Order no. 6262-9-				
DC-B-040	1			
2Phase-045	2			
52 mm (2")		1		
102 mm (4")		2		
155 mm (6")		3		
205 mm (8")		4		
Without LS-010			0	
LS-010, length measuring system (steel)			1	
without brake				0
with brake				1

HPS-170 High Precision Linear Stage

Order no. 6262-9-

User Manual

Version: **00.001** Date: 21.04.2017

CONTENTS

1. ABOUT THIS DOCUMENT

All specifications in this user manual refer only to the standard products that are included in the PI miCos catalog. Any special features that are different, in particular special requests from customers, are supplied with the user manual as additional documentation in the form of "Technical Notes".

1.1 Objective and Target Group of this User Manual

- This user manual contains all information required for the intended use of the HPS-170.
- Basic knowledge on servo systems, motion control concepts and applicable safety measures is assumed.
- The latest version of the user manual and answers to any questions can be obtained from our customer service department (see chapter 9)

1.2 Symbols and Typographic Conventions

The symbols and typographic conventions used in this manual have the following meanings:

NOTICE

Dangerous situation!
If not avoided, the dangerous situation will result in death, injuries or damage to the equipment
-> Actions to take to avoid the situation

NOTICE

Information for easier handling, tricks, tips, etc.

1.3 Other Applicable Documents

All products and programs from PI miCos mentioned in this documentation are described in separate user manuals.
The latest versions of the user manuals can be obtained from our customer service department (see chapter 9).

2. SAFETY

2.1 Intended Use

The HPS-170 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 HPS-170 is intended for positioning, adjusting and shifting of loads on one axis at various velocities. The HPS-170 can be mounted horizontally or vertically.

The intended use of the HPS-170 is only possible in conjunction with suitable electronics. The following options are available:

1. Drive electronics and controller with suitable software
2. Combination device with suitable software

- The electronics are not included in the scope of delivery of the HPS-170.
- The electronics must provide the required voltages. To ensure proper performance of the servo-control system, the electronics must be able to read out and process the signals from reference and limit switches, and from the incremental position encoder.

2.2 General Safety Instructions

The HPS-170 is built according to state-of-the-art technology and recognized safety standards. Improper use of the HPS-170 may result in personal injury and/or damage to the HPS-170.
Only use the HPS-170 for its intended purpose, and only use it if it is in good working order.
Read the user manual.
Immediately eliminate any faults and malfunctions that are likely to affect safety.
The operator is responsible for the correct installation and operation of the HPS-170.

2.2.1 Organizational Measures

User Manual

- Always keep this user manual available when using the HPS-170. If the user manual is lost or damaged, contact our customer service department (see chapter 9).
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- Only use the device on the basis of the complete user manual. If your user manual is incomplete and is therefore missing important information, serious or fatal injury as well as damage to the equipment can result.
- Only install and operate the HPS-170 after you have read and understood this user manual.

Personnel Qualification

The HPS-170 may only be started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

2.2.2 Measures during Installation

The HPS-170 may be damaged by excessively long screws and wrongly mounted parts.

- When mounting the HPS-170, make sure that the mounting screws do not interfere with the stage motion. The screw heads must not protrude from the countersunk holes.
- Observe the depth of the mounting holes in the moving platform.
- Only use screws of the correct length for the respective mounting holes.
- Only mount the HPS-170 and the loads on the mounting fixtures (holes) intended for this purpose.
- The HPS-170 heats up during operation. High temperatures can influence your application.
- Install the HPS-170 so that your application is not affected by the dissipating heat.
- Cable extensions can affect the performance of the HPS-170 and damage the electronics.

- Only use genuine PI miCos parts to connect the HPS-170 to the electronic equipment.
- Do not use cable extensions. If you need longer cables, use cable extensions from PI miCos.
- Avoid short circuiting the lines for motor voltages since this can damage the electronics.

2.2.3 Measures during Start-Up

Do not put your HPS-170 into operation until it is fully mounted and connected.

Your system can be damaged by uncontrolled oscillation of the HPS-170. Noise generated during operation of the HPS-170 is a typical sign of oscillation.

- Immediately switch off the servo-control system of the affected stage axes.
- Check the settings of the servo-control parameters.

Moving parts attached to devices with motorized stages can accelerate rapidly and generate high forces which can cause injury or damage to equipment.

Unintentional motion of the stage is possible when it is connected to the controller for the first time. Defective software or incorrect operation of the software can also result in unintentional motions.

