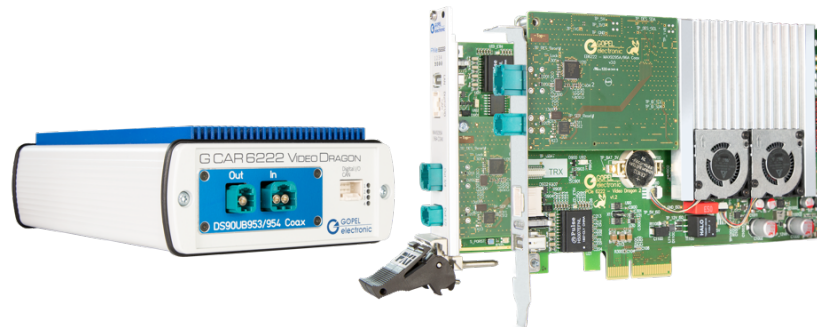




G PCIe / G PXIe / G CAR 6222

Manual (Original documentation)



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1 Introduction

1.1 Notes on this document




This document applies only to the device type **Video Dragon 6222**. Any handling of the device requires the exact knowledge and observance of this manual. The operational safety and the function of the device can only be guaranteed if both the general safety and accident prevention regulations of the legislator and the safety instructions in the manual are observed.



The manual is part of the product. Please make sure that all persons who operate the device have read and understood the manual. Keep the manual in a safe place so that it can be used whenever needed.

This guide highlights some important comments as follows:

Table 1.1: Symbols


| Symbol | Description |
|---|---|
|  | Warning that indicates risk situations and dangers. Disregard can lead to life-threatening situations. |
|  | Information that indicates certain aspects or is important for a particular topic or goal. |
|  | Tip that gives useful hints or recommendations. |

1.2 Intended Use

The **Video Dragon 6222** is a family of measurement cards for the generation and capturing of video data. It is available in 3 variants, as PCI Express plug-in card (**G PCIe 6222**), PXI Express plug-in card (**G PXIe 6222**) or as stand-alone box (**G CAR 6222**).

Typical applications are:

- Create and send image data
- Capture image data
- Recording or playback of the communication or configuration of the DUT



If you use the device for any purpose for which it is not intended, the **GÖPEL electronic GmbH** can not be held liable for resulting damage.

The device is intended for indoor use only and to be used only at an ambient temperature of 0 °C - +50 °C. It must not be exposed to extreme temperatures, temperature fluctuations, heating and cooling systems, direct sunlight, high levels of dust, vibration and impact, extreme humidity or moisture.

The device is only to be used in a technically perfect condition as well as in accordance with its intended use, in a safety-conscious and hazard-conscious manner, observing the operating instructions! In particular, faults that may affect safety must be rectified immediately!

1.3 EMC Protection Measures

The **Video Dragon 6222** complies with the Electromagnetic Compatibility Directive (2014/30/EU).

In order to maintain electromagnetic compatibility, the system may only be operated in the delivered condition. Mechanical and electrical modifications of any kind are not permitted. Only use suitable shielded signal and control cables.



If the product is installed and operated in a system with other equipment, accessories and components, the system as a whole and all its equipment, accessories and components must conform to the EMC directives and standards. The system integrator is responsible for compliance with the EMC Directive 2014/30/EU and national EMC laws for installed systems, system accessories and system components that have not been supplied or tested and approved by **GÖPEL electronic** as manufacturer of the equipment.

1.4 EU Declaration of Conformity

The EU Declaration of Conformity can be found in the appendix to this documentation.

1.5 General Safety Regulations

To avoid personal injury and / or property damage, follow these general safety instructions.

Risk of accident due to electric shock or fire

- In addition to the operating instructions, observe the legal requirements and regulations for accident prevention and environmental protection of the countries in which you operate the system.
- Do not make any changes to the system without the written consent of the manufacturer.
- Never operate damaged devices or components.
- Keep liquids away from the unit and do not place any containers with liquid on the unit.

Danger of tripping or falling due to improperly laid cables

- Lay cables so that nobody can step on them or trip over them.
- Never try to stretch cables to enable a connection. The cables must always have enough clearance.

Damage caused by improper use or failure to observe the safety instructions and warnings is not covered by the warranty. For consequential damages no liability is assumed by **GÖPEL electronic**!

1.6 Liability and Warranty Exclusion

The **Video Dragon 6222** has not been developed, tested or intended for use in safety-related applications. Do not use the device for safety-related systems or vehicle subsystems. The use of such a device within motor vehicles to control the main vehicle functions can be dangerous and lead to malfunction of motor vehicles.

In no event shall **GÖPEL electronic** be responsible for any direct, indirect, incidental, special, exemplary, or consequential damages (including but not limited to the purchase of replacement goods or services, loss of use, loss of data or profit, breakdowns, injury, or potential death) in any way in the case of improper use of the **Video Dragon 6222**

1.7 Supplied Accessories

As accessories to the **Video Dragon 6222** you get:

- **G PCIe 6222 / G PXIe 6222** plug-in card or **G CAR 6222** stand-alone box
- **Media Interface** module (already installed according to your order)
- RJ45 Ethernet cable (only for **G CAR 6222**)
- Power supply (only for **G CAR 6222**)
- CD with driver, software and manual
- **G Patch 6222** (optional)
- Adapter cable for Digital I/O and CAN (for CAN option)

2 Commissioning

2.1 System Requirements

Your system must comply with the following requirements:

- At least 4-times PCIe/ PXle slot for G PCIe/ G PXle 6222
- At least Dual Core CPU
- Windows 7 or Linux (Ubuntu, Debian, Open Suse) from Kernel Version 4.12

2.2 Hardware Installation

After unpacking the **Video Dragon 6222** completely, please check if the **Media Interface** module type matches your order. In addition, check the tightness of the **Media Interface** module on the **Video Dragon 6222**.



Electrostatic discharge (ESD) can damage your system and destroy electronic components. This can lead to irreparable damage to the device or to the system in which the device is operated. The result is unexpected malfunctions of your test system. Never touch the board surface, connector terminals or electronic components.



If your test device needs to be connected to the **Video Dragon 6222** via a [G Patch 6222](#), use the supplied video cable and connect the devices via this connector box. Pay attention to the labeling of the interfaces on the **G Patch 6222**.

2.2.1 G PCIe/ G PXle 6222



Please also compare the manual for your PCIe/ PXle system. If necessary, further installation instructions to be observed are included.

