



PIEZOMOTION

INSTRUCTION MANUAL

Rotary Piezoelectric Motor
Evaluation Kit

Open Loop Series Rotary Motor
RBS Series

Including versions with Factory-Installed Encoder

Discover **affordable precision** with piezoelectric **innovation**.

Table of Contents

1.0 Introduction.....2

2.0 Properties.....5

3.0 Unpacking and Preparation.....5

4.0 Technical Specifications6

 4.1 Specification for RBS Series rotary motors.....6

 4.2 Mechanical Drawings of RBS Series rotary motors without encoder10

5.0 Operation and Control of the Piezo motor12

 5.1 Connecting the Power Supply12

 5.2 Connecting the Driver Board.....12

 5.3 Operation of the Motor and Driver Board12

 5.4 Open loop mode control12

 5.5 Stepping and Continuous Modes.....12

 5.6 Recommended settings to avoid overheating.....13

 5.7 Closing the loop for RBS motors with installed encoder.....14

6.0 Technical Support.....15

7.0 Warranty.....15

OEM Evaluation Kit Instruction Manual

1.0 Introduction

This manual covers the operational characteristics of the RBS Series of rotary piezo motors. The RBS Series represents a quantum leap in design of small size high-performance DC motors. Injection-molded using extremely durable, but light weight engineered reinforced thermoplastics, the RBS Series motors provides low cost with superior precision and ultrafast response/start-stop characteristics. Highly energy efficient, the RBS Series motors consume zero power in hold position while still providing significant torque. Available in a variety of configurations (including non-magnetic) they are the ideal choice for high volume demanding OEM applications where superior performance and economical unit cost are important factors.

The contents of this kit are intended to be used as an evaluation tool for engineers interested in learning more about the performance and operation of Piezo Motion's RBS Series piezoelectric motors (piezo motors). The RBS Series motors combine high performance and excellent quality with an affordable low cost. The main body of the piezo motor is molded using modern reinforced engineered thermoplastics and is aimed at OEM applications.

The electronic driver for the piezo motor is included in the kit, together with cables and a 12 VDC power supply.

