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# Mac Pro (2019) and Mac Pro (Rack, 2019) Overview

## Contents

This article includes the following sections:

- Features
- Serial Number Locations
- Service Considerations
- Special Tools
- Additional Resources



## Features

- **Processor:** Configure from an 8-core to 28-core Intel Xeon W processor
- **Memory:** Configure up to 1.5TB of DDR4 ECC memory in [12 user-accessible DIMM slots](#)
- **Graphics:** Configure two MPX Modules with up to four GPUs
- **Afterburner:** Accelerates ProRes and ProRes RAW codecs in Final Cut Pro X, QuickTime Player X, and supported

third-party apps

- **Storage:** Configure up to 8TB of SSD storage
- **Input/Output:** Mac Pro I/O card and Top I/O provide four Thunderbolt 3 ports (up to 40 Gb/s)
- **Communication:** Two 10Gb Ethernet ports, 802.11ac Wi-Fi, and Bluetooth 5.0
- **Expansion Slots:** Eight PCIe Express expansion slots
- **Mac Pro (Rack, 2019):** Mac Pro is also available for rack mount with all the same performance features and configuration options as the tower.



See a full list of [Mac Pro tech specs](#).

## Serial Number Locations

Mac Pro (2019) serial number is located on the bottom of the space frame. If available, use a mirror to view the serial number. The Mac Pro (Rack, 2019) serial number is located on the bottom of the housing.



**Warning:** Two people may be needed to lift the computer in order to access the serial number. Place a protective cover over the housing if you need to lay the computer on its side.



## Service Considerations

- **Safety:** Mac Pro has several safety considerations you should be aware of before troubleshooting or starting a repair. In addition to electrical shock, weight, and temperature concerns, repairing a Mac Pro configured with wheels or handling the computer in a rack environment are unique to this product. Be sure to review all of the [Mac Pro safety information](#)
- **Shared Procedures:** The functionality and internal configuration is nearly identical between the two models, with a few exceptions due to housing types. The image below shows a side view of the Mac Pro (2019) with the housing removed (left) next to a top down view of the Mac Pro (Rack, 2019) with the top cover removed (right). This is important because some repair procedures are shared between the two models. Images in the shared procedures show one model, but the steps to perform the repair are the same for both.



- **Diagnostics:**

- Apple Service Toolkit 2 (AST 2) provides specific diagnostics for Mac Pro. Search GSX for “AST 2 for Mac Reference Guide” for the latest information and available test suites.
- Two status indicator lights on the exterior of Mac Pro and four diagnostic LEDs on the logic board can be useful when troubleshooting Mac Pro.

- **Troubleshooting:**

- The fans may run at full speed if the housing, or top cover and memory access panel, are not properly seated.
- Some troubleshooting steps may require operating the computer with the housing, or top cover and memory access panel, removed. In order to do so, you must [bypass the housing sensor](#)



- Mac Pro is designed to be extremely configurable, however this can pose a challenge when troubleshooting hardware issues. [Minimum configuration](#) builds up the system from the minimum components needed to operate and verifies expected behaviors as additional components are installed. This approach helps determine which components function together and can potentially identify which component causes a symptom to recur when it is added. If Mac Pro is installed in a rack, remove it before following the minimum configuration steps. The [Mac Pro \(Rack, 2019\) Essentials Guide](#) provides detailed instructions for installing and removing Mac Pro from a rack.



- By default, Mac Pro starts up from the built-in SSD storage. However, it can be configured with additional internal storage using third party accessories. If the additional storage is used as a startup disk, and has a compatible operating system, the Mac Pro can start up from that disk instead. This is helpful to understand if [troubleshooting startup](#) or software issues.

- **Repair:**

- For some repair procedures, it may be helpful to have an additional person assist with moving or holding the computer.
- Solid state drives come as a pair and must be replaced as a pair. The 256GB configuration is a single SSD and therefore is the only storage configuration not replaced as a pair.
- If Mac Pro is installed in a rack, make sure the power cord is disconnected before making any adjustments to internal components. For repair procedures, it is recommended to remove the Mac Pro from the rack and perform the procedure on a solid work surface.

- **System Configuration for Macs with the Apple T2 Security Chip:**

- When replacing the logic board or storage, the repair is not complete until the [System Configuration](#) has

been performed.

- **Important:** The storage is paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Make sure the customer has a [working backup of their data](#) before removing or replacing the storage.

## Special Tools

Servicing Mac Pro requires special tools in addition to the [general tools](#) used for repair.

1. Torx T15 bit (152 mm) (923-03294)
2. 4 mm hex bit (923-04197)
3. Torx T55 Security bit (923-03338)
4. 3/8-inch to 5/16-inch adapter (923-03339)
5. Adjustable torque driver 0.3–1.2 Nm (923-0735)
6. Flexible driver (923-04009)
7. 3/8-inch ratcheting socket wrench (923-03340)



# General Troubleshooting

## Update Software and Firmware

**Important:** Before troubleshooting, ensure the correct version of macOS is installed, and check for and apply the latest software and firmware updates. Computers sometimes exhibit symptoms that indicate the incorrect version of macOS is installed. [Use the Mac operating system that came with your Mac, or a compatible newer version](#) to make sure system build is correct for this computer model.

Firmware refers to software that is written into memory circuits such as flash memory, which will hold the software code indefinitely, even when power is removed from the hardware. Firmware on Intel-based Mac computers prior to computers with an Apple T2 Security Chip is designed to be updated if necessary by running macOS Software Update (available in the Apple ( ) menu under About This Mac) while the computer is connected to the Internet.

For computers with an Apple T2 Security Chip, separate SMC and EFI firmware images have now both been integrated into bridgeOS.

# Quick Check Procedures

## Resetting the System Management Controller (SMC)

The System Management Controller (SMC) is a chip on the logic board that controls all power functions. On some Mac computers, the Apple T2 Security Chip integrates several controllers—such as the SMC, image signal processor, audio controller, and SSD controller. If the computer is experiencing any power issue, such as not starting up, not displaying video, sleep issues, or fan noise issues, resetting the SMC may resolve it.

For more information and instructions to reset the SMC on different computer models,

**Note for iMac (2019 and earlier):** If the power button is pressed while the power cord is being inserted, the iMac will enter a mode that runs the fans at full speed.

**Note for Desktops with the Apple T2 Security Chip:** If the power button is pressed while the power cord is being inserted, the Mac will enter Device Firmware Upgrade (DFU) mode and will need to be restored.

[Guide](#) section: Revive firmware in Mac computers in Apple Configurator.

## Resetting Nonvolatile RAM (NVRAM)

NVRAM stores certain system and device settings in a location that macOS can access quickly. Exactly which settings are stored in the computer's NVRAM varies depending on the type of computer, connected devices, and drives. To reset NVRAM:

## Starting Up in Safe Mode

Safe mode (sometimes called safe boot) is a way to start up a Mac so that it performs certain checks and prevents some software from automatically loading or opening. These changes can help resolve or isolate certain issues on the startup disk.

# Mac Pro (2019) and Mac Pro (Rack, 2019) Diagnostics

## Apple Service Toolkit 2 (AST 2)

AST 2 is a cloud-based diagnostic system to help technicians triage and verify repairs for Mac computers, starting with Mid 2014 models, except for MacBook Pro (Retina, Mid 2014). With AST 2, technicians are able to initiate diagnostics wirelessly on a user's device using Diagnostic Console (a web application on a Mac or iPad). Technicians are also able to view diagnostic results in Diagnostic Console.

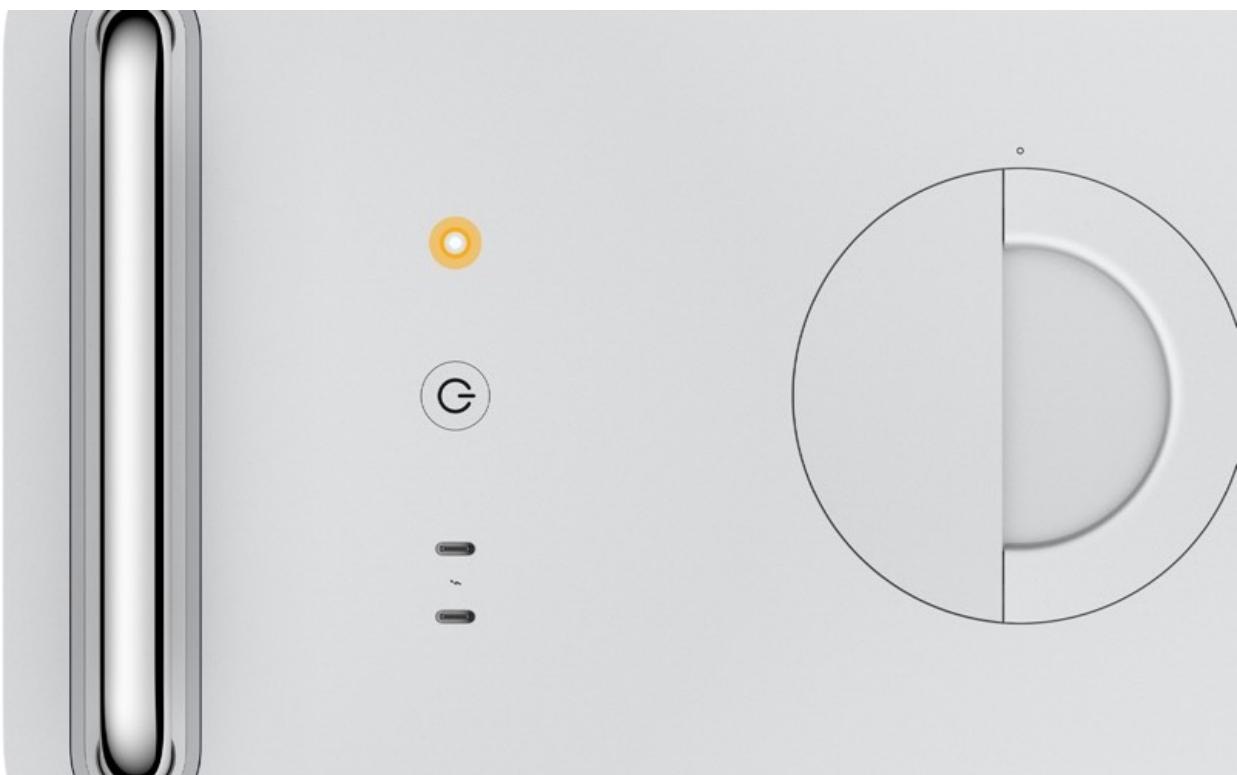
## Status Indicator Lights (SIL)

Both Mac Pro (2019) and Mac Pro (Rack, 2019) contain two status indicator lights (SIL). Both lights are dual colored, white and amber, and have the same [pattern behavior](#).

- **SIL Behavior:**

- No light:
  - Mac Pro is off
- Solid white:
  - Mac Pro is on or in sleep mode
- The amber LED has several patterns:
  - One long flash:
    - Power button is pressed while the computer is shut down and housing is unlocked
    - Computer does not start up
  - One flash rapidly repeating
    - Housing is unlocked while the computer is on
    - Continues running in safety mode with fans on at full speed
  - One flash slowly repeating
    - Memory detection or data error
  - Two flashes slowly repeating
    - System resource overload
    - Too many PCIe 32-bit cards, for example
  - Repeating SOS: three short flashes, three long flashes, three short flashes
    - Firmware recovery mode

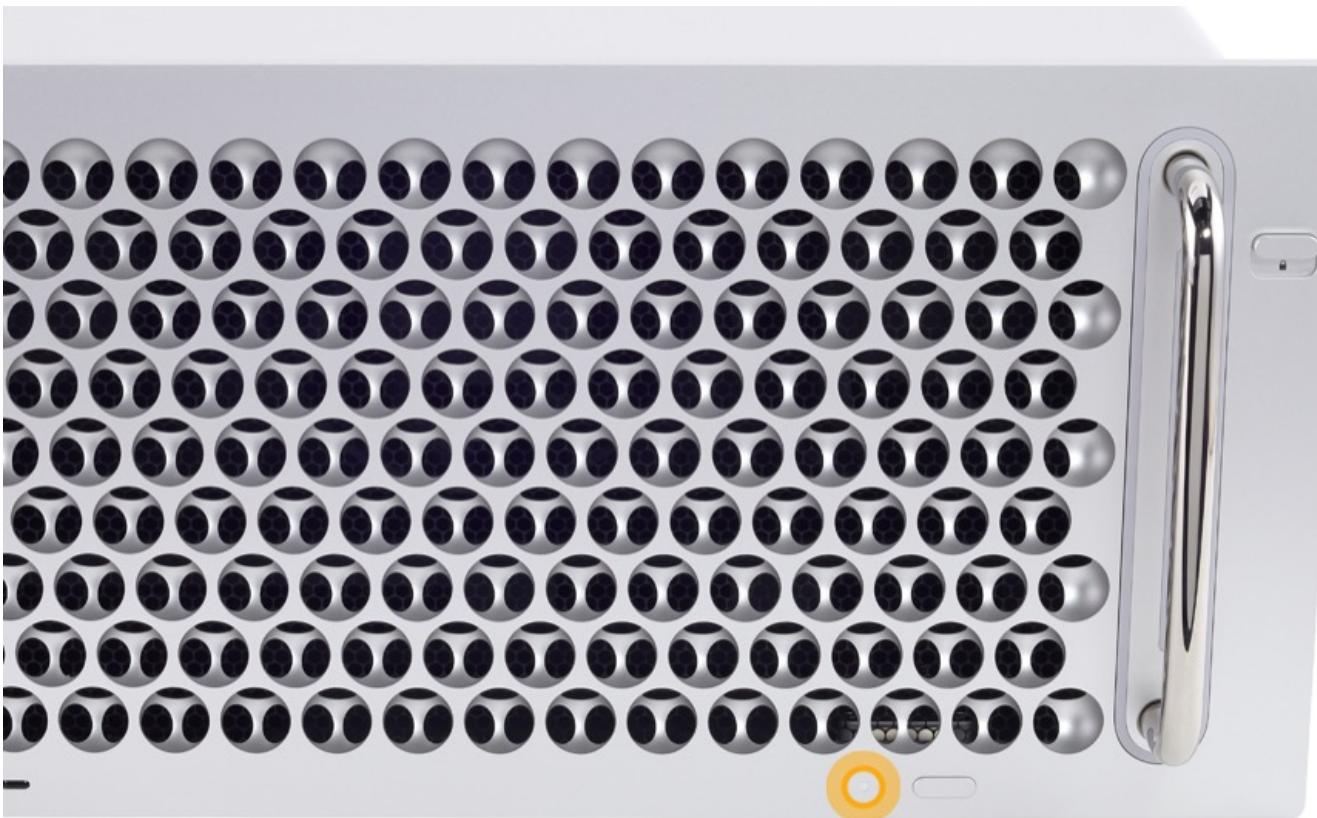
**Mac Pro (2019) Top I/O:** One SIL located near the power button.



**Mac Pro (2019) Power Supply:** One SIL located on the power supply.



**Mac Pro (Rack, 2019) Front Plate:** One SIL located on the front plate near the power button.



**Mac Pro (Rack, 2019) Power Supply:** One SIL located on the power supply.



### Diagnostic LEDs

Mac Pro has four diagnostic LEDs to assist with troubleshooting. They are activated when the diagnostic (diag) button on the logic board is pressed. Follow the instructions to [bypass the housing sensor](#) so you can operate the computer with the housing, or top cover and memory access panel, removed.



1. Indicates the power supply is plugged in, first system voltage regulator is running, and should be supplying Apple T2 security chip with power.
2. System has powered on all of the voltage regulators and CPU should start booting.
3. CPU started boot process, successfully trained all DIMMs.
4. EFI firmware has successfully transferred the startup process from EFI BootROM to macOS.



# Mac Pro (2019) and Mac Pro (Rack, 2019) Bypass the Housing Sensor

## Mac Pro (2019) and Mac Pro (Rack, 2019): Bypass the housing sensor

Mac Pro has four diagnostic LEDs on the logic board that can help you troubleshoot certain issues. In order to power on the computer and [view the diagnostic LEDs](#), you must bypass the housing sensor. In addition, some troubleshooting procedures, such as [Minimum Configuration](#) may also require bypassing the housing sensor in order to operate the computer with the housing, or top cover and memory access panel, removed.

**WARNING HIGH VOLTAGE:** Use extreme caution when operating Mac Pro (2019) with the housing removed and Mac Pro (Rack, 2019) with the top cover and memory access panel removed. Avoid touching the internal components. The power supply and logic board retain a charge whenever the computer is plugged in to an electrical outlet, even when powered off.



- Don't operate the computer for more than a few minutes with the housing sensor bypassed. The slow fan speed may not provide sufficient cooling while the housing is removed.
- Don't disassemble the computer with the housing sensor bypassed.

### Bypass the housing sensor on Mac Pro (2019) and startup the computer:

1. Hold a magnetic source (such as a Wiha Magnetizer/Demagnetizer) directly over the location on the bridge plate shown in the image below.

**Important:** Depending on the strength of the magnet, you may need to place it closer to the logic board edge, directly above the diagnostics LEDs.



2. Use a large flathead screwdriver to short two of the four power button pins, located on the top I/O board. Press the two pins with the flat tip of the screwdriver, then release, keeping the magnet in place.

**Caution:** Be careful not to touch any other components to avoid damage.



3. Remove the magnet and allow the computer to startup. Follow normal shutdown procedures to turn off the computer.  
**Note:** The system fans and blower will run at full speed while the housing is removed.



**Bypass the housing sensor on Mac Pro (Rack, 2019):**

1. Push the power button on the front housing and startup the computer as normal. Then remove the [top cover or memory access panel](#)

**Note:** The system fans and blower will run at full speed while the top cover or memory access panel are removed.

2. If you need the system fans and blower to operate at normal speeds, hold a magnetic source (such as a Wiha Magnetizer/Demagnetizer) directly over the locations shown in the images below.

**Top Cover**



**Memory Access Panel**



# System Configuration for Mac Computers with the Apple T2 Security Chip

## System Configuration for Mac Computers with the Apple T2 Security Chip

**Important:** If you replace the logic board or flash storage in the user's computer, ensure the data is backed up now. You can't recover data after you run the System Configuration suite.

A repair of a Mac computer with the Apple T2 Security Chip isn't complete until you successfully run the AST 2 System Configuration suite. Successfully running the AST 2 System Configuration suite ensures repair quality and compliance with regional communications regulations. Successfully running the AST 2 System Configuration suite also ensures that the Apple T2 Security Chip works, enabling hardware encryption, biometric authentication, and secure startup protection.

The System Configuration Suite optimizes performance and performs tests in the following ways:

- The System Configuration suite conducts tests that verify that you correctly replaced parts and correctly reconnected parts related to the Apple T2 Security Chip during the repair. The System Configuration suite conducts test for parts including the Touch ID sensor, ambient light sensor, Touch Bar, and camera.
- The System Configuration suite pairs the Touch ID sensor and Touch Bar to the logic board and updates their calibration values for performance optimization. If you replaced the logic board, the System Configuration suite writes the system serial number to the new logic board and reports it to Apple. Reporting the logic board serial number to Apple enables iCloud services including FaceTime, Messages, and Apple Pay, and assigns the wireless region.  
**Note:** To comply with regional communications regulations, the computer will display a flashing circle with a line through it (prohibited symbol) until the System Configuration suite assigns the wireless region.
- The final step for all repairs is to update the Apple T2 Security Chip firmware to the most current version.
- You can see the completed steps in the AST 2 Diagnostic Console by selecting the suite in Diagnostics Results and clicking Details.

## When System Configuration Is Required

Perform System Configuration after these part replacements:

Computer Model	Logic Board	Top Case	Display	Touch ID	Flash Storage	Lid Angle Sensor (LAS)
iMac Pro (2017)	•				•	
Mac mini (2018)	•					
MacBook Air (Retina, 13-inch, 2018)	•			•		
MacBook Air (Retina, 13-inch, 2019)	•		•	•		
MacBook Air (Retina, 13-inch, 2020)	•		•	•		
MacBook Pro (13-inch, 2019, Two Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2020, Two Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2018, Four Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2019, Four Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (13-inch, 2020, Four Thunderbolt 3 Ports)	•	•	•	•		
MacBook Pro (15-inch, 2018)	•	•	•	•		
MacBook Pro (15-inch, 2019)	•	•	•	•		
MacBook Pro (16-inch, 2019)	•	•	•	•		•
Mac Pro (2019) and Mac Pro (Rack, 2019)	•					•

## Tools

- Power cord
- USB-C Charge Cable (661-06670) or USB-C to USB-A Cable (923-00504)  
**Important:** Don't use Thunderbolt 3 cables.



- A host computer with:
  - macOS Catalina 10.15 or later
  - [Mac Configuration Utility \(MCU\)](#)
  - [The Latest Apple Service Toolkit](#)

**Note:** Do not use third-party web browsers on a host computer with MCU. Third-party web browsers may impact the performance of System Configuration when MCU and third-party web browsers are open at the same time. Remove any third-party web browsers and then restart the MCU host computer.

- Internet connection

## Before Starting an AST 2 Session

- Add the parts you replaced to the repair.
- Add the known good board (KGB) and known bad board (KBB) serial numbers to the repair.  
**Important:** If you incorrectly enter or don't save the the serial numbers in the repair system, the System Configuration suite won't be available.
- Save the repair.

### Note:

- You must use uppercase when entering the letters of the logic board serial number into the re. To ensure accuracy, it is recommended to scan the QR code on the logic board.
- Close the display after putting the computer into DFU mode.

### Steps

1. Start a diagnostic session on the AST 2 [Diagnostic Console](#).

2. Plug in the user's computer and the host computer.

3. Connect the user's computer to the host computer. If the host computer doesn't have a USB-C port, use a USB-C to USB-A cable. Don't use a USB-C to USB-A cable with a USB-C to USB Adapter.

**Important:** You must connect the USB-C cable to the correct port on the user's computer.

**Notebooks:** Use the USB-C port closest to the Caps Lock key.



**iMac Pro:** Use the USB-C port closest to the Ethernet port.



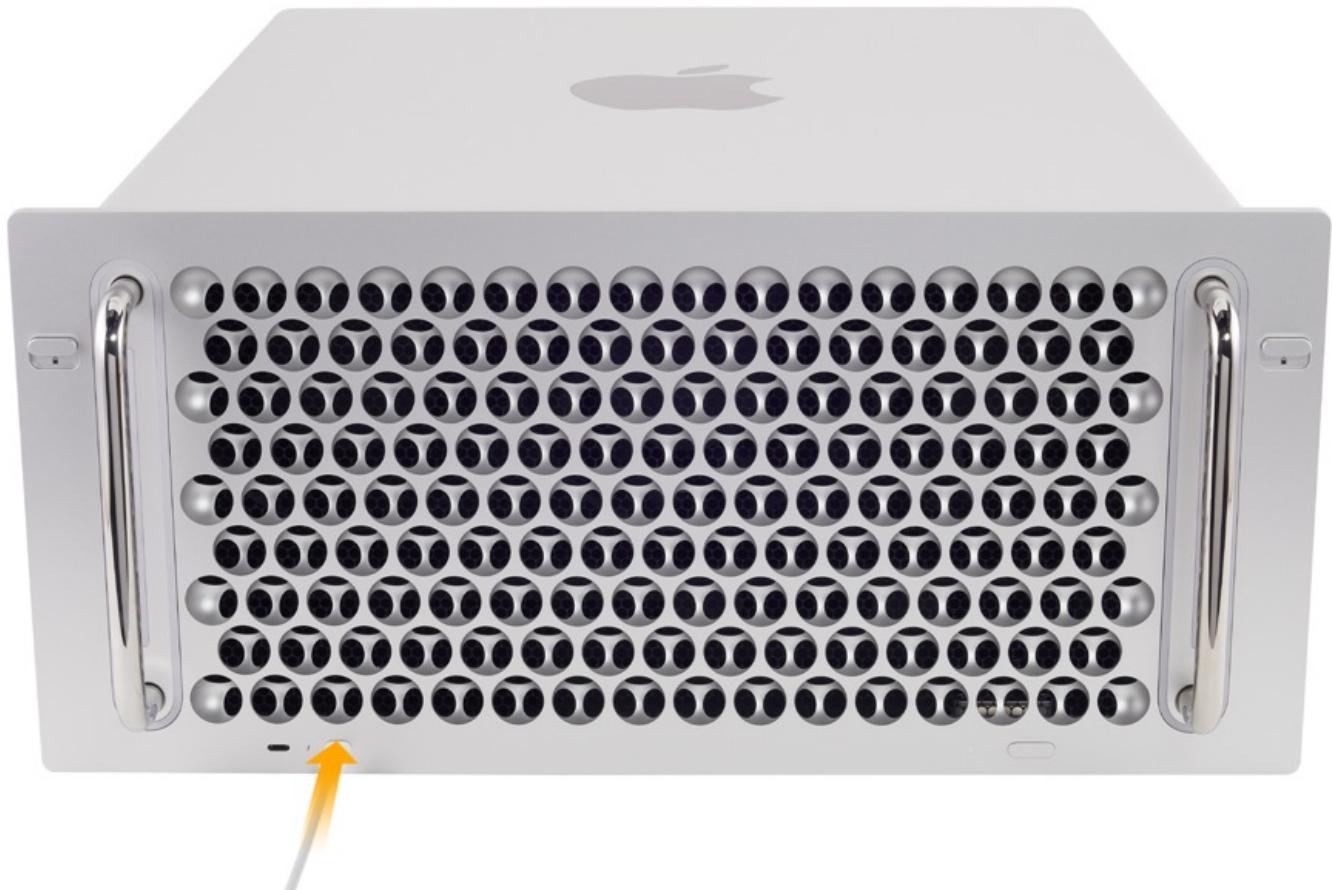
**Mac mini (2018):** Use the USB-C port closest to the HDMI port.



**Mac Pro (2019):** Use the outer USB-C port closest to the edge.



**Mac Pro (Rack, 2019):** Use the USB-C port closest to the power button.

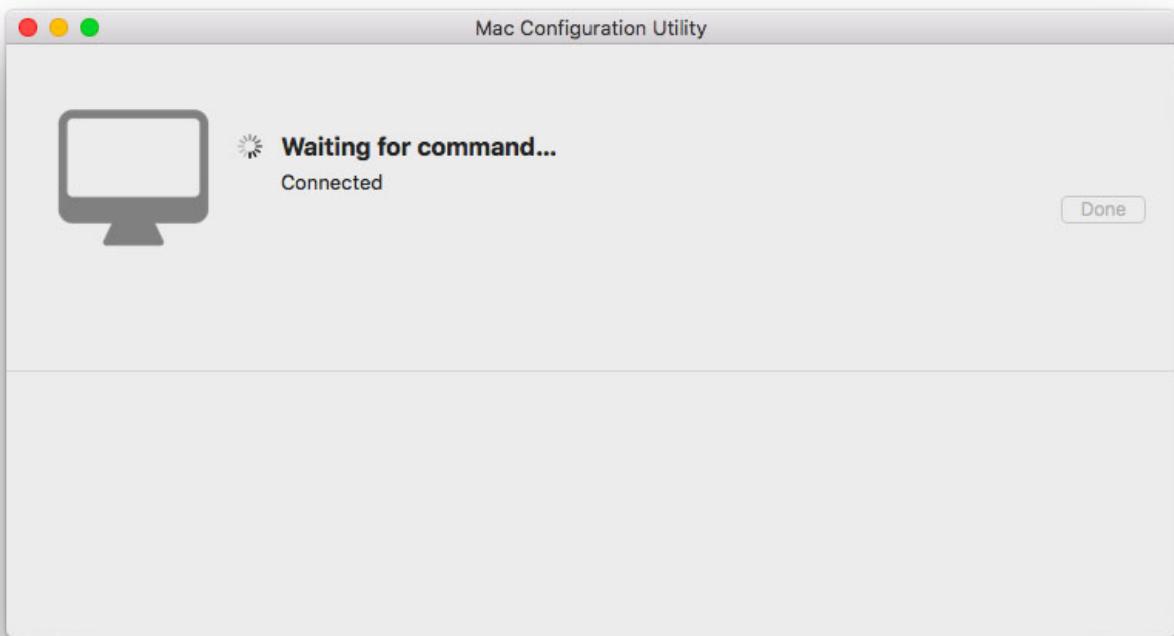


4. Turn on the host computer and connected it to the internet.

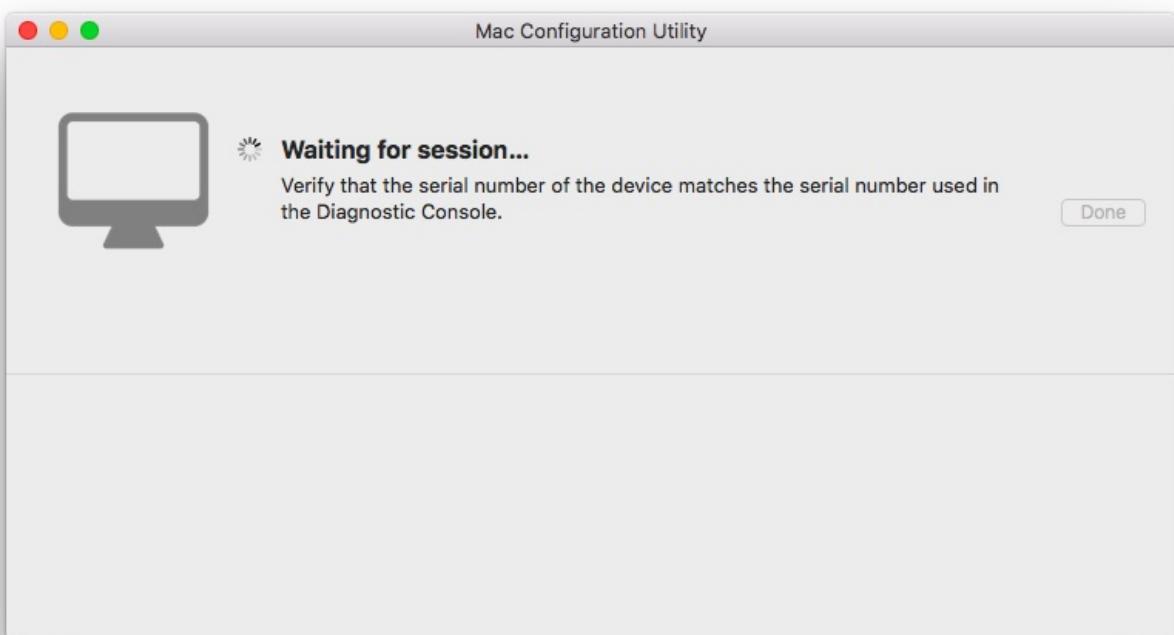
5. Start up the user's computer in [DFU mode](#). If DFU has been performed correctly, MCU will automatically launch and a dialog box will appear on the host computer screen.

- [For desktop computers](#) : Press and hold the power button while connecting the power cord and until the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.
- [For notebooks](#) : Press and hold the power button, then press and hold Left Control-Left Option-Right Shift until you see the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.

**Important:** For display repair and LAS repair in MacBook Pro (16-inch, 2019), look for a prompt to close the display. If you don't close the display when prompted, the System Configuration suite won't run properly and you will need to replace the LAS.



**Note:** If you haven't created a diagnostic session yet, a "Waiting for session..." message will appear.



6. Confirm that a blue bar is next to the name and serial of the user's computer.

**Note:** If the computer doesn't appear, you may have incorrectly entered the serial number or incorrectly saved the repair. Both the system serial number and the part serial numbers must be accurate to continue.

**Connected**

The screenshot shows the Diagnostic Console interface on a MacBook Pro. The left sidebar lists recent diagnostic runs, with an orange arrow pointing to the "System configuration" entry. The main pane displays the "Diagnostic Suites" section, listing several suites with their descriptions and execution times. The "System configuration" suite is highlighted.

Suite	Description	Execution Time
Hardware Test	Check of hardware and software.	3-5 minutes
Storage Test	Functionality of internal Apple storage devices.	8-12 minutes
Power Adapter Test	Functionality of the power adapter and charging circuitry.	1-3 minutes
LCD Pixel Test	Check for pixel anomalies in LCD panels.	5-7 minutes
System Configuration	System configuration anomalies	5-7 minutes

This screenshot is identical to the one above, showing the Diagnostic Console interface on a MacBook Pro. The left sidebar lists recent diagnostic runs, with an orange arrow pointing to the "System configuration" entry. The main pane displays the "Diagnostic Suites" section, listing several suites with their descriptions and execution times. The "System configuration" suite is highlighted.

Suite	Description	Execution Time
Hardware Test	Check of hardware and software.	3-5 minutes
Storage Test	Functionality of internal Apple storage devices.	8-12 minutes
Power Adapter Test	Functionality of the power adapter and charging circuitry.	1-3 minutes
LCD Pixel Test	Check for pixel anomalies in LCD panels.	5-7 minutes
System Configuration	System configuration anomalies	5-7 minutes

7. Choose the System Configuration suite from the Diagnostic Console. Eventually the Apple logo and a progress bar will appear, the user's computer will restart, and test results will appear in the Diagnostic Console.

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< >  diagnostics.apple.com   + 

 Diagnostic Console John Appleseed 

## Diagnostic Suites

POST-REPAIR

-  **Full System Diagnostic (EFI)**  30-90 minutes   
Performs comprehensive testing of hardware functionality and memory module integrity.
-  **Full System Diagnostic (OS)**  15-30 minutes   
Performs comprehensive testing of hardware and graphics functionality.

REPAIR COMPLETION

-  **System Configuration**  1-10 minutes   
Completes required configuration of applicable service parts and updates firmware after repair. This suite becomes available after service part serial numbers are saved in a repair. For more information refer to TP1657: System Configuration.
-  **Trackpad Calibration Check**  3-7 minutes   
Verifies calibration of the trackpad actuator and force sensor. This suite must be run each time the computer is opened and reassembled.

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 AST 2 Diagnostic Console John Appleseed 

[Diagnostic Results](#)

# Suite Complete

**System Configuration**  
April 24th, 2019 6:17 PM

[View Details !\[\]\(efafcae43acae17c4bb9f41420411b00\_img.jpg\)](#)



Suite completed successfully. View Details for more information.

**Note:**

- While the System Configuration suite is running, the display on the user's computer will mostly stay blank.
- Firmware restoration will take about two minutes.

10. If no issues are found, restart the user's computer and run MRI as well as all applicable diagnostics.

- For notebooks, you must run the [Trackpad Calibration Check suite](#) any time you open the computer.

**Note:** For iMac Pro, macOS needs to be reinstalled. Shut down the computer and then restart in recovery mode to install the macOS from Internet Recovery.

11. If issues are found and a diagnostic test fails, follow the instructions on the Diagnostic Console and escalate to CSS.

### Troubleshooting Tips

If the session does not activate (the gray bar doesn't turn blue), verify the following information:

1. The host computer is connected to the internet.
2. The user's computer is connected to power.
3. The user's computer is in [DFU mode](#).
4. You're using the correct port on the user's computer.
5. You're using the correct cable for connecting the host computer and the user's computer.
6. You correctly entered the serial number of the user's computer in the repair and in the Diagnostic Console.
7. You correctly added the parts to the repair.

If the System Configuration suite isn't available, perform the following steps:

1. Verify parts have been added to the repair.
2. Verify the KBB and KGB serial numbers are correct.
3. Verify the repair has been saved.
4. Archive and restart the diagnostic session.
5. Restart the host computer.
6. Open the user's computer and confirm that all parts are properly installed and all flex cables are securely connected.
7. If it has been more than 14 days since parts were added to the repair, escalate to CSS.

If the diagnostic session is interrupted (the blue bar turns gray), perform the following steps:

1. Archive and restart the diagnostic session.
2. Check the network connection.
3. Restart the host computer.
4. Verify that the host computer isn't in sleep mode.
5. Open the user's computer and confirm that all parts are properly installed and all flex cables are securely connected.

# Data Transfer for Mac Computers with the Apple T2 Security Chip

Mac computers with the Apple T2 Security Chip have security features that require a specific [data transfer process](#).

You may be able to transfer data from a damaged logic board before you service it.

## Important:

- This data transfer procedure is only for transferring data from a Mac computer with an Apple T2 Security Chip to an external hard drive.
- If the logic board or flash storage on the user's computer isn't damaged, you can [move content directly from the user's computer to another Mac computer with an Apple T2 Security Chip](#).
- If you replaced the logic board or flash storage on the user's computer, ensure the data is backed up. You can't recover data after running System Configuration.
- The user's computer is unresponsive during the data transfer.  
**Note:** After you complete a logic board or flash storage repair and run System Configuration, the user's computer is responsive. If you have not done a repair, [restore firmware in Apple Configurator 2](#).
- You can't modify files and folders from the volumes on the user's computer. Volumes on the user's computer are read only.  
**Caution:** After the transfer process, some files such as .bin, .etc, .tmp, and .usr may be visible on the external hard drive. This is normal. Don't delete or modify these files or folders or you may cause issues for the customer when they migrate information from the external hard drive back to the user's computer.
- The external hard drive takes 10–20 minutes to be partitioned.
- Data is transferred at USB 2.0 speed. The time it takes to complete the data transfer depends on how much data is on the user's computer, and could take up to four days.
- When the data transfer is complete, return the external hard drive with the user's data to the user. If the data successfully transferred, tell the user how to [use migration assistant to migrate their data back to their computer](#)

## Tools:

- Power cord
- USB-C Charge Cable (661-06670) or USB-C to USB-A Cable (923-00504)



- A host computer with:
  - macOS Catalina 10.15 or later
  - Mac Configuration Utility (MCU).
  - An internet connection
- An external hard drive of equal or greater storage capacity than the storage capacity of the user's computer  
**Note:** The external hard drive will be configured and password protected with the user's computer serial number during the data transfer.

## Steps:

1. Add Retail Data Transfer Setup (076-00399) or ASP Transaction Only Data Transfer Setup - Transaction Only (076-00410) to the repair and save the repair.
2. Open the AST 2 [Diagnostic Console](#) and enter the user computer's serial number to start a diagnostic session.
3. Connect the user's computer to the host computer. If the host computer doesn't have a USB-C port, use a USB-C to USB-

A cable.

**Important:** You must connect the USB-C cable to the correct port on the user's computer.

**Notebooks:** Use the USB-C port closest to the Caps Lock key.



**iMac Pro:** Use the USB-C port closest to the Ethernet port.



**Mac mini (2018):** Use the USB-C port closest to the HDMI port.



**Mac Pro (2019):** Use the USB-C port closest to the edge.



**Mac Pro (Rack, 2019):** Use the USB-C port closest to the power button.



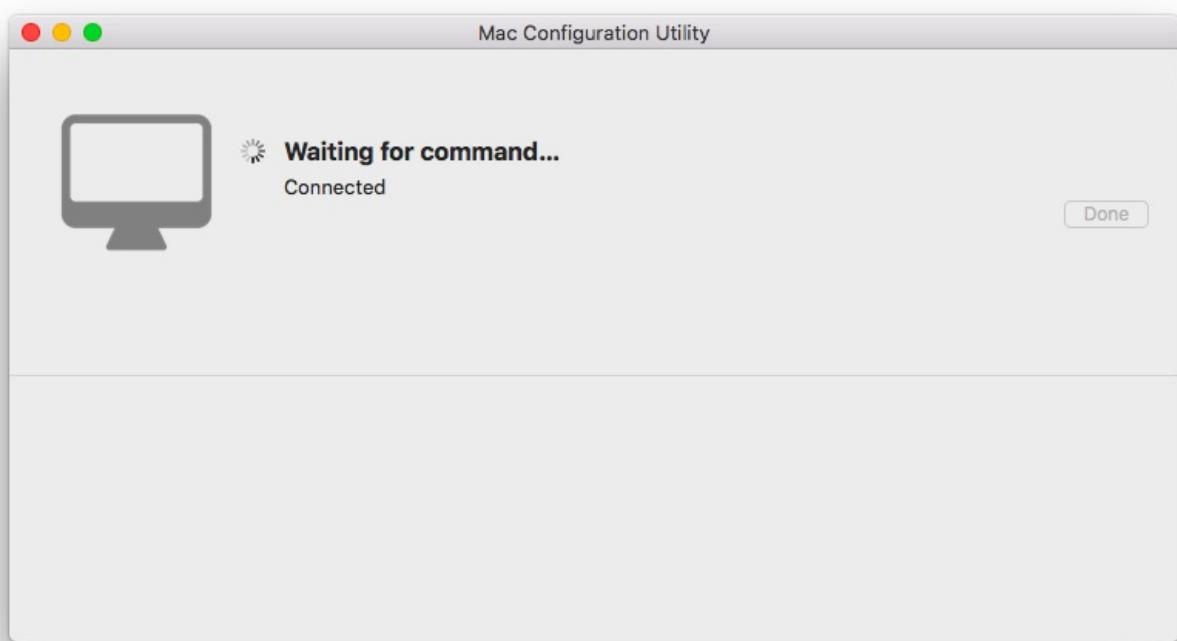
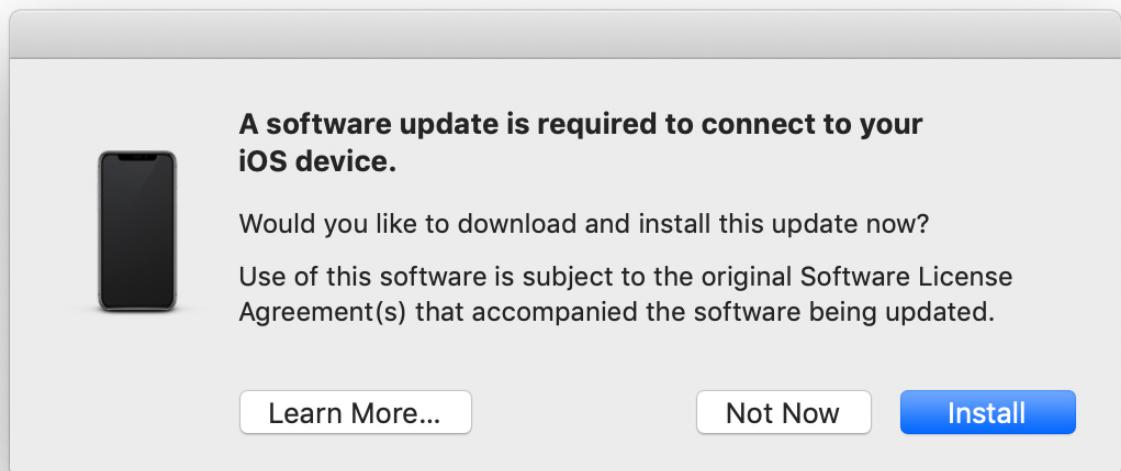
4. Turn on the host computer, connected it to power, and connected it to the internet.

5. Start up the user's computer in [DFU mode](#).

- **For desktop computers**, press and hold the power button while connecting the power cord until the prompt appears in Mac Configuration Utility, which may take up to 10 seconds.
- **For notebooks** press and hold the power button, then press and hold Left Control-Left Option-Right Shift until the prompt appears in Mac Configuration Utility, which may take up to 10 seconds.



**Note:** If an alert message appears prompting a software update, choose “Install.” After the installation is complete, continue to the next step in the System Configuration process. MCU will automatically launch and a dialog box will appear on the host computer screen.



6. Select Data Transfer Setup from the list of diagnostic suites in the Diagnostic Console.

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< > diagnostics.apple.com +

Diagnostic Console John Appleseed

< Results

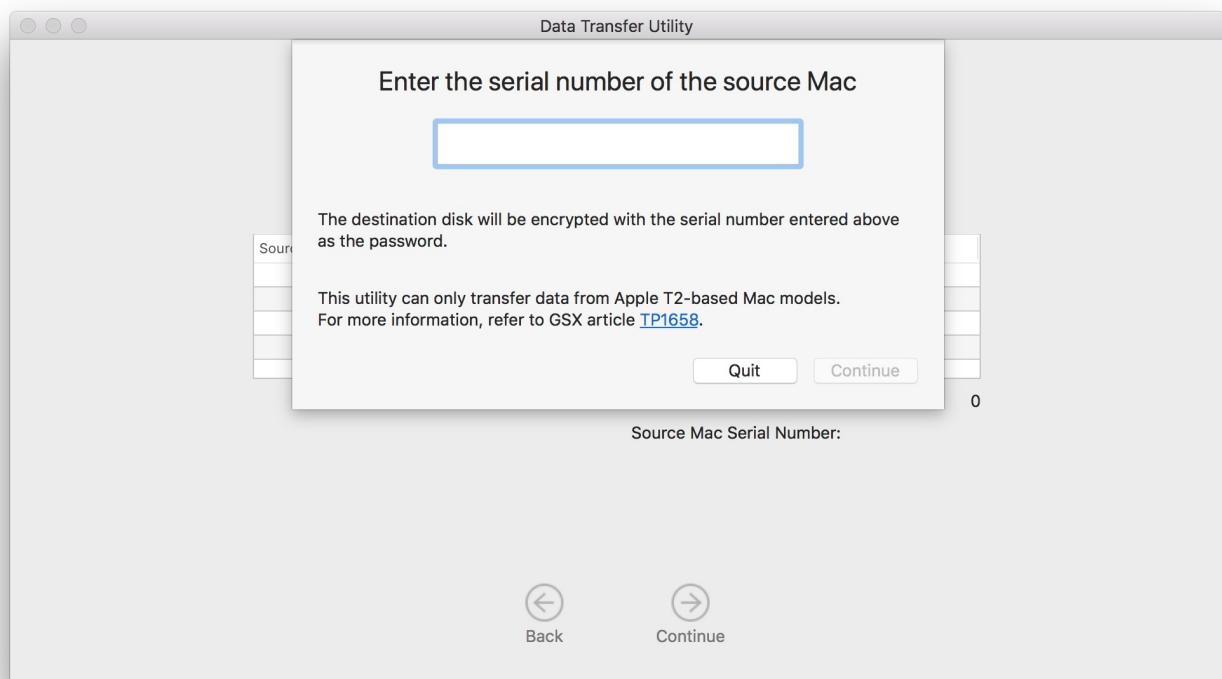
## Diagnostic Suites

	Cooling System		10-20 minutes	
	Graphics & Display		10-15 minutes	
	Audio		2-5 minutes	
	Memory		60-80 minutes	
	Data Transfer Setup		< 2 minutes	

**Note:**

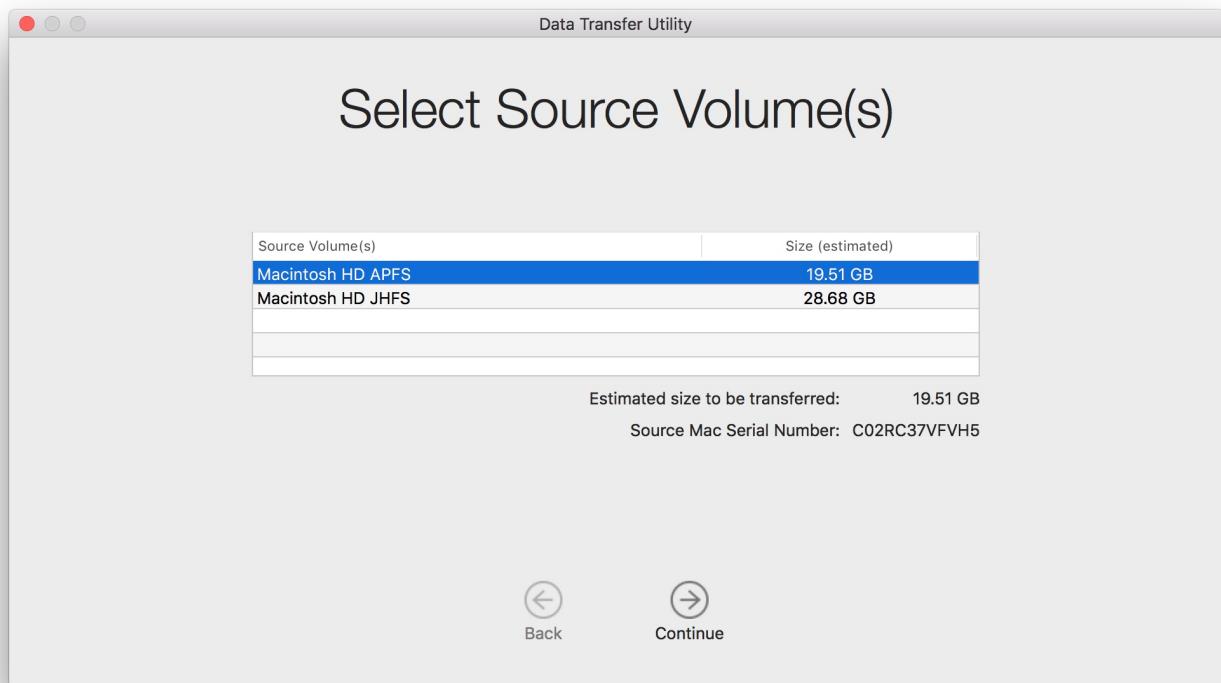
- If the user's computer has FileVault enabled, you will be prompted to enter the password.
- Nothing will appear on the user's computer screen to indicate status. The only status indication will be when the drive mounts as an external volume on the host computer running MCU.

7. Open the Data Transfer Utility app on the host computer and enter the serial number of the user's computer.

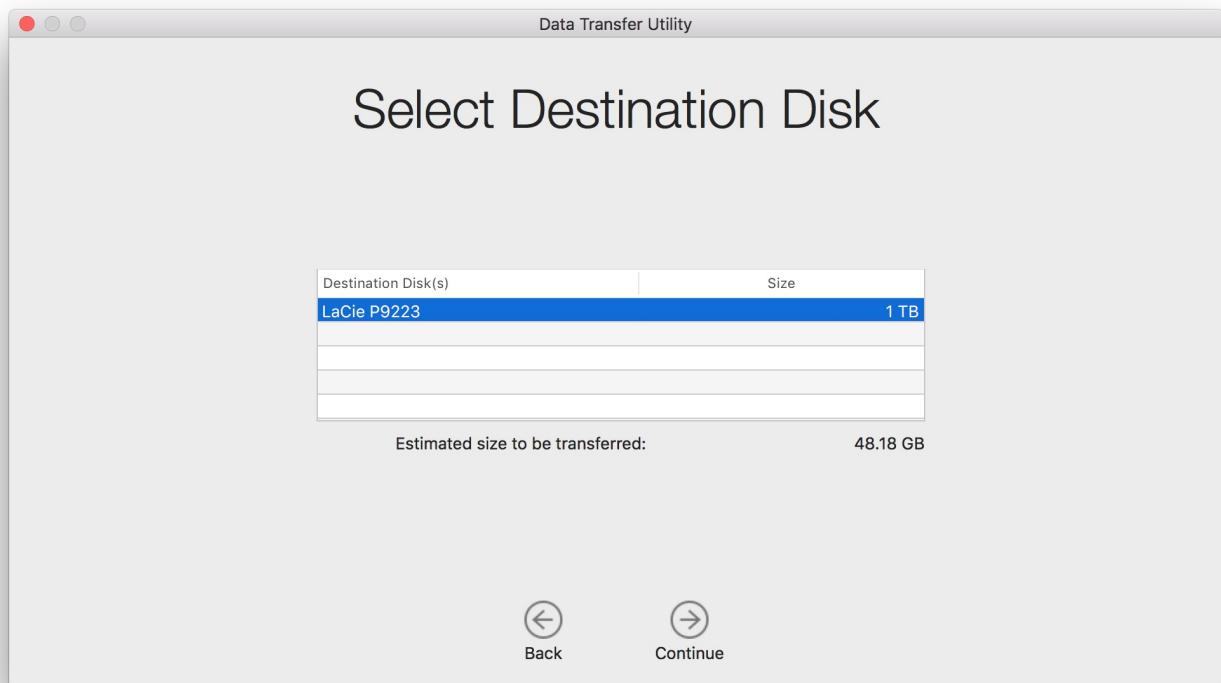


8. Select the source volume and click Continue.

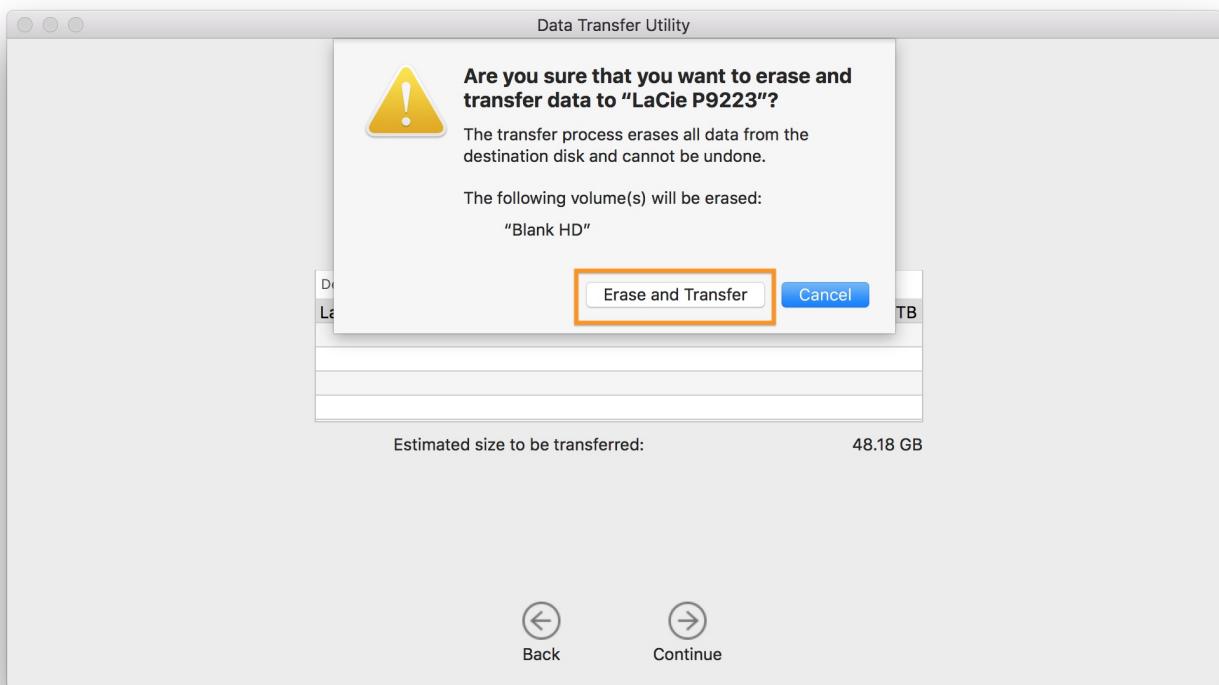
**Note:** If more than one source volume is available, you can select multiple volumes to transfer.



