

# SM & SE Series Motors



## 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).

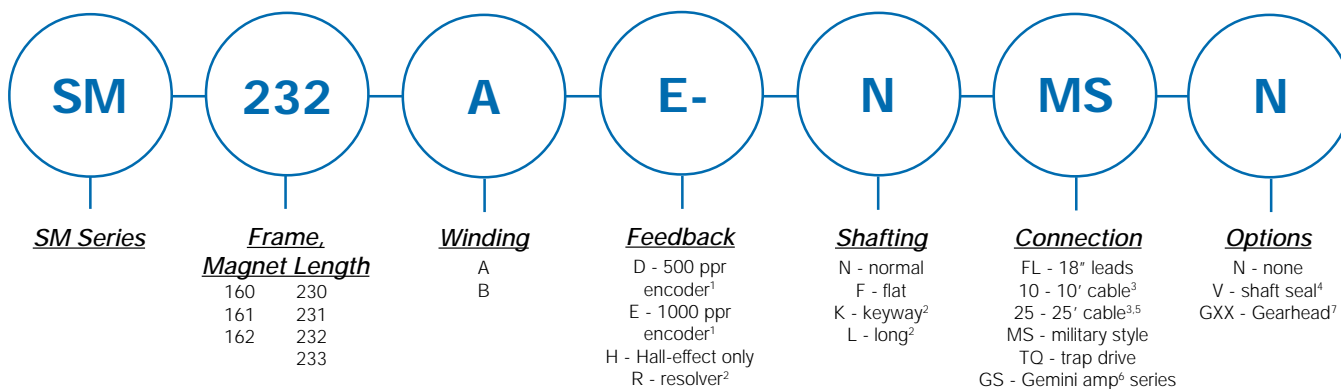
The SM Series motors also feature a rugged anodized aluminum body and connector housing. An IP65 rating can be obtained on motors with MS connectors and an optional shaft seal. All SM motors are CE (LVD) compliant.

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



1 Includes Hall-effect  
2 Not available on size 16 or SM230  
3 Cable is hard-wired  
4 With MS, TO 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

## 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.

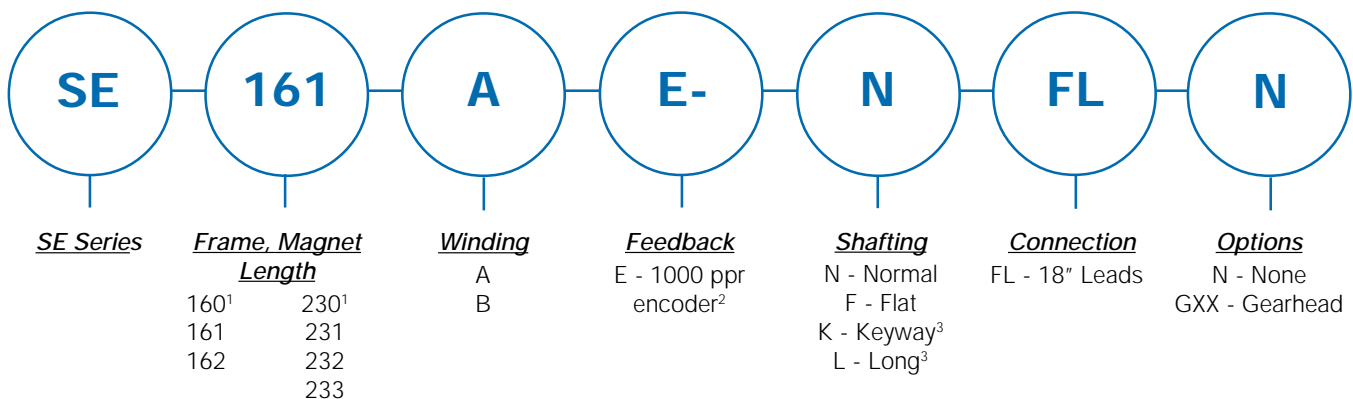
The SE Series servo motors are available with integrated planetary gearheads in ratios up to 100:1. Our unique package integrates the gearhead pinion into the motor shaft, reducing the overall package length by up to 2 inches.



