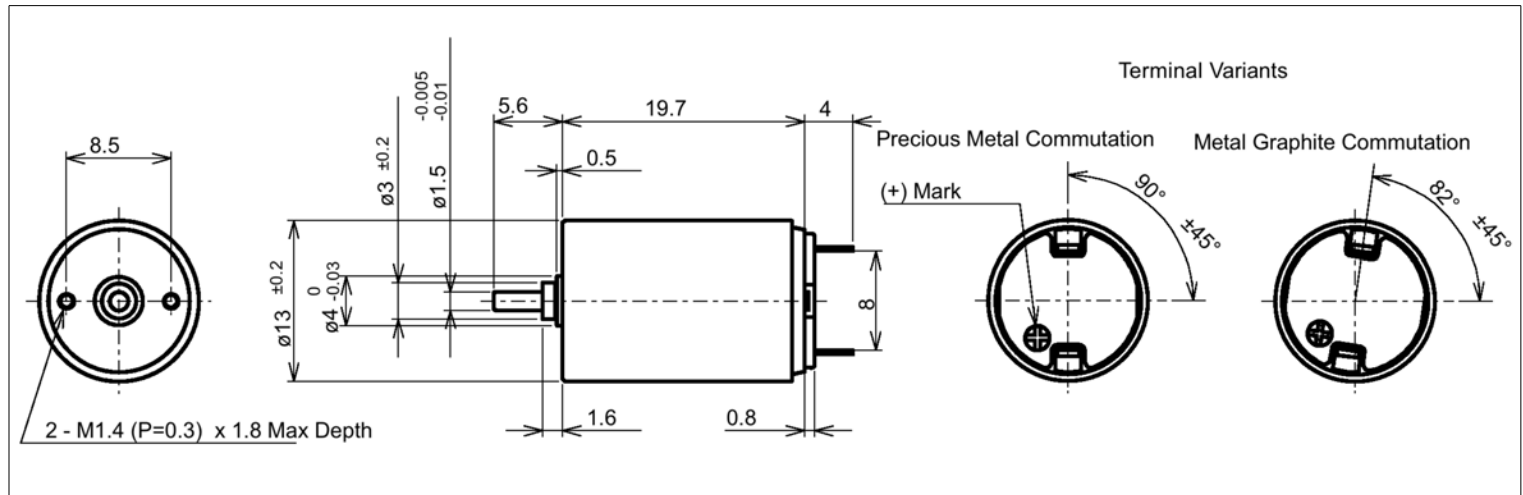


# Coreless DC Motor - 13 mm Ø x 20



C13P03SX010 0.84 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	3.0 Volts	3.0 Volts	3.0 Volts
No-Load Speed	9,800 rpm	9,800 rpm	9,800 rpm
Stall Torque	3.4 mNm	35.0 gcm	0.48 oz-in
No-Load Current	0.040 Amps	0.040 Amps	0.040 Amps
Peak Output Power	0.84 Watts	0.84 Watts	0.84 Watts
Torque Constant	2.83 mNm/A	28.82 gcm/A	0.40 oz-in/A
Terminal Resistance	2.50 Ohms	2.50 Ohms	2.50 Ohms
Back-EMF Constant	0.30 V/krpm	0.30 V/krpm	0.30 V/krpm
Inductance	0.040 mH	0.040 mH	0.040 mH
Rotor Inertia	0.204 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.204 gm cm <sup>2</sup>	0.029 x10 <sup>-4</sup> oz in sec <sup>2</sup>
Mechanical Time Constant	6.4 msec	6.4 msec	6.4 msec
Slope of Speed/Torque Curve	2,890.0 rpm/mNm	280.0 rpm/gcm	20,408.0 rpm/oz-in
Speed Constant	3,379 rpm/Volt	3,379 rpm/Volt	3,379 rpm/Volt
Motor Constant	1.79 mNm/√Watt	18.22 gcm/√Watt	0.25 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 7,900 rpm	0.41 Watts	0.41 Watts	0.41 Watts
Rated Torque @ 7,900 rpm	0.8 mNm	8.4 gcm	0.12 oz-in
Rated Current @ 7,900 rpm	0.330 Amps	0.330 Amps	0.330 Amps

Part Number: How to Order C13P03SX010 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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Commutation Type: Manufactured under a Certified ISO  
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RoHS Compliant

