CHAPTER THREE

3 Specifications

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- SM and NeoMetric Motor Specifications
- SM and NeoMetric Motor Speed/Torque Curves
- SM and NeoMetric Motor Dimensions
- SM and NeoMetric Encoder Specifications
- SM and NeoMetric Motor Part Numbering System

Specifications – TQ10X Servo Controller/Drive

Parameter	Value
Power Input	
Voltage	95-132 VAC single phase
Frequency	50/60 Hz
Power Output—Motor	
Peak Current	10 A (approx 2 sec max duration at 45°C ambient temperature)
Continuous Current	5 A with TQ-HS3 or mounted to heatsink at or below 45°C
Voltage	170 VDC nominal
Peak Power	830 W (1.1 hp) @ 170 V supply voltage
Continuous Power	420 W (0.56 hp)
Switching Frequency	20 kHz
Bandwidth	2 kHz typical (dependent on motor)
Transconductance	1 volt = 1.0 amp
Commutation	120° hall effect sensors for six-state commutation method or brushed DC motor
Short-Circuit Protected	Yes
Power Output—Hall Effect Sensors	
Voltage	+5 VDC ±0.5 VDC
Current	50 mA (max)
Short-Circuit Protected	Yes
Power Output—To Encoder	
Voltage	+5 VDC
Current	200 mA max each output
Hall Inputs	
Low State	Ø-2V
High State	Internal 3 k pull-up resistor to +15 V (open-collector Hall outputs should be used)
Input Frequency	Ø–2 kHz max
Inputs	
Programmable Inputs	5 user-defined, TTL signal levels: low = 0.8 V; high = 2–5V
End-of-travel limits	CW/CCW, 0–5 V, TTL signal levels: low = 0.8 V; high = 2–5V
RS-232C	3-wire (Rx, Tx, GND) connections, RS485 optional
Outputs	
Programmable outputs	2 user-defined, TTL signal levels: low = 0.8 V; high = 2–5V
Fault Output–Isolated	24 V max voltage; 10 mA max current
LED Name	Indication
-Enable (Bicolor)	Green = enabled; Red = power on, not enabled
-Drive temp	Red = fault (drive overtemp, etc.)
-Motor fault	Red = fault (short circuit, motor overtemp, etc.)
-Peak current/Foldback (Bicolor)	Green = current is near peak (over~75%) Red = in foldback (peak current time exceeded)
-Regen (Bicolor)	Green = regen active; Red = overvoltage fault
Performance	
Position Range	±1,073,741,823
Velocity Range	0.01 to 200 rps
Acceleration Range	0.01 to 9999 rps2
Velocity Accuracy	±0.02% of max rate
Velocity Repeatability	±0.02% of set rate
Resolution	400–65,532 encoder counts/rev
Digital Servo Loop	
Update Time	266 µs
Output	12-bit DAC
Servo Tuning	Via RS-232C
Tuning Parameters	PID with digital filter
Protective Circuits	
Short Circuit	Turns off outputs to motor; latched
Overtemperature	55°C ±5°C trip temperature; latched
Undervoltage	80 V min
Memory	
2K of BBRAM	For program, RS232 address, tuning, and setup storage
Physical	
All connection points	10 pin screw terminal, removable
Environment	
Drive Temperature ambient	0-50°C (32-122°F)
Humidity	0-95% non-condensing
Storage	-40-85°C (-40-185°F)

Motor Specifications – Compumotor SM Series Servo Motors

	Symbol	Units	SM161A	SM162A	SM231A	SM232A	SM232B	SM233A	SM233B
Continuous Stall Torque[1]	T_{CS}	oz-in	24	44	46	92	92	140	140
		N-m	0.17	0.31	0.32	0.65	0.65	0.99	0.99
Continuous Stall Current[1]	I_{CS}	amps-rms	2.1	2.1	2.1	2.1	4.1	2.1	4.1
Rated Speed[2]	ω_T	rpm	7,500	7,500	7,500	4,500	7,500	2,800	7,500
		rps	125	125	125	75	125	47	125
Peak Torque[1]	T_{pk}	oz-in	72	132	138	276	276	420	420
		N-m	0.51	0.83	0.97	1.95	1.95	2.97	2.97
Peak Current, rms[1]	I_{pk}	amperes	6.3	6.3	6.3	6.3	12.3	6.3	12.3
Torque @ Rated Speed[1]	T_C	oz-in	20	41	38	78	84	134	114
		N-m	0.14	0.29	0.27	0.55	0.59	0.95	0.81
Rated Power-Output Shaft[1]	Po	Watts	110	222	205	260	362	277	505
Resistance[4]	Ω	ohms	4.53	6.50	5.22	7.50	2.01	9.65	2.58
Inductance[3]	L	millihenries	0.808	1.39	1.64	2.9	0.78	4.08	1.06
Thermal Resistance[1]	R_{th}	°C/watt	2.75	2.00	2.23	1.58	1.50	1.25	1.26
Thermal Time Constant	T_{th}	minutes	30	30	30	35	35	40	40
Electrical Time Constant	T_{te}	milliseconds	0.178	0.21	0.31	0.39	0.39	0.42	0.41
Mechanical Time Constant	T_m	milliseconds	9.2	5.0	13.7	8.6	8.8	5.4	7.0
Rotor Inertia	J	lb-in-sec^2	0.000094	0.00016	0.00046	0.00082	0.00082	0.00117	0.00117
		oz-in^2 (mass)	0.58	0.99	2.84	5.07	5.07	7.23	7.23
		kg-m^2 x 10^{-6}	10.62	18.07	51.97	92.65	92.65	132.19	132.19
Weight	#	pounds (kg)	1.1 (0.5)	1.6 (0.7)	2.6 (1.2)	3.5 (1.6)	3.5 (1.6)	4.4 (2.0)	4.4 (2.0)