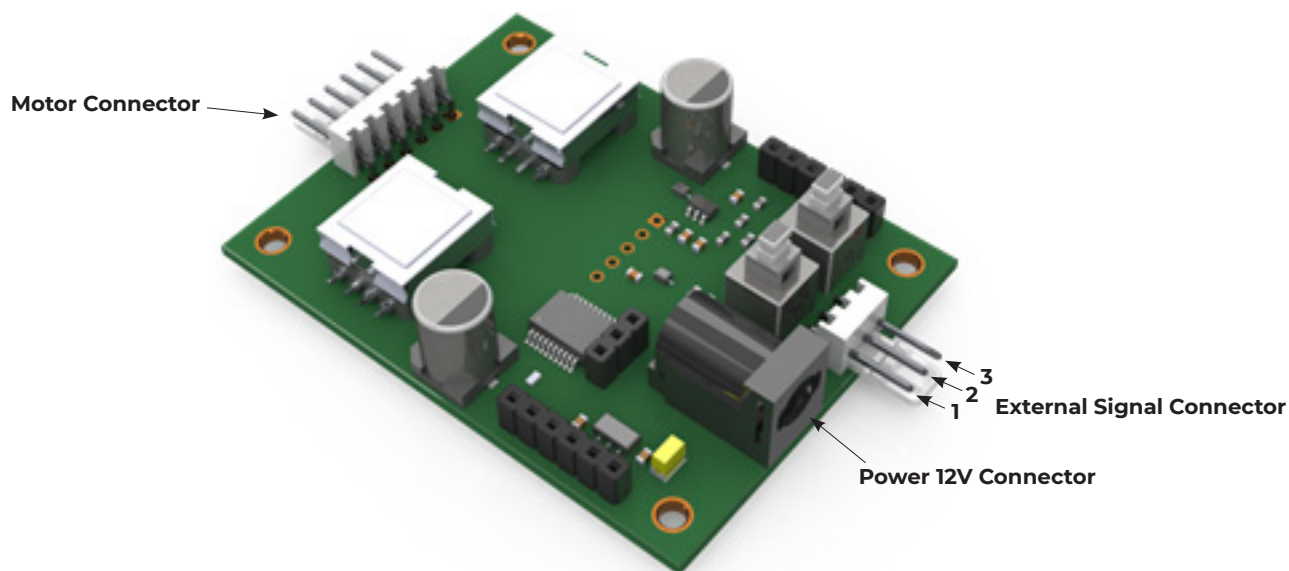


Figure 1. Electronic PCB Driver for RBS Piezomotors

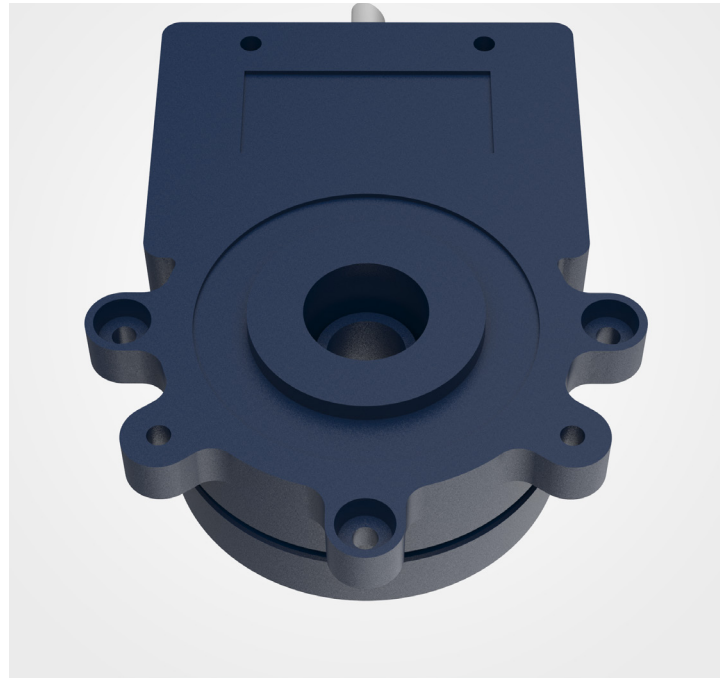
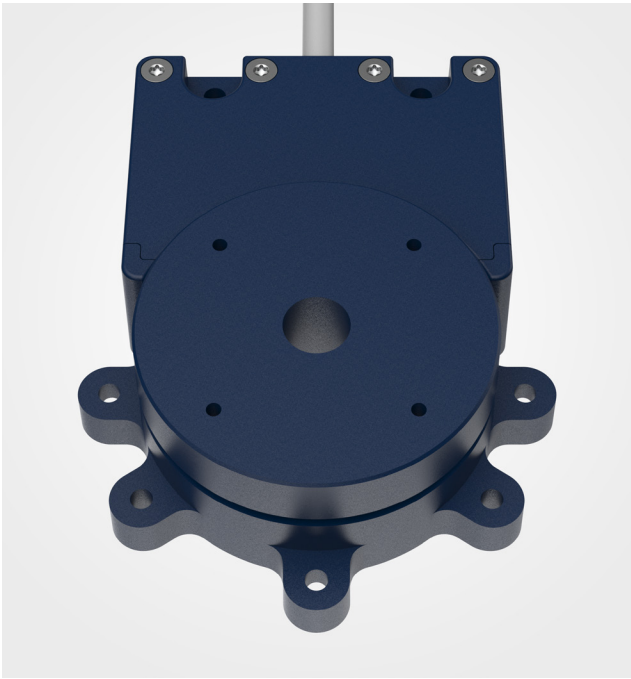


Figure 2. RBS Series Motors - (Hollow Shaft, front & rear)

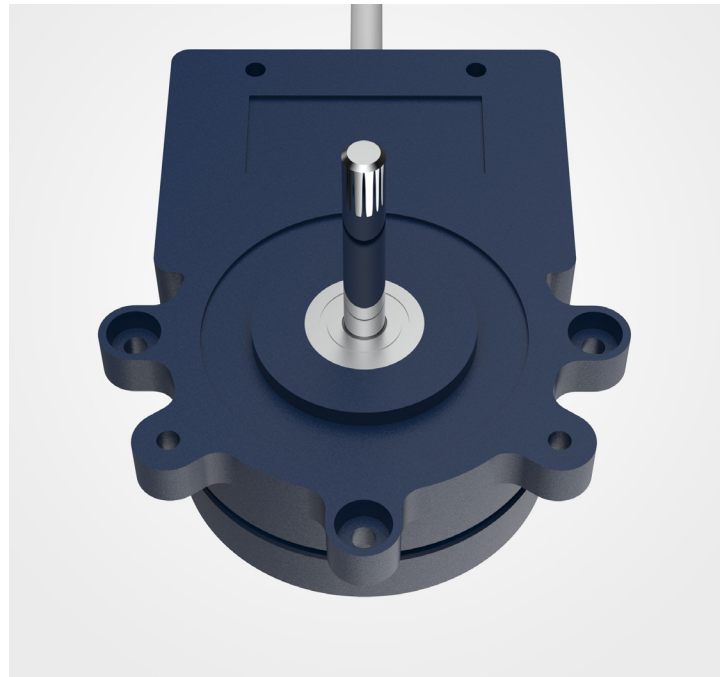
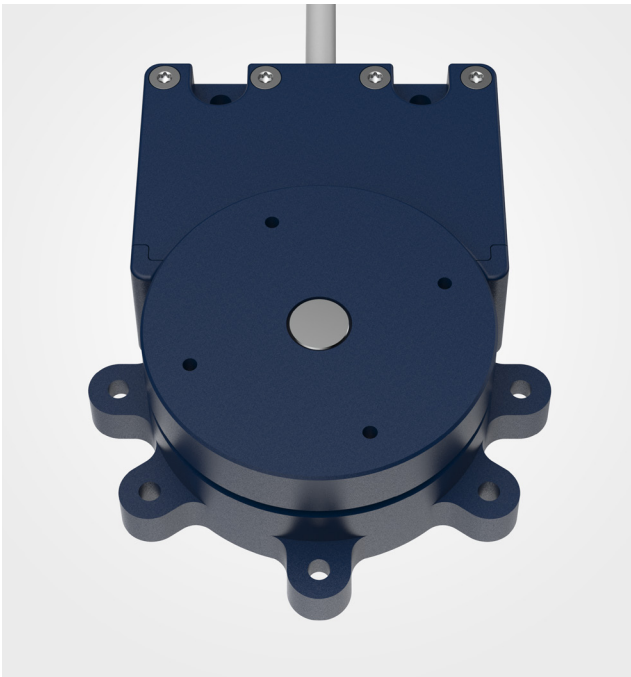