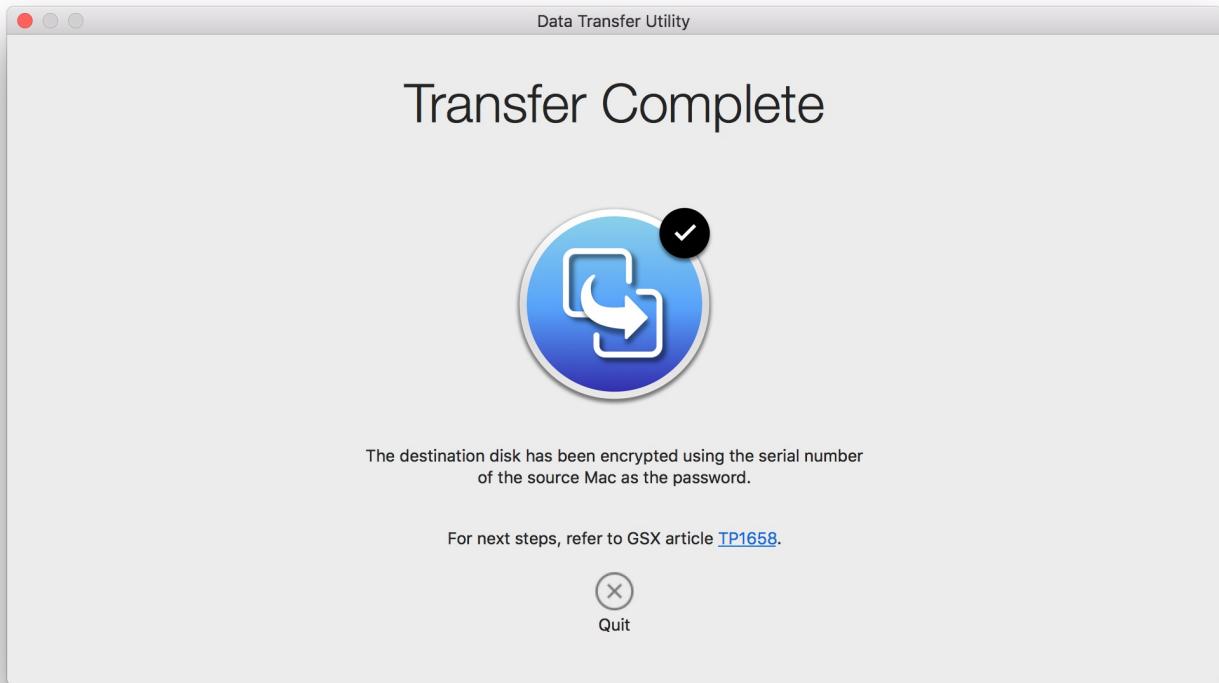
9. Connect an external hard drive to the host computer. Select the destination, and click Continue.



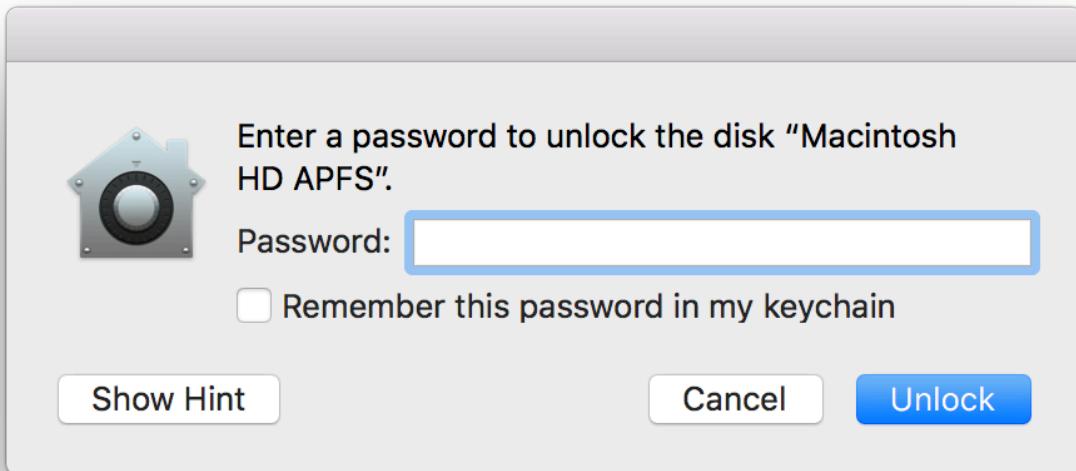
10. Click Erase and Transfer.



11. Confirm that the transfer is successful before closing the repair. Once you close the repair, you can't transfer data again from the known bad (KBB) logic board.



12. Ensure that the password works and the external hard drive is encrypted by disconnecting it and reconnecting it to the host computer.



#### Troubleshooting Tips:

If the Data Transfer Setup suite is unavailable, verify the following information:

1. You added the correct data transfer part number and saved—but didn't close—the repair.
2. You entered the correct serial number of the user's computer into the Diagnostic Console.
3. You used the serial number of the user's computer to create the repair.
4. You correctly connected the user's computer to the host computer, and Mac Configuration Utility is running. A correctly connected device will show as “Apple Mobile Device (DFU Mode)” in System Information > USB.
5. You didn't use a USB-C to USB-A cable with USB-C to USB Adapter.

If the user's computer doesn't complete the Data Transfer Setup suite, perform the following steps:

1. Archive and restart the diagnostic session. Re-run the Data Transfer Setup suite.
2. Restart the host computer.

If the Data Transfer Utility app doesn't show any volumes under Select Source Volume(s), verify the following information:

1. Volume(s) appear in Finder or Disk Utility.
2. You entered the correct serial number of the user's computer into the Data Transfer Utility app.

If the Data Transfer Utility app doesn't recognize the external hard drive, use Disk Utility to initialize the external hard drive.

# Device Firmware Update (DFU) mode for Computers with the Apple T2 Security Chip

This article documents the steps to put both a portable system and a desktop system into Device Firmware Update (DFU) mode. AST 2 System Configuration and Data Transfer Setup suites cannot be run unless the customer computer is in DFU mode. Refer to [System Configuration for Macs with the Apple T2 Security Chip](#) and [Data Transfer for Macs with the Apple T2 Security Chip](#).

## Before you begin:

- To make sure the customer's computer is connected to the host machine correctly.

## For Notebooks:

1. Press and hold the power button (Image 1), then immediately press and hold Left Control-Left Option-Right Shift (Image 2) until you see the prompt appear in Mac Configuration Utility (Image 3), which may take up to 10 seconds.  
**Note:** Use the same keys on all keyboard layouts, even though the placement of the keys may be different on JIS and ISO keyboards.

Image 1



Image 2



**Image 3**



**For iMac Pro:**

1. Press and hold the power button on the rear enclosure (Image 1) and connect the power cord (Image 2).

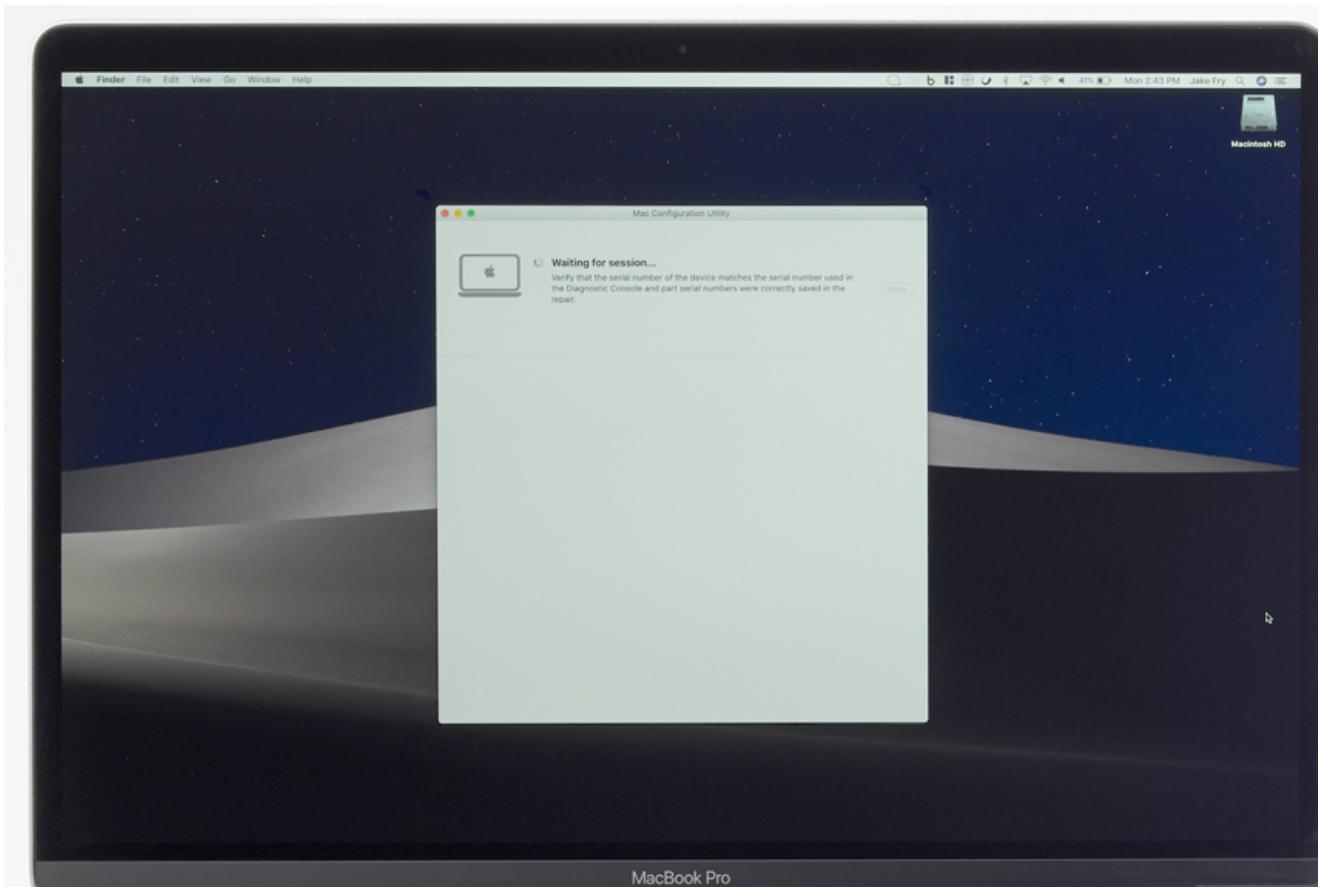
**Image 1**



**Image 2**



2. Continue to hold the power button until you see the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.



**For Mac mini (2018):**

1. Press and hold the power button on the enclosure (Image 1) and connect the power cord (Image 2).

**Image 1**



**Image 2**



2. Continue to hold the power button until you see the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.



**For Mac Pro (2019):**

1. Press and hold the power button (Image 1) and connect the power cord (Image 2).

**Image 1**



**Image 2**



2. Continue to hold the power button until you see the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.



**For Mac Pro (Rack, 2019):**

1. Press and hold the power button (Image 1) and connect the power cord (Image 2).

**Image 1**



**Image 2**

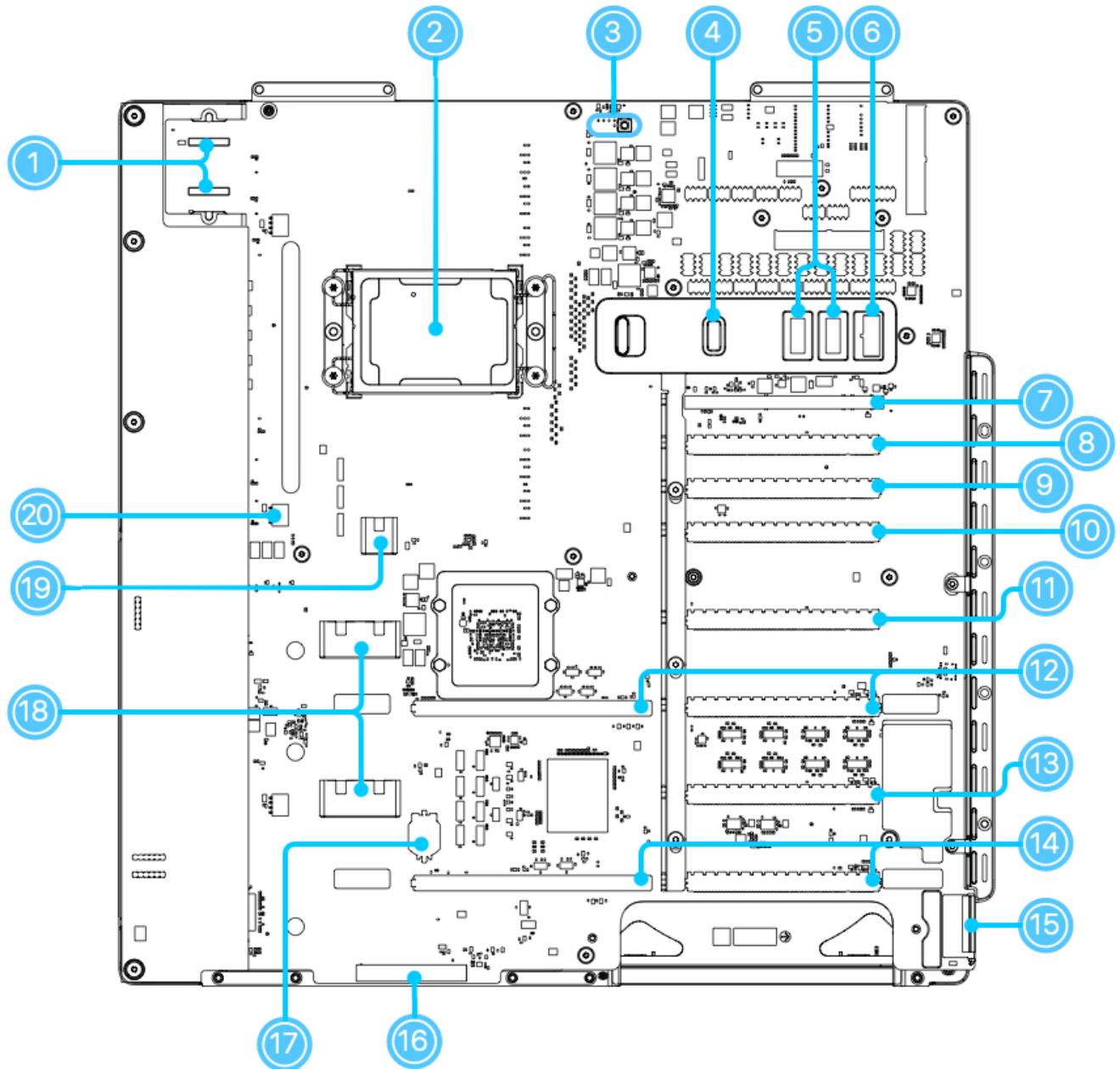


2. Continue to hold the power button until you see the prompt appear in Mac Configuration Utility, which may take up to 10 seconds.



# Mac Pro (2019) and Mac Pro (Rack, 2019) Functional Overview

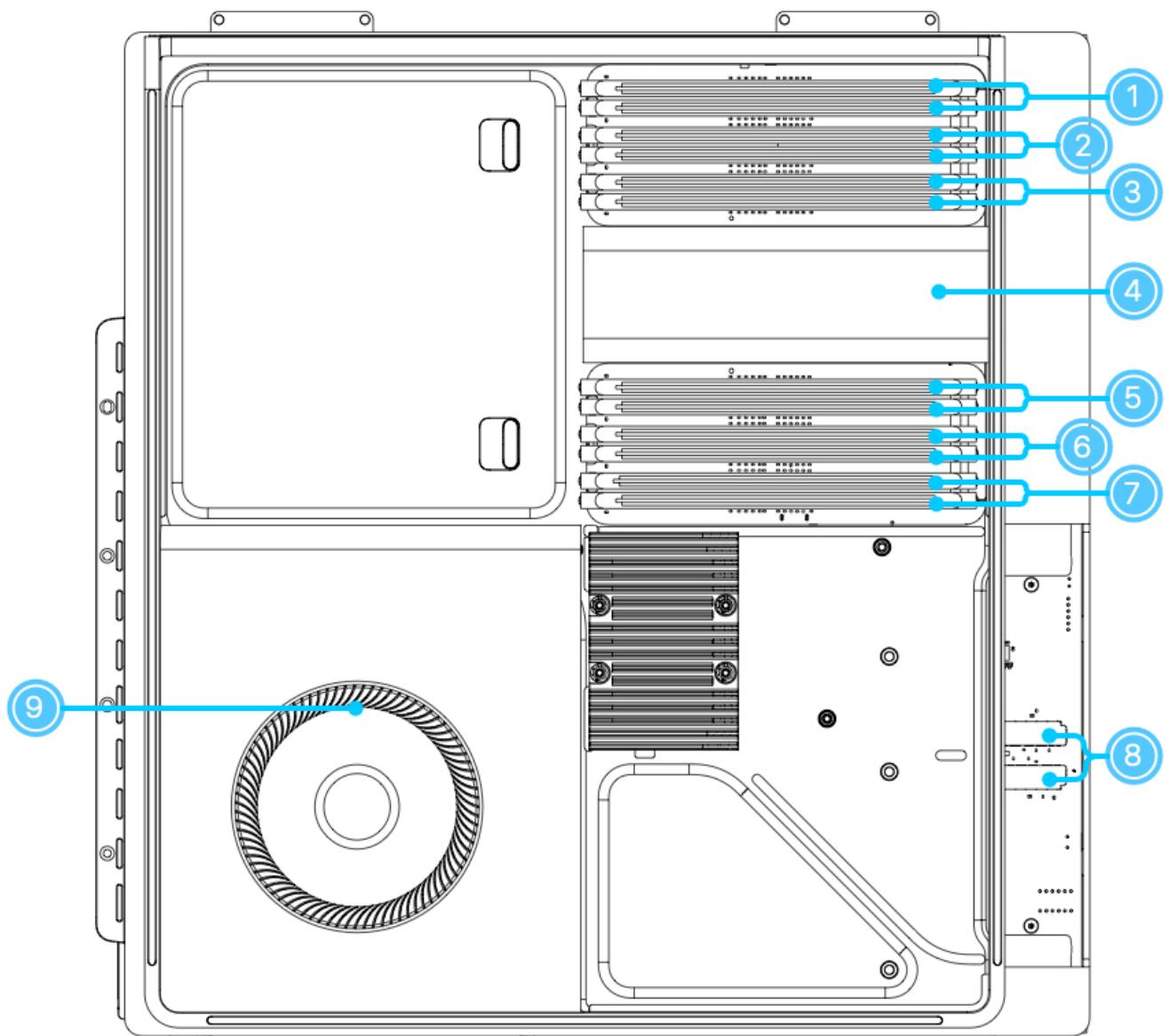
## Logic Board (PCIe side)



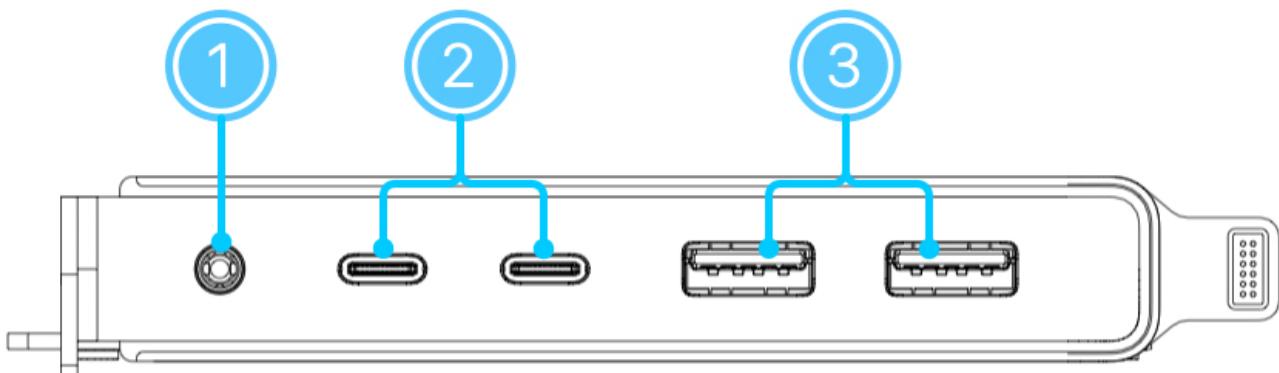
- 1 = TIO flex cable connectors
  - No power when power button is pressed
  - Intermittent shutdown (if flex cable is pinched or damaged)
  - Fan runs at full speed
- 2 = CPU and CPU Socket
  - Intermittent shutdown
  - System freezes or kernel panics
  - Fast or loud system fans
- 3 = Diagnostic LEDs and (diag) Button
  - Used for [diagnostic](#) troubleshooting.
- 4 = USB-3 Port (USB-A)
  - For software activation keys
- 5 - 6 = Two SATA connectors and SATA power
  - Hard drive not detected
  - Hardware RAID issues
- 7 = Apple I/O card slot
  - Refer to the Apple I/O card section below
- 8 - 14 = PCIe slots

- Slots 1 and 3 are MPX Bays
- No video
- Freezes or unstable system
- Freezes during boot
- Kernel panic
- **15** = Ethernet
  - No wired Ethernet connectivity
  - Wired Ethernet data transfer issues
- **16** = Power supply connector
  - No power
  - Intermittent shutdown
- **17** = Coin cell battery
  - No power
  - No video
- **18** = Two PCIe auxiliary power (8 pin)
  - No video (where power for PCIe video cards is required)
  - PCIe cards not detected
- **19** = One PCIe auxiliary power (6 pin)
  - No video (where power for PCIe video cards is required)
  - PCIe cards not detected
- **20** = System fans spring connectors
  - Intermittent shutdown
  - System freezes or kernel panics
  - Noisy fan perception

#### **Logic Board (memory side)**

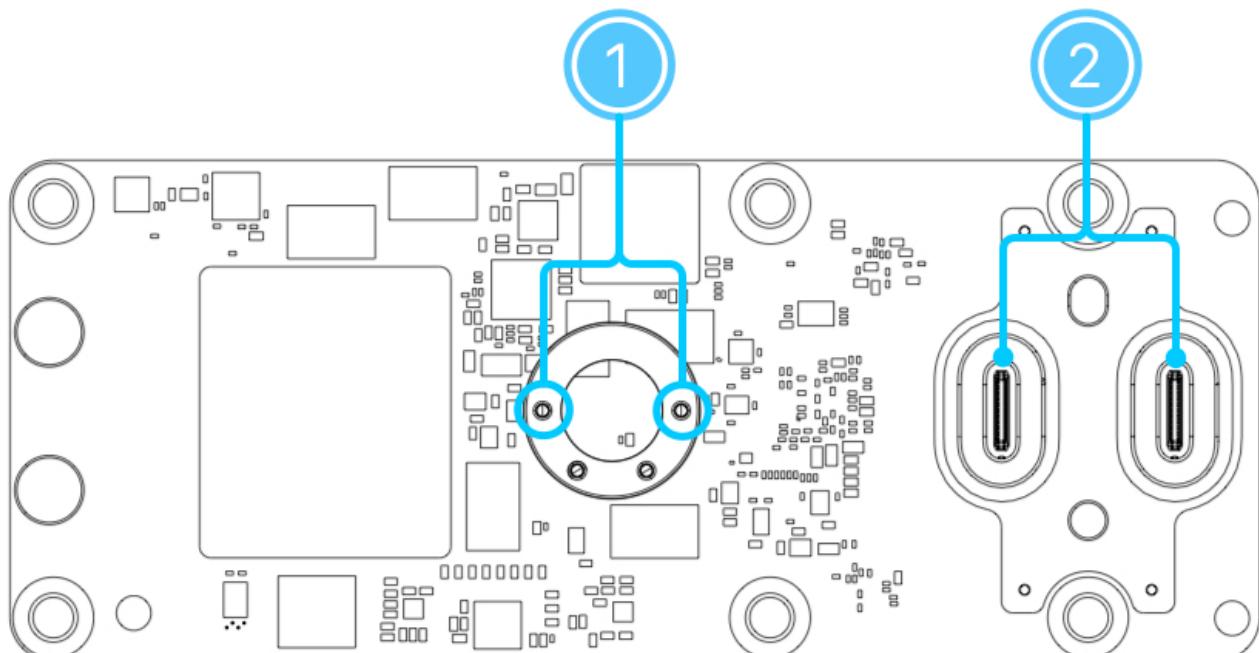


- 1 - 3 = Upper memory DIMMs
  - Error beep tones on startup
  - Freeze or kernel panic
  - No boot
- 4 = Speaker connector (not visible)
  - No sound from internal speaker
  - Distorted sound from internal speaker
- 5 - 7 = Lower memory DIMMs
  - Error beep tones on startup
  - Freeze or kernel panic
  - No boot
- 8 = Flash storage
  - No flash storage seen in System Info
  - No boot from flash storage
- 9 = Blower spring connectors
  - Intermittent shutdown
  - System freezes or kernel panics
  - Noisy fan perception



- 1 = 3.5 mm audio jack
  - No sound from headphones or external speakers
  - No headset controls or microphone input
- 2 = Two Thunderbolt 3 ports (USB-C)
  - USB connectivity issues
  - USB power issues
  - No video to external display
  - No audio to external display speakers
  - Thunderbolt device not found
  - Thunderbolt controller not recognized
  - Thunderbolt driver issue
  - Thunderbolt power issues
- 3 = Two USB-3 ports (USB-A)
  - USB device not found
  - Controller not recognized
  - USB power issues

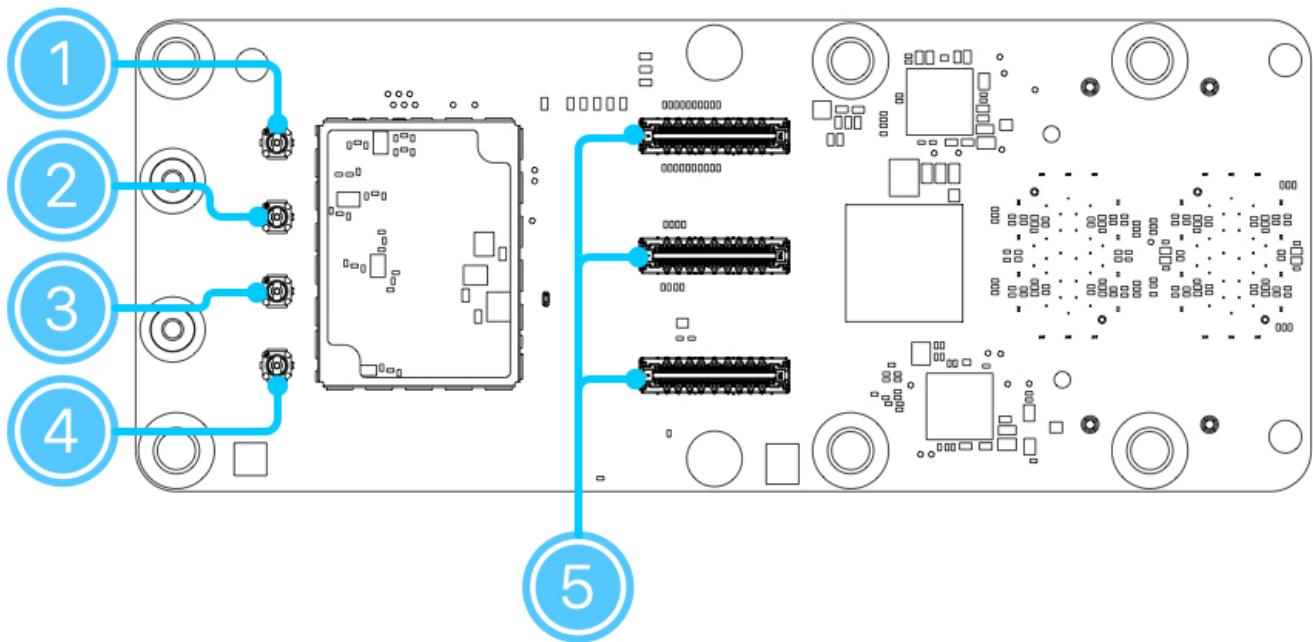
**Top I/O board (TIO) (top side)**



- 1 = POGO pins
  - No power
  - Short these pins to [bypass the housing sensor](#) (TP1788) and operate the computer with the housing removed.
- 2 = Thunderbolt 3 ports (USB-C)
  - USB connectivity issues
  - USB power issues
  - No video to external display
  - No audio to external display speakers
  - Thunderbolt device not found
  - Thunderbolt controller not recognized

- Thunderbolt driver issue
- Thunderbolt power issues

#### Top I/O board (TIO) (bottom side)



- **1 - 4** = Wireless antenna connectors
  - Weak signal strength over Wi-Fi or Bluetooth
  - Cannot connect to Wi-Fi networks or Bluetooth peripherals
  - Slow Wi-Fi or Bluetooth connection speed
- **5** = TIO flex cable connectors
  - No power when power button is pressed
  - Intermittent shutdown (if flex cable is pinched or damaged)
  - Fan runs at full speed

# Mac Pro (2019) and Mac Pro (Rack, 2019) Minimum Configuration

## Minimum Configuration Overview

Minimum Configuration can help you isolate and resolve issues involving 'no power', 'power but no video', or other startup-related symptoms. This method gradually builds up the system from a minimum configuration and verifies expected behaviors at each step. It is helpful in determining:

- Which components function together
- Which component causes a symptom to recur when it is added
- A loose or faulty cable or connector

If you encounter unexpected behavior during a step, you should investigate the last component you reinstalled:

- Backtrack to the previous step
- Remove the last installed component
- Re-verify the expected behavior

**Note:** Minimum configuration testing may not be practical for every repair. Refer to other troubleshooting sections in the service guide for additional direction.

## Minimum configuration consists of the following:

Mac Pro (2019)	Mac Pro (Rack, 2019)
Space Frame	Housing
Antennas	Power Button with Status Indicator Light (SIL) Board
Top I/O (TIO) Board and TIO Flex Cable	Antennas
Logic Board	Front I/O Board and flex cable
Storage	Logic Board
CPU and CPU Thermal Module	Storage
Power Supply	CPU and CPU Thermal Module
System Fans	Power Supply
Blower	System Fans
	Blower



#### **Minimum Configuration Instructions:**

Follow each step. Proceed to the next step only if the computer exhibits **expected** behavior. If **unexpected** behavior is observed after completing a step, then refer to the troubleshooting section of the service guide and follow the appropriate procedure to further isolate the cause of the issue.

Before you begin, make sure you are familiar with how to [bypass the housing sensor](#) in order to operate the computer with the housing, or top cover and memory access panel removed.

**Mac Pro (2019):** For each step, if the computer does not turn on, first verify that the magnet is in place and has not moved out of position. The magnet must be very close to the top edge of the logic board in order to bypass the housing sensor. Then proceed to check behavior.

**Mac Pro (Rack, 2019):** In order for the computer to turn on, both the top cover and memory access panel must be installed or the magnet must be held in place over the housing sensors.



**WARNING HIGH VOLTAGE:** Use extreme caution when operating Mac Pro with the housing, or top cover and memory access panel removed. Avoid touching the internal components. The power supply and logic board retain a charge whenever the computer is plugged in to an electrical outlet, even when powered off.

Additional Safety Precautions:

- **Don't** wear an ESD wrist strap while the computer is plugged in to an electrical outlet.
- **Don't** disassemble the computer while the housing sensor is defeated.
- **Don't** install components while the computer is plugged in to an electrical outlet.

Be sure you are familiar with all [Mac Pro safety considerations](#) before you begin. **Verify**

#### Minimum Configuration:

1. Shut down the computer. Unplug all external cables and the power cord.
2. Remove and disconnect the following components to establish a minimum configuration:
  - [Housing](#) or [Top Cover and Memory Access Panel](#)
  - [Apple I/O Card](#)
  - [Apple Afterburner](#)
  - [MPX Modules](#)
  - [Memory](#)
  - Any remaining PCIe cards
  - SATA cables and USB devices connected to the logic board
3. Plug a known-good power cord into the power port, then plug the other end into an AC outlet.
4. Locate the four diagnostic LEDs on the logic board. Use a black stick to push the diagnostic button next to the LEDs and check the behavior:
  - **Expected behavior:** #1 LED illuminates.
  - **Unexpected behavior:** #1 LED does not illuminate. Suspect a power supply failure.



5. [Bypass the housing sensor](#) and startup the computer. Use a black stick to push the diagnostic button and check the behavior:

- **Expected behavior:**
  - Diagnostic LED #2 illuminates.
  - The power supply SIL should flash with an amber error pattern, indicating a DIMM detection error. This is expected behavior because no DIMMs should be installed.
  - System fans and blower should begin to spin.
- **Unexpected behavior:**
  - Power supply SIL does not illuminate, then suspect a power supply failure.
  - Diagnostic LED #2 does not illuminate, then suspect CPU or logic board failure.
  - If the computer still does not turn on, suspect a failure with the top I/O board, top I/O flex cable, or logic board. For the Rack model, suspect a failure with the power button with status indicator light board.
  - Relevant troubleshooting articles are [No Power](#) and [Will Not Start Up](#).

#### **Verify Memory (DIMMs):**

6. Unplug the power cord from the power port.
7. Install one DIMM in slot #8.
8. Plug the power cord into the power port.
9. Bypass the housing sensor and startup the computer. Use a black stick to push the diagnostic button and check the behavior:

- **Expected behavior:**
  - Fans and blower should begin to spin.
  - Diagnostic LED #3 illuminates.
- **Unexpected behavior:**
  - Diagnostic LED #3 does not illuminate, then suspect DIMM failure.
  - Power supply SIL flashes the amber memory error pattern, then suspect DIMM failure.

10. Repeat steps 6–9, adding one DIMM each time.

**Note:** If the Mac Pro is configured with more than six DIMMs, save time by installing them in pairs. If unexpected behavior is observed, use component isolation to identify an individual DIMM failure.

#### **Verify Apple I/O Card and MPX Modules:**

11. Unplug the power cord from the power port.
12. Install the Apple I/O card into PCIe slot #8.
13. Connect a known good USB keyboard and mouse into the USB ports on the Apple I/O card.
14. Install a known good graphics MPX module (AMD Radeon Pro 580X) into PCIe slot #1.

**Note:** If an MPX module is not available, use any known good PCIe graphics card.

15. Connect a known good, compatible display to the MPX module or graphics card.
16. Plug the power cord into the power port.
17. Bypass the housing sensor and startup the computer.

- **Expected Behavior:**
  - Fans and blower should begin to spin.
  - No SIL error flashes should be seen, indicating that logic board Power On Self Test (POST) has passed.

- The macOS startup process (Apple icon) should appear on the attached display, indicating that the logic board, flash storage, and graphics card are functional.
  - Use a black stick to press the diagnostic button. Diagnostic LED #4 illuminates.
  - **Unexpected Behavior:**
    - No image appears on the display.
18. If unexpected behavior occurs, repeat steps 11–17, but install the graphics card into a different PCIe slot.
- If no image appears on the display after reseating and moving the GPU PCIe card, then suspect a GPU PCIe card failure.
  - Use a black stick to press the diagnostic button. Diagnostic LED #4 does not illuminate, then suspect logic board failure..

#### **Isolate ‘No Video’ Issues:**

19. Use a display that supports video over USB-C. Connect the display to one of the USB-C ports on the Apple I/O card.
- **Expected behavior:**
    - An image should appear on the attached display using either of the Apple I/O card's USB-C ports, as long as a functioning GPU PCIe card is installed.
  - **Unexpected behavior:**
    - If no image appears on the display when connecting to the Apple I/O card, but an image does appear on the display when connecting directly to the GPU PCIe card, then suspect a Apple I/O card failure.
20. Disconnect the display USB-C cable from the Apple I/O card and connect the cable to one of the USB-C ports on the top I/O board or front I/O board, depending on which model you are servicing.
- **Expected behavior:**
    - An image should appear on the attached display using either of the top I/O board's or front I/O board's USB-C ports, as long as a functioning GPU PCIe card is installed.
  - **Unexpected behavior:**
    - If no image appears on the display when connecting to the top I/O board or front I/O board, but an image does appear on the display when connecting to the Apple I/O card and GPU PCIe card, then suspect a top I/O board or front I/O board failure.
    - Note:** You can further isolate by checking the connections of the I/O flex cable.
    - If no image appears on the display when connecting to the Apple I/O card nor the top I/O board (or front I/O board), then suspect a logic board failure.

#### **Verify Startup:**

21. Shut down the computer. Unplug all external cables and the power cord.
22. Reinstall the housing, or top cover and memory access panel.
- Note:** If the housing is not fully seated, the power button and SIL may not function, and the computer may not turn on. Leaving the housing latch unlocked may also cause this behavior.
23. Reconnect the power cord, keyboard, mouse, and display cables, then turn on the computer by pressing the power button.
- **Expected behavior:**
    - Fans and blower should begin to spin.
    - No SIL error flashes should be seen, indicating that logic board Power On Self Test (POST) has passed.
    - macOS startup process (Apple icon) should appear on the attached display.
    - The SIL should illuminate a solid white color, indicating that power is applied and the computer has started up normally.
  - **Unexpected behavior:**
    - If the computer turns on with the housing removed, but does not turn on when using the power button with the housing installed, first try fully reseating the housing, then retest. If the issue persists, suspect power button failure.

# Mac Pro (2019) and Mac Pro (Rack, 2019) Safety

## Electrical Safety



**Warning: HIGH VOLTAGE.** Use extreme caution when troubleshooting with the housing, or top cover and memory access panel removed. Avoid touching the internal components while the computer is plugged in to an electrical outlet. The power supply and logic board retain a charge whether or not the computer is on.

After unplugging the computer from the electrical outlet, wait at least two minutes before removing the housing or top cover and memory access panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch any internal components, especially the logic board and power supply, while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

## Electrical Safety Precautions

Before working on a computer with exposed, potentially energized parts:

- Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles which increase your risk of electric shock.
- Do not wear a cell phone or other signaling device, as these may cause a dangerous startle reflex during energized work.
- Remain alert, focused on the work being performed, and aware of the proximity of grounded objects to your body.
- Use the plastic black stick or other non-metal extension tool as needed to connect or disconnect cables, to keep fingers away from potentially energized parts.
- **If the Mac Pro needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing an ESD grounding system increases your risk of electric shock in this situation.

## Weight



- Depending on how Mac Pro is configured, it may weigh more than 50 pounds (23 kg). It is recommended to have two people assist with lifting or repositioning the computer.
- Don't install wheels if the Mac Pro (2019) weighs more than 50 pounds (23 kg). Computers that weigh more than 50 pounds don't comply with safety standard stability requirements, if they're on wheels. Heavier computers should rest on the feet.
- If a Mac Pro (2019) is configured with wheels, use wheel stoppers to prevent the computer from moving during repair or perform all repair procedures with the computer on its side.

## Mac Pro (Rack, 2019)

- The rack must have adequate strength and stability to support the contents of the rack while each subassembly is being used in its intended operational position and while each component is extended for installation or servicing.
- Consideration should be given to how the rack will be used. For example, caution against sliding out more than one component at a time; doing so may create a stability hazard.
- When installing Mac Pro, the rack is at risk of tipping over and causing personal injury. Before extending the rack to the installation position, read the installation instructions that came with the rack.
- Don't put any load on top of Mac Pro while it's in the installation or servicing position. Don't leave Mac Pro in the installation or servicing position.
- Wear cut-resistant gloves (923-01368) when removing or reinstalling the logic board with internal frame from the rack housing.
- Refer to the [Mac Pro \(Rack, 2019\) Essentials Guide](#) for additional information on installing and removing Mac Pro in a rack.

## Temperature

- Allow the Mac Pro to cool down before you touch the internal components.

# Mac Pro (2019) and Mac Pro (Rack, 2019) Required Tools

## New and Specialized Tools

1. Torx T15 bit (152 mm) (923-03294)
2. 4 mm hex bit (923-04197)
3. Torx T55 Security bit (923-03338)
4. 3/8-inch to 5/16-inch adapter (923-03339)
5. Adjustable torque driver 0.3–1.2 Nm (923-0735)
6. Flexible driver (923-04009)
7. 3/8-inch ratcheting socket wrench (923-03340)



## General Tools

- ESD-safe workstation, including an ESD mat and wrist or heel strap
- ESD-safe bags, to store ESD-sensitive parts while removed from the computer
- ESD-safe tweezers (round-nose)
- Cut-resistant gloves (923-01368)
- Antenna tool (923-01322)
- Wiha Magnetizer/Demagnetizer
- Phillips #1 screwdriver
- Large flathead screwdriver
- Torx T3 screwdriver
- Torx T5 screwdriver
- Torx T8 screwdriver (precision) \*
- Torx T8 screwdriver \*
- Torx T8 bit (923-0734) (optional)

\* Example of Torx T8 screwdriver (precision) (1) and Torx T8 screwdriver (2):



## Additional Tools

- Kapton tape
- Painter's tape (1–2 inches or 2.5–5 cm)
- Black stick or other nonconductive nylon or plastic flat-bladed tool
  - Black stick, pack of 4 (922-5065)
  - Black stick, pack of 24 (922-9004)
  - Black stick, pack of 96 (922-9005)
- Magnifying glass (for reading the serial number)
- USB-C to USB-C Charge Cable (661-06670)
- Digital barcode scanner (923-01232)
- Isopropyl alcohol (IPA) wipe
- Thermal paste
- Ethernet cable
- Sticky notes
- Scissors

# Take Apart Procedure Notes

## Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

## Note About Images in This Guide

In some cases a pre-production model may have been used to document the procedures in this guide. Although there may be small differences in appearance between the image pictured and the computer you are servicing, the procedures are the same unless noted.

## Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



# Housing

## First Steps

### Important:

- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

### Before you Begin:

- Shut down the computer.
- Unplug all external cables and power cord.
- Wait for the internal components to cool down.



## Tools

1. Protective Bag, Mac Pro (2019), 923-03976

1



## Steps For Removal

**Important:** Remove the housing with the computer on the ground.

**Important:** Protect the housing from cosmetic damage whenever it is removed from the space frame.

1. Lift the housing latch and rotate it to the unlocked position.



2. Lift the housing straight up and off the space frame.



**Important:** Protect the housing from cosmetic damage whenever it is removed from the space frame.



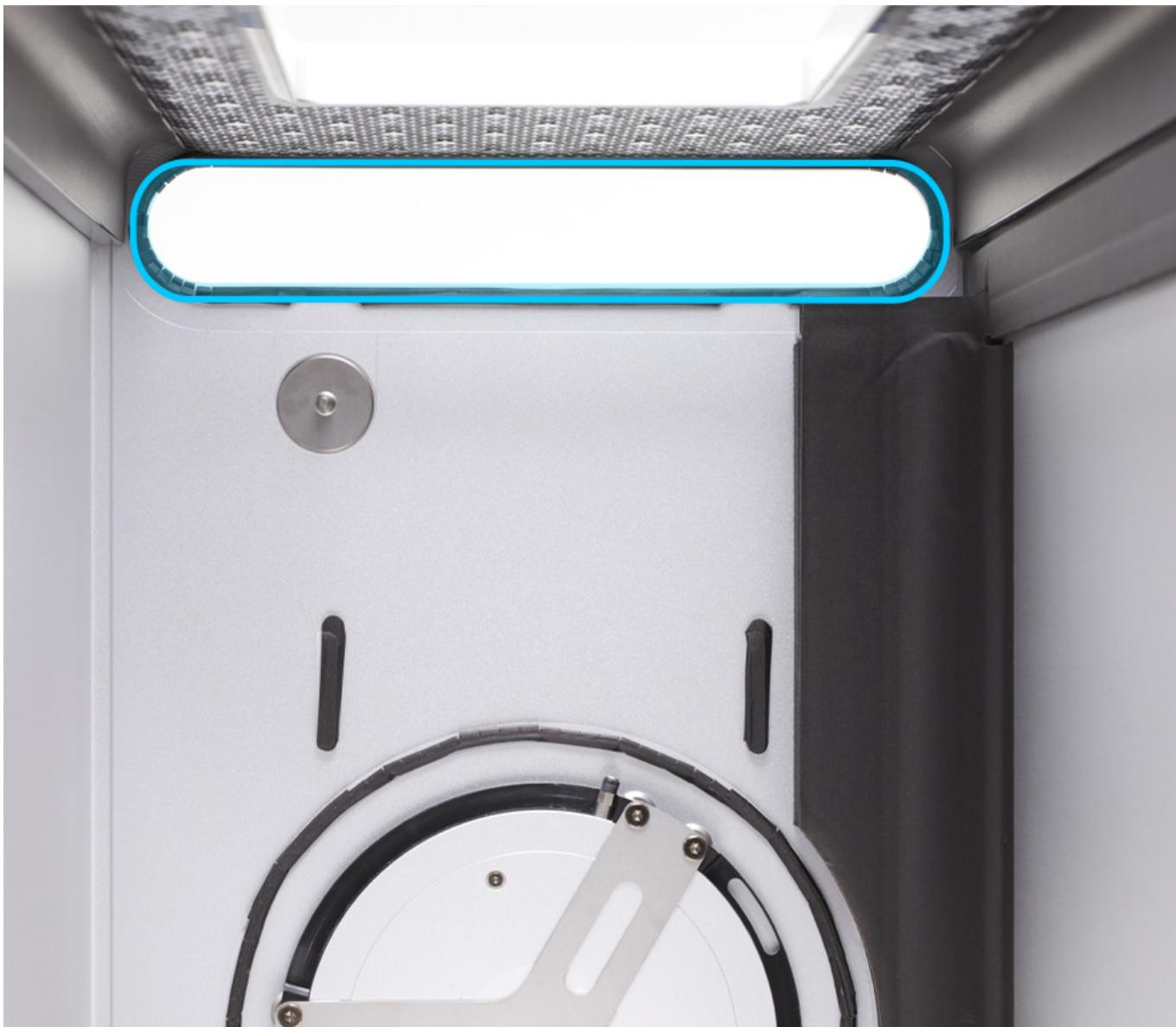
3. **Warning:** Depending on how the Mac Pro is configured, the weight may exceed 50 pounds (23 kg). Have two people lift the computer onto the repair bench.





## Steps For Reassembly

**Important:** Check the antenna gaskets on the inside of the housing. If any gaskets are damaged or missing, replace the housing.



1. Ensure all internal components are fully installed, then have two people place the computer on the floor.





2. Ensure the latch is in the unlocked position and slowly lower the housing over the space frame.



3. Rotate the latch to locked position then lay it flat.



# Power Button with System Indicator Light (SIL)

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Housing](#)



## Tools

1. Black stick
2. Torx T5 screwdriver



## Steps For Removal

1. On a clean, flat surface, position the housing as shown.



2. Reach through the bottom of the housing and remove four T5 screws.



3. The status indicator light (SIL) is held in place by adhesive. Pull slowly to separate it from the housing.



### Steps For Reassembly

1. Use the screw holes to align the power button, then reinstall the four T5 screws (923-03463).





2. A replacement power button comes with an adhesive backing on the SIL. Remove the backing, then use the two holes to align the SIL. Use the flat end of a black stick and press the SIL in place for 15 seconds to activate the adhesive.



3. Verify that the power button sits flush with the top surface of the housing. Press the power button to ensure that it clicks properly.



4. Reinstall the [housing](#).

# Mac Pro (2019) Handles

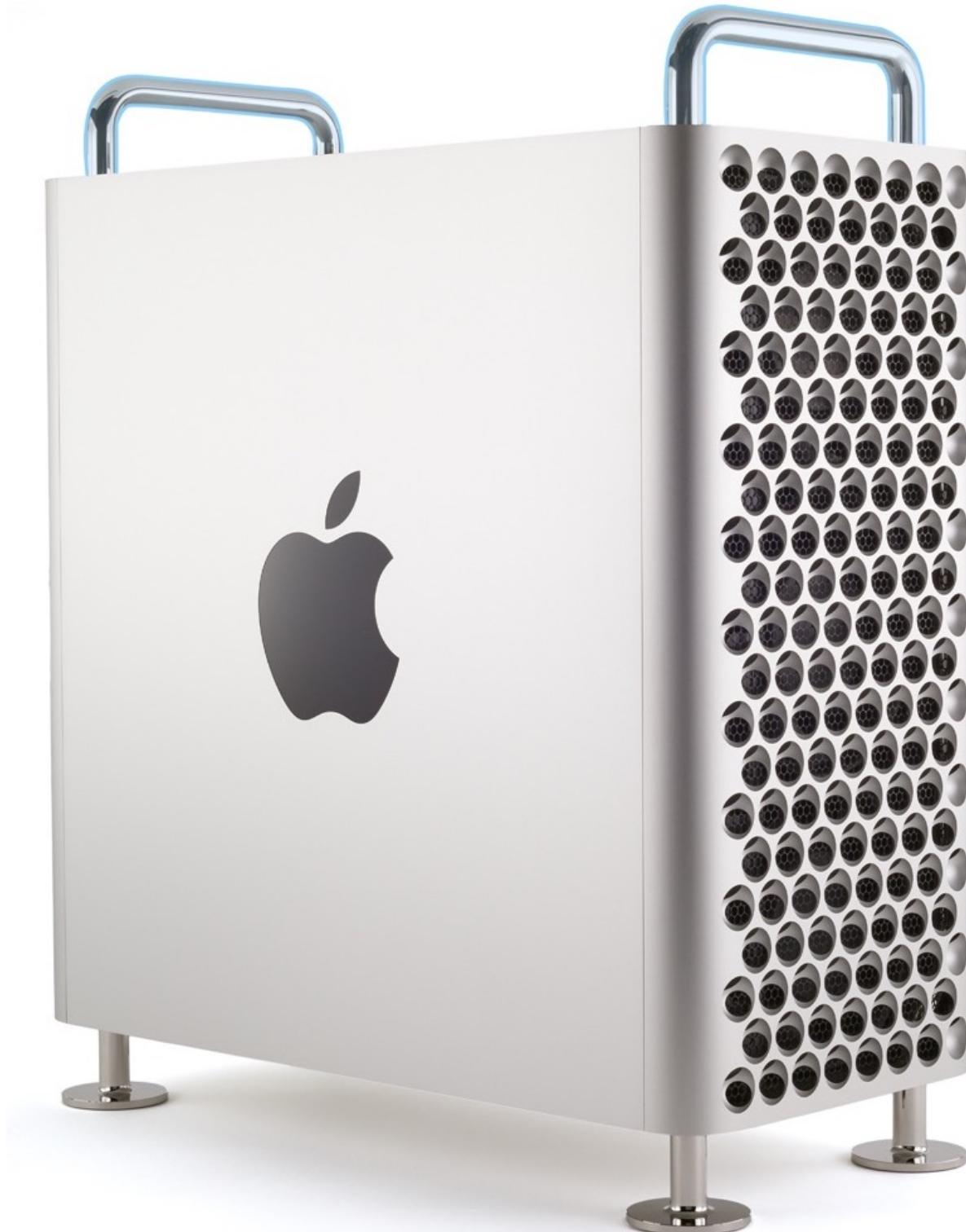
## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Housing](#)



## Tools

1. Painter's tape (1-inch or 2.5 cm wide)

2. Sticky notes
3. Scissors
4. 4 mm hex bit (923-04197)
5. Flexible driver (923-04009)



### Steps For Removal

1. Wrap painter's tape around the space frame bars, just below the handle screw holes.



2. Guide the 4 mm hex bit into the screw hole in the space frame bar. Ensure the bit is securely fit to the screw head.



3. Completely unscrew the 4 mm hex screw.  
**Note:** The screw is captive within the larger T55 top plate screw.



4. Repeat steps 2 and 3 to completely unscrew the 4 mm hex screw from the other side of the handle.

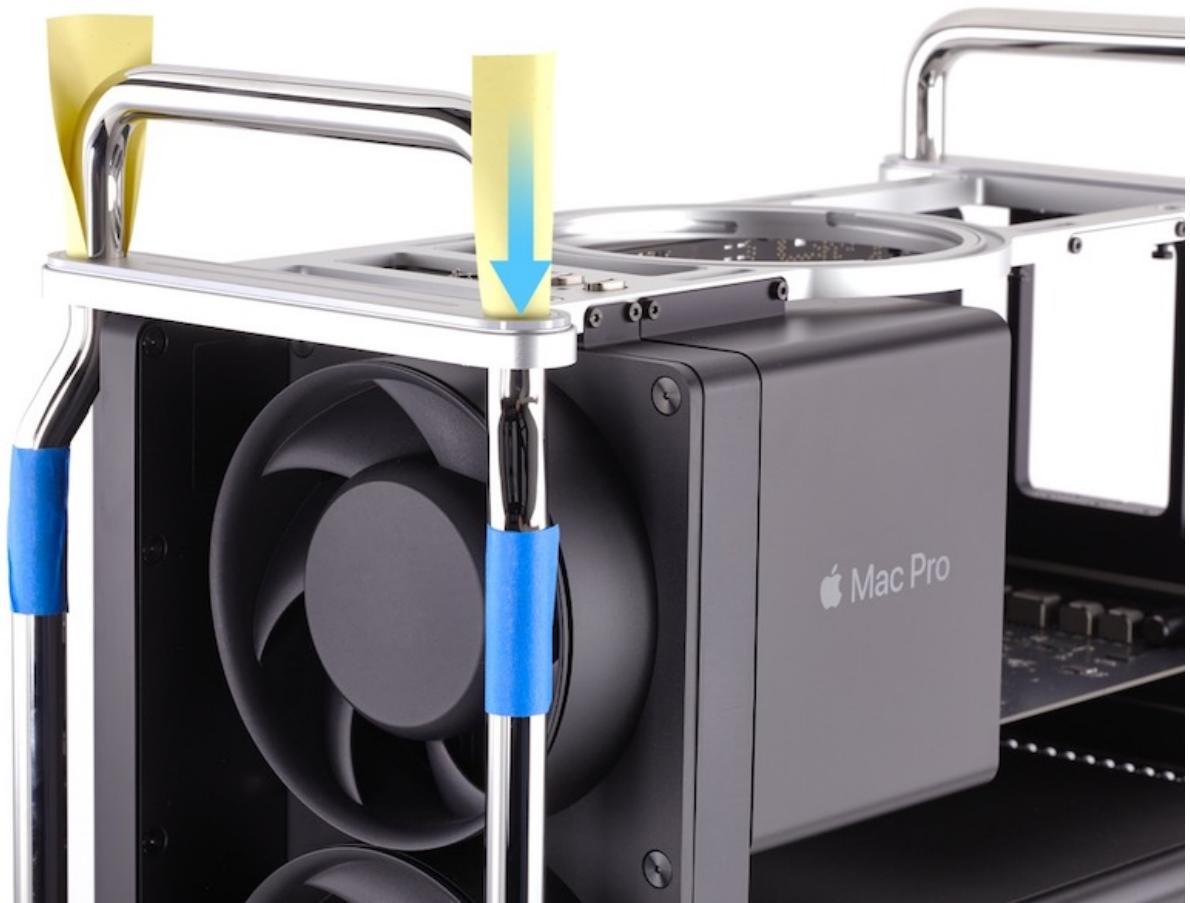


5. Lift the handle off of the space frame.



### Steps For Reassembly

1. Position the handle in the top plate. Cut two sticky notes in half. Insert the shorter edges of the sticky notes in the gap between the handle and the antenna.



2. To ensure the handle is properly aligned, alternate tightening the two 4 mm hex screws. Then remove the sticky notes.



3. Remove the painter's tape.



4. Reinstall the [housing](#).

# Feet and Wheels

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- The feet are shown in the images below, however the removal and reassembly steps are the same for the wheels.



**Warning:** Don't install wheels if the Mac Pro weighs more than 50 pounds (23 kg). Computers that weigh more than 50 pounds don't comply with safety standard stability requirements, if they're on wheels. Heavier computers should rest on the standard feet.

### Remove:

- [Housing](#)



## Tools

1. Painter's tape (1-inch or 2.5 cm wide)
2. 4 mm hex bit (923-04197)
3. Flexible driver (923-04009)



## Steps For Removal

1. Wrap painter's tape around the space frame bars, just above the screw hole. Then lay the computer flat with the PCIe side facing up.



