PograPrint®

Workflow Guidelines
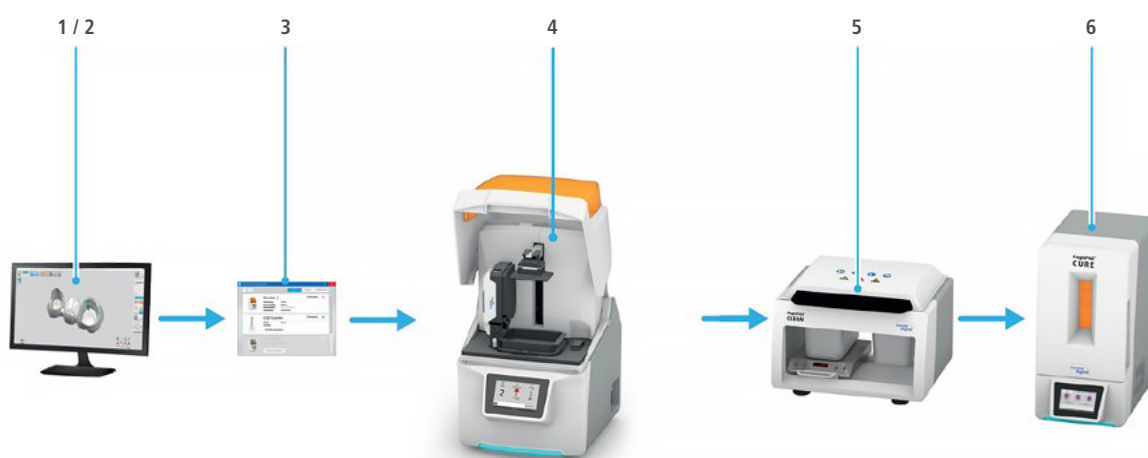
PograPrint® **PR5**

ivoclardigital.com

ivoclar digital:

Table of Contents

1 About this Document

1.1 Workflow

This guide will familiarize you with the workflow of the PrograPrint® System. The PrograPrint System consists of several components that are listed below.

Step	Component	Jobs
1	CAD software **"3Shape Dental System"**	Design of dental restorations and objects
2	CAM software **"3Shape CAMbridge"**	• CAM preparation • Aligning of the dental object on the virtual build platform • If necessary, adding of support structures
3	Software **"PrograPrint Manager"**	Transfer of the print job to PrograPrint PR5
4	3D printer **"PrograPrint PR5"**	3D printing of the dental object
5	Cleaning **"PrograPrint Clean"**	Cleaning of the dental object after the printing process
6	Post-polymerization **"PrograPrint Cure"**	Final polymerization of the dental object after cleaning

1.2   General information

Required PC hardware / software:

Element	Minimum	Recommended
Working memory (RAM)	4 GB	8 GB
Graphics adapter	DirectX 10	1 GB DirectX 11 Nvidia GeForce
Free hard disc space	250 GB	500 GB
Operating system	Windows 10	Windows 10
Processor (CPU)	Intel Core i3 (or equivalent)	Intel Core i7 (or equivalent)
Monitor (resolution)	1366 x 768	1920 x 1200
Network	Network connection	Network connection
Mouse	Standard	3D Connexion SpaceExplorer

Applicable documents and software:

Download link Operating Instructions PograPrint System:
https://www.ivoclardigital.com/prograprint-manual

Download link PograPrint Manager:
https://www.ivoclardigital.com/prograprint-manager

Download link for the required PograPrint software and parameter files:
https://www.ivoclarvivadent.com/en/cad-cam-download-center/

Download link Test File:
https://www.ivoclardigital.com/prograprint-testfile

Download link Occludator components:
https://www.ivoclarvivadent.com/en/cad-cam-download-center/

Here you will find tutorial videos on how to create objects
using ProArt Print Model and ProArt Print Splint in CAMbridge:
https://www.ivoclarvivadent.com/ProArtPrintModel
https://www.ivoclarvivadent.com/ProArtPrintSplint

2   Production Options

2.1   Areas of application for the ProArt Print materials

ProArt Print Wax

- Fabrication of restorations that burn-out
  without leaving residue for the press technique

  (As ProArt Wax is a transfer material, the Instructions for Use
  of the final restorative material must be observed!)

ProArt Print Model

- Fabrication of jaw models
- Models for checking the occlusion
- Segmented models
- Implant models
- Models for the vacuum-forming of splints
  (e.g. aligner models)

ProArt Print Splint

- Therapeutic restorations to correct TMJ problems
  and adjust the occlusal plane
- Occlusal splints
- Drill templates
- Functional try-in bodies for fixed and removable dentures

3 3Shape Dental System

The 3Shape Dental System is a dental CAD software for the creation of dental restorations and objects. Ivoclar Vivadent provides material libraries (.dme files) for the 3Shape CAD software. The files are preconfigured for the respective areas of application, materials or workflows and have been validated for the PrograPrint System.

Before a restoration or object is created in the 3Shape Dental System, the PrograPrint material library has to be imported into the 3Shape Control Panel.

3.1 Importing the PrograPrint material library

First, download the PrograPrint material library (.dme file) from the Ivoclar Vivadent CAD/CAM download center

https://www.ivoclarvivadent.com/cad-cam-download-center/

Then, start the 3Shape Dental System Control Panel on your PC.
Select "Tools" followed by the option "Import/Export". In the newly opened template, the material library can be loaded via the selection "Import materials".

