DC Cube Torque Motors

21, 22, 23 and 24 Series

TYPICAL APPLICATIONS

- Avionics - cockpit instrumentation (altitude, latitude) and displays (indicators and instruments)
- Robotic control systems
- Military targeting / fire control systems
- Sighting systems
- Missiles
- Military actuators
- Direct drive servo systems
- Medical equipment

FEATURES

- 4 pole 13 bar motors – 2 brushes standard and 4 brushes available
- Stainless steel shafts for durable, rugged wear
- Meets MIL-SPEC 810
- Standard nickel plated housing resists corrosion in harsh environments
- Peak torques from 1.0 to 20 oz-in
- Optional gearheads, brakes, resolvers, encoders and potentiometers available
- Available in .75 and 1 inch frame sizes:
  - Model 21 – 1 x 1 x 1 inches
  - Model 22 – 1 x 1 x .75 inches
  - Model 23 – 1 x 1 x 1.35 inches
  - Model 24 – .75 x .75 x .75 inches
- Silver alloy brushes
- Speeds up to (7500) rpm
- Variety of windings available
- Gold plated terminals
- Gold alloy commutator
- Shaft can be modified with front and rear extensions, integrated gear or a pinion

BENEFITS

- High torque-to-inertia ratio in a small package
- Rapid response at all speeds
- Cartridge brush is easily field-replaceable
- Skewed rotors provide minimum cogging torque
- Gold-clad commutator for long life
- Rare earth magnets provide higher performance than standard permanent magnets
- Cubical shape provides weight and space savings and easy mounting
- Torque increases directly with input current for high linearity as a direct servo drive
- Low self inductance

High torque-to-inertia ratio in a compact size

Moog Components Group's family of miniature permanent magnet DC cube torque motors is available in .75 and 1 inch frame sizes. These are rapid response motors at all operating speeds because of their high torque-to-inertia ratio and low self-inductance. Torque increases directly with input current for high linearity.

Cube motors are often used in applications where high torque is required, but the available space is limited. Cube motors lend themselves to easier mounting than cylindrical motors in many applications and are easier to lock into an envelope.

Moog Components Group offers a choice of Alnico or Samarium Cobalt magnet materials to satisfy most any requirement. These rare earth magnets produce a higher magnetic energy per unit volume than most commercially available permanent magnets. Alnico magnets provide enhanced temperature stability while Samarium Cobalt magnets offer high energy with good, stable performance.

We're tooled for hundreds of designs with different windings, end caps and other options including gearheads, brakes, resolvers, encoders and potentiometers. Most designs can easily be adapted to meet different requirements. We can also provide custom engineering services.

CUBE MOTOR PARAMETERS

Part Numbering System Guide

NN NNN A – AA – NN / ANNN [ ]

DESIGN SERIES
(2 Numbers)

HOUSING TYPE
(3 Numbers)
Sequentially assigned by factory

SHAFT
(2 Letters)

ELECTRICAL OPTIONS
(2 Numbers)
Unique to design series

MODIFICATION NUMBER
"D" + 3 Numbers
Each modification number (slash number) has a separate outline modification sheet

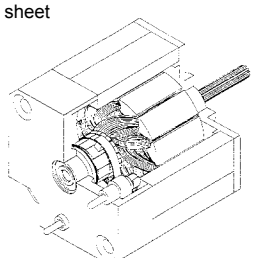
HOUSING CODE
(Either Location)
P = Paladin black
S = Samarium Cobalt magnets
C = Connector

FRAME SIZE
21 1 inch square cube motor
22 1 inch square short version of series 21
23 1 inch square long version of series 21
24 .75 inch square cube motor

TERMINATIONS TYPE
(1 Letter)

