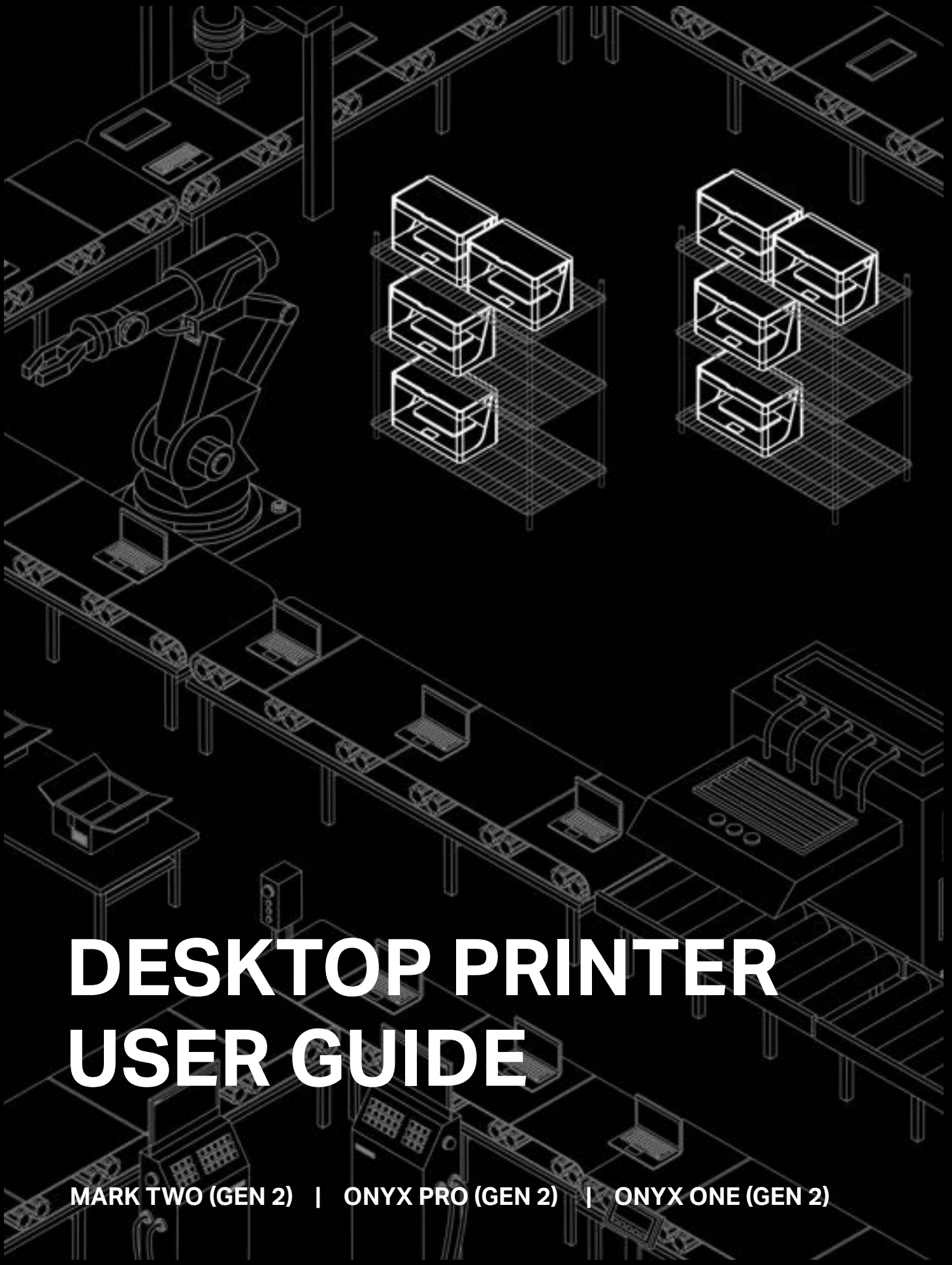

DESKTOP PRINTER USER GUIDE

MARK TWO (GEN 2) | ONYX PRO (GEN 2) | ONYX ONE (GEN 2)

Markforged

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Watertown MA 02472
USA

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For the latest PDF version of this document, visit our support website.

Changes are periodically made to the information herein which will be incorporated in revised editions of this publication.

Markforged may make changes or improvements to the product(s) described in this publication at any time and without notice.

Version 1.6a / January 2022

Original English-language instructions.

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Safety First

Please take a moment to review the following use and safety guidelines.

Labelling scheme

	**DANGER** Indicates a hazard which will result in serious injury or death if not avoided.
	**WARNING** Indicates a hazard which can result in serious injury or death.
	**CAUTION** Indicates a hazard which may cause minor or moderate injury.
	**NOTICE** Mandatory instruction - Indicates a potentially harmful situation in which the printer can be damaged or unsatisfactory function can occur.

Please retain these safety instructions for reference.

For detailed instructions on setup, operation, and maintenance of your Desktop Series printer, visit ***https://support.markforged.com*** or email ***support@markforged.com***.

Safety Hazards

The following notes indicate potential safety hazards that should be recognized when operating a Markforged Desktop Series 3D Printer.

<table>
<tr><th colspan="2">DANGER</th></tr>
<tr><td>  </td><td>Electric Shock
The printer has live electrical components that can cause serious injury or death. Do not open the bottom chamber of the printer. Please consult Markforged or an Authorized Dealer for service.
The printer shall only be installed in buildings where installation meets all required national and local wiring rules and building codes.</td></tr>
<tr><td>  </td><td>The printer relies on proper earthing of the plug for protective bonding. The printer may only be installed in a wall socket where integrity of the protective earth ground is ensured.</td></tr>
<tr><td>  </td><td>Using incorrect fuses can pose a risk of fire. Only replace fuses with same type and rating as specified.</td></tr>
<tr><th colspan="2">WARNING</th></tr>
<tr><td>  </td><td>Hot Surfaces
The print head generates high temperatures and may cause severe burns. Material extruded from the nozzles is extremely hot. Do not touch the print head or nozzles when at operating temperature. Do not reach into the build chamber while a part is printing. Keep all doors closed and guards in place while in operation.</td></tr>
<tr><th colspan="2">CAUTION</th></tr>
<tr><td>  </td><td>Moving parts
The printer has many moving parts including belts, pulleys, and lead screws. Moving parts can entangle and cut. Keep hands, loose clothing, and jewelry away from all moving parts. Keep all doors closed and guards in place while in operation.</td></tr>
<tr><th colspan="2">CAUTION</th></tr>
<tr><td>  </td><td>Pinch points
The moving printer gantry can trap and pinch hands or fingers, causing minor injury. Keep hands away from the moving gantry. Keep all doors closed and guards in place while in operation.</td></tr>
</table>

CAUTION	
	**Sharp Edges** The scraper provided with the printer has very sharp edges and can cut fingers and hands. Always scrape away from hands and body. Rest the bed vertically on a sturdy level surface when removing a part. Always keep fingers and other body parts out of the path of the scraper.
NOTICE	
	Before any installation, maintenance, or repair, disconnect the power cord from the printer.
NOTICE	
	The printer must be plugged into a power socket that is close to the machine and easily accessible. In case of emergency, disconnect the printer from the socket immediately.
NOTICE	
	The printer is designed to work only with Markforged proprietary materials and consumables. Use only materials that have been approved for use in the printer.
NOTICE	
	The printer melts thermoplastics and can emit odors during printing. Make sure to operate the printer in a well ventilated area.

RADIO INTERFERENCE

	NOTICE
	**WARNING: Potential for wireless radio interference** This equipment is compliant with Class A of EN55032. In a residential environment, this equipment may cause radio interference.

SAFETY AND COMPLIANCE

PRODUCT IDENTIFICATION

This *User Guide* covers the following Markforged printers:

- Onyx One (Gen 2) : F-PR-4011
- Onyx Pro (Gen 2) : F-PR-4012; F-PR-4013 (No-WiFi version)
- Mark Two (Gen 2) : F-PR-2027; F-PR-2026 (No-WiFi version)

INTENDED USE

Markforged Desktop Series 3D printers are designed and built to print 3D parts using Markforged proprietary spooled plastics and fibers in a commercial or light industrial environment. Printed Onyx plastic parts are twice as strong as conventional printed plastics and, when combined with continuous fiber reinforcement, can replace machined aluminum tooling in jigs, jaws, and fixtures.

Eiger Cloud software is an integrated suite of tools: part management library, slicer for turning CAD drawings into files for 3D printing, print monitoring tool, and fleet management tool. It offers secure part and build storage and sharing within organizations, allows custom fiber reinforcement for sliced parts, and seamlessly connects online Markforged devices. Offline Eiger provides Eiger functionality for offline users and locally networked devices.

FORESEEABLE MISUSE

Markforged models Onyx One (Gen 2), Onyx Pro (Gen 2), and Mark Two (Gen 2) are intended for use only with *Markforged proprietary plastic and fiber materials*. Use with and performance of materials that have not been evaluated and approved for use with these 3D printers is strongly discouraged and may lead to failed prints and potential safety risks, and may invalidate the Warranty. Installation, power connection, and use of these printers must be in accordance with the instructions contained in this *User Guide*. Contact Markforged via one of the methods specified in the *Safety Booklet* shipped with your printer for any concerns or questions about applications or appropriate use.

FCC COMPLIANCE

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

SHOCK PROTECTION

Insulation category: Class I.

INGRESS PROTECTION

Protection class per EN 60529: IP20.

SOUND OUTPUT

Continuous sound pressure level (L_{eq}) is less than 70dBA.

CLIMATE CONTROL

- Operating temperature: 18.8°C - 35°C (66°F-95°F)
- Operating humidity: 0%-90%, non-condensing
- Operating altitude: <3000 m (9842 ft)
- Pollution degree: 2
- No dedicated exhaust is required

OPERATING ENVIRONMENT

Composite printing materials are highly hygroscopic and will absorb any available moisture. For best results, operate your printer in a typical climate-controlled office environment (20-26°C, 40-60% relative humidity). Running the system or storing the print materials in an extremely humid environment may require additional purge strip prints or an increased frequency in material changeover.

VENTILATION REQUIREMENTS

Markforged Composite Printers melt thermoplastics and emit thermoplastic odors during printing. Ensure your printer is used in a well-ventilated area. No dedicated exhaust is required for the printer. Additional measures may be required based on local regulations.

REDUCING BURN RISKS

- Do not touch the nozzles and print head when hot, unless explicitly instructed to do so
- During a print run, leave all doors closed

ALWAYS FOLLOW SAFETY INSTRUCTIONS

Failing to use your Desktop Series printer in the manner specified by the manufacturer may lead to unsafe operating conditions. Follow all safety instructions posted on the unit and in the written documentation.

Note: Consult the included Safety Sheet *for an explanation of the safety icons used in this manual.*

USER NOTES

ADDITIONAL SUPPORT AND REPLACEMENT PARTS

For safety sheets, product datasheets, and additional information regarding Markforged devices, materials, and replacement parts, see the Markforged Support site (***support.markforged.com***) and our online store (***shop.markforged.com***).

MATERIAL NOMENCLATURE

In this guide, "Onyx" refers to Onyx and Onyx FR; "Nylon" refers to Tough Nylon and Nylon White.

NOTE ON FIBER CAPABILITY

This *User Guide* covers all models of Markforged Desktop Series printers. If your printer model is not fiber-capable, some of the sections in this *User Guide* may not apply. Such sections are indicated by the Markforged logo icon at left.

TABLETOP USE ONLY

Markforged Desktop Series printers are approved for tabletop use only. Set up your printer on a sturdy level surface with sufficient access on all sides. The printer is not approved for free-standing floor use.

POWER DISCONNECT ACCESS

Take care to set up your Desktop Series printer so that the disconnecting device (power switch on the rear face of the printer) is accessible at all times. Note that the power cord can be disconnected as a backup if the power switch becomes inoperable or inaccessible.

CLEANING/DECONTAMINATION

The printer interior and exterior can only be wiped down using a damp microfiber cloth. The clear shield can be cleaned with a microfiber cloth and non-abrasive window cleaner, as other cleaning agents could permanently fog or scratch the surface. Please follow instructions above (*Reducing Burn Risks*) to safely clean your printer.

PRESERVING FACTORY CALIBRATION

Note that the plastic extruder and print head are factory-calibrated; do NOT adjust or disassemble in any way unless specifically instructed to do so by Markforged Support. Warranty claims for assemblies that have been adjusted, disassembled, or modified may not be honored.

PRODUCT DIMENSIONS

Size: 584 x 330 x 355 mm (23 x 13 x 14 in)
Weight: 16 kg (35 lbs)

REPLACEMENT SUPPLIES

Consumable items, print material, and other parts and supplies are available at ***shop.markforged.com.*** The following items are among the most frequently replaced parts for Desktop Series printers:

Item name	SKU
Plastic nozzle	F-PC-2003
Fiber nozzle	F-PC-2004
Fiber Bowden tube	A1042-FRU
Plastic Bowden tube	A1041-FRU
Onyx material spool (800cc)	F-MF-0001
Nylon White material spool (800cc)	F-MF-0003

Contact your Reseller for more information about reordering items. Instructions for installation and maintenance are found at the Markforged Support website, ***support.markforged.com***.

UNBOXING AND ASSEMBLY

WHAT'S IN THE BOX

Your Desktop Series printer ships with a number of accessories, listed below. With the exception of the last four items, everything on the list below can be found in the accessory kit shipped inside your printer.
Note: To make full use of your Desktop Series printer, you will need these additional items: wire cutters; masking tape, painter's tape, or similar; a scale accurate to 1 gram.

- Drybox adapter plug
- 2mm hex key
- 2.5mm hex key
- 3mm hex key
- Plastic shim (in envelope)
- Fiber shim (in envelope)
- 3 fiber nozzles with PTFE tubes installed
- 5 fiber PTFE tubes
- Fiber nozzle torque bit (10mm)
- Plastic nozzle torque bit (7mm)
- Torque wrench
- Plastic feed tube
- USB-A to USB-B cable and cable extender
- Tweezers
- Glue stick (applied to print bed before each print)
- Anti-Seize (applied to plastic/fiber nozzles when installing)
- 3 plastic nozzles
- Wi-Fi antenna
- Scraper
- TrueBed
- 2 50cc spools of carbon fiber (for Mark Two only)
- 50cc fiberglass
- 50cc Kevlar (for Mark Two only)
- 50cc HSHT (for Mark Two only)
- Drybox — shipped separately
- Plastic (Onyx or nylon) spool — in drybox
- Spindle and spindle cap — in drybox
- Power cord — on top of printer

UNBOX AND ASSEMBLE YOUR PRINTER

Supplies

- 3mm hex key
- Wire cutters or similar tool

Please take care when unboxing and assembling your Desktop Series printer. The printer is heavy and may require two people to move or set up. Never lift the printer by its plastic visor. When you finish unboxing your printer, retain the box and protective foam for future shipping.

1. Review the ***Safety Sheet*** that came with your printer.
2. After opening the box containing your printer, perform a two-person lift to remove the printer from the box and set it up in its operating location, on a table or stand rated to support its weight. Position the printer such that its visor opens from the front and the back face remains accessible.
3. Remove the ***Getting Started*** card from the visor and set it aside, then remove and discard the plastic wrap and any tape.
4. Remove the accessory kit from the printer. Remove and discard the plastic wrap.
5. Using wire cutters or a similar tool, carefully remove the two zip ties from the print chamber.
6. Screw the Wi-Fi antenna onto the SMA jack or plug the Ethernet cable into the Ethernet port.
7. **Adjust belt tension:** Manually move the print head to the back left corner of the print chamber. Download a tuning app on your mobile device (see note). Place your phone's microphone close to, but not touching, the back belt and pluck the front stretch of the back belt like a guitar string. Use a 3mm hex key to adjust the rear belt tensioner until the app reads a frequency of **49Hz**. Repeat with the ***back*** stretch of the ***front*** belt and adjust the ***front*** belt tensioner until the app reads a frequency of **62Hz**.
   Note: Recommended free tuning apps: Fine Tuner (iOS), Pano Tuner (Android).

8. Plug the power cord into the printer and wall outlet.
9. Turn your printer on and wait for it to power up; initial startup will take several minutes.
10. Connect your printer to the Internet via:

    - **Ethernet:** Select the Ethernet icon from the dashboard and navigate to **Ethernet > Done**.
    - **Wi-Fi:** Select the Wi-Fi icon from the dashboard and navigate to **Wi-Fi > Configure**. Use the arrow button to select a network from the **Network Name** drop-down menu and enter the password if needed. Then, press **Save**.
      Note: If no networks are listed, power cycle your printer and repeat this step.

11. Update firmware by navigating to **Menu > Settings > Update Manager > Cloud Update**. To update firmware via USB, see ***Updating Firmware***.

QUICK START GUIDE

GUIDE INTRODUCTION

This guide is designed to walk you through the process of setting up your printer and printing for the first time.

Before diving into the printing process, please ensure that you have completed the following steps as described in this *User Guide:*

- Unbox or unpack your printer, drybox, and all other components that were shipped with your printer.
- Review the safety instructions that came with your printer
  Note: Please consult the Safety Sheet *for explanations of the icons used in this document*
- Review the *Network Requirements* section of this *User Guide*
- Connect your printer to the Internet and apply any available firmware updates

Most Desktop Series users print online via Wi-Fi or Ethernet. This guide will walk you through the setup necessary for online printing. If you experience network issues or cannot print online at any point, you will be directed to the relevant section of this *User Guide*.

Supplies

- Drybox
- Plastic feed tube
- Unopened bag of plastic filament
- Unopened spool of fiber filament (if applicable)
- Tweezers
- Glue stick
- Leveling shims (in envelope)
- Scraper
- 2.5mm hex key
- Wire cutters or similar tool (not included in accessory kit)
- Masking tape, painter's tape, or similar (not included in accessory kit)

LOAD PLASTIC

Note: The print head will become hot during the plastic loading process. Exercise caution when working near the nozzles.

Only use materials that have been approved by Markforged for use with this printer. The Desktop Series is designed to work only with proprietary materials and consumables from Markforged.

Always follow proper procedures when storing plastic materials. Nylon or Onyx that has absorbed too much moisture from the air will often cause underextrusion, which can cause print failures. Please take special

care to **never** leave plastic materials exposed to ambient air, and **always** keep plastic materials in the provided drybox.

1. Open your drybox and remove the spindle from the inside. Pull the magnetic spindle cap and spindle body apart.

2. After verifying that the plastic filament material bag has no holes, remove the spool from its packaging. Place the provided desiccant packs in the corners of the drybox.
3. Place the spindle through the center of the spool of plastic filament and attach the spindle cap such that the magnets connect.
4. Place the spool and spindle in the drybox such that filament exits from the **top** of the spool.
Note: The plastic spool is wound under tension. Always hold the plastic against the spool to prevent unwinding during the loading routine.

5. Cut the plastic filament at a 45° angle.
6. Insert one end of the plastic feed tube into the adapter on the side of the drybox, then feed the plastic filament all the way through the tube such that it extends out the other end.

7. Close the drybox cover and press the latches closed until they click **twice each**.
Note: Ensure that the drybox remains closed and fully latched at all times, except when quickly loading or replacing filament.

8. Feed the plastic feed tube through the opening in the back of your printer and let it hang freely.

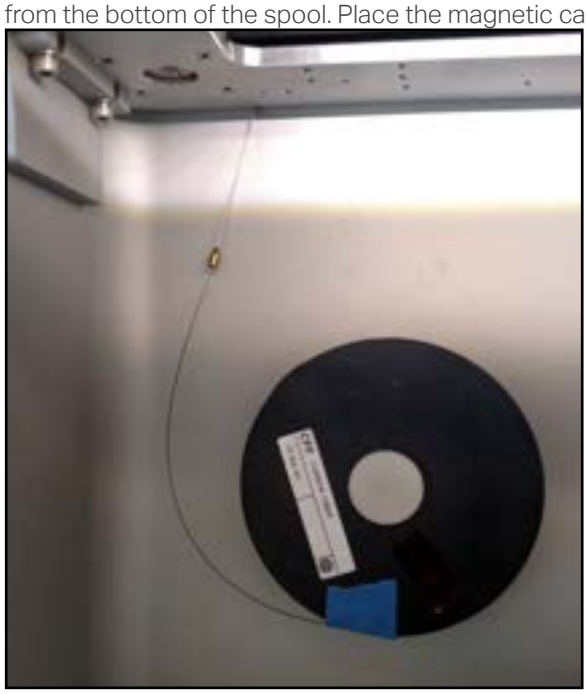
9. Run the Load Plastic routine by selecting **Menu > Materials > Load Plastic > Meter Load** on your printer's touchscreen. Input the type of plastic that you are loading and select **Full Spool**. Follow the onscreen instructions to load plastic before moving on to the next section.
    a. Wait for the plastic nozzle to heat up before feeding filament into the plastic extruder.
    b. Once the extruder motor catches the filament, insert the unattached end of the plastic feed tube into the fitting on the back of the plastic extruder.
    Note: The plastic extruder will start to click as material is extruded from the nozzle. This is normal and expected behavior for the material loading process.
10. Use tweezers to remove extruded plastic material from the nozzle.

LOAD FIBER

1. Open your fiber filament material bag and remove the fiber spool.

2. Hold the end of the fiber to keep it from unspooling and remove the tape from it.
3. Carefully unwind two and a half feet of material from the spool, then re-apply the tape to keep the rest of the material from unspooling.
   *Note: To avoid bending the material, tape it to the **inside** of the spool wall.*

4. Use wire cutters or a similar tool to trim off any filament that appears bent, as it may be difficult to load.
5. Feed the cut end of the material through the fiber feed tube until it reaches the fiber extruder.
6. Run the Load Fiber routine by selecting **Menu > Materials > Load Fiber > Meter Load** on your printer's touchscreen. Input the type of fiber that you are loading and select **50cc Full** or **150cc Full**, depending on the spool size. Follow the onscreen instructions to load fiber. As the fiber is loading, follow steps 7 and 8 below to place your fiber spool on the spindle without letting it unravel.
7. As the fiber feeds through the fiber extruder, put the fiber spool on the spindle such that material exits from the bottom of the spool. Place the magnetic cap on the spindle to keep the spool in place.



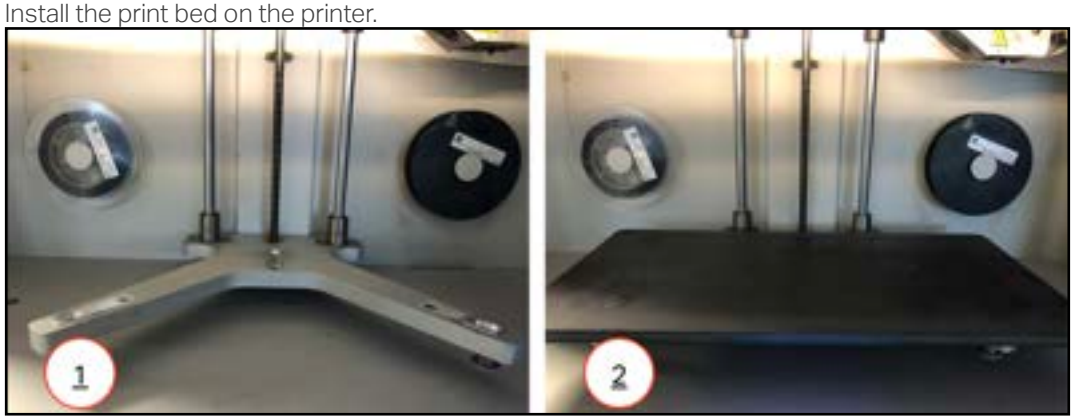
8. When the fiber is under tension on the spool, remove the tape from inside the spool and set it aside for later use. We recommend taping it to the front face of the spool.

9. At the end of the Load Fiber routine, remove the cut piece of fiber from the print head.

SET UP YOUR PRINT BED

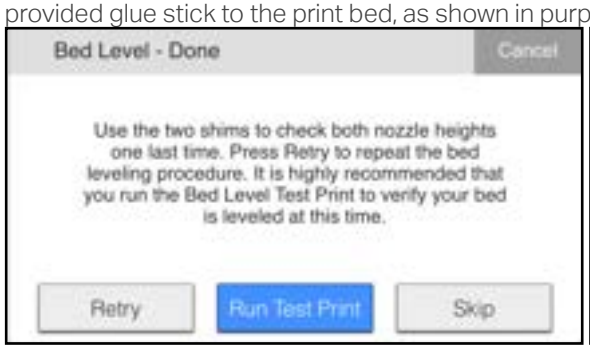
Before printing a part, you will need to level your print bed and apply glue to the region of the bed where the parts will print. Leveling the print bed provides the best chance of print success and minimizes warping. Applying glue ensures a well-adhered first layer and allows for easier part removal. Follow the instructions below to set up your print bed.

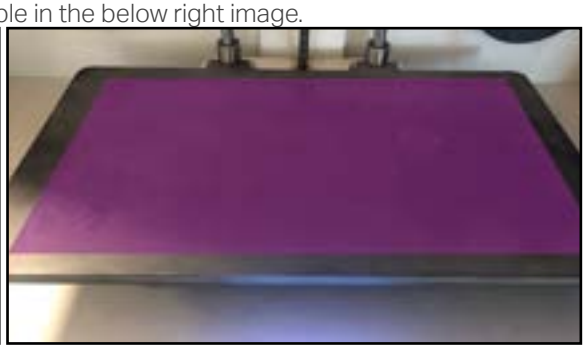
1. Install the print bed on the printer.



2. Run the Shim Bed Level utility by selecting **Menu > Bed Level > Shim Bed Level** on your printer's touchscreen and following the onscreen instructions.
Note: The print head will move autonomously during this utility.

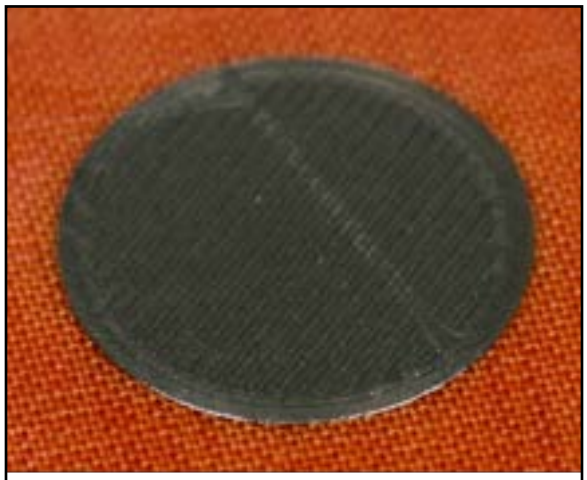
3. When you see the screen in the below left image, pause momentarily. Apply a thin layer of glue from the provided glue stick to the print bed, as shown in purple in the below right image.





4. Run the Bed Level Test Print utility by pressing **Run Test Print** on the printer's touchscreen.
*Note: If you needed to exit the previous utility, navigate to **Menu > Utilities > Test Prints > Bed Level Test Print** on the touchscreen to run the Bed Level Test Print.*

5. Evaluate the resultant disks to see if your bed needs to be adjusted. Compare your results with each of the example disks below.



Well- Leveled

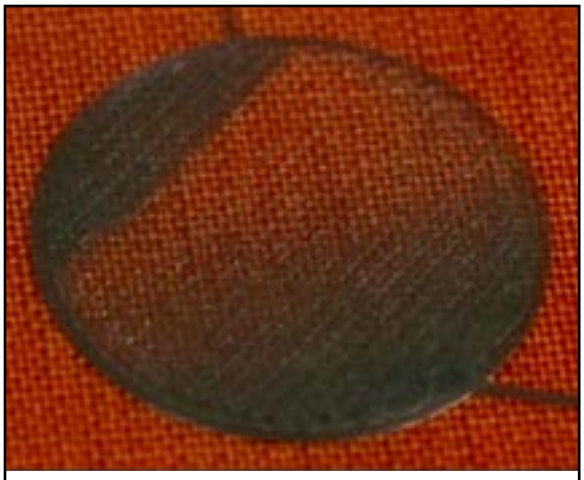
Uniform and solid: Well-leveled

Bed Low

Stringy material or the lines don't connect completely to the outer circle: Bed low

Bed High

Flattened or overly pressed down: Bed high



Bed Very High

Inconsistently or not entirely laid down: Bed very high

6. If the disks over each of the adjustment thumbscrews indicate proper leveling, skip to step 7. If any of your disks indicate a high or low nozzle, complete the following steps and then re-evaluate your results:
    a. Remove the print bed from the printer and use the provided scraper to remove the disks.
    b. Use warm water to clean the glue off of your print bed.
    c. Run the Shim Bed Level utility again but do not loosen the thumbscrews under the print bed when prompted to do so. Base your adjustments off of the results of the previous test print.
    d. Reapply glue to the print bed before running the Bed Level Test Print utility again.
7. After removing the disks, apply glue to the print bed as shown below.

8. Reinstall the print bed on the printer.

PRINT YOUR FIRST PART - ONLINE VERSION

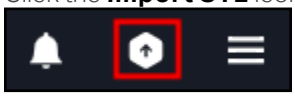
Note: We recommend that users use the online version of Eiger and print via Wi-Fi or Ethernet, but if you are unable to connect your printer to Eiger, please see the section titled Offline Printing*.*

Each user has an Eiger *account* belonging to a single Eiger *organization*. You can only use printers registered to your organization; printers can only belong to only a single Eiger organization.

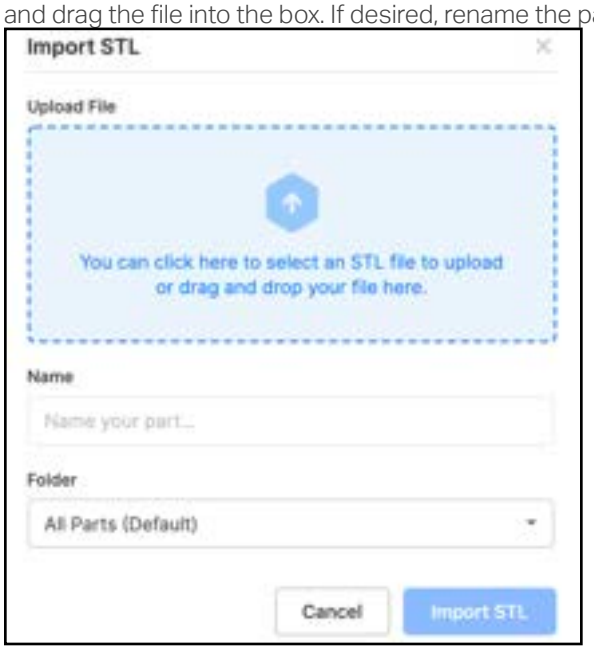
- If you have an Eiger account in the appropriate organization, proceed to step 1.
- If you do not yet have an Eiger account and wish to create a new Eiger organization, navigate to *eiger.io* in your Google Chrome browser and create a new Eiger account and organization. Proceed to step 2.
- If you do not yet have an Eiger account and wish to register your printer to an existing Eiger organization, request that the organization owner add you to the organization. Once you receive your Welcome to Eiger email, proceed to step 1.
- In the unusual event that you need to switch organizations before registering your printer, you must first delete your Eiger account (**Settings > Account Settings > Delete Account**), then follow the appropriate instructions above.
  *Note: If you are the only user in the organization, log in to Eiger and delete the organization (**Settings > Organization Settings > Delete Organization**), then follow the appropriate instructions above.*

1. Log in to your Eiger account: navigate to *eiger.io* in your Google Chrome browser and enter your login credentials.

2. In Eiger, select **Devices** or **Printers** from the sidebar, then click the **Register Device** button in the top right corner of the page. Enter your printer's information in the respective fields. This information can be found on the sticker on your *Getting Started* card, as well as by selecting the menu icon from the dashboard and navigating to **Settings > System Info**.
   *Note: You do not need to include any hyphens in the **Device ID** field.*
3. Import the **Logo Keychain Onyx** part into your Eiger organization following the steps below:
   a. Download the STL file for the part here: https://s3.amazonaws.com/mf.product.doc.images/Links/LogoKeychainOnyx.stl.
   b. Click the **Import STL** icon in the navigation bar.

