Data
Publication

BM(S) Series Motors

- **Torque outputs from 3 oz-in to 35,000 lb-ft**
- **Speeds to 18,000 rpm for typical designs, and to 80,000 rpm for special designs**
- **Framless or housed**

Kollmorgen's Direct Drive Brushless Motors are found in the world's most demanding applications. With a MTBF of over 50,000 hours, these motors exist on critical applications such as implantable heart pumps, aircraft trim actuators, catscans, fin actuators, satellites and other space applications. Kollmorgen's motors also exist on high precision applications such as semiconductor handling and processing, automobile frame welding positioners, antenna drives and positioning systems for observatory telescopes.

Brushless motor designs, which have the same direct drive advantages as their brush-type counterparts, have expanded the performance capability of electro-mechanical drives. Because the commutation characteristics of a brush-type motor can limit its speed range, a brushless motor operates over a broader range of speeds. Also, brush-induced EMI/RFI is eliminated. Another design feature of brushless motors is that their inside-out configuration allows for better heat dissipation, lower rotor inertia and faster response. In addition, the absence of brushes may reduce maintenance requirements.

Brushless systems are well suited for special environments such as high altitudes or deep space, circulating fluids, explosive atmospheres, clean rooms and vacuums. Kollmorgen also offers drive and control electronics for all brushless motor designs.

KOLLMORGEN

Advantages of Brushless Systems

Brushless systems offer distinct mechanical advantages over conventional systems. Placement of brushless windings into the outer stationary member and field magnets onto the inner rotating member allows significant reductions in rotor inertia and increases in acceleration. Winding heat can be transferred directly from the outer member into adjacent heat sinks. Cooling and efficiency are improved. Generally, brushless systems can provide extra performance while surviving a great variety of operating conditions because of improved efficiency and heat dissipation. Kollmorgen brushless motors are available frameless or housed and are easily matched with Kollmorgen servo amplifiers. As new technologies emerge, Kollmorgen will continue to expand the capabilities of these motion control system components.

Brushless Motor System Components

There are four basic components in a brushless motor drive system. They are the Armature, the Field, the Rotor Position Feedback and the servo amplifier.

The Armature

Also known as the stator, the armature is the wound member of the motor and consists of a three phase winding wound on a laminated iron core. The armature is typically the outer member and is stationary. It consists of low loss laminations bonded into a core which may have skewed winding slots. The core and slots are electrically insulated prior to inserting the winding. The winding consists of a series of coils for each motor phase. Phase interconnections are made inside the winding, resulting in a “wye” or “delta” connection. With a three wire termination, there is no reason for the customer to require either a “wye” or “delta” connection. Three leads are typically brought out for connection to the amplifier.

The Field

The field assembly or rotor consists of permanent magnet poles bonded to a flux carrying yoke ring. The magnet material selected will depend upon the application, Available magnet materials include Samarium Cobalt and the high energy Neodymium Iron-Boron compounds. For high speed applications, a magnet retaining band can be placed around the rotor to insure mechanical integrity.

Rotor Position Feedback

High performance Brushless DC systems require rotor position feedback to the amplifier to perform the commutation function, which is required for the motor to rotate. Kollmorgen Brushless DC motor systems typically will include one or more of the following rotor feedback configurations: Hall sensors, encoder, or resolver. Hall sensors have the advantage that they are an integral part of the Armature and therefore do not require the customer to integrate a separate feedback device. For frameless motor applications which require a resolver or encoder, the customer will often need to add these as separate components in their system.

Servo Amplifier

The Servo amplifier is required for a brushless motor to rotate. The Servo amplifier acquires the rotor position feedback. This information is used to direct current into the appropriate windings of the Armature to develop torque. The Servo amplifier uses the rotor position feedback to redirect the current into different winding phases as necessary to continue to generate torque as the rotor rotates. The Servo amplifier will typically close an internal current loop. Optionally, the Servo amplifier can use the rotor position feedback to control the velocity and/or the position of the motor.

Frameless vs. Housed

Kollmorgen brushless motors can be supplied either frameless or housed.

A housed motor includes a shaft, bearings and endbells, along with any feedback devices, into an integral assembly. This is the classical motor configuration. The customer mounts the motor housing into the desired system and provides a mechanical coupling to the motor shaft. The coupling can be a direct shaft coupling, gearing, or belts / pulleys. In some applications, the customer mounts the load directly to the motor shaft with the motor bearings supporting the load. Framelesss motors are supplied as two separate components; the Rotor (Field) and Stator (Armature).

The Frameless motor does not include shaft, bearings, or endbells. Frameless motors are used in applications where the customer desires to minimize the size and weight of the motor and / or obtain the maximum dynamic performance. Since the load is often supported on its own bearing structure, the Frameless motor can be integrated directly onto the system / load shaft and be suspended on the same bearings as the load. This eliminates the need for an additional shaft, bearings, endbells, or other coupling between the motor shaft and the load.

An advantage of a Frameless motor is that, since there is no coupling between the shaft and the load, torsional play between the motor and load is minimized resulting in improved dynamic performance. Another advantage is that inertia matching between the motor and load, which is typically required for housed motor applications, is not a critical requirement for Frameless motor applications since the motor and load are one inertial mass.

System Performance and Commutation

Careful selection of system components optimizes brushless system performance. Kollmorgen offers components for two kinds of brushless commutation systems: six step (trapezoidal) and sinusoidal. Selection should be made based on the application and on the performance requirements. For most servo applications, a six step sequence is appropriate unless very smooth operation under load at slow speed is required. For such applications, sinusoidal amplifiers offer exceptionally smooth operation with low torque ripple.

Brushless motors are not commutated mechanically, as with a commutator and brushes, but electronically based on rotor magnet position information. Kollmorgen six step amplifiers are designed to utilize Hall device position signals for commutation. A Hall device mounted onto the stator convey rotor magnet position to the amplifier. This position information is necessary for commutation which changes the direction of current flow in the proper motor windings at the proper time. The Hall devices are accurately aligned with the stator winding back EMF at the factory.

The Hall device and Motor Phase Output diagram shows proper alignment of the three Hall device outputs with the three motor back emf waveforms. Externally rotating the motor field generates a back EMF voltage in each phase, which is used to align the Hall sensor in the optimum position. Current supplied to each phase will correspond with the Hall device switching points.

External motor phase connections are labeled A, B, and C, “V-AB” refers to the back emf voltage produced across leads A and B. “V-BC” and “V-CA” denote voltages produced across leads B and C and across C and A respectively. Corresponding Hall device outputs are labeled “H-AB”, “H-BC”, and “H-CA”.

Kollmorgen sinusoidal amplifiers are designed to utilize resolver or encoder / Hall sensor position information for commutation. This feedback may be customer supplied or factory supplied for housed brushless motors. Feedback selection will vary depending on the motor selected and the application. Motor selection for a sinusoidal system may require factory consultation to assure performance goals are met. Although six step commutation systems can provide torque with ripple as low as five or six percent, sinusoidal system torque ripple can approach values of one percent. Amplifiers for both system types are pulse width modulated.

Size Constants

Each BMS series motor has nine motor parameters, or size constants, listed on the individual data page for each motor. These parameters are dependent upon the size and shape of the model, but are independent of the winding used. Following is a brief description of the size constants.

Peak Torque (Tp) is the nominal value of developed torque with the rated current Ip applied to the motor. For each winding specified the product of Ip and the nominal torque sensitivity Kt gives Tp.

Motor Constant (Km) is the ratio of peak torque to the square root of power input at 25°C and at stall:

Km = Tp/(Pp)^.5

This ratio is useful during the initial selection of a motor, because it indicates the ability of a motor to convert electrical power into torque. A common use of Km is to determine how much power a motor will dissipate in order to generate a certain amount of torque by using the following equation:

Watts Dissipated = Torque^2 / Km^2

Static Friction (Tf) is the sum of the retarding torques at start-up or at stall within the motor. In a frameless brushless motor, retarding torques consist of magnetic frictional torque and cogging torque. Housed motor TF includes bearing and other retarding torques.

