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A Full Line Up of Powerful Servos to Meet the Demands of Your Application!

Compumotor began manufacturing brushless servo motors with the release of the SM series in the spring of 1995. Since that time, we have continued to expand our product offering and have manufacturing plants in California and Italy.

Innovation in Design

Compumotor utilizes two distinct technologies in the manufacturing of brushless servo motors. The Slotless Design and the Bridged Stator Design both reduce motor manufacturing costs while providing performance advantages to the user.

The slotless design eliminates all detent torque in the motor, providing superior performance in applications requiring smooth, low speed operation. This design also results in higher rotor inertia, providing an advantage in applications involving high inertia loads.

The bridged stator design results in extremely high torque-to-inertia ratios, providing a performance advantage in applications requiring high accelerations. The bridged stator design also greatly reduces detent torque and mechanical noise when compared to a conventional slotted motor.

Compumotor can also provide an integrated planetary gearhead for use with our brushless servo motors. Our unique design integrates the pinion of the gearhead into the motor shaft, reducing total package length by almost two inches.

Standards or Specials in 10 Days

Compumotor's brushless servo motors are manufactured in our modern JIT manufacturing facility. Highly evolved manufacturing philosophies provide levels of service and product availability previously unattainable in the servo motor industry.

Compumotor's lead times average less than ten days for all standard and custom servo motors.

SM Series



- Size 16 and 23
- 0.8 to 11.3 in-lb. continuous torque
- Slotless design
- Rugged housing (IP65 option)
- Connection options

SE Series



- Size 16 and 23
- 0.8 to 10.1 in-lb. continuous torque
- Slotless design
- Plastic encoder cover
- Short package length

BE Series



- Size 16, 23 and 34
- 1.4 to 46 in-lb. continuous torque
- Bridged stator design
- 2000-line encoder standard
- Connection options

M Series



- Size 105, 145 and 205mm
- Up to 90 Nm of power
- Brushless construction
- Encoder feedback and resolver

Planetary Gearheads



- Size 16, 23, 34 and 92
- Integrated pinion design
- Shortest package length available

NeoMetric & J Series



- 70 mm and 92 mm
- 6 to 61 in-lb. continuous torque
- Bridged stator design
- Rugged housing (IP65 option)
- Connection options

SL Series



- Size 42, 63, 102 and 140mm
- 20 to 350 lbs continuous force
- Slotless design
- High speeds
- High precision

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Custom Designed Servo Motors for Your Specific Application!

Compumotor offers a broad range of standard options with all of our brushless servo motor families. Our numerous shaft, feedback and connection options will fulfill the needs of most of our customers. However, we realize that from time to time the need arises to have a custom motor designed specially for your application.

Whether you need custom connectors, mounting, or a custom winding, Compumotor can build a motor designed to your exact specifications. Compumotor provides these special designs for our customers with:

- Minimal impact on product lead time
- Modest impact on pricing
- No minimum quantities

Compumotor's modern manufacturing system allows us to offer custom motor solutions without sacrificing product quality and availability. All of our custom motors are built in our standard servo motor work cell, and our computerized custom product tracking system allows us to provide consistent, high-quality custom products. And, because custom motor manufacturing is integrated into our standard manufacturing process, we can often build and ship custom designed motors and cables in the same time frame as standard products.

Compumotor provides this service for one simple reason: to make it easier for you, our customer, to integrate a Compumotor servo motor into your application. We provide more than just a component, we provide a custom designed servo motor solution.

Common Special Requests

Connectorization

- Right angle connector housing
- MS connectors on back cover
- Special cable lengths
- Hi-flex cables
- Customer specified cables and connectors
- Cable exiting through back cover

Flanges

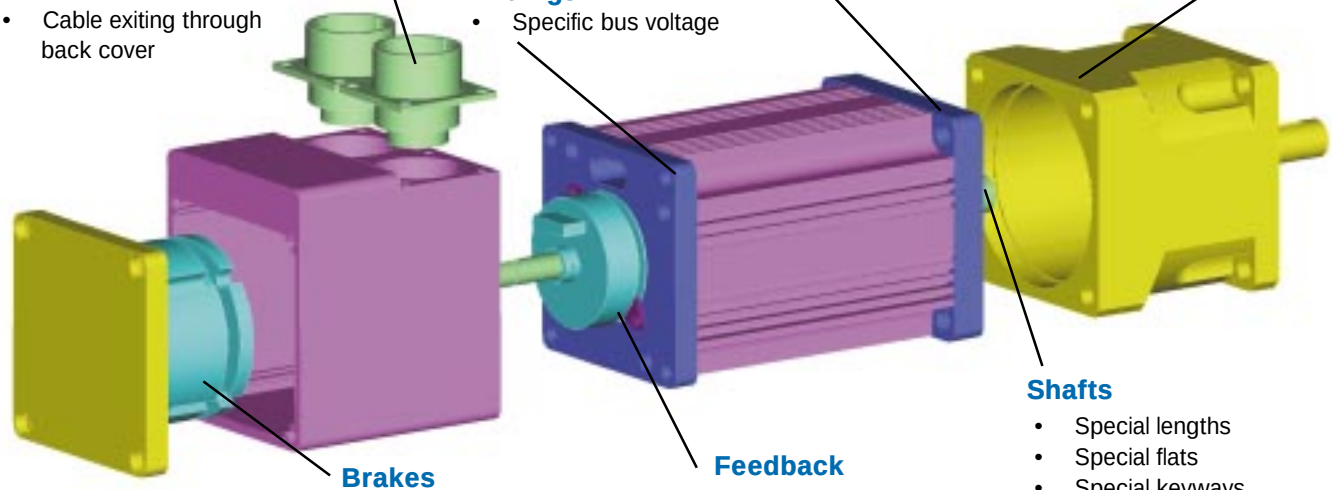
- Tapped mounting holes
- Customer specified flanges
- Face mount

Gearheads

- Non-standard ratios
- Customer specified flanges
- Customer specified output shaft

Windings:

- Specific bus voltage



Brakes

- Internal or external

Feedback

- Higher resolution encoders
- Higher temperature encoders

Shafts

- Special lengths
- Special flats
- Special keyways
- Special shaft diameters
- Metric shaft diameters
- Hollow shafts
- Rear Shaft Extension
- Double flats
- Shaft pinning
- Pressed on gears
- Center tapped
- Special shaft materials







Miscellaneous Options

- Private label back cover
- Special windings
- Shorter lengths
- High speed balancing
- Special finish

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SM Series High-Performance Slotless Design

The SM Series brushless servo motors feature a slotless stator design. This design eliminates all detent torque in the motor, allowing the SM Series motors to provide extremely smooth motion, especially at low speeds. The slotless design also creates a higher rotor inertia, which is ideal for applications involving high inertial loads (such as lead screws and belt drives).

The SM Series motors also feature a rugged anodized aluminum body and connector housing. An IP65 rating can be obtained on motors with MS connectors and an optional shaft seal. All SM motors are CE (LVD) compliant.

The SM Series servo motors are available with integrated planetary gearheads in ratios up to 100:1. Our unique package integrates the gearhead pinion into the motor shaft, reducing the overall package length by up to 2 inches.

