



- **Nanometer resolution**
- **Closed loop regulation**
- **Open loop mode**
- **General I/O**

The PMD101 is a 1-axis driver for use with Piezo LEGS motors from PiezoMotor. It is one of the more advanced drivers in the product range giving the Piezo LEGS motors resolution down in the nanometer/microradian range. Driving the motors in closed loop is possible when reading back position from an positional sensor. The PMD101 supports quadrature encoders, and serial SSI sensors. Issuing a single command will guide the motor to the exact encoder count, taking in to account the parameter settings for ramping behavior.

### Functional principle

The driver controls the Piezo LEGS motor by feeding waveform signals which elongates and bends each of the piezo drive legs. The waveforms are specially designed 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 to a rotary disc.

For each waveform cycle the Piezo LEGS motor will take one full step, by definition called a *waveform-step* (wfm-step). The wfm-step length is load dependant but in the range of a few micrometers for a linear Piezo LEGS motor. Rotary Piezo LEGS motors have their drive legs working on the perimeter of a drive disc. The wfm-step angle depends on the diameter of the rotary motor but is usually less than one milliradian.

The generated signal waveform is made up of a large number of voltage target points in time. Each small voltage change will move the motor only by a fraction of a wfm-step, defined as a *microstep*. The PMD101 driver gives a maximum resolution of 2048 microsteps per full wfm-step. One microstep with highest resolution settings equals  $\sim 2$  nanometer ( $0.002 \mu\text{m}$ ) of linear motion, or  $\sim 0.5$  microradian of angular motion.

### Working with the driver

The PMD101 communicates with the host (PC) via USB. Communication with the driver is through a protocol language (ASCII commands). The user can run in closed loop target mode, or in open loop mode, with full access to set resolution, step frequency (speed) etc. Positional sensors are used to keep track of the precise position of the Piezo LEGS motors. The driver can read limit switches and reset at index. Ramping parameters are set to prevent overshooting when closing in on target in closed loop operation. The PMD101 is a full featured driver for demanding applications.

### Ordering information

#### Driver

|        |   |
|--------|---|
| PMD101 | 1-axis microstep driver for Piezo LEGS motors |
|--------|---|

| Technical Specification       |   |   |
|-------------------------------|---|---|
| Type                          | PMD101                                  | Note  |
| Number of Axis                | 1                                       |   |
| Electrical Phases per Axis    | 4                                       |   |
| Signal Voltage Range          | 0-45 V                                  |   |
| Max Resolution                | 2048 $\mu$ steps / wfm-step             | example LT20 motor at no load:<br>one wfm-step $\approx$ 5 $\mu$ m<br>one $\mu$ step $\approx$ 2.4 nm |
| Open Loop Operation           | Yes                                     |   |
| Closed Loop Operation         | Yes                                     |   |
| Number of Sensor Axis         | 1                                       |   |
| Supported Sensors             | Quadrature<br>Analogue<br>Serial        | with index (ABZ)<br><br>SSi   |
| Quadrature Counting Frequency | 5 MHz                                   |   |
| General I/O                   | 3 in<br>2 out                           | only 1 input pin available when using 2 limit switches  |
| I/O Port Features             | Step direction interface,<br>Analog run |   |
| Host Communication            | RS232 (via USB)                         | hardware implemented USB-to-RS232,<br>commands are sent in plain ASCII format                         |
| Host Connector                | USB                                     |   |
| Motor Connector               | JST BM05B-SRSS-TB                       |   |
| Sensor Connector              | JST BM06B-SRSS-TB                       |   |
| I/O Port Connector            | 2 x 8 pin header                        | for 16 pole IDC plug  |
| Power Supply                  | 12-24 V DC                              | 15 V (1200 mA) AC-DC adaptor included   |
| Dimensions                    | 103 x 65 x 30.4 mm                      |   |

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PiezoMotor Uppsala AB  
Stålgatan 14  
SE-754 50 Uppsala, Sweden

Telephone: +46 18 489 5000  
Fax: +46 18 489 5001

info@piezomotor.com  
www.piezomotor.com

