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Video Adapters

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In this video from ITFreeTraining, I will look at the different kinds of video adapters that are available. A video adapter will allow a connector to be changed from one type of connector to another or, to think of it another way, allow you to put a round peg into a square hole.

VGA

- VGA uses analog
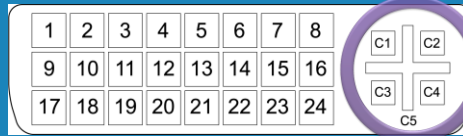
DVI Connector

Analog pins for VGA

To start with, I will look at the VGA connector. VGA uses an analog signal, so unless the signal is changed with a convertor you will need a device that supports analog. The DVI connector has analog pins to support VGA. For this reason, the signal does not need to be converted.

If you consider these two adapters, one converts DVI to VGA and the other VGA to DVI. Essentially, to do this, the correct pins on one side need to be connected to the correct pins on the other side.

In some cases, the DVI plug will not have the analog pins. If this is the case, an active adapter is required in order to convert the digital signal to an analog signal.

In a previous video, I covered the differences between a passive and an active adapter. An active adapter has more electronics in the adapter to convert and recreate a signal. Since, in this case, we are only remapping pins on connectors, we don't need an active adapter. However, if you start having signal loss, you may want to consider an active adapter.

VGA to HDMI/DisplayPort

- HDMI and DisplayPort do not support analog

HDMI/Digital only

VGA/Analog only
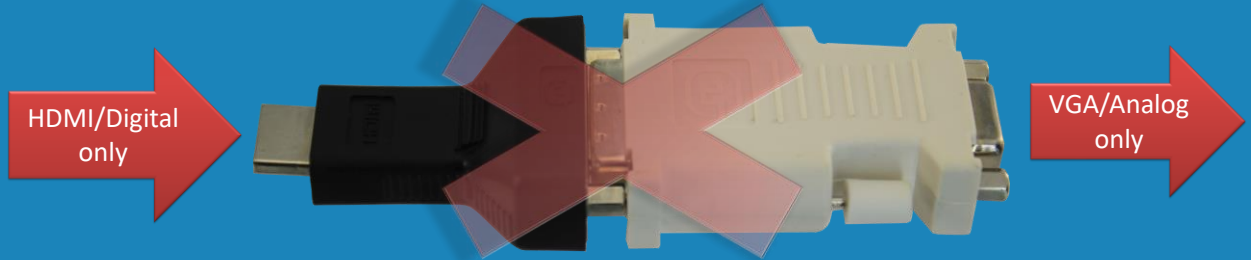
Won't work unless signal is converted

VGA is old technology and you won't come across it too often. You may come across a case where you have an old VGA device that you need to connect to HDMI or DisplayPort. HDMI and DisplayPort do not support analog. For this reason, you won't be able to connect passive adapters together like this. This won't work unless the signal is converted from analog to digital.

It only takes one adapter or device to convert the signal. The problem is the video card under certain circumstances will only be able to output a digital signal where an analog signal is required at the other end. Passive adapters can't convert digital signals to analog and thus an adapter is required that has the ability to convert the signal.

When you use multiple adapters together, it is unlikely   that the video card or any another device will be able to output a signal that will work after being modified multiple times before it gets to the destination. Even if the signal is digital, converting from HDMI and DisplayPort requires signaling and a voltage change. Unless your adapter is designed to specifically to perform a complete signal conversion, the signal will get stopped before it gets to the destination. Passive adapters won't be able to do this and not all active adapters will be able to do this.

Keep this in mind when buying cables. If the cable is a passive cable with different connectors on each end, unless there is a device in the chain that converts the signal, it may not work. Cable connections like DVI to VGA should work since the analog signal is carried on separate wires. However, HDMI to VGA don't expect that to work as a signal conversion is required.

Only one device needs to convert the signal to digital to analog. So as long as the signal is converted somewhere, you can use those special cables that wouldn't normally work. However, if you combine multiple cables and adapters of different types together don't expect it to work. I have in many cases used a HDMI to DisplayPort cable and it won't work with certain devices, so don't expect old standards like VGA to work either.

To make it simple, if you plan to use VGA it should work if you just use the one basic adapter. If however you combine multiple adapters together it most likely won't work. The newer connection use digital and thus more likely to cause problems and VGA is analog.

DVI to HDMI

- HDMI and DVI use similar electrical signaling
  - Identical for some lower resolutions
- Features like audio/HDCP not supported

I will next look at changing DVI to HDMI or vice versa. HDMI and DVI use similar signaling but there are some differences. For compatibility reasons, you will find the lower resolutions use the same signaling. This means that passive adapters or cables will work without the need for the signal to be converted at lower resolutions. If you are using higher resolutions, you may run into problems. In some cases, the device may convert the signal for you, but you cannot guarantee this will occur.

HDMI supports more features than DVI, and you will find that if you convert the signal, some features will be lost, for example audio and HDCP. Keep this in mind if you decide to use one of these adapters.

