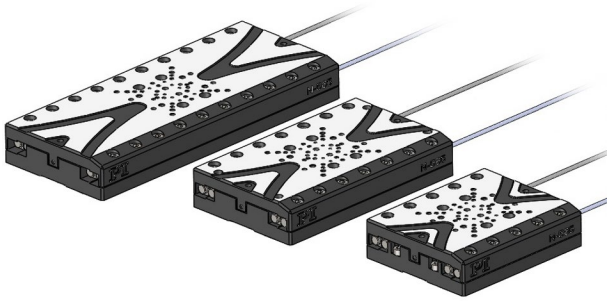
MP148E

N-565 NEXACT® Linear Stage

User Manual

Version: 1.5.0 Date: 23.02.2021



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 drive force, dimensions 65 × 80 × 20 mm (W × L × H), NEXACT® piezoelectric walking drive
- **N-565.260**
  Precision linear stage, 26 mm travel range, PIOne linear encoder, 0.5 nm resolution, 10 N drive force, dimensions 65 × 110 × 20 mm (W × L × H), NEXACT® piezoelectric walking drive
- **N-565.360**
  Precision linear stage, 52 mm travel range, PIOne linear encoder, 0.5 nm resolution, 10 N drive force, dimensions 65 × 160 × 20 mm (W × L × H), NEXACT® piezoelectric walking drive

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Original instructions
First printing: 23.02.2021
Document number: MP148E, LMo / CBo, Version 1.5.0

Contents

1 About this Document

In this Chapter

1.1 Objective and Target Audience of this User Manual

This manual contains information on using the N-565 as intended.

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
Failure to comply could lead to minor injury.

➢ Precautionary measures for avoiding the risk.

NOTICE

Dangerous situation
Failure to comply could cause damage to equipment.

➢ Precautionary measures for avoiding the risk.

INFORMATION

Information for easier handling, tricks, tips, etc.

Symbol/Label	Meaning
1. 2.	Action consisting of 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)
	Warning signs on the product referring to detailed information in this manual

1.3 Definition of Terms

Term	Explanation
Load capacity	Maximum load capacity in the vertical direction when the positioner is mounted horizontally. The contact point of the load is at the center of the platform.
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 switching the controller on, referencing must be done 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 from PI mentioned in this documentation are described in separate manuals.

Product	Document
E-861 NEXACT® Servo Controller	PZ205E User Manual
PIMikroMove	SM148E Software Manual
PIUpdateFinder	A000T0028 User Manual

1.6 Downloading Manuals

INFORMATION

If a manual is missing or problems occur with downloading:

➢ Contact our customer service department (p. 31).

Downloading Manuals

1. Open the website **www.pi.ws**.
2. Search the website for the product number (e.g., N-565) or the product family (e.g., NEXACT®).
3. Click the corresponding product to open the product detail page.
4. Click the ***Downloads*** tab.

   The manuals are shown under ***Documentation***. Software manuals are shown under ***General Software Documentation***.
5. Click the desired manual and fill out the inquiry form.

   The download link will then be sent to the email address entered.

2 Safety

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 use in an environment that is free of dirt, oil, and lubricants.

According to its design, the N-565 is intended for positioning, adjusting and shifting loads in one axis at various velocities.

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

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

It is only possible to use the N-565 as intended when it is installed and only in conjunction with a suitable controller (p. 9). 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.

- Use the N-565 for its intended purpose only, and only when it is in perfect technical condition.
- Read the user manual.
- Eliminate any malfunctions that may affect safety immediately.

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 together 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 to a third party, include this user manual as well as other relevant information provided by the manufacturer.
- Do the work only if the user manual is complete. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- Install and operate the N-565 only after you have read and understood this user manual.

Personnel qualification

The N-565 may only be installed, started, 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 drive force, dimensions 65 × 80 × 20 mm (W × L × H), NEXACT® piezoelectric walking drive
N-565.260	Precision linear stage, 26 mm travel range, PIOne linear encoder, 0.5 nm resolution, 10 N drive force, dimensions 65 × 110 × 20 mm (W × L × H), NEXACT® piezoelectric walking drive
N-565.360	Precision linear stage, 52 mm travel range, PIOne linear encoder, 0.5 nm resolution, 10 N drive force, dimensions 65 × 160 × 20 mm (W × L × H), NEXACT® piezoelectric walking drive

