

Thunderbolt Setup and Configuration



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Thunderbolt overview

Thunderbolt is one of the fastest input/output (I/O) protocols for connecting peripheral devices to your workstation. Your ThinkStation supports two different solutions for adding Thunderbolt 3 (P520, P520c, P720, P920) or Thunderbolt 4 (P350/P360 Tiny) ports: a two port front panel accessible solution and a rear single port solution. This document contains a brief description of Thunderbolt features, followed by detailed instructions for installing the Thunderbolt solutions in your computer.

Thunderbolt is an I/O interface that provides high speed data transfer between your workstation and peripheral devices. Thunderbolt can transfer data, monitor signals, and networking traffic through a simple, industry standard port. Thunderbolt employs the mechanically symmetrical USB Type-C connector, allowing for easy insertion regardless of plug orientation.

Through the use of the USB Type-C port, a Thunderbolt connection functions similar to a typical USB port. Like previous versions of USB, Thunderbolt ports can be used to connect memory keys, external hard drives, and other devices for the portable transfer of data. Unlike previous versions of USB, however, Thunderbolt supports multiple protocols for transferring data and connecting peripheral devices, including USB (all versions), Firewire, Ethernet, and Display Port (with HDMI, DVI, and VGA support by extension).

Brief comparison of supported Thunderbolt 3 & 4 features

	Thunderbolt 3	Thunderbolt 4
Data Transfer	Up to 40Gbps	
Ethernet	10 Gbps peer-to-peer support	
DisplayPort	DP 1.2 support	
Device Charging	100W bi-directional power capacity	
Device Interconnection	Daisy Chain up to 6 devices	
Display support	1x 4K display	2x 4K displays or 1x 8K display
PCIe data rate	16Gbps	32Gbps
Monitor Ports	Thunderbolt	Thunderbolt + mDP

Front Thunderbolt 3 solution

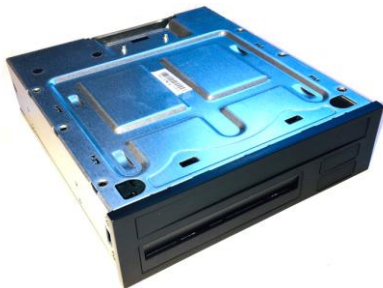
The front Thunderbolt 3 solution provides two ports on the front of your ThinkStation.

Parts list

The following parts are needed for the installation of the front Thunderbolt 3 solution:

- **5.25" FLEX Module (FRU 01EF759)**
- **Front Thunderbolt bezel (FRU 01EF100)**
- **Circuit board bracket (FRU 01EF160)**
- **Thunderbolt 3 PCIe x4 card kit (FRU 01YW003)**
 - PCIe x4 adapter card
 - External DP to DP cable
- **Front Panel IO board and cable kit (FRU 01YW016)**
 - Front panel IO circuit board
 - General purpose input/output (GPIO) cable
 - Mini-SAS cable
 - Internal DP to DP cable

FLEX module



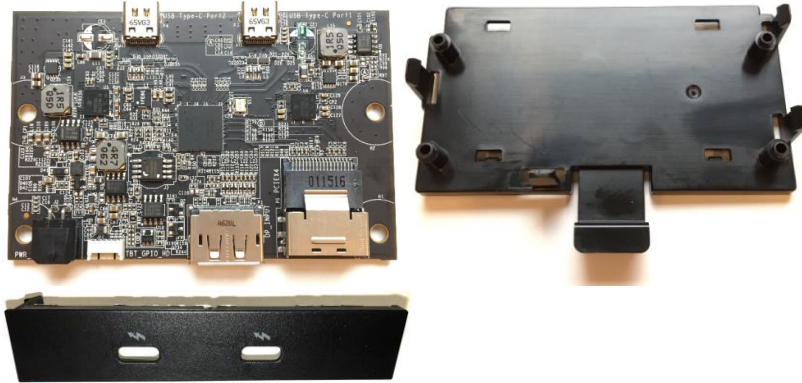
PCIe x4 adapter card



External DP to DP cable (200mm)

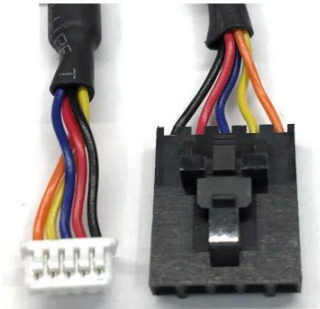


Front panel IO circuit board, bracket, and bezel



Cable connector details (total cable length)

GPIO (600mm)



Mini-SAS (650mm)



Internal DP to DP (650mm)

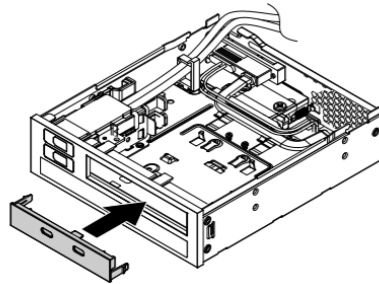


Installation instructions (front port solution)

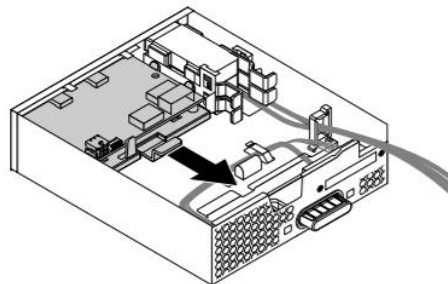
Note: Due to differences in chassis design, portions of this installation procedure will vary depending on the type of workstation you have (P520c, P520, P720, or P920). Where necessary, the installation procedure differences are noted below.