3.2 Creating a job

Start the 3Shape Dental System on your PC and select the icon "New job" from the menu.
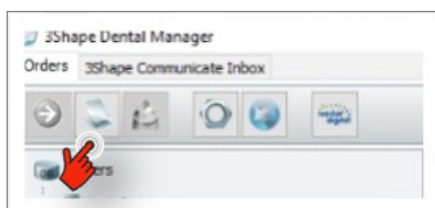

Depending on the application of the object to be created, the correct ProArt Print material type has to be selected in the settings during creation of the job, in order to activate the design-related parameter settings in the CAD design of the restorations.

ProArt Print Model

To load the construction parameters for ProArt Print Model, select the field "Model" in job creation. Select "Ivoclar ProArt Print Model" in the tab "Material".
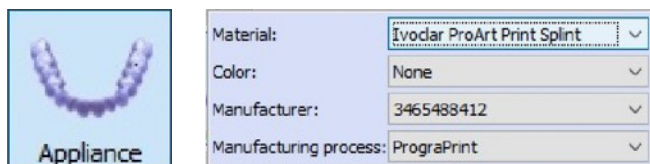
The tab "CAD settings" provides two different options:
- ProArt Print Model   – for solid models
- ProArt Print Model Hollow – for hollowed out models
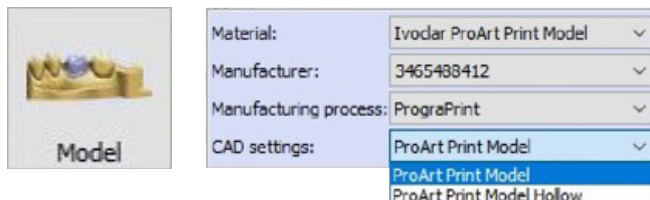
ProArt Print Splint

To load the construction parameters for ProArt Print Splint, select the field "Appliance" in job creation. Select "Ivoclar ProArt Print Splint" in the tab "Material".


ProArt Print Wax

To load the construction parameters for ProArt Print Wax, select the field "Anatomy" in job creation. The tab "Material" offers the option Ivoclar ProArt Print Wax (Press) – for the (ceramic) press method.
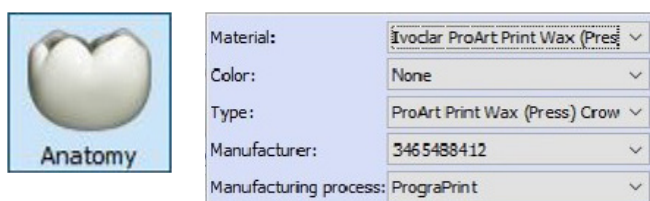
3.3   Updating the material library

If new material libraries are available, the update window in the 3Shape Dental System opens automatically. Material libraries can be selected as required in this window and updated accordingly.
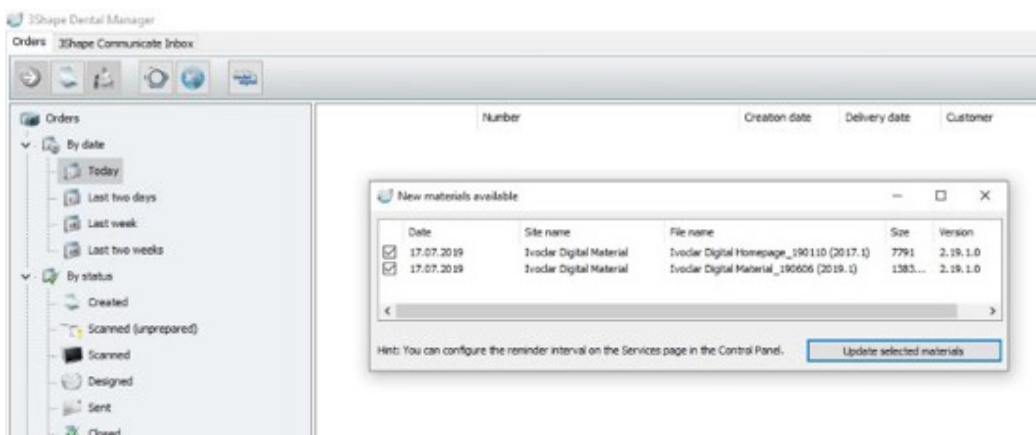
Additional information on the operation of the 3Shape Dental System can be found at www.3shape.com or on the 3Shape YouTube channel in the form of training videos.
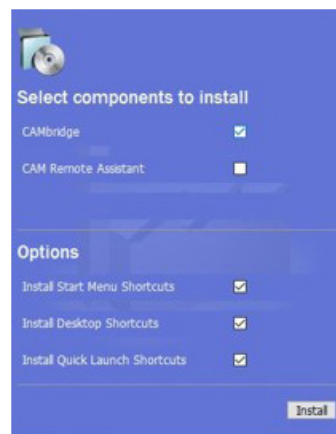
4 3Shape CAMbridge

3Shape CAMbridge™ is a CAM software for the creation of print jobs that can be produced using a PrograPrint PR5 3D printer. With the help of the software, digitally designed restorations and objects are combined in one print job, placed, aligned and, if necessary, supported.