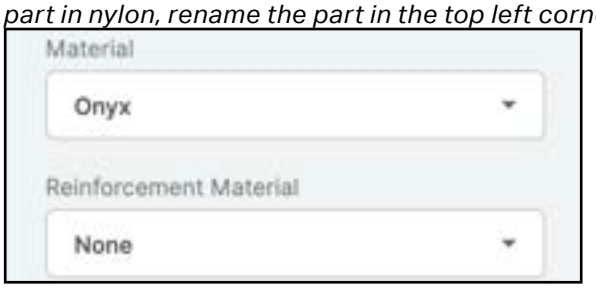


   c. Click within the **Upload File** box and select **LogoKeychainOnyx.stl** from the filesystem, or click and drag the file into the box. If desired, rename the part in the **Name** field.

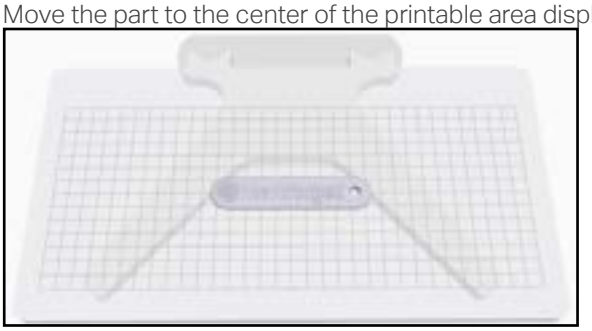


   d. Click **Import STL** to import the file to Eiger. You will be redirected to the Part View page for the newly created part.
4. Select **Desktop Series** from the **Printer Type** drop-down menu in the **Part Settings** panel on the right side of the screen.

5. Select the material types that you will use for this print from the **Material** and **Reinforcement Material** drop-down menus.
   Note: This part can be printed with any combination of fiber and plastic. If you have loaded materials other than the defaults for this part, update the material fields in Eiger. If you print this part in nylon, rename the part in the top left corner of the page to reflect the material change.



6. Click **Save**.
7. Click **Print** at the bottom right corner of the screen.
8. Move the part to the center of the printable area displayed on the screen.



9. Select your printer from the drop-down menu in the **Build Settings** panel at the right side of the screen.
10. Click the **Print** button in the bottom right corner of the page.
11. Verify the print details and address any warnings listed in the pop-up window, then select **Print Now**.
12. Wait for the print to finish successfully; this should take less than an hour.
13. Remove the print bed from the printer and use the provided scraper to remove the part from the print bed.

Warning: The provided scraper is sharp and can cause injury if used incorrectly.

Tip: Always scrape away from your body. When removing a part, brace the bed in a vertical position against a sturdy level surface. Slide the scraper under the corner of the part. Always keep fingers or other body parts out of the path of the scraper when removing a part from the print bed. Maintain an acute angle between the scraper and the print bed while you are removing your part.

14. Use warm water to clean the glue off the print bed.
    Note: Do not use soaps or other cleaners, as these may damage or leave residue on the bed.

USER GUIDE

CREATING EIGER ORGANIZATIONS

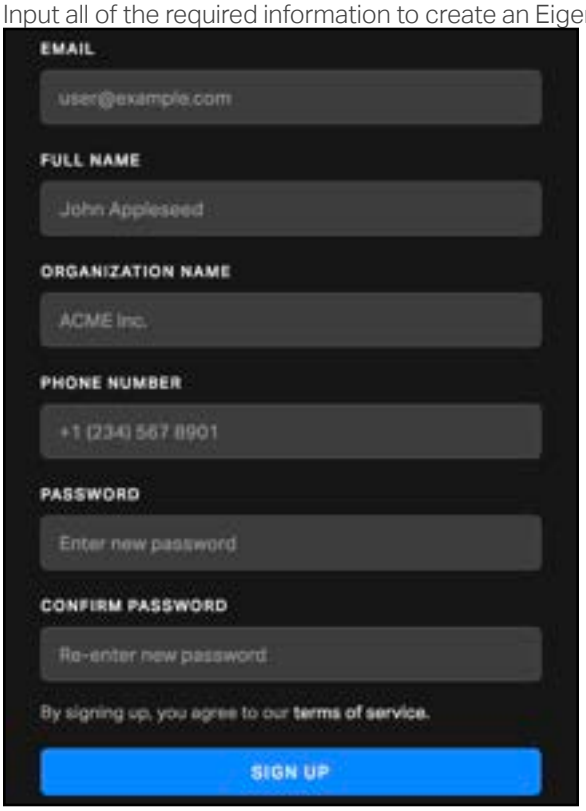
Before you can print to your printer, you will need to register it to an organization in Eiger, our software for setting up and slicing parts. You will need your printer's ID and access key to complete this process. Note that a printer can only be assigned to a single Eiger organization, and a user can only belong to a single organization.

JOIN EXISTING ORGANIZATION

To create an Eiger account in an existing organization, request that the organization owner add you to the organization, then click the link in the Welcome to Eiger email. Enter the email address and temporary password listed in the email, then click **Sign In**. Set your password when prompted, then read and accept the Terms of Service.

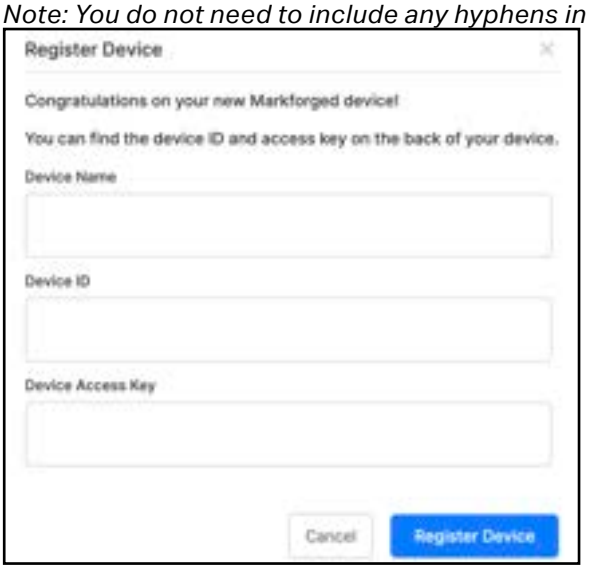
CREATE NEW ORGANIZATION

1. Navigate to *eiger.io* in a Google Chrome browser and click **Sign Up** below the login form.
2. Input all of the required information to create an Eiger organization and click **Sign Up**.



3. You will receive an email from Eiger after creating your organization. Please click on the link within the email to complete the sign-up process.

4. After logging in, Eiger will prompt you to register a device. Find your printer's ID and access key on the stickers provided with your Markforged printer, or by powering on the device and navigating to **Menu > Settings > System Info**.
5. Enter the desired device name, device ID, and device access key into the appropriate fields and click **Register Device**.
   *Note: You do not need to include any hyphens in the **Device ID** field.*



6. **If you wish to add users to the organization:**
   a. Navigate to **Settings > Organization Settings > Users**, then click **Create New User**.
   b. Enter the name and email address of the new user into the appropriate fields.
   c. Press **Create**.
   d. Repeat as needed.

ADD PRINTER TO EXISTING ORGANIZATION

If you already have an organization, you can add a new printer to it at any time with the ID and access key. You can find this information on your printer's touchscreen by navigating to **Menu > Settings > System Info**.

1. Sign into your Eiger account in a Google Chrome browser.
2. Select **Devices** or **Printers** from the sidebar on the main Eiger page.
3. Select the **Register Device** button in the top right corner of the page.
4. Enter the desired device name, device ID, and device access key into the appropriate fields and click **Register Device**.

CONNECTING YOUR PRINTER

BEFORE YOU GET STARTED

If you powered up your printer before adding it to your Eiger account, you will need to power cycle the printer before it will be connected to the account.

CONNECT VIA WI-FI

1. Select the Wi-Fi icon from the dashboard.

2. Press the **Wi-Fi** tile.

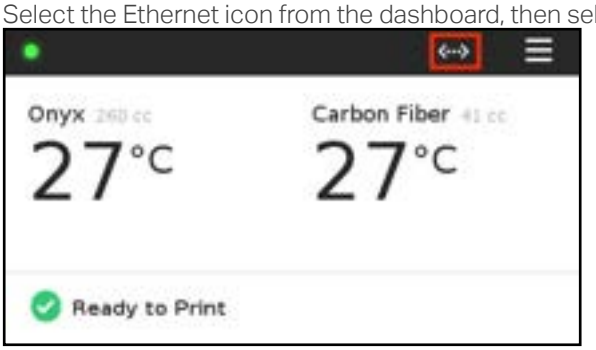
3. Press the **Configure** button to enter your network information.

4. Choose a network from the **Network Name** drop-down menu and enter your network password, if necessary.

5. Press **Save** and wait for your printer to finish connecting.
6. Press **Done** to return to the dashboard.

CONNECT VIA ETHERNET (LAN)

1. Plug your Ethernet cable into the Ethernet port.
   Note: Make sure that your LAN (Local Area Network) uses DHCP.
2. Select the Ethernet icon from the dashboard, then select the **Ethernet** tile.

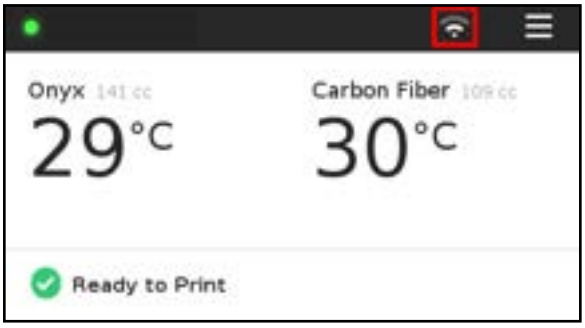


3. Select **Done** to return to the dashboard.

OBTAIN PRINTER'S MAC ADDRESS

Your printer does not inherently have a way to view its IP address, but it does allow you to find the MAC address for either Ethernet or Wi-Fi.

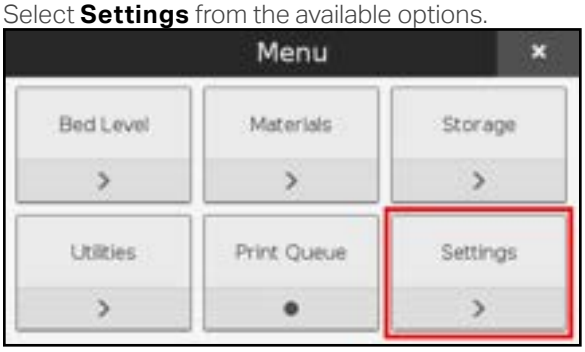
1. Select the Wi-Fi or Ethernet icon from the dashboard.



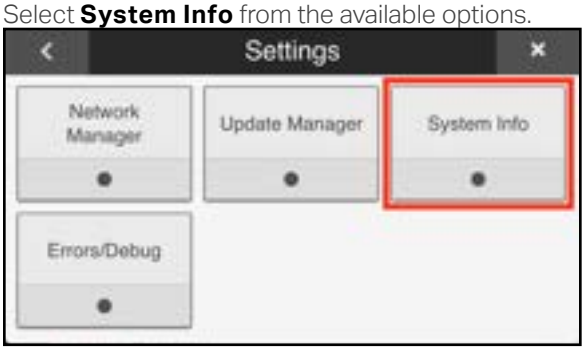
2. Press either the **Ethernet** tile or the **Wi-Fi** tile, depending on which MAC address you'd like to access.
Note: Your printer will display the unique MAC address of whichever connection option is currently enabled, even if the printer is unable to connect to the Internet. Only one MAC address can be displayed at a time.

3. When the **Network** status reads **Online**, press the **Done** button.
4. Select the menu icon from the dashboard.

5. Select **Settings** from the available options.



6. Select **System Info** from the available options.

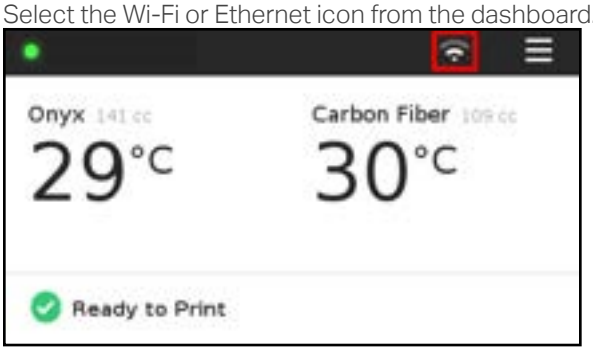


7. Select the Wi-Fi icon at the bottom of the screen.

8. View your MAC address for the enabled connection option.
9. Select the home icon at the bottom of the screen to return to the dashboard.

DISABLE WI-FI OR ETHERNET

1. Select the Wi-Fi or Ethernet icon from the dashboard.



2. Select the **Offline** tile.

3. Select **Done** to return to the dashboard.

NETWORK REQUIREMENTS

Markforged devices communicate on the 2.4GHz Wi-Fi band. For assistance with setting up your network, contact your internal IT team. Note that Markforged devices do not support 5GHz Wi-Fi connections.

WIRED CONNECTIONS

Ethernet connections must utilize cables less than 30 meters in length.

FIREWALL SETTINGS

Markforged devices support both DHCP and static IP configurations. For more information, see the ***Advanced Networking Features*** section below.

For proper operation, printers must be able to make outbound connections to services at the following hostnames on the given ports (no inbound connections are needed):

HOSTNAME	PORT	PROTOCOL	REQUIRED	REASON
s3.amazonaws.com mfeiger-production.s3.amazonaws.com	443	TCP	yes	Downloading .MFP part files produced by Eiger and consumed by printers
cdn.eiger.io	443	TCP	yes	Device operation
www.eiger.io	443	TCP	yes	Connecting to Eiger (required for viewing printer status, queuing print jobs, keeping printer software up to date, etc.)
*.pool.ntp.org	123	UDP	yes	Time synchronization via NTP is required for printers to connect securely to Eiger; see ***Printer Time Synchronization***, below
dms.markforged.com	80, 443	HTTP, HTTPS	yes	Device operation
ipv4.connman.net	80	TCP	no	Network connection status check (primarily used for troubleshooting)
data.logentries.com	443	TCP	no	Remote logging of printer events and errors
data.logentries.com	10000	TCP	no	Legacy setting for remote logging, only required if software version is older than 09/14/2018

Most of these services are cloud-based and geographically distributed, meaning that the underlying IP address ranges are fairly broad and can change over time, while the hostnames remain the same. This flexibility allows Eiger to maintain a higher level of availability and performance, and this mechanism is common for many cloud-based applications you already use and trust.

PRINTER TIME SYNCHRONIZATION

Markforged products require accurate system time for securing HTTPS connections to Eiger and other services; the SSL certificates used to ensure the authenticity of these services have time-limited validity, and the printer's time must fall within this window.

Currently, NTP — Network Time Protocol, on UDP port 123 — is the only supported mechanism for time synchronization, and Markforged printers will attempt to connect to four different servers within the global public NTP server pool, determined by querying hostnames ending in ".pool.ntp.org".

Markforged printers also support customer-specified NTP servers. When a printer receives NTP server IP addresses via DHCP (using DHCP option 042), these addresses will also be used for time synchronization (connecting to UDP port 123).

BROWSER

Markforged products require the Google Chrome browser. WebSockets must be enabled.

If you are unable to connect to your printer due to network issues, you will still be able to print offline via USB.

IMPORTANT PLASTIC INFORMATION

Nylon and Onyx are very susceptible to absorbing moisture. Plastic filament that has absorbed too much moisture will cause a number of printing issues, including failed prints, underextrusion, holes in the roof of parts, etc. **Please take special care to NEVER leave plastic exposed to ambient air, and ALWAYS keep plastic in the provided drybox.**

TIPS TO AVOID RUINING PLASTIC

- **NEVER** leave a plastic spool exposed to ambient atmosphere.
- **DO NOT** open a plastic spool bag until you are ready to use it.
- Make sure that your drybox is ***fully*** **latched and closed.**
- **Do not open the plastic drybox unless absolutely necessary. If the drybox must be opened, make sure to minimize the exposure time.**
- If you plan on leaving your printer unused for an extended period of time, keep the spool in the drybox with the filament loaded in the printer. The drybox and desiccant packs do a good job protecting from moisture, and drybox-stored material should last up to a year before the water content becomes too high for printing. When restarting a machine after a long idle period, run the Wet Plastic Purge utility until it stops steaming (which may take 2–3 runs).
- Inspect bags containing plastic filament for any holes or tears prior to using.
- **When changing spools, always discard any old desiccant packs and replace them with the most recently provided desiccant packs.**
- If you are planning to travel with your printer, unload plastic from the printer, remove the plastic feed tube from the drybox, and use the red drybox adapter plug from the accessory kit to seal the drybox.

LOADING PLASTIC

Note: The print head will become hot during the plastic loading process. Exercise caution when working near the nozzles.

Supplies

- Scale accurate to 1g (for Meter Load)
- Tweezers
- Wire cutters

These instructions are for loading a new or partial spool of plastic (nylon or Onyx) filament into your Desktop Series printer. To do so, first follow the instructions in ***Set Up Plastic for Loading***. Then, depending on whether or not you would like the printer to keep track of how much material remains on the spool, please continue on to read either ***Meter Load Plastic*** or ***Quick Load Plastic***. Before beginning these instructions, please ensure that you successfully do the following:

- Completely unload any plastic that is currently loaded into the printer
- Discard the old plastic spool if you anticipate it will not last another print
- Discard all desiccant packs that did not come with the spool of plastic that you are currently loading
- Review the ***Important Plastic Information*** section of this ***User Guide***

SET UP PLASTIC FOR LOADING

1. Open your drybox and remove the spindle from the inside. Pull the magnetic spindle cap and spindle body apart.
2. After verifying that the bag containing your new plastic spool has no holes, remove the spool from its packaging. Place provided desiccant packs in the corners of the drybox.
3. If this is a partial spool (i.e. you have previously used it to print) and you would like your printer to meter the remaining plastic material, weigh the spool in grams and make a note of the weight.
   Note: When you input this value later, the printer will automatically subtract the weight of the spool to obtain the weight of the material itself.
4. Place the spool on the spindle and attach the magnetic retention cap onto the spindle.

5. Place the spool and spindle in the drybox such that the metal shaft rests in the sheet metal V-grooves and the plastic filament exits from the **top** of the spool.
Note: The plastic spool is wound under tension. Always hold the plastic against the spool to prevent unwinding during the loading routine.

6. Cut the plastic filament at a 45° angle so that it can easily unspool to feed into the tube.
7. Insert one end of the plastic feed tube into the adapter on the side of the drybox, then feed the plastic filament all the way through the tube such that it extends out the other end.
8. Close the drybox cover and press the latches closed until they click **twice each**.
Note: Ensure that the drybox remains closed and fully latched at all times, except when quickly loading or replacing filament.

9. Verify that no leftover or broken plastic filament remains in the printer. If you spot any, please read the section titled ***Clearing the Bowden Tubes*** before continuing with these instructions.

10. Feed the plastic feed tube through the opening in the back of your printer and let it hang freely.

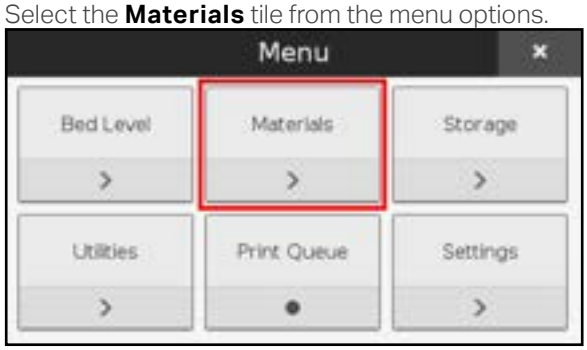
METER LOAD PLASTIC

Material metering is a process carried out by your printer to track how much material is used during printing, and to therefore determine how much material you have left on a spool. In order for material metering to take place, the printer must be told how much material is on the spool when the filament is loaded into the printer. If you run the Meter Load routine and input the weight of your plastic spool, your printer will keep track of the remaining material and can even warn you when your print job may require more plastic than is loaded.

See the ***Resetting Material Meters*** section for additional instructions.

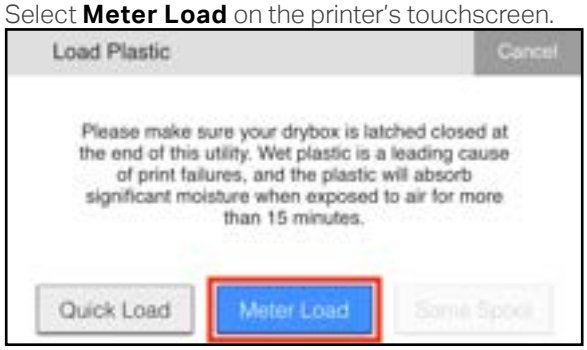
1. Select the menu icon from the dashboard.

2. Select the **Materials** tile from the menu options.



3. Select the **Load Plastic** tile to begin the Load Plastic routine.

4. Select **Meter Load** on the printer's touchscreen.

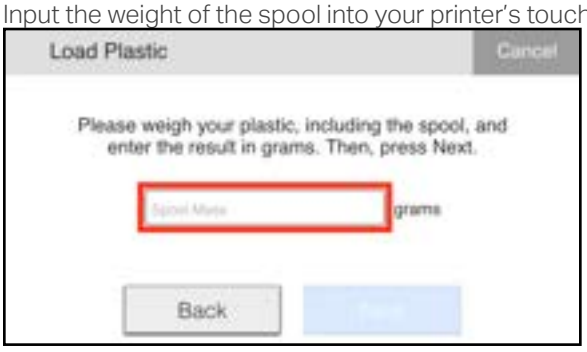


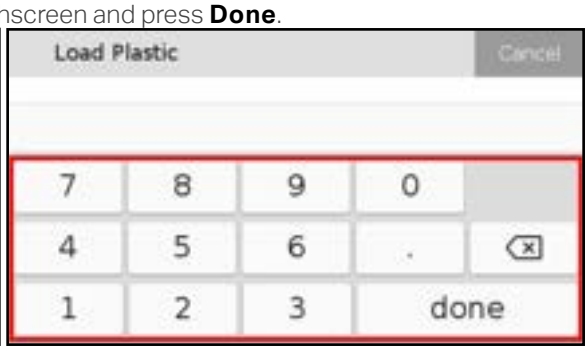
5. Select the type of plastic that you are loading into your printer.

6. Select the type of spool that you are loading.
*Note: Only select **Full Spool** if you are loading a new, standard 800cc spool of material. Otherwise, please select **Partial Spool**.*

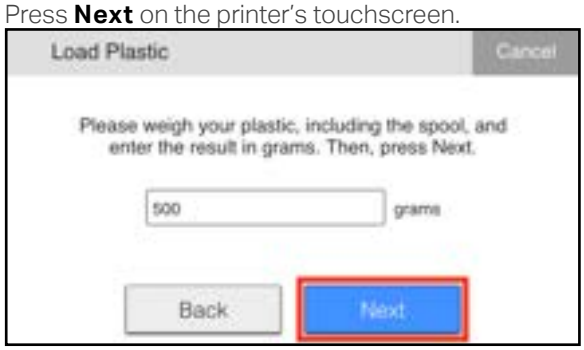
7. If you selected **Full Spool**, skip to step 8. If you selected **Partial Spool**, please follow the additional steps below to provide your printer with accurate weight information:

- Input the weight of the spool into your printer's touchscreen and press **Done**.

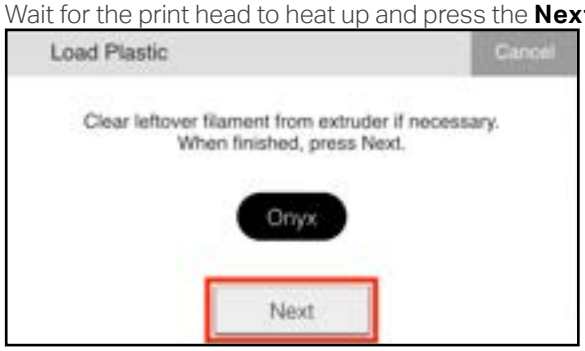




- Press **Next** on the printer's touchscreen.



8. Wait for the print head to heat up and press the **Next** button on the screen.



9. Feed the material from the plastic feed tube into the plastic extruder and insert the feed tube into the extruder's push-to-connect fitting.
10. Wait for the plastic filament to move through the plastic Bowden tube. Once the material begins extruding from the nozzle, press **Stop**.
Note: The plastic extruder will start to click as material is extruded from the nozzle. This is normal and expected behavior for the material loading process.

11. Use tweezers to remove any extruded material that gathers on the nozzle.

12. Press **Done** to exit the utility or press **Retry** to continue extruding material.

QUICK LOAD PLASTIC

Note: We strongly recommend using Meter Load whenever possible to ensure more accurate material measurement.

If you do not want your printer to track the amount of material that is left, or if you don't have the resources necessary to weigh your spool, the printer allows you to run a Quick Load routine. If you use this routine to load plastic, your printer will not be able to display how much material is left, nor will it be able to alert you when your printer is running low on material.

1. Select the menu icon from the dashboard.

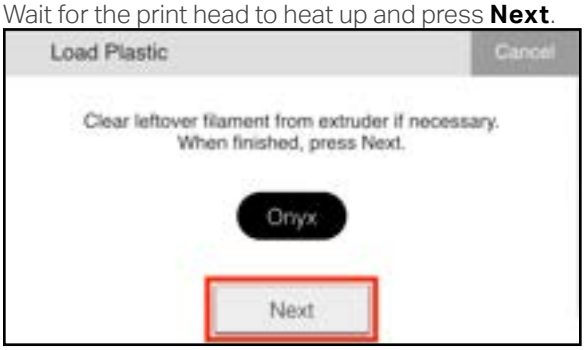
2. Select the **Materials** tile from the menu options.

3. Select the **Load Plastic** tile to begin the Load Plastic routine.

4. Select **Quick Load** on the printer's touchscreen.

5. Select the type of plastic that you are loading into your printer.

6. Wait for the print head to heat up and press **Next**.



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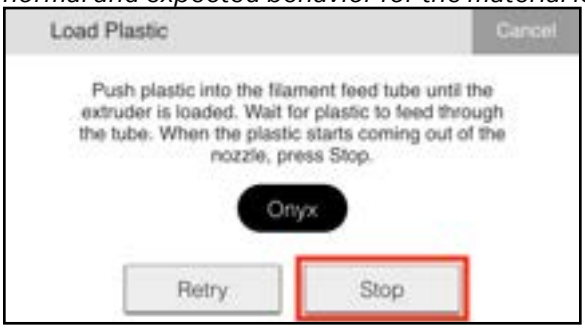

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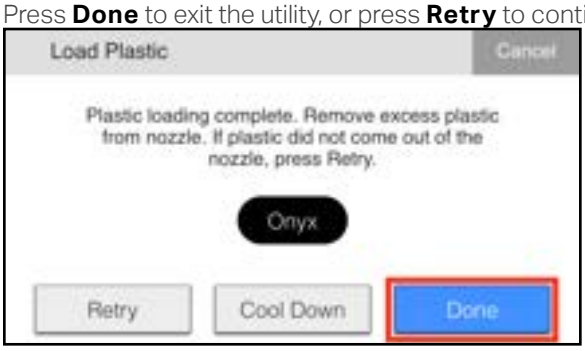
10. Press **Done** to exit the utility, or press **Retry** to continue extruding material.



LOADING FIBER

Supplies

- Scale accurate to 1g (if you plan to run the Meter Load routine)
- Tweezers
- Wire cutters
- Tape

These instructions are for loading a new or partial spool of fiber (carbon fiber, fiberglass, Kevlar, or HSHT) with your fiber-capable Desktop Series printer. To do so, first follow the instructions in *Set Up Fiber for Loading*. Then, depending on whether or not you would like the printer to keep track of how much material remains on the spool, please continue on to read either *Meter Load Fiber* or *Quick Load Fiber*. Before beginning these steps, please ensure that you completely unload any fiber that is currently loaded into the printer.

SET UP FIBER FOR LOADING

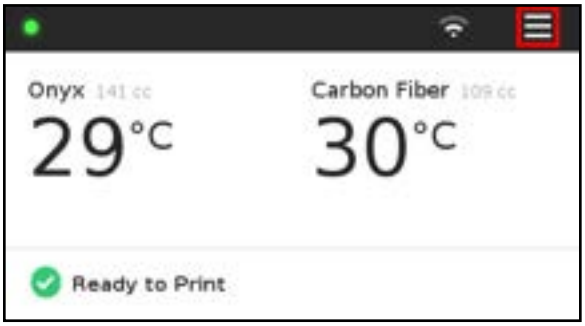
1. If this is a partial spool (i.e. you have previously used it to print) and you would like your printer to meter the remaining fiber material, weigh the spool in grams and make a note of the weight.
   Note: When you input this value later, the printer will automatically subtract the weight of the spool to obtain the weight of the material itself.
2. Hold the end of the fiber to keep it from unspooling and remove the tape from it.
3. Carefully unwind two and a half feet of material from the spool and then re-apply the tape to keep the rest of the material from unspooling.
   *Note: To avoid bending the material, tape it to the **inside** of the spool wall.*
4. Use wire cutters or a similar tool to trim off any filament that appears bent, as it may be difficult to load.
5. Feed the cut end of the material through the fiber feed tube until it reaches the fiber extruder.

METER LOAD FIBER

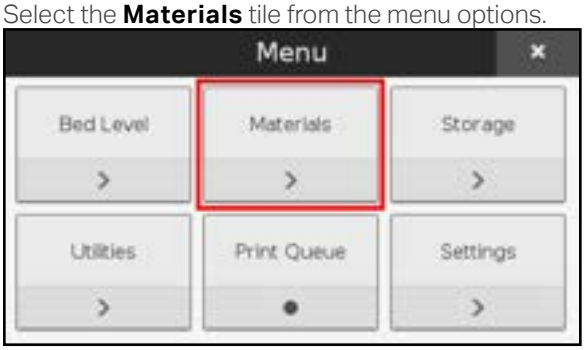
Material metering is the process by which the printer tracks material usage to determine how much filament remains on a spool. If you run the Meter Load routine and input the weight of your fiber spool, your printer will keep track of the remaining material and can even warn you when your print may require more fiber than is loaded.

See the *Resetting Material Meters* section for additional instructions.

