MP117E

N-664 NEXACT® Stage

User Manual

Version: 1.0.1 Date: 18.11.2013

This document describes the following product:

- **N-664.3A**
  Ultra-High Precision Linear Positioning System with NEXACT® Piezo Drive, 30 mm, PIOne Linear Encoder, 0.5 nm Resolution

Physik Instrumente (PI) GmbH & Co. KG · Auf der Römerstr. 1 76228 Karlsruhe, Germany
Telephon +49 721 4846-0 · Telefax +49 721 4846-1019 · E-Mail info@pi.ws

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Contents

1 About this Document

In this Chapter

1.1 Goal and Target Audience of this User Manual

This manual contains information on the intended use of the N-664.

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 on our website or if there are problems in downloading:

➢ Contact our customer service department (p. 33).

The current versions of the manuals are found on our website. For some products (e.g. Hexapod systems and electronics that are delivered with a CD), access to the manuals is password-protected. The password is stored on the CD.

Download freely accessible manuals

1. Open the website **http://www.pi-portal.ws**.
2. Click ***Downloads***.
3. Click the corresponding category (e.g. ***N PiezoWalk® Drives***)
4. Click the corresponding product code (e.g. ***N-664***).
5. Click ***Documents***. The available manuals are displayed.
6. Click the desired manual and save it on the hard disk of your PC or on a data storage medium.

Download password-protected manuals

1. Carry out steps 1 to 5 of the download process for freely accessible manuals.
2. Insert the product CD in the PC drive.
3. Switch to the ***Manuals*** directory on the CD.
4. In the ***Manuals*** directory, open the Release News (file including ***releasenews*** in the file name).
5. Find the user name and password in the ***User login for software download*** section in the Release News.
6. In the ***User login*** area on the left margin in the website, enter the user name and the password in the corresponding fields.
7. Click ***Login***.

   The available manuals are displayed.
8. Click the desired manual and save it on the hard disk of your PC or on a data storage medium.

2 Safety

In this Chapter

2.1 Intended Use

The N-664 is a laboratory device as defined by DIN EN 61010-1. It is intended to be used in interior spaces and in an environment which is free of dirt, oil and lubricants.

Based on its design and realization, the N-664 is intended for single-axis positioning, adjusting and shifting of loads at different velocities.

The N-664 is a stage for nanopositioning technology. The feed is produced by NEXACT® piezo actuators coupled to a ceramic rail (PiezoWalk® principle).

The N-664 is equipped with a linear encoder for direct position measurement.

The intended use of the N-664 is only possible when installed and in connection with a suitable controller (p. 9). The controller is not included in the scope of delivery of the N-664.

2.2 General Safety Instructions

The N-664 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-664.

- Only use the N-664 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-664.

2.3 Organizational Measures

User manual

- Always keep this user manual available by the N-664.
  The latest versions of the user manuals are available for download (p. 3) on our website.
- Add all information given by the manufacturer to the user manual, for example supplements or Technical Notes.
- If you pass the N-664 on to other users, also turn over 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 property damage.
- Only install and operate the N-664 after having read and understood this user manual.

Personnel qualification

The N-664 may only be installed, started up, operated, maintained and cleaned by authorized and appropriately qualified personnel.

3 Product Description

In this Chapter

3.1 Product View

3.1.1 Product Details

Figure 1: N-664.3A stage; moving platform in reference position

1 Base body
2 Moving platform
3 Cable for drive connection
4 Cable for sensor connection
x Positive direction of motion of the stage