2. Insert the 4 mm hex bit into the opening and feel that it secures to the screw.



3. Completely unscrew four 4 mm hex screws and remove the foot.

**Note:** The screws are captive and remain in place inside the space frame bar.



4. Repeat this step if you are removing the other feet.



### Steps For Reassembly

1. Position the feet so that the two pins line up with the holes on the bottom plate screw.



2. Hold the feet so that the pins stay engaged and fully tighten the four 4 mm hex screws.



3. Remove the painter's tape.



4. Reinstall the [housing](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Apple I/O Card

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- For optimum ventilation, space cards out as you install them. If you remove a card and don't install a replacement, place a slot cover (923-03426) over the empty slot to keep foreign objects out of the enclosure. An uncovered slot affects the airflow that cools the internal components, and may cause damage.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)



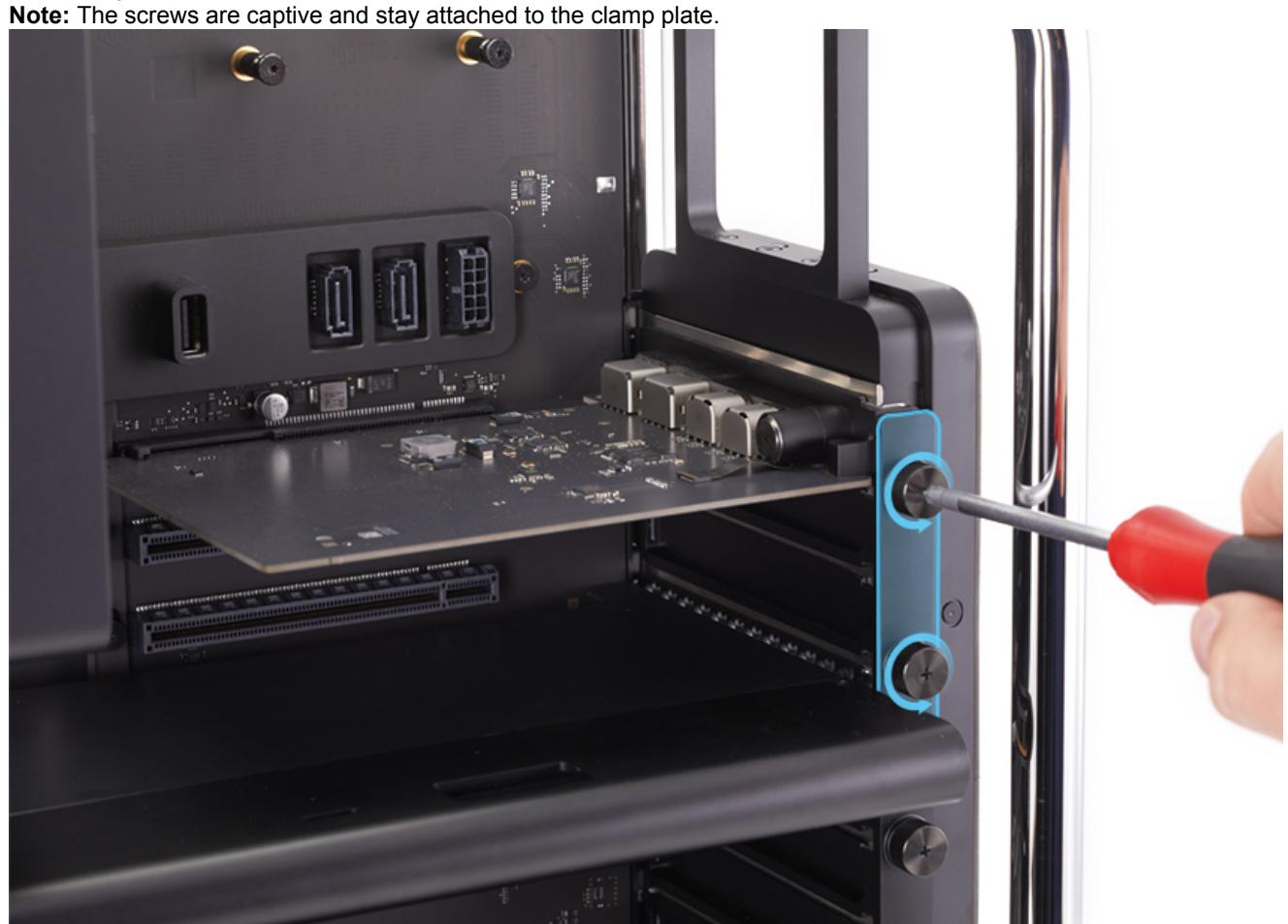
## Tools

1. Phillips #1 screwdriver

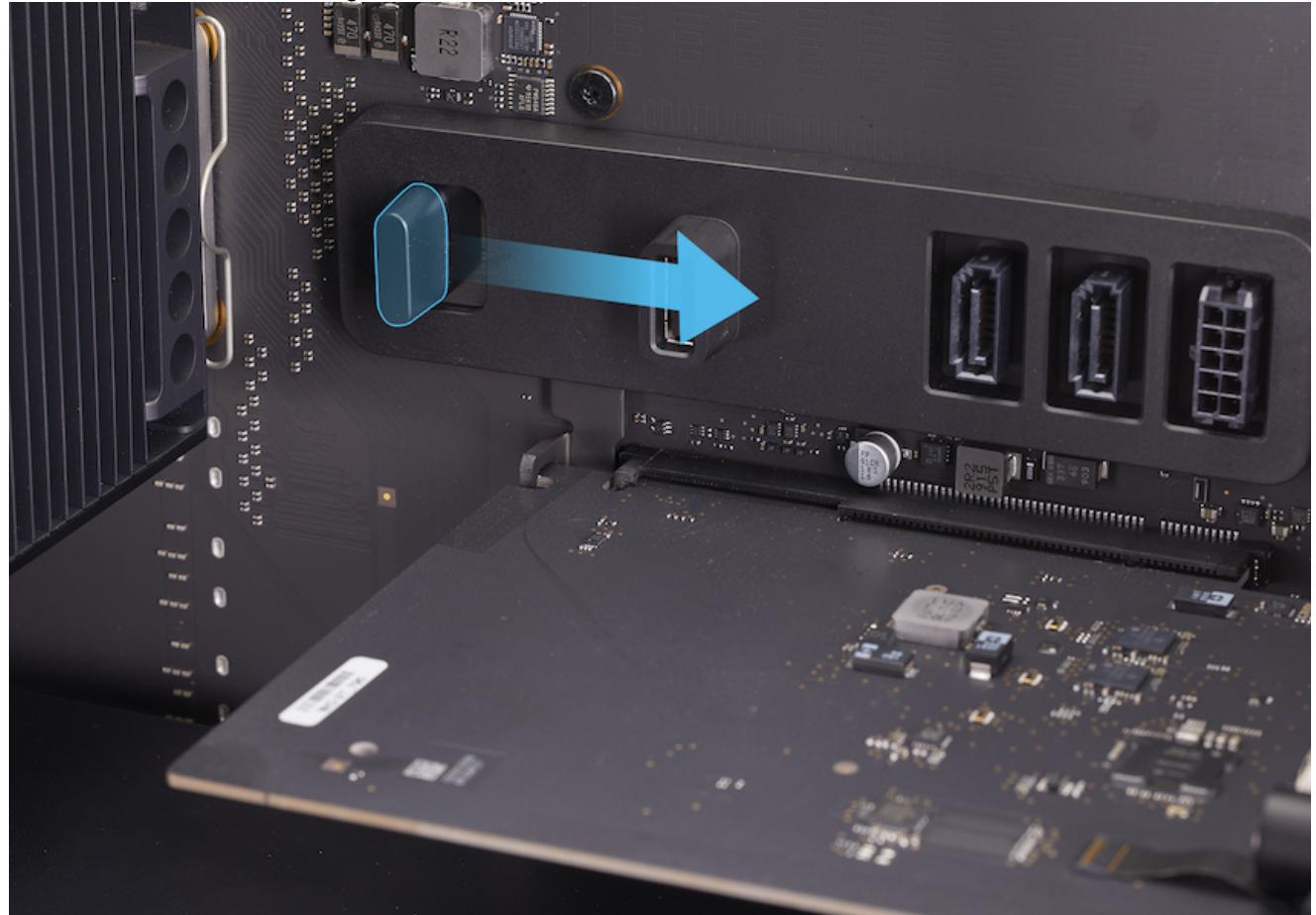


## Steps For Removal

1. Completely unscrew two Phillips #1 screws to remove the upper clamp plate.



2. Slide the PCIe retention latch right to unlock it.



3. Grasp the edges of the Apple I/O (AIO) card and pull it straight out.

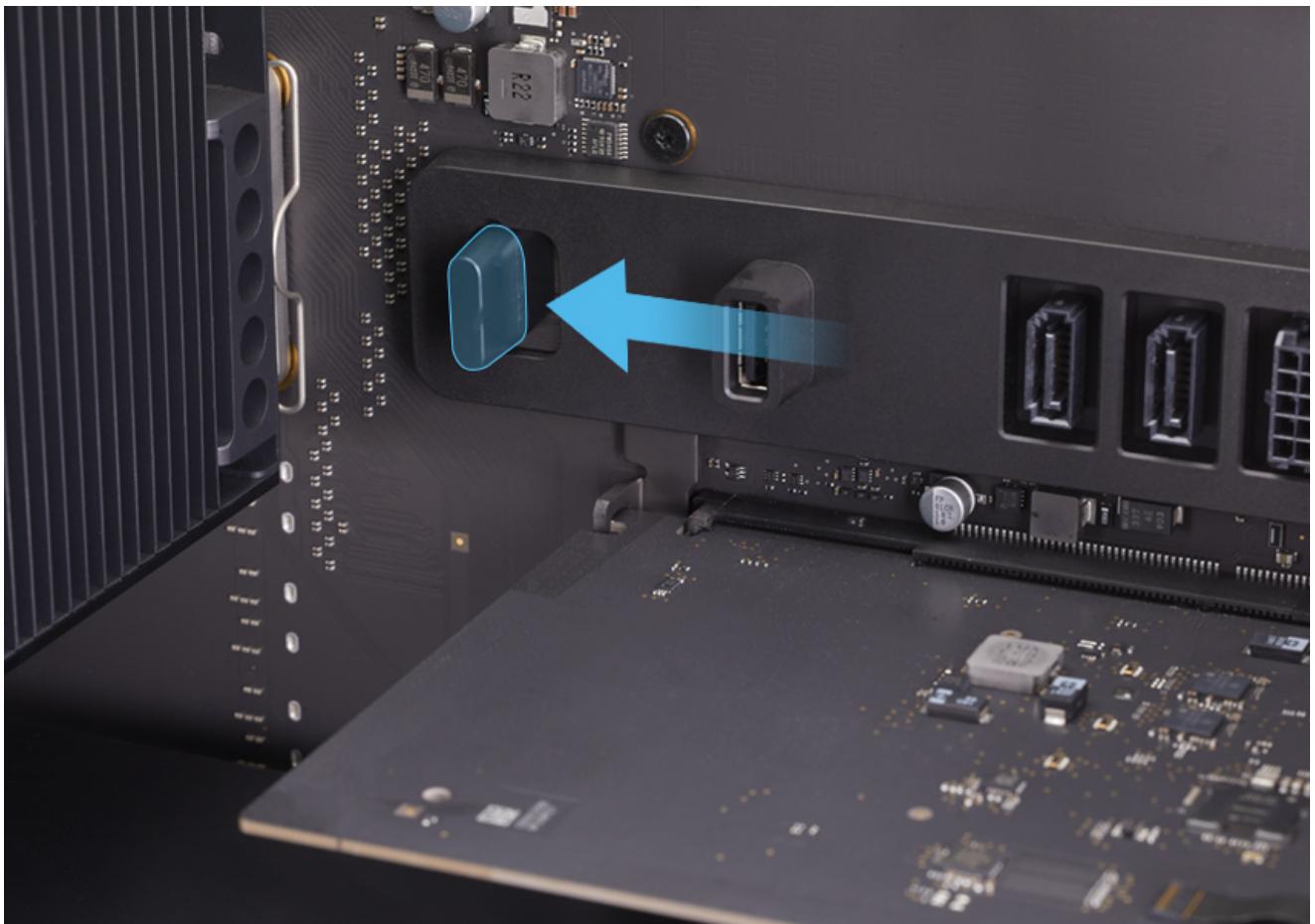


## Steps For Reassembly

1. Install the AIO card into the #8 PCIe slot. Push firmly and evenly until the card is fully seated.



2. Slide the PCIe retention latch left to lock it.



3. Reinstall the upper clamp plate and fully tighten the two Phillips #1 screws.



4. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Apple Afterburner

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- For optimum ventilation, space cards out as you install them. If you remove a card and don't install a replacement, place a slot cover (923-03426) over the empty slot to keep foreign objects out of the enclosure. An uncovered slot affects the airflow that cools the internal components, and may cause damage.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)



## Tools

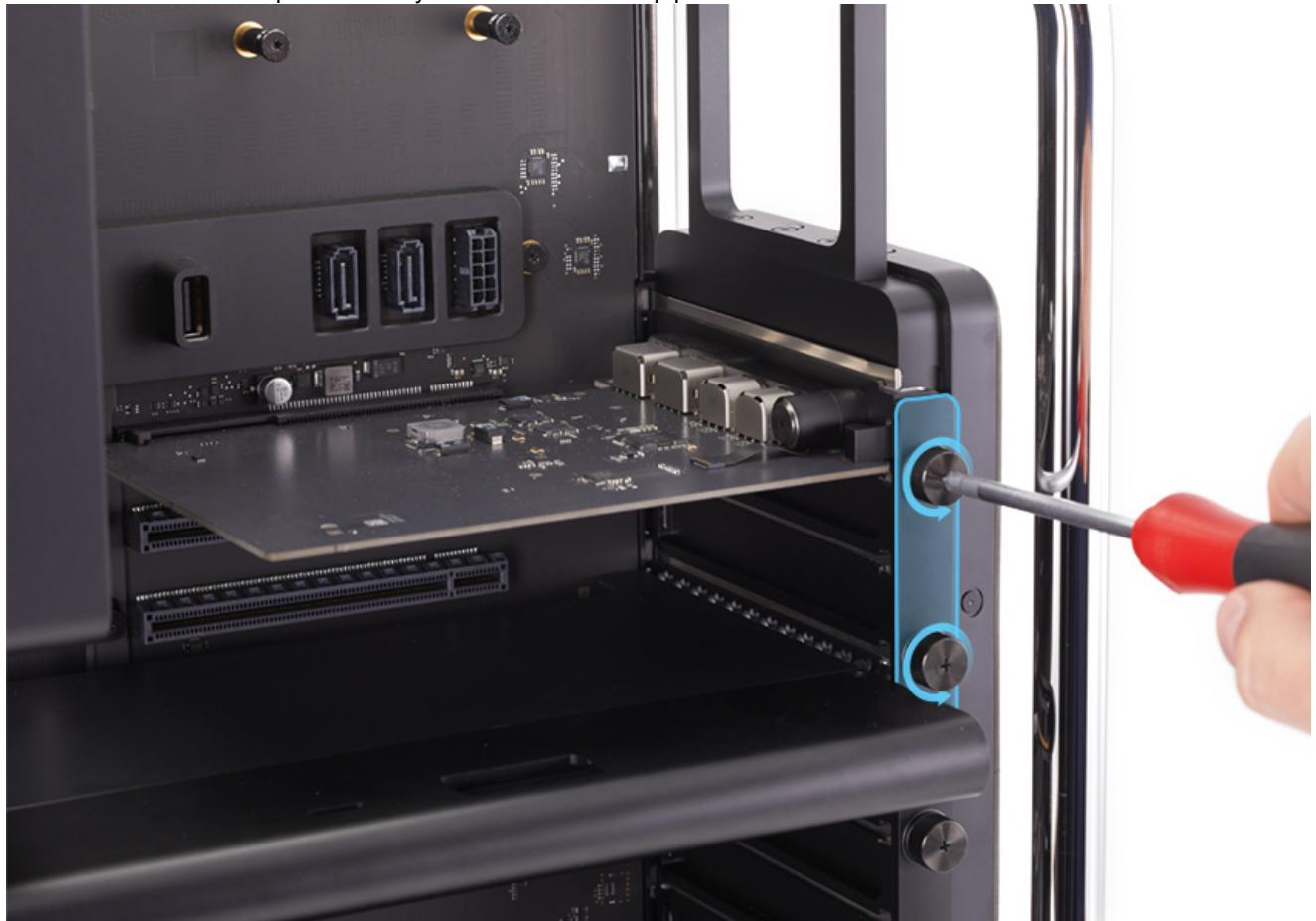
1. Phillips #1 screwdriver



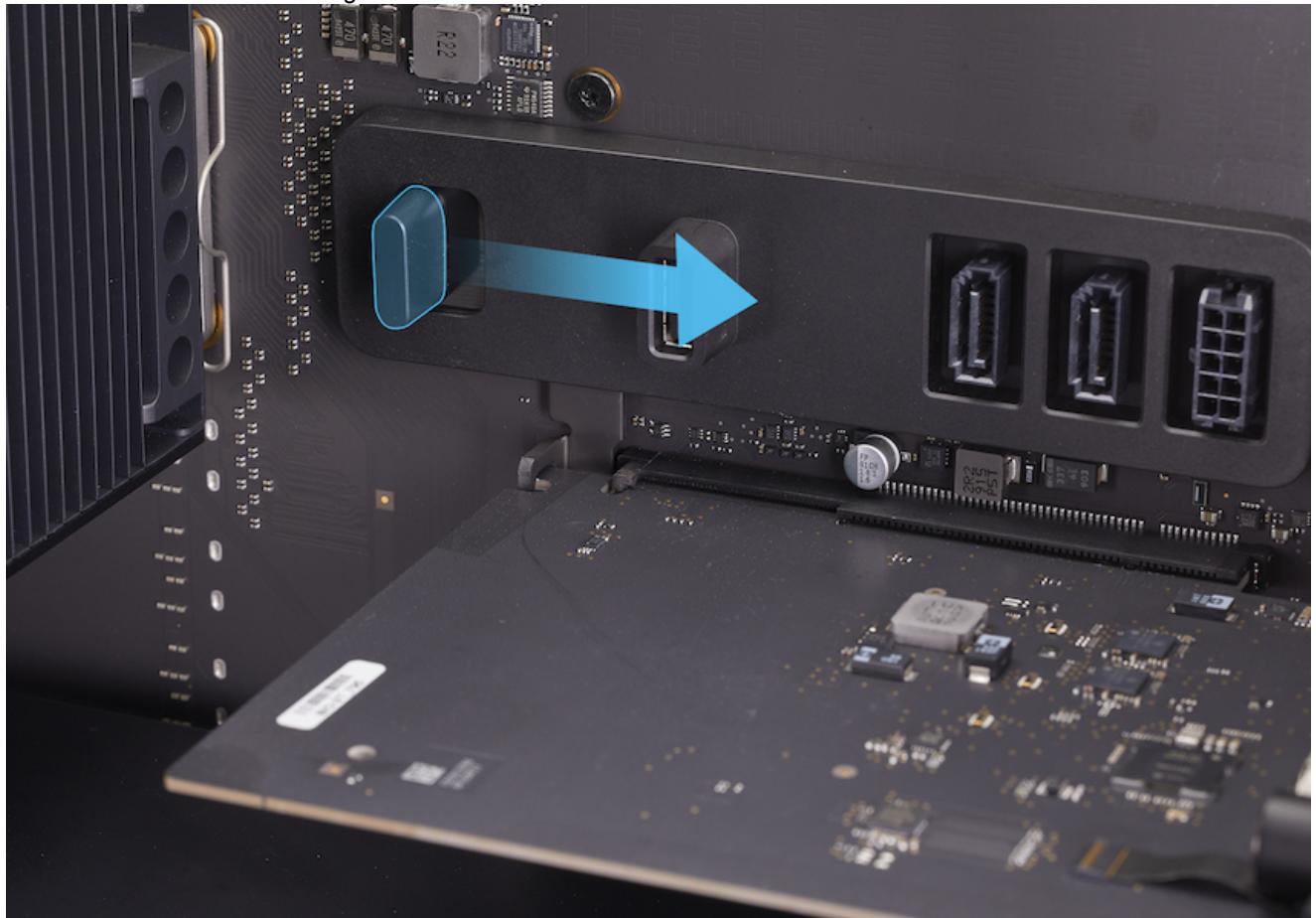
## Steps For Removal

1. Completely unscrew two Phillips #1 screws to remove the upper clamp plate.

**Note:** The screws are captive and stay attached to the clamp plate.



2. Slide the PCIe retention latch right to unlock it.



3. Grasp both sides of the Apple Afterburner card and pull it straight out.

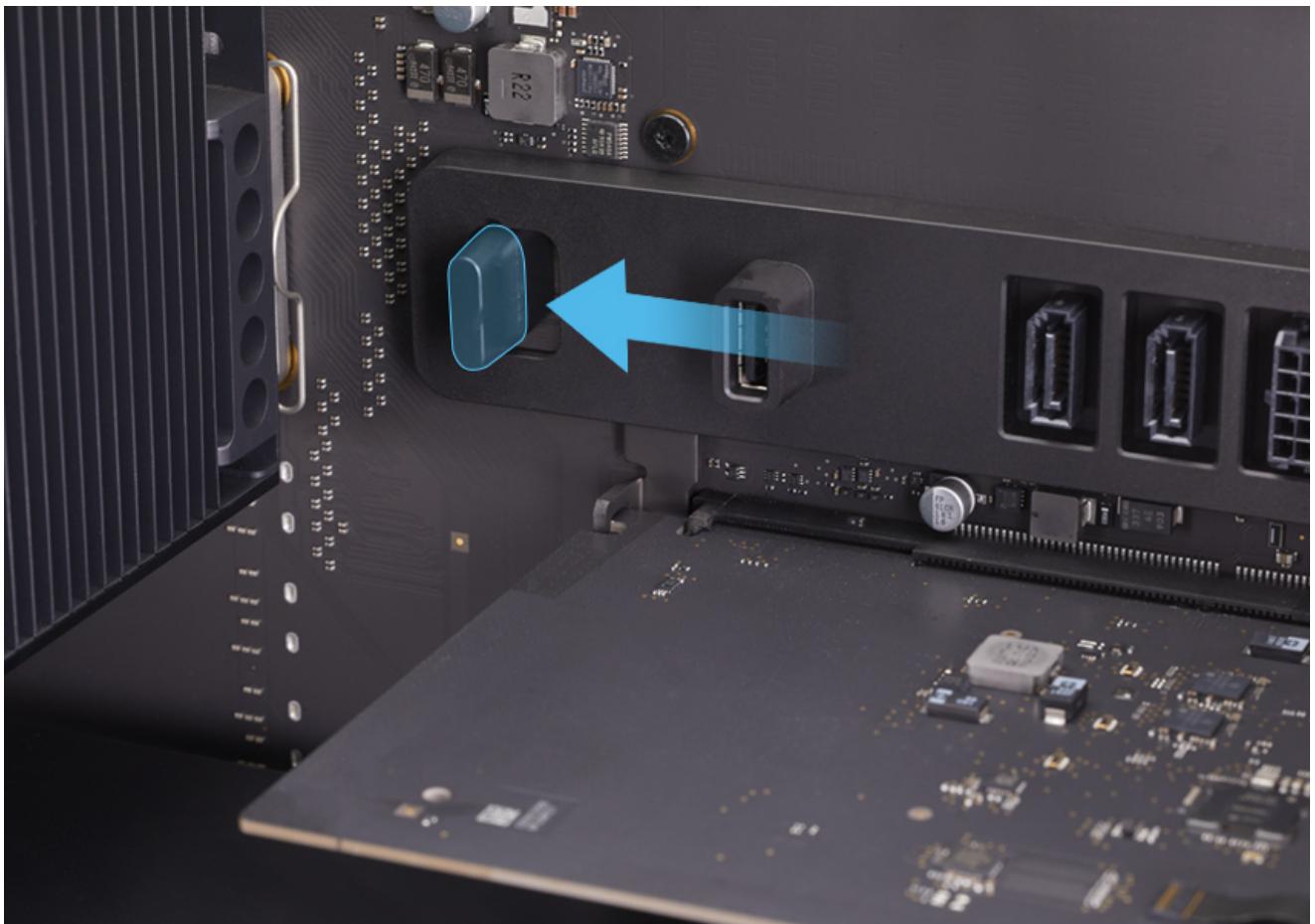


## Steps For Reassembly

1. For optimum performance, install the Apple Afterburner card in #5 PCIe slot. Push firmly and evenly until the card is fully seated.



2. Slide the PCIe retention latch left to lock it.



3. Reinstall the upper clamp plate and fully tighten the two Phillips #1 screws.



4. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) MPX Modules

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- For optimum ventilation, space cards out as you install them. If you remove a card and don't install a replacement, place a slot cover (923-03426) over the empty slot to keep foreign objects out of the enclosure. An uncovered slot affects the airflow that cools the internal components, and may cause damage.
- Depending on how the Mac Pro is configured, multiple MPX modules may be installed. Images in this procedure show one MPX module, but the repair steps are the same for all.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)



## Tools

1. Phillips #1 screwdriver



## Steps For Removal

**Important:** If an Infinity Fabric Link bridge or jumper is installed, remove it and set it aside before proceeding.

- Use a Phillips #1 screwdriver to rotate the lock screws to the unlocked position.
- Pull the Infinity Fabric Link bridge straight off and away from the MPX modules. Set it aside for reuse.

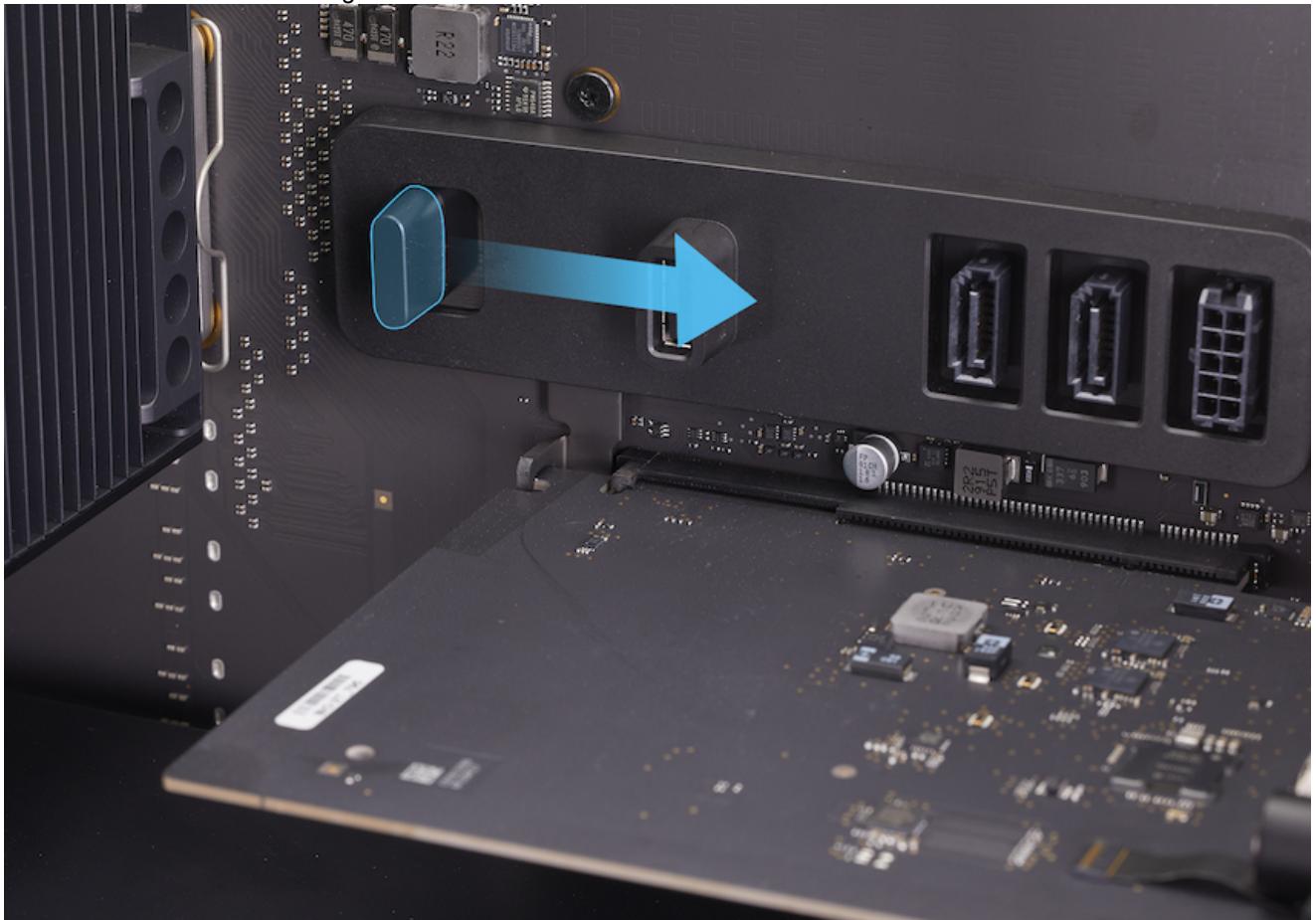


1. Completely unscrew four Phillips #1 screws to remove the left clamp plate and two Phillips #1 screws to remove the right clamp plate.

**Note:** The screws are captive and stay attached to the clamp plates.



2. Slide the PCIe retention latch right to unlock it.



3. Push to reveal the eject lever, then pull the lever to disconnect the MPX module from the logic board.



4. Grasp both sides of the MPX module and pull it straight out.



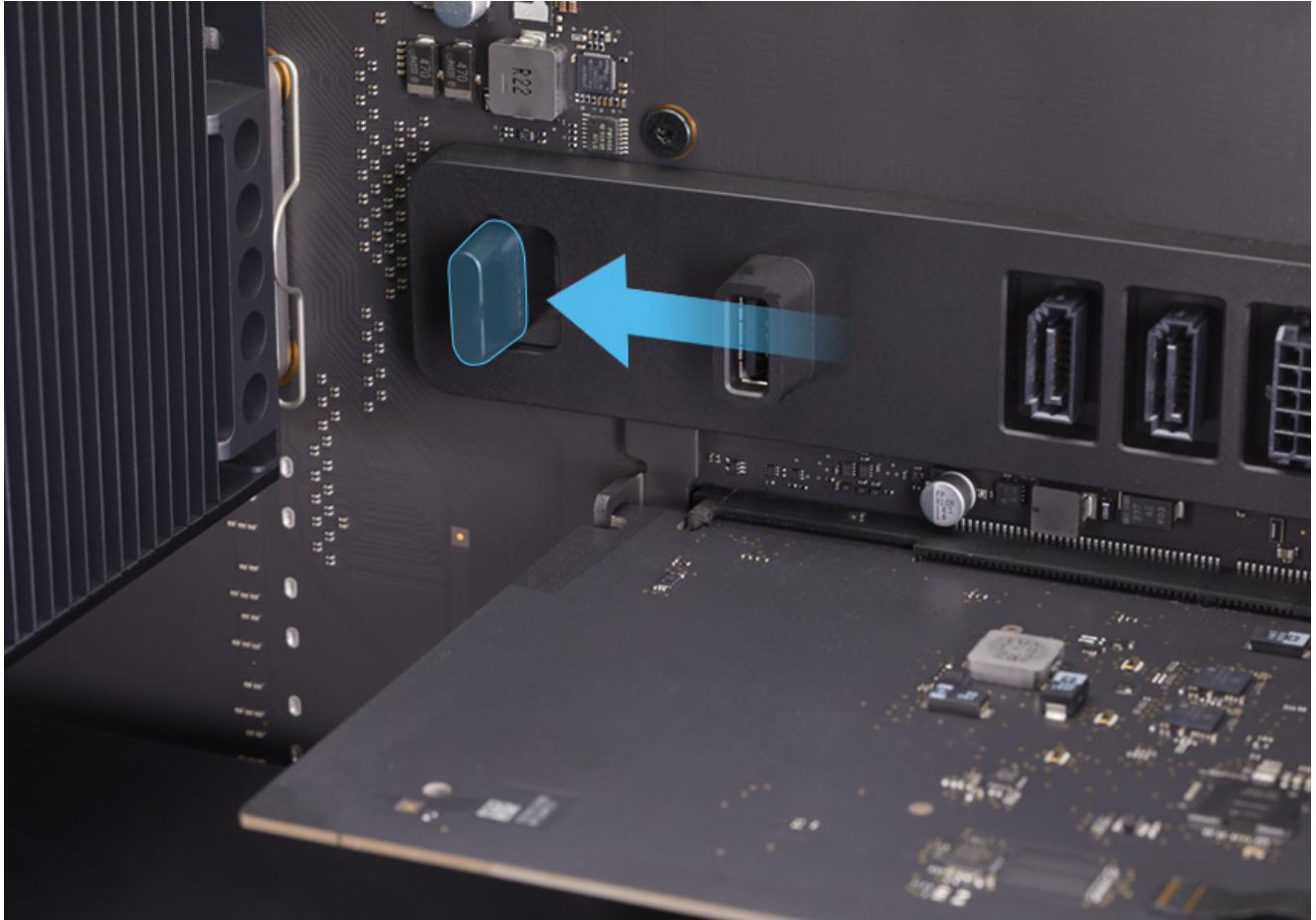
## Steps For Reassembly

**Important:** For optimal performance, install MPX modules in #1 and #3 PCIe slots.

1. Install the MPX module in the intended PCIe slot. Push firmly and evenly until the MPX module is fully seated.  
**Caution:** Ensure the eject lever is flush with the front edge of the module. You may damage components if you attempt to install the MPX module with the lever open.



2. Slide the PCIe retention latch left to lock it.



3. Position the left and right clamp plates and fully tighten the Phillips #1 screws.



**Important:** If an Infinity Fabric Link bridge or jumper was installed, be sure to transfer it to the replacement MPX module.



4. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Power Supply

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)



## Tools

1. Black stick
2. Phillips #1 screwdriver
3. Torx T8 screwdriver



## Steps For Removal

1. Completely unscrew four Phillips #1 screws to remove the left clamp plate and two Phillips #1 screws to remove the right clamp plate.

**Note:** The screws are captive and stay attached to the clamp plate.



2. Remove one T8 screw from the power supply grounding bracket.



3. Place the flat end of a black stick behind the left side of the power supply and grasp the right side with your fingers. Pull the power supply straight out.



## Steps For Reassembly

**Important:** Check the power supply gasket for any damage or misalignment before replacing the power supply. The image below shows the MPX module removed from slot #1 to more clearly see the location and condition of the gasket. You do not need to remove the MPX module unless closer inspection of the gasket is required.



1. Position the power supply in the space frame. Push firmly and evenly until the power supply is fully seated.



2. Reinstall the one T8 screw (923-03408) in the power supply grounding bracket.



3. Position the left and right clamp plates and fully tighten the Phillips #1 screws.



4. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Coin Battery

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)
- [MPX Modules](#)



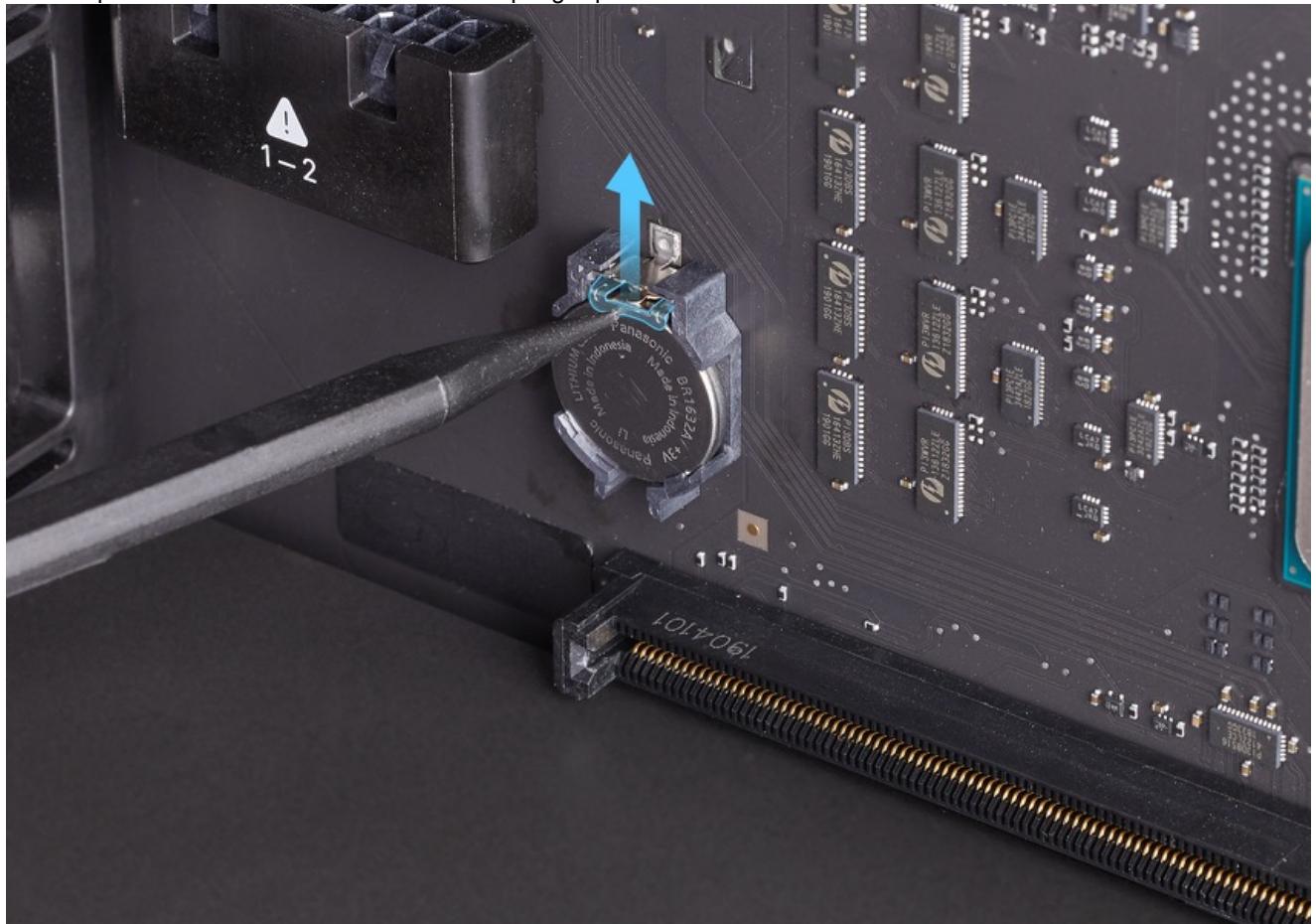
## Tools

1. Black stick



## Steps For Removal

1. Use the pointed end of a black stick to lift the spring clip.

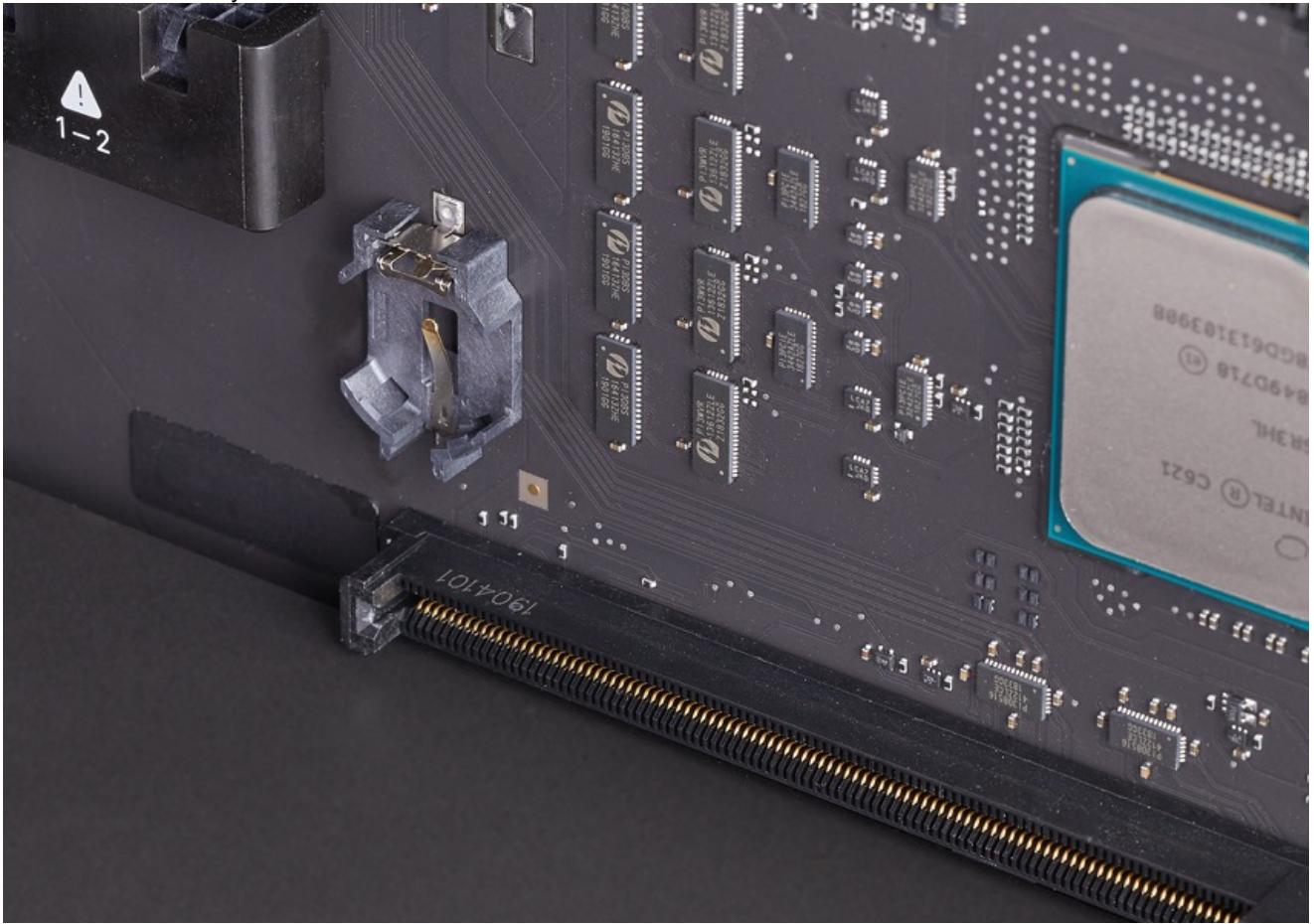


2. Place the pointed end of a black stick behind the battery to remove it from the socket.



## Steps For Reassembly

1. Check that the battery socket is free of debris.



2. Insert the coin cell battery under the spring clip, then press it into the battery socket.



**Warning:** Install only a BR1632A coin battery. If the battery is installed incorrectly or replaced with an incorrect type of

battery, there is a risk of explosion. Dispose of used batteries according to local environmental laws and guidelines.

**Note:** Effective immediately, some coin cell batteries used on Mac systems are now available only from electronics parts distributors (for example, Arvato). If the coin battery needs to be replaced, please order it from an electronics parts distributor.

3. Reinstall the [MPX modules](#).
4. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Memory

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, memory access panel only)



## Tools

1. Compressed air (recommended)



## Steps For Removal

1. Slide the DIMM cover latch to the left and pull the DIMM cover toward you.



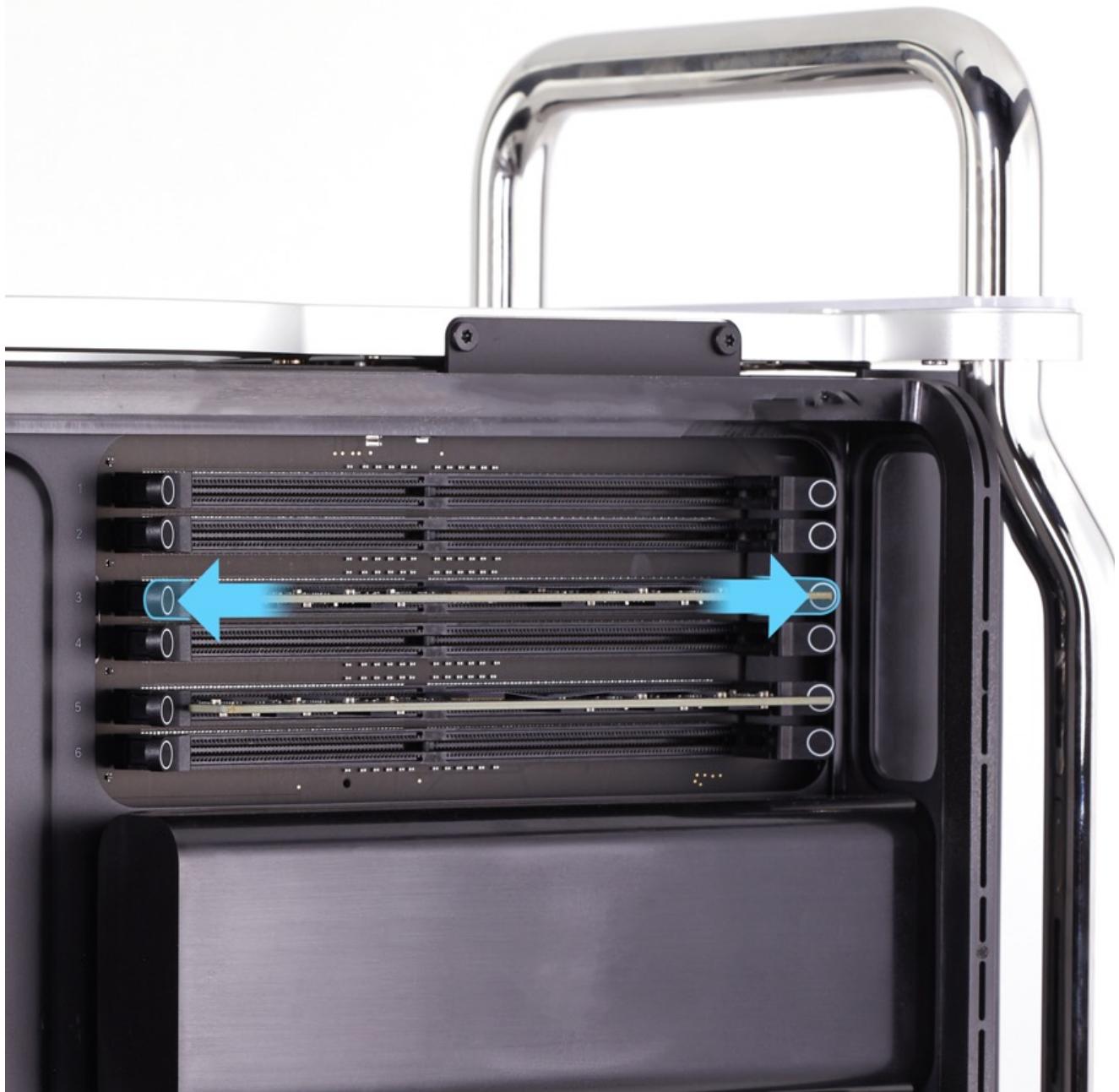
2. Slide the DIMM cover slightly to the left, then pull it straight out and away from the DIMMs.



3. Repeat steps 1 and 2 to remove the bottom DIMM cover.



4. Push the DIMM ejectors on both sides of the DIMM you want to remove.



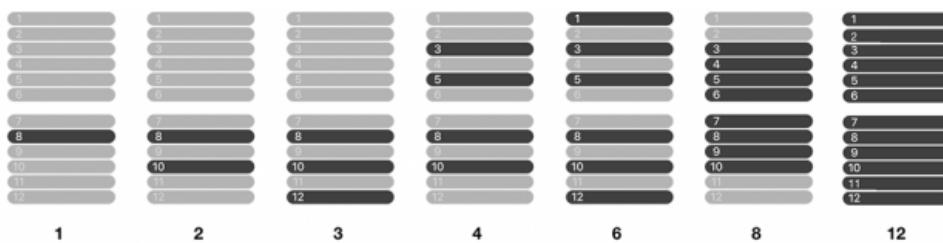
5. Grasp the DIMM by the edges and pull it straight out.

**Caution:** Don't touch the gold connectors on the DIMMs. Handle the DIMMs by the edges only.



## Steps For Reassembly

**Important:** DIMMs must be installed in specific configurations. Refer to the configuration chart below and the [Mac Pro memory support page](#) (HT210103) to identify the DIMM slots that should be used.



1. Make sure the DIMM ejectors are in the open position and the DIMM slots are free of debris.  
**Important:** Use only compressed air to remove any debris.



2. Carefully align the DIMM with the intended slot and orient the DIMM so the notch matches the key in the slot. Push firmly and evenly on both sides until the DIMM ejectors click closed.

**Caution:** Pushing on a DIMM that is misaligned may damage the connectors in the DIMM slot and the small components on the edges of the DIMM.



3. Place the cover over the DIMMs. Align the right edge of the cover with the front opening (1), then push the left side to lock it into place (2).

**Important:** The left side of the DIMM cover (2) has a small slit that engages with the DIMM cover latch.



4. Reinstall the [housing](#). For the rack model, reinstall the [memory access panel](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Speaker

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, memory access panel only)



## Tools

- No tools are required for this procedure.

## Steps For Removal



**Caution:** Perform these steps slowly and carefully to avoid damaging the speaker cable. The cable connects to the back of the logic board and cannot be reconnected or replaced. Damage to the cable requires a logic board replacement.

1. Push the front of the speaker to slide it to the left.

**Important:** Avoid touching the circular speaker cone.



2. Tilt the speaker forward to access the speaker cable.



3. The cable is adhered to the back of the speaker. Gently pull up on the cable to release the adhesive.

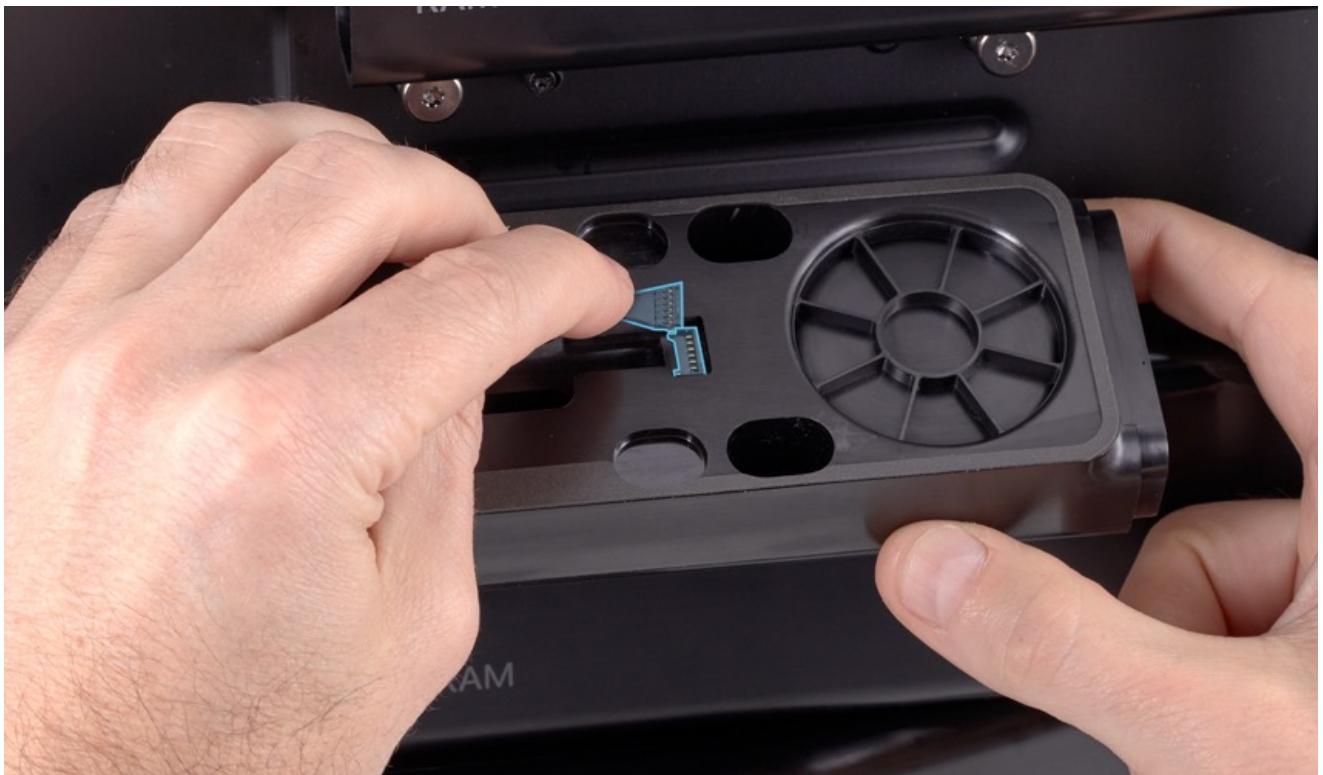


4. Pull up to disconnect the speaker cable.



### Steps For Reassembly

1. Connect the speaker cable to the speaker.



2. Press on the cable to adhere it to the back of the speaker.

**Note:** A replacement speaker comes with an adhesive backing in the speaker cable channel. Remove the backing before pressing the cable in place.



3. Align the keyhole slots on the back of the speaker with the speaker mount screws.



4. Position the right side of the speaker (1) in the front opening, then push the left side of the speaker (2) flush against the back of the logic board.



5. Push the speaker to the right to secure it in place.



6. Reinstall the [housing](#). For the rack model, reinstall the [memory access panel](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) Storage

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.



- This repair is not complete until [System Configuration](#) has been performed.
- Make sure the customer has a working backup of their data before removing or replacing the flash storage. Flash storage modules are paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Data from a damaged logic board or flash storage can sometimes be captured and [transferred before service](#).
- Flash storage modules must be replaced in pairs with the exception of the 256GB configuration, which is a single module.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, memory access panel only)



## Tools

1. Torx T8 screwdriver

The following are required for System Configuration:

2. Digital barcode scanner (923-01232)
3. USB-C to USB-C charge cable (661-06670)
4. Mac Pro (2019) power cord (923-03314)



## Steps For Removal

1. Squeeze the bottom of the blower duct to release one snap-fit hook.



2. Push the flash storage cover to release two snap-fit hooks on the front edge of the blower duct, then tilt the bottom edge of the duct toward you.



3. Ensure the tab hook on the top left corner (1) is free from the slot in logic board wall, then pull the blower duct straight out (2).



4. Remove the flash storage cover.



5. Remove two T8 screws, one from each flash storage module.

**Note:** The 256GB configuration only has one flash storage module installed in the top connector.



6. Pull the flash storage modules straight out of the connectors.

**Caution:** Do not tilt the flash storage modules when removing them from the connectors. A damaged connector requires a logic board replacement.



### Steps For Reassembly



**Important:** If replacing the flash storage:

- For [System Configuration](#) add the parts to the repair and scan the QR codes on the known bad board (KBB) and known good board (KGB) flash storage modules.