4.1 Installing 3Shape CAMbridge

First, download the 3Shape CAMbridge installation file from the Ivoclar Vivadent CAD/CAM download center.

https://www.ivoclarvivadent.com/en/cad-cam-download-center/

Once the download is complete, run the installation file and follow the instructions of the installation wizard.
In the Installation Menu, select either "Install Start Menu Shortcuts" or "Install Desktop Shortcuts", to be able to start the program via the start menu or the desktop icon after successful installation.

4.2 Configuring 3Shape CAMbridge

With the configuration of the 3Shape CAMbridge software, the PrograPrint PR5 3D printer will be stored in the CAM software. This step is mandatory so that the PrograPrint CAMbridge license is recognized and specific software features are activated.

For that purpose, open the menu "Options" and select the "Configuration wizard".
Select the option "Ivoclar", then "PrograPrint" and confirm with "Ok".
The Ivoclar features have now been activated.
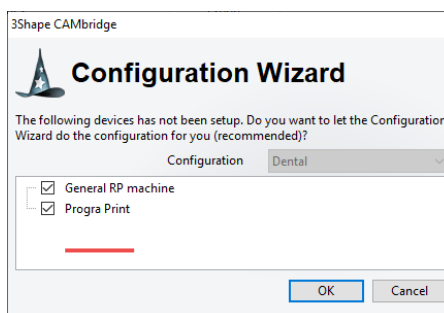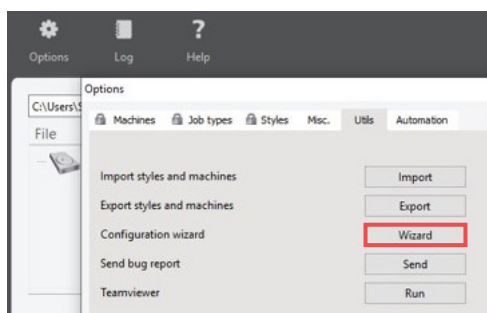
Select the option "Dental" under "Choose configuration" and set the path for the output folder for the created print jobs via "Output Folder" and "Browse" as follows:
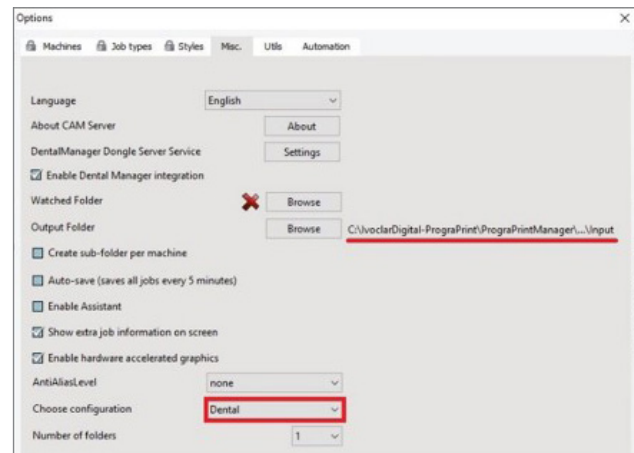
Transfer with a USB flash drive:
C:\IvoclarDigital-PrograPrint\PrograPrintManager\Printers\USB Transfer\Input

Transfer with a LAN:
C:\IvoclarDigital-PrograPrint\PrograPrintManager\Printers\ "respective serial number"

Installing the configuration file:

Ivoclar Vivadent provides a configuration file (.3ce file) for the operation of the 3Shape CAM software. The buildstyles are preconfigured for the PrograPrint PR5 and validated for the PrograPrint System.

Open the menu "Options" in the CAMbridge software and select the "Import" function in "Utils".
Select the configuration file and confirm with "Open".

The import window opens:
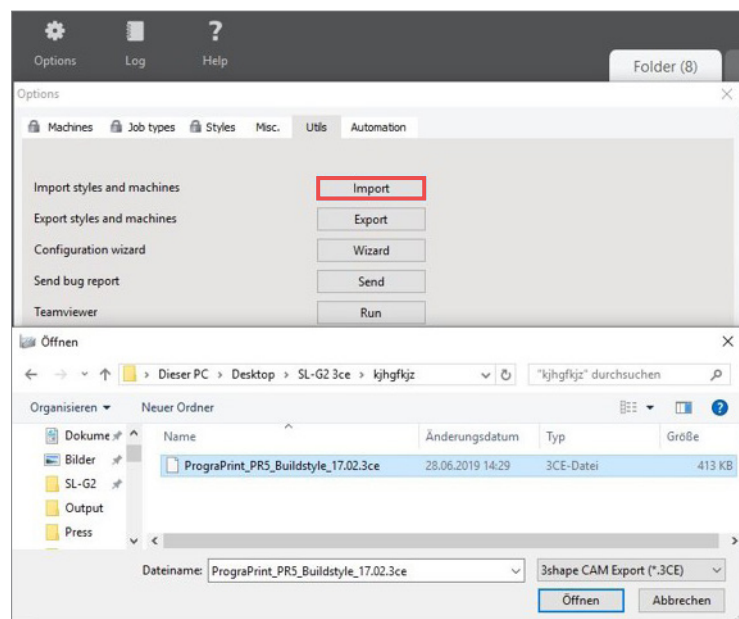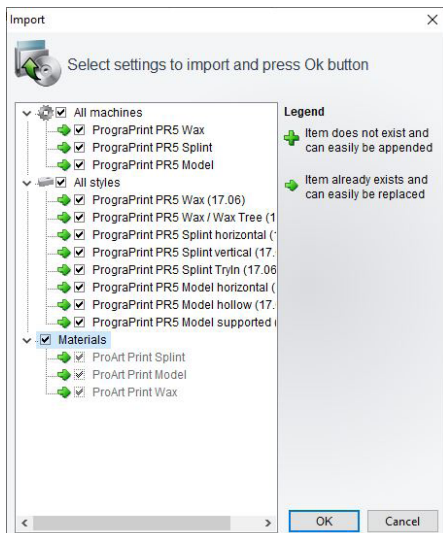
Tick the checkboxes "Machines", "Styles" and "Material". Confirm the selection with "OK". The styles are automatically imported and CAMbridge is now configured for the PrograPrint PR5 System.