3.1.2 Product Labeling

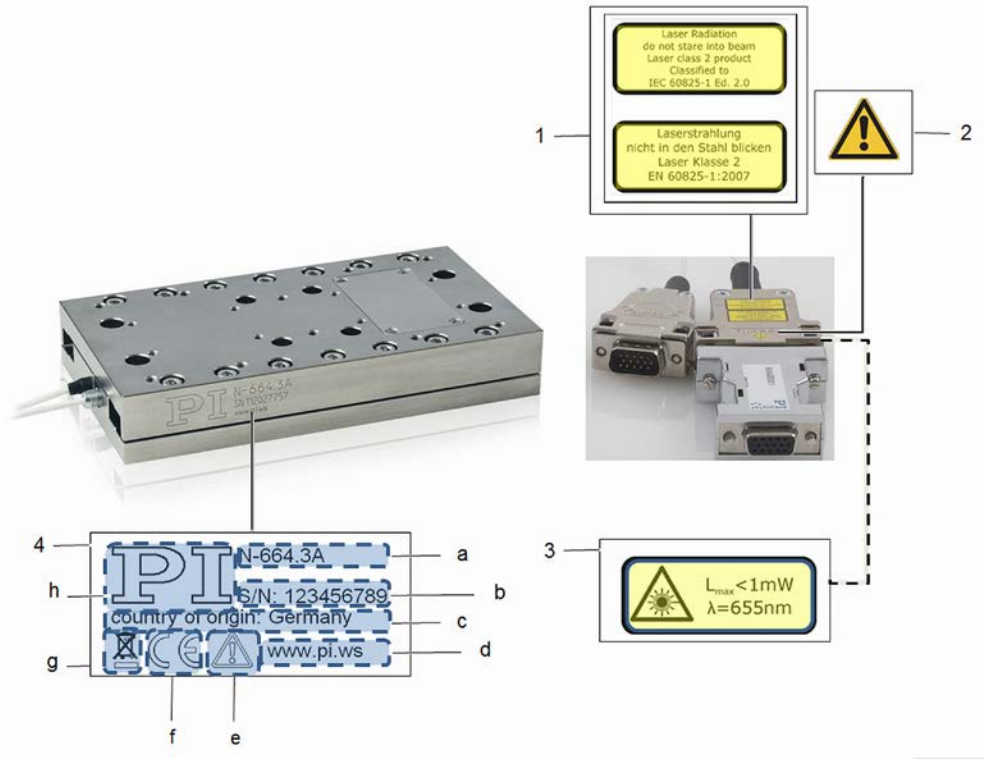


Figure 2: Labeling of stage and connections

1 Notice of laser radiation (p. 29) (here: top side of sensor connector (f))

2 Warning sign "Observe manual!" (here: top side of sensor connector (f))

3 Warning sign and values for the laser (p. 29) (here: bottom side of sensor connector)

4 Type plate specifying:

- *a Product name*
- *b Serial number*
- *c Country of origin*
- *d Address of manufacturer (website)*
- *e Warning sign "Observe manual!"*
- *f CE conformity mark*
- *g Old equipment disposal notice*
- *h Manufacturer logo*

3.2 Scope of Delivery

The N-664 is delivered with the following components.

Item ID	Component
N-664.3A	Stage according to order
N664B0001	Adapter Sub-D 15 (m) to HD Sub-D 15 (f) for sensor connection
MP117E	User manual (this document) in printed form
Screws for mounting the N-664	
1047	M3x12 (ISO 4762), 4 pieces
1025	M2.5x12 (ISO 4762), 4 pieces

3.3 Suitable Controllers

Controller	Description
E-861.1A1	Digital NEXACT® Controller

➢ To order, contact our customer service department (p. 33).

3.4 Technical Features

3.4.1 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. 35).

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.

3.4.2 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-664 with care.
2. Compare the contents against the items covered by the contract and against 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. 35).
- Initiate all motions by sending motion commands to the controller. Do **not** displace the moving platform manually.