Open your **PCIe™/ PXle™** system according to its circumstances. Select a free slot in your **PCIe™/ PXle™** system. Remove the existing slot plate of the selected slot. For this, the fastening screws must be loosened.

The plug-in card should be inserted carefully in the prepared slot. Please note that you need at least one 4x slot for the PCIe plug-in card. After contacting the plug-in card, it must be fastened according to the conditions. Thus, the plug-in card is installed properly. Afterwards, if necessary, the work on the system must be carried out to make it ready for operation again.

Finally, establish all necessary and desired connections to the DUT or the test environment.

2.2.2 G CAR 6222

The hardware installation of the stand-alone box **G CAR 6222** is done by connecting the power supply and the control computer. The **G CAR 6222** starts automatically when the power supply is switched on via the enclosed power supply unit.



Please use the included LAN cable to connect the stand-alone box **G CAR 6222** to the ethernet interface of the PC. Other cables may not be suitable!

Finally, establish all necessary and desired connections to the DUT or the test environment.

2.3 Driver Installation

The drivers are available for you to download from our homepage:

PXI/ PCI:

<https://www.goepel.com/en/automotive-test-solutions/support/pxi/pci-drivers/series-62-driver>

USB:

<https://www.goepel.com/en/automotive-test-solutions/support/usb-automotive-driver>

G-API

<https://www.goepel.com/en/automotive-test-solutions/support/software/g-api-software>

2.3.1 Windows Device Driver

PCIe/ PXIe can run on Windows 7, 8 and 10. The plug-and-play capability of Windows automatically launches a driver installation for each newly detected hardware component through the Hardware Wizard. With the **exe** file included on the enclosed CD, the Hardware Wizard can install the device driver. A restart of the system is not mandatory.

The stand-alone box **G CAR 6222** can also be operated under Windows 7, 8 and 10.

2.3.2 G-API

The **G-API** (Göpel electronic Application Programming Interface) is a software interface. It supports various hardware products from **GÖPEL electronic** and gives the user the opportunity to integrate them into their own applications. The enclosed CD contains the setup for installing the **G-API**, which will guide you through the Hardware Wizard. For more information about **G-API**, its installation and about the **Hardware Explorer**, see the **G-API Quickstart Guide**.

2.3.3 Network Configuration

When using the ethernet interface, no driver installation is required to communicate with the control computer. The device can be addressed directly via the IP address. However, to address the device, you will need a network adapter that has a valid IP address and subnet mask. Otherwise the PC/ Laptop will not be able to communicate

with the **Video Dragon 6222** in the network.

For this setup, open the "Properties" dialog of the corresponding network adapter and select "Internet Protocol Version 4 (TCP/IPv4)".

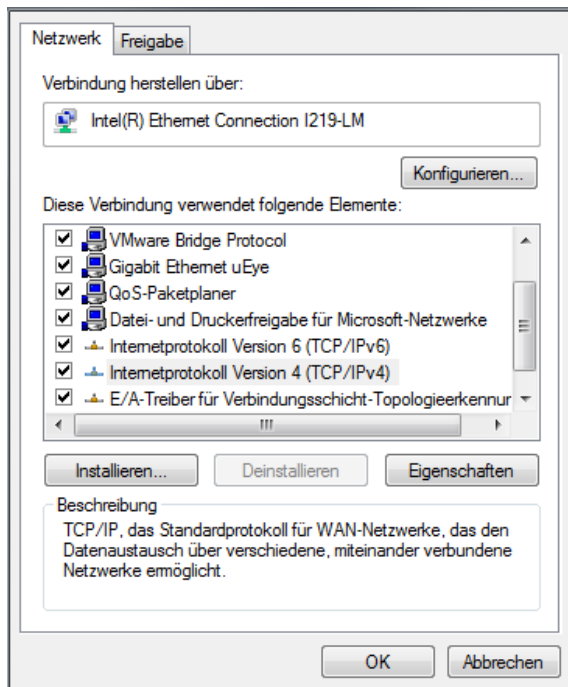


Figure 2.1: Properties of the network adapter

Put a tick next to "Use the following IP address" and set the IP address and subnet mask according to the following rules:

- The IP address of the **Video Dragon 6222** must be different from that of the network adapter.
- The subnet mask must be set to a value such that both IP addresses (**Video Dragon 6222** and network adapter) are located in the same subnet.



Example: The default IP address of the **Video Dragon 6222** is 192.168.1.62 (Port 5134). For example, if you set your network device to IP address 192.168.1.1 and the subnet mask to 255.255.255.0, then both devices are now on the same subnet 192.168.1.xyz.



You can reset the IP address of the **G CAR 6222** to the default IP address via a reset button. This can be found on the [back of the device](#) between the USB and LAN sockets.

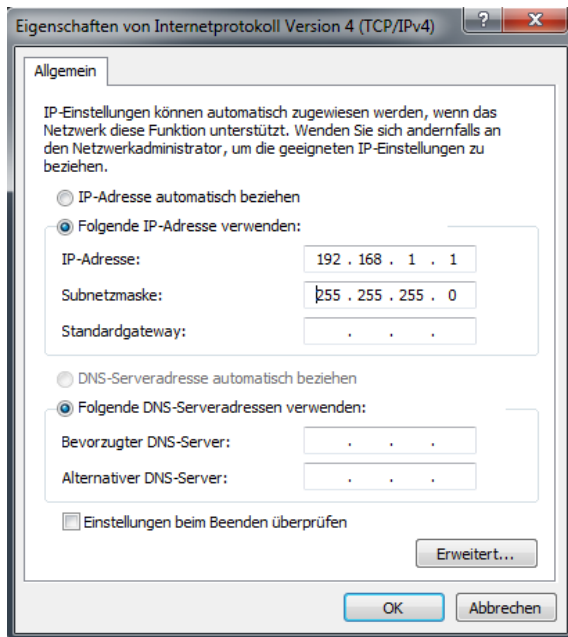


Figure 2.2: Example IP address of the network adapter

After the network adapter has been set up correctly, the **Video Dragon 6222** can be addressed directly after its [hardware installation](#) via its IP address. The IP address of the **Video Dragon 6222** can be changed by means of the **Hardware Explorer**, whereby the entered IP address only becomes effective after a successful restart.

