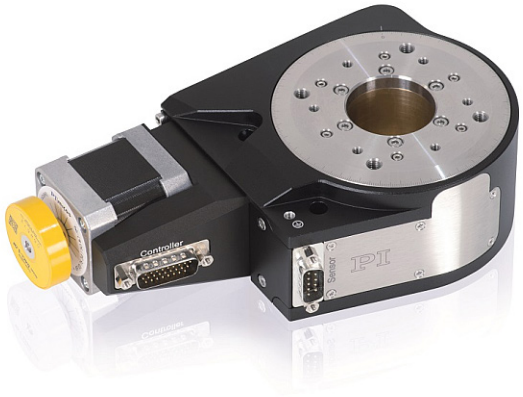
MP154E

L-611 Stage

User Manual

Version: 1.3 Date: 2020-06-29



This document describes the following stages:

- L-611.90SD:
  With 2-phase stepper motor, without encoder
- L-611.9ASD:
  With 2-phase stepper motor and encoder
  with sin/cos signal transmission
- L-611.90AD:
  With ActiveDrive DC motor and encoder
  with A/B quadrature signal transmission
- L-611.94AD:
  With ActiveDrive DC motor and encoder
  with A/B quadrature signal transmission
- L-611.993232:
  With DC motor and encoder
  with A/B quadrature signal transmission
- L-611.993261:
  With DC motor and encoder
  with sin/cos signal transmission
- L-611.995232:
  With BLDC motor and encoder
  with A/B quadrature signal transmission

PI miCos GmbH, Freiburger Strasse 30, 79427 Eschbach, Germany
Phone +49 7634 5057-0, Fax +49 7634 5057-99, Email info@pimicos.com, www.pi.ws

Original instructions
First printing: 29.06.2020
Document number: MP154E, MMa, Version 1.3

Contents

1 About this Document

1.1 Objective and Target Group of this User Manual

This user manual contains the information required for the intended use of the L-611.

Basic knowledge of closed-loop systems, motion control concepts, and applicable safety measures is assumed.

The latest versions of the user manuals are available for download on our website.

1.2 Symbols and Typographic Conventions

The following symbols and typographic conventions are used in this user manual:

NOTICE

Dangerous situation

If not avoided, the dangerous situation will result in damage to equipment.

➢ Measures for avoiding the risk.

INFORMATION

Information for easier handling, tricks, tips, etc.

Symbol/ Label	Meaning
1. 2.	Action consisting of several steps whose sequential order must be observed
➢	Action consisting of one or several steps whose sequential order is irrelevant
▪	Lists
p. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product (example: socket of the RS-232 interface)
	Warning sign affixed to the product that refers to detailed information in this manual.

1.3 Definition of Terms

Term	Explanation
Load capacity	Maximum load capacity in the vertical direction when the stage is mounted horizontally. The contact point of the load is at the center of the platform.
Max. push/pull force	Maximum force in the direction of motion. Some stages may have higher forces but with limited lifetimes. In the case of vertical mounting, the specified value (see 33) for models without a gearhead and brake only applies when the servo mode is on.
Rotary encoder	The rotary encoder is an incremental sensor for capturing changes in position. Signals from the sensor are used for axis position feedback. After the controller is switched on, a reference point definition must be performed before absolute target positions can be commanded and reached.

1.4 Pictures

For better understandability, the colors, proportions and degree of detail in illustrations can deviate from the actual circumstances. Photographic illustrations may also differ and must not be seen as guaranteed properties.

1.5 Further Applicable Documents

The devices and software tools from PI that are mentioned in this documentation are described in separate manuals.

Product	Document
Stages with electric motors	MP146EK Short instructions for stages with electric motors
C-863.12*	User Manual MS249
C-663.12*	User Manual MS241 Technical Note C663T0005
C-884*	User Manual MS243 User Manual C884T0003
C-885*	User Manual C885T0002
C-663.12C885*	User Manual C663T0004
C-863.20C885*	User Manual C863T0005
SMC Hydra*	Technical Manual SMC Hydra (SMC-Hydra CM TT.doc)
PIMikroMove®	SM148E Software Manual

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

2 Safety

2.1 Intended Use

The L-611 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 L-611 is intended for single-axis positioning, adjusting and shifting of loads at different velocities. The L-611 is **not** intended for applications in areas, in which a failure would present severe risks to human beings or the environment.

The L-611 is intended for horizontal or vertical mounting. For the load limits with vertical mounting, see "General Notes on Installation". (p. 15).

The intended use of the L-611 is only possible when completely mounted and connected.

The L-611 must be operated with a suitable controller as specified in the data table p. 33). The controller is not in the scope of delivery of the L-611.

2.2 General Safety Instructions

The L-611 is built according to state-of-the-art technology and recognized safety standards. Improper use of the L-611 may result in personal injury and/or damage to the L-611.

- Only use the L-611 for its intended purpose, and only use it if it is in perfect condition.
- Read the user manual.
- Eliminate any faults and malfunctions that are likely to affect safety immediately.

The operator is responsible for correct installation and operation of the L-611.

2.3 Organizational Measures

User manual

- Always keep this user manual available when using the L-611.
  The latest versions of the user manuals are available on our website for download.
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the L-611 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 damage to equipment.
- Only install and operate the L-611 after you have read and understood this user manual.

Personnel qualification

The L-611 may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

3 Product Description

3.1 Model Overview

Classification of the stages

All models are electromotive rotation stages. They differ with respect to the drive type and encoder equipment.

L-611	Drive type				Rotary encoder type		
	ActiveDrive DC	DC motor	BLDC motor	Stepper motor	Motor shaft A/B	Direct detection	
						A/B	sin/cos
.90AD*	+				+		
.94AD*	+					+	
.90SD				+			
.9ASD**				+			+
.993232		+			+		
.993261**		+					+
.995232			+		+		

* Separate power adapter connection

** Separate sensor connector

Detailed model overview

Order number	Product name
L-611.90SD	Precision rotation stage, stepper motor, 35 mm Ø aperture
L-611.9ASD	Precision rotation stage, stepper motor, aperture with 35 mm diameter, angle measuring system with sin/cos signal transmission
L-611.90AD	Precision rotation stage, ActiveDrive DC motor, 35 mm Ø aperture, rotary encoder
L-611.94AD	Precision rotation stage, ActiveDrive DC motor, 35 mm Ø aperture, incremental angle measuring system with A/B quadrature signal transmission 0.035 µrad sensor resolution
L-611.993232	Precision rotation stage, DC motor, 35 mm Ø aperture, rotary encoder
L-611.993261	Precision rotation stage, DC motor, 35 mm Ø aperture, rotary encoder, incremental angle measuring system with sin/cos signal transmission, 9000 lines/revolution
L-611.995232	Precision rotation stage, BLDC, 35 mm Ø aperture, rotary encoder

➢ For further technical data, see the specifications. (p. 33).