4.3   Using 3Shape CAMbridge

After the start of "3Shape CAMbridge" two software modules start automatically:

Printer module

In the printer module, a digital build platform is loaded with objects, of which a print job is generated.

Wax Tree module

To prepare a print job for the Wax Tree, the STL file must be imported via the "Browse" function from the output folder into the Printer module. You can find instructions of how to use the Wax Tree module in the Ivoclar Vivadent CAD/CAM download center.

https://www.ivoclarvivadent.com/en/cad-cam-download-center/

CAMbridge overview:

Below, the steps necessary to create a print job in CAMbridge are described:
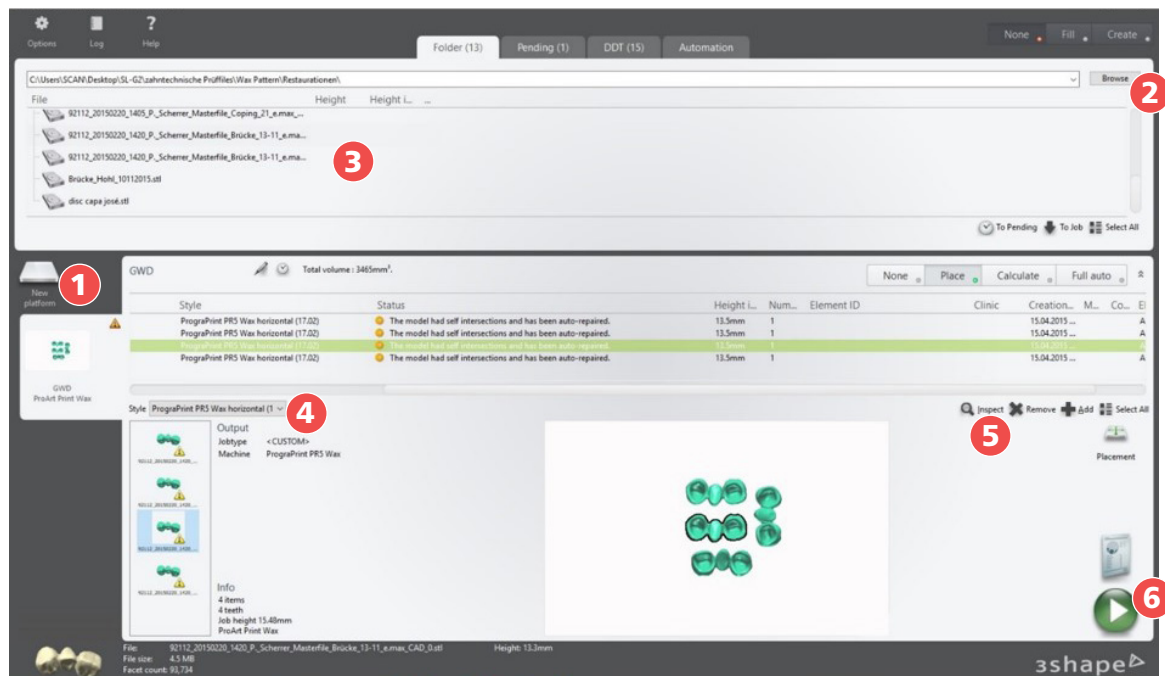
1   Create new job ("New platform")
2   Import data by means of "Browse"
3   Available data in the selected folder

4   Select optional buildstyles
5   CAMbridge Tools via "Inspect"
6   Generate CAM output

Create new job:

In the Printer module of 3Shape CAMbridge, a new platform has to be created, which can then be loaded with objects.

To create a platform, click "New platform" (1) and enter a job name (mandatory field) under "Name".

Select the desired material type (e.g. ProArt Print Splint) in "Machine" and the desired buildstyle (e.g. ProArt Print Splint horizontal) in "Default Style". For optimum results, the buildstyle (e.g. horizontal) must correspond with the alignment of the objects on the build platform.

Areas of application for buildstyles:

Below is a list of which buildstyle in CAMbridge is to be selected for a defined area of application. Vertically aligned objects should always be aligned at an angle to enable sufficient support structures to be added.