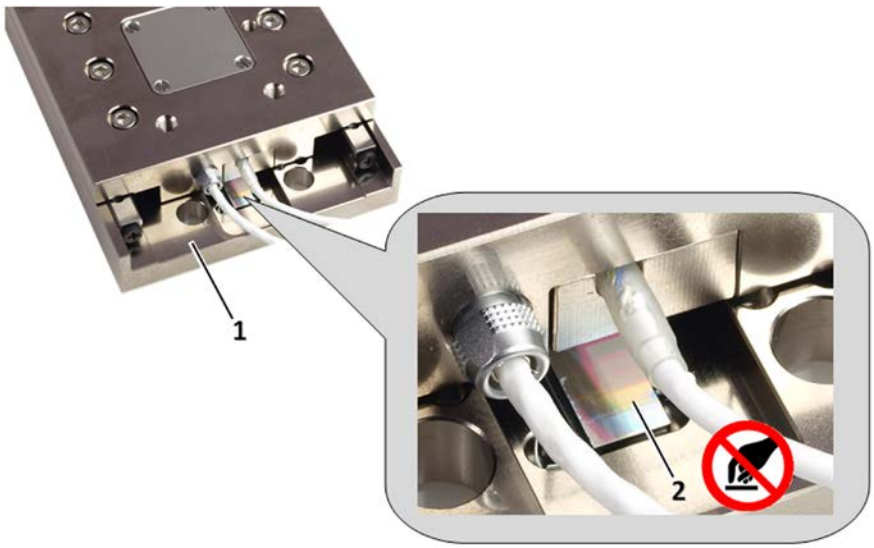


Figure 3: Accessible when the moving platform is driven out: Ruler of the linear encoder

1 Bottom side of the moving platform of the N-664.3A
*2 Detail: Ruler of the linear encoder, **do not touch!***

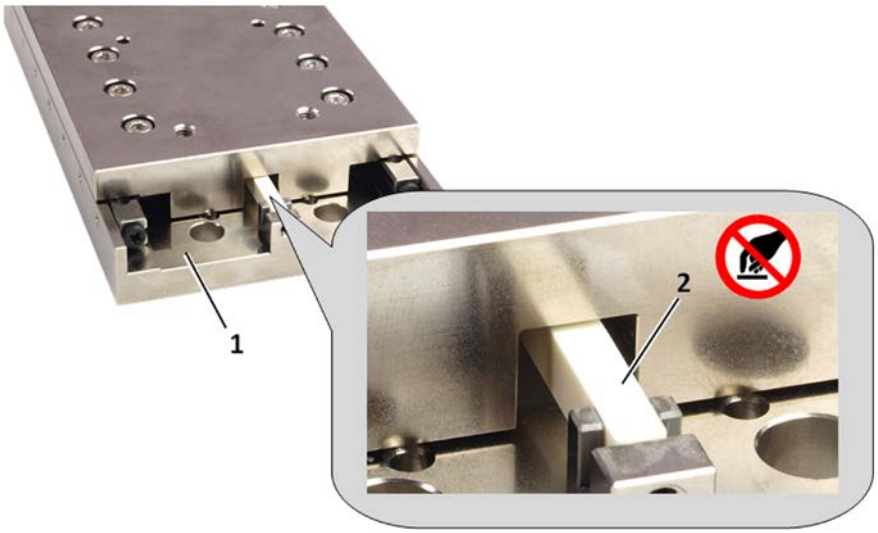


Figure 4: Accessible when the moving platform is driven out: Ceramic rail of the NEXACT® drive

1 Bottom side of the moving platform of the N-664.3A
*2 Detail: 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. 25) 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-664 inoperable.

- ➢ Keep the N-664 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. 25) 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-664 or incorrectly mounted parts can damage the N-664.

- ➢ Only mount the N-664 and the loads on the mounting fixtures (holes) intended for this purpose.

NOTICE

Warping of the N-664 due to mounting on uneven surfaces!

Mounting the N-664 on an uneven surface can warp the N-664. Warping reduces the accuracy.

➢ Mount the N-664 on an even surface. The recommended evenness of the surface is ≤10 µm.

➢ For applications with great temperature changes:
Only mount the N-664 on surfaces that have the same or similar thermal expansion properties as the N-664.

NOTICE

Damage from unsuitable cables!

Unsuitable cables can damage the stage and the electronics.

➢ Only use cables provided by PI for connecting the N-664 to the electronics.

INFORMATION

For the reproducibility of the positioning to be optimal, all components must be affixed with zero-backlash.

➢ Make sure that stage and load are affixed with zero-backlash.

