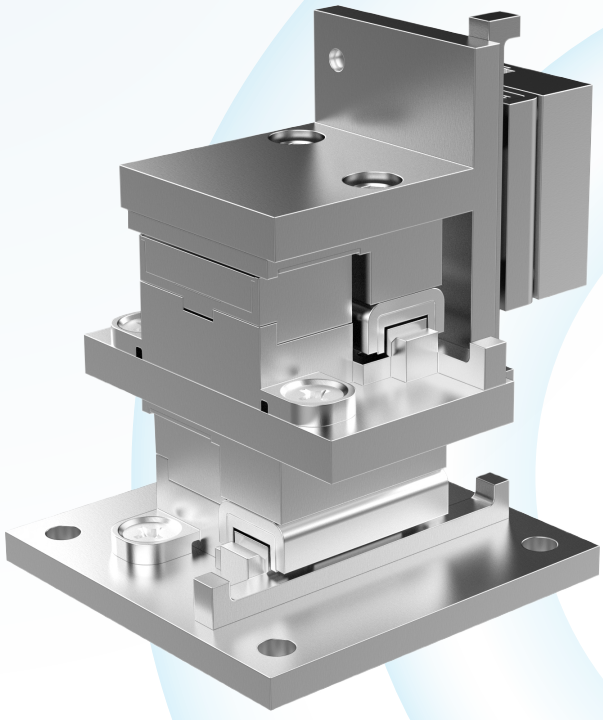
PMC
PIEZO
MOTOR COMPANY

www.piezomotors.com

LRMO-XYZ

Miniature Piezoelectric 3-Axis XYZ Positioning Platform

Innovation In The Design And
Manufacturing Of Piezoelectric Motors



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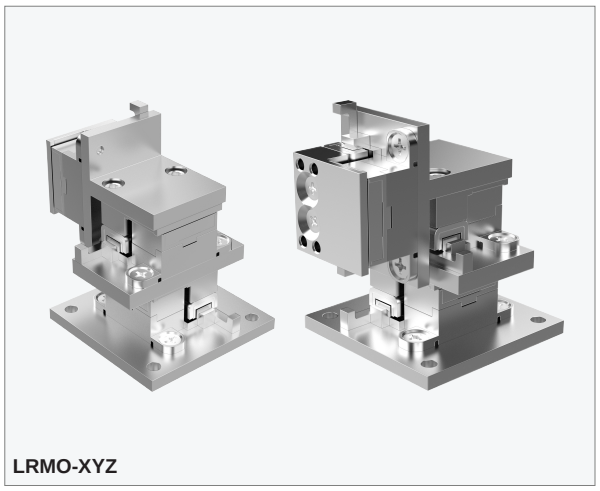
LRMO-XYZ Series

Miniature Piezoelectric 3-Axis XYZ Positioning Platform

INTRODUCTION

Piezo Motor Company's LRMO-XYZ Series combines three LRMO linear piezoelectric actuators into a compact, high-precision three-axis positioning platform. Built around patented ultrasonic piezoceramic technology, the XYZ systems deliver ultra-high resolution, fast response, and excellent force density — ideal for demanding multi-axis positioning tasks in photonics, microscopy, metrology, and precision automation.

Each system is supplied as a complete, ready-to-run multi-axis solution with driver electronics, I²C adapter, Raspberry Pi controller and preloaded Python API. Available exclusively in machined anodized aluminum enclosures.

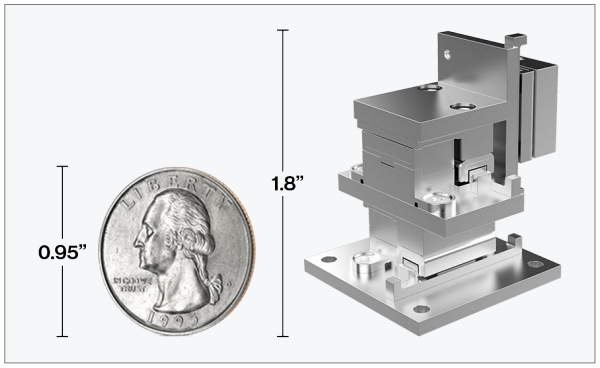


LRMO-XYZ

PRINCIPLE OF OPERATION

US Patent Number 12,143,036

Each linear axis of the XYZ system operates on the electrical excitation of the piezoceramic resonator which induces two independent longitudinal and bending standing waves in perpendicular directions, generating elliptical vibrations at the resonator tip. These vibrations produce linear motion of the passively coupled linear slide, enabling both smooth continuous motion and sub-micron stepped increments on every axis.



