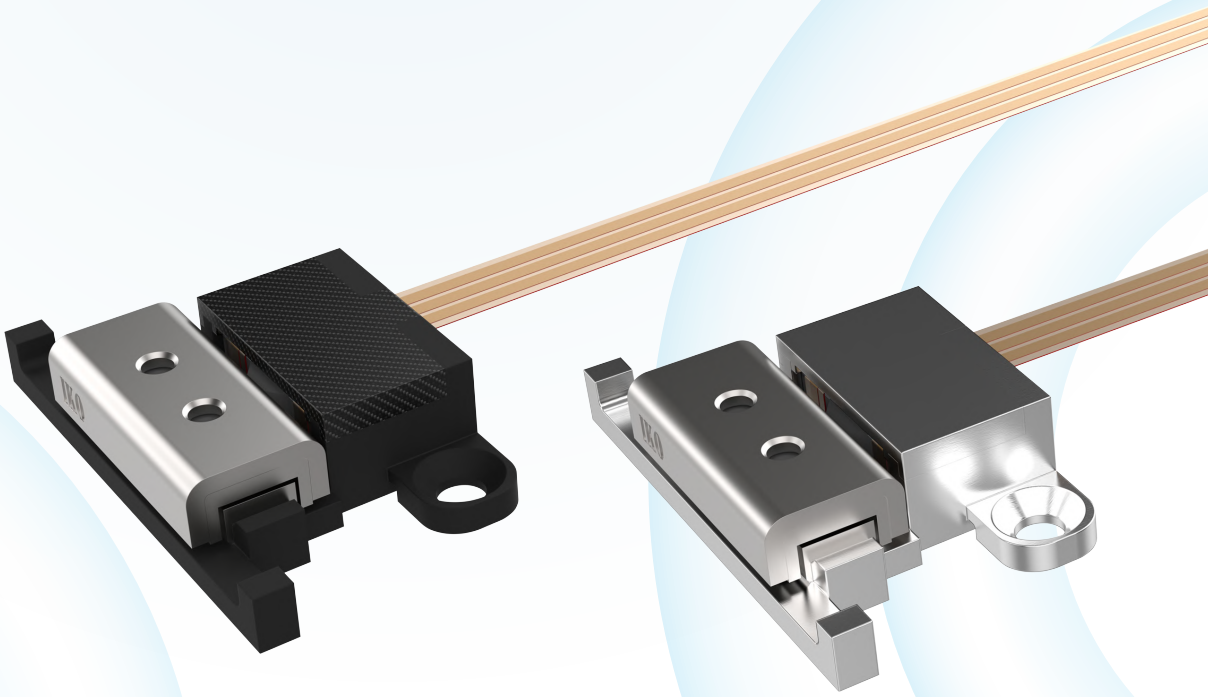
PMC
PIEZO
MOTOR COMPANY

www.piezomotors.com

LRMO Series

Piezoelectric Linear Actuators

Innovation In The Design And
Manufacturing Of Piezoelectric Motors



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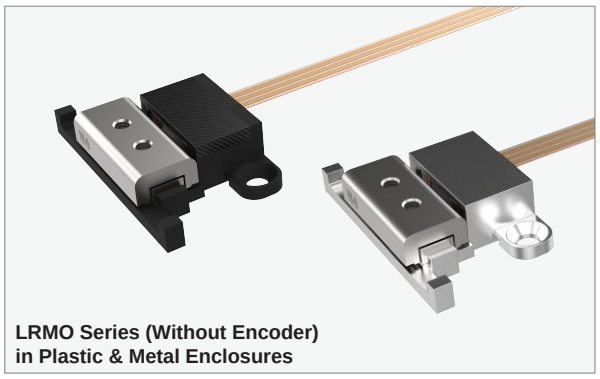
LRMO Series

Piezoelectric Linear Actuators

INTRODUCTION

Piezo Motor Company's LRMO Series actuators deliver industry-leading performance in compact, lightweight linear motion solutions. Built around patented ultrasonic piezoceramic technology, LRMO motors achieve ultra-high resolution, fast response, and excellent force density, making them ideal for a broad spectrum of advanced automation and precision positioning tasks. Available in engineered thermoplastic or machined anodized aluminum enclosures, with or without encoder.

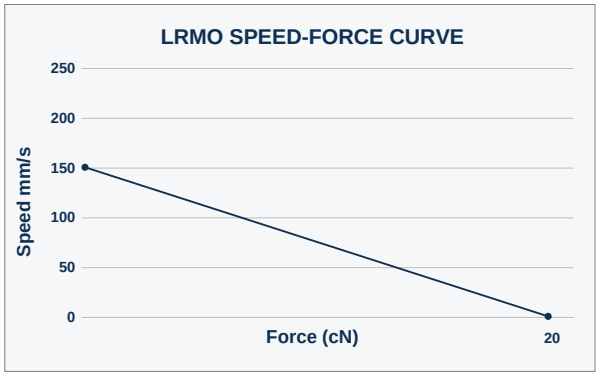


LRMO Series (Without Encoder) in Plastic & Metal Enclosures

PRINCIPLE OF OPERATION

US Patent Number 12,143,036

The LRMO-E Linear piezo actuator operates based on a US patented technology. Electrical excitation of its piezoceramic body, or resonator, induces simultaneously two independent longitudinal and bending ultrasonic standing waves in two perpendicular directions. This action generates elliptical vibrations at the resonator's center, resulting in linear motion of the motor, which is passively in contact with the resonator body.