SM Series Features

- Size 16 and 23
- 0.8 to 11.3 lb-in continuous torque
- Brushless construction
- Slotless design
  - Negligible detent torque
  - Reduced torque ripple
  - Medium inertia
- High-performance neodymium magnets
- Thermostat protected
- TENV housing
- IP65 option
- Feedback options
  - Encoder/Hall effect
  - Hall-effect only
  - Resolver
- Connectorization choices
- Special winding availability
- Ten day deliveries
- Two-year warranty
- CAD (.dxf) drawings available
- CE Compliant

Part Numbering System

SM	232	A	E-	N	MS	N
SM Series	*Frame, Magnet Length* 160 230 161 231 162 232 233	*Winding* A B	*Feedback* D - 500 ppr encoder[1] E - 1000 ppr encoder[1] H - Hall-effect only R - resolver[2]	*Shafting* N - normal F - flat K - keyway[2] L - long[2]	*Connection* FL - 18" leads 10 - 10' cable[3] 25 - 25' cable[3,5] MS - military style TQ - trap drive GS - Gemini amp[6] series	*Options* N - none V - shaft seal[4] GXX - Gearhead[7]

1 Includes Hall-effect
2 Not available on size 16 or SM230
3 Cable is hard-wired
4 With MS, TQ or GS connectors—IP65, not available on size 16
5 Size 23 only
6 See amplifier sections for specific motor/amplifier compatibility
7 Specify "K" shaft option with Gearheads

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SE Series Low-Cost, Space-Saving Package



The SE Series brushless servo motors were created with the OEM in mind. The SE Series motors provide the same performance as the SM Series, but in a lower cost, space-saving package. Designed for embedded applications, these motors are available in flying lead configurations and have a plastic encoder cover. Customer specified connectors or shaft modifications are easily incorporated with minimal impact on price and delivery.

The performance curves and electrical specifications for the SE series motors remain unchanged from the SM Series. All SE Series motors are CE (LVD) compliant.

The SE Series servo motors are available with integrated planetary gearheads in ratios up to 100:1. Our unique package integrates the gearhead pinion into the motor shaft, reducing the overall package length by up to 2 inches.

SE Features

- Size 16 and 23
- 0.8 to 10.1 lb-in continuous torque
- Brushless Construction
- Slotless Design
  - Negligible detent torque
  - Reduced torque ripple
  - Medium Inertia
- High performance neodymium magnets
- Thermostat protected
- 1000 ppr encoder
- Special winding availability
- Ten day deliveries
- Two year warranty
- CAD (.dxf) drawings available
- CE Compliant

SE Part Numbering System

SE	161	A	E-	N	FL	N
SE Series	*Frame, Magnet Length* 160[1] 230[1] 161 231 162 232 233	*Winding* A B	*Feedback* E - 1000 ppr encoder[2]	*Shafting* N - Normal F - Flat K - Keyway[3] L - Long[3]	*Connection* FL - 18” Leads	*Options* N - None GXX - Gearhead

1 SE160 and 230 do not include temperature switch
2 Includes Hall-effect
3 Not available on size 16 or SE230

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Size 16, Encoder Feedback, Specifications*

Parameter	Symbol	Units	SM160A	SM160B	SM161A	SM161B	SM162A	SM162B
Stall Torque Continuous[1]	T_{cs}	lb-in	0.8	0.8	1.6	1.6	2.9	3.1
		oz-in	13	13	26	26	47	49
		Nm	0.09	0.09	0.18	0.18	0.33	0.34
Stall Current Continuous[1,4,8]	I_{cs}(sine)	Amps Peak	2.8	5.6	2.7	5.2	2.6	5.1
Stall Current Continuous[1,7]	I_{cs}(trap)	Amps DC	2.5	4.8	2.3	4.5	2.3	4.4
Peak Torque[6]	T_{pk}	lb-in	2.5	2.5	4.9	4.9	8.8	9.1
		oz-in	40	40	78	78	141	145
		Nm	0.28	0.28	0.55	0.54	0.99	1.02
Peak Current[4,6,8]	I_{pk}(sine)	Amps Peak	8.5	16.7	8.1	15.5	7.8	15.2
Peak Current[6,7]	I_{pk}(trap)	Amps DC	7.4	14.4	7.0	13.4	6.8	13.2
Rated Speed[2]	ω_r	rpm	7,500	7,500	7,500	7,500	7,500	7,500
Current @ Rated Speed	I_r(sine)	Amps	2.5	4.9	2.2	4.2	2.2	4.3
Current @ Rated Speed	I_r(trap)	Amps	2.2	4.2	1.9	3.6	1.9	3.8
Torque @ Rated Speed	T_r	lb-in	0.6	0.6	1.1	1.1	2.3	2.3
		oz-in	10	10	18	18	37	37
		Nm	0.07	0.07	0.13	0.13	0.26	0.26
Shaft Power @ Rated Speed	P_o	watts	57	55	97	100	205	204
Voltage Constant[3,4]	K_b	volts/radian/sec	0.038	0.020	0.079	0.041	0.147	0.078
Voltage Constant[3,4]	K_e	volts/KRPM	4.02	2.08	8.27	4.29	15.39	8.17
Torque Constant[9]	K_t(sine)	oz-in/Amp Peak	4.71	2.43	9.69	5.03	18.03	9.57
		Nm/Amp Peak	0.033	0.017	0.068	0.035	0.126	0.067
Torque Constant[3,4]	K_t(trap)	oz-in/Amp DC	5.43	2.81	11.19	5.81	20.82	11.04
		Nm/Amp DC	0.038	0.02	0.078	0.041	0.146	0.077
Resistance[3]	R	Ohms	3.43	0.90	4.53	1.24	6.50	1.73
Inductance[5]	L	mH	0.53	0.13	0.81	0.21	1.39	0.33
Maximum Bus Voltage	V_m	Volts DC	100	100	170	170	170	170
Thermal Resistance Wind-Amb	R_{th} w-a	°C/watt	3.20	3.20	2.70	2.70	2.00	2.00
Motor Constant	K_m	oz-in/√watt	2.93	2.96	5.26	5.21	8.16	8.40
		Nm/√watt	0.021	0.021	0.037	0.036	0.057	0.059
Viscous Damping	B	oz-in/Krpm	0.162	0.162	0.284	0.284	0.300	0.300
		Nm/Krpm	1.13 E-3	1.13 E-3	1.99 E-3	1.99 E-3	2.10 E-3	2.10 E-3
Static Friction	T_f	oz-in	0.10	0.10	0.15	0.15	0.20	0.20
		Nm	7.0 E-4	7.0 E-4	1.05 E-3	1.05 E-3	1.40 E-3	1.40 E-3
Motor Thermal Time Constant	τ_{th}	minutes	10	10	11.6	11.6	14.2	14.2
Electrical Time Constant	τ_{elec}	millisecs	0.16	0.15	0.18	0.17	0.21	0.19
Mechanical Time Constant	τ_{mch}	millisecs	11.7	11.5	7.7	7.8	5.5	5.2
Intermittent Torque Duration[10]	T_{2x}	seconds	8	8	9	9	14	14
Peak Torque Duration[11]	T_{3x}	seconds	3	3	4	4	5	5
Rotor Inertia	J	lb-in-sec^2	4.4 E-5	4.4 E-5	9.4 E-5	9.4 E-5	1.6 E-4	1.6 E-4
		kg-m^2	5.0 E-6	5.0 E-6	1.1 E-5	1.1 E-5	1.8 E-5	1.8 E-5
Number of Poles	Np		4	4	4	4	4	4
Weight	#	lbs	0.7	0.7	1.1	1.1	1.6	1.6
		kg	0.3	0.3	0.5	0.5	0.7	0.7
Winding Class			H	H	H	H	H	H

* SM & SE Series specifications are identical unless otherwise noted.

