Instruction Manual

Original Instructions

3Dent™

Keep for further reference!

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Identification

Manufacturer address

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Introduction

The 3Dent™ system is an effective Rapid Prototyping/Rapid Manufacturing system, that sets standards in terms of speed and ease of use. Thanks to its low-maintenance and economic operation the system is the ideal choice for small businesses and professional end users.

The 3Dent™ system uses the innovative 3SP™ technology (Scan, Spin and Selectively Photocure). It has been designed especially for use in dental laboratories. The 3Dent™ machine is a complex high-tech system comprising mechanical, electronic, and software components. It meets all necessary national and international requirements and safety regulations.

This document forms an essential part of the system and must be paid close attention when starting up the system and during operation. Therefore, the documentation should be kept in proximity to the machine, so that the operator will be able to access it at all times.

Warranty

These operating instructions must be read carefully before installing the product and putting it into operation. We assume no liability for damage and malfunctions resulting from failure to comply with the operating instructions. Furthermore, no warranty can be provided for faults that are due to subjecting the goods to improper use or application above average strain, nor can any warranty be provided for wearing parts.

In case any material defects or errors occur despite correct usage, EnvisionTEC® offers a warranty period limited to one year starting from the moment the customer is supplied with the goods for the 3Dent™ system and respective accessories. The obligation of EnvisionTEC® is limited to repairing or replacing defective machine parts.

Under no circumstances will EnvisionTEC® assume liability for the consequences or side effects of a violation of warranty conditions, even if this has been agreed to or expected, and even in case of fault or negligence on the part of the company.

EnvisionTEC® expressly refrains from granting any other warranty claims in this respect. Neither representatives/dealers nor employees of the company are authorized to increase or alter the warranty claims.

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Typographic Conventions

This instruction manual uses different formatting elements and symbols. Their meaning is explained in this section.

Formatting Element	Example
Enumerations are indicated by a dot.	• Safety gloves • Safety googles
Instructions with a defined order are numbered consecutively.	1. Loosen the screws. 2. Remove the build platform 3. Clean the holding. 4. Install the build platform. 5. Tighten the screws.
Cross-references or document references are in italics and highlighted in gray.	see chapter *Maintenance* see *Perfactory Software Suite* manual
Software user interface items, menu paths, file names, and product names are in bold.	input field **Machine name** menu **File | Save as…** file **Config.xml** Start **3SP Control**.
Elements of a menu path are separated by a vertical bar.	**About | Help…**
Buttons are marked with square brackets	**[Save]**

Formatting Element	Example
and bold letters.	
Keys that you want to press individually or together are in angle brackets.	<Ctrl>+<S>
User input are displayed in a different font.	`ipconfig -all`
Tips for operation are marked with an icon.	

History of Changes

Date	Changes	Version
March 2016	Document creation	1.0
August 2016	• Differentiation between German and American version • Updated photos and figures • Added information about FPGA	1.1
August 2017	• Updated layout and logo • updated *Health and Safety Notes*	1.2
May 2018	• Removed notes about the micrometer screw • Added notes about using USB sticks • Chapter *3SP Control* transferred into separate user manual and updated references • Updated chapter *Risks when handling photopolymers* • Updated chapter *Processing a Build Job* and *Aligning the PSA with the Build Platform* • Added chapter *Typographic Conventions*	1.3
March 2019	• Updated chapter *PSA* • Updated chapter *Actuator* • Update chapter *Connecting the Heating Unit*	1.4

1 Health and Safety Notes

WARNING!

Risk of injury!

- Use the machine for the intended purposes only.
- Do not carry out changes or modifications to the machine.
- Follow the instructions in this manual.
- Do not carry out tasks that must be executed by trained and authorized personnel only.
- The machine may only be operated if the protecting devices are working properly.

This document forms an essential part of the system and must be paid close attention when starting up the system and during operation. Please make sure that every operator of the machine reads these instructions completely before handling the machine for the first time. For further reference during operation, this document should be kept in proximity to the machine and be available to the operating personnel at all times in order to prevent operating errors and to ensure smooth and trouble-free operation.

1.1 Safety Signs and Safety Regulations

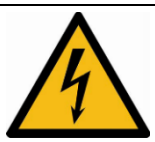
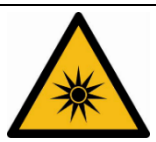
Apart from the safety information given in these instructions, all safety signs on the product itself must constantly be observed. Furthermore, the machine owner is obligated to inform each operator about the local safety regulations valid at the operation site.

1.1.1 Representation of Safety Symbols

Safety instructions are indicated by a pictogram and a signal word. The signal word describes the severity of the risk.

Pictogram	Signal Word	Description
	**DANGER**	Indicates a hazardous situation which, if not avoided, will result in death or serious injury.
	WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
	CAUTION	Indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.
	**NOTICE**	Application hints and particularly useful information.
	**IMPORTANT**	Indicates an obligation to special behavior or an activity required for safe machine handling.

1.1.2 Specific Risk Signs

 Electrical danger	 Hand crushing	 Optical radiation
 Hot surface	 Laser radiation	

1.1.3 Mandatory Action Signs

 Use protective hand wear	 Use protective footwear	 Use protective goggles	 Use protective clothing

1.2 Owner's Responsibilities

The machine has been produced for commercial use. Therefore, it lies within the owner‘s responsibility to ensure that all general safety regulations and codes of practice as well as the safety measures described in this manual are observed at all times.

Apart from this, all environmental regulations must be observed when disposing of any of the components or consumables.

Also make sure that the material safety data sheets for the materials used are observed and kept in proximity to the machine.

1.3 Intended Use

The Ultra 3SP system is designed for small-batch model productions using stereo-lithography processes. The machine works with the 3SP technology that uses a laser unit as light source. It is the machine owner's responsibility to ensure that the machine is used for the intended purpose and within its limitations only.

This includes that the electrical requirements indicated in chapter *Technical Data* and on the machine label must not be exceeded.

1.4 Reasonably Foreseeable Misuse

IMPORTANT

Improper use may cause hazards.

Any other use than that defined in chapter *Intended Use* or which goes beyond that use is considered misuse!

Reasonable foreseeable misuse is e.g.:

- Operating the machine with inappropriate materials

- Exceeding the technical values specified for normal operation
- Operating the machine with damaged machine parts or electric cables
- Unauthorized modifications and changes to the machine

For any damage resulting from misuse:

- The machine owner bears the sole responsibility,
- The manufacturer assumes no liability whatsoever.