Data listed is for SM motors alone. Drive specifications may change some values.

[1] @25°C ambient with 10 x 10 x 0.25 in. mounting plate, 90°C winding temperature. For 40°C ambient operation, reduce values by 12%.

[2] With 500 ppr encoders. For 1,000 ppr encoders, derate to 6000 rpm.

[3] ±30%, line-to-line, inductance bridge measurement method @ 1 kHz

[4] ±10%, line-to-line, at 25°C

Motor Specifications – Compumotor NeoMetric Series Servo Motors (70mm)

Parameter	Symbol	Units	N0701D N0341D	N0701F N0341F	N0702E N0342E	N0702F N0342F	N0703F N0343F	N0703G N0343G	N0704F N0343F	N0704G N0344G
Stall Torque Continuous[1,4]	T_{CS}	lb-in	5.8	5.8	10.6	10.6	16.2	16.2	20.0	20.0
		N-m	0.65	0.65	1.19	1.19	1.83	1.83	2.26	2.26
Stall Current Continuous[1,2]	I_{CS}	amps-rms	2.92	4.56	3.36	4.67	4.59	6.38	4.73	6.57
Rated Speed	ω_r	rpm	4850	7500	3025	4380	2825	4050	2365	3390
		rps	80.8	125	50.4	73	47.1	67.5	39.4	56.5
Peak Torque[1]	T_{pk}	lb-in	17.3	17.3	32.0	32.0	48.6	48.6	60.0	60.0
		N-m	1.95	1.95	3.62	3.62	5.49	5.49	6.78	6.78
Peak Current, rms[1,6]	I_{pk}	amperes	8.8	13.7	10.0	14.0	13.7	19.1	14.2	19.7
Torque @ Rated Speed[1]	T_C	lb-in	4.6	4.6	8.6	8.6	13.0	13.0	15.8	15.8
		N-m	0.52	0.52	0.97	0.97	1.47	1.47	1.79	1.79
Rated Power-Output Shaft[1]	Po	watts	265	415	309	447	435	624	442	634
Voltage Constant[3,4]	K_b	volts/radian/sec	0.221	0.14	0.353	0.253	0.392	0.282	0.468	0.338
Voltage Constant[3,4]	K_e	volts/KRPM	23.11	14.67	36.97	26.52	40.99	29.54	49.02	35.36
Torque Constant[3,4]	K_t	lb-in/amp rms	1.95	1.24	3.12	2.24	3.46	2.50	4.14	2.99
Resistance[3]	R	ohms	5.52	2.27	5.22	2.7	3.36	1.74	3.47	1.80
Inductance[5]	L	millihenries	12.98	5.23	15.86	8.16	12.13	6.30	14.50	7.55
Thermal Resistance[1]	R_{th}	°C/watt	1.44	1.44	1.15	1.15	0.96	0.96	0.87	0.87
Motor Constant	K_m	lb-in/√watt	0.83	0.83	1.37	1.36	1.89	1.89	2.23	2.23
Viscous Damping	B	lb-in/Krpm	0.044	0.044	0.05	0.05	0.0563	0.0563	0.0625	0.0625
Torque-Static Friction	T_f	oz. in.	1.4	1.4	2.1	2.1	2.8	2.8	3.5	3.5
Thermal Time Constant	τ_{th}	minutes	45	45	45	45	45	45	45	45
Electrical Time Constant	τ_e	milliseconds	2.35	2.35	3.03	3.03	3.61	3.61	4.19	4.19
Mechanical Time Constant	τ_m	milliseconds	1.3	1.3	0.77	0.77	0.54	0.54	0.52	0.52
Rotor Inertia	J	lb-in-sec^2	0.000106	0.000106	0.000173	0.000173	0.000240	0.000240	0.000307	0.000307
Weight	#	pounds	3.54	3.54	4.53	4.53	6.04	6.04	7.28	7.28
Winding Class			H	H	H	H	H	H	H	H

[1] @25°C ambient with 10 x 10 x 0.25 in. mounting plate, 90°C encoder temperature.
[2] RMS current, line-to-line, six state commutation.
[3] +/- 10% line-to-line.
[4] Peak value.
[5] +/- 30% line-to-line, inductance bridge measurement @ 1KHz.
[6] Peak current for 2 seconds maximum with initial winding temperature of 40°C.
All specifications are subject to engineering change.

