old equivalent 2R mounting [thickness = 0.416 inch (10.5mm)] |
| 3R-BSM80 | Kit for BSM80 to convert to old equivalent 3R mounting [thickness = 0.561 inch (14.2mm)] |
| 4R-BSM90 | Kit for BSM90 to convert to old equivalent 4R mounting [thickness = 0.804 inch (20.4mm)] |
| 56-BSM90 | Kit for BSM90 to convert to 56 mounting [thickness = 0.952 inch (24mm)] |
| 6R-BSM100 | Kit for BSM100 to convert to old equivalent 6R mounting [thickness = 0.647 inch (16.4mm)] |

**Note:** The standard shaft extension will be reduced by the thickness of the above kit adapter flange. If desired, a custom motor may be ordered with shaft length appropriate for mounting. Dimensions are nominal.

### Brake data for BSM and SSBSM

| Motor code | Brake holding torque Nm (lb-in) | Watts | Brake voltage (Vdc) | Brake current (amps) | Brake times (msec) | | Brake inertia | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Set | Release | (lb-in-s$^2$) | (Kg-cm$^2$) |
| BSM50N | 1.1 (10) | 10.1 | 24 | 0.5 | 3 | 20 | 0.000017 | 0.019 |
| BSM63N | 2 (18) | 11.9 | 24 | 0.6 | 6 | 43 | 0.000016 | 0.018 |
| BSM80 | 4.5 (40) | 19.7 | 24 | 0.7 | 9 | 48 | 0.000111 | 0.125 |
| BSM90 | 15.8 (140) | 22.5 | 24 | 0.9 | 14 | 110 | 0.00016 | 0.181 |
| BSM100 | 39.5 (350) | 33.7 | 24 | 1.4 | 22 | 195 | 0.00064 | 0.723 |
| BSM25C | 1.7 (15) | 10 | 24 | 0.4 | 16 | 27 | 0.00003 | 0.034 |
| BSM33C | 15.8 (140) | 22 | 24 | 0.9 | 14 | 110 | 0.00016 | 0.181 |
| BSM132C | 101.7 (900) | 76 | 24 | 3.16 | 129 | 163 | 0.01529 | 17.277 |

**Note:** All standard brakes used on BSM motors are 24 Vdc. The application needs to provide this voltage to release the brake. The brake is a safety brake only and not intended to be used to decelerate loads. Contact ABB for details. Detailed engineering drawings are available upon request.

# AC servo motors
## Servo motor selection



### Calculating servo motor requirements

In selecting a motion control package, one of the areas requiring identification is the mechanics of the load which will be moved. Once this physical data is obtained, the proper matching of motor and control can easily begin.

The mechanics of the load involve both friction (which is easy to understand) and inertia (which is an unknown, since we have difficulty in recalling the physics we had in school).

The first part of the equation, determining friction of the load, can be accomplished by either estimating, or measuring by simply using a torque wrench.

The second part is determining the inertia. Inertia is the resistance of an object to be accelerated, or decelerated. In motion control, inertia is an important parameter since it defines the torque required to accelerate the load and get it into position.

If no one has told you what the inertia is, then to answer this question, you will have to do a calculation. However, once sufficient information is obtained, the task is relatively simple.

To determine the inertia, the mechanical linkage system which will be moved will be analyzed. These mechanical systems can be divided into four basic categories: direct drive, gear drive, tangential drive, and ballscrew drive.

In the following, each of these mechanical linkage categories and relevant formulas for calculating the load parameters will be presented. In all instances, the formulas reflect the load parameters as “seen” by the motor. Reflecting all these parameters back to the motor shaft make the calculation easier for selecting the motor and control for your motion control application.

## Direct drive

**Direct drive**

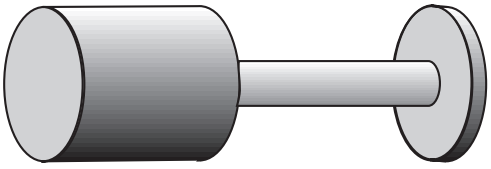



**Figure 1**

**where**

$S_m$ = motor speed (rpm)
$S_1$ = load speed (rpm)
$T_m$ = motor torque
$T_1$ = load torque
$J_t$ = total inertia
$J_1$ = load inertia
$J_m$ = motor inertia

speed (motor) = speed (load)
$S_m = S_1$

torque at motor = torque at load
$T_m = T_1$

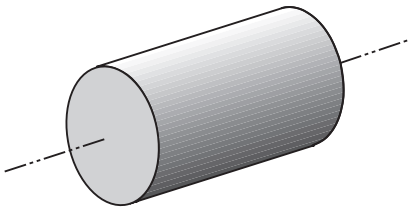
total inertia = inertia (load) + inertia (motor)
$J_t = J_1 + J_m$

The simplest of packages is the first basic category, the direct drive. This would not require the load parameters to be reflected back, since there are no mechanical linkages involved.

The equations for the direct drive are presented in Figure 1. The speed of the load is the same as the motor, the friction of the load is the friction which the motor must overcome, and the load inertia is directly what the motor would “see”.

# AC servo motors
## Inertia

**Solid cylinder:**



**where**

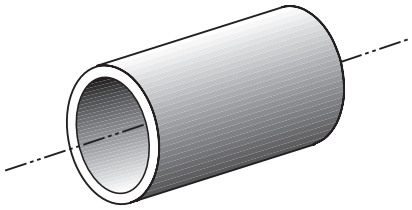
J = inertia
W = weight
R = radius
g = gravitational constant (386 in/s$^2$)(980 cm/s$^2$)
L = length
p = density

For a known weight and radius:

$$J = \frac{1}{2}\frac{W R^2}{g}$$

For a known density, radius, and length:

$$J = \frac{1}{2}\frac{\pi L p R^4}{g}$$



**where**

J = inertia
W = weight
Ro = outer radius
Ri = inner radius
g = gravitational constant (386 in/s$^2$)(980 cm/s$^2$)
L = length
p = density

For a known weight and radius

$$J = \frac{1}{2}\frac{W}{g}(Ro^2 + Ri^2)$$

For a known density, radius, and length:

$$J = \frac{1}{2}\frac{\pi L p}{g}(Ro^4 - Ri^4)$$

| Material | Density (lb/in$^3$) | gm/cm$^3$ |
|---|---|---|
| Aluminum | .098 | 2.72 |
| Copper | .322 | 8.91 |
| Plastic | .040 | 1.11 |
| Steel | .280 | 7.78 |
| Wood | .029 | 0.8 |

**Figure 2**

Inertia can be calculated if either the weight and radius are known; or the density, radius, and length are known. Figure 2 presents the equations.

As an example, if the cylinder were a lead screw with a radius of .312 inches (0.79 cm) and a length of 22 inches (55.8 cm), then the inertia would be:

$$J = \frac{1}{2}\frac{\pi L p R^4}{g} = \frac{1}{2}\frac{\pi (22)(.28)(.312)^4}{386} = 0.000237 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{1}{2}\frac{\pi (55.8)(7.75)(0.79)^4}{980} = 0.26 \text{ gm-cm-s}^2$$

These equations are important since the inertia of mechanical components (i.e. shafts, gears, drive rollers, leadscrews, etc.) can be calculated by using them. Once the inertia is determined, it becomes just a task of reflecting that load inertia and friction through the mechanical linkages to what the motor will “see”.

# AC servo motors
## Gear drive

**Gear drive:**

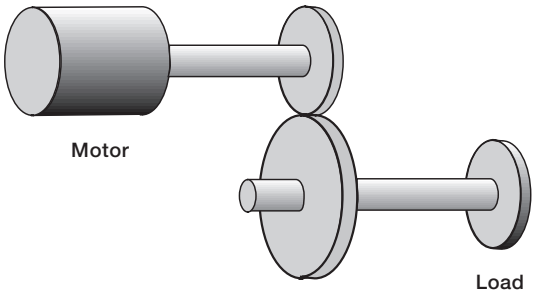



**Figure 3**

**where**

$S_m$ = motor speed (rpm)
$S_1$ = load speed (rpm)
$N$ = gear ratio
$N_1$ = number of load gear teeth
$N_m$ = number of motor gear teeth
$T_m$ = motor torque
$T_1$ = load torque
$e$ = efficiency
$J_t$ = total inertia
$J_1$ = load inertia
$J_m$ = motor inertia

speed (motor) = speed (load) x gear ratio

$$S_m = S_1 \times N$$

or $S_m = S_1 \times N_1 \div N_m$

torque at motor = torque at load ÷ gear ratio

$$T_m = \frac{T_1}{Ne}$$

total inertia = inertia (load) ÷ (gear ratio$^2$) + inertia (motor)

$$J_t = \frac{J_1}{N^2} + J_m$$

In a gear application, since there are mechanical linkages between the load and motor, the load parameters must be reflected back to the motor shaft. Figure 3 presents the equations.

As an example, if a solid cylinder with a diameter of 4 inches (10.16 cm) and weighing 6 pounds (2718 gm) is connected thru a 3:1 gear, the reflected inertia would be determined by the following:

First, calculating inertia for a solid cylinder:

$$J_{load} = \frac{1}{2}\frac{W R^2}{g} = \frac{1}{2}\frac{6\,(2)^2}{386} = .031 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{1}{2}\frac{2718\,(5.08)^2}{980} = 35.7 \text{ gm-cm-s}^2$$

reflecting this inertia thru the gear ratio:

$$J_{ref} = \frac{J_{load}}{N^2} = \frac{.031}{(3)^2} = .0034 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{35.7}{(3)^2} = 3.96 \text{ gm-cm-s}^2$$

The total reflected load inertia which the motor would “see” would be .0034 lb-in-s$^2$ (or metric: 3.96 gm-cm-s$^2$).

The inertia of the gears should be included in the determination of total load inertia to be really accurate (this can be obtained from literature or calculated using the formulas for the inertia of a cylinder). Efficiencies of the gearing should also be considered when calculating torques.

# AC servo motors
## Tangential drive

**Tangential drive:**

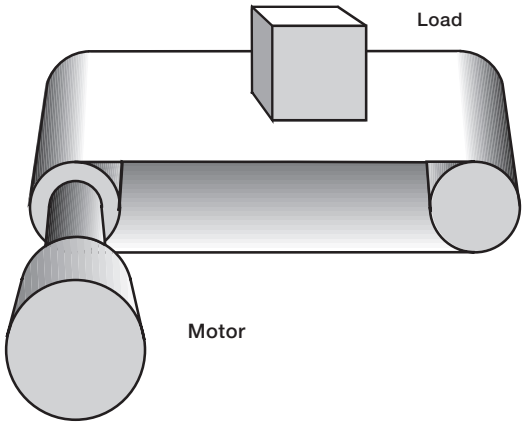



**Figure 4**

**where**

| | | |
|---|---|---|
| Sm | = | motor speed (rpm) |
| $V_1$ | = | load speed (in/min) (cm/min) |
| R | = | radius |
| $T_1$ | = | torque reflected to motor |
| $F_1$ | = | load force |
| $T_f$ | = | friction torque |
| $F_f$ | = | friction force |
| $J_t$ | = | total inertia |
| W | = | load weight + belt weight |
| $J_p$ | = | pulley inertia |
| $J_m$ | = | motor inertia |
| g | = | gravitational constant (386 in/s$^2$) (980 cm/s$^2$) |

$$\text{speed (motor)} = \frac{1}{2\pi} \times \frac{\text{speed (load)}}{\text{radius}}$$

$$Sm = \frac{1}{2\pi} \times \frac{V_1}{R}$$

$$\text{load torque} = \text{load force} \times \text{radius}$$

$$T_1 = F_1 R$$

$$\text{friction torque} = \text{frictional force} \times \text{radius}$$

$$T_f = F_f R$$

$$\text{total inertia} = (\text{weight} \times \text{radius}^2) \div (\text{gravity}) + \text{inertia (pulley \#1)} + \text{inertia (pulley \#2)} + \text{inertia (motor)}$$

$$J_t = \frac{W\ R^2}{g} + J_{p1} + J_{p2} + J_m$$

For this type of drive, the load parameters have to be reflected back to the motor shaft. A tangential drive can be a timing belt and pulley, chain and sprocket, or rack and pinion. See Figure 4 for formulas.