PERFORMANCE & BENEFITS

- Sub-micron positional resolution.
- Compact, lightweight machined aluminum design
- Stepping and continuous modes of motion on each axis.
- Silent operation and low-voltage (5.0 V DC) drive.
- Open-loop and closed-loop (encoder feedback) models.

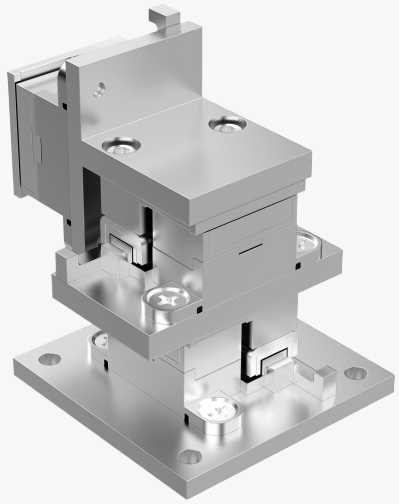
KEY FEATURES

- 9.0 mm travel per axis
- Ultra-fast response (~30 µs)
- Push/pull force ≥ 0.2 N with Self-braking ≥ 0.25 N
- Max speed ≥ 150 mm/s
- Minimum linear step < 0.04 µm
- I²C control
- Low voltage — 5.0 V DC

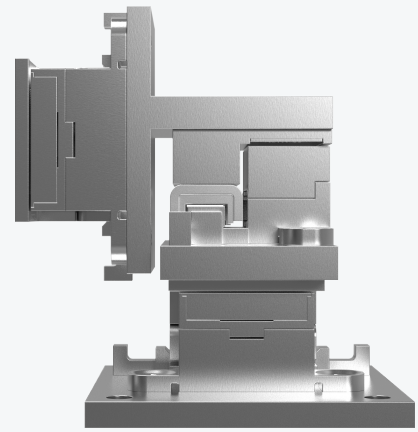
LRMO-N-XYZ

Open-Loop 3-Axis XYZ Positioning Platform

Anodized Aluminum Enclosure | No Encoder | I²C Control



LRMO-XYZ (Front View)



LRMO-XYZ (Side View)

INTRODUCTION

One of the world's smallest lightweight piezoelectric XYZ platform designed for superior precision.

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	
Dimensions of the Controller (Adapter+Drivers)	10 (h) X 60 (w) x 120 (d)
Weight LRMO-XYZ	29g
Weight Controller	40g
Piezoelectric motor	LRMO

ORDERING INFORMATION

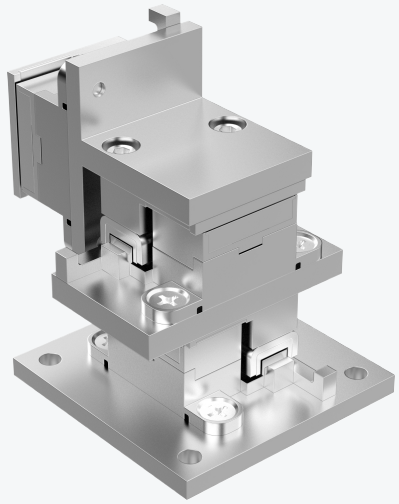
Model	Encoder	Part Number	Kit Number*
LRMO-N-XYZ	No	LRMO-MXYZ-0291-0000	LRMO-MXYZ-0291-0000