FLEX module preparation

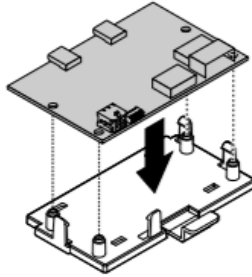
1. The FLEX module is designed with the removable access cover on the bottom. Invert the FLEX module so that the removable cover is facing up and then place it on a flat work surface. Lift the metal tab on the rear of the module and slide the cover back and up to remove it from the module.
2. When viewed from the front, the FLEX module faceplate has slots for 4 devices or ports. The Thunderbolt 3 ports will be installed in the top right slot (with the module oriented as shown below), which is currently filled by a blank bezel. Remove the blank bezel by pressing the two internal retaining tabs and popping the bezel out the front of the faceplate.
3. Install the Thunderbolt 3 bezel in the empty faceplate slot. The bezel should be oriented so that the Thunderbolt 3 icons are below the port openings in its current orientation. The module will be flipped over before it is inserted into the workstation, so these icons will be above the ports in the final orientation. Press the bezel from the front until the retaining tabs snap into place.



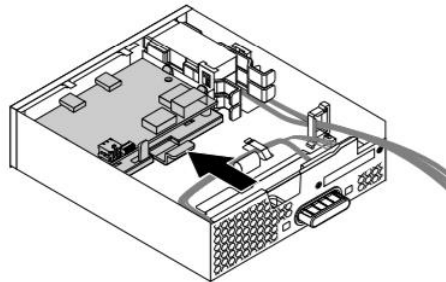
4. Remove the card retaining bracket from the FLEX module by lifting the retention clip slightly and sliding the bracket toward the rear of the module.



5. Install the Thunderbolt I/O adapter card onto the retaining bracket by aligning the four locator holes with the corresponding mounting posts on the bracket. Press down on the card until the four retaining clips snap into place, securely mating the two parts into a single assembly.



6. Install the retaining bracket/adapter card assembly into the FLEX module by reversing the procedure performed in step 4. Slide the assembly forward until the retention clip snaps into place.



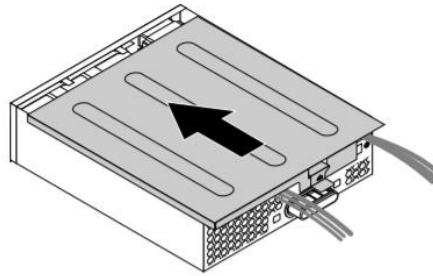
7. Plug four cables into the rear of the adapter card. The power cable is already part of the FLEX module and the remaining 3 cables were supplied with the Thunderbolt 3 kit. Use the following connector layout diagram as a guide for cable connections:



- a – Power cable connector
- b – GPIO cable connector
- c – Internal DP to DP cable connector
- d – mini-SAS cable connector

Note: The power cable is integrated into the FLEX module, originating from the rear power connector. The other 3 cables are supplied as part of the Thunderbolt 3 kit.

8. Route the three cables through the cutout on the rear of the FLEX module and replace the cover. Starting from the rear of the module, engage the cover and slide it forward until it clicks into place.



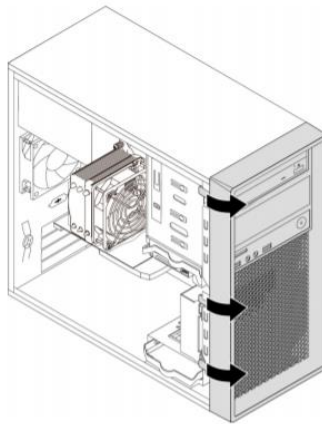
FLEX module and adapter card installation

Prepare the workstation for FLEX module installation by removing the side access cover. Though not necessary, the rest of the installation will be easiest if the workstation is laid on its side at this point.

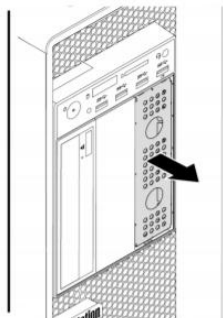
1. Remove the plastic filler blank and the EMI shield from the 5.25" FLEX bay you intend to use.

