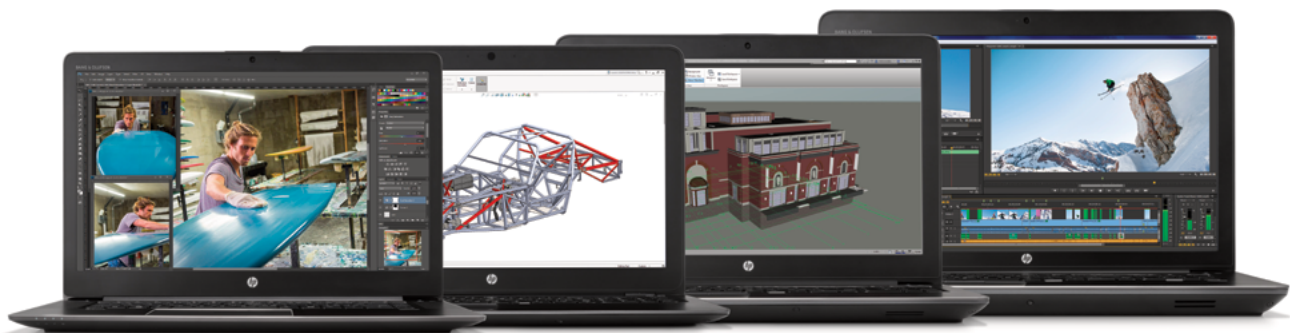


# Multiple displays on HP ZBook Mobile Workstations



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## Summary

Utilizing display outputs from both the Integrated Graphics Processing Unit (iGPU) and the Discrete Graphics Processing Unit (dGPU), the HP ZBook 15 G3 and the HP ZBook 17 G3 Mobile Workstations support up to a maximum of six independent displays, and the HP ZBook Studio G3 Mobile Workstation supports up to a maximum of 5 independent displays with the use of a docking station. The HP ZBook 15u G4 Mobile Workstation supports up to a maximum of three independent displays.

The number of independent displays supported on these four models depends on a number of factors, including whether a docking station is used, whether a DisplayPort™ hub or “daisy-chain” capable display is being used, and whether hybrid graphics is enabled.

The HP ZBook 15u supports display output from iGPU graphics only, while the HP ZBook Studio G3, HP ZBook 15 G3, and HP ZBook 17 G3 support outputs from both the iGPU and the dGPU.

By leveraging display outputs from both the iGPU and the dGPU, HP ZBooks are able to support a large number of independent displays. The usage of both Integrated iGPU and the dGPU is only available when hybrid graphics is enabled.

## HP ZBook docking solutions

### HP ZBook Dock with Thunderbolt 3

The HP ZBook Studio G3, HP ZBook 15 G3, and HP ZBook 17 G3 use the HP ZBook Dock with Thunderbolt 3 that allows users to link up to 10 devices at once through ports that include Thunderbolt™ 3 (which also supports DisplayPort™ 1.2, USB 3.1 Gen 2 and PCIe), four USB 3.0, RJ-45, VGA, combo audio, and two additional DisplayPort™ ports. The HP ZBook Dock with Thunderbolt 3 increases the maximum numbers of independent displays on the HP ZBook 15 G3 and 17 G3 to six and increases the maximum number of independent displays on the HP ZBook Studio G3 to five.

### HP UltraSlim Docking Station

The HP ZBook 15u G4 uses the HP UltraSlim Docking Station, which has three display output connectors: a VGA and two DP. When used together with the HP ZBook 15u G4, a maximum of three independent displays are supported.

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**Note:** The VGA and DisplayPort™ connector on the HP ZBook 15u G4 is disabled when using the HP UltraSlim Docking Station.