- Do not place any objects in areas where they can be caught by moving parts.

Collision of a part in motion at the end of the travel range and high accelerations can cause damage to or wear on the mechanical system.

- Ensure that the automatic limit switch halt is supported by the controller, or that it is activated in the controller.
- Do not disable the evaluation of the limit switch signals by the controller.
- Check the function of the limit switches at about 10 % to 20 % of the maximum velocity.
- In the event of a malfunction of the limit switches, stop motion immediately.
- Ensure that the end of the travel range is approached at low velocity.

Set the control signal so that the moving part does not stop abruptly or try to continue motion at the end of the travel range.

- Determine the maximum velocity for your application.

2.2.4 Measures during Operation

- If noise occurs during operation of the HPS-170, check the settings of the servo-control parameters of your controller.

Highest dynamic force and holding force are reached at a control signal level of 100 % but the motor/drive can overheat in continuous operation.

Highest dynamic force and holding force are reached at a control signal level of 100 % but the motor/drive can overheat in continuous operation.

2.2.5 Measures during Maintenance

The HPS-170 is precision adjusted.

Do not loosen any sealed screws.

Dirt, oil, lubricants and condensation will render the motor/drive inoperable.

- Keep the motor of the HPS-170 free from lubricants.
- Keep the HPS-170 free of dirt and condensation.

3. UNPACKING

1. Unpack the HPS-170 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 miCos immediately.
4. Keep all packaging materials in case the product needs to be returned.

WARNING

Risk of suffocation for children. Keep the packaging foil away from children.
Dispose of packaging materials according to environmental regulations.

NOTICE

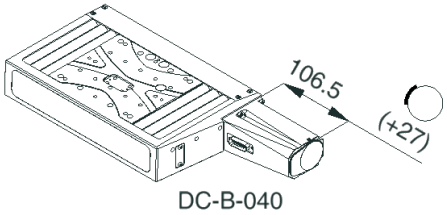
All specifications in this user manual refer only to the standard products that are included in the PI miCos catalog. Any special features that are different, in particular special requests from customers, are supplied with the user manual as additional documentation in the form of "Technical Notes".

4. PRODUCT DESCRIPTION

4.1 Features and Application Area

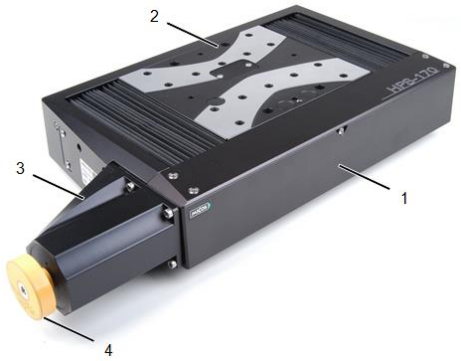
Our products are designed specifically for use in the laboratory.

4.2 Model Overview



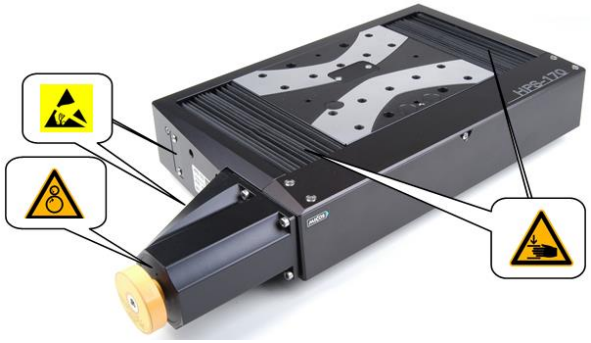
Order no.	6262-9-				
DC-B-040	1				
2Phase-045	2				
52 mm (2")		1			
102 mm (4")		2			
155 mm (6")		3			
205 mm (8")		4			
Without LS-010			0		
LS-010, length measuring system (steel)			1		
without brake				0	
with brake				1	

4.3 Product View



1 base
2 slider
3 motor
4 damper

4.4 Safety Instructions



WARNING

After removing the transport lock (if present), watch out for moving parts.

NOTICE

Protect the product against mechanical damage (knocking, shock, ...).
Never start up an axis if you suspect it to be damaged or broken.
Do not disconnect or connect connectors when voltage is present.

WARNING

Risk of catching by rotating parts such as couplers and ball screws

WARNING

Risk of squeezing or crushing by moving sliders at the places illustrated.