Motor Specifications – Compumotor NeoMetric Series Servo Motors (92mm)

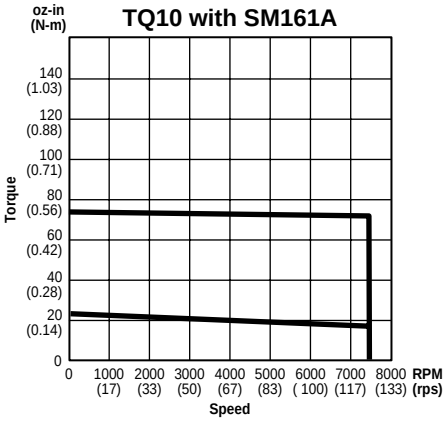
Parameter	Symbol	Units	N0921F	N0921G	N0922G
Stall Torque Continuous[1,4]	T_{CS}	lb-in	16	16	31
		N-m	1.81	1.81	3.50
Stall Current Continuous[1,2]	I_{CS}	amps-rms	4.16	5.76	6.17
Rated Speed	ω_r	rpm	2500	3575	1975
		rps	41.7	59.6	32.9
Peak Torque[1]	T_{pk}	lb-in	48	48	93
		N-m	5.42	5.42	10.51
Peak Current, rms[1,6]	I_{pk}	amperes	12.5	17.3	18.5
Torque @ Rated Speed[1]	T_C	lb-in	12.9	12.9	24.6
		N-m	1.46	1.46	2.78
Rated Power-Output Shaft[1]	Po	watts	383	548	578
Voltage Constant[3,4]	K_b	volts/radian/sec	0.427	0.309	0.556
Voltage Constant[3,4]	K_e	volts/KRPM	44.66	32.37	58.18
Torque Constant[3,4]	K_t	lb-in/amp rms	3.84	2.78	5.0
Resistance[3]	R	ohms	3.72	1.94	2.32
Inductance[5]	L	millihenries	17.11	8.99	14.72
Thermal Resistance[1]	R_{th}	°C/watt	1.06	1.06	0.77
Motor Constant	K_m	lb-in/√watt	1.96	2.00	3.29
Viscous Damping	B	lb-in/Krpm	0.075	0.075	0.0875
Torque-Static Friction	T_f	oz. in.	4	4	6
Thermal Time Constant	τ_{th}	minutes	60	60	60
Electrical Time Constant	τ_e	milliseconds	4.6	4.6	6.4
Mechanical Time Constant	τ_m	milliseconds	1.13	1.13	0.64
Rotor Inertia	J	lb-in-sec^2	0.000363	0.000363	0.000623
Weight	#	pounds	8.1	8.1	11.7
Winding Class			H	H	H

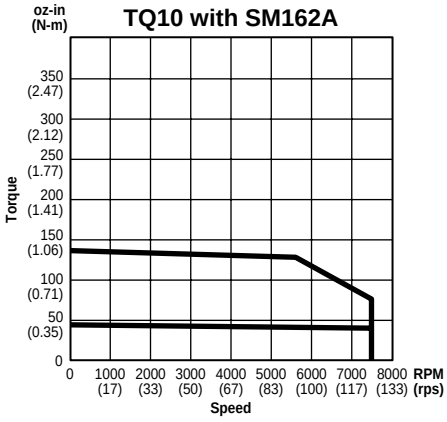
[1] @25°C ambient with 10 x 10 x 0.25 in. mounting plate, 90°C encoder temperature.
[2] RMS current, line-to-line, six state commutation.
[3] +/- 10% line-to-line.
[4] Peak value.
[5] +/- 30% line-to-line, inductance bridge measurement @ 1KHz.
[6] Peak current for 2 seconds maximum with initial winding temperature of 40°C.

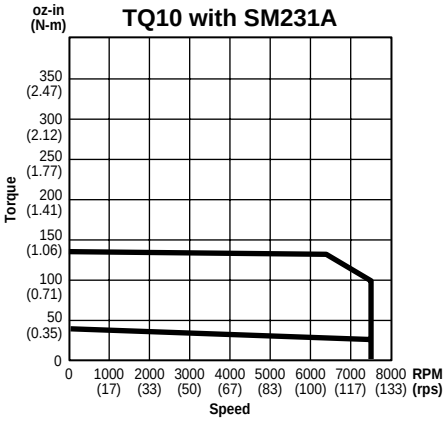
All specifications are subject to engineering change.