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## HP ZBooks utilizing hybrid graphics

The HP ZBook 15 G3 and HP ZBook 17 G3 support up to a maximum of six independent displays with AMD or NVIDIA® graphics when utilizing the HP ZBook Dock with Thunderbolt 3. These six displays are a combination of the internal panel, VGA, Thunderbolt™ 3 from the HP ZBook Dock with Thunderbolt 3, and ports from the Shared Bandwidth Hub on the HP ZBook Dock with Thunderbolt 3 (including the VGA, DisplayPort™ 1 and DisplayPort™ 2). See Table 1 and Figure 1 below for specific configurations.

The HP ZBook Studio G3 supports up to a maximum of five independent displays with AMD or NVIDIA® graphics when utilizing the HP ZBook Dock with Thunderbolt 3. These five displays can include a combination of the internal panel, Thunderbolt™ 3 from the HP ZBook Dock with Thunderbolt 3, and ports from the Shared Bandwidth Hub on the HP ZBook Dock with Thunderbolt 3 (including the VGA, DisplayPort™ 1 and DisplayPort™ 2). The HP ZBook Studio G3 does not have a VGA on the system. See Table 1 and Figure 1 below for specific configurations.

The HP ZBook 15u does not enable additional display outputs from the discrete graphics controller. See the “HP ZBooks utilizing iGPU” section for multiple display configurations on the HP ZBook 15u G4.

**Table 1.** Multiple displays with hybrid graphics

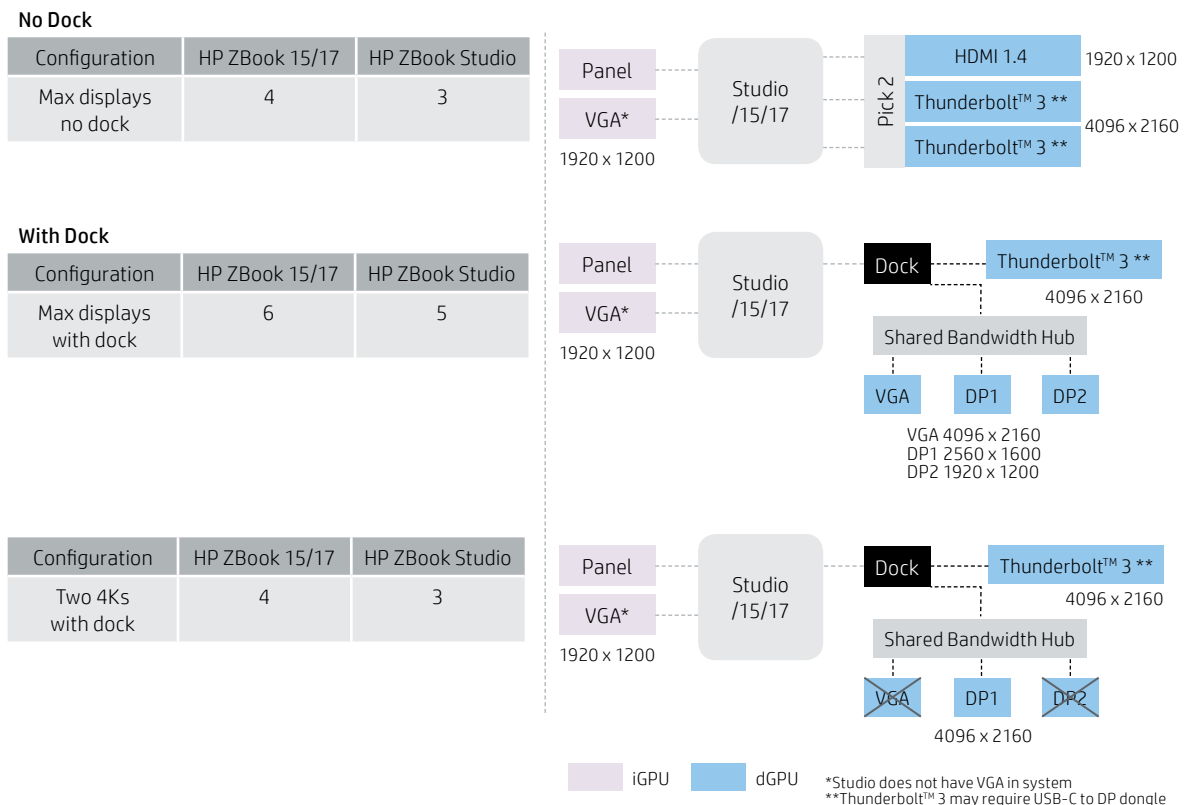
HP ZBook Studio/15/17 G3 Mobile Workstations	
Displays without HP ZBook Dock with Thunderbolt 3	Displays with HP ZBook Dock with Thunderbolt 3
Up to 2 of these are from group A and a maximum of 2 from group B, totalling no more than 3 (HP ZBook Studio) or 4 (HP ZBook 15/17) displays.	Up to 2 of these are from system and a maximum of 4 from dock (w/o 2 4K*). Up to 2 of these are from system and a maximum of 2 from dock (w/ 2 4K*).
<b>System:</b> <ul style="list-style-type: none"> <li>Group A:                             <ul style="list-style-type: none"> <li>Internal Panel (iGPU)</li> <li>VGA** (iGPU)</li> </ul> </li> <li>Group B:                             <ul style="list-style-type: none"> <li>Thunderbolt™ 3 (dGPU)</li> <li>HDMI 1.4 (dGPU)</li> </ul> </li> </ul>	<b>System:</b> <ul style="list-style-type: none"> <li>Internal Panel (iGPU)</li> <li>VGA** (iGPU)</li> </ul> <b>Docking Station:</b> <ul style="list-style-type: none"> <li>Thunderbolt™ 3 (dGPU)</li> <li>VGA* (disable for two 4Ks* with dock) (dGPU)</li> <li>DP1 (supports a 4K* display when VGA and DP2 are disabled) (dGPU)</li> <li>DP2 (disable for two 4Ks* with dock) (dGPU)</li> </ul>
* 4K content required to view 4K resolution. ** Studio does not have VGA in system.	

