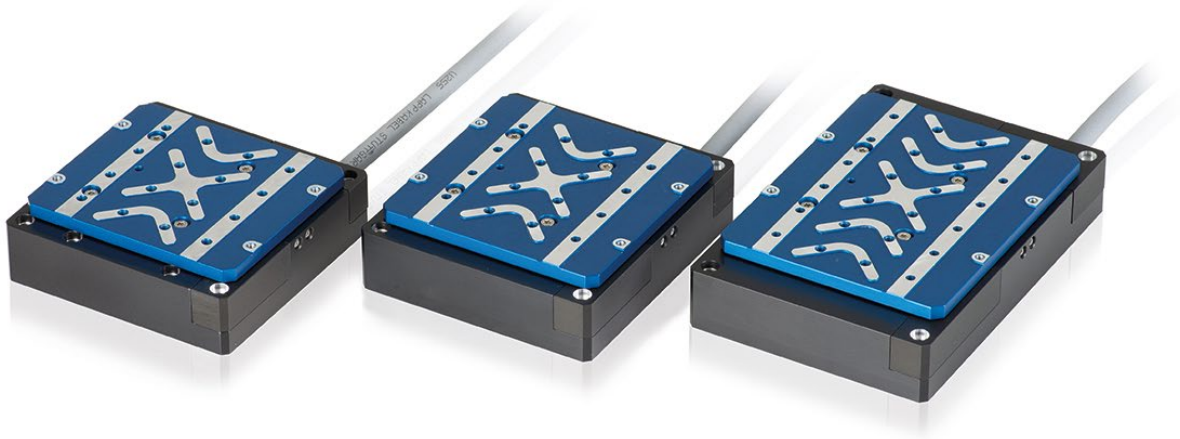
User Manual

V522T0002, applies to V-522, V-524, V-528

KSch, ibs_Che, 8/6/2024

V-522, V-524, V-528
PIMag® Voice Coil Linear Stages



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Contents

About this Document

This document contains the information needed for the intended use of the V-52x.

Basic knowledge of servo systems, drive technologies and suitable safety measures is assumed.

Symbols and Typographic Conventions

DANGER

Imminently hazardous situation

If not avoided, the hazardous situation will result in death or serious injury.

➢ Actions to take to avoid the situation

CAUTION

Dangerous situation

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

➢ Actions to take to avoid the situation.

NOTICE

Dangerous situation

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

➢ Actions to take to avoid the situation.

INFORMATION

Information for easier handling, tricks, tips, etc.

Symbol/Label	Meaning
	Warning sign affixed to the product that refers to detailed information in this manual.

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.

Other Applicable Documents

Product	Document
C-413.2xx PIMag® motion controller	MS224E user manual

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

Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:

➢ Contact our customer service department (p.23).

Downloading manuals

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e. g., V-522).
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 e-mail address entered in the form.

Intended Use

The V-522, V-524 and V-528 PIMag® voice coil linear stages (hereafter referred to as V-52x) are laboratory devices as defined by DIN EN 61010-1.
They are intended to be used in interior spaces and in an environment which is free of dirt, oil, and lubricants.

In accordance with its design and realization, the V-52x is intended for single-axis positioning, adjusting and shifting of loads at different velocities.
There are two versions of the three V-52x models, see p. 6. They differ regarding the location of the cable exit.

The V-52x has a voice coil linear drive and a position sensor. The V-52x can be mounted in any orientation. The specifications of the V-52x apply to horizontal mounting (p. 23).

The V-52x is not intended for applications in areas in which a failure would present severe risks to human beings or the environment. For further information on the operating conditions of the V-52x, see "Ambient Conditions and Classifications" (p. 26).

The intended use of the V-52x is only possible in combination with a suitable controller that is available from PI. The controller is not included in the scope of delivery of the V-52x.

For information about the controller refer to its separate documentation.

Product Description

Model Overview

Six standard versions of the V-52x linear stage are available. They differ with regard to the location of the cable exit and travel range:

Model	Travel range	Location of cable exit
V-522.1AA	5 mm	Cable exit in X, see figure below
V-522.1AB	5 mm	Cable exit in Y, i.e. lateral cable exit, see Figure 10 on p. 30
V-524.1AA	10 mm	Cable exit in X, see figure below
V-524.1AB	10 mm	Cable exit in Y, i.e. lateral cable exit, see Figure 10 on p. 30
V-528.1AA	20 mm	Cable exit in X, see figure below
V-528.1AB	20 mm	Cable exit in Y, i.e. lateral cable exit, see Figure 10 on p. 30

Product View

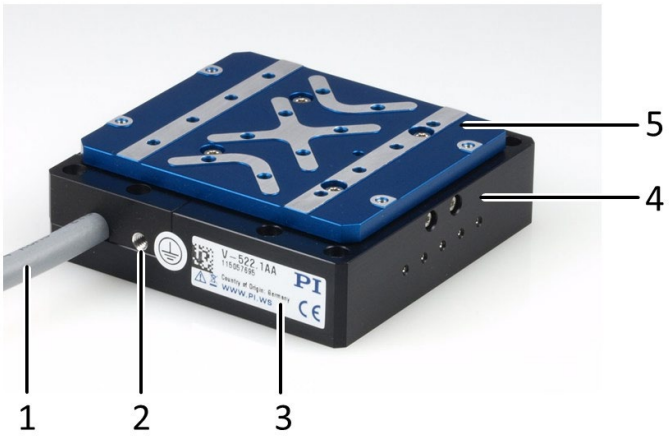

Figure 1: V-52x.1AA, cable exit in X

1 Cable exit for drive and sensor connection (with Sub-D 15(m) connector)
2 Protective earth connection
3 Type plate

4 Base body
5 Motion platform

Product Labeling

On the housing of the V-52x, there is a type plate with the following information:

Labeling	Description
	Data matrix code (example; contains the serial number)
V-522.1AA	Product name (example), the characters following the period refer to the model
116003601	Serial number (example), individual for each V-52x Meaning of each position (from the left): 1 = internal information, 2 and 3 = year of manufacture, 4 to 9 = consecutive number
	Manufacturer's logo
	Warning sign "Pay attention to the manual!"
	Warning sign "Magnetic field"
	Warning sign "Hot surface"
	Prohibition sign for heart pacemakers, defibrillators, and other active implants
	Old equipment disposal (p. 41)
Country of origin: Germany	Country of origin
WWW.PI.WS	Manufacturer's address (website)
	CE conformity mark

Scope of Delivery

Item number	Component
V-52x	PIMag® voice coil linear stage according to order
-	Transport safeguard, consisting of: ▪ Bracket ▪ 4 socket head cap screws A2 M3x6 ISO4762
MP163EK	Short instructions for PIMag® positioners in printed form

Accessories

<table>
<tr><th>Order number</th><th>Description</th></tr>
<tr><td>V-500.AP1</td><td>Adapter for mounting the V-52x onto a honeycomb plate.
Material: Aluminum alloy, anodized, mass: 464 g;
including the following socket head cap screws:
<table>
<tr><th>Description</th><th>Comment</th></tr>
<tr><td>4 M6x10, DIN EN ISO 4762, A2</td><td>Mounting the adapter onto the honeycomb plate</td></tr>
<tr><td>4 M2.5x20, DIN EN ISO 4762, A2</td><td>Not needed for V-52x</td></tr>
<tr><td>4 M2.5x10, DIN EN ISO 4762, A4-70</td><td>Mounting the V-52x onto the adapter</td></tr>
<tr><td>2 3h8x6, DIN EN ISO 2338, A2</td><td>Aligning the V-52x on the adapter</td></tr>
</table></td></tr>
<tr><td>V-528.AP1</td><td>Adapter for setting up an XY system when the upper stage is a V-528.
Material: Aluminum alloy, anodized, mass: 50 g;
including the following socket head cap screws:
<table>
<tr><th>Description</th><th>Comment</th></tr>
<tr><td>4 M2.5x8, DIN EN ISO 4762, A2</td><td>Mounting V-528.AP1 on X axis</td></tr>
<tr><td>4 M2.5x20, DIN EN ISO 4762, A2</td><td>Mounting V-528.1Ax on V-528.AP1</td></tr>
</table></td></tr>
</table>

Suitable Controllers

The V-52x must be connected to a suitable controller. The following controllers from PI are suitable for operating the V-52x:

Controller	Description
C-413.20	PIMag® motion controller, 2 channels, OEM board, USB and SPI interface, force control option
C-413.20A	PIMag® motion controller, 2 channels, OEM board, USB and SPI interface, analog inputs, force control option
C-413.2G	PIMag® motion controller, 2 channels, benchtop device, USB and SPI interface, force control option
C-413.2GA	PIMag® motion controller, 2 channels, benchtop device, USB and SPI interface, analog inputs, force control option

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

Installation

General Notes on Installation

DANGER

Strong magnetic fields affect heart pacemakers!

The V-52x contains permanent magnets that could impair the function of heart pacemakers and other active implants. **The magnetic fields are also effective when the V-52x is not connected to the controller/electric power.**

- ➢ Make sure that people with heart pacemakers and / or other active implants do not have access to the stage.
- ➢ Ensure that hazardous areas are marked correspondingly.

NOTICE

Attraction of magnetizable objects!

The magnets in the V-52x can attract magnetizable objects such as loose screws. Objects attracted can damage the V-52x.