WARNING

It is recommended that all persons entrusted with working with this product and who therefore come into contact with areas marked by the ESD warning symbol, are given training and a comprehensive explanation of the ESD warning symbol with respect to the ESD precautions.

4.5 Scope of Delivery

1. Stage according to order.

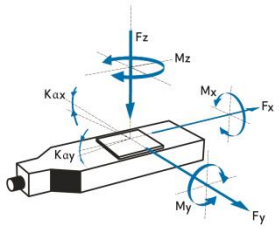
- Mounting accessories (screws & pins) in fast-sealing bag.

4.6 Optional Accessories

For optional accessories, please ask our customer service department (chapter 9) for information on possible use of adapter plates or additional Z-brackets.

4.7 Technical Features

4.7.1 Load Capacity Data



FACTS

Load characteristics	Fx(N)	Fy(N)	Fz(N)	Mx(Nm)	My(Nm)	Mz(Nm)	kax(µrad/Nm)	kay(µrad/Nm)
DC-B-040	100	150	350	400	300	300	8	12
2Phase-048	150	150	350	400	300	300	8	12

4.7.2 Motors

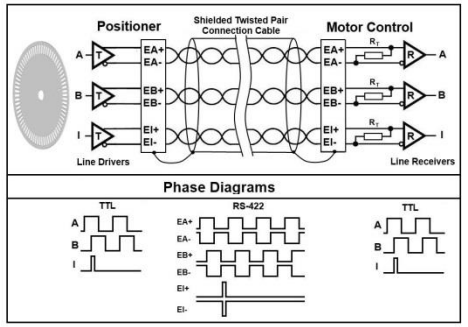
DC-B-040

Motor type		DC brush 3863-024 C
Nominal voltage	V	24
Max. continuous current	A	4
Electrical resistance	Ω	0.64
Electrical inductance	mH	0.180
Torque constant	mNm/A	39.8
Velocity constant	rpm/V	240
n/M slope curve	rpm/mNm	3.9
No load velocity	rpm	5800
Max. continuous velocity at nominal torque	rpm	5510
Inertia	kgm^2	12.0E-6
Continuous torque	mNm	129
Rotary encoder		**RE-015** RS422 2-channel + index
Encoder increments (quad counts)	n	20000

RE-015

Rotary optical encoder RS-422 quadrature

Encoder type		RMHF rotary optical encoder
Quadrature counts per revolution	n	20000
Signal output		RS-422
Channels		2 + index
Supply voltage	VDC	4.5..5.5
Current consumption, Typical (Vcc = 5 V DC)	mA	35
Frequency range	KHz	1000
Code disc inertia	kgm2	1E-7
Operating temperature	°C	-40..85



2Phase-045

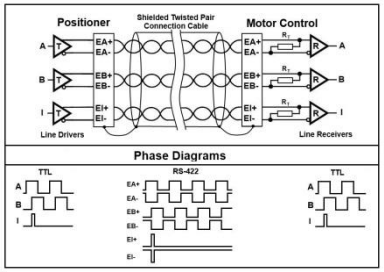
Motor type		PK-245-01B 2-phase bipolar half coil
Phase current	A	1.2
Step angle	°	1.8
Steps	n	200
Coil resistance	Ω	3.3
Coil inductance	mH	2.8
Holding torque	mNm	320
Inertia	kgm^2	6.8E-6
Weight	kg	0.35

4.7.3 Measuring System

LS-010

Linear optical encoder RS-422 quadrature

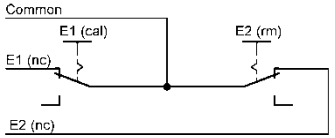
Encoder type		Linear incremental LIA-20
Quadrature counts per mm	n	20000
Resolution	nm	50
Grating period	µm	20
Grating material		Steel
Interpolator	n	Integrated 100 times
Signal output		RS-422 quadrature
Channels		2+1 index
Supply voltage	VDC	5 +/- 10%
Current consumption, Typical (Vcc = 5 V DC)	mA	<200
Frequency range, Counter capability	MHz	8
Operating temperature	°C	0..55
Linear expansion coefficient		Approx. 10.5 e-6
Absolute accuracy	µm	+/- 1
Index position		50 mm starting in the middle of travel
Connector		Sub-D (m)