**Figure 1.** Multiple displays with hybrid graphics diagrams and recommended configurations

**Special note on hybrid graphics during Pre-OS environment**

With hybrid graphics on HP ZBooks, HP is using displays that may be connected to either one or both GPUs. Because the standard industry support for Pre-OS session involves only one GPU, there is a standard industry limitation where only displays connected to the integrated iGPU may be used during Pre-OS. As such, display(s) attached to the dGPU are not viewable during Pre-OS. For example, if users boot with the panel closed and an external display attached to a DisplayPort™ connector driven by the dGPU, that display cannot show any image during Pre-OS session such as during POST, when in BIOS setup, when running early diagnosis, when using Power-On Password, and so on. HP has implemented special support to resolve this limitation. On HP ZBooks with hybrid graphics, any one display whether it is connected to the integrated or discrete GPU is usable (viewable) during Pre-OS. This feature is called “Hybrid Graphics Enhanced Display” and is by default enabled in BIOS.

Recommended configurations: HP ZBook Studio/15/17 Reference Diagrams: HP ZBook Studio/15/17



## HP ZBooks utilizing iGPU

### HP ZBook 15u G4

The HP ZBook 15u G4 supports up to a maximum of three independent displays graphics when utilizing iGPU graphics with and without the use of the HP Ultralim Docking Station.

When using the HP Ultralim Docking Station, these three displays can include a combination of the internal panel, VGA and either of the DisplayPort™ ports on the dock. See Table 2 and Figure 2 below for specific configurations.

Without the use of a dock, these three displays include the internal panel, VGA and DisplayPort™. See Table 2 and Figure 2 below for specific configurations.

### HP ZBook 15 G3 and HP ZBook 17 G3

The HP ZBook 15 G3 and HP ZBook 17 G3 support up to a maximum of three independent displays when utilizing iGPU graphics with and without the use of the HP ZBook Dock with Thunderbolt 3. To support iGPU only mode, these systems must be configured without a discrete graphics controller when ordering from the factory.

