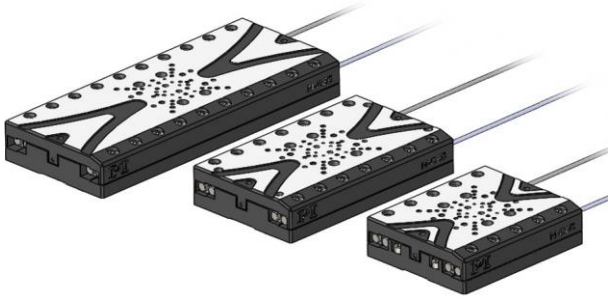
MP148E

N-565 NEXACT® Stage

User Manual

Version: 1.0.0 Date: 27.08.2015



This document describes the following products:

- **N-565.160**
  Precision Linear Stage, 13 mm Travel Range, PIOne Linear Encoder, 0.5 nm Resolution, 10 N Push/Pull Force, Dimensions, 65 × 80 × 20 mm (W × L × H), Piezoelectric Stepping Drive NEXACT®
- **N-565.260**
  Precision Linear Stage, 26 mm Travel Range, PIOne Linear Encoder, 0.5 nm Resolution, 10 N Push/Pull Force, Dimensions, 65 × 110 × 20 mm (W × L × H), Piezoelectric Stepping Drive NEXACT®
- **N-565.360**
  Precision Linear Stage, 52 mm Travel Range, PIOne Linear Encoder, 0.5 nm Resolution, 10 N Push/Pull Force, Dimensions, 65 × 160 × 20 mm (W × L × H), Piezoelectric Stepping Drive NEXACT®

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Subject to change without notice. This manual is superseded by any new release. The latest release is available for download (p. 3) on our website.

Contents

1 About this Document

In this Chapter

1.1 Objective and Target Audience of this User Manual

This manual contains information on the intended use of the N-565.

It assumes that the reader has a fundamental understanding of basic servo systems as well as motion control concepts and applicable safety procedures.

The latest versions of the user manuals are available for download (p. 3) on our website.

1.2 Symbols and Typographic Conventions

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

CAUTION

Dangerous situation

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

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

1.3 Definition

Term	Explanation
Load capacity	Maximum load capacity in the vertical direction when the stage is mounted horizontally. The contact point of the load is in the center of the platform.
Linear encoder	The linear encoder is an incremental sensor for capturing changes in position. Signals from the sensor are used for axis position feedback. After switching on the controller a reference point definition must be performed before absolute target positions can be commanded and reached.

1.4 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.

1.5 Other Applicable Documents

The devices and software tools which are mentioned in this documentation are described in their own manuals.

Product	Document
E-861 NEXACT® Servo Controller	PZ205E User Manual
PIMikroMove	SM148E Software Manual

1.6 Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:

➢ Contact our customer service department (p. 37).

INFORMATION

For products that are supplied with software (CD in the scope of delivery), access to the manuals is protected by a password. Protected manuals are only displayed on the website after entering the password.

The password is included on the CD of the product.

For products with CD: Identify the password

1. Insert the product CD into the PC drive.
2. Switch to the Manuals directory on the CD.
3. In the Manuals directory, open the Release News (file including ***releasenews*** in the file name).
4. Find the user name and the password in the section "User login for software download" in the Release News.

Downloading Manuals

1. Open the website **http://www.pi.ws**.
2. Click ***Info***.
3. If you have a user name and password:
   a) Click ***Login***.
   b) Log in with the user name and password.
4. Click ***>> Product Downloads***.
5. In the ***Product Files*** area, click the corresponding product category.
6. On the right-hand side of the page, select the corresponding sub-category.
7. Navigate to the product code on the page.

   The following manuals are displayed:

   – Freely accessible manuals
   – Manuals that are protected by a password
8. Click the desired manual and save it to the hard disk of your PC or to a data storage medium.

2 Safety

In this Chapter

2.1 Intended Use

The N-565 is a laboratory device as defined by DIN EN 61010-1. It is intended for indoor use and in an environment which is free of dirt, oil and lubricants.

In accordance with its design, the N-565 is intended for single-axis positioning, adjusting and shifting of loads at different velocities.

The N-565 is a stage for nanopositioning technology. The feed is produced by NEXACT® piezo actuators coupled to a ceramic rail (PiezoWalk® principle).

The N-565 is equipped with a linear encoder for direct position measurement.

The intended use of the N-565 is only possible when installed and in connection with a suitable controller (p. 11). The controller is not included in the scope of delivery of the N-565.

2.2 General Safety Instructions

The N-565 is built according to state-of-the-art technology and recognized safety standards. Improper use can result in personal injury and/or damage to the N-565.

- Only use the N-565 for its intended purpose, and only use it if it is in a good working order.
- Read the user manual.
- Immediately eliminate any faults and malfunctions that are likely to affect safety.

The operator is responsible for the correct installation and operation of the N-565.

2.3 Organizational Measures

User manual

- Always keep this user manual available with the N-565.
  The latest versions of the user manuals are available for download (p. 3) on our website.
- Add all information from the manufacturer to the user manual, for example supplements or Technical Notes.
- If you give the N-565 on to other users, 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 N-565 after you have read and understood this user manual.

Personnel qualification

The N-565 may only be installed, started up, operated, maintained and cleaned by authorized and appropriately qualified personnel.