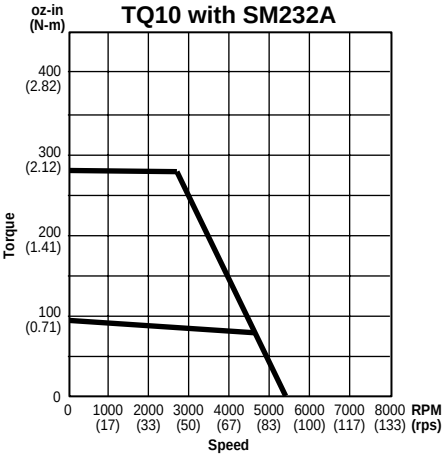
Speed/Torque Curves

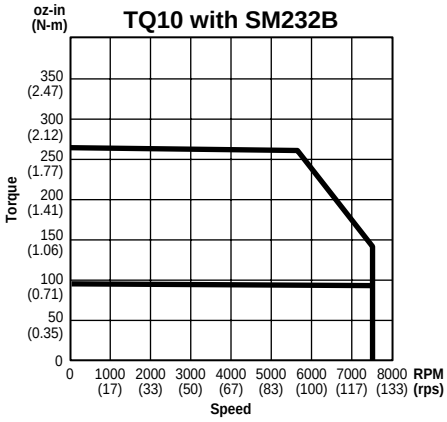
NOTE: Curves are based on 120VAC line, nominal motor K_T and K_C. Actual values may vary ±10%. Line voltage directly limits maximum speed.