- ➢ Make sure that there are no movable, magnetizable objects within a radius of at least 10 cm around the motion range of the V-52x.
- ➢ Apply corresponding precautions also for storage and transport of the V-52x.

NOTICE

Damage to magnetically sensitive objects!

The magnets in the V-52x 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-52x.
- ➢ Apply corresponding precautions also for storage and transport of the V-52x.

NOTICE

Damage due to transportation without transport safeguard!

An impermissible mechanical load on the V-52x due to transportation without a transport safeguard can damage the V-52x as well as cause accuracy losses.

- ➢ Only ship the V-52x in the original packaging and with a transport safeguard installed!

NOTICE

Heating up of the V-52x during operation!

The heat produced during operation of the V-52x can affect your application and it can damage the V-52x.

- ➢ Install the V-52x so that the application is not affected by the dissipated heat.
- ➢ Ensure sufficient ventilation at the place of installation.
- ➢ Make sure that the complete bottom side of the V-52x is in contact with the surface on which the V-52x is mounted.

NOTICE

Impermissible mechanical loading!

Impermissible mechanical loading orientation can damage the V-52x.

- ➢ Avoid push and pull forces >2.5 N on the motion platform.

Removing the Transport Safeguard

Figure 2: 4 M3x6 socket head cap screws and bracket, i. e. transport safeguard, must be removed before startup

Requirements

- ✓ You have read the General Notes on Installation (p. 9).

Tools and accessories

- ▪ Suitable tool to remove M3 socket head cap screws

Removing the transport safeguard

- ➢ Remove the transport safeguard:
  a) Loosen and remove the 4 M3x6 socket head cap screw labeled in the figure above.
  b) Remove the bracket.

Connecting the V-52x to a Protective Earth Conductor

INFORMATION

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

INFORMATION

➢ 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.

The V-52x is not grounded via its connecting cable.

When a functional grounding is required for potential equalization, or when the V-52x is to be operated with a controller that is not offered by PI connecting the V-52x to a protective earth conductor can be required:

➢ Connect the V-52x to a protective earth conductor using the M4 mounting hole marked with the symbol for the protective earth conductor ⏚.

Mounting the V-52x

The V-52x can be mounted either directly onto a suitable surface or with the V-500.AP1 adapter onto a honeycomb plate.

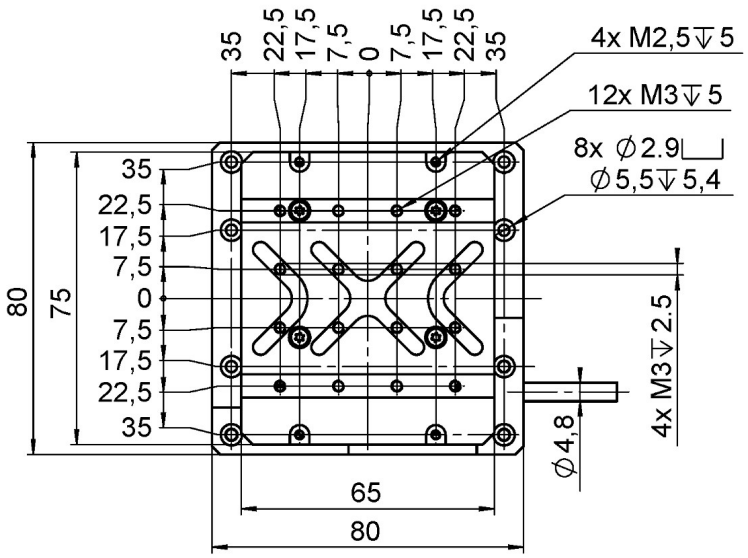

Figure 3: Example V-522.1Ax, top view, the counter-sunk holes are used to mount the V-52x to a surface or the V-500.AP1 adapter, identical for all models

With the V-524.1Ax and the V-528.1Ax models, four of the eight counter-sunk holes are accessible by moving the platform manually, see "Dimensions" beginning on p. 27.

Mounting the V-52x without Adapter

Requirements

✓ You have read the General Notes on Installation (p. 9)

✓ The evenness of the surface is ≤20 µm.

Tools and accessories

- At least 4 M2.5 screws of suitable length
- Suitable tool

Mounting the V-52x without adapter

➢ Mount the V-52x to the surface via at least four of the counter-sunk holes with Ø 2.9 mm / Ø 5.5 mm in the base body using the M2.5 screws, see figure above.

Pay attention to the following items:

– A maximum torque of 0.6 Nm
– The used counter-sunk holes are located symmetrically.

Mounting the V-52x with the V-500.AP1 Adapter onto a Honeycomb Plate

Requirements

✓ You have read the General Notes on Installation (p. 9)

✓ The V-52x is **not** connected to the controller.

✓ The evenness of the surface is ≤20 µm.

✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

- V-500.AP1 adapter, available as optional accessory (p. 8)
- Screws in the scope of delivery of the adapter:
  - 4 M6x10 screws
  - 4 M2.5x10 screws
  - 2 3h8x6 alignment pins

Mounting the V-52x with the V-500.AP1 adapter onto a honeycomb plate

➢ Mount the adapter onto the honeycomb plate:

a) Align the adapter on the honeycomb plate.

b) Mount the adapter with four M6x10 screws; see p. 38 for location of the mounting holes.

Maximum permissible torque: 8.8 Nm

c) Check that the adapter is affixed firmly.

➢ Mount the V-52x onto the adapter:

a) Align the V-52x on the adapter so that the mounting holes in the V-52x and the holes in the adapter overlap.

b) Tighten in the four M2.5 screws; see "Dimensions" starting on p. 27 for location of the mounting holes.

If required: Move the motion platform to the end of the travel range each time to make the mounting holes accessible.

Maximum permissible torque: 0.6 Nm

c) Check that the V-52x is affixed firmly.

Mounting the Load to the V-52x

NOTICE

Screws that are too long!

Screws that are inserted too deeply damage the V-52x.

➢ Observe the depth of the mounting holes in the motion platform, see figure below.
➢ Only use screws of the correct length for the holes.

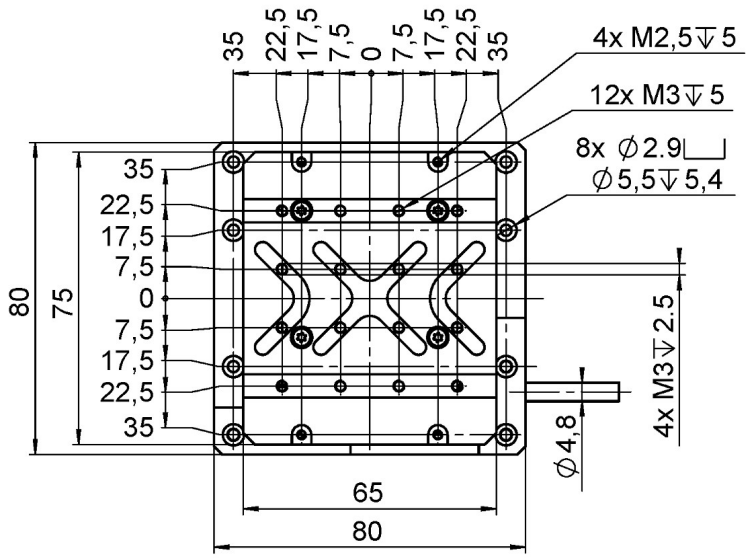

Figure 4: Example V-522.1Ax, top view of the V-52x, the M3 mounting holes are used to mount a load to the V-52x

Requirements

✓ You have read the General Notes on Installation (p. 9)

Tools and accessories

- At least three M3 screws of suitable length
- Suitable tool

Mounting the load to the V-52x

➢ Mount the load to the V-52x via at least three M3 mounting holes with a screw-in depth of 5 mm, see figure above.
Observe a maximum torque of 1.1 Nm.

Setting Up a Multi-Axis System

The V-52x can be used in XY systems.

Designations in these instructions:

- **Lower stage**: Forms the basis of the multi-axis system (X axis); is mounted on a surface
- **Upper stage**: Forms the Y axis of the multi-axis system; is mounted on the lower stage rotated by 90°

General Information on Setting Up a Multi-Axis System

NOTICE

Impermissibly high load on the stages!

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

➢ Include the masses of the moved stages in the calculation of the load to be moved.
➢ For all stages in a multi-axis system: Do not exceed the maximum permissible load.

NOTICE

Screws that are too long!

Screws that are inserted too deeply damage the V-52x.

➢ Observe the depth of the mounting holes (p. 27) in the motion platform.
➢ Only use screws of the correct length for the respective holes.

INFORMATION

Any model of the V-52x can be used as lower or upper stage. However, the orientation of the cable exits should be considered in order to obtain minimized tensile forces of the cables, see the following information box.

If a V-528 is to be used as the upper stage, an adapter is required; see "Accessories" (p. 8).

Depending on the assembly (load, friction, lateral forces of the stages' cables, amongst others) an adjustment of the stage parameters is necessary.

➢ For more information refer to the "Damage due to unsuitable servo parameters" notice on p. 20.

INFORMATION

As best practise for an XY system we recommend the following:

- Make up the XY system by a V-52x.1AA stage and a V-52x.1AB stage.

Thus, both stages can be mounted such that the cable exit of both stages is on the same side.

- Use the **V-52x.1AB stage as lower stage**, so that the upper cable of the V-52x.1AA stage induces only lateral forces on the lower stage.