Damping Coefficient (Fi) is the torque loss due to rotational losses, mostly eddy current, which is proportional to speed. A lower Fi indicates less loss during high speed operation.

Maximum Winding Temperature is the maximum temperature that the motor windings are allowed to reach. This temperature is the sum of the ambient temperature and the temperature rise in the motor windings due to motor operation. Maximum temperature is based on the insulation materials used in motor construction. (Note that Hall sensor assemblies or other auxiliary components such as resolvers, encoders, etc. may have different temperature limits which must be observed during operation.)

Temperature Rise per Watt (TPR) is the ratio of winding temperature rise to average power losses continuously dissipated from the stator. Motor TPR values are classified as "mounted" or "unmounted" indicating the conditions for which the TPR applies. Most TPR values shown under SIZE CONSTANTS are unmounted and apply when a motor is suspended in still, 25°C air. The Motor Performance Curves use a TPR value assuming the motor is housed and mounted to a machine. Customer supplied supplemental cooling can reduce the TPR value significantly resulting in increased continuous speed and torque operation.

Number of Poles is the number of magnetic poles in the rotor.

Rotor Ineria (Jm) is the moment of inertia of the rotor about its axis of rotation.

Motor Weight is the weight of the frameless motor. Note that the customer supplied shaft, hub assembly, bearings, and housing would add to this weight.

Winding Constants

There are six parameters, or winding constants, listed on the individual data page for each motor which vary according to the winding that is used in the model. The variations are governed by the number of wire turns per coil and the wire size. In some cases, values for more than one winding are listed. If none of the specified windings are suitable for a given application, additional windings are available by consulting the factory. Following is a brief description of each parameter.

Peak Current (Ip) is the rated current used to obtain the nominal peak torque from the motor with a nominal torque sensitivity Kt. Ip is selected at a point where the Kt is reduced to 90 percent of its value at low current levels. Current levels above Ip will result in slightly higher torque than Tp, however, Kt will be less than 90 percent of nominal and care must be taken against damage to the motor from rapid heating.

Torque Sensitivity (Kt) is the ratio of the developed torque to winding input current for the designated winding.

Back EMF Constant(Kb) the ratio of voltage generated in the winding to the speed of the rotor. Since both Kb and Kt are determined by the same factors, Kb is directly proportional to Kt.

DC Resistance (Rm) is the resistance measured between any two leads of the winding at 25°C.

Inductance (Lm)is the winding inductance measured between any two leads of the winding. Factory tests are performed at 60 Hz with the rotor in place.

Motor Per formance Curve

Each BMS motor data sheet has a Motor Performance Curve indicating the speed and torque which the motor can produce. These curves are based on the following assumptions:

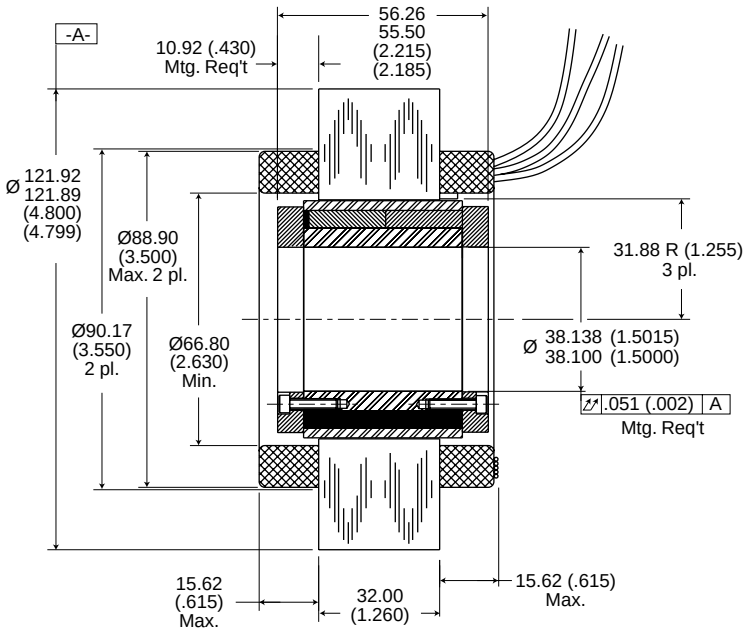
1. An amplifier is utilizing Hall devices for six step commutation
2. The amplifier can supply the motor's Ip to support Intermittent operation
3. The amplifier is connected to a 300 Volt DC bus and can deliver 300 Volts to the motor
4. The A winding is being utilized

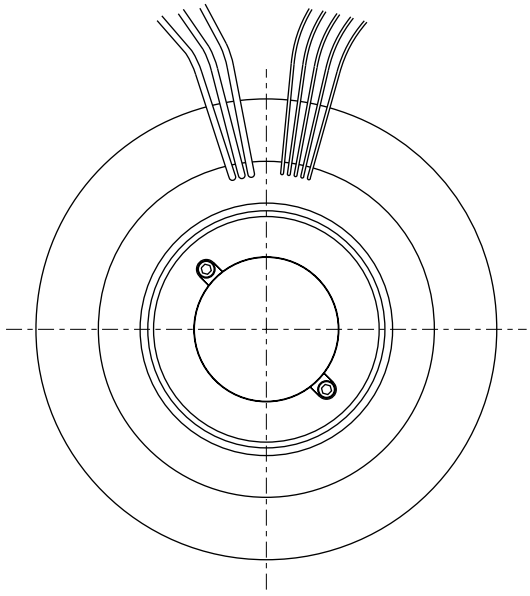
The possible combination of operating voltage, current, and winding combinations are unlimited.

Brushless Motor with Sensors

DIMENSIONS/PERFORMANCE

BMS-2501





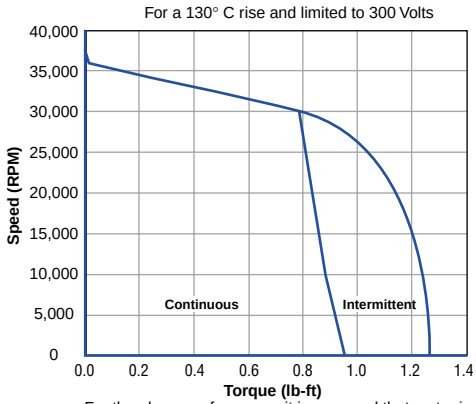
Notes:
1. Mounting surface between Ø121.92 (4.800) and Ø90.17 (3.550)
2. For a C.C.W. rotation as viewed from lead exit end, use excitation sequence table, back page

Motor Leads:
#16 AWG. 1-Red, 1-Black, 1-White
Sensor Leads:
#26 AWG. 1-Red, 1-Black, 1-Orange, 1-Brown, 1-Yellow

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	1.73
	lb-ft	1.28
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	.139
	lb-ft/$\sqrt{\text{Watt}}$	.102
Static Friction (Max.)- T_f	N-m	$2.7x10^{-2}$
	lb-ft	$2.0x10^{-2}$
Damping Coeff. INF Impedence- F_i	N-m per rad/s	$2.3x10^{-5}$
	lb-ft per rad/s	$1.7x10^{-5}$
Max. Winding Temperature	°C	200
Temperature Rise per Watt- TPR	°C/Watt	1.0
Number of Poles	-	4
Rotor Inertia- J_m	kg-m²	$4.84x10^{-4}$
	lb-ft-s²	$3.57x10^{-4}$
Motor Weight	kg(f)	2.9
	lbs	6.4

