



Technical Whitepaper

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20



Configuring Multiple Displays on HP ZBook G7, G8 and G9

Introduction

HP ZBooks support multiple independent displays as standalone systems and when docked. This paper provides detailed configuration information. When connecting multiple displays, HP recommends the use of a docking station.

Systems covered in this document include the HP ZBook G7, G8 and G9 laptops. Docks include the HP Thunderbolt G4 Dock (120W and 280W), the HP USB-C® Dock G5 (120W), and the HP Thunderbolt Dock G4 (280W) USB-C®/A Universal Dock G2 (120W).



Technical Whitepaper

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20

How to use this document

When connecting multiple displays to HP ZBooks, note the display resolution, host DisplayPort™ version, and available ports. To configure multiple displays on HP ZBooks using this document:

1. Note the resolution(s) of the displays you wish to connect.
2. See Table 1 to determine how many displays your system can host and if you need a docking station.
For connecting multiple displays without a dock, refer to the hosts QuickSpecs.
3. See Table 2 to determine if your system has DisplayPort™ 1.2, 1.3, or 1.4.
4. Use Table 3 for docking station compatibility and support for HP ZBooks.
5. Determine if your system is using 4 lane DisplayPort™ (aka DisplayPort™x4 or high resolution mode in HP F10 setup) or 2 lane DisplayPort™ (aka DisplayPort™x2 or default).
6. For the HP Thunderbolt G4 Dock, use Tables 3-7 to determine if your desired configuration is possible, and which ports to use.
7. For the HP USB-C® Dock, use Tables 8-11 to determine if your desired configuration is possible, and which ports to use.
8. Note configuration details, exceptions, and clarifications in the configuration notes sections.
9. An X in a table cell indicates that the configuration is supported. Numbers in parenthesis () are quantities.

Host system considerations

When configuring multiple displays on HP ZBooks using HP Docking Stations, host specifications will determine the maximum resolution of the attached displays.

Table 1 indicates the maximum number of displays supported on HP ZBooks with and without a docking station (not including DisplayPort™ daisy chain), and which graphics operating modes apply.

Graphics Operating Modes

- **Integrated (iGPU).** Graphics that are integrated with the processor. Also called Unified Memory Architecture (UMA) since it uses system memory instead of dedicated video memory. In HP ZBooks, it is primarily Intel® Integrated graphics.
- **Discrete (dGPU).** A separate graphics subsystem in a computer, such as a Mobile PCI Express Module (MXM) graphics, with dedicated video memory. In HP ZBooks, they are typically NVIDIA® Quadro® GPUs.
- **Hybrid.** The system uses iGPU for most tasks to conserve battery life, and switches to dGPU when higher performance is required. In a hybrid configuration, some displays are driven by iGPU while others are driven by dGPU.

Table 1: Maximum Displays Supported by HP ZBooks (no DisplayPort™ daisy-chain)

Host	Number of displays no dock	Number of displays with dock
G9		
HP ZBook Studio 16" G9	Up to 4 iGPU	Up to 4 iGPU
		Up to 5 docked to TBT4
		4 from iGPU +1 from NVIDIA®
		Up to 6 docked to Multi-Function
HP ZBook Fury 16 G9	Up to 5	Up to 5
	(4 from dGPU + 1 from iGPU)	(4 from dGPU + 1 from iGPU)
	Up to 4	Up to 4
	(3 from dGPU + 1 from iGPU)	(3 from dGPU + 1 from iGPU)
	Up to 4 dGPU (NVIDIA®)	Up to 4 dGPU (NVIDIA®)
	Up to 5 dGPU (AMD)	Up to 5 dGPU (AMD)
HP ZBook Power G9⁵	Up to 3 iGPU	Up to 4 iGPU
HP ZBook Firefly G9⁵	Up to 4 iGPU	Up to 4 iGPU