1. Select the menu icon from the dashboard.

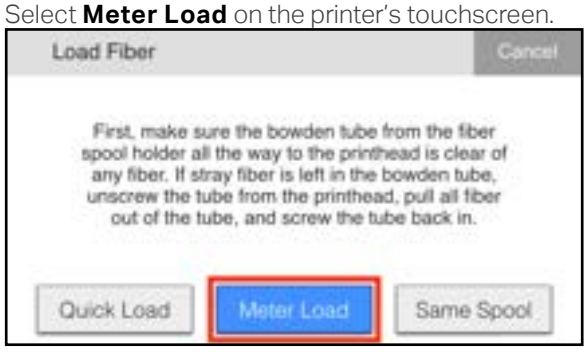


2. Select the **Materials** tile from the menu options.

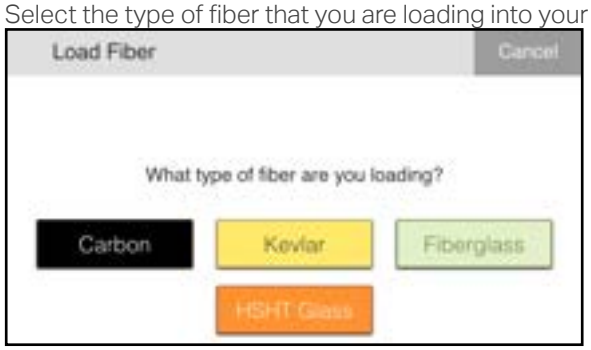


3. Select the **Load Fiber** tile to begin the Load Fiber routine.

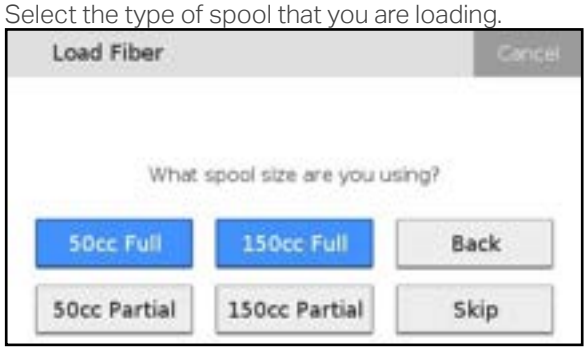
4. Select **Meter Load** on the printer's touchscreen.



5. Select the type of fiber that you are loading into your printer.



6. Select the type of spool that you are loading.

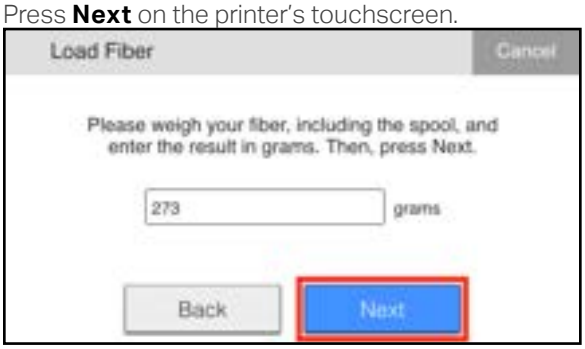


7. If you selected **50cc Full** or **150cc Full**, skip to step 8. If you selected **50cc Partial** or **150cc Partial**, please follow the additional steps below to provide your printer with accurate weight information:

- Retrieve the note you made earlier of the spool's weight.

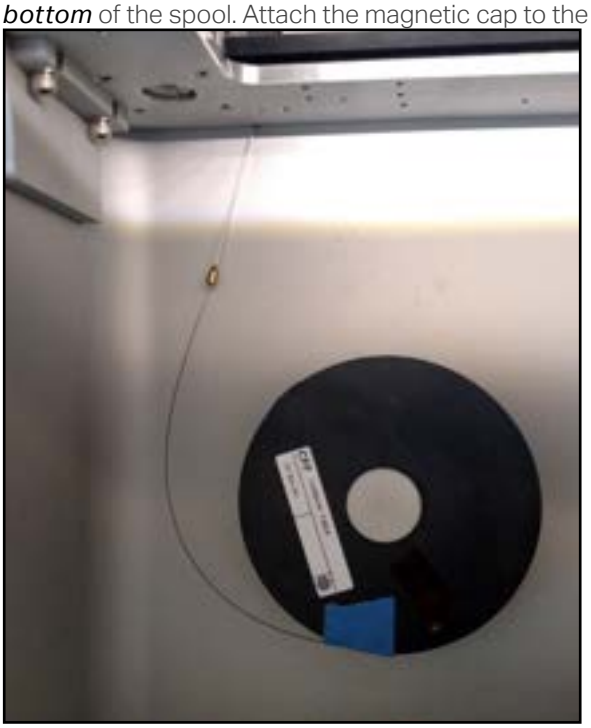
- Input the weight of the spool into your printer's touchscreen and press **Done**.

- Press **Next** on the printer's touchscreen.



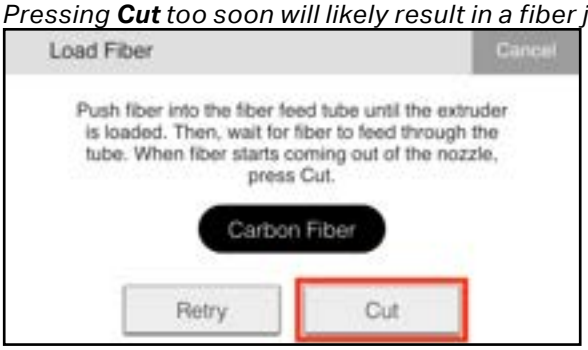
8. Continue feeding the fiber into the feed tube until the extruder catches the material, at which point the fiber will be pulled upward automatically and fed through the Bowden tube until it reaches the print head.

9. As the fiber feeds through the extruder, place the spool on the spindle such that material exits from the ***bottom*** of the spool. Attach the magnetic cap to the spindle to keep the spool in place.



10. Once the fiber is under tension on the spool, remove the tape from inside the spool and set it aside for later use. We recommend taping it to the front face of the spool.

11. When the fiber begins to be extruded from the print head, press **Cut** on the printer's touchscreen.
*Note: Do not press **Cut** until the fiber has been visibly extruded from the nozzle.*
*Pressing **Cut** too soon will likely result in a fiber jam.*



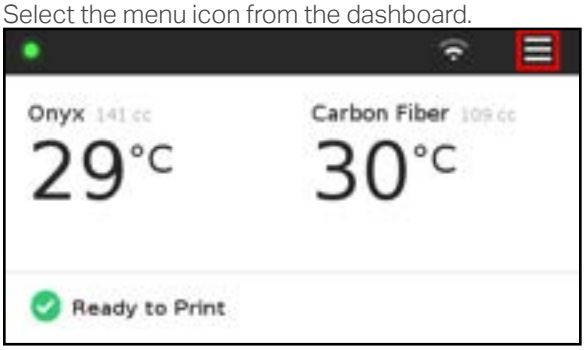
12. Use tweezers to remove the extruded material from the nozzle if it does not fall out on its own.
13. If the routine times out before fiber makes it to the nozzle, simply restart the fiber loading procedure by pressing **Retry**.

14. Press **Done** on the touchscreen to finish the utility.

QUICK LOAD FIBER

If you do not want your printer to track the amount of material that is left, or if you don't have the resources necessary to calculate the weight of the spool, the printer allows you to run a Quick Load routine. If you use this routine to load fiber, your printer will not be able to display how much material is left, nor will it be able to alert you when your printer is running low on material.

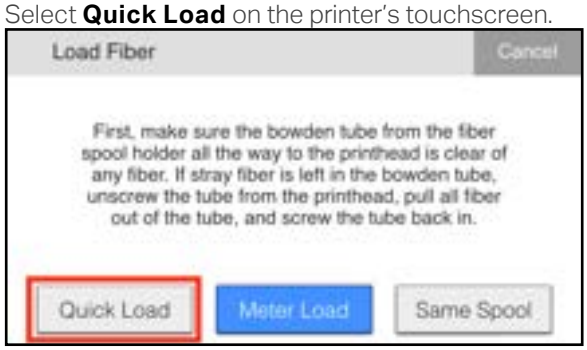
1. Select the menu icon from the dashboard.



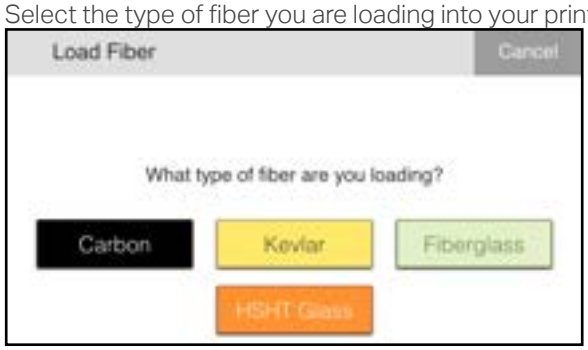
2. Select the **Materials** tile from the menu options.

3. Select the **Load Fiber** tile.

4. Select **Quick Load** on the printer's touchscreen.

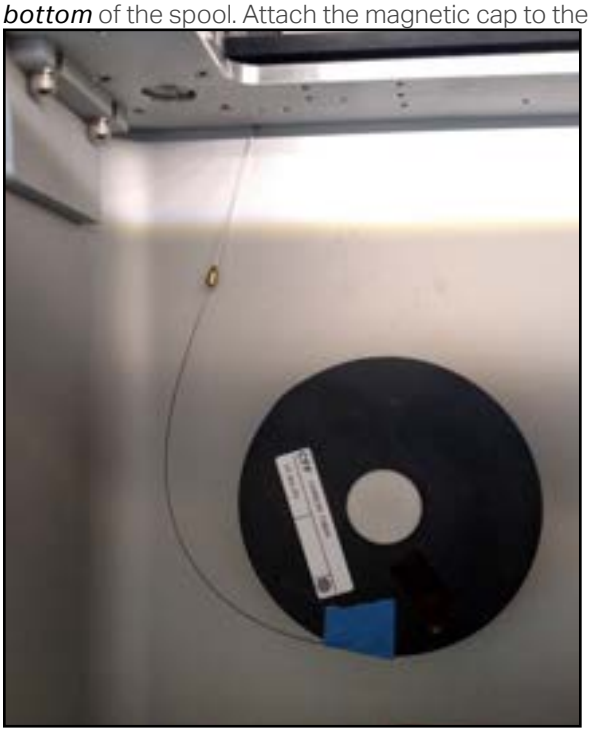


5. Select the type of fiber you are loading into your printer.



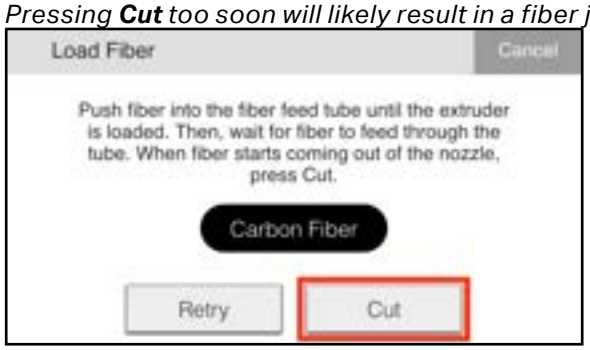
6. Continue feeding the fiber into the feed tube until the extruder catches the material, at which point the fiber will be pulled upward automatically and fed through the Bowden tube until it reaches the print head.

7. As the fiber feeds through the extruder, place the spool on the spindle such that material exits from the ***bottom*** of the spool. Attach the magnetic cap to the spindle to keep the spool in place.



8. Once the fiber is under tension on the spool, remove the tape from inside the spool and set it aside for later use. We recommend taping it to the front face of the spool.

9. When the fiber begins to be extruded from the print head, press **Cut** on the printer's touchscreen.
*Note: Do not press **Cut** until the fiber has been visibly extruded from the nozzle.*
*Pressing **Cut** too soon will likely result in a fiber jam.*



10. Use tweezers to remove the extruded material from the nozzle if it does not fall out on its own.
11. If the routine times out before fiber makes it to the nozzle, simply restart the fiber loading procedure by pressing **Retry**.

12. Press **Done** on the touchscreen to finish the utility.

LEVELING THE PRINT BED

Supplies

- Scraper
- Glue stick
- Leveling shim labeled PLASTIC
- Leveling shim labeled FIBER
- 2.5mm hex key

Before performing any bed leveling procedure, thoroughly clean the print bed with water to remove any glue residue. Dry the print bed with a paper towel before proceeding.

Note: If switching between print beds, you will likely need to run the Adjust Z Offset utility to be able to level the bed; for more information, see Adjusting the Z Offset.

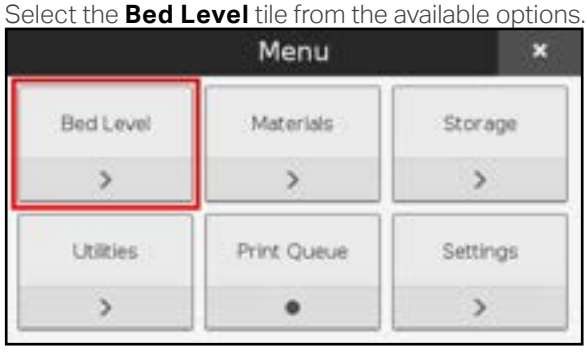
RUN SHIM BED LEVEL UTILITY

The Bed Level Test Print routine (see ***Bed Level Test Print***) should be run every time you use the Shim Bed Level utility. You may need to perform multiple shim level/test print cycles before the bed is completely level.

When you are not running a utility, if you need to manually raise or lower the print bed, you can simply push up or down on the print bed or print stage.

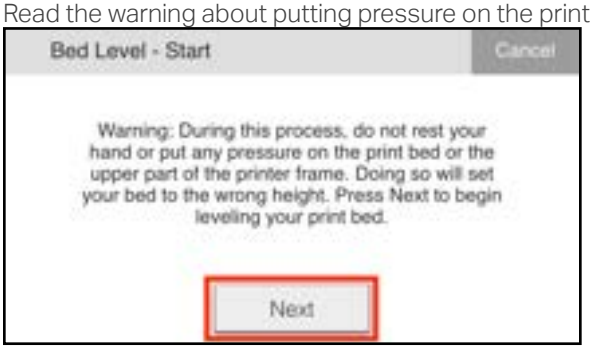
Note: The print head will move autonomously during this utility.

1. Select the menu icon from the dashboard.
2. Select the **Bed Level** tile from the available options.

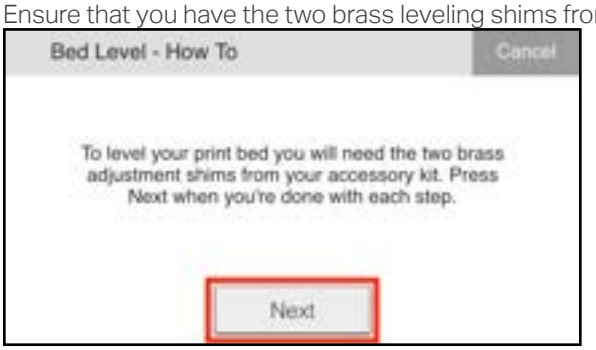


3. Select the **Shim Bed Level** tile from the available options.

4. Read the warning about putting pressure on the print bed during leveling and press **Next**.

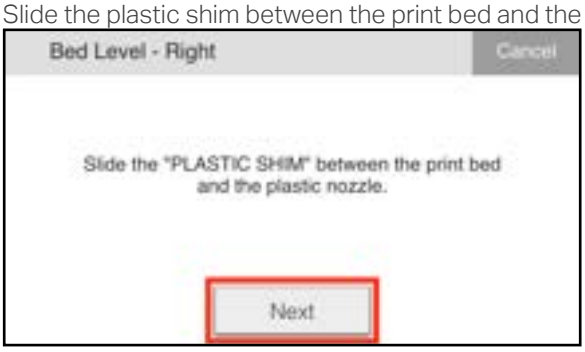


5. Ensure that you have the two brass leveling shims from your accessory kit, then press **Next**.

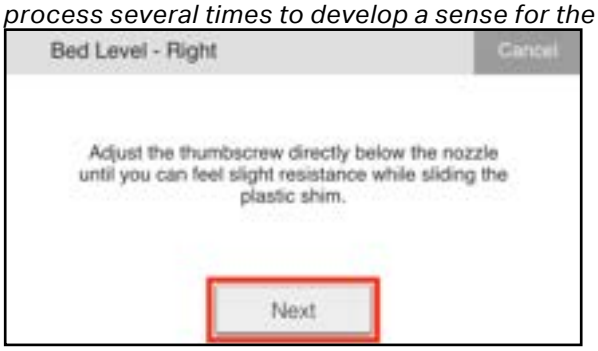


6. Loosen each of the three thumbscrews below the print stage to its lowest point and press **Next**. Take care not to over-loosen the thumbscrews, as they may fall out of the print stage.

7. Slide the plastic shim between the print bed and the plastic nozzle and press **Next**.

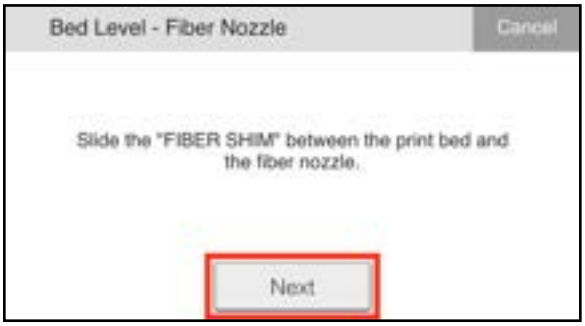


8. Adjust the thumbscrew until you feel slight resistance on the shim and press **Next**.
Note: If this is your first time running the Shim Bed Level utility, you may need to repeat this process several times to develop a sense for the right amount of resistance.

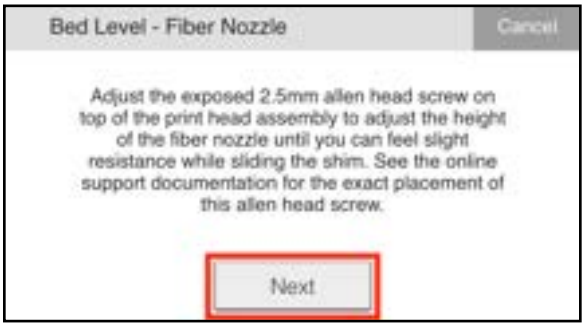


9. Repeat steps 7 and 8 for each thumbscrew, as prompted by the utility.
10. When prompted by the utility, slide the plastic shim between the plastic nozzle and the print bed to verify the tension over the rightmost thumbscrew. If you no longer feel slight resistance on the shim, the print bed is not level. In that case, adjust the thumbscrew until you feel slight resistance on the shim, then press **Retry** to follow suit with the other two thumbscrews. Otherwise, press **Next**.

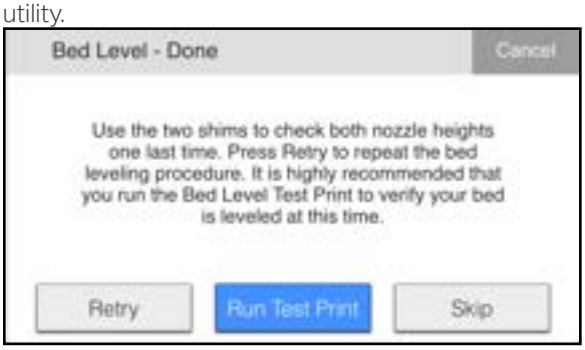
11. Slide the fiber shim between the fiber nozzle and the print bed and press **Next**.



12. Use a 2.5mm hex key to adjust the set screw on the print head, indicated below, until you feel slight resistance on the fiber shim.



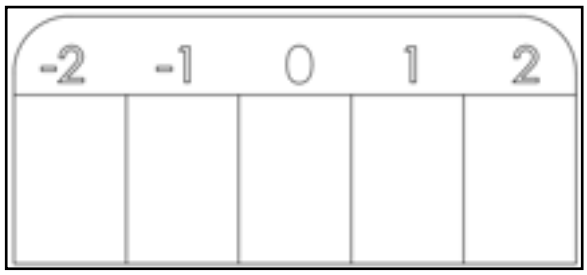
13. Double-check the resistance on both shims and press **Run Test Print** to verify that the bed is level (for more information, see *Bed Level Test Print*, below), **Retry** to re-level the print bed, or **Skip** to exit the utility.



ADJUST FIBER NOZZLE HEIGHT

The Fiber Nozzle Calibration Test Print routine is designed to tell you if your fiber nozzle is set too high or too low. If your fiber nozzle is not set correctly, it can cause stringing or groove marks in the finish of your part, among other issues.

This “staircase” test print is used by the utility to measure the height difference between the two nozzles. During the course of the print, the fiber nozzle is dragged over a series of “steps” at a constant height, leaving marks on the steps that it hits.

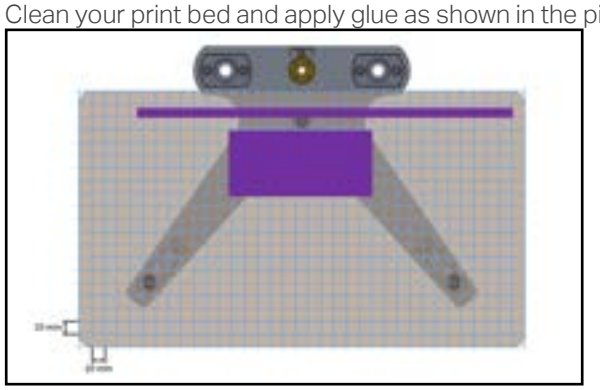


The steps on the part are numbered to help show how accurately calibrated the fiber nozzle is. The steps increase in height from left to right, meaning that “Step -2” is the lowest and “Step 2” is the highest. A correctly calibrated fiber nozzle would first hit the part in the “Step 0” box. Because the fiber nozzle is dragged across the part at a constant height, if the nozzle hits “Step 0”, it will also hit the taller steps to the right of it. Look for the lowest step that the fiber nozzle hits.

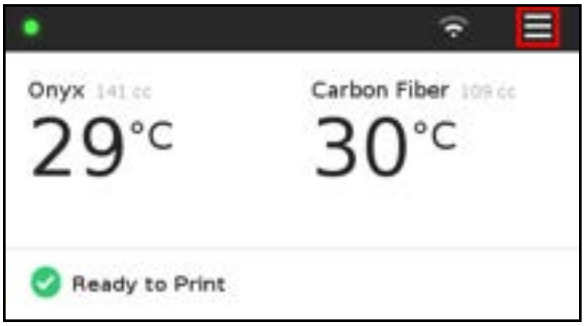
During this print, the fiber nozzle drags across the part three times and pauses between each drag to let you see where the nozzle hit and adjust the fiber nozzle height.

FIBER NOZZLE CALIBRATION TEST PRINT

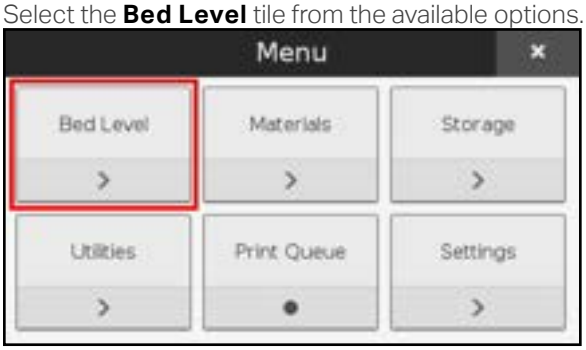
1. Ensure that the print bed is level (see above).
2. Clean your print bed and apply glue as shown in the picture below. Install the print bed.



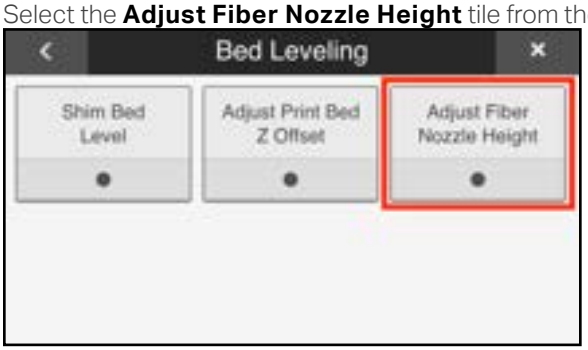
3. Select the menu icon from the dashboard.



4. Select the **Bed Level** tile from the available options.

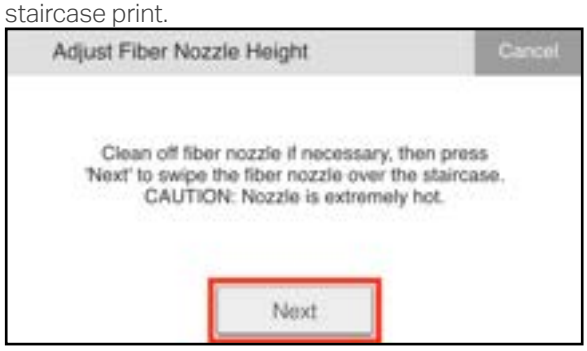


5. Select the **Adjust Fiber Nozzle Height** tile from the available options.



6. Press the **Print Staircase** button.

7. Once the fiber nozzle has finished heating, press **Next** to test the height of the nozzle relative to the staircase print.



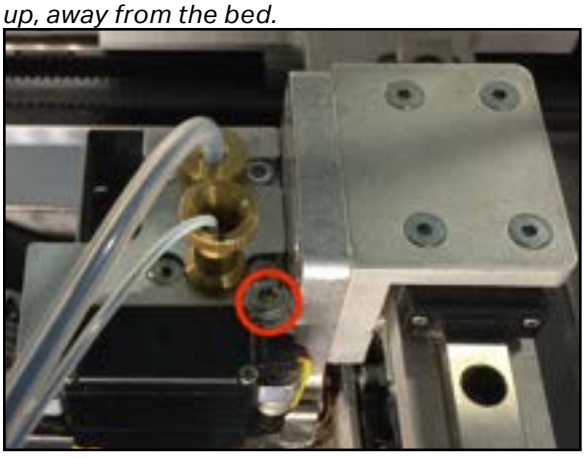
8. Examine the part without removing it from the print bed, and identify the leftmost box that has been marked by the fiber nozzle running over the part.
Note: Marks are more difficult to see on Nylon White; look carefully for the nozzle mark before lowering the nozzle and rerunning the test print.

- If the mark begins in the "Step 0" box, your nozzle is correctly calibrated.

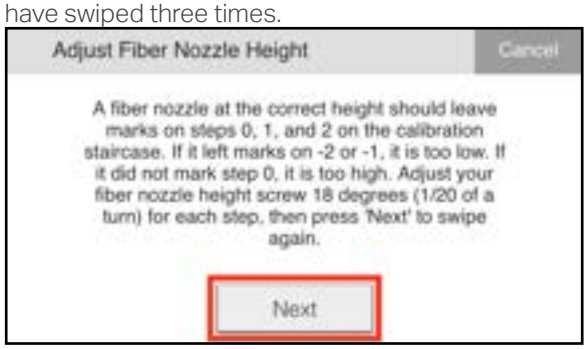
- If the mark begins in a negative numbered box, your nozzle is too low.

- If the mark begins in a positive numbered box, or if there is no mark at all, your nozzle is too high.

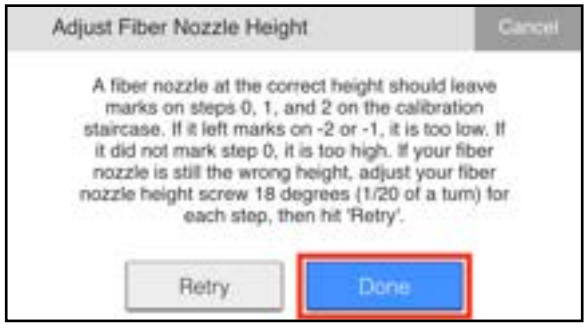
9. Use a 2.5mm hex key to adjust the fiber nozzle height on the print head by rotating the adjustment screw, indicated below.
Note: Rotating the adjustment screw 18° clockwise will lower the fiber nozzle by one step height in the test print; rotating the hex key in a counterclockwise direction will raise the fiber nozzle up, away from the bed.



10. If you removed the print bed during step 8, reinstall it to your printer, then press **Next** to swipe the nozzle over the part again. Continue swiping and adjusting the part until your nozzle is correctly calibrated or you have swiped three times.



11. After the third swipe, press **Done** if the nozzle is correctly calibrated or **Retry** if the nozzle needs further calibration.



PREPARING THE PRINT BED

Supplies

- Glue stick
- Scraper

ABOUT THE TRUEBED

The Markforged TrueBed is produced from a precision composite laminate and is designed to be flat, robust, and easy to use. It includes two locating features at the back of the bed that make the print bed quickly drop into place, every time. The material used in the TrueBed is also resistant to scratches and has no risk of delamination; however, the surface does wear out after many parts have been removed and the bed is still considered a consumable item.

USAGE INFO

- Be sure to apply a layer of glue prior to every print.
- Use warm water and a sponge to wash the TrueBed.
- Use proper scraping technique to avoid damaging the bed when removing parts. For more information, see *Safely Removing Printed Parts*

PREPARE YOUR PRINT BED

1. Before starting a print, ensure that the print bed is totally clean of plastic from any previous prints. Scrape off any plastic with the provided bed scraper.
2. Use the provided glue stick to apply a layer of glue to the area of the print bed where you intend to print. This will keep the part attached to the bed during printing and allow for easier part removal.
3. After each print, use warm water to clean any residual glue from the print bed.
   Note: The bed is waterproof. You can fully submerge the bed and wash it thoroughly. Do not use a dishwasher. Do not use soaps or other cleaners, as these may damage or leave residue on the bed.

PRINTING A PART

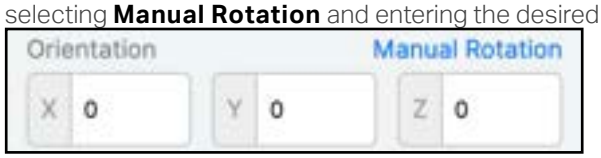
Note: The print head will become hot during the printing process. Exercise caution when working near the nozzles.

If your printer is connected to Eiger, printing is as easy as pressing a button. Please make sure that the print bed is set up and glued before you start printing. Follow the instructions in *Adjust Part Orientation*, below, then continue on to one of the following subsections:

- *Print to Online, Available Printer*
- *Print to Online, Busy Printer*
- *Print to Offline Printer*

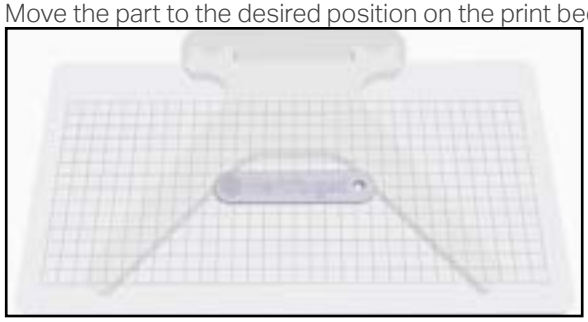
ADJUST PART ORIENTATION

1. Open your part in Eiger and configure it as needed. Change the part's orientation on the print bed by clicking on a face of the part in the main view (which will make that face the base of the print), or by selecting **Manual Rotation** and entering the desired values.



2. Press **Save**.

3. If desired, you can inspect and edit layers by clicking the **Internal View** button in the bottom right corner of the page
4. Click the **Print** button in the bottom right corner of the page.
5. Move the part to the desired position on the print bed.

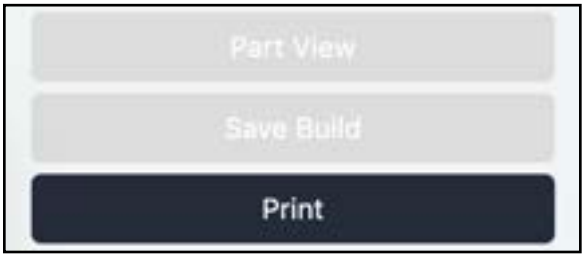


6. Enable or disable the **Cloud Print Generation** toggle button as desired.
Note: With Cloud Print Generation enabled, the MFP file will be generated remotely, on the Eiger server, rather in your web browser.

PRINT TO ONLINE, AVAILABLE PRINTER

1. Select a printer from the **Select Printer** drop-down menu, listed under **Available**.

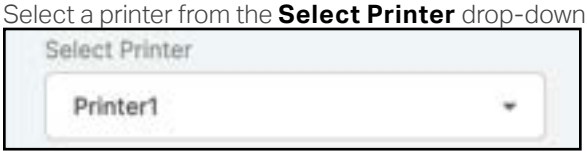
2. Press the **Print** button.



