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The Importance of USB Isochronous (ISO) Transport

» An overview about ISO transport and the challenges with USB extension and distribution

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EXTREME USB®

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What is Isochronous (ISO) Transport?

USB is becoming more and more popular as a connectivity solution to provide high quality and reliable solutions for conference rooms, control rooms, post-production facilities, industrial, and medical applications. Unlike some other audio/video interfaces like HDMI, USB requires bi-directional communication and has bounded latency, even for streaming video and audio.

USB further differentiates the method of communication within the USB data stream for different applications, known as transaction types. The four types of communication or transactions are described in the table below.

Type	Description
Control	Used for configuration, status messaging, and setup of devices
Interrupt (INT)	Typically used for non-periodic small device communication with guaranteed delivery ideal for: • Touch controls • Keyboard and mouse • System notifications from sensors
Bulk	Typically used for large amounts of burst data such as file transfer and data storage devices (i.e. flash drives, hard drives or disc drives)
ISO	Typically used in cameras and video devices for continuous periodic time sensitive information with guaranteed bandwidth ideal for video streams

ISO is also special and unique from all other types of USB communication because:

- Data is NOT retriable/guaranteed — data loss may occur but is acceptable
- Latency is bounded — data must be received within a very restrict time limit
- Does not require acknowledgement of receipt of data
- Traffic is guaranteed a certain percentage of all USB bandwidth — other devices connect to the USB will not decrease the performance of an ISO device

The features in ISO specifically allow for USB communication with real time data like audio and video to be seamless and function without significant delay to be comparable in quality to other traditional AV interfaces.

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Challenges with Extension and Distribution

The fact that ISO requires bi-directional communication with bounded latency is especially problematic in the realm of USB extension, where extended distances and conversion to different mediums like network LAN can delay communication and increase the likelihood of disruption for sent and receipt of data.

The impact of the failure to compensate for these difficulties is described in the table below:

Failure	Impact
Delay is not compensated for by the extender appliance	• Data will be ignored or dropped by the host because it does not arrive on time causing frame drops and audio distortion • The device may fail completely if delays are too long
Data integrity is not maintained by the extender appliance	• The data is too corrupted to decipher by the USB host then video frames will be dropped, and audio will have noticeable distortion • The device may also disconnect from the host if data is too unreliable

There are further complications with USB 3 to be considered, because unlike USB 2.0, USB 3 ISO requires acknowledgement of data periodically. This means it is even more difficult to maintain a reliable and low latency connection at a distance since now there is bounded latency in *both* directions.

Bandwidth Considerations

Since ISO devices are guaranteed bandwidth on the USB, they are less prone to quality degradation when other USB devices are active compared to BULK transport.

For example, in the case where two cameras are compared, both operating at 4K30 and a significant source of USB bandwidth is added to the system like a DisplayLink or file transfer device then:

• The BULK USB camera will have a decrease in performance such as lost frames or overall lower frames per second

• The ISO USB camera will remain relatively unaffected.

What does this all mean?

Since documentation does not always clearly state which devices and applications use ISO USB transaction, it is important to pre-test configurations or choose solutions that specify USB Isochronous support.

As part of Icron's qualification process for initial and subsequent firmware releases of products, ISO USB transaction support is strenuously tested in accordance with not only USB compliant guidelines, but also in real world scenarios.

Icron provides support for all Ranger® 23xx models, 53xx KVMs, Spectra™ USB 3 extenders and USB 3-2-1 Raven™ 3104 Pro. Follow the links below to learn more about these solutions.

USB Extenders:
http://www.icron.com/products/icron-brand/usb-extenders/

USB and Video (KVM) Extenders:
http://www.icron.com/products/icron-brand/kvm-extenders/

USB 3-2-1 Raven 3104 Pro:
http://www.icron.com/products/icron-brand/usb-extenders/cat5/icron-usb-3-2-1-raven-3104-pro/

About Icron

Icron is a Maxim Integrated brand, as well as the leading developer and manufacturer of high-performance USB and video extension solutions for commercial and industrial markets worldwide. Icron's patented extension technology extends USB and video devices over many media types including CAT 5e/6/7, fiber, wireless, DisplayPort® and over a corporate LAN while featuring the ExtremeUSB® and ExtremeUSB-C™ suite of features such as transparent USB extension, true plug-and-play (no software drivers required) and compatibility with Windows®, macOS™, Linux® and Chrome OS™ operating systems. Icron's video and USB extension products are deployed in a wide range of applications including proAV, industrial automation, machine vision, medical imaging, aerospace, interactive whiteboards, digital signage, remote desktop extension, security, enterprise computing and isolated USB, or anywhere a computer needs to be remotely located from a display or peripheral device. Learn more at www.icron.com and www.maximintegrated.com.

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