P520c

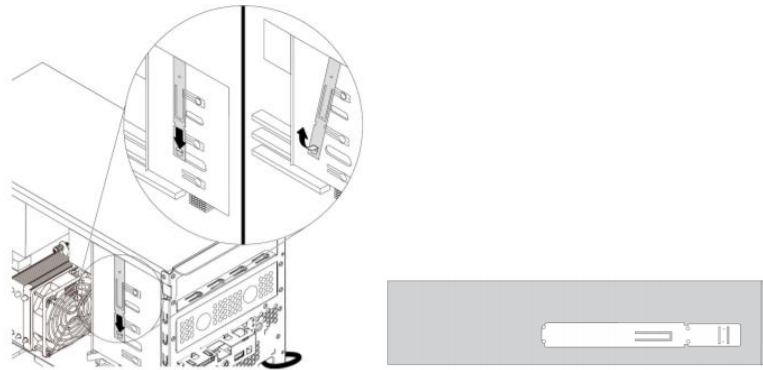
Remove the front bezel by releasing the three plastic tabs and rotating the bezel away from the chassis.



Use the finger cutouts to pull the EMI shield out of the bay.

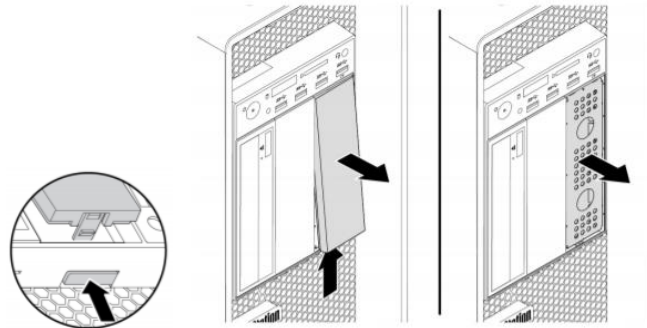


There is an optical drive retainer on the side of the ODD/FLEX bay cage – remove this retainer and install it on the left side of the FLEX module as shown here:



P520, P720, P920

Press the release button to remove the plastic cover from the front of the FLEX bay, and then remove the EMI shield.



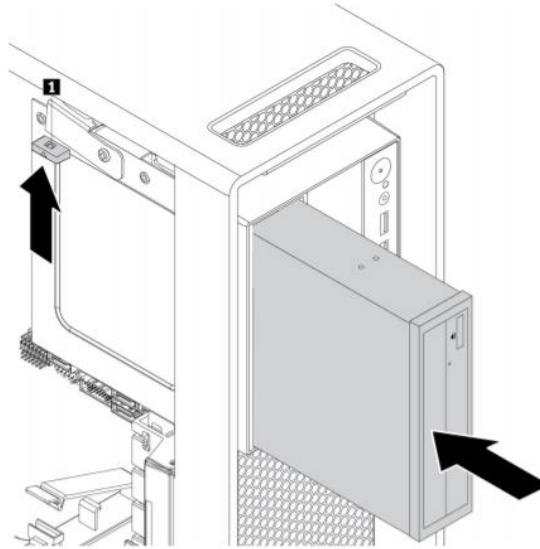
2. Insert the FLEX module, cover down, into the 5.25" FLEX bay that you have just prepared. Feed the GPIO, internal DP to DP, and mini-SAS cables through the bay as you insert the module and help to guide them around any obstacles from the inside of the workstation. Insert the module into the FLEX bay until it latches into place. The FLEX bay latching mechanisms vary across the various workstations, as follows:

P520c

The FLEX module should slide freely all the way into the bay until it latches into place.

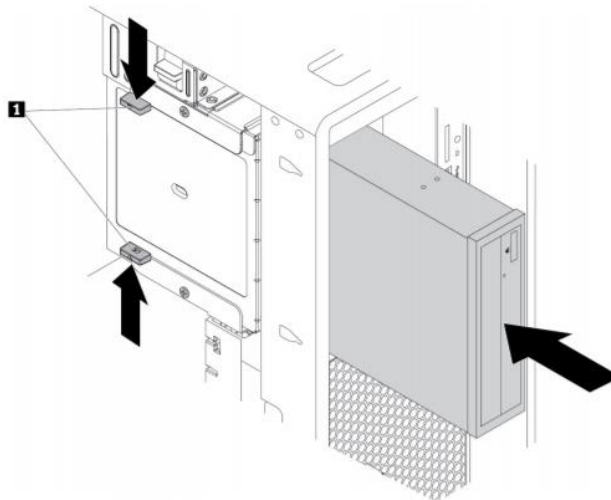
P520

Slide the FLEX module into the bay until it stops, then press tab 1 as shown below and push the module further until it latches into place.



P720

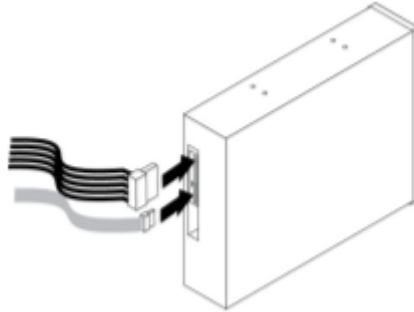
Press the tabs toward each other as shown below and slide the module halfway into the bay. Release the tabs and continue sliding the module in until it latches into place.



