

User Manual

V-408.132020 PIMAG® LINEAR STAGE

Contents

1	Legal Information.....	4
2	Introduction.....	5
2.1	About this Document.....	5
2.1.1	Objective and Target Group.....	5
2.1.2	Explanation of Symbols.....	5
2.1.3	Figures.....	6
2.1.4	Other Applicable Documents.....	6
2.1.5	Downloading Manuals.....	6
2.2	European Declarations of Conformity.....	7
2.3	Customer Service Department.....	7
2.4	Old Equipment Disposal.....	7
3	Safety.....	9
3.1	Intended Use.....	9
3.2	General Safety Instructions.....	9
3.3	Organizational Measures.....	10
3.3.1	User Manual.....	10
3.3.2	General Personnel Qualification.....	10
4	Product Description.....	11
4.1	Product Labeling.....	11
4.1.1	Type Plate.....	11
4.2	Product View.....	12
4.2.1	Base Body.....	12
4.2.2	Drive.....	12
4.2.3	Drive Connector.....	13
4.2.4	Sensor Connector.....	13
4.3	Scope of Delivery.....	13
4.4	Optional Accessories.....	13
5	Unpacking.....	14
6	Installation.....	15
6.1	Mounting the V-408.132020.....	15
6.1.1	Mounting the V-408.132020 from Above.....	16
6.1.2	Mounting the V-408.132020 from Below.....	18
6.1.3	Mounting the V-408.132020 onto an Optical Table.....	19
6.2	Connecting the V-408.132020 to the Protective Earth Conductor	19
6.3	Building a Multi-Axis System.....	21
6.3.1	Building an XY Multi-Axis System.....	21
6.4	Mounting the Load.....	24
6.5	Connecting the V-408.132020.....	26
7	Startup and Operation.....	27

7.1	Determining the Operating Parameters.....	27
7.1.1	Calculating the Nominal Current According to the Ambient Temperature.....	27
7.2	Starting and Operating the V-408.132020.....	27
8	Maintenance.....	31
8.1	Maintenance Run.....	31
8.2	Cleaning.....	31
8.3	Moving the Motion Platform by Hand.....	32
9	Troubleshooting.....	33
10	Transportation.....	35
10.1	Attaching the Transport Safeguard.....	35
10.2	Packing the V-408.132020.....	35
11	Technical Data.....	36
11.1	Specifications.....	36
11.1.1	V-408.132020.....	36
11.1.2	Reference Switch Specifications.....	38
11.1.3	Limit Switch Specifications.....	38
11.2	Maximum Ratings.....	39
11.3	Ambient Conditions and Classifications.....	39
11.4	V-408.132020 Dimensions.....	41
11.4.1	V-500.AP1 and V-408.AP1 Dimensions.....	42
12	Appendix.....	44
12.1	Pin Assignment.....	44
12.1.1	Drive Connector.....	44
12.1.2	Sensor Connector.....	45
13	Glossary.....	46

1 Legal Information



The following trademarks are the intellectual property of Physik Instrumente (PI) SE & Co. KG ("PI") and have been entered in the trademark register of the German Patent and Trade Mark Office and, in some cases, also in other trademark registers under the company name of Physik Instrumente (PI) GmbH & Co. KG: PI®, PIC®, PICMA®, PLine®, PIFOC®, PiezoWalk®, NEXACT®, NEXLINE®, PInano®, NanoCube®, Picoactuator®, PicoCube®, PIMikroMove®, PIMag®, PIHera®

© 2025 Physik Instrumente (PI) SE & Co. KG, Karlsruhe, Germany. The text, photographs, and drawings in this manual are protected by copyright. With regard thereto, Physik Instrumente (PI) SE & Co. KG reserves all rights. The use of any text, images and drawings is permitted only in part and only when indicating the source.

Original instructions
First print: 1/29/2025
Document number: V408M0001en, KSch

Subject to change. This manual is superseded by any new release. The latest respective release is available for download on our website (www.pi.ws).

Publisher:

PI miCos GmbH
Freiburger Straße 30
79427 Eschbach
Germany
info@pimicos.de
www.pi.de

Customer service department:

Physik Instrumente (PI) SE & Co. KG
Auf der Römerstraße 1
76228 Karlsruhe
Germany
service@pi.de
www.pi.de

2 Introduction

2.1 About this Document

2.1.1 Objective and Target Group

This user manual contains the information required for using the V-408.132020 as intended. Basic knowledge of closed-loop systems, motion control concepts, and applicable safety measures is assumed.

This document is intended for persons installing, operating, and maintaining the V-408.132020.





2.1.2 Explanation of Symbols

This chapter explains the symbols and markings used by PI in their user manuals.

Typographic Conventions

Symbol / label	Meaning
1. 2.	Action consisting of one or several steps with strict sequential order
►	Action consisting of one or more steps without relevant sequential order
■	Lists
p. 5	Cross-reference to page 5
RS-232	Label on the product indicating an operating element (example: RS-232 interface socket)

Symbols Used

Symbol / label	Meaning
	General hazard symbol
	Risk of crush hazards
	Warning of magnetic fields
	Prohibition sign for heart pacemakers, defibrillators, and other active implants

DANGER

Dangerous situation

Failure to comply could lead to death or serious injury.

► Precautionary measures for avoiding the risk.

**WARNING****Dangerous situation**

Failure to comply could lead to serious injury.

- Precautionary measures for avoiding the risk.

**CAUTION****Dangerous situation**

Failure to comply could lead to minor injury.

- Precautionary measures for avoiding the risk.

NOTICE**Dangerous situation**

Failure to comply could lead to material damage.

- Precautionary measures for avoiding the risk.

Information

Additional information on the V-408.132020 that can affect your application.

2.1.3 Figures

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.

2.1.4 Other Applicable Documents

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

Document number	Document type	Product
MS251E	User Manual	C-891.130300
SM148E	User Manual	PIMikroMove

The latest versions of the user manuals can be [downloaded \(p. 6\)](#) at www.pi.ws.

2.1.5 Downloading Manuals**Information**

If a manual is missing or problems occur with downloading:

- Contact our [customer service department \(p. 7\)](#).

Downloading Manuals

1. Open the website www.pi.ws.
2. Search the website for the product number (e.g., V-408).
3. In the search results, select the product to open the product detail page.
4. Select **Downloads**.
→ The manuals are shown under **Documentation**. Software manuals are shown under **General Software Documentation**.
5. For the desired manual, select **ADD TO LIST** and then **REQUEST**.

6. Fill out the request form and select **SEND REQUEST**.

→ The download link will be sent to the email address entered in the form.

2.2 European Declarations of Conformity

For the V-408.132020, declarations of conformity were issued according to the following European statutory requirements:

- EMC Directive
- RoHS Directive

The applied standards certifying the conformity are listed below.

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

2.3 Customer Service Department

For enquiries and orders, contact your PI miCos representative or send us an [email](#).

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.

Customer service address:

Physik Instrumente (PI) SE & Co. KG
Auf der Römerstraße 1
76228 Karlsruhe
Germany

service@pi.de
www.pi.de

2.4 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 fulfill the responsibility as the product manufacturer, PI miCos undertakes environmentally correct disposal of all PI miCos equipment free of charge, if it was made available to the market after August 13, 2005.

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

PI miCos GmbH
Freiburger Straße 30
79427 Eschbach
Germany

info@pimicos.de
www.pi.de



3 Safety

3.1 Intended Use

The V-408.132020 is a laboratory device as defined by DIN EN 61010-1. It is intended for indoor use and use in an environment that is free of dirt, oil, and lubricants.

In accordance with its design, the V-408.132020 is intended for positioning, adjusting and shifting loads in one axis at various velocities. It is **not** for applications in areas where failure would result in considerable risks for human beings or the environment.

The V-408.132020 is intended for operation with a horizontally aligned motion axis. A vertically aligned motion axis may only be operated with suitable gravity compensation (not in the scope of delivery).

The intended use of the V-408.132020 is only possible when completely mounted and connected. It needs to be operated with suitable electronics. The electronics are not in the V-408.132020's scope of delivery.

The V-408.132020 may not be used for purposes other than those stated in this user manual. The V-408.132020 may only be used in compliance with the technical specifications and instructions in this user manual.

3.2 General Safety Instructions

The V-408.132020 contains permanent magnets that could impair the function of heart pacemakers and electronic implants.

- Make sure that people with heart pacemakers and / or electronic implants do not have access to the V-408.132020.

The magnets in the V-408.132020 can damage parts susceptible to magnetic influences, e.g., magnetic data carriers and electronic devices.

- Make sure that there are no objects sensitive to magnets within a radius of at least 10 cm around the V-408.132020.

The magnets in the V-408.132020 can attract magnetizable parts, e.g., loose screws. Objects attracted can damage the V-408.132020.

- Make sure that there are no movable, magnetizable objects within a radius of at least 10 cm around the V-408.132020.

Mechanical forces can destroy the V-408.132020.

- Avoid knocks that affect the V-408.132020.
- Do not drop the V-408.132020.

The V-408.132020 is built according to state-of-the-art technology and recognized safety standards. Improper use of the V-408.132020 may result in personal injury and/or damage to the V-408.132020.

- Use the V-408.132020 only for its intended purpose and when it is in perfect condition.
- Read the user manual.
- Eliminate any malfunctions that may affect safety immediately.

The operator is responsible for installing and operating the V-408.132020 correctly.

