Operating instructions
Partbox R3.02

PARTBOX

Legal notice

Table of contents

1. Introduction

These operating instructions contain all of the information required for the safe operation of the Partbox and any activities associated with it. The operating instructions must be kept accessible, complete and ready to hand with the Partbox at all times.

The instructions in this operating manual must be read and followed thoroughly in order to reduce risks of personal injury, damage to property and to avoid dangerous situations. Staff working with the Partbox must have read and understood the operating instructions especially the "Safety" chapter before using the Partbox.

2. Safety

The safety instructions must be read carefully and followed by each Partbox user. The Partbox is an electrical device with moving components and hot surfaces. Therefore the safety instructions listed below must be read by all users before using the Partbox.

2.1 Intended use

The Partbox may only be used for the tasks described in chapter *6 - Operation*. Any other use of the Partbox is considered contrary to its intended use and is not permitted. This also includes the use of the Partbox with materials other than the *Partbox Black* material provided by Schubert Additive Solutions. Any form of modification or alteration to the Partbox is not permitted. Control and access to the Partbox is only via the Partbox operating system. The specifications in section *2.2 Environmental conditions* must be observed for Partbox installation. Repairs and maintenance work may only be carried out by Schubert Additive Solutions GmbH staff. In the event of technical faults, the instructions in chapter *9 What to do if there are malfunctions or technical problems*
must be followed.

2.2 Environmental conditions

The Partbox is designed for indoor use only. The limit values for temperature and humidity must be observed. The room temperature must not exceed 40°C and must not fall below 10°C. The maximum humidity must not exceed 80%. The Partbox must be protected from contact with rain/snow/moisture and dirt. When the Partbox is in operation, noises are generated throughout the printing process which can cause stress or distraction, which is why the Partbox should not be set up in offices. During the printing process, the Partbox melts plastic which causes the generation of odour during operation. The Partbox should therefore only be installed in well-ventilated rooms.

2.3 Warning symbols and pictograms

Warnings draw attention to potential injuries or damage to property and must be observed. Different danger levels are assigned to the warnings in the operating instructions. The danger levels show the extent of the damage that will occur if the warning is neglected. Depending on the danger level, the warnings are marked in different colours.

Hazard level	Explanation
⚠ DANGER	Immediately dangerous situation with high risk that may result in death or serious physical injury.
⚠ WARNING	Potentially dangerous situation with medium risk that may result in death or serious physical injury.
⚠ CAUTION	Potentially dangerous situation with low risk that may result in medium or minor physical injury.
NOTE	Potentially dangerous situation that may result in damage to property.

There are warning symbols and pictograms in the warning notices in the operating instructions and on the warning signs on the Partbox. The warning symbols and pictograms indicate hazards to persons or damage to property and must always be considered

Warning Symbol	Explanation
	DANGER
	Danger to life due to electrical voltage! There is a danger to life in case of contact with electrical components. • Do not remove the electronics compartment cover. • Maintenance work and repairs may only be carried out by Schubert Additive Solutions GmbH staff. • The Partbox may only be installed on a socket that guarantees protective earth functionality. • The Partbox must only be operated from a 230 volt, 50 Hz socket.
	WARNING
	Danger of burns from hot surfaces! Contact with the 270°C hot extruder nozzle and the 80°C hot print bed causes considerable burns. • Before removing the components, wait until the status indicator of the Partbox changes to green. • Do not touch the extruder nozzle. • Use the tweezers in the filament compartment to clean the nozzle and remove filament residue.
	CAUTION
	Danger of crushing due to moving print bed and extruder unit! Print bed and extruder unit movements can crush the hand and individual fingers. • When removing components, do not reach into the movement paths of the print bed and the extruder unit. • When removing filament residue, use the tweezers from the filament compartment.
	Risk of injury from the weight of the Partbox! Lifting and transporting of the Partbox can cause damage to health. • Use a suitable means of transport. • Installation is to be carried out by 2 persons.
	Risk of injury from working on the Partbox contrary to its intended use! Improper work or use of the Partbox can lead to injury and damage to property. • Repairs and maintenance may only be carried out by staff from the Schubert Additive Solutions GmbH. • Carry out all operating steps in line with the information and notes provided in these operating instructions. • In the event of technical faults, disconnect the Partbox from the main power source and contact Schubert Additive Solutions Service.
	Risk of injury due to improperly laid power cable! There is a risk of tripping or falling due to an improperly laid power cable. • Lay the power cable in such a way that there is no risk of tripping. • If the power cable is damaged, it must be replaced immediately.
	Risk of injury from pieces of plastic during part post-processing & filament change! Pieces of plastic may come away at high speed during part post-processing with the side cutter and hit the eyes. • Wear protective goggles when post-processing parts and cutting filament pieces.

	NOTE
(!)	**Smells due to melted thermoplastics during Partbox operation!** Smells that may develop during operation of the Partbox may cause discomfort. • Only set up the Partbox in well-ventilated rooms.
(!)	**Noise during Partbox operation!** Noise generated while the Partbox is in operation can lead to stress or concentration problems. • Do not place the Partbox in offices.
(!)	**Material damage due to improper installation!** Improper installation of the Partbox may result in damage to the Partbox and the installation surface. • Place the Partbox on a stable surface with sufficient load-bearing capacity.
(!)	**Material damage due to improper environmental conditions!** Failure to comply with the installation conditions may result in damage to the Partbox. • Place the Partbox indoors only. • Protect the Partbox from rain, snow, moisture and dirt. • Limit values for temperature and humidity can be found under *2.1 Intended use*.
(!)	**Material damage due to the use of non-approved materials!** The Partbox can be damaged by processing non-approved materials. • Only use the *Partbox Black* material provided by Schubert Additive Solutions for the printing process.

2.4 Staff requirements

Staff type	Qualification	Field of activity
Operating staff	• Every operator must have read and understood the enclosed operating instructions and the safety instructions listed therein.	• Starting print jobs • Removing parts • Changing filaments • Removing filament residue • Inserting spring steel sheets • Part finishing
Specialist Schubert Additive Solutions staff	• Operating staff qualifications Additional: • Skilled worker with mechanical or electrical training	• Operating staff activities Additional: • Maintenance work • Repairs • Service work

3. Technical data

Machine name: Partbox

Model: R3.02

Manufacturer: Schubert Additive Solutions GmbH, Goldbacher Straße 81, 74564 Crailsheim, Germany

E-Mail: print@schubert-additive-solutions.de

Power supply: 230 Volt AC, 50 Hz

Protection class: IP20

Set-up conditions: For indoor use only

Maximum humidity of the working environment: 80 %

Maximum temperature range of the working environment: 10°C–40°C

Weight: 30 kg

Dimensions: 448.5 mm x 434 mm x 439 mm (length x width x height)

Build space: 180 mm x 240 mm x 145 mm (length x width x height)

The serial number is located inside the filament compartment on the left sidewall

CE

4. Unpacking & set-up

CAUTION	
	Risk of injury from the weight of the Partbox! Lifting and transporting the Partbox can cause damage to health. • Use a suitable means of transport. • Installation is to be carried out by 2 persons.
	Smells due to melted thermoplastics during Partbox operation! Smells that may develop during operation of the Partbox may cause discomfort. • Only set up the Partbox in well-ventilated rooms.
	Noise during Partbox operation! Noise generated while the Partbox is in operation can lead to stress or concentration problems. • Do not place the Partbox in offices.
	Material damage due to improper installation! Improper installation of the Partbox may result in damage to the Partbox and the installation surface. • Place the Partbox on a stable surface with sufficient load-bearing capacity.
	Material damage due to improper environmental conditions! Failure to comply with the installation conditions may result in damage to the Partbox. • Place the Partbox indoors only. • Protect the Partbox from rain, snow, moisture and dirt. • Limit values for temperature and humidity can be found under *2.1 Intended use*.

1. Loosen the Velcro fasteners of the transport box lid and remove the top lid.
2. Remove the opening tool supplied.
3. Bend open the lower and side metal flaps on the front of the transport box and lift the front wall off the transport box.
4. Pull the Partbox out of the transport box by the lower foam element and remove the upper foam element.
5. Set up the Partbox on a stable & flat surface.
6. Open the top cover and remove the power cable provided inside.
7. Connect the power cable to the back of the Partbox.
8. Open the casing cover and remove the transport bands by cutting them with the tool provided in the filament compartment.
9. Plug the power cable into the socket and press the power switch on the back of the Partbox.
10. The Partbox automatically connects to the Partbox operating system after a few minutes.
11. As soon as the Partbox is connected to the operating system, the status indicator in the lid of the Partbox lights up white.

5. Structure and function

The Partbox is used for the additive manufacturing of plastic parts using FDM (fused deposition modelling) technology. In FDM technology, the digital part is divided into many layers. In the print process, plastic is melted and extruded through a nozzle to build up the contours of the individual layer. After finishing a layer, the extruder of the Partbox moves up one layer thickness and builds up the next layer. The part is thus built up from many individual layers.