As an example, a belt and pulley arrangement will be moving a weight of 10 lbs (4530 gm). The pulleys are hollow cylinders of 5 pounds (2265 gm) each with an outer radius of 2.5 inches (6.35 cm) and an inner radius of 2.3 inches (5.8 cm). The total inertia would be determined by:

calculating inertia for a hollow cylinder pulley:

$$J_p = \frac{1}{2}\frac{W}{g}(R_0^2 + R_i^2) = \frac{1}{2}\frac{5}{386}(2.5^2 + 2.3^2) = 0.0747 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{1}{2}\frac{2265}{980}(6.35^2 + 5.8^2) = 85.39 \text{ gm-cm-s}^2$$

calculating load inertia:

$$J_1 = \frac{W\ R^2}{g} = \frac{10\ (2.5)^2}{386} = 0.1619 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{4530(6.35)^2}{980} = 186.3 \text{ gm-cm-s}^2$$

the total inertia reflected to the motor shaft would be the sum of the above:

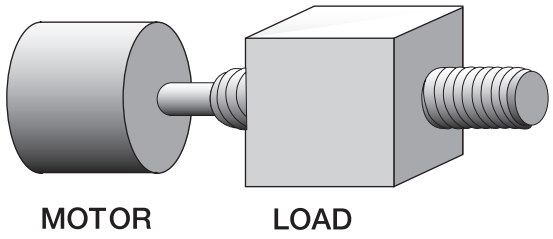
$$J = J_1 + J_{P1} + J_{P2} = 0.1619 + 0.0747 + 0.0747 = 0.3113 \text{ lb-in-s}^2$$

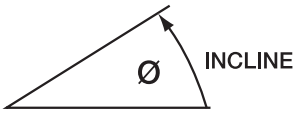
$$\text{Metric} = 357 \text{ gm-cm-s}^2$$

Don't forget to include the inertia of the pulleys, sprockets, or pinion gears in the determination of total inertia.

# AC servo motors
## Ballscrew drive

Leadscrew Drive:




where
Sm = motor speed (rpm)
V1 = load speed (in/min) (cm/min)
P = pitch (rev/inch) (rev/cm)
T1 = torque reflected to motor
F1 = load force
Fp1 = preload force
e = efficiency
Tf = friction torque
Ff = friction force
u = coefficient of friction
W = load weight
Jt = total inertia
J1s = ballscrew inertia
Jm = motor inertia
g = gravitational constant (386 in/s$^2$)(980 cm/s$^2$)

speed (motor) = speed (load) x pitch

$$S_m = V_1 \times P$$

friction torque = $\frac{1}{2\pi}\frac{\text{load force}}{\text{pitch x eff}} + \frac{1}{2\pi}\frac{\text{preload force}}{\text{pitch}} \times 0.2$

$$T_f = \frac{1}{2\pi}\frac{\mu \times W\cos\phi}{P\ e} + \frac{1}{2\pi}\frac{F_{p1}}{P} \times 0.2$$

load torque reflected to motor = $\frac{1}{2\pi}\frac{\text{push or pull force}}{\text{pitch x eff}}$

$$T_1 = \frac{1}{2\pi}\frac{F_1}{P\ e}$$

total inertia = $\frac{\text{load}}{\text{gravity}}\left(\frac{1}{2\pi}\text{ pitch}\right)^2 + \text{leadscrew inertia} + \text{motor inertia}$

$$J_t = \frac{W\sin\phi}{ge}\left(\frac{1}{2\pi P}\right)^2 + J_{1s} + J_m$$

FIGURE 5

The load parameters have to be reflected back to the motor shaft for this type of drive as well. The inertias which have to be considered include the ballscrew as well as the load. If the ballscrew inertia is not readily available, the formula for a cylinder may be used. Figure 5 presents the formulas for determining reflected inertias.

As an example, a 200 lb (90.6 Kg) load will be positioned via a ballscrew which is 0.5 inch (1.27 cm) in radius and 44 inches (111.7 cm) long. The pitch is 5 rev/inch (1.96 rev/cm). The total load and ballscrew inertia would be:

calculating reflected load inertia:

$$J_1 = \frac{W}{g}\left(\frac{1}{2\pi P}\right)^2 = \frac{200}{386}\left(\frac{1}{2\pi 5}\right)^2 = 0.00052 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{90600}{980}\left(\frac{1}{2\pi 1.96}\right)^2 = 0.61 \text{ gm-cm-s2}$$

calculating ballscrew inertia:

$$J_{1s} = \frac{1}{2}\frac{\pi L\rho R^4}{g} = \frac{1}{2}\frac{\pi (44)(.28)(5)^4}{386} = 0.00313 \text{ lb-in-s}^2$$

$$\text{Metric} = \frac{1}{2}\frac{(111.7)(7.75)(1.27)^4}{980} = 3.6 \text{ gm-cm-s}^2$$

The total inertia which would be connected onto the motor shaft would be the sum of these:

$$J = J_1 + J_{1s} = 0.00052 + 0.00313 = 0.00365 \text{ lb-in-s}^2 \text{ (Metric = 4.21 gm-cm-s}^2\text{)}$$

For precision positioning applications, the ballscrew is sometimes preloaded to eliminate or reduce backlash. If preloading is used, the preload torque must be included since it can be significant. The ballscrew's efficiency must also be considered when finally determining torques.

# AC servo motors
## The move profile

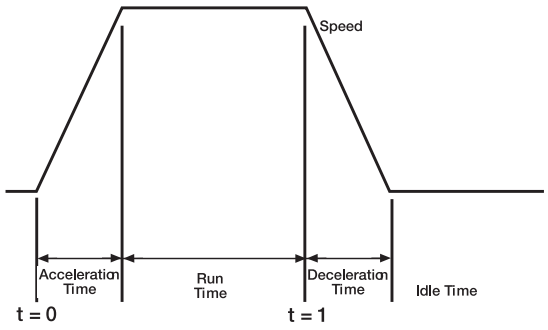



Figure 6

A move profile defines the desired acceleration rate, run time, speed and acceleration rate of the load. For example, suppose with a system at rest (time = 0 in Figure 6), the positioning controller issues a command to the motor to start motion. At t = 0, with full power applied, the motor has not yet started to move. At this instant, there is no feedback signal, but the error signal is large.

As friction and inertia torques are overcome, the motor and load begin to accelerate. As the motor reaches the commanded speed, the error signal is reduced, and in turn the voltage applied onto the motor is reduced. As the system stabilizes at running speed only nominal power (voltage and current) are required (to overcome friction). At time t = 1, the load approaches the desired position and begins to decelerate.

Applications with these move profiles result in most of the input energy dissipated as heat. Such packages are therefore limited by the maximum power dissipation capacity of the motor. In order to guarantee that maximum power handling capability of the motor is not exceeded, each application must be investigated individually. Basic motor dynamic equations must be solved and power calculated for each motor in order to determine whether the application will be handled successfully.

The first step in the process is identifying the acceleration rate. For an example, let's assume that our application has a move profile as identified in Figure 7. The acceleration rate can be determined from the speed and the acceleration time, as follows:

**Example**

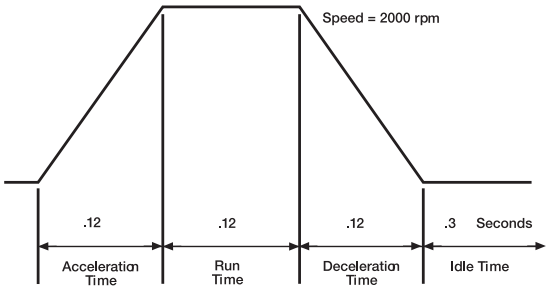



Figure 7

$$\text{accel rate} = \text{speed} \div \text{accel time}$$

$$\text{accel rate (rad/sec}^2\text{)} = \frac{\text{Wm (rad/sec)}}{t_{acc}\text{(sec)}}$$

To convert from RPM to rad/sec divide by 9.55.

For our example the acceleration rate is:

$$\text{accel rate (rad/sec}^2\text{)} = \frac{209 \text{ (rad/sec)}}{.12 \text{ (sec)}} = 1741.6 \text{ rad/sec}^2$$

**Example parameters**

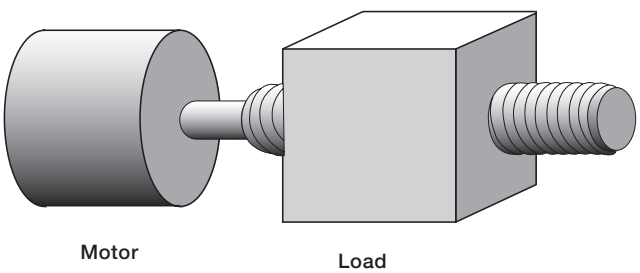



Figure 8

### Motor parameters

| | | |
|---|---|---|
| Inertia | = | .0037 lb-in-s$^2$ (4.26 gm-cm-s$^2$) |
| Continuous stall torque | = | 14.4 lb-in (1.6 Nm) |
| Torque constant | = | 4.8 lb-in/amp (0.54 Nm/amp) |
| Resistance | = | 4.5 ohms |
| Thermal resistance | = | 1.56 ˚C/watt |

### Load conditions

| | | |
|---|---|---|
| Load | = | 200 lbs (90.6 Kg) |
| Ball screw inertia | = | .00313 lb-in-s$^2$ (0.61 gm-cm-s$^2$) |
| Friction torque | = | .95 lb-in (1094 gm-cm) |

# AC servo motors
## Acceleration torque

The torque required to start the load moving, termed acceleration torque (Tacc), is that torque which is needed to overcome the mechanical friction and inertia. Expressed mathematically, the equation is:

$$T_{acc} = (J_t)\ (\text{accel rate}) + T_f$$

where $T_{acc}$ is acceleration torque (lb-in)
$J_t$ is the total inertia (load and motor lb-in-s$^2$)
accel is rotary acceleration of the motor shaft (rad/sec$^2$)
$T_f$ is the total friction torque of the package (lb-in)

As an example, the application calls for moving a 200 lb (90.6 Kg)load thru a ballscrew (having an inertia of .00313 lb-in-s$^2$), (3.6 gm-cm-s$^2$) at an acceleration rate of 1741.6 rad/sec$^2$. Typical motor parameters which will be used in this analysis are indicated in Figure 8.

$$T_{acc} = (J_t)\ (\text{accel rate}) + T_f$$
$$T_{acc} = (J_l + J_{ls} + J_m)\ (\text{accel rate}) + T_f$$
$$T_{acc} = (0.00052 + 0.00313 + 0.0037)\ (1741.6) + 0.95 \qquad \text{Metric} = (0.61 + 3.6 + 4.26)\ 1741.6 + 1094$$
$$= 12.8 + 0.95 \qquad \text{Metric} = 14751 + 1094$$
$$= 13.75 \text{ lb-in} \qquad \text{Metric} = 15845 \text{ gm-cm } (=1.55 \text{ Nm})$$

The motor must be capable of providing torque to accelerate the entire mechanics of the load (friction plus inertia), as well as torque to move itself. In this example, the motor must be capable of supplying a total acceleration torque of 13.75 lb-in (15.8 kg-cm).

## Torque over the duty cycle

The motor must also be capable of providing a certain amount of torque continuously over the duty cycle, or move profile as was defined earlier. In order to determine this, we must look at the rest of the move profile and determine the torques associated with them.

