PIEZOMOTION

INSTRUCTION MANUAL

Linear Piezoelectric Motor
Evaluation Kit

Open Loop Series Linear Motor
Models: LBS004-E | LCS004-E
Including versions with Factory-Installed Encoder

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

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LBS and LCS Series Motors OEM Evaluation Kit Instruction Manual

1.0 Introduction

The LBS & LCS series of linear piezo motors 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 LBS & LCS series provide low cost with superior precision and ultrafast response/start-stop characteristics. Highly energy efficient, the LBS & LCS series consume zero power in hold position while still providing significant force. Available in a variety of configurations (including non-magnetic) the LBS & LCS series is the ideal choice for high volume demanding OEM applications where superior performance and economical unit cost are important factors.

The contents of this evaluation 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 LBS & LCS series linear piezoelectric motors (piezo motors). The LBS & LCS series 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 PCB for the piezo motor is included in the kit, together with cables and a 12 VDC power supply.

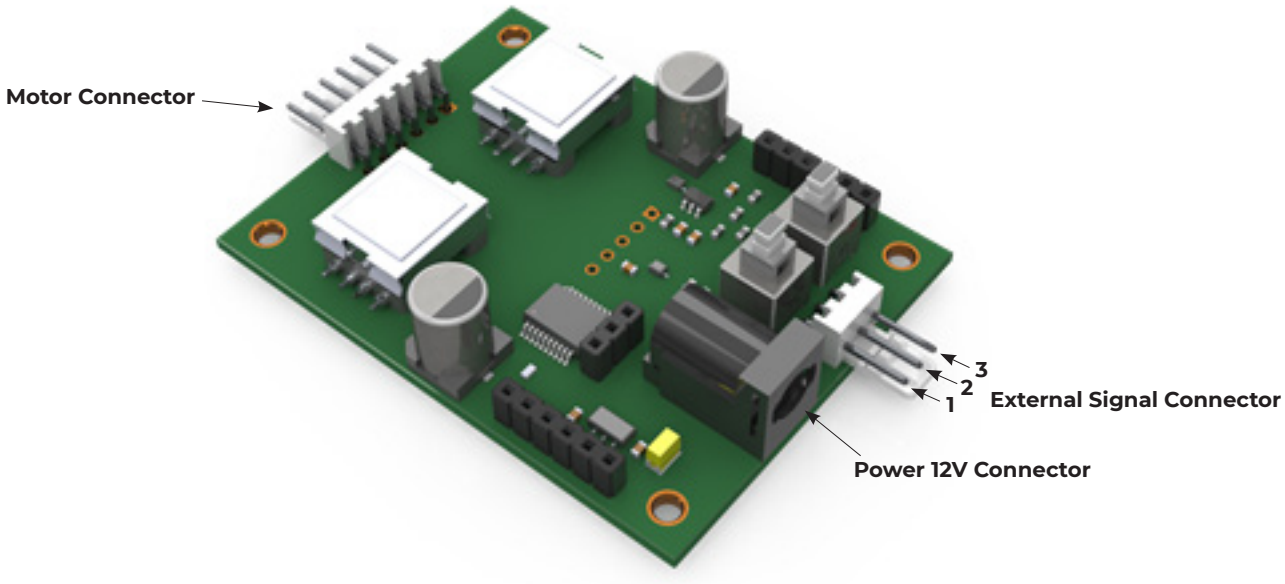


Figure 1. Electronic PCB Driver for LBS & LCS Piezo Linear Motors

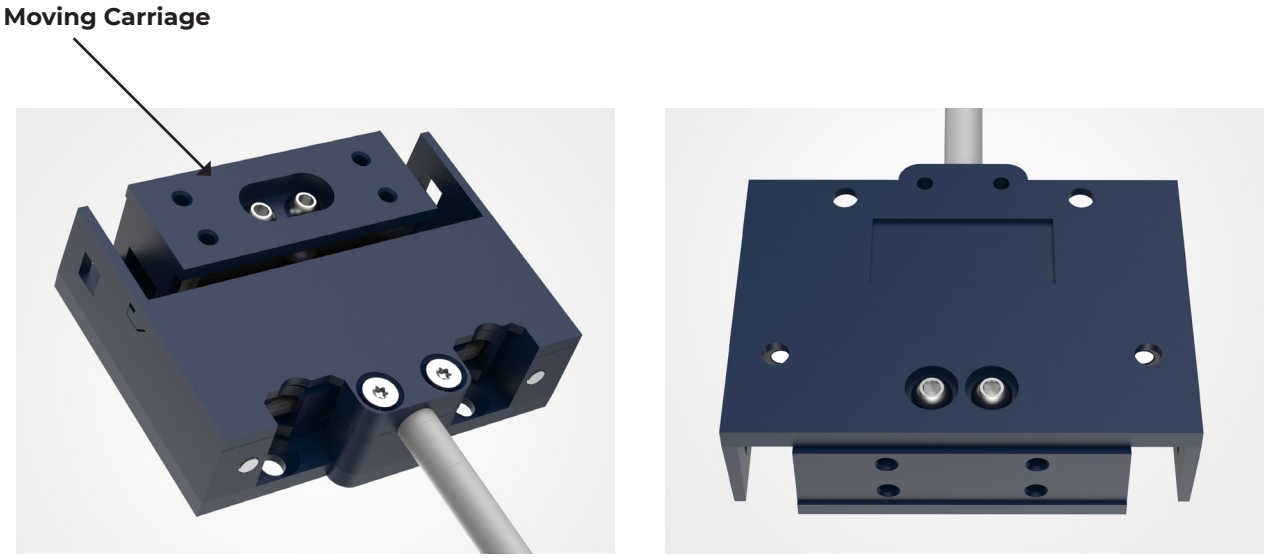


Figure 2. LBS004 Series motors (front & back)

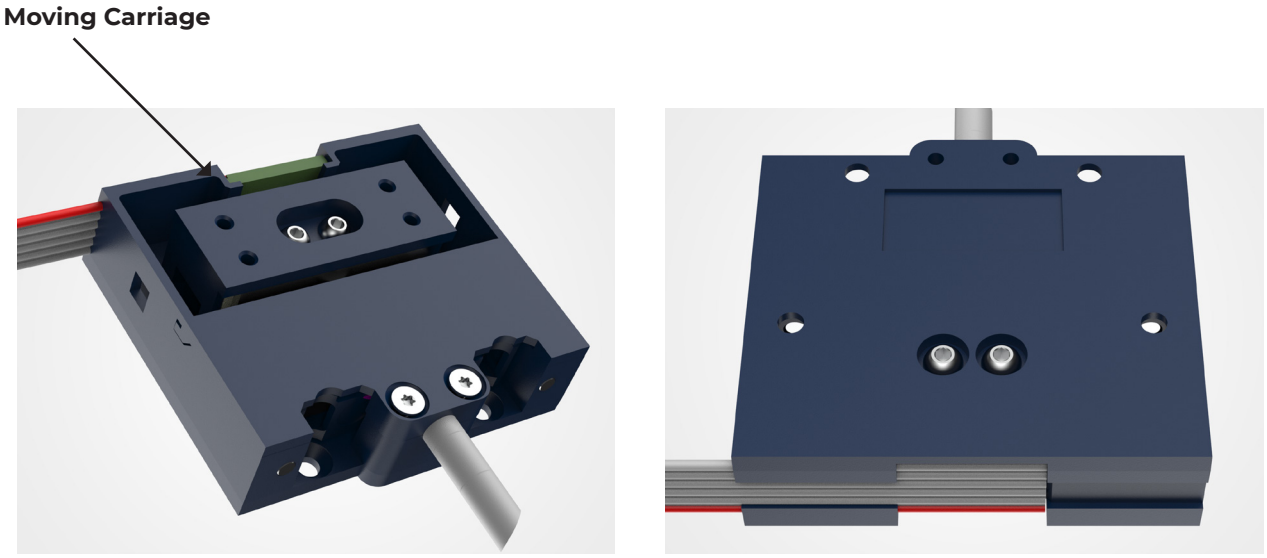


Figure 3. LBS004-E Series motors with factory installed encoder (front & back)

