Piezo LEGS® Linear Twin-C 20N

- **Direct drive - backlash free**
- **Nanometer resolution**
- **Optical mount interface**
- **Quick response and high speed**

The Piezo LEGS 20 N enclosed linear motor is intended for use in a large range of applications; laser and optics applications, moving mirror mounts, replacement for micrometer screws etc. The very high speed dynamics and nanometer resolution makes it ideal for numerous applications.

The LEGS technology is characterized by its outstanding precision. Fast speed and quick response time, as well as long service life are other benefits. In combination with the nanometer resolution the technology is quite unique.

The motor is ideally suited for move and hold applications or for automatic adjustments. When the motor is in hold position it does not consume any power. The drive technology is direct, meaning no gears or lead screws are needed to create linear motion. This means the motor has no mechanical play or backlash. The LTC20 linear motor is available in two different mounting versions.

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. The most basic one is a handheld push button driver. Another option is an analogue driver that regulates the motor 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 two nanometers.

PMD101

Design your own driver

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

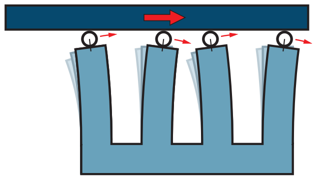
Ordering information	
Motor	
LTC2013-013	Clamp mount, shaft w. M2.5
LTC2014-013	Nut mount, shaft w. M2.5
Drivers and Controllers	
PMCM21-01	Handheld push button driver
PMCM31-01	Analogue driver
PMD101	Microstepping driver
Accessories	
100326	Tip 2.4 HM

Operating Principle

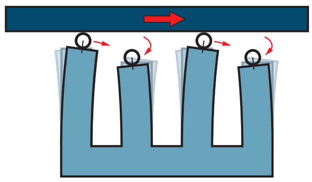
The Piezo LEGS walking principle is of the non-resonant type, i.e. the position of the drive legs is known at any given moment. This assures very good control of the motion over the whole speed range.

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* (~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 (5 µm x 2 kHz = 10 mm/s).

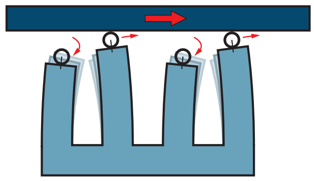
Microstepping is achieved by dividing the *wfm-step* into discrete points. The resolution will be a combination of the number of points in the waveform, and the load. Example: at 9 N load the typical wfm-step length is ~4 µm, and with 2048 discrete points in the waveform the microstep resolution will be ~2 nm. In analog bending mode or with higher resolution D/A converter it is possible to position in the sub nanometer region.



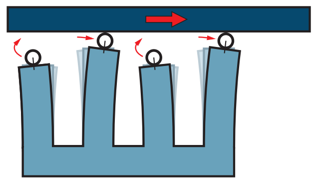
1 *When all four legs are electrically activated they are elongated and bending. As we shall see below, alternate legs move as pairs. Arrows show the direction of motion of the tip of each leg.*



