upnano
upscaling nanofabrication

nanoONE
Operating Manual

Version 2.7 | Status 08.2023

STATUS OF THE OPERATING MANUAL

VERSION	DATE	AMENDMENTS
V1.0	September 2019	First version
V2.0	April 2021	Holistic revision
V2.1	August 2021	Update Conformity Document
V2.2	November 2021	Update Materials
V2.3	July 2022	Revision
V2.4	August 2022	Update Datasheet
V2.5	September 2022	Update Safety and Maintenance
V2.6	February 2023	Update Spillover Protection
V2.7	August 2023	Update Substrate Leveling

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Introduction

This operating manual represents the original operating instructions for the NanoOne printing system from UpNano GmbH in accordance with the machinery directive. The NanoOne is a laser lithography system for the production of three-dimensional (3D) plastic components from the nano and micro to the meso and macro range. Structural details can be in the submicron range. The process used in the NanoOne is based on the principle of two photon polymerization (2PP) and was developed and patented by UpNano GmbH. Starting from a computer aided design (CAD) file, components with structural details smaller than one micron can be produced by means of a generative printing process. The patented process, in combination with a specially developed, intuitive software solution, enables a simple, fast, and economical manufacturing process.

For the printing process, the desired geometry is designed in a CAD program of choice and exported as an STL (stereolithography, also called standard triangulation/tessellation language) file. Since resolution and printing time are contrary, the NanoOne system offers several printing modes to keep the printing time low. This is to ensure that only those areas that require high resolution are printed at this resolution, while coarser areas can be produced at lower resolution and in a shorter time. Depending on the desired resolution, a component can be printed completely in fine (high resolution) or coarse (low resolution) mode. Using an implemented algorithm (adaptive resolution), the object can also be automatically divided into high- and low-resolution segments. Furthermore, it is also possible to provide a printed object with outlines (outer contour lines) to obtain the highest possible surface quality. A systematic scanning algorithm of the NanoOne hardens the individual layers directly in the material volume by means of a femtosecond laser. Repeating, time-consuming material application steps as with conventional stereolithography systems are not necessary with this 2PP-based process.

The printing process can be optimally carried out with the 2PP photoresins offered by UpNano. In addition, the NanoOne is an open system that allows a wide range of commercially available photopolymers to be printed. However, this requires optimization work on the material and process parameters. The range of materials offered also includes hydrogel materials for biocompatible applications. This repertoire of printing materials enables the production of components with different mechanical properties and diverse geometries.

1.1. Manufacturer

For the purposes of MRL 2006/42/EC, the manufacturer is the company:

UpNano GmbH - *hereinafter referred to as UpNano.*
Modecenterstrasse 22/D36, 1030 Vienna, Austria

☎ +43 1 890 16 52
office@upnano.com or support@upnano.com
www.upnano.com

1.2. About this manual

This operating manual describes the technical equipment of the machine.

All functions for normal operation and instructions for cleaning and standard maintenance are described in this operating manual. If necessary, there are references to the individual component documentation in this description.

The status of this operating manual corresponds to the technical status of the machine and the mode of operation at the time of completion in August 2023.

1.3. Limitation of liability

All technical information, data and notes for operation contained in this operating manual correspond to the latest status at the time of printing and are made to the best of UpNano's knowledge, considering our previous experience and knowledge. No liability is accepted for defects, damage or malfunctions which occur because of operating errors, neglected or improper maintenance of the machine or non-observance of these operating manual.

It is expressly pointed out that only the use of original spare parts is permitted in case of repair.

The use of non-approved accessories and spare parts as well as unauthorized conversions and/or modifications are not permitted for safety reasons. UpNano is not liable for any resulting defects or damages.

1.4. Copyright

2. NOTES

2.1. Reading commitment

All persons entrusted with the operation of the NanoOne must have read and understood this operating manual before operating the NanoOne. It is obligatory to complete and sign the protocol, below, prior to the first start-up!

I hereby declare that I have read and understood this operating manual in full:

DATE	POSITION	FIRST AND LAST NAME	SIGNATURE

Qualification, see section 0 and 0.

2.2. Operator

Anyone who operates the machine and uses it as intended or has it operated by suitable and instructed people are considered to be the operator of the printing system. This includes, among others, entrepreneurs, companies and non-profit associations and research institutions.

2.3. Operating personnel

An operator or user is anyone who has been assigned the task of operating the machine by the owner. It is essential to comply with and document the operator qualification requirements, see section 0.

2.4. Product liability

Product liability is limited to damages that occur during proper use by specially instructed operating personnel (or the operator) if the safety devices were fully functional and the operating instructions and safety instructions were observed!

2.5. General information

Notes, especially the safety notes given in the operating manual, provide the operator with information that ensures safe and functional work on the machine.

If such instructions are not followed, malfunctions, damage or impairment of the proper operating sequence may occur! In the worst case, the health of the user may be impaired!

The NanoOne printing system must always be operated to the best of your knowledge and in the manner described in this operating manual. Improper operation can lead to serious health risks for the operator, but also for people in the immediate vicinity. If problems or questions arise during operation that are not covered in this operating manual, please stop the current activity immediately and contact UpNano by email (support@upnano.com) or phone (+43 1 890 16 52).

3. MACHINE DESCRIPTION

The high-resolution 3D printing system NanoOne from the company UpNano enables the generative production of micro components with structural details in the submicron range. The 2PP photopolymerizable materials used are offered as ready-to-use photoresins or as a kit system.

3.1. Machine structure

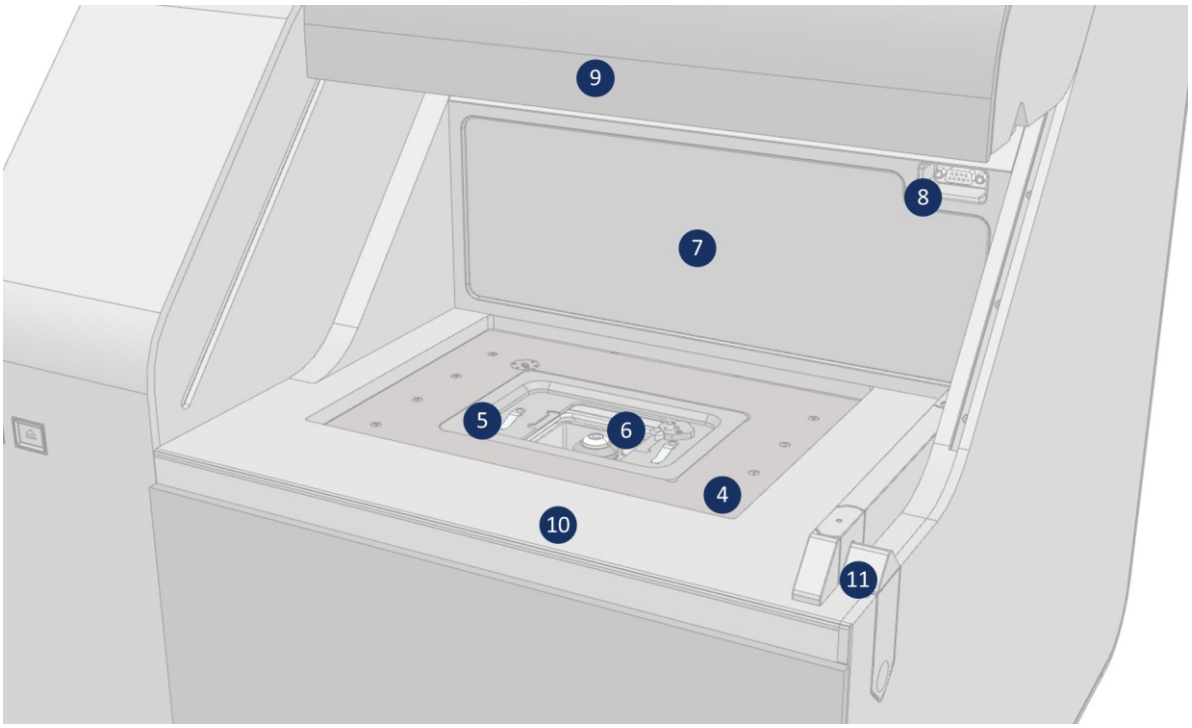
The illustration below shows the NanoOne high-resolution 3D printing system from UpNano. The build room is located in the upper part of the machine and is accessible via an electrically operated build room door at the front of the machine. The build platform behind it forms an axis system with exchangeable stage inserts. These allow the use of different sample holders, from classic microscope slides to microtiter plates and petri dishes for cell culture applications. The lower part of the machine houses the laser, the optical projection system, the mechanics, and the electrical components of the printing system.

The base of the machine must always remain closed and may only be opened by UpNano personnel or personnel authorized by UpNano during repairs and service activities!