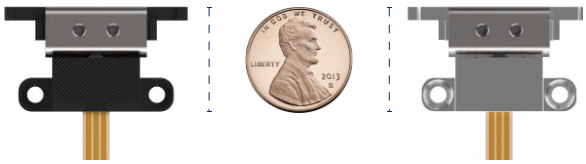


PERFORMANCE & BENEFITS

- Superior stability of velocity control.
- Flexible PCB electrical connection facilitates system integration.
- Unmatched precision and resolution.
- Silent operation and low voltage.
- Ultra-fast response times and exceptional start-stop capabilities.
- Stepping and continuous modes of operation.
- Optional factory-fitted magnetic encoder.

KEY FEATURES

- 9.0 mm travel range
- Ultra-fast response (~30 µs)
- Push/pull force ≥ 0.2 N with self-braking ≥ 0.25 N
- Silent operation
- Low voltage operation — 5.0 V DC



LRMO

Open Loop Linear Piezo Motor

Plastic & Metal Enclosures | No Encoder

LRMO-P Series (Without Encoder)
Plastic Enclosures

LRMO-M Series (Without Encoder)
Metal Enclosures

INTRODUCTION

Linear piezoelectric actuator, open-loop PWM control. Available in plastic (LRMO-P) or machined anodized aluminum (LRMO-M) enclosure.

MOTOR SPECIFICATIONS	
Power Supply Voltage	5.0 V DC
Push/Pull Force	≥0.2 N
Self-Braking Force	≥0.25 N
Motor Response Time	< 30 µs
Travel Range	9.0 mm
Max Speed (continuous mode)	≥150 mm/s
Minimum Linear Step	<0.04 µm
Linear Backlash at Change of Direction	<0.1 µm
Elastic Stiffness	< 200 mN/µm
Linear Hysteresis	<2.0 µm
Pitch	<1 mrad
Maximum Moment Mx	0.07 Nm
Roll	<0.5 mrad
Maximum Moment My	0.12 Nm
Yaw	<1 mrad
Maximum Moment Mz	0.9 Nm
Vertical Runout	3.0 µm
Horizontal Runout	6.0 µm
Frequency Response	4 kHz
Operating Temperature	-20 °C to 80 °C
Maximum Load (Vertical Orientation)	15 g
Maximum Load (Horizontal Orientation)	150 g
Max Current (continuous mode)	300 mA
Max Current at 10 mm/s (PWM mode)	30–40 mA
DIMENSIONS & WEIGHT	
Motor Weight	3.7 g / 6.7 g(metal)
Motor Dimensions	27.1 × 15.48 × 5.5 mm
Driver PCB Dimensions	28 × 28 × 9.6 mm
Driver PCB Weight	4.3 g

ORDERING INFORMATION

Model	Enclosure	Encoder	Part Number	Kit Number*
LRMO-P	Plastic	No	LRMO-P011-0270-0000	LRMO-P011-0271-0000
LRMO-M	Metal	No	LRMO-M012-0270-0000	LRMO-M012-0271-0000

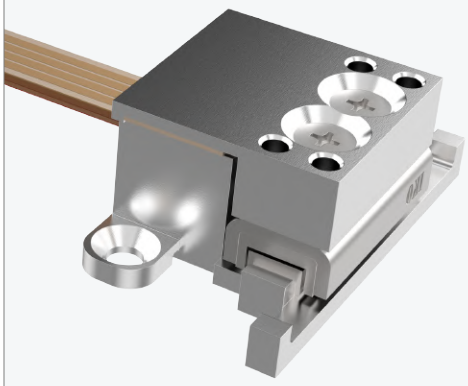
***Evaluation kit includes motor, driver PCB, cables and 120/240 V AC to 5 V DC power adapter.**

LRMO-E

Linear Piezo Motor with Encoder

Plastic & Metal Enclosures | With Encoder

LRMO-E-P Series (With Encoder)
Plastic Enclosures



LRMO-E-M Series (With Encoder)
Metal Enclosures

INTRODUCTION

Identical to LRMO base motor with factory-fitted magnetic encoder. Encoder signal output enables closed-loop control via your controller. Plastic (LRMO-E-P) or anodized aluminum (LRMO-E-M) enclosure.

MOTOR SPECIFICATIONS	
Power Supply Voltage	5.0 V DC
Push/Pull Force	≥0.2 N
Self-Braking Force	≥0.25 N
Motor Response Time	< 30 µs
Travel Range	9.0 mm
Max Speed (continuous mode)	≥150 mm/s
Minimum Linear Step	<0.04 µm
Encoder Resolution (after quadrature)	2.66 µm
Minimum Controlled Linear Step	2.66 µm
Uni-directional Repeatability	2.66 µm
Linear Backlash at Change of Direction	<0.1 µm
Elastic Stiffness	< 200 mN/µm
Linear Hysteresis	<2.0 µm
Pitch	<1 mrad
Maximum Moment Mx	0.07 Nm
Roll	<0.5 mrad
Maximum Moment My	0.12 Nm
Yaw	<1 mrad
Maximum Moment Mz	0.9 Nm
Vertical Runout	3.0 µm
Horizontal Runout	6.0 µm
Frequency Response	4 kHz
Operating Temperature	-20 °C to 80 °C
Maximum Load (Vertical Orientation)	15 g
Maximum Load (Horizontal Orientation)	150 g
Max Current (continuous mode)	300 mA
Max Current at 10 mm/s (PWM mode)	30–40 mA
DIMENSIONS & WEIGHT	
Motor Weight	5.7 g or 6.7 g
Motor Dimensions	27.1x15.48x10.5mm
Driver PCB Dimensions	28 × 28 × 9.6 mm
Driver PCB Weight	4.3 g

