- **Unlimited rotation**
- **Sub-microradian resolution**
- **No power draw in hold position**
- **Quick response**

The Piezo LEGS WavePlate is intended primarily for use in laser applications with standard 0.5 inch (12.7 mm) inserts. The inserts are locked in place with the provided retaining rings. For added mounting flexibility, the turnable part has four M1.6 threaded holes. Fine adjustments are made using the innovative Piezo LEGS friction drive technology with sub-microradian resolution. Manual override of the turnable part allows for coarse positioning.

The WavePlate is ideally suited for move and hold applications within optics or other high precision fields. When the rotary part is in hold position the WavePlate does not consume any power. The drive technology is direct, meaning no gears are needed to create motion. This means there is no mechanical play or backlash in the motion.

Operating modes

The Piezo LEGS can move in full steps (wfm-steps), or partial steps (microsteps) giving positioning resolution in the sub-microradian range. Speed is adjustable from single microsteps per second up to max specified.

Controlling the motor

PiezoMotor offers a range of drivers and controllers. The most basic one is a handheld push button driver. Another option is an analogue driver that regulates the drive speed by means of an ±7 V analogue interface. One of the more advanced alternatives is the PMD101 Microstep Driver/Controller. This product enables the user to vary the waveform as well as speed. The PMD101 is equipped with encoder signal inputs for close loop control. The microstepping feature divides full step cycle into maximum 2048 increments which results in microsteps as small as 0.5 µrad (0.1 arcsec).

PMD101

Design your own driver

Some customers prefer to design their own driver control for ease of integration or for even higher waveform resolution. In this case PiezoMotor can provide information to assist in the design.

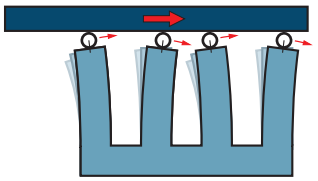
Ordering information	
Motor	
LW2011A-	WavePlate motor
Drivers and Controllers	
PMCM21-01	Handheld push button driver
PMCM31-01	Analogue driver
PMD101	Microstepping driver
Accessories	
102431-05	Motor cable 0.5 m
102431-15	Motor cable 1.5 m

Operating Principle

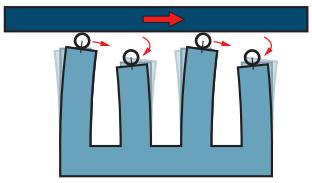
The Piezo LEGS walking principle is of the non-resonant type, i.e. the position of the drive legs is known at any given moment. This assures very good control of the motion over the whole speed range.

The performance of a Piezo LEGS motor is different from that of a DC or stepper motor in several aspects. A Piezo LEGS motor is friction based, meaning the motion is transferred through contact friction between the drive leg and the drive disc. You cannot rely on each step being equal to the next. This is especially true if the motor is operated under varying torques. For each waveform cycle the Piezo LEGS motor will take one full step, referred to as one *wfm-step* (~0.9 mrad at no load). In the schematic illustrations to the right, you can see one step being completed. The rotational velocity of the drive axle is the wfm-step angle multiplied with the waveform frequency (0.9 mrad x 2 kHz = 1.8 rad/s = 100 °/s).

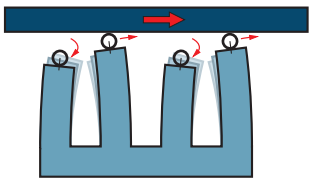
Microstepping is achieved by dividing the *wfm-step* into discrete points. The resolution will be a combination of the number of points in the waveform, and the torque. Example: at 10 mNm torque the typical wfm-step angle is ~0.85 mrad, and with 2048 discrete points in the waveform, the microstep resolution will be ~0.4 µrad. In analog bending mode or with higher resolution D/A converter it is possible to position with even higher resolution.



