



User Manual

N-381.3A NEXACT® LINEAR ACTUATOR

MOTION | POSITIONING



Contents

1	Lega	l Informat	tion	4
2	Abou	ut this Do	cument	5
	2.1	Objectiv	e and Target Group	5
	2.2	Other Ap	pplicable Documents	5
	2.3	Explana	tion of Symbols	5
		2.3.1	Typographic Conventions	5
		2.3.2	Symbols Used	6
	2.4	Figures.		6
	2.5	Downloa	ading Manuals	6
3	Safe	ty		8
	3.1	Intended	d Use	8
	3.2	General	Safety Instructions	8
	3.3	Organiza	ational Measures	8
		3.3.1	User Manual	8
		3.3.2	General Personnel Qualification	8
4	Prod	uct Descri	iption	9
	4.1	Product	Labeling	9
		4.1.1	Type Plate	9
	4.2	Scope o	f Delivery	9
	4.3	Overview	N	9
		4.3.1	Motor Connector	10
		4.3.2	Sensor Connector	10
	4.4	Suitable	Electronics	10
5	Unpa	acking		11
6	Ineta	llation		12
Ŭ	6.1	Mountin	a the N-381.3A	
	011	6.1.1	Clamping the N-381.3A With the Clamping Nut	
		6.1.2	Tightening the N-381.3A to the Clamping Surface	14
		6.1.3	Screwing the N-381.3A into the M12x1 Thread	
	6.2	Fixing th	ne Load	15
	6.3	Connect	ing the N-381.3A	16
7	Star	tup / Oper	ration	17
•	7.1	Starting	and Operating the N-381.3A	
	7.2	Correcti	ng the Sensor's Reference Position	
	7.3	Discharc	ging the N-381.3A	21
0	Main	tononco		22
0		Cleaning	٠	∠3 າວ
_	0.1	Cieannių	J	23
9	Trou	bleshootiı	ng	24

CONTENTS



10	Transportation	25				
11	Customer Service Department					
12	Technical Data	27				
	12.1 Specifications	27				
	12.2 Maximum Ratings	27				
	12.3 Ambient Conditions and Classifications	28				
	12.4 Dimensions	29				
13	Old Equipment Disposal	30				
14	Appendix	31				
	14.1 Pin Assignment	31				
	14.1.1 Motor Connector	31				
	14.1.2 Sensor Connector	32				
	14.2 Reference Point Switch Specifications	32				
	14.3 Torque for Stainless Steel Screws (A2-70)	33				
15	EU Declaration of Conformity	34				



1 Legal Information



The following company names and brands are registered trademarks of Physik Instrumente (PI) GmbH & Co. KG:

PI®, PIC®, NanoCube®, PICMA®, PIFOC, PILine®, NEXLINE®, PiezoWalk®, PicoCube®, PiezoMove®, PIMikroMove, NEXACT®, Picoactuator®, PInano®, NEXSHIFT®, PITOUCH®, PIMag®, PIHera, Q-Motion®

The patents held by PI can be found in our list at <u>http://www.physikinstrumente.com/en/</u><u>about-pi/patents</u>.

© 2018 Physik Instrumente (PI) GmbH & Co. KG, Karlsruhe, Germany. The text, photographs, and drawings in this manual are protected by copyright. With regard thereto, Physik Instrumente (PI) GmbH & Co. KG reserves all rights. The use of any text, images and drawings is permitted only in part and only when indicating the source.

Original instructions First print: 11/21/2018 Document number: MP177en, CBo

Subject to change. This manual is superseded by any new release. The latest versions of the user manuals are available for <u>download (p. 6)</u> at <u>www.pi.ws</u>.

Publisher:

Physik Instrumente (PI) GmbH & Co. KG Auf der Roemerstrasse 1 76228 Karlsruhe Germany info@pi.de

www.pi.de

Customer service department:

Physik Instrumente (PI) GmbH & Co. KG Auf der Roemerstrasse 1 76228 Karlsruhe Germany <u>service@pi.de</u> www.pi.de

MOTION | POSITIONING



2 About this Document

2.1 Objective and Target Group

This user manual contains the information needed for the intended use of the N-381.3A. Basic knowledge of closed-loop systems, motion control concepts, and applicable safety measures is assumed.