Recommendation: **60° to 75°** (see application examples on page 17)

ProArt Print Wax

- PrograPrint PR5 Wax
  – Full-contour pressed objects
- PrograPrint PR5 Wax WaxTree
  – Wax tree

ProArt Print Splint

- PrograPrint PR5 Splint horizontal
  – Drill templates and splints
- PrograPrint PR5 Splint vertical
  – Drill templates and splints
- PrograPrint PR5 Splint TryIn
  – Try-in bodies for fixed and removable dentures

ProArt Print Model

- PrograPrint PR5 Model horizontal
  – Models without supports (requires the bottom surface of the model to be flat!)
- PrograPrint PR5 Model for Aligner (fast)
  – Models without supports (100 µm layer thickness)
    Must be selected as a machine configuration ("Machine")!
- PrograPrint PR5 Model hollow
  – Hollow models with supports (manual alignment! /
    Do not use if the models have already been hollowed out in the CAD!)
- PrograPrint PR5 Model supported
  – Models with supports (manual alignment!)

⚠ Note: If occludator components are used on the models, we recommended using components that are optimized for printing.
These components, the installation instructions and additional information can be downloaded from the Ivoclar Vivadent Download Center.

Importing data

Via "Browse" (2), the restorations and objects created can be loaded onto the build platform. For that purpose, select the folder in which the desired files are stored and import the files (3) onto the build platform by double-clicking them or by means of "drag & drop".

> ❗ Please make sure to generate the CAD files with the material library to prevent faulty print jobs.
> Please ensure that any lettering is concave and at a maximum depth of 0.5 mm.
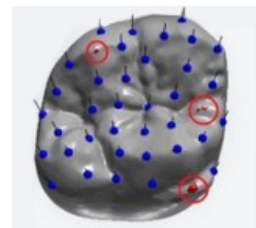
Supporting the objects:

Objects that do not rest flush on the build platform with a parallel, even surface (e.g. solid models) have to be provided with support structures in CAMbridge, as these objects can otherwise not be printed or only with flaws. CAMbridge automatically generates supports in accordance with the selected buildstyles. Normally, objects for the following areas of application need to be supported:

• Crowns, bridges, wax trees, veneers, inlays, etc.

• Splints and drill templates

• Hollow models and, where appropriate, removable dies

An insufficient number of support structures may result in damage to the objects during printing. Therefore, the user has to check all objects for adequate support.

CAMbridge incidates "local minimas" by means of red dots. These are areas closest to the build platform which need to be manually supported by the user. If these areas are not supported with support structures, errors during printing and adhesions to the tank foil may occur.

To view the "local minimas", click on the object and select the field "Inspect" in the toolbar. After that, you can select the button "Local Minima" via the field "Supports".

Aligning the objects:

To optimize the printing results and to prevent printing errors, the following points have to be observed when aligning the objects:

Always align the cavities of the objects away from the build platform. In this way, unpolymerized material can drain off during printing, which facilitates subsequent cleaning.

The alignment of the objects is activated via the button "3D orientation" in the "Inspect Mode".
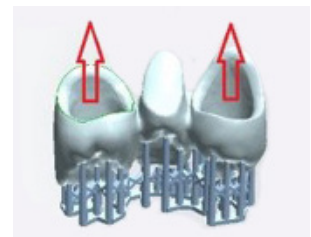
Upon manual placement of the objects, the distance to the edge of the build platform, as well as between the objects must be observed. If the distance is not observed or if objects extend beyond the edge of the build platform, the corresponding object is highlighted in red.

To place objects manually, select the field "Placement".
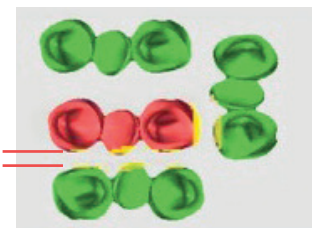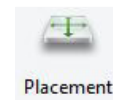
For solid models that are not provided with support structures, it must be ensured that the bottom surface of the model rests parallel and plane on the build platform to prevent faulty print jobs.

Open the field "3D Orientation" in the toolbar (5) and select the field "Bottom surface". By clicking the bottom surface of the model, it is automatically aligned with the build platform.

❗ Removable dies should be placed with the buildstyle "PrograPrint PR5 Model horizontal" directly on the build platform, without additional support structures.
Different buildstyles can be used for the same print job.

For removable dies with small contact surfaces or strongly angled dies the buildstyle "PrograPrint PR5 supported" should be selected. This ensures that they are adequately supported by additional support structures.

CAMbridge tools:

The toolbar can be opened via the button "Inspect" (5).
The following tools are recommended for editing the objects in CAM bridge:
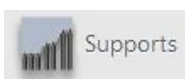
Supports

With the tool "Supports", the support structures of the objects can be edited or supplemented.

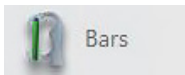| • Show unsupported areas (local minimas)	• Adding / removing supports	• Show flat areas	• Show contact points to the build platform

Slices

The tool "Slices" allows the individual slices to be checked. With this tool, it is also possible to check if the first layer rests plane on the build platform.

Bars

For long-span, vertically built restorations or models, bars (cross struts) are used to provide additional stability with the aim to prevent warpage from occurring during printing and storage.

The pre-configured options "Body" and "Clasp" can be selected.

View

In the option "View", it is possible to check if all the support structures were created with cross-bars to other support structures. Should this not be the case, additional support structures can be added.
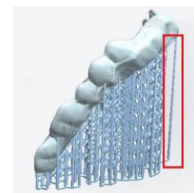
Generating CAMbridge output:

Once the objects are completed in CAMbridge, the print job can be created via the button "Produce" (6). The calculation is performed automatically. The generated print job can be transferred to a PrograPrint PR5 3D printer by means of the PrograPrint Manager.