5.1 Structure – Partbox

5.1.1   Casing

1 Casing lid
2 Casing cover
3 Casing base
4 Status display
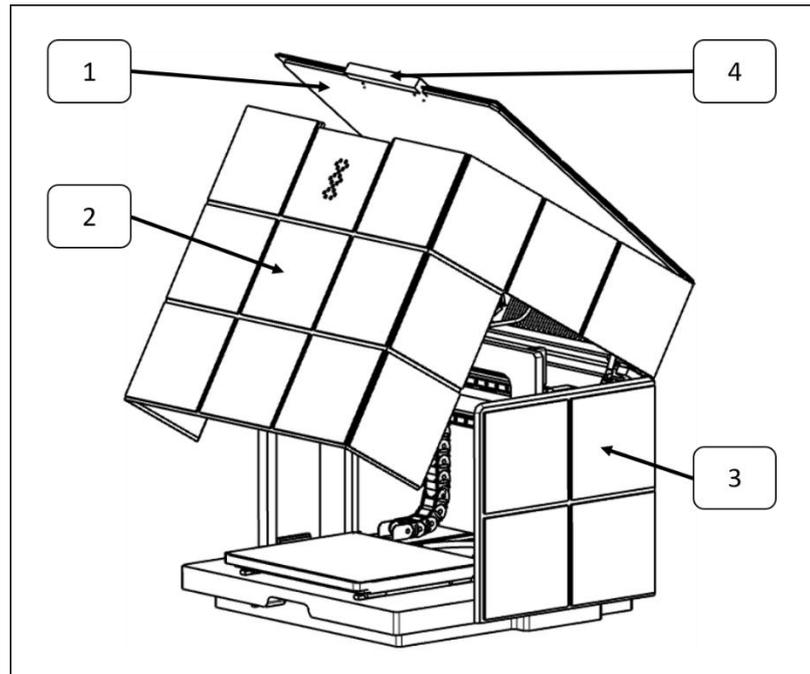
The Partbox has an enclosure to prevent direct access to moving, hot parts during operation. The casing cover [2] is equipped with a sensor that interrupts the printing process if the casing cover [2] is opened during a print job. The paused print job can be resumed via the Operating System; see section *5.2 Partbox operating system.* The casing lid [1] allows access to the filament box. The casing lid [1] can also be opened during the printing process, as there is no danger there. The enclosure base [3] connects the enclosure to the base plate of the Partbox. The status display [4] shows the status of the Partbox by the colour it displays. The different statuses of the Partbox are explained in *5.2.1 Operating System Setup*.

5.1.2   Filament compartment

1 Filament compartment
2 Filament box lid
3 Filament box closure
4 Filament guide tube
5 Filament box valve
6 Tool holder
7 lid lock
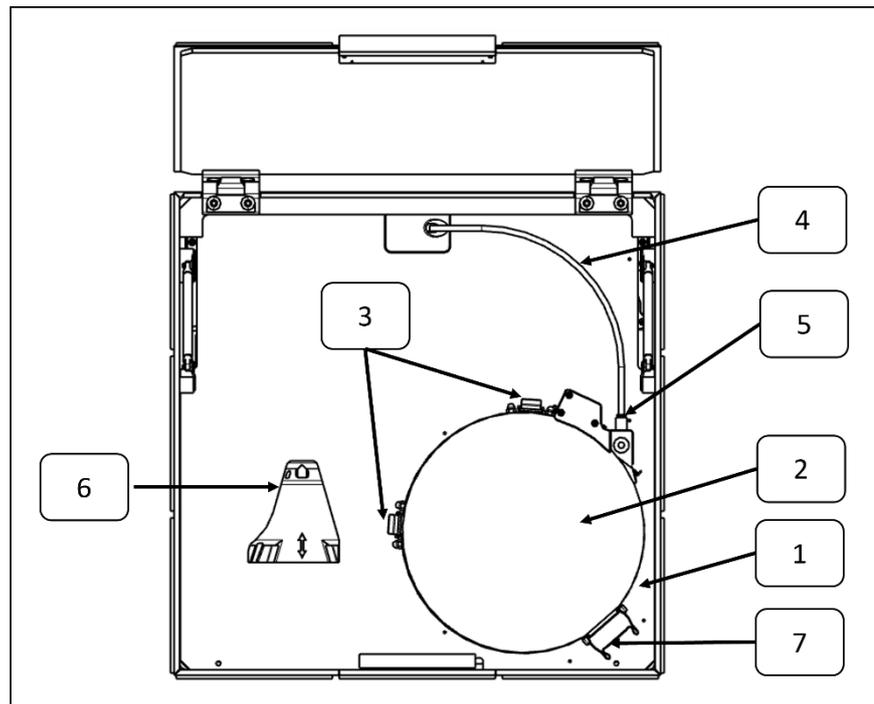
The filament box [1] is used to store the filament roll. The filament box [1] is airtight and protects the hygroscopic filament from the humidity of the surrounding air. The filament box lid [2] is used to close the filament box [1]. The filament box [1] is closed using the filament box closure [3]. By opening the filament box closure [3] in form of two snap hooks, the filament box lid [2] can be opened until it snaps in the lid lock [7]. The purpose of the filament tube [4] is to guide the filament and protect it from the humidity of the surrounding air. The filament tube [4] is sealed to the filament box [1] airtight using the filament box valve [5]. The tool holder [6] containing a side cutter and tweezers, which are used to change the filament and remove filament residue, is located next to the filament box [1].

5.1.3 Build space & extruder

1 Extruder
2 Movement axes
3 Nozzle
4 Hotend
5 Extruder fan
6 Part fan
7 Print bed
8 Coated spring steel plate
9 Casing camera
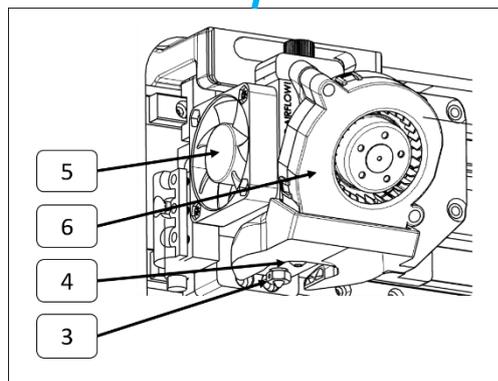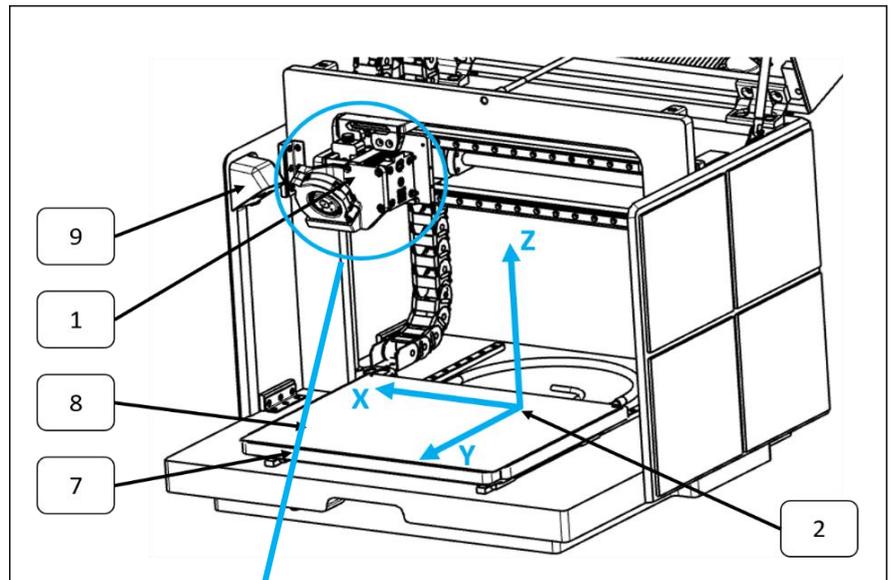
The extruder [1] feeds the filament from the filament box and into the hotend [1] where the filament is melted. The melted filament is extruded through the nozzle [3] to build up the part. **Attention: Hot-end and extruder reach 270°C during the printing process, danger of burns!** To prevent the extruder [1] from overheating, the extruder fan [5] is located at the side of the extruder. After extruding the filament through the nozzle [3], the liquid plastic must solidify quickly. To allow the plastic to solidify quickly, the part fan is located in front of the extruder [1]. The entire extruder unit moves along the movement axes during the printing process [2]. The movement axes [2] are named x-axis, y-axis and z-axis. The part is built up on the heated print bed [7] and the overlying coated spring steel sheet [8]. **Attention: The print bed [7] and the spring steel sheet [8] on which it rests reach a temperature of 80°C during the printing process; there is a risk of burns.** To enable easy removal of the part, the coated spring steel plate [8] is magnetically placed on the print bed [7] and can be removed to release the part. Before starting a print job, the casing camera [9] checks whether the print bed [7] with the spring steel plate [8] lying on it is free of parts. Before a new print job can be started, the part must be removed from the spring steel plate.
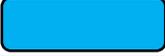
5.2 Partbox operating system

The Partbox can only be controlled via the operating system. The customer receives login details for the operating system by e-mail. If login details are not provided, please contact the Schubert Additive Solutions Service at *print@schubert-additive-solutions.de*. The Partbox operating system can be accessed via *https://os.partbox.io/auth* or with the QR code located under the casing lid of the Partbox.

