



Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



Gearheads



Encoders

Portescap

Product Catalog



GCM

Gearcentralen Micmotor





Table of Contents

2–3	Welcome to Portescap
5–25	Brushless DC Motors
26–33	Sterilizable Brushless DC Slotted Motors and Custom Offerings
35–81	Brush DC Motors
83–99	Disc Magnet Motors
101–127	Can Stack Motors
129–143	Can Stack Linear Actuators
145–167	Gearheads & Encoders

Welcome to Portescap

Portescap is the innovation leader in miniature motors and precision motion control technologies for performance-critical applications that save, improve and enhance lives. We have continually advanced the state of the art for power, precision and efficiency in miniature motion. Driven by our passion for innovation, technical excellence and quality service, we deliver best-in-class products and custom engineering services to ensure a perfect fit for your applications.

Power, Precision, Efficiency



Brushless DC Motors

Optimum speed, torque, life and precision



Brush DC Motors

Outstanding efficiency, power density and acceleration



Disc Magnet Motors

Dynamic performance with fine-step resolution



Can Stack Motors

Accuracy for cost-effective open-loop control



Can Stack Linear Actuators

Direct linear motion, high force in a small package



Gearheads & Encoders

Spur and planetary gearheads, optical and magneto-resistive encoders

For Performance-Critical Applications



Medical devices & clinical diagnostics

Motion components for drills, insulin pumps, infusion pumps, ventilators, arthroscopic shavers, surgical drills and saws, surgical robots, dental handpieces, electronic pipettes, laboratory analyzers and other devices. Autoclavable capability also available.



Aerospace

Light, rugged, powerful motion control for activating seats, window shades, valves, fuel meters, instrumentation, fins, tracking systems and more.



Instrumentation

Miniature rotary and linear technologies for gas detectors, dispensing systems, microscopes, surveying total stations and other instruments.



Automation

Torque, acceleration, efficiency and durability for automated processes such as material handling, conveyors, pick-and-place systems, guide mechanisms and scanners.



Security

Precise, energy-efficient miniature motion for electronic access systems and surveillance camera positioning.



Other

Hand tools, HVAC&R, stage lighting, packaging machines, ATMs, telecom equipment, printers, humanoid robotics, industrial pumps, textile machinery, tattoo machines and more – any application that requires precise, powerful miniature motion.

Choose the Right Technology for Your Application

	Brushless DC Slotted	Brushless DC Slotless	Brush DC	Disc Magnet	Can Stack	Can Stack Linear Actuator
Efficiency/battery life	++	+++	++++	+	+	+
Motor lifetime	++++	++++	++	++++	+++	++
Autoclavability	++++		+			
Ability to withstand harsh environments	++++	+++	++	++	+	+
High power/weight ratio	++++	++++	+++	+++	+	+
High motor acceleration	++	++	+++	++++		
Open loop positioning	+	+		++++	++	+++
Simple control	+	+	++++	++	++	++
Low noise	+++	++++	+++	++	++	+
Ease of achieving linear motion						++++
Max rated continuous torque	++++	++++	+++	++++	+	
Max speed	++++	++++	+++	++	+	+

The Miniature Motion Leader

Continuous innovation to create the highest precision and performance in miniature motion applications.

The widest range of miniature motion technologies to suit virtually any configuration, environment and envelope.

Application-specific customization and rapid prototyping, with research and development teams in strategic locations around the world.

Collaboration to understand your motion control needs and devise a smart, perfect-fit way to do the job better.

A commitment to service and support throughout your application's lifecycle, worldwide.



Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



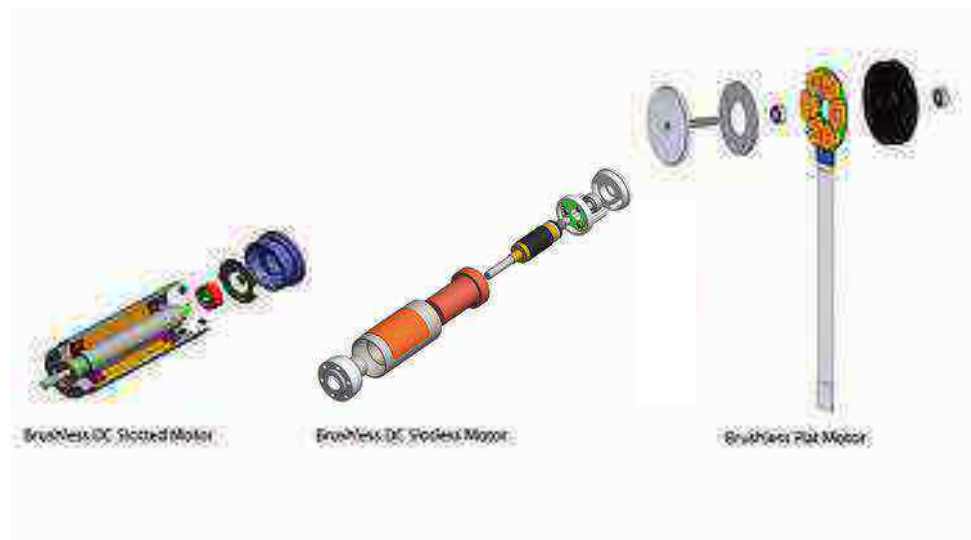
Gearheads



Encoders

Brushless DC Motors

Built for precision, efficiency and reliability, these motors offer the power density needed to deliver top performance in the most compact applications. Available in slotted and slotless designs, they provide exceptional acceleration, speed, torque and position control over a long, trouble-free life.



Exceptionally Efficient, Powerful and Durable

Feature	Details	Application Advantages
Slotless or slotted configurations	<ul style="list-style-type: none">Slotless: self-supporting cylindrical coil	<ul style="list-style-type: none">Zero detent torqueReduced iron lossesHigh efficiencyLinear torque vs. speed
	<ul style="list-style-type: none">Slotted: coils inserted in the slots of the stator	<ul style="list-style-type: none">Excellent torque-to-power ratioHigh current capabilityWithstands rugged environmentsAutoclavable option
Permanent magnet	<ul style="list-style-type: none">Linear torque/speed curve (except iron losses)Torque proportional to currentSpeed proportional to voltage	<ul style="list-style-type: none">Ease of position and speed control
Brushless design	<ul style="list-style-type: none">Electronic commutationNo brushes to wear or spark	<ul style="list-style-type: none">Long life, limited only by ball bearing wearReliable in harsh and dusty environmentsReduced EMIQuiet operation
Winding attached to stator	<ul style="list-style-type: none">Improved heat dissipation via conduction	<ul style="list-style-type: none">Superior overload capacity
Autoclavable versions for slotted motors	<ul style="list-style-type: none">Motor design optimized to withstand exposure to harsh environments including high temperature and pressure cycling	<ul style="list-style-type: none">Long life in medical devices that undergo frequent sterilization



For a Wide Range of Miniature Motion Needs



Medical devices & clinical diagnostics

- Arthroscopic shavers
- Respiratory and ventilation devices
- Miniature pumps
- Laboratory automation
- Powered ENT instruments
- Surgical robots
- Diagnostic analyzers
- Medical analyzers
- Sample prep workstations
- Powered orthopedic drills and saws
- Powered surgical screwdrivers



Aerospace

- Surveillance camera systems
- Seat actuation
- Valve actuation



Instrumentation

- Dosing & dispensing systems
- Gas detection
- Explosive trace detection systems

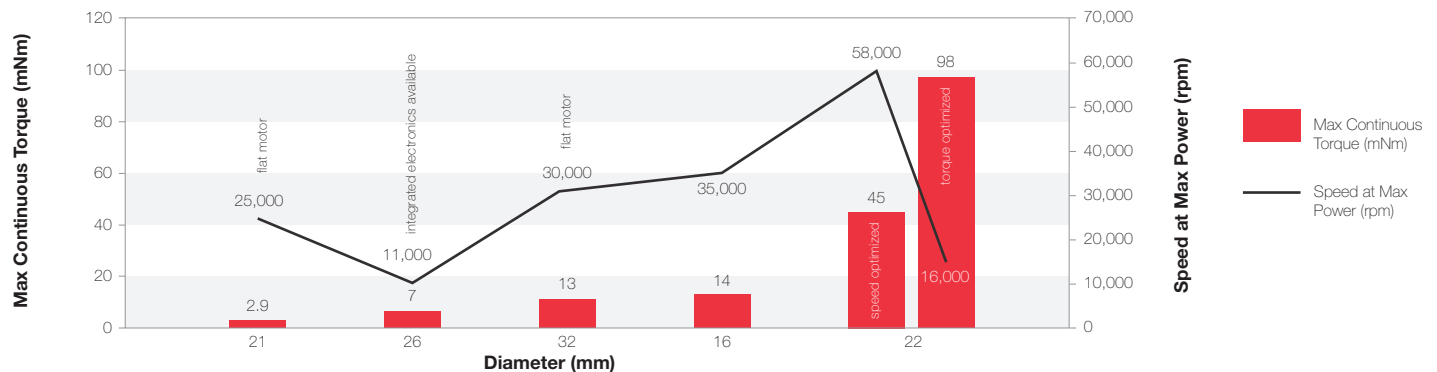


Other

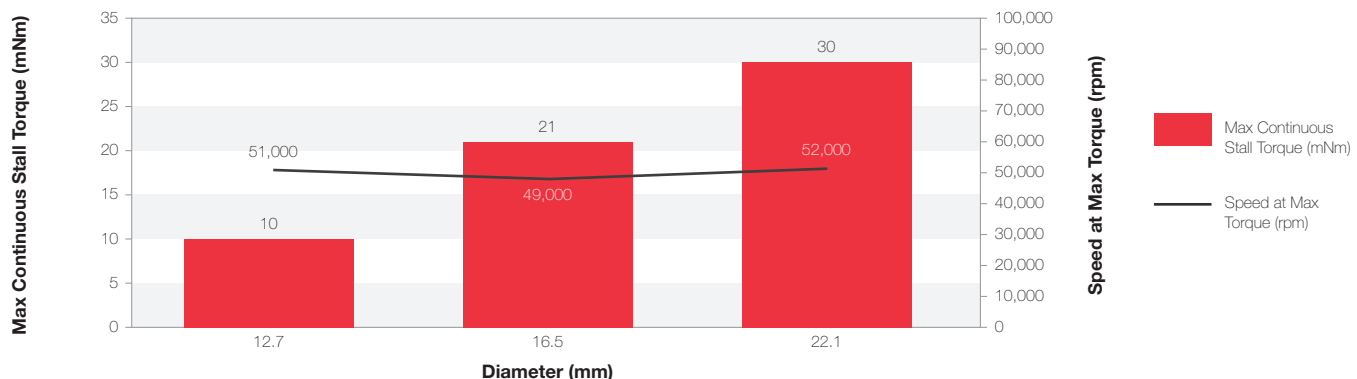
- Nailers & framing systems
- Powered industrial fasteners
- Powered assembly screwdrivers
- Powered professional pruners

Meet your Application's Working Point Requirements

Brushless Slotless



Brushless Slotted



For complete product and application details, visit portescap.com/brushless

Brushless DC Motor Technologies

This glossary of terms provides more information about the technology specifications listed in the Portescap Catalog for brushless DC motors.

Electrical Data

1. Nominal voltage

This voltage is used when measuring no-load speed, no-load current and other parameters. It does not represent a recommended voltage or a limitation of the motor.

2. Optimization direction

Brushless motors equipped with Hall sensors can be tuned so that the sensor positions compensate for the electrical and electronic time response of the commutation sequence. This is especially important for reducing motor losses in high-speed applications.

All the standard motors shown in this catalog are either symmetrical or optimized in the counterclockwise (CCW) direction as seen from the output shaft side of the motor. For optimized motors, optimization speed is mentioned in the specification document. Optimization speed and direction can be customized by request.

3. No-load speed

This is the motor speed as measured without any attachment or friction on the output shaft, with the driver being supplied by the nominal voltage.

4. Typical no-load current

This is the average current measured before the driver power stage, without any attachment or friction on the output shaft and with the driver being supplied by the nominal voltage. This parameter can vary significantly depending on the driver used and the motor temperature. All data are measured using the Hall-sensored version of the commutation, when available, after 30 seconds of running the motor at room temperature.

5. Max continuous mechanical power (@ 25°C)

Within maximum continuous operation specifications (see power curve graph), and with proper selection of speed and torque, this is the highest mechanical power output that can typically be achieved without exceeding the thermal limitation of the motor windings. In some cases, this maximum power can also be limited by the maximum recommended motor speed for the bearing assembly. Maximum continuous power is calculated with the motor in the air at 25°C, with no heat sink or forced air cooling. With improved cooling, it may be possible to exceed this value in short-term operation.

6. Max continuous current

Within maximum continuous operation specifications (see power curve graph), this is the current drawn at the highest output torque the motor can continuously achieve without exceeding the thermal limitations of the windings. Maximum continuous current is usually reached at a very low speed where iron and friction losses are minimal. This value is calculated with the motor in the air at 25°C, with no heat sink or forced air cooling. With improved cooling, it may be possible to exceed this value in short-term operation. This value does not apply to the very short peak current at startup, which can typically reach several tens of amps.

7. Max continuous torque

This is the torque corresponding to the maximum continuous current, usually reached at very low speed. Stall torque, when the motor needs to start from a blocked position, may be lower than this figure due to motor torque ripple.



8. Back EMF constant

Back EMF is a voltage generated by the windings of a permanent magnet motor in rotation. Because this voltage increases with speed and is applied in the opposite direction from the input voltage, the back EMF constant can be used to calculate the motor's speed at any given input voltage, assuming no friction and no loading torque.

The specification document also gives the 0-peak value of the back EMF, which is typically higher than the average value and can be measured on motor phases with an oscilloscope while the motor is back-driven.

9. Torque constant

This value relates the current in the motor phases to the torque created at the rotor level.

10. Motor regulation R/k^2

This value gives the extra joule losses in the motor winding, in watts, multiplied by the torque squared (Nm^2). A lower number indicates a better magnetic design for dealing with high torques. The calculation is based on internal phase resistance, not including wire soldering and connector resistance.

11. Motor regulation $k/R^{1/2}$

This is simply another way of expressing the previous property. In this case, a higher number indicates a more efficient magnetic design for dealing with high torques.

12. Internal resistance - phase to phase

This is the coil phase resistance measured at room temperature before the coil is soldered to the motor circuit assembly.

13. Line to line resistance at connectors

This is the phase resistance measured for the completed motor at room temperature. It includes solder, wire and (if present) connector resistances. In motors with very low resistance, the line to line resistance may differ significantly from the internal resistance.

14. Inductance - phase to phase

This is the motor phase inductance measured with an inductance meter at 1000 Hz.

15. Mechanical time constant

This represents the motor's ability to accelerate quickly at a given voltage and without any current limitation. It typically represents the time needed to reach 63.2% of the motor's final speed under a constant voltage.

16. Electrical time constant

This is the time constant L/R (inductance divided by resistance) that is needed to properly size the driver PWM frequency. It represents the motor's ability to let the current vary quickly. This value is commonly very low in slotless BLDC motors.

Brushless DC Motor Technologies

General Data

17. Maximum motor speed	This is the maximum recommended speed as limited by the bearing assembly type, taking into account the bearing supplier's specification, vibration behavior and other factors.
18. Ambient working temperature range	The recommended ambient working temperature range is based on the properties of the bearing lubricant.
19. Ambient storage temperature range	The recommended ambient storage temperature range is based on the properties of the bearing lubricant.
20. Ball bearings preload	This is the bearing preload force as implemented by design. This might be a static preload in bearings bonded to the shaft after assembly. In that case, it is not possible to measure preload force by applying an external force on the shaft, and there is very little axial play. To maximize bearing life, we recommend that forces on the shaft during operation do not exceed the preload force.
21. Axial static force without shaft support (max)	When press-fitting a part onto the shaft without providing support on the opposite end of the shaft, the applied force is supported entirely by the bearing races. This is the maximum pressing force recommended to avoid damage to the bearings.
22. Maximum winding temperature	This specification is linked to the properties of the thermo-bonding material around the coil copper wires. The maximum winding temperature can be an important consideration for applications that require long product life because operation at high temperatures can lead to failure modes such as fast aging of the bearing lubricant.
23. Thermal resistance	<p>Thermal resistance is given either directly from the coil to the ambient air surrounding the motor, or in two steps: from coil to housing and then from housing to ambient.</p> <p>This value is calculated with the motor in the air at 25°C, with no heat sink or forced air cooling. With the motor installed, the value is likely to decrease in many applications, but it could also be higher if the motor is surrounded by a small volume of air that cannot cool down.</p> <p>Thermal resistance varies with air convection parameters, and is lower at a high temperature of the motor housing. The value can also vary based on speed, especially with flat motors.</p> <p>This value is measured during operation close to the maximum continuous power zone (see power curve graph).</p>
24. Thermal time constant	This value is given directly from the coil to the ambient air surrounding the motor. Along with the thermal resistance, the thermal time constant allows for solving thermal differential equations for the motor. It is measured at a constant voltage supply over time, which means the amount of power loss that can be dissipated tends to decrease due to the increase in winding resistance with increasing temperature.
25. Mass	This is the total motor mass, including cables.
26. Rotor inertia	This assumes an unconnected rotor and is used to determine angular acceleration for a given torque.
27. Hall sensor electrical phasing	In a three-phase BLDC motor with Hall sensors, the sensors are commonly phased at 120° electrically from each other. (See the chart to the right for an example.) This affects driver selection.



Additional Information

28. Balancing

All cylinder motors in this section have their rotors dynamically balanced on two planes through a material removal process.

29. Hall sensors

An external pull-up resistor is required on drive electronics.

30. Power curve

The typical power curve shows the continuous operation working points possible (the colored part of the chart). This is based on purely thermal limitations (the same limitations described under "Max continuous current") that change depending on the cooling conditions of the application – for example, when the motor is mounted to a metal part.

These power curves are common to all coils presented, and they represent typical motor performance with the understanding that many parameters influencing the curves have tolerances around nominal values (no-load current, resistance, torque constant, etc.). These power curves are not plotted at nominal voltage; each working point illustrated will require matching of coil, voltage and load to reach the indicated speed.

Dotted lines show the torque/speed relationships that deliver a given mechanical power value (in watts) at the motor shaft.

Working points outside of the illustrated continuous operation range are possible depending on the duty cycle.

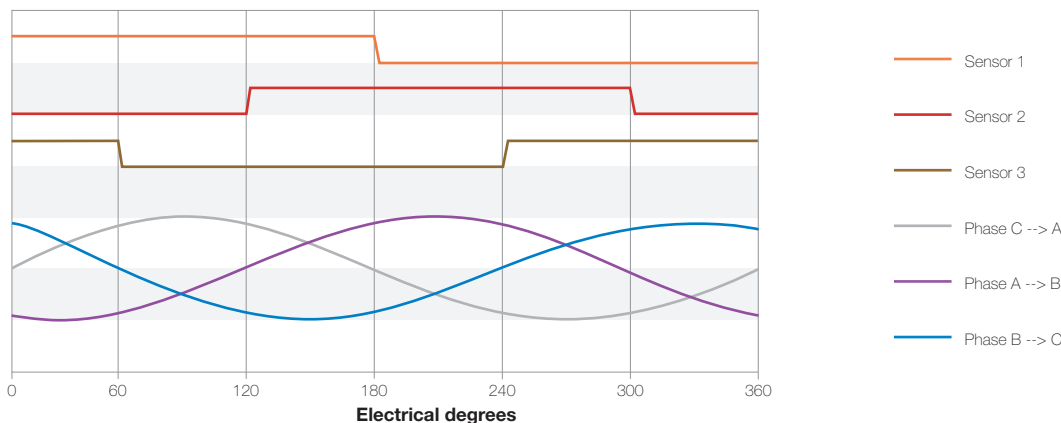
In some cases, the power curve stops early on the high-speed side before the limitation is reached (the flat portion on top of the curve) because measurement was not possible at higher speeds.

In some cases, the maximum recommended motor speed is lower than the maximum continuous thermal limit shown on the power curve. This recommendation is based on characteristics of the bearing assembly.

31. Dielectric test

A dielectric test (also known as hipot or high potential test) is performed on all motors under 500V phases to the housing and during 5 seconds after voltage ramp up. Maximum allowed leakage is 1mA.

Motor signal sequence shaft rotation CW seen from front face for BH and EC series of slotless BLDC motors, or CCW for BF series

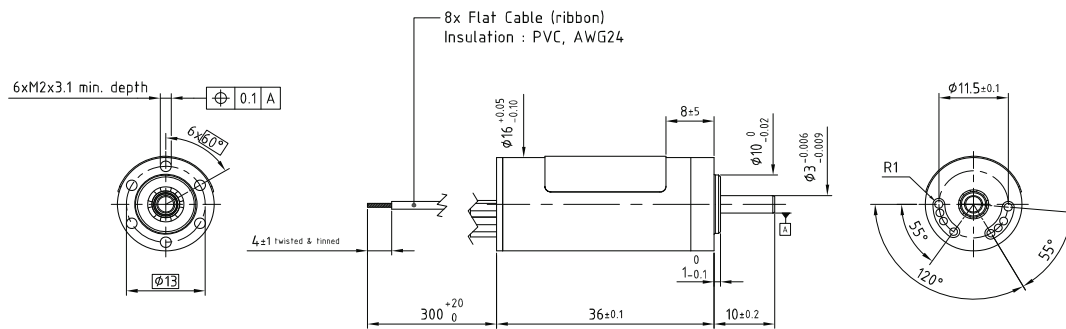


16ECP36 Ultra EC™

2 pole

Ø16mm

27 W



Dimensions in mm

16ECP36 - 8B - **

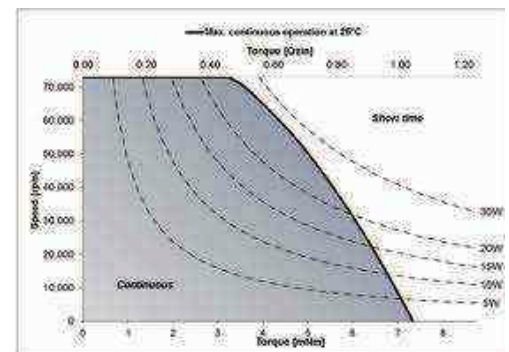
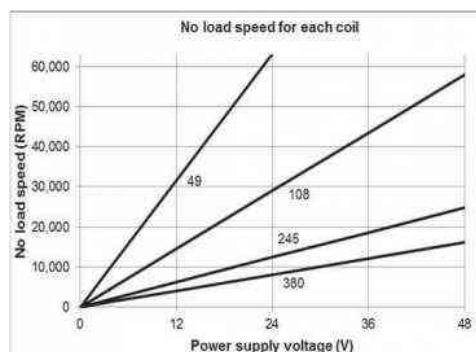
Electrical Data	**	380	245	108	49	
1 Nominal Voltage	U_N	24	24	24	12	Volt
2 Optimization Direction	-	Symetrical	Symetrical	Symetrical	Symetrical	-
3 No-Load Speed	n_0	8,100	12,420	29,000	31,550	rpm
4 Typical No-Load Current	I_0	20	35	85	160	mA
5 Max Continuous Mechanical Power (@25 °C)	P_{max}	27.5	27.5	27.5	27.5	W
6 Max Continuous Current	$I_{e max}$	0.3	0.4	0.9	2.1	A
7 Max Continuous Torque	$M_{e max}$	7.0 (1)	7.2 (1.02)	7.1 (1.01)	7.5 (1.07)	mNm (oz-in)
8 Back EMF Constant	K_E	2.82	1.84	0.80	0.37	V/1000 rpm
9 Torque Constant	k_M	26.9	17.6	7.7	3.5	mNm/A
10 Motor Regulation	R/k^2	71.8	67.9	69.2	62.4	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	3.7 (0.53)	3.8 (0.54)	3.8 (0.54)	4 (0.57)	mNm/W ^{1/2} (oz-in/W ^{1/2})
12 Internal Resistance - phase to phase	R_t	52.00	21.00	4.05	0.78	ohms
13 Line to Line Resistance at Connectors	R_L	52.10	21.10	4.13	0.82	ohms
14 Inductance Phase to Phase	L	3.93	1.63	0.32	0.07	mH
15 Mechanical Time Constant	t_m	3.9	3.7	3.8	3.4	ms
16 Electrical Time Constant	t_e	0.08	0.08	0.08	0.08	ms

General Data

17 Maximum Motor Speed	n_{max}			63,000		rpm
18 Ambient Working Temperature Range	-			-30 to + 100 (-22 to + 212)		°C (°F)
19 Ambient Storage Temperature Range	-			-40 to + 100 (-40 to + 212)		°C (°F)
20 Ball Bearings Preload	-			5.3		N
21 Axial Static Force w/o Shaft Support (max)	-			34		N
22 Maximum Winding Temperature	-			125 (257)		°C (°F)
23 Thermal Resistance	R_{th1}/R_{th2}			3.5 / 17		°C/W
24 Thermal Time Constant	t_w			580		s
25 Weight	-			41 (1.45)		g (oz)
26 Rotor Inertia	J			0.60		g.cm ²
27 Hall Sensor Electrical Phasing	-			120		Electrical °

* Available without hall sensor

with hall effect sensors	
Wire	Description
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3 to 24V DC
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Brown	Sensor 3

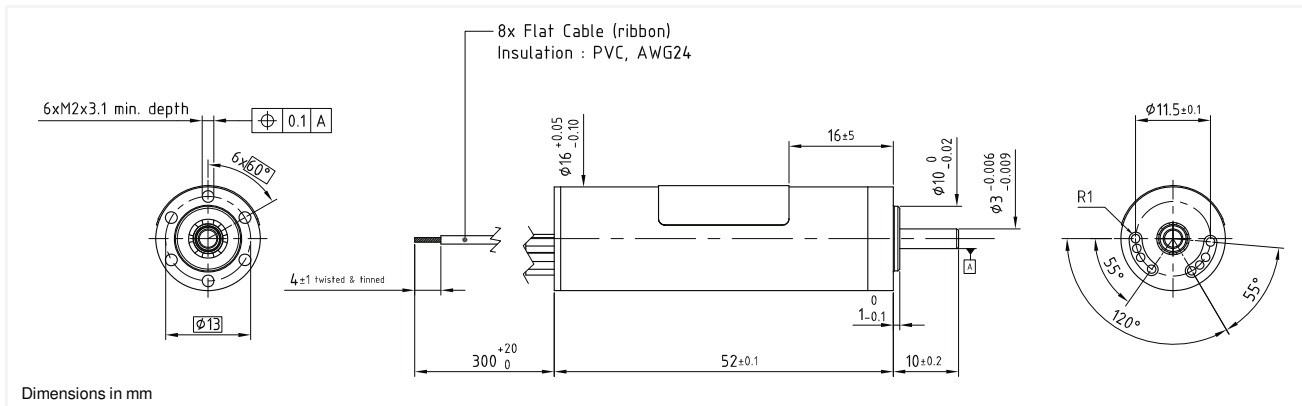


16ECP52 Ultra EC™

2 pole

Ø16mm

37 W



16ECP52 - 8B - **

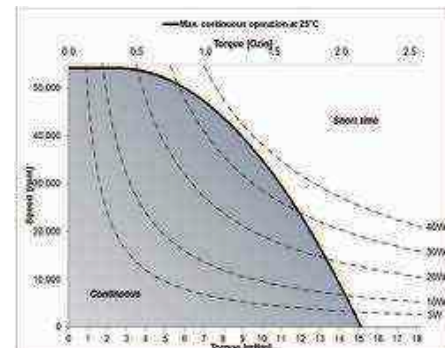
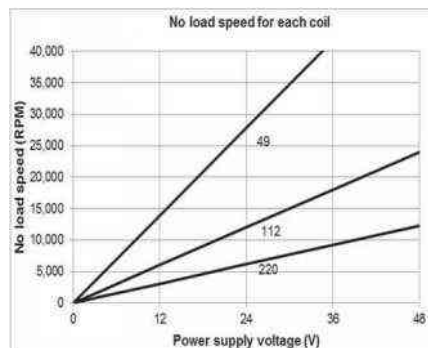
Electrical Data	**	220	112	49	
1 Nominal Voltage	U_N	24	24	24	Volt
2 Optimization Direction	-	Symetrical	Symetrical	Symetrical	-
3 No-Load Speed	n_0	6,144	12,100	27,800	rpm
4 Typical No-Load Current	I_0	19	41	134	mA
5 Max Continuous Mechanical Power (@25 °C)	P_{max}	37.5	37.5	37.5	W
6 Max Continuous Current	$I_{e max}$	0.4	0.8	2.0	A
7 Max Continuous Torque	$M_{e max}$	14.5 (2.06)	14.7 (2.09)	16.1 (2.28)	mNm (oz-in)
8 Back EMF Constant	K_E	3.77	1.93	0.84	V/1000 rpm
9 Torque Constant	k_M	36.0	18.4	8.0	mNm/A
10 Motor Regulation	R/k^2	18.9	18.3	15.4	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	7.3 (1.04)	7.4 (1.05)	8.1 (1.15)	mNm/W ^{1/2} (oz-in/W ^{1/2})
12 Internal Resistance - phase to phase	R_i	24.50	6.20	0.98	ohms
13 Line to Line Resistance at Connectors	R_L	24.60	6.30	1.06	ohms
14 Inductance Phase to Phase	L	2.32	0.60	0.12	mH
15 Mechanical Time Constant	t_m	1.9	1.8	1.5	ms
16 Electrical Time Constant	t_e	0.10	0.10	0.12	ms

General Data

17 Maximum Motor Speed	n_{max}		40,000	rpm
18 Ambient Working Temperature Range	-		-30 to + 100 (-22 to + 212)	°C (°F)
19 Ambient Storage Temperature Range	-		-40 to + 100 (-40 to + 212)	°C (°F)
20 Ball Bearings Preload	-		5.3	N
21 Axial Static Force w/o Shaft Support (max)	-		34	N
22 Maximum Winding Temperature	-		125 (257)	°C (°F)
23 Thermal Resistance	R_{th1}/R_{th2}		3 / 15	°C/W
24 Thermal Time Constant	t_w		750	s
25 Weight	-		62 (2.19)	g (oz)
26 Rotor Inertia	J		1	g.cm ²
27 Hall Sensor Electrical Phasing	-		120	Electrical °

* Available without hall sensor

with hall effect sensors	
Wire	Description
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3 to 24V DC
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Brown	Sensor 3

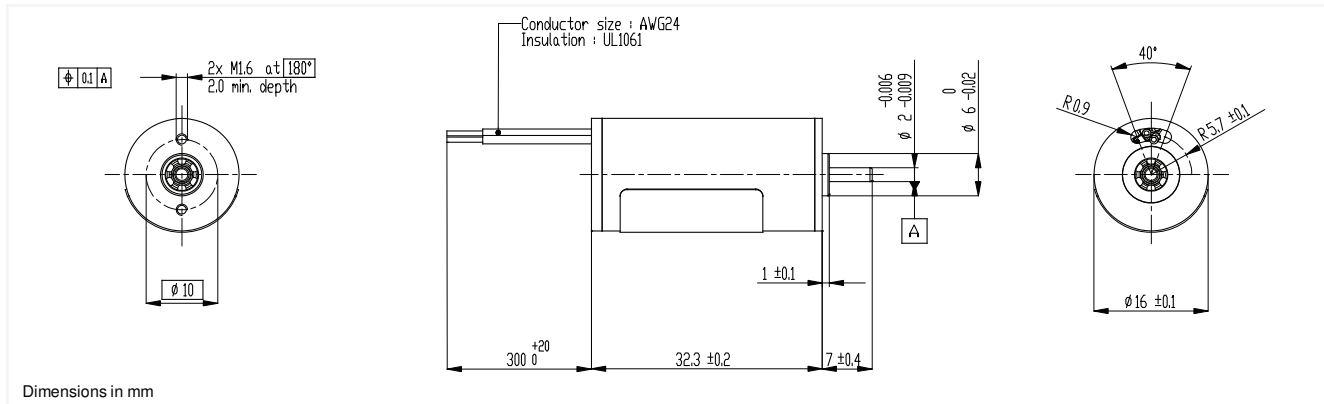


16BHS 2-wires

2 pole

Ø16mm

6 W



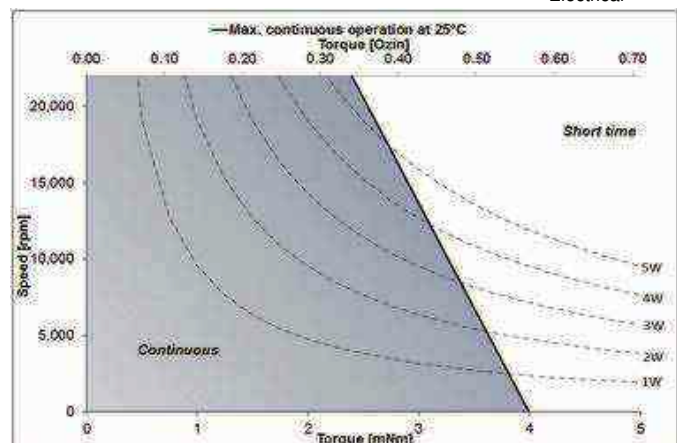
16BHS 2A - **

Electrical Data	**	E	L	P	T	
1 Nominal Voltage	U_N	12	12	12	12	Volt
2 Optimization Direction	-	n.a.	n.a.	n.a.	n.a.	-
3 No-Load Speed	n_0	8,740	12,740	17,100	33,770	rpm
4 Typical No-Load Current	I_0	55.0	75.0	112.0	235.0	mA
5 Max Continuous Mechanical Power (@25°C)	P_{max}	6.0	6.0	6.0	6.0	W
6 Max Continuous Current	$I_{e max}$	0.3	0.4	0.6	1.2	A
7 Max Continuous Torque	$M_{e max}$	3.8 (0.54)	3.6 (0.51)	4 (0.57)	4 (0.57)	mNm (oz-in)
8 Back EMF Constant	K_E	1.19	0.84	0.65	0.34	V/1000 rpm
9 Torque Constant	k_M	11.4	8.1	6.2	3.3	mNm/A
10 Motor Regulation	R/k^2	225.5	251.5	205.5	192.8	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	2.1 (0.3)	2 (0.29)	2.2 (0.32)	2.2 (0.32)	mNm/W ^{1/2} (oz-in/W ^{1/2})
12 Internal Resistance - phase to phase	R_i	29.30	16.50	7.90	2.10	ohms
13 Line to Line Resistance at Connectors	R_L	n.a.	n.a.	n.a.	n.a.	ohms
14 Inductance Phase to Phase	L	1.17	0.66	0.32	0.08	mH
15 Mechanical Time Constant	t_m	11.8	13.2	10.7	10.3	ms
16 Electrical Time Constant	t_e	0.04	0.04	0.04	0.04	ms

General Data

17 Maximum Motor Speed	n_{max}	10,900	rpm
18 Ambient Working Temperature Range	-	-30 to + 80 (-22 to + 176)	°C (°F)
19 Ambient Storage Temperature Range	-	-40 to + 80 (-40 to + 176)	°C (°F)
20 Ball Bearings Preload	-	2.0	N
21 Axial Static Force w/o Shaft Support (max)	-	25.0	N
22 Maximum Winding Temperature	-	125 (257)	°C (°F)
23 Thermal Resistance	R_{th}	22.0	°C/W
24 Thermal Time Constant	t_w	520	s
25 Weight	-	33 (1.17)	g (oz)
26 Rotor Inertia	J	0.500	g.cm ²
27 Hall Sensor Electrical Phasing	-	NA	Electrical °

integrated electronics	
Wire	Description
Red	VCC
Black	GND
Other	3.5-15V DC for E,L,P windings 3.5-5V DC for T winding 2.6A max - care about polarity
Other	Choose CW or CCW for rotation direction seen from shaft output side

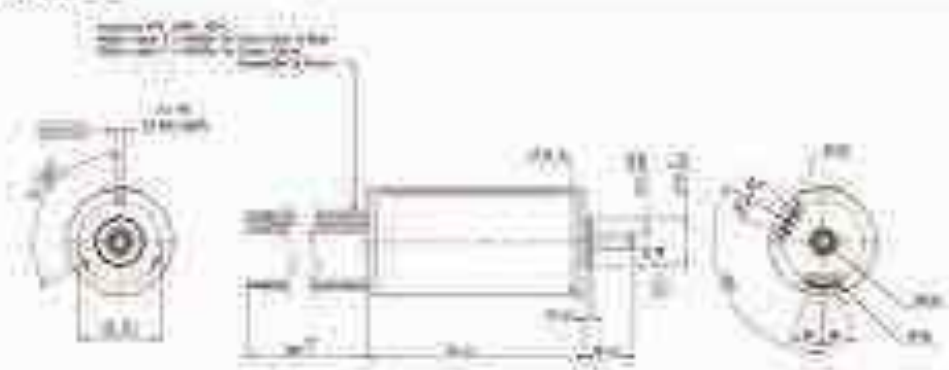


22ECP45 Ultra EC™

2 pole

Ø22mm

80W



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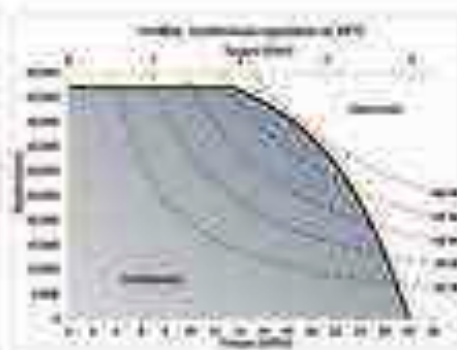
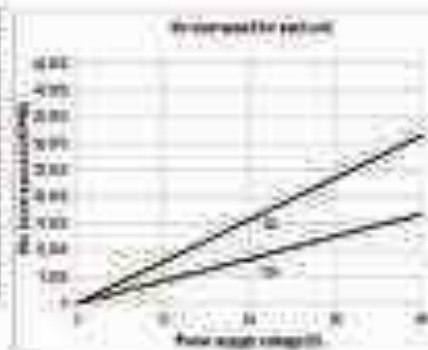
22ECP45 8B - **

	16	24	24	Volt
1. Nominal Voltage	16	24	24	Volt
2. Commutation Direction		Synchronous	Synchronous	
3. No-Load Speed	n_0	6375	18700	rpm
4. Typical No-Load Current	I_0	35	60	mA
5. Max Continuous Mechanical Power (25°C)	P_{mech}	80	80	W
6. Max Continuous Current	I_{max}	1.0	2.0	A
7. Max Continuous Torque	M_{max}	27.7 (0.90)	29.4 (1.7)	100% (100%)
8. Back-EMF Constant	K_e	2.62	1.60	V/1000-rpm
9. Torque Constant	K_t	27.8	14.8	100% (100%)
10. Motor Regulation	Δn	3.0	7.0	100% (100%)
11. Motor Regulation	Δn	11.2 (1.59)	11.9 (1.80)	100% (100%)
12. Internal Resistance - phase to phase	R_i	5.60	1.33	ohm
13. Line to Line Resistance at Connections	R_L	9.68	1.29	ohm
14. Inductance Phase to Phase	L	0.64	0.27	mH
15. Mechanical Time Constant	τ_m	1.8	1.8	ms
16. Electrical Time Constant	τ_e	0.18	0.18	ms

17. Maximum Motor Speed	n_{max}	47500	rpm
18. Ambient Working Temperature Range		-30 to +100 (-22 to +212)	°C (°F)
19. Ambient Storage Temperature Range		-60 to +100 (-40 to +212)	°C (°F)
20. Ball Bearings Preload		0.5	N
21. Axial Static Force -in Shaft Support (max)		24	N
22. Maximum Winding Temperature		125 (257)	°C (°F)
23. Thermal Resistance	$R_{th}(R_{th1})$	19.7	°C/W
24. Thermal Time Constant	τ_{th}	400	s
25. Weight		150 (5.5)	g (oz)
26. Motor Frame		2.30	g (oz)
27. Hall Sensor Electrical Pinning		120	Electrical

**Standard without hall sensor

Wiring and Hall sensor connections	
Gray	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3.5 to 27V DC
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Black	Sensor 3

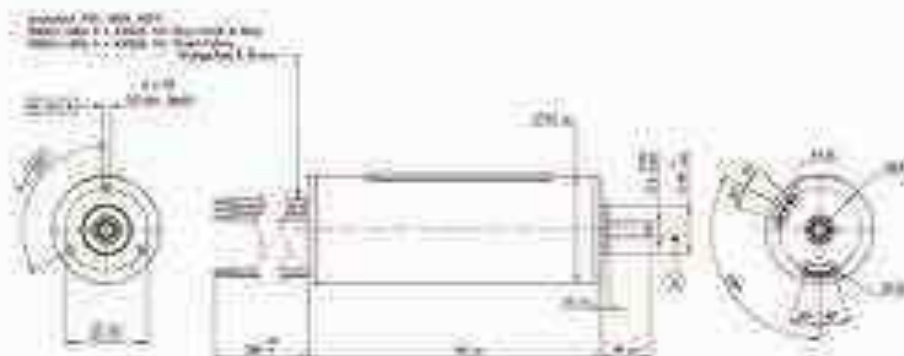


22ECP60 Ultra EC™

2 pole

Ø22mm

120W

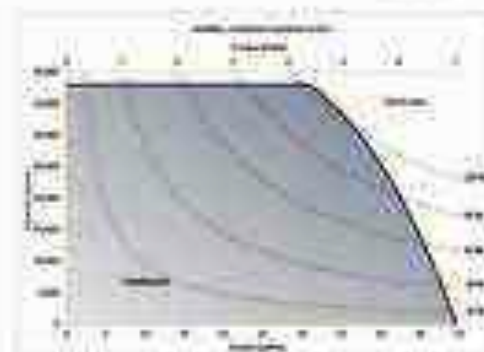
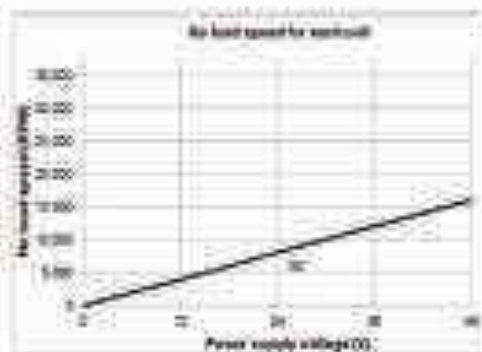


Dimensions in mm

22ECP60 88 - **

1 Nominal Voltage	U_n	24	VDC
2 Optimization Direction		Symmetrical	
3 No-Load Speed	n_0	8000	rpm
4 Typical No-Load Current	I_0	40	mA
5 Max Continuous Mechanical Power (@25°C)	P_{mech}	120	W
6 Max Continuous Current	I_{max}	1.8	A
7 Max Continuous Torque	M_{max}	90.5 (7.15)	when n_0 (see 3)
8 Back EMF Constant	K_e	2.96	V/1000 rpm
9 Torque Constant	K_t	26.3	mNm/A
10 Motor Regulation	$\Delta n/\Delta U$	3.0	10%/V
11 Motor Regulation	$\Delta n/\Delta I$	18.3 (2.8)	when $W^{1/2}$ (see 16/17)
12 Internal Resistance - phase to phase	R_i	2.38	ohms
13 Line to Line Resistance at Connectors	R_L	2.47	ohms
14 Inductance Phase to Phase	L	0.48	mH
15 Mechanical Time Constant	τ_m	1.0	ms
16 Electrical Time Constant	τ_e	0.20	ms
17 Maximum Motor Speed	n_{max}	36000	rpm
18 Ambient Working Temperature Range		-30 to +100 (-22 to +212)	°C (°F)
19 Ambient Storage Temperature Range		-40 to +100 (-40 to +212)	°C (°F)
20 Ball Bearings Axial Load		5.50	N
21 Axial Static Force into Shaft Support (max)		34	N
22 Maximum Winding Temperature		128 (257)	°C (°F)
23 Thermal Resistance	R_{thJA}, R_{thJC}	18.4	°C/W
24 Thermal Time Constant	τ_{th}	1100	s
25 Weight		140 (4.94)	g (oz)
26 Rotor Inertia	J	3.5	g.cm ²
27 Hall Sensor Electrical Phasing		120	Electrical °

with Hall effect sensors	
Color	Connection
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3.5 to 27V DC
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Black	Sensor 3

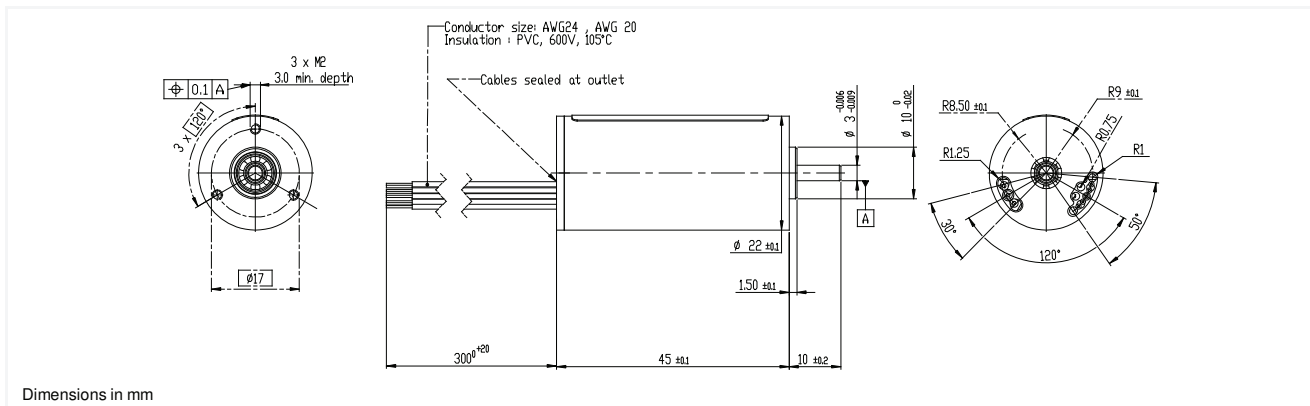


22ECS45 Ultra EC™

2 pole

Ø22mm

120 W



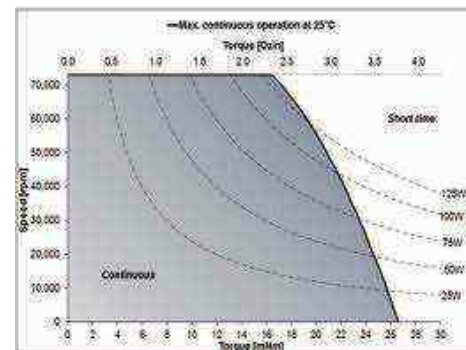
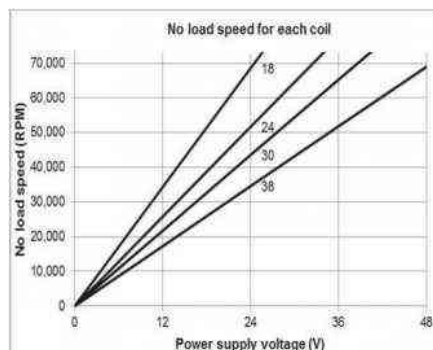
22ECS45 10B - **

Electrical Data	**	38	30	24	18	
1 Nominal Voltage	U_N	24	24	24	24	Volt
2 Optimization Direction	-	CCW	CCW	CCW	CCW	-
3 No-Load Speed	n_0	34,500	43,500	51,600	68,500	rpm
4 Typical No-Load Current	I_0	160	195	240	300	mA
5 Max Continuous Mechanical Power (@25°C)	P_{max}	120	120	120	120	W
6 Max Continuous Current	$I_{e max}$	4.0	5.2	6.4	8.2	A
7 Max Continuous Torque	$M_{e max}$	26.6 (3.77)	26.8 (3.8)	26.7 (3.79)	26.8 (3.8)	mNm (oz-in)
8 Back EMF Constant	K_E	0.69	0.54	0.44	0.34	V/1000 rpm
9 Torque Constant	k_M	6.6	5.2	4.2	3.3	mNm/A
10 Motor Regulation	R/k^2	8.6	8.5	8.5	8.5	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	10.8 (1.53)	10.8 (1.53)	10.8 (1.53)	10.8 (1.53)	mNm/W ^{1/2} (oz-in/W ^{1/2})
12 Internal Resistance - phase to phase	R_i	0.38	0.23	0.15	0.09	ohms
13 Line to Line Resistance at Connectors	R_L	0.42	0.25	0.18	0.11	ohms
14 Inductance Phase to Phase	L	0.057	0.035	0.022	0.013	mH
15 Mechanical Time Constant	t_m	1.9	1.9	1.9	1.9	ms
16 Electrical Time Constant	t_e	0.15	0.15	0.15	0.14	ms

General Data

17 Maximum Motor Speed	n_{max}		73,000		rpm
18 Ambient Working Temperature Range	-		-30 to +100 (-22 to +212)		°C (°F)
19 Ambient Storage Temperature Range	-		-40 to +100 (-40 to +212)		°C (°F)
20 Ball Bearings Preload	-		5.5		N
21 Axial Static Force w/o Shaft Support (max)	-		34		N
22 Maximum Winding Temperature	-		125 (257)		°C (°F)
23 Thermal Resistance	R_{th1}/R_{th2}		2 / 9.7		°C/W
24 Thermal Time Constant	t_w		1,000		s
25 Weight	-		100 (3.52)		g (oz)
26 Rotor Inertia	J		2.30		g.cm ²
27 Hall Sensor Electrical Phasing	-		120		Electrical °

with hall effect sensors	
Wire	Description
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3.5 to 27V DC
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Brown	Sensor 3
Black	NTC 1
White	NTC 2



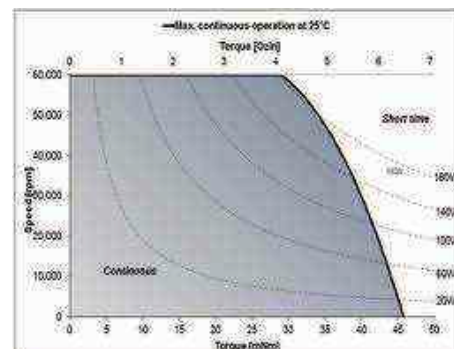
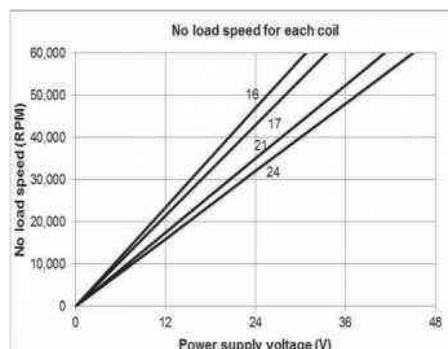
180 W



22ECS60 10B - **

General Data			
17	Maximum Motor Speed	n_{\max}	60,000 rpm
18	Ambient Working Temperature Range	-	-30 to + 100 (-22 to + 212) °C (°F)
19	Ambient Storage Temperature Range	-	-40 to + 100 (-40 to + 212) °C (°F)
20	Ball Bearings Preload	-	5.5 N
21	Axial Static Force w/o Shaft Support (max)	-	34 N
22	Maximum Winding Temperature	-	125 (257) °C (°F)
23	Thermal Resistance	R_{th1}/R_{th2}	1 / 8.4 °C/W
24	Thermal Time Constant	t_w	1,200 s
25	Weight	-	140 (4.93) g (oz)
26	Rotor Inertia	J	3.50 g.cm ²
27	Hall Sensor Electrical Phasing	-	120 Electrical °

with hall effect sensors	
Wire	Description
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3.5 to 27V DC
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Brown	Sensor 3
Black	NTC 1
White	NTC 2

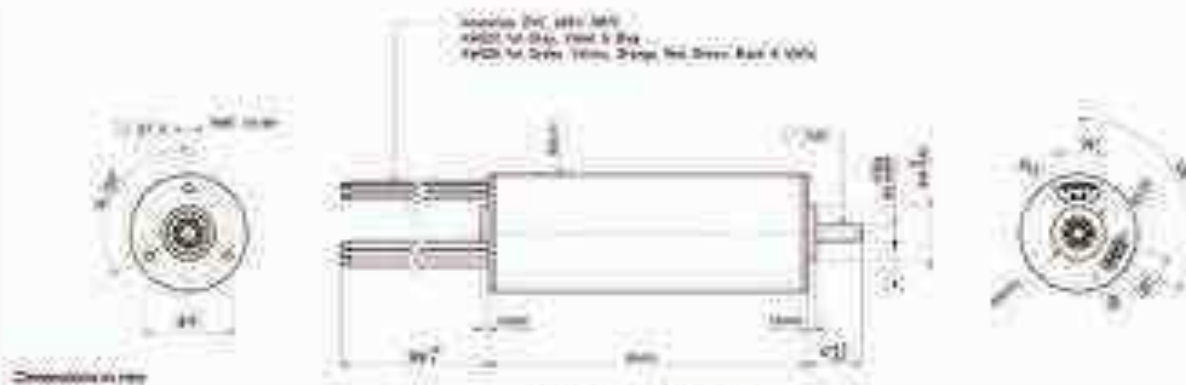


22ECT80 Ultra EC™

4 pole

Ø22mm

86W

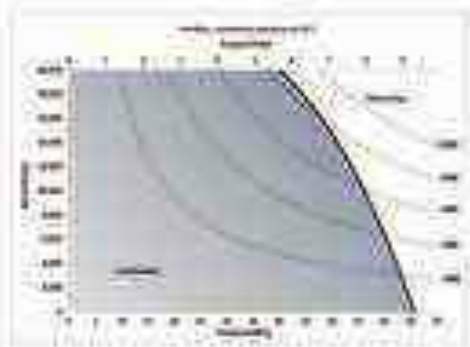
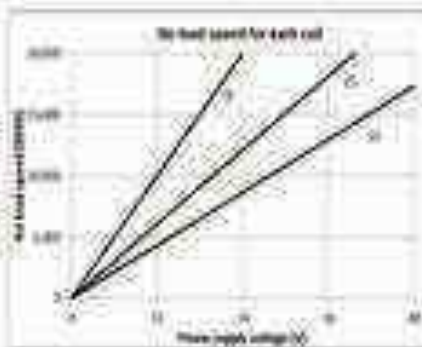


22ECT60 10B - **

		24	24	24	W8
1. Nominal Voltage	U_n	Symmetrical	Symmetrical	Symmetrical	-
2. Optimization Direction					-
3. No-Load Speed	n_0	20,370	12,380	9,180	rpm
4. Typical No-load Current	I_0	320	170	115	mA
5. Max Continuous Mechanical Power (@25°C)	P_{mech}	86	86	86	W
6. Max Continuous Current	I_{max}	5.9	3.6	2.6	A
7. Max Continuous Torque	M_{max}	65.9 (2.34)	66.9 (2.48)	64.3 (2.11)	(mNm (oz-in))
8. Back EMF Constant	K_e	1.18	1.91	2.72	V/1000 rpm
9. Torque Constant	K_t	11.1	15.8	26.0	mNm/A
10. Motor Regulation	$R\%$	3.8	1.8	1.8	10%/New
11. Motor Regulation	$kR\%$	25.5 (2.6)	26 (2.7)	25 (2.5)	mNm/W ^{0.5} (oz-in/W ^{0.5})
12. Internal Resistance - Phase to Phase	R_s	0.18	0.52	1.08	ohm
13. Line To Line Resistance At Connectors	R_L	0.23	0.58	1.11	ohm
14. Inductance Phase To Phase	L	0.02	0.08	0.12	mH
15. Mechanical Time Constant	τ_m	1.3	1.3	1.4	ms
16. Electrical Time Constant	τ_e	0.10	0.13	0.11	ms

17. Maximum Motor Speed	n_{max}	30,000	rpm
18. Ambient Working Temperature Range		-30 to +100 (-22 to +212)	°C (°F)
19. Ambient Storage Temperature Range		-45 to +100 (-40 to +212)	°C (°F)
20. Ball Bearings Preload		8.8	N
21. Axial Static Force into Shaft Support (max)		45.0	N
22. Maximum Winding Temperature		125 (257)	°C (°F)
23. Thermal Resistance	R_{thJA}, R_{thJC}	1.0 (8.8)	°C/W
24. Thermal Time Constant	τ_{th}	960	s
25. Weight		122 (4.34)	g (oz)
26. Rotor Inertia	J	8.71	g-cm ²
27. Hall Sensor Electrical Pinning		120	Exceeds 1"

with hall effect sensors	
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3.5 to 24V
Yellow	GND
Orange	Sensor 1
Red	Sensor 2
Brown	Sensor 3
Black	Thermistor (+)
White	Thermistor (-)

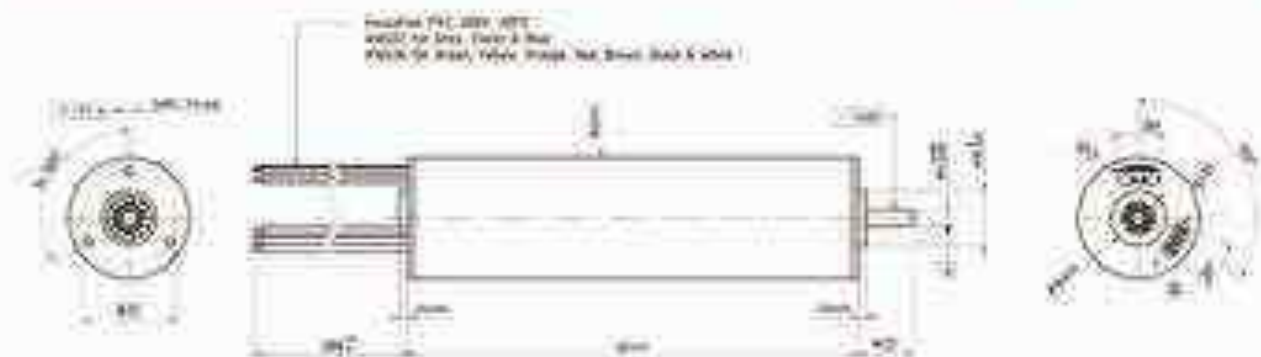


22ECT82 Ultra EC™

4 pole

Φ22mm

104VV



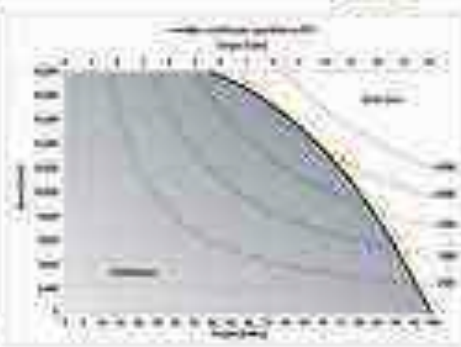
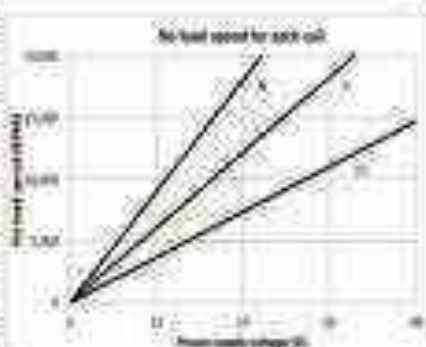
Discussion of the study

22ECT02 108 .44

		24	24	24	V08
1. Terminal Voltage	U_n				
2. Optimization Direction		Symmetrical	Symmetrical	Symmetrical	
3. No-Load Speed	n_0	18,950	12,500	7,800	rpm
4. Typical No-load Current	I_0	435	250	130	mA
5. Max Continuous Mechanical Power (@25°C)	P_{con}	104	104	104	W
6. Max Continuous Current	I_{con}	7.8	5.2	3.2	A
7. Max Continuous Torque	M_{con}	68.4 (30.94)	68.8 (14)	66.5 (13.92)	mNm (oz-in)
8. Back EMF Constant	K_b	1.30	1.06	1.22	V/1000 rpm
9. Torque Constant	k_t	12.4	15.7	30.8	mNm/A
10. Motor Regulation	$R/\%$	0.8	0.8	0.6	10 ³ A/m
11. Motor Regulation	k/R^2	35.8 (5.1)	35.9 (5.1)	35 (5.1)	mNm/W ² (oz-in/W ²)
12. Internal Resistance - Phase to Phase	R_s	0.13	0.27	0.73	ohm
13. Line To Line Resistance At Connectors	R_L	0.16	0.20	0.76	ohm
14. Inductance Phase To Phase	L	0.02	0.03	0.09	mH
15. Mechanical Time Constant	τ_m	1.1	1.0	1.0	ms
16. Electrical Time Constant	τ_e	0.12	0.13	0.13	ms

17 Maximum Motor Speed	n_{max}	20,000	rpm
18 Ambient Working Temperature Range		-30 to +100 (-22 to +212)	°C (°F)
19 Ambient Storage Temperature Range		-40 to +100 (-40 to +212)	°C (°F)
20 Ball Bearings Preload		0.8	N
21 Axial Blade Force w/o Shaft Support (max)		48.0	N
22 Maximum Winding Temperature		125 (257)	°C (°F)
23 Thermal Resistance	R_{JA}, R_{JS}	1.6 / 0.2	°C/W
24 Thermal Time Constant	τ_{θ}	3.140	s
25 Weight		0.74 (0.14)	g (oz)
26 Rotor Inertia	J	15.57	g·cm ²
27 Full Service Electrical Pressure		120	Electrical [®]

with half effect sensors	
Gray	Phase 1
Violet	Phase 2
Blue	Phase 3
Green	3.5 to 24V
Yellow	GN1
Orange	Sensor 1
Red	Sensor 2
Brown	Sensor 3
Black	Thermistor (+)
White	Thermistor (-)

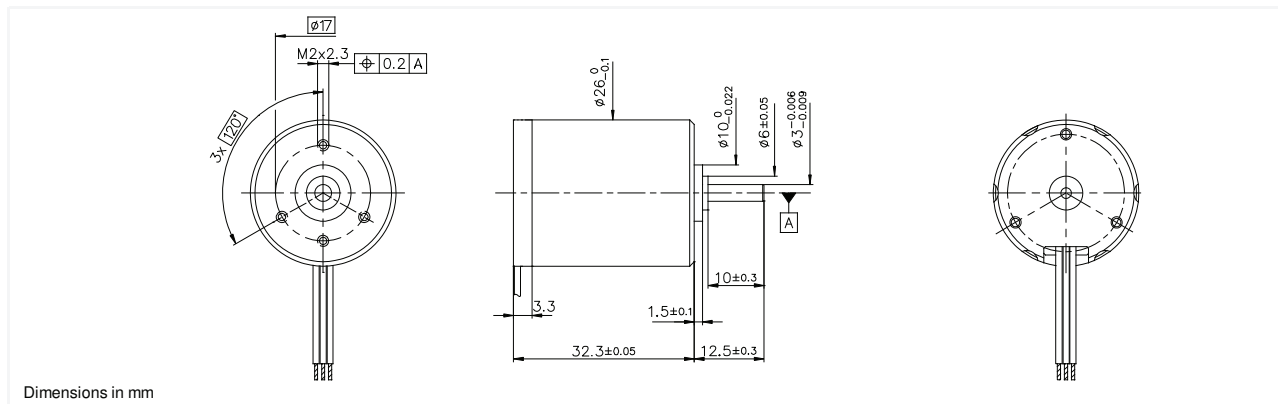


26BC 3C

2 pole

Ø26mm

8 W

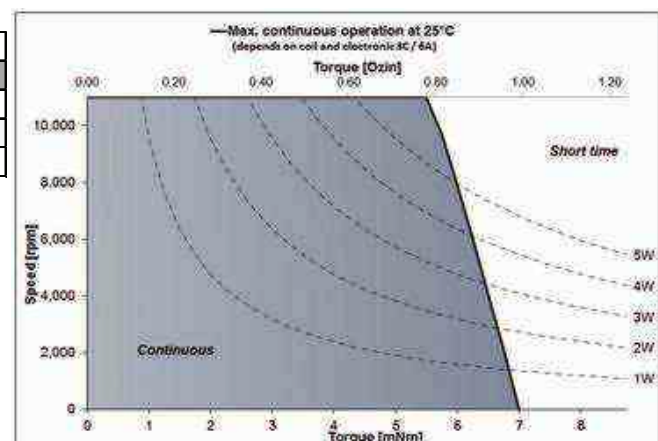


26BC 3C - **

Electrical Data		**	109P	
1	Nominal Voltage	U_N	12	Volt
2	Optimization Direction	-	n.a.	-
3	No-Load Speed	n_0	14,800	rpm
4	Typical No-Load Current	I_0	180.0	mA
5	Max Continuous Mechanical Power (@25 °C)	P_{max}	8.0	W
6	Max Continuous Current	$I_{e max}$	0.8	A
7	Max Continuous Torque	$M_{e max}$	7 (1)	mNm (oz-in)
8	Back EMF Constant	K_E	0.73	V/1000 rpm
9	Torque Constant	k_M	7.0	mNm/A
10	Motor Regulation	R/k^2	102.0	$10^3/Nms$
11	Motor Regulation	$k/R^{1/2}$	3.1 (0.44)	$mNm/W^{1/2}$ (oz-in/ $W^{1/2}$)
12	Internal Resistance - phase to phase	R_I	5.00	ohms
13	Line to Line Resistance at Connectors	R_L	5.00	ohms
14	Inductance Phase to Phase	L	0.09	mH
15	Mechanical Time Constant	t_m	95.0	ms
16	Electrical Time Constant	t_e	0.02	ms

General Data				
17	Maximum Motor Speed	n_{max}	20,000	rpm
18	Ambient Working Temperature Range	-	0 to + 70 (+32 to +158)	°C (°F)
19	Ambient Storage Temperature Range	-	0 to + 70 (+32 to +158)	°C (°F)
20	Ball Bearings Preload	-	5.0	N
21	Axial Static Force w/o Shaft Support (max)	-	45.0	N
22	Maximum Winding Temperature	-	125 (257)	°C (°F)
23	Thermal Resistance	R_{th}	14.0	°C/W
24	Thermal Time Constant	t_w	660	s
25	Weight	-	72 (2.54)	g (oz)
26	Rotor Inertia	J	9.400	$g.cm^2$
27	Hall Sensor Electrical Phasing	-	NA	Electrical °

sensorless	
Wire	Description
Grey	Phase 1
Violet	Phase 2
Blue	Phase 3



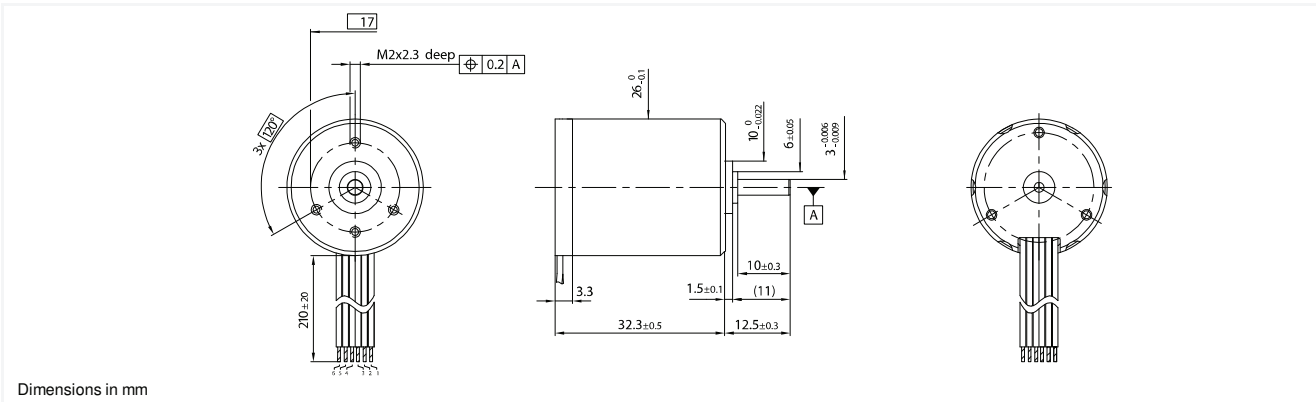
V121616

26BC 6A

2 pole

Ø26mm

4.5 W

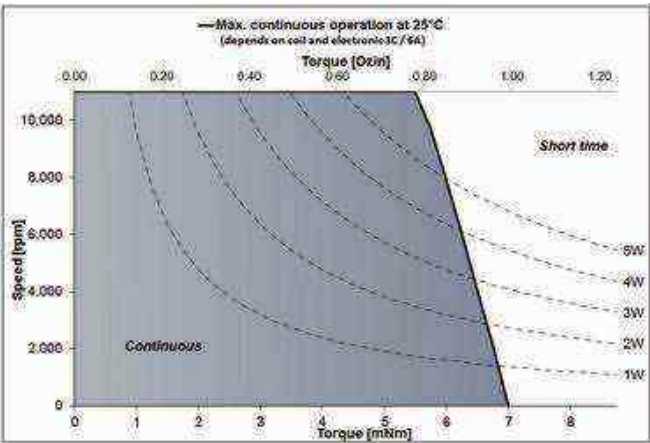


26BC 6A - **

Electrical Data	**	119	113	110	107	
1 Nominal Voltage	U_N	7.5	7.5	15	15	Volt
2 Optimization Direction	-	Symetrical	Symetrical	Symetrical	Symetrical	-
3 No-Load Speed	n_0	12,500	7,250	9,300	4,700	rpm
4 Typical No-Load Current	I_0	250.0	170.0	120.0	50.0	mA
5 Max Continuous Mechanical Power (@25°C)	P_{max}	4.5	4.5	4.5	4.5	W
6 Max Continuous Current	$I_{e\ max}$	1.2	0.6	0.4	0.2	A
7 Max Continuous Torque	$M_{e\ max}$	4 (0.57)	4.2 (0.6)	4.4 (0.63)	4 (0.57)	mNm (oz-in)
8 Back EMF Constant	K_E	0.56	0.96	1.40	2.66	V/1000 rpm
9 Torque Constant	k_M	5.4	9.2	13.4	25.4	mNm/A
10 Motor Regulation	R/k^2	65.2	80.3	98.0	107.0	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	3.92 (0.56)	3.53 (0.5)	3.19 (0.46)	3.06 (0.44)	mNm/W ^{1/2} (oz-in/W ^{1/2})
12 Internal Resistance - phase to phase	R_i	1.90	6.80	17.60	69.00	ohms
13 Line to Line Resistance at Connectors	R_L	1.90	6.80	17.60	69.00	ohms
14 Inductance Phase to Phase	L	0.03	0.12	0.32	1.23	mH
15 Mechanical Time Constant	t_m	61.0	75.0	92.0	100.0	ms
16 Electrical Time Constant	t_e	0.02	0.02	0.02	0.02	ms

General Data					
17 Maximum Motor Speed	n_{max}	14,000			rpm
18 Ambient Working Temperature Range	-	0 to + 70 (+32 to +158)			°C (°F)
19 Ambient Storage Temperature Range	-	0 to + 70 (+32 to +158)			°C (°F)
20 Ball Bearings Preload	-	5.0			N
21 Axial Static Force w/o Shaft Support (max)	-	45.0			N
22 Maximum Winding Temperature	-	125 (257)			°C (°F)
23 Thermal Resistance	R_{th}	14.0			°C/W
24 Thermal Time Constant	t_w	660			s
25 Weight	-	72 (2.54)			g (oz)
26 Rotor Inertia	J	9.400			g.cm ²
27 Hall Sensor Electrical Phasing	-	NA			Electrical °

integrated electronics	
Wire	Description
Brown	Ground
Red	Power supply voltage(2.5 - 18 V)
Orange	Direction CCW/CW
Yellow	Enable start / stop
Green	Logic supply voltage(5 - 18 V)
Blue	Speed signal

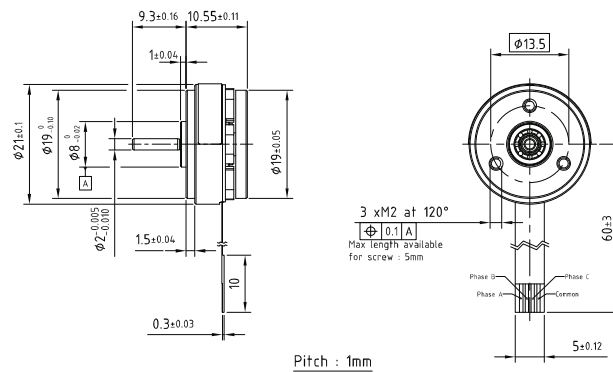


21BF nuvoDisc™

8 pole

Ø21mm

4 W



Dimensions in mm

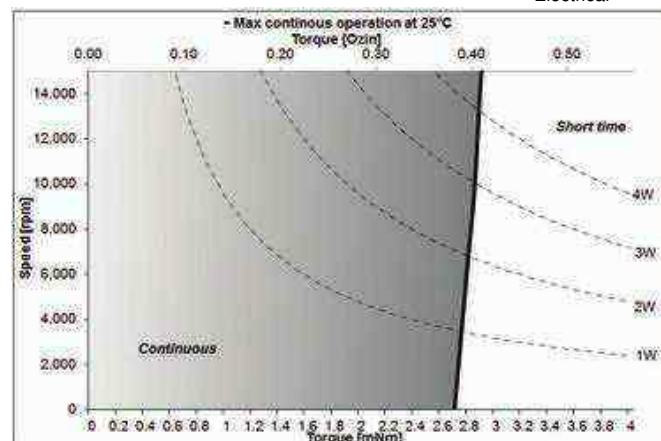
21BF 3C - **

Electrical Data	**	K	
1 Nominal Voltage	U_N	5	Volt
2 Optimization Direction	-	n.a.	-
3 No-Load Speed	n_0	3,900	rpm
4 Typical No-Load Current	I_0	28.0	mA
5 Max Continuous Mechanical Power (@25°C)	P_{max}	4.0	W
6 Max Continuous Current	$I_e max$	0.3	A
7 Max Continuous Torque	$M_e max$	2.7 (0.39)	mNm (oz-in)
8 Back EMF Constant	K_E	0.89	V/1000 rpm
9 Torque Constant	k_M	8.5	mNm/A
10 Motor Regulation	R/k^2	784.0	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	1.1 (0.16)	$mNm/W^{1/2}$ (oz-in/ $W^{1/2}$)
12 Internal Resistance - phase to phase	R_i	56.30	ohms
13 Line to Line Resistance at Connectors	R_L	56.30	ohms
14 Inductance Phase to Phase	L	1.22	mH
15 Mechanical Time Constant	t_m	141.2	ms
16 Electrical Time Constant	t_e	0.02	ms

General Data

17 Maximum Motor Speed	n_{max}	25000	rpm
18 Ambient Working Temperature Range	-	-30 to +80 (-22 to +176)	°C (°F)
19 Ambient Storage Temperature Range	-	-40 to +80 (-40 to +176)	°C (°F)
20 Ball Bearings Preload	-	2.70	N
21 Axial Static Force w/o Shaft Support (max)	-	27.00	N
22 Maximum Winding Temperature	-	125 (257)	°C (°F)
23 Thermal Resistance	R_{th1}/R_{th2}	12.00	°C/W
24 Thermal Time Constant	t_w	200.00	s
25 Weight	-	10 (0.36)	g (oz)
26 Rotor Inertia	J	1.80	$g \cdot cm^2$
27 Hall Sensor Electrical Phasing	-	NA	Electrical °

sensorless	
Wire	Description
Common connection	center point of Y winding



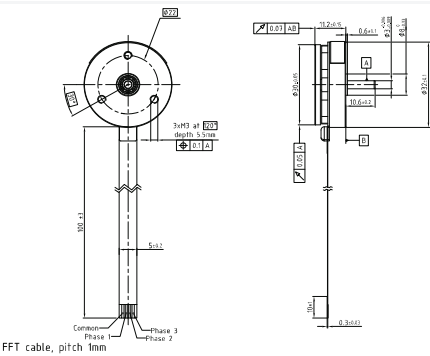
V121616

32BF nuvoDisc™

8 pole

Ø32mm

40 W



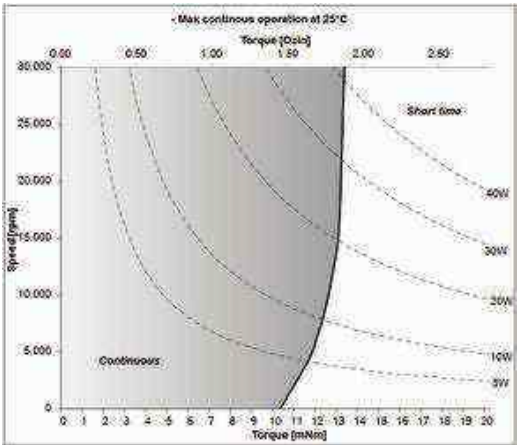
Dimensions in mm

32BF 3C - ** 32BF 8B - **

Electrical Data	**	K	
1 Nominal Voltage	U_N	12	Volt
2 Optimization Direction	-	Symetrical	-
3 No-Load Speed	n_0	13,600	rpm
4 Typical No-Load Current	I_0	100.0	mA
5 Max Continuous Mechanical Power (@25°C)	P_{max}	40.0	W
6 Max Continuous Current	$I_{e max}$	1.5	A
7 Max Continuous Torque	$M_{e max}$	13 (1.85)	mNm (oz-in)
8 Back EMF Constant	K_E	0.87	V/1000 rpm
9 Torque Constant	k_M	8.3	mNm/A
10 Motor Regulation	R/k^2	57.5	$10^3/Nms$
11 Motor Regulation	$k/R^{1/2}$	4.2 (0.6)	$mNm/W^{1/2}$ (oz-in/ $W^{1/2}$)
12 Internal Resistance - phase to phase	R_i	3.95	ohms
13 Line to Line Resistance at Connectors	R_L	3.95	ohms
14 Inductance Phase to Phase	L	0.12	mH
15 Mechanical Time Constant	t_m	64.9	ms
16 Electrical Time Constant	t_e	0.03	ms

General Data			
17 Maximum Motor Speed	n_{max}	30,000	rpm
18 Ambient Working Temperature Range	-	-30 to +80 (-22 to +176)	°C (°F)
19 Ambient Storage Temperature Range	-	-40 to +80 (-40 to +176)	°C (°F)
20 Ball Bearings Preload	-	2.7	N
21 Axial Static Force w/o Shaft Support (max)	-	27.0	N
22 Maximum Winding Temperature	-	125 (257)	°C (°F)
23 Thermal Resistance	R_{th}	13.0	°C/W
24 Thermal Time Constant	t_w	550	s
25 Weight	-	27 (0.96)	g (oz)
26 Rotor Inertia	J	11.300	$g \cdot cm^2$
27 Hall Sensor Electrical Phasing	-	120	Electrical °

with hall effect sensors	
Wire	Description
VDD connection	3.5 to 27V DC
sensorless	
Wire	Description
Common connection	center point of Y winding



Motors For Surgical Applications

Epitomizing the exceptional quality of the Portescap brand, our application specific surgical motors are designed to meet the specialized performance requirements of high-precision powered surgical hand tools. With 20 years of experience designing and manufacturing motors for surgical applications, we know how speed, torque and efficiency affect the performance of powered surgical hand tools. Portescap's autoclavable brushless DC motors, designed to provide high torque in a lightweight ergonomic package, excel at meeting the requirements for exceptional surgical results, and have the robustness to withstand sterilization and exposure to saline.