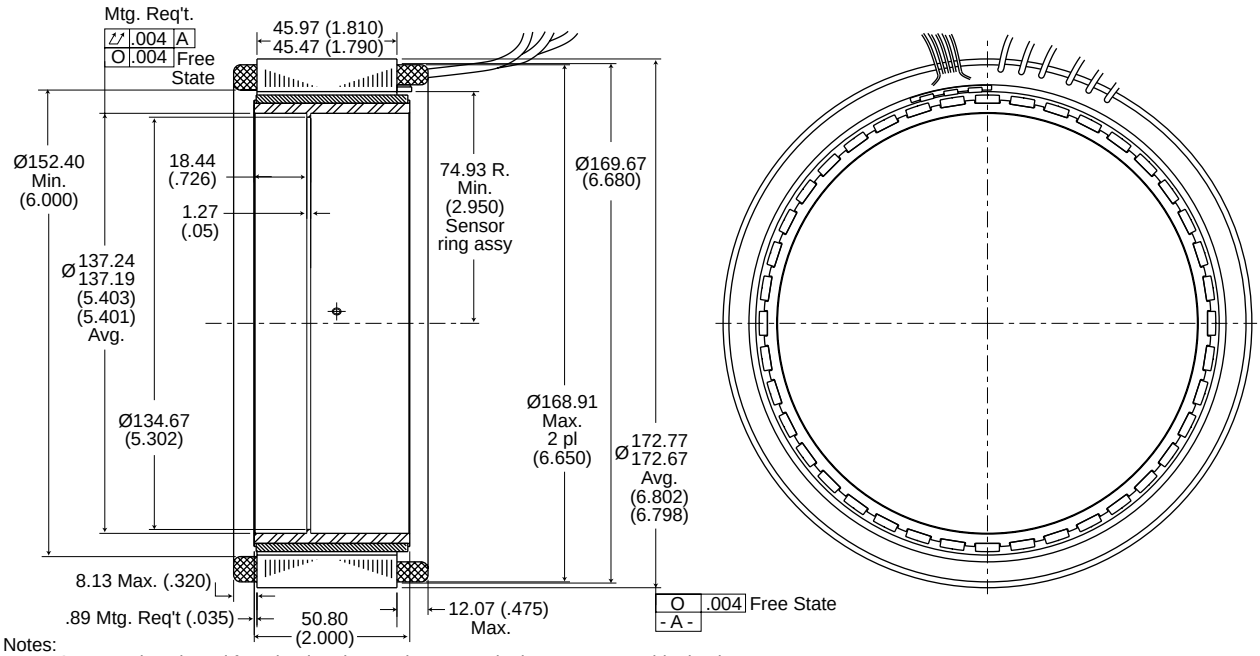
Continuous Operation Curve



For the above performance, it is assumed that motor is housed and would have a TPR of 1.0° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	22.0					
Torque Sensitivity- K_t	N-m/Amp	±10%	.0787					
	lb-ft/Amp	±10%	.0580					
Back EMF Constant- K_b	V per rad/s	±10%	.0787					
DC Resistance (25°C)- R_m	Ohms	±10%	.321					
Inductance- L_m	mH	±30%	.62					

BMS-5905



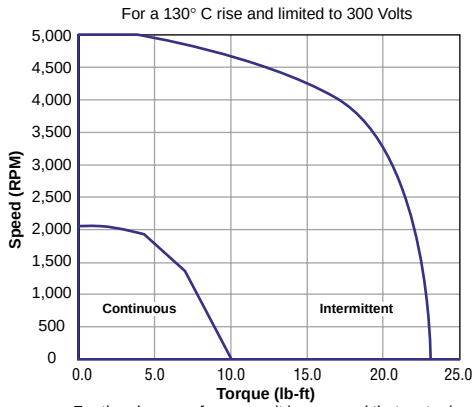
Notes:
1. For C.W. rotation viewed from lead end, energize per excitation sequence table, back page
2. V-AB, V-BC and V-CA is back EMF of motor phases AB, BC and CA respectively aligned with sensor output as shown for C.W. rotation only.
3. Mounting surface is between Ø169.67 (6.680) and Ø172.72 (6.800) on both sides.

Motor leads:
#18 AWG. 2-Black, 2-Red, & 2-White
Sensor leads:
#26 AWG. 1-Black, 1-Brown, 1-Orange, 1-Red and 1-Yellow

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	31.4
	lb-ft	23.1
Motor Constant- K_m	N-m/ $\sqrt{\text{Watt}}$	1.08
	lb-ft/ $\sqrt{\text{Watt}}$	0.798
Static Friction (Max.)- T_f	N-m	0.420
	lb-ft	0.310
Damping Coeff. INF Impedence- F_i	N-m per rad/s	0.00339
	lb-ft per rad/s	0.0025
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	1.00
Number of Poles	-	40
Rotor Inertia- J_m	kg-m^2	4.41x10^{-3}
	lb-ft-s^2	3.25x10^{-3}
Motor Weight	kg(f)	2.27
	lbs	5.00

Continuous Operation Curve



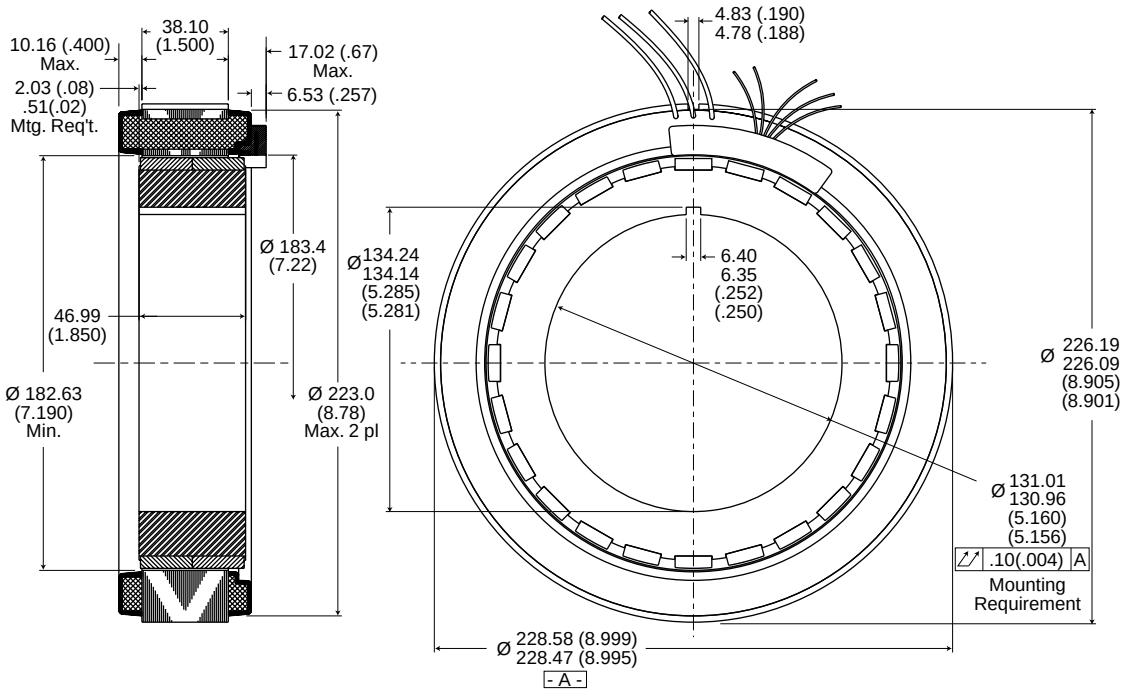
For the above performance, it is assumed that motor is housed and would have a TPR of 0.50° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	58.0					
Torque Sensitivity- K_t	N-m/Amp	±10%, -5%	.541					
	lb-ft/Amp	±10%, -5%	.399					
Back EMF Constant- K_b	V per rad/s	±10%, -5%	.541					
DC Resistance (25°C)- R_m	Ohms	+5%, -10%	.250					
Inductance- L_m	mH	±30%	.150					

Brushless Motor with Sensors

DIMENSIONS/PERFORMANCE

BMS-7101



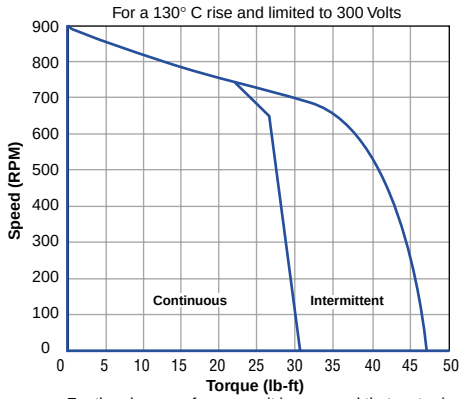
Notes:
1. For C.W. rotation viewed from lead end, energize per excitation sequence table, back page
2. V-AB, V-BC V-CA is back EMF of motor, phases AB, BC and CA respectively, aligned with sensor output as shown for C.W. rotatation only.

