Piezo LEGS® Linear Twin-C 300N

- **Direct drive - backlash free**
- **Nanometer resolution**
- **No power draw in hold position**
- **Quick response**
- **Heavy loads**

The Piezo LEGS 300 N motor is intended for high force and precision applications. This includes applications in vacuum for the semiconductor industry. The advantage of using the Piezo LEGS technology is the very precise positioning resolution, as well as automatic locking giving true set-and-forget performance. The technology is based on direct drive which removes the issues of hysteresis and backlash.

The LEGS technology is characterized by its outstanding precision. Quick response time, as well as long service life are other benefits. In combination with the nanometer or even sub-nanometer resolution the technology is quite unique.

Operating modes

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

Controlling the motor

PiezoMotor offers a range of drivers and controllers. 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 two nanometers.

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.

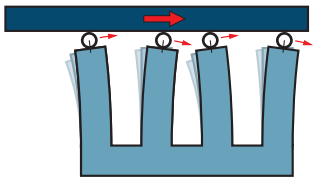
Ordering information	
Motor	
LTC30011-020	Standard
Drivers and Controllers	
PMD101	Microstepping driver

Operating Principle

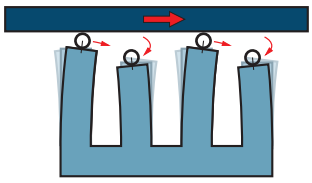
The Piezo LEGS walking principle is of the non-resonant type, i.e. the position of the drive legs is known at any given moment. This assures very good control of the motion over the whole speed range.

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 rod. You cannot rely on each step being equal to the next. This is especially true if the motor is operated under varying loads, as shown in the diagram below. For each waveform cycle the Piezo LEGS motor will take one full step, referred to as one *wfm-step* (~6.5 µm at no load). In the schematic illustrations to the right, you can see one step being completed. The velocity of the drive rod is wfm-step length multiplied with waveform frequency (6.5 µm x 50 Hz = 0.3 mm/s).

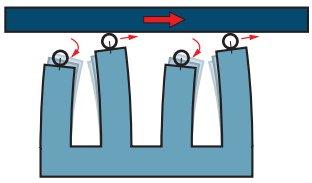
Microstepping is achieved by dividing the *wfm-step* into discrete points. The resolution will be a combination of the resolution of the D/A converter, the number of points in the waveform, and the load. Example: at 150 N load the wfm-step length is ~4.5 µm, and with 2048 discrete points in the waveform the microstep resolution will be ~2.2 nm. In analog bending mode or with higher resolution D/A converter it is possible to position in the sub nanometer region.



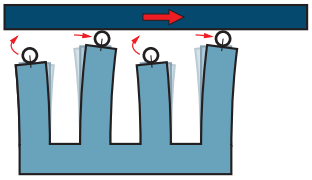
1 *When all four legs are electrically activated they are elongated and bending. As we shall see below, alternate legs move as pairs. Arrows show the direction of motion of the tip of each leg.*



2 *The first pair of legs maintains contact with the rod 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 re-positioned in contact with the rod. 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 rod.*