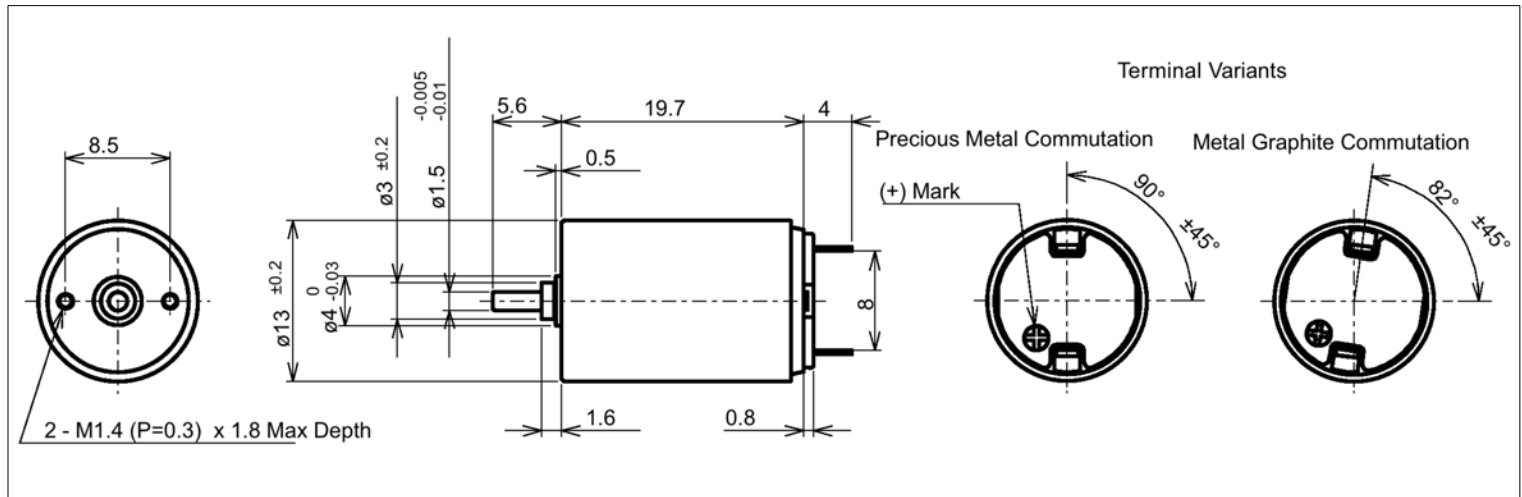
Preliminary - January 2012 Specifications Subject to change without notice

# Coreless DC Motor - 13 mm Ø x 20



C13P03SX000 0.56 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	3.0 Volts	3.0 Volts	3.0 Volts
No-Load Speed	7,400 rpm	7,400 rpm	7,400 rpm
Stall Torque	3.0 mNm	30.0 gcm	0.42 oz-in
No-Load Current	0.020 Amps	0.020 Amps	0.020 Amps
Peak Output Power	0.56 Watts	0.56 Watts	0.56 Watts
Torque Constant	3.77 mNm/A	38.48 gcm/A	0.53 oz-in/A
Terminal Resistance	3.80 Ohms	3.80 Ohms	3.80 Ohms
Back-EMF Constant	0.40 V/krpm	0.40 V/krpm	0.40 V/krpm
Inductance	0.080 mH	0.080 mH	0.080 mH
Rotor Inertia	0.236 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.236 gm cm <sup>2</sup>	0.033 x10 <sup>-4</sup> oz in sec <sup>2</sup>
Mechanical Time Constant	6.3 msec	6.3 msec	6.3 msec
Slope of Speed/Torque Curve	2,484.1 rpm/mNm	246.7 rpm/gcm	17,541.9 rpm/oz-in
Speed Constant	2,531 rpm/Volt	2,531 rpm/Volt	2,531 rpm/Volt
Motor Constant	1.94 mNm/√Watt	19.74 gcm/√Watt	0.27 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 7,400 rpm	0.30 Watts	0.30 Watts	0.30 Watts
Rated Torque @ 7,400 rpm	0.8 mNm	8.1 gcm	0.11 oz-in
Rated Current @ 7,400 rpm	0.230 Amps	0.230 Amps	0.230 Amps