Otherwise, i.e., if the V-52x.1AB is the upper stage, its cable can induce forces in the motion direction of the lower V-52x.1AA stage. These forces reduce the motor forces of the lower V-52x.1AA stage. This can be avoided by an optimized cable management.

Setting up the XY System without Adapter

Requirements

- ✓ You have read and understood the general notes on installation (p. 9).
- ✓ The stages are disconnected from the electronics.
- ✓ You have properly mounted the lower stage on a surface (p. 11) and, if required, connected it to a protective earth conductor (p. 11).
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

- 4 M2.5 screws of suitable length
- Suitable tools for fastening the screws

Setting up the XY system without adapter

1. Place the upper V-52x on the lower V-52x so that the corresponding mounting holes overlap.
2. Mount the upper V-52x to the lower V-52x using four M2.5 screws:

   a) If required, manually displace the motion platform of the upper V-52x until two of the four countersunk holes in the base body are accessible.

   b) Insert a screw into each of the two countersunk holes.

   c) Tighten the screws with a maximum torque of 0.6 Nm each.

   d) Make sure that the screw heads do not protrude from the countersunk holes.

   e) Repeat steps a) to d) for the other two countersunk holes in the base body of the upper V-52x.
3. Check that the upper V-52x is affixed firmly to the lower V-52x.

Setting up the XY System with the V-528.AP1 Adapter

The XY system is set up with the V-528.AP1 adapter when a V-528 is used as the upper stage.

Requirements

- ✓ You have read and understood the general notes on installation (p. 9).
- ✓ The stages are disconnected from the electronics.
- ✓ You have properly mounted the lower stage on a surface (p. 11) and, if required, connected it to a protective earth conductor (p. 11).
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

- 4 M2.5 x 8 socket head cap screws for mounting the adapter plate onto the lower V-52x (included in delivery)
- 4 M2.5 x 20 socket head cap screws for mounting the upper V-528 onto the adapter plate (included in delivery)
- Suitable tools for fastening the screws

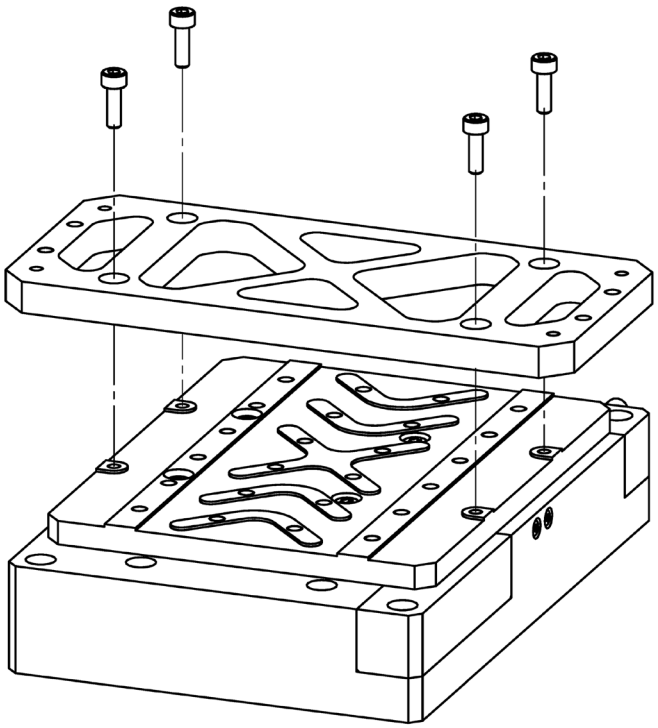

Figure 5: Where to mount the adapter plate onto the lower V-52x stage

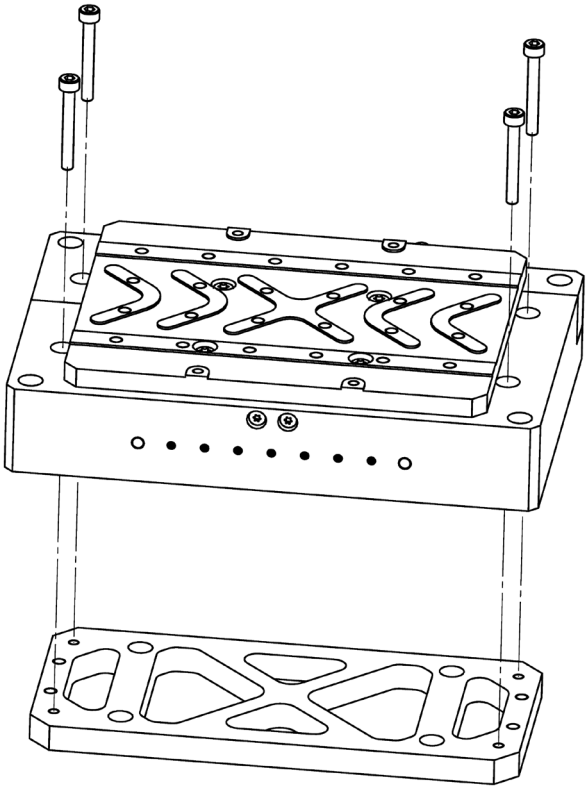

Figure 6: Where to mount the upper V-528 stage onto the adapter plate

Setting up the XY system with the V-528.AP1 adapter

1. Place the upper V-528 on the adapter plate so that the corresponding mounting holes overlap.
2. Mount the upper V-528 on the adapter plate using the 4 **M2.5 x 8** screws:
   a) Insert a screw into each of the four countersunk holes, see Figure 20.
   b) Tighten the screws with a **maximum torque of 0.6 Nm** each.
   c) Make sure that the screw heads do not protrude from the countersunk holes.
3. Place the adapter plate on the lower V-52x so that the corresponding mounting holes overlap.
4. Mount the upper V-528 onto the adapter plate using the 4 **M2.5 x 20** screws:
   a) Insert a screw into each of the four M2.5 mounting holes, see Figure 20.
   b) Tighten the screws with a **maximum torque of 0.6 Nm** each.
5. Check that the upper V-528 is affixed firmly to the lower V-52x.

Connecting the V-52x to the Controller

Requirements

- ✓ You have read and understood the general notes on installation (p. 9).
- ✓ You have installed a suitable controller (p. 8).
- ✓ You have read and understood the user manual of the controller.
- ✓ The controller is switched off.

Connecting the V-52x to the controller

1. Connect the positioner's connector to a ***Motor &Sensor*** socket of the controller.
2. Use the integrated screws to secure the connection against accidental disconnection.

Startup and Operation

General Notes on Startup and Operation

DANGER

Strong magnetic fields affect heart pacemakers!

The V-52x contains permanent magnets that could impair the function of heart pacemakers and other active implants. **The magnetic fields are also effective when the V-52x is not connected to the controller/electric power.**

- ➢ Make sure that people with heart pacemakers and / or other active implants do not have access to the stage.
- ➢ Ensure that hazardous areas are marked correspondingly.

CAUTION

Burning from hot surface!

The surface of the V-52x can heat up during operation. Touching the V-52x can result in minor injuries from burning.

- ➢ Cool the V-52x so that the temperature of its surface and surrounding parts does not exceed 65 °C.
- ➢ If sufficient cooling is not possible: Make sure that the hot V-52x cannot be touched.
- ➢ If sufficient cooling and protection against contact are not possible: Mark the danger zone in accordance with the legal regulations.

NOTICE

Undesired displacement due to lack of self-locking!

The drive of the V-52x does not have any self-locking. Switching off or rebooting the controller or switching off the servo mode for the axis can therefore lead to undesired displacements of the motion platform, e.g. due to the weight force of the moving mass. As a result, the motion platform can move to the hard stop with a high velocity, and/or collisions between the V-52x, the load to be moved and the environment are possible.

- When the motion axis is aligned vertically or tilted: Perform an AutoZero procedure for the axis on the controller so that the weight force of the moving mass is also compensated for when the servo mode is switched off. For details, see the user manual of the C-413.
- Before switching off or rebooting the controller, take suitable measures to ensure that no undesired displacements of the motion platform are possible.
- Make sure that no collisions are possible between the stage, the load to be moved and the environment in the motion range of the stage.
- Ensure that the end of the travel range is approached at low velocity and with low force.

NOTICE

Attraction of magnetizable objects!

The magnets in the V-52x can attract magnetizable objects such as loose screws. Objects attracted can damage the V-52x.

- Make sure that there are no movable, magnetizable objects within a radius of at least 10 cm around the motion range of the V-52x.
- Apply corresponding precautions also for storage and transport of the V-52x.

NOTICE

Damage to magnetically sensitive objects!

The magnets in the V-52x 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-52x.
- Apply corresponding precautions also for storage and transport of the V-52x.

NOTICE

Overheating caused by selecting unfavorable nominal current!

The nominal current as specified in the data table (p. 23) applies when operating at room temperature: As the ambient temperature rises, adjust the nominal current that is driving the stage.
Otherwise the stage could be damaged by overheating.

- Calculate the nominal current according to the ambient temperature (p. 21).
- Adapt the settings of your application (acceleration, velocity, load) so that the nominal current as calculated is not exceeded. If you have questions contact our customer service (p. 23).

NOTICE

Heating up of the V-52x during operation!

The heat produced during operation of the V-52x can affect your application and it can damage the V-52x.

- Ensure sufficient ventilation at the place of installation.
- Ensure that the nominal current and the peak current do not exceed the permissible values (p. 23).

NOTICE

Heating up of the V-52x due to change of parameter settings!