During run time, the torque required is:

$$T_{run} = T_f$$
$$T_{run} = 0.95 \text{ lb-in} \qquad \text{Metric} = (1094 \text{ gm-cm})$$

During the stopping cycle, or deceleration, the torque required is:

$$T_{dec} = -(J_t)\ (\text{accel rate}) + T_f$$
$$T_{dec} = -(.00052 + .00313 + .0037)\ (1741.6) + .95 \qquad \text{Metric} = -(0.61 + 3.6 + 4.26)(1741.6) + 1094$$
$$T_{dec} = -12.8 + .95 \qquad \text{Metric} = -14751 + 1094$$
$$T_{dec} = -11.85 \text{ lb-in} \qquad \text{Metric} = -13657 \text{ gm-cm}$$

Now that these torques are identified, the amount of torque required over the move profile can be calculated. This is termed "determining the RMS torque". It is calculated by simply inserting the figures from the previous page in to the following equation:

$$T^2_{RMS} = \frac{(T^2_{acc} \times t_{acc}) + (T^2_{run} \times t_{run}) + (T^2_{dec} \times t_{dec})}{t_{acc} + t_{run} + t_{dec} + t_{idle}}$$

$$T^2_{RMS} = \frac{(13.75)^2 \times 0.12 + (0.95)^2 \times 0.12 + (11.85)^2 \times 0.12}{0.12 + 0.12 + 0.12 + 0.3} \qquad \text{Metric} = \frac{(15.8)^2 \times 0.12 + (1)^2 \times 0.12 + (13.6)^2 \times 0.12}{0.12 + 0.12 + 0.12 + 0.3}$$

$$T^2_{RMS} = \frac{22.6 + 0.108 + 16.8}{0.66} = 59.86 \qquad \text{Metric} = \frac{29.9 + 0.12 + 22.1}{0.66} = 78.9 \text{ kg-cm}$$

$$T_{RMS} = 7.73 \text{ lb-in} \qquad \text{Metric} = 8.8 \text{ Kg-cm } (= 0.86 \text{ Nm})$$

Thus, this application requires 7.73 lb-in (0.86 Nm) of torque. The motor for this example has the capability of providing a continuous torque of 14 lb-in (1.6 Nm).

# AC servo motors
## Control section

The next step is to determine requirements for a suitable control or drive (amplifier). The control must be able to supply sufficient acceleration current (for the application's acceleration requirements), as well as continuous current (or "RMS" current for the application's duty cycle requirements).
Acceleration current which must be supplied to the motor is calculated from:

$$\text{current (amps), acceleration} = \frac{\text{acceleration torque (lb-in)}}{\text{motor torque constant (lb-in/amp)}}$$

$$I_{acc} = \frac{T_{acc}}{K_{tHOT}}$$

Where $K_{tHOT} = K_{tCOLD} \times 0.9$ (Typical derate for Neodymium magnets).

$$= \frac{13.75 \text{ (lb-in)}}{4.8 \text{ (lb-in/amp)} \times 0.9} = 3.18 \text{ amps} \qquad \text{Metric} = \frac{1.55 \text{ Nm}}{0.54 \text{ Nm/a} \times 0.9} = 3.18 \text{ amp}$$

RMS current over the duty cycle, which the control must be capable of supplying to the motor, is calculated from:

$$\text{current, RMS (amps)} = \frac{\text{RMS torque (lb-in)}}{\text{motor torque constant (lb-in/amp)}}$$

$$I_{RMS} = \frac{T_{RMS}}{K_t}$$

$$= \frac{7.73 \text{ (lb-in)}}{4.8 \text{ (lb-in/amp)} \times 0.9} = 1.78 \text{ amps} \qquad \text{Metric} = \frac{0.86 \text{ Nm}}{0.54 \text{ Nm/a} \times 0.9} = 1.78 \text{ amp}$$

Thus the servo control which would be selected must have the capability of supplying currents of 3.18 amps for acceleration and 1.78 amps continuously (RMS over the duty cycle).

## Temperature approximation

The temperature of the internal motor winding, or how hot a motor gets, depends upon the power dissipated inside the motor, and the motor's ability to eliminate itself of that heat. A measure of the motor's capability to eliminate heat is expressed as the thermal resistance.

The first step in determining the motor's winding temperature is to calculate power dissipation (watts dissipated). Using the previous determination of the applications current over the duty cycle, or $I_{RMS}$, of 1.78 amps, and the motor's resistance:

$$P_{DISS} = I^2 \times R_{HOT}$$

Where $R_{HOT} = R_{COLD} \times 1.5$

$$P_{DISS} = (1.78)^2 \times 4.5 \times 1.5 = 21.3 \text{ watts}$$

Then multiply times the motor's thermal resistance (deg C/watt) to obtain the winding temperature rise:

Temperature Rise = $P_{DISS} \times R_{th} = 21.3 \times 1.56 = 33.3$ deg C rise

Thus total temperature rise in a 25 deg C ambient would be:

Total temperature = ambient temp + temp rise = 25 + 33.3 = 58.3 deg C

Total temperature in a 40 deg C ambient would be:

Total temperature = 40 + 33.3= 73.3 deg C

Since the motor is designed to handle a total temperature of 155 deg C, both would be within the capability of the motor design. This easy calculation works well for speeds below 4000 rpm. At high speeds other dissipation issues such as friction and damping must be considered. If the 155 deg C temperature is exceeded, a larger motor should be investigated for the application.

# AC servo motors
## Temperature rise

The basic equation that determines temperature rise is:

$$T = T_{AMB} + (P_{Diss} \times R_{th})(1 - e^{-t/tTH})$$

Where t = the motors' "on" or operating time, an $t_{TH}$ = motors' thermal time constant - which is a measure of how long it takes to reach 63.2% of the final or steady state temperature.

The exponential rise of temperature versus time can easily be plotted by using the following points:

$$1/2\ t_{TH} = 48\%,\ t_{TH} = 63\%,\ 3x\ t_{TH} = 95\%,\ 5x\ t_{TH} = 98\%,\ 7x\ t_{th} = 99.99\%$$

This final point ($7x\ t_{th}$) is the steady state temperature as calculated in the previous section. These points are shown on the curve in figure 9.

5

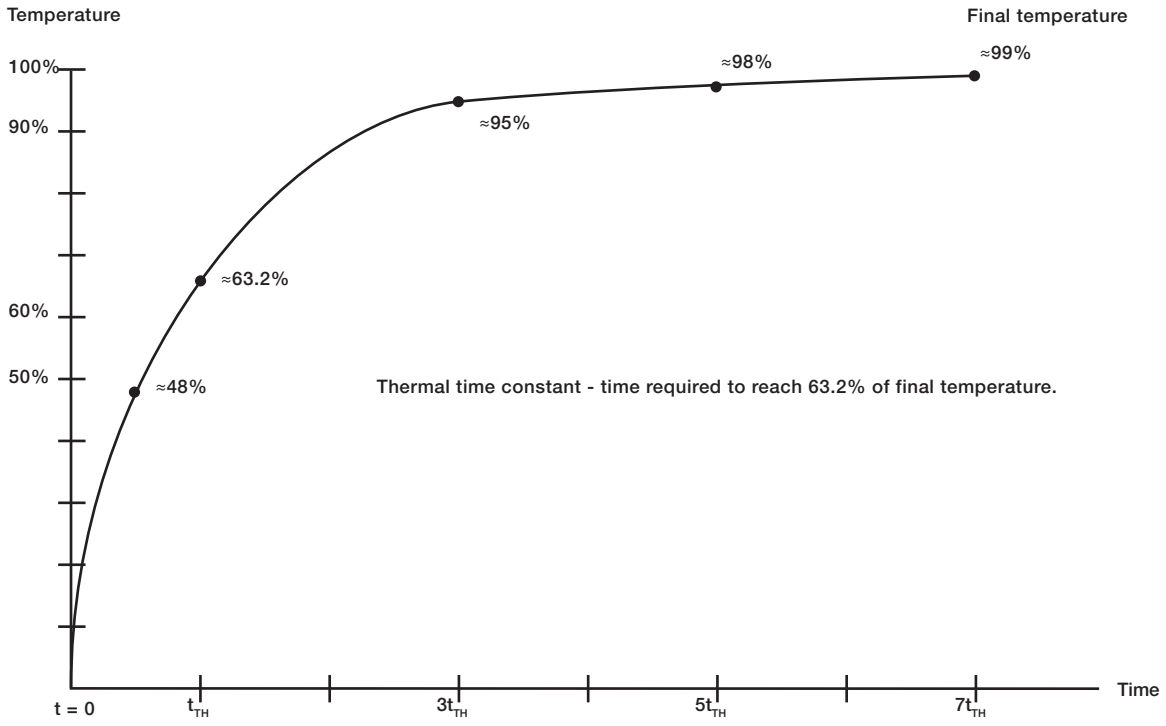



**Figure 9 – Temperature Rise vs. Time**

As an example, take the motor that has $P_{DISS} \times R_{th}$ = 92°C with ambient of 40°C, then temperature rise is shown below, and to determine total temperature, the ambient of 40°C must be added to these figures.

Thus:

| Time | ΔTemp rise | + Ambient | = Total temp. |
|---|---|---|---|
| 1/2 tTH | 48% x 92 = 44.1 | + 40 | = 84.1 |
| tTH | 63.2% x 92 = 58.1 | + 40 | = 98.1 |
| 3 tTH | 95% x 92 = 87.4 | + 40 | = 127.4 |
| 5 tTH | 98% x 92 = 90.1 | + 40 | = 130.1 |
| 7 tTH | 99.9% x 92 = 92.9 | + 40 | = 132.9 |

With power applied, the motor winding heats up, attaining 63.2% of final temperature in one thermal time constant, and essentially reaches final temperature in 7 time constants.

# AC servo motors
## Servo motor requirement sheet

Company _____ Date _____

Contact _____ E-Mail _____

Title _____ Phone _____

Address _____ Fax _____

Address _____ Industry _____

City _____ State, Zip _____

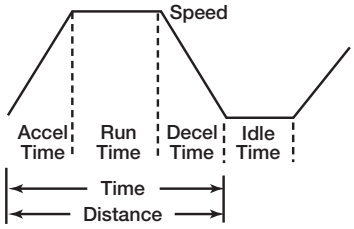
Describe the application and what you are trying to accomplish:

_____

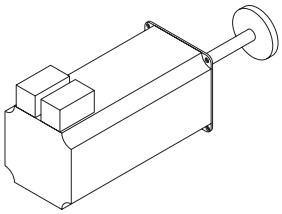
_____

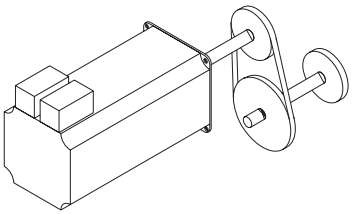


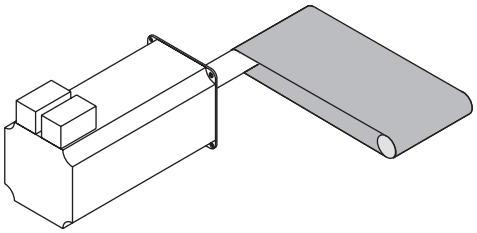
## Velocity profile

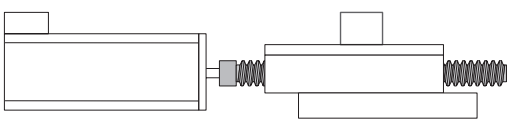



## Load conditions









### Specify

| | | | |
|---|---|---|---|
| Speed | = | _____ | RPM or in/sec or cm/sec |
| Accel time | = | _____ | sec |
| Run time | = | _____ | sec |
| Decel time | = | _____ | sec |
| idle time | = | _____ | sec |

or:

| | | | |
|---|---|---|---|
| Distance | = | _____ | radians; or _____inch or cm |
| Time (total) | = | _____ | sec |
| Idle time | = | _____ | sec |

