CONNEX 500 3D PRINTER

VERSION 3.1

PRINT HEADS

PURGE STATION

SUPPORT MATERIAL

BUILD TRAY
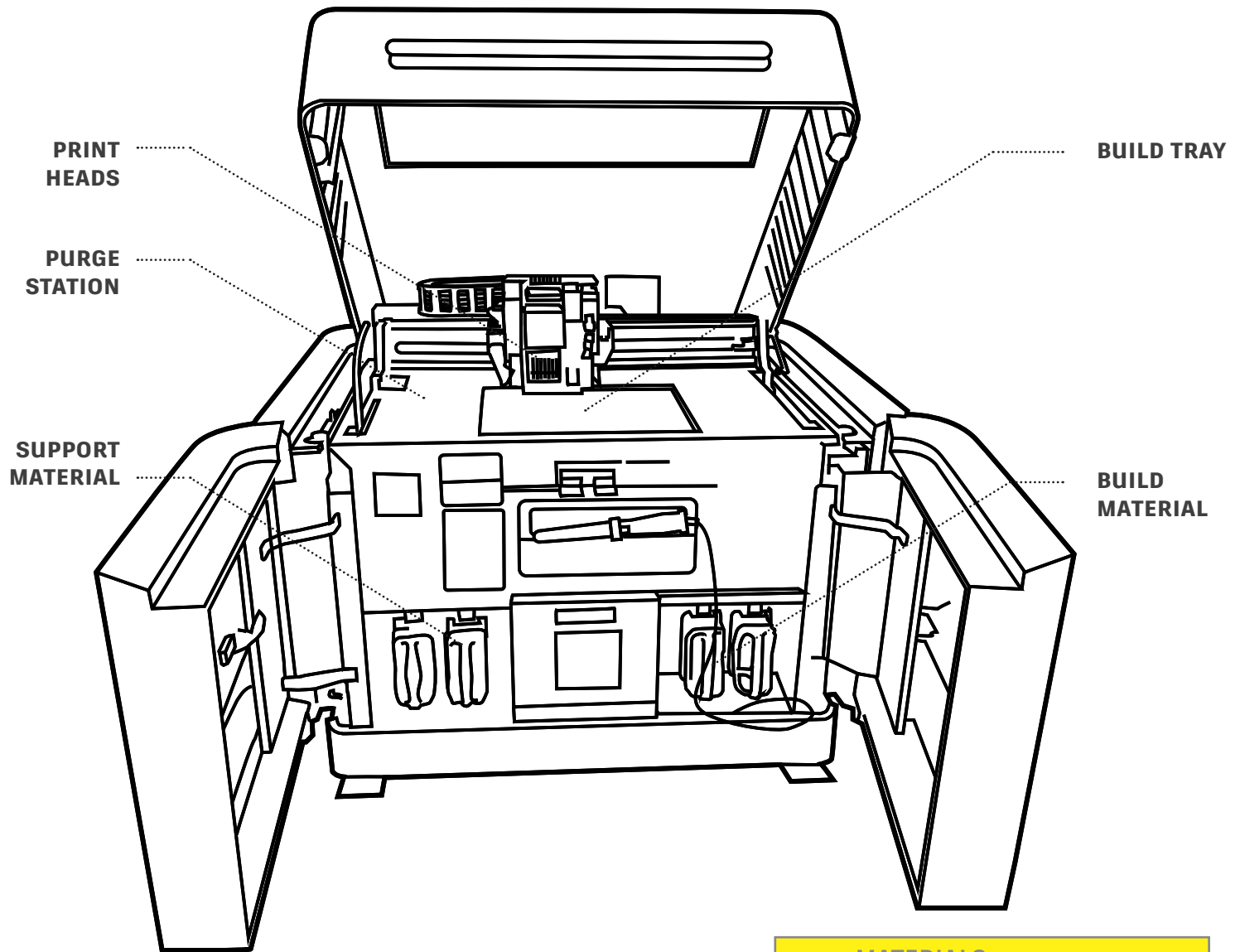
BUILD MATERIAL

MATERIALS

ⓘ ALLOWED MATERIALS

+ Only materials approved and loaded by Shop Staff.

  ▶ See page 6 for details.