When using the HP ZBook Dock with Thunderbolt 3, these three displays can include a combination of the internal panel, VGA, Thunderbolt™ 3 from the HP ZBook Dock with Thunderbolt 3, and ports from the Shared Bandwidth Hub on the HP ZBook Dock with Thunderbolt 3, including the VGA, DisplayPort™ 1 and DisplayPort™ 2. See Table 2 and Figure 2 below for specific configurations.

Without the use of a dock, these three displays can include a combination of the internal panel, VGA (15 G3 and 17 G3 only), HDMI 1.4, and the two Thunderbolt™ 3 ports on the system. The HP ZBook Studio G3 does not have a VGA on the system. See Table 2 and Figure 2 below for specific configurations.

**Table 2.** Displays supported with iGPU

HP ZBook 15u G4 Mobile Workstation		HP ZBook 15/17 G3 Mobile Workstations	
Displays without Ultralim Dock	Displays with Ultralim Dock	Displays without HP ZBook Dock with Thunderbolt 3	Displays with HP ZBook Dock with Thunderbolt 3
Up to 3 of these displays may be active:	Up to 3 of these displays may be active:	Up to 3 of these displays may be active:	Up to 3 of these displays may be active:
Internal panel	Internal panel	Up to 2 of these are from group A and a maximum of 2 from group B, totalling no more than 3 displays.	Up to 2 of these are from group A and a maximum of 2 from group B, totalling no more than 3 displays.
DisplayPort™	DP1 (dock)	<b>System:</b>	<b>System:</b>
VGA	DP2 (dock)	• Group A:	• Group A:
	VGA (dock)	– Internal Panel	– Internal Panel
		– VGA	– VGA
		• Group B:	• Group B:
		– Thunderbolt™ 3	– Thunderbolt™ 3 (dock)
		– Thunderbolt™ 3	– VGA (dock)
		– HDMI 1.4	– DP1 (dock)
			– DP2 (dock)

**Figure 2.** UMA\* graphics diagrams and recommended configurations

Recommended Configurations: HP ZBook 15u

**No Dock**

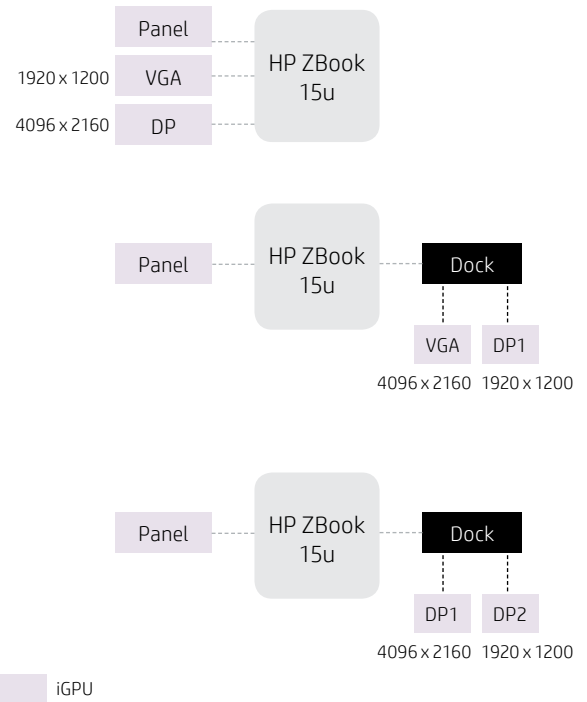
Configuration	HP ZBook 15u
Max displays no dock	3