Technical Whitepaper

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C* Dock G5 (120W)	13-15
HP USB-C/A* Universal Dock G2 (120W)	16-18
Glossary	19-20

Host System	Thunderbolt™ / USB Type-C®	Additional Ports	#of external displays with resolution
HP ZBook Studio 16" G9	(2) Thunderbolt™ 4 with USB4™ Type-C® 40 Gbps signaling rate (USB Power Delivery, DisplayPort™ 1.4)		(3) *8K @30 Hz
	(1) SuperSpeed USB Type-C® 10 Gbps signaling rate (USB Power Delivery, DisplayPort™ 1.4)		
HP ZBook Fury 16 G9	(2) Thunderbolt™ 4 with USB4™ Type-C® 40 Gbps signaling rate (USB Power Delivery, DisplayPort™ 1.4)	(1) Mini DisplayPort™ 1.4	(4)* 8K @30 Hz
		(1) HDMI 2.1	
HP ZBook Power G9	(1) Thunderbolt™ 4 with USB4™ Type-C® 40 Gbps signaling rate (USB Power Delivery, DisplayPort™ 1.4)	(1) HDMI 2.0b	(1)* 8K @30 Hz + (1) 4K @60 Hz
HP ZBook Firefly G9	(2) Thunderbolt™ 4 with USB4™ Type-C® 40 Gbps signaling rate (USB Power Delivery, DisplayPort™ 1.4)	(1) HDMI 2.0b	(2) 8K @30 Hz + (1) 4K @60 Hz

¹ Mini DisplayPort™ 1.4 with dGPU; mini DisplayPort™ 1.2 with iGPU.

² HDMI 2.0b with dGPU; HDMI 1.4 with iGPU.

³ BC 1.2 (Battery Charging) provides higher amperage for charging.

External display resolutions when connected directly to a ZBook.

- For DP1.4 DSC, the resolution up to 8K @60 Hz*
- For DP1.3/DP1.4, the resolution up to 8K @30 Hz*
- For DP1.2, the resolution up to 4K @60 Hz*
- For HDMI 2.1, the resolution up to 8K @30 Hz*
- For HDMI 2.0, the resolution up to 4K @60 Hz*
- For HDMI 1.4b, the resolution up to 4K @30 Hz*

* Resolutions cannot be summed up. Max resolution of each display will be adjusted automatically when connecting multiple display on the host.

Table 3: HP ZBook port summary - DP1.4 DSC for dGPU only.

	iGPU		dGPU			
	Intel®		NVIDIA®		AMD	
	USB-Type C*	Additional ports	USB-Type C*	Additional ports	USB-Type C*	Additional ports
ZBook Firefly G7	DP 1.2	HDMI 1.4b	NA	NA	NA	NA
ZBook Power G7	DP 1.2	HDMI 2.0	NA	NA	NA	NA
ZBook Studio G7	DP 1.2	HDMI 2.0	DP 1.4 DSC	HDMI 2.0	NA	NA
ZBook Create G7	DP 1.2	HDMI 2.0	DP 1.4 DSC	mDP 1.4 DSC	NA	NA
ZBook Fury G7	DP 1.2	HDMI 2.0b mDP 1.4	DP 1.4 DSC	HDMI 2.1 mDP 1.4 DSC	DP 1.4 DSC	HDMI 2.1 mDP 1.4 DSC
ZBook Firefly G8	DP 1.4	HDMI 2.0	NA	NA	NA	NA
ZBook Power G8	DP 1.4	HDMI 2.0	NA	NA	NA	NA
ZBook Studio G8	DP 1.4	HDMI 2.0b mDP 1.4	NA	HDMI 2.1 mDP 1.4 DSC	NA	NA
ZBook Fury G8	DP 1.4	HDMI 2.0b mDP 1.4	DP 1.4 DSC	HDMI 2.1 mDP 1.4 DSC	DP 1.4 DSC	HDMI 2.1 mDP 1.4 DSC
ZBook Firefly G9	DP 1.4	HDMI 2.0b	NA	NA	NA	NA
ZBook Power G9	DP 1.4	HDMI 2.0b	NA	NA	NA	NA
ZBook Studio G9	DP 1.4	NA	DP 1.4 DSC	NA	NA	NA
ZBook Fury G9	DP 1.4	HDMI 2.0b mDP 1.4	DP 1.4 DSC	HDMI 2.1 mDP 1.4 DSC	NA	NA