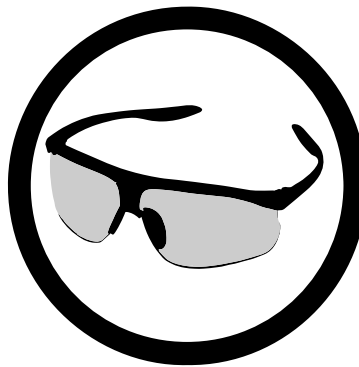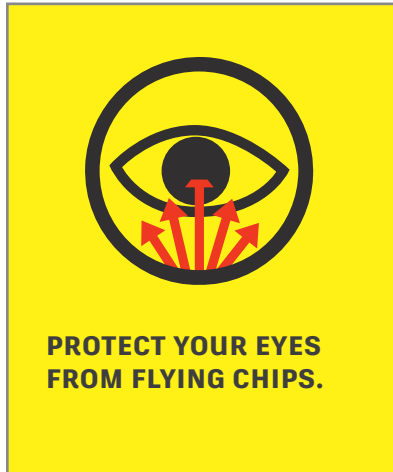# OBJET CONNEX 500 3D PRINTER

KEEP IT SAFE

VERSION 3.1

USE PERSONAL PROTECTIVE EQUIPMENT WHEN OPERATING THE PRINTER AND BATH.

P. 3

PROTECT YOUR EYES FROM FLYING CHIPS.

Always wear safety glasses when cleaning parts.

UNCURED (LIQUID) RESIN IS HAZARDOUS.

Wear gloves when handling cartridges, cleaning parts and cleaning the machine.

THE CURING LIGHT IS A STRONG UV SOURCE THAT CAN CAUSE SKIN AND EYE BURNS.
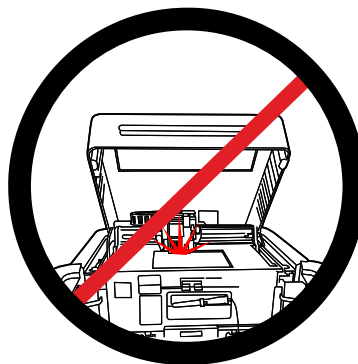
Do not lift the lid when the machine is operating.

The Objet Connex 500 3D printer can build 3D models in various materials. The models can be up to 19.7" (500mm) x 15.7" (400mm) x 7.9" (200mm). The printer works by spraying tiny droplets of liquid resin, which is rolled flat and cured with UV light.

The printer holds 2 cartridges of Model Material, and two of Support Material. The model can be built from a single material or a mix of two materials if different cartridges are loaded.

3D printing is a type of *additive manufacturing*. This style of 3D printing is called Polyjet printing.

To make a model, first create an .STL file in a program like Fusion 360. Open the .STL file with the **Object Studio** software and prepare it for printing. After printing, the model will need to be cleaned.

STEPS FOR SUCCESSFUL USE

To make a 3D part, you need to complete each step in order.

1. Prepare the model.
2. Select a printer.
3. Insert (open) the model.
4. Set printing options.
5. Send the tray to the Job Manager.
6. Check the Job Manager.
7. Bring the printer online.
8. Record the resin usage.
9. Clean the machine.
10. Clean the 3D part.

PREPARE THE MODEL

Find or create an .STL file.

The surface of the 3D model will be made of a mesh of small geometric bodies. The finer the mesh, the more detail will appear in the printed model. A finer mesh will also make a larger file. Files over 150 MB may crash the **Objet Studio** software.

It is critical that your 3D model is *closed* or *watertight*. Use the validation procedure in **Objet Studio** to ensure that your model is closed. If it isn't, use a mesh editing program like Netfabb or Meshmixer to fix the problem.

OBJET CONNEX 500 3D PRINTER

MATERIALS

VERSION 3.1

USERS CAN REPLACE AN EMPTY CARTRIDGE, BUT MAY NOT SWITCH MATERIALS.

P. 5

UNDERSTANDING THE AVAILABLE MATERIALS

Understanding the material properties before printing can help reduce expensive waste. There are four cartridges in each printer - two for model material and two for support material.

+ Shop users can **replace** an empty cartridge.
+ Only Shop Staff can switch materials.

There are a wide variety of materials available.