1.4.1 Modifications or Changes

Unauthorized modifications or changes render all claims for liability and guarantees null and void.

Therefore, do not make any alterations or complements to the machine without previous consultation and written confirmation of the manufacturer.

1.4.2 Spare and wear parts as well as auxiliary materials

The use of spare and wear parts from third party manufacturers can lead to risks. Only use original parts or parts released by the manufacturer.

The manufacturer shall accept no liability for damage caused by the use of unreleased spare and wear parts or auxiliary materials not released by the manufacturer.

1.5 Residual Risks

The machine has been constructed according to the state-of-the art and the approved safety regulations. Nevertheless, the operation of the machine can cause especially the following risks to the health and safety of the operator or third persons.

1.5.1 Laser radiation hazard

Laser radiation emitted by the image scanner may cause severe damages to eyes and skin. Do not expose your eyes or skin to direct laser radiation or laser beams focused through optical lenses.

Always keep the hood of the upper machine compartment closed when operating the machine. The machine may only be operated if the protecting devices are working properly.

The machine may only be operated by instructed and specially trained personnel. Only execute the calibration tasks described in this user manual.

For the remaining tasks, have the machine calibrated by trained and authorized service personnel only.

Particular hazards can be caused by:

- Incomplete covers or broken parts
- Improper assembly, incorrect wiring, defective parts etc.

1.5.2 Mechanical hazards

- Risk of injury from hand crushing caused by automatically moving machine parts inside the upper machine compartment.
  Always keep the hood of the upper machine compartment closed when operating the machine. The machine may only be operated if the protecting devices are working properly.
  The machine may only be operated by instructed and specially trained personnel.
  Only execute the calibration tasks described in this user manual.
  For the remaining tasks, have the machine calibrated by trained and authorized service personnel only.
- Risk of injury from crushing caused by machine overturning during transport.
  Do not try to move the machine yourself.
  Have the machine transported by trained personnel only.
- Risk of injury from crushing caused by falling down of material vat. Use two persons to lift the material vat.
  Hold the material vat only on the upper edge. Do not put your hands below the vat.
  Wear safety boots.
- Risk of injury caused by improper handling of the build platform.
  Only remove the build platform if you cannot clean it inside the machine.
  Before taking out the build platform make sure that all persons are clear of the danger zone.
  Avoid unnecessary movements. Avoid non-ergonomic joint positions
- Risk of slipping, stumbling or falling of persons: Keep the floor of the machine area clear of loose cables, objects or liquids.

1.5.3 Thermal hazards

- The material vat may be hot and cause burnings. Hold the material vat only on the upper edge.
  Do not touch the lower part of the vat.

1.5.4 Hazardous substances

Risk to health from photopolymers:

- Use the appropriate personal protective equipment.
- Observe the relevant material safety data sheets supplied with the photopolymers.

Particular hazards can be caused by:

- Setting an inappropriate temperature:
  The material may overheat. Overheated material may cause the release of toxic gases/vapors and burnings.
  Do not change the resin temperature set by the service technician.
- Inappropriate filling of the vat:
  The initial filling of the material vat will be carried out by the service technician during the machine installation.
  Do not try to change the material in the vat yourself! Contact your customer service.

1.5.5 Hazards caused by high pressure

The material bottle may be under pressure while the machine is connected and may cause injuries when it is opened.

Disconnect the machine via the **3SP Control** software before opening or replacing the material bottle.

1.5.6 Electrical hazard

Improper use of conducting components can lead to severe injuries.

Make sure that all conducting components are in good order and condition!

The switch cabinet may be opened by trained and authorized service personnel only.

Particular hazards can be caused by:

- Incomplete covers or broken parts
- Improper assembly, incorrect wiring, defective parts etc.
- Do not try to set up the machine yourself. Have the machine set up by trained and authorized service personnel only.

1.5.7 Hazards caused by insufficient stability

- The machine must be positioned on a flat and even surface to prevent the machine from moving.
- Check the horizontal orientation of the machine at regular intervals. This can be done by use of a spirit level placed on the build platform.
- If the machine is not levelled any more, e. g. if it has suffered an impact, have the machine repositioned by trained and authorized service personnel.

1.6 Risks when handling photopolymers

WARNING!

Risk of injury!

The use of the photopolymers intended for the machine may cause risks to the health and safety of the operator or third persons.

In order to ensure a safe handling of the photopolymers, the following hazard and precautionary statements must be observed.

1.6.1 Hazard statements

- H302 Harmful if swallowed.
- H315 Causes skin irritation.
- H317 May cause an allergic skin reaction.
- H318 Causes serious eye damage.
- H319 Causes serious eye irritation.
- H332 Harmful if inhaled.
- H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.
- H335 May cause respiratory irritation.
- H360f May damage the unborn child. Suspected of damaging fertility.
- H361f Suspected of damaging fertility.
- H373 May cause damage to organs through prolonged or repeated exposure.
- H412 Harmful to aquatic life with long lasting effects.
- H413 May cause long-lasting harmful effects to aquatic life.

Other hazards:

- Polymerization with heat evolution may occur in the presence of radical forming substances (e.g. peroxides), reducing substances, and/or heavy metal ions.
- People who suffer from skins problems, asthma, allergies, chronic or recurring respiratory illnesses must not be deployed in processes, which use this substance. Process vapors can irritate airways, skin and eyes.

1.6.2 Precautionary statements

- P101 If medical advice is needed, have product container or label at hand.
- P102 Keep out of reach of children.

- P201 Obtain special instructions before use.
- P261 Avoid breathing dust/fume/gas/mist/vapors/spray.
- P264 Wash thoroughly after handling.
- P270 Do not eat, drink or smoke when using this product.
- P271 Use only outdoors or in a well-ventilated area.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/protective clothing/eye protection.
- P302+P352 If on skin: Wash with water and soap.
- P305+P351+P338 If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- P308+P313 If exposed or concerned: Get medical advice/attention.
- P404 Store in a closed container.
- P405 Store locked up.
- P501 Dispose of contents and container in accordance with local regulation.

IMPORTANT

Do not use other materials than the photopolymers delivered by EnvisionTEC.

Also make sure that the relevant material safety data sheets supplied with the photopolymers are observed.

Those components of the photopolymers delivered by EnvisionTEC that have been classified as hazardous do not have a threshold limit value (TLV). Therefore, it is not necessary to give concrete instructions concerning the TLV.

Please observe, however, the following hint concerning air change:

IMPORTANT

Make sure that the extraction is sufficient. EnvisionTEC recommends an air change of 25m³/h per m² effective surface of the laboratory as described in EN 13779.