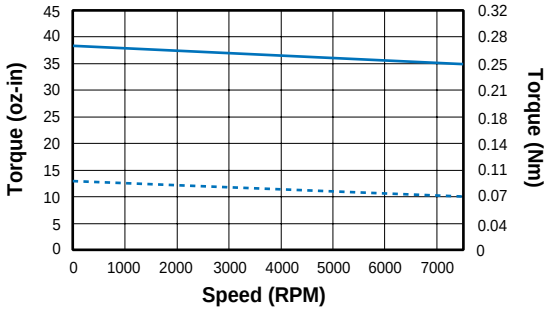
1 *@ 25°C ambient, 125°C winding temperature, motor connected to a 10"x10"x1/4" aluminum mounting plate, @40°C ambient derate phase currents and torques by 12%.*
2 *Maximum speed is 7500RPM. For higher speed operation please call the factory.*
3 *Measured Line to Line, ±10% line-to-line*
4 *Value is mesured peak of sine wave.*
5 *±30%, Line-to-Line, inductance bridge measurement @ 1 kHz*
6 *Initial winding temperature must be 60°C or less before peak current is applied.*
7 *DC current through a pair of motor phases of a trapazoidally (six state) commutated motor.*
8 *Peak of the sinusoidal current in any phase for a sinusoidally commutated motor.*
9 *Total motor torque per peak of the sinusoidal amps measured in any phase, +/-10%.*
10 *Maximum Time duration with 2 times rated applied with initial winding temp at 60°C.*
11 *Maximum Time duration with 3 times rated applied with initial winding temp at 60°C.*

Note: These specifications are based on theoretical motor performance and are not specific to any amplifier.

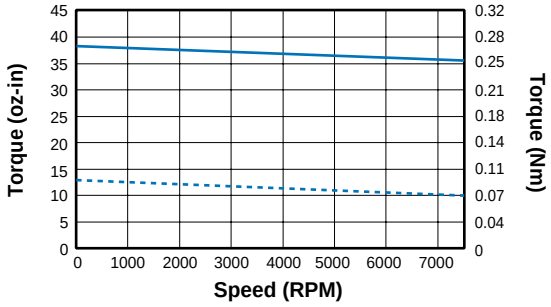
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Size 16, Encoder Feedback, Performance Curves
(SM & SE Series data are identical unless otherwise noted)

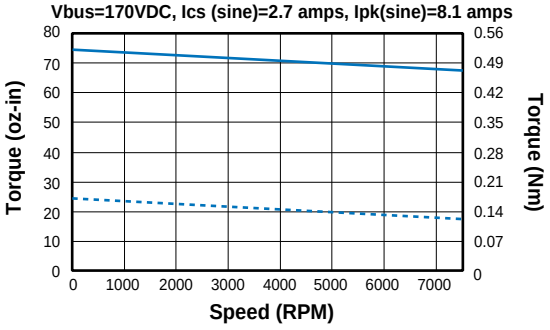
SM160AE
Vbus=75VDC, Ics (sine)=2.8 amps, Ipk(sine)=8.5 amps



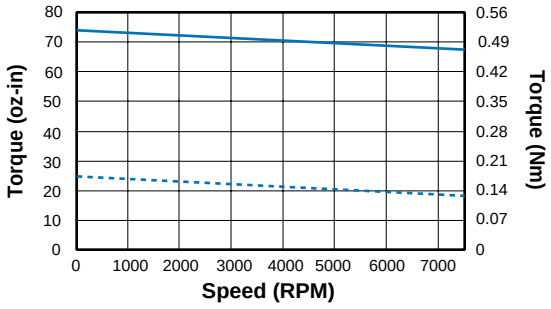
SM160BE
Vbus=75VDC, Ics (sine)=5.6 amps, Ipk(sine)=16.7 amps



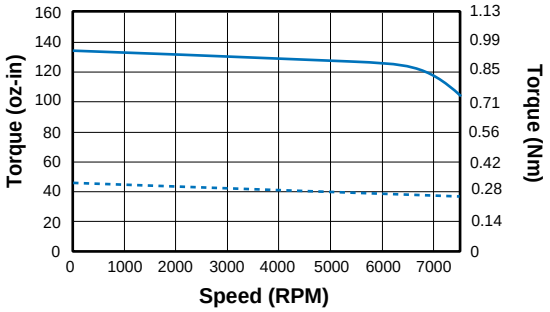
SM161AE
Vbus=170VDC, Ics (sine)=2.7 amps, Ipk(sine)=8.1 amps



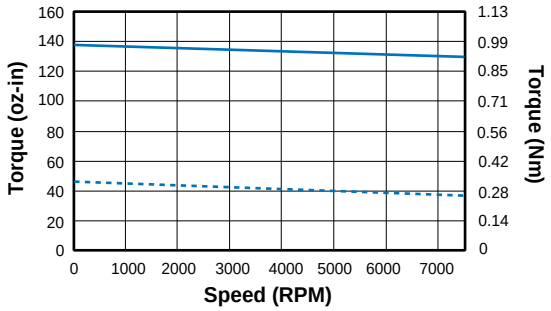
SM161BE
Vbus=170VDC, Ics (sine)=5.2 amps, Ipk(sine)=15.5 amps



SM162AE
Vbus=170VDC, Ics (sine)=2.6 amps, Ipk(sine)=7.8 amps



SM162BE
Vbus=170VDC, Ics (sine)=5.1 amps, Ipk(sine)=15.2 amps



CONTINUOUS PEAK (170 VAC or 75VDC as noted)

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Size 23, Encoder Feedback, Specifications*