1. Install the module marked **01** in the bottom connector.



2. Install the module marked **00** in the top connector.

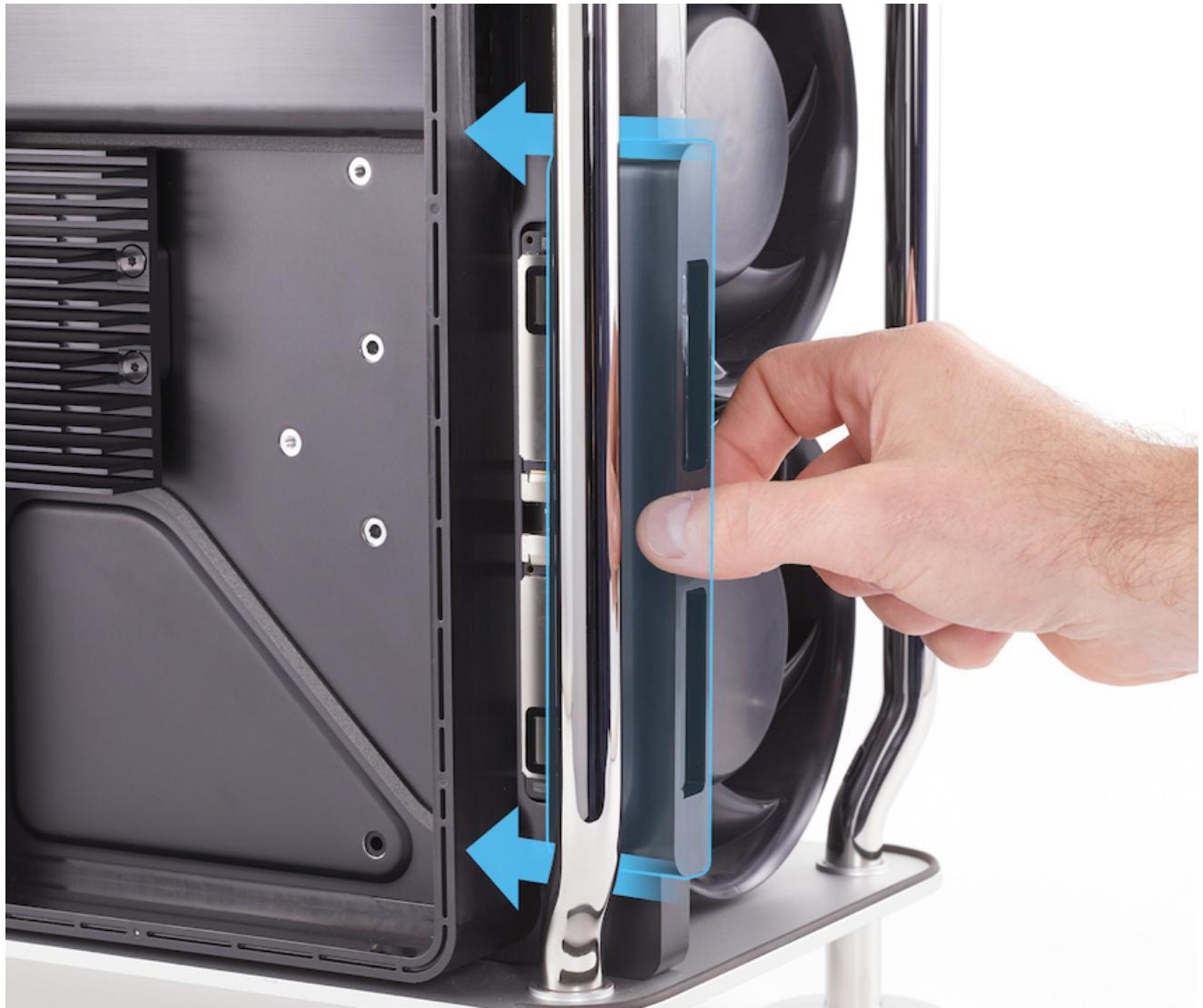


3. Reinstall the two T8 screws (923-03425).





4. Slide the flash storage cover into place.



5. Insert the tab hook on the blower duct into the slot in the logic board wall.



6. Push the front of the flash storage cover to align the slots with the two snap-fit hooks on the blower duct.



7. Push on the bottom of the blower duct until the bottom snap-fit hook snaps into place.



8. Reinstall the [housing](#). For the rack model, reinstall the [memory access panel](#).
9. The repair is not complete until [System Configuration](#) has been performed.



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< > 📖 [diagnostics.apple.com](https://diagnostics.apple.com) ⌂ + ⌄

Diagnostic Console John Appleseed

## Diagnostic Suites

POST-REPAIR

Full System Diagnostic (EFI)  
Performs comprehensive testing of hardware functionality and memory module integrity. ⓘ 30-90 minutes ➤

Full System Diagnostic (OS)  
Performs comprehensive testing of hardware and graphics functionality. ⓘ 15-30 minutes ➤

REPAIR COMPLETION

 System Configuration  
Completes required configuration of applicable service parts and updates firmware after repair. This suite becomes available after service part serial numbers are saved in a repair. For more information refer to TP1657: System Configuration. ⓘ 1-10 minutes ➤

# Mac Pro (2019) and Mac Pro (Rack, 2019) Blower

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

Mac Pro (2019)

Mac Pro (Rack, 2019)

- |  |  |
|--|--|
| <ul style="list-style-type: none"><li>• <a href="#">Housing</a></li><li>• <a href="#">MPX Modules</a></li><li>• <a href="#">Power Supply</a></li></ul> | <ul style="list-style-type: none"><li>• <a href="#">Top Cover and Memory Access Panel</a></li><li>• <a href="#">Apple Afterburner</a> (if installed)</li><li>• <a href="#">MPX Modules</a></li><li>• <a href="#">Power Supply</a></li><li>• <a href="#">CPU Thermal Module</a></li><li>• <a href="#">System Fans</a></li><li>• <a href="#">Logic Board with Internal Frame</a></li></ul> |
|--|--|



## Tools

1. Torx T8 screwdriver



## Steps For Removal

1. Fully loosen three captive T8 screws.

**Note:** The screws are visible through holes in the logic board and will remain in place when fully loosened.



2. Rotate the computer to access the other side. Squeeze the bottom of the blower duct to release one snap-fit hook.



3. Push the SSD cover to release two snap-fit hooks on the front edge of the blower duct, then tilt the bottom edge of the duct toward you.



4. Ensure the tab hook on the top left corner (1) is free from the slot in logic board wall, then pull the duct straight out (2).

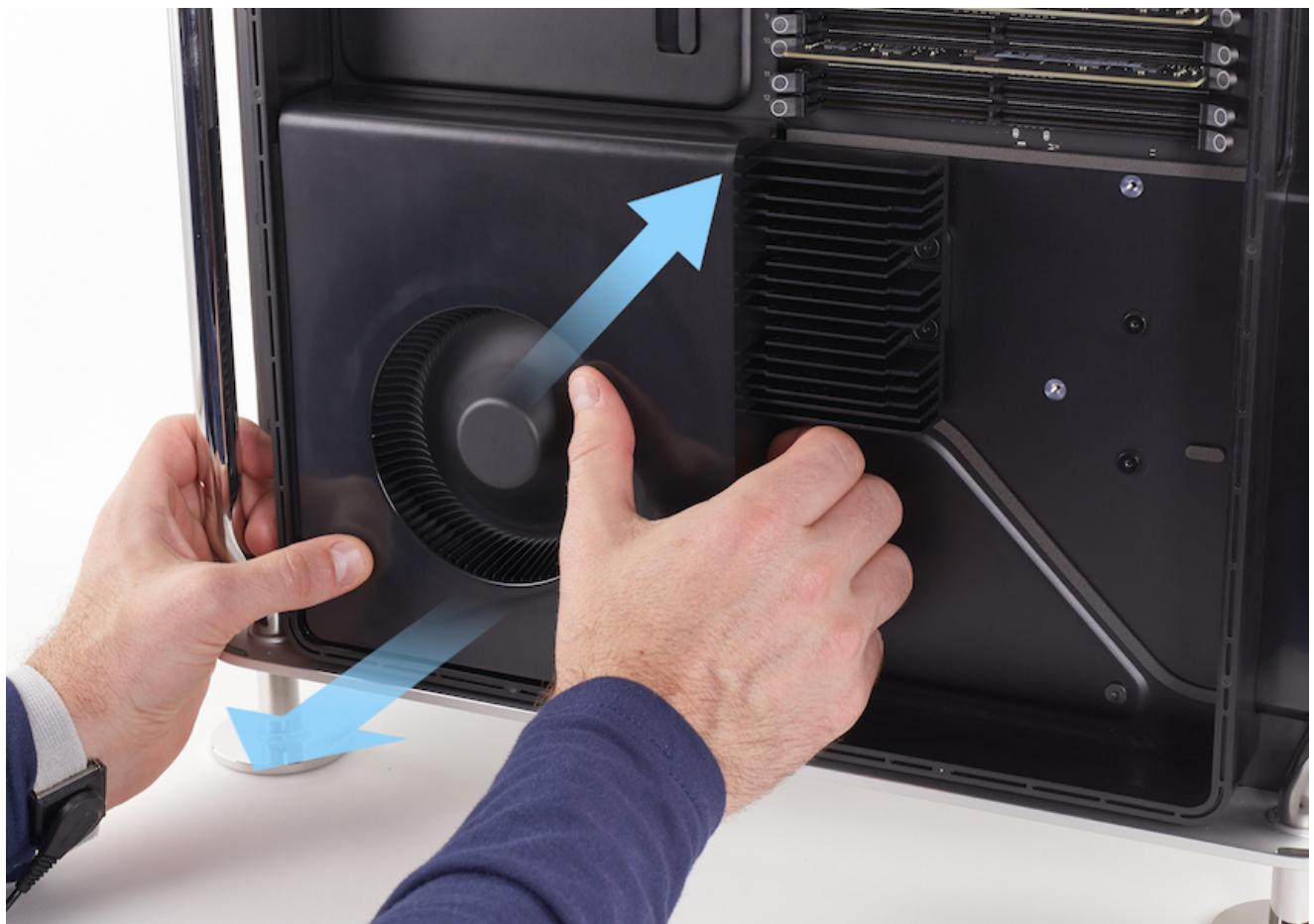


5. Remove the bottom DIMM cover.



6. Push the blower up and to the right, then pull it straight out.

**Note:** If the blower does not move freely, ensure the screws are fully loosened.



## Steps For Reassembly

**Important:** Check for damage to the blower contact springs. You will need to replace the logic board if the springs are damaged. Verify the oval grommet is positioned correctly. If needed, use a black stick to fix the grommet so it is not pinched or protruding.



1. Insert the mounting pin into the oval grommet and push the blower flush.



2. Position the computer with the system fans facing you. Insert the T8 screwdriver in screw hole #2. Push the blower forward while turning the screwdriver. When you feel the screw engage, **partially** tighten it.



3. Insert the T8 screwdriver in screw hole #3. Push down on the blower while turning the screwdriver. When you feel the screw engage, **partially** tighten it.



4. Insert the T8 screwdriver in screw hole #1. Push the blower into the bottom corner while turning the screwdriver. When you feel the screw engage, **partially** tighten it.



5. After all three screws are engaged, **fully** tighten them.



6. Insert the tab hook on the blower duct into the slot in the logic board wall.



7. Push the front of the SSD cover to align the slots with the two snap-fit hooks on the blower duct.



8. Push on the bottom of the blower duct until the bottom snap-fit hook snaps into place.



**Continue reassembly for Mac Pro (2019)**

9. Reinstall the [power supply](#).
10. Reinstall the [MPX modules](#).
11. Reinstall the [housing](#).

**Continue reassembly for Mac Pro (Rack, 2019)**

9. Reinstall the [logic board with internal frame](#).
10. Reinstall the [system fans](#).
11. Reinstall the [CPU thermal module](#).
12. Reinstall the [power supply](#).
13. Reinstall the [MPX modules](#).
14. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
15. Reinstall the [top cover and memory access panel](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) CPU Thermal Module

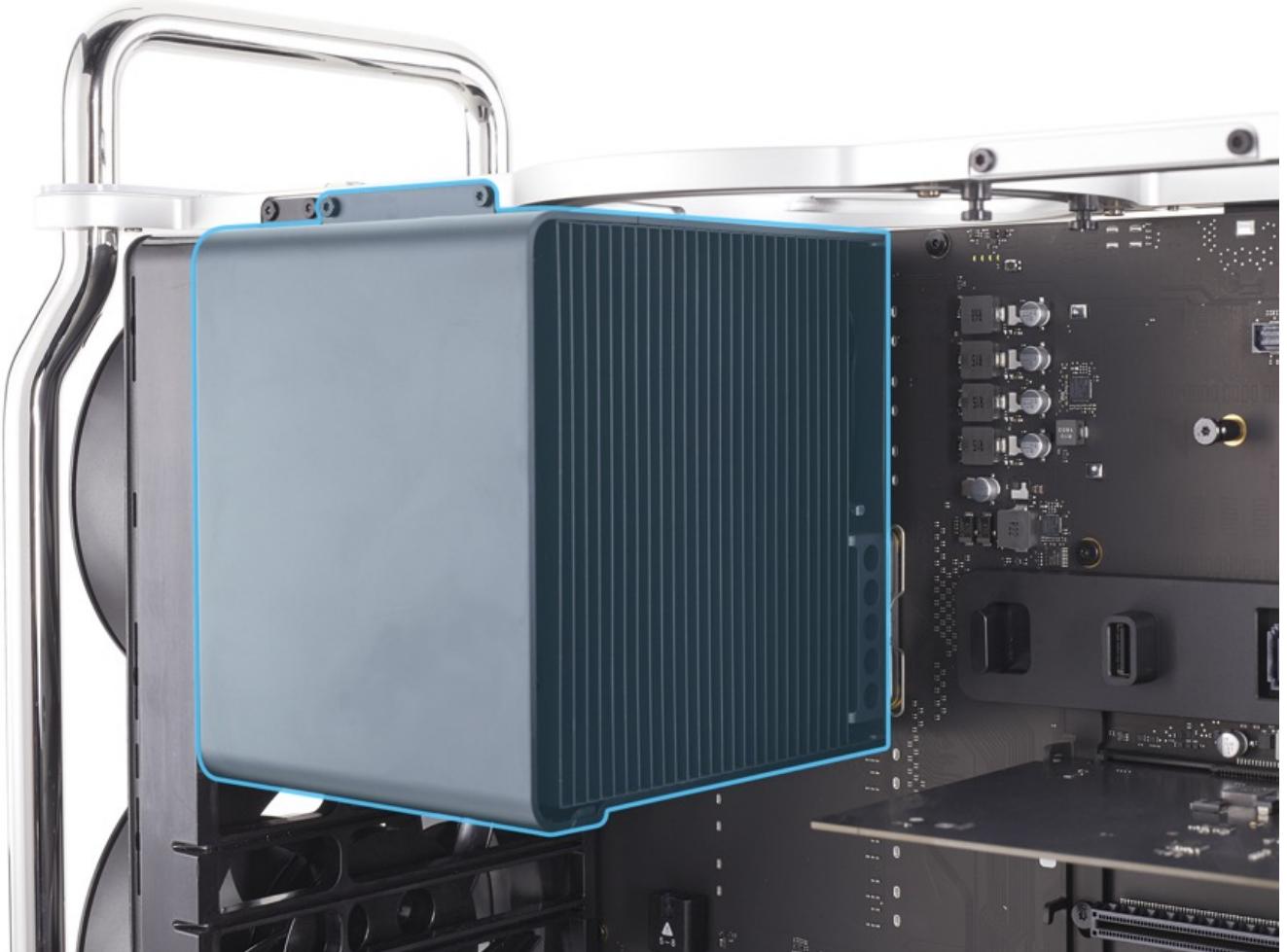
## First Steps

### Important:

- Only [Apple-certified technicians](#) (OP1859) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)



## Tools

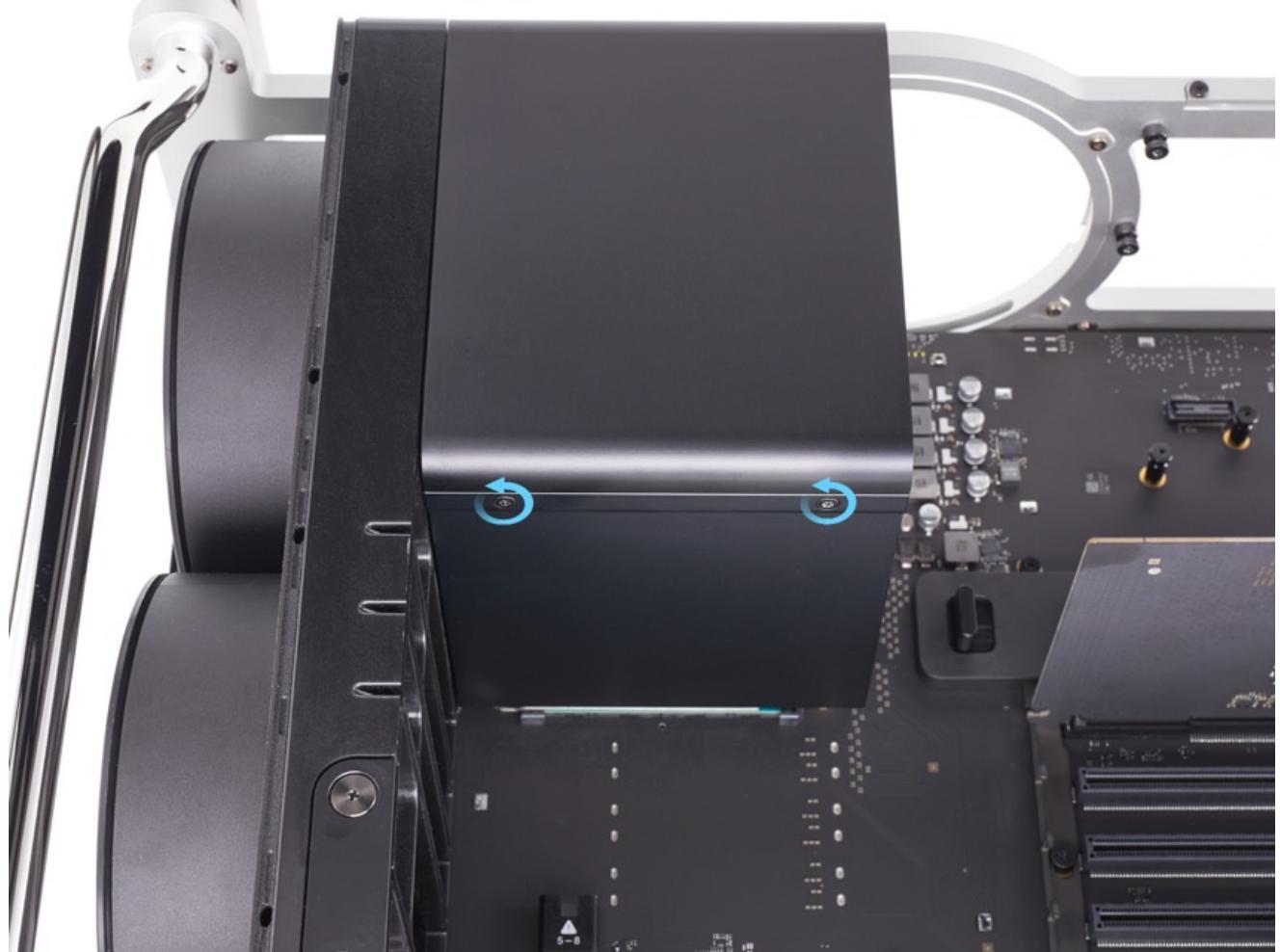
1. Torx T8 screwdriver
2. Torx T15, 152 mm bit, (923-03294)
3. Adjustable torque driver (0.3–1.2 Nm), (923-0735)
4. Thermal paste
5. Isopropyl alcohol (IPA) wipe

**Note:** The thermal kit (076-00449) is included with the CPU thermal module service part and contains IPA wipes and thermal paste.



## Steps For Removal

1. Remove two T8 screws from the bottom of the CPU thermal module cover.



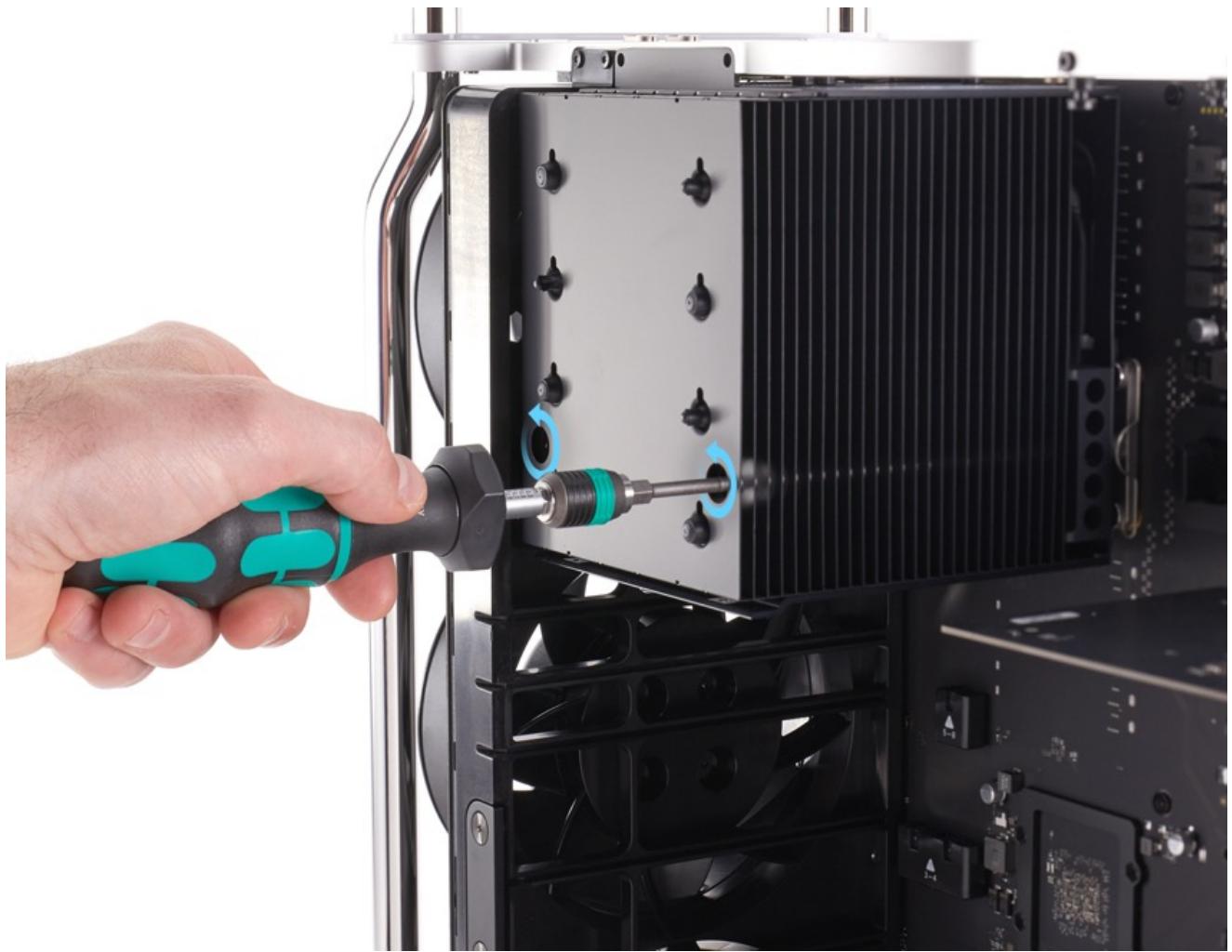
2. Pull the bottom of the cover, then lift it up and off the top of the thermal module.



3. Remove two T8 screws from the top of the thermal module.



4. Use the adjustable torque driver set to 1.2 Nm with the Torx T15, 152 mm bit to remove two T15 screws.



5. Slide the thermal module straight out of the enclosure.

**Note:** The bond created by the thermal paste may cause some resistance.



Use IPA wipes to completely remove the thermal paste from the contact plate of the thermal module and the CPU.

6. Use IPA wipes to completely remove the thermal paste from the contact plate of the thermal module and the CPU.



### Steps For Reassembly

1. A new thermal module ships with a protective film over the copper plate. Remove the film and apply a full syringe of thermal paste in a thick horizontal line across the plate.



2. Align the guide rail of the thermal module with the bridge plate rail screws, then slide it into place.



3. Use the adjustable torque driver set to 1.2 Nm to reinstall the two T15 screws (923-03406).



**Caution:** Install the screws in the following order to ensure the thermal paste is distributed evenly:

1. Partially install the right screw until it is hand-tight.
2. Fully install the left screw until you hear the torque driver click.
3. Then fully tighten the right screw until you hear the torque driver click.





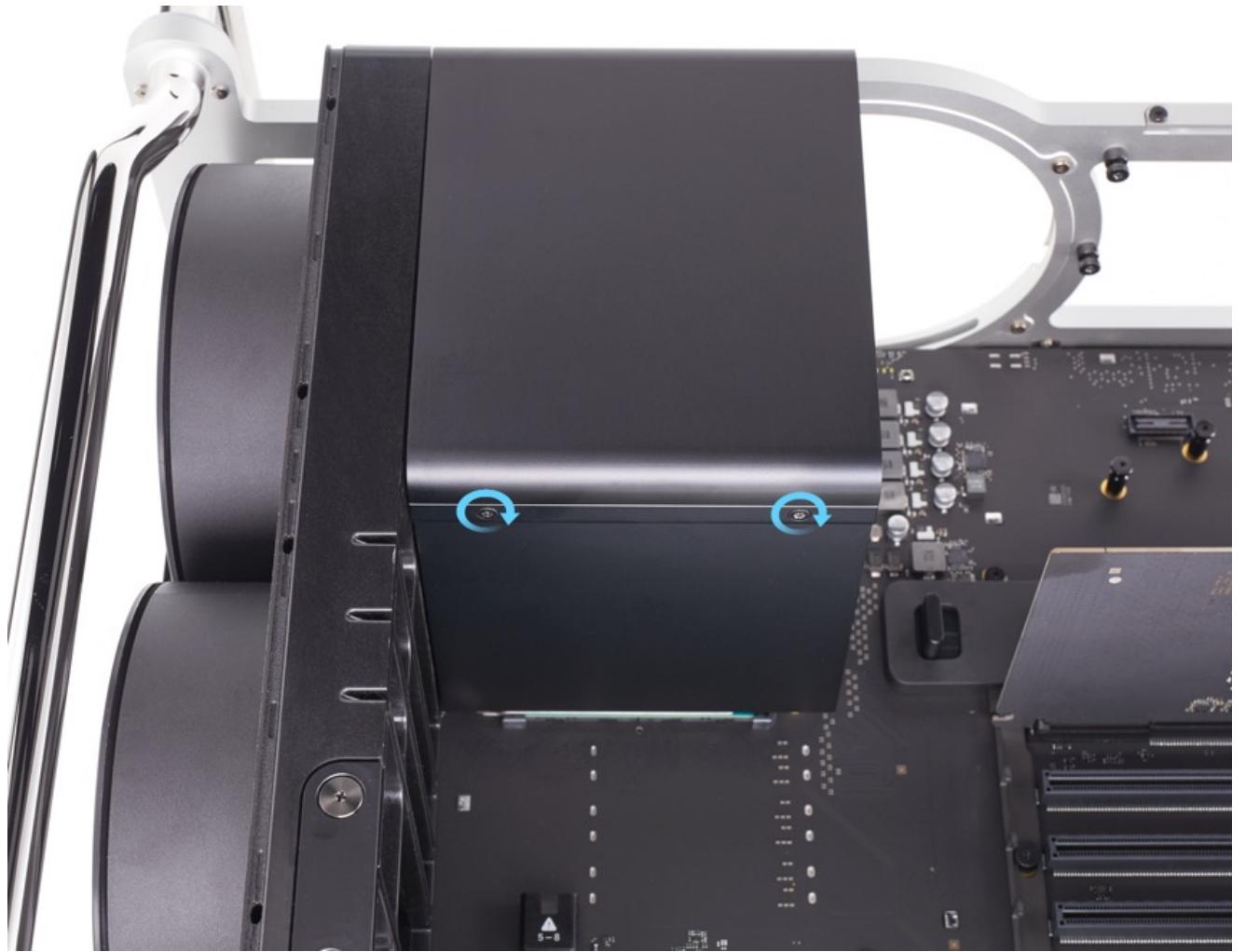
4. Reinstall the two T8 screws (923-03421) in the top of the thermal module.





5. Place the cover over the CPU thermal module, then reinstall the two T8 screws (923-03410).





6. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) CPU

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure.
- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model, top cover only)
- [CPU Thermal Module](#)



## Tools

1. Isopropyl alcohol (IPA) wipe
2. Compressed air (optional)



## Steps For Removal

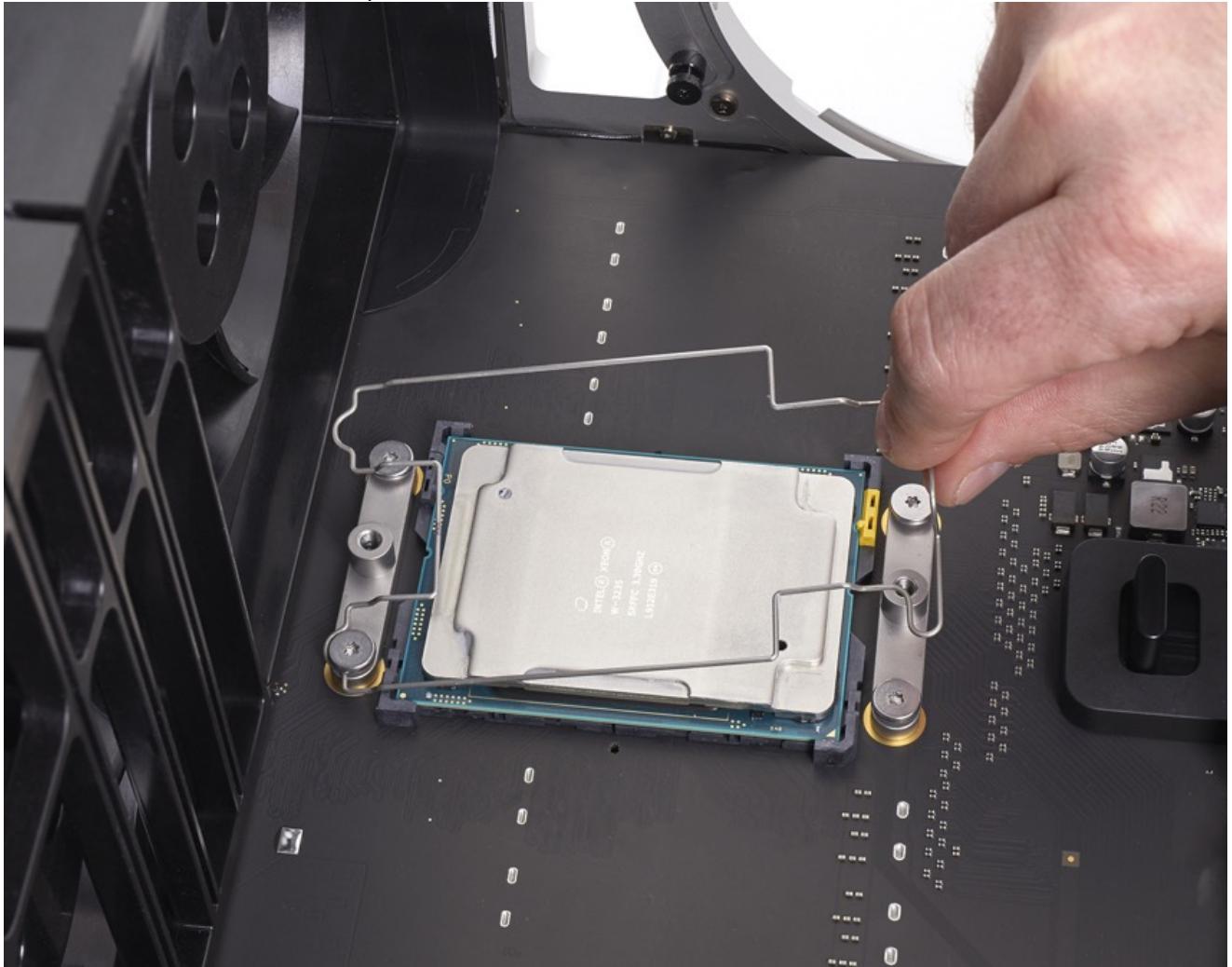
**Caution:** Don't loosen or remove the CPU socket screws.



1. Lay the computer flat with the CPU facing up.
2. Pull the right side of the retention clip out from under the CPU screws.



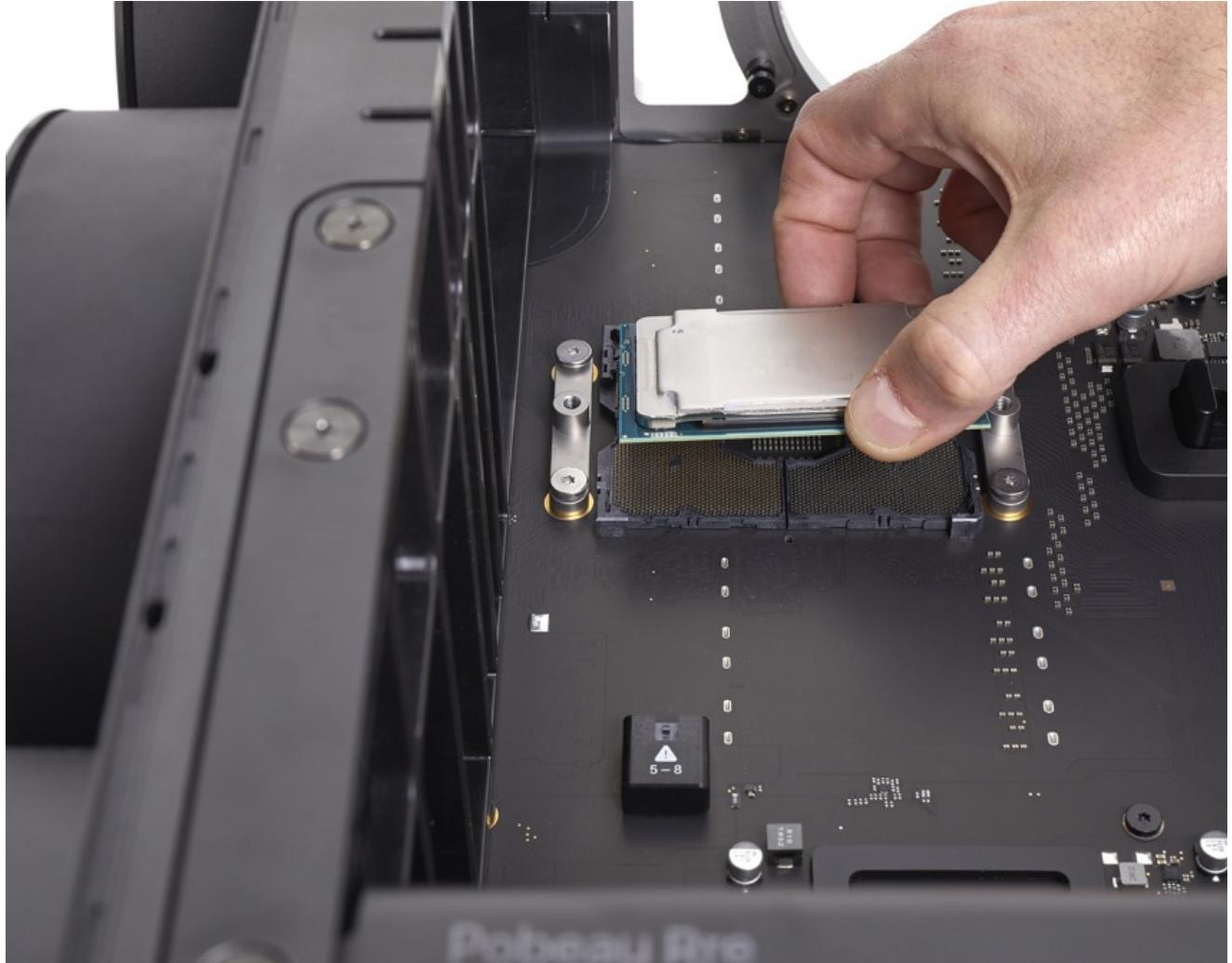
3. Push the left side of the retention clip out from under the CPU screws.



**Caution:** Follow these guidelines when removing the CPU:

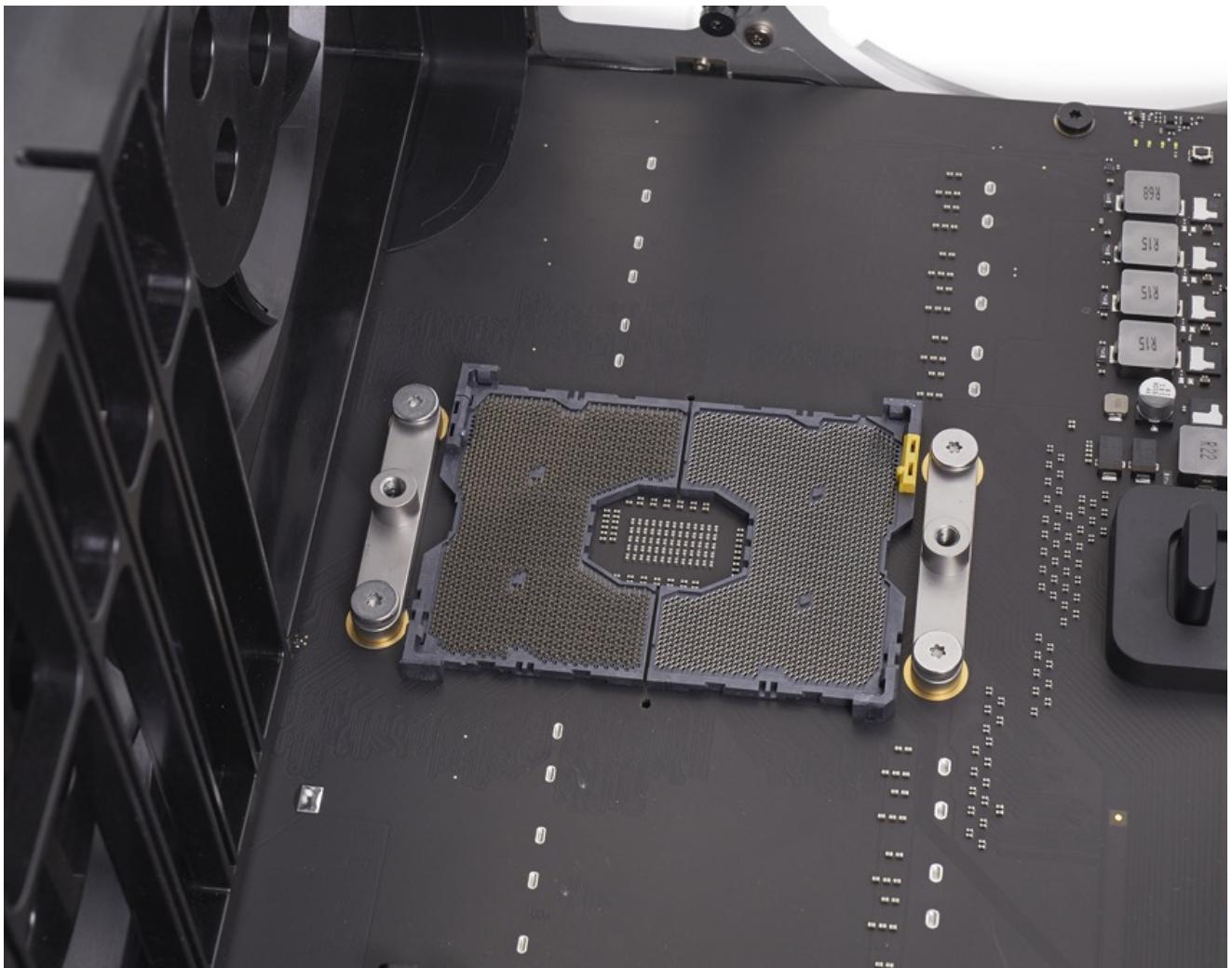
- Place the CPU in an ESD-safe bag whenever it is removed from the logic board.
- Don't touch the gold contacts on the CPU or the CPU socket.
- Use only compressed air to remove any debris.

4. Grasp the sides of the CPU and lift it out of the CPU socket.

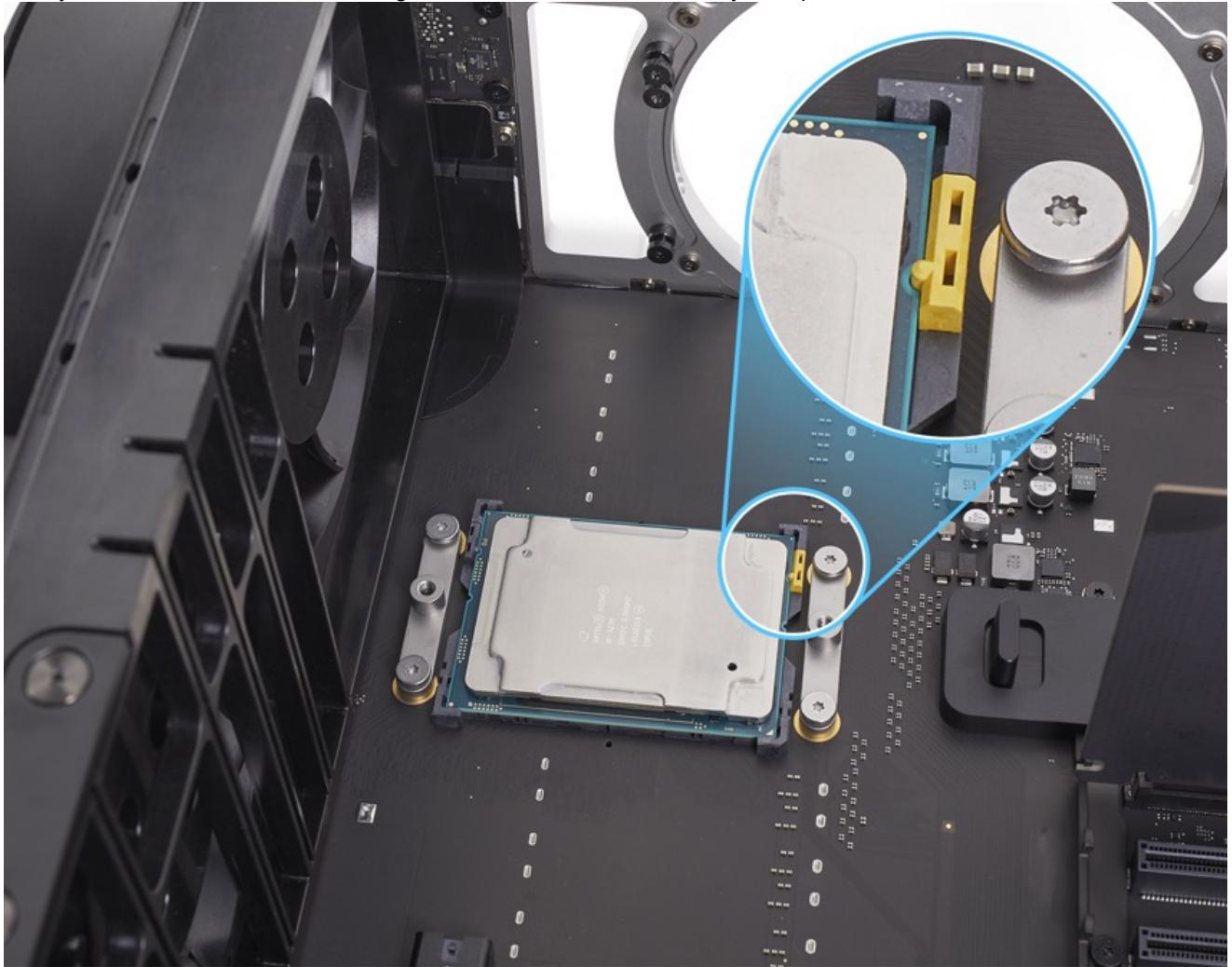


### Steps For Reassembly

1. Inspect the CPU socket for damage and debris. Use only compressed air to remove any debris.



2. Gently reinstall the CPU. Be sure to align the notch in the CPU with the yellow pin in the socket.



3. Reinstall the retention clip.



4. Reinstall the [CPU thermal module](#).
5. Reinstall the [housing](#). For the rack model, reinstall the [top cover](#).

# Mac Pro (2019) and Mac Pro (Rack, 2019) System Fans

## First Steps

### Important:

- Wear an ESD wrist strap and take precautions to avoid ESD.
- This procedure is shared between Mac Pro (2019) and Mac Pro (Rack, 2019). Images in this procedure show one model, but the steps to perform the repair are the same for both.

### Remove:

- [Housing](#)
- [Top Cover and Memory Access Panel](#) (rack model)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)



## Tools

1. Torx T8 screwdriver
2. Torx T8 bit (923-0734) (optional)

**Note:** Some of the images show a Torx T8 L-key. This tool is no longer required.



## Steps For Removal

1. Squeeze the bottom of the blower duct to release one snap-fit hook.



2. Push the flash storage cover to release two snap-fit hooks on the front edge of the blower duct, then tilt the bottom edge of the duct toward you.



3. Ensure the tab hook on the top left corner (1) is free from the slot in logic board wall, then pull the blower duct straight out (2).



4. Remove three T8 screws in the order shown.
  - 1 = long
  - 2 and 3 = medium
5. Rotate the computer to access the other side. Remove two T8 screws from the top of the system fans.



6. Remove one T8 screw from the bottom of the system fans.

**Important:** Use a standard Torx T8 screwdriver instead of the L-key shown in the image below. Slowly remove the screw, as the standard Torx T8 screwdriver will be inserted in the screw head at an angle.



**Caution:** Review steps 7 and 8 before proceeding. Perform these steps slowly to avoid damaging the top I/O flex cable

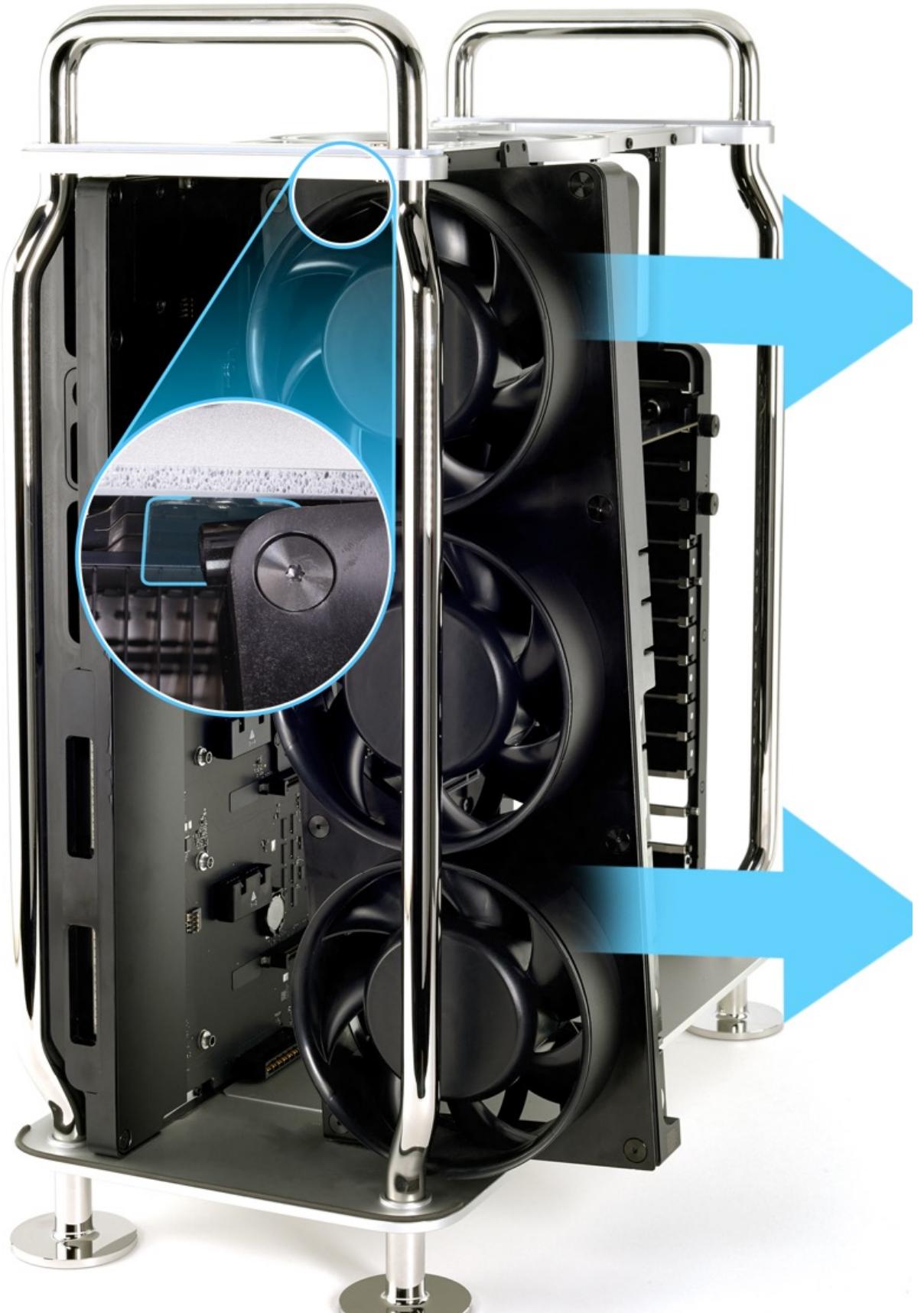
when removing the fan.



7. Pull the bottom of the system fans toward you about 1-inch (2.5 cm). Then pull the top of the system fans to separate them from the top alignment pin.



8. Avoid the top I/O flex cable by keeping the system fans at an angle as you pull them out of the space frame.



### Steps For Reassembly



**Caution:** Check the three sets of contact springs for damage. You will need to replace the logic board if any of them are damaged.



1. Avoid the top I/O flex cable by keeping the system fans at an angle as you install them.



2. Align the system fans with the lower screw standoffs. Push firmly to engage the top alignment pin.





2.

3. Reinstall one T8 screw in the bottom of the system fans.

**Important:** You can use the Torx T8 bit (923-0734) instead of the L-key shown in the image below to properly thread the screw in the screw hole. Then use a standard Torx T8 screwdriver to fully install the screw. If the Torx T8 bit (923-0734) is not available, use just the standard Torx T8 screwdriver. Slowly tighten the screw to avoid stripping it, as the standard Torx T8 screwdriver will be inserted in the screw head at an angle.

- 923-03418:



- 923-03433: Mac Pro (Rack, 2019) uses a different screw, however the location is the same.



4. Reinstall two T8 screws (923-03417) in the top of the system fans.



5. Rotate the computer to access the other side. Reinstall three T8 screws in the order shown.

- 1 and 2 = medium, (923-03404)



- 3 = long, (923-03405)



6. Insert the tab hook on the blower duct into the blind slot in the logic board wall.



7. Push the front of the flash storage cover to align the slots with the two snap-fit hooks on the blower duct.



8. Push on the bottom of the blower duct until the bottom snap-fit hook snaps into place.



9. Reinstall the [power supply](#).
10. Reinstall the [MPX modules](#).
11. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
12. Reinstall the [housing](#). For the rack model, reinstall the [top cover and memory access panel](#).

# Top I/O Flex Cable

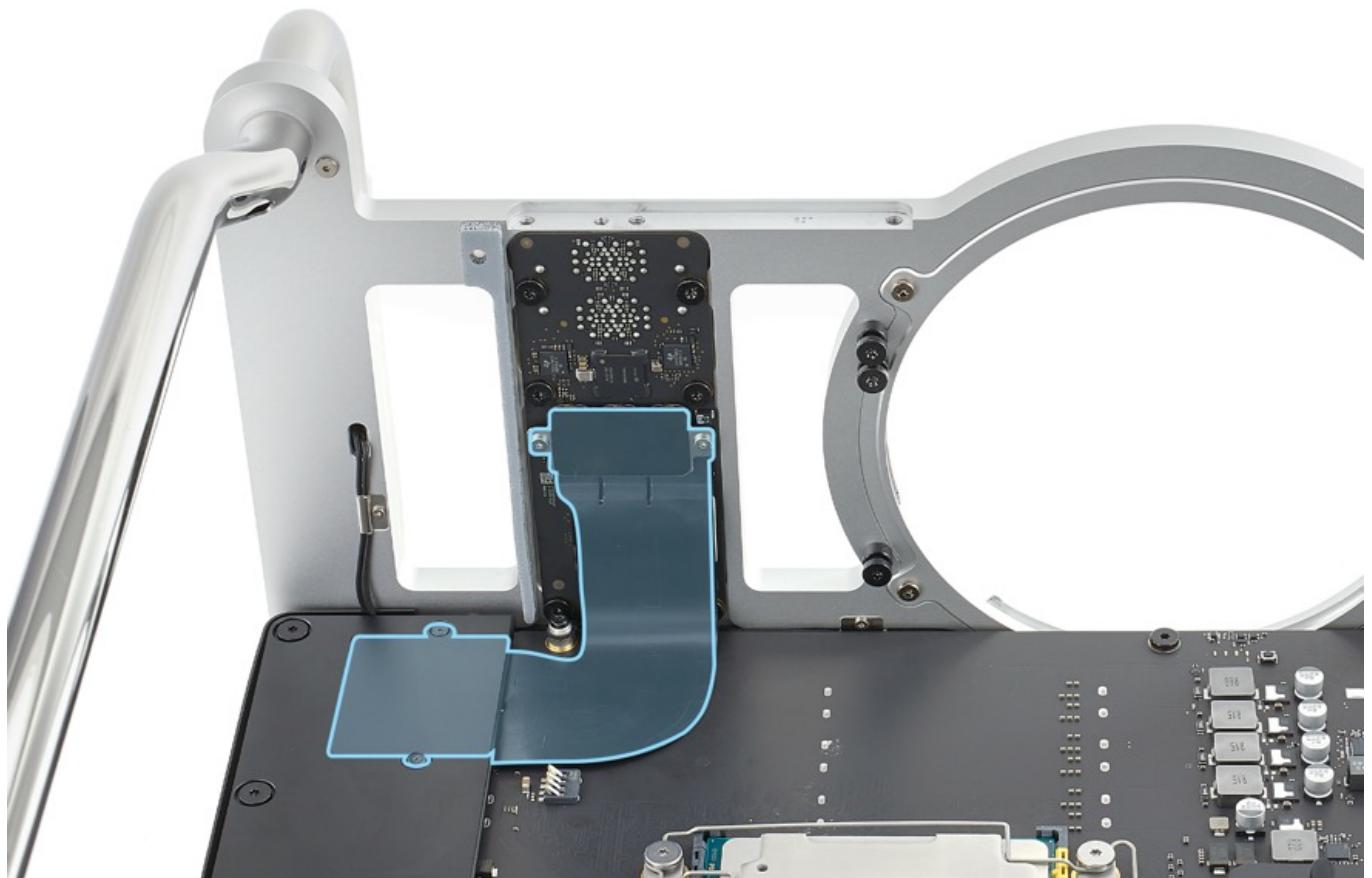
## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Housing](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [CPU Thermal Module](#)
- [System Fans](#)



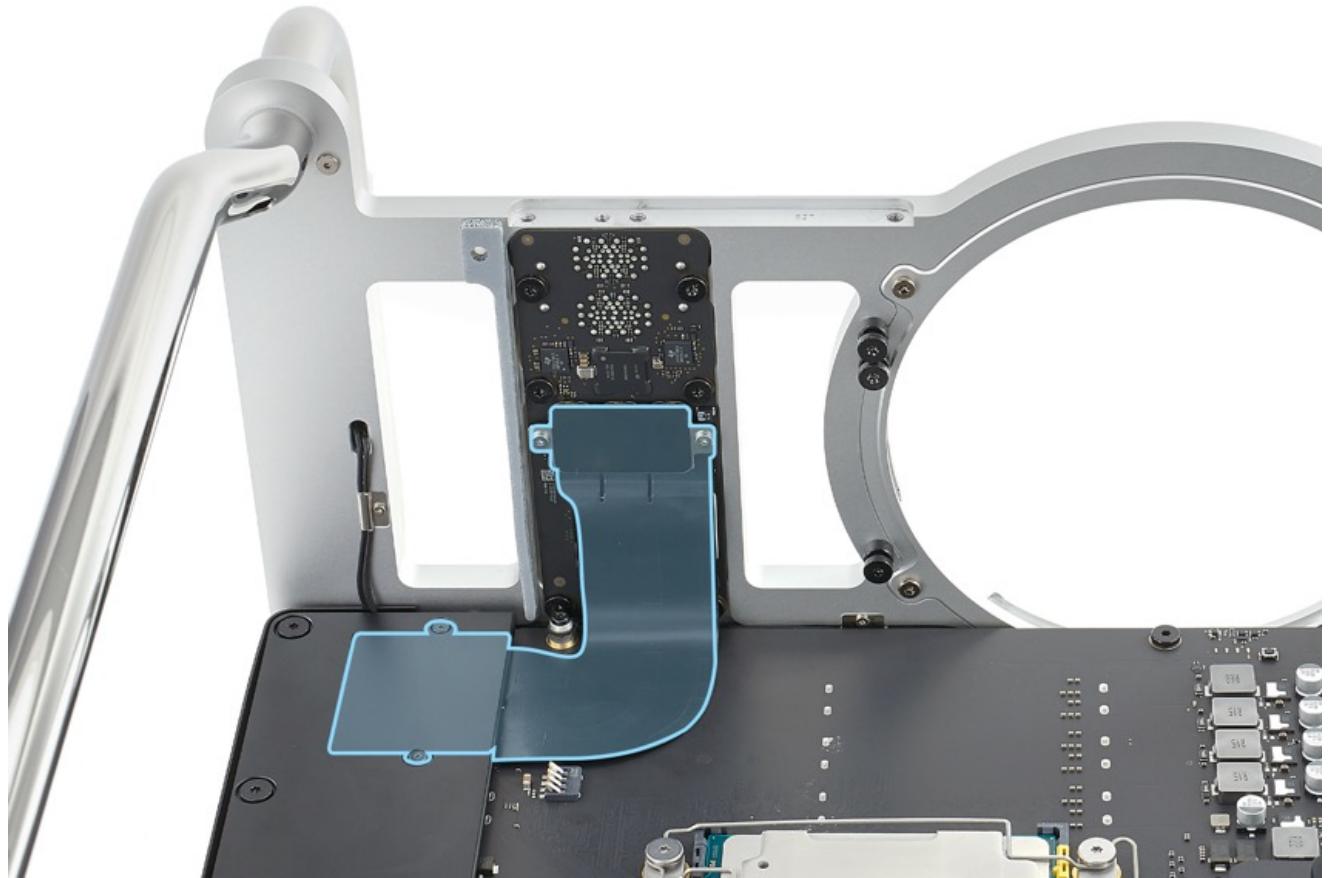
## Tools

1. Black stick
2. Torx T5 screwdriver



## Steps For Removal

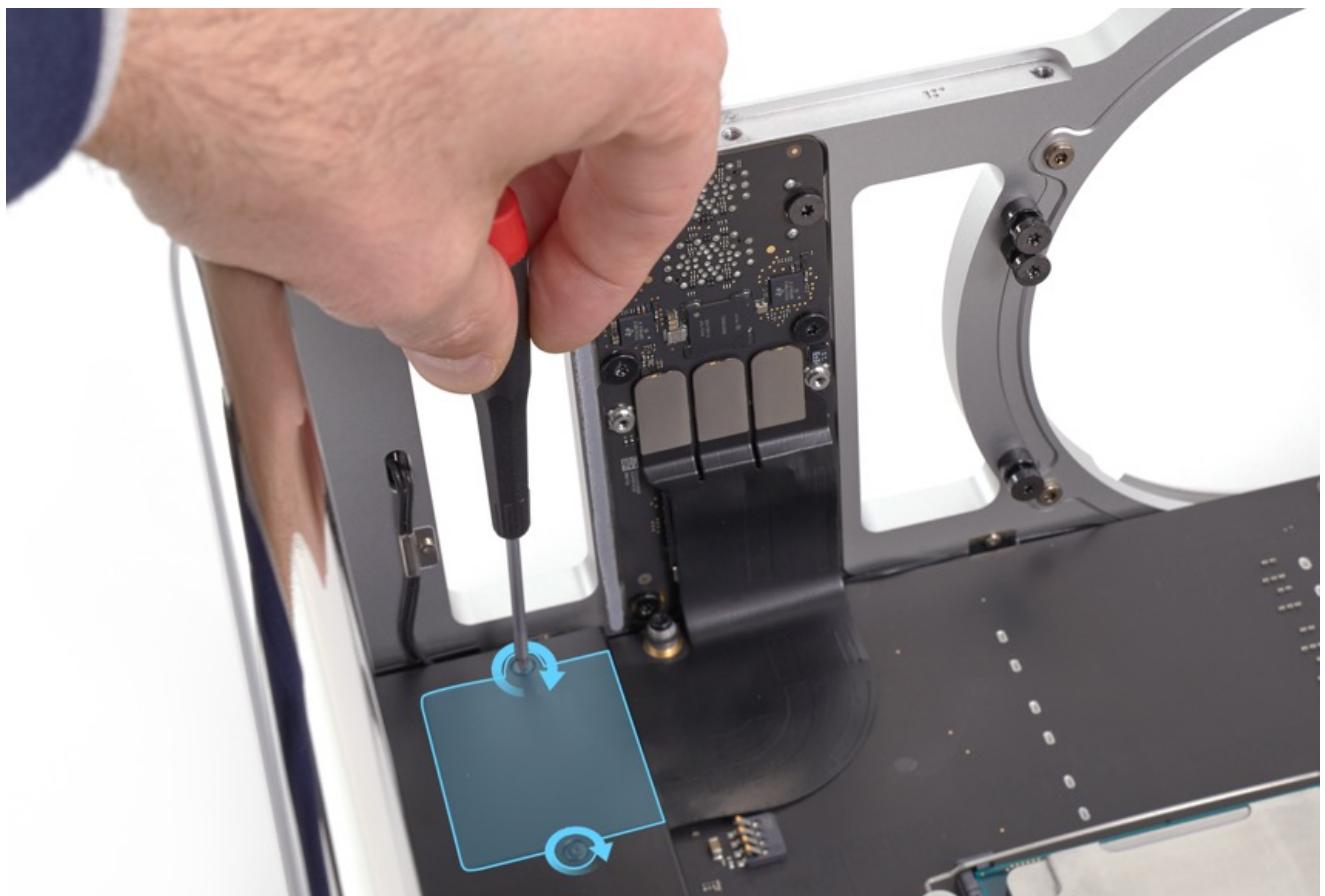
1. Lay the computer on its side so you can easily access the Top I/O (TIO) flex cable.



