

L-306.011100 / 011112 / 013112

Compact Z positioner

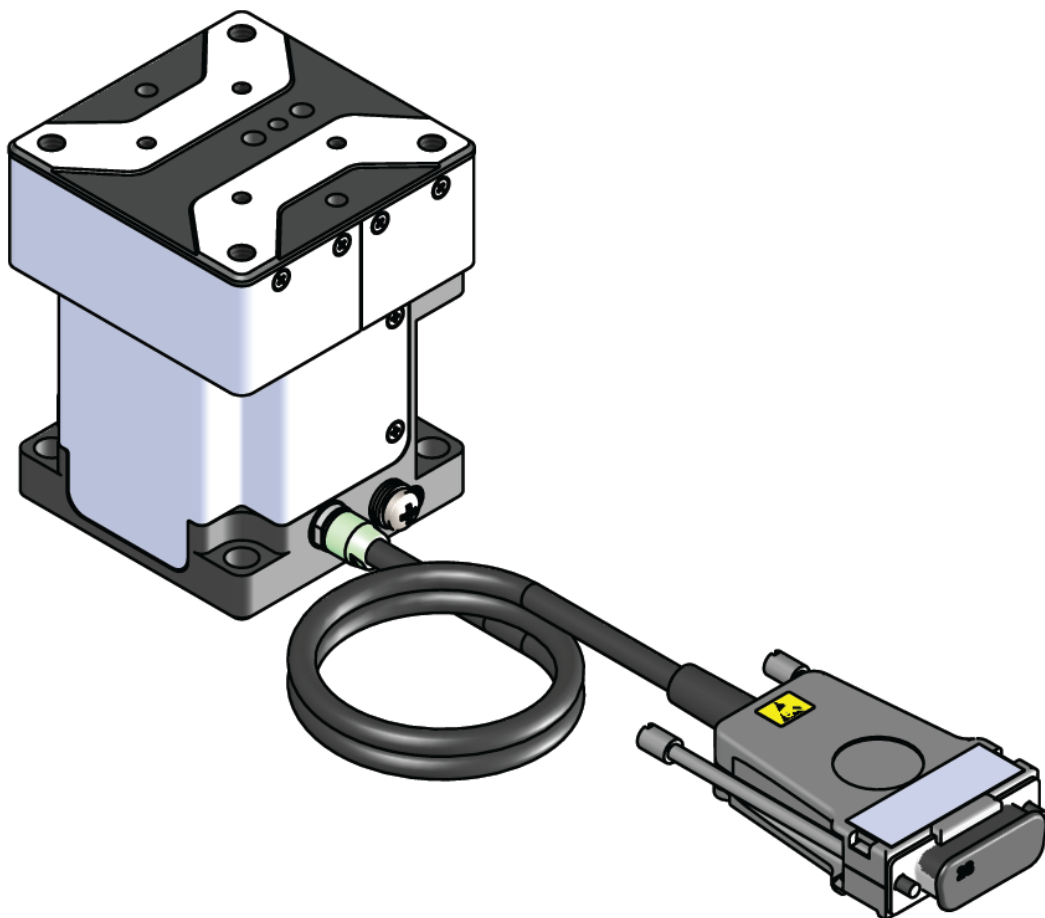


Figure 1: Schematic product view

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Other Applicable Documents

Product	Document
L-xxx positioners	Short Instructions MP146EK
C-863.12*	User Manual MS249
C-663.12*	User Manual MS241 Technical Note C663T0005
C-885*	User Manual C885T0002
C663.12C885*	User Manual C663T0004
C863.20C885*	User Manual C863T0005
SMC Hydra*	Technical Manual SMC Hydra (SMC-Hydra CM TT.doc)

* Depending on the ordered controller. Further documents included in the data carrier(s) provided with the controller.

Further devices and software tools from PI that are mentioned in this documentation are, if applicable, described in separate manuals.

You can download user documentation for standard products from our web site www.pi.ws.

Safety

Intended Use

The product is a laboratory device as defined by DIN EN 61010. It is intended for indoor use and use in an environment which is free of dirt, oil, and lubricants.

In accordance with its design, the product is intended for single-axis positioning, adjusting and shifting of loads at different velocities. The product is **not** intended for applications in areas, in which a failure would present severe risks to human beings or the environment.

The product is intended for horizontal mounting.

The intended use of the product is only possible when completely mounted and connected.

The product must be operated with a suitable controller. The controller is **not** included in the scope of delivery of the positioner.

General Safety Instructions

The product is built according to state-of-the-art technology and recognized safety standards. Improper use of the product may result in personal injury and/or damage to the positioner.

- Only use the product for its intended purpose, and only if it is in perfect condition.
- Read the user manual.
- Immediately eliminate any faults and malfunctions that are likely to affect safety.