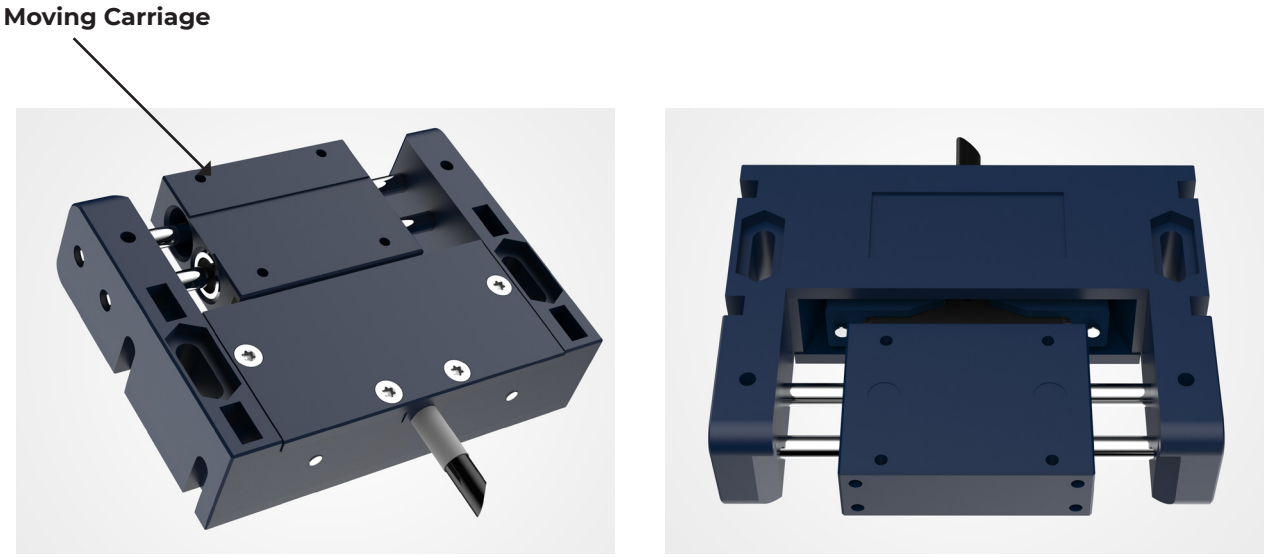


Figure 4. LCS004 Series motor (front & back)

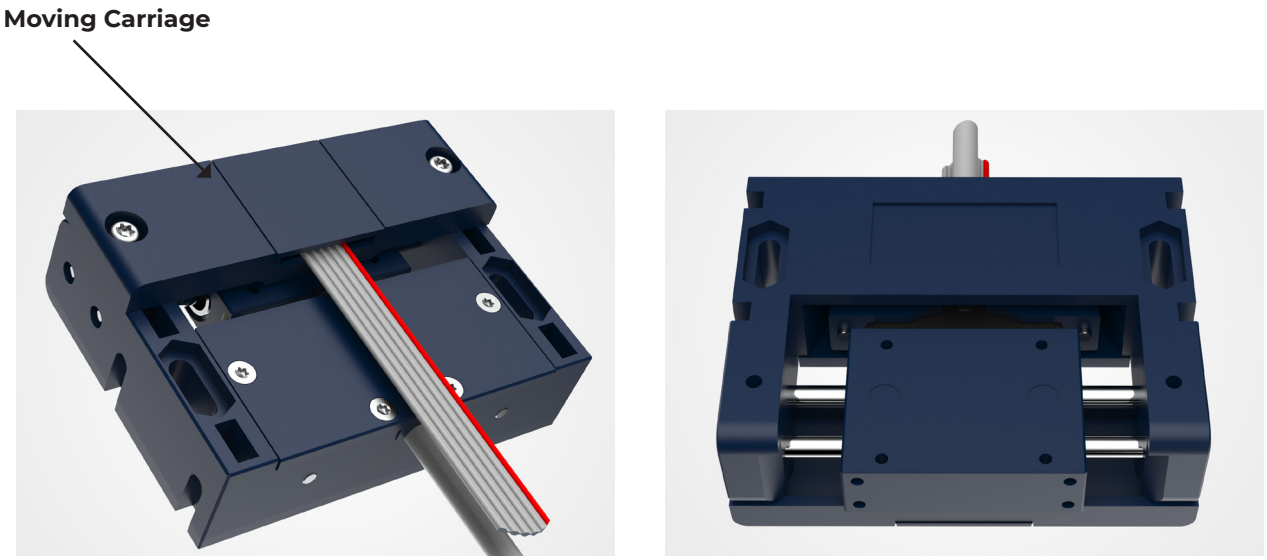


Figure 5. LCS004-E Series motor with factory installed encoder (front and back)