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.*

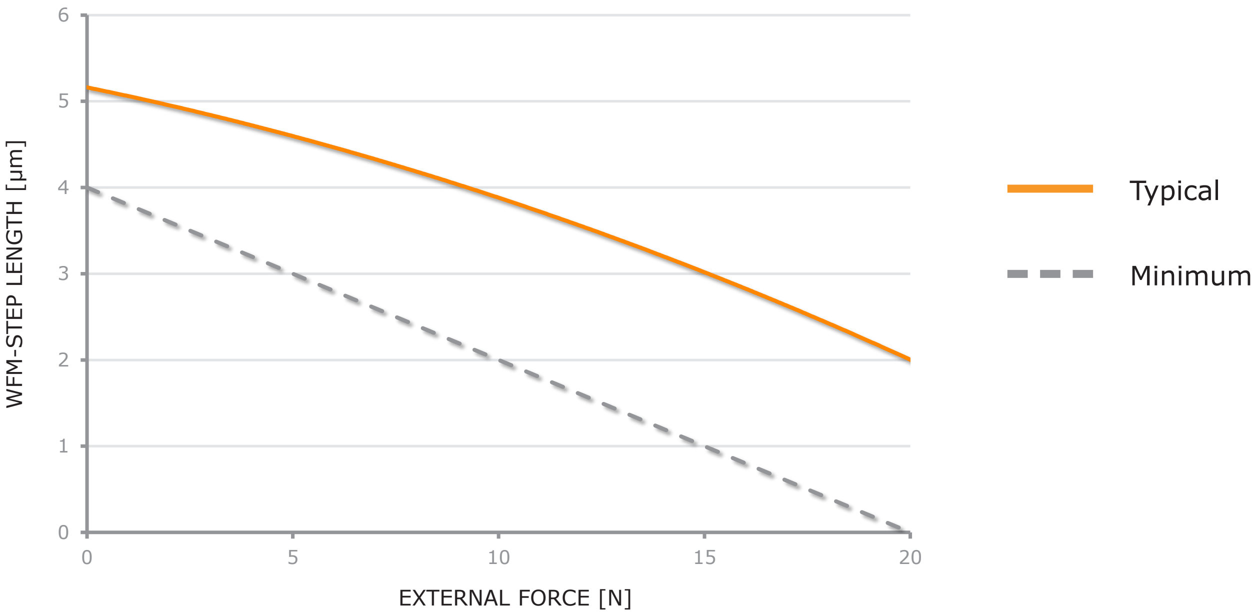
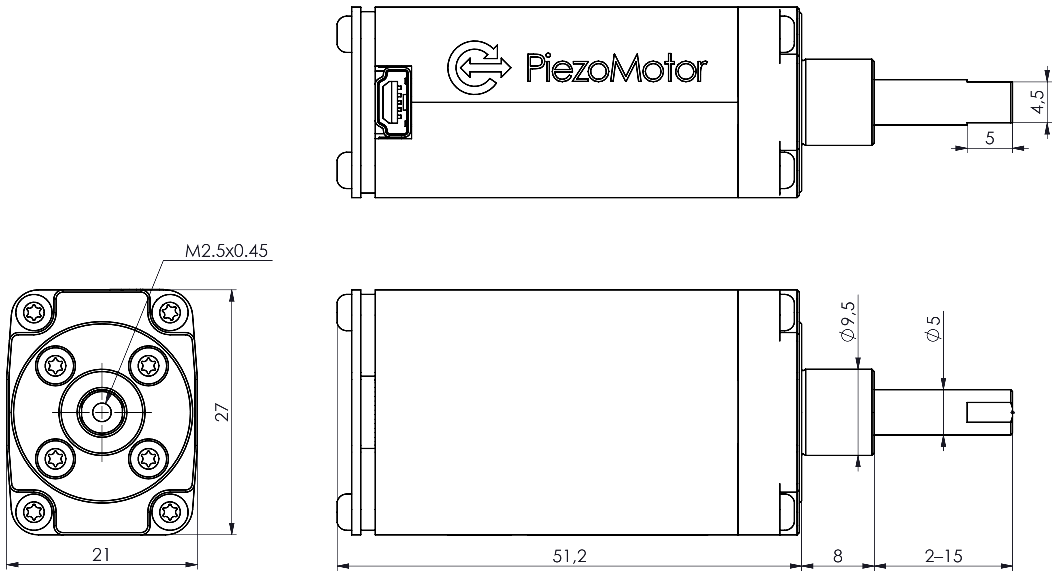
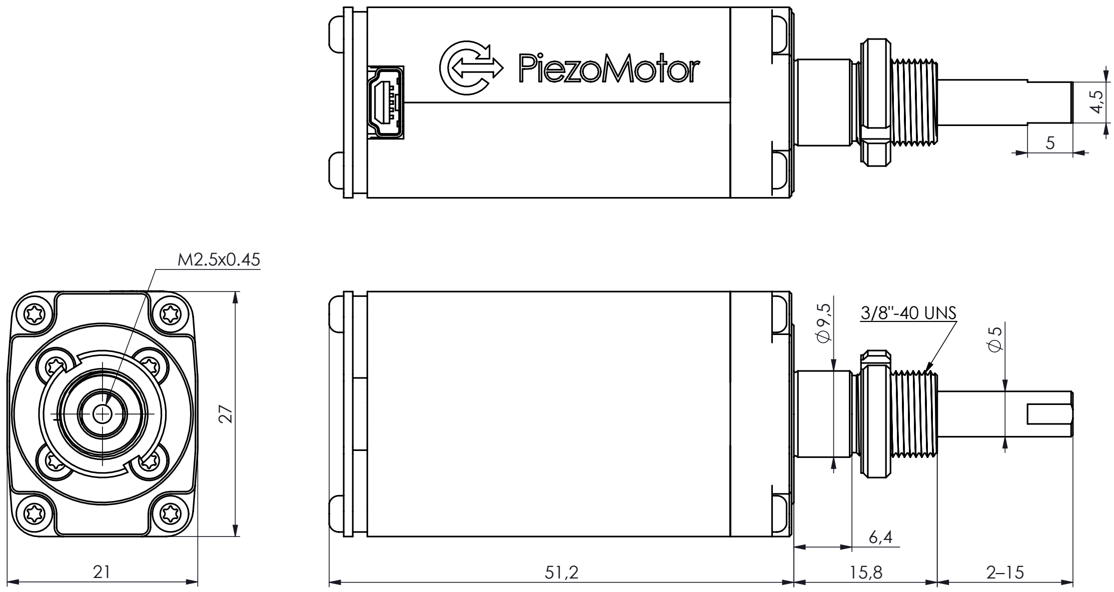