Part Number: How to Order C13P03SX000 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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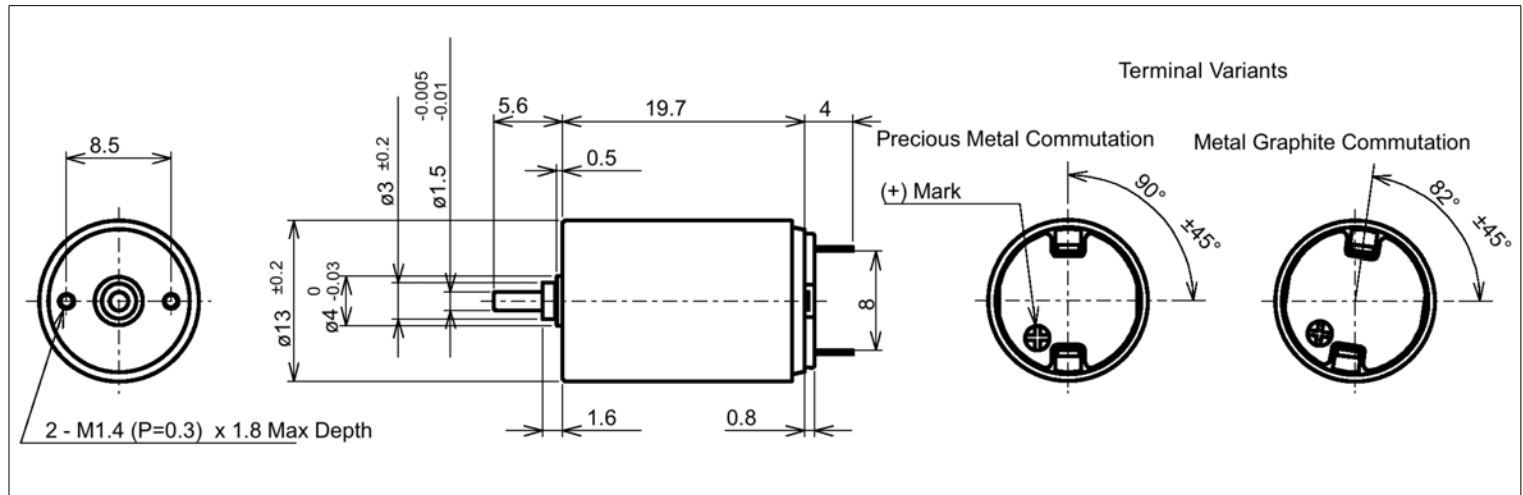
Preliminary - January 2012 Specifications Subject to change without notice

# Coreless DC Motor - 13 mm Ø x 20



C13P06SX000 1.53 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	6.0 Volts	6.0 Volts	6.0 Volts
No-Load Speed	12,600 rpm	12,600 rpm	12,600 rpm
Stall Torque	4.8 mNm	48.0 gcm	0.67 oz-in
No-Load Current	0.027 Amps	0.027 Amps	0.027 Amps
Peak Output Power	1.53 Watts	1.53 Watts	1.53 Watts

Torque Constant	4.43 mNm/A	45.22 gcm/A	0.63 oz-in/A
Terminal Resistance	5.60 Ohms	5.60 Ohms	5.60 Ohms
Back-EMF Constant	0.46 V/krpm	0.46 V/krpm	0.46 V/krpm
Inductance	0.110 mH	0.110 mH	0.110 mH
Rotor Inertia	0.232 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.232 gm cm <sup>2</sup>	0.033 x10 <sup>-4</sup> oz in sec <sup>2</sup>

Mechanical Time Constant	6.6 msec	6.6 msec	6.6 msec
Slope of Speed/Torque Curve	2,652.2 rpm/mNm	262.5 rpm/gcm	18,728.4 rpm/oz-in
Speed Constant	2,154 rpm/Volt	2,154 rpm/Volt	2,154 rpm/Volt
Motor Constant	1.87 mNm/√Watt	19.11 gcm/√Watt	0.27 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 9,500 rpm	0.99 Watts	0.99 Watts	0.99 Watts
Rated Torque @ 9,500 rpm	1.4 mNm	14.2 gcm	0.20 oz-in
Rated Current @ 9,500 rpm	0.340 Amps	0.340 Amps	0.340 Amps