3.2 Product View

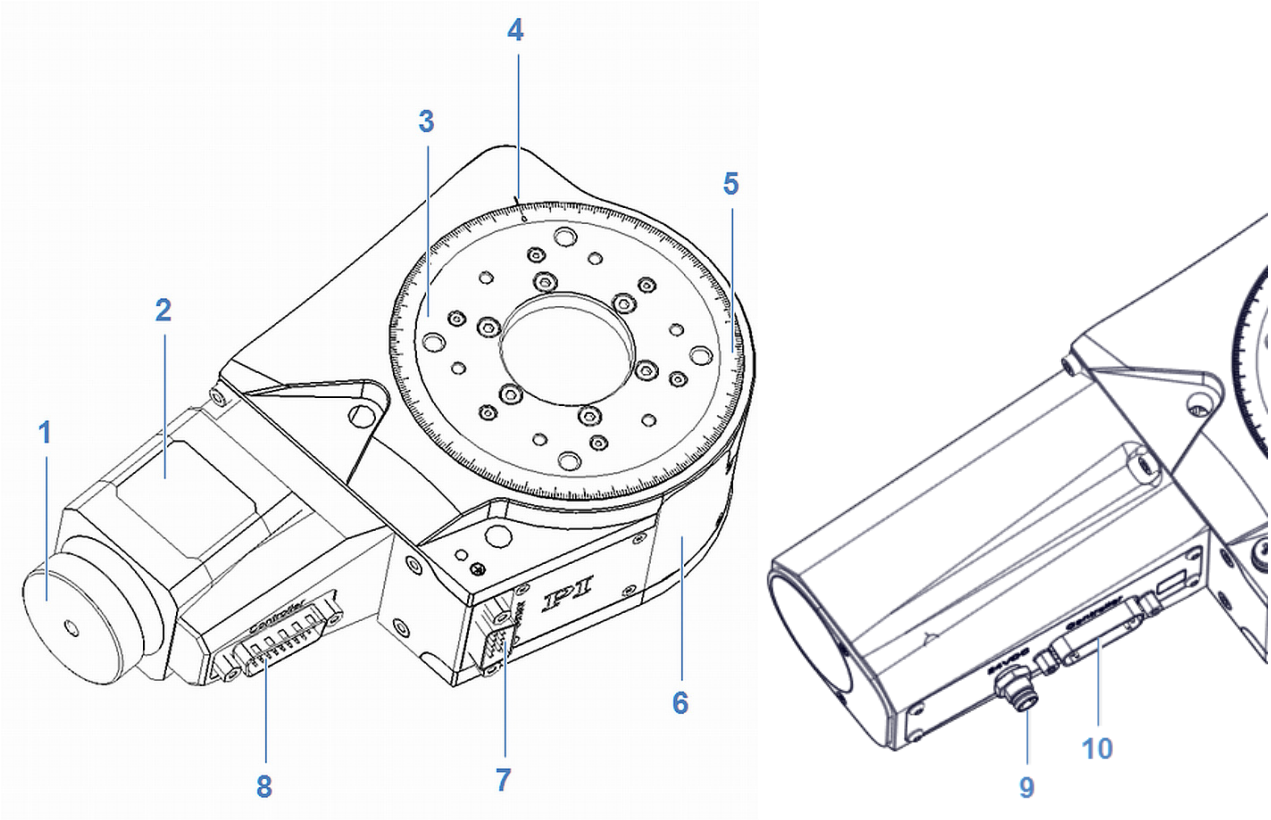


Figure 1: Parts of the L-611 (left: L-611.9ASD, right: L-611.90AD/ L-611.94AD, detail)

1 Vibration absorber
2 Motor
3 Platform
4 Reading mark
5 Angle scale
6 Base body
7 Encoder connection (D-Sub 9 panel plug; L-611.9ASD model only)
8 Motor connector (panel plug HD D-Sub 26)
9 Power adapter connector (panel plug M8 4-pin, L-611..90AD/ L-611..94AD models only)
10 Motor connector (D-Sub 15 panel plug)

