PMC
PIEZO
MOTOR COMPANY

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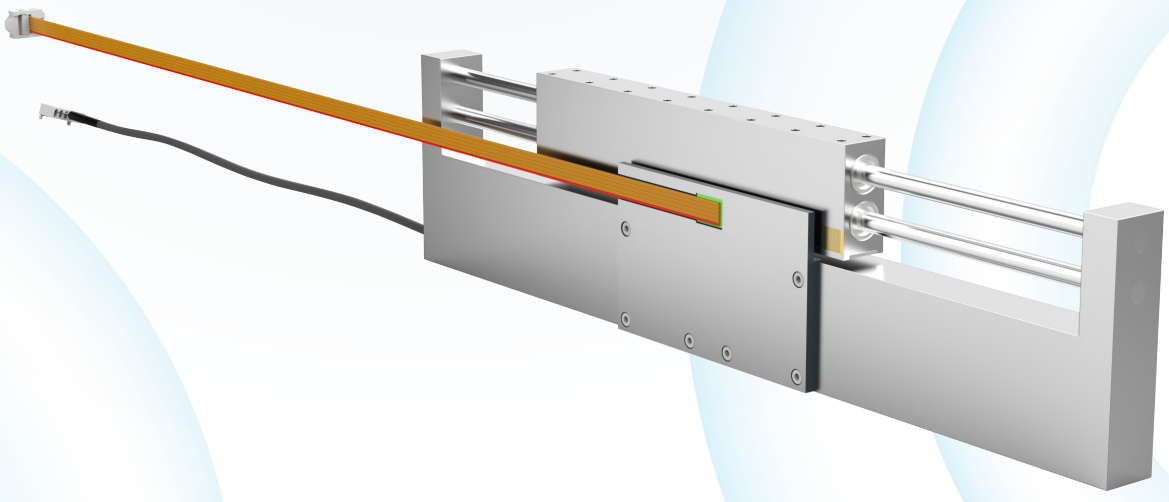
# LRMO-150

## Linear Piezoelectric Motor

Innovation In The Design And
Manufacturing Of Piezoelectric Motors



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# LRMO-150

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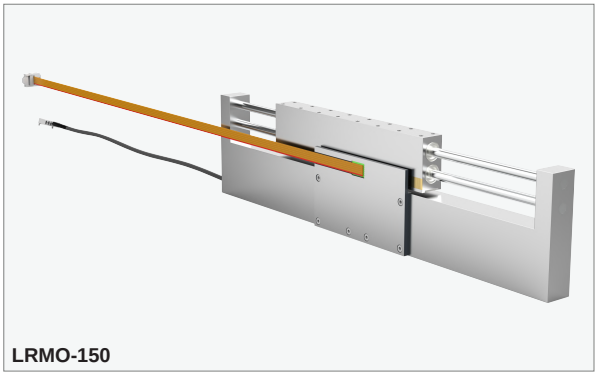
## INTRODUCTION

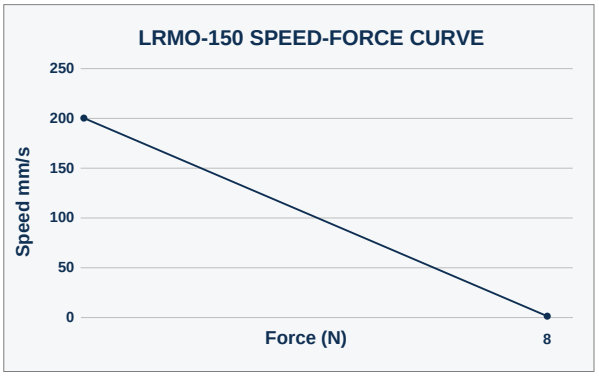
Piezo Motor Company's novel series of linear piezoelectric motors represents a quantum leap in design construction of compact, high-precision, performance linear motor technologies. This new range of linear motors combines extended travel range, superior nanometer precision and ultrafast response at a very economical cost. The LRMO-150 is available in both Open-Loop and Closed-Loop (with factory fitted encoder) versions.