5.2.1 Operating system setup

After logging in the operating system at *https://os.partbox.io/auth*, the Partbox button is automatically loaded. All the Partboxes available to the user are shown under *Network*. The serial number is displayed for each Partbox. The status of your Partbox is also displayed.
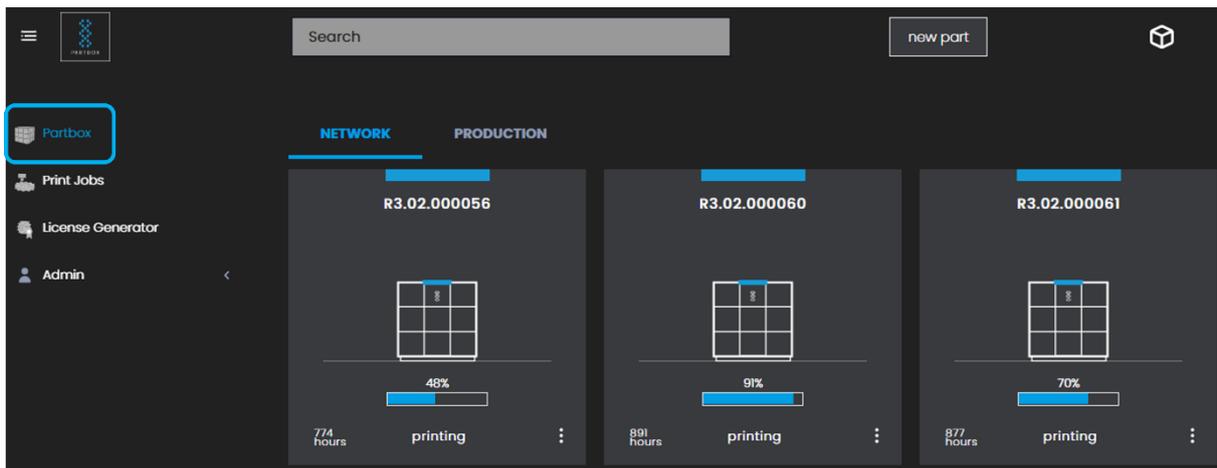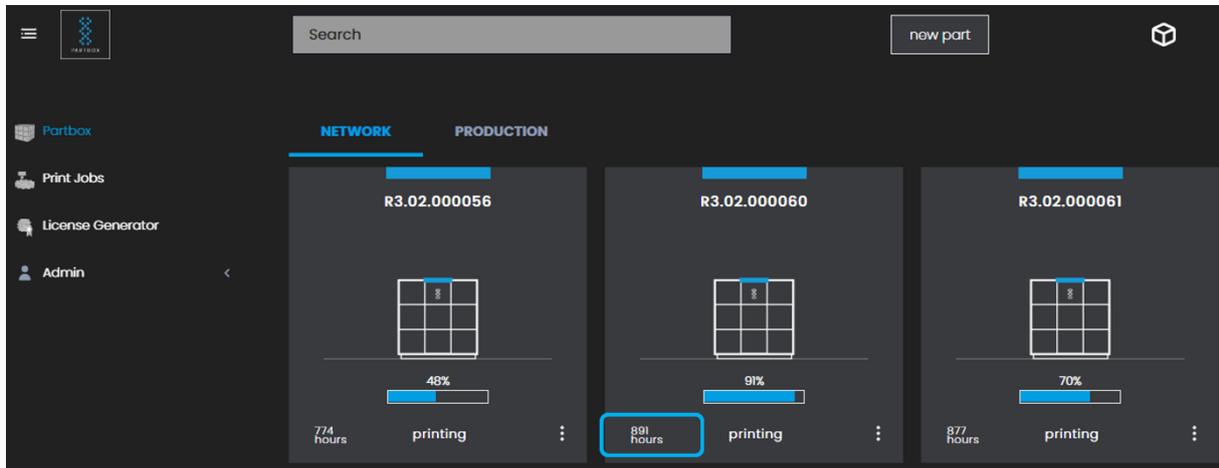

The Partbox can be in the following statuses:

Status	Colour status display	Description
No connection	🟥	The Partbox is not connected to the Partbox operating system.
Open	🟥	The casing cover of the Partbox is open. A print job cannot be started when the casing cover is open.
Ready	⬜	The Partbox is online and ready for the next print job.
Downloading	🟦	The Partbox downloads the started print job.
Preparing	🟦	The Partbox is currently being prepared. The print bed and extruder nozzle are heated up.
Printing	🟦	The Partbox is in the printing process.
Finishing	🟦	Print job completed. Wait for extruder and print bed to cool down for safe part removal
Paused	🟥	Print job is paused.
Finished	🟩	The Partbox has completed the print job and has cooled down. The part can be removed safely.
Error	🟥	The Partbox is in error mode.
Occupied	🟨	The print bed of the Partbox is occupied.

Offline		The Partbox is not switched on.

Below the status message, the remaining printing hours for the respective Partbox are shown.

The following functions can be selected for the Partbox via the marked button, depending on the current status of the Partbox.
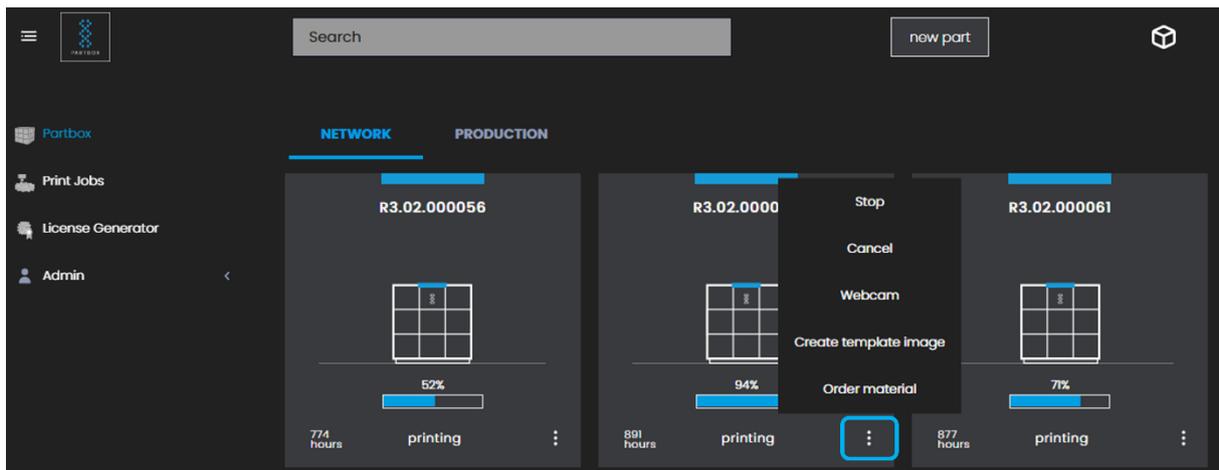
Function	Description
Stop	Pauses the current print job. Print job can be resumed via 'Resume'.
Cancel	Cancels the current print job. The print job cannot be resumed.
Webcam	Shows a photograph of the pressure chamber.
Create template image	Creates a new template for visual inspection of the build space, which checks whether there is a part on the print bed before starting a print job. This function is only available with the status "Printer Admin".
Order material	Triggers a material order. The ordered filament will be sent to you by post.
Unload Material	Starts the material unloading process to unload an empty or opened filament roll. See chapter *7.2 Changing an empty filament roll in the printing process*
Load material	Starts the material loading process. See chapter *7.1 Loading a filament roll.*
Resume	Resume a paused print job.