3.3 Direction of Motion

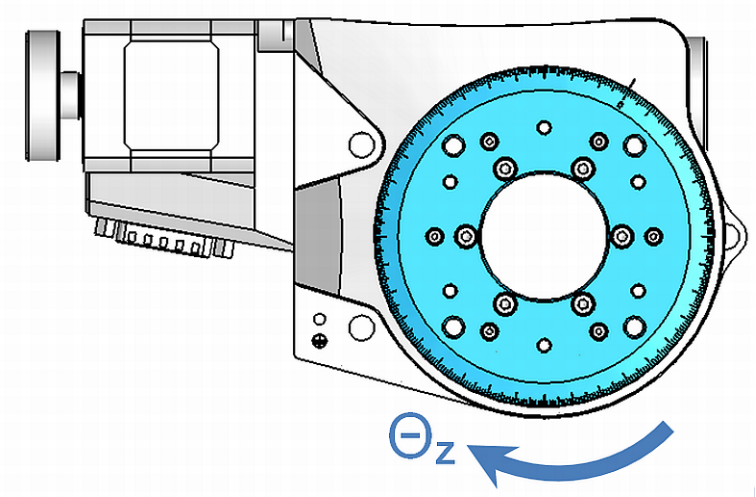


Figure 2: Direction of motion of the platform

Θ_z (arrow direction:) Direction of motion on positive commanding

3.4 Product Labeling

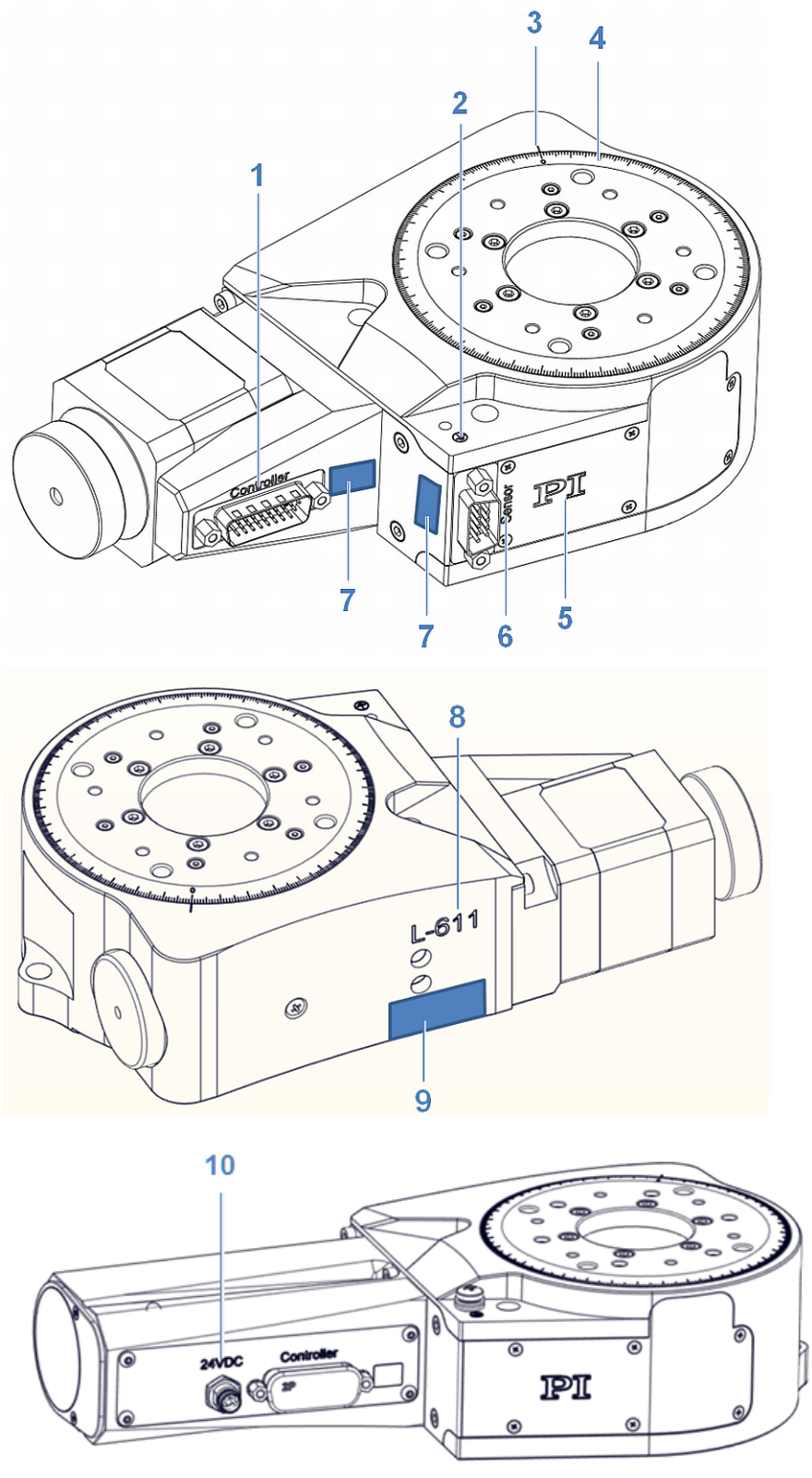


Figure 3: Product labeling

Position	Labeling	Description
1	Controller	Motor connector
2	⏚	Protective earth symbol, marks the protective earth connection of the L-611 (p. 17)
3	(Line)	Reading mark
4	(Angle scale)	Angle specification 0° Angle increment (intervals): ▪ Short line: 1° ▪ Medium line: 5° ▪ Long line: 10°
5, 9	PI	Manufacturer's logo
6	Sensor	Encoder connection (L-611.9ASD model only)
7		Warning sign "Electrostatic sensitive devices"
8	L-611	Product series
9		Old equipment disposal
9	Country of origin: Germany	Country of origin
9	L-611.90SD	Product name (example), the characters after the period refer to the model
9	415002159	Serial number (example), individual for each L-611 Meaning of the places (counting from left): 1 = internal information, 2 and 3 = year of manufacture, 4 to 9 = consecutive numbers
9	CE	CE conformity mark
9	WWW.PI.WS	Manufacturer's address (website)
10	24V DC	Power supply connector

3.5 Scope of Delivery

Item number	Component	Available with L-611	
L-611.9xSD	Stage according to order (p. 5)	**.90SD** **.9ASD** **.993232** **.993261** **.995232**	**.90AD** **.94AD**
64475010	Screw set for mounting the positioner ▪ 1 socket head screw, ISO 4762* M6x18 ▪ 2 socket head screws, ISO 4762* M6x50 ▪ 3 washers, DIN 433-6	+	+
MP146EK	Short instructions for stages with electric motors	+	+
7300900006-0180	Wide-range power supply, 120 W 24 V DC, secondary, incl. cable		+

* Corresponds to DIN 912

3.6 Technical Features

3.6.1 Encoder

The L-611.9ASD, L-611.9ASD, L-611.993232, and L-611.993261 models are equipped with an optical encoder that detects the position directly. For the encoder resolution, refer to the table in the "Specifications" section (p. 33).

The L-611.90AD, L-611.993232, and L-611.995232 models are equipped with an optical encoder that detects the position indirectly.

For the encoder resolution, refer to the table in the "Specifications" section (p. 33).

The encoder of the L-611.993261 is operated with sin/cos signal evaluation and the encoders of the other models with A/B quadrature signal evaluation.

L-611.90SD model does not have an encoder.

3.6.2 Reference Point Switch

The models are equipped with a direction-sensing reference point switch (see "Reference Point Switch Specifications" (p. 36)).

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

After a reference move, the 0 mark on the scale ring of the platform is above the 0 mark in the base body.

3.6.3 Integrated PWM Amplifier

The L-611.90AD and L-611.94AD models are equipped with a PWM amplifier ("ActiveDrive Concept"). The motor and PWM amplifier are installed in a common case and therefore optimally integrated and shielded. The PWM amplifier only receives the control signals from the controller, whereas the supply voltage is provided via an external power adapter. The ActiveDrive concept allows high motor power and dynamics at low power loss.

4 Unpacking

1. Unpack the L-611 with care.
2. Compare the contents with the items listed in the contract and the packing list.
3. Inspect the contents for signs of damage. If there is any sign of damage or missing parts, contact PI immediately.
4. Keep all packaging materials in case the product needs to be returned.

5 Installation

5.1 General Notes on Installation

NOTICE

Cable break!

A cable break leads to failure of the positioner.

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

NOTICE

Heating of the L-611 during operation!

The heat produced during operation of the L-611 can affect your application.

- Install the L-611 so that the application is not impaired by the dissipated heat.

INFORMATION

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

- If possible, simulate the motion of the positioner 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.

5.2 Attaching the L-611 to a Surface

NOTICE

Warping of the L-611 due to mounting on uneven surfaces!

Mounting the L-611 on an uneven surface can warp the L-611. Warping reduces the accuracy.

- Mount the L-611 onto an even surface. The recommended flatness of the surface is ≤5 µm.
- For applications with large temperature changes:
  Only mount the L-611 on surfaces that have the same or similar thermal expansion properties as the L-611.

