BULLETIN LCG

Series GM8000, GM9000, GM14900

LO-COG® DC Gearmotors

Pittman brand LO-COG® brush-commutated DC gearmotors offer smooth, quiet operation and long life. LO-COG gearmotors feature sintered steel spur gears and are available with several reduction ratios and torque ratings to provide an economical solution for a wide range of applications. Armatures are skewed to minimize magnetic cogging, even at low speeds, and windings are resin impregnated for greater reliability in incremental motion applications. An innovative cartridge brush assembly reduces audible and electrical noise and significantly improves brush life by maintaining optimum brush force throughout the life of the motor. For precision motor control, Hewlett-Packard® optical encoders are available in 2 or 3 channel versions with several CPR ranges to meet your position, velocity and direction feedback needs.

Construction

- **2 pole permanent magnet stators are constructed of ceramic magnets enclosed in heavy-gauge steel return rings**
- **Diamond turned commutators ensure maximum brush life**
- **Standard copper graphite brushes (Other brush materials available)**
- **Precision ground hardened stainless steel shafts**
- **Silicon-steel laminations**
- **Self-aligning, sintered bronze bearings**

Options

- **High-torque gears or high-torque wide-face gears**
- **Low noise, primary cluster gears**
- **Custom cables**
- **Multiple shaft configurations**
- **Shaft-mounted pulleys and gears**
- **Ball bearings**
- **Multiple windings**
- **Electromechanical brakes**
- **Integrated Hewlett-Packard® optical encoders**
- **Adaptors available for other encoders**
- **RFI suppression**
- **Dynamic armature balancing**

Series GM8000

- **11 ratios from 6.3.1 to 1803.6.1**
- **Peak Torques to 100 oz·in standard**
- **160 and 175 oz·in gearheads optional**
- **Available in 3 motor lengths**
- **Encoder resolutions from 96 to 1024**

Series GM9000

- **12 ratios from 5.9.1 to 4732.5.1**
- **Peak Torques to 175 oz·in standard**
- **300 and 500 oz·in gearheads optional**
- **Available in 6 motor lengths**
- **Encoder resolutions from 96 to 2048**

Series GM14000

- **4 ratios from 5.9.1 to 218.4.1**
- **Peak Torques to 175 oz·in standard**
- **300 and 500 oz·in gearheads optional**
- **Available in 7 motor lengths**
- **Encoder resolutions from 96 to 2048**

PITTMAN®
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Power Your Ideas™

PittmanExpress℠

Get same day shipment of sample motors for models listed in the Pittman Express Catalog (Bulletin PE).

Every Pittman motor is subjected to automated performance testing prior to shipment.