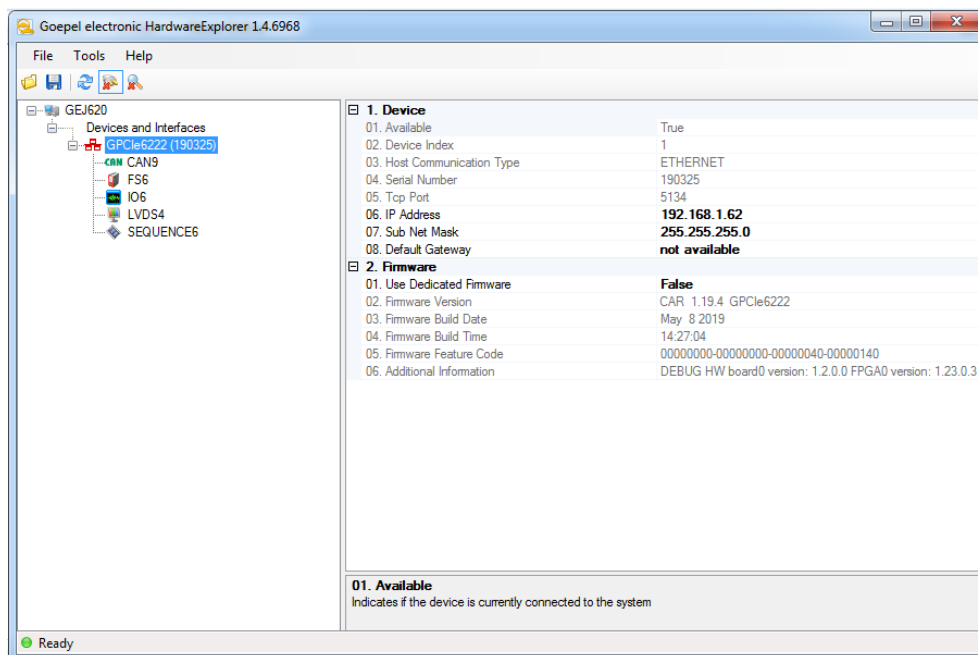


Figure 2.3: Hardware Explorer with G PCIe 6222 plug-in card



A second way to change the IP address is to use the **G-API** command `G_COMMON_ETHERNET_IPADDRESS_SET`. The new IP address is effective after a restart.



It is necessary to change the static IP address if you want to operate several **Video Dragon 6222** or other **GÖPEL electronic** devices (such as **basicCAN 61xx**) in the same network. In this case, always connect only the device whose IP address is to be changed and change it. Make a note of the new IP addresses and the associated serial numbers if you need this information again later. If all devices have different IP addresses, they can be operated together on the same network.

2.4 Firmware Update

To update the firmware, do the following:

- Download the latest firmware update file from <https://www.goepel.com/en/automotive-test-solutions/support/firmware/series-62-firmware>
- Open the **GÖPEL electronic Hardware Explorer**
- Right-click on the selected device (for example "GPCle6222") and select "Flash Firmware"
- Select the appropriate update file in the selection window and confirm with "OK"
- Confirm after successful flashing with "OK"

Due to the large number of different **Media Interface** modules, there are different firmware variants. The table below lists the firmware variants and which **Media Interface** modules are assigned to the variants:

Table 2.1: Firmware Variants

| Firmware Variant | Media Interface |
|------------------|---|
| VAR 1 | DS90UB940_2x, DS90UB953_4x, DS90UB953_DS90UB954, DS90UB954_4x, MAX9295A_4x, AX9295A_AX9296A, AX9296A_4x |
| VAR 2 | INAP562T_INAP562R |
| VAR 3 | DS90UB947_DS90UB948, DS90UB988_2x |



Please make sure to use the correct firmware variant when updating the firmware. The installation of the wrong firmware variant could lead to a loss of functionality and thus cause malfunctions of your application. (In such a case, reinstalling the correct firmware variant can restore the functionality.)

2.5 Replacing the Media Interface Module

The **Media Interface** modules can perform a variety of different test tasks and are compatible with different systems. Therefore, it may be necessary to install a different **Media Interface** module for new test tasks.



Independent replacement of the media interface is not intended. Please send the device to us. Arrangements for this can be made with our [sales department](#).

3 Technical Description

3.1 Product Description

The **Video Dragon 6222** is a test system from **GÖPEL electronic** zur Erzeugung und Aufnahme von Videodaten. for generating and recording video data. This test system is available in 3 variants: As PCI Express plug-in card (**G PCIe 6222**), PXI Express plug-in card (**G PXIe 6222**) and as stand-alone box (**G CAR 6222**). It has been specially adapted to the needs and transmission standards in the vehicle sector. Thus, in addition to the video data also control data (sideband) can be sent or received.

The **Video Dragon 6222** is characterized by its configurable **Media Interface** module, which allows the system to be adapted quickly to current test tasks. It is also a frame generator and frame grabber and also supports a wide range of transmission standards. This makes the **Video Dragon 6222** ideal for future test tasks.

The following features make the **Video Dragon 6222** an extremely versatile video test system:

- Xilinx MPSoC with Quad-Core ARM Cortex A53 processor
- 4 GByte DDR4 RAM
- High Speed interface PCI Express Gen2 4x for control and data exchange with the PC (only PCIe and PXIe variant)
- Currently available **Media Interface** modules support the standards APIX2/3, FPD-Link III, GMSL1/2 for video or data transmission
- Configurable **Media Interface** module for technical adaptation of the system to the test object
- Versatile use for test objects with various connections thanks to the use of a Breakout Box (**G Patch 6222**)
- Connection to the **Media Interface** module via a differential high-speed interface (e.g. MIPI CSI-2)
- Universal **digital I/O- interface** for triggering or status output as well as for interaction with test objects
- Sideband communication using UART, SPI, I²C or MII; depending on the **Media Interface** module
- **CAN-/ CAN FD interface** for configuration or residual bus simulation of the test environment
- State visualization by **LEDs**
- Real-time clock for time synchronization

The variants **G PCIe 6222** and **G PXIe 6222** have been developed as plug-in cards for a PCIe/ PXIe bus system. PCIe (Peripheral Component Interconnect Express)/ PXIe (PCI Express eXtensions for Instrumentation) devices can be easily plug-and-play with little installation effort into your desktop or other peripherals. PCIe/ PXIe provides a stable mechanical form factor and is standardized by an industry consortium that specifies hardware, electronics, software, power and cooling requirements.

The **G PCIe 6222** and **G PXIe 6222** plug-in card supports PCIe up to version 2.1 and 4 lanes (4x). The transmission rates achievable with this are 12 GBit/s (net).

