



NanoScanZ

Fine Piezo Focussing
Manual Version 2.3



FM 61600

Worldwide distribution

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**PLEASE NOTE THAT THE NANOSCAN 100 AND
NANOSCAN 200 HAVE BEEN DISCONTINUED AND ARE NO LONGER
AVAILABLE FROM PRIOR SCIENTIFIC.**

IMPORTANT SAFETY INFORMATION

SECTION I

Definition of Warnings:



Danger Electrical Shock hazard



Warning - read instructions to determine possible hazard.

These signs are displayed on the front of the NanoScan Z above the Z stage connector.

Caution: Read these operating instructions fully before use and pay particular attention to sections containing this symbol. Use this unit only as specified by the operating instructions or the intrinsic protection offered by the unit may be impaired.

- **Keep this manual in a safe place as it contains important safety information and operating instructions.**
- Before using the stage system, please follow and adhere to all warnings, safety and operating instructions located either on the product or in this User's Manual.
- The high voltage drivers can produce hazardous voltages and currents. Use caution when operating the drivers and when handling the linear actuators.

- Piezoactuators have large capacitance and are capable of storing hazardous amounts of electrical energy over long periods of time. Various conditions such as load and temperature changes can also cause piezoactuators to accumulate charge.
- Before disconnecting the DB-9 connector from the NanoScanZ:
 - Set the command voltage to 0.0V.
 - Turn the AC power to the NanoScanZ off.
 - Wait a minimum of one minute before disconnecting.
- **Do not** expose the product to water or moisture.
- **Do not** expose the product to extreme hot or cold temperatures.
- **Do not** expose the product to open flames.
- **Do not** allow objects to fall on or liquids to spill on the product.
- Connect the AC power cord only to a mains power supply marked on the product.
- Only connect to an earthed power supply socket. THIS UNIT IS CLASS I CONTRUCTION AND MUST BE EARTHED!
- Make sure the electrical cord is located so that it will not be subject to damage.

- Ensure that the mains switch / IEC socket/ mains plug is easily accessible to allow the unit to be switched off.
- Before replacing a fuse, disconnect the equipment from the main supply. Always disconnect power from product before connecting the components together.
- DANGER – Never alter the AC cord or plug. The power cord set must be an appropriately rated and approved cord set in accordance in the regulations of the country it is used in. If the supplied plug adapter is not the correct fitting for your geographic area or if you are unsure about the relevant regulations, please contact your supplier for advice
- Ensure that the ventilations slots in the controller case are free from obstruction.
- Do not in any way attempt to tamper with the product, doing so will void the warranty, and may damage the system. This product does not contain consumer serviceable components, all repairs or services should be performed by Authorised Service Centres, contact your local dealer for details.
- This product is designed to comply with BSEN 61010-1 and can be flash tested. It is fitted with radio frequency interference suppressors. Therefore it is recommended that only a D.C. test be performed. Performing flash tests repeatedly can damage insulation.

GENERAL INFORMATION

SECTION 2

The Prior NanoScanZ includes a PZT actuated linear piezo stage of exceptional resolution and stability and comes complete with a position sensitive detector for closed loop operation. The Prior NanoScanZ stage inserts directly into the Prior microscope range of stages and has a large through hole that accepts a range of specialised Prior sample holders.

2.1 Before you begin

Before unpacking the Prior NanoScanZ read this entire operation manual, paying special attention to the following section on “Handling the Prior NanoScanZ”, and the safety information in Section 1.

Check the contents of the package against the shipping list and notify your vendor immediately if any items are missing.

2.2 Handling the Prior NanoScanZ

The Prior NanoScanZ is a high precision scientific instrument and therefore requires special handling in order to ensure proper operation. Mishandling can cause permanent damage to the NanoScanZ stage. To ensure a long and useful life the following guidelines should be strictly followed.

- Do not lift by the cable, always lift by the stage frame (outer portion).
- Do not drop, treat roughly, or physically shock the NanoScanZ stage.
- Do not move the translation stage by pushing on it with your hands or any other object.
- Avoid applying a torque between the moving stage and the frame.
- Always mount the Prior NanoScanZ on a flat and clean surface.
- Ensure the underside of the Prior NanoScanZ is free of particles and dust before mounting

- Do not immerse in any liquid. If the Prior NanoScanZ requires cleaning slightly dampen a lint free cloth with iso-propanol or ethanol and lightly wipe the surface. Do not get any liquid or lint into the EDM grooves.
- Never disassemble the NanoScanZ stage, there are no user serviceable parts inside
- Do not plug the RS232 connector into the Z stage socket, this is likely to cause severe damage to your computer.

2.3 Description of Parts

Please take time to identify each of the parts supplied with your NanoScanZ system.

