



Why Use Frame Grabbers for Imaging Applications?

Reaching maximum throughput is one of the crucial criteria in industrial and factory automation. Increasing sensor resolutions and framerates help reaching the goal, but bring bandwidth to their limits and offer new transfer questions. The current implementation of high bandwidth interfaces like 10GigE, direct camera to PC connections and embedded systems prompts many users of imaging applications to inquire both about optimally connecting their cameras in the best possible configuration. Using frame grabbers in industrial environments brings specific benefits for high-speed applications in terms of speed, data security and synchronized processing for multiple cameras.

THE PURPOSE OF FRAME GRABBERS

It is important to know the functionality and purpose of a frame grabber to better understand if this device is right for a specific imaging system and application. Essentially, the frame grabber enables the high-speed image acquisition of high resolution images with special synchronization features in real-time.

It manages the image data load from the camera to the memory of the PC by utilizing the capabilities of the PCI bus. The Direct Memory Access (DMA) controller in the frame grabber avoids overloading the CPU with image transfer operations by moving the image data to the PC's RAM memory directly or vice versa. Frame grabbers completely handle all tasks required to move this data to and from the memory, freeing the CPU to do other tasks. They are also able to do all image processing and any additional manipulation of the image data onboard. The frame grabber accepts fast trigger sources and/or encoder inputs to seamlessly synchronize with the movement of objects in the image captures. They allow for many different acquisition processes and to manage the deceleration of image processing in the background of application processes. The frame grabber can transmit a general signal "image ready" to the Signal Processing System (SPS) or other connected devices to leverage this type of automation when used for example, as an output manager.



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THE BENEFITS OF FRAME GRABBERS

Major benefits using a frame grabber help to achieve the optimum results for a vision system to take advantage from maximum speed and throughput.

- Delegation of all acquisition and I/O synchronization to a single device
- Managing all external devices including their triggering and synchronization
- Very high data rates of up to 25 GB/s
- All-in-one approach provides many advanced imaging functions
- Preprocessing and image preparation done by the frame grabber (like debayering or color correction)
- CPU stays free for other tasks
- Dual triggering enables signal synchronization for line scan applications for precise synchronization without any physical triggering
- Very low latencies of less than 1µs possible

These frame grabber features provide very easy solutions to both manage and synchronize imaging systems in real time with multiple cameras while managing many trigger modalities, all at the same time. More advanced CoaxPress models, like the Euresys CoaxLink Quad 3D-LLE with its onboard IP, perform 3D laser line extraction and triangulation which allow them to execute precise coordination of laser lines during measurement tasks.

THE ONGOING IMPORTANCE OF FRAME GRABBERS

Even today, frame grabbers enable applications to reach maximum speeds and resolutions for the connected cameras with CoaxLink models being the fastest way to connect the camera to a PC and enable very high resolutions with no transmission latency. High bandwidth solutions with a direct connection commonly used in 10GigE based applications, for example, are much slower and completely rely on network cards. Using a frame grabber removes the risk of losing data. Onboard buffers can temporarily store image data so that the frame grabber can reconstruct or mirror the images prior to transferring them to the host PC. The transfer of the images directly to RAM memory are immediately available for CPU or GPU tasks. More importantly, this ancillary device synchronizes all interfaces, devices, and parameters correctly for multiple cameras and systems based on position and timing parameters while performing image preprocessing onboard thus reducing the CPU load, allowing it to perform other tasks.



WHY USE FRAME GRABBERS FOR IMAGING APPLICATIONS?

FOUR CRITERIA FOR CHOOSING THE RIGHT FRAME GRABBER

To individual specifications of each frame grabber will be key to choosing the right one for an application to achieve an outstanding imaging performance and system integration. There are four application criteria to consider when looking at the specifications of a frame grabber.

1. **Camera Type** The frame grabber will depend on the camera type and the following options:
 - a. **Speed of camera sensor** What is the speed of the sensor, is it an area or line scan sensor?
 - b. **Chromaticity** Color images are bigger and therefore need more bandwidth capacities
 - c. **Environment** The image acquisition environment for which it will be used is important
2. **Camera's supported interface** The supported interface of the camera will determine the options for frame grabbers as there are various models for all kinds of interfaces and connection types.
3. **Number of cameras** How many cameras will be connected within the imaging system? When multiple cameras need to be supported and synchronized or if there is a planned upgrade of a currently installed system, it is best to obtain a frame grabber.
4. **Software** The frame grabber must be compatible with the software environment of the application.

All the necessary information to make the best decision for a frame grabber for a given application including its supported features are available within the manufacturer's data sheets for each device.

TYPICAL FRAME GRABBER APPLICATIONS

Frame grabbers are most often used to bring maximum image transfer rates to high-speed applications. Industrial inspections, broadcasting and sports benefits from the low-latency synchronization of (multiple) cameras to achieve best image analysis from different angles and perspectives. Production quality inspection on high-speed conveyer line is most common example of where frame grabbers excel. They can synchronize the image captures with the incoming triggers while preprocessing the images to determine the pass/fail criteria of a product and signal the rejection circuitry with a significant CPU unload. This allows the CPU to be available for faster processing of other tasks.

WHY TO CONSIDER A FRAME GRABBER FOR YOUR APPLICATION

When you need high-speed image acquisition of high resolution images with special synchronization features in real-time, the frame grabber will be a good fit. The frame grabber provides unique functionalities to an imaging system. It allows application engineers and system integrators to build an imaging system with advanced acquisition processing while creating a very reliable and consistent image acquisition pipeline with no risk of data loss. Frame grabbers are convenient and the most reliable way to connect a camera to a PC, especially for high resolution applications needing high speed data transfer and triggering functionalities.



For further questions please contact our FRAMOS team at experts@framos.com, the right expert will get back to you!