1.7 Interventions in Emergency Situations

An intervention in emergency situations includes individually or in combination:

- Shutdown in case of an emergency.

- First aid measures and medical attendance.

1.7.1 Shutdown in Case of an Emergency

In case of an emergency, immediately press the power on/emergency stop button. This will deactivate the laser and stop all machine movements.

1.7.2 First aid measures and medical attendance

Initiate the necessary first aid measures and seek medical attendance.

If a person has been exposed to the photopolymer, please follow the instructions given in the respective material safety data sheet.

1.8 Operator's Position

The machine may only be operated by one person. The operator stands in front of the machine, so that they can see the screen.

1.9 Personnel Qualification

Employees / Activity	Personnel specially trained for the activity	Trained operators	Instructed personnel with specialist training (mechanics / electrical engineering)
Transport	X	–	–
Set-Up	–	–	X
Troubleshooting and fault elimination	–	–	X
Calibration tasks	–	–	X
Operation	–	X	–
Maintenance	–	–	X
Disposal/Recycling	X	–	–

Legend: X permitted, – not permitted

1.10 Personal Protective Equipment

IMPORTANT

When working with photopolymers, observe the instructions regarding personal protective equipment in the relevant material safety data sheets supplied.

For reasons of accident prevention, make sure that all operators wear suitable protective clothing:

- protective goggles
- protective gloves
- safety boots
- laboratory coats

2 Technical Data

2.1 Machine Properties

Footprint:	74cm x 76cm x 117cm
Space required to operate the machine:	150cm front | 150cm back | 100cm sides
Weight:	180kg without material 192kg with material

2.2 Electrical Requirements

- 100V – 230V, max. 253W, 2.0A, fuse 3.15A
- The power fluctuation should be less than ±7%. Otherwise EnvisionTEC recommends to install a 1:1 transformer (power stabilizer) with the system.

2.3 Environmental Conditions

	Operating	Non-operating with material	Non-operating without material
Temperature	21°C - 28°C	10°C - 35°C	0°C - 50°C
Humidity	≤70%	≤70%	≤70%

- Ideal working temperature is around 23°C.
- Room must allow heat generated from the system to dissipate at 0.03 m^3/min airflow.
- Make sure that the extraction is sufficient. EnvisionTEC recommends an air change of 25 m^3/h per m^2 effective surface of the laboratory as described in EN 13779.
- Do not expose the machine to direct sunlight or any other UV radiation.
- Do not set up the Ultra 3SP machine in humid or dusty places or in places where it may come into contact with smoke or steam.
- Air conditioning units should be at least three meters away from the Ultra 3SP machine with no airflow pointing directly at the machine.

3 Delivery

The 3Dent system has been packed carefully prior to shipping, in order to practically rule out the possibility of damage to the machine if transported properly.

If you notice any external damage to the packaging upon delivery, indicate this damage to the transportation company immediately and ask them to sign a damage report.

3.1 Positioning

In order to obtain the best possible results, choose the position of your machine with care.

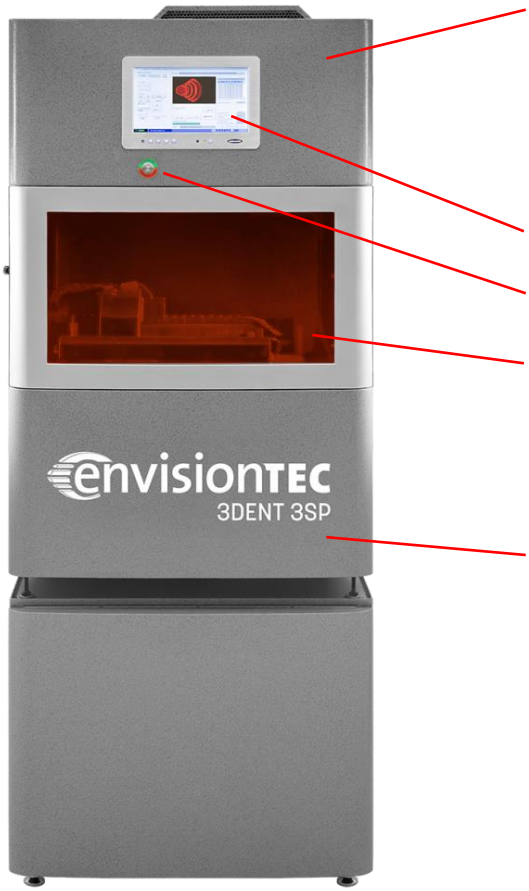
Therefore, the following should be observed:

- Avoid installing the product in a place exposed to vibrations or impacts.
- Position the machine on a flat and even surface and adjust the four levelling feet using a 13 mm spanner or an adjustable wrench to prevent the machine from moving.
- Ensure that sufficient power points (sockets) are available near the machine location.

4 Construction of the 3Dent machine

Different from other Rapid Prototyping systems, the 3Dent system does not use a projector but a laser unit for the curing of resins. Beside a much longer life cycle of the light source, this technique has the advantage of a minimized preparation phase for a build job and provides a more accurate processing.

4.1 Overview



Upper machine compartment containing the integrated computer, the Material Identification Module and the Temperature control for the material heating

Touchscreen

Power on/Emergency stop button

Middle compartment containing the laser assembly, PSA, and build platform

Lower machine compartment containing the material vat, heating and material supply

4.2 Integrated Computer

The 3Dent system is equipped with an integrated computer with Windows system software. The computer can be operated by use of the touchscreen located at the front of the machine. The **3SP Control** application used for the processing of build jobs is controlled using the integrated computer, while the **Perfactory Software Suite** must be operated on a second, external computer.

4.3 Build Platform

The 3Dent uses a removable granite build platform.

The use of a removable platform allows for an easier cleaning and prevents remains of cured material to fall into the liquid resin.

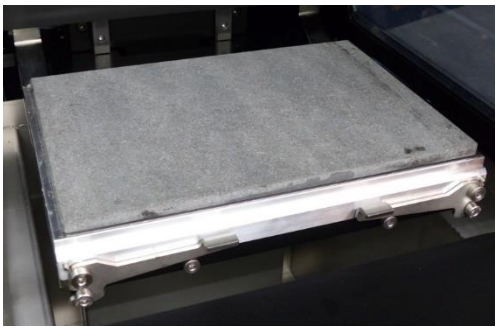


Figure 1: Granite build platform

4.4 PSA

The so-called Pre-stretched assembly (PSA) is an important component of the 3Dent system, which is essential for the realization of any building process. The PSA's stretched film is highly elastic, allowing the built parts to easily separate regardless of their size.