3.2 Product View

3.2.1 Product Details

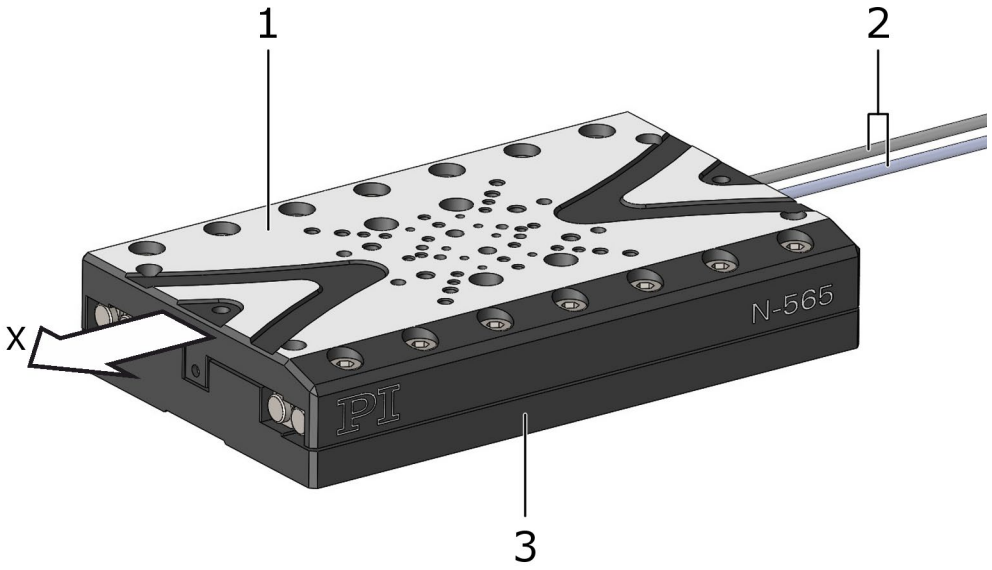


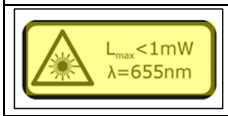
Figure 1: N-565 product view

1 Motion platform
2 Cable exit (cable for sensor and drive connector)
3 Base body

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

3.2.2 Product Labeling

Labeling	Description
N-565 / N-565.x60	Product name. Characters following the period identify the model exactly.
123456789	Serial number (example), individual for each N-565 Meaning of each position (from the left): 1 = internal information 2 and 3 = year of manufacture 4 to 9 = consecutive number
⚠	Warning sign "Pay attention to the manual!"
	Old equipment disposal (p. 41)
Country of origin: Germany	Country of origin
PI	Manufacturer's logo
www.pi.de	Manufacturer's address (website)

Labeling	Description
CE	CE conformity mark
⏚	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
	Notice of laser radiation (p. 29) (here: top of sensor socket)
	Warning sign "Pay attention to the manual!" (here: top of sensor socket)
	Warning sign and values for the laser (p. 29) (here: bottom of sensor socket)

3.3 Scope of Delivery

Product number	Description
N-565	Positioner according to order (p. 7)
5860500028	Screw set for mounting of the N-565: ▪ 4 socket head screws, M3x12, ISO 4762 ▪ 2 dowel pins, 3 m6 × 8, ISO 2338
N664B0001	Adapter D-sub 15 (m) to HD D-sub 15 (f) for sensor connector
MP137EK	Short instructions for NEXACT® positioners

3.4 Suitable Controllers

Product number	Description
E-861.1A1	PiezoWalk® NEXACT® controller, 1 axis, benchtop device, linear encoder, USB and RS-232 interfaces, I/O, connector for joystick

➢ To order, contact our customer service department (p. 31).

3.5 Technical Features

3.5.1 Linear Encoder (Sensor)

The positioner is equipped with an optical linear encoder. Refer to the table in the "Specifications" section (p. 33) for the encoder resolution.

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 Switch

The positioner is equipped with a direction-sensing reference switch, which is located at about the midpoint of the travel range. This sensor sends a TTL signal indicating whether the positioner is on the positive or negative side of the reference switch.

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

4 Unpacking

1. Unpack the N-565 with care.
2. Compare the contents with the scope of delivery according to the contract and the delivery note.
3. Inspect the contents for signs of damage. If any parts are damaged or missing, contact our customer service department (p. 31) immediately.
4. Keep all packaging materials in case the product needs to be returned.

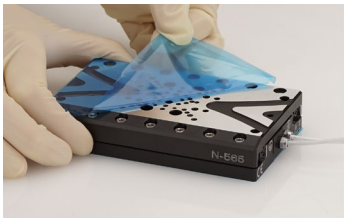
Remove the protective foil

The top and bottom surfaces of the N-565 are scratch-sensitive. For this reason, the N-565 is equipped with a protective foil.

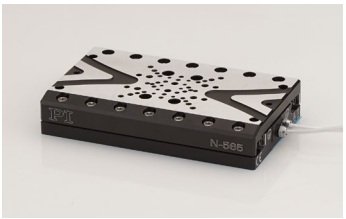
➢ Remove the protective foil from the top and bottom surfaces of the N-565 before using for the first time.

N-565's delivery status

Remove the protective foil



N-565 without protective foil



5 Installation

In this Chapter

5.1 General Notes on Installing

NOTICE

Damage from changes in position due to external forces!

Moving the platform of the positioner by external forces can damage the drive. Changes in position caused by external forces acting on the positioner can also damage the load or the surroundings.

- Make sure that forces acting the platform in the direction of motion do **not** exceed the active push/pull force of the drive (p. 33) particularly when the positioner is mounted vertically.
- Trigger all motion by sending motion commands to the controller. Do **not** move the platform by hand.