+ **Vero**
  - ▸ Rigid material, similar to acrylic
  - ▸ Colors: Black, White, Clear
+ **Tango Black Plus**
  - ▸ Flexible and rubbery
  - ▸ Color: Black
+ **Digital ABS**
  - ▸ Similar to ABS
  - ▸ Color: Ivory
+ **Endur**
  - ▸ Slightly softer than Vero, similar to Polypropylene
  - ▸ Color: White
+ **Medical Clear**
  - ▸ Rigid material designed for prolonged skin contact. Has specific medically approved uses. See Shop Staff or the Stratasys website for details.
  - ▸ Color: Clear

Digital Materials

When two materials are mixed together, Stratasys calls it a *digital material*.

Vero and Tango can be mixed digitally by using two different cartridges.

+ Vero Black and Vero White can be mixed for rigid grey materials.
+ Tango Black+ and Vero Black can be mixed to create flexible black materials.
+ Tango Black+ and Vero White can be mixed to create flexible grey materials.

Digital ABS cannot be mixed, but is called digital because it requires two cartridges.

SELECT A PRINTER

Because material cartridges are changed by Shop Staff, select a printer that has the materials you want. If you need something different, see Shop Staff.

Check the card on top of each printer to see sample of installed materials.

To confirm that the card is correct, open the doors and look at the two cartridges on the right side.

Erase Info after Cleaning

MATERIAL 1	
MATERIAL 2	
INFO	

Name

Phone

Email

Erase Info after Cleaning

INSERT (OPEN) THE MODEL

Each printer is attached to two dedicated computers.

+ The one on the desk closest to the printer is used to prepare the model and is referred to as the Design Computer.

+ The one hidden in the printer enclosure controls the printer and is referred to as the On-board computer.

+ The two computers share one keyboard, monitor and mouse using a KVM switch.

The program that prepares the model is **Objet Studio**.

+ If **Objet Studio** is not on the computer you are using, use the KVM switch to access the software on the Design Computer.

1. Open **Objet Studio**.
2. Insert (open) your .STL file with the **Insert** button.
   ▶ Open more than one file by Control clicking.
3. Select the units.
4. Check the **Assembly** box if needed.
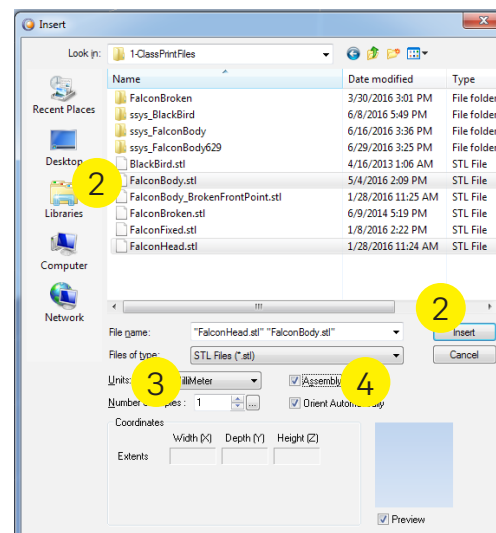
An assembly is created by using multiple components with a common coordinate system. Each component can be assigned a different material. For example, you can print a car with a rigid white body and rubbery black tires - as a single item.

If you have multiple files that are part of an assembly, open them with the **Assembly** checkbox checked - this will position the parts relative to each other. If not, they will be printed as physically separate items relative to the Tray.

You'll use commands under the three tabs to prepare the model and change settings.

+ **Tray Settings**
+ **Model Settings**
+ **Job Manager**

+ To switch computers, activate the KVM switch by pressing [scroll lock] [scroll lock] [enter] on the keyboard.

+ Buttons on the front of the KVM unit can also be used to switch computers.

Note: **Objet Studio** has an interface quirk. The **Model Settings** tab disappears if the model is not selected, even if the model is open.

