

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Subject to its express reservation of rights to supplement or amend its contentions as may be appropriate in view of discovery, further investigation, and/or the claim construction process, Plaintiff Stratasys, Inc. (“Plaintiff” or “Stratasys”) provides its preliminary disclosure of asserted claims and infringement contentions to Shenzhen TuoZhu Technology Co., Ltd., Shanghai Lunkuo Technology Co., Ltd., Bambulab Limited and TuoZhu Technology Limited (collectively, “Defendants” or “Bambu Lab”), pursuant to the Court’s Scheduling Order, D.I. 20; the Court’s October 30, 2024 Order extending the time to comply with P.R. 3-1, 3-2, 3-3, and 3-4, D.I. 22; and P.R. 3-1. Nothing in these contentions should be interpreted as an admission or concession regarding the scope of the asserted claims.

Disclosure of Asserted Claims for U.S. Patent No. 10,569,466 (“the ’466 Patent”) under P.R. 3-1(a): Claims 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 16, 17, 19, and 20.

Disclosure of Accused Instrumentalities for the ’466 Patent under P.R. 3-1(b): For each of the Asserted Claims, all Bambu Lab branded or manufactured three-dimensional (3-D) printers with a tag reader, including but not limited to the Bambu Lab X1C, X1E, P1S, P1P, A1, and A1 mini printers, alone or in combination with Bambu Lab software, such as Bambu Studio, and/or the Bambu Lab Automated Material System (“AMS”) or AMS Lite and all Bambu Lab Parts.

Bambu Lab has not yet produced any discovery. Based on information available to-date, the Bambu Lab X1C and X1E have no material differences relevant to these infringement contentions. The X1E includes several upgrades over the X1C, including an active heating chamber, an Ethernet socket, and certain air purification filters. <https://bambulab.com/en/x1e>. The X1E is also better for certain filament types and has a higher max temperature for the toolhead. *Id.* Accordingly, references to components or functionality of either the X1C or X1E in this chart—other than the heating chamber, ethernet socket, and certain air purification filters that are only in the X1E—apply to both printers.

Based on information available to-date, the Bambu Lab P1S and P1P have no material differences relevant to these infringement contentions. The P1S includes several upgrades over the P1P, including an enclosure, air filter, and cooling fans. See <https://us.store.bambulab.com/collections/3d-printer/products/p1s> (comparing P1P to P1S). The P1P is also ideal for certain filament types. *Id.* Accordingly, references to components or functionality of either the P1S or P1P in this chart—other than the enclosure, air filter, and cooling fans that are only in the P1S—apply to both printers.

Additionally, “controlling and operating the AMS on Bambu Studio and Bambu Handy is essentially the same [on the P1 series] as on the X1.” <https://wiki.bambulab.com/en/p1/manual/connect-ams>. Accordingly, references in this chart to operation of the AMS with the X1 series also apply to operation of the AMS with the P1 series, and vice versa.

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Based on information available to-date, the Bambu Lab A1 and A1 mini have no material differences relevant to these infringement contentions. See <https://bambulab.com/en-us/compare> (comparing A1 and A1 mini upon selection). The A1 includes several upgrades over the A1 mini, including a larger build volume, higher max build plate temperature, and larger display. *Id.* Accordingly, references to components or functionality of either the A1 or A1 mini in this chart—other than the larger build volume, higher max build plate temperature, and larger display—apply to both printers.

Additionally, the Bambu Lab A1 and A1 mini as “A1 series printers can only be connected to one AMS lite for use.” <https://wiki.bambulab.com/en/ams-lite/manual/faq>. Accordingly, references in this chart to the operation of the AMS Lite with the A1 printer also applies to the operation of the AMS Lite with the A1 mini printer, and vice versa.

Disclosure of Priority Date under P.R. 3-1(e): The asserted claims of the '466 Patent are each entitled to a priority date of at least as early as October 28, 2013.

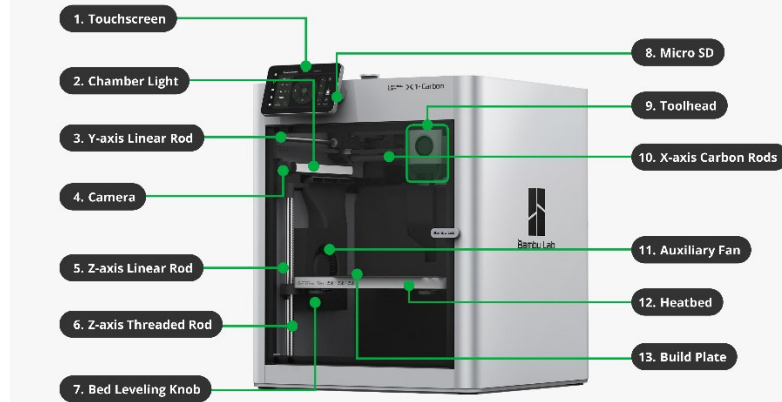
Disclosures under P.R. 3-1(c)-(d): Stratasys identifies in the chart below specifically where each element of each Asserted Claim is found within each Accused Instrumentality.

Disclosure under P.R. 3-1(f): At this time, Stratasys does not intend to rely on the assertion that its own products or other instrumentalities practice the claimed invention. Stratasys reserves the right to amend and/or supplement this disclosure as discovery progresses.

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Claim	Contention
1. A method, comprising: providing a three-dimensional printer	<p data-bbox="472 235 1885 341">To the extent the preamble of the claim is limiting, Bambu Lab provides various additive manufacturing systems (i.e., 3D printers) for use (e.g., by its customers), including the X1C, X1E, and P1S, P1P, A1 and A1 mini. See, e.g.:</p> <div data-bbox="730 375 1339 1193">A photograph of a Bambu Lab X1 Carbon 3D printer. The printer is a tall, rectangular machine with a light gray upper section and a dark gray lower section. On top of the printer is a filament rack with a curved, transparent lid. Inside the rack, several spools of filament in various colors (green, blue, red, white) are visible. The printer has a control panel on the left side of the upper section. The Bambu Lab logo is visible on the front of the lower section.</div> <p data-bbox="472 1230 833 1266">https://bambulab.com/en/x1</p>

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<https://wiki.bambulab.com/en/x1>

“How does X1 work?”

The X1 3D printer is a machine that uses plastic filament as the material for creating 3D objects.

Most of the time, the printable objects are files with the .stl extension that hold the 3D model which needs to be processed before it's ready to be printed with a piece of software called a slicer.

The slicer, in our case the Bambu Lab Studio, takes that .stl file and slices it into layers which are then printed by the X1. All these slices are then converted into code, a type of language which tells the machine how to move its axis to print the model.

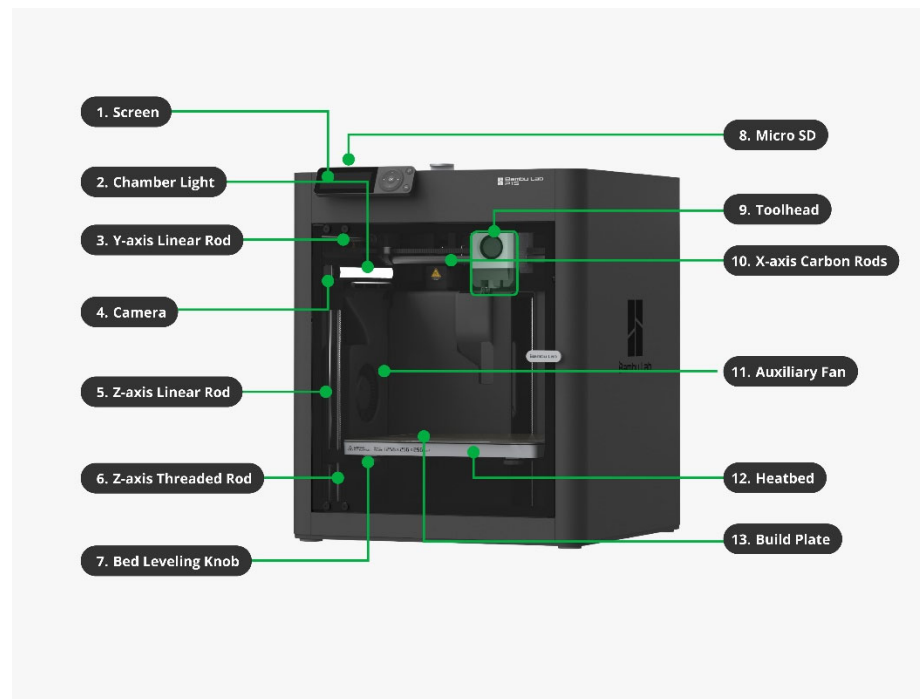
Besides the movement, the slicer is also able to integrate various other settings inside the generated file, like the temperatures of the filament, printing speeds, and generate supports for some sections of the print.”

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<https://wiki.bambulab.com/en/x1/manual/intro-x1>

The Bambu Lab X1C and X1E are largely the same; the X1E includes several upgrades over the X1C, including an active heating chamber, an ethernet socket, and certain air purification filters.

<https://bambulab.com/en/x1e>. The X1E is also better for certain filament types and has a higher max temperature for the toolhead. *Id.* Accordingly, references to components or functionality of either the X1C or X1E in this chart—other than the heating chamber, ethernet socket, and certain air purification filters that are only in the X1E—apply to both printers.



<https://wiki.bambulab.com/en/p1>

““How does the P1 series work?”

The Bambu Lab P1 inherits the X1 series' renowned kinematics and motion control technology and the wealth of sensors that ensure its reliability. It can connect the automatic material system (AMS) for multi-color

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printing. Great for beginners, professionals, or others who enjoy the fun of being creative, the P1P has been designed for easy setup and use in minutes. Additionally, it allows upgrading and customizing hardware with mod-friendly features for people to enjoy the fun of making their one-of-a-kind 3D printer.”

<https://wiki.bambulab.com/en/p1/manual/intro-p1p>

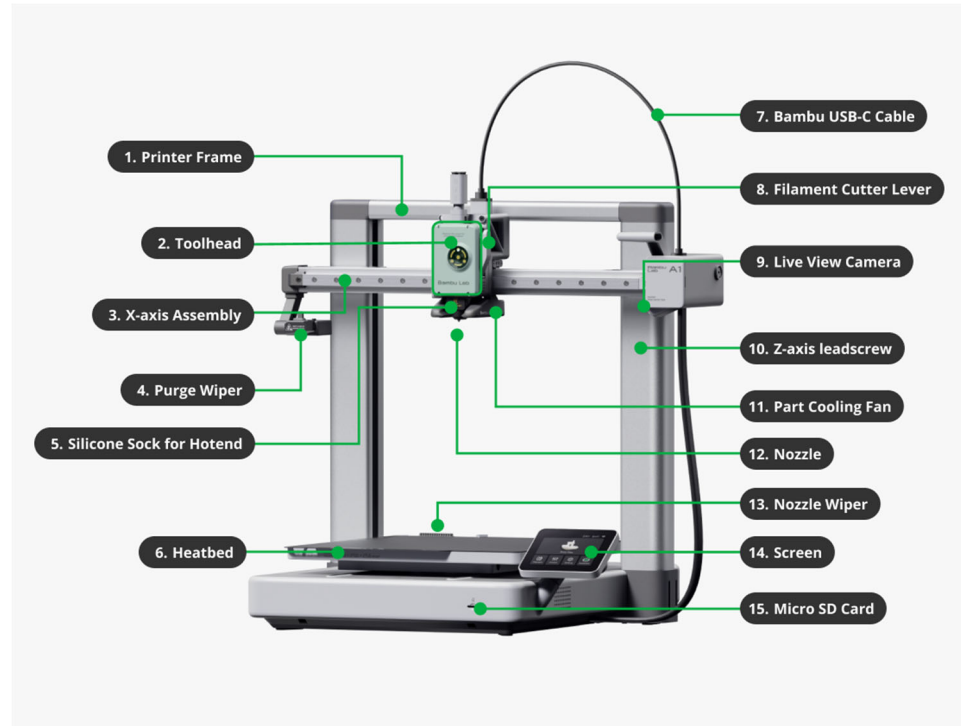


https://us.store.bambulab.com/products/p1p?gad_source=1&gclid=Cj0KCQiAly5BhDeARIsABRc6Zui1LA-KlLBpMwwu10C9BEnkbXOizh2T2VXHke9YId_ufwLMvZNDOAaAjzfEALw_wcB

The Bambu Lab P1S and P1P are largely the same; the P1S includes several upgrades over the P1P, including an enclosure, air filter, and cooling fans. See <https://us.store.bambulab.com/collections/3d-printer/products/p1s> (comparing P1P to P1S). The P1P is also ideal for certain filament types. *Id.* Accordingly,

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references to components or functionality of either the P1S or P1P in this chart—other than the enclosure, air filter, and cooling fans that are only in the P1S—apply to both printers.



<https://wiki.bambulab.com/en/a1>

“How does the A1 work?”

The A1 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 typically involves the following steps:

Creation or acquisition of a digital model

First, generate a 3D model or obtain an existing digital model using computer-aided design software, online resources, or other means.

Slicing

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Next, Bambu Studio slices the digital model into multiple thin layers. Each layer's information is converted into "G-code," a language understood by the printer. The G-code provides instructions to the printer regarding movement paths and speeds of the different axes during the printing process.

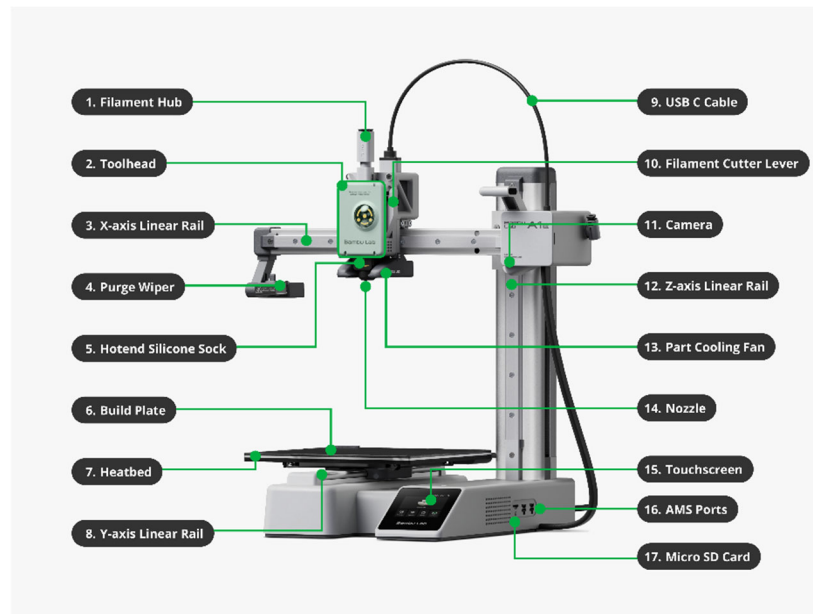
Preparing the printer

Before initiating the printing process, the printer needs to be prepared. This involves loading the printing filament, positioning the build plate, and calibrating the printer's parameters to ensure optimal print quality.

Printing

Once all preparations are complete, the A1 printer gradually constructs the object layer by layer on the print platform."

<https://wiki.bambulab.com/en/a1/manual/intro-a1>



<https://wiki.bambulab.com/en/a1-mini>

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“How does the A1 mini work?”

The A1 mini 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 mini typically involves the following steps:

Creation or acquisition of a digital model:

First, you need to create a 3D model or acquire an existing digital model. This can be done through computer-aided design software, online resources, or other sources.

Slicing

Next, Bambu Studio slices the digital model into multiple thin layers. The information for each layer is automatically converted into a language that the printer can understand, known as "G-code." This code instructs the printer on the movement paths and speeds of the various axes during the printing process.

Preparing the printer

Before starting the printing process, you must prepare the printer. This includes loading the printing filament, placing the build plate, and calibrating the printer's parameters to ensure print quality.

Printing

Once everything is prepared, the A1 mini gradually prints layer by layer onto the print platform, gradually building the object.”

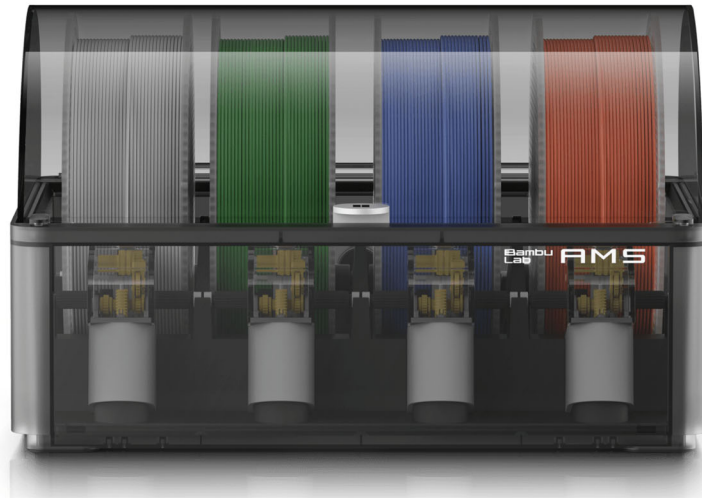
<https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini>

The Bambu Lab A1 and A1 mini are also largely the same, including but not limited to the same filament support, sensor capability, types of electronics, and any differences are irrelevant to these infringement contentions. See <https://bambulab.com/en-us/compare> (comparing A1 and A1 mini upon selection). The A1 includes several upgrades over the A1 mini, including a larger build volume, higher max build plate temperature, and larger display. *Id.* Accordingly, references to components or functionality of either the A1 or A1 mini in this chart—other than the larger build volume, higher max build plate temperature, and larger display—apply to both printers.

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that includes a tag sensor;

Bambu Lab provides various 3D printers, including the X1C, X1E, and P1S, and P1P, that support the Bambu Lab Automatic Material System (AMS), which includes four bays, include RFID tag readers. The 3D printers and AMS are each provided alone or in combination.



Color, the ultimate expression of emotions, is brought to you by Bambu Lab's Automatic Material System (AMS). You can now enjoy printing freely in multiple colors and materials, a 3D Printing Maestro.



<https://bambulab.com/en/x1>

Similarly, Bambu Lab provides the Bambu Lab A1 and A1 mini printers that support the Bambu Lab AMS Lite, which includes RFID sensors. The 3D printers and AMS Lite are each provided alone or in combination.

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“Bambu Lab AMS lite - Automatic Material System

...

The A1 series printers can only be connected to one AMS lite, so it can only support 4-color printing at most. The AMS lite is not compatible with X1 and P1 series printers.

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	<p>...</p> <p>Product Features</p> <ul style="list-style-type: none">• Multi-Color/Multi-Material Capability• Automatic Filament Backup• Improved Spool Compatibility• Easy to Maintain• RFID Filament Sync” <p>https://us.store.bambulab.com/collections/bambu-lab-ams-lite/products/ams-lite</p>
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Also, see <https://wiki.bambulab.com/en/x1/manual/intro-ams> regarding the AMS:

Bambulab AMS RFID readers and sniffing

The Bambulab AMS RFID readers are located between slot 1&2 and slot 3&4



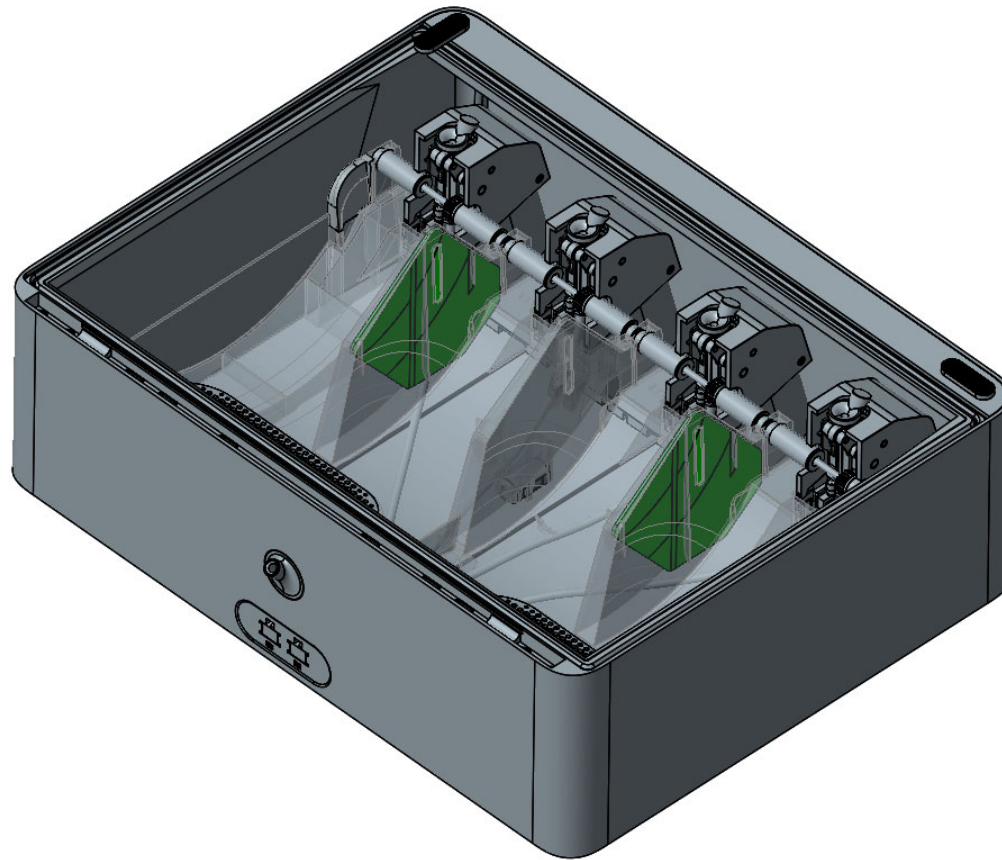
“RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).”

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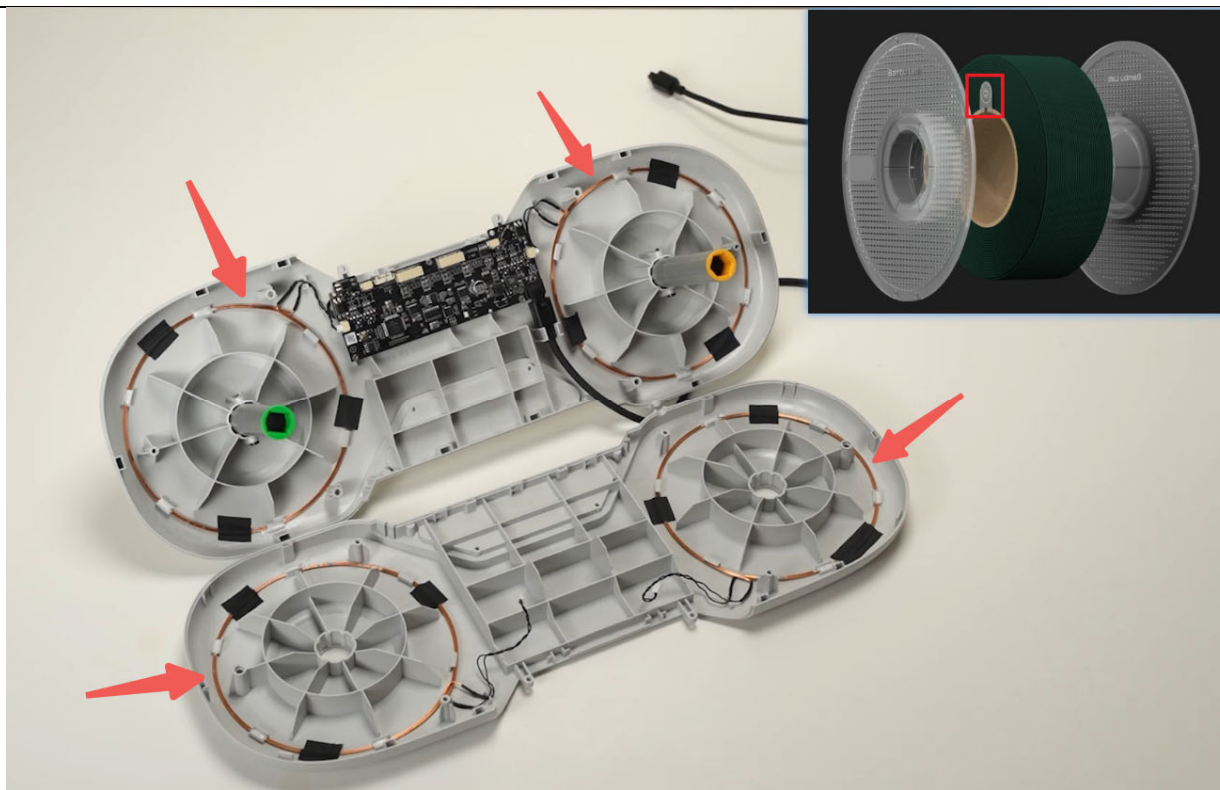


Also, see <https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>, regarding the AMS Lite:

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.

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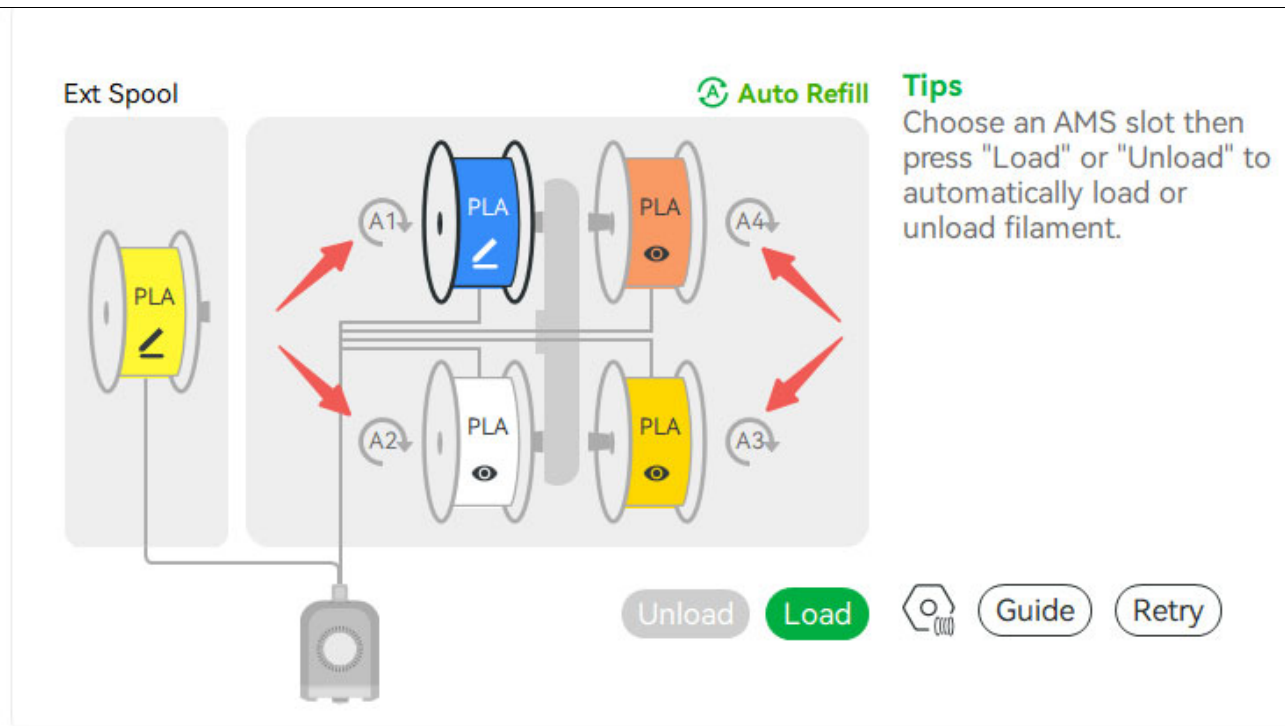


RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

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		<div data-bbox="714 186 1648 1430"><div data-bbox="1585 203 1627 235">✕</div><div data-bbox="756 276 966 316">AMS Settings</div><div data-bbox="756 357 1050 397">☒ Insertion update</div><div data-bbox="798 414 1596 519"><p>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds.</p><p>Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</p></div><div data-bbox="756 673 1081 714">☒ Update on startup</div><div data-bbox="798 730 1596 836"><p>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</p></div><div data-bbox="756 868 1123 909">☒ AMS filament backup</div><div data-bbox="798 925 1596 998"><p>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</p></div><div data-bbox="766 1023 1585 1372"></div></div>	
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Click here to read the RIFD info”

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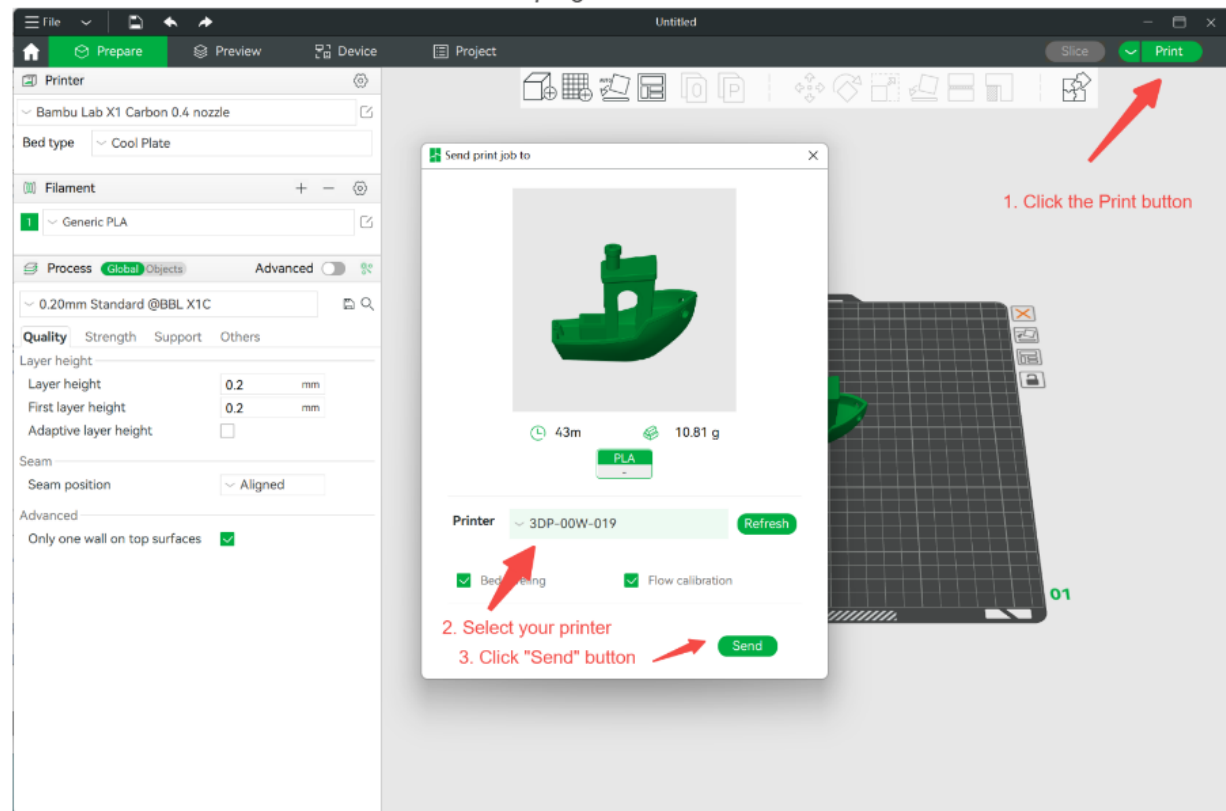
<p>receiving a request from a client over a network to fabricate an object on the three-dimensional printer,</p>	<p>The Accused Instrumentalities are used to receive a request from a client over a network to fabricate an object on the three-dimensional printer.</p> <p>A request to fabricate an object from a three-dimensional model on the Bambu 3D printers is received from the Bambu Studio application, which is executed on a personal computer, over the printer's network connection (e.g., Wi-Fi or Ethernet).</p> <p>"Printing from Bambu Studio" explains how to send print jobs from Bambu Studio to the printer (https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio):</p> <h3>Printing from Bambu Studio</h3> <p>When printing with Bambu Studio, it's possible to send the sliced files directly to the printer via Wi-Fi. Here's how to do it:</p> <ol style="list-style-type: none">1. Import the 3D model you want to slice, and after adjusting the settings, click on the Slice button2. After the model has been sliced, click on the Print button. A window will show up where the printer can be selected, and the calibration options can be enabled or disabled.3. When ready to print, simply click the Send button, and the file will be sent to the printer. The printing process will start. <p> receiving a request</p> <p>https://wiki.bambulab.com/en/software/bambu-studio/studio-quick-start</p>
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Send print job via WLAN or SD Card

To send the print job to the printer via WLAN, click “Print” on the top right-hand corner. This will prompt a pop-up window with a quick preview of the model and will also ask you to select the Printer you want to send it to from the drop-down list, and you will also give you the option to choose whether or not you want the printer to perform certain functions like Bed Leveling, flow calibration, etc before the print starts. Once done, click “Send” to send the file to the printer and start printing

Note: You will need to have Bambu Network plug-in installed to be able to send files via WLAN



<https://wiki.bambulab.com/en/software/bambu-studio/studio-quick-start>

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	<p><i>See, e.g.,</i> https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio (X1 series guide explaining printing from Bambu Studio); https://wiki.bambulab.com/en/a1/manual/first-print-with-ams-lite (A1 series guide explaining printing from Bambu Studio); https://wiki.bambulab.com/en/a1-mini/manual/first-print-with-ams-lite (A1 mini series guide explaining printing from Bambu Studio); https://wiki.bambulab.com/en/p1/manual/print-from-bambu-studio (P1 series guide explaining printing from Bambu Studio).</p>
the three-dimensional printer coupled to a supply of a build material including a tag that stores at least one property of the build material;	<p>The Bambu Lab printers may be coupled to a supply of a build material including a tag that stores at least one property of the build material. The Bambu Lab filaments are provided on a spool that includes an RFID tag. The RFID tag includes data of various properties of the build material, including for example type and color of the build material.</p>

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RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

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When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.

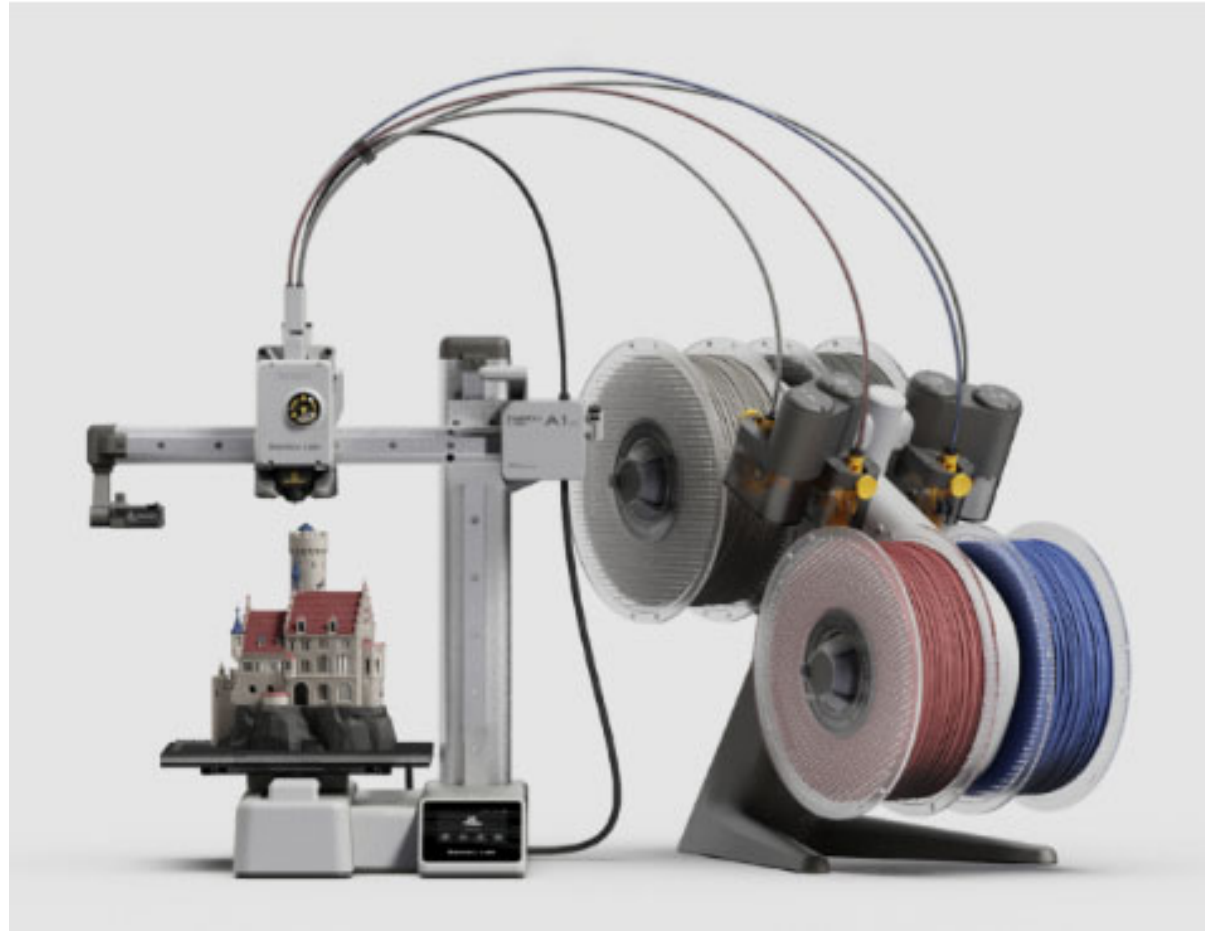


When the filament in a slot has been sent out to AMS, or the extruder detects that there is a filament inside, the RFID reading function cannot be used. Click to read will show that AMS is busy and cannot read the filament information.