A Solder eyelet terminals (pin type terminals, 2 leaf springs)
B Lead out the rear
C (Not used)
D Cover can and unshielded leads (radial exit)
E (Not used)
F (Not used)
G (Not used)
H (Not used)
I (Not used)
J Leads out the side
K Turret type terminals
L Screw terminals #4-40, side exit with cartridge brushes (4)
M Screw terminals #4-40, side exit with cartridge brushes (2)
N Pin type terminals with flush cartridge brushes (2)
O (Not used)
P (Not used)
Q Turret type terminals with flush (snap in) cartridge brushes (2)
R Leads out the side with flush (snap in) cartridge brushes (2)
S (Not used)
T (Not used)
U 4 leaf springs, 2 pin terminals, 2 leads
V Pin type terminals with flush (snap in) cartridge brushes (4)
W Leads out the side with flush (snap in) cartridge brushes (4)
X 4 cartridge brushes, 2 pin terminals, 2 leads
Y #2-64 screw terminals, 180° apart
Z 4 leaf springs, 4 pin terminals

Examples of Typical Cube Motors



Standard Cube Motor

1.21 Cube Series
- 1.02 in x 1.02 in x 1.069 in max
- 1.355 in x 1.355 in x 1.02 in max - cartridge screw type
- Peak Torques: 7.6 oz-in Alnico magnet
  15.0 oz-in Samarium Cobalt magnet

2.22 Cube Series
- 1.02 in x 1.02 in x 0.812 in max
- Peak Torques: 3.6 oz-in Alnico magnet
  7.0 oz-in Samarium Cobalt magnet

3.23 Cube Series
- 1.02 in x 1.02 in x 1.343 in max
- 1.355 in x 1.355 in x 1.500 in max - cartridge screw type
- Peak Torques: 12.0 oz-in Alnico magnet
  20.0 oz-in Samarium Cobalt magnet

4.24 Cube Series
- 0.750 in x 0.750 in x 0.750 in max
- Peak Torques: 2.7 oz-in Alnico magnet
  (2.7) oz-in Samarium Cobalt magnet

Integrated Motion Technology

In many gimballed systems for the military, aerospace and industrial market segments, rotary electromechanical components such as motors, resolvers and slip ring assemblies often find themselves sharing common envelopes and structures. For this reason, Moog Components Group has a unique niche in the marketplace by providing and integrating these traditional components into one assembly so the individual components have been optimized to work together.

Today, Moog Components Group is in the unique position to provide engineering and manufacturing expertise for all rotary components that share the gimbal's structure. Moog Components Group's fractional horsepower DC motors provide the torque for continuous rotation for scanning applications such as radar, missiles, seekers, aerial targets and target acquisition systems while the slip ring assemblies pass the power and data across the rotating interface. Our resolvers provide the positional feedback often within arc seconds of accuracy.

These components can, of course, be provided separately or be integrated. Integrated products typically share a common structure and bearing which reduces piece part count and system weight. Integration and test is performed at the factory providing a "plug and play" subsystem. Moog Components Group also provides complete actuator systems with control electronics. This integrated concept reduces the number of items that would otherwise have to be procured and stocked by the OEM.

System enhancements and upgrades occur naturally when dealing with one company that has the engineering and manufacturing expertise for rotary component needs.

SPECIFICATIONS ON TYPICAL CUBE MOTORS

The following tables presents a cross-section of Moog Components Group cube motor designs. Tooling charges may apply to new designs.