Part Number: How to Order C13P06SX000 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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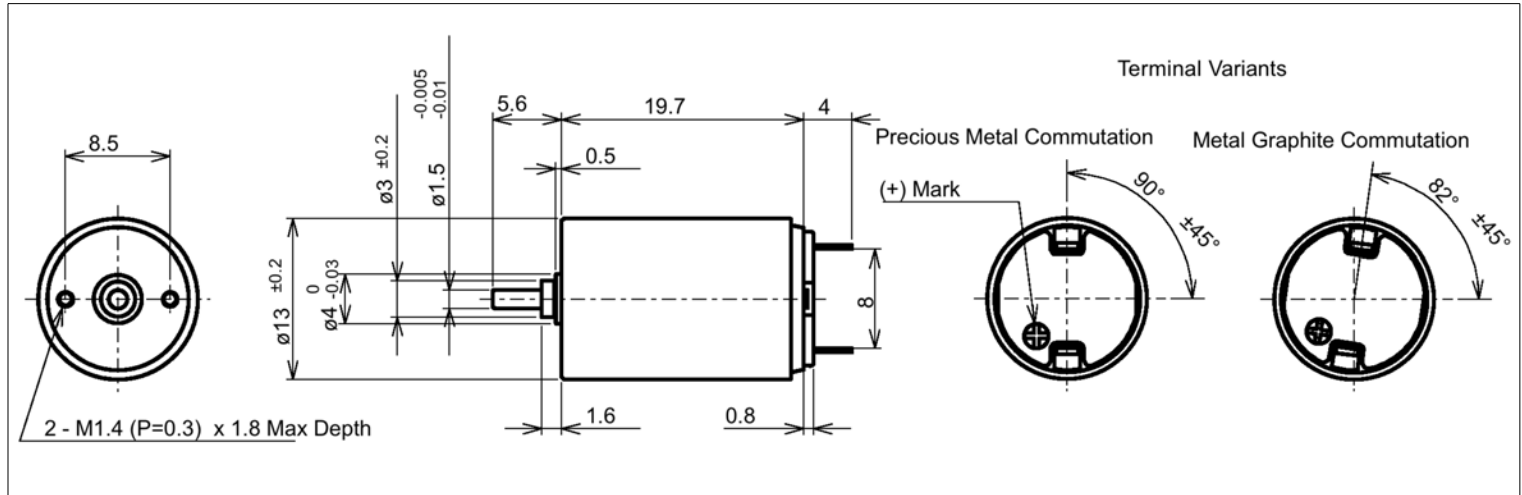
Preliminary - January 2012 Specifications Subject to change without notice

# Coreless DC Motor - 13 mm Ø x 20



C13P06SX010 1.05 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	6.0 Volts	6.0 Volts	6.0 Volts
No-Load Speed	10,500 rpm	10,500 rpm	10,500 rpm
Stall Torque	3.9 mNm	40.0 gcm	0.56 oz-in
No-Load Current	0.020 Amps	0.020 Amps	0.020 Amps
Peak Output Power	1.05 Watts	1.05 Watts	1.05 Watts
Torque Constant	5.31 mNm/A	54.14 gcm/A	0.75 oz-in/A
Terminal Resistance	8.10 Ohms	8.10 Ohms	8.10 Ohms
Back-EMF Constant	0.56 V/krpm	0.56 V/krpm	0.56 V/krpm
Inductance	0.140 mH	0.140 mH	0.140 mH
Rotor Inertia	0.229 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.229 gm cm <sup>2</sup>	0.032 x10 <sup>-4</sup> oz in sec <sup>2</sup>
Mechanical Time Constant	6.6 msec	6.6 msec	6.6 msec
Slope of Speed/Torque Curve	2,669.8 rpm/mNm	262.5 rpm/gcm	18,852.8 rpm/oz-in
Speed Constant	1,799 rpm/Volt	1,799 rpm/Volt	1,799 rpm/Volt
Motor Constant	1.87 mNm/√Watt	19.02 gcm/√Watt	0.26 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 7,550 rpm	0.79 Watts	0.79 Watts	0.79 Watts
Rated Torque @ 7,550 rpm	1.3 mNm	13.5 gcm	0.19 oz-in
Rated Current @ 7,550 rpm	0.270 Amps	0.270 Amps	0.270 Amps