### Direct drive (Circle units)

| | | | |
|---|---|---|---|
| Load inertia | = | _____ | lb-in-s$^2$ (kg-cm$^2$)(kg-cm-s$^2$) |
| Load friction | = | _____ | lb-in (g-cm) |

### Reduction – belt or gearing (Circle units)

| | | | |
|---|---|---|---|
| Load inertia | = | _____ | lb-in-s$^2$ (kg-cm$^2$)(kg-cm-s$^2$) |
| or diameter | = | _____ | inch (mm) |
| and length | = | _____ | inch (mm) |
| Load friction | = | _____ | lb-in (g-cm) |
| Belt/gear ratio | = | _____ | :1 |
| Efficiency | = | _____ | % |

### Linear – belt pulley or rack & pinion (Circle units)

| | | | |
|---|---|---|---|
| Load weight | = | _____ | lbs (kg) |
| Belt/rack weight | = | _____ | lbs (kg) |
| Pulley radius | = | _____ | inch (mm) |
| Pulley inertias | = | _____ | lb-in-s$^2$ (kg-cm$^2$)(kg-cm-s$^2$) |
| Total friction | = | _____ | lb-in (g-cm) |
| Gear ratio | = | _____ | :1 |
| Efficiency | = | _____ | % |

### Linear – ball screw (Circle units)

| | | | |
|---|---|---|---|
| Load weight | = | _____ | lbs (kg) |
| load friction | = | _____ | lb-in (g-cm) |
| Screw pitch | = | _____ | rev/inch (mm/rev) |
| Screw inertia | = | _____ | lb-in-s$^2$ (kg-cm$^2$)(kg-cm-s$^2$) |
| or Diameter | = | _____ | inch (mm) |
| and Length | = | _____ | inch (mm) |
| Efficiency | = | _____ | % |

# AC servo motors
## Conversion tables

### Rotary Inertia (to convert from A to B, multiply by value in table)

| A \ B | gm-cm² | oz-in² | gm-cm-s² | kg-cm² | lb-in² | oz-in-s² | lb-ft² | kg-cm-s² | lb-in-s² | lb-ft-s² or slug-ft² |
|---|---|---|---|---|---|---|---|---|---|---|
| gm-cm² | 1 | 5.46 x 10-3 | 1.01 x 10-3 | 10-3 | 3.417 x 10-4 | 1.41 x 10-5 | 2.37 x 10-6 | 1.01 x 10-6 | 8.85 x 10-7 | 7.37 x 10-8 |
| oz-in² | 182.9 | 1 | 0.186 | 0.182 | 0.0625 | 2.59 x 10-3 | 4.34 x 10-4 | 1.86 x 10-4 | 1.61 x 10-4 | 1.34 x 10-5 |
| gm-cm-s² | 980.6 | 5.36 | 1 | 0.9806 | 0.335 | 1.38 x 10-2 | 2.32 x 10-3 | 10-3 | 8.67 x 10-4 | 7.23 x 10-5 |
| kg-cm² | 1000 | 5.46 | 1.019 | 1 | 0.3417 | 1.41 x 10-2 | 2.37 x 10-3 | 1.019 x 10-3 | 8.85 x 10-4 | 7.37 x 10-5 |
| lb-in² | 2.92 x 103 | 16 | 2.984 | 2.926 | 1 | 4.14 x 10-2 | 6.94 x 10-3 | 2.98 x 10-3 | 2.59 x 10-3 | 2.15 x 10-4 |
| oz-in-s² | 7.06 x 104 | 386.08 | 72 | 70.615 | 24.13 | 1 | 0.1675 | 7.20 x 10-2 | 6.25 x 10-2 | 5.20 x 10-3 |
| lb-ft² | 4.21 x 105 | 2304 | 429.71 | 421.40 | 144 | 5.967 | 1 | 0.4297 | 0.3729 | 3.10 x 10-2 |
| kg-cm-s² | 9.8 x 105 | 5.36 x 103 | 1000 | 980.66 | 335.1 | 13.887 | 2.327 | 1 | 0.8679 | 7.23 x 10-2 |
| lb-in-s² | 1.129 x 106 | 6.177 x 103 | 1.152 x 103 | 1.129 x 103 | 386.08 | 16 | 2.681 | 1.152 | 1 | 8.33 x 10-2 |
| lb-ft-s² or slug-ft² | 1.355 x 107 | 7.41 x 104 | 1.38 x 104 | 1.35 x 104 | 4.63 x 103 | 192 | 32.17 | 13.825 | 12 | 1 |

5

### Torque (to convert from A to B, multiply by value in table)

| A \ B | dyne-cm | gm-cm | oz-in | kg-cm | lb-in | Nm | lb-ft | kg-cm |
|---|---|---|---|---|---|---|---|---|
| dyne-cm | 1 | 1.019 x 10-3 | 1.416 x 10-5 | 1.0197 x 10-6 | 8.850 x 10-7 | 10-7 | 7.375 x 10-8 | 1.019 x 10-8 |
| gm-cm | 980.65 | 1 | 1.388 x 10-2 | 10-3 | 8.679 x 10-4 | 9.806 x 10-5 | 7.233 x 10-5 | 10-5 |
| oz-in | 7.061 x 104 | 72.007 | 1 | 7.200 x 10-2 | 6.25 x 10-2 | 7.061 x 10-3 | 5.208 x 10-3 | 7.200 x 10-4 |
| kg-cm | 9.806 x 105 | 1000 | 13.877 | 1 | 0.8679 | 9.806 x 10-2 | 7.233 x 10-2 | 10-2 |
| lb-in | 1.129 x 106 | 1.152 x 103 | 16 | 1.152 | 1 | 0.112 | 8.333 x 10-2 | 1.152 x 10-2 |
| Nm | 107 | 1.019 x 104 | 141.612 | 10.197 | 8.850 | 1 | 0.737 | 0.101 |
| lb-ft | 1.355 x 107 | 1.382 x 104 | 192 | 13.825 | 12 | 1.355 | 1 | 0.138 |
| kg-m | 9.806 x 107 | 105 | 1.388 x 103 | 100 | 86.796 | 9.806 | 7.233 | 1 |

### Material densities

| | Oz/in² | lb/in³ | gm/cm³ |
|---|---|---|---|
| Aluminum | 1.57 | 0.098 | 2.72 |
| Brass | 4.96 | 0.31 | 8.6 |
| Bronze | 4.72 | 0.295 | 8.17 |
| Copper | 5.15 | 0.322 | 8.91 |
| Plastic | 0.64 | 0.04 | 1.11 |
| Steel | 4.48 | 0.28 | 7.75 |

### Friction coefficients

| (Sliding) | m |
|---|---|
| Steel on steel | 0.58 |
| Steel on steel (greased) | 0.15 |
| Aluminum on steel | 0.45 |
| Copper on steel | 0.36 |
| Brass on steel | 0.40 |
| Plastic on steel | 0.20 |
| Linear bearings | 0.001 |

### Mechanism efficiencies

| | |
|---|---|
| Acme screw (bronze nut) | 0.4 |
| Acme screw (plastic nut) | 0.5 |
| Ball screw | 0.9 |
| Helical gear | 0.7 |
| Spur gear | 0.6 |
| Timing belt/pulley | 0.9 |

### Temperature

°F = (1.8 x °C) + 32

°C = .555 (°F - 32)

### Gravity

(Acceleration constant)

g = 386 in/s² = 32.2 ft/s² = 9.8 m/s²

# AC servo motors
## Conversion tables

### Length (to convert from A to B, multiply by value in table)

| A \ B | Inch | Feet | Micro inch | Micron | Millimeter | Centimeter | Meter |
|---|---|---|---|---|---|---|---|
| Inch | 1 | 8.33 x 10-2 | 1.0 x 106 | 2.51 x 104 | 25.4 | 2.54 | 2.54 x 10-2 |
| Feet | 12 | 1 | 1.2 x 107 | 3.05 x 105 | 305 | 30.5 | 0.305 |
| Micro-Inch | 1.0 x 10-6 | 1.2 x 104 | 1 | 2.54 x 10-2 | 2.54 x 10-5 | 2.54 x 10-6 | 2.54 x 10-8 |
| Micron | 3.937 x 10-5 | 3.28 x 10-6 | 39.37 | 1 | 0.001 | 1.0 x 10-4 | 1.0 x 10-6 |
| Millimeter | 3.937 x 10-2 | 3.28 x 10-3 | 3.937 x 104 | 1000 | 1 | 0.1 | 0.001 |
| Centimeter | 0.3937 | 3.28 x 10-2 | 3.937 x 105 | 1 x 104 | 10 | 1 | 0.01 |
| Meter | 39.37 | 3.28 | 3.937 x 107 | 1 x 106 | 1000 | 100 | 1 |

### Power (to convert from A to B, multiply by value in table)

| A \ B | Watts | Kilowatts | ft-lb/sec | in-lb/sec | Hp (imperial) | Hp (SI) |
|---|---|---|---|---|---|---|
| Watts | 1 | 1 x 10-3 | 0.74 | 8.85 | 1.34 x 10-3 | 1.33 x 10-3 |
| Kilowatts | 1000 | 1 | 738 | 8850 | 1.34 | 1.33 |
| ft-lb/sec | 1.35 | 1.36 x 10-3 | 1 | 12 | 1.82 x 10-3 | 1.81 x 10-3 |
| in-lb/sec | 0.113 | 1.13 x 10-4 | 8.3 x 10-2 | 1 | 1.52 x 10-4 | 1.53 x 10-4 |
| Hp (Imperial) | 746 | 0.746 | 550 | 6600 | 1 | 0.995 |
| Hp (SI) | 750 | 0.750 | 553 | 6636 | 1.005 | 1 |

### Mass (to convert from A to B, multiply by value in table)

| A \ B | oz-m | lb-m | slug | gm | kg |
|---|---|---|---|---|---|
| oz-m | 1 | 6.25 x 10-2 | 1.94 x 10-3 | 28.35 | 2.835 x 10-2 |
| lb-m | 16 | 1 | 3.11 x 10-2 | 453.6 | 0.453 |
| slug | 514.72 | 32.2 | 1 | 14590 | 14.59 |
| gm | 3.53 x 10-2 | 2.205 x 10-3 | 6.85 x 10-5 | 1 | 0.001 |
| kg | 35.274 | 2.205 | 6.85 x 10-2 | 1000 | 1 |

### Force (to convert from A to B, multiply by value in table)

| A \ B | oz-f | lb-f | Newtons | dyne | gm-f | kg-f |
|---|---|---|---|---|---|---|
| oz-f | 1 | 6.25 x 10-2 | 0.278 | 2.78 x 104 | 28.35 | 2.835 x 10-2 |
| lb-f | 16 | 1 | 4.448 | 4.448 x 105 | 453.6 | 0.4535 |
| Newtons | 3.596 | 0.225 | 1 | 1 x 105 | 101.9 | 0.1019 |
| dyne | 3.59 x 10-5 | 2.248 x 10-6 | 1.0 x 10-5 | 1 | 1.02 x 10-3 | 1.02 x 10-6 |
| gm-f | 3.53 x 10-2 | 2.205 x 10-3 | 9.81 x 10-3 | 981 | 1 | 0.001 |
| kg-f | 35.3 | 2.205 | 9.81 | 9.81 x 105 | 1000 | 1 |