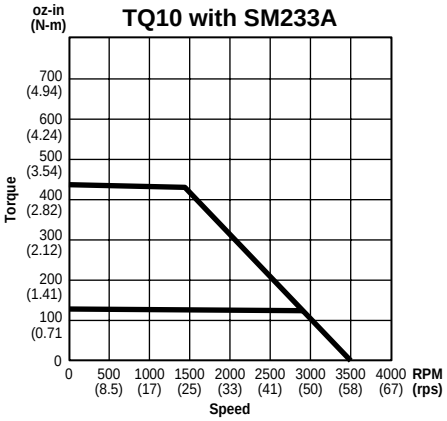


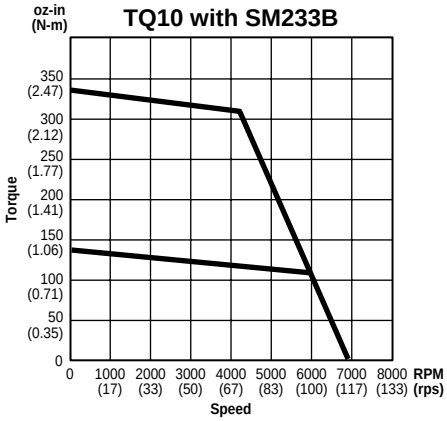






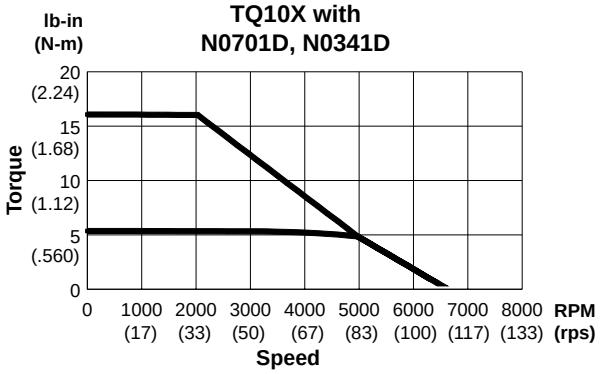


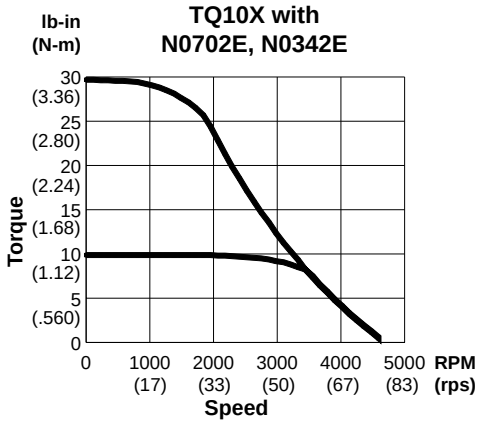


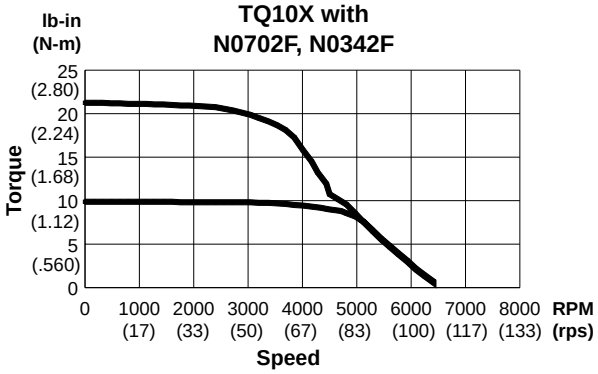


Speed/Torque Curves

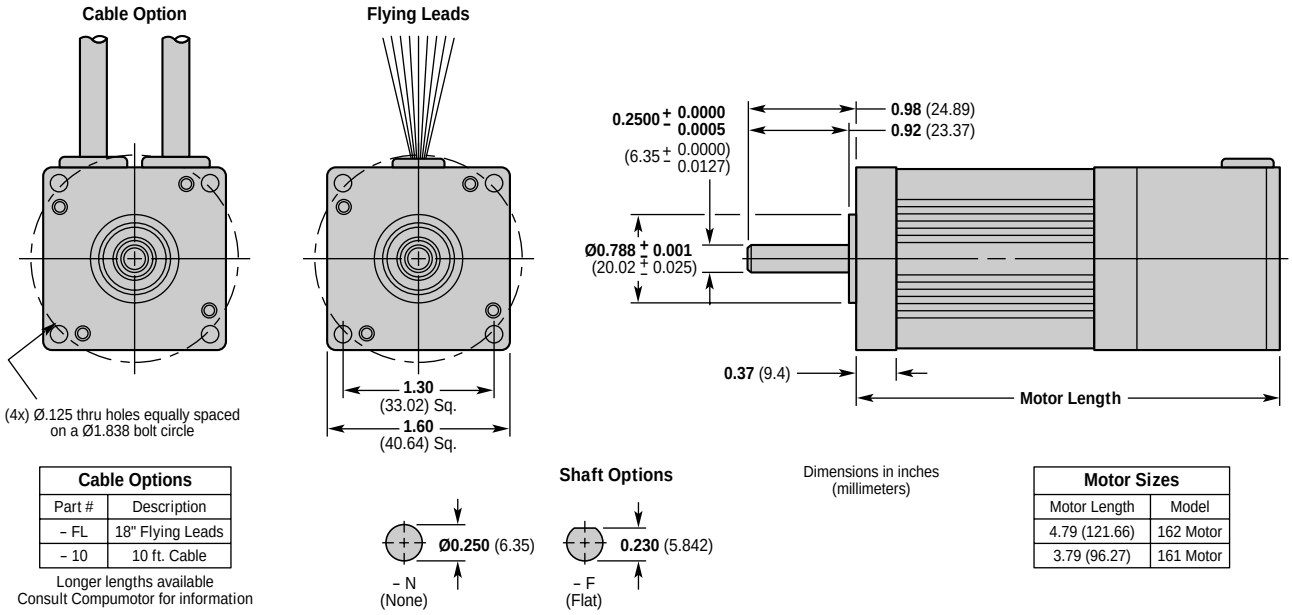
NOTE: Curves are based on 120VAC line, nominal motor K_T and K_C. Actual values may vary ±10%. Line voltage directly limits maximum speed.







Motor Dimensions – Compumotor SM Series, Size 16



Cable Options	
Part #	Description
– FL	18" Flying Leads
– 10	10 ft. Cable

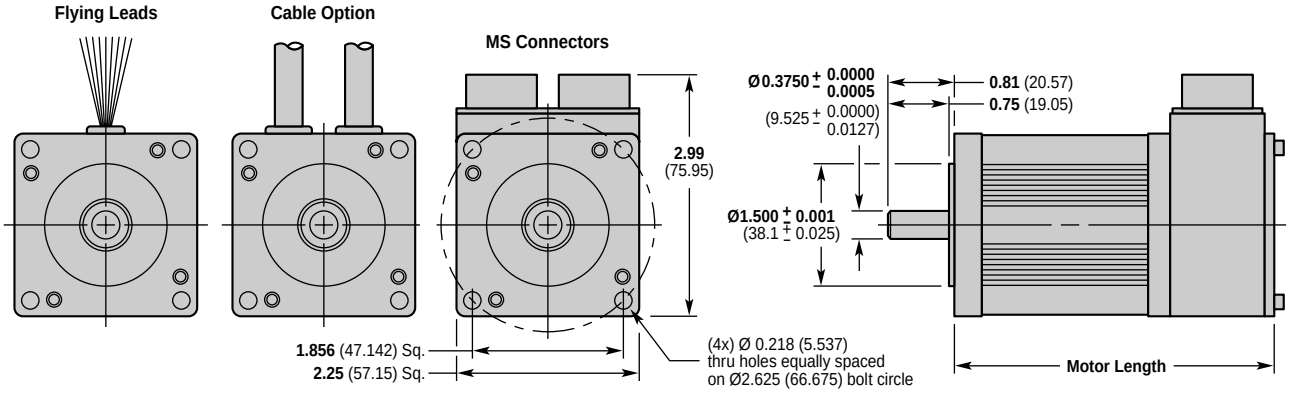
Longer lengths available
Consult Compumotor for information