5.2 Attaching the N-664 to a Surface

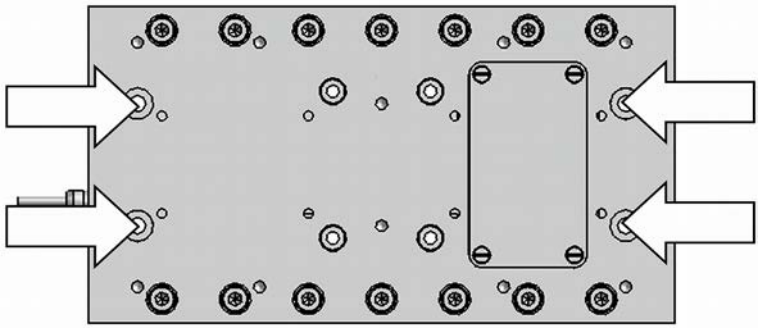
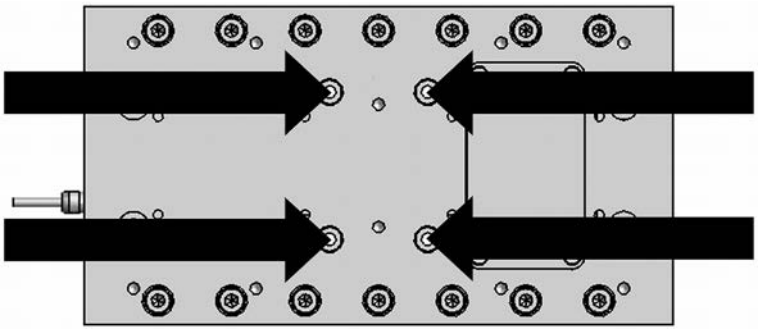
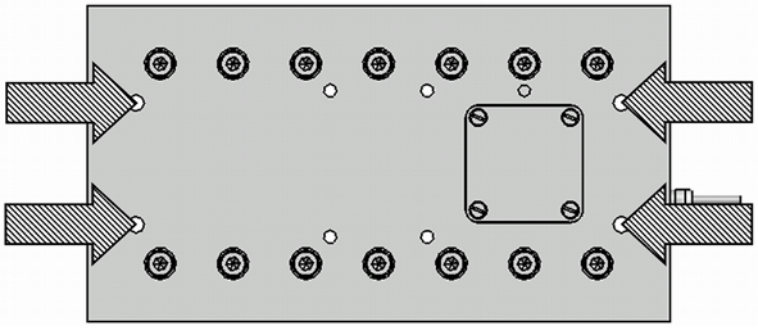
Options for attaching the N-664 to a surface

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. 25) and perform a reference move to the reference point switch (see the user manual of the controller).

The mounting holes of the N-664 are intended for the following mounting options:

Mounting option	Mounting holes, details see "Dimensions" (p. 38)
Mounting from above with M3x12 screws	 *Figure 5: N-664, 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 M2.5x12 screws This mounting option is used e.g. when setting up an XY system consisting of two N-664.3A stages (p. 20).	 *Figure 6: N-664, top view: holes with Ø 2.7 mm and counterbore, for mounting from above with M2.5 screws*
Mounting from below with M4 screws	 *Figure 7: N-664, bottom view: M4 holes for mounting from below with M4 screws*

NOTICE

Screws that are too long!

The N-664 can be damaged by screws that are screwed in too deeply.

- ➢ Observe the depth of the mounting holes (p. 38).
- ➢ Only use screws of the correct length for the respective mounting holes.

NOTICE

Protruding screw heads!

Protruding screw heads can damage the N-664.

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

Prerequisites

- ✓ You have read and understood the General Notes on Installation (p. 13).
- ✓ You have provided a suitable surface. For the required position of the holes, see "Dimensions" (p. 38).
  - For mounting from **above with M3x12 screws**: Four M3 holes with a depth of at least 3 mm are present.
  - For mounting from **above with M2.5x12 screws**: Four M2.5 holes with a depth of at least 2.5 mm are present.
  - For mounting from **below with M4 screws**: Four through-holes for M4 screws are present. The thickness of the surface and the depth of the counterbores at the through-holes in the surface are matched for compliance with the maximum screw-in depth of 9 mm in the N-664.
  - The evenness of the surface is ≤10 µm.
  - For applications with great temperature changes:
    The surface should have the same or similar thermal expansion properties as the N-664.
- ✓ You accounted for the space required for cable routing free of kinks and in accordance with regulations.

