Storage Configurator

Lenovo ThinkStation P350

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Overview

The purpose of this document is to provide guidelines for users on how to optimally configure the system storage in the ThinkStation P350 platform in order to insure proper functionality.

The P350 utilizes both 2.5” and 3.5” SATA HDDs as well as NVMe M.2 SSDs with an on-board RAID controller for both drive types. In the Tower (TWR) chassis, there are a maximum of four SATA drive locations and three NVMe drive locations for a total of seven drives that can physically be installed in the system. In the Small Form Factor (SFF) chassis, there are a maximum of two SATA drive locations and three NVMe drive locations for a total of five drives that can be physically installed in the system.

When the appropriate number of drives are present in the system, the P350 can support RAID 0, 1, 5, and 10 for the SATA drives and RAID 0 and 1 for the M.2 drives. A given RAID level will only be available or shown for selection if the system detects enough drives to support it. RAID configurations are discussed in Sections 3.

Considerations

- The P350 has on-board RAID support for both the NVMe and SATA. At the time of writing there are no add-in RAID controllers certified to work on the P350.

- The ability to maximize the number of NVMe drives is dependent upon using a single optional NVMe M.2 PCIe Add In Card, and the two on-board NVMe M.2 slots.

- In the tower form factor, the ability to maximize the number of SATA drives is dependent upon using a Flex Bay or Front-Access Storage Enclosure (FASE) and optional storage drive cage. For more information see Section 2. Additionally, the use of four SATA drives will utilize all the available SATA ports on the motherboard. The system cannot be configured with an optical disk drive (ODD) when using 4 SATA hard drives.

- In the small form factor, the system is limited to two SATA drives and can simultaneously utilize an ODD. The only Lenovo certified ODDs are slim drives.

- Although the system can support a wide array of configurations of NVMe and SATA drives, care should be given when selecting drives based on the types of RAID arrays that are desired.

    - A given array should not mix drive types or logical sizes. Mixing drive brands does not pose any issues so long as the brands share the same Lenovo part numbers.

    - Each RAID level requires a certain minimum and or maximum number of drives. If altering the system storage devices after purchase, it will be necessary to verify there are the proper types and number of devices for a desired RAID configuration.

    - The PCIe M.2 adapter and one onboard slot are limited to Gen 3 specifications while the other onboard slot is a Gen 4 slot. See Section 2 for slot identification. The single M.2
      Add In Card is only capable of Gen 3 speeds, even if Gen 4 drives are used. Only the two Gen 3 M.2 drives can be utilized together in a RAID configuration, but Gen 4 drives used in the Gen 3 slots or used in an array with a drive limited to Gen 3 will only run at Gen 3 speeds.

Section 1 – Installing NVMe Devices

Please make sure the NVMe devices are installed into the following PCIe slot locations on the ThinkStation P350 motherboard seen below. The NVMe drives may use the dedicated Gen 4 capable onboard M.2 slot see *Figure 1*, or use up to two Gen 3 M.2 NVMe drives using the one onboard Gen 3 M.2 slot and one AIC single M.2 adapter in PCIe slot 3.

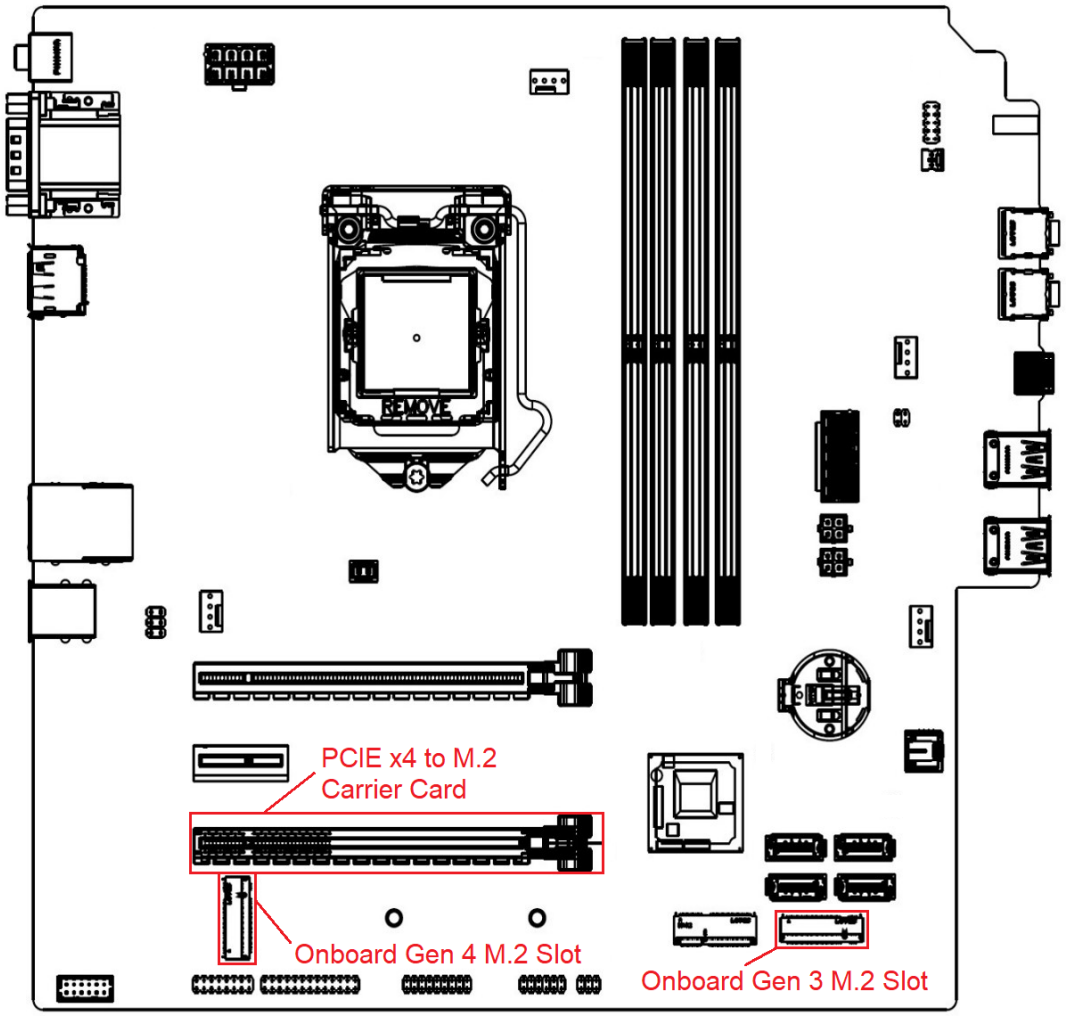
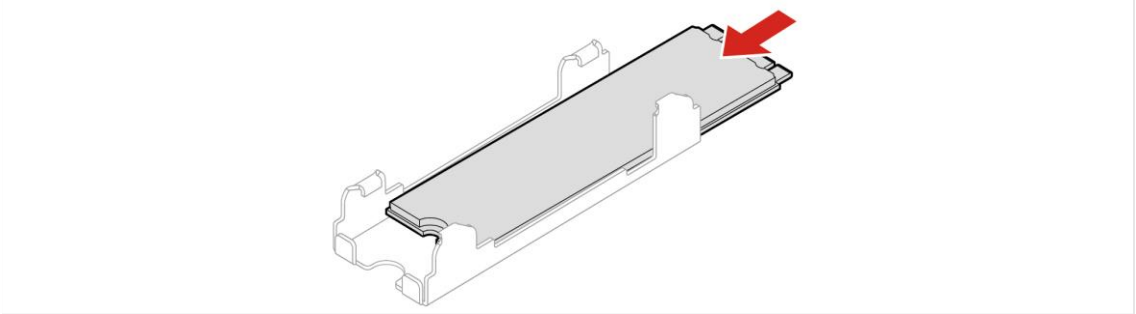


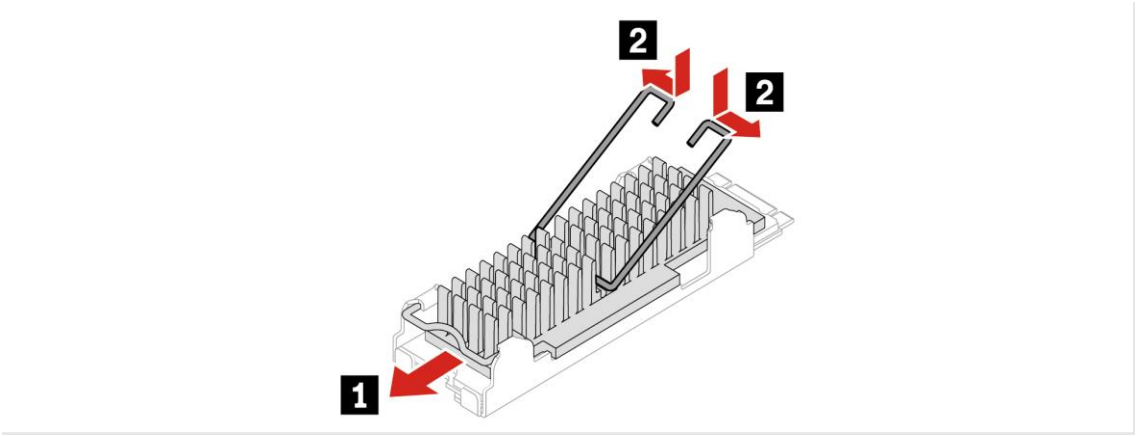
Figure 1

For M.2 NVMe drives in the onboard M.2 slots:

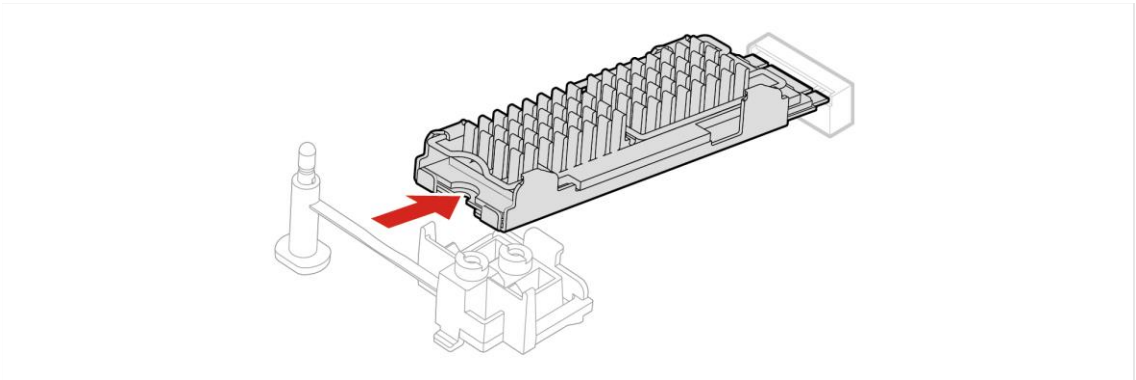
1. Remove the film that covers the thermal pad on the bracket, if any. Then, install the M.2 solid-state drive by sliding the drive in the bracket.



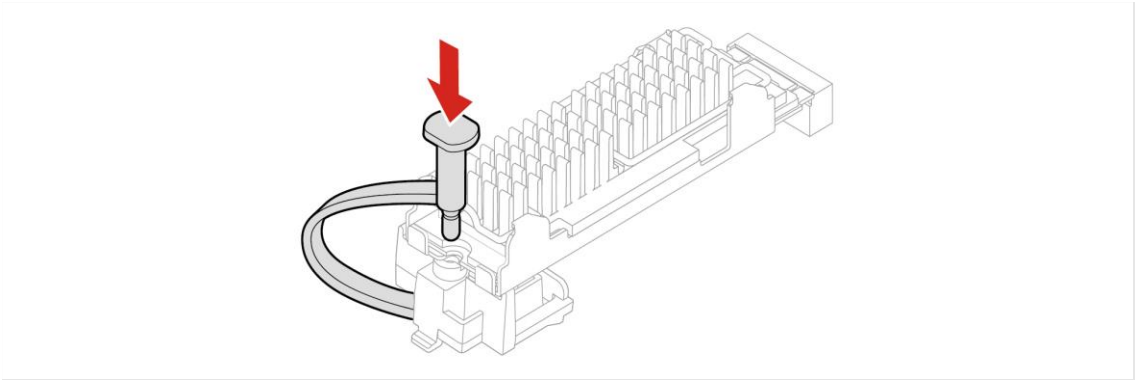
2. Remove the film that covers the thermal pad at the bottom of the heat sink, if any. Then, install the heat sink onto the M.2 drive in the bracket.



3. Install the heat sink with the bracket into the system.

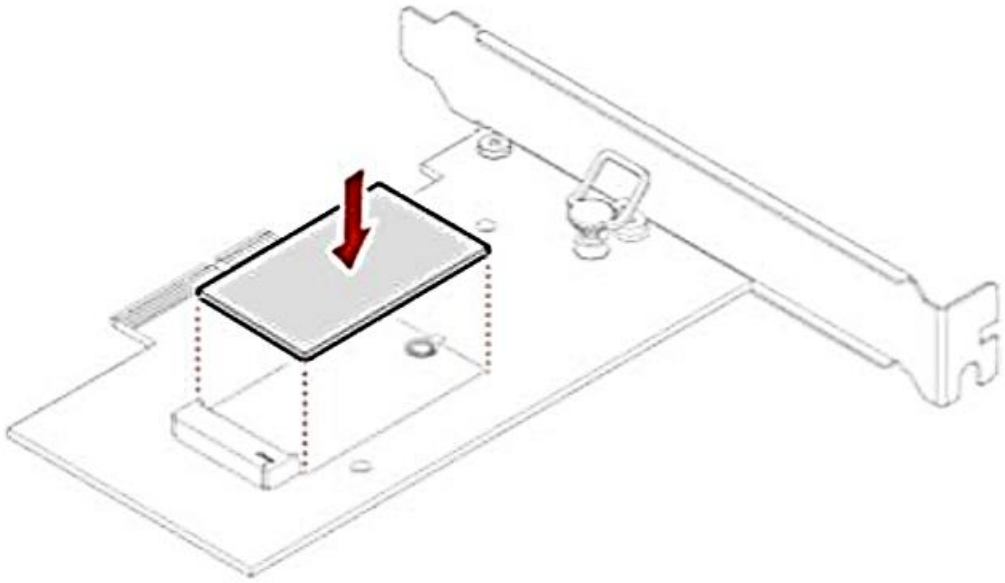


4. Insert the stopper.

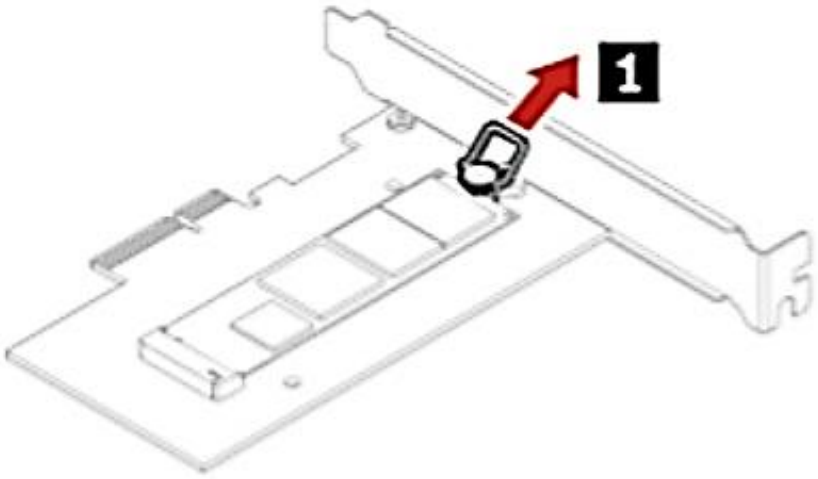


For M.2 NVMe drives installed in the Add-in Card:

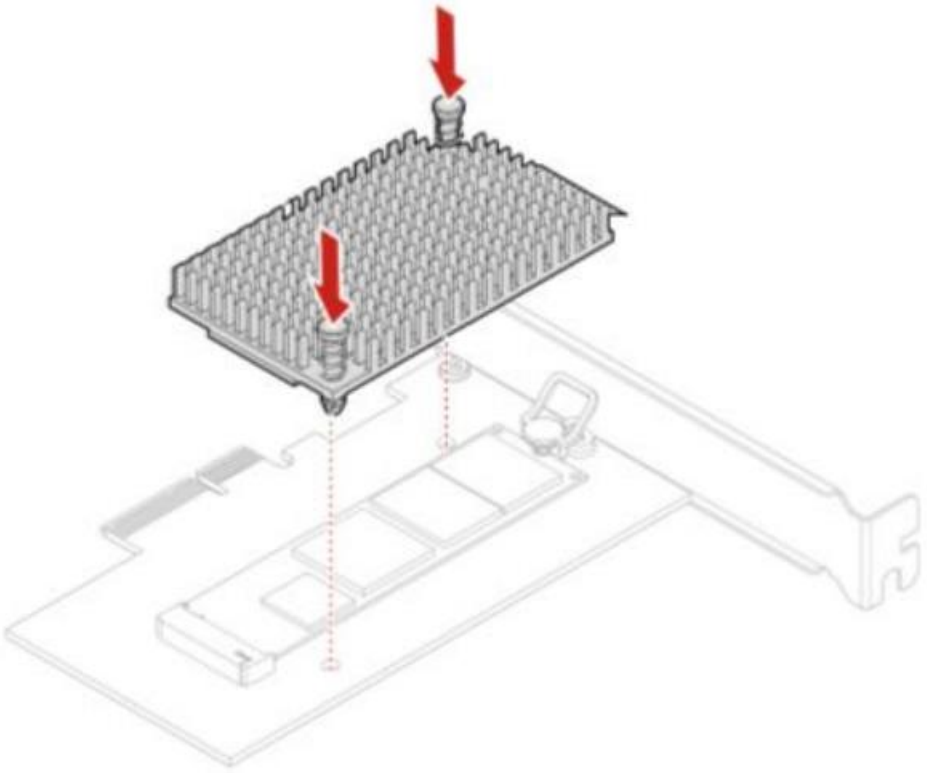
1. Ensure that a thermal pad is placed in position on the M.2 solid-state drive PCIe adapter.