3.3 Organizational Measures

3.3.1 User Manual

- ▶ Always keep this user manual available with the V-408.132020. The latest versions of the user manuals can be [downloaded \(p. 6\)](#) at www.pi.ws.
- ▶ Add all information from the manufacturer such as supplements or technical notes to the user manual.
- ▶ If you give the V-408.132020 to a third party, also include this user manual as well as other relevant information provided by the manufacturer.
- ▶ Only use the device on the basis of the complete user manual. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- ▶ Only install and operate the V-408.132020 after you have read and understood this user manual.

3.3.2 General Personnel Qualification

The V-408.132020 may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.

4 Product Description

4.1 Product Labeling

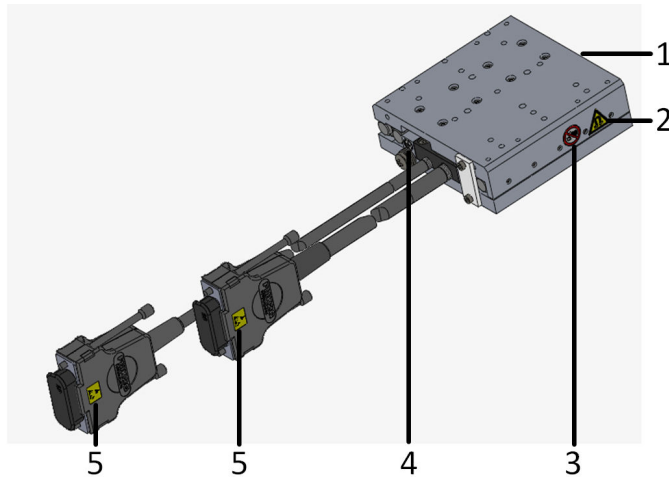


Figure 1: Product label on the V-408

1. Type plate
2. Warning symbol: Magnetic field
3. Prohibition sign for heart pacemakers, defibrillators, and other active implants
4. Symbol for the protective earth conductor
5. Warning symbol: Electrostatic-sensitive device

4.1.1 Type Plate

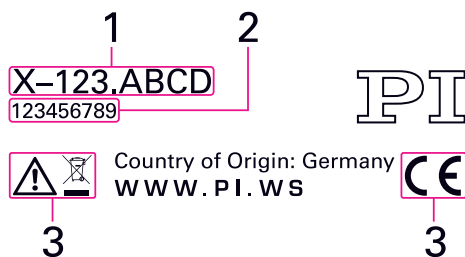


Figure 2: Type plate of the V-408.132020

1. Product number (example)
2. Serial number (example), individual for each V-408.132020
3. Warning and conformity symbols ([old equipment disposal \(p. 7\)](#), [CE mark \(p. 7\)](#))

4.2 Product View

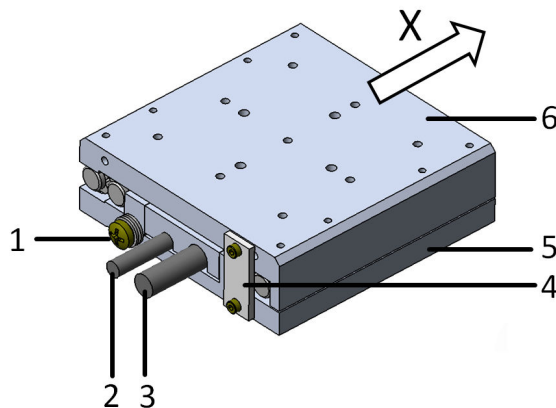


Figure 3: Example view of the V-408.132020

1. Screw for the protective earth conductor connector
 2. Cable exit of the motor cable (with HD Sub-D 26 (m) connector)
 3. Cable exit sensor cable (with Sub-D 15 (f) connector)
 4. Transport safeguard
 5. Base body
 6. Motion platform
- X: The arrow shows the positive direction of motion

4.2.1 Base Body

The base body is the basis of the positioner. The V-408.132020 [is mounted onto a surface via the base body \(p. 15\)](#).

The base body comprises the following subassembly (subassemblies):

Reference switch

The reference switch is a sensor whose fixed position serves as the reference point for incremental sensor signals.

The V-408.132020 is equipped with an [optical reference switch \(p. 38\)](#).

See the controller user manual and/or associated software manuals for the commands that make use of the reference point signal.

Limit switches

The limit switches are sensors at each end of the travel range that enable the electronics to abort motion in order to prevent the motion platform from colliding with the mechanical hard stop.

The V-408.132020 is equipped with [noncontact Hall effect limit switches \(p. 38\)](#).

Position sensor

The position sensor is an incremental sensor: It measures the position of the motion platform relative to a known reference point.

4.2.2 Drive

The drive of the V-408.132020 is a 3-phase magnetic linear motor. The linear motor transfers the drive force to the motion platform directly and free of friction.

4.2.3 Drive Connector

The drive connector transmits the supply voltage for the drive.

4.2.4 Sensor Connector

The sensor connector transmits the V-408.132020's sensor signals as well as the signals of the reference switch and the limit switches.

4.3 Scope of Delivery

Each component can be identified according to its item number.

Product number	Description
V-408.132020	Linear stage according to the order
V408B9900	Mounting hardware for the V-408, consisting of <ul style="list-style-type: none"> ■ 2 dowel pins, ISO 2338, 3 h8 × 8 ■ 4 socket head screws, ISO 4762 M2.5×8 For securing extension cables: <ul style="list-style-type: none"> ■ 4 spacer bolts, 4-40 UNC-2B, 4.5 mm across flats, 6.3 mm height
000036450	M4 screw set for protective earth, consisting of: <ul style="list-style-type: none"> ■ 1 flat-head screw with cross recess, ISO 7045 M4×8 ■ 2 safety washers ■ 2 flat washers
MP163EK	Short instructions for PIMag® linear stages

4.4 Optional Accessories

Product number	Description
V-500.AP1	Adapter for mounting the positioner onto an optical table. Material: Aluminum alloy, anodized; mass: 464 g.
V-408.AP1	Adapter for setting up an XY system when the upper positioner is a V-408.232020. Material: Aluminum alloy, anodized; mass: 65 g.
C-815.00SA0302-0300	Extension cable for motor signals, HD D-sub 26 (m/f), 3 m
C-815.00SA4041-0300	Extension cable for sensor signals, D-sub 15 (m/f), 3 m

To order, contact our [customer service department \(p. 7\)](#).

5 Unpacking

The V-408 is delivered with the transport safeguard installed.

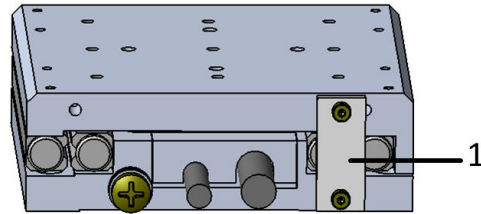


Figure 4: Example of V-408.132020: Positioner with transport safeguard

1. Plastic part with 2 M2 screws

Tools and Accessories

- Hex key, across flats 1.5

Unpack the V-408.132020 and remove the transport safeguard

1. Unpack the V-408.132020 with care.
2. Compare the contents with the scope of delivery according to the contract and the delivery note. If any of the parts are wrong or are missing, contact PI immediately.
3. Inspect the contents for signs of damage. If there is any sign of damage, contact PI immediately.
4. Remove the transport safeguard:
 - a) Loosen and remove both M2 screws.
 - b) Remove the plastic part.
5. Keep all packaging materials and the transport safeguard in case the product needs to be returned.

6 Installation

6.1 Mounting the V-408.132020

The V-408.132020 can be mounted onto a surface or via the V-500.AP1 adapter to an optical table.

The V-408.132020 can be mounted onto a surface from below or from above.



DANGER



Strong magnetic fields affect heart pacemakers!

The V-408.132020 contains permanent magnets that could impair the function of heart pacemakers and electronic implants.



- Make sure that people with heart pacemakers and / or electronic implants do not have access to the V-408.132020.



CAUTION



Risk of cuts and crushing!

If the motion platform moves back to the middle of the travel range, the force exerted by it can be very high. Risk of minor injury from cuts and crushing if fingers or limbs get caught between the V-408.132020's platform and the base body or a fixed part or obstacle.



- Use safeguards to protect limbs areas where they could be caught by moving parts.

NOTICE



Attraction of magnetizable objects!

The magnets on the bottom of the V-408.132020's motion platform can attract magnetizable objects such as loose screws. Objects attracted can damage the V-408.132020.

- Make sure that there are no movable, magnetizable objects within a radius of at least 10 cm around the motion range of the V-408.132020's platform.

NOTICE



Damage to magnetically sensitive objects!

The magnets on the bottom of the V-408.132020's motion platform can damage magnetically sensitive objects such as magnetic data carriers and electronic devices.

- Make sure that there are no magnetically sensitive objects within a radius of at least 10 cm around the motion range of the V-408.132020's platform.

NOTICE



V-408.132020 heating up during operation!

High temperatures can overheat the V-408.132020.

- Install the V-408.132020 in such a way to provide a 5 cm ventilation space around the V-408.132020.
- Provide sufficient ambient cooling.
- Ensure sufficient ventilation at the place of installation.
- Make sure that the complete bottom of the V-408.132020 is in contact with the surface on which the V-408.132020 is mounted.

NOTICE**Damage due to collisions!**

Collisions can damage the V-408.132020, the load to be moved, and the surroundings.

- ▶ Make sure that collisions are not possible between the V-408.132020, the load to be moved, and the surroundings in the motion range of the V-408.132020.
- ▶ Do not place any cables or other objects in areas where they could be caught by moving parts.

NOTICE**Protruding screw heads!**

Protruding screw heads can damage the V-408.132020.

- ▶ Make sure that the screw heads are fully countersunk and cannot interfere with motion.