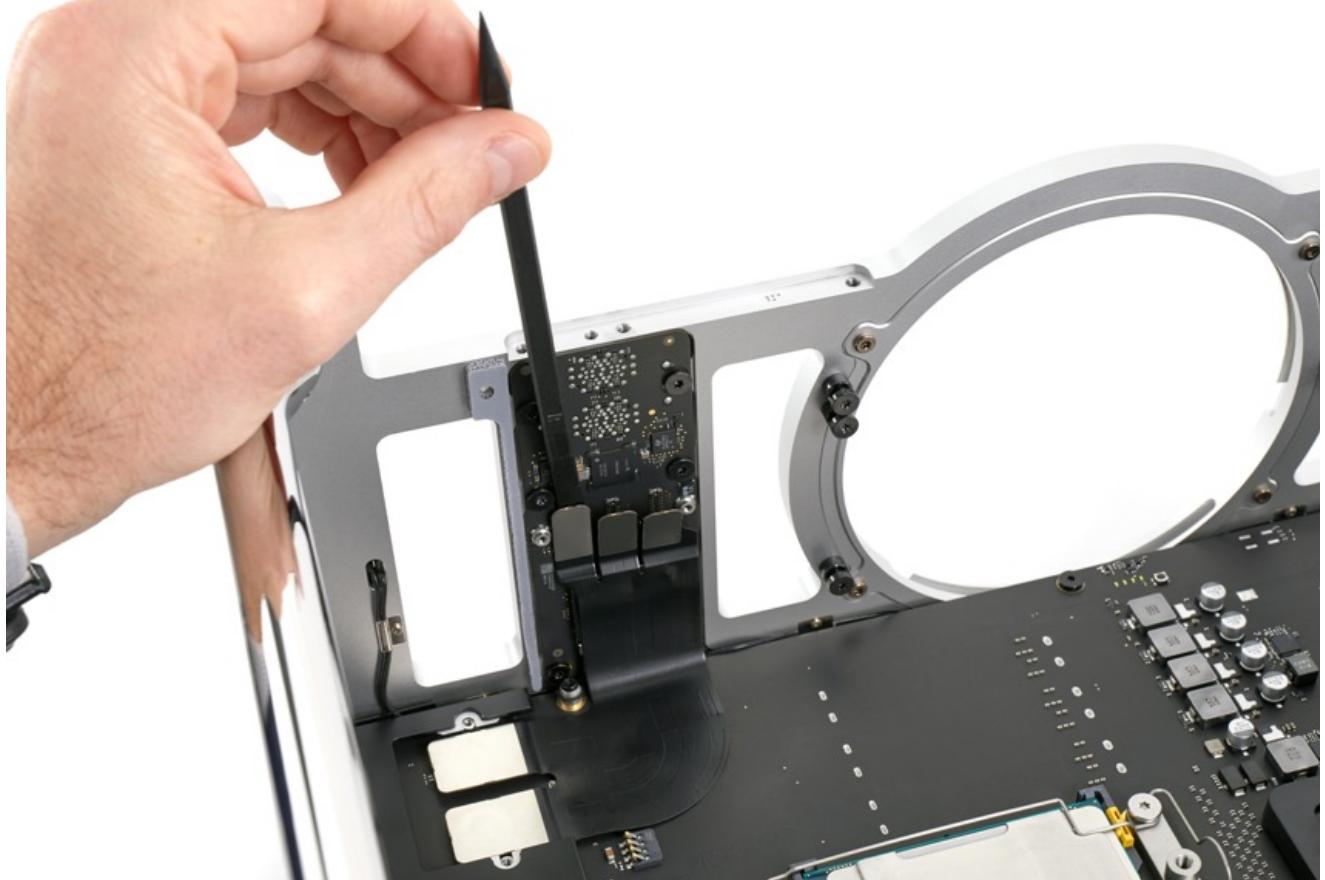
2. Remove two T5 screws from the TIO flex cable cowling on the TIO board, then remove the cowling.



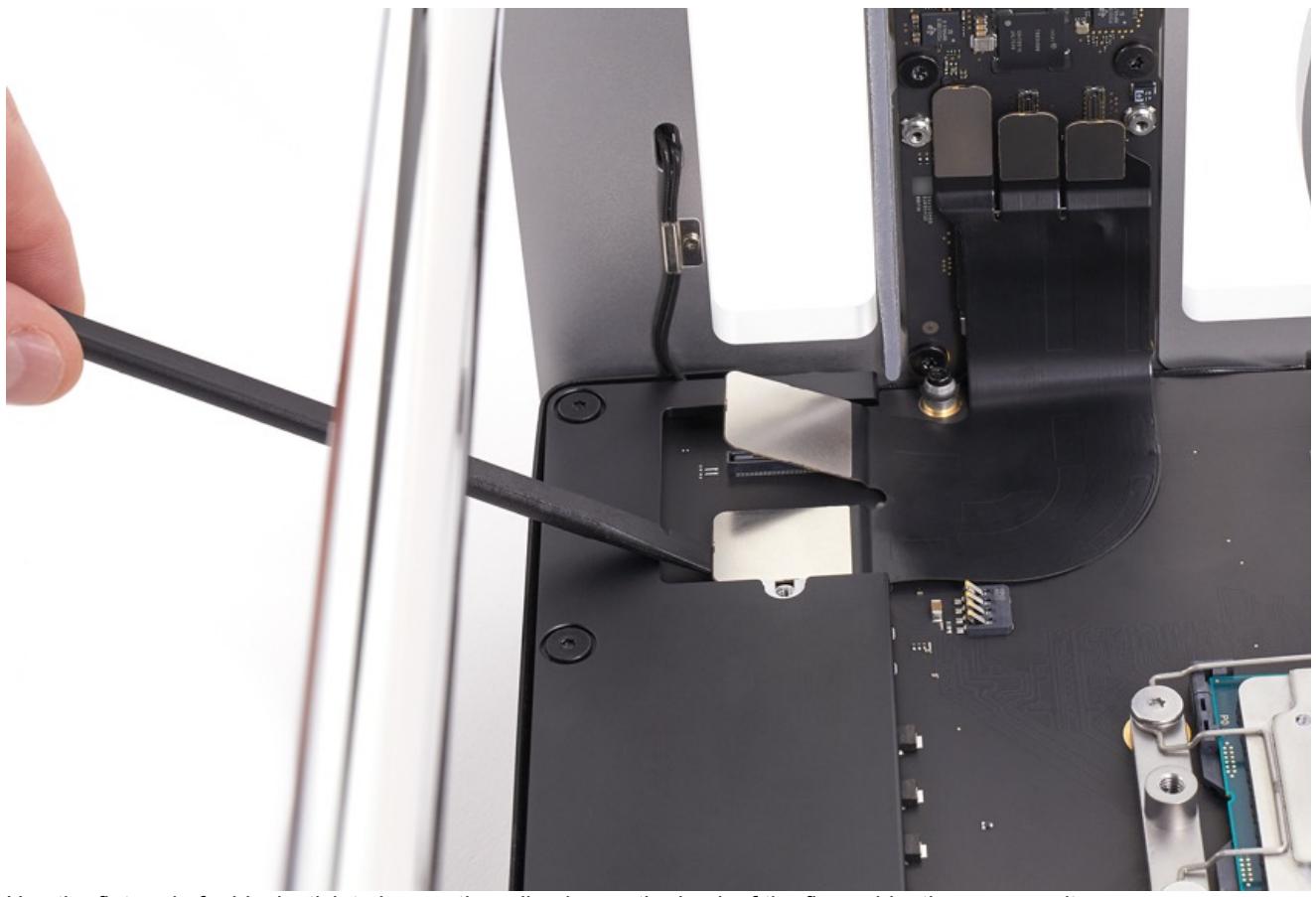
3. Remove two T5 screws from the TIO flex cable cowling on the logic board, then remove the cowling.



4. Use the flat end of a black stick to disconnect the three TIO flex cable connectors from the TIO board.



5. Use the flat end of a black stick to disconnect the two TIO flex cable connectors from the logic board.

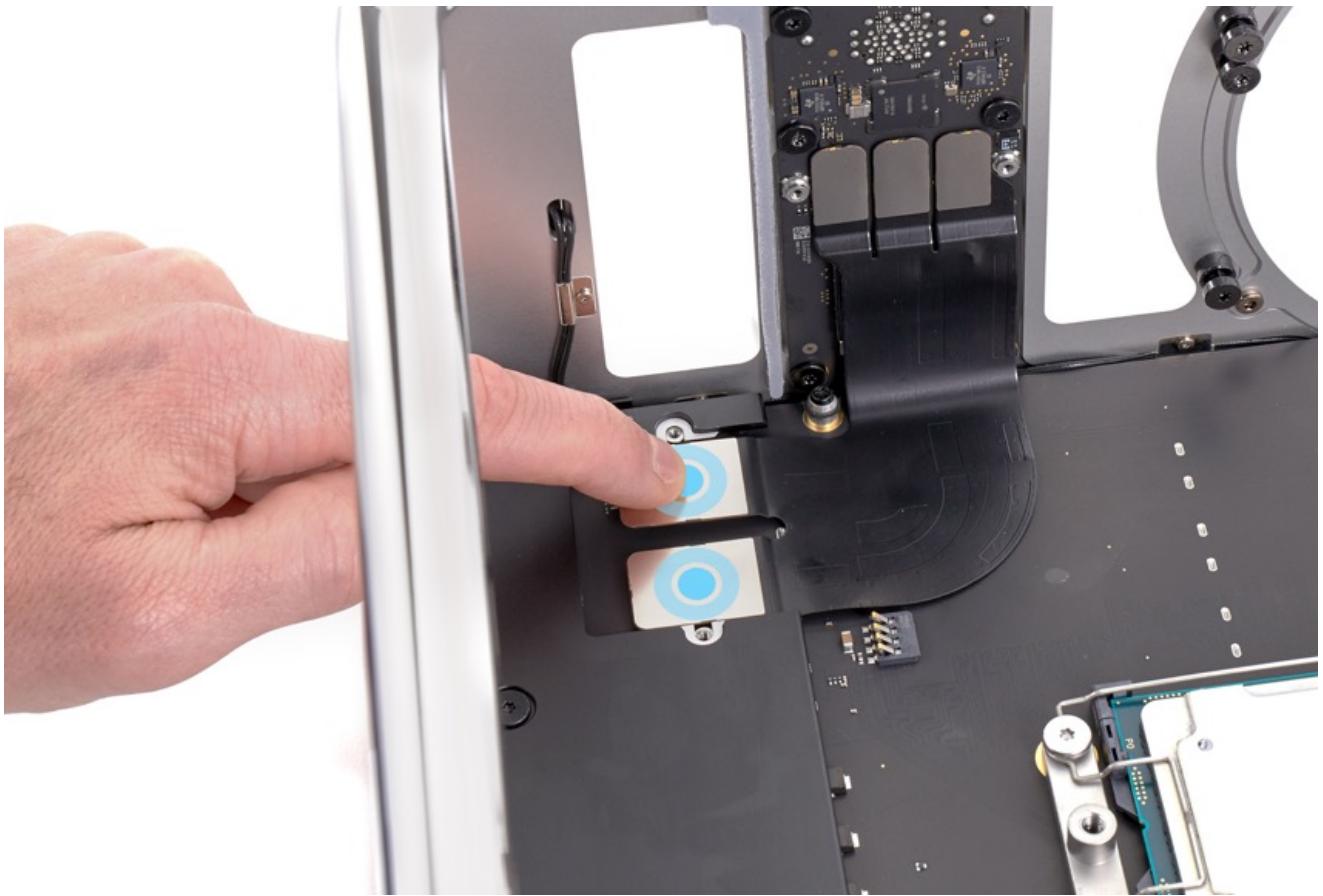


6. Use the flat end of a black stick to loosen the adhesive on the back of the flex cable, then remove it.



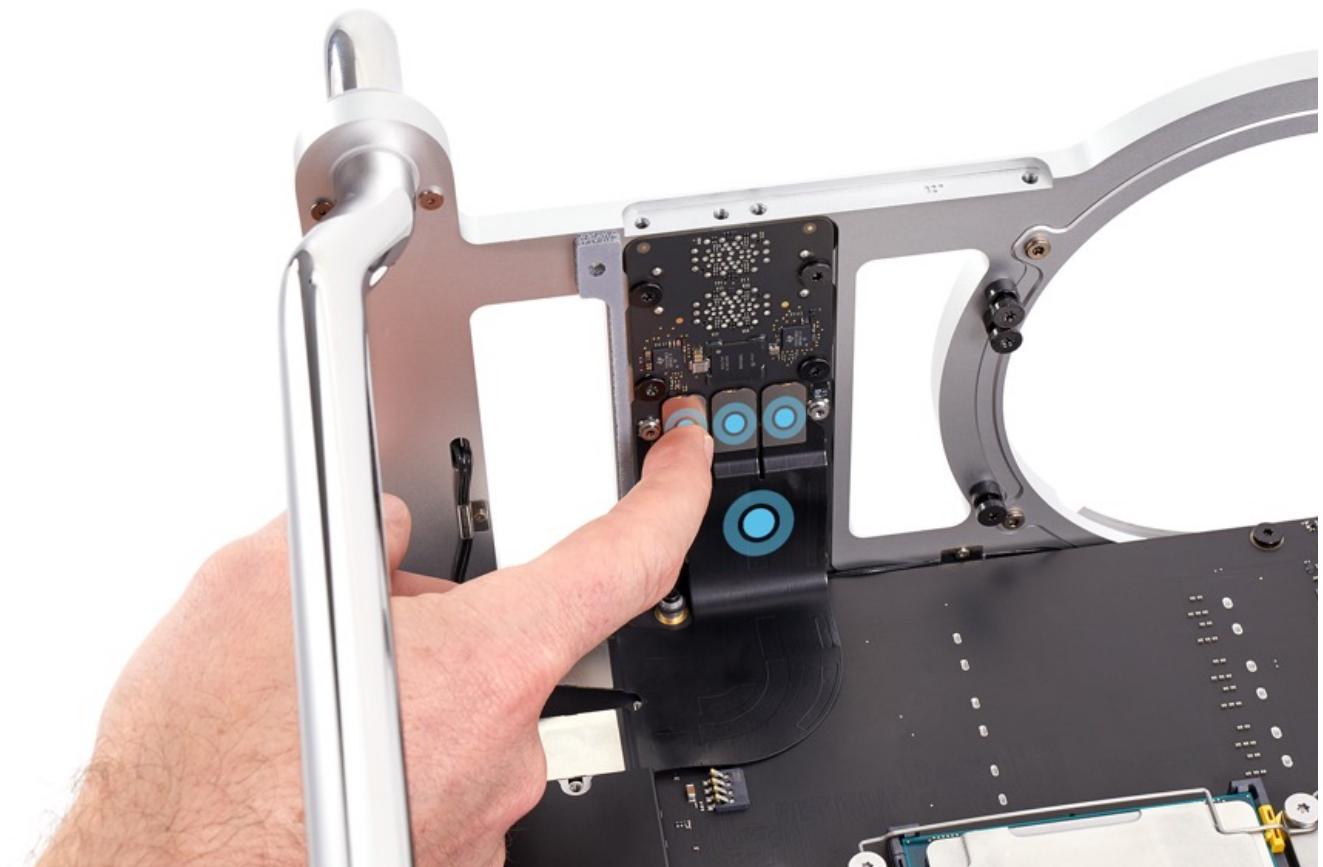
### Steps For Reassembly

1. Connect the two TIO flex cable connectors to the logic board. Apply even pressure along the entire length of the connectors to ensure they are fully connected.



2. Connect the three TIO flex cable connectors to the TIO board. Apply even pressure along the entire length of the connectors to ensure that they are fully connected, then press on the cable for 15 seconds to adhere it to the TIO board.

**Note:** A replacement TIO flex cable comes with an adhesive backing. Remove the backing before connecting the cable.



3. Reinstall the cowling on the logic board and the two T5 screws.

- Screw: 923-03412



- Cowling: 923-03428



4. Reinstall the cowling on the TIO board and the two T5 screws.

- Screw: 923-03457



- Cowling: 923-03458



5. Reinstall the [system fans](#).

6. Reinstall the [CPU thermal module](#).

7. Reinstall the [power supply](#).

8. Reinstall the [MPX modules](#).

9. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.

10. Reinstall the [housing](#).

# Mac Pro (2019) Top I/O Board

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Housing](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [CPU Thermal Module](#)
- [System Fans](#)
- [Top I/O Flex Cable](#)
- [PCIe Slots Frame](#)



## Tools

1. Antenna tool (923-01322)
2. Black stick
3. Torx T5 screwdriver
4. Torx T8 screwdriver
5. USB-C to USB-C charge cable (661-06670)
6. ESD-safe round-nose tweezers



### Steps For Removal

1. Remove the T8 system fans alignment pin and screw.



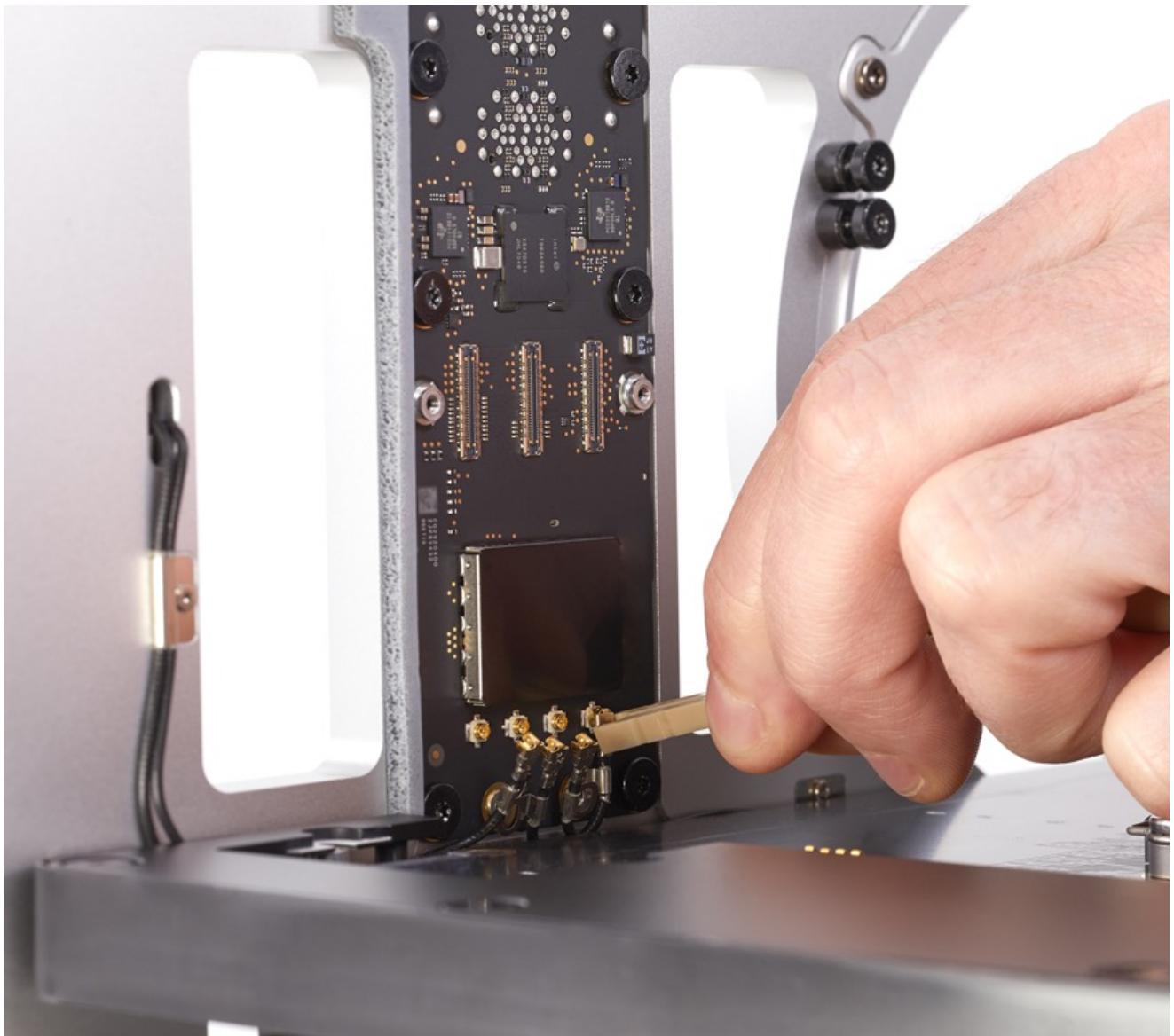
2. Remove two T5 screws from the antenna cowling, then remove the cowling.



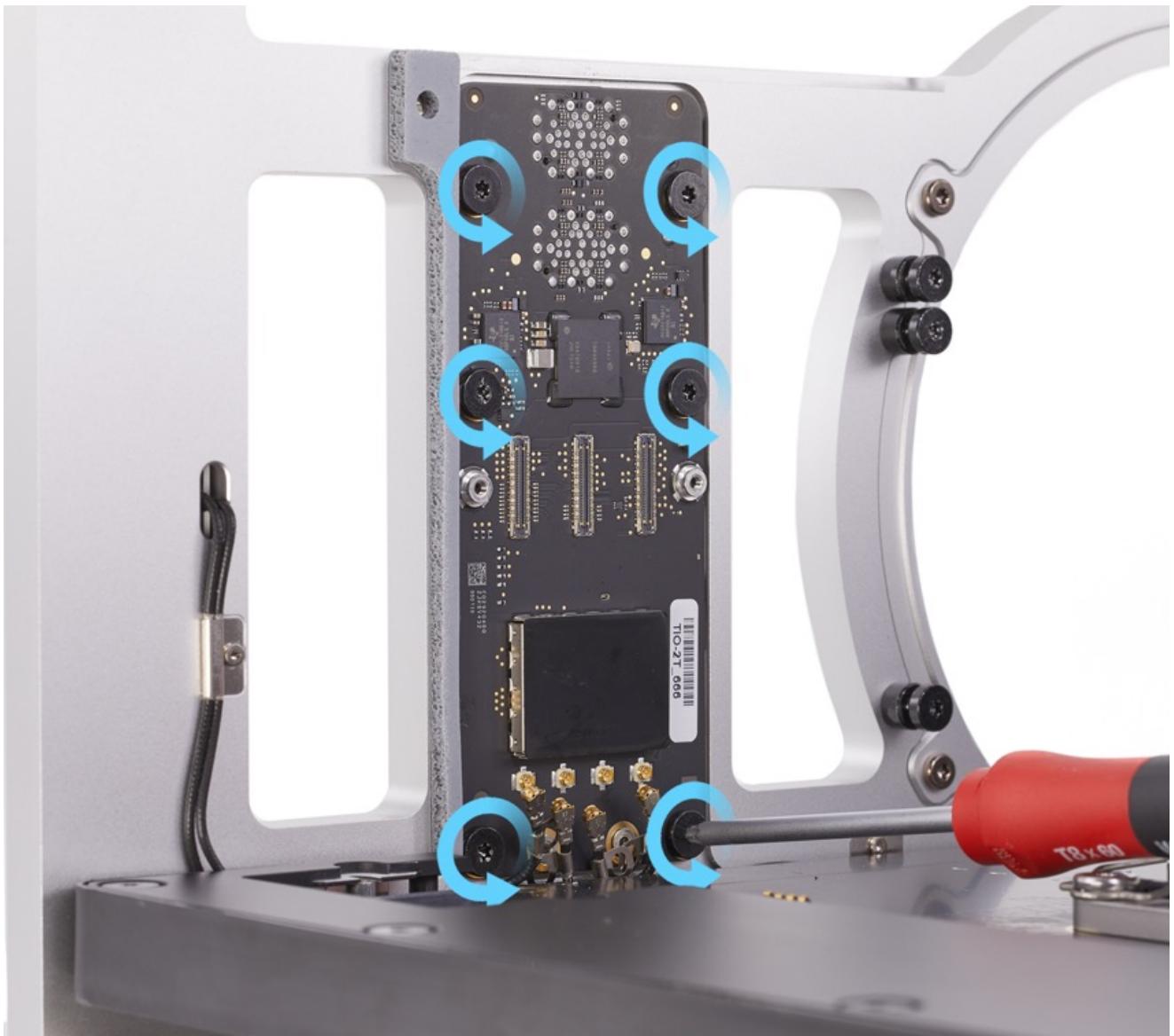
**Caution:** Use care when handling the antenna cables and connectors.



3. Use the antenna tool to disconnect the connectors from the TIO board.



4. Remove six T8 screws from the TIO board, then remove the board from the bridge plate.



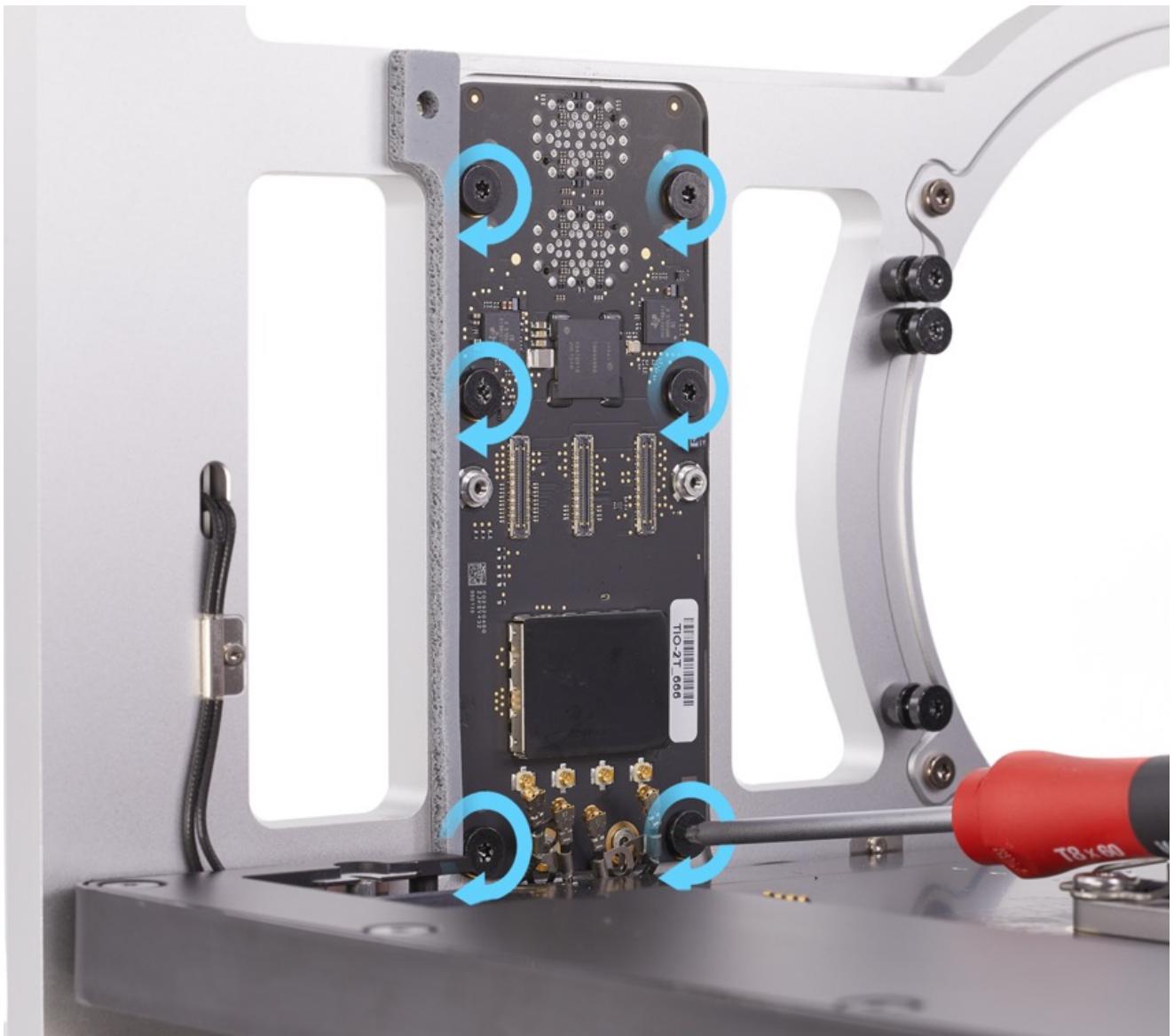
### Steps For Reassembly

1. Reinstall the TIO board. Use a black stick to hold back the antenna cables as you position the TIO board.



2. Partially install six T8 screws (923-03413) in the TIO board.

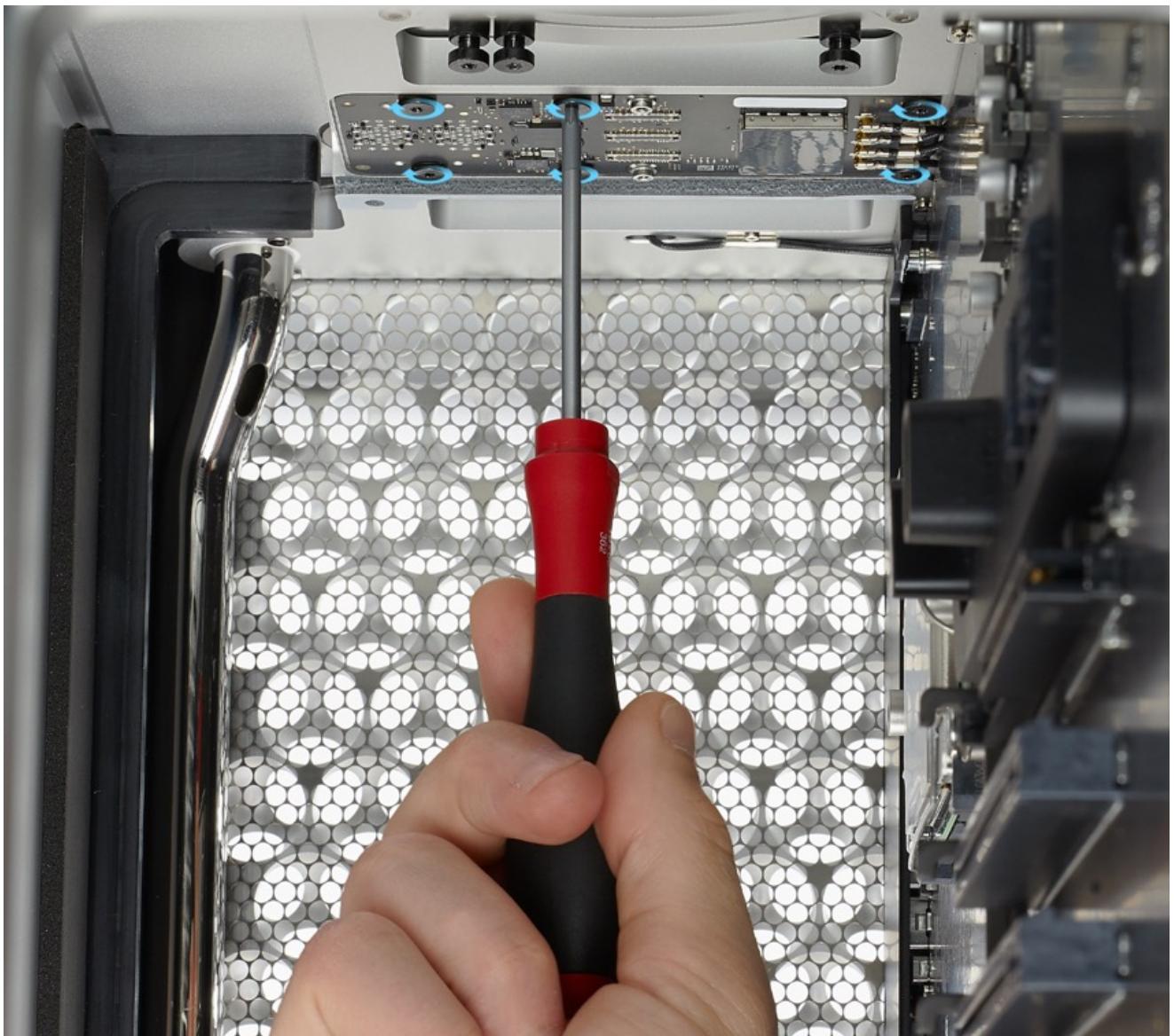




3. Temporarily reinstall the housing to check alignment. Plug both ends of the USB-C charge cable into the top I/O ports.



4. With the housing still installed, reach through the back opening and fully tighten the six T8 screws. Then remove the USB-C charge cable and the housing.



5. Use the flat end of the antenna tool to connect the antenna cables to the TIO board.  
**Note:** If needed, use round-nose tweezers to help position the antenna cable connectors.



**Caution:** Check that the cables are connected in the orientation shown.



6. Reinstall the antenna cowling (923-03427). Engage the teeth at an angle, then lay it down over the antenna connectors.





7. Install two T5 screws (923-03420) in the antenna cowling.





8. Reinstall the system fans alignment pin and T8 screw.



9. Reinstall the [PCIe slots frame](#).
10. Reinstall the [top I/O flex cable](#).
11. Reinstall the [system fans](#).
12. Reinstall the [CPU thermal module](#).
13. Reinstall the [power supply](#).
14. Reinstall the [MPX modules](#).
15. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
16. Reinstall the [housing](#).

# Logic Board

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.



- This repair is not complete until [System Configuration](#) has been performed.
- Make sure the customer has a working backup of their data before removing or replacing the logic board. The solid state drives (SSDs) are paired to the logic board and the data cannot be accessed or recovered when installed in another logic board. Data from a damaged logic board or SSD can sometimes be [captured and transferred before service](#).

### Remove:

- [Housing](#)
- [Apple I/O Card](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [System Fans](#)
- [CPU Thermal Module](#)
- [Top I/O Flex Cable](#)
- The logic board can be removed with the [blower](#), [memory](#), [speaker](#), and [storage](#) installed. Remove them only if you are replacing the logic board.



## Tools

1. Torx T8 screwdriver
  - Ethernet cable (not shown)

The following are required for System Configuration:

2. Digital barcode scanner (923-01232)
3. USB-C to USB-C charge cable (661-06670)
4. Mac Pro (2019) power cord (923-03314)

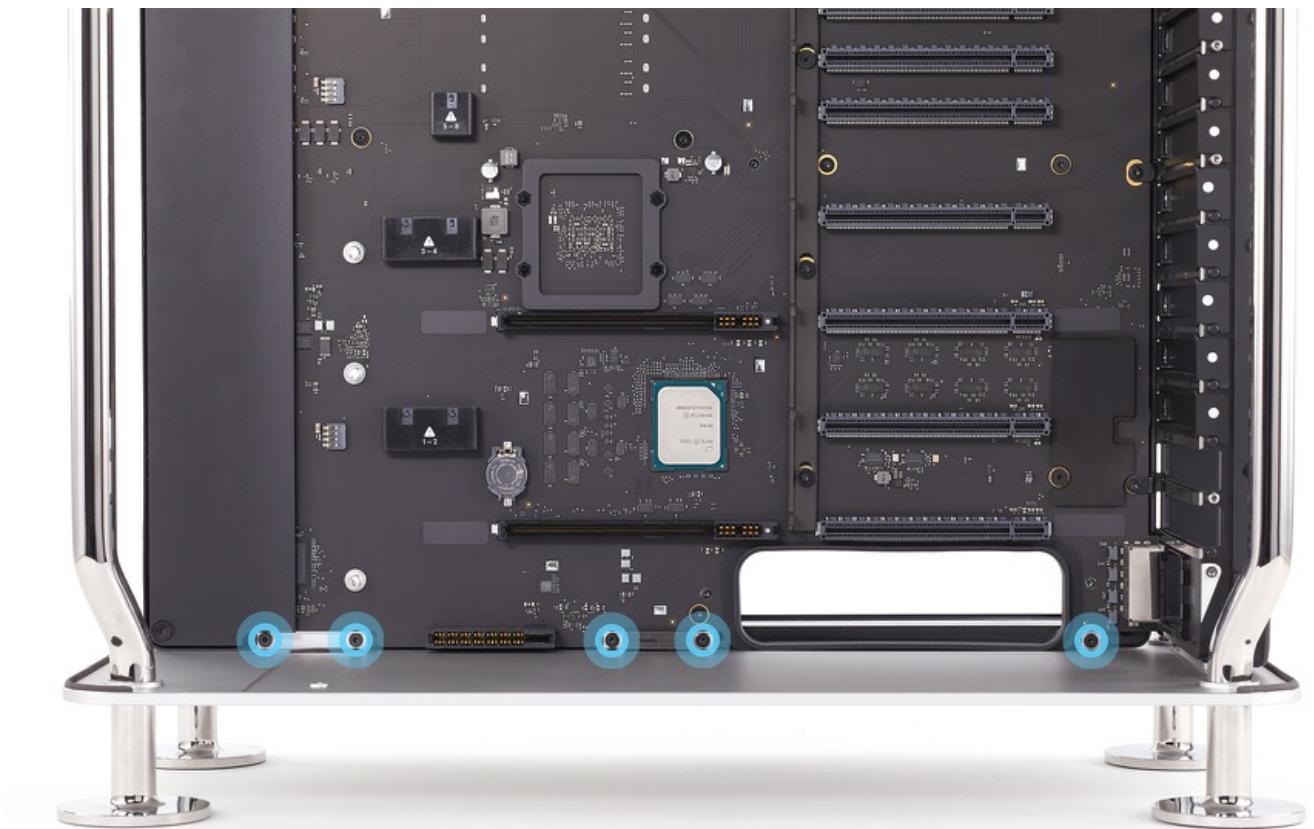


### Steps For Removal

1. Remove any remaining PCIe slot covers.



2. Remove five T8 screws from the bottom of the logic board.



3. Rotate the computer to access the memory side. Remove four T8 screws from the top of the logic board.



4. Remove four T8 screws from the left side of the logic board access panel.



**Important:** Review steps 5–7 before proceeding. Perform these steps slowly to avoid damage.

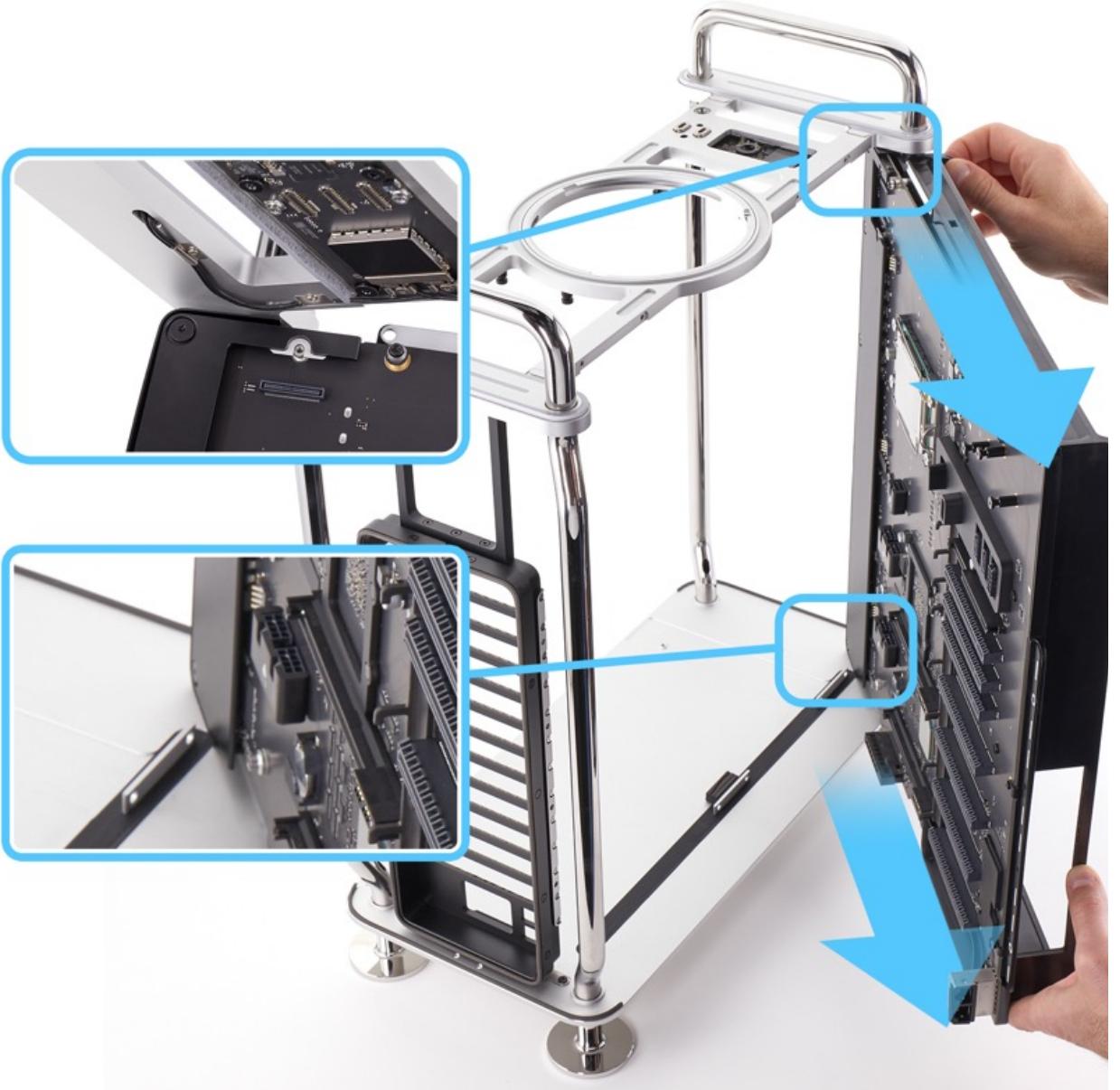
5. Lean the logic board toward you, just enough to clear the alignment notches on the space frame.



6. Slide the logic board to the right (1) to allow room for the ethernet jack, then pivot the left side toward you (2).  
**Stop before fully removing it from the space frame.**



7. Make sure the logic board is clear of the top plate antenna cables and bottom plate screw mounts, then slide it out of the space frame.



## Steps For Reassembly



**Important:** If replacing the logic board:

- Transfer the [CPU](#).
- For [System Configuration](#), add the parts to the repair and scan the QR code on the known bad board (KBB) and known good board (KGB) logic boards. Scan only the QR code near the power supply connector.



**Important:** Review steps 1–3 before proceeding. Perform these steps slowly to avoid damage.

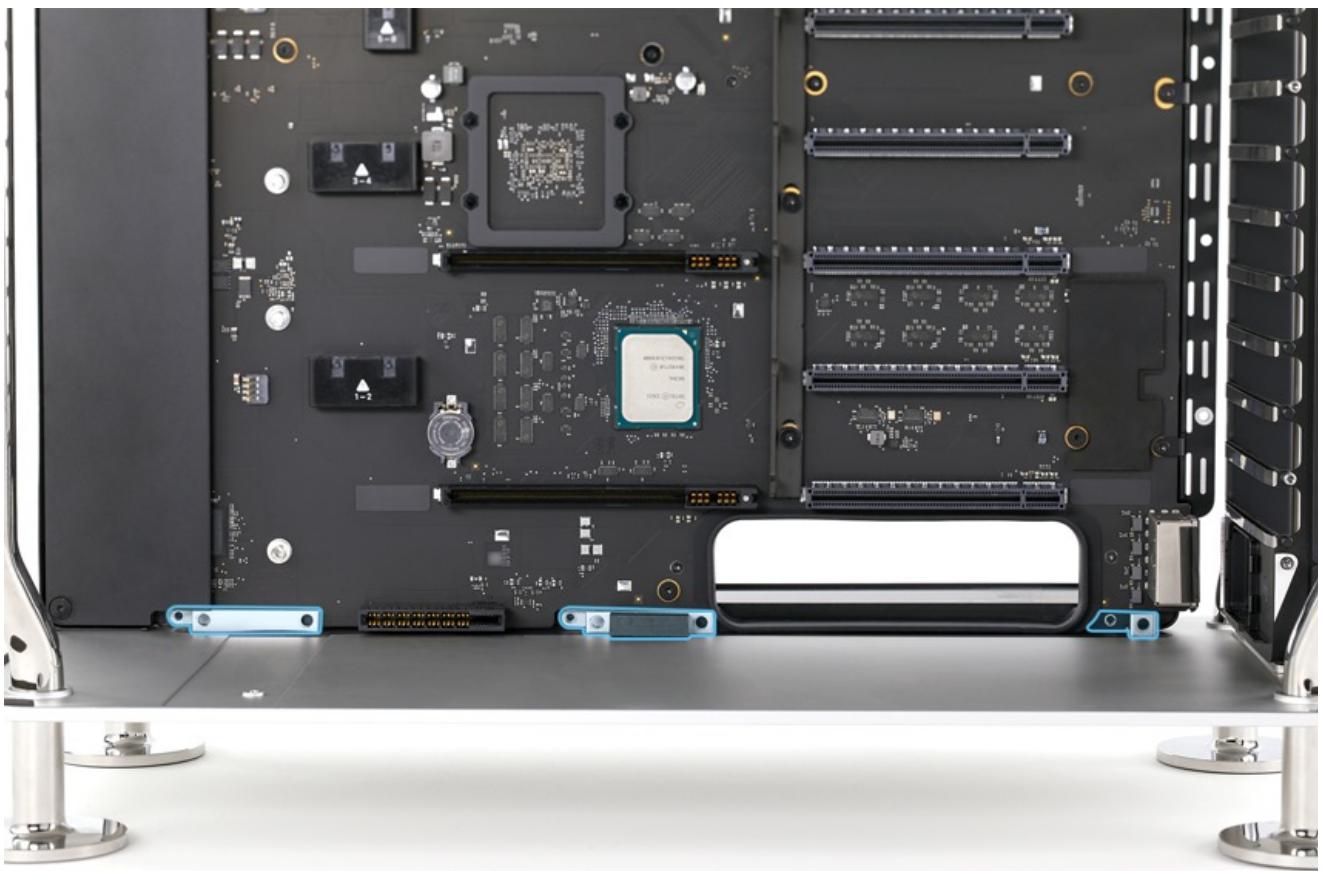
1. Insert the logic board at an angle (1), then pivot the left side toward the space frame (2).  
***Stop before fully inserting it into the space frame.***



2. Slide the logic board further to the right (1), then pivot the left side the rest of the way into the space frame (2).



3. Use the screw holes and ethernet ports opening to align the logic board in the space frame.



4. Partially install four T8 screws (923-03409) in the side of the logic board in the following order.





5. Plug both ends of an ethernet cable into the ethernet ports to check alignment. Once the board is properly aligned, fully tighten the four T8 screws in the side of the logic board, then remove the ethernet cable.

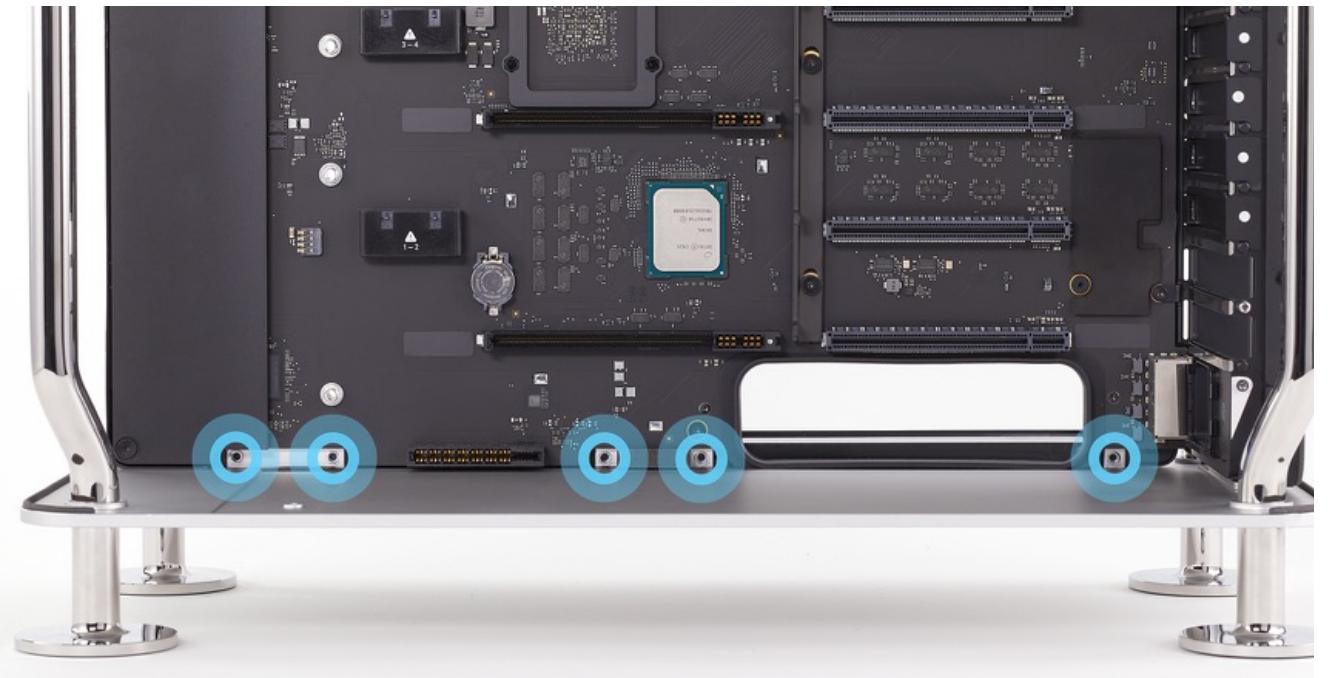


6. Reinstall the four T8 screws (923-03419) in the top of the logic board.



7. Turn the computer to access the other side. Reinstall the five T8 screws (923-03419) in the bottom of the logic board.





8. Reinstall the PCIe slot covers.



9. If you replaced the logic board, reinstall the [storage](#), [speaker](#), [memory](#), and [blower](#).
10. Reinstall the [top I/O flex cable](#).
11. Reinstall the [system fans](#).
12. Reinstall the [CPU thermal module](#).
13. Reinstall the [power supply](#).
14. Reinstall the [MPX modules](#).
15. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
16. Reinstall the [Apple I/O card](#).
17. Reinstall the [housing](#).
18. The repair is not complete until [System Configuration](#) has been performed.