P920

Remove the large air baffle from the chassis to gain full access to the inside of the workstation. Insert the FLEX module into the bay and push it until it latches into place.

3. Connect the SATA signal and power cables to the connector on the rear of the FLEX module.



4. Install the Thunderbolt 3 PCIe x4 card in the appropriate slot, as designated by the following table:

P520c:	PCIe slot 4
P520:	PCIe slot 6
P720:	Primary choice: PCIe slot 2; Secondary choice: slot 1
P920:	Primary choice: PCIe slot 2; Secondary choice: slot 4

5. Route and connect the 3 cables that extend from the rear of the FLEX module

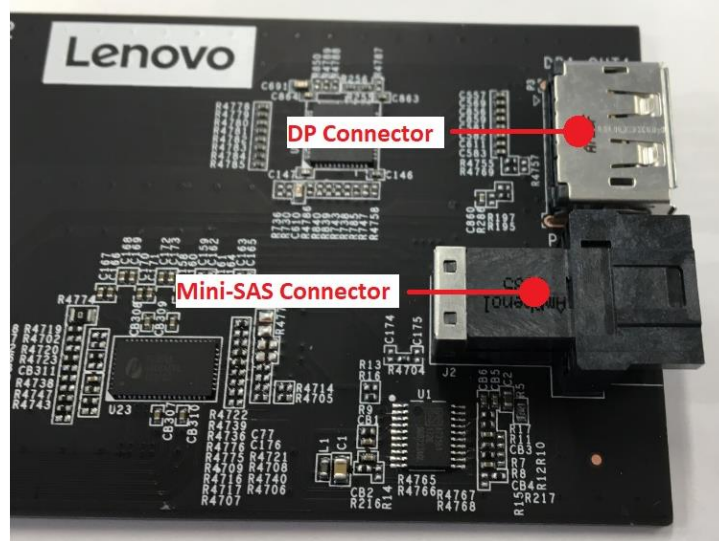
Cable routing: this will vary depending on the particular workstation and the currently installed system components. However, typically the cables should be routed from the rear of the FLEX module toward the bottom of the workstation, passing directly behind the front system fan, to an area near the PCIe slots.

Cable connections:

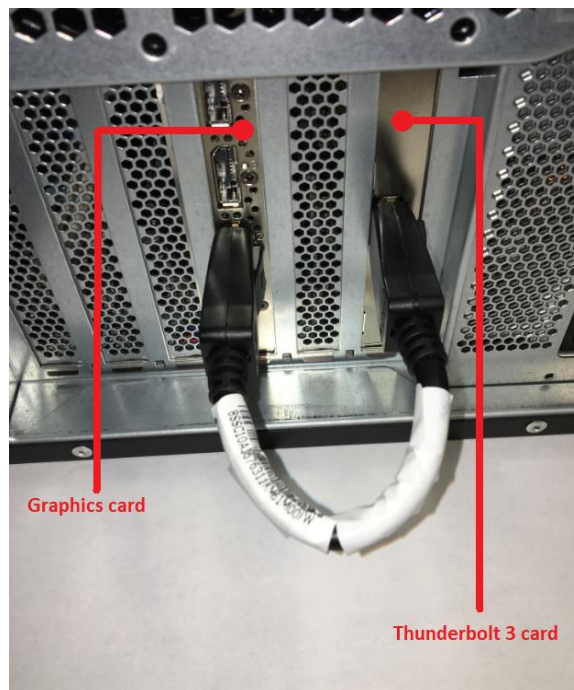
- GPIO cable: connected to a black, 5-pin connector that is located along the bottom edge of the motherboard (when viewed from the side of the workstation). The precise connector location varies across the four workstations covered in this guide, but it is in the general vicinity of the SATA connectors and looks like this:



- DP to DP and mini-SAS cables: connected to the front of the PCIe x4 card as indicated below:



6. Installation of internal components is now complete, so replace the workstation's side access cover. Note – if you are working with a P920, don't forget to first replace the air baffle and then replace the side cover.
7. The PCIe x4 card must now be connected to your graphics adapter with the external DP to DP cable. If your graphics adapter only has miniDP ports, you will need a miniDP to DP adapter to complete this connection. Depending on the graphics adapter being used and the slot locations of the adapters, the connection should look like this:



8. Reconnect all peripheral devices, connect the power cable, and power on the workstation. Enter the BIOS Setup utility by pressing the F1 key while the Lenovo splash screen is displayed. Refer to the BIOS Configuration section at the end of this document for instructions on enabling and configuring Thunderbolt 3 in BIOS.



Rear Thunderbolt 3 solution

The rear Thunderbolt 3 solution provides one port on the rear of your ThinkStation.