<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

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The AMS lite is shown below coupled to the A1, with the spools of build material having RFID tags.

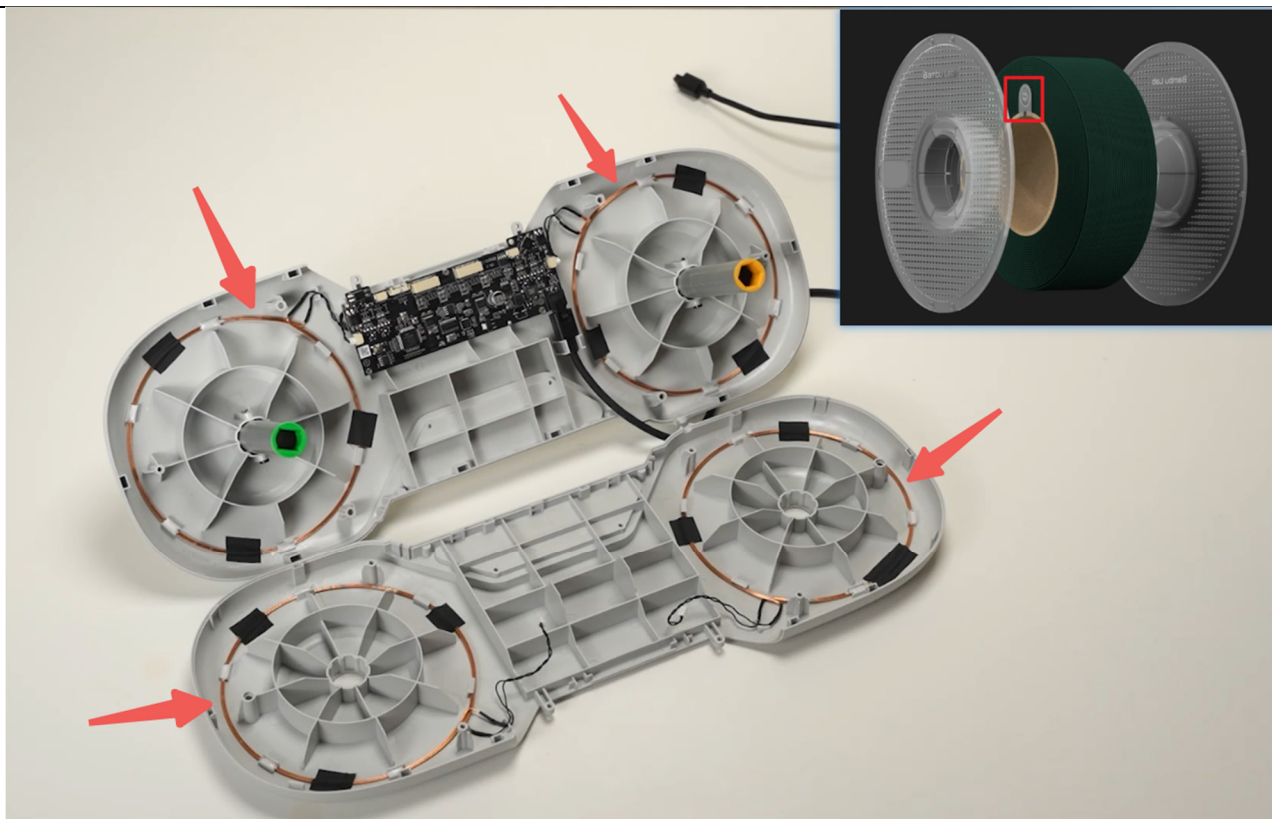


<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.

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RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

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		<div data-bbox="1591 207 1627 240">✕</div> <div data-bbox="758 277 961 310">AMS Settings</div> <div data-bbox="758 365 800 397">✓</div> <div data-bbox="814 365 1050 397">Insertion update</div> <div data-bbox="804 418 1587 516"><p>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds.</p></div> <div data-bbox="804 535 1593 633"><p>Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</p></div> <div data-bbox="758 682 800 714">✓</div> <div data-bbox="814 682 1075 714">Update on startup</div> <div data-bbox="804 734 1583 831"><p>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</p></div> <div data-bbox="758 880 800 912">✓</div> <div data-bbox="814 880 1115 912">AMS filament backup</div> <div data-bbox="804 932 1577 997"><p>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</p></div> <div data-bbox="768 1029 1583 1370"></div>	
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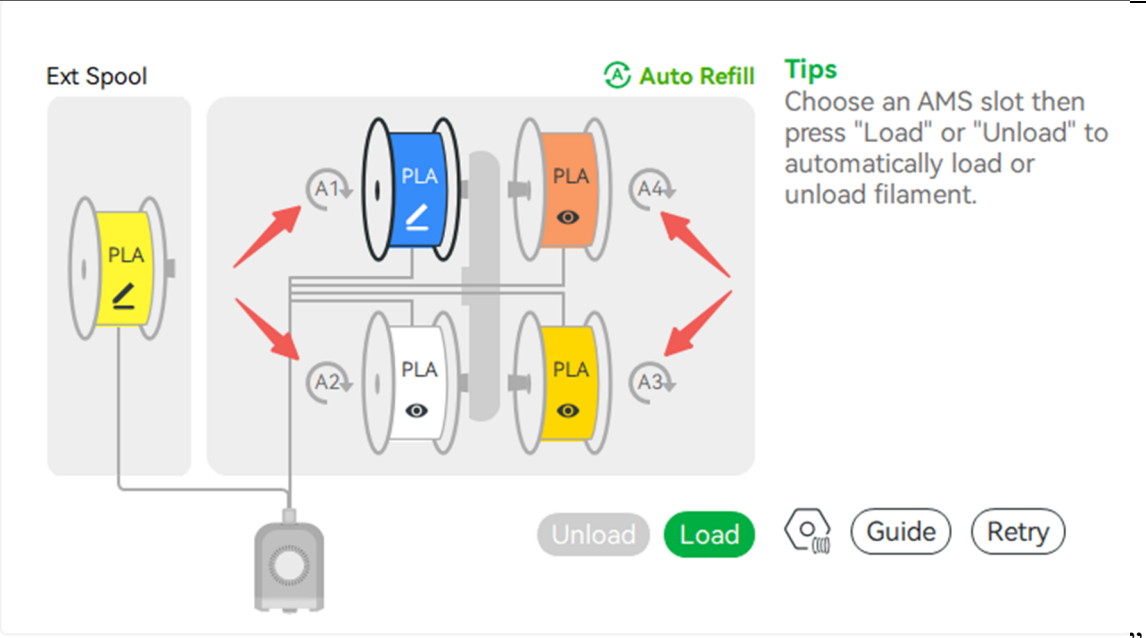
	<div data-bbox="617 191 1755 824">The screenshot shows the Bambulab AMS Lite software interface. On the left, there is an 'Ext Spool' section with a yellow spool of PLA filament. In the center, there is a 4-spindle AMS unit with four spools of PLA filament in different colors: blue (top-left), orange (top-right), white (bottom-left), and yellow (bottom-right). Red arrows labeled A1, A2, A3, and A4 point to each spool. To the right of the AMS unit, there is a green 'Auto Refill' button and a 'Tips' section that reads: 'Choose an AMS slot then press "Load" or "Unload" to automatically load or unload filament.' At the bottom of the interface, there are four buttons: 'Unload' (grey), 'Load' (green), a gear icon, 'Guide' (grey), and 'Retry' (grey). The entire interface is enclosed in a light grey border.</div> <p>https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite</p> <p>“Load filaments to AMS and configure filament information Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to AMS setup and loading filament.”</p> <p>https://wiki.bambulab.com/en/x1/manual/multi-color-printing</p>
reading data from the tag with the tag sensor;	The Accused Instrumentalities are used to read data from the tag with the tag sensor.

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RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

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Reading RFID

Bambu's official filament roll has RFID tags on both sides, and on AMS there are two RFID-reading circuit boards that can read the filament information.

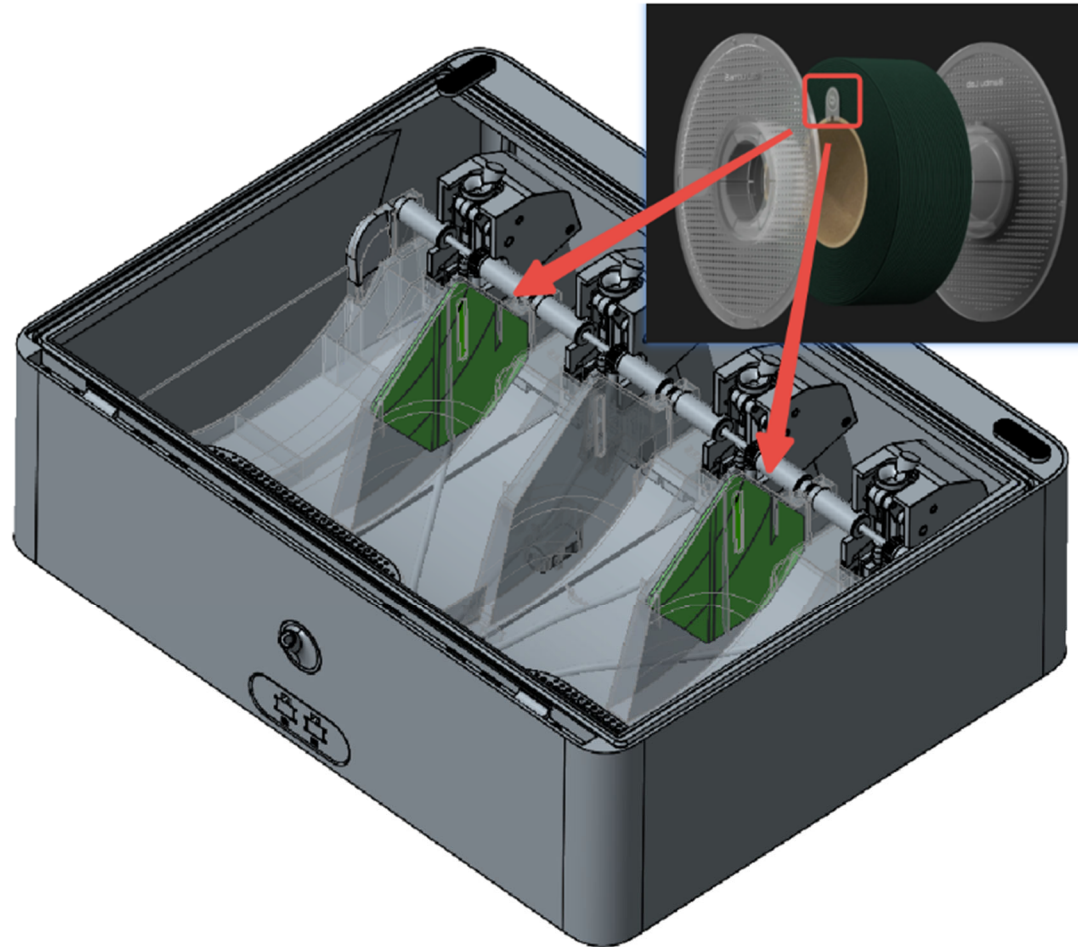


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When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.



When the filament in a slot has been sent out to AMS, or the extruder detects that there is a filament inside, the RFID reading function cannot be used. Click to read will show that AMS is busy and cannot read the filament information.

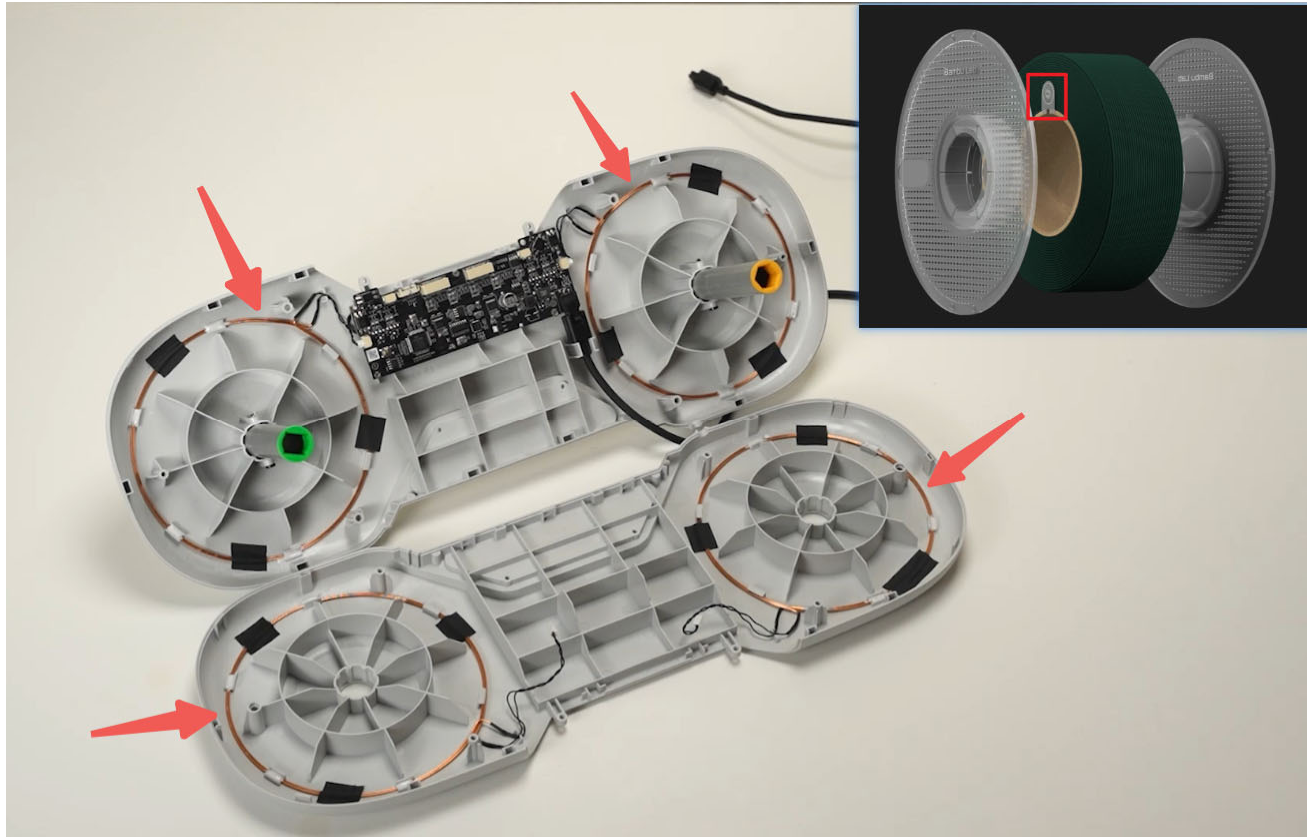
<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Also, see <https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>, regarding the AMS Lite:

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.



RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

		<div><div>×</div><div>AMS Settings</div><div><div><div>☒ Insertion update</div><div>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds. Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</div></div><div><div>☒ Update on startup</div><div>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</div></div><div><div>☒ AMS filament backup</div><div>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</div></div><div></div></div></div>	
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

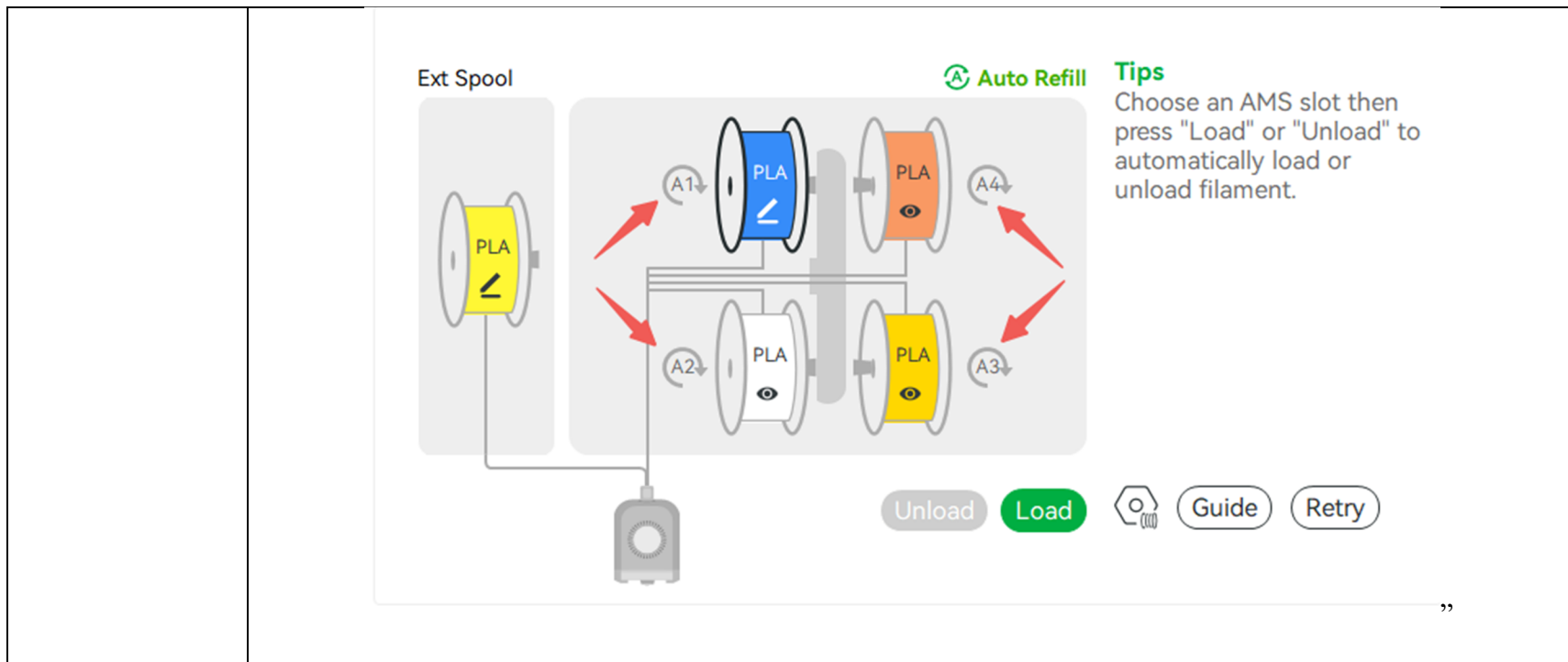


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

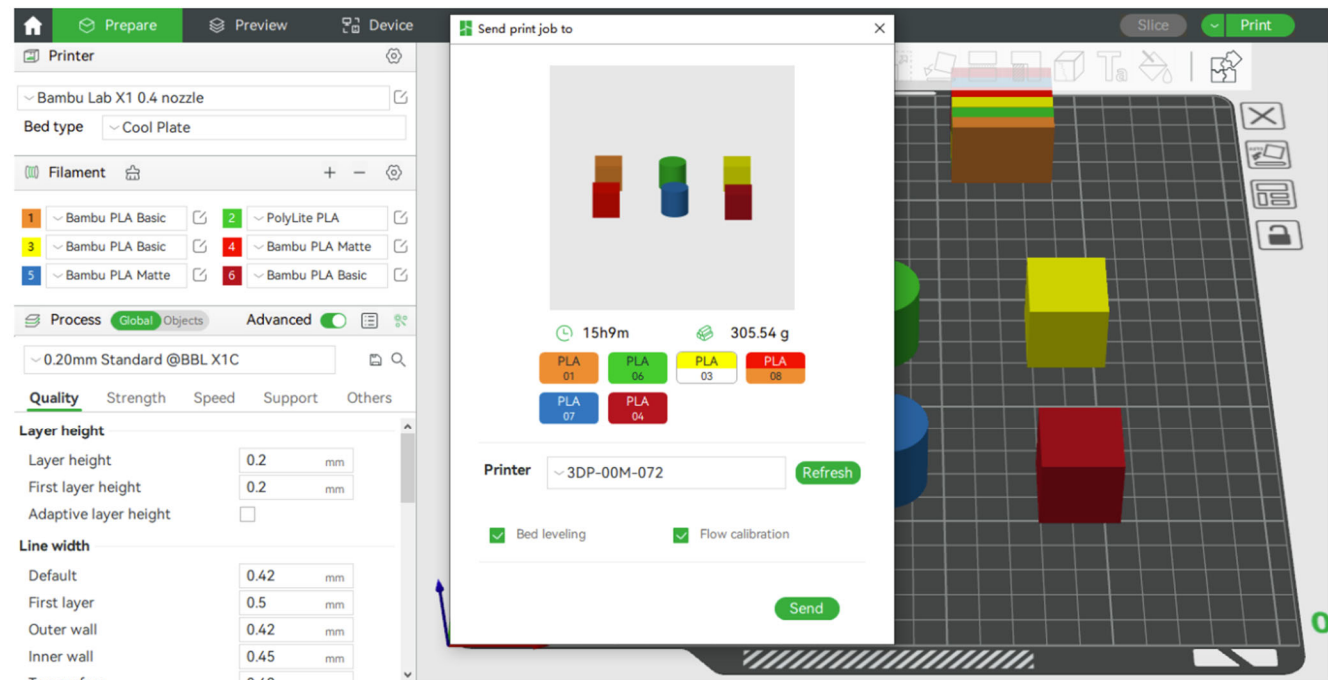
providing the data from the tag to the client over the network, the data including at least one property of the build material;

The Accused Instrumentalities are used to provide the data from the tag to the client over the network, the data including at least one property of the build material.

The data from the RFID tag is provided to Bambu Studio, which is coupled to the 3D printers via a network connection. The data includes various properties of the build material, including for example type and color of the build material.

Automatic mapping function

When you send a multi-color print task in the slicer, the model is automatically matched to the closest color filament in the AMS slots. You can also customize the filaments in the window.



<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

“Load filaments to AMS and configure filament information

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

	<p>Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to AMS setup and loading filament.”</p> <p>https://wiki.bambulab.com/en/x1/manual/multi-color-printing</p> <p>Also, see:</p> <p>“Bambu Studio AMS mapping</p> <p>Bambu Studio will do AMS mapping (matching the filament type and color) to the current print job. The above part of the AMS mapping widget is the source color and type for the current project and the bottom part is the target index and color of the AMS slot.”</p>
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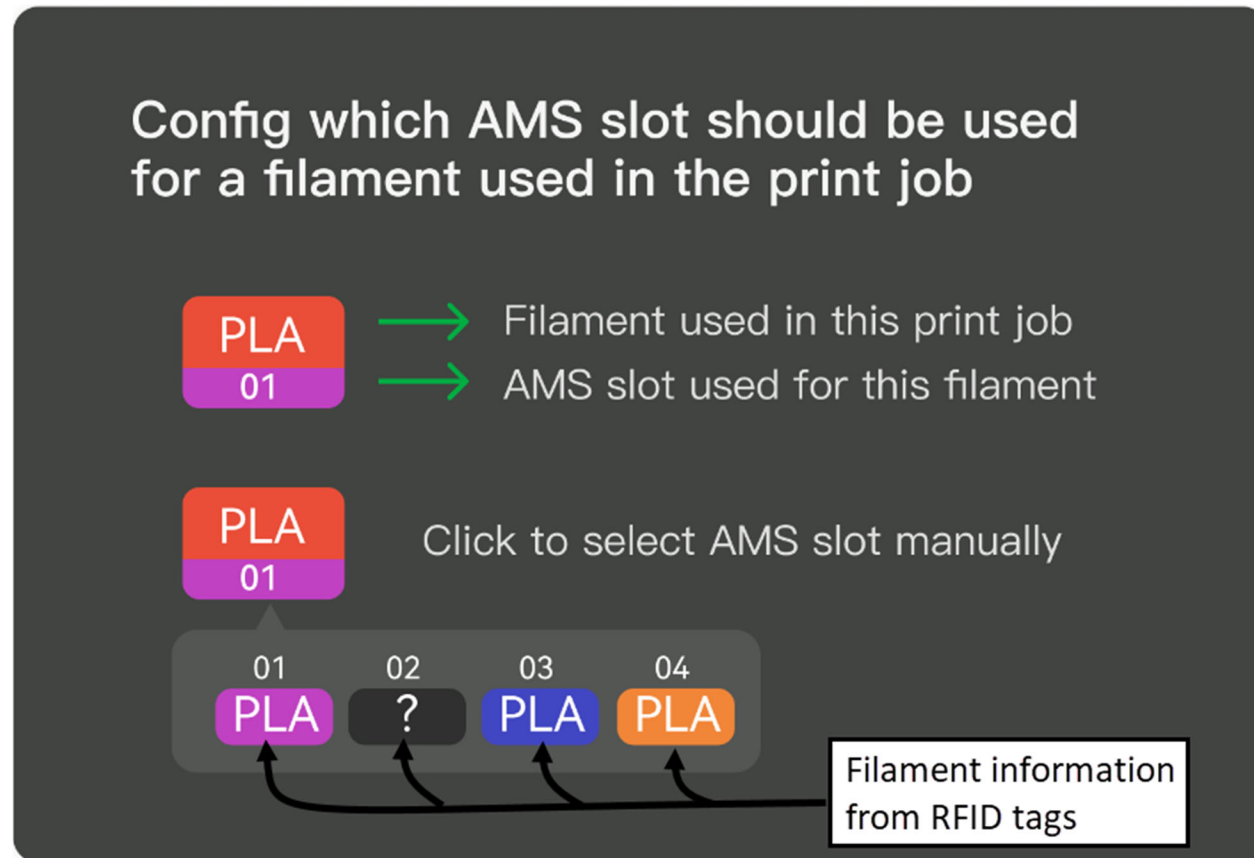
Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

The screenshot displays the Bambu Studio interface. On the left, the 'Printer' settings panel is visible, showing 'Bambu Lab X1 0.4 nozzle' and 'Cool Plate' bed type. The 'Filament' section is highlighted with a red box, showing five slots, each with 'Bambu PLA Basic' selected. Below this, the 'Process' tab is active, showing '0.20mm Standard @BBL X1C' and various settings for Layer height, Line width, and Quality. On the right, the 'Send and Print' dialog box is open, showing a preview of three Minion figurines. Below the preview, the estimated time is '1d5h53m' and weight is '679.68 g'. A red box highlights the filament selection area, showing 'PLA 02', 'PLA 04', 'PLA 01', and 'PLA 03' buttons. A red arrow points from the filament selection area in the 'Send and Print' dialog to the filament selection area in the 'Printer' settings panel. Below the filament selection, there is a message: 'Please click each filament above to specify its mapping AMS slot before sending the print job'. The 'Printer' dropdown shows '3DP-00W-014' with a 'Refresh' button. Checkmarks are shown for 'Bed leveling', 'Flow calibration', 'Timelapse', and 'Enable AMS'. A link 'Can't connect to the printer' with a question mark icon is present. A 'Print' button is at the bottom right.

<https://wiki.bambulab.com/en/software/bambu-studio/use-ams-on-bambu-studio>

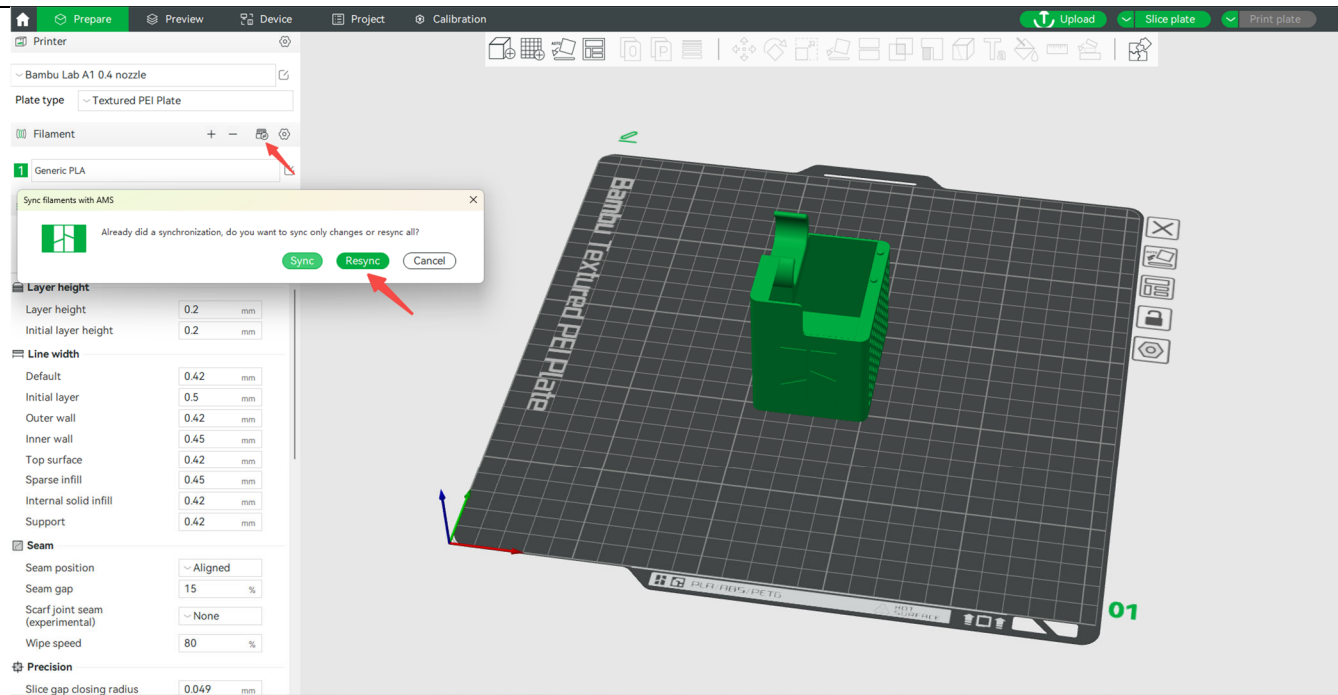
Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

The following annotated image from <https://wiki.bambulab.com/en/ams/manual/ams-function-introduction> shows the filament properties from the filaments in the different slots of the AMS being displayed to the user:



The filament information can also be manually synchronized:

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<https://wiki.bambulab.com/en/software/bambu-studio/use-ams-on-bambu-studio>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

receiving one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag; and

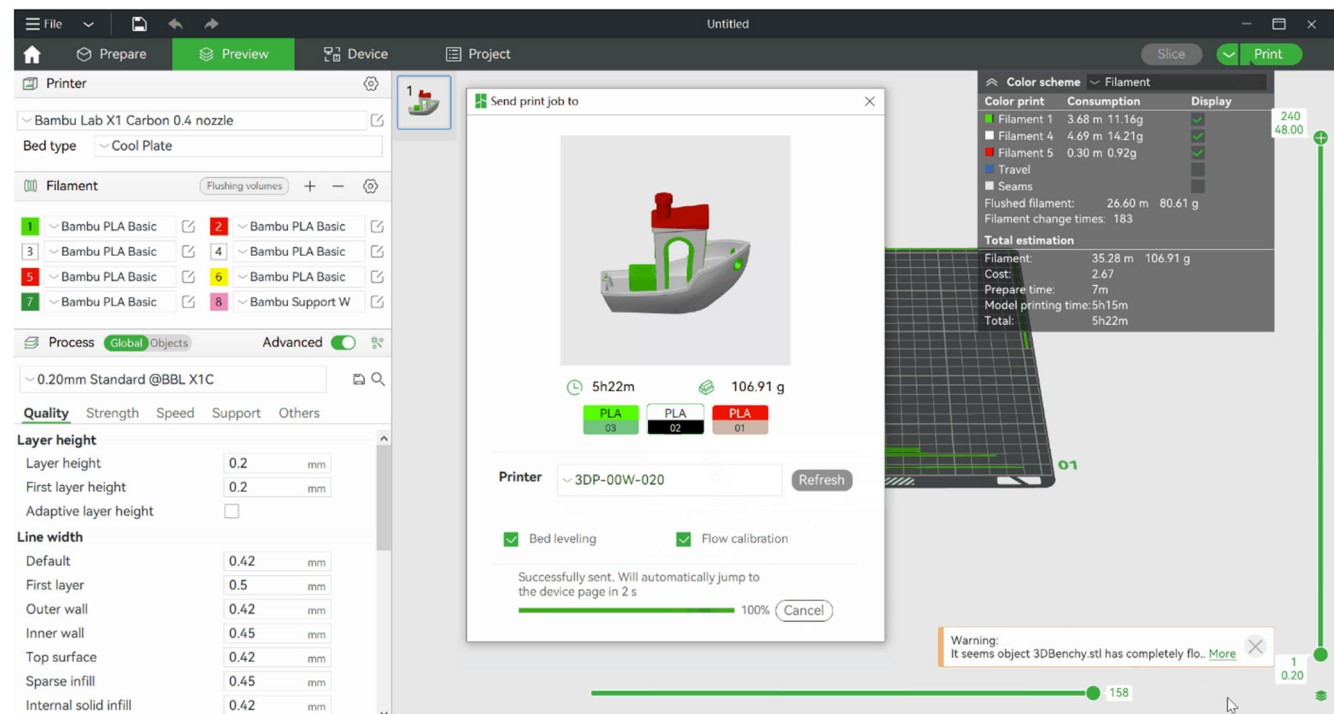
The Accused Instrumentalities are used to receive one or more operational parameters from the client selected for use in controlling operation of the three-dimensional printer when fabricating the object with the build material having the at least one property stored in the tag.

Bambu Studio can be used to initiate a build, based on the data received from the data tag (e.g., the type and color of build materials to use in the build), and send fabrication instructions back to the printer to fabricate the object based on the type and color of build materials (i.e., properties stored in the tag).

Main Feature Introduction

Remote Printing

After we have finished slicing, we can send the result to the printer for printing. In the print dialog, we can select which printer to use, and we can also choose the filaments in the AMS.



<https://wiki.bambulab.com/en/software/bambu-studio/remote-control>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

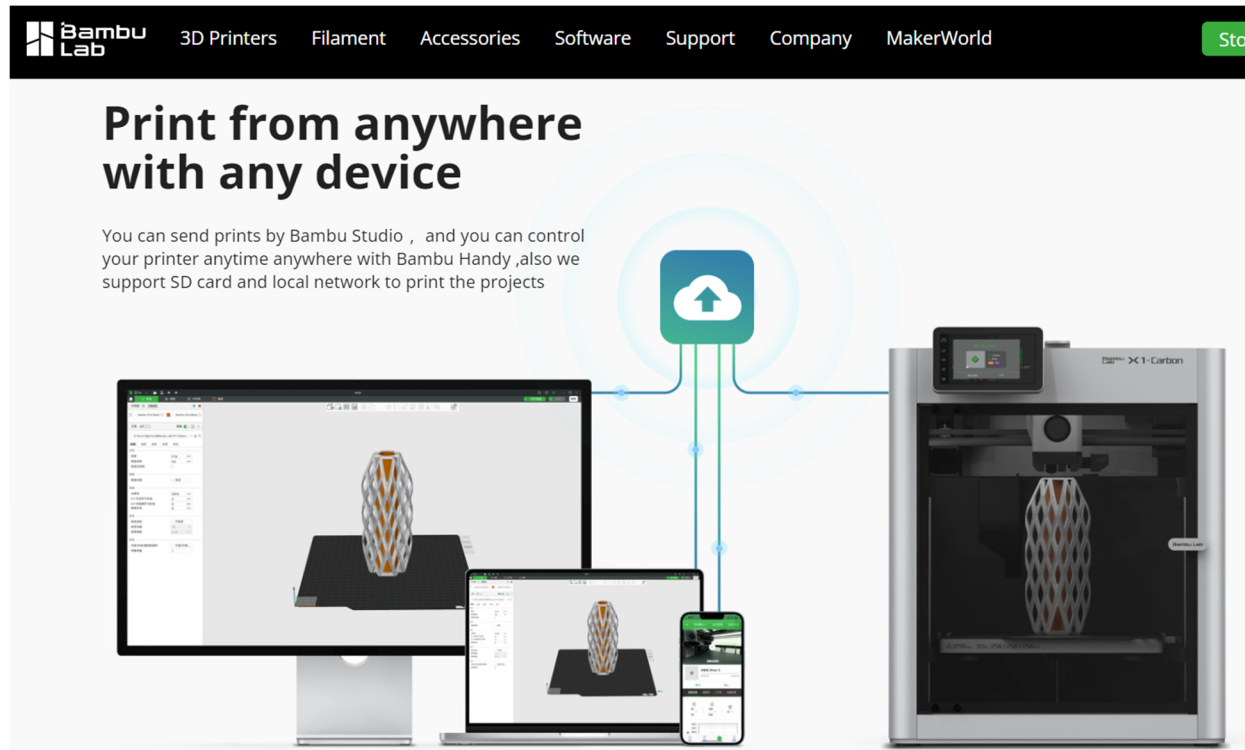
	<p>See also https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio (X1 series guide explaining printing from Bambu Studio); https://wiki.bambulab.com/en/a1/manual/first-print-with-ams-lite (A1 series guide explaining printing from Bambu Studio); https://wiki.bambulab.com/en/a1-mini/manual/first-print-with-ams-lite (A1 mini series guide explaining printing from Bambu Studio); https://wiki.bambulab.com/en/p1/manual/print-from-bambu-studio (P1 series guide explaining printing from Bambu Studio).</p>
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fabricating the object with the build material according to the one or more operational parameters.