2.0 Properties

Some of the unique properties of the LBS & LCS series 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 Force 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 LBS & LCS Series motor 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 Models LBS & LCS series motors
Electronic Driver PCB
Interconnect cables
Power Supply 12 VDC

Table 1 – Parts List

4.0 Technical Specifications

4.1 Combined specification for LBS, and LCS Series Linear Motors

Weight	22 g
Dimensions	40x31x11 mm
Linear Force	4 N
Linear Stroke	9 mm
Stroke Type	Fixed
Velocity Range	0 to 200 mm/s
Minimum Linear Step	< 0.05 µm
Driver Supply Voltage	12 V
Driver Output Voltage	60 V
Response Time Range	20 µs to 30 µs
Angular Hysteresis at Direction Change	< 1.5 arc.min
Operating Temperature Range	-20 to 80°C
Connection Type	Molex connector
Wire Length	30 cm
Encoder	No Encoder

Table 2 – LBS004 without encoder Specifications

Weight	22 g
Dimensions	40x31x11 mm
Bi-Directional Repeatability	±2.6 µm
Linear Force	4 N
Linear Stroke	9 mm
Stroke Type	Fixed
Velocity Range	0.014 to 140 mm/s
Minimum Linear Step	< 0.05 µm
Driver Supply Voltage	12 V
Driver Output Voltage	60 V
Response Time Range	20 µs to 30 µs
Angular Hysteresis at Direction Change	< 1.5 arc.min
Operating Temperature Range	-20 to 80°C
Connection Type	Molex connector
Wire Length	30 cm
Encoder	Optical

Table 3 – LBS004-E with encoder Specifications

Weight	45 g
Dimensions	60x47x15 mm
Linear Force	4 N
Linear Stroke	15 mm
Stroke Type	Fixed
Velocity Range	0 to 200 mm/s
Minimum Linear Step	< 0.05 µm
Driver Supply Voltage	12 V
Driver Output Voltage	60 V
Response Time Range	20 µs to 30 µs
Angular Hysteresis at Direction Change	< 1 arc.min
Operating Temperature Range	-20 to 80°C
Connection Type	Molex connector
Wire Length	30 cm
Encoder	No Encoder

Table 4 – LCS004 without encoder Specifications

Weight	50 g
Dimensions	60x47x20 mm
Bi-Directional Repeatability	±2.6 µm
Linear Force	4 N
Linear Stroke	15 mm
Stroke Type	Fixed
Velocity Range	0.014 to 140 mm/s
Minimum Linear Step	< 0.05 µm
Driver Supply Voltage	12 V
Driver Output Voltage	60 V
Response Time Range	20 µs to 30 µs
Angular Hysteresis at Direction Change	< 1 arc.min
Operating Temperature Range	-20 to 80°C
Connection Type	Molex connector
Wire Length	30 cm
Encoder	Optical