NOTICE**Excessively long screws and locating pins**

Screws and locating pins that are inserted too deeply can damage the V-408.132020.

- ▶ Pay attention to the [depth of the mounting and locating holes \(p. 41\)](#) in the V-408.132020.
- ▶ Only use screws and locating pins of the correct length for the respective mounting holes.

NOTICE**Damage due to mechanical stress on the cable!**

The cable will break from excessive bending or crushing. A broken cable will lead to failure of the V-408.132020 or damage to the V-408.132020 or the electronics.

- ▶ Install the V-408.132020 so that the cable cannot be bent or crushed too strongly.

6.1.1 Mounting the V-408.132020 from Above

Overview

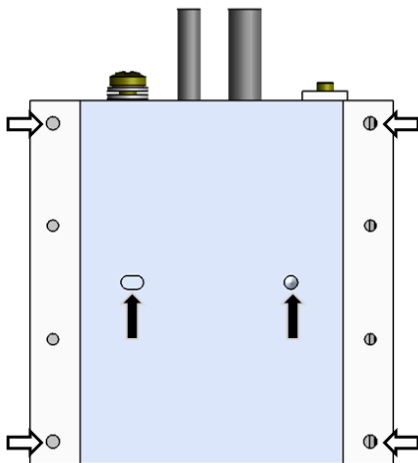


Figure 5: Holes for mounting onto a surface or onto the V-500.AP1 adapter

The arrows point to the following holes in the underneath of the V-408.132020:

Black arrows (align):	Locating holes Ø 3 mm H7, depth 3.5 mm
White arrows (mounting from above):	Countersunk holes M2.5 (Ø 2.9 mm / Ø 5.5 mm), depth 2.9 mm

Tools and Accessories

- [Screw set for mounting the V-408.132020 \(p. 13\)](#)
- Suitable screwdriver

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).
- ✓ The V-408.132020 is **not** connected to the electronics.
- ✓ You have provided a suitable surface with the holes necessary for the screws and if required, locating pins. For the position and depth required for the holes, see ["Dimensions" \(p. 41\)](#).
 - The surface flatness is $\leq 20 \mu\text{m}$.
 - For applications with large temperature fluctuations: The surface should have the same or similar thermal expansion properties as the V-408.132020 (e.g., underlying surface made of aluminum).
- ✓ You have accounted for the space required to route cables according to regulations and without bending them.
 - The cable routing does **not** obstruct the motion of the V-408.132020.
 - The cable does **not** rub against sharp edges when the V-408.132020 is in motion.

Mounting the V-408.132020 from above

1. Optional: Insert the locating pins into the corresponding holes in the underlying surface.
2. Align the V-408.132020 on the underlying surface so that the corresponding mounting holes in the V-408.132020 and underlying surface are in line.
3. Allow access to the mounting holes in the base body of the V-408.132020 by [moving the platform by hand \(p. 32\)](#).
4. Insert the screws in the accessible mounting holes completely and tighten them with a **maximum torque of 0.6 Nm**.
5. Repeat steps 3 and 4 for all concealed mounting holes.
6. Check that the V-408.132020 is securely attached to the surface.

6.1.2 Mounting the V-408.132020 from Below

Overview

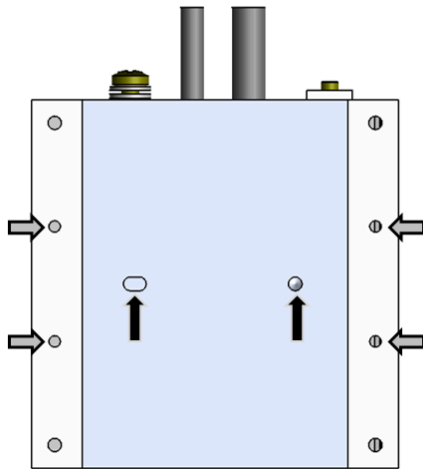


Figure 6: Holes for mounting onto a surface or onto the V-500.AP1 adapter from below
The arrows point to the following holes in the underneath of the V-408.132020:

Black arrows (align):	Locating holes Ø 3 mm H7, depth 3.5 mm
Gray arrows (mounting from below):	Threaded holes M3, depth 6 mm

Tools and Accessories

- 4 M3 screws of suitable length
- Optional: 2 locating pins of suitable length with Ø3 mm h8
- Suitable screwdriver

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).
- ✓ You have provided a suitable underlying surface with the holes necessary for the screws and if required, locating pins. For the position and depth required for the holes, see ["Dimensions" \(p. 41\)](#).
 - The surface flatness is $\leq 20 \mu\text{m}$.
 - For applications with large temperature fluctuations: The surface should have the same or similar thermal expansion properties as the V-408.132020 (e.g., underlying surface made of aluminum).
- ✓ You have accounted for the space required to route cables according to regulations and without bending them.
 - The cable routing does **not** obstruct the motion of the V-408.132020.
 - The cable does **not** rub against sharp edges during movements of the V-408.132020.

Mounting the V-408.132020 from below

1. Optional: Insert the locating pins into the respective holes in the underlying surface, see the figure above.
2. Align the V-408.132020 on the underlying surface so that the corresponding mounting holes in the V-408.132020 and underlying surface are in line.

3. Fix the V-408.132020 to the underlying surface using the M3 mounting holes, see the figure above: Pay attention to a **maximum screw-in depth of 6 mm** and a **maximum torque of 1.1 Nm**.
4. Check that the V-408.132020 is attached firmly on the underlying surface.

6.1.3 Mounting the V-408.132020 onto an Optical Table

Tools and Accessories

- V-500.AP1 adapter, available as [optional accessory \(p. 13\)](#)
- Screws in the scope of delivery of the adapter:
 - 4 screws ISO 4762, M2.5x10, A4
 - 4 screws ISO 4762, M6x10, A2
 - 2 locating pins ISO 2338, 3h8x6, A2
- Suitable screwdrivers

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).
- ✓ The optical table flatness is $\leq 20 \mu\text{m}$.
- ✓ You have accounted for the space required to route cables according to regulations and without bending them.

Mounting the V-408.132020 with Adapter onto the Optical Table

1. Mount the adapter on the optical table:
 - a) Align the adapter on the optical table. Use the locating holes and locating pins provided for aligning.
 - b) Mount the adapter with four M6x10 screws and a **maximum torque of 8.8 Nm**; see "[V-500.AP1 and V-408.AP1 Dimensions \(p. 42\)](#)" for the position of the holes.
 - c) Check that the adapter is fixed firmly.
2. Mount the V-408.132020 onto the adapter
 - a) Align the V-408.132020 on the adapter. For aligning, use the two locating pins with $\varnothing 3 \text{ mm}$ h8x6 and the locating hole provided, see the figure on .
 - b) Mount the V-408.132020 with four M2.5x10 screws and a **maximum torque of 0.6 Nm**; see "[Dimensions \(p. 41\)](#)" for the position of the holes.

Push the motion platform to the end of the travel range to make the mounting holes accessible.
3. Check that the V-408.132020 is fixed firmly.

6.2 Connecting the V-408.132020 to the Protective Earth Conductor

The V-408.132020 is supplied with a grounding screw set that is already fixed to the V-408.132020. The position for attaching the protective earth conductor is marked with the appropriate symbol (see "[Dimensions](#)" (p. 41)).

NOTICE



Damage to the protective earth conductor

If the protective earth conductor gets between the motion platform and base body of the V-408.132020, it can block the table and cause damage to the table and the protective earth conductor.

- Make sure that the protective earth conductor cannot touch the motion platform.

Information

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

Overview

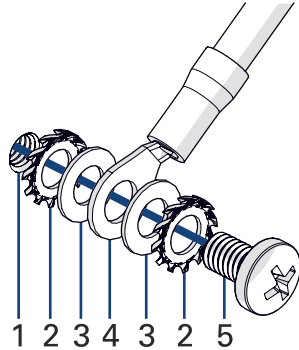


Figure 7: Protective earth connector on the V-408.132020

1. Protective earth connector on the V-408.132020 indicated by the protective earth symbol
2. Lock washer
3. Flat washer
4. Cable lug of the protective earth conductor
5. Screw, M4×8 ISO 7045

Tools and Accessories

- Suitable protective earth conductor:
 - Cable cross section $\geq 0.75 \text{ mm}^2$
 - Contact resistance $< 0.1 \Omega$ at 25 A at all points relevant for attaching the protective earth conductor
- Suitable screwdriver
- Optional: Suitable aid (e.g., liquid adhesive) for securing the screw connection

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).

Connecting the V-408.132020 to the Protective Earth Conductor

1. If necessary, attach a suitable cable lug to the protective earth conductor.
2. Attach the cable lug of the protective earth conductor to the protective earth connector of the V-408.132020 as shown in the illustration.
3. Tighten the screw with a torque of 1.2 Nm to 1.5 Nm.
4. Make sure that the contact resistance is $< 0.1 \Omega$ at 25 A at all points relevant for attaching the protective earth conductor.
5. If there is any vibration in your application, secure the screw connection for the protective earth conductor in a suitable manner (e.g., with liquid adhesive) to prevent it from unscrewing by itself.

6.3 Building a Multi-Axis System

NOTICE



Impermissibly high load on the positioners!

In a multi-axis system, the stage used for the upper axis must also be moved. Impermissibly high loads impair the motion and can damage the positioners.

- ▶ Pay attention to the [maximum permissible forces \(p. 36\)](#) that may act on the motion platform.
- ▶ In the case of multi-axis systems, include the masses of the positioners to be moved when calculating the load.

NOTICE



Unwanted changes in position with vertical mounting!

