

## MP184E L-741 / V-741 Precision XY Stage User Manual

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**This document describes the following precision XY stages with 305 mm x 305 mm travel range:**

- L-741.131100:  
With stepper motor, without encoder
- L-741.131111:  
With stepper motor and linear encoder,  
sin/cos signal transmission
- L-741.131112:  
With stepper motor and linear encoder,  
A/B quadrature signal transmission
- L-741.133111:  
with DC motor and linear encoder,  
sin/cos signal transmission
- L-741. 133112:  
with DC motor and linear encoder,  
A/B quadrature signal transmission
- L-741.133132:  
with DC motor, with rotary encoder,  
A/B quadrature signal transmission
- V-741.136111:  
with linear motor and linear encoder,  
sin/cos signal transmission



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Subject to change. This manual is superseded by any new release. The latest release is available for download from our website (p. 3).

## Contents

<b>1</b>	<b>About this Document</b>	<b>1</b>
1.1	Objective and Target Group of this User Manual .....	1
1.2	Symbols and Typographic Conventions.....	1
1.3	Pictures .....	2
1.4	Other Applicable Documents .....	2
1.5	Downloading Manuals.....	3
<b>2</b>	<b>Safety</b>	<b>5</b>
2.1	Intended Use .....	5
2.2	General Safety Instructions .....	5
2.3	Organizational Measures.....	5
<b>3</b>	<b>Product Description</b>	<b>7</b>
3.1	Model Overview .....	7
3.2	Product View .....	8
3.2.1	Mechanical Parts and Protective Earth Connection .....	8
3.2.2	Electrical Connections .....	9
3.3	Direction of Motion .....	9
3.4	Product Labeling.....	10
3.5	Scope of Delivery.....	11
3.6	Suitable Controllers .....	11
3.7	Technical Features.....	12
3.7.1	Encoder.....	12
3.7.2	Limit Switches.....	12
3.7.3	Reference Switch.....	12
<b>4</b>	<b>Unpacking</b>	<b>13</b>
<b>5</b>	<b>Installation</b>	<b>15</b>
5.1	General Notes on Installation.....	15
5.2	Attaching the L-741 / V-741 to a Surface .....	17
5.3	Connecting the L-741 / V-741 to the Protective Earth Conductor .....	20
5.4	Attaching the Load to the L-741 / V-741 .....	23
5.5	Connecting the L-741 / V-741 to a Controller .....	24
<b>6</b>	<b>Startup</b>	<b>25</b>
6.1	General Notes on Startup.....	25
6.2	Putting the Stage into Operation .....	27
6.2.1	L-741 / V-741 Entries in the PI Stage Database .....	27

<b>7</b>	<b>Maintenance</b>	<b>29</b>
7.1	General Notes on Maintenance .....	29
7.2	Performing a Maintenance Run (L-741 Model).....	29
7.3	Cleaning the L-741 / V-741 .....	29
7.4	Packing, Transporting, Storing, Returning.....	30
7.4.1	Designations of Relevant Components .....	31
7.4.2	Move to Reference Position .....	32
7.4.3	Securing the positioner mechanically.....	34
7.4.4	Packing.....	35
7.4.5	Returning the Device .....	35
<b>8</b>	<b>Troubleshooting</b>	<b>37</b>
8.1	Possible Causes and Remedies .....	37
8.2	Moving the Platform Manually .....	38
<b>9</b>	<b>Customer Service Department</b>	<b>39</b>
<b>10</b>	<b>Technical Data</b>	<b>41</b>
10.1	Specifications.....	41
10.1.1	Data Table.....	41
10.1.2	Maximum Ratings .....	48
10.1.3	Ambient Conditions and Classifications .....	48
10.1.4	Limit Switch Specifications .....	48
10.1.5	Reference Switch Specifications.....	49
10.2	Dimensions .....	50
10.3	Pin Assignment .....	52
10.3.1	HD D-Sub 26 (m) .....	52
10.3.2	D-Sub 15 (m).....	55
10.4	Tightening Torque for Screws, ISO 4762 - A2.....	56
<b>11</b>	<b>Old Equipment Disposal</b>	<b>57</b>
<b>12</b>	<b>EU Declaration of Conformity</b>	<b>59</b>

# 1 About this Document

## 1.1 Objective and Target Group of this User Manual

This user manual contains the necessary information on the intended use of the L-741 / V-741.

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 (page 3).

## 1.2 Symbols and Typographic Conventions

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

### **CAUTION**



#### **Dangerous situation**

If not avoided, the dangerous situation will result in minor injury.

- Measures for avoiding the risk.

### **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
<b>RS-232</b>	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 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.

### 1.4 Other Applicable Documents

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

Product	Document
Positioners with electric motors	MP146EK Short instructions for positioners with electric motors
Positioners with PIMag® drives	MP163EK Short instructions for positioners with PIMag® drives
C-663.12 Stepper Motor Controller	MS241E User Manual
C-863.11 DC Motor Controller	MS205E User Manual
C-863 DC Motor Controller	MS249E User Manual
C-884 DC Motor Controller	MS243E User Manual
SMC Hydra motion controller	Hardware Manual
ACS SpiiPlusEC	ACS SpiiPlusEC Installation Guide ACS SpiiPlusEC IMPU Only Installation Guide
C-891 PIMag® Motion Controller	MS251E User Manual
C-885/C-891.11C885	C885T0002 User Manual C891T0005 User Manual

## 1.5 Downloading Manuals

### ***INFORMATION***

If a manual is missing or problems occur with downloading:

- Contact our customer service department (p. 39).

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e.g., L-741).
3. Click the corresponding product to open the product detail page.
4. Click ***Downloads***.  
The manuals are shown under ***Documentation***.
5. Click the desired manual and fill out the inquiry form.  
The download link will then be sent to the email address entered.





## 2 Safety

### 2.1 Intended Use

The L-741 / V-741 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-741 / V-741 is intended for positioning, adjusting and shifting of loads on two axes at various velocities. The L-741 / V-741 is **not** intended for applications in areas, in which a failure would present severe risks to human beings or the environment.

The intended use of the L-741 / V-741 is only possible when completely mounted and connected and in a horizontal position.

The L-741 / V-741 must be operated with a suitable controller (p. 11). The controller is not in the scope of delivery of the L-741 / V-741.

### 2.2 General Safety Instructions

The L-741 / V-741 is built according to state-of-the-art technology and recognized safety standards. Improper use of the L-741 / V-741 may result in personal injury and/or damage to the L-741 / V-741.

- Only use the L-741 / V-741 for its intended purpose, and only use it if it is in perfect condition.
- Read the user manual.
- Immediately eliminate any faults and malfunctions that are likely to affect safety (p. 37).

The operator is responsible for correct installation and operation of the L-741 / V-741.

### 2.3 Organizational Measures

#### User manual

- Always keep this user manual available when using the L-741 / V-741.  
The latest versions of the user manuals are available on our website (p. 3) for download.
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the L-741 / V-741 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-741 / V-741 after you have read and understood this user manual.

### **Personnel qualification**

The L-741 / V-741 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 stages

All models are precision XY stages with linear stage with crossed roller bearings. They differ with respect to the drive type and encoder equipment.

L-741 / V-741	Drive type			Rotation encoder	Linear encoder	
	Stepper motor	DC motor	Linear motor	A/B quadrature	A/B quadrature	sin/cos*
L-741.131100	+					
L-741.131111	+					+
L-741.131112	+				+	
L-741.133111		+				+
L-741.133112		+			+	
L-741.133132		+		+		
V-741.136111			+			+

\* Separate sensor connection

#### Detailed model overview

Order number	Product name
L-741.131100	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, 2-phase stepper motor
L-741.131111	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, 2-phase stepper motor, linear encoder with sin/cos signal transmission
L-741.131112	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, 2-phase stepper motor, linear encoder with A/B quadrature signal transmission
L-741.133132	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, DC motor, rotary encoder with A/B quadrature signal transmission
L-741.133111	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, DC motor, linear encoder with sin/cos signal transmission

Order number	Product name
L-741.133112	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, DC motor, linear encoder with A/B quadrature signal transmission
V-741.136111	Precision XY stage, 410 mm × 410 mm width, 305 mm × 305 mm travel range, linear motor, linear encoder with sin/cos-signal transmission

➤ For further technical data, see the specifications. (p. 41).