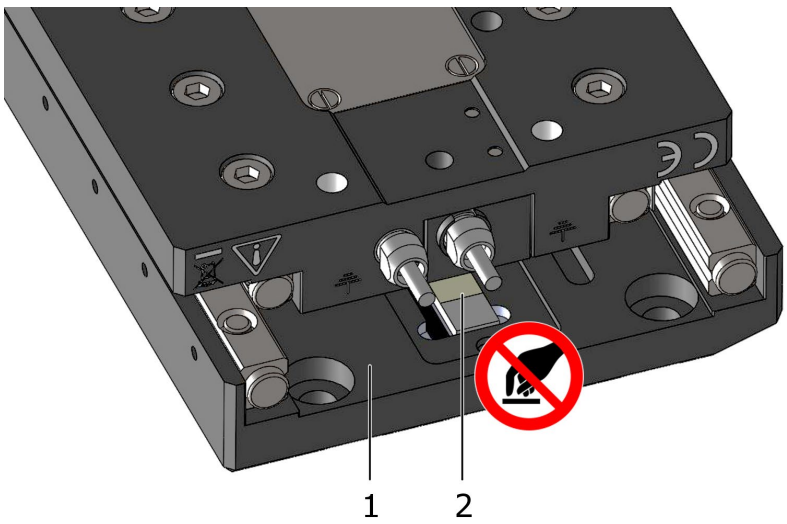


Figure 2: Accessible when the platform is moved out: Encoder scale

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

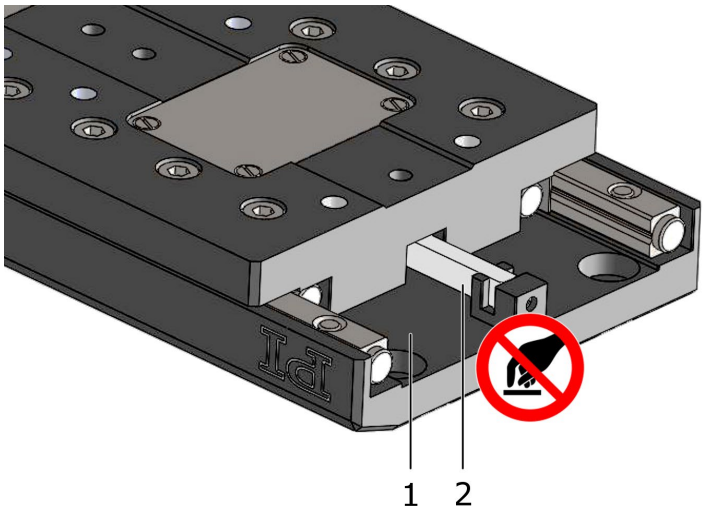


Figure 3: Accessible when the platform is moved out: Ceramic rail of the NEXACT® drive

1 Bottom of the N-565's platform
2 **Do not touch** the ceramic rail of the NEXACT® drive!

NOTICE

Damage from mechanical actions!

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

➢ Treat the encoder scale with extreme care.

The encoder scale is not accessible in the reference position of the platform (delivery condition). If necessary before installing and removing:

➢ Start the positioner (p. 23) and do a reference move to the reference switch (refer to the user manual for the controller).

NOTICE

Malfunction due to contamination!

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

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

The ceramic rail and the encoder scale are not accessible in the reference position of the platform (delivery condition). If necessary before installing and removing:

➢ Start the positioner (p. 23) and do a reference move to the reference switch (refer to the user manual for the controller).

NOTICE

Damage due to improper mounting!
Improper mounting of the N-565 or incorrectly mounted parts can damage the N-565.

- Only use the holes or threads intended for the purpose of fixing the N-565 and loads.
- Install the N-565 so that the platform and all parts attached to it can move freely within the entire travel range.

NOTICE

Warping the N-565 when mounting onto uneven surfaces!
The N-565 could warp if mounted on an uneven surface. Warping reduces the accuracy.

- Mount the N-565 onto a flat surface. The recommended flatness of the surface is ≤10 µm.
- For applications with large temperature changes:
  Mount the N-565 only onto surfaces that have the same or similar thermal expansion properties as the N-565.

NOTICE

Damage due to unsuitable cables!
Unsuitable cables can damage the N-565 and the electronics.

- Use cables provided by PI only to connect the N-565 to the electronics.