The *Production* button is next to the *Network* button. Information about the user's print jobs is listed here. Print jobs planned/queued for the future can also be cancelled by clicking on the delete button on the right side.
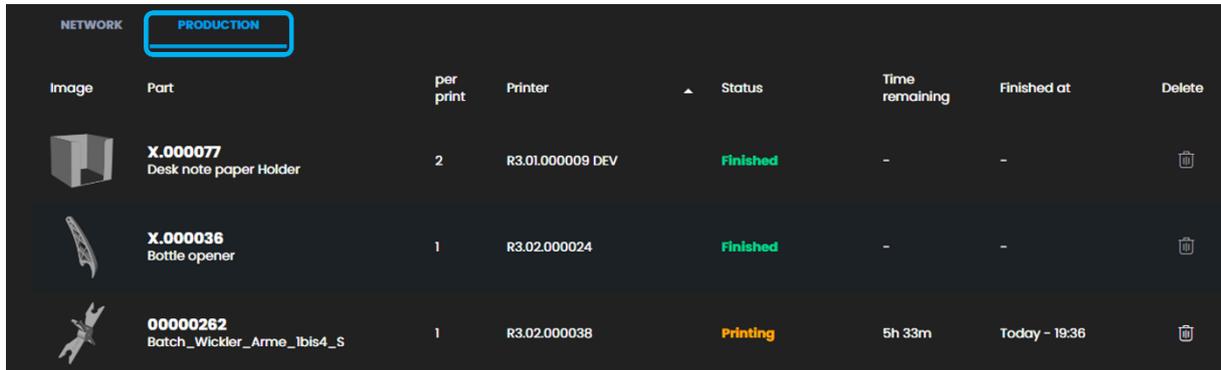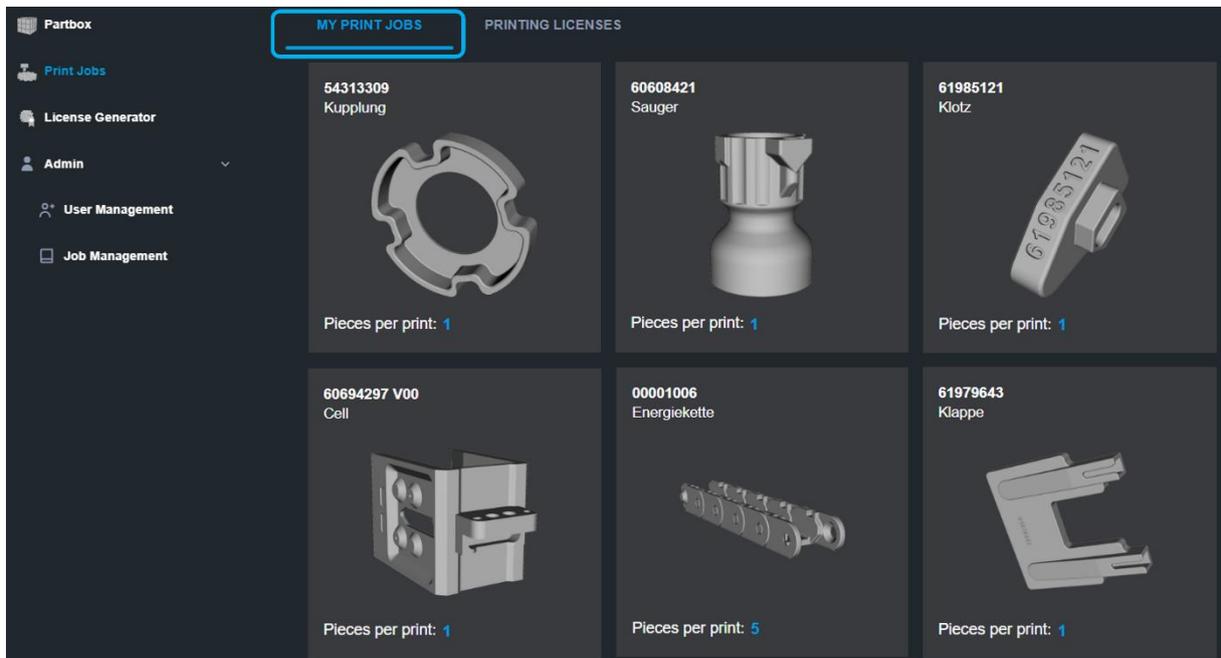

The parts that can be produced by the user are stored under the *Print jobs* button. *My Print jobs* shows the print jobs uploaded by the user, which can be printed by the user as often as they like, subject to the hourly account, or can be sent to other Partbox users via a licence.

New print jobs can be added via the *New Part* button. An individual part number and part name must be assigned for each new part. *Pieces per print* contains information on how many parts are in the G-code. The part's G-code can be uploaded using the upload button or by dragging & drop into the dotted field. To do this, a G-code must be created first. The creation of a G-code is described in chapter *6.1 Part preparation & slicing* Several G-codes with different numbers of parts per print can be uploaded under one part number. In the example of the energy chain shown below, a G-code is stored for an energy chain with one, five and fifteen links respectively.
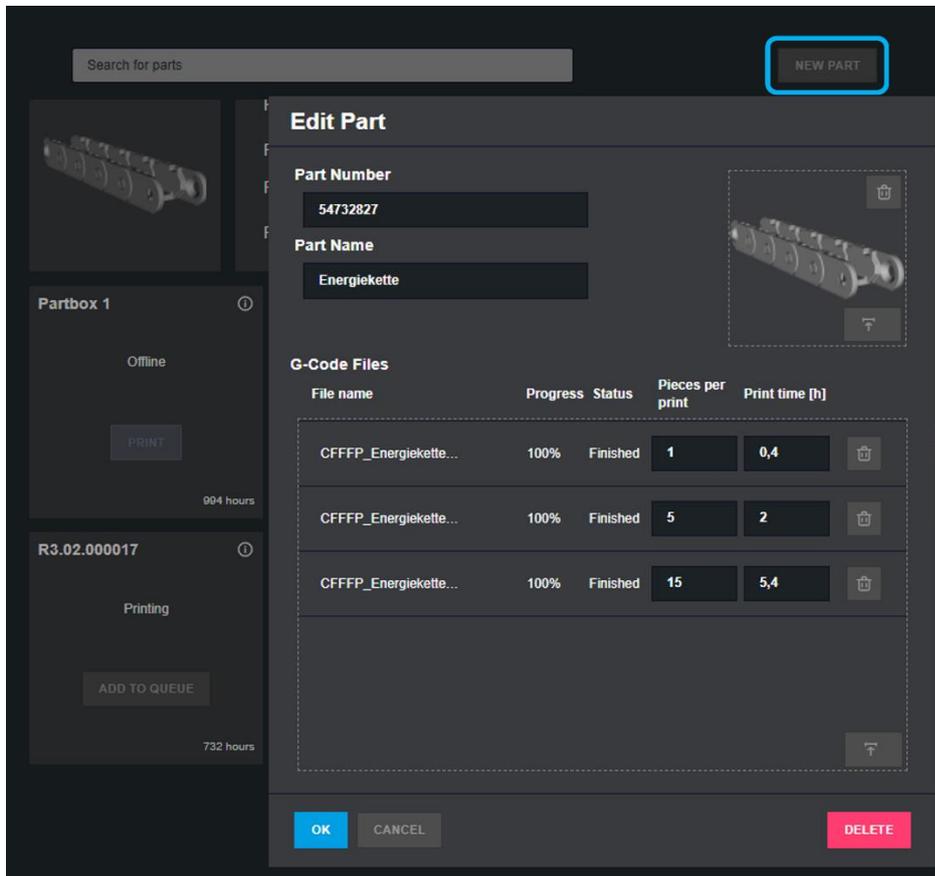
An added print job can be started via the *Print jobs* button. After selecting the requested print job, a free Partbox can be selected to start the printing process via the *start printing* button.
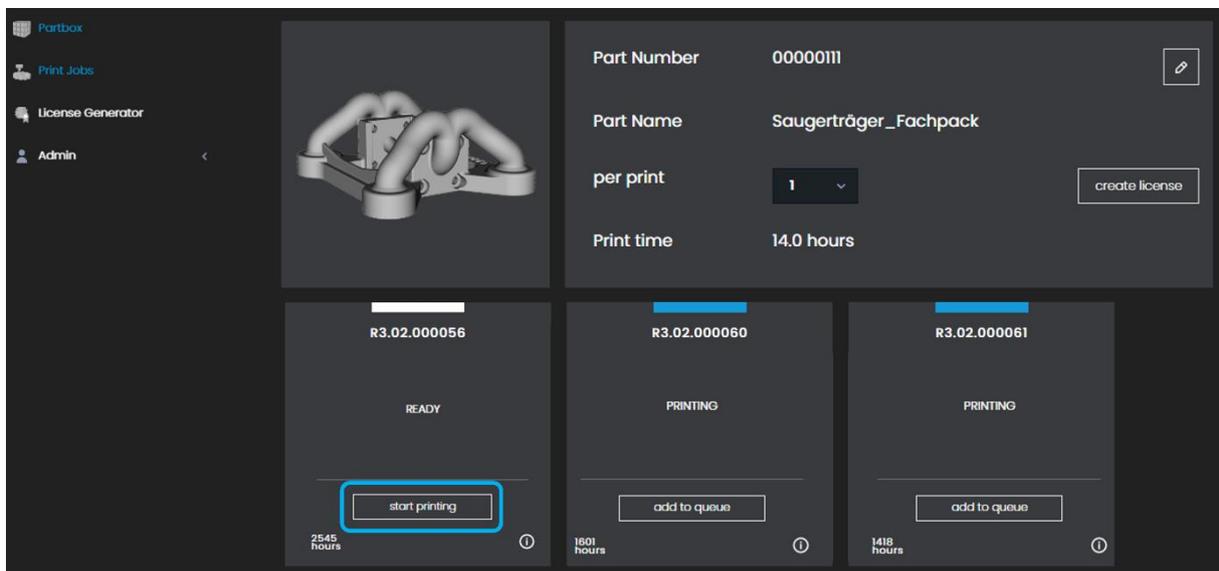
The *Printing licences* button lists the parts for which the user has received a licence. Information on how to create a part licence can be found in chapter *5.2.2 Licensed parts*
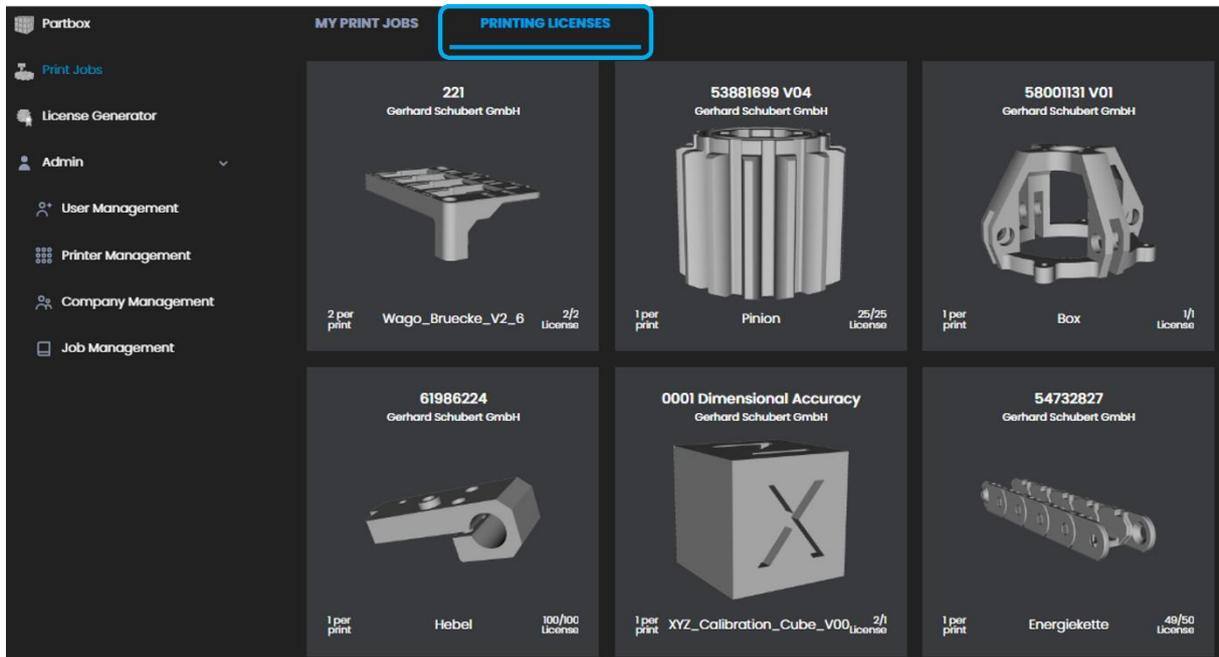
5.2.2   Licensed parts