## 3.2 Product View

### 3.2.1 Mechanical Parts and Protective Earth Connection

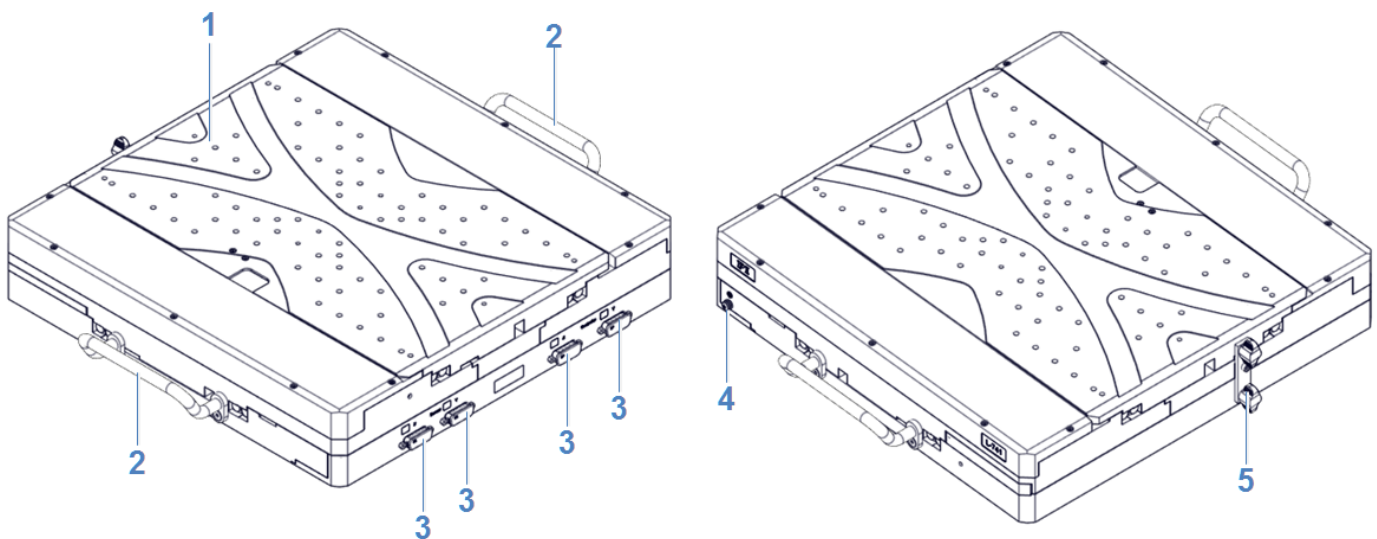
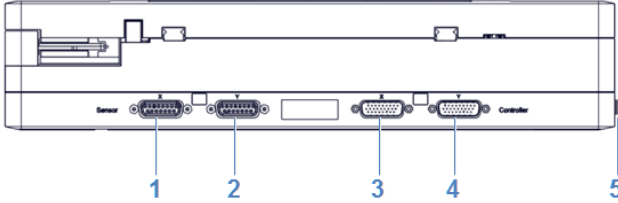
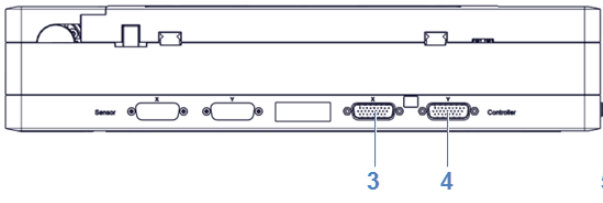


Figure 1: Parts

- 1 Platform
- 2 Handle
- 3 ESD protection
- 4 Protective earth connection
- 5 Transport safeguard

3.2.2 Electrical Connections

Connection type and assignments depend on the model (for pin assignment, see p. 52).

L-741.131111 L-741.133111 V 741.136111	L-741.131100 L-741.131112 L-741.133132 L-741.133112
	

Pos.	Connection	L-741.131111 L-741.133111 V 741.136111	L-741.131100 L-741.131112 L-741.133132 L-741.133112
1	Sensor connection, X axis (D-Sub 15 panel plug)	+	
2	Sensor connection, Y axis (D-Sub 15 panel plug)	+	
3	Motor connection, X axis (HD D-Sub 26 panel plug)	+	+
4	Motor connection, Y axis (HD D-Sub 26 panel plug)	+	+
5	Protective earth connection (screw ISO 7045, M4x8)	+	+

3.3 Direction of Motion

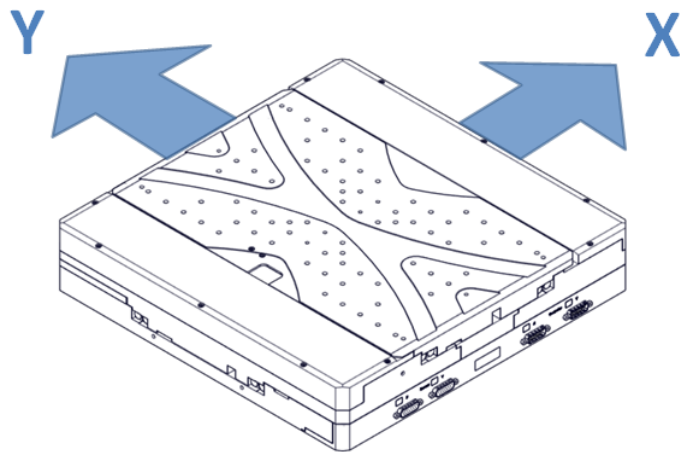


Figure 2: Direction of the motion of the platform

X, Y (arrow direction:) Direction of motion on positive command

### 3.4 Product Labeling

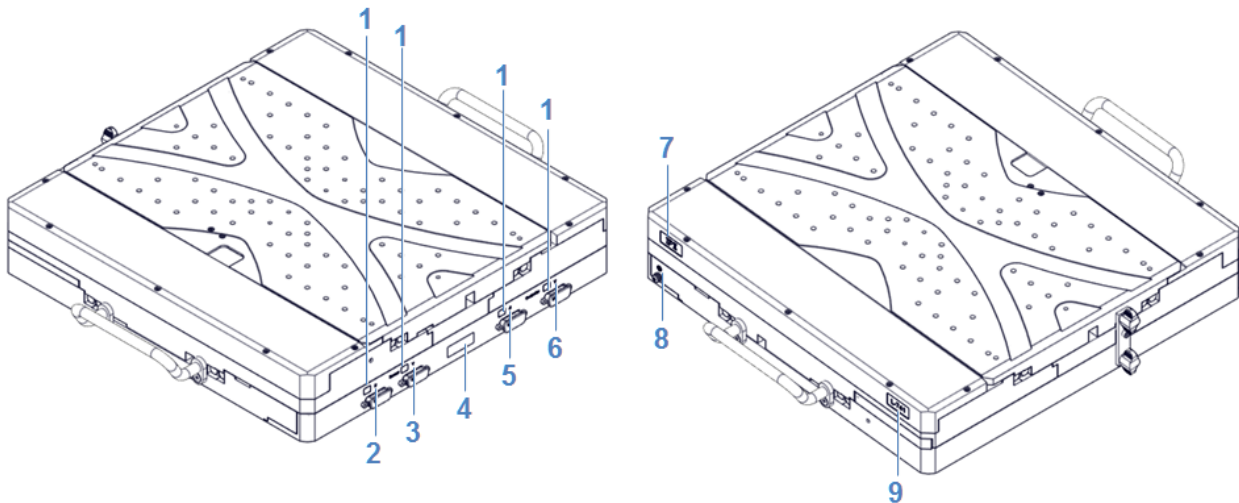








Figure 3: Product labeling (see following table)

Position	Labeling	Description
1		Warning sign "Electrostatic sensitive devices"
2	Sensor X	Encoder connection, X axis
3	Sensor Y	Encoder connection, Y axis
4		Warning sign "Observe manual!"
4		Old equipment disposal
4	Country of origin: Germany	Country of origin
4	WWW.PI.WS	Manufacturer's address (website)
4	L-741.131111	Complete product code (example)
4		CE conformity mark
4	418002159	Serial number (example), individual for each L-741 / V-741 Meaning of the places (counting from left): 1 = internal information, 2 and 3 = year of manufacture, 4 to 9 = consecutive numbers
5	X	Motor connection, X axis
6	Y	Motor connection, Y axis
7, 4		Manufacturer's logo
8		Protective earth conductor connection (p. 20)
9, 4	L-741 (or V-741)	Product series

### 3.5 Scope of Delivery

Item number	Component
L-741.xxxxxx or V-741.xxxxxx	Stage according to the order (p. 7)
MP146EK MP139EK	Short instructions for stages with electric motors Short instructions for stages with PIMag® drives
L741B0010	Mounting accessories: <ul style="list-style-type: none"> <li>• 4 socket head screw, ISO 4762* M6x35</li> <li>• 2 dowel pins, ISO 2338** - 4 h8 x 12</li> </ul>

\* Corresponds to DIN 912

\*\* Corresponds to DIN 7

### 3.6 Suitable Controllers

The L-741 / V-741 must be connected to a suitable controller. The following controllers from PI are suitable for operating the L-741 / V-741:

	C-663.12*	SMC Hydra	C-863*	C-891*	C-884	C-885 with C-663. 12C885	C-885 with C-891. 11C885	C-885 with C-863. 20C885	Modular ACS controller
Motion axes per controller (max.)	1	2	1	1	6	20	20	40	
PC interfaces	USB, RS-232, daisy chain network	RS-232, LAN	USB, RS-232, LAN	RS-232, LAN	RS-232, LAN	USB, LAN	USB, LAN	USB, LAN	USB, LAN
Multiple controllers on the same PC	+	+	+	+	+	+	+	+	+
L-741.131100	+	+				+			+
L-741.131112	+	+				+			+
L-741.131111		+							+
L-741.133111		+		+			+		+
L-741.133112			+		+			+	+
L-741.133132			+		+			+	+
V-741.136111		+		+			+		+

\* 2 controllers are required for operation.

PC software is in the scope of delivery of the controllers from PI. The operation of the controllers is described in the corresponding user manuals.

Please note that the cables for connecting the L-741 / V-741 to the electronics must be ordered separately.

➤ To order, contact our customer service department (p. 39).

## 3.7 Technical Features

### 3.7.1 Encoder

The L-741.131111, L-741.131112, L-741.133111, L-741.133112, and V-741.136111 models are equipped with an optical linear encoder. Optical linear encoders measure the actual position directly (direct metrology). Errors occurring in the drive, such as nonlinearity, backlash or elastic deformations cannot influence measuring of the position.

Model L-741.133132 is equipped with an optical rotary encoder. A rotary encoder, also called an incremental rotary encoder, is implemented at a rotating point in the drivetrain, e.g., the motor shaft.

Refer to the table in the "Specifications" section For the encoder resolution (p. 41).

Model L-741.131100 does not have an encoder.