Parameter	Symbol	Units	SM230A	SM230B	SM231A	SM231B	SM232A	SM232B	SM233A	SM233B
Stall Torque Continous[1]	T_{cs}	lb-in	1.7	1.6	3.8	3.4	6.6	7.0	10.1	9.7
		oz-in	27	26	61	54	106	111	161	156
		Nm	0.19	0.18	0.43	0.38	0.74	0.78	1.13	1.09
Stall Current Continuous[1,4,8]	I_{cs}(sine)	Amps Peak	2.7	5.5	2.9	5.5	2.8	5.4	2.7	5.3
Stall Current Continuous[1,7]	I_{cs}(trap)	Amps DC	2.4	4.7	2.5	4.8	2.4	4.7	2.4	4.5
Peak Torque[6]	T_{pk}	lb-in	5.1	4.9	11.3	10.0	19.8	20.9	30.2	29.2
		oz-in	82	78	181	160	316	334	483	467
		Nm	0.57	0.55	1.27	1.12	2.21	2.34	3.38	3.27
Peak Current[4,6,8]	I_{pk}(sine)	Amps Peak	8.2	16.4	8.8	16.6	8.3	16.1	8.1	15.8
Peak Current[6,7]	I_{pk}(trap)	Amps DC	7.1	14.2	7.6	14.3	7.2	14.0	7.1	13.6
Rated Speed[2]	ω_r	rpm	7500	7500	7500	7500	7500	7500	5800	5800
Current@Rated Speed	I_r(sine)	Amps	2.4	4.9	2.5	4.8	2.3	4.5	2.4	4.6
Current@Rated Speed	I_r(trap)	Amps	2.1	4.2	2.2	4.2	2.0	3.9	2.0	4.0
Torque@Rated Speed	T_r	lb-in	1.4	1.3	2.9	2.8	5.1	5.4	8.1	7.6
		oz-in	22	21	47	44	81	86	129	121
		Nm	0.15	0.15	0.33	0.31	0.57	0.60	0.90	0.85
Shaft Power@Rated Speed	P_o	watts	122	116	261	244	449	477	553	519
Voltage Constant[3,4]	K_b	Volts/rad/s	0.081	0.039	0.169	0.079	0.310	0.169	0.484	0.242
Voltage Constant[3,4]	K_e	Volts/KRPM	8.48	4.09	17.70	8.27	32.46	17.70	50.68	25.34
Torque Constant[9]	K_t(sine)	oz-in/Amp Peak	9.93	4.79	20.72	9.69	38.02	20.72	59.35	29.68
		Nm/Amp Peak	0.070	0.034	0.145	0.068	0.266	0.145	0.415	0.208
Torque Constant[3,4]	K_t(trap)	oz-in/Amp DC	11.47	5.54	23.93	11.19	43.90	23.93	68.53	34.27
		Nm/Amp DC	0.080	0.039	0.168	0.078	0.307	0.168	0.480	0.240
Resistance[3]	R	Ohms	4.43	1.12	5.22	1.46	7.50	2.00	9.65	2.58
Inductance[5]	L	mH	1.19	0.28	1.64	0.44	2.90	0.78	4.08	1.06
Maximum Bus Voltage	V_m	Volts DC	100	100	170	170	340	170	340	170
Therm. Resistance Wind-Amb	R_{th} w-a	°C/watt	2.67	2.67	2.00	2.00	1.54	1.54	1.25	1.25
Motor Constant	K_m	oz-in/√watt	5.45	5.23	10.47	9.26	16.03	16.92	22.06	21.33
		Nm/√watt	0.038	0.037	0.073	0.065	0.112	0.118	0.154	0.149
Viscous Damping	B	oz-in/Krpm	0.160	0.160	0.250	0.250	0.360	0.360	0.540	0.540
		Nm/Krpm	1.12 E-3	1.12 E-3	1.75 E-3	1.75 E-3	2.52 E-3	2.52 E-3	3.78 E-3	3.78 E-3
Static Friction	T_f	oz-in	0.20	0.20	0.30	0.30	0.70	0.70	1.00	1.00
		Nm	1.40 E-3	1.40 E-3	2.10 E-3	2.10 E-3	4.90 E-3	4.90 E-3	7.00 E-3	7.00 E-3
Motor Thermal Time Constant	τ_{th}	minutes	18.3	18.3	20	20	21.6	21.6	23.3	23.3
Electrical Time Constant	τ_{elec}	millisecs	0.27	0.25	0.31	0.30	0.39	0.39	0.42	0.41
Mechanical Time Constant	τ_{mch}	millisecs	18.3	19.9	9.5	12.2	7.2	6.5	5.4	5.8
Intermittent Torque Duration[10]	T_{2x}	seconds	11	11	11	11	18	18	20	20
Peak Torque Duration[11]	T_{3x}	seconds	5	5	4	4	6	6	7	7
Rotor Inertia	J	lb-in-sec²	2.4 E-4	2.4 E-4	4.6 E-4	4.6 E-4	8.2 E-4	8.2 E-4	1.2 E-3	1.2 E-3
		kg-m²	2.7 E-5	2.7 E-5	5.2 E-5	5.2 E-5	9.3 E-5	9.3 E-5	1.3 E-4	1.3 E-4
Number of Poles	Np		4	4	4	4	4	4	4	4
Weight	#	lbs	1.2	1.2	2.1	2.1	3.0	3.0	3.9	3.9
		kg	0.5	0.5	1.0	1.0	1.4	1.4	1.8	1.8
Winding Class			H	H	H	H	H	H	H	H

* SM & SE Series specifications are identical unless otherwise noted.

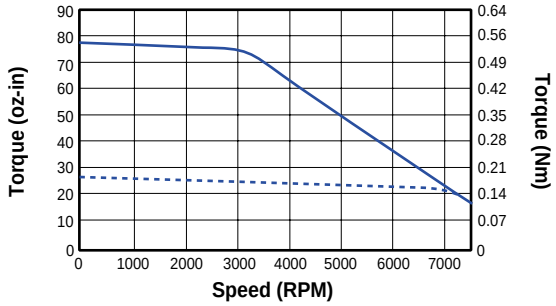
1 *@ 25°C ambient, 125°C winding temperature, motor connected to a 10"x10"x1/4" aluminum mounting plate, @40°C ambient derate phase currents and torques by 12%.*
2 *Maximum speed is 7500RPM. For higher speed operation please call the factory.*
3 *Measured Line to Line, ±10% line-to-line*
4 *Value is mesured peak of sine wave.*
5 *±30%, Line-to-Line, inductance bridge measurement @ 1 kHz*
6 *Initial winding temperature must be 60°C or less before peak current is applied.*
7 *DC current through a pair of motor phases of a trapezoidally (six state) commutated motor.*
8 *Peak of the sinusoidal current in any phase for a sinusoidally commutated motor.*
9 *Total motor torque per peak of the sinusoidal amps measured in any phase, +/-10%.*
10 *Maximum Time duration with 2 times rated applied with initial winding temp at 60°C.*
11 *Maximum Time duration with 3 times rated applied with initial winding temp at 60°C..*

Note: These specifications are based on theoretical motor performance and are not specific to any amplifier.

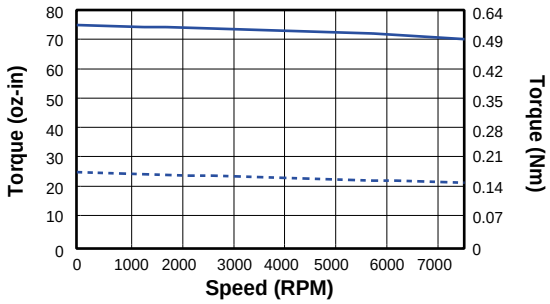
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Size 23, Encoder Feedback, Performance Curves
(SM & SE Series data are identical unless otherwise noted)

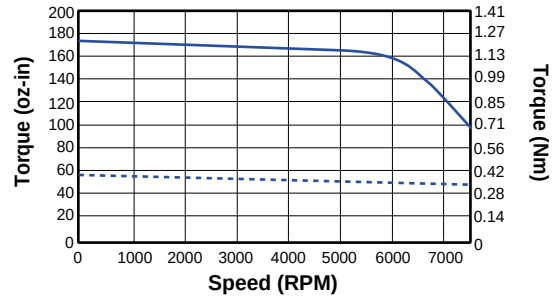
SM230AE
Vbus=75VDC, Ics (sine)=2.7 amps, Ipk(sine)=8.2 amps



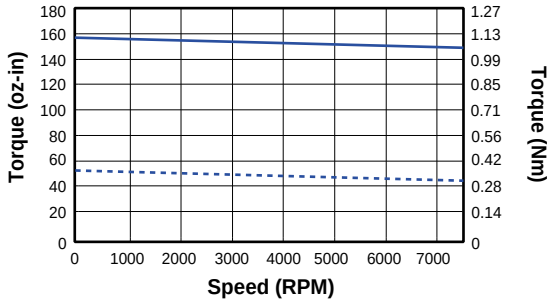
SM230BE
Vbus=75VDC, Ics (sine)=5.5 amps, Ipk(sine)=16.4 amps