### 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



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

**Custom Designed Servo Motors For Your Specific Application. Call 1-800-358-9070 Today.**

Size 16, Encoder Feedback, Specifications\*

Parameter	Symbol	Units	SM160A	SM160B	SM161A	SM161B	SM162A	SM162B
Stall Torque Continuous <sup>1</sup>	$T_{cs}$	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 <sup>1,4,8</sup>	$I_{cs}(\text{sine})$	Amps Peak	2.8	5.6	2.7	5.2	2.6	5.1
Stall Current Continuous <sup>1,7</sup>	$I_{cs}(\text{trap})$	Amps DC	2.5	4.8	2.3	4.5	2.3	4.4
Peak Torque <sup>6</sup>	$T_{pk}$	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 <sup>4,6,8</sup>	$I_{pk}(\text{sine})$	Amps Peak	8.5	16.7	8.1	15.5	7.8	15.2
Peak Current <sup>6,7</sup>	$I_{pk}(\text{trap})$	Amps DC	7.4	14.4	7.0	13.4	6.8	13.2
Rated Speed <sup>2</sup>	$\omega_r$	rpm	7,500	7,500	7,500	7,500	7,500	7,500
Current @ Rated Speed	$I_r(\text{sine})$	Amps	2.5	4.9	2.2	4.2	2.2	4.3
Current @ Rated Speed	$I_r(\text{trap})$	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 <sup>3,4</sup>	$K_b$	volts/radian/sec	0.038	0.020	0.079	0.041	0.147	0.078
Voltage Constant <sup>3,4</sup>	$K_e$	volts/KRPM	4.02	2.08	8.27	4.29	15.39	8.17
Torque Constant <sup>9</sup>	$K_t(\text{sine})$	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 <sup>3,4</sup>	$K_t(\text{trap})$	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 <sup>3</sup>	R	Ohms	3.43	0.90	4.53	1.24	6.50	1.73
Inductance <sup>5</sup>	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/ $\sqrt{\text{watt}}$	2.93	2.96	5.26	5.21	8.16	8.40
		Nm/ $\sqrt{\text{watt}}$	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	$\tau_{th}$	minutes	10	10	11.6	11.6	14.2	14.2
Electrical Time Constant	$\tau_{elec}$	milliseconds	0.16	0.15	0.18	0.17	0.21	0.19
Mechanical Time Constant	$\tau_{mch}$	milliseconds	11.7	11.5	7.7	7.8	5.5	5.2
Intermittent Torque Duration <sup>10</sup>	$T_{2x}$	seconds	8	8	9	9	14	14
Peak Torque Duration <sup>11</sup>	$T_{3x}$	seconds	3	3	4	4	5	5
Rotor Inertia	J	lb-in-sec <sup>2</sup>	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 <sup>2</sup>	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.

<sup>1</sup> @ 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%.

<sup>2</sup> Maximum speed is 7500RPM. For higher speed operation please call the factory.

<sup>3</sup> Measured Line to Line, ±10% line-to-line

<sup>4</sup> Value is measured peak of sine wave.

<sup>5</sup> ±30%, Line-to-Line, inductance bridge measurement @ 1 kHz

<sup>6</sup> Initial winding temperature must be 60°C or less before peak current is applied.

<sup>7</sup> DC current through a pair of motor phases of a trapezoidally

(six state) commutated motor.

<sup>8</sup> Peak of the sinusoidal current in any phase for a sinusoidally commutated motor.

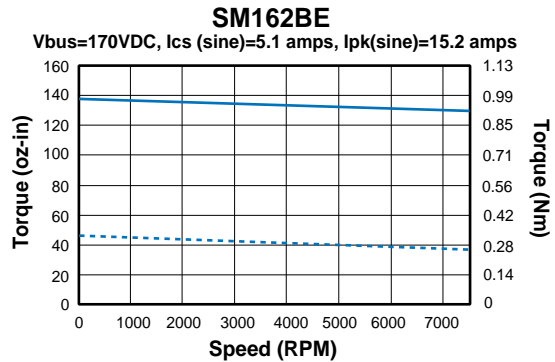
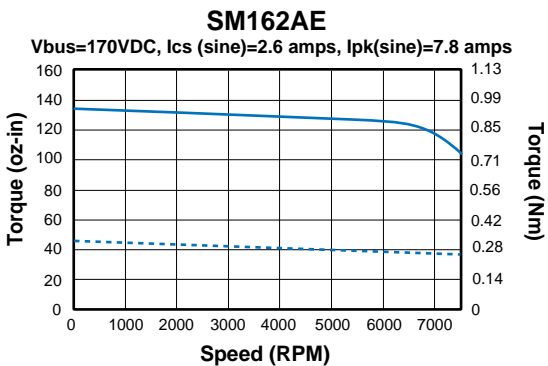
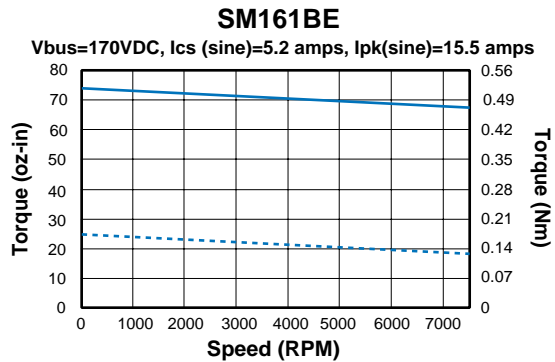
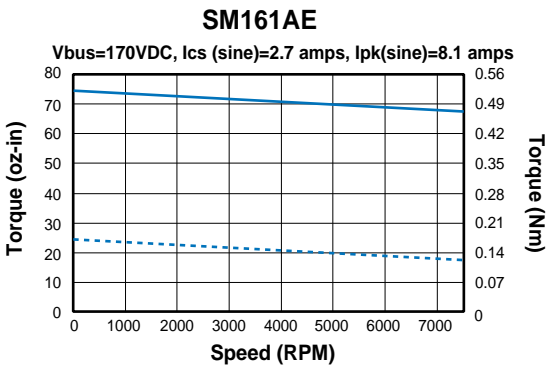
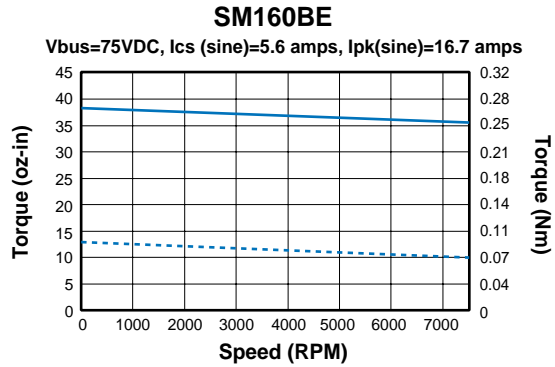
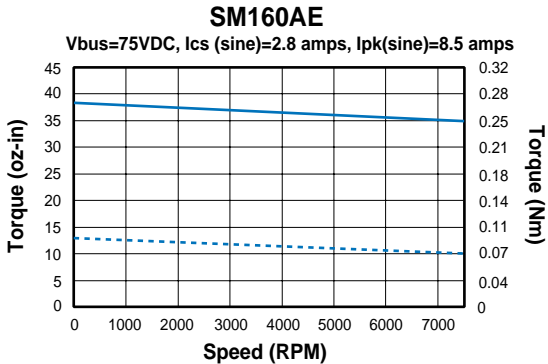
<sup>9</sup> Total motor torque per peak of the sinusoidal amps measured in any phase, +/-10%.