3.2 Overview of G PCIe 6222

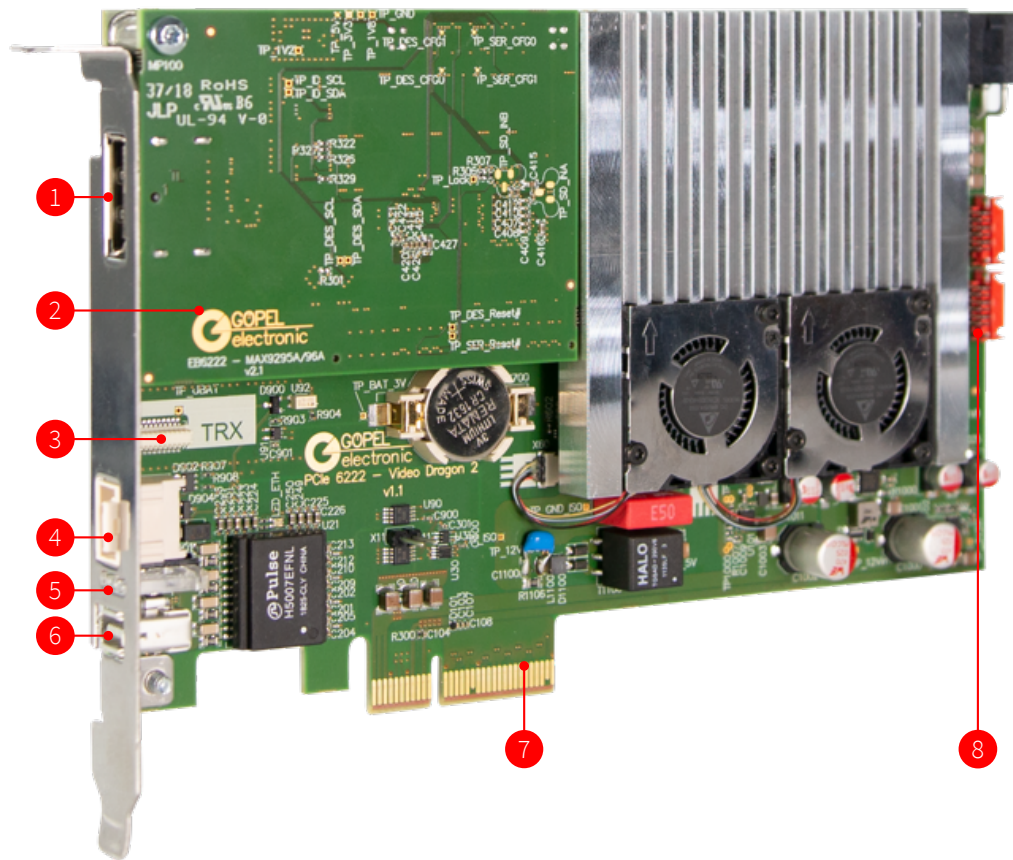


Figure 3.1: Overview of G PCIe 6222

Table 3.1: Components of the G PCIe 6222 plug-in card

| Position | Description |
|----------|--|
| 1 | DUT Connection for video and data signals |
| 2 | Media Interface module |
| 3 | Slot for CAN transceiver |
| 4 | Socket " Digital I/O / CAN " |
| 5 | LEDs/ Statusanzeige ; LED1 = left .. LED4 = right (in the picture) |
| 6 | Socket " LAN " |
| 7 | PCIe Interface 4x |
| 8 | 2x Socket " SYNC "; upper socket in the picture: "SYNC left", lower socket: "SYNC right" |

3.3 Overview of G PXle 6222

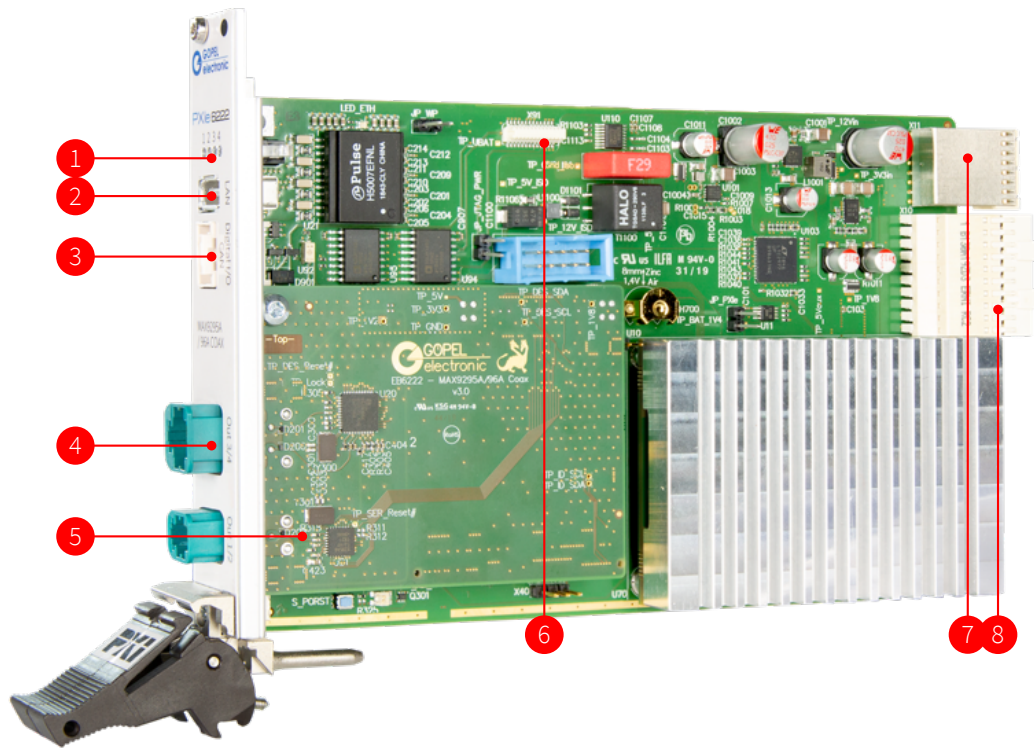


Figure 3.2: Overview of G PXle 6222

Table 3.2: Components of the G PXle 6222 plug-in card

| Position | Description |
|----------|--|
| 1 | LEDs/ Statusanzeige ; LED1 = left .. LED4 = right (in the picture) |
| 2 | Socket "LAN" |
| 3 | Socket "Digital I/O / CAN" |
| 4 | DUT Connection for video and data signals |
| 5 | Media Interface module |
| 6 | Slot for CAN transceiver |
| 7 | Socket "SYNC" |
| 8 | PXle Interface |