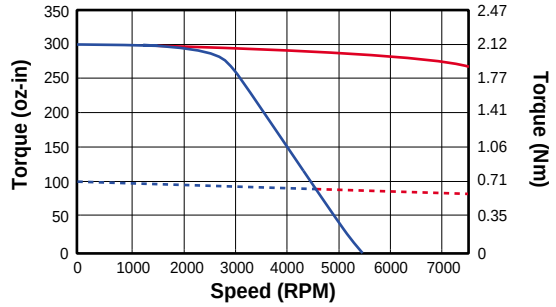
SM231AE
Ics (sine)=2.9 amps, Ipk(sine)=8.8 amps



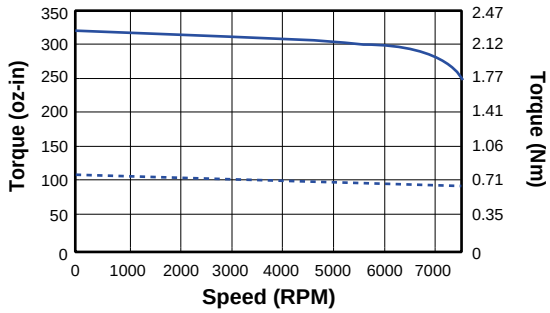
SM231BE
Ics (sine)=5.5 amps, Ipk(sine)=16.6 amps



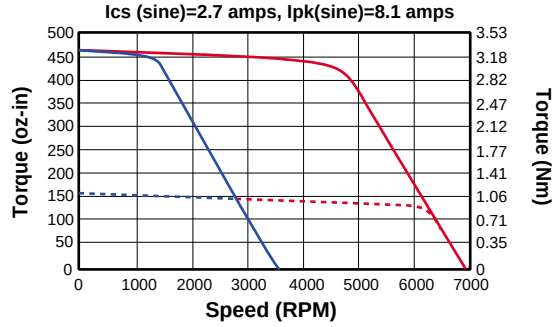
SM232AE
Ics (sine)=2.8 amps, Ipk(sine)=8.3 amps



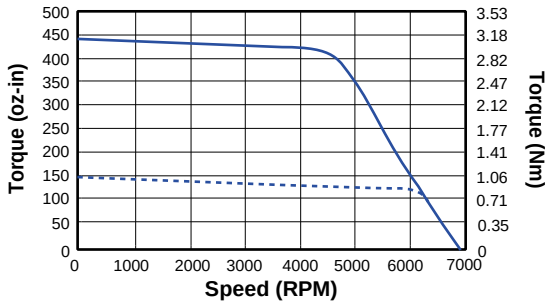
SM232BE
Ics (sine)=5.4 amps, Ipk(sine)=16.1 amps



SM233AE
Ics (sine)=2.7 amps, Ipk(sine)=8.1 amps



SM233BE
Ics (sine)=5.3 amps, Ipk(sine)=15.8 amps



CONTINUOUS PEAK — 170 or 75 VDC as noted

CONTINUOUS PEAK — 340 VDC

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Size 23, Resolver Feedback, Specifications*

Parameter	Symbol	Units	SM231A	SM231B	SM232A	SM232B	SM233A	SM233B
Stall Torque Continous[1]	T_{cs}	lb-in	4.3	3.8	7.4	7.8	11.3	10.9
		oz-in	68	60	118	125	180	174
		Nm	0.48	0.42	0.83	0.88	1.26	1.22
Stall Current Continuous[1,4,7]	I_{cs}(sine)	Amps Peak	3.3	6.2	3.1	6.0	3.0	5.9
Peak Torque[6]	T_{pk}	lb-in	12.7	11.2	22.1	23.3	33.8	32.7
		oz-in	203	179	354	373	540	523
		Nm	1.42	1.25	2.48	2.61	3.78	3.66
Peak Current[4,6,7]	I_{pk}(sine)	Amps Peak	9.8	18.5	9.3	18.0	9.1	17.6
Rated Speed[2]	ω_r	rpm	7500	7500	7500	7500	6000	6000
Current@Rated Speed	I_r(sine)	Amps	2.9	5.5	2.7	5.3	2.7	5.3
Current@Rated Speed	I_r(trap)	Amps	2.5	4.8	2.4	4.6	2.4	4.6
Torque@Rated Speed	T_r	lb-in	3.4	3.1	6.0	6.1	9.0	8.8
		oz-in	54	50	96	98	144	140
		Nm	0.38	0.35	0.67	0.69	1.01	0.98
Shaft Power@Rated Speed	P_o	watts	300	277	533	544	639	621
Voltage Constant[3,4]	K_b	Volts/rad/s	0.169	0.079	0.310	0.169	0.484	0.242
Voltage Constant[3,4]	K_e	Volts/KRPM	17.70	8.27	32.46	17.70	50.68	25.34
Torque Constant[8]	K_t(sine)	oz-in/Amp Peak	20.72	9.69	38.02	20.72	59.35	29.68
		Nm/Amp Peak	0.145	0.068	0.266	0.145	0.415	0.208
Resistance[3]	R	Ohms	5.22	1.46	7.50	2.00	9.65	2.58
Inductance[5]	L	mH	1.64	0.44	2.90	0.78	4.08	1.06
Maximum Bus Voltage	V_m	Volts DC	170	170	340	170	340	170
Therm. Resistance Wind-Amb	R_{th} w-a	°C/watt	2.00	2.00	1.54	1.54	1.25	1.25
Motor Constant	K_m	oz-in/√watt	10.47	9.26	16.03	16.92	22.06	21.33
		Nm/√watt	0.073	0.065	0.112	0.118	0.154	0.149
Viscous Damping	B	oz-in/Krpm	0.25	0.25	0.36	0.36	0.54	0.54
		Nm/Krpm	1.75 E-3	1.75 E-3	2.52 E-3	2.52 E-3	3.78 E-3	3.78 E-3
Static Friction	T_f	oz-in	0.30	0.30	0.70	0.70	1.00	1.00
		Nm	2.10 E-3	2.10 E-3	4.90 E-3	4.90 E-3	7.00 E-3	7.00 E-3
Motor Thermal Time Constant	τ_{th}	minutes	20	20	21.6	21.6	23.3	23.3
Electrical Time Constant	τ_{elec}	millisecs	0.31	0.30	0.39	0.39	0.42	0.41
Mechanical Time Constant	τ_{mch}	millisecs	9.5	12.2	7.2	6.5	5.4	5.8
Intermittent Torque Duration[9]	T_{2x}	seconds	11	11	18	18	20	20
Peak Torque Duration[10]	T_{3x}	seconds	4	4	6	6	7	7
Rotor Inertia	J	lb-in-sec^2	4.8 E-4	4.8 E-4	8.4 E-4	8.4 E-4	1.2 E-3	1.2 E-3
		kg-m^2	5.4 E-5	5.4 E-5	9.5 E-5	9.5 E-5	1.3 E-4	1.3 E-4
Number of Poles	Np		4	4	4	4	4	4
Weight	#	lbs	2.1	2.1	3.0	3.0	3.9	3.9
		kg	1.0	1.0	1.4	1.4	1.8	1.8
Winding Class			H	H	H	H	H	H

* SE Series not available with resolver.