Part Number: How to Order C13P06SX010 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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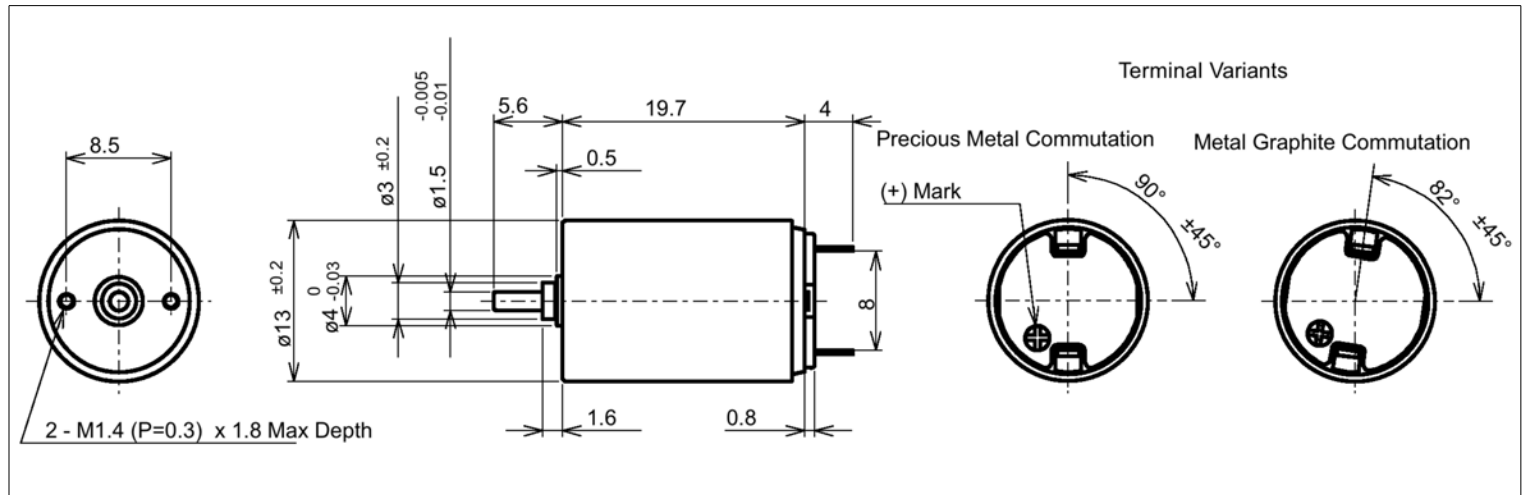
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# Coreless DC Motor - 13 mm Ø x 20



C13P06SX020 0.70 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	6.0 Volts	6.0 Volts	6.0 Volts
No-Load Speed	8,600 rpm	8,600 rpm	8,600 rpm
Stall Torque	3.2 mNm	33.0 gcm	0.46 oz-in
No-Load Current	0.017 Amps	0.017 Amps	0.017 Amps
Peak Output Power	0.70 Watts	0.70 Watts	0.70 Watts
Torque Constant	6.44 mNm/A	65.67 gcm/A	0.91 oz-in/A
Terminal Resistance	12.00 Ohms	12.00 Ohms	12.00 Ohms
Back-EMF Constant	0.67 V/krpm	0.67 V/krpm	0.67 V/krpm
Inductance	0.220 mH	0.220 mH	0.220 mH
Rotor Inertia	0.223 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.223 gm cm <sup>2</sup>	0.032 x10 <sup>-4</sup> oz in sec <sup>2</sup>
Mechanical Time Constant	6.5 msec	6.5 msec	6.5 msec
Slope of Speed/Torque Curve	2,670.7 rpm/mNm	260.6 rpm/gcm	18,859.4 rpm/oz-in
Speed Constant	1,483 rpm/Volt	1,483 rpm/Volt	1,483 rpm/Volt
Motor Constant	1.86 mNm/√Watt	18.96 gcm/√Watt	0.26 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 8,600 rpm	0.38 Watts	0.38 Watts	0.38 Watts
Rated Torque @ 8,600 rpm	0.7 mNm	6.8 gcm	0.09 oz-in
Rated Current @ 8,600 rpm	0.120 Amps	0.120 Amps	0.120 Amps

Part Number: How to Order C13P06SX020 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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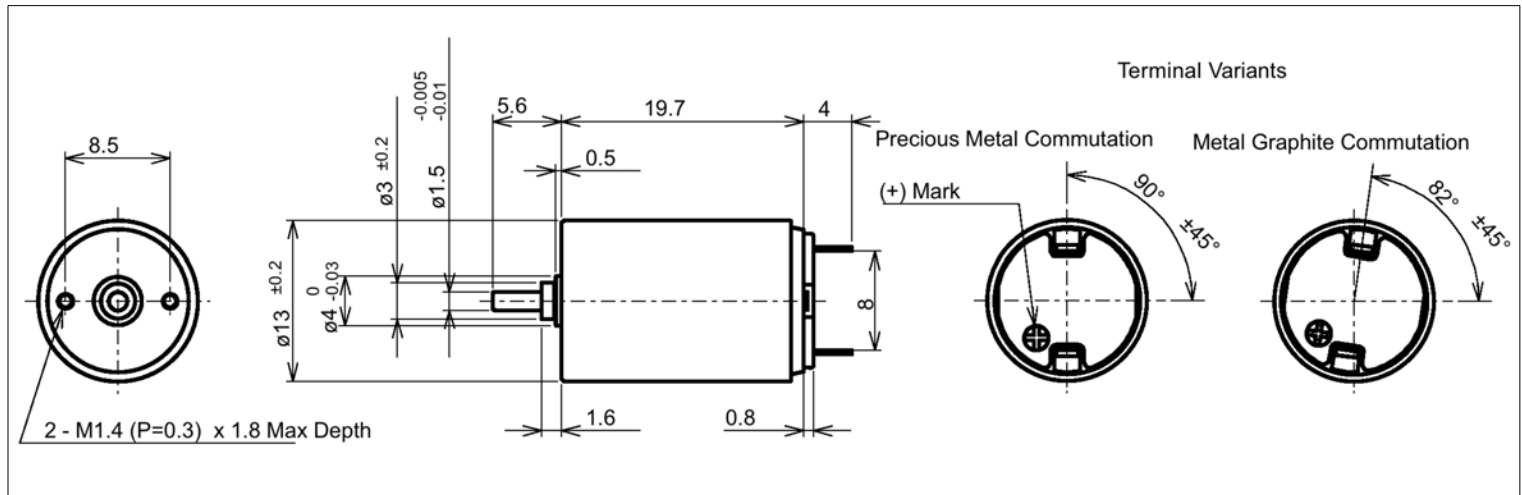
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# Coreless DC Motor - 13 mm Ø x 20