Shaft Options

Dimensions in inches (millimeters)

Motor Sizes	
Motor Length	Model
4.79 (121.66)	162 Motor
3.79 (96.27)	161 Motor

Motor Dimensions – Compumotor SM Series, Size 23



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Part #	Description
– FL	18" Flying Leads
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Longer lengths available
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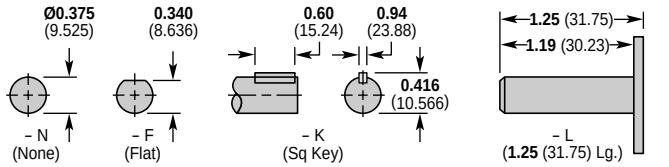
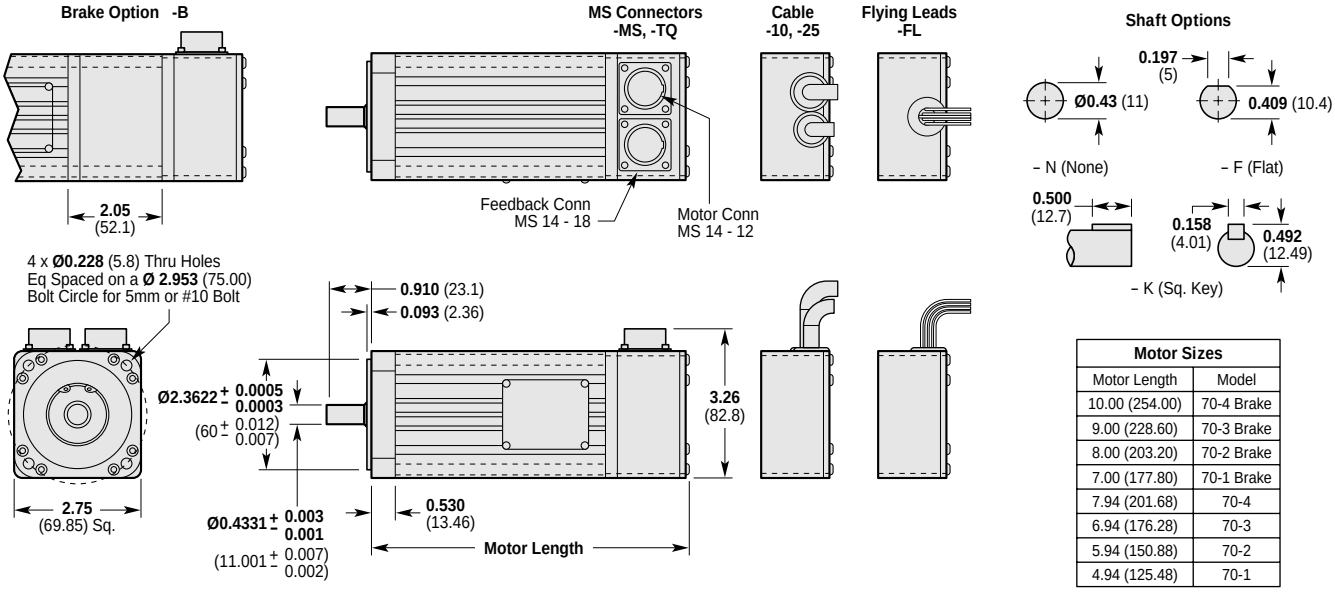
Shaft Options



Dimensions in inches (millimeters)