2.2 Other Applicable Documents

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

Document number	Document type	Product
PZ195E	User Manual	E-712 modular digital piezo controller
PZ205E	User Manual	E-861 PiezoWalk® NEXACT® controller / driver
E861T0013	User Manual	E-861.11C885 NEXACT® controller module
E862T0001	Technical Note	E-862 NEXACT® drive electronics
SM148E	Software Manual	PIMikroMove

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

2.3 Explanation of Symbols

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

2.3.1 Typographic Conventions

Symbol / Label	Meaning
1. 2.	Action consisting of several steps whose sequential order must be observed
•	List item
р. 5	Cross-reference to page 5
RS-232	Labeling of an operating element on the product (example: socket of the RS-232 interface)
Start > Settings	Menu path in the PC software (example: to open the menu, the <i>Start</i> and <i>Settings</i> menus must be clicked successively)
POS?	Command line or a command from PI's General Command Set (GCS) (example: command to get the axis position)
Device S/N	Parameter name (example: parameter where the serial number is stored)
5	Value that must be entered or selected via the PC software



2.3.2 Symbols Used

Symbol / label	Meaning
	Risk of crushing
	General hazard symbol

DANGER

Dangerous situation

Failure to observe can lead to death or serious injury.

Measures for avoiding the risk.

WARNING

Dangerous situation

Failure to observe can lead to serious injury.

Action to take to avoid the risk.

CAUTION

Dangerous situation

Failure to observe can lead to minor injury.

Actions to take to avoid the risk.

NOTICE



Dangerous situation

Failure to observe can lead to material damage.

Action to take to avoid the risk.

Information

Additional information on the N-381.3A that can affect your application.

2.4 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.

2.5 Downloading Manuals

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

For products that are supplied with software (data storage device in the scope of delivery), access to the manuals is protected by a password. Protected content is only displayed on the website after entering the access data. You need the data storage device for the product to get the access data.

If a manual is missing or problems occur with downloading, contact our <u>customer service</u> <u>department (p. 26)</u>.



Downloading Manuals

- 1. Open the website <u>www.pi.ws</u>.
- If the product was shipped with a data storage device: Log into the website:
 a) Click *Login*.
 - b) Enter the login data.

The login data is in the *[...]_Releasenews_[...].pdf* in the *Manuals* directory on the data storage device.

If necessary: Follow the link and register yourself to get the login data.

- c) Click Login or press the Enter key.
- 3. Search for the product:
 - a) Click Search.
 - b) Enter the product number up to the period (e.g., N-381) or the product family (e.g., NEXACT®) into the search field.
 - c) Click Start search or press the Enter key.
 - d) If necessary: Click *Load more results* at the bottom of the list.
- 4. Click the corresponding product in the list of search results.
- 5. Click the *Downloads* tab.
- → The manuals are shown under **Documentation**.
- 6. Click the desired manual and save it.



3 Safety

3.1 Intended Use

The N-381.3A is a laboratory device as defined by DIN EN 61010-1. It is intended for indoor use and use in an environment that is free of dirt, oil, and lubricants.

In accordance with its design, the N-381.3A is intended for positioning, adjusting and shifting loads in one axis at various velocities. The N-381.3A is **not** intended for applications in areas, in which a failure would present severe risks to human beings or the environment.

The intended use of the N-381.3A is only possible when completely mounted and connected. The N-381.3A must be operated with <u>suitable electronics (p. 10)</u>. The electronics are not in the scope of delivery of the N-381.3A.

The N-381.3A may not be used for purposes other than those stated in this user manual. The N-381.3A may only be used in compliance with the technical specifications and instructions in this user manual.

3.2 General Safety Instructions

The N-381.3A is built according to state-of-the-art technology and recognized safety standards. Improper use of the N-381.3A may result in personal injury and/or damage to the N-381.3A.

- ▶ Use the N-381.3A only for its intended purpose and if it is in perfect condition.
- ▶ Read the user manual.
- Eliminate any faults and malfunctions that are likely to affect safety immediately.

The operator is responsible for correct installation and operation of the N-381.3A.

3.3 Organizational Measures

3.3.1 User Manual

- Always keep this user manual available with the N-381.3A. The latest versions of the user manuals can be <u>downloaded (p. 6)</u> at <u>www.pi.ws</u>.
- Add all information from the manufacturer such as supplements or technical notes to the user manual.
- If you give the N-381.3A to a third party, also include this user manual as well as other relevant information provided by the manufacturer.
- Only use the device on the basis of the complete user manual. Missing information due to an incomplete user manual can result in minor injury and damage to equipment.
- Only install and operate the N-381.3A after you have read and understood this user manual.

3.3.2 General Personnel Qualification

The N-381.3A may only be installed, started up, operated, maintained, and cleaned by authorized and appropriately qualified personnel.