The Accused Instrumentalities are used to fabricate the object with the build material according to the one or more operational parameters.

The Bambu Lab printers then fabricate the object according to the instructions received from Bambu Studio.



<https://bambulab.com/en/x1>

See, e.g., <https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio> (X1 series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/a1/manual/first-print-with-ams-lite> (A1 series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/a1-mini/manual/first-print-with-ams-lite> (A1 mini series guide explaining printing from Bambu Studio);

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<https://wiki.bambulab.com/en/p1/manual/print-from-bambu-studio> (P1 series guide explaining printing from Bambu Studio).

“How does X1 work?

The X1 3D printer is a machine that uses plastic filament as the material for creating 3D objects.

Most of the time, the printable objects are files with the .stl extension that hold the 3D model which needs to be processed before it's ready to be printed with a piece of software called a slicer.

The slicer, in our case the Bambu Lab Studio, takes that .stl file and slices it into layers which are then printed by the X1. All these slices are then converted into code, a type of language which tells the machine how to move its axis to print the model.

Besides the movement, the slicer is also able to integrate various other settings inside the generated file, like the temperatures of the filament, printing speeds, and generate supports for some sections of the print.”

<https://wiki.bambulab.com/en/x1/manual/intro-x1>

““How does the P1 series work?

The Bambu Lab P1 inherits the X1 series' renowned kinematics and motion control technology and the wealth of sensors that ensure its reliability. It can connect the automatic material system (AMS) for multi-color printing. Great for beginners, professionals, or others who enjoy the fun of being creative, the P1P has been designed for easy setup and use in minutes. Additionally, it allows upgrading and customizing hardware with mod-friendly features for people to enjoy the fun of making their one-of-a-kind 3D printer.”

<https://wiki.bambulab.com/en/p1/manual/intro-p1p>

“How does the A1 work?

The A1 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 typically involves the following steps:

Creation or acquisition of a digital model

First, generate a 3D model or obtain an existing digital model using computer-aided design software, online resources, or other means.

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Slicing

Next, Bambu Studio slices the digital model into multiple thin layers. Each layer's information is converted into "G-code," a language understood by the printer. The G-code provides instructions to the printer regarding movement paths and speeds of the different axes during the printing process.

Preparing the printer

Before initiating the printing process, the printer needs to be prepared. This involves loading the printing filament, positioning the build plate, and calibrating the printer's parameters to ensure optimal print quality.

Printing

Once all preparations are complete, the A1 printer gradually constructs the object layer by layer on the print platform.”

<https://wiki.bambulab.com/en/a1/manual/intro-a1>

“How does the A1 mini work?

The A1 mini 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 mini typically involves the following steps:

Creation or acquisition of a digital model:

First, you need to create a 3D model or acquire an existing digital model. This can be done through computer-aided design software, online resources, or other sources.

Slicing

Next, Bambu Studio slices the digital model into multiple thin layers. The information for each layer is automatically converted into a language that the printer can understand, known as "G-code." This code instructs the printer on the movement paths and speeds of the various axes during the printing process.

Preparing the printer

Before starting the printing process, you must prepare the printer. This includes loading the printing filament, placing the build plate, and calibrating the printer's parameters to ensure print quality.

Printing

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

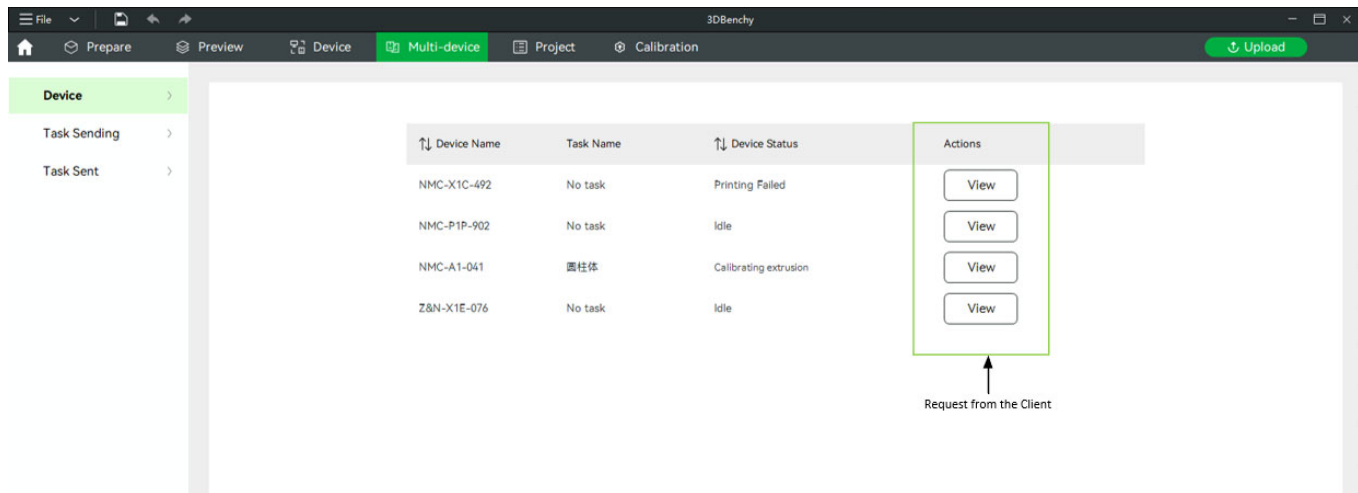
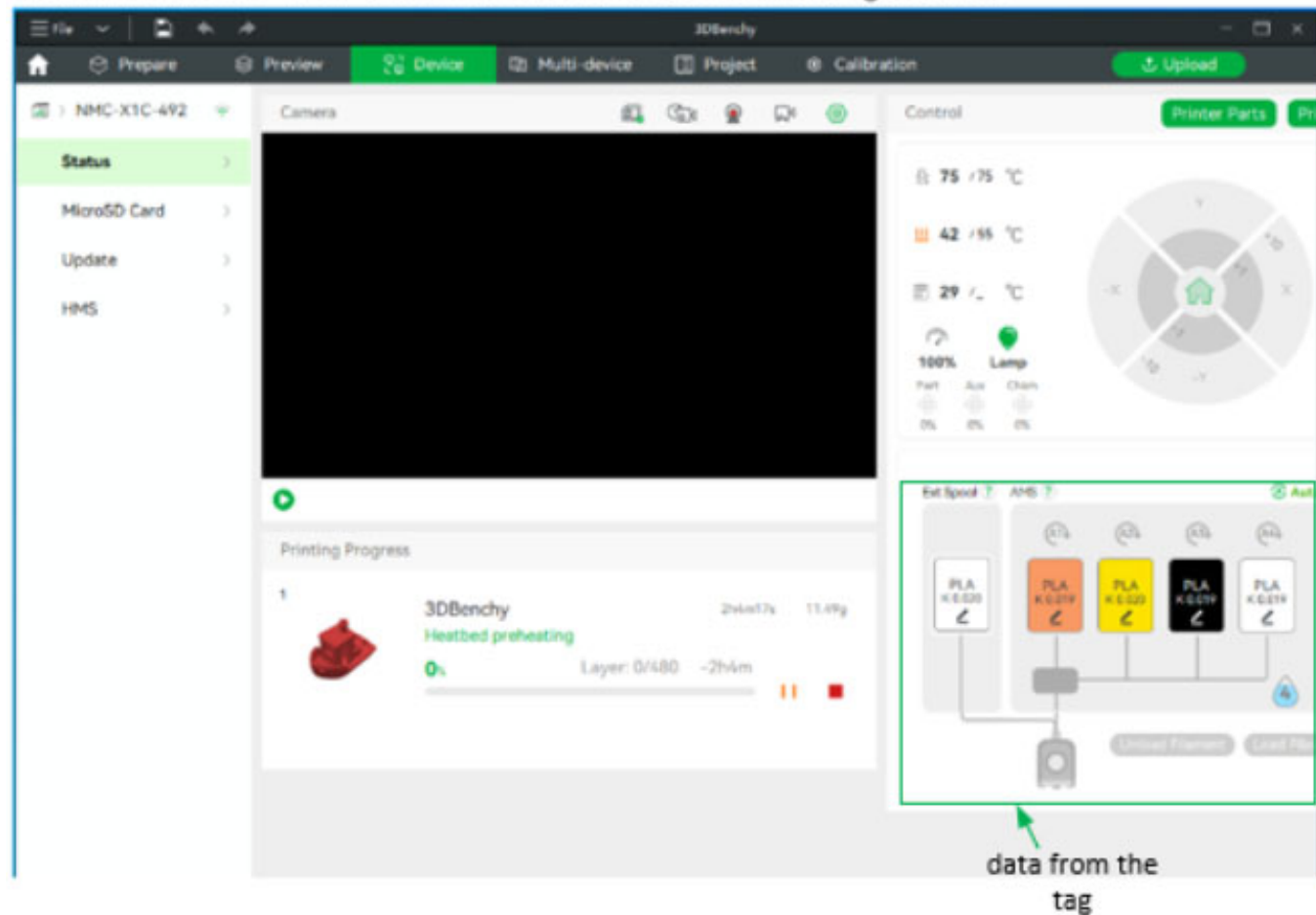
	<p>Once everything is prepared, the A1 mini gradually prints layer by layer onto the print platform, gradually building the object.”</p> <p>https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini</p>
2. The method of claim 1, further comprising receiving a request from the client for the data from the tag.	<p>The Accused Instrumentalities are used to receive a request from the client for the data from the tag.</p> <p>Bambu Studio requests information from the Bambu 3D printer about what filaments have been detected by the printer in the AMS of the printer from reading the RFID tag of each filament spool in the AMS. For example, this information can be requested by viewing the device status of a 3D printer in Bambu Studio:</p>  <p>https://wiki.bambulab.com/en/software/bambu-studio/multi-device-management (annotated)</p>

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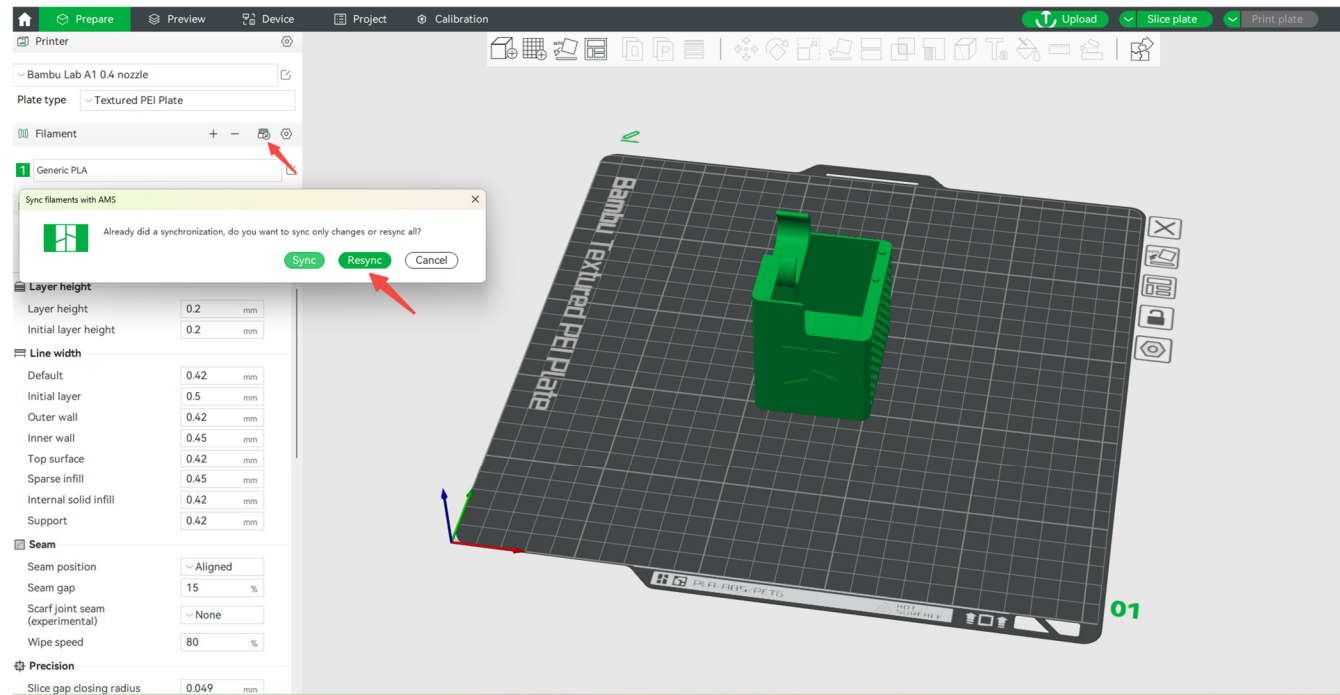
You can click the "View" button to check the status of a single device.



<https://wiki.bambulab.com/en/software/bambu-studio/multi-device-management>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Also, the filament information can also be manually synchronized:



<https://wiki.bambulab.com/en/software/bambu-studio/use-ams-on-bambu-studio>

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3. The method of claim 1, wherein the three-dimensional printer is coupled to a first supply of a first build material and a second supply of a second build material different from the first build material, the first supply including a first tag that stores at least one property of the first build material, and the second supply including a second tag that stores at least one property of the second build material.

For each of the Accused Instrumentalities, the three-dimensional printer is coupled to a first supply of a first build material and a second supply of a second build material different from the first build material, the first supply including a first tag that stores at least one property of the first build material, and the second supply including a second tag that stores at least one property of the second build material.

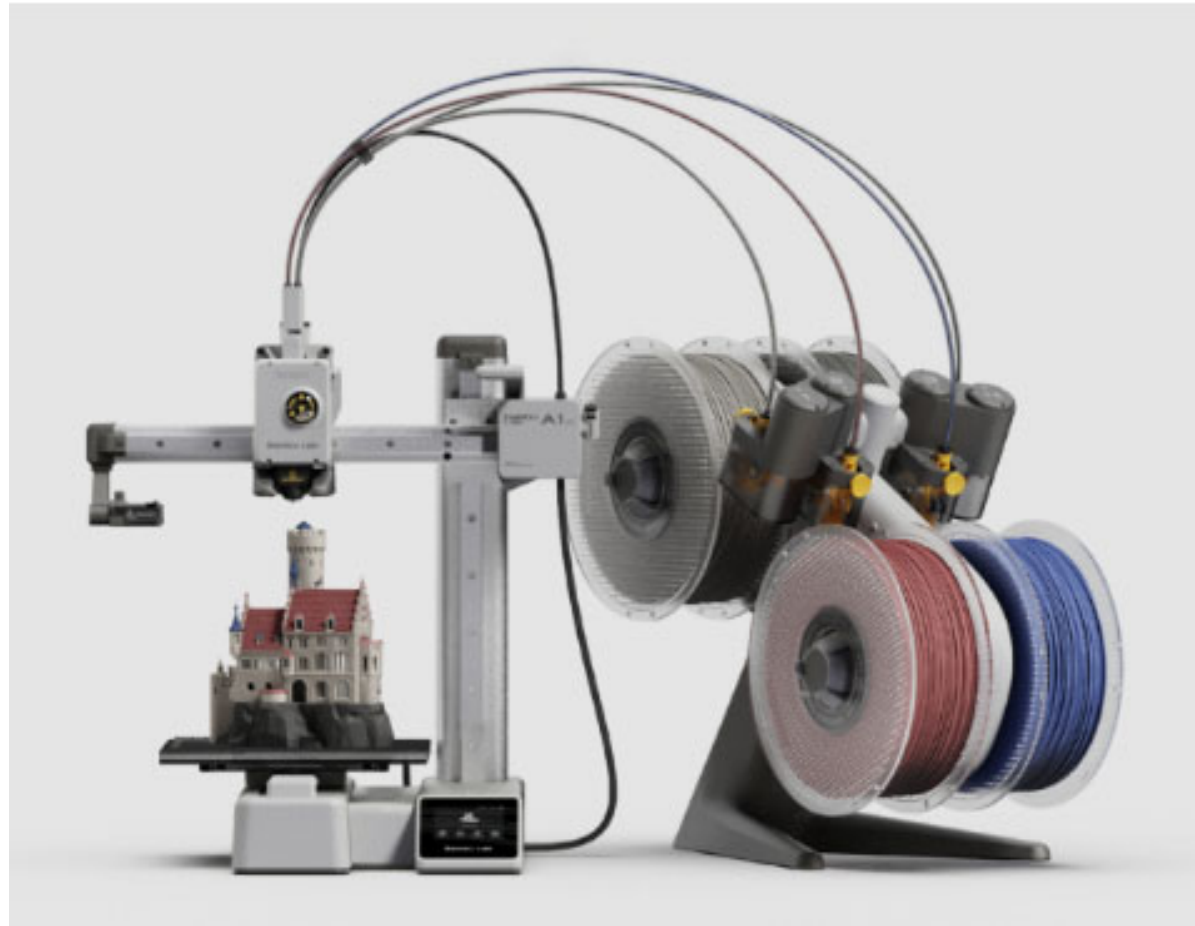
The Bambu 3D X1C, X1E, P1P and P1S printers are designed to be coupled to the AMS. The AMS has four bays, each of which couples a filament spool to the printer. The spool in each bay can have a different filament material and/or filament color.



<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

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The Bambu A1 and A1 Mini are designed to be coupled to the AMS Lite. The AMS Lite has four spool holders, each of which couples a filament spool to the printer. The spool in each spool holder can have a different filament material and/or filament color.



<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

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As noted for claim 1, each filament spool (which can be used in the AMS and the AMS Lite) has an RFID tag that identifies at least the filament material type and filament color:

RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

“Load filaments to AMS and configure filament information

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to [AMS setup and loading filament.](#)
<https://wiki.bambulab.com/en/x1/manual/multi-color-printing>

Reading RFID

Bambu's official filament roll has RFID tags on both sides, and on AMS there are two RFID-reading circuit boards that can read the filament information.

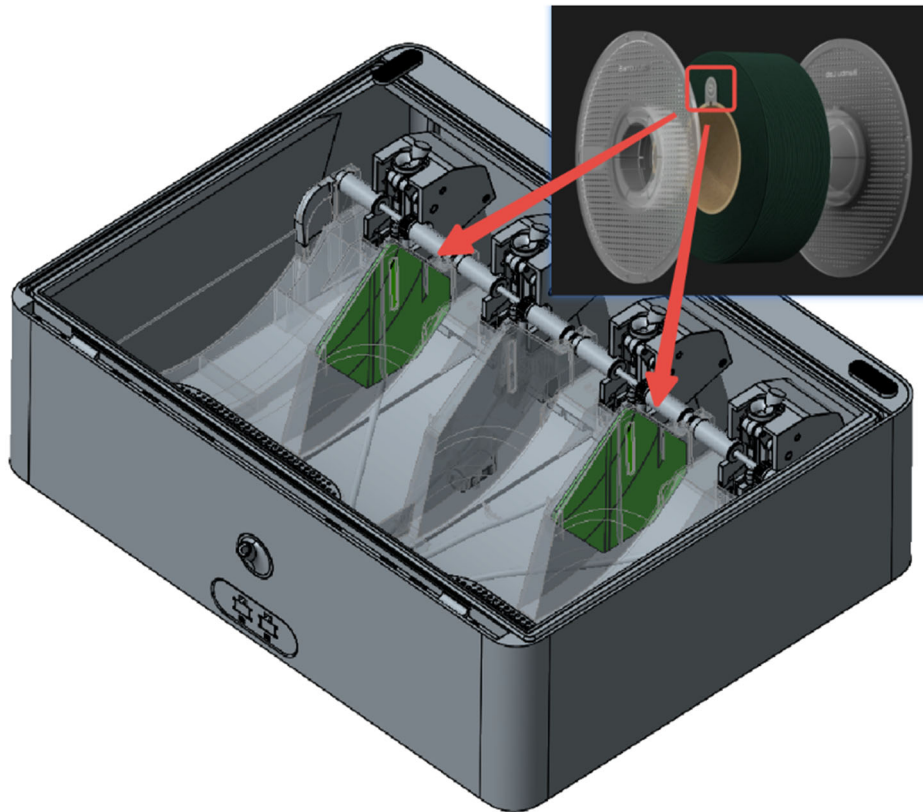


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When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.



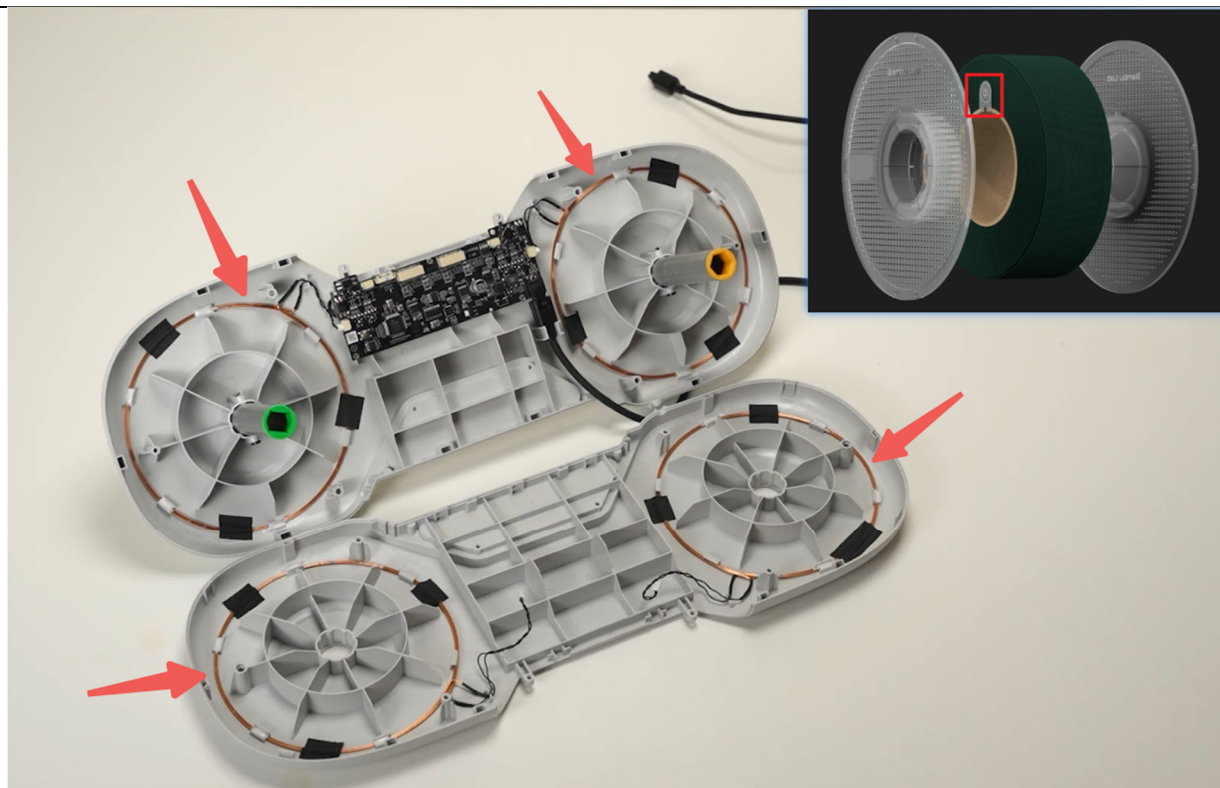
When the filament in a slot has been sent out to AMS, or the extruder detects that there is a filament inside, the RFID reading function cannot be used. Click to read will show that AMS is busy and cannot read the filament information.

<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466



RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

		<div><div>×</div><div><div>AMS Settings</div><div><div><div>✓ Insertion update</div><div>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds. Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</div></div><div><div>✓ Update on startup</div><div>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute.The reading process will rotate the filament spools.</div></div><div><div>✓ AMS filament backup</div><div>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</div></div><div></div></div></div></div>	
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

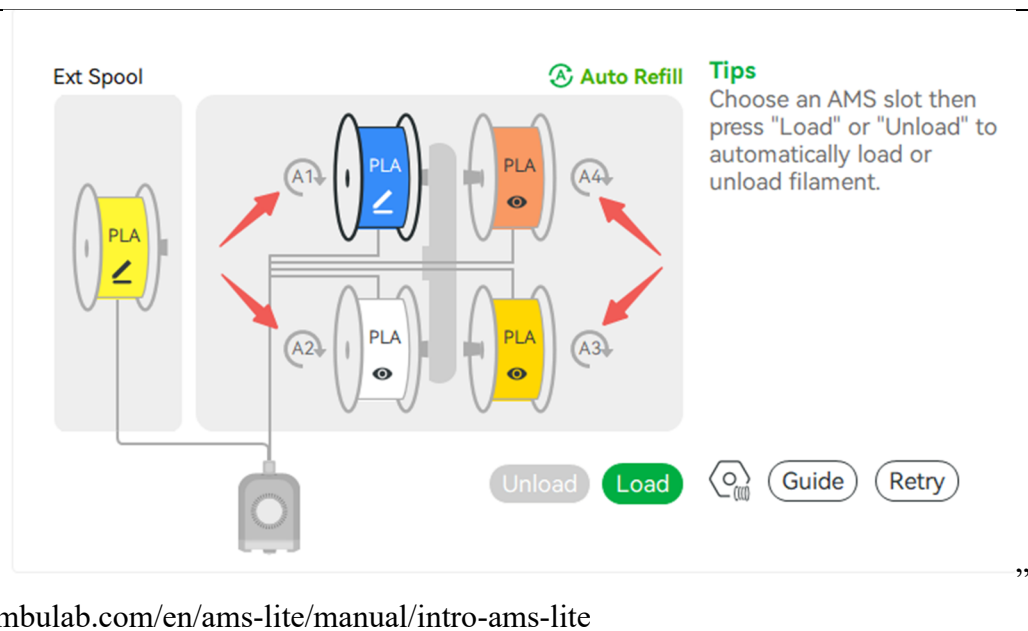


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

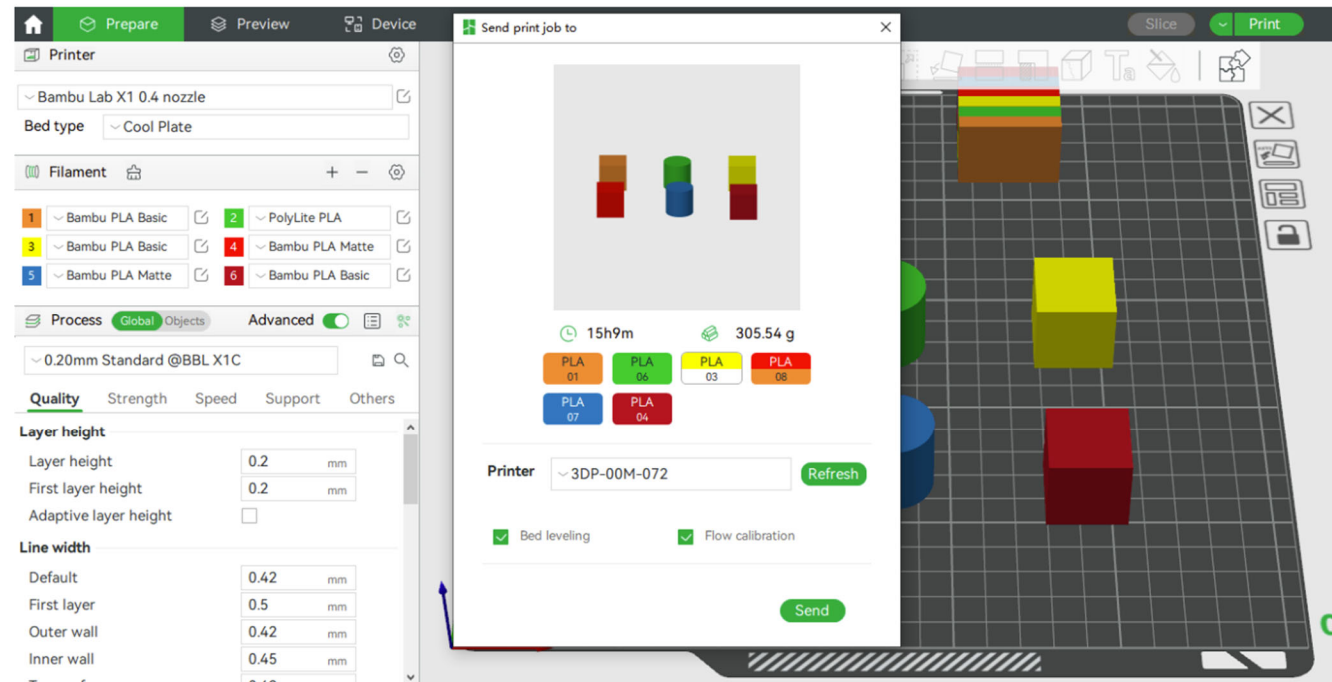
4. The method of claim 3, further comprising providing data from the first tag and the second tag to the client over the network, the data including at least one property of the first build material and the second build material.

The Accused Instrumentalities are each used to provide data from the first tag and the second tag to the client over the network, the data including at least one property of the first build material and the second build material.

The data from the RFID tags is provided to Bambu Studio, which is coupled to the 3D printer via a network connection. The data includes various properties of the build material, for example the type and color of the build material.

Automatic mapping function

When you send a multi-color print task in the slicer, the model is automatically matched to the closest color filament in the AMS slots. You can also customize the filaments in the window.



<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

“Load filaments to AMS and configure filament information

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to [AMS setup and loading filament.](#)”

<https://wiki.bambulab.com/en/x1/manual/multi-color-printing>

The following annotated image from <https://wiki.bambulab.com/en/ams/manual/ams-function-introduction> shows the filament properties from the filaments in the different slots of the AMS being displayed to the user:

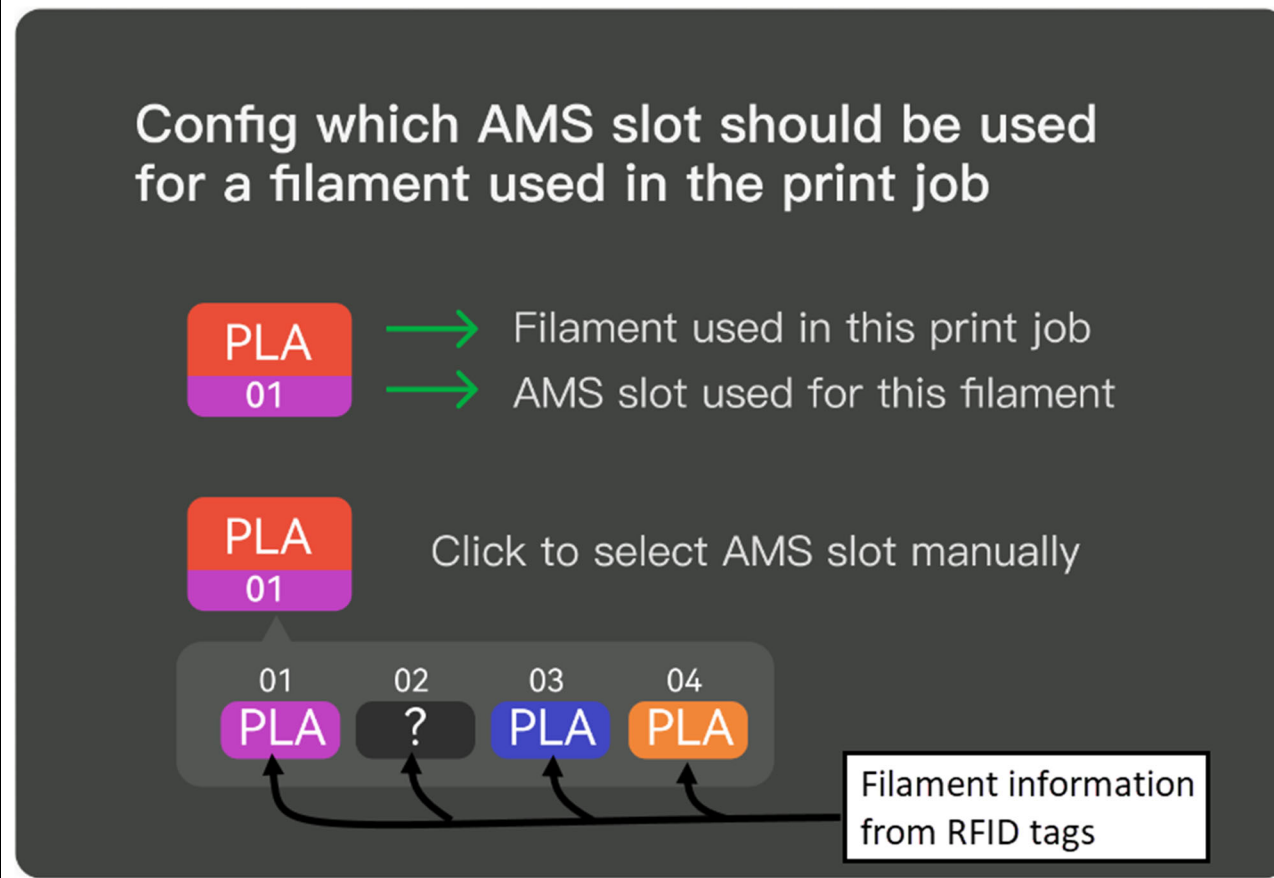


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

5. The method of claim 4, further comprising receiving a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer.

The Accused Instrumentalities are each used to receive a selection of one of the first build material and the second build material from the client for use in fabricating the object using the three-dimensional printer.

Bambu Studio offers various ways of selecting of the materials for fabrication of objects:

Select filament for objects/parts in the object list on the left sidebar

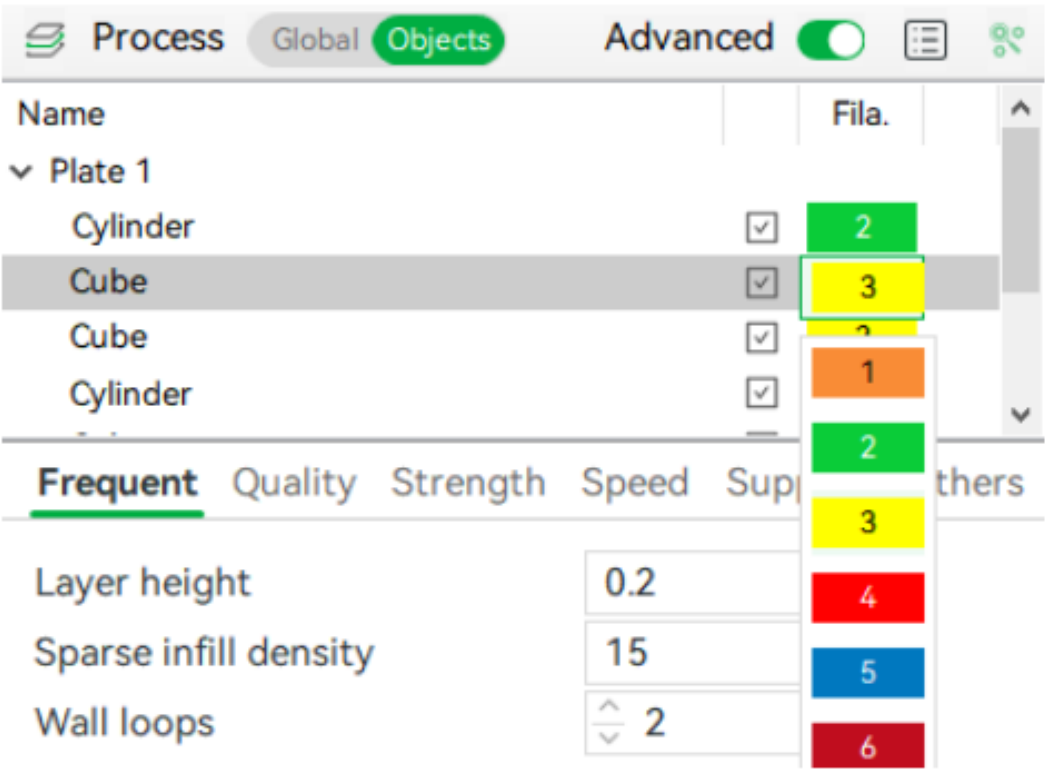
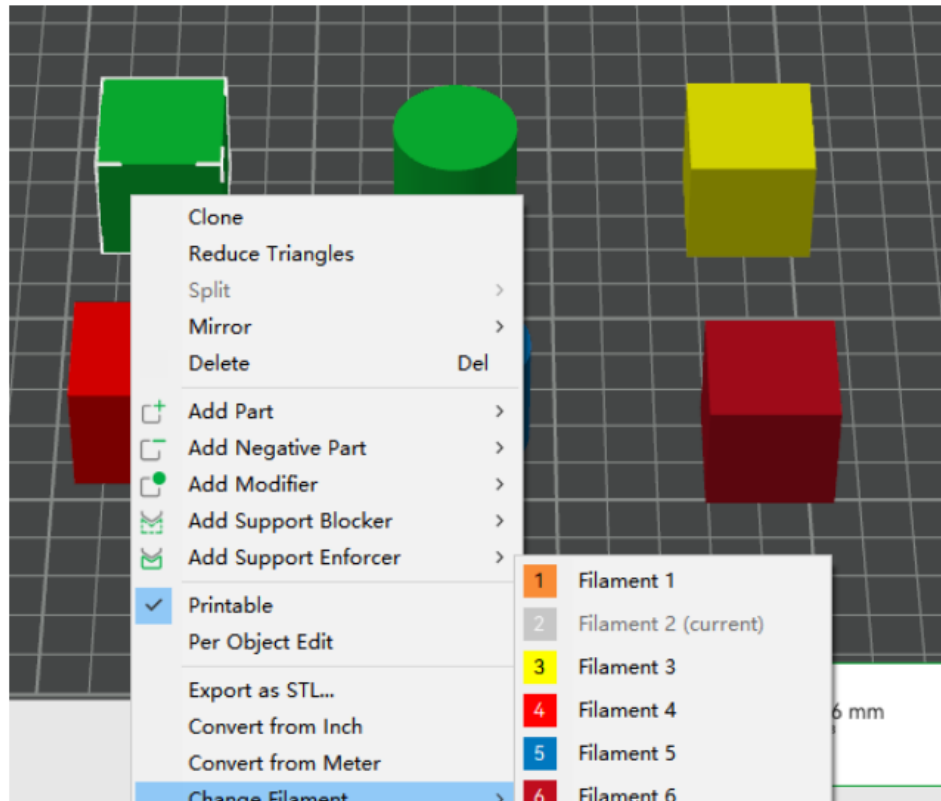


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Right click target object/part and select filament from the context menu



Select the object, and use the shortcut key 1-9 to bind the corresponding filament to selected objects/parts

“In Filament [sic] block, you can complete all filament management tasks:

- **Add a filament**

Click the  button to add a new filament to the project. The newly added filament will be appended to filament list.