❗ Notes regarding the location of the saved output data can be found in "Configuring 3Shape CAMbridge" on page 10/11.

Examples:

Wax Tree

⚠ For the Wax Tree, the interface to the investment ring should come to rest on the build platform by means of "Bottom surface".

Bottom surface

Hollow models

⚠ Hollow models should be designed with the buildstyle "PrograPrint PR5 Model supported" or "PrograPrint PR5 Model hollow" and it is imperative to align them at an angle.
This way, unpolymerized material can flow off more easily from below the model during the printing process.
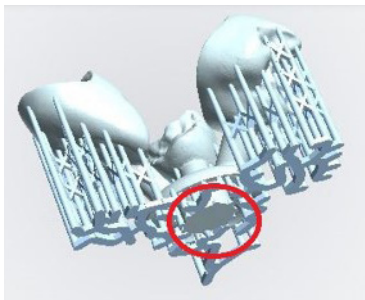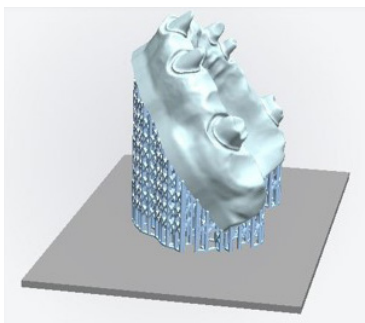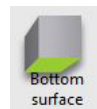It also facilitates the cleaning process.
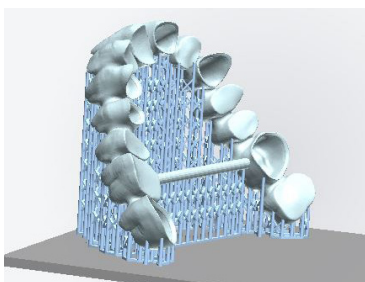
Long-span bridges and models

⚠ For long-span bridges or models, bars (cross struts) should be inserted to provide additional stability against warpage during printing and storage.

The pre-configured options "Body" and "Clasp" can be selected.

Horizontal buildstyles help achieve an ideal accuracy of fit in long-span bridges.

5 Importing Print Jobs

5.1 Installing the PrograPrint® Manager

To install the PrograPrint Manager, download the installation file:

https://www.ivoclardigital.com/prograprint-manager

or

https://www.ivoclarvivadent.com/cad-cam-download-center/

Once the download is complete, run the installation file and follow the instructions of the installation wizard. After successful installation, the symbol for the PrograPrint Manager is located in the toolbar of your Windows interface, via which the software can be opened.
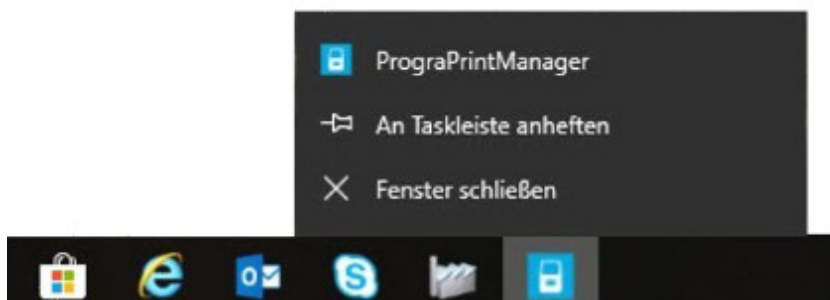
> ❗ Comprehensive information on using the PrograPrint Manager can be found in the PrograPrint PR5 Operating Instructions:
>
> www.ivoclardigital.com/prograprint-manual

5.2   Transferring the print jobs to the 3D printer

The PrograPrint Manager software transfers the print jobs created in 3Shape CAMbridge to the PrograPrint PR5 3D printer. The following options are available for the transfer of the print jobs:

Transfer with a USB flash drive:

Intermediate storage of the print jobs on a USB flash drive connected to the CAM PC.

(Folder: USB-Transfer\Input)

After that, the flash drive is connected to the PrograPrint PR5 3D printer and the print jobs are imported from there.

Transfer with a LAN:

Transfer via a LAN connection to a PrograPrint PR5 3D printer registered in the same network.

(Folder: Printers\ "respective serial number")
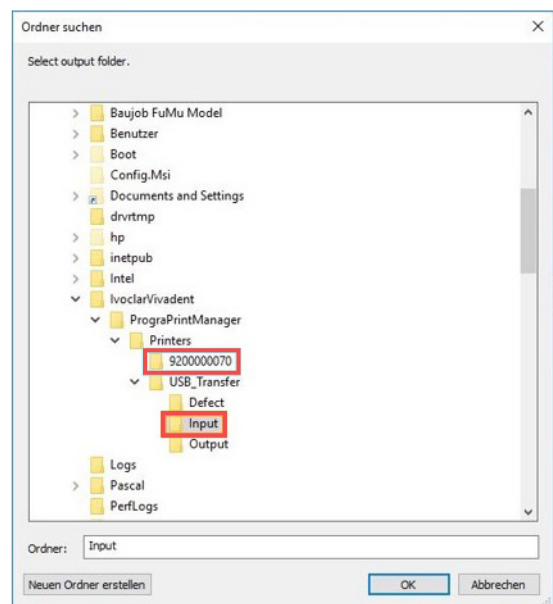
> ⊘ The software PrograPrint Manager processes and encodes the print job upon import.
> Therefore, it is not possible to import print jobs to the PrograPrint PR5 3D printer without the PrograPrint Manager.