Gearmotor Data

Line No.	Parameter	Symbol	Units	Reduction Ratios 6.3:1	9.9:1	19.5:1	30.9:1	60.5:1	95.9:1	187.7:1	297.5:1	581.8:1	922.3:1	1803.6:1
MECHANICAL SPECIFICATIONS														
1	Max. Load Standard Gears[1]	T_L	oz·in (N·m)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)	100 (0.71)
2	Max. Load Cut Steel Gears[1]	T_L	oz·in (N·m)	N/A (N/A)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)	160 (1.13)
3	Max. Load Wide Face Gears[1]	T_L	oz·in (N·m)	N/A (N/A)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)	175 (1.24)
4	Gearbox Shaft Rotation[2]	—	—	CW	CCW	CCW	CW	CW	CCW	CCW	CW	CW	CCW	CCW
5	Gearbox Efficiency	—	%	81	73	73	66	66	59	59	53	53	48	48
6	Gearbox Weight (Mass)	W_G	oz (g)	2.35 (66.6)	2.49 (70.6)	2.49 (70.6)	2.62 (74.3)	2.62 (74.3)	2.76 (78.2)	2.76 (78.2)	3.11 (88.2)	3.11 (88.2)	3.25 (92.1)	3.25 (92.1)
7	Gearbox Length	L_2	in max (mm max)	0.968 (24.6)	0.968 (24.6)	0.968 (24.6)	0.968 (24.6)	0.968 (24.6)	0.968 (24.6)	0.968 (24.6)	1.164 (29.6)	1.164 (29.6)	1.164 (29.6)	1.164 (29.6)
8	Length, GM82X2	L_3	in max (mm max)	2.977 (75.6)	2.977 (75.6)	2.977 (75.6)	2.977 (75.6)	2.977 (75.6)	2.977 (75.6)	2.977 (75.6)	3.173 (80.6)	3.173 (80.6)	3.173 (80.6)	3.173 (80.6)
9	Length, GM82X3	L_3	in max (mm max)	3.102 (78.8)	3.102 (78.8)	3.102 (78.8)	3.102 (78.8)	3.102 (78.8)	3.102 (78.8)	3.102 (78.8)	3.298 (83.8)	3.298 (83.8)	3.298 (83.8)	3.298 (83.8)
10	Length, GM82X4	L_3	in max (mm max)	3.352 (85.1)	3.352 (85.1)	3.352 (85.1)	3.352 (85.1)	3.352 (85.1)	3.352 (85.1)	3.352 (85.1)	3.548 (90.1)	3.548 (90.1)	3.548 (90.1)	3.548 (90.1)
11	Length, GM87X2	L_3	in max (mm max)	2.91 (73.9)	2.91 (73.9)	2.91 (73.9)	2.91 (73.9)	2.91 (73.9)	2.91 (73.9)	2.91 (73.9)	3.106 (78.9)	3.106 (78.9)	3.106 (78.9)	3.106 (78.9)
12	Length, GM87X3	L_3	in max (mm max)	3.035 (77.1)	3.035 (77.1)	3.035 (77.1)	3.035 (77.1)	3.035 (77.1)	3.035 (77.1)	3.035 (77.1)	3.231 (82.1)	3.231 (82.1)	3.231 (82.1)	3.231 (82.1)
13	Length, GM87X4	L_3	in max (mm max)	3.285 (83.4)	3.285 (83.4)	3.285 (83.4)	3.285 (83.4)	3.285 (83.4)	3.285 (83.4)	3.285 (83.4)	3.481 (88.4)	3.481 (88.4)	3.481 (88.4)	3.481 (88.4)
NO-LOAD SPEED														
14	GM8X22	S_{NL}	rpm (rad/s)	1246 (130)	786 (82.3)	402 (42.1)	253 (26.5)	130 (13.6)	81.8 (8.57)	41.8 (4.38)	26.4 (2.76)	13.5 (1.41)	8.51 (.891)	4.35 (.456)
15	GM8X23	S_{NL}	rpm (rad/s)	1317 (138)	831 (87.0)	425 (44.5)	268 (28.1)	137 (14.3)	86.5 (9.06)	44.2 (4.63)	27.9 (2.92)	14.3 (1.50)	9.00 (.942)	4.60 (.482)
16	GM8X24	S_{NL}	rpm (rad/s)	1612 (169)	1017 (107)	520 (54.5)	328 (34.3)	168 (17.6)	106 (11.1)	54.1 (5.67)	34.1 (3.57)	17.5 (1.83)	11.0 (1.15)	5.63 (.590)

[1]Represents gearbox capability only. Continuous load torque capability will vary with gear ratio, motor selection, and operating conditions.
[2]Shaft rotation is designated while looking at output shaft with motor operating in a clockwise direction. Gearmotor is polarity reversible.