With PI controllers, the parameters ***Soft limit min*** (ID 0x0C000000) and ***Soft limit max*** (ID 0x0C000000) define the settings of the peak current. When a system of a V-52x and a C-413 controller is delivered the settings of these parameters equal the specified value of the nominal current (p. 23).

It is possible to change parameter values (see user manual of the controller). However, with the C-413 controller, overheating and damage of the V-52x is possible if the stage is operated with peak current longer than 3 seconds because the C-413 does not feature an I^2t protection.

- Only change the parameter settings of the peak current, if you operate the stage for <3 s.
- Ensure that the nominal current and the peak current do not exceed the permissible values (p. 23).

NOTICE

Damage due to unsuitable servo parameters!

When unsuitable servo parameters are used, the voice coil drive can be damaged by excessive heating up or by the platform moving with high velocity to the hard stop. In addition, unsuitable servo parameters reduce the accuracy of positioning.

- Check whether the servo parameters are suitable for the given load, i.e. whether you notice excessive heating up or whether the platform moves to the hard stop.
- If required adjust the servo parameters. For how to change parameters in general refer to the manual of the C-413 controller.
- If you have questions regarding adjusting the servo parameters contact our customer service (p. 23).

NOTICE

Damage from transport safeguard that has not been removed!

Damage can occur to the V-52x if the transport safeguard (see Figure 2 on p. 10) of the V-52x has not been removed and a motion is commanded.

- Remove the transport safeguard before you start up the system consisting of the V-52x and a controller!

Temperature Dependency of the Nominal Current: Calculating the Nominal Current

The nominal current as specified in the data table (p. 23) applies when operating at room temperature: As the ambient temperature rises, adjust the nominal current that is driving the stage.

Calculating the nominal current

➢ Calculate the nominal current according to the ambient temperature as follows:

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

With:

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

T = Ambient temperature

$I(T_{ref})$ = Nominal current, determined at reference temperature T_{ref}, see specifications

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

T_{max} = Maximum temperature of positioner components, see specifications

Starting the V-52x

Requirements

✓ You have read and understood the general notes on startup and operation (p. 18).
✓ You have properly installed (p. 8) the stage.
✓ You have read and understood the documentation of the controller.
✓ You have read and understood the manual of the PC software.
✓ The controller and the PC software have been properly installed and all connections on the controller have been set up (see user manual of the controller).

Starting the V-52x

➢ Start the stage (see user manual of the controller)

The startup comprises the following steps:

– Defining the reference point of the axis
– Commanding of first motions for testing

Maintenance

DANGER

Strong magnetic fields affect heart pacemakers!

The V-52x contains permanent magnets that could impair the function of heart pacemakers and other active implants. **The magnetic fields are also effective when the V-52x is not connected to the controller/electric power.**

- Make sure that people with heart pacemakers and / or other active implants do not have access to the stage.
- Ensure that hazardous areas are marked correspondingly.

NOTICE

Malfunction due to incorrect cleaning!

Liquid inside the stage due to incorrect cleaning or condensation will render the V-52x inoperable.

- If required: Clean the surface of the V-52x with a towel that is lightly dampened with a mild cleanser or disinfectant.
- Avoid condensation in the environment of the V-52x.

NOTICE

Damage from opening the V-52x!

The V-52x is maintenance-free. Opening the housing causes damage to the V-52x.

- Only loosen screws according to the instructions in this document.
- Do not open the V-52x.

Maintenance Run

Frequent motion along a limited travel range can case 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.

Performing a Maintenance Run

1. Make sure that collisions between the V-52x, the load to be moved, and the surroundings are not possible over the entire travel range of the V-52x. If necessary, remove the load from the V-52x's motion platform for the maintenance run.
2. Perform a maintenance run over the entire travel range:

f) Command the V-52x to the end of a travel range and from there to the opposite end of the travel range (see manual for the electronics).

g) If necessary: Command the V-52x to a position where the load can be mounted onto the motion platform again and mount the load back onto the V-52x (p. 13).

Customer Service

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

Technical Data

Specifications

	V-522.1AA V-522.1AB	V-524.1AA V-524.1AB	V-528.1AA V-528.1AB	Unit	Tolerance
Motion					
Active axes	X	X	X		
Travel range in X	5	10	20	mm	
Maximum velocity in X, unloaded	250	250	250	mm/s	
Straightness (Linear crosstalk in Y with motion in X)	±0.25	±0.5	±1.25	µm	Typ.
Flatness (Linear crosstalk in Z with motion in X)	±0.25	±0.25	±0.5	µm	Typ.
Pitch (Rotational crosstalk in θY with motion in X)	±50	±100	±200	µrad	Typ.

	V-522.1AA V-522.1AB	V-524.1AA V-524.1AB	V-528.1AA V-528.1AB	Unit	Tolerance
Yaw (Rotational crosstalk in θZ with motion in X)	±50	±100	±200	µrad	Typ.
Positioning					
Minimum incremental motion in X	0.02	0.02	0.02	µm	Typ.
Bidirectional repeatability in X	0.24	0.24	0.24	µm	Typ.
Reference switch	Optical	Optical	Optical		
Reference switch repeatability	1	1	1	µm	Max.
Integrated sensor	Incremental linear encoder	Incremental linear encoder	Incremental linear encoder		
Sensor signal	Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak		
Sensor resolution *	10	10	10	nm	
Drive Properties					
Drive type	Voice coil	Voice coil	Voice coil		
Nominal voltage	24	24	24	V	
Nominal current, RMS	1	1	1	A	Typ.
Peak current, RMS	3	3	3	A	Typ.
Drive force in X	3.4	2.9	2.3	N	Typ.
Peak force in X	10.2	8.7	6.9	N	
Force constant	3.4	2.9	2.3	N/A	
Motor constant	1.3	1.1	0.85	N/√W	Typ.
Time constant	0.32	0.32	0.32	ms	
Resistance phase-phase	7.2	7.2	7.2	Ω	Typ.
Inductance phase-phase	1.7	1.7	1.7	mH	
Back EMF	3.4	2.9	2.3	V·s/m	Max.
Permissible maximum temperature for drive components	75	75	75	°C	
Mechanical Properties					
Permissible push force in Z	100	100	100	N	Max.
Moved mass in X, unloaded	131	137	150	g	

	V-522.1AA V-522.1AB	V-524.1AA V-524.1AB	V-528.1AA V-528.1AB	Unit	Tolerance
Guide	Crossed roller guide	Crossed roller guide	Crossed roller guide		
Overall mass	460	500	580	g	
Material	Aluminium	Aluminium	Aluminium		
Miscellaneous					
Operating temperature range	18 to 45	18 to 45	18 to 45	°C	
Connector	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)		
Cable length	2	2	2	m	
Cable exit	V-52x.1AA: Cable exit in X V-52x.1AB: Cable exit in Y				
Recommended controllers / drivers	C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)		

* With C-413 controller

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.

Maximum Ratings

The V-52x is designed for the following operating data:

Maximum operating voltage	Maximum operating frequency	Maximum power consumption
24 VDC	⎓	65 W

Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the V-52x:

Area of application	For indoor use only
Maximum altitude	2000 m
Air pressure	1100 hPa to 795 hPa (corresponds to roughly 825 torr to 596 torr)
Relative humidity during operation	20 % to 80 %
Operating temperature range	18 °C to 45 °C
Storage temperature range	-20 °C to 60 °C
Transport temperature range	-20 °C to 60 °C
Overvoltage category	II
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP20