- **Delete a filament**

Click the  button to remove the last (with the largest index).

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

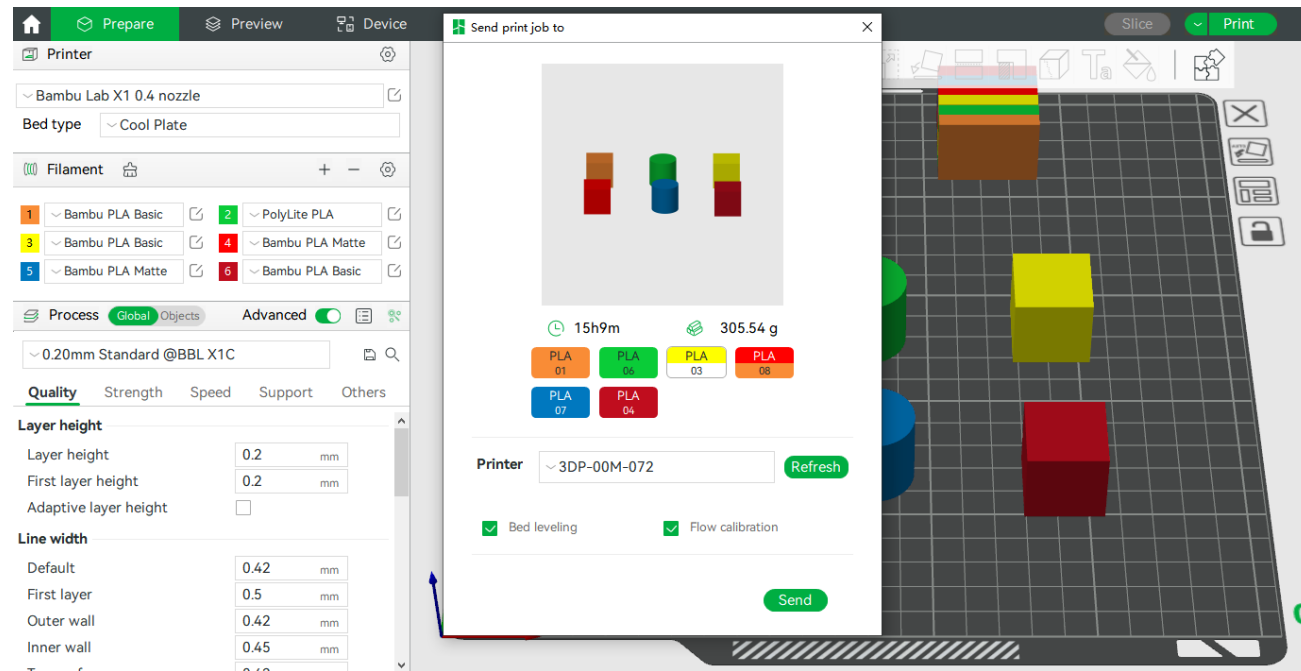
- **Set colors/types of filaments**

Set the filament type and color for each filament. When a printer is connected, you may quickly copy the color&type from an AMS slot.”

“Print Multi-Color Model

When printing with AMS, the filament list in the sliced project does not necessarily need to be exactly the same as the AMS filament list.

When sending the print task, the filament mapping from the slice project to AMS is automatically built according to the color and material type (PLA/ABS/PC...)



The automatic mapping matches filament with the same type and similar color. Normally, you don't need to modify anything. But if you are not satisfied with the result of the automatic mapping, then modify it manually.”

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

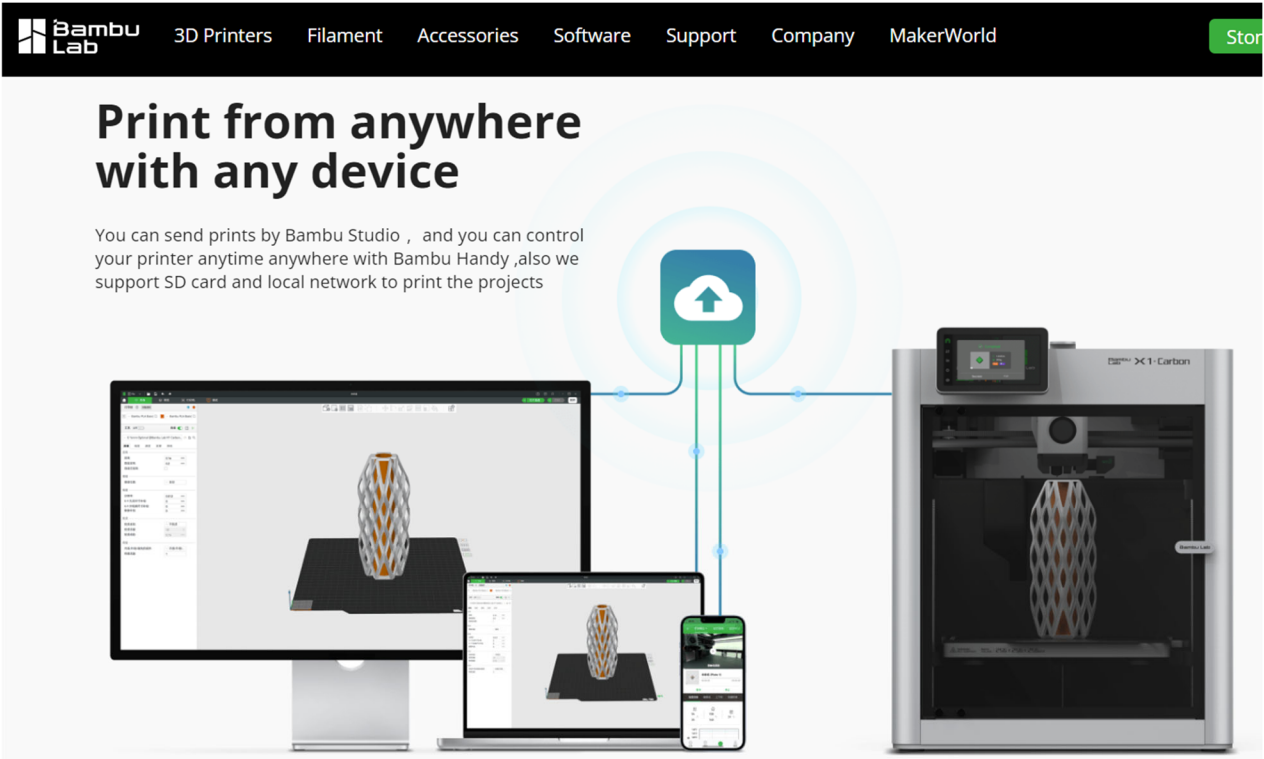
<p>7. The method of claim 1, further comprising fabricating the object with the three-dimensional printer based upon the one or more operational parameters received from the client.</p>	<p>https://wiki.bambulab.com/en/software/bambu-studio/multi-color-printing</p> <p>The Accused Instrumentalities are used to fabricate the object with the three-dimensional printer based upon the one or more operational parameters received from the client.</p> <p>The Bambu Lab printers then fabricate the object according to the instructions (operational parameters) received from Bambu Studio.</p>  <p>https://wiki.bambulab.com/en/x1/</p> <p>See also, https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio</p>
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Printing from Bambu Studio

When printing with Bambu Studio, it's possible to send the sliced files directly to the printer via Wi-Fi. Here's how to do it:

Import the 3D model you want to slice, and after adjusting the settings, click on the Slice button

After the model has been sliced, click on the Print button.

A window will show up where the printer can be selected, and the calibration options can be enabled or disabled.

When ready to print, simply click the Send button, and the file will be sent to the printer.

<https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio>

See, e.g., <https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio> (X1 series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/a1/manual/first-print-with-ams-lite> (A1 series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/a1-mini/manual/first-print-with-ams-lite> (A1 mini series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/p1/manual/print-from-bambu-studio> (P1 series guide explaining printing from Bambu Studio).

“How does X1 work?

The X1 3D printer is a machine that uses plastic filament as the material for creating 3D objects.

Most of the time, the printable objects are files with the .stl extension that hold the 3D model which needs to be processed before it's ready to be printed with a piece of software called a slicer.

The slicer, in our case the Bambu Lab Studio, takes that .stl file and slices it into layers which are then printed by the X1. All these slices are then converted into code, a type of language which tells the machine how to move its axis to print the model.

Besides the movement, the slicer is also able to integrate various other settings inside the generated file, like the temperatures of the filament, printing speeds, and generate supports for some sections of the print.”

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

<https://wiki.bambulab.com/en/x1/manual/intro-x1>

““How does the P1 series work?

The Bambu Lab P1 inherits the X1 series' renowned kinematics and motion control technology and the wealth of sensors that ensure its reliability. It can connect the automatic material system (AMS) for multi-color printing. Great for beginners, professionals, or others who enjoy the fun of being creative, the P1P has been designed for easy setup and use in minutes. Additionally, it allows upgrading and customizing hardware with mod-friendly features for people to enjoy the fun of making their one-of-a-kind 3D printer.”

<https://wiki.bambulab.com/en/p1/manual/intro-p1p>

“How does the A1 work?

The A1 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 typically involves the following steps:

Creation or acquisition of a digital model

First, generate a 3D model or obtain an existing digital model using computer-aided design software, online resources, or other means.

Slicing

Next, Bambu Studio slices the digital model into multiple thin layers. Each layer's information is converted into "G-code," a language understood by the printer. The G-code provides instructions to the printer regarding movement paths and speeds of the different axes during the printing process.

Preparing the printer

Before initiating the printing process, the printer needs to be prepared. This involves loading the printing filament, positioning the build plate, and calibrating the printer's parameters to ensure optimal print quality.

Printing

Once all preparations are complete, the A1 printer gradually constructs the object layer by layer on the print platform.”

<https://wiki.bambulab.com/en/a1/manual/intro-a1>

“How does the A1 mini work?

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

	<p>The A1 mini 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 mini typically involves the following steps:</p> <p>Creation or acquisition of a digital model: First, you need to create a 3D model or acquire an existing digital model. This can be done through computer-aided design software, online resources, or other sources.</p> <p>Slicing Next, Bambu Studio slices the digital model into multiple thin layers. The information for each layer is automatically converted into a language that the printer can understand, known as "G-code." This code instructs the printer on the movement paths and speeds of the various axes during the printing process.</p> <p>Preparing the printer Before starting the printing process, you must prepare the printer. This includes loading the printing filament, placing the build plate, and calibrating the printer's parameters to ensure print quality.</p> <p>Printing Once everything is prepared, the A1 mini gradually prints layer by layer onto the print platform, gradually building the object.” https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini</p>
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

8. The method of claim 1, wherein the tag includes at least one of a radio frequency identification (RFID) tag, an optically-identifiable tag, a magnetically-identifiable tag, and a mechanical feature of the supply.

The tag of the Accused Instrumentalities includes at least one of a radio frequency identification (RFID) tag, an optically-identifiable tag, a magnetically-identifiable tag, and a mechanical feature of the supply.

As noted for claim 1, the tag in each of the filament spools is a radio frequency identification (RFID) tag.

RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

	<p>Automatic Filament Identification</p> <p>Bambu Lab filaments use RFID which is read by the AMS to automatically identify and apply the best settings for your material.</p> <p>The RFID tag is synchronized automatically to Bambu Studio.</p> <p>https://us.store.bambulab.com/products/ams-multicolor-printing</p>
9. The method of claim 1, wherein the data includes at least one of a material identification number, a build material type, a build material diameter, an extruder temperature requirement, a build material melting temperature, a build material color, a build material color lot number, a cost per unit of build material, a build material density, a build material tensile strength, a build material viscosity, a build material recycle code, and a build material expiration date.	<p>In the Accused Instrumentalities, the data includes at least one of a material identification number, a build material type, a build material diameter, an extruder temperature requirement, a build material melting temperature, a build material color, a build material color lot number, a cost per unit of build material, a build material density, a build material tensile strength, a build material viscosity, a build material recycle code, and a build material expiration date.</p> <p>According to https://github.com/Bambu-Research-Group/RFID-Tag-Guide, the RFID tags used in the Bambu filament spools are MiFare tags that include blocks of data:</p> <p>MiFare tags also contain "Blocks" of data. Each block contains info about the spool, such as Material, Color, Manufacturing Date, etc. See Tag structure section for details</p>

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number, a cost per unit of build material, a build material density, a build material tensile strength, a build material viscosity, a build material recycle code, and a build material expiration date.

The blocks of data include the following data:

Block Overview

Summary of what kind of data is stored in each block. Detailed info for each block is documented below.

sec	blk	Data
0	0	Block 0 UID and Tag Manufacturer Data
0	1	Block 1 Tray Info Index
0	2	Block 2 Filament Type
0	3	Block 3 MIFARE encryption keys, Unrelated to BambuLab
1	0	Block 4 Detailed Filament Type
1	1	Block 5 Spool Weight, Color Code
1	2	Block 6 Min/Max Hotend, Bed Temp, Bed Temp Type, Drying Time, Drying Temp
1	3	Block 7 MIFARE encryption keys, Unrelated to BambuLab
2	0	Block 8 X Cam Info
2	1	Block 9 Tray UID
2	2	Block 10 Unknown
2	3	Block 11 MIFARE encryption keys, Unrelated to BambuLab
3	0	Block 12 Production Date/Time

Block 2

Example Data: AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA

position	length	type	Description
0 (AA)	16	string	Filament Type

Block 4

Example Data: AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA AA

position	length	type	description
0 (AA)	16	string	Detailed Filament Type

Known Values:

- PLA Basic
- PLA Tough
- Support for PLA
- PLA-CF
- PETG Basic

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	Block 5			
	Example Data: AA AA AA AA BB BB __ __ CC CC CC CC __ __ __ __			
	position	length	type	Description
	0 (AA)	4	RGBA	Color in hex RBGA
	4 (BB)	2	uint16 (LE)	Spool Weight in grams (E8 03 --> 1000 g)
	8 (CC)	8	float (LE)	Filament Diameter in millimeters

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Block 6

Example Data: AA AA BB BB CC CC DD DD EE EE FF FF _ _ _ _

position	length	type	Description
0 (AA)	2	uint16 (LE)	Drying Temperature in °C
2 (BB)	2	uint16 (LE)	Drying time in hours
4 (CC)	4	uint16 (LE)	Bed Temperature Type (types unknown)
6 (DD)	2	uint16 (LE)	Bed Temperature in °C
8 (EE)	2	uint16 (LE)	Min Temperature for Hotend in °C
10 (FF)	2	uint16 (LE)	Max Temperature for Hotend in °C

<https://github.com/Bambu-Research-Group/RFID-Tag-Guide>

As annotated above, these blocks of data include UID (material identification number), filament type (build material type and detailed build material type), filament diameter (build material diameter), min/max hot end (extruder) temperature (an extruder temperature requirement), drying temperature (a build material melting temperature), and filament color (build material color).

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<p>10. The method of claim 1, wherein the one or more operational parameters includes at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement.</p>	<p>The one or more operational parameters of the Accused Instrumentalities includes at least one of an extruder temperature, a feed rate, a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement</p> <p>Bambu Studio allows the setting of operational parameters including nozzle temperature (extruder temperature), bed temperature (build platform temperature), aux cooling fan/part cooling fan (cooling requirement):</p> <div data-bbox="598 513 1749 1000"><p>Control printer</p><p>After the printer is selected, we can use the 'Control' widgets in the right panel of the 'Device' Page for the following controls:</p><ul style="list-style-type: none">▸ X/Y/Z/E move▸ Bed temperature▸ Nozzle temperature▸ Lamp▸ Aux Cooling Fan▸ Part Cooling Fan▸ Speed Level</div> <p>https://wiki.bambulab.com/en/software/bambu-studio/remote-control</p>
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Bambu Studio allows the setting of operational parameters including cooling (cooling requirement):

Filament **Cooling** Setting Overrides Advanced

Cooling for specific layer

No cooling for the first layers

Part cooling fan

Min fan speed threshold	Fan speed	<input type="text" value="10"/>	%	Layer time	<input type="text" value="30"/>	s
Max fan speed threshold	Fan speed	<input type="text" value="80"/>	%	Layer time	<input type="text" value="3"/>	s
Keep fan always on	☒					
Slow printing down for better layer cooling	☒					
Force cooling for overhangs and bridges	☒					

Auxiliary part cooling fan

Fan speed %

<https://wiki.bambulab.com/en/software/bambu-studio/auto-cooling>

Bambu Studio allows the setting of operational parameters including flow ratio/flow rate (feed rate):

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Where to change filament flow rate?

Every slicer profile comes with a pre-configured flow ratio set according to the filament used. The Bambu Filaments are tuned and should provide a good surface finish, but when using aftermarket filaments, the flow rate value might need to be changed.

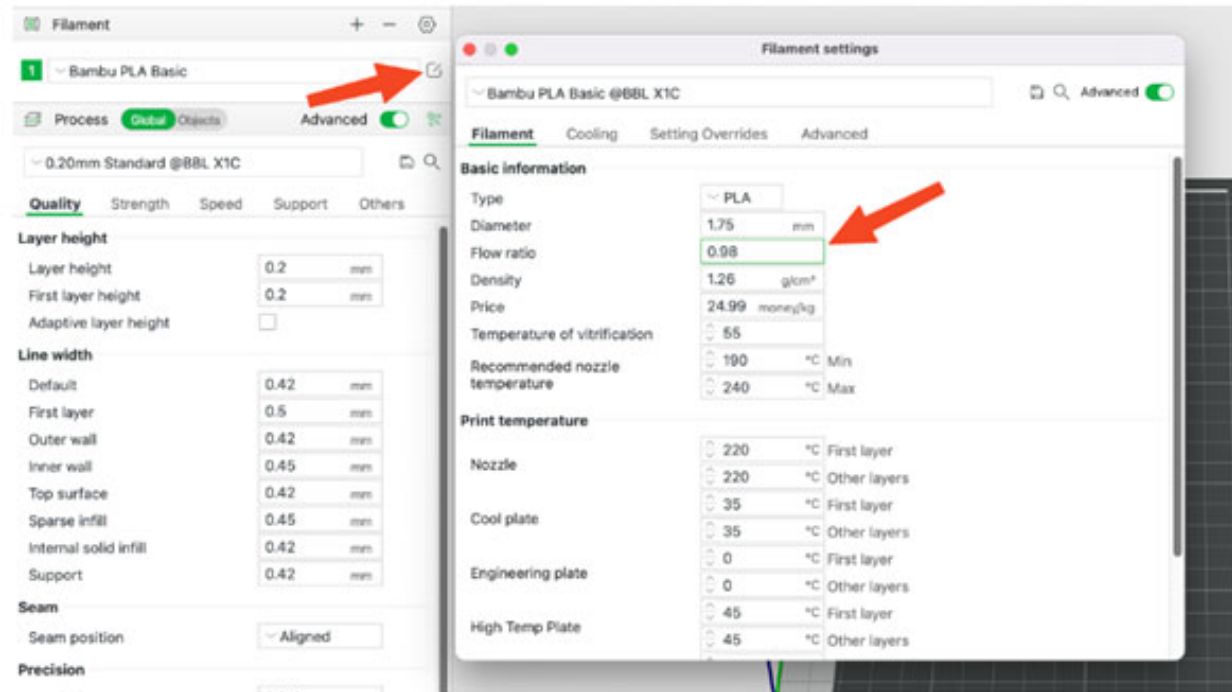
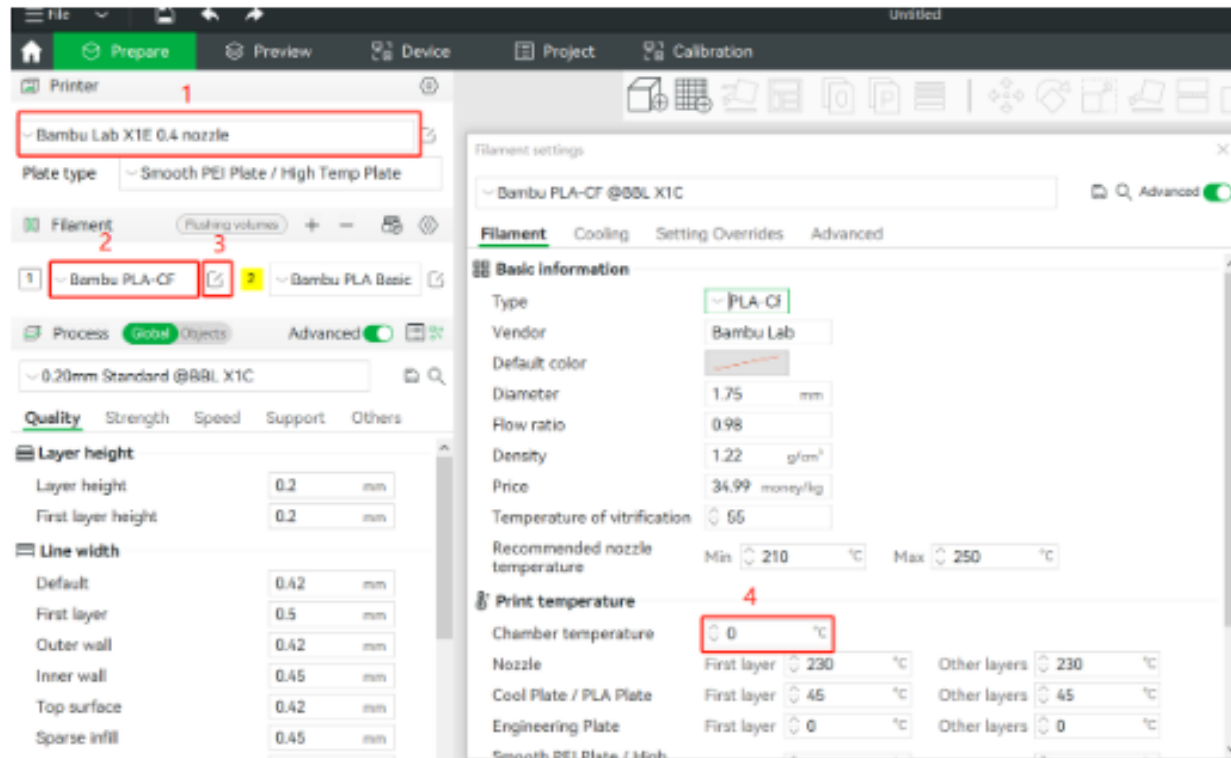


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Bambu Studio allows the setting of operational parameters including chamber temperature (build volume temperature):



<https://wiki.bambulab.com/en/software/bambu-studio/chamber-temperature>

Bambu Studio allows the setting of operational parameters including raft settings (rafting requirement):

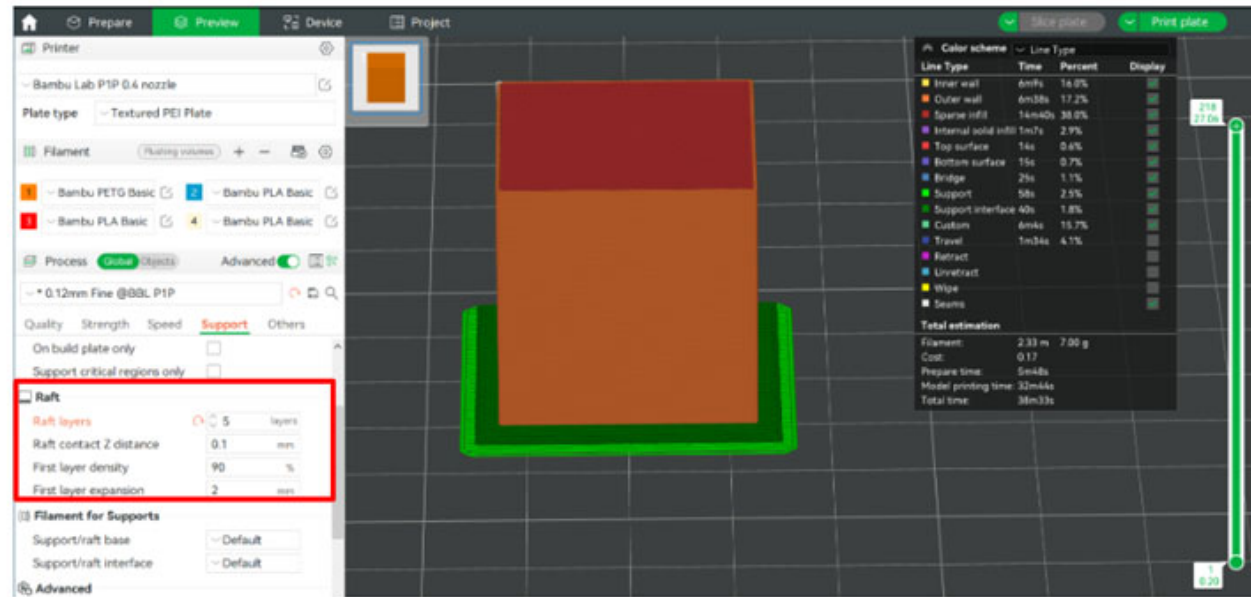
Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Raft is a type of support, which is used to generate support at the bottom of the model to lift it up. Usually, when printing materials such as ABS that are prone to warping, then you can enable the raft.

The raft contact Z distance represents the distance between the top of the raft layer and the model.

The first layer density means the density of the first layer of the raft and the support.

The first layer expansion can be used to expand the first raft and support layer, improving the bed adhesion.



<https://wiki.bambulab.com/en/software/bambu-studio/support>

Bambu Studio allows the setting of operational parameters including support styles (support structure requirement):

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Support styles

Both normal and tree supports have different styles to further adjust the final support structure.

Normal support has two styles:

- **Grid:** the support region is expanded and normalized to rectangles. This is the default style of normal support.
- **Snug:** the support region is NOT expanded, but tightly aligned with the overhang areas. This style is useful when the expanded supports have any side effects, such as in the following case.

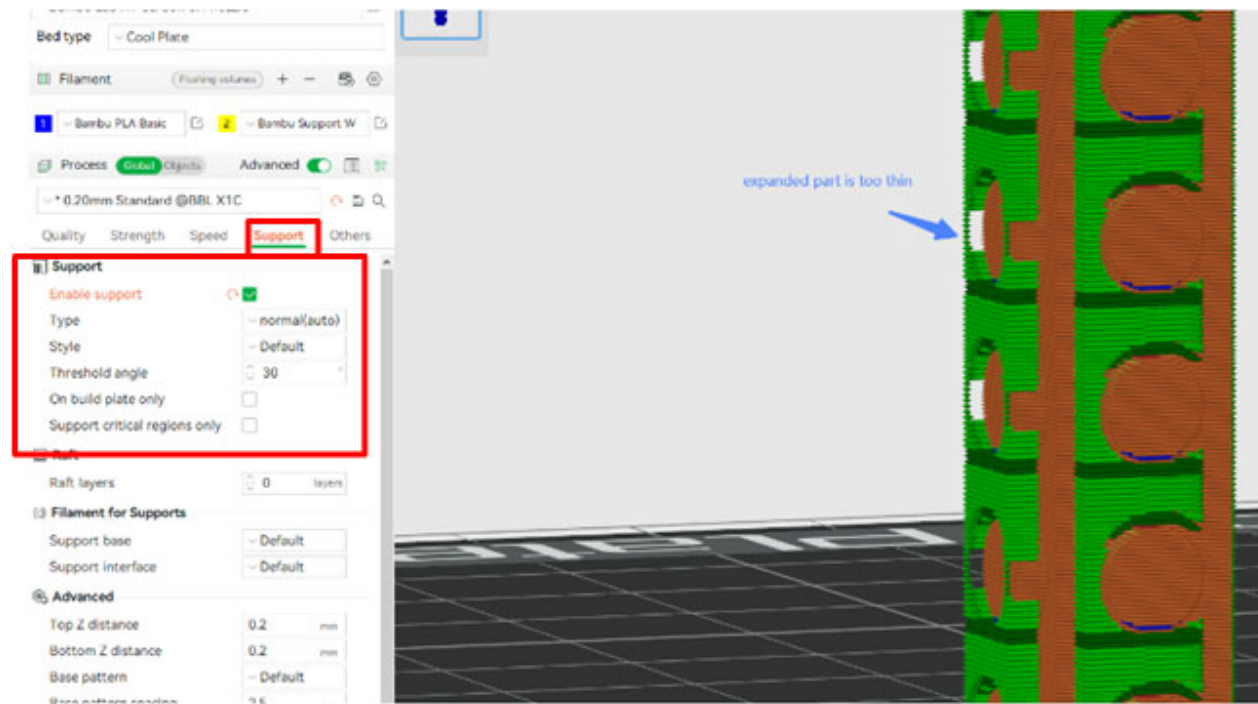
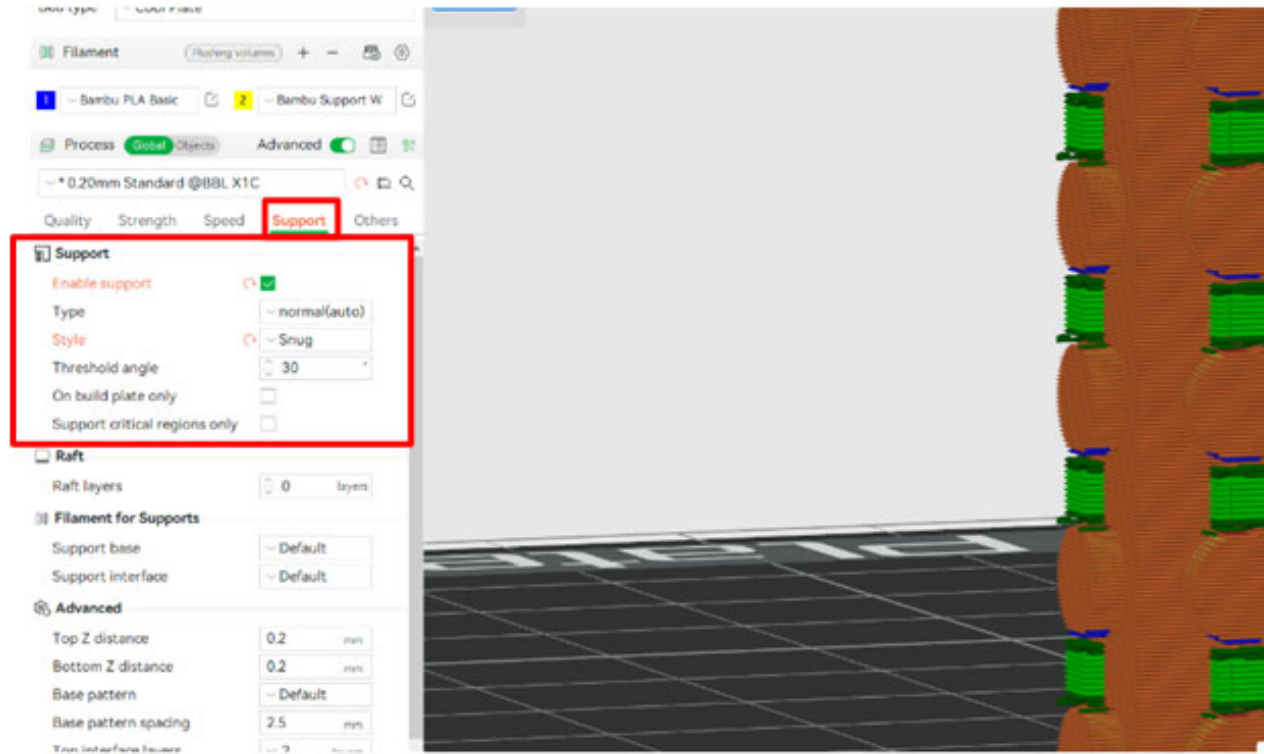


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

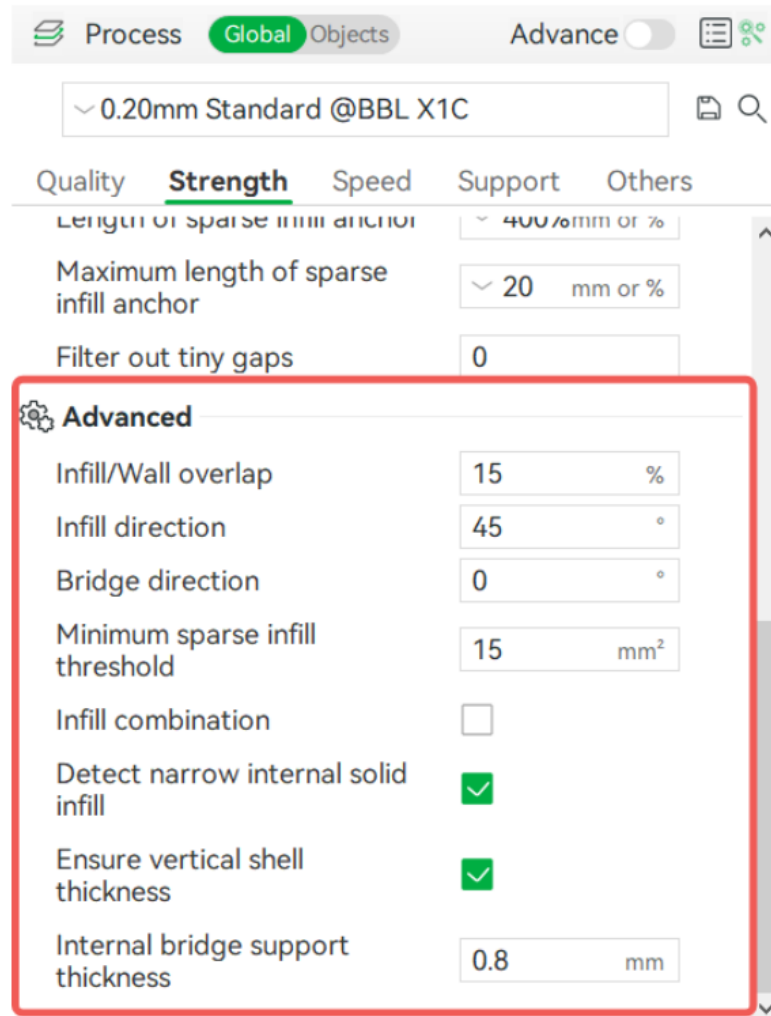


<https://wiki.bambulab.com/en/software/bambu-studio/support>

Bambu Studio allows the setting of operational parameters including the infill parameters (infill requirement):

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In Bambu Studio, you can set some advanced parameters related to strength in **Process - Strength - Advanced**.



