



- **Nanometer resolution**
- **Closed loop control**
- **Open loop mode**
- **Servo mode**
- **Stackable boards for multiaxis**

The PMD401 is a 1-axis controller/driver for use with Piezo LEGS motors from PiezoMotor. Boards can be stacked to form multi axis systems, and piggy-back on customers mainboard for close integration in various OEM applications. For linear motors it provides resolution down to sub-nanometer range and millimeters per second speeds. PMD401 is the ideal choice for system designs where one or several Piezo LEGS motors are used.

Functional principle

The board controls the Piezo LEGS motor by feeding waveform signals which elongate and bend each of the piezoelectric actuator legs within the motor. The waveforms are designed specifically to make the drive legs perform a precise walking motion. The motion of the drive legs is transferred via friction contact to a linear rod or a rotary disc.

For each waveform cycle the Piezo LEGS motor will take one full step, called a *waveform-step* (wfm-step). The wfm-step length is load dependant but typically a few micrometers for a linear Piezo LEGS motor, and less than one milliradian for a rotary motor.

The PMD401 gives a maximum resolution of 8192 microsteps per full wfm-step. One microstep equals ~ 0.5 nanometer ($0.0005 \mu\text{m}$) of linear motion, or ~ 0.1 microradian of angular motion.

Working with the PMD401

The PMD401 communicates with the host via 2-wire RS485 (115200n81). Communication with the controller is through ASCII commands, where a maximum of 127 boards can be addressed over the same line.

The controller can operate closed loop (target mode) or open loop. Position sensors should be used to keep track of the precise position of the Piezo LEGS motors. The controller can read quadrature or serial encoder and limit switches. Acceleration and deceleration parameters are available in closed loop operation.

As an alternative, the PMD401 can be used like a servo amplifier together with an external motion controller. The external controller may control the speed via SPI interface.

To get started using the PMD401, the customer can get a breakout board with terminal blocks for easy access to power and communication. Power supply and converter cable (USB-to-RS485) are also available as accessory items.

Ordering information

Controller

PMD401-01B	1-axis microstep controller/driver for Piezo LEGS motors
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Accessories

CB-PMD401	Connector board / Breakout board
105787-HK-ALL	Power supply 48V
107401	USB-to-RS485 converter cable

Technical Specification			
Type	PMD401-01B	Note	
Number of Axes	1	Boards can be stacked for multi-axis	
Signal Voltage Range	0-45 V		
Resolution	8192 microsteps constitutes 1 wfm-step	example LT20 linear motor at no load: 1 microstep \approx 0.0005 μ m 1 wfm-step \approx 5 μ m	
Maximum Stepping Rate	<i>Type of Motor</i>	Examples given for a few standard motors. Maximum number of wfm-steps per second [Hz] is based on power consumption at low duty cycle when motor is not heated. Controller makes measurement on motor during unpark and sets the maximum stepping rate.	
	<i>Wfm-step Frequency [Hz]</i>		
	LL06		1500
	LR80		1000
	LT20	750	
	LT40	350	
Supported Sensors	Quadrature SSI BiSS	- ABZ single ended, 15 MHz counting - 8/30/(32) bit, 130/330 kbps - 18/26/32 bit, 330 kbps	
Host Communication	Two-wire RS485	Commands are sent in ASCII format, 115.2 kbps (n81)	
Servo Control	SPI	Slave to external motion controller 16 bit (signed), max 500 kbps	
General I/O	4 in 3 out	Depending on encoder type and use of limit switches	
Stacking Connector*	6-pole, ERNI MicroStac 114711	48V, GND, RS485	
Motor Connector	5-pole, JST SM05B-SRSS-TB	Output motor phases and GND. Two connectors, parallel connection.	
Sensor/Servo Connector	6-pole, JST SM06B-SRSS-TB	Input for sensors or SPI servo interface	
Limit Switch Connector	4-pole, JST SM04B-SRSS-TB	Input for external limit switches	
Power Connector*	2-pole, JST SM02B-SRSS-TB	Input for 48V supply	
Communication Connector*	3-pole, JST SM03B-SRSS-TB	Input for RS485	
Power Supply	48 VDC, 5 W	48 VDC \pm 5%	
Dimensions	59 x 39 mm		

* Power and communication can be provided through either stacking connector or through power/communication connectors.

Note: All specifications are subject to change without notice.



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