Figure 1 *Typical motor performance with rhombic waveform (Rhomb S) at 650 Hz drive frequency. Wfm-step length is the average distance the drive rod moves when the legs take one step (i.e. for one waveform cycle). Using other waveforms than rhombic will give a different curve. Dotted line is guaranteed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

Main Dimensions LTC2013-013

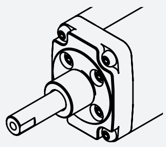
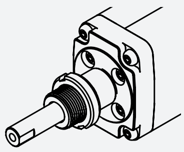


Main Dimensions LTC2014-013



Note:
Refer to drawings for details. Read installation guidelines carefully. Drive shaft has only limited bending moment capability, and absolutely no rotational torque is allowed. In order to safely mount an endpiece in the threaded hole, you must first release the motor completely (it must not be fixed in position). Thereafter, hold on only to the flat part of the shaft and fasten endpiece tightly.

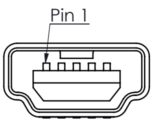
150030-02

Technical Specification				
Type	**LTC2013-013 (clamp mount)**	**LTC2014-013 (nut mount)**	**Unit**	**Note**
Stroke	12.8	12.8	mm	
Speed Range	0-10	0-10	mm/s	recommended, no load
Step Length	0.001[a]-4	0.001[a]-4	µm	no load, microsteps up to full wfm-steps
Resolution [a]	< 1	< 1	nm	
Recommended Operating Range	0-10	0-10	N	for best microstepping performance and life time
Stall Force	20	20	N	
Holding Force	22	22	N	
Maximum Voltage	48	48	V	
Connector	USB mini-B	USB mini-B		
Mechanical Size	51.2 x 27 x 21	51.2 x 27 x 21	mm	see drawing for details
Material in Motor Housing	Stainless Steel, Aluminum	Stainless Steel, Aluminum		
Mounting	Clamp 	Nut 		
Weight	95	95	gram	approximate
Operating Temp.	0 to +50	0 to +50	ºC	

a. Driver dependant

Connector Type

The motor connector is USB mini-B. Motor cable is included (1.5 m with USB mini-B to JST 05SR-3S).



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

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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