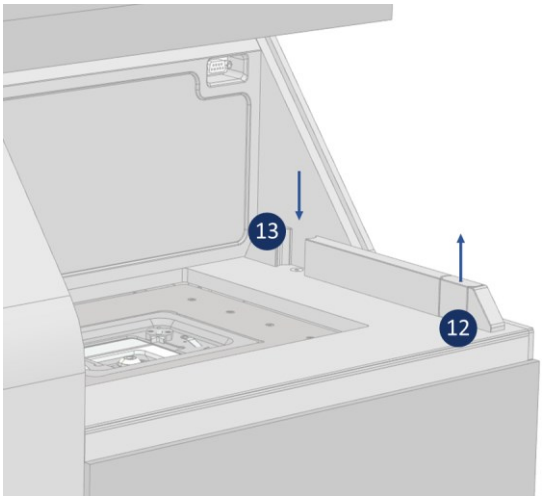
The operating elements of the NanoOne are located on the front left side of the machine. The printing system is started up by actuating the **on/off switch (1)** or switched off after printing. The door is automatically opened or closed by actuating the **door switch (2).** The machine status is displayed via an **LED status bar (3)** which is illuminated according to the status.

The build room door can only be opened by the user when the system is inactive. When the build room door is opened, the laser and axis system are de-energized for safety reasons.

In the build room of the machine is the build platform, which is based on a piezo-controlled **stage (4)** and can be adapted to the desired sample holder/substrate by inserting different **stage inserts (5),** thus offering a high degree of flexibility. The **objective (6)** is screwed into the center of the build platform. A list of available stage inserts as well as sample holders is mentioned in section 11. A **HEPA filter (7)** is installed behind the lattice element on the rear wall of the build room. A CG element transforms the HEPA filtered air into a laminar airstream, which flows over the build platform, and protects printed parts from contamination by dust or similar. HEPA filtered air is provided when the build room door is open, as well as in the closed state. At the upper right corner of the rear wall is the **connection socket (8)** for the laser power meter. This is required for the power calibration of the objectives, which is performed with the help of the THINK3D operating software. In the open state, the build room is illuminated by an LED module integrated in the build room door. For sample alignment/control as well as visual monitoring of the printing process, the printing system is equipped with two camera systems that can be called up via the THINK3D software. The **build room camera (9)** is installed in the light canopy (not shown in the figure, position indicated) of the door. The second camera system is the so-called **sample camera (10),** which is installed in the lower part of the machine (not shown in the illustration, position indicated). This enables the view through the objective and thus the visualization of the component in corresponding magnification. Thus, the printing process can be followed in real time.

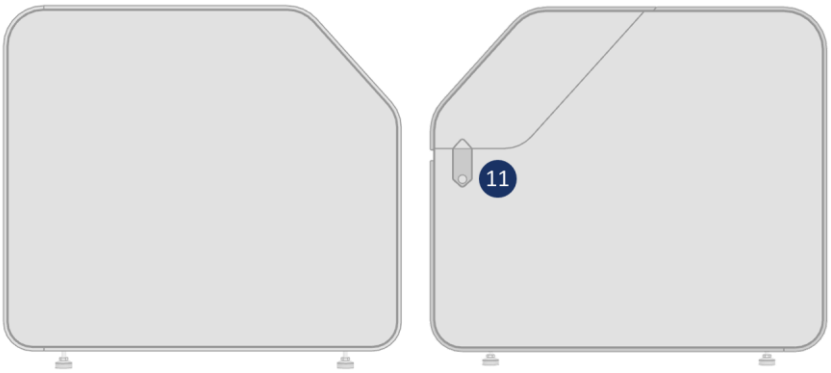


On the right side of the machine there are openings for **cable and hose feed-throughs (11)** which allow the connection of additional modules, such as the bio module offered by UpNano. The **shutter (12)** of the feedthrough is magnetically fixed and can be removed by pulling it out. During use of the feedthrough, the shutter can be stored in the rear part of the build room, in the **shutter holder (13)** provided for this purpose. To ensure (laser) safe and dust-free operation, the system must not be operated without an inserted cable bushing or shutter.

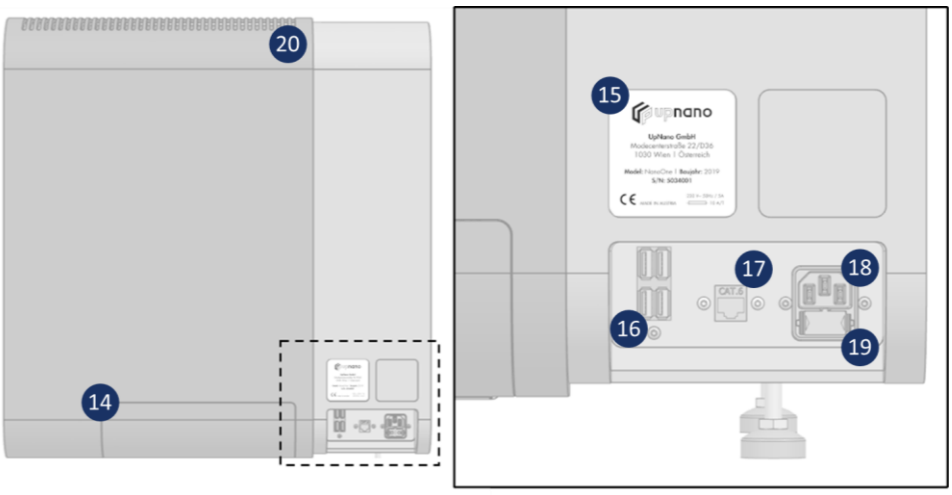


The cable and hose feedthrough must be closed during operations. This can be done either via the shutter or appropriate accessories sold by UpNano.

There are no further operating elements on the left or right side of the housing. On the right side, only the seam and thus the opening of the build room door is visible, as well as the recess for the previously described cable and **hose feed-through (11)** at the lower end of the same.

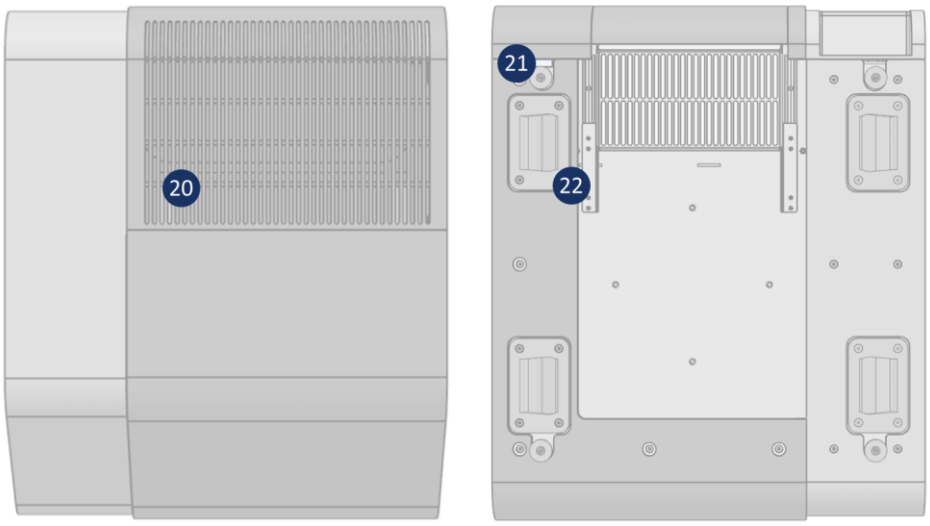


In the lower area of the back of the machine is the **filter drawer (14)** of the air intake filter, which must be opened for cleaning and maintenance work. In addition, the **nameplate (15)** of the NanoOne, four **USB ports (16),** as well as the **ethernet (17)** and **power connector (18)** are located at the bottom right corner. In the lower part of the power socket there is also the compartment for the **device fuses (19)**.



The **ventilation openings (20)** for the machine's exhaust air are located on the rear upper edge or the top of the machine.

The ventilation opening on the top of the machine must always remain freely accessible and must not be covered to prevent damage to the system!

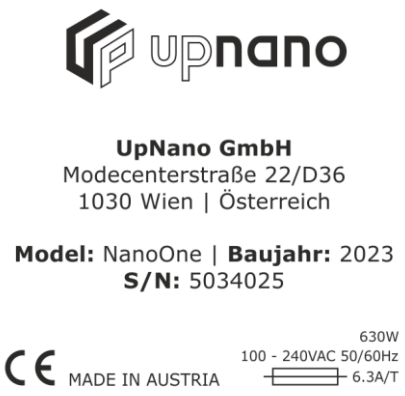


The system can be aligned using the four **adjustable feet (21)** on the underside of the machine. For lifting and transporting the system, **recessed grips (22)** are also integrated into the frame of the system.

When transporting the machine, always follow the manufacturer's instructions to prevent damage to the machine or injury to personnel, see section 7.

3.2. Type plate

The type plate is attached to the rear of the machine. The plate contains information on the model's name, serial number, year of manufacture and electrical connection data.