INFORMATION

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

5.2 Mounting the N-565 onto a Surface

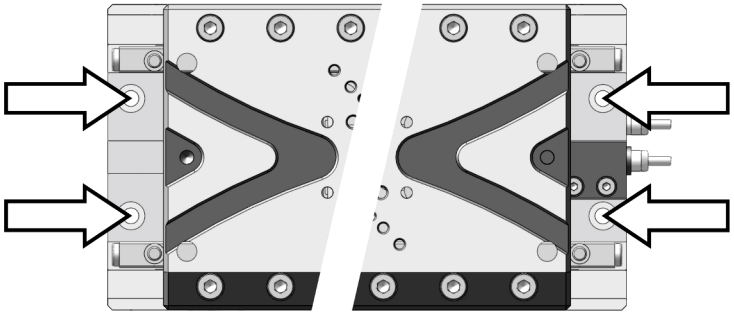
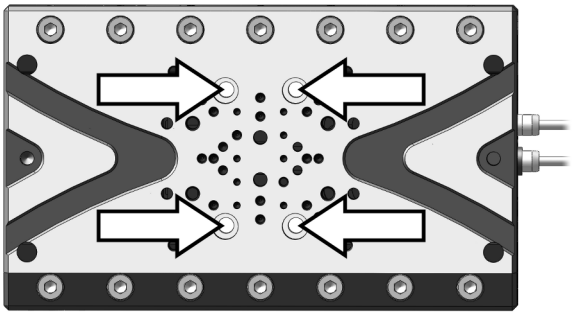
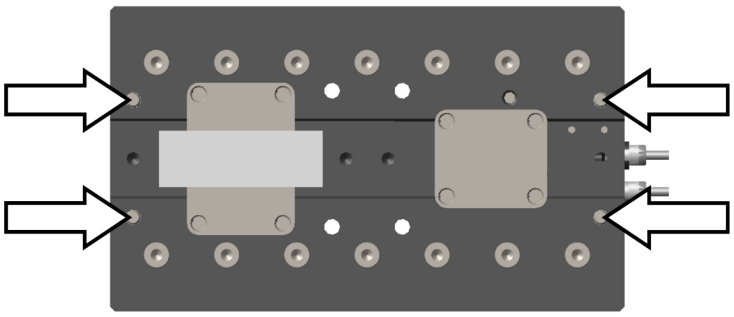
Options for mounting the N-565 onto an underlying surface

INFORMATION

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

- Start the positioner (p. 23) and do a reference move to the reference switch (refer to the user manual for the controller).

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

Mounting option	Mounting holes, see "Dimensions" for details (p. 36)
Mounting from above with M3x12 screws	 Figure 4: 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 For example, this mounting is used when building an XY system consisting of two N-565 positioners (p. 18).	 Figure 5: 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 6: N-565, bottom view: M4 holes for mounting from below with M4 screws

NOTICE

Excessively long screws!
Screws inserted too deeply can damage the N-565.

- ➢ Pay attention to the depth of the mounting holes (p. 36).
- ➢ 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 motion.

Requirements

- ✓ You have read and understood the general notes on installation (p. 13).
- ✓ You have provided a suitable underlying surface. For the required position of the holes, see "Dimensions" (p. 36).
  - 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 are provided for M4 screws. The thickness of the underlying surface and the depth of the counterbores for the through-holes in the underlying surface are matched so that compliance with the maximum screw-in depth of 7.5 mm in the N-565 is adhered to.
  - The surface flatness is ≤10 µm.
  - For applications with large temperature fluctuations:
    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 according to regulations and without bending them.

Tools and accessories

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

  or
  - Four M4 screws of suitable length, not included in the scope of delivery
- Suitable screwdriver

Mounting the N-565 onto an underlying surface

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

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

   – Start the positioner (p. 23) and command the platform to a suitable position (refer to the user manual for the controller and arrows in the illustration).

2. Align the positioner on the underlying surface so that the corresponding mounting holes in the positioner and underlying surface are in line.
3. Screw the screws into the mounting holes according to the selected mounting option (p. 23):

   – Mounting from **above**: Insert the screws through the platform and the base body of the N-565 into the underlying surface.

   – Mounting from **below**: Insert the screws through the underlying 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 fixed firmly to the underlying surface.

5.3 Building an XY System

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

➢ Contact our customer service department (p. 31) for other possible combinations.

NOTICE

Impermissibly high load on the linear stages!

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

➢ Include the mass of the moved linear stage in the calculation of the load to be moved.
➢ For all linear stages in a multi-axis system: Do **not** exceed the maximum permissible load.
➢ For all linear stages in a multi-axis system, make sure that forces acting on the motion platform in the respective direction of motion do **not** exceed the active push/pull force of the drive (p. 33).

Designations in these instructions:

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

Requirements

- ✓ You have read and understood the general notes on installation (p. 13).
- ✓ You have accounted for the space required to route cables according to regulations and without bending them.
- ✓ You have mounted the lower positioner onto an underlying surface (p. 15) properly.

Tools and accessories

- 4 M3 screws included in the scope of delivery of the upper positioner (p. 9)
- Suitable screwdriver