9:41 AM \* 100%

< > 📖 [diagnostics.apple.com](https://diagnostics.apple.com) ⌂ + ⌄

Diagnostic Console John Appleseed

## Diagnostic Suites

POST-REPAIR

Full System Diagnostic (EFI)  
Performs comprehensive testing of hardware functionality and memory module integrity. ⓘ 30-90 minutes ➤

Full System Diagnostic (OS)  
Performs comprehensive testing of hardware and graphics functionality. ⓘ 15-30 minutes ➤

REPAIR COMPLETION

System Configuration  
Completes required configuration of applicable service parts and updates firmware after repair. This suite becomes available after service part serial numbers are saved in a repair. For more information refer to TP1657: System Configuration. ⓘ 1-10 minutes ➤

# Mac Pro (2019) Locking Ring

## First Steps

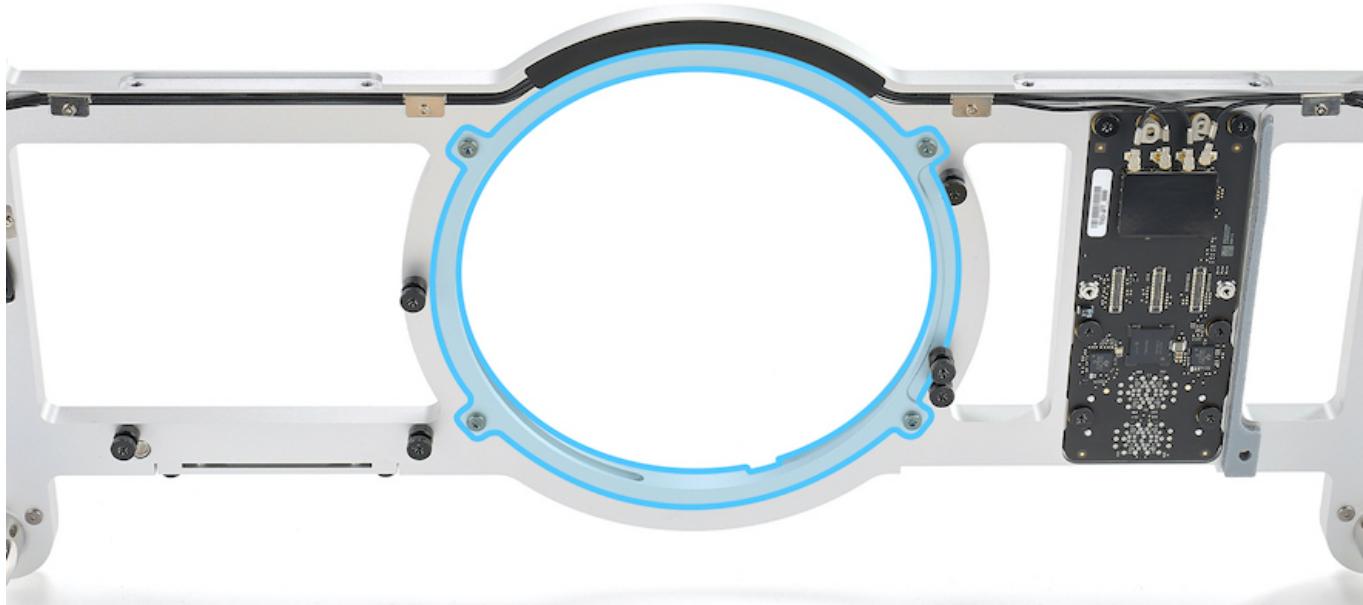


### Caution:

- Only [Apple-certified technicians](#) (OP1859) should perform this procedure.
- Wear an ESD wrist strap and [follow ESD guidelines](#) (OP100).

### Remove:

- [Housing](#)
- [Apple I/O Card](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [System Fans](#)
- [CPU Thermal Module](#)
- [Top I/O Flex Cable](#)
- [Logic Board](#)
  - The logic board can be removed with the [blower](#), [memory](#), [speaker](#), and [storage](#) installed. Only remove these parts if you are also replacing the logic board.



## Tools

1. Torx T8 screwdriver



## Steps For Removal

1. Remove four T8 screws from the locking ring. Then remove the locking ring from the top plate.



### Steps For Reassembly

1. Use the notch in the locking ring as a guide to reinstall it in the top plate.



2. Reinstall the four T8 screws (923-03417).



3. Temporarily reinstall the housing to verify the housing latch functions properly. If the housing latch doesn't lock or unlock properly, inspect it for damage and replace the housing if necessary.



4. Reinstall the following parts in the order listed.

- [Logic board](#)

**Note:** If you replaced the logic board, reinstall the [blower](#), [memory](#), [speaker](#), and [storage](#).

- [Top I/O flex cable](#)
- [CPU thermal module](#)
- [System fans](#)
- [Power supply](#)
- [MPX modules](#)
- [Apple Afterburner](#) (if the Mac Pro was configured with one)
- [Apple I/O card](#)
- [Housing](#)

# Mac Pro (2019) PCIe Slots Frame

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Housing](#)
- [Apple I/O Card](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)



## Tools

1. Torx T8 screwdriver (precision)
  2. Torx T8 screwdriver
- Ethernet cable (not shown)



## Steps For Removal

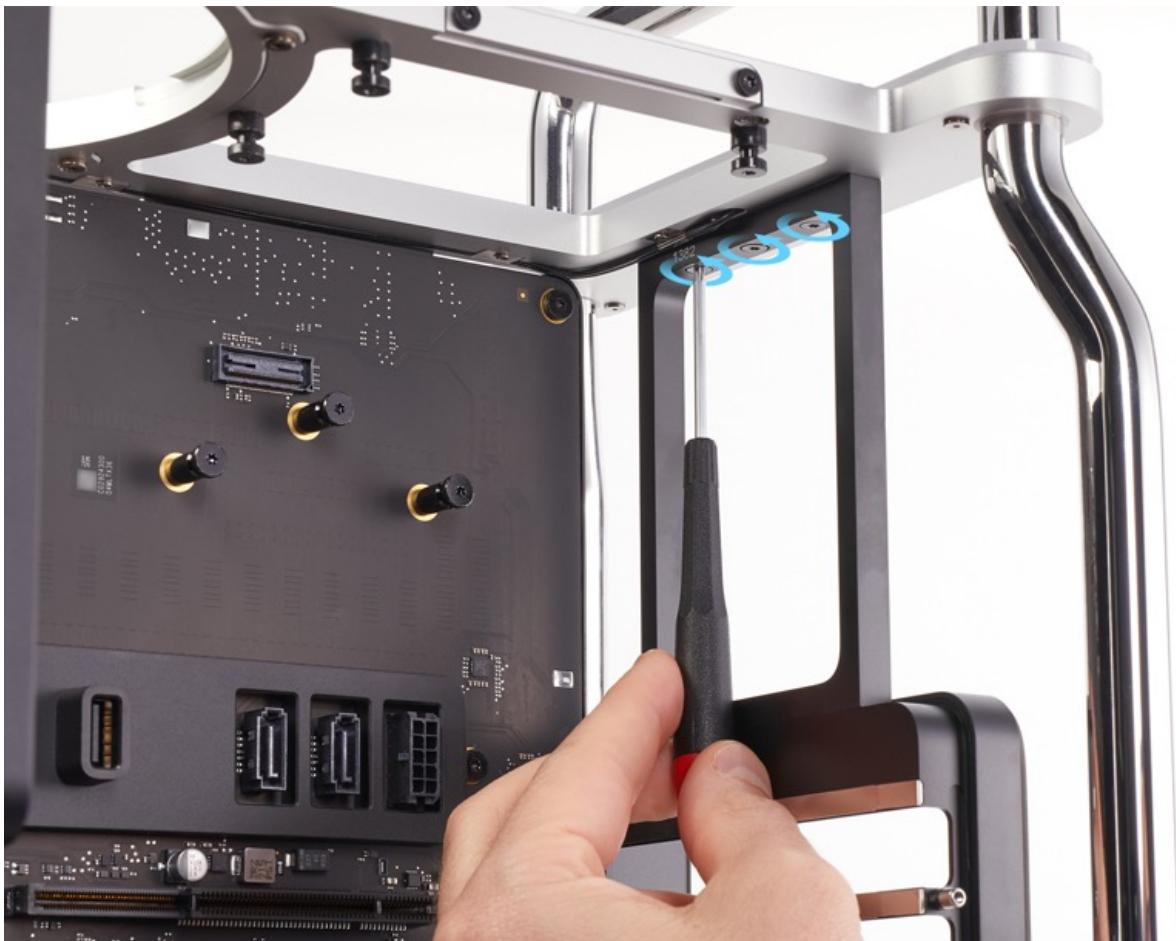
1. Remove all of the PCIe slot covers.



2. Turn the computer to access the memory side. Remove four T8 screws from the left side of the logic board.



3. Turn the computer to access the PCIe side. Use the Torx T8 precision screwdriver to remove three T8 screws from the top of the PCIe slots frame.



4. Tilt and lift the PCIe slots frame out of the space frame.



## Steps For Reassembly

1. Align the holes on the bottom of the PCIe slots frame with the rubber gaskets on the bottom plate. Then tilt the frame into position.

**Note:** The rubber gaskets are available as part of a kit (923-03337).



2. Use the small Torx screwdriver to partially install three T8 screws (923-03423) in the top of the PCIe slots frame.





3. Turn the computer to access the memory side. Partially install four T8 screws (923-03409) in the side of the logic board in the following order.





4. Plug both ends of an ethernet cable into the ethernet ports to check alignment.



5. Once the PCIe slots frame is properly aligned, fully tighten the screws.



6. Reinstall the PCIe slot covers.



7. Reinstall the [power supply](#).
8. Reinstall the [MPX modules](#).
9. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
10. Reinstall the [Apple I/O card](#).
11. Reinstall the [housing](#).

# Mac Pro (2019) Antennas

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Housing](#)
- [Apple I/O Card](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [CPU Thermal Module](#)
- [System Fans](#)
- [Top I/O Flex Cable](#)
- [PCIe Slots Frame](#)
- [Logic Board](#)
  - The logic board can be removed with the [blower](#), [memory](#), [speaker](#), and [storage](#) installed. Only remove these if you are also replacing the logic board.
- [Handles](#)



## Tools

1. Antenna tool (923-01322)
2. ESD-safe round-nose tweezers
3. Sticky notes
4. Scissors
5. Torx T5 screwdriver



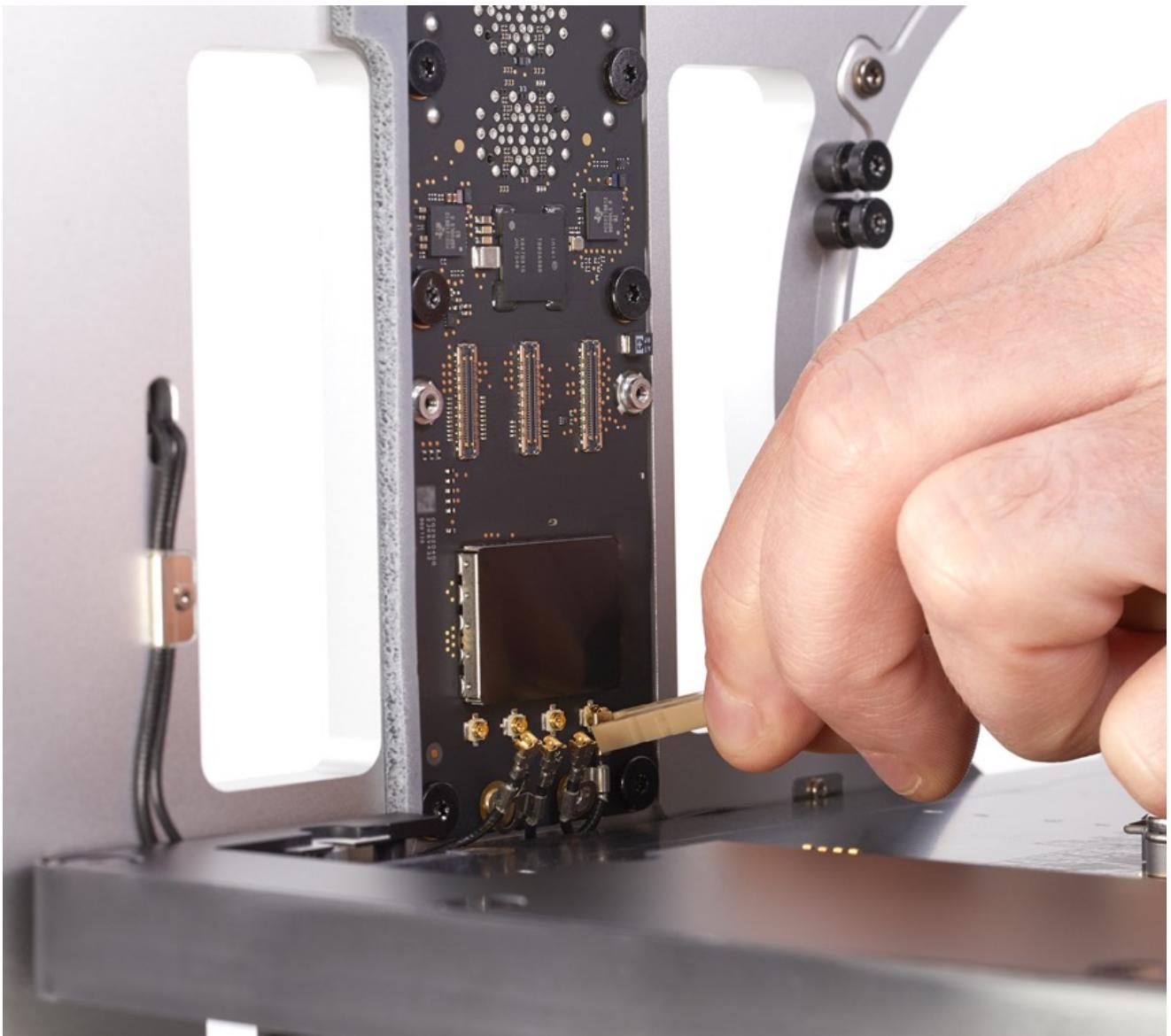
### Steps For Removal

**Note:** Although the logic board is shown in the images of steps 1 and 2, it should be removed as part of the first steps.

1. Remove two T5 screws from the antenna cowling, then remove the cowling.



2. Use the antenna tool to disconnect the connectors from the TIO board.



3. Lay the space frame on its side. Then remove six T5 screws from the antenna cable routing clips.

**Note:** Carefully peel up the Mylar tape and save it for reuse.

**Tip:** Loosely apply the Mylar tape on the lower half of the top plate ring until replacement.



4. Remove eight T5 screws that hold the antennas in place, four on each side of the space frame.



5. Remove the antennas from the space frame and carefully guide the antenna cables through the holes.



### Steps For Reassembly

1. Route the antenna cables through the holes and position the antennas in the space frame.



2. Partially install the eight T5 screws (923-03424).



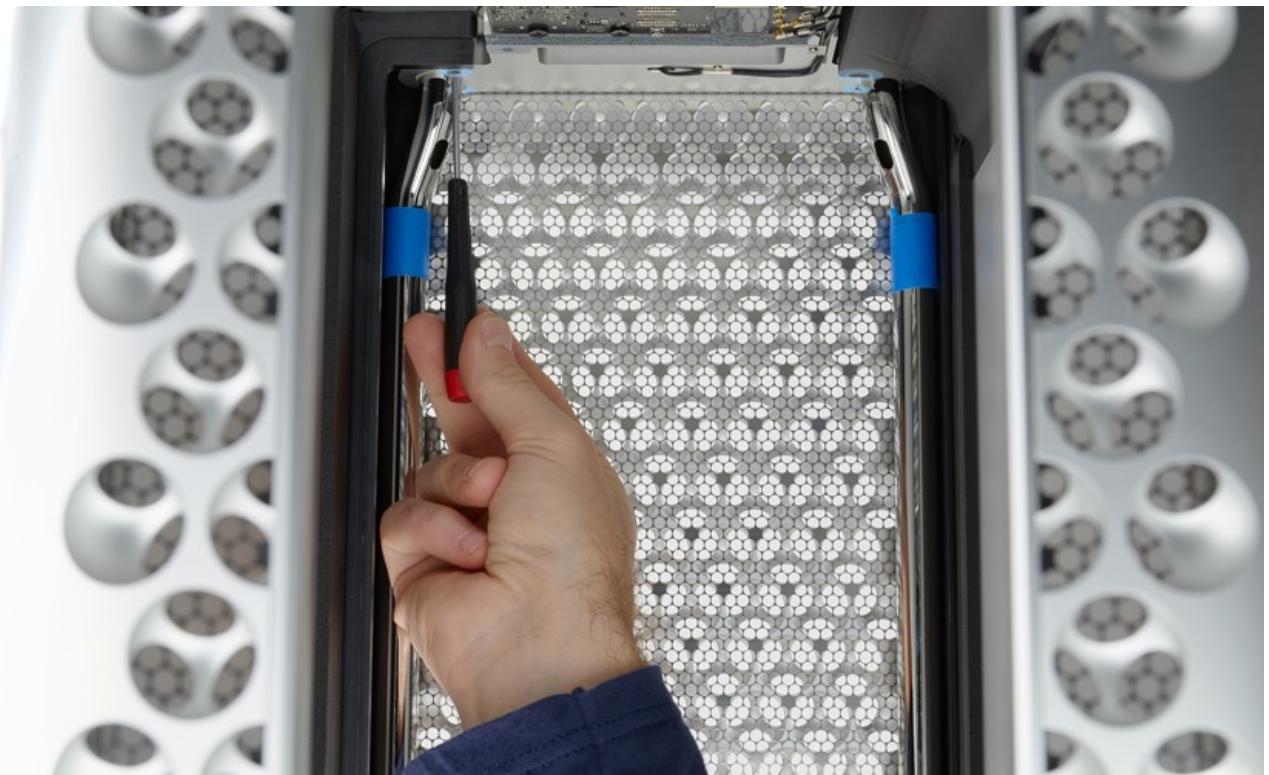
3. Temporarily reinstall the housing to check alignment.



4. Take a stack of two sticky notes and cut them in half. Place the shorter edges of the sticky notes in the gap between the housing and the antenna. Repeat this step to check alignment for the other antenna.



5. With the housing still installed, reach through the back opening and fully tighten the eight antenna screws.  
**Note:** If you are unable to reach the outer screws (closest to the housing), tighten the four inner screws, two for each antenna.

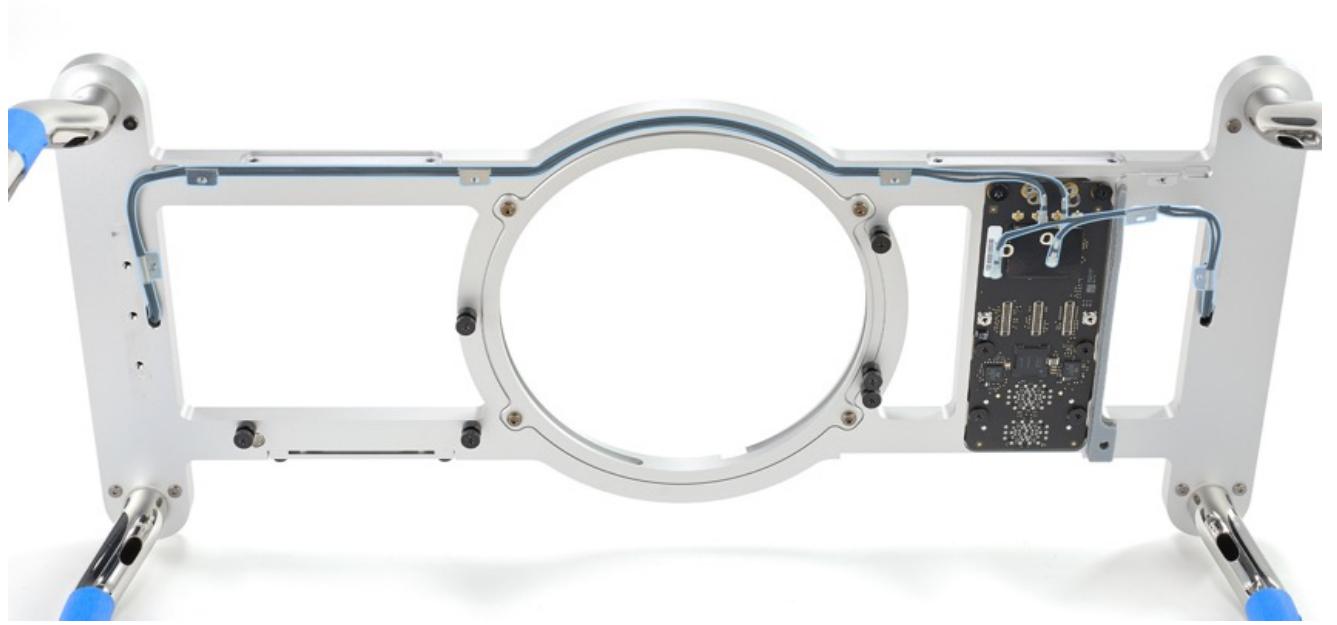


6. Remove the housing and verify the eight antenna screws are fully installed.



7. Reinstall six T5 screws (923-03422) to secure the antenna cable routing clips to the top plate.  
**Note:** Make sure the antenna routing clips are positioned in the cutouts of the space frame.





8. Reapply the Mylar tape over the antenna cables.



**Note:** Although the logic board is shown in the images below, it should still be removed.

9. Use the flat end of the antenna tool to connect the antenna cables to the TIO board.  
**Note:** If needed, use round-nose tweezers to help position the antenna cable connectors.



**Caution:** Check that the cables are connected in the following orientation.



10. Reinstall the antenna cowling (923-03427). Engage the teeth at an angle, then lay it down over the antenna connectors.





11. Reinstall two T5 screws (923-03457) in the antenna cowling.





12. Reinstall the [handles](#).
13. Reinstall the [PCIe slots frame](#).
14. Reinstall the [logic board](#).  
**Note:** If you replaced the logic board, reinstall the [blower](#), [memory](#), [speaker](#), and [storage](#).
15. Reinstall the [top I/O flex cable](#).
16. Reinstall the [system fans](#).
17. Reinstall the [CPU thermal module](#).
18. Reinstall the [power supply](#).
19. Reinstall the [MPX modules](#).
20. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
21. Reinstall the [Apple I/O card](#).
22. Reinstall the [housing](#).

# Mac Pro (2019) Space Frame

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.
- Two people may be needed to hold the space frame during removal and reassembly.

### Remove:

- [Housing](#)
- [Apple I/O Card](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [System Fans](#)
- [CPU Thermal Module](#)
- [Top I/O Flex Cable](#)
- [Top I/O Board](#)
- [PCIe Slots Frame](#)
- [Logic Board](#)
  - The logic board can be removed with the [blower](#), [memory](#), [speaker](#), and [storage](#) installed. Only remove these if you are also replacing the logic board.
- [Handles](#)
- [Feet and Wheels](#)



## Tools

1. 3/8-inch ratcheting socket wrench (923-03340)
2. 3/8-inch to 5/16-inch adapter (923-03339)
3. Torx T55 security bit (923-03338)



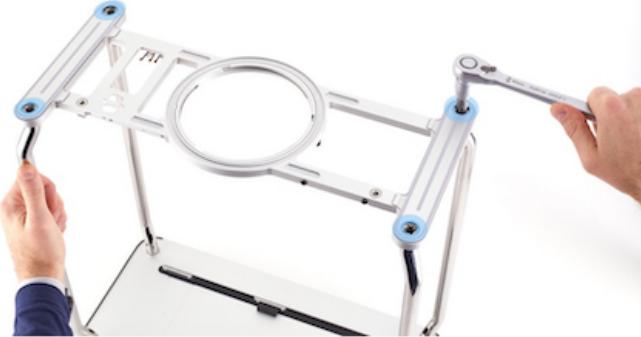
## Steps For Removal

**Note:** Some of the images in this procedure show only the top plate, but the steps to perform the repair for the bottom plate

are the same.

**Important:** Don't remove the top plate and bottom plate at the same time. Ensure that one plate is attached to the space frame bars at all times.

1. Remove four T55 security screws. Lift the top or bottom plate off the space frame bars.  
**Note:** It may be helpful to have another technician hold the space frame.



## Steps For Reassembly



**Important:** Transfer six T8 screws (923-03407) and the [antennas](#) if replacing the top plate.



1. Align the holes of the top or bottom plate with the space frame bars.



**Important:** The TIO opening (1) should be opposite the PCIe slots frame alignment plate (2).



2. Partially reinstall four T55 security screws.

**Note:** It may be helpful to have another technician hold the space frame while tightening the screws.

- Bottom Plate Screws: 923-03414



- Top Plate Screws: 923-03415



3. Temporarily reinstall the [housing](#) to check alignment, then fully tighten the screws.

**Caution:** Use extreme care not to scratch the housing when tightening the screws.



4. Remove the housing, then proceed with the reassembly steps.
5. Reinstall the [feet and wheels](#).
6. Reinstall the [handles](#).
7. Reinstall the [PCIe slots frame](#).
8. Reinstall the [logic board](#).  
**Note:** If you replaced the logic board, reinstall the [blower](#), [memory](#), [speaker](#), and [storage](#).
9. Reinstall the [top I/O board](#).
10. Reinstall the [top I/O flex cable](#).
11. Reinstall the [system fans](#).
12. Reinstall the [CPU thermal module](#).
13. Reinstall the [power supply](#).
14. Reinstall the [MPX modules](#).
15. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
16. Reinstall the [Apple I/O card](#).
17. Reinstall the [housing](#).

# Mac Pro (Rack, 2019) Top Cover and Memory Access Panel

## First Steps

### Important

- Do not apply external power while the computer is under repair.
- Wear an ESD wrist strap and take precautions to avoid ESD.

## First Steps

- Shut down the computer.
- Unplug all external cables and the power cord.
- Wait for the internal components to cool down.
- If installed in a rack, remove the computer and place it on a clean, solid work surface. Refer to the [Mac Pro \(Rack, 2019\) Essentials Guide](#) for how to remove and install the computer from a rack.



## Tools

- No tools are required.

## Steps For Removal

1. Slide the top cover release latches to the unlocked position and lift the top cover.



2. Pull the top cover away from the front plate and set it aside.



3. Push the silver tabs on the memory access panel to reveal the release levers, then pull the release levers to unlock the panel.



4. Pull the memory access panel away from the housing and set it aside.



### Steps For Reassembly

1. Align the edge of the memory access panel with the housing opening.



2. Firmly press near the release levers and listen for them to click into place.



3. Align the edge of the top cover with the slot in the front plate.



4. Verify that the edges of the top cover are aligned with the slots in the housing.



5. Firmly press near the release latches and listen for them to click into place.



# Mac Pro (Rack, 2019) Logic Board with Internal Frame

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Top Cover and Memory Access Panel](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [System Fans](#)



## Tools

1. T5 screwdriver
2. T8 screwdriver
3. Cut-resistant gloves (923-01368)

If replacing the logic board, the following tools are also required to complete [System Configuration](#):

4. Digital barcode scanner (923-01232)
5. USB-C to USB-C charge cable (661-06670)
6. Mac Pro (2019) power cord (923-03314)



### Steps For Removal

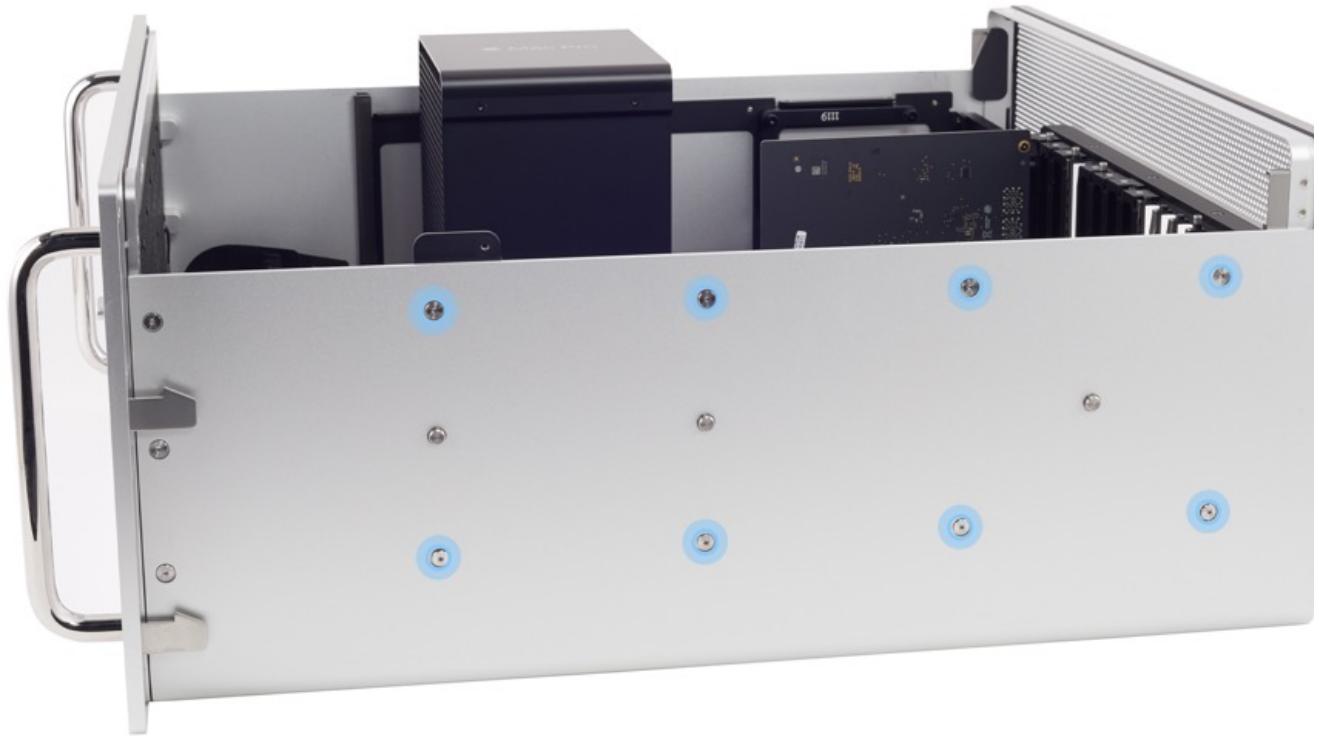
1. Remove two T5 screws from the front I/O board flex cable cowling. Remove the cowling and set it aside.



2. Disconnect the two front I/O flex cable connectors from the logic board.



3. Remove sixteen T8 screws, eight from each side of the housing.



4. **Warning:** To avoid pinching your fingers, put on cut-resistant gloves. Grab both sides of the internal frame and carefully lift the logic board out of the housing.

**Note:** The image below shows the logic board with internal frame already removed from the housing.



**Important:** Continue with the removal steps only if you are replacing the logic board, or if you are need to replace the top frame, PCIe slots frame, or bottom frame.

- If replacing the logic board, remove the following parts. Then proceed with steps 5–7.
  - [CPU thermal module](#)
  - [CPU](#)
  - [Blower](#)
  - [Memory](#)
  - [Speaker](#)
  - [Storage](#)
- If replacing the top frame or PCIe slots frame, remove the [CPU thermal module](#). Then proceed with steps 5–6.
- If replacing the bottom frame, jump to step 7.

5. Hold the top frame while removing four T8 screws from the top of the logic board and three T8 screws from the PCIe slots frame bracket. Then set the top frame aside.



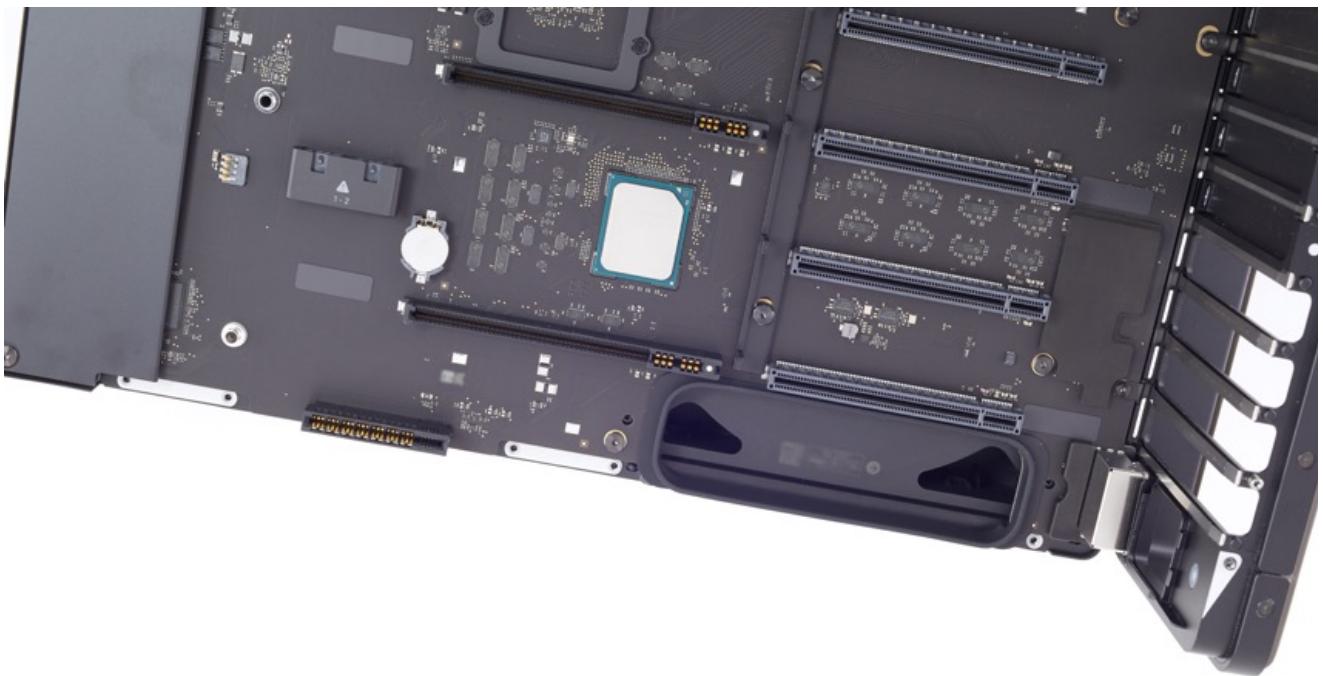
**Note:** If replacing the top frame, remove two T8 screws from the PCIe slots frame bracket and set the bracket aside.



6. Remove four screws from the side of the logic board and lift the PCIe slots frame off of the bottom frame alignment pins.



7. Lay the logic board memory side down. Remove five screws from the bottom of the logic board, then remove the bottom frame.



## Steps For Reassembly

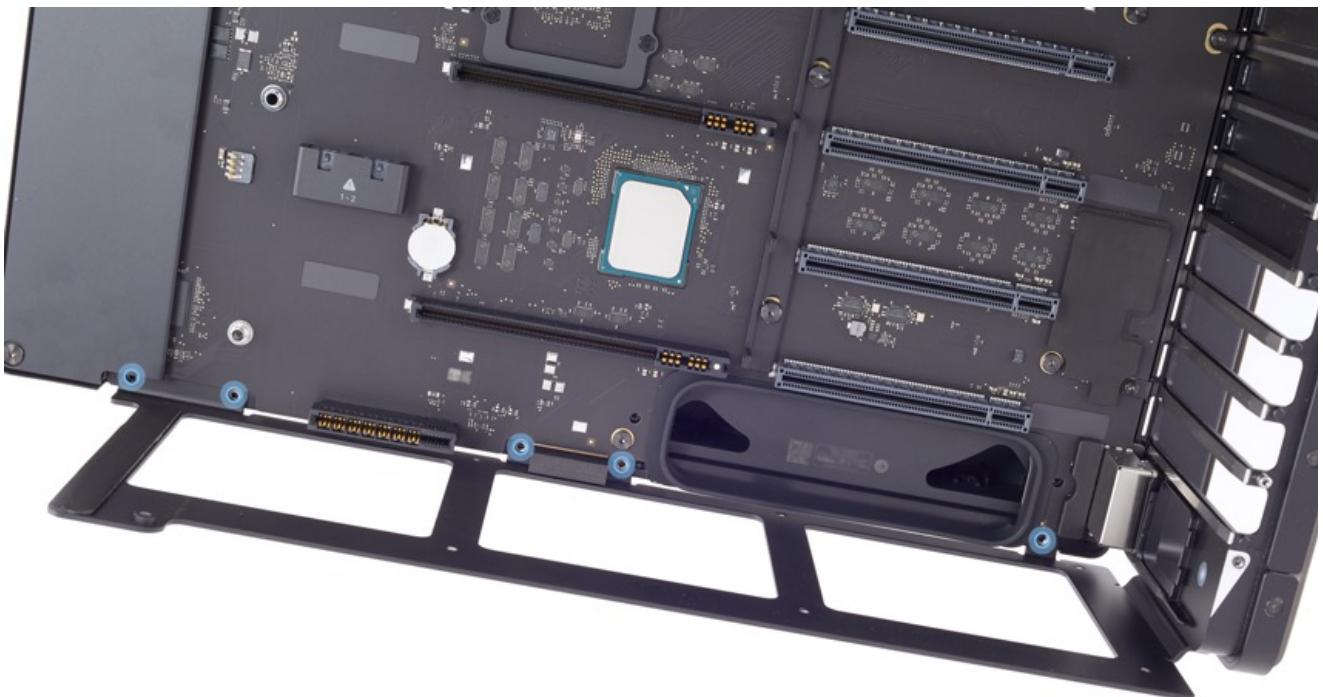


**Important:** If replacing the logic board:

- For [System Configuration](#), add the parts to the repair and scan the QR code on the known bad board (KBB) and known good board (KGB) logic boards. Scan only the QR code near the power supply connector.



1. Position the bottom frame and reinstall five T8 screws (923-03419).



2. Align the three holes on the bottom of the PCIe slots frame with the pins on the bottom frame. Then reinstall four T8 screws (923-03409) on the side of the logic board.



3. Align the screw holes on the top frame with the PCIe slots frame bracket. Reinstall two T8 screws (923-03432).





4. Use the three holes on the bottom of the PCIe slots frame bracket to position the top frame. Reinstall four T8 screws (923-03419) on the top of the logic board and three T8 screws (923-03645) on the PCIe slots frame.
- T8 (923-03419):



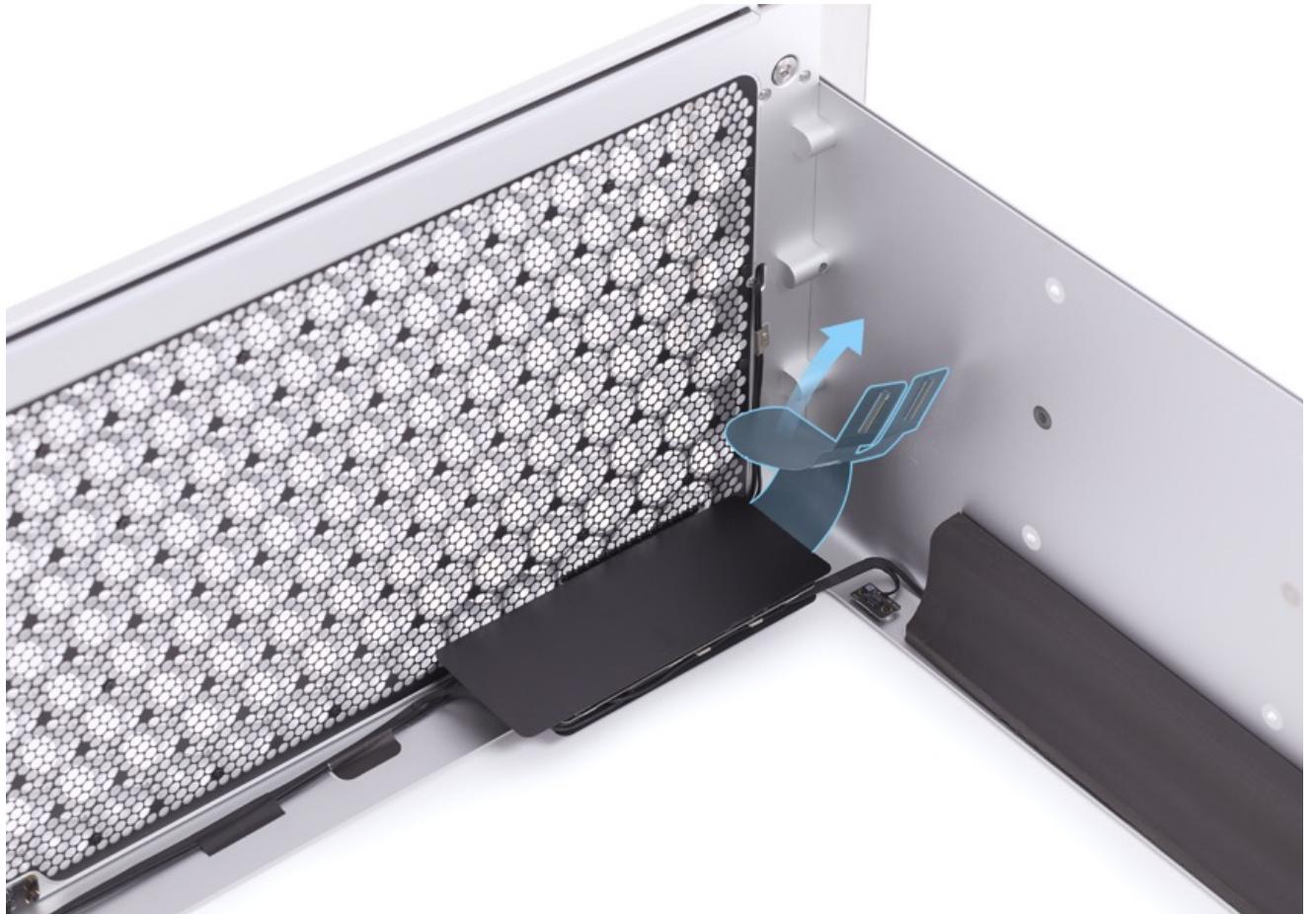
- T8 (923-03645):



5. If you replaced the logic board, reinstall the following parts:

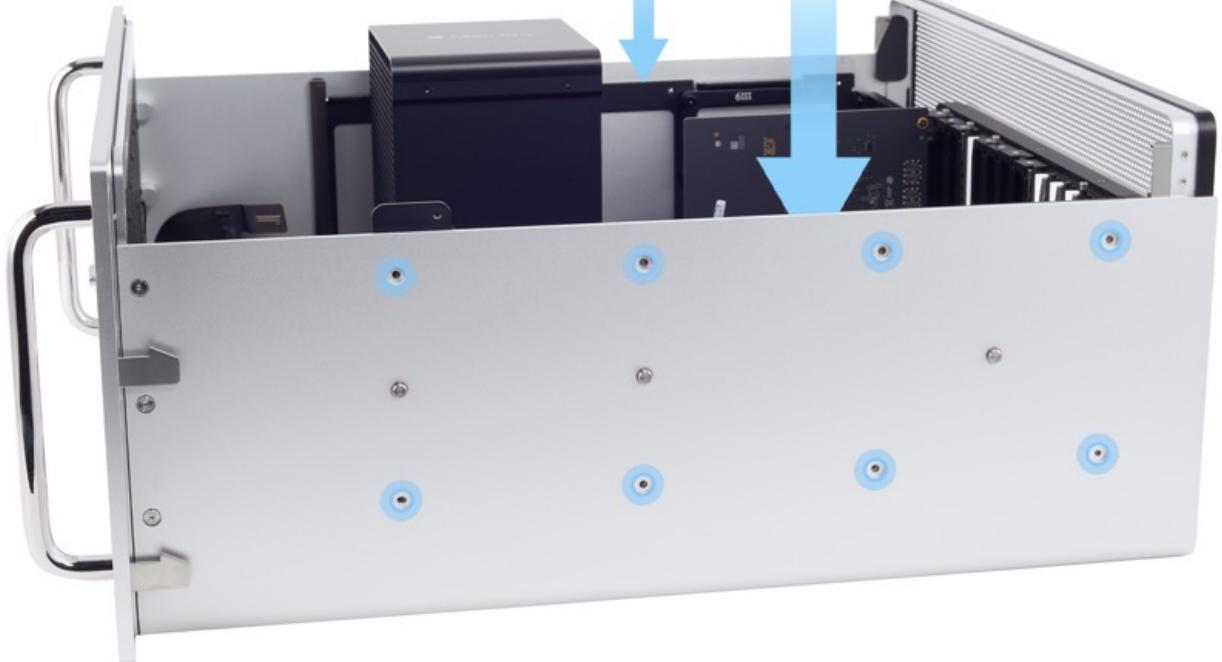
- [Storage](#)
- [Speaker](#)
- [Memory](#)
- [Blower](#)
- [CPU](#)
- [CPU thermal module](#)

6. Move the front I/O flex cable out of the way. Use Kapton tape to tape it against the housing.



7. **Warning:** To avoid pinching your fingers, put on cut-resistant gloves. Hold the edges of the top and bottom frames and carefully lower the internal frame into the housing. Then, reinstall sixteen T8 screws (923-03430).





8. Reconnect the front I/O flex cable to the logic board. There are two connectors, press firmly and evenly to ensure they are fully seated.



9. Reinstall the front I/O flex cable cowling (923-03453) and two T5 screws (923-03412).

- Cowling (923-03453):



- T5 (923-03412):



10. Reinstall the [system fans](#).
11. Reinstall the [power supply](#).
12. Reinstall the [MPX modules](#).
13. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
14. Reinstall the [top cover and memory access panel](#).
15. The repair is not complete until [System Configuration](#) has been performed.

Diagnostic Suites

POST-REPAIR

Full System Diagnostic (EFI)  
Performs comprehensive testing of hardware functionality and memory module integrity. (i) 30-90 minutes >

Full System Diagnostic (OS)  
Performs comprehensive testing of hardware and graphics functionality. (i) 15-30 minutes >

REPAIR COMPLETION

 System Configuration  
Completes required configuration of applicable service parts and updates firmware after repair. This suite becomes available after service part serial numbers are saved in a repair. For more information refer to TP1657: System Configuration. (i) 1-10 minutes >

# Mac Pro (Rack, 2019) Front I/O Board and Flex Cable

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Top Cover and Memory Access Panel](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [System Fans](#)
- [Logic Board with Internal Frame](#)



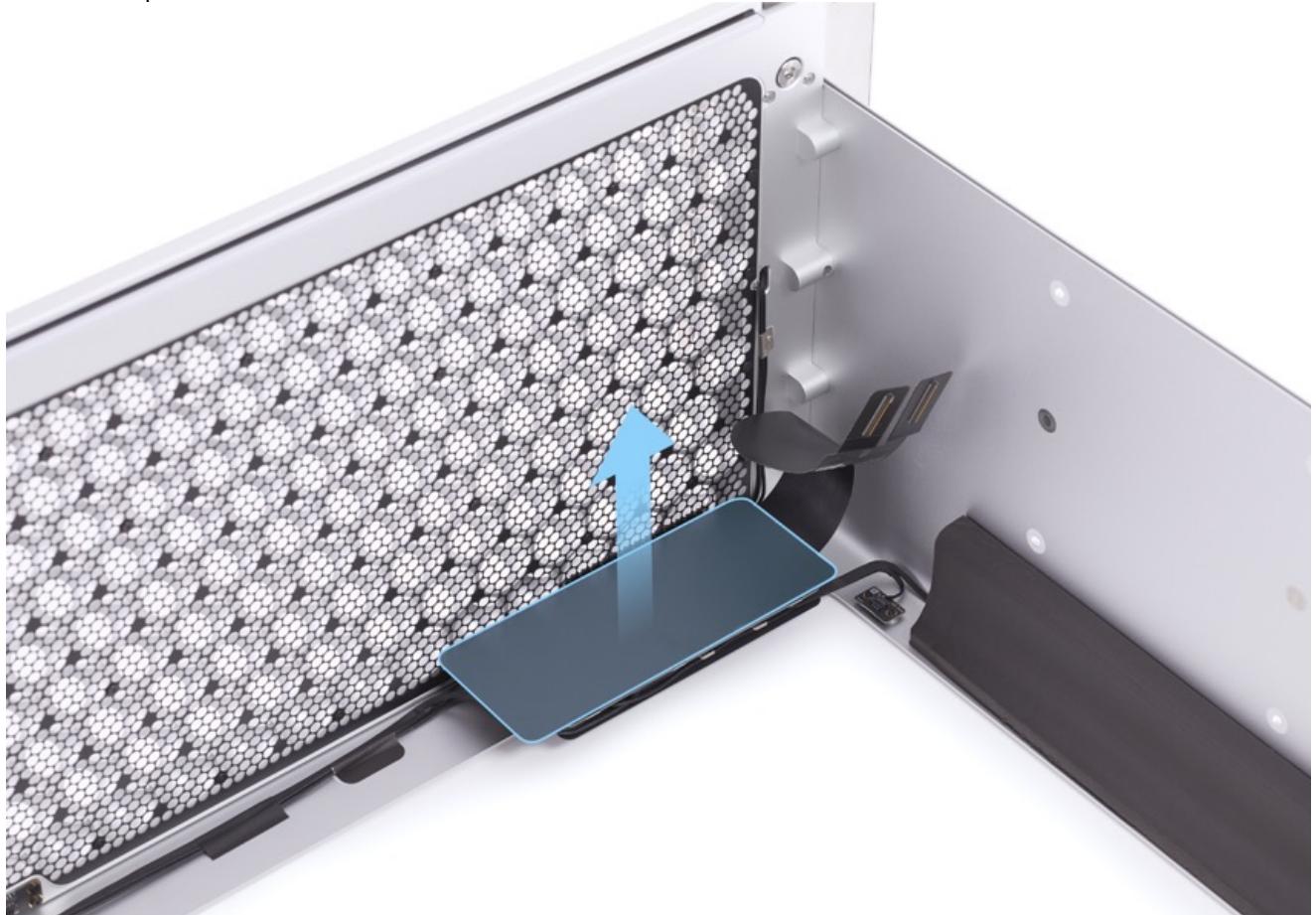
## Tools

1. Torx T3 screwdriver
2. Torx T5 screwdriver
3. Torx T8 screwdriver
4. Antenna tool (923-01322)
5. USB-C to USB-C charge cable (661-06670)
6. Black stick (optional)
7. ESD-safe round-nose tweezers (optional)

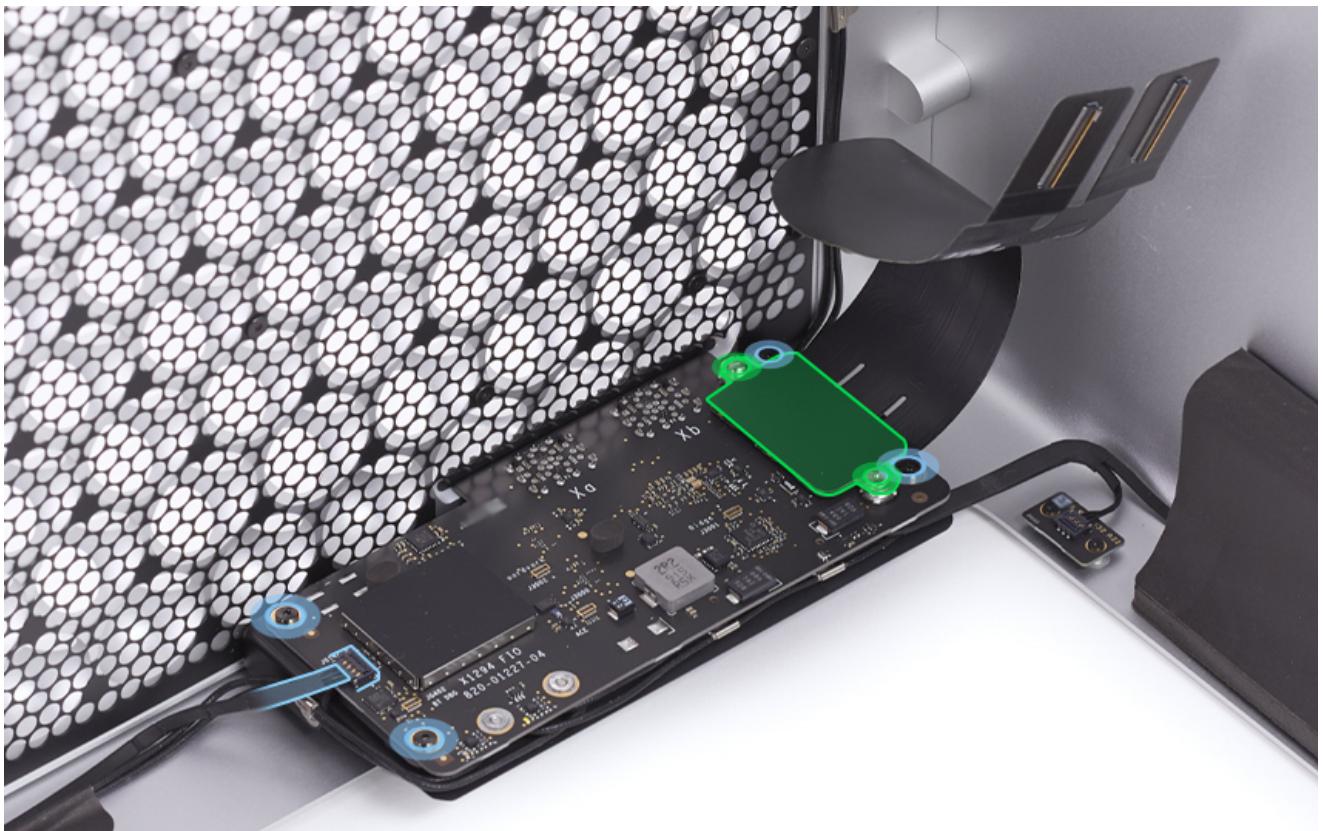


### Steps For Removal

1. Remove the protective cover from the front I/O board.



2. Remove two T5 screws and the flex cable cowling (green), then disconnect the flex cable. Disconnect the power button cable (blue). Remove four T5 screws from the corners of the board (blue).



3. Turn the computer over to access the other side. Remove the protective cover from the front I/O board.

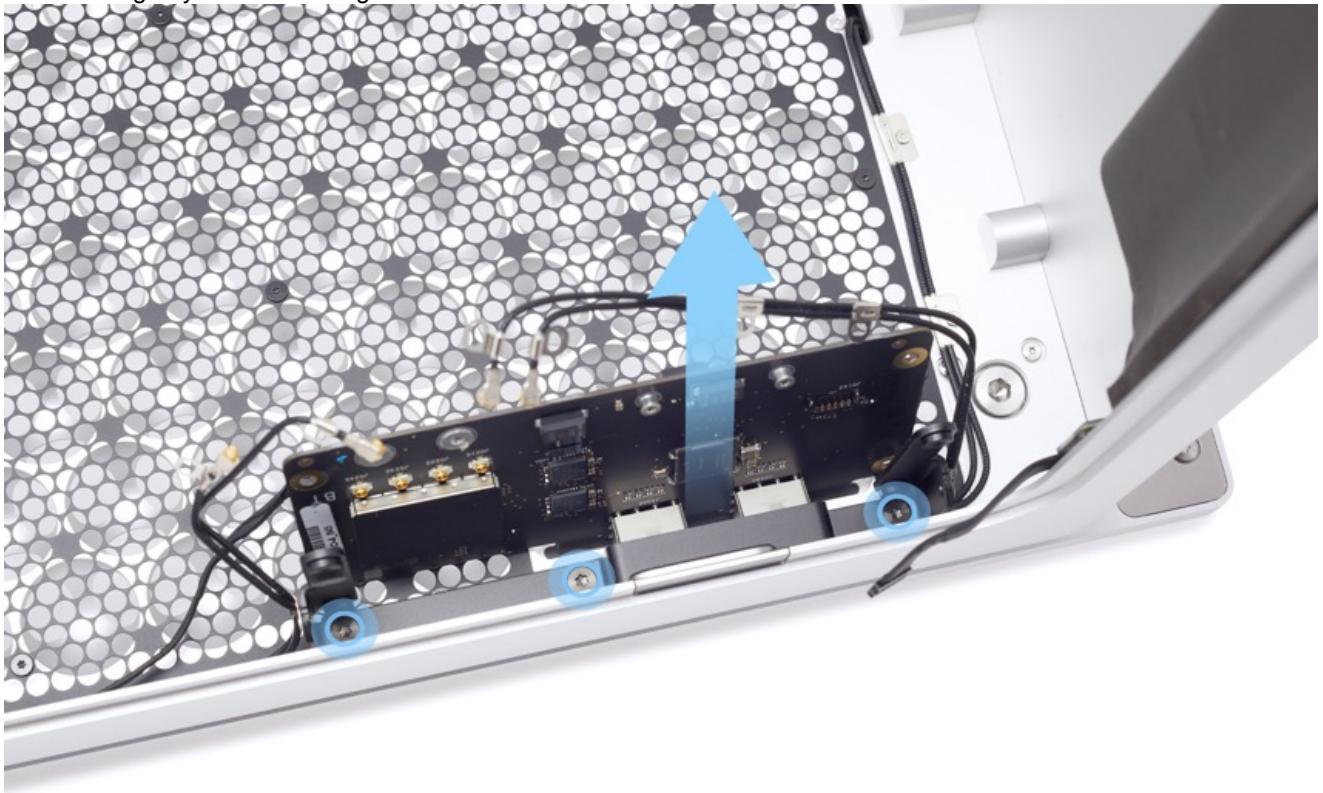


4. Remove two T3 screws (green) from the antenna cable clips. Disconnect the housing sensor cable (blue). Remove two T5 screws and the antenna cable cowling (blue), then use the antenna tool to disconnect the antenna cable connectors.