Process Global Objects Advance

0.20mm Standard @BBL X1C

Quality **Strength** Speed Support Others

Length of sparse infill anchor 400% mm or %

Maximum length of sparse infill anchor 20 mm or %

Filter out tiny gaps 0

Advanced

Infill/Wall overlap 15 %

Infill direction 45 °

Bridge direction 0 °

Minimum sparse infill threshold 15 mm²

Infill combination ☐

Detect narrow internal solid infill ☒

Ensure vertical shell thickness ☒

Internal bridge support thickness 0.8 mm

<https://wiki.bambulab.com/en/software/bambu-studio/parameter/strength-advance-settings>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

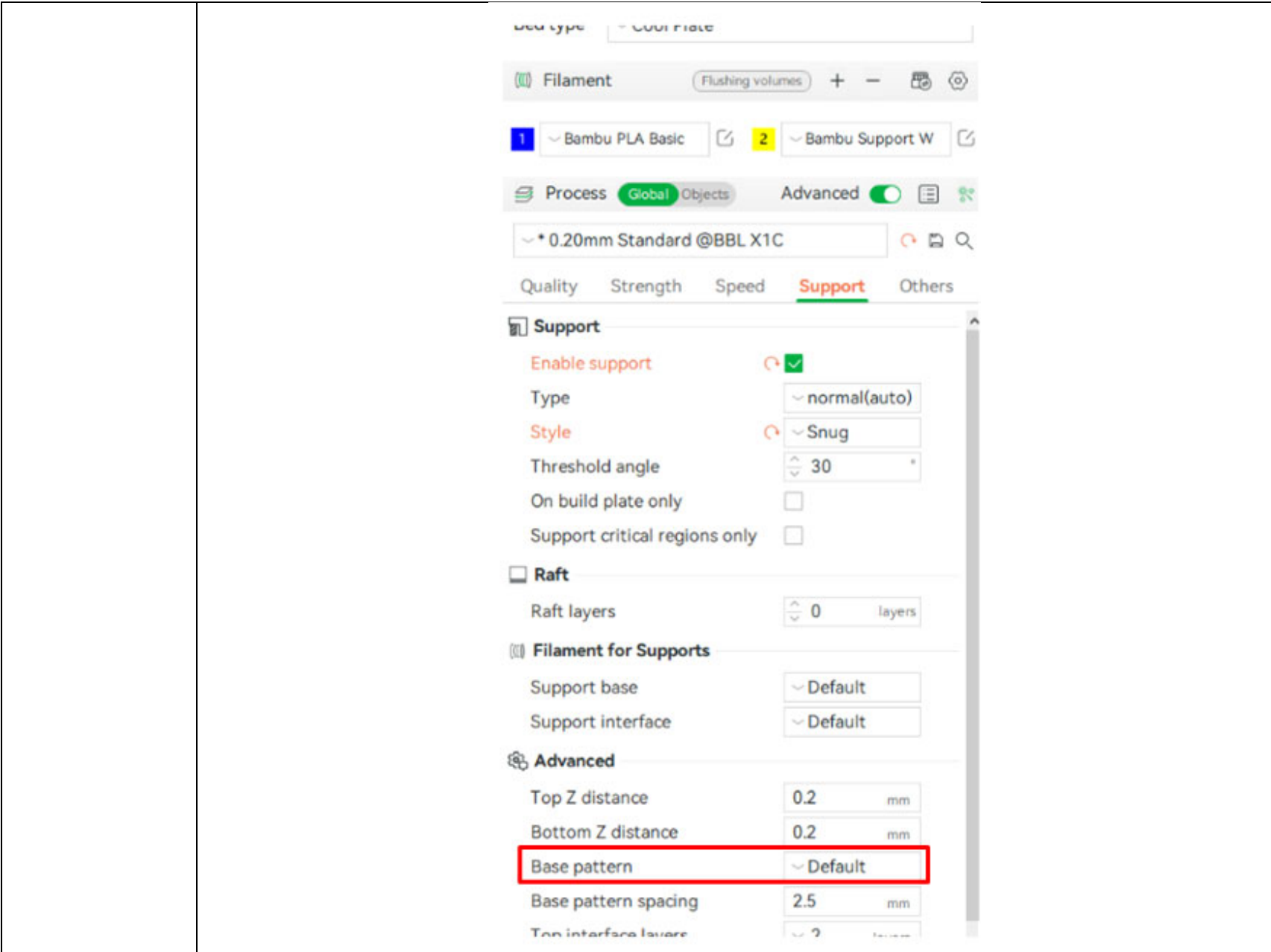


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

	<p>Base & interface pattern settings</p> <p>‣ Base pattern This is the infill pattern of the support base. There are currently 5 patterns, as shown below.</p> <p>‣ Rectilinear is the most commonly used support and default pattern for normal support, which usually goes in two directions (left to right, front to back)</p> <p>‣ Rectilinear grid is similar to rectilinear, except it alternates the direction of every layer, so its strength is much better but can be harder to remove.</p> <p>‣ Honeycomb is very different than the other two, and is a good balance of strength and stability for taller support structures.</p> <p>‣ Lightning is an extremely sparse infill pattern for tree support, which can save both material and printing time, but with lower strength.</p> <p>‣ Hollow is a default pattern for tree support, which means no infill at all.</p> <p>https://wiki.bambulab.com/en/software/bambu-studio/support</p> <p>All of these operational parameters set in Bambu Studio are communicated to the printer for printing the 3D object.</p>
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

11. The method of claim 1, wherein the supply includes at least one of a cartridge, a spool, a filament, a number of pellets, and a liquid.

The supply of the Accused Instrumentalities includes at least one of a cartridge, a spool, a filament, a number of pellets, and a liquid.

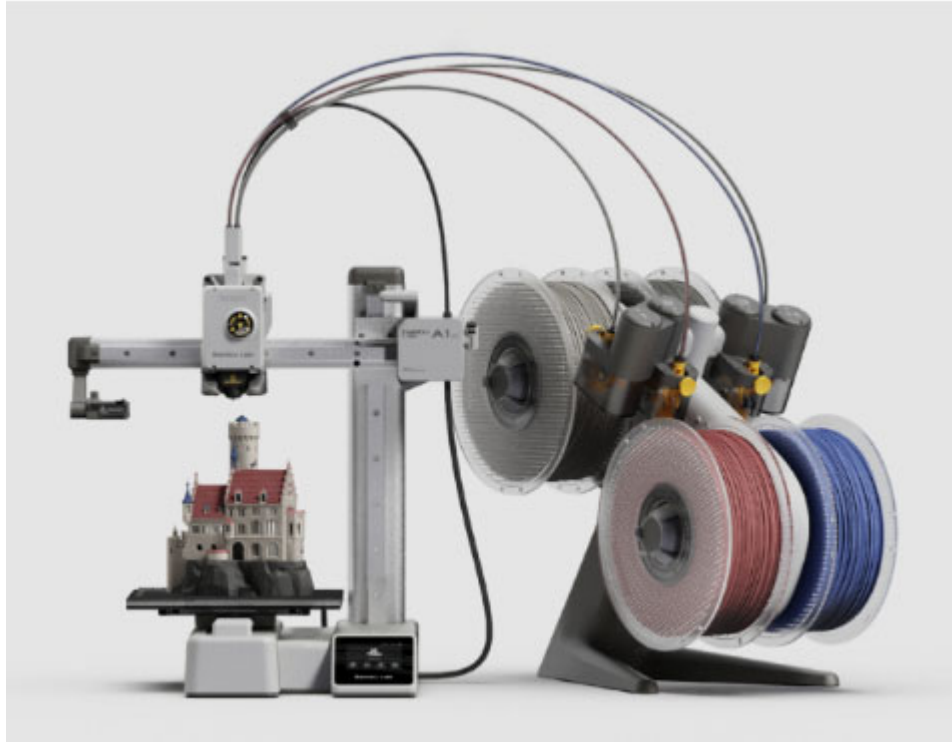
As discussed above with respect to claim 1 and as shown below, the supply of build material received by the AMS of the Bambu 3D printers is a spool of filament:



<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

As discussed above with respect to claim 1 and as shown below, the supply of build material received by the AMS Lite of the Bambu 3D printers is a spool of filament:



<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

12. The method of claim 1, wherein the tag includes a radio frequency identification (RFID) tag, and the RFID tag is at least one of a passive RFID tag and an active RFID tag.

The tag of the Accused Instrumentalities includes a radio frequency identification (RFID) tag, and the RFID tag is at least one of a passive RFID tag and an active RFID tag.

The Bambu Lab filaments include an RFID tag coupled to the filament spool that is at least one of a passive RFID tag and an active RFID tag.

RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

<https://wiki.bambulab.com/en/x1/manual/intro-ams>

Automatic Filament Identification

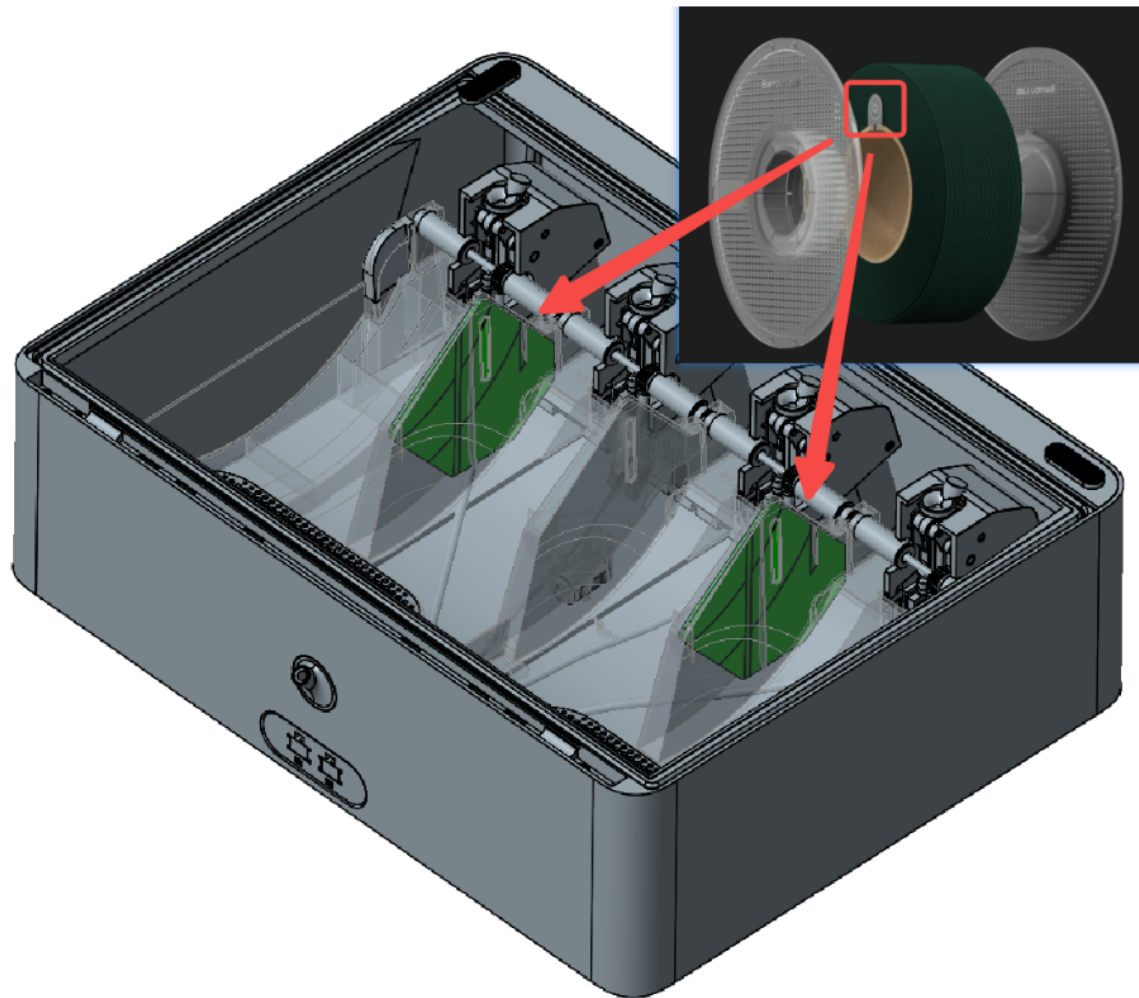
Bambu Lab filaments use RFID which is read by the AMS to automatically identify and apply the best settings for your material.

The RFID tag is synchronized automatically to Bambu Studio.

<https://store.bambulab.com/products/ams-multicolor-printing>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Bambu's official filament roll has RFID tags on both sides, and on AMS there are two RFID-reading circuit boards that can read the filament information.

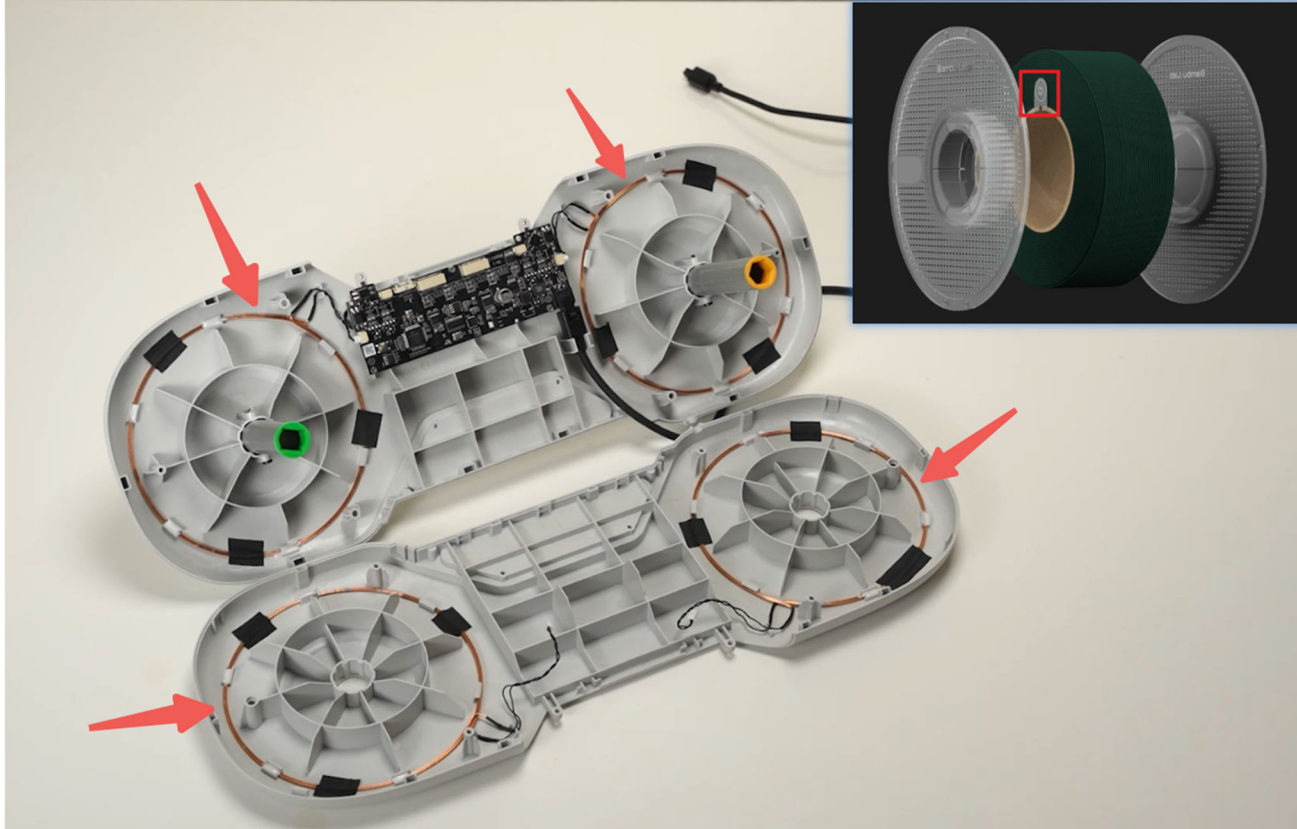


<https://wiki.bambulab.com/en/x1/manual/intro-ams>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.



RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

		<div><div>×</div><div>AMS Settings</div><div><div><div>☒ Insertion update</div><div>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds. Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</div></div><div><div>☒ Update on startup</div><div>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</div></div><div><div>☒ AMS filament backup</div><div>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</div></div></div><div></div></div>	
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

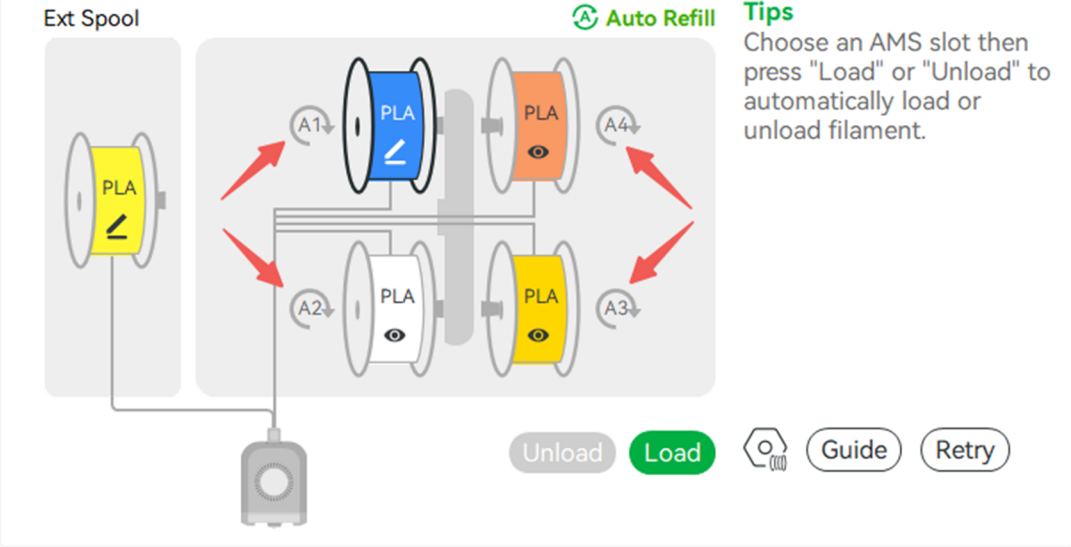
	 <p>https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite</p>
<p>16. The method of claim 1, wherein the tag sensor includes at least one of a radio frequency identification (RFID) reader, an optical scanner, a magnetic reader, and a contact point sensor.</p>	<p>The tag sensor of the Accused Instrumentalities includes at least one of a radio frequency identification (RFID) reader, an optical scanner, a magnetic reader, and a contact point sensor.</p> <p>The AMS of the Bambu 3D printers includes RFID readers:</p>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Reading RFID

Bambu's official filament roll has RFID tags on both sides, and on AMS there are two RFID-reading circuit boards that can read the filament information.

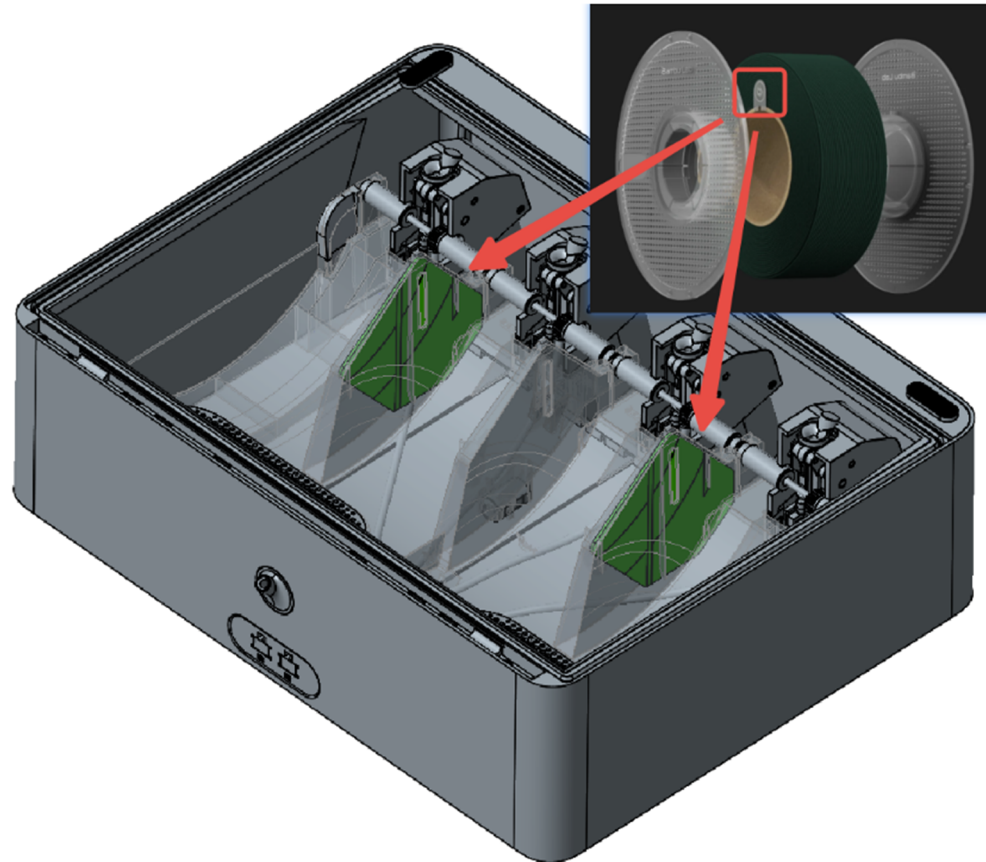


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.



When the filament in a slot has been sent out to AMS, or the extruder detects that there is a filament inside, the RFID reading function cannot be used. Click to read will show that AMS is busy and cannot read the filament information.

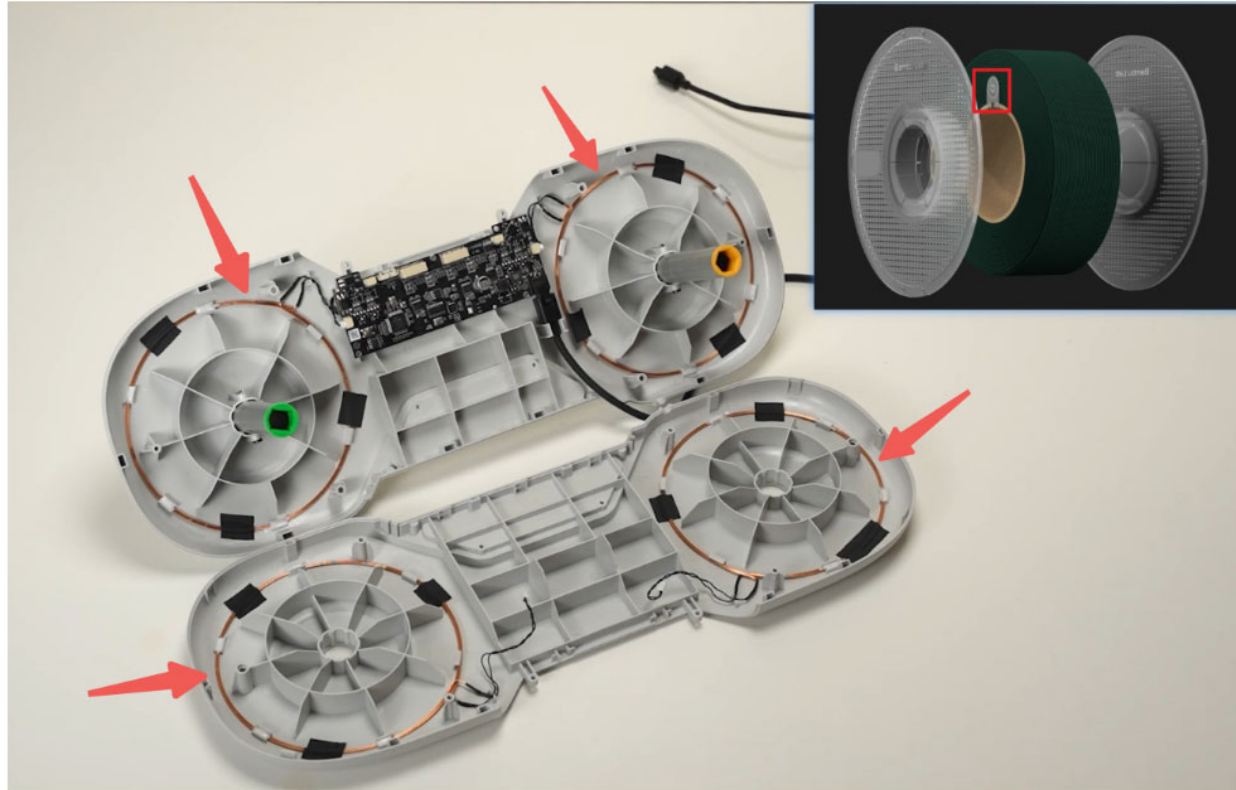
<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

The AMS lite of the Bambu 3D printers includes RFID readers:

Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.



RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

17. The method of claim 1, further comprising performing a diagnostic test to determine whether the one or more operational parameters is suitable for the three-dimensional printer.

The Accused Instrumentalities are used to perform a diagnostic test to determine whether the one or more operational parameters is suitable for the three-dimensional printer.

Bambu Studio performs a diagnostic test to determine whether an operational parameter, such as a support structure requirement for the build, is suitable for the three-dimensional printer (e.g., whether the support structure filament detected in the AMS of the printer is compatible with the build material filament detected in the AMS). For example, if the detected build material is PLA and the detected support material is Support for PA/PET (<https://us.store.bambulab.com/collections/support/products/support-for-pa-pet>) instead of Support for PLA (<https://us.store.bambulab.com/products/support-for-pla>), the following error message is produced as a result of a diagnostic test comparing the required support structure to the support structure actually in the 3D printer:

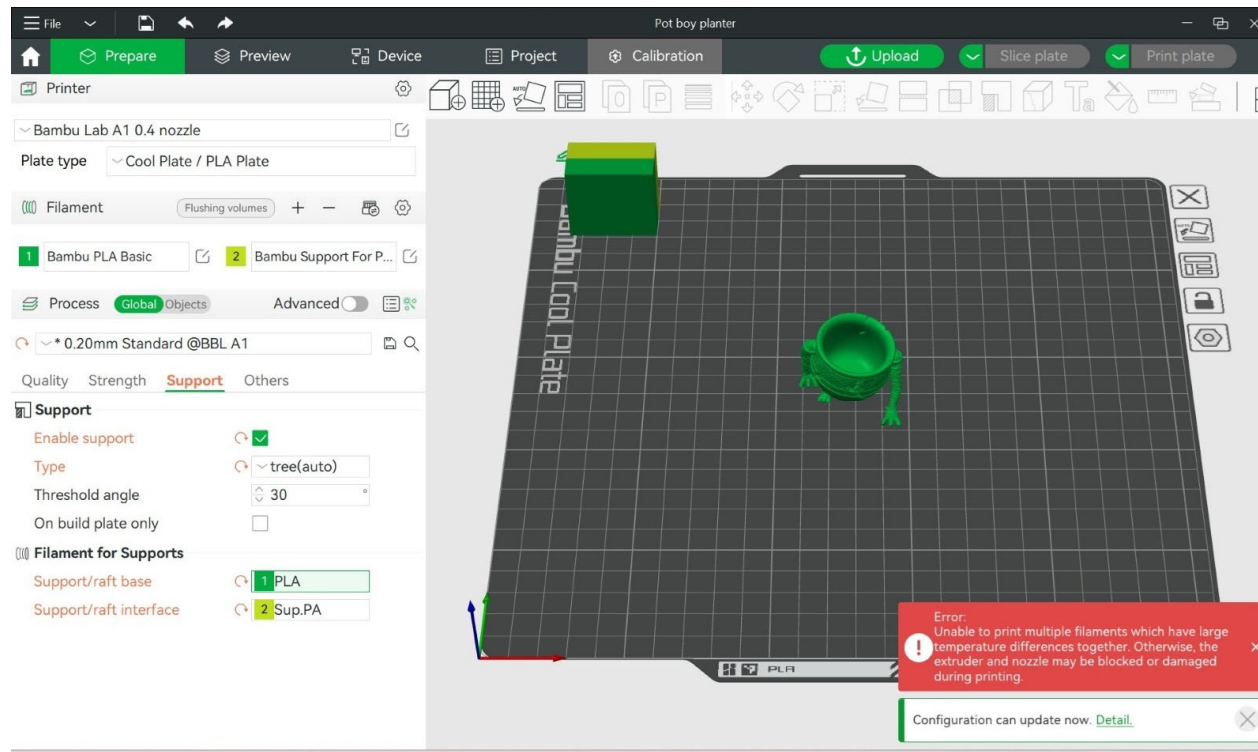


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

However, if compatible Support for PLA is detected in the AMS, then the diagnostic test does not produce such an error:

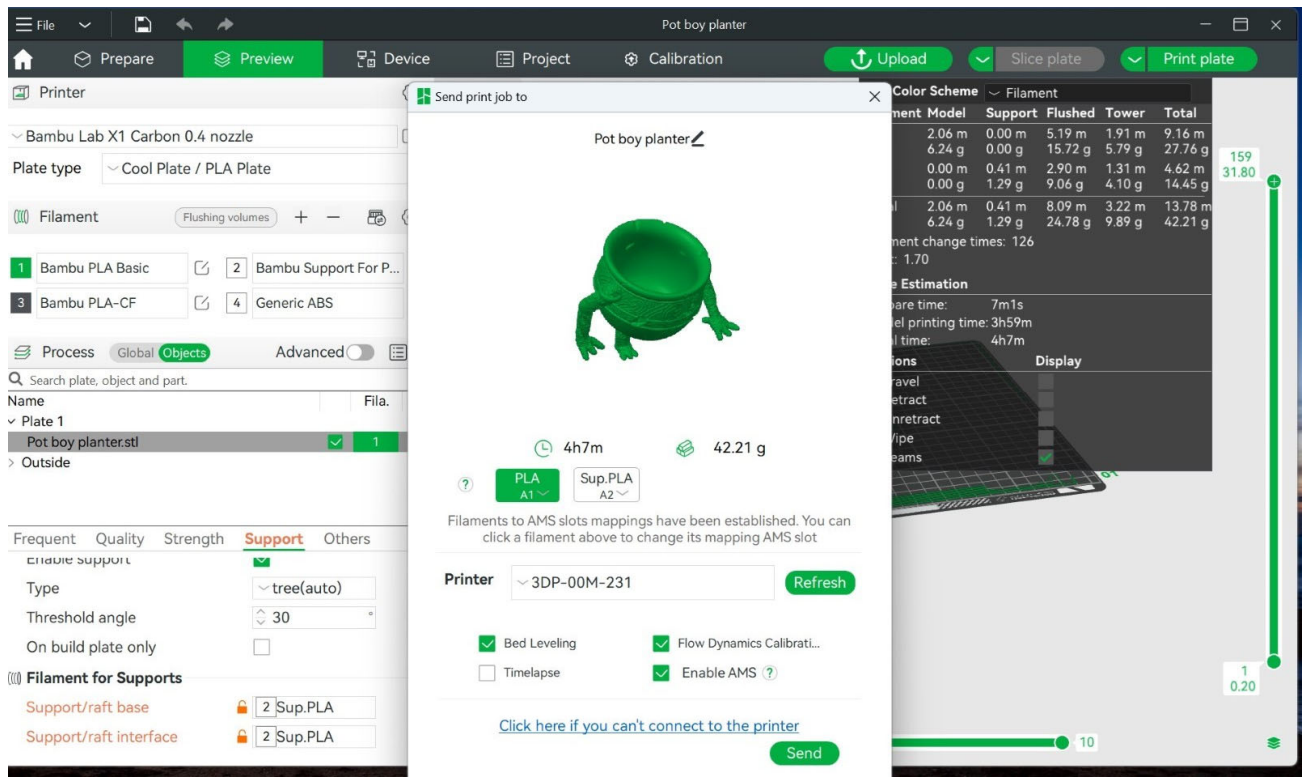
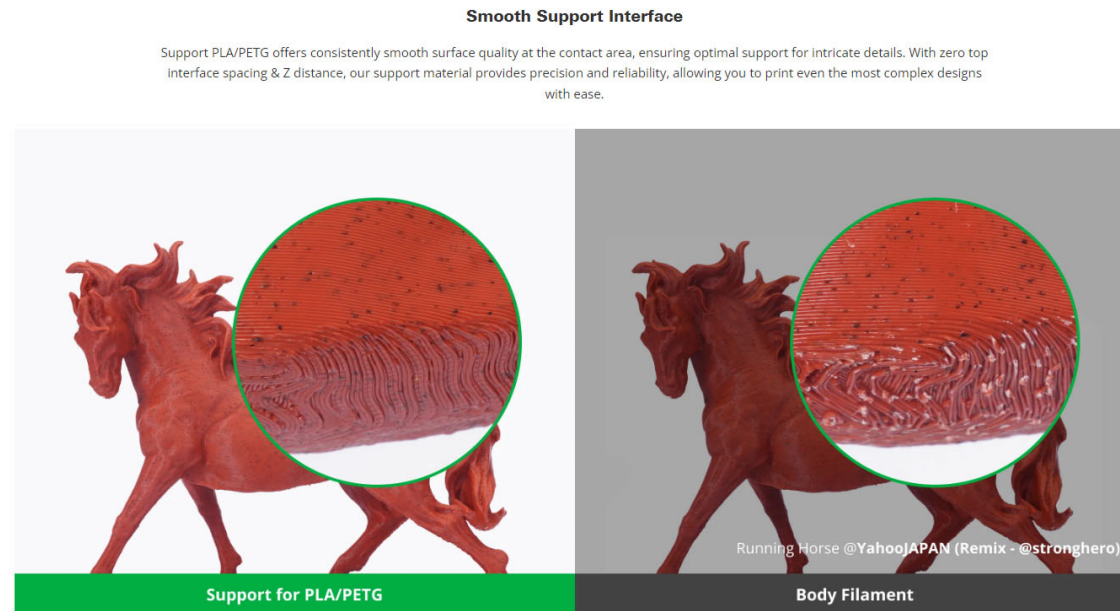


Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

Additionally, Bambu Studio changes the support offset setting if a compatible support material (e.g., Support for PLA/PETG) is used versus using the build material (e.g., PLA) as the support structure. See [Support for PLA/PETG | Bambu Lab US](#):



The default offset setting when using the same material for both the part and the support structure is 0.2mm. However, if a compatible support material is used, that offset is changed to 0 or no extra gap.

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

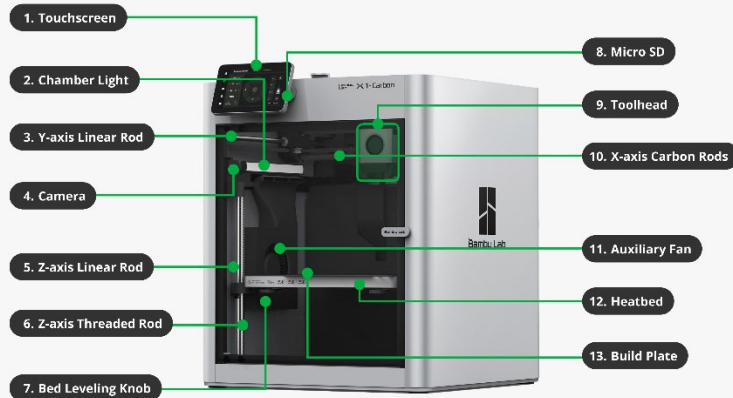
19. A method,
comprising:
providing a three-
dimensional
printer

To the extent the preamble of the claim is limiting, Bambu Lab sells various additive manufacturing systems (i.e., 3D printers) for use by its customers, including the X1C, X1E, and P1S, P1P, A1 and A1 mini. See, e.g.:



<https://bambulab.com/en/x1>

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<https://wiki.bambulab.com/en/x1>

“How does X1 work?”

The X1 3D printer is a machine that uses plastic filament as the material for creating 3D objects.

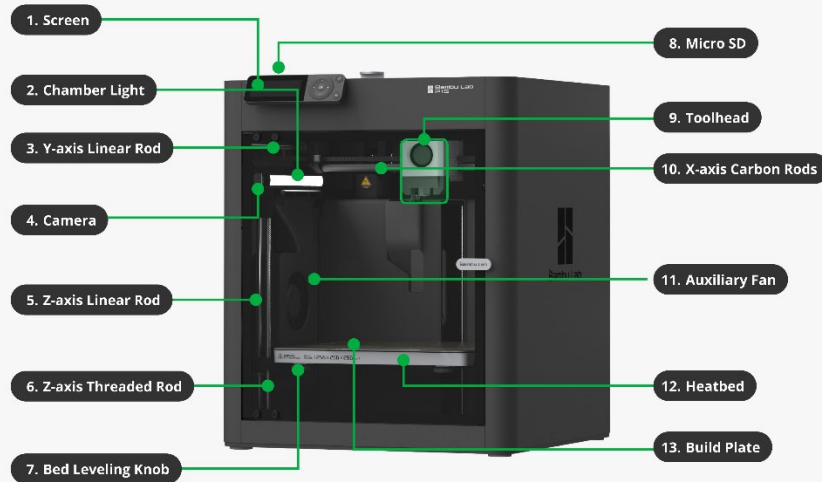
Most of the time, the printable objects are files with the .stl extension that hold the 3D model which needs to be processed before it's ready to be printed with a piece of software called a slicer.

The slicer, in our case the Bambu Lab Studio, takes that .stl file and slices it into layers which are then printed by the X1. All these slices are then converted into code, a type of language which tells the machine how to move its axis to print the model.

Besides the movement, the slicer is also able to integrate various other settings inside the generated file, like the temperatures of the filament, printing speeds, and generate supports for some sections of the print.”

<https://wiki.bambulab.com/en/x1/manual/intro-x1>

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<https://wiki.bambulab.com/en/p1>

““How does the P1 series work?”

The Bambu Lab P1 inherits the X1 series' renowned kinematics and motion control technology and the wealth of sensors that ensure its reliability. It can connect the automatic material system (AMS) for multi-color printing. Great for beginners, professionals, or others who enjoy the fun of being creative, the P1P has been designed for easy setup and use in minutes. Additionally, it allows upgrading and customizing hardware with mod-friendly features for people to enjoy the fun of making their one-of-a-kind 3D printer.”