Spine Drills



ENT Microdebridors



Arthroscopic Shavers

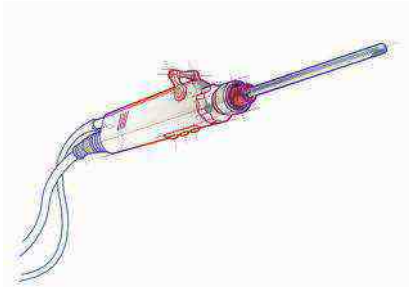


Large Bone Drills



Application Specific Motors For Powered Surgical Hand Tools

Portescap designs and manufactures mini motors for various medical applications, including arthroscopic shavers, large bone orthopedic drills, ENT microdebriders, ENT drills, high-speed spine and neuro drills, and more.



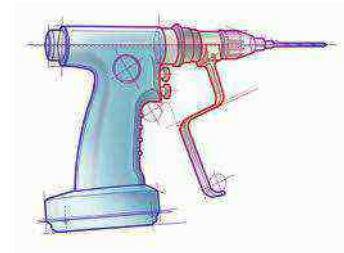
Arthroscopic joint shavers

Arthroscopic procedures require high torque, speed and efficiency. Portescap BLDC motors are an ideal solution for powered surgical hand tools used in minimally invasive surgical procedures to repair joints such as the hip, knee, and shoulder.



ENT microdebriders

Optimized for ENT microdebrider (ENT shaver) applications, motor torque and speed make Portescap motors an ideal solution for powered surgical hand tools used in minimally invasive surgical procedures of the ear, nose and throat. Also see our ENT drill motor for high-speed drilling applications.



Large bone orthopedic drills

Orthopedic surgery procedures require high torque, speed and efficiency. Portescap BLDC motors enable the design of lightweight and powerful orthopedic drills, screwdrivers and reamers used in joint replacement procedures.

Working with You to Save, Improve and Enhance Lives

Motor performance tailored to your application requirements

High and low volume manufacturing

Samples available upon request

Vertically integrated design and manufacturing

Contact us for more information about our application specific surgical motors or to review requirements of your surgical application.

North America Sales.america@portescap.com

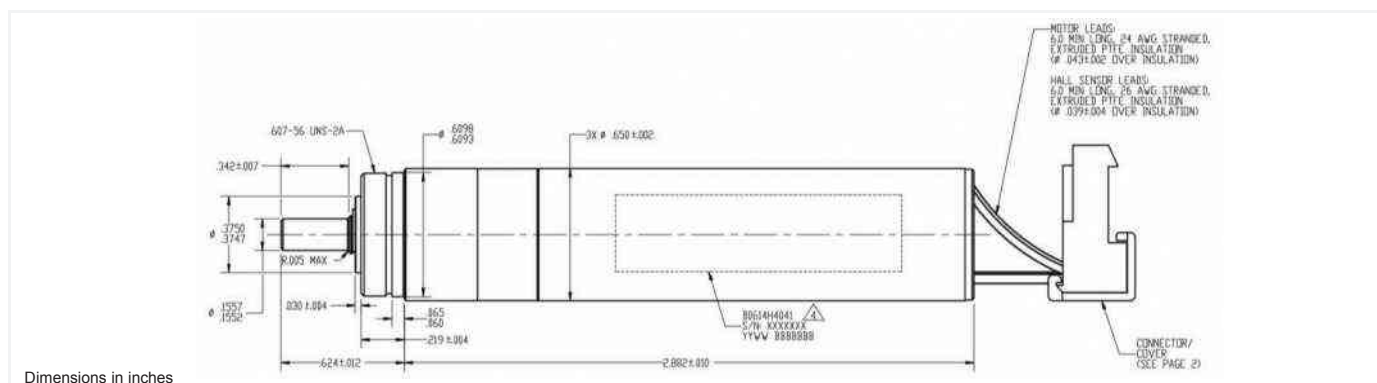
South America Vendas@portescap.com

Europe, Middle East, Africa Sales.europe@portescap.com

Asia, India Sales.asia@portescap.com

ARTHROSCOPIC JOINT SHAVER – Brushless Slotted

Ø 0.65 in.



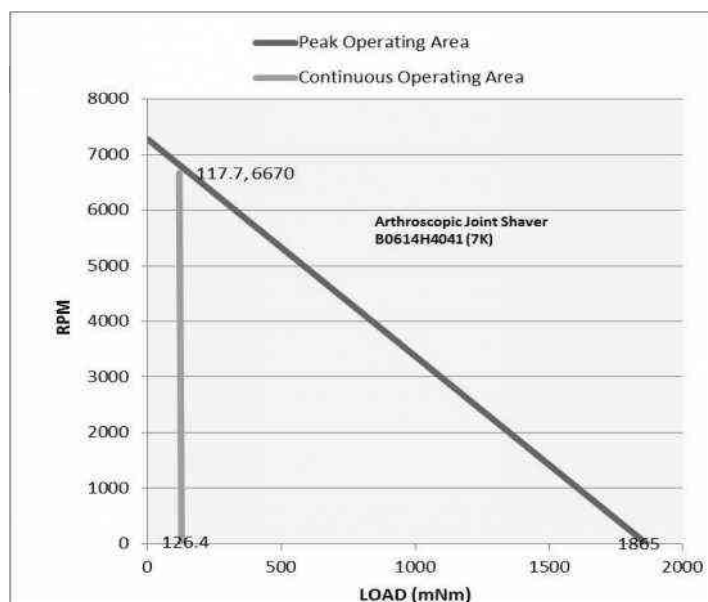
B0614H4041

Electrical Data	Part Number	B0614H4041	Units
1 Nominal Voltage	U_N	24	Volt
2 Max No-Load Current ($\pm 50\%$)	I_{nl}	645	mA
3 No-Load Speed	W_{nl}	7,277	rpm
4 Resistance - Phase to Phase	R	0.36	ohm
5 Continuous Stall Torque	T_{cs}	117.7 (16.7)	mNm (oz-in)
6 Continuous Stall Current	I_{cs}	4.37	A
7 Peak Torque for 1s	T_{pk}	1865 (264)	mNm (oz-in)
8 Peak Current	I_{pk}	66.0	A
9 Back EMF Constant	K_e	3.300	v/1000 rpm
10 Torque Constant	K_t	31.38 (4.44)	mNm/A (oz.-in/A)
11 Motor Regulation $R/K_t \cdot 2$	-	0.4	$10^3/Nms$
12 Motor Regulation $K_t/R \cdot 1/2$	-	52.3	mNm/W $^{1/2}$
13 Inductance - Phase to Phase	L	0.060	mH @1Khz
General Data			
14 Thermal Resistance (winding to ambient)	R_{th}	12.5	$^{\circ}C/W$
15 Thermal Time Constant	t_w	950	s
16 Mechanical Time Constant	t_m	2.50	ms
17 Electrical Time Constant	t_e	0.16	ms
18 Rotor Inertia	J	12.56 (17.8)	$kgm^2 \cdot 10^{-8}$ (oz-in-sec $^2 \cdot 10^{-6}$)
19 Max Winding Temperature	-	155 (311)	$^{\circ}C (^{\circ}F)$
20 Shaft Load Max.: radial (static)	-	63.0 (14.2), @ 5mm from front of bearing	N (lb)
axial (static)	-	30.56 (6.87)	N (lb)
21 Mass	M	107 (3.8)	g (oz)
22 Length	L	73.3 (2.9)	mm (in)
23 Tolerances	-	Tolerances on all values $\pm 10\%$ unless otherwise specified.	

Lead color	Function
Blue	Phase A
Brown	Phase B
Violet	Phase C
Red	4.5 to 24 vdc
Yellow	Hall 1
Orange	Hall 2
White	Hall 3
Black	Supply RTN

Notes

- Solution includes a BLDC motor and 6:1 gearhead
- Three phase motor with Wye connections
- Designed for sterilization in an autoclavable
- Hall sensors: supply voltage 4.5V - 24V
- Typical housing material 303 SS
- Typical shaft material 17-4 PH
- Motor is RoHS Compliant
- Above parameters specified for 25 Deg C ambient temperature



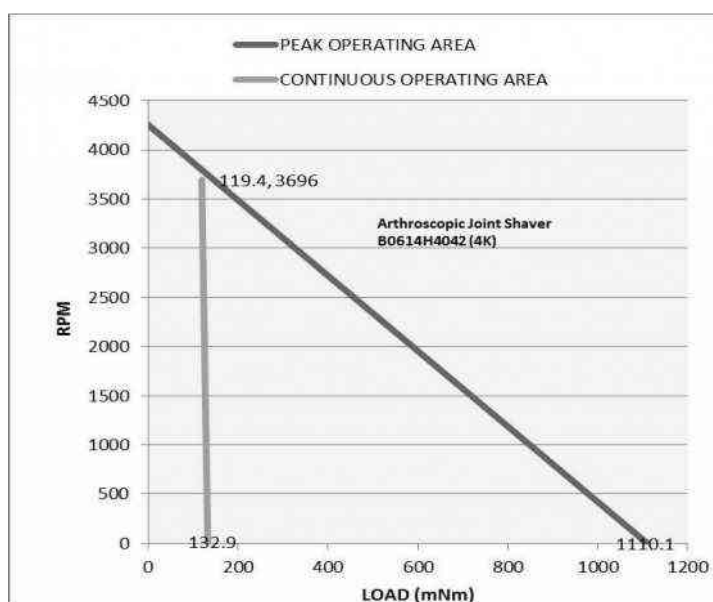
Ø 0.65 in.



Electrical Data		Part Number	B0614H4042	Units
1	Nominal Voltage	U _N	24	Volt
2	Max No-Load Current (±50%)	I _{nl}	600	mA
3	No-Load Speed	W _{nl}	4,255	rpm
4	Resistance - Phase to Phase	R	1.03	ohm
5	Continuous Stall Torque	T _{cs}	119.4 (16.9)	mNm (oz-in)
6	Continuous Stall Current	I _{cs}	2.59	A
7	Peak Torque for 1s	T _{pk}	1110.1 (157.2)	mNm (oz-in)
8	Peak Current	I _{pk}	22.9	A
9	Back EMF Constant	K _e	5.640	v/1000 rpm
10	Torque Constant	K _t	53.88 (7.62)	mNm/A (oz.-in/A)
11	Motor Regulation R/Kt ²	-	0.4	10 ⁹ Nms
12	Motor Regulation Kt/R ^{1/2}	-	53.1	mNm/W ^{1/2}
13	Inductance - Phase to Phase	L	0.180	mH @1Khz
General Data				
14	Thermal Resistance (winding to ambient)	R _{th}	12.5	°C/W
15	Thermal Time Constant	t _w	950	s
16	Mechanical Time Constant	t _m	2.43	ms
17	Electrical Time Constant	t _e	0.17	ms
18	Rotor Inertia	J	12.56 (17.8)	kgm ² 10 ⁻⁸ (oz-in-sec ² 10 ⁻⁶)
19	Max Winding Temperature	-	155 (311)	°C (°F)
20	Shaft Load Max.: radial (static)	-	63.0 (14.2), @ 5mm from front of bearing	N (lb)
	axial (static)	-	30.56 (6.87)	N (lb)
21	Mass	M	107 (3.8)	g (oz)
22	Length	L	73.3 (2.9)	mm (in)
23	Tolerances	-	Tolerances on all values ±10% unless otherwise specified.	

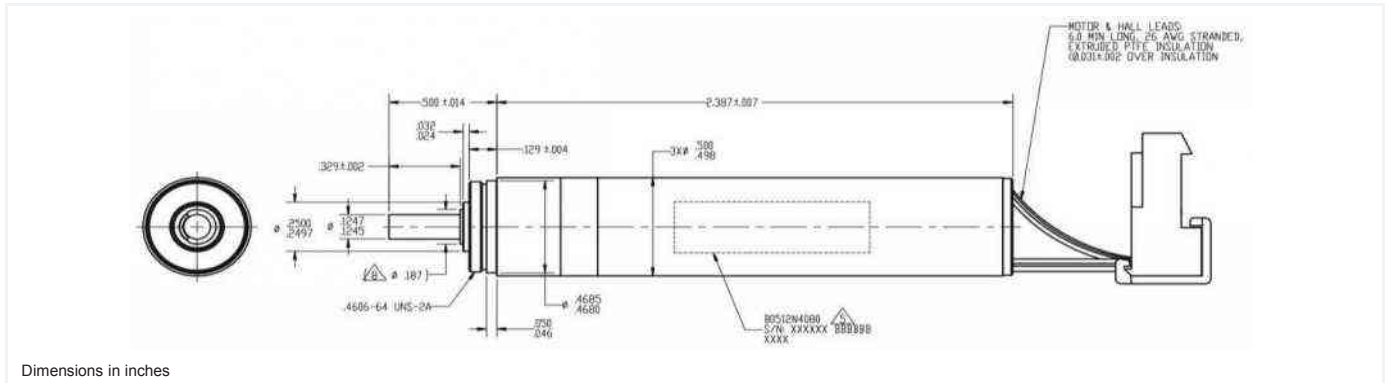
<u>Lead color</u>	<u>Function</u>
Blue	Phase A
Brown	Phase B
Violet	Phase C
Red	4.5 to 24 vdc
Yellow	Hall 1
Orange	Hall 2
White	Hall 3
Black	Supply RTN

- Solution includes a BLDC motor and 6:1 gearhead
- Three phase motor with Wye connections
- Designed for sterilization in an autoclavable
- Hall sensors: supply voltage 4.5V - 24V
- Typical housing material 303 SS
- Typical shaft material 17-4 PH
- Motor is RoHS Compliant
- Above parameters specified for 25 Deg C ambient temperature



ENT MICRODEBRIDER (24V) – Brushless Slotted

Ø 0.5 in.



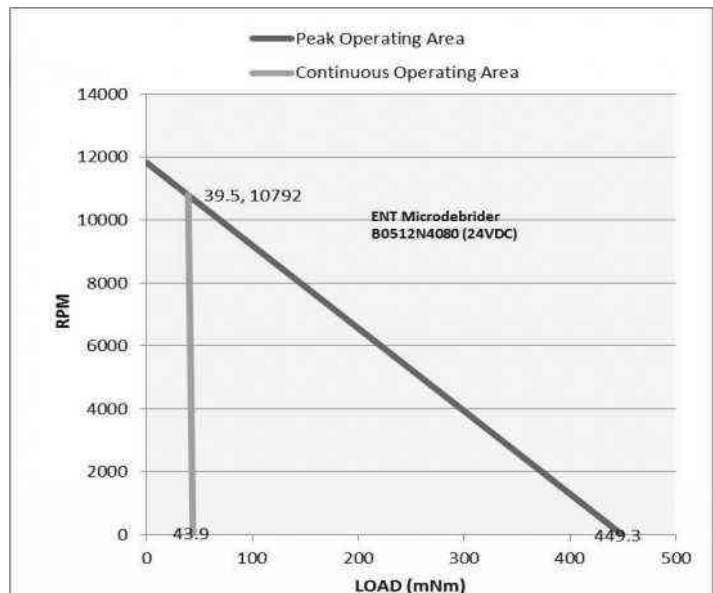
B0512N4080

Electrical Data		Part Number	B0512N4080	Units
1	Nominal Voltage	U_N	24	Volt
2	Max No-Load Current (±50%)	I_{nl}	855	mA
3	No-Load Speed	W_{nl}	11,829	rpm
4	Resistance - Phase to Phase	R	0.91	ohm
5	Continuous Stall Torque	T_{cs}	39.5 (5.6)	mNm (oz-in)
6	Continuous Stall Current	I_{cs}	2.44	A
7	Peak Torque for 1s	T_{pk}	449.3 (63.6)	mNm (oz-in)
8	Peak Current	I_{pk}	26.4	A
9	Back EMF Constant	K_e	1.980	v/1000 rpm
10	Torque Constant	K_t	18.9 (2.7)	mNm/A (oz.-in/A)
11	Motor Regulation $R/K_t I^2$	-	2.5	$10^9/Nms$
12	Motor Regulation $K_t/R I^2$	-	19.8	mNm/W $^{1/2}$
13	Inductance - Phase to Phase	L	0.062	mH @1Khz
General Data				
14	Thermal Resistance (winding to ambient)	R_{th}	15.9	°C/W
15	Thermal Time Constant	t_w	490	s
16	Mechanical Time Constant	t_m	3.03	ms
17	Electrical Time Constant	t_e	0.07	ms
18	Rotor Inertia	J	3.15 (4.46)	kgm 2 10 $^{-8}$ (oz-in-sec 2 10 $^{-6}$)
19	Max Winding Temperature	-	155 (311)	°C (°F)
20	Shaft Load Max.: radial (static)	-	19.25 (4.3), @ 5mm from front of bearing	N (lb)
	axial (static)	-	3.27 (0.74)	N (lb)
21	Mass	M	48 (1.7)	g (oz)
22	Length	L	61 (2.39)	mm (in)
23	Tolerances	-	Tolerances on all values ±10% unless otherwise specified.	

Lead color	Function
Blue	Phase A
Brown	Phase B
Violet	Phase C
Red	4.5 to 24 vdc
Yellow	Hall 1
Orange	Hall 2
White	Hall 3
Black	Supply RTN

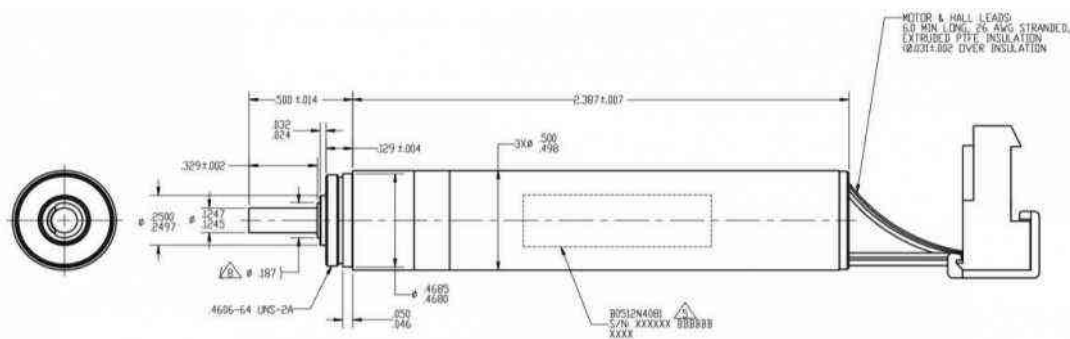
Notes

- Solution includes a BLDC motor and 5:1 gearhead
- Three phase motor with Wye connections
- Designed for sterilization in an autoclavable
- Hall sensors: supply voltage 4.5V - 24V
- Typical housing material 303 SS
- Typical shaft material 17-4 PH
- Motor is RoHS Compliant
- Above parameters specified for 25 Deg C ambient



ENT MICRODEBRIDER (48V) – Brushless Slotted

Ø 0.5 in.



Dimensions in inches

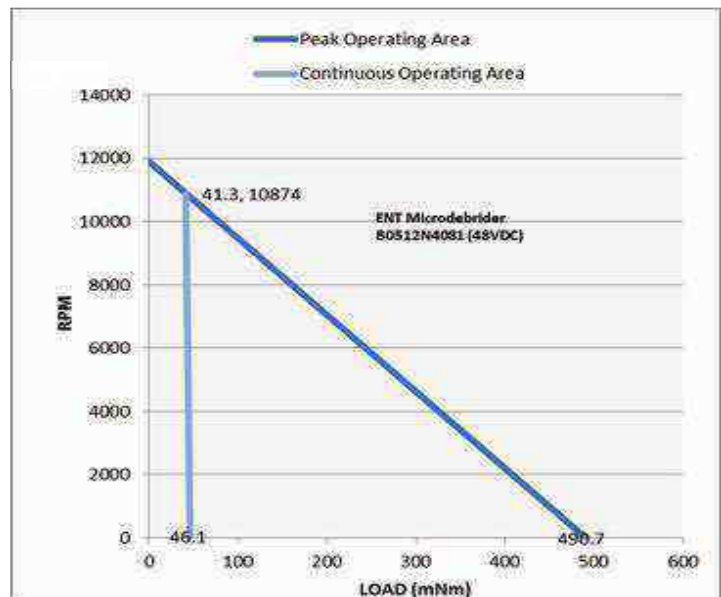
B0512N4081

Electrical Data	Part Number	B0512N4081	Units
1 Nominal Voltage	U_N	48	Volt
2 Max No-Load Current (±50%)	I_{nl}	375	mA
3 No-Load Speed	W_{nl}	11,910	rpm
4 Resistance - Phase to Phase	R	3.34	ohm
5 Continuous Stall Torque	T_{cs}	41.3 (5.9)	mNm (oz-in)
6 Continuous Stall Current	I_{cs}	1.27	A
7 Peak Torque for 1s	T_{pk}	490.7 (69.5)	mNm (oz-in)
8 Peak Current	I_{pk}	14.4	A
9 Back EMF Constant	K_e	3.965	v/1000 rpm
10 Torque Constant	K_t	37.85 (5.35)	mNm/A (oz.-in/A)
11 Motor Regulation R/K_t^2	-	2.3	10 ⁹ /Nms
12 Motor Regulation $K_t/R^{1/2}$	-	20.7	mNm/W ^{1/2}
13 Inductance - Phase to Phase	L	0.250	mH @1Khz
General Data			
14 Thermal Resistance (winding to ambient)	R_{th}	15.9	°C/W
15 Thermal Time Constant	t_w	490	s
16 Mechanical Time Constant	t_m	2.77	ms
17 Electrical Time Constant	t_e	0.07	ms
18 Rotor Inertia	J	3.15 (4.46)	kgm ² 10 ⁻⁸ (oz-in-sec ² 10 ⁻⁶)
19 Max Winding Temperature	-	155 (311)	°C (°F)
20 Shaft Load Max.: radial (static)	-	19.25 (4.3), @ 5mm from front of bearing	N (lb)
axial (static)	-	3.27 (0.74)	N (lb)
21 Mass	M	48 (1.7)	g (oz)
22 Length	L	61 (2.39)	mm (in)
23 Tolerances	-	Tolerances on all values ±10% unless otherwise specified.	

Lead color	Function
Blue	Phase A
Brown	Phase B
Violet	Phase C
Red	4.5 to 24 vdc
Yellow	Hall 1
Orange	Hall 2
White	Hall 3
Black	Supply RTN

Notes

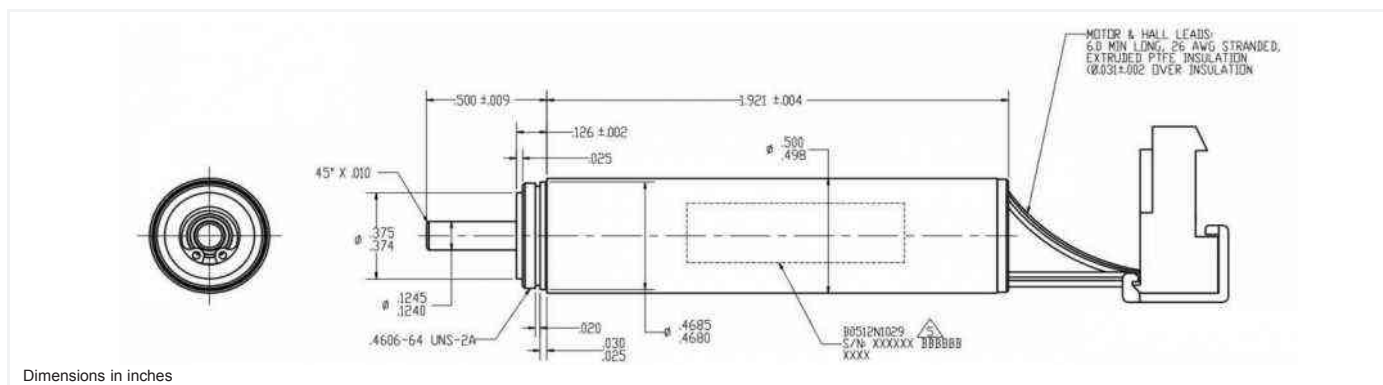
- Solution includes a BLDC motor and 5:1 gearhead
- Three phase motor with Wye connections
- Designed for sterilization in an autoclavable
- Hall sensors: supply voltage 4.5V - 24V
- Typical housing material 303 SS
- Typical shaft material 17-4 PH
- Motor is RoHS Compliant
- Above parameters specified for 25 Deg C ambient temperature



V121616

SPINE DRILL – Brushless Slotted

Ø 0.5 in.



B0512N1029

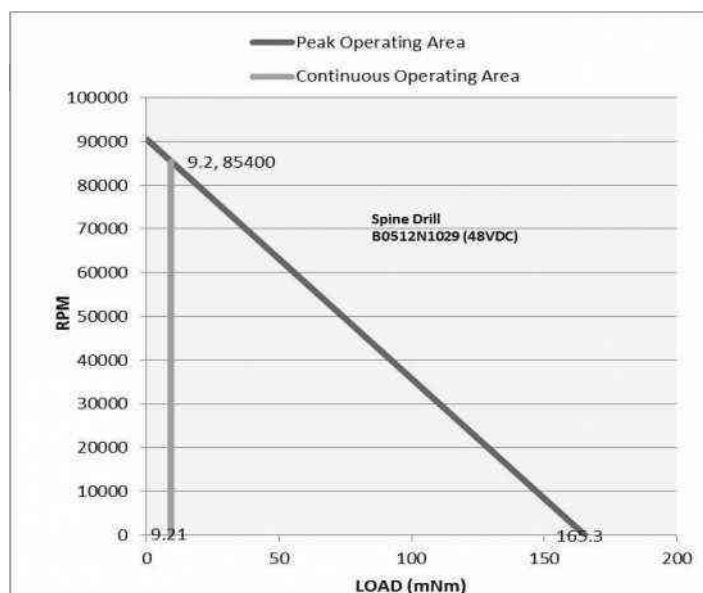
Electrical Data	Part Number	B0512N1029	Units
1 Nominal Voltage	U_N	48	Volt
2 Max No-Load Current (±50%)	I_{nl}	420	mA
3 No-Load Speed	W_{nl}	90,500	rpm
4 Resistance - Phase to Phase	R	1.46	ohm
5 Continuous Stall Torque	T_{cs}	9.2 (1.31)	mNm (oz-in)
6 Continuous Stall Current	I_{cs}	1.93	A
7 Peak Torque for 1s	T_{pk}	165.3 (23.4)	mNm (oz-in)
8 Peak Current	I_{pk}	32.8	A
9 Back EMF Constant	K_e	0.528	v/1000 rpm
10 Torque Constant	K_t	5.04 (0.71)	mNm/A (oz.-in/A)
11 Motor Regulation R/K_t^2	-	57.5	10 ³ /Nms
12 Motor Regulation $K_t/R^{1/2}$	-	4.2	mNm/W ^{1/2}
13 Inductance - Phase to Phase	L	0.110	mH @1Khz
General Data			
14 Thermal Resistance (winding to ambient)	R_{th}	15.9	°C/W
15 Thermal Time Constant	t_w	490	s
16 Mechanical Time Constant	t_m	2.73	ms
17 Electrical Time Constant	t_e	0.08	ms
18 Rotor Inertia	J	3.15 (4.46)	kgm ² 10 ⁻⁸ (oz-in-sec ² 10 ⁻⁶)
19 Max Winding Temperature	-	155 (311)	°C (°F)
20 Shaft Load Max.: radial (static)	-	41.22 (9.27) @ 5mm from front of bearing	N (lb)
axial (static)	-	0.01 (0.002)	N (lb)
21 Mass	M	38.5 (1.36)	g (oz)
22 Length L	L	48.8 (1.92)	mm (in)
23 Tolerances	-		

Tolerances on all values ±10% unless otherwise specified.

Lead color	Function
Blue	Phase A
Brown	Phase B
Violet	Phase C
Red	4.5 to 24 vdc
Yellow	Hall 1
Orange	Hall 2
White	Hall 3
Black	Supply RTN

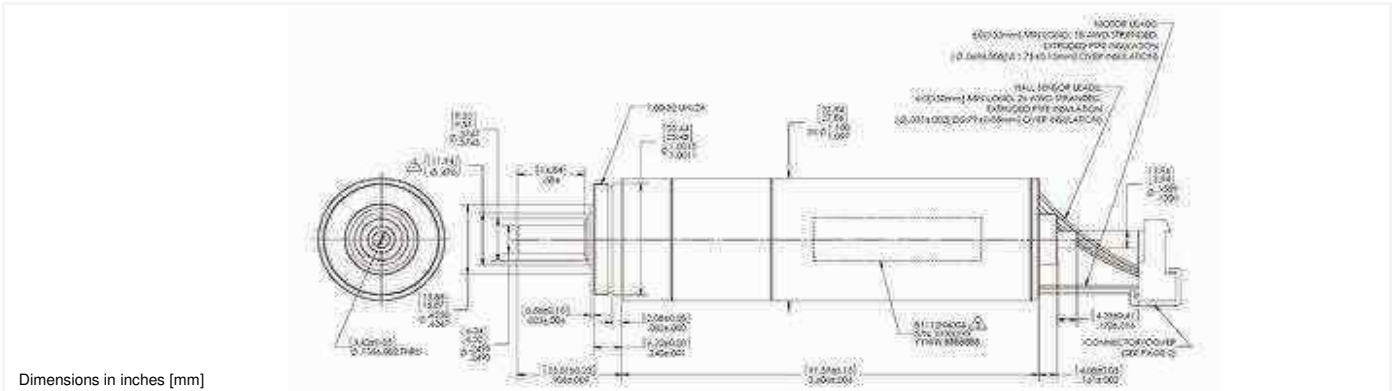
Notes

- Three phase motor with Wye connections
- Designed for sterilization in an autoclavable
- Hall sensors: supply voltage 4.5V - 24V
- Typical housing material 303 SS
- Typical shaft material 17-4 PH
- Motor is RoHS Compliant
- Above parameters specified for 25 Deg C ambient temperature



LARGE BONE DRILL – Brushless Slotted

Ø 1.1 in.



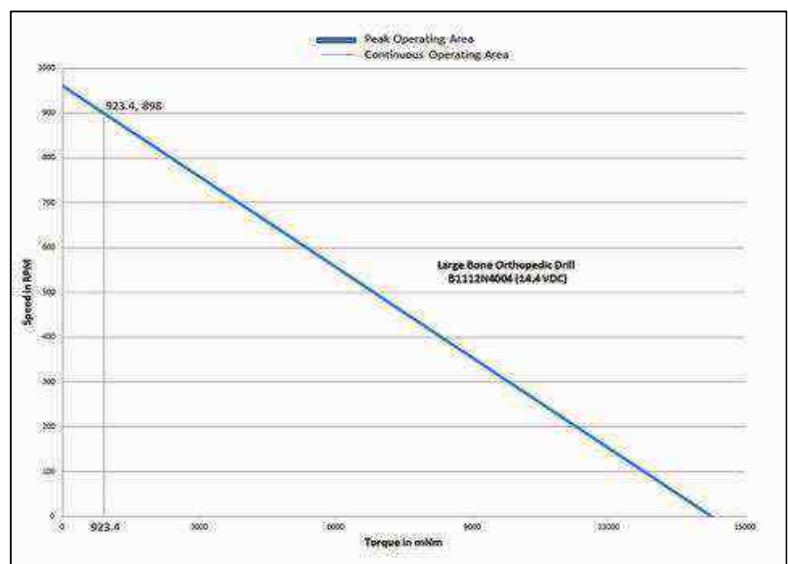
B1112N4004

Electrical Data		Part Number	B1112N4004	Units
1	Nominal Voltage	U_N	14.4	Volt
2	Max No-Load Current ($\pm 50\%$)	I_{nl}	900	mA
3	No-Load Speed	W_{nl}	957	rpm
4	Resistance - Phase to Phase	R	0.117	ohm
5	Continuous Stall Torque	T_{cs}	923.4 (130.8)	mNm (oz-in)
6	Continuous Stall Current	I_{cs}	9.29	A
7	Peak Torque for 1s	T_{pk}	14276 (2017.2)	mNm (oz-in)
8	Peak Current	I_{pk}	123.0	A
9	Back EMF Constant	K_e	14.990	v/1000 rpm
10	Torque Constant	K_t	116.0 (16.4)	mNm/A (oz.-in/A)
11	Motor Regulation R/K_t^2	-	0.0087	$10^3/Nms$
12	Motor Regulation $K_t/R^{1/2}$	-	339.0	mNm/W $^{1/2}$
13	Inductance - Phase to Phase	L	0.061	mH @1Khz
General Data				
14	Thermal Resistance (winding to ambient)	R_{th}	8.3	$^{\circ}C/W$
15	Thermal Time Constant	t_w	900	s
16	Mechanical Time Constant	t_m	1.85	ms
17	Electrical Time Constant	t_e	0.52	ms
18	Rotor Inertia	J	84.74 (120.0)	$kgm^2 \cdot 10^{-8}$ (oz-in-sec $^2 \cdot 10^{-6}$)
19	Max Winding Temperature	-	155 (311)	$^{\circ}C$ ($^{\circ}F$)
20	Shaft Load Max.: radial (static)	-	101.31 (22.77) , @ 5mm from front of bearing	N (lb)
	axial (static)	-	55.34 (12.44)	N (lb)
21	Mass	M	350 (12.4)	g (oz)
22	Length L	L	91.6 (3.61)	mm (in)
23	Tolerances	-	Tolerances on all values $\pm 10\%$ unless otherwise specified.	

Lead color	Function
Blue	Phase A
Brown	Phase B
Violet	Phase C
Red	4.5 to 24 vdc
Yellow	Hall 1
Orange	Hall 2
White	Hall 3
Black	Supply RTN

Notes

- Three phase motor with Wye connections
- Designed for sterilization in an autoclavable
- Hall sensors: supply voltage 4.5V - 24V
- Typical housing material 303 SS
- Typical shaft material 17-4 PH
- Motor is RoHS Compliant
- Above parameters specified for 25 Deg C ambient temperature



V121616



Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



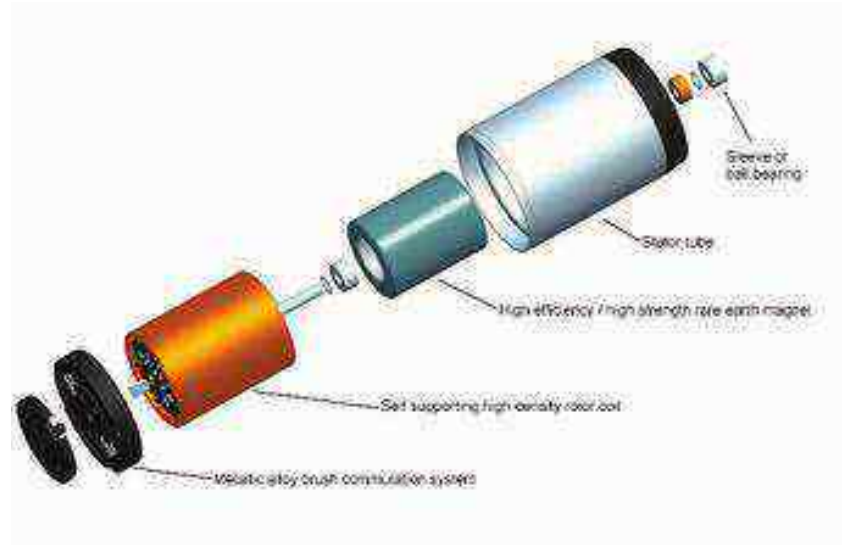
Gearheads



Encoders

Brush DC Motors

Featuring a permanent magnet, coreless design, our brush DC motors deliver high efficiency and power density in a small, lightweight package. Built of high-quality materials for optimal performance, these motors offer a low moment of inertia, low friction and a long commutator life. They're perfect for compact applications requiring high acceleration, torque and efficiency, with no cogging.



Compact, Efficient, Versatile Performance

Feature	Details	Application Advantages
Ultra-compact design	<ul style="list-style-type: none"> • Exceptional power density • High torque-to-volume ratio • Lightweight • Excellent heat dissipation 	<ul style="list-style-type: none"> • Greater design flexibility • User comfort and convenience in handheld applications
Coreless rotor	<ul style="list-style-type: none"> • Ironless, self-supporting coil • Minimal air gaps • No inactive coil heads 	<ul style="list-style-type: none"> • High acceleration, low moment of inertia • Low friction, low starting voltage • No cogging • No iron losses
Precious metal commutation system	<ul style="list-style-type: none"> • Low contact resistance, low friction • Available with REE coils 	<ul style="list-style-type: none"> • Low no-load current, low starting voltage • Reduced electro erosion for longer brush lifetime
Graphite-copper commutation	<ul style="list-style-type: none"> • High current carrying capacity • Available with REE coils 	<ul style="list-style-type: none"> • Perfect for boost in start-stop applications or incremental motions • Reduced electro erosion for longer brush lifetime
Neodymium permanent magnet	<ul style="list-style-type: none"> • High magnetic flux • Exceptional resistance to demagnetization 	<ul style="list-style-type: none"> • High power and efficiency in a small, lightweight package • Linear speed-torque curve • Consistent power density over the motor lifetime
Alnico permanent magnet	<ul style="list-style-type: none"> • Medium magnetic flux 	<ul style="list-style-type: none"> • Low magnetic flux leakage • Cost-effective • Linear speed-torque curve • Consistent power density over the motor lifetime



Ideal for Small, Portable and Handheld Devices



Medical devices & clinical diagnostics

- Laboratory automation
- Infusion systems
- Insulin pumps
- Diagnostic analyzers
- Miniature pumps



Instrumentation

- Dosing & dispensing systems
- Gas detection
- Land surveying
- Microscopes
- Explosive trace detection systems



Automation

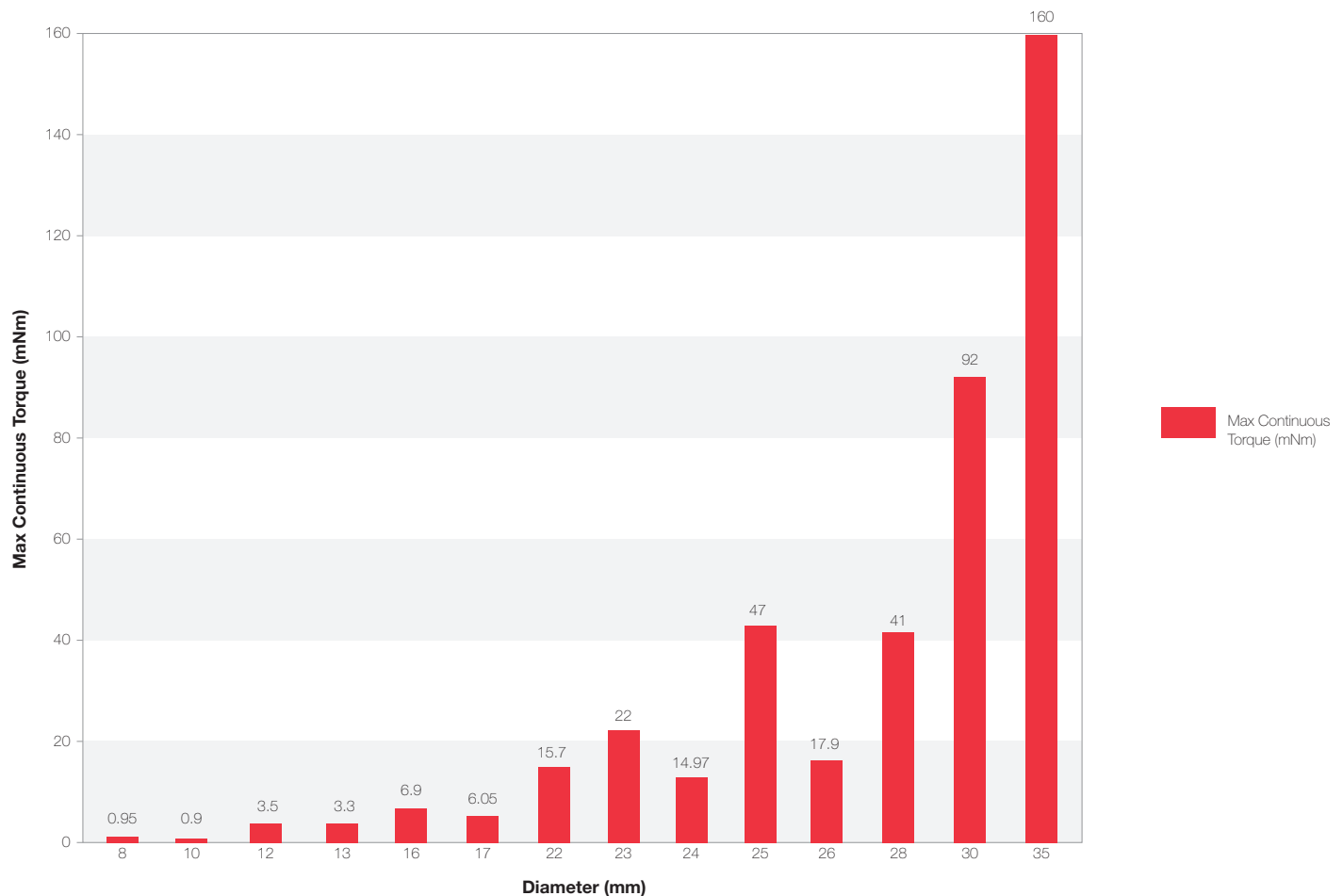
- Humanoid robots



Other

- Power hand tools
- Rotary tattoo machines
- Valve actuation

Meet your Application's Working Point Requirements



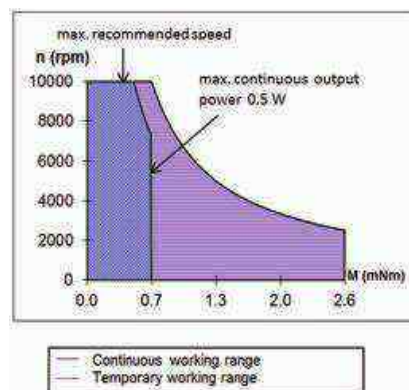
For complete product and application details, visit portescap.com/brush-dc

0.65 mNm



08GS61 **,3**

Execution Table	
Gearbox	Single Shaft
R10	7
R08	Upon Request

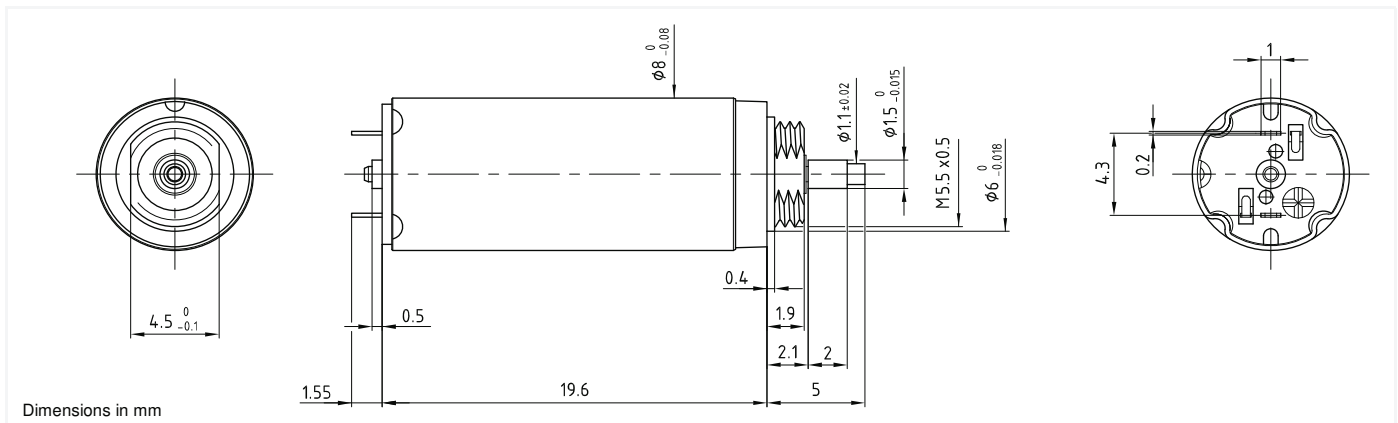


08G61

Precious metal commutation

Ø8mm

0.95 mNm

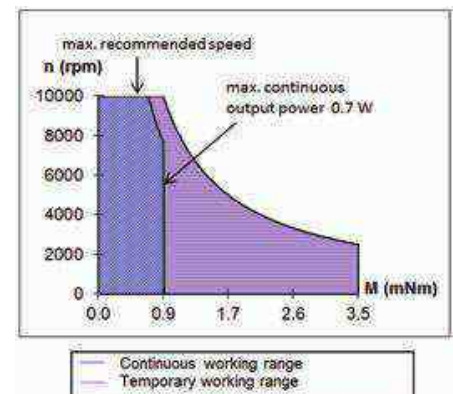


08G61 **** .3

Electrical Data		****	107	205C	
1	Nominal Voltage	V	3	9	Volt
2	No-Load Speed	n_0	9,780	11,760	rpm
3	No-Load Current	I_0	6.0	2.5	mA
4	Terminal Resistance	R	11.8	54.0	Ω
5	Output Power	$P_{2max.}$	0.6	0.7	W
6	Stall Torque	mNm	0.73 (0.11)	1.2 (0.17)	mNm (oz-in)
7	Efficiency	$\eta_{max.}$	72	77	%
8	Max Continuous Speed	$n_{e max.}$	10,000	10,000	rpm
9	Max Continuous Torque	$M_{e max.}$	0.8 (0.14)	0.95 (0.14)	mNm (oz-in)
10	Max Continuous Current	$I_{e max.}$	0.29	0.13	A
11	Back-EMF Constant	k_E	0.30	0.75	mV/rpm
12	Torque Constant	k_M	2.86	7.20	mNm/A
13	Motor Regulation	R/k^2	1,440.0	1,040.0	$10^3/Nms$
14	Friction Torque	T_F	0.02 (0.01)	0.02 (0.01)	mNm (oz-in)
15	Rotor Inductance	L	0.03	0.16	mH
16	Mechanical Time Constant	t_m	5.0	3.6	ms
17	Rotor Inertia	J	0.04	0.04	$g.cm^2$
General Data					
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	18/85		$^{\circ}C/W$
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	5/100		S
20	Operating Temperature Range:	motor	-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
		rotor	100 $^{\circ}C$ (212 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
21	Shaft Load Max.:		With sleeve bearings		
	(2 mm from bearing)	-radial	0.5 (1.8)		N (oz)
		-axial	30 (107.9)		N (oz)
22	Shaft Play:	-radial	<0.015 (0.0006)		mm (inch)
		-axial	0.100 (0.0039)		mm (inch)
23	Weight	g	4.6 (0.17)		g (oz)

Execution Table

Gearbox	Single Shaft
R10	5
MR2	Upon Request



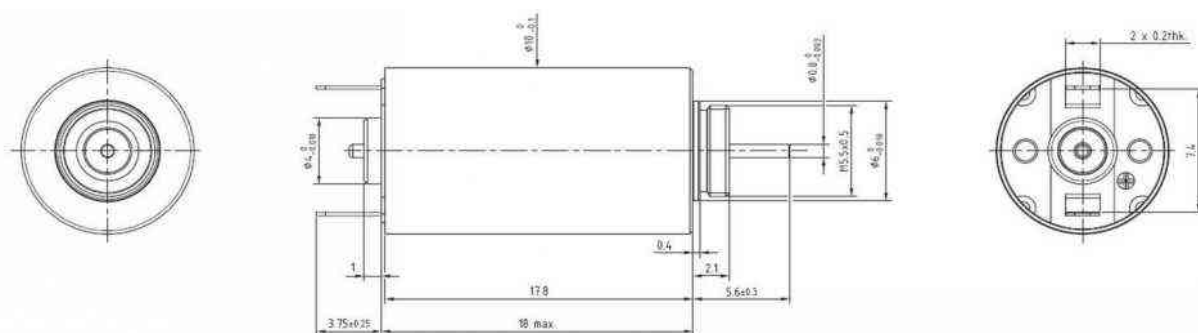
V121616

10NS61 Athlonix™

Precious metal commutation

Ø10mm

0.9 mNm

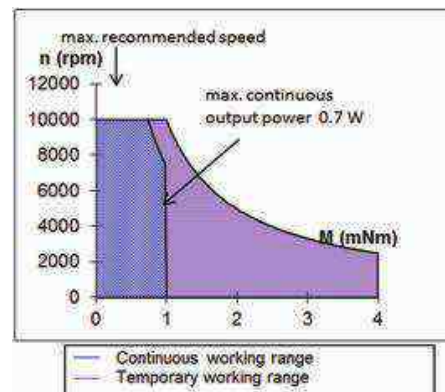


Dimensions in mm

10NS61 **** .5

Electrical Data	****	107C	105C	104C	
1 Nominal Voltage	V	3	6	9	Volt
2 No-Load Speed	n_0	10,100	10,400	10,700	rpm
3 No-Load Current	I_0	11.0	4.2	3.6	mA
4 Terminal Resistance	R	10.8	43.0	98.0	Ω
5 Output Power	P_{2max}	0.7	0.7	0.7	W
6 Stall Torque	mNm	0.76 (0.11)	0.75 (0.11)	0.71 (0.1)	mNm (oz-in)
7 Efficiency	η_{max}	64	68	64	%
8 Max Continuous Speed	$n_{e max}$	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max}$	0.9 (0.13)	0.9 (0.13)	0.85 (0.13)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	0.34	0.17	0.12	A
11 Back-EMF Constant	k_E	0.29	0.57	0.81	mV/rpm
12 Torque Constant	k_M	2.72	5.40	7.70	mNm/A
13 Motor Regulation	R/k^2	1,500.0	1,500.0	1,600.0	$10^3/Nms$
14 Friction Torque	T_F	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)	mNm (oz-in)
15 Rotor Inductance	L	0.01	0.02	0.03	mH
16 Mechanical Time Constant	t_m	7.3	7.3	8.1	ms
17 Rotor Inertia	J	0.05	0.05	0.05	g.cm ²
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	23/48			°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	5/150			S
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)			°C (°F)
	rotor	100 °C (212 °F)			°C (°F)
21 Shaft Load Max.:		With sleeve bearings			
(2 mm from bearing)	-radial	0.5 (1.8)			N (oz)
	-axial	30 (107.9)			N (oz)
22 Shaft Play:	-radial	<0.015 (0.0006)			mm (inch)
	-axial	0.100 (0.0039)			mm (inch)
23 Weight	g	16 (0.57)			g (oz)

Execution	
Gearbox	Single Shaft
R10	3

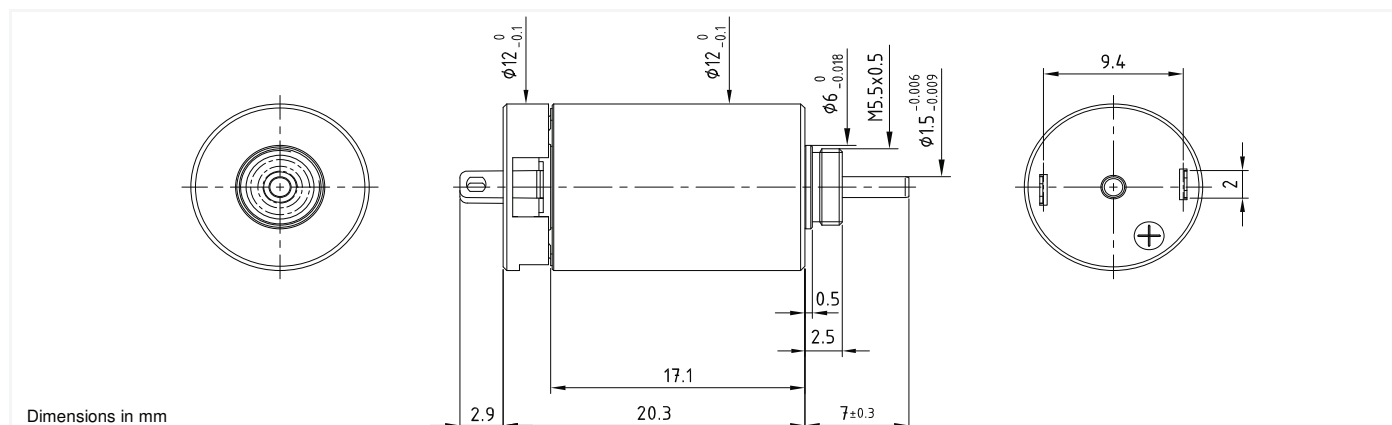


12GS88 Athlonix™

Precious metal commutation

Ø12mm

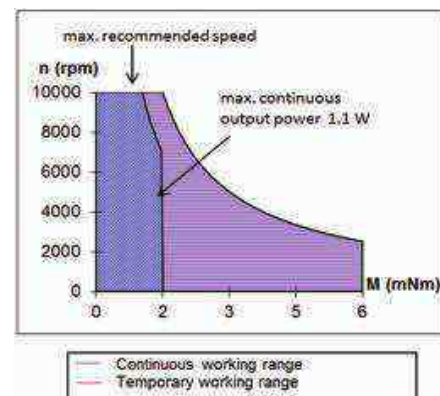
1.5 mNm

**12GS88 **** .1007**

Electrical Data		****	210E	208F	
1 Nominal Voltage	V		3	6	Volt
2 No-Load Speed	n_0		7,280	9,000	rpm
3 No-Load Current	I_0		14.0	12.0	mA
4 Terminal Resistance	R		7.4	20.6	Ω
5 Output Power	$P_{2max.}$		1.2	1.1	W
6 Stall Torque	mNm		1.54 (0.22)	1.78 (0.26)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$		66	64	%
8 Max Continuous Speed	$n_{e max.}$		10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$		1.51 (0.21)	1.45 (0.21)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$		0.41	0.25	A
11 Back-EMF Constant	k_E		0.40	0.64	mV/rpm
12 Torque Constant	k_M		3.80	6.10	mNm/A
13 Motor Regulation	R/k^2		512.0	550.0	$10^3/Nms$
14 Friction Torque	T_F		0.07 (0.01)	0.07 (0.01)	mNm (oz-in)
15 Rotor Inductance	L		0.09	0.25	mH
16 Mechanical Time Constant	t_m		9.7	12.0	ms
17 Rotor Inertia	J		0.19	0.21	$g.cm^2$
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		14/66		$^{\circ}C/W$
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		5/150		S
20 Operating Temperature Range:	motor		-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
	rotor		100 $^{\circ}C$ (212 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
21 Shaft Load Max.:			With sleeve bearings		
(5mm from bearing)	-radial		1.5 (5.4)		N (oz)
	-axial		150 (539.5)		N (oz)
22 Shaft Play:	-radial		<0.03 (0.0012)		mm (inch)
	-axial		0.15 (0.0059)		mm (inch)
23 Weight	g		13.5 (0.48)		g (oz)

Execution Table

Gearbox	Single Shaft	MR2
R10	Upon Request	Upon Request
R13	Upon Request	Upon Request



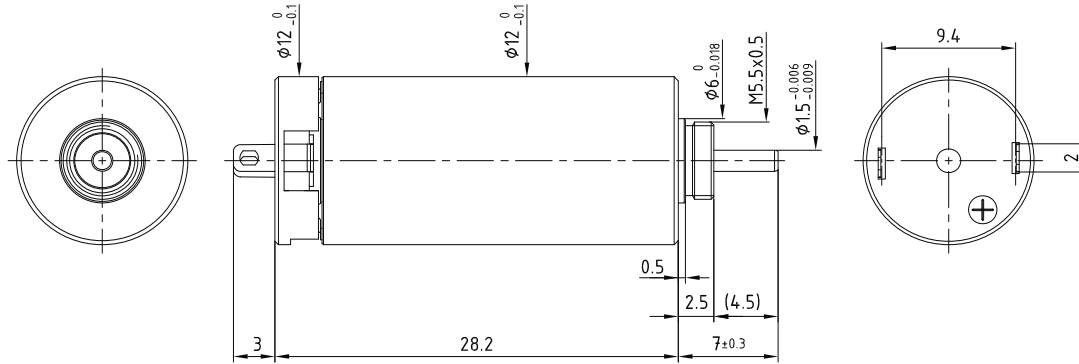
V121616

12G88 Athlonix™

Precious metal commutation

Ø12mm

3.5 mNm



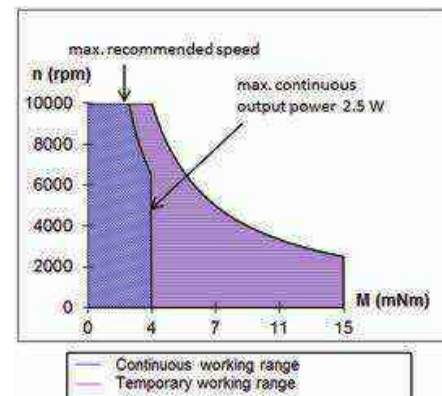
Dimensions in mm

12G88 **** .1001

Electrical Data		****	215E	210E	
1	Nominal Voltage	V	4.5	9	Volt
2	No-Load Speed	n_0	8,670	9,900	rpm
3	No-Load Current	I_0	16.0	9.0	mA
4	Terminal Resistance	R	3.2	12.3	Ω
5	Output Power	$P_{2max.}$	2.7	2.4	W
6	Stall Torque	mNm	6.8 (0.97)	6.3 (0.9)	mNm (oz-in)
7	Efficiency	$\eta_{max.}$	80	79	%
8	Max Continuous Speed	$n_{e max.}$	10,000	10,000	rpm
9	Max Continuous Torque	$M_{e max.}$	3.5 (0.44)	3.1 (0.44)	mNm (oz-in)
10	Max Continuous Current	$I_{e max.}$	0.73	0.37	A
11	Back-EMF Constant	k_E	0.51	0.90	mV/rpm
12	Torque Constant	k_M	4.90	8.60	mNm/A
13	Motor Regulation	R/k^2	130.0	170.0	$10^3/Nms$
14	Friction Torque	T_F	0.08 (0.02)	0.08 (0.02)	mNm (oz-in)
15	Rotor Inductance	L	0.08	0.25	mH
16	Mechanical Time Constant	t_m	3.8	4.3	ms
17	Rotor Inertia	J	0.29	0.26	g.cm ²
General Data					
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	10/50		°C/W
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	6/300		S
20	Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
		rotor	100 °C (212 °F)		°C (°F)
21	Shaft Load Max.:		With sleeve bearings		
	(5mm from bearing)	-radial	1.5 (5.4)		N (oz)
		-axial	150 (539.5)		N (oz)
22	Shaft Play:	-radial	<0.015 (0.0006)		mm (inch)
		-axial	0.300 (0.012)		mm (inch)
23	Weight	g	15 (0.53)		g (oz)

Execution Table

Gearbox	Single Shaft	MR2
R10	1003	1005
R13	1002	1004

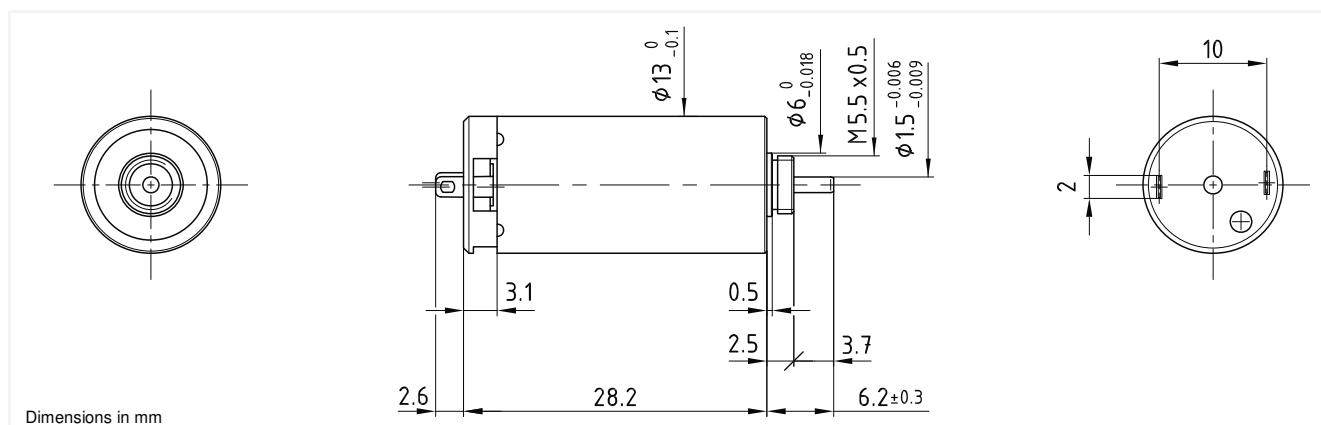


13N88

Precious metal commutation

Ø13mm

3.3 mNm



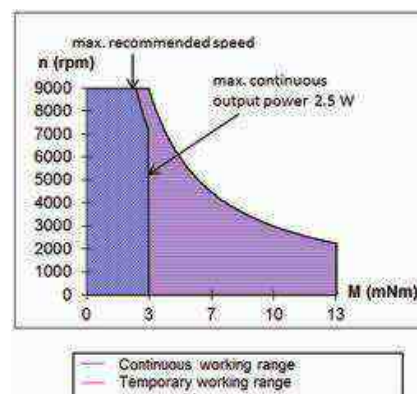
Dimensions in mm

13N88 ****.1

Electrical Data	****	213E	110	107	
1 Nominal Voltage	V	6	12	24	Volt
2 No-Load Speed	n_0	12,290	12,400	14,150	rpm
3 No-Load Current	I_0	25.6	13.6	8.8	mA
4 Terminal Resistance	R	4.2	13.7	47.4	Ω
5 Output Power	P_{2max}	2.4	2.6	2.5	W
6 Stall Torque	mNm	6.5 (0.93)	8 (1.14)	8.2 (1.17)	mNm (oz-in)
7 Efficiency	η_{max}	75	77	75	%
8 Max Continuous Speed	$n_{e max}$	9,000	9,000	9,000	rpm
9 Max Continuous Torque	$M_{e max}$	3 (0.47)	3.3 (0.47)	3.2 (0.46)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	0.69	0.38	0.21	A
11 Back-EMF Constant	k_E	0.48	0.95	1.67	mV/rpm
12 Torque Constant	k_M	4.58	9.10	15.90	mNm/A
13 Motor Regulation	R/k^2	200.0	165.0	185.0	$10^3/Nms$
14 Friction Torque	T_F	0.12 (0.02)	0.12 (0.02)	0.14 (0.02)	mNm (oz-in)
15 Rotor Inductance	L	0.07	0.25	0.80	mH
16 Mechanical Time Constant	t_m	5.6	5.5	5.3	ms
17 Rotor Inertia	J	0.28	0.33	0.29	g.cm ²
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		10/40		$^{\circ}C/W$
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		6/300		S
20 Operating Temperature Range:	motor		-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
	rotor		100 $^{\circ}C$ (212 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
21 Shaft Load Max.:			With sleeve bearings		
(5mm from bearing)	-radial		1.5 (5.4)		N (oz)
	-axial		150 (539.5)		N (oz)
22 Shaft Play:	-radial		<0.03 (0.0012)		mm (inch)
	-axial		0.15 (0.0059)		mm (inch)
23 Weight	g		18 (0.64)		g (oz)

Execution Table

Gearbox	13N88	13N88D12	MR2
R13	1	3	Upon Request
R16	Upon Request	Upon Request	Upon Request



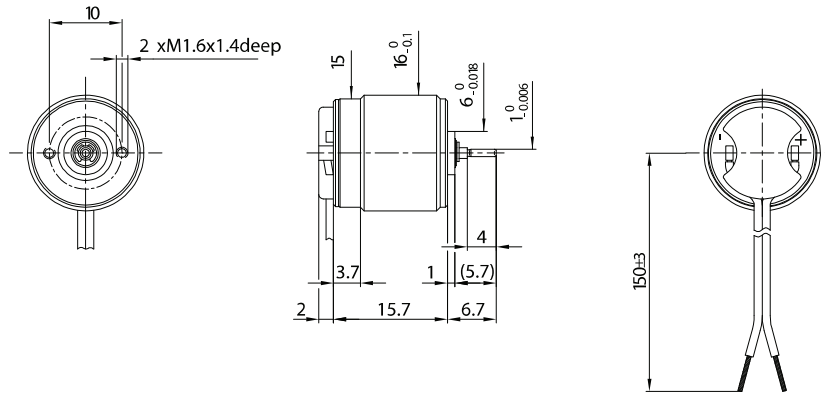
V121616

16C18

Precious metal commutation

Ø16mm

1.12 mNm



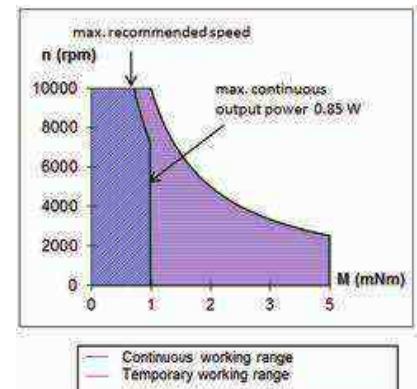
Dimensions in mm

16C18 **** .67

Electrical Data		****	115	210	207	205	204	
1	Nominal Voltage	V	1.5	4	6	12	15	Volt
2	No-Load Speed	n_0	15,300	14,700	15,700	16,200	16,000	rpm
3	No-Load Current	I_0	74.8	23.0	18.4	10.4	6.9	mA
4	Terminal Resistance	R	1.2	7.5	18.0	65.0	162.0	Ω
5	Output Power	P_{2max}	0.7	0.8	0.7	0.8	0.7	W
6	Stall Torque	mNm	1.1	1.3	1.1	1.2	0.8	mNm (oz-in)
7	Efficiency	η_{max}	57	63	59	58	53	%
8	Max Continuous Speed	$n_{e max}$	10,000	10,000	10,000	10,000	10,000	rpm
9	Max Continuous Torque	$M_{e max}$	0.98 (0.15)	1.12 (0.15)	1 (0.15)	1 (0.14)	0.79 (0.11)	mNm (oz-in)
10	Max Continuous Current	$I_{e max}$	1.19	0.48	0.31	0.16	0.10	A
11	Back-EMF Constant	k_E	0.09	0.26	0.36	0.70	0.87	mV/rpm
12	Torque Constant	k_M	0.88	2.48	3.44	6.68	8.30	mNm/A
13	Motor Regulation	R/k^2	1555.0	1220.0	1520.0	1460.00	2350.00	$10^3/Nms$
14	Friction Torque	T_F	0.07 (0.02)	0.06 (0.01)	0.06 (0.01)	0.07 (0.02)	0.06 (0.01)	mNm (oz-in)
15	Rotor Inductance	L	20.00	150.00	250.00	1000.00	1000.00	mH
16	Mechanical Time Constant	t_m	48.0	50.0	41.0	60.0	63.0	ms
17	Rotor Inertia	J	0.31	0.41	0.27	0.41	0.27	g.cm ²
General Data								
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}			15/40			°C/W
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}			4/230			S
20	Operating Temperature Range:	motor			-30 °C to 85 °C (-22 °F to 185 °F)			°C (°F)
		rotor			100 °C (212 °F)			°C (°F)
21	Shaft Load Max.:				With sleeve bearings			
	(5mm from bearing)	-radial			1.5 (5.4)			N (oz)
		-axial			100 (359.6)			N (oz)
22	Shaft Play:	-radial			<0.03 (0.0012)			mm (inch)
		-axial			0.15 (0.0059)			mm (inch)
23	Weight	g			14 (0.49)			g (oz)

Execution Table

Gearbox	Single Shaft	F16
B16	67	76
BA16	67	76
R16	67	76

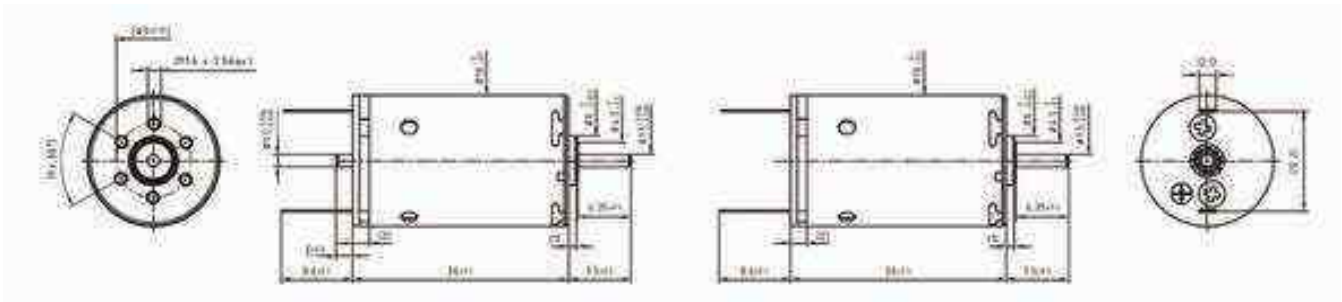


16DCP Athlonix™

Graphite-Copper commutation

Ø16mm

2.42 mNm



Dimensions in mm

16DCP 26G1/G2 **** .*

Electrical Data	****	211P	208P	209E	205P	
1 Nominal Voltage	V	3	6	9	12	Volt
2 No-Load Speed	n_0	7210	7543	7358	7179	rpm
3 No-Load Current	I_0	77.2	40.1	26.3	19.1	mA
4 Terminal Resistance	R	3.4	12.2	30.8	51.5	Ω
5 Output Power	$P_{2max.}$	1.2	1.2	1.2	1.3	W
6 Stall Torque	mNm	2.94 (0.42)	3.16 (0.45)	2.82 (0.4)	3.13 (0.45)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	50	51	49	51	%
8 Max Continuous Speed	$n_{e max.}$	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max.}$	2.33 (0.33)	2.36 (0.34)	2.25 (0.32)	2.42 (0.35)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	0.72	0.38	0.24	0.18	A
11 Back-EMF Constant	k_E	0.38	0.73	1.11	1.53	mV/rpm
12 Torque Constant	k_M	3.63	6.98	10.63	14.65	mNm/A
13 Motor Regulation	R/k^2	256.16	249.71	272.91	239.61	$10^3/Nms$
14 Friction Torque	T_F	0.25 (0.035)	0.25 (0.035)	0.25 (0.035)	0.25 (0.035)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	26.42	25.27	28.31	24.95	ms
16 Rotor Inertia	J	1.03	1.01	1.04	1.04	g.cm ²
General Data						
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	7/35				°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	6/380				S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30°C to 85°C (-22°F to 185°F)				°C (°F)
	rotor	100°C (212°F)				°C (°F)
20 Shaft Load Max.:		With sleeve bearings				
(5mm from bearing)	-radial	1.5 (5.39)				N (oz)
	-axial	100 (359.6)				N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
22 Weight	g	23 (0.82)				g (oz)

* Also available with ball bearing

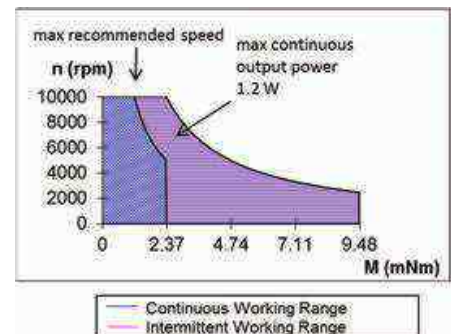
Execution Table

Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

G1:standard commutation

G2:special commutation for double shaft version



16DCP Athlonix™

Graphite-Copper commutation

Ø16mm

2.42 mNm



Dimensions in mm

16DCP 26G1/G2 **** .*

Electrical Data	****	107P	106P	205E	
1 Nominal Voltage	V	18	21	24	Volt
2 No-Load Speed	n_0	9184	8684	7489	rpm
3 No-Load Current	I_0	16.0	13.2	10.0	mA
4 Terminal Resistance	R	76.1	129.5	208.2	Ω
5 Output Power	P_{2max}	1.2	1.1	1.2	W
6 Stall Torque	mNm	3.84 (0.55)	3.16 (0.45)	2.94 (0.42)	mNm (oz-in)
7 Efficiency	η_{max}	55	51	50	%
8 Max Continuous Speed	$n_{e max}$	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max}$	2.36 (0.34)	2.18 (0.31)	2.28 (0.33)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	0.15	0.12	0.09	A
11 Back-EMF Constant	k_E	1.83	2.22	2.93	mV/rpm
12 Torque Constant	k_M	17.45	21.21	27.94	mNm/A
13 Motor Regulation	R/k^2	250.11	287.70	266.57	$10^3/Nms$
14 Friction Torque	T_F	0.25 (0.035)	0.25 (0.035)	0.25 (0.035)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	24.92	24.89	28.15	ms
16 Rotor Inertia	J	1.00	0.87	1.06	g.cm ²
General Data					
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		7/35		°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		6/380		S
19 Operating Temperature Range:	t_{w1}/t_{w2}		-30°C to 85°C (-22°F to 185°F)		°C (°F)
	rotor		100°C (212°F)		°C (°F)
20 Shaft Load Max.:			With sleeve bearings		
(5mm from bearing)	-radial		1.5 (5.39)		N (oz)
	-axial		100 (359.6)		N (oz)
21 Shaft Play:	-radial		0.03 (0.0012)		mm (inch)
	-axial		0.15 (0.0059)		mm (inch)
22 Weight	g		23 (0.82)		g (oz)