4 Product Description

4.1 Product Labeling

4.1.1 Type Plate



Figure 1: Type plate of the N-381.3A

- 1. Data matrix code (example; contains the serial number)
- 2. Product number (example)
- 3. Serial number (example), individual for each N-381.3A Meaning of the position (counting from the left):
 1 = internal information,
 2 and 3 = year of manufacture,
 4 to 9 = consecutive numbers
- 4. Warning and conformity symbols (old equipment disposal (p. 30), CE mark (p. 34))

4.2 Scope of Delivery

Product number	Description
N-381.3A	NEXACTUATOR linear actuator, 30 mm, 20 nm encoder resolution
MP177EN	User manual for N-381.3A

4.3 Overview



Figure 2: Example product view of the N-381.3A



- 1. Sensor cable (N-381.3A only)
- 2. Motor cable for supply voltage
- 3. Carbon sleeve
- 4. Clamping surface
- 5. Clamping nut
- 6. Mounting shaft with M12 thread
- 7. Extendable pusher, nonrotating
- 8. Wrench flat for open-end wrench
- 9. M3 inner thread in the pusher

4.3.1 Motor Connector

The motor connector transmits the supply voltage for the N-381.3A's drive.

4.3.2 Sensor Connector

The sensor connector transmits the N-381.3A's sensor signals.

4.4 Suitable Electronics

The N-381.3A must be connected to suitable electronics that supply the necessary voltages for operating the N-381.3A and if required, evaluate the sensor signals. The following electronics are suitable for operating the N-381.3A:

Product number	Description
E-712	Modular, digital piezo controller
E-861	PiezoWalk® NEXACT® controller / driver
E-861.11C885	NEXACT® controller module
E-862	NEXACT® drive electronics

To order, contact our <u>customer service department (p. 26)</u>.

\mathbf{PI}

5 Unpacking

NOTICE



Malfunction due to soiling!

Any type of soiling; e.g., dust, oil, lubricant or condensation, will render the N-381.3A inoperable.

- Keep the N-381.3A free of dirt and condensation.
- ► Keep the N-381.3A's drive free of lubricants.

NOTICE



Tensile forces on the connecting cables can damage the N-381.3A.

Avoid tensile forces on the connecting cables.

NOTICE

Destruction of the N-381.3A due to mechanical overload! Mechanical forces can destroy the N-381.3A.

- Avoid knocks that affect the N-381.3A.
- ► Do not drop the N-381.3A.
- ► Do **not** move the N-381.3A's pusher by hand.

Unpacking the N-381.3A

- 1. Unpack the N-381.3A 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 <u>customer service department (p. 26)</u> immediately.
- 4. Keep all packaging materials in case the product needs to be returned.

A



6 Installation

6.1 Mounting the N-381.3A

You can choose from the following options for installing the N-381.3A:

- Clamping with the M12 nut supplied (p. 13)
- <u>Tightening on the clamping surface (p. 14)</u>
- Screwing the stud into an M12x1 threaded hole (p. 14)

CAUTION

Risk of crushing by moving parts!

Risk of minor injuries from crushing between the N-381.3A's pusher or the load and a fixed part or obstacle.

- ▶ Use safeguards to protect limbs in areas where they could be caught by moving parts.
- Maintain the safety distances according to DIN EN ISO 13857 when installing protective structures.

NOTICE

Mechanical overload due to high torques and high loads!

High torques when fixing the load as well as high loads can overload the N-381.3A's pusher. Mechanical overload can damage the N-381.3A as well as lead to loss of accuracy.

- ▶ Pay attention to the torque range (p. 33) given for the screws used during installation.
- Avoid torques >1.1 Nm on the N-381.3A's pusher.
- ▶ Do **not** exceed the maximum permissible loads according to the <u>specifications (p. 27)</u>.

NOTICE

Damage due to collisions!

Collisions can damage the N-381.3A, the load to be moved, and the surroundings.

- Make sure that collisions are not possible between the N-381.3A, the load to be moved, and the surroundings in the motion range of the N-381.3A.
- Do not place any cables or other objects in areas where they could be caught by moving parts.

NOTICE

Damage when moving the pusher by hand!

Moving the N-381.3A's pusher by hand can damage the drive.

- ▶ Do **not** move the N-381.3A's pusher by hand.
- Initiate all motion by sending motion commands to the controller.



6.1.1 Clamping the N-381.3A With the Clamping Nut



Figure 3: N-381.3A clamped with clamping nut

- 1. Clamping nut
- 2. Mounting shaft with M12 thread
- 3. Mechanical mounting for the actuator

Tools and Accessories

Hook wrench for M10/M12 slotted nuts with an outer diameter from 25 to 28 mm

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ The N-381.3A is **not** connected to the electronics.
- ✓ You have a suitable mounting with the following properties (see also <u>"Dimensions" (p. 29)</u>):
 - The mounting has a through-hole for the N-381.3A's mounting shaft.
 - The N-381.3A and the entire <u>clamping surface (p. 9)</u> can be inserted completely into the mounting (see figure).
 - The mounting has a hard stop for the front side of the N-381.3A.