LRMO-150

## PRINCIPLE OF OPERATION

Piezo Motor Company's linear piezo motors work on a principle of excitation of ultrasonic standing waves within a piezoelectric resonator. Piezo Motor Company's electronic drivers have been designed to provide an economical user-control interface. Each driver PCB is pre-programmed for the specific motor model and is software configurable to provide optimization of drive signals and integrated controls. Closed-loop control of the motor is achieved via an encoder mounted on the motor.




## PERFORMANCE & BENEFITS

- Extended Stroke
  150 mm, (customizable lengths available.)
- Ultra-Fine Resolution: 0.04 µm open-loop (≈25,000 steps/mm).
- Fast Response: 20–30 µs
- High Force Density: Compact design with superior force-to-weight ratio.
- Low Power: 0 W at hold; ~0.5 W at 1 mm/s.
- EMI Immunity: No emissions; unaffected by EMI/RF
- Lightweight: No coils or magnets.

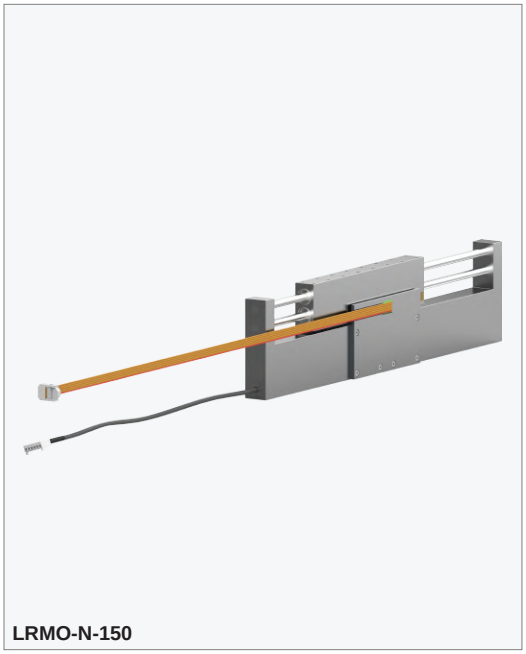
## KEY FEATURES

- Low voltage — 12.0 V DC.
- 25,000 steps per mm of travel.
- Superior precision and resolution.
- Silent operation in continuous mode.
- Energy efficient, zero power consumption in hold mode.

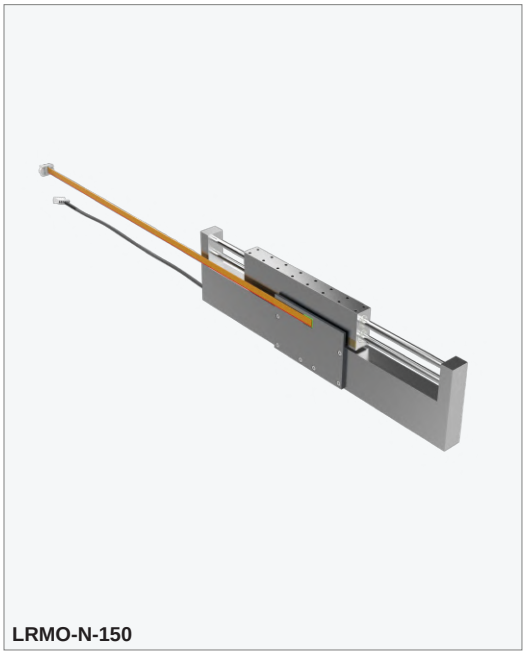
# LRMO-N-150

## Open-Loop Linear Piezoelectric Motor

**Without Encoder**



LRMO-N-150



LRMO-N-150

## INTRODUCTION

High-precision linear piezoelectric motor with 150 mm travel range. Open-loop PWM control for precision positioning applications.