3 Product Description

In this Chapter

3.1 Model Overview

The N-565 is available in the following versions:

Model	Description
N-565.160	Precision Linear Stage, 13 mm Travel Range, PIOne Linear Encoder, 0.5 nm Resolution, 10 N Push/Pull Force, Dimensions, 65 × 80 × 20 mm (W × L × H), Piezoelectric Stepping Drive NEXACT®
N-565.260	Precision Linear Stage, 26 mm Travel Range, PIOne Linear Encoder, 0.5 nm Resolution, 10 N Push/Pull Force, Dimensions, 65 × 110 × 20 mm (W × L × H), Piezoelectric Stepping Drive NEXACT®
N-565.360	Precision Linear Stage, 52 mm Travel Range, PIOne Linear Encoder, 0.5 nm Resolution, 10 N Push/Pull Force, Dimensions, 65 × 160 × 20 mm (W × L × H), Piezoelectric Stepping Drive NEXACT®

3.2 Product View

3.2.1 Product Details

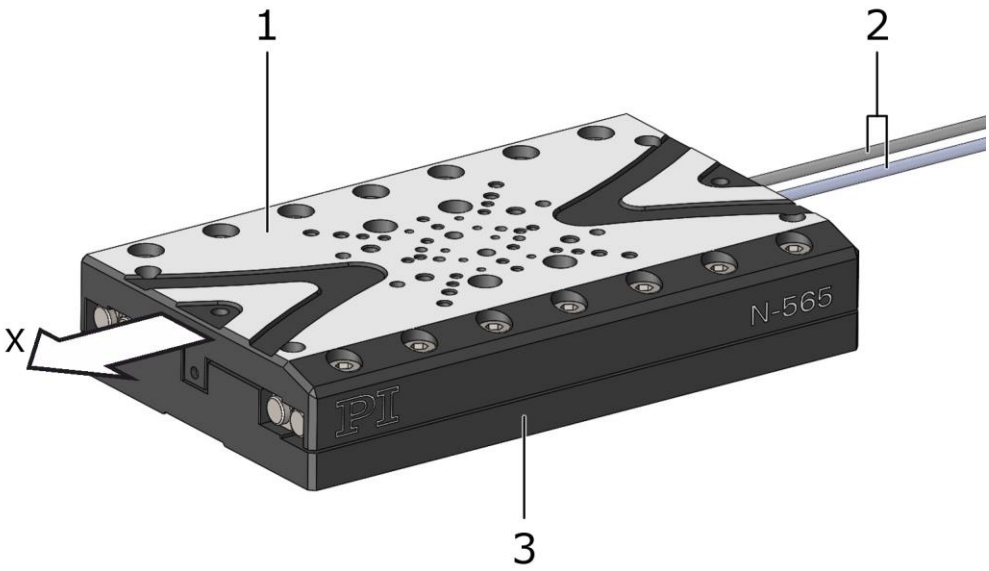


Figure 1: N-565 product view

1 Moving platform

2 Cables for connecting sensor and drive to the controller

3 Base body

The arrow in the figure shows the positive direction of motion.

3.2.2 Product Labeling

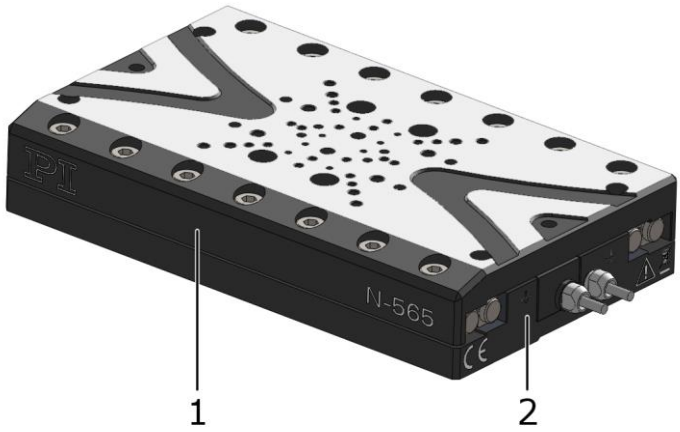


Figure 2: Position of the product labeling on the stage

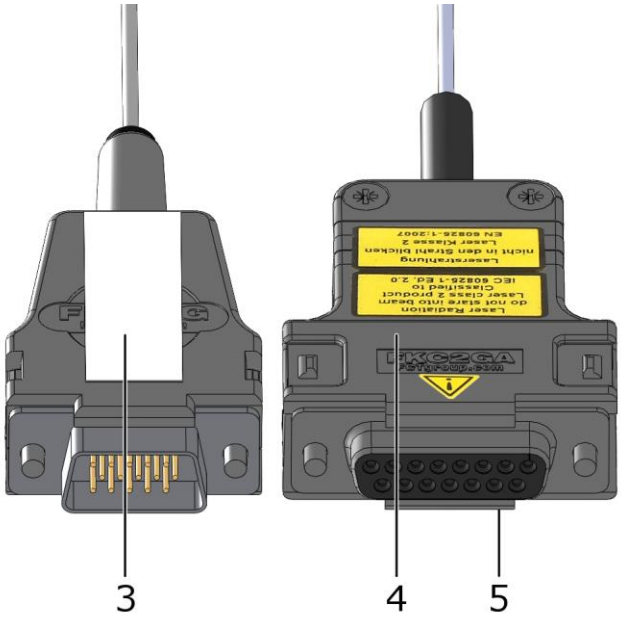
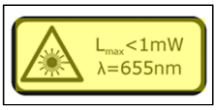


Figure 3: Position of the product labeling on the motor and sensor connector

Position	Labeling	Description
1, 3	N-565 / N-565.x60	Product name. Characters following the period identify the model exactly.
3	414000946	Serial number (example), individual for each N-565 Meaning of the places (counting from left): 1 = internal information, 2 and 3 = year of manufacture, 4 to 9 = consecutive numbers
2, 3		Warning sign "Observe manual!"
2, 3		Old equipment disposal (p. 47)
3	Country of origin: Germany	Country of origin
1, 3	PI	Manufacturer's logo
3	WWW.PIMICOS.COM	Manufacturer's address (website)
2, 3	CE	CE conformity mark
2		Symbol for the protective earth conductor, marks the position of the holes via which the N-565 is to be connected to the protective earth conductor
4		Notice of laser radiation (p. 33) (here: Top side of sensor connector)
4		Warning sign "Observe manual!" (here: Top side of sensor connector)
5		Warning sign and values for the laser (p. 33) (here: Bottom side of sensor connector)

3.3 Scope of Delivery

Item ID	Components
N-565	Stage according to order (p. 7)
5870500002	Screw set for mounting of the N-565: ▪ 4 M3x16 socket-head cap screws, ISO 4762 ▪ 2 dowel pins 3 m6 x 8, ISO 2338
000036450	Accessories for connection to the grounding system: ▪ 1 M4x8 flat-head screw with cross recess, ISO 7045 ▪ 2 safety washers ▪ 2 flat washers
N664B0001	Adapter Sub-D 15 (m) to HD Sub-D 15 (f) for sensor connection
MP137EK	Short instructions for the NEXACT® stage

3.4 Suitable Controllers

Controller	Description
E-861.1A1	Digital NEXACT® Controller

➢ To order, contact our customer service department (p. 37).