**With Dock**

Configuration	HP ZBook 15u
Max displays with dock	3

Configuration	HP ZBook 15u
Max displays with dock	3

Reference Diagrams: HP ZBook 15u



Recommended Configurations: HP ZBook 15/17

**No Dock**

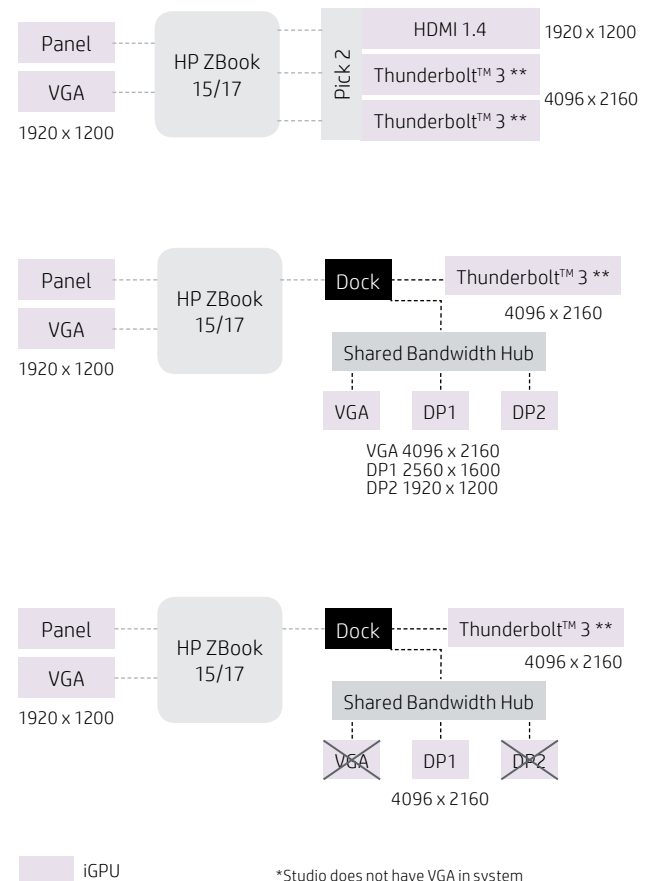
Configuration	HP ZBook 15/17
Max displays no dock	Pick any 3

**With Dock**

Configuration	HP ZBook 15/17
Max displays with dock #1	Pick any 3

Configuration	HP ZBook 15/17
Two 4Ks with dock	Pick any 3

Reference Diagrams: HP ZBook 15/17



\*Studio does not have VGA in system  
 \*\*Thunderbolt™ 3 may require USB-C to DP dongle

## HP ZBooks with dGPU graphics

### HP ZBook 15u G4

The HP ZBook 15u does not enable additional display outputs from the discrete graphics controller. See the “HP ZBooks utilizing iGPU” section for multiple display configurations on the HP ZBook 15u G4.

### HP ZBook 15 G3 and HP ZBook 17 G3

The HP ZBook 15 G3 and ZBook 17 G3 support up to a maximum of six independent displays with AMD graphics and up to a maximum of four independent displays with NVIDIA® graphics when utilizing dGPU graphics and the HP ZBook Dock with Thunderbolt 3. The HP ZBook 15 G3 and 17 G3 support up to a maximum of four independent displays with AMD and NVIDIA® graphics without the use of the HP ZBook Dock with Thunderbolt 3.

When using the HP ZBook Dock with Thunderbolt 3 and AMD graphics, these six displays can include a combination of six of the following: internal panel, VGA, Thunderbolt™ 3 from the HP ZBook Dock with Thunderbolt 3, and ports from the Shared Bandwidth Hub on the HP ZBook Dock with Thunderbolt 3, including the VGA, DisplayPort™ 1 and DisplayPort™ 2. See Table 3 and Figure 3 below for specific configurations.

When using the HP ZBook Dock with Thunderbolt 3 and NVIDIA® graphics, these four displays can include a combination of four of the following: internal panel, VGA, Thunderbolt™ 3, and ports from the Shared Bandwidth Hub on the HP ZBook Dock with Thunderbolt 3, including the VGA, DisplayPort™ 1 and DisplayPort™ 2. See Table 3 and Figure 3 below for specific configurations.