3.4 Overview of G CAR 6222

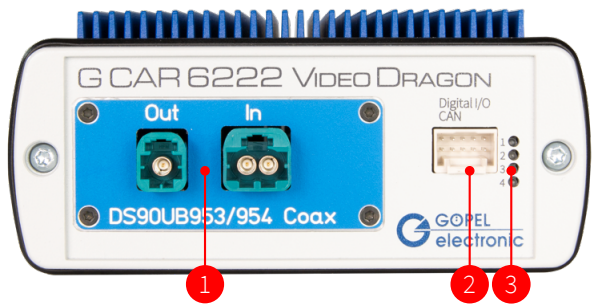


Figure 3.3: Overview of G CAR 6222 - DUT Side

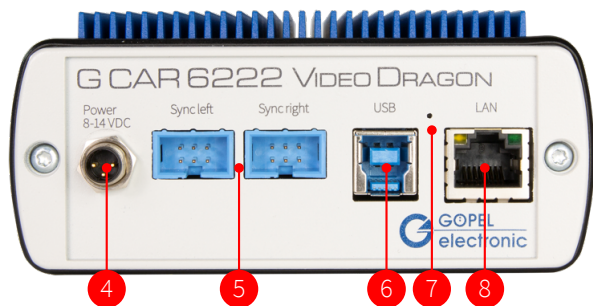


Figure 3.4: Overview of G CAR 6222 - Rear side

Table 3.3: Components of the G CAR 6222

| Position | Description |
|----------|---|
| 1 | Media Interface module with DUT Connection for video and data signals |
| 2 | Socket "Digital I/O / CAN" |
| 3 | LEDs/ Statusanzeige; LED1 = left .. LED4 = right (in the picture) |
| 4 | Socket "Power Supply" |
| 5 | 2x Socket "SYNC" |
| 6 | Socket "USB" |
| 7 | IP Reset |
| 8 | Socket "LAN" |

3.5 Technical Specifications

Table 3.4: General Specifications

| Property | Value | Unit | Comment |
|---|--|--------------|---|
| Processor | ARM Cortex A53 | | |
| RAM | 4 | GByte | DDR4 |
| Operating temperature | 0 .. +50 | °C | |
| Dimensions L x B x H | 170 x 110 x 20 173 x 100 x 20 185 x 111 x 50 | mm x mm x mm | PCIe (without front panel) PXle (without front panel) G CAR |
| Weight with Media Interface module | 235 245 750 | g | PCIe (without front panel) PXle (without front panel) G CAR |

3.5.1 General Electrical Specifications

Table 3.5: General Electrical Specifications

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Comment |
|------------------------|---|------|---------------------|---------------------|----------------|--|
| Power Supply | | | | | | |
| U _{SS} | Supply voltage | | 12 + 3.3 8 .. 14 | | VDC VDC | PCIe/PXle G CAR |
| I _{SS} | Supply current | | 700 150 750 | 1000 300 2000 | mA mA mA | at 12V for PCIe/PXle at 3.3V for PCIe/PXle G CAR |
| P _{SS} | Power consumption | | 9 | | W | |
| Digital Inputs | | | | | | |
| N | Amount | | 2 | | | |
| U _{IH} | High-level input voltage | 2 | 5 | 5.5 | V | |
| U _{IL} | Low-level input voltage | | | 0.8 | V | |
| f _{MAX} | Maximum switching frequency | | | 5 | MHz | |
| Digital Outputs | | | | | | |
| N | Amount | | 2 | | | |
| U _{OH} | High-level output voltage | | 5 | | V | |
| I _O | Output current | | | 5 | mA | per channel |
| f _{MAX} | Maximum switching frequency | | | 5 | MHz | |
| CAN (optional) | | | | | | |
| C | Transfer rate | | | 5 | Mbit/s | for CAN-FD |
| U _{BATint} | Internal battery voltage | | 12 | | V | switchable |
| U _{BAText} | External battery voltage | | | 24 | V | |
| R _A | Terminating resistor CAN transceiver | | 120 | | Ω | switchable |

3.6 Design and Function

With its open hardware concept with the configurable **Media Interface** module and the FPGA, the **Video Dragon 6222** is equipped for a multitude of current and future test requirements in the video field. The interchangeability of the **Media Interface** module supports different transmission standards and enables it to act as a transmitter and/ or receiver of video data. The focus of the supported standards is clearly in the vehicle sector. The **Media Interface** modules can be designed differently, depending on the specification of the serializer and deserializer or test requirements. Some **Media Interface** modules each have a serializer ("generator") and a deserializer circuit ("grabber"). Others are equipped with several deserializers, for example.

With the serializer, the **Video Dragon 6222** can send video data. This can be used, for example, to output stored images or videos to test a connected display.

The deserializer is used to receive video data. This allows the function of video sources, such as cameras or instrument clusters, to be checked. Received videos can be forwarded to the real receiver (e.g. a display) at the same time without having to change the system structure. For this, the **G Patch 6222** Breakout Box can be very helpful.