Figure 3. RBS Series Motors- (Solid Shaft, front & rear)

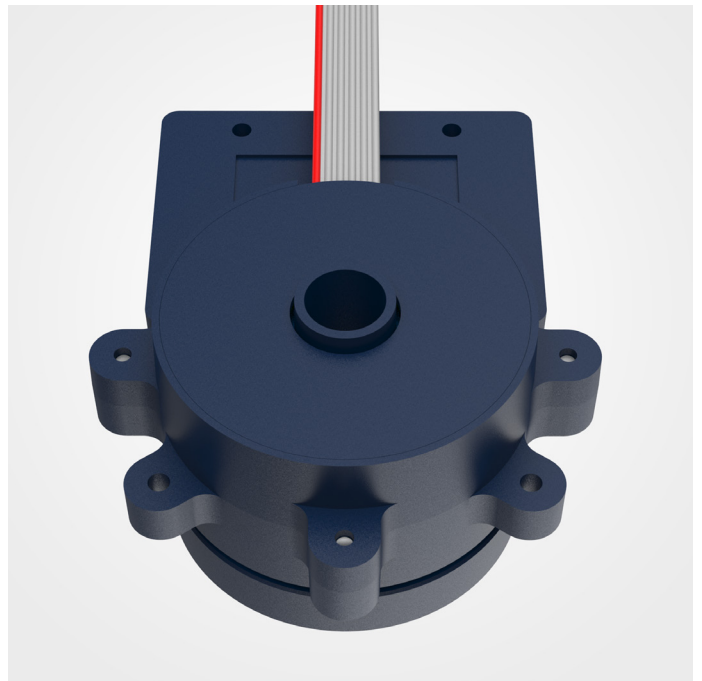
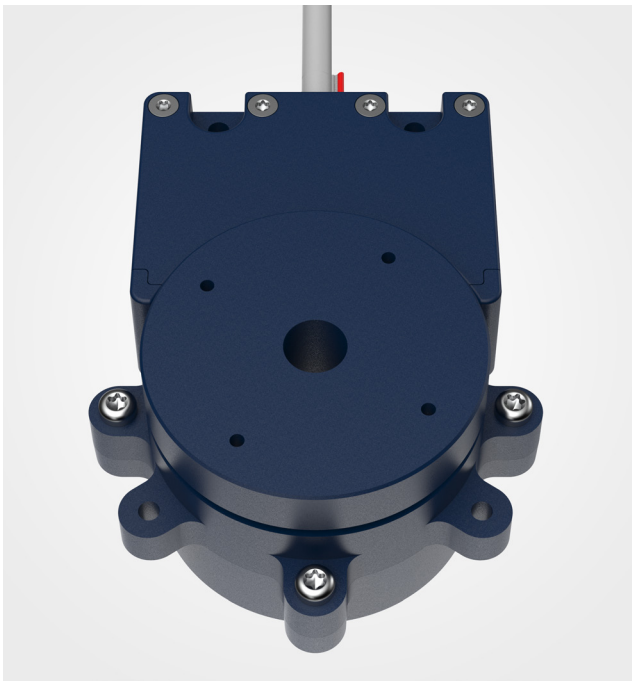


Figure 4. RBS Series Motors with Factory-Fitted Encoder - (Hollow Shaft, front & rear)