If the load exceeds the self-locking of the V-408.132020 when the stage is mounted vertically, unwanted changes in the position of the motion platform will occur. Unwanted changes in the position of the motion platform can damage the drive, the load, or the environment.

- ▶ If the V-408.132020 is mounted vertically, make sure that the installed load is lower than the self-locking of the drive. (see [Specifications \(p. 36\)](#))

NOTICE



Excessively long screws and locating pins

Screws and locating pins that are inserted too deeply can damage the V-408.132020.

- ▶ Pay attention to the [depth of the mounting and locating holes \(p. 41\)](#) in the V-408.132020.
- ▶ Only use screws and locating pins of the correct length for the respective mounting holes.

NOTICE



Protruding screw heads!

Protruding screw heads can damage the V-408.132020.

- ▶ Make sure that the screw heads are fully countersunk and cannot interfere with motion.

6.3.1 Building an XY Multi-Axis System

The V-408.132020 can be used in XY systems. If a V-408.232020 is used as upper positioner, an adapter is necessary, see ["Optional Accessories" \(p. 13\)](#).

Designations in these instructions:

- **Lower positioner:** Forms the basis of the multi-axis system, is attached to an underlying surface
- **Upper positioner:** Forms the upper axis of the multi-axis system, is attached to the lower positioner rotated by 90°

Overview

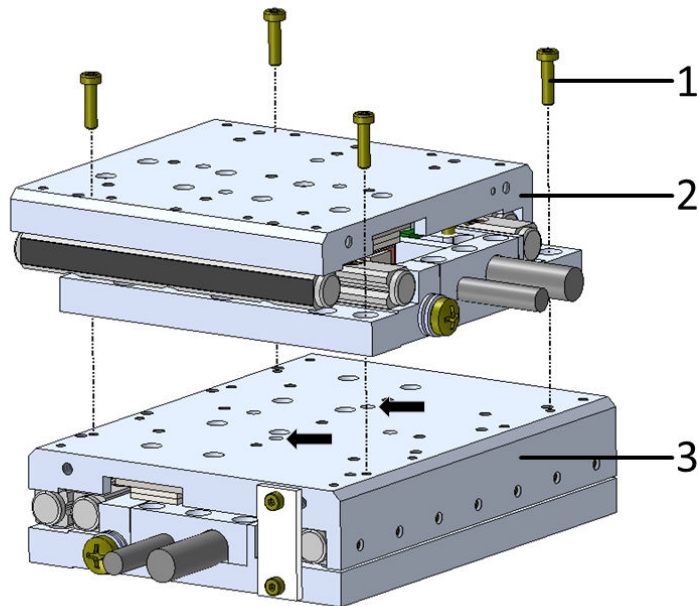


Figure 8: Example of a V-408.132020 on a V-408.232020

1. 4 M2.5×10 screws
2. Upper positioner
3. Lower positioner

Black arrows: Holes for aligning, Ø 3 mm H7, depth 3.5 mm

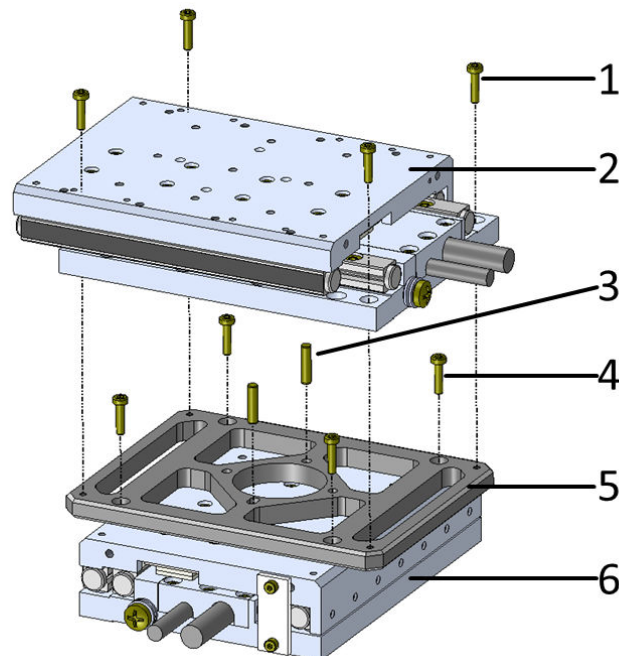


Figure 9: Example of a V-408.232020 on a V-408.232020

1. 4 M2.5×10 screws
2. Upper positioner
3. 2 3h8×12 locating pins
4. 4 M2.5×10 screws

5. V-408.AP1 adapter
6. Lower positioner

See "[Dimensions](#)" ([p. 41](#)) for the exact position of the mounting holes.

Tools and Accessories

If the upper positioner is a V-408.132020:

- 4 M2.5×10 screws (not in the scope of delivery)
- Optional: 2 3h8×6 locating pins (not in the scope of delivery)
- Suitable screwdriver

If the upper positioner is a V-408.232020:

- V-408.AP1 adapter, available as [optional accessory \(p. 13\)](#)
- Screws in the scope of delivery of the adapter:
 - 4 (from 8) screws, ISO 14580, M2.5×10, A2
 - 2 locating pins, ISO 2338, 3h8×12, A2
- Suitable screwdriver

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).
- ✓ The positioners are **not** connected to the electronics.
- ✓ The lower positioner is properly [mounted on a surface \(p. 15\)](#) or [with an adapter on an optical table \(p. 19\)](#).
- ✓ The motion platform of the lower positioner is suitably fixed, e.g., by [attaching the transport safeguard \(p. 35\)](#).
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Setting Up a Multi-Axis System Without Adapter

If the upper positioner is a V-408.132020:

1. Put the upper positioner on the lower positioner so that the corresponding mounting holes in the upper and lower positioners are in line.
Optional: For aligning, use the two 3h8×6 locating pins and the locating holes provided, see the black arrows in the figure above.
2. Mount the upper positioner onto the lower positioner as shown in the figure above.
 - a) Move the positioner's motion platform by hand until the countersunk holes in the base body are accessible.
 - b) Mount the positioner over the four countersunk holes in the base body with a **maximum torque of 0.6 Nm**.
3. Check that the upper positioner is fixed firmly.

Setting Up a Multi-Axis System With Adapter

If the upper positioner is a V-408.232020

1. Mount the adapter onto the lower positioner.
 - a) Put the adapter on the lower positioner so that the corresponding mounting holes in the adapter and the lower positioner are in line.
Optional: For aligning, use the two locating pins and the locating holes provided, see the figure above.
 - b) Mount the adapter onto the lower positioner with four M2.5×10 screws and a **maximum torque of 0.6 Nm**.
 - c) Check that the adapter is fixed firmly.
2. Mount the upper positioner onto the adapter, see the figure above.

- a) Put the upper positioner on the adapter so that the corresponding mounting holes in the upper positioner and the adapter are on line.

Optional: For aligning, use two locating pins and the locating holes provided, see the figure above.

- b) Move motion platform of the upper positioner by hand until the countersunk holes in the base body are accessible.

- c) Mount the positioner with four M2.5×10 screws and a **maximum torque of 0.6 Nm** over the four countersunk holes in the base body, see [Dimensions \(p. 41\)](#).

3. Check that the upper positioner is fixed firmly.

6.4 Mounting the Load

NOTICE



Impermissibly high load on the V-408.132020

An impermissibly high load on the V-408.132020 impairs the motion and can damage the V-408.132020.

- Pay attention to the [maximum permissible forces \(p. 36\)](#) that may act on the V-408.132020.
- In the case of multi-axis systems, include the masses of the positioners to be moved when calculating the load.

NOTICE



Excessively long screws and locating pins

Screws and locating pins that are inserted too deeply can damage the V-408.132020.

- Pay attention to the [depth of the mounting and locating holes \(p. 42\)](#).
- Only use screws and locating pins of the correct length for the respective mounting holes.

Overview

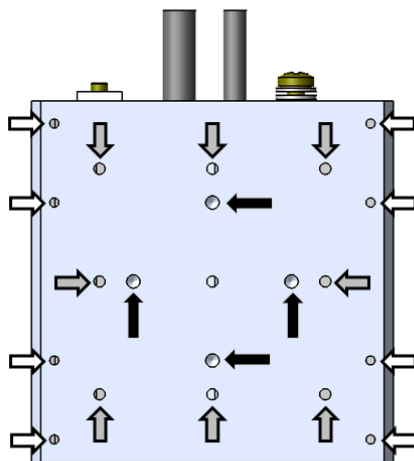


Figure 10: Position of the mounting holes for fixing the load

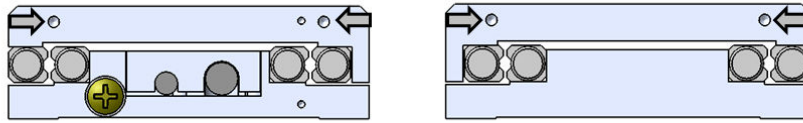


Figure 11: Mounting holes for fixing the load onto the side

The arrows mark the following holes in the sides and in the platform of the V-408.132020:

Black arrows (aligning):	Locating holes Ø 3mm H7, depth 3 mm
White arrows (mounting):	Threaded holes M2.5, depth 9 mm
Gray arrows (mounting):	Threaded holes M3, depth 6 mm

Tools and Accessories

- At least 3 screws with suitable [dimensions \(p. 41\)](#)
- Suitable tool for tightening the screws
- Optional: 2 suitably dimensioned dowel pins as locating pins for aligning the load on the V-408.132020

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).
- ✓ You have mounted the V-408.132020 [onto the surface \(p. 15\)](#) properly.
- ✓ The V-408.132020 is not connected to the electronics.
- ✓ The motion platform of the V-408.132020 is suitably fixed, e.g., by [attaching the transport safeguard \(p. 35\)](#).
- ✓ You have prepared the load so that it can be fixed 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 three points are provided for fixing the load on the platform.