3.6.1 Block Diagram

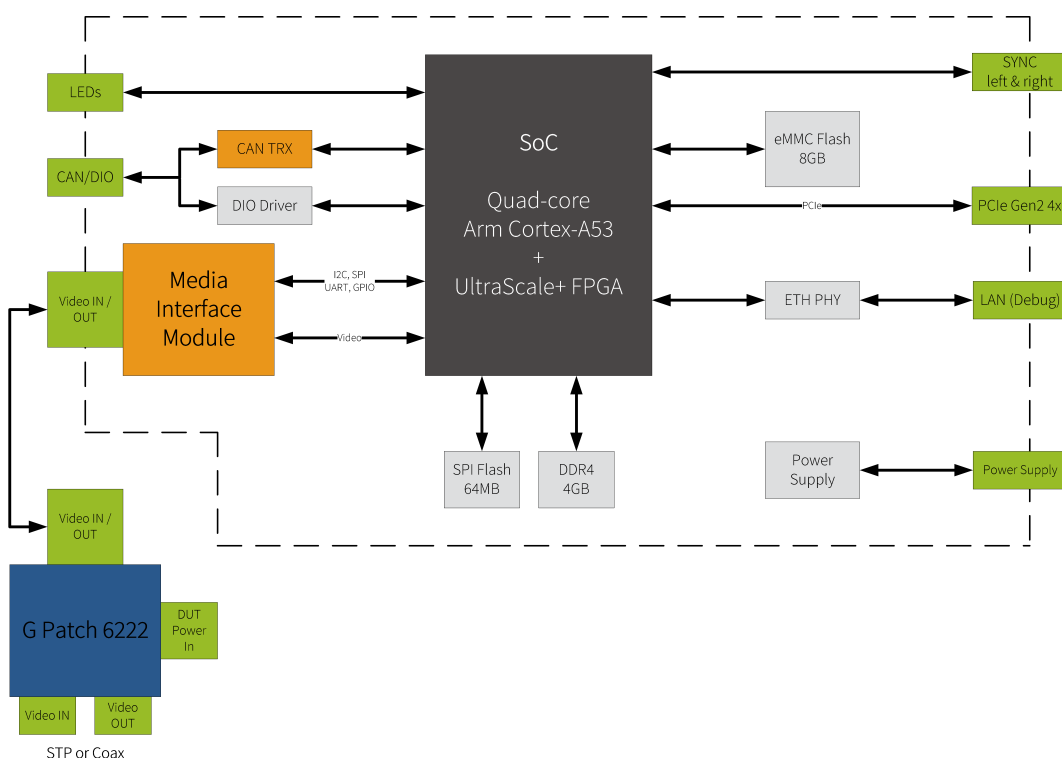


Figure 3.5: Block Diagram

3.6.2 LAN/ Ethernet

To configure and control the **G PCIe 6222** and **G PXle 6222** plug-in card via PC, the card has an "ix Industrial®" Ethernet socket. If necessary, if the card is e.g. in a rack that is only for power, this interface can act as a host interface. An adapter cable from "ix Industrial®" to RJ45 can also be ordered from **GÖPEL electronic** (see [Spare Parts and Accessories](#)). The **G CAR 6222** has a standard RJ45 Ethernet socket.

3.6.3 LEDs/ Status Indication

The LEDs arranged on the front panel provide information about the current operating status of the **Video Dragon 6222**. The display states of the LEDs are explained in the following table:

Table 3.6: Display states of the status LEDs

| LED1 | LED2 | LED3 | LED4 | Bemerkung |
|----------------------|----------|------|------|---------------------------------|
| blinking alternately | | | | Bootloader software is running |
| | blinking | | | Firmware is running |
| ON (shortly) | | | | Execution of a firmware command |
| | | | ON | Ethernet connection established |

3.6.4 Power Supply



When using the **G CAR 6222** in a test bench, for example, we recommend supplying the device via the test bench instead of using a plug-in power supply. This avoids large potential differences.

An external supply is required to operate the **G CAR 6222**. This includes an external 12VDC power adapter included in the delivery, which is connected to the rear side of the device. The centre contact of the power supply unit is connected to mains earth. The power adapter has the following specifications:

Table 3.7: Specifications of the power adapter

| Property | Value | Unit | Comment |
|-------------------------|------------|------|--------------|
| Model | BET-0600 | | |
| Cable length | 1.5 | m | |
| AC Input voltage | 90 .. 264 | V | |
| DC Output voltage | 12 | V | |
| DC Output current | 5000 | mA | |
| Operating temperatur | -20 .. +60 | °C | |
| Power | 60 | W | |
| Ripple | 120 | mV | Peak to peak |
| Weight | 300 | g | |
| Type of input connector | IEC socket | | |

The device-side connector is a 3-pin M8 socket from PHOENIX CONTACT (Item No. 1456035; plug side: 1681172).

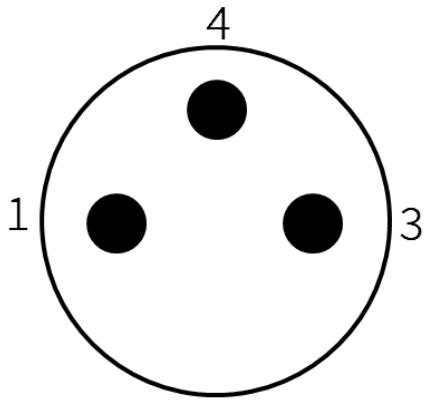


Figure 3.6: Schematic drawing of the socket of the power supply

The following table shows the pin assignment of the connector:

Table 3.8: Pin assignment of the power supply

| Pin | Signal |
|---------|------------|
| Housing | GND_SHELL |
| 1 | V_ISO_IN |
| 3 | GND_ISO_IN |
| 4 | GND_SHELL |



GND_SHELL is connected to the housing of the G CAR 6222.

The PCIe/ PXle plug-in cards of the **Video Dragon 6222** are supplied via the PCIe/ PXle interface.

3.6.5 Digital I/O and CAN/ CAN FD

The **Video Dragon 6222** offers the possibility to use independent signals from the **Media Interface** module for communication and interaction with the test device. Two universal digital inputs and outputs as well as an optional CAN communication interface are available. Additionally, GPIOs can be routed from the Media Interface to the DIOs and vice versa. The CAN interface can be used as gateway from CAN to the UART (CANoverUART protocol) of the Media Interface. The electrical parameters of the interfaces are listed in the section [Electrical characteristics](#).

The following table shows the pin assignment of the Digital I/O / CAN connector (Type: Molex iGrid 501646-1000):

Table 3.9: Pin assignment of the Digital I/O / CAN connector

| Pin | Signal | Comment |
|-----|------------------|--------------------------|
| 1 | U _{Bat} | Terminal voltage for CAN |
| 2 | GND | Ground |
| 3 | CAN H | CAN diff. p |
| 4 | CAN L | CAN diff. n |
| 5 | 5V Out | Output, 50mA |
| 6 | GND | Ground |
| 7 | DO 0 | Digital Output 0 |
| 8 | DO 1 | Digital Output 1 |
| 9 | DI 0 | Digital Input 0 |
| 10 | DI 1 | Digital Input 1 |

These interfaces are galvanically isolated from the mainboard (see [Galvanic Isolation](#)). Both the digital I/O and CAN interfaces are powered internally by the **Video Dragon 6222**. The CAN interface can also be supplied externally via U_{Bat}. The following graphic shows the voltage supply of the interfaces:

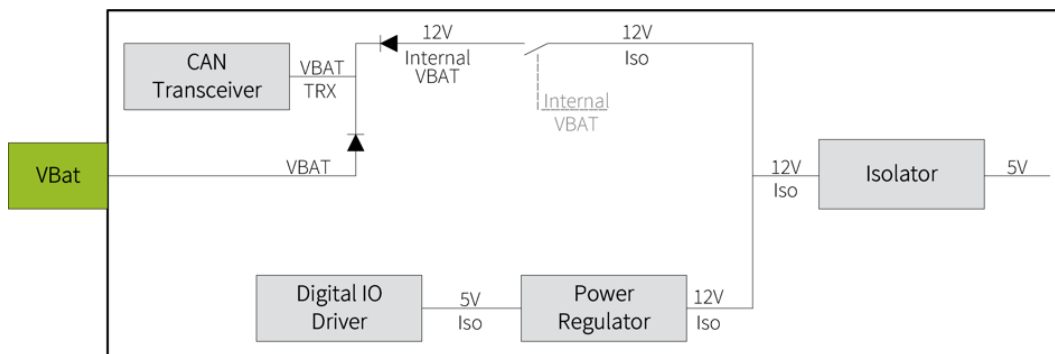


Figure 3.7: Voltage supply of Digital I/O / CAN

The drivers of the digital outputs are always supplied with the internal, isolated 5V. The digital outputs can be used to output previously defined states or to control/ synchronize the **Video Dragon 6222** with the test setup. The digital inputs in turn can control the **Video Dragon 6222** via external devices.