DP1.4 * Intel TGL worldwide silicon issues cannot be fixed so that DSC is disabled on docking (MST mode), but it's still supported with direct output (SST mode).



Docking Station Considerations

HP offers Thunderbolt™ docks and USB Type-C® docks. Table 4 summarizes supported docks by system, along with power and charging notes. HP Docking Stations recommended for HP ZBooks include the HP Thunderbolt G4 Dock (120W and 280W), the HP USB-C® Dock G5 (120W), and the HP USB C®/A Universal Dock G2 (120W). Check compatibility on <https://pcb.inc.hp.com/> and search by notebook.



Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20

Consider power requirements when choosing a dock. For example, the HP Thunderbolt 120W G4 Dock fully functions on HP ZBooks, but some models require additional power for charging. In that case, order the HP Thunderbolt 280W G4 Dock. The combo cable connects the dock to the host system's Thunderbolt™ 4 or USB-C® port and uses a separate barrel connector to provide power.

Due to space limitations, the tables in this document use the following abbreviations:

FPC. Full Performance Charging.

CWW. Charging with warning . The HP ZBook will charge with this warning message: "HP Notifications - Smart AC adapter power output is too low for this computer." or "HP Notifications - For full performance, connect a higher capacity power adapter."

MF. Multi-function mode.

DSC. Display Stream Compression.

Docking Station SKUs

- HP Thunderbolt 120W G4 Dock (4JOA2AA)
- HP Thunderbolt 280W G4 Dock with Combo Cables (4JOG4AA)
- HP USB-C® Dock G5 (5TW10AA)
- HP USB-C®/ A Universal Dock G2 (5TW13AA)

Table 4: HP ZBook G7/G8/G9 Docking station compatibility and support matrix

Host	HP Thunderbolt 120W G4 Dock		HP Thunderbolt 280W G4 Dock		HP USB-C® Dock G5 (120W)		HP USB-C®/A Universal Dock G2 (120W)	
	FPC	CWW	FPC	CWW	FPC	CWW	FPC	CWW
HP ZBook Studio G8		X	X			X		X
HP ZBook Fury 15 G8		X	X			X		X
HP ZBook Fury 17 G8		X	X			X		X
HP ZBook Power G8		X	X			X		X
HP ZBook Firefly 15 G8	X		X		X		X	
HP ZBook Firefly 15 G8	X		X		X		X	
HP ZBook Firefly 14 G7 HP ZBook Firefly 15 G7	X		X		X		X	
HP ZBook Power G7		X	X			X		X
HP ZBook Studio G7 HP ZBook Create G7		X	X			X		X
HP ZBook Fury 15 G7 HP ZBook Fury 17 G7		X	X			X		X
ZBook Firefly G9	X		X		X		X	
ZBook Power G9		X	X			X		X
ZBook Studio G9		X	X			X		X
ZBook Fury G9		X	X			X		X



HP USB-C® Dock G5 (120W)

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20



Back view

Ports HP USB-C® Dock G5

The HP USB-C® Dock G5 120W ports include:

- (1) HDMI 2.0 port
- (2) DisplayPort™ 1.4 ports

Configuration notes: HP USB-C® Dock G5

1. For USB-C® functionality, host PC must support the DisplayPort™ Alt mode protocol through its USB-C® port. Thunderbolt™-enabled notebooks will function at USB-C® speeds.

The number of displays supported and their resolution depend on the host.