ORDERING INFORMATION

Model	Enclosure	Encoder	Part Number	Kit Number*
LRMO-E-P	Plastic	Yes	LRMO-P011-1270-0000	LRMO-P011-1271-0000
LRMO-E-M	Metal	Yes	LRMO-M012-1270-0000	LRMO-M012-1271-0000

***Evaluation kit includes motor, driver PCB, cables and 120/240 V AC to 5 V DC power adapter.**

LRMO-E-CL

Linear Piezo Motor System with Closed-Loop Software

Plastic & Metal Enclosures | With Encoder

LRMO-E-P-CL (With Encoder) Plastic Enclosure
LRMO-E-M-CL Series (With Encoder) Metal Enclosures

INTRODUCTION

Fully integrated closed-loop system. Combines the LRMO-E encoder motor with PMC's dedicated closed-loop driver PCB and Python API software. Position and velocity commands via USB. Plastic or anodized aluminum enclosure.

MOTOR SPECIFICATIONS	
Power Supply Voltage	5.0 V DC
Push/Pull Force	≥0.2 N
Self-Braking Force	≥0.25 N
Motor Response Time	< 30 µs
Travel Range	9.0 mm
Max Speed (continuous mode)	≥150 mm/s
Minimum Linear Step	<0.04 µm
Encoder Resolution (after quadrature)	2.66 µm
Minimum Controlled Linear Step	2.66 µm
Uni-directional Repeatability	2.66 µm
Linear Backlash at Change of Direction	<0.1 µm
Elastic Stiffness	< 200 mN/µm
Linear Hysteresis	<2.0 µm
Pitch	<1 mrad
Maximum Moment Mx	0.07 Nm
Roll	<0.5 mrad
Maximum Moment My	0.12 Nm
Yaw	<1 mrad
Maximum Moment Mz	0.9 Nm
Vertical Runout	3.0 µm
Horizontal Runout	6.0 µm
Frequency Response	4 kHz
Operating Temperature	-20 °C to 80 °C
Maximum Load (Vertical Orientation)	15 g
Maximum Load (Horizontal Orientation)	150 g
Max Current (continuous mode)	300 mA
Max Current at 10 mm/s (PWM mode)	30–40 mA
DIMENSIONS & WEIGHT	
Motor Weight	5.7 g or 6.7 g
Motor Dimensions	27.1x15.48x10.5mm
Driver PCB Dimensions	28 × 28 × 9.6 mm
Driver PCB Weight	4.3 g

EXAMPLE PYTHON API COMMANDS

Home(direction)
Move to zero (CW / CCW)

getPosition()
Read position in encoder pulses

Velocity(value)
Set speed: 0.01 – 150 mm/s

Move(action)
Move Left / Right / Stop

Position(value)
Go to absolute position (pulses)

setPWMsettings(dc, freq)
Configure velocity via PWM

ORDERING INFORMATION

Model	Enclosure	Encoder	Part Number	Kit Number*
LRMO-E-P-CL	Plastic	Yes	LRMO-P011-1270-0000	LRMO-P011-1281-0000
LRMO-E-M-CL	Metal	Yes	LRMO-M012-1270-0000	LRMO-M012-1281-0000

***Evaluation kit includes motor, driver PCB, USB cable and Python API software.**

LRMO Motion Control
and Driver Electronics

PWM | UART | I²C | Open-loop & Closed-loop

INTRODUCTION

The LRMO electronic driver is designed to offer an economical interface for user control. Motion of the motor is achieved via PWM (Pulse Width Modulation) control signals via the J1 connector on the driver. The driver PCB also supports UART and I2C interfaces. Each driver PCB is pre-programmed for the specific motor model and allows for software configurability, optimizing drive signals and integrating controls. Motor operation can be finely regulated through closed-loop control using an optional encoder factory-installed on the actuator.

LRMO OPEN LOOP DRIVER PCB OPTIONS

Standard Open Loop Driver PCB (Red)
For Single Channel Control

Part No.: ROLR-PPCB-0370-0000

PMC's **Open-Loop RED Driver PCB** provides open-loop motor control without positional feedback. Drive current is automatically stabilized to compensate for temperature and load variations.