The Partbox operating system enables the printing and creation of licensed print jobs. With a licensed print job, the owner of the part can define exactly who is allowed to print the part and how often. This ensures full control over the virtual part and protects the licensor's property.

To create a part licence, select the part you want to create a licence for under the *Print jobs – My print jobs* button. The *Create licence* button can be used to create a licence for the selected part.
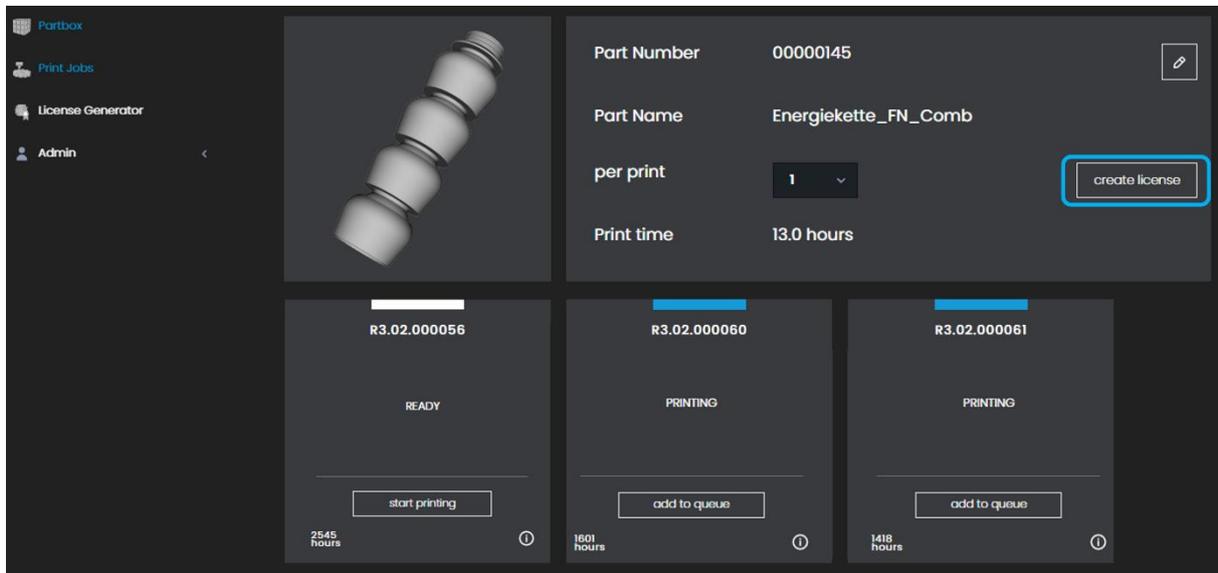
In addition to the licence recipient's e-mail address, the *Quantity* field can be used to define how often the licence recipient may print the part. In a licence package, licences can be sent for several parts, where it can be defined for each individual part how often it can be printed. The part licence is sent to the recipient via the *Send* button and will then be ready for production.
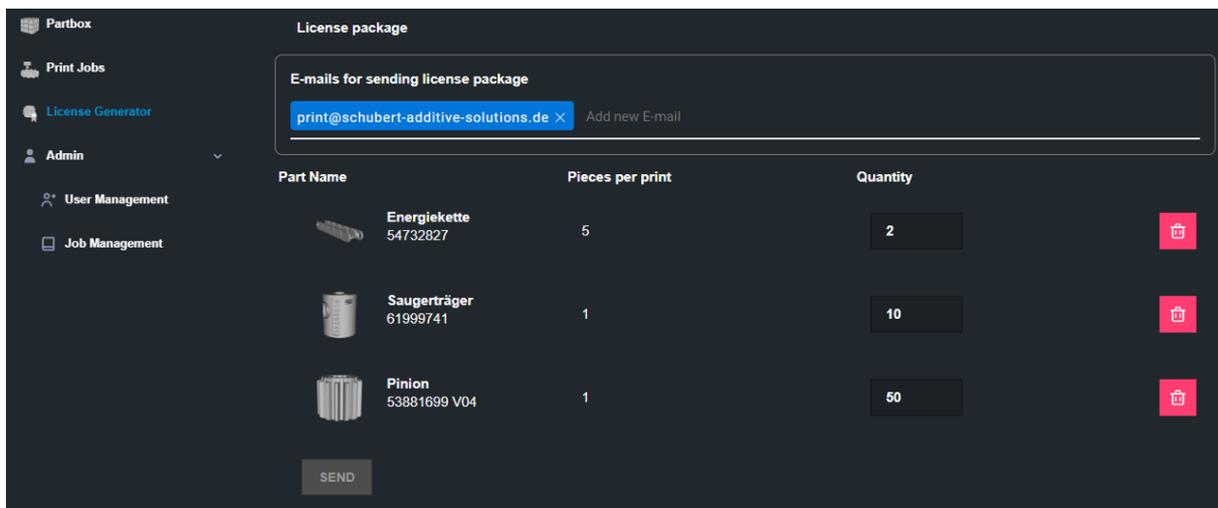
If a Partbox user receives a licence for a part, they will receive an e-mail containing the information on this. The part licence is located in the Partbox operating system under the *Print jobs – Printing licences* tab and is ready for production.

5.2.3   Licence generator

The creator does not have to be a Partbox user to create a part licence. The publicly accessible licence generator can be accessed via the link https://os.partbox.io/licensegenerator. All part manufacturers can generate and send licences for their parts via this link. However, part licences can only be produced on the Partbox. The free-to-use licence generator allows manufacturers to create licences for their parts and send them to Partbox users without losing control of their part and property. Use of the licence generator is free of charge. Whether costs are charged for the licence sent and the cost amounts are the responsibility of the part manufacturer and Schubert Additive Solutions has no control over this.

After pressing the *generate license link* button the license link is generated and can be send to the receiver. If the receiver copies the license link into the browsers adress field the license will be loaded into the Partbox OS under *printing licenses*.