Table 9: Video resolution for USB-C® Dock G5

Number of Displays	Configuration	Output Ports
(1) One	(1) 2.5K	Any
	(1) 4K	Any
	(1) 5k single cable	Either DisplayPort™
	(1) 5k dual cable	Both DisplayPort™
	(1) 8k dual cable	Both DisplayPort™
	(1) 8k single cable	Any 2
(2) Two	(2) FHD	Any 2
	(2) 2.5K	Any 2
	(1) 4K and (1) FHD	Any 2
	(2) 4K	Any 2



Technical Whitepaper

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C* Dock G5 (120W)	13-15
HP USB-C/A* Universal Dock G2 (120W)	16-18
Glossary	19-20

Table 10: Single Display HP USB-C* Dock G5

Single Display Configuration	MST Ports DisplayPort™ 1, DisplayPort™ 2, HDMI	DisplayPort™ high-resolution host			DisplayPort™ host multi-function		
		DisplayPort™ Version					
		1.2	1.3/ 1.4	1.4 DSC	1.2 MF	1.3/ 1.4 MF	1.4 MF DSC
(1) FHD	Any Port	X	X	X	X	X	X
(1) 2.5K	Any Port	X	X	X	X	X	X
(1) 3K	Any Port	X	X	X	X	X	X
(1) 4K UHD/DCI @30 Hz	Any Port	X	X	X	X	X	X
(1) 4K UHD/DCI	Any Port	X	X	X	-	-	X
(1) 5K single cable @30 Hz	Any Port	X	X	X	-	X	X
(1) 5K single cable	Any Port	-	X	X	-	-	X
(1) 5K dual cable	Two DisplayPort™ Ports	-	X	X	-	-	X
(1) 5K Thunderbolt™ (multiple tiles)	Not supported	N/A	N/A	N/A	N/A	N/A	N/A
(1) 6K single cable @30 Hz	Any Port	X	X	X	-	-	X
(1) 6K single cable	Any Port	-	-	X	-	-	X
(1) 6K Thunderbolt™ (multiple tiles)	Not supported	N/A	N/A	N/A	N/A	N/A	N/A
(1) 8K single cable @30 Hz	Any Port	-	X	X	-	-	X
(1) 8K single cable	Any Port	-	-	X	-	-	-
(1) 8K dual cable	Two DP Ports	-	-	X	-	-	-
(1) 8K Thunderbolt™ (multiple tiles) @30 Hz	Not supported	N/A	N/A	N/A	N/A	N/A	N/A
(1) 8K Thunderbolt™ (multiple tiles)	Not supported	N/A	N/A	N/A	N/A	N/A	N/A

Table 11: Dual Displays HP USB-C* Dock G5

Dual Display Configuration	MST Ports DisplayPort™ 1, DisplayPort™ 2, HDMI	DisplayPort™ high-resolution host			DisplayPort™ host multi-function		
		DisplayPort™ Version					
		1.2	1.3/ 1.4	1.4 DSC	1.2 MF	1.3/ 1.4 MF	1.4 MF DSC
(2) FHD	Any 2 Ports	X	X	X	X	X	X
(2) 2.5K @30 Hz	Any 2 Ports	X	X	X	X	X	X
(2) 2.5K	Any 2 Ports	X	X	X	-	X	X
(1) 4K DCI @30 Hz + (1) FHD @30 Hz	Any 2 Ports	X	X	X	X	X	X
(1) 4K DCI + (1) FHD	Any 2 Ports	X	X	X	-	-	X
(1) 4K DCI @30 Hz + (1) 2.5K @30 Hz	Any 2 Ports	X	X	X	-	X	X
(1) 4K DCI + (1) 2.5K	Any 2 Ports	-	X	X	-	-	X
(2) 4K UHD @30 Hz	Any 2 Ports	X	X	X	-	X	X
(2) 4K UHD	Any 2 Ports	-	X	X	-	-	X
(2) 4K DCI @30 Hz	Any 2 Ports	X	X	X	-	-	X
(2) 4K DCI	Any 2 Ports	-	-	X	-	-	X
(2) 5K single cable @30 Hz	Any 2 Ports	-	X	X	-	-	X
(2) 5K single cable	Any 2 Ports	-	-	X	-	-	-
(1) 5K dual cable + (1) 2.5K	Both DisplayPort™ Ports for 5K + 2.5K on HDMI	-	-	X	-	-	X
(1) 5K dual cable + (1) 4K	Both DisplayPort™ Ports for 5K + 4K on HDMI	-	-	X	-	-	X
(2) 8K single cable @30 Hz	Any 2 Ports	-	-	X	-	-	-
(2) 8K single cable	Any 2 Ports	-	-	X	-	-	-