Dimensions

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

V-522.1AA

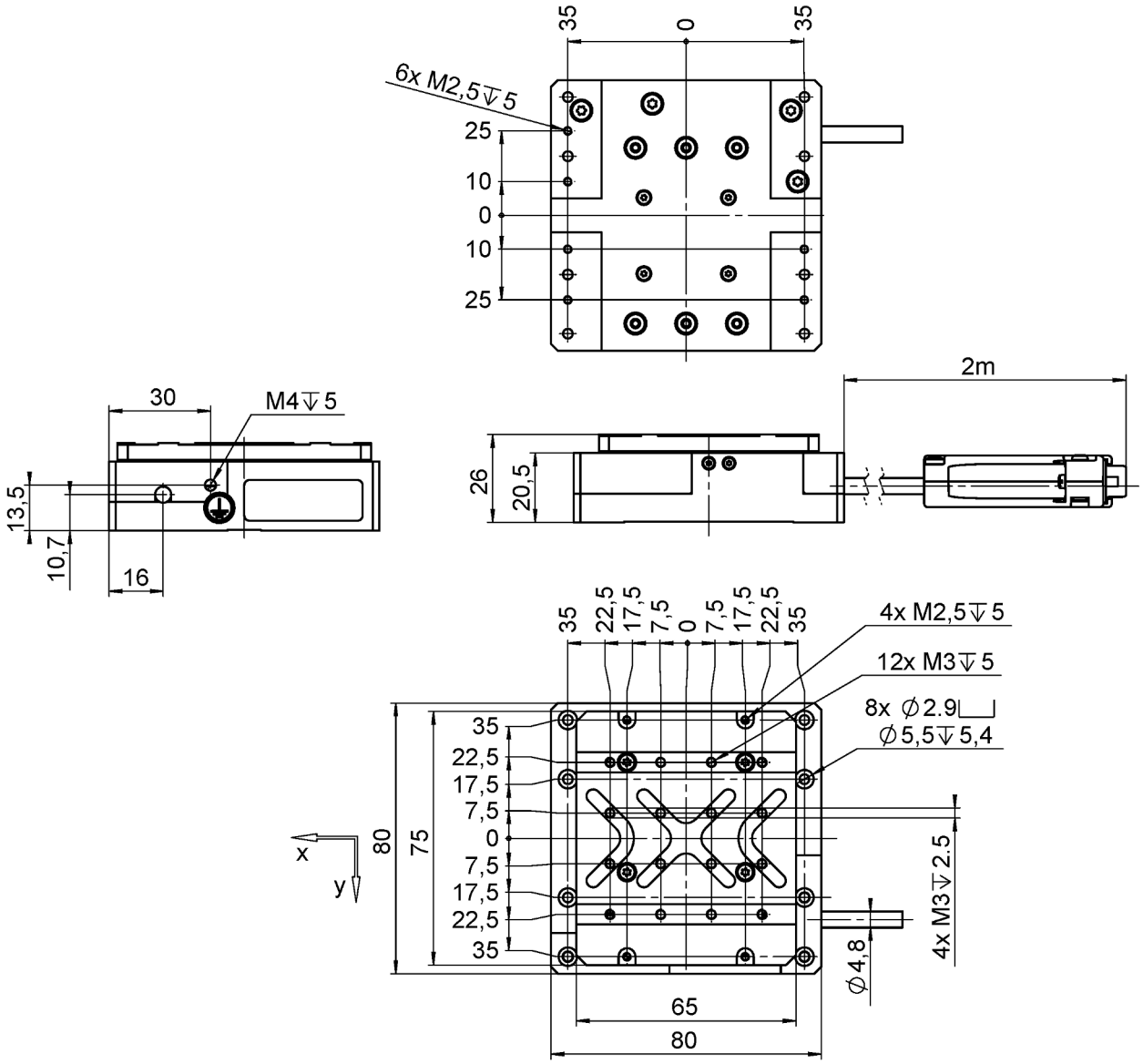

Figure 7: Dimensions of the V-522.1AA, cable exit in X, see figure below.
The orientation of the Y axis corresponds to the positive motion direction of a V-52x.1AB mounted on top.

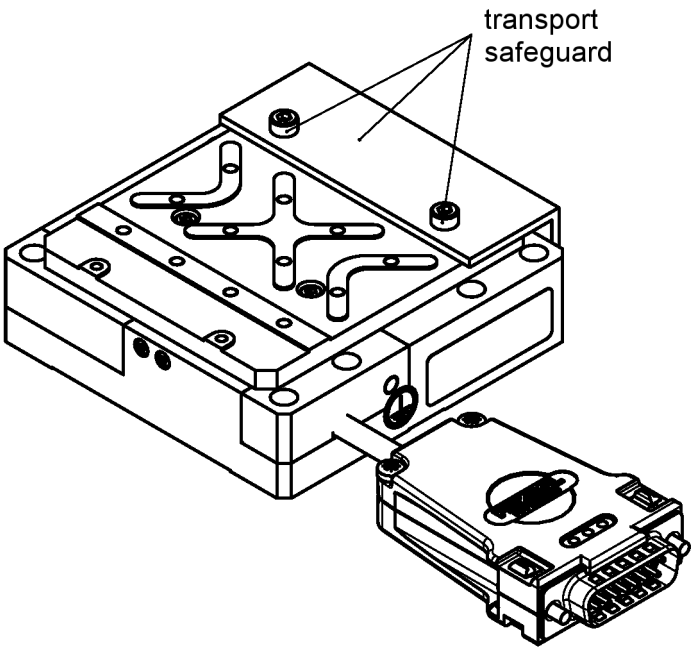

Figure 8: V-522.1AA with transport safeguard and cable exit

V-522.1AB

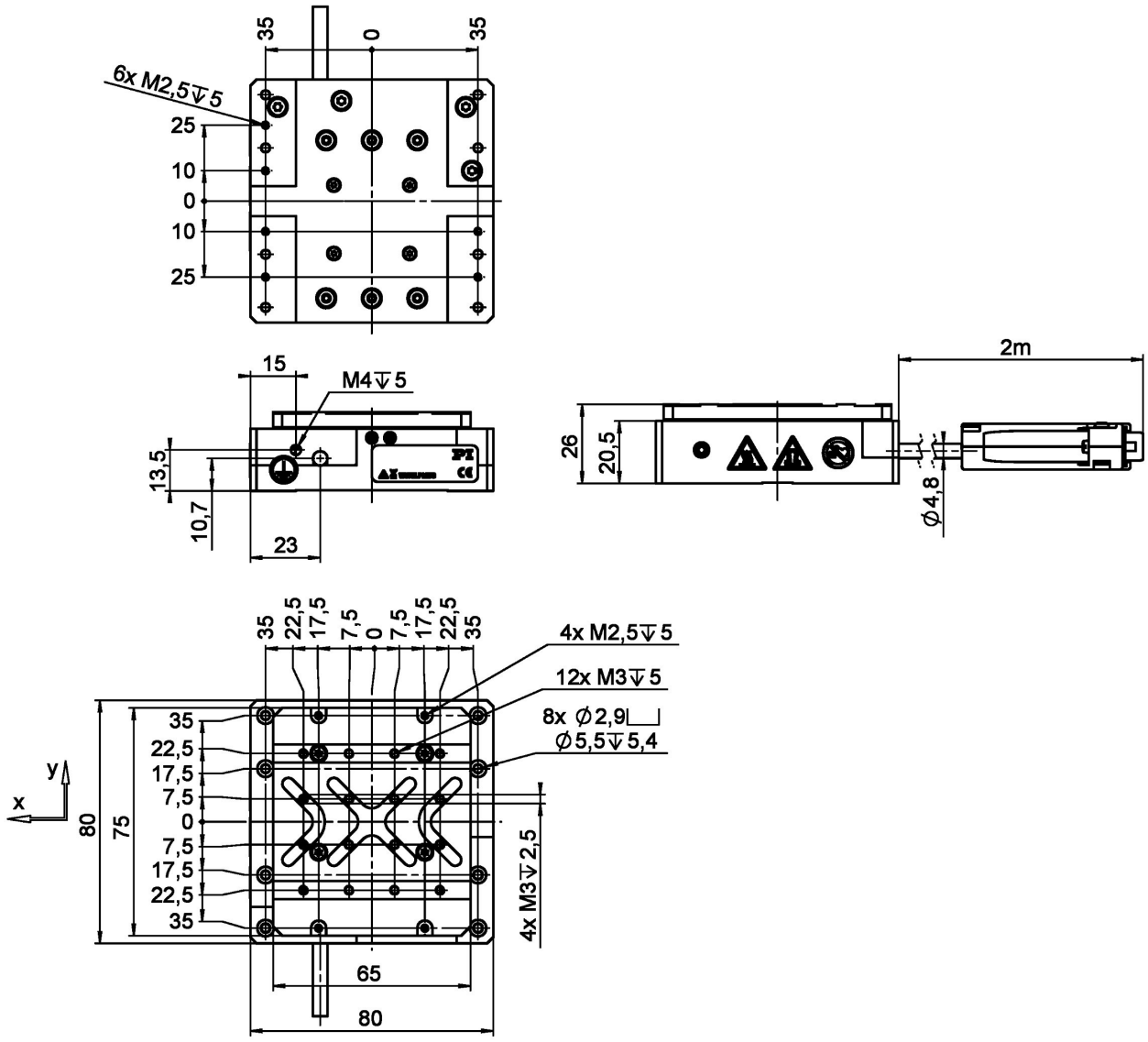

Figure 9: Dimensions of the V-522.1AB, cable exit in Y, see figure below.
The orientation of the Y axis corresponds to the positive motion direction of a V-52x.1AA mounted on top.