Please have the serial number of the machine at hand when contacting UpNano or quote it when reordering spare parts.

3.3. Technical specifications

Listed are the basic specifications of UpNano's NanoOne printing system:

Electrical properties	
Rated voltage range	AC 100–240 V
Rated frequencies	50/60 Hz
Rated current max.	3 A (230 V) respectively 6.3 A (100 V)
Max. power consumption	630 W (typically < 400 W)
Main supply overvoltage	category II
Grounding equipment conductor	required
Electrical safety	in accordance with IEC 61010-1:2010
Laser safety	class 1, internal laser class 4 according to IEC 60825-1:2014

Ambient conditions	
Operating conditions	indoors
Operating temperature	21°C (± 2°C)
Temperature stability	± 1°C (within 2 hours)
Storage temperature	20°C (± 10°C)
Maximum relative humidity	60%
Sound pressure level	60 dB
Air pressure for internal vibration isolation	not required

Weights and measures	nanoONE 1000 & 250	nanoONE bio
Total weight	124 kg	144 kg
Dimensions (W x L x H)	58.5 x 71 x 65 cm³	100 x 71 x 65 cm³
Minimum wall distance	5 cm	10 cm

Specifications				
Accessible writing area	up to 120 x 100 mm²			
Horizontal and vertical resolution	≤ 10 nm			
Max. travel distance z-axis	49 mm			
Objectives	**40x/1.4**	**20x/0.7**	**10x/0.4**	**5x/0.25***
Horizontal feature size	≤ 220 nm	≤ 420 nm	≤ 730 nm	≤ 1.2 µm
Vertical feature size	≤ 550 nm	≤ 2.9 µm	≤ 9.2 µm	≤ 23 µm
Field of view	Ø 0.66 mm	Ø 1 mm	Ø 2 mm	Ø 5 mm
Typical writing speed	150 mm/s	300 mm/s	600 mm/s	1,200 mm/s
Typical throughput in galvo-mode	0.05 mm³/h	0.25 mm³/h	4 mm³/h	30 mm³/h
Typical throughput using adaptive resolution	0.25 mm³/h	2.25 mm³/h	40 mm³/h	300 mm³/h

By adapting the parameters, a throughput of > 450 mm³ per hour can be achieved

Femtosecond laser	nanoONE 1000	nanoONE 250	nanoONE bio
Max. average power	1,000 mW	250 mW	1,000 mW
Pulse length	90 fs	95 fs	90 fs
Center wavelength	780 nm	780 nm	780 nm
Repetition rate	80 MHz	80 MHz	80 MHz

Software	THINK3D

3.4. Operating elements

On/off switch

The on/off switch of the system is located on the left front at the level of the LED status bar. By pressing this switch, the system, as well as the integrated computer, is started and booted up or switched off. To turn off, the on/off switch must be pressed for approximately 3-4 seconds. During the start-up process, the progress is displayed on the status bar; as soon as the system is ready for operation, the LED status bar lights up fully. All states of the status bar are described in section 3.5

After pressing the on/off switch, it takes up to 4 seconds for the system to start. Be sure to avoid pressing the on/off switch repeatedly as this may cause an interrupt of the NanoOne Firmware.

Door switch

Next to the on/off switch on the left front side of the system is the switch for the build room door. This opens or closes the build room door when the system is in idle state

The build room door can only be opened by the user when the system is in idle state. If the door is opened by force, the laser is switched off and the axis system is made powerless for safety reasons.

Operating software

The system is controlled via the specially developed THINK3D operating software. The printing system works as a network printer. It must be registered in the network and be in the same network as the operating computer. The computer and the printing system are not connected to each other by a cable. It is therefore possible to install the devices at different locations. For more information on the interface and operation of THINK3D, refer to the corresponding software manual.

3.5. LED status bar

The LED status bar on the front of the machine provides the operator with visual feedback on the status of the printing system. The following statuses are defined:

In the "progress bar" display mode, the length of the illuminated area of the LED status bar (illuminated in the respective defined color) corresponds to the percentage progress of the system start-up or print job.

CONDITION	DISPLAY MODE	COLOUR
System start-up	Progress bar	white
System ready	Illuminated	white
Running job	Progress bar	blue
Print job completed	3x flashing	white/blue
Print job finished	Illuminated	blue
Error	Illuminated	red
Shutdown	Progress bar	white

4. OPERATIONAL SAFETY

During operation, it must be ensured that...

- the ambient conditions comply with the specifications described in the operating manual, see 3.3.
- the printing system is stored, installed, and operated exclusively in a clean environment.
- the machine is operated in a low-vibration environment to ensure high print quality.
- all safety devices and housing covers are fitted to the machine and fully functional.
- all plugs on the back of the machine are fully inserted and are not near sharp, pointed, or hot objects that could damage the cables.
- all operators have read and understood this operating manual in full.
- the cable and hose feed-throughs are closed, either with the shutter or a corresponding equipment.
- an objective is mounted on the adapter ring.

4.1. Safety devices

A class IV laser is installed in the printing system, which is why the build room door is equipped with an interlock system to ensure laser safety. In the event of forced opening or deliberate override of the build room door motor and the resulting opening of the printing system, the laser is switched off and the axis system is made powerless.

The built room door can only be opened by the operator in the idle state. If the door is opened by force, the laser is switched off and the axis system is made powerless.

The safety devices built into the NanoOne as well as the laser-safe housing meet the requirements of EN 61010-1:2010 and EN 60825-1:2014, which are to be used as safety regulations for electrical measuring, control and laboratory devices and laser devices.

The motor force for the drive of the build room door is limited on the hardware side to prevent injuries and crushing.

4.2. Laser safety

The NanoOne is classified as a laser protection class I system according to EN 60825-1:2014. The laser module, the laser head and the generated laser beam are not accessible to the operator at any time during standard operation.

For warranty and laser safety reasons, the machine housing may only be opened by UpNano employees or by persons trained and authorized by UpNano. If the build room door is opened, the laser is switched off.

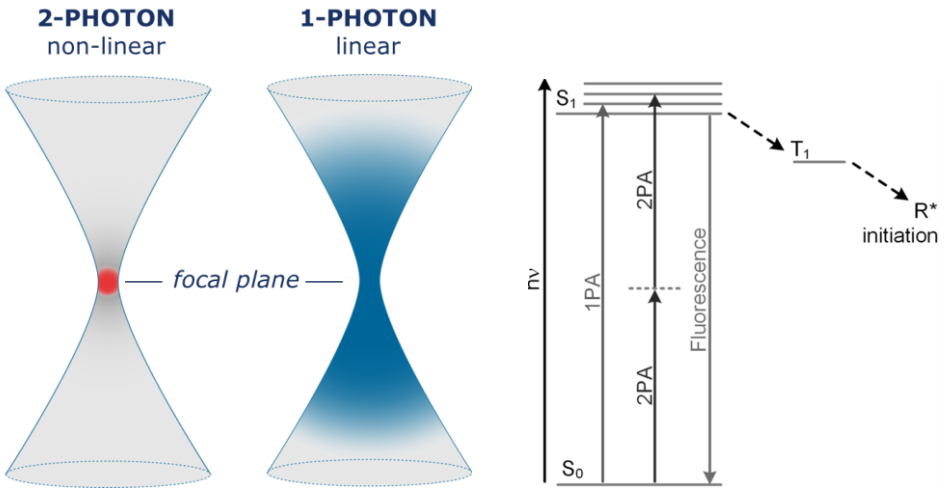
The laser installed in the system is classified in laser protection class IV and, according to the manufacturer, operates at a wavelength of approximately 780 nm with an average output power of 1 W or 250 mW, depending on the model variant.

UpNano accepts no liability for damage or injury caused by improper handling or partial opening or removal of the housing! A laser of protection class IV is by definition an increased safety and fire hazard. Removal of the housing or parts of the housing can result in dangerous radiation exposure, which can lead to serious skin and eye injuries.

4.3. Intended use

The 2PP photoresin is printed onto a selected substrate, which has previously been inserted into the build room by means of an appropriate sample holder and stage insert. Different printing modes can be used, see section 5.

The ultra-short pulse laser radiation causes 2-photon absorption (2PA) of the photoinitiator from the ground state (S0) to the first excited state (S1). From here, the excited photoinitiator can enter a triplet state (T1), from where the radical polymerization of the 2PP photoresin is initialized. In addition, relaxation processes such as fluorescence emission also occur to a certain extent, whereby some of the excitation energy is lost as light. Since in 2PA the laser power required for initialization is only achieved in the focal point (voxel, shown in red in the figure), the polymerization range is spatially limited to this small volume.



In contrast to 1-photon excitation (1PA), which is linearly dependent on the light intensity, no polymerization takes place in the 2PA in the areas outside the focal plane due to the non-linear dependence on the light intensity. As a direct consequence, this 2PP based printing process does not require active repetitive material deposition. Components can be produced directly on the inserted sample carrier or freely in the material volume. The possibility of free-floating production (top-down) depends on the properties of the printing material used, in particular its viscosity. Non-polymerized material is removed after the printing process by placing it in an appropriate developer solution.