### 3.7.2 Limit Switches

The stage is equipped with optical limit switches.

Each limit switch sends its signal to the controller on a dedicated line. The controller then stops the motion. If the controller does not stop the motion in time, the stage runs into the hard stop.

See "Limit Switch Specifications" for more information (p. 48).

### 3.7.3 Reference Switch

The stage is equipped with a direction-sensing reference switch (see "Reference Switch Specifications" (p. 48)).

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



## **4 Unpacking**

1. Unpack the L-741 / V-741 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

#### **DANGER**



##### **For V-731 models: Magnetic fields!**

Magnetic fields may damage or interfere with sensitive devices and objects (e. g. **cardiac pacemakers**, EC-cards, magnetic data carriers). **The fields are also effective when the positioner is not connected to the controller/electric power.**



Loose magnetizable objects (e.g. made of iron, steel) may be attracted and cause damages. The corresponding pull might not be manually compensated.

- If applicable, note the usual precautions for applying pacemakers.
- Remove loose magnetizable objects and sensitive devices from the installation site.
- Ensure that hazardous areas are marked correspondingly and that the usual precautions are applied.
- Keep sufficient distance from the positioner.
- Apply corresponding precautions also for storage and transport of the positioner.

#### **NOTICE**



##### **Cable break!**

A cable break leads to failure of the stage.

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

#### **NOTICE**



##### **Heating up of the L-741 / V-741 during operation!**

The heat produced during operation of the L-741 / V-741 can affect your application.

- Install the L-741 / V-741 so that the application is not impaired by the dissipated heat.

#### **NOTICE**



##### **Damage due to removed caps or screws!**

Removing caps and screws can lead to contamination and failure of the L-741 / V-741.

- Do **not** loosen screws on the stage, except when removing the transport safeguard (p. 18).
- Do **not** remove any caps other than the ESD protection.
- Remove the ESD protection only when connecting to the controller.

### ***INFORMATION***

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

- If possible, simulate the stage 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 stage and the application, in accordance with the legal regulations.

## 5.2 Attaching the L-741 / V-741 to a Surface

### NOTICE



#### Warping of the L-741 / V-741 due to mounting on uneven surfaces!

Mounting the L-741 / V-741 on an uneven surface can warp the L-741 / V-741. Warping reduces the accuracy.

- Mount the L-741 / V-741 onto an even surface. The recommended flatness of the surface is  $\leq 5 \mu\text{m}$ .
- For applications with large temperature changes:  
Only mount the L-741 / V-741 on surfaces that have the same or similar thermal expansion properties as the L-741 / V-741.

### NOTICE



#### Damage to the V-741 by impact of the platform with hard stops!

The V-741 has a linear drive without self-locking. When the XY stage is tipped, the platform can hit the hard stops without braking.

- Only mount the V-741 onto absolutely horizontal surfaces.
- Remove the transport lock just before mounting onto the surface.

### 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. 50)):
  - For mounting from above: 8 threaded holes M6 are provided.
  - If you use locating pins to align the stage: Two 4 mm  $\varnothing$  locating holes are present.
  - The surface flatness is  $\leq 5 \mu\text{m}$ .
  - For applications with large temperature changes: The surface should have the same or similar thermal expansion properties as the L-741 / V-741 (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 (p. 11)
  - 8 socket head cap screws, ISO 4762 M6x35
  - 2 dowel pins, ISO 2338 - 4 h8 × 12, for use as locating pins
- Allen wrench AF 5
- Hex key, AF 3

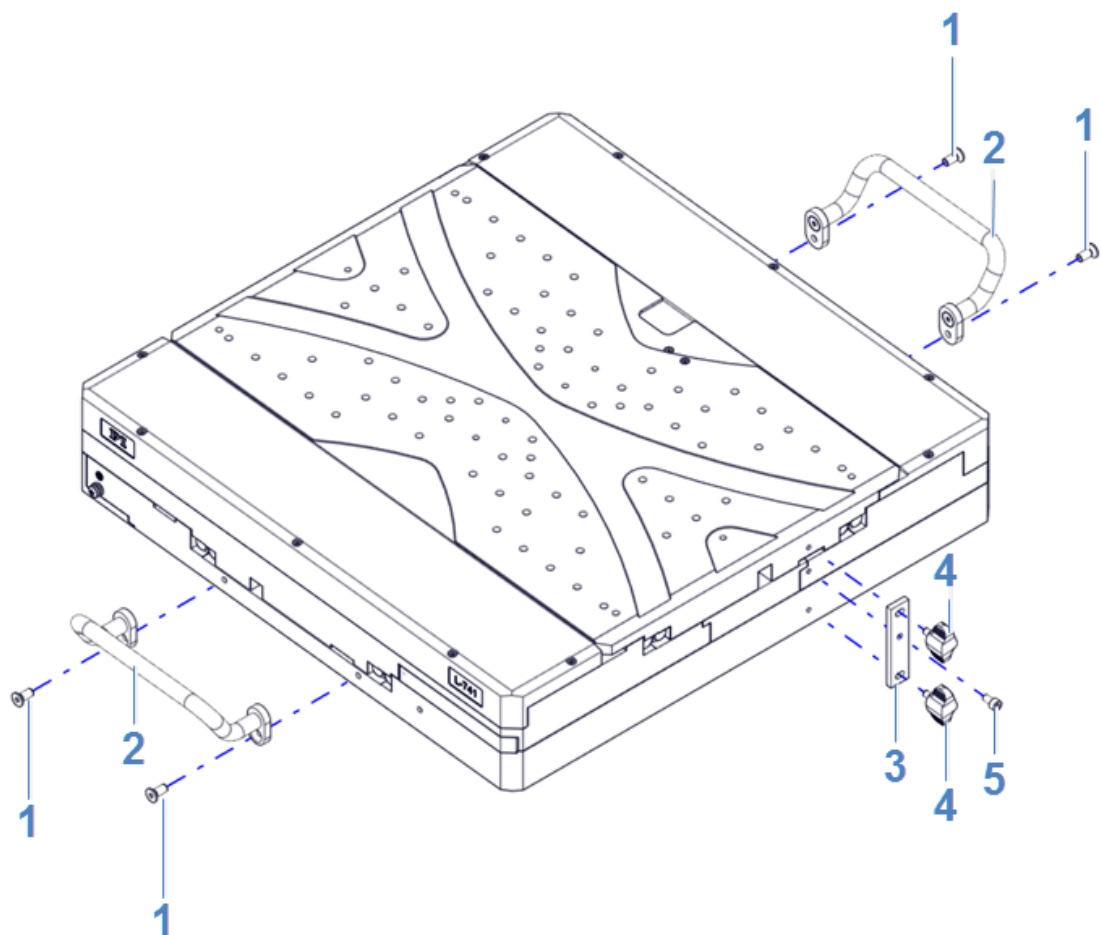
**Attaching the stage to a surface**

Figure 4: Remove the handle and the transport lock

- 1 Screw for the handle
  - 2 Handle
  - 3 Perforated plate for the transport lock
  - 4 Wing screw for the transport lock
  - 5 Screw for the transport lock
1. Remove both handles: Loosen the screws for the handles (see figure above).
  2. Remove the screw and both wing screws of the transport lock (see figure above).

3. If you use locating pins to align the stage:
  - a) Insert the locating pins into the respective holes in the surface.
  - b) Place the stage on the surface so that the locating pins are inserted into the corresponding locating holes on the other side.
4. Move the platform in the X direction so that two of the fixing holes (through-holes) become accessible (see figure below).

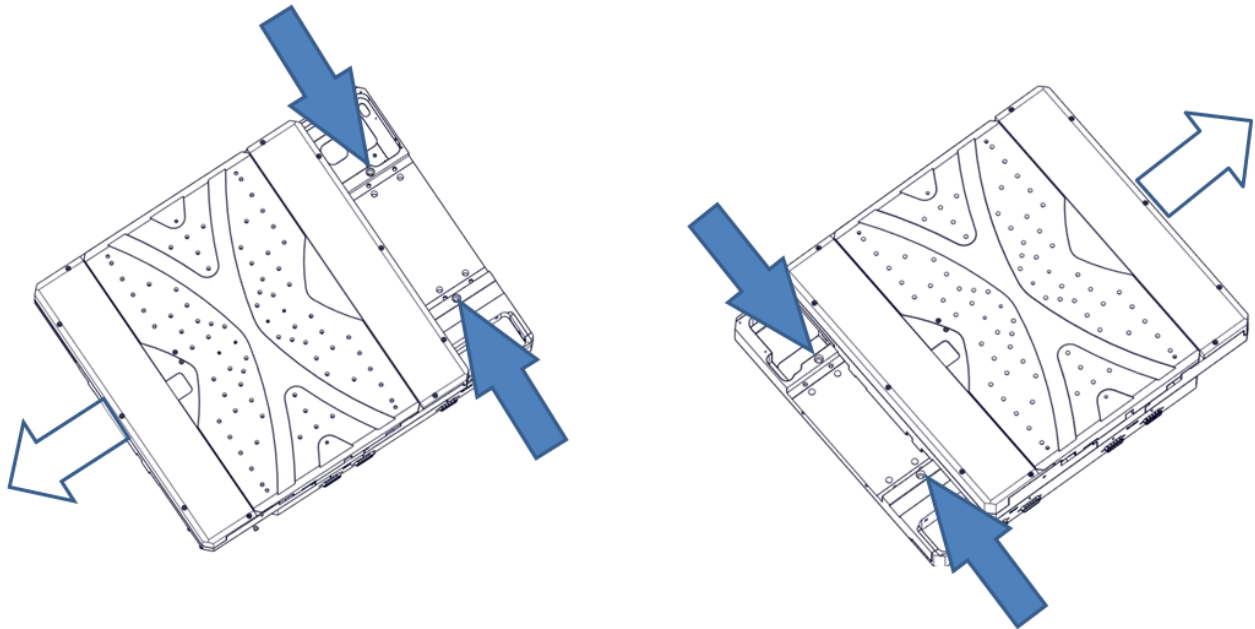


Figure 5: Position of the through-holes for mounting the stage (schematic)