Parts list

The following parts are needed for the installation of the front Thunderbolt 3 solution:

- **Rear Thunderbolt 3 adapter kit (FRU 01AJ971)**
 - PCIe x4 adapter card
 - Internal General purpose input/output (GPIO) cable
 - External DP to DP cable

PCIe x4 adapter card



Cable connector details (total cable length)

GPIO (300mm)



External DP to DP (330mm)



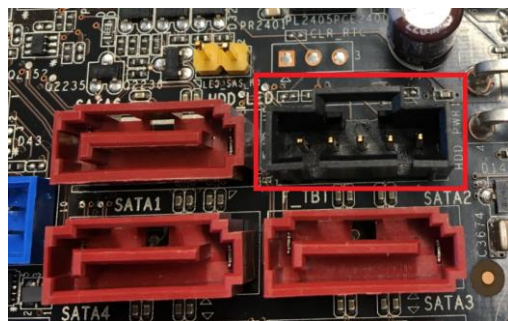
Installation instructions (rear port solution)

Note: Due to differences in chassis design, portions of this installation procedure will vary depending on the type of workstation you have (P520c, P520, P720, or P920). Where necessary, the installation procedure differences are noted below.

1. Lay the workstation down on its side and remove the side access cover – this will facilitate access to the motherboard. If you are working with a P920, remove the air baffle from the middle of the chassis.
2. Install the Thunderbolt 3 PCIe x4 card in the appropriate slot, as designated by the following table:

P520c:	PCIe slot 4
P520:	PCIe slot 6
P720:	Primary choice: PCIe slot 2; Secondary choice: slot 1
P920:	Primary choice: PCIe slot 2; Secondary choice: slot 4

3. Connect the GPIO cable between the connector on the front of the adapter card and the motherboard. The motherboard connector location varies across the four workstations covered in this guide, but it is in the general vicinity of the SATA connectors and looks like this:



4. Replace the workstation side access cover and latch it into place. Note – if you are working with a P920, don't forget to first replace the air baffle and then replace the side cover.

5. The PCIe x4 card must now be connected to your graphics adapter with the external DP to DP cable. If your graphics adapter only has miniDP ports, you will need a miniDP to DP adapter to complete this connection.
6. Reconnect all peripheral devices, connect the power cable, and power on the workstation. Enter the BIOS Setup utility by pressing the F1 key while the Lenovo splash screen is displayed. Refer to the BIOS Configuration section at the end of this document for instructions on enabling and configuring Thunderbolt 3 in BIOS.



P350/P360 Tiny Thunderbolt solution

This section will show you how to set up the Thunderbolt cards in P350 Tiny Workstations. The P350/P360 Tiny Thunderbolt 4 solution provides one port on the rear of your ThinkStation.

Parts list

The following parts are needed for the installation of the front Thunderbolt 4 solution:

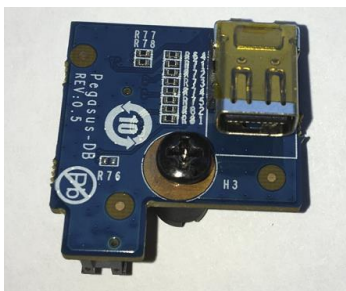
- P350 Tiny Thunderbolt 4 Card (FRU 5C51D95673)
 - P360 Tiny equivalent card (FRU 5C51H31593)



- Internal miniDP to miniDP cable (FRU 5C11C97938)



- BTB card (FRU 5C50V94331)
 - P360 Tiny equivalent card (FRU 5C51H31587)



- P350 PCIe Riser (FRU 5C50W00876)
 - P360 Tiny equivalent card (FRU 5C50W00909)

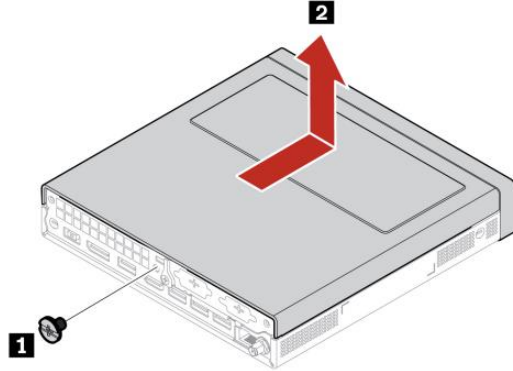


- External DP to miniDP cable (FRU 5C11C97936)



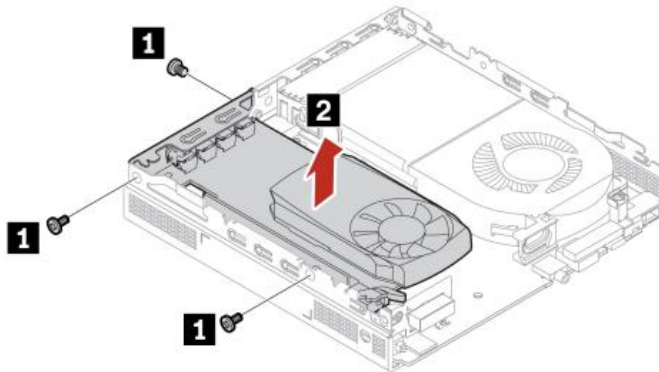
Installation instructions (P350/P360 Tiny)