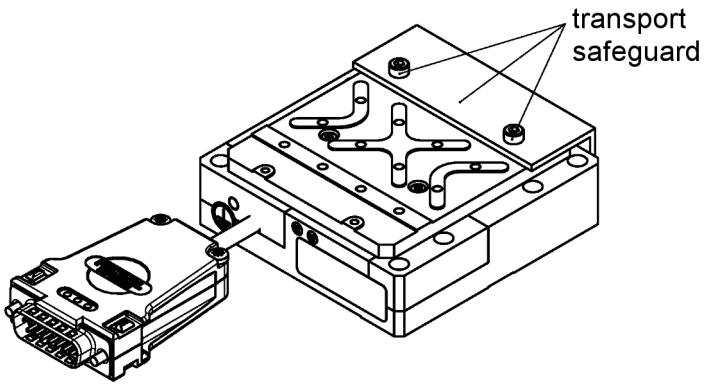

Figure 10: V-522.1AB with transport safeguard and cable exit

V-524.1AA

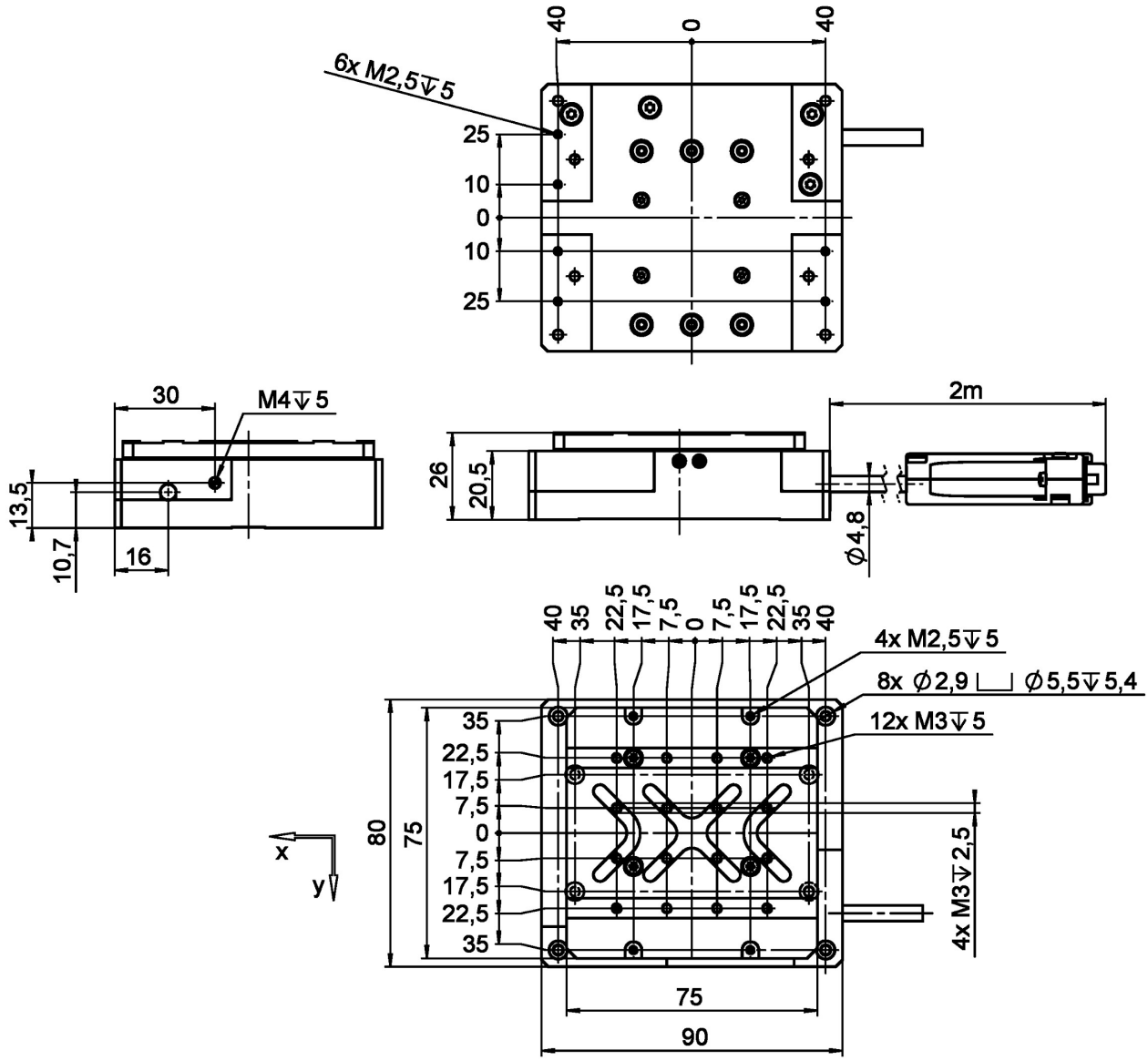

Figure 11: Dimensions of the V-524.1AA, cable exit in X, see figure below.
The orientation of the Y axis corresponds to the positive motion direction of a V-52x.1AB mounted on top.

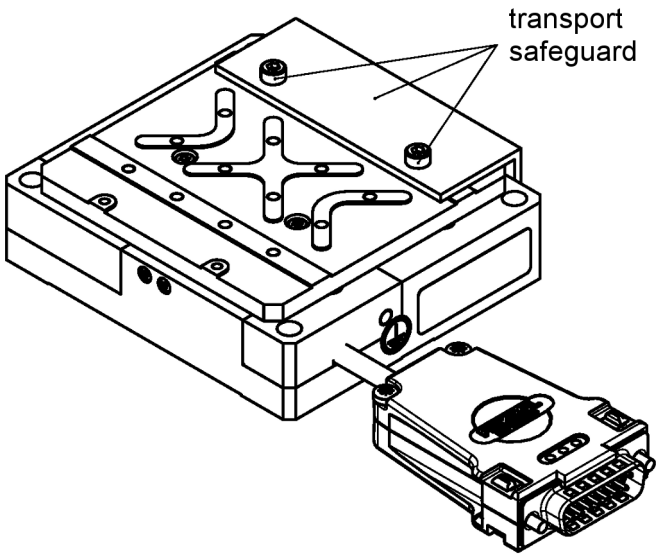

Figure 12: V-524.1AA with transport safeguard and cable exit

V-524.1AB

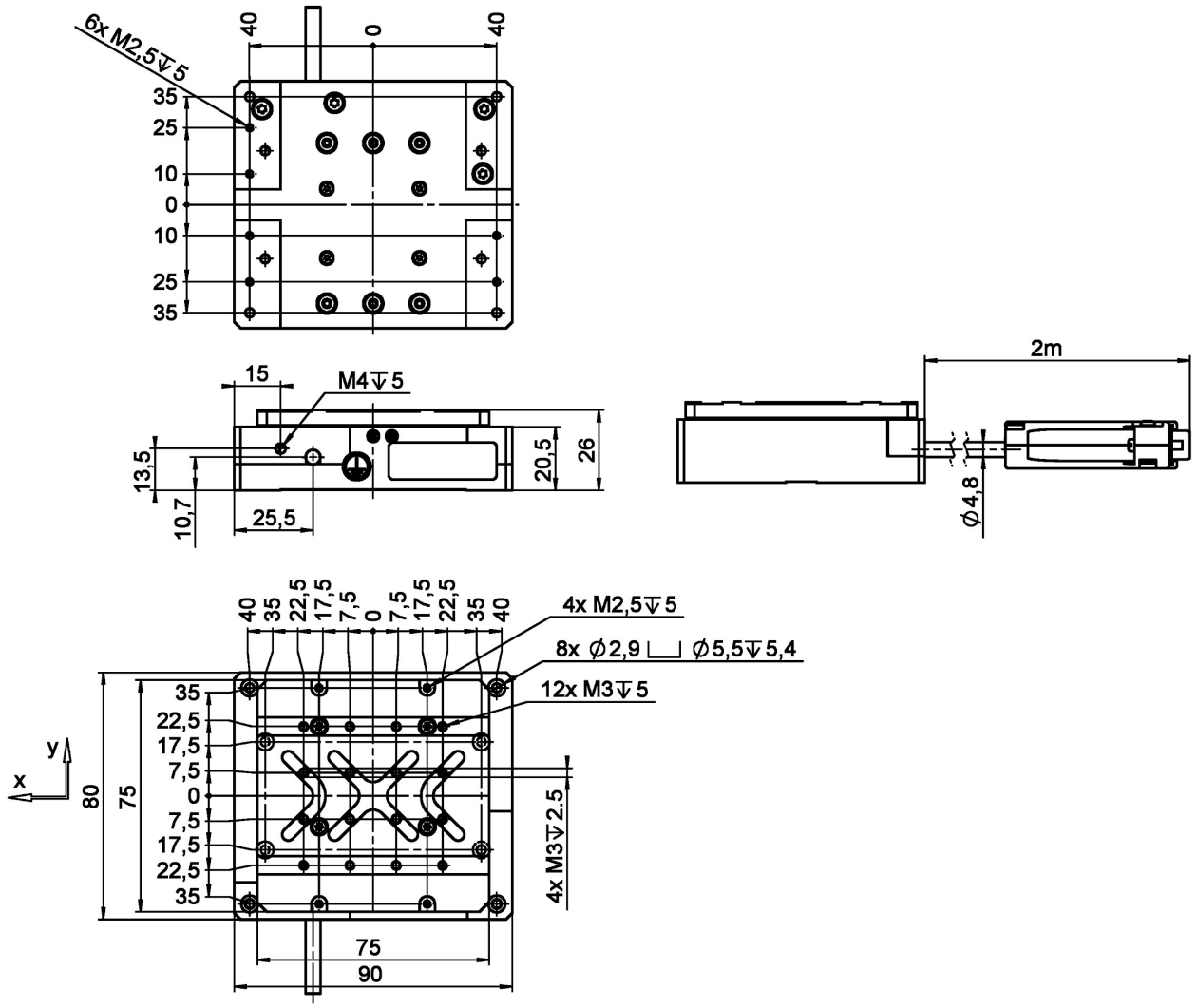

Figure 13: Dimensions of the V-524.1AB, cable exit in Y, see figure below.
The orientation of the Y axis corresponds to the positive motion direction of a V-52x.1AA mounted on top.

