Baumer
Passion for Sensors

Application Note

10 GigE Cameras with Baumer GAPI SDK

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Description
From version 2.9.0 the Baumer GAPI SDK also supports cameras with a 10 GigE interface according IEEE802.3an. This application note explains how to configure a system for 10GigE and describes Baumer tested PC systems for the use of 10 GigE cameras in combination with the Baumer GAPI SDK.

Products
Baumer VQXT

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1 Recommended PC Systems

The Baumer GAPI SDK is tested with two concurrent 10 GigE camera streams at full bandwidth utilizing the Baumer Filter Driver. The captured images are displayed using the Camera Explorer. Besides that, no other processes, such as third party software, Antivirus Software or any user interaction, are running on the PC.

Notice
On Windows systems it is strongly recommended to use the supplied Baumer Filter Driver to achieve optimal performance.

1.1 Hardware

Baumer considers the hardware that is used for these tests to be the minimum recommended configuration:

CPU	Intel® Core™ i7-7820X (8 Cores, 3,6 GHz)
RAM	2 x 16 GB RAM (Dual-Channel)
NIC	Intel(R) Ethernet Converged Network Adapter X550-T2

The test described in paragraph 1 causes a load of around 15% on the above-mentioned PC system.

In view of the fact that in addition to image acquisition and display, image processing processes have to be carried out during application use, it might be necessary to specify a significantly more powerful system.

1.2 Operating System

Baumer recommends the 64bit operating systems Windows 7 (SP1) and Windows 10 (V1607) including the latest patches as well as all modern Linux variants (e. g. Ubuntu 16.4, Debian 9.3, Fedora 27).

1.3 System Configuration Advice

The image capturing process can be influenced by a large number of parameters, such as parallel running processes. The following parameters and settings should therefore be checked if corrupted images occur:

Parameter		Recommended action
Windows OS / Firewall		deactivate if necessary
Windows OS / Defender Antivirus		deactivate if necessary
Windows OS / Power Profile		set to high performance
Network Settings / Paket Size		set to maximum
Network Settings / Jumbo Frames		set to maximum
Network Settings / Receive Buffer Count		set to maximum
Baumer GAPI / *bsysgige.xml*	Streaming via socket driver	set StreamSocketSize to 256 MB
	Streaming via filter driver	set FilterDriverBufferCount to 50.000
	MaxResendsPerPacket	set to 10
	ResendRetryTreshold	set to 1300

1.4 Camera Explorer Image and Package Statistics View

The Camera Explorer provides statistics information in the info view. You can use this view to check the stability of the image stream.

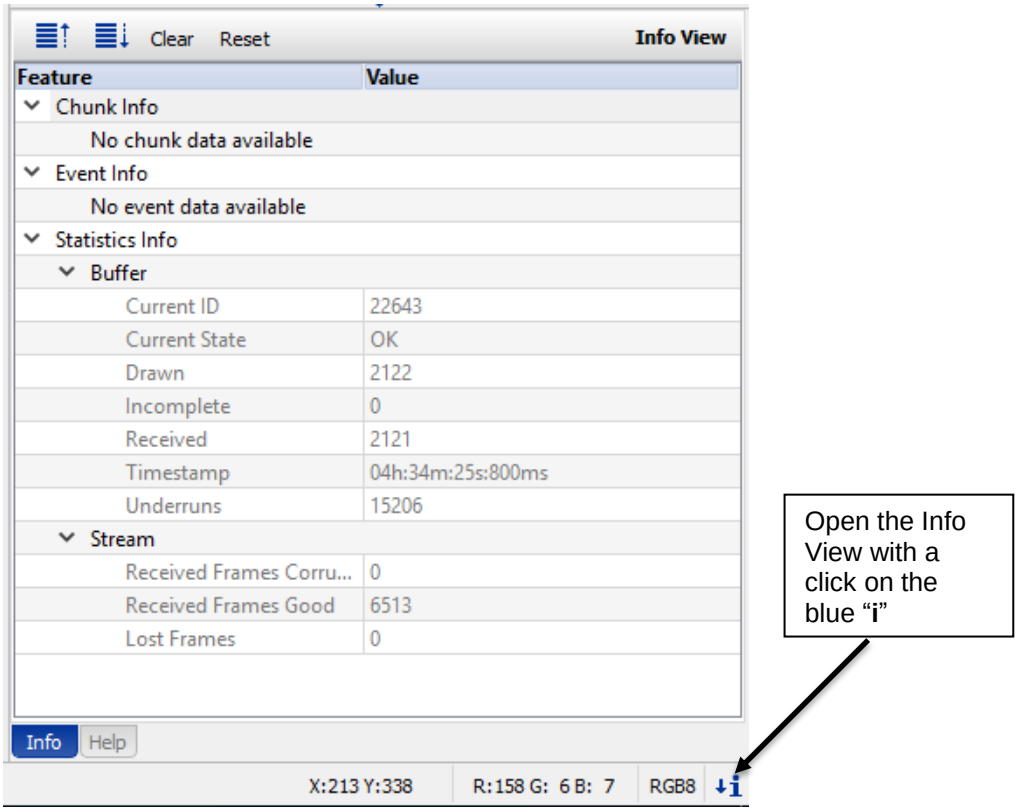

Figure 1: Camera Explorer Network Statistics Info View

1.5 Resend Algorithm – Network Advice

10 GigE allows for a theoretic maximum bandwidth of 10 Gbit/s. The GigE Vision Standard utilizes the UDP protocol which allows the use of 100 % of the available network bandwidth and does not reserve space for necessary packet resend.