6. Operation

## 6.1 Part preparation & slicing

1. To upload your own print jobs to the Partbox operating system, they must be generated first. The part must be available in a suitable 3D data format for this. Suitable data formats for the creation of a print job include the formats .stl/.amf and .3mf, for example. These formats can be generated using CAD programs such as Solidworks or Siemens NX.
2. The part in the appropriate data format must be converted into a G-code. The G-code contains all parameters that the Partbox needs for the production of the part.
3. The G-code is created using a slicer. Only the "Cura" slicer is intended for use with the Partbox. This can be downloaded via the following link:
   https://ultimaker.com/software/ultimaker-cura/
4. To obtain an error-free print and so as not to damage the Partbox, the Partbox profile supplied in the starter pack must be loaded. To do this, add the Partbox profile in the Cura slicer under Settings – Configure setting visibility – Profiles – Import.
5. After setting up the Partbox in the Cura slicer, the first print job can be created.
6. Once the print job has been created, it can be added to the part list via the Partbox operating system using the *New Part* tab, a print job can be started, and a licence can be issued for the part.

6.2 Printing parts

WARNING
Danger of burns from hot surfaces!   Contact with the 270°C hot extruder nozzle and the 80°C hot print bed causes considerable burns.   - Before removing the components, wait until the status indicator of the Partbox changes to green.   - Do not touch the extruder nozzle.   - Use the tweezers in the filament compartment to clean the nozzle and remove filament residue.

CAUTION
Danger of crushing due to moving print bed and extruder unit!   Print bed and extruder unit movements can crush the hand and individual fingers.   - When removing components, do not reach into the movement paths of the print bed and the extruder unit.   - When removing filament residue, use the tweezers from the filament compartment.

1. After creating a print job and uploading it to the Partbox operating system, the print job is ready for production. The requested print job can be selected and started via the *My print jobs* or *Printing licences* buttons.
2. Before starting a print job, the available filament quantity should be checked. It is important to directly close the filament box afterwards to protect the filament from humidity. If the filament quantity is not sufficient for the print job, the filament roll can be changed based on the procedure described in chapter *7.3 Changing an opened filament roll before or during a print job*.

3. Before the start of a print job it is important to apply the glue stick which comes with the Partbox on the print bed to ensure a good adhesion between the print bed and the printed part during the printing process. If the glue stick is not used, in rare occasions the part can detach from the print bed during the printing process and damage the Partbox. The metal side of the print bed always has to face downwards and the plastic-coated side upwards. The glue stick has to be applied to the plastic coating of the print bed. The glue stick should be applied in a thin and even layer.
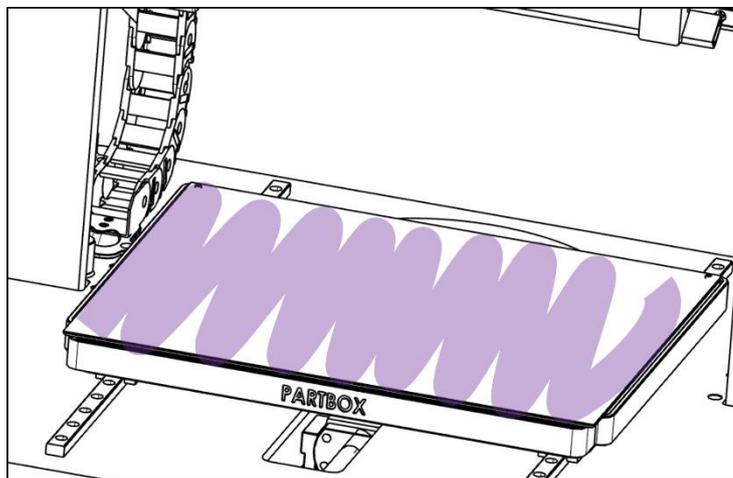
4. As soon as a new print job is started, the colour of the status light changes from white to blue and the Partbox starts the print bed and nozzle heating process. The status on the Partbox operating system changes from *Ready* to *Preparing*. As soon as the heating process is completed, the Partbox starts the printing process and the status changes to *Printing*. Before each print job, the Partbox starts a calibration process to achieve optimal print results and extrudes a filament line in the front area of the print bed.
5. The progress of the print job in percent can be viewed at any time via the Partbox operating system. If necessary, the print job can be paused or cancelled via the operating system.
6. If the end of the filament roll is reached during the printing process, the Partbox will interrupt the print job and the status light will be red. The filament roll can be changed by following the procedure described in section *7.2 Changing the filament of an empty filament roll in the printing process*. After changing the filament roll, the print job can be continued via the *Resume* button.
7. Once the print job has finished and the Partbox has cooled down, the colour of the status light changes from blue to green. The part can now be safely removed from the print bed.
8. At regular intervals of around 3 print jobs the glue layer on the print bed has to be removed and restored. For this the print bed should be removed from the Partbox and washed using regular water. After this a new layer of glue stick should be applied.

6.3 Part removal

WARNING
Danger of burns from hot surfaces! Contact with the 270°C hot extruder nozzle and the 80°C hot print bed causes considerable burns.   • Before removing the components, wait until the status indicator of the Partbox changes to green.   • Do not touch the extruder nozzle.   • Use the tweezers in the filament compartment to clean the nozzle and remove filament residue.

1. When the Partbox has finished a print job, the Partbox changes its status from *Printing* to *Finished* and the colour of the status indicator changes to green. The part can now be removed from the print bed.
2. To make it easier to remove the part from the print bed, the magnetic spring steel plate can be removed from the print bed. This is hooked onto two pins at the rear corners of the print bed and can be removed from the print bed by lifting the front or side edge. To remove the part from the spring steel plate, bend the edges of the spring steel plate slightly downwards. The part now detaches from the spring steel sheet. The spring steel sheet should be held as close to the edges as possible to avoid coating contamination, which can impair part adhesion.
3. To prepare the Partbox for the next print job, remove any filament residue from the spring steel plate and the build chamber. To remove filament residue from the print bed, or the extruder nozzle, use the tweezers located in the lid of the Partbox, as these parts may still be hot after the print job has been completed. Filament residue from poorly accessible areas or in the axles of the Partbox should also be removed using tweezers.
4. After removing the part, the spring steel sheet must be placed back on the print bed. Make sure that the spring steel plate is correctly aligned. The plastic-coated side of the spring steel plate must face upwards when it is put back. The recesses in the spring steel plate must also face backwards when put back.
To align the spring steel plate correctly, it must be hooked onto the pins in the rear corners of the print bed with the recesses.
5. At regular intervals of around 5 print jobs the glue layer on the print bed has to be removed and restored. For this the print bed should be removed from the Partbox and washed using regular water. After this a new layer of glue stick should be applied.

6.4 Part finishing

CAUTION	
⚠️	**Risk of injury from pieces of plastic during component reworking & filament change!** Pieces of plastic may come away at high speed during post-processing of parts with the side cutter and hit the eyes. ● Wear protective goggles when post-processing and cutting filament pieces.

1. After the printing process, existing support structures may have to be removed from the part. To facilitate the removal of support structures, there is a small side cutter in the lid of the Partbox next to the filament box, which can be used to remove the support structures.

7. Changing filaments

CAUTION	
⚠️	**Risk of injury from pieces of plastic during component reworking & filament change!** Pieces of plastic may come away at high speed during component finishing with the side cutter and hit the eyes. • Wear protective goggles when reworking components and cutting filament pieces.
ⓘ	**Impairment of the filament due to improper handling!** Partbox Black filament is highly hygroscopic and absorbs moisture from the surrounding air. Damp filament severely impairs the printing process. • Only remove new filament rolls from the vacuum bag during the change process. • Immediately pack opened filament rolls in vacuum bags with silica gel. • After inserting the filament roll, close the filament box with the filament box closure and insert the silica gel into the filament box.

| WARNING	
⚠️	**Danger of burns from hot surfaces!** Contact with the 270°C hot extruder nozzle and the 80°C hot print bed causes considerable burns. • Before removing the components, wait until the status indicator of the Partbox changes to green. • Do not touch the extruder nozzle. • Use the tweezers in the filament compartment to clean the nozzle and remove filament residue.

7.1 Loading a filament roll

1. If no filament roll is loaded in the Partbox, the Partbox operating system will display the *Load material* status. To load new filament, run the *Load* command via the three dots. The status of the Partbox changes to *Heating nozzle, please wait* while the Partbox heats up the hot-end. The heating process can take up to five minutes. After heating up, the status of the Partbox changes to *Please load new material*.

2. The casing lid must be opened to gain access to the filament box. To open the filament box the two snap hooks have to be opened. After that the lid can be opened until it snaps into the lid hook.
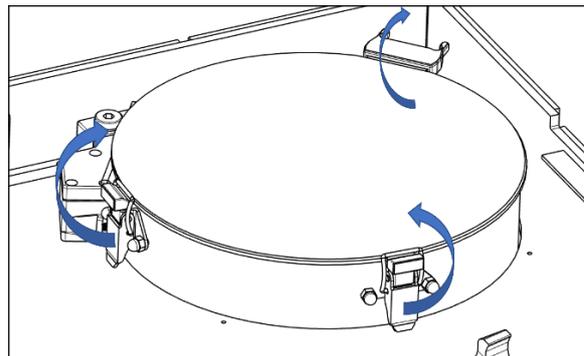
3. To prevent the filament from absorbing moisture from the surrounding air, only now open the vacuum bag of the new filament roll and remove the filament roll.