The operator is responsible for correct installation and operation of the positioner.

Organizational Measures

User manual

- Always keep this user manual available when using the positioner. The latest versions of the user manuals are available on our website www.pi.ws for download.
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the product to other users, also include this user manual as well as all other relevant information provided by the manufacturer.
- Only use the device on the basis of the complete user manual. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- Only install and operate the product after you have read and understood this user manual.

Personnel qualification

The product may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

Product Description

Product View and Component Designations

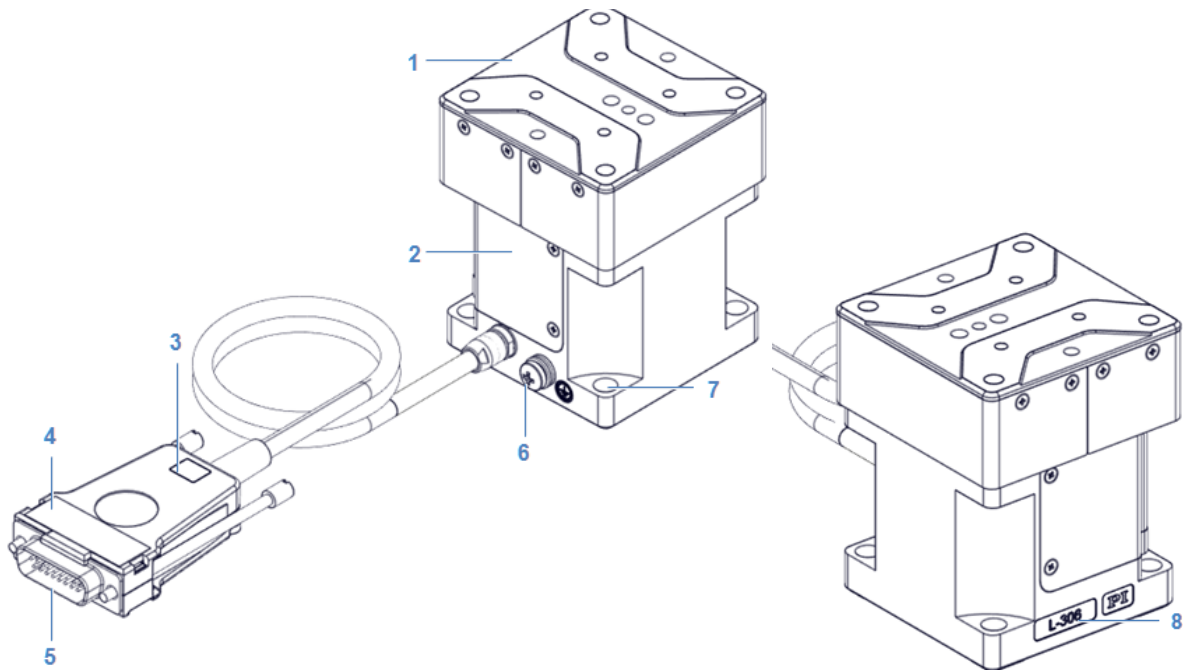


Figure 1: Parts of the positioner (schematic view)

- 1 Platform incl. mounting interface for payload
- 2 Base body
- 3 ESD warning sign
- 4 Product label, incl. detailed model designation and serial no.
- 5 Connector (HD D-Sub 26, male, protection cap removed)
- 6 Protective earth (PE) connector
- 7 Mounting hole for surface mounting
- 8 Product line label

Direction of Motion

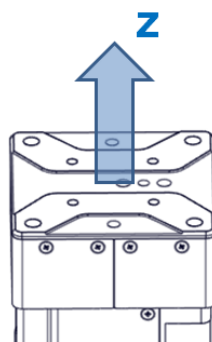


Figure 2: Direction of motion of the platform

Z (arrow direction:) Direction of motion on positive command

Technical Features

All types of this product line are Z positioners with crossed roller bearings including an anti-creep system.

Position Sensors

Models L-306.011112 and L-306.013112 include a linear incremental encoder. For specifications, see the “Technical Data” section (p. 18).

Limit Switches

The product provides optical limit switches.

Each limit switch closes a contact on a dedicated line to the controller. If reached, the controller stops the motion. If the controller does not stop the motion in time, the positioner runs into a hard stop.

Reference Point Switch

The positioner is equipped with one direction-sensing reference point switch that is located at about the midpoint of the travel range. This sensor provides a TTL signal indicating whether the positioner is on the positive or negative side of the reference point switch.

The commands that use the reference signal are described in the user manual for the controller and/or in the corresponding software manuals.