Table 5 – LCS004-E with encoder Specifications

4.2 Mechanical Drawings of LBS and LCS Series linear motors

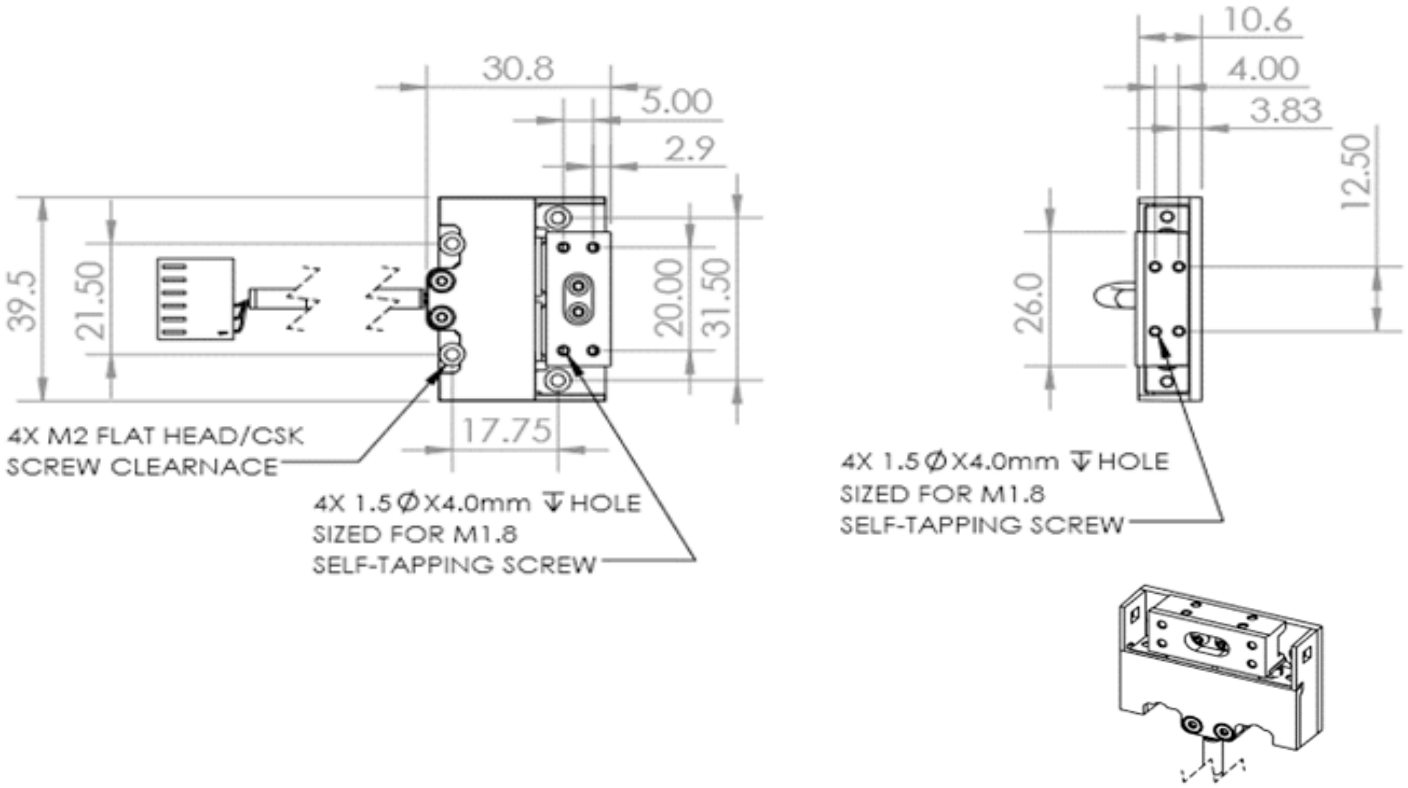


Figure 6. Mechanical drawing (mm) of LBS004 linear motor without encoder

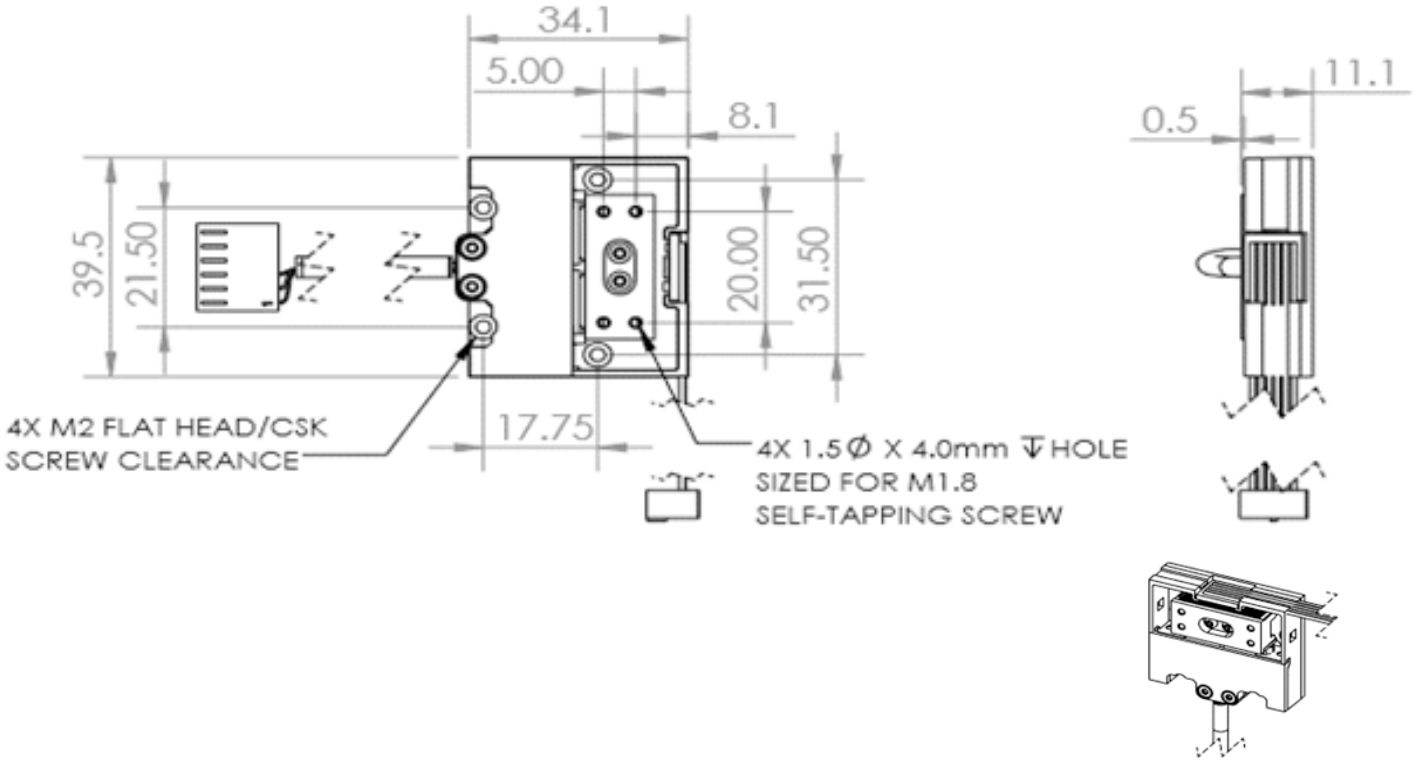


Figure 7. Mechanical drawing (mm) of LBS004-E linear motor with factory installed encoder