4.7.4 Limit Switch

Mechanical limit switches – MLS –

Max. voltage (resistive load)	V	30
Max. current (resistive load)	A	1
Contact type		Normal closed
Max. switch voltage (resistive load)	VDC	3-24
Operations		>5x10^4
Operating temperature	°C	-40 to +85

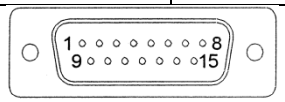


4.7.5 Connector

ST-060

DC motor, Sub-D (m), 15-pin, motor pin assignment with mechanical limit switches

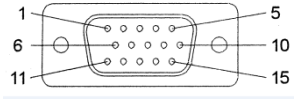
Sub-D (m) 15-pin	Function	
1	EA+	Encoder channel A+
2	EB+	Encoder channel B+
3	EC+	Encoder channel I+
4	EGND	Supply encoder GND
6	M+	DC brush motor +
7	LE2	Limit forward
8	LCOM	Limit common
9	EA-	Encoder channel A-
10	EB-	Encoder channel B-
11	EC-	Encoder channel I-
12	E5V	Encoder supply voltage
14	M-	DC brush motor -
15	LE1	Limit reverse



ST-010

2SM motor, Sub-HD (m), 15-pin, motor pin assignment with mechanical limit switches

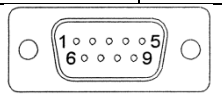
Sub-HD (m) 15-pin	Function	
1	MA+	Motor phase A+
2	MA-	Motor phase A-
3	nc	
4	nc	
5	MB+	Motor phase B+
6	MB-	Motor phase B-
7	nc	
8	nc	
9	nc	
10	nc	
11	nc	
12	nc	
13	LE2	Limit forward
14	LE1	Limit reverse
15	LCOM	Limit common



ST-001

Linear encoder, Sub-D (m), 9-pin, RS-422 pin assignment

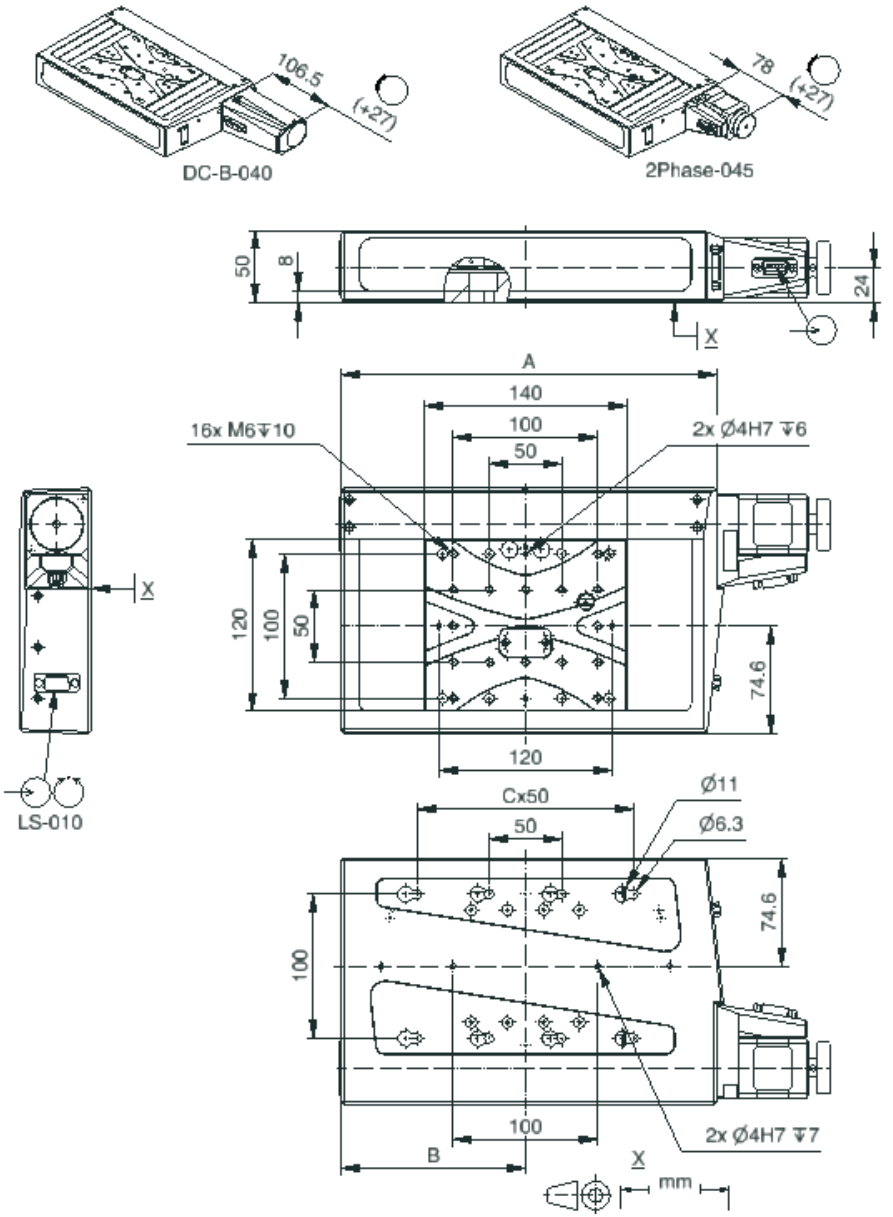
Sub-D (m) 9-pin	Function	
1	EA+	Encoder channel EA+
2	EB+	Encoder channel B+
3	EC+	Encoder channel I+
4	EGND	Supply encoder GND
5	E5V	Encoder supply
6	EA-	Encoder channel EA-
7	EB-	Encoder channel EB-
8	EC-	Encoder channel I-
9	nc	
Housing	Shield	Shield of encoder, read head