In addition to classic photopolymers, hydrogel materials for biocompatible cell applications can also be processed with the NanoOne. For more details, see section 0. The cells can be placed on prefabricated structures (scaffolds) or mixed directly into a biocompatible printing material and printed along with it, thus embedding the vital cells in the printing material. When using hydrogel materials in combination with cells, it is recommended to use phosphate-buffered saline (PBS) or the respective cell culture medium for development.

The NanoOne printing system can generally be operated under normal light conditions. Since the photopolymers used are materials that can be polymerized by light, care should be taken not to expose the printing material or the build room to direct sunlight or particularly bright white light during material/sample holder insertion. This applies in particular to colorless printing materials, which should be handled under light protection. This can be remedied by using shading options. Further information on handling the printing materials can be found in the respective product data sheet.

Biological applications

The NanoOne Bio, a model variant of the NanoOne series, enables printing in the presence of living cells using biocompatible materials such as hydrogel materials. For this purpose, cells are suspended in the material and can be printed in appropriate (glass-bottom) microtiter plates and petri dishes under sterile conditions. The Bio wizard of the THINK3D operating software, which is specially designed to meet the requirements of biological printing processes, supports the user in creating the printing process. To ensure physiological conditions during the printing process, the NanoOne Bio is equipped with the so-called bio unit, a stage top incubation system from ibidi, which allows precise control of temperature and CO_2 content as well as humidity.

All information on handling the BioUnit can be found in the *BioUnit Operating Instructions*.

4.4. Operator qualification

For all activities on the system, sufficient language skills are assumed to be able to read and understand this operating manual and the accompanying documents.

After the installation of the printing system, the basic knowledge for a safe handling of the NanoOne is imparted in the course of a two-day training workshop, which is held by UpNano employees. Each new employee must receive this basic knowledge through systematic reading of this manual and documented training by the trained system operator, or by operators trained and qualified by the system operator.

Technician

In the course of the two-day training workshop, one or more people defined by the owner are trained by UpNano employees on the topics of preparation, operation, transport, maintenance and cleaning of the printing system. After the training, these instructed persons are able to operate the NanoOne independently.

4.5. Workplace

The interfaces at the machine for the operator are:

- on the local controls on the front of the system or the operating computer.
- in the build room of the printing system, accessible by opening the build room door.
- on the connection elements for the stage top incubator, as well as its cable routing.

At the local operating elements, the user carries out operating steps of manual operation as well as operating steps that are required for cleaning, inspection or maintenance. On all other machine parts, only the machine function is inspected during operation. The progress of the print job can be monitored and documented by means of the integrated camera systems, which can be called up via the THINK3D operating software. Directly on the printing system, the LED status bar provides visual feedback on the progress of the print job, see section 3.5.

4.6. Residual risks

Before carrying out maintenance or cleaning work on the machine, make sure that the printing system is switched off and disconnected from the mains. The printing system must be switched off for refitting the objectives, material vats, stage inserts and/or substrates.

Before installing the machine, make sure that its power connection is equipped with a protective earth conductor. The power plug is the main disconnect of the machine. Both the plug socket at the rear of the system and the socket to which the system is connected must therefore be freely accessible. Do not replace the supplied cables with inferior cables. If you need to replace one of the cables, for example due to a cable break, contact our customer service to clarify the specifications or to order the appropriate replacement part.

Failure to comply with this operating manual, such as manipulating the printing system while it is connected to the power supply, may result in damage to highly sensitive system components, e.g., due to electrostatic charging.

4.7. Protective measures

Personal protective equipment

The printing system is safe to operate due to the integrated safety devices as well as the housing and does not pose any danger to the operator if operated properly. Therefore, it is not necessary to wear laser safety goggles. Personal protective equipment such as safety goggles and gloves should be worn when handling the printing materials and during the chemical development steps following the printing process. It is also recommended to wear work clothes (such as a lab coat). Further information on the printing materials can be found in the corresponding material safety data sheets (MSDS).

Workplace

Always keep the work area of the NanoOne free of materials, tools, and other parts. Never store unsealed fluid containers on or in the immediate vicinity of the printing system or the operating computer.

The ventilation openings of the printing system must be freely accessible at all times, in active as well as in idle state, and must not be obstructed or covered under any circumstances.

Covering the ventilation openings may cause irreparable damage to the printing system, for which UpNano accepts no liability.

For the post-processing, chemical development of the printed components, a chemical workstation, preferably a chemical workbench with fume cupboard and exhaust air purification, should be used in order to avoid possible contamination with the various organic solvents. An appropriate cell laboratory environment with a sterile workbench is also recommended for the NanoOne Bio in order to be able to prepare and post-process samples with cells appropriately under sterile conditions.

Stability

The machine is stable during normal operation. During installation and commissioning, the system is positioned by UpNano personnel and adjusted using the adjustable feet on the underside of the machine. For countries with increased earthquake risk, the machine can be equipped with an earthquake anchorage and thus fixed to the work table or workbench. If necessary, a corresponding concept will be worked out.

5. PRINT PROCESS

This chapter provides an overview over all steps necessary to print, including the system start-up, preparation, printing, and post-processing. Also, it describes the different print modii: vat, bottom up and top down.

In Vat mode, which is the default print mode of the NanoOne, the print material is placed into a material vat with a window of precision glass. This vat is placed on an adapter ring and is then positioned above the objective, see section 0. The glass substrate, see section 0, is brought into contact with the material. Starting from the substrate surface, the material is polymerized layer by layer and the printed object is pulled out of the material vat, keeping the distance between the objective and the printing plane constant. This allows large objects with a height of up to 40 mm to be produced.

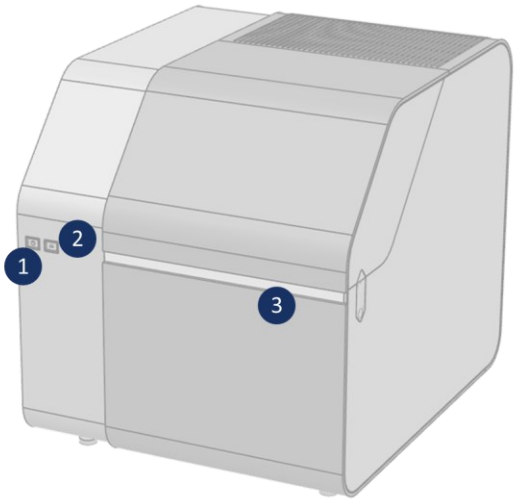
The selected printing material can also be applied/inserted directly onto/into a sample carrier. Depending on the geometry and the necessary parameters, the component is cured from the bottom up (referred to below as bottom-up) or vice versa from the top down (referred to below as top-down).

The bottom-up mode is suitable for the production of small structures.

The advantage of the top-down mode as well as the vat mode is that the laser beam is not focused through already polymerized material and thus light scattering and resulting artifacts can be prevented. In top-down mode, it must be noted that the component lies freely in the material during the printing process.

5.1. System Start-up

The printing system is powered up by pressing the **on/off switch (1)** on the front of the machine. During the process the **LED status bar (3)** shows the progress (left to right). As soon as the status bar is fully illuminated in white, the printing system is powered up and ready for operation. In addition, the operating computer must be booted and the THINK3D operating software must be started. After each system restart, the piezo-controlled stage must be newly referenced.



5.2. Preparation

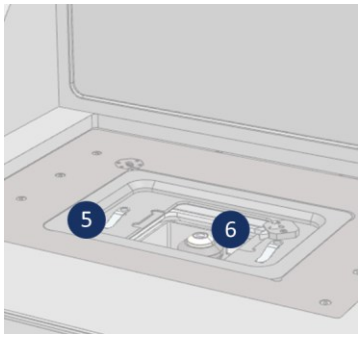
Before starting a new print job, it may be necessary to replace the objective, the material vat and/or the stage insert. For this purpose, the build room must be opened by actuating the **door switch (2)** and closed again after completion of the setup.

The built room is illuminated with red light during the opening of the built room door and in the open state to protect the photosensitive printing materials.

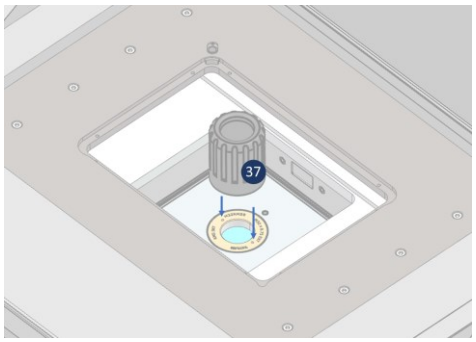
Before opening the build room door, make sure that the laser is switched off.