| MOTOR SPECIFICATIONS | |
|---|---|
| Power Supply Voltage | 12.0 V DC |
| Push/Pull Force | ≥8.0 N |
| Self-Braking Force | ≥10.0 N |
| Motor Response Time | ≈30 µs |
| Travel Range | 150.0 mm |
| Max Speed | 200 mm/s |
| Minimum Linear Step | <0.04 µm |
| Linear Backlash at Change of Direction | ≤ 1 µm |
| Elastic Stiffness | ≈ 220 mN/µm |
| Linear Hysteresis | ≤ 2.0 µm |
| Pitch | ≤450 µRad |
| Maximum Moment Mx | 0.07 Nm |
| Roll | ≤225 µRad |
| Maximum Moment My | 0.12 Nm |
| Yaw | ≤450 µRad |
| 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 (at listed specification) | 1 kg |
| Max Current over velocity range | 1.2 A |
| **DIMENSIONS & WEIGHT** | |
| Motor Weight | 500g |
| Motor Dimensions | 321x77x20 mm |
| Driver PCB Dimensions | 40x63x25 mm |
| Driver PCB Weight | 25 g |

## ORDERING INFORMATION

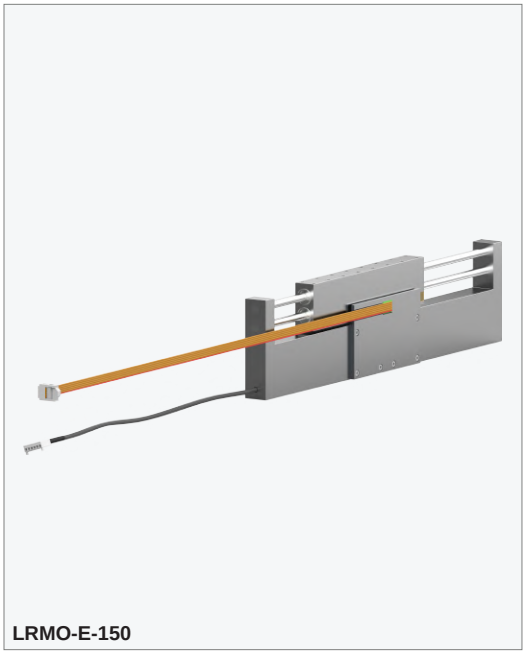
| Model | Encoder | Part Number | Kit Number* |
|---|---|---|---|
| LRMO-N-150 | No | LRMO-M012-0471-2002 | LRMO-M012-0471-2002 |

***Evaluation Kit without Encoder, Includes; Linear motor, Open-loop Driver PCB, 110/240 VAC to12 V DC power adapter, cables.**

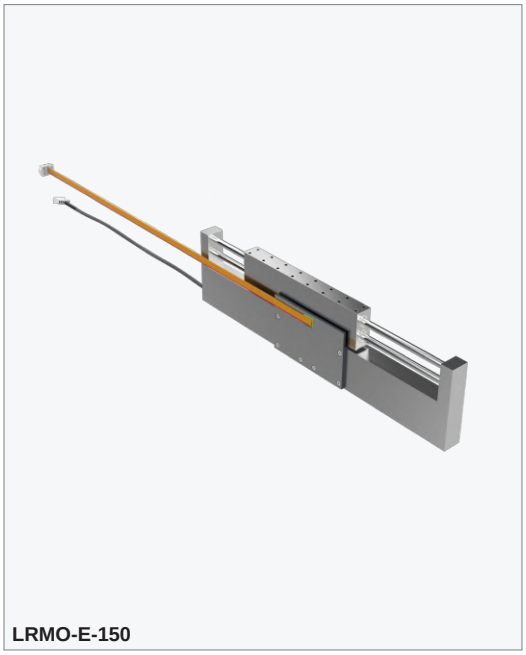
# LRMO-E-150

## Close-Loop Linear Piezoelectric Motor

**With Encoder**



LRMO-E-150



LRMO-E-150

## INTRODUCTION

High-precision linear piezoelectric motor with 150 mm travel range and factory-fitted optical encoder. Closed-loop control enables precise positioning with 2.6 µm resolution.