5. Remove three T8 screws from the front I/O bracket. Partially lift the bracket and carefully remove the front I/O board out from underneath it.

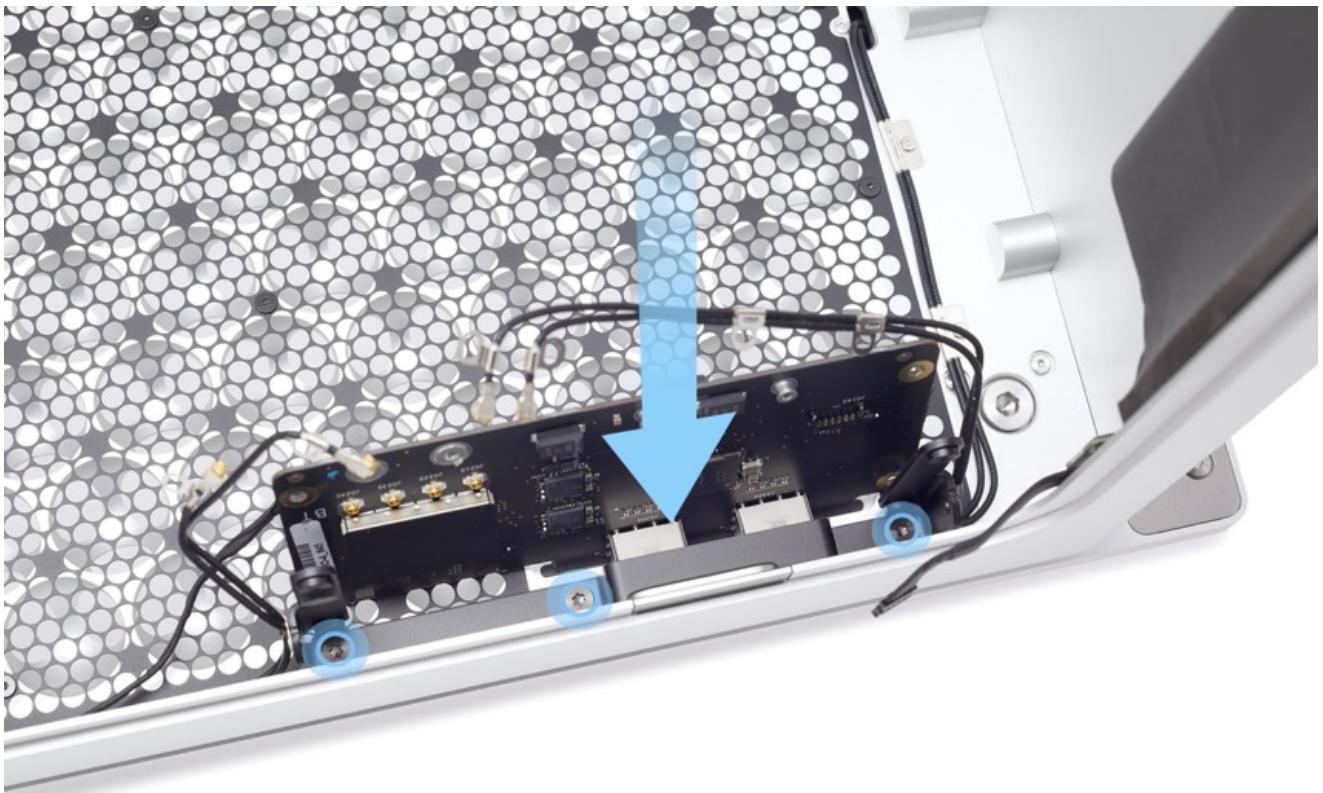
**Caution:** The antenna cables are still attached to the sides of the bracket. Don't pull the bracket too far away from the front housing or you could damage the antenna cables.



## Steps For Reassembly

1. Slide the front I/O board under the bracket and into position in the front plate. Reinstall three T8 screws (923-03436).





2. To check alignment, plug both ends of the USB-C charge cable into the ports.



3. Connect the housing sensor cable. Use the flat end of the antenna tool to connect the antenna cables.



4. Reinstall two T3 screws to the antenna cable clips (green). Reinstall the antenna cable cowling, then reinstall the two T5 screws to the cowling (blue).

- T3 screws (green): 923-03447



- T5 screws (blue): 923-03446



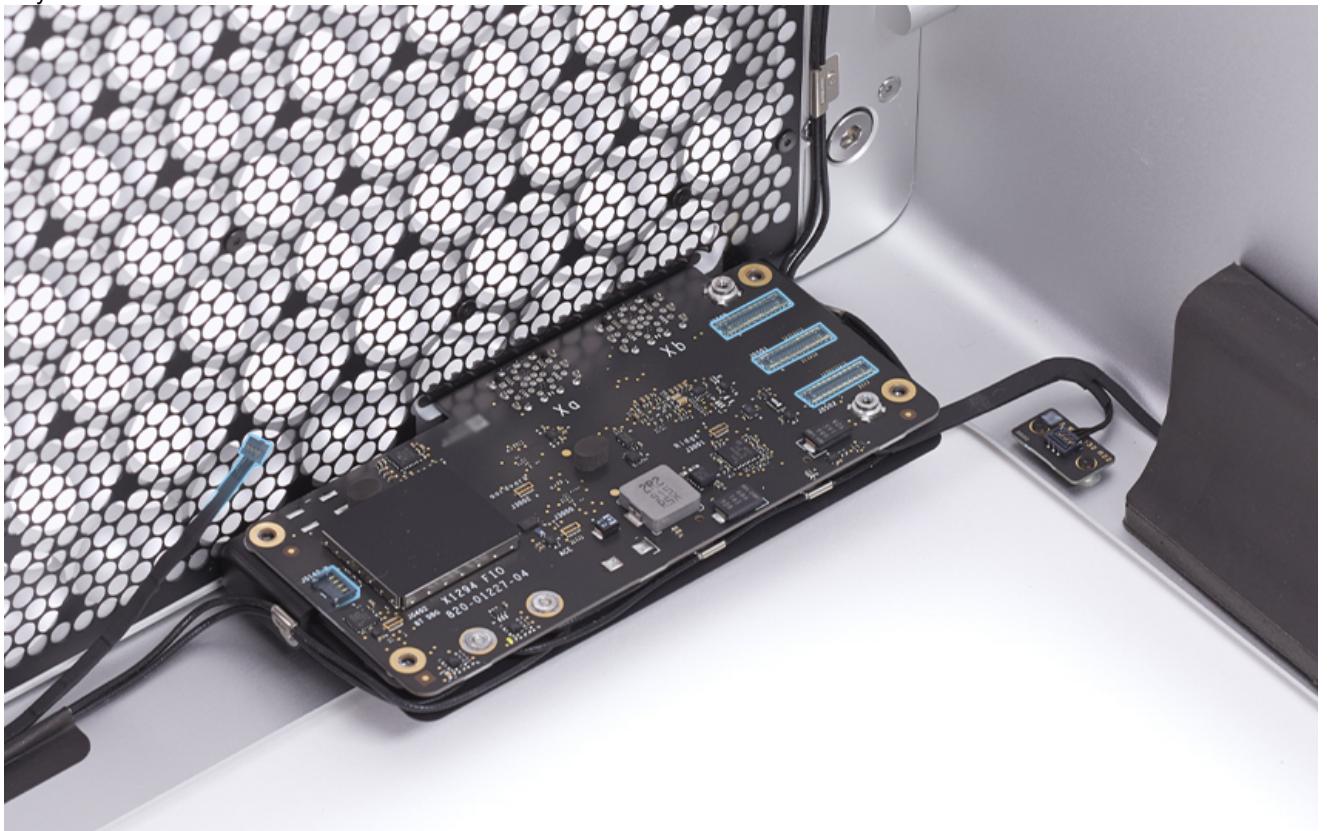
- Antenna Cowling: 923-03427



5. Reinstall the protective cover.



6. Reconnect the flex cable and power button cable. Press evenly on the three flex cable connectors to ensure they are fully seated.



7. Reinstall four T5 screws (blue) to the front I/O board. Reinstall the flex cable cowling and the two T5 screws (green).
  - T5 screws (blue): 923-03445



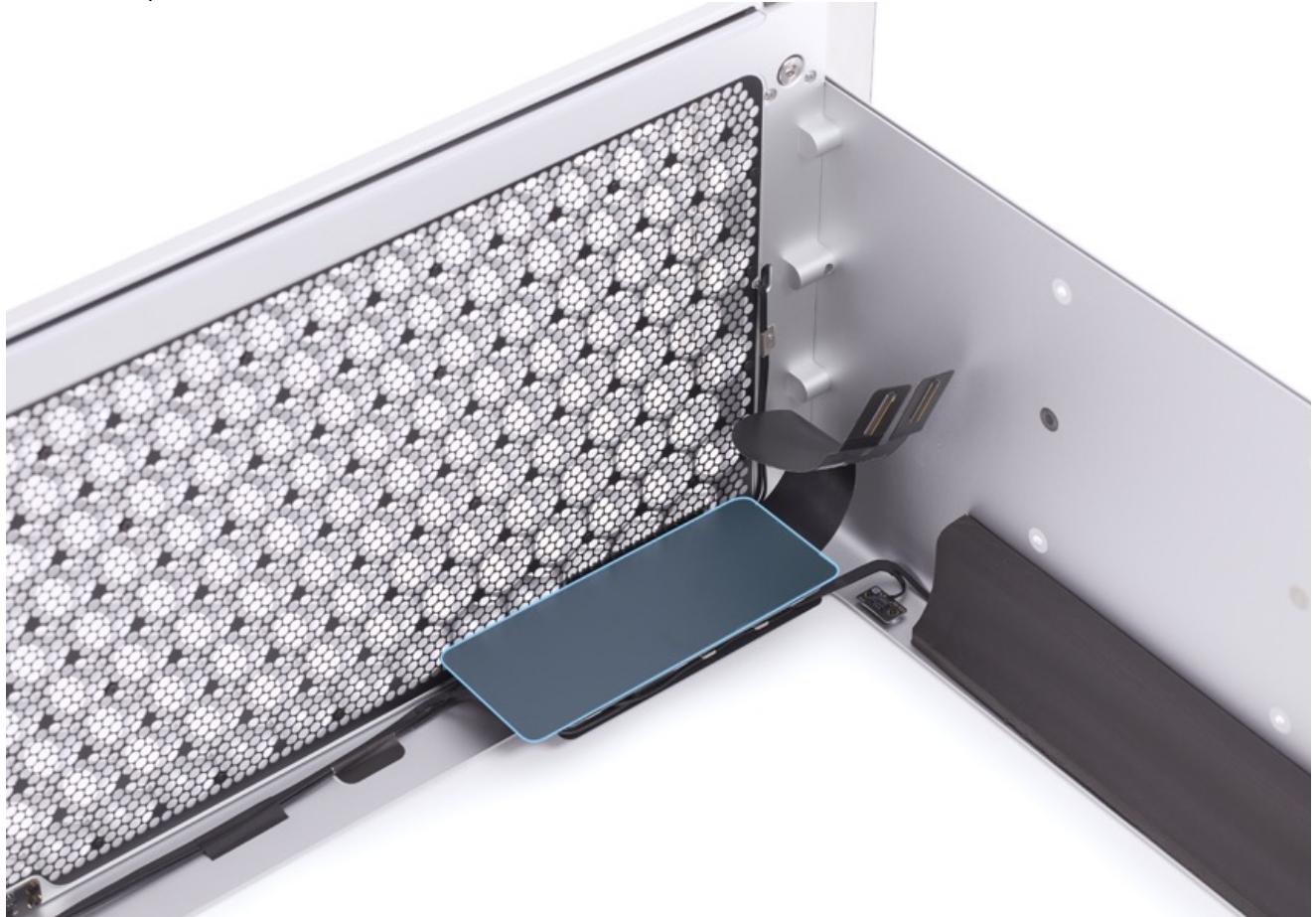
- T5 screws (green): 923-03457



- Cowling: 923-03458



8. Reinstall the protective cover over the board.



9. Reinstall the [logic board with internal frame](#).
10. Reinstall the [system fans](#).
11. Reinstall the [power supply](#).
12. Reinstall the [MPX modules](#).
13. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
14. Reinstall the [top cover and memory access panel](#).

# Mac Pro (Rack, 2019) Front Plate

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Top Cover and Memory Access Panel](#)
- [Apple Afterburner](#) (if installed)
- [MPX Modules](#)
- [Power Supply](#)
- [System Fans](#)
- [Logic Board with Internal Frame](#)



## Tools

1. Torx T8 screwdriver



## Steps For Removal

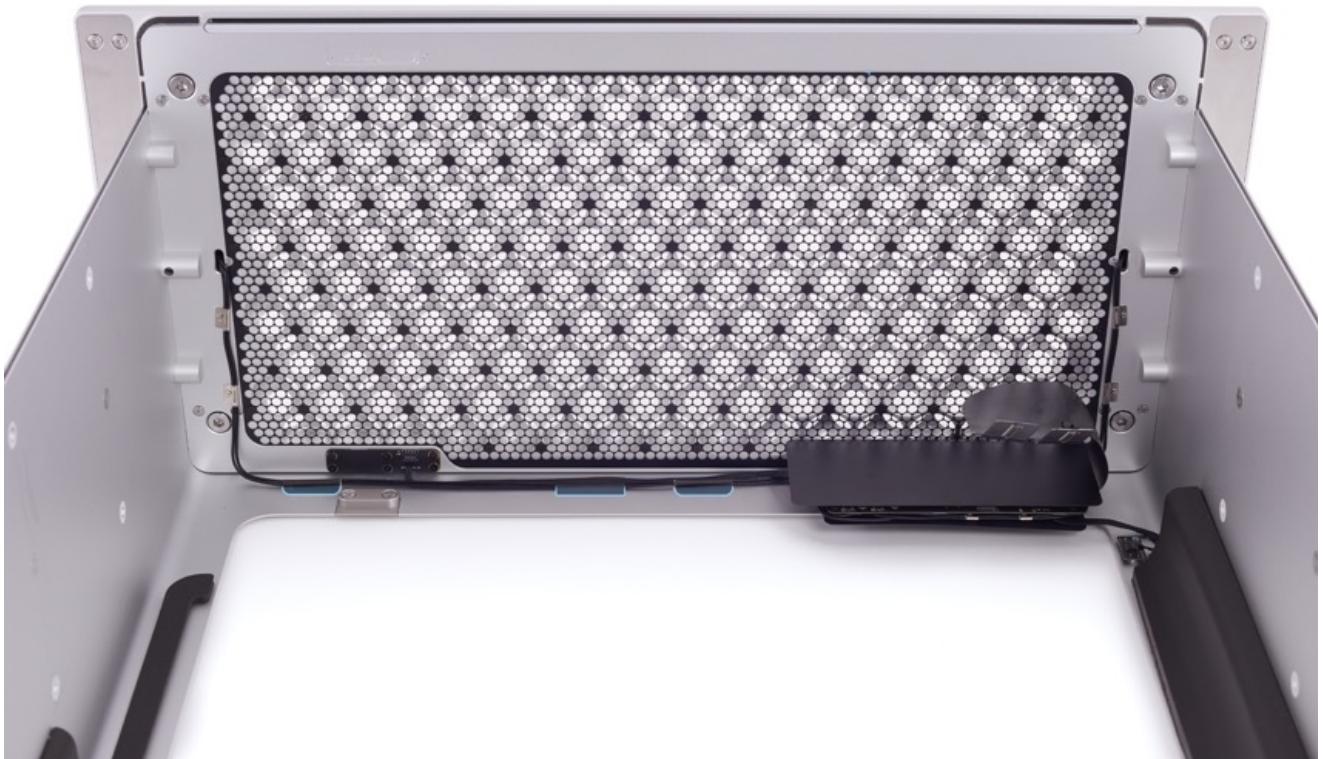
1. Remove the protective cover from the front I/O board.



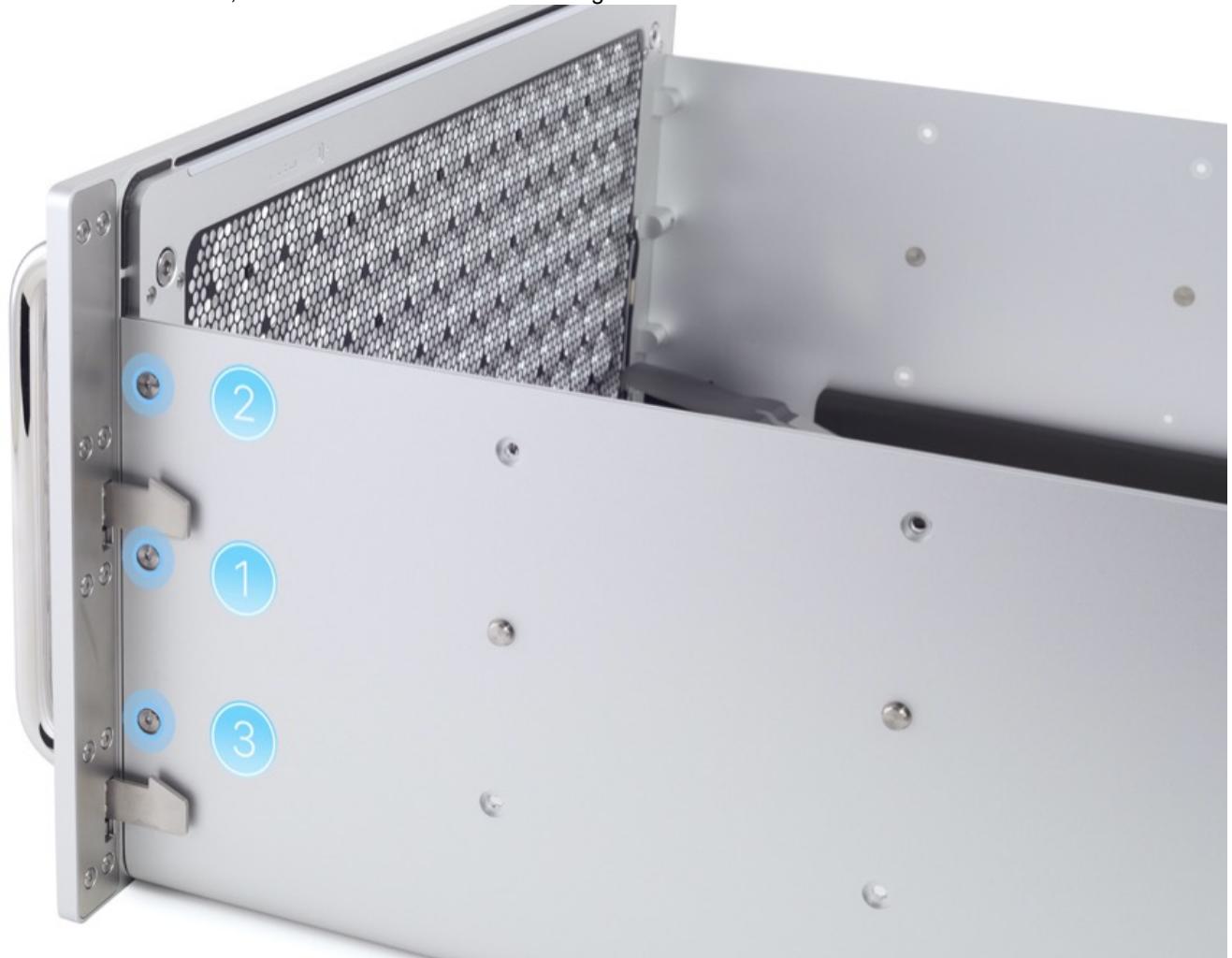
2. Disconnect the housing sensor cable.



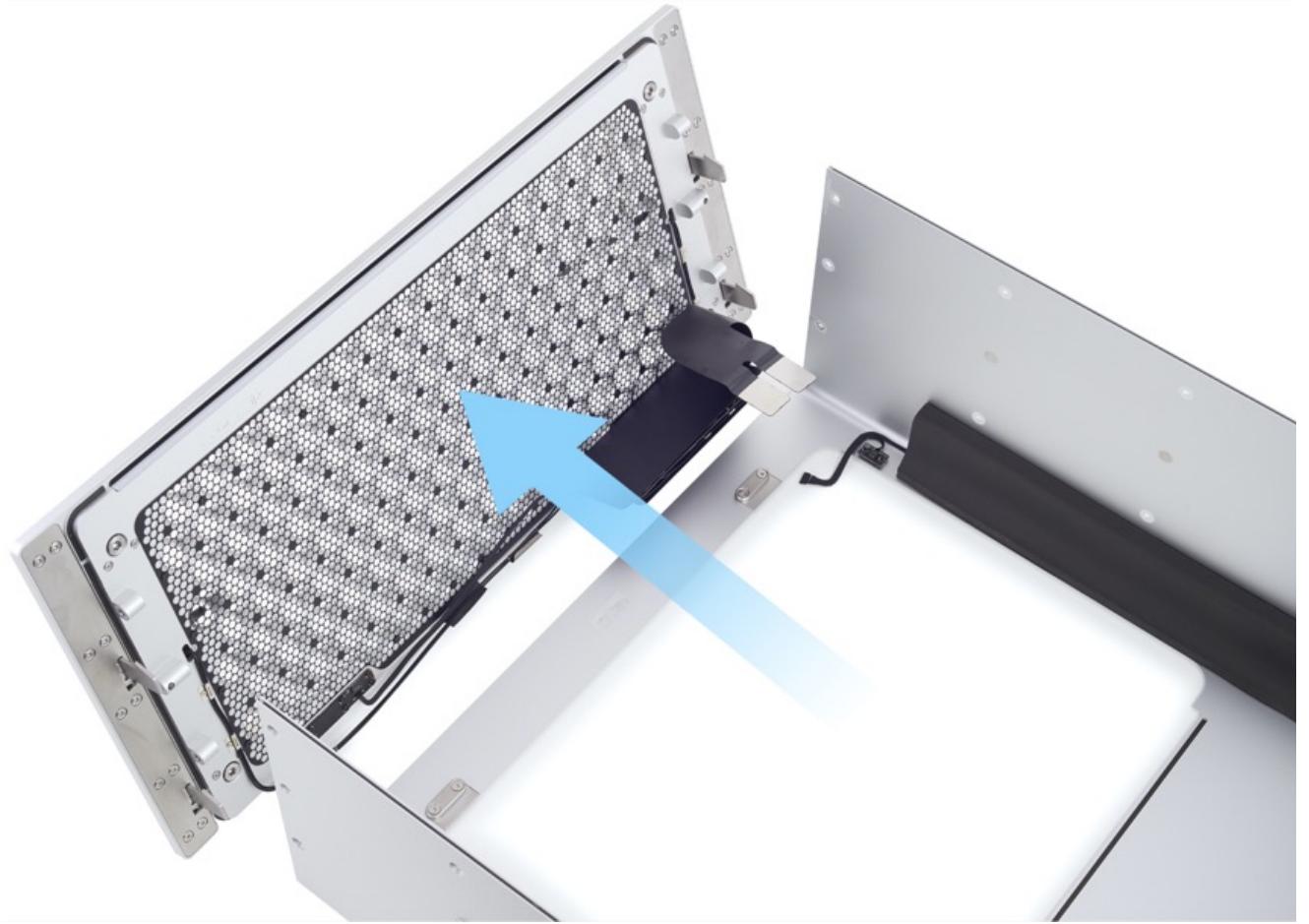
3. Gently peel up the tape on the antenna and power button cables.



4. Remove six T8 screws, three from each side of the housing.

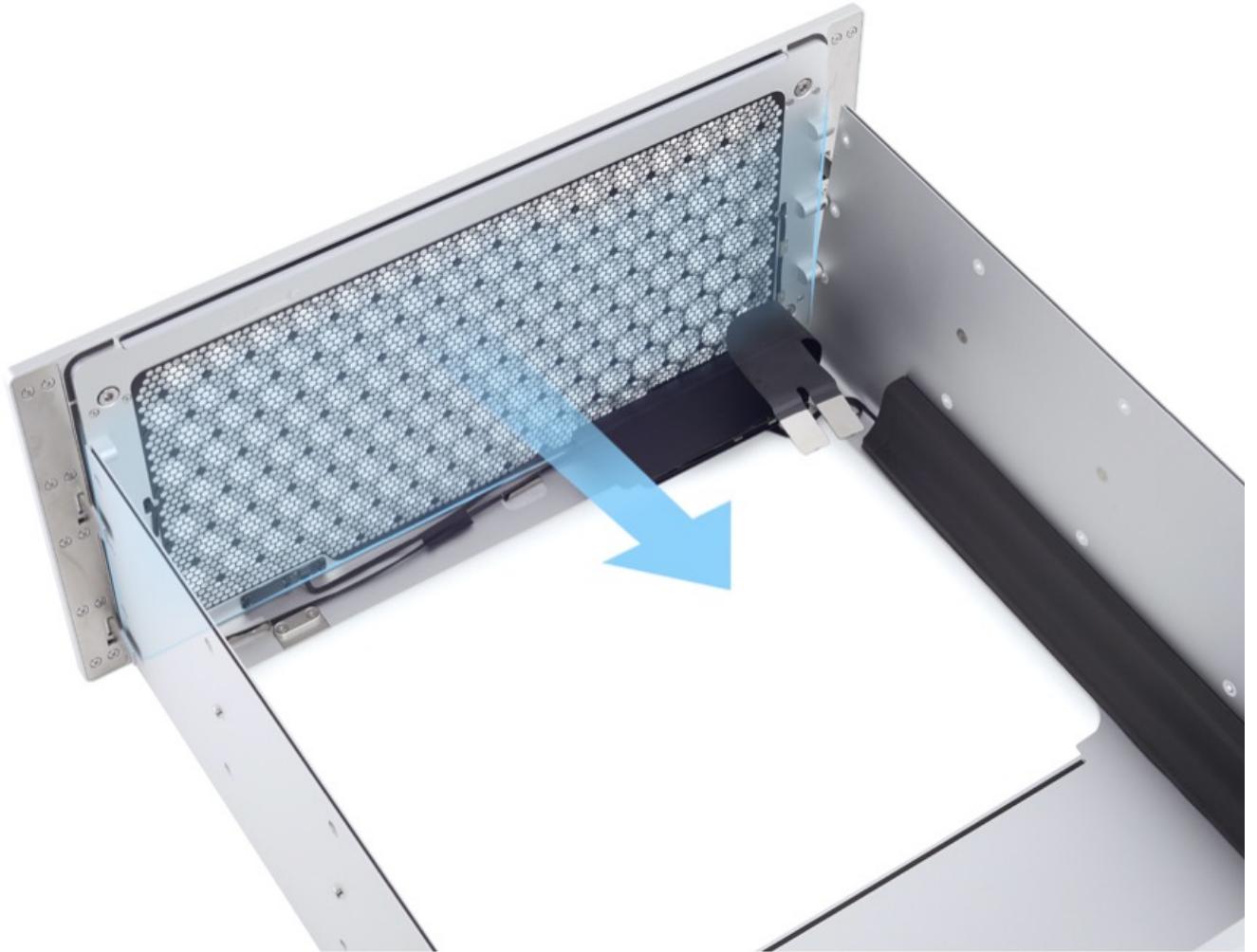


5. Pull the front plate away from the housing.



### Steps For Reassembly

1. Align the slots in the front plate with the front edges of the housing. Push the front plate firmly onto the housing.



2. Reapply the tape on the antenna and power button cables to the housing.



3. Reinstall the six T8 screws, three on each side.
  - 1 (long): 923-03881
  - 2 and 3 (short): 923-03442



4. Reconnect the housing sensor cable to the front I/O board.



5. Reapply the protective cover.



6. Reinstall the [logic board with internal frame](#).
7. Reinstall the [system fans](#).
8. Reinstall the [power supply](#).
9. Reinstall the [MPX modules](#).
10. Reinstall the [Apple Afterburner](#) if the Mac Pro was configured with one.
11. Reinstall the [top cover and memory access panel](#).

# Mac Pro (Rack, 2019) Housing

## First Steps

### Important:

- Only [Apple-certified technicians](#) should perform this procedure. Wear an ESD wrist strap and take precautions to avoid ESD.

### Remove:

- [Top Cover and Memory Access Panel](#)
- [Apple Afterburner](#)
- [MPX Modules](#)
- [Power Supply](#)
- [Logic Board with Internal Frame](#)
- [Front Plate](#)



## Tools

- No tools are required.

## Steps For Removal

1. When all components are removed, the housing is the remaining part.

**Important:** The housing sensors and housing sensors cable are included with a replacement housing.



## Steps For Reassembly

1. Reinstall the [front plate](#).
2. Reinstall the [logic board with internal frame](#).
3. Reinstall the [power supply](#).
4. Reinstall the [MPX modules](#).
5. Reinstall the [Apple Afterburner](#) if the Mac Pro is configured with one.
6. Reinstall the [top cover and memory access panel](#).

# Mac Pro (Rack, 2019) Rack Rails

## First Steps

### First Steps:

- Only [Apple-certified technicians](#) should perform this procedure.
- Shut down the computer.
- Unplug all external cables and the power cord.
- This procedure provides removal and reassembly steps only for the inner rails that attach to the sides of the Mac Pro. Refer to the [Mac Pro \(Rack, 2019\) Essentials Guide](#) for detailed instructions on how to remove and install the Mac Pro from a rack.

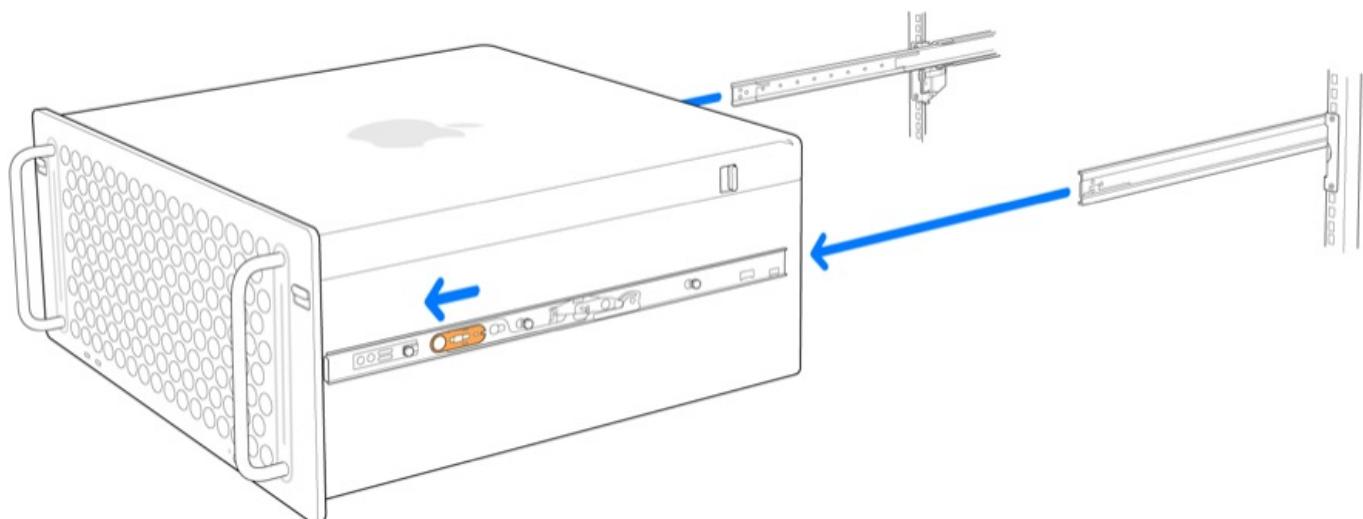


## Tools

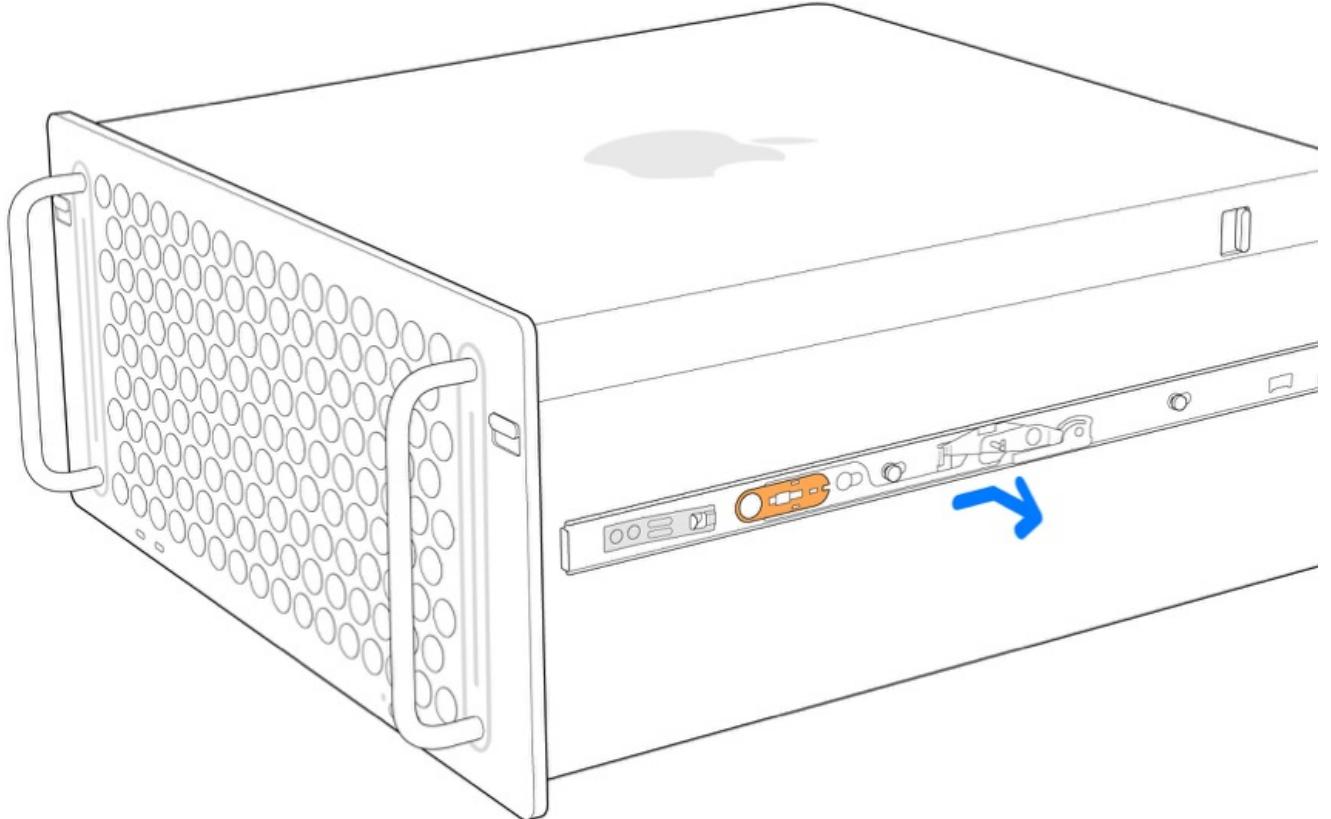
- No tools are required.

## Steps For Removal

**Note:** The inner rails remain attached to the sides of the Mac Pro after it has been removed from the rack.

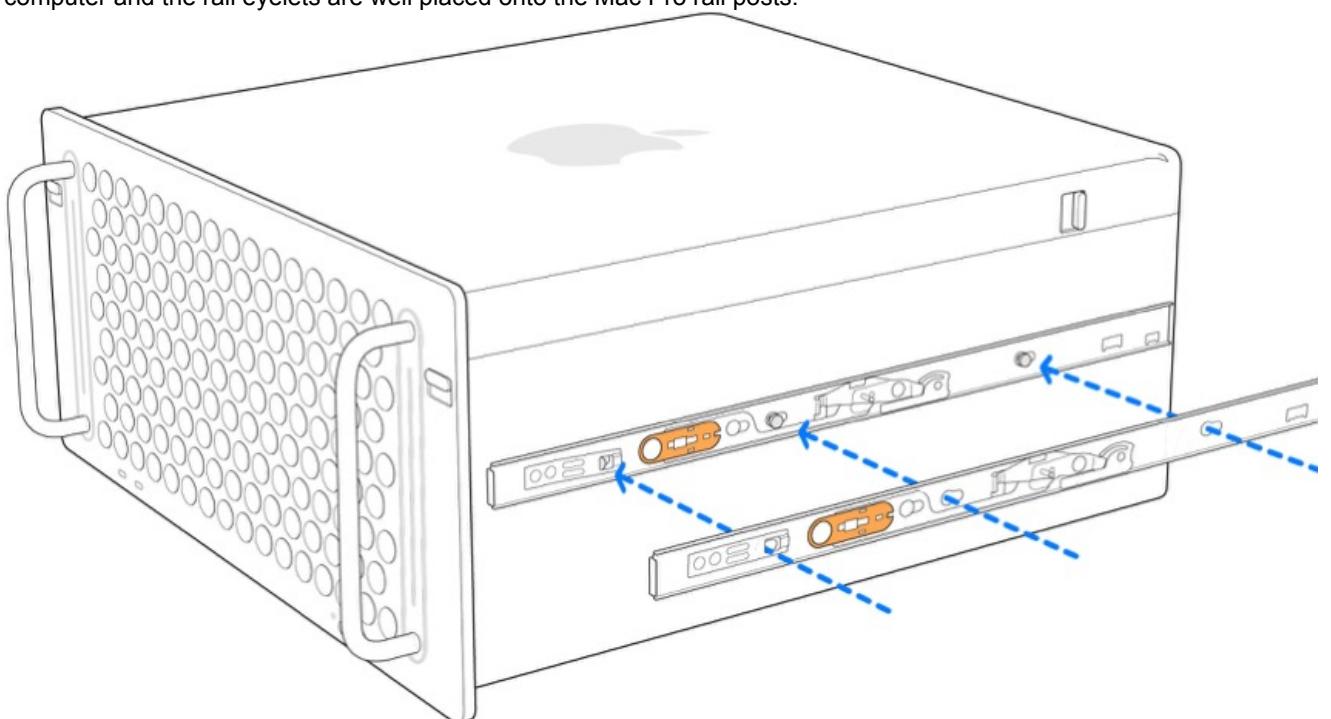


1. Detach the rail by pulling the spring latch forward, then sliding the rail back. Repeat this step to remove the rail on the other side.

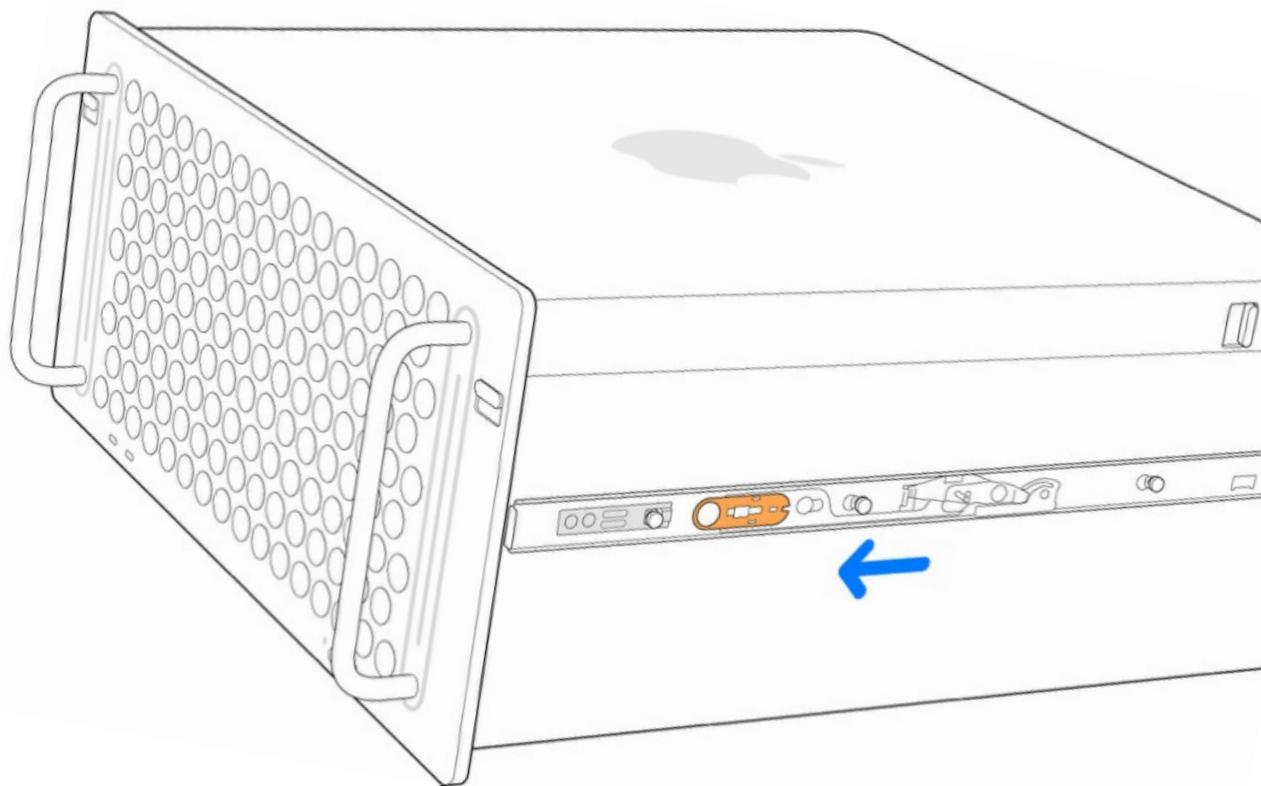


### Steps For Reassembly

1. Attach the inner rails to the sides of Mac Pro, making sure that the release latches are towards the front of the computer and the rail eyelets are well placed onto the Mac Pro rail posts.



2. Slide the rail section forward until the spring lock engages the forward post.

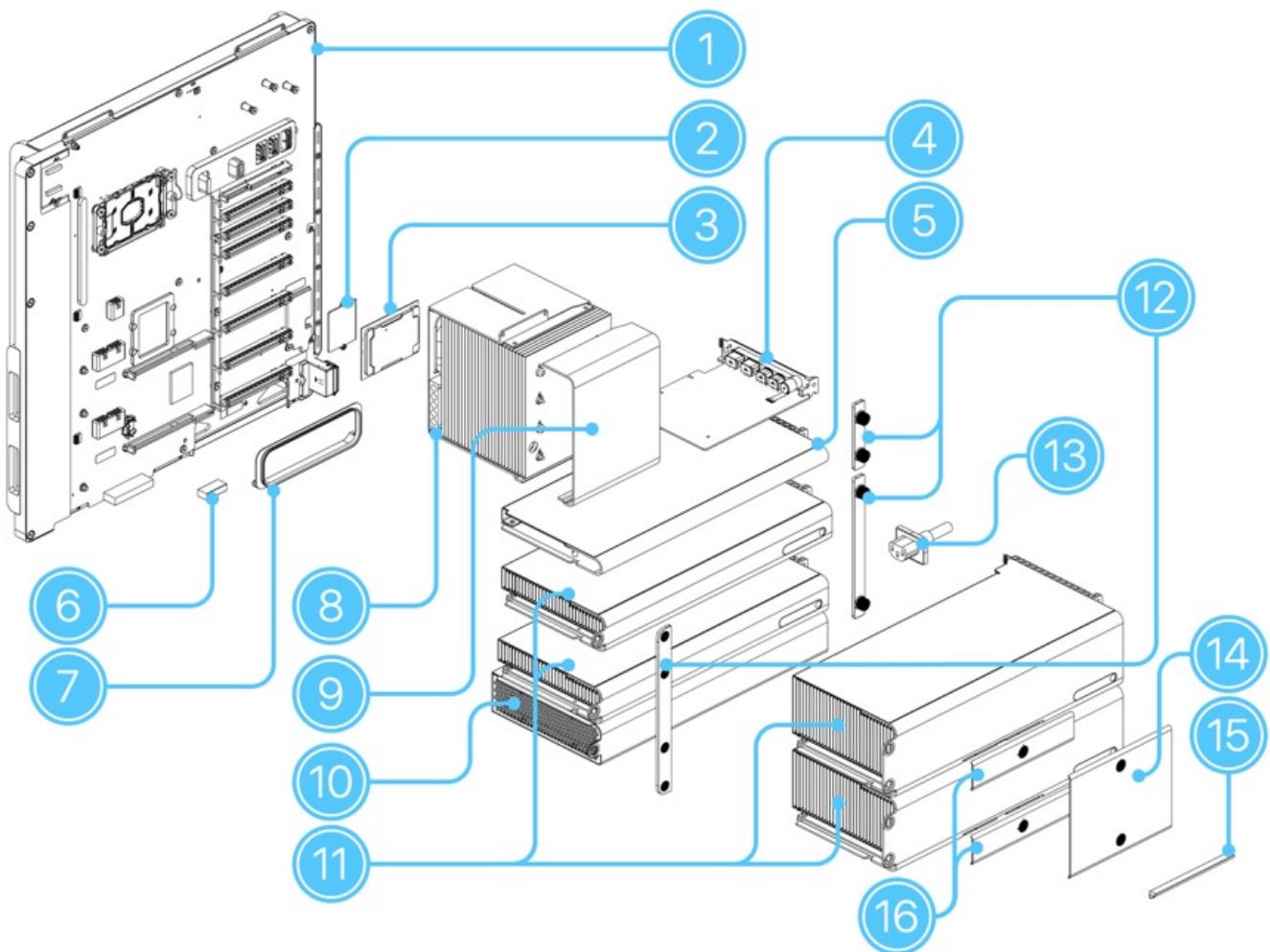


# Mac Pro (2019) and Mac Pro (Rack, 2019) Exploded Views

**Important:** Mac Pro (2019) and Mac Pro (Rack, 2019) share all of the parts listed under the two “Logic Board” exploded view images. Refer to the Mac Pro (2019) exploded view image or the Mac Pro (Rack, 2019) exploded view image for parts specific to each model.

## Logic Board - PCIe side

Click the image to expand.

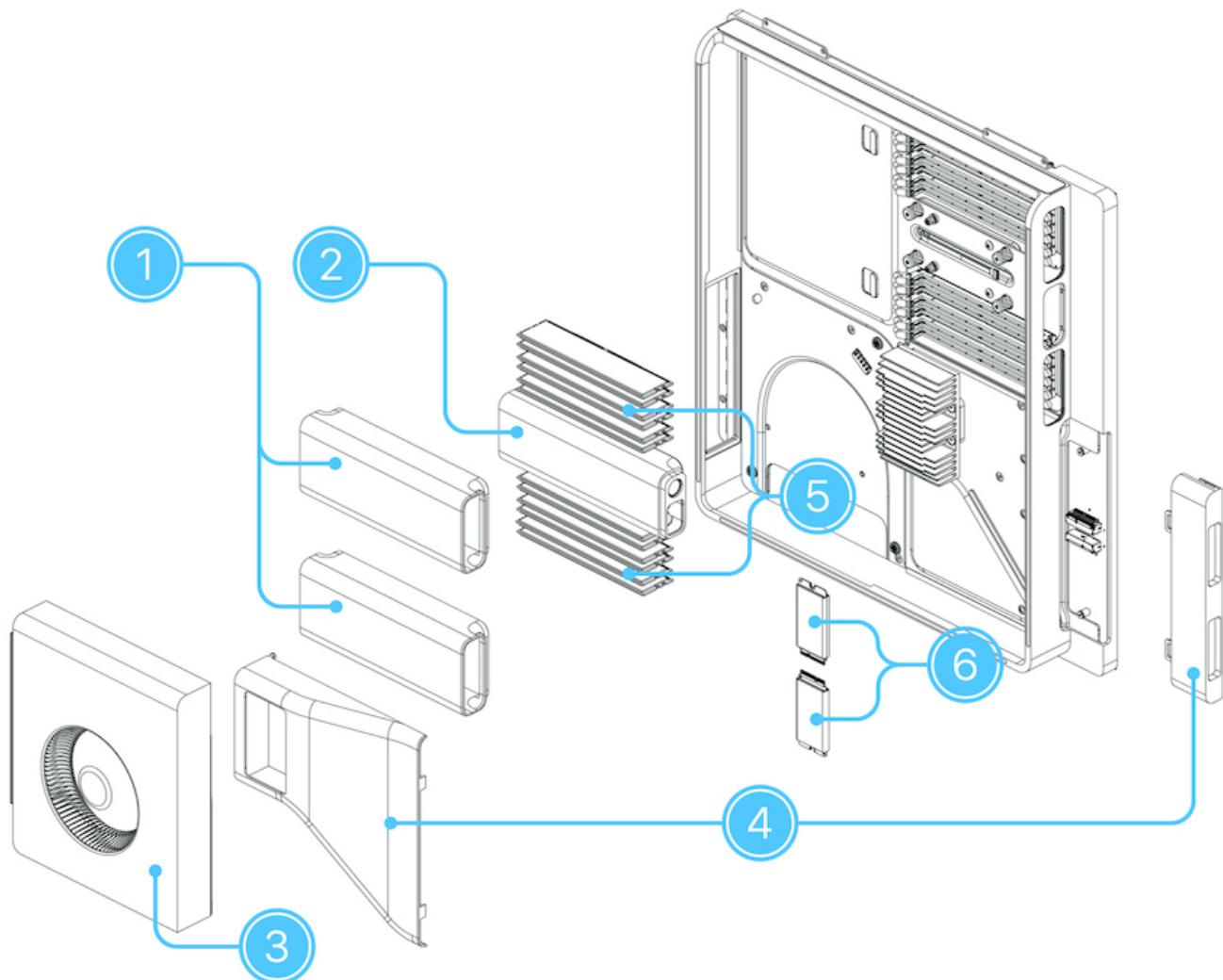


1. Logic Board
  - 661-13048
2. Cowling, Top I/O Flex Cable to Logic Board
  - 923-03428
3. CPU
  - 661-13049, 8-core, 3.5GHz Intel Xeon W
  - 661-13050, 12-core, 3.3GHz Intel Xeon W
  - 661-13051, 16-core, 3.2GHz Intel Xeon W
  - 661-13052, 24-core, 2.7GHz Intel Xeon W
  - 661-13053, 28-core, 2.5GHz Intel Xeon W
4. Apple I/O Card
  - 923-03330
5. Apple Afterburner
  - 661-13055
6. EMI Gasket
  - 923-03318
7. Power Supply Gasket
  - 923-03665
8. CPU Thermal Module
  - 923-03293
9. CPU Thermal Module Cover
  - 923-03324

10. Power Supply
  - 661-13071
11. MPX Modules
  - 661-13056, AMD Radeon Pro 580X MPX Module
  - 661-13054, AMD Radeon Pro Vega II MPX Module
  - 661-13057, AMD Radeon Pro Vega II Duo MPX Module
12. Clamp Plates (kit)
  - 076-00449 (includes left, right, and upper clamp plates)
13. Power Cord
  - 923-03314
14. Infinity Fabric Link Bridge
  - 923-03336
15. Infinity Fabric Link Cap
  - Not available separately. Ships with MPX Modules.
16. Infinity Fabric Link Jumper
  - 923-03852 (single)

#### Logic Board - Memory side

Click the image to expand.