Controller Box:



NanoScanZ Stage (100 and 200µm):



NanoScanZ Stage (400 µm)

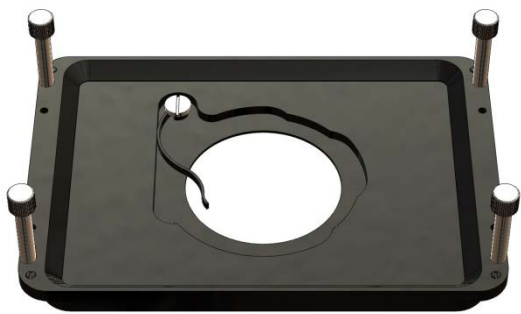


NanoScanZ Stage Inserts (100 and 200µm):

H471:



H472:



H499:



NanoScanZ Stage Inserts (400 µm):

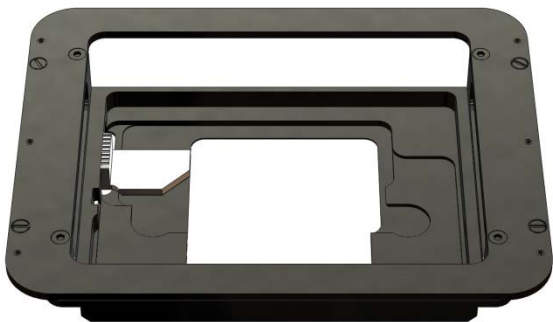
NZ301:



NZ302:



NZ303:



NZ304:



RS232 Cable (image not shown)

USB cable (image not shown)

Please ensure all parts have arrived in the original packaging and have not suffered any damaged during transit. Should any part be damaged on initial inspection, report this to your distributor immediately.

UNPACKING THE SYSTEM

SECTION 3

The NanoScanZ System consists of the NanoScanZ Controller, the NanoScanZ Stage, an RS232 Cable, an USB cable and one or more of the following stage inserts and adaptor plates.

NZ100 and NZ200:

A: H471 – Slide Holder Insert.

B: H472 – 35mm Petri Dish Holder Insert.

C: H499 – Universal Sample Holder Insert.

D: H489 - Adaptor Plate for Nikon, Olympus and Zeiss Manual stages.

NZ400:

A: NZ301 – Well Plate Holder Insert.

B: NZ302 – Universal Holder Insert.

C: NZ303 – Slide Holder Insert.

D: NZ304 – Terasaki Plate Holder Insert.

E: NZ305 - Adaptor Plate for Nikon, Olympus and Zeiss Manual stages.

INSTALLATION

SECTION 4

Install the XY Stage onto your microscope before installing the NanoScanZ stage. The NanoScanZ must be installed horizontally. Instructions on how to install the XY stage are not provided here and will have been provided with the XY stage. If in doubt, contact Prior.

When planning to install the stage minimise the load carried by the NanoScanZ stage. Heavier loads reduce the stage response time and may cause fatigue and/or reduced motion. Install the sample holder into the NanoScanZ stage before installing onto the XY stage.

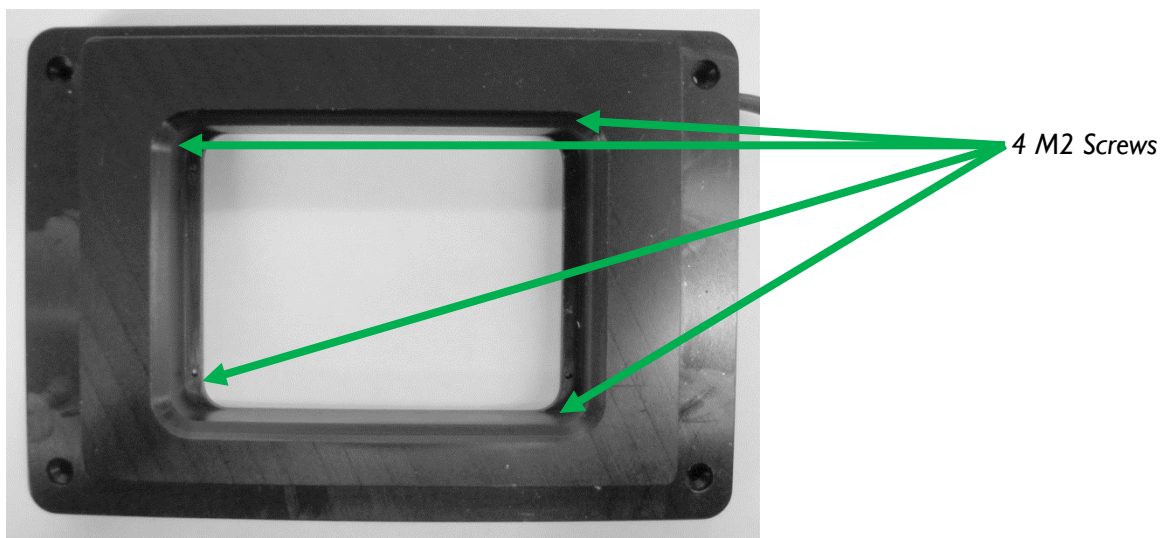
It is important that screws are tightened gently and are not over-tightened. The NanoScanZ is a delicate instrument and exerting too much force upon it may cause damage.

4.1 Installing the sample holder into the NZ100 or NZ200

To attach the Prior sample holder into the NanoScanZ Stage, use the following procedure.

Equipment required: Prior NanoScanZ, Prior NanoScanZ sample holder, 4 M2 Screws, Lint free cloth.