Motor Leads:
#18 AWG. 1-Black, 1-Red & 1-White
Sensor Leads:
#26 AWG. 1-Red, 1-Black, 1-Brown, 1-Orange & 1-Yellow

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	63.7
	lb-ft	47
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	2.17
	lb-ft/$\sqrt{\text{Watt}}$	1.60
Static Friction (Max.)- T_f	N-m	0.79
	lb-ft	0.58
Damping Coeff. INF Impedence- F_i	N-m per rad/s	0.0271
	lb-ft per rad/s	0.020
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	0.65
Number of Poles	-	24
Rotor Inertia- J_m	kg-m^2	2.62x10^{-2}
	lb-ft-s^2	1.93x10^{-2}
Motor Weight	kg(f)	8.2
	lbs	18

Continuous Operation Curve

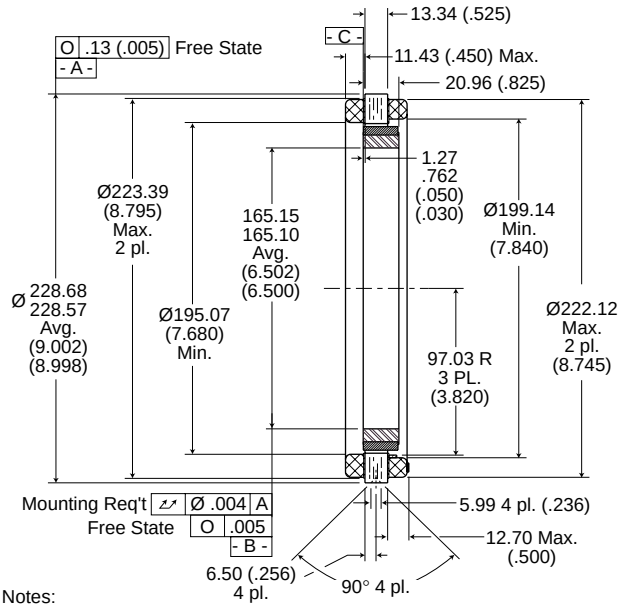


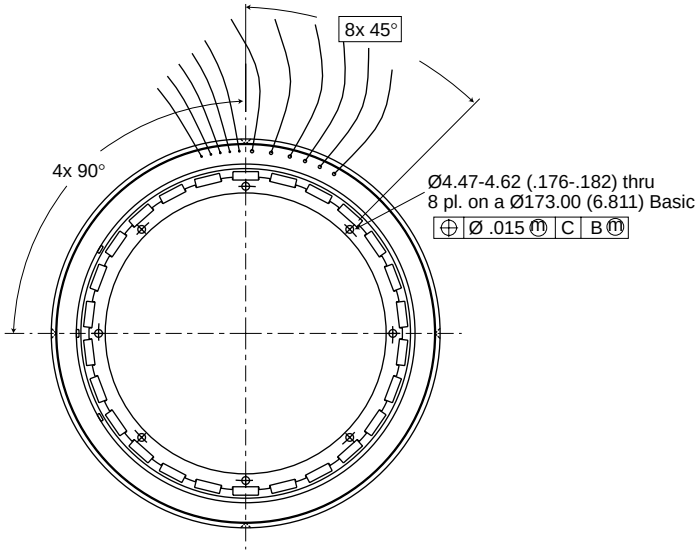
For the above performance, it is assumed that motor is housed and would have a TPR of 0.325° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	20.0	11.2	14.1			
Torque Sensitivity- K_t	N-m/Amp	±10%	3.19	5.71	4.52			
	lb-ft/Amp	±10%	2.35	4.21	3.33			
Back EMF Constant- K_b	V per rad/s	±10%	3.19	5.71	4.52			
DC Resistance (25°C)- R_m	Ohms	±10%	2.15	6.87	4.39			
Inductance- L_m	mH	±30%	5.8	19	8.2			

DIMENSIONS/PERFORMANCE

BMS-7404





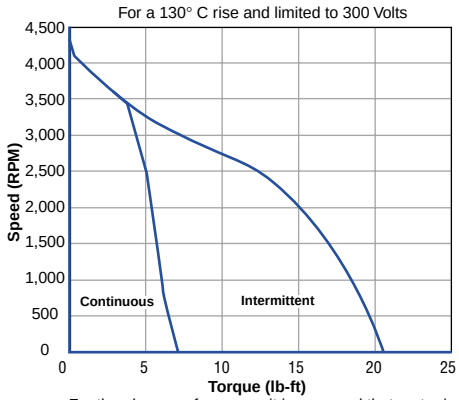
Notes:
1. For C.W. rotation viewed from lead end, energize per excitation sequence table, back page.
2. V-AB, V-BC V-CA is back EMF of motor, phases AB, BC and CA respectively, aligned with sensor output as shown for C.W. rotatation only.

Motor Leads:
#18 AWG. 2-Black, 2-Red & 2-White
Sensor Leads:
#26 AWG. 1-Blue, 1-Brown, 1-Green, 1-Orange & 1-Yellow

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	27.8
	lb-ft	20.5
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	0.724
	lb-ft/$\sqrt{\text{Watt}}$	0.534
Static Friction (Max.)- T_f	N-m	0.217
	lb-ft	0.160
Damping Coeff. INF Impedence- F_i	N-m per rad/s	1.3×10^{-3}
	lb-ft per rad/s	9.6×10^{-4}
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	1.10
Number of Poles	-	26
Rotor Inertia- J_m	kg-m^2	7.6×10^{-3}
	lb-ft-s^2	5.6×10^{-3}
Motor Weight	kg(f)	2.09
	lbs	4.60

Continuous Operation Curve



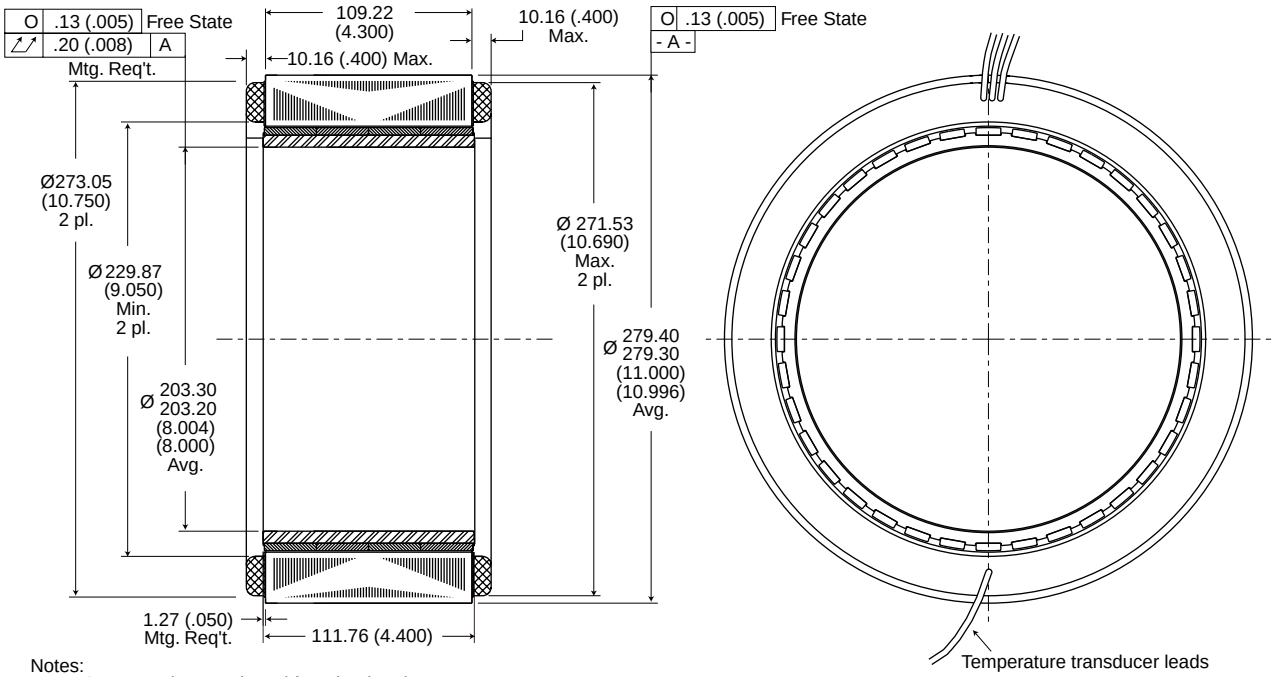
For the above performance, it is assumed that motor is housed and would have a TPR of 0.55° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	41.0					
Torque Sensitivity- K_t	N-m/Amp	±10%	0.678					
	lb-ft/Amp	±10%	0.500					
Back EMF Constant- K_b	V per rad/s	±10%	0.678					
DC Resistance (25°C)- R_m	Ohms	±10%	0.877					
Inductance- L_m	mH	±30%	1.52					