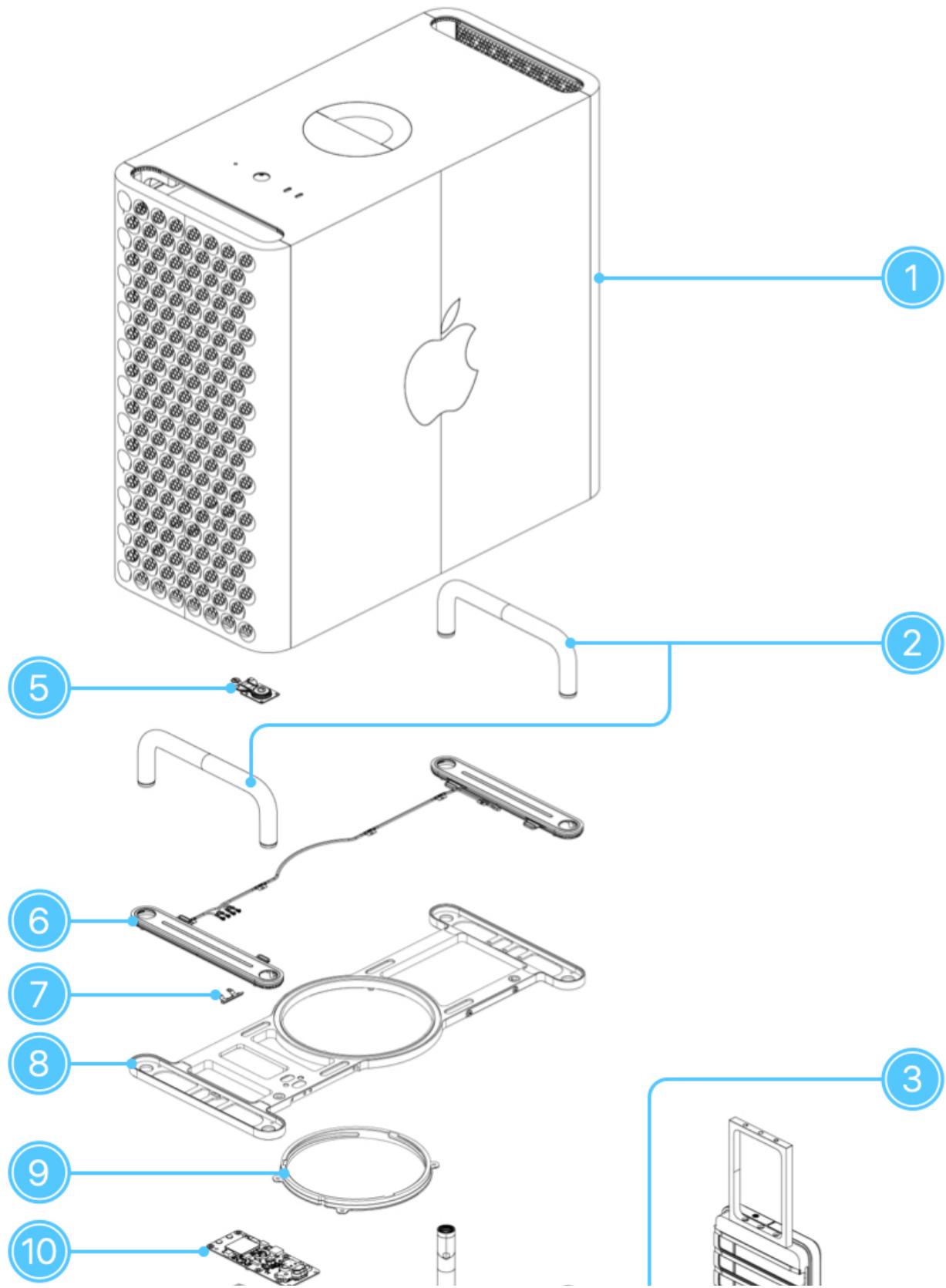


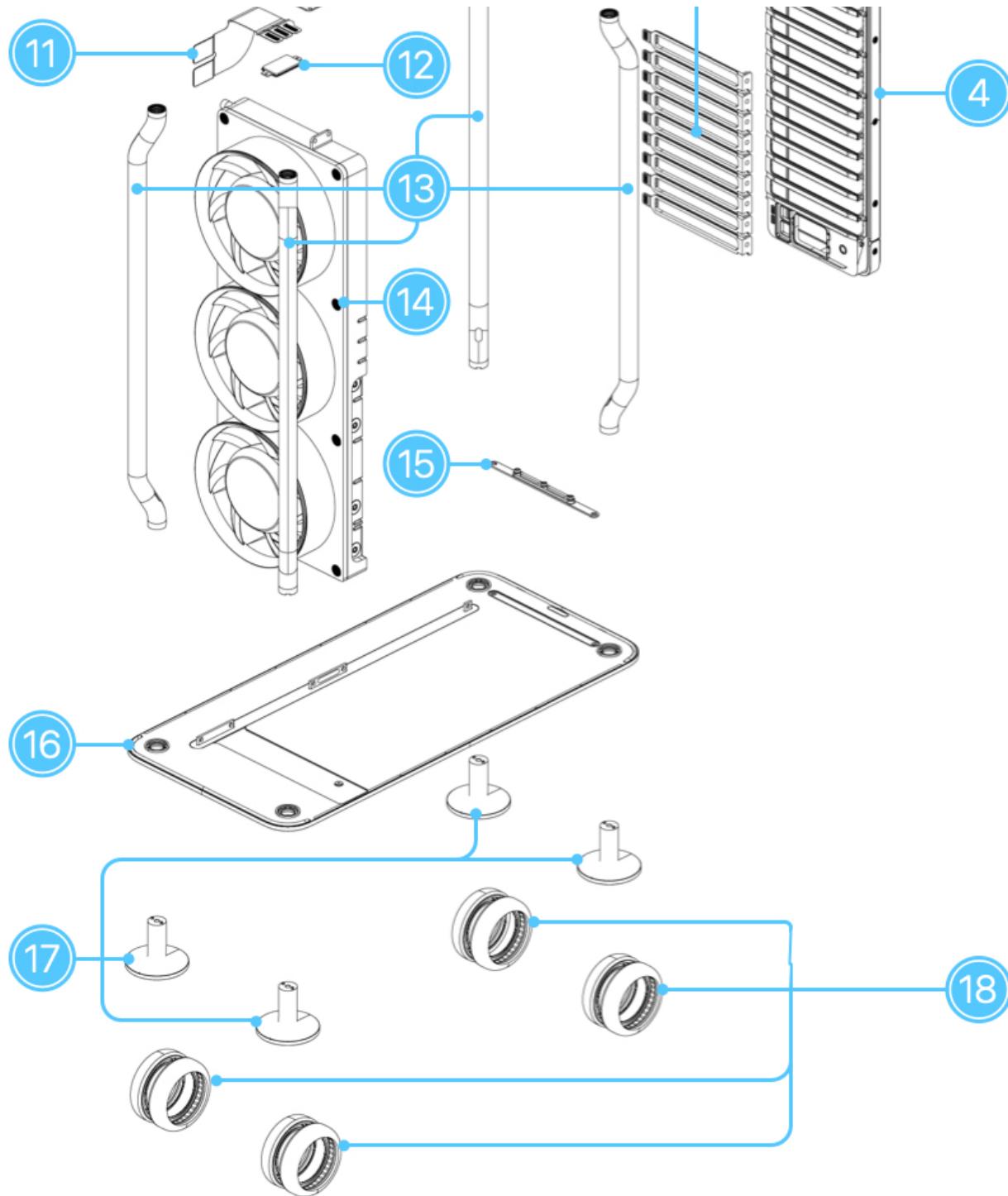
1. Memory (DIMM) Covers
  - 923-03322
2. Speaker
  - 923-03326
3. Blower
  - 923-03328
4. Blower Duct and Flash Storage Cover
  - 923-04232
5. Memory (DIMMs)
  - 661-13062, 8GB DIMM
  - 661-13063, 16GB DIMM
  - 661-13064, 32GB DIMM

- 661-13065, 64GB DIMM
  - 661-13066, 128GB DIMM
6. Storage (flash storage module)
- 661-13067, 256GB (single module)
  - 661-13068, 1TB, 2 x 512GB
  - 661-13069, 2TB, 2 x 1TB
  - 661-13070, 4TB, 2 x 2TB
  - 661-14045, 8TB, 2 x 4TB

#### Mac Pro (2019)

Click the image to expand.



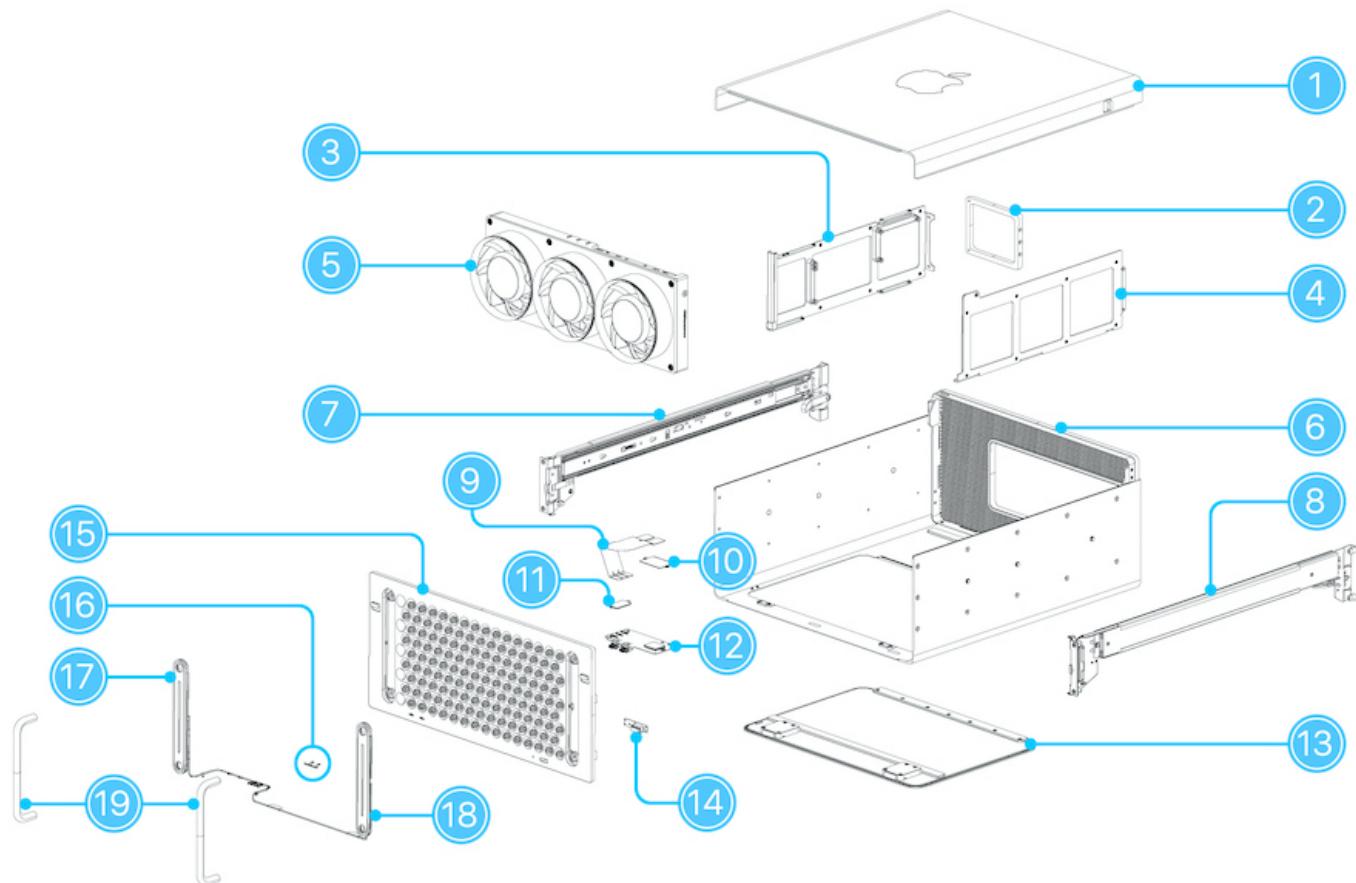


1. Housing
  - 661-15739
2. Handle
  - 923-03331 (single)
3. PCIe Slot Covers
  - 923-03426
4. PCIe Slots Frame
  - 923-03316
5. Power Button with Status Indicator Light (SIL)
  - 923-03317
6. Antennas
  - 076-00455 (pair)
7. Cowling, Antenna
  - 923-03427
8. Space Frame Top Plate
  - 923-03336
9. Locking Ring
  - 923-04208
10. Top I/O (TIO) Board
  - 923-03329

11. Top I/O (TIO) Flex Cable
  - 923-03456
12. Cowling, TIO Flex Cable to TIO Board
  - 923-03458
13. Space Frame Bars
  - 923-03334
14. System Fans
  - 923-03327
15. PCIe Slots Frame Mount Plate
  - 923-03337
16. Space Frame Bottom Plate
  - 923-03335
17. Foot
  - 923-03332 (single)
18. Wheel
  - 923-03333 (single)

### Mac Pro (Rack, 2019)

Click the image to expand.



1. Top Cover
  - 923-03666
2. PCIe Slots Frame Bracket
  - 923-03451
3. Internal Frame, Top (left)
  - 923-03668
4. Internal Frame, Bottom (right)
  - 923-03669
5. System Fans
  - 923-03327
6. Housing
  - 923-03667
7. Rack Slide Rail, Left
  - 923-03658
8. Rack Slide Rail, Right
  - 923-03659
9. Front I/O (FIO) Flex Cable
  - 923-03675
10. Cowling, FIO Flex Cable to Logic Board

- 923-03453
- 11. Cowling, FIO Flex Cable to FIO Board
  - 923-03452
- 12. Front I/O Board
  - 923-03674
- 13. Memory Access Panel
  - 923-03670
- 14. Kit, Power Button with Status Indicator Light (SIL) Board
  - 076-00454
- 15. Front Plate
  - 923-03681
- 16. Cowling, Antenna Cables
  - 923-03427
- 17. Antenna, Left
  - 923-03449
- 18. Antenna, Right
  - 923-03450
- 19. Handle
  - 923-03878 (single)

# Mac Pro (2019) and Mac Pro (Rack, 2019) Screw Charts and Screw Location Diagrams

## Contents

- Screw Chart for Mac Pro (2019) and Mac Pro (Rack, 2019)
- Screw Chart for Mac Pro (Rack, 2019)
- Screw Location Diagrams for Mac Pro (2019)
- Screw Location Diagrams for Mac Pro (Rack, 2019)

## Screw Chart for Mac Pro (2019) and Mac Pro (Rack, 2019)

**Important:** Screws shared between both models are listed in the following chart. Screws specific to the rack model are listed in the **Screw Chart for Mac Pro (Rack, 2019)** chart below.

<b>923-03321</b> Torx T8    HDD Accessory Bay on Logic Board (3)	<b>923-03404</b> Torx T8    Fan Screw, Rear (short) (2)	<b>923-03405</b> Torx T8    Fan Screw, Rear (long) (1)
<b>923-03406</b> Torx T15    CPU Thermal Module to CPU (2)	<b>923-03407</b> Torx T8    CPU Thermal Module Alignment Pin (3) HDD Accessory Bay Alignment Pin (3)	<b>923-03408</b> Torx T8    Power Supply Grounding Bracket (1)
<b>923-03409</b> Torx T8    Logic Board to PCIe Slots Frame (4)	<b>923-03410</b> Torx T8    Thermal Module Cover (2)	<b>923-03411</b> Torx T8    PCIe Slots Frame to Top Plate (3)

<b>923-03412</b> Torx T5  	<b>923-03413</b> Torx T8  	<b>923-03414</b> Torx Security T55  
Logic Board to TIO Flex Cowling (2) Logic Board to FIO Flex Cowling (2) (rack)	Top I/O (TIO) Board (6)	Bottom Plate (4)
<b>923-03415</b> Torx Security T55  	<b>923-03416</b> Torx T8  	<b>923-03417</b> Torx T8  
Top Plate (4)	PCIe Slots Frame Mount Plate (2)	System Fans to Top Plate (2) System Fans to Top Frame (2) (rack)
<b>923-03418</b> Torx T8  	<b>923-03419</b> Torx T8  	<b>923-03420</b> Torx T5  
System Fans to Bottom Plate (1)	Logic Board to Top Plate (4) Logic Board to Bottom Plate (5) Logic Board to Top Frame (4) (rack) Logic Board to Bottom Frame (5) (rack)	Antenna Cowling (2)
<b>923-03421</b> Torx T8  	<b>923-03422</b> Torx T5  	<b>923-03424</b> Torx T5  
Thermal Module to Top Plate (2) Thermal Module to Top Frame (2) (rack)	Antenna Cable Routing Clips (6)	Antennas to Top Plate (8)

<b>923-03425</b> Torx T8  Flash Storage (2)	<b>923-03435</b> Torx T8  HDD Accessory Bay Clamp Plate (2)	<b>923-03457</b> Torx T5  TIO Board to TIO Flex Cowling (2) FIO Board to FIO Flex Cowling (2) (rack)
<b>923-03463</b> Torx T5  Power Button with SIL (4)		

### Screw Chart for Mac Pro (Rack, 2019)

**Important:** Screws shown in the following chart are specific to the rack model. Screws shared between both models are listed in the previous chart.

<b>923-03430</b> Torx T8  Housing to Internal Frame (16)	<b>923-03432</b> Torx T8  PCIe Slots Frame Bracket to Top Frame (2)	<b>923-03433</b> Torx T8  System Fans to Bottom Frame (1)
<b>923-03436</b> Torx T8  Front I/O (FIO) Bracket (3)	<b>923-03441</b> Torx T3  Housing Sensor (4)	<b>923-03442</b> Torx T8  Front Plate, Outer (4)

<b>923-03443</b> 4 mm Hex	<b>923-03445</b> Torx T5	<b>923-03446</b> Torx T5
 Handle (4)	 Front I/O Board (4)	 Antenna Cowling (2)
<b>923-03447</b> Torx T3	<b>923-03448</b> Torx T3	<b>923-03645</b> Torx T8
 Antenna Cable Clips to FIO Board (2)	 Antenna Cable Clips to FIO Bracket (2) Antenna Cable Clips to Front Plate (4)	 PCIe Slots Frame Bracket to PCIe Slots Frame (3)
<b>923-03879</b> Torx T5	<b>923-03880</b> Torx T5	<b>923-03881</b> Torx T8
 Antennas, Outer (8)	 Power Button with SIL Board	 Front Plate, Center (2)
<b>923-03882</b> Torx T3		
 Antennas, Center (4)		

## Screw Location Diagrams for Mac Pro (2019)

### Power Button with Status Indicator Light:

- **923-03463** (T5): Power Button with SIL to Housing





**Power Supply:**

- **923-03408** (T8): Power Supply Grounding Bracket





**Storage:**

- **923-03425** (T8): Flash Storage





**System Fans:**

- 923-03417 (T8): System Fans to Space Frame Top Plate





- 923-03418 (T8): System Fans to Space Frame Bottom Plate



- 923-03433 (T8): System Fans to Bottom Frame

**Note:** The Mac Pro (Rack, 2019) uses a different screw, however the location is the same for both.





- 1 (long) = **923-03405** (T8): System Fans to Logic Board Support Frame



- 2 and 3 (medium) = **923-03404** (T8): System Fans to Logic Board Support Frame

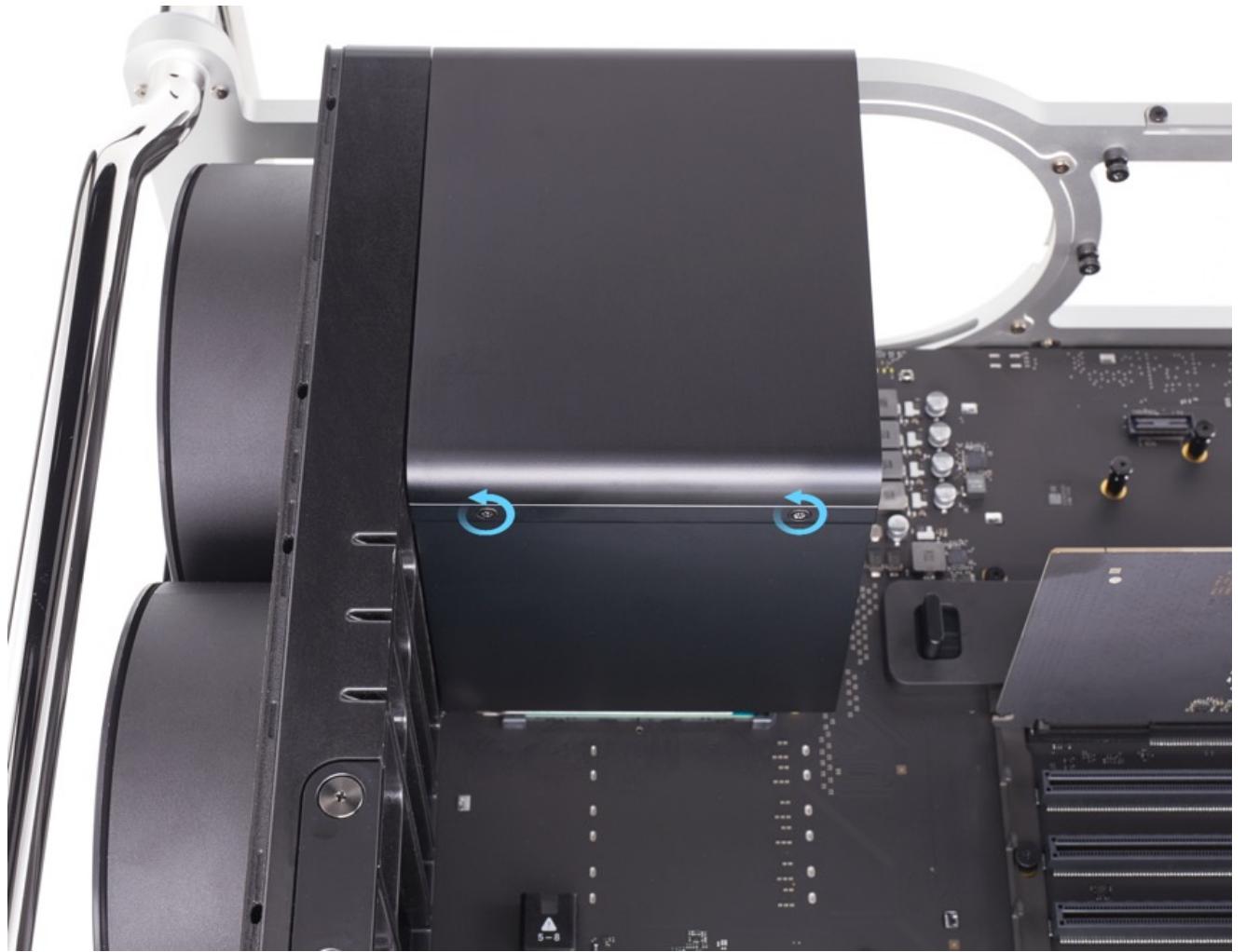




**CPU Thermal Module:**

- 923-03410 (T8): CPU Thermal Module Cover to Thermal Module





- 923-03421 (T8): CPU Thermal Module to Space Frame Top Plate





- **923-03406** (T15): CPU Thermal Module to CPU Socket





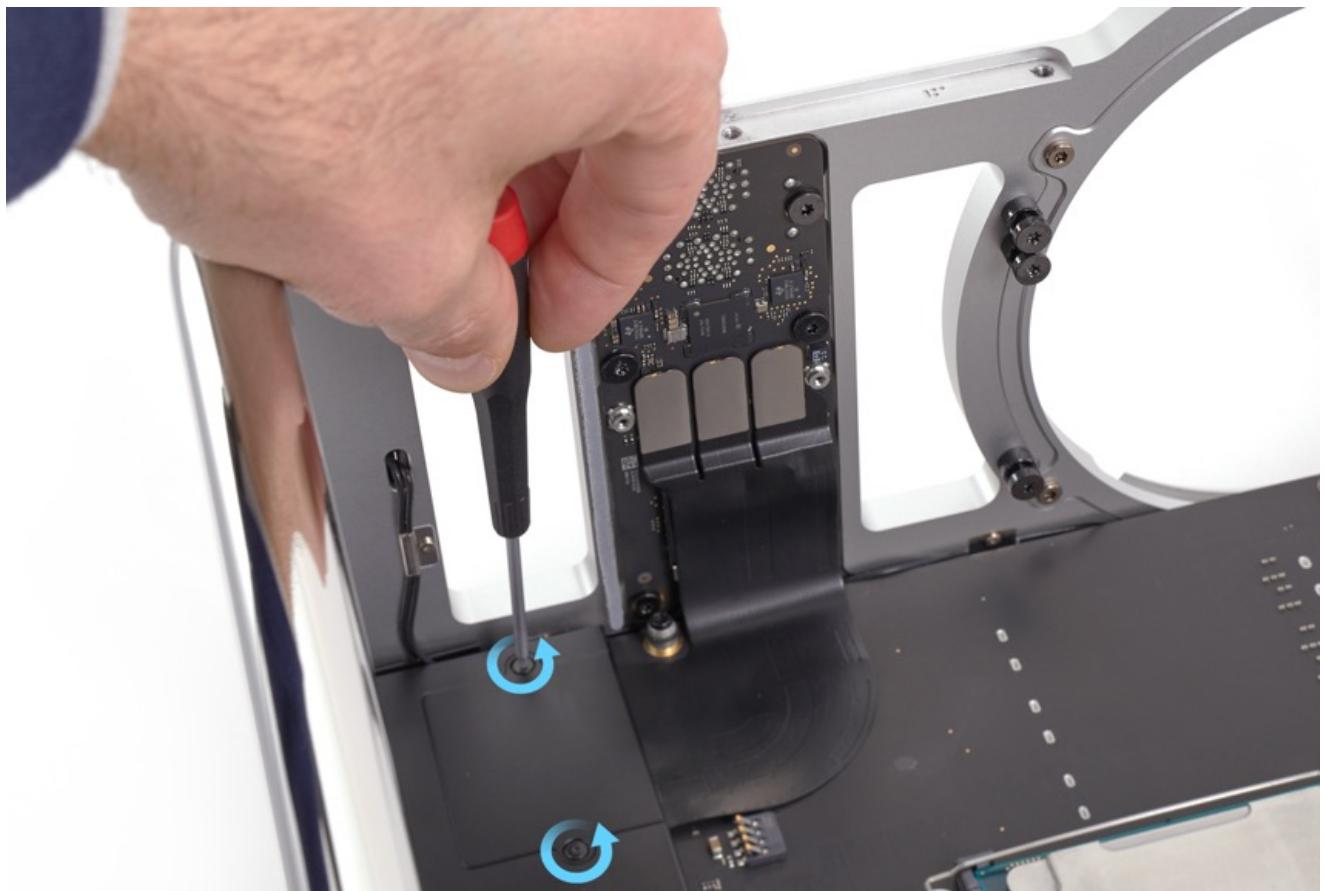
**Top I/O Board and Flex Cable:**

- **923-03457** (T5): TIO Flex Cable Cowling to TIO Board





- 923-03412 (T5): TIO Flex Cable Cowling to Logic Board

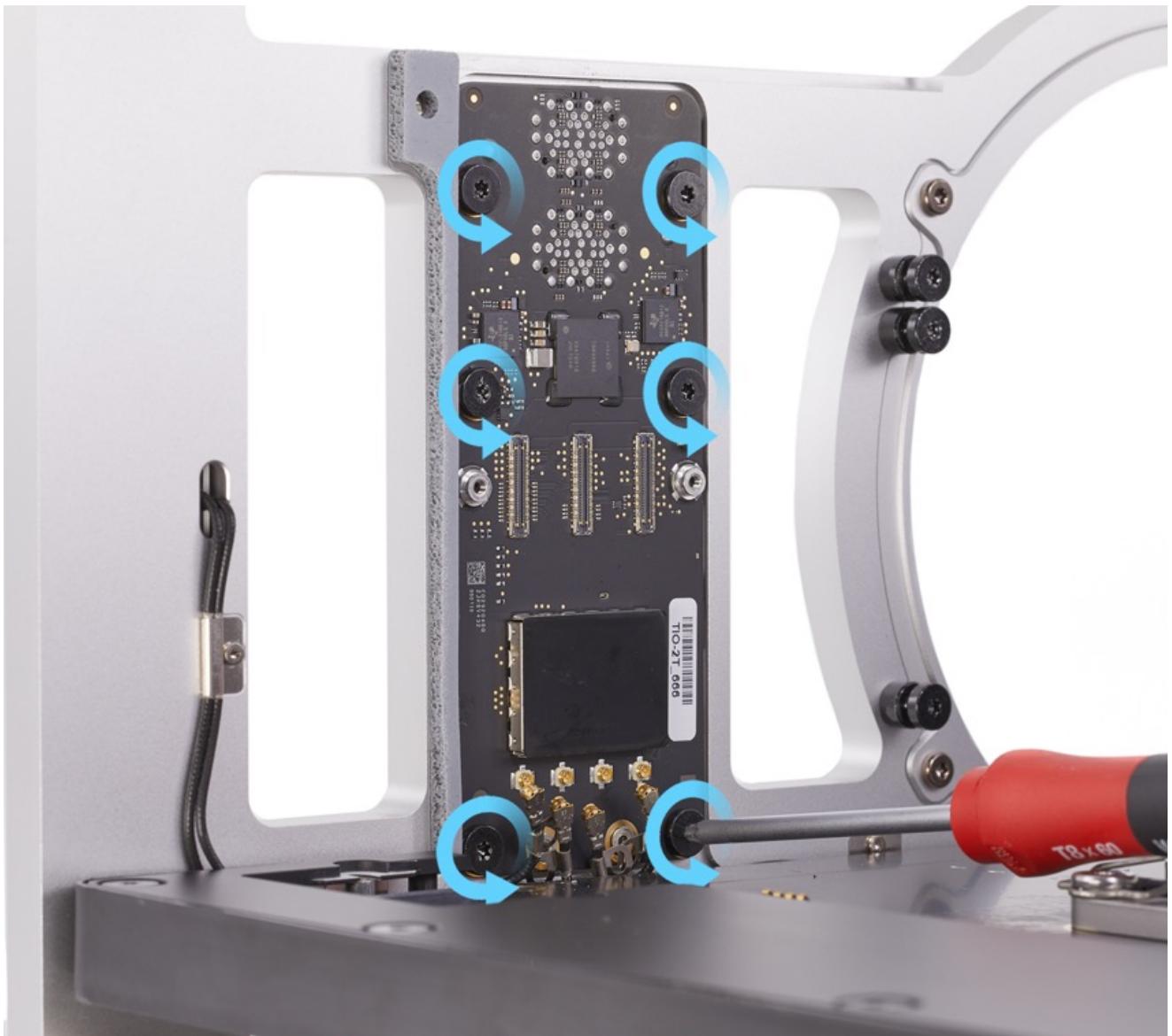


- 923-03420 (T5): Antenna Cables Cowling



- 923-03413 (T8): TIO Board to Space Frame Top Plate

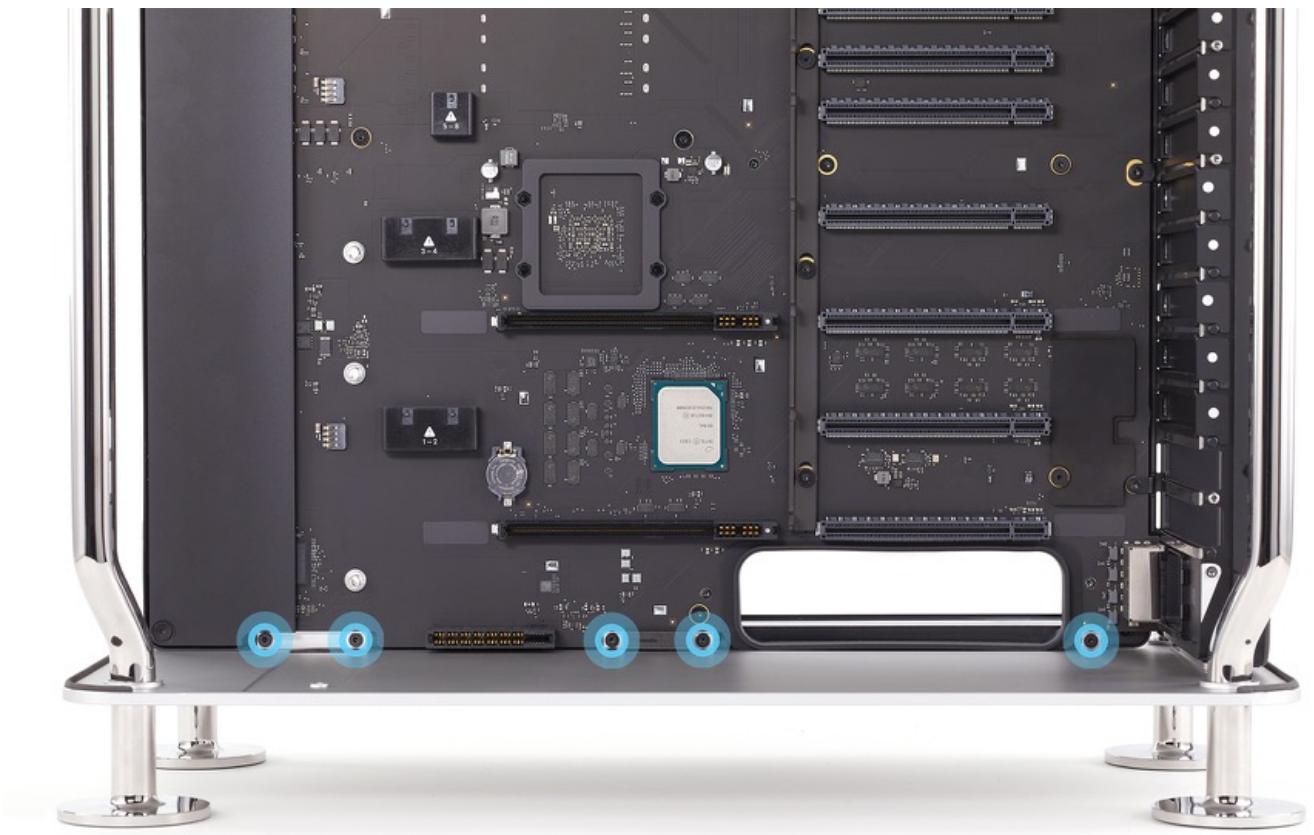




**Logic Board:**

- **923-03419** (T8): Logic Board to Space Frame Bottom Plate





- **923-03409 (T8): Logic Board to PCIe Slots Frame**





- **923-03419 (T8): Logic Board to Space Frame Top Plate**





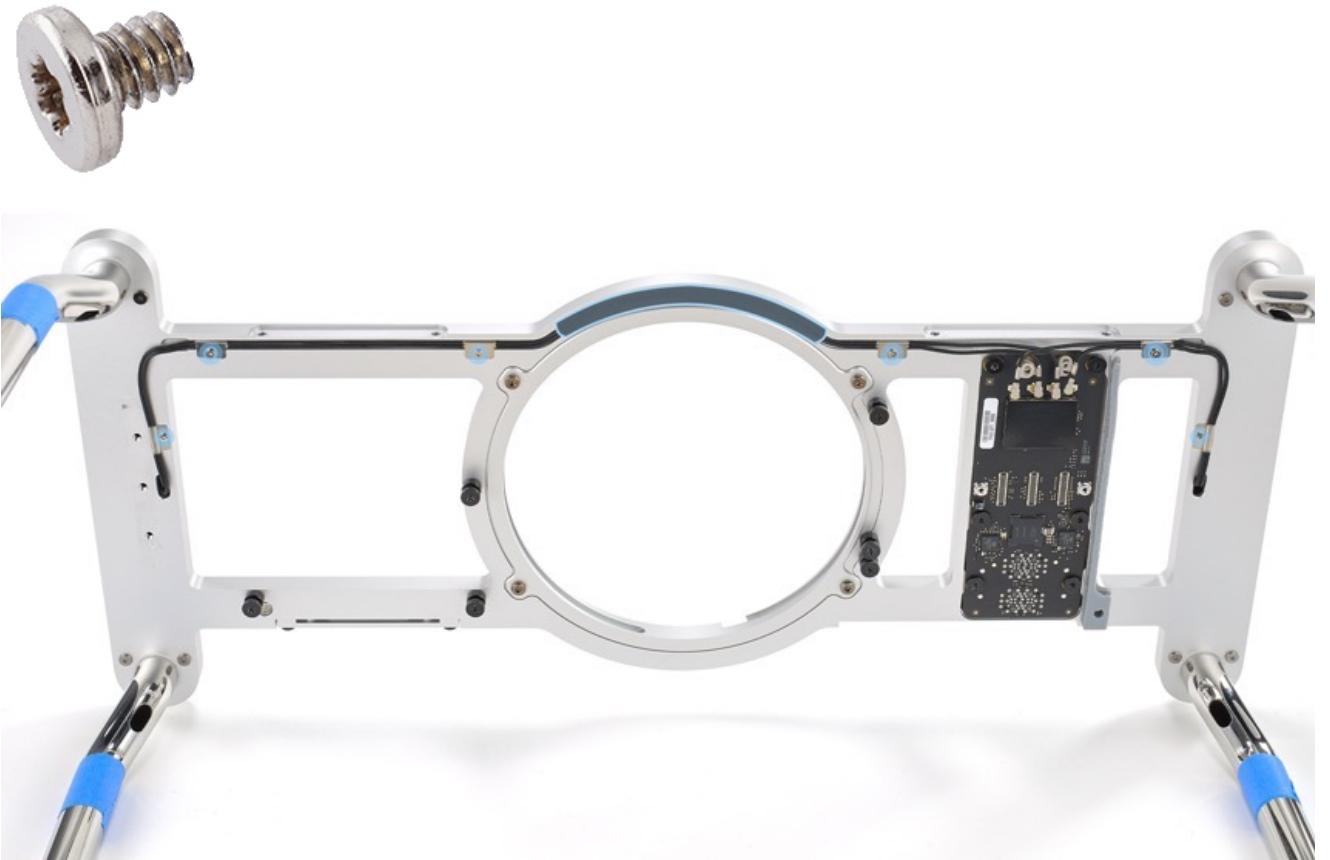
#### PCIe Slots Frame:

- 923-03411 (T8): PCIe Slots Frame to Space Frame Top Plate

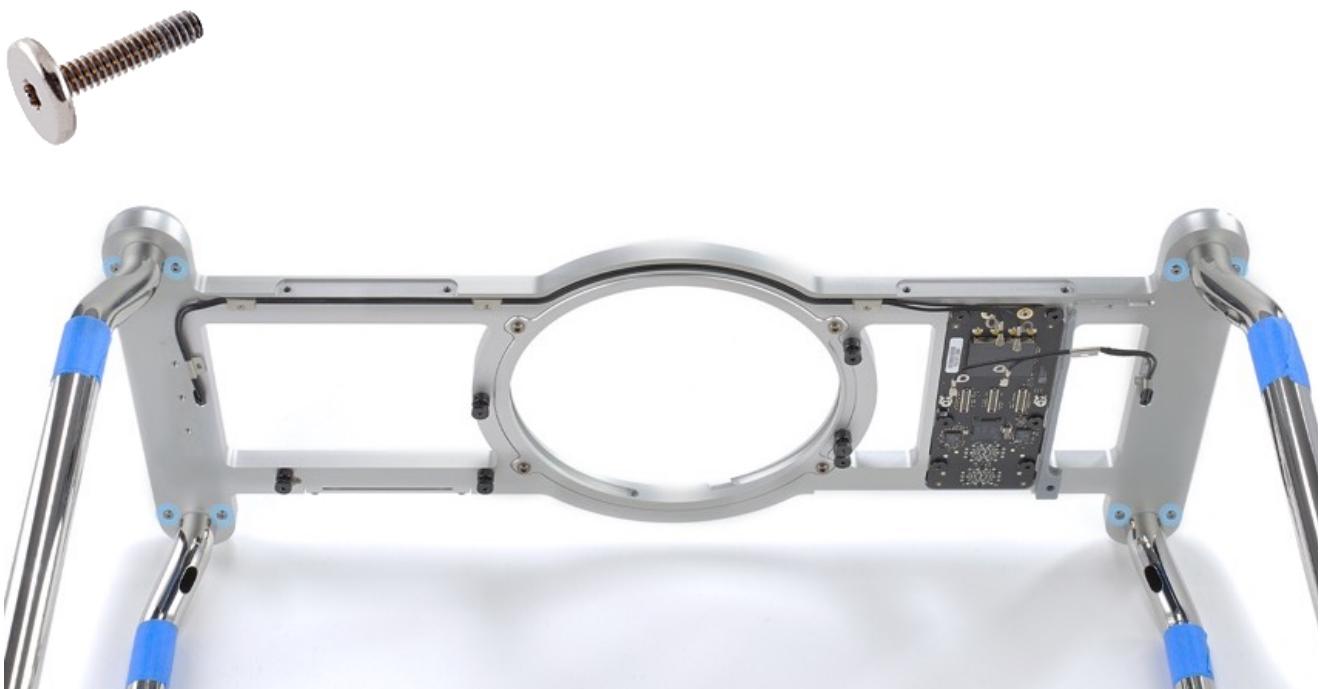


#### Space Frame and Antennas:

- 923-03422 (T5): Antenna Routing Clips to Space Frame Top Plate



- 923-03424 (T5): Antennas to Space Frame Top Plate

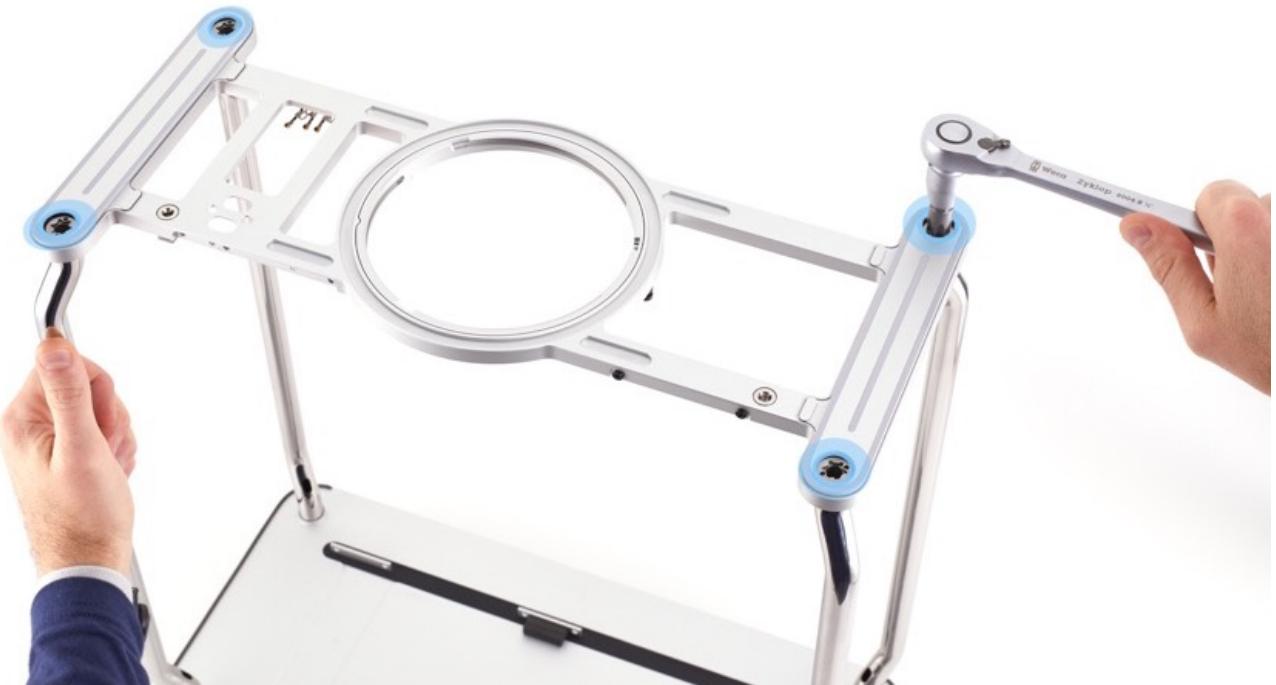


- 923-03414 (T55 Security): Bottom Plate





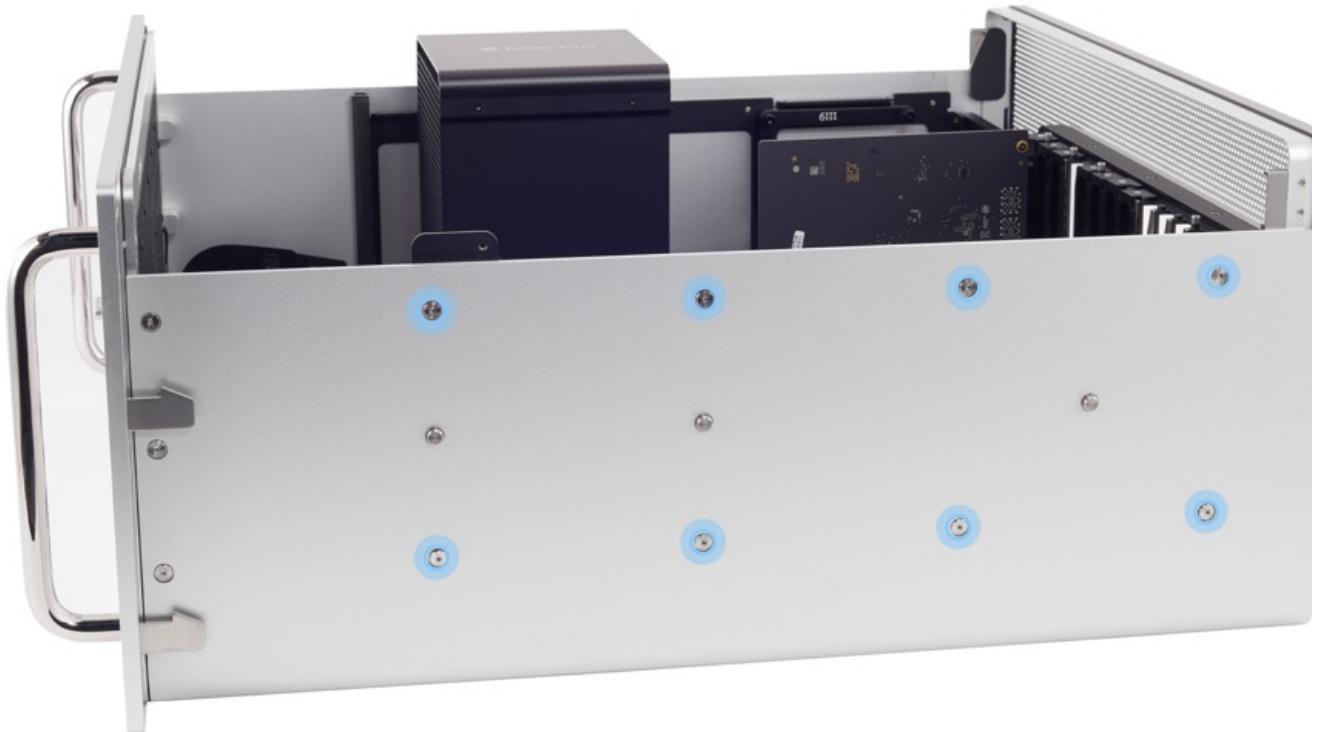
- 923-03415 (T55 Security): Top Plate



## Screw Location Diagrams for Mac Pro (Rack, 2019)

### Logic Board with Internal Frame:

- 923-03430 (T8): Housing to Internal Frame



- **923-03645** (T8): PCIe Slots Frame Bracket to PCIe Slots Frame





- **923-03432** (T8): PCIe Slots Frame Bracket to Top Frame





**Power Button with Status Indicator Light (SIL) Board:**

- **923-03880** (T5): Power Button with SIL Board





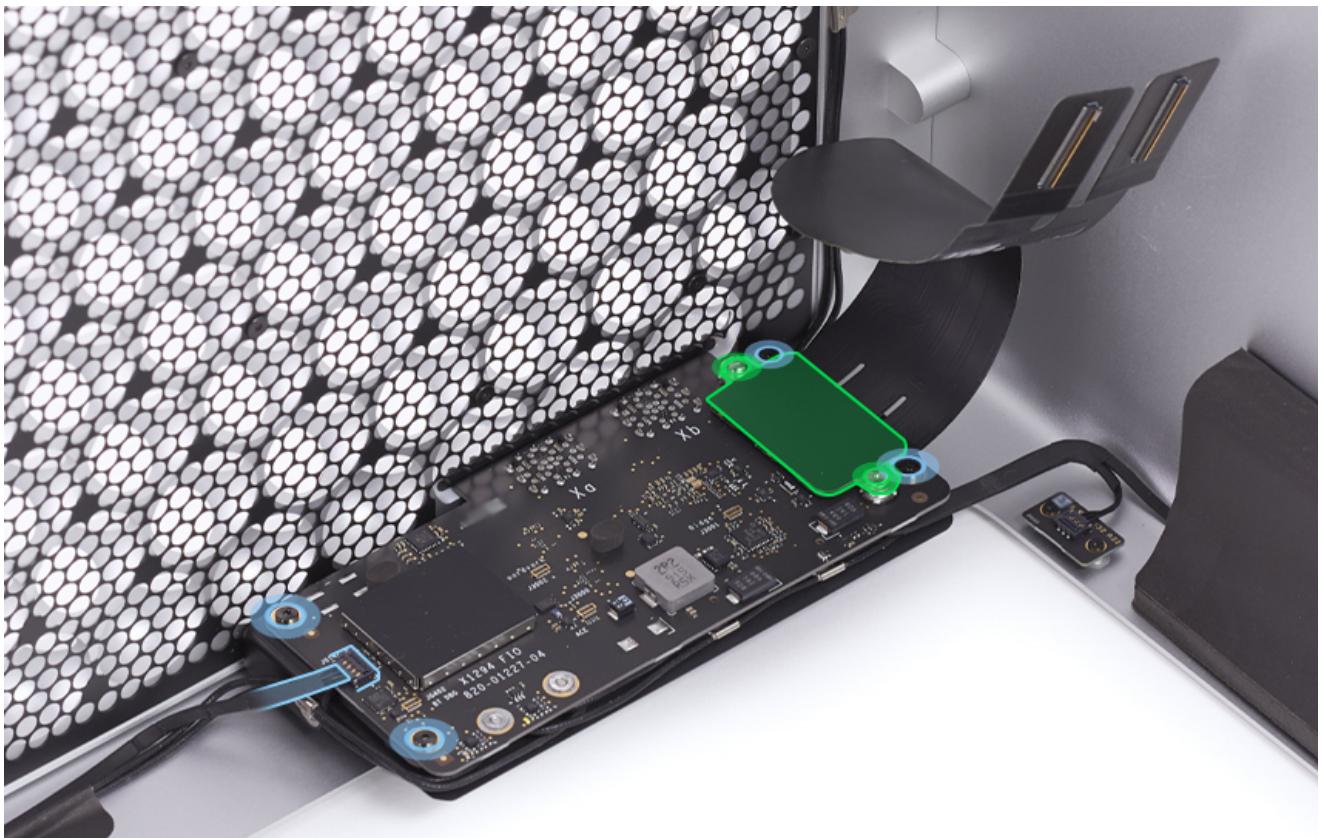
**Front I/O Board and Flex Cable:**

- Blue = **923-03445** (T5): Front I/O (FIO) Board to FIO Bracket



- Green = **923-03457** (T5): FIO Flex Cable Cowling to FIO Board





- Green = **923-03447** (T3): Antenna Cable Clips to FIO Board

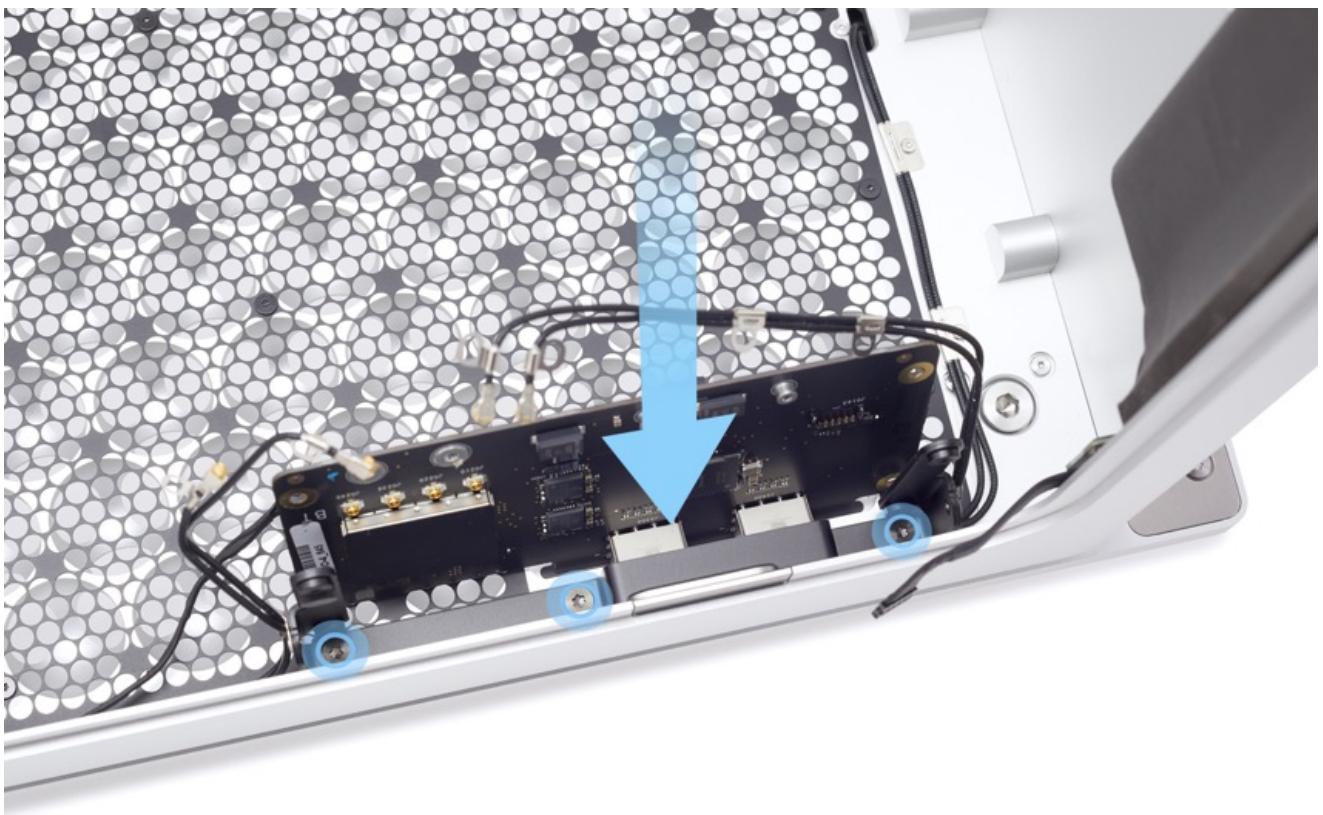


- Blue = **923-03446** (T5): Antenna Cowling





- 923-03436 (T8): Front I/O Bracket to Housing

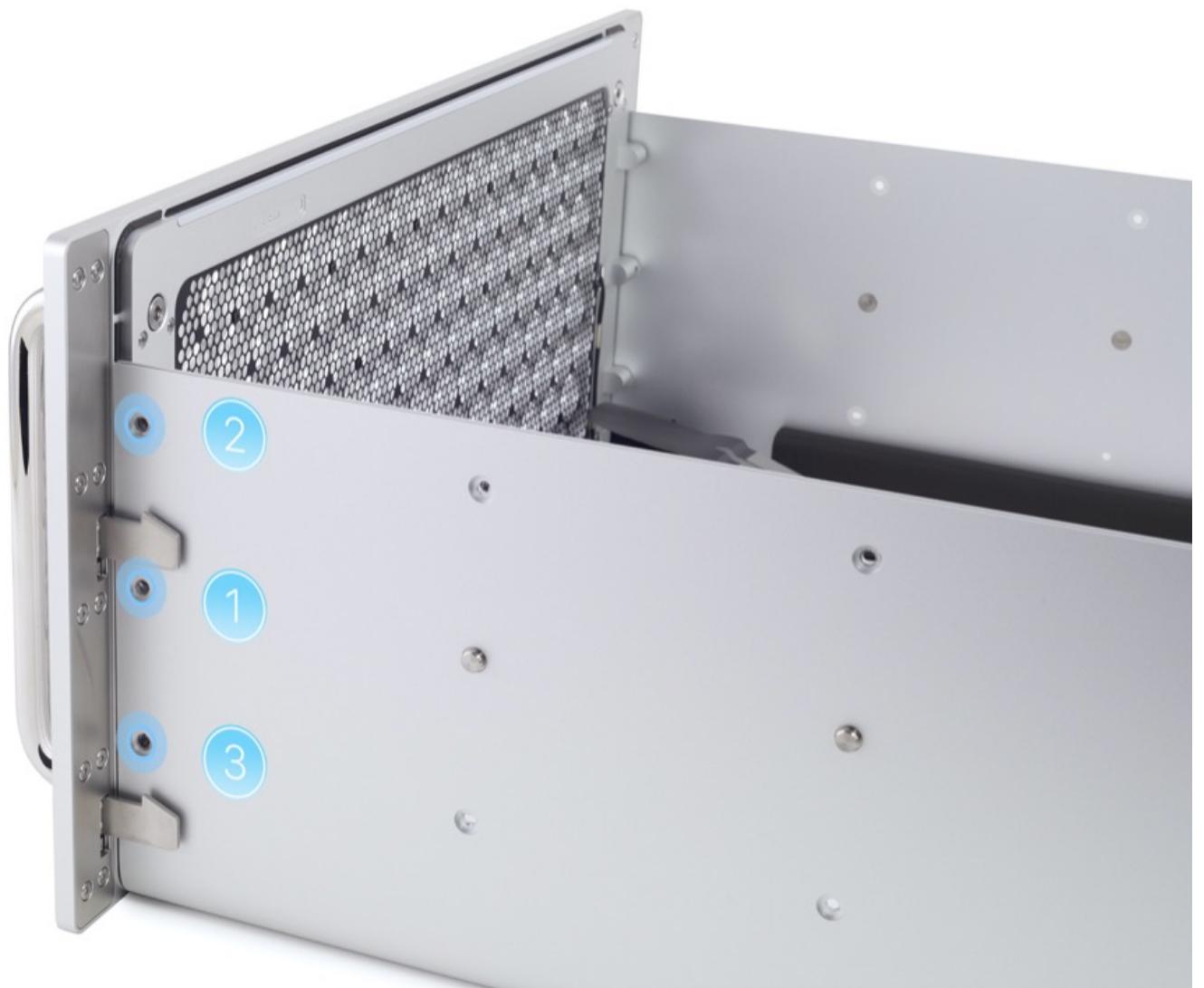


#### Front Plate:

- 1 (long) = 923-03881 (T8): Front Plate, Center



- 2 and 3 (short) = **923-03442** (T8): Front Plate, Outer



#### Handles:

- **923-03443** (4 mm Hex): Handles





**Antennas:**

- Blue = **923-03879** (T5): Antennas, Outer



- Orange = **923-03882** (T3): Antennas, Center





- **923-03448 (T5):** Antenna Cable Clips to Front I/O Bracket and to Front Plate