Building an XY System

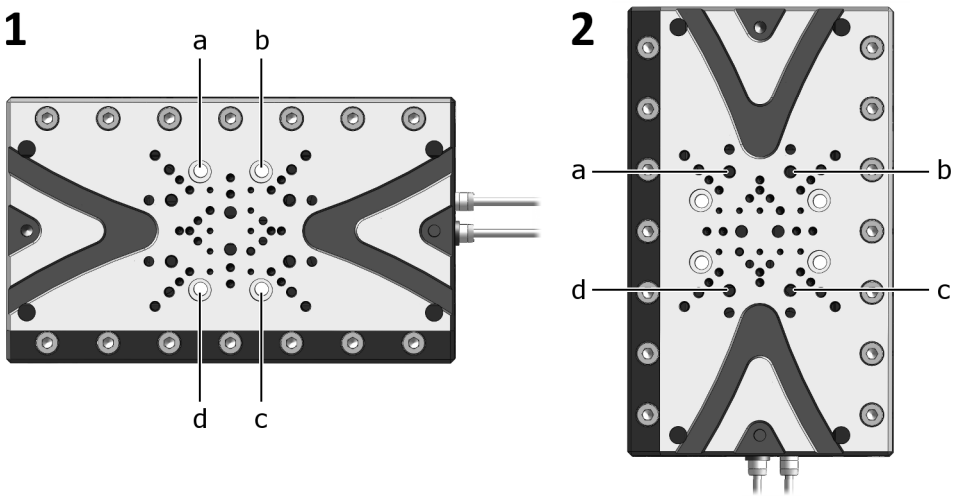


Figure 7: Building an XY system from two N-565.260 positioners

1 Upper positioner (platform in reference position) with
a, b, c, d: mounting holes Ø 3.4 mm with counterbore for M3 socket head screws
2 Lower positioner with
a, b, c, d: M3 mounting holes in the platform

Holes that are aligned during attachment are marked with the same letter.

1. If necessary: Allow access to the required mounting holes in the base body of the upper positioner.
   – Start the upper positioner (p. 23) and do a reference move to the reference switch (refer to the user manual for the controller).
2. Position the upper positioner rotated by 90° on the platform of the lower positioner (see above figure).
3. Put the upper positioner so that the mounting holes in the upper and lower positioner are in line (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 positioner is firmly seated.

5.4 Fixing the Load to the N-565

NOTICE

Excessively long screws!
Screws inserted too deeply can damage the N-565.

- ➢ Pay attention to the depth of the mounting holes (p. 36).
- ➢ Only use screws of the correct length for the respective mounting holes.

Requirements

- ✓ You have read and understood the general notes on installation (p. 13).
- ✓ You have fixed the positioner properly (p. 15).
- ✓ You have prepared the load so that it can be fixed to the mounting holes in the platform:
  - The gap between the center of gravity of the load and the center of the platform is as small as possible in all directions.
  - At least two points are provided for fixing the load on the platform.

Tools and accessories

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

Fixing the load to the N-565

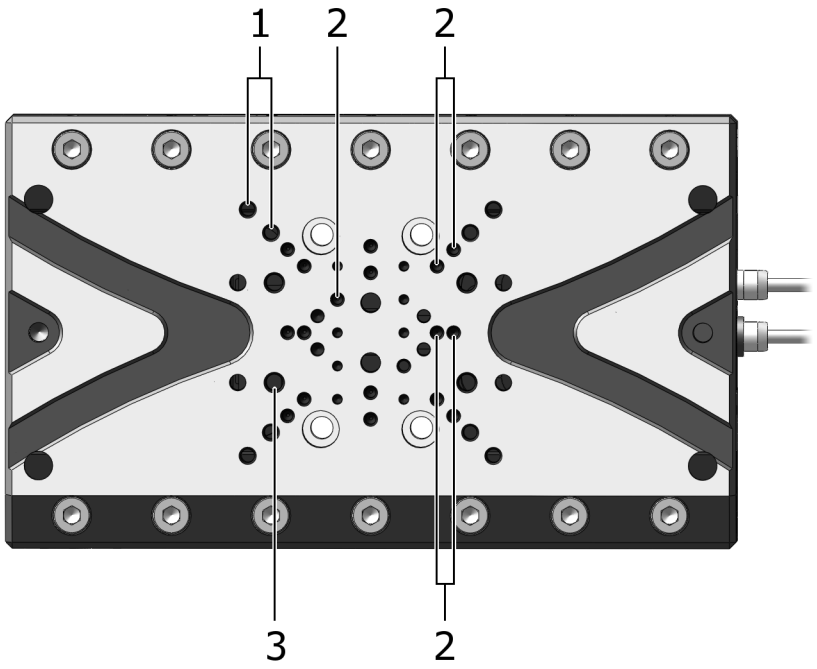


Figure 8: Mounting holes for fixing the load to the platform

1 8 × M2.5 holes with 4 mm thread depth
2 18 × M2 holes with 3 mm thread depth
3 4 × M3 holes with 5 mm thread depth

Refer to Dimensions (p. 36) for the exact position

1. Align the load so that the selected mounting holes in the platform can be used to fix it.
2. Use the screws to fix the load to the selected mounting holes in the platform.

   Maximum screw-in depth in the 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 sitting firmly on the platform of the positioner.