The LRMO RED driver PCB is **available in two variants:** a **standard single-channel version** for controlling one motor, and an I²C-enabled version with full **I²C functionality for multi-channel (multi-motor) control.**

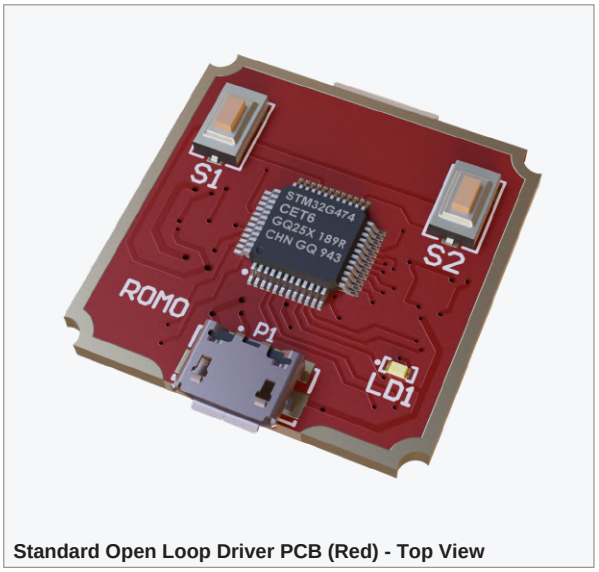
The LRMO RED driver PCB is compatible with both LRMO (non-encoder) and LRMO-E (encoder-equipped) motors. For applications requiring closed-loop control with the RED driver, the control loop must be implemented externally by the user using encoder feedback and a third-party controller.

Control Interfaces	
PWM (TTL-compatible)	via J1 connector
UART	Serial commands via J2 connector
I²C (Single-channel Control)	Serial commands via J2 connector

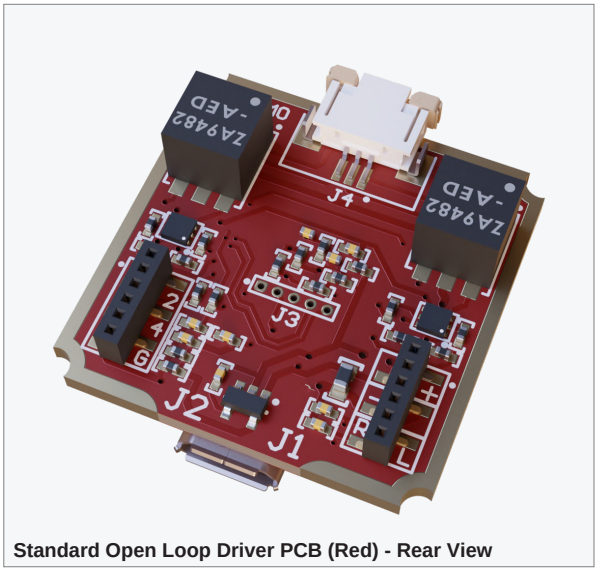
Each PCB is factory-configured for the selected serial interface.

Additional Features:

- Manual control via two onboard push-buttons.
- Compact, low-overhead solution for cost-sensitive for open-loop applications using a single motor.



Standard Open Loop Driver PCB (Red) - Top View



Standard Open Loop Driver PCB (Red) - Rear View

LRMO Motion Control
and Driver Electronics

PWM | UART | I²C | Open-loop & Closed-loop

LRMO I²C Open-Loop Driver PCB (Red)
For Multi-Channel Control

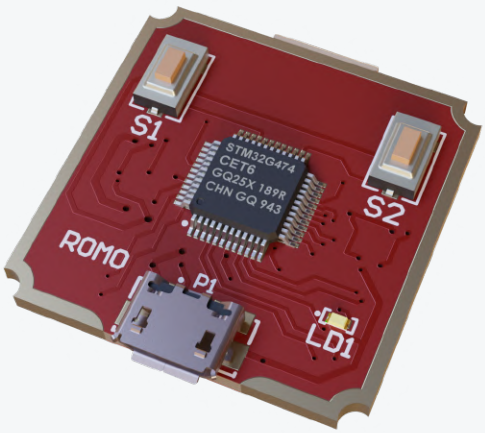
Part No.: ROLR-PPCB-0250-000

PMC's I²C RED driver PCB provides open-loop motor control without positional feedback using an I²C communication interface, enabling synchronized multi-axis operation. Drive current is automatically stabilized against temperature and load variations.

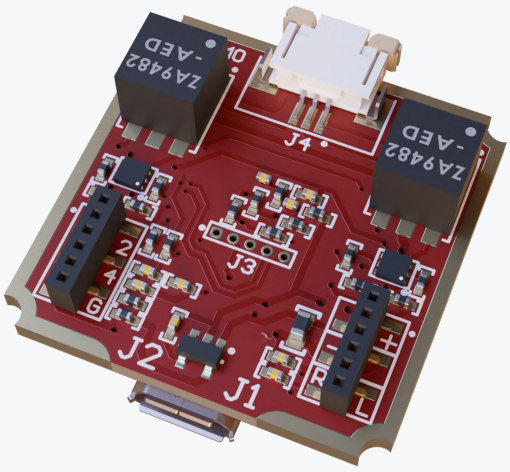
Control Interfaces	
I²C	Serial communication via J2 connector ◦ **SCL** – clock line ◦ **SDA** – data line

Additional Features:

- Enables full I²C functionality with support for multiple driver PCBs on a shared bus.
- Unique, configurable I²C addresses per driver.
- Control of multiple motors.
- Compatible with PMC I²C adapter board.
- Scalable via daisy-chaining for multi-axis systems.
- Ideal for multi-axis, synchronized, or distributed motion control.