6 PrograPrint® PR5

6.1 Preparing the 3D printer

Print jobs created in 3Shape CAMbridge can be processed with the PrograPrint PR5 3D printer. Once up to 8 print jobs have been imported to the PrograPrint PR5 printer by means of the PrograPrint Manager (LAN or USB flash drive), the print jobs appear in the job menu of the user interface.

Perform the set-up and installation of the device as described in the Operating Instructions. Before the start of a print job, make sure that...

- the protective cap of the material bottle has been removed.
- the valve has been attached to the material bottle to be used.
- the material bottle including the valve has been correctly placed in the cartridge.
- the material type in the bottle corresponds with the material type of the print job.
- the cartridge has been placed in the PrograPrint PR5 and has been secured and opened.
- the build platform PrograPrint Stage has been inserted and secured.

6.2   Starting a print job

The print job can be selected via the job menu and started with the arrow keys. The view automatically changes to job processing of the device status, where the remaining printing duration is indicated.

⚠ PrograPrint PR5 does not log the material batches used. Batches may be mixed up, particularly when inserting a new material bottle into an existing cartridge.

It is advisable for the user to make note of the batches in a separate document to ensure of batch traceability.

After printing, the following process steps have to be followed:

• Cleaning the objects in PrograPrint Clean
• Post-curing the objects in PrograPrint Cure
• Removing the objects from the PrograPrint Stage
• If necessary, post-processing

❗ Comprehensive information on using the PrograPrint PR5 can be found in the corresponding Operating Instructions:
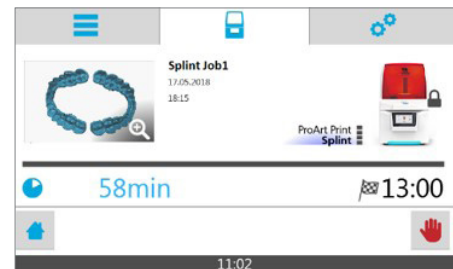
www.ivoclardigital.com/prograprint-manual

7 PograPrint® Clean

7.1 Preparation

Perform the set-up and installation of the device as described in the Operating Instructions. PograPrint Clean cleans the objects printed with PograPrint PR5 and removes any adhering unpolymerized material.

⚠️ Isopropanol is used as the cleaning agent. The device must be used in an explosion-proof extraction cabinet. Please obtain information about the correct handling of isopropanol from the Operating Instructions and the package insert of PograPrint Clean before starting up the device.

If the device is not used for a longer period of time (2–3 months, depending on the ambient temperature), the isopropanol should be replaced. The idle time favours the absorption of water, which results in insufficient cleaning results.

7.2 Cleaning objects

The printed objects are removed from the PograPrint 3D printer on the PograPrint Stage and placed in the build platform holder. Perform the rough cleaning first, followed by fine cleaning (at 850 rpm) according to the specified cleaning parameters.

		Rough cleaning	**Fine cleaning**
	ProArt Print Splint	10 min	5 min
Cleaning time	**ProArt Print Model**	5 min	5 min
	ProArt Print Wax	2 min	2 min

⚠️ The objects remain on the PograPrint Stage during the entire cleaning process and are only removed after post-curing in the PograPrint Cure.

❗ Comprehensive information on operating the PograPrint Clean can be found in the corresponding Operating Instructions:

www.ivoclardigital.com/prograprint-manual

8   PrograPrint® Cure

8.1   Preparation

Perform the set-up and installation of the device as described in the Operating Instructions. Cleaned objects have to be post-cured in PrograPrint Cure to achieve the specified final material properties. Incorrectly post-cured or unpolymerized medical devices must not be used on patients.

⚠ The material ProArt Print Wax should be deaerated for approx. 1 hour
before post-curing.

8.2   Post-curing objects

The completely cleaned and dried objects are placed in the polymerization chamber of the PrograPrint Cure on the PrograPrint Stage. The preset curing program for the respective material type is selected and started via the user interface of the device.

⚠ The objects remain on the PrograPrint Stage during the entire post-curing process
and are only removed from the PrograPrint Cure once the curing process has been completed.

🛈 Comprehensive information on operating the PrograPrint Cure can be found
in the corresponding Operating Instructions:

www.ivoclardigital.com/prograprint-manual

9 Post-processing

9.1 Post-processing the objects

Removing the objects from the build platform:

After cleaning in PograPrint Clean and post-curing in PograPrint Cure, the objects are removed from the PograPrint Stage. To do so, use the scraper from the PograPrint PR5 accessories to carefully loosen the objects at the point of connection to the build platform.

To prevent damaging the objects and the build platform in the process, please observe the following points:

- If possible, loosen the objects along the longitudinal axis.
- Hold the scraper in an almost horizontal position.
- Use little to moderate pressure.

⚠ Objects for intraoral use (e.g. splints) have to be cleaned again before they are placed in the patient's mouth to remove any possible isopropanol residue.

Separating the supports:

After detaching the objects from the build platform, support structures may need to be removed (e.g. from crowns, bridges and splints). To do so, use the cutter from the PograPrint PR5 accessories to separate the supports at the contact point one after the other. The support residues remaining on the objects can be removed with a tungsten carbide bur at medium speed.