Fixing the Load

1. If necessary: Insert the locating pins into the corresponding holes in the motion platform.
2. Align the load on the motion platform so that the mounting holes selected in the motion platform can be used for mounting the load.
3. Place the load onto the motion platform so that the locating pins are inserted into the corresponding locating holes in the load.
4. Tighten the screws in all mounting holes.
5. Check that the load is fixed firmly to the motion platform.

6.5 Connecting the V-408.132020

NOTICE



Damage due to incorrect connection of the V-408.132020!

Connecting unsuitable electronics or the wrong cable can lead to damage to the V-408.132020 or the electronics.

- ▶ Make sure that the electronics support the drive type of the V-408.132020 and have been configured accordingly.
- ▶ Pay attention to the [operating voltage range \(p. 39\)](#), which is specified for the V-408.132020.
- ▶ Use cables from PI miCos only to connect the V-408.132020 to the electronics.
- ▶ Pay attention to correct [pin assignment \(p. 44\)](#).

Tools and Accessories

- Suitable electronics
- Optional: [extension cable \(p. 13\)](#)
 - C-815.00SA0302-0300 extension cable for motor signals, HD D-sub 26-pole (m/f), 3 m
 - C-815.00SA4041-0300 extension cable for sensor signals, D-sub 15-pole (m/f), 3 m
 - 4 space bolts, included with [V408B9900 mounting hardware \(p. 13\)](#)

Requirements

- ✓ You have read and understood the [safety instructions \(p. 15\)](#).
- ✓ You have read and understood the user manual for the electronics.
- ✓ You have installed the electronics properly.
- ✓ The electronics are switched off.

Connecting the V-408.132020

1. Optional: Use extension cable.
 - a) Fix the space bolts onto the extension cable's connectors.
 - b) Connect the extension cable for the motor signals to the V-408.132020's HD D-sub 26-pole connector and the corresponding socket on the electronics.
 - c) Connect the extension cable for the sensor signals to the V-408.132020's D-sub 15-pole socket and the corresponding connector on the electronics.
2. Connect the motor cable's HD D-sub 26-pole connector to the corresponding socket on the electronics.
3. Connect the sensor cable's D-sub 15-pole socket to the corresponding connector on the electronics.
4. Secure the connectors against unintentional removal.

7 Startup and Operation

7.1 Determining the Operating Parameters

7.1.1 Calculating the Nominal Current According to the Ambient Temperature

The nominal current in the [data table \(p. 36\)](#) only applies when operating at room temperature. The nominal current needed for operating the V-408.132020 must be adjusted when the ambient temperature rises.

Calculating the Nominal Current

1. Calculate the nominal current according to the ambient temperature as follows:

$$I(T) = I(T_{\text{ref}}) \cdot \sqrt{\frac{T_{\text{max}} - T}{T_{\text{max}} - T_{\text{ref}}}}$$

Variables:

$I(T)$ = Nominal current, depending on ambient temperature T

T = Ambient temperature

$I(T_{\text{ref}})$ = Nominal current, determined at reference temperature T_{ref} , see [specifications \(p. 36\)](#)

T_{ref} = Reference temperature (22 °C)

T_{max} = Maximum temperature of positionierer components, see [specifications \(p. 36\)](#)

7.2 Starting and Operating the V-408.132020



DANGER



Strong magnetic fields affect heart pacemakers!

The V-408.132020 contains permanent magnets that could impair the function of heart pacemakers and electronic implants.



- Make sure that people with heart pacemakers and / or electronic implants do not have access to the V-408.132020.



CAUTION



Risk of cuts and crushing!

If the motion platform moves back to the middle of the travel range, the force exerted by it can be very high. Risk of minor injury from cuts and crushing if fingers or limbs get caught between the V-408.132020's platform and the base body or a fixed part or obstacle.



- Use safeguards to protect limbs areas where they could be caught by moving parts.

NOTICE**Overheating caused by unfavorable nominal current**

The [specified nominal current \(p. 36\)](#) applies when operating at room temperature. The nominal current needed for operating the V-408.132020 must be adjusted when the ambient temperature rises. Otherwise the V-408.132020 could be damaged by overheating.

- ▶ Calculate the nominal current according to the [ambient temperature \(p. 27\)](#).
- ▶ Adapt your application (acceleration, speed, load) so that the calculated nominal current is not exceeded. If you have any questions, contact our [customer service department \(p. 7\)](#).

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

Operating voltages that are too high or incorrectly connected can cause damage to the V-408.132020.

- ▶ Pay attention to the [operating voltage range \(p. 39\)](#), which is specified for the V-408.132020.
- ▶ Pay attention to correct [pin assignment \(p. 44\)](#).

NOTICE**Heating up of the V-408.132020 during operation!**

The heat produced during operation of the V-408.132020 can affect your application.

- ▶ Ensure sufficient ventilation at the place of installation.
- ▶ Ensure that the effective nominal current and the peak current do not exceed the permissible values.

NOTICE**Damage from transport safeguard that has not been removed!**

Damage can occur to the V-408.132020 if the transport safeguard of the V-408.132020 has not been removed and a motion is commanded.

- ▶ Remove the transport safeguard before you start up the V-408.132020 and electronics system.

NOTICE**Unintentional change in position due to missing self-locking!**

The drive of the V-408.132020 does not have self-locking. The V-408.132020 can therefore move unintentionally in the following cases:

- Switching off or rebooting the controller
- Switching off the servo mode or the drive for the axis
- Safety switch-off by the controller due to overtemperature or overcurrent

Unintentional changes of position can damage the V-408.132020, the load to be moved, and the surroundings.

- ▶ Operate the V-408.132020 only with a horizontally aligned motion axis.
- ▶ If you want to operate the V-408.132020 with a vertically aligned motion axis: Attach suitable gravity compensation (not in the scope of delivery). Contact our [customer service department \(p. 7\)](#) for details on gravity compensation.
- ▶ Before switching off or rebooting the controller, take suitable measures to ensure that unintentional changes in the position of the motion platform are not possible.

NOTICE**Damage due to collisions!**

Collisions can damage the V-408.132020, the load to be moved, and the surroundings.

- ▶ Stop the motion immediately if an electronics 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 due to the high acceleration!**

High acceleration can cause considerable wear and damage the V-408.132020.

- ▶ Stop motion immediately if a malfunction occurs.
- ▶ Avoid collisions with objects in the workspace or the end of the travel range.
- ▶ Approach the end of the travel range always at a 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.

NOTICE**Damage due to unsuitable servo-control parameters!**

If unsuitable servo-control parameters are used, the V-408.132020's drive can be damaged by excessive heat or the platform can hit the hard stop at high velocity. In addition, unsuitable servo-control parameters reduce the positioning accuracy.

- ▶ Check whether the servo-control parameters are suitable for the specified load, i.e., whether excessive heating occurs or the platform hits the hard stop at high velocity.
- ▶ If necessary, adapt the servo-control parameters. To find out how to change parameters in general, refer to manual for the controller.
- ▶ If you have questions on adapting the servo-control parameters, contact our [customer service department \(p. 7\)](#).

NOTICE**Uncontrolled oscillation!**

Oscillation can cause irreparable damage to the V-408.132020 and/or the load. Oscillation is indicated by a humming noise and can be caused by the following:

- The load and/or dynamics during operation differ considerably to the calibration settings.
- The V-408.132020 is operated near to its resonant frequency.
- ▶ If you notice oscillations, stop the V-408.132020 immediately.

NOTICE**Unintentional motion!**

The V-408.132020 can move unintentionally when connecting the electronics. 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 V-408.132020, check whether a startup macro has been defined in the electronics and if necessary, cancel the selection.

Information

Unsuitable servo-control parameter settings can be perceived as follows:

- Oscillation
- Imprecise positioning
- Long settling times

If the performance of the V-408.132020 is not satisfactory:

- Check the servo-control parameter settings of your electronics.

Requirements

- ✓ You have read and understood the [safety instructions \(p. 27\)](#).
- ✓ You have [installed \(p. 15\)](#) the V-408.132020 correctly.
- ✓ The V-408.132020 is connected to the [protective earth conductor \(p. 19\)](#).
- ✓ You have read and understood the user manual for the electronics.
- ✓ You have read and understood the manual for the PC software used.
- ✓ The electronics and if required, the PC software, have been installed (refer to the user manual for the electronics).

Starting and Operating the V-408.132020

1. Start the electronics (refer to the user manual for the electronics).
2. Configure the electronics for the V-408.132020 during startup:
 - If you are using a controller from PI: In the PC software, select the entry in the positioner database that matches the V-408.132020 exactly.
 - If you are using electronics from another manufacturer: Configure the electronics according to the parameters of the V-408.132020 (see ["Specifications" \(p. 36\)](#)).
3. If the V-408.132020 has an [incremental sensor \(p. 36\)](#): Do a reference move (refer to the user manual for the electronics).
4. Optional: Correct the phase with the FPH command ([refer to the user manual for the electronics \(p. 6\)](#)).
5. Start a few motion cycles for testing purposes (refer to the user manual for the electronics).

8 Maintenance

NOTICE



Damage due to improper maintenance!

Improper maintenance can lead to misalignment and failure of the V-408.132020.

- ▶ Loosen screws only according to the instructions in this manual or the instructions of our [customer service department \(p. 7\)](#).