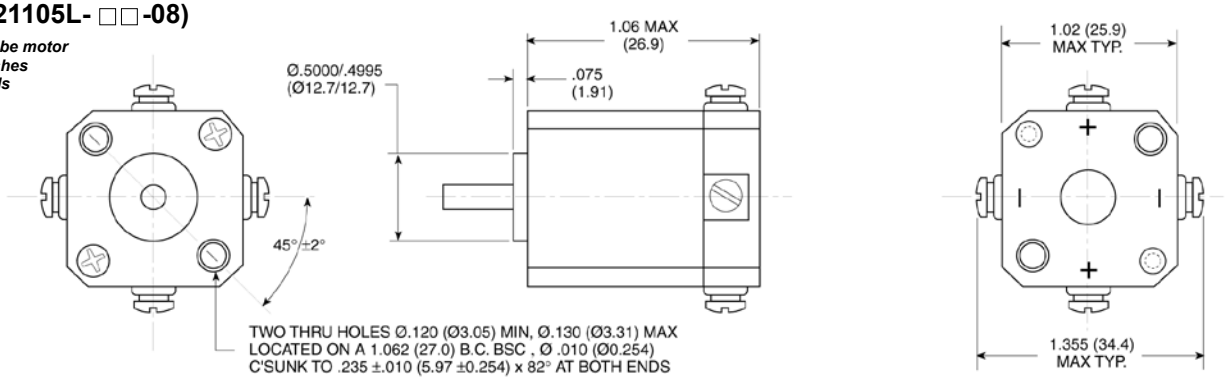
Part Number	Length inches (metric)	Peak Torque (oz-in) (Nm)	Volts at Peak Torque (Volts)	Current at Peak Torque (amps)	Torque Constant (oz-in/amp)	Back EMF (V/rad/sec) x10E–2 (Nm/amp)	DC Resistance (Ohms)	Inductance (mH)	Inertia (oz-in-sec2) x10E–4 (KgCm2 x10E–4)	No Load Speed (RPM)	No Load Current (Ma)	Starling Voltage (Volts)	Weight (oz) (gm)
21105N-□□-03	1.06	7.5	26.0	1.7	5.3	3.74	15.0	6.0	1.3	6500	85	1.0	2.93
	26.9	.053	26.0	1.7	.037	3.74	15.0	6.0	.018	6500	85	1.0	83.06
21105A-□□-04	1.06	7.5	41.7	0.975	7.55	5.3	44.0	16.0	1.3	6500	60	0.75	2.93
	26.9	.053	41.7	0.975	.053	5.3	44.0	16.0	.018	6500	60	0.75	83.06
21105N-□□-08	1.06	8.6	13.0	3.3	2.6	1.8	3.9	1.3	1.3	6500	150	1.0	2.93
	26.9	.061	13.0	3.3	.018	1.8	3.9	1.3	.018	6500	150	1.0	83.06
21105N-□□-10	1.06	6.0	8.0	5.0	1.2	0.85	1.6	0.4	1.3	6500	225	1.0	2.93
	26.9	.042	8.0	5.0	.009	0.85	1.6	0.4	.018	6500	225	1.0	83.06
21105N-□□-12	1.06	6.5	26.0	1.7	4.6	3.25	15.0	6.0	1.3	7000	85	1.0	2.93
	26.9	.046	26.0	1.7	.033	3.25	15.0	6.0	.018	7000	85	1.0	83.06
21105N-□□-13	1.06	6.5	41.7	0.975	6.7	4.8	44.0	16.0	1.3	7000	60	1.0	2.93
	26.9	.046	41.7	0.975	.048	4.8	44.0	16.0	.018	7000	60	1.0	83.06
21605A-□□-14S	1.06	11.0 min.	20.5	2.95	3.8	2.68	7	3.3	1.3	7000	217	1.0	2.93
	26.9	.078	20.5	2.95	.027	2.68	7	3.3	.018	7000	217	1.0	83.06
21607A-□□-15S	1.06	12.0 min.	24	3.5	4.75	3.35	7.5	3.5	1.3	6500	90	0.75	2.93
	26.9	.85	24	3.5	.034	3.35	7.5	3.5	.018	6500	90	0.75	83.06
21607J-□□-16S	1.06	8.5	20	1.5	5.5	3.9	13	5	1.3	4600	100	1.5	2.93
	26.9	.060	20	1.5	.039	3.9	13	5	.018	4600	100	1.5	83.06
21607J-□□-19S	1.06	12.0	25.9	2.9	5.0	3.5	9	4	1.3	6800	60	1.0	2.93