Tools and accessories

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

  or

  - Four M2.5x12 screws, in the scope of delivery

  or

  - Four M4 screws of suitable length, not in the scope of delivery
- Suitable Allen wrench or screwdriver:
  - For M3 screws: Allen wrench AF 2.5
  - For M2.5 screws: Allen wrench AF 2

Attaching the N-664 to a surface

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

   When the required mounting holes in the base body of the N-664 are covered by the moving platform:

   - Start up the stage (p. 25) and perform a reference move to the reference point switch (see the user manual of the controller).
2. Align the stage on the surface so that the corresponding mounting holes in stage are above the holes in the surface.
3. Screw in the screws on the mounting holes according to the selected mounting option (p. 25):
   - For mounting from **above**: Introduce the screws through the moving platform and the base body of the N-664 into the surface.
   - For mounting from **below**: Introduce the screws through the surface into the base body of the N-664. Maximum screw-in depth: 9 mm.

   Maximum torque: 0.5 Nm
4. Ensure that no screw heads protrude from the counter-sunk mounting holes.
5. Check that the N-664 fits on the surface without backlash.

5.3 Setting Up an XY System

Two N-664.3A stages can be combined to an XY system.

- ➢ For further combination possibilities, contact our customer service department (p. 33).

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. 35).

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. 13).
- ✓ You accounted for the space required for cable routing free of kinks and in accordance with regulations.
- ✓ You have properly attached the lower stage to a surface (p. 16).

Tools and accessories

- Four M2.5 screws, in the scope of delivery of the upper stage (p. 9)
- Allen wrench AF 2

Setting up an XY system

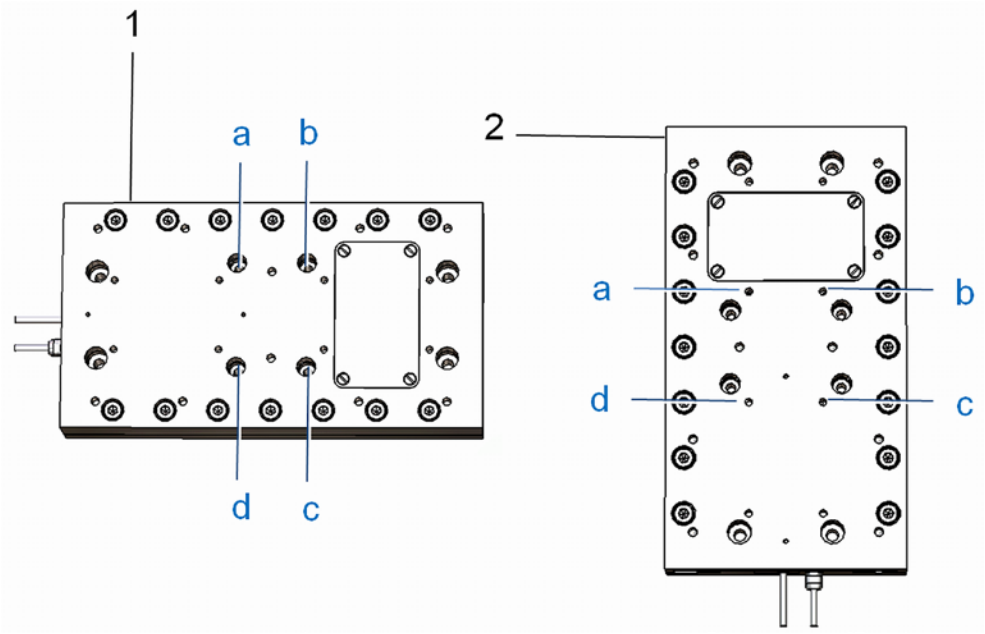


Figure 8: Setting up an XY system consisting of two N-664.3A stages

1 Upper stage (moving platform in reference position) with
a - d) mounting holes Ø 2.7 mm with counterbore for M2.5 socket head cap screws

2 Lower stage with
a - d) M2.5 mounting holes in the platform

Holes that overlap during attachment are marked with the same letters.

1. If necessary: Make the required mounting holes in the base body of the upper stage accessible.
   - Start up the upper stage (p. 25) 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 M2.5 screw into each of the holes.
5. Ensure that no screw heads protrude from the counter-sunk mounting holes.
6. Check that the upper stage fits without backlash.

5.4 Affixing the Load to the N-664

NOTICE

Screws that are too long!

The N-664 can be damaged by screws that are screwed in too deeply.

- ➢ Observe the depth of the mounting holes (p. 38).
- ➢ Only use screws of the correct length for the respective mounting holes.