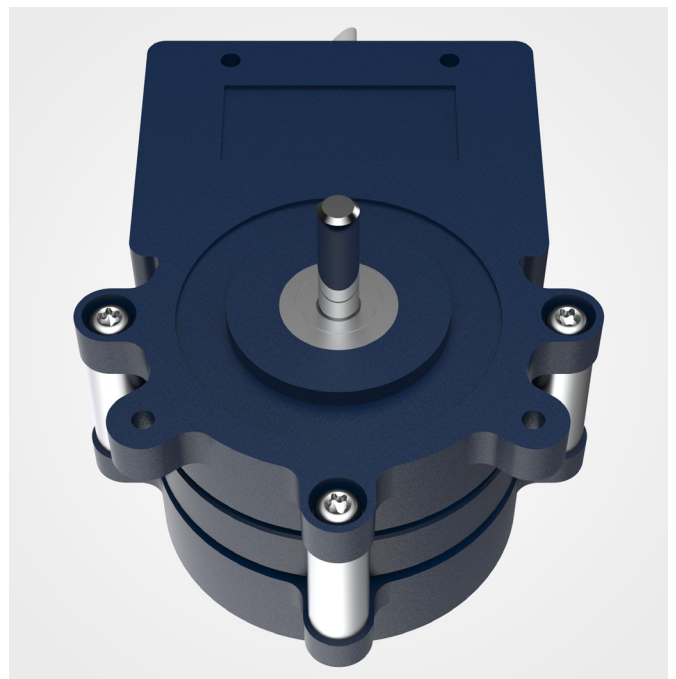
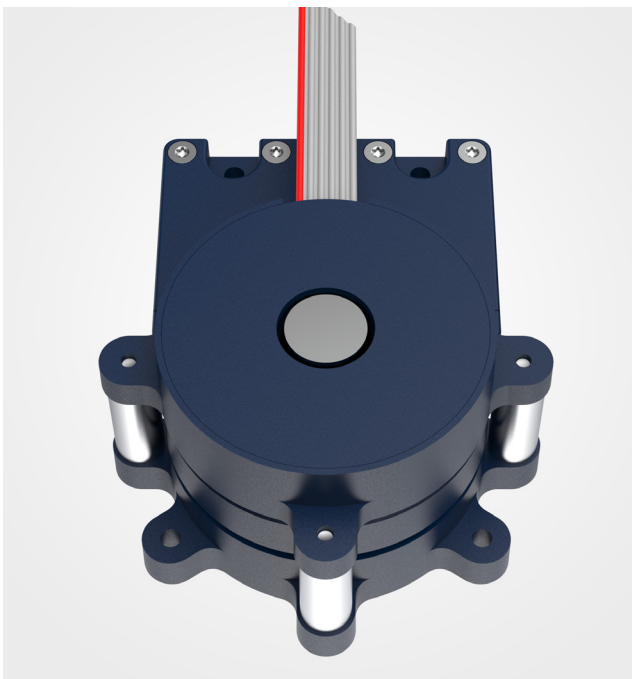


Figure 5. RBS Series Motors with Factory-Fitted Encoder - (Solid Shaft, front & rear)

2.0 Properties

Some of the unique properties of the RBS Series motors include:

- Modern reinforced engineered thermoplastic design provides reliability and low cost
- Superior precision and resolution
- Ultra-Fast response time with superior start-stop characteristics
- High torque for size
- Designed for direct drive applications
- Stepping and Continuous mode of operation
- Six orders of magnitude speed dynamic range
- When not energized, the motor serves as a brake and consumes zero power
- Silent operation in continuous mode
- Low voltage and decreased possibility for electrical arcing

3.0 Unpacking and Preparation

After unpacking the RBS series motors evaluation kit, check the contents against the items listed in the table below. If any items are missing contact Piezo Motion immediately for replacement parts.

DESCRIPTION
Piezo motor Model RBS Series motors (hollow shaft) or RBS Series motors (metal shaft)
Electronic Driver PCB
Interconnect cables
Power Supply 12V DC

Table 1 – Description

4.0 Technical Specifications

4.1 Specification for RBS Series rotary motors

Weight	68 g
Dimensions	66x52x20 mm
Nominal Outside Diameter	32 mm
Torque	>30 mN.m
Rotational Speed	>100 rpm
Driver Supply Voltage	12 V
Current Options	360 mA 360 mA
Driver Output Voltage	60 V
Response Time Range	30 μ s to 50 μ s
Minimum Angular Step	< 10 μ rad
Angular Hysteresis at Direction Change	< 10 arc.min
Operating Temperature Range	-20 to 80°C
Shaft Type	Solid Shaft
Shaft Length	15 mm
Shaft Style	Plain
Connection Type	Molex connector
Wire Length	30 cm
Encoder	No Encoder

Table 2 – RBS Series Solid Shaft Specifications without Encoder

Weight	68 g
Dimensions	66x52x20 mm
Nominal Outside Diameter	32 mm
Torque	>30 mN.m
Rotational Speed	>100 rpm
Driver Supply Voltage	12 V
Current Options	360 mA 360 mA
Driver Output Voltage	60 V
Response Time Range	30 μ s to 50 μ s
Minimum Angular Step	< 10 μ rad
Angular Hysteresis at Direction Change	< 10 arc.min
Operating Temperature Range	-20 to 80°C
Shaft Type	Hollow Shaft
Shaft Style	Plain
Connection Type	Flying lead
Wire Length	15 cm
Encoder	No Encoder