- Using a lint free cloth, gently wipe off the top of the Prior NanoScanZ and the Prior sample holder to remove any particles or dust.
- Using a lint free cloth, gently wipe the underside of the sample holder to remove any particles or dust.
- Gently place the Prior sample holder into the cut out on the Prior NanoScanZ.



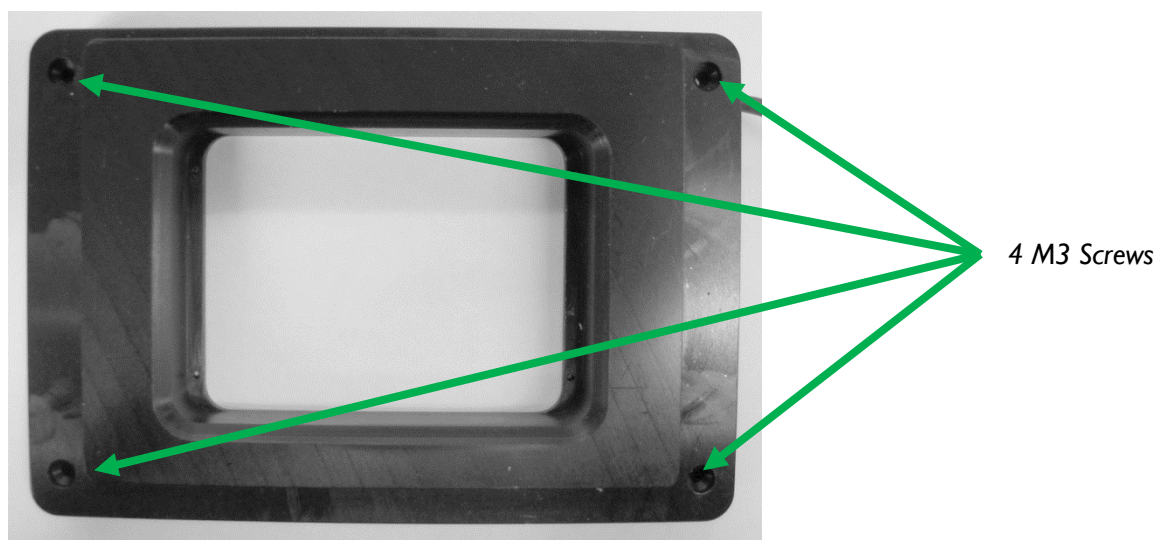
- Secure the Prior sample holder by alternately and evenly tightening the four captive screws (shown above), while making sure that no torque is applied between the outer frame and inner stage.

4.2 Installing the NZ100 and NZ200 NanoScanZ Stage

To install the Prior NanoScanZ in a motorised XY Stage use the following procedure:

Equipment required: NanoScanZ Stage (with sample holder installed), lint free cloth, small screw driver, Motorised stage, installed on microscope.

- Using a lint free cloth gently wipe the bottom of the Prior NanoScanZ and the top of the Prior microscope stage to remove any particles or dust.
- Gently place the Prior NanoScanZ into the cut out on the Prior microscope stage, handling by the outer frame only.
- Secure the Prior NanoScanZ by alternately and evenly tightening the four M3 screws as shown below.

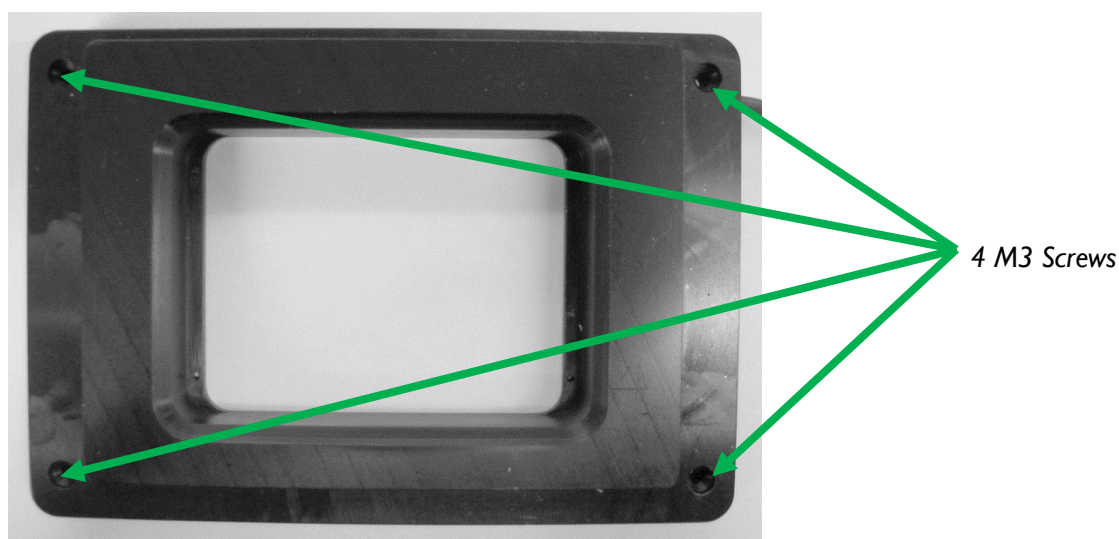


4.3 Installing the NZI00 and NZ200 NanoScanZ Stage onto the manual stage adaptor.

To install the Prior NanoScanZ on a Manual Olympus or Nikon XY Stage use the following steps:

Equipment required: NanoScanZ Stage (with sample holder installed), lint free cloth, small screw driver, Manual Stage, installed on microscope, H489 adaptor plate.