Unpacking / Scope of Delivery

1. Before opening the packaging, check the packaging for signs of damage. If there is any sign of damage, contact PI immediately (service@pi.de).
2. Compare the delivered items with the items listed in the contract and the list below. If items included in the following table are missing, contact service@pi.de.

Component
L-306-type precision Z positioner, model according to the order
Adapter/extension cable for the ordered controller (length: 3 m)
Mounting accessory, incl. <ul style="list-style-type: none">- 4 screws ISO 4762 M6x20- 2 alignment pins ISO 8734 4m6x12
Short instructions for positioners with electric motors
Packaging material

3. Remove the positioner from the packaging. Keep the packaging material for potential subsequent transport, storage or return of the positioner.

Mechanical Installation

General Notes on Installation

NOTICE



Electrostatic hazard

Touching the pins in the connections of the positioner can damage electrostatic sensitive devices (ESD) of the positioner. Also for this reason, the positioner is supplied with a protection cap on the connector.

- Do **not** remove the protection cap from the connector until you connect the positioner to the controller.

NOTICE



Cable break!

A cable break leads to failure of the positioner.

- Install the positioner so that the cable is not bent too strongly or crushed.

NOTICE



Heating of the positioner during operation!

The heat produced during operation of the positioner can affect your application.

- Install the positioners that the application is not impaired by the dissipated heat.
- Avoid excess of the allowed max. velocity (5 mm/s). Operation within the allowed velocity range is automatically ensured by correct selection/detection of the product model in the motion control software.

INFORMATION

For optimal repeatability, all components must be connected firmly together.

INFORMATION

The use of locating pins during mounting reduces deviations from the ideal alignment of the positioner.

- If possible, simulate the positioner motion with a mounted load or make suitable calculations to detect collisions or unfavorable center of gravity constellations.
- If necessary, take suitable constructive measures to avoid collisions and instability in the overall system.

- Avoid or mark danger zones that result from the installation of the positioner and the application, in accordance with the legal regulations.

Attaching the Positioner to a Surface

INFORMATION

For mounting onto a surface, the positioner provides 4 mounting holes matching M6 screws in its base body and 2 holes $\varnothing 4$ mm for alignment pins in the bottom side.

Mounting screws and locating pins are provided with the positioner.