Change or insert objective

The objective must be selected according to the required component resolution and defined accordingly in the operating software. If the objective used does not meet the requirements or if no objective is used, it must be screwed into the Z-axis of the system. Before changing the objective or inserting an **objective (6),** the **stage insert (5)** must be removed.



If the diameter of the adapter ring and the thread diameter of the objective do not match, the adapter ring can be replaced. To do this, firstly turn off the NanoOne while the build room door is open. Then use the **tool (37)** included in the scope of delivery and place its two metal pins in the holes of the adapter ring. Turning counterclockwise will release the ring. The same operation can be repeated when inserting a matching adapter ring. Always make sure that the objective adapter ring is screwed in tightly. Afterwards turn on the NanoOne again, the build room door will close automatically.



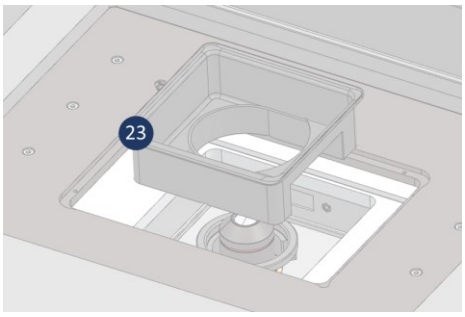
Avoid pressing down on the z-stage while removing the adapter ring. Moving the piezo-controlled stage manually while the NanoOne is powered can cause damage.

Objectives not in use should always be stored in the objective case provided. If an objective that has been removed or is to be used becomes dirty, it must be cleaned immediately, see section 0.

It is not allowed to operate the printing system without having an objective mounted.

Remove or insert spillover protector

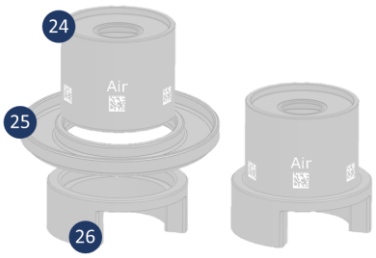
The **spillover protector (23)** must always be used when printing in the so-called *Vat mode*. The protector is placed over the objective to collect possible spillover of the material during printing. The opening on the spillover protection is placed towards the integrated barcode reader on the right side.



Always make sure the spillover protection is used and placed correctly in the machine for all print jobs using Vat-mode.

Change or insert material vat

For the production of higher structures, the use of the so-called *Vat mode* is recommended. When using this print mode, a **material vat (24)** with a **spillover ring (25)** is placed on the **adapter ring (26)** located in the build room. The magnets installed in the adapter ring as well as in the material vat facilitate the insertion and ensure the correct alignment of the vat.



The adapter ring is connected to the machine by a plug-in system and can remain in the machine even when sample carriers are used. To facilitate cleaning of the interior, the adapter ring can be removed by pulling it in the vertical direction.

Before inserting the material vat, make sure that the correct objective is inserted.

The material vat to be used depends on the type of objective used and the immersion medium and is marked accordingly with *Objective Vat Air* or *Objective Vat Oil.* The two material vats differ in height and are adapted to the working distance of the respective objective type. For air immersion objectives, an *Objective Vat Air* must be used and for oil immersion objectives, an *Objective Vat Oil* must be used.

For immersion objectives, the appropriate immersion medium must be applied to the objective before the material vat is inserted.

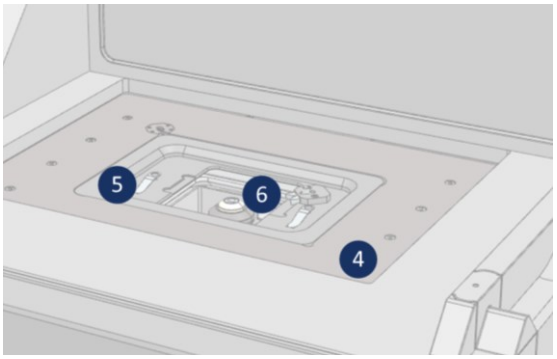
In order to counteract the formation of air bubbles when inserting the *Objective Vat Oil* material vat, it can be slightly tilted towards the objective.

Before starting a print job, the barcode reader integrated in the printing system can be used to check whether the material vat used matches the print mode and objective specifications stored in the operating software. If there is no match, the user will receive a corresponding error message.

If the material vat needs to be replaced or removed at a time when there is still print material in the vat, it can be closed with a **material vat lid (27),** which is included in the scope of delivery, and stored accordingly.

To prevent material contamination, the material vat lid should be placed on the material vat before it is removed from the build room.

Change or insert stage insert



The **build platform (4)** can be adapted to the substrate used by inserting a suitable **stage insert (5).** The stage insert can be fixed via a snap mechanism at the upper left corner of the build platform. If a stage insert is already inserted, it can be removed after actuating the snap mechanism.

When inserting the stage insert, make sure that there is sufficient distance to the inserted **objective (6)** to avoid damaging it. If necessary, move the Z-axis of the system further down. Never move the stage manually, as this may damage the axes.

Insert print material

The print material is applied by means of a manual dispenser (included in the scope of delivery) to which the UpNano material cartridges can be connected. The correct operation of the dispenser can be found in the enclosed Nordson instruction manual.

In short, the drive rod must be pulled outward as far as possible. Then the material cartridge can be placed in the correct position by attaching and rotating it. The cap of the material cartridge must be replaced with a dispensing tip. The teeth of the drive rod must be aligned downwards. The drive rod can then be brought into contact with the piston of the material cartridge. The material is dispensed by gently pulling the trigger.

After dispensing, the material cartridge must be closed again with the corresponding lid. For print jobs that are executed in Vat mode, the material vat is filled with print material. If possible, avoid dispensing print materials directly in the build room of the NanoOne as this could cause spillage.

If spilled material gets into the internal of the system (passing the edges of the z-stage table), please contact UpNano immediately. Further operation can damage the system.

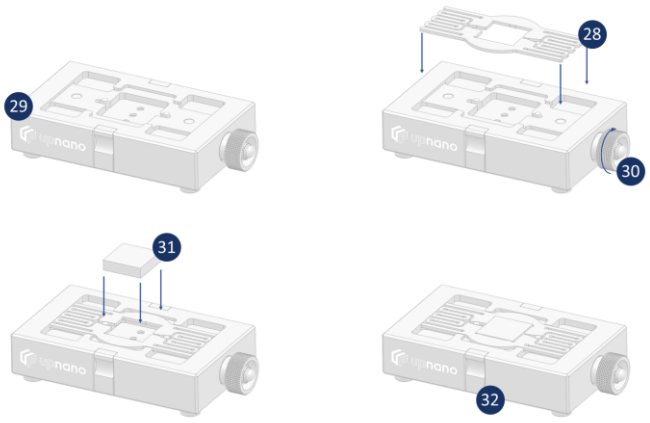
In contrast, in bottom-up and top-down mode, the printing material must be applied to the respective substrate. For example, the material is dispensed onto a glass slide or into a corresponding microfluidic chip or microtiter plate. For biocompatible print jobs, material preparation and placement must be performed within a sterile workbench. The substrate, sealed after filling, can then be inserted into the machine.

The material UpSol, which is especially suitable for the top down or bottom-up mode, is considered as an exception. This must be extracted from an amber glass vial using a pipette and dispensed onto a glass slide etc. as described above. In addition, a lead time for evaporation of the solvent must be taken into account for this material (it is recommended to prepare the samples the day before).

Before inserting the print material, make sure that the desired objective is correctly screwed in, in order to prevent contamination of the underlying optical unit.

Insert and remove glass slides

UpNano offers special glass substrates in three different sizes for the vat mode, including corresponding glass holders. Square substrates with an edge length of 10x10 mm, 20x20 mm or 40x40 mm as well as round 1-inch substrates are available, the thickness is 5.5 mm regardless of the format or dimension. The glass substrates can be inserted into or removed from the glass holder using the assembly tool included in the scope of delivery. The glass holder together with the substrate can then be inserted into the stage insert like a microscope slide.



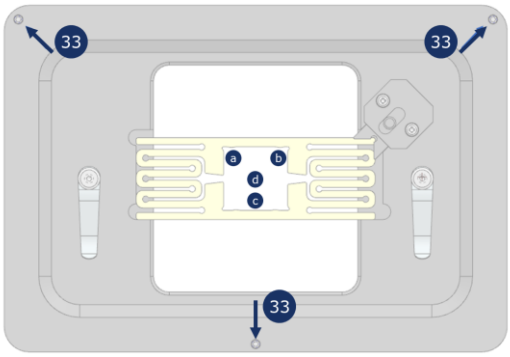
Make sure that the substrate is oriented downwards and thus hangs in the build room. To insert the glass substrate into a suitable **glass holder (28),** it must first be inserted into the **assembly tool (29)**. The glass holder is clamped by turning the **knob (30)**. Now the **glass substrate (31)** can be inserted and fixed in place by turning the knob in the opposite direction. Make sure that both the glass holder and the glass substrate lie flat on the assembly tool. If the glass substrate is to be removed again, the glass holder must be inserted and clamped. Then the substrate can be pressed up with the **lifter (32)** and removed.