4.7.6 Technical Data

TECHNICAL DATA				
Travel range (mm)	52	102	155	205
Pitch angle (µrad)	±20	±25	±30	±35
Straightness / Evenness (µm)	±0.75	±1	±2	±3
Yaw angle (µrad)	±40	±40	±40	±40
Weight (kg)	5	5.5	6	6.5
Motor	DC-B-040	2Phase-048	Linear scale	
Pitch (mm)	2	2	LS-010	
Max. velocity (mm/sec)	90	35		
Typical resolution (µm)	0.2	0.1	0.05	
Calculated resolution (µm)	0.1 (RE)	10(FS)	0.05	
Bidirectional repeatability (µm)	±1	±1	±0.05	
Unidirectional repeatability (µm)	0.2	0.2	0.05	
Nominal current (A)	3.8	1.2		
Max. operating voltage (V)	24	<100		
Accuracy	on request			
Velocity range (mm/sec)	0.001..90			
Material	Aluminum, (black anodized)			

Travel (mm)	52	102	155	205
A	261	311	381	456
B	127.5	152.5	187.5	225
C	3	3	5	6



4.8 Ambient Conditions

For indoor use only.

- The HPS-170 was calibrated at an ambient temperature of 20 °C (+/- 3 °C).
- The permissible operating temperature is between 20 °C and 40 °C.
- The permissible relative humidity is between 20% and 80%.
- Always keep the HPS-170 free of dirt, dust and corrosive gases.

5. INSTALLATION

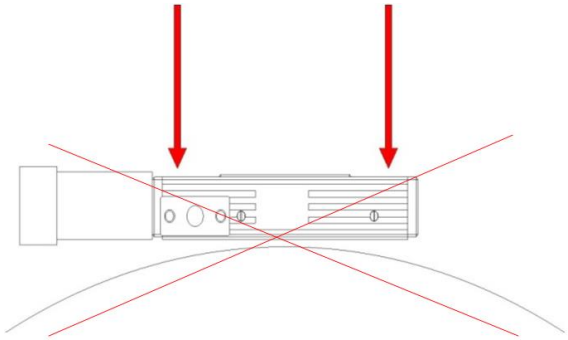
5.1 General Notes on Installation

Requirements

The axis must be screwed onto a surface with an evenness better than 5 µm.

It is necessary to make sure that no dust, dirt or other foreign bodies are between the surface and the axis, otherwise the properties of the axis can be impaired by mechanical tension.

To guarantee the prescribed specifications (see Internet www.pimicos.com), the **evenness of the mounting surface must be better than 5 µm**. (Reference surface of PI miCos measuring granite is 3 µm).



5.2 Mounting the Stage

Requirements

You have read and understood the general notes on installation (see chapter 5.1).

Mounting material

Screws, pins, and auxiliary material or tools supplied (see chapter 4.5.0 "Scope of Delivery").