C13P12SX010 1.70 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	12.0 Volts	12.0 Volts	12.0 Volts
No-Load Speed	13,500 rpm	13,500 rpm	13,500 rpm
Stall Torque	5.0 mNm	51.0 gcm	0.70 oz-in
No-Load Current	0.020 Amps	0.020 Amps	0.020 Amps
Peak Output Power	1.70 Watts	1.70 Watts	1.70 Watts

Torque Constant	8.21 mNm/A	83.70 gcm/A	1.16 oz-in/A
Terminal Resistance	19.80 Ohms	19.80 Ohms	19.80 Ohms
Back-EMF Constant	0.86 V/krpm	0.86 V/krpm	0.86 V/krpm
Inductance	0.410 mH	0.410 mH	0.410 mH
Rotor Inertia	0.229 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.229 gm cm <sup>2</sup>	0.032 x10 <sup>-4</sup> oz in sec <sup>2</sup>

Mechanical Time Constant	6.7 msec	6.7 msec	6.7 msec
Slope of Speed/Torque Curve	2,713.8 rpm/mNm	264.7 rpm/gcm	19,163.4 rpm/oz-in
Speed Constant	1,163 rpm/Volt	1,163 rpm/Volt	1,163 rpm/Volt
Motor Constant	1.84 mNm/√Watt	18.81 gcm/√Watt	0.26 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 10,600 rpm	1.11 Watts	1.11 Watts	1.11 Watts
Rated Torque @ 10,600 rpm	1.3 mNm	13.4 gcm	0.19 oz-in
Rated Current @ 10,600 rpm	0.180 Amps	0.180 Amps	0.180 Amps

Part Number: How to Order C13P12SX010 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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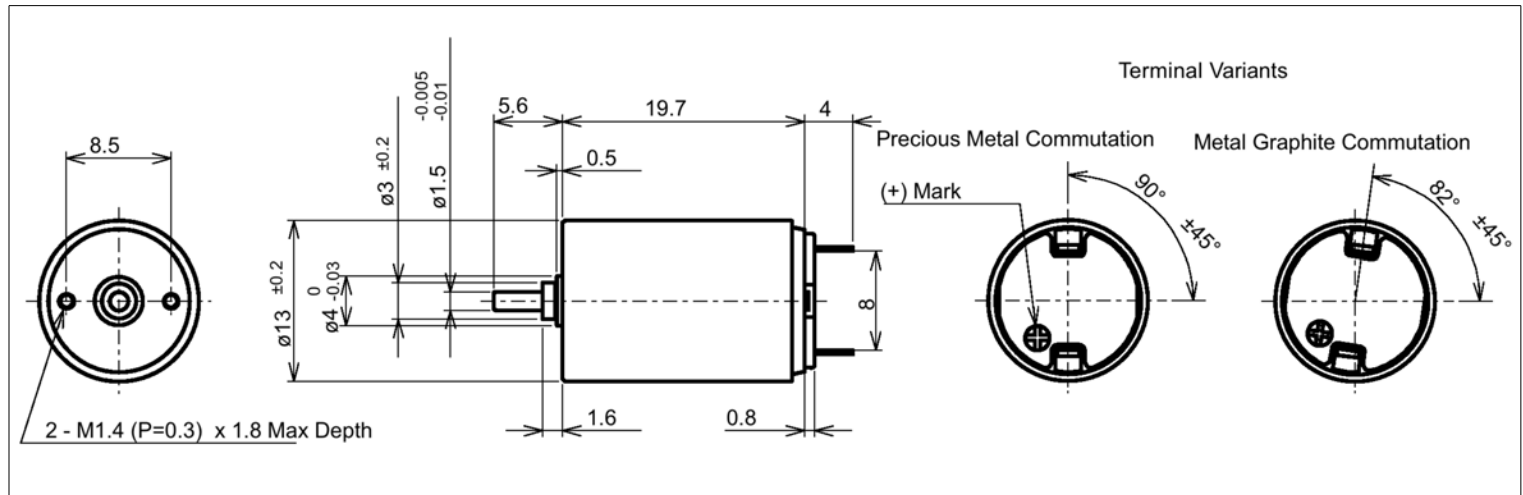
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# Coreless DC Motor - 13 mm Ø x 20