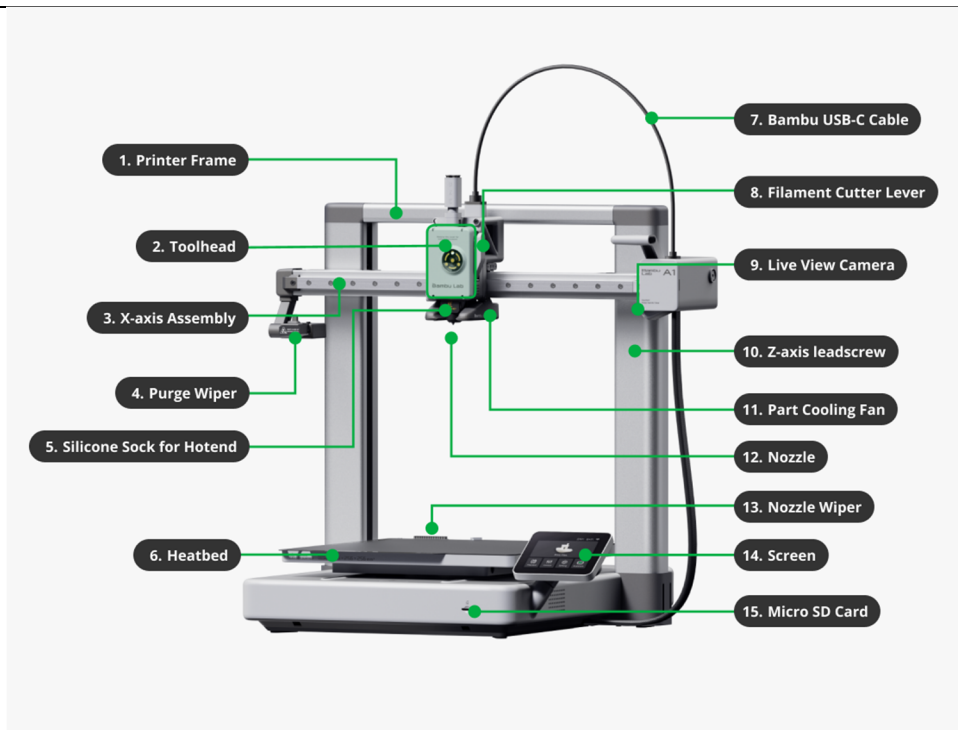
<https://wiki.bambulab.com/en/p1/manual/intro-p1p>

Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466



https://us.store.bambulab.com/products/p1p?gad_source=1&gclid=Cj0KCQiAIsy5BhDeARIsABRc6Zui1LA-KILBpMwwu10C9BEnkbXOizh2T2VXHke9YId_ufwLMvZNDOAaAjzfEALw_wcB

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<https://wiki.bambulab.com/en/a1>

“How does the A1 work?”

The A1 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 typically involves the following steps:

Creation or acquisition of a digital model

First, generate a 3D model or obtain an existing digital model using computer-aided design software, online resources, or other means.

Slicing

Next, Bambu Studio slices the digital model into multiple thin layers. Each layer's information is converted into "G-code," a language understood by the printer. The G-code provides instructions to the printer regarding movement paths and speeds of the different axes during the printing process.

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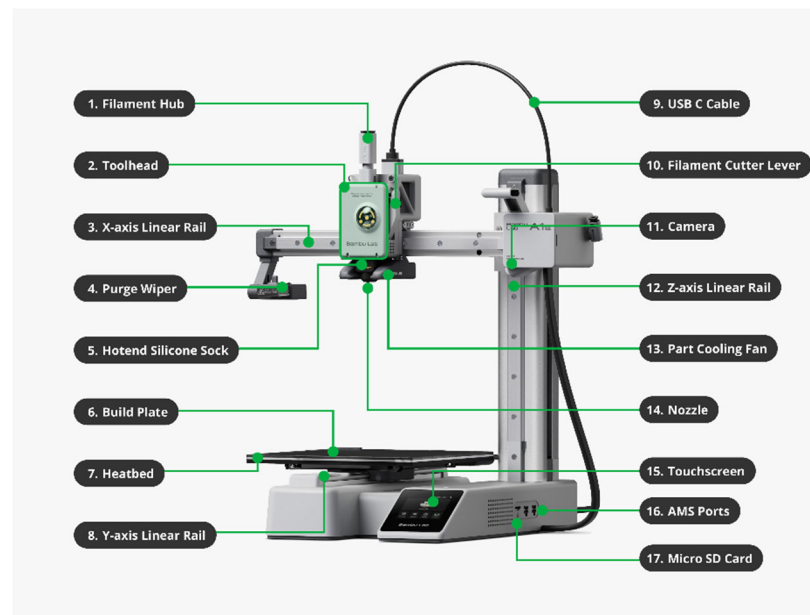
Preparing the printer

Before initiating the printing process, the printer needs to be prepared. This involves loading the printing filament, positioning the build plate, and calibrating the printer's parameters to ensure optimal print quality.

Printing

Once all preparations are complete, the A1 printer gradually constructs the object layer by layer on the print platform.”

<https://wiki.bambulab.com/en/a1/manual/intro-a1>



<https://wiki.bambulab.com/en/a1-mini>

“How does the A1 mini work?”

The A1 mini 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 mini typically involves the following steps:

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Creation or acquisition of a digital model:

First, you need to create a 3D model or acquire an existing digital model. This can be done through computer-aided design software, online resources, or other sources.

Slicing

Next, Bambu Studio slices the digital model into multiple thin layers. The information for each layer is automatically converted into a language that the printer can understand, known as "G-code." This code instructs the printer on the movement paths and speeds of the various axes during the printing process.

Preparing the printer

Before starting the printing process, you must prepare the printer. This includes loading the printing filament, placing the build plate, and calibrating the printer's parameters to ensure print quality.

Printing

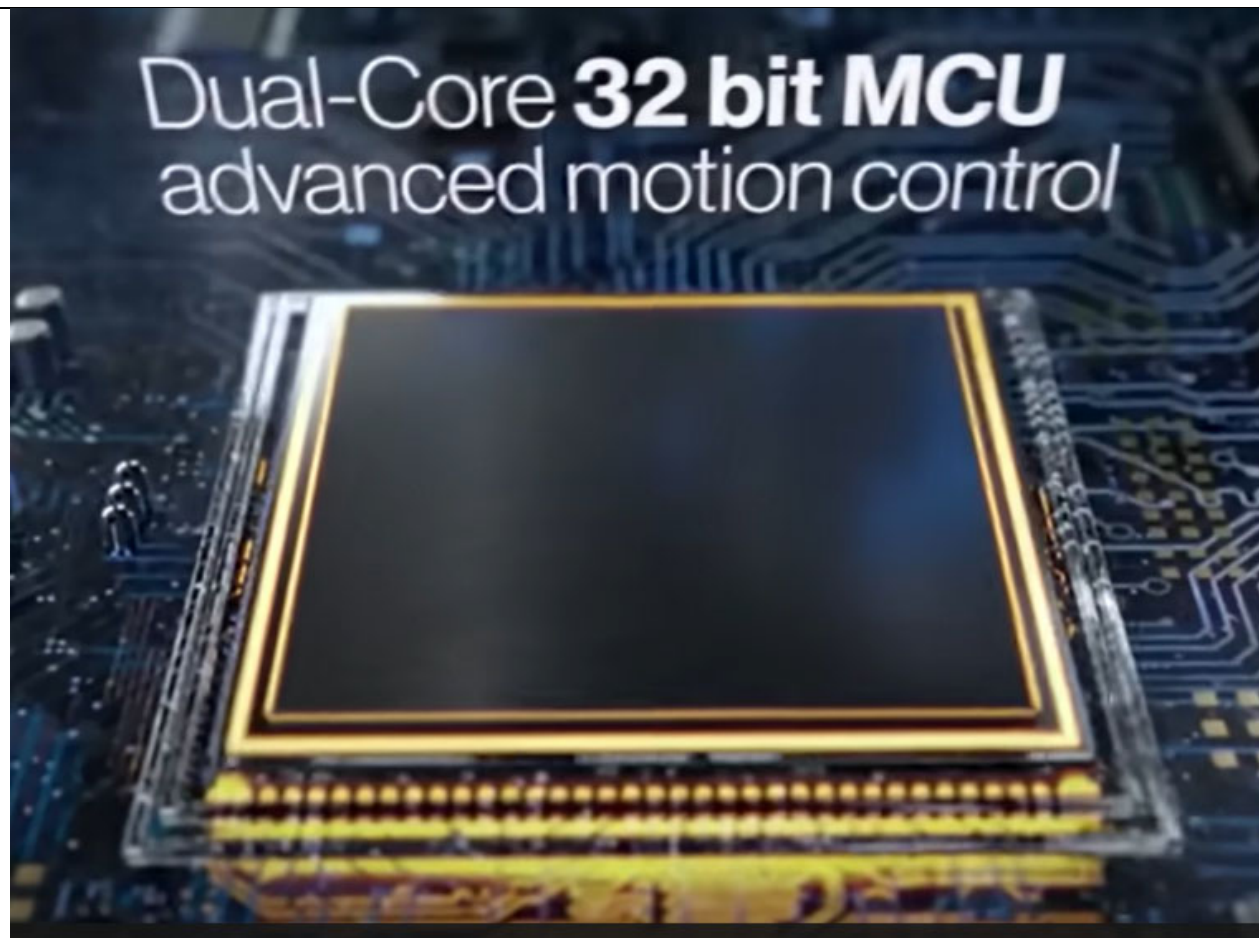
Once everything is prepared, the A1 mini gradually prints layer by layer onto the print platform, gradually building the object.”

<https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini>

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<p>that includes a controller;</p>	<p>The three-dimensional printer includes a controller such as a CPU, MCU, and/or associated circuitry.</p> <p>The X1 has many electronic components inside, but here are the most important:</p> <p><u>Logic Board</u></p> <p>Every 3D printer comes with a logic board that has the CPU, stepper drivers, and the required connections for different electronics attached to the printer. In the case of the X1, the board has a quad-core CPU and a dual-core MCU.</p> <p>The CPU handles the smart capabilities of the X1 including the AI spaghetti detection, flow calibration, vibration compensation, and the connection between the Slicer/App and the printer.</p> <p>The MCU handles the actual movement of the printer after getting the stream of g-code from the CPU.</p> <p>https://wiki.bambulab.com/en/x1/manual/intro-x1</p>
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<https://bambulab.com/en/x1>

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The article provided at <https://wiki.bambulab.com/zh/x1/maintenance/replace-ap-board> discusses the Bambu Lab printers' AP mainboard as being an Application Board that controls the information flow within the printer:

What is the AP board?

AP Board refers to the Application board, it is a circuit board that controls the interaction of information within the unit. It provides a self-contained operating environment that delivers all system capabilities needed to support the printer's applications, including memory management, system firmware, graphics processing and multimedia decoding.

...

Connectors on the AP board

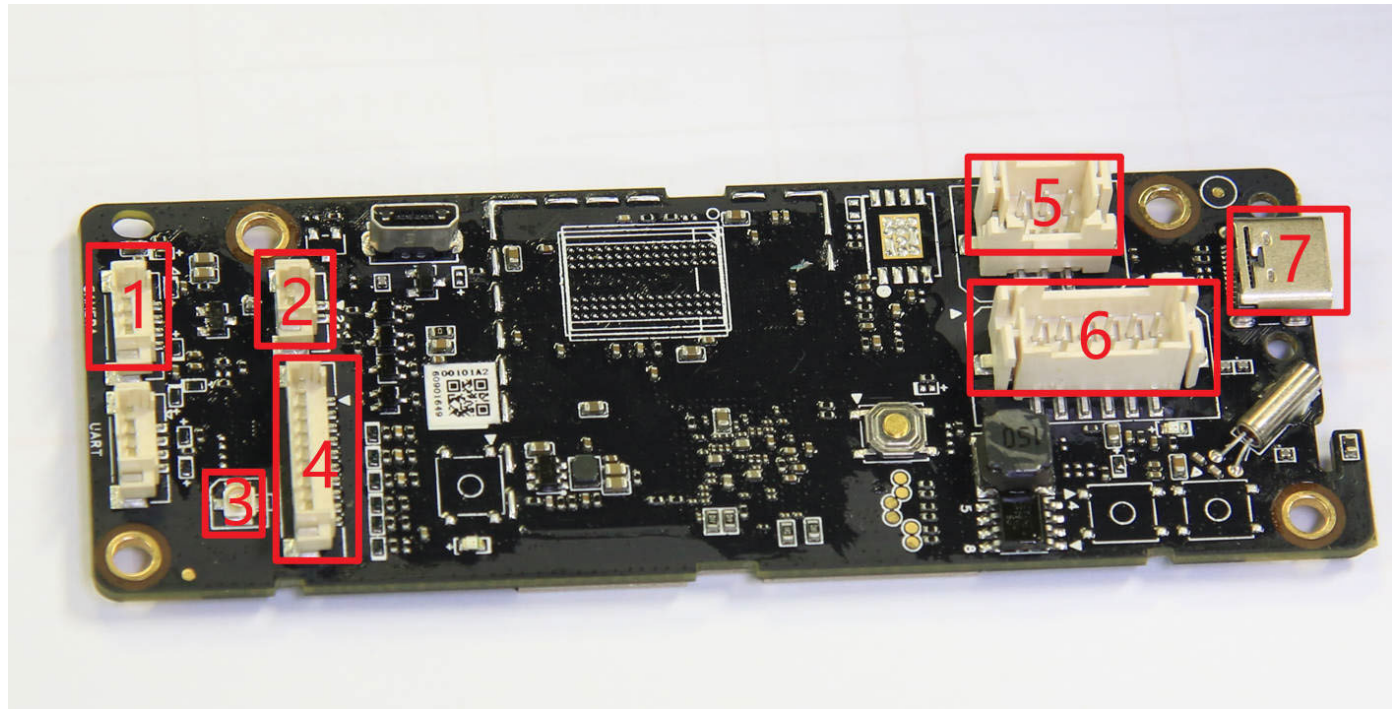


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NO.Connect object		NO.Connect object		NO.Connect object	
1	The chamber camera	4	Button PCBA	7	USB-C cable to Toolhead
2	The chamber LED	5	MC board (Power)		
3	WIFI antenna	6	MC board (Communication)		

The AP motherboard is in communication with the RFID system (tag sensor).

Furthermore, the Bambu Lab printers have a Machine Controller, which controls the various moving parts of the printer (see <https://wiki.bambulab.com/en/x1/maintenance/replace-mc-board>):

What it is

MC stands for Machine Controller, which is the unit that controls all the moving parts of the printer.

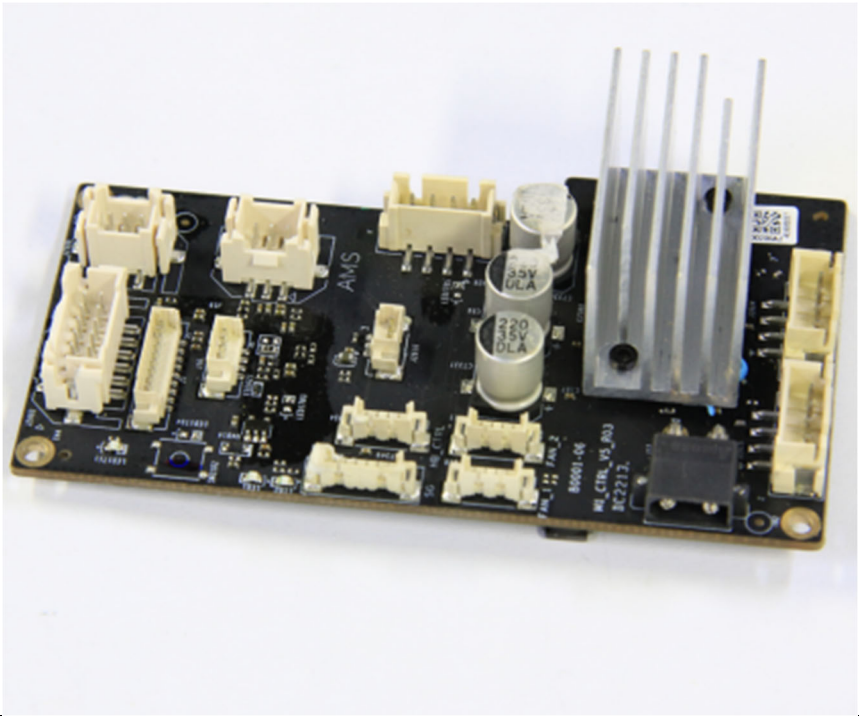


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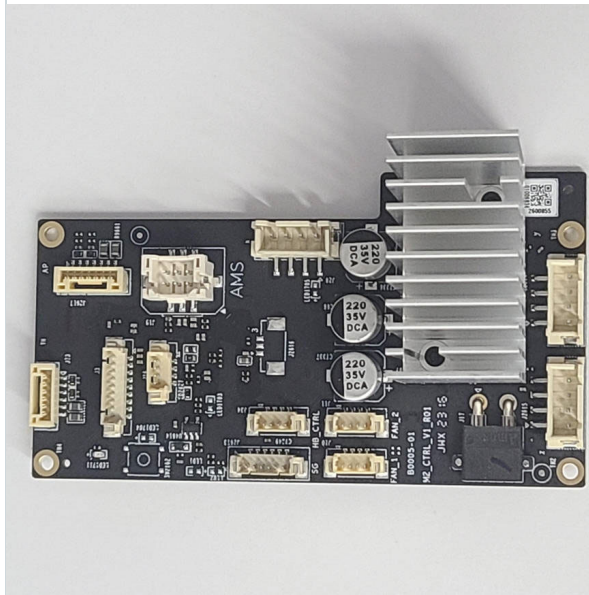
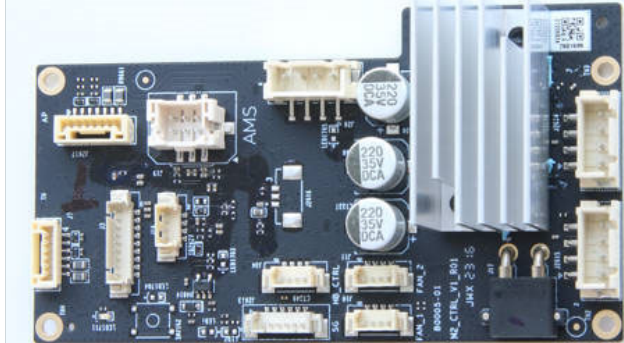
“MC board of P series

A wiki page guide you how to remove and install the MC board of P series.

MC Board of P series

MC stands for Machine Controller, which is the unit that controls all the moving parts of the printer.

There are differences in the heatsink of the MC boards for P1P and P1S, but the boards are the same.”



MC board for P1S

<https://wiki.bambulab.com/en/p1/maintenance/mc-board>

“Replace the AP Board for P1 Series

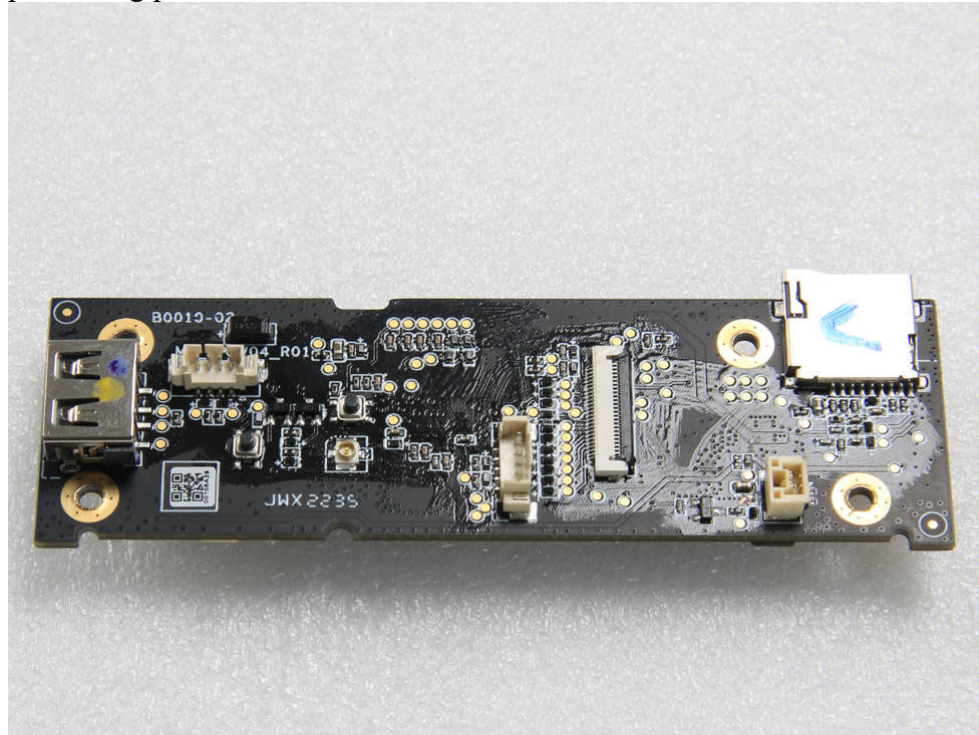
This guide shows how to remove and install the AP board for P1 Series

AP Board

The AP board is a circuit board that controls the printer and provides the required Wi-Fi connectivity and

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processing power.



Friendly reminder: The AP boards for P1S and P1P have the same appearance and installation method, but these two boards are not compatible. In other words, P1P can only use the AP board specifically designed for P1P, while P1S can only use the AP board specifically designed for P1S.”

<https://wiki.bambulab.com/en/p1/maintenance/ap-board>

“Electrical Components

The A1 incorporates various electronic components, and here is a brief overview of some of the most important components and their functions:

Circuit board

The main control board of the A1 printer consists of a low-power SoC (System-on-Chip) with a dual-core processor, Wi-Fi baseband, Bluetooth baseband, RF module, and other peripherals. It also includes a dual-

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core MCU (Microcontroller Unit) and a single-core MCU. Additionally, it incorporates stepper motor drivers and connectors required for connecting various electronic devices to the printer.

The SoC is primarily responsible for handling the user interface of the A1 printer and managing the connection between the slicing software/mobile application and the printer. On the other hand, the MCU controls the printer's heating and movement after receiving the CPU's G-code stream.”

<https://wiki.bambulab.com/en/a1/manual/intro-a1>

“Electrical Components

The A1 mini incorporates various electronic components, and here is a brief overview of some of the most important components and their functions:

Circuit board

The mainboard contains a low-power SoC (System-on-Chip) with a dual-core processor, Wi-Fi baseband, Bluetooth baseband, RF module, and other peripherals. It also includes a dual-core MCU and a single-core MCU. Additionally, it features stepper motor drivers and connectors necessary for connecting different electronic devices to the printer. The SoC handles the user interaction and the communication between the slicing software/mobile application and the printer. The MCU controls the actual heating and movement of the printer after receiving G-code instructions from the CPU.

Camera

The printer integrates a camera used for spaghetti detection (to be supported in future firmware updates) and real-time monitoring of prints using the Bambu Slicer or Bambu Handy application. In addition to the monitoring function, the camera can record videos of the prints to the micro SD card and generate time-lapse videos. The machine is not equipped with night vision, but the camera module has an auxiliary light to illuminate the print.”

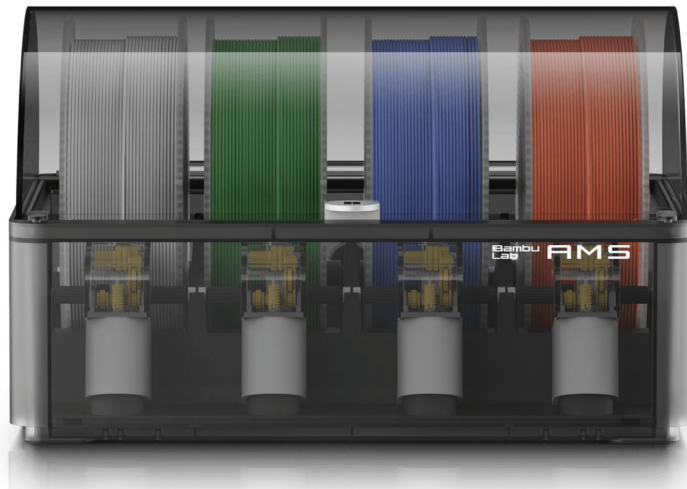
<https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini>

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and a tag sensor;

The three-dimensional printer includes a tag sensor.

Bambu Lab sells various 3D printers, including the X1C, X1E, and P1S, and P1P, in combination with its Automatic Material System (AMS), which includes four bays, include RFID tag readers.



Color, the ultimate expression of emotions, is brought to you by Bambu Lab's Automatic Material System (AMS). You can now enjoy printing freely in multiple colors and materials, a 3D Printing Maestro.



<https://bambulab.com/en/x1>

Similarly, the AMS Lite sold with the A1 and A1 Mini includes RFID sensors:

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“Bambu Lab AMS lite - Automatic Material System

...

The A1 series printers can only be connected to one AMS lite, so it can only support 4-color printing at most. The AMS lite is not compatible with X1 and P1 series printers

...

Product Features

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- Multi-Color/Multi-Material Capability
- Automatic Filament Backup
- Improved Spool Compatibility
- Easy to Maintain
- RFID Filament Sync”

<https://us.store.bambulab.com/collections/bambu-lab-ams-lite/products/ams-lite>

Also, see <https://wiki.bambulab.com/en/x1/manual/intro-ams> regarding the AMS:

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Bambulab AMS RFID readers and sniffing

The Bambulab AMS RFID readers are located between slot 1&2 and slot 3&4



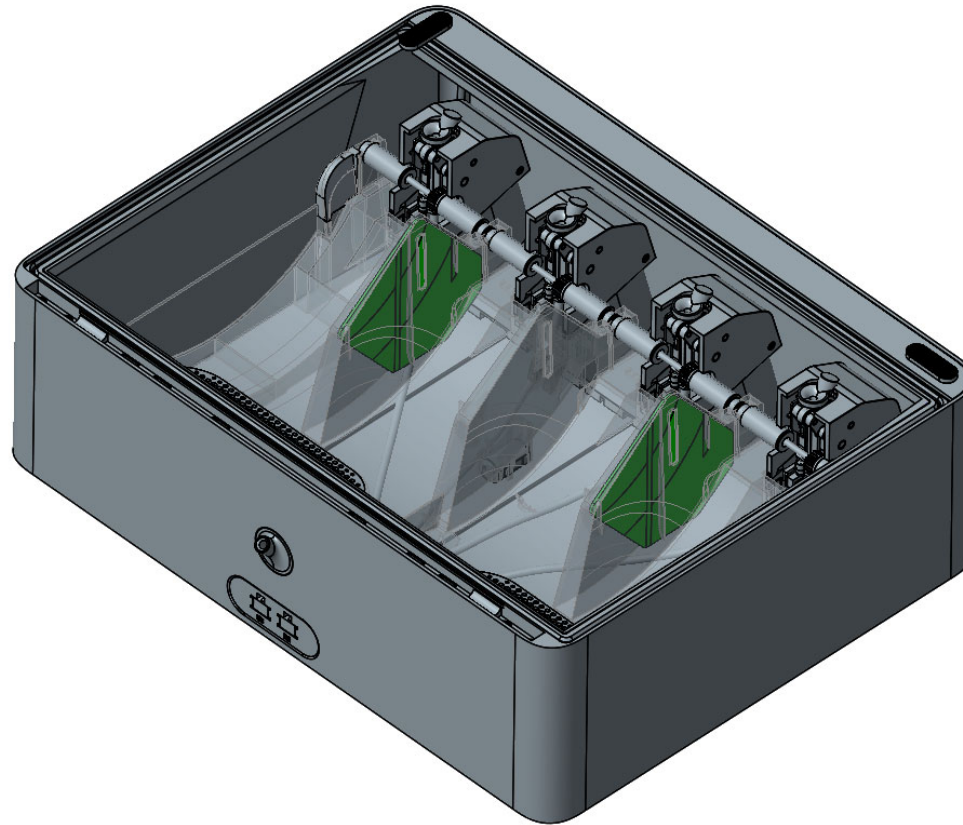
“RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).

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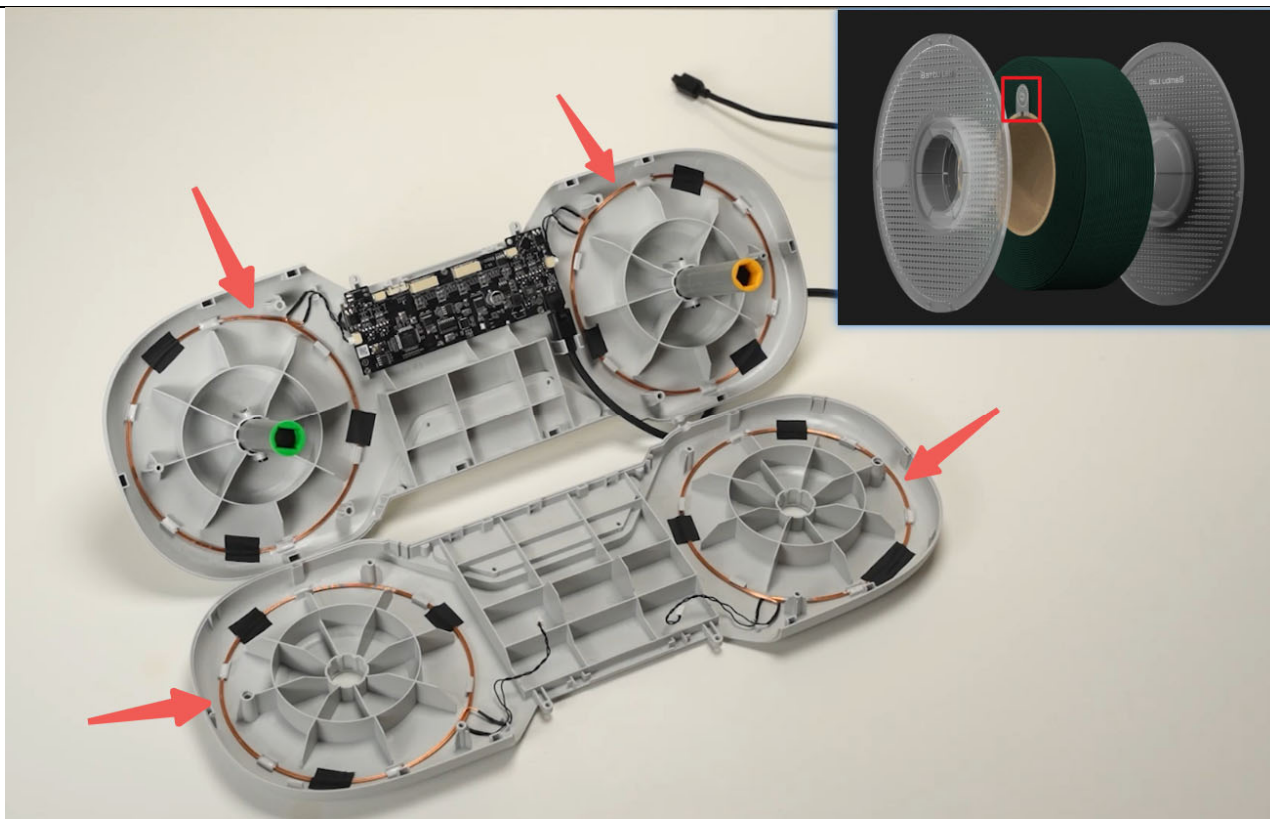
”

Also, see <https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>, regarding the AMS Lite:

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.

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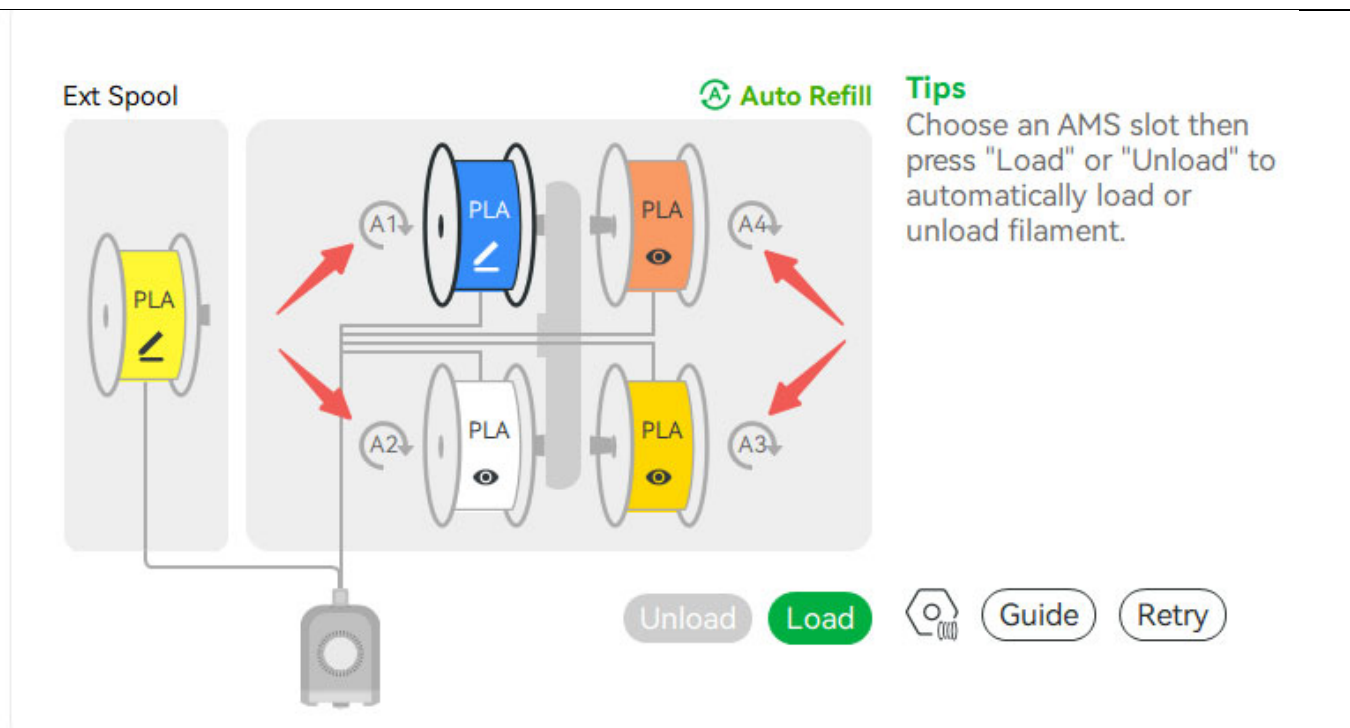


RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

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		<div data-bbox="714 186 1648 1430"><div data-bbox="756 276 966 316">AMS Settings</div><div data-bbox="756 357 1050 406">☒ Insertion update</div><div data-bbox="798 414 1596 519"><p>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds.</p><p>Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</p></div><div data-bbox="756 673 1081 722">☒ Update on startup</div><div data-bbox="798 730 1596 836"><p>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</p></div><div data-bbox="756 868 1123 917">☒ AMS filament backup</div><div data-bbox="798 925 1596 1006"><p>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</p></div><div data-bbox="766 1023 1585 1372"></div></div>	
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466



Click here to read the RIFD info”

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coupling a container of a build material to the three-dimensional printer,

The Accused Instrumentalities include a three-dimensional printer coupled with a container of a build material.

The filament spools are coupled to the three-dimensional printer via the AMS or AMS Lite.

When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.