Technical Whitepaper

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20

Table 12: Triple Displays HP USB-C® Dock G5

Triple Display Configuration	MST Ports DisplayPort™ 1, DisplayPort™ 2, HDMI	DisplayPort™ high-resolution host			DisplayPort™ host multi-function		
		DisplayPort™ Version					
		1.2	1.3/ 1.4	1.4 DSC	1.2 MF	1.3/ 1.4 MF	1.4 MF DSC
(3) FHD @30 Hz	All 3 Ports	X	X	X	X	X	X
(3) FHD	All 3 Ports	X	X	X	-	X	X
(3) 2.5K @30 Hz	All 3 Ports	X	X	X	-	X	X
(3) 2.5K	All 3 Ports	-	X	X	-	-	X
(3) 4K UHD @30 Hz	All 3 Ports	-	X	X	-	-	X
(3) 4K UHD	All 3 Ports	-	-	X	-	-	X
(3) 4K DCI @30 Hz	All 3 Ports	-	X	X	-	-	X
(3) 4K DCI	All 3 Ports	-	-	X	-	-	X
(3) 5K single cable @30 Hz	All 3 Ports	-	-	X	-	-	-
(3) 5K single cable	Not supported	N/A	N/A	N/A	N/A	N/A	N/A
(3) 8K @30 Hz	Not supported	N/A	N/A	N/A	N/A	N/A	N/A
(3) 8K	Not supported	N/A	N/A	N/A	N/A	N/A	N/A
(2) 5K single cable @30 Hz + (1) FHD @30 Hz	All 3 Ports	-	X	X	-	-	X
(2) 5K single cable + (1) FHD	5K on DPs + FHD on HDMI	-	-	X	-	-	-
(2) 5K single cable @30 Hz + (1) 2.5K @30 Hz	All 3 Ports	-	X	X	-	-	X
(2) 5K single cable + (1) 2.5K	5K on DPs + 2.5K on HDMI	-	-	X	-	-	-
(2) 5K single cable @30 Hz + (1) 4K UHD @30 Hz	All 3 Ports	-	-	X	-	-	X
(2) 5K single cable + (1) 4K UHD	5K on DPs + 4K on HDMI	-	-	X	-	-	-

Configuration notes: HP USB-C® Dock G5

¹ For USB-C® functionality, host PC must support the DisplayPort™ Alt mode protocol through its USB-C® port. Thunderbolt™-enabled notebooks will function at USB-C® speeds.

² HDMI is limited to 4K @60 Hz DSC.

³ DSC is disabled when display is attached to the VGA port or to an external DisplayPort™-to-VGA dongle.

⁴ DisplayPort™ Multi-stream (MST) mode is not supported on the DisplayPort™ and Type-C® DisplayPort™ Ports.

⁵ Unless noted, resolution is driven at 8bpp, 60Hz.

⁶ Chart shows capability of dock. Actual support depends on host. For example, some host cannot support 8K. Some host support 3 simultaneous displays while others support 4 or more. Some hosts use 2 internal pipes to support a single display (such as an 8K display).