- Place adaptor plate onto Manual stage and secure with four screws provided.
- Using a lint free cloth gently wipe the bottom of the Prior NanoScanZ and the top of the adaptor plate to remove any particles or dust.
- Gently place the Prior NanoScanZ into the cut out on the adaptor plate, handling by the outer frame only.
- Secure the Prior NanoScanZ by alternately and evenly tightening the four M3 screws, as shown below.

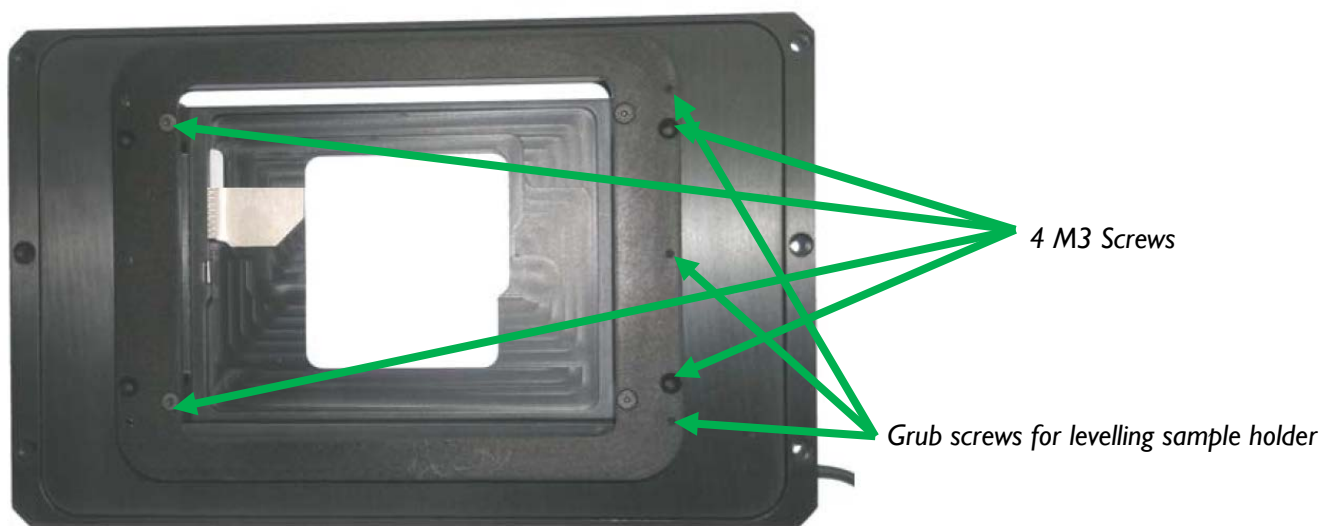


4.4 Installing the sample holder into the NZ400.

To attach the Prior sample holder into the NanoScanZ Stage, use the following procedure:

Equipment required: Prior NanoScanZ, Prior NanoScanZ sample holder, 4 M3 Screws, Lint free cloth.

- Using a lint free cloth, gently wipe off the top of the Prior NanoScanZ and the Prior sample holder to remove any particles or dust.
- Using a lint free cloth, gently wipe the underside of the sample holder to remove any particles or dust.
- Gently place the Prior sample holder into the cut out on the Prior NanoScanZ.
- Secure the Prior NanoScanZ by alternately and evenly tightening the four M3 screws
- If the plate is not level then loosen the 4 M3 screws, then use the 6 grub screws to make the plate level, before retightening the 4 M3 screws. Failure to loosen the 4 M3 screws first may result in damage to the stage.

