Getting started with allPIXA evo: 10 GigE hardware components

Content

1. Introduction: 10 GigE for high speed data transfer

The 10 GigE Vision Standard provides a reliable and future-proof standard protocol for high speed cameras. It allows for data rates 10 times higher than the well-known GigE Vision standard.

1.1. Advantages of 10 GigE

Reliable

10 GigE has been used in data centres for many years and is therefore a mature technology. Network adapters and drivers are available to ensure fast data transfer. Components are off the shelf available and can be changed, if necessary, without long lead times.

Long cables

Optical cables can directly be used with the SFP+ output. Depending on the optical transceiver and cable quality, fibre optical cables with 400 m and longer are possible. In addition, direct attach copper cables are available for short distances up to 30 m.

System cost

The resulting system cost by using standard components are lower than by using special and dedicated hardware components.

2. allPIXA evo with Dual 10 GigE

The allPIXA evo line scan camera is fully compatible with the 10 GigE vision standard and provides two SFP+ ports. For streaming image data, one SFP+ port (single channel) or both ports (two channels) can be used. The recommended hardware components, system requirements and how to set up the camera are introduced in this document.

3. User software: GCT

To access the camera and for setting parameters we recommend using the Chromasens **GCT** software. Please download the actual version of the **GCT** software from our homepage:

Download: https://www.chromasens.de/allpixa-evo-downloads#software

We refer to our user manual to get full information about the features and to learn how to use **GCT**:

allPIXA evo manual: https://www.chromasens.de/allpixa-evo-downloads

and **GCT** manual: https://www.chromasens.de/allpixa-evo-downloads#software

4. Hardware components

For connecting the camera to the PC you need (for one link and optical cables)

- 2 x SFP+ transceivers
- 1 x Fibre optical cable
- 1 x PCI Network adapter for SFP+

4.1 SFP+ Transceiver

Use SFP+ transceivers to connect the fibre optical cable to the camera and to the network adapter. There are different SFP+ transceivers available. There is no guarantee that each transceiver works in all network adapters. Please refer to our list of recommended hardware components in section 6.

4.2 Network adapter

Network adapters with 1 or 2 SFP+ interfaces are available. To get best results with the allPIXA evo camera a network interface adapter with a large receive buffer is recommend (32k receive buffer for UDP stream). With network adapters having smaller receive buffers lost packages may occur which can result in black stripes in the image. Please refer to our list of recommended hardware components in section 6.

4.3   Cables

Single mode and multimode optical fibres can be used. Please note that the type of the cable must fit to the type of the transceiver. With SR transceivers and the appropriate multimode cables up to 400 m cable length is possible. Please refer to our list of recommended hardware in section 6.

5. Possible system setups with the allPIXA evo camera

The camera can be used in the following system setups:

- Single link (one channel connected to the network adapter in the PC)
- Dual single link (two channels are connected to the network adapter in the PC)
- Dual Link (special hardware and drivers are required)
- 10GigE to 1GigE (conversion to 1GigE for use with standard GigE port of PC)

5.1   Single Link Mode

To operate the camera in *single link mode* you need

- **1 x** network interface card with a single port (or more for operating two cameras)
- **2 x** transceivers (types see below)
- **1 x** appropriate fibre optical cable