Table 3 – RBS Series Hollow Shaft Specifications without Encoder

Weight	76 g
Dimensions	66x52x31 mm
Minimum Controlled Linear	196.0 μ rad
Nominal Outside Diameter	32 mm
Minimum Controlled Angular Step	196.0 μ rad
Uni-directional Repeatability	± 1 arc-min
Torque	>30 mN.m
Rotational Speed	>100 rpm
Driver Supply Voltage	12 V
Current Options	360 mA 360 mA
Driver Output Voltage	60 V
Response Time Range	30 μ s to 50 μ s
Minimum Angular Step	< 10 μ rad
Angular Hysteresis at Direction Change	< 10 arc.min
Operating Temperature Range	-20 to 80°C
Shaft Type	Solid Shaft
Shaft Length	15 mm
Shaft Style	Plain
Connection Type	Molex connector
Wire Length	30 cm
Encoder	Optical

Table 4 – RBS Series Solid Shaft Specifications with Encoder

Weight	76 g
Dimensions	66x52x31 mm
Minimum Controlled Linear	196.0 μ rad
Nominal Outside Diameter	32 mm
Minimum Controlled Angular Step	196.0 μ rad
Uni-directional Repeatability	± 1 arc-min
Torque	>30 mN.m
Rotational Speed	>100 rpm
Driver Supply Voltage	12 V
Current Options	360 mA 360 mA
Driver Output Voltage	60 V
Response Time Range	30 μ s to 50 μ s
Minimum Angular Step	< 10 μ rad
Angular Hysteresis at Direction Change	< 10 arc.min
Operating Temperature Range	-20 to 80°C
Shaft Type	Hollow Shaft
Shaft Style	Plain
Connection Type	Flying lead
Wire Length	15 cm
Encoder	Optical

Table 5 – RBS Series Hollow Shaft Specifications with Encoder

4.2. Mechanical Drawings of RBS Series rotary motors without encoder

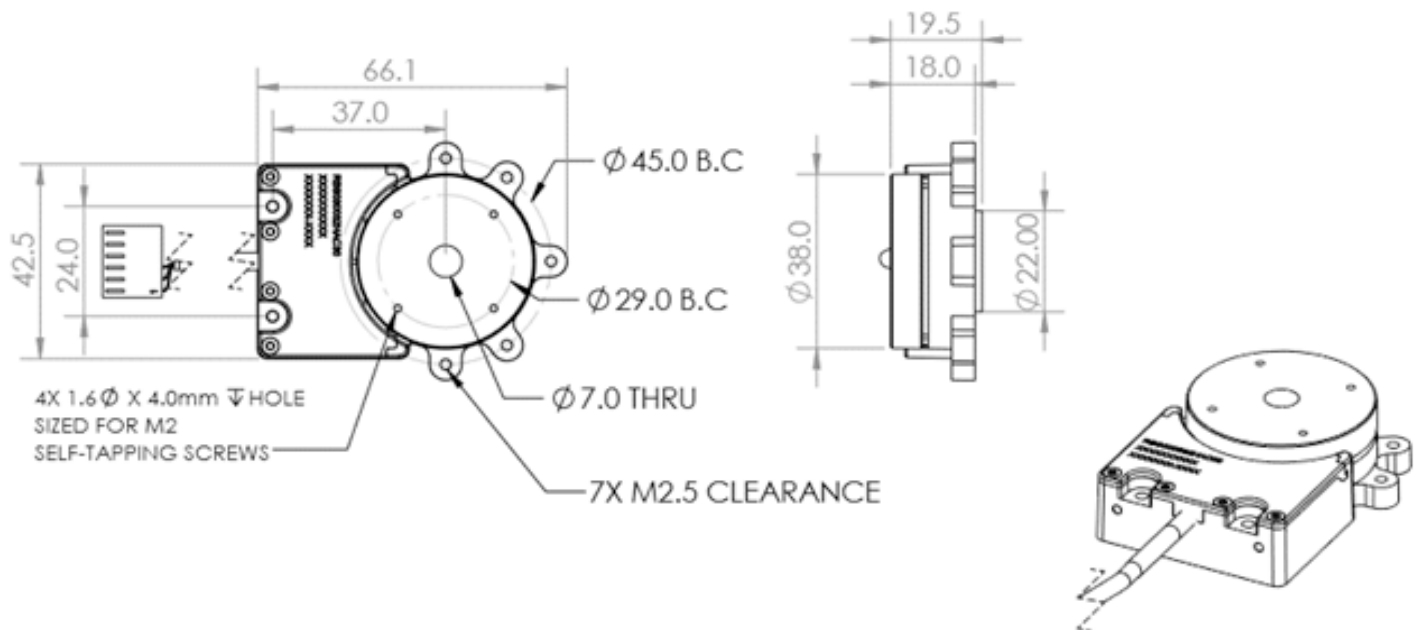


Figure 6 – Mechanical drawing (mm) of RBS Hollow Shaft Rotary Motor without Encoder