Motor Data

Line No.	Parameter	Symbol	Units	8X22	8X23	8X24
17	Continuous Torque (Max.)[3]	T_C	oz·in (N·m)	1.6 (11.2×10^{-3})	2.0 (14.1×10^{-3})	2.6 (18.5×10^{-3})
18	Peak Torque (Stall)	T_{PK}	oz·in (N·m)	7.4 (52.0×10^{-3})	10.5 (74.2×10^{-3})	16.8 (118.6×10^{-3})
19	Motor Constant	K_M	oz·in/√W (N·m/√W)	1.12 (7.9×10^{-3})	1.30 (9.2×10^{-3})	1.49 (710.5×10^{-3})
20	No-Load Speed	S_0	rpm (rad/s)	7847 (822)	8298 (869)	10158 (1064)
21	Friction Torque	T_F	oz·in (N·m)	0.35 (2.5×10^{-3})	0.35 (2.5×10^{-3})	0.35 (2.5×10^{-3})
22	Rotor Inertia	J_M	oz·in·s^2 (kg·m^2)	1.4×10^{-4} (9.89×10^{-7})	1.7×10^{-4} (1.20×10^{-6})	2.3×10^{-4} (1.62×10^{-6})

[3]Continuous torque specified at 25°C ambient temperature and without additional heat sink.

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Motor Data, continued

Line No.	Parameter	Symbol	Units	8X22	8X23	8X24
26	Electrical Time Constant	τ_E	ms	0.52	0.55	0.54
27	Mechanical Time Constant	τ_M	ms	15.6	14.1	14.7
28	Viscous Damping—Infinite Source Impedance	D	oz·in/krpm (N·m/(rad/s))	0.0153 ($1.03x10^{-6}$)	0.0176 ($1.19x10^{-6}$)	0.0202 ($1.36x10^{-6}$)
29	Viscous Damping—Zero Source Impedance	K_D	oz·in/krpm (N·m/(rad/s))	0.92 (6.20×10^{-5})	1.25 (8.43×10^{-5})	1.63 (1.10×10^{-4})
30	Maximum Winding Temperature	θ_{MAX}	°F (°C)	311 (155)	311 (155)	311 (155)
31	Thermal Impedance	R_{TH}	°F/watt °C/watt	75.9 (24.4)	72.9 (22.7)	70.5 (21.4)
32	Thermal Time Constant	τ_{TH}	min	7.75	9.00	10.70
33	Motor Weight (Mass)	W_M	oz (g)	4.69 (133.0)	5.05 (143.2)	5.81 (164.7)

Model GM8XX2 Winding Data (Other windings available upon request)

Line No.	Parameter	Symbol	Units	GM8X22			
34	Reference Voltage	E	V	12.0	19.1	24.0	30.3
35	Torque Constant	K_T	oz·in/A (N·m/A)	1.94 (13.7×10^{-3})	3.07 (21.7×10^{-3})	3.88 (27.4×10^{-3})	4.88 (34.5×10^{-3})
36	Back-EMF Constant	K_E	V/krpm (V/rad/s)	1.43 (13.7×10^{-3})	2.27 (21.7×10^{-3})	2.87 (27.4×10^{-3})	3.61 (34.5×10^{-3})
37	Resistance	R_T	Ω	3.10	7.61	12.1	19.1
38	Inductance	L	mH	1.57	3.93	6.27	9.92
39	No-Load Current	I_{NL}	A	0.25	0.16	0.12	0.10
40	Peak Current (Stall)[4]	I_P	A	3.88	2.51	1.99	1.59

Model GM8XX3 Winding Data (Other windings available upon request)

Line No.	Parameter	Symbol	Units	GM8X23			
41	Reference Voltage	E	V	12.0	19.1	24.0	30.3
42	Torque Constant	K_T	oz·in/A (N·m/A)	1.88 (13.3×10^{-3})	2.94 (20.8×10^{-3})	3.73 (26.4×10^{-3})	4.71 (33.3×10^{-3})
43	Back-EMF Constant	K_E	V/krpm (V/rad/s)	1.39 (13.3×10^{-3})	2.18 (20.8×10^{-3})	2.76 (26.4×10^{-3})	3.48 (33.3×10^{-3})
44	Resistance	R_T	Ω	2.17	5.20	8.24	13.1
45	Inductance	L	mH	1.17	2.85	4.57	7.29
46	No-Load Current	I_{NL}	A	0.27	0.17	0.13	0.11
47	Peak Current (Stall)[4]	I_P	A	5.54	3.67	2.91	2.32