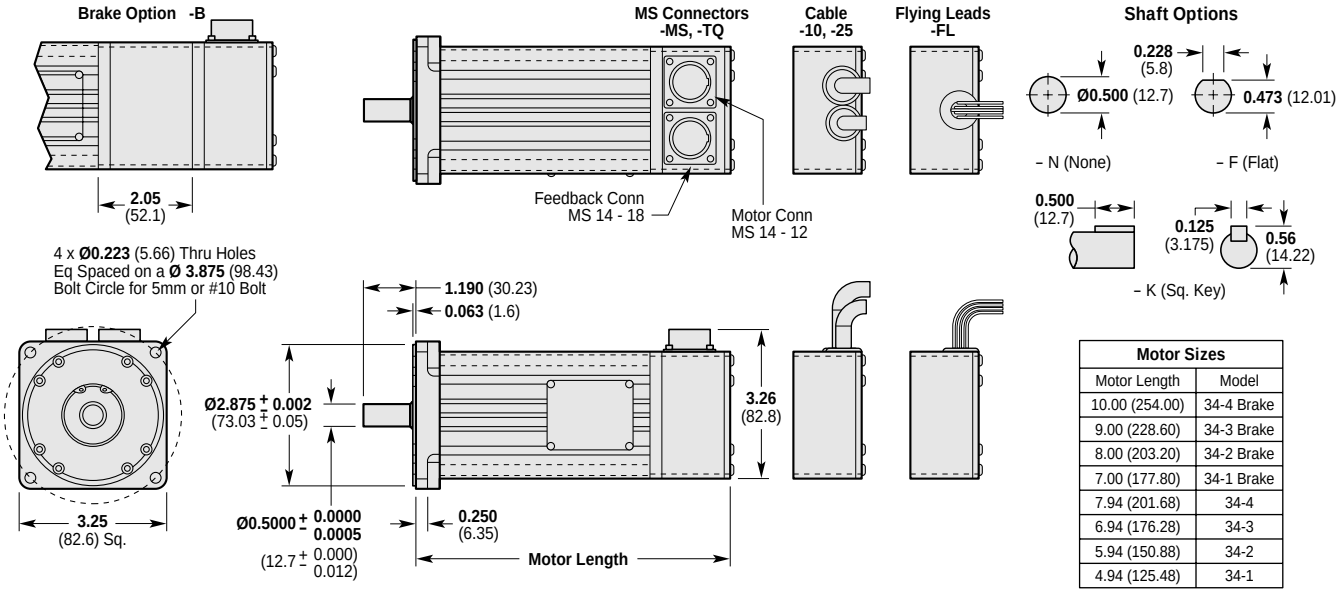
Motor Sizes	
Motor Length	Model
5.98 (151.89)	233 Motor
4.98 (126.49)	232 Motor
3.98 (101.09)	231 Motor

Motor Dimensions – Compumotor NeoMetric Series, Size 70



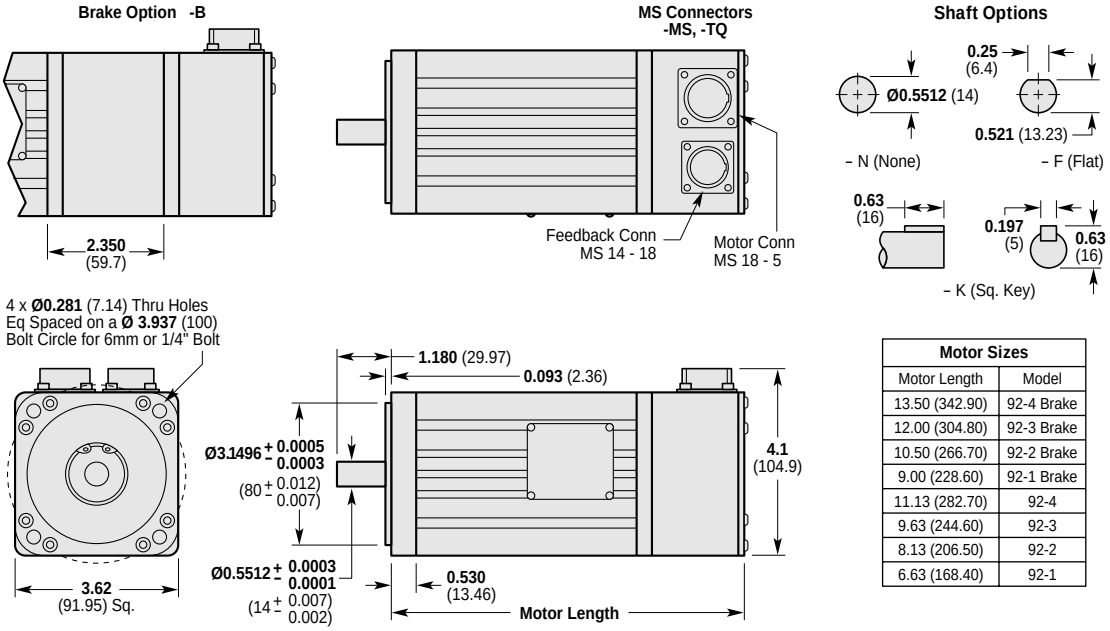
Motor Sizes	
Motor Length	Model
10.00 (254.00)	70-4 Brake
9.00 (228.60)	70-3 Brake
8.00 (203.20)	70-2 Brake
7.00 (177.80)	70-1 Brake
7.94 (201.68)	70-4
6.94 (176.28)	70-3
5.94 (150.88)	70-2
4.94 (125.48)	70-1

Motor Dimensions – Compumotor NeoMetric Series, Size 34



Motor Sizes	
Motor Length	Model
10.00 (254.00)	34-4 Brake
9.00 (228.60)	34-3 Brake
8.00 (203.20)	34-2 Brake
7.00 (177.80)	34-1 Brake
7.94 (201.68)	34-4
6.94 (176.28)	34-3
5.94 (150.88)	34-2
4.94 (125.48)	34-1