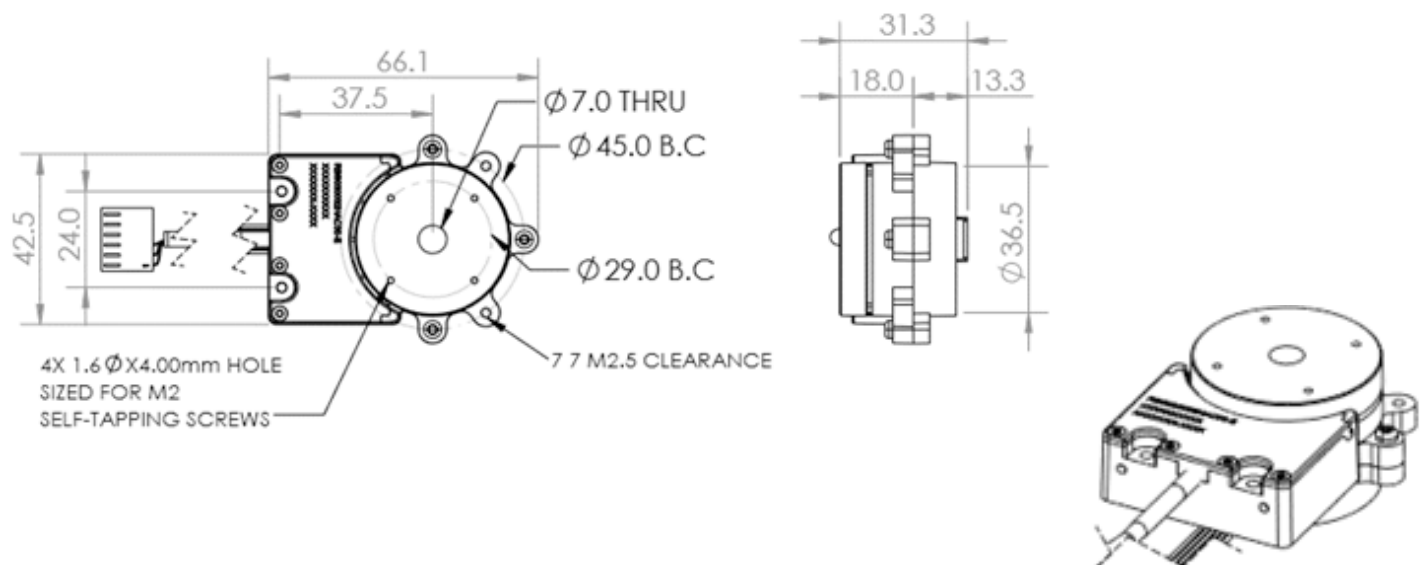


Figure 7 – Mechanical drawing (mm) of RBS Hollow Shaft Rotary Motor with Installed Encoder

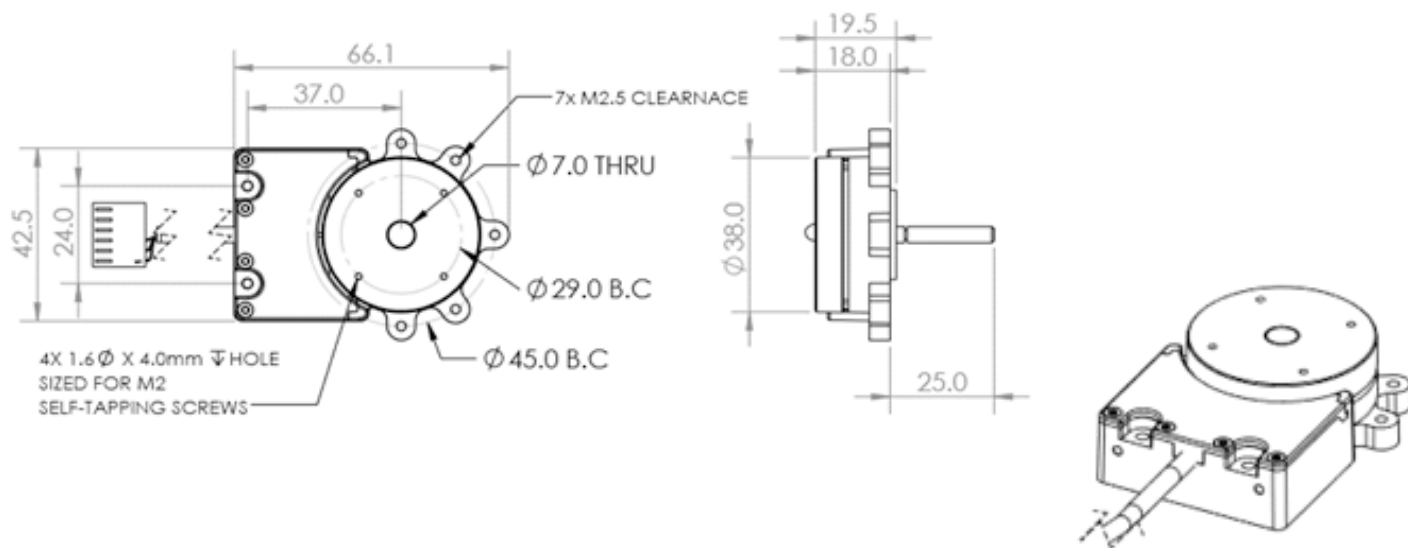


Figure 8 – Mechanical drawing (mm) of RBS Solid Shaft Rotary Motor without Encoder