Insert glass holder

The substrate (holder) can simply be inserted into the matching stage insert. When using the universal frame, the size of the holder can be adapted to the substrate size accordingly. If the stage insert with snap-in mechanism supplied by UpNano is used, the lateral form springs must also be placed on the slide. In both cases, care must be taken to ensure that the substrates rests completely flat in the stage insert.

The system offers a high degree of flexibility, so a variety of substrates and standardized object/glass substrates can be used. When using the bottom-up mode, make sure that the bottom plate of the substrate is made of glass and is not thicker than 170±5 µm.

Levelling the Substrate



In case of very thin and large-surface parts, it may be necessary to additionally level the glass substrate manually. For this purpose, the **adjustment screws (33)** on the edges of the stage insert can be adjusted. In the first step, the screws need to be to the neutral position with the screws slightly protruding the bottom of the stage insert (0.5 mm) and the top side being flush with the surface. After inserting the metal holder with the substrate, the interface must be detected in the *center of the substrate (a)* using the autofocus function. This position needs to be set as the zero reference. The focusing process must be repeated in *the corners (b, c)* and *on the edge (d) of the substrate* and the height difference noted. Afterwards, the screws can be readjusted accordingly. For negative values turn clockwise and for positive values turn counterclockwise. Then the focusing process is repeated on position b, c, and d until the difference between the measurements is negligible. Point a is always needs to be reset as the zero reference.

When using the accessory part Automatic Substrate-Tilt Correction Insert, the instructions for the automatic levelling are given separately.

5.3. Printing

The status bar on the front of the machine provides visual feedback on the progress of the current print job, see section 3.5. In addition, the print job can be tracked using the integrated camera systems. The sample camera provides real-time images of the current print layer in the magnification of the objective used, while the build room camera provides insight into the entire build room.

During the printing process, the machine is closed and is controlled exclusively via the THINK3D operating software. It is not possible to open the build room of the printing system or to make changes within the build room during operation.

5.4. Post-processing

The end of a print job is indicated by the LED status bar flashing blue 3 times. After that, the status bar will be solid blue, indicating to the user that the finished part(s) can be removed.

As soon as the status bar lights up blue, the build room can also be opened again by pressing the door switch.

The substrate is removed from the stage insert. Depending on the size of the printed components, they can be cleaned with an appropriate developer solution.

Non-polymerized material is removed after the printing process by placing it in an appropriate developer solution, preferably isopropyl alcohol (IPA). It is advisable to repeatedly exchange the developer solution for fresh solution. This is done in a particularly resource-saving way by using a cascade of three developer baths of increasing purity. More detailed instructions can be found in the material data sheet.

Biological samples or components for biological applications are transferred directly to a sterile workbench and only opened there. Non-polymerized print material can be carefully removed with a pipette and the components cleaned with PBS or the respective cell culture medium.

After the substrate has been removed from the printing system, this process must be confirmed in the software. The confirmation switches the system back to the ready-to-operate state, which is indicated by a continuously white status bar.

If the system is returned to the ready-to-operate state after the completion of a print job before the substrate is removed, this can lead to the manufactured component being damaged by the axis moving in the positive Z direction.

Before removing the substrate, the axis can be moved in the Z-direction until there is no more contact with the material. This allows excess material to drip off and remain in the vat. This procedure is a deviation from the "best practice approach" and the user must be aware that damage to the component may occur.

System Shutdown

To switch off the system, the on/off switch must be pressed for approximately 3-4 seconds. During the process, the status bar shows the progress (right to left). As soon as the status bar is off, the process is finished, and the system is shut down.

The system can also be switched off during a print job. The print job is aborted and the stage remains in the last position. When restarting the system, the stage must be aligned.

6. OPERATING SOFTWARE

The NanoOne printing system is operated via the company's own THINK3D operating software. All settings of a print job, from the design to the parameter definition to the start or monitoring of the print, can be carried out with the help of this software interface. All software functions and their operation are explained in detail in the enclosed software manual.

7. TRANSPORT

The NanoOne printing system is set up at the intended location and adjusted accordingly.

This section of the manual is intended for technicians who are qualified to transport the printing system in accordance with the operator qualification in section 0

Transport work may only be carried out by authorized and demonstrably trained personnel. It is essential to comply with the operator qualification, see section 0. Before transporting the machine, it is essential to consult with an UpNano employee regarding the recommended transport method.

7.1. Lifting and transporting

The machine has a simple square design, the overall center of gravity of the system is in the middle, which is why there is no significant tilting moment. Due to its own weight, of around 125 kg and the external dimensions of the printing system, the machine may only be lifted by at least two, but preferably four people. The machine may be difficult to lift due to its weight or shape. Use suitable lifting equipment to manipulate machine parts. Recessed grips on the underside of the system allow a secure hold during carrying.

If the machine is to be transported or moved by the operator and/or instructed technicians of the operator, appropriate packaging and transport protection must be provided. UpNano accepts no liability for damage resulting from transport.

When moving machines or components, no persons may be present in the immediate danger zone. Sufficient space must be kept free in the surrounding area.

7.2. Transport packaging

For the transport and storage of the machine, UpNano exclusively recommends the use of the supplied transport box! If required, this can be reordered, see section 11.

In addition, all supplied transport locks must be inserted in the mechanical stage located in the installation space before transport. This includes the cross-stage safety device that should be inserted in the build room and the transport safety devices of the optical system. For more information, please contact UpNano.

Keep dry!

Mark the packaging to protect it from moisture. Ensure that the packaging is protected from moisture.

This side up!

Marks the top of the packaging. Ensure that the marked top side is not on the bottom.

7.3. Setting up and connecting

The assembly and installation of the system at the location defined by the customer is carried out by UpNano employees and approved by the customer.

The system is lifted by the recessed grips on the underside of the system and brought to the defined position. The system is brought into a horizontal position with the aid of the four adjustable feet on the underside of the machine. The position can be checked with the aid of a bubble level or spirit level. Before commissioning, all inserted transport locks must be removed.

The system is connected to the local 230 V power supply via the power socket using a power cable included in the scope of delivery. In addition, the system is connected to the local network via the Ethernet socket using an Ethernet cable also included in the scope of delivery. The system construction is designed in accordance with EN 60204-1 (insulation, zeroing, earth connection for PE / PEN). The mains disconnection is made via a plug-socket combination. Access to the power socket at the rear of the system and the socket to which the system is connected must be freely accessible.

After transport or re-installation of the system by instructed technicians of the operator, it must be ensured that the power supply and network connection are restored.

For the operation of the NanoOne Bio, an additional socket is required for the power supply. In addition, the bio unit must be connected to an installed CO_2 supply line or connected to an external cylinder for the regulation of the CO_2 content in the system. Depending on the available options, the system can be connected directly to a compressed air supply line or connected to an external air compressor pump.

8. CLEANING, MAINTENANCE AND SERVICING

The production of micro components requires a high degree of cleanliness, as potential contamination, for example by dust particles, can negatively influence the print result. Therefore, high standards of cleanliness should be maintained when working with the printing system. When cleaning and handling cleaning agents, we recommend that you always wear gloves for your own health and safety.

Be sure to remove the gloves before changing workstations or operating the computer.

8.1. Cleaning

Without exception, cleaning work may only be carried out when the machine is switched off.

Isopropanol is recommended as a cleaning agent for the system, components and accessories. The cleaning agent must never be applied directly to the machine, always use a cloth moistened with iso-propanol for cleaning. Never use water to clean the machine. It may possibly result in machine damage, but certainly in increased cleaning effort.

The use of aggressive cleaning agents or coarse sponges can also lead to scratches and damage to system parts. The build room of the machine is designed in such a way that contamination can only occur on the build platform or in the area of the objective holder. Always clean any contamination, for example caused by spilled material, immediately using a cloth moistened with isopropanol.

If heavy contamination occurs, dripping material can contaminate the optical components underneath. In this case, inform an UpNano employee immediately.

The build room door, which should always be kept closed when idle, and the integrated HEPA filter prevent excessive dust build-up in the build room of the machine. Should slight contamination nevertheless occur, this can be removed with the aid of a cloth moistened with isopropanol.

Cleaning the objectives and material vats

When inserting the objective, make sure that it is clean. Dust or stains can cause reflections and thus artifacts in the printed part.

As a general rule, if the objective is not dirty, do not clean it! Any cleaning increases the likelihood that the objective will be damaged, so you should only clean the optics when necessary. The immersion oil should always be cleaned when removing the objective.

Light soiling due to dust can be removed with the aid of a bellows. For cleaning dirtier objectives, it is recommended to use high-purity iso-propanol (99.9%) and optical cleaning tissues (e.g. Lens Cleaning Tissue, Thorlabs). With the moistened cleaning tissue, the objective can be cleaned carefully without excessive pressure.