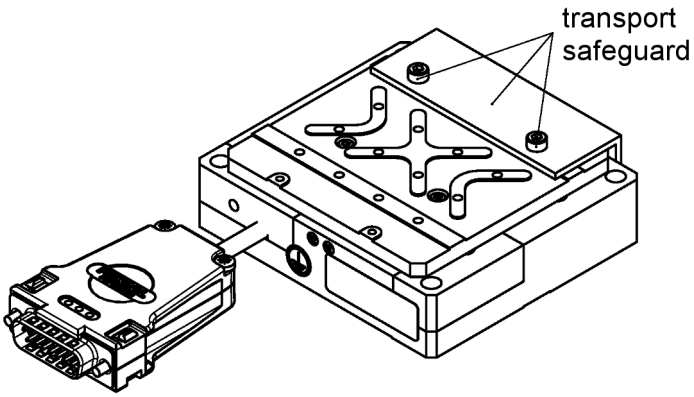

Figure 14: V-524.1AB with transport safeguard and cable exit

V-528.1AA

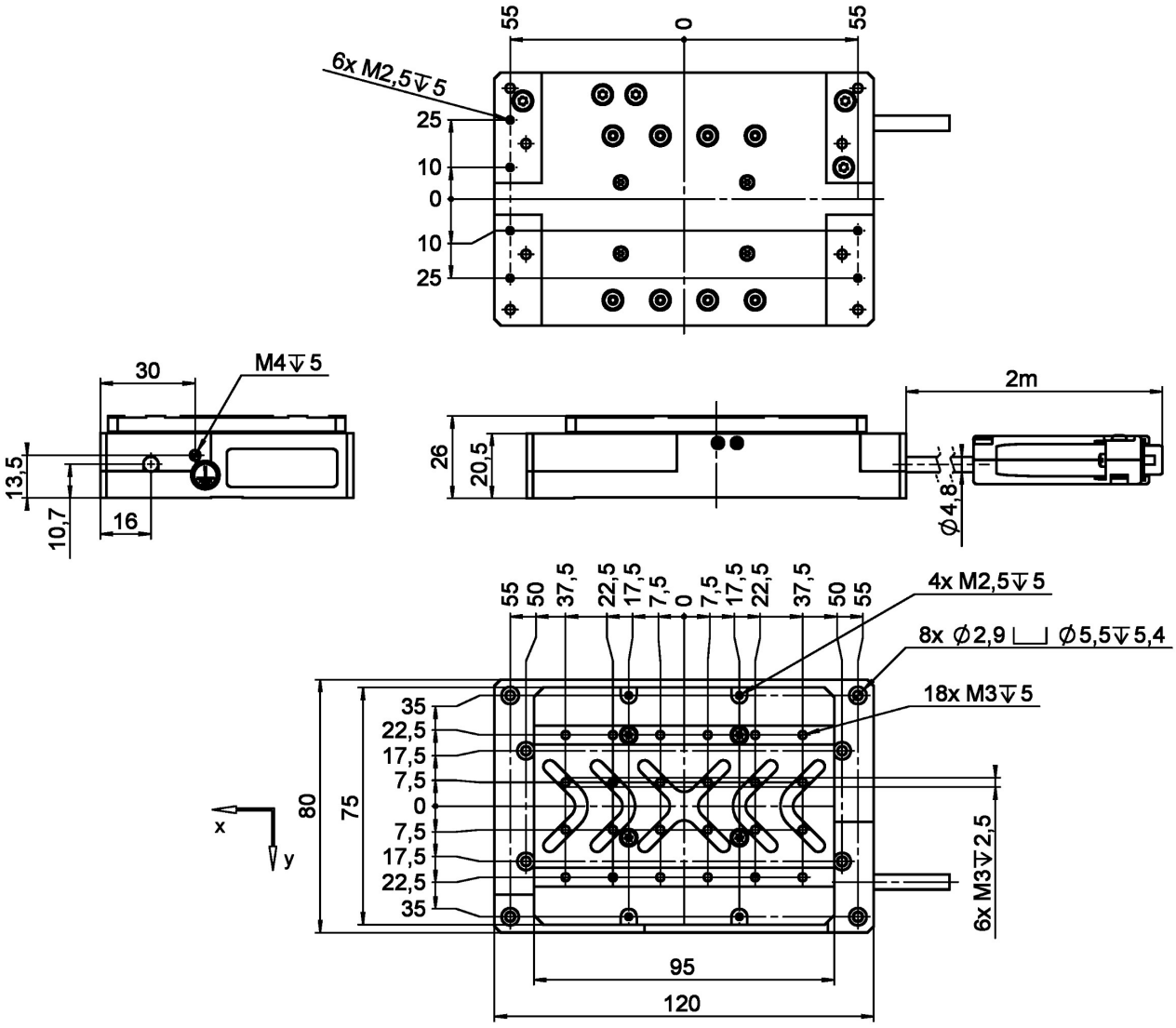

Figure 15: Dimensions of the V-528.1AA, cable exit in X, see figure below.
The orientation of the Y axis corresponds to the positive motion direction of a V-52x.1AB mounted on top.

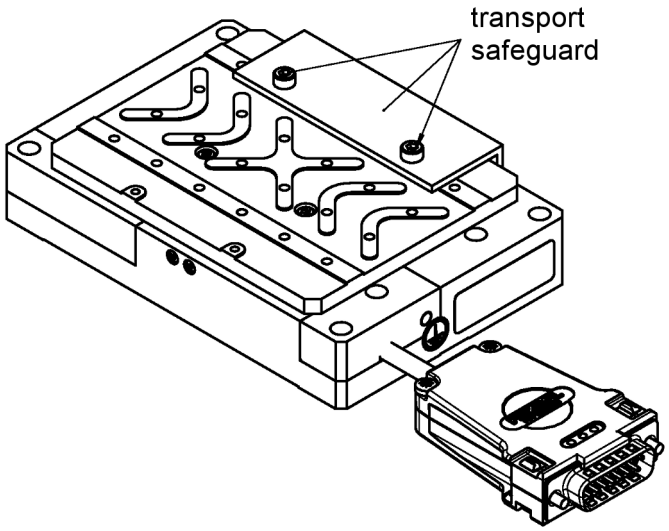

Figure 16: V-528.1AA with transport safeguard and cable exit

V-528.1AB

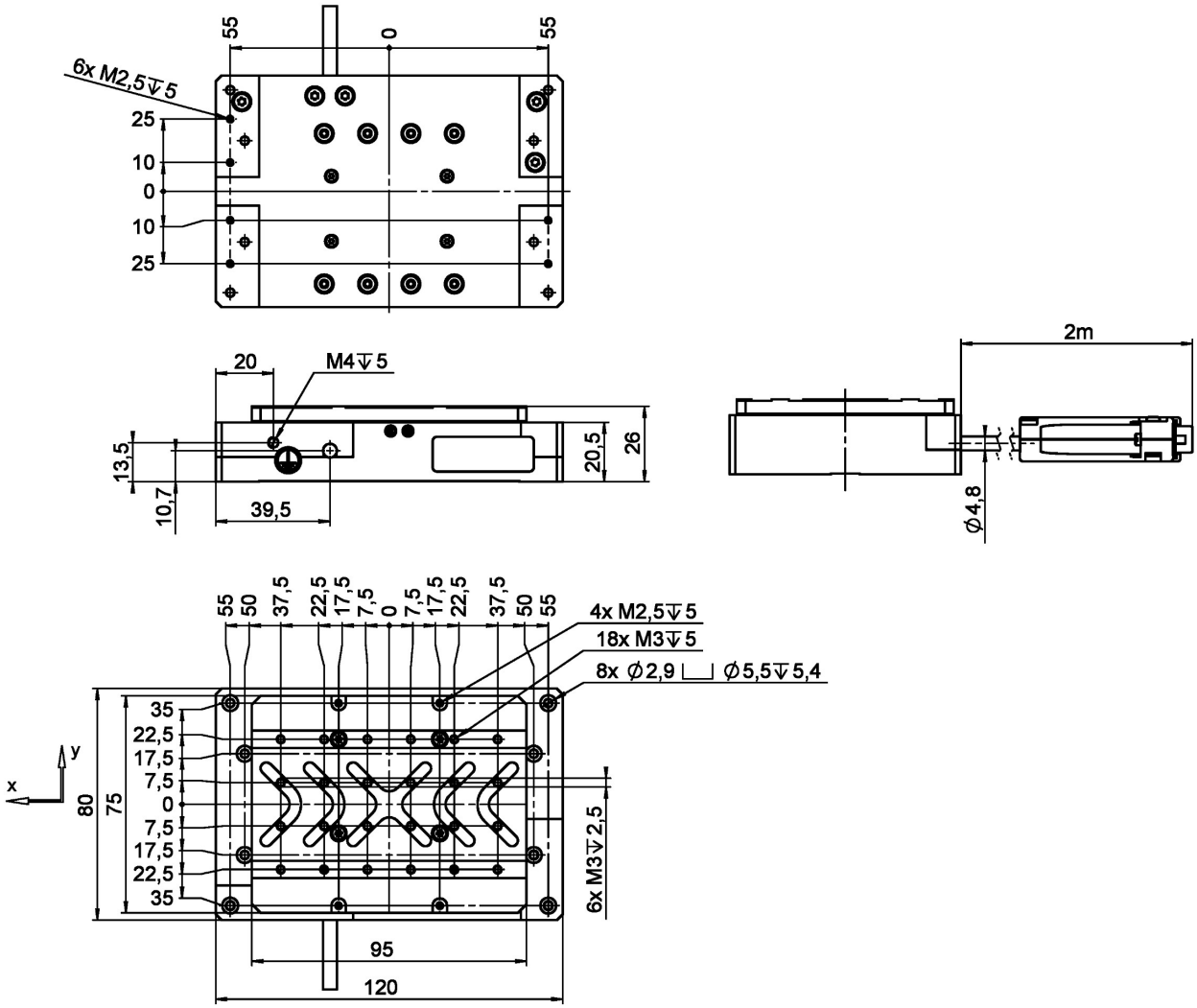

Figure 17: Dimensions of the V-528.1AB, cable exit in Y, see figure below.
The orientation of the Y axis corresponds to the positive motion direction of a V-52x.1AA mounted on top.