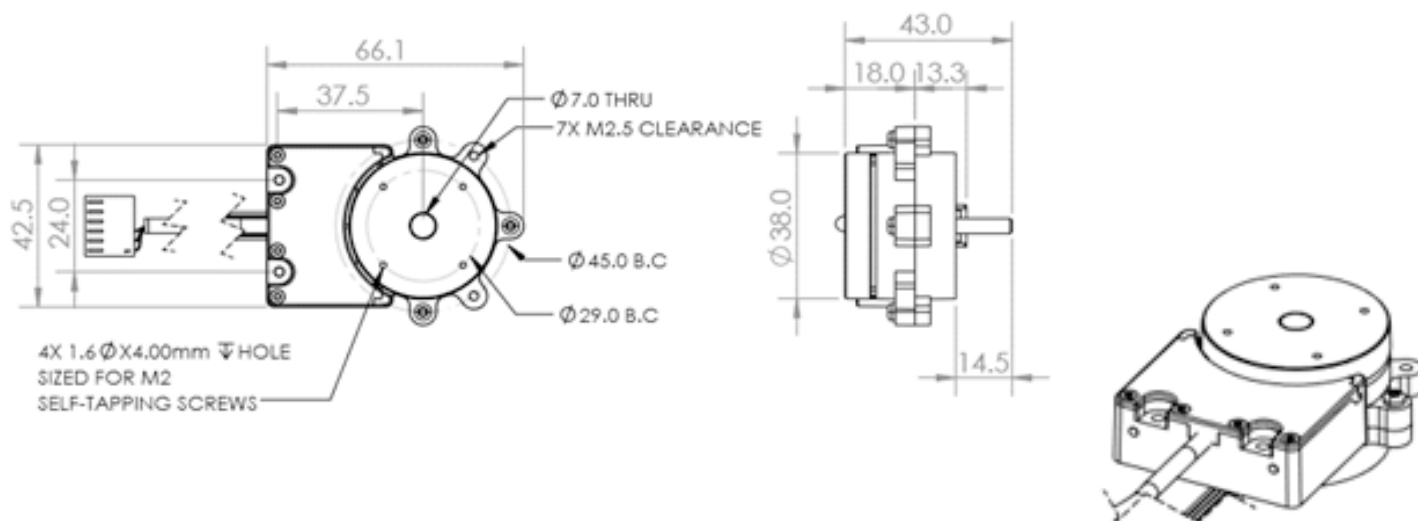


Figure 9 – Mechanical drawing (mm) of RBS Solid Shaft Rotary Motor with Installed Encoder

5.0 Operation and Control of the Piezo motor

5.1 Connecting the Power Supply

Connect the 12 VDC Power Supply to the Power Supply Connector located on the electronic driver PCB (Figure 1). Connect the other end of the Power Supply to an appropriate wall power socket.

5.2 Connecting the Driver Board

The piezo motor connects to the driver board by a connector on the end of the motor wire. This connector mates with the corresponding connector on the electronic driver PCB. The connectors can only be joined in one possible orientation. Press the connector gently in place so that it is flush with the edges of the receptacle on the driver PCB.

5.3 Operation of the Motor and Driver Board

The electronic driver PCB generates the drive signals required by the piezo motor. Motion is created causing the rotor to rotate. The design enables travel in both directions. Manual control of rotation is achieved by pushing alternatively the two buttons on the driver board.

5.4 Open loop mode control

The driver board can be controlled using an external signal source PWM (Pulse Width Modulation) mode. Control signals are applied to Pin **1** or Pin **2** on the External Signal Connector (**1,2,3**) Fig. 1; depending on the desired direction of travel. Pin **3** is the common wire. The unused wire must be held at TTL high or be left open. The control signals applied to Pins **1** or **2** must be TTL compatible. A “high” level (1.8 to 12 Volts) disables travel, a “low” level (0 to 0.8 Volts) enables travel.

5.5 Stepping and Continuous Modes

The mode of travel, stepping or continuous, depends on the type of signal applied to the External Signal Connector (**1,2,3**) Fig. 1. A constant “low” level (D.C.) signal will result in continuous motion at maximum speed. A pulse or pulse train will result in stepping operation.

In the stepping mode (PWM mode), the size of each step is determined by the pulse duration, and the speed of travel is determined by the pulse repetition rate. The minimum pulse duration is around 30 μ s. The maximum repetition rate F, measured in Hertz, is determined by the Dynamic range of the piezo motor and it is 4 kHz for all PIEZO MOTION rotary motors.