	26.9	.085	25.9	2.9	.035	3.5	9	4	.018	6800	60	1.0	83.06
21605A-□□-20S	1.06	12.0	28	3.2	5.4	3.8	10.5	5	1.3	6700	60	0.75	2.93
	26.9	.085	28	3.2	.038	3.8	10.5	5	.018	6700	60	0.75	83.06
21105K-□□-22S	1.06	7.2	12	2.1	4.5	3.2	7	3.3	1.3	3400	60	1.0	2.93
	26.9	.051	12	2.1	.032	3.2	7	3.3	.018	3400	60	1.0	83.06
22613J-□□-01	0.812	3.6	26.0	0.6	6.0	4.2	43.0	12.0	0.65	5000	45	1.0	2.0
	20.6	.025	26.0	0.6	.042	4.2	43.0	12.0	.009	5000	45	1.0	56.70
22613M-□□-01	0.812	3.6	26.0	0.6	6.0	4.2	43.0	12.0	0.65	5000	45	1.5	2.0
	20.6	.025	26.0	0.6	.042	4.2	43.0	12.0	.009	5000	45	1.5	56.70
23101L-□□-01	1.50	10.0	26.0	2.1	4.8	3.4	12.0	5.0	2.2	5800	125	1.0	4.3
	38.1	.071	26.0	2.1	.034	3.4	12.0	5.0	.031	5800	125	1.0	121.9
23101L-□□-02	1.50	12.0	18.0	3.27	3.7	2.6	5.5	2.2	2.2	5500	175	1.0	4.3
	38.1	.085	18.0	3.27	.026	2.6	5.5	2.2	.031	5500	175	1.0	121.9
24618R-□□-04	0.75	1.7	15.0	0.58	3.7	2.6	26.0	8.5	0.35	5000	50	1.5	1.25
	19.1	.012	15.0	0.58	.026	2.6	26.0	8.5	.005	5000	50	1.5	35.44
24618N-□□-05	0.75	2.7	12.0	1.0	2.7	1.9	12	—	0.35	5725	50	1.0	1.25
	19.1	.019	12.0	1.0	.019	1.9	12	—	.005	5725	50	1.0	35.44
24618R-□□-09	0.75	1.0	6	0.75	1.35	0.95	8	1.4	0.35	6000	125	1.0	1.25
	19.1	.007	6	0.75	.010	0.95	8	1.4	.005	6000	125	1.0	35.44
24618V-□□-10	0.75	2.5	26	0.425	5.75	4.1	61	—	0.35	5500	30	1.0	1.25
	19.1	.018	26	0.425	.041	4.1	61	—	.005	5500	30	1.0	35.44
24618V-□□-11	0.75	1.5	15.0	0.555	2.7	1.9	22.5	—	0.35	6600	75	1.25	1.25
	19.1	.011	15.0	0.555	.019	1.9	22.5	—	.005	6600	75	1.25	35.44
24618V-□□-15	0.75	1.0	7.5	0.575	1.8	1.3	13	1.4	0.35	5000	70	0.75	1.25
	19.1	.007	7.5	0.575	.013	1.3	13	1.4	.005	5000	70	0.75	35.44