8.1 Maintenance Run

Frequent motion along a limited travel range can cause uneven distribution of the lubricant. The maintenance run serves the purpose of distributing the existing lubricant.

- Perform a maintenance run at regular intervals, at the latest after a period of six months. The more often motion is performed over a limited travel range, the shorter the interval has to be between the maintenance runs.

Doing a Maintenance Run

1. Make sure that collisions between the V-408.132020, the load to be moved, and the surroundings are not possible over the entire travel range of the V-408.132020. If necessary, remove the load from the V-408.132020 for the maintenance run.
2. Do a maintenance run over the entire travel range:
 - a) Command the V-408.132020 to the end of a travel range and from there to the opposite end of the travel range (see manual for the electronics).
 - b) If necessary: Command the V-408.132020 to a position where the load can be mounted onto the V-408.132020 again, and [mount the load back onto the V-408.132020 \(p. 24\)](#).

8.2 Cleaning

NOTICE



Damage due to unsuitable cleaning agents!

Some cleaning agents can cause rusting on the V-408.132020 or dissolve plastics, paints or adhesives.

- ▶ Do **not** clean with water or acetone.

Auxiliary Materials Required

- Soft, lint-free cloth
- Mild cleaning agent or disinfectant

If you have any questions on the materials recommended for the V-408 contact our [customer service department \(p. 7\)](#).

Requirements

- ✓ You have disconnected the V-408.132020 from the electronics.

Cleaning the V-408.132020

1. Dampen the cloth with the cleaning agent or disinfectant.
2. Carefully wipe the surfaces of the V-408.132020.

8.3 Moving the Motion Platform by Hand

It may be necessary to move the motion platform manually,

- to allow access to the mounting holes in the positioner's base body for the mounting screws,
- to move the motion platform away from the mechanical hard stop and make the V-408.132020 operational again.

Requirements

- ✓ You have disconnected the V-408.132020 from the electronics.

Moving the Motion Platform by Hand

1. Exert a steady force on the motion platform to move it.

9 Troubleshooting

The V-408.132020 does not move, no operating noise can be heard

Defective electronics	▶ Check the electronics.
Electronics not connected correctly	▶ Check all connecting cables (p. 26).
Excessive load	▶ Reduce the acceleration and velocity. ▶ Adapt the servo-control parameters, see the user manual for the electronics. ▶ Reduce the load, see "Specifications" (p. 36) .
Excessive counterforces in the direction of motion	▶ Reduce the counterforces in the direction of motion.
Transport safeguard has not been removed	▶ Remove the transport safeguard (p. 14) .
When operating with the C-891 controller: Overheating protection was activated	▶ Wait a few minutes until the positioner has cooled down. ▶ Restore operational readiness of the system; see documentation for the controller.
When operating with the C-891 controller: Overcurrent protection was activated	▶ Restore operational readiness of the system; see documentation for the controller. ▶ Reduce the acceleration and/or velocity in the application; see documentation for the controller.

Reduced positioning accuracy

Warped base body	▶ Mount the V-408.132020 onto an even surface (p. 15).
Increased wear due to small motion over a long period of time	▶ Perform a maintenance run (p. 31).
Lateral forces on motion platform too high	▶ Avoid lateral forces on the V-408.132020's motion platform.
Target position is approached too slowly or with overshoot	▶ Check whether the servo control parameter settings correspond to the selected closed-loop control mode; see user manual for the controller. ▶ If necessary, correct the settings of the servo control parameters.
The target position is not kept stable due to inappropriately set speed / acceleration	▶ Correct the corresponding servo control parameter settings (see the user manual for the controller).

Uncontrolled oscillation

Large changes to the load or the alignment of the V-408.132020	▶ Switch off the servo control system or the controller immediately. ▶ Check whether the servo control parameter settings correspond to the selected closed-loop control mode; see user manual for the controller. ▶ If necessary, correct the settings of the servo control parameters.
--	--

Increased wear

Increased wear due to small motion over a long period of time	▶ Perform a maintenance run (p. 31).
---	--

Traveling to the hard stop with maximum force

- Ensure that the end of the travel range is approached at low velocity and with low force.

If the problem is not listed in the table or cannot be solved as described, contact our [customer service department \(p. 7\)](#).

10 Transportation

Pay attention to the [ambient conditions and classifications \(p. 39\)](#) when transporting the V-408.132020.

NOTICE



Mechanical overload due to transportation without safeguard

An impermissible mechanical load on the V-408.132020 due to transportation without a safeguard can damage the V-408.132020 and lead to loss of accuracy.

- ▶ Transport the V-408.132020 only with the transport safeguard attached.
- ▶ Ship the V-408.132020 only in the original packaging and with the transport safeguard attached.

10.1 Attaching the Transport Safeguard

Overview

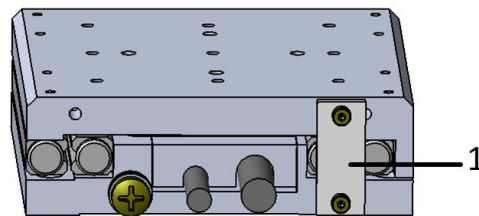


Figure 12: Example of V-408.132020: Positioner with transport safeguard

1. Plastic part with 2 M2 screws

Tools and Accessories

- Transport safeguard, [including 2 M2x5 screws \(p. 14\)](#)
- Hex key AF 1.5

Requirements

- ✓ The V-408.132020 was [disconnected from the electronics \(p. 26\)](#).

Attaching the transport safeguard

1. Tighten the transport safeguard to the base body and the [motion platform \(p. 12\)](#) with the screws.

10.2 Packing the V-408.132020

1. Pack the V-408.132020 in the original packaging.
2. If the V-408.132020 is to be sent, use a stable outer box.

11 Technical Data

Subject to change. You can find the latest product specifications on the product web page at www.pi.ws.

11.1 Specifications

11.1.1 V-408.132020

Motion	V-408.132020	Tolerance
Active axes	X	
Travel range in X	25 mm	
Maximum velocity in X, unloaded	500 mm/s	
Straightness error in Y (straightness)	$\pm 4 \mu\text{m}$	Typ.
Straightness error in Z (flatness)	$\pm 4 \mu\text{m}$	Typ.
Angular error around Y (pitch)	$\pm 150 \mu\text{rad}$	Typ.
Angular error around Z (yaw)	$\pm 150 \mu\text{rad}$	Typ.

Positioning	V-408.132020	Tolerance
Minimum incremental motion in X	$0.02 \mu\text{m}$	Typ.
Bidirectional repeatability in X	$0.2 \mu\text{m}$	Typ.
Reference switch	Optical, direction sensing (pulse signal), 5 V, TTL	
Limit switches	Hall effect, N/O contact, 5 V, TTL	
Integrated sensor	Incremental linear encoder	
Sensor signal	Sin/cos, 1 V peak-peak	
Sensor signal period	$80 \mu\text{m}$	
Sensor resolution	10 nm	

Drive properties	V-408.132020	Tolerance
Drive type	Iron core 3-phase linear motor	
Nominal voltage	24 V	
Peak voltage	48 V	
Nominal current, RMS	1.1 A	Typ.
Peak current, RMS	3.2 A	Typ.
Drive force in X	5 N	Typ.
Peak force in X	14 N	
Force constant	4.6 N/A	
Resistance phase-phase	2.46 Ω	Typ.
Inductance phase-phase	1.94 mH	
Back EMF	2.81 V·s/m	Max.
Pole pitch N-N	18 mm	
Permissible maximum temperature for drive components	80 °C	

Mechanical properties	V-408.132020	Tolerance
Permissible push force in Y	80 N	Max.
Permissible push force in Z	80 N	Max.
Permissible torque in θ_X	2.3 N·m	Max.
Permissible torque in θ_Y	1.3 N·m	Max.
Permissible torque in θ_Z	1.3 N·m	Max.
Moved mass in X, unloaded	230 g	
Guide	Crossed roller guide	
Overall mass	790 g	
Mass without cable	500 g	
Material	Aluminum, black anodized	

Miscellaneous	V-408.132020	Tolerance
Operating temperature range	5 to 40 °C	
Connector	HD D-sub 26 (m)	
Sensor connector	D-sub 15 (f)	
Cable length	2 m	
Recommended controllers / drivers	C-891, C-885 with C-891.10C885 A-811.CE G-901	

Note on sensor resolution: interpolated

At PI, technical data is specified at 22 ± 3 °C. Unless otherwise stated, the values are for unloaded conditions. Some properties are interdependent. The designation "typ." indicates a statistical average for a property; it does not indicate a guaranteed value for every product supplied. During the final inspection of a product, only selected properties are analyzed, not all. Please note that some product characteristics may deteriorate with increasing operating time.

11.1.2 Reference Switch Specifications

Type	Incremental, optical sensor
Supply voltage	+5 V
Signal output	0 V / +5 V (TTL level)

The approximate position of the reference switch is the middle of the motion platform. The reference switch outputs a pulse signal.