***System includes: LRMO-E-XYZ System, 3 × open-loop I²C driver PCBs, I²C adapter board, Raspberry Pi controller with preloaded Python API, dual 5 V DC power supplies, and interconnect cables.**

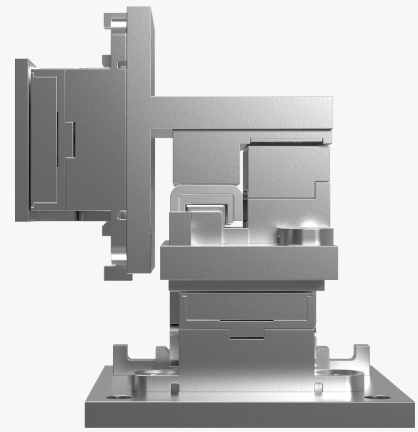
LRMO-E-XYZ

Closed-Loop 3-Axis XYZ Positioning Platform

Anodized Aluminum Enclosure | With Encoder | Python API



LRMO-E-XYZ (Front View)



LRMO-E-XYZ (Side View)

INTRODUCTION

One of the world's smallest lightweight piezoelectric XYZ platform designed for superior precision.

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	
Dimensions LRMO-E-XYZ	38 (h) x 30 (w) x 32 (d)
Dimensions of the Controller (Adapter+Drivers)	10 (h) X 60 (w) x 120 (d)
Weight LRMO-XYZ	30g
Weight Controller	40g
Piezoelectric motor	LRMO-E

ORDERING INFORMATION

Model	Encoder	Part Number	Kit Number*
LRMO-E-XYZ	Yes	LRMO-MXYZ-1291-0000	LRMO-MXYZ-1291-0000

***System includes: LRMO-E-XYZ System with factory-fitted magnetic encoders, 3 × closed-loop I²C driver PCBs, I²C adapter board, Raspberry Pi controller with preloaded Python API, dual 5 V DC power supplies, and interconnect cables.**

LRMO-N-XYZ & LRMO-E-XYZ

I²C / API Command Summary Commands

Open-loop & Closed-loop

SYSTEM CONTROL OVERVIEW (OPEN-LOOP OPERATION)

- **LRMO-N-XYZ (Open-Loop)** - Motion controlled via PWM signals, timing, and drive current. No encoder feedback; position determined indirectly via command duration and calibration. Simple, compact, high-speed architecture without feedback electronics.
- **LRMO-E-XYZ (Closed-Loop)** - Real-time encoder feedback (2.6 µm resolution) on every axis enables homing and absolute positioning (0–9000 µm) through the PMC Python API. Velocity stabilised across 0.01–200 mm/s. Precise, repeatable, fully programmable multi-axis control.

LRMO-N-XYZ - I²C / API Command Summary (Open-Loop)

Command	Function
PiezoMotor(Number_I2C_Bus)	Creates the motor controller object on the specified I²C bus (typically 1)
Move(address, param)	Executes directional motion (continuous or PWM-based)
MotorType(address, motorType)	Sets actuator type (Linear / Rotary)
PWMTimeSettings(address, direction, duty_cycle_percent, frequency_Hz)	Configures PWM timing (step behaviour)
PWMGeneratorSettings(address, direction, run_motor_periods, period_of_PWM, prescale)	Advanced PWM control
Current(address, current)	Sets motor drive current
setAddress(address, new_address)	Changes I²C address

LRMO-E-XYZ - I²C / API Command Summary (Close-Loop)

Command	Function
PiezoMotor(Number_I2C_Bus)	Creates the motor controller object on the specified I²C bus (typically 1)
Home(address)	Executes homing routine and blocks until complete
getPosition(address)	Reads back axis position and returns value in µm
Position(address, value)	Commands absolute position in µm (blocks until complete)
Velocity(address, value)	Sets velocity (mm/s)
Move(address, action)	Open-loop direction command (Left / Right / Stop)
setPWMsettings(address, duty_cycle_percent, frequency_Hz)	Configures PWM duty cycle and frequency
setAddress(address, new_address)	Changes I²C address