1. Remove computer cover

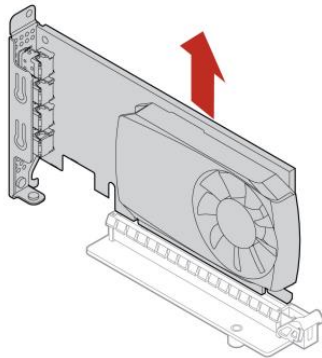


2. Follow the diagrams below to remove any existing PCIe adapters and insert the Thunderbolt PCIe card

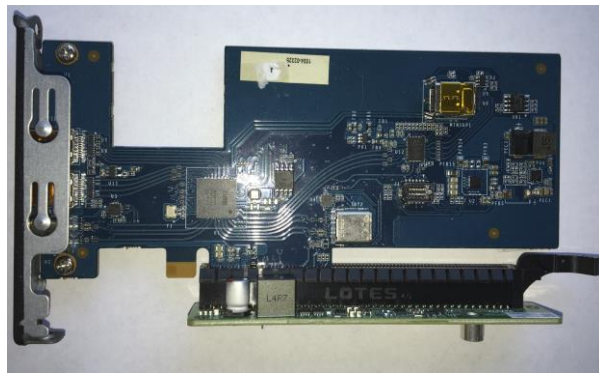
Remove the PCIe card from the computer



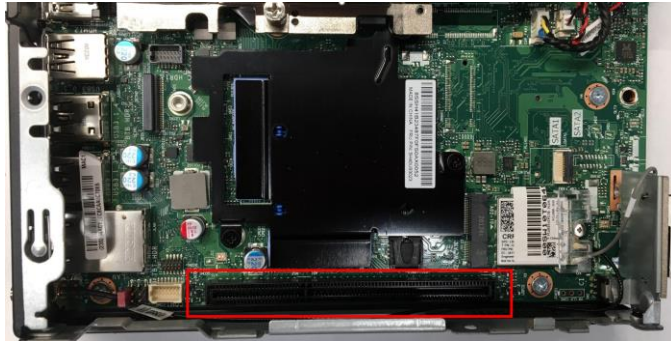
Remove the PCIe riser card from the PCIe adapter



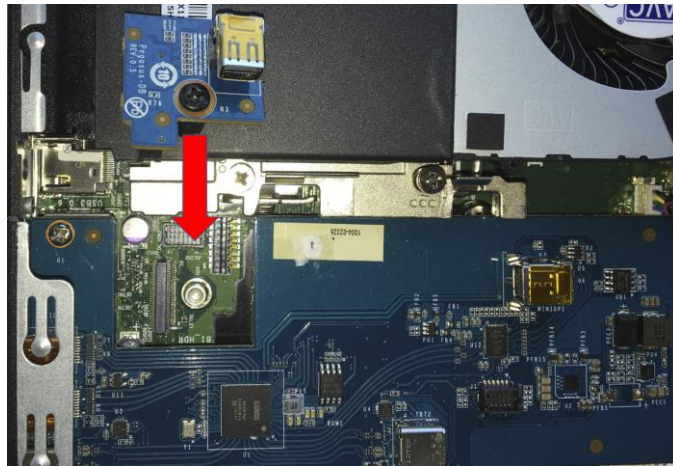
3. Install the Thunderbolt card in the PCIe riser



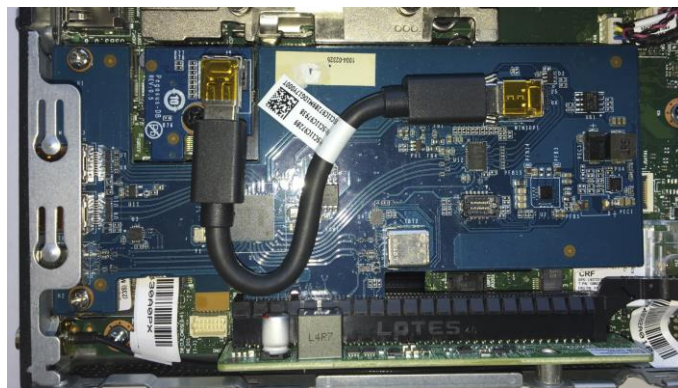
4. Install the Thunderbolt card/PCIe riser assembly into the PCIe x8 slot on the motherboard