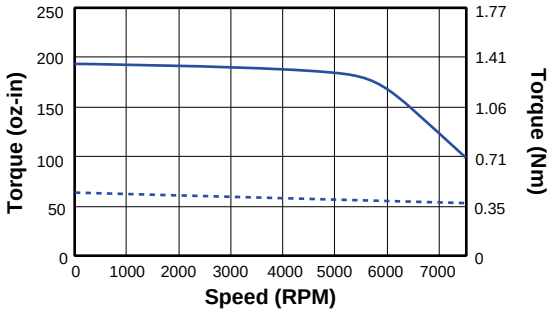
1 *@ 25°C ambient, 150°C winding temperature, motor connected to a 10"x10"x1/4" aluminum mounting plate, @40°C ambient derate phase currents and torques by 12%.*
2 *Maximum speed is 7500RPM. For higher speed operation please call the factory.*
3 *Measured Line to Line, ±10% line-to-line*
4 *Value is mesured peak of sine wave.*
5 *±30%, Line-to-Line, inductance bridge measurement @ 1 kHz*
6 *Initial winding temperature must be 60°C or less before peak current is applied.*
7 *Peak of the sinusoidal current in any phase for a sinusoidally commutated motor.*
8 *Total motor torque per peak of the sinusoidal amps measured in any phase, +/-10%.*
9 *Maximum Time duration with 2 times rated applied with initial winding temp at 60°C.*
10 *Maximum Time duration with 3 times rated applied with initial winding temp at 60°C.*

Note: These specifications are based on theoretical motor performance and are not specific to any amplifier.

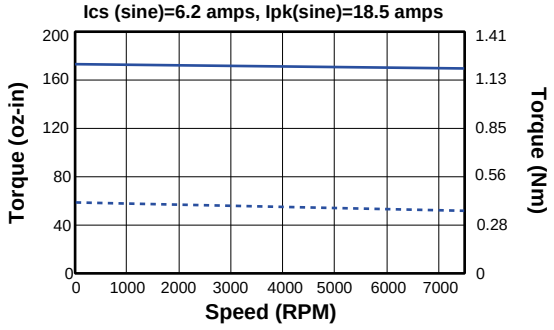
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Size 23, Resolver Feedback, Performance Curves
(SM Series only)

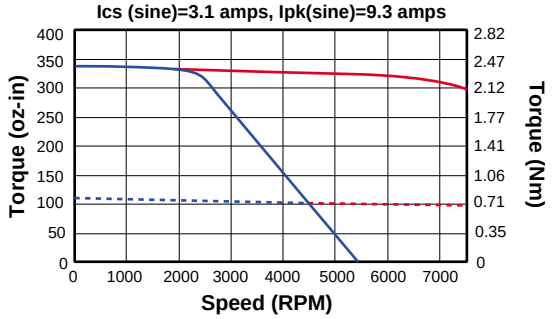
SM231AR
Ics (sine)=3.3 amps, Ipk(sine)=9.8 amps



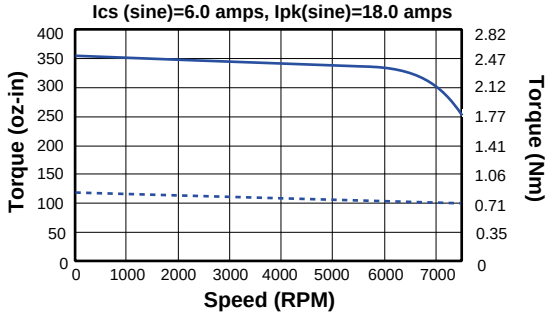
SM231BR
Ics (sine)=6.2 amps, Ipk(sine)=18.5 amps



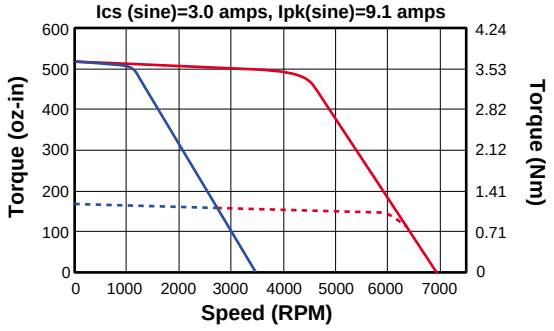
SM232AR
Ics (sine)=3.1 amps, Ipk(sine)=9.3 amps



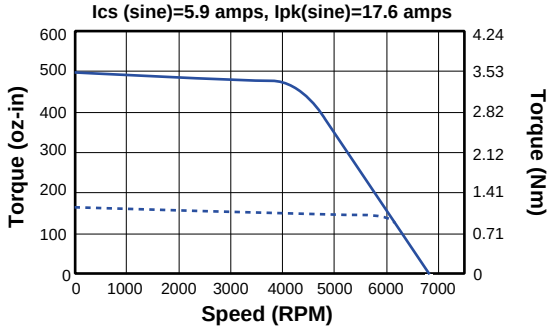
SM232BR
Ics (sine)=6.0 amps, Ipk(sine)=18.0 amps



SM233AR
Ics (sine)=3.0 amps, Ipk(sine)=9.1 amps



SM233BR
Ics (sine)=5.9 amps, Ipk(sine)=17.6 amps



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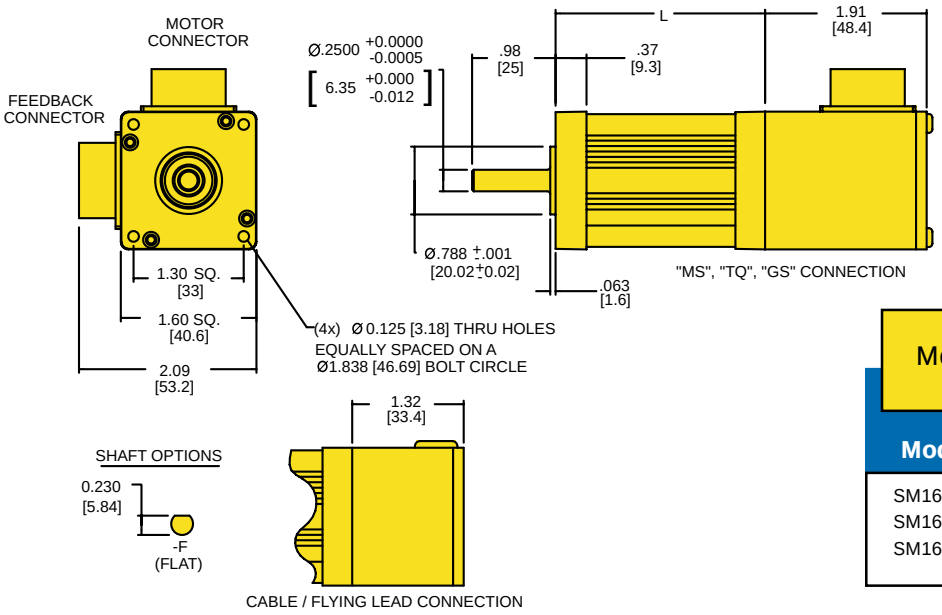
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SM Series Dimensional Drawings

Size 16, Dimensional Drawing

Dimensions in inches (mm)