Brushless Motor

DIMENSIONS/PERFORMANCE

BM-8901



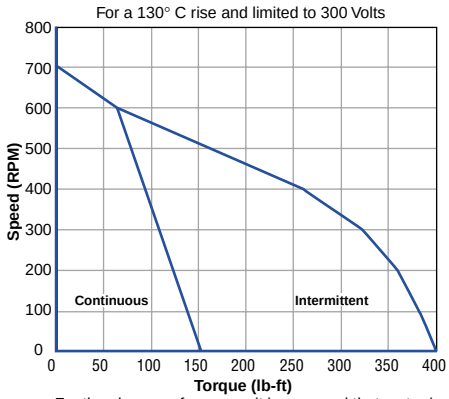
Notes:
1. For C.W. Rotation, as viewed from lead end, energize per excitation sequence table, back page.
2. Mounting surface is between Ø273.05 (10.750) and Ø279.40 (11.000) on both sides.

Motor leads:
#10 AWG. 1-Black, 1-Red, & 1-White
Temperature transducer leads:
#24 AWG. 1-White, 1-Black

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	540
	lb-ft	398
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	7.29
	lb-ft/$\sqrt{\text{Watt}}$	5.38
Static Friction (Max.)- T_f	N-m	3.5
	lb-ft	2.6
Damping Coeff. INF Impedence- F_i	N-m per rad/s	0.133
	lb-ft per rad/s	0.0980
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	0.40
Number of Poles	-	36
Rotor Inertia- J_m	kg-m^2	5.95x10^{-2}
	lb-ft-s^2	4.39x10^{-2}
Motor Weight	kg(f)	20
	lbs	42.7

Continuous Operation Cur ve

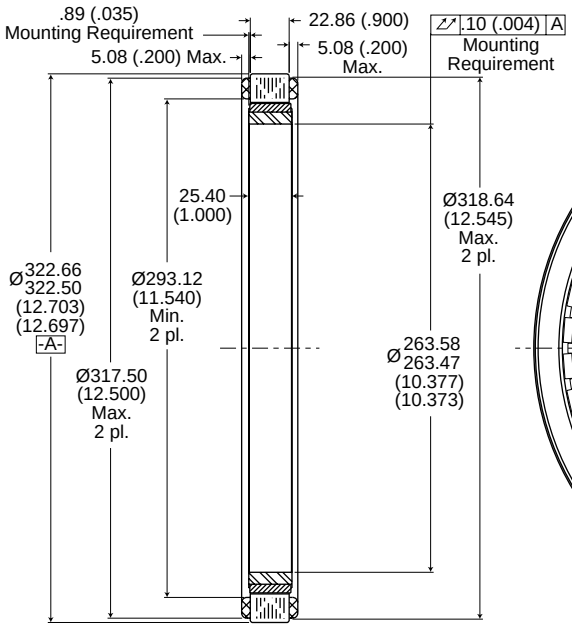


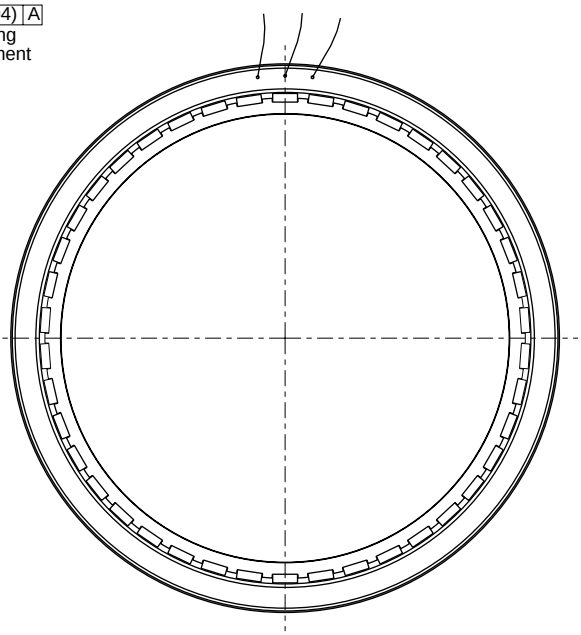
For the above performance, it is assumed that motor is housed and would have a TPR of 0.20° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	130					
Torque Sensitivity- K_t	N-m/Amp	±10%	4.15					
	lb-ft/Amp	±10%	3.06					
Back EMF Constant- K_b	V per rad/s	±10%	4.15					
DC Resistance (25°C)- R_m	Ohms	±10%	0.324					
Inductance- L_m	mH	±30%	1.8					

DIMENSIONS/PERFORMANCE

BM-11301





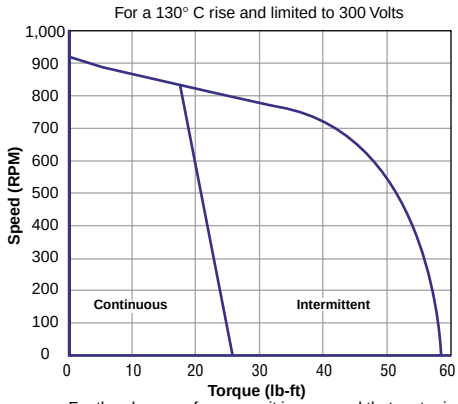
Notes:
1. For CW rotation as viewed from lead end, energize per excitation sequence table, back page.
2. Mounting surface is between Ø318.64 (12.545) and Ø322.58 (12.700) on both sides.

Motor Leads:
#20 AWG. 1-Red, 1-White & 1-Black

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	79.8
	lb-ft	58.9
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	2.4
	lb-ft/$\sqrt{\text{Watt}}$	1.74
Static Friction (Max.)- T_f	N-m	1.4
	lb-ft	1.0
Damping Coeff. INF Impedence- F_i	N-m per rad/s	0.0139
	lb-ft per rad/s	0.0102
Max. Winding Temperature	°C	200
Temperature Rise per Watt- TPR	°C/Watt	0.49
Number of Poles	-	42
Rotor Inertia- J_m	kg-m^2	3.05x10^{-2}
	lb-ft-s^2	2.25x10^{-2}
Motor Weight	kg(f)	3.63
	lbs	8.0