3.5 Technical Features

3.5.1 Linear Encoder (Sensor)

The stage is equipped with an optical linear encoder. For the encoder resolution, refer to the table in the "Specifications" section (p. 39).

Optical linear encoders measure the actual position directly (direct metrology). Therefore, errors occurring in the drivetrain, such as nonlinearity, backlash or elastic deformation, cannot influence the measurement of the position.

3.5.2 Reference Point Switch

The stage is equipped with a direction-sensing reference point switch that is located approximately in the middle of the travel range. This sensor transmits a TTL signal that indicates whether the stage is on the positive or negative side of the reference point switch.

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

4 Unpacking

1. Unpack the N-565 with care.
2. Compare the contents with the items listed in the contract and the packing list.
3. Inspect the contents for signs of damage. If parts are missing or you notice signs of damage, contact PI immediately.
4. Keep all packaging materials in case the product needs to be returned.

5 Installation

In this Chapter

5.1 General Notes on Installation

NOTICE

Damage from changes in position due to external forces!

Displacement of the moving platform of the stage from externally acting forces can damage the drive. Changes in position of the moving platform that are triggered by externally acting forces can also damage the load or the environment.

- Especially when the stage is vertically mounted, make sure that the forces that act on the moving platform in the direction of motion do **not** exceed the active push/pull force of the drive (p. 39).
- Initiate all motions by sending motion commands to the controller. Do **not** displace the moving platform manually.

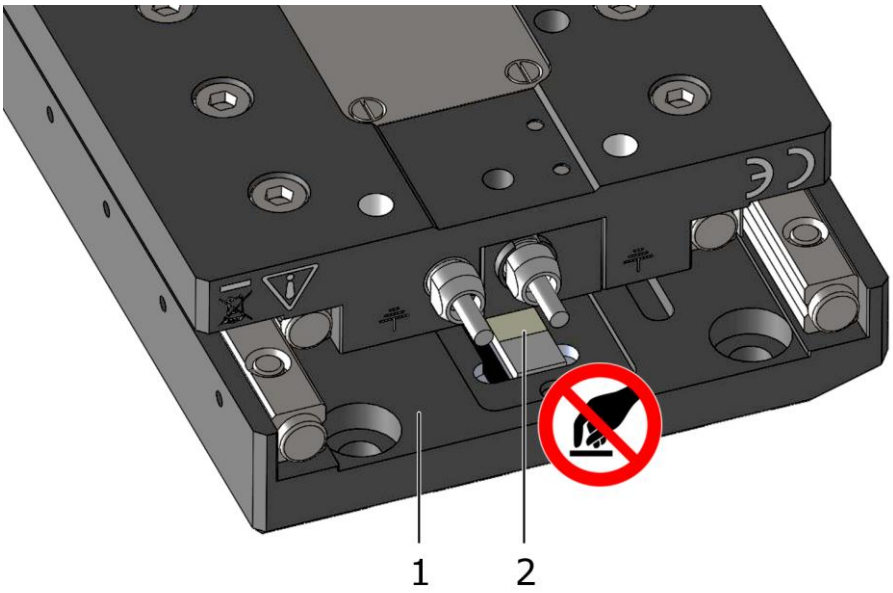


Figure 4: Accessible when the moving platform is driven out: Ruler of the linear encoder

1 Bottom of the moving platform of the N-565
2 Scale of the linear encoder, ***do not touch!***

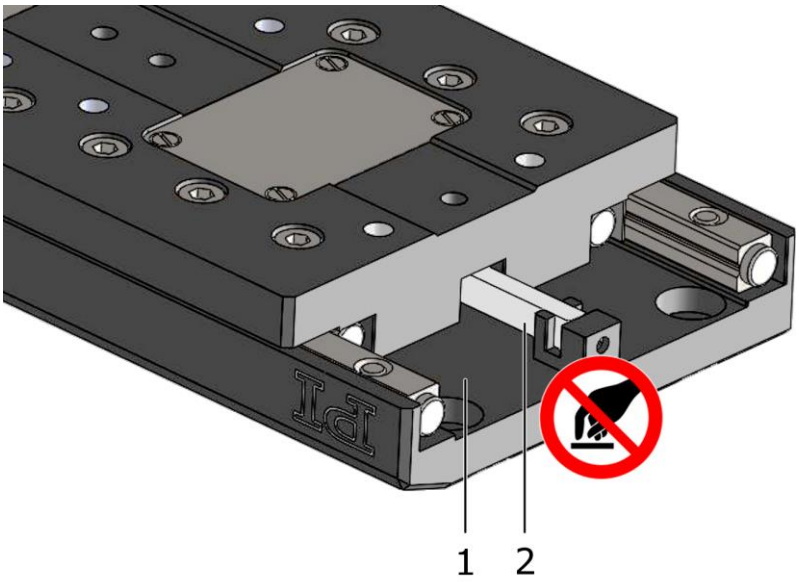


Figure 5: Accessible when the moving platform is driven out: Ceramic rail of the NEXACT® drive

1 Bottom of the moving platform of the N-565
2 Ceramic rail of the NEXACT® drive, ***do not touch!***

NOTICE

Damage from mechanical actions!

The ruler of the linear encoder is scratch-sensitive and can be damaged by mechanical actions, e.g. from pointed objects.

- ➢ Treat the ruler with extreme care.

The ruler is not accessible in the reference position of the moving platform (delivery state). If necessary before installation and demounting:

- ➢ Start up the stage (p. 29) and perform a reference move to the reference point switch (see the user manual of the controller).

NOTICE

Malfunction due to soiling!

Any type of soiling, e.g. dust, oil, grease or condensation, will render the N-565 inoperable.

- ➢ Keep the N-565 free from dirt and condensation.
- ➢ Avoid touching the ceramic rail of the NEXACT® drive and the ruler of the linear encoder.

The ceramic rail and the ruler are not accessible in the reference position of the moving platform (delivery state). If necessary before installation and demounting:

- ➢ Start up the stage (p. 29) and perform a reference move to the reference point switch (see the user manual of the controller).

NOTICE

Damage from incorrect mounting!

