

Hollow shaft motor/encoder

CM-5000 series, 5" brushless DC , 2.0" ID through shaft

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Description:

The CM-5000 is a high performance brushless DC motor with integral optical encoder characterized by a very high torque to inertia ratio. Six different sizes are available with peak torques from 1010 oz.in through 6654 oz.in @ 100 V. For different motor windings, please contact the factory.

The motor was specifically designed for high speed, high resolution positioning applications and is available with the following encoder configurations:

- ultra low distortion incremental sine/cosine, specifically designed for use with interpolators, yielding up to 144 million measuring steps
- digital incremental up to 36,000 c/r (144,000 measuring steps)
- high resolution digital incremental from 50,000 c/r (200,000 measuring steps) to 2,250,000 c/r (9 million measuring steps)
- 18/20 bit absolute in parallel format (external electronics necessary)

Applications include semiconductor robots, turret scanners, capstan drives, spinners etc.

Ordering information:

CM-5000-(1)-(2): sine/cosine output encoder.

(1) motor size, see specsheet

(2) standard linecounts: 2,000 c/r, 9,000 c/r

CM-5050-(1)-(2): digital output encoder.

(1) motor size, see specsheet

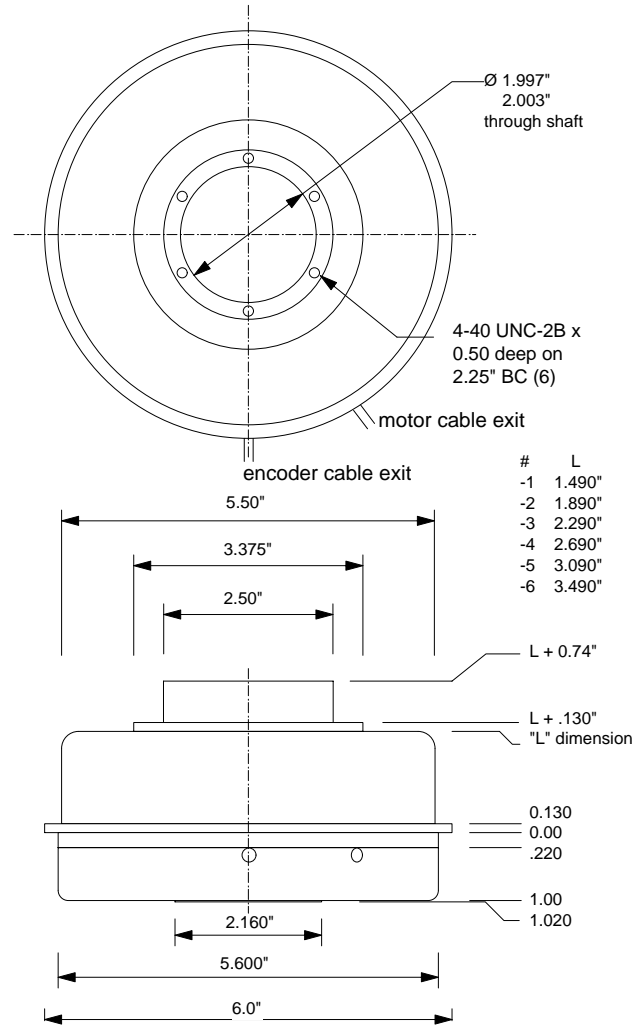
(2) standard linecounts: 2,000, 4,000, 9,000, 18,000 & 36,000 c/r

CM-5050-HHC-(1)-(2): digital output, high resolution

(1) motor size, see specsheet

(2) standard linecounts: 50,000, 62,500, 100,000, 125,000, 200,000, 225,000, 250,000, 281,000, 400,000, 450,000, 500,000, 562,500, 900,000, 1,125,000, 1,800,000 & 2,250,000 c/r.

For absolute output, please consult factory.