| MOTOR SPECIFICATIONS | |
|---|---|
| Power Supply Voltage | 12.0 V DC |
| Push/Pull Force | ≥8.0 N |
| Self-Braking Force | ≥10.0 N |
| Motor Response Time | ≈30 µs |
| Travel Range | 150.0 mm |
| Max Speed | 200 mm/s |
| Minimum Linear Step | <0.04 µm |
| Encoder Resolution (after quadrature) | 2.6 µm |
| Minimum Controlled Linear Step | 2.6 µm |
| Uni-directional Repeatability | 2.6 µm |
| Linear Backlash at Change of Direction | ≤ 1 µm |
| Elastic Stiffness | ≈ 220 mN/µm |
| Linear Hysteresis | ≤ 2.0 µm |
| Pitch | ≤450 µRad |
| Maximum Moment Mx | 0.07 Nm |
| Roll | ≤225 µRad |
| Maximum Moment My | 0.12 Nm |
| Yaw | ≤450 µRad |
| 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 (at listed specification) | 1 kg |
| Max Current over velocity range | 1.2 A |
| **DIMENSIONS & WEIGHT** | |
| Motor Weight | 500g |
| Motor Dimensions | 321x77x20 mm |
| Driver PCB Dimensions | 40x63x25 mm |
| Driver PCB Weight | 25 g |

## ORDERING INFORMATION

| Model | Encoder | Part Number | Kit Number* |
|---|---|---|---|
| LRMO-E-150 | Yes | LRMO-M012-1471-2002 | LRMO-M012-1471-2002 |

***Evaluation Kit with Optical Encoder, Closed Loop, Includes; Linear motor, Close-Loop Driver PCB, 110/240 VAC to12 V DC power adapter, cables.**

# LRMO-N-150 Motion Control

## and Driver Electronics

**PWM | Serial | Open-loop & Closed-loop**

## INTRODUCTION

Control of the LRMO-150 Series Linear Motor is simple and flexible. Each motor is operated via a dedicated driver PCB, which converts motion commands into precise electrical excitation using optimized frequency and amplitude signals to actuate the piezo resonator.

The driver supports multiple control interfaces, including PWM & serial, enabling seamless integration into a wide range of systems. Each PCB is pre-configured for the specific motor model, with additional software configurability to optimize performance and system integration.

In the close-loop configuration, a companion daughter board provides closed-loop feedback and serial communication, enabling accurate position control via Piezo Motor Company's software or external controllers.

The LRMO-150 driver architecture offers a compact, cost-effective control solution, while enabling fine motion regulation through closed-loop operation when required.

## LRMO-150 OPEN LOOP DRIVER PCB OPTIONS

**Standard Open Loop Driver PCB**
**Part No.: ROLR-PPCB-0470-0000**

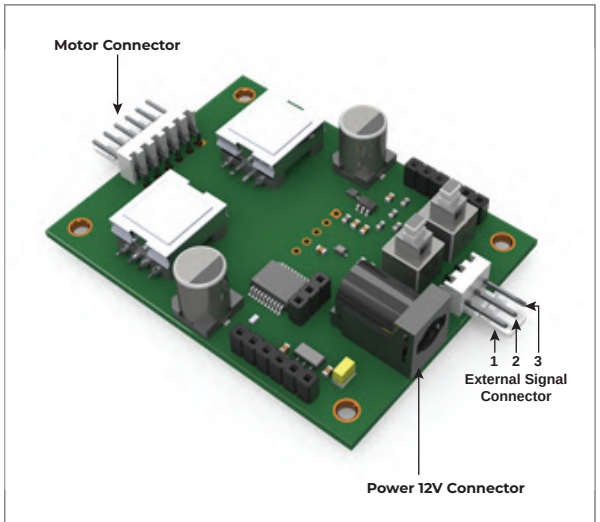
The driver board can be controlled using an external signal source PWM (Pulse Width Modulation). Control signals are applied to the External Signal Connector to generate the desired motion. Control of speed using PWM is implemented by varying the pulse duration and repetition rate of input signals onto the two directional control pins. Size of step is determined by the pulse duration, and speed is determined by pulse rate. The minimum pulse duration is approximately 30µs.