Without the use of a dock, these four displays can include a combination of the internal panel, system VGA, HDMI 1.4, and the two Thunderbolt™ 3 ports on the system. See Table 3 and Figure 3 below for specific configurations.

### HP ZBook Studio G3

The HP ZBook Studio G3 does not have a VGA on the system and therefore supports a maximum of 4 independent displays with the HP ZBook Dock with Thunderbolt 3 and a maximum of 3 independent displays without the HP ZBook Dock with Thunderbolt 3.

When using the HP ZBook Dock with Thunderbolt 3, these four displays can include a combination of four of the following: internal panel, Thunderbolt™ 3 from the HP ZBook Dock with Thunderbolt 3, and ports from the Shared Bandwidth Hub on the HP ZBook Dock with Thunderbolt 3, including the VGA, DisplayPort™ 1 and DisplayPort™ 2. See Table 3 and Figure 3 below for specific configurations.

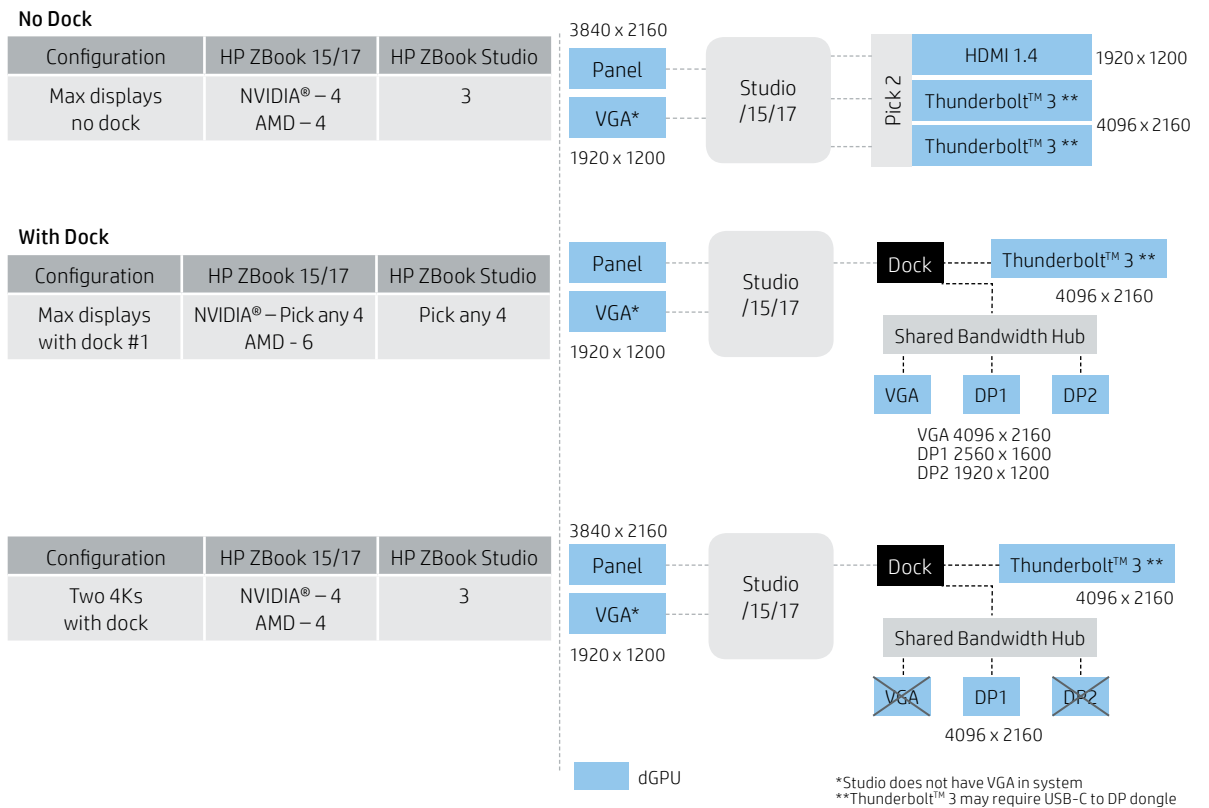
Without the use of a dock, these three displays can include a combination of the internal panel, HDMI 1.4, and the two Thunderbolt™ 3 ports on the system. See Table 3 and Figure 3 below for specific configurations.