NOTICE

Excessive torque on the clamping nut!

- Excessive torque on the clamping nut can damage the N-381.3A.
- Do not exceed the maximum torque.

Clamping the N-381.3A with the clamping nut

- 1. Screw the clamping nut completely out of the mounting shaft of N-381.3A.
- 2. Position the N-381.3A in the mounting of your application.
- 3. Tighten the clamping nut with a torque of 15 to 20 Nm.



6.1.2 Tightening the N-381.3A to the Clamping Surface



Figure 4: N-381.3A in the clamping mechanism

- 1. Carbon sleeve: Do not clamp here!
- 2. Clamping screw
- 3. Clamping mechanism

Tools and Accessories

If your clamping mechanism has clamping screws: Suitable screwdriver for clamping screw(s)

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ The N-381.3A is **not** connected to the electronics.
- ✓ You have a suitable clamping mechanism for the <u>clamping surface (p. 9)</u> of the N-381.3A. For more details, see <u>"Dimensions" (p. 29)</u>.

NOTICE



Damage due to incorrect clamping!

- Clamping to the carbon sleeve will damage the N-381.3A.
- ► Clamp the N-381.3A to the metal surface only.
- ▶ Do not overtighten the screw in the clamping mechanism.

Tightening the N-381.3A to the clamping surface

- 1. Push the N-381.3A far enough into the clamping mechanism so that it is resting on the metal clamping surface.
- 2. Position the N-381.3A in the clamping mechanism according to your application.
- 3. Clamp the N-381.3A in the clamping mechanism tightly. If you clamping mechanism has clamping screws, tighten the screw(s) only as much as necessary.

6.1.3 Screwing the N-381.3A into the M12x1 Thread

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ The N-381.3A is **not** connected to the electronics.



✓ The M12 hole for mounting the mounting shaft (p. 9) has a minimum thread depth of 12.5 mm.

Screwing the N-381.3A into the M12x1 thread

1. Screw the mounting shaft of the N-381.3A into the threaded hole.

6.2 Fixing the Load



Figure 5: Fixing the load with an M3 screw

- 1. M3 inner thread in the pusher
- 2. AF7 wrench flat for open-end wrench

Tools and Accessories

- M3 screw of suitable <u>length (p. 29)</u>
- Screwdriver for M3 screw
- SW7 open-end wrench for fixing the pusher

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ The N-381.3A is **not** connected to the electronics.
- ✓ You have fixed the N-381.3A properly.
- The distance between the center of gravity of the load and the center of the hole in the pusher is as small as possible in all directions.

NOTICE



Mechanical overload due to high torques and high loads!

High torques when fixing the load as well as high loads can overload the N-381.3A's pusher. Mechanical overload can damage the N-381.3A as well as lead to loss of accuracy.

- ▶ Pay attention to the torque range (p. 33) given for the screws used during installation.
- ► Avoid torques >1.1 Nm on the N-381.3A's pusher.
- ▶ Do not exceed the maximum permissible loads according to the <u>specifications (p. 27)</u>.



Fixing the Load

- 1. Use an open-end wrench with a matching jaw size to hold the pusher in place.
- 2. Fix the load to the mounting hole in the pusher with a suitable screw.
- 3. Remove the open-end wrench from the pusher.

6.3 Connecting the N-381.3A

Tools and Accessories

■ If necessary: Suitable screwdriver for the locking screws of the connectors.

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ You have read and understood the user manual for the electronics used.
- ✓ You have installed the electronics properly.
- ✓ The electronics are switched off.

NOTICE



Connecting unsuitable electronics or a wrong cable can damage the N-381.3A or the electronics.

- ► Connect the N-381.3A only to suitable electronics from PI (p. 10).
- ▶ Use cables from PI only to connect the N-381.3A to the electronics.

N-381.3A anschließen

- 1. Connect the N-381.3A's motor connector to the corresponding connector of the electronics.
- 2. Connect the N-381.3A's sensor connector to the corresponding connector of the electronics.
- 3. Secure the connectors against unintentional removal.