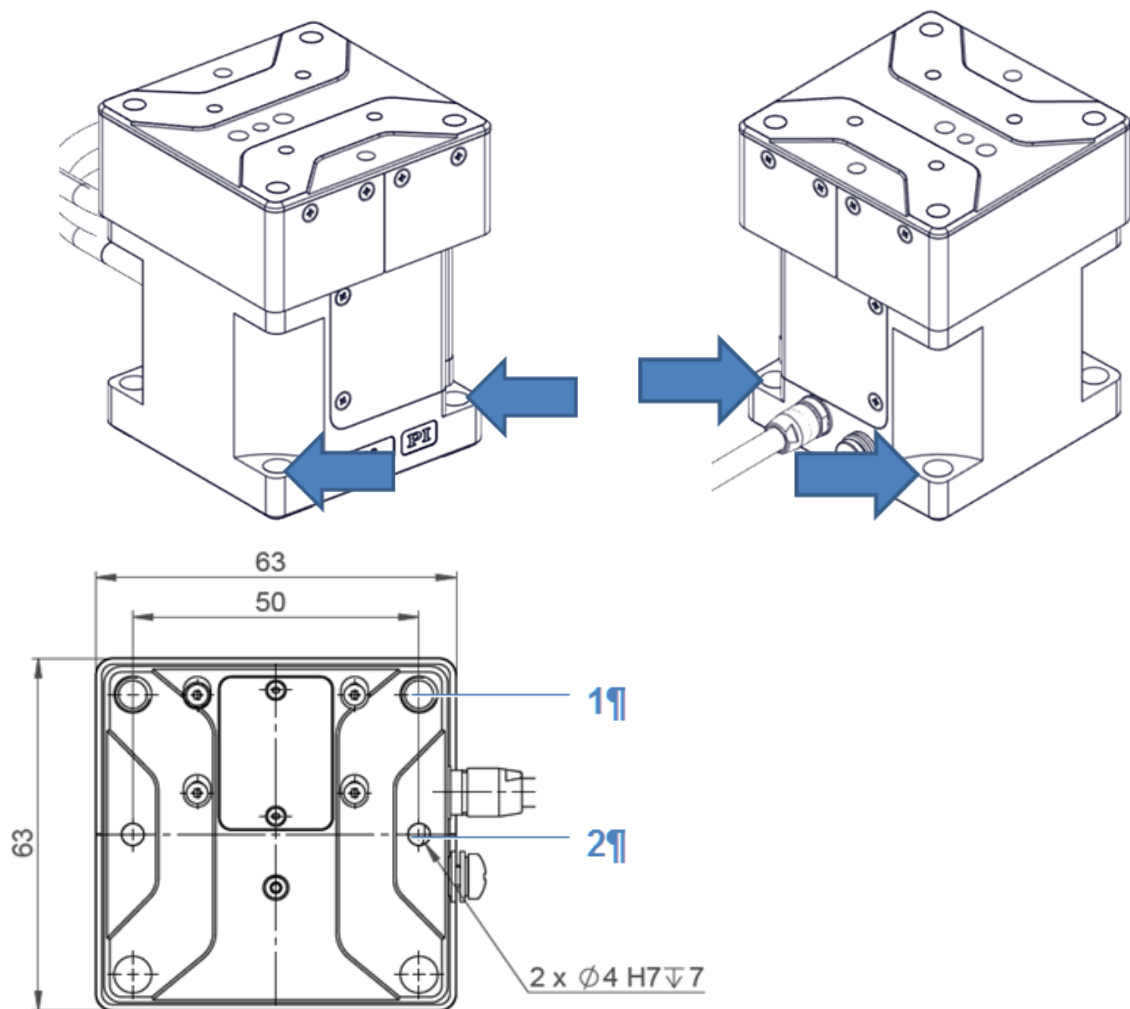


Figure 3: Hole positions and hole pattern (bottom view)

- 1 Hole for mounting screw (1 of 4 total)
- 2 Hole for alignment pin (1 of 2 total)

Requirements

- ✓ You have read and understood the general notes on installation (p. 7).
- ✓ You have provided a suitable surface (for the required position and depth of the holes for accommodating the screws and locating pins, see illustration above).
 - Four M6 threaded holes are present.
 - If you use locating pins to align the positioner: Two \varnothing 4 mm locating holes are present.
 - The flatness of the surface is $\leq 10 \mu\text{m}$.
 - For applications with large temperature changes: The surface should have the same or similar thermal expansion properties as the positioner (e.g., surface made of aluminum).
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

- Mounting accessories; in the scope of delivery.
 - 4 socket head screws, ISO 4762 M6x20
 - 2 dowel pins, ISO 8734 - 4 m6 \times 12, for use as locating pins
- Hex key AF 5 (not included in the scope of delivery)

Mounting the positioner onto a surface

1. If you use locating pins to align the positioner:
 - a. Insert the locating pins into the respective holes in the surface.
 - b. Place the positioner on the surface so that the locating pins are inserted into the corresponding locating holes on the other side.
2. Otherwise: Align the positioner on the surface so that the corresponding mounting holes in the positioner and the surface overlap.
3. Insert the screws into all mounting holes and tighten.
4. Check that the positioner is affixed firmly to the surface.

Connecting the Positioner to the Protective Earth Conductor

INFORMATION

It is only necessary to connect the positioner to the protective earth conductor when both of the following conditions are met:

- The load on the platform of the positioner must be connected to the protective earth conductor, but it is not possible to connect the protective earth conductor directly to the load.
- The load and the platform are connected conductively to each other.

INFORMATION

- Observe the applicable standards for connecting the protective earth conductor.

An M4 hole for the protective earth conductor connection is marked on the corresponding side of the positioner.