The PSA consists of the following components:

- inner frame
- stretched film
- outer frame
- separating foil

The stretched film is fitted between the two metal frames. The glass plate on top of the film protects it from any damage, while the separating foil between these two components prevents them from being in direct contact with each other.

Figure 2: PSA

Upon delivery, the machine already contains the pre-assembled PSA.

Due to the high pressure values the PSA is exposed to, it has to be replaced after a certain service time. The PSA's life cycle depends on different factors such as the frequency of use, the used material, and the geometry of the build parts.

Damages to the stretched film or a reduced transparency are common indications for a due PSA replacement. In both cases the quality of the built parts might be affected.

The pre-assembled PSA can be ordered from your retailer or directly from EnvisionTEC. For further details about the PSA replacement see chapter *Replacing the PSA*.

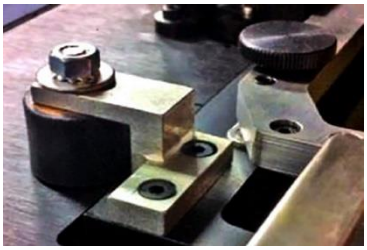


Figure 3: Transportation lock

4.5 Actuator

The actuator moves the PSA frame up and down, driven by a motor. Before starting a build job, the PSA frame must be locked, and the actuator moved down. After finishing the build job, the actuator moves up again automatically. The PSA frame can then be unlocked and opened.

4.6 Laser Unit

DANGER!

Risk of injury!

Laser radiation may cause severe damages to eyes and skin.

- Do not expose your eyes or skin to direct laser radiation or laser beams focused through optical lenses.
- Always use the supplied eye protection.

The laser unit in the 3Dent machine consists of a rail-mounted laser head which is moved in x and y-direction by two independent control modules.

Using a multi-cavity laser diode with an orthogonal mirror spinning at 20,000 rpm, the light is reflected through the spinning drum and goes through a series of optical elements, thereby focusing the light onto the surface of the photo polymer. While the laser unit moves in x-direction, the laser head scans the surface in y-direction, curing the areas of the photopolymer that are determined by the previously created job file.

The laser diode is classified class 4 according to DIN EN 60825-1 21 and CFR Part 1040.10. It is absolutely necessary to take overall safety measures against user's modules, equipment and systems into which our LDs are incorporated and/or integrated.

When handling the laser diodes, always wear appropriate safety glasses to prevent direct and reflected laser light from entering to the eye. Laser beams focused through optical instruments increase the chance of eye hazard.

4.7 Material Identification Module

The 3Dent has a Material Identification Module (MIM) installed, that will help you monitor the material consumption at any time.

Furthermore, the MIM ensures that only high-quality polymers provided by EnvisionTEC are used.

The Material Identification Module is located in the upper compartment of the machine. The module receives the information from Tags which are always delivered together with new material bottles.

The machine can only process a build job if the material tag is registered. Position the tag on the tag reader of the machine. The orientation of the tags on the surface of the tag reader is not important.

Figure 4: Tag reader

4.8 Material Vat with Heating Function

The material vat of the machine is situated in the lower machine section.

The material vat is used for heating the material up to the perfect processing temperature.

For further information on the usage of the heating function, see chapter *Connecting the Heating Unit*.

5 Starter Kit

The scope of delivery of the 3Dent system includes a starter kit containing useful tools for the operation and cleaning of the machine.

5.1 Contents of the Starter Kit

- Hardware Manual
- Perfactory Software Suite and appropriate User Manual
- Univeral scraper
- Philips head screw driver, shaft thickness 4.75 mm
- Hexagonal wrench, 3.0 mm, 2.0 mm, 1.5 mm
- Squeegee
- Protective rubber gloves
- Protective goggles for laser applications
- Material vat

5.2 How to Use the Starter Kit

Squeegee	Please use the squeegee to clear remaining material from the PSA.
Universal Scraper	The main use for the universal scraper is to remove the cured parts from the build platform. Apart from this, the scraper can also be used to remove material residues from the platform.
Philips Head Screw Driver	The screw driver is used for different screws in the 3Dent system.
Hexagonal wrenches	The hexagonal wrenches can be used to newly align the PSA if you find that its parallelism to the build platform has to be corrected. They can also be used for several other screws on the machine.
Rubber Gloves	Make sure to always use the provided rubber gloves while working with resins!
Protective Goggles	All laser applications will be done by authorized service technicians only! In the unusual case that you have to work on the machine with the laser ignited, always use the provided goggles!

6 Putting into Operation

IMPORTANT

Putting the machine into operation with increased voltage applied will damage the unit.

- Always apply the voltage indicated on the rating plate.
- The machine will be factory-set with the correct voltage in accordance with the country of delivery.

IMPORTANT

Pulling the main cable or pressing the power on/emergency stop button while the machine is switched on can damage the machine and result in loss of data.

- Disconnect cable or press the power on/emergency stop button only in case of an emergency.

WARNING!

Risk of injury!

Laser irradiation may cause severe damages to eyes and skin.

- Do not expose your eyes or skin to direct laser irradiation or laser beams focused through optical lenses.
- Always use the supplied eye protection.

Once the machine has been successfully installed, it can be put into operation. Connect the main power cable at the rear of the machine.

At the rear side you can also find two USB ports where you can connect a keyboard and/or mouse.

Press the power on/emergency stop button on the front of the machine to switch the machine on. Then switch on the touchscreen using the corresponding button below the screen. Finally, start the **3SP Control** software.

If you want to shut down the system, use **[Exit]** to close the **3SP Control** software first. Then shut down the computer and switch the screen off. The machine will switch off automatically.

6.1 Important Settings Prior to First Operation

6.1.1 Software and Network Settings

The provided **Perfactory Software Suite** should be installed on a second, externally operating computer. Consequently, the two units have to be connected through a network to be able to transfer the prepared job files to the 3Dent system.

Alternatively you can use a USB stick to transfer the build job files to the machine.

For further information on the setup of the **Perfactory Software Suite** see the *Perfactory Software Suite manual*.

Sharing a Folder

Make sure that the folders containing the prepared job files for your build models are shared in the network and can be accessed and used on the internal computer of your machine.

6.1.2 Connecting the Heating Unit

The 3Dent machine is equipped with a heating function which holds the material on a certain temperature level.

The respective processing temperature for the material used can be found in the corresponding cookbook.

The material heating is located in the lower segment of the 3Dent machine. The cable connects the heating device to the power source and the temperature control unit, which is located in the upper compartment of the machine.