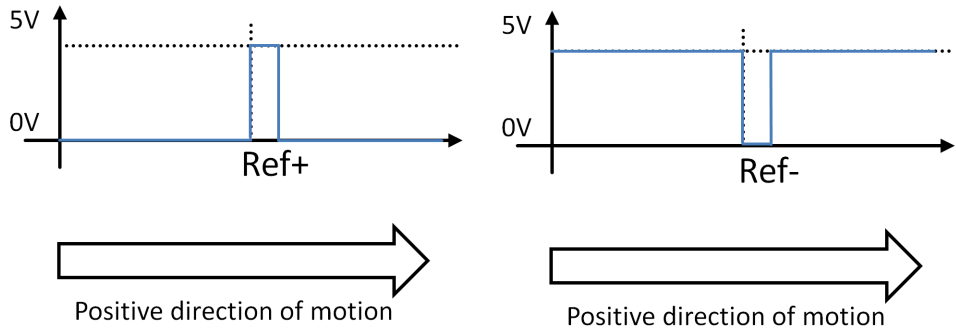


Figure 13: Reference signal of the V-408

11.1.3 Limit Switch Specifications

Type	Magnetic sensor (Hall effect)
Supply voltage	+5 V
Signal output	0 V / +5 V (TTL level)
Signal logic	The signal level changes when passing the limit switch. The signal logic is active high. That means: Normal motor operation: low (0 V) Limit switch reached: high (+5 V)

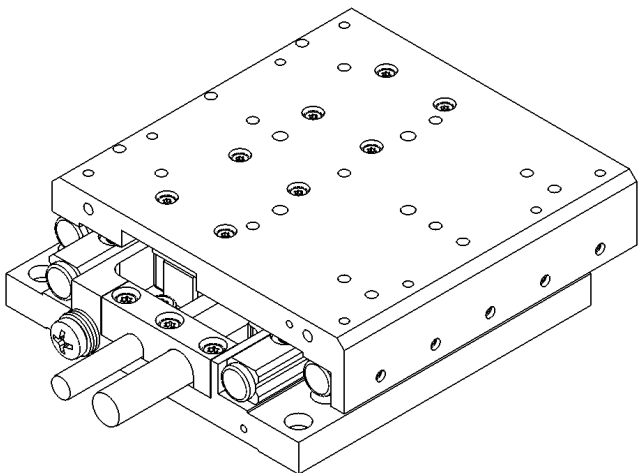


Figure 14: Example V-408.132020; V-408 at the positive limit switch, i.e., the signal to pin 15 of the encoder connector (PLIM) is high

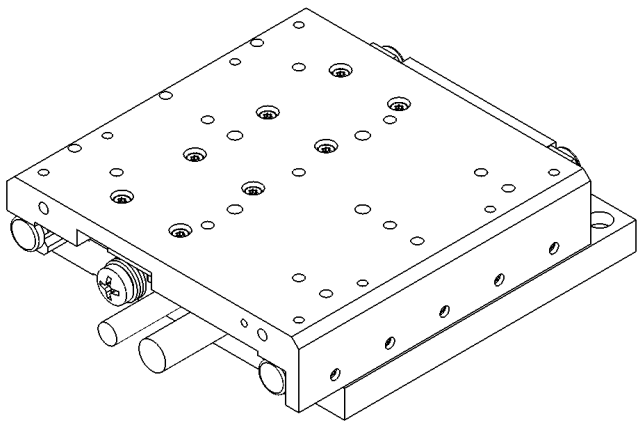


Figure 15: Example for V-408.132020; V-408 at the negative limit switch, i.e., the signal to pin 8 of the encoder connector (NLIM) is high

11.2 Maximum Ratings

The V-408.132020 is designed for the following operating data:

Maximum operating voltage	Maximum operating frequency	Maximum power consumption
48 V	— — —	45 W

11.3 Ambient Conditions and Classifications

Pay attention to the following ambient conditions and classifications for the V-408.132020:

Area of application	For indoor use only
Maximum altitude	2000 m above msl
Relative humidity	Max. 80 % for temperatures to 31 °C, decreasing linearly to 50 % at 40 °C
Storage temperature	-20 °C to 60 °C
Transport temperature	-20 °C to 60 °C
Overvoltage category	II
Supply voltage fluctuations	Max. ± 10 % of the nominal voltage
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP20