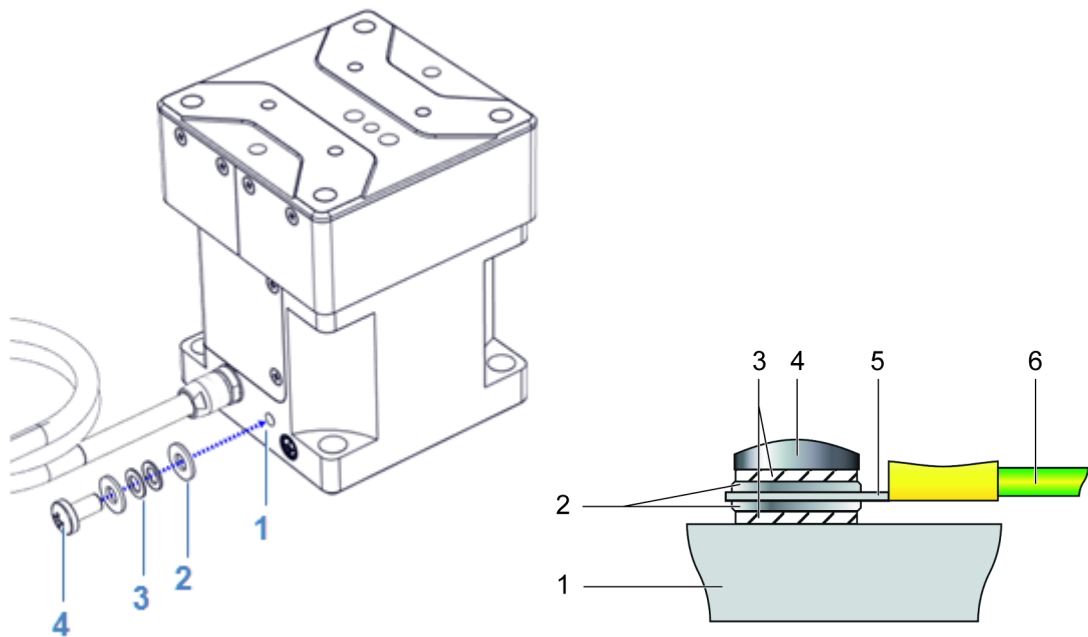


Figure 4: Components / mounting of the protective earth connector

- 1 Base body of the positioner
- 2 Flat washer
- 3 Safety washer
- 4 Screw
- 5 Cable lug
- 6 Protective earth conductor

Requirements

- ✓ You have read and understood the general notes on installation (p. 7).

Tools and accessories

- Suitable protective earth conductor: Cross-sectional area of the cable core $\geq 0.75 \text{ mm}^2$
- Philipps head screwdriver or compliant tool

Connecting the positioner to the Protective Earth Conductor

1. If necessary, attach a suitable cable lug to the protective earth conductor.
2. Loosen the screw and remove the mounted components of the PE connection (see illustration above).
3. Affix the cable lug of the protective earth conductor on the protective earth connection using the M4 screw and further components, according to the sequence shown in the profile view above.
4. Tighten the M4 screw with a torque of 1.2 Nm to 1.5 Nm.
5. Make sure that the contact resistance at all connection points relevant for attaching the protective earth conductor is $<0.1 \Omega$ at 25 A.

Affixing the Load to the Positioner

NOTICE



Impermissibly high load on the positioner!

An impermissible high load impairs the motion of the platform and can damage the positioner.

- When considering the mass and mounting method of the load, pay attention to the specified maximum permissible forces that may act on the platform (p. 18).

NOTICE



Excessively long screws!

Screws and locating pins that are inserted too deeply can damage the positioner.

- Pay attention to the depth of the mounting holes in the platform.
- Only use screws and locating pins of the suiting length for the respective mounting holes.

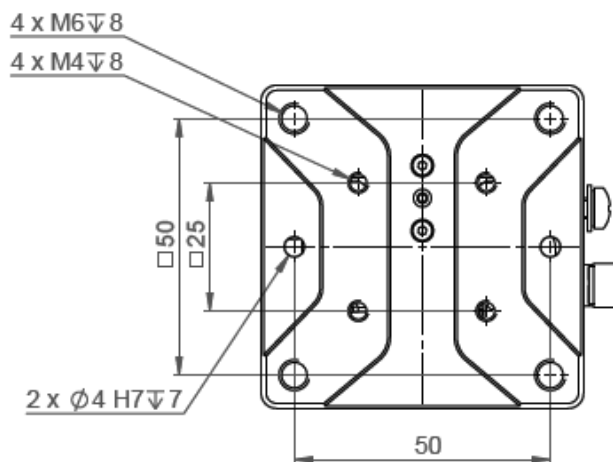


Figure 5: Position of the holes for mounting the payload

Requirements

- ✓ You have read and understood the general notes on installation (p. 7).
- ✓ You have mounted the positioner properly onto a surface.
- ✓ The positioner is **not** connected to the controller.
- ✓ You have prepared the load so that it can be affixed to the mounting holes on the platform:
 - The distance between the center of gravity of the load and the center of the platform is as small as possible in all directions.
 - At least two points are provided for mounting the load on the platform (ideally: three or four mounting points).

- If you use locating pins for aligning the load: You have made two locating holes of $\varnothing 4$ mm H7 in the load for accommodating locating pins.

Tools and accessories

- At least 2 screws of suitable length. Options:
 - M4 screws
 - M6 screws
- Suitable tool for tightening the screws
- Optional: 2 dowel pins, ISO 8734 - 4 m6 of suitable length for aligning the load on the positioner.

Affixing the load

1. Align the load so that the selected mounting holes in the platform can be used to affix it.
2. If you use locating pins to align the load:
 - a. Insert the locating pins into the locating holes in the platform.
 - b. Place the load on the platform so that the locating pins are inserted into the corresponding locating holes on the other side.
3. Use the screws to affix the load on the selected mounting holes in the platform.
4. Check that the load is affixed firmly to the platform of the positioner.

Connecting the Positioner to a Controller

NOTICE



Damage if an incorrect controller or cable is applied!

Connecting a positioner to an unsuitable controller or using an unsuitable motor cable can cause damage to the positioner or controller.