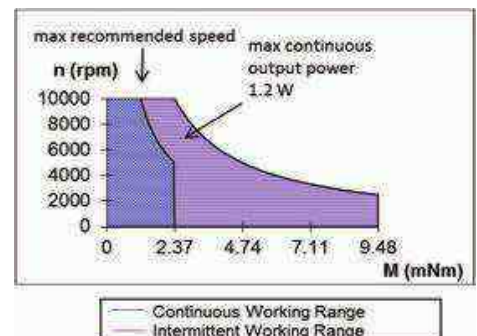
* Also available with ball bearing

Execution Table			
Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

G1:standard commutation

G2:special commutation for double shaft version

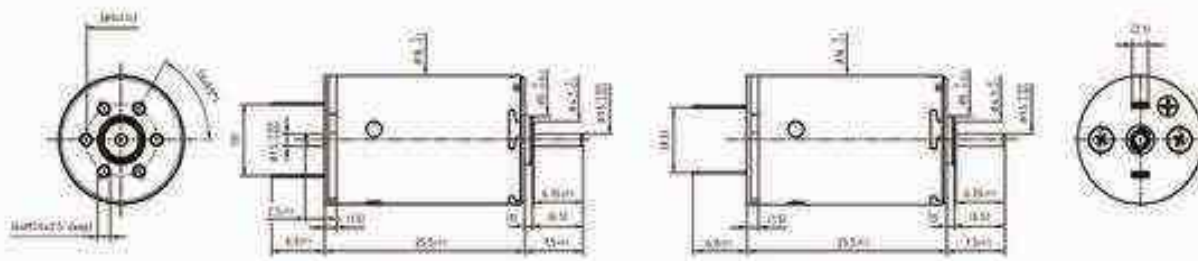


16DCP Athlonix™

Precious metal commutation

Ø16mm

2.63 mNm



Dimensions in mm

16DCP 26P1/P2 ****.*

Electrical Data	****	211P	208P	209E	205P	
1 Nominal Voltage	V	3	6	9	12	Volt
2 No-Load Speed	n_0	7727	8044	7904	7658	rpm
3 No-Load Current	I_0	19.4	10.1	6.6	4.8	mA
4 Terminal Resistance	R	3.3	12.1	30.7	51.4	Ω
5 Output Power	P_{2max}	1.4	1.4	1.3	1.4	W
6 Stall Torque	mNm	3.25 (0.47)	3.4 (0.49)	3.04 (0.44)	3.35 (0.48)	mNm (oz-in)
7 Efficiency	η_{max}	73	74	72	73	%
8 Max Continuous Speed	$n_{e max}$	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max}$	2.58 (0.37)	2.59 (0.37)	2.46 (0.35)	2.63 (0.38)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	0.73	0.38	0.24	0.18	A
11 Back-EMF Constant	k_E	0.38	0.73	1.11	1.53	mV/rpm
12 Torque Constant	k_M	3.63	6.98	10.63	14.65	mNm/A
13 Motor Regulation	R/k^2	248.57	247.65	272.02	239.14	$10^3/Nms$
14 Friction Torque	T_F	0.063 (0.009)	0.063 (0.009)	0.063 (0.009)	0.063 (0.009)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	25.64	25.06	28.22	24.90	ms
16 Rotor Inertia	J	1.03	1.01	1.04	1.04	g.cm ²
General Data						
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	7/35				°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	6/380				S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30°C to 85°C (-22°F to 185°F)				°C (°F)
	rotor	100°C (212°F)				°C (°F)
20 Shaft Load Max.:		With sleeve bearings				
(5mm from bearing)	-radial	1.5 (5.39)				N (oz)
	-axial	100 (359.6)				N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
22 Weight	g	23 (0.82)				g (oz)

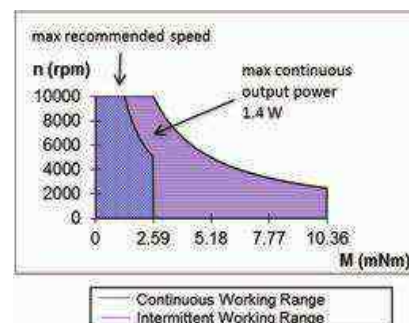
* Also available with ball bearing

Execution Table			
Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

P1:standard commutation

P2:special commutation for double shaft version

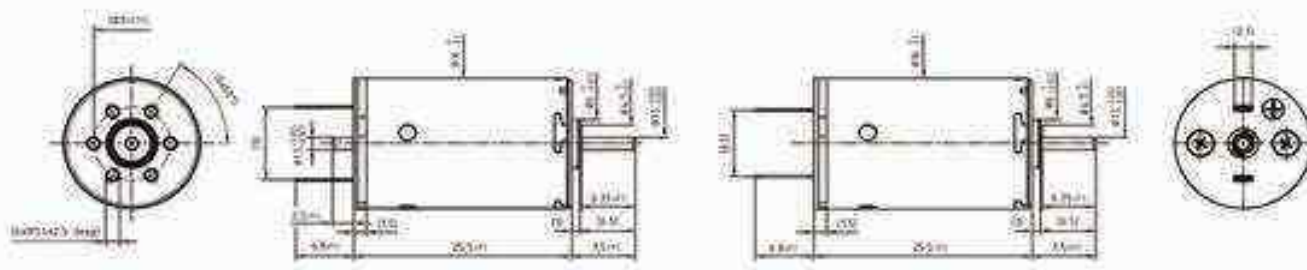


16DCP Athlonix™

Precious metal commutation

Ø16mm

2.63 mNm



Dimensions in mm

16DCP 26P1/P2 ****.*

Electrical Data	****	107P	106P	205E	
1 Nominal Voltage	V	18	21	24	Volt
2 No-Load Speed	n_0	9684	9259	8022	rpm
3 No-Load Current	I_0	4.0	3.3	2.5	mA
4 Terminal Resistance	R	76.0	129.4	208.1	Ω
5 Output Power	P_{2max}	1.4	1.3	1.3	W
6 Stall Torque	mNm	4.06 (0.58)	3.37 (0.48)	3.15 (0.45)	mNm (oz-in)
7 Efficiency	η_{max}	76	73	73	%
8 Max Continuous Speed	$n_{e max}$	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max}$	2.57 (0.37)	2.39 (0.34)	2.49 (0.36)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	0.15	0.12	0.09	A
11 Back-EMF Constant	k_E	1.83	2.22	2.93	mV/rpm
12 Torque Constant	k_M	17.45	21.21	27.94	mNm/A
13 Motor Regulation	R/k^2	249.78	287.47	266.44	$10^3/Nms$
14 Friction Torque	T_F	0.063 (0.009)	0.063 (0.009)	0.063 (0.009)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	24.89	24.87	28.14	ms
16 Rotor Inertia	J	1.00	0.87	1.06	$g \cdot cm^2$
General Data					
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	7/35			$^{\circ}C/W$
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	6/380			S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)			$^{\circ}C$ ($^{\circ}F$)
	rotor	100 $^{\circ}C$ (212 $^{\circ}F$)			$^{\circ}C$ ($^{\circ}F$)
20 Shaft Load Max.:		With sleeve bearings			
(5mm from bearing)	-radial	1.5 (5.39)			N (oz)
	-axial	100 (359.6)			N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)			mm (inch)
	-axial	0.15 (0.0059)			mm (inch)
22 Weight	g	23 (0.82)			g (oz)

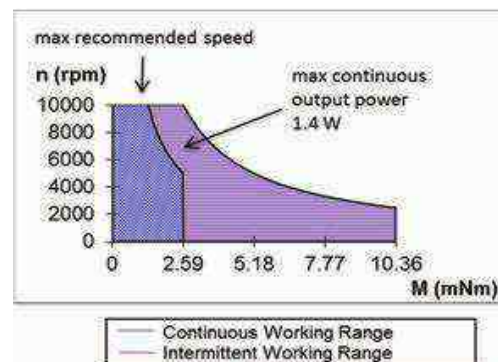
* Also available with ball bearing

Execution Table			
Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

P1:standard commutation

P2:special commutation for double shaft version

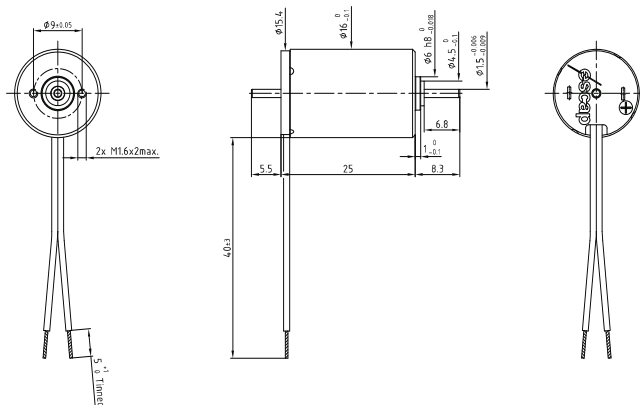


16NS78 Athlonix™

Precious metal commutation

Ø16mm

2.6 mNm

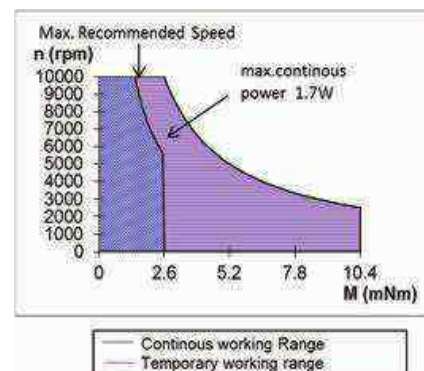


Dimensions in mm

16NS78 **** .1

Electrical Data		****	213E	212F	
1	Nominal Voltage	V	6	7.5	Volt
2	No-Load Speed	n_0	10,280	10,865	rpm
3	No-Load Current	I_0	25.0	18.0	mA
4	Terminal Resistance	R	7.5	12.2	Ω
5	Output Power	P_{2max}	1.7	1.6	W
6	Stall Torque	mNm	4.3	3.9	mNm (oz-in)
7	Efficiency	η_{max}	68	69	%
8	Max Continuous Speed	$n_{e max}$	10,000	10,000	rpm
9	Max Continuous Torque	$M_{e max}$	2.6 (0.34)	2.4 (0.34)	mNm (oz-in)
10	Max Continuous Current	$I_{e max}$	0.50	0.38	A
11	Back-EMF Constant	k_E	0.57	0.67	mV/rpm
12	Torque Constant	k_M	5.40	6.40	mNm/A
13	Motor Regulation	R/k^2	255.0	300.0	$10^3/Nms$
14	Friction Torque	T_F	0.12 (0.02)	0.12 (0.02)	mNm (oz-in)
15	Rotor Inductance	L	0.15	0.23	mH
16	Mechanical Time Constant	t_m	12.8	15.0	ms
17	Rotor Inertia	J	0.50	0.50	g.cm ²
General Data					
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	13/38		°C/W
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	7/400		S
20	Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
		rotor	100 °C (212 °F)		°C (°F)
21	Shaft Load Max.:		With sleeve bearings		
	(5mm from bearing)	-radial	1.5 (5.4)		N (oz)
		-axial	100 (359.6)		N (oz)
22	Shaft Play:	-radial	<0.03 (0.0012)		mm (inch)
		-axial	0.15 (0.0059)		mm (inch)
23	Weight	g	19 (0.68)		g (oz)

Execution Table		
Gearbox	Single Shaft	MR2
B16	3	Upon request
BA16	3	Upon request
R16	Upon request	Upon request

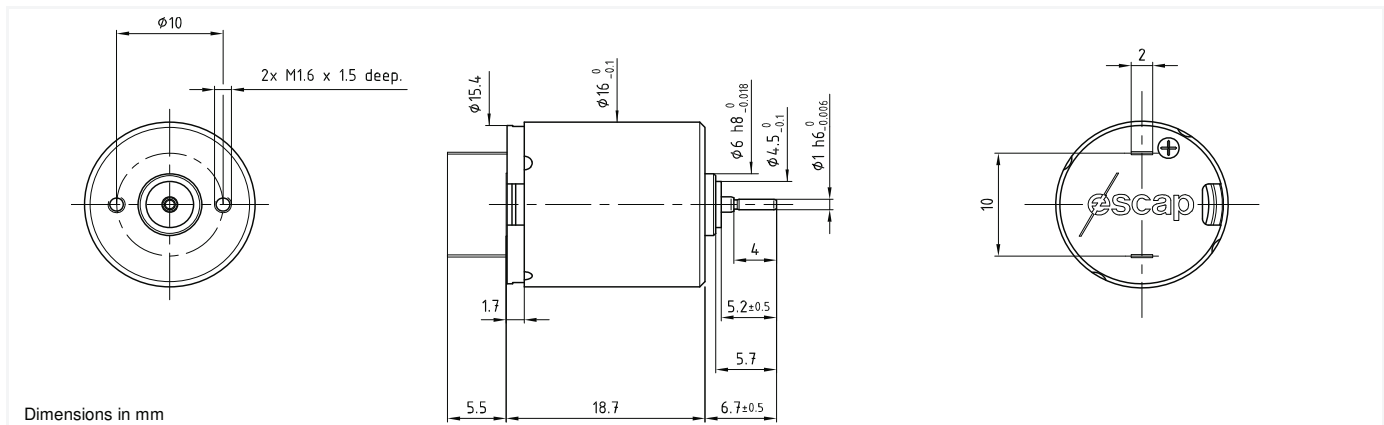


16S78 Athlonix™

Precious metal commutation

Ø16mm

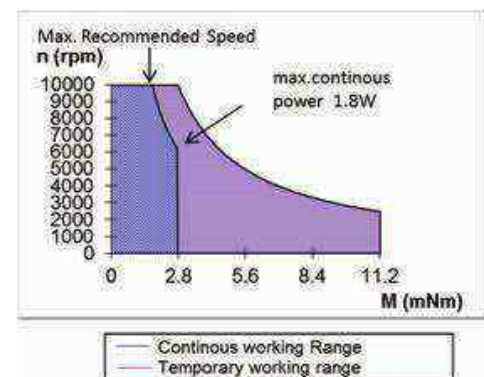
2.8 mNm



16S78 ****.1

Electrical Data		****	208P	210E	209E
1 Nominal Voltage	V		6	7.5	12
2 No-Load Speed	n_0		10,280	10,865	12,430
3 No-Load Current	I_0		25.0	18.0	8.4
4 Terminal Resistance	R		7.5	12.2	18.6
5 Output Power	$P_{2max.}$		1.7	1.6	1.8
6 Stall Torque	mNm		4.3	3.9	5.9
7 Efficiency	$\eta_{max.}$		68	69	78
8 Max Continuous Speed	$n_{e max.}$		10,000	10,000	10,000
9 Max Continuous Torque	$M_{e max.}$		2.6 (0.34)	2.4 (0.34)	2.8 (0.4)
10 Max Continuous Current	$I_{e max.}$		0.50	0.38	0.32
11 Back-EMF Constant	k_E		0.57	0.67	0.95
12 Torque Constant	k_M		5.40	6.40	9.10
13 Motor Regulation	R/k^2		255.0	300.0	225.0
14 Friction Torque	T_F		0.12 (0.02)	0.12 (0.02)	0.08 (0.02)
15 Rotor Inductance	L		0.15	0.23	0.35
16 Mechanical Time Constant	t_m		12.8	15.0	11.3
17 Rotor Inertia	J		0.50	0.50	0.50
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}			13/38	°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}			7/400	S
20 Operating Temperature Range:	motor		-30°C to 85°C (-22°F to 185°F)		°C (°F)
	rotor		100°C (212°F)		°C (°F)
21 Shaft Load Max.:			With sleeve bearings		
(5mm from bearing)	-radial		1.5 (5.4)		N (oz)
	-axial		100 (359.6)		N (oz)
22 Shaft Play:	-radial		<0.03 (0.0012)		mm (inch)
	-axial		0.15 (0.0059)		mm (inch)
23 Weight	g		19 (0.68)		g (oz)

Execution Table		
Gearbox	Single Shaft	MR2
B16	2	3
BA 16	2	3
R16	2	3



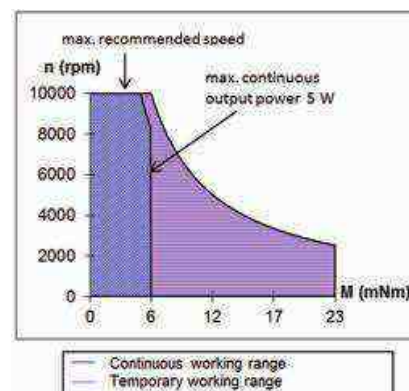
5.8 mNm



Electrical Data		****	220P	214E	213E	211E	210E	205E	
1	Nominal Voltage	V	3	8	9	12	15	32	Volt
2	No-Load Speed	n ₀	11,025	9,250	7,980	8,690	9,000	8,150	rpm
3	No-Load Current	I ₀	45.0	10.0	8.0	6.5	5.5	2.0	mA
4	Terminal Resistance	R	0.5	5.4	7.6	13.0	19.5	135.0	Ω
5	Output Power	P _{2max}	4.1	4.2	4.6	4.2	4.2	2.5	W
6	Stall Torque	mNm	16 (2.27)	12.1 (1.72)	12.7 (1.8)	12.1 (1.72)	12.2 (1.73)	8.8 (1.25)	mNm (oz-in)
7	Efficiency	h _{max}	83	84	84	84	84	82	%
8	Max Continuous Speed	n _{e max}	10,000	10,000	10,000	10,000	10,000	10,000	rpm
9	Max Continuous Torque	M _{e max}	5.5 (0.76)	5.3 (0.76)	5.8 (0.83)	5.4 (0.77)	5.4 (0.77)	4.8 (0.68)	mNm (oz-in)
10	Max Continuous Current	I _{e max}	2.20	0.66	0.55	0.42	0.35	0.13	A
11	Back-EMF Constant	k _E	0.27	0.86	1.12	1.37	1.65	3.90	mV/rpm
12	Torque Constant	k _M	2.58	8.20	10.70	13.10	15.80	37.20	mNm/A
13	Motor Regulation	R/k ²	75.1	80.3	66.4	75.75	78.11	97.55	10 ³ /Nms
14	Friction Torque	T _F	0.12 (0.02)	0.08 (0.02)	0.09 (0.02)	0.09 (0.02)	0.09 (0.02)	0.07 (0.01)	mNm (oz-in)
15	Rotor Inductance	L	0.01	0.12	0.15	0.26	0.40	1.70	mH
16	Mechanical Time Constant	t _m	6.0	6.4	5.3	6.1	5.8	7.8	ms
17	Rotor Inertia	J	0.80	0.80	0.80	0.80	0.74	0.80	g.cm ²

18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	8 / 35	°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	6 / 500	S
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)	°C (°F)
	rotor	100 °C (212 °F)	°C (°F)
21 Shaft Load Max.:		With sleeve bearings	
(5mm from bearing)	-radial	1.5 (5.4)	N (oz)
	-axial	100 (359.6)	N (oz)
22 Shaft Play:	-radial	<0.03 (0.0012)	mm (inch)
	-axial	0.15 (0.0059)	mm (inch)
23 Weight	q	24 (0.85)	g (oz)

Execution Table		
Gearbox	Single Shaft	MR2
B16	5	Upon Request
BA16	5	Upon Request
R16	1	Upon Request

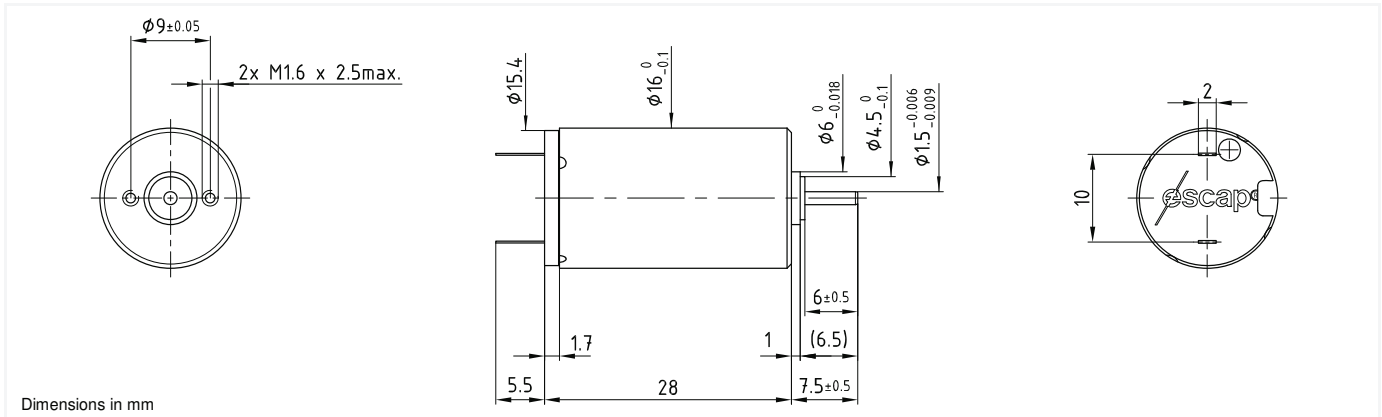


16N78 Athlonix™

Precious metal commutation

Ø16mm

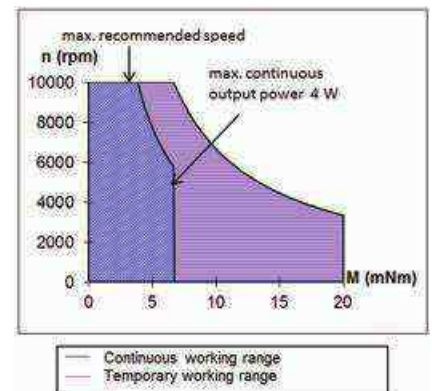
6.9 mNm



16N78 ****.1001

Electrical Data	****	135	212P	214E	212E	210E	208E	
1 Nominal Voltage	V	1.5	6	9	12	18	24	Volt
2 No-Load Speed	n_0	9,475	8,350	8,275	8,380	9,270	8,200	rpm
3 No-Load Current	I_0	60.0	18.0	10.0	5.0	5.0	4.0	mA
4 Terminal Resistance	R	0.2	3.0	7.5	13.2	27.5	60.5	Ω
5 Output Power	P_{2max}	4.7	5.4	5.2	5.2	4.9	4.9	W
6 Stall Torque	mNm	11.5 (1.63)	13.6 (1.93)	12.4 (1.76)	12.4 (1.76)	12 (1.7)	11 (1.56)	mNm (oz-in)
7 Efficiency	η_{max}	83	82	83	86	83	81	%
8 Max Continuous Speed	$n_{e max}$	10,000	10,000	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max}$	6 (0.98)	6.9 (0.98)	6.6 (0.94)	6.6 (0.94)	6.2 (0.88)	6.3 (0.9)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	4.00	1.03	0.65	0.49	0.34	0.23	A
11 Back-EMF Constant	k_E	0.16	0.71	1.08	1.42	1.93	2.90	mV/rpm
12 Torque Constant	k_M	1.50	6.80	10.30	13.60	18.40	27.70	mNm/A
13 Motor Regulation	R/k^2	88.9	64.9	70.7	71.37	81.23	78.85	10 ³ /Nms
14 Friction Torque	T_F	0.09 (0.02)	0.12 (0.02)	0.1 (0.02)	0.07 (0.01)	0.09 (0.02)	0.08 (0.02)	mNm (oz-in)
15 Rotor Inductance	L	0.01	0.10	0.30	0.50	1.00	2.40	mH
16 Mechanical Time Constant	t_m	9.8	6.8	8.8	8.6	9.7	9.3	ms
17 Rotor Inertia	J	1.10	1.05	1.25	1.20	1.20	1.18	g.cm ²
General Data								
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6 / 25					°C/W	
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	12/250					S	
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)					°C (°F)	
	rotor	100 °C (212 °F)					°C (°F)	
21 Shaft Load Max.:		With sleeve bearings						
(5mm from bearing)	-radial	1.5 (5.4)					N (oz)	
	-axial	100 (359.6)					N (oz)	
22 Shaft Play:	-radial	<0.03 (0.0012)					mm (inch)	
	-axial	0.15 (0.0059)					mm (inch)	
23 Weight	g	24 (0.85)					g (oz)	

Execution Table		
Gearbox	Single Shaft	MR2
B16	1005	1008
BA16	1005	1008
R16	1001	1007

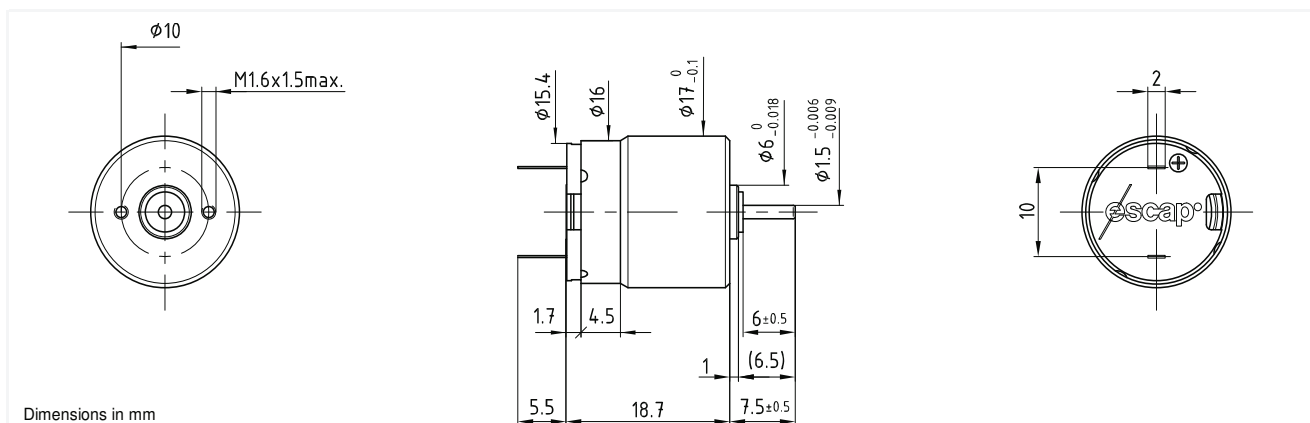


17S78

Precious metal commutation

Ø17mm

2.8 mNm



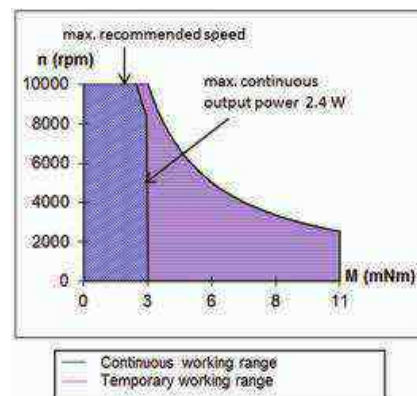
Dimensions in mm

17S78 **** .1

Electrical Data	****	208P	210E	209E	
1 Nominal Voltage	V	6	7.5	12	Volt
2 No-Load Speed	n_0	10,280	10,865	12,430	rpm
3 No-Load Current	I_0	25.0	18.0	8.4	mA
4 Terminal Resistance	R	7.5	12.2	18.6	Ω
5 Output Power	P_{2max}	1.7	1.6	1.8	W
6 Stall Torque	mNm	4.3 (0.61)	3.9 (0.56)	5.9 (0.84)	mNm (oz-in)
7 Efficiency	η_{max}	68	69	78	%
8 Max Continuous Speed	$n_{e max}$	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max}$	2.6 (0.34)	2.4 (0.34)	2.8 (0.4)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	0.50	0.38	0.32	A
11 Back-EMF Constant	k_E	0.57	0.67	0.95	mV/rpm
12 Torque Constant	k_M	5.40	6.40	9.10	mNm/A
13 Motor Regulation	R/k^2	255.0	300.0	225.0	$10^3/Nms$
14 Friction Torque	T_F	0.12 (0.02)	0.12 (0.02)	0.08 (0.02)	mNm (oz-in)
15 Rotor Inductance	L	0.15	0.23	0.35	mH
16 Mechanical Time Constant	t_m	12.8	15.0	11.3	ms
17 Rotor Inertia	J	0.50	0.50	0.50	g.cm ²
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		13/38		°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		7/400		S
20 Operating Temperature Range:	motor		-30°C to 85°C (-22°F to 185°F)		°C (°F)
	rotor		100°C (212°F)		°C (°F)
21 Shaft Load Max.:			With sleeve bearings		
(5mm from bearing)	-radial		1.5 (5.4)		N (oz)
	-axial		100 (359.6)		N (oz)
22 Shaft Play:	-radial		<0.03 (0.0012)		mm (inch)
	-axial		0.15 (0.0059)		mm (inch)
23 Weight	g		19 (0.68)		g (oz)

Execution Table

Gearbox	Single Shaft	F16	MR2
B16	5	5	Upon Request
BA16	5	5	Upon Request
R16	1	1	96



V121616

17DCT Athlonix™

Graphite-Copper commutation

Ø17mm

5.88 mNm



Dimensions in mm

17DCT 26G1/G2 ****.*

Electrical Data	****	216P	211P	209P	208P	207P	
1 Nominal Voltage	V	3	6	9	12	15	Volt
2 No-Load Speed	n_0	7657	7690	7498	8011	8206	rpm
3 No-Load Current	I_0	92.6	46.3	30.1	24.1	19.7	mA
4 Terminal Resistance	R	1.0	3.4	7.8	12.2	18.7	Ω
5 Output Power	$P_{2max.}$	4.1	4.5	4.5	4.5	4.4	W
6 Stall Torque	mNm	10.8 (1.53)	12.57 (1.79)	12.61 (1.79)	13.43 (1.91)	13.3 (1.89)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	68	70	70	71	71	%
8 Max Continuous Speed	$n_{e max.}$	10000	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max.}$	5.25 (0.75)	5.68 (0.81)	5.77 (0.82)	5.76 (0.82)	5.65 (0.81)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	1.54	0.83	0.55	0.44	0.35	A
11 Back-EMF Constant	k_E	0.38	0.76	1.17	1.46	1.78	mV/rpm
12 Torque Constant	k_M	3.63	7.26	11.16	13.96	17.03	mNm/A
13 Motor Regulation	R/k^2	74.24	64.05	62.25	62.43	64.59	$10^3/Nms$
14 Friction Torque	T_F	0.3 (0.042)	0.3 (0.042)	0.3 (0.042)	0.3 (0.042)	0.3 (0.042)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	7.81	6.61	6.38	6.32	6.28	ms
16 Rotor Inertia	J	1.05	1.03	1.02	1.01	0.97	$g.cm^2$
General Data							
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}			6/25			$^{\circ}C/W$
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}			12/250			S
19 Operating Temperature Range:	t_{w1}/t_{w2}			-30°C to 85°C (-22°F to 185°F)			$^{\circ}C (^{\circ}F)$
	rotor			100°C (212°F)			$^{\circ}C (^{\circ}F)$
20 Shaft Load Max.:				With sleeve bearings			
(5mm from bearing)	-radial			1.5 (5.39)			N (oz)
	-axial			100 (359.6)			N (oz)
21 Shaft Play:	-radial			0.03 (0.0012)			mm (inch)
	-axial			0.15 (0.0059)			mm (inch)
22 Weight	g			27 (0.96)			g (oz)

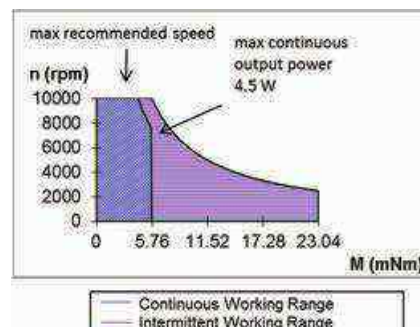
* Also available with ball bearing

Execution Table			
Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

G1:standard commutation

G2:special commutation for double shaft version



17DCT Athlonix™

Graphite-Copper commutation

Ø17mm

5.88 mNm



Dimensions in mm

17DCT 26G1/G2 ****.*

Electrical Data	****	209E	205P	107P	205E	
1 Nominal Voltage	V	18	24	36	48	Volt
2 No-Load Speed	n_0	7869	7628	9653	7988	rpm
3 No-Load Current	I_0	15.8	11.5	9.6	6.0	mA
4 Terminal Resistance	R	30.8	51.5	76.1	208.2	Ω
5 Output Power	$P_{2max.}$	4.3	4.6	4.5	4.4	W
6 Stall Torque	mNm	12.07 (1.71)	13.33 (1.89)	16.16 (2.29)	12.55 (1.78)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	70	71	73	70	%
8 Max Continuous Speed	$n_{e max.}$	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max.}$	5.49 (0.78)	5.88 (0.84)	5.75 (0.82)	5.56 (0.79)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	0.27	0.21	0.17	0.11	A
11 Back-EMF Constant	k_E	2.23	3.07	3.65	5.85	mV/rpm
12 Torque Constant	k_M	21.25	29.31	34.89	55.88	mNm/A
13 Motor Regulation	R/k^2	68.23	59.91	62.53	66.65	$10^3/Nms$
14 Friction Torque	T_F	0.3 (0.042)	0.3 (0.042)	0.3 (0.042)	0.3 (0.042)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	7.08	6.24	6.23	7.04	ms
16 Rotor Inertia	J	1.04	1.04	1.00	1.06	$g.cm^2$
General Data						
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/25				$^{\circ}C/W$
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	12/250				S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)				$^{\circ}C$ ($^{\circ}F$)
	rotor	100 $^{\circ}C$ (212 $^{\circ}F$)				$^{\circ}C$ ($^{\circ}F$)
20 Shaft Load Max.:		With sleeve bearings				
(5mm from bearing)	-radial	1.5 (5.39)				N (oz)
	-axial	100 (359.6)				N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
22 Weight	g	27 (0.96)				g (oz)

* Also available with ball bearing

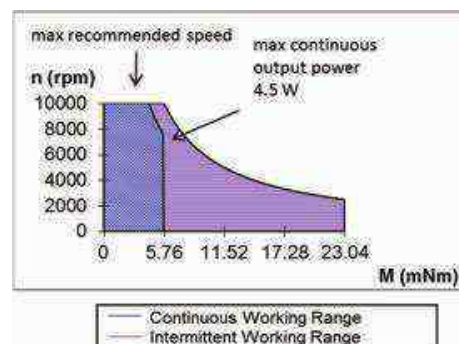
Execution Table

Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

G1:standard commutation

G2:special commutation for double shaft version

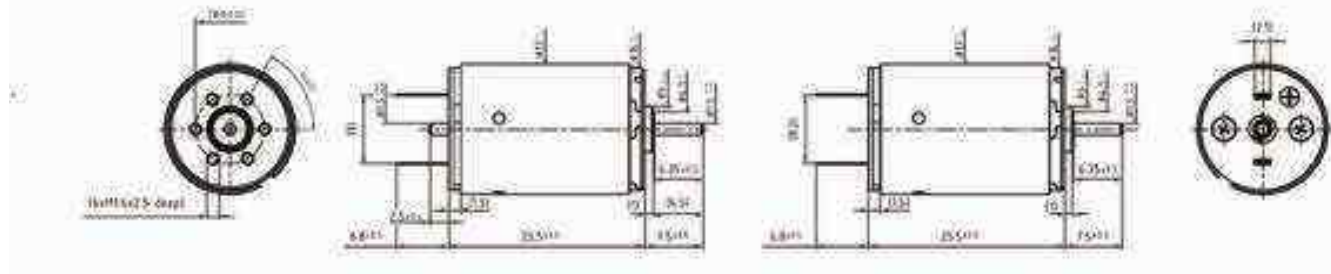


17DCT Athlonix™

Precious metal commutation

Ø17mm

6.14 mNm



Dimensions in mm

17DCT 26P1/P2 **** .*

Electrical Data		****	216P	211P	209P	208P	207P	
1 Nominal Voltage	V		3	6	9	12	15	Volt
2 No-Load Speed	n_0		7838	7842	7645	8158	8358	rpm
3 No-Load Current	I_0		24.7	12.3	8.0	6.4	5.3	mA
4 Terminal Resistance	R		0.9	3.3	7.7	12.1	18.6	Ω
5 Output Power	$P_{2max.}$		4.6	4.7	4.8	4.7	4.7	W
6 Stall Torque	mNm		12.31 (1.75)	13.21 (1.88)	13.02 (1.85)	13.79 (1.96)	13.62 (1.93)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$		84	84	84	85	84	%
8 Max Continuous Speed	$n_{e max.}$		10000	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max.}$		5.81 (0.83)	6.02 (0.86)	6.05 (0.86)	6.03 (0.86)	5.92 (0.84)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$		1.63	0.84	0.55	0.44	0.35	A
11 Back-EMF Constant	k_E		0.38	0.76	1.17	1.46	1.78	mV/rpm
12 Torque Constant	k_M		3.63	7.26	11.16	13.96	17.03	mNm/A
13 Motor Regulation	R/k^2		66.64	62.15	61.45	61.92	64.25	$10^3/Nms$
14 Friction Torque	T_F		0.08 (0.011)	0.08 (0.011)	0.08 (0.011)	0.08 (0.011)	0.08 (0.011)	mNm (oz-in)
15 Mechanical Time Constant	τ_m		7.01	6.41	6.30	6.27	6.25	ms
16 Rotor Inertia	J		1.05	1.03	1.02	1.01	0.97	g.cm ²
General Data								
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}				6/25			°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}				12/250			S
19 Operating Temperature Range:	t_{w1}/t_{w2}				-30°C to 85°C (-22°F to 185°F)			°C (°F)
	rotor				100°C (212°F)			°C (°F)
20 Shaft Load Max.:					With sleeve bearings			
(5mm from bearing)	-radial				1.5 (5.39)			N (oz)
	-axial				100 (359.6)			N (oz)
21 Shaft Play:	-radial				0.03 (0.0012)			mm (inch)
	-axial				0.15 (0.0059)			mm (inch)
22 Weight	g				27 (0.96)			g (oz)

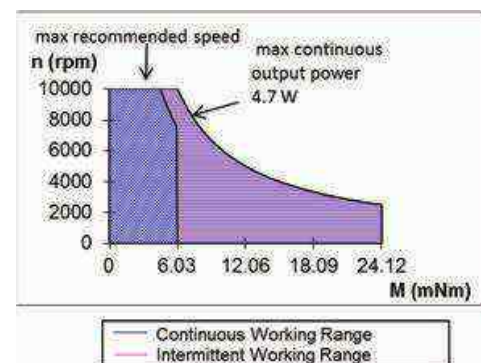
* Also available with ball bearing

Execution Table			
Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

P1:standard commutation

P2:special commutation for double shaft version

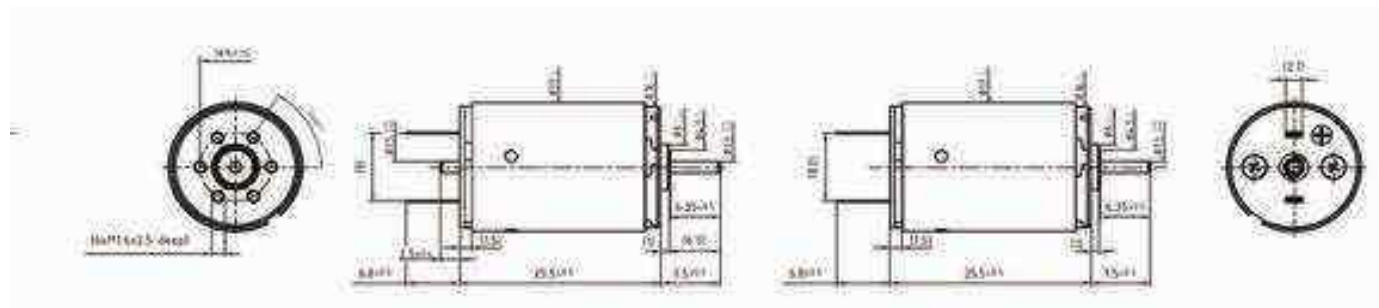


17DCT Athlonix™

Precious metal commutation

Ø17mm

6.14 mNm



Dimensions in mm

17DCT 26P1/P2 **** .*

Electrical Data	****	209E	205P	107P	205E	
1 Nominal Voltage	V	18	24	36	48	Volt
2 No-Load Speed	n_0	8030	7769	9800	8145	rpm
3 No-Load Current	I_0	4.2	3.1	2.6	1.6	mA
4 Terminal Resistance	R	30.7	51.4	76.0	208.1	Ω
5 Output Power	$P_{2max.}$	4.5	4.8	4.7	4.6	W
6 Stall Torque	mNm	12.36 (1.76)	13.6 (1.93)	16.43 (2.33)	12.8 (1.82)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	84	84	86	84	%
8 Max Continuous Speed	$n_{e max.}$	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max.}$	5.75 (0.82)	6.14 (0.87)	6 (0.85)	5.8 (0.83)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	0.27	0.21	0.17	0.11	A
11 Back-EMF Constant	k_E	2.23	3.07	3.65	5.85	mV/rpm
12 Torque Constant	k_M	21.25	29.31	34.89	55.88	mNm/A
13 Motor Regulation	R/k^2	68.01	59.79	62.45	66.62	$10^3/Nms$
14 Friction Torque	T_F	0.08 (0.011)	0.08 (0.011)	0.08 (0.011)	0.08 (0.011)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	7.06	6.23	6.22	7.04	ms
16 Rotor Inertia	J	1.04	1.04	1.00	1.06	g.cm ²
General Data						
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/25				°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	12/250				S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30°C to 85°C (-22°F to 185°F)				°C (°F)
	rotor	100°C (212°F)				°C (°F)
20 Shaft Load Max.:		With sleeve bearings				
(5mm from bearing)	-radial	1.5 (5.39)				N (oz)
	-axial	100 (359.6)				N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
22 Weight	g	27 (0.96)				g (oz)

* Also available with ball bearing

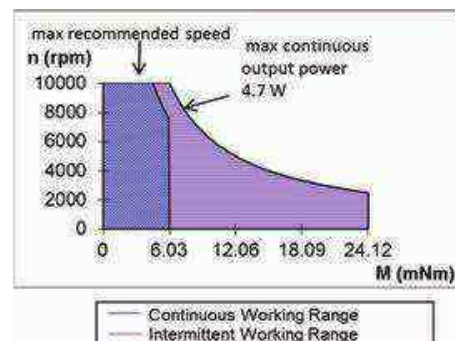
Execution Table

Gearbox	Single Shaft	MR2	M Sense B
R16	1	2	Upon Request
B16	3	4	Upon Request
BA16	3	4	Upon Request

Note:

P1:standard commutation

P2:special commutation for double shaft version

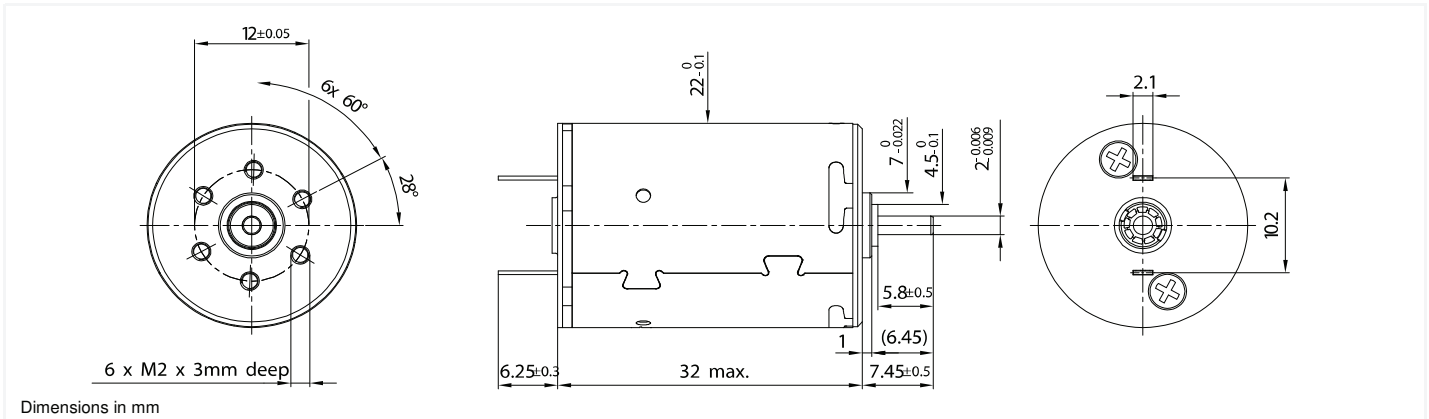


22DCP Athlonix™

Graphite-Copper commutation

Ø22mm

6.21 mNm



22DCP 32G1 **** .1

Electrical Data	****	221P	216P	213P	211P	210P	209P	
1 Nominal Voltage	V	3	6	9	12	15	18	Volt
2 No-Load Speed	n_0	8094	9574	9874	9598	9600	9211	rpm
3 No-Load Current	I_0	132.6	77.4	53.0	38.7	30.9	24.8	mA
4 Terminal Resistance	R	0.9	2.2	4.3	8.0	12.3	18.8	Ω
5 Output Power	$P_{2max.}$	2.2	3.7	4.1	3.9	4.0	3.8	W
6 Stall Torque	mNm	10.44 (1.48)	15.6 (2.21)	17.23 (2.45)	17.1 (2.43)	17.29 (2.45)	16.94 (2.4)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	63	69	71	71	71	70	%
8 Max Continuous Speed	$n_{e max.}$	10000	10000	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max.}$	5.13 (0.73)	5.82 (0.83)	6.04 (0.86)	6.11 (0.87)	6.14 (0.87)	6.21 (0.88)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	1.64	1.08	0.77	0.56	0.45	0.37	A
11 Back-EMF Constant	k_E	0.36	0.61	0.89	1.22	1.52	1.90	mV/rpm
12 Torque Constant	k_M	3.39	5.82	8.48	11.63	14.54	18.18	mNm/A
13 Motor Regulation	R/k^2	81.20	64.28	60.00	58.76	58.16	56.95	$10^3/Nms$
14 Friction Torque	T_F	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	38.97	30.70	28.44	27.50	27.12	26.89	ms
16 Rotor Inertia	J	4.80	4.78	4.74	4.68	4.66	4.72	g.cm ²
General Data								
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22						°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550						S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 °C to 85 °C (-22 °F to 185 °F)						°C (°F)
	rotor	100 °C (212 °F)						°C (°F)
20 Shaft Load Max.:		With sleeve bearings						
(5mm from bearing)	-radial	1.5 (5.4)						N (oz)
	-axial	100 (359.6)						N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)						mm (inch)
	-axial	0.15 (0.0059)						mm (inch)
22 Weight	g	58 (2.05)						g (oz)

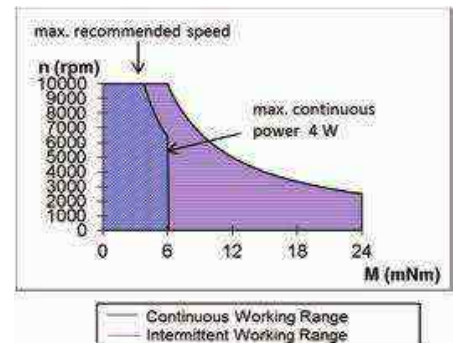
* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

G1:standard commutation

G2:special commutation for double shaft version

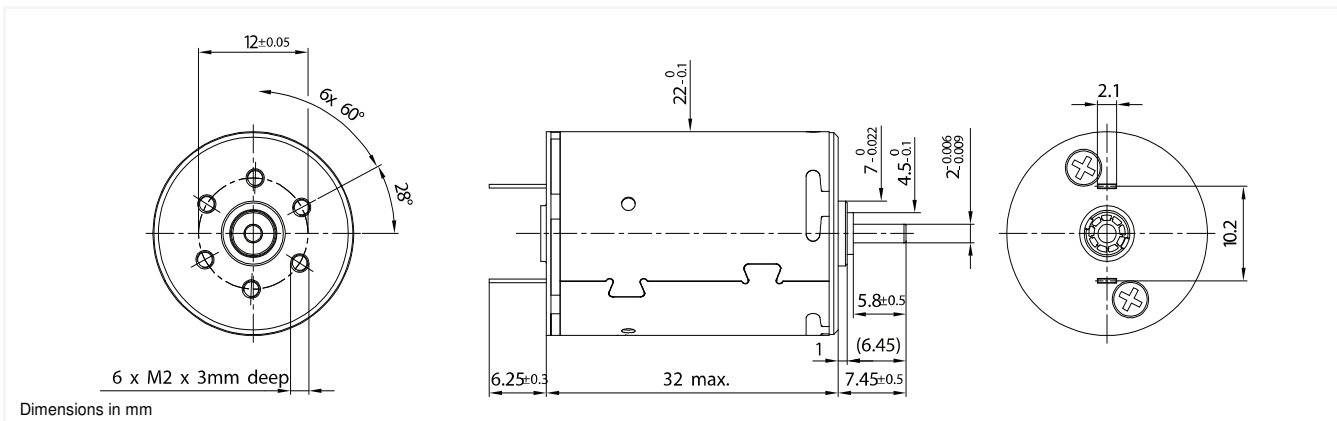


22DCP Athlonix™

Graphite-Copper commutation

Ø22mm

6.21 mNm

**22DCP 32G1 ****.1**

Electrical Data	****	212E	211E	210E	209E	208E	
1 Nominal Voltage	V	21	24	30	36	48	Volt
2 No-Load Speed	n_0	10,201	10,308	10,645	10,123	10,889	rpm
3 No-Load Current	I_0	23.5	20.8	17.2	13.6	11.0	mA
4 Terminal Resistance	R	23.6	30.6	46.3	71.9	112.8	Ω
5 Output Power	$P_{2max.}$	4.0	4.1	4.2	3.9	4.3	W
6 Stall Torque	mNm	16.56 (2.35)	16.53 (2.35)	16.53 (2.35)	16.09 (2.28)	17 (2.41)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	70	70	70	70	70	%
8 Max Continuous Speed	$n_{e max.}$	10,000	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$	5.81 (0.83)	5.77 (0.82)	5.67 (0.81)	5.74 (0.82)	5.69 (0.81)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	0.33	0.29	0.23	0.19	0.15	A
11 Back-EMF Constant	k_E	2.00	2.27	2.74	3.46	4.29	mV/rpm
12 Torque Constant	k_M	19.14	21.64	26.20	33.03	41.01	mNm/A
13 Motor Regulation	R/k^2	64.5	65.3	67.4	65.89	67.07	$10^3/Nms$
14 Friction Torque	T_F	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	30.3	30.2	30.1	30.1	30.0	ms
16 Rotor Inertia	J	4.70	4.63	4.47	4.56	4.48	g.cm ²
General Data							
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22					°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550					S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 °C to 85 °C (-22 °F to 185 °F)					°C (°F)
	rotor	100 °C (212 °F)					°C (°F)
20 Shaft Load Max.:		With sleeve bearings					
(5mm from bearing)	-radial	1.5 (5.4)					N (oz)
	-axial	100 (359.6)					N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)					mm (inch)
	-axial	0.15 (0.0059)					mm (inch)
22 Weight	g	58 (2.05)					g (oz)

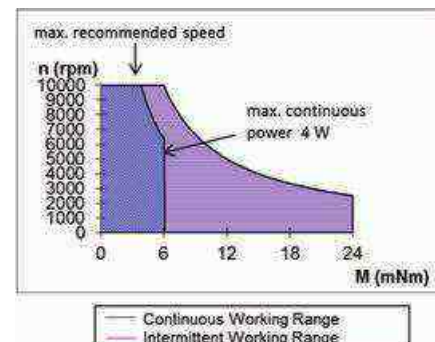
* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

G1:standard commutation

G2:special commutation for double shaft version

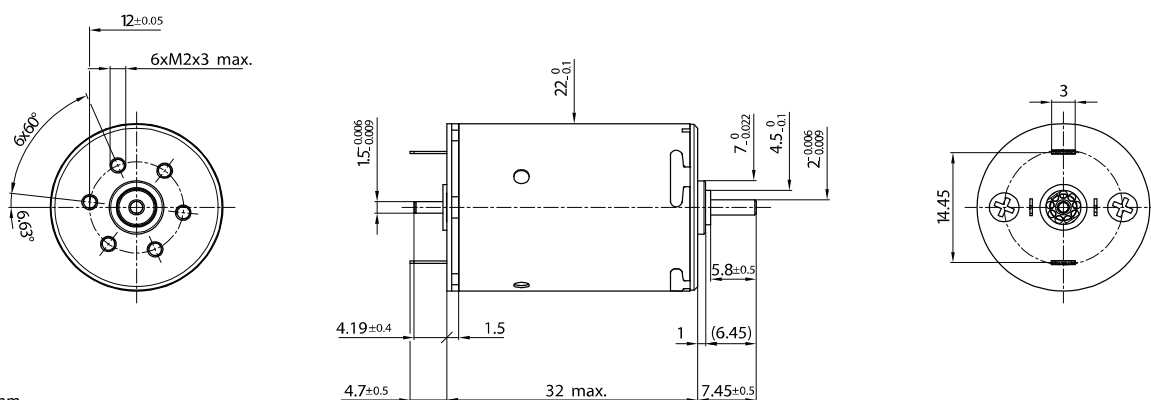


22DCP Athlonix™

Precious metal commutation

Ø22mm

6.5 mNm



Dimensions in mm

22DCP 32P2 **** .2

Electrical Data	****	221P	216P	213P	211P	210P	209P	
1 Nominal Voltage	V	3	6	9	12	15	18	Volt
2 No-Load Speed	n_0	8321	9739	10022	9741	9741	9348	rpm
3 No-Load Current	I_0	58.9	34.4	23.6	17.2	13.8	11.0	mA
4 Terminal Resistance	R	0.7	2.0	4.1	7.8	12.1	18.6	Ω
5 Output Power	P_{2max}	2.9	4.1	4.4	4.2	4.2	4.0	W
6 Stall Torque	mNm	13.65 (1.94)	17.47 (2.48)	18.34 (2.6)	17.81 (2.53)	17.83 (2.53)	17.37 (2.46)	mNm (oz-in)
7 Efficiency	η_{max}	77	80	80	80	80	80	%
8 Max Continuous Speed	$n_{e max}$	10000	10000	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max}$	6.09 (0.87)	6.38 (0.91)	6.45 (0.92)	6.44 (0.92)	6.45 (0.92)	6.5 (0.93)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	1.85	1.13	0.78	0.57	0.46	0.37	A
11 Back-EMF Constant	k_E	0.36	0.61	0.89	1.22	1.52	1.90	mV/rpm
12 Torque Constant	k_M	3.39	5.82	8.48	11.63	14.54	18.18	mNm/A
13 Motor Regulation	R/k^2	63.83	58.37	57.22	57.28	57.22	56.34	$10^3/Nms$
14 Friction Torque	T_F	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	30.63	27.87	27.12	26.81	26.68	26.60	ms
16 Rotor Inertia	J	4.80	4.78	4.74	4.68	4.66	4.72	$g \cdot cm^2$
General Data								
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22						$^{\circ}C/W$
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550						S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)						$^{\circ}C$ ($^{\circ}F$)
	rotor	100 $^{\circ}C$ (212 $^{\circ}F$)						$^{\circ}C$ ($^{\circ}F$)
20 Shaft Load Max.:		With sleeve bearings						
(5mm from bearing)	-radial	1.5 (5.4)						N (oz)
	-axial	100 (359.6)						N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)						mm (inch)
	-axial	0.15 (0.0059)						mm (inch)
22 Weight	g	58 (2.05)						g (oz)

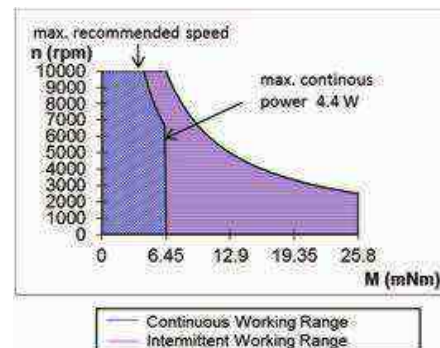
* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

P1:standard commutation

P2:special commutation for double shaft version

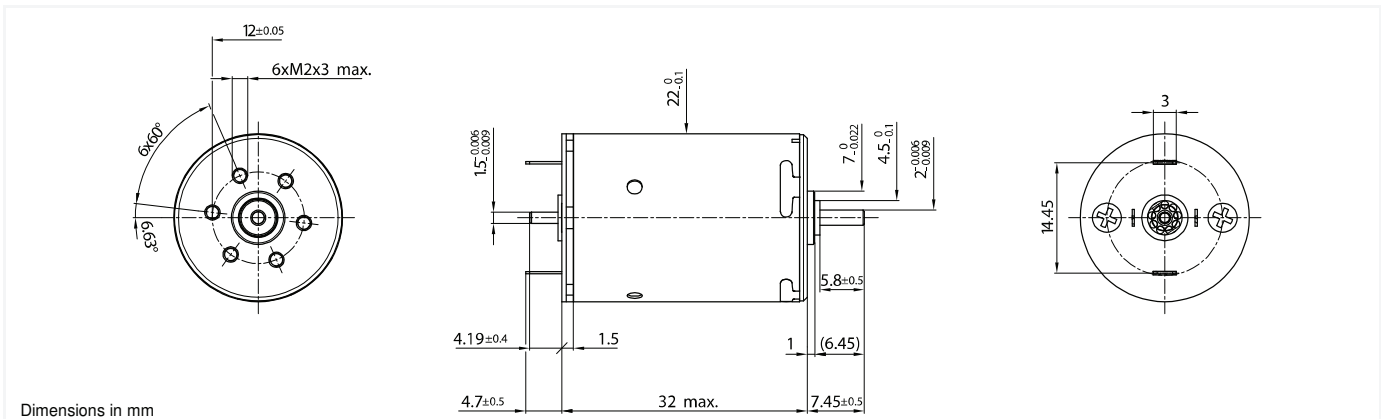


22DCP Athlonix™

Precious metal commutation

Ø22mm

6.5 mNm

**22DCP 32P2 **** .2**

Electrical Data	****	212E	211E	210E	209E	208E	
1 Nominal Voltage	V	21	24	30	36	48	Volt
2 No-Load Speed	n_0	10,357	10,465	10,806	10,281	11,049	rpm
3 No-Load Current	I_0	10.5	9.2	7.6	6.1	4.9	mA
4 Terminal Resistance	R	23.4	30.4	46.1	71.7	112.6	Ω
5 Output Power	$P_{2max.}$	4.2	4.3	4.4	4.1	4.5	W
6 Stall Torque	mNm	16.95 (2.41)	16.89 (2.4)	16.85 (2.39)	16.39 (2.33)	17.28 (2.45)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	80	80	80	79	80	%
8 Max Continuous Speed	$n_{e max.}$	10,000	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$	6.08 (0.86)	6.04 (0.86)	5.93 (0.84)	6 (0.85)	5.94 (0.85)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	0.33	0.29	0.23	0.19	0.15	A
11 Back-EMF Constant	k_E	2.00	2.27	2.74	3.46	4.29	mV/rpm
12 Torque Constant	k_M	19.14	21.64	26.20	33.03	41.01	mNm/A
13 Motor Regulation	R/k^2	64.0	64.9	67.2	65.70	66.95	10 ³ /Nms
14 Friction Torque	T_F	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	0.2 (0.03)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	30.1	30.0	30.0	30.0	30.0	ms
16 Rotor Inertia	J	4.70	4.63	4.47	4.56	4.48	g.cm ²
General Data							
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22					°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550					S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 °C to 85 °C (-22 °F to 185 °F)					°C (°F)
	rotor	100 °C (212 °F)					°C (°F)
20 Shaft Load Max.:		With sleeve bearings					
(5mm from bearing)	-radial	1.5 (5.4)					N (oz)
	-axial	100 (359.6)					N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)					mm (inch)
	-axial	0.15 (0.0059)					mm (inch)
22 Weight	g	58 (2.05)					g (oz)

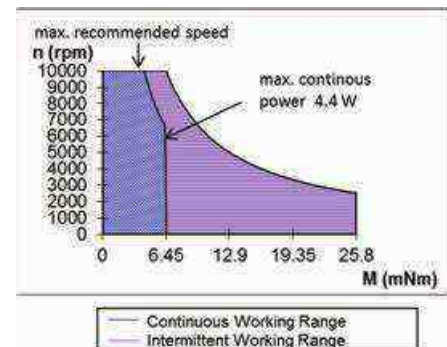
* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

P1:standard commutation

P2:special commutation for double shaft version

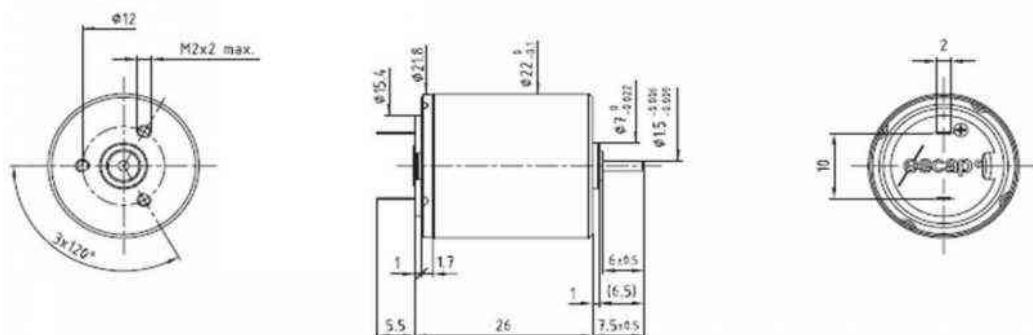


22S28

Precious metal commutation

Ø22mm

4.1 mNm

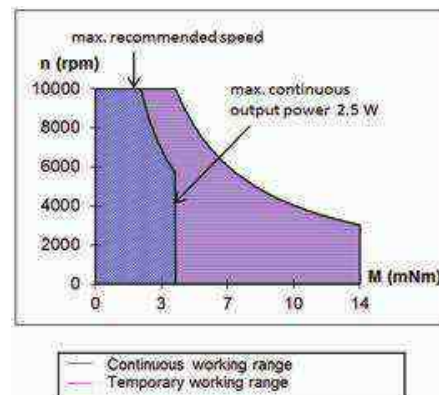


Dimensions in mm

22S28 **** .1

Electrical Data		****	208E	205E	
1	Nominal Voltage	V	15	24	Volt
2	No-Load Speed	n_0	9,600	7,940	rpm
3	No-Load Current	I_0	6.0	2.8	mA
4	Terminal Resistance	R	35.0	140.0	Ω
5	Output Power	$P_{2max.}$	2.5	2.4	W
6	Stall Torque	mNm	6.3 (0.9)	4.9 (0.7)	mNm (oz-in)
7	Efficiency	$\eta_{max.}$	78	76	%
8	Max Continuous Speed	$n_{e max.}$	10,000	10,000	rpm
9	Max Continuous Torque	$M_{e max.}$	4.1 (0.56)	3.9 (0.56)	mNm (oz-in)
10	Max Continuous Current	$I_{e max.}$	0.29	0.15	A
11	Back-EMF Constant	k_E	1.54	2.97	mV/rpm
12	Torque Constant	k_M	14.70	28.40	mNm/A
13	Motor Regulation	R/k^2	160.0	170.0	$10^3/Nms$
14	Friction Torque	T_F	0.09 (0.02)	0.08 (0.02)	mNm (oz-in)
15	Rotor Inductance	L	0.92	3.60	mH
16	Mechanical Time Constant	t_m	25.6	25.5	ms
17	Rotor Inertia	J	1.60	1.50	g.cm ²
General Data					
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	5/30		°C/W
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	5/480		S
20	Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
		rotor	100 °C (212 °F)		°C (°F)
21	Shaft Load Max.:		With sleeve bearings		
	(5mm from bearing)	-radial	1.5 (5.4)		N (oz)
		-axial	100 (359.6)		N (oz)
22	Shaft Play:	-radial	<0.03 (0.0012)		mm (inch)
		-axial	0.15 (0.0059)		mm (inch)
23	Weight	g	49 (1.73)		g (oz)

Execution Table		
Gearbox	Single Shaft	MR2
R22	Upon Request	Upon Request
M22	Upon Request	Upon Request
K24	Upon Request	Upon Request
K27	Upon Request	Upon Request

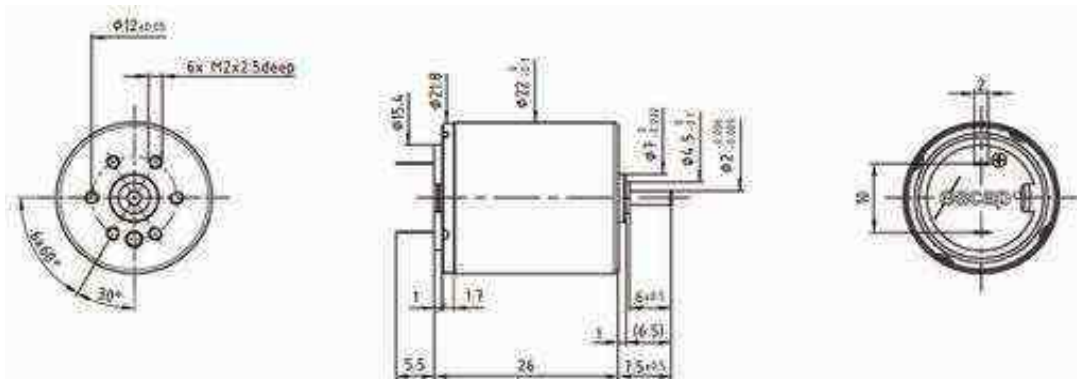


22S78

Precious metal commutation

Ø22mm

8.9 mNm

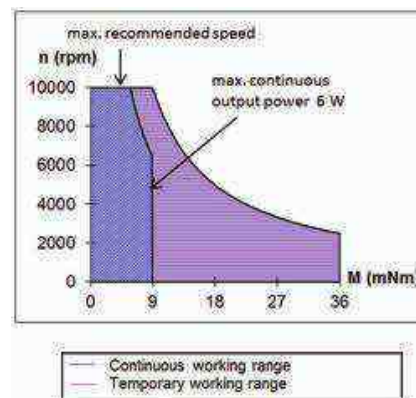


Dimensions in mm

22S78 ****.1

Electrical Data		****	210E	208E	
1	Nominal Voltage	V	18	24	Volt
2	No-Load Speed	n ₀	7,780	8,550	rpm
3	No-Load Current	I ₀	4.5	3.3	mA
4	Terminal Resistance	R	18.0	35.0	Ω
5	Output Power	P _{2max.}	5.5	4.6	W
6	Stall Torque	mNm	22 (3.12)	18.3 (2.6)	mNm (oz-in)
7	Efficiency	h _{max.}	87	87	%
8	Max Continuous Speed	n _{e max.}	10,000	10,000	rpm
9	Max Continuous Torque	M _{e max.}	8.9 (1.1)	7.7 (1.1)	mNm (oz-in)
10	Max Continuous Current	I _{e max.}	0.41	0.29	A
11	Back-EMF Constant	k _E	2.30	2.80	mV/rpm
12	Torque Constant	k _M	22.00	26.70	mNm/A
13	Motor Regulation	R/k ²	37.0	49.0	10 ³ Nms
14	Friction Torque	T _F	0.09 (0.02)	0.09 (0.02)	mNm (oz-in)
15	Rotor Inductance	L	0.50	0.92	mH
16	Mechanical Time Constant	t _m	7.0	7.8	ms
17	Rotor Inertia	J	1.90	1.60	g.cm ²
General Data					
18	Thermal Resistance (rotor/body)	R _{th1} / R _{th2}	5/30		°C/W
19	Thermal Time Constant (rotor/stator)	t _{w1} /t _{w2}	5/480		S
20	Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
		rotor	100 °C (212 °F)		°C (°F)
21	Shaft Load Max.: (5mm from bearing)	-radial	With sleeve bearings		
		-axial	1.5 (5.4)		N (oz)
			100 (359.6)		N (oz)
22	Shaft Play:	-radial	<0.03 (0.0012)		mm (inch)
		-axial	0.15 (0.0059)		mm (inch)
23	Weight	g	49 (1.73)		g (oz)

Execution Table	
Gearbox	Single Shaft
R22	1



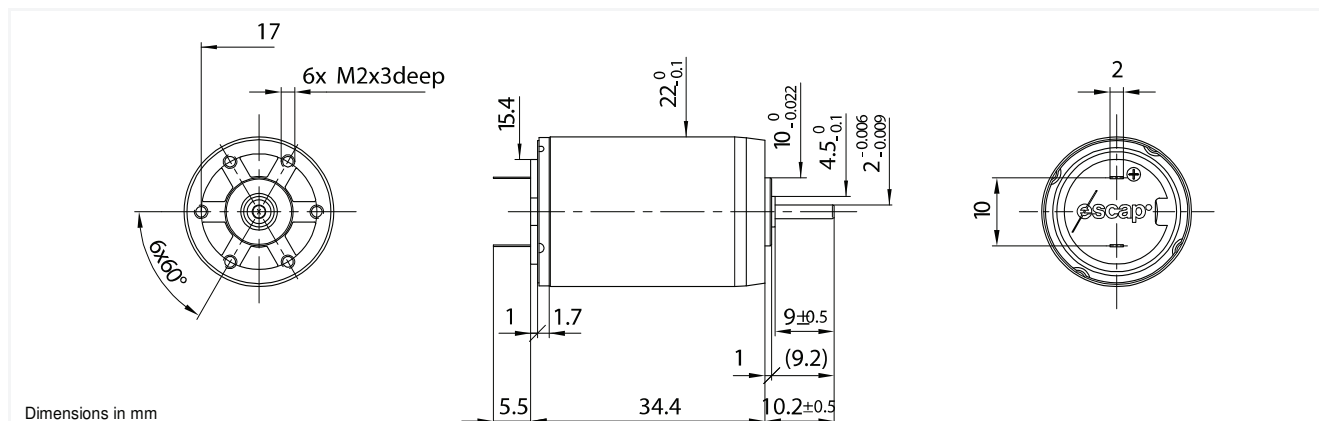
V121616

22V28

Precious metal commutation

Ø22mm

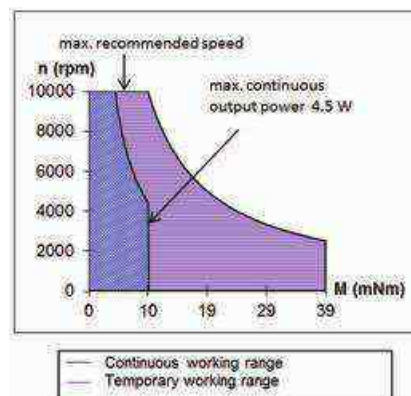
9.7 mNm



22V28 **** .201

Electrical Data	****	213P	216E	213E	210E	208E	
1 Nominal Voltage	V	6	9	12	15	24	Volt
2 No-Load Speed	n_0	7,100	6,725	7,630	7,550	6,340	rpm
3 No-Load Current	I_0	15.0	9.0	7.6	6.0	3.2	mA
4 Terminal Resistance	R	3.0	6.7	11.9	24.5	75.0	Ω
5 Output Power	$P_{2max.}$	4.1	4.4	3.8	3.3	3.6	W
6 Stall Torque	mNm	16 (2.27)	17.1 (2.43)	15 (2.13)	11.5 (1.63)	11.5 (1.63)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	83	84	83	81	81	%
8 Max Continuous Speed	$n_{e max.}$	10,000	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$	9.1 (1.38)	9.7 (1.38)	8.5 (1.21)	7.4 (1.05)	8.1 (1.15)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	1.15	0.77	0.58	0.40	0.23	A
11 Back-EMF Constant	k_E	0.84	1.33	1.56	1.97	3.75	mV/rpm
12 Torque Constant	k_M	8.00	12.70	14.90	18.80	35.80	mNm/A
13 Motor Regulation	R/k^2	47.0	42.0	54.0	69.00	58.00	$10^3/Nms$
14 Friction Torque	T_F	0.12 (0.02)	0.12 (0.02)	0.11 (0.02)	0.11 (0.02)	0.11 (0.02)	mNm (oz-in)
15 Rotor Inductance	L	0.15	0.50	0.55	0.80	3.30	mH
16 Mechanical Time Constant	t_m	15.0	16.4	17.3	20.0	13.9	ms
17 Rotor Inertia	J	3.20	3.90	3.20	2.90	2.40	g.cm ²
General Data							
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	7/16					°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	8/460					S
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)					°C (°F)
	rotor	100 °C (212 °F)					°C (°F)
21 Shaft Load Max.:		With sleeve bearings					
(5mm from bearing)	-radial	3.0 (10.8)					N (oz)
	-axial	150 (539.5)					N (oz)
22 Shaft Play:	-radial	<0.03 (0.0012)					mm (inch)
	-axial	0.15 (0.0059)					mm (inch)
23 Weight	g	68 (2.4)					g (oz)

Execution Table				
Gearbox	Single Shaft	F16	E9	MR2
R22	202	202	225	Upon Request
M22	201	201	204	Upon Request
K24	202	202	225	Upon Request
K27	202	202	225	Upon Request