Motor Dimensions – Compumotor NeoMetric Series, Size 92



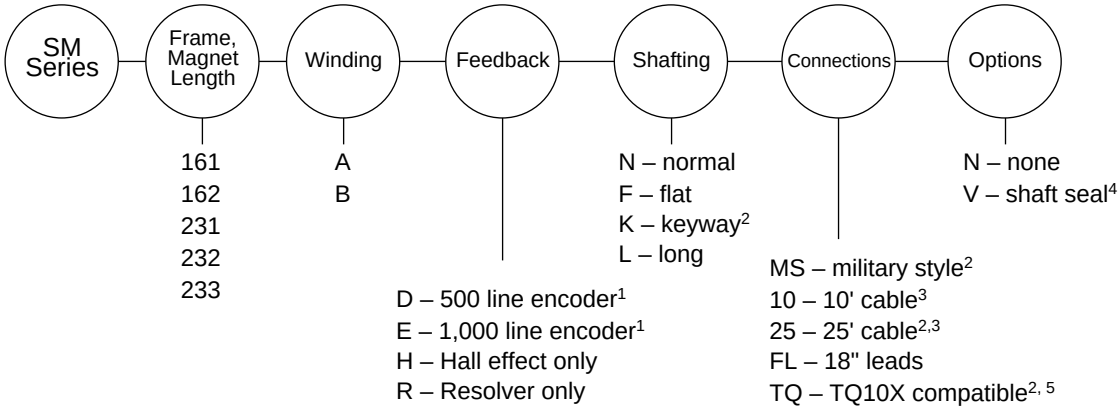
Motor Sizes	
Motor Length	Model
13.50 (342.90)	92-4 Brake
12.00 (304.80)	92-3 Brake
10.50 (266.70)	92-2 Brake
9.00 (228.60)	92-1 Brake
11.13 (282.70)	92-4
9.63 (244.60)	92-3
8.13 (206.50)	92-2
6.63 (168.40)	92-1

Encoder Specifications – Compumotor SM & NeoMetric Series Motors

Parameter	Value
Performance	
Accuracy	±2 min of arc
Electrical	
Input Power	5VDC ± 5% @ 135 mA
Operating Frequency	100 kHz maximum (pre-quadrature)
Output Device	26LS31
Sink/Source, nominal	20 mA
Suggested User Interface	26LS32

Motor Part Numbering System

The diagram below illustrates the part numbering system for Compumotor SM Series servo motors

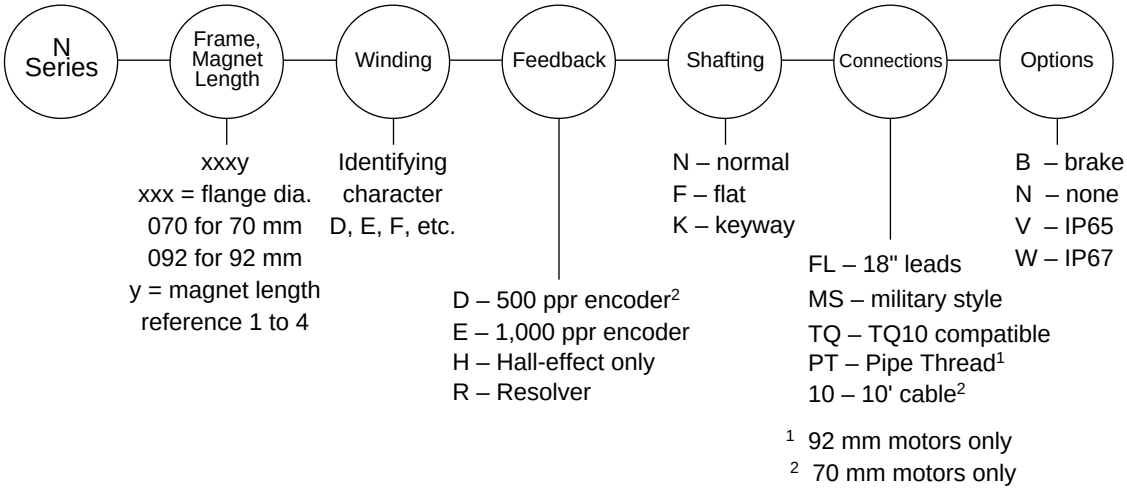


[1] includes Hall effect sensors
[2] not available on size 16 motors
[3] cable is hardwired to motor
[4] size 23 with MS or TQ connectors–IP65
[5] MS recommended for TQ10X; TQ can be used also.

Example: SM-231AE-NMSN = 23 Frame, 1" magnet, A winding, 1,000 line Encoder, Normal shaft, MS cable, No options

Motor Part Numbering System— Compumotor NeoMetric Series Servo Motor

The diagram below illustrates the part numbering system for Compumotor NeoMetric Series servo motors.



[1] 92 mm motors only
[2] 70 mm motors only

Example: N0702EE-KMSN