4. To prevent the filament from unwinding from the filament roll, the end of the filament is bent and pushed into a hole in the filament roll. Cut the bend end of the filament roll to a sharp edge with the side cutter located in the lid of the Partbox. The sharp edge facilitates insertion of the filament.
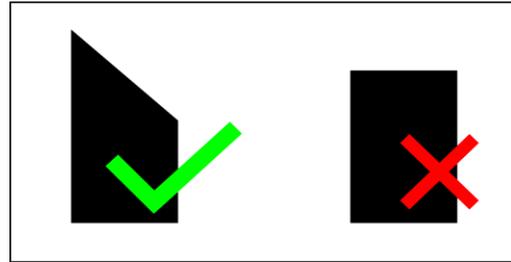

5. Insert the filament end through the filament passage into the filament tube. Due to the preload of the filament sensor, you will have to overcome a slight resistance. Push the filament into the filament tube until it reaches the extruder and you feel some resistance.
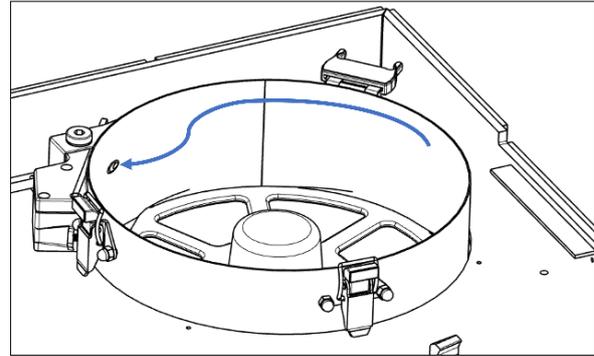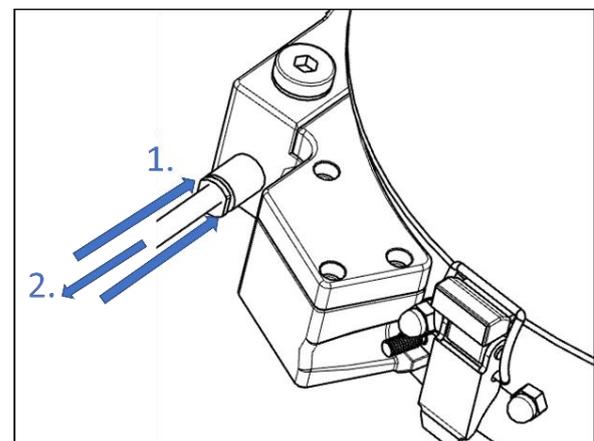

6. Insert the filament roll into the filament box. Ensure that the filament roll is in the right place. When inserting the filament roll, ensure that the filament is not trapped under the filament roll.

7. To protect the filament from the humidity of the surrounding air, there are two bags of silica gel in the vacuum bag of the filament roll. Place the bags of silica gel in the centre of the filament box.

8. Close the lid and seal it airtight by closing the two snap hooks.
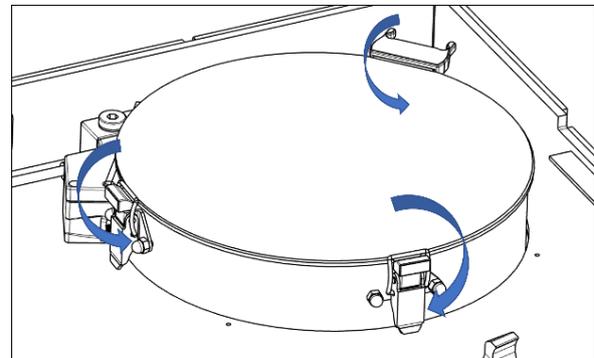
9. Remove the filament tube from the filament valve. To do this, push in the blue ring of the valve and pull the filament tube out of the valve. The *Load material* command now has to be run via the Partbox operating system in order to start the extruder. While the extruder is feeding the material, the *Loading material* status shows. The filament now has to be pushed deeper into the filament tube with slight force. If the filament is correctly loaded from the extruder, the filament is slowly pulled into the filament tube by the extruder.

10. Confirm correct filament feeding by clicking on the *Yes* button in the Partbox operating system. If the filament has not been fed correctly, press the *Repeat* button and insert the filament into the filament tube again. If the filament does not retract despite the tip being cut, pull the filament back a little and press it into the tube again with slight force until you feel a slight click.

11. If no filament is extruded out of the nozzle the filament tube attached to the extruder has to be removed. The filament tube is connected to the extruder by a valve. To remove the filament tube from the valve, push in the black ring of the valve and pull the filament tube out of the valve. Now the end of the filament has to be guided into the opening of the extruder and the load process can be started again by using the operating system.
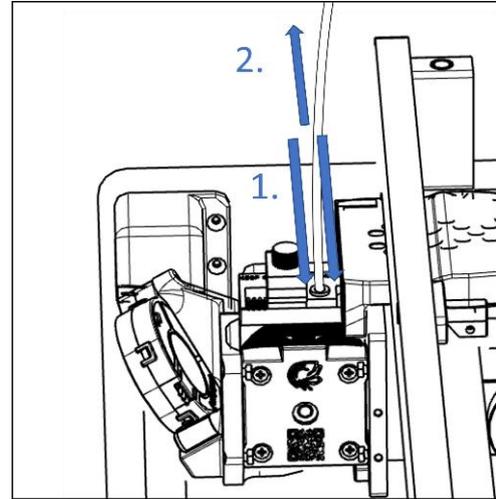
12. After loading the filament correctly, push the filament tube back into the valve until the stop in the valve is reached.
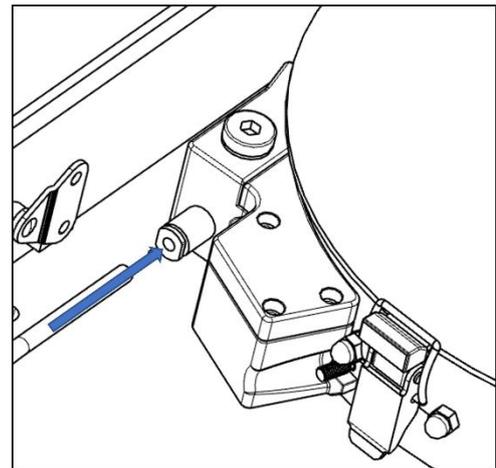

13. When loading the filament, a small amount of filament is extruded or residue may remain on the nozzle. Before continuing the printing process, remove any filament residue using the tweezers located in the tool holder next to the filament box. Attention: There is a risk of burns due to the high temperature of the nozzle and the print bed.

14. Close the casing cover. The Partbox is now ready for the next print job. A print job that has already been started can be resumed via the *Resume* button in the Partbox operating system.

## 7.2 Changing an empty filament roll in the printing process

1. If all of the filament in the filament roll is emptied during a print job, the Partbox detects the end of the filament roll and pauses the print job. The status light in the lid of the Partbox is red to indicate the print job is paused and the status changes to *Load material*.

2. Open the casing lid to access the filament box. When the filament roll is completely empty, the filament tube must be removed from the valve. To do this, the blue ring of the valve must be pressed in and the hose can be pulled out of the valve.
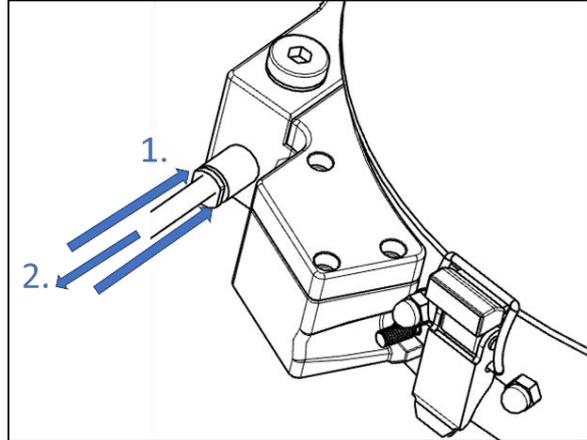

3. Access the Partbox operating system. Due to the emptied filament roll, the Partbox is in *Load material* status. Run the *Unload material* command to start the filament unloading process.