5.5 Connecting the N-565 to the Controller

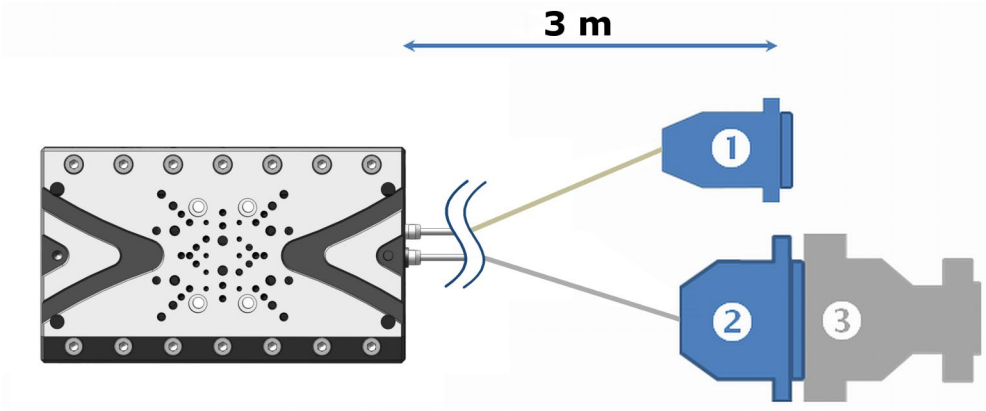


Figure 9: N-565: Connections

1 HD D-sub 15 (m) drive connector
2 D-sub 15 (f) sensor socket
3 D-sub 15 (m) adapter to HD D-sub 15 (f)

Requirements

- ✓ You have read and understood the general notes on installation (p. 13).
- ✓ You have installed a suitable controller (p. 9).
- ✓ You have read and understood the user manual for the controller.
- ✓ The controller is switched off.

Tools and accessories

- N664B0001 adapter, included in the scope of delivery (p. 9)
- Screwdriver for slotted screws (SL)

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

1. Connect the positioner's drive connector to the corresponding controller socket (refer to the user manual for the controller).
2. Connect the positioner's sensor socket to the controller:
   a) Connect the positioner's sensor socket to the plug side of the adapter (D-sub 15 (m)).
   b) Use the integrated screws to secure the connectors against accidental disconnection.
   c) Connect the socket side of the adapter (HD D-sub 15 (f)) to the controller's panel plug (refer to the user manual for the controller).
3. Use the integrated screws to secure the controller's connections against accidental disconnection.

6 Starting and Operating

In this Chapter

6.1 General Notes on Starting

NOTICE

Damage due to collisions!

Collisions can damage the N-565, the load to be moved, and the surroundings.

- Make sure that no collisions are possible between the N-565, the load to be moved, and the surroundings in the motion range of the N-565.
- 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!

Moving the platform of the positioner by external forces can damage the drive. Changes in position caused by external forces acting on the positioner can also damage the load or the surroundings.

- Make sure that forces acting the platform in the direction of motion do **not** exceed the active push/pull force of the drive (p. 33) particularly when the positioner is mounted vertically.
- Trigger all motion by sending motion commands to the controller. Do **not** move the platform by hand.

NOTICE

Uncontrolled oscillation!

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

If uncontrolled oscillation occurs during operation of the N-565:

- ➢ Switch the servo control system of the affected axis off immediately.
- ➢ Check the settings of the servo control parameters.

INFORMATION

Impact forces can cause encoder malfunction.

- ➢ Avoid impact force on the positioner.
- ➢ Do a reference move (refer to the user manual for the controller).

INFORMATION

The positive direction of motion is in the opposite direction of the cable exit.

INFORMATION

The repeatability of the positioning is only ensured when the reference 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 switch.

INFORMATION

If you ordered the N-565 as a system with controller, the controller is preconfigured as follows:

- Suitable parameter sets for the N-565 are stored on the controller.
- The sensor's reference position is in the middle of the N-565's travel range.

In this case, it is not necessary to assign the positioner type in the PC software and to correct the sensor's reference position.

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 *PIStages3.dat* database.

- ➢ Use the PIUpdateFinder to update the *PIStages3.dat* database on your PC. The PIUpdateFinder is included in the software package for the E-861.1A1 controller.

Refer to the user manual for the E-861.1A1 controller for further information on positioner databases.

6.3 Operating the N-565

Requirements

- ✓ You have read and understood the general notes on starting and operating (p. 23).
- ✓ You have read and understood the user manual for the controller.
- ✓ You have read and understood the user manual for the PC software.
- ✓ You have mounted the N-565 (p. 13) properly.
- ✓ The controller and the required PC software have been installed. All connections to the controller have been established (refer to the user manual for the controller).

Operating the N-565

- ➢ Follow the instructions in the manual for the electronics (p. 9) used for starting and operating 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 stress can induce charges in piezo actuators. Piezo actuators can remain charged for several hours after disconnecting the electronics. Touching or short-circuiting the contacts in the drive connector of the N-565 could lead to minor electric shocks.

If you want to avoid these minor electric shocks:

- ➢ Discharge the N-565, **before** you pull the drive connector out of the controller.

Discharging the piezo actuators of the drive

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

1. If you are working in closed-loop operation: Switch the servo mode on the controller off.
2. Set the piezo voltage on the controller to 0 V by sending an `RNP` command (refer to the user manual for the controller).
3. If possible: Switch the controller off.
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

NOTICE

Damage from ultrasonic cleaning!
Ultrasonic cleaning can damage the N-565.

➢ Do **not** do any ultrasonic cleaning.

Requirements

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

✓ You have disconnected the N-565 from the electronics.