Model GM8XX4 Winding Data (Other windings available upon request)

Line No.	Parameter	Symbol	Units	GM8X24			
48	Reference Voltage	E	V	12.0	19.1	24.0	30.3
49	Torque Constant	K_T	oz·in/A (N·m/A)	1.54 (10.9×10^{-3})	2.47 (17.5×10^{-3})	3.09 (21.9×10^{-3})	3.86 (27.3×10^{-3})
50	Back-EMF Constant	KE	V/krpm (V/rad/s)	1.14 (10.9×10^{-3})	1.83 (17.5×10^{-3})	2.29 (21.9×10^{-3})	2.86 (27.3×10^{-3})
51	Resistance	R_T	Ω	1.17	2.79	4.33	6.75
52	Inductance	L	mH	0.58	1.50	2.34	3.65
53	No-Load Current	I_{NL}	A	0.36	0.23	0.18	0.15
54	Peak Current (Stall)[4]	I_P	A	10.3	6.85	5.54	4.49

[4]Theoretical values supplied for reference only.

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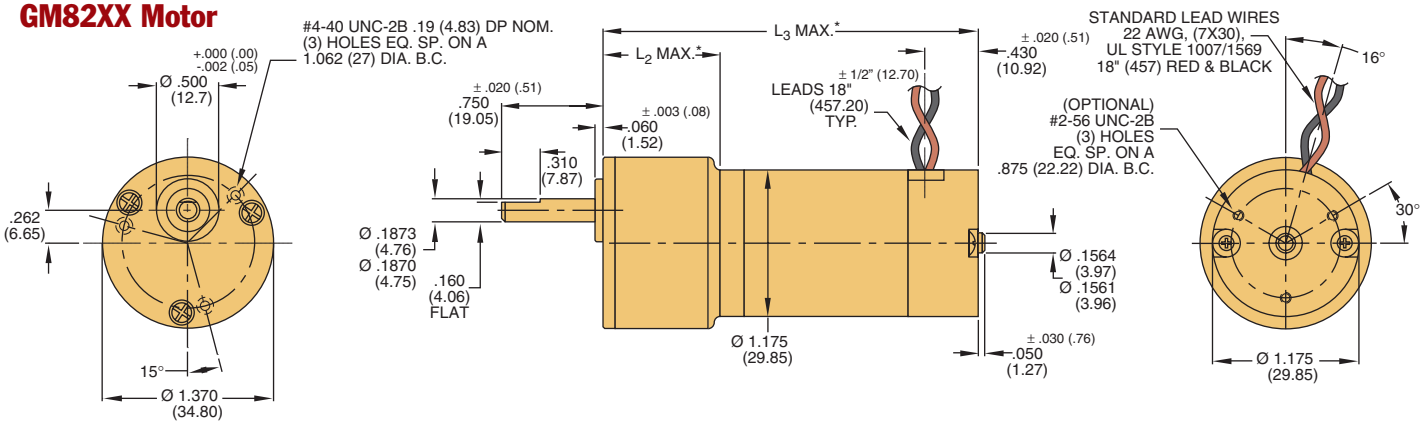
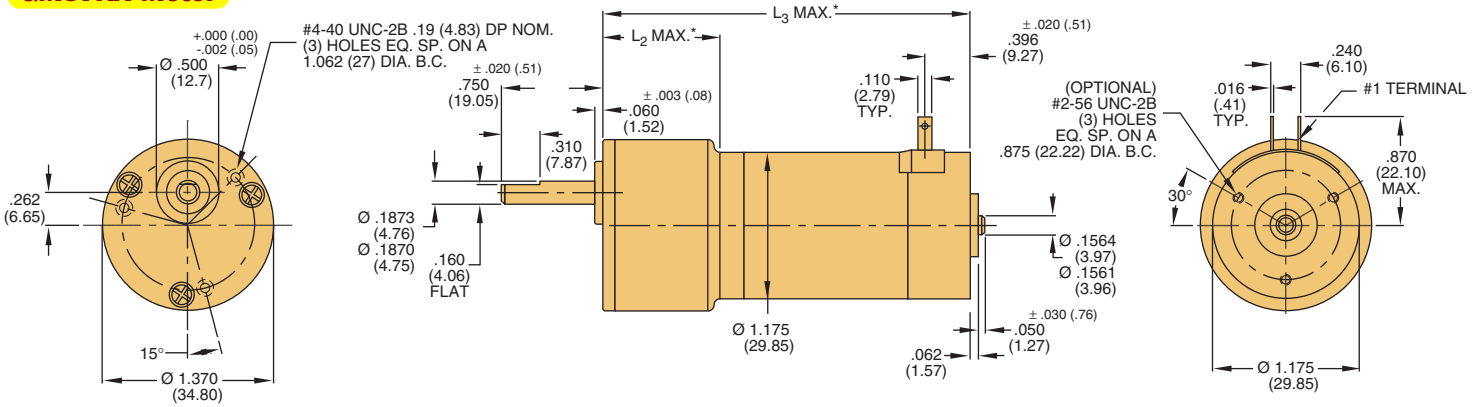
GM82XX Motor