It is possible to move the platform accordingly.  
Alternatively, to move the platform via a drive screw:

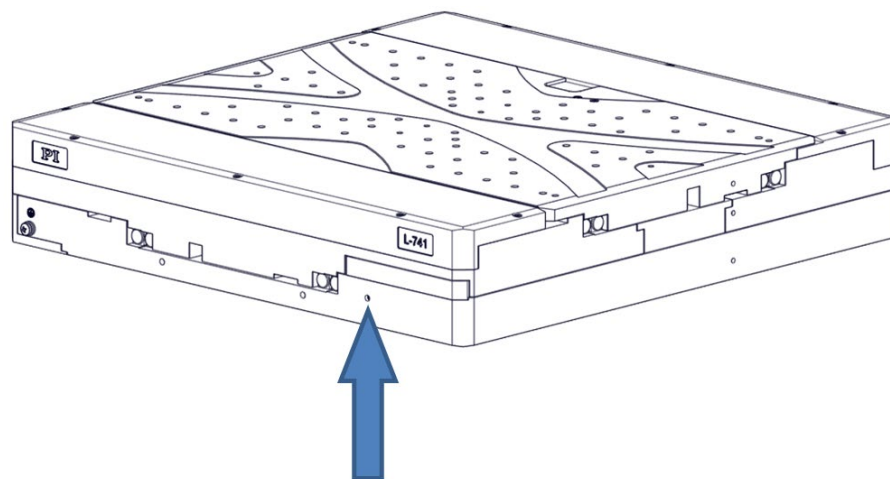


Figure 6: Position of the drive screw access

- a) Insert a hex key AF3 into the drive screw access until you sense a mechanical resistance.
- b) Turn the hex key clockwise or counterclockwise to move the platform in the positive or negative X direction.

5. Align the stage on the surface so that the corresponding mounting holes in the stage and the surface are aligned.
6. Tighten all screws in the mounting holes selected. Pay attention to the permissible tightening torques (p. 56)
7. Repeat steps 4 to 6 for all remaining mounting holes.
8. Check that the stage is affixed firmly to the surface.

### 5.3 Connecting the L-741 / V-741 to the Protective Earth Conductor

#### **INFORMATION**

It is only necessary to connect the L-741 / V-741 to the protective earth conductor when both of the following conditions are met:

- The load on the platform of the L-741 / V-741 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.

A protective earth connection is located on front side of the L-741 / V-741 (see also Figure 1, p.8).



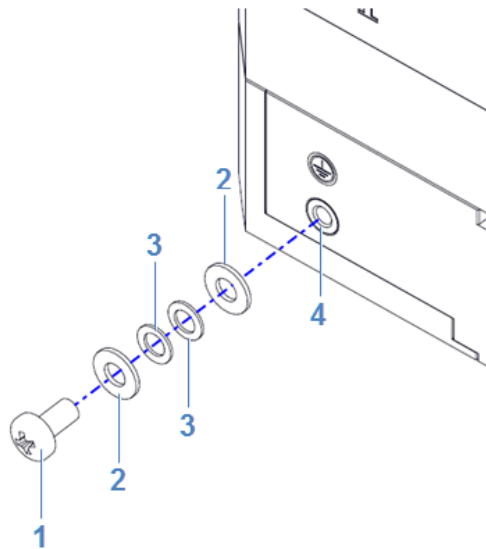


Figure 7: Protective earth connection setup (exploded view)

- 1 Screw, M4x8, ISO 7045
- 2 Flat washer
- 3 Safety washer
- 4 M4 mounting hole

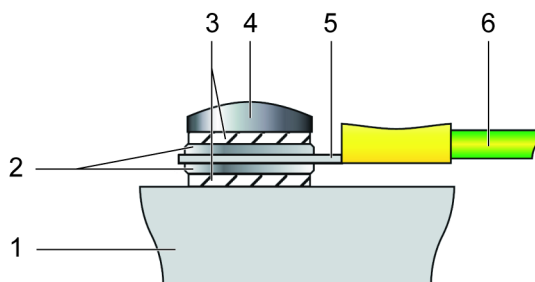


Figure 8: Mounting of the protective earth conductor (profile view)

- 1 Base body of the L-741 / V-741 (front side)
- 2 Flat washer
- 3 Safety washer
- 4 Screw, M4x8, ISO 7045
- 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  $\geq 0.75 \text{ mm}^2$
- PH1 screwdriver or similar tool

### **Connecting the L-741 / V-741 to the protective earth conductor**

1. If necessary, attach a suitable cable lug to the protective earth conductor.
2. Remove the screw and the safety and flat washers of the protective earth connection (p. Figure 7).
3. Tighten the screw (together with the safety and flat washers) to affix the cable lug of the protective earth conductor to the protective earth connection (p. Figure 8)
4. Tighten the screw with a torque of 1.2 Nm to 1.5 Nm.
5. Make sure that the contact resistance is  $<0.1 \Omega$  at 25 A at all connection points relevant for attaching the protective earth conductor.

## 5.4 Attaching the Load to the L-741 / V-741

### 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. 41).

### Requirements

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have mounted the stage onto a surface properly (p. 17).
- ✓ 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 (p.50):
  - 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 M6 screws of suitable length
- Suitable tool for tightening the screws.
- Optional: Dowel pins, ISO 2338 - 4 h8 x 12 (locating pins)

### Affixing the load

1. If you use locating pins for aligning the load: Insert the locating pins into the holes provided in the platform (p.50).
2. Align the load so that the selected mounting holes in the platform can be used to affix it.
3. Use the screws to affix the load to the selected mounting holes in the platform.
4. Check that the load is affixed firmly to the platform of the stage.

## 5.5 Connecting the L-741 / V-741 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. 11).
- To connect the stage to the controller, only use suitable cables for your specific positioner/controller combination.
- For inquiries and orders contact our customer service (p. 39).

### 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 (to be ordered separately)
- Suitable tools for tightening the screws to the connections

### Connecting the L-741 / V-741 to a controller

1. Remove the ESD protection from all connections of the L-741 / V-741.
2. Connect the L-741 / V-741 and the controller to each other.
3. Use the integrated screws to secure the connections against accidental disconnection.

## 6 Startup

### 6.1 General Notes on Startup

#### DANGER

**For V-731 models: Magnetic fields!**

Magnetic fields may damage or interfere with sensitive devices and objects (e. g. **cardiac pacemakers**, EC-cards, magnetic data carriers). **The fields are also effective when the positioner is not connected to the controller/electric power.**



Loose magnetizable objects (e.g. made of iron, steel) may be attracted and cause damages. The corresponding pull might not be manually compensated.

- If applicable, note the usual precautions for applying pacemakers.
- Remove loose magnetizable objects and sensitive devices from the installation site.
- Ensure that hazardous areas are marked correspondingly and that the usual precautions are applied.
- Keep sufficient distance from the positioner.
- Apply corresponding precautions also for storage and transport of the positioner.

#### CAUTION

**Risk of crushing by moving parts!**

Risk of minor injury from crushing between the moving parts of the stage or the load and a fixed part or obstacle.

- Use safeguards to protect limbs areas where they could be caught by moving parts.
- Observe the safety distances in accordance with DIN EN ISO 13857 when installing protective structures.

#### NOTICE

**Damage due to collisions!**

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

- Make sure that collisions are not possible between the stage, the load to be moved, and the surroundings in the motion range of the stage.
- 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. 11).
- To connect the stage to the controller, only use suitable cables for your specific positioner/controller combination.
- For inquiries and orders contact our customer service (p. 39).

**NOTICE****Operating voltage excessively high or incorrectly connected!**

Operating voltages that are excessively high or incorrectly connected can cause damage to the L-741 / V-741.

- Do **not** exceed the operating voltage range (p. 48) that is specified for the L-741 / V-741.
- Operate the L-741 / V-741 only when the operating voltage is properly connected; see "Pin Assignment" (p. 52).

**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-741 / V-741 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-741 / V-741, 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-741.4xSD 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 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 switch.

## 6.2 Putting the Stage into Operation

### Requirements

- ✓ You have read and understood the general notes on startup (p. 25).
- ✓ When starting up with a load or in a multi-axis system: You have properly installed the stage (p. 15).
- ✓ 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-741 / V-741 to the Controller" (p. 24) and the user manual for the controller).

### Putting the stage into operation

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

### 6.2.1 L-741 / V-741 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!**

Removing caps and screws can lead to contamination and failure of the L-741 / V-741.

- Do **not** loosen any screws on the stage (except those related to the transport safeguard).
- Do **not** remove any caps other than the ESD protection.

### 7.2 Performing a Maintenance Run (L-741 Model)

Depending on the operating conditions and the period of use of the L-741, the following maintenance measures are required:

**Maintenance run**

The maintenance run serves the purpose of distributing 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 the L-741 is to be operated continuously in an industrial environment over a small travel range (<20 % of the entire travel range), perform a maintenance run across the entire travel range every 5000 motion cycles.

**Lubrication**

Under laboratory conditions, it is only necessary to relubricate the stage in exceptional cases. For continuous industrial use, the lubrication intervals must be defined individually.

- If you have any questions on relubricating, contact our customer service department (p. 39).