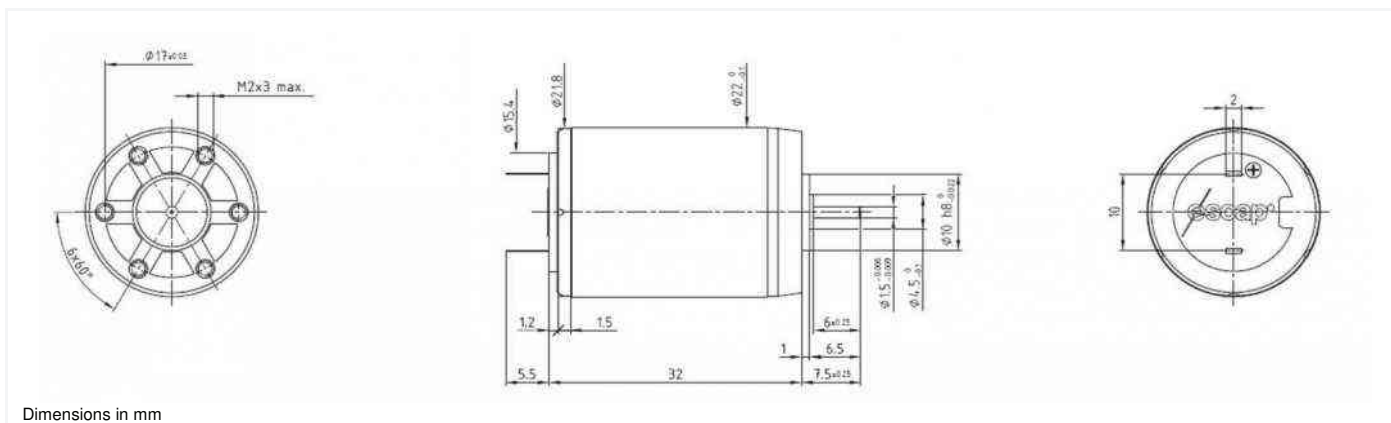


22N78 Athlonix™

Precious metal commutation

Ø22mm

15.7 mNm

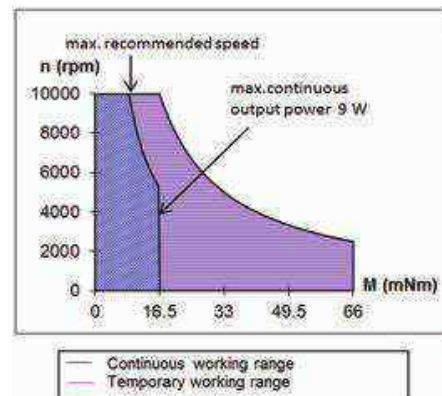


Dimensions in mm

22N78 ** .1001**

Electrical Data	****	319P	313P	311P	216E	215E	208E	
1 Nominal Voltage	V	6	9	12	18	24	48	Volt
2 No-Load Speed	n_0	8,660	6,860	7,280	8,250	9,075	6,350	rpm
3 No-Load Current	I_0	28.0	10.0	11.0	6.0	5.0	0.0	mA
4 Terminal Resistance	R	0.6	2.5	3.9	7.7	11.0	107.0	Ω
5 Output Power	P_{2max}	13.0	12.0	12.0	11.3	11.5	10.0	W
6 Stall Torque	mNm	66 (9.35)	45 (6.38)	48 (6.8)	49 (6.94)	55 (7.79)	32 (4.54)	mNm (oz-in)
7 Efficiency	η_{max}	90	90	88	90	91	91	%
8 Max Continuous Speed	$n_{e max}$	10,000	10,000	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max}$	15.7 (2.06)	14.5 (2.06)	14.8 (2.1)	13.8 (1.96)	14.5 (2.06)	12.9 (1.83)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	2.40	1.18	0.95	0.67	0.58	0.18	A
11 Back-EMF Constant	k_E	0.69	1.31	1.64	2.18	2.64	7.54	mV/rpm
12 Torque Constant	k_M	6.60	12.50	15.70	20.80	25.20	72.00	mNm/A
13 Motor Regulation	R/k^2	13.8	16.0	15.8	17.80	17.32	20.64	$10^3/Nms$
14 Friction Torque	T_F	0.07 (0.01)	0.25 (0.04)	0.11 (0.02)	0.12 (0.02)	0.12 (0.02)	0.07 (0.01)	mNm (oz-in)
15 Rotor Inductance	L	0.04	0.16	0.25	0.50	0.60	7.00	mH
16 Mechanical Time Constant	t_m	6.7	7.0	6.6	8.4	7.8	6.9	ms
17 Rotor Inertia	J	4.90	4.39	4.20	4.74	4.50	3.32	g.cm ²
General Data								
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22					°C/W	
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550					S	
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)					°C (°F)	
	rotor	100 °C (212 °F)					°C (°F)	
21 Shaft Load Max.:		With sleeve bearings						
(5mm from bearing)	-radial	3.0 (10.8)					N (oz)	
	-axial	150 (539.5)					N (oz)	
22 Shaft Play:	-radial	<0.03 (0.0012)					mm (inch)	
	-axial	0.15 (0.0059)					mm (inch)	
23 Weight	g	53 (1.87)					g (oz)	

Execution Table			
Gearbox	Single Shaft	MR2	E9
R22	1001	1008	1005
M22	1001	1008	1005
K24	1001	1008	1005
K27	1001	1008	1005



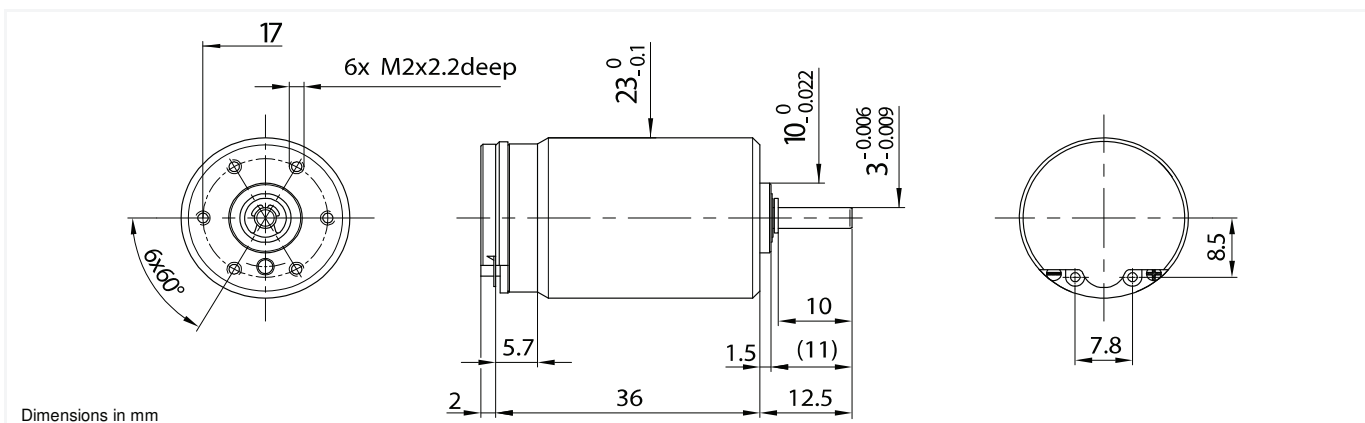
V121616

23GST2R82

Graphite-Copper commutation

Ø23mm

22 mNm

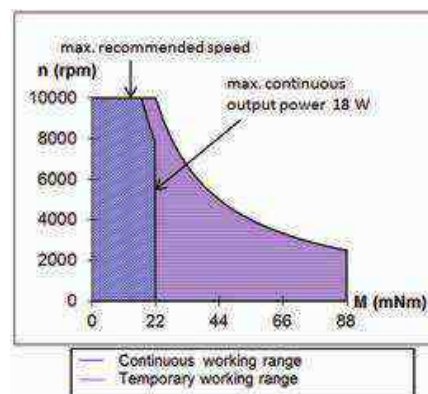


23GST2R82 **** .1

Electrical Data		****	216P	216E	
1	Nominal Voltage	V	12	24	Volt
2	No-Load Speed	n_0	8,690	9,010	rpm
3	No-Load Current	I_0	90.0	60.0	mA
4	Terminal Resistance	R	2.0	6.9	Ω
5	Output Power	P_{2max}	17.2	18.0	W
6	Stall Torque	mNm	80 (11.33)	87 (12.33)	mNm (oz-in)
7	Efficiency	η_{max}	77	76	%
8	Max Continuous Speed	$n_{e max}$	10,000	10,000	rpm
9	Max Continuous Torque	$M_{e max}$	21 (3.12)	22 (3.12)	mNm (oz-in)
10	Max Continuous Current	$I_{e max}$	1.70	0.90	A
11	Back-EMF Constant	k_E	1.36	2.62	mV/rpm
12	Torque Constant	k_M	13.00	25.00	mNm/A
13	Motor Regulation	R/k^2	12.0	11.0	$10^3/Nms$
14	Friction Torque	T_F	1.17 (0.17)	1.5 (0.22)	mNm (oz-in)
15	Rotor Inductance	L	0.08	0.30	mH
16	Mechanical Time Constant	t_m	5.6	5.2	ms
17	Rotor Inertia	J	4.70	4.70	g.cm ²
General Data					
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	7/16		°C/W
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	12/460		S
20	Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
		rotor	100 °C (212 °F)		°C (°F)
21	Shaft Load Max.:		With ball bearings		
	(5mm from bearing)	-radial	6.0 (21.6)		N (oz)
		-axial	250 (899.2)		N (oz)
22	Shaft Play:	-radial	<0.03 (0.0012)		mm (inch)
		-axial	0.15 (0.0059)		mm (inch)
23	Weight	g	80 (2.83)		g (oz)

Execution Table

Gearbox	Single Shaft	E9	MR2
R22	2	Upon Request	Upon Request
M22	2	Upon Request	8
K27	2	Upon Request	Upon Request

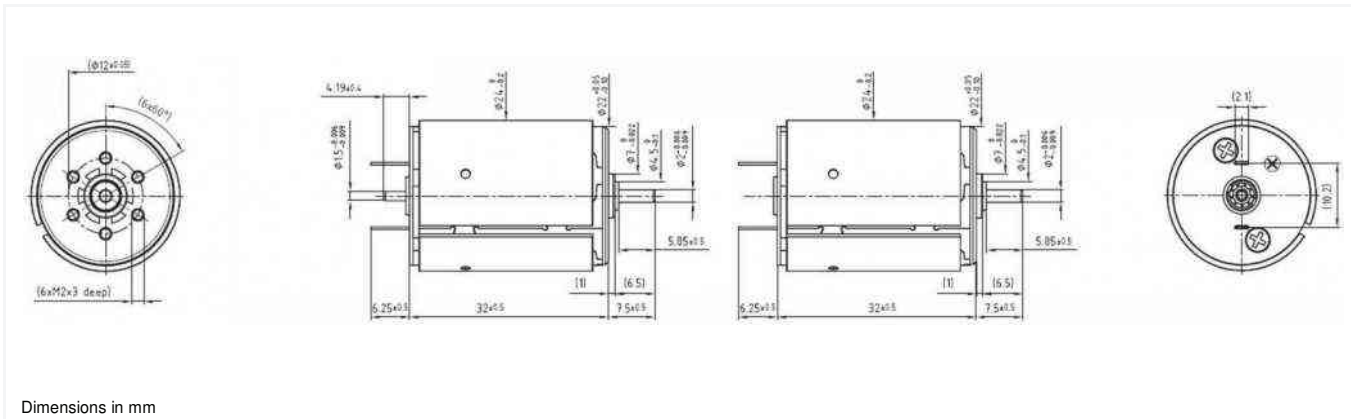


24DCT Athlonix™

Graphite-Copper commutation

Ø24mm

14.47 mNm



Dimensions in mm

24DCT 32G1/G2 **** .*

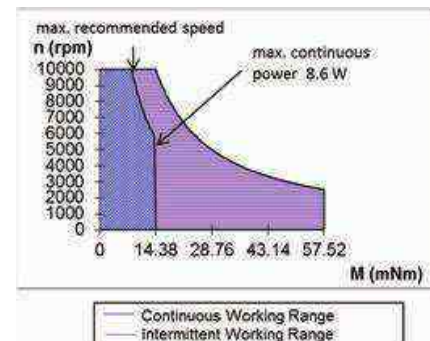
Electrical Data		****	226P	221P	216P	215P	213P	212P	
1	Nominal Voltage	V	3	6	9	12	15	18	Volt
2	No-Load Speed	n ₀	5651	7324	6414	7613	7342	7342	rpm
3	No-Load Current	I ₀	90.3	58.0	33.9	30.1	23.2	19.3	mA
4	Terminal Resistance	R	0.6	0.9	2.2	2.7	4.3	6.1	Ω
5	Output Power	P _{2max.}	3.6	7.1	6.9	8.8	8.7	8.8	W
6	Stall Torque	mNm	25.95 (3.68)	49.3 (6.99)	54.54 (7.73)	66 (9.35)	66.88 (9.48)	67.8 (9.61)	mNm (oz-in)
7	Efficiency	η _{max.}	76	82	83	84	84	84	%
8	Max Continuous Speed	n _{e max.}	10000	10000	10000	10000	10000	10000	rpm
9	Max Continuous Torque	M _{e max.}	10.07 (1.43)	12.29 (1.75)	13.87 (1.97)	14.01 (1.99)	14.37 (2.04)	14.47 (2.05)	mNm (oz-in)
10	Max Continuous Current	I _{e max.}	2.11	1.64	1.07	0.96	0.76	0.64	A
11	Back-EMF Constant	k _E	0.52	0.81	1.39	1.57	2.03	2.44	mV/rpm
12	Torque Constant	k _M	4.98	7.75	13.29	14.95	19.38	23.26	mNm/A
13	Motor Regulation	R/k ²	22.80	15.56	12.31	12.08	11.49	11.34	10 ³ /Nms
14	Friction Torque	T _F	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	mNm (oz-in)
15	Mechanical Time Constant	τ _m	10.78	7.47	5.88	5.70	5.45	5.33	ms
16	Rotor Inertia	J	4.73	4.80	4.78	4.72	4.74	4.70	g.cm ²
General Data									
17	Thermal Resistance (rotor/body)	R _{th1} / R _{th2}	6/22				°C/W		
18	Thermal Time Constant (rotor/stator)	t _{w1} /t _{w2}	9/550				S		
19	Operating Temperature Range:	t _{w1} /t _{w2}	-30 °C to 85 °C (-22 °F to 185 °F)				°C (°F)		
		rotor	100 °C (212 °F)				°C (°F)		
20	Shaft Load Max.:		With sleeve bearings						
	(5mm from bearing)	-radial	3 (10.79)				N (oz)		
		-axial	100 (359.6)				N (oz)		
21	Shaft Play:	-radial	0.03 (0.0012)				mm (inch)		
		-axial	0.15 (0.0059)				mm (inch)		
22	Weight	g	72 (2.54)				g (oz)		
* Also available with ball bearing									

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

G1: standard commutation

G2: special commutation for double shaft version



14.47 mNm



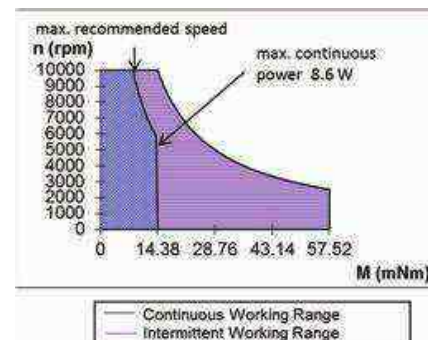
Electrical Data		****	215E	214E	213E	212E	210E	
1	Nominal Voltage	V	21	24	30	36	48	Volt
2	No-Load Speed	n_0	6952	7048	7810	7810	7602	rpm
3	No-Load Current	I_0	15.7	13.9	12.4	10.3	7.5	mA
4	Terminal Resistance	R	10.1	13.0	16.4	23.6	46.3	Ω
5	Output Power	$P_{2max.}$	7.7	7.8	9.0	9.0	8.4	W
6	Stall Torque	mNm	59.2 (8.39)	59.34 (8.41)	66.32 (9.4)	66.15 (9.37)	61.6 (8.73)	mNm (oz-in)
7	Efficiency	$\eta_{max.}$	83	83	84	84	84	%
8	Max Continuous Speed	$n_{e\ max.}$	10000	10000	10000	10000	10000	rpm
9	Max Continuous Torque	$M_{e\ max.}$	13.88 (1.97)	13.8 (1.96)	13.86 (1.97)	13.84 (1.97)	13.53 (1.92)	mNm (oz-in)
10	Max Continuous Current	$I_{e\ max.}$	0.50	0.44	0.39	0.32	0.23	A
11	Back-EMF Constant	k_E	3.00	3.38	3.82	4.58	6.27	mV/rpm
12	Torque Constant	k_M	28.63	32.27	36.44	43.72	59.86	mNm/A
13	Motor Regulation	R/k^2	12.30	12.44	12.33	12.36	12.92	$10^3/Nms$
14	Friction Torque	T_F	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	mNm (oz-in)
15	Mechanical Time Constant	τ_m	5.91	5.87	5.84	5.81	5.77	ms
16	Rotor Inertia	J	4.81	4.72	4.74	4.70	4.47	g.cm ²

17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22	°C/W
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550	S
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30 °C to 85 °C (-22 °F to 185 °F)	°C (°F)
	rotor	100 °C (212 °F)	°C (°F)
20 Shaft Load Max.:		With sleeve bearings	
(5mm from bearing)	-radial	3 (10.79)	N (oz)
	-axial	100 (359.6)	N (oz)
21 Shaft Play:	-radial	0.03 (0.0012)	mm (inch)
	-axial	0.15 (0.0059)	mm (inch)
22 Weight	g	72 (2.54)	g (oz)

* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

G2:special commutation for double shaft version

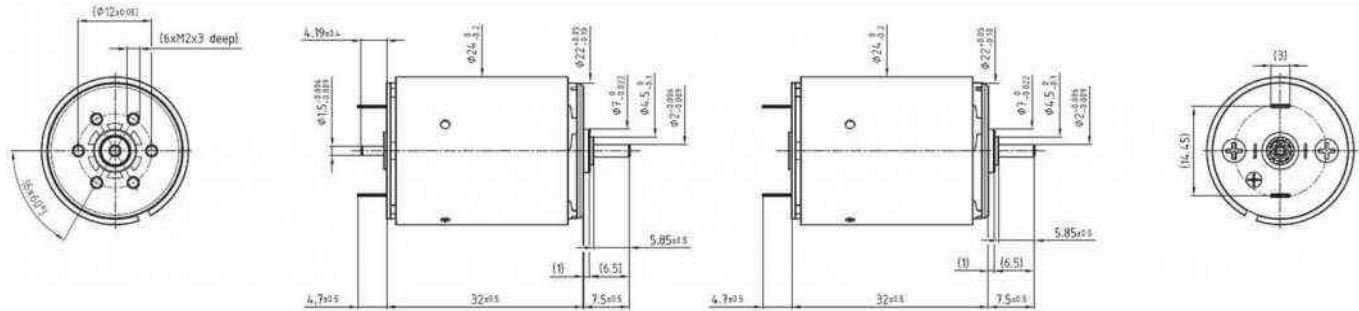


24DCT Athlonix™

Precious metal commutation

Ø24mm

14.97 mNm



Dimensions in mm

24DCT 32P1/P2 ****.*

Electrical Data	****	226P	221P	216P	215P	213P	212P	
1 Nominal Voltage	V	3	6	9	12	15	18	Volt
2 No-Load Speed	n_0	5718	7365	6444	7641	7368	7370	rpm
3 No-Load Current	I_0	44.1	28.4	16.6	14.7	11.4	8.6	mA
4 Terminal Resistance	R	0.4	0.7	2.0	2.5	4.1	5.9	Ω
5 Output Power	P_{2max}	5.3	8.5	7.5	9.4	9.1	9.1	W
6 Stall Torque	mNm	40.6 (5.75)	63.07 (8.94)	60.34 (8.55)	71.54 (10.14)	70.38 (9.97)	70.35 (9.97)	mNm (oz-in)
7 Efficiency	η_{max}	86	89	88	89	89	90	%
8 Max Continuous Speed	$n_{e max}$	10000	10000	10000	10000	10000	10000	rpm
9 Max Continuous Torque	$M_{e max}$	12.86 (1.83)	14.15 (2.01)	14.81 (2.1)	14.81 (2.1)	14.96 (2.12)	14.97 (2.13)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	2.62	1.85	1.13	1.00	0.78	0.65	A
11 Back-EMF Constant	k_E	0.52	0.81	1.39	1.57	2.03	2.44	mV/rpm
12 Torque Constant	k_M	4.98	7.75	13.29	14.95	19.38	23.26	mNm/A
13 Motor Regulation	R/k^2	14.75	12.23	11.18	11.18	10.96	10.97	$10^3/Nms$
14 Friction Torque	T_F	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	mNm (oz-in)
15 Mechanical Time Constant	τ_m	6.97	5.87	5.34	5.28	5.20	5.16	ms
16 Rotor Inertia	J	4.73	4.80	4.78	4.72	4.74	4.70	g.cm ²
General Data								
17 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/22					$^{\circ}C/W$	
18 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	9/550					S	
19 Operating Temperature Range:	t_{w1}/t_{w2}	-30°C to 85°C (-22°F to 185°F)					$^{\circ}C (^{\circ}F)$	
	rotor	100°C (212°F)					$^{\circ}C (^{\circ}F)$	
20 Shaft Load Max.:		With sleeve bearings						
(5mm from bearing)	-radial	3 (10.79)					N (oz)	
	-axial	100 (359.6)					N (oz)	
21 Shaft Play:	-radial	0.03 (0.0012)					mm (inch)	
	-axial	0.15 (0.0059)					mm (inch)	
22 Weight	g	72 (2.54)					g (oz)	

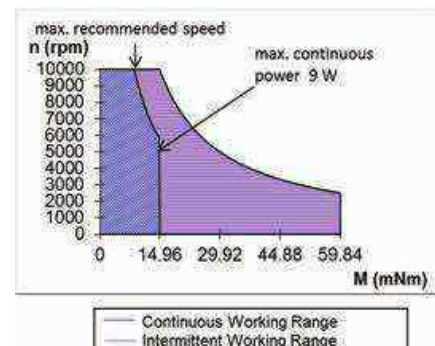
* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

P1:standard commutation

P2:special commutation for double shaft version

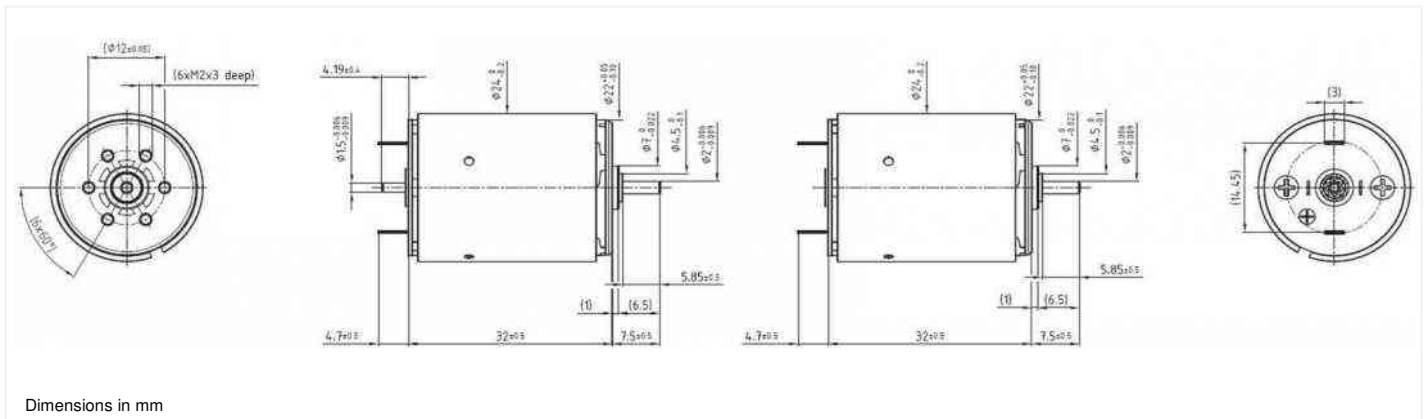


24DCT Athlonix™

Precious metal commutation

Ø24mm

14.97 mNm



24DCT 32P1/P2 ****.*								
Electrical Data		****	215E	214E	213E	212E	210E	
1	Nominal Voltage	V	21	24	30	36	48	Volt
2	No-Load Speed	n ₀	6980	7076	7837	7837	7631	rpm
3	No-Load Current	I ₀	7.7	6.8	6.0	5.0	3.7	mA
4	Terminal Resistance	R	9.9	12.8	16.2	23.4	46.1	Ω
5	Output Power	P _{2max.}	8.0	8.0	9.2	9.2	8.6	W
6	Stall Torque	mNm	60.64 (8.59)	60.51 (8.57)	67.38 (9.55)	66.95 (9.49)	62.1 (8.8)	mNm (oz-in)
7	Efficiency	η _{max.}	88	88	89	89	88	%
8	Max Continuous Speed	n _{e max.}	10000	10000	10000	10000	10000	rpm
9	Max Continuous Torque	M _{e max.}	14.25 (2.02)	14.14 (2.01)	14.18 (2.01)	14.13 (2.01)	13.79 (1.96)	mNm (oz-in)
10	Max Continuous Current	I _{e max.}	0.50	0.44	0.39	0.32	0.23	A
11	Back-EMF Constant	k _E	3.00	3.38	3.82	4.58	6.27	mV/rpm
12	Torque Constant	k _M	28.63	32.27	36.44	43.72	59.86	mNm/A
13	Motor Regulation	R/k ²	12.05	12.24	12.18	12.26	12.87	10 ³ Nms
14	Friction Torque	T _F	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	0.22 (0.04)	mNm (oz-in)
15	Mechanical Time Constant	τ _m	5.80	5.78	5.77	5.76	5.75	ms
16	Rotor Inertia	J	4.81	4.72	4.74	4.70	4.47	g.cm ²
General Data								
17	Thermal Resistance (rotor/body)	R _{th1} / R _{th2}	6/22				°C/W	
18	Thermal Time Constant (rotor/stator)	t _{w1} /t _{w2}	9/550				S	
19	Operating Temperature Range:	t _{w1} /t _{w2}	-30 °C to 85 °C (-22 °F to 185 °F)				°C (°F)	
		rotor	100 °C (212 °F)				°C (°F)	
20	Shaft Load Max.:		With sleeve bearings					
	(5mm from bearing)	-radial	3(10.79)				N (oz)	
		-axial	100 (359.6)				N (oz)	
21	Shaft Play:	-radial	0.03 (0.0012)				mm (inch)	
		-axial	0.15 (0.0059)				mm (inch)	
22	Weight	g	72 (2.54)				g (oz)	
* Also available with ball bearing								

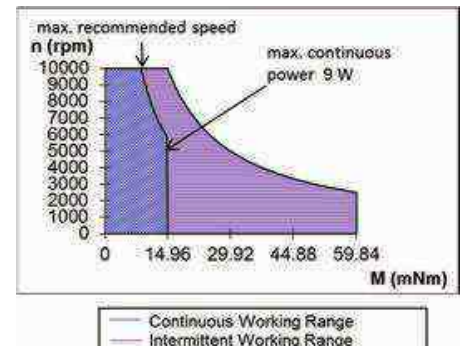
* Also available with ball bearing

Execution			
Gearbox	Single Shaft	MR2	E9
R22	4	5	6
M22	1	2	3
K24	7	8	9
K27	1	2	3

Note:

P1:standard commutation

P2:special commutation for double shaft version

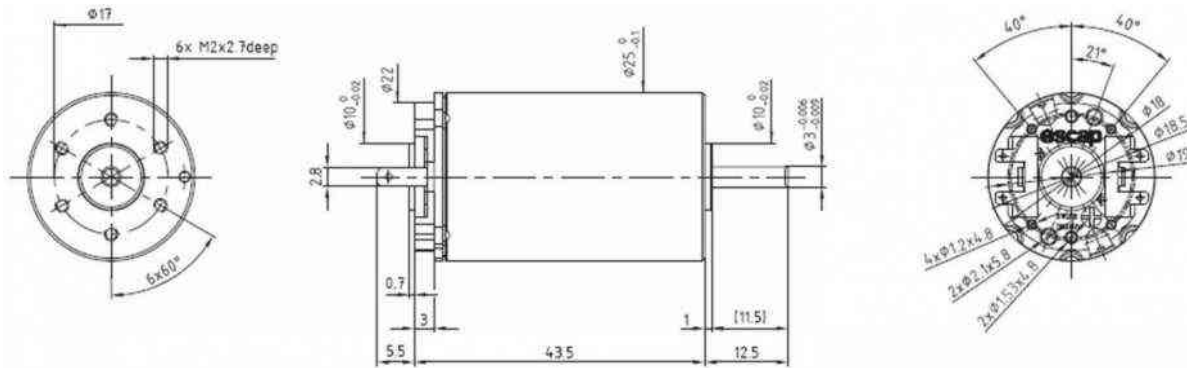


25GST2R82

Graphite-Copper commutation

Ø25mm

33 mNm



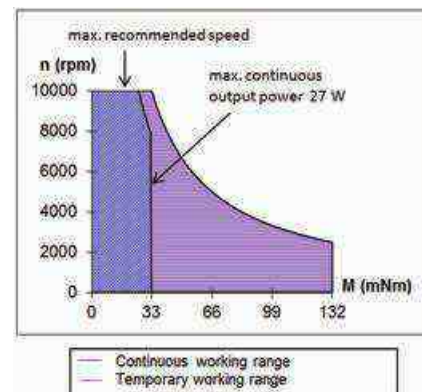
Dimensions in mm

25GST2R82 **** .1

Electrical Data	****	228E	230E	216P	216E	
1 Nominal Voltage	V	18	18	24	35	Volt
2 No-Load Speed	n_0	11,125	11,450	10,320	7,850	rpm
3 No-Load Current	I_0	110.0	110.0	70.0	40.0	mA
4 Terminal Resistance	R	1.6	1.3	3.3	12.5	Ω
5 Output Power	$P_{2max.}$	23.8	26.0	24.0	23.3	W
6 Stall Torque	mNm	172 (24.36)	206 (29.18)	160 (22.66)	118 (16.72)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	81	83	81	78	%
8 Max Continuous Speed	$n_{e max.}$	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$	30 (4.68)	33 (4.68)	30 (4.25)	30 (4.25)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	2.10	2.30	1.45	0.75	A
11 Back-EMF Constant	k_E	1.60	1.56	2.30	4.40	mV/rpm
12 Torque Constant	k_M	15.30	14.90	22.00	42.00	mNm/A
13 Motor Regulation	R/k^2	6.9	5.9	6.8	7.10	$10^3/Nms$
14 Friction Torque	T_F	1.68 (0.24)	1.64 (0.24)	1.54 (0.22)	1.68 (0.24)	mNm (oz-in)
15 Rotor Inductance	L	0.10	0.10	0.10	0.80	mH
16 Mechanical Time Constant	t_m	6.9	5.9	6.8	7.1	ms
17 Rotor Inertia	J	10.00	10.00	10.00	10.00	g.cm ²
General Data						
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	6/13				°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	10/450				S
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)				°C (°F)
	rotor	100 °C (212 °F)				°C (°F)
21 Shaft Load Max.:		With ball bearings				
(5mm from bearing)	-radial	12.0 (43.2)				N (oz)
	-axial	680 (2,445.9)				N (oz)
22 Shaft Play:	-radial	<0.03 (0.0012)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
23 Weight	g	111 (3.92)				g (oz)

Execution Table

Gearbox	Single Shaft	E9	HEDS	MR2
R32	1	2	4	Upon Request
M22	5	11	Upon Request	Upon Request



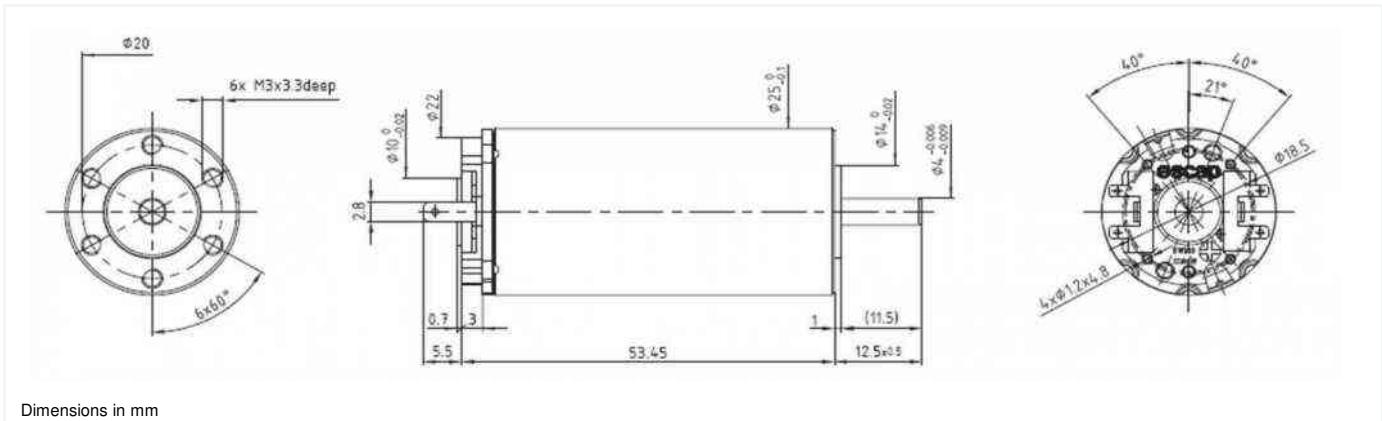
V121616

25GT2R82

Graphite-Copper commutation

Ø25mm

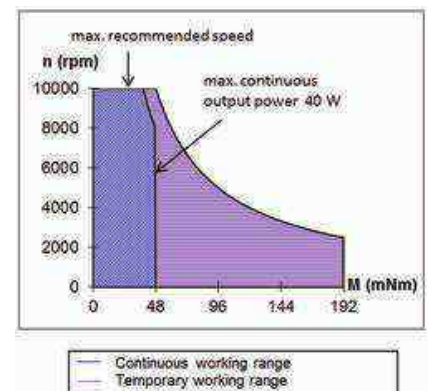
47 mNm



25GT2R82 **** .1

Electrical Data	****	222E	222P	230E	219E	
1 Nominal Voltage	V	15	18	24	36	Volt
2 No-Load Speed	n_0	4,075	9,460	10,000	8,260	rpm
3 No-Load Current	I_0	80.0	140.0	120.0	65.0	mA
4 Terminal Resistance	R	4.0	1.3	1.8	7.4	Ω
5 Output Power	$P_{2max.}$	36.8	33.0	37.0	33.0	W
6 Stall Torque	mNm	129 (18.27)	249 (35.27)	315 (44.61)	194 (27.48)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	73	81	82	78	%
8 Max Continuous Speed	$n_{e max.}$	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$	47 (5.95)	42 (5.95)	47 (6.67)	41 (5.81)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	1.44	2.50	2.20	1.06	A
11 Back-EMF Constant	k_E	3.60	1.88	2.40	4.30	mV/rpm
12 Torque Constant	k_M	34.40	18.00	23.00	41.10	mNm/A
13 Motor Regulation	R/k^2	3.4	4.0	4.2	4.40	$10^3/Nms$
14 Friction Torque	T_F	2.75 (0.39)	2.5 (0.36)	2.76 (0.4)	2.65 (0.38)	mNm (oz-in)
15 Rotor Inductance	L	0.30	0.08	0.14	0.50	mH
16 Mechanical Time Constant	t_m	4.4	5.2	5.5	5.7	ms
17 Rotor Inertia	J	13.00	13.00	12.50	13.00	$g.cm^2$
General Data						
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	5 / 11				$^{\circ}C/W$
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	10/450				S
20 Operating Temperature Range:	motor	-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)				$^{\circ}C$ ($^{\circ}F$)
	rotor	100 $^{\circ}C$ (212 $^{\circ}F$)				$^{\circ}C$ ($^{\circ}F$)
21 Shaft Load Max.:		With ball bearings				
(5mm from bearing)	-radial	25.0 (89.9)				N (oz)
	-axial	1,000 (3,596.9)				N (oz)
22 Shaft Play:	-radial	<0.03 (0.0012)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
23 Weight	g	145 (5.12)				g (oz)

Execution Table				
Gearbox	Single Shaft	E9	HEDS	MR2
R32	6	8	-	Upon Request
R40	1	2	4	Upon Request
M22	9	Upon Request	Upon Request	Upon Request

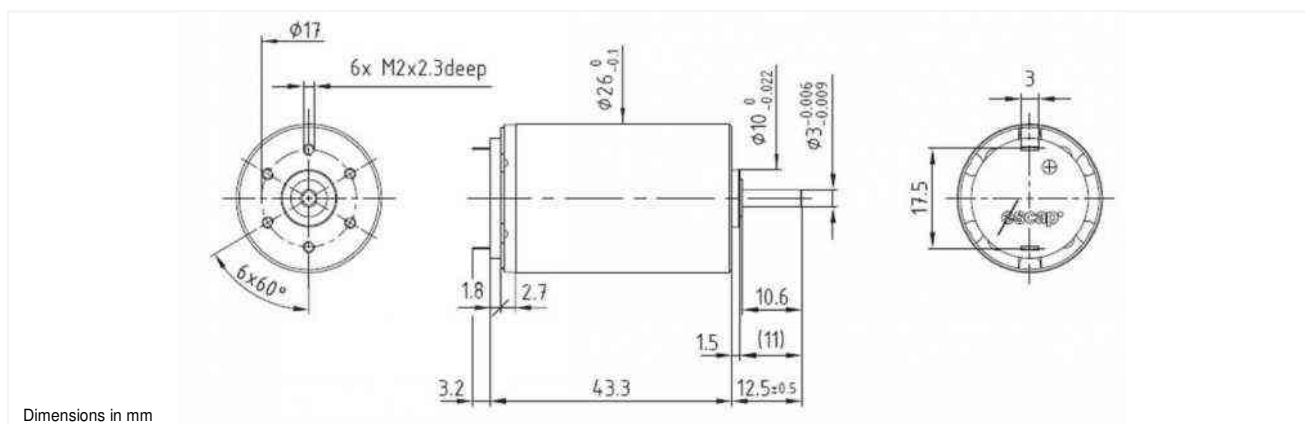


26N58

Precious metal commutation

Ø26mm

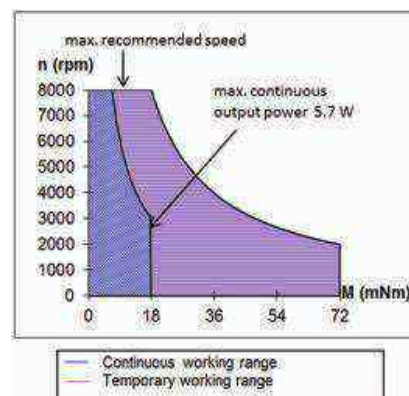
17.9 mNm



26N58 ****.1

Electrical Data		****	216P	216E	113	110	
1	Nominal Voltage	V	6	12	15	24	Volt
2	No-Load Speed	n ₀	4,600	4,735	5,470	6,660	rpm
3	No-Load Current	I ₀	31.0	16.0	15.0	20.0	mA
4	Terminal Resistance	R	2.5	10.0	15.2	32.0	Ω
5	Output Power	P _{2max.}	6.2	6.0	5.2	4.6	W
6	Stall Torque	mNm	29.6 (4.2)	28.6 (4.06)	25 (3.55)	25 (3.55)	mNm (oz-in)
7	Efficiency	h _{max.}	79	78	77	70	%
8	Max Continuous Speed	n _{e max.}	8,000	8,000	8,000	8,000	rpm
9	Max Continuous Torque	M _{e max.}	17.9 (2.45)	17.3 (2.45)	15.1 (2.14)	13.3 (1.89)	mNm (oz-in)
10	Max Continuous Current	I _{e max.}	1.47	0.74	0.60	0.41	A
11	Back-EMF Constant	k _E	1.29	2.50	2.70	3.51	mV/rpm
12	Torque Constant	k _M	12.30	23.90	25.80	33.50	mNm/A
13	Motor Regulation	R/k ²	16.5	17.5	22.8	28.51	10 ³ /Nms
14	Friction Torque	T _F	0.38 (0.06)	0.38 (0.06)	0.38 (0.06)	0.38 (0.06)	mNm (oz-in)
15	Rotor Inductance	L	0.22	0.80	1.00	1.50	mH
16	Mechanical Time Constant	t _m	9.9	10.5	13.7	17.1	ms
17	Rotor Inertia	J	6.00	6.00	6.00	6.00	g.cm ²
General Data							
18	Thermal Resistance (rotor/body)	R _{th1} / R _{th2}	5 / 12				°C/W
19	Thermal Time Constant (rotor/stator)	t _{w1} /t _{w2}	10/640				S
20		Operating Temperature Range:	-30 °C to 85 °C (-22 °F to 185 °F)				°C (°F)
		motor					
		rotor	100 °C (212 °F)				°C (°F)
21		Shaft Load Max.:	With sleeve bearings				
		(5mm from bearing)	-radial	6.0 (21.6)			N (oz)
			-axial	250 (899.2)			N (oz)
22		Shaft Play:	-radial	<0.03 (0.0012)			mm (inch)
			-axial	0.15 (0.0059)			mm (inch)
23		Weight	q	114 (4.03)			q (oz)

Execution Table		
Gearbox	Single Shaft	Double Shaft for E9
R22	5	9
M22	5	9
K24	5	9
K27	5	9

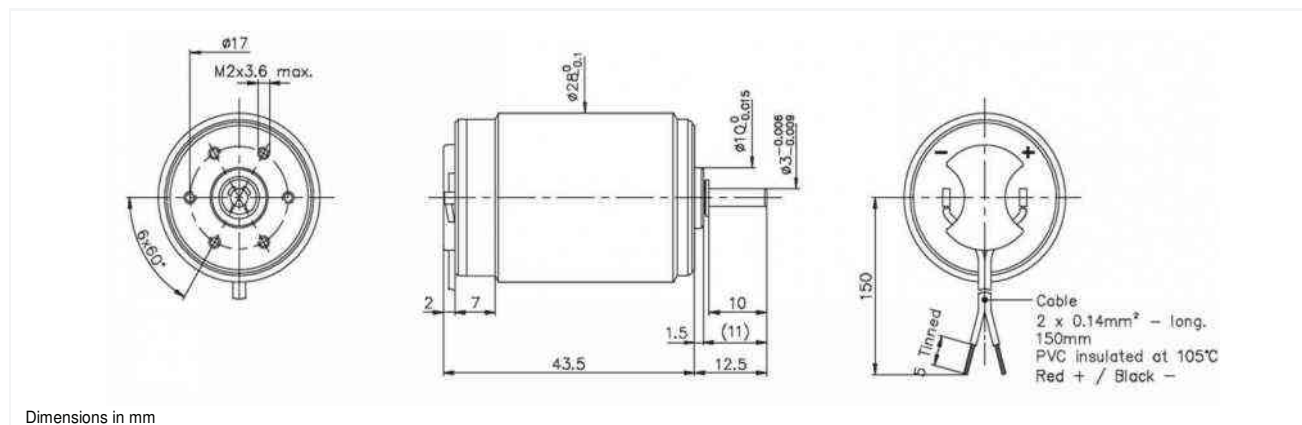


28L28

Precious metal commutation

Ø28mm

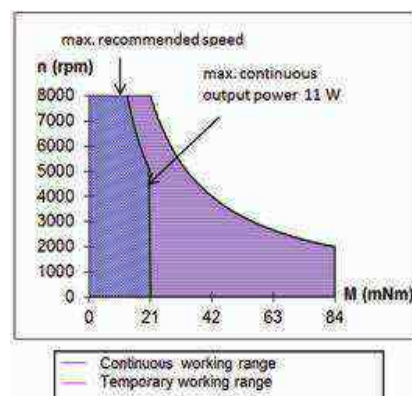
21 mNm



28L28 **** .49

Electrical Data	****	219	416E	413E	410E	
1 Nominal Voltage	V	12	24	28	36	Volt
2 No-Load Speed	n ₀	5,300	5,590	5,325	5,000	rpm
3 No-Load Current	I ₀	22.0	11.0	9.0	6.6	mA
4 Terminal Resistance	R	6.0	19.5	33.0	71.0	Ω
5 Output Power	P _{2max.}	9.6	10.0	9.3	9.0	W
6 Stall Torque	mNm	43 (6.09)	50 (7.09)	32 (4.54)	34 (4.82)	mNm (oz-in)
7 Efficiency	h _{max.}	80	82	80	78	%
8 Max Continuous Speed	n _{e max.}	8,000	8,000	8,000	8,000	rpm
9 Max Continuous Torque	M _{e max.}	19.9 (2.98)	21 (2.98)	19.4 (2.75)	18.5 (2.62)	mNm (oz-in)
10 Max Continuous Current	I _{e max.}	0.95	0.53	0.40	0.28	A
11 Back-EMF Constant	k _E	2.24	4.26	5.20	7.10	mV/rpm
12 Torque Constant	k _M	21.40	40.70	49.70	67.80	mNm/A
13 Motor Regulation	R/k ²	13.0	12.0	13.2	15.20	10 ³ /Nms
14 Friction Torque	T _F	0.47 (0.07)	0.45 (0.07)	0.45 (0.07)	0.45 (0.07)	mNm (oz-in)
15 Rotor Inductance	L	0.50	2.40	3.20	5.20	mH
16 Mechanical Time Constant	t _m	13.5	21.0	17.8	16.7	ms
17 Rotor Inertia	J	10.40	17.50	13.50	11.00	g.cm ²
General Data						
18 Thermal Resistance (rotor/body)	R _{th1} / R _{th2}	5 / 12				°C/W
19 Thermal Time Constant (rotor/stator)	t _{w1} /t _{w2}	13/760				S
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)				°C (°F)
	rotor	100 °C (212 °F)				°C (°F)
21 Shaft Load Max.:		With sleeve bearings				
(5mm from bearing)	-radial	6.0 (21.6)				N (oz)
	-axial	250 (899.2)				N (oz)
22 Shaft Play:	-radial	<0.018 (0.0007)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
23 Weight	q	125 (4.41)				g (oz)

Execution Table		
Gearbox	Single Shaft	Double Shaft for E9
R22	164	317
M22	164	317
R32	49	315

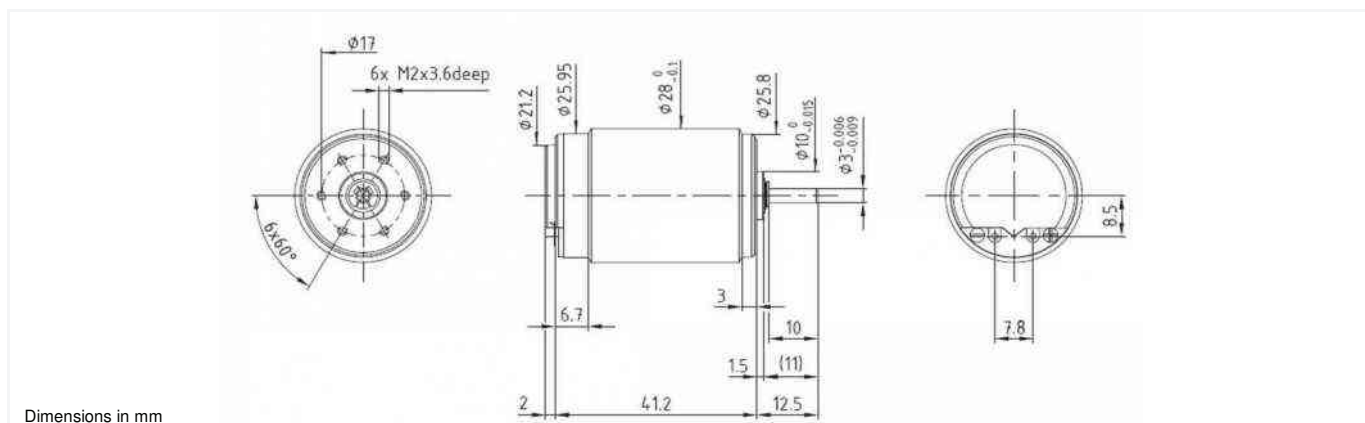


28LT12

Graphite-Copper commutation

Ø28mm

24 mNm



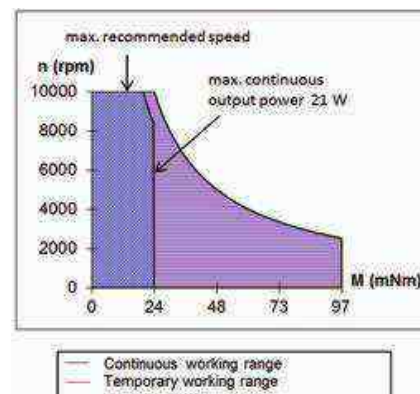
Dimensions in mm

28LT12 **** .49

Electrical Data		****	219	416E	
1 Nominal Voltage	V		18	32	Volt
2 No-Load Speed	n_0		7,860	7,345	rpm
3 No-Load Current	I_0		65.0	35.0	mA
4 Terminal Resistance	R		6.2	19.9	Ω
5 Output Power	$P_{2max.}$		19.0	20.0	W
6 Stall Torque	mNm		63 (8.93)	65 (9.21)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$		72	73	%
8 Max Continuous Speed	$n_{e max.}$		10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$		23 (3.4)	24 (3.4)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$		1.13	0.63	A
11 Back-EMF Constant	k_E		2.24	4.26	mV/rpm
12 Torque Constant	k_M		21.40	40.70	mNm/A
13 Motor Regulation	R/k^2		13.0	12.0	$10^3/Nms$
14 Friction Torque	T_F		1.39 (0.2)	1.42 (0.21)	mNm (oz-in)
15 Rotor Inductance	L		0.50	2.40	mH
16 Mechanical Time Constant	t_m		13.9	21.4	ms
17 Rotor Inertia	J		10.70	17.80	g.cm ²
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		5 / 12		°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		27/760		S
20 Operating Temperature Range:	motor		-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
	rotor		100 °C (212 °F)		°C (°F)
21 Shaft Load Max.:			With sleeve bearings		
(5mm from bearing)	-radial		6.0 (21.6)		N (oz)
	-axial		250 (899.2)		N (oz)
22 Shaft Play:	-radial		<0.018 (0.0007)		mm (inch)
	-axial		0.15 (0.0059)		mm (inch)
23 Weight	g		135 (4.77)		g (oz)

Execution Table

Gearbox	Single Shaft	Double Shaft for E9
R22	164	319
M22	164	-
R32	49	316



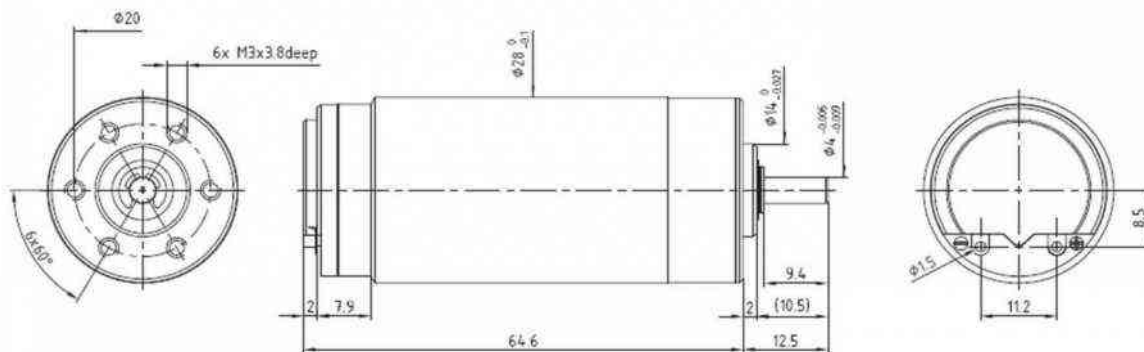
V121616

28DT12

Graphite-Copper commutation

Ø28mm

41 mNm



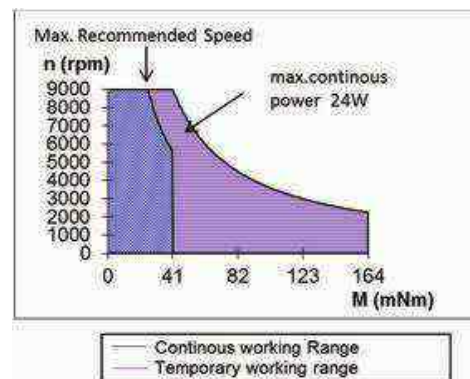
Dimensions in mm

28DT12 **** .1

Electrical Data	****	222P	219P	222E	219E	
1 Nominal Voltage	V	12	15	24	28	Volt
2 No-Load Speed	n_0	6,840	7,100	6,851	6,870	rpm
3 No-Load Current	I_0	210.0	180.0	110.0	90.0	mA
4 Terminal Resistance	R	1.9	2.9	6.2	9.9	Ω
5 Output Power	P_{2max}	24.0	24.0	27.0	24.0	W
6 Stall Torque	mNm	102 (14.45)	101 (14.31)	126 (17.85)	107 (15.16)	mNm (oz-in)
7 Efficiency	η_{max}	67	66	69	68	%
8 Max Continuous Speed	$n_{e max}$	9,000	9,000	9,000	9,000	rpm
9 Max Continuous Torque	$M_{e max}$	37 (5.1)	36 (5.1)	41 (5.81)	37 (5.24)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	2.50	2.00	1.40	1.10	A
11 Back-EMF Constant	k_E	1.70	2.04	3.40	3.95	mV/rpm
12 Torque Constant	k_M	16.20	19.50	32.50	37.70	mNm/A
13 Motor Regulation	R/k^2	7.0	8.0	6.0	7.00	$10^3/Nms$
14 Friction Torque	T_F	3.4 (0.49)	3.4 (0.49)	3.4 (0.49)	3.4 (0.49)	mNm (oz-in)
15 Rotor Inductance	L	0.20	0.30	0.75	1.10	mH
16 Mechanical Time Constant	t_m	14.0	14.4	12.0	12.6	ms
17 Rotor Inertia	J	20.00	18.00	20.00	18.00	$g \cdot cm^2$
General Data						
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}	3.5/8				$^{\circ}C/W$
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}	18/630				S
20 Operating Temperature Range:	motor	-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)				$^{\circ}C$ ($^{\circ}F$)
	rotor	100 $^{\circ}C$ (212 $^{\circ}F$)				$^{\circ}C$ ($^{\circ}F$)
21 Shaft Load Max.:		With sleeve bearings				
(5mm from bearing)	-radial	8.0 (28.8)				N (oz)
	-axial	500 (1,798.5)				N (oz)
22 Shaft Play:	-radial	<0.025 (0.001)				mm (inch)
	-axial	0.15 (0.0059)				mm (inch)
23 Weight	g	200 (7.06)				g (oz)

Execution Table

Gearbox	Single Shaft	Double Shaft for E9	HEDS
R32	4	106	103
R40	1	98	Upon Request

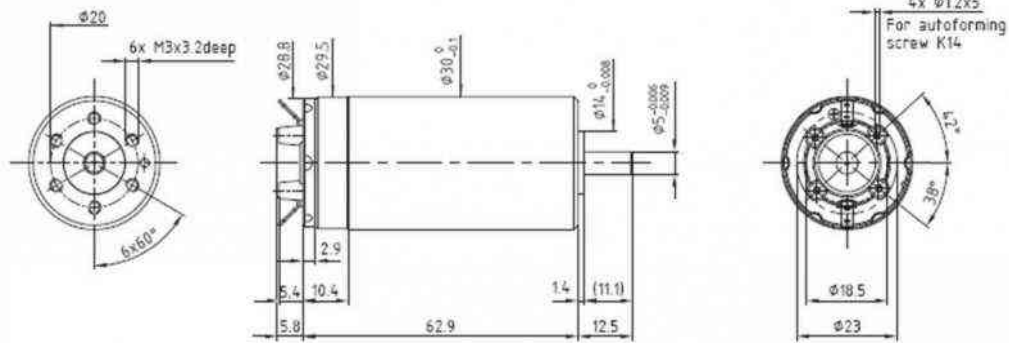


30GT2R82

Graphite-Copper commutation

Ø30mm

92 mNm



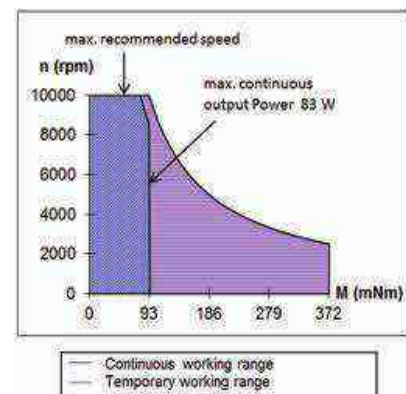
Dimensions in mm

30GT2R82 **** .4

Electrical Data		****	234P	234E	
1 Nominal Voltage	V		15	35	Volt
2 No-Load Speed	n_0		7,090	8,600	rpm
3 No-Load Current	I_0		180.0	90.0	mA
4 Terminal Resistance	R		0.5	1.6	Ω
5 Output Power	$P_{2max.}$		77.0	82.0	W
6 Stall Torque	mNm		628 (88.94)	847 (119.95)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$		85	88	%
8 Max Continuous Speed	$n_{e max.}$		10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$		87 (13.03)	92 (13.03)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$		4.50	2.50	A
11 Back-EMF Constant	k_E		2.10	4.05	mV/rpm
12 Torque Constant	k_M		20.10	38.70	mNm/A
13 Motor Regulation	R/k^2		1.2	1.1	$10^3/Nms$
14 Friction Torque	T_F		3.62 (0.52)	3.48 (0.5)	mNm (oz-in)
15 Rotor Inductance	L		0.06	0.24	mH
16 Mechanical Time Constant	t_m		4.0	3.6	ms
17 Rotor Inertia	J		33.00	33.00	$g.cm^2$
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		4.5/9		$^{\circ}C/W$
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		18/630		S
20 Operating Temperature Range:	motor		-30 $^{\circ}C$ to 85 $^{\circ}C$ (-22 $^{\circ}F$ to 185 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
	rotor		100 $^{\circ}C$ (212 $^{\circ}F$)		$^{\circ}C$ ($^{\circ}F$)
21 Shaft Load Max.:			With ball bearings		
(5mm from bearing)	-radial		35.0 (125.9)		N (oz)
	-axial		100 (359.6)		N (oz)
22 Shaft Play:	-radial		negligible		mm (inch)
	-axial		negligible		mm (inch)
23 Weight	g		310 (10.94)		g (oz)

Execution Table

Gearbox	Single Shaft	E9	HEDS
R32	4	5	20
R40	4	5	Upon Request



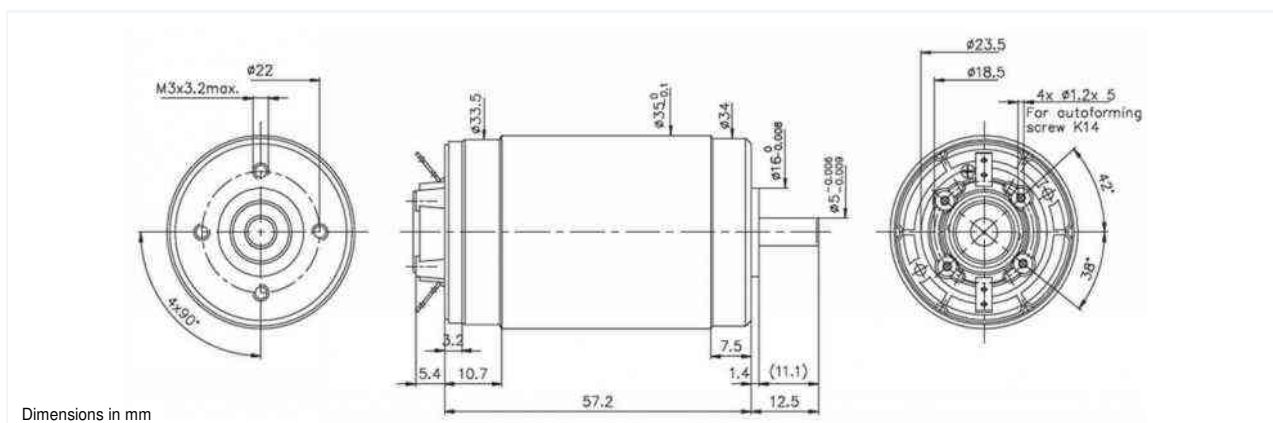
V121616

35NT2R32

Graphite-Copper commutation

Ø35mm

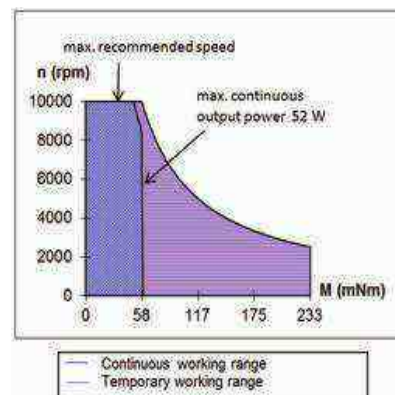
56 mNm



35NT2R32 **** .1

Electrical Data	****	228P	228E	416SP	
1 Nominal Voltage	V	9	15	24	Volt
2 No-Load Speed	n_0	5,020	4,315	4,365	rpm
3 No-Load Current	I_0	180.0	90.0	50.0	mA
4 Terminal Resistance	R	1.0	3.6	8.3	Ω
5 Output Power	P_{2max}	33.0	33.0	35.0	W
6 Stall Torque	mNm	151 (21.39)	137 (19.41)	150 (21.25)	mNm (oz-in)
7 Efficiency	η_{max}	74	73	75	%
8 Max Continuous Speed	$n_{e max}$	9,000	9,000	9,000	rpm
9 Max Continuous Torque	$M_{e max}$	52 (7.65)	54 (7.65)	56 (7.94)	mNm (oz-in)
10 Max Continuous Current	$I_{e max}$	3.30	1.75	1.18	A
11 Back-EMF Constant	k_E	1.76	3.40	5.40	mV/rpm
12 Torque Constant	k_M	16.80	32.50	51.60	mNm/A
13 Motor Regulation	R/k^2	3.5	3.4	3.1	$10^3/Nms$
14 Friction Torque	T_F	3 (0.43)	2.93 (0.42)	2.6 (0.37)	mNm (oz-in)
15 Rotor Inductance	L	0.13	0.52	1.30	mH
16 Mechanical Time Constant	t_m	16.8	16.3	16.2	ms
17 Rotor Inertia	J	48.00	48.00	52.00	g.cm ²
General Data					
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		4/8		°C/W
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		40/920		S
20 Operating Temperature Range:	motor		-30 °C to 85 °C (-22 °F to 185 °F)		°C (°F)
	rotor		100 °C (212 °F)		°C (°F)
21 Shaft Load Max.:			With ball bearings		
(5mm from bearing)	-radial		35.0 (125.9)		N (oz)
	-axial		100 (359.6)		N (oz)
22 Shaft Play:	-radial		negligible		mm (inch)
	-axial		negligible		mm (inch)
23 Weight	g		310 (10.94)		g (oz)

Execution Table			
Gearbox	Single Shaft	E9	HEDS
R32	54	66	Upon Request
R40	1	96	Upon Request

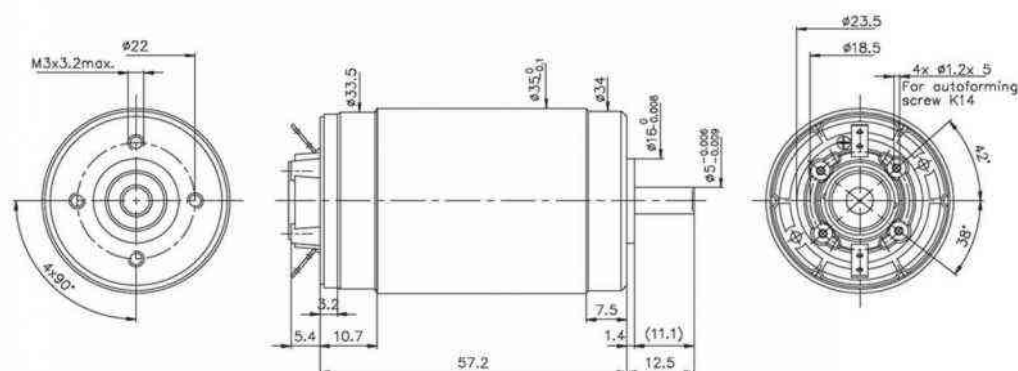


35NT2R82

Graphite-Copper commutation

Ø35mm

114 mNm

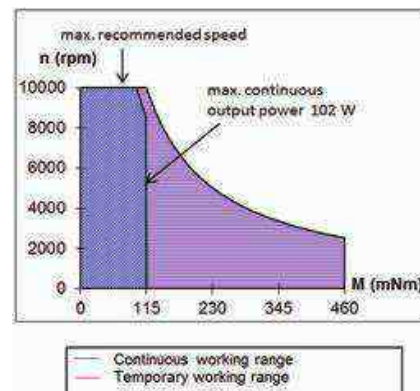


Dimensions in mm

35NT2R82 **** .1

Electrical Data		****	426P	226E	426SP	426E	
1	Nominal Voltage	V	18	28	32	60	Volt
2	No-Load Speed	n_0	6,765	6,935	5,850	5,760	rpm
3	No-Load Current	I_0	141.0	80.0	80.0	40.0	mA
4	Terminal Resistance	R	0.6	1.6	2.2	7.7	Ω
5	Output Power	$P_{2max.}$	102.0	91.0	103.0	107.0	W
6	Stall Torque	mNm	828 (117.26)	676 (95.73)	756 (107.06)	782 (110.75)	mNm (oz-in)
7	Efficiency	$\eta_{max.}$	87	87	86	86	%
8	Max Continuous Speed	$n_{e max.}$	9,000	9,000	9,000	9,000	rpm
9	Max Continuous Torque	$M_{e max.}$	108 (13.74)	97 (13.74)	109 (15.44)	114 (16.15)	mNm (oz-in)
10	Max Continuous Current	$I_{e max.}$	4.40	2.60	2.20	1.19	A
11	Back-EMF Constant	k_E	2.65	4.02	5.45	10.37	mV/rpm
12	Torque Constant	k_M	25.30	38.40	52.00	99.00	mNm/A
13	Motor Regulation	R/k^2	0.9	1.1	0.8	0.77	$10^3/Nms$
14	Friction Torque	T_F	3.57 (0.51)	3.07 (0.44)	4.16 (0.59)	3.96 (0.57)	mNm (oz-in)
15	Rotor Inductance	L	0.10	0.22	0.40	1.70	mH
16	Mechanical Time Constant	t_m	6.1	5.9	5.9	5.5	ms
17	Rotor Inertia	J	71.40	54.00	71.40	71.40	g.cm ²
General Data							
18	Thermal Resistance (rotor/body)	R_{th1} / R_{th2}		4/8			°C/W
19	Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}		40/920			S
20	Operating Temperature Range:	motor		-30 °C to 85 °C (-22 °F to 185 °F)			°C (°F)
		rotor		100 °C (212 °F)			°C (°F)
21	Shaft Load Max.:			With ball bearings			
	(5mm from bearing)	-radial		35.0 (125.9)			N (oz)
		-axial		100 (359.6)			N (oz)
22	Shaft Play:	-radial		negligible			mm (inch)
		-axial		negligible			mm (inch)
23	Weight	g		310 (10.94)			g (oz)

Execution Table			
Gearbox	Single Shaft	E9	HEDS
R32	54	66	Upon Request
R40	1	96	Upon Request



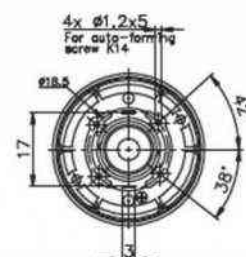
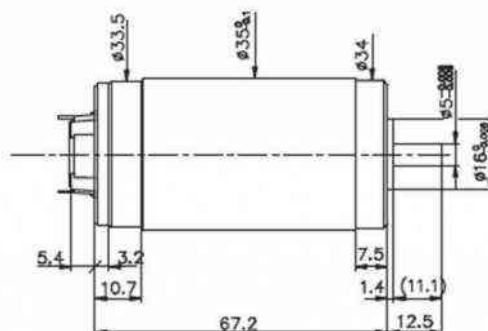
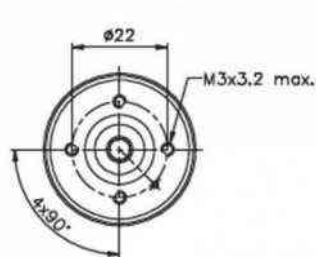
V121616

35GLT2R82

Graphite-Copper commutation

Ø35mm

160 mNm

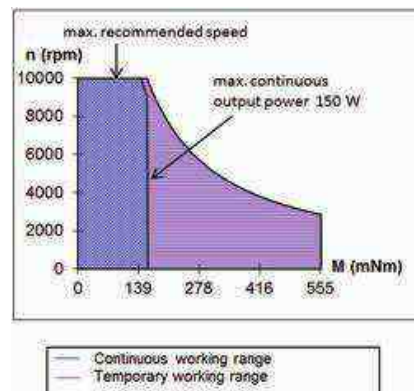


Dimensions in mm

35GLT2R82 **** .1

Electrical Data	****	426P	326P	234E	426SP	426E	
1 Nominal Voltage	V	24	24	48	48	90	Volt
2 No-Load Speed	n_0	6,260	5,835	7,490	6,175	5,439	rpm
3 No-Load Current	I_0	120.0	120.0	70.0	60.0	60.0	mA
4 Terminal Resistance	R	0.7	0.9	2.3	2.5	9.5	Ω
5 Output Power	$P_{2max.}$	136.0	124.0	122.0	142.0	150.0	W
6 Stall Torque	mNm	1327 (187.92)	1043 (147.71)	1300 (184.1)	1409 (199.54)	1487 (210.58)	mNm (oz-in)
7 Efficiency	$\eta_{max.}$	89	87	89	89	85	%
8 Max Continuous Speed	$n_{e max.}$	10,000	10,000	10,000	10,000	10,000	rpm
9 Max Continuous Torque	$M_{e max.}$	142 (18.7)	132 (18.7)	130 (18.41)	150 (21.25)	160 (22.66)	mNm (oz-in)
10 Max Continuous Current	$I_{e max.}$	4.20	3.50	2.20	2.10	1.05	A
11 Back-EMF Constant	k_E	3.82	4.09	6.39	7.75	16.44	mV/rpm
12 Torque Constant	k_M	36.50	39.10	61.00	74.00	157.00	mNm/A
13 Motor Regulation	R/k^2	0.5	0.6	0.6	0.46	0.39	$10^3/Nms$
14 Friction Torque	T_F	4.38 (0.63)	4.69 (0.67)	4.27 (0.61)	4.44 (0.63)	9.42 (1.34)	mNm (oz-in)
15 Rotor Inductance	L	0.10	0.15	0.25	0.40	1.70	mH
16 Mechanical Time Constant	t_m	3.9	4.4	4.0	4.0	2.7	ms
17 Rotor Inertia	J	83.00	75.00	65.00	85.00	70.00	g.cm ²
General Data							
18 Thermal Resistance (rotor/body)	R_{th1} / R_{th2}			4/8			
19 Thermal Time Constant (rotor/stator)	t_{w1}/t_{w2}			75/950			
20 Operating Temperature Range:	motor	-30 °C to 85 °C (-22 °F to 185 °F)					°C (°F)
	rotor	100 °C (212 °F)					°C (°F)
21 Shaft Load Max.:		With ball bearings					
(5mm from bearing)	-radial	35.0 (125.9)					N (oz)
	-axial	100 (359.6)					N (oz)
22 Shaft Play:	-radial	negligible					mm (inch)
	-axial	negligible					mm (inch)
23 Weight	g	360 (12.7)					g (oz)

Execution Table			
Gearbox	Single Shaft	E9	HEDS
R32	1	50	Upon Request
R40	1	50	Upon Request





Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



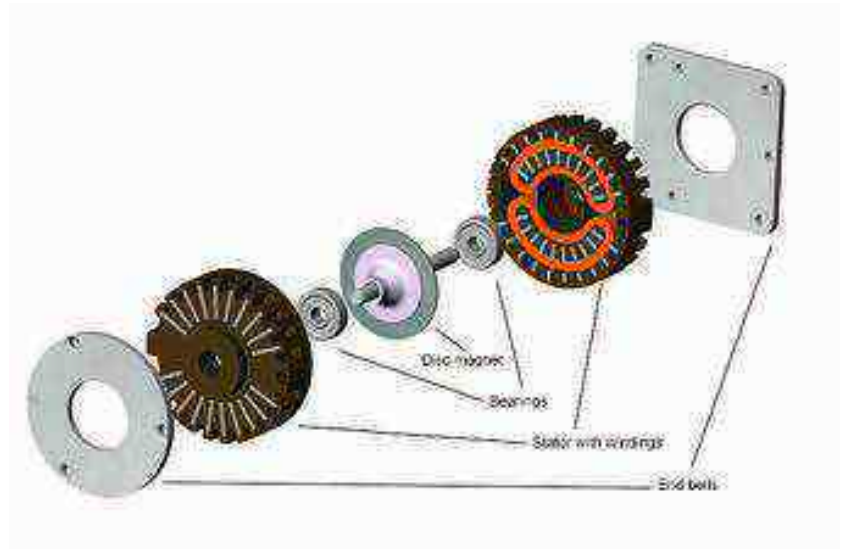
Gearheads



Encoders

Disc Magnet Motors

Get the simple motion control and precision of a stepper motor with the speed and acceleration of a brushless DC motor. The unique thin disc magnet enables finer step resolutions compared to a conventional permanent magnet stepper, while the low inertia and a shorter magnetic circuit with lower iron losses deliver significantly higher acceleration and maximum speed. These motors can be driven as a servo motor in applications requiring extremely fast incremental motion.