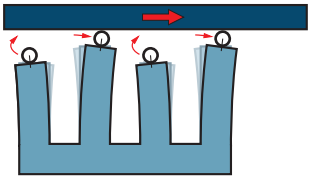
1 *When all legs are electrically activated they are elongated and bending. As we shall see below, alternate legs move as pairs. Arrows show the direction of motion of the tip of each leg.*



2 *The first pair of legs maintains contact with the drive disc and moves towards the right. The second pair retracts and their tips begin to move left.*



3 *The second pair of legs has now extended and repositioned in contact with the drive disc. Their tips begin moving right. The first pair retracts and their tips begin to move left.*



4 *The second pair of legs has moved right. The first pair begins to elongate and move up towards the drive disc.*

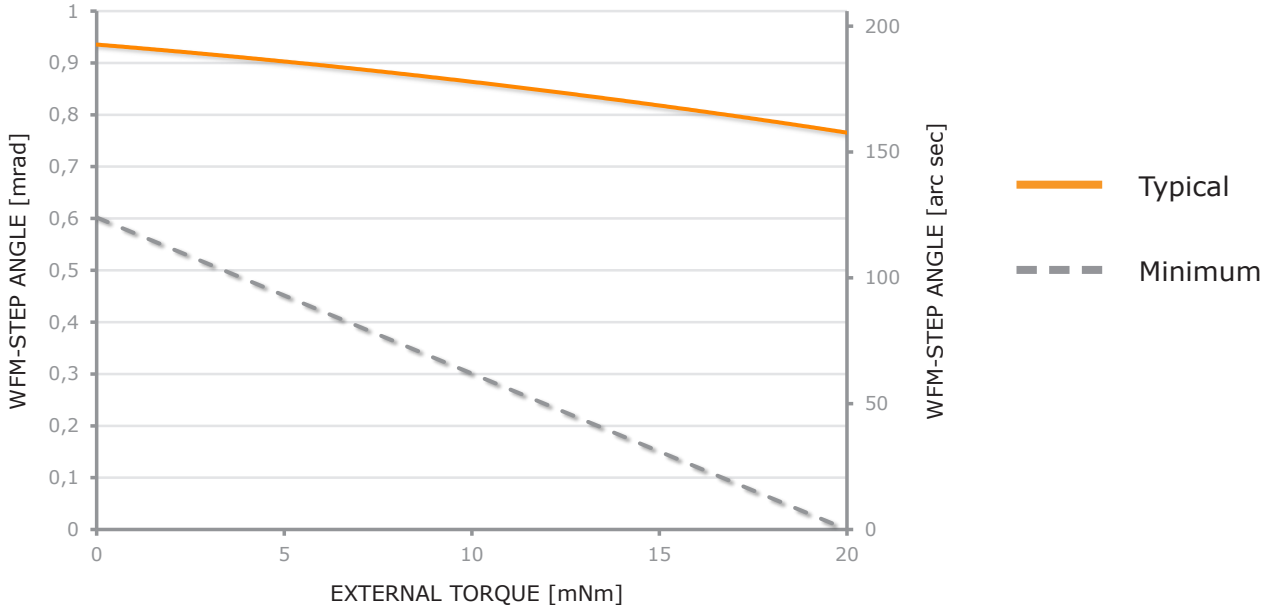
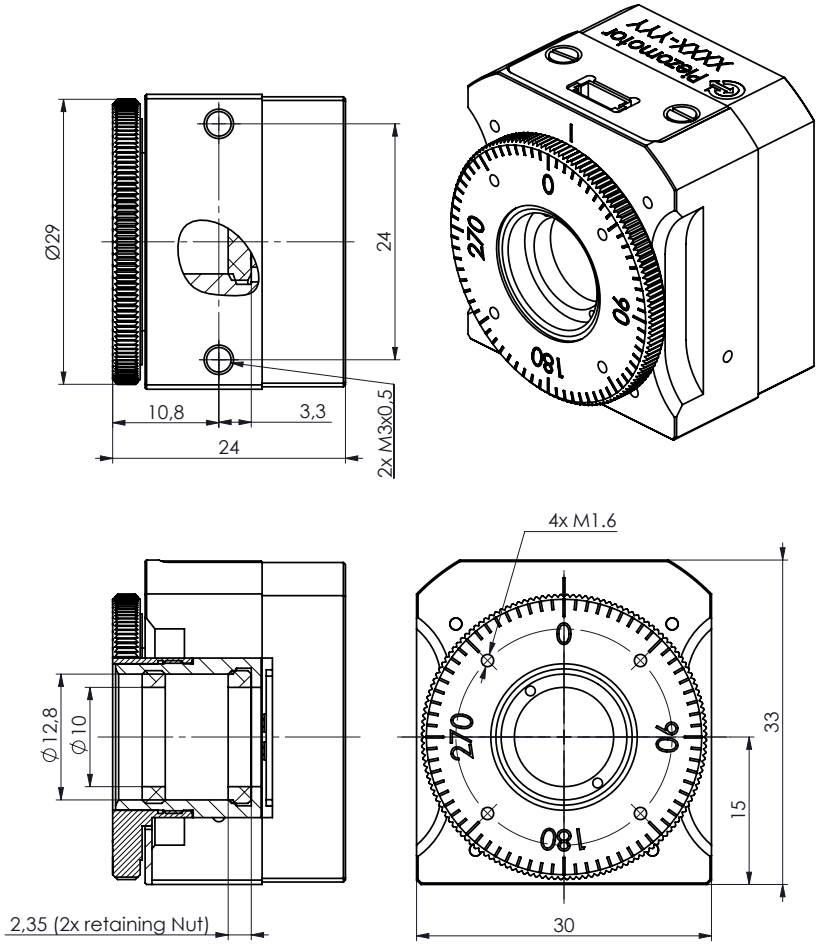