Part Number	Length (inches)	Peak Torque (oz.-in.)	Volts at Peak Torque (Volts)	Current at Peak Torque (amp)	Torque Constant (oz.in./amp)	Back EMF (V/Rad./s)	Term. Res. (Ohms)	Term. Ind. (mH)	Rotor Inertia (oz.in.s²)	Frictional Torque (oz.in.)	Motor Constant (oz.in./sq.rt.watts)	Weight (oz.)	(Commutation)	Pot. End-End Travel	Pot. Linearity
DC MT/POT AS-889-003	1.500	12.0	21.6	2.40	5.00	0.035	9.00	4.50	1.6E-04	0.30	1.67	4.0	Potentiometer	250°	Absolute +/- .50%
MT/RESOLVER AS-891-002	2.000	1.3	13.3	0.42	3.50	0.025	32.00	6.00	7.8E-06	0.20	0.62	3.2	Resolver	Accuracy < 6'	Transformation Ratio 0.454 +/- 5%
MT/POT/GHD AS-915-001	3.375	66.5	26.1	2.90	5.50	0.039	9.00	4.50	3.0E-04	3.50	1.83	6.0	None	Gear Ratio 4.84:1	Back Lash < 0.5°

Cube Motor Typical Outlines

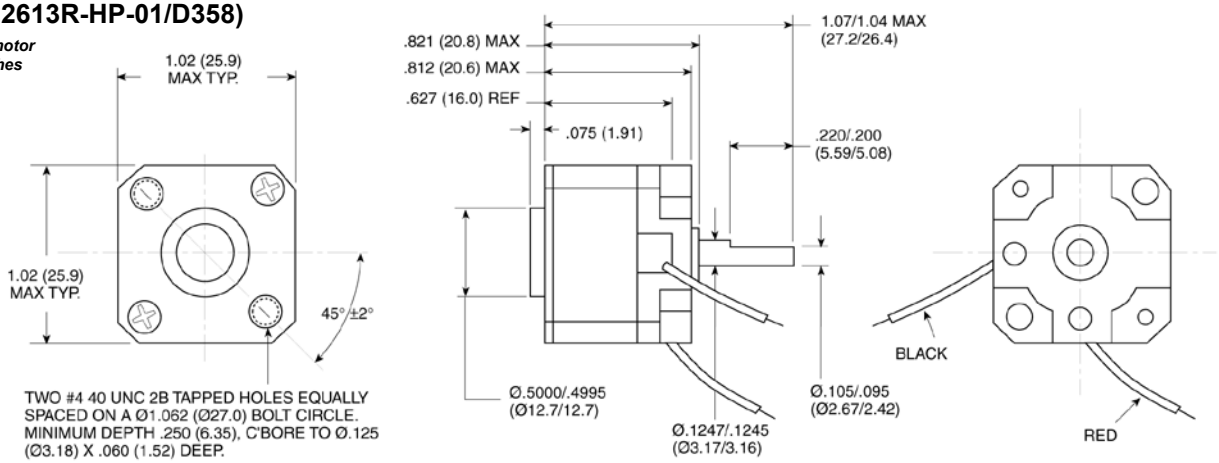
21 Series (21105L- □□-08)

Standard 1 inch cube motor with cartridge brushes and screw terminals



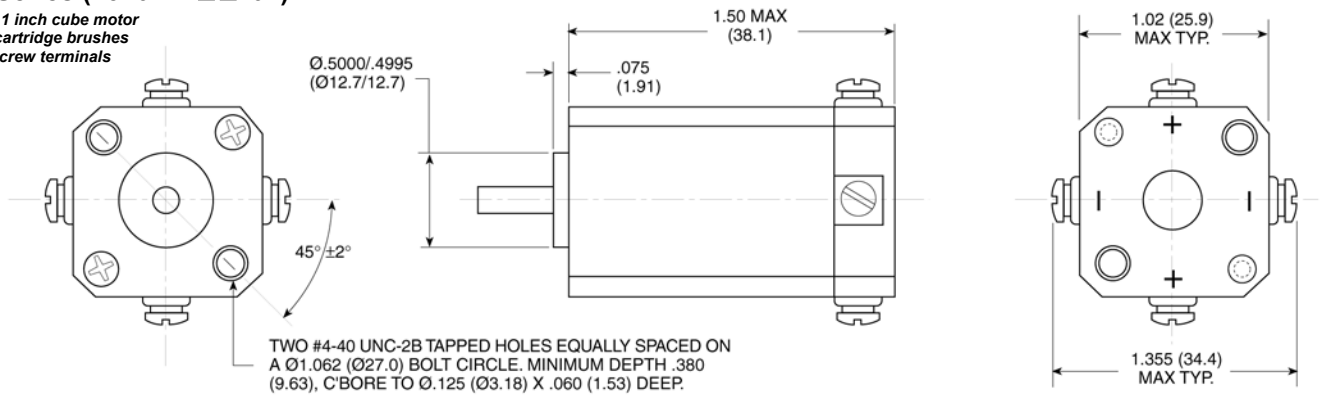
22 Series (22613R-HP-01/D358)

Short 1 inch cube motor with cartridge brushes and lead wires



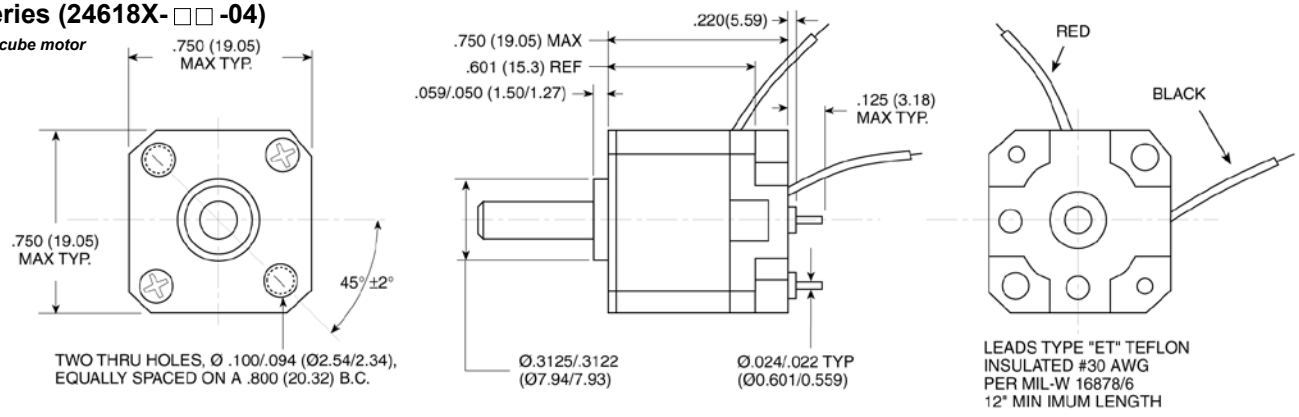
23 Series (23101L- □□-02)

