TECHNICAL NOTE:

ADVANTAGES OF COAXPRESS

A comparison of CoaXPress with other vision standards

Overview

CoaXPress is an established high-speed vision interface solution ideal for many applications. It has been an international machine vision standard since 2011 with the key aim to support the fastest cameras on the market. Compared to other vision standards, CoaXPress offers a number of advantages.

In this paper we compare CoaXPress with other video interface standards used in machine vision and related areas and present the advantages of CoaXPress in detail.

	CoaXPress	Camera Link	USB3 Vision	10 GigE Vision	Camera Link HS
Single link speed	12.5 Gbps [CXP-12]	6.8 Gbps [80-bit]	5 Gbps	10 Gbps	3.125 Gbps
Max speed	N x 12.5 Gbps e.g. 4x = 50 Gbps	6.8 Gbps	5 Gbps [no link aggregation]	20 Gbps [2 cables; rarely more possible]	21.825 Gbps [CX4 cable]
Bandwidth	5000 Mbytes/s [4xCXP-12]	1000 Mbytes/s [80-bit]	500 Mbytes/s [Superspeed]	1000 Mbytes/s [10GigE]	5000 Mbytes/s
Reliability at high data rates	High [supports constant high data throughput]	High	Medium to low [sustainable rate lower than max speed, also less predictable]	Medium to low [sustainable rate lower than max speed, also less predictable]	High
Cabling	Coax	Camera Link cable	Standard passive or active cable	CAT-5e / CAT-6a / CAT-7	CX4 cables
Max cable length	>100m at CXP-3 speed, 40m at CXP-12 speed	4-10m	5m std cable; 16m active cable	100m for copper cable; longer with fiber	15m; longer with fiber
Cable cost	Medium	Medium / High	Low	Medium	Medium
Data Integrity	CRC	none	CRC / Resend	CRC / Resend	CRC / Resend
Real-time trigger	Yes	Yes	No	No	Yes
Power over cable	13W per cable	8W	4.5W	13W/25W with copper cables	No

Overall benefits of CoaXPress

- **Speed:** high-speed data rates; up to 8 x 12.5 Gbps = 100 Gbps.
- **Speed support:** as a dedicated vision standard, CoaXPress is designed to continuously support high speeds 24/7.
- **Sensor support:** supports the latest image sensors.
- **Cable:** cost-effective standard coax cable (high-flex options available).
- **Cable lengths:** long cables possible, 40m at 12.5 Gbps, >100m at 3.125 Gbps.
- **Uplink:** up to 42 Mbps uplink channel for camera control, triggering and firmware updates.
- **Triggering:** precise triggering capability; virtually no latency.
- **Data integrity:** built-in.
- **Multiple cameras:** excellent support.
- **Power over CoaXPress:** 13W per cable.
- **GenICam:** full GenICam support including GenTL for “plug-and-play” experience.
- **Ease of integration:** image data, communication, control and power over a single coax cable.
- **Development:** the standard is hosted by JIIA and maintained by worldwide companies under the G3 agreement, which ensures future support and backward compatibility.

CoaXPress versus other vision standards

CoaXPress compared with Camera Link

Disadvantages of Camera Link in comparison with CoaXPress:

- **Speed:** 6.8 Gbps (80-bit).
- **Sensor support:** too slow for the latest image sensors.
- **Cable:** Camera Link cables are bulky and expensive.
- **Cable lengths:** very short compared to CXP: 4-7m at 85 MHz.
- **Data integrity:** not built in; data corruption not detected.
- **Power over Camera Link:** lower with 8W and not supported by all cameras and frame grabbers.

CoaXPress compared with 10 GigE Vision

Disadvantages of 10 GigE in comparison with CoaXPress:

- **Speed:** 10 Gbps per link, max. 20 Gbps with 2 links.
- **Sensor support:** not fast enough for the latest image sensors.
- **Power consumption:** High.
- **Triggering:** no real-time triggering.
- **Cable:** Cat-6/Cat-7 cables used in 10 GigE have lower performance in maximum speed, attenuation, flexibility and reliability, compared to coaxial cables.
- **CPU usage:** Relies on CPU and internal PC memory bus.
- **Processing & buffering:** No offloading possible unless additional hardware added. In CoaXPress, this is handled by the frame grabber.
- **Interface card:** network card still necessary, for higher speeds a frame grabber (then no advantage over CoaXPress).
- **PC with 10 GigE:** almost only computers used in server applications like 10 GigE PHY's and MAC's come with 10 GigE connections as standard.

CoaXPress compared with USB3 Vision

Disadvantages of USB3 in comparison with CoaXPress:

- **Speed:** considerably lower speed (5 Gbps) and lower bandwidth.
- **Sensor support:** too slow for the latest image sensors.
- **Data integrity:** a problem with higher speeds.
- **Power over USB3:** low with 4.5W.
- **Cable length:** limited to 3m-5m.
- **Multiple cameras:** problematic.
- **Processing & buffering:** No offloading possible unless additional hardware added.
- **Applications:** Only useful for low end applications.

CoaXPress compared with Camera Link HS

Disadvantages of Camera Link HS in comparison with CoaXPress:

- **Costs:** higher than CoaXPress.
- **Complexity of system:** perceived as complex.
- **Power over Camera Link HS:** not possible.
- **Providers:** effectively only provided by Teledyne DALSA.

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