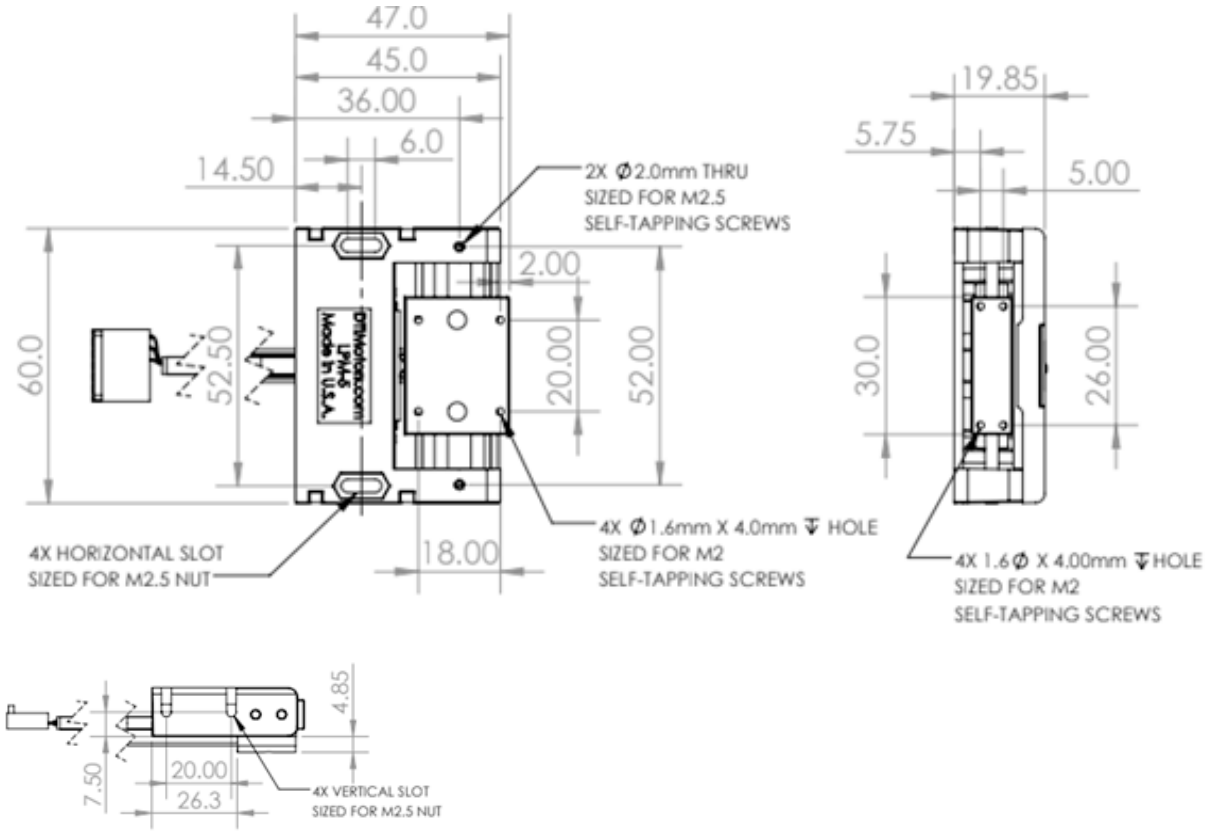


Figure 8. Mechanical drawing (mm) of LCS004 linear motor without encoder

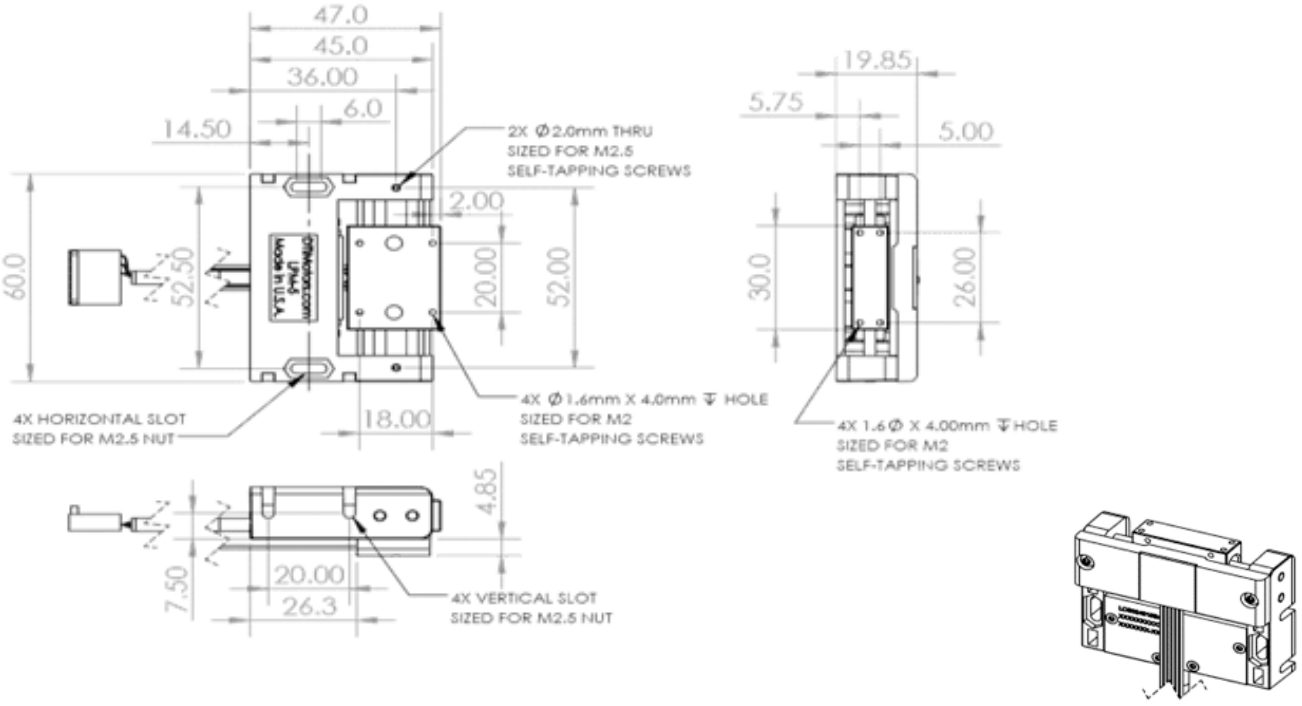


Figure 9. Mechanical drawing (mm) of LCS004-E linear motor with factory installed encoder

5.0 Operation and Control of the Piezomotor

5.1 Connecting the Power Supply

Connect the 12 VDC Power Supply to the Power Supply Connector located on the electronic driver PCB (Figures 1 and 2). Connect the other end of the Power Supply to an appropriate wall power socket.