Simple Speed, Power and Precision

Feature	Details	Application Advantages
Stepper motor design	<ul style="list-style-type: none">• No need for encoder feedback	<ul style="list-style-type: none">• Simple open-loop positioning that can be digitally controlled
Microstepping capability	<ul style="list-style-type: none">• Radial magnetization with high number of poles• Much smaller step angles compared to conventional stepper	<ul style="list-style-type: none">• Nearly servo-like accuracy in a simpler positioning system
Thin multipolar rare earth disc magnet	<ul style="list-style-type: none">• Low rotor inertia	<ul style="list-style-type: none">• High acceleration• High start and stop frequencies• High power rate
Simple magnetic circuit	<ul style="list-style-type: none">• No coupling between phases• Sinusoidal torque function• Low detent torque	<ul style="list-style-type: none">• Superior angular resolution in microstep mode
Optimally dimensioned iron circuit	<ul style="list-style-type: none">• Torque constant linear up to two times nominal current	<ul style="list-style-type: none">• High peak torques• Capability to boost current
Choice of sintered bronze bearings or ball bearings	<ul style="list-style-type: none">• Long bearing and lubrication life• Choice of bearing performance characteristics	<ul style="list-style-type: none">• Increased service life and reliability for any application



Exceptional Dynamic Performance



Medical devices & clinical diagnostics

- Laboratory automation
- Medical pipettes
- Diagnostic analyzers
- Medical analyzers
- Sample preparation workstations



Security

- Access systems
- Surveillance



Aerospace

- Surveillance camera systems
- Valve actuation



Automation

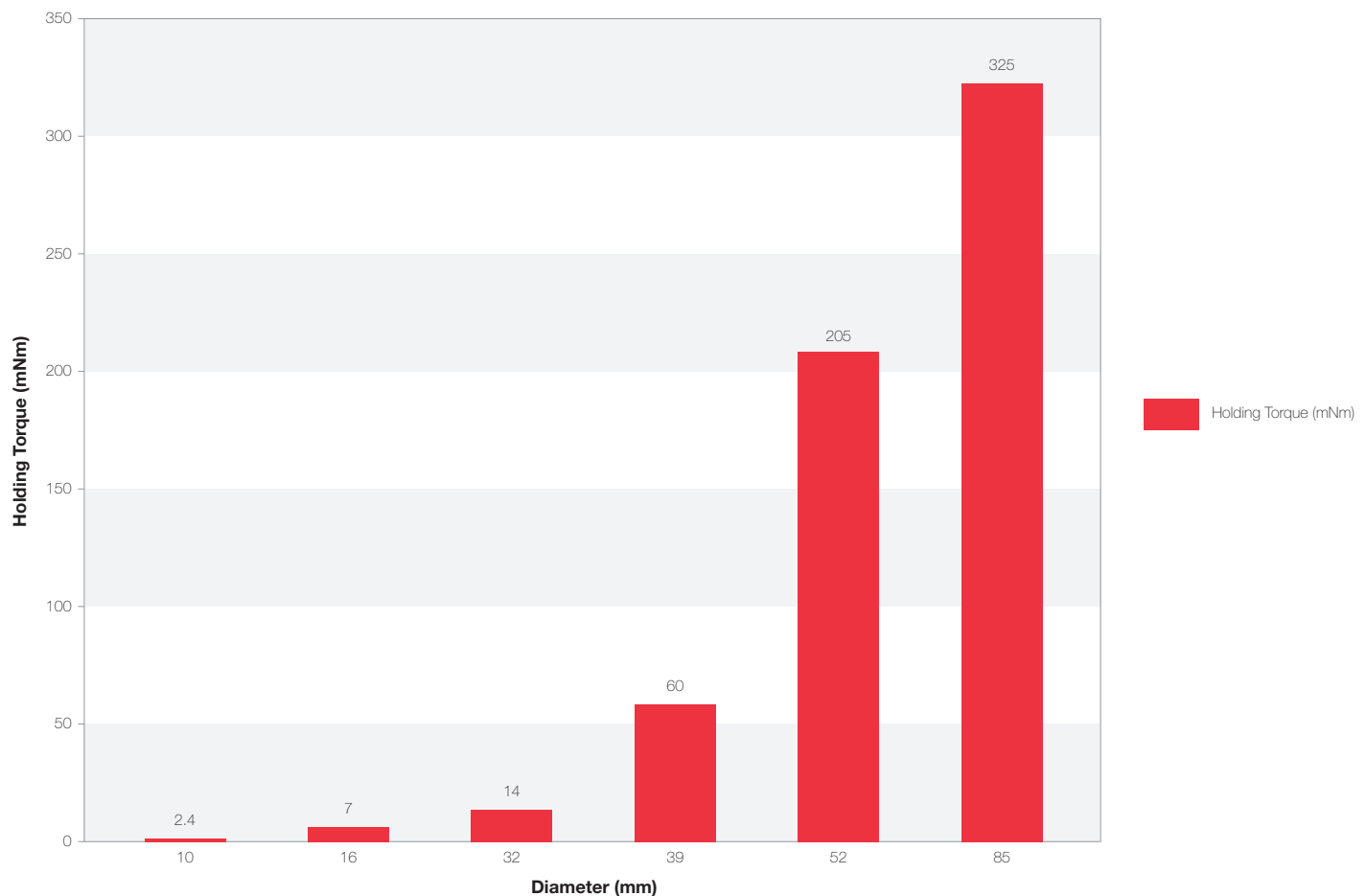
- Textile yarn guide
- Pick and place machines



Other

- Electronics assembly
- Semiconductor assembly systems

Meet your Application's Working Point Requirements

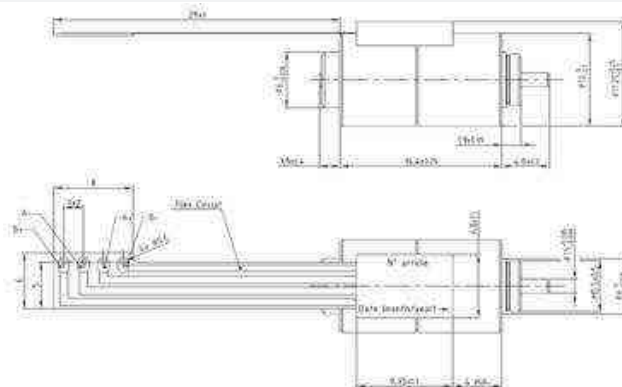


For complete product and application details, visit portescap.com/disc-magnet

P010 104

Ø10mm

1.5 mNm



Dimensions in mm

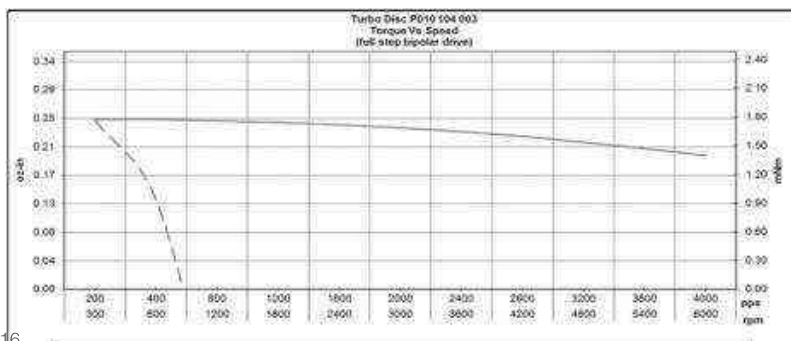
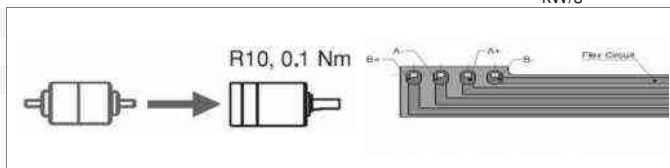
P010 104

Electrical Data	P010 104 020 21	P010 104 003 21	
1 Resistance per Phase, typ	19.0	3.0	Ohms
2 Inductance per Phase, typ	13.7	1.8	mH
3 Nominal Phase Current (2 ph. On)	0.15	0.37	A
4 Nominal Phase Current (1 ph. On)	0.21	0.52	A
5 Back EMF Amplitude	1.10	0.46	V/kstep/s
Coil independent parameters			
6 Holding Torque, nominal current	1.5 (0.21)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)	2.1 (0.3)		mNm (oz-in)
8 Detent Torque	0.9 (0.13)		mNm (oz-in)
9 Rotor Inertia	0.070		kgm ² x 10 ⁻⁷
10 Step Angle	9		Degree
11 Absolute Accuracy 2 ph. On, Full step mode	+/- 5%		% Full Step
12 Steps Per Revolution	40		
13 Ambient Temperature Range (operating)	-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature	130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)	100		°C/W
16 Natural Resonance Frequency (nominal current)	230		Hz
17 Electrical Time Constant	0.60		ms
18 Angular Acceleration (nominal current)	210,000		rad/s ²
19 Bearing Type	Ball		
20 Dielectric Withstanding Voltage	500 VRMS for 5 seconds		VAC
21 Radial Shaft Play	30 @ 2N		µm
22 Axial Shaft Play	40 @ 2N		µm
23 Maximum Radial Shaft Load	2.5 (9)		N (oz)
24 Maximum Axial Shaft Load (3)	2.5 (9)		N (oz)
25 Weight	9 (0.32)		g (oz)
26 Power Rate (nominal current)	0.5		kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

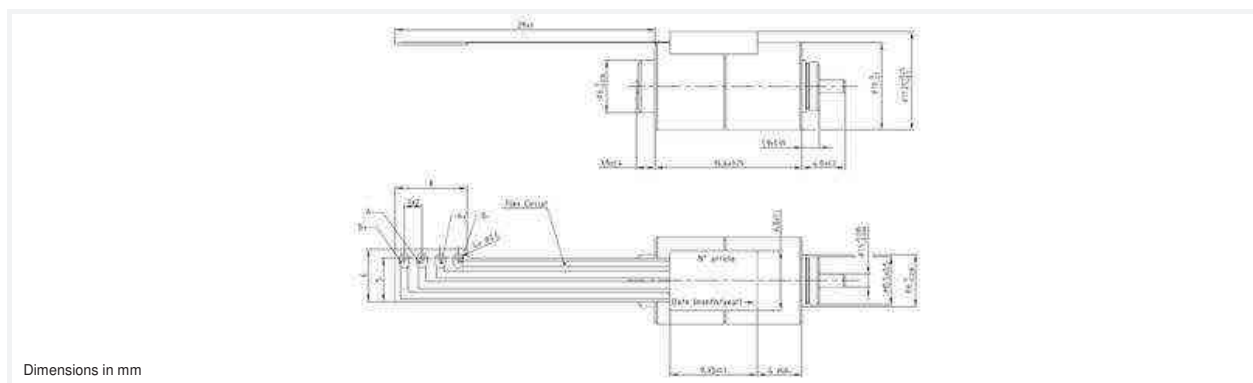
(3) Shaft must be supported when press-fitting a pulley or pinion



P010 064

Ø10mm

1.8 mNm



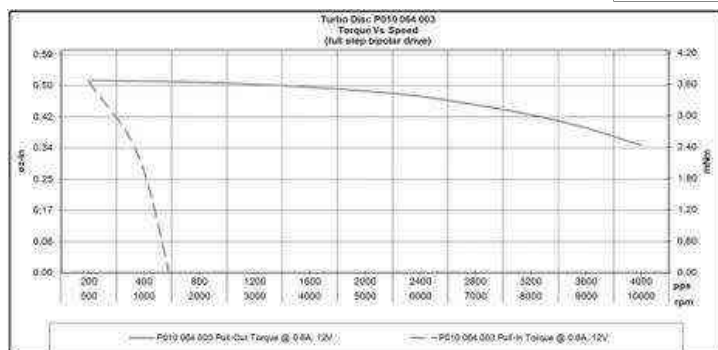
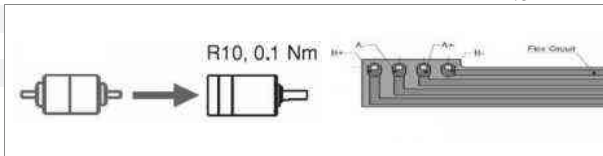
P010 064

Electrical Data	P010 064 020 21	P010 064 003 21	
1 Resistance per Phase, typ	19.0	3.0	Ohms
2 Inductance per Phase, typ	13.7	1.8	mH
3 Nominal Phase Current (2 ph. On)	0.15	0.37	A
4 Nominal Phase Current (1 ph. On)	0.21	0.52	A
5 Back EMF Amplitude	2.20	0.94	V/kstep/s
Coil independent parameters			
6 Holding Torque, nominal current	1.8 (0.25)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)	2.5 (0.35)		mNm (oz-in)
8 Detent Torque	0.9 (0.13)		mNm (oz-in)
9 Rotor Inertia	0.070		kgm ² x 10 ⁻⁷
10 Step Angle	15		Degree
11 Absolute Accuracy 2 ph. On, Full step mode	+/- 5%		% Full Step
12 Steps Per Revolution	24		
13 Ambient Temperature Range (operating)	-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature	130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)	100		°C/W
16 Natural Resonance Frequency (nominal current)	200		Hz
17 Electrical Time Constant	0.60		ms
18 Angular Acceleration (nominal current)	260,000		rad/s ²
19 Bearing Type	Ball		
20 Dielectric Withstanding Voltage	500 VRMS for 5 seconds		VAC
21 Radial Shaft Play	30 @ 2N		µm
22 Axial Shaft Play	40 @ 2N		µm
23 Maximum Radial Shaft Load	2.5 (9)		N (oz)
24 Maximum Axial Shaft Load (3)	2.5 (9)		N (oz)
25 Weight	9 (0.32)		g (oz)
26 Power Rate (nominal current)	0.5		kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

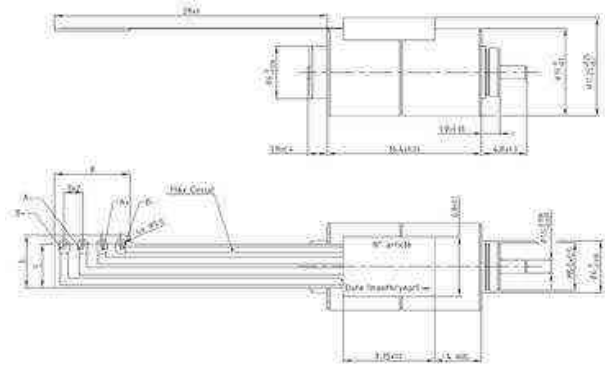
(3) Shaft must be supported when press-fitting a pulley or pinion



PH010 104

Ø10mm

2.1 mNm

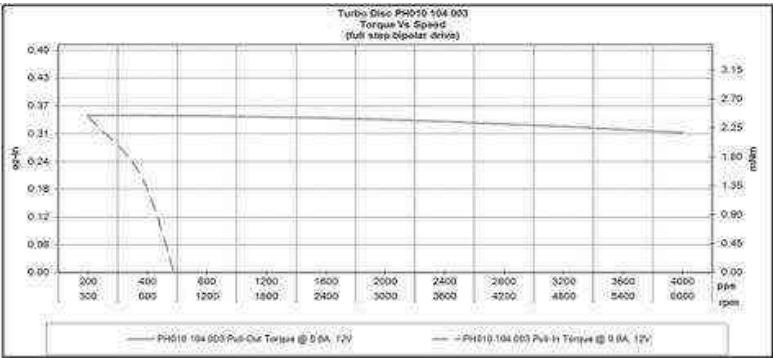
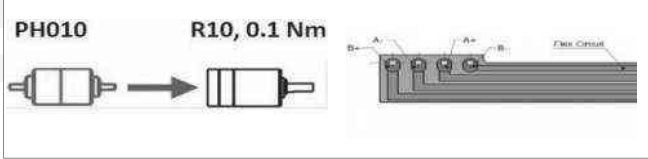


Dimensions in mm

PH010 104

Electrical Data	PH010 104 020 02	PH010 104 010 02	PH010 104 003 02	
1 Resistance per Phase, typ	19.0	10.0	3.0	Ohms
2 Inductance per Phase, typ	8.4	4.2	1.3	mH
3 Nominal Phase Current (2 ph. On)	0.15	0.20	0.37	A
4 Nominal Phase Current (1 ph. On)	0.21	0.28	0.52	A
5 Back EMF Amplitude	1.58	1.18	0.64	V/kstep/s
Coil independent parameters				
6 Holding Torque, nominal current		2.1 (0.3)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		3.16 (0.45)		mNm (oz-in)
8 Detent Torque		1 (0.14)		mNm (oz-in)
9 Rotor Inertia		0.070		kgm ² x 10 ⁻⁷
10 Step Angle		9		Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%		% Full Step
12 Steps Per Revolution		40		
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature		130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)		100		°C/W
16 Natural Resonance Frequency (nominal current)		276		Hz
17 Electrical Time Constant		0.42		ms
18 Angular Acceleration (nominal current)		301,758		rad/s ²
19 Bearing Type		Ball		
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds		VAC
21 Radial Shaft Play		30@2N		µm
22 Axial Shaft Play		40@2N		µm
23 Maximum Radial Shaft Load		2.5 (9)		N (oz)
24 Maximum Axial Shaft Load (3)		2.5 (9)		N (oz)
25 Weight		9 (0.32)		g (oz)
26 Power Rate (nominal current)		0.5		kW/s

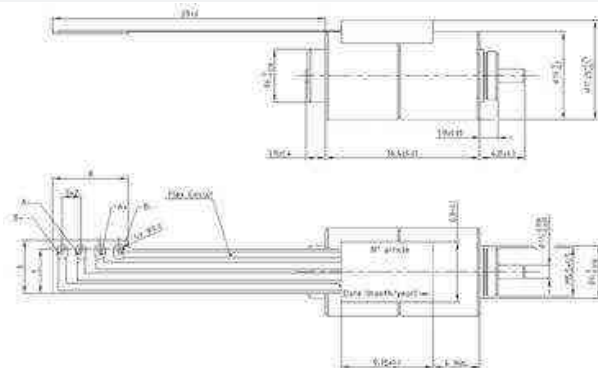
- (1) Measured with 1 phase ON. The max coil temperature must be respected
(2) Motor unmounted
(3) Shaft must be supported when press-fitting a pulley or pinion



PH010 064

Ø10mm

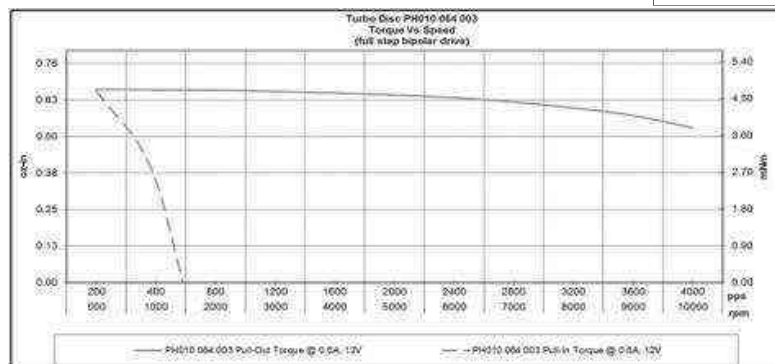
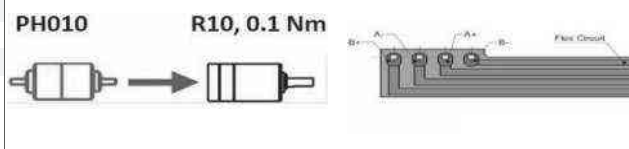
2.4 mNm



Dimensions in mm

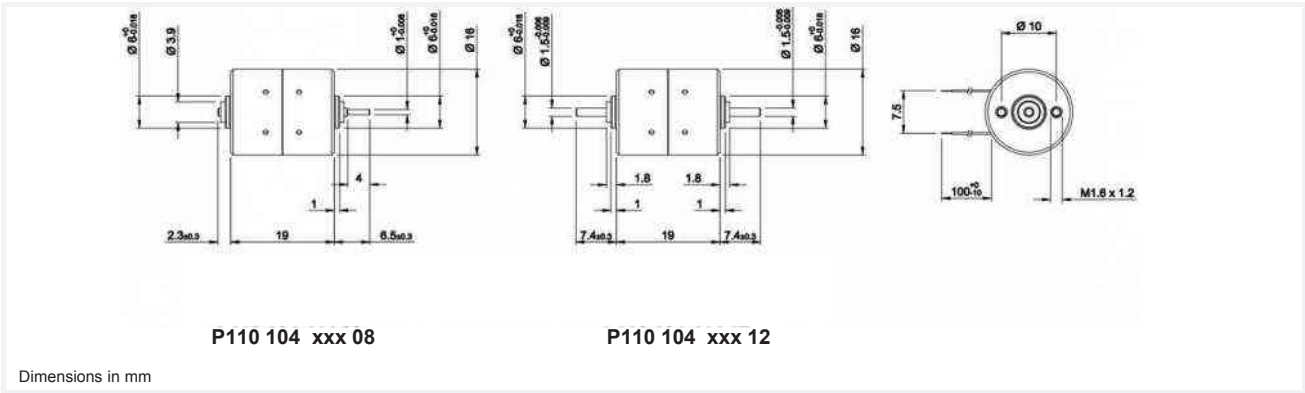
PH010 064

Electrical Data		PH010 064 020 02	PH010 064 010 02	PH010 064 003 02	
1	Resistance per Phase, typ	19.0	10.0	3.0	Ohms
2	Inductance per Phase, typ	8.4	4.2	1.3	mH
3	Nominal Phase Current (2 ph. On)	0.15	0.20	0.37	A
4	Nominal Phase Current (1 ph. On)	0.21	0.28	0.52	A
5	Back EMF Amplitude	3.00	2.25	1.21	V/kstep/s
Coil independent parameters					
6	Holding Torque, nominal current		2.4 (0.34)		mNm (oz-in)
7	Holding Torque, 1.5x nominal current (1)		3.6 (0.51)		mNm (oz-in)
8	Detent Torque		1.1 (0.16)		mNm (oz-in)
9	Rotor Inertia		0.070		kgm ² x 10 ⁻⁷
10	Step Angle		15		Degree
11	Absolute Accuracy 2 ph. On, Full step mode		+/- 5%		% Full Step
12	Steps Per Revolution		24		
13	Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)		°C (°F)
14	Maximum Coil Temperature		130 (266)		°C (°F)
15	Thermal Resistance Coil-ambient (2)		100		°C/W
16	Natural Resonance Frequency (nominal current)		229		Hz
17	Electrical Time Constant		0.42		ms
18	Angular Acceleration (nominal current)		343,775		rad/s ²
19	Bearing Type		Ball		
20	Dielectric Withstanding Voltage		500 VRMS for 5 seconds		VAC
21	Radial Shaft Play		30@2N		µm
22	Axial Shaft Play		40@2N		µm
23	Maximum Radial Shaft Load		2.5 (9)		N (oz)
24	Maximum Axial Shaft Load (3)		2.5 (9)		N (oz)
25	Weight		9 (0.32)		g (oz)
26	Power Rate (nominal current)		0.5		kW/s
(1) Measured with 1 phase ON. The max coil temperature must be respected					
(2) Motor unmounted					
(3) Shaft must be supported when press-fitting a pulley or pinion					



P110 104

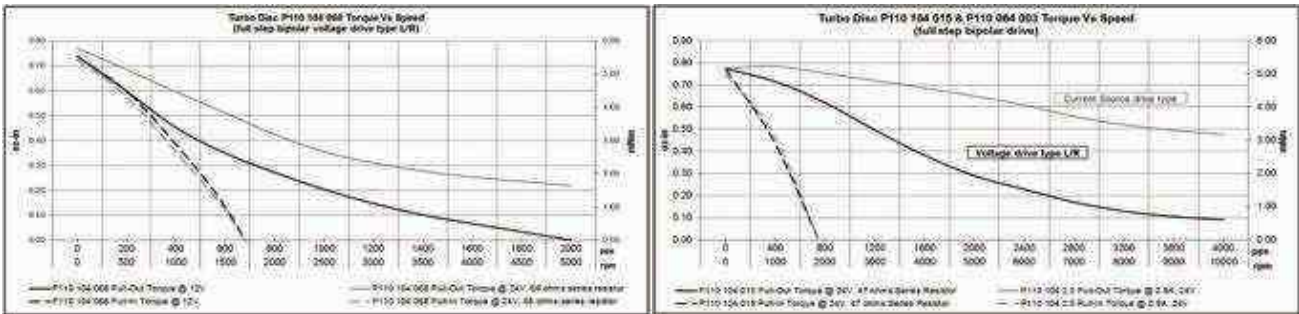
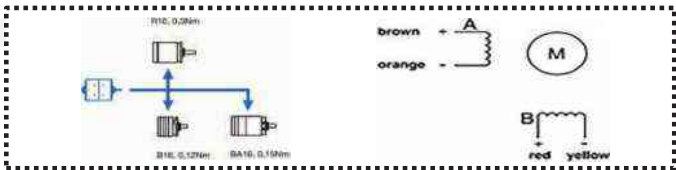
Ø16mm 6.2 mNm



P110 104

Electrical Data	P110 104 068 08/12	P110 104 015 08/12	P110 104 2.5 08/12	
1 Resistance per Phase, typ	62.0	15.0	2.5	Ohms
2 Inductance per Phase, typ	46.0	12.0	2.2	mH
3 Nominal Phase Current (2 ph. On)	0.12	0.25	0.63	A
4 Nominal Phase Current (1 ph. On)	0.17	0.35	0.90	A
5 Back EMF Amplitude	5.70	2.80	1.10	V/kstep/s
Coil independent parameters				
6 Holding Torque, nominal current		6.2 (0.88)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		8.7 (1.23)		mNm (oz-in)
8 Detent Torque		1.65 (0.24)		mNm (oz-in)
9 Rotor Inertia		0.400		kgm ² x 10 ⁻⁷
10 Step Angle		9		Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%		% Full Step
12 Steps Per Revolution		40		
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature		130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)		45		°C/W
16 Natural Resonance Frequency (nominal current)		200		Hz
17 Electrical Time Constant		0.80		ms
18 Angular Acceleration (nominal current)		155,000		rad/s ²
19 Bearing Type		Ball		
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds (30@2N)		VAC
21 Radial Shaft Play		30@2N		µm
22 Axial Shaft Play		40@2N		µm
23 Maximum Radial Shaft Load		2.5 (9)		N (oz)
24 Maximum Axial Shaft Load (3)		2.5 (9)		N (oz)
25 Weight		23 (0.81)		g (oz)
26 Power Rate (nominal current)		1.2		kW/s

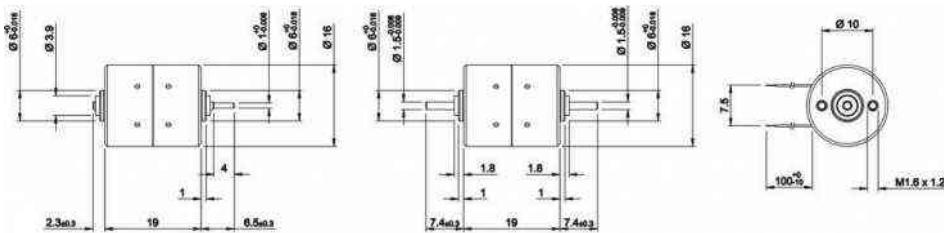
- (1) Measured with 1 phase ON. The max coil temperature must be respected
(2) Motor unmounted
(3) Shaft must be supported when press-fitting a pulley or pinion



P110 064

Ø16mm

7 mNm



P110 064 xxx 08

P110 064 xxx 12

Dimensions in mm

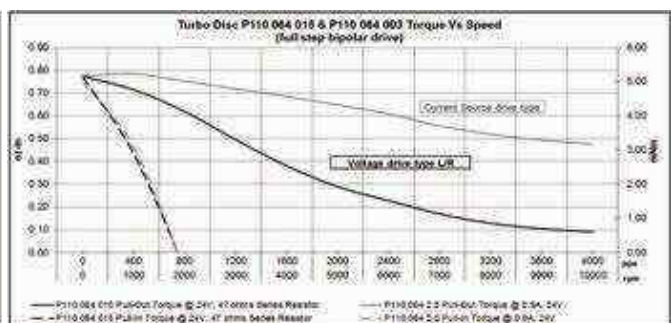
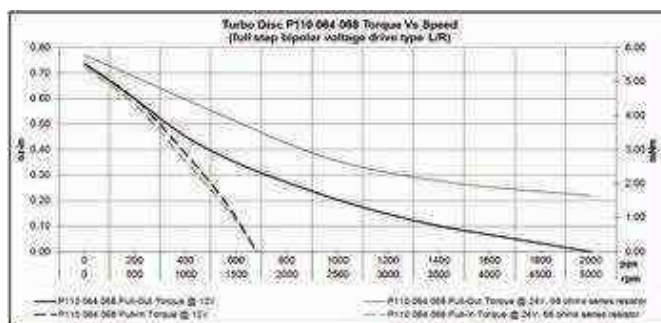
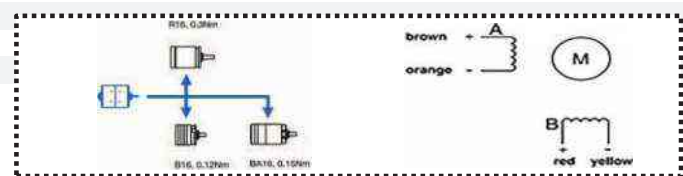
P110 064

Electrical Data	P110 064 068 08/12	P110 064 015 08/12	P110 064 2.5 08/12	
1 Resistance per Phase, typ	62.0	15.0	2.5	Ohms
2 Inductance per Phase, typ	46.0	12.0	2.2	mH
3 Nominal Phase Current (2 ph. On)	0.12	0.25	0.63	A
4 Nominal Phase Current (1 ph. On)	0.17	0.35	0.90	A
5 Back EMF Amplitude	10.80	5.20	2.00	V/kstep/s
Coil independent parameters				
6 Holding Torque, nominal current		7 (0.99)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		10 (1.42)		mNm (oz-in)
8 Detent Torque		1.65 (0.24)		mNm (oz-in)
9 Rotor Inertia		0.400		kgm ² x 10 ⁻⁷
10 Step Angle		15		Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%		% Full Step
12 Steps Per Revolution		24		
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature		130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)		45		°C/W
16 Natural Resonance Frequency (nominal current)		160		Hz
17 Electrical Time Constant		0.80		ms
18 Angular Acceleration (nominal current)		175,000		rad/s ²
19 Bearing Type		Ball		
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds (30@2N)		VAC
21 Radial Shaft Play		30@2N		µm
22 Axial Shaft Play		40@2N		µm
23 Maximum Radial Shaft Load		2.5 (9)		N (oz)
24 Maximum Axial Shaft Load (3)		2.5 (9)		N (oz)
25 Weight		23 (0.81)		g (oz)
26 Power Rate (nominal current)		1.2		kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

(3) Shaft must be supported when press-fitting a pulley or pinion

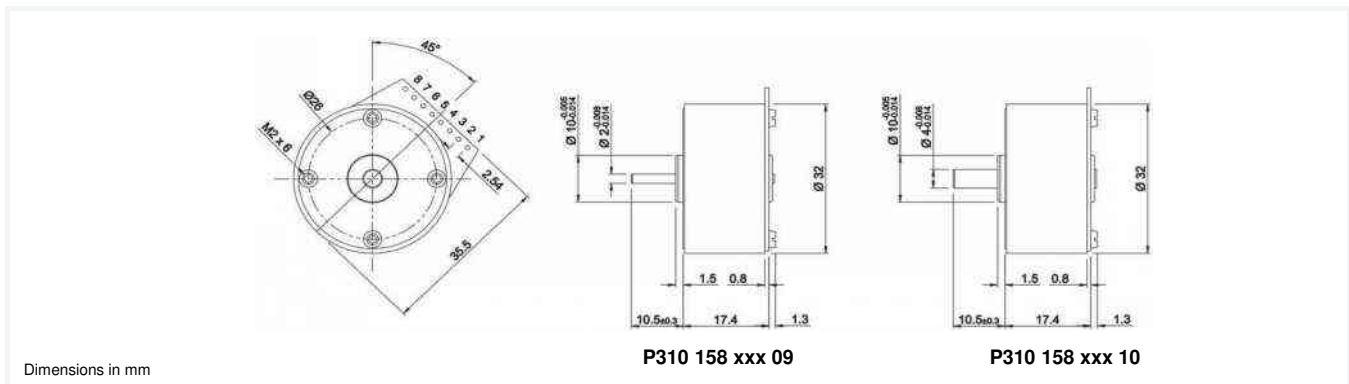


V121616

P310

Ø32mm

14 mNm



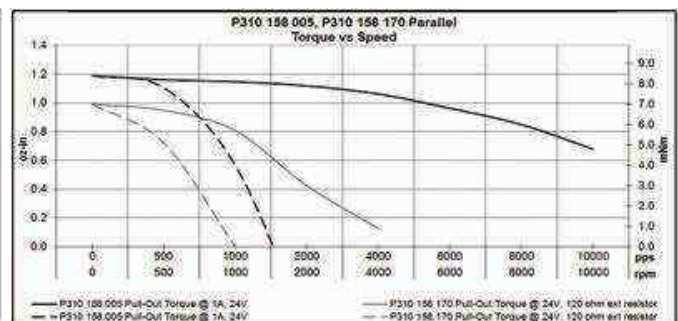
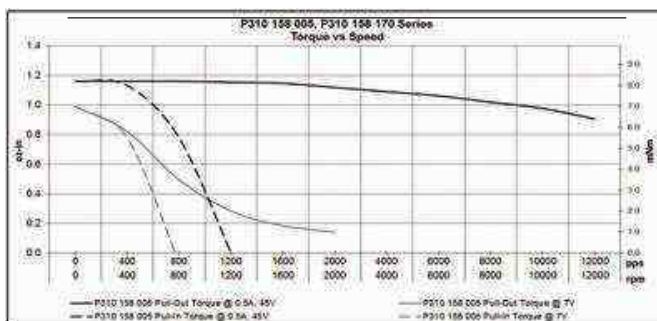
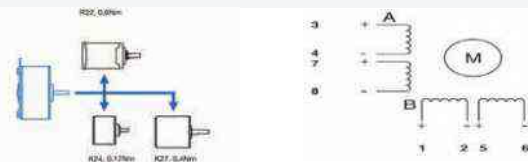
P310

Electrical Data	P310 158 170 09/10(series)	P310 158 170 09/10 (parallel)	P310 158 005 09/10 (series)	P310 158 005 09/10 (parallel)	
1 Resistance per Phase, typ	332.0	83.0	10.5	2.6	Ohms
2 Inductance per Phase, typ	184.0	46.0	6.4	1.6	mH
3 Nominal Phase Current (2 ph. On)	0.06	0.12	0.36	0.72	A
4 Nominal Phase Current (1 ph. On)	0.09	0.17	0.51	1.00	A
5 Back EMF Amplitude	18.00	9.00	3.20	1.60	V/kstep/s
Coil independent parameters					
6 Holding Torque, nominal current		14 (2)			mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		20 (2.83)			mNm (oz-in)
8 Detent Torque		2.6 (0.37)			mNm (oz-in)
9 Rotor Inertia		0.860			kgm ² x 10 ⁻⁷
10 Step Angle		6			Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%			% Full Step
12 Steps Per Revolution		60			
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)			°C (°F)
14 Maximum Coil Temperature		130 (266)			°C (°F)
15 Thermal Resistance Coil-ambient (2)		25			°C/W
16 Natural Resonance Frequency (nominal current)		230			Hz
17 Electrical Time Constant		0.60			ms
18 Angular Acceleration (nominal current)		140,000			rad/s ²
19 Bearing Type		Sleeve or Ball			
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds (35@5N / 15@1N)			VAC
21 Radial Shaft Play		35@5N / 15@1N			µm
22 Axial Shaft Play		100@5N / 10@1N			µm
23 Maximum Radial Shaft Load		1 / 10 (3.6 / 36)			N (oz)
24 Maximum Axial Shaft Load (3)		0.5 / 20 (1.8 / 72)			N (oz)
25 Weight		40 (1.4)			g (oz)
26 Power Rate (nominal current)		1.7			kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

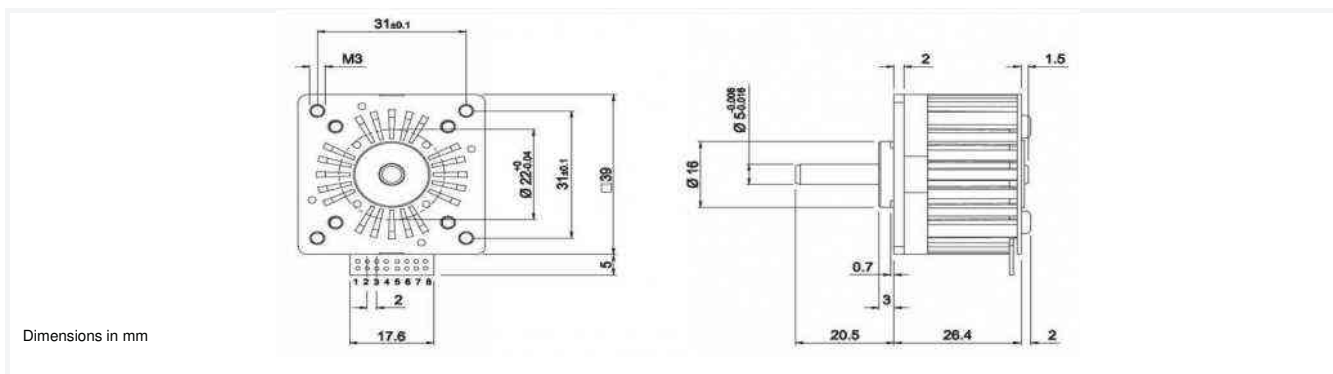
(3) Shaft must be supported when press-fitting a pulley or pinion



P430

Ø39mm

60 mNm



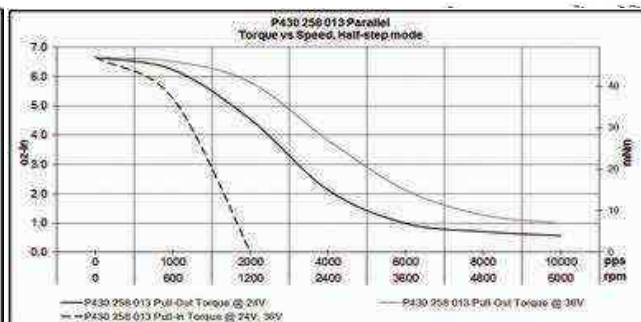
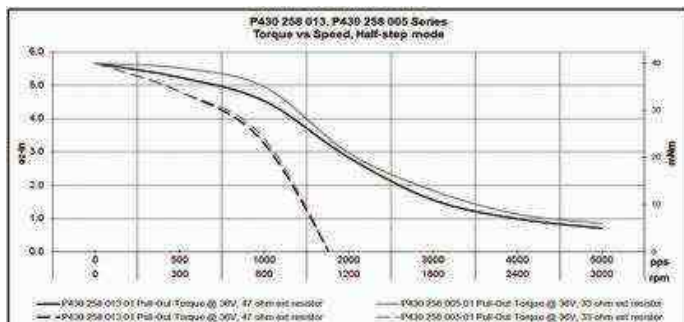
P430

Electrical Data	P430 258 013 01 (series)	P430 258 013 01 (parallel)	P430 258 005 01 (series)	P430 258 005 01 (parallel)	
1 Resistance per Phase, typ	26.0	6.5	10.0	2.5	Ohms
2 Inductance per Phase, typ	40.0	10.0	14.0	3.5	mH
3 Nominal Phase Current (2 ph. On)	0.34	0.68	0.56	1.12	A
4 Nominal Phase Current (1 ph. On)	0.50	1.00	0.80	1.60	A
5 Back EMF Amplitude	7.50	3.80	4.70	2.30	V/kstep/s
Coil independent parameters					
6 Holding Torque, nominal current		60 (8.5)			mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		86 (12)			mNm (oz-in)
8 Detent Torque		6.5 (0.93)			mNm (oz-in)
9 Rotor Inertia		3.000			kgm ² x 10 ⁻⁷
10 Step Angle		3.6			Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%			% Full Step
12 Steps Per Revolution		100			
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)			°C (°F)
14 Maximum Coil Temperature		130 (266)			°C (°F)
15 Thermal Resistance Coil-ambient (2)		11			°C/W
16 Natural Resonance Frequency (nominal current)		360			Hz
17 Electrical Time Constant		1.50			ms
18 Angular Acceleration (nominal current)		200,000			rad/s ²
19 Bearing Type		Ball			
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds (15@5N)			VAC
21 Radial Shaft Play		15@5N			µm
22 Axial Shaft Play		10@5N			µm
23 Maximum Radial Shaft Load		20 (72)			N (oz)
24 Maximum Axial Shaft Load (3)		30 (108)			N (oz)
25 Weight		100 (3.5)			g (oz)
26 Power Rate (nominal current)		12.0			kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

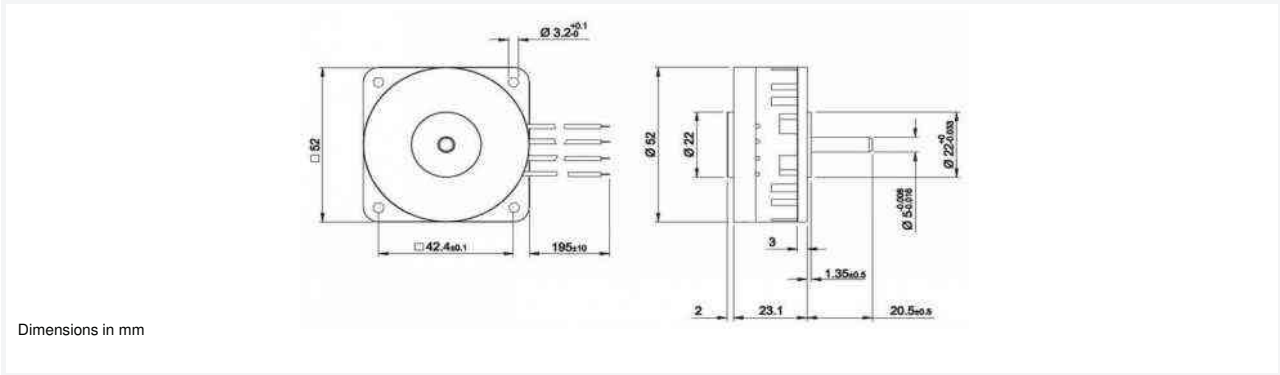
(2) Motor unmounted

(3) Shaft must be supported when press-fitting a pulley or pinion



P520

Ø52mm 120 mNm



Dimensions in mm

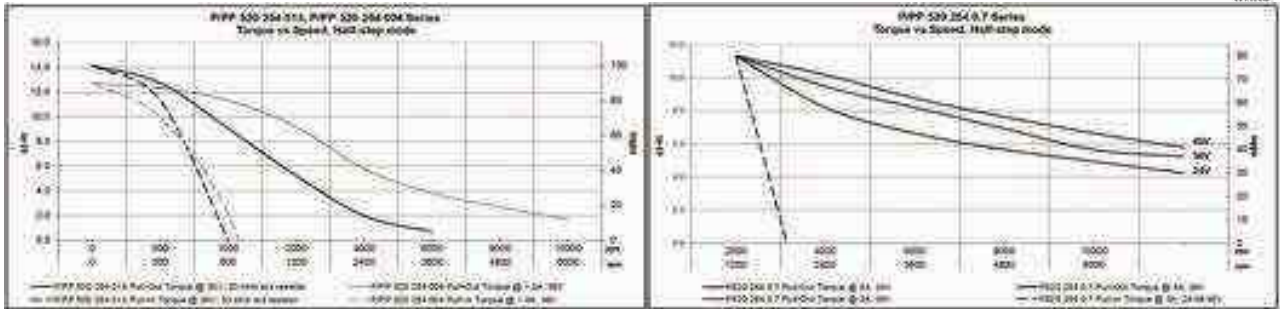
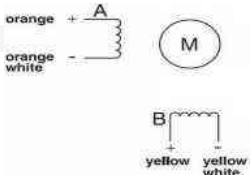
P520

Electrical Data	P520 254 013 60	P520 254 004 60	P520 254 0.7 60	
1 Resistance per Phase, typ	13.5	4.4	0.7	Ohms
2 Inductance per Phase, typ	27.0	8.0	1.3	mH
3 Nominal Phase Current (2 ph. On)	0.50	0.90	2.30	A
4 Nominal Phase Current (1 ph. On)	0.75	1.30	3.30	A
5 Back EMF Amplitude	9.80	5.50	2.10	V/kstep/s
Coil independent parameters				
6 Holding Torque, nominal current		120 (17)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		170 (24)		mNm (oz-in)
8 Detent Torque		18 (2.55)		mNm (oz-in)
9 Rotor Inertia		12.000		kgm ² x 10 ⁻⁷
10 Step Angle	4	3.6	3.6	Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%		% Full Step
12 Steps Per Revolution		100		
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature		130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)	10	9.5	9.5	°C/W
16 Natural Resonance Frequency (nominal current)		250		Hz
17 Electrical Time Constant		1.80		ms
18 Angular Acceleration (nominal current)		100,000		rad/s ²
19 Bearing Type		Ball		
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds (15@5N)		VAC
21 Radial Shaft Play		15@5N		µm
22 Axial Shaft Play		10@5N		µm
23 Maximum Radial Shaft Load		20 (72)		N (oz)
24 Maximum Axial Shaft Load (3)		30 (108)		N (oz)
25 Weight		180 (6.3)		g (oz)
26 Power Rate (nominal current)		12.0		kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

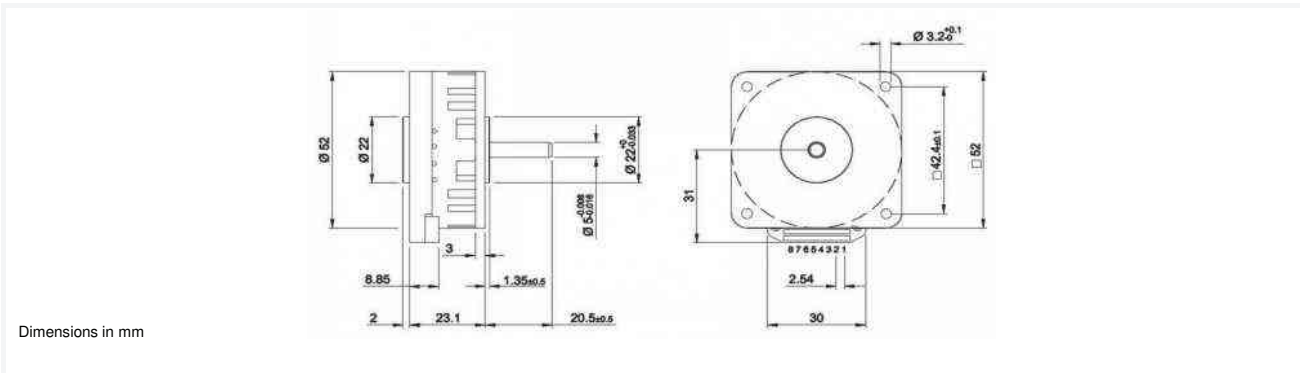
(3) Shaft must be supported when press-fitting a pulley or pinion



PP520

Ø52mm

120 mNm



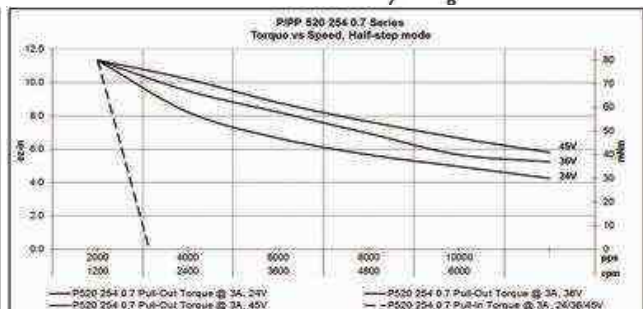
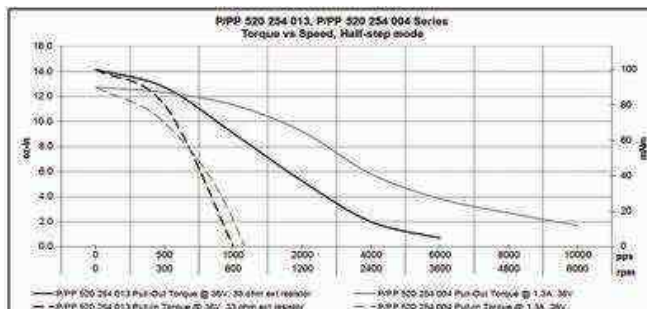
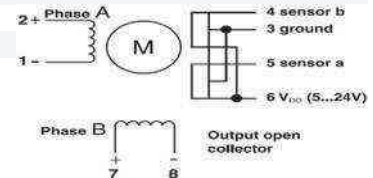
PP520

Electrical Data	PP520 258 013 01	PP520 258 004 01	PP520 258 0.7 01	
1 Resistance per Phase, typ	13.5	4.4	0.7	Ohms
2 Inductance per Phase, typ	27.0	8.0	1.3	mH
3 Nominal Phase Current (2 ph. On)	0.50	0.90	2.30	A
4 Nominal Phase Current (1 ph. On)	0.75	1.30	3.30	A
5 Back EMF Amplitude	9.80	5.50	2.10	V/kstep/s
Coil independent parameters				
6 Holding Torque, nominal current		120 (17)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)		170 (24)		mNm (oz-in)
8 Detent Torque		18 (2.55)		mNm (oz-in)
9 Rotor Inertia		12.000		kgm ² x 10 ⁻⁷
10 Step Angle	4	3.6	3.6	Degree
11 Absolute Accuracy 2 ph. On, Full step mode		+/- 5%		% Full Step
12 Steps Per Revolution		100		
13 Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature		130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)	10	9.5	9.5	°C/W
16 Natural Resonance Frequency (nominal current)		250		Hz
17 Electrical Time Constant		1.80		ms
18 Angular Acceleration (nominal current)		100,000		rad/s ²
19 Bearing Type		Ball		
20 Dielectric Withstanding Voltage		500 VRMS for 5 seconds (15@5N)		VAC
21 Radial Shaft Play		15@5N		µm
22 Axial Shaft Play		10@5N		µm
23 Maximum Radial Shaft Load		20 (72)		N (oz)
24 Maximum Axial Shaft Load (3)		30 (108)		N (oz)
25 Weight		180 (6.3)		g (oz)
26 Power Rate (nominal current)		12.0		kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

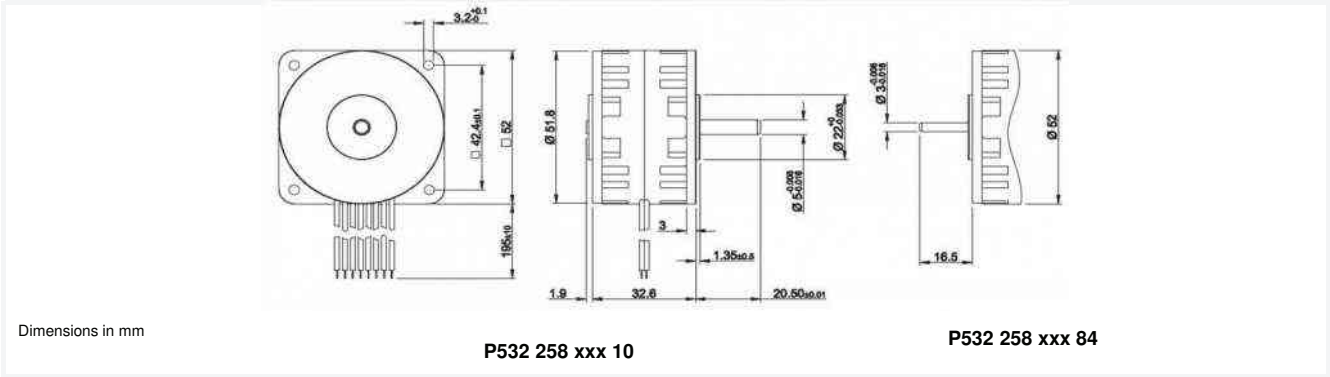
(3) Shaft must be supported when press-fitting a pulley or pinion



P532

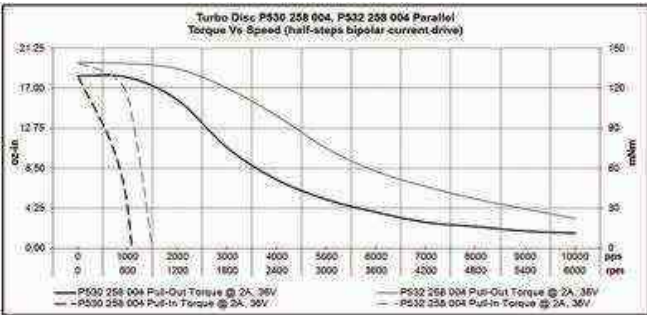
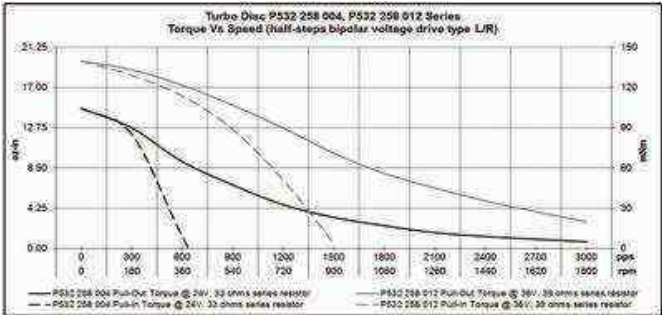
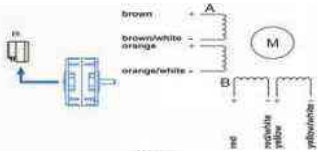
Ø52mm

205 mNm



P532						
Electrical Data		P532 258 012 10/84 (series)	P532 258 004 10/84 (series)	P532 258 004 10/84 (parallel)	P532 258 0.7 10/84 (parallel)	
1	Resistance per Phase, typ	27.0	8.8	2.2	0.4	Ohms
2	Inductance per Phase, typ	64.0	20.0	5.0	0.7	mH
3	Nominal Phase Current (2 ph. On)	0.40	0.70	1.40	3.70	A
4	Nominal Phase Current (1 ph. On)	0.56	1.00	2.00	5.20	A
5	Back EMF Amplitude	21.00	12.00	6.00	2.30	V/kstep/s
Coil independent parameters						
6	Holding Torque, nominal current		205 (29)			mNm (oz-in)
7	Holding Torque, 1.5x nominal current (1)		300 (42.5)			mNm (oz-in)
8	Detent Torque		40 (5.67)			mNm (oz-in)
9	Rotor Inertia		12.000			kgm ² x 10 ⁻⁷
10	Step Angle	4	3.6	3.6	3.6	Degree
11	Absolute Accuracy 2 ph. On, Full step mode		+/- 5%			% Full Step
12	Steps Per Revolution		100			
13	Ambient Temperature Range (operating)		-20 to 50 (-4 to 122)			°C (°F)
14	Maximum Coil Temperature		130 (266)			°C (°F)
15	Thermal Resistance Coil-ambient (2)	7	7.3	7.3	7.3	°C/W
16	Natural Resonance Frequency (nominal current)		330			Hz
17	Electrical Time Constant		2.30			ms
18	Angular Acceleration (nominal current)		195,000			rad/s ²
19	Bearing Type		Ball			
20	Dielectric Withstanding Voltage		500 VRMS for 5 seconds (25@5N)			VAC
21	Radial Shaft Play		25@5N			µm
22	Axial Shaft Play		25@5N			µm
23	Maximum Radial Shaft Load		20 (72)			N (oz)
24	Maximum Axial Shaft Load (3)		30 (108)			N (oz)
25	Weight		250 (8.8)			g (oz)
26	Power Rate (nominal current)		35.0			kW/s
(1) Measured with 1 phase ON. The max coil temperature must be respected						

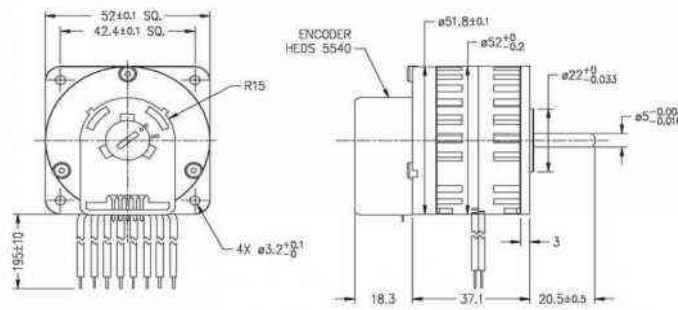
- (1) Measured with 1 phase ON. The max coil temperature must be respected
(2) Motor unmounted
(3) Shaft must be supported when press-fitting a pulley or pinion



P532 With Encoder

Ø52mm

205 mNm



Dimensions in mm

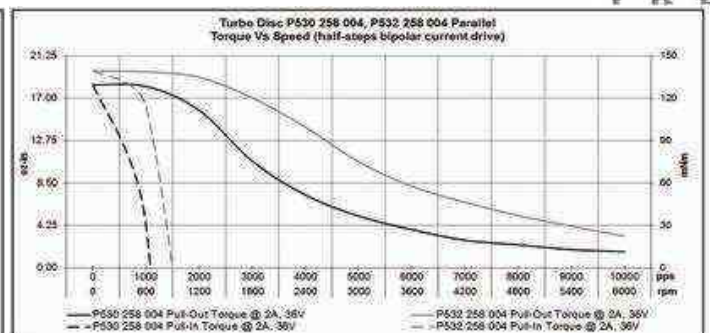
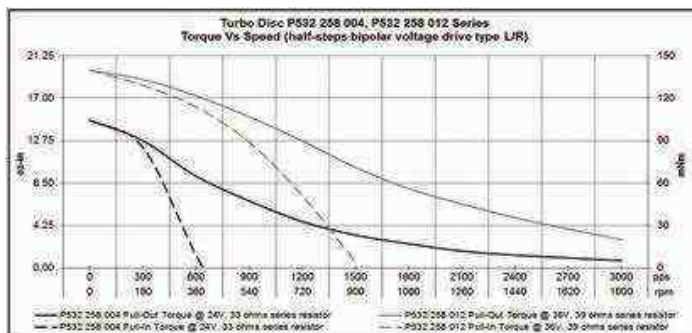
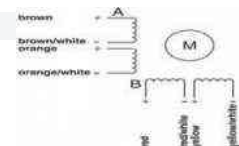
P532EN

Electrical Data	P532 012 137 HEDS 5540 A14 (series)	P532 004 137 HEDS 5540 A14 (series)	P532 004 137 HEDS 5540 A14 (parallel)	P532 0.7 137 HEDS 5540 A14 (parallel)	
1 Resistance per Phase, typ	27.0	8.8	2.2	0.4	Ohms
2 Inductance per Phase, typ	64.0	20.0	5.0	0.7	mH
3 Nominal Phase Current (2 ph. On)	0.40	0.70	1.40	3.70	A
4 Nominal Phase Current (1 ph. On)	0.56	1.00	2.00	5.20	A
5 Back EMF Amplitude	21.00	12.00	6.00	2.30	V/kstep/s
Coil independent parameters					
6 Holding Torque, nominal current			205 (29)		mNm (oz-in)
7 Holding Torque, 1.5x nominal current (1)			300 (42.5)		mNm (oz-in)
8 Detent Torque			45 (6.4)		mNm (oz-in)
9 Rotor Inertia			13.000		kgm ² x 10 ⁻⁷
10 Step Angle	4	3.6	3.6	3.6	Degree
11 Absolute Accuracy 2 ph. On, Full step mode			+/- 5%		% Full Step
12 Steps Per Revolution			100		
13 Ambient Temperature Range (operating)			-20 to 50 (-4 to 122)		°C (°F)
14 Maximum Coil Temperature			130 (266)		°C (°F)
15 Thermal Resistance Coil-ambient (2)	7	7.3	7.3	7.3	°C/W
16 Natural Resonance Frequency (nominal current)			350		Hz
17 Electrical Time Constant			1.50		ms
18 Angular Acceleration (nominal current)			171,000		rad/s ²
19 Bearing Type			Ball		
20 Dielectric Withstanding Voltage			500 VRMS for 5 seconds (25@5N)		VAC
21 Radial Shaft Play			25@5N		µm
22 Axial Shaft Play			25@5N		µm
23 Maximum Radial Shaft Load			20 (72)		N (oz)
24 Maximum Axial Shaft Load (3)			30 (108)		N (oz)
25 Weight			260 (9.2)		g (oz)
26 Power Rate (nominal current)			35.0		kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

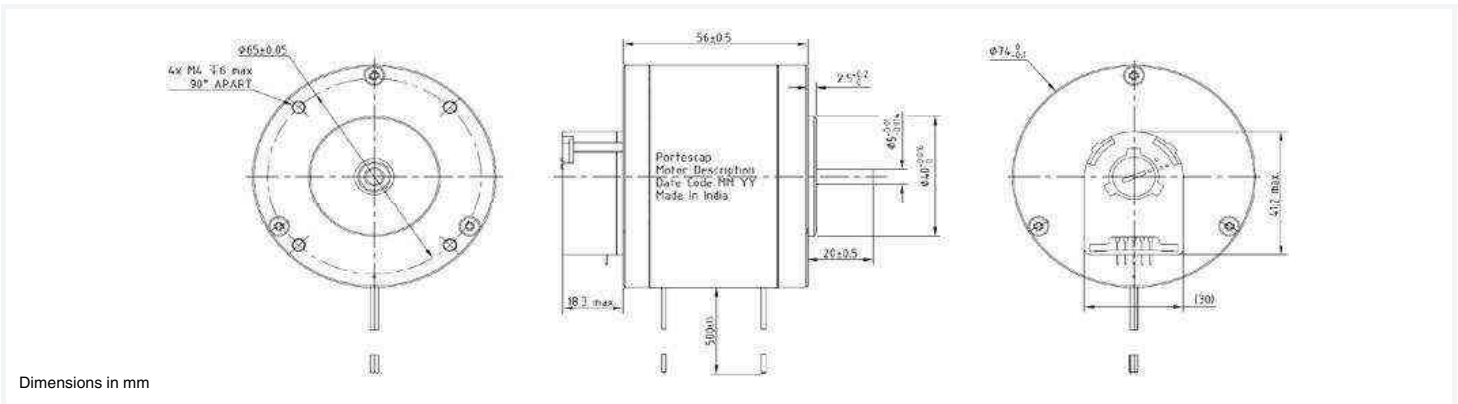
(3) Shaft must be supported when press-fitting a pulley



P760 With Encoder

Ø74mm

325 mNm



P760 With Encoder

Electrical Data

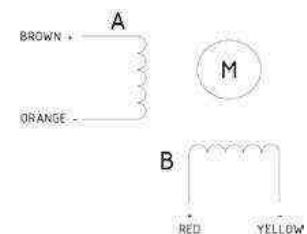
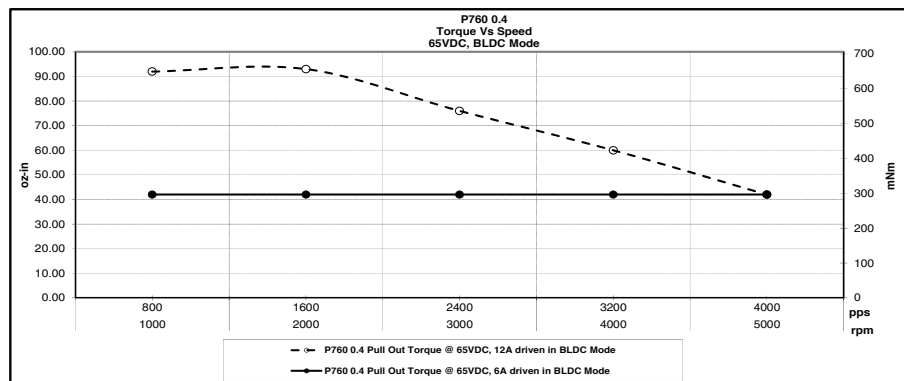
P760 0.4 05 HEDS 5540 A11

1	Resistance per Phase, typ	0.4	Ohms
2	Inductance per Phase, typ	2.1	mH
3	Nominal Phase Current (2 ph. On)	4.30	A
4	Nominal Phase Current (1 ph. On)	6.00	A
5	Back EMF Amplitude	7.10	V/kstep/s
Coil independent parameters			
6	Holding Torque, nominal current	325 (46)	mNm (oz-in)
7	Holding Torque, 1.5x nominal current (1)	485 (68.7)	mNm (oz-in)
8	Detent Torque	20 (2.8)	mNm (oz-in)
9	Rotor Inertia	17.0	kgm ² x 10 ⁻⁷
10	Step Angle	7.5	Degree
11	Absolute Accuracy 2 ph. On, Full step mode	+/- 5%	% Full Step
12	Steps Per Revolution	48	
13	Ambient Temperature Range (operating)	-20 to 50 (-4 to 122)	°C (°F)
14	Maximum Coil Temperature	130 (266)	°C (°F)
15	Thermal Resistance Coil-ambient (2)	5	°C/W
16	Natural Resonance Frequency (nominal current)	240	Hz
17	Electrical Time Constant	4.70	ms
18	Angular Acceleration (nominal current)	190,000	rad/s ²
19	Bearing Type	Ball	
20	Dielectric Withstanding Voltage	500 VRMS for 5 seconds	VAC
21	Radial Shaft Play	25 @ 5N	µm
22	Axial Shaft Play	25 @ 5N	µm
23	Maximum Radial Shaft Load	20 (72)	N (oz)
24	Maximum Axial Shaft Load (3)	30 (108)	N (oz)
25	Weight	700 (25)	g (oz)
26	Power Rate (nominal current)	58.0	kW/s

(1) Measured with 1 phase ON. The max coil temperature must be respected

(2) Motor unmounted

(3) Shaft must be supported when press-fitting a pulley or pinion





Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



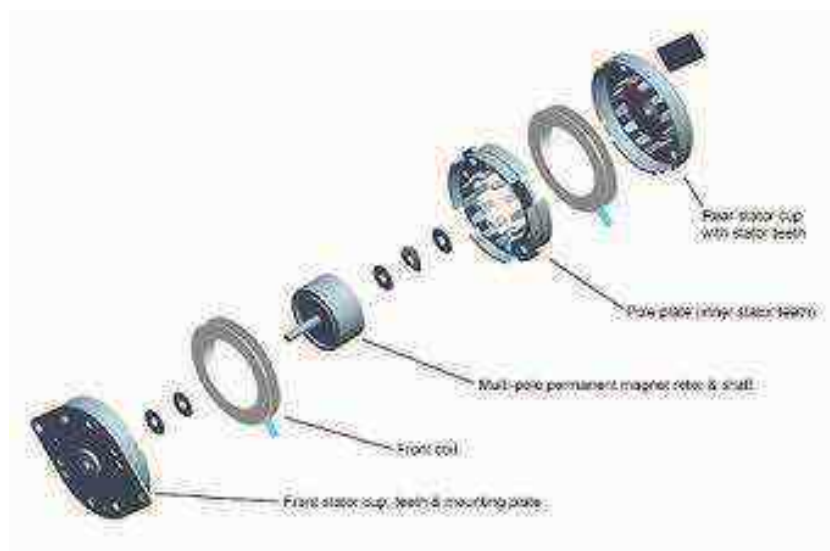
Gearheads



Encoders

Can Stack Motors

These stepper motors eliminate the need for closed-loop feedback, providing accurate positioning in steps that typically range from 3.6 to 18 degrees (100 to 20 steps per revolution). Our can stack motors are the simplest motion solution for a wide range of applications that require high continuous motor torque but don't require the absolute positioning of a servo system.



Simple, Cost-Effective, Accurate Positioning

Feature	Details	Application Advantages
Stepper motor design	<ul style="list-style-type: none">• No need for encoder feedback	<ul style="list-style-type: none">• Simple open-loop positioning that can be digitally controlled
Step angle variation: 3.6° to 18°	<ul style="list-style-type: none">• Designed to accommodate coarse to fine mechanical resolution	<ul style="list-style-type: none">• Flexibility to meet most application positioning requirements
Simple construction	<ul style="list-style-type: none">• Basic mechanical design with proven performance• No brushes to replace	<ul style="list-style-type: none">• Compact, reliable, cost-effective motion control
Radially magnetized permanent magnet rotor	<ul style="list-style-type: none">• High torque-to-size ratio	<ul style="list-style-type: none">• Design flexibility• Overall reduction in machine size
Bobbin wound coil design	<ul style="list-style-type: none">• Unipolar/bipolar windings designed for optimum performance	<ul style="list-style-type: none">• Exceptionally efficient motor output for power input
Sintered bronze bearing design, Ball bearings optional	<ul style="list-style-type: none">• Long bearing and lubrication life• Choice of bearing performance characteristics	<ul style="list-style-type: none">• Increased service life and reliability for any application



A Classic Design with Wide-Ranging Application



Medical devices & clinical diagnostics

- Laboratory automation
- Infusion systems
- Diagnostic analyzers
- Miniature pumps
- Pipettes



Instrumentation

- Dosing & dispensing systems
- Gas detection
- Land surveying
- Microscopes



Security

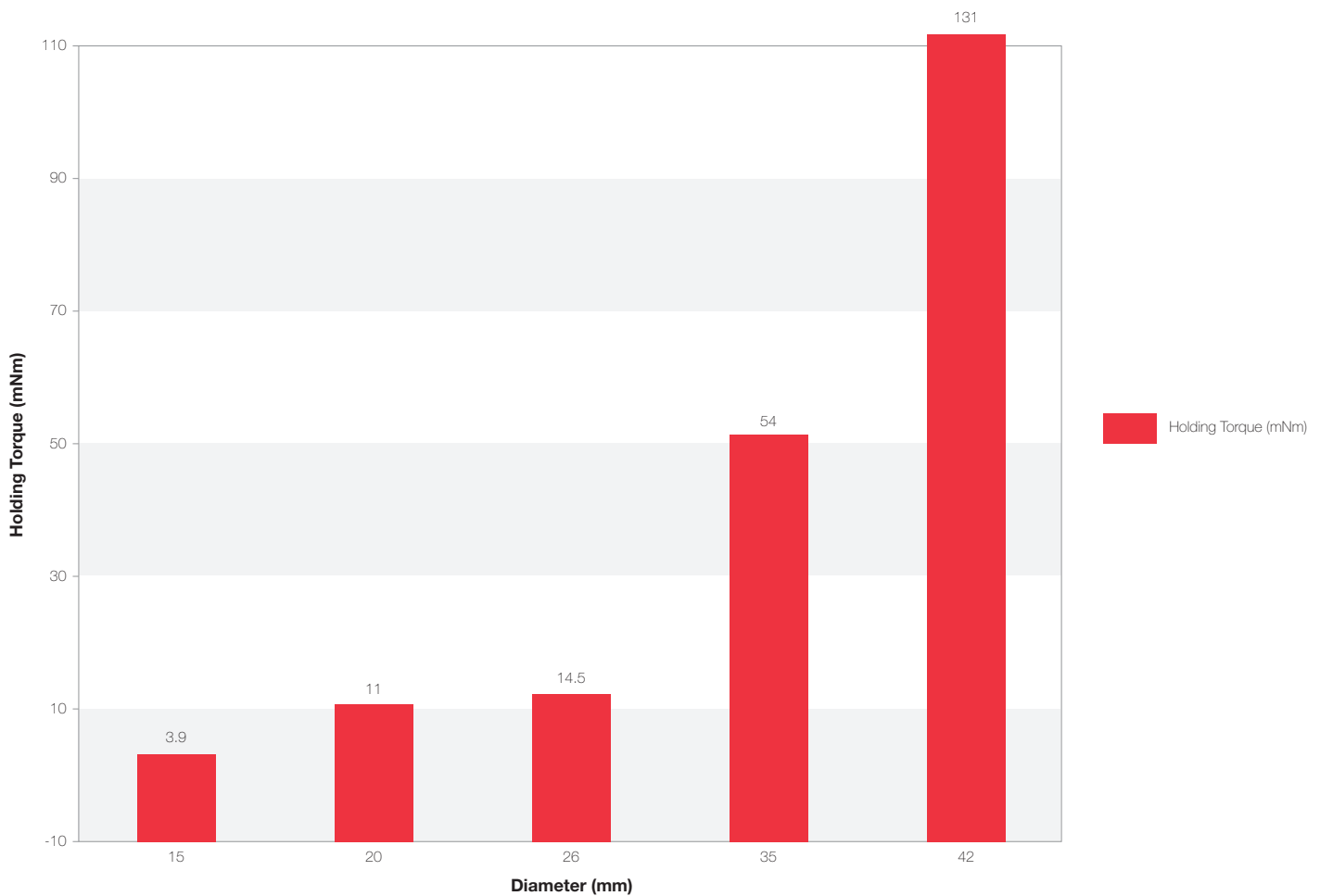
- Access systems
- Camera positioning



Other

- Damper actuation
- Valve actuation

Meet your Application's Working Point Requirements



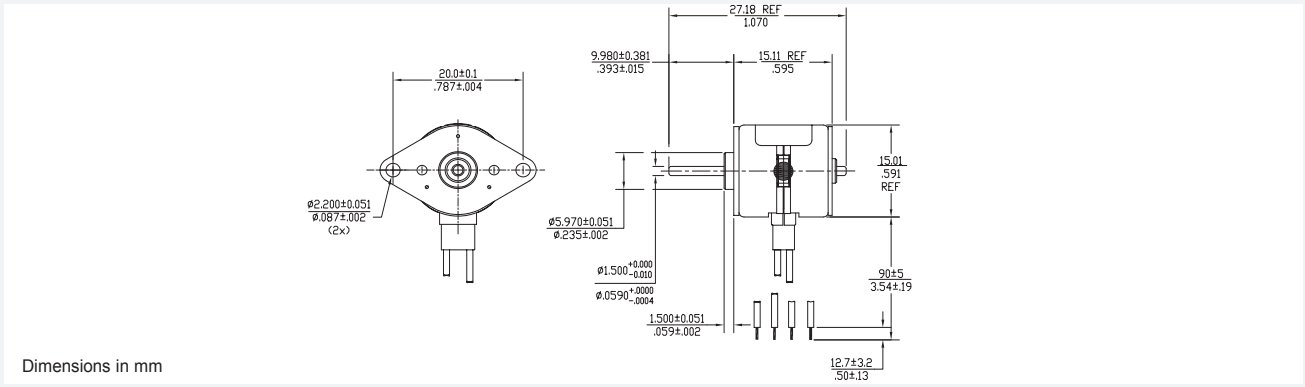
For complete product and application details, visit portescap.com/can-stack

15M020D

RoHS Compliant

Ø15mm

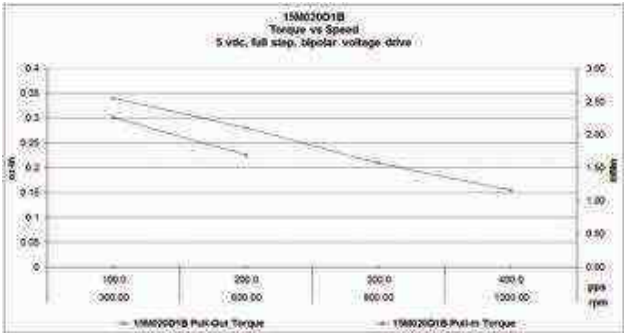
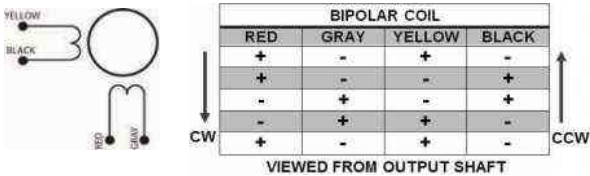
3.87 mNm



15M020D		
Electrical Data		
15M020D1B		
Bipolar		
1	Operating Voltage	5 VDC
2	Resistance per Phase, ± 10%	40.0 Ohms
3	Inductance per Phase, typ	14.0 mH
4	Rated Current per Phase *	0.13 A
Coil independent parameters		
5	Holding Torque, MIN *	3.87 (0.55) mNm (oz-in)
6	Detent Torque, Max	1.62 (0.23) mNm (oz-in)
7	Rotor Inertia	0.115 (0.00063) gcm ² (oz-in-s ²)
8	Step Angle	18.0 Degree
9	Absolute accuracy 2 ph. On, Full step	± 1.5 Degree
10	Steps per Revolution	20
11	Ambient Temp Range (operating)	-20 to +70 (-4 to +158) °C (°F)
12	Maximum Coil Temperature	130 (266) °C (°F)
13	Bearing Type	Sintered Bronze Sleeve
14	Insulation Resistance at 500 VDC	100 Mohms
15	Dielectric Withstanding Voltage	450 VRMS for 2 Seconds VAC
16	Weight	14 (0.5) g (oz)
17	Leadwire	AWG #28, UL1429 (80° C, 150 V)

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

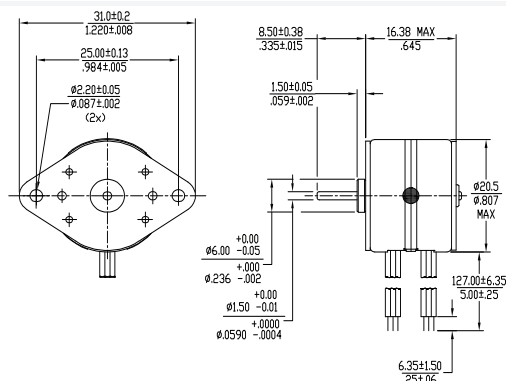


20M024D

RoHS Compliant

Ø20mm

11 mNm



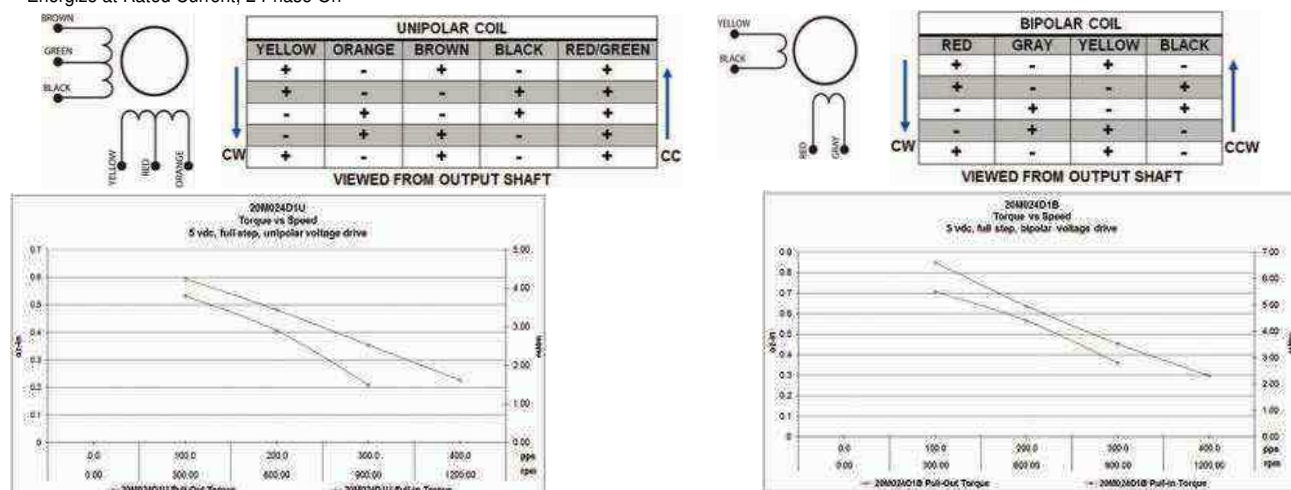
Dimensions in mm

20M024D

Electrical Data	20M024D1U Unipolar	20M024D2U Unipolar	20M024D1B Bipolar	20M024D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	20.0	115.2	20.0	115.2	Ohms
3 Inductance per Phase, typ	3.9	20.3	7.8	52.8	mH
4 Rated Current per Phase *	0.25	0.10	0.25	0.10	A
Coil independent parameters					
5 Holding Torque, MIN *	7.8(1.1)	7.8(1.1)	11(1.56)	11(1.56)	mNm (oz-in)
6 Detent Torque, Max		3.87 (0.55)			mNm (oz-in)
7 Rotor Inertia		0.41 (0.00225)			gcm ² (oz-in-s ²)
8 Step Angle		15.0			Degree
9 Absolute accuracy 2 ph. On, Full step		±1			Degree
10 Steps per Revolution		24			
11 Ambient Temp Range (operating)		-20 TO 70 (-4 TO 158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100			Mohms
15 Dielectric Withstanding Voltage		450 VRMS for 2 seconds			VAC
16 Weight		23.5 (0.83)			g (oz)
17 Leadwire		AWG #28, UL1429 (80° C, 150 V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