7 Startup / Operation

7.1 Starting and Operating the N-381.3A

Tools and Accessories

Electronics from PI (p. 10)

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ For startup with a load or in a multi-axis system: You have installed the N-381.3A properly (p. 12).
- \checkmark You have read and understood the user manual for the electronics used.
- ✓ If a digital controller is used: You have read and understood the manual for the PC software used.
- ✓ The electronics and if required, the PC software, have been installed (see the user manual for the electronics).



CAUTION

Risk of crushing by moving parts!

Risk of minor injuries from crushing between the N-381.3A's pusher or the load and a fixed part or obstacle.

- ► Use safeguards to protect limbs in areas where they could be caught by moving parts.
- Maintain the safety distances according to DIN EN ISO 13857 when installing protective structures.

NOTICE

Destruction of the piezo actuator due to electric flashovers

Using the N-381.3A in environments that increase the electrical conductivity can lead to the destruction of the piezo actuator by electric flashovers. Electric flashovers can be caused by moisture, high humidity, liquids, and conductive materials (e.g., metal dust). In addition, electric flashovers can also occur in certain air pressure ranges due to the increased conductivity of the air.

- Avoid operating the N-381.3A in environments that can increase the electrical conductivity.
- Operate the N-381.3A only within the permissible <u>ambient conditions and</u> <u>classifications (p. 28)</u>.

NOTICE

Reduced lifetime of the piezo actuator due to permanently applied voltage! Applying a continuous voltage to piezo actuators leads to a considerable reduction in the lifetime of the piezo ceramic.

- When the N-381.3A is not being used (e.g., to ensure temperature stability of the electronics), <u>discharge (p. 21)</u> it.
- ▶ If possible, limit the maximum operating voltage during continuous operation.



NOTICE

Operating voltage excessively high or incorrectly connected!

Operating voltages that are too high or incorrectly connected can cause damage to the N-381.3A.

- ▶ Pay attention to the <u>operating voltage range (p. 27)</u>, which is specified for the N-381.3A.
- ▶ Pay attention to correct <u>pin assignment (p. 31)</u>.

NOTICE

Damage due to collisions!

Collisions can damage the N-381.3A, the load to be moved, and the surroundings.

- ▶ Stop the motion immediately if an electronics malfunction occurs.
- If possible, adapt the travel range limits of your mechanical system in the software that you use for commanding the motion.

NOTICE



Uncontrolled oscillation!

Oscillation can cause irreparable damage to the N-381.3A. Oscillation is indicated by a humming noise and can be caused by the following:

- A change in the load and/or dynamics requires the servo-control parameters to be adjusted.
- The N-381.3A is operated near to its resonant frequency.
- If you notice oscillation:
- ▶ In closed-loop operation, switch off the servo mode immediately.
- ► In open-loop operation, stop the N-381.3A immediately.

NOTICE

Unintentional motion!

The N-381.3A can move unintentionally when connecting the electronics. Defective or incorrect operation of the software can also result in unintentional motion.

- ▶ Do not place any objects in areas where they can be caught by moving parts.
- Before connecting the N-381.3A, check whether a startup macro has been defined in the electronics and if necessary, cancel the selection.

Information

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

- Oscillation
- Imprecise positioning
- Long settling times

If the performance of the N-381.3A is not satisfactory:

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

Starting and Operating the N-381.3A

- 1. Start and operate the controller (see user manual for the controller).
- 2. Configure the controller for the N-381.3A during startup:
 - If you ordered the N-381.3A as system with controller, the default factory settings for your system are loaded automatically. It is not necessary to select the mechanics from the positioner database.
 - If you ordered the N-381.3A separately (without controller):



Select the **N-381.3A** entry from the positioner database in PC software. If the N-381.3A does not reach its full travel range in closed-loop operation, calibrate the sensor (p. 19).

3. Start a few motion cycles for testing purposes (see user manual for the controller).

7.2 Correcting the Sensor's Reference Position

Information

If you ordered the N-381.3A separately (without controller), it may be necessary to the correct the sensor's reference position. Correcting makes sure that the N-381.3A is able to reach its full travel range in closed-loop operation.

If you ordered the N-381.3A as system with controller, it is not necessary to correct the reference position.

Requirements

- ✓ You have read and understood the general safety instructions (p. 8).
- ✓ The N-381.3A has been installed properly (p. 12).
- ✓ The electronics and the required PC software have been installed.

Correcting the Sensor's Reference Position

- Open PlMikroMove and establish communication with the controller in the Start Up Controller window. If the Start Up Controller window is not displayed, click Connections > New... in the main menu.
 - a) Establish connection between the PC and controller during the *Connect controller* step. For details, see PIMikroMove <u>manual (p. 5)</u>.
 - b) Select the N-381.3A during the Select connected stages step, click the Assign -> button and then OK.
 - c) Click the *Close* button during the *Start up axes* step to close the window.
- 2. Open the expanded single axis window in PIMikroMove's main window:
 - a) Click the > button on the right-hand edge of the single axis window. If the single axis window is not displayed, click *View* > *Single Axis Window* in the main menu and select the N-381.3A.
 - b) Enlarge the window with the mouse to display the parameter values.