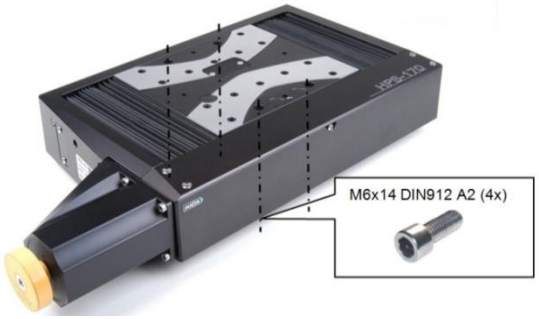
- DIN 912 screws and DIN 6325 dowel pins, m6 tolerance field

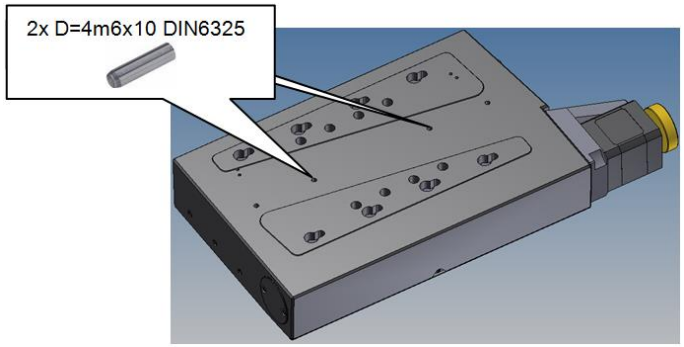
Tightening torques of the mounting screws to be used should not have values higher than the following:

- M3 DIN 912 1.5 Nm
- M4 DIN 912 2.0 Nm
- M5 DIN 912 2.5 Nm
- M6 DIN 912 3.0 Nm

Mounting the HPS-170

1. Displace the moving platform of the HPS-170 to the center position by hand until all of the countersunk holes in the base body required for mounting are accessible (see following illustration).
2. Mount the stage with the screws supplied.
3. Make sure that the screw heads do not protrude from the countersunk holes.





5.3 Affixing the Load

Requirements

You have read and understood the general notes on installation (see chapter 5.1).

Mounting material

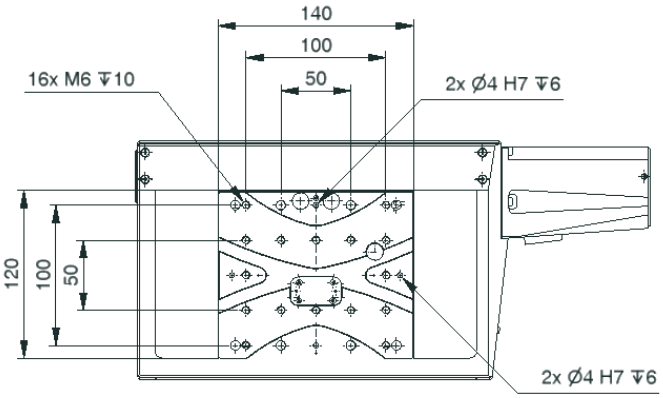
- DIN 912 screws and DIN 6325 dowel pins, m6 tolerance field

Tightening torques of the mounting screws to be used should not have values higher than the following:

- M3 DIN 912 1.5 Nm
- M4 DIN 912 2.0 Nm
- M5 DIN 912 2.5 Nm
- M6 DIN 912 3.0 Nm

Mounting the Additional Part

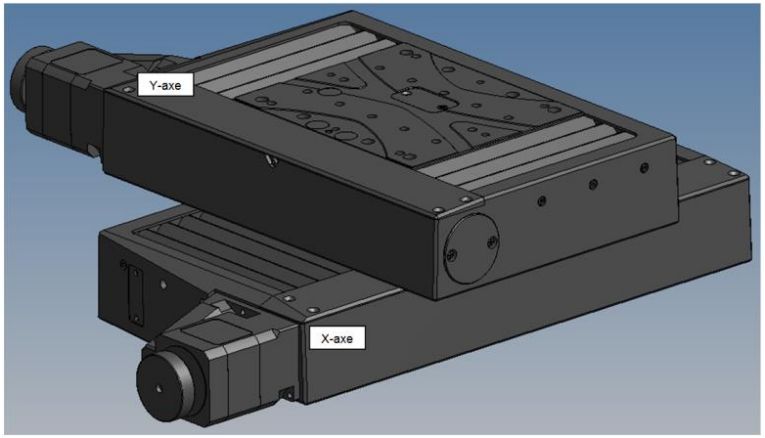
- Select the mounting position so that the existing fixing holes in the slider of the HPS-170 can be used for the additional part to be affixed.
- Mount the additional part with the corresponding screws.