### 7.3 Cleaning the L-741 / V-741

**Requirements**

- ✓ You have disconnected the stage from the controller.

**Cleaning the Stage**

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

## 7.4 Packing, Transporting, Storing, Returning

### HINWEIS

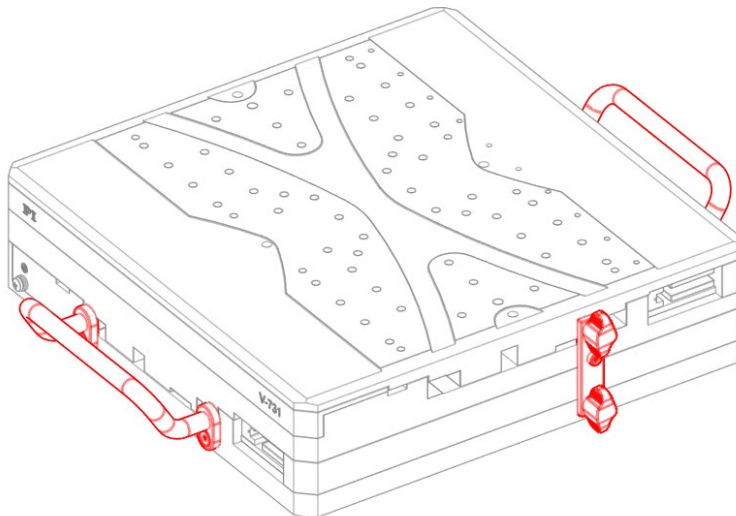


**For positioners of the V-7xx series: Possible damage after disassembly due to missing or incomplete transport lock**

In contrast to the L-7xx series models, the moving components of the cross table can be moved very easily for V-7xx series models, even after disconnection from the controller. If the base body is tilted accordingly, undesirably high accelerations and decelerations of these components as well as collisions can occur and cause damage to the device. This is prevented by installing appropriate components to secure the device during transport.

If you wish to detach the device from its mounting surface:

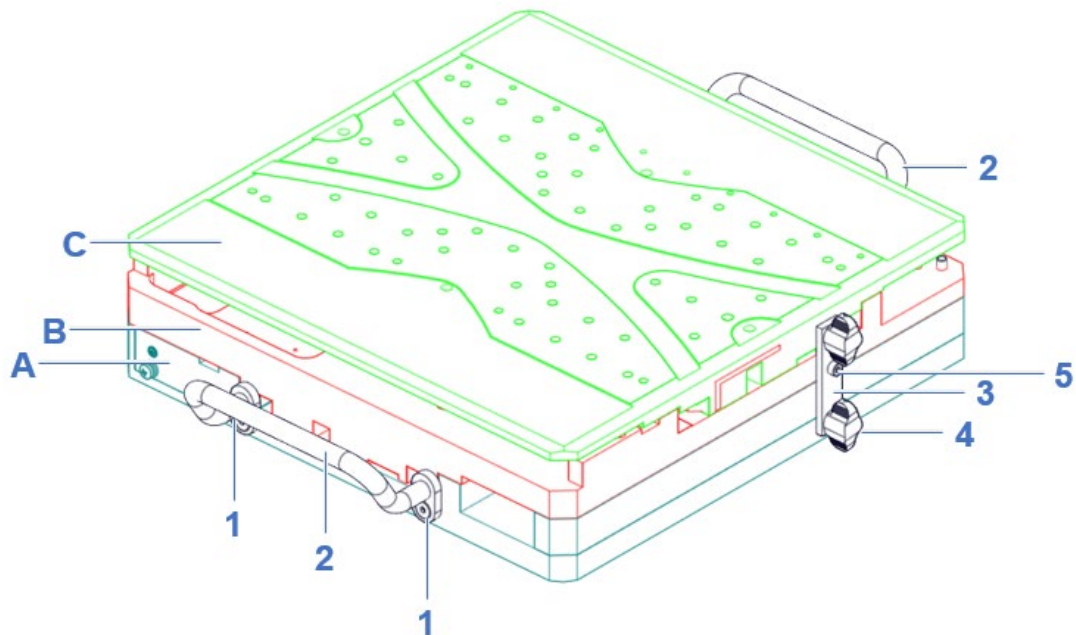
- After uninstalling the device: Ensure that all components of the transport lock are fitted before the device is moved from its horizontal position. Follow the instructions below.



### INFORMATION

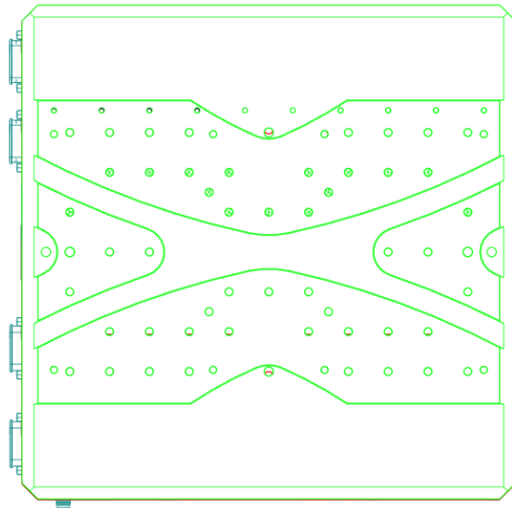
If the positioner is not to be used for a longer period of time, we recommend storing it in its original packaging if possible (delivery condition). To do this, the platform must be in the reference position ( $X = 0$ ,  $Y = 0$ ).

### 7.4.1 Designations of Relevant Components



A	Base body
B	X component
C	Platform / Y component
1	Mounting screw for carrying handle / X-lock (example, 4 in total)
2	Carrying handle / X-lock (example, 2 in total)
3	Y-lock
4	Wing screw for Y lock (example, 2 in total)
5	Hex socket screw for Y-lock

### 7.4.2 Move to Reference Position



#### INFORMATION

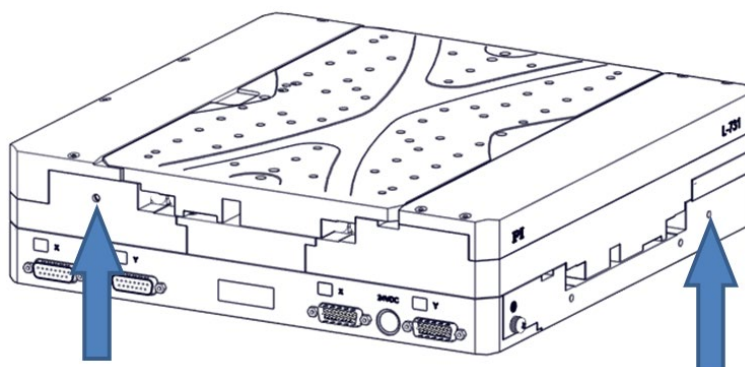
In contrast to the L-7xx series models, the moving components of the cross table can be moved very easily by hand (see below).

#### Procedure for Models L-7xx (also applicable for V-7xx models)

1. Establish (or keep, respectively) the connection to the controller.
2. Using the motion control software, command the platform to the position  $X = 0$  and  $Y = 0$ .

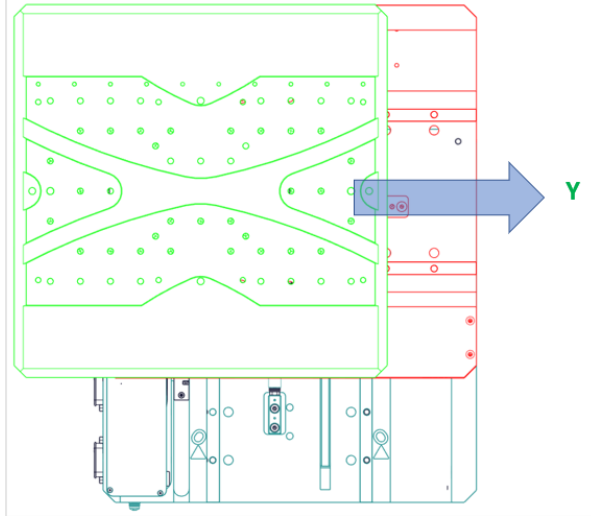
#### Manual Procedure for Models L-7xx

Alternatively, move the platform manually (using a hex key for spindle access) to the reference positions for X and Y that are shown in the next section (corresponding the positioning for V-7xx). For instructions, refer to the section "Attaching the L-741 / V-741 to a Surface" (p. 17)