The LRMO-150 driver PCB is compatible with both LRMO-150 (non-encoder) and LRMO-E-150 (encoder-equipped) motors. For applications requiring closed-loop control with the Open-Loop driver, the control loop must be implemented externally by the user using encoder feedback and a third-party controller.

| Control Interface | |
|---|---|
| **PWM (TTL-compatible)** | via J1 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.




**Electronic PCB Driver for LRMO-LG Piezomotors**

# LRMO-E-150 Motion Control

## and Driver Electronics

**PWM | Serial | Open-loop & Closed-loop**

## LRMO-E-150 CLOSED LOOP DRIVER PCB OPTIONS

**Standard Closed Loop Driver PCB**
**Part No.: ROLR-PPCB-1480-0000**

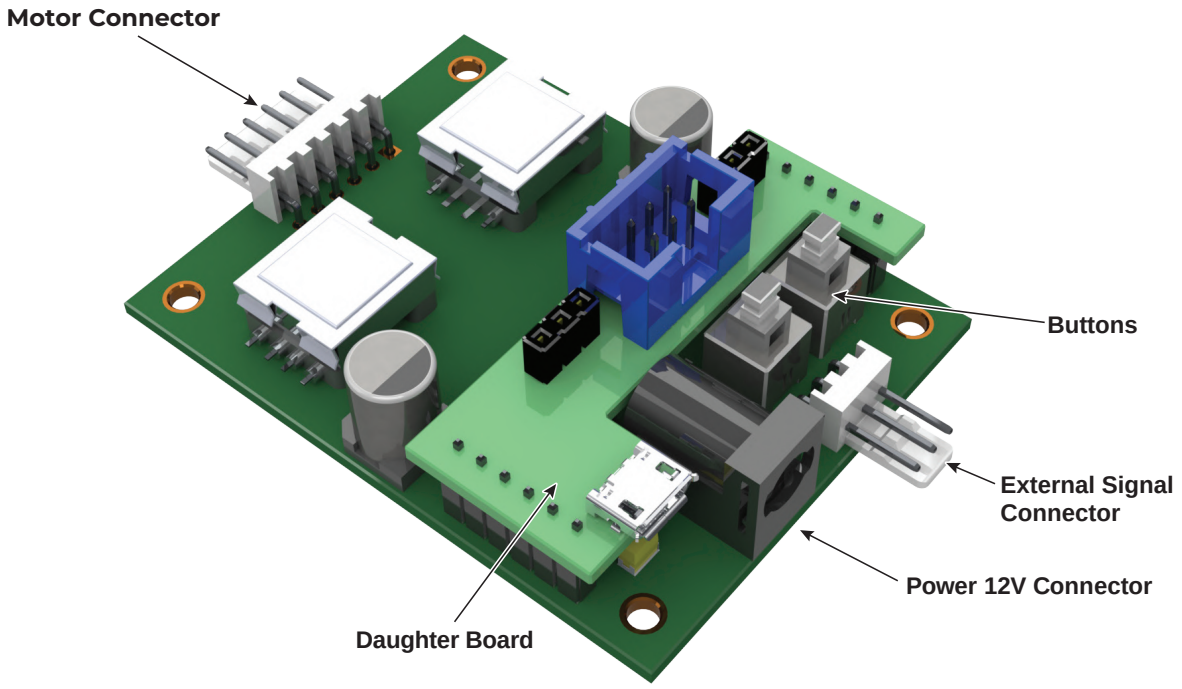
In closed-loop control (feedback control) mode, an additional daughter PCB is mounted on driver PCB. Feedback from an external optical encoder, mounted on the piezo-motor, is fed to the daughter board and used to close the loop. The position and speed of the motor can then be controlled through an elaborate set of commands via either a USB port (through Piezo Motor Company (PMC)'s GUI) or serial (RS 232) port commands.