Prerequisites

- ✓ You have read and understood the General Notes on Installation (p. 13).
- ✓ You have properly mounted the stage (p. 16).
- ✓ You 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-664

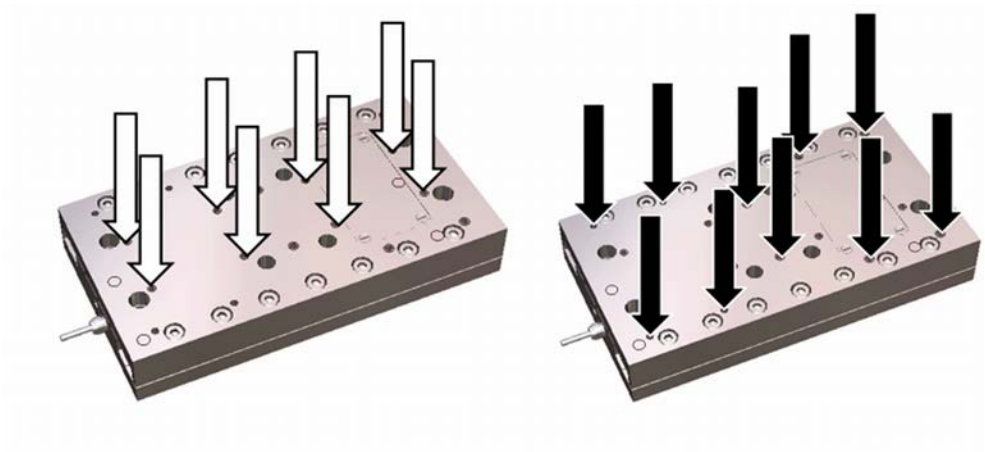


Figure 9: Mounting holes for affixing the load to the moving platform

White arrows: 8 x M2.5 through-holes with 5 mm thread depth
Black arrows: 10 x M3 holes with 4 mm thread depth
Exact position see Dimensions (p. 38)

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-664:

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

   Maximum torque:

   – M2.5 screws: 0.8 Nm
   – M3 screws: 1.8 Nm
3. Check that the load fits on the moving platform of the stage without backlash.

5.5 Connecting the N-664 to the Controller

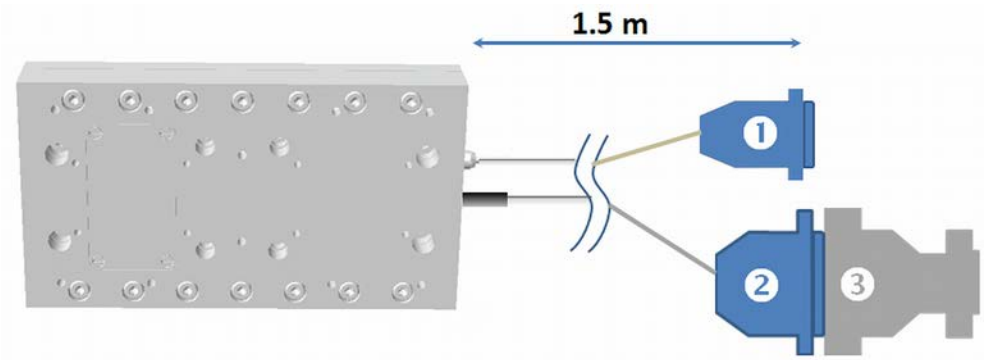


Figure 10: N-664: Connections

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. 13).
- ✓ You have installed a suitable controller (p. 9).
- ✓ 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. 9)
- Screwdriver for slotted screws (SL)

Connecting the N-664 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 get 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. 35).
- ➢ 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-664 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-664:

- ➢ 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 switch.

6.2 Operating Parameters

If you use the software enclosed with the E-861.1A1 controller, the operating parameters can be loaded from the *PIStages2.dat* stage database.

- ➢ Download the PI Update Finder from the PI website (http://www.update.pi-portal.ws) and use it to update the *PIStages2.dat* stage database on your PC.

For more information about the *PIStages2.dat* stage database, see user manual of the E-861.1A1 controller.

6.3 Operating the N-664

Prerequisites

- ✓ You have read and understood the General Notes on Start-Up and Operation (p. 25).
- ✓ 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. 13).
- ✓ 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-664

- ➢ Follow the instructions in the manual of the used controller for start-up and operation of the N-664.