Mechanical Data:

shaft ID:	1.997" - 2.003"
shaft loading:	40 lbs axial, 35 lbs radial
shaft runout:	.0002" T.I.R.
starting torque:	4.5 oz.in max @20°C
shaft rotation:	continuous, reversible
shaft speed:	1,500 RPM max
shaft material:	416 stainless
housing material:	aluminum (stainless optional)
bearing life:	manufacturer's specs
moment of inertia:	0.07 oz.in.sec ²
weight:	approx. 5 lbs
temperature:	operating: -20°C to +90°C
shock:	50 G's @ 11 ms
vibration:	5-2,000 Hz @ 20 G's
humidity:	98% without condensation

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Motor specifications

size constants @ 25°C ambient:

parameter	symbol	unit	-1	-2	-3	-4	-5	-6
maximum rated torque @ temperature rise of 80°C	Tr	in-oz	1313	3019	4405	5760	7156	8651
		Nm	9.2	21.3	31.1	40.6	50.5	61.0
maximum continuous stall torque @ temperature rise of 80°C	Tc	in-oz	201	419	623	790	997	1192
		Nm	1.41	2.96	4.40	5.57	7.04	8.41
Max. continuous power output	Pout	Watt	271	360	464	468	591	665
motor constant	Km	in-oz/ W	30.2	61.2	86.9	108.6	128.0	146.2
		Nm/W	0.21	0.43	0.61	0.78	0.90	1.03
electrical time constant	Te	ms	1.56	3.00	4.14	5.05	5.93	6.87
mechanical time constant	Tm	ms	4,5	2.4	1.8	1.6	1.4	1.3
thermal resistance*	TPR	°C/Watt	1.3	1.2	1.1	1.0	0.9	0,8
maximum cogging torque	Tf	in-oz	5.5	13.4	18.1	23.7	29.6	36.2
		Nm	0.04	0.09	0.14	0.17	0.2	0.26
viscous damping	Fi	in-oz/rpm	3.6E-3	7.5E-3	0.01	0.015	0.018	0.021
		Nm/rpm	2.6E-5	5.3E-5	8.0E-5	1.0E-4	1.3E-4	1.5E-4
hysteresis drag torque	Th	in-oz	4.8	10.3	15.6	20.9	25.5	29.8
		Nm	0.03	0.07	0.11	0.45	0.18	0.21
rotor inertia	Jm	oz.in.s ²	2.9E-2	6.3E-2	9.7E-2	1.3E-1	1.6E-1	2.0E-1
		Kg.m ²	2.0E-4	4.5E-4	6.8E-4	9.2E-4	1.1E-3	1.4E-3
number of poles	P		12	12	12	12	12	12
weight		lbs	3.9	5.7	7.5	9.2	11	12.8
		kg	1.8	2.6	3.4	4.2	5	5.8

Winding constants @ design voltage Vp = 100 V, 25° ambient

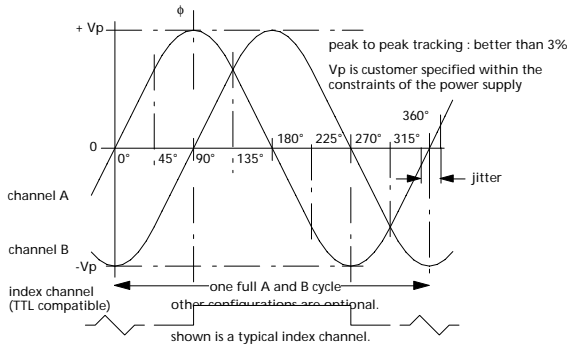
peak torque, ± 25%	Tp	in-oz	1010	2323	3389	4431	5505	6654
		Nm	7.13	16.4	23.93	31.29	38.87	47.0
peak current, ±15%	Ip	Ampere	11.1	14.4	15.2	16.6	18.5	20.7
torque sensitivity, ±10%	Kt	in-oz/A	90.6	181.1	223.3	266.5	297.7	321.1
		Nm/A	0.64	1.14	1.58	1.88	2.10	2.27
no-load speed	Snl	rpm	1477	833	602	504	451	418
		rad/s	156	87	63	53	47	44
voltage constant	Kb	V/krpm	67.0	119.2	165.1	197.1	220.1	237.5
		V/rad/s	0.64	1.14	1.58	1.88	2.10	2.27
terminal resistance, ± 12%	Rm	Ohm	6.97	6.94	6.59	6.02	5.41	4.83
terminal inductance, ±30%	Lm	mH	14.0	20.8	27.3	30.4	32.1	33.2