**Table 3.** Displays supported with dGPU

HP ZBook Studio/15/17 G3 Mobile Workstations	
Displays without HP ZBook Dock with Thunderbolt 3	Displays with HP ZBook Dock with Thunderbolt 3
<p>Up to 2 of these are from group A and a maximum of 2 from group B, totalling no more than 3 displays.</p> <p><b>System:</b></p> <ul style="list-style-type: none"> <li>• Group A:                             <ul style="list-style-type: none"> <li>– Internal Panel (iGPU)</li> <li>– VGA** (iGPU)</li> </ul> </li> <li>• Group B:                             <ul style="list-style-type: none"> <li>– Thunderbolt™ 3 (dGPU)</li> <li>– HDMI 1.4 (dGPU)</li> </ul> </li> </ul>	<p>Up to 2 of these are from system and a maximum of 4 from dock (w/o 2 4K*). Up to 2 of these are from system and a maximum of 2 from dock (w/ 2 4K*).</p> <p><b>System:</b></p> <ul style="list-style-type: none"> <li>• Internal Panel (iGPU)</li> <li>• VGA** (iGPU)</li> </ul> <p><b>Docking Station:</b></p> <ul style="list-style-type: none"> <li>• Thunderbolt™ 3 (dGPU)</li> <li>• VGA** (disable for two 4Ks* with dock) (dGPU)</li> <li>• DP1 (supports a 4K* display when VGA and DP2 are disabled) (dGPU)</li> <li>• DP2 (disable for two 4Ks* with dock) (dGPU)</li> </ul>
<p>* 4K content required to view 4K resolution.                      ** Studio does not have VGA in system.</p>	

**Figure 3.** dGPU diagrams and recommended configurations

Recommended Configurations: HP ZBook Studio/15/17 Reference Diagrams: HP ZBook Studio/15/17



## HP ZBooks and DP 1.2 “daisy-chain” feature

DisplayPort™ v1.2 supports “Multi-Stream Transport,” which allows multiple video streams across a single DisplayPort™ connection. This is commonly referred to as DP 1.2 “daisy-chain” feature where multiple displays may be driven by a single DisplayPort™ connector.


The HP ZBooks, UltraSlim Docking Station, and the HP ZBook Dock with Thunderbolt 3 support the DisplayPort™ v1.2 “daisy-chain” feature. With the use of a DisplayPort™ 1.2 hub or a DisplayPort™ 1.2 display that supports Multi-Stream Transport or “daisy-chaining,” a user may connect multiple external displays to a single DP connector on a supporting docking station. A dongle is needed to connect Thunderbolt™ 3 port to a DisplayPort™ 1.2 hub or a DisplayPort™ 1.2 display for this feature.