Long 1 inch cube motor with cartridge brushes and screw terminals



24 Series (24618X- □□-04)

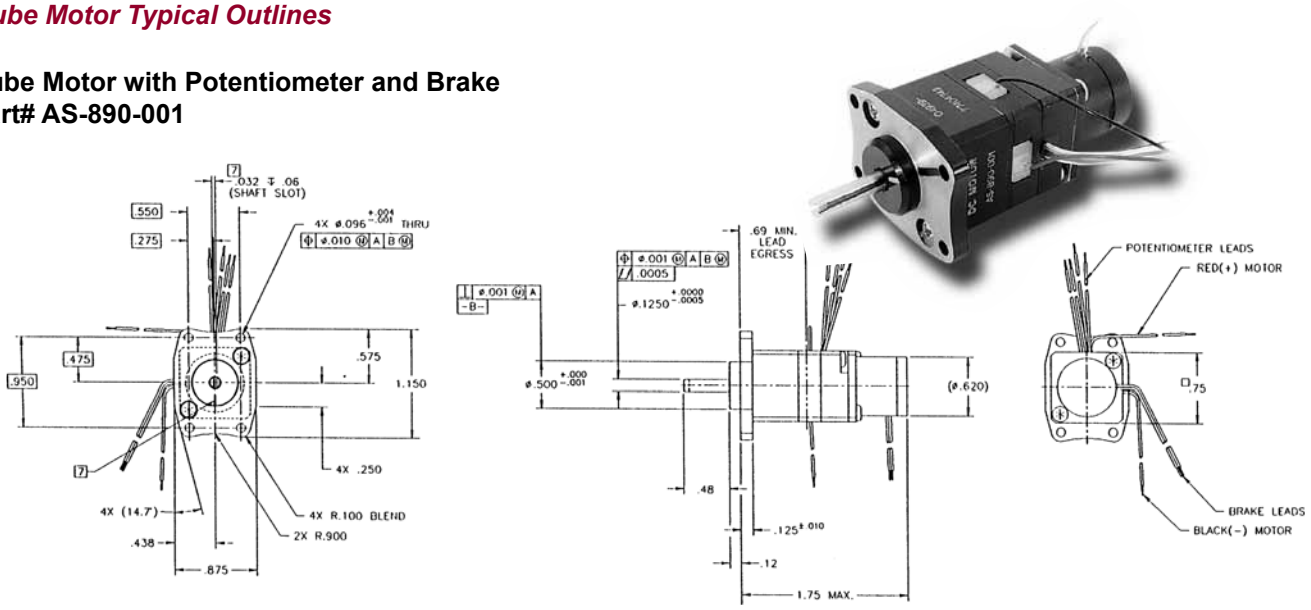
3/4 inch cube motor



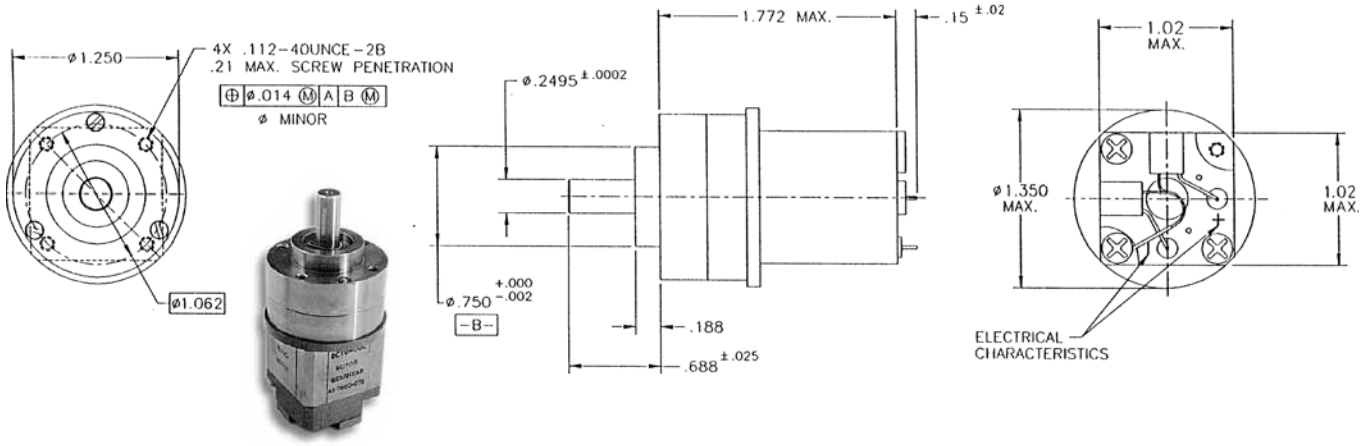
Dimensions are in inches (millimeters)