<sup>10</sup> Maximum Time duration with 2 times rated applied with initial winding temp at 60°C.

<sup>11</sup> 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.

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



----- CONTINUOUS      \_\_\_\_\_ PEAK (170 VAC or 75VDC as noted)

Custom Designed Servo Motors For Your Specific Application. Call 1-800-358-9070 Today.

Size 23, Encoder Feedback, Specifications\*

Parameter	Symbol	Units	SM230A	SM230B	SM231A	SM231B	SM232A	SM232B	SM233A	SM233B
Stall Torque Continuous <sup>1</sup>	$T_{cs}$	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 <sup>1,4,8</sup>	$I_{cs}(\text{sine})$	Amps Peak	2.7	5.5	2.9	5.5	2.8	5.4	2.7	5.3
Stall Current Continuous <sup>1,7</sup>	$I_{cs}(\text{trap})$	Amps DC	2.4	4.7	2.5	4.8	2.4	4.7	2.4	4.5
Peak Torque <sup>6</sup>	$T_{pk}$	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 <sup>4,6,8</sup>	$I_{pk}(\text{sine})$	Amps Peak	8.2	16.4	8.8	16.6	8.3	16.1	8.1	15.8
Peak Current <sup>6,7</sup>	$I_{pk}(\text{trap})$	Amps DC	7.1	14.2	7.6	14.3	7.2	14.0	7.1	13.6
Rated Speed <sup>2</sup>	$\omega_r$	rpm	7500	7500	7500	7500	7500	7500	5800	5800
Current@Rated Speed	$I_r(\text{sine})$	Amps	2.4	4.9	2.5	4.8	2.3	4.5	2.4	4.6
Current@Rated Speed	$I_r(\text{trap})$	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 <sup>3,4</sup>	$K_b$	Volts/rad/s	0.081	0.039	0.169	0.079	0.310	0.169	0.484	0.242
Voltage Constant <sup>3,4</sup>	$K_e$	Volts/KRPM	8.48	4.09	17.70	8.27	32.46	17.70	50.68	25.34
Torque Constant <sup>9</sup>	$K_t(\text{sine})$	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
		oz-in/Amp DC	11.47	5.54	23.93	11.19	43.90	23.93	68.53	34.27
Torque Constant <sup>3,4</sup>	$K_t(\text{trap})$	Nm/Amp DC	0.080	0.039	0.168	0.078	0.307	0.168	0.480	0.240
Resistance <sup>3</sup>	R	Ohms	4.43	1.12	5.22	1.46	7.50	2.00	9.65	2.58
Inductance <sup>5</sup>	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/ $\sqrt{\text{watt}}$	5.45	5.23	10.47	9.26	16.03	16.92	22.06	21.33
		Nm/ $\sqrt{\text{watt}}$	0.038	0.037	0.073	0.065	0.112	0.118	0.154	0.149
		oz-in/Krpm	0.160	0.160	0.250	0.250	0.360	0.360	0.540	0.540
Viscous Damping	B	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
		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	$\tau_{th}$	minutes	18.3	18.3	20	20	21.6	21.6	23.3	23.3
Electrical Time Constant	$\tau_{elec}$	milliseconds	0.27	0.25	0.31	0.30	0.39	0.39	0.42	0.41
Mechanical Time Constant	$\tau_{mch}$	milliseconds	18.3	19.9	9.5	12.2	7.2	6.5	5.4	5.8
Intermittent Torque Duration <sup>10</sup>	$T_{2x}$	seconds	11	11	11	11	18	18	20	20
Peak Torque Duration <sup>11</sup>	$T_{3x}$	seconds	5	5	4	4	6	6	7	7
Rotor Inertia	J	lb-in-sec <sup>2</sup>	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-m <sup>2</sup>	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.