C13P12SX000 1.04 Watts Peak

Global Motion Products



Not to Scale - Dimensions in millimeters (mm)

Nominal Voltage	12.0 Volts	12.0 Volts	12.0 Volts
No-Load Speed	9,700 rpm	9,700 rpm	9,700 rpm
Stall Torque	4.2 mNm	43.0 gcm	0.60 oz-in
No-Load Current	0.010 Amps	0.010 Amps	0.010 Amps
Peak Output Power	1.04 Watts	1.04 Watts	1.04 Watts
Torque Constant	11.49 mNm/A	117.18 gcm/A	1.63 oz-in/A
Terminal Resistance	32.70 Ohms	32.70 Ohms	32.70 Ohms
Back-EMF Constant	1.20 V/krpm	1.20 V/krpm	1.20 V/krpm
Inductance	0.790 mH	0.790 mH	0.790 mH
Rotor Inertia	0.248 kg-m <sup>2</sup> x10 <sup>-7</sup>	0.248 gm cm <sup>2</sup>	0.035 x10 <sup>-4</sup> oz in sec <sup>2</sup>
Mechanical Time Constant	6.1 msec	6.1 msec	6.1 msec
Slope of Speed/Torque Curve	2,300.1 rpm/mNm	225.6 rpm/gcm	16,242.6 rpm/oz-in
Speed Constant	831 rpm/Volt	831 rpm/Volt	831 rpm/Volt
Motor Constant	2.01 mNm/√Watt	20.49 gcm/√Watt	0.28 oz-in/√Watt

Ratings below are at 60°C. At room temperature the ratings would be considerably higher.

Rated Power @ 7,000 rpm	0.73 Watts	0.73 Watts	0.73 Watts
Rated Torque @ 7,000 rpm	1.3 mNm	13.5 gcm	0.19 oz-in
Rated Current @ 7,000 rpm	0.125 Amps	0.125 Amps	0.125 Amps

Part Number: How to Order C13P12SX000 Characteristics - Specifications at 22 °C

Radial Load Rating	Radial Play	Max Temperature	65 °C
Radial Load Distance	Thrust Play ≤ 0.300 mm	Min Temperature	-10 °C
Axial Load	Magnet Type NdFeB	Max Winding Temp	100 °C
Press Fit Force - Max	Bearing Type Sleeve Bearings	Mass	13.6 grams
Gearbox Options	13 mm Ø Metal Planetary Gearbox P13 Series. 12 mm Ø G12 Series Precision Spur Gearbox.		
Encoder Options	Integral 3 Channel Magnetoresistive w/ Complementary Outputs & Line Drivers up to 256 Lines per		
Options - Other	Metal Graphite Commutation. Wire Leads and Connectors. Lubricants.		