I²C Open-Loop Driver PCB (Red)
For Multi-Channel Control - Top View



I²C Open-Loop Driver PCB (Red)
For Multi-Channel Control - Rear View

LRMO Motion Control
and Driver Electronics

PWM | UART | I²C | Open-loop & Closed-loop

LRMO CLOSED LOOP DRIVER PCB OPTIONS

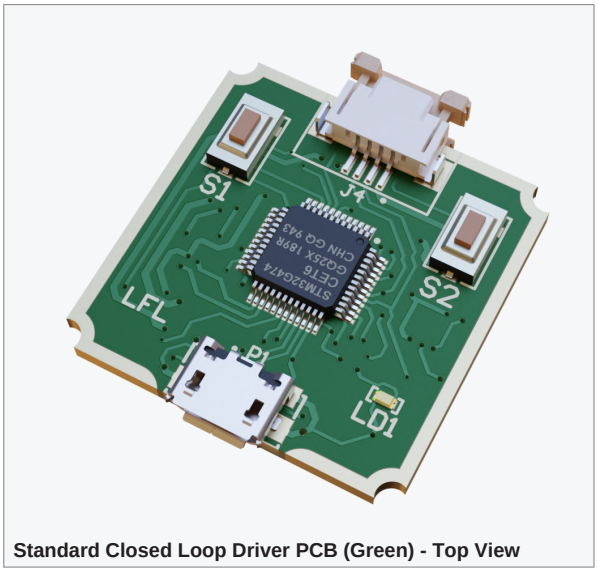
Standard Closed Loop Driver PCB (Green)
For Single Channel Control

Part No.: LRMO-PPCB-1280-0000

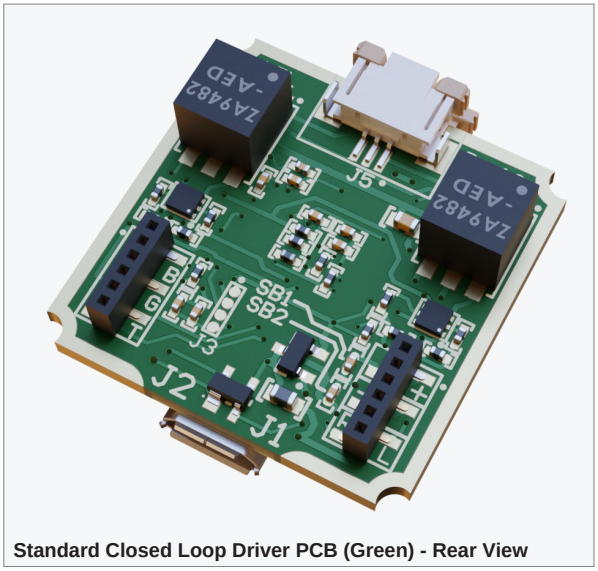
PMC's **Closed-Loop GREEN Driver PCB** provides precise motor control using positional feedback from an encoder. Drive current is automatically stabilized to compensate for temperature and load variations.

The GREEN driver PCB is **available in two variants: a standard single-channel version** for controlling one motor, and an I²C-enabled version with full **I²C functionality for multi-channel (multi-motor) control.**

The GREEN driver PCB is compatible with LRMO-E (encoder-equipped) motors only and is designed for use with PMC's Python™ API, enabling simple integration and high-precision motion control.



Standard Closed Loop Driver PCB (Green) - Top View



Standard Closed Loop Driver PCB (Green) - Rear View

Control Interfaces

PMC Python™ API

- Closed-loop control is executed onboard.
- Position and speed commands are issued via the Python™ API.
- Connection via Micro-USB.
- No external motion controller required.

UART	Serial commands via J2 connector.

Additional Features:

- Manual control via two onboard push-buttons.
- Compact, low-overhead solution for cost-sensitive for open-loop applications using a single motor.

LRMO Motion Control
and Driver Electronics

PWM | UART | I²C | Open-loop & Closed-loop

LRMO CLOSED LOOP DRIVER PCB OPTIONS

I²C Closed-Loop Driver PCB
For Multi-Channel Control

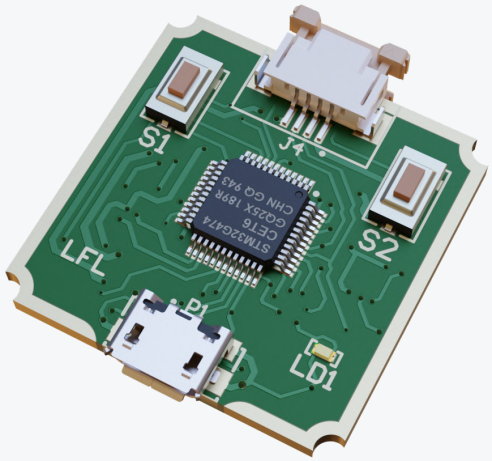
Part No.: LRMO-PPCB-1260-0000

PMC's I²C GREEN driver PCB provides closed-loop control with encoder feedback using an I²C communication interface, enabling synchronized multi-axis operation. Drive current is automatically stabilized against temperature and load variations.