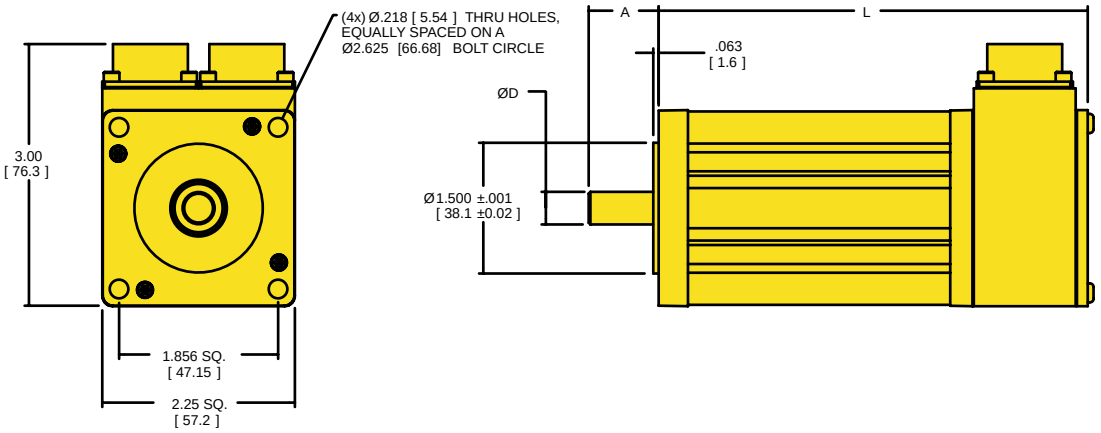


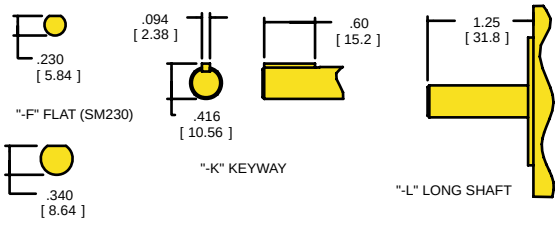
Motor Sizes

Model	Motor Length "L"
SM160	1.97 [50.0]
SM161	2.47 [62.7]
SM162	3.47 [88.1]

Size 23, Dimensional Drawing

Dimensions in inches (mm)





Motor Sizes

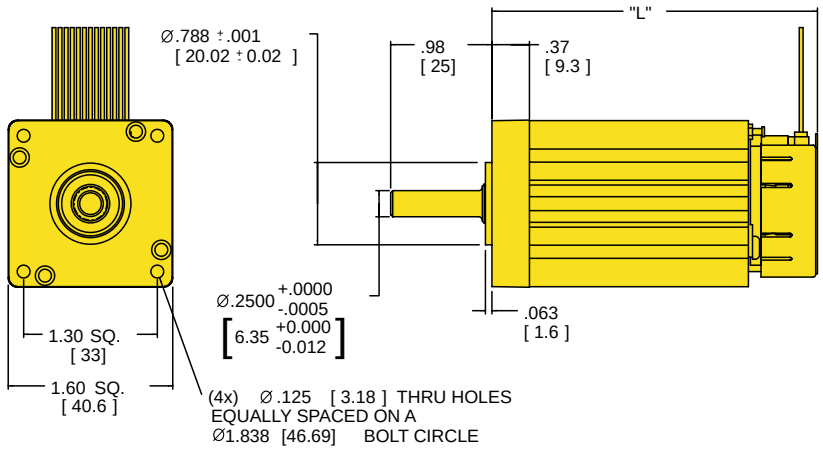
Model	Motor Length "L"	Shaft Length "A"	Shaft Diameter "D"
SM230	3.36 [85.3]	.78 [19.8]	.2500 +.0000/-.0005 [6.350 +0.000/-0.013]
SM231	3.98 [101.1]	.82 [20.8]	.3750 +.0000/-.0005 [9.525 +0.000/-0.013]
SM232	4.98 [126.5]	.82 [20.8]	.3750 +.0000/-.0005 [9.525 +0.000/-0.013]
SM233	5.98 [151.9]	.82 [20.8]	.3750 +.0000/-.0005 [9.525 +0.000/-0.013]

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SE Series Dimensional Drawings

Size 16, Dimensional Drawing

Dimensions in inches (mm)

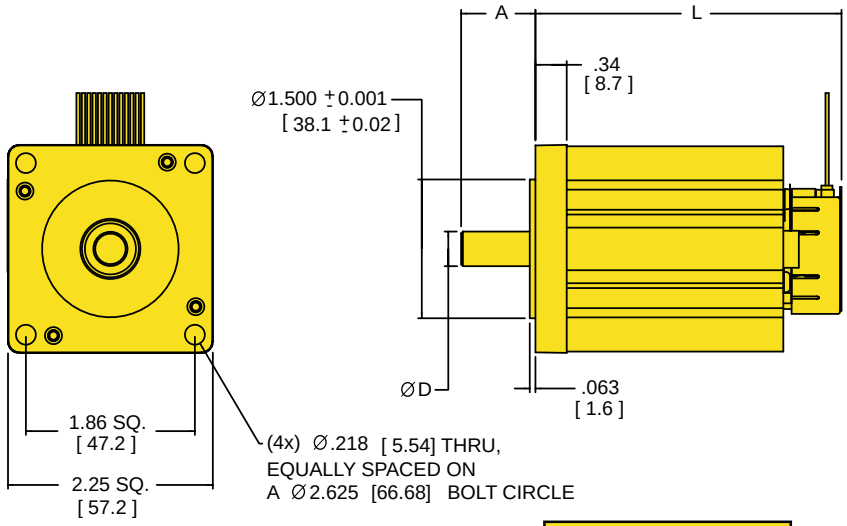


Motor Sizes

Model	Motor Length "L"
SE160	2.67 [67.8]
SE161	3.17 [80.5]
SE162	4.17 [105.9]

Size 23, Dimensional Drawing

Dimensions in inches (mm)



Motor Sizes

Model	Motor Length "L"	Shaft Length "A"	Shaft Diameter "D"
SE230	2.70 [68.6]	.78 [19.8]	.2500 +.0000/-.0005 [6.350 +0.000/-0.013]
SE231	3.36 [85.3]	.82 [20.8]	.3750 +.0000/-.0005 [9.525 +0.000/-0.013]
SE232	4.36 [110.7]	.82 [20.8]	.3750 +.0000/-.0005 [9.525 +0.000/-0.013]
SE233	5.36 [136.1]	.82 [20.8]	.3750 +.0000/-.0005 [9.525 +0.000/-0.013]

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Feedback Specifications

Encoder Specifications

Mechanical

Electrical

Accuracy	±2 min of arc
Input power	5 VDC ±5%, 135 mA
Operating frequency	100 kHz max
Output device	26LS31
Sink/Source, nominal	20 mA
Suggested user interface	26LS32

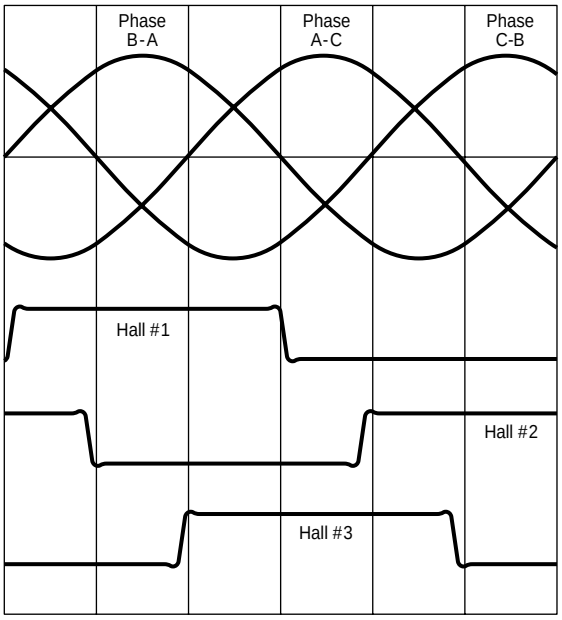
Hall-Effect Specifications

Electrical

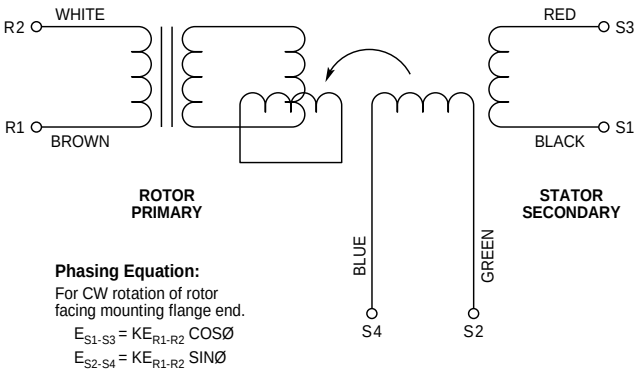
Input power	5 VDC ±5%, 80 mA
Output device (open collector)	LM339
Maximum pull up	12 VDC
Sink	16 mA

Commutation Chart

Clockwise rotation as viewed from front shaft.