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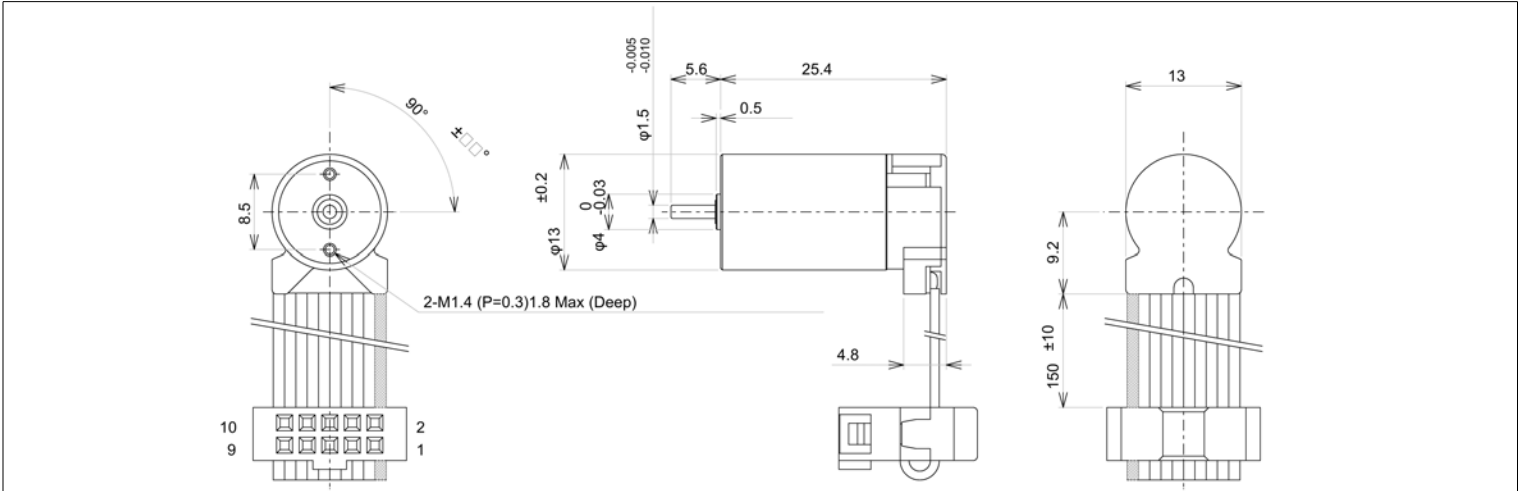
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RoHS Compliant

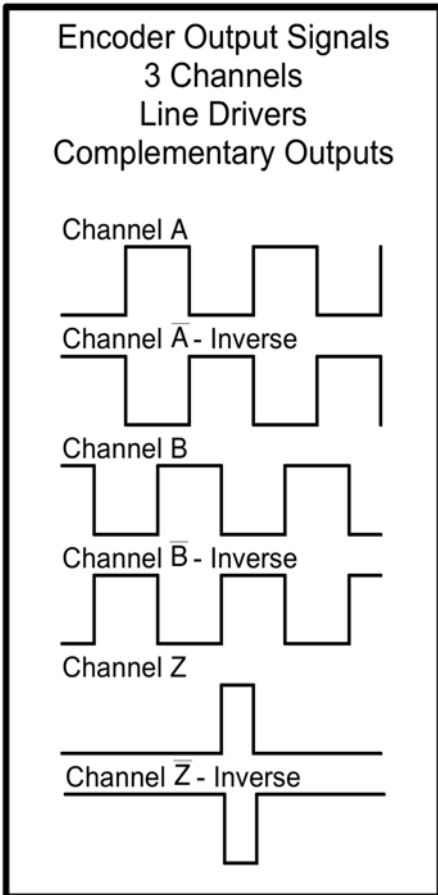
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# 13 mm Ø Encoder - 3 Channel

Series EM13xxxxZ50 - Line Drive - Compl. Out



Not to Scale - Dimensions in millimeters (mm)



Supply Voltage - Max	5.20 Volt
Supply Voltage - Min	4.75 Volt
Supply Current - Max	≤ 25 mA
Output Current - Max	≤ 5 mA
Max Temp - Operating	60°C
Min Temp - Operating	-10°C
Relative Humidity - Operating	20% to 85%

Above Drawing is for encoder mounted to 13 mm diameter x 20 mm long Coreless dc motor.

Encoder is compatible with 13 mm diameter x 20 mm and x 28 mm long Coreless dc motors.

Length increase for integrated encoder is 5.7 mm.

Counts per Track per Rev.  
32, 64, 128, 256

Maximum Frequency Response  
Corresponds to a motor rotor speed of 18,750 rpm

Pinout Details	
Connector Pin Number	Function
1	Motor +
2	Vcc
3	Ground
4	Motor -
5	Channel A - Inv
6	Channel A
7	Channel B - Inv
8	Channel B
9	Channel Z - Inv
10	Channel Z

Connector Details	
Manufacturer:	Molex
Housing Assembly:	54559-1011
Upper Housing:	54560-1011
Strain Relief:	54561-1011
Flat Band Cable:	AWG#28

**This Encoder Is Only Available Mounted To A Global Motion Products Coreless DC Motor. It Is Not Sold Separately.**

Line Drivers, Complementary Outputs, and Index Track can be ignored. Utilize only signals needed. This encoder employs a Magnetoresistive Effect Element. It can be integrated into a range of 13 mm diameter coreless dc motors that have options for either 12 mm Ø spur or 13 mm Ø planetary gearboxes.

Similar versions of this encoder are available for 10 and 16 mm/17 mm diameter coreless dc motors. A 16 mm diameter 2 Channel Optical version also is available. This encoder is not sold separately.

Characteristics and Specifications at 22°C

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**RoHS Compliant**