2. Pull the retention latch outward on the M.2 solid-state drive adapter.



3. Hold the new drive by its edges so as not to touch the circuit board and ensure that the circuit board side is facing upward. Align the notch in the new M.2 NVMe drive with the slot key in the M.2 slot. Insert the plug of the retention latch into the hole to secure the new drive.



Section 2 – Installing HDDs/SSDs

The ThinkStation P350 is fairly limited on how many HDD's/SSD's can be installed in the P350 platform. Notice from the P350 motherboard screenshot that there are only four SATA port connections, labelled SATA1, SATA2, SATA3, and SATA4 in order as they show up in the system BIOS.

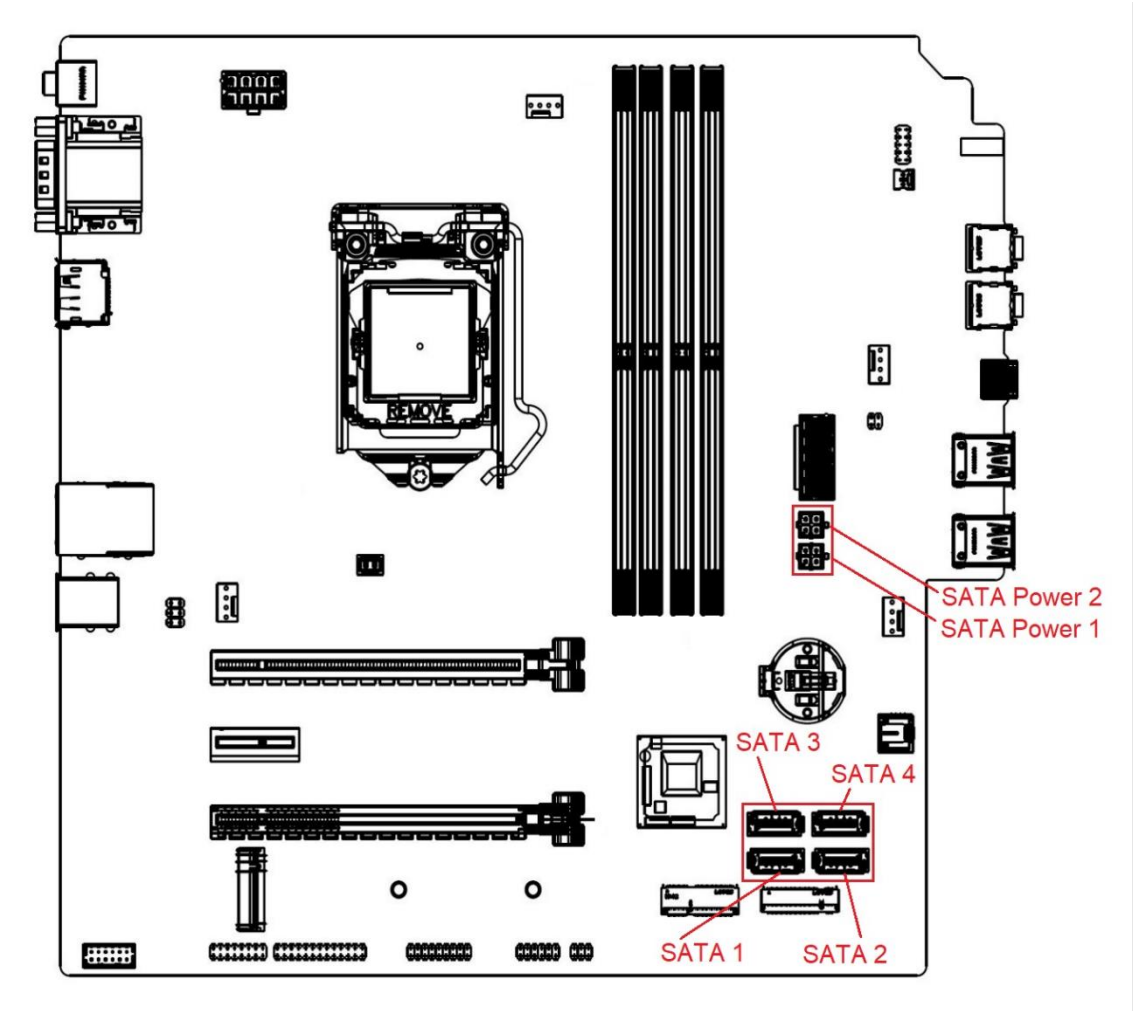
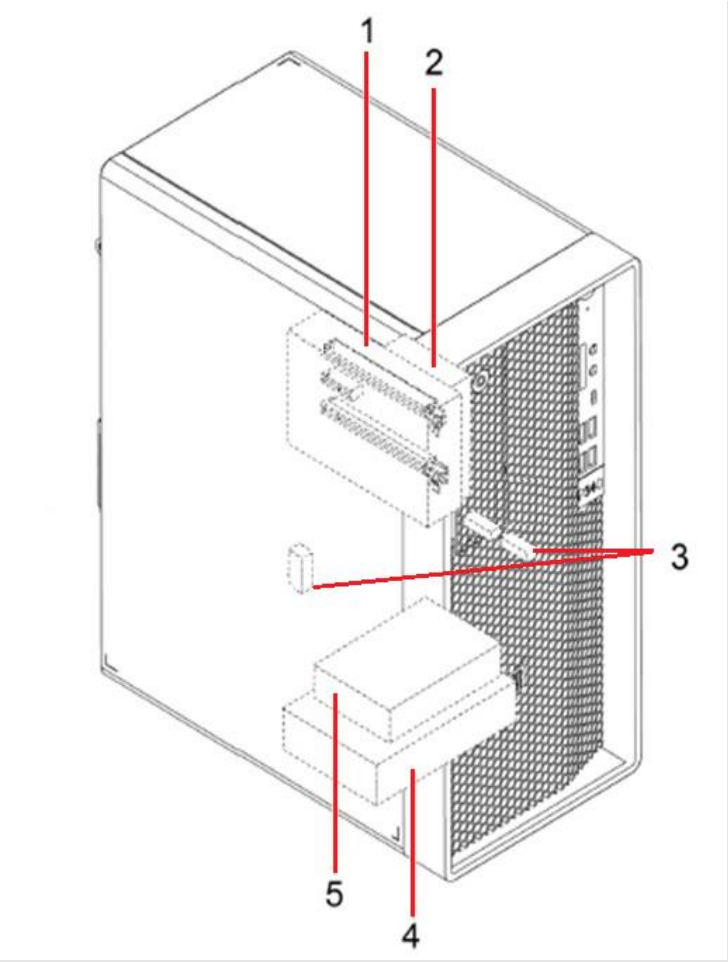


Figure 1

Note: Additional parts may be required to install additional HDD's/SSD's.

P350 Tower



1 – Flex bay (optional) to install a 3.5” secondary storage drive cage or a 3.5” front-access storage enclosure (FASE)

2 – 2.5” secondary (optional) storage drive cage

3 – Two M.2 solid-state drive slots

4 – 3.5” primary storage drive cage

5 – 2.5” secondary (optional) storage drive cage

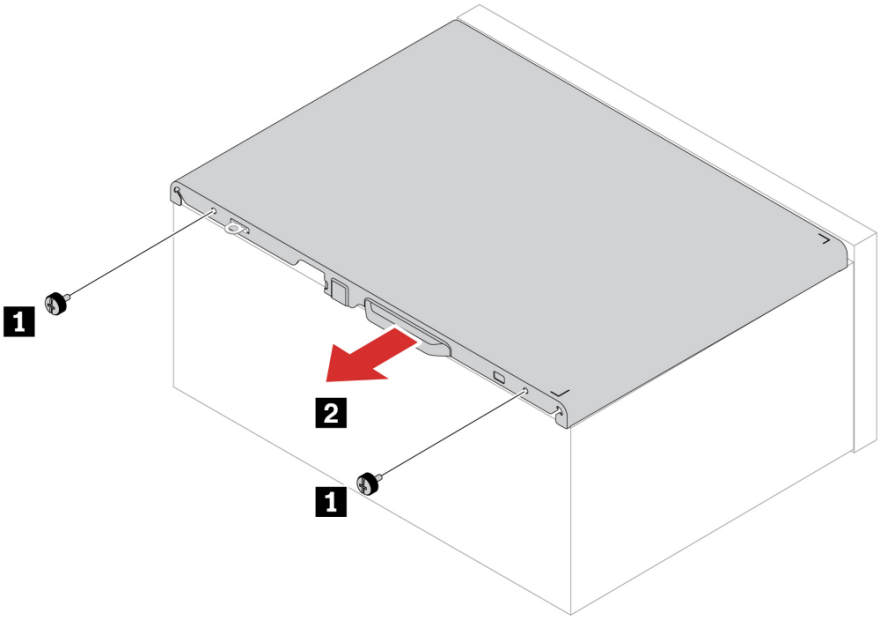
6 – Slot 3 for additional M.2 solid-state drive

Note 1: When adding additional drives after purchase, additional parts will likely be required such as Add-In-Cards, enclosures, and cables. See Appendix in Section 4.

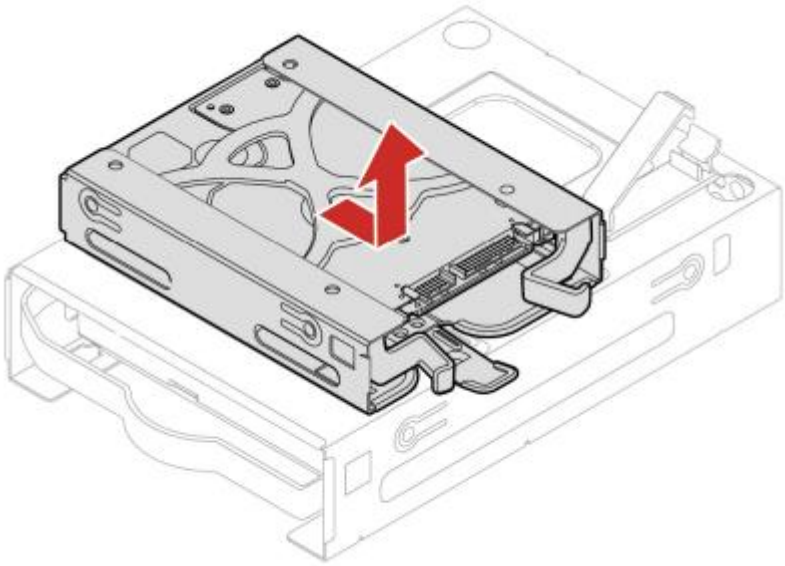
Note 2: if the unit was purchased without a slim ODD, FASE, 2nd 3.5” HDD, or 2nd 2.5” drive, then the slim ODD bracket will not be present. Users wishing to add any of those components will need to purchase the option kit for the device to be added, as well as the option kit for the slim ODD bracket in order to complete the installation. (see Appendix).

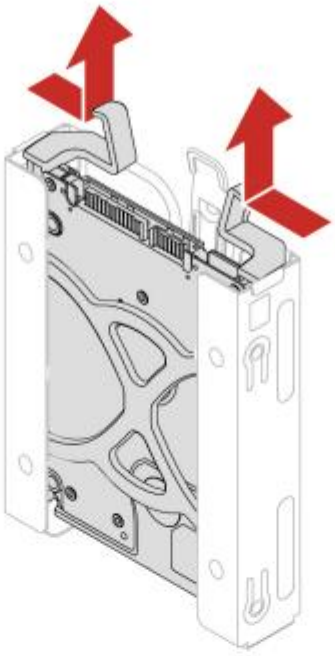
Removal and install secondary storage drive:

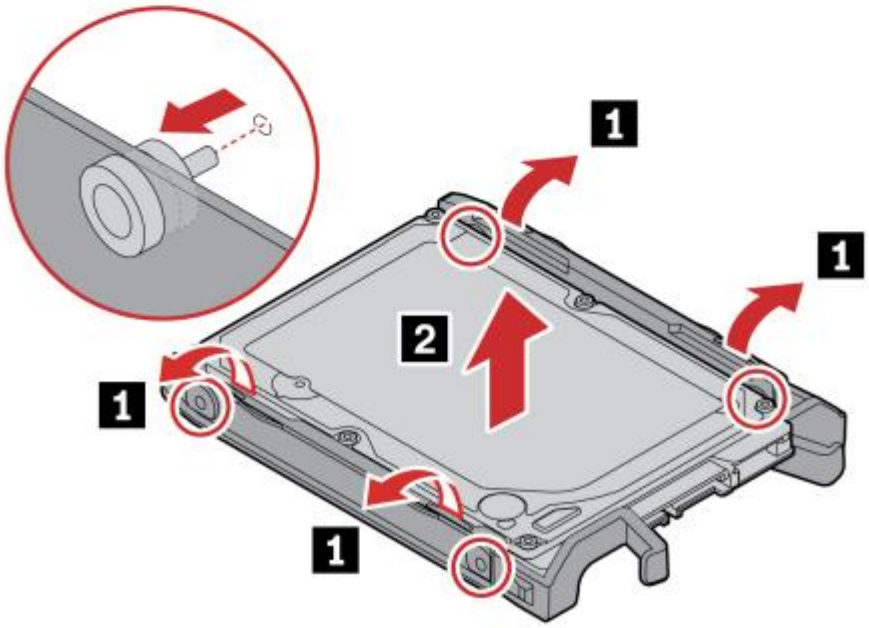
1. Power down the system. Remove the power cable and all attached devices and cables from the system. Lay down the computer to place the computer cover facing up.



