Technical white paper

Three-display support with the HP Compaq Elite 8300 Ultra-slim Desktop PC

2nd Edition

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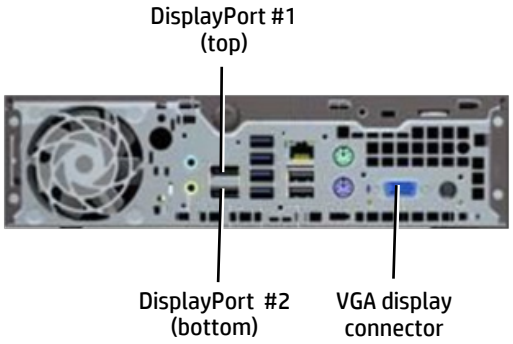
Introduction

The HP Compaq Elite 8300 Ultra-slim Desktop PC provides connections for up to three displays with two digital DisplayPort connectors and one analog VGA display connector on the system's rear I/O panel (Figure 1). This document provides details regarding the capabilities and limitations for supporting three displays.

Figure 1: Rear view of the HP Compaq Elite 8300 Ultra-slim Desktop PC in desktop orientation.



The HP Compaq Elite 8300 Ultra-slim Desktop features Intel HD graphics as part of its standard feature set. For increased graphics performance, a discrete Mobile PCI Express Module (MXM) graphics solution can be added. The presence or absence of the discrete MXM graphics solution effects how three displays are supported.

Support for three displays without MXM graphics

In general, three displays are supported if the two displays driven by the DisplayPort outputs are connected using either a DisplayPort-to-DisplayPort cable or an HP DisplayPort-to-VGA adapter. The third display is driven by the system's analog VGA port.

Enabling three displays

The Intel hardware and drivers allocate internal resources in the order in which displays are activated. Any display that can support a resolution higher than 1920x1200@60Hz should be enabled first with the resolution to 1920x1200@60Hz or lower before enabling lower-resolution displays.

Limitations with three displays

While Intel's 3rd generation Core processors and supporting chipsets provide support for three displays, the following limitations do apply.

Processor limitations

With no MXM graphics installed, three-display operation is only supported when using 3rd generation Intel Core processors. Other processor models, including Intel's 2nd generation Core processors and all Pentium and Celeron branded parts, will drive only two displays, although any two of the three connections can be used with either processor family.Three displays are supported when MXM graphics is installed in a system using any processor family.

Operating system limitations

Support for three displays is not possible with systems running the Microsoft Windows XP operating system due to limitations inherent in the operating system. Windows XP only allows for the support of two displays from one graphics controller.

Other limitations

Using an HP DisplayPort-to-dual link DVID adapter is not recommended in a three-display configuration. The DisplayPort connector controlling the adapter will have limited bandwidth, restricting the adapter to supporting modes of 1920x1200@60Hz and lower. DVI-capable displays of 1920x1200@60Hz and lower resolutions do not require dual-link DVI support. Most high-resolution displays requiring dual-link DVI do not support many resolutions lower than their native high resolution. Configuring three such displays using a DisplayPort-to-dual link DVID adapter would result in a potentially unacceptable experience.

DisplayPort adapters like HP's DisplayPort-to-VGA adapter are active adapters and communicate to the system using DisplayPort protocol. DisplayPort adapters like HP's DisplayPort-to-DVI and DisplayPort to HDMI adapters are passive adapters and communicate to the system using TMDS protocol. The system has limitations depending on which type of adapter is used.

If one or two displays are connected to the system with an HP DisplayPort-to-DVID adapter, HP DisplayPort-to-HDMI adapter, or any other similar passive DisplayPort adapter, the system will be limited to supporting only two active displays. If three displays are connected, you can use either the Intel Graphics Control panel or the operating system's display controls to select which two displays are to be active. Once two of three connected displays are enabled, one display will need to be disabled before another can be enabled.