System set up for *single link mode*
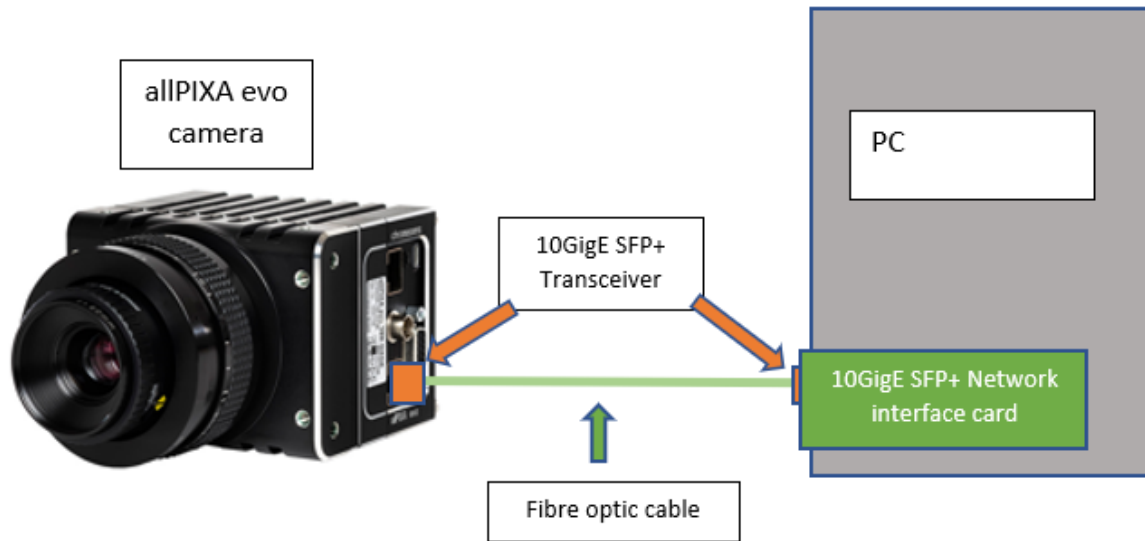
Application examples

- Line times of up to 50 kHz with a ROI of 8192 pixels are possible with RGB 8 bit
- Line times of up to 40 kHz with a ROI of 10240 pixels are possible with RGB 8 bit

5.2   Dual Single Link Mode for transferring to one or two PCs

With ***dual single link mode,*** the full image is split up into two ROIs where each ROI is streamed via one channel. Each ROI can be sent to different PCs which makes it possible to split up image processing to two different PCs and so handle the large number of image data.

There are two options:

- **Option 1: one PC:**
  Stream both channels to a single PC (requires a network interface card with two ports) and use two applications on a single PC

To operate the camera in ***dual single link mode*** on one PC you need

- **1 x** network interface card with two SFP+ ports
- **4 x** transceivers (types see below)
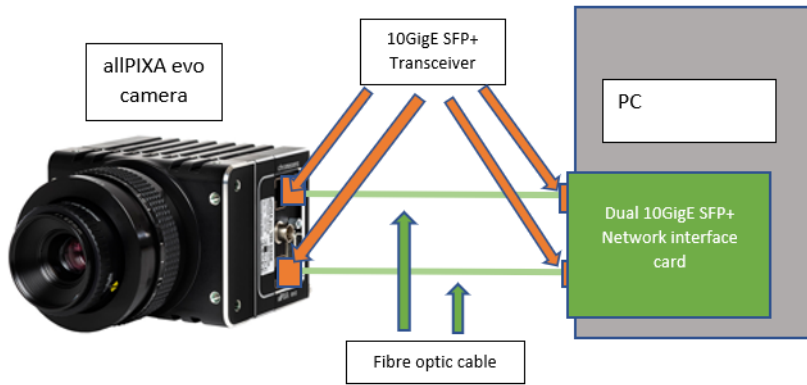- **2 x** appropriate fibre optical cable

- **Option 2: two PCs:**
- Stream the two channels to two different PCs with two applications

To operate the camera in ***dual single link mode*** on two PCs you need

- **2 x** network interface card with one SFP+ port
- **4 x** transceivers (types see below)
- **2 x** appropriate fibre optical cable