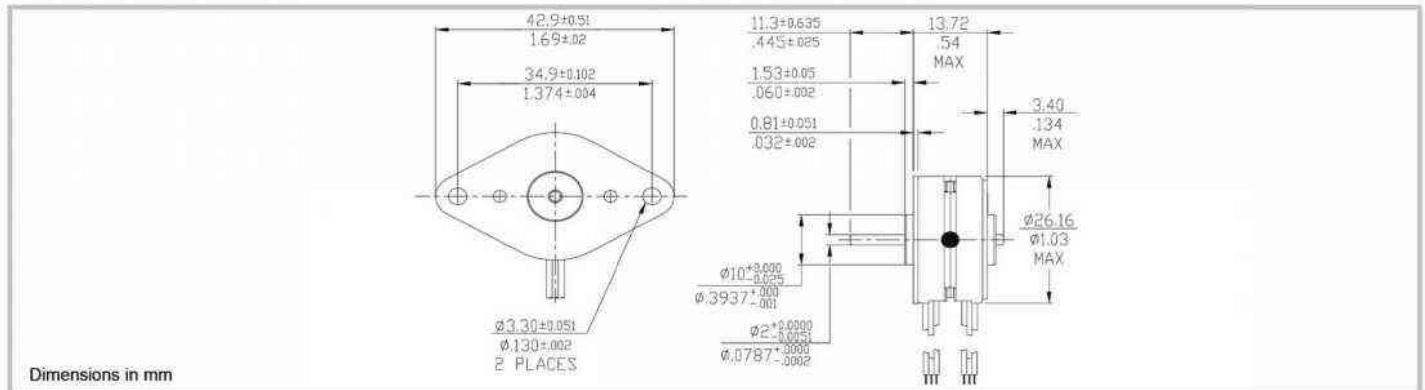


26M024B

RoHS Compliant

Ø26mm

7.8 mNm

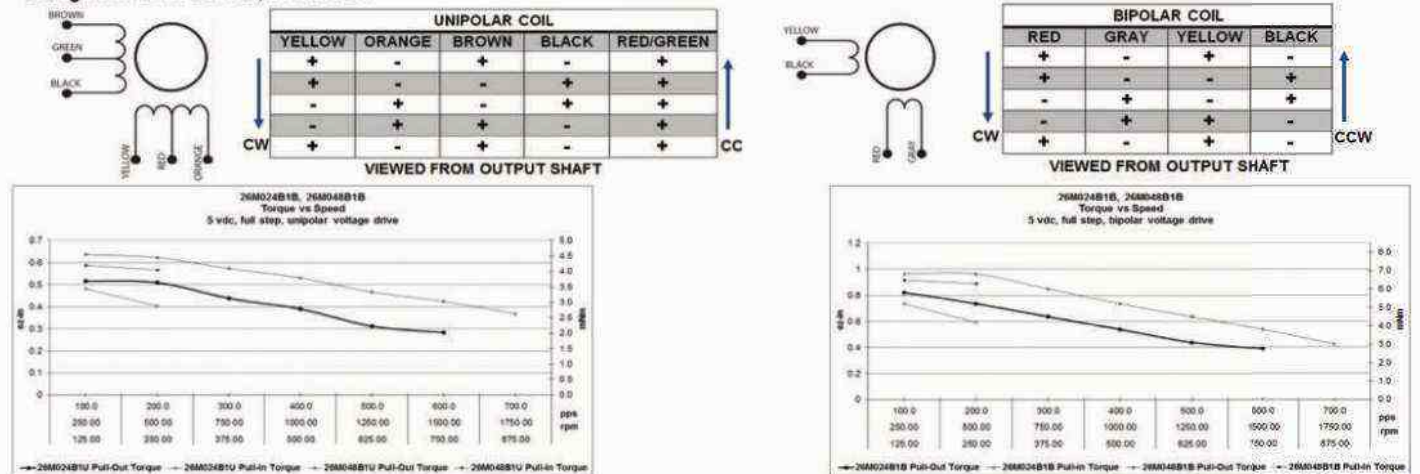


26M024B

Electrical Data	26M024B1U Unipolar	26M024B2U Unipolar	26M024B1B Bipolar	26M024B2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	19.6	110.0	19.8	108.0	Ohms
3 Inductance per Phase, typ	4.1	29.9	7.7	52.4	mH
4 Rated Current per Phase *	0.26	0.11	0.25	0.11	A
Coil independent parameters					
5 Holding Torque, MIN *	6.3 (0.9)	6.3 (0.9)	7.8 (1.1)	7.8 (1.1)	mNm (oz-in)
6 Detent Torque, Max		1.34 (0.19)			mNm (oz-in)
7 Rotor Inertia		1.1 (0.00601)			gcm ² (oz-in-s ²)
8 Step Angle		15.0			Degree
9 Absolute accuracy 2 ph. On, Full step		± 1			Degree
10 Steps per Revolution		24			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		34 (1.2)			g (oz)
17 Leadwire		AWG #28, UL1429 (80° C, 150 V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

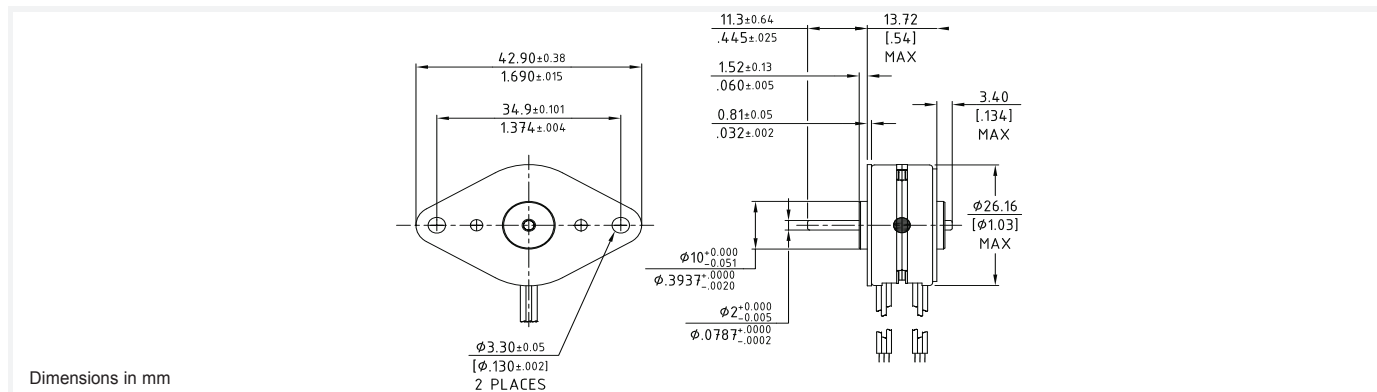


26M024D

RoHS Compliant

Ø26mm

12 mNm

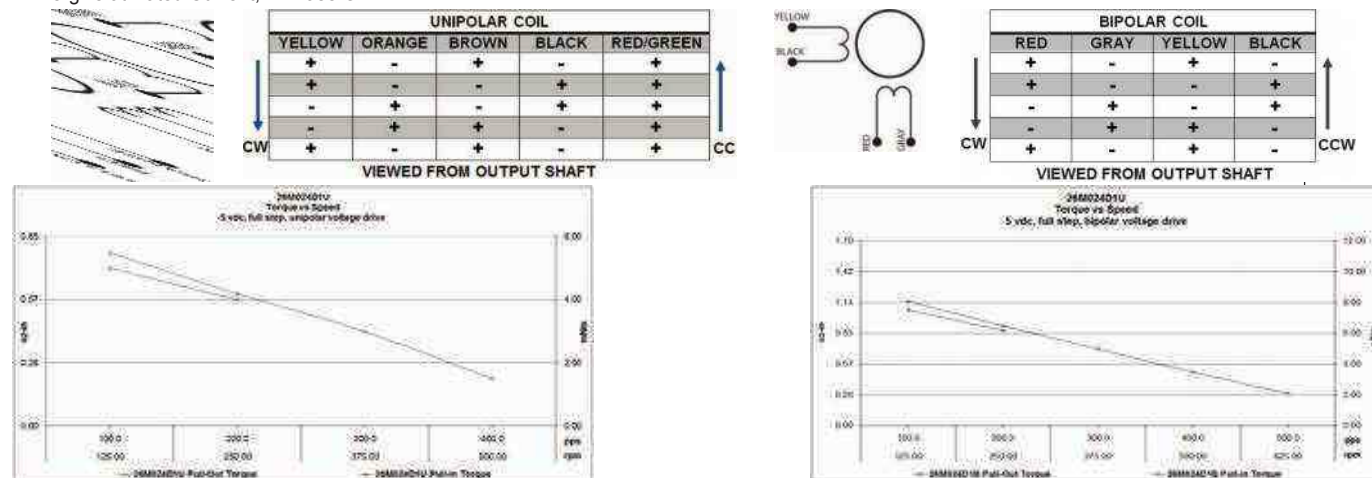


26M024D

Electrical Data	26M024D1U Unipolar	26M024D2U Unipolar	26M024D1B Bipolar	26M024D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, $\pm 10\%$	19.6	110.0	19.8	108.0	Ohms
3 Inductance per Phase, typ	3.8	26.6	9.0	44.3	mH
4 Rated Current per Phase *	0.26	0.11	0.25	0.11	A
Coil independent parameters					
5 Holding Torque, MIN *	9.5 (1.35)	9.5 (1.35)	12 (1.7)	12 (1.7)	mNm (oz-in)
6 Detent Torque, Max			4.2 (0.6)		mNm (oz-in)
7 Rotor Inertia			1.1 (0.00601)		gcm ² (oz-in-s ²)
8 Step Angle			15.0		Degree
9 Absolute accuracy 2 ph. On, Full step			± 1		Degree
10 Steps per Revolution			24.0		
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		34 (1.2)			g (oz)
17 Leadwire		AWG #28, UL1429 (80° C, 150 V)			

All Motor Data Values at 20°C Unless Otherwise Specified

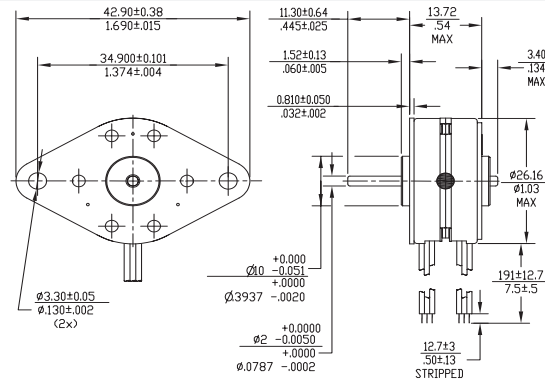
* Energize at Rated Current, 2 Phase On



26M048B

RoHS Compliant

Ø26mm 10.6 mNm



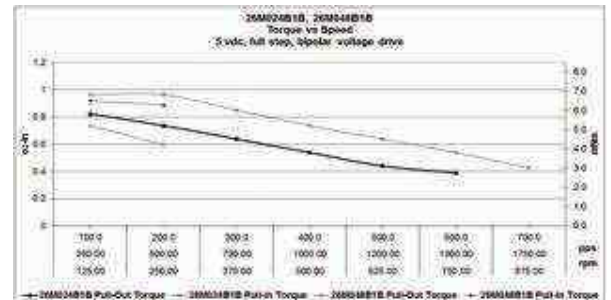
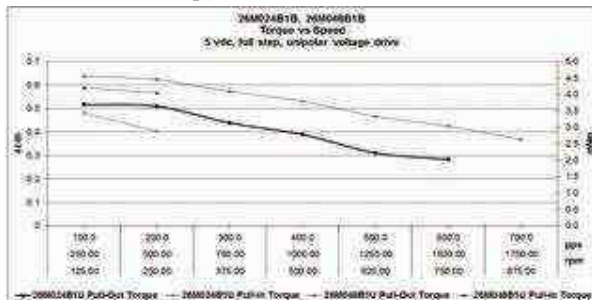
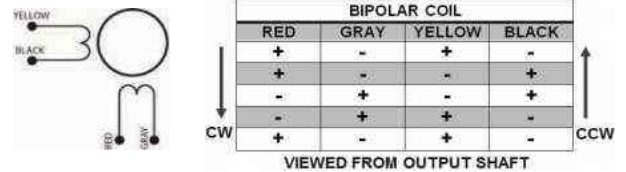
Dimensions in mm

26M048B

Electrical Data	26M048B1U Unipolar	26M048B2U Unipolar	26M048B1B Bipolar	26M048B2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	19.6	110.0	19.8	108.0	Ohms
3 Inductance per Phase, typ	5.3	36.5	13.0	60.7	mH
4 Rated Current per Phase *	0.26	0.11	0.25	0.11	A
Coil independent parameters					
5 Holding Torque, MIN *	9.2 (1.3)	9.2 (1.3)	10.6 (1.5)	10.6 (1.5)	mNm (oz-in)
6 Detent Torque, Max		0.85 (0.12)			mNm (oz-in)
7 Rotor Inertia		1.1 (0.00601)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		± .5			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		34 (1.2)			g (oz)
17 Leadwire		AWG #28, UL1429 (80° C, 150 V)			

All Motor Data Values at 20°C Unless Otherwise Specified

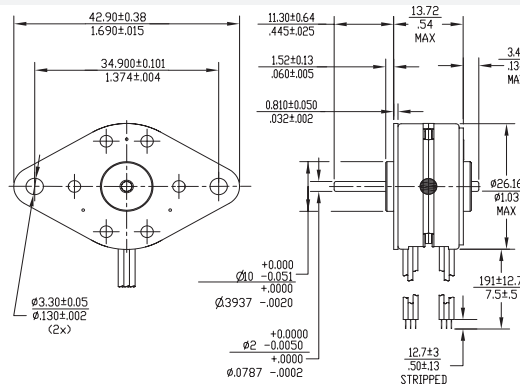
* Energize at Rated Current, 2 Phase On



26M048D

RoHS Compliant

Ø26mm 14.5 mNm



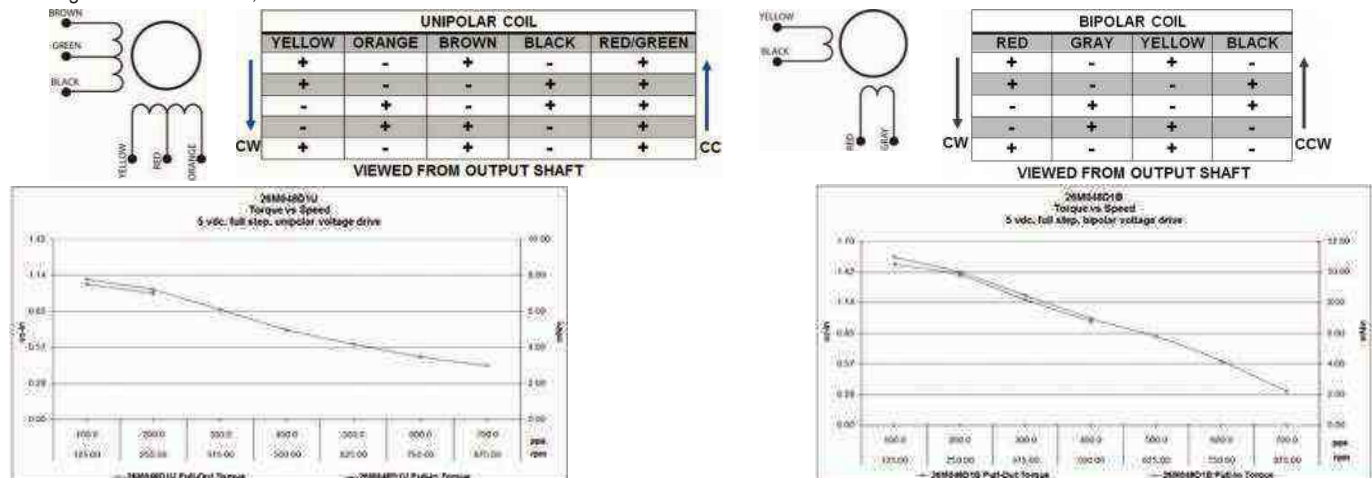
Dimensions in mm

26M048D

Electrical Data	26M048D1U Unipolar	26M048D2U Unipolar	26M048D1B Bipolar	26M048D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, $\pm 10\%$	19.6	110.0	19.8	108.0	Ohms
3 Inductance per Phase, typ	4.9	33.0	12.0	55.0	mH
4 Rated Current per Phase *	0.26	0.11	0.25	0.11	A
Coil independent parameters					
5 Holding Torque, MIN *	11.5 (1.63)	11.5 (1.63)	14.5 (2.05)	14.5 (2.05)	mNm (oz-in)
6 Detent Torque, Max		4.2 (0.6)			mNm (oz-in)
7 Rotor Inertia		1.1 (0.00601)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		$\pm .5$			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		34 (1.2)			g (oz)
17 Leadwire		AWG #28, UL1429 (80° C, 150 V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

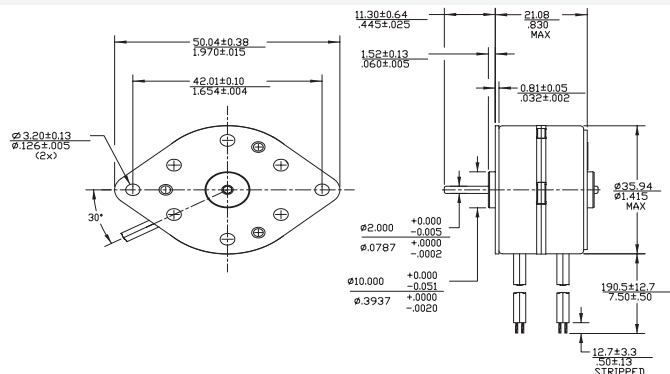


35L024B

RoHS Compliant

Ø35mm

25 mNm



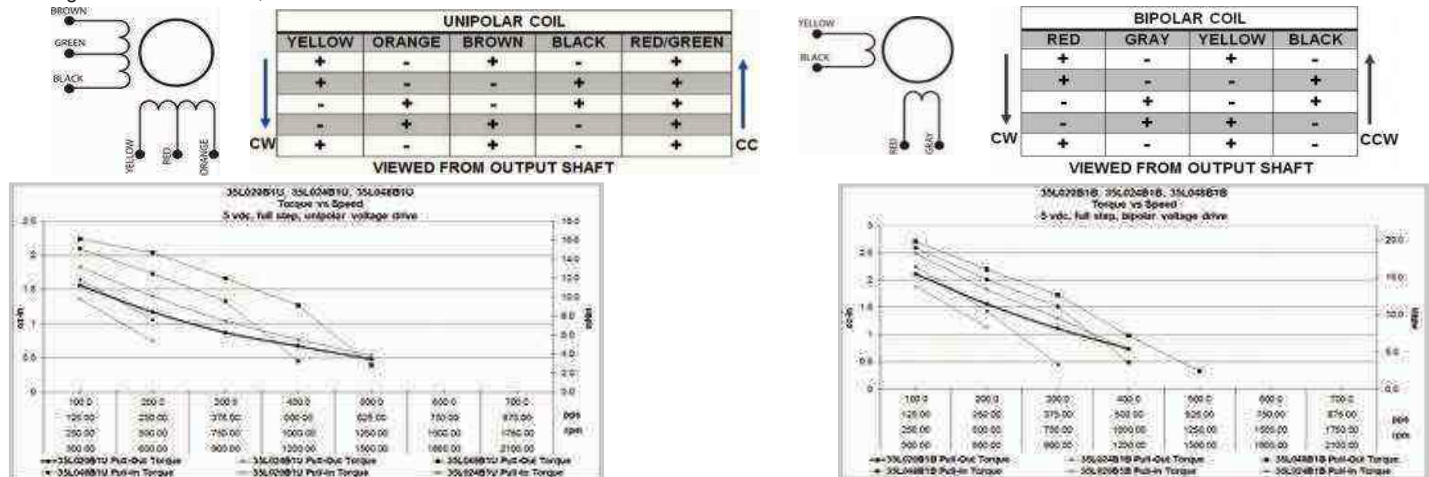
Dimensions in mm

35L024B

Electrical Data	35L024B1U Unipolar	35L024B2U Unipolar	35L024B1B Bipolar	35L024B2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	11.0	64.0	11.0	64.0	Ohms
3 Inductance per Phase, typ	7.4	38.0	14.2	65.0	mH
4 Rated Current per Phase *	0.45	0.19	0.45	0.19	A
Coil independent parameters					
5 Holding Torque, MIN *	20 (2.8)	20 (2.8)	25 (3.5)	25 (3.5)	mNm (oz-in)
6 Detent Torque, Max		4.2 (0.6)			mNm (oz-in)
7 Rotor Inertia		4 (0.021)			gcm ² (oz-in-s ²)
8 Step Angle		15.0			Degree
9 Absolute accuracy 2 ph. On, Full step		± 1			Degree
10 Steps per Revolution		24.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		88 (3.1)			g (oz)
17 Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

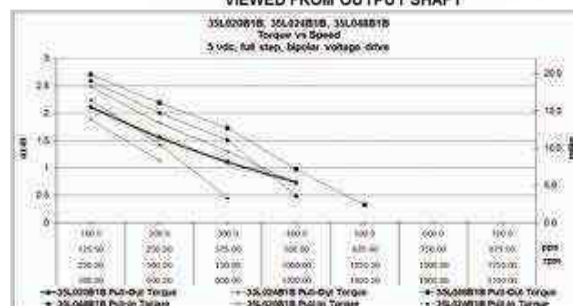
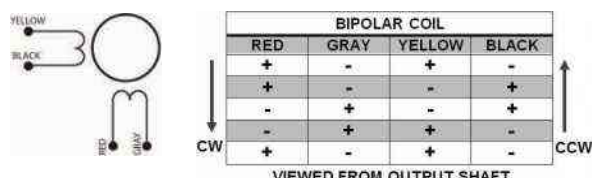
* Energize at Rated Current, 2 Phase On



28 mNm



* Energize at Rated Current, 2 Phase On

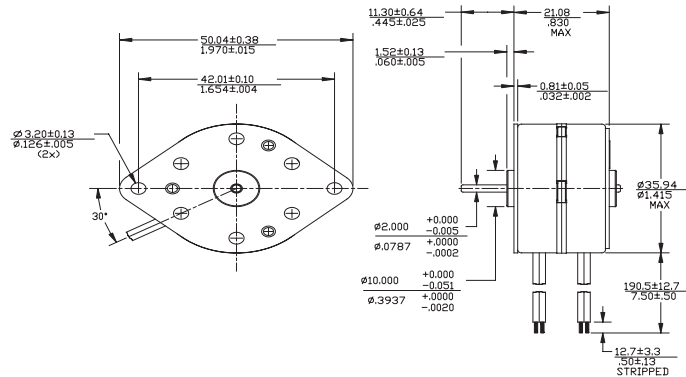


35L048D

RoHS Compliant

Ø35mm

54 mNm



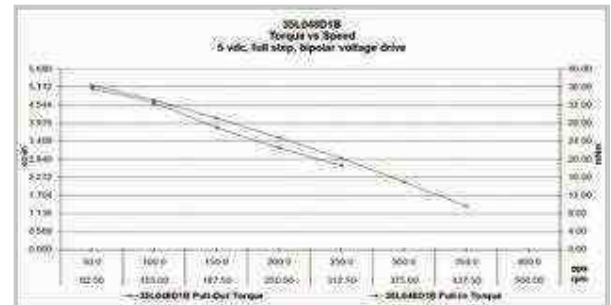
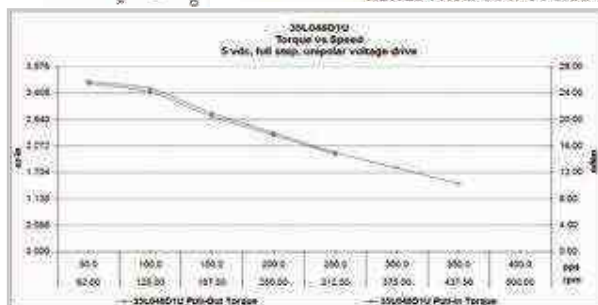
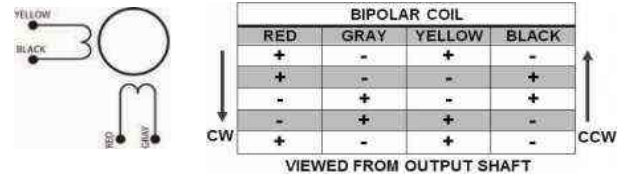
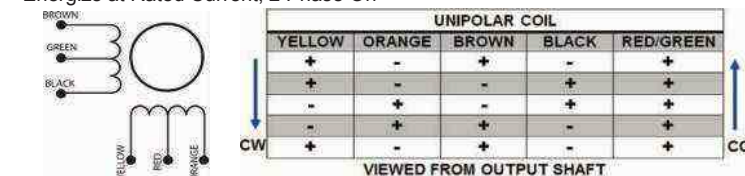
Dimensions in mm

35L048D

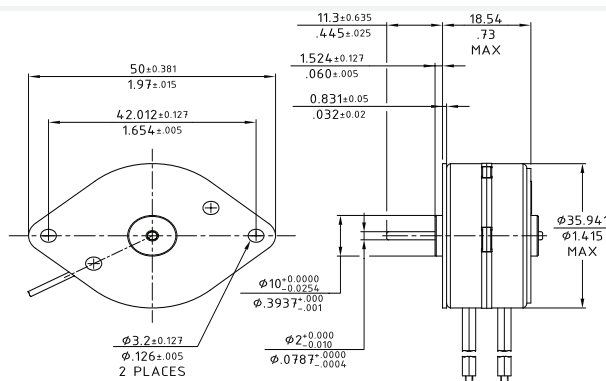
Electrical Data	35L048D1U Unipolar	35L048D2U Unipolar	35L048D1B Bipolar	35L048D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	11.0	64.0	11.0	64.0	Ohms
3 Inductance per Phase, typ	7.4	35.0	13.0	60.0	mH
4 Rated Current per Phase *	0.45	0.19	0.45	0.19	A
Coil independent parameters					
5 Holding Torque, MIN *	46 (6.5)	46 (6.5)	54 (7.6)	54 (7.6)	mNm (oz-in)
6 Detent Torque, Max		12.1 (1.8)			mNm (oz-in)
7 Rotor Inertia		4 (0.021)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		± .5			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		88 (3.1)			g (oz)
17 Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On



20 mNm



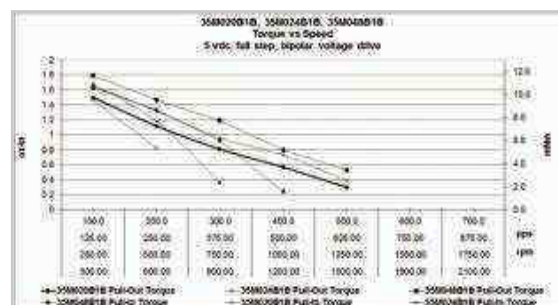
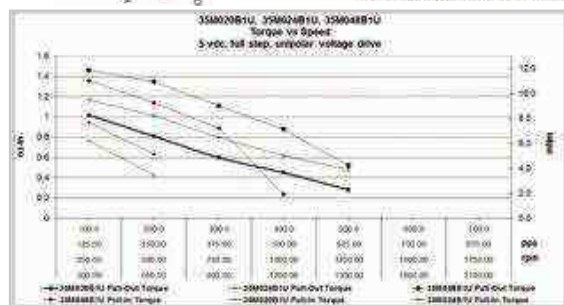
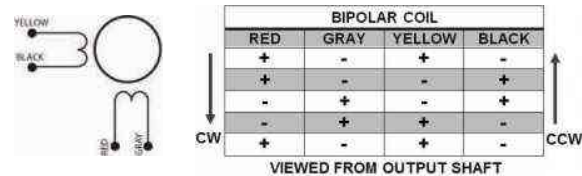
Dimensions in mm

35M024B

Electrical Data		35M024B1U Unipolar	35M024B2U Unipolar	35M024B1B Bipolar	35M024B2B Bipolar	
1	Operating Voltage	5	12	5	12	VDC
2	Resistance per Phase, ± 10%	12.5	72.0	12.5	72.0	Ohms
3	Inductance per Phase, typ	7.2	32.8	14.2	76.0	mH
4	Rated Current per Phase *	0.40	0.17	0.40	0.17	A
Coil independent parameters						
5	Holding Torque, MIN *	16.93 (2.4)	16.93 (2.4)	19.76 (2.8)	19.76 (2.8)	mNm (oz-in)
6	Detent Torque, Max		2.12 (0.3)			mNm (oz-in)
7	Rotor Inertia		2 (0.011)			gcm ² (oz-in-s ²)
8	Step Angle		15.0			Degree
9	Absolute accuracy 2 ph. On, Full step		± 1			Degree
10	Steps per Revolution		24.0			
11	Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12	Maximum Coil Temperature		130 (266)			°C (°F)
13	Bearing Type		Sintered Bronze Sleeve			
14	Insulation Resistance at 500 VDC		100.0			Mohms
15	Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16	Weight		88 (3.1)			g (oz)
17	Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

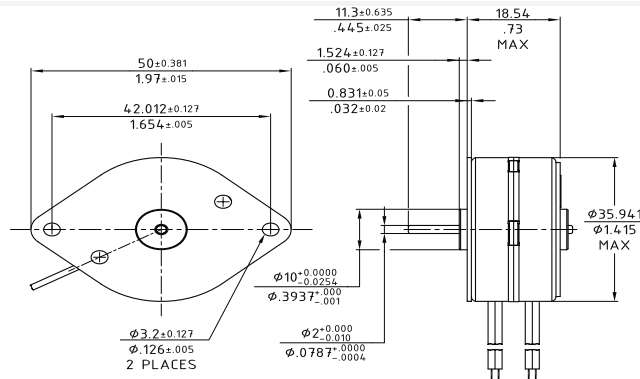


35M048B

RoHS Compliant

Ø35mm

20 mNm



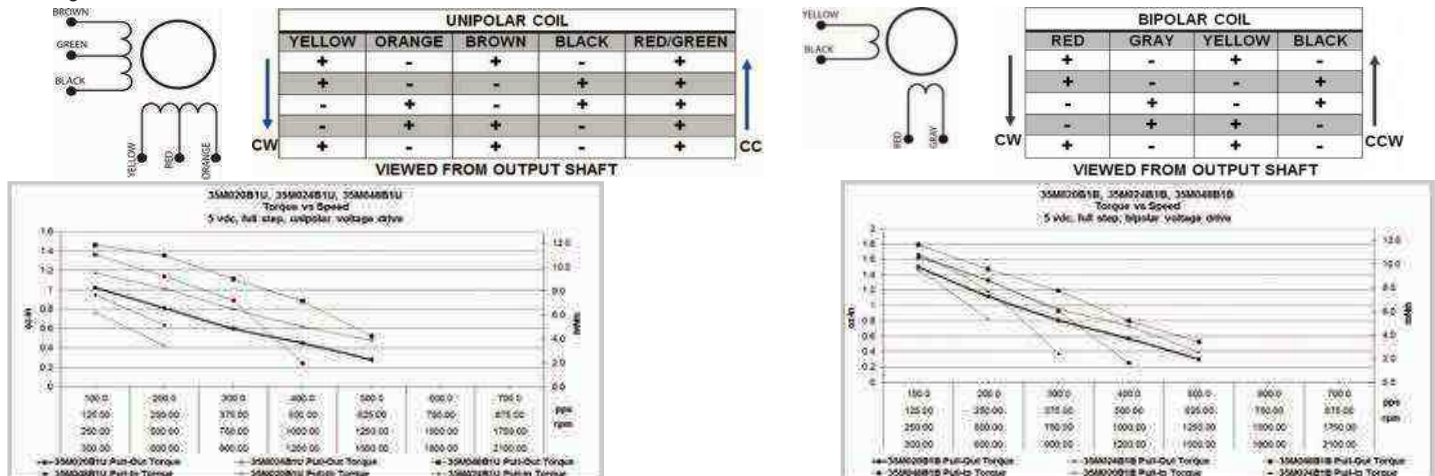
Dimensions in mm

35M048B

Electrical Data	35M048B1U Unipolar	35M048B2U Unipolar	35M048B1B Bipolar	35M048B2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	12.5	72.0	12.5	72.0	Ohms
3 Inductance per Phase, typ	7.8	36.0	16.4	86.0	mH
4 Rated Current per Phase *	0.40	0.17	0.40	0.17	A
Coil independent parameters					
5 Holding Torque, MIN *	18.35 (2.6)	18.35 (2.6)	19.76 (2.8)	19.76 (2.8)	mNm (oz-in)
6 Detent Torque, Max		2.12 (0.3)			mNm (oz-in)
7 Rotor Inertia		2 (0.011)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		± .5			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		88 (3.1)			g (oz)
17 Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

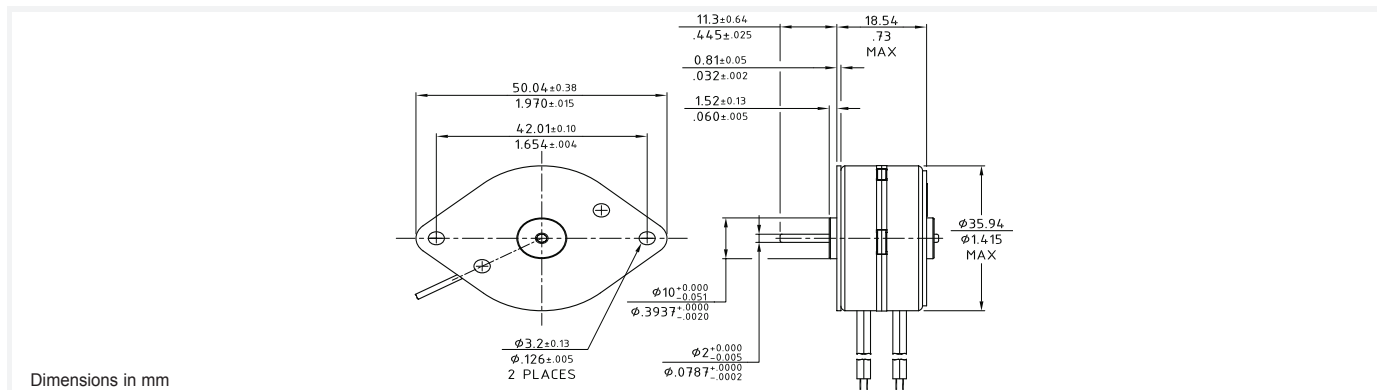


35M048D

RoHS Compliant

Ø35mm

25 mNm

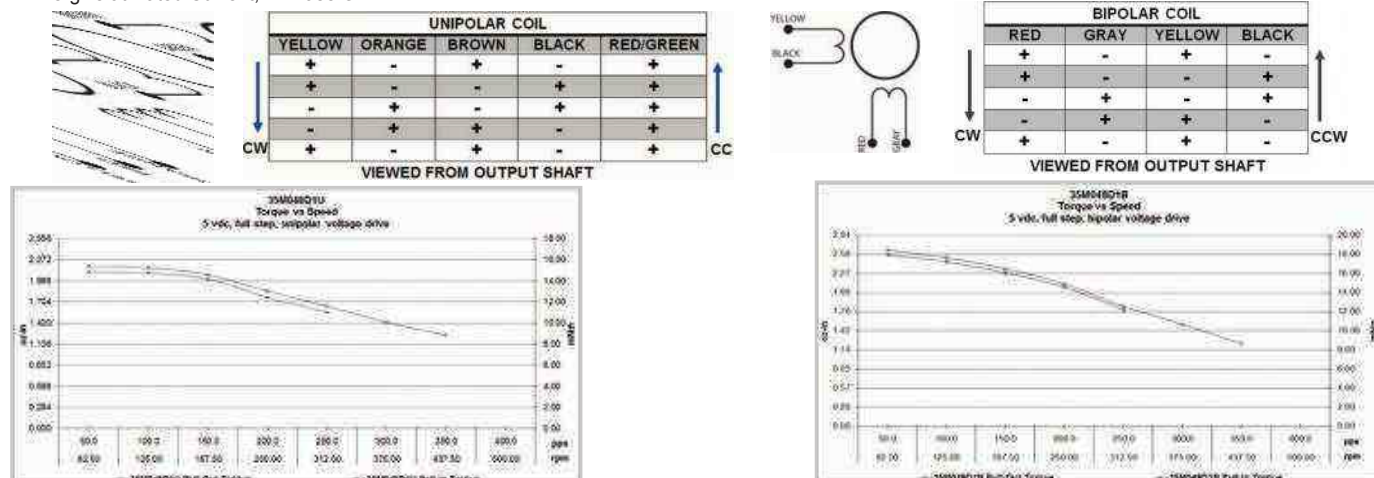


35M048D

Electrical Data	35M048D1U Unipolar	35M048D2U Unipolar	35M048D1B Bipolar	35M048D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, $\pm 10\%$	12.5	72.0	12.5	72.0	Ohms
3 Inductance per Phase, typ	8.5	38.0	16.3	90.0	mH
4 Rated Current per Phase *	0.40	0.17	0.40	0.17	A
Coil independent parameters					
5 Holding Torque, MIN *	20 (2.8)	20 (2.8)	25 (3.5)	25 (3.5)	mNm (oz-in)
6 Detent Torque, Max		6.3 (0.89)			mNm (oz-in)
7 Rotor Inertia		2 (0.011)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		$\pm .5$			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		88 (3.1)			g (oz)
17 Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

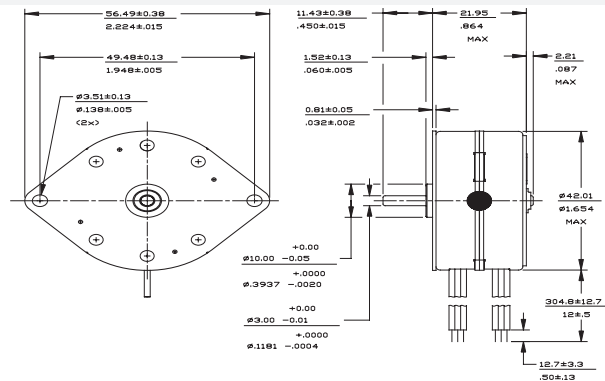


42L048D

RoHS Compliant

Ø42mm

131 mNm



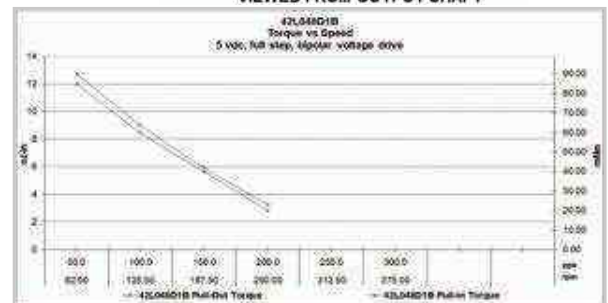
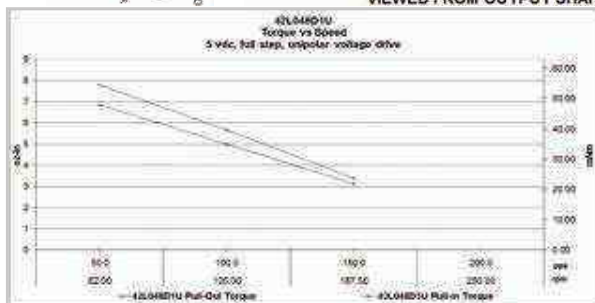
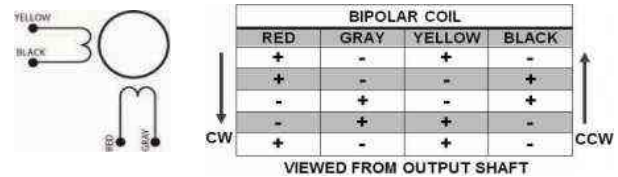
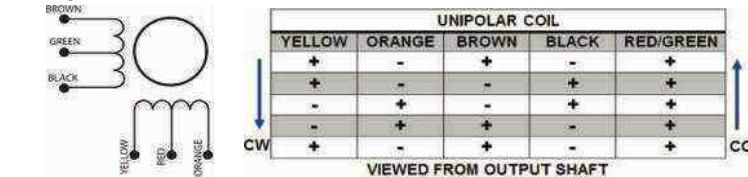
Dimensions in mm

42L048D

Electrical Data	42L048D1U Unipolar	42L048D2U Unipolar	42L048D1B Bipolar	42L048D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	5.2	30.0	5.2	30.0	Ohms
3 Inductance per Phase, typ	2.1	11.3	4.2	22.3	mH
4 Rated Current per Phase *	0.96	0.40	0.96	0.40	A
Coil independent parameters					
5 Holding Torque, MIN *	106 (15.1)	106 (15.1)	131 (18.5)	131 (18.5)	mNm (oz-in)
6 Detent Torque, Max		29.7 (4.2)			mNm (oz-in)
7 Rotor Inertia		19.5 (0.1066)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		± .5			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		116.4 (4.1)			g (oz)
17 Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

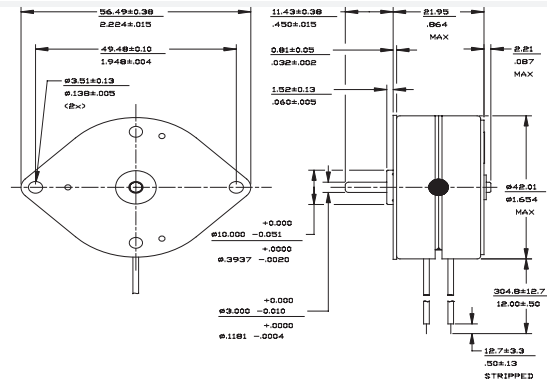
* Energize at Rated Current, 2 Phase On



42M048C

RoHS Compliant

Ø42mm 83.8 mNm



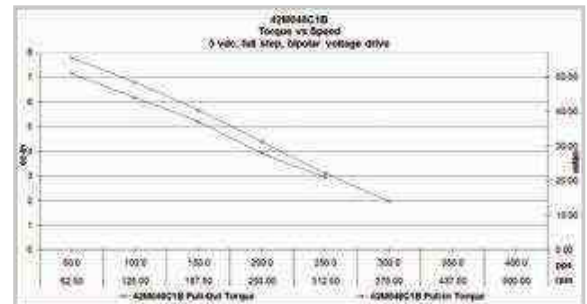
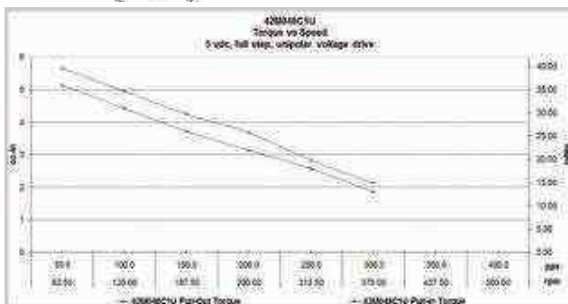
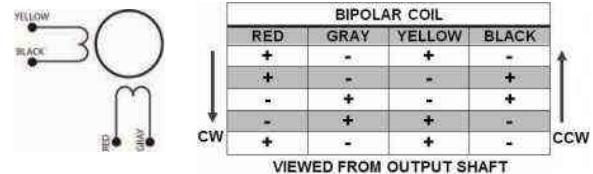
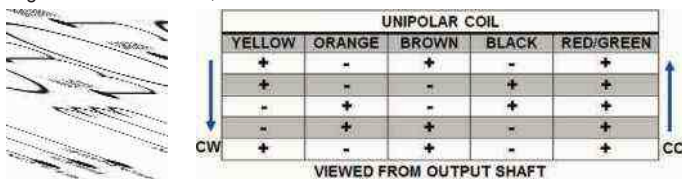
Dimensions in mm

42M048C

Electrical Data	42M048C1U Unipolar	42M048C2U Unipolar	42M048C1B Bipolar	42M048C2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, $\pm 10\%$	9.1	52.4	9.1	52.4	Ohms
3 Inductance per Phase, typ	8.1	51.7	16.7	85.7	mH
4 Rated Current per Phase *	0.55	0.23	0.55	0.23	A
Coil independent parameters					
5 Holding Torque, MIN *	66.2 (9.4)	66.2 (9.4)	83.8 (11.9)	83.8 (11.9)	mNm (oz-in)
6 Detent Torque, Max		12.7 (1.8)			mNm (oz-in)
7 Rotor Inertia		12.5 (0.068)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		$\pm .5$			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		145 (5.1)			g (oz)
17 Leadwire		AWG #26, UL 1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On



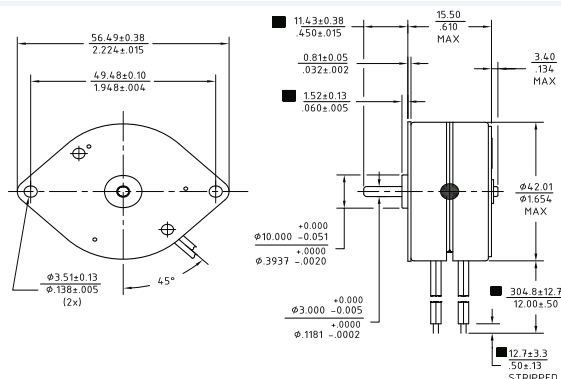
Ø42mm 114.4 mNm

Dimensions in mm

All Motor Data Values at 20°C Unless Otherwise Specified

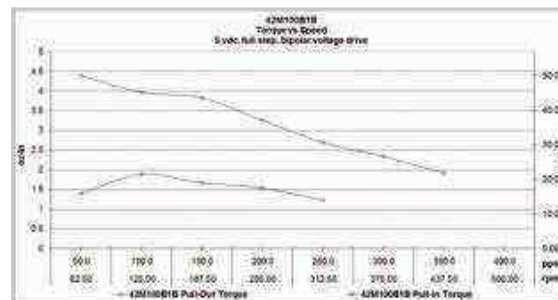
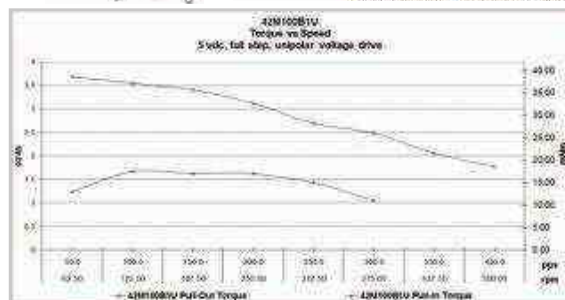
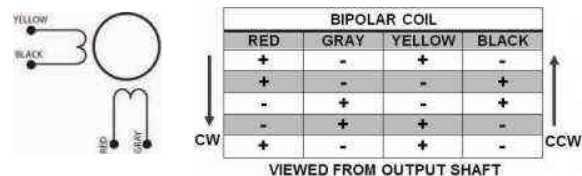
* Energize at Rated Current, 2 Phase On

Ø42mm 49.4 mNm



42M100B

* Energize at Rated Current, 2 Phase On



Ø42mm 60.7 mNm



All Motor Data Values at 20 °C Unless Otherwise Specified

UNIPOLAR COIL

	YELLOW	ORANGE	BROWN	BLACK	RED/GREEN
CW	+	-	+	-	+
	+	-	+	-	+
	-	+	-	+	+
	-	+	-	+	+
CC	+	-	+	-	+

BIPOLAR COIL

	RED	GRAY	YELLOW	BLACK
CW	+	-	+	-
	+	-	+	-
	-	+	-	+
	-	+	-	+
CCW	+	-	+	-

42M100Q1U Torque vs Speed
5 vdc, full step, unipolar voltage drive

Speed (rpm)	50.0	100.0	150.0	200.0	250.0	300.0	350.0	400.0	450.0
42M100Q1U Pull-Out Torque (oz-in)	4.5	4.8	4.5	3.8	3.0	2.2	1.6	1.2	1.0
42M100Q1U Pull-In Torque (oz-in)	3.2	3.8	3.5	2.8	2.0	1.5	1.1	0.8	0.7

42M100Q1B Torque vs Speed
5 vdc, full step, bipolar voltage drive

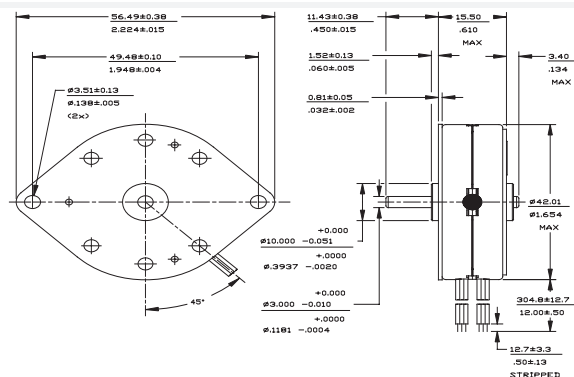
Speed (rpm)	50.0	100.0	150.0	200.0	250.0	300.0	350.0	400.0	450.0
42M100Q1B Pull-Out Torque (oz-in)	5.5	5.8	5.2	4.5	3.5	2.5	1.8	1.2	1.0
42M100Q1B Pull-In Torque (oz-in)	4.2	4.8	4.2	3.5	2.5	1.8	1.2	0.8	0.7

42S048D

RoHS Compliant

Ø42mm

60 mNm



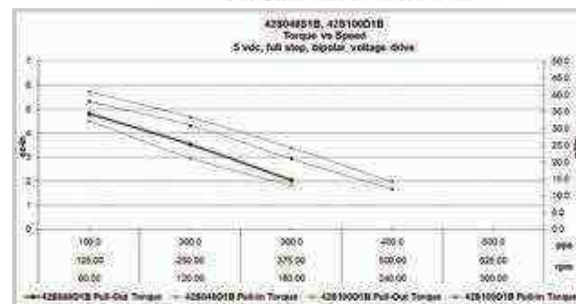
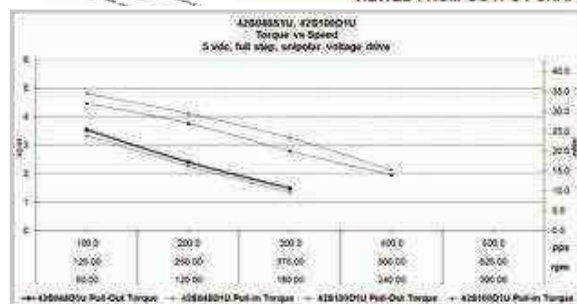
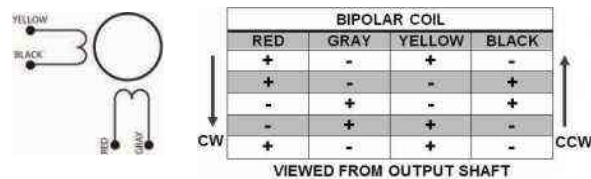
Dimensions in mm

42S048D

Electrical Data	42S048D1U Unipolar	42S048D2U Unipolar	42S048D1B Bipolar	42S048D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	12.5	75.0	12.5	75.0	Ohms
3 Inductance per Phase, typ	6.4	34.1	10.4	58.0	mH
4 Rated Current per Phase *	0.40	0.16	0.40	0.16	A
Coil independent parameters					
5 Holding Torque, MIN *	50.8 (7.2)	50.8 (7.2)	60 (8.5)	60 (8.5)	mNm (oz-in)
6 Detent Torque, Max		12 (1.7)			mNm (oz-in)
7 Rotor Inertia		9.5 (0.052)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		± .5			Degree
10 Steps per Revolution		48.0			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100.0			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		88 (3.1)			g (oz)
17 Leadwire		AWG#28, UL3265 (125°C, 150V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

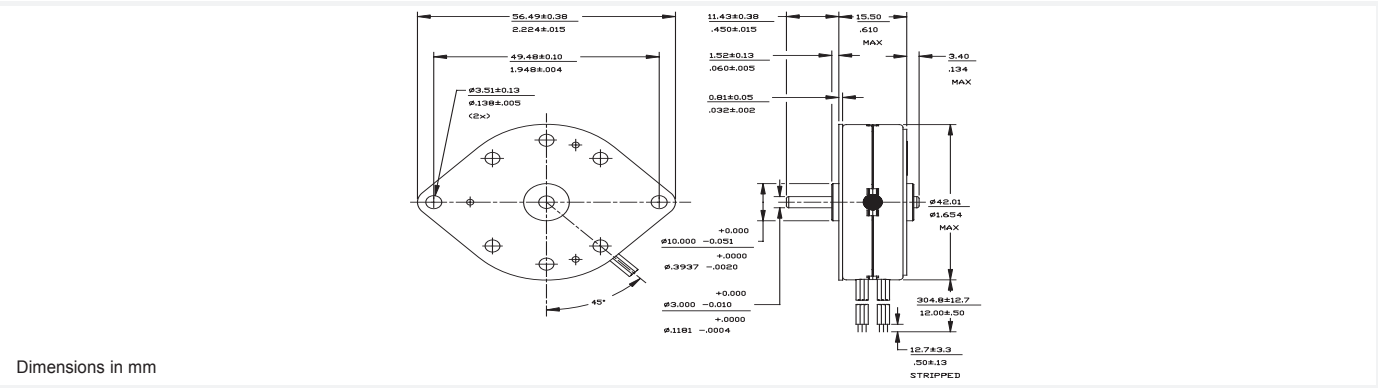


42S100D

RoHS Compliant

Ø42mm

53 mNm

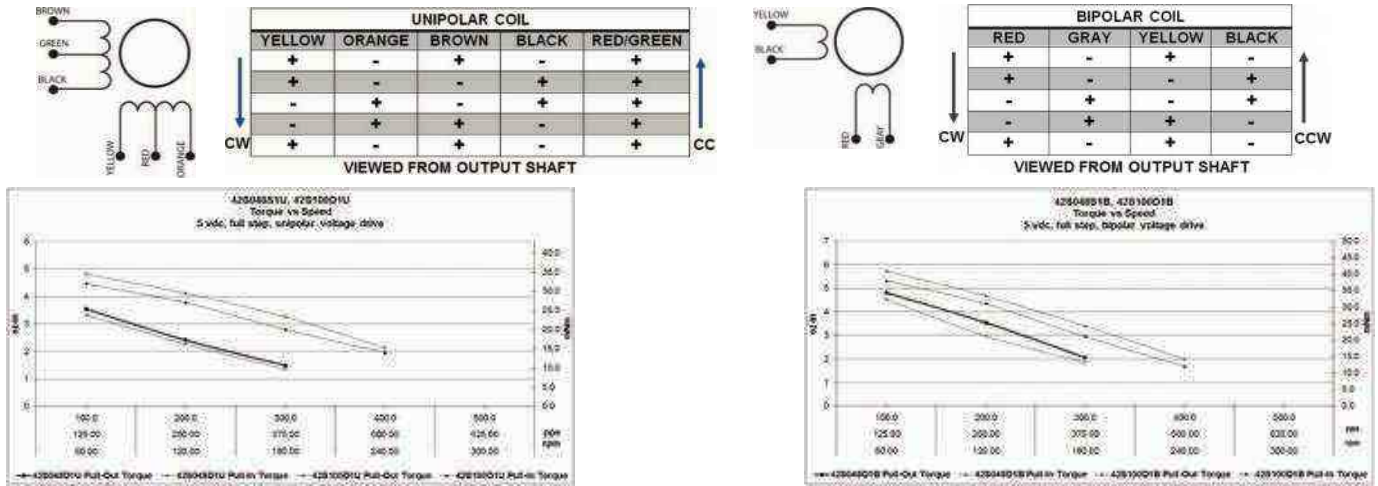


42S100D

Electrical Data	42S100D1U Unipolar	42S100D2U Unipolar	42S100D1B Bipolar	42S100D2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	12.5	75.0	12.5	75.0	Ohms
3 Inductance per Phase, typ	6.4	36.7	10.8	60.7	mH
4 Rated Current per Phase *	0.40	0.16	0.40	0.16	A
Coil independent parameters					
5 Holding Torque, MIN *	49.4 (7)	49.4 (7)	53 (7.5)	53 (7.5)	mNm (oz-in)
6 Detent Torque, Max		11.3 (1.6)			mNm (oz-in)
7 Rotor Inertia		9.5 (0.052)			gcm ² (oz-in-s ²)
8 Step Angle		3.6			Degree
9 Absolute accuracy 2 ph. On, Full step		± .4			Degree
10 Steps per Revolution		100			
11 Ambient Temp Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		88 (3.1)			g (oz)
17 Leadwire		AWG#28, UL3265 (125°C, 150V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

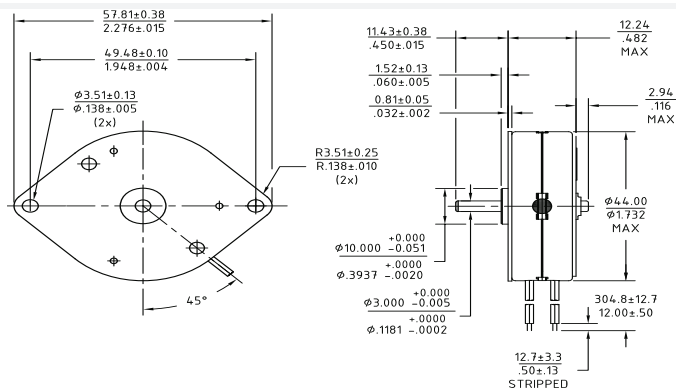


44M100D

RoHS Compliant

Ø44mm

46.6 mNm



Dimensions in mm

44M100D

Electrical Data

44M100D1B Bipolar

44M100D2B Bipolar

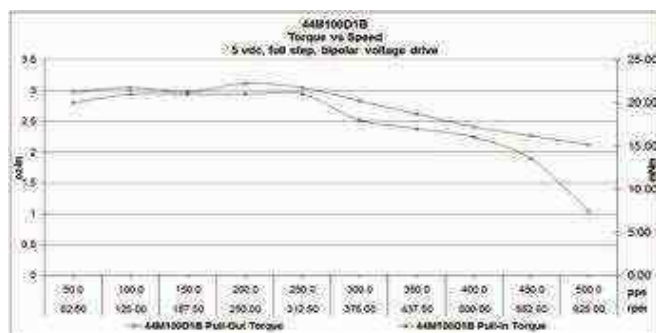
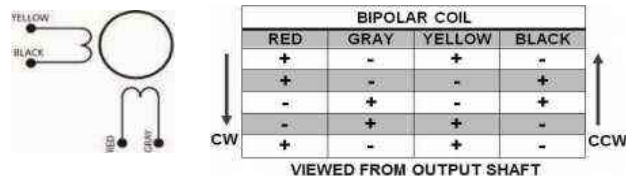
1	Operating Voltage	5	12	VDC
2	Resistance per Phase, ± 10%	12.5	70.0	Ohms
3	Inductance per Phase, typ	6.7	35.0	mH
4	Rated Current per Phase *	0.40	0.17	A

Coil independent parameters

5	Holding Torque, MIN *	46.6 (6.6)	mNm (oz-in)
6	Detent Torque, Max	8.47 (1.2)	mNm (oz-in)
7	Rotor Inertia	8.3 (0.045)	gcm ² (oz-in-s ²)
8	Step Angle	3.6	Degree
9	Absolute accuracy 2 ph. On, Full step	±0.4	Degree
10	Steps per Revolution	100	
11	Ambient Temp Range (operating)	-20 TO 70 (-4 TO 158)	°C (°F)
12	Maximum Coil Temperature	130 (266)	°C (°F)
13	Bearing Type	Sintered Bronze Sleeve	
14	Insulation Resistance at 500 VDC	100	Mohms
15	Dielectric Withstanding Voltage	650 VRMS for 2 seconds	VAC
16	Weight	88 (3.1)	g (oz)
17	Leadwire	AWG#28, UL3265 (125°C, 150V)	

All Motor Data Values at 20°C Unless Otherwise Specified

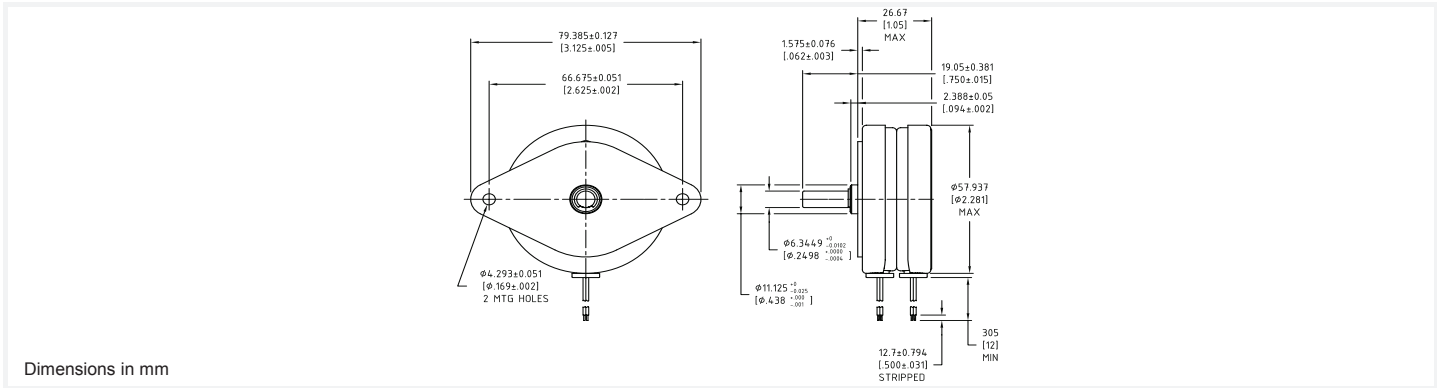
* Energize at Rated Current, 2 Phase On



57L048B

RoHS Compliant

Ø57mm 110.8 mNm



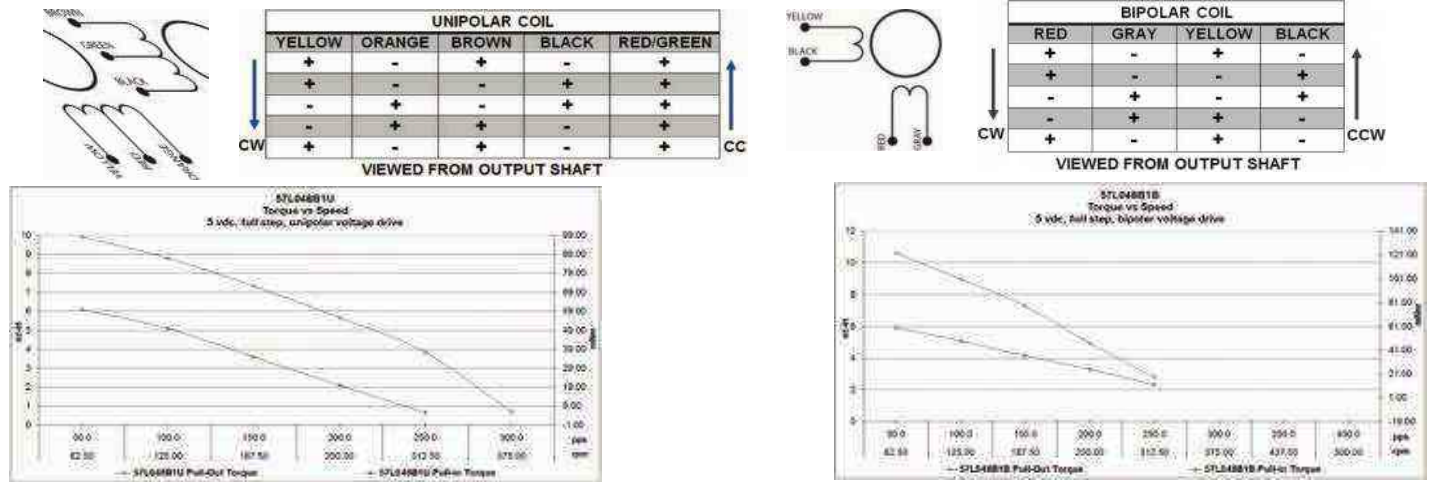
Dimensions in mm

57L048B

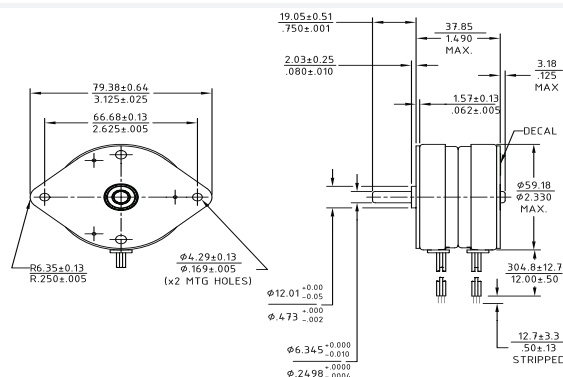
Electrical Data	57L048B1U Unipolar	57L048B2U Unipolar	57L048B1B Bipolar	57L048B2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	6.3	36.0	6.3	36.0	Ohms
3 Inductance per Phase, typ	7.0	36.8	14.2	78.8	mH
4 Rated Current per Phase *	0.79	0.33	0.79	0.33	A
Coil independent parameters					
5 Holding Torque, MIN *	98.8 (14)	98.8 (14)	110.8 (15.7)	110.8 (15.7)	mNm (oz-in)
6 Detent Torque, Max		9.9 (1.4)			mNm (oz-in)
7 Rotor Inertia		34 (0.19)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		±0.5			Degree
10 Steps per Revolution		48			
11 Ambient Temp Range (operating)		-20 TO 70 (-4 TO 158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100			Mohms
15 Dielectric Withstanding Voltage		650 VRMS for 2 seconds			VAC
16 Weight		255.15 (9)			g (oz)
17 Leadwire		AWG #26, UL1430 (105°C, 300V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

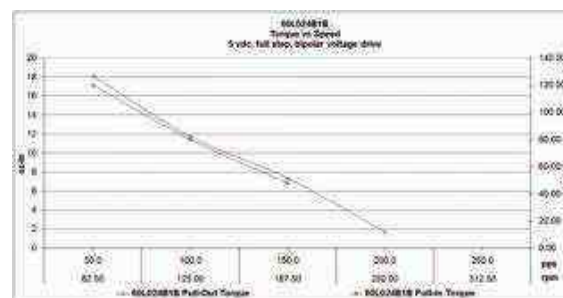
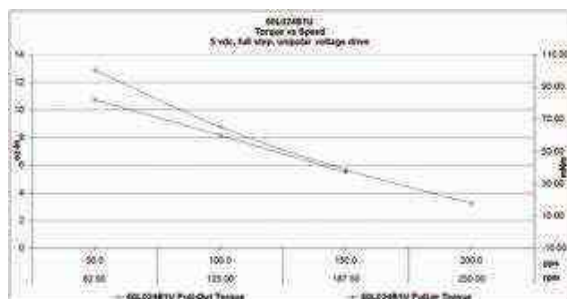
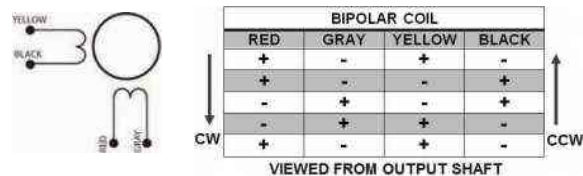


Ø60mm 169.5 mNm



60L024B

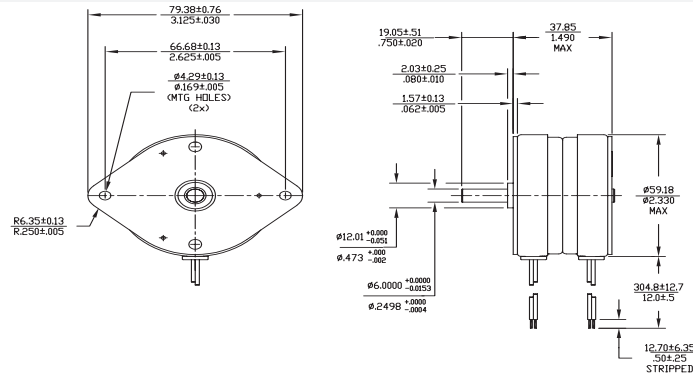
* Energize at Rated Current, 2 Phase On



60L048B

RoHS Compliant

Ø60mm 215.4 mNm



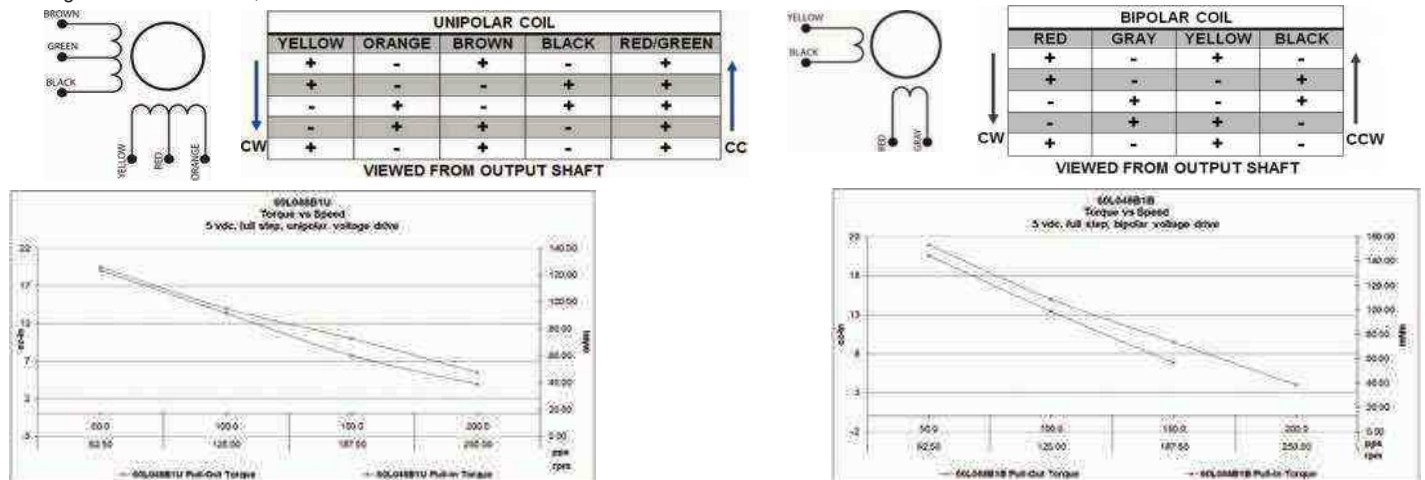
Dimensions in mm

60L048B

Electrical Data	60L048B1U Unipolar	60L048B2U Unipolar	60L048B1B Bipolar	60L048B2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	4.6	26.2	4.6	26.2	Ohms
3 Inductance per Phase, typ	6.4	33.0	12.0	68.6	mH
4 Rated Current per Phase *	1.10	0.46	1.10	0.46	A
Coil independent parameters					
5 Holding Torque, MIN *	183.6 (26)	183.6 (26)	215.38 (30.5)	215.38 (30.5)	mNm (oz-in)
6 Detent Torque, Max		28.25 (4)			mNm (oz-in)
7 Rotor Inertia		95 (0.52)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		±0.5			Degree
10 Steps per Revolution		48			
11 Ambient Temp Range (operating)		0 TO 60 (32 TO 140)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100			Mohms
15 Dielectric Withstanding Voltage		650 VRMS for 2 seconds			VAC
16 Weight		478 (16.8)			g (oz)
17 Leadwire		AWG #24, UL 1430 (105°C,600V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On

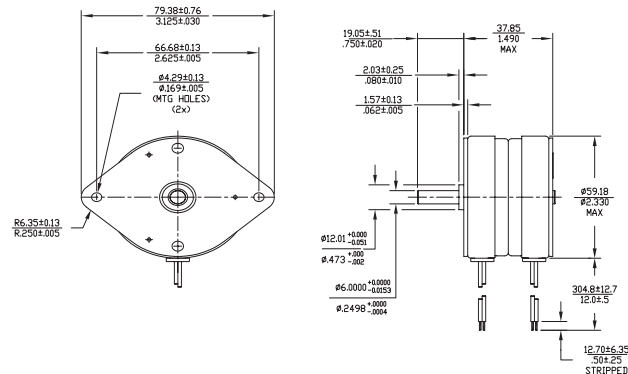


60L048C

RoHS Compliant

Ø60mm

300 mNm



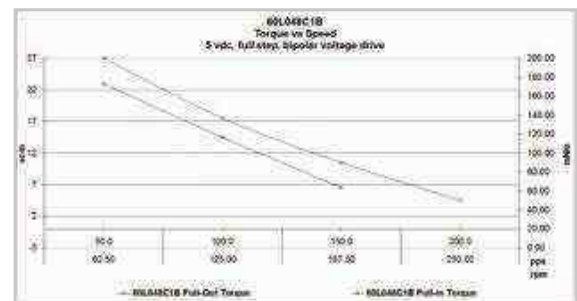
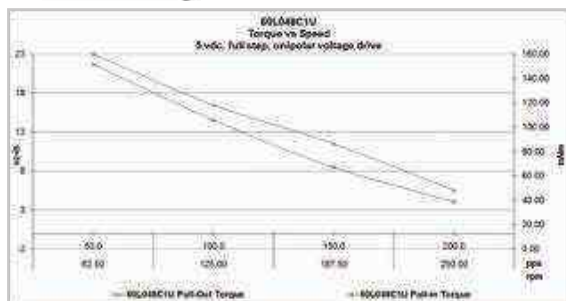
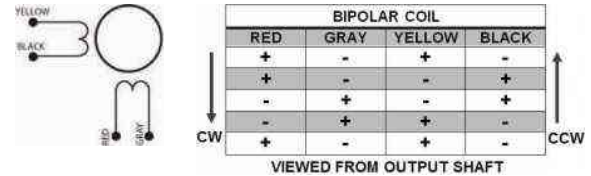
Dimensions in mm

60L048C

Electrical Data	60L048C1U Unipolar	60L048C2U Unipolar	60L048C1B Bipolar	60L048C2B Bipolar	
1 Operating Voltage	5	12	5	12	VDC
2 Resistance per Phase, $\pm 10\%$	4.6	26.2	4.6	26.2	Ohms
3 Inductance per Phase, typ	5.8	41.2	16.0	79.0	mH
4 Rated Current per Phase *	1.10	0.46	1.10	0.46	A
Coil independent parameters					
5 Holding Torque, MIN *	251.39 (35.6)	251.39 (35.6)	300.11 (42.5)	300.11 (42.5)	mNm (oz-in)
6 Detent Torque, Max		35.31 (5)			mNm (oz-in)
7 Rotor Inertia		95 (0.52)			gcm ² (oz-in-s ²)
8 Step Angle		7.5			Degree
9 Absolute accuracy 2 ph. On, Full step		± 0.5			Degree
10 Steps per Revolution		48			
11 Ambient Temp Range (operating)		0 TO 60 (32 TO 140)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Sintered Bronze Sleeve			
14 Insulation Resistance at 500 VDC		100			Mohms
15 Dielectric Withstanding Voltage		650 VRMS for 2 seconds			VAC
16 Weight		478 (16.8)			g (oz)
17 Leadwire		AWG #24, UL 1430 (105°C, 600V)			

All Motor Data Values at 20°C Unless Otherwise Specified

* Energize at Rated Current, 2 Phase On





Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



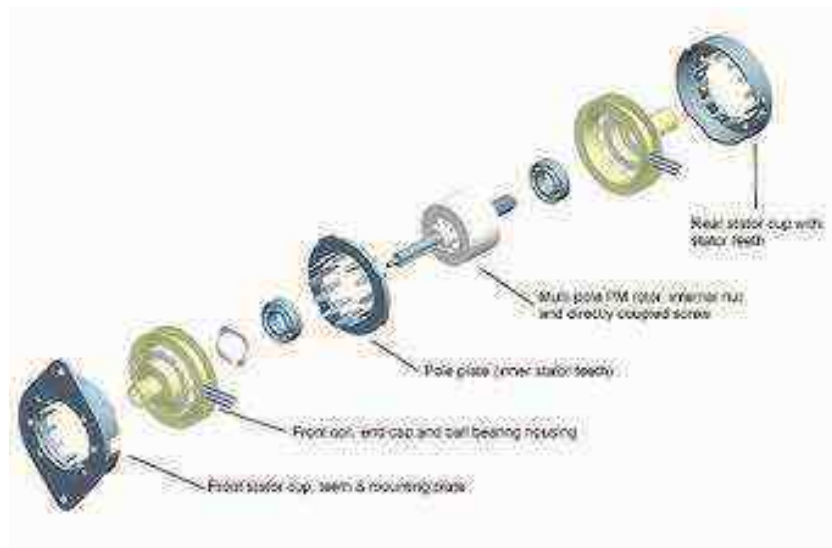
Gearheads



Encoders

Can Stack Linear Actuators

Provide high linear force and accurate positioning in a small package. Our can stack linear actuators combine a 7.5 or 15 degree stepping can stack motor with an integrated lead screw. By eliminating the need for external gears, belts or separate threaded shafts, these compact linear actuators help lower total costs while increasing the performance and reliability of your machine.