Continuous Operation Curve



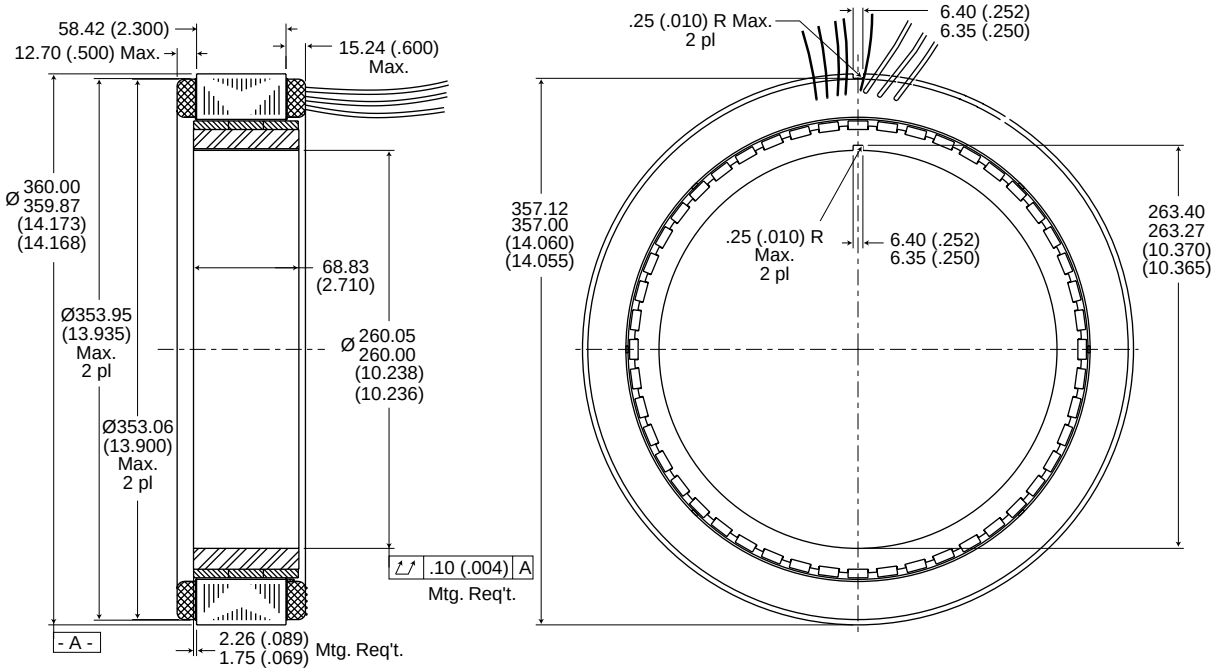
For the above performance, it is assumed that motor is housed and would have a TPR of 0.49° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	25.6					
Torque Sensitivity- K_t	N-m/Amp	±10%	3.12					
	lb-ft/Amp	±10%	2.30					
Back EMF Constant- K_b	V per rad/s	±10%	3.12					
DC Resistance (25°C)- R_m	Ohms	±10%	1.75					
Inductance- L_m	mH	±30%	2.2					

Brushless Motor with Sensors

DIMENSIONS/PERFORMANCE

BMS-11805



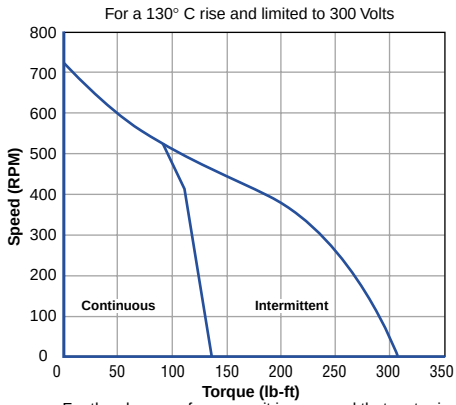
Notes:
1. For C.W. rotation as viewed from lead end, energize per excitation sequence table, back page.
2. V-AB, V-BC and V-CA is back EMF of motor phases AB, BC and CA respectively aligned with sensor output as shown for C.W. rotation only.
3. Mounting surface is between Ø353.95 (13.935) and Ø359.97 (14.172) on both sides.

Motor leads:
#12 AWG. 1-Black, 1-Red, & 1-White
Sensor leads:
#26 AWG. 1-Black, 1-Brown, 1-Orange, 1-Red and 1-Yellow

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	415
	lb-ft	306
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	6.28
	lb-ft/$\sqrt{\text{Watt}}$	4.63
Static Friction (Max.)- T_f	N-m	2.03
	lb-ft	1.50
Damping Coeff. INF Impedence- F_i	N-m per rad/s	0.0990
	lb-ft per rad/s	0.0730
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	0.120
Number of Poles	-	48
Rotor Inertia- J_m	kg-m^2	0.163
	lb-ft-s^2	0.120
Motor Weight	kg(f)	19.5
	lbs	43.0

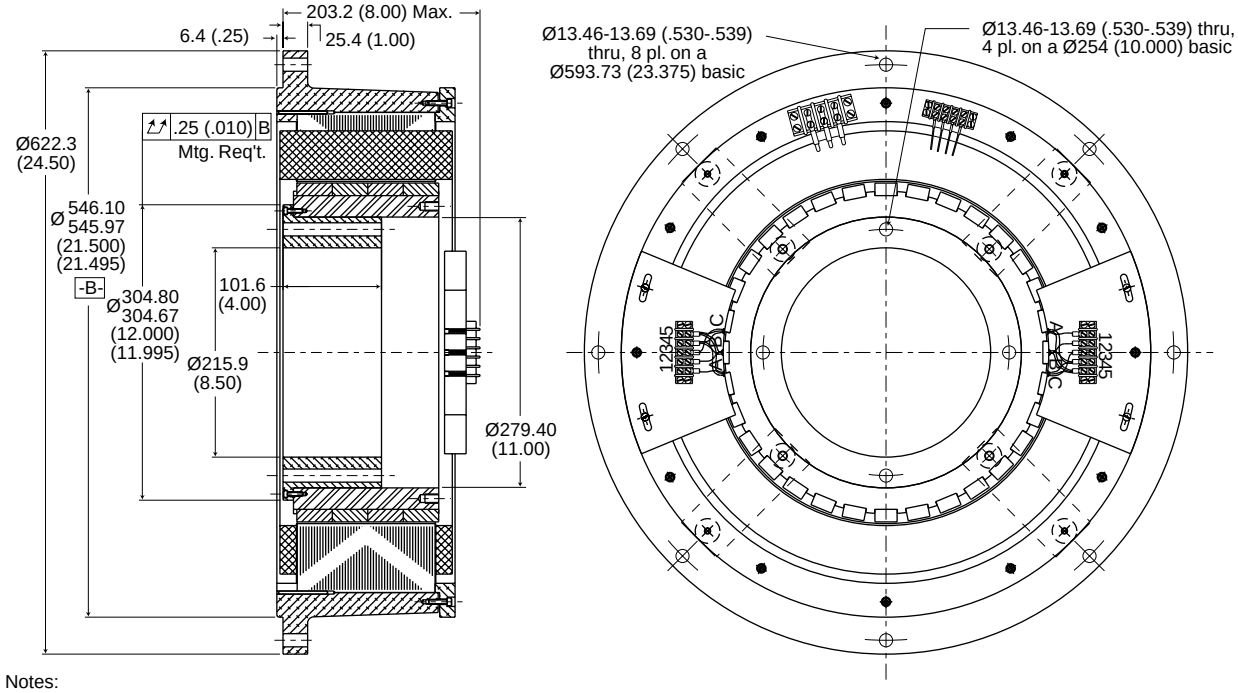
Continuous Operation Curve



For the above performance, it is assumed that motor is housed and would have a TPR of 0.12° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	105	42.1	35.0	70.0		
Torque Sensitivity- K_t	N-m/Amp	±10%	3.96	9.90	11.9	5.94		
	lb-ft/Amp	±10%	2.92	7.30	8.76	4.38		
Back EMF Constant- K_b	V per rad/s	±10%	3.96	9.90	11.9	5.94		
DC Resistance (25°C)- R_m	Ohms	±10%	0.397	2.51	3.79	0.946		
Inductance- L_m	mH	±30%	2.0	12.5	18	4.5		

BMS-13701



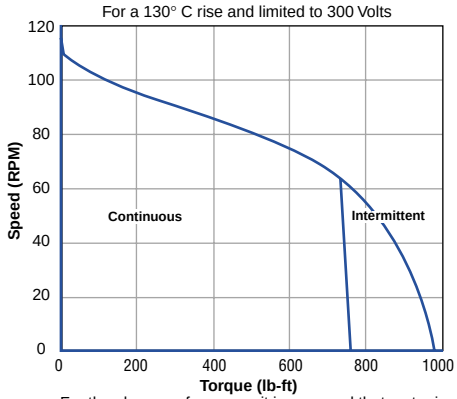
Notes:
1. For C.W. rotation viewed from terminal block end, energize per excitation sequence table, back page.
2. V-AB, V-BC and V-CA is back EMF of motor phases AB, BC and CA respectively aligned with sensor output as shown for C.W. rotation only.