5.2 Connecting the Driver Board

The piezomotor 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 piezomotor. Motion is created causing the slider of the motor to move forward and backwards. Manual movement of motor is achieved by pushing alternatively the two buttons on the driver board. Release the button when the motor has reached its terminal left or right position.

5.4 Open loop mode control

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

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 (Pins 1,2,3) Fig. 1. A constant “low” level (D.C.) signal will result in continuous motion at maximum speed quickly until it reaches a mechanical stop at either end of the motor. 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 approximately 30 µs. 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 linear 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

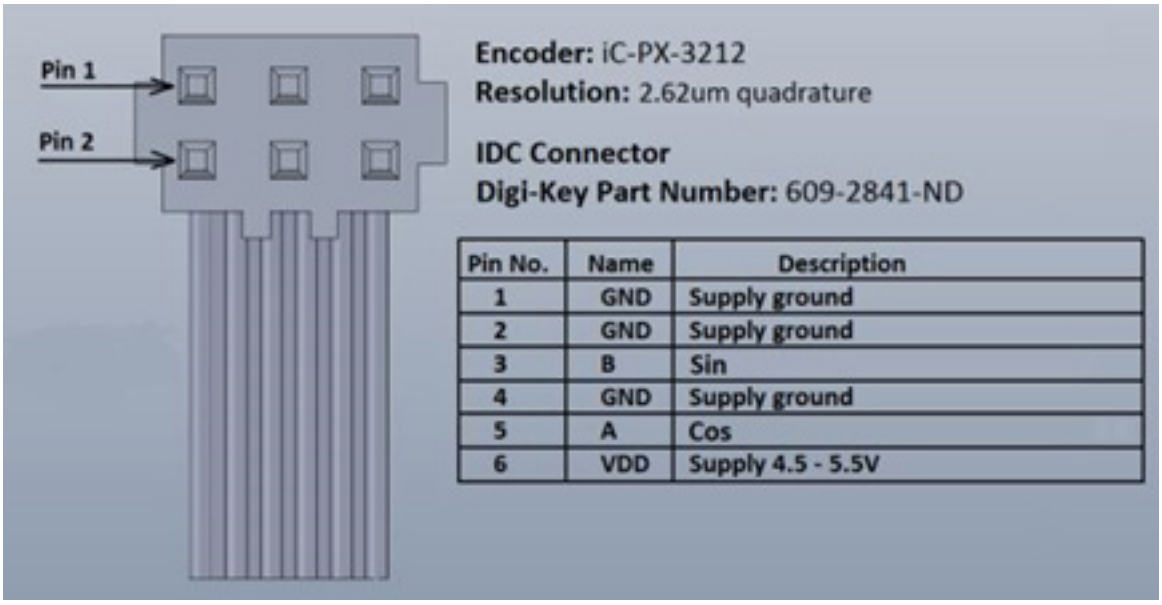
Piezo Motion's range of piezomotors are designed for precise control applications using a duty cycle. They are not designed for prolonged operation in Continuous (non-stepping) Mode, which can lead to overheating of the motor and possible internal damage not protected under warranty.
To avoid overheating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

For LBS and LCS 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.



Pin No.	Name	Description
1	GND	Supply ground
2	GND	Supply ground
3	B	Sin
4	GND	Supply ground
5	A	Cos
6	VDD	Supply 4.5 - 5.5V

Figure 10. Pinout of the Piezo Motion installed encoder connector for LBS and LCS motors. The model of the encoder is iC-PX3212 from iC Hous. The maximum resolution after quadrature is 2.66 µm.

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

Piezo Motion products are produced to state-of-the-art production methods and are subject to strict quality control. 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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