<sup>1</sup> @ 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%.

<sup>2</sup> Maximum speed is 7500RPM. For higher speed operation please call the factory.

<sup>3</sup> Measured Line to Line, ±10% line-to-line

<sup>4</sup> Value is measured peak of sine wave.

<sup>5</sup> ±30%, Line-to-Line, inductance bridge measurement @ 1 kHz

<sup>6</sup> Initial winding temperature must be 60°C or less before peak current is applied.

<sup>7</sup> DC current through a pair of motor phases of a trapezoidally (six state) commutated motor.

<sup>8</sup> Peak of the sinusoidal current in any phase for a sinusoidally commutated motor.

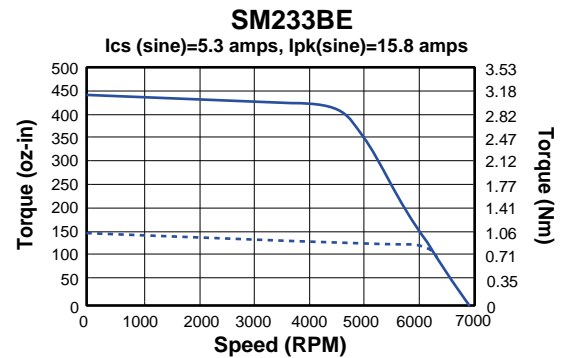
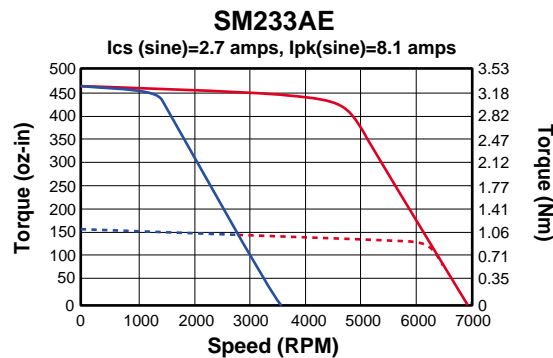
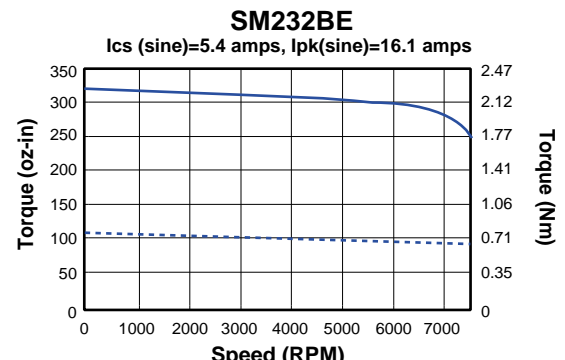
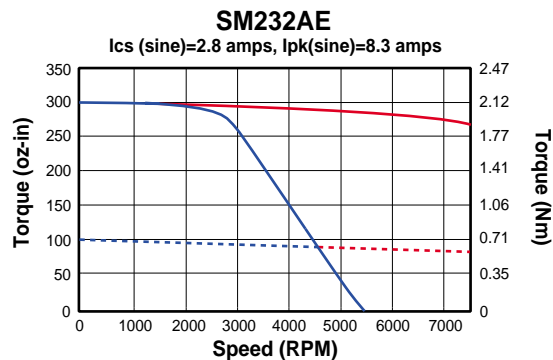
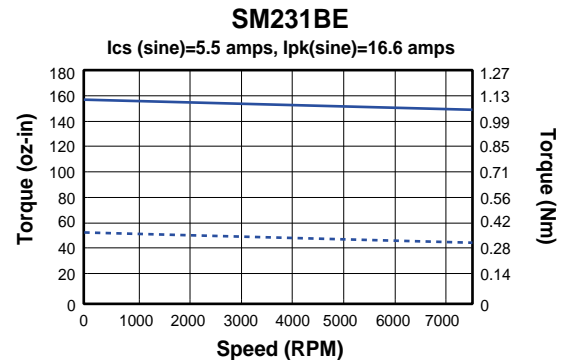
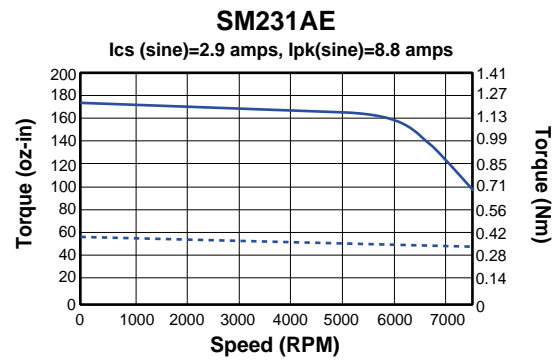
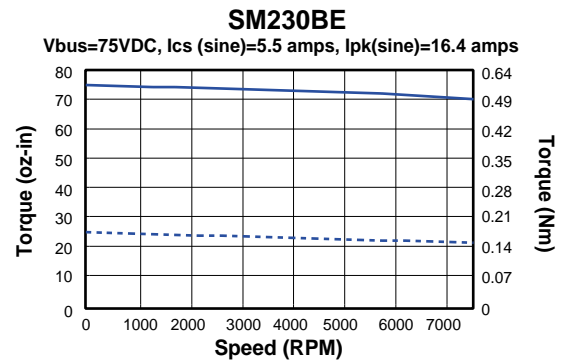
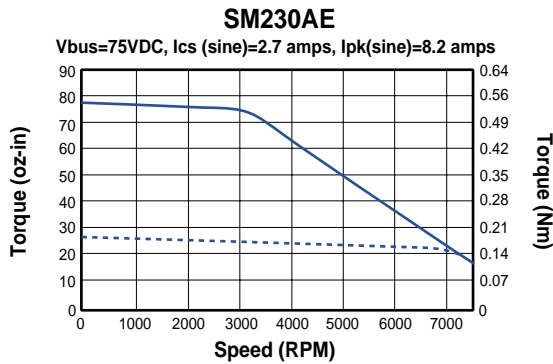
<sup>9</sup> Total motor torque per peak of the sinusoidal amps measured in any phase, +/-10%.