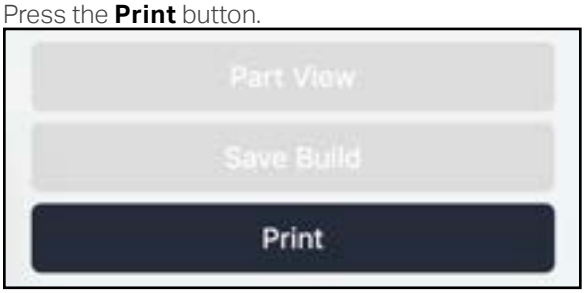
3. Verify the print details and address any material warnings listed in the pop-up window.
4. Select **Print Now**.

PRINT TO ONLINE, BUSY PRINTER

1. Select a printer from the **Select Printer** drop-down menu, listed under **Busy**.



2. Press the **Print** button.



3. Verify the print details and address any material warnings listed in the pop-up window.

4. Select **Add to Queue** to add the print to the end of the print job queue for that printer, or select **Print Next** to add the print to the top of the print job queue for that printer.

PRINT TO OFFLINE PRINTER

Important: Do not use the factory reset USB drive that came with your printer.

Supplies

- USB drive (FAT32 format) or USB-A to USB-B cable

Print via USB Drive

1. Select **Export Build** from the **Select Printer** drop-down menu, listed under **Download**.
2. Press the **Export Build** button.

3. Save the desired file to the root directory of a FAT32-formatted USB drive.
Note: Your MFP file cannot be in a folder. When naming your MFP file, please limit the characters in the file name to ASCII characters. Your printer will not recognize file names with non-standard ASCII characters.

4. Eject the USB drive from your computer and plug it into the back of the printer.
5. Select the menu icon from the dashboard, then navigate to **Storage > Print From Storage**.
   *Note: Markforged printers do not recognize encrypted devices. If the **Print From Storage** tile is grayed out, consult your IT department to ensure that your USB drive and its contents are not encrypted.*
6. Select the part file on the screen and press **Print**.

Print via USB Cable

To print a file directly from your computer, use the USB-A to USB-B cable from the accessory kit to transfer the exported MFP file to the printer as if it were an external drive.

1. Select **Export Build** from the **Select Printer** drop-down menu, listed under **Download**.
2. Press the **Export Build** button.

3. Use the USB-A to USB-B cable to connect your computer to the USB-B port at the back of the printer.
   Note: This is different from the USB port where you would insert a thumb drive into the printer.

4. On the computer, the printer will appear among the list of external drives. Open it in the filesystem as you would a thumb drive.
5. Copy the MFP file to the printer.
6. On the computer, eject the printer as you would a thumb drive.
7. On the printer's touchscreen, select the menu icon from the dashboard.
8. Navigate to **Storage > Print from Storage**.
   *Note: Markforged printers do not recognize encrypted devices. If the **Print From Storage** tile is grayed out, consult your IT department to determine whether your computer is encrypted. If so, you will need to print online or via USB drive instead; see above for more information.*
9. Select the MFP file you just transferred to the printer and press **Print**.

SAFELY REMOVING PRINTED PARTS

WARNING: Always pry with the scraper in a direction away from your body. The part may separate from the bed quickly and unexpectedly. Failing to scrape away from your body may result in injury.

Supplies

- Bed scraper

1. Select **Clear Bed** on the touchscreen.
2. Remove the print bed from the printer.
3. Rest the print bed on the ground and securely brace it against your leg.
   Note: Make sure to stand such that the scraper cannot strike your feet even by accident.
4. Maintain a low angle between the scraper and the print bed while you are removing your part. Scraping at a steeper angle may damage your print bed.
5. To lift a part without damaging it, level your scraper against the bed with the edge touching one of the corners of the part, then push downward toward the center. Maintain pressure against the part until it dislodges and slides to the ground.

6. If the glue has dried, you can run warm water over it to rehydrate. Do not immerse the print bed or part in water.

REMOVING SUPPORT MATERIAL

Printed supports can be removed with a pair of needle-nose pliers. Grab a small number of support pieces with the pliers, as close to the surface of the part as possible, and twist while peeling the supports away from the surface.

If removing the supports leaves small strings of material behind on the surface of the part, wet sanding and/or carefully trimming with a utility knife can be effective.

Note that the quality of surface finish depends partly on the orientation of the part on the bed, and the support structures will tend to leave behind more or less residue depending on their angle of surface attachment. If a given part's support structures are leaving behind unacceptable amounts of material residue, you can experiment with adjusting the **Support Angle** setting in the Eiger **Part Settings** menu — which changes the direction of the zigzag support-material pattern — or enabling **Turbo Supports**, which reduces the number of support structures.

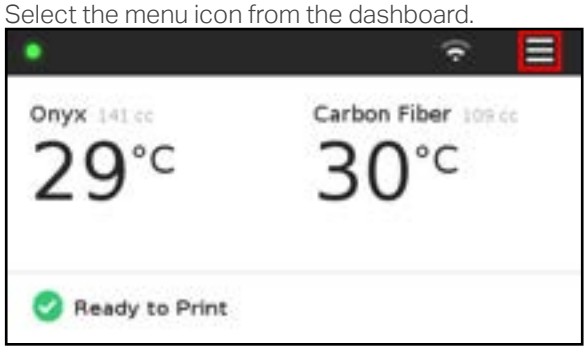
*Note: If the **Turbo Supports (Beta)** toggle switch does not appear in the Part Settings panel, navigate to **Settings > Account Settings** and click the **Enable Experimental Features** toggle switch, then return to the Part View page for the part in question.*

UNLOADING PLASTIC

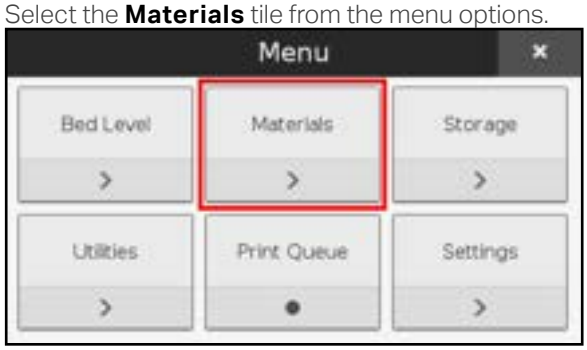
Supplies

- Wire cutters

1. Select the menu icon from the dashboard.

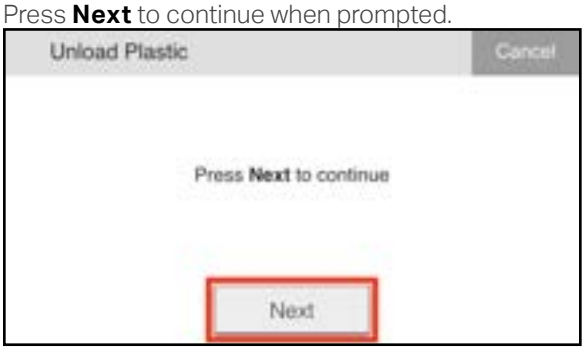


2. Select the **Materials** tile from the menu options.



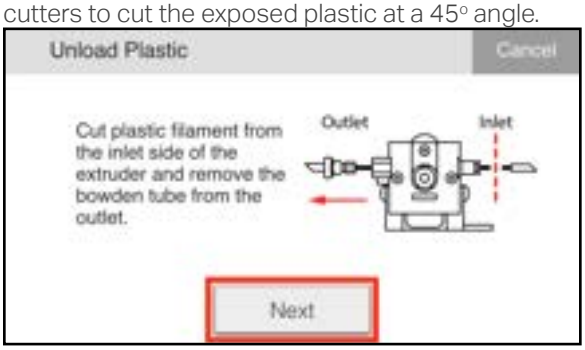
3. Select the **Unload Plastic** tile to run the Unload Plastic routine.

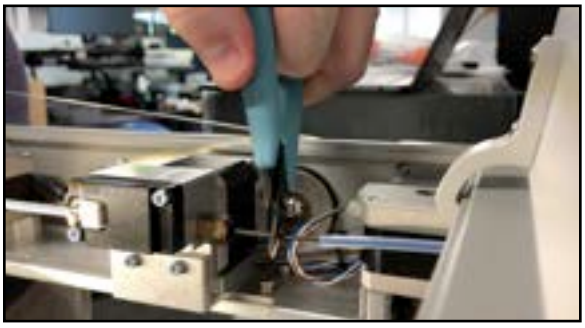
4. Press **Next** to continue when prompted.



5. Push in the black push-to-connect fitting to release the plastic feed tube from the back of the extruder.

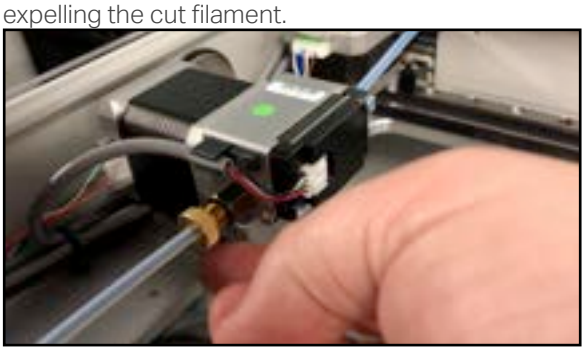
6. Pull the feed tube from the push-to-connect fitting to expose the plastic material and use a pair of wire cutters to cut the exposed plastic at a 45° angle.



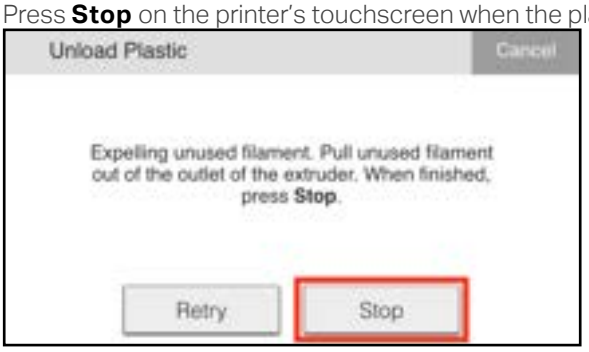


7. Open the drybox and wind the cut plastic filament back onto the spool. Tape the loose end of the filament to the spool. Close the drybox.

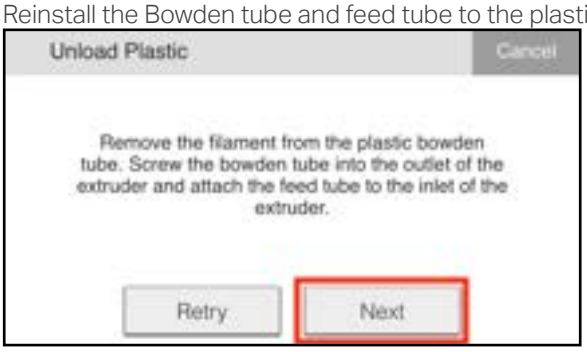
8. Unscrew and remove the Bowden tube from the front (outlet) of the extruder, then press **Next** to begin expelling the cut filament.



9. Take hold of the cut plastic material and help direct it free from the plastic extruder.
10. Press **Stop** on the printer's touchscreen when the plastic has been completely unloaded.



11. Direct the plastic filament free of the Bowden tube.
12. Reinstall the Bowden tube and feed tube to the plastic extruder, then press **Next**.



13. Press **Load Plastic** to load a different spool; see *Loading Plastic* for more information. Otherwise, press **Skip**.

14. If you pressed **Skip**, select **Yes** to cool the print head or **No** to skip cooldown.

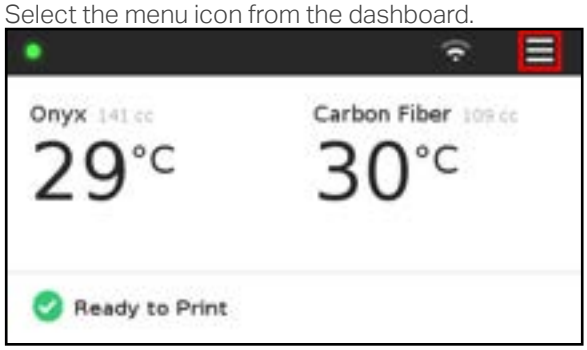
15. Press **Done** to exit the routine.

UNLOADING FIBER

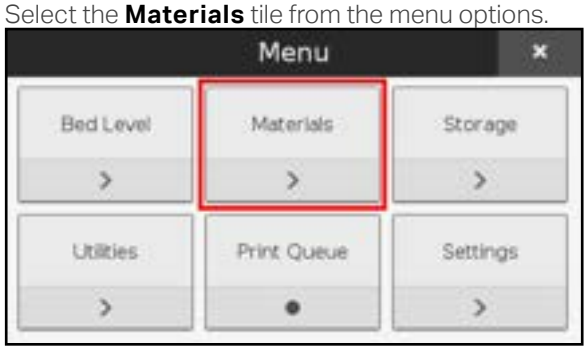
Supplies

- Tape (if there is none adhered to the side of the fiber spool)

1. Select the menu icon from the dashboard.



2. Select the **Materials** tile from the menu options.



3. Select the **Unload Fiber** tile to run the Unload Fiber routine.

4. Press **Next** on the screen to disable the fiber extruder.

5. Carefully wind the remaining fiber back onto the spool.
6. Tape the end of the fiber filament to keep it from unspooling and press the **Next** button on the printer's touchscreen.

7. Press **Load Fiber** to load a different spool, or **Not Now** to exit the routine.

RESETTING MATERIAL METERS

Eiger's estimate of remaining print material is deliberately conservative. To improve the accuracy of material metering, you can re-weigh your spool *without unloading material* by using the Reset Plastic Meter and Reset Fiber Meter utilities.

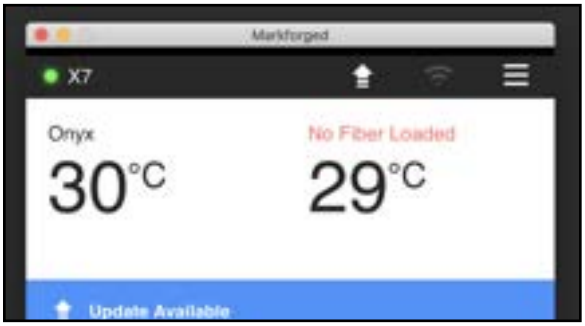
1. Select **Menu > Materials > Reset Plastic Meter** or **Reset Fiber Meter**.
2. Carefully remove the appropriate spool from the drybox or printer, setting aside the spindle. ***Do not unload the filament from the printer.***
3. Weigh the spool as normal.
4. Enter the new spool weight at the prompt, then press **Done**.
5. Replace the spindle and carefully replace the spool, making sure the filament is wound back onto the spool as normal to prevent any slack in the line.

UPDATING FIRMWARE

UPDATE FIRMWARE VIA CLOUD UPDATE

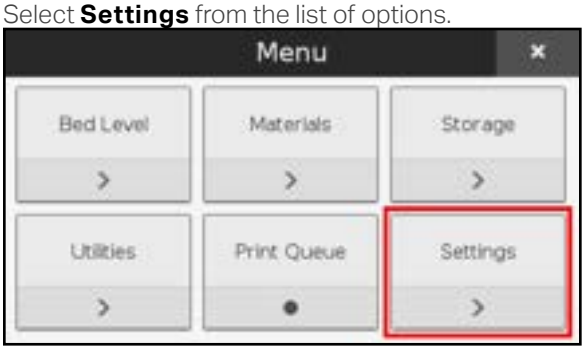
Your printer can be updated via the Cloud Update utility. Before beginning, make sure that your printer is connected to the Internet. For more information, see *Connecting Your Printer.*

Note: When a cloud update becomes available for a connected online printer, a blue banner will appear on the dashboard — select it to begin the cloud update procedure.

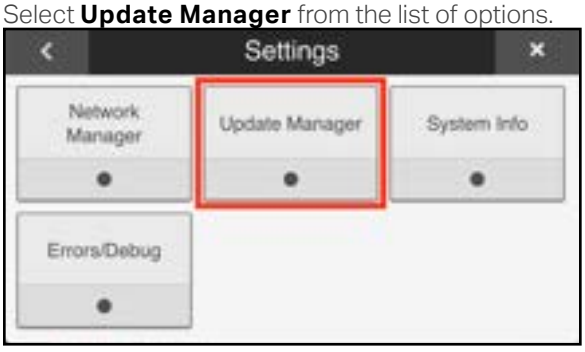


Alternatively, proceed with the following steps:

1. Select the menu icon from the dashboard.
2. Select **Settings** from the list of options.



3. Select **Update Manager** from the list of options.



4. Press the **Cloud Update** tile if it is available. The update will take a few minutes to install, after which your printer will restart. Do not turn your printer off during the update process.
   *Note: An update is available if the **Cloud Update** tile is blue. If the tile is gray, your system is either up to date or not connected to the Internet.*

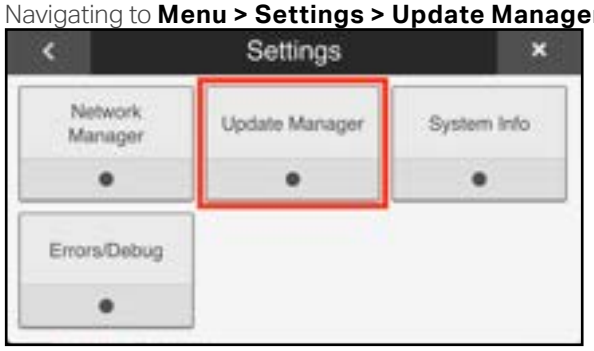
UPDATE FIRMWARE VIA USB

Your printer can be updated via USB. You will need a different USB drive than the one that came with your printer. The USB drive should be FAT32-formatted, and the update will need to be placed in the root folder of the drive.

Note: The update must be the only file in the root directory, otherwise the firmware update will fail.

1. Log into your Eiger account and navigate to **Settings > Account Settings > Downloads**.
2. Click the **Download** button in the Printer Update row to download the USB update.
3. Copy the USB update to the root directory of an otherwise empty FAT32-formatted USB drive. Insert the drive into the USB port of your printer.
   Note: If your device does not have a Wi-Fi adapter installed, it will not recognize a USB drive inserted after the device has been powered on. If the device cannot access the contents of your USB drive, power cycle the device (with the USB drive still inserted) and try again.
4. Begin the update process by either:

   - Selecting the blue **Update Available** banner at the bottom of the screen.
   - Navigating to **Menu > Settings > Update Manager** on your printer's touchscreen.



5. Press **USB Update** to apply the update. The update will take a few minutes to install, after which your printer will restart. Do not turn your printer off during the update process.

MAINTENANCE SCHEDULE UTILITY

The Maintenance Schedule utility tracks consumable lifetimes and notifies you when components are due for maintenance or replacement. This tool builds on years of customer and internal print data to offer a preventive maintenance schedule based on material usage. Along with the maintenance procedures listed below, you should perform routine maintenance and upkeep on your printer according to the *Preventive Maintenance Schedule*, below.

The new utility tracks material usage in *cubic centimeters* (CC) rather than *print hours*. This is a more accurate measure of consumable lifetimes -- for instance, different layer heights cause very different rates of nozzle wear, and the Maintenance Schedule Utility will correctly account for that difference. The utility also tracks fiber and plastic material usage separately, reducing waste compared to the previous schedule.

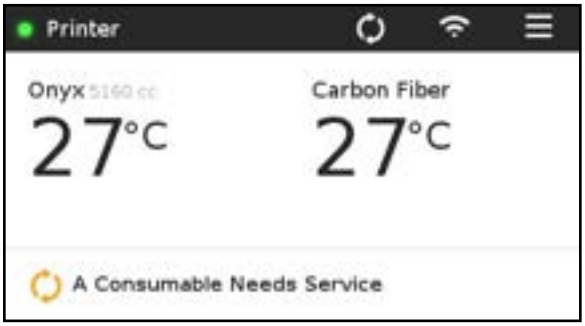
Note: See Initial Setup *below for information about the initial state of the consumable trackers.*

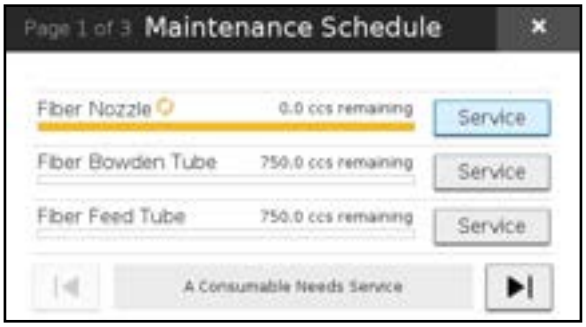
The following maintenance routines are tracked in the Maintenance Schedule utility.

- Plastic tubes and nozzles are replaced every **3,200 CC** of plastic printed
- Fiber tubes and nozzles are replaced every **750 CC** of fiber printed
- Belt tension should be adjusted every **500 print hours**, or after changing any component of the motion system

Note: The terms "feed tube" and "load tube" are used interchangeably in our utilities and documentation.

As a consumable comes due for regular maintenance or replacement, a banner will appear on the dashboard (below left); selecting the banner will bring you to the Maintenance Schedule utility (below right), which allows you to select maintenance routines.



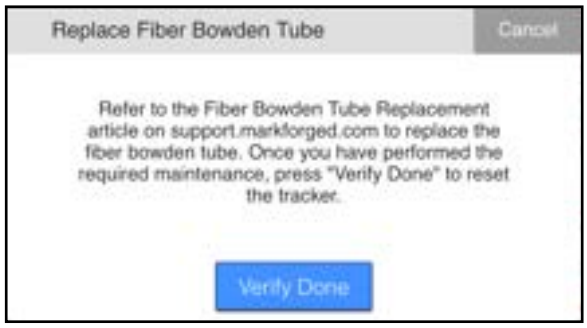


In the images above, note that the **Fiber Nozzle** progress bar is highlighted, a replacement icon is displayed, and a **Consumable Needs Service** banner appears, indicating that the fiber nozzle is due for replacement.

As you complete each maintenance procedure, the printer will reset its associated material-usage counter, and display the remaining lifespan of the consumable, expressed in *cubic centimeters of print material usage*.

Note: Belt tension is still scheduled using print hours. The belt tension timer must be manually reset.

If there is an onboard maintenance utility for a given consumable item (for instance, the Replace Fiber Nozzle utility), then selecting **Service** will open that utility. However, if there is no onboard utility associated with a component, then selecting **Service** will display a screen like the following, directing you to the appropriate support article.



After you complete the maintenance routine, remember to select **Verify Done** in the Maintenance Schedule utility to reset the onboard consumables tracker.

INITIAL SETUP

After you perform the software update to install the utility on an existing printer for the first time, the counters will not yet be set — the utility only starts tracking each consumable item as you complete its maintenance procedure.

For instance: the first time you replace your fiber nozzle ***after*** the utility is installed, the utility will begin to track its age based on material usage — but until it does so, you should follow the previous maintenance schedule (tracking print hours).

Desktop and Industrial printers shipped after mid-November 2020 track material usage in the Maintenance Schedule utility from their first print.

ADJUSTING BELT TENSION

Supplies

- 3mm hex key
- Mobile device equipped with tuner app (see below)

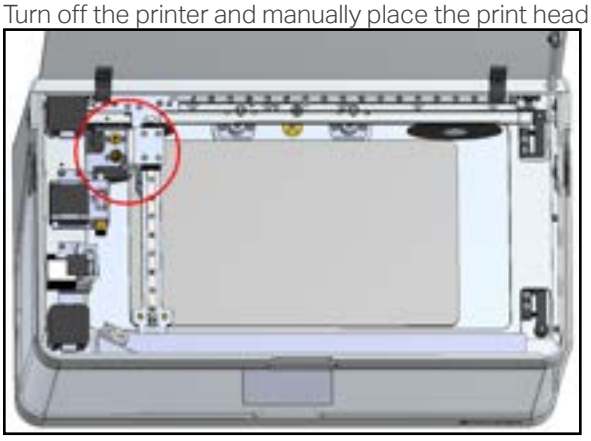
The print head on your printer moves using a system of motors, pulleys, and belts. For optimal operation, it is important that belt tension is maintained at the correct level. Excessive belt tension will contribute to premature bearing wear. Insufficient belt tension can lead to reduced printing accuracy and/or dislocation.

Belt tension is adjusted at the factory using a calibrated meter to measure the audio frequency of the belt when it is plucked, as there is a direct relationship between belt tension and frequency.

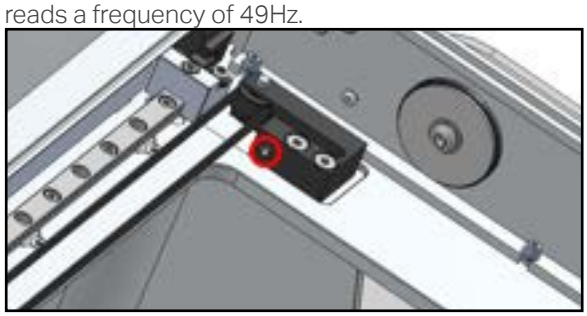
Since belts may stretch over time, it is recommended that users occasionally (every 500 print hours) measure belt tension and adjust as necessary. This can be done with any device that allows you to measure audible frequencies in hertz (Hz). One inexpensive option is to use a mobile device equipped with the free version of either the Fine Tuner app (for iOS) or the Pano Tuner app (for Android). These applications are designed to tune musical instruments, but they can also be used as accurate frequency meters.

Note: To ensure accurate measurements, always take frequency adjustments in quiet surroundings.

1. Install and open a tuner app on your mobile device.
   Note: If you are using the Fine Tuner app, you can disregard the lower of the two numbers on the main screen.
2. Turn off the printer and manually place the print head in the back left corner.



3. Place your phone's microphone close to, but not touching, the back belt. Pluck the front stretch of the back belt as if it were a guitar string. Use a 3mm hex key to adjust the rear belt tensioner until the app reads a frequency of 49Hz.



4. Place your phone's microphone close to, but not touching, the front belt. Pluck the back stretch of the front belt as if it were a guitar string. Use a 3mm hex key to adjust the front belt tensioner until the app reads a frequency of 62Hz.
5. Reset the belt tension counter on your device (**Menu > Utilities > Maintenance > Maintenance Schedule**). Updating this counter will allow your device to warn you proactively when the belt tension next needs to be adjusted.

TIPS FOR BEST RESULTS

- Make measurements in quiet surroundings. If you cannot secure a quiet environment, consider investing in a shotgun condenser microphone to plug into your mobile device.
- Place your phone's microphone close to, but not touching, the belt.
- Remove any protective case on your phone, if necessary, to get the most accurate reading.
- Do not over-pluck the belt such that it vibrates against the gantry plate.
- When you initially pluck the belt, it will produce harmonics at multiples of the fundamental frequency. These will quickly die off and you will be left with only the fundamental frequency. For this reason, ignore early readings that appear to have measured a multiple of your target frequency. With a little practice, you will obtain highly repeatable and accurate results in under two minutes.

REPLACING THE FIBER NOZZLE

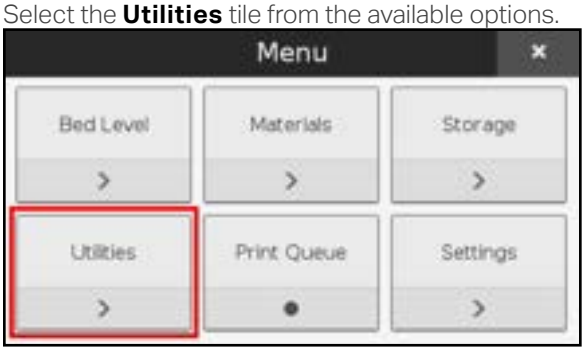
Supplies

- 10mm torque wrench
- Anti-Seize
- Replacement fiber nozzle
- Replacement PTFE tube

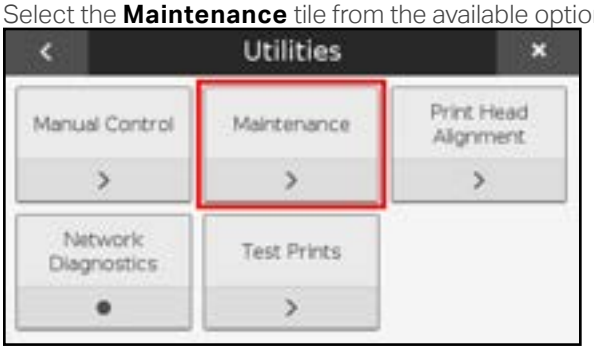
The fiber nozzle should be replaced every 750 CCs of fiber printed.

Before you begin the process of replacing your fiber nozzle, please note that your printer has a built-in utility which will walk you through the replacement process step by step.
Note: Completing this utility will also reset the fiber nozzle counter in the Maintenance Schedule utility, allowing your device to warn you proactively when the fiber nozzle next needs to be replaced.

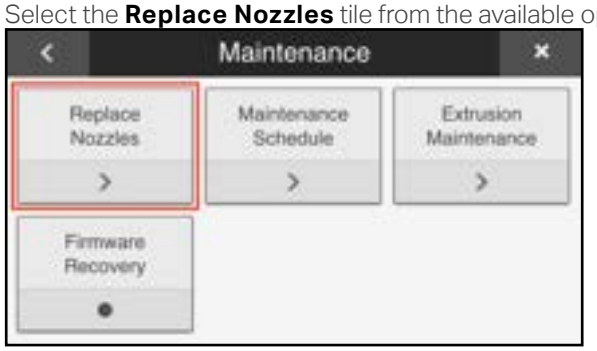
1. Select the menu icon from the dashboard.
2. Select the **Utilities** tile from the available options.



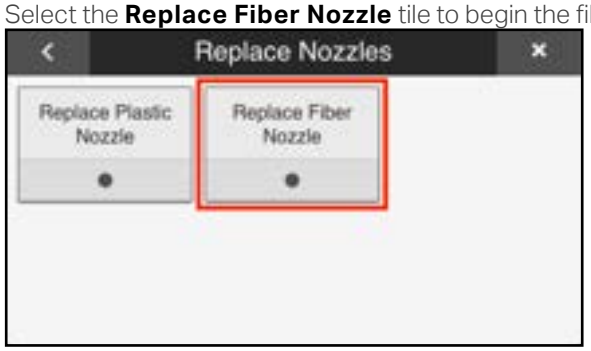
3. Select the **Maintenance** tile from the available options.



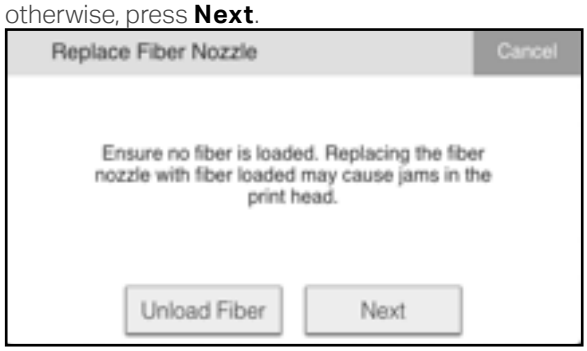
4. Select the **Replace Nozzles** tile from the available options.



5. Select the **Replace Fiber Nozzle** tile to begin the fiber nozzle replacement utility.

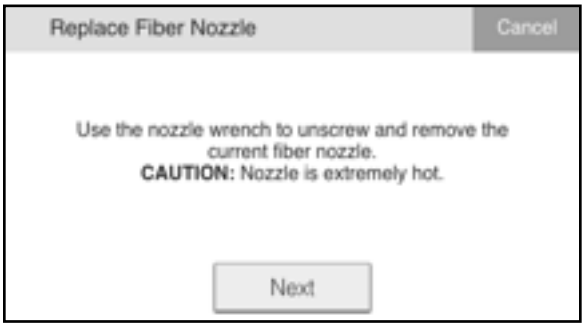


6. If fiber is currently loaded into the printer, press **Unload Fiber** and follow the onscreen instructions; otherwise, press **Next**.



7. When prompted by the utility, use the 10mm torque wrench to remove the fiber nozzle from the print head.
Note: Do not touch the nozzle with your hands, as it will be very hot.