Ordering Information

PART NUMBERS

Model	Part Number	Evaluation Kit Description
LRMO-N-XYZ	LRMO-MXYZ-0291-0000	System includes: 3 × LRMO linear piezo actuators, 3 × open-loop I²C driver PCBs, I²C adapter board, Raspberry Pi controller with preloaded Python API, dual 5 V DC power supplies, and interconnect cables.
LRMO-E-XYZ	LRMO-MXYZ-1291-0000	System includes: 3 × LRMO-E linear piezo actuators with factory-fitted magnetic encoders, 3 × closed-loop I²C driver PCBs, I²C adapter board, Raspberry Pi controller with preloaded Python API, dual 5 V DC power supplies, and interconnect cables.
USB-12C Cable	I2CX-CABL-0290-0000	USB-to-I²C interface cable – optional accessory enabling direct PC control of LRMO-XYZ systems as an alternative to Raspberry Pi. Delivers reliable I²C communication with full multi-axis addressing support.

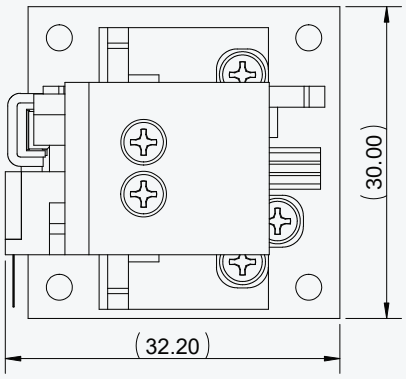
For custom inquires, contact us at info@piezomotors.com

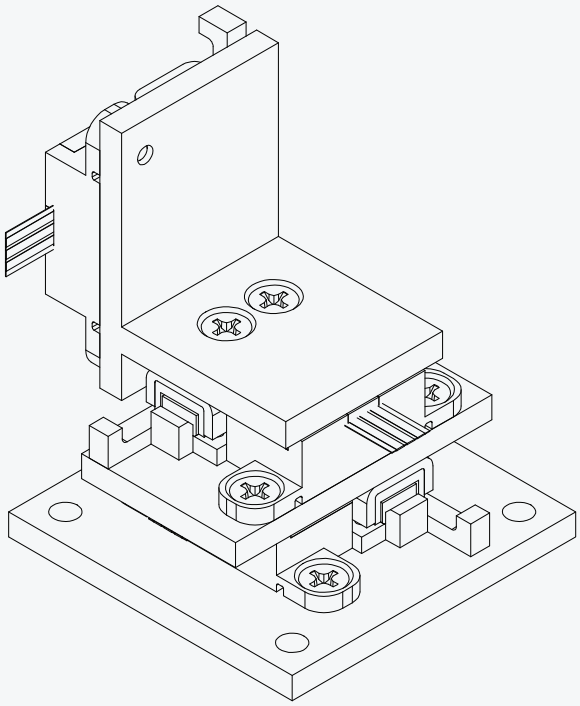
Mechanical Drawings

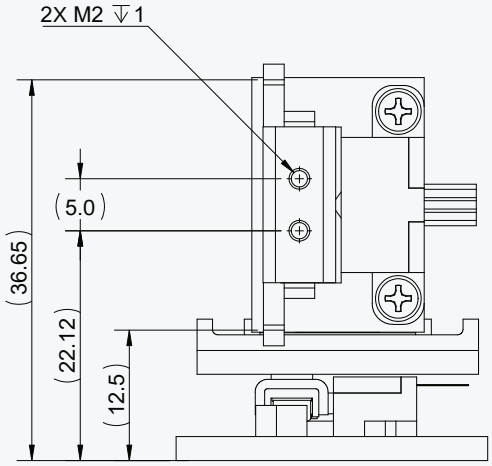
LRMO-N-XYZ Series

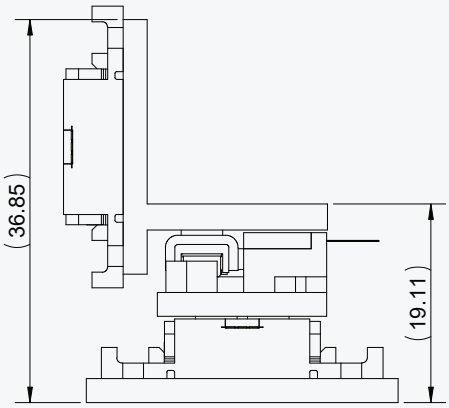
Standard and Encoder Models | All Dimensions in mm