The correct temperature (in °C) is preinstalled at the factory.

It usually takes some time for the vat to be heated to the correct temperature.

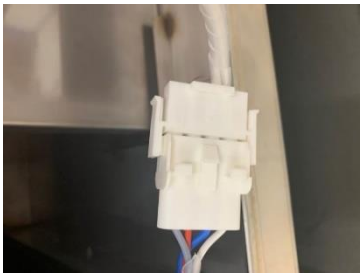


Figure 5: Connectors of the heating unit

Figure 6: Temperature controller

7 Normal Operation

7.1 Standard Procedures

7.1.1 Opening and Closing the PSA

To open and close the PSA assembly, do the following:

Unlock the PSA frame by lifting the locking lever up. Then lift up the PSA frame and use the latch at the top of the machine to secure it in the upper position.

To lower the PSA frame, release the latch while holding the handle and slowly close the PSA frame. Lock the PSA frame by moving the locking lever down.

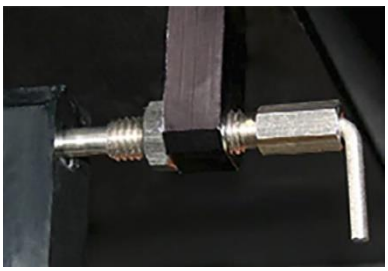


Figure 7: Latch to secure the PSA frame

7.1.2 Cleaning the Build Platform

When a build job has been completed, the build platform always has to be cleaned carefully. Material residues might damage the PSA or result in faulty build jobs.

6. Elevate the build platform out of the resin.
7. Unlock the build platform and lift it out of the machine. Do not fully open the latches, but put them into an angle of 45° to the frame.
8. As soon as the majority of material has flowed back, remove the build platform from the machine.
9. Put the platform onto a tissue or into a suitable bowl and remove the built parts from the surface using a universal scraper.

IMPORTANT

Do **not** use paper tissues to clean granite platforms!

The porosities of the granite platform would be filled up with cellulose residues which would impair the adhesion of the models to the build platform during the next build job.

10. After that, thoroughly clean the build platform with isopropanol. Make sure that the bottom side and especially the sections that will be in contact with the frame are carefully cleaned.
11. Carefully clean the parts of the platform frame that will be in contact with the build platform. Small amounts of cured resin between build platform and frame can impair the parallelism of the build platform with the PSA.

12. Reinstall the build platform into its frame and secure it with its brackets.

7.1.3 Cleaning the PSA

After accomplishing the build job, clean the PSA using the provided squeegee. After that, check, whether any residues of cured material remain on the surface of the stretched film.

If so, remove them with an edgeless item such as a piece of carton. You might, for instance, use conventional playing cards.

7.1.4 Material Bottle

Do not refill the material bottle while processing a build job.

To refill the material bottle, take the following steps:

1. Open the lower door on the machine.
2. The material bottle is located at the right side of the material vat. Remove the lid from the empty bottle. Be sure not to spill any of the material. Refill the bottle with the same material.
3. Place the refilled bottle beside the material vat. Make sure that the tube of the material pump is correctly introduced into the bottle and fasten the lid.
4. Close the door and replace the material tag (see chapter *Material Identification Module*).

Figure 8: Material bottle

7.1.5 Installation of the Material Vat

DANGER!

Risk of injury!

Do not inhale chemical vapors. Avoid contact with skin or eyes.

- Always wear suitable protective clothing (gloves, goggles, breathing protection, protective overall, etc.).
- Wash your hands thoroughly after working with resins.
- Be sure not to spill any chemical substances!

The material vat has a capacity of about 15kg. This makes the vat one of the heaviest parts of the 3Dent system that can decisively influence the machine's balance.

The positioning of the material vat as well as the initial filling will be carried out by the service technician during the machine installation.

If you have to clean the material compartment, you can take out the vat and replace it after cleaning.

Please take the following steps:

1. Open the PSA and lock it to the upper part of the machine.
2. Elevate the build platform to the uppermost position.
3. Disconnect the material vat from the cable of the temperature control unit.
4. Take the material vat out of the lower compartment of the machine.
5. Clean the bottom of the material compartment.
6. Put the material vat back into the indicated area. The two bars holding the build platform should be centered within the recess at the back of the vat.
7. Once the material vat has been replaced, check whether the machine is still balanced correctly and, if needed, readjust the levelling feet.

7.1.6 Replacing the PSA

In case the PSA is damaged or the film comes off, the PSA has to be replaced as soon as possible. You can order a new PSA from your authorized distributor or directly from EnvisionTEC.

To replace the PSA, please take the following steps:

1. Disconnect the **3SP Control** application.
2. Open the middle door on the machine.
3. Open the PSA and lock it at the top of the machine.
4. Make sure that no material remains on the PSA.
5. Unfasten the screws of the PSA. Start with the lower screws, so that the PSA does not fall down while working.
6. Remove the old PSA and the separation film.
7. Clean the glass plate with glass cleaner. Do not use any resolvents. If you find residues of cured resin on the glass, it can be cleared off with a razorblade. Be sure not to scratch the glass.
8. Put in the separation film; make sure it is not damaged or stained and position it in the center with its rough side facing the glass.
9. Fasten the new PSA to the frame with the four screws. Do not fully screw them in at once, as this might cause a gap between the film and glass. Instead of this, tighten the screws only slightly one by one, so as to fasten them in a regular way until all four of them are completely fixed.

10. After that, check whether it is fixed correctly. Make sure that there is no gap between the PSA and metal frame in either of the corners. Also check if there are any bubbles to be seen in the middle of the PSA. Finally, make sure that the glass cannot be moved within its frame.

7.2 Processing a Build Job

The creation of a build job is carried out with the EnvisionTEC Software Suite. The application should not be installed on the Ultra 3SP machine, but on an individual computer.

The needed build job folder can be transferred to the machine via the network or by using an USB stick. Please choose an appropriate place on the integrated computer to store your job folder. You can create a folder in which you keep all your build jobs.

HINT

If you save the job files in a folder **C:\Jobs** on the integrated computer of the machine, these job files will automatically be displayed on the **Jobs** page of the **3SP Control** software.

For a transmission via the Ethernet connection, please select the job folder on your external PC and copy it to the integrated computer.

If the job folder is stored on a USB stick, insert the stick into one of the USB ports at the rear of the machine and copy the job folder to the integrated computer.

The USB ports can also be used to connect an external mouse or keyboard.