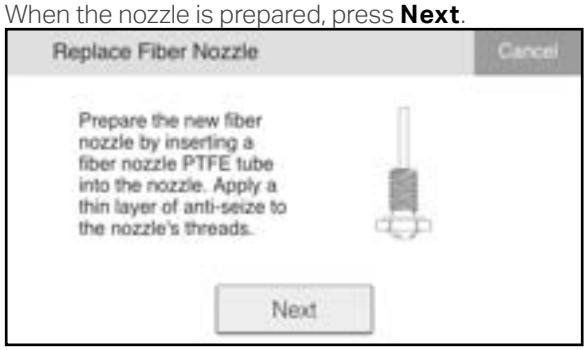
8. Press **Next**.



9. Insert the PTFE tube into the replacement fiber nozzle.

10. Apply a small amount of Anti-Seize to the end of the threads of the new fiber nozzle.
Note: Be sure not to get any of the Anti-Seize inside the nozzle.

11. When the nozzle is prepared, press **Next**.



12. Using the torque wrench, screw the new nozzle partway into the print head, then unscrew it and screw it in again; this helps disperse the Anti-Seize over all of the threads.
13. Tighten the nozzle with the torque wrench until it clicks.

14. Press **Reload Fiber** and follow the onscreen instructions, or press **Skip** to proceed without loading fiber.

15. Press **Adjust** and follow the onscreen instructions to recalibrate the fiber nozzle height, or press **Skip** to proceed without doing so.
Note: We recommend recalibrating the fiber nozzle height after replacing the fiber nozzle in order to prevent print quality issues. If you would prefer to calibrate fiber nozzle height at another time, see Adjust Fiber Nozzle Height *in the* Leveling the Print Bed *section, above.*

16. **If you skipped recalibrating the fiber nozzle height:** Press **Cool Down** to cool the fiber nozzle, or press **Done** to exit the utility.

REPLACING THE PLASTIC NOZZLE

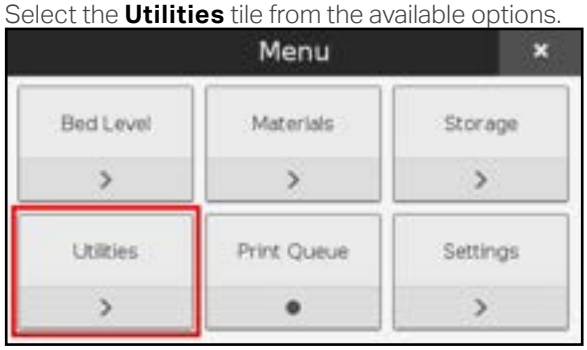
Supplies

- 7mm torque wrench
- Anti-Seize
- Replacement plastic nozzle

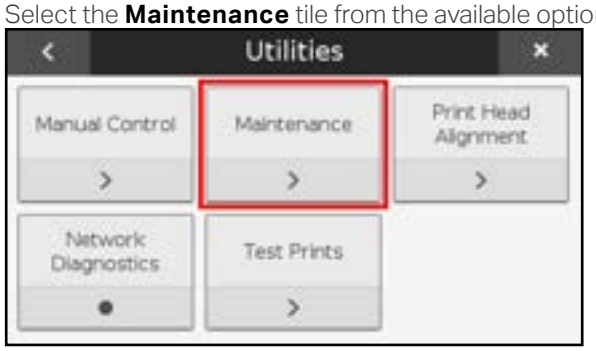
The plastic nozzle should be replaced every 3200 CCs printed. If you are experiencing underextrusion, it may be necessary to replace the nozzle as part of troubleshooting; for more information, see *Underextrusion Troubleshooting*.

Before you begin the process of replacing your plastic nozzle, please note that your printer has a built-in utility that will walk you through the process of replacing your nozzle step by step.
Note: Completing this utility will also reset the plastic nozzle counter in the Maintenance Schedule utility, allowing your device to warn you proactively when the plastic nozzle next needs to be replaced.

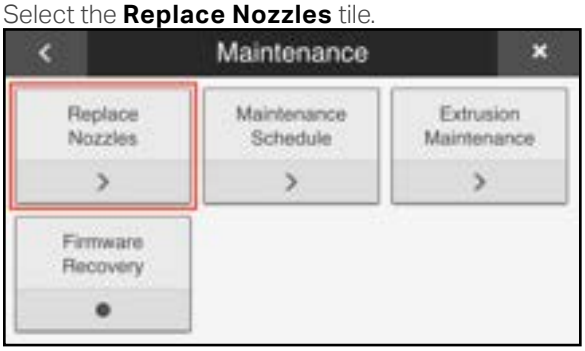
1. Select the menu icon from the dashboard.
2. Select the **Utilities** tile from the available options.



3. Select the **Maintenance** tile from the available options.



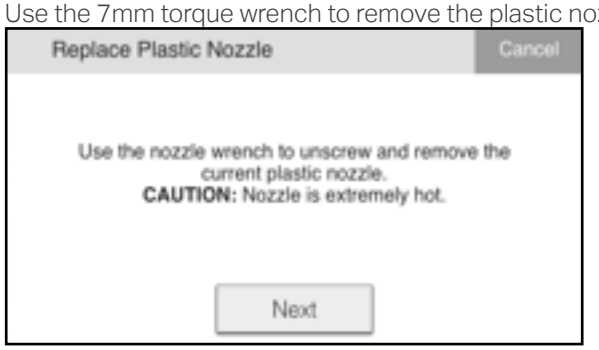
4. Select the **Replace Nozzles** tile.



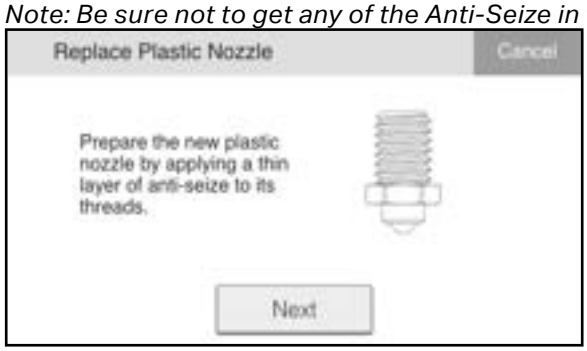
5. Select the **Replace Plastic Nozzle** tile.

6. If plastic is loaded, press the **Unload Plastic** button and follow the onscreen instructions; otherwise, press **Next**.

7. Use the 7mm torque wrench to remove the plastic nozzle and press **Next** on the touchscreen.



8. Transfer the washer from the old nozzle to the new nozzle. **Take care not to misplace it**.
9. Apply a small amount of Anti-Seize to the end of the threads of the *new* nozzle and press **Next** on the touchscreen.
Note: Be sure not to get any of the Anti-Seize in the nozzle.



10. Using the torque wrench, screw the new nozzle partway into the print head, then unscrew it and screw it in again; this helps disperse the Anti-Seize over all of the threads.
Note: If you are installing both fiber and plastic nozzles at the same time, make sure that the white print head cover on the underside of the print head remains properly aligned and tucked in to the head, and that no gap remains between the fiber nozzle and the heater block.

11. Tighten the nozzle until it clicks.
Note: Ensure that the torque wrench has solid contact at all points on the nozzle. Failure to do so may result in your plastic nozzle being stripped.

12. Press the **Reload Plastic** button on the touchscreen.

13. Select **Meter Load** and follow the onscreen instructions to reload plastic.

14. Press **Done** to finish the utility.

15. Run the Shim Bed Level utility (**Menu > Bed Level > Shim Bed Level**). For more information, see *Run Shim Bed Level Utility* in the *Leveling the Print Bed* section, above.
16. Run the Bed Level Test Print utility to confirm that the bed is level (**Menu > Utilities > Test Prints > Bed Level Test Print**). For more information, see *Bed Level Test Print*, below.
17. If applicable, run the fiber nozzle height calibration utility (**Menu > Bed Level > Adjust Fiber Nozzle Height**). For more information, see *Adjust Fiber Nozzle Height* in the *Leveling the Print Bed* section, above.

BED LEVEL TEST PRINT

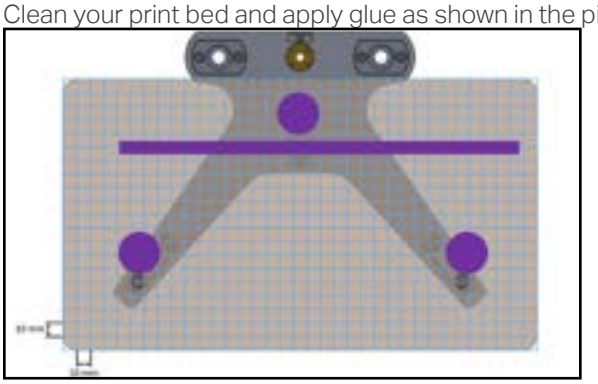
Supplies

- Glue stick

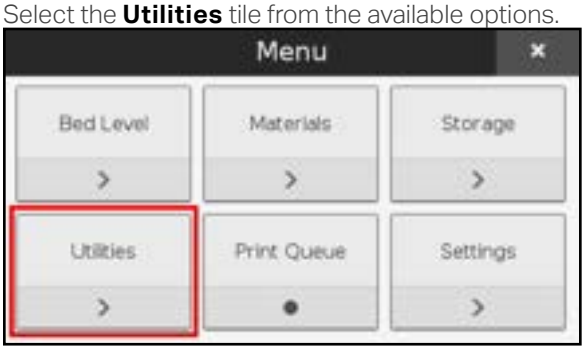
An out-of-level print bed can cause even simple prints to fail. If you would like to ensure that your print bed is level, you can run the Bed Level Test Print utility.

Note: The print head will become hot during the printing process. Exercise caution when working near the nozzles.

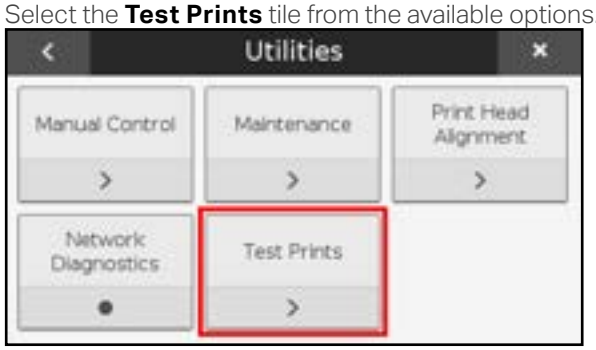
1. Clean your print bed and apply glue as shown in the picture below. Install the print bed.



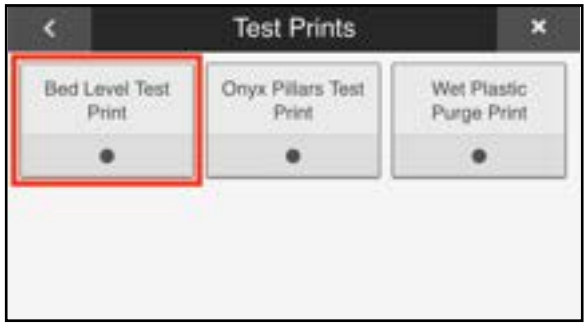
2. Select the menu icon from the dashboard.
3. Select the **Utilities** tile from the available options.



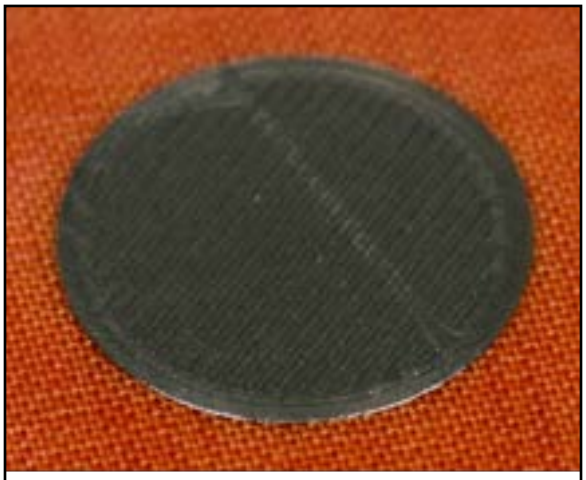
4. Select the **Test Prints** tile from the available options.



5. Select the **Bed Level Test Print** tile.



6. Evaluate your test print disks to see if your bed needs to be adjusted. Compare your results with each of the example disks below.
Note: For more information, please see Leveling the Print Bed*.*



Well- Leveled

Uniform and solid: Well-leveled

Bed Low

Stringy material or the lines don't connect completely to the outer circle: Bed low

Bed High

Flattened or overly pressed down: Bed high

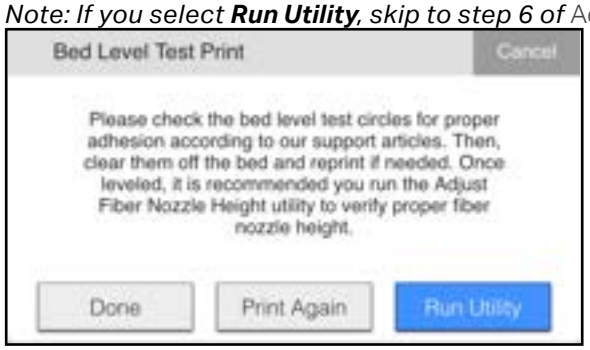
Bed Very High

Inconsistently or not entirely laid down: Bed very high

7. If any of your disks indicate a high or low nozzle, complete the following steps and then re-evaluate your results:

- After pressing **Done**, remove the print bed from the printer and use the provided scraper to peel the disks off the print bed.
- Use warm water to clean the glue off of your print bed.
- Run the Shim Bed Level utility again, but do ***not*** loosen the thumbscrews under the print bed when prompted to do so. Base your adjustments off of the results of the Bed Level Test Print utility.
- Reapply glue to the print bed in the same spots as before and run the Bed Level Test Print utility again.

8. After you have examined the test print disks, remove them from the print bed. If the test print disks indicate that the bed is level, press **Run Utility** to calibrate the fiber nozzle height, if applicable; see *Adjust Fiber Nozzle Height*, above, for more information. Otherwise, press **Print Again** to reprint the test print disks, or press **Done** to exit the utility.
*Note: If you select **Run Utility**, skip to step 6 of* Adjust Fiber Nozzle Height*, above.*



ADJUSTING THE XY OFFSET

Supplies

- Glue stick
- Scraper

In cases where continuous fiber is incorrectly aligned with the plastic portion of a part, the Fiber Nozzle XY Offset utility is used to update relative nozzle position, which is stored internally by the printer. XY misalignment may manifest as fiber strands being put down outside the channels laid out for them by Eiger -- in rare extreme cases, fiber may even be visible outside the boundaries of the plastic part. If you think you may be experiencing such a problem, contact Markforged Support.

Most users will never need to adjust their XY offset settings, but in the rare cases where the fiber and plastic nozzles on the print head may have become misaligned, this utility will print a test part that can be used to identify and correct offset issues.

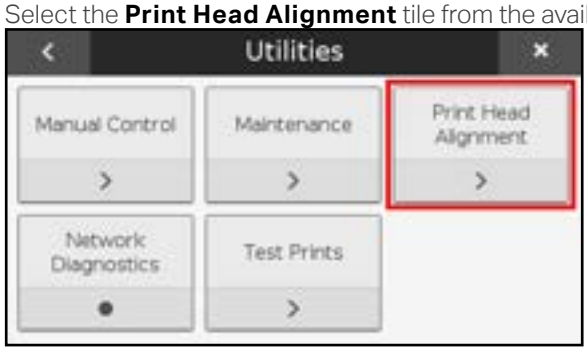
Note: The print head will become hot during the printing process. Exercise caution when working near the nozzles.

RUN UTILITY TEST PRINT

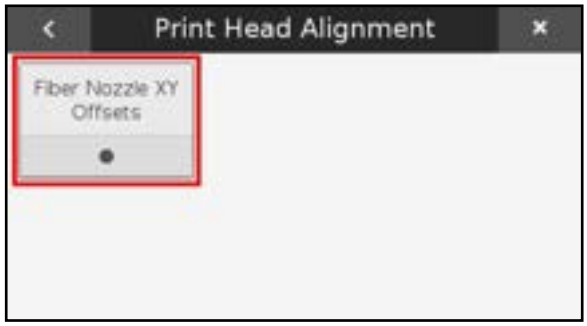
1. Clean your print bed and apply a 4" by 4" square of glue to its center. Install the print bed into your printer.
2. Select the menu icon from the dashboard.

3. Select the **Utilities** tile from the available options.

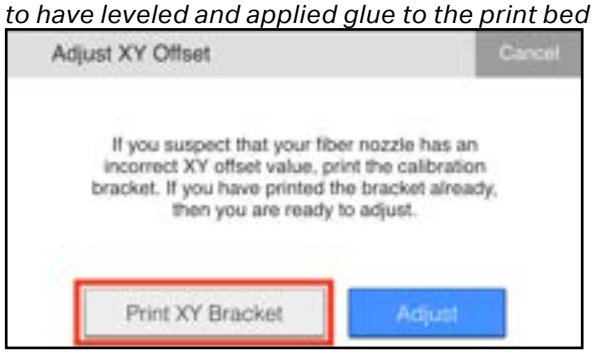
4. Select the **Print Head Alignment** tile from the available options.



5. Select the **Fiber Nozzle XY Offsets** tile.



6. Press the **Print XY Bracket** button. *Do not* remove the printed part until after completing the steps in the subsection below.
*Note: The printer will automatically begin printing the part when the button is pressed. Be sure to have leveled and applied glue to the print bed before pressing the **Print XY Bracket** button.*

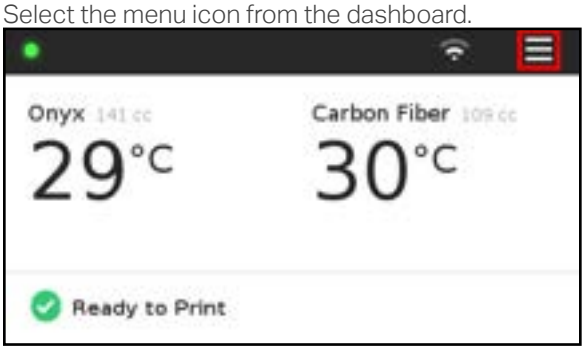


7. When the test part finishes printing, press **Next** to start adjusting the XY offset.
*Note: If you pressed **Next**, skip to step 5 in the* Adjust XY Offset *instructions, below.*

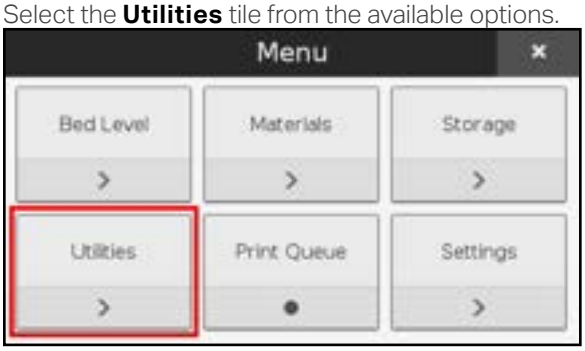
ADJUST XY OFFSET

To adjust the XY offset, you will need to know how far off the current values are from standard. The most accurate way to find this information is to print the test part via the steps above and leave it on the print bed during the adjustment routine. If you have printed the test part and haven't exited the utility, skip to step 5 below.

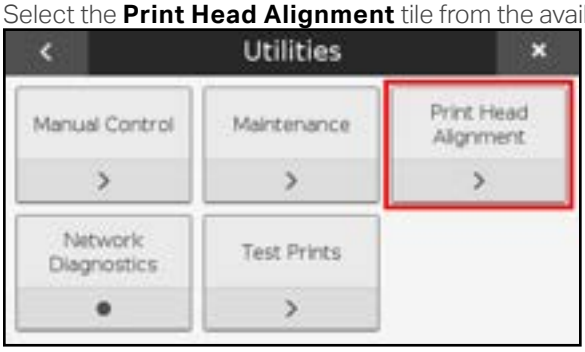
1. Select the menu icon from the dashboard.



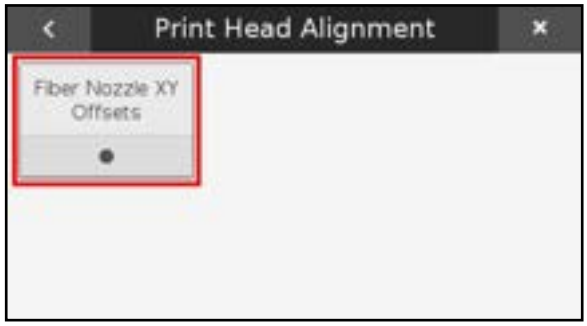
2. Select the **Utilities** tile from the available options.



3. Select the **Print Head Alignment** tile from the available options.

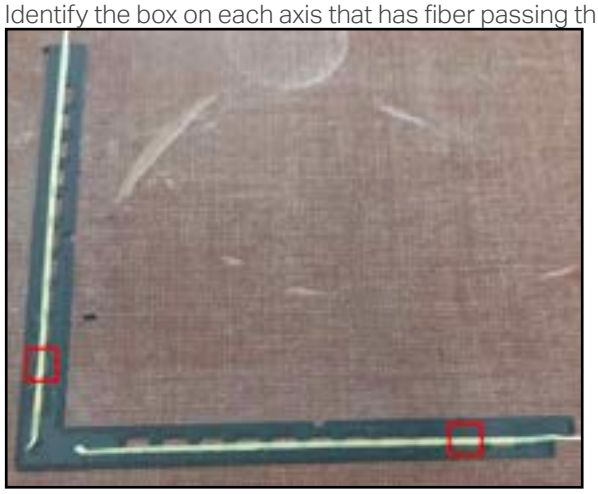


4. Select the **Fiber Nozzle XY Offsets** tile.

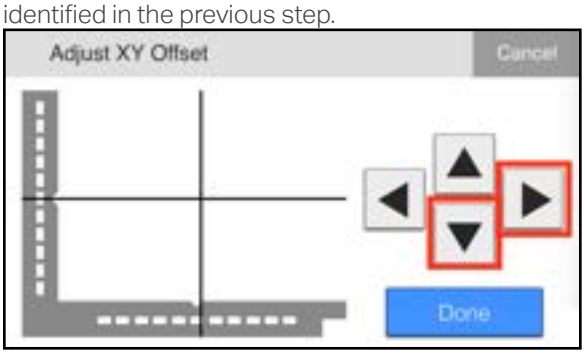


5. Press the **Adjust** button.

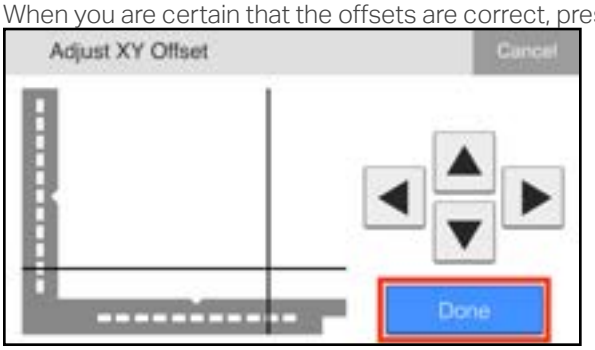
6. Identify the box on each axis that has fiber passing through its center.



7. In the utility, use the arrow buttons to adjust the black lines until they pass through the boxes that you identified in the previous step.



8. When you are certain that the offsets are correct, press the **Done** button.



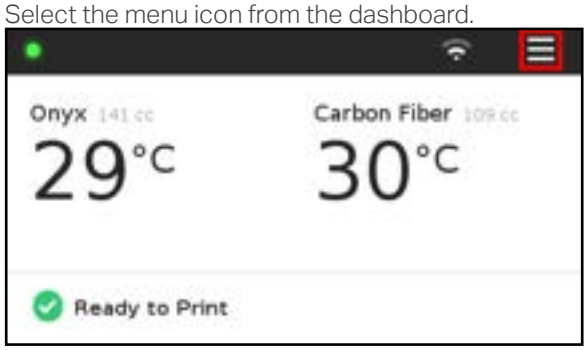
9. Press **Print XY Bracket** and follow the onscreen prompts to confirm that the new XY offset value is correct (recommended), or press **Later** to exit the utility.

ADJUSTING THE Z OFFSET

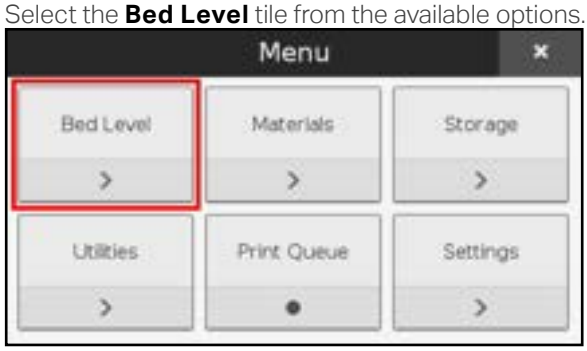
Occasionally, you may have trouble getting enough travel from your printer's leveling screws to properly level the bed. This could happen while switching between two print beds or after a system reset, for example. To achieve better leveling, you can run through the following steps to adjust the Z offset on your printer.

Before running the Adjust Z Offset utility, be sure to raise the fiber nozzle up such that it sits no lower than your plastic nozzle. Please also ensure that the print bed is present and placed on the print stage.

1. Select the menu icon from the dashboard.



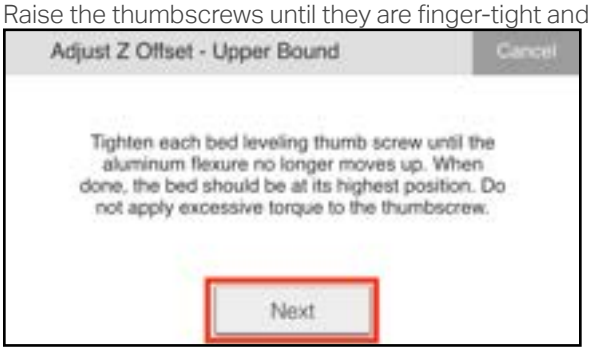
2. Select the **Bed Level** tile from the available options.



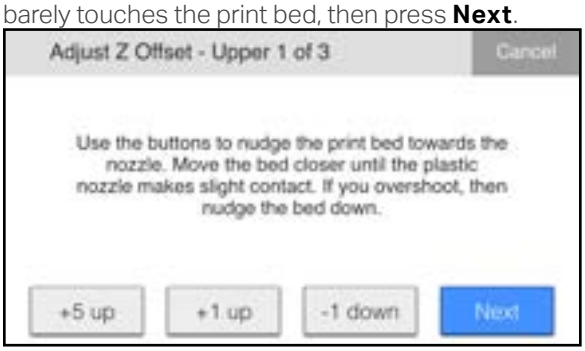
3. Select the **Adjust Print Bed Z Offset** tile from the available options.

4. Read the safety warning on the screen and press **Continue** when prompted.

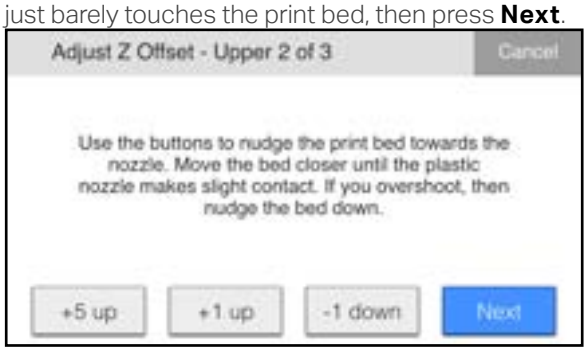
5. Raise the thumbscrews until they are finger-tight and at their highest position, then press **Next**.



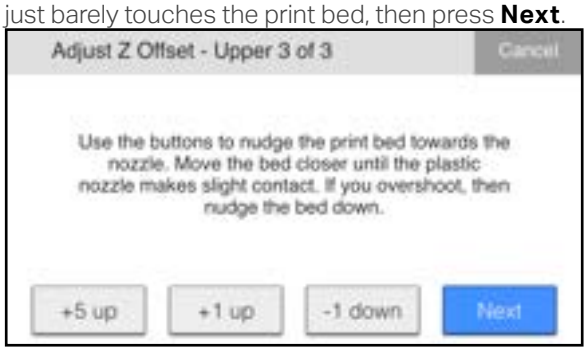
6. Using the onscreen buttons, adjust the height of the print bed at the first point until the plastic nozzle just barely touches the print bed, then press **Next**.



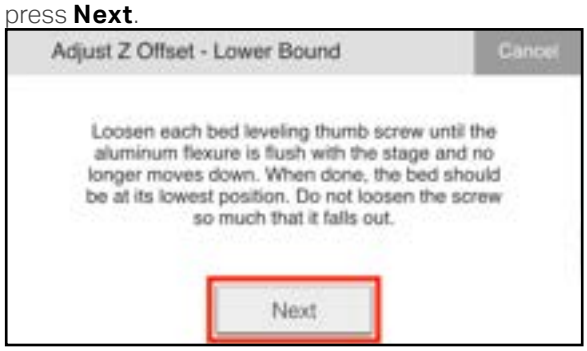
7. Using the onscreen buttons, adjust the height of the print bed at the second point until the plastic nozzle just barely touches the print bed, then press **Next**.



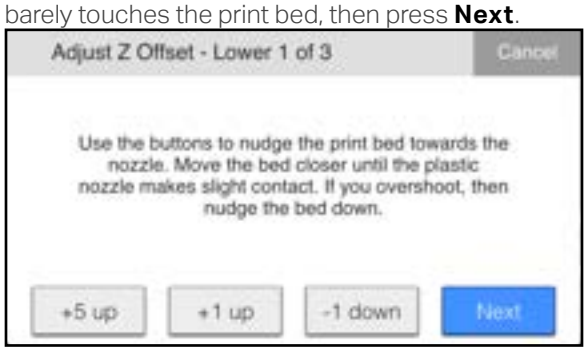
8. Using the onscreen buttons, adjust the height of the print bed at the third point until the plastic nozzle just barely touches the print bed, then press **Next**.



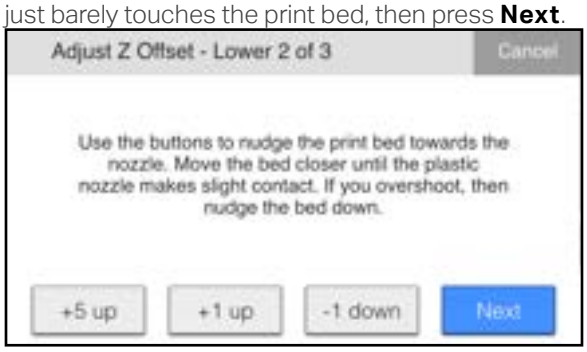
9. Lower the thumbscrews until the flexures are bottomed out and flush against the print stage, then press **Next**.



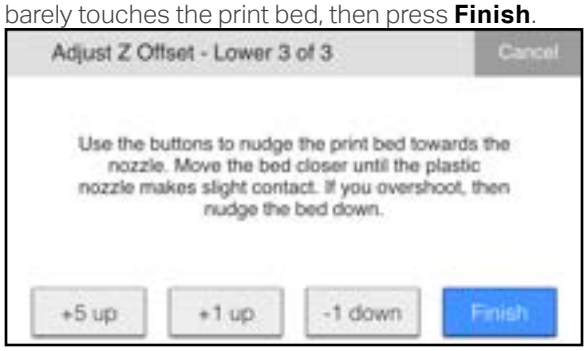
10. Using the onscreen buttons, adjust the height of the print bed at the first point until the plastic nozzle just barely touches the print bed, then press **Next**.



11. Using the onscreen buttons, adjust the height of the print bed at the second point until the plastic nozzle just barely touches the print bed, then press **Next**.



12. Using the onscreen buttons, adjust the height of the print bed at the third point until the plastic nozzle just barely touches the print bed, then press **Finish**.