2. Disconnect the signal and power cables from HDD.



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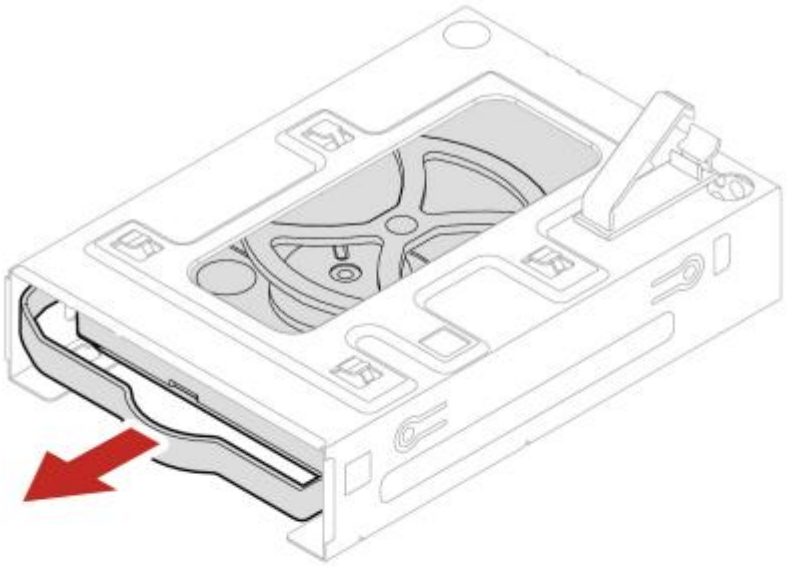
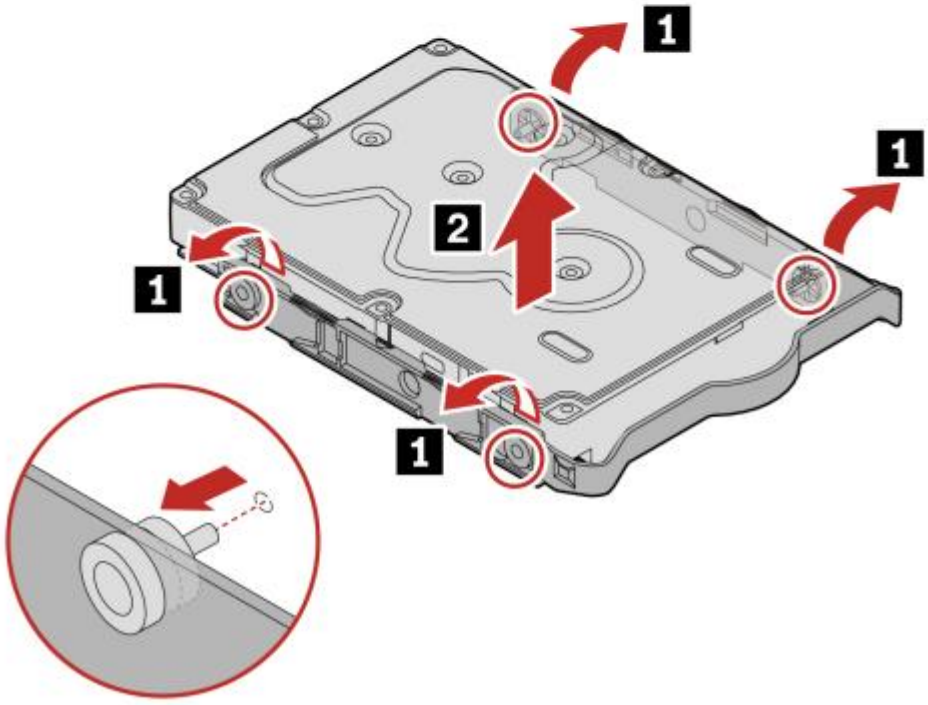


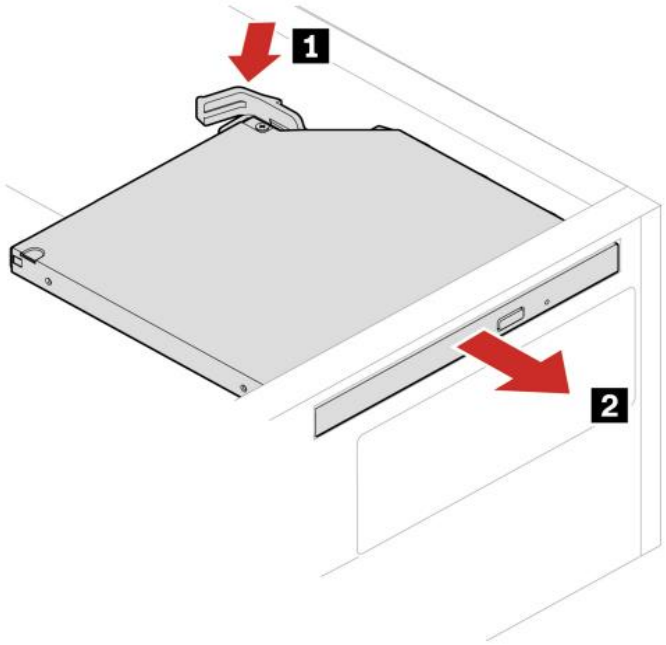


3. Reverse the steps to reassemble the system.

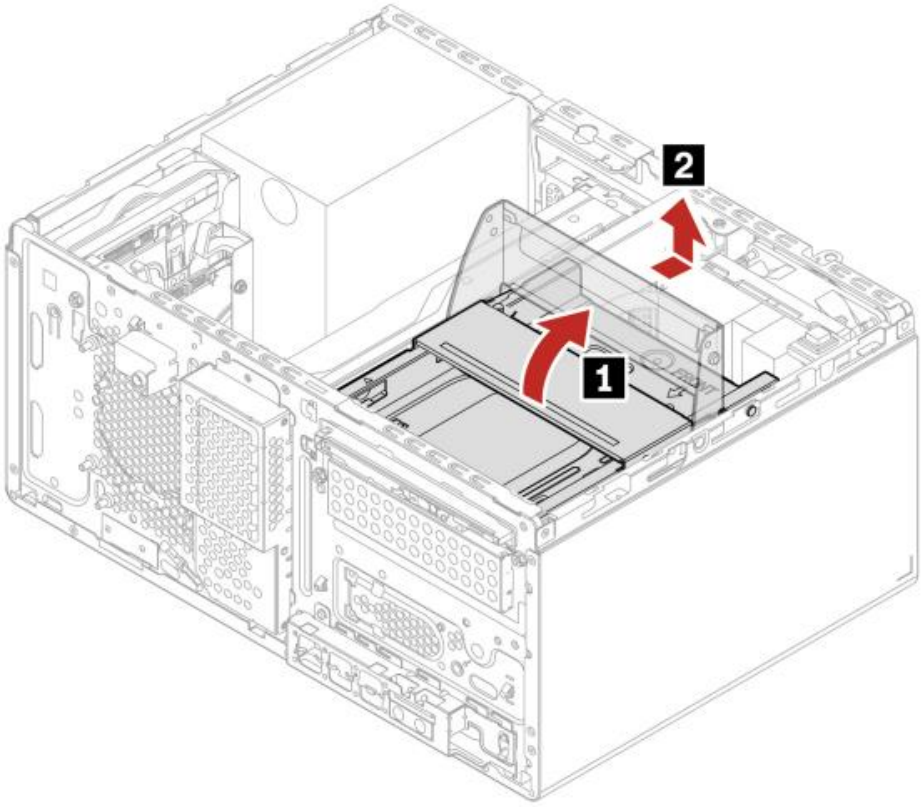
Removal and install Slim ODD bracket:

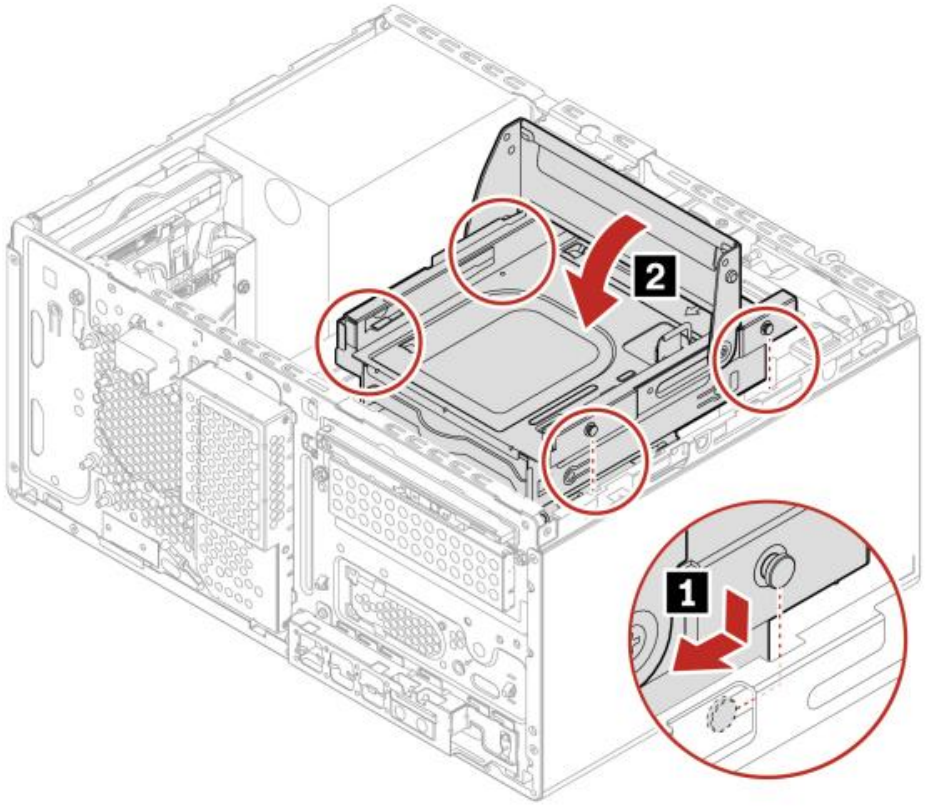
Note: The following steps describes how to remove Slim ODD bracket if the system was ordered with Slim ODD. If the unit was ordered without ODD, the Slim ODD bracket will not be present and need to purchase an option Slim ODD bracket kit (see Appendix).

1. Remove a side cover.
2. Disconnect the signal and power cable from the slim optical drive.



3. Disconnect the signal cable and power cable (if any) from the secondary storage drive under the slim optical drive.



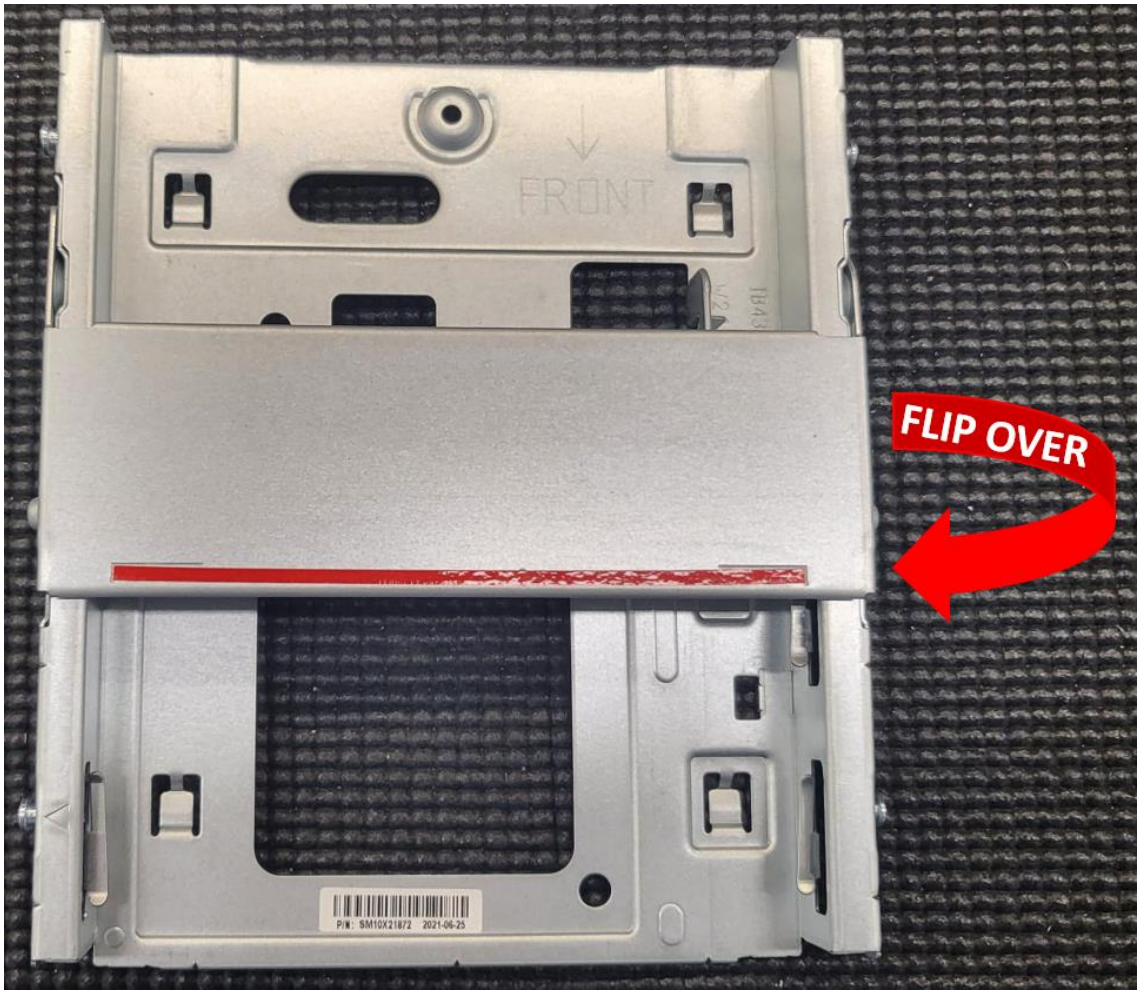


4. Reverse the steps to reassemble the system.

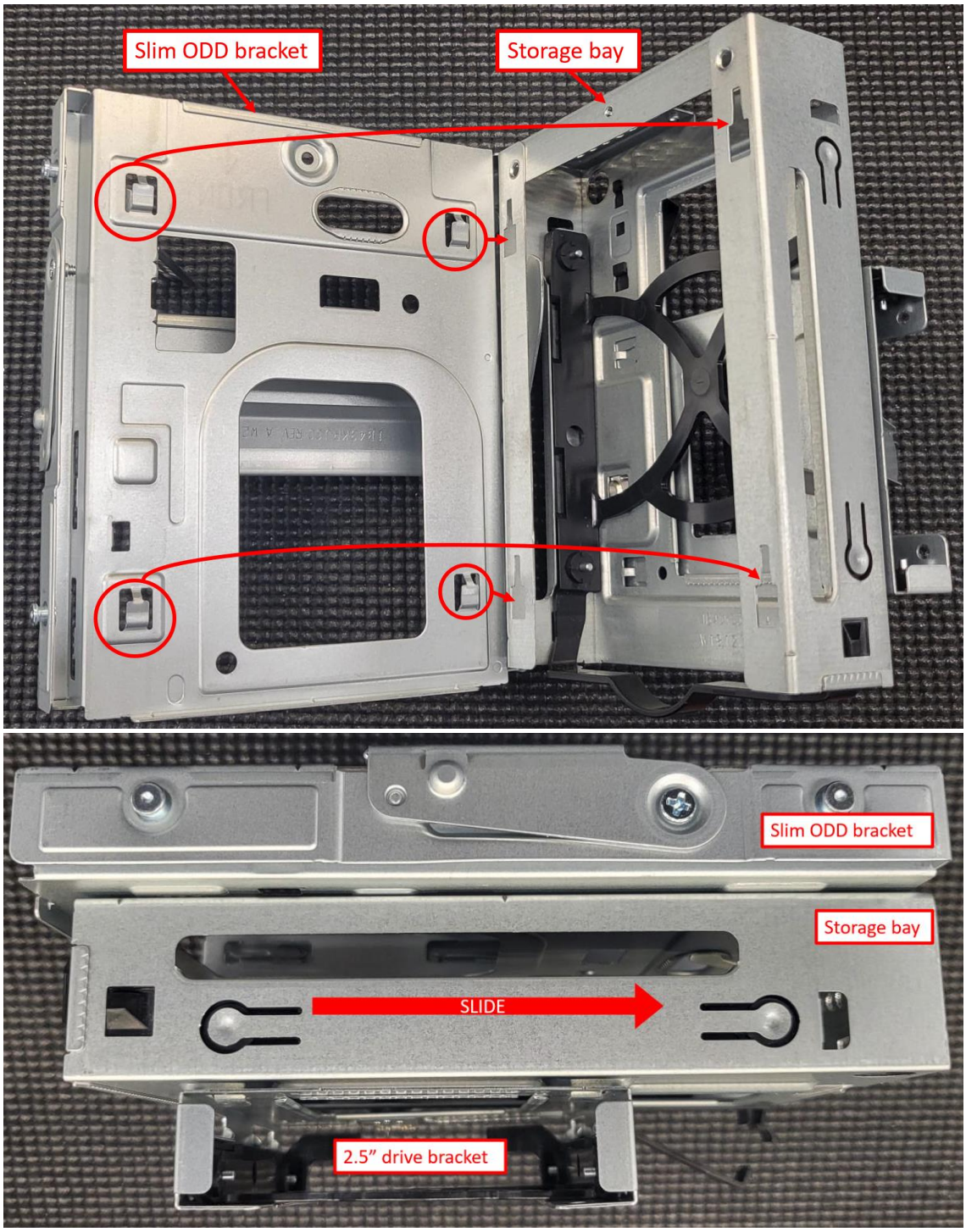
Installing Flex additional storage bay:

Note: Flex additional storage bay requires Slim ODD bracket to be installed. If the unit was ordered without ODD, the Slim ODD bracket will not be present and need to purchase an option Slim ODD bracket kit (see Appendix).

1. Remove side cover.
2. Disconnect ODD cables.
3. Remove slim ODD and slim ODD bracket (if installed).
4. Flip Slim ODD bracket that the red handle will be downside.