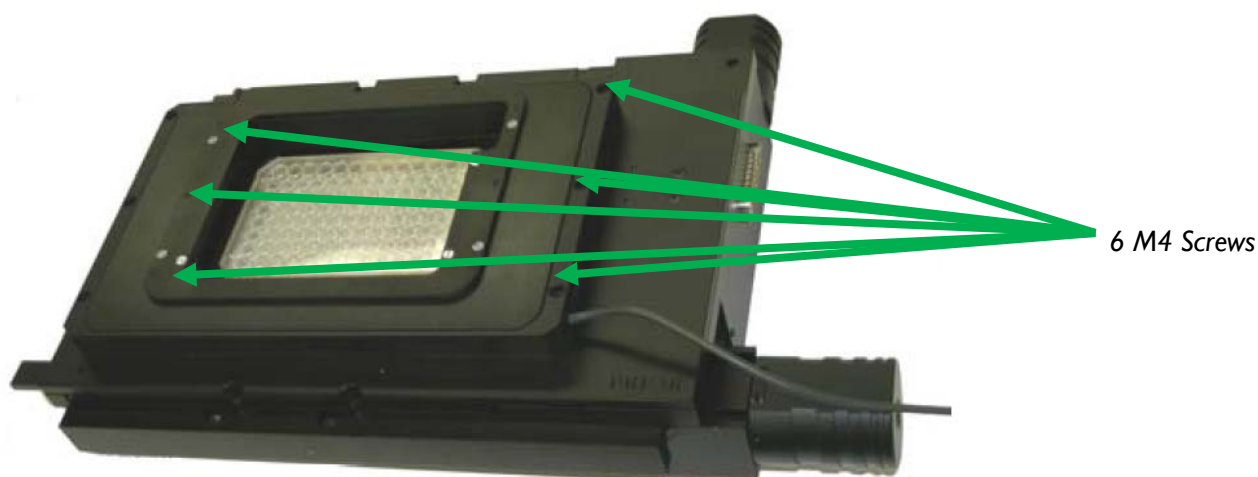


4.5 Installing the NZ400 NanoScanZ Stage.

To install the Prior NanoScanZ in a motorised XY Stage use the following procedure:

Equipment required: NanoScanZ Stage, lint free cloth, small screw driver, Motorised stage installed on microscope.

- Using a lint free cloth gently wipe the bottom of the Prior NanoScanZ and the top of the Prior microscope stage to remove any particles or dust.
- Gently place the Prior NanoScanZ onto the stage and align the six screws with the corresponding holes in the stage top. Ensure the hole in the centre of the NanoScanZ is coincident with the hole in the stage, handling by the outer frame only. (It may be necessary to turn the NanoScanZ unit through 180 degrees to align the holes).
- Secure the Prior NanoScanZ by alternately and evenly tightening the six M4 screws,



4.6 Installing the NZ400 NanoScanZ Stage onto the manual adaptor.

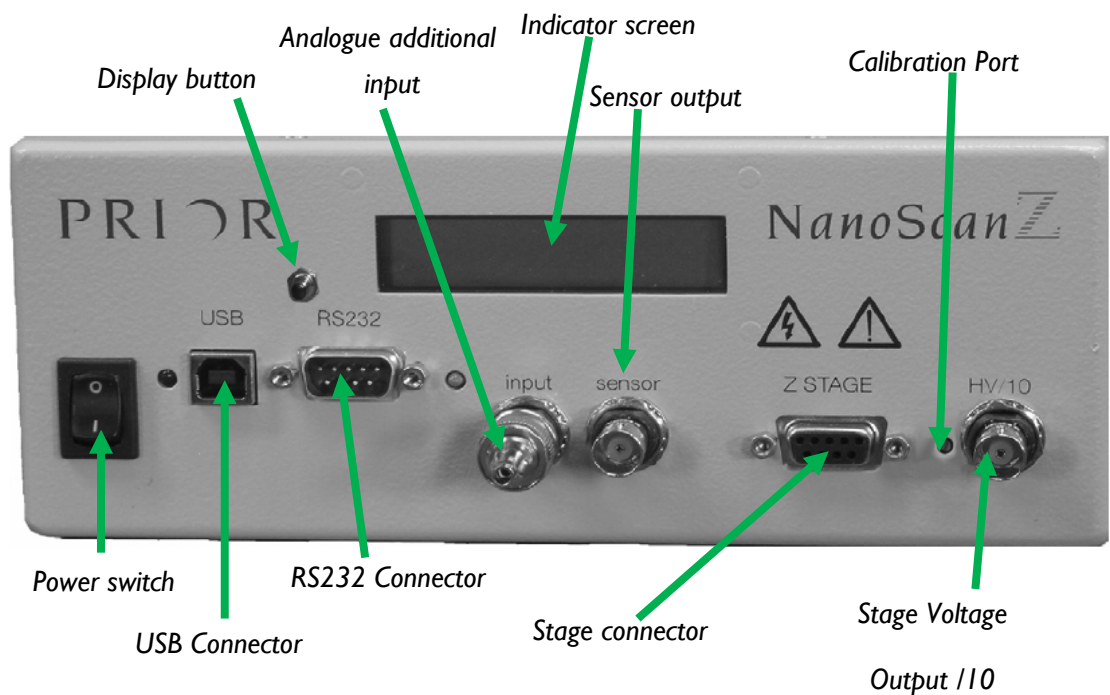
To install the Prior NanoScanZ on a Manual Olympus, Nikon or Zeiss XY Stage use the following steps:

Equipment required: NanoScanZ Stage (with sample holder installed), lint free cloth, small screw driver, Manual Stage, installed on microscope, NZ305 adaptor plate.

- Place adaptor plate onto Manual stage and secure with four or three screws provided.
- Using a lint free cloth gently wipe the bottom of the Prior NanoScanZ and the top of the Prior microscope stage to remove any particles or dust.
- Gently place the Prior NanoScanZ onto the stage and align the six screws with the corresponding holes in the stage top. Ensure the hole in the centre of the NanoScanZ is coincident with the hole in the stage, handling by the outer frame only. (It may be necessary to turn the NanoScanZ unit through 180 degrees to align the holes).
- Secure the Prior NanoScanZ by alternately and evenly tightening the six M4 screws.