- Only connect the positioner to a suitable controller (see "Data Table", p.18)
- If an adapter cable is applied: Use the cable included in the delivery.

Requirements

- ✓ You have read and understood the general notes on installation (p.7).
- ✓ You have installed the controller.
- ✓ You have read and understood the user manual of the controller.
- ✓ The controller is switched off.

Connecting the positioner to a controller

1. Remove the protection cap from the connector.
2. Connect the positioner to the controller (if applicable, using the adapter cable for your controller included in the delivery).
3. Use the integrated screws to secure the connections against accidental disconnection.

Starting and Operating the Positioner

Requirements

- ✓ You have read and understood the user manual for the controller used.
- ✓ You have read and understood the manual for the PC software used.
- ✓ The controller and the required PC software have been installed. All connections on the controller have been set up (see "Connecting the Positioner to a Controller" (p.14) and the user manual for the controller).

Starting and operating the positioner

1. Start and operate the controller (see user manual for the controller).
Configure the controller during startup using the PC software for the positioner used (see user manual for the controller and the PC software): Select the entry in the positioner database that exactly matches the positioner model used.
2. Start a few motion cycles for testing purposes (see user manual for the controller).

Maintenance

General Notes on Maintenance

NOTICE



Damage due to improper maintenance!

Improper maintenance can result in misalignment and failure of the L-306.

- Only loosen screws according to the instructions in this manual.

Performing a Maintenance Run

Depending on the operating conditions and the period of use of the L-306, the following maintenance measures are required:

Maintenance run

The maintenance run serves to distribute the existing lubricant.

- After 500 operating hours or at least after 1 year, perform a maintenance run over the entire travel range, in order for the existing lubricant to be distributed evenly.
- If you operate your positioner continuously over only a short travel range (<20% of the entire travel range), perform a run across the entire travel range approximately every 2000 motion cycles.

Lubrication

Under laboratory conditions, the positioner needs extra lubrication in exceptional cases only. For continuous industrial use, the lubrication intervals must be defined individually.

- Do not relubricate the L-306 without consulting our customer service department. (p. 17).

Manually Moving the Platform

INFORMATION

It is necessary to repeat the reference move after moving manually and connecting to the controller.

In some cases it may be helpful or necessary to move the platform by hand. E.g. this can be necessary when the platform is stuck at the beginning or the end of the travel range (has reached the hard stop).

Requirements

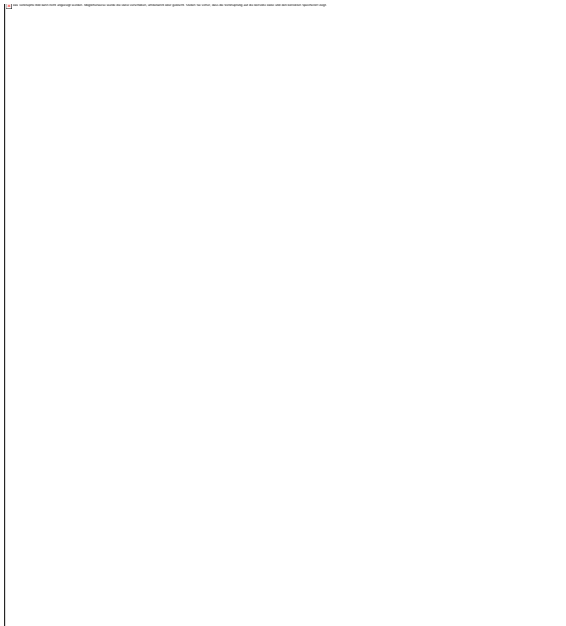
The positioner is **not** connected to the controller.

Tools and accessories

- Hex key AF 1.5 mm or compliant tool

Procedure

1. Insert the hex key in the corresponding hole of the platform shown below.



2. If lifting of the platform is required: Turn the hex key clockwise until the intended platform position is reached.
For moving down, turn the hex key counter-clockwise correspondingly. Insert the hex key in the corresponding hole of the platform shown below.

Cleaning the L-306

Requirements

- ✓ You have disconnected the positioner from the controller.

Cleaning the positioner

- If necessary, clean the surface of the positioner with a cloth that has been dampened with isopropyl alcohol or a mild cleanser/disinfectant.

Customer Service

For inquiries and orders, contact your PI sales engineer or send us an email (service@pi.de).

- If you have questions concerning your system, have the following information ready:
 - Product and serial numbers of all products in the system
 - Firmware version of the controller (if present)
 - Version of the driver or the software (if present)
 - Operating system on the PC (if present)
- If possible: Take photographs or make videos of your system that can be sent to our customer service department if requested.

Disposal



In accordance with EU law, electrical and electronic equipment may not be disposed of in EU member states via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations.