Motor Leads:
Terminal strip provided for connection to motor.
Sensor Leads:
Terminal strip provided for connection to sensors.

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	1322
	lb-ft	975
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	24.1
	lb-ft/$\sqrt{\text{Watt}}$	17.8
Static Friction (Max.)- T_f	N-m	4.1
	lb-ft	3
Damping Coeff. INF Impedence- F_i	N-m per rad/s	0.542
	lb-ft per rad/s	0.400
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	0.10
Number of Poles	-	32
Rotor Inertia- J_m	kg-m²	0.95
	lb-ft-s²	0.70
Motor Weight	kg(f)	158
	lbs	350

Continuous Operation Curve



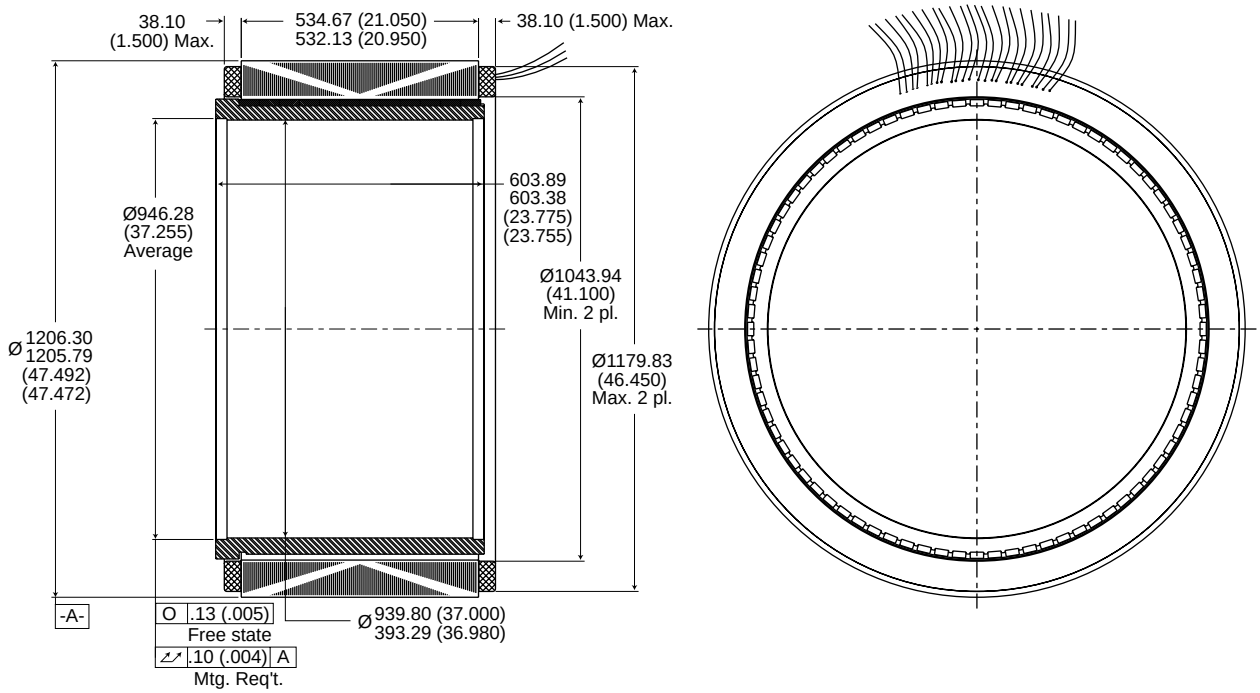
For the above performance, it is assumed that motor is housed and would have a TPR of 0.050° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	50.0					
Torque Sensitivity- K_t	N-m/Amp	±10%	26.4					
	lb-ft/Amp	±10%	19.5					
Back EMF Constant- K_b	V per rad/s	±10%	26.4					
DC Resistance (25°C)- R_m	Ohms	±10%	1.20					
Inductance- L_m	mH	±30%	24					

Brushless Motor

DIMENSIONS/PERFORMANCE

BM-40702



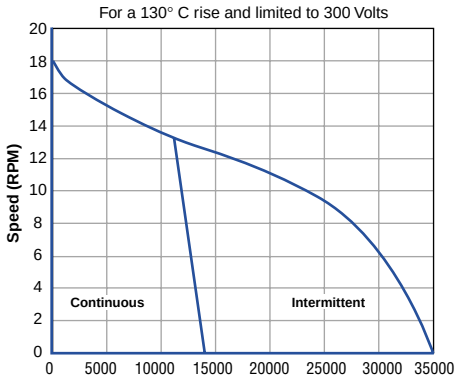
Notes:
1. For C.W. rotation as viewed from lead end, energize per excitation sequence table, back page.

Motor Leads:
#10 AWG. 2-Black, 2-Red, 2-White, 2-Green, 2-Blue, 2-Orange, 2-Brown, 2-Yellow, 2-Gray, 2-Violet, 2-Red/White and 2-Black/White

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	47454
	lb-ft	35000
Motor Constant- K_m	N-m/ $\sqrt{\text{Watt}}$	283.1
	lb-ft/ $\sqrt{\text{Watt}}$	208.7
Static Friction (Max.)- T_f	N-m	203
	lb-ft	150
Damping Coeff. INF Impedence- F_i	N-m per rad/s	284.5
	lb-ft per rad/s	210
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	0.024
Number of Poles	-	80
Rotor Inertia- J_m	kg-m²	184.4
	lb-ft-s²	136
Motor Weight	kg(f)	170
	lbs	3760