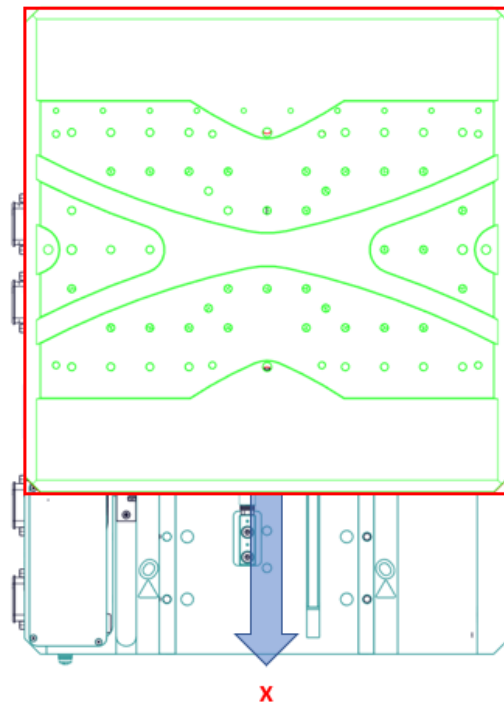


**Manual motion of the platform for models V-7xx**

1. Move the platform / Y-component in Y-direction so that it covers the X-component completely.



2. Move the X-component in X-direction so that it covers the base body completely.

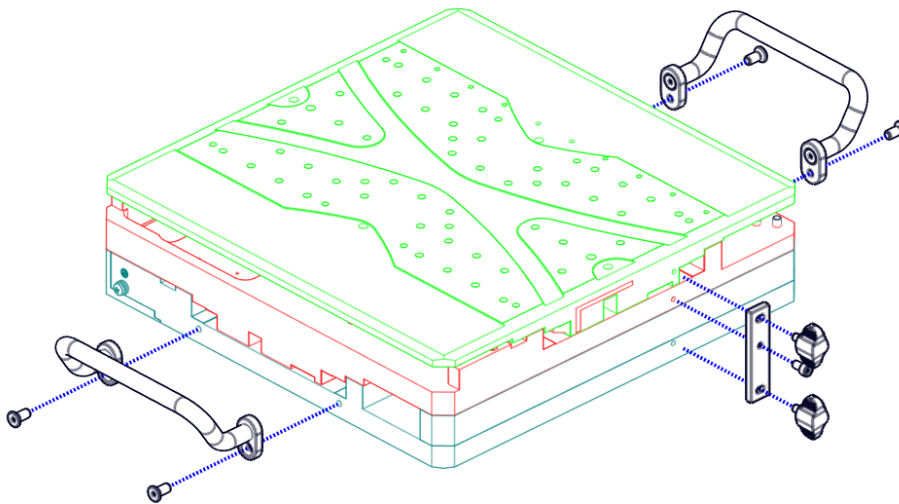


### 7.4.3 Securing the positioner mechanically

#### Required tools and material

- 2 handles, X-lock, Wing screws and hex screws provided with the positioner (previously removed according to section “Attaching the L-741 / V-741 to a Surface” (p. 17)
- Hex key AF 3 mm or compliant tool

#### Mount the two handles and the X-lock



1. Place one of the two handles on the base body so that the corresponding mounting holes in the handle and in the base body overlap.
2. In the mounting holes for the X-lock, insert the screws and tighten them with a torque of **max. 3 Nm**.
3. Repeat step 1 and step 2 correspondingly for the remaining handle.
4. Place the Y-lock on the base body, X and Y components so that the intended mounting holes overlap.
5. In the outer mounting holes for the Y-lock, insert the wing screws and tighten them with a torque of max. **1.5 Nm**.
6. In the middle mounting hole for the Y-lock, insert the hex-socket screw and it with a torque of max. **1.5 Nm**.
7. Check the firm mechanical connection of the locks.

#### 7.4.4 Packing

Pack the device according to the delivery state.

##### **INFORMATION**

- Store the device in a dry and normal temperature environment, if possible, in the original packaging.

#### 7.4.5 Returning the Device

1. Contact our customer service department before returning the product (service@pi.de).
2. if not already done: Remove the device completely from the installation site. When loosening the mounting screws, proceed in reverse order as described in section "Fastening the L 731 / V 731 to a base" (page 18). Disconnect the electrical connections to the controller and, if necessary, to the protective earth (PE).
3. Ensure that the positioner is properly secured (see section "Securing the positioner mechanically", p. 34)
4. If possible, use the original packaging.





## 8 Troubleshooting

### 8.1 Possible Causes and Remedies

Problem	Possible causes	Solution
Reduced positioning accuracy	Warped base body	➤ Mount the L-741 / V-741 onto an even surface. The recommended flatness of the surface is $\leq 5 \mu\text{m}$ .
	Increased wear due to small motion over a long period of time	➤ Perform a maintenance run over the entire travel range.
Impairment of the function after system modification	<ul style="list-style-type: none"> <li>▪ Controller was replaced.</li> <li>▪ L-741 / V-741 was replaced by another model.</li> </ul>	➤ Load the parameters from the stage database that correspond to the combination of controller and the L-741 / V-741 model.
Mechanical system does not move; no operating noise can be heard.	Controller not correctly connected or defective.	<ul style="list-style-type: none"> <li>➤ Check all connecting cables.</li> <li>➤ Check the controller.</li> <li>➤ If necessary, check the power adapter of the stage.</li> </ul>
For L-741.131100 / L-741.131111 / L-741.131112 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.	<p>The motor skips steps. The information on the current position is lost without the controller detecting the state.</p> <ul style="list-style-type: none"> <li>➤ Use a stepper motor in the application to determine the maximum velocity for a stage.</li> <li>➤ Start a new reference move.</li> </ul>

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. 39).

## 8.2 Moving the Platform Manually

### INFORMATION

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

V-741: The platform can be easily moved by hand without aid.

L-741: The platform can be moved with more force by hand without aid. Alternatively, the drive screw can be used to move the platform without damaging the drive.

This can be necessary when the platform is stuck at the beginning or the end of the travel range (has reached the hard stop).

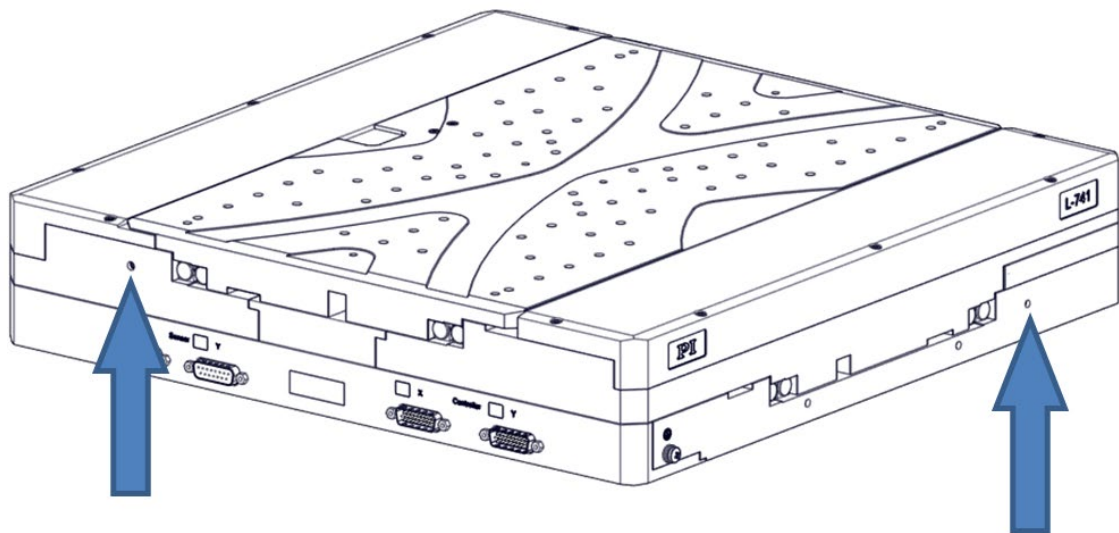


Figure 9: Position of the spindle accesses for the Y direction (left arrow) and X direction (right arrow)

### Requirements

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

### Tools and accessories

Hex key AF 3

### Moving the platform manually

- Insert the hex key into the corresponding spindle access.
- Turn the hex key as far as necessary:
  - Clockwise rotation: Platform moves in a positive direction
  - 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 ([info@pi.de](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 (p. 3) for download.



## 10 Technical Data

### 10.1 Specifications

The specified data applies to a temperature of 20 °C ( $\pm 3$  °C) and **horizontal** installation.

#### 10.1.1 Data Table

##### L-741.1311xx

Motion	L-741.131100 / L-741.131111 / L-741.131112	Unit	Tolerance
Active axes	X, Y		
Travel range	305 × 305	mm	
Angular error xry (pitch)	$\pm 60$	$\mu\text{rad}$	Typ.
Angular error xrz (yaw)	$\pm 40$	$\mu\text{rad}$	Typ.
Angular error yrx (pitch)	$\pm 60$	$\mu\text{rad}$	Typ.
Angular error yrz (yaw)	$\pm 40$	$\mu\text{rad}$	Typ.
Straightness / flatness	$\pm 4$	$\mu\text{m}$	Typ.
Orthogonality	$\pm 96.963$	$\mu\text{rad}$	Typ.
Velocity	45	mm/s	Max.

Positioning	L-741.131100	L-741.131111	L-741.131112	Unit	Tolerance
Integrated sensor	–	Incremental linear encoder	Incremental linear encoder		
Sensor signal	–	Sin/cos, 1 V peak-peak, 20 $\mu\text{m}$ signal period	A/B quadrature, TTL		
Design resolution	10.0	0.001	0.01	$\mu\text{m}$	
Sensor resolution rotary encoder	–	–	–	Cts./rev.	
Sensor resolution linear encoder	–	0.001	0.01	$\mu\text{m}$	
Minimum incremental motion	1	0.05	0.05	$\mu\text{m}$	Typ.
Unidirectional repeatability	1	0.05	0.05	$\mu\text{m}$	Typ.
Bidirectional repeatability	$\pm 2.5$	$\pm 0.5$	$\pm 0.5$	$\mu\text{m}$	Typ.

Positioning	L-741.131100	L-741.131111	L-741.131112	Unit	Tolerance
Reference switch repeatability	<1	<1	<1	μm	Typ.
Reference and limit switches	Forked photoelectric sensor, N/C contact, 5V, NPN				

Mechanical properties	L-741.131xxx	Unit	Tolerance
Drive screw type	Ball screw		
Drive screw pitch	2	mm	
Guide type	Crossed roller guide with anti-creep system		
Push/pull force $F_x$ , $F_y$ power on	100	N	Max.
Load capacity	200	N	Max.
Permissible torque $M_x$ in $\theta_x$	125	Nm	Max.
Permissible torque $M_y$ in $\theta_y$	125	Nm	Max.
Permissible torque $M_z$ in $\theta_z$	125	Nm	Max.