The Baumer GAPI does handle the resend of packages where and when necessary but will need some available bandwidth to do so. Especially in larger network configurations where packet-loss is more of an issue, it is advisable to configure your system and cameras to utilize no more than 90% of the maximum bandwidth to ensure there is always room for necessary packet resends.

Bandwidth issues usually show through corrupted images. Several camera configuration options can reduce the necessary bandwidth.

- Reduce the frame-rate (fps) (e.g. AcquisitionFrameRate, AcquisitionFrameRateEnable)
- Reduce the frame size (e.g. reduce ROI, Binning etc.)
- Choose a smaller pixel format e.g. Mono8 instead of Mono12 to achieve higher frame-rates at similar bandwidth

It is also a good idea to set a packet delay (GevSCPD) to introduce small gaps between packages (see figure 2). This will spread the data of one image out and can help the system to process the data as it arrives at a slower but steady rate.

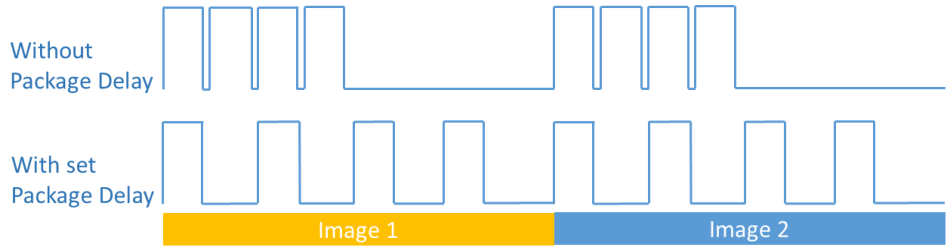

Figure 2: Flow of packages with and without a set package delay (GevSCPD)

Notice

Calculation example, package delay

A 10GigE Network provides a bandwidth of 10 Gbit/s which equals 10bit/ns. If the package size is set to 9000 Byte (72000 bit) one package will need around 7200 ns to be sent.

To introduce a 10% gap between each package GevSCPD would therefore be set to 720 ns

Attention: Different Camera might use different Units for the GevSCPD parameter, please refer to the Technical Data Sheet for more information.

1.6 Resend Algorithm – Configuration

The Baumer resend algorithm is responsible to re-transfer packets which were not transferred correctly. Quite often packages are dropped if the system is temporarily unable to process packages at the required speed during a spike in processing activity. There are a few parameters to configure the algorithm, the ideal values depend on the overall system and its performance. All parameters can be configured in the bsysgige.xml file.

ResendRetryThreshold – As there might be a queue of packages waiting to be processed by the system a requested resend-package will be queued at the end and cannot be confirmed as arrived immediately. The ResendRetryThreshold parameter sets the number of packages the system should wait until it is requested again or finally given up on. As a rule of thumb this parameter should be around the same amount of packages as would be required to send one image. The maximum latency until a package is marked as lost will be ResendRetryThreshold * MaxResendsPerPacket * transfer time of one frame

Notice

Calculation example

A 12 MPixel 8bit mono image would be roughly 12 Mbyte. With Jumbo frames set to 9000 Byte it will be sent as 1334 Frames so the ResendRetryThreshold should be set to this value. If you use a smaller ROI the value should be adjusted accordingly.

MaxResendsPerPacket – This parameter specifies how often a package can be requested for resend before giving up. A high value increases the chance to recover a package but will lead to a high system load as lost packages might be requested over and over again. For the Baumer test-system a value of 10 delivers a stable image stream.

In case the system does produce incomplete images the ResendRetryThreshold can be raised by 100 at a time until no more incomplete images are received. If that doesn't help the MaxResendsPerPacket should be raised by 1 at a time to see if a stable transfer can be reached.

1.7 Further Configuration and Optimization

Below we have collected some measurements to be taken in order to increase system performance and stability.

Windows

- Check the Task Manager for running processes, try to disable or stop any unnecessary process. Even if a process is idle at the moment it might produce bursts of activity at some event or scheduled time and thereby reduce the performance of the system
- Check the Task manager for running services, again try to disable or stop anything unnecessary
- Especially Anti-Virus software or Indexing systems can reduce the overall performance of a windows system

General Network Optimization

- Please refer to the Baumer Application Note for general GigE configuration suggestions: **AN201622_Baumer_Application_Note_GigE-Adapter-Settings_v01_EN.pdf**
- Check if the 10GigE adapter is on the Baumer compliance list (others might work but are not tested for possible issues)
- Install the most recent Baumer Filter Driver if not done already
- Check the 10GigE network adapter if the Baumer Filter Driver is selected
- Check the 10GigE network adapter and remove any other Protocols or Services not needed

2 Related Topics

Baumer Application Note for general GigE configuration suggestions:
AN201622_Baumer_Application_Note_GigE-Adapter-Settings_v01_EN.pdf

3 Support

In the case of any questions or for troubleshooting please contact our support team.

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4 Legal information

Baumer Group

The Baumer Group is one of the worldwide leading manufacturers of sensors, encoders, measuring instruments and components for automated image processing. Baumer combines innovative technologies and customer-oriented service into intelligent solutions for factory and process automation and offers an unrivalled wide technology and product portfolio. With around 2,600 employees and 38 subsidiaries in 19 countries, the family-owned group of companies is always close to the customer. Baumer provides clients in most diverse industries with vital benefits and measurable added value by worldwide consistent high quality standards and outstanding innovative potential. Learn more at www.baumer.com on the internet.

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