Axis:	1 - N-381.3A on E-861 on RS-232: COM1, 9600 baud 🔹		Servo	Load and Save Parameters	re View		
State:	servo off		Reference using neg. limit	Name	ID	Active Value	СС
[Reference using ref. position	P term	0x1	100	0
			Reference using pos. limit	I term	0x2	50	0
	0 000000		Reference stage Find edge	D term	0x3	0	0
osition:	-0.00020			I limit	0x4	2000	0
	0,000020			following error	0x8	2	0
			neg, lim, ref. pos, lim,	maximum closed loop velocity	0xA	10,000000	0
			Motor out	closed loop acceleration	0xB	50,000000	0
		<		closed loop deceleration	0xC	50,000000	0
	Home FI		last successfully (20)	numerator	0xE	50000	0
	HALT		Last error on controller:	denominator	0xF	1	0
	TPAL I			range minimum	0x700	-42949,672940	0
DL Target:	0,000000			range maximum	0x700	42949,672940	0
mm]	(III)			travel range minimum	0x30	0,000000	0
ten size:	0.100000			travel range maximum	0x15	29,000000	0
mm]	0,10000			reference position	0x16	14,500000	0
alocitu	5 000000			distance between reference and negative limit	0x17	14,500000	0
elocity:	5,00000			distance between reference and positive limit	0x2F	14,500000	0

Figure 6: Expanded single axis window

- 3. Set the following parameter values on the table:
 - travel range maximum (0x15) = 30
 - reference position (0x16) = 15.5



- distance between reference and negative limit (0x17) = 15.5

If any of the parameters to be set are not displayed in the table, click **Configure View > Select parameters...** in the menu above the parameter table and add the parameter. Note that parameter values are sent to the controller only when you confirm input with the **Enter** key.

- 4. Start a reference move by clicking the *Reference using ref. position* button. The new parameter values are then saved to the controller's volatile memory.
- 5. Command motion in a positive direction in open-loop operation (*servo off*) at low velocity up to the physical end of the travel range (hard stop):
 - a) Select the *PiezoWalk(R) channels* tab in PIMikroMove's main window.
 - b) Enter the following values:
 - Open-loop velocity: 200,000000
 - Open-loop number of steps: 500,000000
 - c) Click the > button several times until the pusher has moved out completely.

P	I PIMikro Connectio	Move 2.29.0.1) Tools (a) () DiezoWalk(R) chann	(enter help search	here	0. ? ©				-	×
	1	Step Amplitude	Open-Loop Analog Driving 0,000000	Open-Loop Velocity 200,000000	< <	Open-Loop Number of Steps 500,000000	>	Open-Loop Remaining Steps	HALT	Relax Relax	A 4
L	sst errors E-861 (CC	M1):									?

Figure 7: Move to the physical end of the travel range (hard stop) in a positive direction

- 6. Note the position displayed in the single axis window (hard stop in a positive direction).
- 7. Calculate the parameter **0x2F** (gap between the reference point switch and hard stop in a positive direction).

Formula:

Parameter 0x2F = position at the hard stop in a positive direction - current position of the reference point switch (parameter 0x16) - tolerance 0.1

Example calculation:

Position at the hard stop in positive direc- tion	Minus the value of parameter 0x16	Minus tol- erance	Result for parameter 0x2F
30.76 mm	-15.5 mm	-0.1 mm	= 15.16 mm

8. Calculate the parameter **0x17** (gap between the reference point switch and hard stop in a negative direction).

Formula:

Parameter **0x17** = overall travel range - parameter **0x2F** (gap between the reference point switch and hard stop in a positive direction) Example calculation:

Overall travel rangeMinus the value of parameter 0x2F		Result for parameter 0x17*
30 mm	-15.16 mm	= 14.84 mm

* The new value of parameter 0x17 also applies to parameter 0x16 (reference position).



- 9. Change the value of parameter **0x16**, **0x17** and **0x2F** in the expanded single axis window so that the calculated values correspond.
- 10. Start a reference move by clicking the *Reference using ref. position* button. The new parameter values are then saved to the controller's volatile memory.
- 11. Check whether the full travel range (0 to 30 mm) is reached in closed-loop operation:
 - a) Switch servo mode on by checking the Servo box.
 - b) Click the |< and |> buttons to move the pusher in or out completely. The N-381.3A should stop at position 30 mm in a positive direction and 0 mm in a negative direction.
- 12.Optional: To prevent losing of any changes when the controller is switched off, save the parameter changes as user-defined positioner (user stage) or to the controller's nonvolatile memory.