The Close loop driver PCB is compatible with LRMO-LG-E (encoder-equipped) motors only and is designed for use with PMC's close loop software, enabling simple integration and high-precision motion control.

| Control Interfaces | |
|---|---|
| **PMC's PLC Software (Windows)** | |
| **RS 232** | Serial commands |

**Additional Features:**

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



# Performance Chart

## and Ordering Information

**Motor/Driver Part Configurations**

## MOTOR CONFIGURATIONS

| Model | Encoder | Travel Range | Push/Pull | Min. step | Max Speed | Power Supply | Kit Number |
|---|---|---|---|---|---|---|---|
| LRMO-N-150 | Without | 150 mm | ≥8.0 N | <0.04 µm | 200 mm/s | 12 V DC | LRMO-M012-0471-2002 |
| LRMO-E-150 | With | 150 mm | ≥8.0 N | <0.04 µm | 200 mm/s | 12 V DC | LRMO-M012-0471-2002 |

## PART NUMBERS & EVALUATION KIT DETAILS

| Model | Part Number | Evaluation Kit Description |
|---|---|---|
| LRMO-N-150 | LRMO-M012-0471-2002 | Linear Motor Evaluation Kit without Encoder, Includes; Linear motor, Open-Loop Driver PCB, 110/240 VAC to12 V DC power adapter, cables. |
| LRMO-E-150 | LRMO-M012-1471-2002 | Linear Motor Evaluation Kit with Optical Encoder, Closed Loop, Includes; Linear motor, Close-Loop Driver PCB, 110/240 VAC to12 V DC power adapter, cables. |

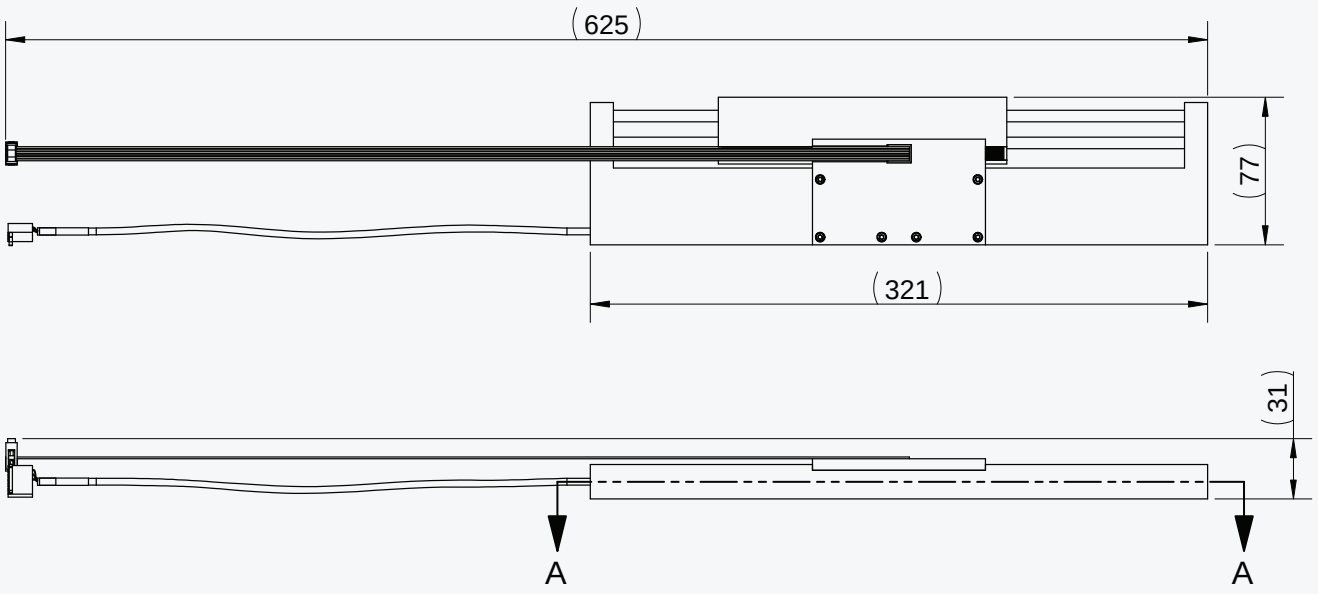
For custom inquires, contact us at info@piezomotors.com