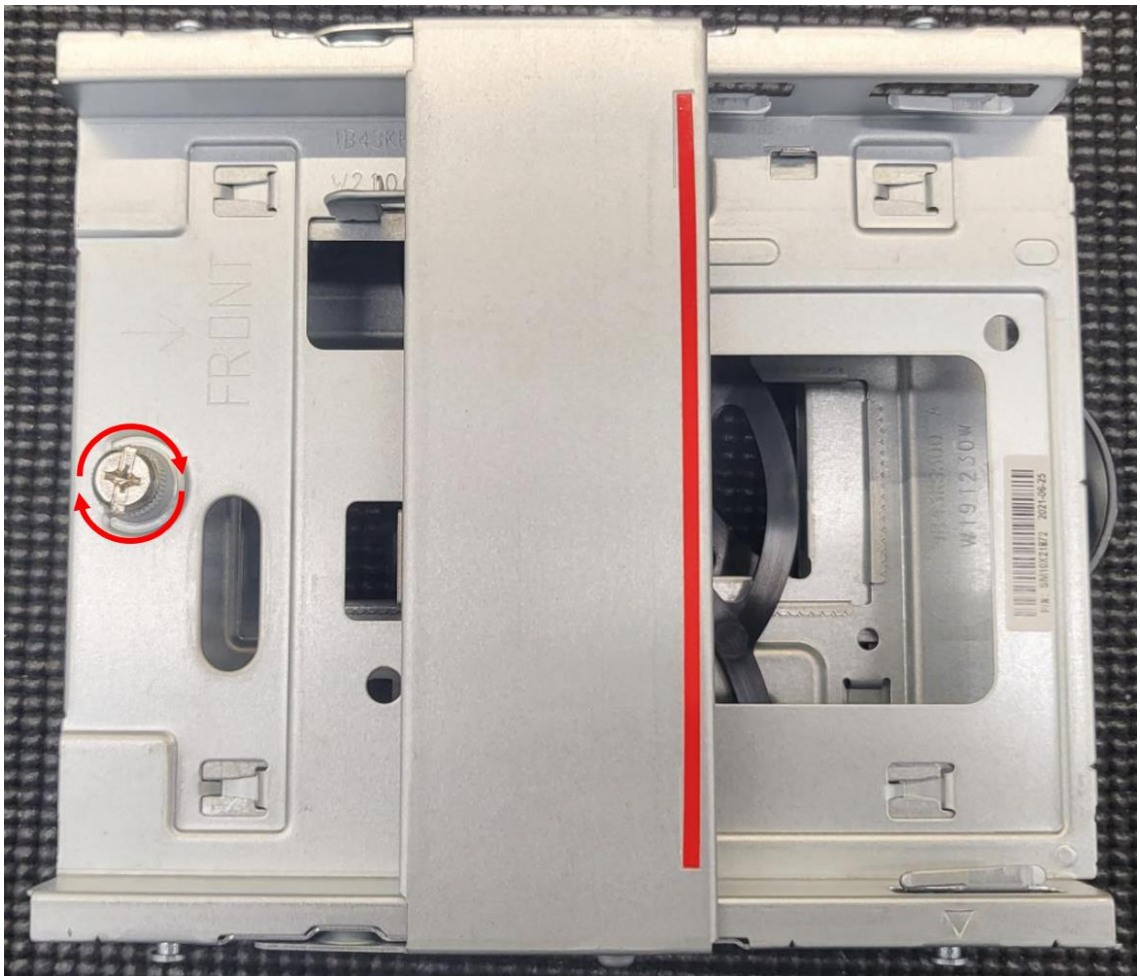


5. Align hooks on slim ODD bracket with holes on storage bay and slide it.



Note: The above images also show the 2.5” storage bay assembly attached to the 3.5” storage bay assembly. For more information on the 2.5” storage bay installation, please refer to Removal and install secondary storage bay.

6. Secure the slim ODD bracket and storage bay assembly together with the provided thumb screw.



7. Install slim ODD bracket assembly back into system.

Storage drive in the front-access storage enclosure:

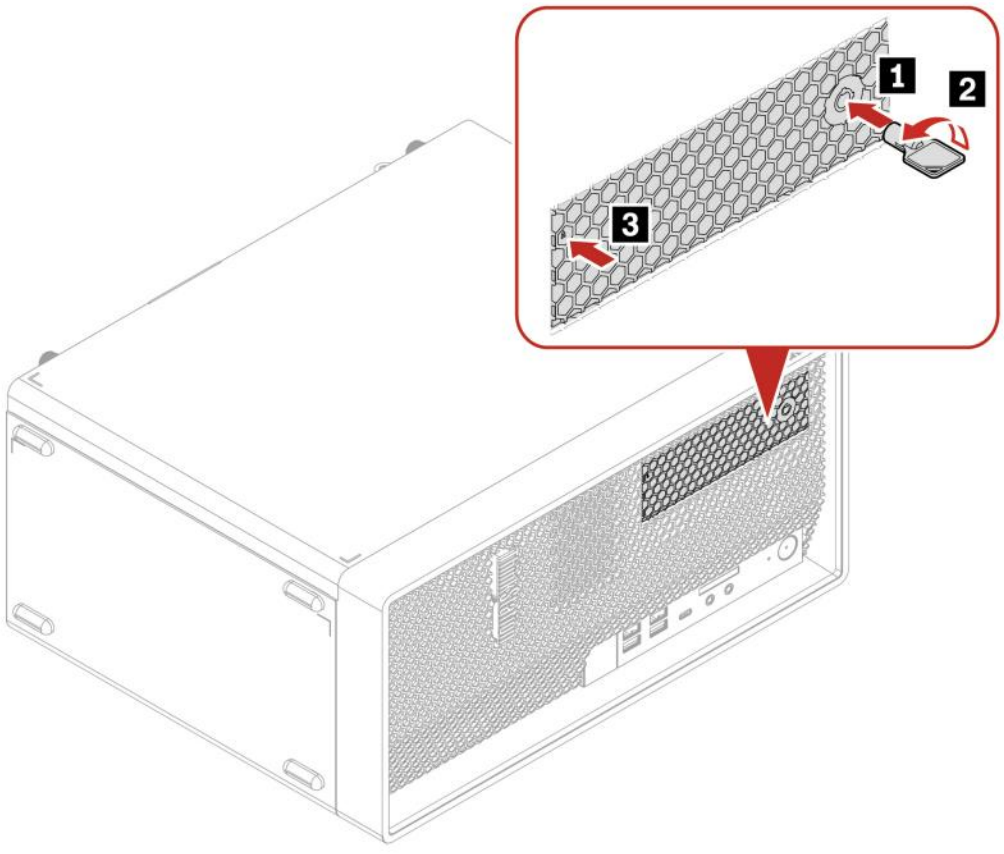
The storage drive in front-access storage enclosure is hot swappable only when the following settings are set:

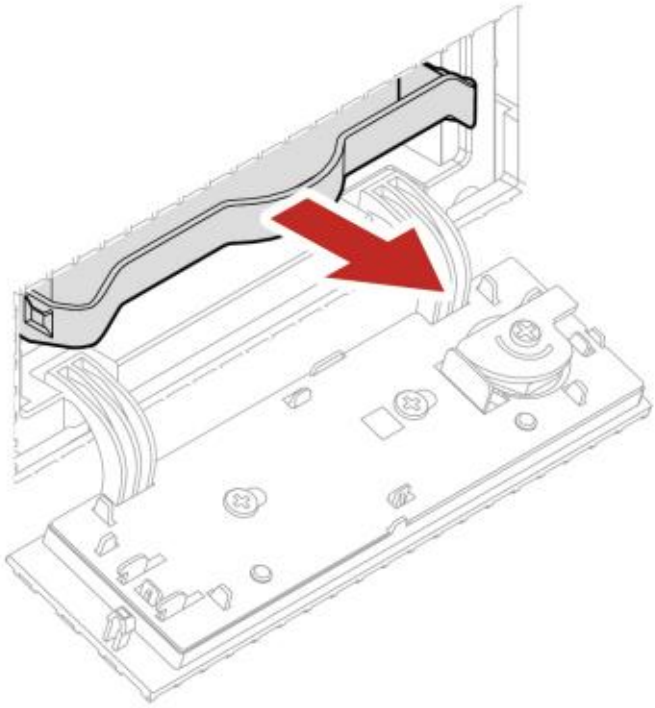
- The eSATA mode of the SATA 4 connector is enabled in BIOS by doing following:
    1. Restart the computer. When the logo screen is displayed, press F1.
    2. Select **Devices** -> **ATA Drive Setup** -> **SATA Drive 4 Hot-Plug Support** and press Enter
    3. Select Enabled and press Enter.
    4. Press F10 to save the changes and exit
- The SATA cable of the front-access storage is connected to the SATA 4 connector on the system board.
- The operating system of your system does not reside on the storage drive installed in the front-access storage enclosure.

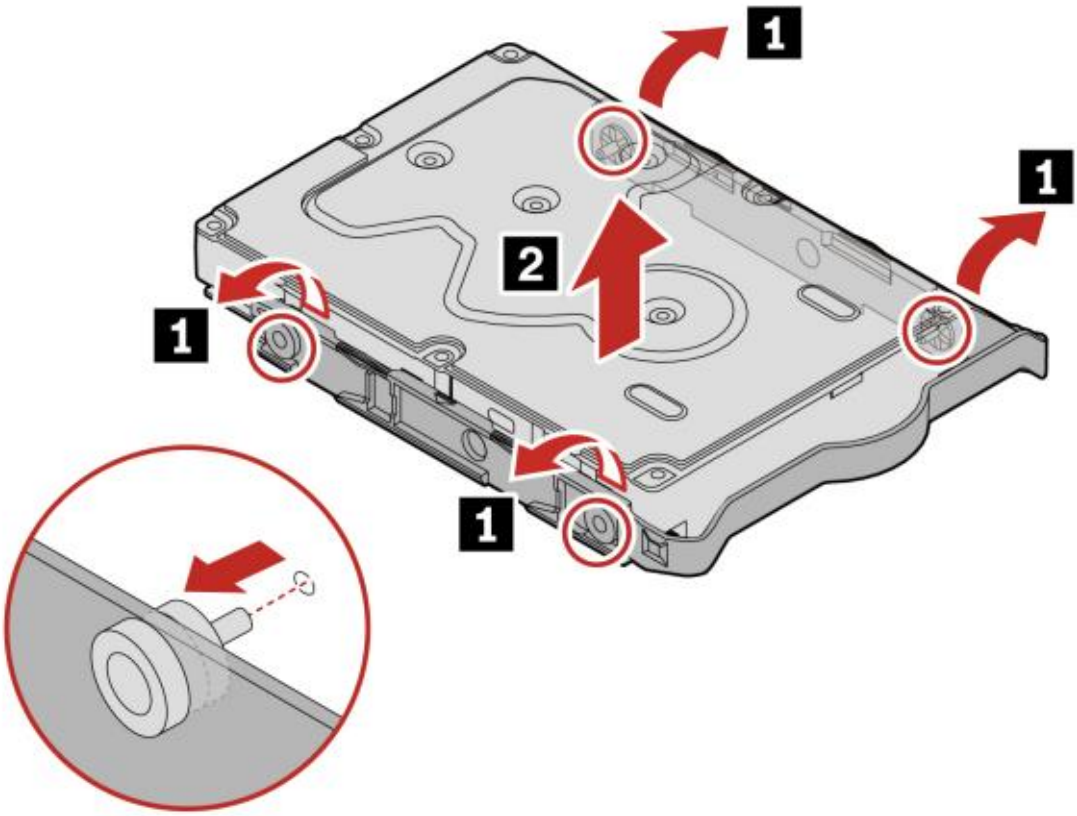
Attention: if any of the above requirements are not met, do not install or replace the storage drive when the computer is turned on. Otherwise, data on the storage drive might get damaged.

Removal steps of the 3.5” storage drive:

Note: Before removing an old 3.5” storage drive, safely eject the old storage drive from the operating system first.



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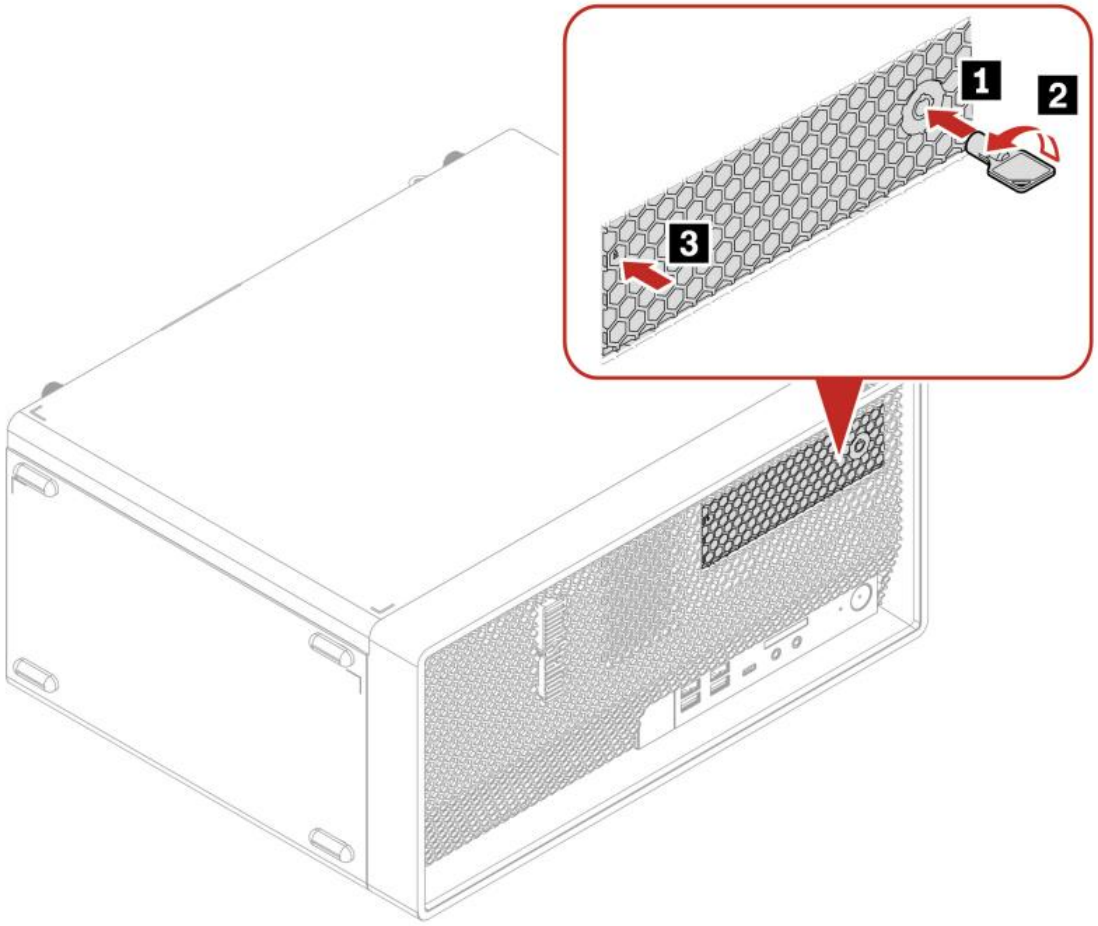
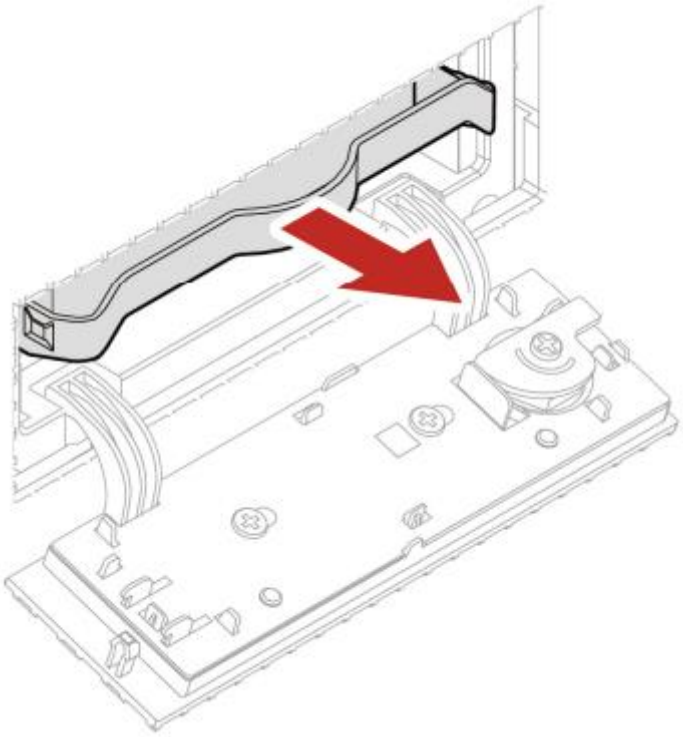
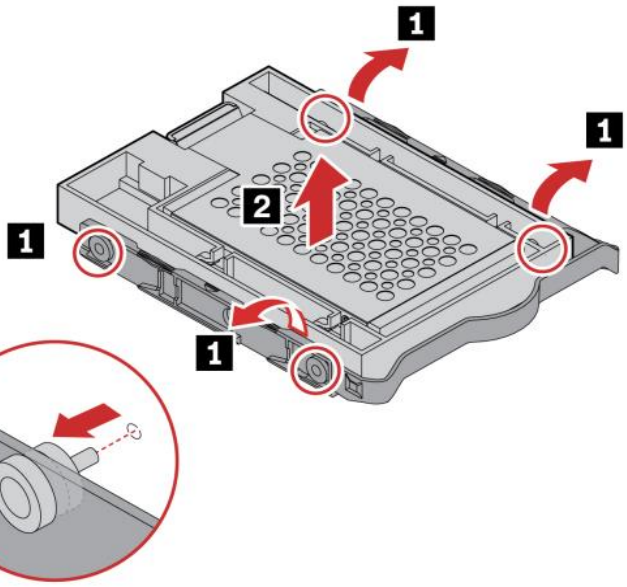
Replacement procedure of the 2.5” storage drive, Type-2 storage drive converter, and bracket:



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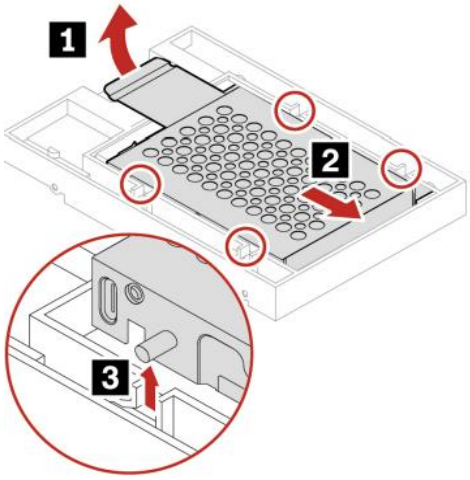
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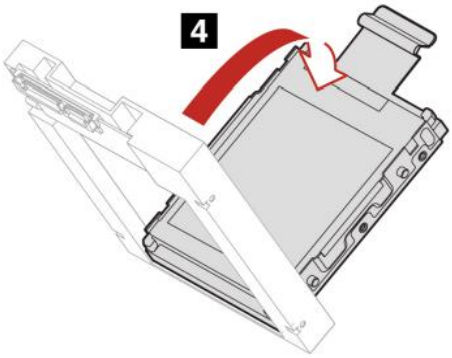
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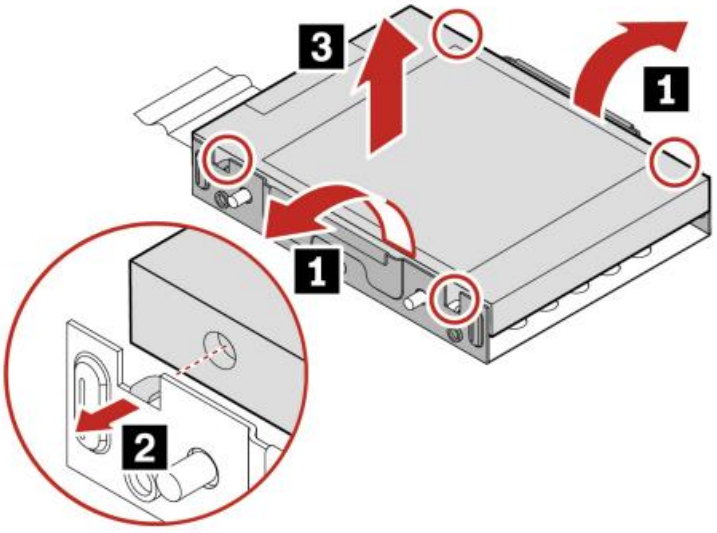
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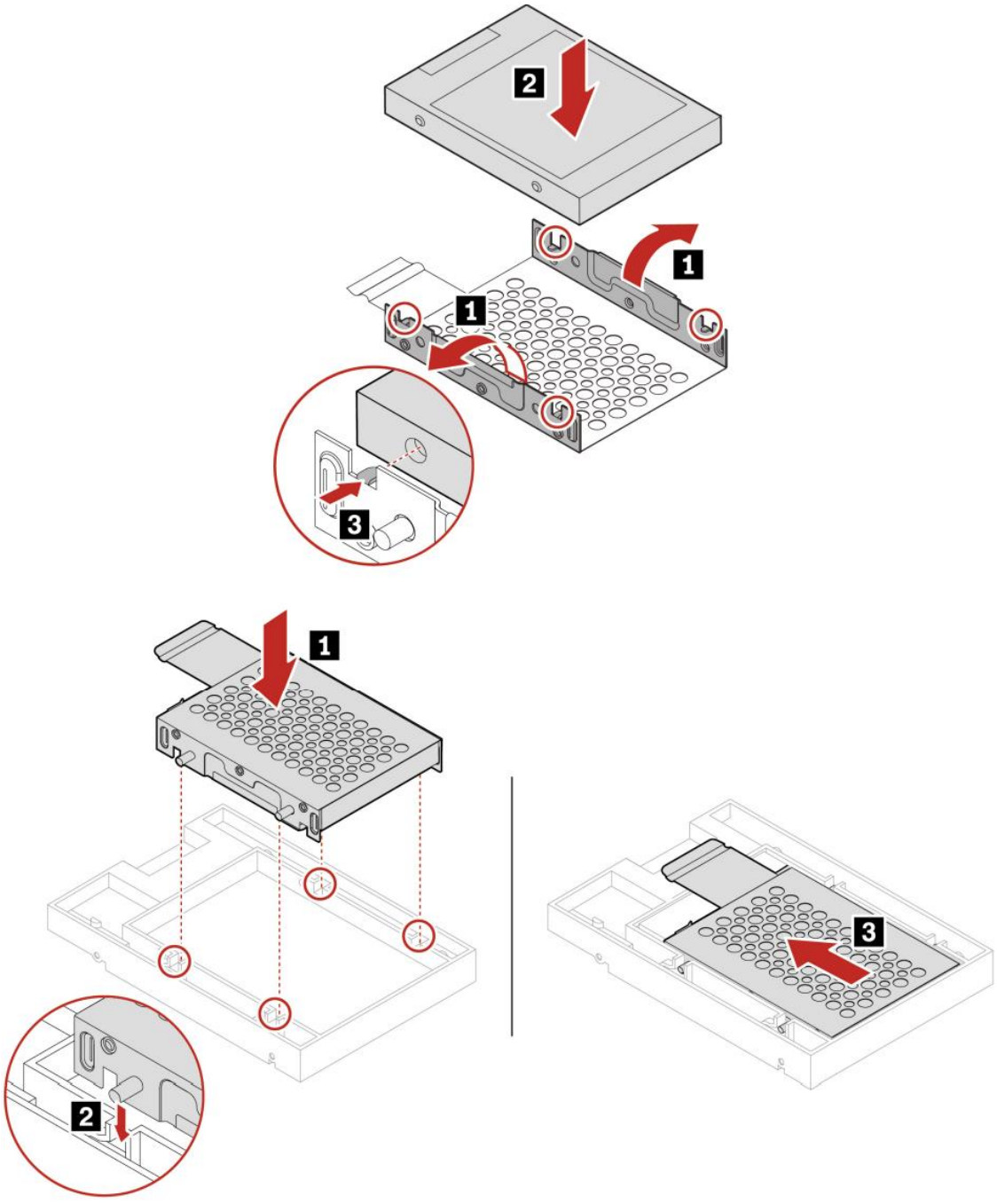
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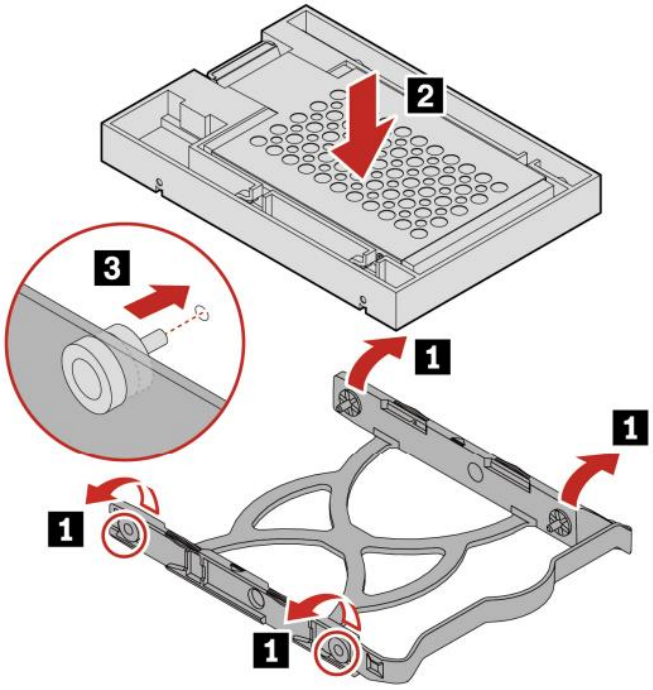
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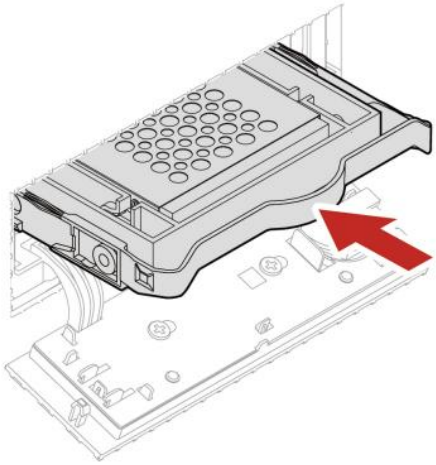

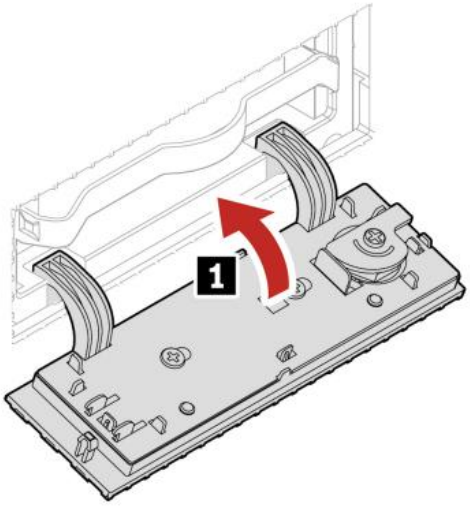
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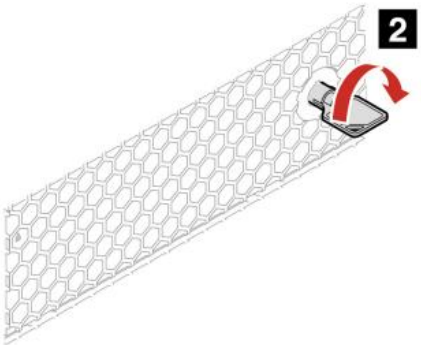
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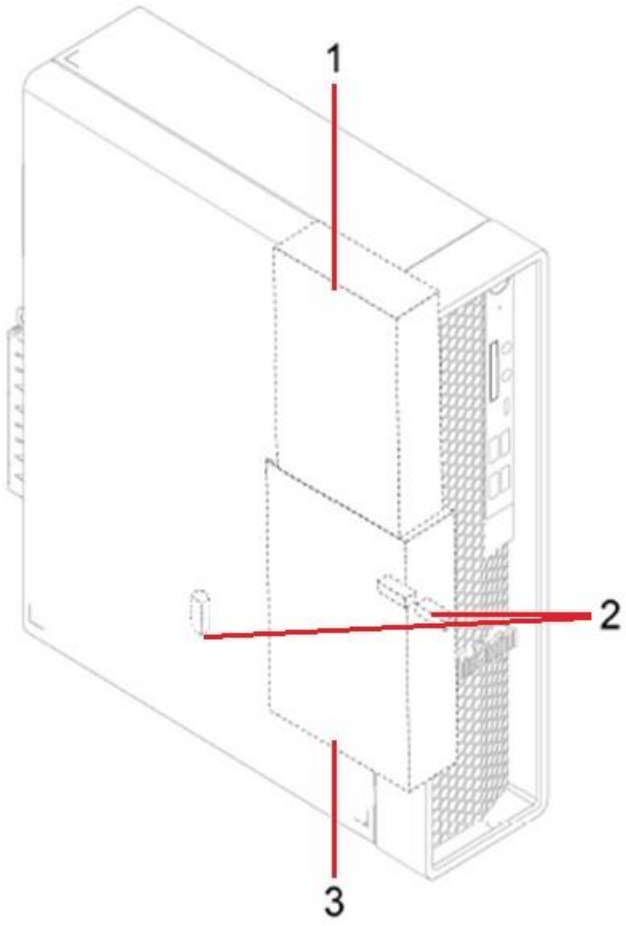
P350 Small Form Factor



1 – Secondary storage bay

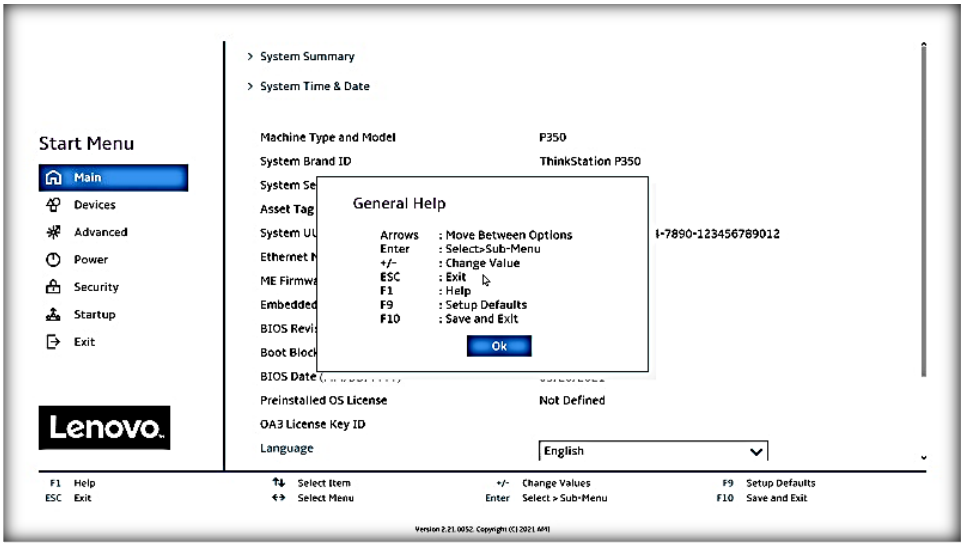
2 – Two M.2 solid-state drive slots

3 – Primary storage bay

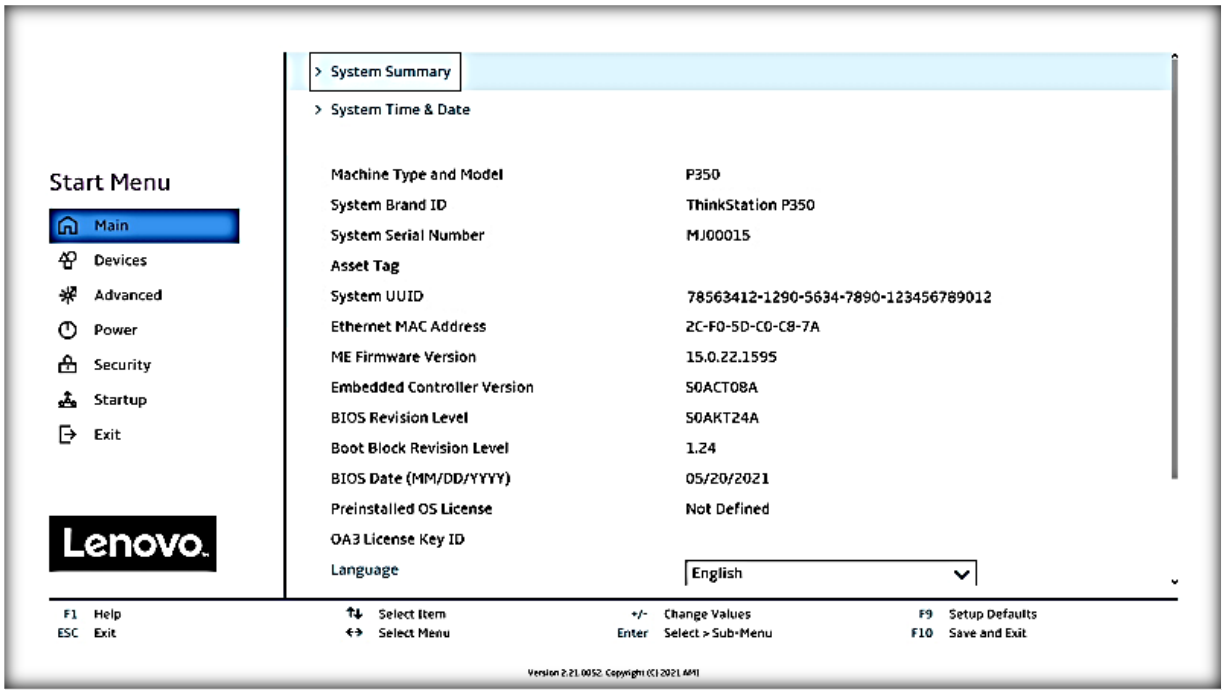
Section 3 – Configuring RAID for P350

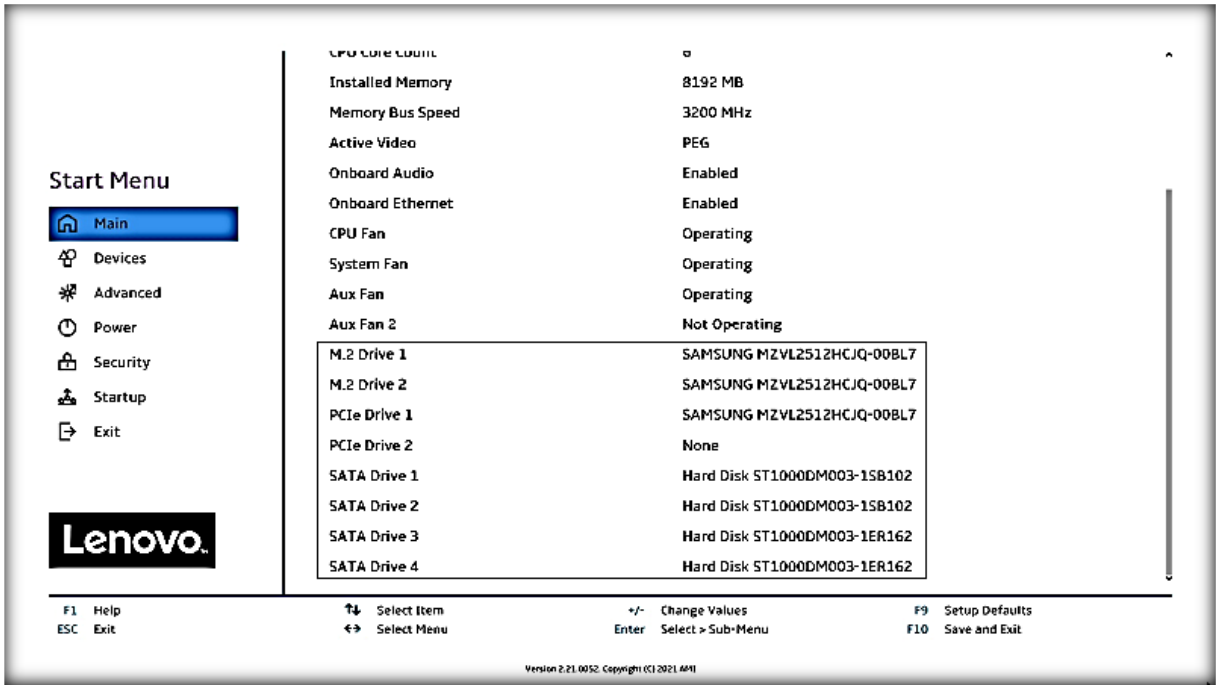
Please refer to the following steps to configure RAID for both NVMe and SATA drives.