Example PWM Control Setting for Minimum Step (approx. 0.04 μm)

- Set Pulse Duration to between 30 μs - 40 μs
- Set Frequency to between 3 kHz - 4 kHz

Example setting for stepping (PWM) mode operation with 50% duty cycle

- Set repetition rate/frequency = 100 Hz (period of 10 ms)
- Set pulse duration = 5 ms.
- Duty cycle = 50%.

5.6 Recommended settings to avoid overheating

Piezo Motion's range of piezomotors are designed for precise control applications using a duty cycle. They are not designed for prolonged operation in Continuous (non-stepping) Mode, which can lead to overheating of the motor and possible internal damage not protected under warranty.

To avoid overheating of the motor please follow the guidelines in the table below and ensure that motion control settings for Continuous Mode and/or Stepping (PWM) Mode are within the limits specified in the table below.

For applications requirements exceeding the recommended guideline, please contact Piezo Motion's Technical Support.

Model/Series #	Max. Operating Power (W)	Max. Operating Power (W)	Recommended PWM Duty Cycle	Maximum Duration in Continuous Mode
RBS Series	4.32 W	1.8W	40%	30s
LBS004	4.2 W	1.7W	40%	20s
LCS004	4.2 W	1.7W	40%	20s
LCS010 (10N)	19.2 W	5.8W	30%	15s
RAS(300mA)	1.5 W	0.5 W	30%	10 sec.
RAS(100mA)	0.5 W	0.25 W	50%	30 sec.
RAS(50mA)	0.25 W	0.13 W	50%	60 sec.
LAS(100mA)	0.5 W	0.25 W	50%	30 sec.

Table 6 – Recommended Guidelines for Motion Control.

5.7 Closing the loop for RBS motors with Piezo Motion installed encoder

For RBS motors with Piezo Motion installed encoder, the user can close the loop by using the feedback signals from the encoder connector as shown in Figure 13.

The model of the encoder is PX04S 30-500, iC-PX3212 from iC Hous. The rotary encoder has a resolution of 196 μ rad (32,000 PPR) after interpolation and quadrature detection.

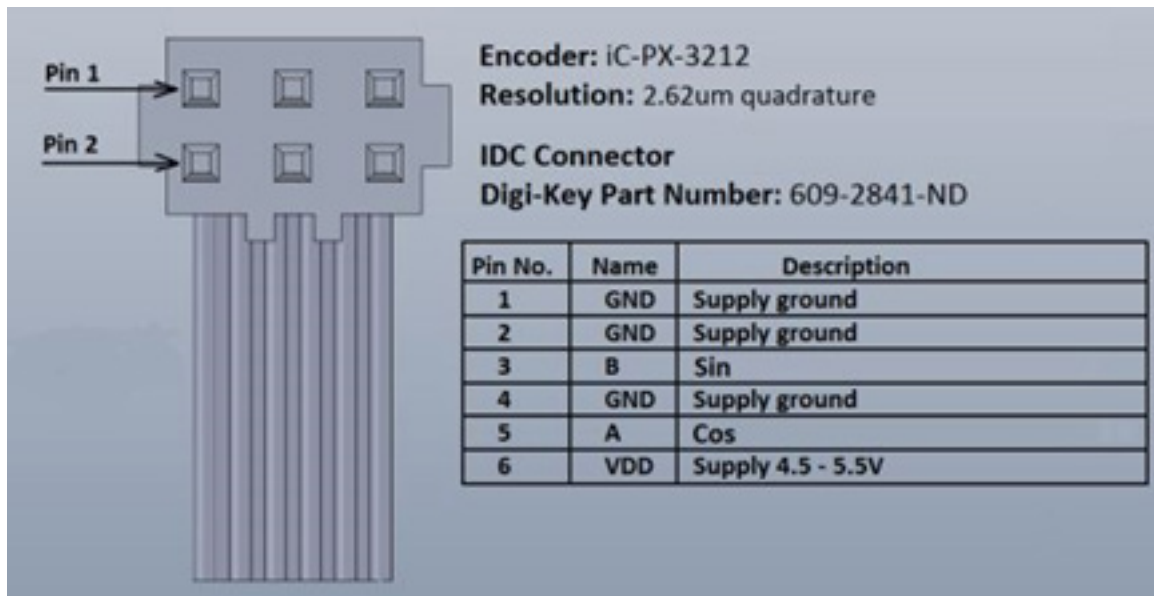


Figure 10 – Pinout of the Piezo Motion installed encoder connector for RBS motors.

6.0 Technical Support

Technical support is available from 9 AM to 5.30 PM U.S. Eastern Time. Please refer to contact information at end of manual.

7.0 Warranty

All sales and deliveries are made exclusively on the basis of our general Terms and Conditions of Business. These are available to view and download on the Piezo Motion homepage at <http://piezomotion.com/terms-and-conditions/>

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