The voltage "U_{Bat} TRX" can be fed internally via a switchable 12V supply or also in parallel via the external VBat. If the external voltage is used, the internal supply should be switched off with the **G-API** command **G_Can_Node_InternalVBat_Disable**. With **G_Can_Node_InternalVBat_Enable** the internal supply is switched on again.

A pluggable transceiver board is used for the CAN interface. This transceiver board is optional and can also be installed later. To do this, remove the **G PCIe 6222/ G PXIe 6222** plug-in card from the PCIe/ PXIe slot (see [Commissioning](#)) and plug the transceiver board into slot on the board (see [Overview of G PCIe 6222](#) or [Overview of G PXIe 6222](#)). Then the **G PCIe 6222/ G PXIe 6222** board is reinstalled.

For the stand-alone box **G CAR 6222** it is not intended to change the CAN transceiver independently. Please send the device to us. Arrangements for this can be made with our [sales department](#).

The following CAN transceiver board is currently available:

- TJA1044GT (CAN High Speed/ CAN FD with up to 5Mbit/s)

The **120 Ω bus termination resistor** located on the transceiver can be deactivated by software with the **G-API** command **G_Can_Node_BusTermination_Disable**. With **G_Can_Node_BusTermination_Enable** the bus termination resistor is reactivated.

When ordering the CAN option, an adapter cable for Digital I/O / CAN is supplied. If only the digital I/Os are to be used, the cable can optionally be ordered separately (see [Spare Parts and Accessories](#)).

The following table shows the pin assignment of 9-pin DSub connector of the adapter cable:

Table 3.10: DSub 9 connector of the Digital I/O / CAN adapter cable

| Pin DSub | Signal | Comment |
|----------|------------------|--------------------------|
| 1 | DO 0 | Digital Output 0 |
| 2 | CAN L | CAN diff. n |
| 3 | GND | Ground |
| 4 | DI 0 | Digital Input 0 |
| 5 | DI 1 | Digital Input 1 |
| 6 | DO 1 | Digital Output 1 |
| 7 | CAN H 0 | CAN diff. p |
| 8 | 5V Out | Output, 50mA |
| 9 | U _{Bat} | Terminal voltage for CAN |

3.6.6 Galvanic Isolation

Overvoltages can damage expensive test equipment or lead to unsafe test results. The potential separation protects against overvoltages and can suppress dangerous surges. It also prevents ground loops responsible for data errors due to ground potential differences.

On the **Video Dragon 6222**, the CAN communication interface and the digital inputs and outputs are electrically isolated from the **Media Interface** module and all other interfaces.



When using the electrically isolated interfaces, please make sure to connect the isolated ground with the test sample ground.

3.6.7 SYNC

There are two SYNC (Synchronization) connectors on the **Video Dragon 6222**. These are used to connect multiple **Video Dragon 6222** so that the cards can synchronize with each other. "SYNC left" will be connected with the left placed card and "SYNC right" with the right placed card. This means that the "SYNC left" connector of one **Video Dragon 6222** is connected to "SYNC right" of the other device.



The SYNC connectors are not to be used for any purpose other than the above purpose.

3.6.8 G Patch 6222

G Patch 6222 is a Breakout Box from **GÖPEL electronic** for simplified contacting of **Video Dragon 6222** devices with your DUTs. The test devices often have different connectors than the **Media Interface** module of the **Video Dragon 6222**. The box routes the signals from the **Video Dragon 6222** to various Coax and STP variants and at the same time offers the possibility to supply the test device with voltage.



The **G Patch 6222** will be configured by us according to your test requirements. More information about the **G Patch 6222** and its variants can be obtained in the **G Patch 6222** manual and through **GÖPEL electronic Sales**.

Which **Media Interface** modules are compatible with the different **G Patch 6222** variants can be found in the following table:



The compatibility listed above is only given if you use standardized cables and pin assignments of the connectors. Otherwise, please contact our **support** team.

Table 3.11: Compatibility

| Video Dragon 6222 | G Patch 6222 | | | | | | | | | | | | | | | |
|--------------------|---------------|---------------|-----------------|---------------|---------------|-----------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|----------------|----------------|---------------|
| Media Interface | Coax Var.1 | Coax Var.2 | Coax Var.2.1 | Coax Var.3 | Coax Var.4 | Coax Var.4.1 | STP Var.1 | STP Var.2 | STP Var.3 | STP Var.4 | STP Var.5 | STP Var.8 | STP Var.9 | STP Var.9.1 | STP Var.9.2 | STP Var.12 |
| DS90UB940_2x STP | | | | | | | | X | | | | | | X | | |
| DS90UB947_948 STP | | | | | | | | | | | X | X | X | | | |
| DS90UB953_4x Coax | | X | | | X | | | | | | | | | | | |
| DS90UB954_4x Coax | | | X | | | | | | | | | | | | | |
| DS90UB953_954 Coax | X | | | X | | | | | | | | | | | | |
| DS90UB953_954 STP | | | | | | | | | X | | | | X | | | |
| DS90UB9702 Coax | | | X | | | X | | | | | | | | | | |
| DS90UB971_4x Coax | | X | | | X | | | | | | | | | | | |
| DS90UB981_2x STP | | | | | | | | | | | | X | | | X | |
| DS90UB988 STP | | | | | | | | | | | | X | | X | | |
| INAP562T_562R STP | | | | | | | X | | | X | | X | X | | | X |
| MAX9295A_4x Coax | | X | | | X | | | | | | | | | | | |
| MAX9296A_4x Coax | | | X | | | X | | | | | | | | | | |
| MAX9296A_4x STP | | | X | | | X | | | | | | | | X | | |
| MAX9295A_96A Coax | X | | | X | | | | | | | | | | | | |
| MAX9295A_96A STP | | | | | | | | | X | | | | X | | | |
| MAX96714_4x Coax | | | X | | | X | | | | | | | | | | |
| MAX96737/ 760 Coax | X | | | X | | | | | | | | | | | | |
| MAX96737/ 760 STP | | | | | | | | | X | | | | X | | | |
| MAX96792_4x Coax | | | X | | | X | | | | | | | | | | |
| MAX96793_4x Coax | | X | | | X | | | | | | | | | | | |
| MAX96793_4x STP | | | | | | | | | | | | | | X | | |
| MAX96878_2x STP | | | | | | | | | | | | X | X | | | |

3.7 Signal Processing in the Video Dragon

3.7.1 Video Pipeline

The following figure shows a simplified overview of the flow of video data, starting from the **Media Interface** module to the host system and vice versa. The example below shows a **Media Interface** module with a deserializer and a serializer. The part of the FPGA logic adapts to the conditions of the **Media Interface** module.