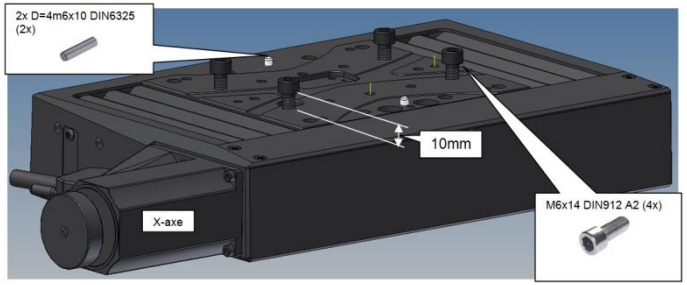


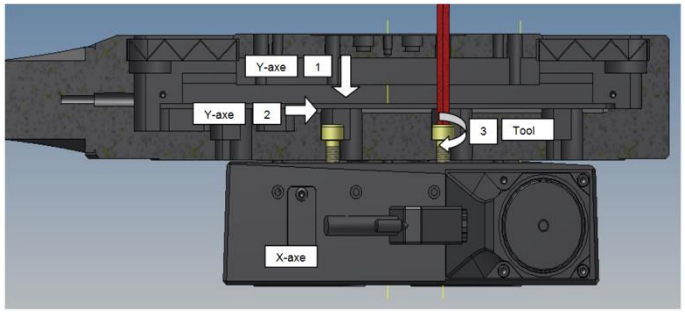
- Select the mounting position so that the existing fixing holes in the slider of the HPS-170 can be used for the additional part to be affixed.
- Mount the additional part with the corresponding screws.

5.4 Setting up an XY System

Two HPS-170 can be stacked to form an XY system as follows:







Requirements

You have read and understood the general notes on installation (see chapter 5.1).

Tools and Accessories for Combining two HPS-170

- Use the mounting material supplied (for example, pins, screws and washers) with the HPS-170 to carry out XY mounting.
- The mounting procedure is described in chapter 5.2.
- Special adapter plates are not required for the standard axes.
- The mounting screws must protrude out by 10 mm.
- To prevent too much negative influence on the travel behavior of the Y axis, the shortest possible travel range should be selected. In extreme Y-axis positions, an adapter plate is used to allow sufficient space for stiffening.

6. START-UP

6.1 General Notes on Start-Up

This stage must be started up with a suitable cable and the associated controllers.

7. MAINTENANCE

Depending on the operating conditions and the period of use of the HPS-170, the following maintenance measures are required:

Maintenance Run

The maintenance run is performed to redistribute the existing lubricant on the guidings of the stage.

- To evenly distribute the existing lubricant on the stage guidings, perform a maintenance run across the entire travel range after 500 hours of operation, or after 1 year at the latest.
- If the stage is to be operated continuously in an industrial environment over a small travel (less than 20 percent of the entire travel range), perform a maintenance run across the entire travel range every 5000 motion cycles.

Lubrication

Under laboratory conditions, the guidings of the stage need to be lubricated in exceptional cases only. For continuous industrial use, the lubrication intervals must be defined individually.

- Do not lubricate the guidings of the HPS-170 without consulting our customer service department (see chapter 9).

- To lubricate the guidings, follow the instructions specified in the maintenance manual, which you can obtain from our customer service department.

8. TROUBLESHOOTING

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 (see chapter 9).

9. CUSTOMER SERVICE

For inquiries and orders, contact your PI miCos sales engineer or send us and email (info@pimicos.com).
If you have questions concerning your system, have the following information ready:

1. Product codes and serial numbers of all products in the system
2. Current firmware of the controller (if present)
3. Software version of the driver or the user software (if present)
4. User operating system (if present)

10. OLD EQUIPMENT DISPOSAL

In accordance with EU directive 2002/96/EC (WEEE), as of 13 August 2005, electrical and electronic equipment may not be disposed of in the member states of the EU 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
http://www.pimicos.com

11. EC DECLARATION OF CONFORMITY

An EC Declaration of Conformity has been issued for the HPS-170 in accordance with the following European directives:

2014/30/EU, EMC Directive
2011/65/EU, RoHS Directive

The applied standards certifying the conformity are listed below.

EMV: EN 61326-1:2013
Safety: EN 61010-1:2010
DIN EN ISO 12100:2010
RoHS: EN 50581:2012