5. Install the BTB card into the computer and tighten the Phillips head screw



6. Install the miniDP to miniDP cable



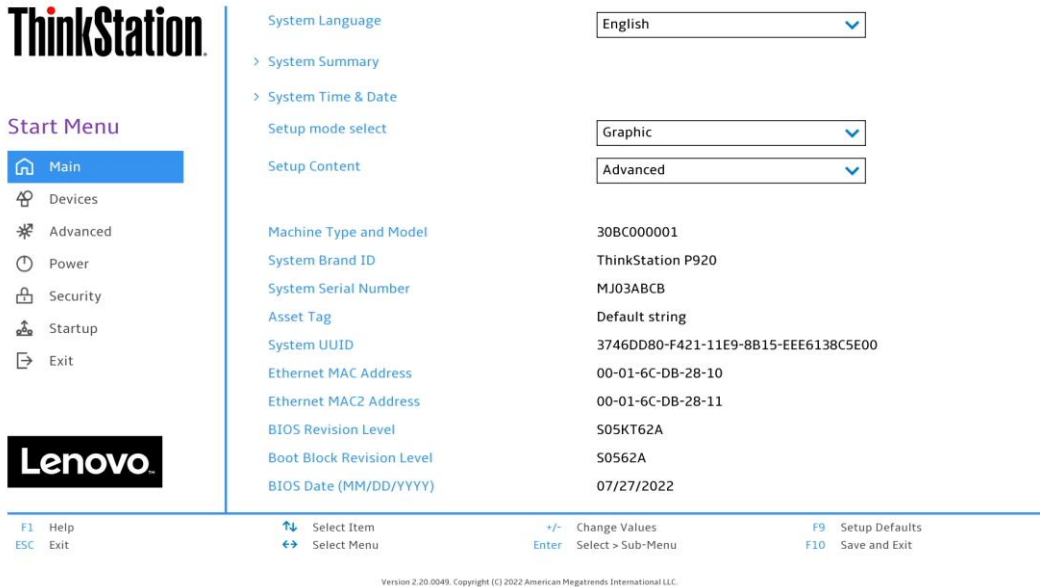
7. Replace computer cover

8. Connect the DP to miniDP loopback cable

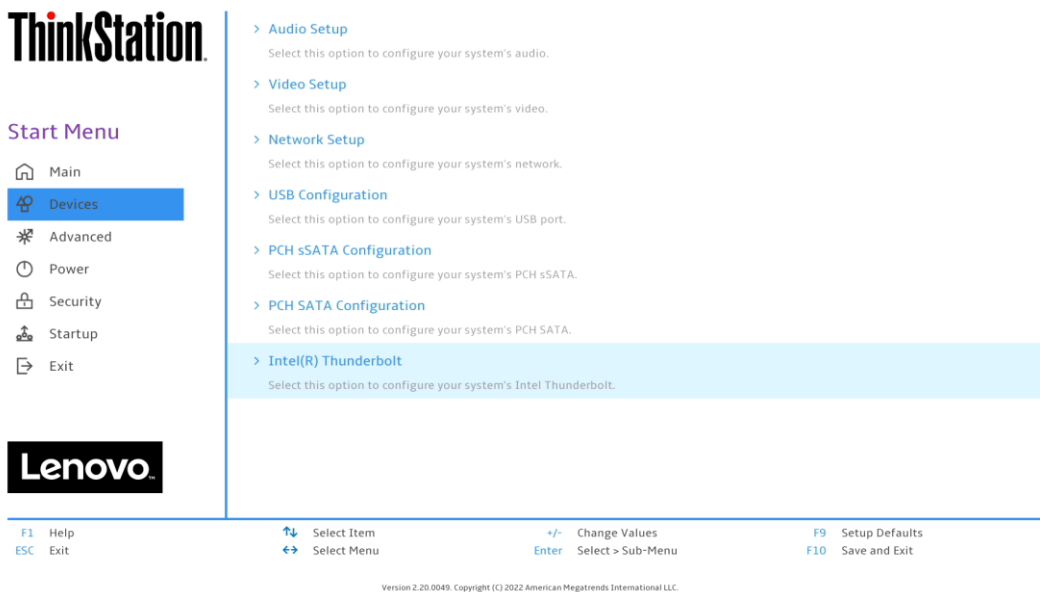


BIOS configuration

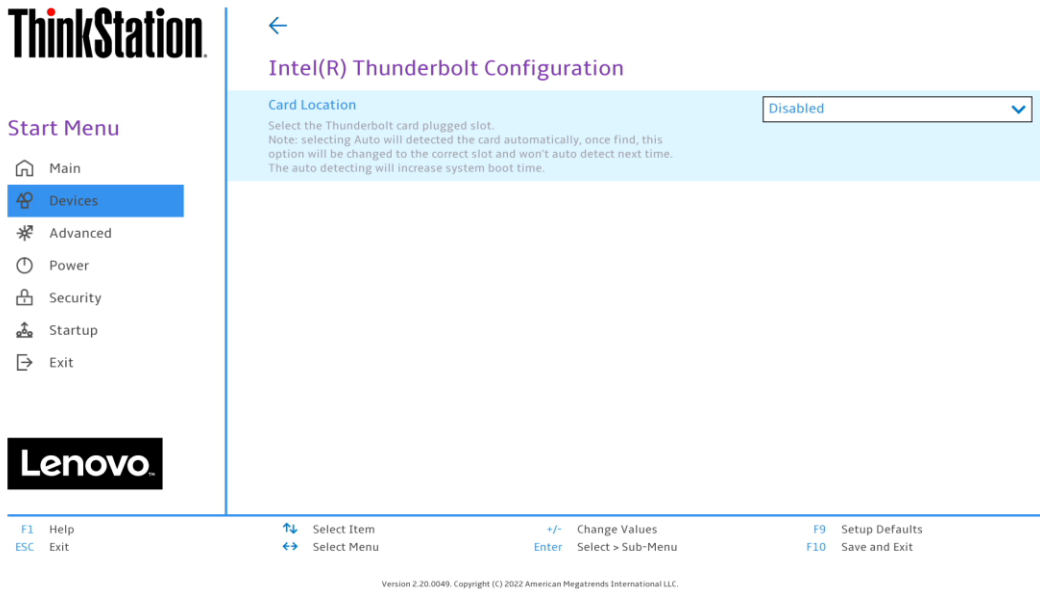
In order to begin using the Thunderbolt ports that you have just installed, they need to be enabled in BIOS. The last step of the installation guides above should have led you to the main menu of the BIOS setup screen:



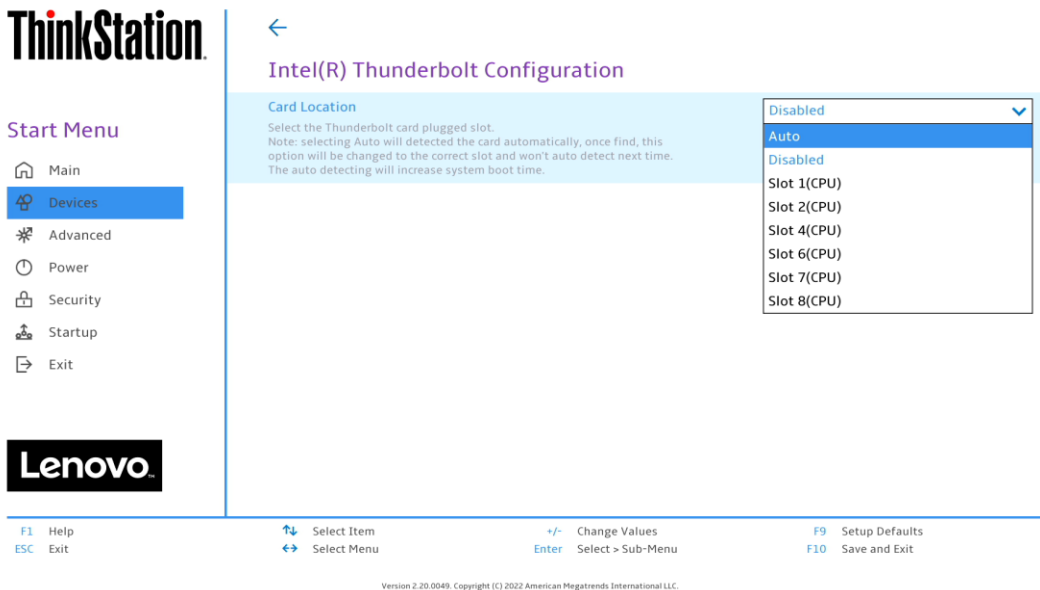
Press F1 on this screen to proceed to the Main window of the Setup utility. From this screen, select **Devices > Intel(R) Thunderbolt**, as shown below:



When you first arrive at the Thunderbolt Configuration page, it will show that the Thunderbolt card is **Disabled**:



Click on the pulldown menu to enable the Thunderbolt card. The appropriate PCIe slot can be set to Auto, which will allow the BIOS to detect the adapter card on the next boot, or it can be manually set to the desired slot, as shown here:



Once the Card Location option has been enabled, the following additional configuration options will be made available. You can change the configuration to work best with your Thunderbolt environment.

ThinkStation

Start Menu

- Main
- Devices**
- Advanced
- Power
- Security
- Startup
- Exit

Lenovo

Intel(R) Thunderbolt Configuration

Card Location

Select the Thunderbolt card plugged slot.
Note: selecting Auto will detected the card automatically, once find, this option will be changed to the correct slot and won't auto detect next time. The auto detecting will increase system boot time.

Security Level

Security level selection.

Wake From Thunderbolt Devices

Enable or disable system wake from Thunderbolt devices.

AIC Support

Apply GO2Sx command before going to sleep

Keyboard Legend:

- F1 Help
- ESC Exit
- ↑ Select Item
- ↔ Select Menu
- +/- Change Values
- Enter Select > Sub-Menu
- F9 Setup Defaults
- F10 Save and Exit

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When configuration is complete, press F10 to save all settings, exit the BIOS Setup utility and reboot the system.

Revision History

Version	Date	Author	Changes/Updates
1.1	10/10/2022	Jim Pfaltzgraff	Added Tiny installation instructions Updated with TBT 4 info Updated BIOS screen captures
1.0	3/25/2019	Jim Pfaltzgraff	Initial launch release