<sup>10</sup> Maximum Time duration with 2 times rated applied with initial winding temp at 60°C.

<sup>11</sup> 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.

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



-----    ———    -----    ———  
 CONTINUOUS    PEAK    CONTINUOUS    PEAK  
 170 or 75 VDC as noted    340 VDC

Custom Designed Servo Motors For Your Specific Application. Call 1-800-358-9070 Today.

Size 23, Resolver Feedback, Specifications\*

Parameter	Symbol	Units	SM231A	SM231B	SM232A	SM232B	SM233A	SM233B
Stall Torque Continuous <sup>1</sup>	$T_{cs}$	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 <sup>1,4,7</sup>	$I_{cs}(\text{sine})$	Amps Peak	3.3	6.2	3.1	6.0	3.0	5.9
Peak Torque <sup>6</sup>	$T_{pk}$	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 <sup>4,6,7</sup>	$I_{pk}(\text{sine})$	Amps Peak	9.8	18.5	9.3	18.0	9.1	17.6
Rated Speed <sup>2</sup>	$\omega_r$	rpm	7500	7500	7500	7500	6000	6000
Current@Rated Speed	$I_r(\text{sine})$	Amps	2.9	5.5	2.7	5.3	2.7	5.3
Current@Rated Speed	$I_r(\text{trap})$	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 <sup>3,4</sup>	$K_b$	Volts/rad/s	0.169	0.079	0.310	0.169	0.484	0.242
Voltage Constant <sup>3,4</sup>	$K_e$	Volts/KRPM	17.70	8.27	32.46	17.70	50.68	25.34
Torque Constant <sup>8</sup>	$K_t(\text{sine})$	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 <sup>3</sup>	R	Ohms	5.22	1.46	7.50	2.00	9.65	2.58
Inductance <sup>5</sup>	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	$R_{in} w-a$	°C/watt	2.00	2.00	1.54	1.54	1.25	1.25
Motor Constant	$K_m$	oz-in/ $\sqrt{\text{watt}}$	10.47	9.26	16.03	16.92	22.06	21.33
		Nm/ $\sqrt{\text{watt}}$	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	$\tau_{th}$	minutes	20	20	21.6	21.6	23.3	23.3
Electrical Time Constant	$\tau_{elec}$	milliseconds	0.31	0.30	0.39	0.39	0.42	0.41
Mechanical Time Constant	$\tau_{mch}$	milliseconds	9.5	12.2	7.2	6.5	5.4	5.8
Intermittent Torque Duration <sup>9</sup>	$T_{2x}$	seconds	11	11	18	18	20	20
Peak Torque Duration <sup>10</sup>	$T_{3x}$	seconds	4	4	6	6	7	7
Rotor Inertia	J	lb-in-sec <sup>2</sup>	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 <sup>2</sup>	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.

<sup>1</sup> @ 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%.

<sup>2</sup> Maximum speed is 7500RPM. For higher speed operation please call the factory.

<sup>3</sup> Measured Line to Line, ±10% line-to-line

<sup>4</sup> Value is measured peak of sine wave.

<sup>5</sup> ±30%, Line-to-Line, inductance bridge measurement @ 1 kHz

<sup>6</sup> Initial winding temperature must be 60°C or less before peak current is applied.

<sup>7</sup> Peak of the sinusoidal current in any phase for a sinusoidally commutated motor.

<sup>8</sup> Total motor torque per peak of the sinusoidal amps measured in any phase, +/-10%.