⁷ The maximum number of supported displays is reduced by one (1) when using an 8K external display.

⁸ On displays with the dual DisplayPort™ cable, both cables must be attached to the docks DisplayPort™ ports.



Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20

Glossary

Combo Cable

HP Thunderbolt 280W G4 Dock with Combo Cables connects the dock to the host system's Thunderbolt™ 4 or USB-C® port and uses a separate barrel connector to provide power over A/C passthrough up to 230W.

Display Stream Compression (DSC)

DSC is a VESA standard that enables visually lossless image compression to increase the amount of data carried by a display interface data rate, saving power. It reduces the video interface data rate, which reduces system power, prolongs battery life, and reduces interconnects, enabling sleeker designs.

DisplayPort™ Daisy Chain

Connecting a series of devices together using a single connection between each two devices. Daisy chainable displays have both a DisplayPort™ input and a DisplayPort™ output. The DisplayPort™ output connects to the next downstream display.

DisplayPort™ High Resolution

Refers to four (4) lane DisplayPort™.

DisplayPort™ Multi-function

Refers to two (2) lane DisplayPort™, aka Default mode.

Graphics Processing Units (GPUs)

- Integrated (iGPU). Graphics that is integrated with the processor. Also called Unified Memory Architecture (UMA) since it uses system memory instead of dedicated video memory. In HP ZBooks, it is primarily Intel® Integrated graphics.
- Discrete (dGPU). A separate graphics subsystem in a computer, such as a Mobile PCI Express Module (MXM) graphics, with dedicated video memory. In HP ZBooks, they are typically NVIDIA® Quadro® GPUs.
- Hybrid. The system uses iGPU for most tasks to conserve battery life, and switches to dGPU when higher performance is required. In a hybrid configuration, some displays are driven by iGPU while others are driven by dGPU.

Multi Stream Transport (MST) Hub

MST hubs are devices that take one (1) DisplayPort™ or mini DisplayPort™ video connection, and go to many video connections, usually extra DisplayPort™, mini DisplayPort™, DVI or HDMI connections. This is accomplished through DisplayPort™ MST, or Multi-Stream Transport function.

Resolution Definitions

- FHD = 1920 x1200 or 1920 x 1080
- 2.5K = 2560 x 1600 or 2560 x 1440
- 3K = 3440x1440
- 4K UHD = 3840 x 2160
- 4K DCI = 4096 x 2160
- 5K = 5120 x 2880
- 6K = 6016x3384 (Apple XDR)
- 8K = 7680 x 4320



Technical Whitepaper

Contents & navigation

Introduction	1
How to use this document	2
Host System Considerations	2-5
Docking Station Considerations	6
HP Thunderbolt Dock G4 (120W/280W)	7-12
HP USB-C® Dock G5 (120W)	13-15
HP USB-C/A® Universal Dock G2 (120W)	16-18
Glossary	19-20

Thunderbolt™ 4

Thunderbolt™ 4 defines a superset of capabilities that runs on USB-C® connectors and cables. This enables docks and displays to connect to a Thunderbolt™ 3 port with a USB-C® connector.

Thunderbolt™ Cables

There are active, passive, and full-featured versions of Thunderbolt™ 4 cables on the market. A full-featured Thunderbolt™ 4 cable supports USB 3.1, DisplayPort™ 1.2, and Thunderbolt™. Use HP cables to avoid issues with improperly marked cables.

USB-C®

USB-C® is a specification for connectors and cables.

USB-C® High Resolution (a.k.a. Alt mode and USB-C® Video)

USB-C® High Resolutions requires the host PC to support the DisplayPort™ Alt mode protocol through its USB-C® port. Thunderbolt™-enabled notebooks will function at USB-C® speeds. Charging and port replication is supported on notebooks that have implemented USB-C® industry specifications. Alt mode includes support for DisplayPort™, Thunderbolt™ 4, and HDMI—all from the same USB-C® connector.