If the **3SP Control** application is already open, click **[Explorer]** to open the Windows Explorer.

NOTICE

If jobs are started directly from the USB stick and the USB stick is pulled out during the build process, your build job will be stopped and you will not be able to resume it.

- Do not start a job directly from the USB stick.

Follow the next steps to start the job:

1. Open the **3SP Control** application.
2. Make sure that there are no material residues on the PSA, build platform or platform frame. If you find any remains of cured resin, clean the build platform and PSA (see chapter *Cleaning the Build Platform* and *Cleaning the PSA*).
3. It is necessary to stir the material, so that the ingredients will be evenly mixed again. Information on when and how often a certain material has to be mixed can be found in the respective cookbook.
4. Connect the machine by tapping **[Connect]**.
5. Lower the build platform into the resin.
6. Tap **[Home]**. The machine moves to the Home position starts pumping material into the vat.The platform should now be covered with resin for about 1mm. If this is not the case, contact the customer service.
7. Close and lock the PSA (see *Opening and Closing the PSA*).
8. Navigate to the **Actuator** section in the **3SP Control** software.
9. Tap the down arrow button to move the actuator to the bottommost position.
10. Tap **[Start Job]**.

7.3 Completion of a Build Job

IMPORTANT

Risk of damage to machine parts!

Make sure that there are no material residues remaining on the build platform. This might damage the PSA and impair the quality of your product.

WARNING!

Risk of injury!

Avoid skin contact with building materials.

- Always wear protective gloves while handling PSA, build platform, and material vat!

After completion of a build job, please take the following steps:

1. Open the PSA and lock it in the upper position, see chapter *Opening and Closing the PSA*.
2. Elevate the build platform out of the resin.
3. Unlock the build platform and lift it out of the machine. Do not fully open the brackets, but put them into an angle of 45° to the platform's frame. This permits you to position the build platform on the frame and let the uncured material flow back into the vat.
4. As soon as the majority of material has flowed back, take out the build platform and carefully remove the built parts with the universal scraper.
5. Thoroughly clean the build platform and make sure that no residues remain (see chapter *Cleaning the Build Platform*).
6. Clean the PSA with the squeegee or a soft paper tissue. Remaining cured resin can be cleared off with a small amount of isopropanol. Do not use any metal or hard plastic tools.
7. Reinstall the build platform into its frame and secure it with its brackets.
8. When you are sure that there is absolutely no cured material remaining on the PSA or build platform, lower the platform into the resin.
9. Close the PSA.
10. Tap **[Home]**.

8 Regular Checkings

When your machine is delivered, it is thoroughly installed and calibrated by an authorized service technician.

However, due to the high strain and pressure values the system is exposed to, the alignment of the components may be affected after a certain operating time. Therefore, regular checking should ensure that especially the build platform and PSA are still accurately levelled.

8.1 Levelling the Build Platform

After your machine has been professionally installed, the build platform is perfectly horizontal to the material surface. This is an essential requirement for the achievement of an ideal material supply and correct build job results.

After a certain operating time, the horizontal orientation of the machine might be compromised and should therefore be checked at regular intervals.

This can be done by use of a spirit level placed on the cleaned build platform.

In case the machine is not correctly levelled, correct its position by adjusting the four levelling feet.

8.2 Aligning the PSA with the Build Platform

8.2.1 Checking the Parallelism

One of the most important requirements for an accurate building process and high-quality results is that the PSA is perfectly aligned with the build platform. When installing the machine, the service technician precisely levels both components. In consequence of the high pressure during the building process, however, the parallelism may eventually be affected. A regular examination of the PSA's orientation is therefore essential.

The check can be done using a normal sheet of paper with a thickness of 0.1 mm and a feeler gauge with a thickness of 0.15 mm.

NOTICE

If the parallel orientation of the PSA has been lost, you may even see it. If you look at the PSA from above and the material does not show a uniform color throughout the surface, be sure to carry out the alignment check.

Take the following steps to check the PSA's orientation.

1. Take out the material vat.
2. Clean the build platform and the PSA.
3. Start the **3SP Control** application, close and lock the PSA.
4. Connect the machine with **[Connect]**.
5. Tap **[Home]**.
6. Once you hear the material pump starts working, tap **[Cancel Motion]**.
7. Lower the build platform by 0.15 mm. This corresponds to the thickness of the feeler gauge.
8. Open the lower machine compartment.
9. Place the sheet of paper on the build platform.
10. Slowly lower the PSA.
11. Close and lock the PSA, see chapter *Opening and Closing the PSA*.
12. Go to the **Actuator** section of the **3SP Control** software.
13. Tap the **[Down]** arrow button to move the actuator to its defined lower position.
14. Gently push the feeler gauge between build platform and paper and check whether the gap between PSA and build platform is equally wide at all sides. The feeler gauge should move through the gap, but there should not be too much space between the two components and you should feel a resistance.

If the check reveals that the PSA is not aligned properly, adjust it as follows:

1. First loosen the small Allen screws (2) on the side. This unlocks the Allen screws (3) that are used to level the PSA.
2. Then loosen the locking screw (1) on one corner of the PSA.
3. The Allen screw (3) can now be turned with an Allen key.
   Turn clockwise to raise the PSA up, and turn counterclockwise to lower it. Always turn the Allen screws only a little (~ 1/8 turn)!
4. Tighten the locking screw (1) again.
5. Use the feeler gauge to check the distance between the PSA and the build platform.

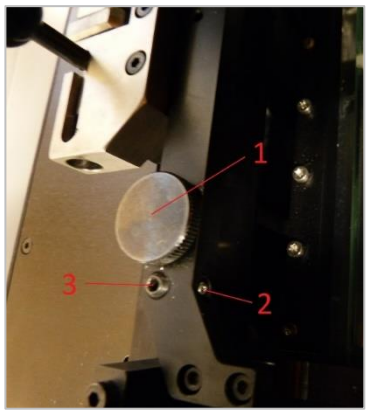


Figure 9: Screws for parallel alignment

6. Proceed in the same way for the other three corners: loosen the locking screw (1), adjust with the Allen screw (3), tighten the locking screw (1), and check the clearance.
7. Adjust the orientation of the PSA using the Allen screws (3), and then repeat the feeler gauge test described above.
8. Repeat this process until the PSA is aligned at the correct distance exactly

parallel to the build platform.

9. Finally tighten the small Allen screws (2).

8.2.2 Determining the Initial Build Position of the Build Platform

After a realignment of the PSA, it is necessary to control the first layer thickness by adjusting the gap between the PSA and the build platform at its home position.