Cleaning the N-565

➢ Clean the surfaces of the N-565 with a cloth dampened with a mild cleanser or disinfectant (e.g., isopropyl alcohol).

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.
The laser is fully shielded before dispatch and when the N-565 is used as intended. Radiation can only be emitted by the laser if the N-565 is opened. The laser beam can dazzle and irritate the eyes.

- 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 Target position is not kept stable Uncontrolled oscillation of the N-565	▪ 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.
Reduced holding force and feed force	▪ Ceramic rail of the NEXACT® drive is dirty	➢ Contact our customer service department (p. 31).
No or limited motion	▪ Excessive load	➢ Reduce the load (see "Data Table" (p. 33)).
	▪ Encoder scale is contaminated, e.g., after being touched	➢ Contact our customer service department (p. 31).
	▪ Encoder malfunction due to abrupt impact	➢ Do a reference move (refer to the user manual for the controller)

If the problem with your system is not listed in the table above or cannot be solved as described, contact our customer service department (p. 31).

9 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.

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

Motion	N-565.160	N-565.260	N-565.360	Tolerance
Active axes	X	X	X	
Travel range in X	13 mm	26 mm	52 mm	
Maximum velocity in X	10 mm/s	10 mm/s	10 mm/s	
Rotational crosstalk in θY with motion in X	50 µrad	100 µrad	200 µrad	+80 %
Rotational crosstalk in θZ with motion in X	50 µrad	50 µrad	50 µrad	+60 %

Positioning	N-565.160	N-565.260	N-565.360	Tolerance
System resolution in X	0.5 nm	0.5 nm	0.5 nm	
Unidirectional repeatability in X	50 nm	50 nm	50 nm	±100 %
Minimum incremental motion in X	0.003 µm	0.003 µm	0.003 µm	typ.
Integrated sensor	PIOne: Incremental linear encoder	PIOne: Incremental linear encoder	PIOne: Incremental linear encoder	
Sensor resolution	0.5 nm	0.5 nm	0.5 nm	
Reference switch	Optical	Optical	Optical	

Drive properties	N-565.160	N-565.260	N-565.360	Tolerance
Drive type	NEXACT® piezo walking drive	NEXACT® piezo walking drive	NEXACT® piezo walking drive	
Drive force in negative direction of motion in X	10 N	10 N	10 N	typ.
Drive force in positive direction of motion in X	10 N	10 N	10 N	typ.

Mechanical properties	N-565.160	N-565.260	N-565.360	Tolerance
Guide	Crossed roller guide	Crossed roller guide	Crossed roller guide	
Holding force in X, passive	10 N	10 N	10 N	min.
Overall mass	300 g	400 g	600 g	±5 %
Permissible push force in Z	20 N	20 N	20 N	max.
Material	Aluminum, black anodized	Aluminum, black anodized	Aluminum, black anodized	

Miscellaneous	N-565.160	N-565.260	N-565.360	Tolerance
Connector	HD D-sub 15 (m)	HD D-sub 15 (m)	HD D-sub 15 (m)	
Sensor connector	D-sub 15-pole (f)	D-sub 15-pole (f)	D-sub 15-pole (f)	
Recommended controllers / drivers	E-861.1A1	E-861.1A1	E-861.1A1	
Cable length	3 m	3 m	3 m	

The N-565 positioner series replaces the LPS-65 series.

10.1.2 Ambient Conditions and Classifications

Pay attention to the following ambient conditions and classifications for the N-565:

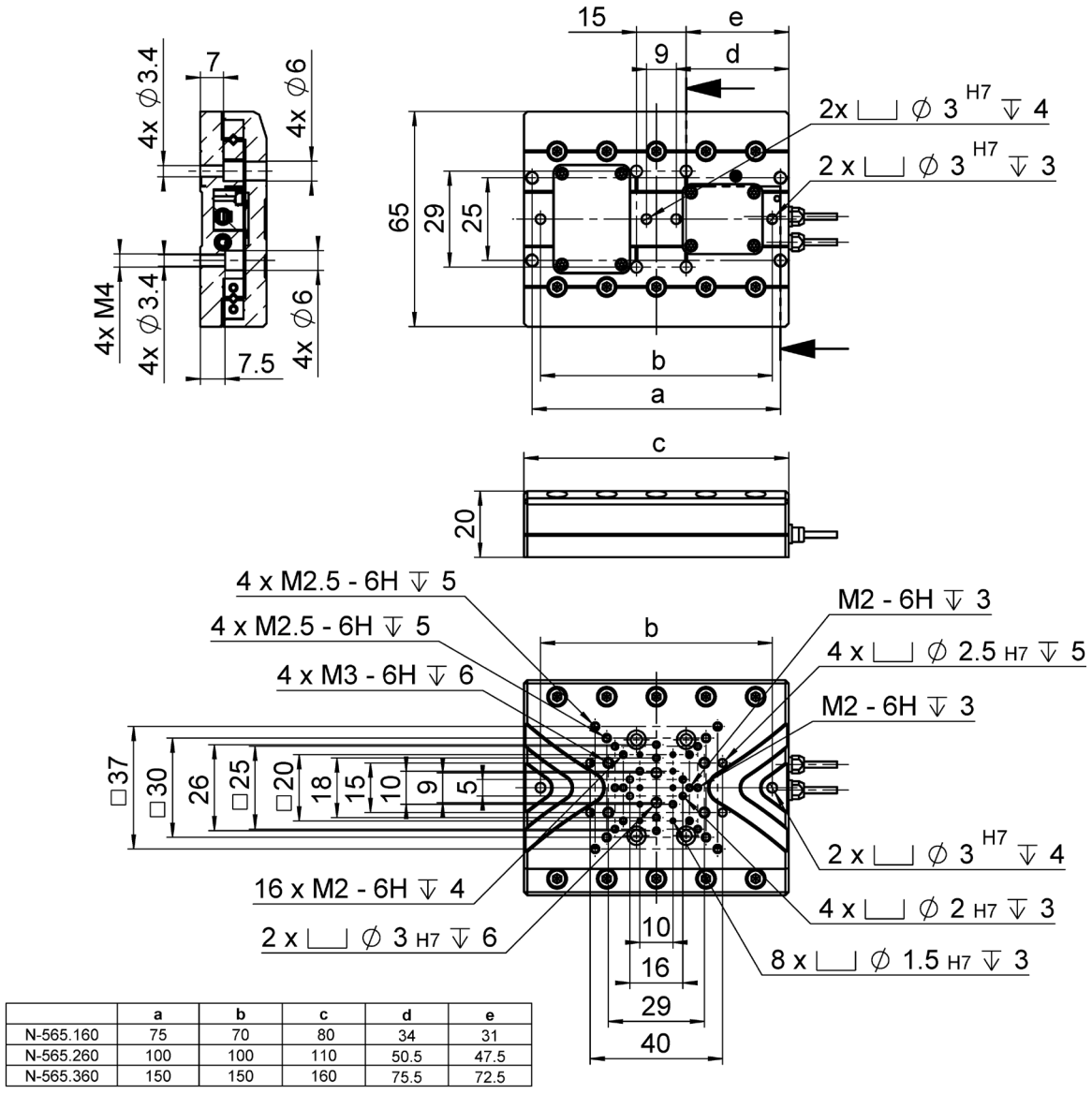
Area of application	For indoor use only
Maximum altitude	2000 m
Air pressure	1100 hPa to 0.1 hPa
Relative humidity	Highest relative humidity of 80% for temperatures up to 31 °C, noncondensing Decreasing linearly to 50 % relative air humidity at 40 °C, noncondensing
Operating temperature	10 °C to 50 °C
Storage temperature	-20 °C to 60 °C
Transport temperature	-20 °C to 60 °C
Overvoltage category	II
Protection class	I
Degree of pollution	1
Degree of protection according to IEC 60529	IP20

10.2 Maximum Ratings

The positioner 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



	a	b	c	d	e
N-565.160	75	70	80	34	31
N-565.260	100	100	110	50.5	47.5
N-565.360	150	150	160	75.5	72.5

Figure 10: N-565, dimensions in mm

10.4 Pin Assignment

10.4.1 Drive Connector

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

Figure 11: HD D-sub 15 connector (m) for the drive, connector 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 "-" sign indicates that the corresponding pin has not been assigned.

** 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 Connector

Pin assignment of the D-sub (f) socket of the N-565

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

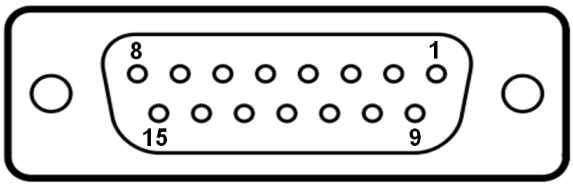


Figure 12: D-sub 15 socket (f) for sensor, connector side

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 switch	Output
11	-	-	-
12	-	-	-
13	-	-	-
14	-	-	-
15	-	-	-

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

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:

- D-sub 15 (m) connector: See the table in the "Sensor connection" section.

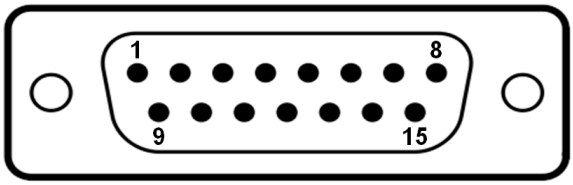


Figure 13: D-sub 15 (m) connector for sensor, connector side

- HD D-sub 15 (f) socket: See the following table.

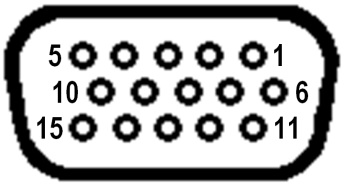


Figure 14: HD D-sub 15 socket (f) for sensor, connector side

Pin	Signal*	Function	Direction
1	REF	Reference 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 EU Declaration of Conformity

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

EMC Directive

RoHS Directive

The applied standards certifying the conformity are listed below.

EMC: EN 61326-1

Safety: EN 61010-1

RoHS: EN 50581 or EN IEC 63000