1. Boot into the BIOS by pressing the function F1 key at the “Lenovo” splash screen.



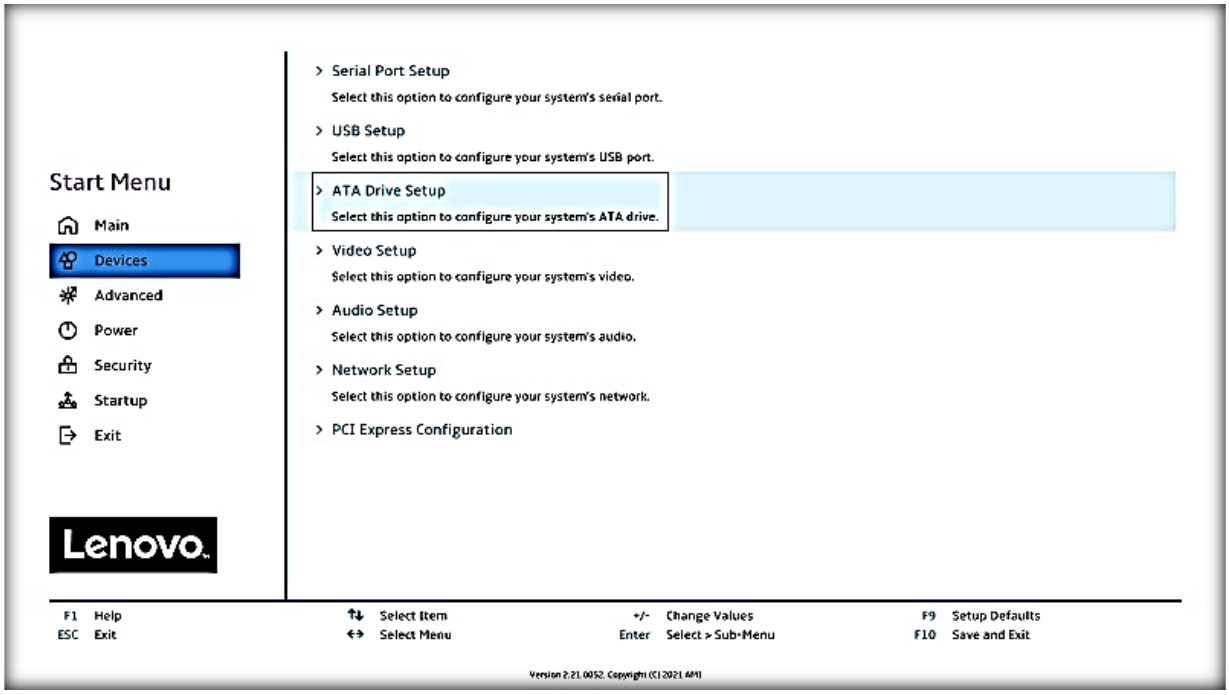
2. Select “System Summary” and scroll down to verify BIOS is recognizing all the drives installed in the system.



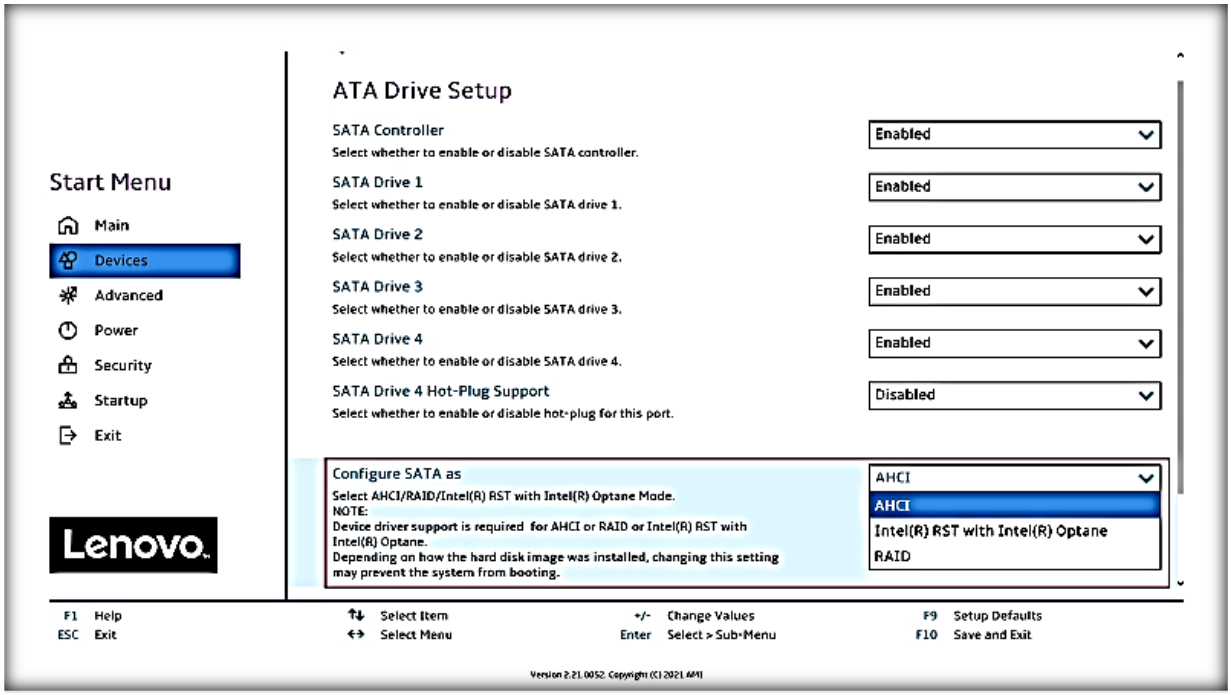


Note: From this point forward, the examples will utilize the SATA drives. The process is the same for both drive types.

3. Select the “Devices” menu at the BIOS main screen setup utility and then select “ATA Drive Setup”.



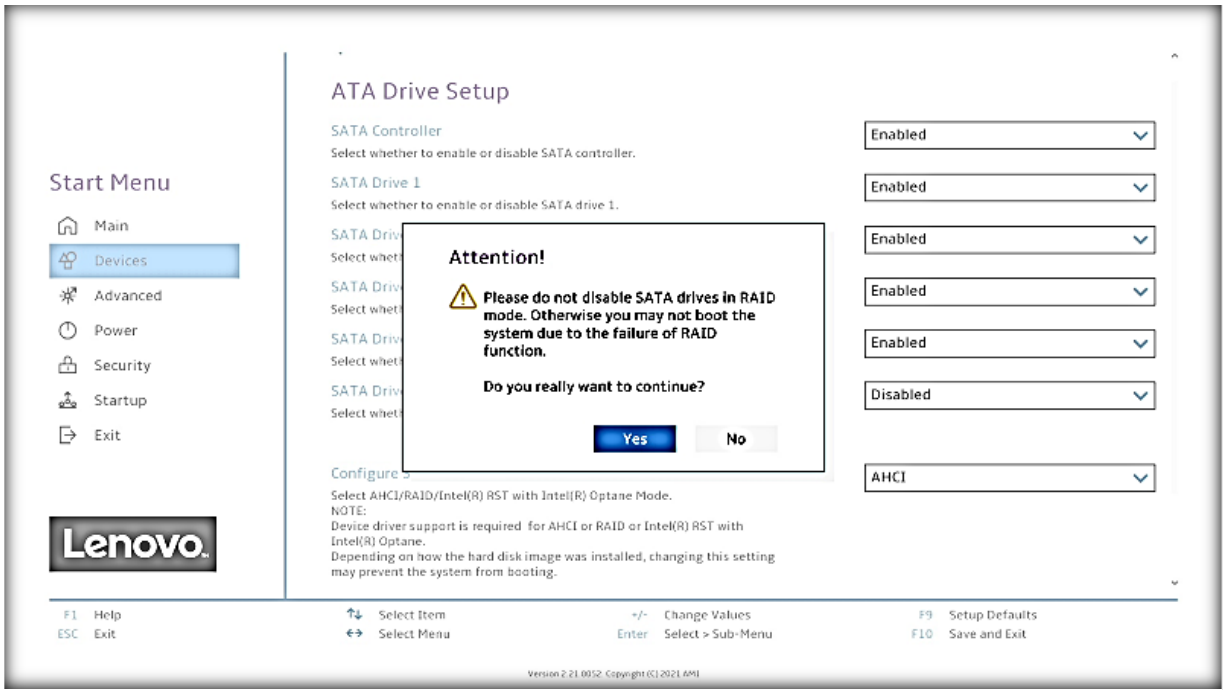
4. In the “ATA Drive Setup” menu, select “Configure SATA as” and change or verify the option is set to “RAID”.



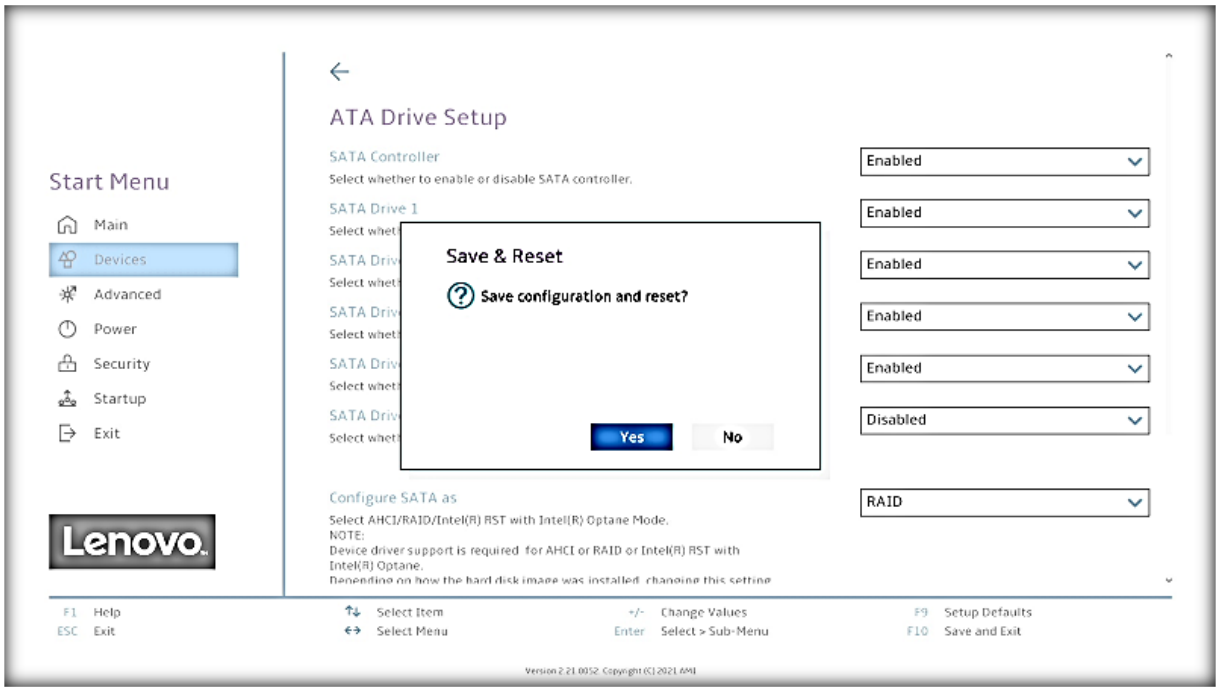
Notes: In order to secure erase any drives, the ‘Configure SATA as’ option must be set to ‘AHCI’ mode.

The “Intel(R) RST with Intel (R) Optane” option utilizes an Optane device for RAID cache, but only when an Intel Optane device is present in the system.

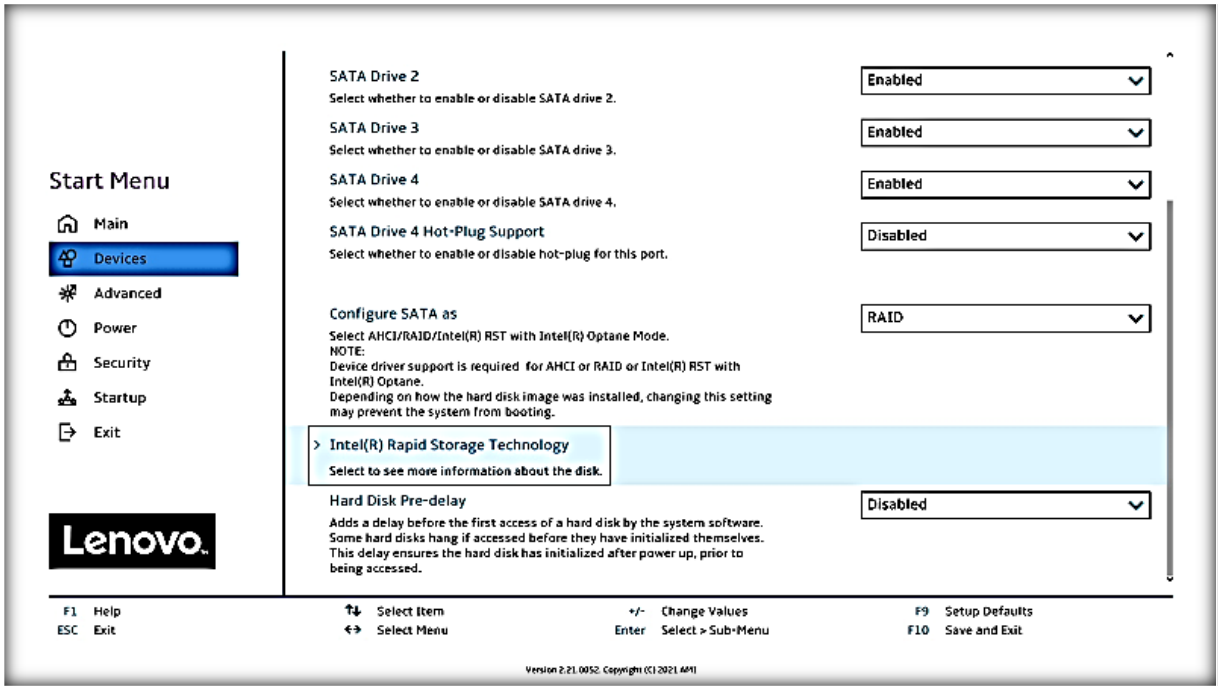
5. When selecting to enable RAID the system will prompt a warning that changing the setting may result in the failure of the system to boot. Select “Yes” to continue.