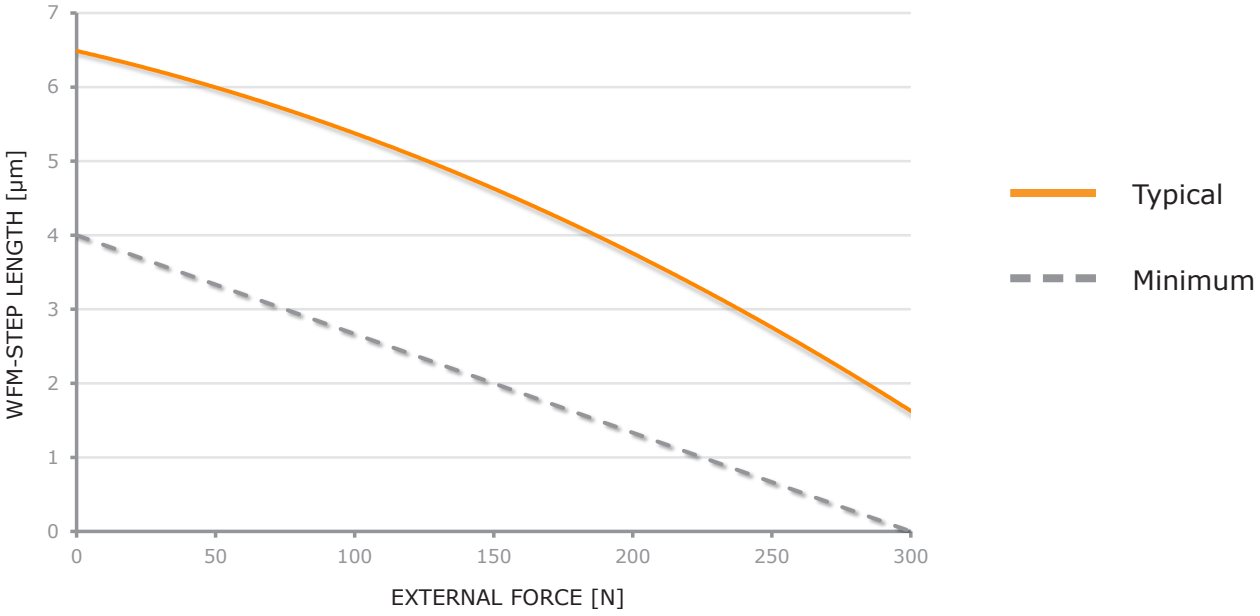
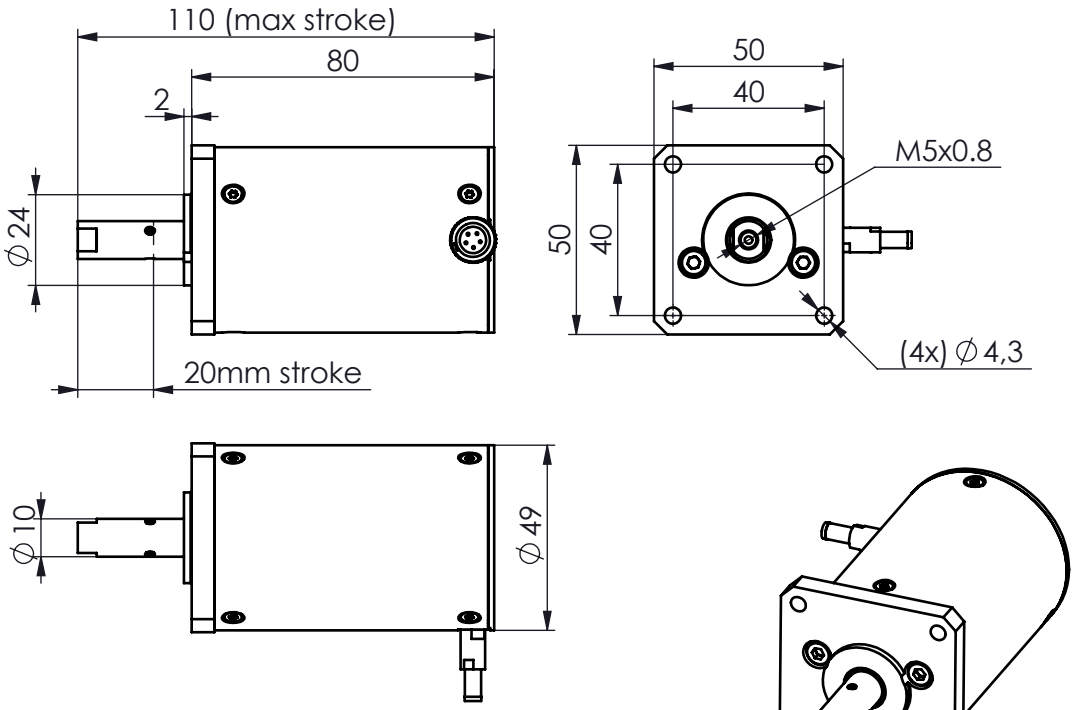


Figure 1 *Typical motor performance with rhombic waveform (Rhomb S) at 50 Hz drive frequency. Wfm-step length is the average distance the drive rod moves when the legs take one step (i.e. for one waveform cycle). Using other waveforms than rhombic will give a different curve. Dotted line is guaranteed minimum for these drive conditions.*

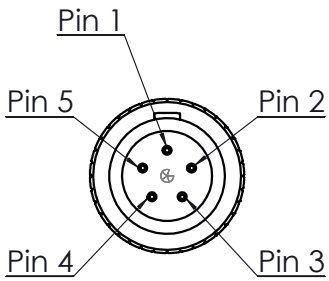
Main Dimensions LTC30011-020

Standard version



Note: Refer to drawings for details.

Electrical Connector Type



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

150046-01

Technical Specification			
Type	**LTC30011-020** (standard version)	**Unit**	**Note**
Maximum Stroke	20	mm	
Speed Range	0-0.3	mm/s	recommended, no load
Step Length	0.001[a]-4	µm	no load, microsteps up to full wfm-steps
Resolution	< 1	nm	
Recommended Operating Range	0-150	N	for best microstepping performance and life time
Stall Force	300	N	
Holding Force	330	N	
Maximum Voltage	48	V	
Connector	LEMO FGG-1B305-CLAM31		
Mechanical Size	80 x 50 x 50	mm	see drawing for details
Material in Motor Housing	Stainless Steel		
Weight	955	gram	approximate
Operating Temperature	−20 to +70	ºC	

a. Driver dependant

Note: All specifications are subject to change without notice.

Visit our website for application examples, CAD files, videos and more...

www.piezomotor.com

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