In a three-display configuration, both Display Ports must use DisplayPort protocol and operate at the same link rate. Support for three displays is limited to configurations with a display connected to the system's VGA connector via a VGA-to-VGA cable plus one or more DisplayPort-capable displays connected with DisplayPort-to-DisplayPort cables or one or more VGA-capable displays connected with a HP DisplayPort-to-VGA adapter. In these configurations, each attached display will be limited to a maximum of 1920x1200@60Hz resolution due to the processor's internal hardware resources being shared by all three display outputs. All 3 displays can be enabled by using either the Intel Graphics Control panel or the operating system's display controls. See Table 1 for a summary of 3-display configurations.

NOTE:

It is possible to have a three-display configuration consisting of one DisplayPort display capable of higher than 1920x1200@60Hz support (like 2560x1600 or 2560x1440), one 1920x1200@60Hz DisplayPort display and a VGA monitor with up to 1920x1200@60Hz support. Both DisplayPort monitors must be connected with DisplayPort-to-DisplayPort cables and operating at the same display port link rate. For this configuration, the 1920x1200@60Hz display must support the 2.7Gbits/sec DisplayPort link rate that the higher resolution display will require. With some exceptions, HP DisplayPort monitors with 1920x1200 and lower resolution do not support the higher 2.7Gbits/sec link rate since the lower 1.62Gbits/sec link rate suffices for this resolution.

If a system is configured with a display connected to the system's VGA connector using a VGA-to-VGA cable plus one or more DisplayPort-capable displays connected with DisplayPort-to-DisplayPort cables, we recommend that both DisplayPort monitors be the same type/model to ensure that they operate at the same link rate.

Table 1: Summary of 3-display configurations without MXM graphics installed

DisplayPort #1 (top)	DisplayPort #2 (bottom)	VGA port	Result
DP	DP	VGA	All outputs active [1]
DP	DP-VGA	VGA	All outputs active [1]
DP	DP-DVI/HDMI	VGA	Only two displays can be active [2]
DP-VGA	DP	VGA	All outputs active [1]
DP-VGA	DP-VGA	VGA	All outputs active [1]
DP-VGA	DP-DVI/HDMI	VGA	Only two displays can be active [2]
DP-DVI/HDMI	DP	VGA	Only two displays can be active [2]
DP-DVI/HDMI	DP-VGA	VGA	Only two displays can be active [2]
DP-DVI/HDMI	DP-DVI/HDMI	VGA	Only two displays can be active [2]

NOTES:

DP: Directly connected Display Port monitor
DP-VGA: VGA monitor connected with DP to VGA or other active DisplayPort adapter
DP-DVI/HDMI: DVI-D or HDMI monitor attached using a DP-to-DVI-D, DP-to-HDMI, or other passive DisplayPort adapter
VGA: Directly connected VGA monitor
[1] All three displays are limited to a maximum resolution of 1920 x 1200.
[2] Intel Graphics Control panel or the operating system's display controls must be used to select the two active displays.

Support for three displays with MXM graphics installed

When the optional discrete MXM graphics solution is installed, the bottom DisplayPort connector and the VGA connector are controlled by the discrete MXM graphics solution. Any combination of three displays is supported and will work within the limits of the display interfaces or adapters used. Drivers for both the discrete MXM graphics solution and the Intel HD graphics must be installed.

With three displays attached, the operating system controls can be used to enable and control some features of each display. Advanced features can be controlled using either the Intel HD graphics control panel or the control panel provided by the discrete MXM graphics solution. The Intel control panel will only control the display connected to the top DisplayPort connector while the discrete MXM graphics solution's control panel will control the displays connected to the bottom DisplayPort connector or the VGA output.

NOTE:
The top DisplayPort connector (Figure 1) is always controlled by the Intel HD graphics supplied by the processor. With MXM graphics installed, the Intel HD graphics can be disabled by using the BIOS menu controls, although doing so will disable the top DisplayPort connector and limit operation to two displays.

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