6.4 Discharging the Piezo Actuators of the Drive

INFORMATION

The N-664 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-664 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-664 is maintenance-free.

7.2 Cleaning the N-664

Prerequisites

- ✓ You have discharged the piezo actuators of the N-664.
- ✓ You have disconnected the N-664 from the controller.

Cleaning the N-664

- ➢ Clean the surfaces of the N-664 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-664 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-664, the laser is fully shielded. Laser radiation can exit from the laser only if N-664 is opened. The laser beam can cause glare and irritation.

- Do **not** open or disassemble the N-664.
- Contact our customer service department if there is any malfunction of the N-664.

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 oscillations of the N-664	▪ 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 soiled, e.g. from being touched	➢ Contact our customer service department (p. 33).
No or limited motion	▪ Excessive load ▪ Excessive counterforces in the direction of motion	➢ Reduce the load (see "Data table" (p. 35)). In the case of vertical mounting: ➢ Ensure gravity compensation so that the maximum load (p. 35) is not exceeded.
	▪ Ruler of the encoder is soiled, e.g. from being touched	➢ Contact our customer service department (p. 33).
	▪ 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. 33).

9 Customer Service

For inquiries and orders, contact your PI sales engineer or send us an e-mail (mailto: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)

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

	N-664.3A	Units	Tole-rance
Active axes	X		
Motion and positioning			
Travel range	30	mm	
Min. incremental motion	2	nm	
Integrated sensor	PIOne linear nanometrology encoder		
Open-loop resolution	0.03	nm	typ.
Closed-loop resolution	0.5*	nm	
Max. step frequency, open-loop	0.8	kHz	max.
Max. velocity	10*	mm/s	max.
Linearity	< 0.002% (0,5 µm) along the entire travel range; 0.03% (5 nm) along 20 µm		
Bidirectional repeatability	< 10	nm	
Pitch	40	µrad	typ.
Yaw	40	µrad	typ.

	N-664.3A	Units	Tole-rance
Mechanical properties			
Stiffness in motion direction	2.5	N/µm	+/- 20 %
Max. load	20	N	
Max. push / pull force (active)	10	N	max.
Max. holding force (passive)	15	N	min.
Lateral force	50	N	max.
Drive properties			
Drive type	NEXACT® linear drive		
Operating voltage	-10 to 45	V	
Miscellaneous			
Operating temperature range	10 to 50	°C	
Material	Aluminum, nickel-plated		
Mass	530	g	+/- 5 %
Cable length	1.5	m	+/- 10 mm
Connector	HD sub-D connector, 15-pin (Motor) D-Sub 15 (f) 15-pol (Sensor)		
Recommended controller	E-861 controller for NEXACT® linear drives and positioners		

* With E-861. Depending on drive electronics

10.1.2 Ambient Conditions and Classifications

The following ambient conditions and classifications must be observed for the N-664:

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 70 °C
Transport temperature	-20 °C to 70 °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. Note that the decimal places are separated by a comma in the drawings.