<sup>9</sup> Maximum Time duration with 2 times rated applied with initial winding temp at 60°C.

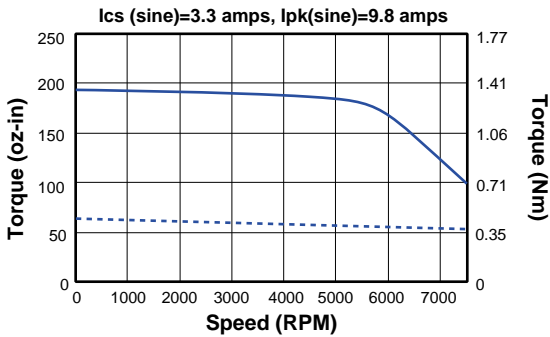
<sup>10</sup> Maximum Time duration with 3 times rated applied with initial winding temp at 60°C.

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

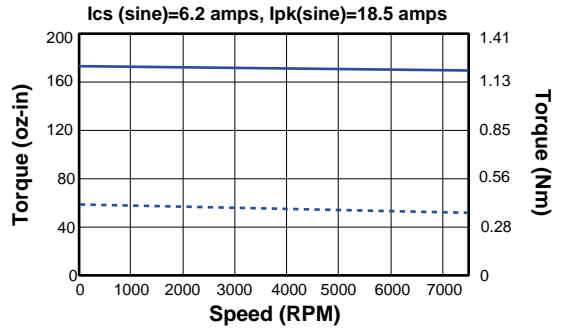


# Size 23, Resolver Feedback, Performance Curves (SM Series only)

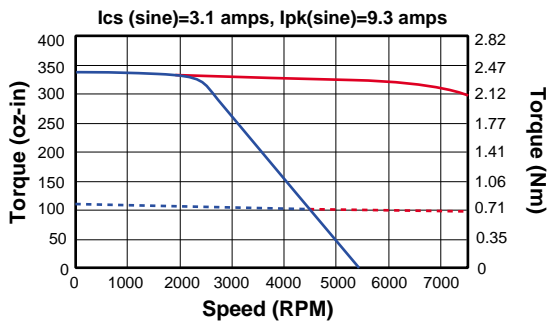
**SM231AR**



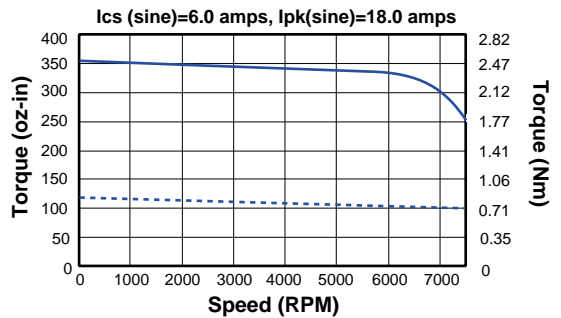
**SM231BR**



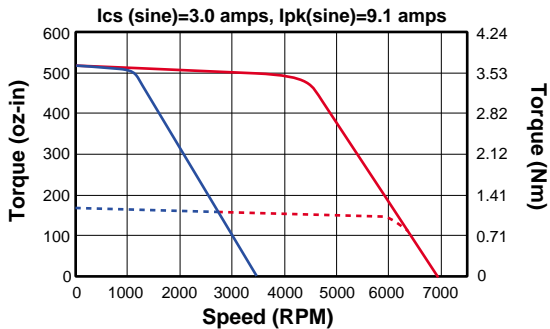
**SM232AR**



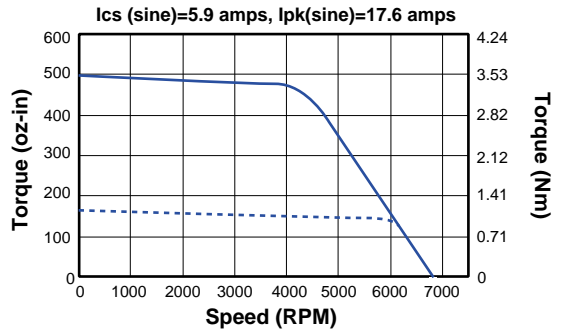
**SM232BR**



**SM233AR**



**SM233BR**



-----    \_\_\_\_\_    -----    \_\_\_\_\_  
 CONTINUOUS    PEAK    CONTINUOUS    PEAK  
 170 VDC                      340 VDC