13. Wait for the offsets to save, then press **Done**.

ONYX PILLARS TEST PRINT

Supplies

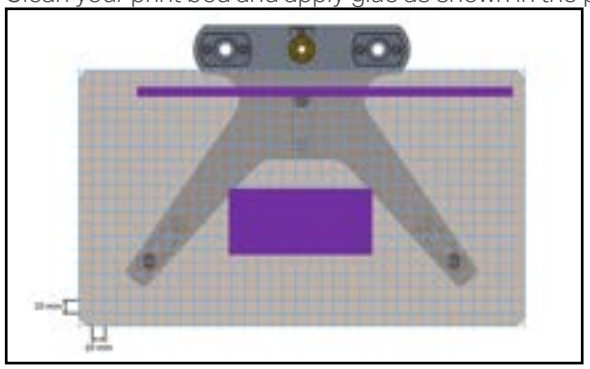
- Glue stick
- Scraper

The Onyx Pillars Test Print utility can be used to diagnose printing issues on your printer. This test print is significantly more effective at diagnosing wet Onyx than the Wet Plastic Purge routine. In addition, this utility can help diagnose underextrusion as well as several other printing issues.

This routine will run for about 15 minutes and then pause to allow you to inspect the test part. Wet plastic or underextrusion issues may be visible at this time. As with any paused print, after inspecting the part, you will have the option to stop the print or to resume it. Resuming the print will allow it to run for another hour or so and may provide more definitive results as to the quality of your plastic and prints.

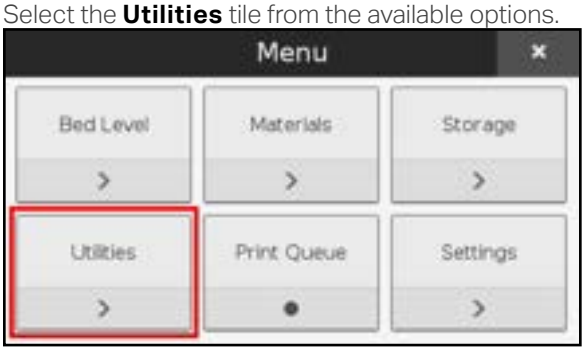
RUN UTILITY TEST PRINT

1. Clean your print bed and apply glue as shown in the picture below. Place your print bed into your printer.

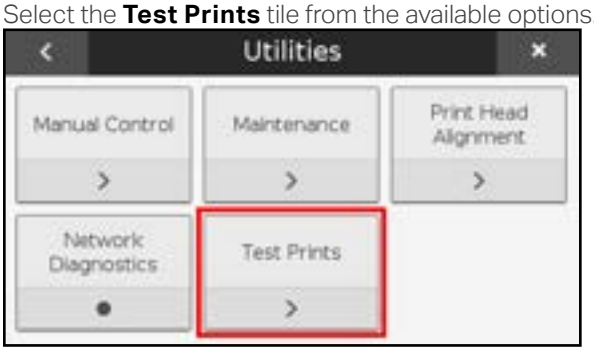


2. Select the menu icon from the dashboard.

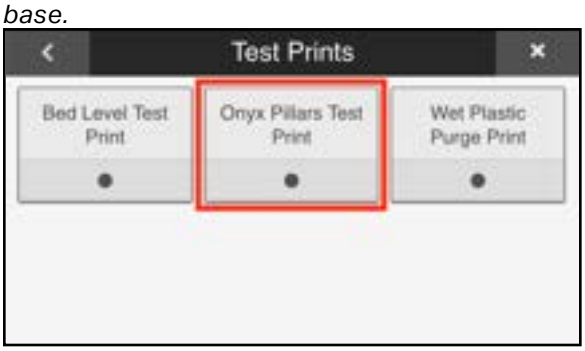
3. Select the **Utilities** tile from the available options.



4. Select the **Test Prints** tile from the available options.



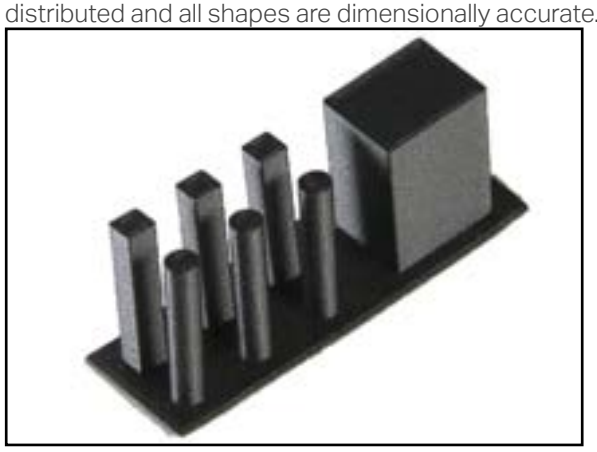
5. Select the **Onyx Pillars Test Print** tile.
*Note: This print will pause at layer 30 to allow you to inspect the part for print issues. Ensure that you press **Resume** in a timely manner to prevent the rest of the part from failing to adhere to its base.*



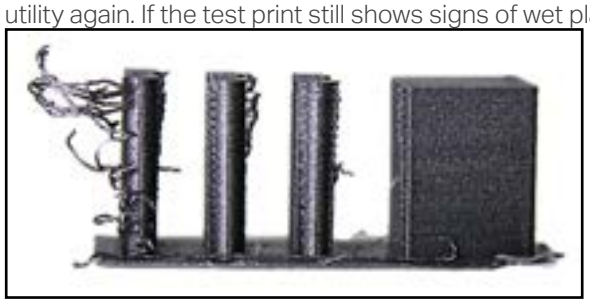
DIAGNOSE PRINTING PROBLEMS

The Onyx Pillars Test Print utility can be used as a diagnostic for several issues on your printer. See below for pictures and descriptions of potential failure modes for this part and what they mean. If you experience a failure mode that is not shown here, please contact Support for additional assistance.

- **Good test pillars:** Walls and floors are well-formed, lacking gaps or stringing. Plastic is uniformly distributed and all shapes are dimensionally accurate.



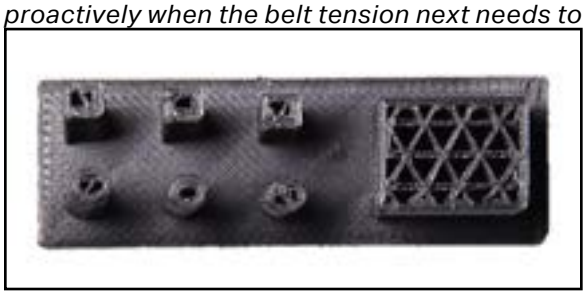
- **Pillars with wet plastic:** Stringing may occur between pillars or off of walls.
  Solution: Remove and discard several feet of filament from the spool. Reload the plastic and run the utility again. If the test print still shows signs of wet plastic, discard the spool and replace it.



- **Pillars with underextrusion:** There are gaps in roofs or floors.
  Solution: Run the Underextrusion Troubleshooting utility. For more information, see *Underextrusion Troubleshooting*.

- **Pillars with pitted walls:** Gaps appear on vertical walls.
  Solution: Check for tangled print material in the drybox or jams in the extruder or print head. If necessary, change the nozzle.

- **Dimensionally inaccurate pillars:** Circular pillars may incorrectly print as ovals. Square pillars may incorrectly print as rectangles. Plastic is not evenly distributed.
  Solution: Check the belt tension and the bearings in your pulleys. Dimensional inaccuracy on this print can be a sign that the motion system on your printer needs to be calibrated. For more information, see *Adjusting Belt Tension*.
  Note: Ensure that you reset the belt tension counter afterward, allowing your device to warn you proactively when the belt tension next needs to be adjusted.



WET PLASTIC PURGE

Supplies

- Glue stick
- Scraper

The Wet Plastic Purge routine is designed to purge any plastic from your print head and extruder that may have absorbed water from the air. Some amount of absorption can happen over time because the extruder and Bowden tube are not a fully closed system. Plastic filament that sits in the extruder or print head for more than four hours can absorb water from the air and have a negative impact on your print. Therefore, the Wet Plastic Purge routine purges your Bowden tube of any potentially wet material to help ensure successful, high-quality prints.

The wet plastic purge line will automatically print at the beginning of every print job if more than four hours have passed since the previous print.

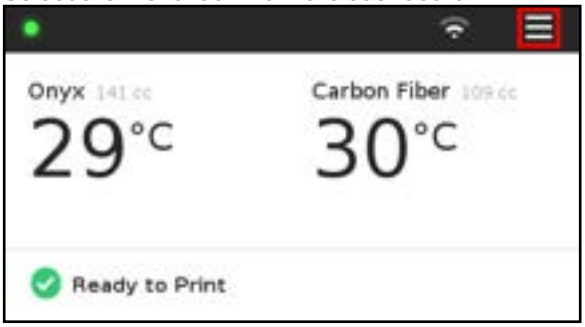
Note: The purge line takes only five minutes to print and uses less than $1 worth of material.

You can also use the Wet Plastic Purge utility to gain some insight into whether your plastic material has absorbed moisture. Below, you can find some examples of what a well-formed purge line should look like and what would be expected of a purge line printed with wet material.

RUN WET PLASTIC PURGE UTILITY

Note: The print head will become hot during this process. Exercise caution when working near the nozzles.

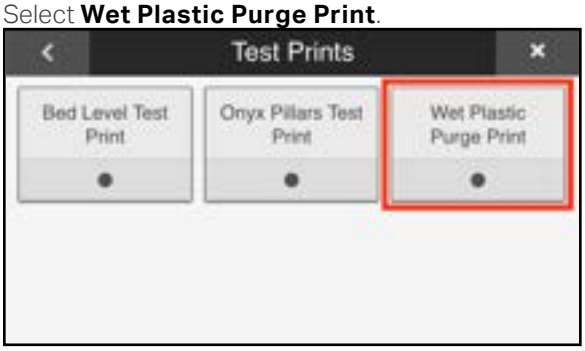
1. Apply a line of glue parallel to the far edge of your print bed as you would for a purge line on a normal print.
2. Select the menu icon from the dashboard.



3. Select **Utilities**.

4. Select **Test Prints**.

5. Select **Wet Plastic Purge Print**.



DIAGNOSE WET MATERIAL

When the purge line finishes printing, inspect it for rough spots. The rightmost end of the purge line should have about an inch-long section of rough finish; this is the portion of nylon material that was sitting in the nozzle.

The next six inches of the purge line should have a smooth finish; this is the section of nylon that was sitting in the Bowden tube.

The remaining length of the purge line should be rough again, then transition into a smooth finish; this is

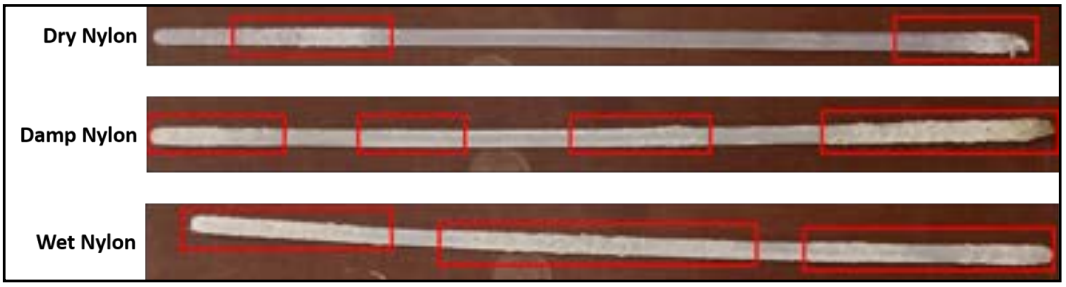
the section of filament that was sitting in the extruder and the drybox. See the picture below for a visual representation of a well-formed purge line.

If your purge line appears to have more rough patches than described, consider running the utility again. Doing so will ensure that nearly all the filament in the second purge line will come from the drybox. If the second purge line also has a rough finish, then the filament in your drybox has likely been exposed to moisture.

The image below shows the purge lines from three different spools of nylon.

- Top: A spool that was properly cared for and stored in a drybox
- Middle: A spool that had been exposed to air for a short period of time
- Bottom: A spool that had been exposed to air for several hours

On each purge line, the rough patches are outlined in red. If your purge line resembles either of the bottom two examples, it may be time to replace your spool.



The following two images show rough purge lines due to wet material (above) paired with clean smooth purge lines (below), in Nylon White (left) and Onyx (right).

Finally, some disastrously wet Nylon White material:

Note: If necessary, you can enable or disable the automatic purge line print by selecting ***Menu > Settings > System Info*** *on your touchscreen, selecting the gears icon at the bottom of the screen, and toggling the* ***Wet Plastic Purge*** *switch on or off.* ***To avoid printing issues, we recommend that this routine be enabled at all times.***

AUTO-PAUSE AND MATERIAL METERING

Note on Resetting Material Meters

Eiger's estimate of remaining print material is deliberately conservative. To improve the accuracy of material metering, you can run the Reset Plastic Meter or Reset Fiber Meter utility to re-weigh your spool without unloading material. For more information, see *Resetting Material Meters*, above.

Note on Early "Low on Material" Warnings

When using material metering on a composite printer, Eiger and your printer will warn you if there is insufficient material to finish a print; in addition, the printer will pause the print, if the extruder model and settings allow. Read on to learn why a print might pause with a **Low on Material** warning even with some material remaining on the spool.

The **Full Spool** option during **Meter Load** is faster than the **Partial Spool** option but results in a less accurate material estimation. Plastic spools (Onyx and Nylon White) are sold with a minimum of 800 cm^3 of material, but they may have up to 75 cm^3 of extra material at no additional cost due to the way the material is spooled during manufacturing. If you select the **Full Spool** option during **Meter Load**, the material estimation will be set to 800 cm^3. When the material estimation reaches <1 cm^3, the print will pause; however, the plastic spool may still have up to 75 cm^3 of material remaining. In that case, you can reset the material meter, which will allow you to weigh the spool and update the material estimation accordingly.

If you are loading a new spool of material and wish to ensure a more accurate material estimation from the beginning, you can select **Partial Spool** while running **Meter Load**, which will allow you to set the material estimation according to the weight of the spool. Note that a small amount of material may be left on the spool even then, due to conservative material usage estimations when printing.

MATERIAL METERING AND AUTO-PAUSE

Material metering is a feature on all Markforged printers; when enabled, it allows your printer to track material consumption. Material metering is only active when **Meter Load** is selected when loading plastic or fiber material; it is deactivated when the **Quick Load** option is selected during material loading. When material metering is enabled, your printer will update the estimated amount of remaining material over the lifetime of the spool and warn you when the material estimation is low.

Auto-Pause is also a feature on all Markforged printers; when enabled, it will pause the current print when the material estimate is low or when the end of the spool is reached (depending on the extruder model; see below). The behavior of the Auto-Pause feature relies on the model-specific sensors inside your printer's plastic extruder. You can find your printer's extruder model by navigating to **Menu > Settings > System Info** on the touchscreen.

Extruder Type A1095

This extruder is present on Gen 1 Desktop (Onyx One, Onyx Pro, Mark Two) printers. As this extruder lacks sensors to detect when the end of the spool has been reached, the printer relies solely on material metering to pause the print when material is low. If **Quick Load** is selected when loading material, the printer will not know how much material remains and will not pause when material is low. It is highly recommended to always use **Meter Load** whenever loading material.

Extruder Type A3648

This extruder is present on all Gen 2 Desktop and Industrial printers. This extruder has a second-generation sensor that detects when the end of the spool has been reached. The A3648 extruder enables the **Plastic Issue Detection** setting, which is turned **ON** by default. **Plastic Issue Detection** can sense when material runs out as well as whether there are any jams or extrusion issues while printing.

If the **Plastic Issue Detection** setting is turned **ON**: The print will pause when the end of the spool physically reaches the extruder. The printer will only alert you if the material estimation is too low to finish a print.

If the **Plastic Issue Detection** setting is turned **OFF**: The print will only pause when the material estimation reaches a set threshold. A small amount of material will remain on the spool to ensure that the printer does not "air print," or attempt to continue printing with no material loaded. If **Quick Load** was used when loading plastic, the printer will not know how much material remains and will not pause for low material. It is highly recommended to keep the **Plastic Issue Detection** setting turned **ON** and to use **Meter Load** when loading plastic and fiber material.

USING THE AUTO-PAUSE FEATURE

The Auto-Pause feature is designed to alert you if your printer is running low on plastic or fiber, if applicable, so as to prevent your printer from running out of material during a print. *This feature only works if you use the **Meter Load** option when loading materials*.

Unless instructed otherwise by Markforged Support, you should leave Auto-Pause enabled at all times.

If Eiger or your printer determines that there is less material loaded into the printer than is needed, you will be prompted with the following options:

- **Turn the Auto-Pause feature on:** This will cause your print to pause if the amount of remaining material becomes too low so that you can replace it and continue your print.
- **Turn the Auto-Pause feature off:** This will cause your printer to run regardless of the amount of material that is left, potentially leading to a failed print.
- **Cancel the print:** The print will be canceled. It is not possible to resume a canceled print.
- **Reload new material:** Immediately swap out the partial spool of material for a new spool and continue the current print.

If you choose to enable the Auto-Pause feature, either through Eiger or on your printer, and the print does pause, you will receive a notification on the printer's touchscreen and via email.

ENABLE AND DISABLE AUTO-PAUSE FEATURE IN EIGER

When printing from Eiger, Auto-Pause is enabled by default; when you press **Print**, Eiger will automatically check whether the printer has enough material to run the print. If the material estimation is too low, you will receive an onscreen pop-up like this one:

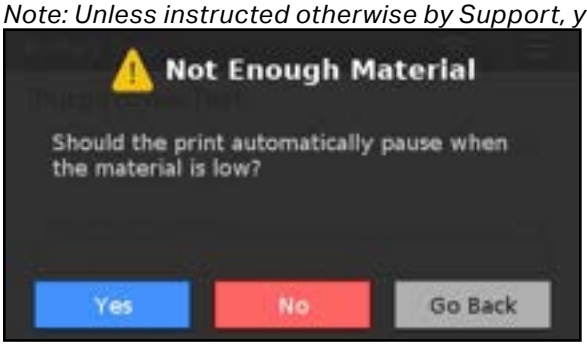
ENABLE AND DISABLE AUTO-PAUSE FEATURE ON PRINTER

When printing a part from onboard storage or from your printer's queue, your printer will check whether there is enough material loaded to run the print. If the material estimation is too low, you will receive an onscreen notification prompting you to select an option for the print.

Examples of onscreen Auto-Pause notifications

- If the material estimation is too low to complete a print, you will receive a notification prompting you to either continue or go back.

- If you choose to continue with the print, your printer will ask if you would like to continue with the Auto-Pause feature turned on or off.
Note: Unless instructed otherwise by Support, you should leave Auto-Pause enabled at all times.



- If you choose to go back, you will be directed to the home screen.
- If you choose to reload material and continue with the print, you can select the **Resume** option on your printer's touchscreen. If there is enough material loaded to finish the print, the printer will resume printing; otherwise the printer will prompt you to go back or to enable the Auto-Pause feature again.

RESUME PRINT AFTER AUTO-PAUSE

Any time your printer resumes from a pause, it will check whether you have enough material to continue printing.

- If the material estimation is too low to complete the print, you will be prompted with a warning and presented with the options to continue the print anyway or to go back to reload.

- If your printer determines that you have no material loaded, you will be prompted with the following screen.

- If your printer determines that you have enough material to complete the print, you will be prompted to resume the print.

FIBER JAM TROUBLESHOOTING

Supplies

- 2mm hex key
- 10mm torque wrench
- Tweezers
- Replacement PTFE tube
- Anti-Seize

Note that the print head is factory-calibrated; do NOT adjust or disassemble in any way unless specifically instructed to do so by Markforged Support. Warranty claims for assemblies that have been adjusted, disassembled, or modified may not be honored.

Automatic fiber jam detection is enabled by default. We recommend that you enable fiber jam detection so that, in the event of a fiber jam, your printer will be able to prompt you to take appropriate action.

The most common causes of a fiber jam are as follows:

Extruder Jam

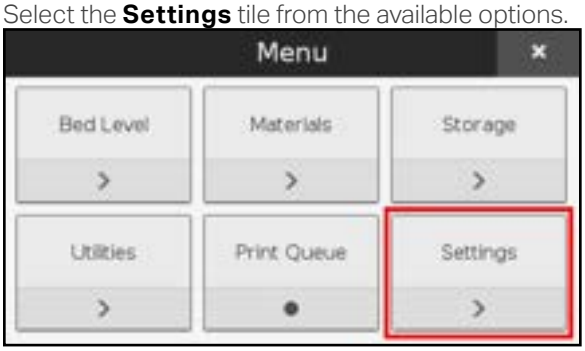
This failure is most common when printing with Kevlar. If the part has a high volume of Kevlar, the repeated use of the fiber cutter (many times per part layer) increases the likelihood of extruder jams. Due to its flexibility, Kevlar tends to bend or break more frequently than the other fiber materials, and can become caught in the extruder.

Nozzle Jam as a Result of Incorrect Fiber Nozzle Height

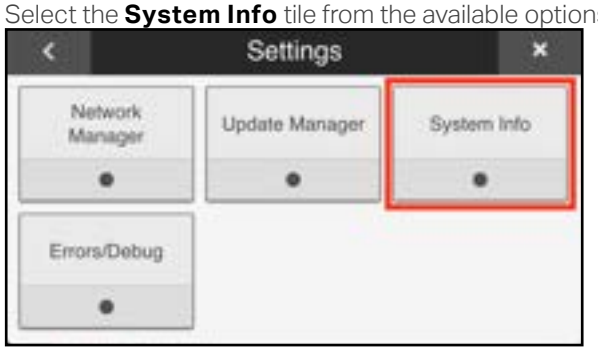
A fiber nozzle set to the incorrect height can cause the nozzle to jam, along with other print issues. Fiber jams due to poor leveling are most common when printing with Carbon Fiber. Carbon Fiber is thicker than the other fiber materials, and requires extra care when leveling the fiber nozzle.

ENABLING / DISABLING FIBER JAM DETECTION

1. Select the menu icon from the dashboard.
2. Select the **Settings** tile from the available options.



3. Select the **System Info** tile from the available options.



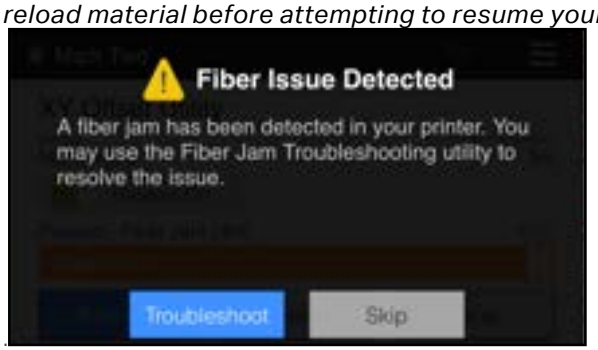
4. Select the gears icon from the row of icons at the bottom of the screen.

5. Enable or disable automatic jam detection as needed by toggling the **Fiber Jam Detection** switch.

DETECT AND DEBUG FIBER JAMS

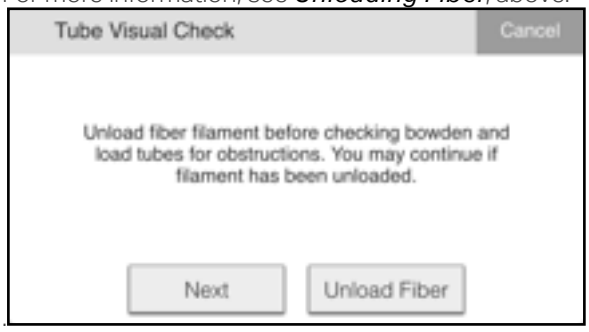
In the event of a suspected fiber jam, your printer will pause the print and a prompt will appear on its touchscreen. Follow the onscreen steps to diagnose and attempt to resolve the jam. Once the jam has been resolved, the print can resume from where it paused.

1. Press **Troubleshoot** on the touchscreen.
   Note: If you choose to skip these troubleshooting steps, it is recommended that you unload and reload material before attempting to resume your print.

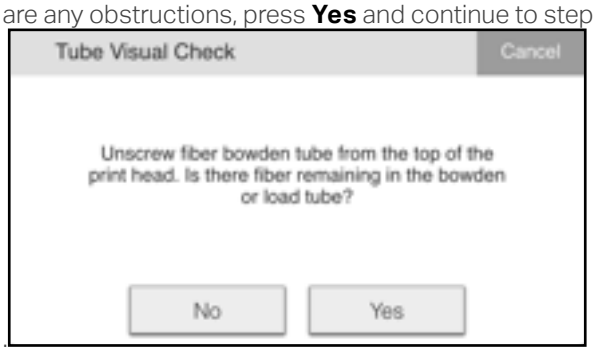


2. Follow the onscreen prompts until you reach the screen below. Ensure that the area below your print bed is clear, then press **Next**.

3. Wait for the nozzles to cool completely.
4. If you haven't already done so, it is recommended that you unload fiber from the print head at this time. For more information, see ***Unloading Fiber***, above.

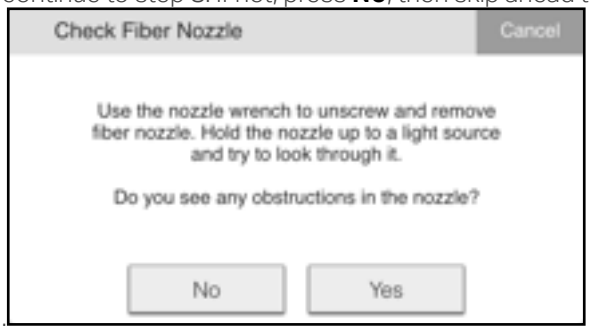


5. Detach the fiber Bowden tube from the print head and check for obstructions in the Bowden tube. If there are any obstructions, press **Yes** and continue to step 6. If not, press **No** and skip ahead to step 7.

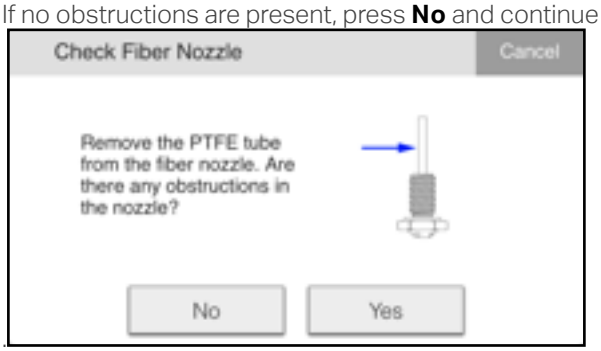


6. If any obstructions are present in the fiber Bowden or feed tubes, remove the remaining filament from inside the obstructed tube.

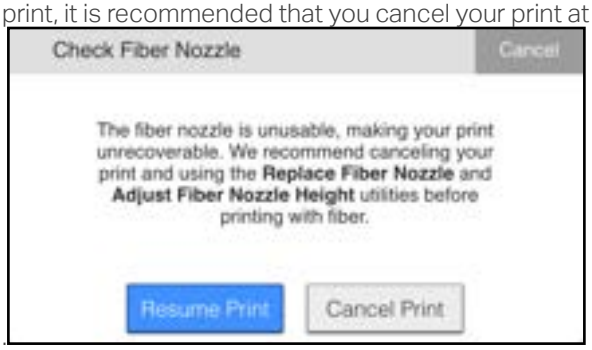
7. Using the nozzle wrench, unscrew and remove the fiber nozzle from the print head, then hold it up to a source of light to check for obstructions. If you see any obstructions in the fiber nozzle, press **Yes** and continue to step 8. If not, press **No**, then skip ahead to step 10.



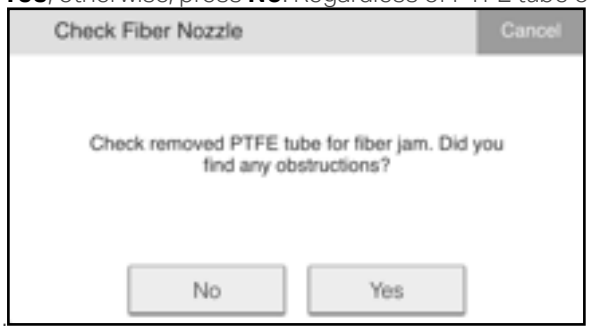
8. Remove the PTFE tube from your fiber nozzle, then check again for obstructions inside the nozzle itself. If no obstructions are present, press **No** and continue to step 9.



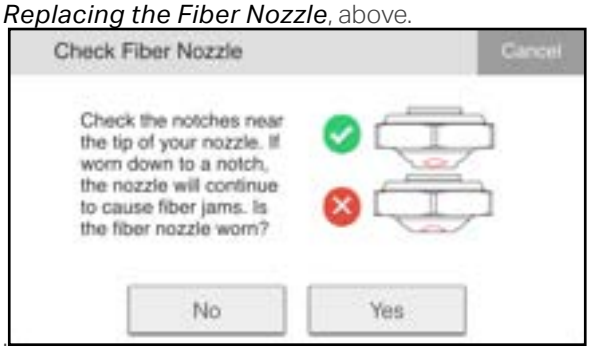
If an obstruction is present, your nozzle is unfortunately no longer usable. While you may resume your print, it is recommended that you cancel your print at this time and install a new fiber nozzle.



9. Check the PTFE tube you removed from the nozzle for obstructions. If obstructions are present, press **Yes**; otherwise, press **No**. Regardless of PTFE tube obstructions, continue to step 10.

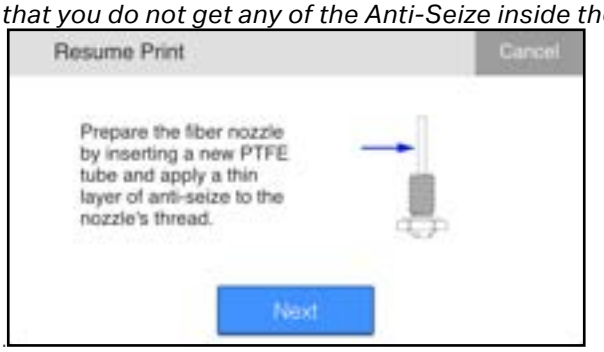


10. Looking at the face of your fiber nozzle, examine the wear indicator notches on the side of the nozzle. If the nozzle resembles the nozzle to the right of the *red X* in the image below, it is worn through and unfortunately no longer usable. While you may resume your print, it is recommended that you cancel your print at this time and install a new fiber nozzle; for more information on fiber nozzle replacement, see *Replacing the Fiber Nozzle*, above.

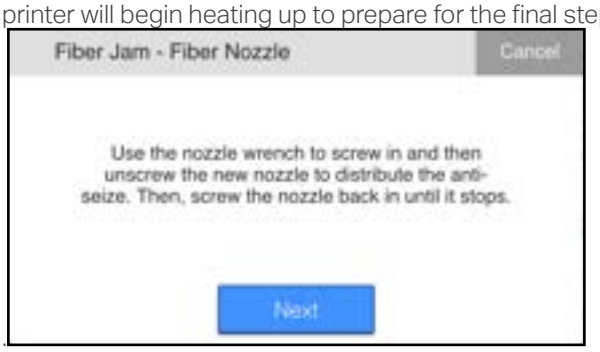


If your nozzle resembles the diagram to the right of the *green checkmark* in the image above, it is not worn through and can be reinstalled; press **No** to continue to step 11.