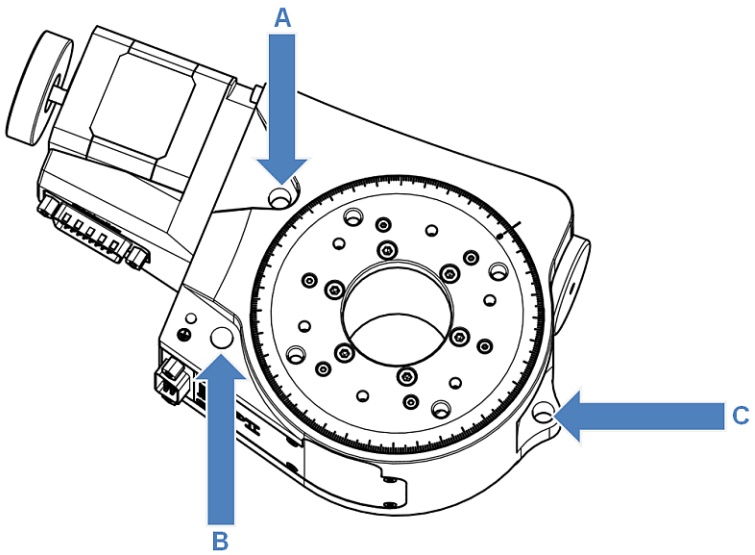


Figure 4: Position of the holes for mounting the positioner

Requirements

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have provided a suitable surface (for the required position and depth of the holes for accommodating the screws and locating pins, see "Dimensions" (p. 37)):
  - There are three M6 threaded holes.
  - The surface flatness is ≤5 µm.
  - For applications with large temperature changes: The surface should have the same or similar thermal expansion properties as the L-611 (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 kit; in the scope of delivery (p. 10)
  - 1 socket head screw, ISO 4762 M6x18
  - 2 socket head cap screws, ISO 4762 M6x50
  - 3 washers, DIN 433-6
- Hex key, AF 5

Mounting the stage onto a surface

1. Place washers on all mounting holes.
2. Tighten all M6x50 screws in A and B the mounting holes completely.
3. Screw in M6x18 screws in mounting hole C completely.
4. Check that the positioner is affixed firmly to the surface.

5.3 Connecting the L-611 to the Protective Earth Conductor

INFORMATION

It is only necessary to connect the L-611 to the protective earth conductor when both of the following conditions are met:

- The load on the platform of the L-611 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

➢ Pay attention to the applicable standards for connecting the protective earth conductor.

On the top of the L-611, there is an M4 hole for connecting the protective earth conductor. In the following figure, this hole is marked with an arrow.

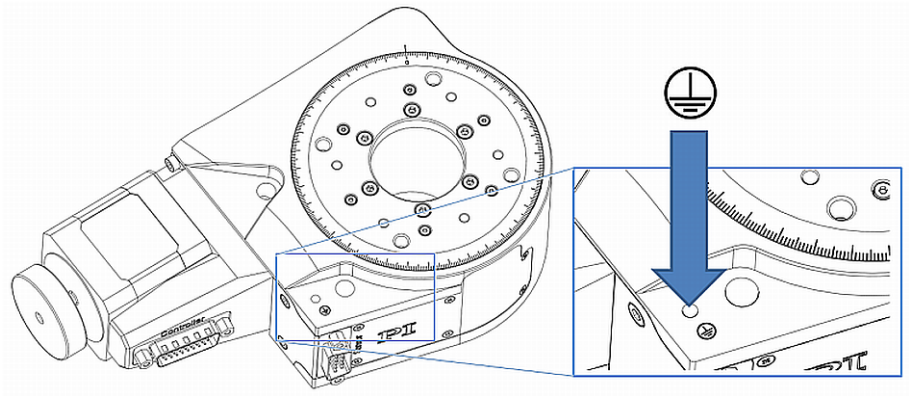


Figure 5: Position of the protective earth connection

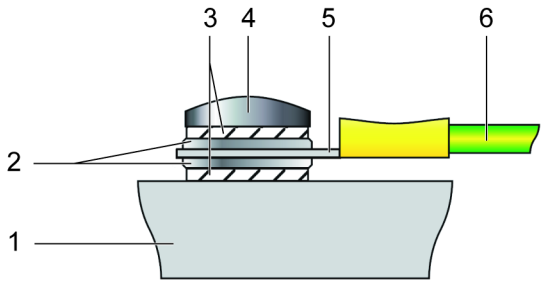


Figure 6: Mounting of the protective earth conductor (profile view)

1 Base body of the L-611
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. 15).

Tools and accessories

- Suitable protective earth conductor: Cable cross section ≥ 0.75 mm^2
- Screw, M4x8, ISO 7045
- 2 washers ISO 7089-4
- 2 safety washers S4
- Suitable screwdriver

Connecting the L-611 to the protective earth conductor

1. If necessary, attach a suitable cable lug to the protective earth conductor.
2. Use the M4 screw (together with the washers and self-locking washers) to affix the cable lug of the protective earth conductor to the protective earth connection of the L-611 as shown in the profile view.
3. Tighten the M4 screw with a torque of 1.2 Nm to 1.5 Nm.
4. Make sure that the contact resistance is <0.1 Ω at 25 A at all connection points relevant for attaching the protective earth conductor.

5.4 Affixing the Load to the L-611

NOTICE

Impermissibly high load on the stage!

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

➢ 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. 33).

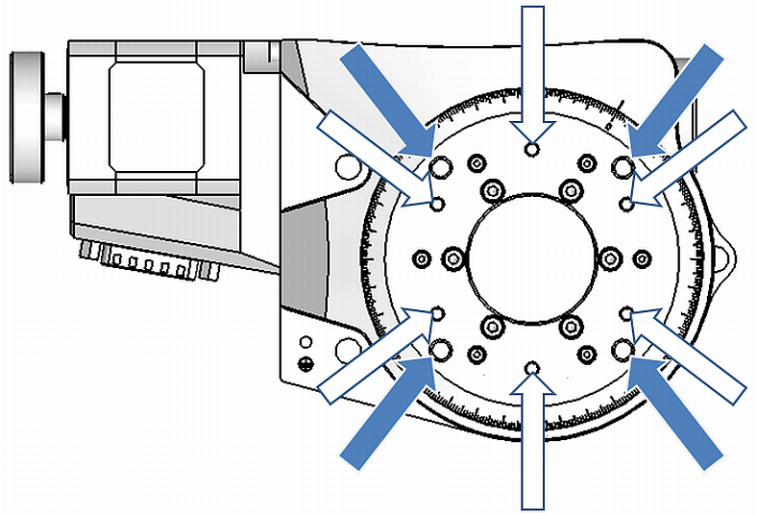


Figure 7: Position of the holes for mounting the load

Blue / dark arrows: Holes with M6 thread
White / bright arrows: Holes with M4 thread

Requirements

✓ You have read and understood the general notes on installation (p. 15).