Option 1: **System set up for *dual single link mode* using one PC**

Option 2: System set up for *dual single link mode* using two PCs
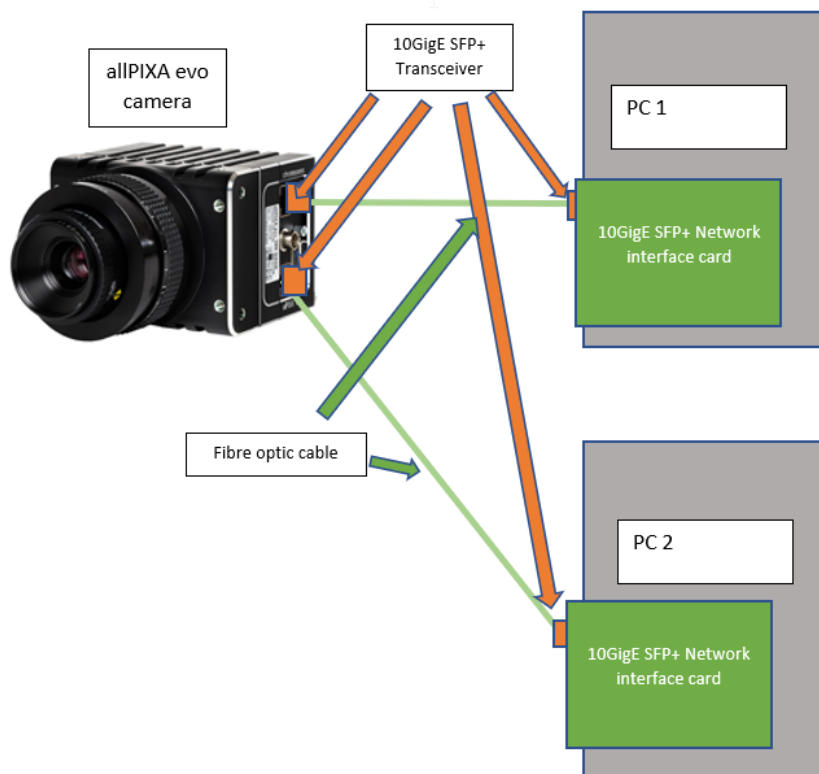
Features

With ***dual single link mode,*** the data rates are higher than with single link. The resulting transfer speed depends on settings and on the ROI. Data rates of up to 6.2 Gbit/s on each channel are possible under Windows 10 and Windows 7.

5.3 Dual Link Mode

With *dual link mode* link aggregation can be used by combining both channels to speed up the data transfer rate.

Please contact our support team to find the best hardware and software solution for your application.

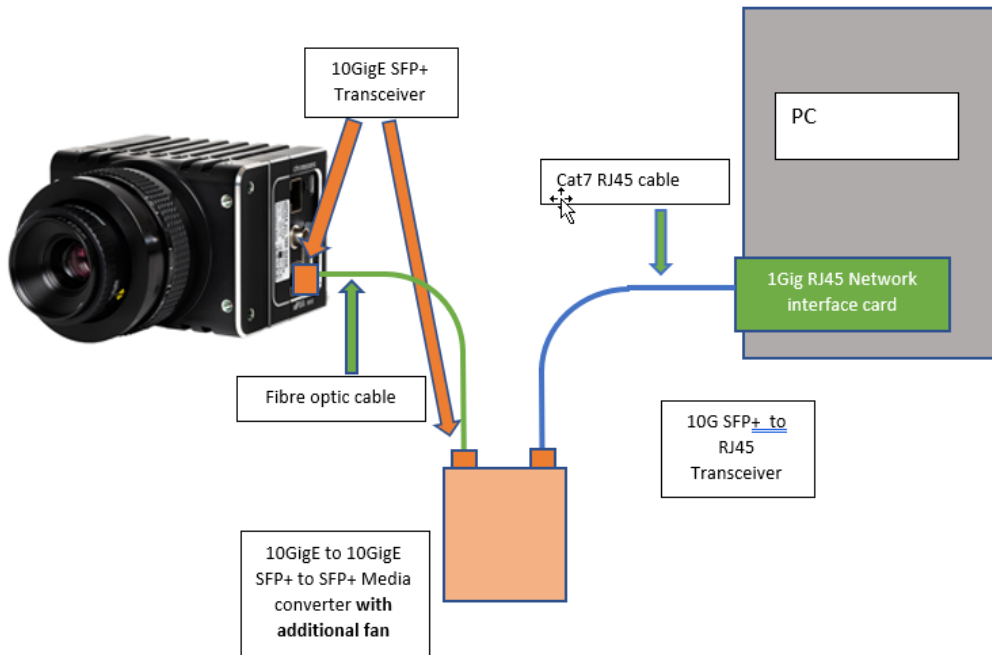|	
NOTE I	Windows 10 do not support link aggregation.
NOTE II	Higher data rates with *dual link mode* is still possible under Windows 10 if special hardware, drivers, and software is used.

5.4 Converting 10GigE to 1GigE

This mode is only useful for low data rates meaning slow speeds and small ROIs – e.g. 5k RGB 8 bit as well as for Mono 8bit mode.