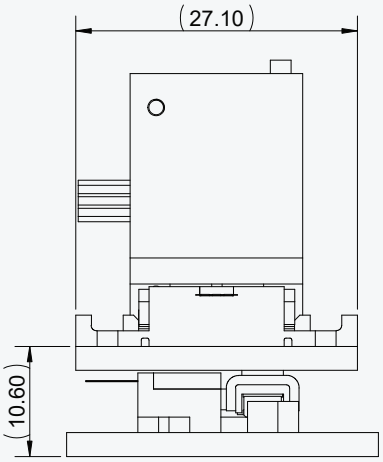
STANDARD MODEL











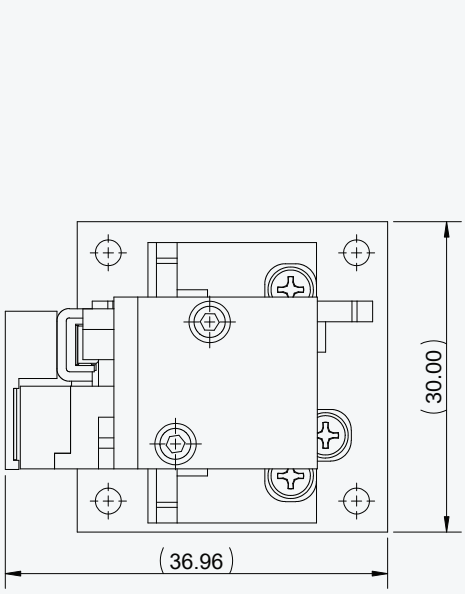
Dimensions in mm

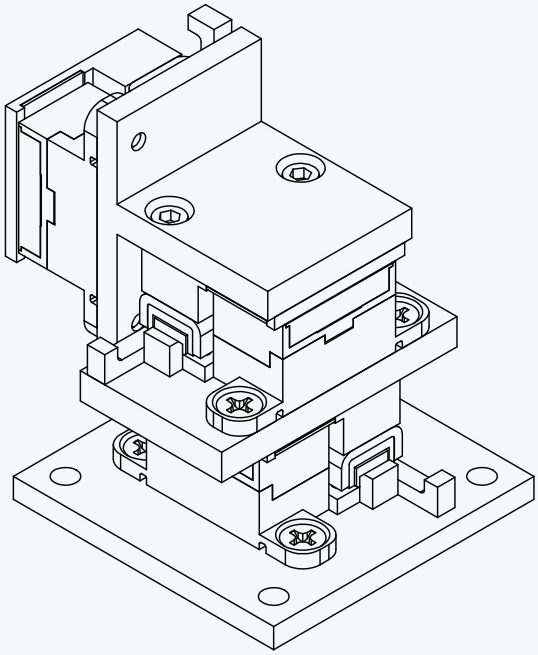
Mechanical Drawings

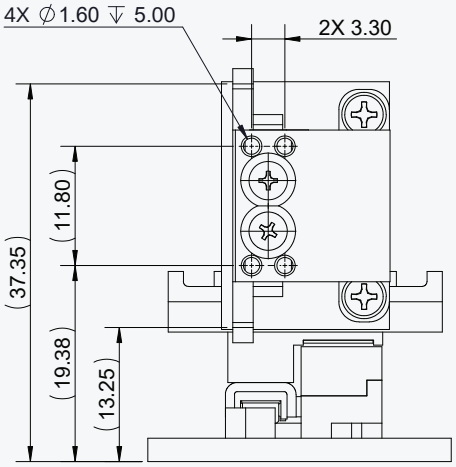
LRMO-E-XYZ Series

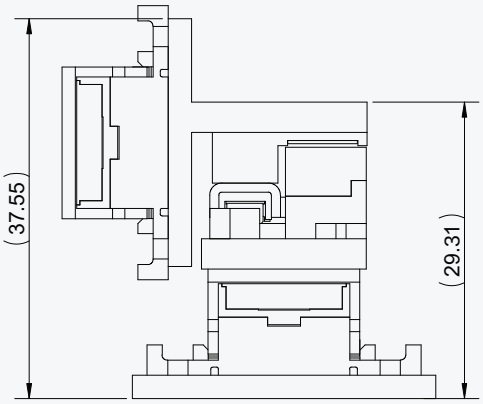
Standard and Encoder Models | All Dimensions in mm

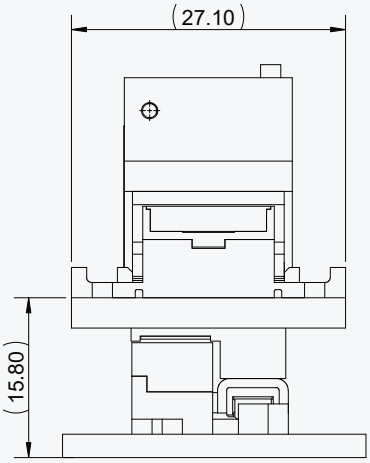
ENCODER MODEL











Dimensions in mm

Why Piezo Motors?

LRMO-XYZ 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 / 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	✓ 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.
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Applications

The LRMO-XYZ system is engineered for demanding OEM applications where precision, compactness, and energy efficiency are critical. The 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.