4.7 Installing the NanoZ controller

Complete this section after installing the NanoScanZ stage into the XY Stage. Familiarise yourself with the connectors on the front face of the Controller box.



Note: Please ensure you note the position of the Stage and RS232 connections, it is important to connect these correctly.

Power Switch: 1 = on, 0 = off.

USB Indicator: Illuminated Red = USB Connected.

USB Connector: Port for supplied USB cable.

RS232 Connector: Port for supplied RS232 cable.

Power Indicator: Illuminates green, when power on.

Analogue Additional Input: BNC connector for PCI board control.

(Note: Must be capped by supplied terminator when not in use).

Indicator Screen: Displays position of stage and mode of operation.

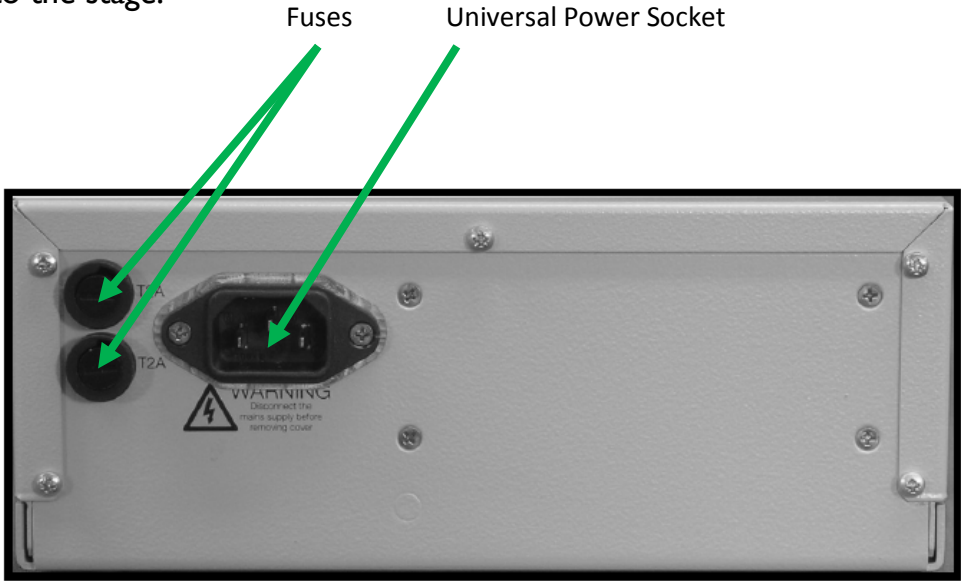
Sensor Output: BNC Connector, supplying the output of the Closed loop sensor.

Stage connector: Port for NanoScanZ stage.



Warning: This connector outputs high voltage. Always ensure the stage connector is screwed securely into the socket before powering the system. Do not plug any other connector into this socket.

Stage Voltage Output/I0: BNC connector outputting a tenth of the voltage supplied to the stage.



Universal Power Socket: 100-240 VAC 60/50 Hz.
Fuses: Two fuses, fuse rating: V250T2A

4.8 Connecting the NanoScanZ stage to the controller.



Do not connect both the Optional Analogue Input and the RS232/USB connection simultaneously. Damage to the unit may result.

- a) Ensure the Power Switch is in the off (Down) position.
- b) Ensure that the terminator is connected to the additional analogue input, or a connection is made to a DAQ board, the output from the DAQ board should be set to 0 Volts.
- c) Connect the 9 PIN NanoScanZ stage connector to the Stage output on the controller, and secure with the two screws, (the stage may make a slight click, this is normal operation).
- d) Connect the control connector (RS232 connector, USB connector, or optional analogue input).
- e) Push the supplied power cord into the Universal power socket on the reverse of the unit and connect it to the mains supply.
- f) Your NanoScanZ System is now ready for use.

GETTING STARTED

SECTION 5

5.1 Switching on your NanoScanZ system.

Once you have completed the installation in section 4 you are ready to begin controlling the NanoScanZ stage. The simplest method of control is RS232. You can connect to the NanoScanZ controller with both USB and RS232.

To use a ProScan with the NanoScanZ, connect the NanoScanZ controller to a ProScan controller via RS232 - computer to ProScan RS232-1 port, NanoScanZ to ProScan RS232-2 port. If connected via a ProScan controller, you must use a "< " before any command sent to the NanoScanZ, the NanoScanZ responses will be prefixed by a "<").

Warning: With no power the unit will lower to a state below 0 on the Z scale, on power up the NanoScanZ controller will return to the 0 position. Ensure that there are no obstructions in the NanoScanZ stages path on power up.

Switch the power switch on:

The display indicator will display the software version installed, e.g.

PIEZO 1.8

Whilst this is displayed the system is starting up – please wait. The display of

ABS 0.0000v

shows that the system is ready to accept commands. In this mode, ABS is the input voltage – if no voltage is connected this number may vary slightly.

Connect to the controller by RS232 or USB.