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Encoder specifications

sine/cosine output



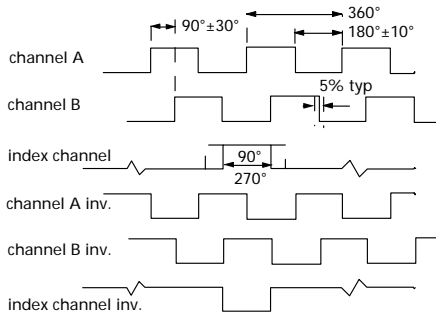
sine/cosine: CM-5000 Model

- power supply: ± 5 Vdc @ 60 mA max.
- output format: A/B sine/cosine, incremental
- output: default $V_{out} = \pm 0.5$ V , zero-centered
- frequency response: flat up to 100 kHz
- distortion: less than 5% (Rmax/Rmin)

digital, incremental: CM-5050 Model

- power supply: + 5Vdc $\pm 10\%$ @ 100 mA max (no load)
- output format: A/B quadrature, incremental, digital
- frequency response: 150 kHz min. @ 85 °C
- output: linedriver 26LS31,EIA std. RS 422 & DIN 66259 compatible

digital, incremental or HHC output

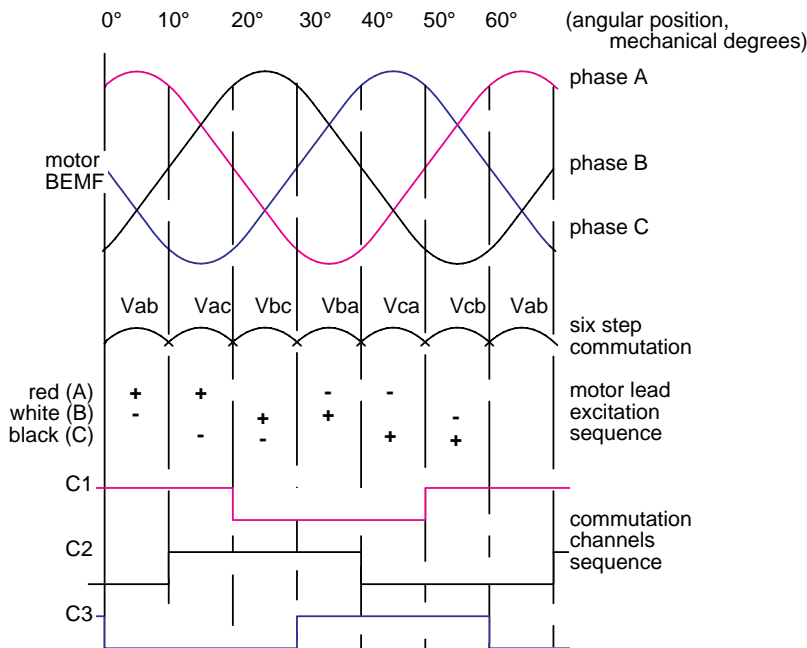


HHC (interpolated): CM-5050-HHC Model

- power supply: + 5Vdc $\pm 10\%$ @ 250 mA max (no load)
- output format: A/B quadrature, incremental, digital
- frequency response: 2.0 MHz min. @ 85 °C
- output: linedriver 26LS31,EIA std. RS 422 & DIN 66259 compatible

- digital, absolute: 18, 20 & 22 bits
- Consult factory

Motor excitation sequence and "Hall" switch output



Motor wire color code:

- red phase A
- white phase B
- black phase C

"Hall" switch color code:

- brown C1
- orange C2
- yellow C3
- blue + 5V to + 24V
- green ground