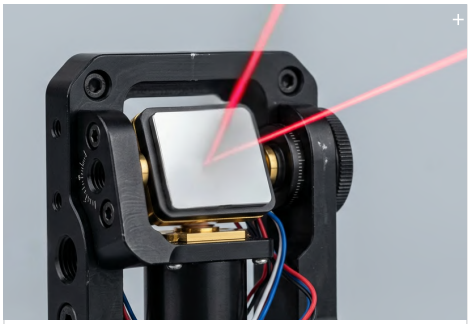
MEDICAL & DIAGNOSTIC
OCT scanners, surgical robotics, drug delivery micro-pumps

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

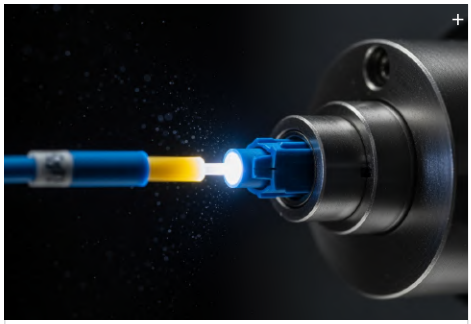
ROBOTICS & AUTOMATION
Pick-and-place, collaborative robot joints, gripper mechanisms.

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

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

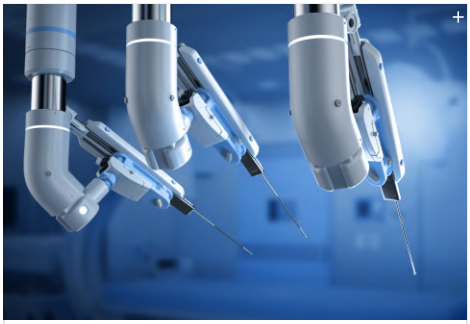


BEAM STEERING
Precision angular adjustment of optical paths and mirrors.

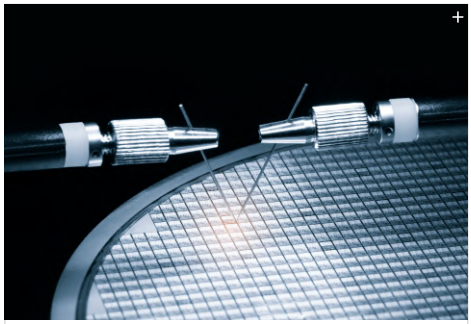


FIBRE ALIGNMENT
Sub-µrad alignment of fibre optic components.

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