In order to fulfil the responsibility as the product manufacturer, PI undertakes environmentally correct disposal of all old PI equipment made available on the market after 13 August 2005 without charge.

Any old PI equipment can be sent free of charge to the following address:

Physik Instrumente (PI) GmbH & Co. KG
Auf der Roemerstrasse 1
76228 Karlsruhe, Germany

Specifications

Technical Data

	L-306.011100	L-306.011112	L-306.013112	Unit	Tolerance
Motion and positioning					
Travel range	13			mm	
Sensor resolution	-	5	50	μm	
Design resolution	2.5	0.005	0.05	μm	
Minimum incremental motion	2.5	0.2	0.2	μm	typ.
Unidirectional repeatability	0.2	0.1	0.1	μm	typ.
Bidirectional repeatability	±1.5	±0.5	±0.5	μm	typ.
Pitch	±75			μrad	typ.
Yaw	±100			μrad	typ.
Straightness / flatness	±3			μm	typ.
Velocity	5			mm/s	max.
Reference and limit switches	Optical				
Mechanical properties					
Guide type	Crossed roller guide, anti-creep system				
Drive screw type	Ball screw				
Drive screw pitch	0.5			mm	
Push / pull force	20			N	max.
Holding force, power off	5		0.5	N	typ.
Permissible lateral force	10			N	max.
Load capacity	20			N	max.
Permissible torque in θ_x, θ_y	1			Nm	max.
Permissible torque in θ_z	2			Nm	max.
Drive properties					
Motor type	2-phase stepper motor		DC motor		
Operating voltage	48		48	V	max.
Power consumption	5		7		W




User Manual

L306T0002, applies to L-306.011100 / 011112 / 013112

MMA, 2019-MAR-14

	L-306.011100	L-306.011112	L-306.013112	Unit	Tolerance
Miscellaneous					
Operating temperature range	5 ... 40			°C	
Humidity	20 ... 80% rel., not condensing				
Material	Anodized aluminum, steel				
Mass	0.7			kg	±5 %
Moved mass	0.25			kg	±5 %
Connection	HD D-Sub 26 (male)				
Cable length (mounted cable)	0.5			m	
Recommended controllers	C-663.12 SMC Hydra C-885 with C-663.12C885 ACS modular controller		C-863 C-884 C-885 with C-863.20C885 ACS modular controller		

Maximum Ratings

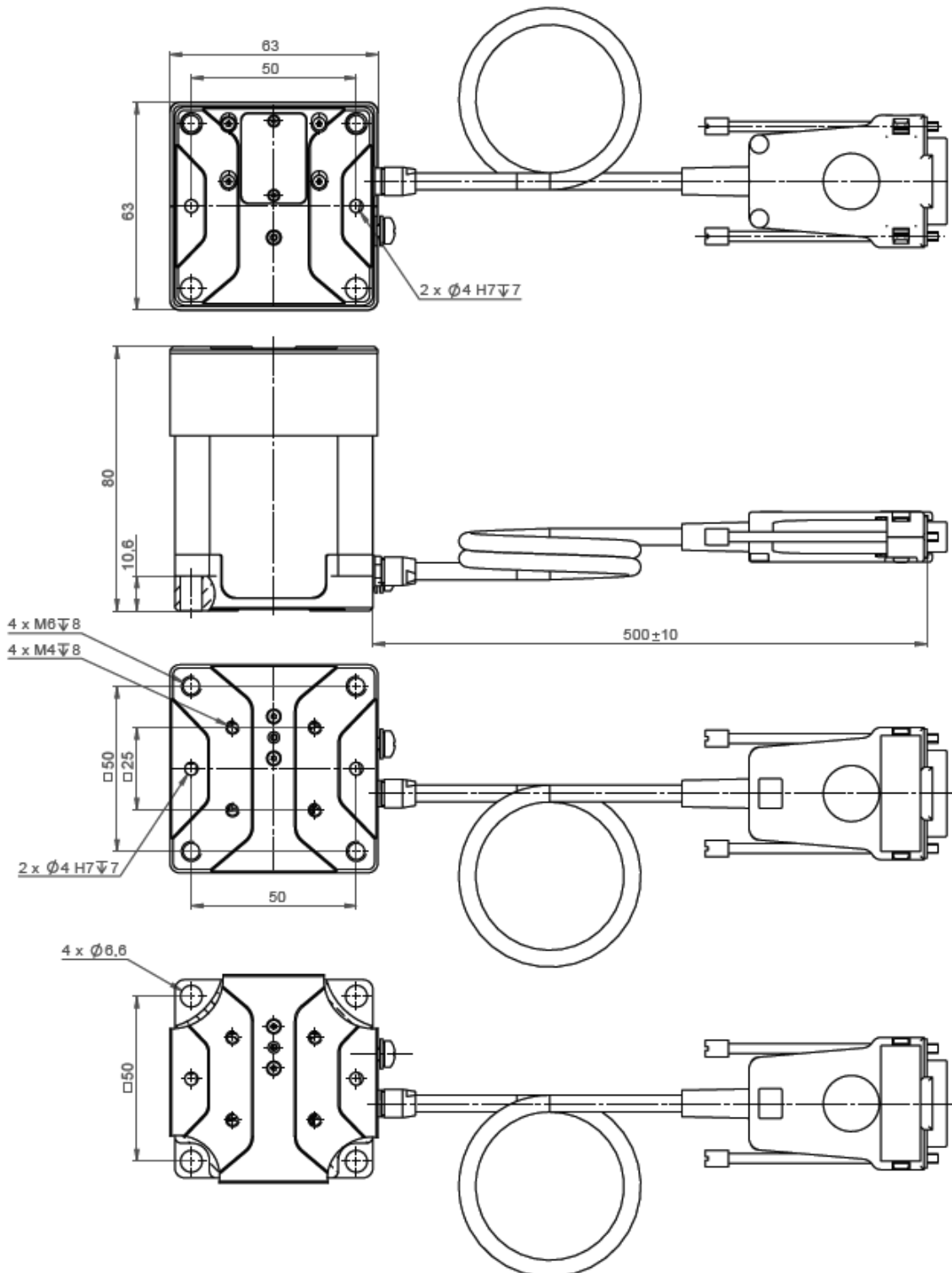
Models	Maximum operating voltage 	Operating frequency 	Maximum power consumption 
L-306.011100	48 V	0 Hz	5 W
L-306.011112	48 V	0 Hz	5 W
L-306.013112	48 V	0 Hz	7 W