Ensure you're working in the correct tab, by selecting the model you want to work with.
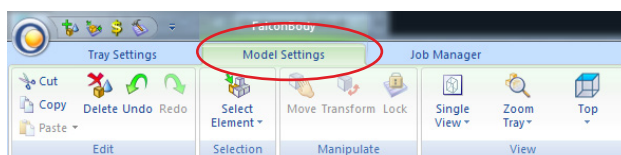
Model selected - Model Settings tab is visible.
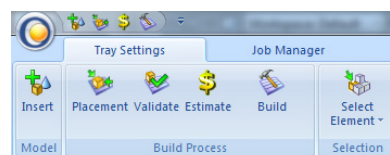
Model not selected - Model Settings tab is hidden.

SET TRAY AND MATERIAL OPTIONS

Confirm that the materials loaded in the printer are accurately listed in the software.

1. Click the **Tray Settings** tab. This ensures that the **Model** tab will display the correct materials available.

   ▶ Ensure that you are **not** in the **Model Settings** tab, which allows you to work with the two materials you selected in the Tray Settings tab.

2. Confirm that the materials loaded in the printer are correctly listed in the **Currently Loaded** toolbar.

   ▶ If not, select the correct materials from the menu.

3. Confirm that the correct **Single Material** or **Multiple Materials** button is checked.

   ▶ If the materials are exactly the same, check **Single Material**.

   ▶ If the materials are different in any way, check **Multiple Materials**.

4. Double check that the materials list at the bottom of the **Tray Settings** tab matches your selection.
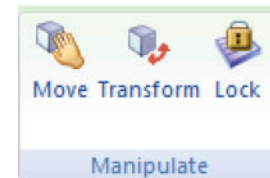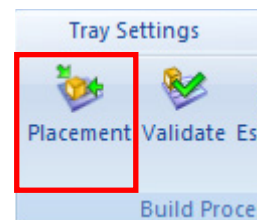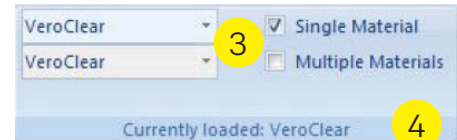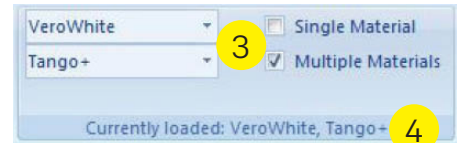
Model Placement

Objet Studio will place your part upon opening. Clicking the **Placement** button prompts suggestions for different placement and orientation options to create fast and lower cost printing.

+ The **Placement** button is in the **Tray Settings** tab.

Model Manipulation

The **Manipulate** tools in the **Model Settings** tab are used to move, transform and lock the model.

+ Move - drag the parts in the X or Y axis.
+ Transform - rotate, move or scale by inputting values.
+ Lock - fixes the part in place when using the Placement button.

Tip: The horizontal lines on the screen roughly approximate an area printed in a single pass of the head. Keep your parts within the fewest number of lines possible for the fastest speed.

Printing speed is related to orientation

+ Z (height)
   ▶ Z is the slowest axis to print; when possible orient the part's shortest dimension along the Z axis.
+ X (right and left)
   ▶ The lines onscreen represent the approximate print area of a single pass of the print head.
   ▶ Contain the model in as few stripes as possible.
   ▶ X prints fastest, and should be parallel to the longest dimension of the print.
+ Y (forward and back)
   ▶ When possible, Y should be longer than Z but shorter than X.

OBJET CONNEX 500 3D PRINTER

MORE TRAY SETTINGS

VERSION 3.1

THESE SETTINGS ALLOW YOU TO CHANGE HOW THE PART WILL BE PRINTED.

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CHANGING MODEL DIMENSIONS

The dimensions tool allows you to scale the part or change X, Y or Z individually. Remember that scale is critical to time and cost of printing.

+ Type a number to change the dimension of that axis.
  ▶ Deselect **Uniform Scale** to change an individual axis.
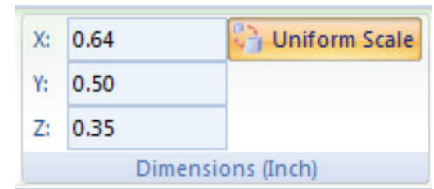
CHANGING MODEL SURFACE QUALITY

When the support material is removed, the build material under it will have a matte finish.