11.4 V-408.132020 Dimensions

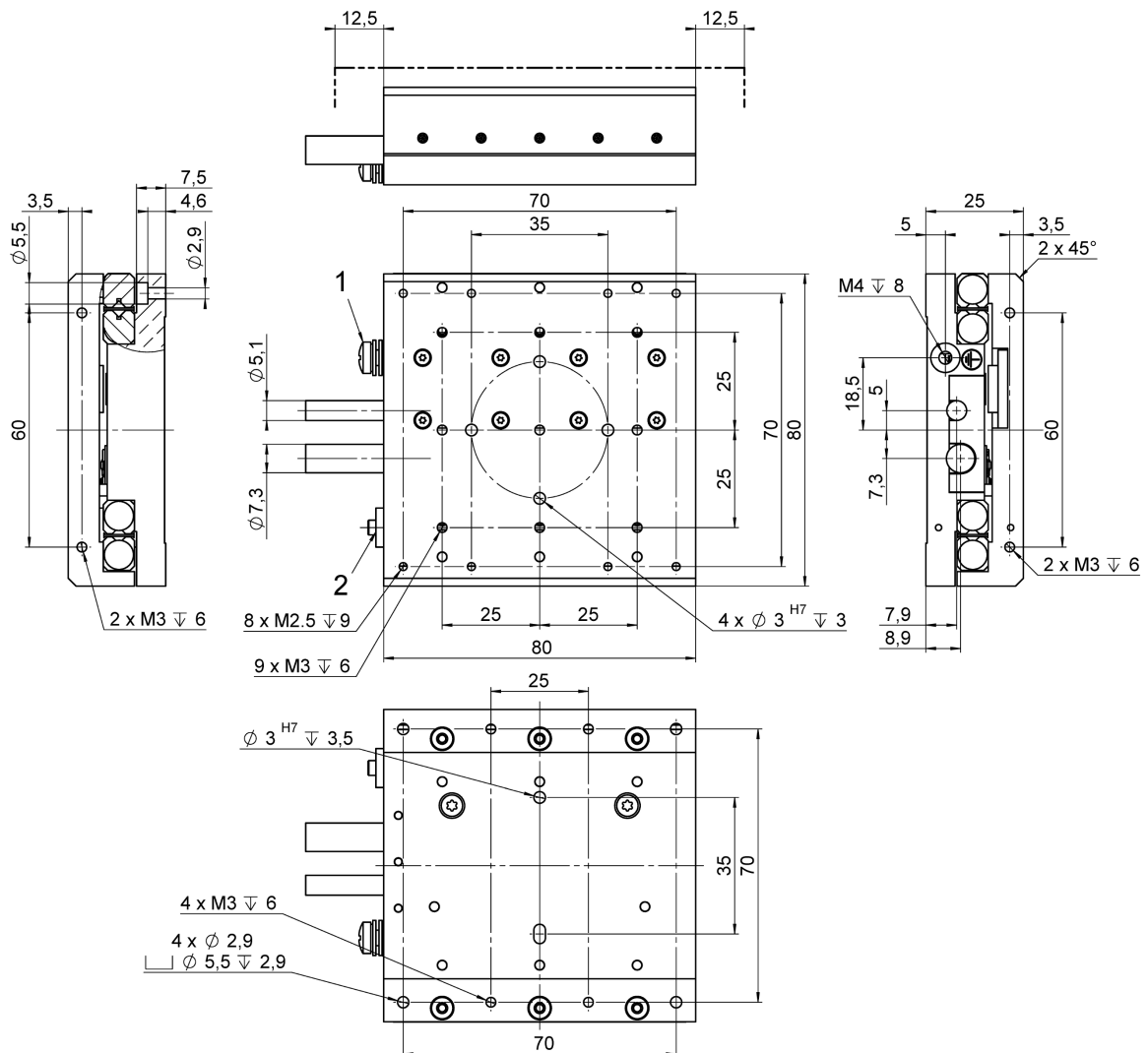


Figure 16: Dimensions of the V-408.132020

1. Grounding stud
2. Transport safeguard

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

11.4.1 V-500.AP1 and V-408.AP1 Dimensions

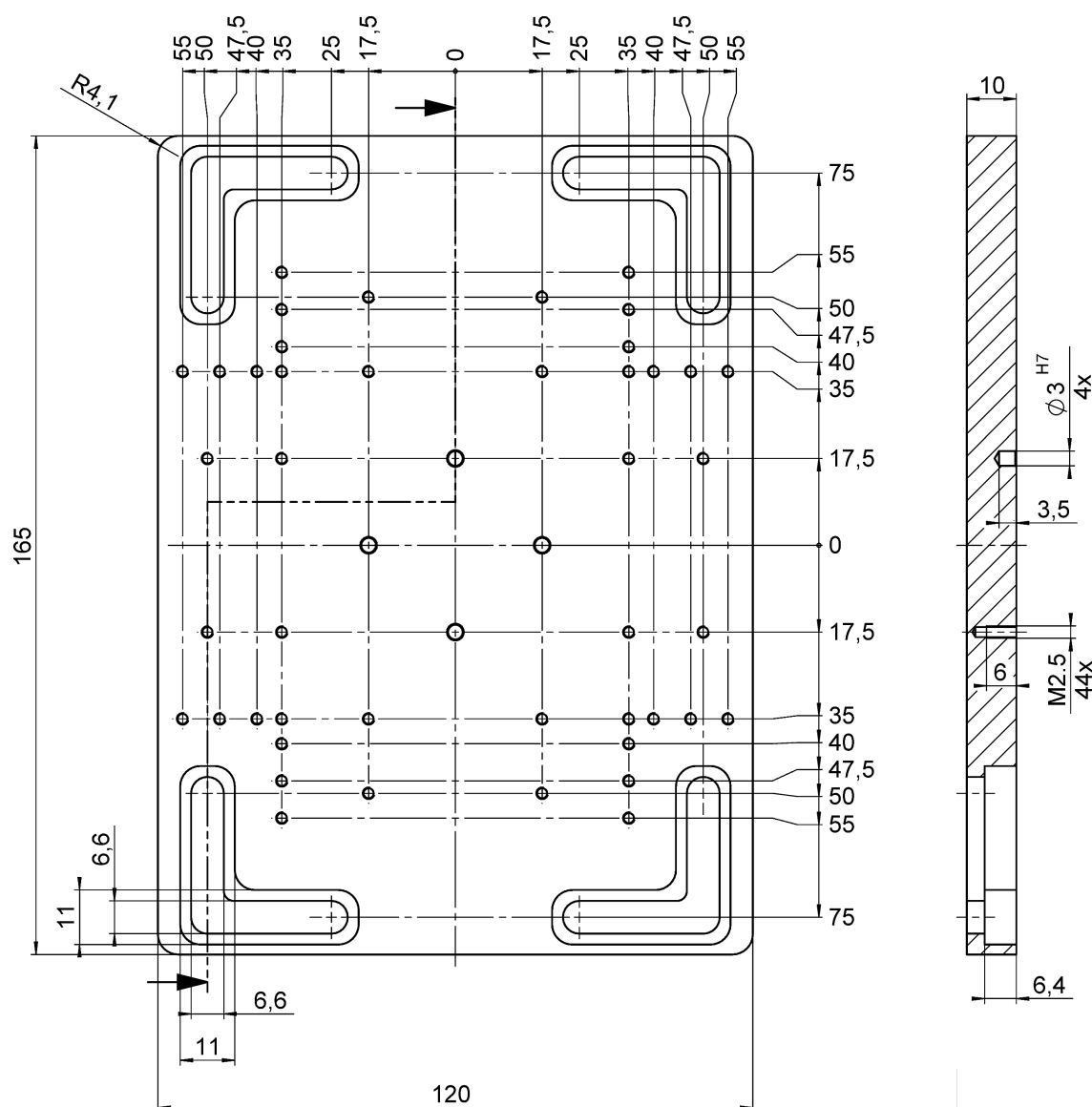


Figure 17: V-500.AP1

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

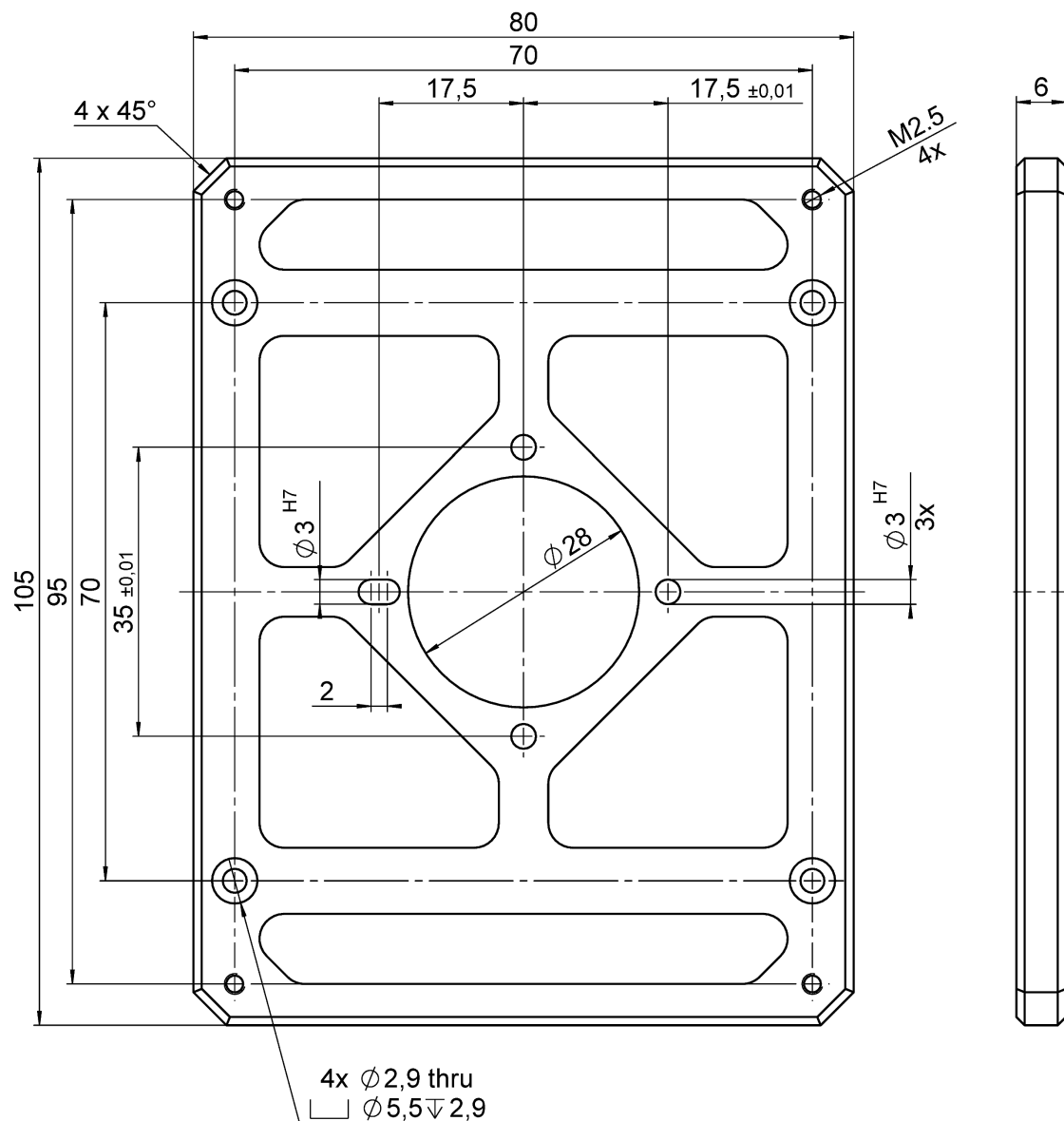


Figure 18: V-408.AP1

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

12 Appendix

12.1 Pin Assignment

12.1.1 Drive Connector

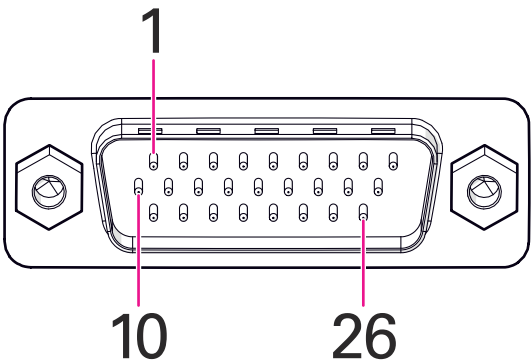


Figure 19: HD D-sub 26 (m)

Pin	Signal	Function
1	Ph1	Phase 1
2	Ph1	Phase 1
3	Ph2	Phase 2
4	Ph2	Phase 2
5	Ph3	Phase 3
6	Ph3	Phase 3
7 - 26	NC	Not connected
Housing	GND	Ground

12.1.2 Sensor Connector

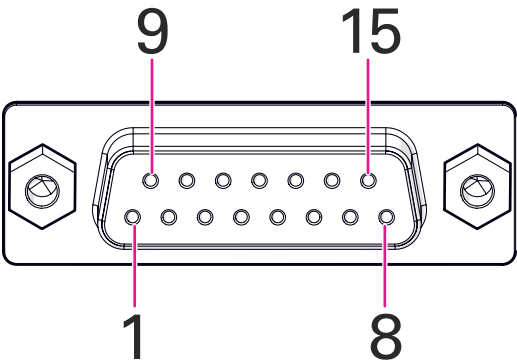


Figure 20: D-sub 15 (f)

Pin	Signal	Function
1	Vcc 5 V	Input: Power supply
2	AGND	Encoder Ground
3	SIN+	Encoder sine+
4	SIN-	Encoder sine-
5	-	Not connected
6	COS+	Encoder cosine+
7	COS-	Encoder cosine-
8	N-Limit	Output: Limit switch negative
9	-	Not connected
10	REF+	Output: Reference switch, positive
11	-	Not connected
12	REF-	Output: Reference switch, negative
13	Used	
14	GND	Ground
15	P-Limit	Output: Limit switch positive

Glossary

Lateral Force

Also: Lateral load capacity

Maximum permissible force orthogonally to the positioning direction. This value is directly valid for the motion platform or the slider with mounting rails at the product. The value is reduced when the force acts above the platform/slider.

Limit Switch

Each limit switch sends its signal to the controller on a dedicated line. The controller then interrupts the motion avoiding that the positioner moves until the hard stop and gets damaged. PI positioners have mechanical, noncontact optical or Hall effect limit switches.

Linear Encoder

The linear encoder is an incremental sensor for detecting changes in position. Signals from the sensor are used for axis position feedback. After the controller is switched on, referencing must be done before absolute target positions can be commanded and reached.

Load Capacity

Maximum load in the vertical direction when the V-408.132020 is mounted horizontally. The contact point of the load is at the center of the motion platform.

Reference Switch

Many of the positioners are equipped with a direction sensing reference switch positioned approx. in the middle of the travel range. It is recommended to approach the reference switch always from the same direction to obtain best position repeatability.

Function: Optical, magnetic

Sensor Resolution

The sensor can be the critical element of position resolution so it may be necessary to specify the sensor resolution separately. Rotary encoder: Impulses per screw rotation. Linear encoder: Smallest motion still detected by the sensor system.

Specifications

The performance specifications are checked before dispatch. The performance specifications apply to room temperature (22 ± 3 °C), systems in closed-loop operation are calibrated at this temperature. It may be necessary to reset the operating parameters when operating at considerably lower or higher temperatures.