GM87XX Motor



Notes:
- Unless otherwise specified, all tolerances are to be ±.005 (.01)
- All measurements are in inches (mm)

*See line numbers 7 through 13 in gearmotor data chart

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[click image to zoom]

GM8000 Series

Pittman's GM8000 Series spur gearmotors come in two models. The **GM8200** models have side-exiting **lead wires**, while the **GM8700** models are configured with **side terminals.** All models are available in three lengths. Integrated Hewlett-Packard® optical encoders are available on all Series GM8000 motors for reliable position, velocity, and direction feedback. All encoders feature rugged metal housings, 5-VDC operation, and TTL outputs.

- Output torques to 175 oz-in
- 8 standard reduction ratios from 6.3:1 to 187.7:1
- Skewed, 7-slot armature reduces magnetic cogging at low speeds
- Long, maintenance-free operation
- Diamond-turned commutators ensure maximum brush life
- Ball bearings or sleeve bearings available (part numbers which contain an "S" have ball bearings).

Products

ID	Max. Continuous Torque (oz-in)	Peak Torque (oz-in)	Gear Ratio	No load speed (rpm)	Kt (oz-in/amp)	Ke (v/krpm)	Rated voltage (V)	Encoder (ppr)	Features	Unit Price
GM8712-11	6	26	6.3:1	1227	3.06	2.27	19.1	None		$90.82
GM8712-21	16	72	19.5:1	396	3.06	2.27	19.1	None		$91.67
GM8712-31	46	201	60.5:1	128	3.06	2.27	19.1	None		$91.82
GM8712-41	100	557	187.0:1	41	3.06	2.27	19.1	None		$93.33
GM8712S030	100	557	187.0:1	41	3.87	2.86	24	None		$93.59
GM8724S008	14.5	42	6.3:1	720	3.09	2.29	12	None		$109.85
GM8724S009	14.5	42	6.3:1	720	3.09	2.29	12	500 CPR		$205.75
GM8724S010	14.5	42	6.3:1	720	6.18	4.57	24	None		$110.81
GM8724S011	14.5	42	6.3:1	720	6.18	4.57	24	500 CPR		$206.71
GM8724S012	21	60	9.9:1	455	3.09	2.29	12	None		$135.28
GM8724S013	21	60	9.9:1	455	6.18	4.57	24	None		$136.24
GM8724S014	41.5	117	19.5:1	230	3.09	2.29	12	None		$135.28
GM8724S015	41.5	117	19.5:1	230	3.09	2.29	12	500 CPR		$231.18