4. As soon as the status of the Partbox changes to *Please load new material*, the remaining piece of filament in the filament tube is pushed back. Pull the remaining piece of filament out of the filament tube.
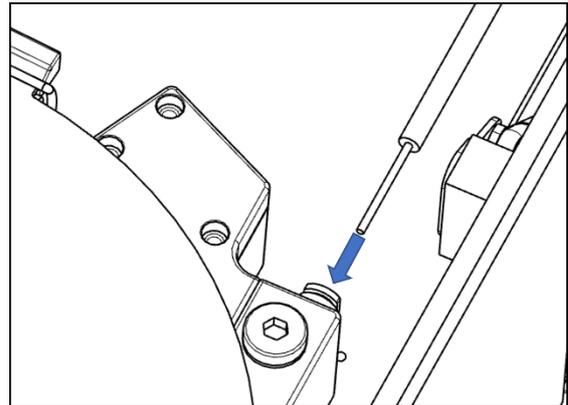
5. If the end of the filament has been pulled so far into the filament tube that it cannot be pulled out of the upper end of the filament tube, the filament must be pulled out of the lower end of the filament tube.

6. In this case, the casing cover must be opened and the filament tube removed from the extruder. To do this, press the black ring on the top of the extruder in and pull the filament tube out of the extruder.
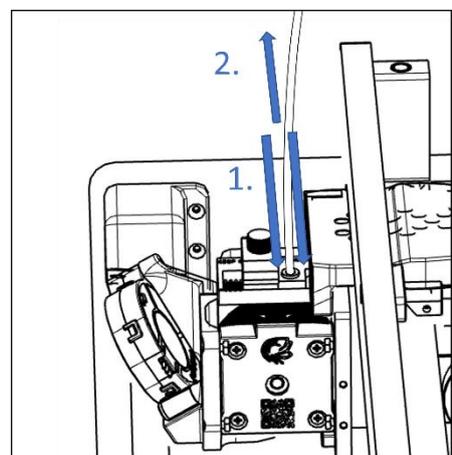
7. After removing the remaining pieces of filament from the filament tube, the filament tube must be put back into the opening of the extruder.
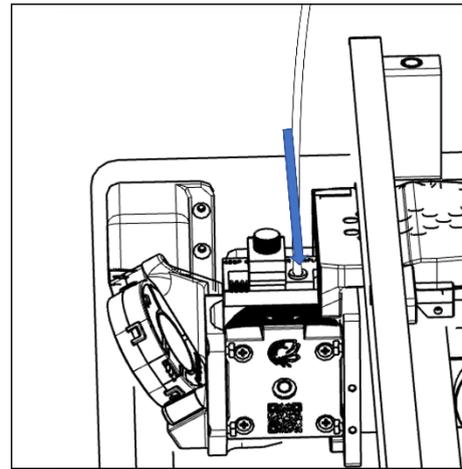
8. Open the filament box by opening the two snap hooks and remove the empty filament roll from the holder.
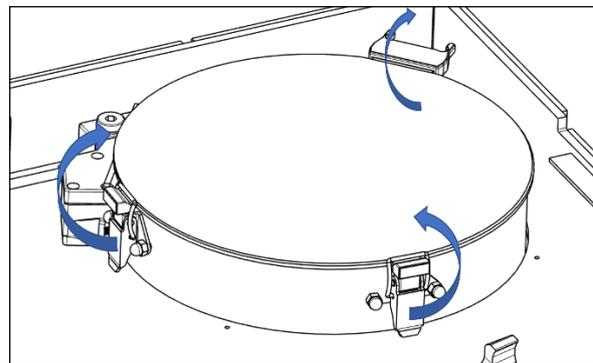
9. Load the new filament roll according to 7.1 *Loading a filament roll* and start the printing process via the operating system manually.

7.3 Changing an opened filament roll before or during a print job

1. If the amount of filament is too low for the print job, the filament roll can be replaced with a full filament roll before or during a print job.

2. Open the Partbox operating system to change the material before starting a print job. Click on the *Unload* button under *Network*. The Partbox will change status to *Heating nozzle, please wait* and will first heat up the hot-end and then eject the filament. It can take up to five minutes to heat up. Once the hot-end is heated, the extruder will pull the filament from the hot-end and the status will change to *Please load new material*.

3. To change the material during a print job that has already started, pause the print job via the Partbox operating system. To do this, press the *Stop* button under *Network*. After pausing the print job, press the *Unload material* button to start the material unloading process.

4. Open the casing lid to access the filament box.

5. Open the filament box by opening the two snap hooks.
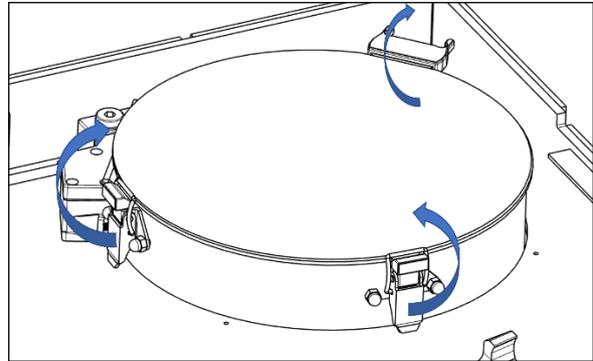
6. Turn the filament roll clockwise to wind up the filament in the filament tube. Remove the opened spool and pack it in a vacuum bag with silica gel to protect the filament from the humidity of the surrounding air. The further process for loading the filament can be carried out according to section 7.1 Loading a filament roll.

8. Dismantling & packing up

CAUTION	
	Risk of injury from the weight of the Partbox! Lifting and transporting the Partbox can cause damage to health. • Use a suitable means of transport. • Installation is to be carried out by 2 persons.

1. Switch off the mains switch on the back of the Partbox.
2. Remove the power cable from the Partbox and place it in the lid of the Partbox.
3. Place the Partbox in the foam element.
4. Push the Partbox into the transport box with the foam element.
5. Push the front of the transport box into the lower and side flaps of the transport box using the tabs.
6. Bend the tabs with the opening tool provided.
7. Fit the upper foam element onto the Partbox.
8. Put the lid of the Partbox on and pull the Velcro fasteners through the tabs.

9. What to do if there are malfunctions or technical problems

DANGER	
	Danger to life due to electrical voltage! There is a danger to life in case of contact with electrical components. • Do not remove the electronics compartment cover. • Maintenance work and repairs may only be carried out by Schubert Additive Solutions GmbH staff.
WARNING	
	Danger of burns from hot surfaces! Contact with the 270°C hot extruder nozzle and the 80°C hot print bed causes considerable burns. • Before removing the components, wait until the status indicator of the Partbox changes to green. • Do not touch the extruder nozzle. • Use the tweezers in the filament compartment to clean the nozzle and remove filament residue.
CAUTION	
	Danger of crushing due to moving print bed and extruder unit! Print bed and extruder unit movements can crush the hand and individual fingers. • When removing components, do not reach into the movement paths of the print bed and the extruder unit. • When removing filament residue, use the tweezers from the filament compartment.

9.1 Malfunctions

9.1.1 Extrusion malfunctions

If the Partbox does not extrude material during a print job, first check that the filament has been loaded correctly in the extruder.
1. Open the casing lid of the Partbox and remove the filament tube in the filament box.
2. To do this, press the blue ring of the hose valve and pull the filament tube out of the valve.
3. *Pull lightly on the filament. If the filament can be pulled out of the tube, the filament has not been loaded correctly from the extruder. In this case, follow the steps for loading the material in chapter *7.1 Loading a filament roll*.

In addition, check if there is a problem with the filament tube that prevents the correct extrusion of the material. To do this, check the route of the filament tube in the filament compartment up to the extruder for kinks or pinched areas. If the material is loaded correctly and there is no problem with the filament tube, there is a defect in the extruder unit of the Partbox. In this case, please contact Schubert Additive Solutions Support.

9.1.2 Lack of print bed adhesion

Should the part detach from the print bed during the printing process, the cause may be the coated spring steel sheet.
1. Check that the plastic-coated side of the spring steel plate is facing upwards. If printing has been done directly on the uncoated side of the spring steel sheet, adhesion is insufficient and the part may peel off during the printing process.
2. A grease-free surface is also important to guarantee sufficient adhesion. Cleaning the plastic coating with an alcohol-based cleaner to remove grease from the surface can improve part adhesion.
3. To improve the part adhesion, a even layer of glue stick has to be applied to the plastic side of the print bed. If the glue stick layer is too thick the quality of the print can be affected. In this case the print bed has to be washed using water as explained in *6.2 printing parts*

9.1.3 Part defects

If the part has surface defects, such as small holes or thread formation, the cause may be humid filament. In this case a new filament roll has to be loaded into the Partbox as per the procedure described in chapter *7.1 Loading a filament roll*.

10.   Contact

Schubert Additive Solutions GmbH Goldbacher Straße 81 74564 Crailsheim Germany		Tel.: +49 07951 4727 - 0 E-Mail: print@schubert-additive-solutions.de
Support Goldbacher Straße 81 74564 Crailsheim Germany		Tel.: +49 07951 4727 - 111 E-Mail: Support@partbox.io
Engineering Goldbacher Straße 81 74564 Crailsheim Germany		Tel.: +49 07951 4727 – 0 E-Mail: Print@schubert-additive-solutions.de