Resolver Schematic Diagram for SM



Phasing Equation:
For CW rotation of rotor facing mounting flange end.

$E_{S1-S3} = KE_{R1-R2}$ COSØ

$E_{S2-S4} = KE_{R1-R2}$ SINØ

Resolver Specifications

Parameter	Value
Input voltage @ 7 kHz	4.25 volts
Input current, max	55 mA
Input power, nominal	0.12 watts
Impedance ZSO (@ 90°)	58+j145 ohms
Impedance ZRO	53+j72 ohms
Impedance ZRS	42+j55 ohms
Transformation ratio	0.470 ±5%
Output voltage	2.0 ±5% volts
DC rotor resistance	23 ±10% ohms
DC stator resistance	19 ±10% ohms
Sensitivity	35 mV/degree
Max error from EZ	±10 minutes
Phase shift, open circuit	5° leading, ±3"
Null voltage, total	20 mV rms
Impedance ZSS	50+j128 ohms
Inertia	Incl. with motor spec.

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Wiring and Cable Specifications

Flying Leads, Cabled and "MS" Connection

Options

The **"FL" (Flying Lead) connection** option for the SM Series motors features 18" leads extending from the motor body. Wire color codes are the same as listed below for the "MS" connection option.

The **"10" and "25" connection** option for the SM Series motors consist of either 10 feet or 25 feet of jacketed cable extending from the motor body. These cables terminate in flying leads. Wire color codes are the same as listed below for the "MS" connection option.

The **"MS" connection** option for the SM Series motors provides quick disconnect, bayonet style connectors attached to the motor body. Mating cables are specified and ordered separately. With the "MS" connection option, the motor phase and temperature switch wires are in one cable/conector, and the hall and encoder signals are in the other cable/connector. This option works well when using an amplifier with a built-in controller, or when all cables enter into a cabinet or enclosure and then are wired into a terminal strip. When specifying the "R" (resolver) feedback option, the motor phase wires reside in one connector, the resolver signal and temperature switch wires in the other.

Encoder/Hall Feedback Connection

Designation	Pin Number MS14-18	Wire Color
Encoder +5	H	Red
Encoder Ground	G	Black
CH A +	A	White
CH A -	B	Yellow
CH B +	C	Green
CH B -	D	Blue
Index +	E	Orange
Index -	F	Brown
Hall Ground	K	White/Green
Hall +5	M	White/Blue
Hall 1	T	White/Brown
Hall 2	U	White/Orange
Hall 3	P	White/Violet
Brake[1]	R	Red/Blue
Brake[1]	S	Red/Blue
Shield	N.C.	Clear
N.C.	N.C.	Orange/Yellow
N.C.	N.C.	Orange/Yellow

Motor Connection

Designation	Pin Number MS14-12	Wire Color
Phase A	J	Red/Yellow
Phase B	K	White/Yellow
Phase C	L	Black/Yellow
Ground	M	Green/Yellow
Temp[2]	G	Orange/Yellow or Yellow
Temp[2]	H	Orange/Yellow or Yellow
Shield	N.C.	Clear

1 Brake will operate regardless of polarity connection
2 For motors with the "R" (resolver) feedback option, the temperature switch is connected to leads in the feedback cable/connector

Resolver Feedback Connection

Designation	Pin Number MS14-18	Wire Color
S1, COS +	E	Black
S2, SIN +	L	Green
S3, COS -	J	Red
S4, SIN -	G	Blue
R1, EXC +	C	Brown
R2, EXC -	U	White
Temp[2]	R	Orange/Yellow or Yellow
Temp[2]	N	Orange/Yellow or Yellow
Brake[1]	S	Red/Blue
Brake[1]	T	Red/Blue
Shield	N.C.	Clear

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Wiring and Cable Specifications (Continued)

"GS" Connection Option

The **"GS"** connection option for the SM Series motors provides quick disconnect, bayonet style connectors attached to the motor body. Mating cables are specified and ordered separately. Wiring for the "GS" connection option for SM motors is similar to the "MS" option, except the temperature switch leads have been moved to the feedback connector. This connection option should be selected when operating the SM motors with the Gemini family of amplifiers.

Motor Connection

Designation	Pin Number MS14-12	Wire Color
Phase A	J	Black 1
Phase B	K	Black 2
Phase C	L	Black 3
Ground	M	Green/Yellow

Encoder/Hall Feedback Connection

Designation	Pin Number MS14-18	Wire Color
Encoder +5	H	Red
Encoder Ground	G	Black
CH A +	A	White
CH A -	B	Yellow
CH B +	C	Green
CH B -	D	Blue
Index +	E	Orange
Index -	F	Brown
Hall Ground	K	White/Green
Hall +5	M	White/Blue
Hall 1	T	White/Brown
Hall 2	U	White/Orange
Hall 3	P	White/Violet
Brake[1]	R	Red/Blue
Brake[1]	S	Red/Blue
Temp	L	Orange/Yellow
Temp	N	Orange/Yellow

1 *Brake will operate regardless of polarity connection*

"TQ" Connection Option

The **"TQ"** connection option for the SM Series motors provides quick disconnect, bayonet style connectors attached to the motor body. Mating cables are specified and ordered separately. The "TQ" connection option joins the motor phase, hall effect and temperature switch wires in one connector. The second connector has only encoder signals. This connection option applies well in applications where the hall and motor phase wires connect directly to an amplifier, while the encoder signals connect directly to a controller.

Motor/HallConnection

Designation	Pin Number MS14-12	Wire Color
Phase A	J	Red/Yellow
Phase B	K	White/Yellow
Phase C	L	Black/Yellow
Ground	M	Green/Yellow
Temp	G	Orange/Yellow or Yellow
Temp	H	Orange/Yellow or Yellow
Hall Ground	F	White/Green
Hall +5	B	White/Blue
Hall 1	C	White/Brown
Hall 2	D	White/Orange
Hall 3	E	White/Violet
Shield	N.C.	Clear

Encoder Feedback Connection

Designation	Pin Number MS14-18	Wire Color
Encoder +5	H	Red
Encoder Ground	G	Black
CH A +	A	White
CH A -	B	Yellow
CH B +	C	Green
CH B -	D	Blue
Index +	E	Orange
Index -	F	Brown
Brake[1]	R	Red/Blue
Brake[1]	S	Red/Blue
Shield	N.C.	Clear

1 *Brake will operate regardless of polarity of connection*

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