### Linear velocity (to convert from A to B, multiply by value in table)

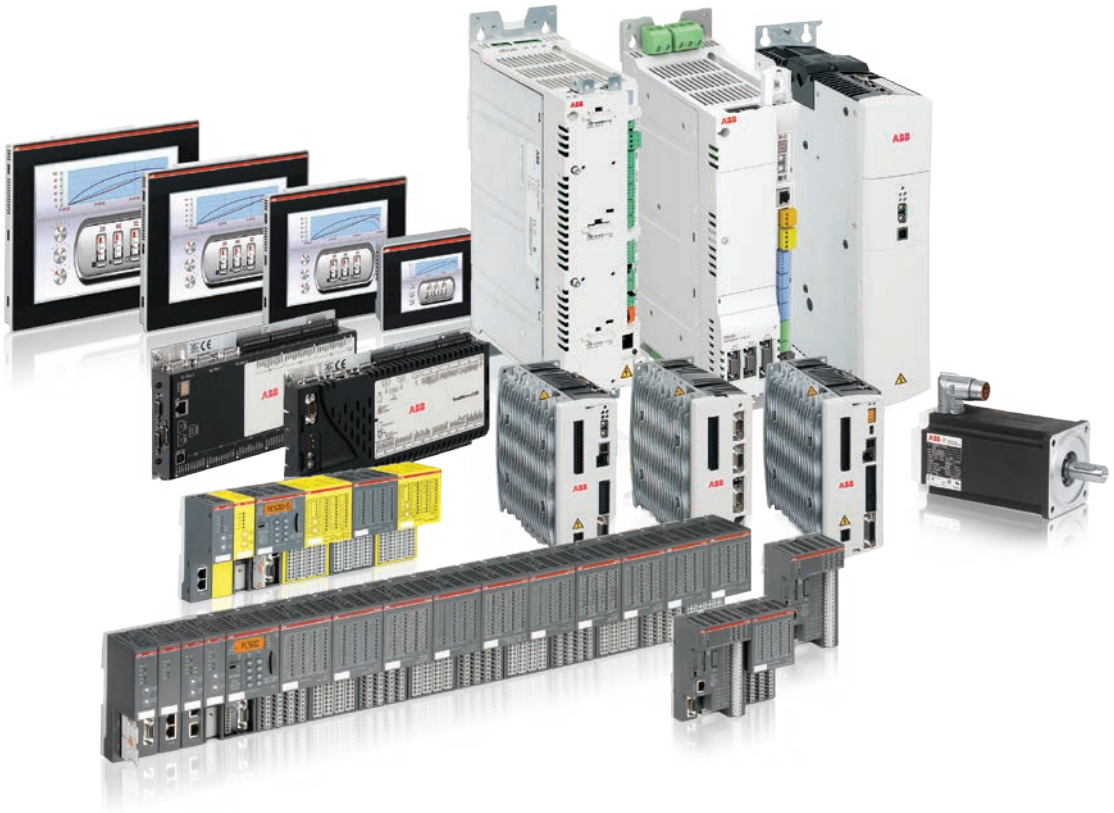
| A \ B | in/sec | feet/sec | mm/sec | cm/sec | meter/sec | inch/min | feet/min | meter/min | km/hour | miles/hour |
|---|---|---|---|---|---|---|---|---|---|---|
| in/sec | 1 | 0.083 | 25.4 | 2.54 | 2.54 x 10-2 | 60 | 5 | 1.524 | 0.091 | 5.7 x 10-2 |
| feet/sec | 12 | 1 | 304.8 | 30.48 | 0.3048 | 720 | 60 | 18.29 | 1.09 | 0.682 |
| mm/sec | 3.937 x 10-2 | 3.3 x 10-3 | 1 | 0.1 | 0.001 | 2.36 | 0.197 | 0.059 | 3.6 x 10-3 | 2.24 x 10-3 |
| cm/sec | 0.3937 | 3.28 x 10-2 | 10 | 1 | 0.01 | 23.62 | 1.97 | 0.59 | 3.6 x 10-2 | 2.24 x 10-2 |
| meter/sec | 39.37 | 3.281 | 1000 | 100 | 1 | 2362.2 | 197 | 60 | 3.6 | 2.24 |
| inch/min | 0.0167 | 1.39 x 10-3 | 0.42 | 0.042 | 4.2 x 10-4 | 1 | 8.33 x 10-2 | 2.54 x 10-2 | 1.52 x 10-3 | 9.5 x 10-4 |
| feet/min | 0.2 | 0.0167 | 5.08 | 0.508 | 5.08 x 10-3 | 12 | 1 | 0.3048 | 1.8 x 10-2 | 1.14 x 10-2 |
| meter/min | 0.656 | 5.46 x 10-2 | 16.667 | 1.67 | 1.67 x 10-2 | 39.4 | 3.28 | 1 | 5.9 x 10-2 | 0.37 |
| km/hour | 10.936 | 0.911 | 277.8 | 27.78 | 0.2778 | 656 | 54.67 | 16.67 | 1 | 0.62 |
| miles/hour | 17.59 | 1.47 | 447 | 44.7 | 0.447 | 1056 | 88 | 26.8 | 1.609 | 1 |

# MINT® motion control

## Capability without complexity

ABB offers solutions to a variety of machine control applications in many industries. Our capability includes intelligent programmable drives, plug-in controller options for drives, real-time Ethernet controllers, PLC systems and standard analogue and stepper-based control products.





# Motion controllers

## MINT® programmable, analog, PTO, CANopen and POWERLINK

### NextMove ESB-2

- Compact panel mount motion controller
- Up to 8 axes of coordinated motion
- Stepper and analog axis control
- CANopen manager for system expansion
- MINT programming for multitasking control of communications, logic, motion and HMI interaction in simple motion applications

### NextMove e100

- Compact panel mount motion controller
- Ethernet PowerLink technology for real-time motion control
- Stepper and analog axis control
- CANopen manager for system expansion
- MINT programming for multitasking control of communications, logic, motion and HMI interaction in simple motion applications



Compact motion controller for analog and stepper control

Compact motion controller with real time Ethernet POWERLINK technology

**Series NextMove ESB-2**

- Up to 8 axes of coordinated motion
- 4 x PTO (Stepper) axes
- 3 or 4 x analog controlled axes with encoder feedback
- Maximum of 8 axes of control
- Digital and analog I/O including 4 x high speed registation latches
- Options
  - RS232 or RS422 serial option
  - Differential / single-ended stepper interfaces
  - 7 axis or 8 axis variants

**Series NextMove e100**

- 1 to 16 axes interpolated axes via POWERLINK
- Additional CN profiled POWERLINK axes
- 4 x PTO (stepper) axes
- 3 x analog controlled axes with encoder feedback
- Maximum of 30 axes of control
- Digital and analog I/O including 4 x high speed registation latches
- Options
  - Differential / single-ended stepper interfaces
  - 8, 12 or 16 axes of interpolated motion

# Servo drives
## Analog, PTO, POWERLINK and EtherCAT options

### MicroFlex analog

- Compact motion control drive for single and three-phase operation
- +/– 10 V analog speed / torque demand or Pulse + Direction inputs
- Choice of resolver feedback or incremental encoder

### MicroFlex e100

- Compact motion control drive for single and three-phase operation
- Ethernet PowerLink technology for real-time motion control
- MINT Lite programming for multitasking control of communications, logic, motion and HMI interaction in simple motion applications



Compact motion control drive for simple analog or PTO control

Compact motion control drive with real time Ethernet POWERLINK technology

**Series MicroFlex analog**

- 1 or 3-phase operation from 105 to 250 V AC
- 3, 6 and 9 A rms
- IP20 enclosure for cabinet installation (UL open)
- Auto-tuning and anti-resonance digital filters
- Suitable for single drive and multi-axis systems
- Controls rotary and linear AC servo motors
- Options
  - Space saving footprint EMC filter
  - Brake units

For further information, see flyer “ABB motion control drives, MicroFlex brushless AC servo drives”, code: 3AUA0000123110 EN.

**Series MicroFlex e100**

- 1 or 3-phase operation from 105 to 250 V AC
- 3, 6 and 9 A rms
- IP20 enclosure for cabinet installation (UL open)
- Real-time Ethernet operation with PowerLink
- Suitable for single drive and multi-axis systems
- Controls rotary and linear AC servo motors
- Options
  - Space saving footprint EMC filter
  - Brake units

For further information, see flyer “ABB motion control products, MicroFlex e100 servo drives”, code: 3AUA0000116018 EN.

## MicroFlex e150

- Compact motion control drive with embedded safety for single and three-phase operation
- Ethernet technology including EtherCAT® for real-time motion control
- Advanced MINT programming for multitasking control of communications, logic, motion and HMI interaction in high performance motion applications

## MotiFlex e100

- Wide voltage range, DC bus capability and three-phase operation for a broad range of applications
- Ethernet PowerLink technology for real-time motion control
- MINT programming for multitasking control of communications, logic, motion and HMI interaction, plus a multi-axis plug-in motion option



Intelligent motion control drive with embedded safety and EtherCAT® technology

Versatile motion control drive with integrated real-time Ethernet POWERLINK technology

**Series MicroFlex e150**

- 1 or 3-phase operation from 105 to 250 V AC
- 3, 6 and 9 A rms
- IP20 enclosure for cabinet installation (UL open)
- Embedded real-time Ethernet including EtherCAT®, Modbus TCP and Ethernet/IP™
- Suitable for single drive and multi-axis systems
- Controls rotary and linear AC servo motors
- Safe torque-off feature as standard
- Options
  - MINT Motion programming
  - Space-saving footprint EMC filter
  - Resolver adapter
  - Dual encoder splitter
  - Brake units

For further information, see flyer “ABB motion control products, MicroFlex e150 servo drives”, code: 3AUA0000097609 EN.

**Series MotiFlex e100**

- Three-phase operation from 180 to 528 V AC
- 1.5 to 65 A rms in three frame sizes
- IP20 enclosure for cabinet installation (UL open)
- Real time Ethernet operation with PowerLink
- Suitable for single drive and multi-axis systems
- Controls rotary and linear AC servo motors
- Integrated DC bus for energy sharing capability
- Options
  - Plug-in motion controller for up to five axes
  - Fieldbus options
  - Plug-in IO options (digital or analog)
  - Secondary feedback options, resolver or encoder
  - Filters, brake resistors, chokes and DC bus bars

For further information, see flyer “ABB motion control products, MotiFlex e100 servo drives”, code: 3AUA0000116019 EN.

# AC motion control drives
## EtherCAT® and POWERLINK options

### MotiFlex e180

- EtherCAT® , Modbus/TCP, EtherNet/IP and POWERLINK
- DSL combined power and feedback option (December 2015)
- Advanced MINT programming for multi-tasking control of communications, logic, motion and HMI interaction in high performance motion applications
- Safety as standard

MotiFlex e180
(Size A)

Versatile Motion Control Drive with integrated real-time Ethernet technology

6

### Series MotiFlex e180

- Three-phase operation 200...480 V AC
- 2.3 to 90 A Arms in four frame sizes (A-D)
- IP20 enclosure for cabinet installation (UL Open)
- Real-time Ethernet with EtherCAT and PowerLink and Modbus TCP and EtherNet/IP
- Suitable for single drive and multi-axis systems
- Controls rotary and linear AC servo motors
- Safe torque off as standard
- Memory unit for firmware, settings and functionality level
- Options
  - Drive functionality levels (Single axis Mint motion) or EtherCAT Slave
  - Feedback options, resolver, encoder, serial encoders or DSL (December 2015)
  - Filters, brake resistors, and chokes

**For further information, see flyer**
**“ABB motion control drives, MotiFlex e180 servo drives”,**
**code: 3AUA0000168682 EN.**

# AC motion control drives
## MicroFlex® series


MicroFlex e150

### MicroFlex e150 (EtherCAT, Ethernet/IP, Modbus TCP/IP, MINT programming)

- Compact EtherCAT motion control drive
- Simple to advanced motion technology fully integrated
- Powerful PC tool for commissioning and auto-tuning
- Precise control of rotary and linear motors
  Embedded EtherCAT®, Ethernet/IP™, Modbus TCP/IP
- Standard I/O: (10) inputs + (7) outputs
- Universal and Dual Encoder function
- Safe Torque Off (STO) SIL3 PLe
- USB, RS422 and RS485 serial
- 7 - segment display communications

| Input voltage | 1/3 phase 105-250 V AC | |
|---|---|---|
| Bus voltage | 160-320 V DC | |
| Output current amps (rms) | | Order code |
| Continuous rms | Peak (3 seconds) | |
| 3 | 6 | E152A03EIOA |
| 6 | 12 | E152A06EIOA |
| 9 | 18 | E152A09EIOA |

**Note:** Will accept either incremental or absolute encoder feedback (BiSS, EnDat, SSI, SmartAbs®).
Dual encoder mode and resolver supported via option.