Incorrect mounting of the N-565 or incorrectly mounted parts can damage the N-565.

- ➢ Only mount the N-565 and the loads on the mounting fixtures (holes) intended for this purpose.

NOTICE

Warping of the N-565 due to mounting on uneven surfaces!

Mounting the N-565 on an uneven surface can warp the N-565. Warping reduces the accuracy.

- ➢ Mount the N-565 on an even surface. The recommended evenness of the surface is ≤10 µm.
- ➢ For applications with large temperature changes:
  Only mount the N-565 on surfaces that have the same or similar thermal expansion properties as the N-565.

NOTICE

Damage from unsuitable cables!

Unsuitable cables can damage the stage and the electronics.

- ➢ Only use cables provided by PI for connecting the N-565 to the electronics.

INFORMATION

For optimum repeatability, all components must be firmly affixed to each other.

5.2 Mounting the N-565 on a Surface

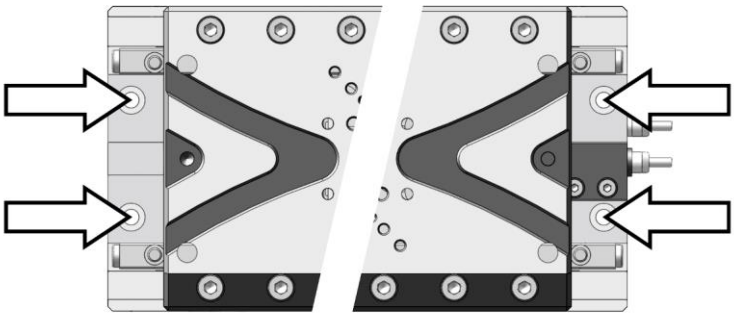
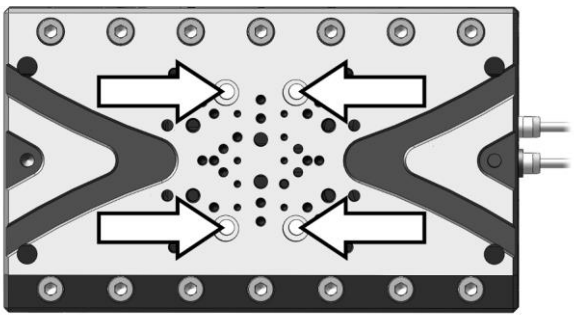
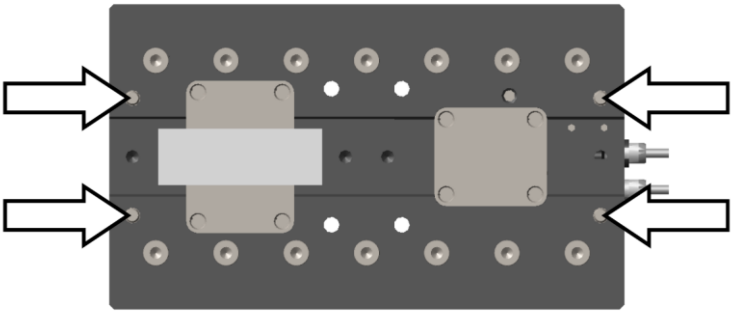
Options for mounting the N-565 onto a surface

INFORMATION

The mounting holes in the base body of the stage are only accessible from above when the moving platform is in the reference position (delivery state). If necessary:

- ➢ Start up the stage (p. 29) and perform a reference move to the reference point switch (see the user manual of the controller).

The mounting holes of the N-565 are intended for the following mounting options:

Mounting option	Mounting holes, details see "Dimensions" (p. 42)
Mounting from above with M3x12 screws	 *Figure 6: N-565, top view: M4 holes (with core hole diameter Ø 3.4 mm and counterbore), for mounting from above with M3 screws*
Mounting from above with M3x12 screws This mounting option is used e.g. when setting up an XY system consisting of two N-565 stages (p. 22).	 *Figure 7: N-565, top view: holes with Ø 3.4 mm and counterbore, for mounting from above with M3 screws*
Mounting from below with M4 screws	 *Figure 8: N-565, bottom view: M4 holes for mounting from below with M4 screws*

NOTICE

Screws that are too long!

The N-565 can be damaged by screws that are screwed in too deeply.

- ➢ Observe the depth of the mounting holes (p. 42).
- ➢ Only use screws of the correct length for the respective mounting holes.

NOTICE

Protruding screw heads!

Protruding screw heads can damage the N-565.

- ➢ Ensure that the screw heads do not protrude from countersunk holes so that they do not interfere with the stage motion.

Prerequisites

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have provided a suitable surface. For the required position of the holes, see "Dimensions" (p. 42).
  - For mounting from **above with M3x12 screws**: Four M3 holes with a depth of at least 5 mm are provided.
  - For mounting from **below with M4 screws**: Four through-holes for M4 screws are provided. The thickness of the surface and the depth of the counterbores at the through-holes in the surface are matched so that compliance with the maximum screw-in depth of 7.5 mm in the N-565 is observed.
  - The evenness of the surface is ≤10 µm.
  - For applications with large temperature changes:
    The surface should have the same or similar thermal expansion properties as the N-565.
- ✓ You have accounted for the space required to route cables without bending and according to regulations.

Tools and accessories

- Screws according to the selected mounting option (see above):
  - Four M3x12 screws, in the scope of delivery

  or

  - 4 M4 screws of suitable length, not in the scope of delivery
- Suitable screwdriver:

Mounting the N-565 on a Surface

1. Only for mounting from **above:**

   When the required mounting holes in the base body of the N-565 are covered by the moving platform:

   - Start up the stage (p. 29) and command the moving platform to a suitable position (see user manual of the controller and arrows in the illustration).
2. Align the stage on the surface so that the corresponding mounting holes in the stage and the surface overlap.
3. Screw the screws into the mounting holes according to the selected mounting option (p. 29):

   - Mounting from **above**: Insert the screws through the moving platform and the base body of the N-565 into the surface.
   - Mounting from **below**: Insert the screws through the surface into the base body of the N-565. Maximum screw-in depth: 7.5 mm.

   Maximum torque: 0.5 Nm
4. Make sure that screw heads do not protrude from the countersunk holes.
5. Check that the N-565 is affixed firmly to the surface.