Especially in the area of the lens you should not rub too hard to avoid scratches. For cleaning the objective, it is recommended to wrap the objective in a cleaning cloth and, while holding it slightly tilted, drip a drop of isopropanol on it. The objective can then be dried with a bellows and the process repeated if necessary.

The use of solvents or acids for cleaning the objective can cause irreparable damage to the objective or its attachment!

To clean the material vat, the first step is to remove any remaining material. This can be drawn up with a pipette or wiped out. Then the vat can be carefully cleaned with isopropanol.

The bottom of the material vat consists of a 170 µm high precision glass plate! Be careful not to scratch or break it during cleaning.

Do not fill chemicals like isopropanol or acetone into a vat for cleaning, this may dissolve the high precision glass plate.

Cleaning the BioUnit

Without exception, cleaning work may only be carried out when the machine is switched off.

The same recommendations apply to cleaning the bio unit as to cleaning the machine itself. It is recommended to use a cloth moistened with isopropanol as a cleaning agent. We strongly advise against applying the cleaning agent directly to the system. The use of aggressive cleaning agents or coarse sponges can also lead to scratches and damage to system parts.

In addition to the superficial cleaning of the system housing, the water column must be checked for microbial contamination prior to operation. If microbial contamination is present, the column must be cleaned according to the manufacturer's instructions. Detailed cleaning instructions are given in the *ibidi Gas Incubation System Instruction Manual*, see 7.2.2.

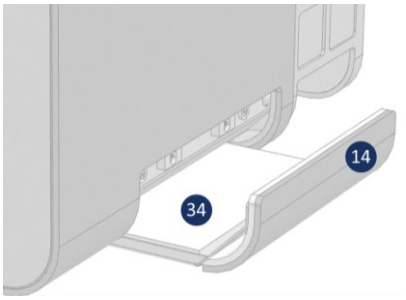
8.2. Maintenance and servicing

Maintenance work may only be carried out by technicians with the appropriate qualification in accordance with the operator qualification in section 0

Filter change

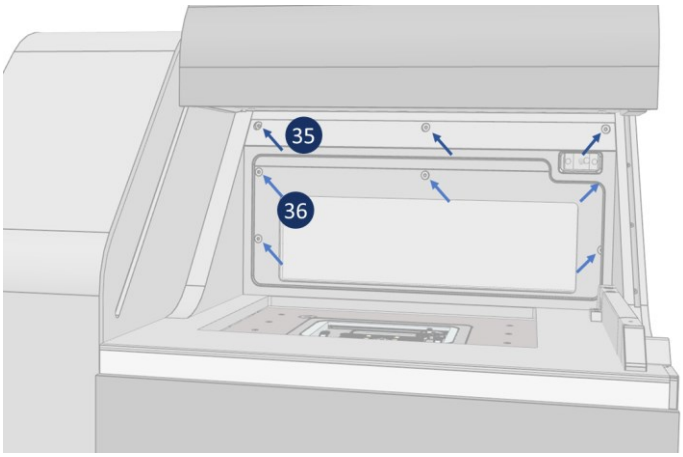
System filter

Sufficient ventilation of the system is ensured by the ventilation openings on the top of the system and internally installed radial fans. In order to prevent contamination by dust or similar during ventilation, a **filter drawer (14)** with **filter inserts (34)** is located in the lower part of the machine at the point where air is drawn in. The filter drawer can be pulled out and the inserts can be changed.



To ensure constant system performance, the filters must not be contaminated. In addition, the defined maintenance intervals must be observed. In order to extend the life cycle of the filter inserts, it is recommended that the system surface is regularly cleaned of dust. Also make sure to clean the space under the NanoOne printer. If the area under the machine is contaminated with dust, dirty air will get sucked in resulting a faster pollution of the system filter.

HEPA filter

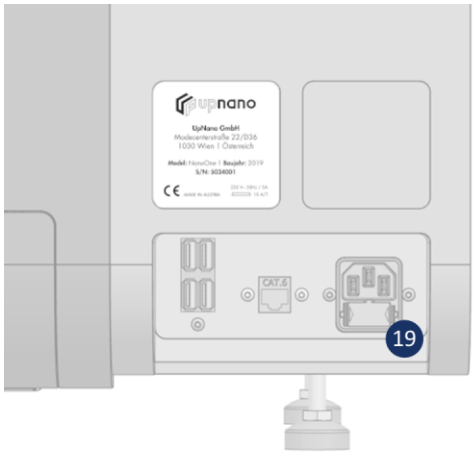


The HEPA filter is installed behind the lattice element on the rear wall of the build room. To replace the filter, the back panel of the build room must first be removed. To do this, the three M4 x 12 **screws of the cover (35)** must be loosened at the upper edge of the rear panel and then the panel must be pulled out upwards. The retaining plate behind it can then be removed. To do this, unscrew the five M4 x 10 screws of the **retaining plate (36)** and remove them in the same way in order to loosen the filter insert. When removing the retaining plate, make sure that the CG element stretched over the retaining plate is not damaged. When inserting the new filter insert, pay attention to the flow direction of the filter! The arrow on the side of the insert must point into the build room or towards the user! After the filter insert has been replaced, the remaining components must be reattached and hand-tightened to a torque of approximately 1.5 to 2.5 Nm.

FILTER TYPE	MAINTENANCE INTERVAL
System filter insert	Check monthly for contamination and replace, if necessary, but at least once a quarter.
HEPA filter element	Replace once a year

Fuses

The printing system is protected externally by a device fuse which is located in the power connection socket at the rear of the system. The fuse slots are clipped into the socket. With the aid of a small-slotted screwdriver, the snap can be pressed back, and the fuse module removed. The two device fuses are simply plugged into the module and can be pulled out and replaced with new ones.



FUSE TYPE	MAINTENANCE INTERVAL
T5AH250VAC - 5x 20 mm 10 A / T	annual

9. TROUBLESHOOTING

Faults on internal machine parts may only be investigated and eliminated by UpNano employees. The operator or trained technician can only eliminate faults that are directly related to the printing process or accessories installed. These include among others:

ERROR	TROUBLESHOOTING
Printing system does not start up	• Check the power supply of the printing system.

	• Check the device fuses of the printing system. See section 0.
Build room door does not open	• Make a further attempt to open by pressing the door switch again. • Ensure that the build room door can move freely. For example, remove objects placed on the door. • End a running print job via the operating software, see software manual.
Print system cannot establish a network connection	• Check the network connection of the printing system. • Check the network settings. By default, DHCP mode is required. If you want to use a different mode, please contact an UpNano.
Print job cannot be started	• Make sure that the printing system is switched on and ready for operation. In this state, the LED status bar lights up white. • Check whether the build room door is closed.
Unusual operating noise	• Check the system and HEPA filters for contamination. If necessary, change the filters as 0 section 0.
Scanner does not move	• Restart both the software and the printing system.
Stage does not move	• Restart both the software and the printing system.
Squeaking noise during stage movement	• The piezo-controlled axis naturally causes a very high, squeaking noise.
Fan stuck or no more fan noise present	• Restart the printing system.

No laser power detectable	• Restart both the software and the printing system.

If the described troubleshooting has not led to the desired success, contact an UpNano immediately.

9.1. Behaviour in the event of accidents or malfunctions

If accidents or malfunctions occur during operation of the machine, the machine must be disconnected from the mains immediately by pulling out the power plug.

Inform UpNano immediately of any malfunctions or accidents that occur in connection with the operation of the system.

10. DISMANTLING AND DISPOSAL

The system must be switched off and disconnected from the power supply for disassembly or removal of any accessories.

Skilled workers of industrial assembly or comparable professions are to be used for decommissioning. In addition, knowledge of hazardous substances and waste disposal is required.

After dismantling, collect the system parts according to type and send them for processing or disposal. Used substances and materials must be handled properly and disposed of in an environmentally friendly manner. When disposing of the machine or parts of the machine, the local waste management laws must be observed.

The waste materials are to be collected in accordance with internal company guidelines and external regulations of the relevant country and disposed of in accordance with the law.

11. SPARE PARTS, ACCESSORIES AND CONSUMABLES

Note that the specified spare parts sometimes have a considerable influence on the quality and availability of safety-relevant parts and functions.

Therefore, only UpNano approved spare parts with corresponding specification or higher quality components may be used.

The proof of equivalence is the responsibility of the operator and his authorised representative and must be documented for the purposes of maintenance.

More detailed information on spare parts, accessories and consumables can be found in the current price list, these as well as the parts and materials can be requested at office@upnano.at, please indicate the serial number of the device or the customer number with each request.