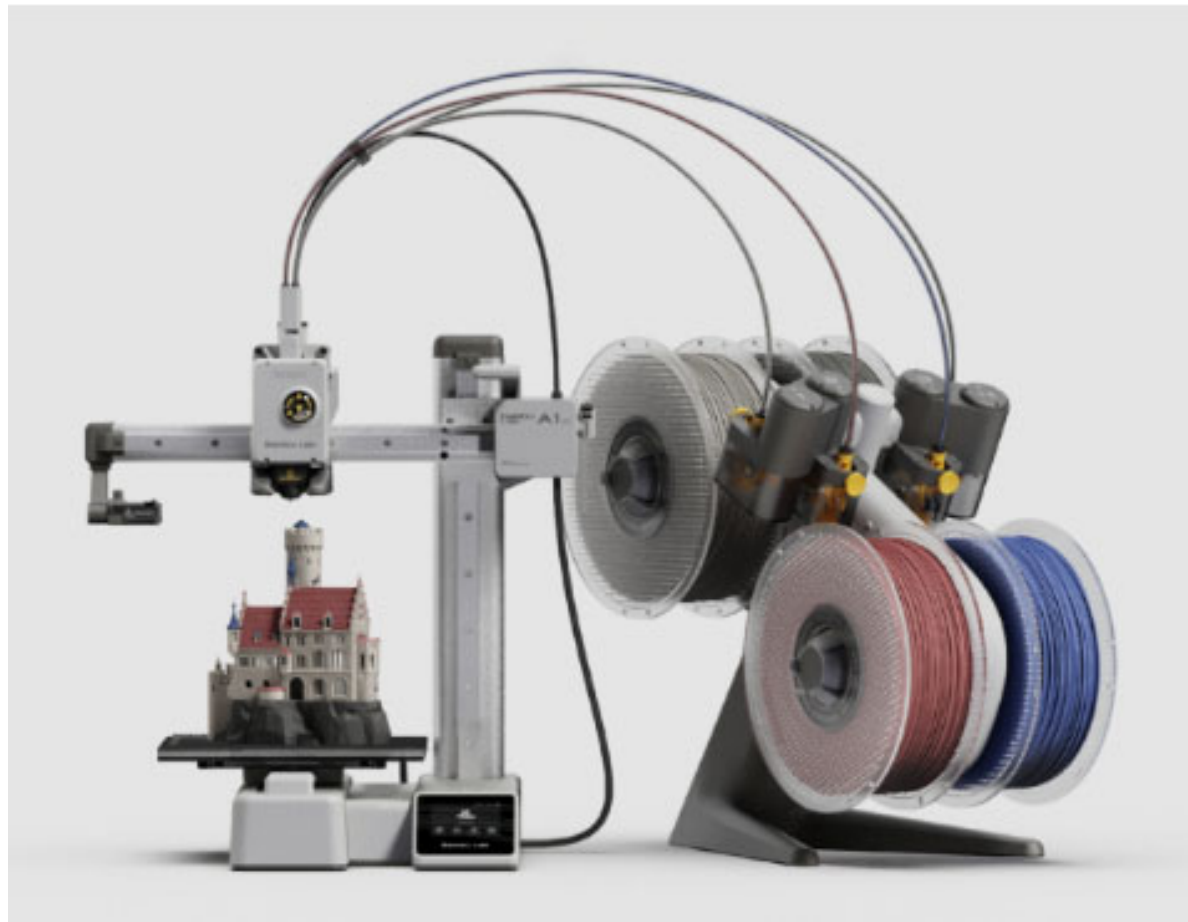


<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

Further detailed description here: <https://wiki.bambulab.com/en/x1/manual/connect-ams>

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The AMS lite is shown below with filament spools coupled to the printer:



<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

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the container including a tag that stores at least one property of the build material;

The container of the Accused Instrumentalities includes a tag that stores at least one property of the build material.

The Bambu Lab filament spools include an RFID tag, with the RFID tag including data of various properties of the build material, including for example type and color of the build material.

RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

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When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.



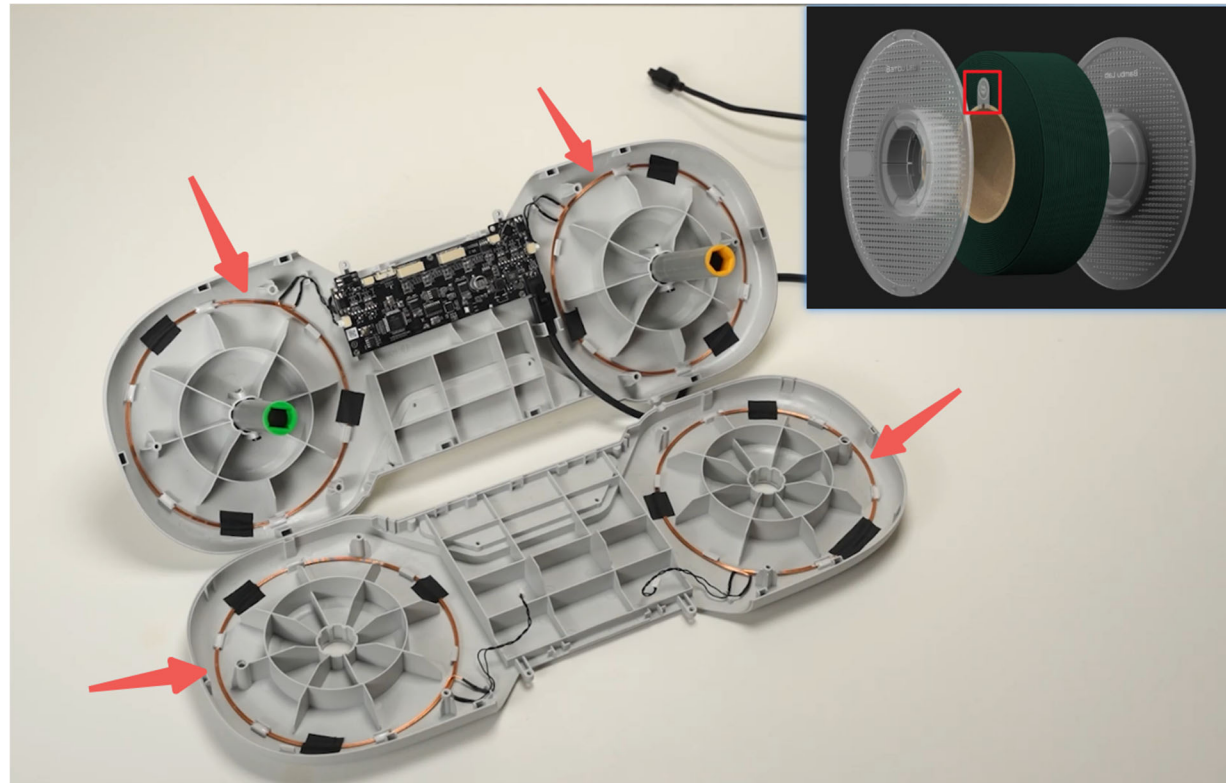
When the filament in a slot has been sent out to AMS, or the extruder detects that there is a filament inside, the RFID reading function cannot be used. Click to read will show that AMS is busy and cannot read the filament information.

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<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.



RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

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		<div><div>×</div><div>AMS Settings</div><div><div><div>☒ Insertion update</div><div>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds. Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</div></div><div><div>☒ Update on startup</div><div>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</div></div></div><div><div>☒ AMS filament backup</div><div>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</div></div><div></div></div>	
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

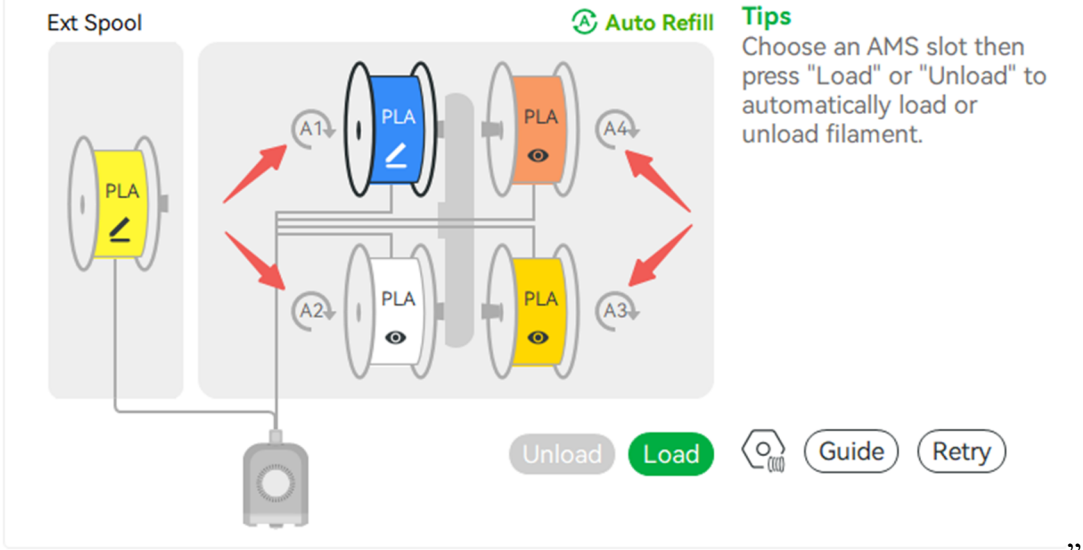
	<div data-bbox="646 240 1722 787"></div> <p>https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite</p> <p>“Load filaments to AMS and configure filament information Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to AMS setup and loading filament.”</p> <p>https://wiki.bambulab.com/en/x1/manual/multi-color-printing</p>
reading data from the tag with the tag sensor;	The Accused Instrumentalities are used to read data from the tag with the tag sensor.

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RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

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Reading RFID

Bambu's official filament roll has RFID tags on both sides, and on AMS there are two RFID-reading circuit boards that can read the filament information.

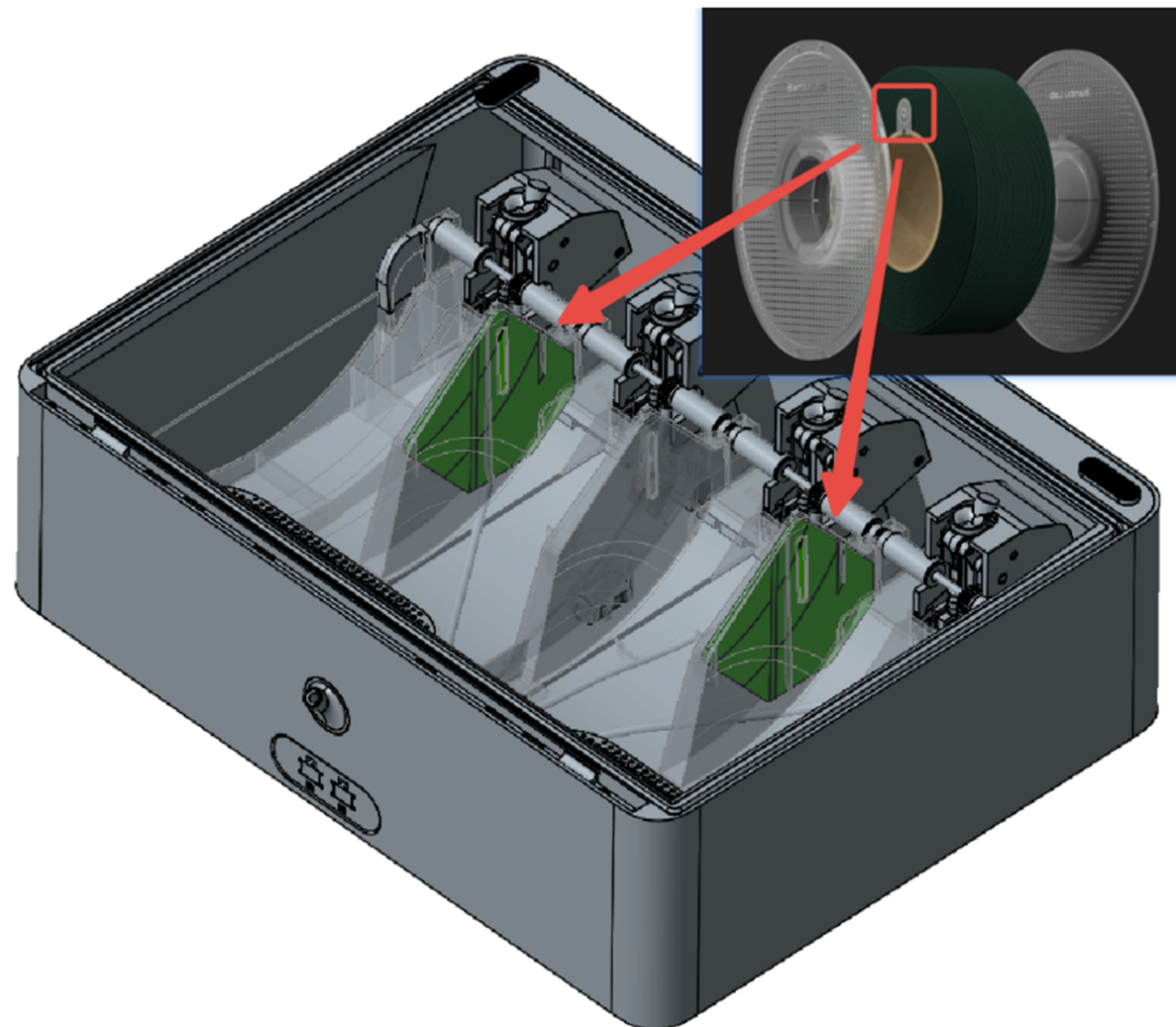


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When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.



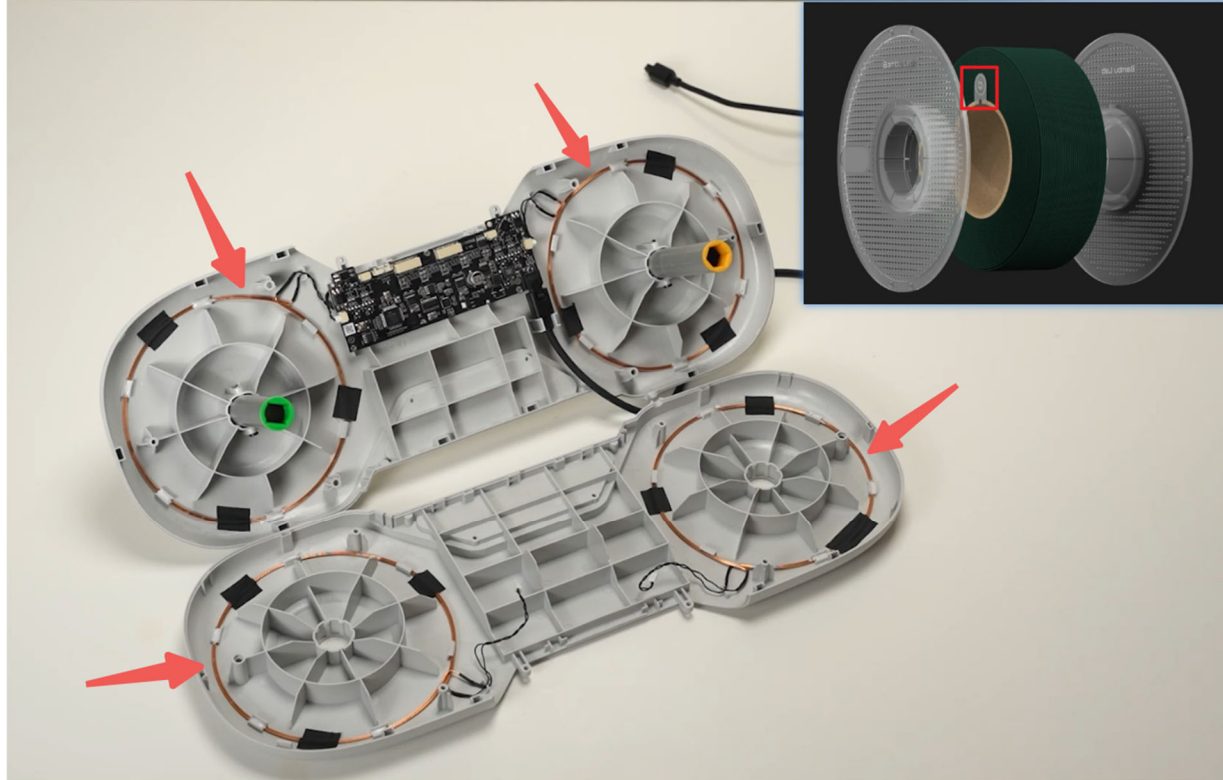
When the filament in a slot has been sent out to AMS, or the extruder detects that there is a filament inside, the RFID reading function cannot be used. Click to read will show that AMS is busy and cannot read the filament information.

<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

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“Reading RFID

Each slot in AMS lite has a corresponding RFID coil. You just need to place the spool on the rotary holder of each slot and insert the filament to read its information.

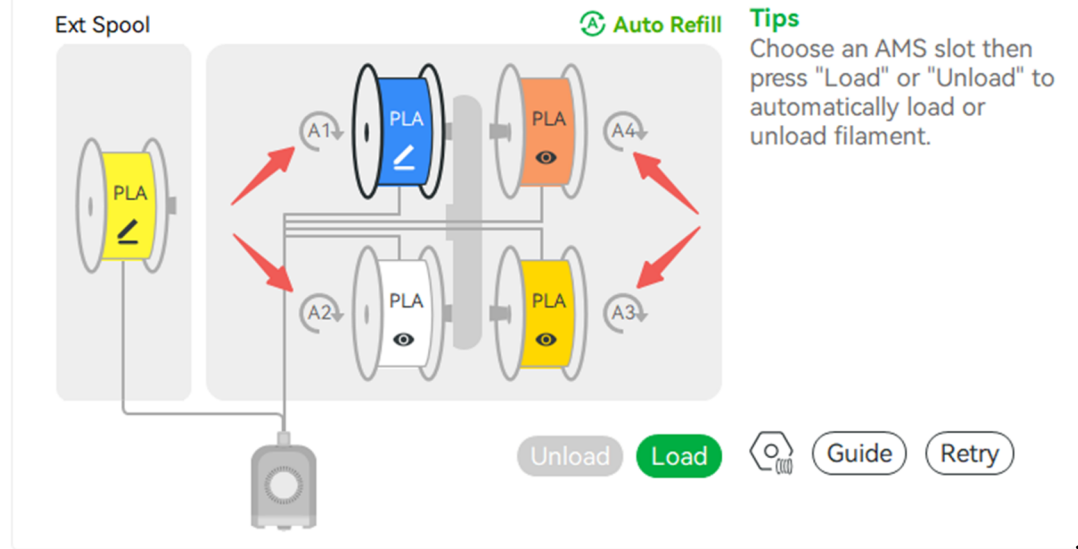


RFID reading function can be set on the slicer for update on insertion/startup, or you can also manually click the icon beside each slot on the slicer for reading RFID.

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		<div><div>×</div><div>AMS Settings</div><div><div><div>✓ Insertion update</div><div>The AMS will automatically read the filament information when inserting a new Bambu Lab filament spool. This takes about 20 seconds. Note: if new filament is inserted during printing, the AMS will not automatically read any information until printing has finished.</div></div><div><div>✓ Update on startup</div><div>The AMS will automatically read the information of inserted filament on start-up. It will take about 1 minute. The reading process will rotate the filament spools.</div></div><div><div>✓ AMS filament backup</div><div>AMS will continue to another spool with the same filament properties automatically when current filament runs out.</div></div><div></div></div></div> <td></td>	
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Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466



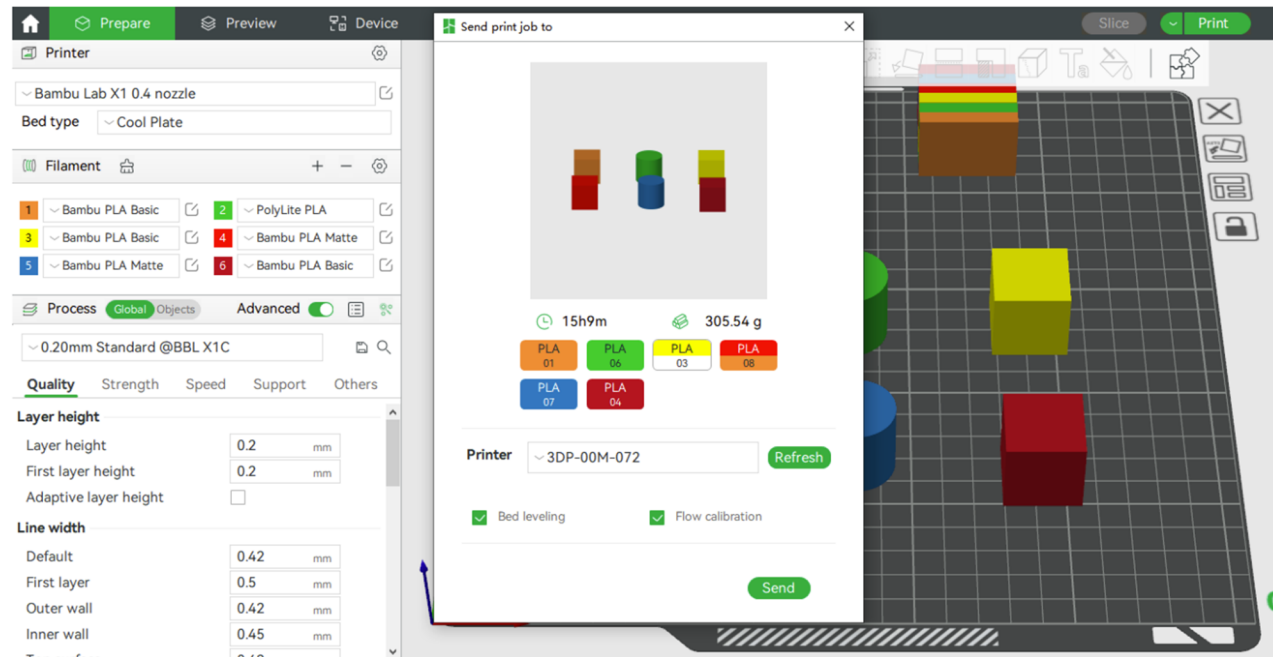
<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

The data includes various properties of the build material, including the type of the build material.

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Automatic mapping function

When you send a multi-color print task in the slicer, the model is automatically matched to the closest color filament in the AMS slots. You can also customize the filaments in the window.



<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

“Load filaments to AMS and configure filament information

Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to [AMS setup and loading filament](#).”

<https://wiki.bambulab.com/en/x1/manual/multi-color-printing>

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transmitting the data to the controller;

The Accused Instrumentalities are used to transmit the data to the controller.

The AMS and AMS Lite transmit the filament information to the controller of the three dimensional printer, as shown by the filament information displayed on a screen of the three-dimensional printer.

RFID system

The **RFID System** can automatically identify the RFID tag on the Bambulab filament spools, which can then sync the filament information to the Bambulab slicer (Bambu Studio).



<https://wiki.bambulab.com/en/x1/manual/intro-ams>

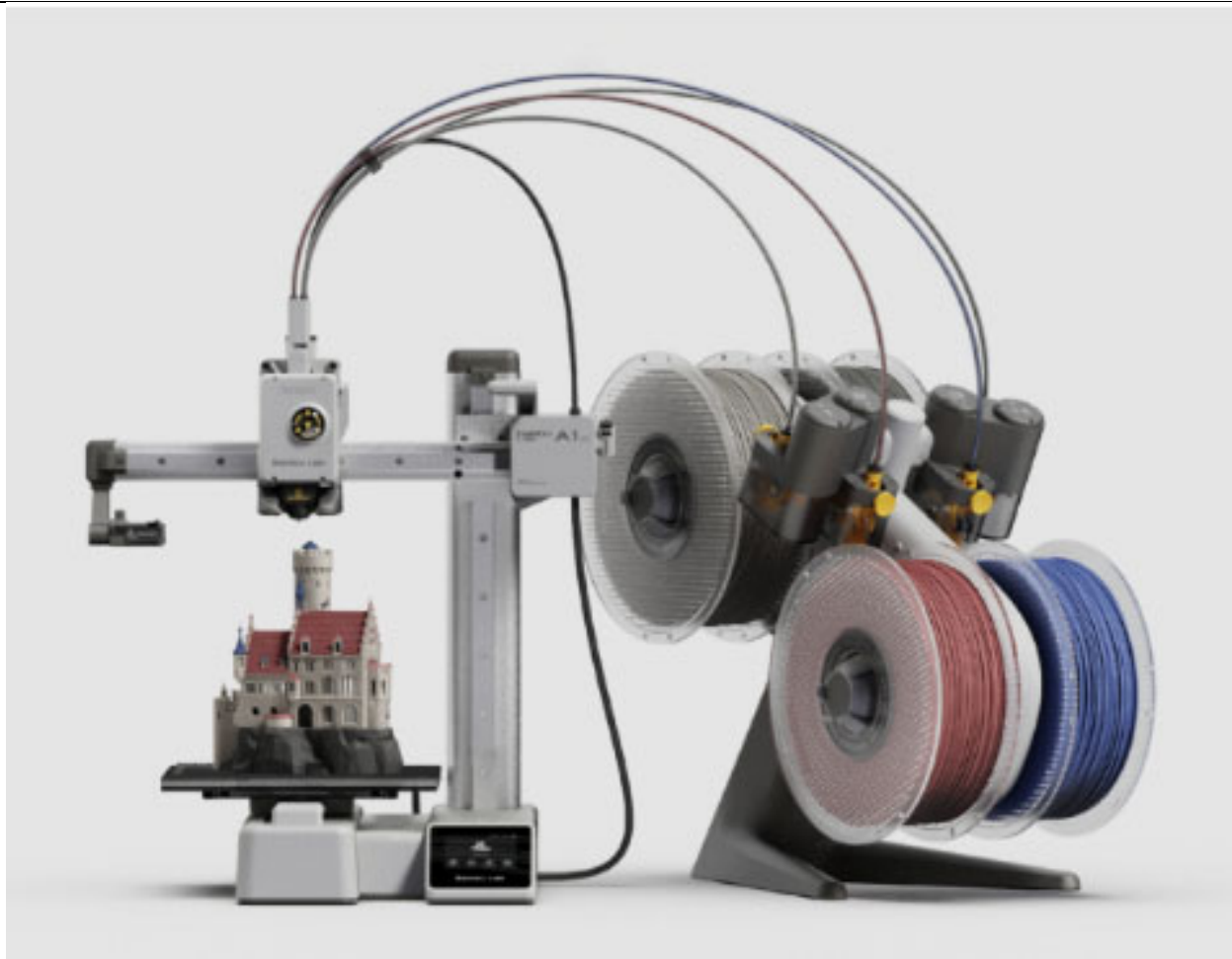
Exhibit F - Exemplary Infringement Evidence for U.S. Patent No. 10,569,466

When AMS reads the RFID, it will preload first to tighten the filament roll. It then sends the filament out of AMS a section to turn the spool, allowing the circuit board to scan the RFID tag and read the RFID information.



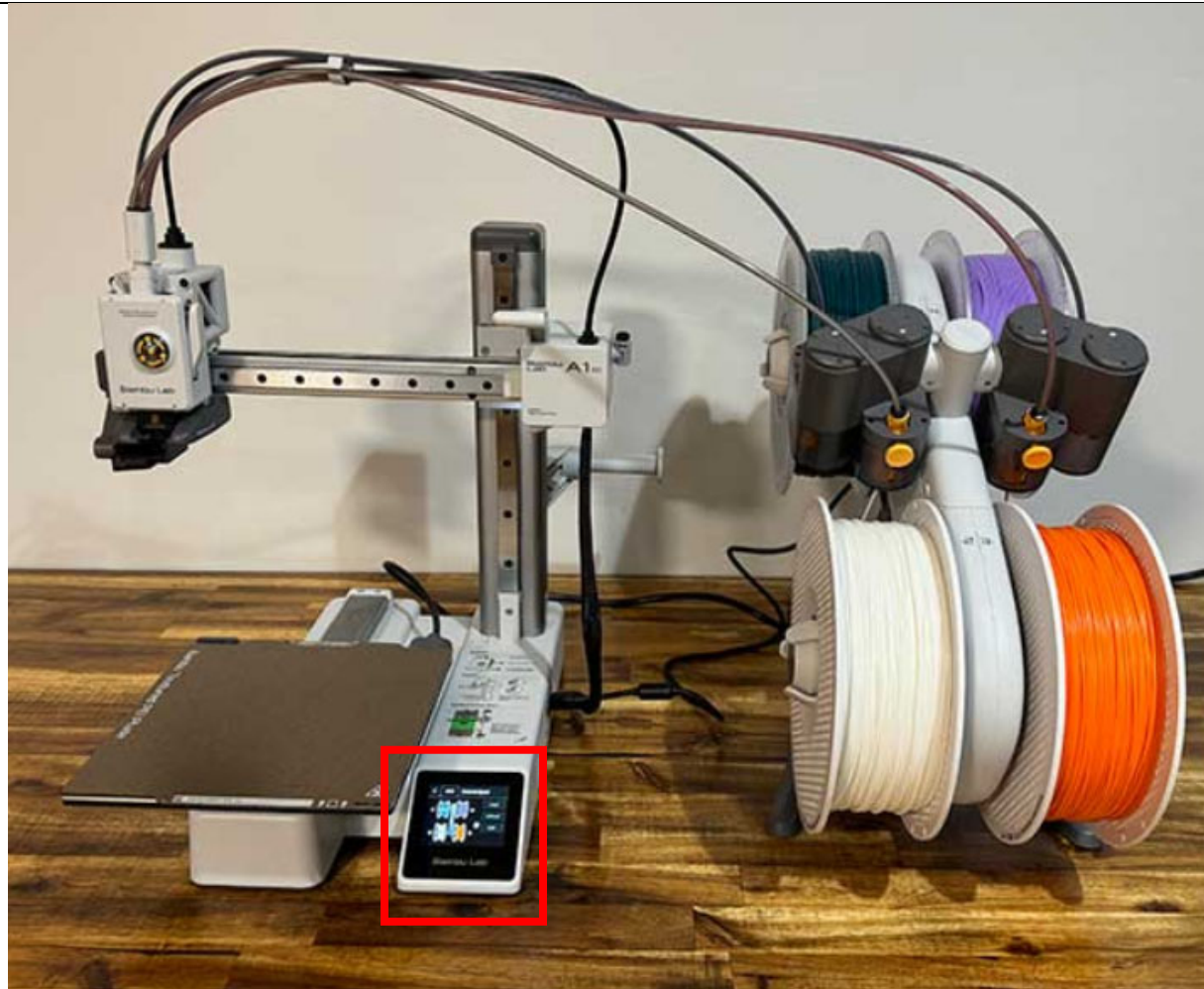
<https://wiki.bambulab.com/en/ams/manual/ams-function-introduction>

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<https://wiki.bambulab.com/en/ams-lite/manual/intro-ams-lite>

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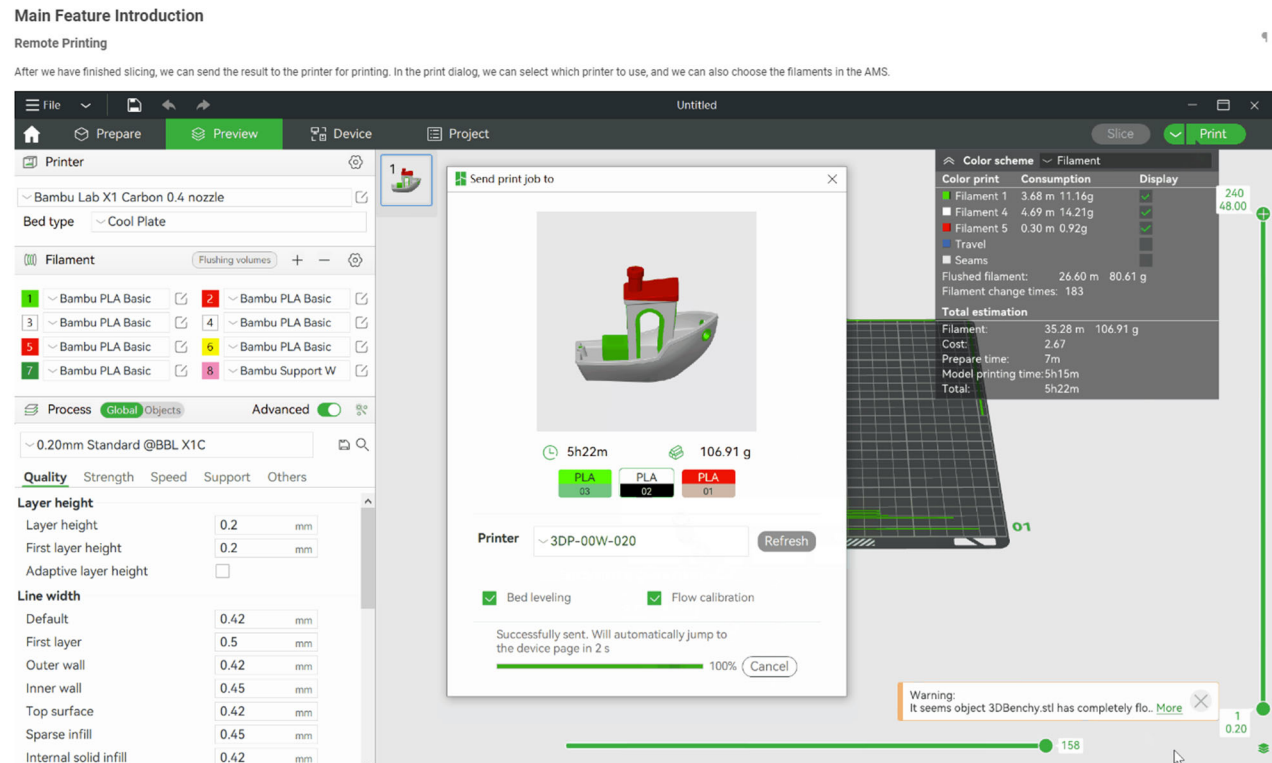
<https://the-gadgeteer.com/2023/12/19/bambu-lab-a1-mini-3d-printer-review-4-color-printing-is-awesome/>

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determining an operational parameter for configuring the three-dimensional printer for a fabrication process using the build material based upon at least one property of the build material in the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement;

The Accused Instrumentalities are used to determine an operational parameter for configuring the three-dimensional printer for a fabrication process using the build material based upon at least one property of the build material in the data, the operational parameter including at least one of a build platform temperature, a build volume temperature, an infill requirement, a rafting requirement, a support structure requirement, and a cooling requirement.

Bambu Studio generates fabrication instructions based on the data received from the data tag (e.g., the type and color of build materials to use in the build), and sends the fabrication instructions to the printer to fabricate the object based on the type and color of build materials.



<https://wiki.bambulab.com/en/software/bambu-studio/remote-control>

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	<p>“Load filaments to AMS and configure filament information</p> <p>Before starting multi-color printing, it is necessary to insert the (AMS) with the filament and set up the filament information. If you are using an official Bambulab filament, the AMS will automatically detect the filament type and color through RFID technology. However, if you are using a third-party filament, you will need to manually configure the relevant information. For details, please refer to AMS setup and loading filament.”</p> <p>https://wiki.bambulab.com/en/x1/manual/multi-color-printing</p>
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Bambu Studio configures printer parameters based on read data from the RFID sensor of the filament from the spool.

Bambu Studio describes a support structure requirement as the operational parameter:

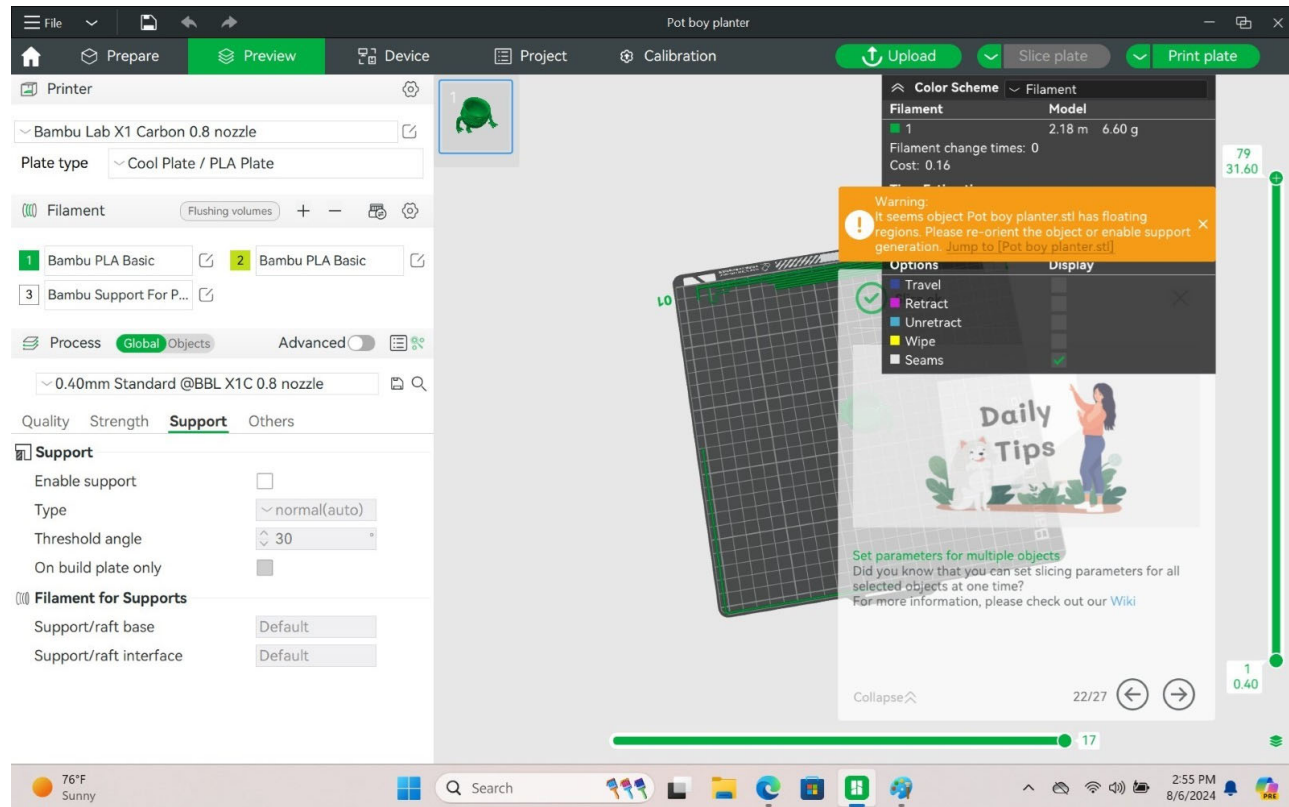
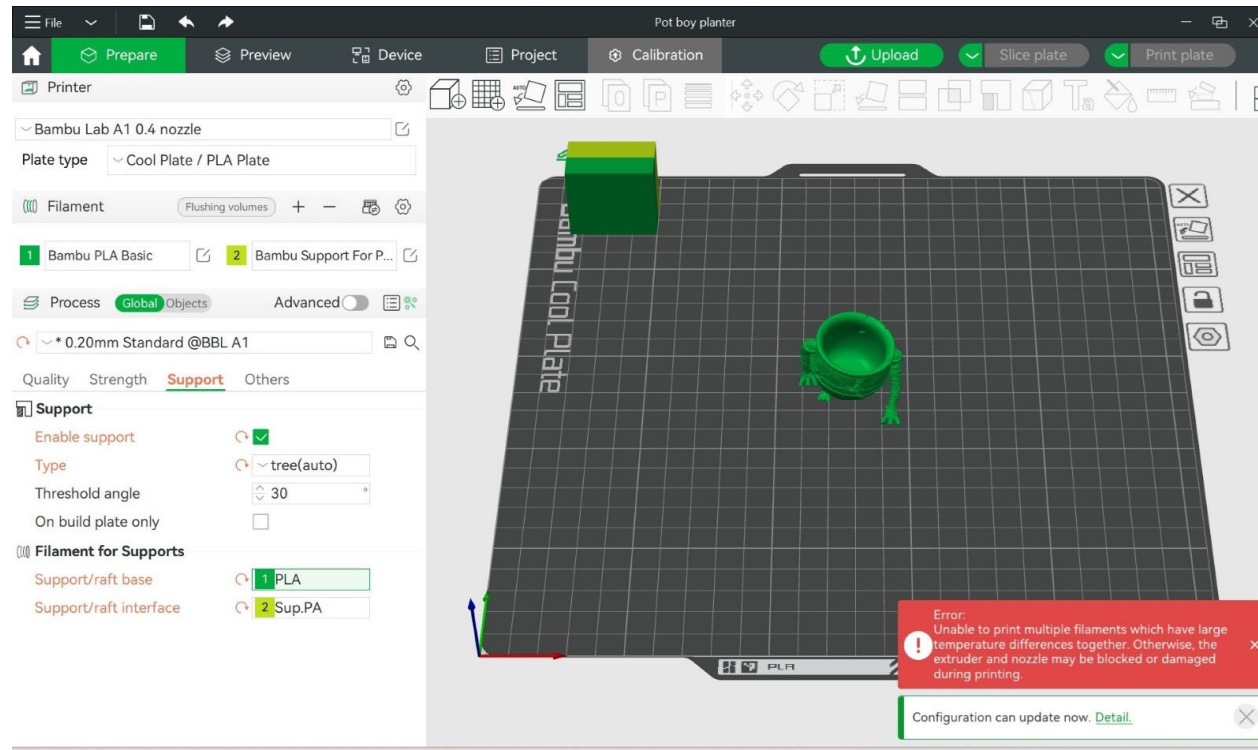


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The support structure is based on the type of filament used. When an incorrect filament is used, Bambu Studio provides an error. In the example below, when PLA filament is used as the build material with Sup. PA filament as the support structure, an error occurs as there is a large temperature difference between the filaments used for the support structure.