Ambient Conditions and Classifications

Area of application	For indoor use only
Maximum altitude	2000 m
Relative humidity	Max. 80 % for temperatures up to 31 °C Linearly decreasing to 50 % at 40 °C
Storage temperature	-20 °C ... 70 °C
Transport temperature	-20 °C ... 70 °C
Supply fluctuations	Max. ±10 % of the nominal voltage
Degree of pollution	2
Degree of protection according to IEC 60529	IP00

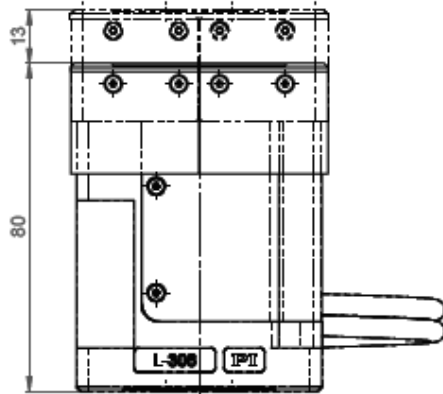
Dimensions

Values in mm; decimal places separated by comma.

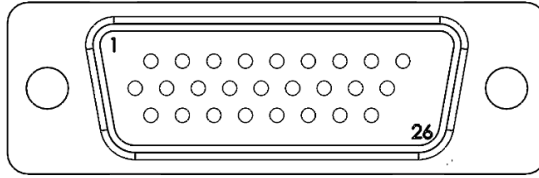


User Manual

L306T0002, applies to L-306.011100 / 011112 / 013112
MMa, 2019-MAR-14



Pin Assignment HD D-Sub 26 (Male)



Pin	Signal		Direction
	L-306.011100	L-306.011112/L-306.013112	
1	Motor A+	Motor A+	Input
2	-	-	-
3	Motor A-	Motor A-	Input
4	-	-	-
5	Motor B+	Motor B+	Input
6	-	-	-
7	Motor B-	Motor B-	Input
8	-	-	-
9	-	-	-
10	REF	REF	Output
11	Limit LE1 (neg.)	Limit LE1 (neg.)	Output
12	Limit LE2 (pos.)	Limit LE2 (pos.)	Output
13	-	-	-
14	-	-	-
15	-	-	-
16	-	-	-
17	-	-	-
18	Limit Power (+5 V)	Limit Power (+5 V)	Input
19	-	Encoder A+	Output
20	-	Encoder A-	Output
21	-	Encoder B+	Output
22	-	Encoder B-	Output
23	-	Encoder C+	Output
24	-	Encoder C-	Output
25	GND	GND	-
26	-	Encoder Power (+5 V)	Input

EU Standards Compliance (CE)

For the L-306 positioner series, an EC Declaration of Conformity has been issued in accordance with the following European directives:

- EMC Directive
- RoHS Directive

The applied standards certifying the conformity are listed below.

- EMC: EN 61326-1
- Safety: EN 61010-1
- RoHS: EN 50581