### EtherCAT slave device drive (standard TCP/IP, non-programmable)

| Input voltage | 1/3 phase 105-250 V AC | |
|---|---|---|
| Bus voltage | 160-320 V DC | |
| Output current amps (rms) | | Catalog number |
| Continuous rms | Peak (3 seconds) | |
| 3 | 6 | E152A03EINA |
| 6 | 12 | E152A06EINA |
| 9 | 18 | E152A09EINA |


MicroFlex e100

### MicroFlex e100 (Ethernet POWERLINK)

- Compact Ethernet Powerlink motion control drive
- Simple motion programming with MINT Lite software and auto-tuning
- Ethernet - Powerlink, Modbus TCP and TCP/IP
- Universal encoder
- CANopen port for simple expansion
- USB and RS485 serial communications
- LEDs: Drive status, CANopen, Ethernet Powerlink

| Input voltage | 1/3 phase 105-250 V AC | |
|---|---|---|
| Bus voltage | 160-320 V DC | |
| Output current amps (rms) | | Oder code |
| Continuous rms | Peak (3 seconds) | |
| 3 | 6 | MFE230A003BW |
| 6 | 12 | MFE230A006BW |
| 9 | 18 | MFE230A009BW |

**Note:** Will accept either incremental or absolute encoder feedback (BiSS, EnDat, SSI, SmartAbs®)


MicroFlex analog

### MicroFlex analog

- Compact analog motion control drive
- Encoder/resolver feedback and simulated encoder output
- RS232/422 serial communications for PC tools
- Analog or pulse and direction control

| Input voltage | 1/3 phase 105-250 V AC | | |
|---|---|---|---|
| Bus voltage | 160-320 V DC | | |
| Output current amps (rms) | | Order code (RS232 versions) | Order code (RS485 versions) |
| Continuous rms | Peak (3 seconds) | | |
| Encoder feedback | | | |
| 3 | 6 | FMH2A03TR-EN23W | FMH2A03TR-EN43W |
| 6 | 12 | FMH2A06TR-EN23W | FMH2A06TR-EN43W |
| 9 | 18 | FMH2A09TR-EN23W | FMH2A09TR-EN43W |
| Resolver feedback | | | |
| 3 | 6 | FMH2A03TR-RN23W | FMH2A03TR-RN43W |
| 6 | 12 | FMH2A06TR-RN23W | FMH2A06TR-RN43W |
| 9 | 18 | FMH2A09TR-RN23W | FMH2A09TR-RN43W |

# AC motion control drives
## MotiFlex® e100

MotiFlex e100 Size A
(1.5 A - 16 A)



MotiFlex e100 Size B
(21 A - 33.5 A)

MotiFlex e100 Size C
(48 A - 65 A)

### MotiFlex e100

- Advanced servo drive/motion controller
- Simple motion programming with Mint Lite software, auto-tuning and plug-in motion controller option
- Universal and dual encoder function including optional resolver interface
- Ethernet Powerlink interface (real time) and CANopen DSP 401 network manager for expansion
- DC bus operation with simple link system
- 2 x expansion card slots for secondary feedback, Mint programmable options, fieldbus and 1/0 expansion

| | Input voltage | 3 phase 180-560 V AC | |
|---|---|---|---|
| | Bus voltage | 325-650 V DC | |
| | Output current amps (rms) rated operation 200% 3 seconds | | Order code |
| | Continuous | Peak | |
| Size A | 1.5 | 3 | MFE460A001BW |
| | 3 | 6 | MFE460A003BW |
| | 6 | 12 | MFE460A006BW |
| | 10.5 | 21 | MFE460A010BW |
| | 16 | 32 | MFE460A016BW |
| Size B | 21 | 40 | MFE460A021BW |
| | 26 | 54 | MFE460A026BW |
| | 33.5 | 68 | MFE460A033BW |
| Size C | 48 | 96 | MFE460A048BW |
| | 65 | 130 | MFE460A065BW |

### Accessories for MotiFlex e100

| Description | Order code |
|---|---|
| AC power and motor power brackets | OPT-CM-001 |
| Signal and feedback cable bracket size A | OPT-CM-002 |
| Signal and feedback cable bracket size B / C | OPT-CM-003 |
| DC bus bars for A size drive x 2 | OPT-MF-DC-A |
| DC bus bars for B size drive x 2 | OPT-MF-DC-B |
| DC bus bars for C size drive - 160mm x 2 | OPT-MF-DC-C |
| DC bus bars for C size drive - 212mm x 2 | OPT-MF-DC-D |
| Spare connector kit for 1 - 16A | OPT-MF-CN-A |
| Spare connector kit for 21 - 33.5A | OPT-MF-CN-B |
| Spare connector kit for 48 - 65A | OPT-MF-CN-C |
| USB signal isolator | OPT-CNV-003 |

### AC line reactors for use with MotiFlex e100

| Control current rating | | Order code |
|---|---|---|
| 1 - 6 | Size A | LRAC02502 |
| 10 - 16 | Size A | LRAC03502 |
| 21 - 33.5 | Size B | LRAC05502 |
| 48 - 65 | Size C | LRAC130ACB2 |

### Plug in option cards for use with MotiFlex e100

| Description | Order code |
|---|---|
| Single axis MINT motion option (plug-in) | OPT-MF-100 |
| Multi-axis MINT motion option (plug-in) | OPT-MF-101 |
| Analog I/O 16 bit 4 off inputs and 4 off outputs differential +/-10 V DC | OPT-MF-001 |
| Digital I/O card 6 off digital inputs (AC optos), 4 off digital output | OPT-MF-005 |
| Incremental encoder + halls with simulated encoder out option | OPT-MF-011 |
| Resolver with simulated encoder out option card | OPT-MF-013 |
| **Feildbus options** | |
| Fieldbus carrier option (required for ALL fieldbus cards) | OPT-MF-030 |
| DeviceNet fieldbus option | OPT-FB-001 |
| Profibus fieldbus option | OPT-FB-002 |
| Ethernet/IP fieldbus option | OPT-FB-004 |
| Modbus TCP fieldbus option | OPT-FB-005 |
| Profinet I/O fieldbus option | OPT-FB-006 |

# AC motion control drives
## MotiFlex® e180

Frame Size A

### MotiFlex e180

- Integrated EtherCAT, Modbus/TCP, TCP/IP, EtherNet/IP and EtherNet Powerlink (EPL)
- EtherCAT DS402 slave, analog drive, step and direction programming option
- Single-axis MINT programming option with advanced MINT programming for multi-tasking control of communications, logic, motion and HMI interaction in high-performance motion applications
- Safe Torque Off (STO) as standard
- Controls rotary and linear AC servo motors with up to 300% overload modes; induction motors up to 150%
- Removable memory unit for firmware, application programs, functionality level, fast service replacements and moving settings from one drive to another
- Dual encoder is supported (incremental encoder input and output), single or multi-turn absolute encoders and resolver interface
- Common DC bus operation
- Partnered with ABB's AC500 PLC line with EtherCAT real-time high-performance or Modbus TCP control for simple applications

Frame Size B

| Frame | Size | Ratings / 4 kHz | | | | | | | | 3 phase 200 - 480 V AC 270-650 V DC |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 110% 60s | | 150% 60s | | 200% 3s | | 300% 3s | | Partial Catalog Number 1 2 |
| | | I2N | I2max | I2N | I2max | I2N | I2max | I2N | I2max | |
| A | -03A0-4 | 3.0 | 3.3 | 3.0 | 4.5 | 3.0 | 6.0 | 2.0 | 6.0 | MFE180-04AN-03A0-4 |
| | -05A0-4 | 5.0 | 5.5 | 5.0 | 7.5 | 4.0 | 8.0 | 2.7 | 8.1 | MFE180-04AN-05A0-4 |
| | -07A0-4 | 6.4 | 7.1 | 6.0 | 9.0 | 4.7 | 9.4 | 3.2 | 9.6 | MFE180-04AN-07A0-4 |
| B | -016A-4 | 14.0 | 15.4 | 11.0 | 16.5 | 9.0 | 18.0 | 7.0 | 21.0 | MFE180-04AN-016A-4 |
| C | -024A-4 | 21.5* | 23.7* | 17.0* | 25.5* | 13.5 | 27.0 | 10.0 | 30.0 | MFE180-04AN-024A-4 |
| | -031A-4 | 28.0* | 30.8* | 25.0* | 37.5* | 21.0 | 42.0 | 16.0 | 48.0 | MFE180-04AN-031A-4 |
| | -046A-4 | 41.0* | 45.1* | 35.0* | 52.5* | 28.0 | 56.0 | 20.0 | 60.0 | MFE180-04AN-046A-4 |
| D | -060A-4 | 62.0* | 68.2* | 46.0* | 69.0* | 35.0 | 70.0 | 25.0 | 75.0 | MFE180-04AN-060A-4 |
| | -090A-4 | 90.0* | 99.0* | 70.0* | 105.0* | 55.0 | 110.0 | 40.0 | 120.0 | MFE180-04AN-090A-4 |

Frame Size C

| Frame | Size | Ratings / 8 kHz | | | | | | | | 3 phase 200 - 480 V AC 270-650 V DC |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 110% 60s | | 150% 60s | | 200% 3s | | 300% 3s | | Partial Catalog Number 1 2 |
| | | I2N | I2max | I2N | I2max | I2N | I2max | I2N | I2max | |
| A | -03A0-4 | 3.0 | 3.3 | 3.0 | 4.5 | 2.3 | 4.6 | 1.6 | 4.8 | MFE180-04AN-03A0-4 |
| | -05A0-4 | 4.0 | 4.4 | 4.0 | 6.0 | 3.0 | 6.0 | 2.2 | 6.6 | MFE180-04AN-05A0-4 |
| | -07A0-4 | 5.0 | 5.5 | 4.0 | 6.0 | 4.0 | 8.0 | 3.0 | 9.0 | MFE180-04AN-07A0-4 |
| B | -016A-4 | 10.0 | 11.0 | 9.0 | 13.5 | 7.0 | 14.0 | 5.0 | 15.0 | MFE180-04AN-016A-4 |
| C | -024A-4 | 17.5* | 19.3* | 15.0* | 22.5* | 12.0 | 24.0 | 9.0 | 27.0 | MFE180-04AN-024A-4 |
| | -031A-4 | 25.0* | 27.5* | 20.0* | 30.0* | 18.0 | 36.0 | 13.0 | 39.0 | MFE180-04AN-031A-4 |
| | -046A-4 | 33.0* | 36.3* | 31.0* | 46.5* | 25.0 | 50.0 | 17.0 | 51.0 | MFE180-04AN-046A-4 |
| D | -060A-4 | 45.0* | 49.5* | 35.0* | 52.5* | 28.0 | 56.0 | 21.0 | 63.0 | MFE180-04AN-060A-4 |
| | -090A-4 | 55.0* | 60.5* | 47.5* | 71.3* | 40.0 | 80.0 | 30.0 | 90.0 | MFE180-04AN-090A-4 |

**NOTES:**
For pricing included with "complete" catalog number, see MotiFlex e180 List Price page.
* To achieve listed 110% and 150% ratings, only Frames C and D models (-024A-4 to -090A-4) require a mains choke (AC or DC)
1) Add required feedback interface (+ plus code) to base drive part number
2) Add programming option (+ plus code) if applicable

**MotiFlex e180 has four different overload modes as user selection:** 110%, 150%, 200%, 300%
$I_{2N}$ Maximum continuous rms current in selected overload mode. Load current duty cycle rms should be lower than this
$I_{2max}$ Maximum overload rms current for 60s (110%, 150%) or 3s (200%, 300%) in selected overload mode

Frame Size D

**Some 4kHz or 8kHz selection guidelines include the following:**
- 4kHz gives higher output currents
- Use 8kHz for applications requiring:
  - quieter operating environments
  - decreased motor losses with derated drives

110% / 150% ratings are similar to "Heavy Duty" mode matching the application and motor type.
200% / 300% ratings are similar to "Dynamic" mode matching the application and motor type.