5.3 Setting Up an XY System

Two N-565 stages can be combined to an XY system.

- ➢ For further combination possibilities, contact our customer service department (p. 37).

NOTICE

Impermissibly high load on the stages!

In an XY system, the stage for the Y-axis must be moved as well. Impermissibly high loads interfere with the motion and can damage the stages.

- ➢ Include the mass of the moved stage in the calculation of the load to be moved.
- ➢ For all stages in a multi-axis system: Do **not** exceed the maximum permissible load.
- ➢ For all stages in a multi-axis system, make sure that forces that act upon the moving platform in the respective direction of motion do **not** exceed the active push/pull force of the drive (p. 39).

Designations in these instructions:

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

Prerequisites

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have accounted for the space required to route cables without bending and according to regulations.
- ✓ You have properly attached the lower stage to a surface (p. 18).

Tools and accessories

- 4 M3 screws, in the scope of delivery of the upper stage (p. 11)
- Suitable screwdriver

Setting up an XY system

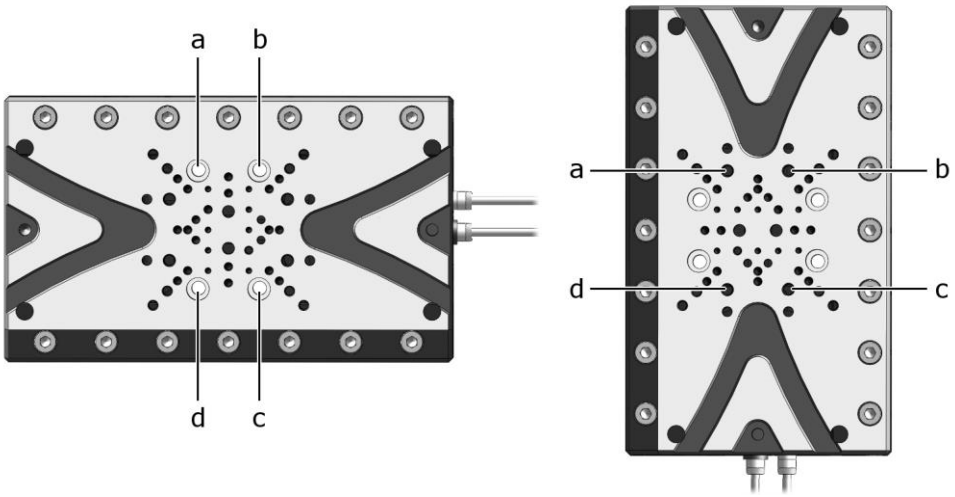


Figure 9: Setting up an XY system consisting of two N-565.260 stages

1 Upper stage (moving platform in reference position) with
a - d) mounting holes Ø 3.4 mm with counterbore for M3 socket head cap screws
2 Lower stage with
a - d) M3 mounting holes in the platform
Holes that overlap during attachment are marked with the same letter.

1. If necessary: Make the required mounting holes in the base body of the upper stage accessible.
   - Start up the upper stage (p. 29) and perform a reference move to the reference point switch (see the user manual of the controller).
2. Position the upper stage rotated by 90° on the moving platform of the lower stage (see above figure).
3. Align the upper stage so that the required mounting holes in the upper and lower stage overlap (holes a to d in the above figure).
4. Completely screw in one M3 screw into each of the holes.
5. Make sure that screw heads do not protrude from the countersunk holes.
6. Check that the upper stage is affixed firmly.

5.4 Affixing the Load to the N-565

NOTICE

Screws that are too long!

The N-565 can be damaged by screws that are screwed in too deeply.

- ➢ Observe the depth of the mounting holes (p. 42).
- ➢ Only use screws of the correct length for the respective mounting holes.

Prerequisites

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have properly (p. 18) mounted the stage.
- ✓ You have prepared the load so that it can be affixed to the mounting holes on the moving platform:
  - The distance between the center of gravity of the load and the center of the moving platform is as small as possible in all directions.
  - At least two points are provided for affixing the load on the moving platform.

Tools and accessories

- At least two screws of suitable length. Options:
  - M2.5 screws
  - M3 screws
- Suitable tools for fastening the screws

Affixing the load to the N-565

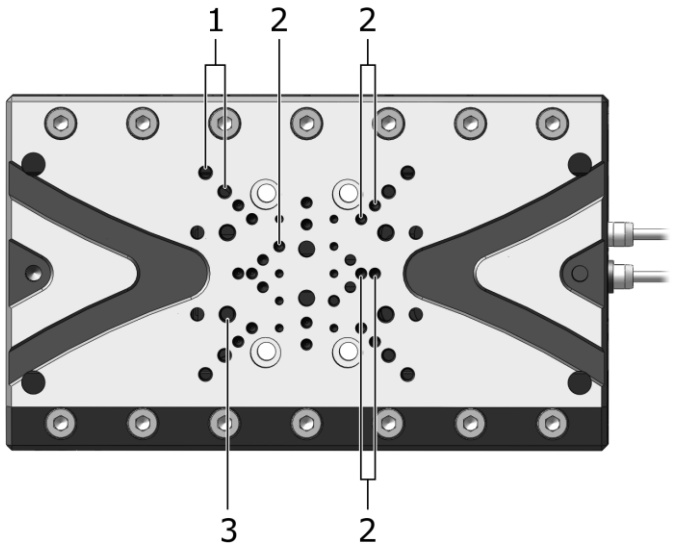


Figure 10: Mounting holes for affixing the load to the moving platform

1 8 x M2.5 holes with 4 mm thread depth
2 18 x M2 holes with 3 mm thread depth
3 4 x M3 holes with 5 mm thread depth
For the exact position, see Dimensions (p. 42)

1. Align the load so that the selected mounting holes in the moving platform can be used for affixing it.
2. Affix the load to the selected mounting holes in the moving platform using the screws.

   Maximum screw-in depth in the moving platform of the N-565:

   – M2 screws: 3 mm
   – M2.5 screws: 4 mm
   – M3 screws: 5 mm

   Maximum torque:

   – M2 screws: 0.3 Nm
   – M2.5 screws: 0.7 Nm
   – M3 screws: 1.3 Nm
3. Check that the load is affixed firmly to the moving platform of the stage.