However, when Sup. PLA filament is used for the support structure filaments, the print job is able to be completed, indicating that the operational parameter (support structure filaments) is based on the property (type) of the filament.

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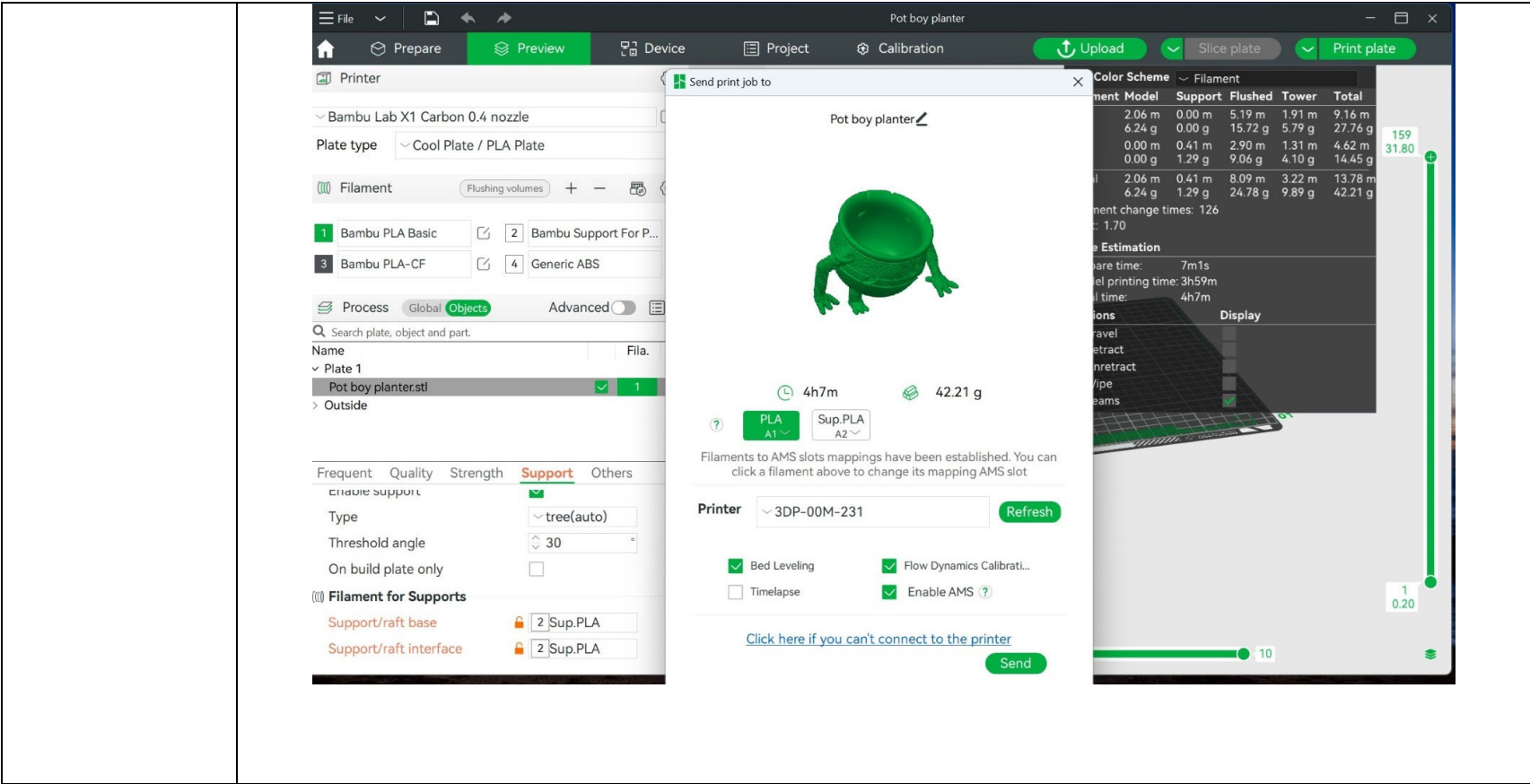


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If you are using an official Bambulab filament spool, AMS will automatically identify the type and color of the filament via RFID. You can tap the slot of the identified filament on the screen to view the specific information, but you cannot manually modify it.



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controlling operation of the three-dimensional printer with the controller according to the operational parameter; and

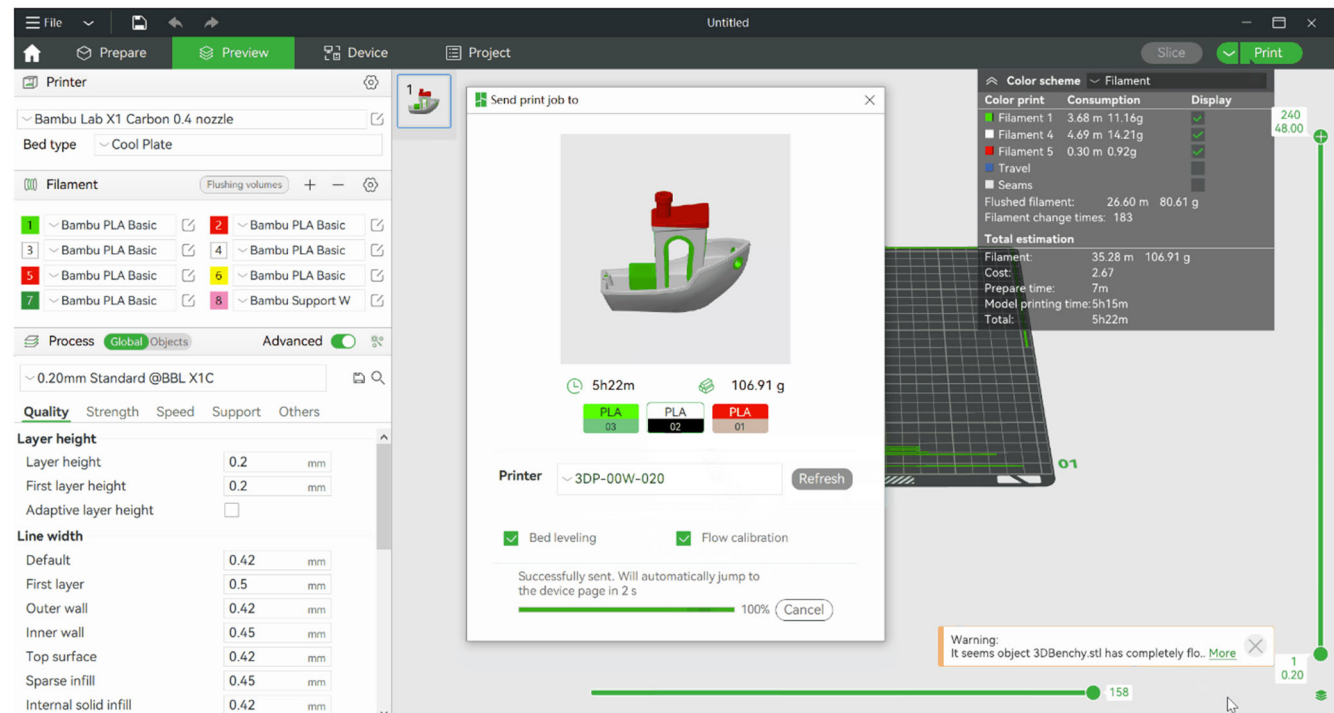
The Accused Instrumentalities control operation of the three-dimensional printer with the controller according to the operational parameter.

Bambu Studio can be used to initiate a build, based on the data received from the data tag (e.g., the type and color of build materials to use in the build), and send fabrication instructions back to the printer to fabricate the object based on the type and color of build materials (i.e., properties stored in the tag).

Main Feature Introduction

Remote Printing

After we have finished slicing, we can send the result to the printer for printing. In the print dialog, we can select which printer to use, and we can also choose the filaments in the AMS.



<https://wiki.bambulab.com/en/software/bambu-studio/remote-control>

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See, e.g., <https://wiki.bambulab.com/en/x1/manual/print-from-bambu-studio> (X1 series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/a1/manual/first-print-with-ams-lite> (A1 series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/a1-mini/manual/first-print-with-ams-lite> (A1 mini series guide explaining printing from Bambu Studio); <https://wiki.bambulab.com/en/p1/manual/print-from-bambu-studio> (P1 series guide explaining printing from Bambu Studio).

The three dimensional printer includes a controller, such as a CPU and/or MCU, that uses the received instructions to control the operation of the printer to fabricate an object.

The X1 has many electronic components inside, but here are the most important:

Logic Board

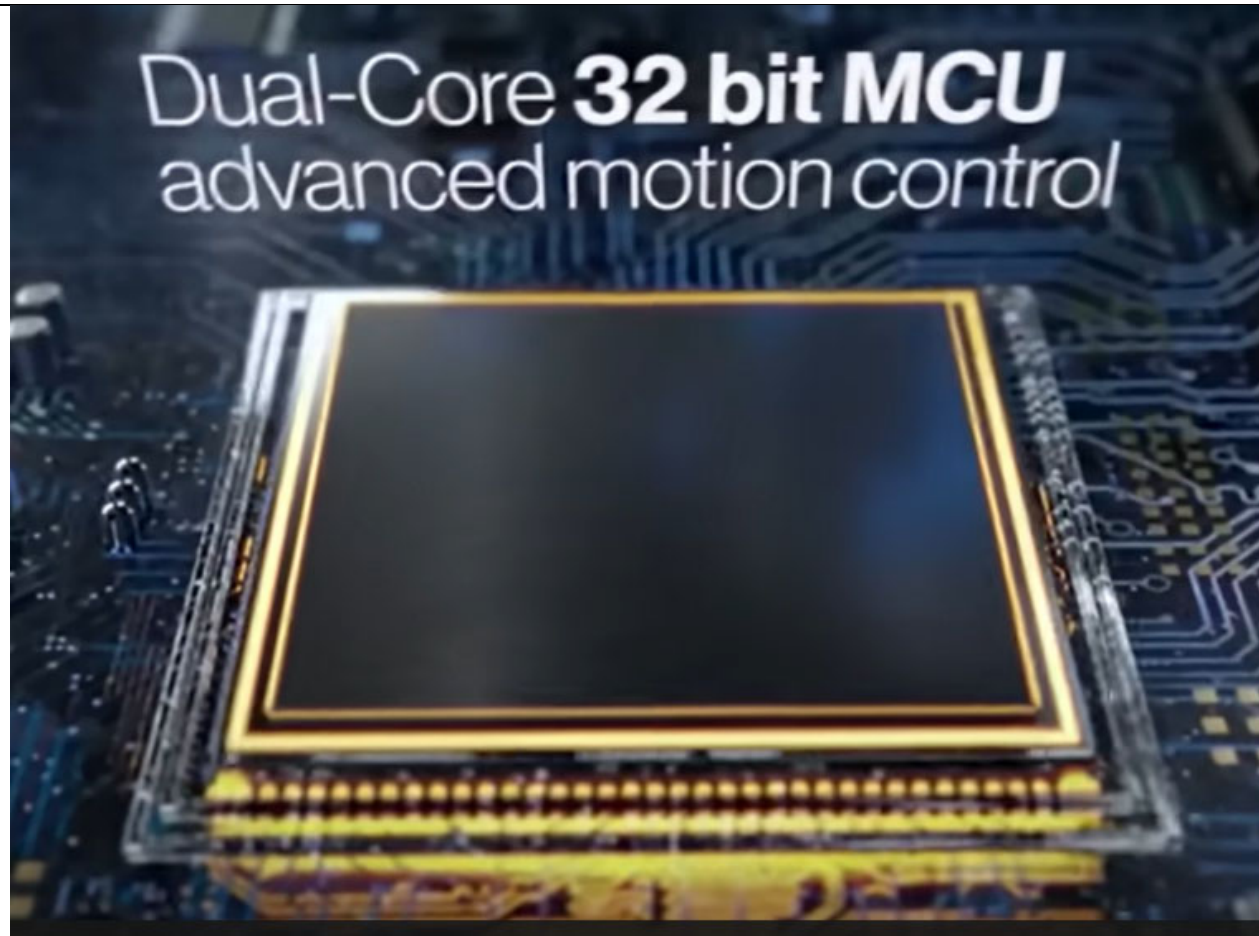
Every 3D printer comes with a logic board that has the CPU, stepper drivers, and the required connections for different electronics attached to the printer. In the case of the X1, the board has a quad-core CPU and a dual-core MCU.

The CPU handles the smart capabilities of the X1 including the AI spaghetti detection, flow calibration, vibration compensation, and the connection between the Slicer/App and the printer.

The MCU handles the actual movement of the printer after getting the stream of g-code from the CPU.

<https://wiki.bambulab.com/en/x1/manual/intro-x1>

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<https://bambulab.com/en/x1>

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The article provided at <https://wiki.bambulab.com/zh/x1/maintenance/replace-ap-board> discusses the Bambu Lab printers' AP mainboard as being an Application Board that controls the information flow within the printer:

What is the AP board?

AP Board refers to the Application board, it is a circuit board that controls the interaction of information within the unit. It provides a self-contained operating environment that delivers all system capabilities needed to support the printer's applications, including memory management, system firmware, graphics processing and multimedia decoding.

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Connectors on the AP board

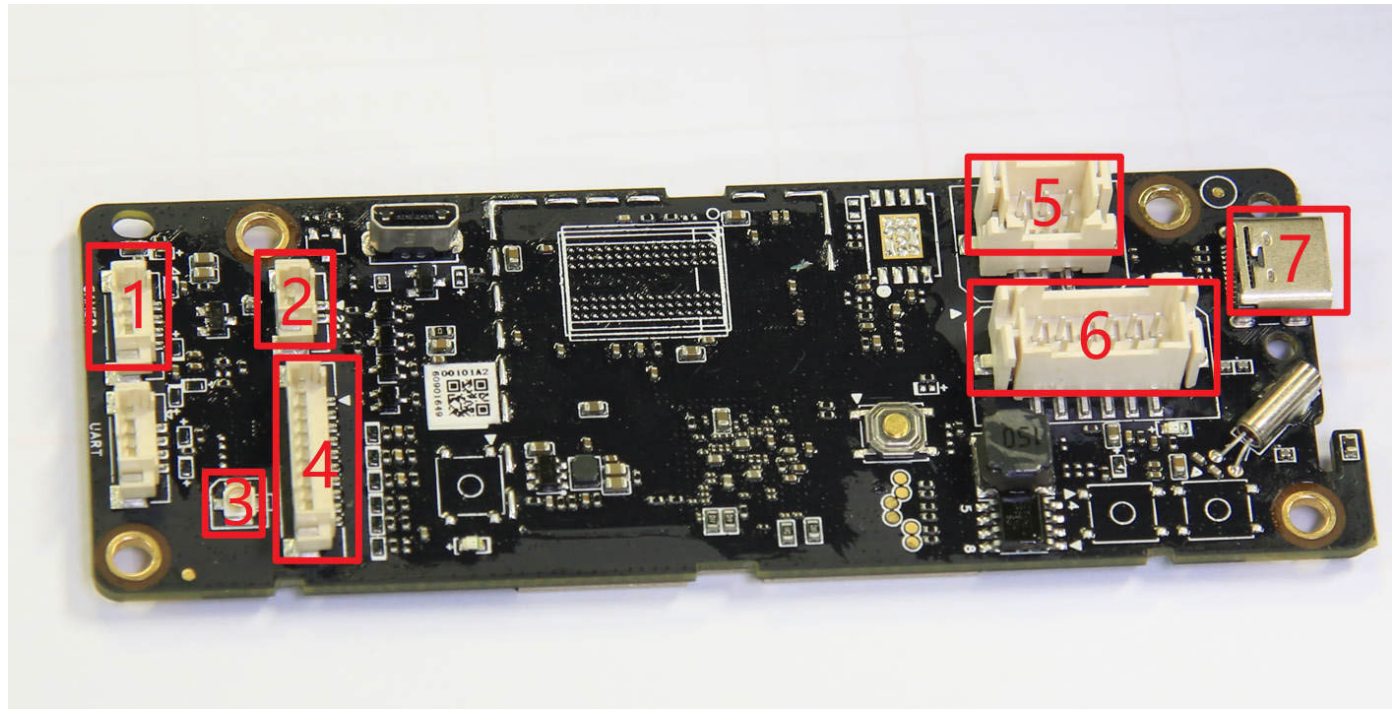


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NO.Connect object		NO.Connect object		NO.Connect object	
1	The chamber camera	4	Button PCBA	7	USB-C cable to Toolhead
2	The chamber LED	5	MC board (Power)		
3	WIFI antenna	6	MC board (Communication)		

The AP motherboard is in communication with the RFID system (tag sensor).

Furthermore, the Bambu Lab printers have a Machine Controller, which controls the various moving parts of the printer (see <https://wiki.bambulab.com/en/x1/maintenance/replace-mc-board>):

What it is

MC stands for Machine Controller, which is the unit that controls all the moving parts of the printer.

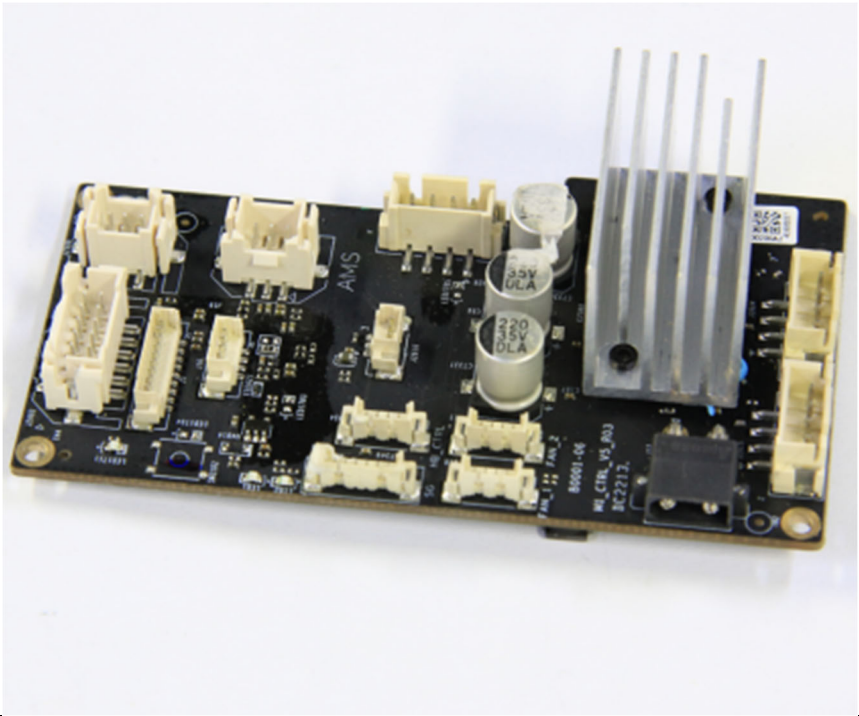


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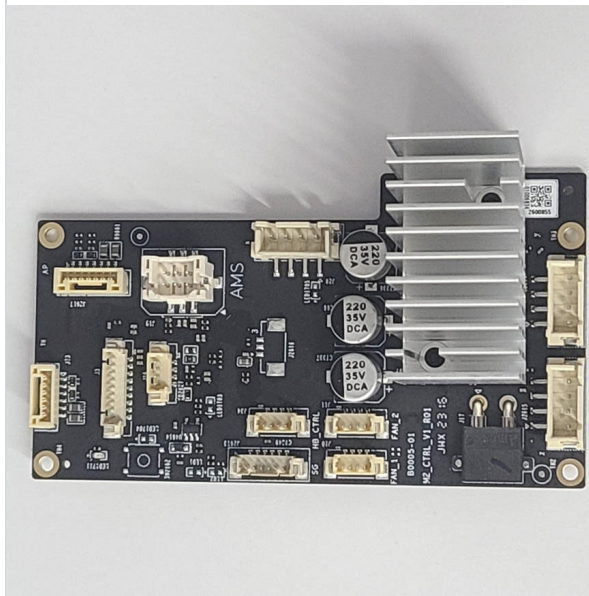
“MC board of P series

A wiki page guide you how to remove and install the MC board of P series.

MC Board of P series

MC stands for Machine Controller, which is the unit that controls all the moving parts of the printer.

There are differences in the heatsink of the MC boards for P1P and P1S, but the boards are the same.”



MC board for P1S

<https://wiki.bambulab.com/en/p1/maintenance/mc-board>

“Replace the AP Board for P1 Series

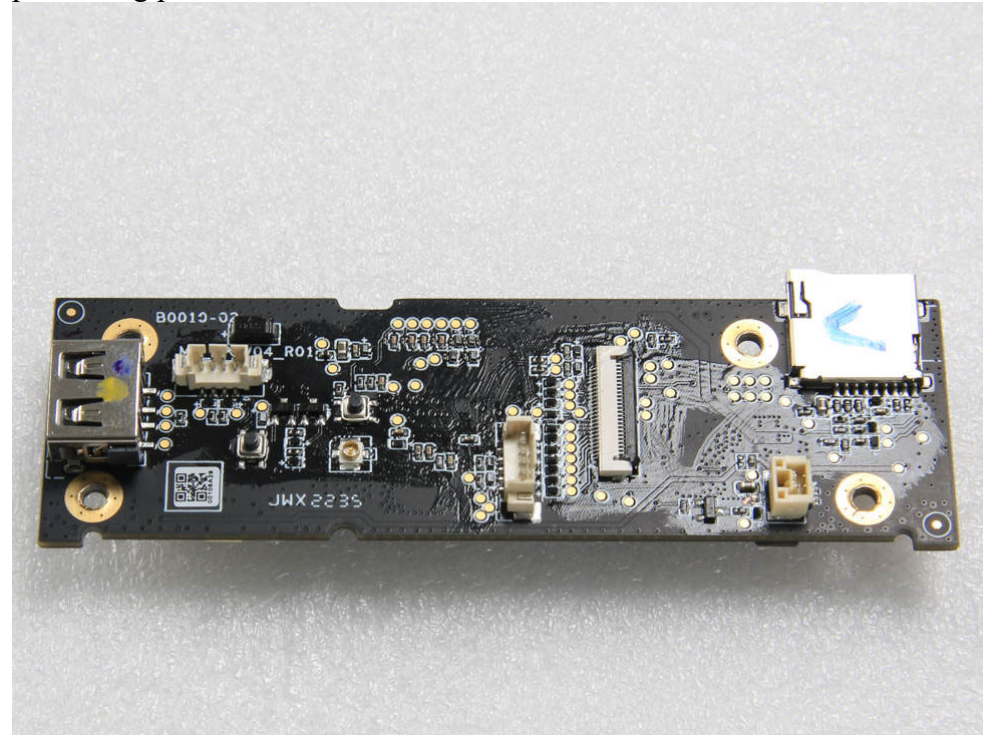
This guide shows how to remove and install the AP board for P1 Series

AP Board

The AP board is a circuit board that controls the printer and provides the required Wi-Fi connectivity and

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processing power.



Friendly reminder: The AP boards for P1S and P1P have the same appearance and installation method, but these two boards are not compatible. In other words, P1P can only use the AP board specifically designed for P1P, while P1S can only use the AP board specifically designed for P1S.”

<https://wiki.bambulab.com/en/p1/maintenance/ap-board>

“Electrical Components

The A1 incorporates various electronic components, and here is a brief overview of some of the most important components and their functions:

Circuit board

The main control board of the A1 printer consists of a low-power SoC (System-on-Chip) with a dual-core processor, Wi-Fi baseband, Bluetooth baseband, RF module, and other peripherals. It also includes a dual-

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core MCU (Microcontroller Unit) and a single-core MCU. Additionally, it incorporates stepper motor drivers and connectors required for connecting various electronic devices to the printer.

The SoC is primarily responsible for handling the user interface of the A1 printer and managing the connection between the slicing software/mobile application and the printer. On the other hand, the MCU controls the printer's heating and movement after receiving the CPU's G-code stream.”

<https://wiki.bambulab.com/en/a1/manual/intro-a1>

“Electrical Components

The A1 mini incorporates various electronic components, and here is a brief overview of some of the most important components and their functions:

Circuit board

The mainboard contains a low-power SoC (System-on-Chip) with a dual-core processor, Wi-Fi baseband, Bluetooth baseband, RF module, and other peripherals. It also includes a dual-core MCU and a single-core MCU. Additionally, it features stepper motor drivers and connectors necessary for connecting different electronic devices to the printer. The SoC handles the user interaction and the communication between the slicing software/mobile application and the printer. The MCU controls the actual heating and movement of the printer after receiving G-code instructions from the CPU.

Camera

The printer integrates a camera used for spaghetti detection (to be supported in future firmware updates) and real-time monitoring of prints using the Bambu Slicer or Bambu Handy application. In addition to the monitoring function, the camera can record videos of the prints to the micro SD card and generate time-lapse videos. The machine is not equipped with night vision, but the camera module has an auxiliary light to illuminate the print.”

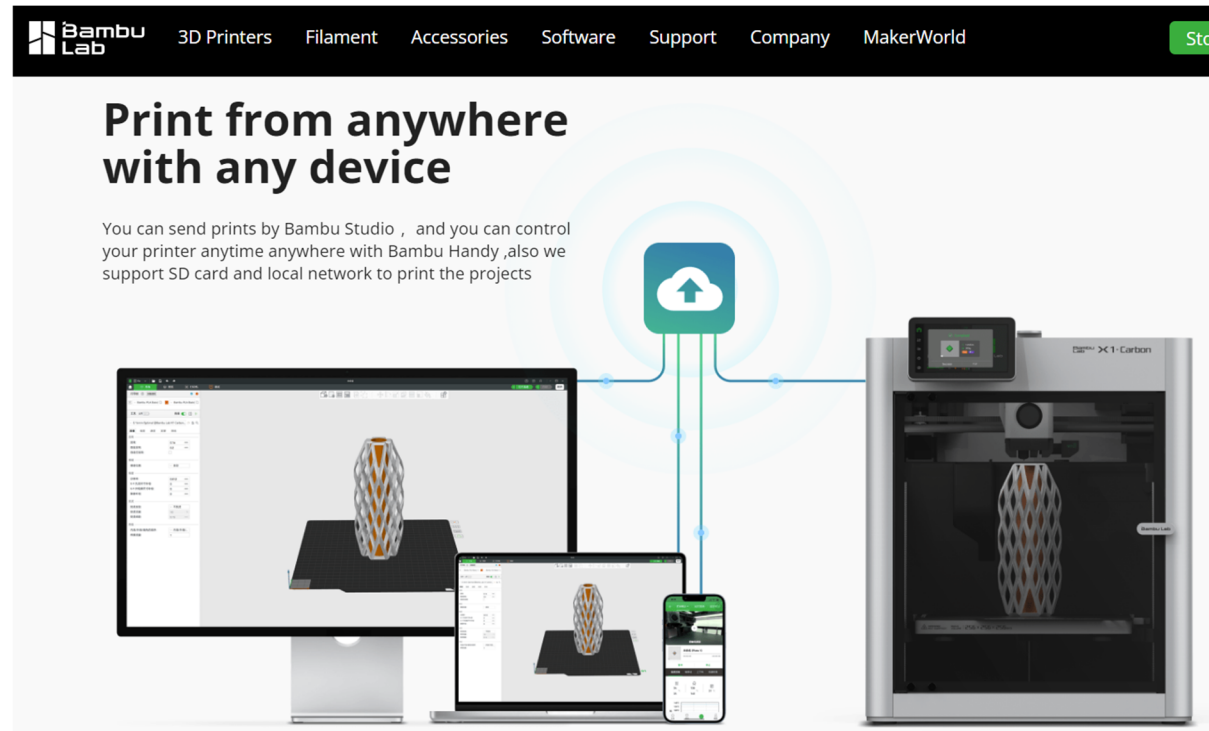
<https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini>

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fabricating an object with the three-dimensional printer based upon the operational parameter.

The Accused Instrumentalities are used to fabricate an object with the three-dimensional printer based upon the operational parameter.

The Bambu Lab printers then fabricate the object according to the instructions received from Bambu Studio.



<https://bambulab.com/en/x1>

“How does X1 work?

The X1 3D printer is a machine that uses plastic filament as the material for creating 3D objects.

Most of the time, the printable objects are files with the .stl extension that hold the 3D model which needs to be processed before it's ready to be printed with a piece of software called a slicer.

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	<p>The slicer, in our case the Bambu Lab Studio, takes that .stl file and slices it into layers which are then printed by the X1. All these slices are then converted into code, a type of language which tells the machine how to move its axis to print the model.</p> <p>Besides the movement, the slicer is also able to integrate various other settings inside the generated file, like the temperatures of the filament, printing speeds, and generate supports for some sections of the print.”</p> <p>https://wiki.bambulab.com/en/x1/manual/intro-x1</p> <p>““How does the P1 series work?</p> <p>The Bambu Lab P1 inherits the X1 series' renowned kinematics and motion control technology and the wealth of sensors that ensure its reliability. It can connect the automatic material system (AMS) for multi-color printing. Great for beginners, professionals, or others who enjoy the fun of being creative, the P1P has been designed for easy setup and use in minutes. Additionally, it allows upgrading and customizing hardware with mod-friendly features for people to enjoy the fun of making their one-of-a-kind 3D printer.”</p> <p>https://wiki.bambulab.com/en/p1/manual/intro-p1p</p> <p>“How does the A1 work?</p> <p>The A1 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 typically involves the following steps:</p> <p>Creation or acquisition of a digital model</p> <p>First, generate a 3D model or obtain an existing digital model using computer-aided design software, online resources, or other means.</p> <p>Slicing</p> <p>Next, Bambu Studio slices the digital model into multiple thin layers. Each layer's information is converted into "G-code," a language understood by the printer. The G-code provides instructions to the printer regarding movement paths and speeds of the different axes during the printing process.</p> <p>Preparing the printer</p> <p>Before initiating the printing process, the printer needs to be prepared. This involves loading the printing filament, positioning the build plate, and calibrating the printer's parameters to ensure optimal print quality.</p> <p>Printing</p>
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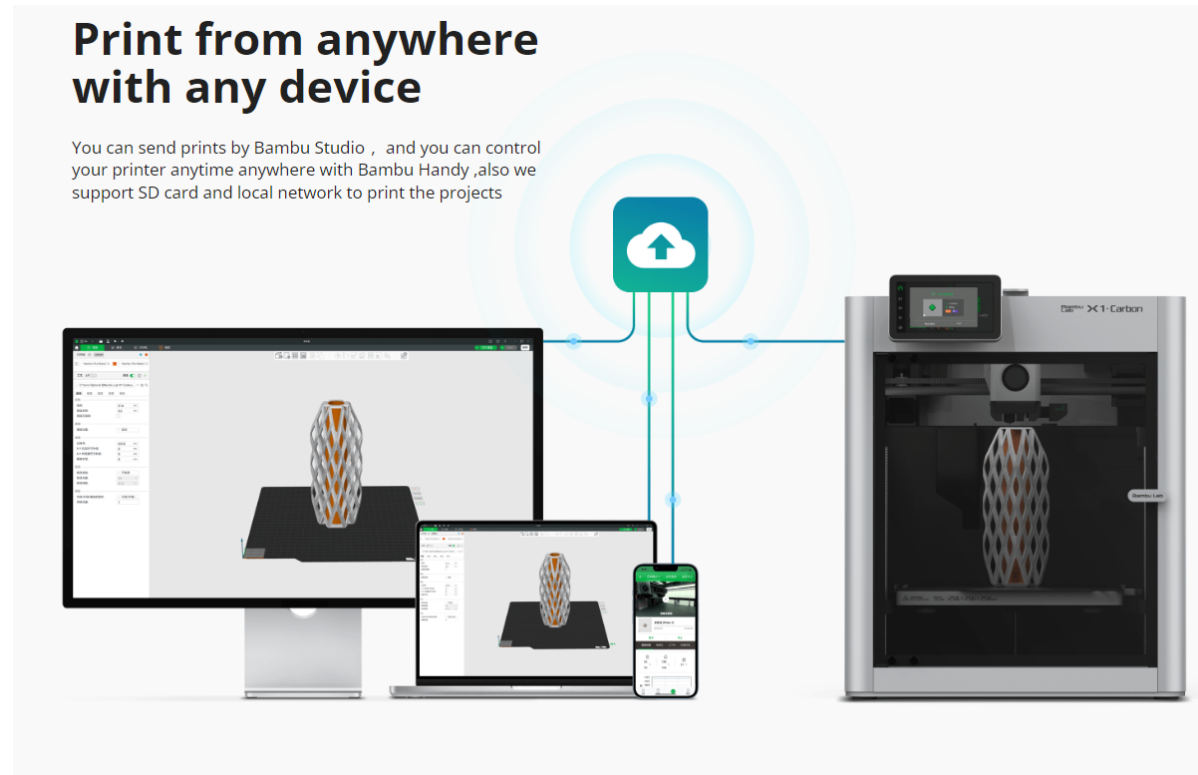
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	<p>Once all preparations are complete, the A1 printer gradually constructs the object layer by layer on the print platform.”</p> <p>https://wiki.bambulab.com/en/a1/manual/intro-a1</p> <p>“How does the A1 mini work?</p> <p>The A1 mini 3D printer is a machine that uses plastic filament to create 3D objects. It can transform digital models into physical objects. The working principle of the A1 mini typically involves the following steps:</p> <p>Creation or acquisition of a digital model:</p> <p>First, you need to create a 3D model or acquire an existing digital model. This can be done through computer-aided design software, online resources, or other sources.</p> <p>Slicing</p> <p>Next, Bambu Studio slices the digital model into multiple thin layers. The information for each layer is automatically converted into a language that the printer can understand, known as "G-code." This code instructs the printer on the movement paths and speeds of the various axes during the printing process.</p> <p>Preparing the printer</p> <p>Before starting the printing process, you must prepare the printer. This includes loading the printing filament, placing the build plate, and calibrating the printer's parameters to ensure print quality.</p> <p>Printing</p> <p>Once everything is prepared, the A1 mini gradually prints layer by layer onto the print platform, gradually building the object.”</p> <p>https://wiki.bambulab.com/en/a1-mini/manual/intro-a1-mini</p>
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20. The method of claim 1, wherein the client includes a computing device.

Client devices are connected to the three-dimensional printer via the cloud, and the client can be a computing device.



<https://bambulab.com/en/x1>