The conversion is done by using a media converter from 10GigE to 1GigE (RJ45 connector, copper cable). Connect one SFP+ port of the allPIXA evo with the SFP+ port of the media converter. Connect the RJ45 connecter of the media converter to a 1 GigE network port of the PC. Please refer to our list of recommended hardware in section 6.

System set up for 10 GigE to 1 GigE using media converter
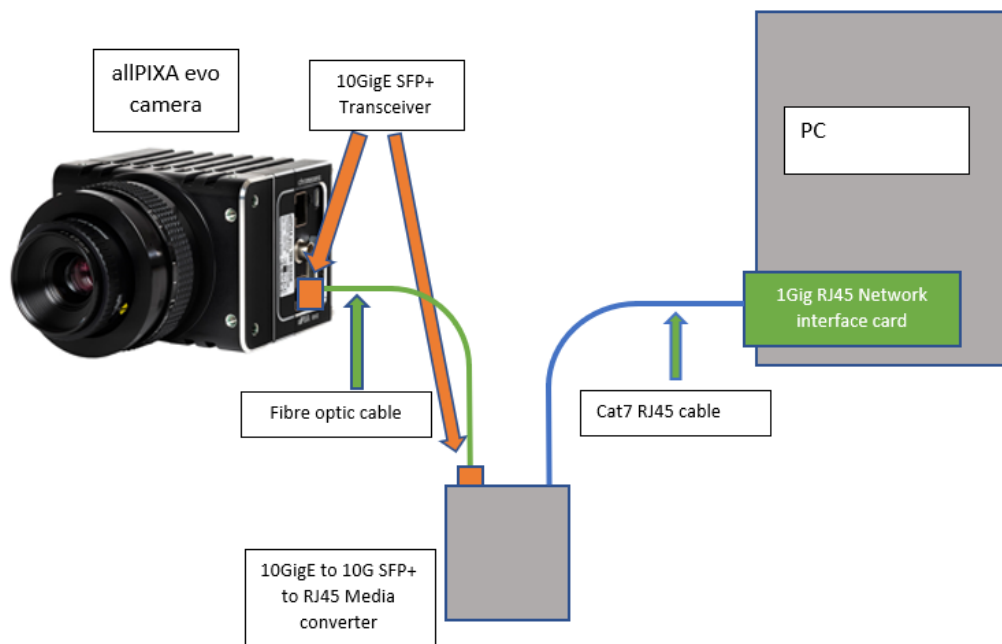
For higher speeds and better performance a SFP+ to SFP+ converter with a SFP+ to RJ45 transceiver plugged into one SFP+ slot of the media converter is recommended. Please refer to our list of recommended hardware in section 6.

10GigE SFP+ Transceiver

Cat7 RJ45 cable

PC

1Gig RJ45 Network interface card

Fibre optic cable

10G SFP+ to RJ45 Transceiver

10GigE to 10GigE SFP+ to SFP+ Media converter **with additional fan**

NOTE I	Please do not use the SFP+ to RJ45 Transceiver direct in the camera. The transceiver gets extremely hot within a short time, what leads to a overheat shut down of the camera which might cause damage to the camera
NOTE II	The use of SFP+/RJ45 transceivers in a media converter requires additional measures for sufficient and safe cooling of the converter and the transceiver. Uncooled operation leads to an automatic shut off of the connection (in about 15 minutes) and might cause damage to the media converter.

6. Tested Components

We continuously test components and expand our list of tested hardware components. Please check our homepage or/and with our support team for the actual list of tested components.

6.1 Starter kit

There are starter kits available with the allIXA evo which provide a set of recommended network components. Please ask our sales team for more information.