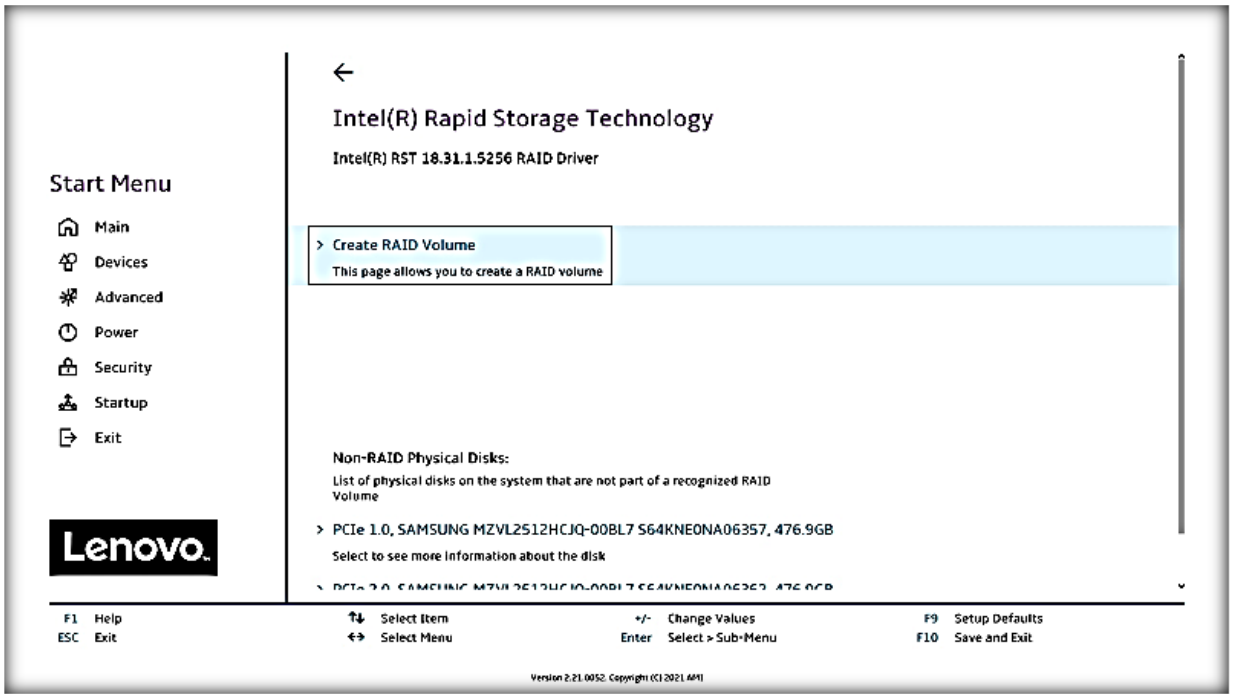
6. Press F10 to save and Exit BIOS setup.



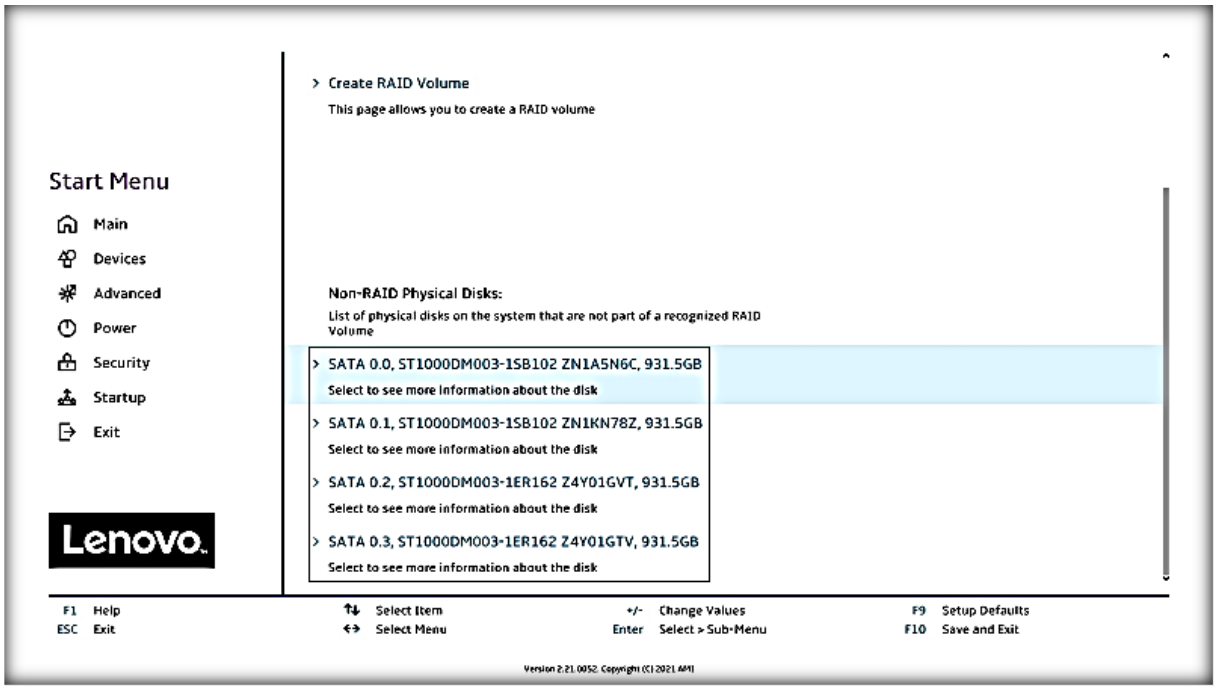
7. As the system reboots, press the function F1 key at the Lenovo splash screen to enter the BIOS setup. Select the “Devices” menu at the BIOS main screen setup utility and then “Intel(R) Rapid Storage Technology”.



8. Select “Create RAID Volume”.

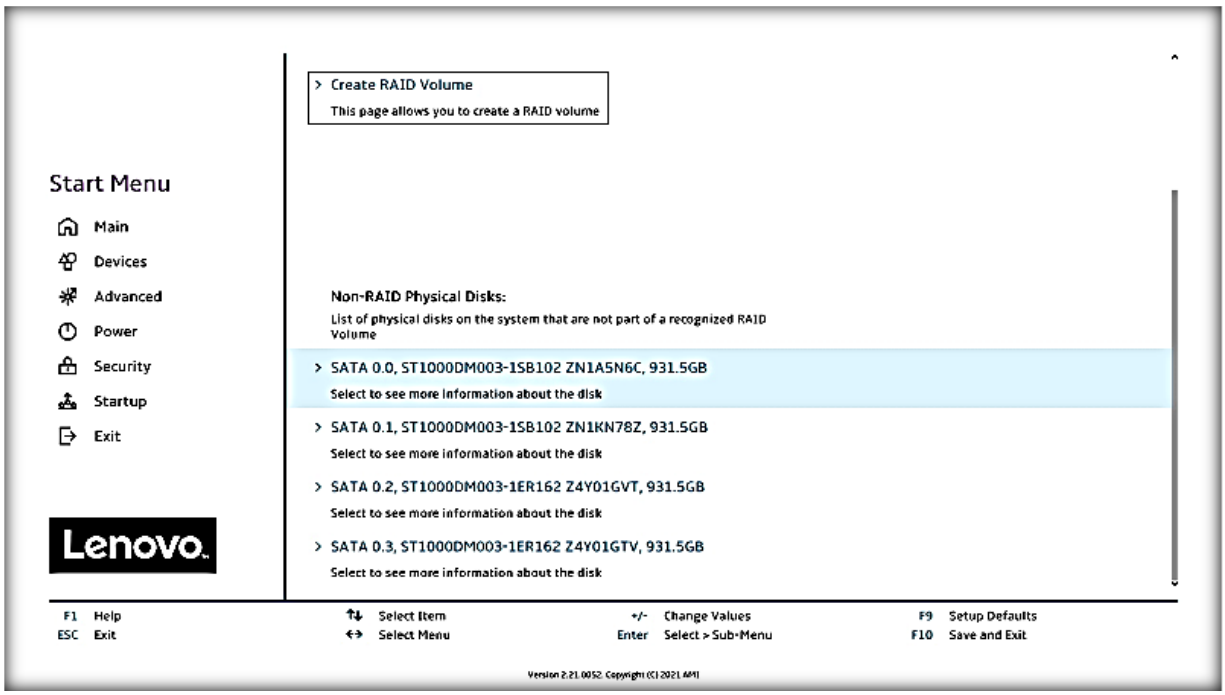


9. Verify all the desired drives are available.

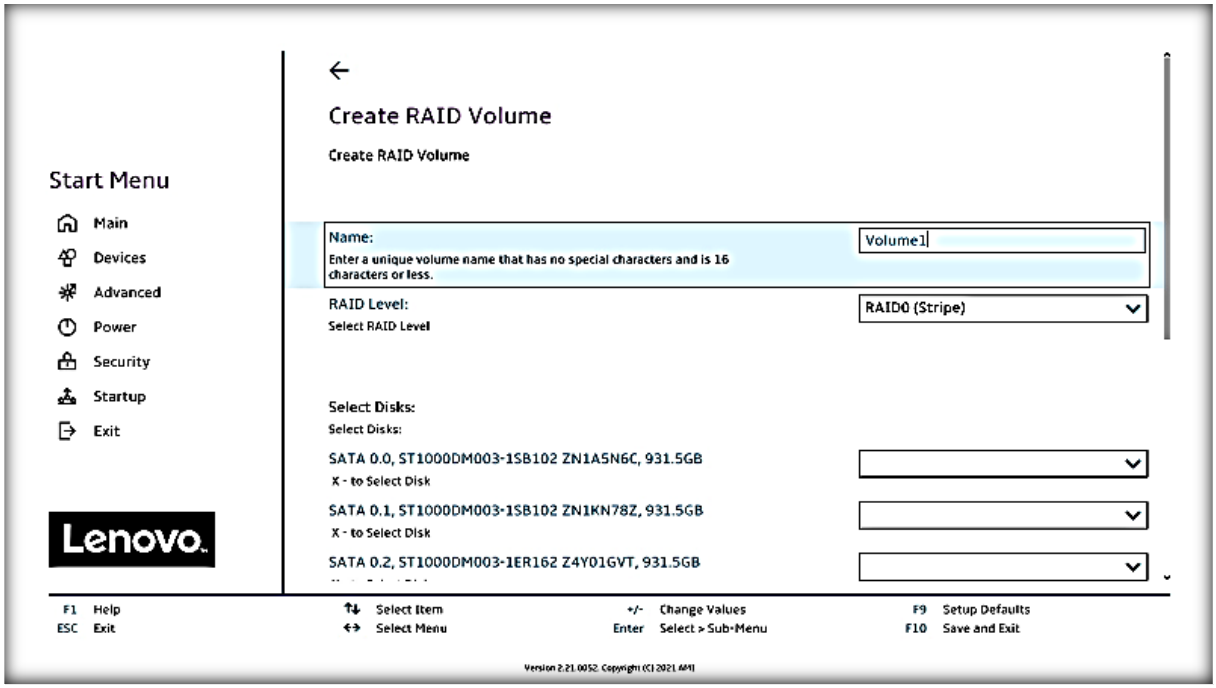


10. If all the disks installed are not shown as available, it may be necessary to clear any previous data from the disks. If no arrays have been created previously but there is an existing volume shown, it will be necessary to delete any previous arrays. Advance to step 16 to complete the process to delete any arrays. Return and proceed to step 11 once the desired drives are available.

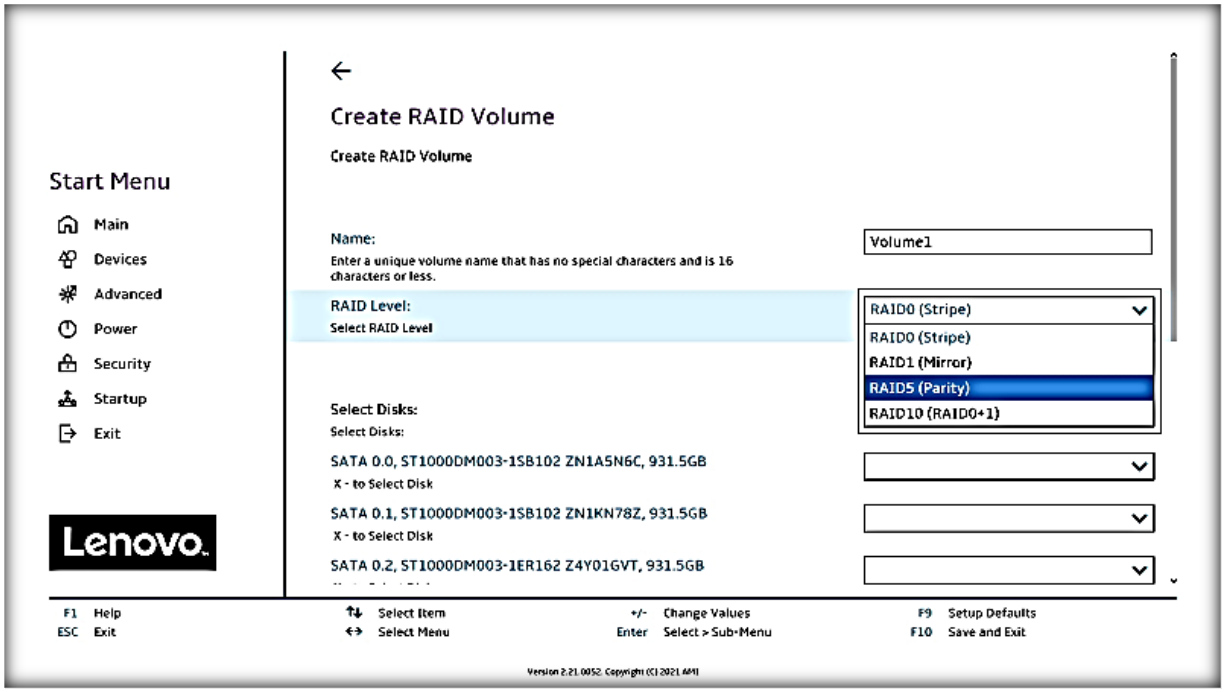
11. Select “Create RAID Volume”.



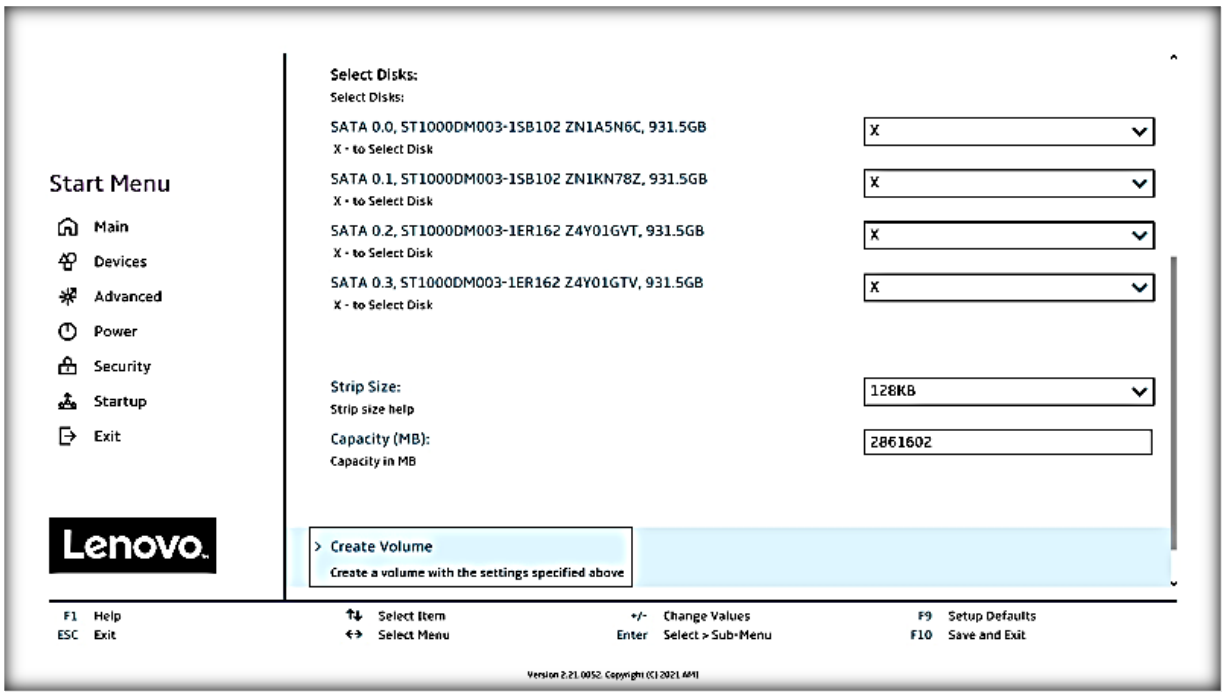
12. Choose a name for the volume.