Cube Motor Typical Outlines

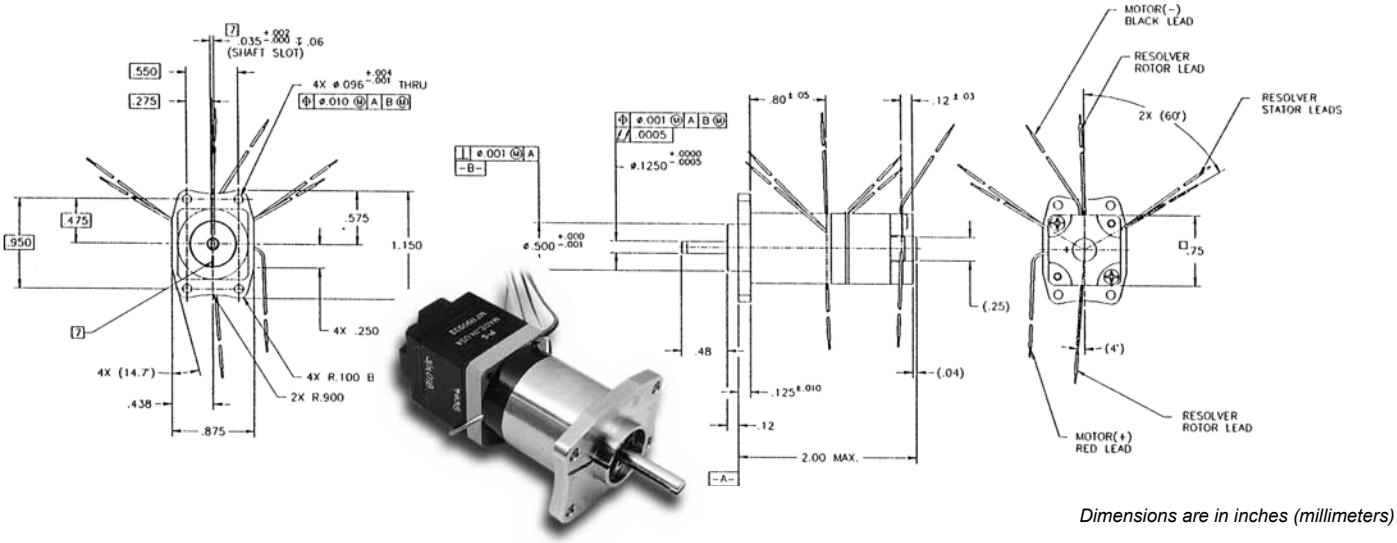
Cube Motor with Potentiometer and Brake
Part# AS-890-001



Cube Motor with a Gearhead
Part# AS-798Q-002



Cube Motor with a Resolver
Part# AS-891-001



Dimensions are in inches (millimeters)