12. APPENDIX

12.1. Operating manual of purchased components

- Operating Instructions Nordson EFD, DispensGun
- Instruction Manual ibidi Heating System, Universal Fit, for 1 Chamber
- Instruction Manual ibidi Gas Incubation System

12.2. Declaration of Conformity

KONFORMITÄTSERKLÄRUNG

gemäß EG-Richtlinie Maschinen 2006/42/EG gemäß Anhang II A Originalkonformitätserklärung

Hersteller:	UpNano GmbH Modecenterstraße 22/D36 1030 Wien Austria

erklärt in alleiniger Verantwortung, dass das nachfolgend angeführte Produkt

Produkt:	3D Drucker
Model:	NanoOne
Seriennummer:	5034001-5034099
Jahr der CE Kennzeichnung:	2022

den einschlägigen Bestimmungen der folgenden EG-Richtlinien entspricht:

Maschinenrichtlinie 2006/42/EG
EMV-Richtlinie 2014/30/EU
Richtlinie zur Beschränkung gefährlicher Stoffe (RoHS 2) 2011/65/EU

Bei der Konstruktion wurden folgende harmonisierte EN-Normen berücksichtigt:

EN ISO 12100	*Allg. Gestaltungsleitsätze, Risikobeurteilung*
EN ISO 13849-1	*Sicherheitsbezogene Teile von Steuerungen*
EN ISO 14118:2018-07	*Vermeidung von unerwartetem Anlauf*
EN ISO 14120: 2016-05	*Trennende Schutzeinrichtungen*
EN 61326-1:2013	*Elektrische Mess-, Steuer-, Regel- und Laborgeräte - EMV-Anforderungen*
EN 60825-1:2014	*Sicherheit von Lasereinrichtungen*
EN 61010-1:2010	*Sicherheitsbestimmungen für elektrische Mess-, Steuer-, Regel- und Laborgeräte*

Name und Anschrift der bevollmächtigten Person für die Zusammenstellung der techn. Unterlagen:

Dr. Peter Gruber
Modecenterstraße 22/D36
A-1030 Wien

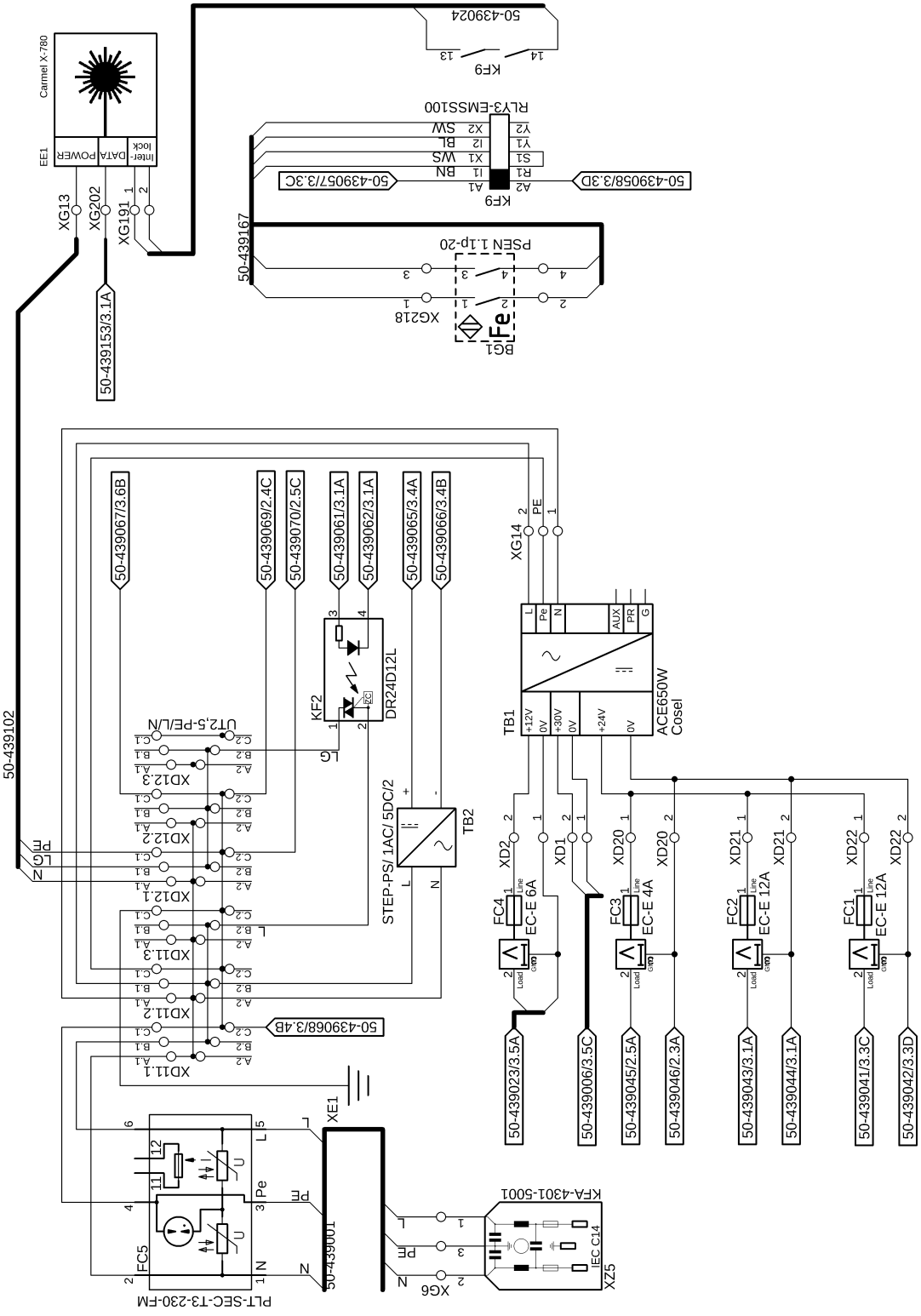
Diese Erklärung bezieht sich nur auf unser Produkt in dem Zustand, in dem es in Verkehr gebracht wurde; vom Endnutzer nachträglich angebrachte Teile und / oder nachträglich vorgenommene Eingriffe bleiben unberücksichtigt.

Wien, am 22. Sept. 2022

UpNano GmbH | Modecenterstraße 22/D36
1030 Wien | Österreich | FN: 498407b

Dr. Bernhard Küenburg, CEO

12.3. Cable diagrams



12.4. Glossary

two-photon polymerization, 2PP	**Additive manufacturing process for the production of three-dimensional macro-, meso-, micro- and nanostructures based on non-linear excitation by laser light.**
Voxel	Smallest unit of volume to be polymerized. The voxel has an ellipsoidal shape. Its volume increases with the laser power. Note: When changing the laser intensity, the layer spacing (Δz) must sometimes be adapted.
Bottom Up	Print mode in which the component is built up layer by layer, from bottom to top. Here, the laser path leads through already solidified material, which can lead to voxel distortions at higher penetration depths (higher print objects).
Top Down	Print mode in which the component is built up layer by layer, from top to bottom. This mode is preferably used with highly viscous or solid materials (UpSol). In top-down mode, the laser beam does not pass through already solidified material.
Vat mode	Print mode in which the component is pulled out of the material vat placed on top of the objective. Between the last polymerized layer and the glass bottom of the material vat there is always a film of liquid 3D printing resin. *Caution*: If several objects whose height exceeds the distance between the focus point and the bottom of the tray are printed one after the other in Vat mode, the components can be crushed by the stage by refocusing on the substrate.
Stitching	Components that are larger than the viewing area of the lens are divided into sections to be manufactured one after the other. The joining of these individual sections is called stitching. A proprietary stitching technique in which the layers overlap each other ensures that stitching seams do not represent weak points in the material.
ΔXY	Line spacing distance between the individual lines in X and Y direction.

ΔZ	Layer spacing distance between the individual print layers.
Block height	If a part is stitched, the individual parts are printed sequentially in blocks with a defined height (block height). The block height is limited. If it is set too high, the laser may be shadowed by an already existing adjacent block. If the block height exceeds the distance between the focus point and the bottom of the vat, an existing block will be squashed when the next block is printed. Caution: This can also happen if several objects whose height exceeds the distance between the focus point and the bottom of the vat are printed sequentially in Vat mode.
Numerical aperture (NA)	The numerical aperture is a dimensionless quantity that describes the ability of an optical element to focus light. It has a strong influence on the size of the voxel, especially on its axial expansion. Thereby, the voxel becomes smaller with increasing NA.
Laser output	The laser power is specified in mW and corresponds to the average power density measured after the objective in the course of the objective power calibration.
Scanning speed	The scan speed is the speed at which the voxel is rasterized across the print field. The actual print speed (throughput) depends on several factors.
Print speed / throughput	The print speed depends on the objective used, the scan speed, Δxy, Δz, the axis speed, the scan mode and the part geometry. It can reasonably only be estimated.
Block Z Overlap	When stitching parts, it is sometimes advisable to select an overlap between two blocks. This overlap is specified as a percentage of the voxel height, where 100% corresponds to the height of an entire voxel.

12.5. Customer service

For technical information, in case of problems or further questions, our customer service is at your disposal.

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