✓ You have mounted the stage onto a surface properly (p. 15).

✓ The stage 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 affixing the load to the platform (ideally: three attachment points).

Tools and accessories

- At least 2 screws of suitable length. Options:
  - M6 screws
  - M4 screws
- Suitable tool for tightening the screws

Affixing the load

1. Align the load so that the selected mounting holes in the platform can be used to affix it.
2. Use the screws to affix the load to the selected mounting holes in the platform.
3. Check that the load is affixed firmly to the platform of the positioner.

5.5 Connecting the L-611 to a Controller

NOTICE

Damage if an incorrect controller or motor cable is connected!

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

➢ Only connect a stage to a suitable controller (p. 10).

➢ To connect the positioner to the controller, only use a motor or respectively sensor cable that is provided with the positioner.

Requirements

✓ You have read and understood the general notes on installation (p. 15).

✓ You have installed the controller.

✓ You have read and understood the user manual for the controller.

✓ The controller is switched off.

Tools and accessories

- Cable from the scope of delivery of the positioner (p. 10)
- Suitable tools for tightening the screws to the connections

Connecting the L-611 to a controller

1. Remove the ESD protection from all connections of the L-611.
2. Connect the L-611 and the controller to each other.
3. Use the integrated screws to secure the connections against accidental disconnection.

5.6 Connecting the Power Supply to the L-611

Connecting a power adapter is only necessary with the L-611.90AD and L-611.94AD models.

Requirements

✓ The power cord is **not** connected to the power socket.

Tools and accessories

- Supplied components:
  - 24 V wide input range power supply
  - Adapter for the power adapter connection; barrel connector, 5.5 mm x 2.1 mm to M8 4-pin (f)
  - Power cord
- If one of the components supplied for connection to the power source has to be replaced: Use a sufficiently measured and certified replacement component. Details:
  - Power supply: Output 24 V DC, maximum output current 5 A
  - Power cord: Three wires, cable cross section at least 3 × 0.75 mm^2 (3 × AWG18), maximum length 2 m

Connecting the power adapter to the L-611

1. Connect the M8 connector (f) of the adapter to the M8 panel plug of the L-310.
2. Connect the barrel connector of the adapter to the barrel connector socket of the power adapter.
3. Connect the power cord to the power adapter.

6 Startup

6.1 General Notes on Startup

NOTICE

Damage due to collisions!

Collisions can damage the positioner, the load to be moved, and the surroundings.

- Make sure that no collisions are possible between the positioner, the load to be moved, and the surroundings in the motion range of the positioner.
- Do not place any objects in areas where they can be caught by moving parts.
- Stop the motion immediately if a controller malfunction occurs.
- If possible, adapt the travel range limits of your mechanical system in the software that you use for commanding the motion.

NOTICE

Damage if an incorrect controller or motor cable is connected!

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

- Only connect a stage to a suitable controller (p. 10).
- To connect the positioner to the controller, only use a motor cable that is suitable for the controller (see following table).

NOTICE

Operating voltage excessively high or incorrectly connected!

Operating voltages that are excessively high or incorrectly connected can cause damage to the L-611.

- Do **not** exceed the operating voltage range (p. 35) that is specified for the L-611.
- Operate the L-611 only when the operating voltage is properly connected; see "Pin Assignment" (p. 39).

NOTICE

Damage or considerable wear due to high accelerations!

High accelerations can cause damage to or considerable wear on the mechanics.

- Stop the motion immediately if a controller malfunction occurs.
- Ensure that the end of the travel range is approached at low velocity.
- Determine the maximum velocity for your application.

NOTICE

Unintentional motion!

Unintentional motion of the L-611 is possible when it is connected to the controller. Defective or incorrect operation of the software can also result in unintentional motion.

- ➢ Do not place any objects in areas where they can be caught by moving parts.
- ➢ Before connecting the L-611, check whether a macro is defined as the startup macro in the controller, and cancel the selection of the startup macro if necessary.

INFORMATION

The maximum velocity for an L-611.90SD should be determined in the application. If the commanded velocity is too high, the stepper motor might stop without the controller detecting this state.

INFORMATION

The repeatability of the positioning is only ensured when the reference point switch is always approached from the same side. Controllers from PI fulfill this requirement as a result of the automatic direction sensing for reference moves to the reference point switch.

6.2 Starting and Operating the Positioner

Requirements

- ✓ You have read and understood the general notes on startup (p. 23).
- ✓ When starting and operating with a load or in a multi-axis system: You have properly installed the stage.
- ✓ 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 L-611 to the Controller" (p. 20) 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 stage used (see user manual for the controller, and the PC software):

   - If you use a controller from PI: Select the entry in the positioner database that exactly fits the positioner model used (p. 25).
   - If you use a controller from another manufacturer: Enter the parameters into the corresponding PC software that exactly fit the positioner model used; see the overview of the operating parameters for stepper motor controllers.

2. Start a few motion cycles for testing purposes (see user manual for the controller).

6.2.1 L-611 Entries in the PI Stage Database

For PI controllers, you can select the connected stage from a stage database in the corresponding PC software. The appropriate operating parameters are therefore loaded to the controller. You can find a detailed description in the user manual for the controller or in the manual for the PC software used.

7 Maintenance

7.1 General Notes on Maintenance

NOTICE

Damage due to improper maintenance!

Improper maintenance can result in misalignment and failure of the L-611.

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

7.2 Performing a Maintenance Run

Depending on the operating conditions and the period of use of the L-611, the following maintenance measures are required:

Maintenance run

The maintenance run serves the purpose of distributing the existing lubricant.

- To evenly distribute the existing lubricant, perform a maintenance run around at least one complete platform revolution after 500 hours of operation or after 1 year at the latest.
- If you move the L-611 over a small travel range (<20°) in continuous industrial operation, perform a maintenance run around at least one complete platform revolution after every 5000 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.

- If you have any questions on relubricating, contact our customer service department (p. 31).

7.3 Cleaning the L-611

Requirements

- ✓ You have disconnected the stage from the controller.

Cleaning the positioner

- If necessary, clean the surfaces of the positioner with a cloth that is dampened with a mild cleanser or disinfectant.