Figure 1 *Typical motor performance with rhombic waveform (Rhomb S) at 650 Hz drive frequency. Wfm-step angle is the average distance the drive disc rotates when the legs take one step (i.e. for one waveform cycle). Using other waveforms than rhombic will give a different curve. Dotted line is guaranteed minimum for these drive conditions.*

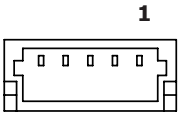
Main Dimensions LW20



Note: Refer to drawings for details.

Electrical Connector Type

On motor type A (standard) the connector is
JST BM05B-SRSS-TB.



Pin Assignment		
Pin	**Terminal**	**Cable Color**
1	Phase 1	Yellow
2	Phase 2	Green
3	Phase 3	White
4	Phase 4	Grey
5	Ground (GND)	Black or brown

150066-00

Technical Specification			
Type	**LW2011A**	**Unit**	**Note**
Angular Range	360	º	continuous
Speed Range	0-100	º/s	recommended, no load
Step Angle	0.0001[a]-0.6 0.02[a]-125 0.006[a]-35	mrad arc sec mº	no load, microsteps up to full wfm-steps
Recommended Operating Range	0-10	mNm	for best microstepping performance and life time
Stall Torque	20	mNm	
Holding Torque	25	mNm	
Maximum Voltage	48	V	
Connector	JST BM05B-SRSS-TB		
Mechanical Size	33 x 30 x 24	mm	see drawing for details
Material in Motor Housing	Stainless Steel		
Weight	107	gram	
Operating Temp.	−20 to +70	ºC	

a. Driver dependant

Item no. **LW2011A-00A**

Stall Torque
20 = 20 mNm

Version

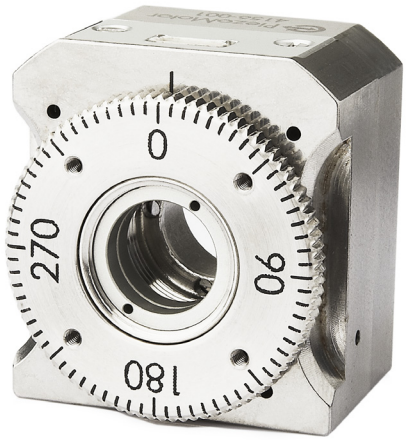
Motor type
A = SS / Stainless Steel

Encoder
00 = No Encoder

Connector
A = JST connector

Cable (standard lengths)
00 = No cable (JST connector only)
05 = 0.5 m
15 = 1.5 m

Note: All specifications are subject to change without notice.



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PiezoMotor

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