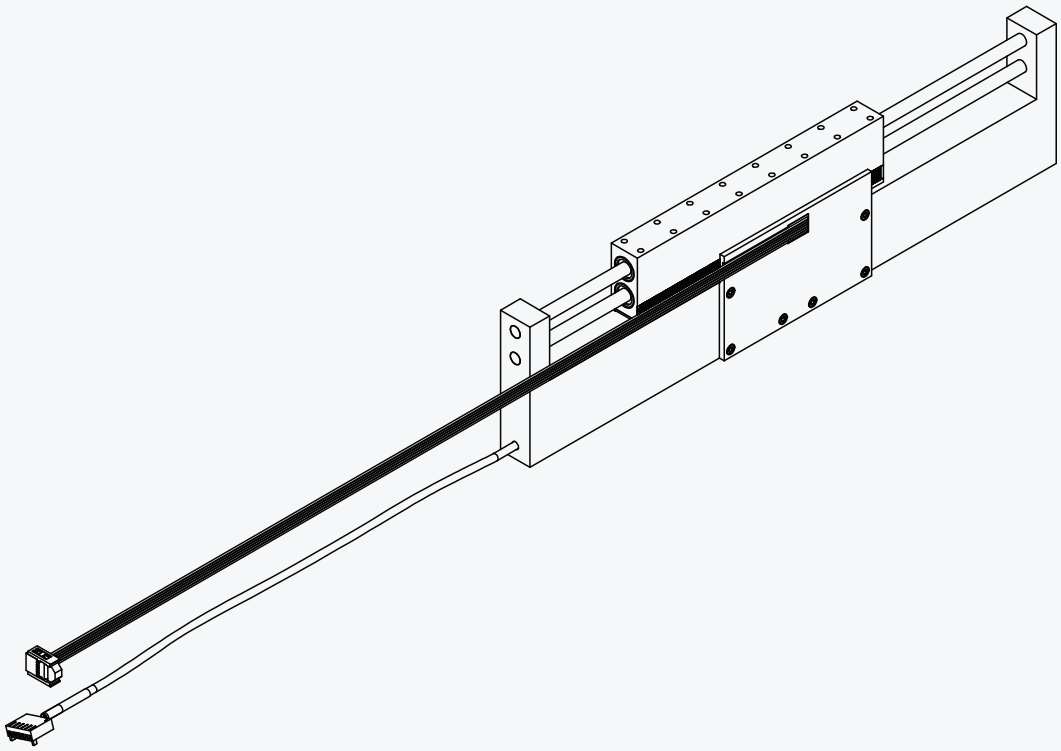
# Mechanical Drawings

## LRMO-150

**LRM0-150 Model | All Dimensions in mm**

**ENCODER VERSION** **(Note - Non-encoder version has same dimensions).**



**Dimensions in mm**

# Why Piezo Motors?

## LRMO-150 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 | ✓ ≥10 N | — None | — Detent only | — None |
| Sub-30 µs response | ✓ ~30 µs | ■ ~ms range | ■ Step limited | ✓ Fast |
| Size / force 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 | ✓ 12 V DC | ■ 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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| Asia | +91 98606 24731 | devendra@piezomotors.com |

# Applications

The LRMO-150 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.