8 Troubleshooting

8.1 Possible Causes and Remedies

Problem	Possible causes	Solution
Reduced positioning accuracy	Warped base body	➢ Mount the L-611 onto an even surface. The recommended flatness of the surface is ≤ 5 µm.
	Increased wear due to small motion over a long period of time	➢ Perform a maintenance run around at least 360°.
Impairment of the function after system modification	▪ Controller was replaced. ▪ The LS611 was replaced by another model.	Controller from PI: ➢ Load the parameters from the positioner database that correspond to the combination of controller and the L-611 model. Controller from a third-party supplier: ➢ Check the operating parameters.
Mechanical system does not move; no operating noise can be heard.	Controller not correctly connected or defective.	➢ Check all connecting cables. ➢ Check the controller. ➢ Check the power adapter of the positioner.
For L-611.90SD models: Actual position deviates from the displayed position.	The motor is overloaded by an external load torque or the mass to be driven in the case of strong acceleration or deceleration.	The motor skips steps. The information on the current position is lost without the controller detecting the state. ➢ Use a stepper motor in the application to determine the maximum velocity for a stage. ➢ Start a new reference move.

If the problem that occurred with your system is not listed in the table above or cannot be solved as described, contact our customer service department (p. 31).

8.2 Moving the Platform by Hand

Moving the platform is only possible with the L-611.90SD and L-611.9ASD models.

The vibration absorber can be used to move the platform without damaging the drive.

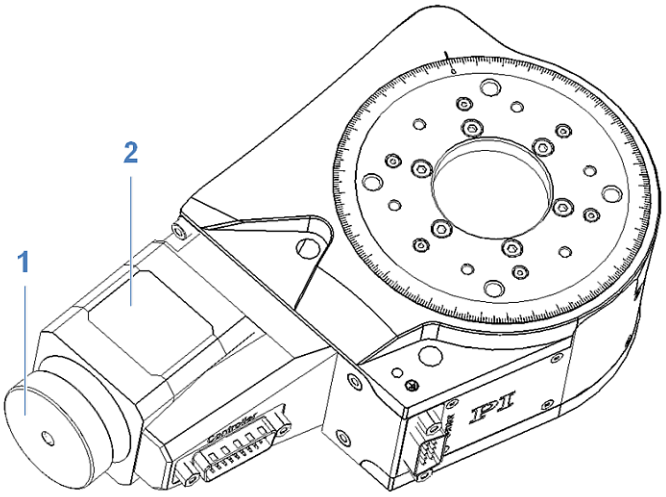


Figure 8: Position of the vibration absorber

1 Vibration absorber
2 Motor

Requirements

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

Moving the platform by hand

- Turn the vibration absorber as far as necessary:
  - Clockwise rotation: Platform moves in a positive direction (increasing scale values)
  - Counterclockwise rotation: Platform moves in a negative direction

9 Customer Service Department

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

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

The latest versions of the user manuals are available on our website for download.

10 Technical Data

10.1 Specifications

10.1.1 Data Table

Motion	L-611	Unit	Toler-ance
Active axes	θ_Z		
Rotation range	>360	°	
Wobble	±15	µrad	
Flatness	±1	µm	
Eccentricity	±2.5	µm	
Angular velocity	L-611.xxSD: 50 L-611.xxAD: 200 L-611.99xxxx: 200	°/s	max.

Positioning	L-611.9ASD L-611.993261	L-611.94AD	L-611.90AD L-611.xxx232	L-611.90SD	Unit	Tole-rance
Integrated sensor	Incremental angle measuring system	Incremental angle measuring system	Rotary encoder	–		
Sensor signal	sin/cos, 1 V peak-peak,	A/B quadrature, TTL	A/B quadrature, TTL	–		
Sensor resolution rotary encoder	–	–	20000	–	cts./ rev.	
Sensor resolution angle measuring system	9000	9000	–	–	Lines/ rev.	
Design resolution	L-611.9ASD: 0.174 L-611.993261: 0.87	3.49	3.49	349	µrad	
Minimum incremental motion	L-611.9ASD: 0.87 L-611.993261: 3.5	17.45	35	8.72	µrad	typ.

Unidirectional repeatability	L-611.9ASD: 0.87 L-611.993261: 3.5	17.45	35	20	µrad	Typ.
Bidirectional repeatability	±3.5	±17.45	±175	±175	µrad	Typ.
Reference switch	Hall effect, N/C contact, 5V, NPN	Hall effect, N/C contact, 5V, TTL	Hall effect, N/C contact, 5V, TTL	Hall effect, N/C contact, 5V, NPN		
Reference switch repeatability	<2	<2	<2	<2	µrad	Typ.

Mechanical properties	L-611	Unit	Tole-rance
Bearing	Ball bearings		
Worm gear ratio	90:1		
Load capacity / axial force	100	N	Max.
Permissible lateral force	50	N	Max.
Permissible torque M_X in θ_X, θ_Y	40	Nm	Max.
Permissible torque M_Z in θ_Z	3	Nm	Max.
Moment of inertia	770	kg·mm²	±20 %

Drive properties	L-611.9xSD	L-611.9xAD	L-611.993xxx	L-611.995xxx	Unit	Toler-ance
Motor type	2-phase stepper motor	ActiveDrive DC motor (PWM)	DC motor	BLDC motor		
Operating voltage, nominal	24	24	24	24	V	Nom.
Operating voltage, max.	48	24	48	48	V	Max.
Motor resolution	200	–	–	–	Full steps/rev.	

Miscellaneous	L-611.9xSD	L-611.9xAD	L-611.993xxx	L-611.995xxx	Unit	Tole-rance
Operating temperature range	5 to 40	5 to 40	5 to 40	5 to 40	°C	
Material	Aluminum anodized, stainless steel, red bronze	Aluminum anodized, stainless steel, red bronze	Aluminum anodized, stainless steel, red bronze	Aluminum anodized, stainless steel, red bronze		
Mass	2.6	2.6	2.6	2.6	kg	±5 %
Moved mass	1.1	1.1	1.1	1.1	kg	±5 %
Connector	HD D-sub 26 (m) L-611.9ASD additional D-sub 9 (m) (sensor)	D-sub 15 (m)	HD D-sub 26 (m) L-611.993261 additional D-sub 9 (m) (sensor)	HD D-sub 26 (m)		
Recommended controllers/drivers	C-663.12 (single axis) SMC Hydra (double axis) C-885 with C-663.12C885 (up to 20 axes) ACS modular controller	C-863 (single axis) C-884 (up to 6 axes) C-885 with C-863.20C885 (to 40 axes)	C-863 (single axis) C-884 (up to 6 axes) C-885 with C-863.20C885 (to 40 axes) ACS modular controller	C-891 (single axis) C-885 with C-891.11C885 (up to 20 axes) ACS modular controller		

* 200x interpolated

10.1.2 Maximum Ratings

The L-611 positioners are designed for the following operating data. With the exception of the L-611.90AD and L-611.94AD models, these values are **not** suitable for continuous operation.