5.5 Connecting the N-565 to the Controller

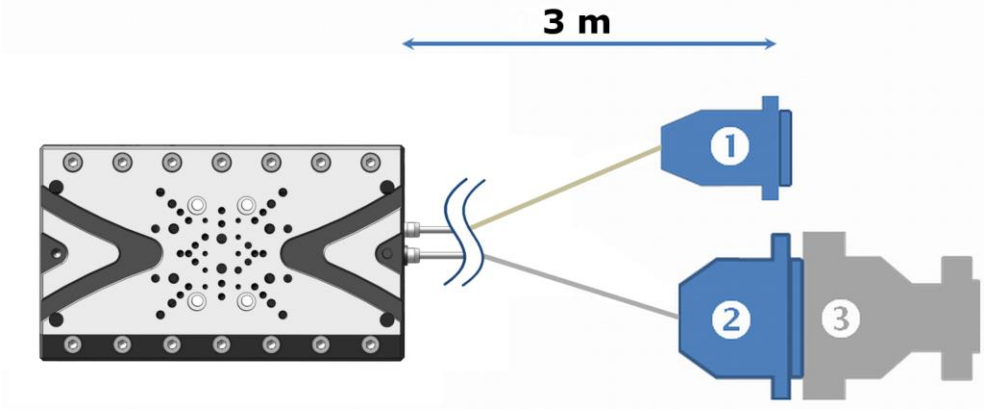


Figure 11: N-565: Connections

1 *HD Sub-D 15 (m) drive connector*
2 *Sub-D 15 (f) sensor connector*
3 *Adapter Sub-D 15 (m) to HD Sub-D 15 (f)*

Prerequisites

- ✓ You have read and understood the general notes on installation (p. 15).
- ✓ You have installed a suitable controller (p. 11).
- ✓ You have read and understood the user manual of the controller.
- ✓ The controller is switched off.

Tools and accessories

N664B0001 adapter, in the scope of delivery (p. 11)

- Screwdriver for slotted screws (SL)

Connecting the N-565 to the E-861.1A1 controller

1. Connect the drive connector of the stage to the corresponding controller socket (see user manual of the controller).
2. Connect the sensor connector (f) of the stage to the controller:
   a) Connect the sensor connector (f) of the stage to the connector side of the adapter (Sub-D 15 (m)).
   b) Secure the connection with the integrated screws against accidental disconnection.
   c) Connect the female side of the adapter (HD Sub-D 15 (f)) to the panel plug of the controller (see user manual of the controller).
3. Secure the connections on the controller with the integrated screws against accidental disconnection.

6 Start-Up and Operation

In this Chapter

6.1 General Notes on Start-Up and Operation

NOTICE

Damage from collisions!

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

- ➢ 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.
- ➢ Do not place any objects in areas where they can be caught by moving parts.
- ➢ Stop the motion immediately if a controller malfunction occurs.
- ➢ If possible, adapt the travel range limits of your mechanical system in the software that you use for commanding the motion.

NOTICE

Damage from changes in position due to external forces!

Displacement of the moving platform of the stage from externally acting forces can damage the drive. Changes in position of the moving platform that are triggered by externally acting forces can also damage the load or the environment.

- ➢ Especially when the stage is vertically mounted, make sure that the forces that act on the moving platform in the direction of motion do **not** exceed the active push/pull force of the drive (p. 39).
- ➢ Initiate all motions by sending motion commands to the controller. Do **not** displace the moving platform manually.

NOTICE

Uncontrolled oscillation!

Your application and the N-565 can be damaged by uncontrolled oscillations. Uncontrolled oscillations can be identified by the fact that the stage approaches the target position too slowly or too fast or does not keep it stable (servo jitter).

If uncontrolled oscillations occur during the operation of the N-565:

- ➢ Immediately switch off the servo-control system of the affected axis.
- ➢ Check the settings of the servo-control parameters.

INFORMATION

Shock-like impacts can cause encoder malfunction.

- ➢ Protect the stage from shock-like impacts.
- ➢ Carry out a reference move (see user manual of the controller).

INFORMATION

The positive direction of motion is away from the cable exit side.

INFORMATION

The repeatability of the positioning is only ensured when the reference point switch is always approached from the same side. Recommended controllers from PI fulfill this requirement with their automatic direction detection for reference moves to the reference point switch.

6.2 Operating Parameters

If you use the software included in the scope of delivery of the E-861.1A1 controller, the operating parameters can be loaded from the *PIMicosStages2.dat* stage database.

- ➢ Download the PI Update Finder from the PI website (http://update.pi-portal.ws) and use it to update the *PIMicosStages2.dat* stage database on your PC.

For further information on the stage databases, refer to the user manual of the E-861.1A1 controller.

6.3 Operating the N-565

Prerequisites

- ✓ You have read and understood the general notes on start-up and operation (p. 29).
- ✓ You have read and understood the user manual of the controller.
- ✓ You have read and understood the user manual of the PC software.
- ✓ You have properly mounted the stage (p. 15).
- ✓ The controller and the required PC software have been installed. All connections with the controller have been established (see user manual of the controller).

Operating the N-565

- ➢ Follow the instructions in the manual of the controller used for startup and operation of the N-565.

6.4 Discharging the Piezo Actuators of the Drive

INFORMATION

The N-565 is driven by NEXACT® piezo actuators. Temperature changes and compressive stresses can induce charges in piezo actuators. After being disconnected from the electronics, piezo actuators can stay charged for several hours. Touching or short-circuiting the contacts in the drive connector of the N-565 can trigger unpleasant electric shocks.

If you want to avoid these unpleasant electric shocks:

- ➢ Discharge the stage **before** you pull out the drive connector from the controller.

Discharging the piezo actuators of the drive

If you want to pull out the connector of the drive from the controller:

1. If you are working in closed-loop operation: Switch off the servo mode on the controller.
2. Set the piezo voltage on the controller to 0 V by sending an `RNP` command (see user manual of the controller).
3. If possible: Switch off the controller.
4. Wait at least 10 seconds before disconnecting the controller.

7 Maintenance

In this Chapter

7.1 General Notes on Maintenance

The N-565 is maintenance-free.

7.2 Cleaning the N-565

Prerequisites

- ✓ You have discharged the piezo actuators of the N-565.
- ✓ You have disconnected the N-565 from the controller.