Example 1:
- 6A RMS, 20A Peak (≤ 3s)
- The -016A-4 Frame B 4kHz 300% Drive is rated for 7A RMS, 21A Peak - exceeding requirements

Example 2:
- 5.6A RMS, 8.8A Peak (≤ 3s)
- The -07A0-4 Frame A 4kHz 150% Drive is rated for 6A RMS, 9A Peak - exceeding requirements

# AC motion control drives
## MotiFlex® e180

Frame Size A

### Feedback interface to base drive

| Description | Order plus code |
|---|---|
| FB-01: Incremental encoder + halls | +L517 |
| FB-02: Digital encoder (serial interfaces), ±SinCos (1v pk-pk), EnDat, Smart Abs, SSI, BiSS, Hiperface | +L518 |
| FB-03: Resolver | +L516 |

**NOTE:**
1) See Type Code List Price for complete catalog numbers.

For pricing included with “complete” catalog number, see MotiFlex e180 List Price page.

On all variants:
- Incremental encoder input
- Simulated encoder output

### Programming option

| Description | Order plus code |
|---|---|
| Standard firmware installed as default if no other option is selected<br>(EtherCAT DS402 slave, analog drive, step and direction (12-24 Vdc) controlled Drive. | - |
| Single axis MINT programming | +N8020 |

**NOTE:**
1) See Type Code List Price for complete catalog numbers.

For pricing included with “complete” catalog number, see MotiFlex e180 List Price page.

Frame Size B

Frame Size C

Frame Size D

# AC motion control drives

## How to select a MotiFlex® e180 Drive

**Type designation:**

MFE180 - 04AN - xxAx - 4 + Lxxx + Nxxx

**Product series**

MotiFlex e180

**Constructions**

04AN: Air cooled module

**Size**

**Voltage ratings**

4 200 to 480 VAC +/= 10%

**Feedback options**

+L517 FB-01: Incremental encoder + halls

+L518 FB-02: Digital encoder (serial interfaces) + SinCos (1v pk-pk), EnDat, Smart Abs, SSI, BiSS, Hiperface (not DSL)

+L516 FB-03: Resolver

**Functionality level options**

+N8020 MINT single-axis programming

-- Standard firmware installed as default if no other option is selected (EtherCAT DS402 slave, analog Drive, step and direction (12-24 Vdc) controlled Drive)



## Dimensions

### Drive only

| Frames | Height | | Width | | Depth | | Weight | |
|---|---|---|---|---|---|---|---|---|
| | mm | in | mm | in | mm | in | kg | lb |
| A | 364 | 14.3 | 90 | 3.54 | 144 | 5.67 | 3 | 6.61 |
| B | 380 | 15 | 100 | 3.94 | 221 | 8.7 | 5 | 11 |
| C | 467 | 18.4 | 165 | 6.5 | 223 | 8.78 | 10 | 22 |
| D | 467 | 18.4 | 220 | 8.66 | 223 | 8.78 | 17 | 37.5 |

**NOTES:**
Height is the maximum measure without clamping plates
In depth an additional 50 mm (2 in) should be reserved for feedback cabling


### Accessory Brackets

| Frames | Drive height w/ bracket | |
|---|---|---|
| | mm | in |
| A | 474 | 18.66 |
| B | 476 | 18.74 |
| C | 558 | 21.96 |
| D | 644 | 25.35 |


## Technical data

| | |
|---|---|
| **Supply connection** | |
| **AC Supply** | 3-phase 200 to 480 V AC +/-10%<br>50/60 Hz +/-5% |
| **DC supply** | 270 to 650 V DC +/-10% |
| **Motor connection** | |
| **Voltage** | 3-phase output voltage |
| **Frequency** | 0 to +/-500 Hz |
| **Motor control** | Torque, velocity, position, closed loop vector control, open loop V/Hz |
| **Motor types** | Asynchronous motors (standard induction, servo) and synchronous motors (servo, high torque), linear servo motors, linear induction motors |
| **Switching frequency / Control** | 4 / 8 kHz; Space vector modulation |
| **Braking power connection** | |
| **Braking chopper** | As standard in all types |
| **Braking resistor** | External resistor connected to Drive |
| **Product compliance** | |
| **CE** | Low Voltage Directive 2006/95/EC, EN 61800-5-1: 2007<br>Machinery Directive 2006/42/EC, EN 61800-5-2: 2007<br>EMC Directive 2004/108/EC, EN 61800-3: 2004 + A1: 2012 |
| **C-Tick** | Pending |
| **UL** | cUL/UL508C (2010) Power Conversion Equipment. |
| **RoHs** | RoHS directive 2011/65/EU |
| **TUV** | STO function |

| | |
|---|---|
| **Environmental limits** | |
| **Ambient temperature**<br>**Transport**<br>**Storage**<br>**Operation**<br>**Temperature** | <br>-40 to +70°C (-40 to +158°F)<br>-40 to +70°C (-40 to +158°F)<br>0 to +55°C (32 to 131°F), no frost allowed.<br>Above 40°C (104°F) with derating of 2%/1°C |
| **Cooling method**<br>**Air-cooled** | <br>Dry clean air |
| **Altitude** | 0 to 2000 m (6560 ft) above sea level.<br>Derating above 1000 m (3280 ft) 1%/100 m (328 ft) |
| **Relative humidity** | Max. 95%, no condensation allowed |
| **Degree of protection** | IP20 acc. to EN 60529;<br>Open Type acc. to UL 508C |
| **Contamination levels** | No conductive dust allowed |
| **Vibration** | Sinusoidal vibration (EN 60068-2-6:2008):<br>2 to 9 Hz: 3.0 mm (0.12)<br>9 to 200 Hz: 1g |
| **Shock** | Half sine pulse (IEC 60068-2-27:2008):<br>10g for 11 ms |
| **EMC** | Category C3 with optional filter (according to EN 61800-3) |
| **Functional safety** | Safe torque off (STO according EN 61800-5-2)<br>EN 61508 ed2: SIL 3,<br>EN 62061: SIL CL 3, EN ISO 13849-1: PL e |

# Motion controllers
## NextMove

NextMove e100

### NextMove e100 (Ethernet Powerlink, Modbus® TCP and Modbus RTU)

- Compact, high performance motion controller
- Real-time Ethernet Powerlink and Modbus® TCP/IP
- 8, 12 or 16 axes of interpolated motion
- (16 MN + 14 CN) profiled axes = max. 30 Powerlink axes
- 4 stepper axes / 3 analog axes
- CANopen® network manager
- RS232/422 and USB communications
- Advanced multitasking MINT programming
- ActiveX® controls
- Integrated digital/analog I/O including high speed registration inputs.

| Number of axes | Order code | | Price |
|---|---|---|---|
| | Differential stepper | Single ended stepper | |
| 8 | NXE100-1608DBW | NXE100-1608SBW (1) | |
| 12 | NXE100-1612DBW | NXE100-1612SBW (1) | |
| 16 | NXE100-1616DBW | NXE100-1616SBW (1) | |

(1) For use with DSMS stepper/driver.

6

NextMove ESB-2

### NextMove ESB-2

- Compact, panel mount motion controller
- Economical and simple to install
- Powerful multitasking MINT programming
- 4 axes of closed loop control
- 4 axes of open loop control (step/direction outputs)
- Max. 8 axes
- USB, serial and CANopen® provide flexible communications to PLC, distributed I/O and other devices
- Integrated digital/analog I/O including high speed registration inputs
- Firmware variant allows the controller to operate as a CANopen® DS402 master and control up to 64 axes.

| Number of axes | Serial port | Order code | | Price |
|---|---|---|---|---|
| | | Differential stepper | Single ended stepper | |
| 7 | RS232 / USB | NSB202-501W | NSB203-501W | |
| 7 | RS485 / USB | NSB202-502W | NSB203-502W | |
| 8 | RS232 / USB | NSB204-501W | NSB205-501W | |
| 8 | RS485 / USB | NSB204-502W | NSB205-502W | |

NextMove PCI-2

### NextMove PCI-2

- Compact, high performance PCI-bus motion controller
- 4 stepper axes + 4 analog axes = max. 8 axes
- Onboard digital and analog I/O
- CANopen® for distributed control
- High speed PCI bus interface
- Advanced multitasking MINT or ActiveX® programming
- Firmware variant allows the controller to operate as a CANopen® DS402 master and control up to 64 axes.

| Number of axes | Order code | | Price |
|---|---|---|---|
| | PNP outputs | NPN outputs | |
| 1 (2) | PCI201-501 | PCI201-511 | |
| 2 (2) | PCI201-502 | PCI201-512 | |
| 3 (2) | PCI201-503 | PCI201-513 | |
| 4 (2) | PCI201-504 | PCI201-514 | |
| 8 (3) | PCI201-508 | PCI201-518 | |

(2) User configurable for servo or stepper. (3) 4-axis servo control and 4-axis stepper.

MotiFlex e100 connection panel

### Plug in option cards for use with MotiFlex e100

- Plug-in motion controller
- 4 POWERLINK axes + 1 analog axes = max. 5 axes
- Onboard digital and analog I/O
- Encoder input for electronic gearing functions
- CANopen® manager for I/O expansion (via host drive)
- Add CP600 HMI via RS485 Modbus® RTU
- Fully utilize drive I/O and interfaces including additional option cards.

| Description | Order code | Price |
|---|---|---|
| Single axis MINT motion option (plug-in) | OPT-MF-100 | |
| Multi-axis MINT motion option (plug-in) | OPT-MF-101 | |

# ABB DriveSize and MCSize Software Tool

DriveSize is ABB's product selection software. The MCSize plug-in is specifically for the determination of servo motors and selected drives for motion control systems.