Device	Maximum operating voltage	Operating frequency	Maximum power consumption
L-611.90SD L-611.9ASD	48 V	-	10 W
L-611.90AD L-611.94AD	24 V	-	40 W
L-611.993232 L-611.993261	48 V	-	90 W
L-611.995232	48 V	-	85 W

10.1.3 Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the L-611:

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	-25 °C to 85 °C
Transport temperature	-25 °C to 85 °C
Supply fluctuations	Max. ±10 % of the nominal voltage
Degree of pollution	2
Degree of protection according to IEC 60529	IP00

10.1.4 Reference Point Switch Specifications

Type	Magnetic (Hall effect) sensor
Supply voltage	+5 V/GND, supplied by the motor controller through the motor connector.
Signal output	Open collector
Signal logic	Direction sensing by means of different signal levels on the left and right side of the reference point switch: The signal level changes from 0 to +5 V when the reference point switch is passed.
Hysteresis	0.2 to 0.4 mm (when arriving from the positive or negative direction)

10.2 Dimensions

Due to different electrical connections, the shapes of the individual models deviate slightly; however, the dimensions depicted in each case are identical. Dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

10.2.1 L- 611.9ASD / L 611.90SD

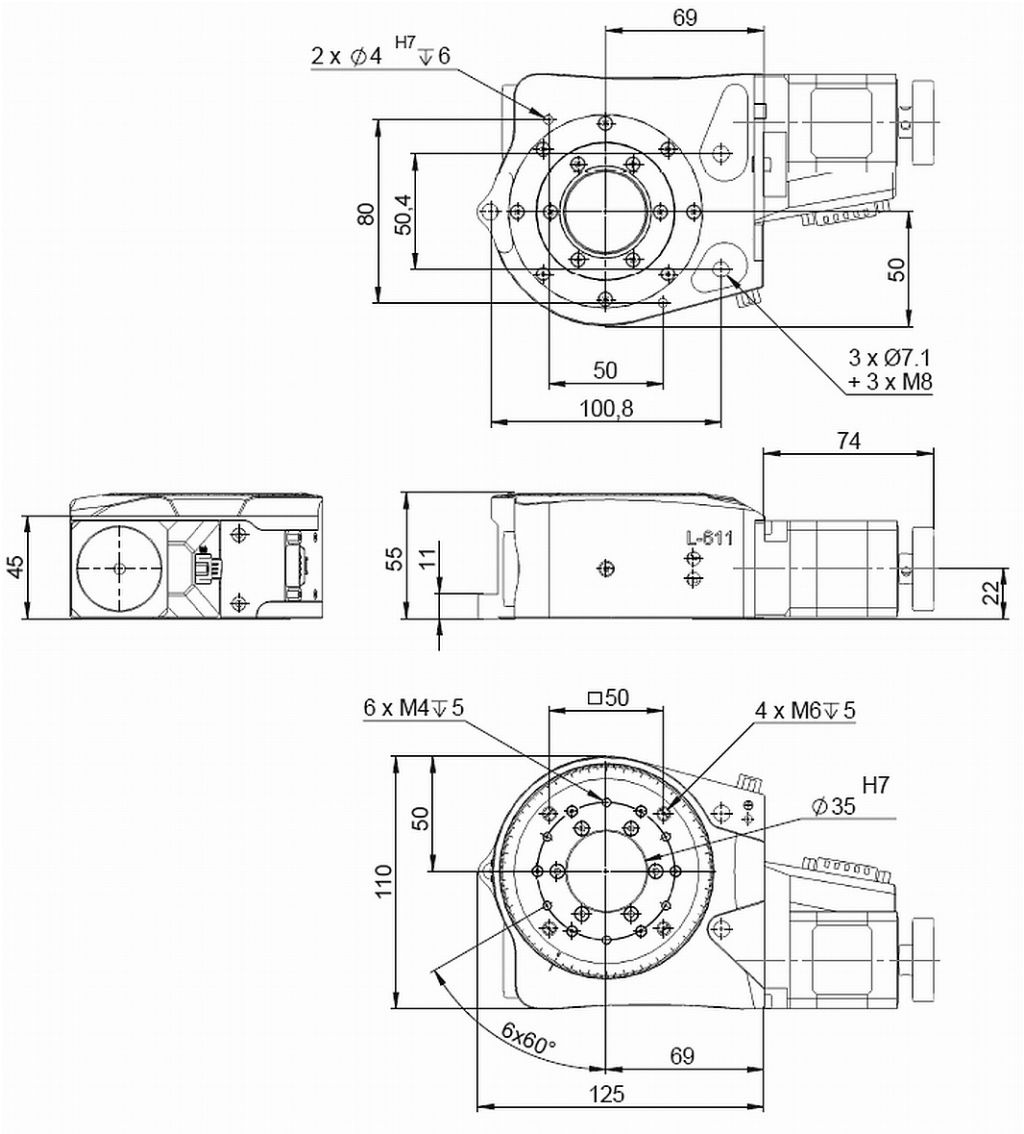


Figure 9: Dimensions

10.2.2 L-611.90AD / L-611.94AD / L-611.993232 / L-611.993261 / L-611.995232

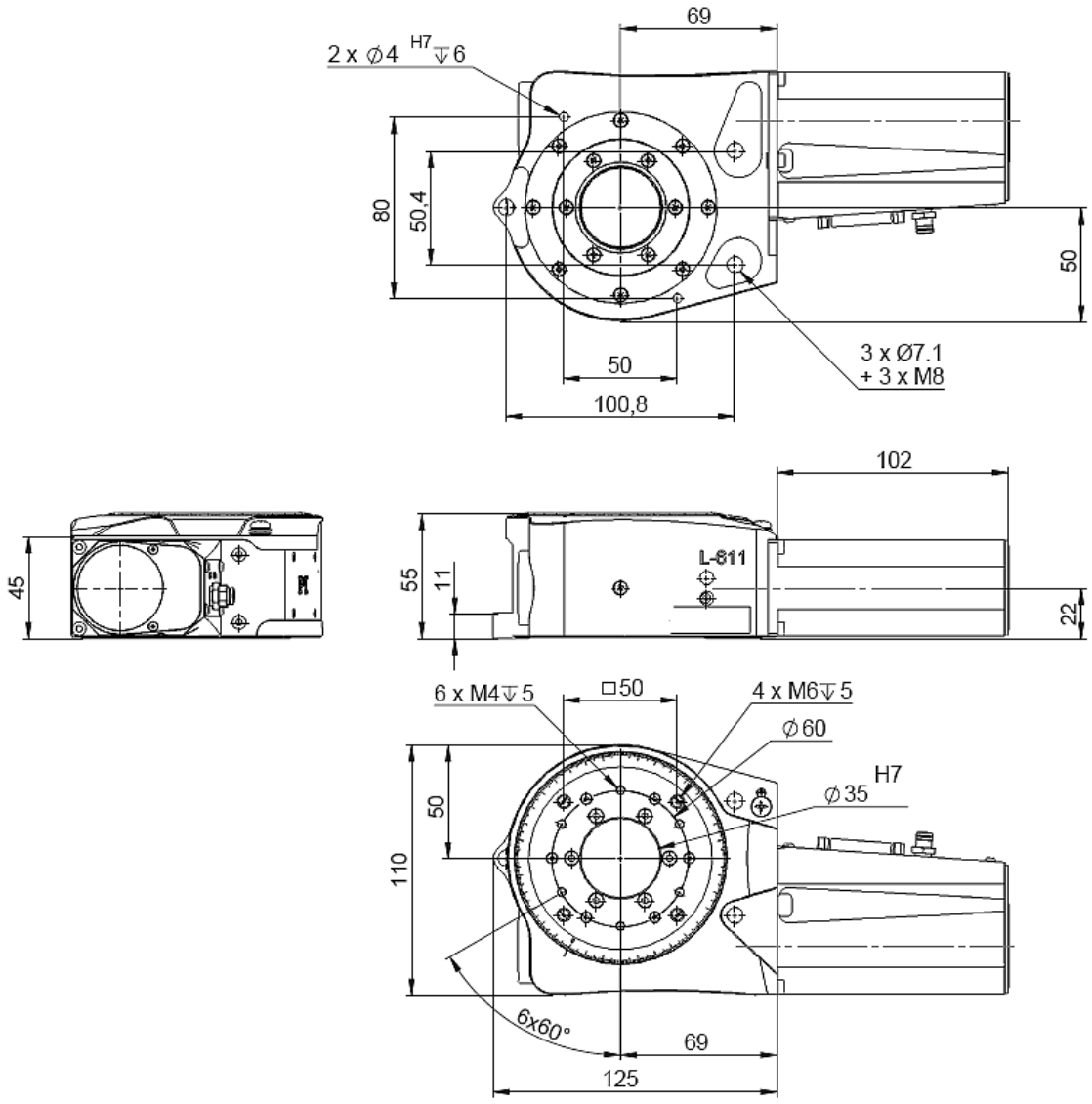


Figure 10: Dimensions

10.3 Pin Assignment

10.3.1 D-Sub 15 (m)

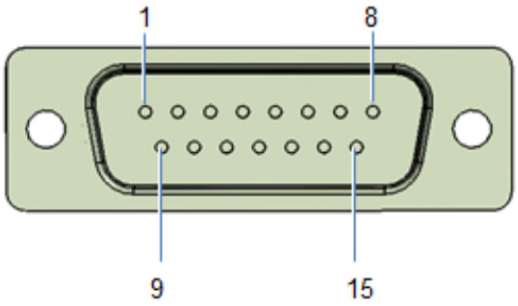


Figure 11: D-Sub 15 panel plug

Pin	Signal	Direction
1	Motor brake	Input
2	Motor +	Input
3	MAGN	Input
4	Power (+5 V)	Input
5	GND	-
6	ID	Output
7	Encoder A-	Output
8	Encoder B-	Output
9	Motor -	Input
10	GND	-
11	SIGN	Input
12	GND	-
13	REF	Output
14	Encoder A+	Output
15	Encoder B+	Output

10.3.2 HD D-Sub 26 (m)

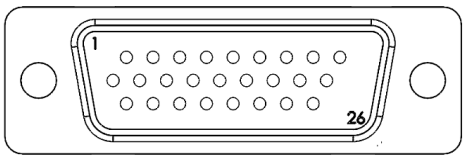


Figure 12: HD D-Sub 26 panel plug

L-611.90SD / L-611.9ASD

Pin	Signal	Direction
1	Motor A+	Input
2	Motor A+	Input