6.2 Transceivers

Transceivers with SFP+ interface suitable for 10GigE

Tested transceivers on the allPIXA evo camera:
(all transceivers are of type SR using 850 nm for multimode fibres)

- Finisar FTLX8574D3BCL Class 1 21CFR1040:10

- HP 10Gb SR SFP+ 21CFR(J) CLASS1

- F24-HP-J9150A SFP+ 10G 850nm 300M 21CFR(J) Class 1

- SR FS SFP-10GSR-85 10G SFP+ 850NM 300M

Tested transceivers on the network card:
(all transceivers are of type SR using 850 nm for multimode fibres)

- Finisar FTLX8574D3BCL Class 1 21CFR1040:10

- HP 10Gb SR SFP+ 21CFR(J) CLASS1

- F24-HP-J9150A SFP+ 10G 850nm 300M 21CFR(J) Class 1

- SR FS SFP-10GSR-85 10G SFP+ 850NM 300M

- Programmable Transceiver: Flexoptics P.8596.02 MMF 850nm 0,6-11,3Gbits/s programmed to „Intel E10GSFPSR"

NOTE	Some manufacturers encode their cards. Those cards can only be used with the appropriate transceivers.
	Example: intel X710 chipsets only work with intel or intel configured transceivers

6.3 Fibre optical cable

We tested multimode fibre cables which fits to the above SR transceivers with 850 nm. Cables are available with different quality levels named by OM**X**. Cables with quality OM**2** can be used for up to 80 m, OM**3** for up to 300 m and OM**4** for up to 400 m cable length.

Tested fibre optic cable:

- Rosenberger fibre optic cable RO-PN: 759302 D-PK,LLC/LLC, 50µ OM3

6.4   Network interface cards

The *allPIXA evo* camera is a high performance 10GigE camera which uses UDP streaming to transmit the data. To operate the *allPIXA evo* camera with high speeds, a high-performance network interface card with a large receive buffer is recommend (32k receive buffer for UDP stream). If the receive buffer of the network card is smaller, data packets can be lost and black stripes in the image can occur.

For a reliable data transfer with high speed, we recommend using a high-performance network adapter. In addition, a high-performance PC with sufficient resources should be used.

The following high-performance network card is tested with best results:

Myricom ARC Series C-Class 10GbE Networkadapter

- Single Link: Myricom 1x 10GbE SFP+ 10G-PCIE-8B-S
- Dual link: Myricom 2x 10GbE SFP+ 10G-PCIE2-8C2-2S

NOTE	**GCT** provides a PowerShell script to adjust the settings of the Myricom cards automatically.

The following network cards have been tested. The performance depends on network settings and PC resources. We recommend using a high-performance PCs with sufficient resources.

10GigE Network cards/ network adapters with Intel chipset 82599ES.

- HP 560SFP+ - Netzwerkadapter - 10Gb Ethernet x 2
  With Intel 82599 controller (Chromasens item No. #190502)

- 10GTEK X520-10G-2S-X8 10G NIC
  Intel® 82599 chipset

- StarTech/ Dell 2-Port 10G Fiber Network Card with Open SFP+ - PCIe,
  Intel® 82599 chipset
  Product ID: PEX20000SFPI

For all these cards a PowerShell script is included in **GCT** to set the parameters of the network card.
See **GCT** manual: https://www.chromasens.de/allpixa-evo-downloads#software page 3-5 and the "read me" for **GCT**.

6.5   Media converters

For direct conversion **10GigE to 1 GigE** (SFP+ to RJ45)
(recommended only for slow speeds and small ROIs):

- Planet 10G/5G/2.5G/1G100M Copper to 10GBASE-X SFP+ Media converter Typ XT-705°

For Conversion **10GigE to 10GigE** (SFP+ to SFP+) with SFP+/ RJ45 Transceiver
(for higher performance)

- OEO Model No. FOCS-F2-1SFPP-1SFPP-AC00. We have tested this device by using special cooling measures.

SFP+ To RJ45 Transceiver:

- 10Gtek ASF-10G-T 10Base-T RJ45 30m 21 CFR(J) class1
- FS SFP-10G-T SFP+´30

NOTE I	The SFP+ to RJ45 transceivers require special cooling measures. Only use SFP+ to RJ45 transceivers with sufficient and safe cooling of the converter and the transceiver.
NOTE II	Please contact our support team to get more information for using media converters to convert to 1 GigE

References

- https://www.chromasens.de/sites/default/files/downloads/public/allPIXAevo/GCT-Manual-E01.pdf

- https://www.chromasens.de/sites/default/files/downloads/public/allPIXAevo/PMA_CHR_CD40195_R01_allPIXA_evo_UserManual.pdf

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