+ Click **Glossy** to leave areas of the model uncoated, if they didn't require supports.
  ▶ Overhangs and the underside of the model will still require Support Material. There will also be a distinct boundary like the one that exists between the Glossy and the Matte areas.
+ Click **Matte** to cover the entire part with a layer of support material, which results in a uniform matte surface finish.
  ▶ These parts will be more dimensionally accurate than parts with a mixed surface finish.
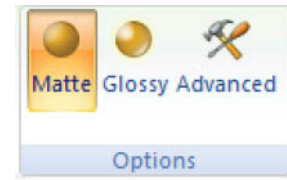
CHANGING MODEL INTERIOR QUALITY

Changing the interior of the part can save money and change the weight of the part.

Click the **Advanced** button to show more options.

+ **Grid Style** changes the overall density of the Support Material.
  ▶ Light support is best for delicate parts.
  ▶ Heavy support is best for large, heavy parts.
+ **Hollow** saves money by filling the interior of your part with less expensive support material and covering it with the more expensive model material.
 ▶ Clear prints will show the support material if printed hollow.

SELECT THE MODEL MATERIAL

If the printer is loaded with multiple materials you can check the Model Settings menu for possible blends of the Model Materials.

+ Hovering over a material combination displays more information.

Other options

+ Coat with
  ▶ This will create a coating of one material over the model.
  ▶ For example, you could create a rigid ball with a squishy coating.
+ Separate to Shells
  ▶ If you inserted (opened) an .STL file with multiple geometric bodies, this will break it into component parts.
  ▶ This option allows you to work with a single file, if it contains multiple bodies (the inverse of the Assembly option).
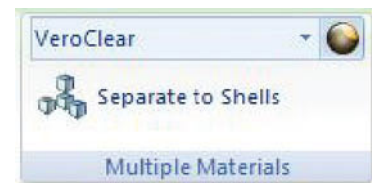
SEND THE TRAY TO THE JOB MANAGER

1. Click the **Tray Settings** tab.
2. Click **Placement** if you need to continue working on the placement of the model.
3. Click **Validate** to ensure that the model is printable.
+ If the part is orange, it isn't watertight.
  ▸ Use Netfabb or Meshmixer to fix the model.
+ If the model is red, it is outside the printable area of the tray.
  ▸ Place the model directly on the tray.
4. Click **Estimate** to show build time and material use.
  ▸ See Shop Staff before starting any print with a duration of more than 12 hours.
5. Click **Build**.
  ▸ If prompted with the message "Automatic Placement hasn't been performed, do you want to proceed anyway?" click "Yes," even if you have, to proceed.
  ▸ Otherwise, "No" will return you to the software without sending the job to print.
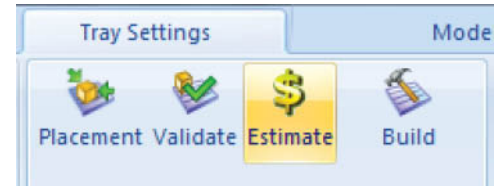
Select a Print Mode

Print Modes can be confusing, as the software may offer options that aren't possible. Be sure to read carefully.

+ High Quality
  ▸ Both cartridges must be the same material.
  ▸ This mode prints in higher resolution than normal.
  ▸ Printing speed is normal.
+ High Speed
  ▸ Both cartridges must be the same material.
  ▸ This mode prints faster than normal.
  ▸ Resolution is normal.
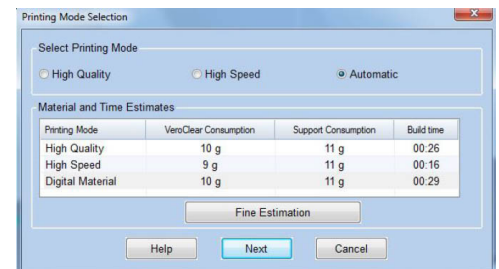
Save the file

+ Select "No, use only the selected model material".
+ Save your tray.
  ▸ Do not save to a thumb drive.
  ▸ Save to "Documents" or "Z drive User Storage"
  ▸ Use the format First_Last_Project.objtf
  ▸ example: Chris_Smith_Gears.objtf

Canceling a Job in the Job Manager

When your job has been sent to the Job Manager, be careful if you have to cancel the job.

+ Do not cancel the job when the status is "preprocessing".
+ Wait for the job status to become "Building %" or "Waiting".