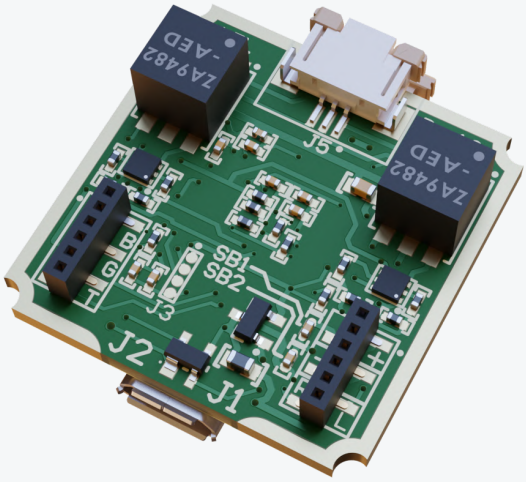
Control Interfaces	
I²C	Serial communication via J2 connector ◦ **SCL** – clock line ◦ **SDA** – data line

Additional Features:

- Enables full I²C functionality with support for multiple driver PCBs on a shared bus.
- Unique, configurable I²C addresses per driver.
- Control of multiple motors.
- Compatible with PMC I²C adapter board.
- Scalable via daisy-chaining for multi-axis systems.
- Ideal for multi-axis, synchronized, or distributed motion control.



I²C Closed-Loop Driver PCB (Green)
For Multi-Channel Control - Top View



I²C Closed-Loop Driver PCB (Green)
For Multi-Channel Control - Rear View

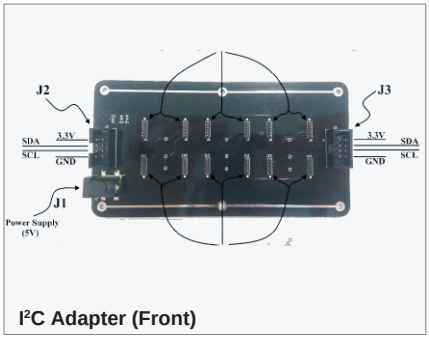
LRMO Motion Control
and Driver Electronics

PWM | UART | I²C | Open-loop & Closed-loop

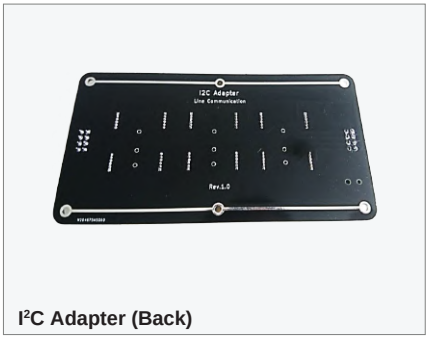
I²C ADAPTER

For use with up to six (6) **I²C Red or I²C Green Driver** PCB for OPEN-LOOP Control or Closed-Loop control.

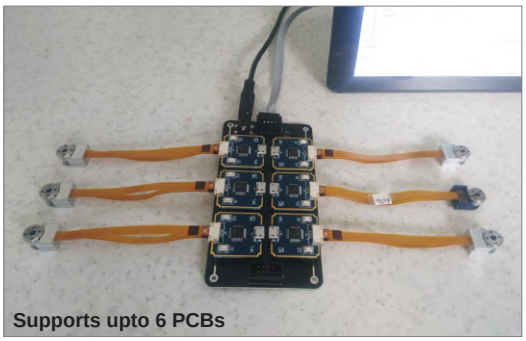
Part Number: **I2CX-PPCB-0290-0000**



I²C Adapter (Front)



I²C Adapter (Back)


Supports upto 6 PCBs

LRMO DRIVER PCB SPECIFICATIONS AND CONTROL ARCHITECTURE

Open Loop	Standard Open-Loop (Red)	I²C Driver Open-Loop (Red)
Key Feature	Basic open-loop	Multi-channel, daisy-chainable*
Control Interface	PWM / UART / Control I²C	I²C (Multi-channel functionality)
Applicable on Models	LRMO-P, LRMO-M, LRMO-E-P, LRMO-E-M	LRMO-P, LRMO-M, LRMO-E-P, LRMO-E-M
Part Number	ROLR-PPCB-0370-0000	ROLR-PPCB-0250-000

Closed-Loop	Standard Closed-Loop (Green)	I²C Driver Closed-Loop (Green)
Key Feature	Closed-loop, USB, single channel control	Closed-loop multi-channel, USB, daisy-chainable*
Control Interface	Python API / UART	I²C (Multi-channel functionality)
Applicable on Models	LRMO-E-P, LRMO-E-M	LRMO-E-P, LRMO-E-M
Part Number	LRMO-PPCB-1280-0000	LRMO-PPCB-1260-0000

Performance Chart

and Ordering Information

Motor/Driver Part Configurations — All Six Variants

PART NUMBERING

LRMO	—	Material	—	Encoder	Driver	Firmware	Kit	—	Customisation
LRMO	—	P011	—	1	2	8	1	—	0000
LRMO		P011 = Plastic M012 = Anodized Aluminum		0 = without 1 = with	3 = 7.5V 2 = 5V	7 = Open Loop 8 = Closed Loop	0 = Motor Only 1 = Eval Kit		

LRMO-P011-1281-0000: LRMO Series, Plastic, with Encoder, 5V Driver, Closed-Loop Firmware, Kit.