PI PIMikroMove 2	.29.0.1		
Connections E-8	61 (COM1) Tools View Help		
🗧 🖨 🖨	Select connected stages		
Axes	Start up axes		
Show data recorder			
Ste	Configure controller joystick(s)		
1	Calibrate controller joystick	•	
	Save parameters as User Stage type		
	Save parameters to non-volatile memory		

Figure 8: Save the parameter settings

7.3 Discharging the N-381.3A

The N-381.3A must be discharged in the following cases:

- When the N-381.3A is not in use but the electronics remain switched on to ensure temperature stability
- If the N-381.3A is accidentally disconnected from the electronics during operation

Requirements

✓ You have read and understood the general safety instructions (p. 8).

Tools and Accessories

Electronics from PI (p. 10)

Information

The N-381.3A is driven by NEXACT® piezo actuators. Temperature changes and compressive stress can induce charges in piezo actuators. After disconnection from the electronics, piezo actuators can remain charged for several hours. Touching or short-circuiting the contacts in the N-381.3A's motor connector can lead to electric shocks (max. 45 V).

Discharge the N-381.3A before disconnecting the connector from the electronics.

Discharging a N-381.3A Connected to the Electronics

1. Set the piezo voltage to 0 V on the electronics.



Discharging a N-381.3A not Connected to the Electronics

1. Insert the N-381.3A's motor connector into the **switched-off** electronics from PI and maintain the connection for a few seconds.



8 Maintenance

NOTICE



Damage due to improper maintenance!

The N-381.3A is maintenance-free. Improper maintenance can result in the failure of the N-381.3A.

- ► Loosen screws only when instructed in this manual.
- ▶ Do not open the N-381.3A.

8.1 Cleaning

Requirements

✓ You have disconnected the N-381.3A from the electronics.

Auxiliary Materials Required

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

If you have any questions on the auxiliary materials recommended for the N-381.3A, contact our <u>customer service department (p. 26)</u>.

NOTICE

Damage due to unsuitable cleaning agents!

Some cleaning agents can cause rusting on the N-381.3A or dissolve plastics, paints or adhesives.

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

Cleaning the N-381.3A

- 1. Dampen the cloth with the cleaning agent or disinfectant.
- 2. Carefully wipe the surfaces of the N-381.3A.



9 Troubleshooting

The positioner does not move	
Cable not connected correctly	Check the cable connections.
Unsuitable cable used. If unsuitable cables are used, interference is possible in the signal transmission between the N-381.3A and the electronics.	 Only use genuine PI parts for connecting the N-381.3A to the electronics. If you need extension cables, contact our <u>customer service department (p. 26)</u>.
Defective actuator	If possible, replace the defective actuator with another actuator and test the new combination.
Reduced positioning accuracy	
Excessive load	Do not exceed the maximum permissible loads according to the <u>specifications (p. 27)</u> .
Uncontrolled oscillation	
Large changes to the load or the alignment of the N-381.3A	 Switch off the servo control system or the controller immediately. Check the servo control parameter settings (see the user manual for the controller). If necessary, correct the settings of the servo control parameters.
Increased wear	
Moving to the hard stop	 Avoid motion in open-loop operation. If motion is necessary in open-loop operation, stop the axis in time.
Reduced holding force and feed force	
Ceramic rail of the NEXACT® drive is dirty	 Contact our <u>customer service depart-</u> ment (p. 26).



10 Transportation

Preparing the N-381.3A for Transportation

- 1. Pay attention to the ambient conditions and classifications (p. 28).
- 2. Pack the N-381.3A in the original packaging.
- 3. If the N-381.3A is to be sent, use a stable outer box.



11 Customer Service Department

For enquiries and orders, contact your PI representative or send us an <u>email</u>. If you have any questions concerning your system, provide the following information:

- Product and serial numbers of all products in the system
- Firmware version of the controller (if applicable)
- Version of the driver or the software (if applicable)
- Operating system on the PC (if applicable)

If possible: Take photographs or make videos of your system that can be sent to our customer service department if requested.