SCHEDULING THE PRINT TIME

You need to schedule the print job so that you can be present when it finishes the job.

+ You must be present when the print finishes.
+ You can only schedule 24 hours in advance.
+ You must clean the printer as soon as the job is complete.
+ Only one job can be scheduled at a time.

1. Right click on the job.
2. Choose **Stop**.
   ▶ If the status is **Waiting**, the job has already been scheduled. You can skip to Step 4 and right-click the **Scheduling Clock** button.
3. Wait for the job status to change to **Stopped** or **Waiting**.
4. Right click and select the **Scheduling Clock**.
5. Input the job start time.
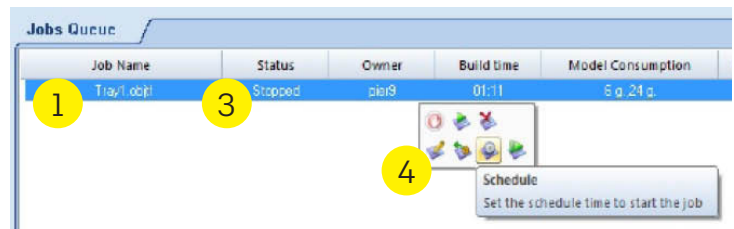
Recording the print information

Let other shop users know the status of the machine.

+ Information to write on the job cards:
  ▶ Name
  ▶ Phone number
  ▶ Email

Determine the correct card to use

+ Immediate Jobs (printing right now):
  ▶ Use the black card.
+ Scheduled Jobs (printing in the future):
  ▶ Flip the Scheduling Card to the red **Job Scheduled** side to show that your print is scheduled.
  ▶ After cleaning the machine, flip the Scheduling Card back to the blue side to show it's available.
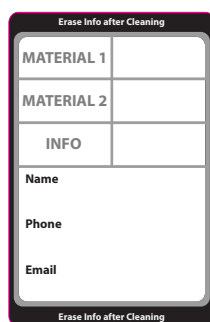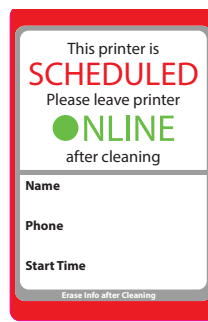
In use   **Scheduled**   **Available**

BRING THE PRINTER ONLINE

There is a computer running Windows XP inside each printer. It shares the keyboard, monitor and mouse with the design computer on the desktop.

To switch between computers, press [scroll lock] [scroll lock] [enter].

+ If the computer locks up, try resetting the switch.
  ▶ To reset the switch, press the buttons on the front of the KVM unit.

Check the status

There is a status light on the bottom center of the screen.

+ Ghosted
  ▶ In use.

+ Green
  ▶ Online; waiting for data from the Job Manager.
  ▶ Leave the printer in this mode after cleaning unless there is a job scheduled.
  ▶ Check the Job Manager for scheduled jobs every time you clean the machine.

+ Red
  ▶ Offline.
  ▶ The printer will not function in this mode.

Change the status

If the button is red, click it once to change the status to green.

+ Press the rotate button to see the temperature of the print heads.
  ▶ Once they are all green, the print will start.

Record the resin usage

Users must log print jobs for the Objet, Fortus and Zprinter on their individual print tracker.

+ If you do not have a print tracker, click the tree icon on the Design Computer and fill out the request form.
  ▶ The form will be emailed to you.

Objet Resin
Record Form

+ All resin use must be recorded and paid for.
  ▶ Model material = $0.41 per gram.
  ▶ Support material = $0.15 per gram.
+ All project with 1,000 grams or more material (model and support combined) must have Shop Staff approval before printing.

+ Once the print head is moving and printing layers, you can leave the area.
+ You must be present at the end of the print job.
 ▶ Failure to clean the printer immediately after the job is complete may result in loss of printing privileges.

THE PRINTER MUST BE LEFT CLEAN FOR THE NEXT USER

A printer cleaning station is next to each printer. It's stocked with water, alcohol, scrapers, microfiber cloths and gloves.