DisplayPort to DVI/HDMI

- Uses different signaling (Voltage also different)
- Dual mode supports DVI/HDMI
    - Most devices support dual mode
    - DVI single mode only
    - In older HDMI adapters resolution may be lower

The next connection I will look at is DisplayPort. DisplayPort uses very different signaling compared to HDMI and DVI. Also, the voltage used is different. DisplayPort uses 3.3 volts while HDMI and DVI use 5 volts. For this reason, an active adapter or passive adapter with a small amount of electronics is required. Simple re-wiring will not work because the voltage also needs to be changed.

The signal must also be changed to either HDMI or DVI. To do this, the device needs to support dual mode. This is not to be confused with Dual mode in DVI which means it supports two data streams. Dual mode in this case means it supports multiple display signals using the same connector. The good news is that most devices on the market support dual mode. A device that supports dual mode will essentially detect that either DVI or HDMI is on the other side and will change the signal. However, the adapter is still required to up the voltage.

Due to DisplayPort having fewer pins than DVI, dual mode only supports DVI in single mode. This will limit the display to a maximum resolution of 2560 by 1600 at 60Hz. If you are using HDMI, the resolution may be limited depending on how old your adapter is. Since the signal needs to go through an active adapter, the older adapters were required to re-transmit less data. This is because higher resolutions were not in use when the adapter was first created. Newer adapters should not have this problem and will be able to transmit higher resolutions. If you are planning to buy an adapter, check the specification of the adapter to see what the maximum resolution that it supports is.

Splitter Cables

- Divides a video signal into two

Power from USB cable

Passive cable
Effectively divides signal in half

Active cable
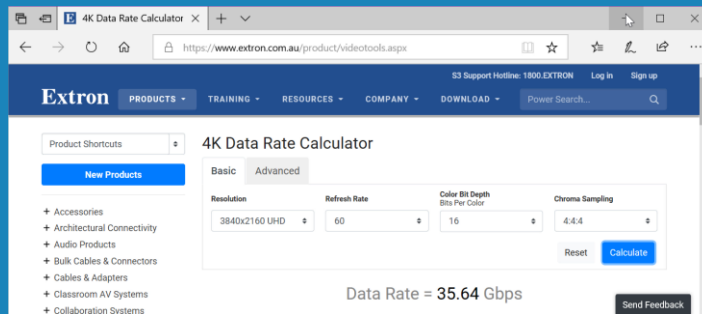Recreates or boosts signal
May require additional power

The next adapter that you may come across is a splitter cable. A splitter cable essentially divides a video signal into two. The simple video splitters are the passive cables. Using a cable like this essentially divides the signal in half. This reduces the signal and for this reason you generally need to keep the cable length shorter and higher resolutions may not work.

You can also use an active splitter. An active splitter either recreates a signal or boosts it. This allows for longer cable lengths and higher resolutions. To do this, some active splitters require additional power. In some cases, the power may be obtained through the cable itself, in other cases as in this example, power may be obtained from another source such as a USB cable.

Different active splitters will support different resolutions. You may also find that if you purchase a cheaper splitter, it may say it supports certain resolutions but may be unreliable at higher resolutions. At the end of the day, you get what you pay for. If you are planning on spending more on an active splitter, it is worth having a look for some reviews for the splitter to see how reliable it is before you buy it.

Cable Length and Quality

- Shorter cables more reliable
- Cables rated by transfer speed or max resolution
- 4K Data Rate Calculator
  - https://www.extron.com.au/product/videotools.aspx

The last point that I will look at in this video is cable length and quality. When you start using adapters or splitter cables this becomes important. Each time you use an adapter or split a signal, you are effectively reducing the signal strength and thus reducing its reliability.

Generally speaking, shorter cables are more reliable. The quality of the cable can make a difference, but if all things are equal, shorter is better. When buying a cable, it will often be rated by transfer speed or max resolution. A lot of cables you will see on the market will have the 4k logo on them. This means they will support 4k resolution and anything below it, but it is a good idea to also look at what hertz rate they support.

If you are given a transfer rate, you can use an online calculator to work out what speed the cable will need to be rated at to support the resolution that you want to use. In this case, I will use this online calculator to work out what speed cable I need. The options you select will determine what cable you will need. In this case I will use 60 for the refresh rate, 16 for the color bit depth and the highest chroma sampling rate.

You could choose lower options, but I like to select the higher options and that way I know, regardless of which options I choose, the resolution will be supported.

In this example I need a cable that supports 36 Gigabits per second. Generally speaking, I would look at purchasing a cable that is a bit higher than that, say around 40 Gigabits per second. This way I have some extra bandwidth, for example, for audio or reliability problems.

It is always better to get a faster cable than a slower one, but ultimately your budget will determine which cable you purchase.

Well, that is it for this video. I hope you found this video useful and I hope to see you in other videos from us. Until the next video, I would like to thank you for watching.

References
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"Digital Visual Interface" https://en.wikipedia.org/wiki/Digital_Visual_Interface
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"DisplayPort" https://en.wikipedia.org/wiki/DisplayPort

Credits
Trainer: Austin Mason http://ITFreeTraining.com
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