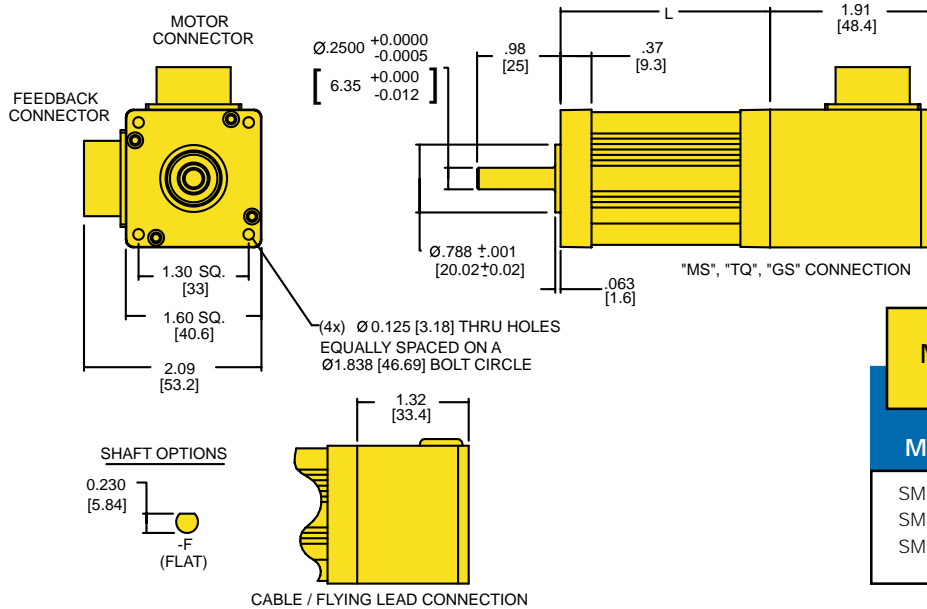
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# SM Series Dimensional Drawings

## Size 16, Dimensional Drawing

Dimensions in inches (mm)

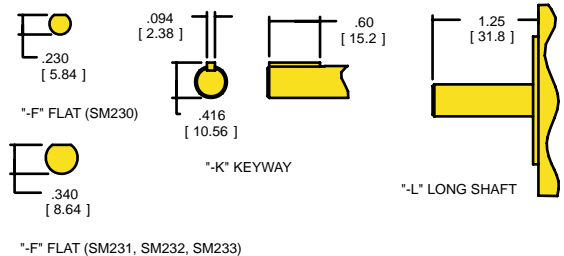
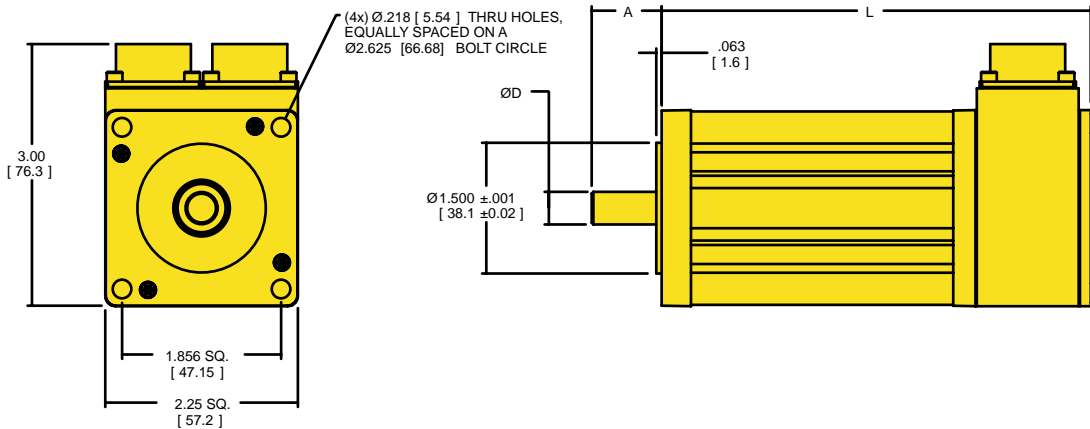


### Motor Sizes

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)



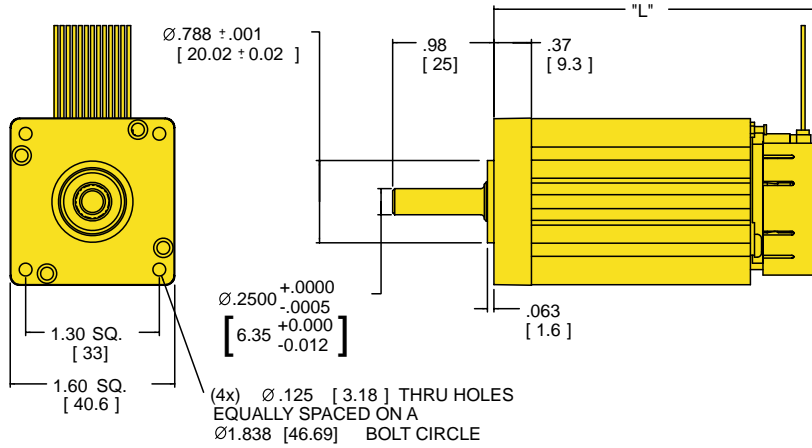
### Motor Sizes

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]

# SE Series Dimensional Drawings

## Size 16, Dimensional Drawing

Dimensions in inches (mm)