Powerful, Self-Contained Linear Motion

Feature	Details	Application Advantages
Can stack design with built-in lead screw	<ul style="list-style-type: none"> No need for separate transmission components Reversible Unipolar or bipolar windings 	<ul style="list-style-type: none"> Compact, cost-effective control of linear positioning and velocity Simpler, more reliable machine design High linear power in compact package Less maintenance
Operation in single step, half step or microstepping modes	<ul style="list-style-type: none"> Open-loop, digitally controlled positioning No need for feedback devices such as encoders 	<ul style="list-style-type: none"> Reduced machine cost and complexity Precise resolution to suit almost any application Quiet operation
Captive and non-captive actuator designs	<ul style="list-style-type: none"> Choice of rotating screw or pure linear motion via grooved shaft Tip of actuator threaded to accept adapters or direct connection to load 	<ul style="list-style-type: none"> Adaptable to application requirements Anti-rotation can be part of machine design, or integrated with the actuator
Brushless commutation	<ul style="list-style-type: none"> No brushes to wear out or replace 	<ul style="list-style-type: none"> Long life with minimal maintenance Quiet operation
Ball bearings	<ul style="list-style-type: none"> Long bearing life Dependable performance in wide range of operating conditions 	<ul style="list-style-type: none"> Reliable, low-maintenance operation for any application



Linear Motion Simplified



Medical devices & clinical diagnostics

- Infusion systems
- Diagnostic analyzers
- Medical analyzers
- Pipettes
- Sample preparation workstations
- Dosing and dispensing systems



Instrumentation

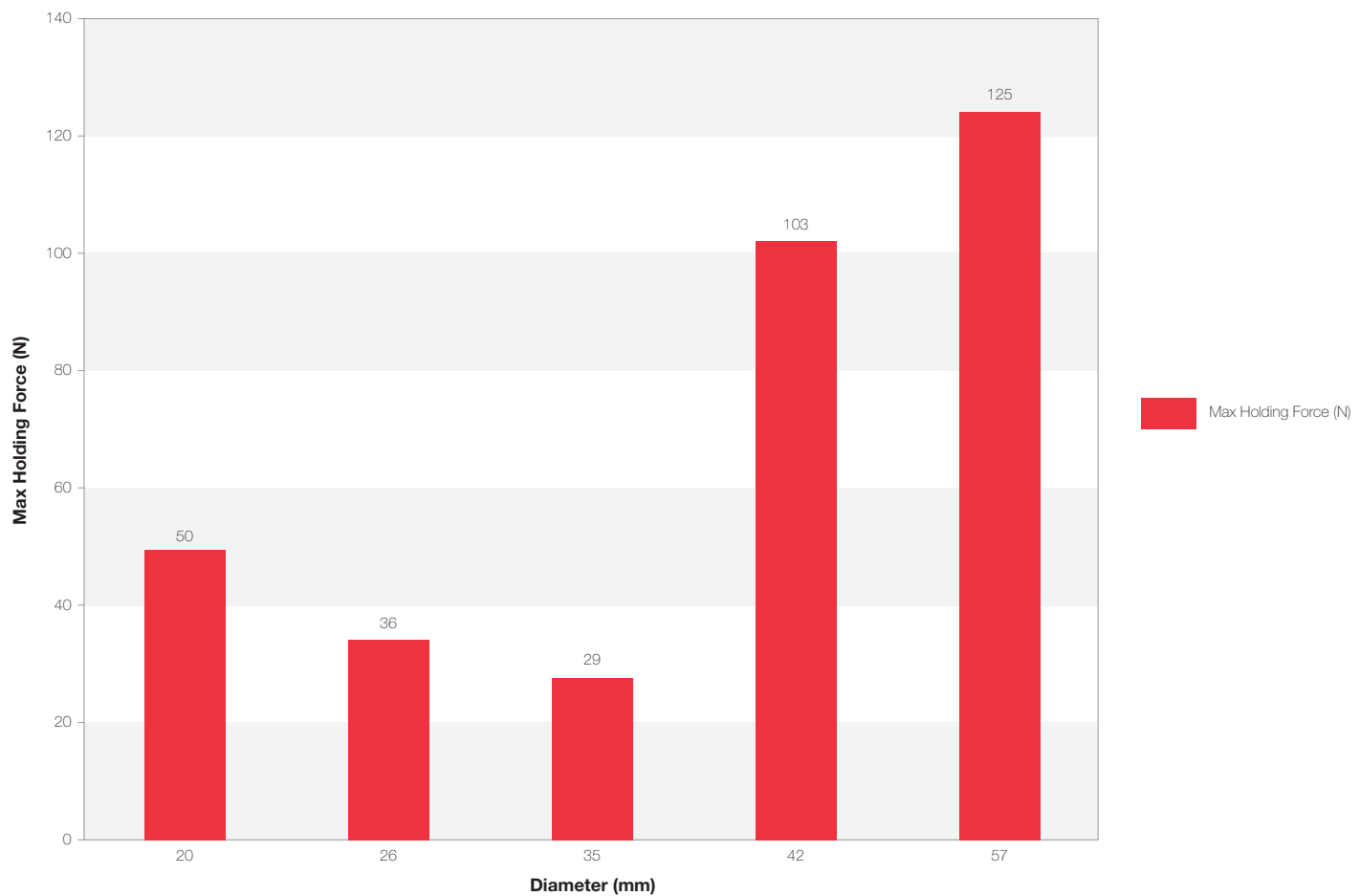
- Land surveying
- Microscopes



Other

- Stage lighting
- Valve actuation
- Security & access

Meet your Application's Working Point Requirements



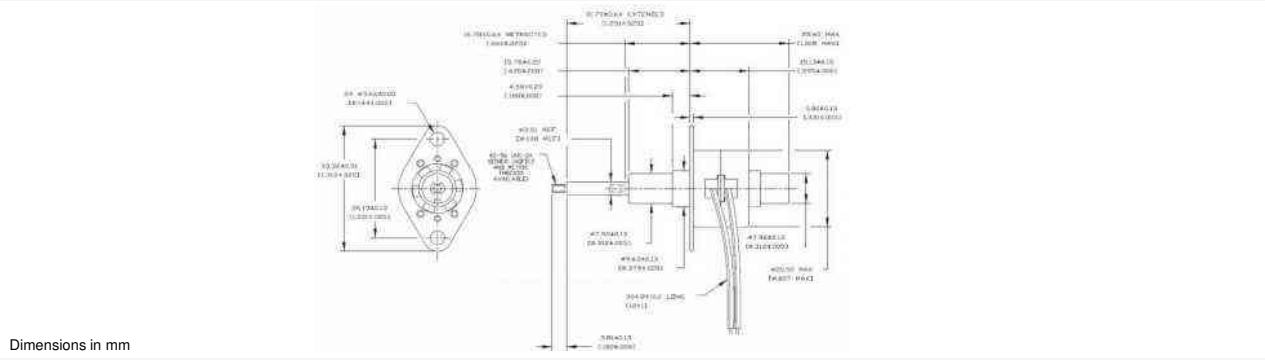
For complete product and application details, visit
portescap.com/linear-actuators

20DAM-K

RoHS Compliant

Ø20mm

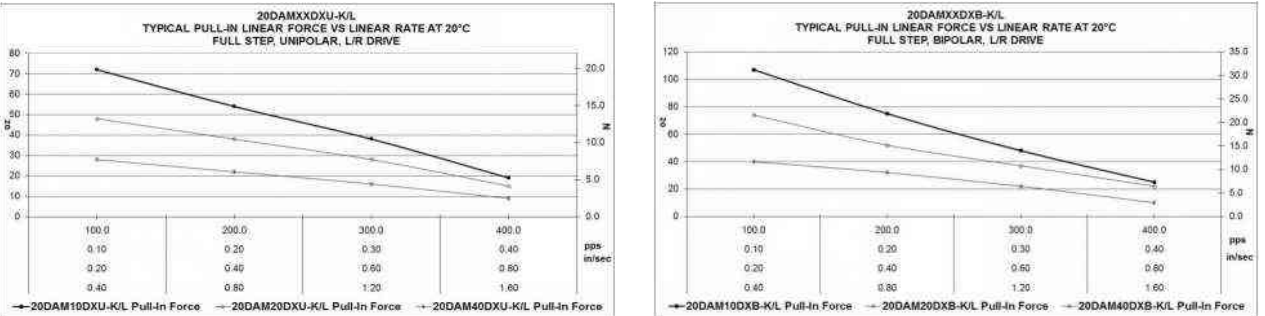
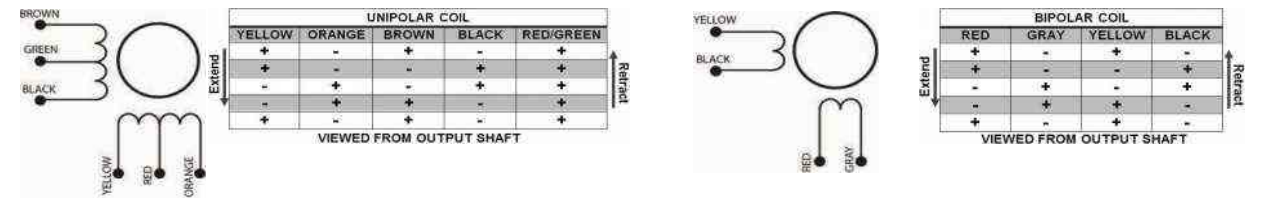
30.6 N



Electrical Data		20DAMXXD1B-K Bipolar	20DAMXXD2B-K Bipolar	20DAMXXD1U-K Unipolar	20DAMXXD2U-K Unipolar	
1	Operating Voltage #	5	12	5	12	VDC
2	Resistance per Phase, ± 10%	20.0	115.2	20.0	115.2	Ohms
3	Inductance per Phase, typ	7.2	40.8	3.8	20.3	mH
4	Rated Current per Phase, 1 Phase ON	0.35	0.14	0.35	0.14	A
5	Input Power	2.5	2.5	2.5	2.5	W
Coil independent parameters		XX Linear travel per step				
6	Min. Holding Force @ rated current	10 @ .001" (0.0254mm)	30.6 (110)	20.9 (75)		N (oz)
		20 @ .002" (0.0508mm)	20.9 (75)	13.9 (50)		N (oz)
		40 @ .004" (0.1016mm)	11.1 (40)	8.3 (30)		N (oz)
7	Min. Holding Force (Unenergized)	10 @ .001" (0.0254mm)		20.9 (75)		N (oz)
		20 @ .002" (0.0508mm)		11.1 (40)		N (oz)
		40 @ .004" (0.1016mm)		2.8 (10)		N (oz)
8	Stroke Length, Typ		15 (0.59)			mm (in)
9	Linear Travel Accuracy		± 1 Step			
10	Steps per Revolution		24			
11	Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12	Maximum Coil Temperature		130 (266)			°C (°F)
13	Bearing Type		Ball Bearing			
14	Insulation Resistance at 500 VDC		20			Mohms
15	Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16	Weight		25 (0.88)			g (oz)
17	Leadwire		AWG #28, UL1429 (80° C, 150 V)			

All Motor Data Values at 20 °C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R*1)



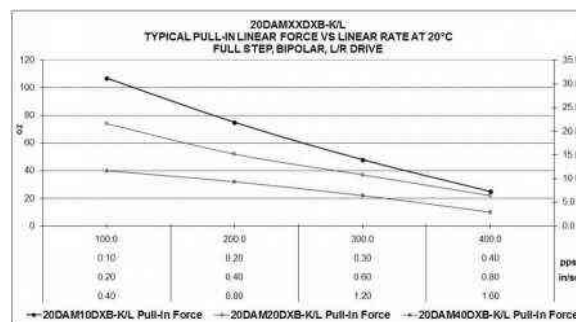
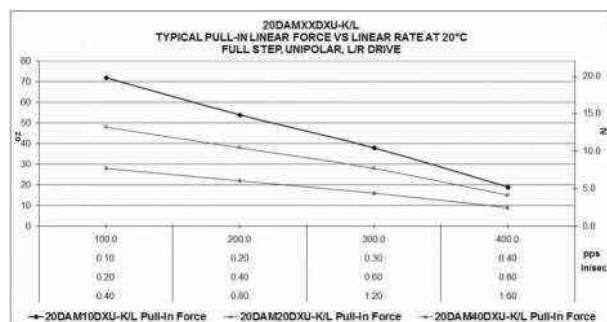
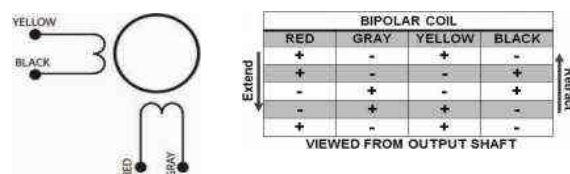
30.6 N



Electrical Data		20DAMXXD1B-L Bipolar	20DAMXXD2B-L Bipolar	20DAMXXD1U-L Unipolar	20DAMXXD2U-L Unipolar	
1	Operating Voltage #	5	12	5	12	VDC
2	Resistance per Phase, ± 10%	20.0	115.2	20.0	115.2	Ohms
3	Inductance per Phase, typ	7.2	40.8	3.8	20.3	mH
4	Rated Current per Phase, 1 Phase ON	0.35	0.14	0.35	0.14	A
5	Input Power	2.5	2.5	2.5	2.5	W
Coil independent parameters		XX	Linear travel per step			
6	Min. Holding Force @ rated current	10 @ .001" (0.0254mm)	30.6 (110)		20.9 (75)	N (oz)
		20 @ .002" (0.0508mm)	20.9 (75)		13.9 (50)	N (oz)
		40 @ .004" (0.1016mm)	11.1 (40)		8.3 (30)	N (oz)
7	Min. Holding Force (Unenergized)	10 @ .001" (0.0254mm)	20.9 (75)			N (oz)
		20 @ .002" (0.0508mm)	11.1 (40)			N (oz)
		40 @ .004" (0.1016mm)	2.8 (10)			N (oz)
8	Stroke Length, Typ	50 (1.97)				mm (in)
9	Linear Travel Accuracy	± 1 Step				
10	Steps per Revolution	24				
11	Ambient Temperature Range (operating)	-20 to +70 (-4 to +158)				°C (°F)
12	Maximum Coil Temperature	130 (266)				°C (°F)
13	Bearing Type	Ball Bearing				
14	Insulation Resistance at 500 VDC	20				Mohms
15	Dielectric Withstanding Voltage	650 for 2 seconds				VAC
16	Weight	25 (0.88)				g (oz)
17	Leadwire	AWG #28, UL1429 (80°C, 150 V)				
All Motor Data Values at 20°C Unless Otherwise Specified			# Voltage in case of voltage driver (indicator of R*I)			

All Motor Data Values at 20°C Unless Otherwise Specified

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# Voltage in case of voltage driver (indicator of R*I)
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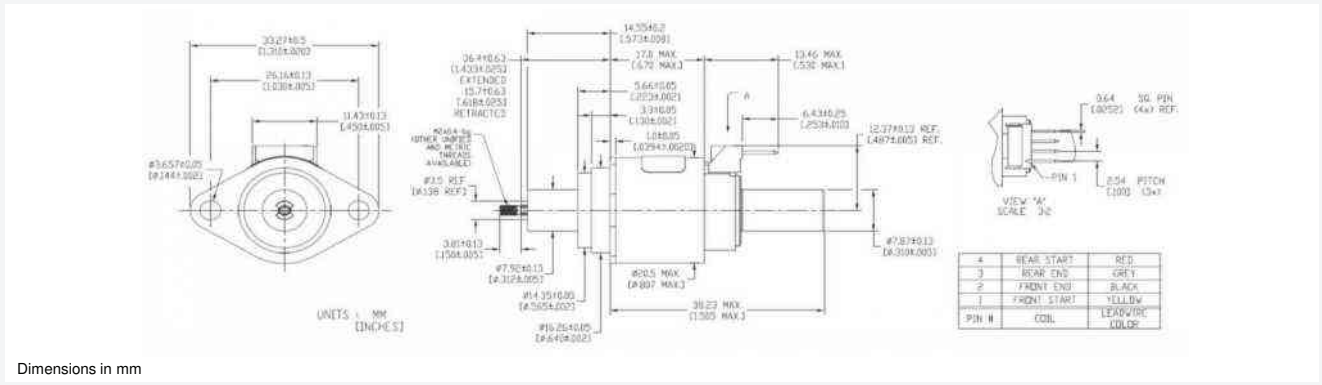


20DBM-K

RoHS Compliant

Ø20mm

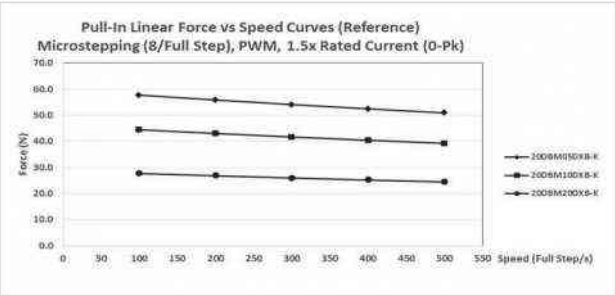
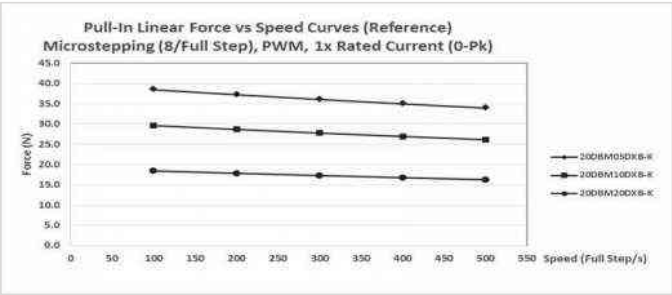
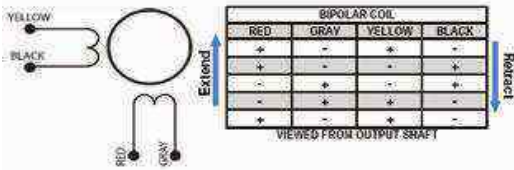
50 N



20DBM-K					
Electrical Data		20DBMXXD2B-K	20DBMXXD1B-K	20DBMXXD3B-K	20DBMXXD4B-K
		Bipolar	Bipolar	Bipolar	Bipolar
1	Operating Voltage #	12	5	2.9	1.4
2	Resistance per Phase, ± 10%	100.5	17.5	5.7	1.4
3	Inductance per Phase, typ	45.0	7.0	2.4	0.6
4	Rated Current per Phase, 1 Phase ON	0.17	0.41	0.71	1.41
5	Input Power	2.9	2.9	2.9	2.9
Coil independent parameters		XX	Linear travel per step		
6	Min. Holding Force @ rated current	05	@ .0005" (0.0127mm)	50 (180)	N (oz)
		10	@ .001" (0.0254mm)	35 (126)	N (oz)
		20	@ .002" (0.0508mm)	22 (79)	N (oz)
7	Min. Holding Force (Unenergized)	05	@ .0005" (0.0127mm)	50 (180)	N (oz)
		10	@ .001" (0.0254mm)	13.9 (50)	N (oz)
		20	@ .002" (0.0508mm)	5.5 (20)	N (oz)
8	Stroke Length, Typ			20 (0.79)	mm (in)
9	Linear Travel Accuracy			± 1 Step	
10	Steps per Revolution			48	
11	Ambient Temperature Range (operating)			-20 to +70 (-4 to +158)	°C (°F)
12	Maximum Coil Temperature			130 (266)	°C (°F)
13	Bearing Type			Ball Bearing	
14	Insulation Resistance at 500 VDC			20	Mohms
15	Dielectric Withstanding Voltage			650 for 2 seconds	VAC
16	Weight			35 (1.23)	g (oz)
17	Leadwire				

All Motor Data Values at 20°C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R*I)



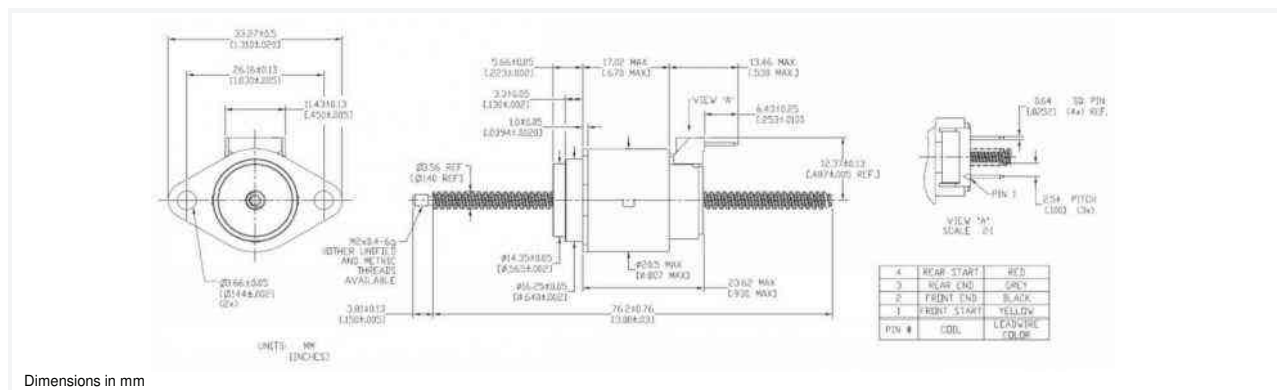
Curves created with a 5 Volt motor and a 24 Volt power supply.

20DBM-L

RoHS Compliant

Ø20mm

50 N



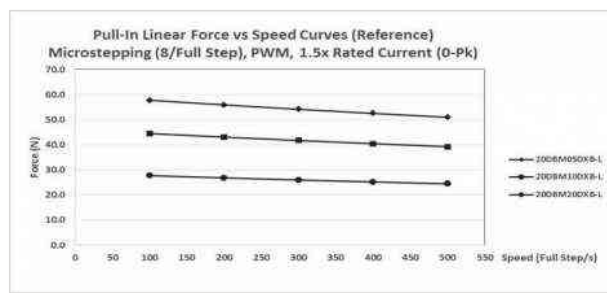
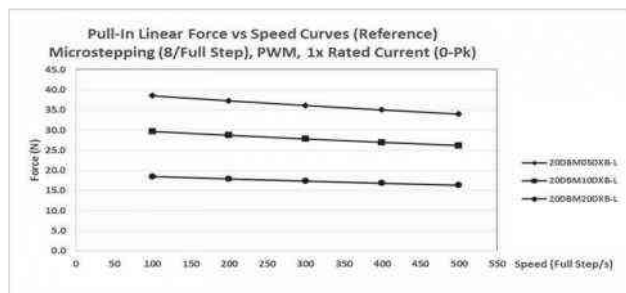
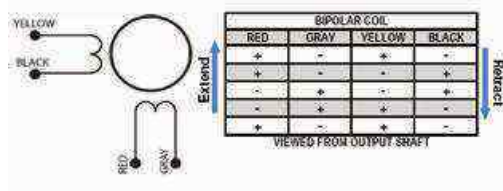
Dimensions in mm

20DBM-L

Electrical Data	20DBMXXD2B-L Bipolar	20DBMXXD1B-L Bipolar	20DBMXXD3B-L Bipolar	20DBMXXD4B-L Bipolar	
1 Operating Voltage #	12	5	2.9	1.4	VDC
2 Resistance per Phase, ± 10%	100.5	17.5	5.7	1.4	Ohms
3 Inductance per Phase, typ	45.0	7.0	2.4	0.6	mH
4 Rated Current per Phase, 1 Phase ON	0.17	0.41	0.71	1.41	A
5 Input Power	2.9	2.9	2.9	2.9	W
Coil Independent parameters					
	XX	Linear travel per step			
6 Min. Holding Force @ rated current	05 @ .0005" (0.0127mm) 10 @ .001" (0.0254mm) 20 @ .002" (0.0508mm)	50 (180) 35 (126) 22 (79)			
7 Min. Holding Force (Unenergized)	05 @ .0005" (0.0127mm) 10 @ .001" (0.0254mm) 20 @ .002" (0.0508mm)	50 (180) 13.9 (50) 5.5 (20)			
8 Stroke Length, Typ		50 (1.97)			
9 Linear Travel Accuracy		± 1 Step			
10 Steps per Revolution		48			
11 Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)			
12 Maximum Coil Temperature		130 (266)			
13 Bearing Type		Ball Bearing			
14 Insulation Resistance at 500 VDC		20			
15 Dielectric Withstanding Voltage		650 for 2 seconds			
16 Weight		35 (1.23)			
17 Leadwire					

All Motor Data Values at 20 °C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R*I)



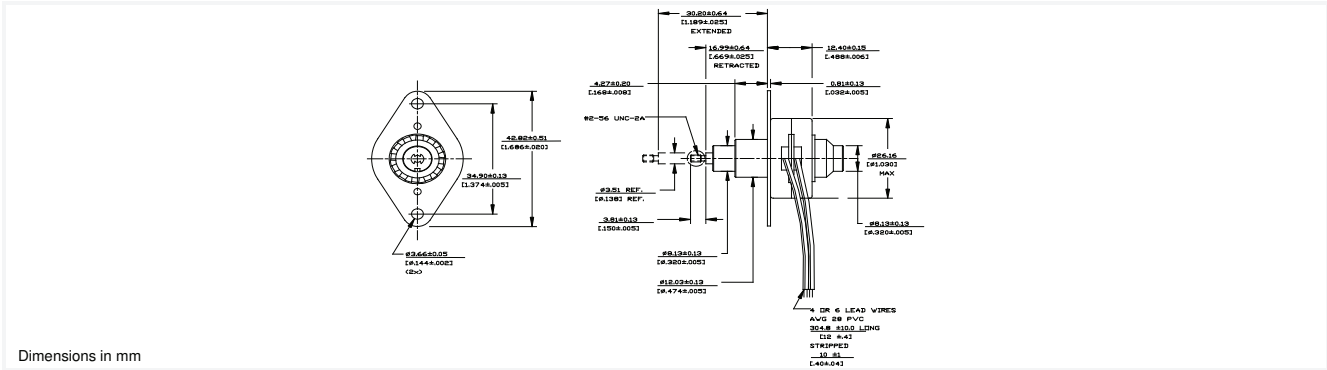
Curves created with a 5 Volt motor and a 24 Volt power supply.

26DAM-K

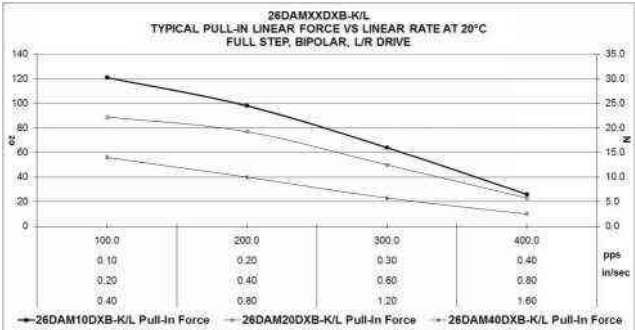
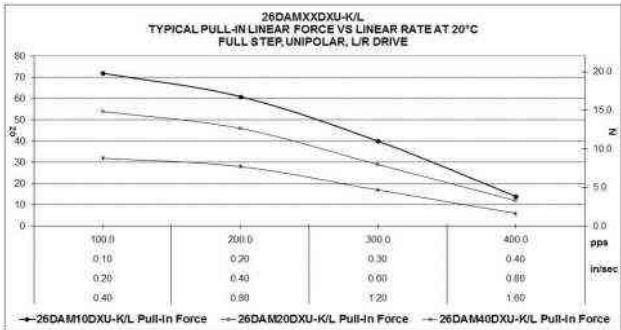
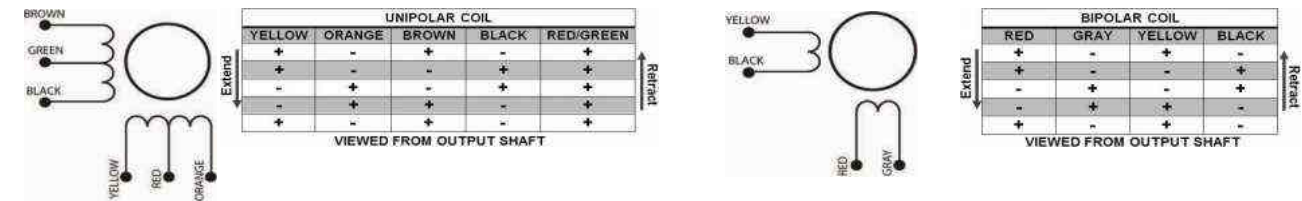
RoHS Compliant

Ø26mm

33.4 N



26DAM-K					
Electrical Data		26DAMXXD1B-K	26DAMXXD2B-K	26DAMXXD1U-K	26DAMXXD2U-K
		Bipolar	Bipolar	Unipolar	Unipolar
1	Operating Voltage #	5	12	5	12
2	Resistance per Phase, ± 10%	14.6	84.0	14.6	84.0
3	Inductance per Phase, typ	6.5	33.6	3.8	20.5
4	Rated Current per Phase, 1 Phase ON	0.48	0.20	0.48	0.20
5	Input Power	3.4	3.4	3.4	3.4
Coil independent parameters		XX Linear travel per step			
6	Min. Holding Force @ rated current	10	@ .001" (0.0254mm)	33.4 (120)	20 (72)
		20	@ .002" (0.0508mm)	25 (90)	15.3 (55)
		40	@ .004" (0.1016mm)	14.5 (52)	8.9 (32)
7	Min. Holding Force (Unenergized)	10	@ .001" (0.0254mm)	20 (72)	N (oz)
		20	@ .002" (0.0508mm)	13.9 (50)	N (oz)
		40	@ .004" (0.1016mm)	5.56 (20)	N (oz)
8	Stroke Length, Typ			13.2 (0.52)	mm (in)
9	Linear Travel Accuracy			± 1 Step	
10	Steps per Revolution			24	
11	Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)		°C (°F)
12	Maximum Coil Temperature		130 (266)		°C (°F)
13	Bearing Type		Ball Bearing		
14	Insulation Resistance at 500 VDC		20		Mohms
15	Dielectric Withstanding Voltage		650 for 2 seconds		VAC
16	Weight		34 (1.2)		g (oz)
17	Leadwire		AWG #28, UL1429 (80°C, 150 V)		
All Motor Data Values at 20 °C Unless Otherwise Specified		# Voltage in case of voltage driver (indicator of R*I)			



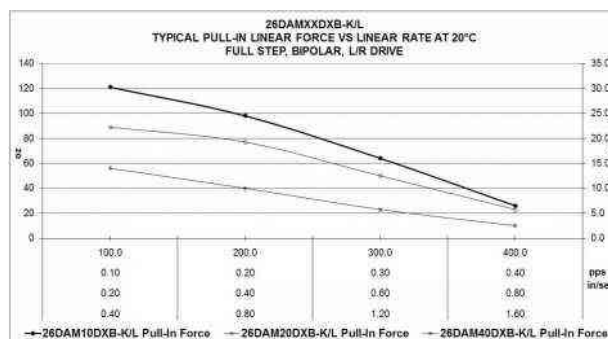
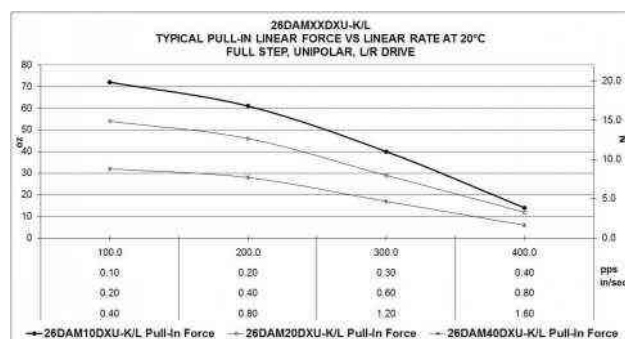
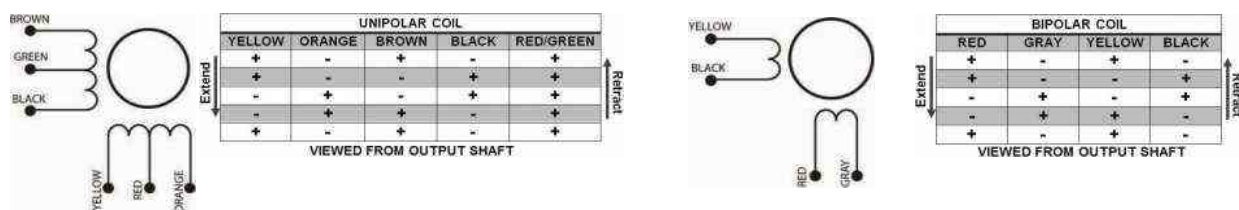
33.4 N



Electrical Data		26DAMXXD1B-L Bipolar	26DAMXXD2B-L Bipolar	26DAMXXD1U-L Unipolar	26DAMXXD2U-L Unipolar	
1	Operating Voltage #	5	12	5	12	VDC
2	Resistance per Phase, $\pm 10\%$	14.6	84.0	14.6	84.0	Ohms
3	Inductance per Phase, typ	6.5	33.6	3.8	20.5	mH
4	Rated Current per Phase, 1 Phase ON	0.48	0.20	0.48	0.20	A
5	Input Power	3.4	3.4	3.4	3.4	W
Coil independent parameters						
XX Linear travel per step						
6	Min. Holding Force @ rated current	10 @ .001" (0.0254mm)	33.4 (120)	20 (72)		N (oz)
		20 @ .002" (0.0508mm)	25 (90)	15.3 (55)		N (oz)
		40 @ .004" (0.1016mm)	14.5 (52)	8.9 (32)		N (oz)
7	Min. Holding Force (Unenergized)	10 @ .001" (0.0254mm)		20 (72)		N (oz)
		20 @ .002" (0.0508mm)		13.9 (50)		N (oz)
		40 @ .004" (0.1016mm)		5.56 (20)		N (oz)
8	Stroke Length, Typ	48 (1.89)				mm (in)
9	Linear Travel Accuracy	± 1 Step				
10	Steps per Revolution	24				
11	Ambient Temperature Range (operating)	-20 to +70 (-4 to +158)				°C (°F)
12	Maximum Coil Temperature	130 (266)				°C (°F)
13	Bearing Type	Ball Bearing				
14	Insulation Resistance at 500 VDC	20				Mohms
15	Dielectric Withstanding Voltage	650 for 2 seconds				VAC
16	Weight	34 (1.2)				g (oz)
17	Leadwire	AWG #28, UL1429 (80° C, 150 V)				
All Motor Data Values at 20°C Unless Otherwise Specified			# Voltage in case of voltage driver (indicator of R*I)			

All Motor Data Values at 20°C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R^*I)

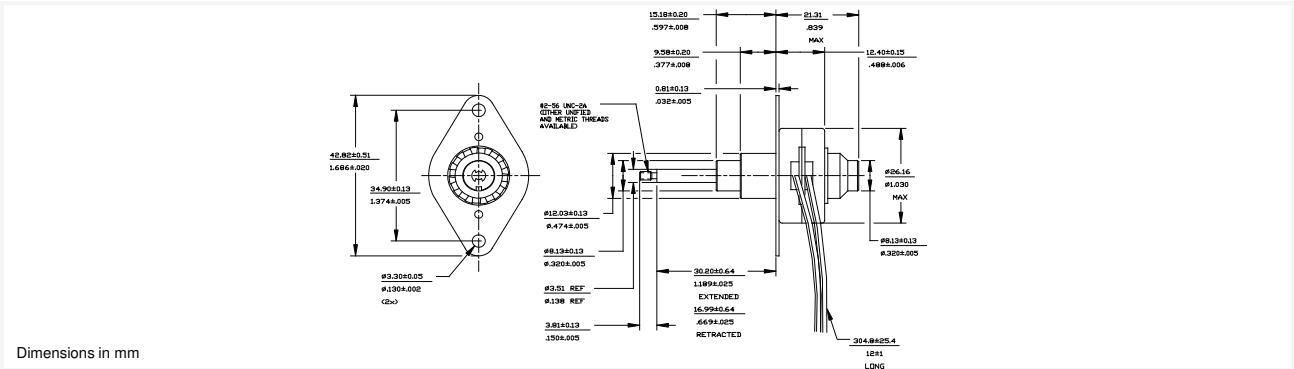


26DBM-K

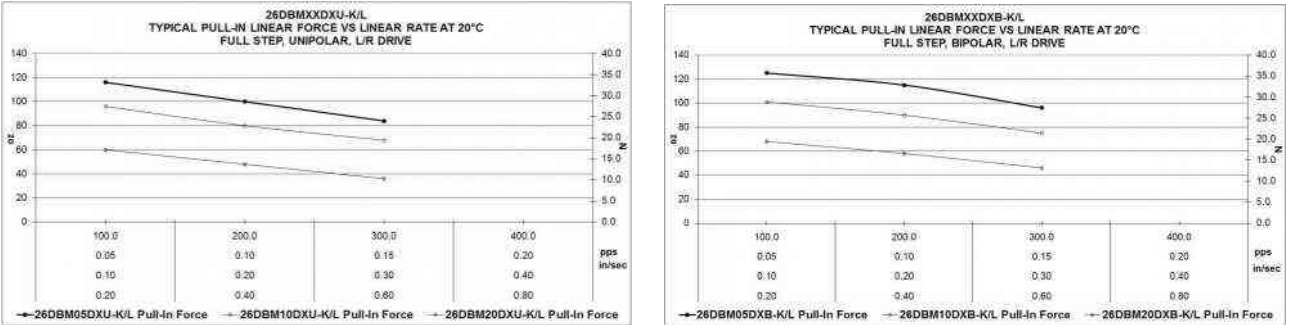
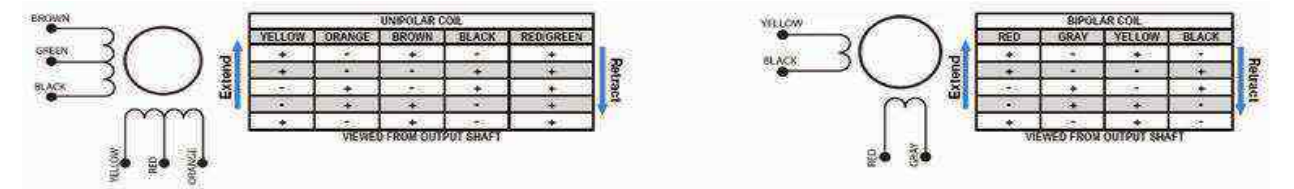
RoHS Compliant

Ø26mm

35.6 N



26DBM-K					
Electrical Data		26DBMXXD1B-K	26DBMXXD2B-K	26DBMXXD1U-K	26DBMXXD2U-K
		Bipolar	Bipolar	Unipolar	Unipolar
1	Operating Voltage #	5	12	5	12
2	Resistance per Phase, ± 10%	14.6	84.0	14.6	84.0
3	Inductance per Phase, typ	8.4	43.3	5.0	26.5
4	Rated Current per Phase, 1 Phase ON	0.48	0.20	0.48	0.20
5	Input Power	3.4	3.4	3.4	3.4
Coil independent parameters		XX	Linear travel per step		
6	Min. Holding Force @ rated current	05	@ .0005" (0.0127mm)	35.6 (128)	34.2 (123)
		10	@ .001" (0.0254mm)	28.9 (104)	28.1 (101)
		20	@ .002" (0.0508mm)	19.2 (69)	17.8 (64)
7	Min. Holding Force (Unenergized)	05	@ .0005" (0.0127mm)	34.2 (123)	N (oz)
		10	@ .001" (0.0254mm)	13.9 (50)	N (oz)
		20	@ .002" (0.0508mm)	5.5 (20)	N (oz)
8	Stroke Length, Typ			13.2 (0.52)	mm (in)
9	Linear Travel Accuracy			± 1 Step	
10	Steps per Revolution			48	
11	Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)		°C (°F)
12	Maximum Coil Temperature		130 (266)		°C (°F)
13	Bearing Type		Ball Bearing		
14	Insulation Resistance at 500 VDC		20		Mohms
15	Dielectric Withstanding Voltage		650 for 2 seconds		VAC
16	Weight		34 (1.2)		g (oz)
17	Leadwire		AWG #28, UL1429 (80° C, 150 V)		
All Motor Data Values at 20°C Unless Otherwise Specified			# Voltage in case of voltage driver (indicator of R*I)		

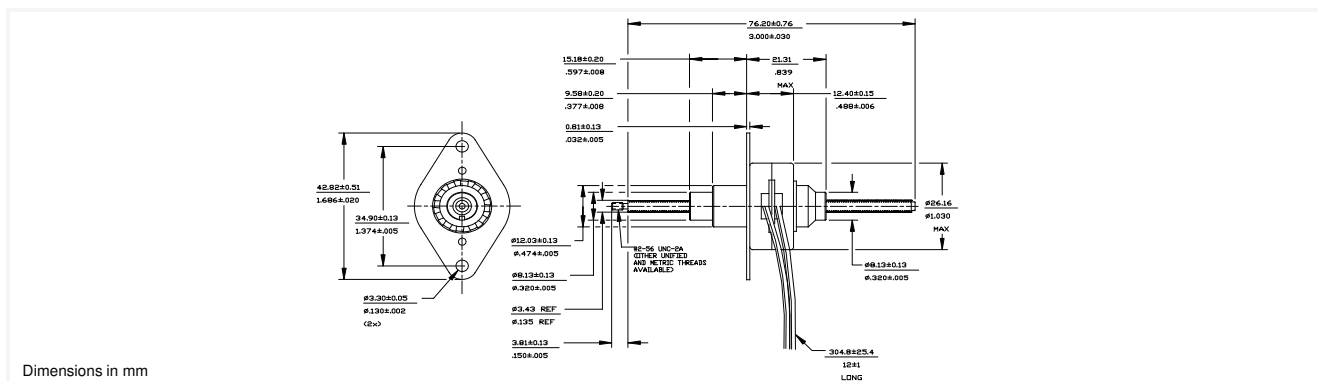


26DBM-L

RoHS Compliant

Ø26mm

35.6 N

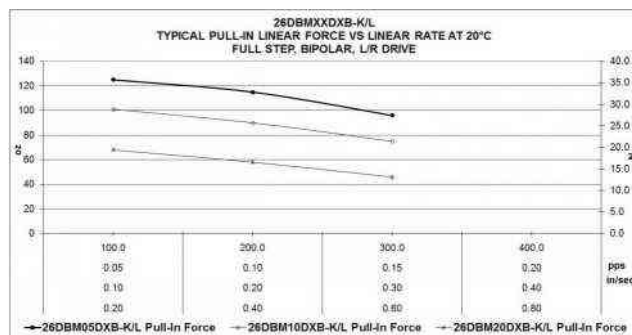
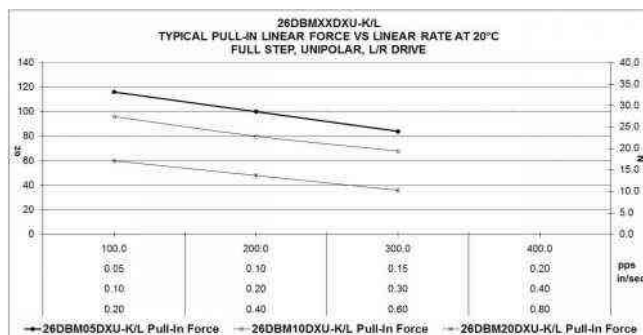
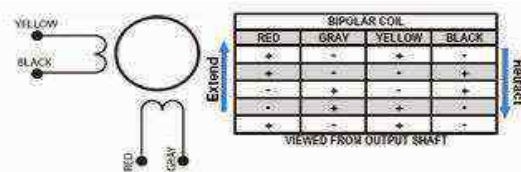
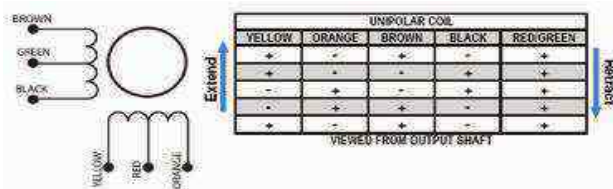


26DBM-L

Electrical Data	26DBMXXD1B-L Bipolar	26DBMXXD2B-L Bipolar	26DBMXXD1U-L Unipolar	26DBMXXD2U-L Unipolar	
1 Operating Voltage #	5	12	5	12	VDC
2 Resistance per Phase, $\pm 10\%$	14.6	84.0	14.6	84.0	Ohms
3 Inductance per Phase, typ	8.4	43.3	5.0	26.5	mH
4 Rated Current per Phase, 1 Phase ON	0.48	0.20	0.48	0.20	A
5 Input Power	3.4	3.4	3.4	3.4	W
Coil independent parameters					
	XX	Linear travel per step			
6 Min. Holding Force @ rated current	05 @ .0005" (0.0127mm)	35.6 (128)		34.2 (123)	N (oz)
	10 @ .001" (0.0254mm)	28.9 (104)		28.1 (101)	N (oz)
	20 @ .002" (0.0508mm)	19.2 (69)		17.8 (64)	N (oz)
7 Min. Holding Force (Unenergized)	05 @ .0005" (0.0127mm)		34.2 (123)		N (oz)
	10 @ .001" (0.0254mm)		13.9 (50)		N (oz)
	20 @ .002" (0.0508mm)		5.5 (20)		N (oz)
8 Stroke Length, Typ		48 (1.89)			mm (in)
9 Linear Travel Accuracy		± 1 Step			
10 Steps per Revolution		48			
11 Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12 Maximum Coil Temperature		130 (266)			°C (°F)
13 Bearing Type		Ball Bearing			
14 Insulation Resistance at 500 VDC		20			Mohms
15 Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16 Weight		34 (1.2)			g (oz)
17 Leadwire		AWG #28, UL1429 (80°C, 150 V)			

All Motor Data Values at 20°C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R*I)

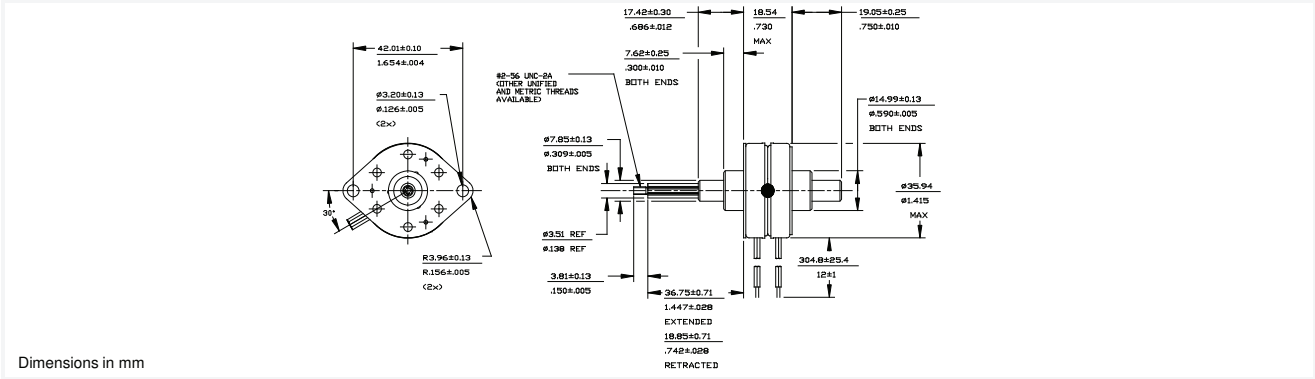


35DBM-K

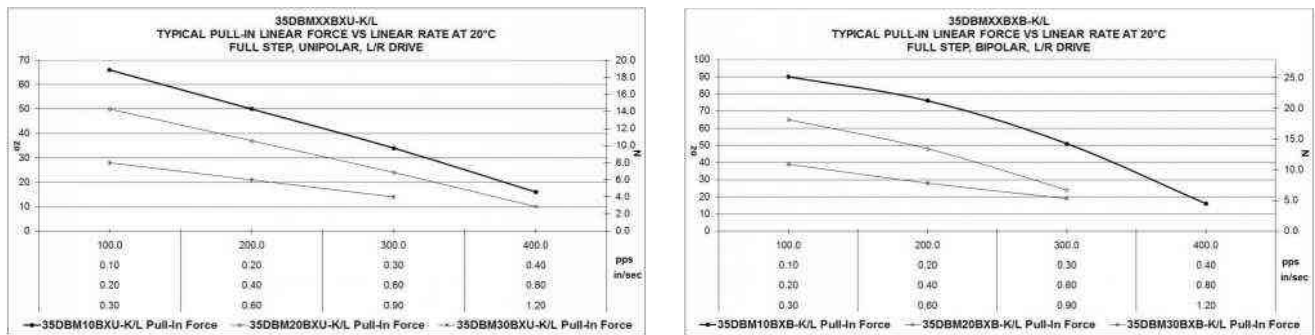
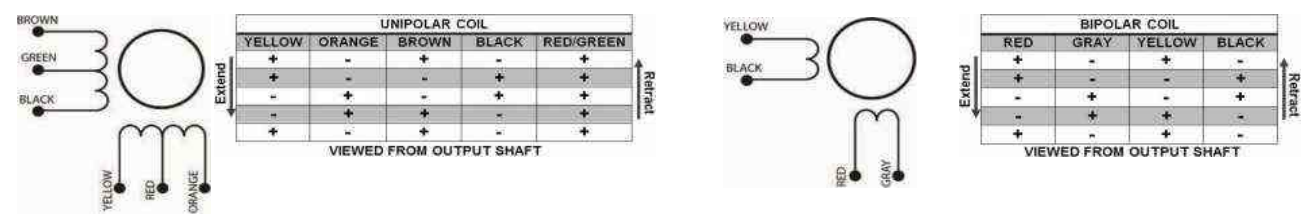
RoHS Compliant

Ø35mm

28.9 N



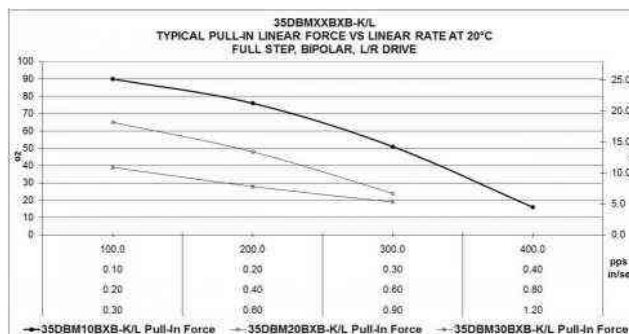
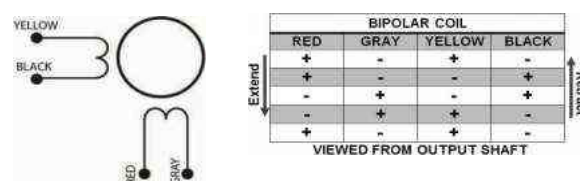
Electrical Data		35DBMXXB1B-K	35DBMXXB2B-K	35DBMXXB1U-K	35DBMXXB2U-K	
		Bipolar	Bipolar	Unipolar	Unipolar	
1	Operating Voltage #	5	12	5	12	VDC
2	Resistance per Phase, ± 10%	10.0	58.0	10.0	58.0	Ohms
3	Inductance per Phase, typ	11.2	60.0	5.2	30.0	mH
4	Rated Current per Phase, 1 Phase ON	0.71	0.30	0.71	0.30	A
5	Input Power	5.0	5.0	5.0	5.0	W
Coil independent parameters		XX	Linear travel per step			
			10 @ .001" (0.0254mm)		20.9 (75)	N (oz)
6	Min. Holding Force @ rated current	20 @ .002" (0.0508mm)	28.9 (103.9)		15.3 (55)	N (oz)
		30 @ .003" (0.0762mm)	23.6 (84.9)		8.3 (30)	N (oz)
		10 @ .001" (0.0254mm)	13.3 (47.8)			N (oz)
7	Min. Holding Force (Unenergized)	20 @ .002" (0.0508mm)		11.1 (40)		N (oz)
		20 @ .002" (0.0508mm)		2.8 (10)		N (oz)
		30 @ .003" (0.0762mm)		1.4 (5)		N (oz)
8	Stroke Length, Typ		17.9 (0.71)			mm (in)
9	Linear Travel Accuracy		± 1 Step			
10	Steps per Revolution		48			
11	Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)			°C (°F)
12	Maximum Coil Temperature		130 (266)			°C (°F)
13	Bearing Type		Ball Bearing			
14	Insulation Resistance at 500 VDC		20			Mohms
15	Dielectric Withstanding Voltage		650 for 2 seconds			VAC
16	Weight		85.2 (3)			g (oz)
17	Leadwire		AWG 26, UL 1429			
All Motor Data Values at 20°C Unless Otherwise Specified			# Voltage in case of voltage driver (indicator of R*I)			



28.9 N



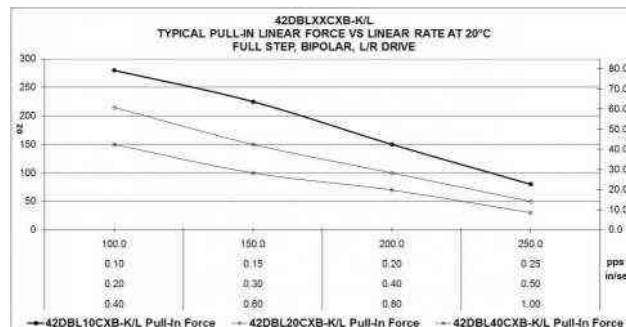
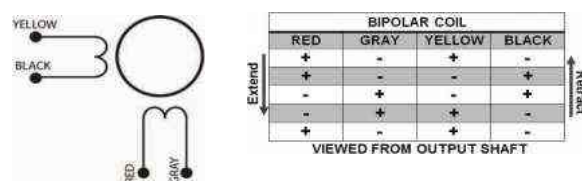
Electrical Data		35DBMXXB1B-L Bipolar	35DBMXXB2B-L Bipolar	35DBMXXB1U-L Unipolar	35DBMXXB2U-L Unipolar	
1	Operating Voltage #	5	12	5	12	VDC
2	Resistance per Phase, ± 10%	10.0	58.0	10.0	58.0	Ohms
3	Inductance per Phase, typ	11.2	60.0	5.2	30.0	mH
4	Rated Current per Phase, 1 Phase ON	0.71	0.30	0.71	0.30	A
5	Input Power	5.0	5.0	5.0	5.0	W
Coil independent parameters						
6	Min. Holding Force @ rated current	XX	Linear travel per step			
		10 @ .001" (0.0254mm)	28.9 (103.9)		20.9 (75)	N (oz)
		20 @ .002" (0.0508mm)	23.6 (84.9)		15.3 (55)	N (oz)
7	Min. Holding Force (Unenergized)	30 @ .003" (0.0762mm)	13.3 (47.8)		8.3 (30)	N (oz)
		10 @ .001" (0.0254mm)	11.1 (40)			N (oz)
		20 @ .002" (0.0508mm)	2.8 (10)			N (oz)
8	Stroke Length, Typ			1.4 (5)		N (oz)
				63.5 (2.5)		mm (in)
9	Linear Travel Accuracy			± 1 Step		
10	Steps per Revolution			48		
11	Ambient Temperature Range (operating)			-20 to +70 (-4 to +158)		°C (°F)
12	Maximum Coil Temperature			130 (266)		°C (°F)
13	Bearing Type			Ball Bearing		
14	Insulation Resistance at 500 VDC			20		Mohms
15	Dielectric Withstanding Voltage			650 for 2 seconds		VAC
16	Weight			85.2 (3)		g (oz)
17	Leadwire			AWG 26, UL 1429		
All Motor Data Values at 20°C Unless Otherwise Specified			# Voltage in case of voltage driver (indicator of R*I)			



102.9 N



Electrical Data		42DBLXXC1B-K Bipolar	42DBLXXC2B-K Bipolar	42DBLXXC1U-K Unipolar	42DBLXXC2U-K Unipolar	
1	Operating Voltage #	5	12	5	12	VDC
2	Resistance per Phase, ± 10%	5.0	28.8	5.0	28.8	Ohms
3	Inductance per Phase, typ	5.5	39.3	3.7	15.0	mH
4	Rated Current per Phase, 1 Phase ON	1.41	0.59	1.41	0.59	A
5	Input Power	10.0	10.0	10.0	10.0	W
Coil independent parameters		XX	Linear travel per step			
6	Min. Holding Force @ rated current	10 @ .001" (0.0254mm)	102.9 (370)		100 (360)	N (oz)
		20 @ .002" (0.0508mm)	83.4 (300)		72.3 (260)	N (oz)
		40 @ .004" (0.1016mm)	55.6 (200)		50 (180)	N (oz)
		10 @ .001" (0.0254mm)			100 (360)	N (oz)
7	Min. Holding Force (Unenergized)	20 @ .002" (0.0508mm)	83.4 (300)			N (oz)
		40 @ .004" (0.1016mm)	19.5 (70)			N (oz)
			24.1 (0.95)			mm (in)
8	Stroke Length, Typ		± 1 Step			
9	Linear Travel Accuracy		48			
10	Steps per Revolution		-20 to +70 (-4 to +158)			°C (°F)
11	Ambient Temperature Range (operating)		130 (266)			°C (°F)
12	Maximum Coil Temperature		Ball Bearing			
13	Bearing Type		20			Mohm
14	Insulation Resistance at 500 VDC		650 for 2 seconds			VAC
15	Dielectric Withstanding Voltage		156 (5.51)			g (oz)
16	Weight		AWG 26, UL 1430			
17	Leadwire					
All Motor Data Values at 20°C Unless Otherwise Specified			# Voltage in case of voltage driver (indicator of R*I)			



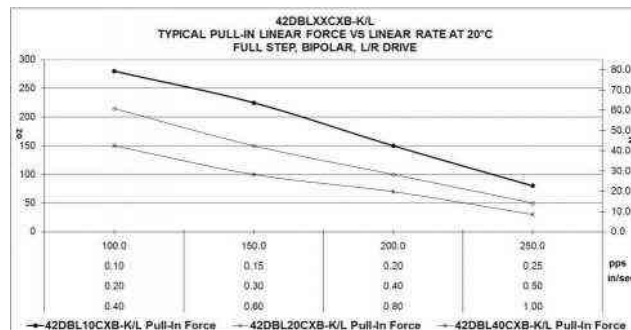
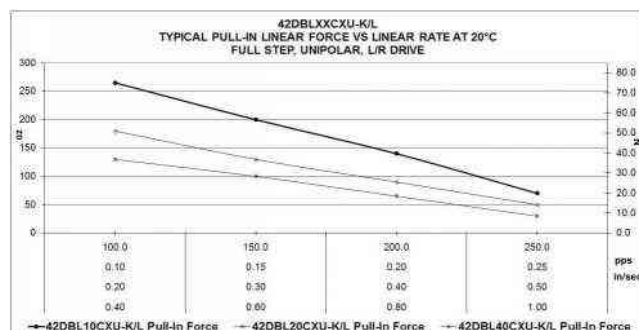
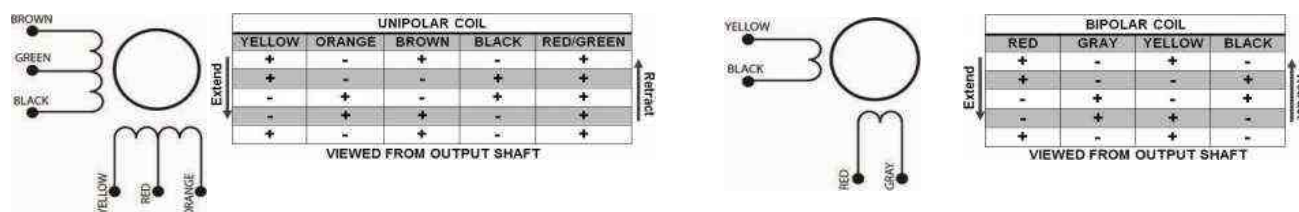
102.9 N



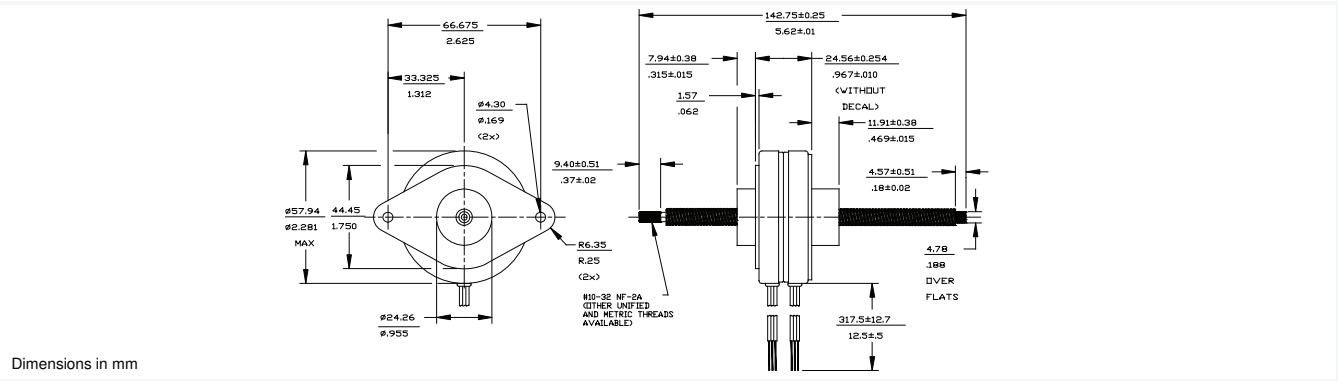
42DBL-L

All Motor Data Values at 20 °C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R^*I)



57DBM-L RoHS Compliant Ø57mm 124.6 N



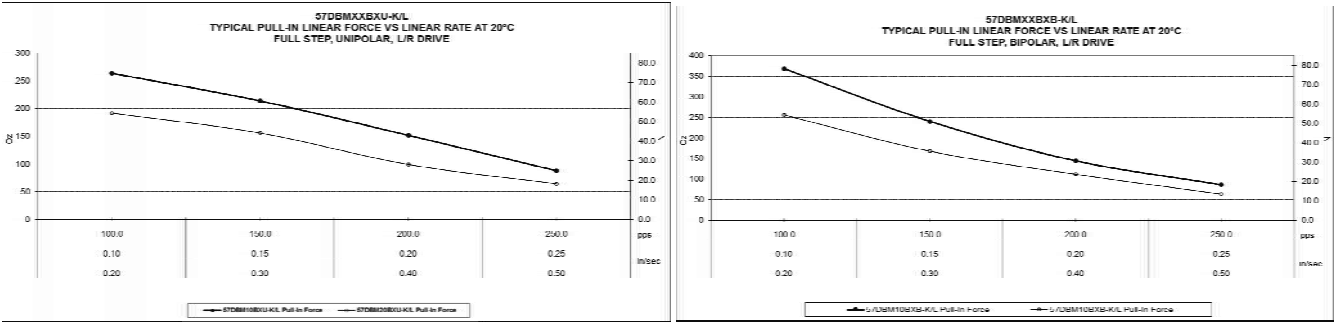
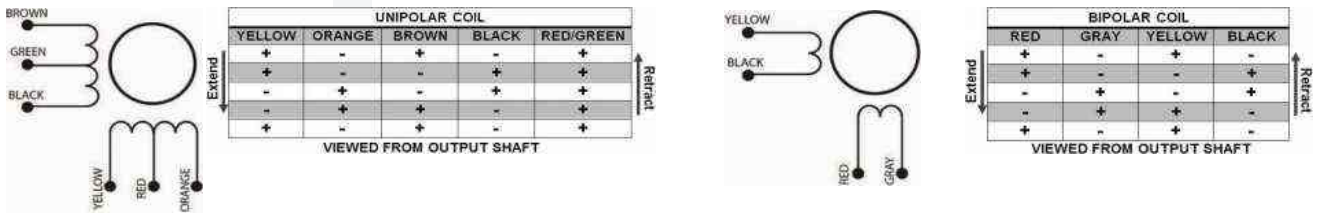
Dimensions in mm

57DBM-L

Electrical Data	57DBMXXB1B-L Bipolar	57DBMXXB2B-L Bipolar	57DBMXXB1U-L Unipolar	57DBMXXB2U-L Unipolar	
1 Operating Voltage #	5	12	5	12	VDC
2 Resistance per Phase, ± 10%	4.3	25.0	4.3	25.0	Ohms
3 Inductance per Phase, typ	6.3	36.0	5.0	25.0	mH
4 Rated Current per Phase, 1 Phase ON	1.64	0.67	1.64	0.67	A
5 Input Power	12.0	12.0	12.0	12.0	W
Coil independent parameters					
XX Linear travel per step					
6 Min. Holding Force @ rated current	10 @ .001" (0.0254mm)	124.6 (448)	89 (320)	N (oz)	
	20 @ .002" (0.0508mm)	102.4 (368)	71 (256)	N (oz)	
7 Min. Holding Force (Unenergized)	10 @ .001" (0.0254mm)		89 (320)	N (oz)	
	20 @ .002" (0.0508mm)		71 (256)	N (oz)	
8 Stroke Length, Typ			76.2 (3)	mm (in)	
9 Linear Travel Accuracy			± 1 Step		
10 Steps per Revolution			48		
11 Ambient Temperature Range (operating)		-20 to +70 (-4 to +158)		°C (°F)	
12 Maximum Coil Temperature		130 (266)		°C (°F)	
13 Bearing Type		Ball Bearing			
14 Insulation Resistance at 500 VDC		20		Mohms	
15 Dielectric Withstanding Voltage		650 for 5 seconds		VAC	
16 Weight		454 (16)		g (oz)	
17 Leadwire		AWG 26, MIL-W-16878/4			

All Motor Data Values at 20°C Unless Otherwise Specified

Voltage in case of voltage driver (indicator of R*I)





Brushless dc motors



Brush dc motors



Disc magnet motors



Can stack motors



Can stack linear actuators



Gearheads



Encoders

Gearheads & Encoders

Gearheads

Gearheads are used between the motor and the load to reduce the speed and/or increase the torque delivered to the load with the best possible efficiency. We offer both planetary and spur gearheads, with each design offering advantages suited to particular applications.

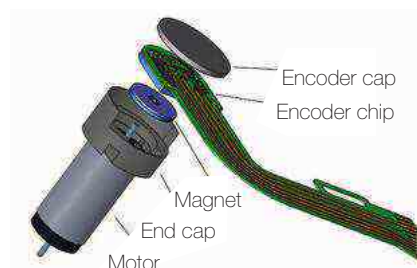
Spur and Planetary Gearheads



Type	Details	Application Advantages
Spur gear concept: Only one transmission point per train	<ul style="list-style-type: none">• Low friction per train• Multiple trains can be configured to suit design intent• Input and output shaft not necessarily in line• Dual output shafts possible• Direction of rotation can be reversed by using an odd number of reduction stages	<ul style="list-style-type: none">• Good efficiency, about 0.9 per train• Long gearbox of smaller diameter or short gearbox of large diameter• Free choice for placing the motor relative to the output shaft• Accommodates mounting of a sensor, potentiometer, etc.• Low noise
Planetary concept: 3 or 4 transmission points per train	<ul style="list-style-type: none">• Higher reduction ratio per train, with a tradeoff of higher friction• Can transmit higher torques• Input and output of a train have the same direction of rotation• Less backlash	<ul style="list-style-type: none">• Higher lifetime due to planetary arrangement• Efficiency about 0.85 per train• Exceptional performance in a very compact gearbox• For any number of trains, the load always rotates in the same direction as the motor• Less shock in case of a rapid reversal of motor rotation

Encoders

Encoders provide feedback for accurate control of speed and positioning. We offer three types – optical, magnetic and magnetoresistive – all featuring a robust design suitable for severe environments. Resolutions from 1 to 1024 lines per revolution are available, with up to 3 channels.



Optical, Magnetic and Magnetoresistive Encoders

Type	Details / Features		Advantages for Application
Optical	<ul style="list-style-type: none">• Transmissive optical system• 3 Channel (A, B, Z)• Optional line driver	<ul style="list-style-type: none">• High accuracy• High line count• Ultra low jitter	<ul style="list-style-type: none">• Very precise positioning• No sensitivity to external magnetic field
Magnetic: M-Sense	<ul style="list-style-type: none">• Hall sensor array interpolated• 3 Channel (A, B, Z)• Integrated RS422 line driver	<ul style="list-style-type: none">• Integrated design• High line count	<ul style="list-style-type: none">• High resolution in a compact design and low diameter• Long commutation lines can be handled between encoder and driver• Axial and radial cable output
Magnetic: MR2	<ul style="list-style-type: none">• Magnetoresistive sensor interpolated• 3 Channel (A, B, Z)• Integrated design	<ul style="list-style-type: none">• Compact design• High line count	<ul style="list-style-type: none">• Insensitive to temperature• Very low sensitivity to unwanted external field• High resolution in a shorter length
Magnetic: Type D/F	<ul style="list-style-type: none">• Digital Hall sensor (not interpolated)• 2 Channel (A, B)• Insensitive to hostile environment	<ul style="list-style-type: none">• Compact design• Negligible unit length increase for Type F• Very low current consumption	<ul style="list-style-type: none">• Very low power consumption• Gamma ray-proof version available on request



Gearheads and Encoders for any Miniature Application



Medical devices & clinical diagnostics

- Surgical hand tools
- Laboratory automation
- Infusion systems
- Insulin pumps
- Medical analyzers
- Sample preparation workstations



Aerospace

- Surveillance camera systems
- Seat actuation
- Valve actuation

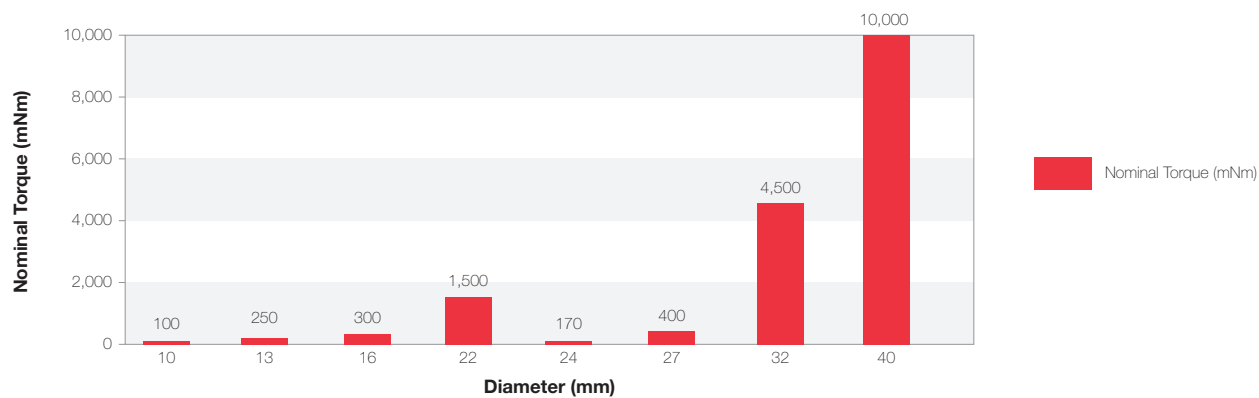


Other

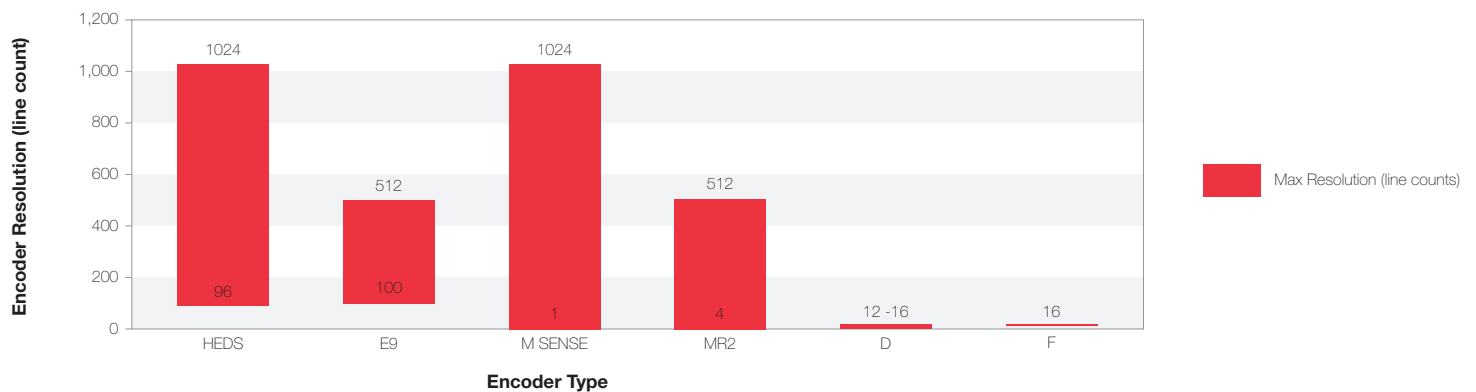
- Nailers & framing systems
- Power hand tools

Meet your Application's Working Point Requirements

Gearheads



Encoders



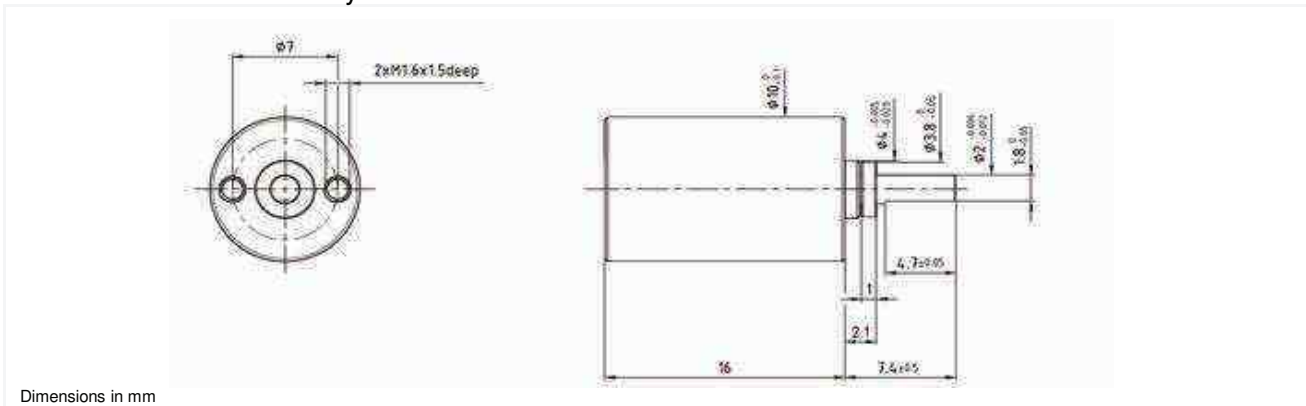
For complete product and application details, visit portescap.com/gearheads-encoders

R10

Planetary Gearbox

Ø 10mm

0.1 Nm



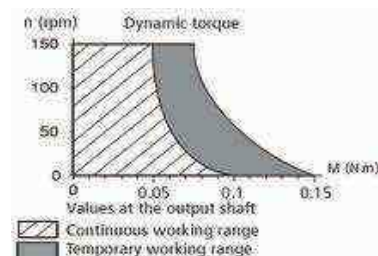
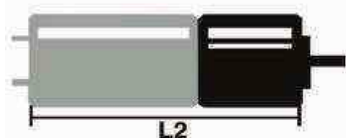
Dimensions in mm

Ratio	****	4	16	64	256	1024	4096
1	Number of Gear Stages	1	2	3	4	5	6
2	Direction of Rotation	=	=	=	=	=	=
3	Efficiency	0.9	0.8	0.7	0.65	0.6	0.5
4	L(mm)	9	12.5	16	19.5	23	26.5
5	Weight g (oz)	3 (0.105)	4 (0.141)	5 (0.176)	6 (0.211)	7 (0.246)	8 (0.282)
6	Available with Motor - L2 = Length with motor (mm)						
	08GS61	25.6	29.1	32.6	36.1	39.6	43.1
	08G61	28.6	32.1	35.6	39.1	42.6	46.1
	P010	25.4	28.9	32.4	35.9	39.4	42.9
	10NS61	27	30.5	34	37.5	41	44.5
	12G88	37.2	40.7	44.2	47.7	51.2	54.7

* Ratio available upon request.
Please contact us.