Drive properties	L-741.131xxx	Unit	Tolerance
Motor type	Stepper motor, 2-phase		
Operating voltage, nominal	24	V	Nom.
Operating voltage, max.	48	V	Max.
Step resolution	200	Full steps/re v.	

Miscellaneous	L-741.131100 / L-741.131112	L-741.131111	Unit	Tolerance
Operating temperature range	5 to 40	5 to 40	°C	
Material	Aluminum, black anodized	Aluminum, black anodized		
Mass	27.5	27.5	kg	±5 %
Moved mass in X, unloaded	19.9	19.9	kg	±5 %
Moved mass in Y, unloaded	6.1	6.1	kg	±5 %

Miscellaneous	L-741.131100 / L-741.131112	L-741.131111	Unit	Tolerance
Connector	L-741.131100. 2 × HD D-sub 26 (m) (motor) L-741.131112. 2 × HD D-sub 26 (m) (motor/sensor)	2 × HD D-sub 26 (m) (motor) 2 × D-sub 15 (f) (sensor)		
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	SMC Hydra (double axis) ACS modular controller		

**L-741.1331xx**

Motion	L-741.133111 / L-741.133112 / L-741.133132	Unit	Tolerance
Active axes	X, Y		
Travel range	305 × 305	mm	
Angular error xry (pitch)	±60	μrad	Typ.
Angular error xrz (yaw)	±40	μrad	Typ.
Angular error yrx (pitch)	±60	μrad	Typ.
Angular error yrz (yaw)	±40	μrad	Typ.
Straightness / flatness	±4	μm	Typ.
Orthogonality	±96.963	μrad	Typ.
Velocity	L-741.133111 / L-741.133112: 50 L-741.133132: 90	mm/s	Max.

Positioning	L-741.133111	L-741.133112	L-741.133132	Unit	Tolerance
Integrated sensor	Incremental linear encoder	Incremental linear encoder	Incremental rotary encoder		
Sensor signal	Sin/cos, 1 V peak- peak, 20 μm signal period	A/B quadrature, TTL	A/B quadrature, TTL		
Design resolution	0.001	0.01	0.1	μm	
Sensor resolution rotary encoder	—	—	20000	Cts./rev.	
Minimum incremental motion	0.1	0.5	0.8	μm	Typ.
Unidirectional repeatability	0.1	0.5	0.8	μm	Typ.
Bidirectional repeatability	±0.5	±0.5	±2.5	μm	Typ.

Positioning	L-741.133111	L-741.133112	L-741.133132	Unit	Tolerance
Reference switch repeatability	<1	<1	<1	μm	Typ.
Reference and limit switches	Forked photoelectric sensor, N/C contact, 5V, NPN				

Mechanical properties	L-741.133xxx	Unit	Tolerance
Drive screw type	Ball screw		
Drive screw pitch	2	mm	
Guide type	Crossed roller guide with anti-creep system		
Push/pull force $F_x$ , $F_y$ power on	100	N	Max.
Load capacity	200	N	Max.
Permissible torque $M_x$ in $\theta_x$	125	Nm	Max.
Permissible torque $M_y$ in $\theta_y$	125	Nm	Max.
Permissible torque $M_z$ in $\theta_z$	125	Nm	Max.

Drive properties	L-741.133xxx	Unit	Tolerance
Motor type	DC motor		
Operating voltage, nominal	24	V	Nom.
Operating voltage, max.	48	V	Max.

Miscellaneous	L-741.133111	L-741.133112 / L-741.133132	Unit	Tolerance
Operating temperature range	5 to 40	5 to 40	°C	
Material	Aluminum, black anodized	Aluminum, black anodized		
Mass	28	28	kg	±5 %
Moved mass in X, unloaded	20.2	20.2	kg	±5 %
Moved mass in Y, unloaded	6.1	6.1	kg	±5 %
Connector	2 × HD D-sub 26 (m) (motor) 2 × D-sub 15 (f) (sensor)	2 × HD D-sub 26 (m) (motor/sensor)		



Miscellaneous	L-741.133111	L-741.133112 / L-741.133132	Unit	Tolerance
Recommended controllers/drivers	SMC Hydra (double axis) C-891 (single axis) C-885 with C-891.11C885 (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) ACS modular controller		

**V 741**

<b>Motion and positioning</b>	<b>V-741.136111</b>	<b>Unit</b>	<b>Tolerance</b>
Active axes	X, Y		
Travel range	305 × 305	mm	
Integrated sensor	Incremental linear encoder		
Design resolution	0.001	μm	
Sensor signal	Sin/cos, 1 V peak-peak, 20 μm signal period		
Minimum incremental motion	0.02	μm	Typ.
Unidirectional repeatability	0.1	μm	Typ.
Bidirectional repeatability	±0.25	μm	Typ.
Angular error xry (pitch)	±70	μrad	Typ.
Angular error xrz (yaw)	±50	μrad	Typ.
Angular error yrx (pitch)	±60	μrad	Typ.
Angular error yrz (yaw)	±50	μrad	Typ.
Orthogonality	±96.963	μrad	Typ.
Straightness / flatness	±3	μm	Typ.
Velocity	200	mm/s	Max.
Acceleration in X, without load	3	m/s <sup>2</sup>	Max.
Acceleration in Y, without load	9	m/s <sup>2</sup>	Max.
Reference and limit switches	Forked photoelectric sensor, N/C contact, 5V, NPN		


<b>Mechanical properties</b>	<b>V-741.136111</b>	<b>Unit</b>	<b>Tolerance</b>
Load capacity	50	N	Max.
Permissible torque in $\theta_x, \theta_y$	125	Nm	Max.
Permissible torque in $\theta_z$	125	Nm	Max.
Guide	Crossed roller guide with anti-creep system		

Drive properties	V-741.136111	Unit	Tolerance
Motor type	Ironless 3-phase linear motor		
Operating voltage, nominal	48	V	Nom.
Operating voltage, max.	48	V	Max.
Peak force	80	N	Max.
Nominal force	29	N	Typ.
Peak current, RMS	5	A	Typ.
Nominal current, RMS	1.5	A	Typ.
Force constant, RMS	19.9	N/A	Typ.
Motor constant	4.89	N/√W	Typ.
Electrical time constant	0.4	ms	
Resistance phase-phase	11	Ω	Typ.
Inductance phase-phase	3.6	mH	Typ.
Back EMF phase-phase	16	Vs/m	Max.
Pole pitch N-N	30	mm	

Miscellaneous	V-741.136111	Unit	Tolerance
Operating temperature range	5 to 40	°C	
Material	Aluminum, black anodized		
Moved mass in X	25.5	kg	±5 %
Moved mass in Y	9.2	kg	±5 %
Overall mass	33	kg	±5 %
MTBF	20000	h	
Connector	2 × HD D-sub 26 (m) (motor) 2 × D-sub 15 (f) (sensor)		
Recommended controller	SMC Hydra (double axis) C-891 (single axis) C-885 with C-891.11C885 (up to 20 axes) ACS modular controller		

### 10.1.2 Maximum Ratings

The L-741 / V-741 stages are designed for the following operating data:

Maximum operating voltage*

48 V

\* **Not** suitable for continuous operation except the V-741.

### 10.1.3 Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the L-741 / V-741:

Area of application	For indoor use only
Maximum altitude	2000 m
Relative humidity	20% ... 90%, not condensing
Storage temperature	10 °C to 50 °C
Transport temperature	10 °C to 50 °C
Supply fluctuations	Max. $\pm 10$ % of the nominal voltage
Degree of pollution	2
Degree of protection according to IEC 60529	IP00

### 10.1.4 Limit Switch Specifications

Type	Optical sensor
Supply voltage	+5 V/GND, supplied via the motor connector
Signal output	Open collector
Signal logic	<p>The signal level changes when passing the limit switch. The signal logic is active high. That means:</p> <ul style="list-style-type: none"> <li>Normal motor operation: low (0 V)</li> <li>Limit switch reached: high (+5 V)</li> </ul>

**10.1.5 Reference Switch Specifications**

Type	Optical 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 switch: The signal level changes from 0 to +5 V when the reference switch is passed.
Hysteresis	0.2 to 0.4 mm (when arriving from the positive or negative direction)

## 10.2 Dimensions

Dimensions in mm. Note that the decimal places are separated by a comma in the drawings.