When pushing the feeler gauge between build platform and paper as described in chapter *Checking the Parallelism*, the feeler gauge should move through the gap, but there should not be too much space between the two components and you should feel a resistance.

If this is the case, the current initial build position can be retained. Otherwise, carry out the following steps:

1. Start the **3SP Control** software.
2. Switch to the Service mode (see *3SP Control user manual*).
3. Connect the machine with **[Connect]**.
4. Navigate to the **Build Platform** section.
5. Tap **[Reset Position]** to delete the build platform's current position value.
6. Use the **Move by** input field to move the build platform up or down, according to the result of your test.
7. As soon as the feeler gauge moves smoothly between paper and build platform at all corners, tap **[Define Home Position]**. The new home position is saved.

To test the new home position, follow the next steps:

1. Open the PSA, see chapter *Opening and Closing the PSA*.
2. Use **[Home]** to move the build platform to the new initial build position.
3. Slowly lower the PSA.
4. Lock the PSA, see chapter *Opening and Closing the PSA*.

After putting back the material vat, check whether the resin spreads evenly between the PSA and the build platform. Furthermore, you should be able to see the build platform through the resin.

If so, the initial build position of the build platform has been determined successfully If you notice problems when building jobs, e. g. the parts do not stick to the build platform or cannot be removed from the build platform, repeat the described process.

You may also need to adjust the burn-in range (see chapter *Perfactory Buildstyle Editor* in the *Perfactory Software Suite User Guide*).

Annex: Troubleshooting

Problem	Potential Cause	Remedy
The parts on the upper or bottom side of the build platform are not built; the other parts are shifted upward or downward (in y-direction).	The **Laser Center Shift** is not set correctly.	Make sure the correct value for the **Laser Center Shift** is set in your Buildstyle (see *Perfactory Software Suite manual)*.
The parts are distorted or sheared.	The **Laser Motion Misalignment Compensation** is not set correctly.	Make sure the calibration data file (*.cdx) is loaded and the **Laser Motion Misalignment Compensation** function is enabled in the Buildstyle Editor (see *Perfactory Software Suite manual)*. If you do not have a cdx file, contact your customer service.
The models show dimensioning errors. The models built at the edges of the build envelope (in y-direction) are bigger than they should be.	The **Laser Scanning Compensation** is not set correctly.	Make sure the calibration data file (*.cdx) is loaded and the Laser Scanning Compensation function is enabled in the Buildstyle Editor (see *Perfactory Software Suite manual*). If you do not have a cdx file, contact your customer service.
	The laser power is too low at the edges of the build platform.	The laser is probably defective and has to be replaced. Please contact your customer service.
All parts have wrong dimensions in x-direction when compared to the model.	The **Motion Adjustment Coefficient** is not set correctly.	Make sure a value has been specified for the **Motion Adjustment Coefficient** function in the Buildstyle Editor (see *Perfactory Software Suite manual)*.
The parts built at the center of the build envelope are overcured. Parts at the edges are fine or even undercured.	There is a significant laser power difference between the center of the build envelope and the edges.	The laser head will probably have to be replaced. Please contact your customer service.

Problem	Potential Cause	Remedy
All build parts show undercuring or delamination.	The laser power has dropped.	Please contact your customer service. The laser head will have to be cleaned. The laser might as well be defective.
Parts built on one side of the build envelope are detached from the build platform.	The PSA might not be aligned correctly with the build platform.	Follow the calibration steps described in chapter *Aligning the PSA with the Build Platform.*
	The machine might have to be levelled.	Check the machine alignment using a spirit level and, if necessary, adjust it with the four levelling feet at the bottom of the machine (see chapter *Levelling the Build Platform*).
The lateral surfaces of the models show horizontal lines.	The belts conducting the laser assembly are not tensed equally, causing the assembly to vibrate.	Loosen the two screws of the pulley on the left hand side. Move the pulley to the left to apply more tension to the belt. Make sure that both belts are equally tensed.
The model shows curved instead of straight surfaces in laser direction or parts are sheared in opposite directions in the same job.	The laser assembly should be realigned.	Contact your customer service for laser head exchange or repair.
The first flat surfaces attached to the supports are peeling and not fully attached.	You are using a buildstyle that is not suitable for the material used.	Check whether you are using a suitable buildstyle for the material (see *Perfactory Software Suite manual)*.
	The resin is too cold.	Check the respective cookbook for the correct processing temperature.
	The particles in the resin have separated.	Remix the material.
The supports are unusually soft and unstable.	The value for **Support Extra Exposure** is too low.	Set a higher value for **Support Extra Exposure** using the Buildstyle Editor (see

Problem	Potential Cause	Remedy
		Perfactory Software Suite manual). The recommended value can be found in the respective safety data sheet for the material used.
A few seconds after starting a job, the motion control is automatically disconnected and the message **Build failed** is displayed in the machine status. The laser is on the left side.	The communication between the 3SP controller board and the laser head has failed.	Reset the 3SP board at the back side of the machine.
		Check the coaxial cable connection to the 3SP controller board and the laser head or replace the cable. If resetting the controller board is not successful, the laser might be damaged. In this case call your customer service.
During the job process, **3SP Control** shows no progress, the laser head does not move and the displayed **Seconds per section** is unusually high.	Check the 3SP controller board at the back side of the machine. If both orange lights are permanently on, the board will probably have to be changed.	Please contact your customer service.
When a job is started, the laser assembly moves to the left side and sticks there. **3SP Control** keeps showing progress in the job processing.	You are using a buildstyle that is not suitable for the machine.	Use a different buildstyle (with correct dimensions of the build platform) that is suitable for the machine, (see *Perfactory Software Suite manual)*.
The parts stick to the PSA instead of platform.	The PSA might be misaligned.	Follow the calibration steps described in chapter *Aligning the PSA with the Build Platform.*
	The machine might not be levelled correctly.	Check the machine alignment using a spirit level and, if necessary, adjust it with the four levelling feet at the bottom of the machine (see chapter *Levelling the Build Platform*).