Manually breaking off the support structures is not recommended as this may cause tears on the objects!

Any resulting flaws can be repaired. Wax can be repaired with customary dental wax. For the Splint material, please refer to the ProArt Print Splint Instructions for Use.

9.2   Post-processing surfaces

Post-processing models:

Upon printing of the first layers, there is an effect that is called "burn in". These layers are irradiated with increased energy to ensure adhesion of the object to the build platform.

The increased energy results in excess exposure of these first material layers, which leads to slight protrusion, e.g. on the model or die base.

These protrusions occur in objects without supports and can be removed with a tungsten carbide bur or a scalpel. For models with removable dies, the protrusion on the dies and the model cavities must be removed as otherwise the accuracy of fit of the dies may be negatively affected.
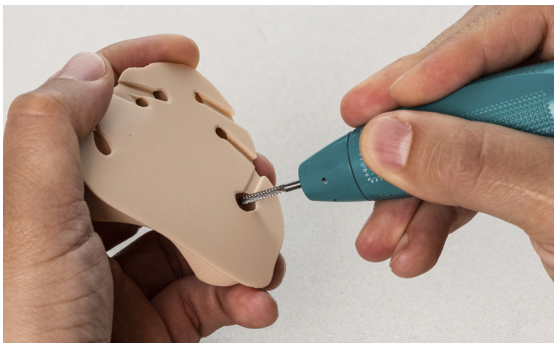
⚠️ Please use the usual protective equipment when prost-processing the objects (extraction, protective goggles, laboratory/work clothes) to protect yourself from dust exposure!

Post-processing wax (crowns):

In printed crowns made of ProArt Print Wax, crown margins may be overlapped by supports, which may lead to inaccuracies of fit.

Hence, the objects should be levelled with a tungsten carbide bur before further processing. In order to achieve an excellent marginal fit, it is recommended to manually adjust the crown margins with dental wax.

10 Maintenance of the Cartridge System

10.1 Removing material residue

Inadequately supported objects or other causes may lead to faulty results, whereby the printed object is incomplete. Also, the liquid material often contains already polymerized residues and other particles. To prevent the subsequent print jobs from being negatively affected, all already polymerized particles must be removed from the liquid material and from the tank foil.

Use the pincers in the PrograPrint PR5 accessories to remove all particles.

Make sure not to contaminate or damage the tank foil in the process.
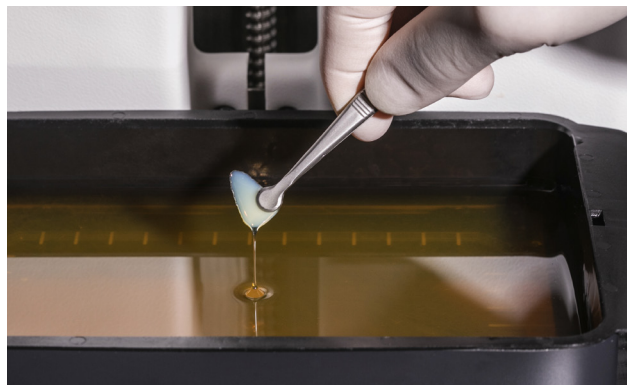
10.2 Mixing the material

If the materials are not used for a longer period of time, certain components may sediment. It is therefore recommended to mix the material already filled in the tank after two weeks of non-use. This applies to the material types ProArt Print Model and ProArt Print Wax.

Use the silicone spatula of the PrograPrint PR5 accessories to agitate the material carefully.

Make sure not to contaminate or damage the tank foil in the process.

11 Disposal

<u>Disposal of material in the PrograPrint Pool and material bottle:</u>

If there is residue of unpolymerized material in the tank or the material bottle, this must also be disposed of together with the material itself. Information on the disposal of the ProArt Print materials can be found in the respective MSDS (Material Safety Data Sheets) in Chapter 13 "Notes on disposal".

In general, the unpolymerized material is considered hazardous waste and must not be disposed of with the domestic waste and must not be released into the environment or waste water.

The official national regulations must be observed for the disposal. To prevent any leaking of material residue, make absolutely sure that the material bottle is disposed with correctly attached and closed valve (90° position).

The PrograPrint Pool must not contain any material residue which may leak from the tank after disposal. After cleaning the tank with isopropanol, make sure that there is no isopropanol residue in the tank. Further notes on the disposal of isopropanol can be found in the respective MSDS (Material Safety Data Sheets) in Chapter 13 "Notes on disposal".

<u>Disposal of contaminated isopropanol from PrograPrint Clean:</u>

For the disposal of contaminated isopropanol from the cleaning process, please observe the notes in the PrograPrint Clean Operating Instructions, Chapter 9.5 "Disposal of the cleaning agent".

In this context, also observe Chapter 13 "Notes on disposal" from the MSDS (Material Safety Data Sheets) of isopropanol and the ProArt Print materials. Contaminated isopropanol is considered hazardous waste and must not be disposed of in the domestic waste and must not be released into the environment or waste water. The official national regulations must be observed for the disposal.

Ivoclar Vivadent recommends to dispose of contaminated isopropanol in its closed, original container. As an alternative, a tight and resealable container for solvents or alcoholic liquids can be used.

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[1] Based on sales figures

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