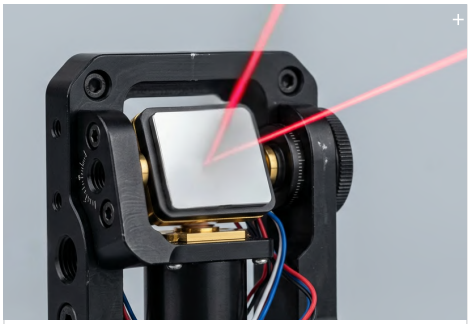
### MEDICAL & DIAGNOSTIC
OCT scanners, surgical robotics, drug delivery micro-pumps

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

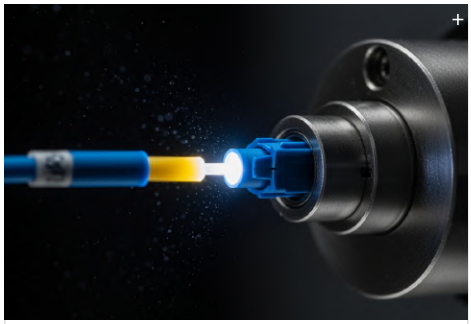
### ROBOTICS & AUTOMATION
Pick-and-place, collaborative robot joints, gripper mechanisms.

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

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

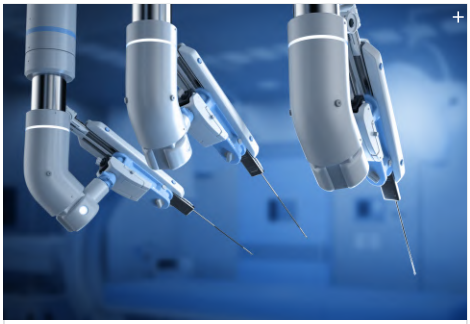


### BEAM STEERING
Precision angular adjustment of optical paths and mirrors.

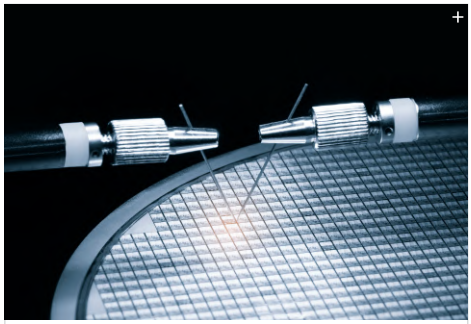


### FIBRE ALIGNMENT
Sub-µrad alignment of fibre optic components.

### 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

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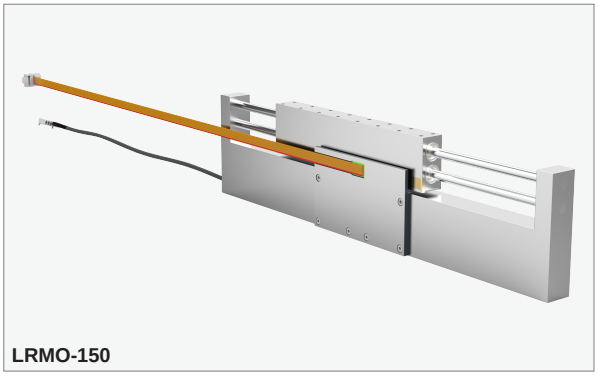

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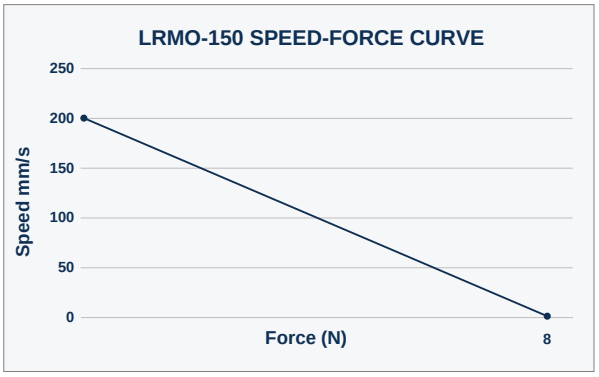


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