Steps for cleaning:

1. Remove your part from the printer.
   - ▶ Take it to the Print Cleaning Station.
2. Put on PPE: gloves and glasses.
3. Clean the printer.
   - ▶ Clean the print tray
   - ▶ Clean the print head block.
4. Clean the part.
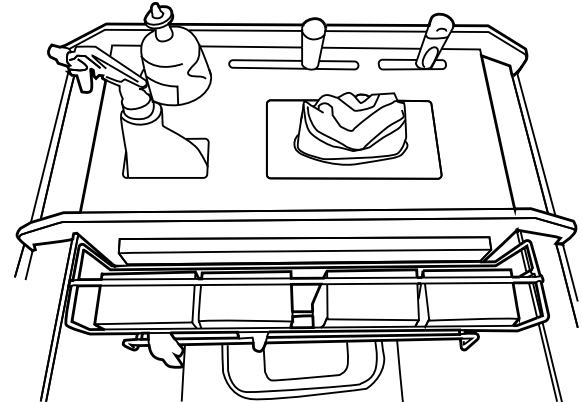
Remove the part from the printer

Be careful with the scrapers; they are sharp enough to cut you. Only use a scraper to remove a part - never use a knife or X-acto blade.

1. Use a scraper to remove the part from the printer bed.
2. Use a scraper to remove the thin layer of material (the carpet) left on the bed.
3. Temporarily drop off the part at the cleaning station.
   - ▶ You must clean the printer before cleaning the part.
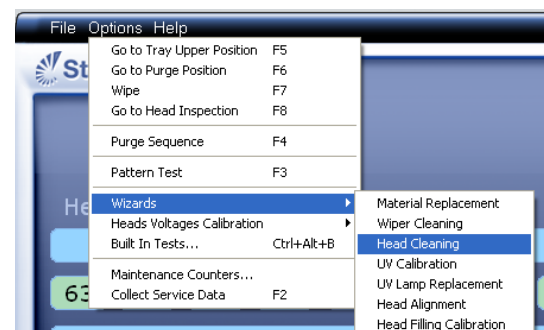
Clean the print tray

Use a new, clean microfiber cloth.

1. Spray water directly onto the cloth and not the machine.
   - ▶ The cloth should be damp, but not dripping.
   - ▶ Do not spray the printer bed or other components.
2. Wipe the tray until it's clean.
3. Use an additional damp cloth if needed.

Run the Head Cleaning Wizard

Use the On-board Computer.

1. Select Options > Wizards > Head Cleaning
2. Follow the instructions to move the head into position.
3. Ensure that the tray is empty and the door is closed.
   - ▶ The tray must be empty to avoid a head collision.
4. The tray will lower and the print head will move to the center of the machine.
5. The wizard will ask if the heads are clean.
   - ▶ The heads are not clean yet.
   - ▶ Do not click yes.

OBJET CONNEX 500 3D PRINTER

**CLEANING
THE PRINTER**

VERSION 3.1

TAKE YOUR TIME AND CLEAN THE PRINTER THOROUGHLY.

P. 13

CLEAN THE PRINT HEAD BLOCK

+ You must wear nitrile gloves while cleaning with alcohol or handling uncured resin.
+ Only use new, clean microfiber cloths from the cleaning station.
+ The print head can be damaged by improper cleaning methods or cleaning supplies.
    ▸ Carefully follow instructions to avoid damaging the equipment.
+ Position the mirror and light for a clear view of the cleaning process.