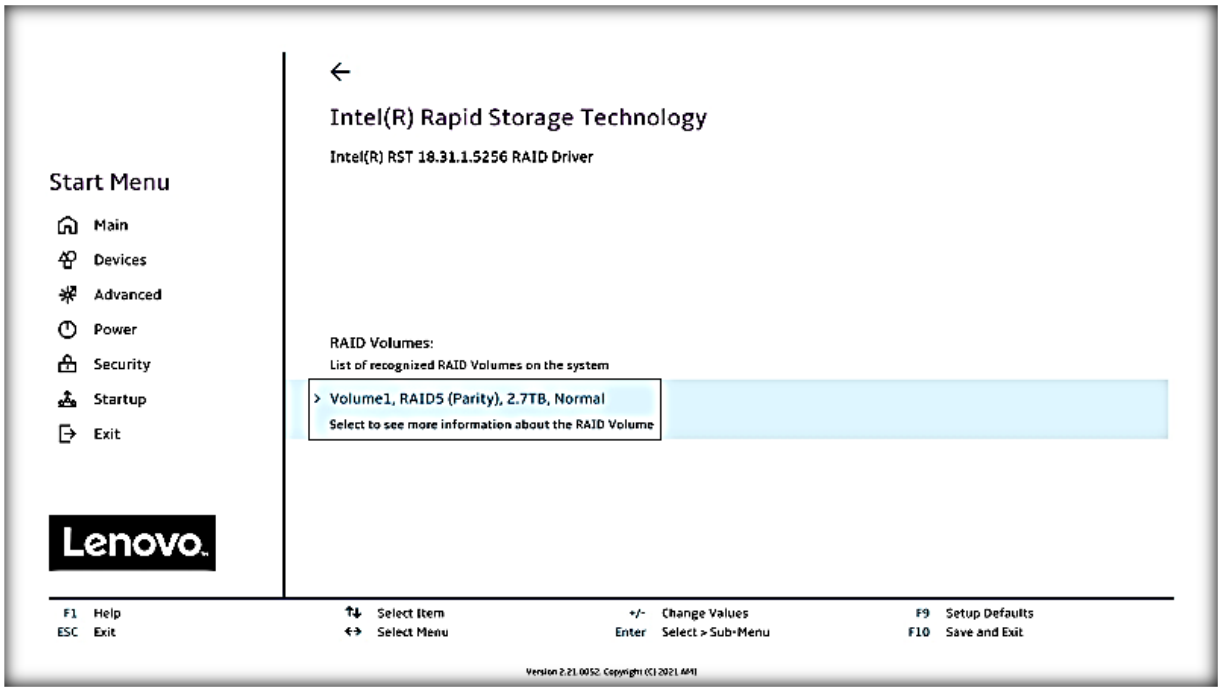
13. Select the drop-down box for “RAID Level” and select the desired RAID level. The RAID level options displayed are based on the type and number of drives available in the system.



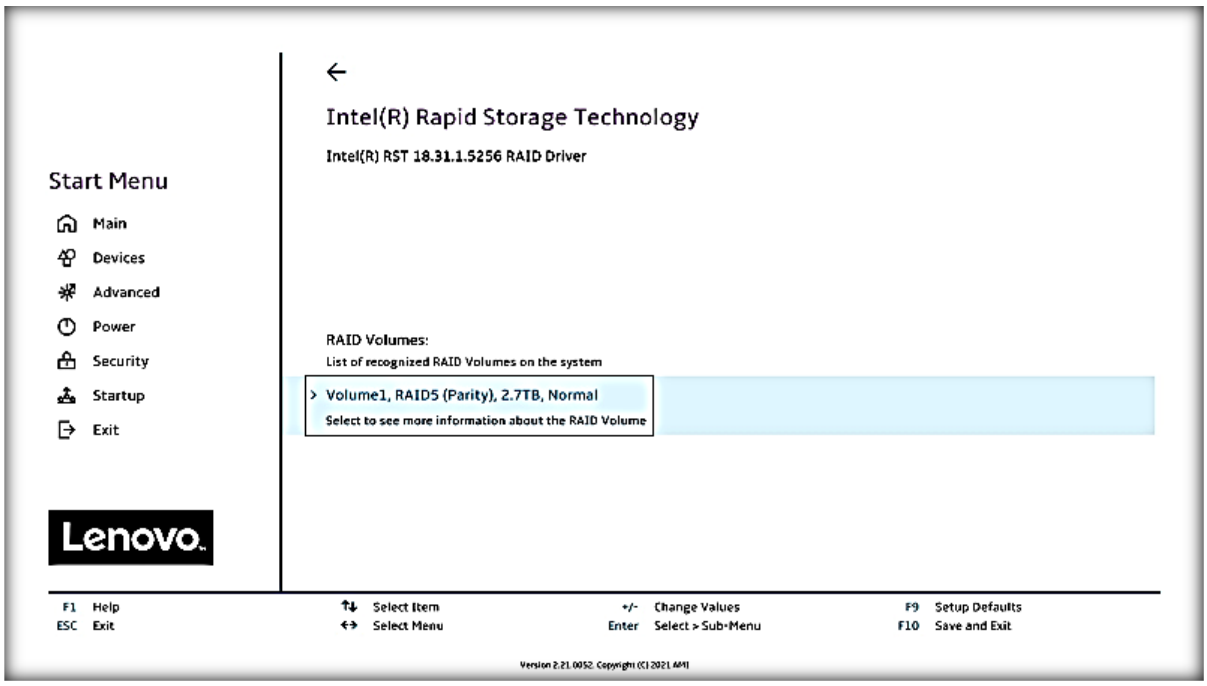
14. On the same page, select the drop-down box for each drive and select X to add the drive to the array. Once all the required drives are added, select “Create Volume”.



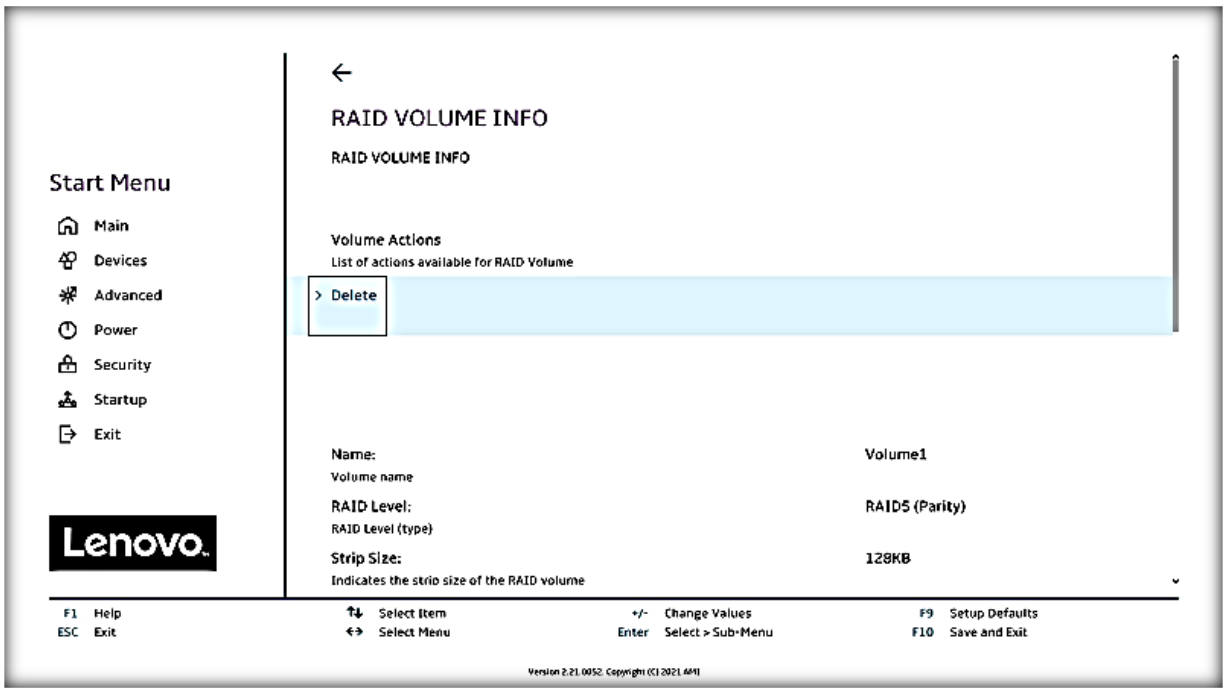
15. From the opening page of the “Intel(R) Rapid Storage Technology”, verify the volume was created properly.



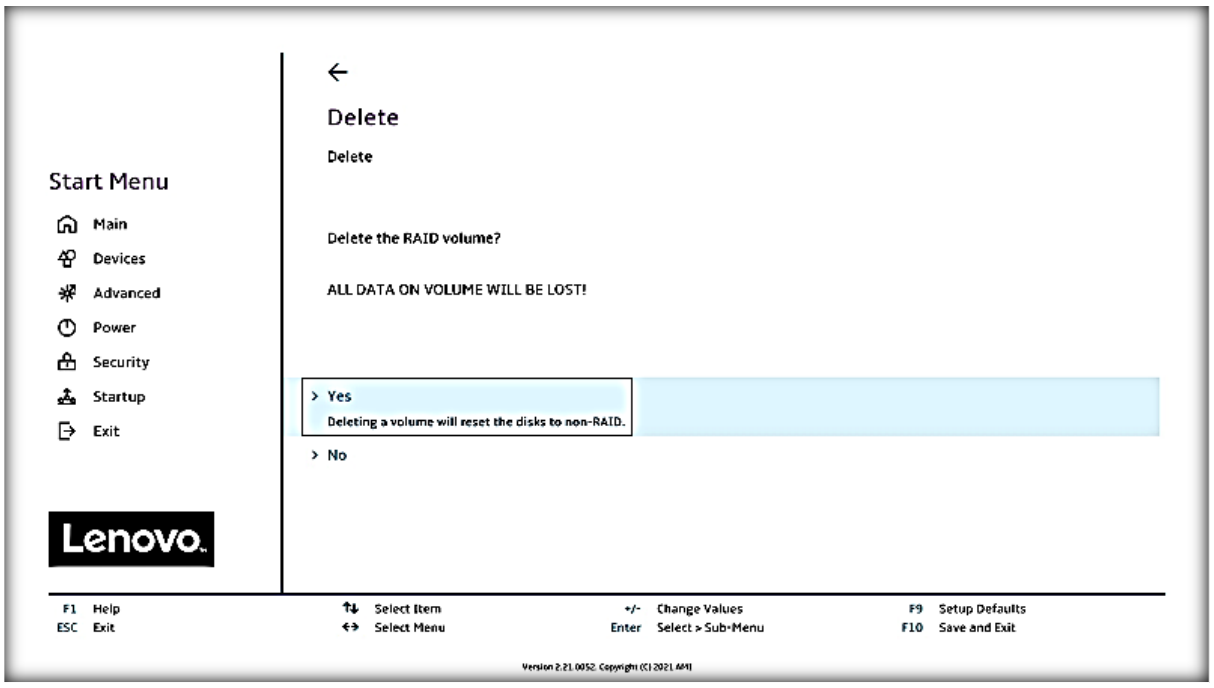
16. To delete an array, select a displayed volume to view information about it.



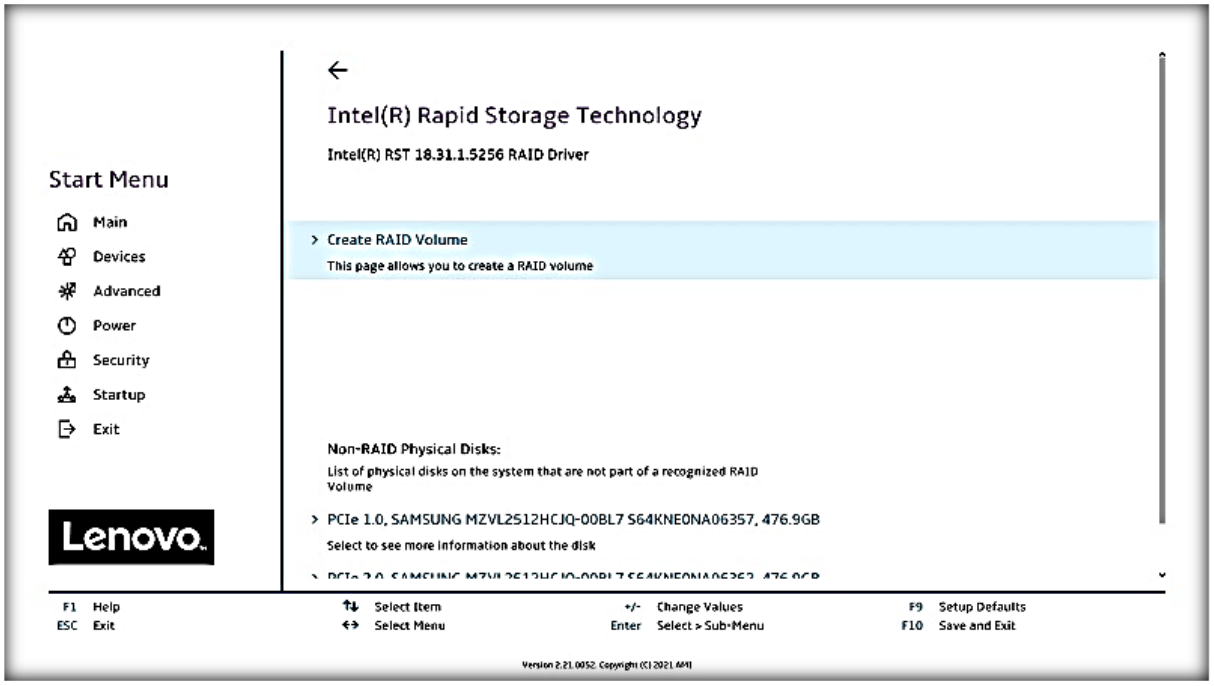
17. Select the “Delete” option.



18. Select “Yes” to confirm the deletion of the volume.



19. To verify the array was deleted, return the opening page of the “Intel(R) Rapid Storage Technology” and verify the drives are once again seen as available for the creation of a new array.



Note: The user may not see the RAID array show up in the BIOS boot sequence until after a bootable operating system has been installed on the array.

Section 4 – Appendix

- On some P350 Tower configurations, the hardware required to support the addition of certain storage components (listed below) may be not present. In order to install these components, it might be necessary to add the Slim ODD Bracket assembly, which is available via Option PN 4XF1L42848 or FRU 5M11C16639. This additional bracket will add the required supporting structure to allow these additional storage options to be installed properly.

    - Slim ODD
    - Flex bay/FASE
    - Secondary 2.5” storage bay

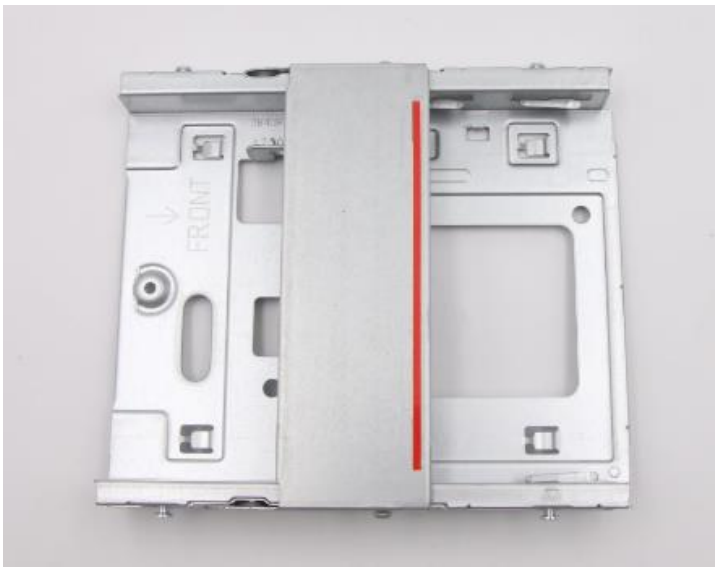
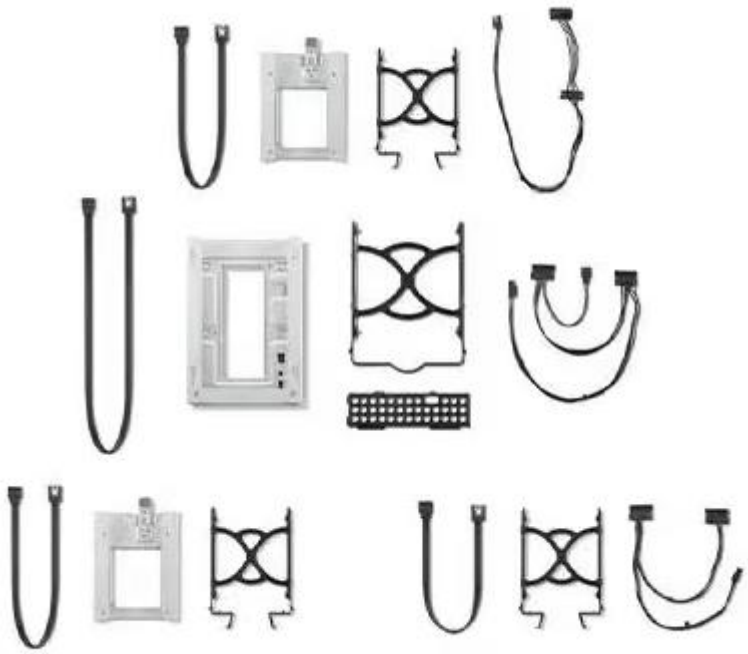


Figure 3 – Slim ODD Bracket Assembly (Tower only)

- Additional detail for the ThinkStation 3.5” FASE kit – Option PN 4XH1B85931 (Tower only)

- Additional detail for the ThinkStation Storage Kit – Option PN 4XH1B85930



- Additional detail for the 2.5”” to 3.5” Conversion Kit – Option PN 4XF0G94539

Section 5 – Document Revision History

Version	Date	Author	Updates
1.0	6/15/2021	Scott Crowe	Initial launch release
1.1	3/16/2023	A Panteleev	Added Section 4 Add more detailed information on how to install additional storage drives