Problem	Potential Cause	Remedy
	The build parameters are not correct.	Check whether you are using the right buildstyle (see *Perfactory Software Suite manual)*.
	The laser power is not correct.	If none of the other measures solves the problem, there might be a problem with the laser power. Please contact your customer service. In any case, clean the PSA using a piece of carton (e.g. a playing card). Also clean the build platform. Make sure that no cured material falls into the resin.
There is material between stretched film and separation foil.	The PSA might have a hole or be stretched out.	Replace the PSA and the separation foil. It is important to replace both items, as the separation foil cannot be cleaned.
	The PSA might not be sealed properly.	
The build platform does not move. (1) The build platform moves down, but won't move up. (2) The build platform moves up, but won't move down.	The platform probably hit an obstacle and lost its connection with the z-axis.	Disconnect the machine. Use a cloth or plastic rubber cable to manually move the axis clockwise by ½ to 1 inch (1.5cm to 2.5cm). Reconnect and try to move the platform.
	(1) The PSA position sensor may be faulty.	(1) Open the PSA, then try to move the platform up again. If it works, the PSA position sensor is defective. Otherwise, one of the PSA position sensors is defective.
	(1)+(2) One of the PSA position limit sensors may be faulty.	(1)+(2) Please contact your customer service for repair or replacement.
The build platform repeatedly gets stuck during the building process. The motion	The motor driver for the z-stage, the motion controller board or the PSU is defective.	Replace the components one at a time to find out which one is defective. After each exchange, check

Problem	Potential Cause	Remedy
controller of **3SP Control** is still connected.		whether the build platform can be moved without error again.
The laser assembly makes some unusual noise when moving from left to right. The outer surfaces of the build parts show lines.	The rails might need to be lubricated.	Grease the rails.
	The rail bearings might be misaligned.	If this does not solve the problem, contact your service technician to have the rail bearings re-aligned.
When moving the build platform, a scraping noise can be heard.	The build platform is touching the sides of the material vat.	Realign the material vat and make sure that the z-stage is positioned within the recess of the vat and that the build platform does not get in touch with it.
	The z-stage has to be greased.	Grease the z-stage.
	There is a problem with the motor coupling.	Loosen the couplings and check whether the motor runs quietly.
	There is a problem with the bearings.	If the coupling is okay, the slide bearings will have to be replaced.
	Check whether the motor itself makes the noise.	If the motor makes the noise, it might be defective. Please contact your customer service.
The z-stage is making a thudding noise when moved.	One of the components of the z-axis such as lead screw, lead screw nut or coupling is damaged.	Please contact your customer service to have the respective component replaced.
Clicking **[Start JOB]** does not start the build job.	The material tag has probably run out.	Check the **Material Info** field in the **Settings** tab. If the value is **0** after clicking **[Refresh]**, please replace the material and respective tag.

Problem	Potential Cause	Remedy
After clicking **[Home]**, the machine starts pumping and won't stop.	The material bottle is empty.	Make sure there is resin in the bottle.
	The material tag has run out.	Check the **Material Info** field in the **Settings** tab. If the value is **0** after clicking **[Refresh]**, please replace the material and respective tag.
	The tubing is blocked.	Check the tube for blockings.
	The pump is defective.	Check the pump's switch and fuses.
Clicking **[Home]**, **3SP Control** constantly displays an ongoing levelling process, but the pump cannot be heard.	There might be a problem with the pump relay, the wiring or the fuses.	Check the voltage of the pump relay. Check the pump wiring. Check whether suitable fuses are used. If none of these measures is successful, the pump may have to be replaced. Please contact your customer service.
After clicking **[Home]**, the message **...done!** never appears.	The material bottle is empty.	Make sure there is material in the bottle.
	The level sensor is not set correctly.	Contact your customer service to have the level sensor set.
The value in the **PSA Frame Pres.** field of **3SP Control** does not change when the PSA is moved up and down. (1) The value is unusually low. (2) The value is unusually high.	(1) There are remains of cured material on the PSA or the PSA is not correctly aligned to the build platform.	(1) Clean the PSA and check whether it is correctly aligned to the build platform.
	(1)+(2) The pressure sensor is defective.	(1)+(2) If this does not solve the problem or if the indicated pressure value is higher than usual, the pressure sensor will have to be replaced. Please contact your customer service for repair or replacement.
Clicking **[Connect]** does not connect the motor. You should hear a loud	Check whether the door closes correctly.	Make sure the safety switch is fully depressed when the door is closed.

Problem	Potential Cause	Remedy
click.	The file **communication.dll** has not been loaded correctly.	Load the correct file **communication.dll** for your machine.
	The driver is missing or corrupted.	Check the motion controller at the rear of the machine. If you see a blinking red light, the motion controller is not loaded. Start the software and reload the driver.
When clicking **[Connect]**, you can hear the connecting sound and **3SP Control** displays that the motor has been connected, but it still won't move. The green light on the driver board is on.	The motor wiring is defective.	Check the motor wiring.
	The motor driver board is defective.	If the wiring is fine, the motor driver board will probably have to be replaced. Please contact your customer service.
All parts have wrong dimensions in z-direction.	Check whether the motor coupling is tight.	Tighten the screws on both sides of the coupling or contact your customer service. If this does not solve the problem, ask your customer service to verify the corresponding axis configuration in the **Machine.cfg** file.
The part surfaces have a bad quality, sharp details are missing and signs of overcuring can be found.	Check the quality of the PSA. Due to small scratches, it might not be transparent anymore.	The PSA has to be replaced. **Important:** Always make sure that no cured material residues remain on the platform, as they might also scratch or damage the PSA.
It is possible to move the build platform up and down by hand even when it is placed and locked.	The build platform is not attached correctly.	Contact your customer service for repair or replacement of the build platform.
The monitor on the machine is on, but	The monitor wiring is not correct.	Remove all monitor cables and restart the internal computer.

Problem	Potential Cause	Remedy
cannot be operated.		Reconnect the monitor and check whether the problem is solved. If this measure was not successful, please contact your customer service to have your monitor replaced.
Windows does not load on the internal computer.	There is a problem with the power supply.	Check the power connections and UPS/surge protector. Shut down the computer by pressing the blue button at the front of the touch screen. If it won't shut down, use the main power switch at the rear of the machine to shut down the entire system. Restart the computer/machine.
	The screen saver is activated.	Open the **Display** section in the **Control Panel** and select **None** for **Screensaver** and **Black** for **Color**.
	A blue background is loaded.	
	Windows Update is activated.	Go to the **Settings** section and disable the **Automatic Updates** function.
	A USB stick has been left in the machine during reboot.	Remove USB stick, then restart the computer/ machine.
During the build process the computer restarts and a blue screen is displayed.	Windows Update is activated.	Go to the **Settings** section and disable the **Automatic Updates** function.
The build platform stops moving when the touch screen is used during job processing.	The touch screen receives a double clicking signal causing the build platform to freeze.	Open the **Touchkit** application. Select the **Settings** tab and tap **Option**. Remove the tick in the **Enable Auto Right Click** check box.