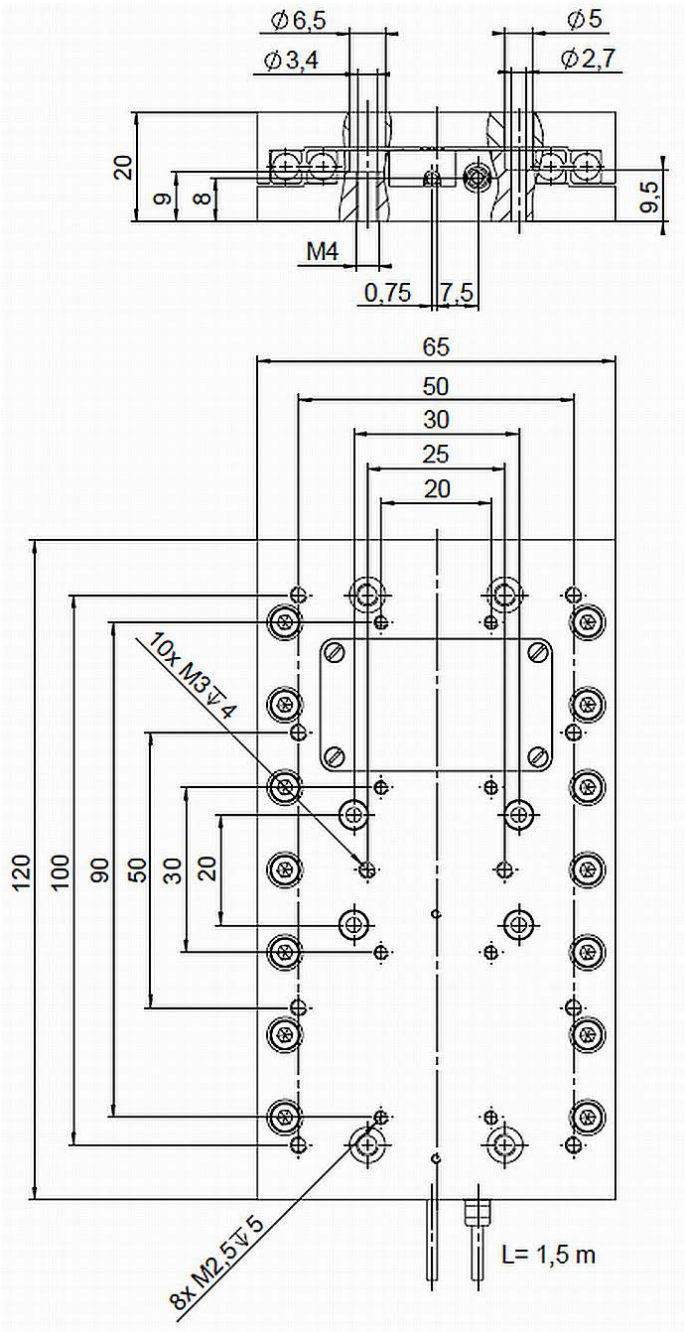


Figure 11: Dimensions of the N-664.3A, moving platform in reference position

10.4 Pin Assignment

10.4.1 Drive Connection

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

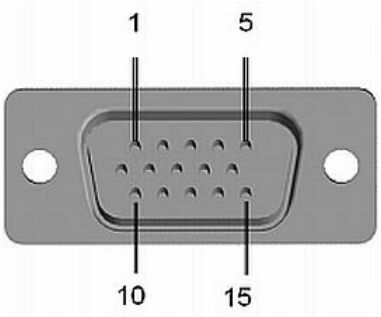


Figure 12: HD Sub-D 15 connector (m) for the drive, mating side

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-664

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

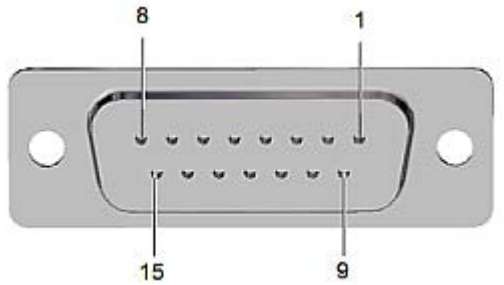


Figure 13: Sub-D 15 connector (f) for sensor, mating side

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.

Pin assignment of the N664B0001 adapter

The pin assignments of the N664B0001 adapter, which is included in the scope of delivery of the N-664, are as follows:

- Sub-D 15 (m) connector: See above, "Pin assignment of the Sub-D 15 (f) connector on the N-664"
- HD Sub-D 15 (f) connector: See following table

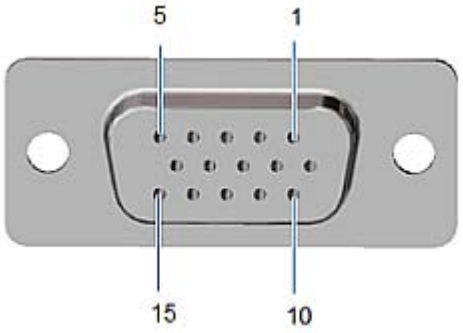


Figure 14: HD Sub-D 15 (f) connector for sensor, mating side

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

11 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

12 EC Declaration of Conformity

For the N-664, 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.

Electromagnetic Emission: EN 61000-6-3:2007, EN 55011:2009

Electromagnetic Immunity: EN 61000-6-1:2007