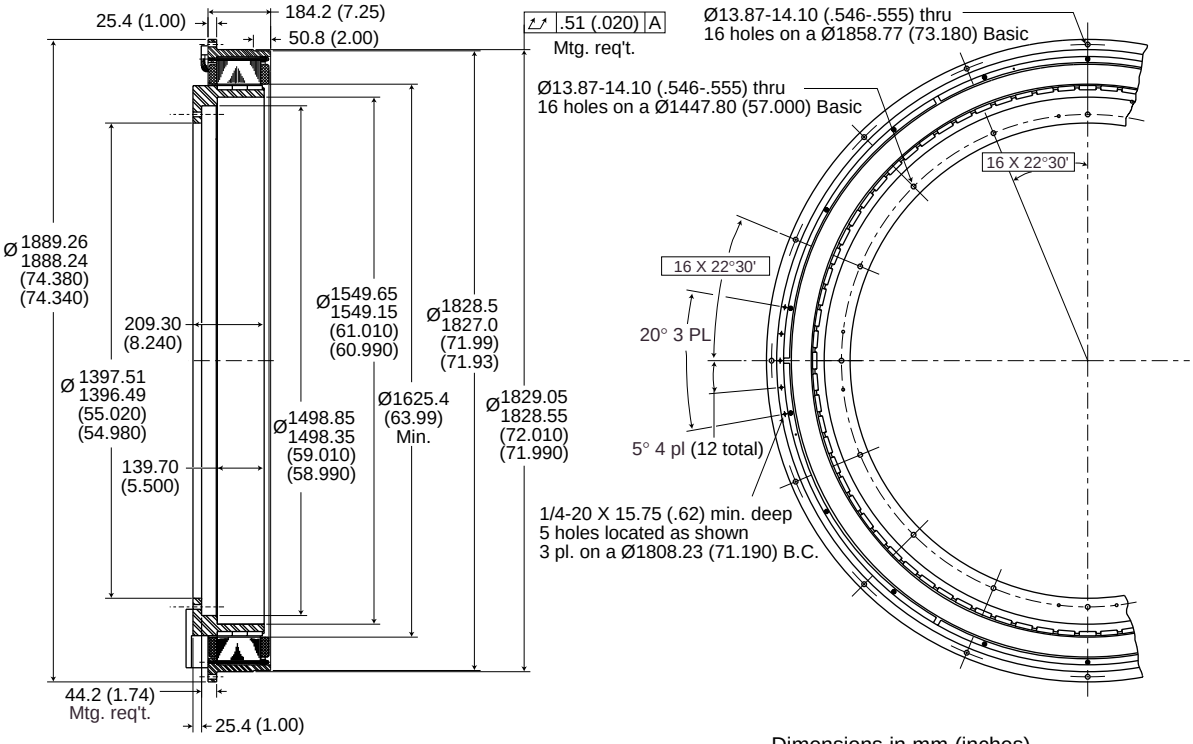
Continuous Operation Curve



For the above performance, it is assumed that motor is housed and would have a TPR of 0.024° C/Watt

Winding Constants are per winding (4 windings per motor)			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	73.5					
Torque Sensitivity- K_t	N-m/Amp	±10%	161.4					
	lb-ft/Amp	±10%	119.0					
Back EMF Constant- K_b	V per rad/s	±10%	161.4					
DC Resistance (25°C)- R_m	Ohms	±10%	1.30					
Inductance- L_m	mH	±30%	60.0					

BM-63702



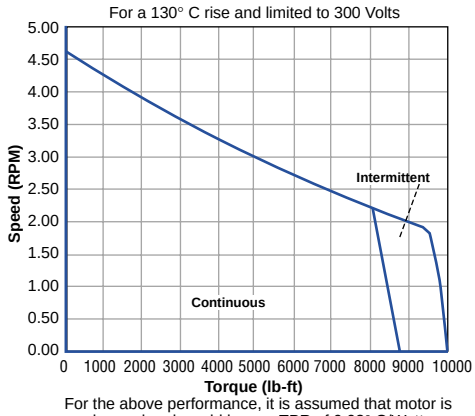
Notes:
1. For a CW rotation, as viewed from the lead end, energize per excitation sequence table, back page.

Motor Leads:
#10 AWG. 2-Black, 2-Red, 2-Green, and 2-White

Dimensions in mm (inches).
Product designed in inches.
Metric conversions provided for reference only.

Size Constants	Units	Value
Peak Torque Rating- T_p	N-m	13500
	lb-ft	10000
Motor Constant- K_m	N-m/$\sqrt{\text{Watt}}$	217
	lb-ft/$\sqrt{\text{Watt}}$	160
Static Friction (Max.)- T_f	N-m	102
	lb-ft	75
Damping Coeff. INF Impedence- F_i	N-m per rad/s	94.9
	lb-ft per rad/s	70.0
Max. Winding Temperature	°C	155
Temperature Rise per Watt- TPR	°C/Watt	0.03
Number of Poles	-	80
Rotor Inertia- J_m	kg-m²	111
	lb-ft-s²	82
Motor Weight	kg(f)	1006
	lbs	2235

Continuous Operation Curve



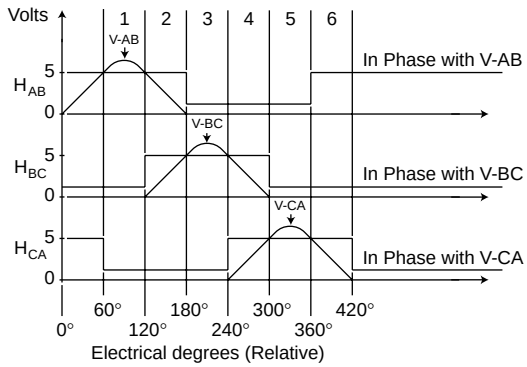
For the above performance, it is assumed that motor is housed and would have a TPR of 0.03° C/Watt

			Winding Designation					
Winding Constants	**Units**	**Tolerances**	**A**	**B**	**C**	**D**	**E**	**F**
Peak Current- I_p	Amperes	Rated	21.7					
Torque Sensitivity- K_t	N-m/Amp	±10%	624					
	lb-ft/Amp	±10%	460					
Back EMF Constant- K_b	V per rad/s	±10%	624					
DC Resistance (25°C)- R_m	Ohms	±10%	8.3					
Inductance- L_m	mH	±30%	320					

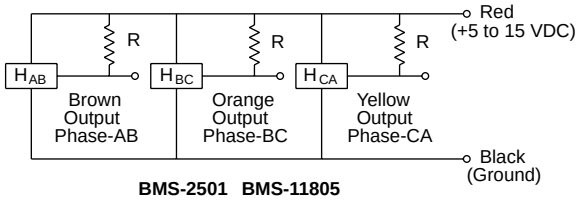
Excitation Sequence Table

Step	Black	Red	White
1	⊕	⊖	
2	⊕		⊖
3		⊕	⊖
4	⊖	⊕	
5	⊖		⊕
6		⊖	⊕

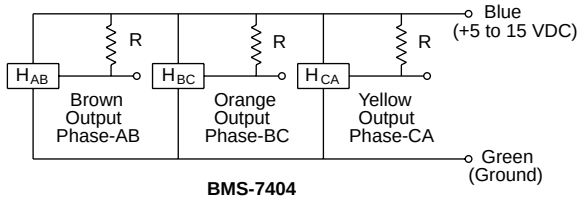
BMS Series Sensor Output Table



BMS Sensor Wiring Diagrams

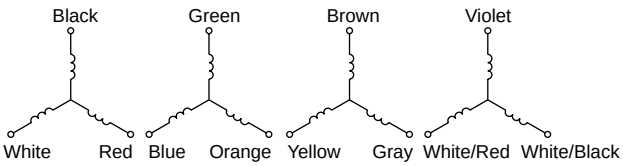


BMS-2501 BMS-11805
BMS-5905 BMS-13701
BMS-7101



BMS-7404

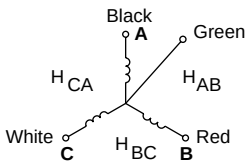
Motor Wiring Diagrams



BM-40702

Phase “A”	Black lead
Phase “B”	Red lead
Phase “C”	White lead

BM-8901 BMS-7101
BM-11301 BMS-7404
BMS-5905 BMS-13701



BM-63702
BMS-2501
BMS-11805

Note:
These models are representative of BM(S) Series motors. Please consult your Kollmorgen representative for obtaining outline and assembly drawing for additional information, or call 540-639-9045.

Kollmorgen enjoys a reputation of excellence based on constant endeavors to update products. Information in this brochure is subject to change.

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TABLE OF STANDARD OPTIONS

TABLE OF STANDARD OPTIONS

These standard options allow our customers to modify existing catalog motors to achieve the features as described below. Please consult factory for application information.

Higher Torque	
Magnet Materials	Alnico
	Neodymium-Iron-Boron
	Samarium Cobalt
Lamination Materials	Silicon Steel
	Vanadium Permedur
Magnetic pole Count	Up to 2 times the catalog model. *Consult factory*
Higher Power	
Stack Length Increase	0.25 inches to 3 inches
(Magnets & Laminations)	(motor length increases the same as the stack length)
Speed/Torque Changes	
Winding Wire Gages	#20 - 28 AWG *(standard)*
	#00-48 AWG
Installation Features	
Shaft Geometry	Round *(standard)*
	Hollow, keyway, flat or integral gear
Mounting	Bolt hole diameter and circumferential pattern *(customer specified)*
Lead Length	18 inches *(standard)*
	7 to 48+ inches *(customer specified)*
Lead Color	Red/White/Black *(standard)*
	Colors to be specified by customer
Durability	
Varnishes or Encapsulation	115°C *(standard)*
	200°C