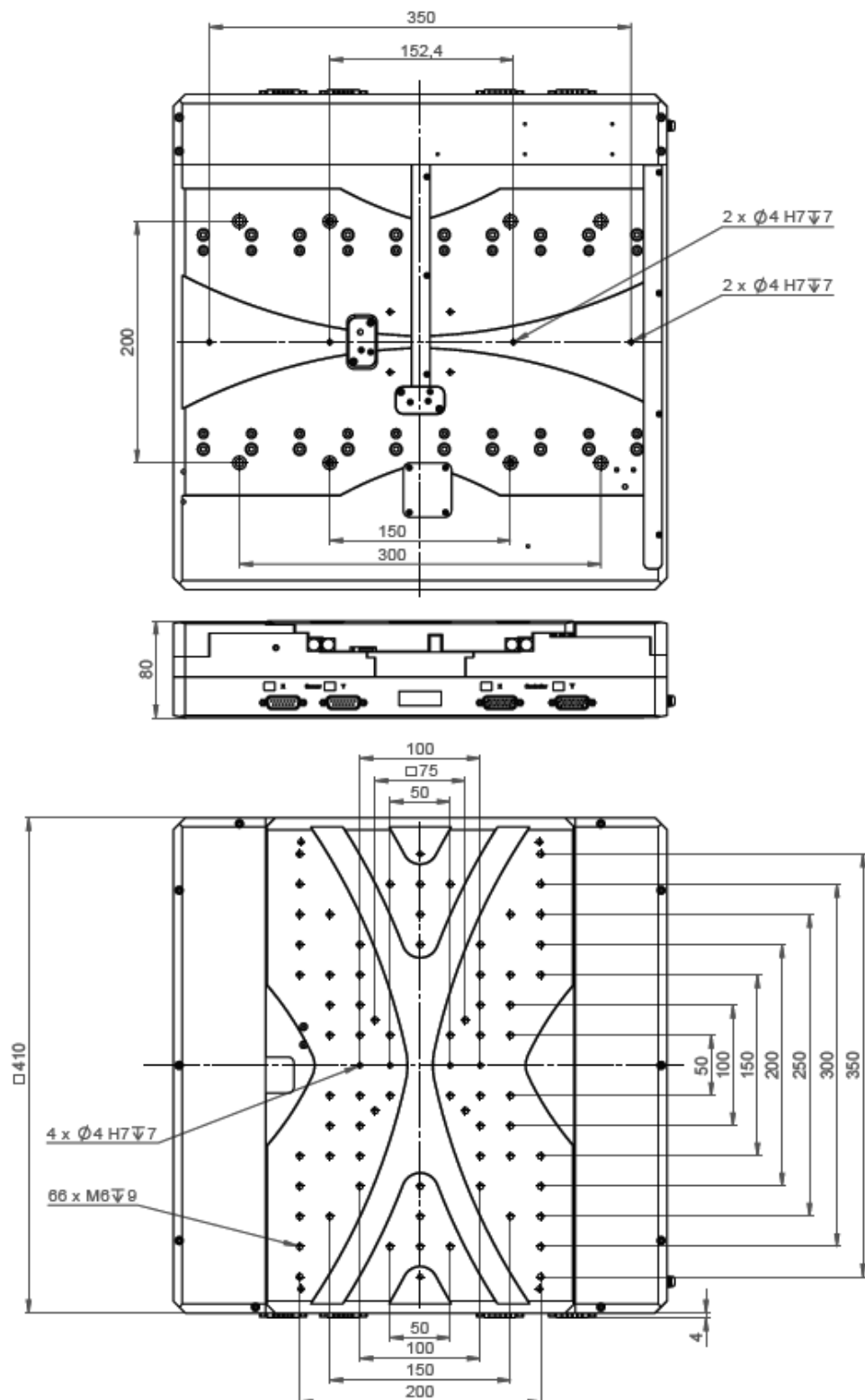


Figure 10: Dimensions; Platform in reference position

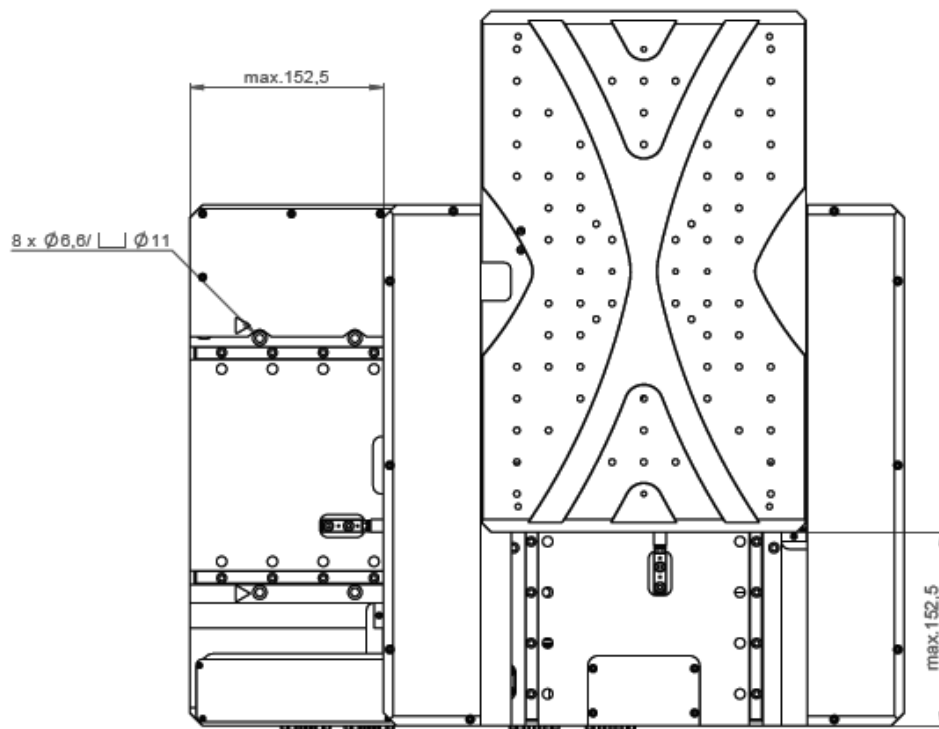


Figure 11: Dimensions; Platform moved out

## 10.3 Pin Assignment

### 10.3.1 HD D-Sub 26 (m)

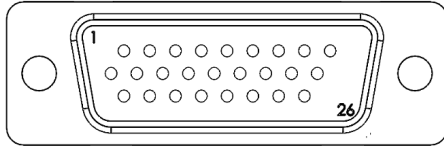


Figure 12: HD D-Sub 26 panel plug

#### L-741.1331xx

Pin	L-741.133132	L-741.133111	L-741.133112	Direction
1	Motor +	Motor +	Motor +	Input
2	Motor +	Motor +	Motor +	Input
3	Motor -	Motor -	Motor -	Input
4	Motor -	Motor -	Motor -	Input
5	-	-	-	-
6	-	-	-	-
7	-	-	-	-
8	-	-	-	-
9	-	-	-	-
10	REF	REF	REF	Output
11	Limit neg.	Limit neg.	Limit neg.	Output
12	Limit pos.	Limit pos.	Limit pos.	Output
13	-	-	-	-
14	-	-	-	-
15	-	-	-	-
16	-	-	-	-
17	ID I/O	ID I/O	ID I/O	Bidirectional
18	Limit Power & Encoder (+5 V)	Limit Power (+5 V)	Limit Power & Encoder (+5 V)	Input
19	Encoder A+	-	Encoder A+	Output
20	Encoder A-	-	Encoder A-	Output
21	Encoder B+	-	Encoder B+	Output
22	Encoder B-	-	Encoder B-	Output
23	Encoder C+	-	Encoder C+	Output
24	Encoder C-	-	Encoder C-	Output
25	GND	GND	GND	-
26	-	-	-	-



**L-741.1311xx**

Pin	L-741.131100 / L-741.131111	L-741.131112	Direction
1	Motor A+	Motor A+	Input
2	Motor A+	Motor A+	Input
3	Motor A-	Motor A-	Input
4	Motor A-	Motor A-	Input
5	Motor B+	Motor B+	Input
6	Motor B+	Motor B+	Input
7	Motor B-	Motor B-	Input
8	Motor B-	Motor B-	Input
9	-	-	-
10	REF	REF	Output
11	Limit neg.	Limit neg.	Output
12	Limit pos.	Limit pos.	Output
13	-	-	-
14	-	-	-
15	-	-	-
16	-	-	-
17	ID I/O	ID I/O	Bidirectional
18	Limit Power (+5 V)	Limit Power & Encoder (+5 V)	Output
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	-	-	-

**V-741.136111**

Pin	V-741.136111	Direction
1	Motor U / Phase 1	Input
2	Motor U / Phase 1	Input
3	Motor V / Phase 2	Input
4	Motor V / Phase 2	Input
5	Motor W Phase 3	Input
6	Motor W / Phase 3	Input
7	-	-
8	-	-
9	-	-
10	REF	Output
11	Limit neg.	Output
12	Limit pos.	Output
13	-	-
14	-	-
15	-	-
16	-	-
17	ID I/O	Bidirectional
18	Limit Power (+5 V)	Input
19	-	-
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	GND	-
26	-	

### 10.3.2 D-Sub 15 (m)

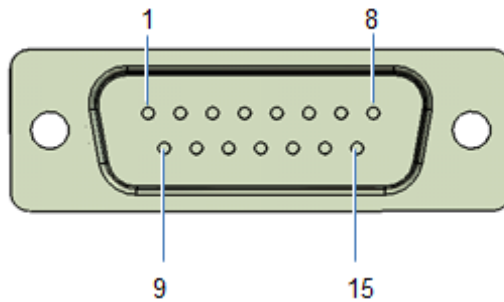


Figure 13: D-Sub 15 panel plug

Pin	L-741.133111	L-741.131111	V-741.136111	Direction
1	Encoder Power 5V DC	Encoder Power 5V DC	Encoder Power 5V DC	Input
2	Encoder GND	Encoder GND	AGND	-
3	sin +	sin +	sin +	Output
4	sin -	sin -	sin -	Output
5	-	-	-	-
6	cos +	cos +	cos +	Output
7	cos -	cos -	cos -	Output
8	Limit neg.	Limit neg.	Limit neg.	Output
9	-	-	NTC	Output
10	REF +	REF +	REF +	Output
11	-	-	PTC	Output
12	REF -	REF -	REF -	Output
13	-	-	-	Output
14	GND	GND	GND	-
15	Limit pos.	Limit pos.	Limit pos.	Output

## 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-741 / V-741 in accordance with the following European directives:

- EMC Directive
- RoHS Directive

The standards applied for certifying the conformity are listed below.

- EMC: EN 61326-1
- Safety: EN 61010-1
- RoHS: EN 50581 or EN IEC 63000