MIRROR IMAGE OF THE UNDERSIDE OF THE PRINT HEAD

PRINT HEAD BLOCK

UV LIGHT

ROLLER WHEEL

UV LIGHT
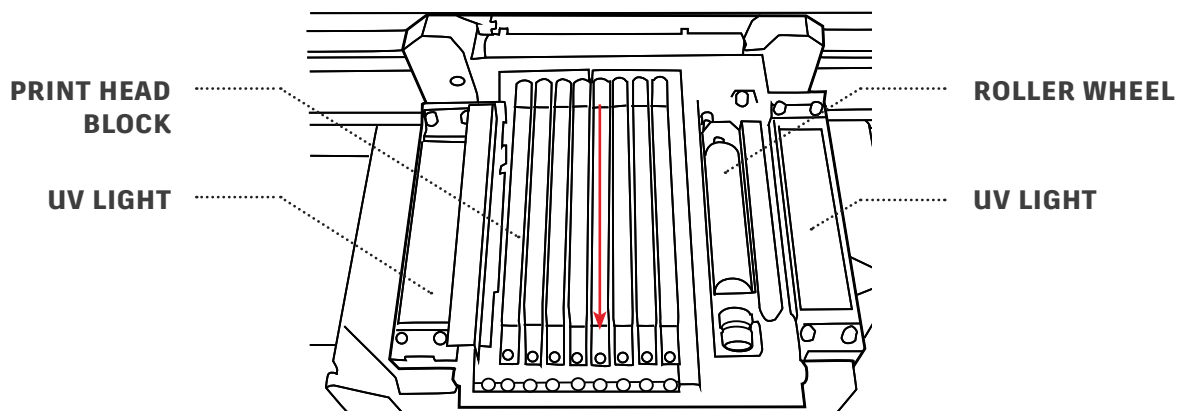
Clean the Print Head Block

1. Fold a new, clean microfiber cloth into quarters.
2. Moisten the cloth with alcohol from the cleaning tray.
3. Wipe from the back to the front.
    ▸ Use firm pressure.
    ▸ See the red arrow in the illustration.
4. Use a new section of the cloth for each wipe.

Note: If there is dried resin on the Print Head Block, see Shop Staff.

Clean the UV lights

+ Use a new, clean microfiber cloth, moistened with alcohol and wipe the lens clean.
    ▸ If there is dried resin on the lens, see Shop Staff.

Clean the Roller Wheel

1. Press a new, clean microfiber cloth, moistened with alcohol, against the roller.
2. Roll the roller and slowly work the cloth forward.

OBJET CONNEX 500 3D PRINTER

POST PROCESSING

VERSION 3.1

GET THE PRINTER READY FOR THE NEXT JOB BEFORE CLEANING YOUR PART.

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FINAL PRINTER CLEANING STEPS

1. Remove all items from inside the printer.
2. Place the mirror and light back into the cabinet.
3. Deposit all microfiber cloths into the regular waste trash after use.
4. Close the doors and lid.
5. Erase your name from the black In Use job card.

Prep the computer and printer for the next user

1. Within the Head Cleaning Wizard click **Yes**, now that the heads are clean.
2. Switch to **Objet Studio** on the Design Computer.
   ▸ [scroll lock] [scroll lock] [enter]
3. Click the status button, and wait for it to turn green.

Clean the part

All cleaning of parts must take place on the metal cleaning station, or inside the power blaster.

There are three methods for cleaning your part.

+ Manual "picking"
   ▸ Remove the large pieces of support material with various picks and scrapers.
   ▸ Using too much force can easily damage thin pieces.
+ Soaking in a water bath
   ▸ Soaking in water for up to a full day will swell the support material and make it easier to pick off.
   ▸ The expansion of the support material sometimes pushes on thin areas causing them to break.
+ Power Blaster

Using the Power Blaster

1. Place the part inside the cabinet.
2. Ensure that the small end of the water valve is pointed at the spray wand you wish to use. Hold the spray wand securely.
3. Close the door and turn on the power.
4. Use only clean hands or unsoiled gloves in the machine.
5. Hold the hose, step on the foot pedal and blast away the support material.
6. Clean up when done.
   ▸ Empty the two drainage filters of any residual resin.
   ▸ Leave the door open.
   ▸ Leave the gloves inside out.
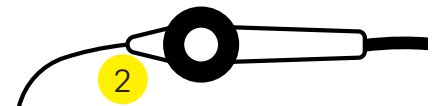
AREA AND MACHINE PREPARATION

1. Prepare the model.
2. Select a printer.
3. Insert (open) the model.
4. Set tray and material options.
5. Send the tray to the Job Manager.

USE THE VALIDATION PROCEDURE OR A MESH EDITING PROGRAM TO CLOSE MODEL.

PRINTING THE MODEL

1. Run the Job Manager.
2. Bring the printer online.
3. Record the resin usage.
4. Start the print job.

RECORD PRINT INFORMATION TO NOTIFY SHOP USERS OF THE MACHINE STATUS.

CLEANUP

1. Remove your part from the machine.
2. Clean the machine.
3. Clean your part.

CLEAN THE MACHINE BEFORE CLEANING THE PART.