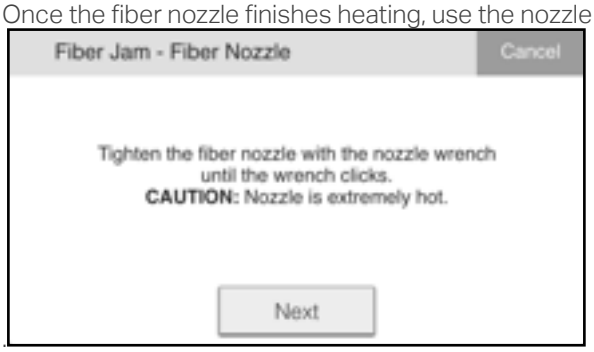
11. Prepare your fiber nozzle for reinstallation by inserting a new PTFE tube into the nozzle and applying a thin layer of Anti-Seize to the nozzle's threads. Then, press **Next**.
Note: It is recommended that you always install an unused PTFE tube into the fiber nozzle, as removal of the PTFE tube may cause crimps or dents that can lead to future fiber jams. Ensure that you do not get any of the Anti-Seize inside the nozzle.



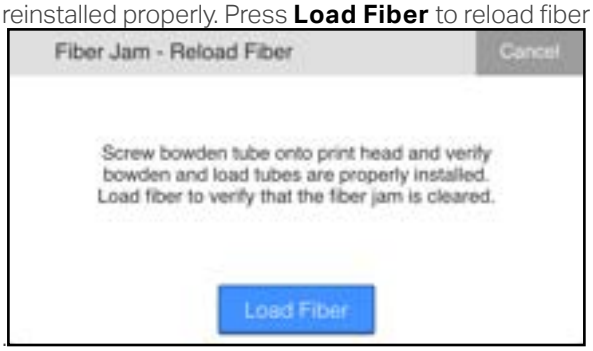
12. Using the nozzle wrench, screw the new nozzle partway into the print head, then unscrew it and screw it in again until snug; this helps disperse the Anti-Seize over all of the threads. Once you press **Next**, your printer will begin heating up to prepare for the final steps of reinstallation.



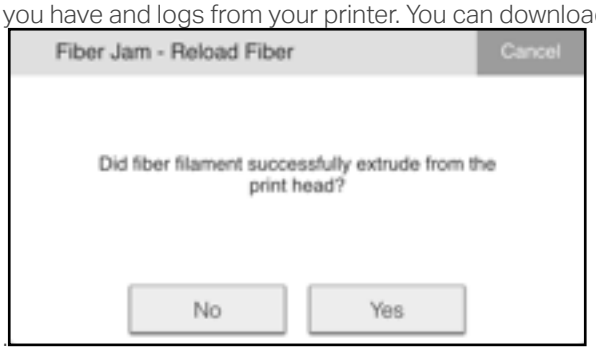
13. Once the fiber nozzle finishes heating, use the nozzle wrench to tighten the nozzle until the wrench clicks.



14. Reinstall the fiber Bowden tube into the print head, then verify that the fiber Bowden and feed tubes are reinstalled properly. Press **Load Fiber** to reload fiber before resuming your print.



15. After reloading fiber, you will be asked if fiber successfully extruded from the print head. If it did not, please contact Markforged Support. To help in diagnosis, please provide any photos of the obstructions you have and logs from your printer. You can download logs from your printer's Device page in Eiger.



If fiber did successfully extrude, then you have cleared your fiber jam!

16. Follow the onscreen prompts to return to the pause screen on your printer, where you will have the option to resume your print.

Ensure that you reinstall any components you removed during this procedure before attempting to print.

STORING MATERIAL

PLASTIC FILAMENT

Long-term storage of plastic outside of the drybox will severely degrade the print quality produced by a spool. The plastic filament readily absorbs water from the environment. This increased moisture content will degrade print performance and may clog the print head.

If you need to remove the plastic from the provided drybox, please store it in another air-tight container. Markforged recommends the **Pelican 1430** case.

Important:

Each spool of Onyx ships with two desiccant packs, while spools of nylon ship with one. ***A spool in the drybox should ONLY be stored with the desiccant packs it shipped with. Any extra / leftover packs from previous spools of material have likely absorbed moisture, which will permeate to the partial spool, making it wet.***

Do not store partial spools of material in any type of sealable bag, as those do not protect spools from moisture. Air-tight containers used for partial spool storage must have solid walls.

If you plan on leaving your printer unused for an extended period of time, just keep the spool in the drybox with the filament loaded in the printer. The drybox and desiccant packs do a good job protecting from moisture, and drybox-stored material should last up to a year before the water content becomes too high for printing. When restarting a machine after a long idle period, run the Wet Plastic Purge Print utility until it stops steaming (which may take 2–3 runs).

Shelf Life

Unopened spools of plastic filament have a minimum shelf life of two years from date of manufacture when stored in their original sealed packaging at temperatures between 55 - 90° F (13 - 33° C). Once unsealed, plastic spools should be stored in a drybox or similarly sized airtight container. Plastic spools can be stored in this manner for up to one year. Plastic spools must be stored with the desiccant pack(s) they shipped with at all times.

Drying Plastic Material

We strongly recommend that you do not attempt to dry your material. Improper drying can degrade material performance, leading to to part failure and printer malfunction or damage. Markforged does not test or support customer material-drying configurations.

FIBER FILAMENT

Store all composite filaments at room temperature in a cool, dry place, out of direct sunlight. Kevlar® should be stored in a bag or container which blocks exposure to all light.

Shelf Life

Unopened fiber spools have a minimum shelf life of two years from date of manufacture when stored in their original sealed packaging at temperatures between 55 - 90° F (13 - 33° C). Once unsealed, fiber spools can be stored for up to one year.

OFFLINE PRINTING

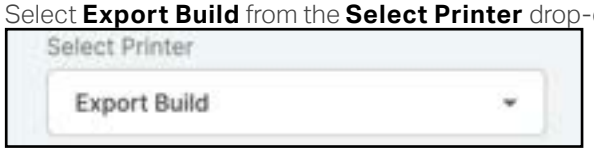
Important: Do not use the factory reset USB drive that came with your printer.

Supplies

- USB drive (FAT32 format) or USB-A to USB-B cable

CREATE AND EXPORT BUILD

1. Sign into Eiger in a Google Chrome browser and import your STL file.
2. Configure the settings and layers in Eiger as necessary and click **Save.**
3. Once your part has been sliced and saved, click **Print** at the bottom right of the screen.
4. Click and drag your part to position it on the print bed.
5. Select **Export Build** from the **Select Printer** drop-down menu on the right side of the screen.



6. Click **Export Build** at the bottom right of the screen. Eiger will generate the print and then download it.

7. You can now either transfer the saved MFP file to a USB thumb drive or print directly from your computer using the included USB cable. See the relevant subsection below

PRINT VIA USB DRIVE

1. Save the desired file to the root directory of a FAT32-formatted USB drive.
   Note: Your MFP file cannot be in a folder. When naming your MFP file, please limit the characters in the file name to ASCII characters. Your printer will not recognize file names with non-standard ASCII characters.
2. Eject the USB drive from your computer and plug it into the back of the printer.
3. Select the menu icon from the dashboard, then navigate to **Storage > Print From Storage**.
   *Note: Markforged printers do not recognize encrypted devices. If the **Print From Storage** tile is grayed out, consult your IT department to ensure that your USB drive and its contents are not encrypted.*
4. Select the file from the USB drive and press **Print**.

PRINT VIA USB CABLE

To print a file directly from your computer, use the USB-A to USB-B cable from the accessory kit to transfer the exported MFP file to the printer as if it were an external drive.

1. Use the USB-A to USB-B cable to connect your computer to the USB-B port at the back of the printer.
   Note: This is different from the USB port where you would insert a thumb drive into the printer.
   
2. On the computer, the printer will appear among the list of external drives. Open it in the filesystem as you would a thumb drive.
3. Copy the MFP file to the printer.
4. On the computer, eject the printer as you would a thumb drive.
5. On the printer's touchscreen, select the menu icon from the dashboard.
6. Navigate to **Storage > Print from Storage**.
   *Note: Markforged printers do not recognize encrypted devices. If the **Print From Storage** tile is grayed out, consult your IT department to determine whether your computer is encrypted. If so, you will need to print online or via USB drive instead; see above for more information.*
7. Select the MFP file you just transferred to the printer and press **Print**.

ACCESSING USB ON A NON-WI-FI ENABLED DEVICE

If your printer does not have a Wi-Fi adapter installed, it will not recognize a USB drive inserted after the device has been powered on. If the printer cannot access the contents of your USB drive, power cycle the printer (with the USB drive still inserted) and try again.

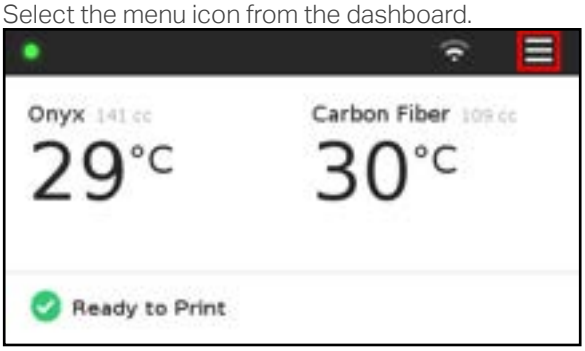
CLEARING THE BOWDEN TUBES

Supplies

- 2mm hex key (if clearing the fiber Bowden tube)

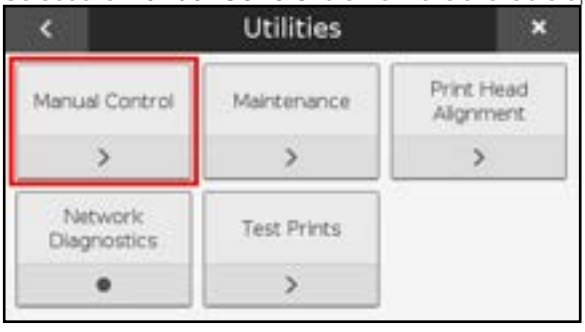
When loading material after the previous spool has run out, you may need to remove any leftover filament that may remain in the tube between the extruder motor and the print head. This process involves extracting filament from the Bowden tube and heating one or both nozzles to release the melted material from the print head.

1. Select the menu icon from the dashboard.

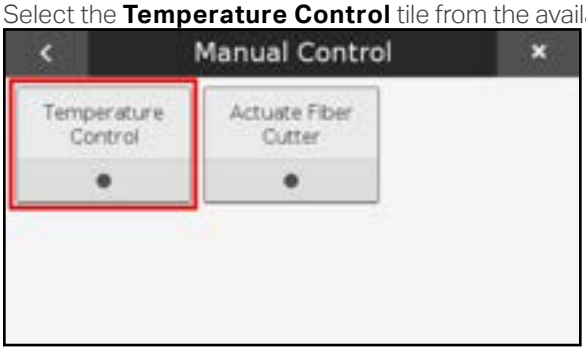


2. Select the **Utilities** tile from the available options.

3. Select the **Manual Control** tile from the available options.

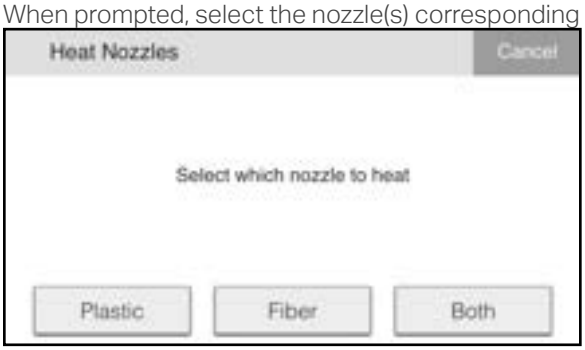


4. Select the **Temperature Control** tile from the available options.

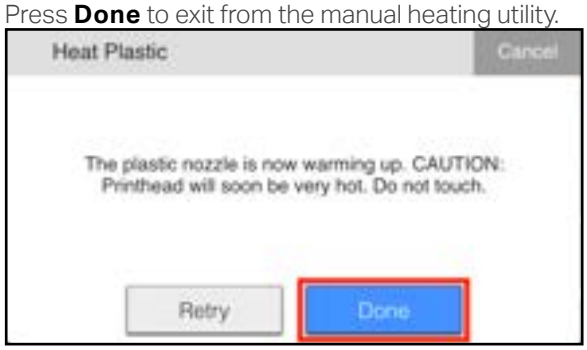


5. When prompted, select the **Heat** option on the screen.

6. When prompted, select the nozzle(s) corresponding to the Bowden tube(s) that you wish to clear.



7. Press **Done** to exit from the manual heating utility.



8. While the nozzle is heating up, remove the Bowden tube from the extruder.

- **Plastic**: Remove the thumbscrew that connects the plastic Bowden tube to the plastic extruder.
- **Fiber**: Use a 2mm hex key to slightly loosen the top left socket head cap screw on the fiber extruder, then remove the fiber Bowden tube from the fiber extruder.
  Note: Do not unscrew it all the way. It should require no more than one full turn to loosen.

9. Once the nozzle is hot, pull the filament from the Bowden tube.
   Note: The tip of the filament that was inside the print head may be hot.
10. Once the fragment of filament has been removed, reattach the Bowden tube to the extruder.

- **Plastic**: Insert the nut into the plastic extruder and tighten the thumbscrew.
- **Fiber**: Insert the tube's metal insert into the notch on the front of the fiber extruder and tighten the screw.

11. Load new materials. For more information, please read *Loading Plastic* and *Loading Fiber*.

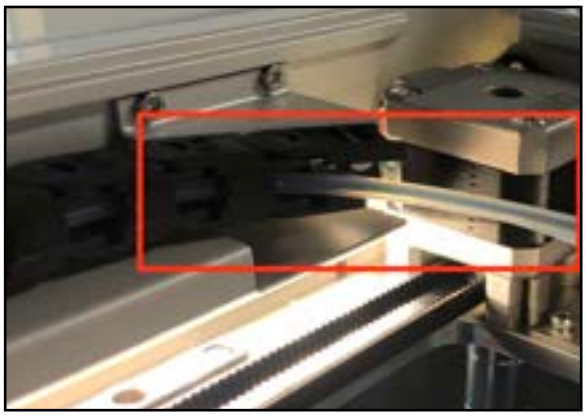
REPLACING BOWDEN TUBES

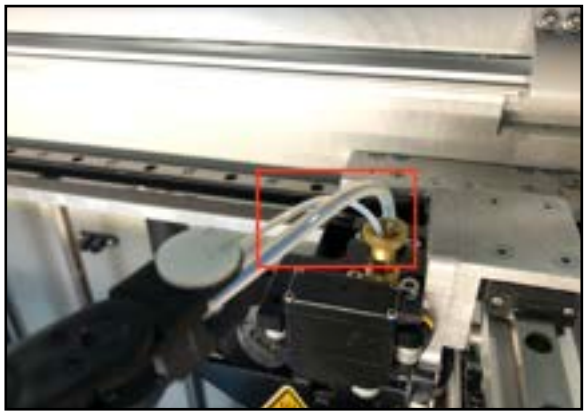
REPLACE PLASTIC BOWDEN TUBE

Supplies

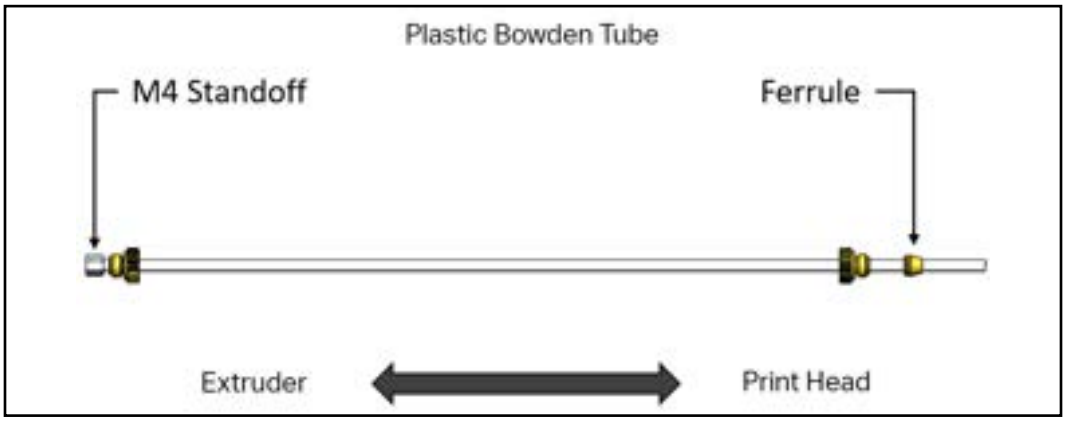
- 10mm open-ended wrench (optional)

Your printer's plastic Bowden tube wears naturally over time due to the abrasiveness of the print material; it will wear fastest where the tube bends sharply.





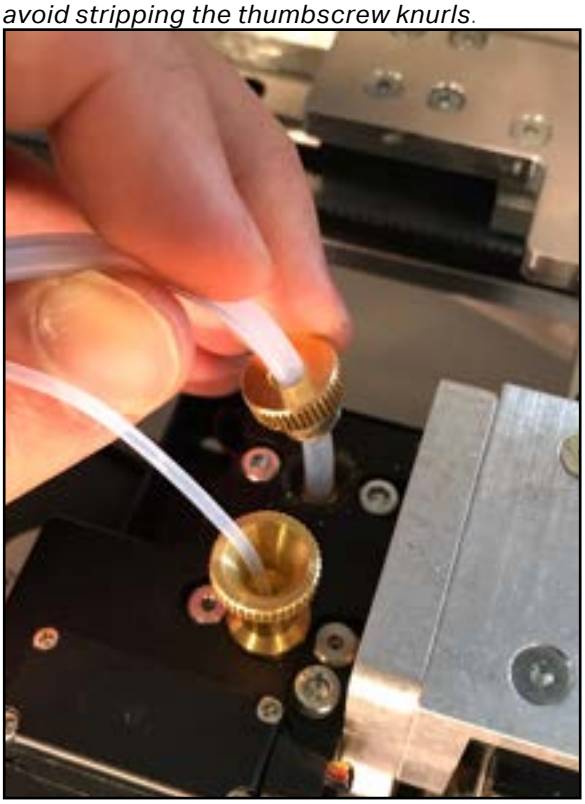
Replacing the tube is a relatively simple maintenance operation taking roughly 10 minutes to finish. Below is a diagram of the plastic Bowden tube assembly. Note that the two ends of the tube have different hardware installed.



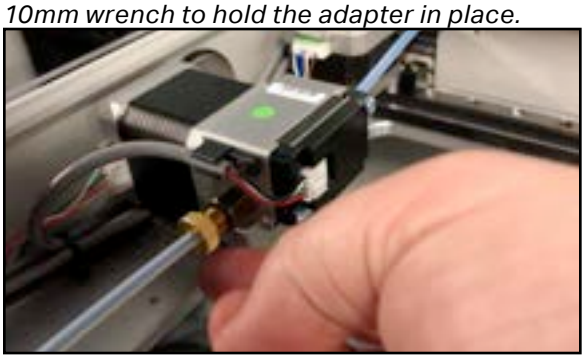
REMOVE PLASTIC BOWDEN TUBE

1. Begin by removing any plastic filament from the Bowden tube using the Unload Plastic utility. For more information, see *Unloading Plastic*. Ensure that the Bowden tube is completely clear of print material.

2. Unscrew the Bowden tube retaining screw from the print head. Withdraw the screw and tube, along with the ferrule.
Note: If you are unable to loosen the thumbscrew by hand, use a pair of pliers and take care to avoid stripping the thumbscrew knurls.

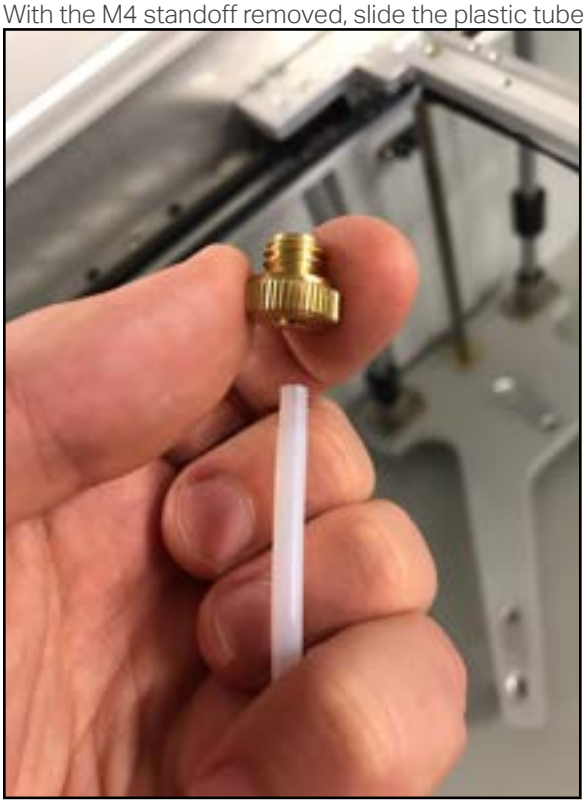


3. Detach the *extruder end* of the Bowden tube by unscrewing the second retaining screw from the extruder's brass adapter. The M4 standoff (shown in step 4) sits inside the extruder and will pull out along with the Bowden tube.
   Note: If you have trouble removing the Bowden tube retaining screw from the adapter, use a 10mm wrench to hold the adapter in place.

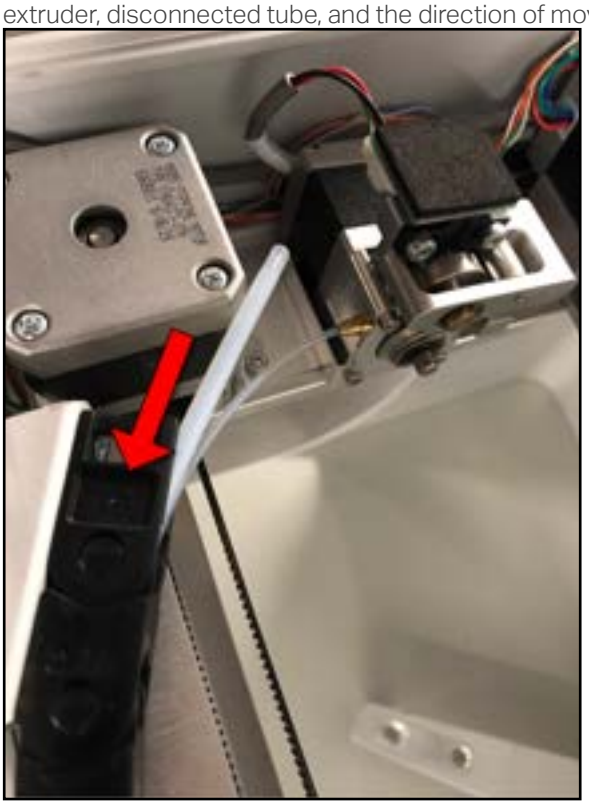


4. Unscrew the M4 standoff screw from the *extruder end* of the Bowden tube. **Do not pull the standoff screw directly off the tube!** It is threaded onto the plastic tube and must be unscrewed rather than pulled straight off. Note the threads in the image below:

5. With the M4 standoff removed, slide the plastic tube retaining screw off of this end.

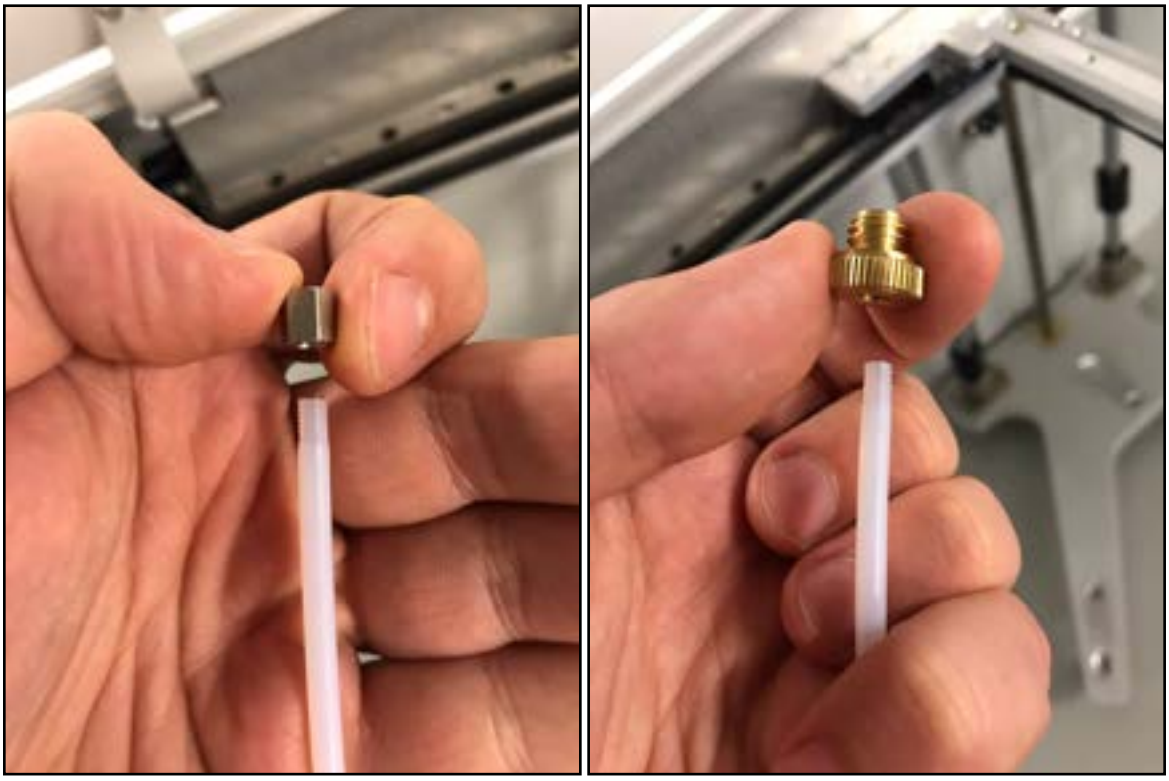


6. Remove the old Bowden tube from the flexible black energy chain. Grasp the Bowden tube by the print head end and pull forward until the entire tube is free of the energy chain. The image below shows the extruder, disconnected tube, and the direction of movement:



INSTALL PLASTIC BOWDEN TUBE

1. Begin by removing the M4 standoff and the retaining screw from the ***extruder side*** of the replacement Bowden tube.

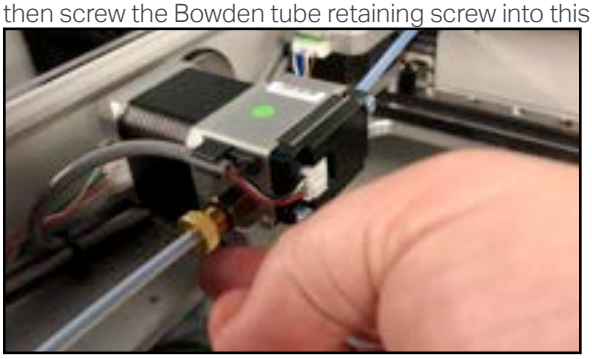


2. Manually slide the print head to the back right corner of the printer. This straightens the energy chain, making it easier to snake the tube through.

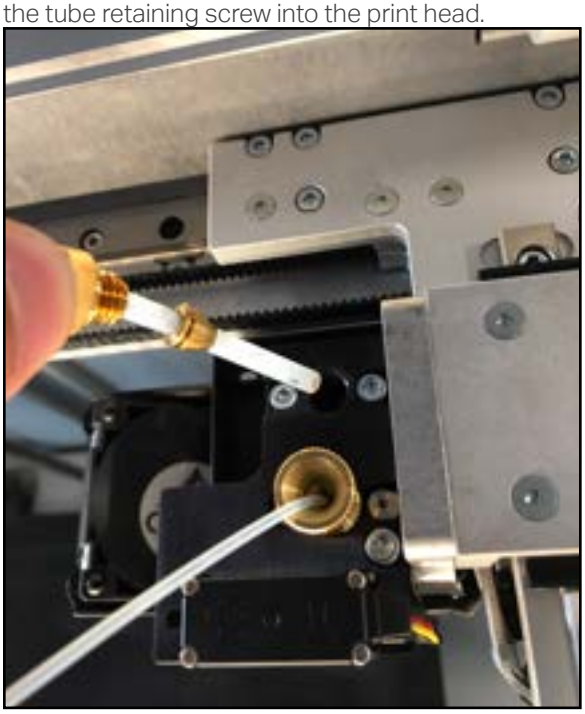
3. Grasp the now-exposed ***extruder end*** of the Bowden tube and insert it into the ***print head end*** of the flexible black energy chain, then snake it all the way through to the extruder.

4. Once the Bowden tube passes all the way back through the energy chain, install the following hardware:
    a. Slide the Bowden tube retaining screw on first, with the threads facing the extruder.
    b. Screw the M4 standoff back onto the threaded plastic of the Bowden tube.

5. With the ***extruder end*** hardware reinstalled, insert the M4 standoff into the brass fitting of the extruder, then screw the Bowden tube retaining screw into this brass fitting.



6. At the ***print head end*** of the Bowden tube, carefully insert the ferrule into the appropriate opening. Now screw the print head end tube retaining screw partway into the print head. Unscrew it, then finger-tighten the tube retaining screw into the print head.



7. Reset the plastic Bowden tube counter on your device (**Menu > Utilities > Maintenance > Maintenance Schedule**). Updating this counter will allow your device to warn you proactively when the plastic Bowden tube next needs to be replaced.
8. You can now load material and resume printing. For more information, see *Loading Plastic*.

REPLACE FIBER BOWDEN TUBE

Supplies

- Wire cutters
- Tape, if there is none adhered to the side of the fiber spool
- 2mm hex key

Note: Take care not to discard any hardware you remove during this procedure, as you may need it during the reinstallation.

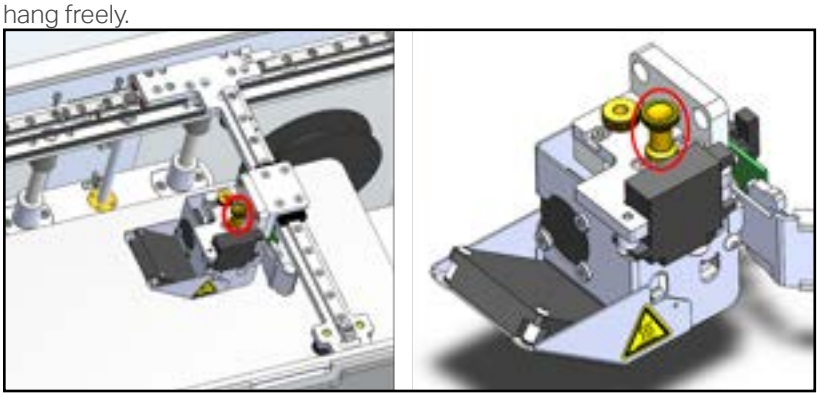
The following image shows the **print head end** of the fiber Bowden tube.

Important: Do not remove the PTFE (flexible plastic tube) from the metal inserts on the fiber Bowden tube. Replacement fiber Bowden tubes are shipped as an assembly with the metal tube already attached. Removal of the tube from the metal insert will require a full Bowden tube replacement.

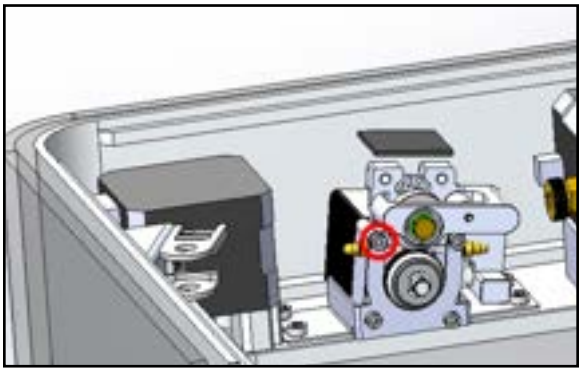
REMOVE FIBER BOWDEN TUBE

1. Follow the directions in *Unloading Fiber*, above, to unload the fiber filament from the Bowden tube.

2. Undo the fiber tube nut at the print head and detach the fiber Bowden tube from the print head. Let it hang freely.



3. Use the provided 2mm hex key to slightly loosen the top left socket head cap screw on the fiber extruder.
Note: Do not unscrew the screw all the way. It should require no more than one full turn to loosen.