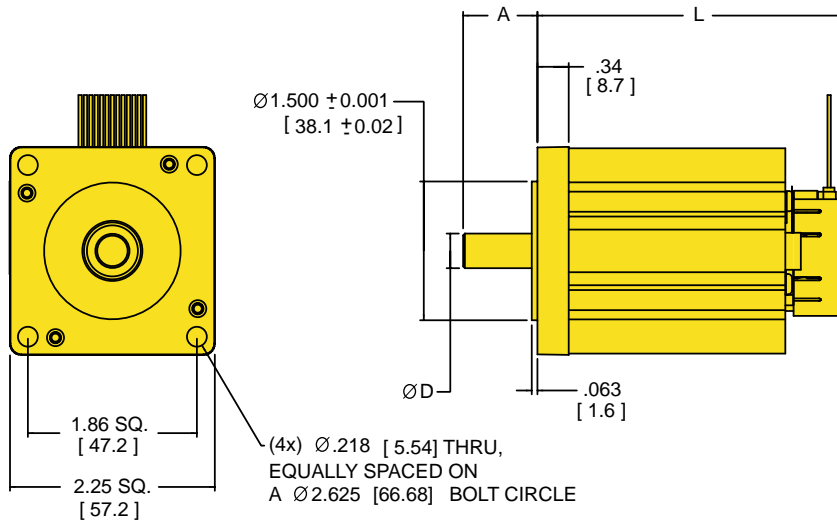


### Motor Sizes

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

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

### Electrical

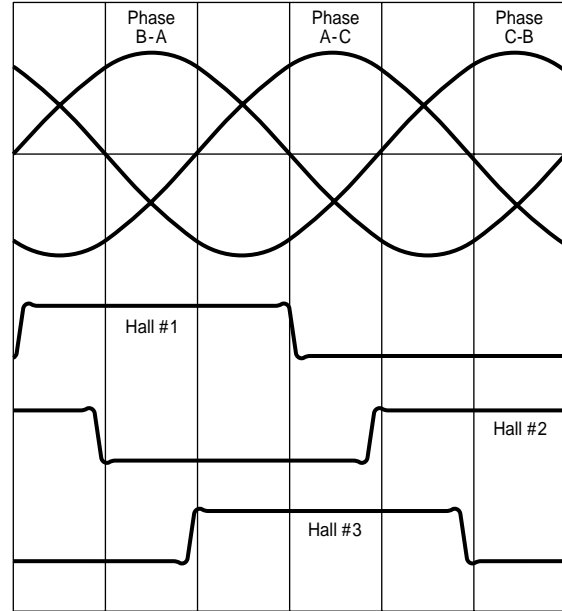
## Hall-Effect Specifications

### Electrical

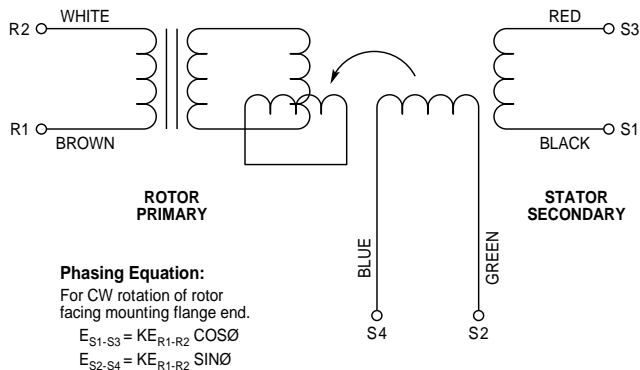
Input power	5 VDC ±5%, 80 mA
Output device (open collector)	LM339
Maximum pull up	12 VDC
Sink	16 mA

## Commutation Chart

Clockwise rotation as viewed from front shaft.



## Resolver Schematic Diagram for SM



## Resolver Specifications

Parameter	Value
Input voltage @ 7 kHz	4.25 volts
Input current, max	55 mA
Input power, nominal	0.12 watts
Impedance Z <sub>SO</sub> (@ 90°)	58+j145 ohms
Impedance Z <sub>RO</sub>	53+j72 ohms
Impedance Z <sub>RS</sub>	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 Z <sub>SS</sub>	50+j128 ohms
Inertia	Incl. with motor spec.

# 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/connector, 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 <sup>1</sup>	R	Red/Blue
Brake <sup>1</sup>	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 <sup>2</sup>	G	Orange/Yellow or Yellow
Temp <sup>2</sup>	H	Orange/Yellow or Yellow
Shield	N.C.	Clear

- <sup>1</sup> Brake will operate regardless of polarity connection
- <sup>2</sup> 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 <sup>2</sup>	R	Orange/Yellow or Yellow
Temp <sup>2</sup>	N	Orange/Yellow or Yellow
Brake <sup>1</sup>	S	Red/Blue
Brake <sup>1</sup>	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 <sup>1</sup>	R	Red/Blue
Brake <sup>1</sup>	S	Red/Blue
Temp	L	Orange/Yellow
Temp	N	Orange/Yellow

### “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/Hall 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	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 <sup>1</sup>	R	Red/Blue
Brake <sup>1</sup>	S	Red/Blue
Shield	N.C.	Clear

<sup>1</sup> Brake will operate regardless of polarity connection

<sup>1</sup> Brake will operate regardless of polarity of connection