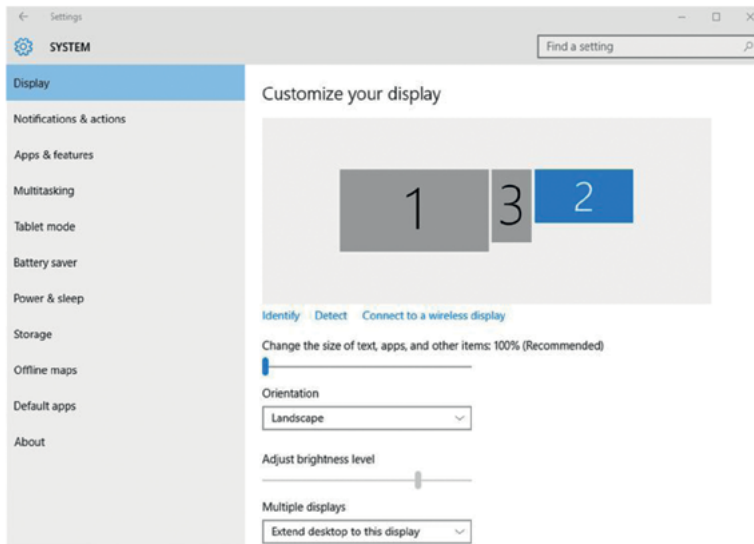
On all HP ZBooks, this capability provides for more flexibility on the type of displays and an expansion of the number of displays that may be used. For example, three DP displays may be connected with the use of a DP 1.2 hub with all three DP monitors connected to the hub, and the hub connected to a supporting docking station.

On the HP ZBook 15 G3 and HP ZBook 17 G3, the maximum number of independent displays is increased to eight with the use of DP 1.2 “daisy-chain” feature. This requires hybrid graphics to be enabled, one monitor connected to VGA, and at least one “daisy-chain” connection on (a) system DP, (b) docking station DP 1, and (c) docking station DP 2.

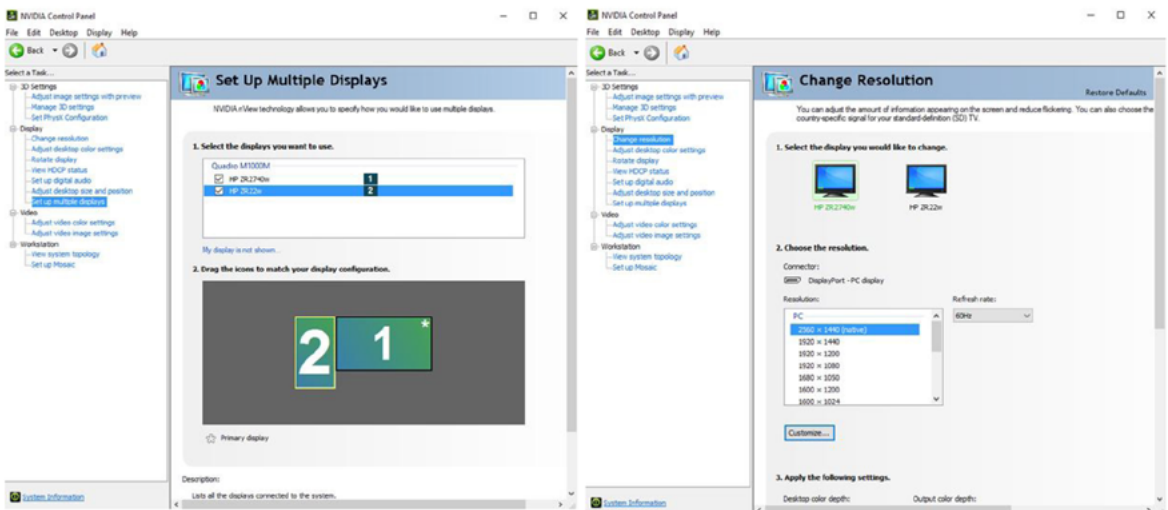
## Multiple displays management

Users may use Windows Display Manager to setup and manage multiple displays. To launch Windows Display Manager, right-click any empty area of your desktop, and then select Screen Resolution on Windows 8/8.1 or Display Settings on Windows 10 or 7.

Tip: A quick way to enable all displays connected (up to the maximum supported) in extended desktop mode is to use Windows presentation key and choose "Extend" mode. 1- Connect displays. 2- Press Windows logo key  + P. 3- Select Extend.



Users may also use NVIDIA® Control Panel to manage multiple displays and resolutions on HP ZBook G3 Mobile Workstations with NVIDIA® graphics.



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