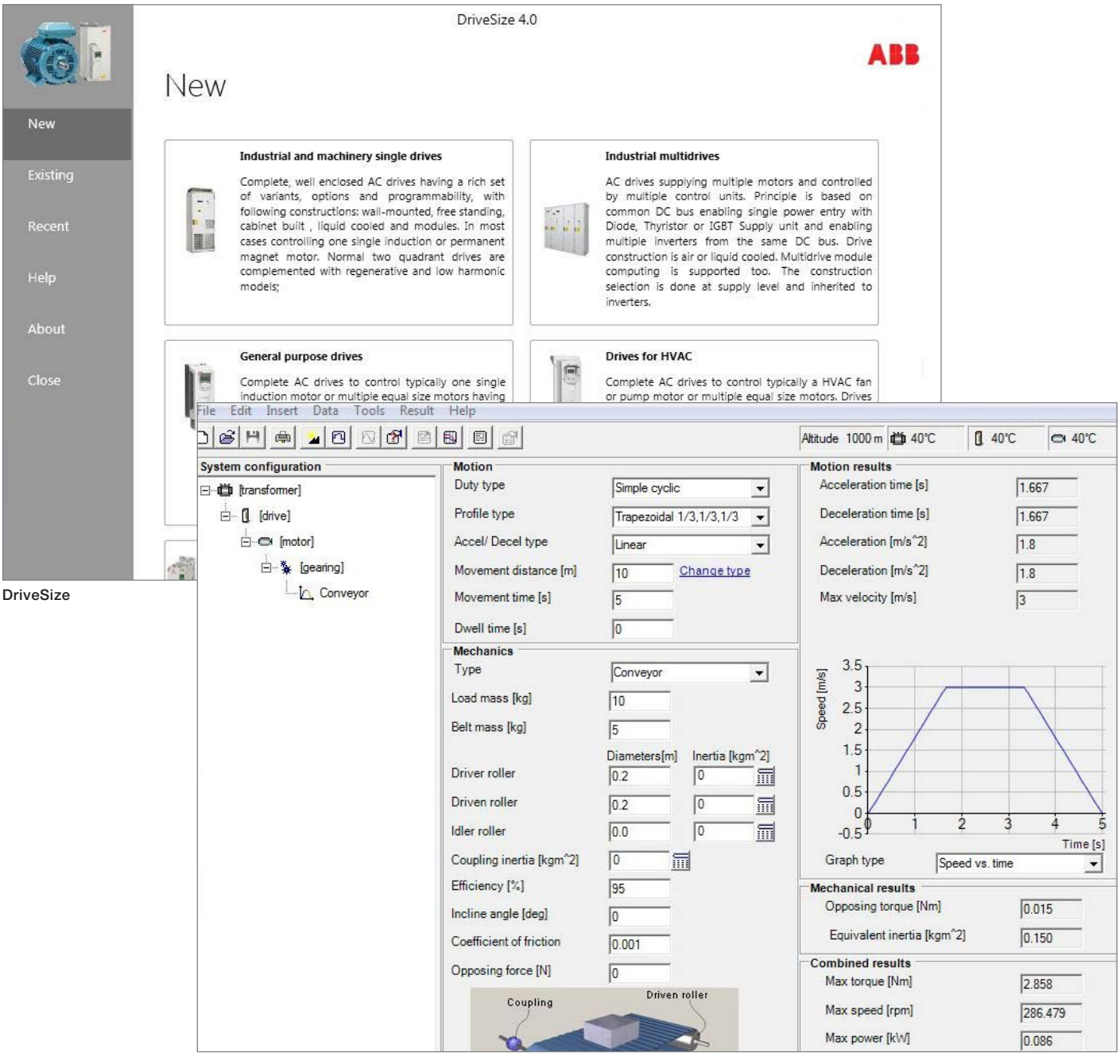
MC Size is available with a motor database, motor selection criteria and user selection information to make the process of choosing a servo motor and drive easier and more accurate.

Download DriveSize and MCSize from ABB's website:

http://new.abb.com/drives/software-tools/drivesize

**NOTES:**

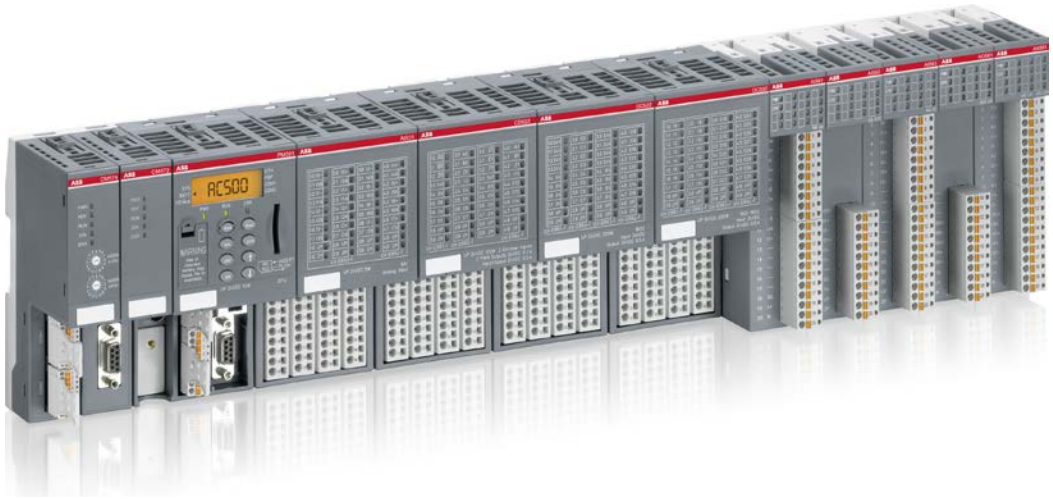
- MCSize does not contain product price information, but attempts to ascertain a low-cost solution by offering lower current motors. It is necessary to check the cost of alternative solutions to determine the best offering for specific customer requirements.
- MCSize does not select the feedback type or other motor options. Please ensure you identify the required options, including the feedback type, and modify the specified part numbers accordingly.




**DriveSize**

# PLC AC500
## AC500 system overview

### AC500, superior local extension capabilities for I/O communication and best-in-class CPU functionality and industry leading performance.



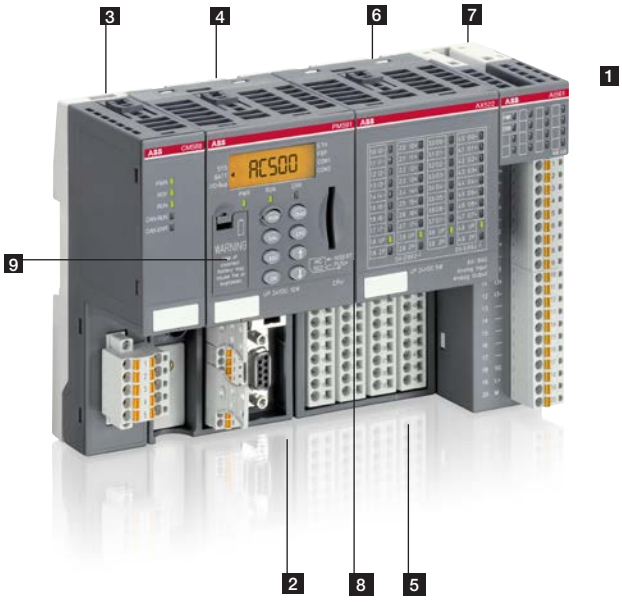
**1** AC500 CPUs can be locally expanded with up to 10 I/O modules (Standard S500 and S500-eCo I/O modules can be mixed).



**2** Terminal base

**3** Communication module
Up to 4 modules in numerous combinations to communicate with nearly everything

**4** CPU module




**5** S500 Terminal unit

**6** S500 I/O module

**7** S500-eCo I/O module

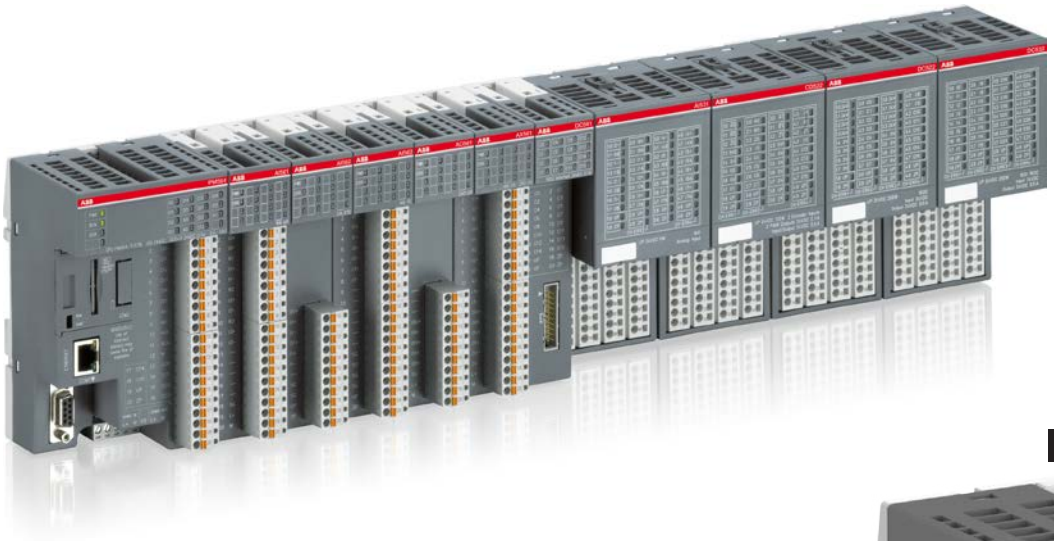

**8** SD-card

**9** Battery

MCSize

# PLC AC500
## AC500-eCo system overview

AC500-eCo CPUs can be locally expanded with up to 10 I/O modules.
New AC500-eCo CPUs for use with pluggable terminal blocks available.



**1** AC500-eCo CPUs can be locally expanded with up to 10 I/O modules (Standard S500 and S500-eCo I/O modules can be mixed).

AC500-eCo Starter Kits Available!



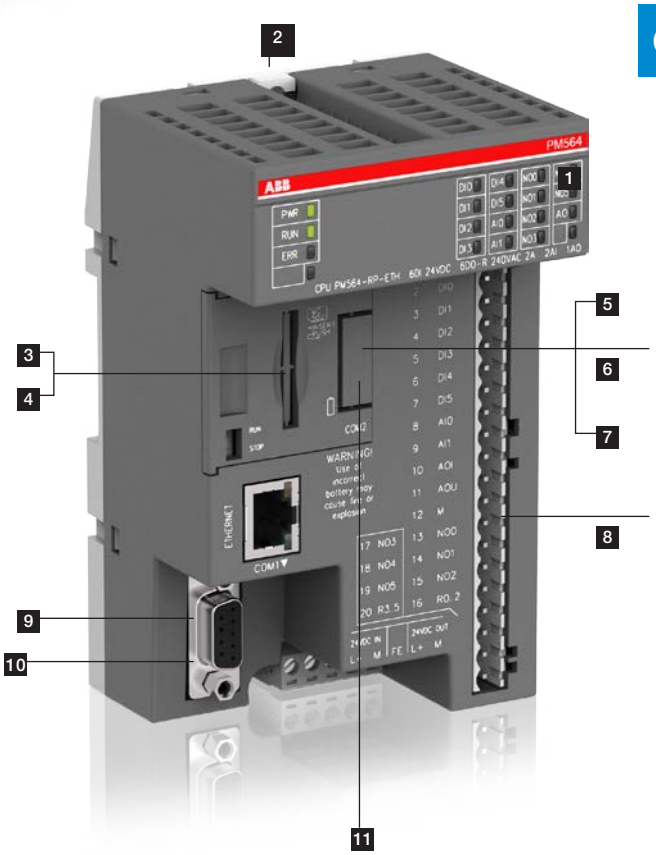
**2** Wall mounting

**3** SD-card adapter

**5** Adapter with realtime clock
**6** Adapter with COM2 & realtime clock


**4** SD-card

**7** Adapter with COM2




**8** Terminal blocks

**9** RS485 isolator for COM1

**10** COM1 USB
**11** COM2 USB programming cable

# PLC AC500

## PLC AC500-XC for extreme conditions; ruggedized variants when interacting with the elements in wind, solar, water, cranes, robotics, marine, and other harsh environment applications




**Operating in wet environments**
- Increased resistance to 100% humidity with condensation.

**Extended operating temperature**
- 40°C up to +70°C operating temperature

**Use at high altitudes**
- Operating altitude up to 4,000 m above sea level

**Extended immunity to hazardous gases and salt mist**
- G3, 3C2 immunity
- Salt mist EN 60068-2-52 / EN 60068-2-1

**Extended immunity to vibration**
- 4 g root mean square random vibration up to 500 Hz
- 2 g sinusoidal vibration up to 500 Hz

**Extended EMC requirements**
- EN 61000-4-5 surge immunity test
- EN 61000-4-4 transient / burst immunity test

# For your notes

# For your notes

# For your notes

# Contact us

You can find the address of your local sales organization on the ABB homepage:

**www.abb.com/motion**



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