Customer service address:

Physik Instrumente (PI) GmbH & Co. KG Auf der Roemerstrasse 1 76228 Karlsruhe Germany

<u>service@pi.de</u> <u>www.pi.de</u>



12 Technical Data

12.1 Specifications

	N-381.3A
Active axes	Х
Motion and positioning	
Travel range	30 mm
Integrated sensor	Incremental linear encoder
Sensor resolution	20 nm*
Travel range in analog mode, open loop	±5 μm (max.)
Resolution, open loop	0.03 nm**
Resolution, closed loop	20 nm*
Max. velocity	10 mm/s*
Mechanical properties	
Max. push/pull force (active)	10 N
Max. holding force (passive)	15 N
Permissible lateral force	10 N (max.)
Drive properties	
Drive type	NEXACT® linear drive
Operating voltage	-10 V to +45 V
Miscellaneous	
Operating temperature range	0 to 50 °C
Material	Chromium steel / CFK
Mass	255 g
Cable length	1.5 m
Motor connector	HD D-sub 15 (m)
Sensor connector	HD D-sub 15 (f)
Recommended electronics	E-712, E-861, E-861.11C885, E-862

* With E-861. Depends on the control electronics.

** 1 nm with E-861. Depends on the control electronics. All specifications based on room temperature (22 °C \pm 3 °C). Ask about customized versions.

12.2 Maximum Ratings

The N-381.3A is designed for the following operating data:



Maximum operating volt-	Maximum operating fre-	Maximum power con-
age	quency	sumption
45 V	1500 Hz	

12.3 Ambient Conditions and Classifications

The following ambient conditions and classifications for the N-381.3A must be observed:

Area of application	For indoor use only
Maximum altitude	2000 m above msl
Air pressure	1100 hPa to 0.1 hPa
Relative humidity	Max. 80 % for temperatures to 31 °C, linearly decreasing to 50 % at 40 °C
Storage temperature	-20 °C to 80 °C
Transport temperature	-25 °C to 80 °C
Supply voltage fluctuations	Max. ± 10 % of the nominal voltage
Overvoltage category	II
Degree of pollution	1
Protection class	1
Degree of protection according to IEC 60529	IP20



12.4 Dimensions



Figure 9: Dimensions of the N-381.3A Dimensions in mm.



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

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

Physik Instrumente (PI) GmbH & Co. KG Auf der Roemerstrasse 1 76228 Karlsruhe Germany

info@pi.de www.pi.de







14 Appendix

- 14.1 Pin Assignment
- 14.1.1 Motor Connector



Figure 10: HD D-sub 15 motor connector (m), front view (not the soldering side)

Pin	Signal	Function
1	Piezo 1	Input: Piezo 1 power supply
2	Piezo 3	Input: Piezo 3 power supply
3	NC	Not connected
4	NC	Not connected
5	NC	Not connected
6	Piezo 0	Input: Piezo 0 power supply
7	Piezo 2	Input: Piezo 2 power supply
8	Bridge	Bridge to pin 15
9	NC	Not connected
10	NC	Not connected
11	Piezo GND	Piezo voltage ground
12	Piezo GND	Piezo voltage ground
13	NC	Not connected
14	NC	Not connected
15	Bridge	Bridge to pin 8

The connector shell is connected to the cable shield.



14.1.2 Sensor Connector



Figure 11: HD D-sub 15 sensor connector (w), front view (not the soldering side)

Pin	Signal	Function
1	REF-	Output: Reference point switch (-)
2	+5V VDD	Input: Encoder power supply
3	NC	Not connected
4	SIN+	Output: Encoder signal sine (+)
5	COS+	Output: Encoder signal cosine (+)
6	NC	Not connected
7	NC	Not connected
8	NC	Not connected
9	SIN-	Output: Encoder signal sine (-)
10	COS-	Output: Encoder signal cosine (-)
11	NC	Not connected
12	+5V VDD LS	Input: Reference point switch power supply
13	GND LS	Reference point switch ground
14	GND	Ground
15	GND	Ground

The connector shell is connected to the cable shield.

14.2 Reference Point Switch Specifications

Туре	Optical sensor
Supply voltage	+5 V
Signal output	0 V / +5 V (TTL level)
Signal logic	Direction sensing via different signal levels on the left and right of the reference point switch.



14.3 Torque for Stainless Steel Screws (A2-70)

Screw size	Minimum torque	Maximum torque
M6	4 Nm	6 Nm
M5	2.5 Nm	3.5 Nm
M4	1.5 Nm	2.5 Nm
M3	0.8 Nm	1.1 Nm
M2.5	0.3 Nm	0.4 Nm
M2	0.15 Nm	0.2 Nm
M1.6	0.06 Nm	0.12 Nm



15 EU Declaration of Conformity

An EU Declaration of Conformity was issued for the N-381.3A 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