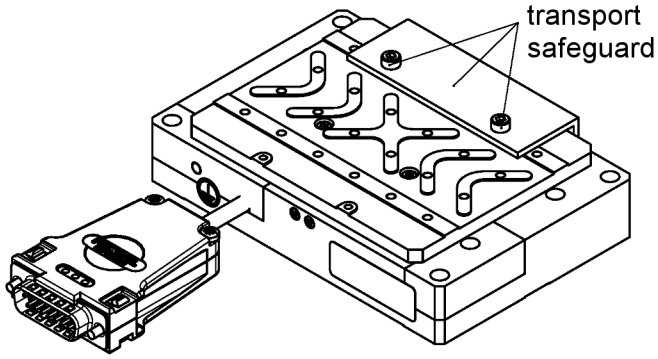

Figure 18: V-528.1AB with transport safeguard and cable exit

V-500.AP1 Adapter

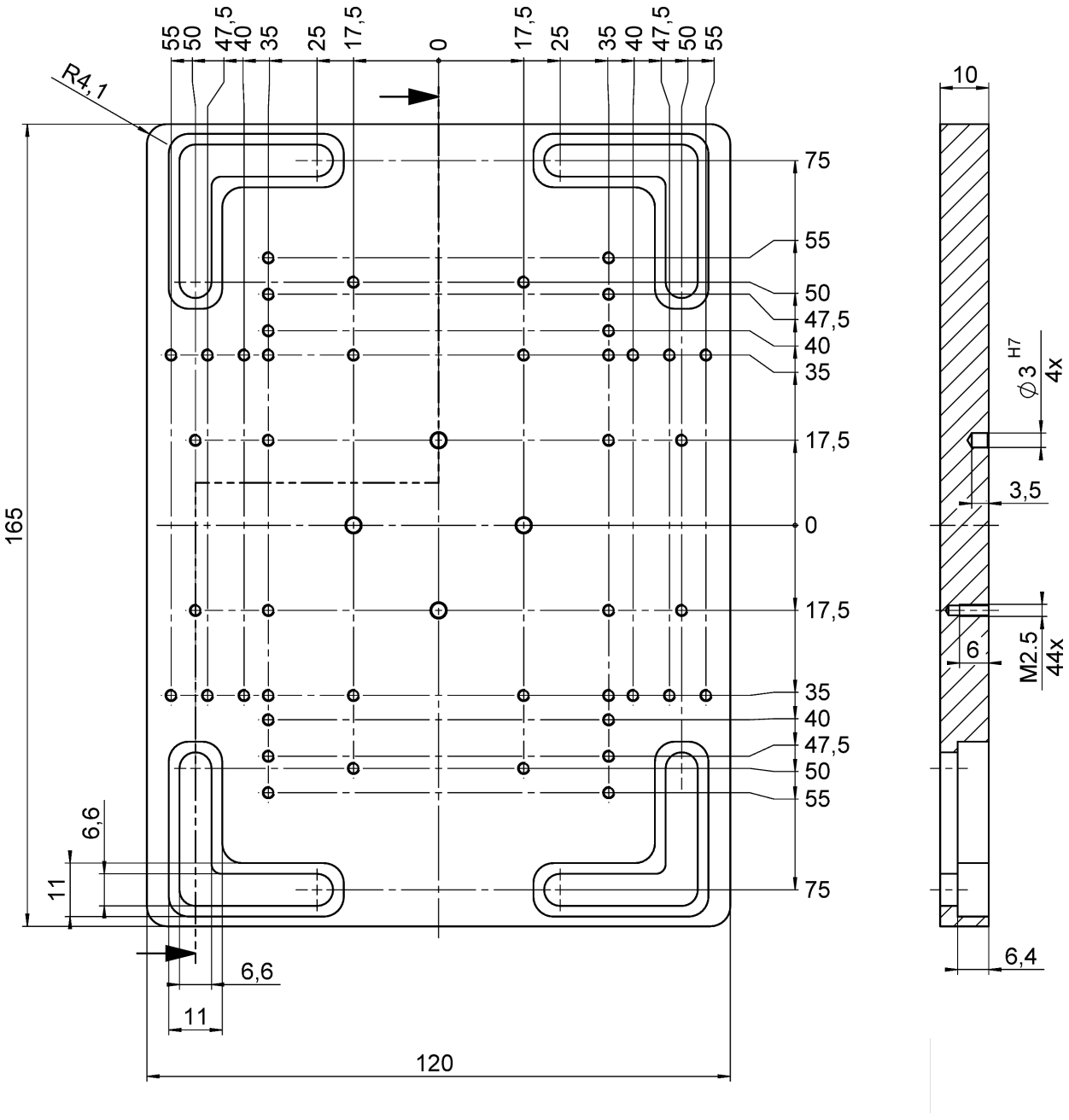

Figure 19: V-500.AP1

V-528.AP1 Adapter

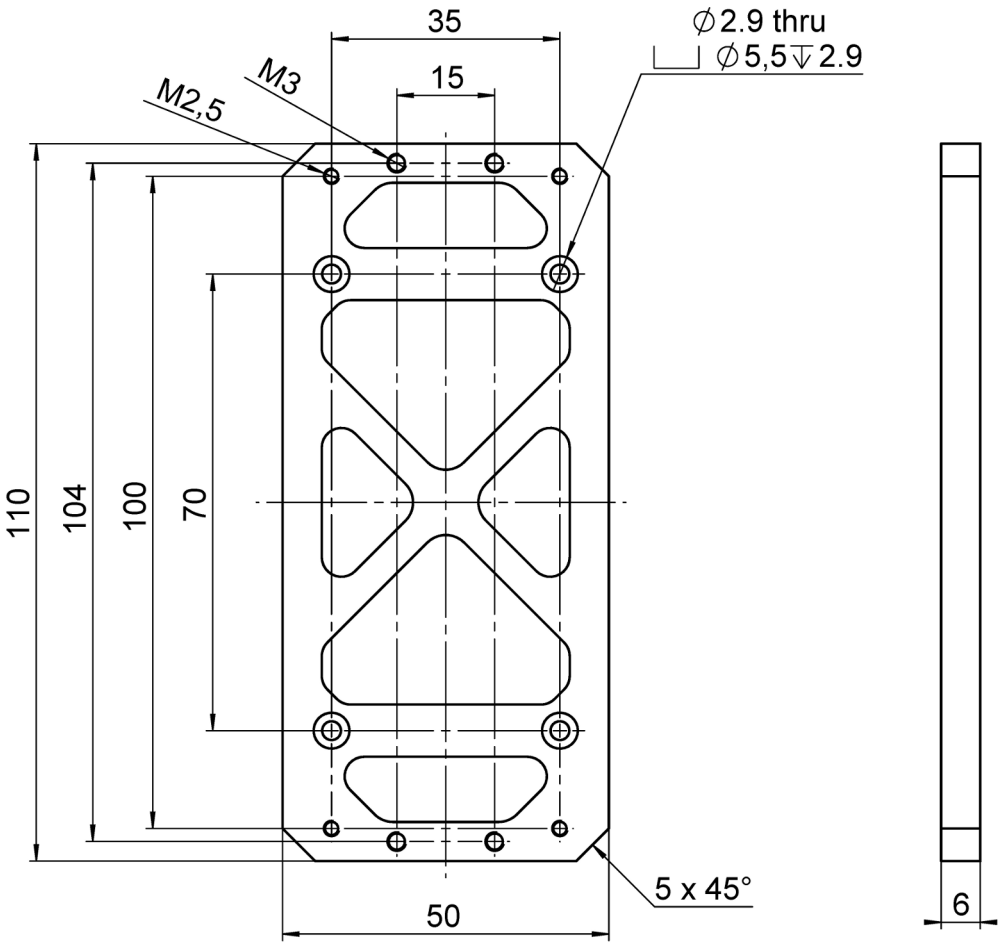

Figure 20: V528.AP1

Pin Assignments

Motor & Sensor

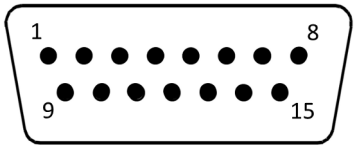

Figure 21: Sub-D 15 (m) connector

Pin	Function*	Direction
1	-	-
2	Motor (-)	Input current
3	AGND	GND
4	VDD, +5 V	Input
5	-	-
6	SPI_CS_EEPROM	TTL input
7	SPI_MOSI	TTL input
8	SPI_MISO	TTL output
9	Motor (+)	Input current
10	AGND	GND
11	AGND	GND
12	-	-
13	Reference	TTL output
14	SPI_CLK	TTL input
15	SPI_CS_SENSOR	TTL input

* The "-" sign indicates that the corresponding pin has not been assigned.

Old Equipment Disposal

In accordance with the applicable EU law, electrical and electronic equipment may not be disposed of with unsorted municipal wastes in the member states of the EU.

When disposing of your old equipment, observe the international, national and local rules and regulations.

To meet the manufacturer's product responsibility with regard to this product, Physik Instrumente (PI) GmbH & Co. KG ensures environmentally correct disposal of old PI equipment that was first put into circulation after 13 August 2005, free of charge.

If you have old PI equipment, you can send it postage-free to the following address:

Physik Instrumente (PI) GmbH & Co. KG

Auf der Römerstr. 1

D-76228 Karlsruhe, Germany