ABS (absolute) displays the absolute position of the NanoScanZ stage as requested by the RS232 or USB connection. For the NanoScanZ 100 0-10 corresponds to 0-100 μm , for the NanoScanZ 200 0-20 corresponds to 0 to 200 μm and for the NanoScanZ 400 0-40 corresponds to 0 to 400 μm .

5.2 Care during operation

- a) During operation ensure that there are no physical constraints on the moving stage or anything fixed to the moving stage.
- b) Never apply a voltage greater than +10V or less than 0V to the additional analogue input of the NanoScanZ.
- c) Maintain a clean working environment to reduce the chance of particles or other substances from gathering in the EDM grooves.
- d) The Prior NanoScanZ is a high precision scientific instrument and should be handled with care during operation. Failure to do so may result in permanent damage
- e) Never disconnect the 9-Pin connector with the power on. (Always set the command voltage to zero and turn the power off before disconnecting). Allow 1 minute for the Piezo Stage actuators to discharge before disconnecting.

5.3 Using the additional analogue in-out control

Warning: Set the Digital, (USB/RS232), control to 0 before using this feature.

When using the optional control mechanism use the following procedure.

- a) Install the Prior NanoScanZ as discussed in Section 4.
- b) Ensure the unit is not powered.
- c) Remove all USB and RS232 connections.
- d) Set the command signal to 0.0 Volts from the user control system.
- e) Turn the power switch on.
- f) The command voltage now controls the position of the NanoScanZ stage, do not exceed + 10V control voltage.
- g) 0 to +10V corresponds to:
 - i) - 0-100 μ m movement for the NanoScanZ 100 *or*
 - ii) - 0-200 μ m movement for the NanoScanZ 200 *or*
 - iv) - 0-400 μ m movement for the 400 μ m units.

No indication of position is provided by the display while the system is used in this mode.

ADVANCED OPERATION SECTION 6

6.1 Connecting your system via USB Operation

The following setup is required for USB communication with the NanoScanZ controller in Windows 7. If you are not running Windows 7, please contact Prior for advice. There is no software installation required for RS232 communication. See Appendix I for instructions to setup Prior Terminal.

Please note that connection to a PC using USB is only possible if the PC is running Win XP or older. Connection to a PC running Win 7 and above is available using the RS232 cable provided. If your PC does not have a RS232 com port you can use a USB to RS232 converter to connect the PC USB port to the NanoScan RS232 port

Installation

Select an open USB port on the PC and connect the NanoScanZ using the cable provided. The software needed should install automatically. To see if the NanoScanZ is able to communicate with the computer, type '?' in PriorTerminal.

If the communication does not occur it could be that the Communications Port (also referred to as either the 'Com' or 'Port') is not the correct one. Ensure the USB cable is attached! Type '?' in the control box. If nothing happens then try changing the coms port (using the box in the left hand corner of Prior Terminal' and again type '?').

If there are a large number of coms ports, or for any other reason you don't wish to use this method, open the control panel from the start menu, open "system" or Right-click on **My Computer** and select **Properties**. Click on the **Hardware** tab. Click **Device Manager**. Expand **Ports (COM & LPT)**. You should see **Prior Communication Port -> COM device (COMn)** listed, where *n* is the COM number assigned to the port.

If this fails then it is probably that the driver is not installed properly. The driver is bundled in the download along with the 'Prior Terminal'. Go to Control Panel > Systems > Hardware > Device Manager. Scan for hardware changes, select 'Prior Virtual Comport'. Right click 'Update driver' and select the correct driver. The driver will be located in the 'Prior Scientific' program files as it is automatically included in the Prior Terminal download.

The exact driver to be used will vary depending on the system you are using. If ProScan or OptiScan III use the ProScan 3 USB Driver.

6.2 RS232 Command Set

A description of how to connect via RS232 using Prior Terminal is provided in Appendix I. The NanoScanZ controller can accept commands from either serial port, or USB port (with appropriate divers installed on PC). The port defaults to a baud rate of 9600, this can be increased to 38400 if desired (see BAUD below, use baud 9600 if system is daisy chained via ProScan Controller).

When connected to the ProScan control commands to the NanoScanZ should be prefixed by a "<", responses will also be prefixed by "<" .

Commands are terminated with a Carriage Return code <CR> (the 'ENTER' key of the PC keyboard).

One or more of the following delimiters separates commands from arguments.

COMMA

SPACE

TAB

EQUALS

SEMICOLON

COLON

\$	None	0 or 4	returns the movement status, 0 stationary, 4 moving.
U	n	R	move up by the amount specified by n i.e., "U 1.234" in microns.
U	None	R	move up by the amount specified by C command. (recommended as less characters to transmit).
D	n	R	move down by the amount specified n.
D	None	R	move down by the amount specified by C command.
C	None	n	report default step size in microns.
C	n	R	set default step size in microns.
Z	None	R	set current position to zero, display changes to REL 0, (relative display mode), (PZ command returns 0, no movement of stage).