3	Motor A-	Input
4	Motor A-	Input
5	Motor B+	Input
6	Motor B+	Input
7	Motor B-	Input
8	Motor B-	Input
9	-	-
10	REF	Output
11	-	-
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	ID	Output
18	Power (+5 V)	Input
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	GND	-
26	-	-

L-611.993232 / L-611.993261 / L-611.995232

Pin	Signal	Direction
1	Motor + / Phase 1	Input
2	Motor + / Phase 1	Input
3	Motor - / Phase 2	Input
4	Motor - / Phase 2	Input
5	Phase 3	Input
6	Phase 3	Input
7	-	-
8	-	-
9	-	-
10	REF	Output
11	GND	-
12	GND	-
13	Hall 1	Output
14	Hall 2	Output
15	Hall 3	Output
16	-	-
17	ID	Output
18	REF 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	-
26	Encoder Power (+5 V)	Input

10.3.3 D-Sub 9 (m)

The D-Sub 9 panel plug is only provided with the -L-611. 9ASD and L-611.993261 models.

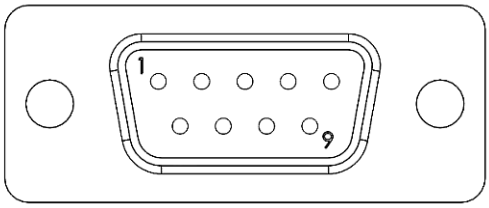


Figure 13: D-Sub 9 panel plug

Pin	Signal	Direction
1	Encoder A+	Output
2	Encoder B+	Output
3	Encoder C+	Output
4	Encoder GND	-
5	Encoder Power (+ 5V)	Input
6	Encoder A-	Output
7	Encoder B-	Output
8	Encoder C-	Output
9	-	-

10.4 Tightening Torque for Screws, ISO 4762 - A2

The following tightening torques for screws according to ISO4762 (corresponds to DIN 912) - A2 may not be exceeded.

Value	Maximum tightening torque
M3	1.5 Nm
M4	2 Nm
M5	2.5 Nm
M6	3 Nm

11 Old Equipment 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 miCos GmbH undertakes environmentally correct disposal of all old PI miCos equipment made available on the market after 13 August, 2005 without charge.

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

PI miCos GmbH

Freiburger Strasse 30

79427 Eschbach, Germany

12 EU Declaration of Conformity

An EU Declaration of Conformity has been issued for the L-611 in accordance with the following European directives:

- Machinery Directive
- EMC Directive
- RoHS Directive

The standards applied for certifying the conformity are listed below.

- Safety of Machinery: EN ISO 12100
- Electrical Safety: EN 61010-1
- EMC: EN 61326-1
- RoHS: EN 50581