MOTOR CONFIGURATIONS

Model	Enclosure	Encoder	Push/Pull	Min. step	Max Speed	Power Supply	Part Number	Kit Available
LRMO-P	Plastic	Without	≥0.2 N	<0.04 µm	≥150 mm/s	5.0 VDC	LRMO-P011-0270-0000	✓
LRMO-M	Anodized Aluminum	Without	≥0.2 N	<0.04 µm	≥150 mm/s	5.0 VDC	LRMO-M012-0270-0000	✓
LRMO-E-P	Plastic	With	≥0.2 N	<0.04 µm	≥150 mm/s	5.0 VDC	LRMO-P011-1270-0000	✓
LRMO-E-M	Anodized Aluminum	With	≥0.2 N	<0.04 µm	≥150 mm/s	5.0 VDC	LRMO-M012-1270-0000	✓

PART NUMBERS & EVALUATION KIT DETAILS

Model	Part Number	Kit Number	Evaluation Kit Description
LRMO-P	LRMO-P011-0270-0000	LRMO-P011-0271-0000	Includes LRMO motor, Plastic Enclosure, Electronic Driver PCB, 120/240 V AC to 5.0 VDC power adapter and cables.
LRMO-M	LRMO-M012-0270-0000	LRMO-M012-0271-0000	Includes LRMO motor, Anodized Aluminum Enclosure, Electronic Driver PCB, 120/240 V AC to 5.0 VDC power adapter and cables.
LRMO-E-P	LRMO-P011-1270-0000	LRMO-P011-1271-0000	Includes LRMO-E motor, Plastic Enclosure, Electronic Driver PCB, 120/240 V AC to 5.0 VDC power adapter and cables.
LRMO-E-M	LRMO-M012-1270-0000	LRMO-M012-1271-0000	Includes LRMO-E motor, Anodized Aluminum Enclosure, Electronic Driver PCB, 120/240 V AC to 5.0 VDC power adapter and cables.
LRMO-E-P-CL	LRMO-P011-1281-0000	LRMO-P011-1281-0000	Includes LRMO-E motor, Plastic Enclosure, Electronic Driver PCB, USB to Micro USB adapter cable and Python API.
LRMO-E-M-CL	LRMO-M012-1281-0000	LRMO-M012-1281-0000	Includes LRMO-E motor, Anodized Aluminum Enclosure, Electronic Driver PCB, USB to Micro USB adapter cable and Python API.

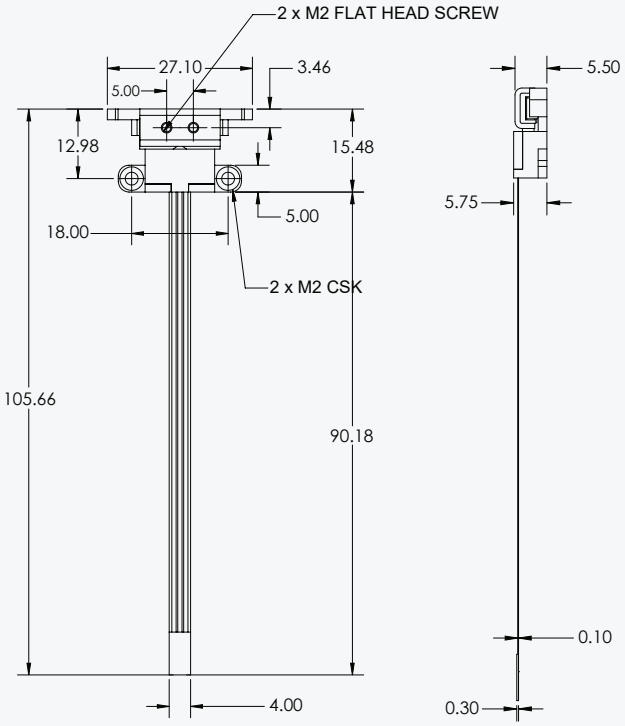
For custom inquires, contact us at info@piezomotors.com

Mechanical Drawings

LRMO Series

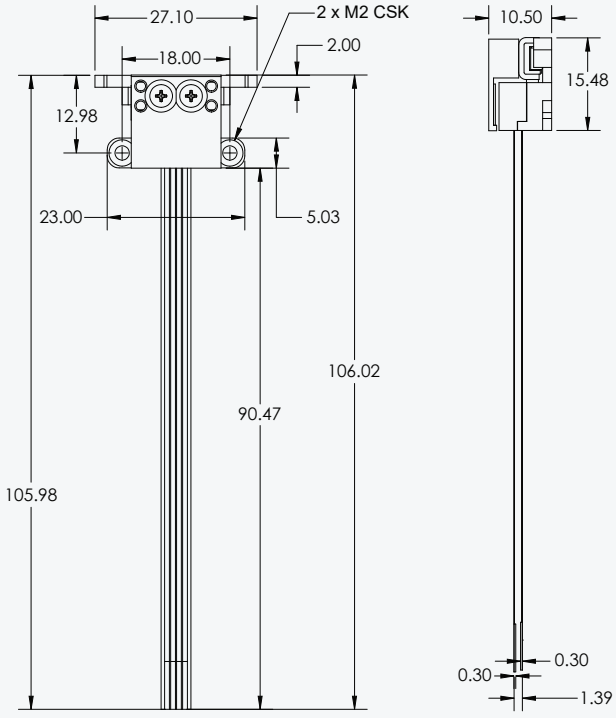
Standard and Encoder Models | All Dimensions in mm

STANDARD MODEL



Dimensions in mm

ENCODER MODEL



Dimensions in mm

Why Piezo Motors?