M	None	R	move to zero including any offset added by PZ command, moves to REL 0 (relative display mode) if in REL mode and ABS 0 if in ABS mode.
PZ	n	R	set current position to n, Sets to REL display mode (unless position same as ABS). E.g., if at absolute position 50, setting position to zero "PZ, 0" position then reported range of -50 to +50 microns. To return to ABS mode use "V,0" "PZ,0" this will return the stage to 0 microns and set the screen display to ABS mode.
PZ	None	R	report current position.
V	n	R	move to absolute position n, range 0...100 for 100µm units or 0...200 for 200µm units. This is a 'real' absolute position and is independent of any relative offset added by the PZ command
VER	None	nmn	reports version as 3 digit number e.g., 100 = version 1.00.
BAUD	n	R	sets baud rate where n = 9600,19200,38400 controller always powers up at 9600 baud. NOTE: DO NOT change the baud rate of the Piezo controller when daisy chained to a ProScan.
BAUD	n	None	reports baud rate where n = 9600,19200,38400.
SERIAL	n	R	reports serial number.
VALUEDIS	None	n	Displays n the offset voltage, on power up the voltage should read between +0.5 and +1.5V.
PIEZORANGE	None	n	N, Range of travel
PIEZORANGE	n	0	Sets the range of travel.

?	None	n	n is controller information: PIEZO INFORMATION DSP_1 IS NOT FITTED DSP_2 IS NOT FITTED DRIVE CHIPS 000100 JOYSTICK NOT FITTED STAGE = NONE FOCUS = PIEZO FOURTH = NONE FILTER_1 = NONE FILTER_2 = NONE SHUTTERS = 000 END
FOCUS	None	n	n is focus information : FOCUS = PIEZO TYPE = 10 MICRONS/REV = 100 END
STAGE	None	n	n is stage information: STAGE = NONE END
DATE	None		returns product/compilation date. E.g., "Prior Scientific Instruments Piezo NZ100 Controller Version 1.0 compiled Feb 27 2006 09:30:49".

When NanoScanZ controller is daisy chained from a RS232-2 port of a ProScan controller (input from computer to RS232-1 or USB) then all commands must be preceded by a "<" character. All responses will be preceded by a "<" command. E.g., transmit "<PZ" receive "<35.456" The DLL handles this feature automatically.

6.3 Error Codes

If a command is not valid a response of “E,n” is returned the n specifying an error type as listed below. Machine or human readable messages are chosen using the ERROR Command.

Code	Error
R	No Error
E,8	Value out of range
E,4	Command parse error, ie wrong number of parameters
E,5	Unknown command
E,21	Invalid checksum

TROUBLESHOOTING

SECTION 7

If you have any problems with your NanoScanZ, please do not hesitate to contact Prior Scientific for advice and support. Do not attempt to disassemble the unit yourself in order to attempt repairs; it contains no user serviceable parts and such disassembly will not only void the warranty but likely damage the unit.

Problem:

The NanoScanZ Stage is not moving the correct distance.

Suggested Solution:

Power cycle the unit.

- Hold down display button
- Display changes e.g. VALUE=1.750V
- Turn calibration pot to set value to 1.00 V
 - Clockwise= Up
 - Anticlockwise = Down
- Care should be taken as the pot is sensitive.

This is applicable only to the NanoScan 100.

Follow a similar procedure for other variants.

If the NanoScan 200 does not move the correct distance 200µm, power cycle the unit. The display should change e.g. VALUE=0.750V. Adjust the calibration port to 0 then focus adjust the value upwards to less than 0.25 V.

If the NanoScan 400 does not move the correct distance, power cycle the unit. The display should change e.g. VALUE=1.750V. Adjust the calibration port to 0 then focus adjust the value upwards to less than 0.25 V.

Problem:

The NanoScanZ stage is not at 0, when I use the optional analogue 0-10V input and set it to 0V.

Suggested solution:

Power cycle the unit and reconnect to Optional Analogues input following instructions in section 5.3.

SYSTEM SPECIFICATIONS

SECTION 8

Specifications for the Prior NanoScanZ system.

OUTPUT VOLTAGE RANGE: 0 to 150 V

OUTPUT CURRENT: 150 mA

RMS NOISE: 1 mV

DIGITAL INTERFACE: 50-PIN CONNECTOR:

DAC: 16 BIT

ANALOG INTERFACE: 0.0 to 10.0V FRONT PANEL BNC

FRONT PANEL ACCESSIBLE OUTPUT SIGNALS: OUTPUT VOLTAGE $\div 10$ (0.0 to 15.0V)
POSITION SIGNAL (0.0 to 10.0 V)

FRONT PANEL ADJUSTMENTS: SENSOR OFFSET

CONNECTOR TYPE: DB-9

POWER REQUIREMENT; 100-240 VAC 60/50 Hz

REPLACEMENT PARTS SECTION 9

USB Cable	W3045
RS232 Cable	H276
Fuse: (fuse rating: V250T2A)	W507

RETURNS AND REPAIRS

SECTION 10

Should you experience problems with your NanoScanZ and want to send it back for service, warranty or otherwise, **a Return Material Authorisation (RMA) number must be obtained from the appropriate Prior Scientific office before returning any equipment.**

Prior Scientific Instruments Ltd.
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