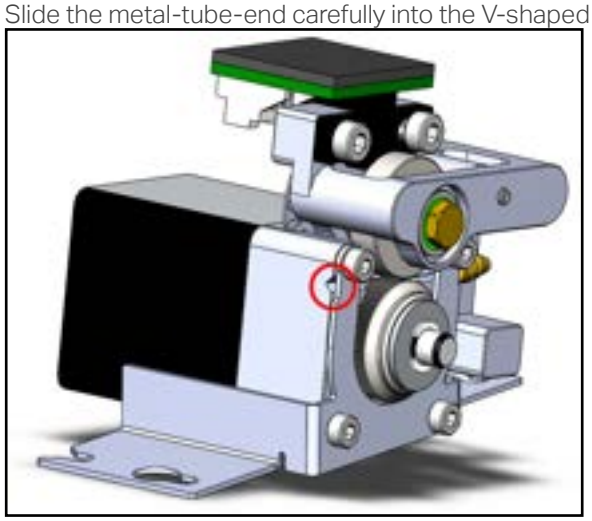


4. Remove the fiber Bowden tube and metal insert from the extruder.
5. Carefully remove the old fiber Bowden tube assembly and unthread it from the energy chain in the direction of the print head.
Note: The energy chain is the segmented black chain that holds the tubes that run between the extruders and the print head. If the Bowden tube appears to be stuck, try wiggling it around, slightly changing the position of the print head, or using a pair of pliers to gently help push the Bowden tube through. You should not need to use more than minimal force to remove the tube.

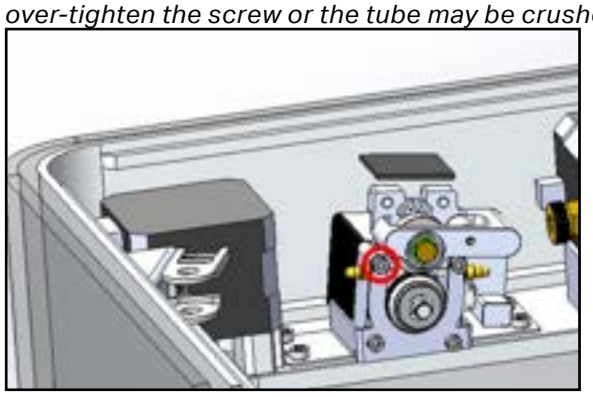
INSTALL FIBER BOWDEN TUBE

1. Carefully thread the fiber Bowden tube from the print head, through the energy chain, to the extruder. Make sure that the fiber tube is run along the inside path (nearer the center of the printer), and that it does not wrap around or tangle with the plastic Bowden tube.
Note: If the Bowden tube appears to become stuck during this process, try wiggling it around or using a pair of pliers to gently guide it through.

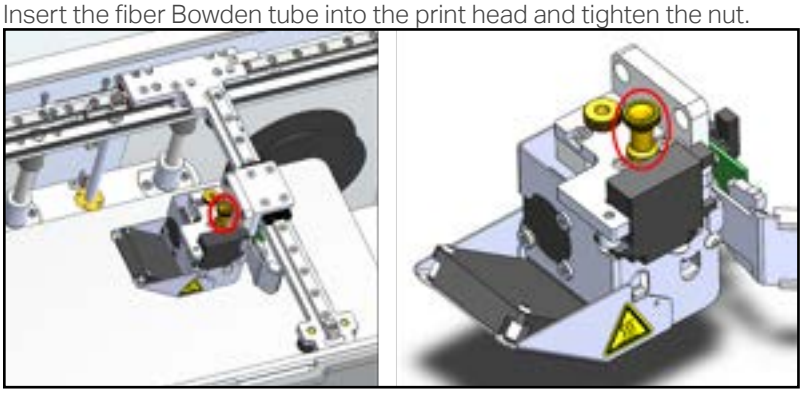
2. Slide the metal-tube-end carefully into the V-shaped channel in the side of the extruder.



3. Use the provided 2mm hex key to tighten the fiber Bowden tube set screw.
Note: Be sure that the tube stays in place while you are tightening the screw. Be careful not to over-tighten the screw or the tube may be crushed.



4. Insert the fiber Bowden tube into the print head and tighten the nut.



5. Reset the fiber Bowden tube counter on your device (**Menu > Utilities > Maintenance > Maintenance Schedule**). Updating this counter will allow your device to warn you proactively when the fiber Bowden tube next needs to be replaced.
6. You can now load material and resume printing. For more information, see *Loading Fiber*.

DEBUG MODE

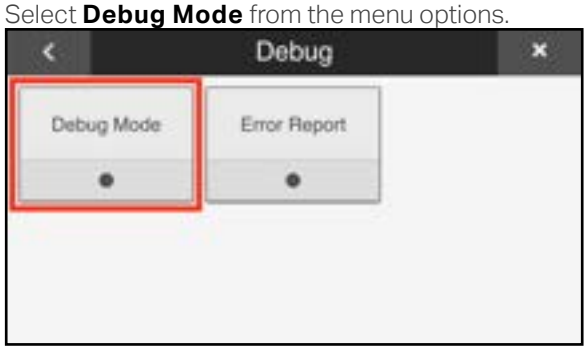
To aid in troubleshooting, Markforged printers are equipped with a Debug Mode. A printer in Debug Mode generates verbose logs of all firmware communications for sharing with our Support team.

A printer in Debug Mode will remain so even after a power cycle, failed print, or print pause. It will revert to normal operation after a print is completed successfully.

It is not necessary to activate Debug Mode unless instructed to do so by Markforged Support.

1. Select the menu icon from the dashboard, then select the **Settings** tile.
2. Select **Errors/Debug** from the menu options.

3. Select **Debug Mode** from the menu options.



4. Toggle the slider to the **Debug Mode** position, then press **Done**.

UNDEREXTRUSION TROUBLESHOOTING

Note that the plastic extruder and print head are factory-calibrated; do NOT adjust or disassemble in any way unless specifically instructed to do so by Markforged Support. Warranty claims for assemblies that have been adjusted, disassembled, or modified may not be honored.

Underextrusion occurs when resistance in the plastic material feeding system limits the rate at which the nozzle can dispense plastic, leading to visible gaps or stringing on the roofs of printed parts. Underextrusion can also be identified by a clicking noise coming from the left side of your printer, which indicates that the plastic extruder cannot overcome the level of resistance in the feeding system.

Typically, defects on vertical walls are *not* the result of underextrusion. If your printed parts have vertical wall defects and you are uncertain as to why, please contact Markforged Support.

Sources of resistance leading to underextrusion

- Loosely wound plastic material protruding past the walls of the spool and tangling around the spindle
- Material exiting from the bottom of the plastic spool and causing friction at the drybox adapter
- Desiccant packs rubbing against the plastic spool
- Twists or bends in the plastic feed tube, creating excess friction with the plastic material
- Worn-out plastic tubes
- Worn-out drybox adapter

*Note: If your drybox has a **brass** adapter and you are experiencing underextrusion problems while printing with Onyx, you will need to replace your drybox adapter with the newer A2 tool steel adapter, which is more resistant to wear. If you have an active Markforged Success Plan, a replacement A2 steel drybox adapter is covered under wear and tear. Please contact Markforged Support for this replacement item. You may also purchase an A2 steel drybox adapter at* markforged.com/shop.

RUNNING THE UNDEREXTRUSION TROUBLESHOOTING UTILITY

This utility will prompt you to examine or change components in four areas of the plastic material feeding system. In between each prompt, the printer will run an extrusion check to evaluate whether your troubleshooting actions have improved the printer's extrusion. Each check will heat up the plastic material nozzle, home the print head to the back right corner of the print chamber, and extrude approximately 0.25cc of plastic material.

CHECK FOR BASIC SETUP ERRORS

Complete these basic setup checks every time that you suspect there may be underextrusion in the system, as the way that the material feeds from the drybox to the plastic extruder can change while printing and unspooling material, and new errors may occur without user intervention.

1. Open the drybox to check for tangled or unspooling plastic material. Re-spool any material that has become tangled in the drybox.
2. Ensure that the plastic material feeds over the top of the material spool. If the spool is feeding upside-down, with material coming up to the adapter from the bottom of the drybox, simply remove the material and spindle and flip it over in the drybox.
3. Check that there are the appropriate number of desiccant packs, and that the packs lay flat against the bottom of the drybox.
4. If the plastic feed tube appears twisted or bent:
    a. Ensure that the drybox location allows for an easy path between the drybox and the printer that does not force the plastic feed tube to twist or bend.
    b. **If the feed tube still appears bent:** Reload plastic (**Menu > Materials > Unload Plastic**, then at the end of the utility select **Load Plastic**) to ensure that the plastic filament itself is not twisted.

Once you have finished checking for basic setup errors, ensure that the drybox is closed and fully latched. Leaving the drybox open for too long will allow the plastic material to absorb moisture and negatively impact print quality.

START THE UTILITY

1. Clear your print bed of prints and debris.
2. Wash your print bed and apply an inch-wide layer of glue to its rearmost edge to ensure that the purge line adheres to the print bed.
3. Start the utility by navigating to **Menu > Utilities > Maintenance > Extrusion Maintenance > Underextrusion Troubleshooting**.
4. Confirm that the part shows signs of underextrusion (see above).
5. Wet Plastic Purge Line:
    a. Print a purge line to ensure that there is no wet plastic to affect the results of the underextrusion test. You may skip this step if the utility allows.
    *Note: When the **Skip** button is not available, you must run the purge line since your printer*

has been idle for long enough to potentially have wet material around the plastic extruder.

b. Clear the purge line from the print bed when it completes and push the print bed down to the bottom of the stage.

6. Skip Ahead:

- Only use the **Skip Ahead** selection if you have been told by later instructions to do so. This function allows you to exit the utility if consumables aren't on hand and resume at the point the utility was closed.
- If using the **Skip Ahead** function, replace any necessary components before resuming the utility. For example, if you exit the utility while waiting for a replacement drybox adapter, replace the drybox adapter when you receive it, restart the utility, and then select **Drybox Adapter** from the **Skip Ahead** screen.

EXTRUSION CHECKS

The utility begins with an initial extrusion check, which evaluates whether the printer shows the symptoms of underextrusion that this utility can address.

Each subsequent extrusion check will run through the same steps as the initial extrusion check to evaluate whether the printer's extrusion has improved. If so, the clicking from the extruder will slow or stop altogether.

Every time the utility runs an extrusion check, you will be asked whether you hear clicking coming from the plastic extruder. Selecting **Yes** will let you continue troubleshooting; selecting **No** will exit the utility; selecting **Retry** will extrude additional plastic material. If clicking has stopped but your printed parts still show signs of underextrusion, you should contact Markforged Support with a picture of your part and the printer logs.

If the clicking noise goes away after changing a component, it usually means that the source of resistance has been eliminated. If the clicking decreases but does not completely disappear, you will need to continue the troubleshooting workflow to locate and fix any other causes of underextrusion.

REPLACE PLASTIC MATERIAL

This utility will follow the same steps as the Unload Plastic and Load Plastic utilities but will only allow you to reload the same type of material as was previously loaded. For more information, please see *Unloading Plastic* and *Loading Plastic*.

Before discarding the unloaded material, record the spool ID located on a barcode sticker on the material spool (starting with EX0 or X0). If this utility does not improve the quality of underextrusion, please provide the spool ID of the discarded material to Markforged Support.

REPLACE WORN PLASTIC TUBES

Note: The plastic Bowden tube, which runs between the plastic extruder and print head, should be replaced every 3200 CCs printed. However, some printing conditions can accelerate this wear. The plastic feed tube, which runs between the drybox and plastic extruder, should be changed around this time as well.

If you have an active Markforged Success Plan, replacement plastic Bowden tubes are covered under

wear and tear. Please contact Markforged Support for this replacement item. You may also purchase plastic Bowden tubes at markforged.com/shop*; ensure that you purchase the correct plastic Bowden tube for your model of printer.*

*After replacing these components, reset the plastic Bowden tube and plastic load tube counters on your device (**Menu > Utilities > Maintenance > Maintenance Schedule**). Updating these counters will allow your device to warn you proactively when these components next need to be replaced.*

In this utility, you will be asked whether you have a spare plastic Bowden tube and plastic feed tube on hand. If you do, select **Yes** and complete the following steps. If not, acquire them before running the utility.

1. Select **Retract** to withdraw the plastic material from the print head and Bowden tube. To replace the plastic Bowden tube, please see *Replacing the Plastic Bowden Tube*.

2. At this time, also replace the plastic feed tube. Open the drybox and respool all plastic material left in the feed tube. Close the drybox, then press on the push-to-connect fittings on the drybox and plastic extruder to detach the old tube. Insert the new plastic feed tube through the inlet on the back of the printer, then connect it securely to the drybox adapter and plastic extruder inlet.
3. When you have finished, select **Reload** to load material back into the print head and continue the utility. For more information, please see *Loading Plastic*.

If you do not have a plastic Bowden tube on hand, or cannot perform the replacement at this time, you may exit the utility here.

When you are ready to replace the plastic tubes, follow the instructions in *Replacing the Plastic Bowden Tube* and in step 2 above, then restart the utility. After printing a purge line, select **Skip Ahead > Plastic Tubes**. This will bring you back into the utility, where you can test whether replacing the plastic feed tubes improved the printer's extrusion.

REPLACE THE DRYBOX ADAPTER

In this utility, you will be asked whether you have a replacement A2 steel drybox adapter on hand. If you do, select **Yes** and complete the following:

1. Select **Retract** to unload the plastic material from the print head and Bowden tube. Pull the material back into the drybox.

2. Open a web browser and visit *support.markforged.com*. Navigate to **Troubleshooting > Print Issues > Replace Drybox Adapter** and follow the instructions to replace your drybox adapter.
3. When you have finished, select **Reload** on the printer's touchscreen to load material back into the print head and continue the utility. For more information, see *Loading Plastic*.

If you do not have an A2 steel drybox adapter on hand, or cannot perform the replacement at this time, you can select **No** to exit the utility here.

When you are ready to replace the drybox adapter, follow the steps in the *Replace Drybox Adapter* support article, then restart the utility. After printing a purge line, select **Skip Ahead > Drybox Adapter**. This will bring you back into the utility, where you can test whether replacing the drybox adapter improved the printer's extrusion.

CONTACT MARKFORGED SUPPORT

If you have completed the underextrusion utility and still see signs of underextrusion, or if you have been instructed to contact Markforged Support at any time during the utility, please follow these guidelines to resolve your issue as quickly as possible.

- Submit a ticket through *support.markforged.com* and input all device information.
- Attach an image of the part(s) where you are seeing underextrusion. Include pictures of the part from multiple angles, if possible.
- Supply the current material spool ID of the plastic material loaded into the printer and any spool IDs you have recorded while replacing material.
- Attach the printer logs. You may save the printer logs to your computer from the device screen on Eiger or to USB from your printer. To learn how to save logs to USB, visit *support.markforged.com* and navigate to **Troubleshooting > Software > Save Logs to USB**.

CHANGING THE ACCESS KEY

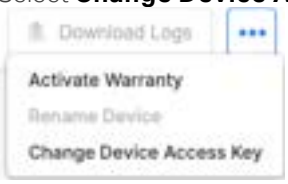
Each Markforged device uses an access key to authenticate its connection to Eiger. While the default device access key ordinarily suffices, you may need to change the device access key to meet heightened organization security requirements.

The access key is how Eiger identifies your device, which is necessary to monitor your device status or start print jobs from Eiger. As a result, you must change the device access key in two places: in Eiger and on your device. We recommend that you store the new device access key somewhere safe, such as a password vault.

Follow the instructions below to set up the new access key in Eiger before finalizing the access key setup on the device.

Note: Only the organization owner can change the device access key in Eiger. These instructions only apply to Cloud Eiger.

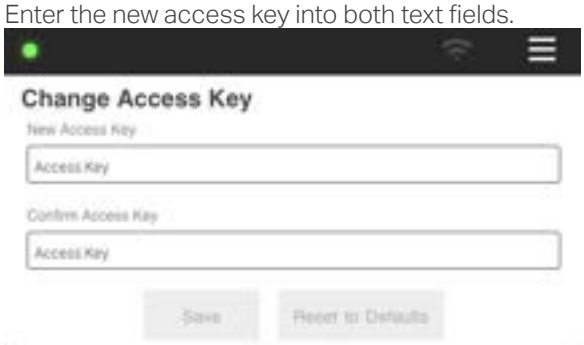
1. Log in to Eiger, then navigate to the Device page for the device in question.
2. Click the Actions button in the top right corner of the page.
3. Select **Change Device Access Key** from the drop-down menu.



4. Enter the desired new access key in both fields of the pop-up window.
5. Click **Change Access Key** to update the access key in Eiger.
   Note: Once these changes take effect, your device will disconnect from Eiger until you follow the instructions below to update the access key on the device as well.

6. Navigate to **Menu > Settings > Security** on the touchscreen of the device in question.

7. Enter the new access key into both text fields.



8. Press **Save** to finalize the new device access key. Your device should automatically connect to Eiger at this time.

To update multiple device access keys, repeat the above process for each additional device.

ADDITIONAL INFORMATION

- If you enter the access key incorrectly or update the access key in one location and not the other, your device will display an **Access Key Error** error message on its dashboard.
- If your device will not connect to Eiger after you've updated the access key:
    a. Ensure that the access key has been updated in Eiger ***as well as*** on the device in question.
    b. Re-enter your access key on the device and in Eiger.
    c. Ensure that your printer is connected to the Internet.
    d. Reset your device access key back to factory default.
    e. If these steps don't resolve your issue or you need assistance, contact Support.
- If you forget your custom access key, contact Support.

ADVANCED NETWORK SETTINGS

Markforged has added a number of advanced networking features to our devices to provide more flexibility and ease of use for customers with specific IT requirements. Continue reading to learn more about these features.

Note: The images in this section feature example inputs. When running these utilities, enter the information for your network configuration.

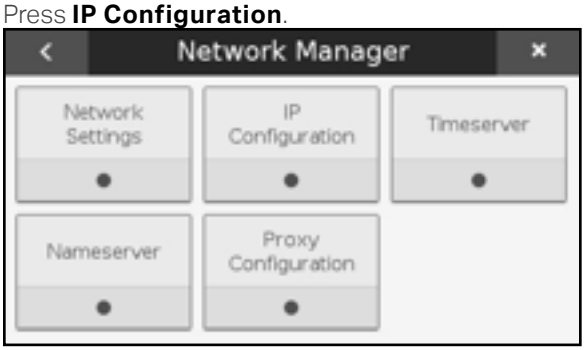
STATIC IP ADDRESSING

When a device connects to the Internet, the network facilitating the connection provides the device with an IP address, which allows any other device on the network to identify and connect to your device.

Your device can be assigned either a ***static*** or ***dynamic*** IP address. By default, dynamic IP addressing is enabled on your device; your network will automatically assign an IP address to your device by picking the next available address from a list. If desired, you can enable static IP addressing on your device instead; the provider, or the device itself, will define an IP address that will not change once set. Generally, dynamic addresses are more suited for home networking devices, while static addresses are more suited to business solutions.

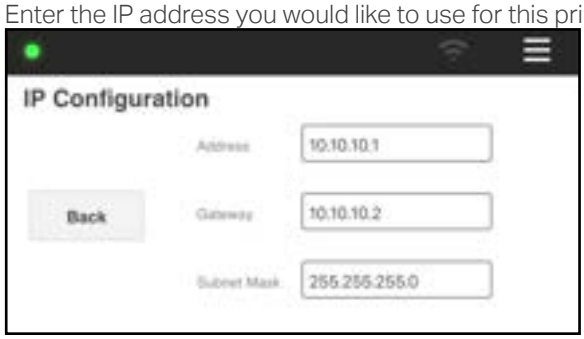
Set Up Static IP Addressing

1. Configure a DNS server. For more information, see *DNS Setup* below.
2. Navigate to **Menu > Settings > Network Manager**.
3. Press **IP Configuration**.



4. Set the toggle from **DHCP** to **Manual**.

5. Press **Configure**.
6. Enter the IP address you would like to use for this printer, then press **Back**.



7. Press **Save**.
8. Power cycle your printer to finalize static IP setup.

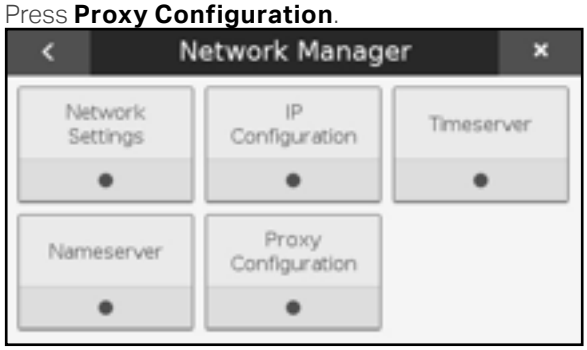
PROXY CONFIGURATION

A proxy server serves as a hub through which Internet requests are processed. By connecting through one of these servers, a Markforged device sends a request to the server, which then processes the request and returns the requested content. In this way, it serves as an intermediary between the device and the rest of the Internet. Proxies are used for a number of reasons, such as to filter and monitor web traffic.

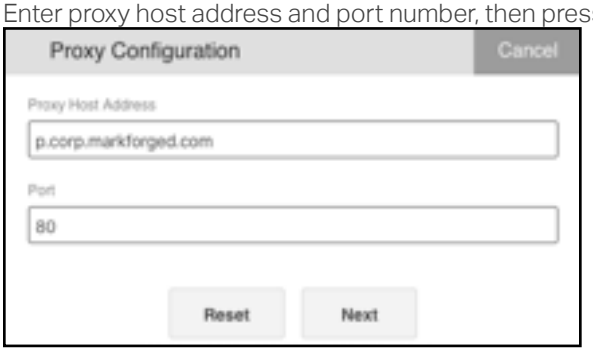
The proxy configuration feature supports HTTP/S proxies using CONNECT. At this time, it does not support PAC files or TLS/SSL re-termination. WebSockets must be allowed, and outstanding WebSocket connections to *www.eiger.io* must be preserved. Note that, at this time, Markforged has not been able to test all brands of proxies. Explicit instructions can be provided for Wingate Manager, but it is expected that Markforged proxy configurations should work with most full-featured proxy software.

Configure Proxy Settings

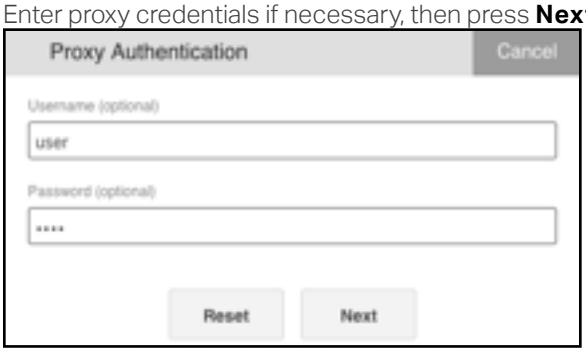
1. Set up an NTP server. For more information, see *NTP Setup* below.
2. Navigate to **Menu > Settings > Network Manager**.
3. Press **Proxy Configuration**.



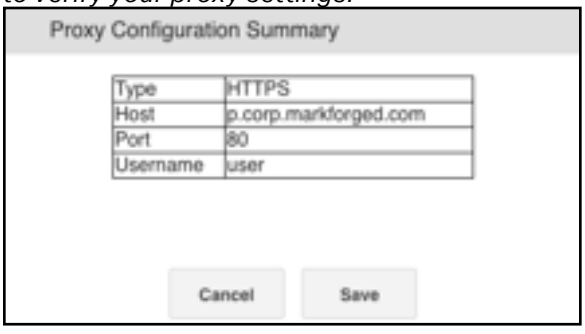
4. Press **Start Configuration**.
5. Enter proxy host address and port number, then press **Next**.



6. Enter proxy credentials if necessary, then press **Next**.



7. Press **Save** to finalize proxy configuration.
*Note: You can return to this screen (**Menu > Settings > Network Manager > Proxy Configuration**) to verify your proxy settings.*



DNS SETUP

DNS, which stands for Domain Name System, is the Internet equivalent of a phone book. It allows your web browser (or cloud-connected 3D printer) to translate a hostname, such as ***www.eiger.io***, into the IP addresses where that website or service is hosted. This is important because it's far easier for people to remember a

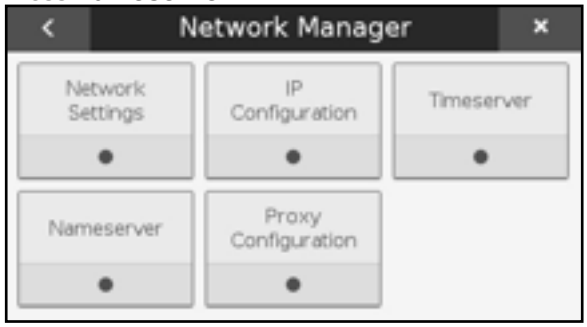
website's hostname than a set of IP addresses, and using hostnames and DNS allows the IP addresses for an application to change dynamically. If additional servers are added to an application cluster to handle increased load, or if degraded servers are replaced with new servers, DNS records can be updated to reflect the new set of IP addresses.

Configure a Custom DNS Server

Note: DNS server IP addresses are usually configured using DHCP, along with a device's IP address and router information. For most users with straightforward networking setups, the default DNS configuration will suffice. If your device is automatically able to obtain an IP address using DHCP, DNS will usually be configured the same way.

For customers with manually configured networks or multiple DNS environments, explicit DNS configuration is possible. If you need to configure a custom DNS server for your internal network, follow these steps.

1. Navigate to **Menu > Settings > Network Manager**.
2. Press **Nameserver**.



3. Set the toggle from **Automatic** to **Override**.

4. Enter the IP address for the desired DNS server into the **Server Address** field.

5. Press **Save** to finalize the new DNS configuration. If you require further assistance, please reach out to Support.

NTP SETUP

NTP stands for Network Time Protocol, a common Internet protocol (RFC 5905) used for synchronizing a device's internal clock with trusted time servers (also known as NTP servers) over a network. As Markforged devices do not have battery-backed internal clocks, the system time must be set using NTP from an accessible time server. Accurate system time is required for secure communication with Eiger, and annotating local log files with accurate timestamps makes debugging problems far easier, since events logged by printers can be correlated with events in Eiger or other network services.

Time Synchronization Options

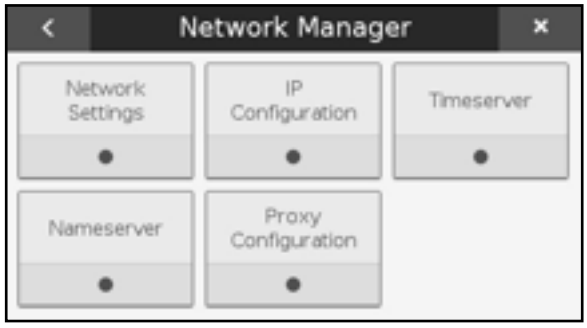
Note: Most users with straightforward networking configurations likely do not need to make any NTP configuration changes to their Markforged device. By default, Markforged devices will try to use the public NTP pool.

The easiest way to configure a specific time server on a Markforged device is via DHCP, by adding the time server IP address(es) to the device's DHCP configuration (also called a "lease" or "reservation") using DHCP option 042. Markforged devices will still attempt to use the Internet NTP Pool, but they will also synchronize time with DHCP-specified NTP servers. Any DHCP-specified NTP server address supersedes using the local default gateway / router as an NTP server.

Finally, explicit time server configuration is also an option. This method is useful if the DHCP configuration presented to the Markforged device isn't configurable, or if your environment doesn't offer DHCP. To change the NTP configuration settings of your device, follow the steps below.

1. Navigate to **Menu > Settings > Network Manager**.

2. Press **Timeserver**.



3. Set the toggle from **Automatic** to **Override**.

4. Enter either the IP address or hostname for the desired NTP server into the **Server Address** field.

5. Press **Save** to finalize the new NTP configuration. If you require further assistance, please reach out to Support.

Preventive Maintenance Schedule

Every Day

Clear debris from print bed, print chamber, and touchscreen

After each print run, **wash print bed in sink**

- ☐ Use wet sponge to remove remaining glue
- ☐ **Do not use soap**
- ☐ Dry with paper towel or lint-free cloth

Check your consumables

- ☐ Confirm that **sufficient plastic and fiber material** is loaded for next print
- ☐ **Check nozzles, tubes, and tube tips** for wear
- ☐ **Material pathway** should have as few bends as possible, with dry box positioned near printer inlet hole

Check bed level (5-20 min)

- ☐ **Bed Level Test Print** utility

Ensure that the bearings underneath the Y-rail are **properly tightened** and **clear of dust**

If you notice a clicking noise coming from the left side of your printer, **run the Underextrusion Troubleshooting utility**

Short Term

Update all software: **Menu → Settings → Update Manager**

Desiccant pouches in your dry box should be thrown out and replaced every time you switch plastic spools

Check **flexible tubes** for wear, especially if using Onyx (5-10 min)

Check Industrial Series **laser lens** for smudges and debris, and clean if necessary using the included wipes

Confirm that the **print nozzles** are in working order (1 min)

- ☐ First sign of **plastic nozzle** wear is degradation of print quality
- ☐ Tip of **fiber nozzle** flattens/wears toward arrow features; if arrow touches lip of nozzle, replace nozzle
- ☐ **Heat and clean nozzles** with tweezers and brass wire brush

Level bed and **adjust nozzle** every 2-4 prints and after dislocation, failed print, and maintenance (15 min)

- ☐ Plastic: **Laser Bed Level** (for Industrial Series) or **Shim Bed Level** routine
- ☐ Fiber: **Adjust Fiber Nozzle** routine

If several days pass between prints, **clear wet material** from Bowden tube and extruder before printing

- ☐ **Menu → Utilities → Test Prints → Wet Plastic Purge Print** (5-10 min)

Check for fiber inside the fiber Bowden tube when the printer is inactive, as this may indicate a fiber nozzle jam.

- ☐ If automatic fiber jam detection is enabled, your print will pause to allow you to debug fiber jams

Long Term

The **Maintenance Schedule** utility may be able to alert you when it is time to perform maintenance.

Replace the **plastic and fiber nozzles**

- ☐ Plastic nozzle: Replace every 3200 CCs printed (5 min)
- ☐ Fiber nozzle: Replace every 750 CCs of fiber printed (1 min)

Check **belt tension** and adjust if necessary every 500 print hours or after changing any component of the motion system (5 min)

- ☐ Industrial: Tune belt to 82-84Hz; see support article
- ☐ Desktop: Tune rear belt tension to 49Hz, front belt tension to 62Hz; see support article

Replace all **Bowden and feed tubes**

- ☐ Replace the **plastic** Bowden and feed tubes every 3200 CCs printed (5-10 min)
- ☐ The **fiber** Bowden and feed tubes wear more quickly when printing carbon fiber — watch for thinning or sheared walls. Replace every 750 CCs of fiber printed (5 min)

Replacement Schedule

750 CCs of Fiber Printed	3200 CCs of Plastic Printed
Fiber feed tube	Plastic feed tube
Fiber Bowden tube	Plastic Bowden tube
Fiber nozzle	Plastic nozzle

Rev. 1/2022. Download current version at *support.markforged.com*.

For replacement consumables, contact your local Reseller.

To display current usage metrics: *Menu→Settings→System Info→*. 🏆Counter only resets after full factory system reset.