LRMO Series vs. Conventional Motor Technologies

TECHNOLOGY COMPARISON

Feature	LRMO Series	DC Motor	Stepper Motor	Voice Coil
Zero holding power	✓ Zero current	— Continuous draw	— Current in hold	— Current in hold
Self-braking force	✓ 0.25 N	— None	— Detent only	— None
Non-magnetic*	✓ Yes	— No	— No	✓ Yes
Sub-30 µs response	✓ ~30 µs	■ ~ms range	■ Step limited	✓ Fast
Size / torque ratio	✓ Excellent	■ Good	■ Moderate	— Low
Silent operation	✓ Yes	■ Brushless: yes	■ Acoustic noise	✓ Yes
Positional resolution	✓ <0.04 µm	■ Encoder limited	■ Step limited	■ Sensor limited
Gearbox required	✓ No	■ Often yes	✓ No	✓ No
Voltage	✓ 5 V	■ Varies	■ Varies	■ Varies

***Contact PMC for details**

ABOUT PIEZO MOTOR COMPANY

Founded in 2024, Piezo Motor Company is at the forefront of innovation in the design and manufacturing of piezoelectric motors. Headquartered in the USA, we have a global reach through a network of international distributors, delivering cutting-edge technology to clients worldwide.

Our team comprises highly skilled experts with extensive experience in piezoelectric motor and actuator design and physics. We are passionate about harnessing the unique properties of piezoelectric materials to create motors that offer unmatched precision, efficiency, and reliability. Our solutions are tailored to meet the diverse needs of industries ranging from medical devices to aerospace and robotics.

We pride ourselves on our commitment to excellence and innovation, continuously pushing the boundaries of what piezoelectric technology can achieve. Our dedication to research and development ensures that we remain leaders in this dynamic field, providing our clients with the most advanced and effective solutions available. Join us on our journey as we revolutionize the world of motion control with piezoelectric technology.

CONTACT US: Order an evaluation kit or contact our engineering team to discuss your application.

Email: sales@piezomotors.com | **Web:** www.piezomotors.com | **Address:** Boca Raton, FL 33496

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Applications

The LRMO series is engineered for demanding OEM applications where precision, compactness, and energy efficiency are critical. The hollow shaft, zero holding-power consumption, and sub-30 µs response time open up design possibilities that are not achievable with conventional electromagnetic motors.

PHOTONICS & FIBER OPTICS
Polarisation control, variable attenuators, wave-length-selective switches.

MICROSCOPY & IMAGING
Objective turrets, polarisation rotators, confocal beam scanners.

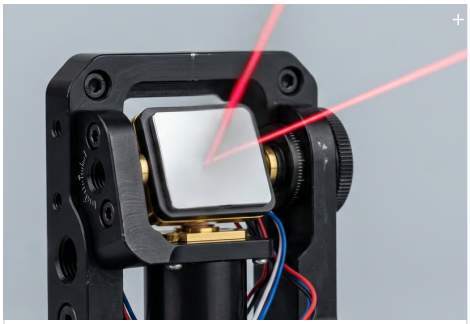
MEDICAL & DIAGNOSTIC
OCT scanners, surgical robotics, drug delivery micro-pumps

SCIENTIFIC INSTRUMENTATION
Cryogenic stages, vacuum-compatible mecha-nisms, spectroscopy platforms.

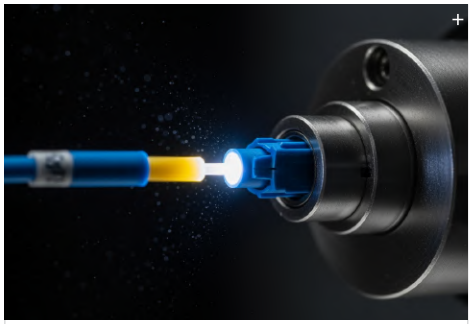
ROBOTICS & AUTOMATION
Pick-and-place, collaborative robot joints, gripper mechanisms.

AEROSPACE & DEFENCE
Antenna pointing, gimbal drives, electro-optical payloads.

OPTICAL FILTER WHEELS
Fast, silent filter changes in microscopy and spectroscopy.

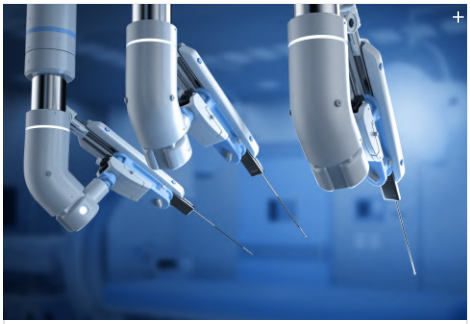


BEAM STEERING
Precision angular adjustment of optical paths and mirrors.

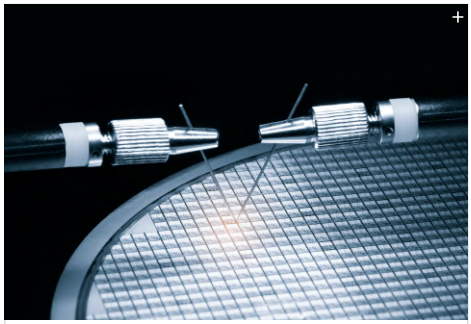


FIBRE ALIGNMENT
Sub-µrad alignment of fibre optic components.

MICRO ROBOTICS
Compact direct-drive joints and end-effectors.



MEDICAL DEVICES
Drug delivery, lab-on-chip, and surgical robotics.



SEMICONDUCTOR
Wafer handling and mask alignment systems.

+ = Stock Image