Characteristics	R10 • 200 •	
7	Shaft Bearings	Sleeve
8	Maximum Static Torque	Nm (oz-in)
9	Maximum Radial Force @ 8mm from mounting face	N (lb)
10	Maximum Axial Force	N (lb)
11	Maximum Press Fit Force	N (lb)
12	Average Backlash @ no-load	1°
13	Average Backlash @ 0.3 Nm	3°
	Shaft Play:	
14	-radial	µm
15	-axial	µm
16	Maximum Recommended Input Speed	rpm
17	Operating Temperature Range:	°C (°F)

Motor + gearbox = L2

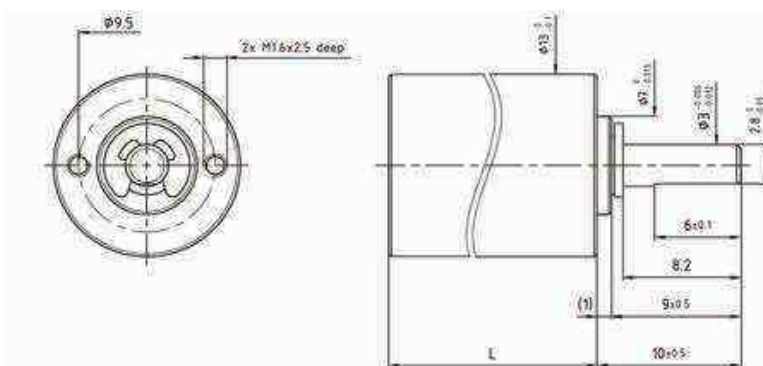


R13

Planetary Gearbox

Ø 13mm

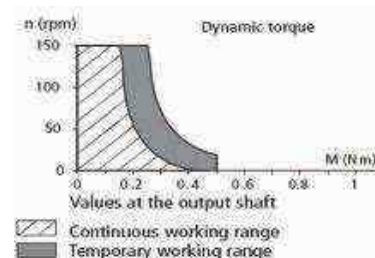
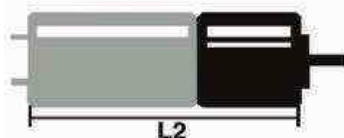
0.25 Nm



Dimensions in mm

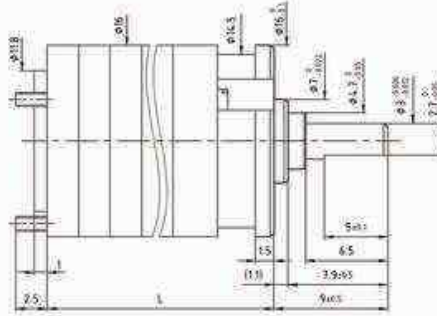
Ratio	****	5.5	22	30.2	88	121	166	352	484	665.5	915
1 Number of Gear Stages		1	2	2	3	3	3	4	4	4	4
2 Direction of Rotation		=	=	=	=	=	=	=	=	=	=
3 Efficiency		0.85	0.75	0.75	0.65	0.65	0.65	0.55	0.55	0.55	0.55
4 L(mm)		14.5	18.6	18.6	22.7	22.7	22.7	26.8	26.8	26.8	26.8
5 Weight g (oz)		6 (0.211)	9 (0.317)	9 (0.317)	12 (0.423)	12 (0.423)	12 (0.423)	15 (0.529)	15 (0.529)	15 (0.529)	15 (0.529)
6 Available with Motor - L2 = Length with motor (mm)											
13N 88		42.7	46.8	46.8	50.9	50.9	50.9	55	55	55	55
12G 88		42.7	46.8	46.8	50.9	50.9	50.9	55	55	55	55

Characteristics		R13 • 0 •	R13 2R • 0 •
7 Shaft Bearings		Sleeve	Ball Bearing
8 Maximum Static Torque	Nm (oz-in)	0.5 (71)	0.5 (71)
9 Maximum Radial Force			
@ 8mm from mounting face	N (lb)	5 (1.12)	20 (4.5)
10 Maximum Axial Force	N (lb)	8 (1.8)	10 (2.2)
11 Maximum Press Fit Force	N (lb)	100 (23)	100 (23)
12 Average Backlash @ no-load		1.25°	1.25°
13 Average Backlash @ 0.3 Nm		2°	2°
Shaft Play:			
14 -radial	µm	≤ 20	≤ 10
15 -axial	µm	50-150	≤ 50
16 Maximum Recommended Input Speed	rpm	7500	7,500
17 Operating Temperature Range:	°C (°F)	-30 to +85 (-22 to +185)	

Motor + gearbox = L2

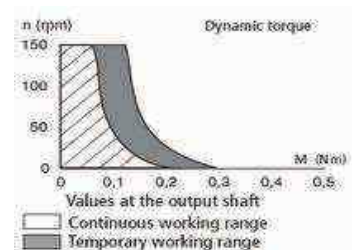
Spur Gearbox

0.12 Nm



Dimensions in mm

Characteristics			B16 • 0 •	B16 2R • 0 •
7	Shaft Bearings		Sleeve	Ball Bearing
8	Maximum Static Torque	Nm (oz-in)	0.4 (56)	0.4 (56)
9	Maximum Radial Force			
	@ 8mm from mounting face	N (lb)	5 (1.1)	10 (2.2)
10	Maximum Axial Force	N (lb)	5 (1.1)	10 (2.2)
11	Maximum Press Fit Force	N (lb)	100 (23)	100 (23)
12	Average Backlash @ no-load		1.5°	1.5°
13	Average Backlash @ 0.3 Nm		3°	3°
	Shaft Play:			
14	-radial	µm	≤ 20	≤ 10
15	-axial	µm	50-150	≤ 100
16	Maximum Recommended Input Sp	rpm	8000	8000
17	Operating Temperature Range:	°C (°F)	-30 to +65 (-22 to +150)	

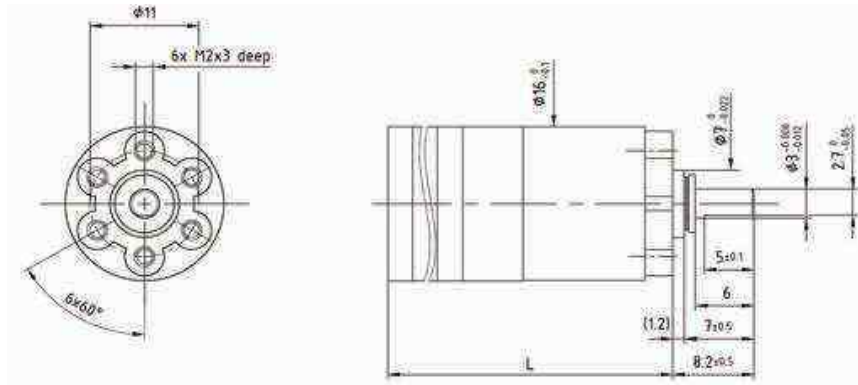


BA16

Gearbox with Spur Gears and Planetary Output

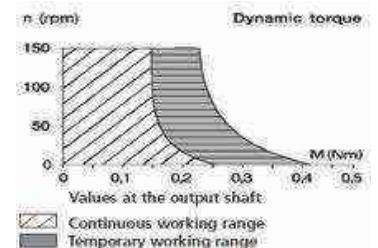
Ø 16mm

0.2 Nm



Dimensions in mm

Ratio	****	22.5	40.5	67.5	121.5	202.5	243	364.5	607.8	1093.5	1822.5	3280.5
1	Number of Gear Stages	3	3	4	4	5	5	5	6	6	7	7
2	Direction of Rotation	=	=	≠	≠	=	=	=	≠	≠	=	=
3	Efficiency	0.72	0.72	0.65	0.65	0.59	0.59	0.59	0.53	0.53	0.48	0.48
4	L (mm)	26.7	26.7	29.2	29.2	31.7	31.7	31.7	34.2	34.2	36.7	36.7
5	Weight g (oz)	12 (0.423)	12 (0.423)	13 (0.458)	13 (0.458)	14 (0.493)	14 (0.493)	15 (0.529)	15 (0.529)	15 (0.529)	16 (0.564)	16 (0.564)
6	Available with Motor - L2 = Length with motor (mm)											
	16C18	45.4	45.4	47.9	47.9	51.4	51.4	51.4	52.9	52.9	55.4	55.4
	16N28/78	54.7	54.7	57.2	57.2	59.7	59.7	59.7	62.2	62.2	64.7	64.7
	16G88	54.7	54.7	57.2	57.2	59.7	59.7	59.7	62.2	62.2	64.7	64.7
	17S78	48.4	48.4	50.9	50.9	53.4	53.4	53.4	55.9	55.9	58.4	58.4
	17N78	52.6	52.6	55.1	55.1	57.6	57.6	57.6	60.1	60.1	62.6	62.6
	P110	45.7	45.7	48.2	48.2	50.7	50.7	50.7	53.2	53.2	55.7	55.7
	16DCP/17DCT	52.7	52.7	55.2	55.2	57.7	57.7	57.7	60.2	60.2	62.7	62.7
Characteristics		BA16 • 0 •				BA16 2R • 0 •						
7	Shaft Bearings	Sleeve				Ball Bearing						
8	Maximum Static Torque	Nm (oz-in)				0.4 (57)						
9	Maximum Radial Force											
	@ 8mm from mounting face	N (lb)				5 (1.1)						
10	Maximum Axial Force	N (lb)				10 (2.2)						
11	Maximum Press Fit Force	N (lb)				200 (44)						
12	Average Backlash @ no-load	1.5°				1.5°						
13	Average Backlash @ 0.3 Nm	3°				3°						
	Shaft Play:											
14	-radial	µm				≤ 30						
15	-axial	µm				≤ 150						
16	Maximum Recommended Input Speed	rpm				8000						
17	Operating Temperature Range:	°C (°F)				-30 to +65 (-22 to +150)						

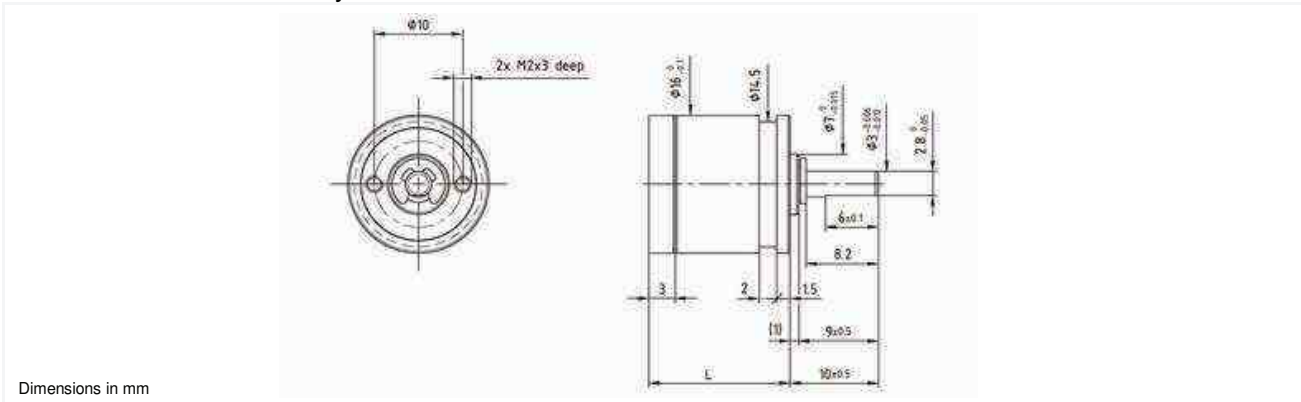


R16

Planetary Gearbox

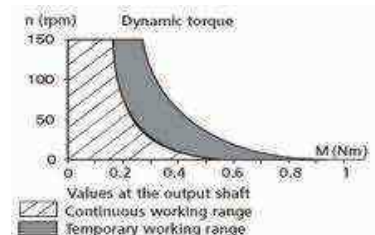
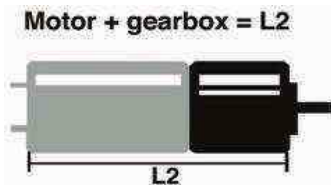
Ø 16mm

0.3 Nm



Dimensions in mm

Ratio	****	5.5	22	30.2	88	121	166	352	484	665.5	915
1	Number of Gear Stages	1	2	2	3	3	3	4	4	4	4
2	Direction of Rotation	=	=	=	=	=	=	=	=	=	=
3	Efficiency	0.85	0.75	0.75	0.65	0.65	0.65	0.55	0.55	0.55	0.55
4	L(mm)	16	20.1	20.1	24.2	24.2	24.2	28.3	28.3	28.3	28.3
5	Weight g (oz)	10 (0.352)	13 (0.458)	13 (0.458)	16 (0.564)	16 (0.564)	16 (0.564)	19 (0.670)	19 (0.670)	19 (0.670)	19 (0.670)
6	Available with Motor - L2 = Length with motor (mm)										
	16C18	31.7	35.8	35.8	39.9	39.9	39.9	44	44	44	44
	16N28/78	44	48.1	48.1	52.2	52.2	52.2	56.3	56.3	56.3	56.3
	16G88	44	48.1	48.1	52.2	52.2	52.2	56.3	56.3	56.3	56.3
	17S78	34.7	38.8	38.8	42.9	42.9	42.9	47	47	47	47
	17N78	41.9	46	46	50.1	50.1	50.1	54.2	54.2	54.2	54.2
	P110	35	39.1	39.1	43.2	43.2	43.2	47.3	47.3	47.3	47.3
	16DCP/17DCT	42	46.1	46.1	50.2	50.2	50.2	54.3	54.3	54.3	54.3
	16ECP36	50.5	54.6	54.6	58.7	58.7	58.7	62.8	62.8	62.8	62.8
	16ECP52	66.5	70.6	70.6	74.7	74.7	74.7	78.8	78.8	78.8	78.8
	32BF	27.2	31.3	31.3	35.4	35.4	35.4	39.5	39.5	39.5	39.5
Characteristics					R16 • 0 •			R16 2R • 0 •			
7	Shaft Bearings				Sleeve			Ball Bearing			
8	Maximum Static Torque	Nm (oz-in)			1 (141)			1 (141)			
9	Maximum Radial Force										
	@ 8mm from mounting face	N (lb)			5 (1.12)			20 (4.5)			
10	Maximum Axial Force	N (lb)			8 (1.8)			10 (2.2)			
11	Maximum Press Fit Force	N (lb)			100 (23)			100 (23)			
12	Average Backlash @ no-load				1.25°			1.25°			
13	Average Backlash @ 0.3 Nm				2°			2°			
	Shaft Play:										
14	-radial	µm			≤ 20			≤ 10			
15	-axial	µm			50-150			≤ 50			
16	Maximum Recommended Input Speed	rpm			7500			7,500			
17	Operating Temperature Range:	°C (°F)			-30 to +85 (-22 to +185)						

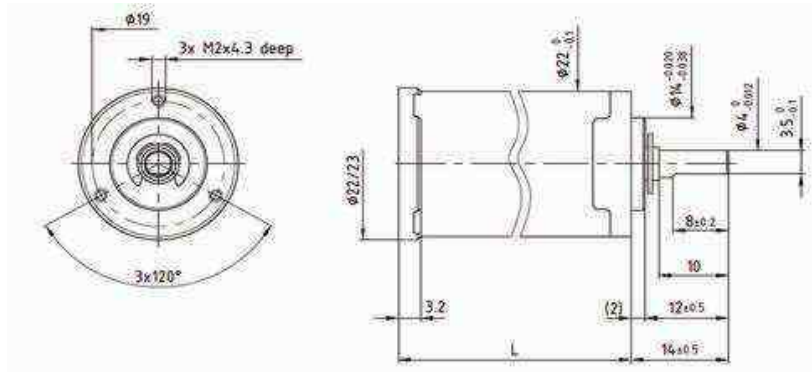


R22

Planetary Gearbox

Ø 22mm

0.6 Nm

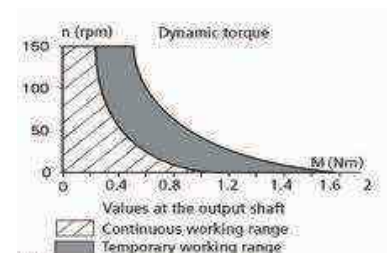
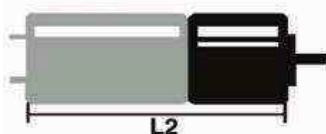


Dimensions in mm

Ratio	****	5.75	16.2	19.4	27.6	33.1	65.5	93.2	111	132	159	190	376	641	1090
1	Number of Gear Stages	1	2	2	2	2	3	3	3	3	3	3	4	4	4
2	Direction of Rotation	=	=	=	=	=	=	=	=	=	=	=	=	=	=
3	Efficiency	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.5	0.5
4	L(mm)	25	32.5	32.5	32.5	32.5	40	40	40	40	40	40	40	40	40
5	Weight g (oz)	20 (0.705)	25 (0.881)	25 (0.881)	25 (0.881)	25 (0.881)	30 (1.058)	30 (1.058)	30 (1.058)	30 (1.058)	30 (1.058)	30 (1.058)	33 (1.164)	33 (1.164)	33 (1.164)
6	Available with Motor - L2 = Length with motor (mm)														
	22S78	51	58.5	58.5	58.5	58.5	66	66	66	66	66	66	66	66	66
	22N78	57	64.5	64.5	64.5	64.5	72	72	72	72	72	72	72	72	72
	22V28	59.4	66.9	66.9	66.9	66.9	74.4	74.4	74.4	74.4	74.4	74.4	74.4	74.4	74.4
	22V48	61.2	68.7	68.7	68.7	68.7	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2	76.2
	23GST82	60.1	67.6	67.6	67.6	67.6	75.1	75.1	75.1	75.1	75.1	75.1	75.1	75.1	75.1
	26N58	68.3	75.8	75.8	75.8	75.8	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3	83.3
	26N48	67.1	74.6	74.6	74.6	74.6	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1	82.1
	28L18/28	68.5	76	76	76	76	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5
	28LT12	66.2	73.7	73.7	73.7	73.7	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2	81.2
	P310	42.4	49.9	49.9	49.9	49.9	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4	57.4
	22DCP/24DCT	55*	62.5	62.5	62.5	62.5	70	70*	70	70	70	70	70	70	70

Characteristics		R22 - 0 -	R22 2R - 0 -
7	Shaft Bearings	Sleeve	Ball Bearing
8	Maximum Static Torque	Nm (oz-in)	2 (283)
9	Maximum Radial Force		
	@ 8mm from mounting face	N (lb)	10 (2.2)
10	Maximum Axial Force	N (lb)	10 (2.2)
11	Maximum Press Fit Force	N (lb)	300 (67.4)
12	Average Backlash @ no-load	1.5°	1.5°
13	Average Backlash @ 0.3 Nm	3°	3°
	Shaft Play:		
14	-radial	µm	≤ 25
15	-axial	µm	50-150
16	Maximum Recommended Input Spee	rpm	5000
17	Operating Temperature Range:	°C (°F)	-30 to +65 (-22 to +150)

Motor + gearbox = L2

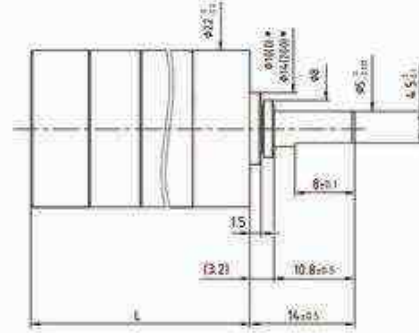
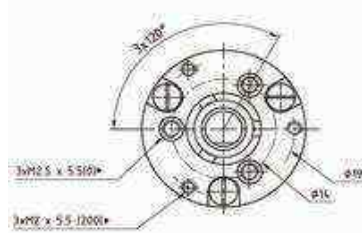


M22

Planetary Gearbox

Ø 22mm

1.5 Nm



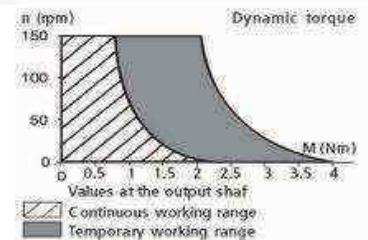
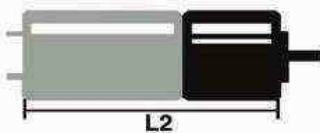
Dimensions in mm

Ratio	****	3.67	5	13.4	18.3	25	49.3	67.2	91.7	125	180.8	246.5	336.1	458.3	625	903.8
1	Number of Gear Stages	1	1	2	2	2	3	3	3	3	4	4	4	4	4	5
2	Direction of Rotation	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
3	Efficiency	0.8	0.8	0.7	0.7	0.7	0.6	0.6	0.6	0.6	0.55	0.55	0.55	0.55	0.55	0.5
4	L (mm)	22.6	22.6	29.5	29.5	29.5	36.4	36.4	36.4	36.4	43.3	43.3	43.3	43.3	43.3	50.2
5	Weight g (oz)	26 (0.917)	26 (0.917)	33 (1.164)	33 (1.164)	33 (1.164)	40 (1.552)	40 (1.552)	40 (1.552)	40 (1.552)	47 (1.657)	47 (1.657)	47 (1.657)	47 (1.657)	47 (1.657)	54 (1.904)
6	Available with Motor - L2 = Length with motor (mm)															
	22V28	57	57	63.9	63.9	63.9	70.8	70.8	70.8	70.8	77.7	77.7	77.7	77.7	77.7	84.6
	22V48	58.8	58.8	65.7	65.7	65.7	72.6	72.6	72.6	72.6	79.5	79.5	79.5	79.5	79.5	86.4
	22N78	54.6	54.6	61.5	61.5	61.5	68.4	68.4	68.4	68.4	75.3	75.3	75.3	75.3	75.3	82.2
	22N98	56.5	56.5	63.4	63.4	63.4	70.3	70.3	70.3	70.3	77.2	77.2	77.2	77.2	77.2	84.1
	23GST82	58.6	58.6	65.5	65.5	65.5	72.4	72.4	72.4	72.4	79.3	79.3	79.3	79.3	79.3	86.2
	25GST82	66.1	66.1	73	73	73	79.9	79.9	79.9	79.9	86.8	86.8	86.8	86.8	86.8	93.7
	25GT	76.05	76.05	82.95	82.95	82.95	89.85	89.85	89.85	89.85	96.75	96.75	96.75	96.75	96.75	103.65
	26N58	65.9	65.9	72.8	72.8	72.8	79.7	79.7	79.7	79.7	86.6	86.6	86.6	86.6	86.6	93.5
	26N48	64.7	64.7	71.6	71.6	71.6	78.5	78.5	78.5	78.5	85.4	85.4	85.4	85.4	85.4	92.3
	28L28	66.1	66.1	73	73	73	79.9	79.9	79.9	79.9	86.8	86.8	86.8	86.8	86.8	93.7
	28LT12	63.8	63.8	70.7	70.7	70.7	77.6	77.6	77.6	77.6	84.5	84.5	84.5	84.5	84.5	91.4
	22DCP/24DCT	54.6	54.6	61.5	61.5	61.5	68.4	68.4	68.4	68.4	75.3	75.3	75.3	75.3	75.3	82.2
	22ECP45	67.6	67.6	74.5	74.5	74.5	81.4	81.4	81.4	81.4	88.3	88.3	88.3	88.3	88.3	95.2
	22ECP60	82.6	82.6	89.5	89.5	89.5	96.4	96.4	96.4	96.4	103.3	103.3	103.3	103.3	103.3	110.2

Characteristics M22 • 0 / • 200 •

7	Shaft Bearings		Sleeve
8	Maximum Static Torque	Nm (oz-in)	4 (556)
9	Maximum Radial Force		
	@ 8mm from mounting face	N (lb)	50 (11)
10	Maximum Axial Force	N (lb)	70 (16)
11	Maximum Press Fit Force	N (lb)	100 (22)
12	Average Backlash @ no-load		2°
13	Average Backlash @ 0.3 Nm		3°
	Shaft Play:		
14	-radial	µm	≤ 200
15	-axial	µm	50-150
16	Maximum Recommended Input Speed	rpm	7500
17	Operating Temperature Range:	°C (°F)	-30 to +65 (-22 to +150)

Motor + gearbox = L2

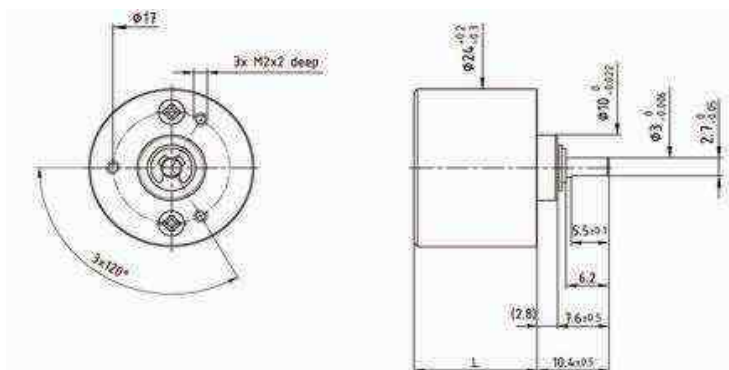


K24

Spur Gearbox

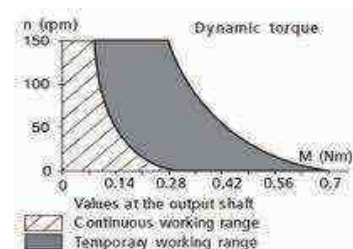
Ø 24mm

0.17 Nm



Dimensions in mm

Ratio	****	5	8	20	32	64	128	320	800	2048
1 Number of Gear Stages		2	2	4	4	4	4	6	6	6
2 Direction of Rotation		=	=	=	=	=	=	=	=	=
3 Efficiency		0.85	0.85	0.75	0.75	0.75	0.75	0.65	0.65	0.65
4 L (mm)		15	15	18	18	18	18	21	21	21
5 Weight g (oz)		15 (0.529)	15 (0.529)	18 (0.634)	18 (0.634)	18 (0.634)	18 (0.634)	20 (0.705)	20 (0.705)	20 (0.705)
6 Available with Motor - L2 = Length with motor (mm)										
22V28		49.4	49.4	52.4	52.4	52.4	52.4	55.4	55.4	55.4
22V48		51.2	51.2	54.2	54.2	54.2	54.2	57.2	57.2	57.2
22N78		47	47	50	50	50	50	53	53	53
22N98		48.9	48.9	51.9	51.9	51.9	51.9	54.9	54.9	54.9
26N58		58.3	58.3	61.3	61.3	61.3	61.3	64.3	64.3	64.3
26N48		57.1	57.1	60.1	60.1	60.1	60.1	63.1	63.1	63.1
P310		32.4	32.4	35.4	35.4	35.4	35.4	38.4	38.4	38.4
22DCP/24DCT		50.2	50.2	53.2	53.2	53.2	53.2	56.2	56.2	56.2
Characteristics				K24 • 0 •				K24 2R • 0 •		
7 Shaft Bearings					Sleeve			Ball Bearing		
8 Maximum Static Torque		Nm (oz-in)			0.7 (100)			0.7 (100)		
9 Maximum Radial Force										
@ 8mm from mounting face		N (lb)			5 (1.1)			20 (4.5)		
10 Maximum Axial Force		N (lb)			8 (1.8)			10 (2.2)		
11 Maximum Press Fit Force		N (lb)			30 (6.7)			30 (6.7)		
12 Average Backlash @ no-load					1.5°			1.5°		
13 Average Backlash @ 0.3 Nm					2.5°			2.5°		
Shaft Play:										
14 -radial		µm			≤ 40			≤ 10		
15 -axial		µm			50-150			≤ 10		
16 Maximum Recommended Input Speed		rpm			5000			5,000		
17 Operating Temperature Range:		°C (°F)			-30 to +65 (-22 to +150)					

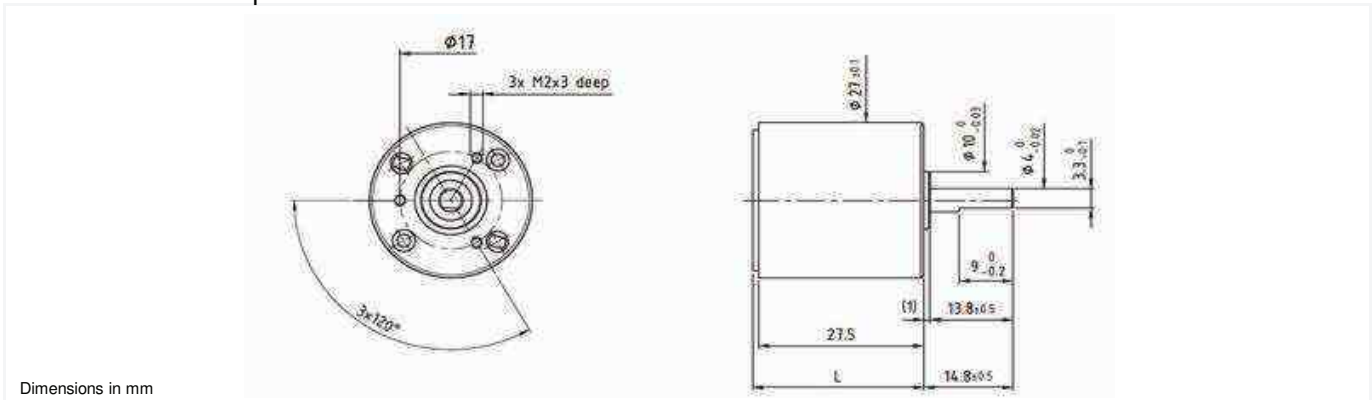


K27

Spur Gearbox

Ø 27mm

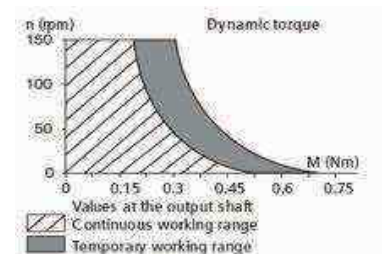
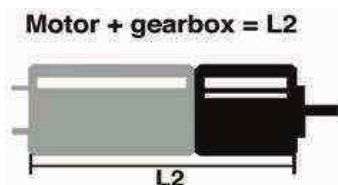
0.4 Nm



Dimensions in mm

Ratio	****	6.2	18.6	27.9	55.7	99.1	198	501	979	2970
1 Number of Gear Stages		4	4	4	4	6	6	6	6	9
2 Direction of Rotation		=	=	=	=	=	=	=	=	≠
3 Efficiency		0.65	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.4
4 L (mm)		28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5
5 Weight g (oz)		40 (1.410)	40 (1.410)	40 (1.410)	40 (1.410)	42 (1.481)	42 (1.481)	42 (1.481)	42 (1.481)	48 (1.693)
6 Available with Motor - L2 = Length with motor (mm)										
22V28		62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9	62.9
22V48		64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7	64.7
22N78		60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5
22N98		62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4
23GST82		63.6	63.6	63.6	63.6	63.6	63.6	63.6	63.6	63.6
26N58		71.8	71.8	71.8	71.8	71.8	71.8	71.8	71.8	71.8
26N48		70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6
P310		45.9	45.9	45.9	45.9	45.9	45.9	45.9	45.9	45.9
22DCP/24DCT		60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5	60.5

Characteristics			K27 • 0 •	K27 2R • 0 •
7	Shaft Bearings		Sleeve	Ball Bearing
8	Maximum Static Torque	Nm (oz-in)	0.7 (100)	0.7 (100)
9	Maximum Radial Force @ 8mm from mounting face	N (lb)	20 (4.5)	25 (5.5)
10	Maximum Axial Force	N (lb)	8 (1.8)	40 (9)
11	Maximum Press Fit Force	N (lb)	300 (67.5)	60 (13.5)
12	Average Backlash @ no-load		2°	2°
13	Average Backlash @ 0.3 Nm		3°	3°
	Shaft Play:			
14	-radial	µm	≤ 60	≤ 20
15	-axial	µm	50-150	≤ 100
16	Maximum Recommended Input Speed	rpm	4000	4,000
17	Operating Temperature Range:	°C (°F)	-30 to +65 (-22 to +150)	

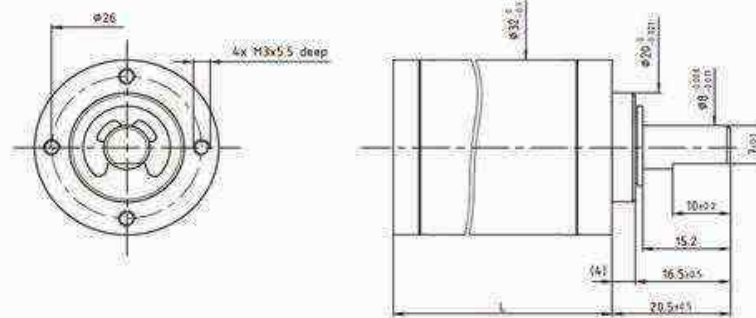


R32

Planetary Gearbox

Ø 32mm

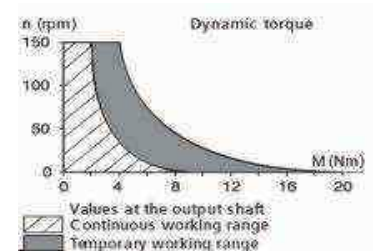
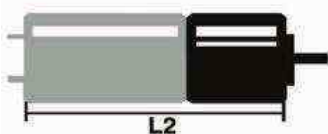
4.5 Nm



Dimensions in mm

Ratio	****	5.75	17.4	24	33	72.3	99.8	138	190	301	416	574	792	1090
1 Number of Gear Stages		1	2	2	2	3	3	3	3	4	4	4	4	4
2 Direction of Rotation		=	=	=	=	=	=	=	=	=	=	=	=	=
3 Efficiency		0.8	0.75	0.75	0.75	0.65	0.65	0.65	0.65	0.55	0.55	0.55	0.55	0.55
4 L(mm)		32	38	38	38	44	44	44	44	50	50	50	50	50
5 Weight g (oz)		124 (4.373)	145 (5.114)	145 (5.114)	145 (5.114)	175 (6.172)	175 (6.172)	175 (6.172)	175 (6.172)	205 (7.231)	205 (7.231)	205 (7.231)	205 (7.231)	205 (7.231)
6 Available with Motor - L2 = Length with motor (mm)														
25GST82		75.5	81.5	81.5	81.5	87.5	87.5	87.5	87.5	93.5	93.5	93.5	93.5	93.5
25GT82		85.45	91.45	91.45	91.45	97.45	97.45	97.45	97.45	103.45	103.45	103.45	103.45	103.45
28L18/28		75.5	81.5	81.5	81.5	87.5	87.5	87.5	87.5	93.5	93.5	93.5	93.5	93.5
28LT12		73.2	79.2	79.2	79.2	85.2	85.2	85.2	85.2	91.2	91.2	91.2	91.2	91.2
28DT12		96.6	102.6	102.6	102.6	108.6	108.6	108.6	108.6	114.6	114.6	114.6	114.6	114.6
30GT82		94.9	100.9	100.9	100.9	106.9	106.9	106.9	106.9	112.9	112.9	112.9	112.9	112.9
35NT32/82		89.2	95.2	95.2	95.2	101.2	101.2	101.2	101.2	107.2	107.2	107.2	107.2	107.2
35GLT2R82		99.2	105.2	105.2	105.2	111.2	111.2	111.2	111.2	117.2	117.2	117.2	117.2	117.2
22ECT60		92	98	98	98	104	104	104	104	110	110	110	110	110
22ECT82		114	120	120	120	126	126	126	126	132	132	132	132	132
Characteristics		R32 2R • 0 •												
7 Shaft Bearings		Ball bearing												
8 Maximum Static Torque	Nm (oz-in)	20 (2832)												
9 Maximum Radial Force														
@ 8mm from mounting face	N (lb)	180 (40.5)												
10 Maximum Axial Force	N (lb)	150 (33.75)												
11 Maximum Press Fit Force	N (lb)	500 (112.5)												
12 Average Backlash @ no-load		1°												
13 Average Backlash @ 0.3 Nm		2°												
Shaft Play:														
14 -radial	µm	≤ 10												
15 -axial	µm	≤ 10												
16 Maximum Recommended Input Speed	rpm	6000												
17 Operating Temperature Range:	°C (°F)	-30 to +85 (-22 to +185)												

Motor + gearbox = L2

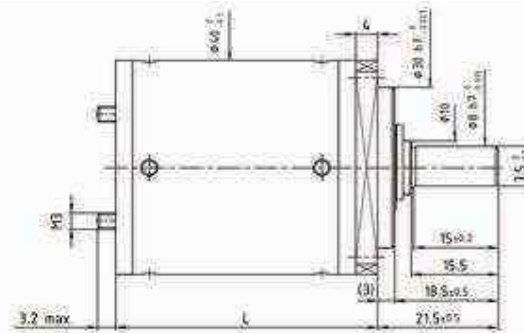
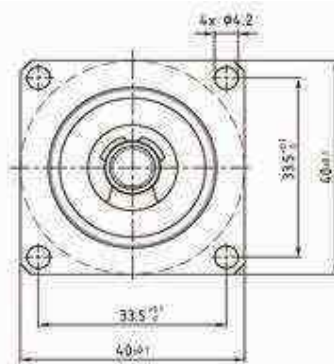


R40

Planetary Gearbox

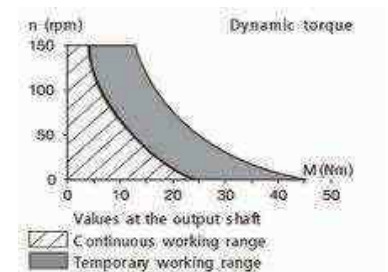
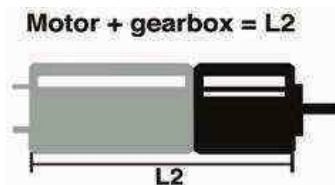
Ø 40mm

10 Nm



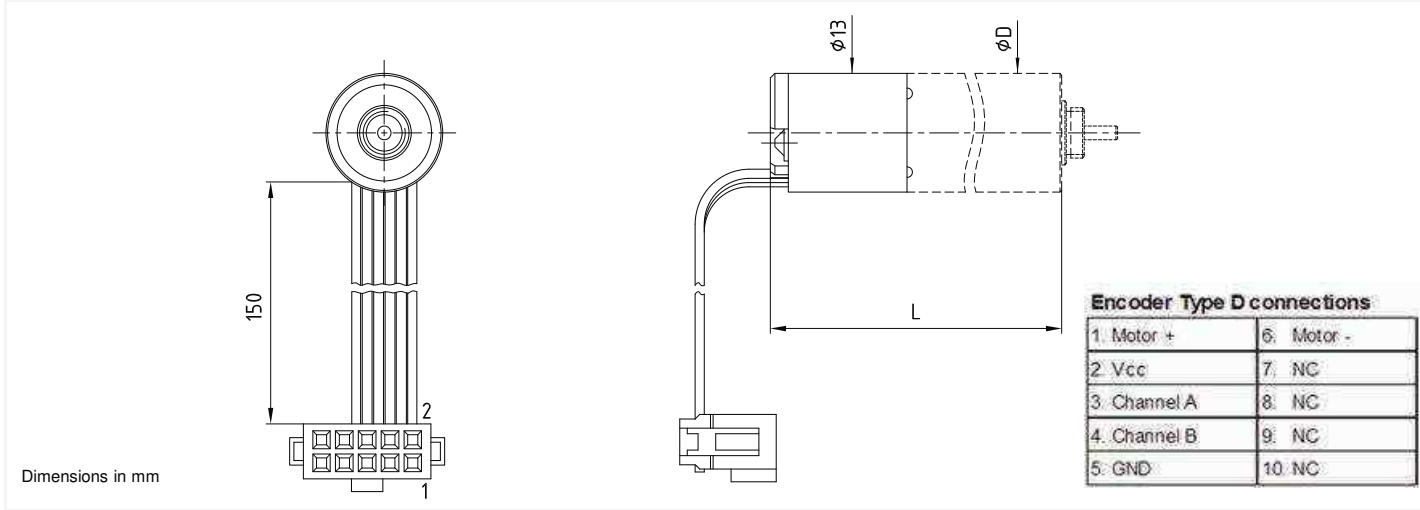
Dimensions in mm

Ratio	****	3.56	5.6	15.2	24	54.2	85.3	134	193	303	478	753
1 Number of Gear Stages		1	1	2	2	3	3	3	4	4	4	4
2 Direction of Rotation		=	=	=	=	=	=	=	=	=	=	=
3 Efficiency		0.85	0.85	0.7	0.7	0.6	0.6	0.6	0.5	0.5	0.5	0.5
4 L(mm)		38.3	38.3	46.8	46.8	55.3	55.3	55.3	63.8	63.8	63.8	63.8
5 Weight g (oz)		245 (8.642)	245 (8.642)	285 (10.052)	285 (10.052)	340 (11.993)	340 (11.993)	340 (11.993)	400 (14.109)	400 (14.109)	400 (14.109)	400 (14.109)
6 Available with Motor - L2 = Length with motor (mm)												
25GT82		91.75	91.75	100.25	100.25	108.75	108.75	108.75	117.25	117.25	117.25	117.25
28DT12		102.9	102.9	111.4	111.4	119.9	119.9	119.9	128.4	128.4	128.4	128.4
30GT82		101.2	101.2	109.7	109.7	118.2	118.2	118.2	126.7	126.7	126.7	126.7
35NT32/82		95.5	95.5	104	104	112.5	112.5	112.5	121	121	121	121
35GLT82		105.5	105.5	114	114	122.5	122.5	122.5	131	131	131	131
Characteristics R40 - 0 -												
7 Shaft Bearings						Ball Bearing						
8 Maximum Static Torque			Nm (oz-in)			40 (5700)						
9 Maximum Radial Force												
@ 8mm from mounting face			N (lb)			600 (135)						
10 Maximum Axial Force			N (lb)			400 (90)						
11 Maximum Press Fit Force			N (lb)			600 (135)						
12 Average Backlash @ no-load						1°						
13 Average Backlash @ 0.3 Nm						1.3°						
Shaft Play:												
14 -radial			µm			≤ 10						
15 -axial			µm			≤ 10						
16 Maximum Recommended Input Speed			rpm			6000						
17 Operating Temperature Range:			°C (°F)			-30 to +85 (-22 to +185)						



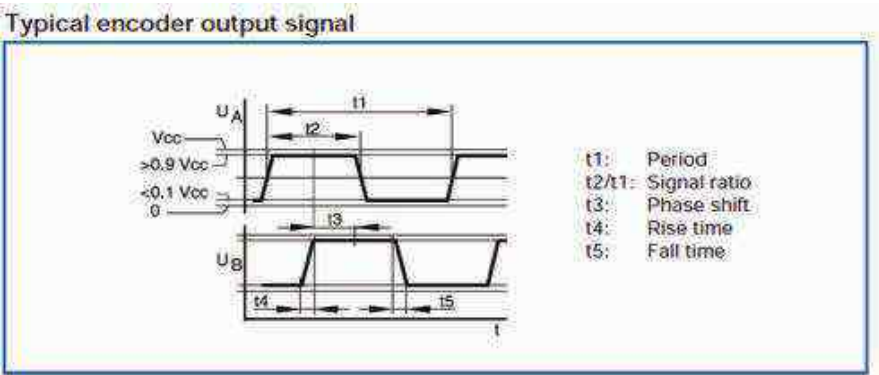
D12

Integrated Magnetic Encoder



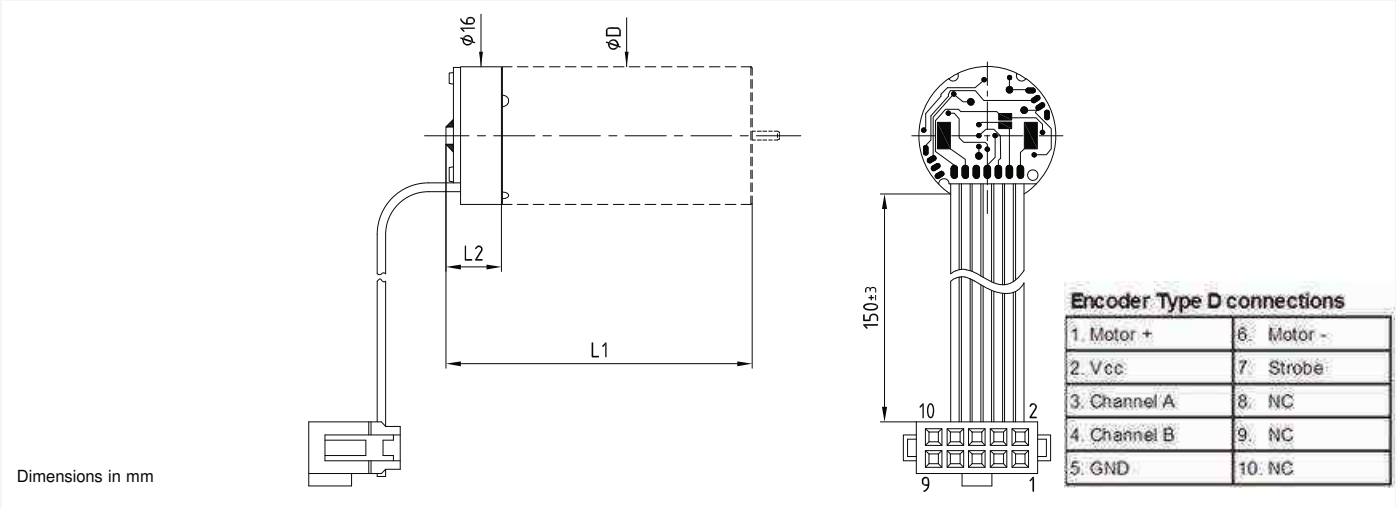
Characteristics @ 22 °C			
1	Number of Lines Available	12	LPR
2	Supply Voltage	5	Volt
3	Supply Current	Typcial	4
		Rise Time	125
		Fall Time	50
4	Output Signal	Two channels square wave	
5	Electrical Phase Shift	90 ± 40	degree
6	Signal Ratio	50 ± 25	%
7	Maximum Count Frequency	10	kHz
8	Operating Temperature Range:	-20 to +85	°C (°F)
9	Code Wheel Moment of Inertia	0.1	10 ⁻⁷ x kgm ²
10	Weight	Varies by motor size. Contact us.	
			g (oz)

Available on motor types	13N88
Length with motor - mm (in)	40.4 (1.59)



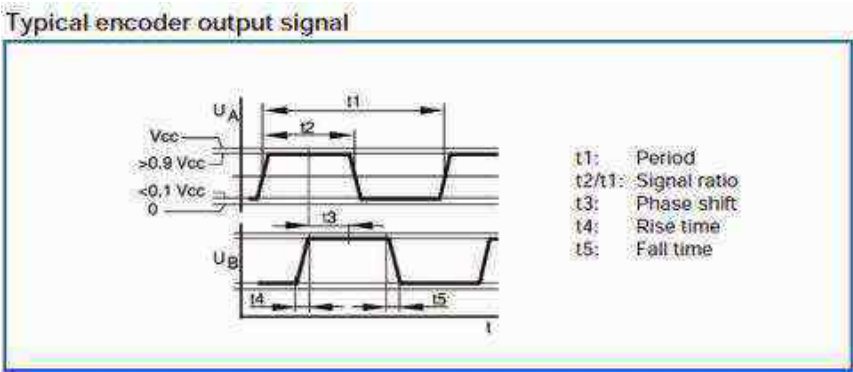
D16

Integrated Magnetic Encoder



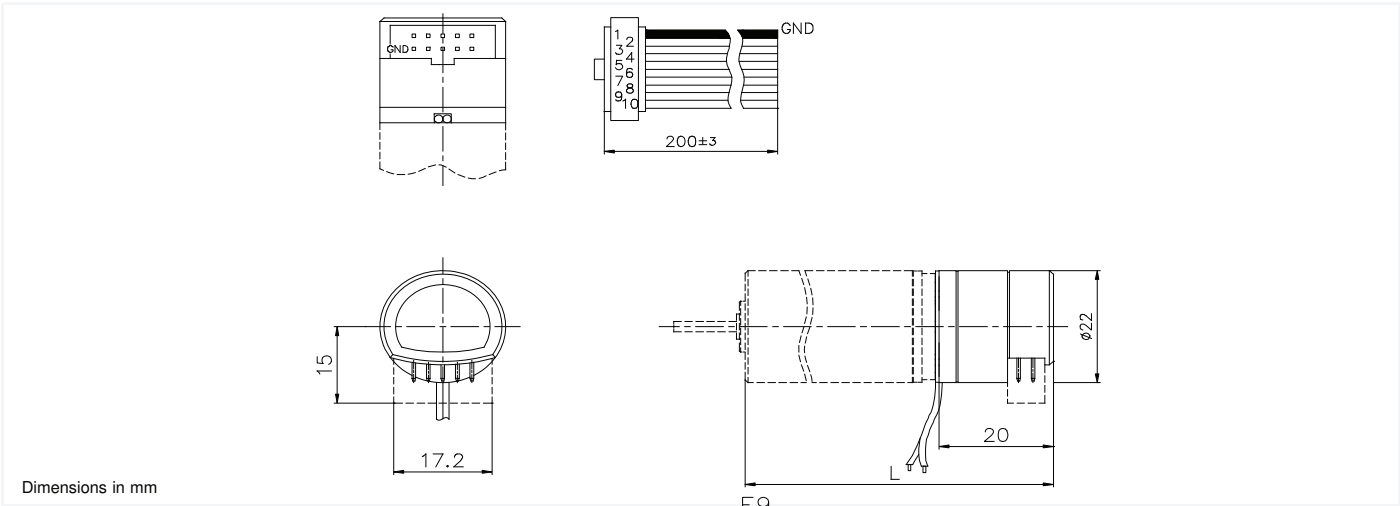
Characteristics @ 22 °C			
1	Number of Lines Available	16	LPR
2	Supply Voltage	5	Volt
3	Supply Current	Typcial 4	mA
	Rise Time	125	ns
	Fall Time	50	ns
4	Output Signal	Two channels square wave	
5	Electrical Phase Shift	90 ± 40	degree
6	Signal Ratio	50 ± 25	%
7	Maximum Count Frequency	10	kHz
8	Operating Temperature Range:	-20 to +85	°C (°F)
9	Code Wheel Moment of Inertia	0.1	10 ⁻⁷ x kgm ²
10	Weight	Varies by motor size. Contact us.	
			g (oz)

Available on motor types	22N28	22V28
Length with motor - mm (in)	37.8 (1.49)	40.1 (1.58)



E9

3 Channel Optical Encoder



Characteristics @ 22 °C			
1	Number of Lines Available	100, 144, 200, 256, 300, 360, 500 ⁽¹⁾ , 512 ⁽¹⁾	LPR
2	Supply Voltage	5 ± 10%	Volt
3	Supply Current	Typical	10
		Maximum	20
		Stand-by	50
4	Output Signal	Compatible	CMOS
5	Electrical Phase Shift	90 ± 20	degree
6	Duty Cycle	50 ± 10	%
7	Maximum Count Frequency	200	kHz
8	Operating Temperature Range:	-40 to +85	°C (°F)
9	Code Wheel Moment of Inertia	0.12	10 ⁻⁷ x kgm ²
10	Weight	6.2 (0.22)	g (oz)

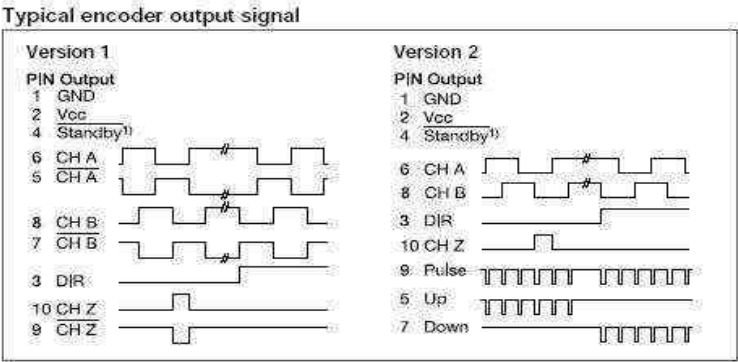
Available on motor types	22N48	22V48	23LT12	23V48	23GST	25GST	25GT	26N58
Length with motor - mm (in)	53.9 (2.13)	56.2 (2.22)	58 (2.29)	59 (2.33)	69.2 (2.33)	63.7 (2.51)	73.65 (2.9)	62 (2.41)

Available on motor types	28L28	28LT12	28DT12	30GT	35NT	35GLT
Length with motor - mm (in)	61.5 (2.42)	64.4(2.54)	85.8 (3.38)	88.3 (3.48)	82.6 (3.25)	92.6 (3.65)

(1) Ask for the 2R (ball bearing type) motor for use with the E9 in 500 or 512 line version

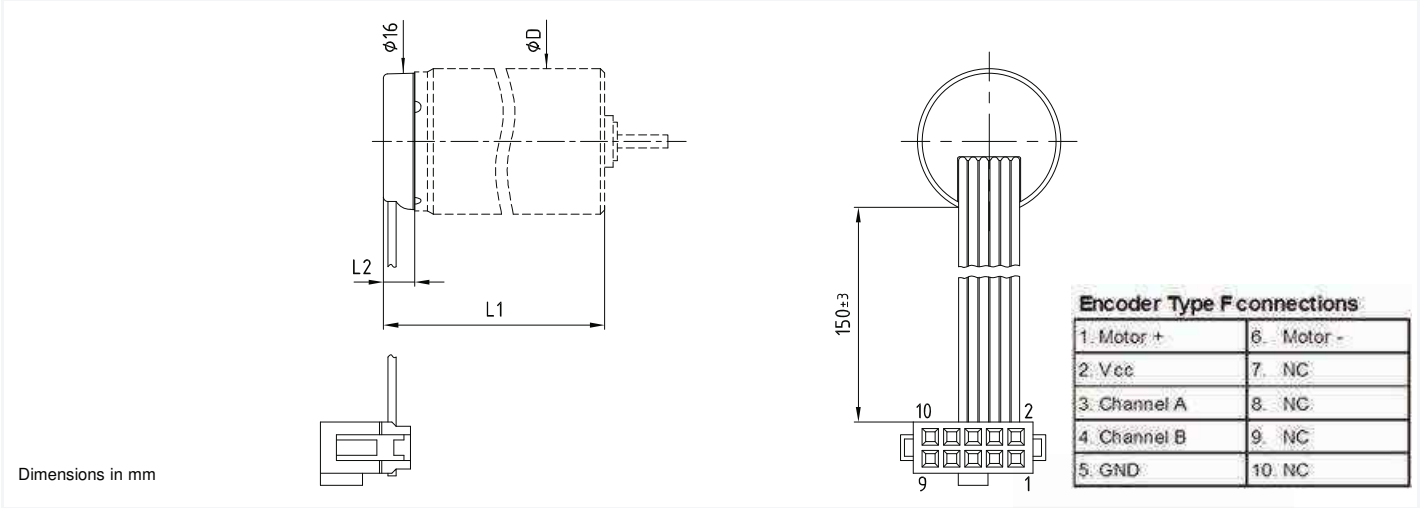
Features

- 2 channel quadrature output & index channel
 - stand-by function with latched state of channels (to de-activate the stand-by mode, connect to the pin 4 to the +5V
- Compact size
 - Complementary outputs
 - up/down pulse signals (on request)
 - Single 5vdc supply
- integrated direction of rotation detection
 - CMOS capable
 - the input Stand-by has to be connected to 0vdc or + 5vdc



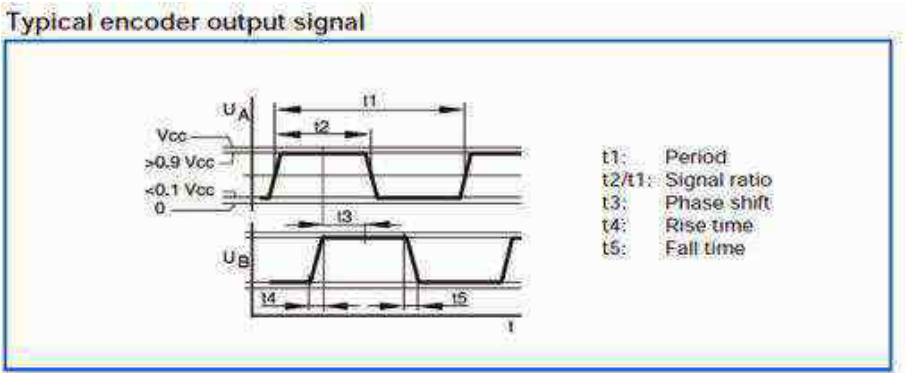
F16

Integrated Magnetic Encoder



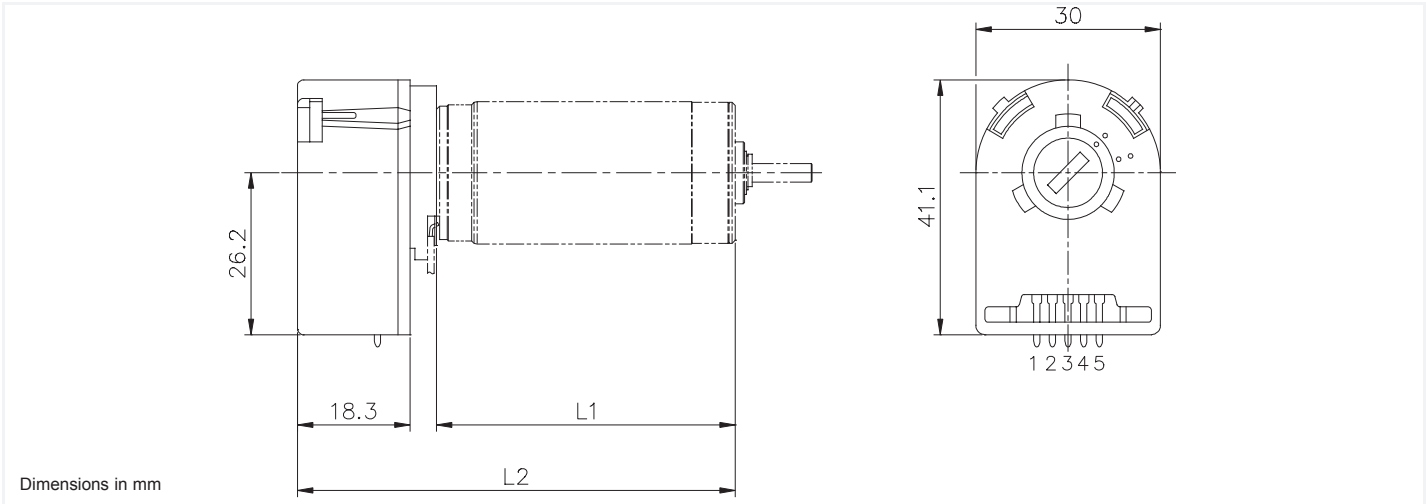
Characteristics @ 22 °C			
1	Number of Lines Available	16	LPR
2	Supply Voltage	3.5 to 15	Volt
3	Supply Current	Typical 6	mA
	Rise Time	5	µs
	Fall Time	0.2	µs
4	Output Signal	Two channels square wave	
5	Electrical Phase Shift	90 ± 40	degree
6	Signal Ratio	50 ± 25	%
7	Maximum Count Frequency	15	kHz
8	Operating Temperature Range:	-20 to +85	°C (°F)
9	Code Wheel Moment of Inertia	0.1	10 ⁻⁷ x kgm ²
10	Weight	Varies by motor size. Contact us.	
			g (oz)

Available on motor types	16C 18	16N28	17S78	17N78	22N28	22V28
Length with motor - mm (in)	18.6 (0.73)	30 (1.18)	20.2 (0.795)	27.8 (1.09)	34 (1.34)	36.3 (1.43)



HEDS 5500/5540

Optical Encoder

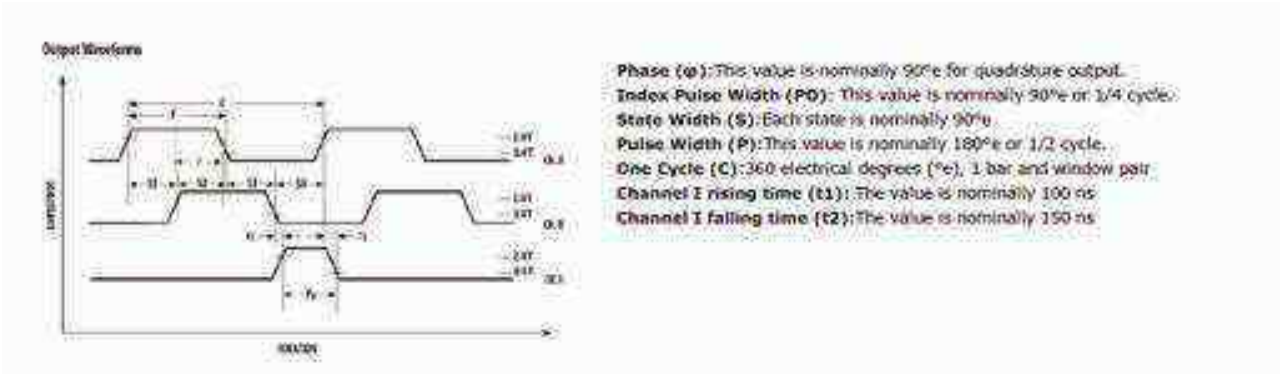


Characteristics @ 22°C			
1	Number of Lines Available	96 to 1024	LPR
2	Supply Voltage	5 ± 10%	Volt
3	Supply Current	Typcial 17 - 57	mA
4	Output Signal	2 channels, square wave in quadrature 3 Channels (with index)	CMOS
5	Electrical Phase Shift	90 ± 10	degree
6	Maximum Count Frequency	100	kHz
7	Operating Temperature Range:	-40 to +100	°C (°F)
8	Code Wheel Moment of Inertia	0.6 X 10 ⁻⁷	10 ⁻⁷ x kgm ²
9	Weight	17	g (oz)

Available on motor types	22N48	22N98	22V48	23GST	26N48	28LT12	28D11	28DT12
Length with motor - mm (in)	54.9 (2.16)	54.9 (2.16)	57.2 (2.25)	58.6 (2.31)	63 (2.48)	63.8 (2.51)	82.1 (3.23)	85.2 (3.35)

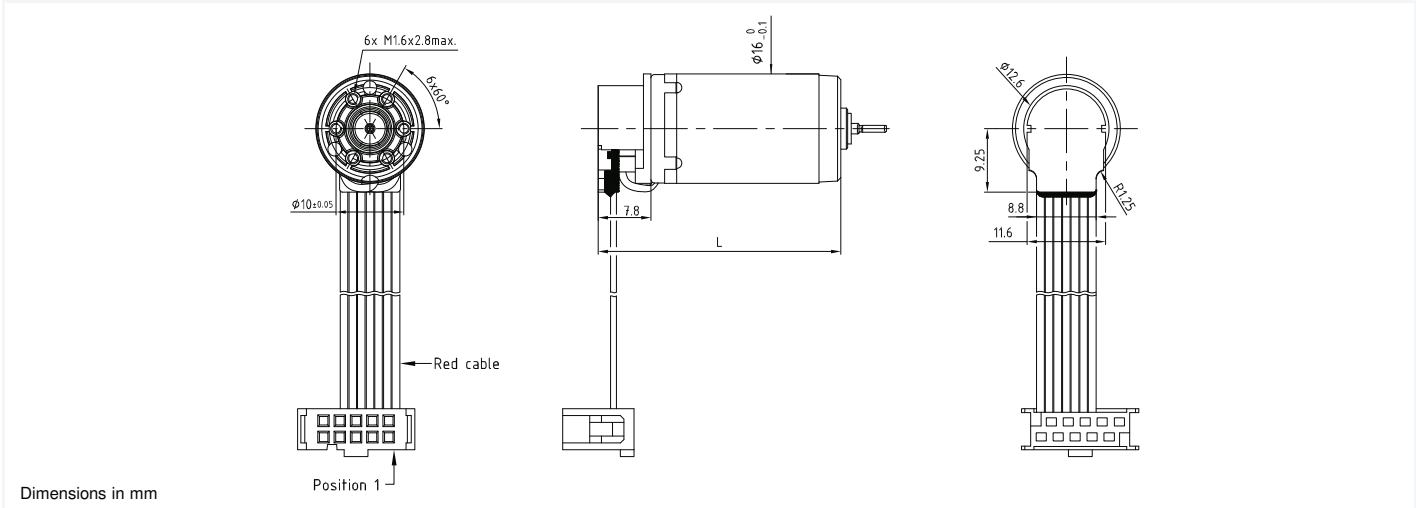
Available on motor types	35NT
Length with motor - mm (in)	83.45 (3.29)

*On request, encoder available on other motors. Encoder also available with line-driver.



MR2

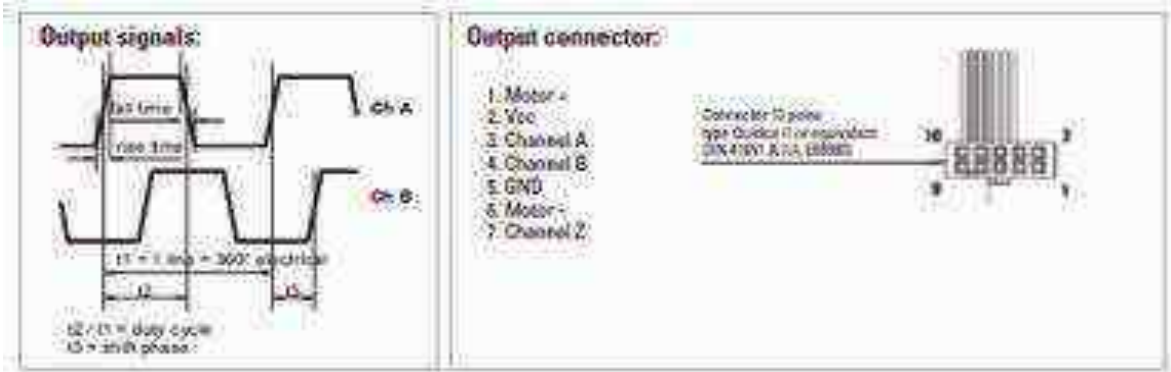
Magneto Resistive Encoder



Characteristics @ 22 °C			
1	Number of Lines Available	512, 500, 400, 256, 250, 200, 160, 128, 100, 80, 64, 50, 40, 32, 20, 16, 8, 4	LPR
2	Supply Voltage	5 ± 10%	Volt
3	Supply Current	Typical / Max	20/25
	Rise Time	60	ns
	Fall Time	60	ns
4	Maximum Count Frequency	1.28	MHz
5	Electrical Phase Shift	90 ± 45	degree
6	Duty Cycle	50 ± 15	%
7	Maximum Speed @ 512	37,500	rpm
8	Operating Temperature Range:	-25 to +85	°C (°F)
9	Weight	Varies by motor size. Contact us.	
			g (oz)

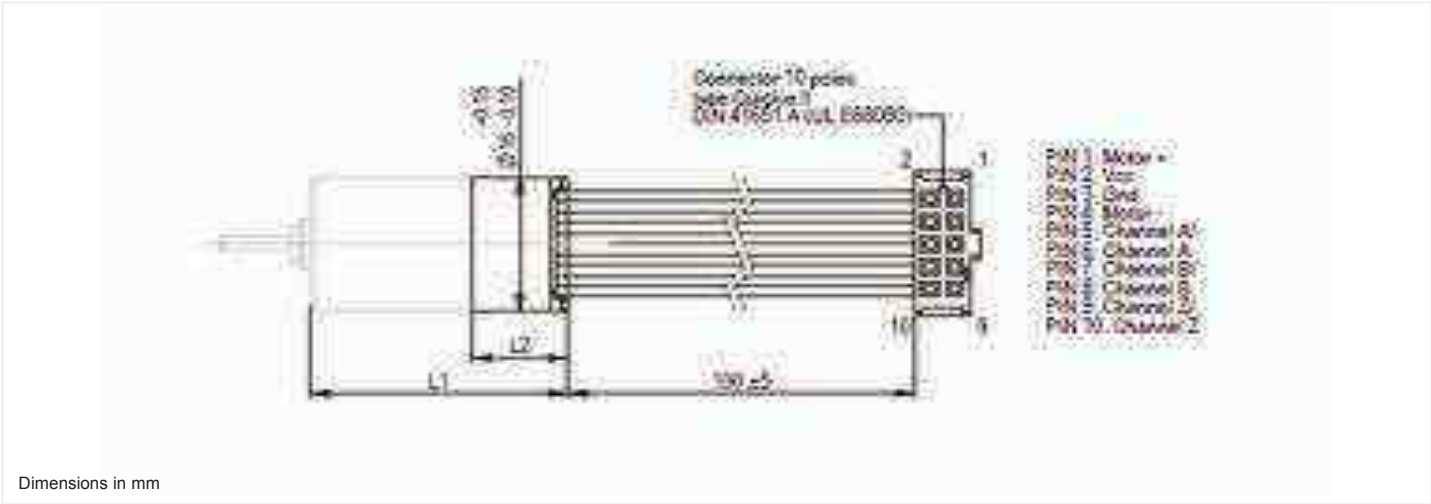
Available on motor types	12G88	13N88	16G88	16N48	16N98	17S98	17N98	22N48
Length with motor - mm (in)	33.8 (1.33)	34.35 (1.35)	35.8 (1.41)	33.2 (1.31)	33.2 (1.31)	23.9 (0.94)	31.1 (1.22)	39.35 (1.55)

Available on motor types	22N98	22V48	25GST
Length with motor - mm (in)	39.35 (1.55)	41.65 (1.64)	53.9 (2.12)



M Sense B

Magnetic Encoder with RS422 Line Driver



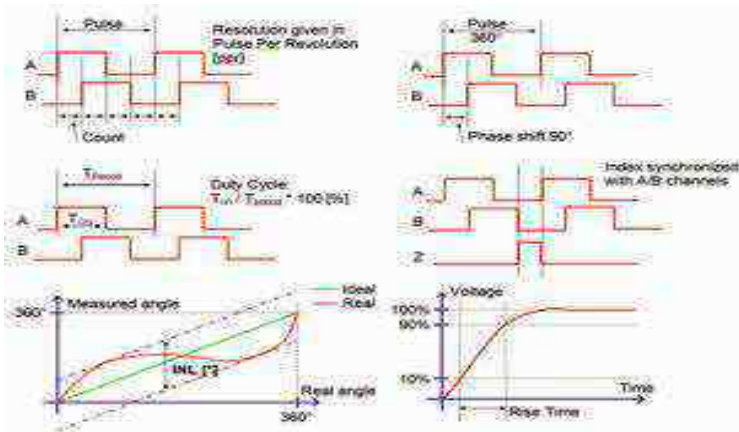
Characteristics @ 22°C & 5000 rpm				
1	Number of Lines Available		1024, 512, 256, 128..1	LPR
2	Supply Voltage		4.5 / 5.5	Volt
3	Supply Current	Typical / Max	16/23	mA
4	Rise/Fall time (CL=50pF)	Max	60	ns
5	Output Frequency		0.5	MHz
6	Electrical Phase Shift	90 ± 45 up to 256 ppr	90 ± 75 for 512 & 1024 ppr	degree
7	Duty Cycle	50 ± 15 up to 256 ppr	50 ± 25 for 512 & 1024 ppr	%
8	INL (Integral Non Linearity)	Max	1.5	degree
9	Maximum Speed @ 1024ppr	Max	30,000	rpm
10	Line Driver Parameters		4mA / 10MHz (default configuration)	
11	Cable Type		AWG28 Ribbon cable pitch 1.27mm	
12	Operating Temperature Range	Min / Max	-40 to +100	°C
13	Weight		Varies by motor size. Contact us.	
			g (oz)	

Available on motor types	16S78	16N48	16N98	17N78	22S48	22N48	22N98
L1 Length with motor - mm (in)	27.1 (1.07)	27.1 (1.07)	36.4 (1.43)	34.4 (1.35)	36.6 (1.44)	46.4 (1.83)	46.4 (1.83)
L2 Length of encoder - mm (in)	10 (0.39)	10 (0.39)	10 (0.40)	10 (0.40)	9.45 (0.38)	13.1 (0.52)	13.1 (0.52)

Available on motor types	30GT	P110	23GST	25GST	35NT	35GLT
L1 Length with motor - mm (in)	**	32.4 (1.28)	**	**	**	**
L2 Length of encoder - mm (in)	**	13.6 (0.54)	**	**	**	**

Available on motor types	16ECP36	16ECP52	22DCP
L1 Length with motor - mm (in)	**	**	**
L2 Length of encoder - mm (in)	**	**	**

** Available on request



Encoder performance option available on request (contact us):

Optional Line driver type: 4mA-10MHz (default) / 50mA-10MHz / 50mA-300kHz / 20mA-3MHz. 4mA-10MHz is recommended for use as single ended outputs. Other options are dedicated for use of differential outputs.

Other parameters can be customized: Index synchronization mode, minimal edge distance, direction of rotation, low current mode and other.

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