Cleaning the N-565

- ➢ Clean the surfaces of the N-565 with a cloth that is slightly dampened with a mild cleanser or disinfectant (e.g. ethanol or isopropanol).
- ➢ Do **not** do any ultrasonic cleaning.

8 Troubleshooting

In this Chapter

8.1 General Notes on Troubleshooting

CAUTION

Risk of glare and irritation!

The linear encoder of the N-565 uses a class 2 laser according to DIN EN60825-1:2007. Technical data of the laser: $L_{max} \leq 1$ mW, λ=655 nm.

On delivery and if used according to the intended use of the N-565, the laser is fully shielded. Laser radiation can exit from the laser only if N-565 is opened. The laser beam can cause glare and irritation.

- Do **not** open or disassemble the N-565.
- Contact our customer service department if there is any malfunction of the N-565.

8.2 Possible Causes and Correction

Problem	Possible Causes	Solution
Target position is approached too slowly or with overshoot	▪ Servo-control parameters are not optimally set ▪ Large changes in the load	1. Switch off the servo-control system immediately. 2. Check the settings of the servo-control parameters. 3. If necessary, correct the settings of the servo-control parameters.
Target position is not kept stable		
Uncontrolled oscillation of the N-565		
Reduced holding force and feed force	▪ Ceramic rail of the NEXACT® drive is soiled	➢ Contact our customer service department (p. 37).
No or limited motion	▪ Excessive load	➢ Reduce the load (see "Data Table" (p. 39)).
	▪ Scale of the encoder is soiled, e.g. from being touched	➢ Contact our customer service department (p. 37).
	▪ Encoder malfunction due to shock impact	➢ Carry out a reference move (see user manual of the controller)

If the problem that occurred with your system is not listed in the table above or cannot be solved as described, contact our customer service department (p. 37).

9 Customer Service

For inquiries and orders, contact your PI sales engineer or send us an e-mail (info@pi.ws).

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

The latest versions of the user manuals are available for download (p. 3) on our website.

10 Technical Data

In this Chapter

10.1 Specifications

10.1.1 Data Table

Preliminary data	N-565.160	N-565.260	N-565.360	Unit	Tolerance
Active axes	X	X	X		
Motion and Positioning					
Travel	13	26	52	mm	
Integrated sensor	Optical linear encoder PIOne	Optical linear encoder PIOne	Optical linear encoder PIOne		
Sensor resolution	0.5	0.5	0.5	nm	
Minimum incremental motion	2	2	2	nm	
Velocity, closed-loop	10	10	10	mm/s	max.
Unidirectional repeatability	±5	±5	±5	nm	typ.
Pitch at full travel range	±30	±40	±80	µrad	typ.
Yaw at full travel range	±30	±30	±30		
Straightness and flatness of motion at full travel range	±1	±1	±1.5	µm	typ.
Mechanical Properties					
Load capacity	20	20	20	N	max.
Feed force (active)	10	10	10	N	max.
Holding force (passive)	10	10	10	N	min.

Drive Properties					
Motor Type	NEXACT® piezo stepping drive	NEXACT® piezo stepping drive	NEXACT® piezo stepping drive		
Operating voltage	-10 to 50	-10 to 50	-10 to 50	V	
Miscellaneous					
Operating temperature range	10 to 50	10 to 50	10 to 50	°C	
Material	Al (black anodized)	Al (black anodized)	Al (black anodized)		
Mass	0.3	0.4	0.6	kg	±5 %
Dimensions	65 × 80 × 20	65 × 110 × 20	65 × 160 × 20	mm	
Cable length	3	3	3	m	±10 mm
Connector	HD Sub-D (m) 15-pin (motor) HD Sub-D (f) 15-pin (sensor)	HD Sub-D (m) 15-pin (motor) HD Sub-D (f) 15-pin (sensor)	HD Sub-D (m) 15-pin (motor) HD Sub-D (f) 15-pin (sensor)		
Recommended controller/driver	E-861.1A1: single-axis motion controller E-712: modular controller system for up to 6 axes	E-861.E-861.1A1: single-axis motion controller E-712: modular controller system for up to 6 axes	E-861.1A1: single-axis motion controller E-712: modular controller system for up to 6 axes		

* The N-565 stage series replaces the LPS-65 series.

10.1.2 Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the N-565:

Area of application	For indoor use only
Maximum altitude	2000 m
Air pressure	1100 hPa to 0.1 hPa
Relative humidity	Highest relative humidity 80 % for temperatures to 31 °C, non-condensing Decreasing linearly to 50 % relative humidity at 40 °C, non-condensing
Operating temperature	10 °C to 50 °C
Storage temperature	-20 °C to 60 °C
Transport temperature	-20 °C to 60 °C
Overvoltage category (in acc. with EN 60664-1:2007 / VDE 0110-1)	II
Protection class (acc. to EN 61140 / VDE 0140-1)	I
Degree of pollution (acc. to EN 60664-1:2007 / VDE 0110-1)	1
Degree of protection (acc. to IEC 60529)	IP20

10.2 Maximum Ratings

The stage is designed for the following operating data:

Maximum Operating Voltage	**Maximum Operating Frequency**	**Maximum Power Consumption**
45 V	1500 Hz	40 W

10.3 Dimensions

Dimensions in mm.

Characters used to separate decimal places:

- Depth and diameter of holes: Period
- All other dimensions: Comma

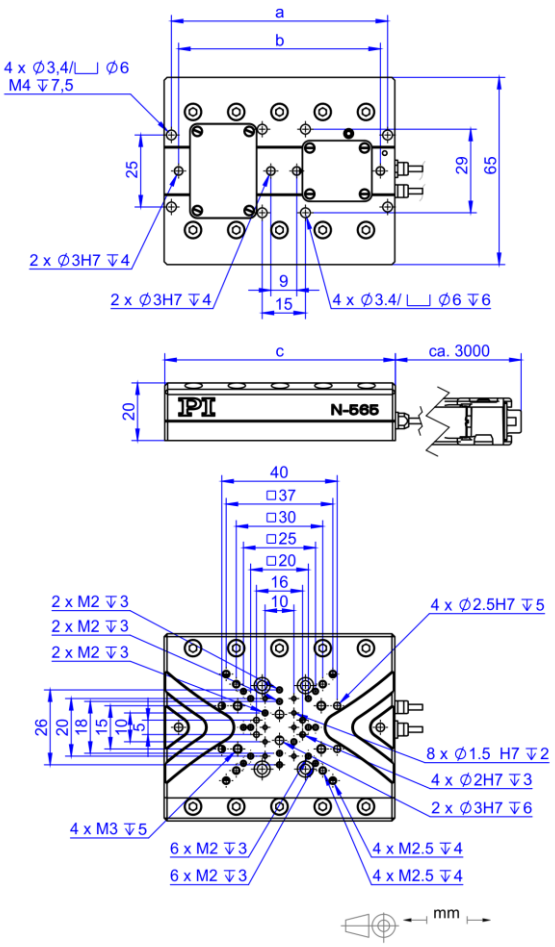


Figure 12: Dimensions of the N-565

Models	a	b	c
N-565.160	75	70	80
N-565.260	100	100	110
N-565.360	150	150	160

10.4 Pin Assignment

10.4.1 Drive Connection

The HD Sub-D-15 connector transmits the signals to control the drive.

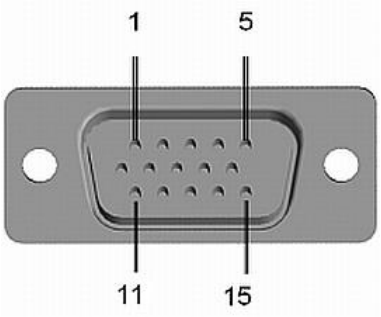


Figure 13: HD Sub-D 15 connector (m) for the drive, mating side

Pin	Function*	Direction
1	Piezo 1	Input
2	Piezo 3	Input
3	-	-
4	-	-
5	-	-
6	Piezo 0	Input
7	Piezo 2	Input
8	AMP ("Amplifier enable")**	Output
9	-	-
10	-	-
11	Piezo GND	AGND
12	Piezo GND	AGND
13	-	-
14	-	-
15	Internal use	-

* The character "-" indicates that the corresponding pin is not connected.

** This pin is connected to the GND in the connector shell. In the E-861.1A1 controller, this pin is used to activate the amplifiers.

10.4.2 Sensor Connection

Pin assignment of the Sub-D (f) connector on the N-565

The Sub-D 15 connection transmits the signals from and to the integrated incremental linear encoder ("sensor") and the reference point switch.

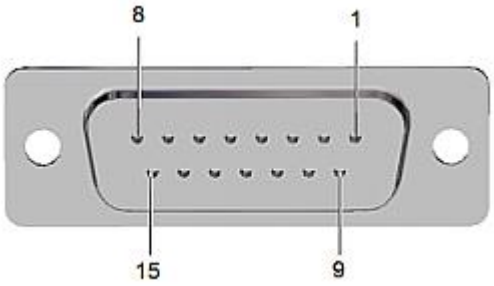


Figure 14: Sub-D 15 connector (f) for sensor, mating side

Pin	Signal*	Function	Direction
1	V_{DD}	Supply voltage (+ 5V)	Input
2	GND	GND	GND
3	COS +	Encoder signal 1 (cosine)	Output
4	COS -	Encoder signal 1 (cosine, inverted)	Output
5	-	-	-
6	SIN +	Encoder signal 2 (sine)	Output
7	SIN -	Encoder signal 2 (sine, inverted)	Output
8	-	-	-
9	-	-	-
10	REF	Reference point switch	Output
11	-	-	-
12	-	-	-
13	-	-	-
14	-	-	-
15	-	-	-

* The character "-" indicates that the corresponding pin is not connected.

10.4.3 Pin Assignment of the N664B0001 Adapter

The pin assignments for the N664B0001 adapter that is included in the scope of delivery of the N-565 are as follows:

- Sub-D 15 (m) connector: See "Sensor Connection for N-565"
- HD Sub-D 15 (f) connector: See following table

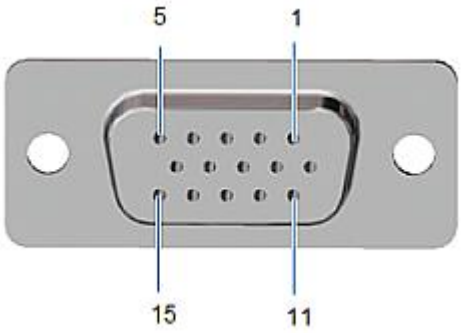


Figure 15: HD Sub-D 15 (f) connector for sensor, mating side

Pin	Signal*	Function	Direction
1	REF	Reference point switch	Output
2	V_{DD}	Supply voltage (+ 5V)	Input
3	-	-	-
4	COS +	Encoder signal 2 (cosine)	Output
5	SIN +	Encoder signal 1 (sine)	Output
6	-	-	-
7	-	-	-
8	-	-	-
9	COS -	Encoder signal 2 (cosine, inverted)	Output
10	SIN -	Encoder signal 1 (sine, inverted)	Output
11	-	-	-
12	-	-	-
13	-	-	-
14	GND	GND	GND
15	-	-	-

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

11 Old Equipment Disposal

In accordance with EU law, electrical and electronic equipment may not be disposed of in EU member states via the municipal residual waste.

Dispose of your old equipment according to international, national, and local rules and regulations.

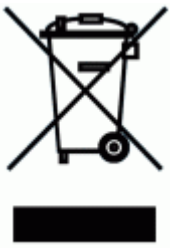
In order to fulfil its responsibility as the product manufacturer, Physik Instrumente (PI) GmbH & Co. KG undertakes environmentally correct disposal of all old PI equipment made available on the market after 13 August 2005 without charge.

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

Physik Instrumente (PI) GmbH & Co. KG

Auf der Roemerstr. 1

D-76228 Karlsruhe, Germany



12 EC Declaration of Conformity

For the N-565, an EC Declaration of Conformity has been issued in accordance with the following European directives:

2004/108/EC, EMC Directive

2011/65/EU, RoHS Directive

The applied standards certifying the conformity are listed below.

EMC: EN 61326-1:2013

Safety: EN 61010-1:2010

RoHS: EN 50581:2012

If an electrical operating device is designed to be integrated into another electrical operating device: The operator is responsible for standards compliant integration of the electrical device into the overall system.