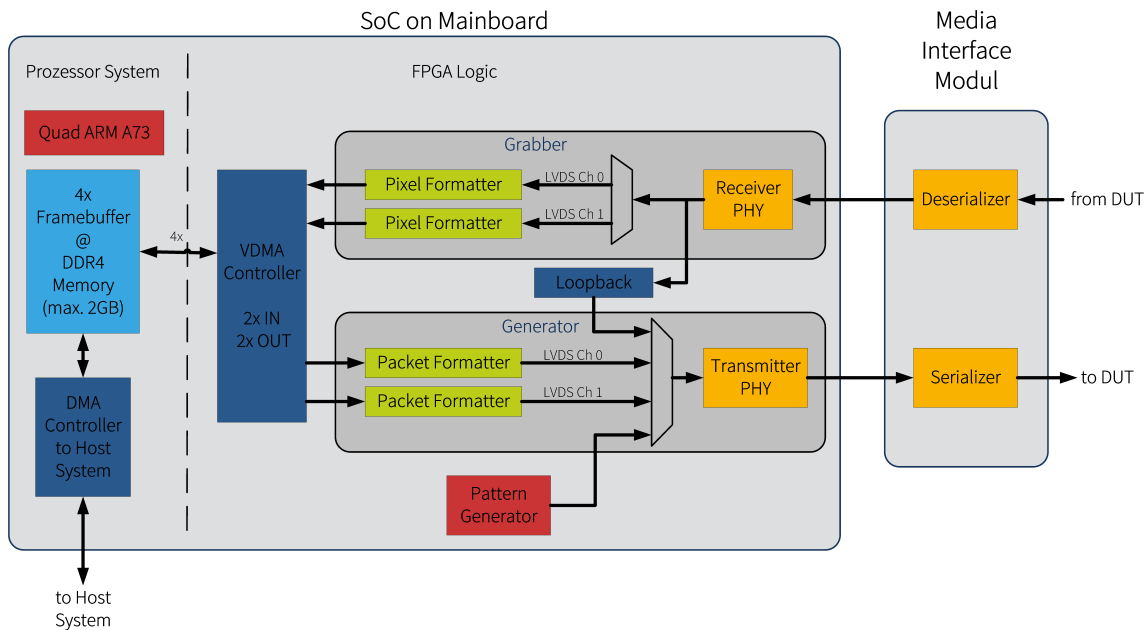


Figure 3.8: Video Pipeline of the **Video Dragon 6222** - Schematic Illustration

Each framegrabber interface has a receiver (PHY), which receives the video data in a protocol determined by the deserializer (e.g.: MIPI CSI-2) and decodes the video data of all channels. The user can determine which data is to be recorded via the two channels. For example, virtual channel 0 with data type RGB888 can be passed on via the first channel and virtual channel 1 with data type RAW16 via the second channel. In parallel, the complete video data stream can be passed to the output via the loopback path. The video data of both channels is then converted into the desired format by the Pixel Formatter and transferred via the VDMA controller into the ring buffer of the main memory of the **Video Dragon 6222**. From there the recorded images can be made available to the host system via DMA.

When using the **Video Dragon 6222** as a generator, the images are first written to the memory by the host system. This is also done via DMA, in order not to load the processor and to obtain maximum performance. The VDMA in the FPGA logic automatically fetches these images and passes them to the Packet Formatter. There are also two video channels per generator interface to transfer videos with different data types. The Packet Formatter forms the data packets from the images, which are adapted to the protocol that the Serializer understands. Before the packets are transmitted to the PHY, the source of the data must be set via a multiplexer. This can be either one of the two generator channels, the loopback or the internal pattern generator. The packets are then sent to the serializer of the **Media Interface** module and transmitted from there to the UUT.

4 Media Interface Modules

The **Media Interface** module ensures the adaptation of the **Video Dragon 6222** to the respective test device. Due to the large number of transmission standards used in the vehicle sector for the exchange of video data, a universal connection is not possible otherwise. A transmission system always consists of a transmitter and a matching receiver. The transmitter is also called a serializer because it serializes the video data generated by a graphics chip and transmits it over a few lines. The deserializer (receiver) converts this data and transmits it over a larger number of lines, for example to a display.

The table on the following page lists the currently available serializers and their supported standards.



The compatible circuits in the table below are only an extract of all possible serializers and deserializers. Since there are also many customer specific circuits, we recommend to contact our [sales department](#) to ask for the compatibility of a specific serializer or deserializer.

The circuits on the modules often have a variety of configuration registers that define the transmit or receive mode and include all the parameters necessary for data transmission. The configuration depends on the test device and its parameter settings, as these are generally not changeable. For the **Media Interface** module to work properly, a module configuration must be made by the user. The module configuration is described in the chapter [First Steps](#) using an example.



Please also use the documentation of the respective serializer/ deserializer module and the **Dragon Suite**.

Table 4.1: Available Media Interface Modules

| Media Interface | Transmission standard | Cable type | Compatible serializer | Compatible deserializer |
|-------------------|-----------------------|------------|---|--|
| DS90UB940 2-times | FPD-Link III | Coax, STP | DS90UB949, DS90UB947, DS90UB941, DS90UB929, DS90UB925, DS90UB927 | - |
| DS90UB947/ 948 | FPD-Link III | STP | DS90UB949, DS90UB947, DS90UB941, DS90UB929, DS90UB925, DS90UB927 | DS90UB948, DS90UB948, DS90UB926, DS90UB928 |
| DS90UB953 4-times | FPD-Link III | Coax | - | DS90UB954, DS90UB960, DS90UB934, DS90UB914 |
| DS90UB954 4-times | FPD-Link III | Coax | DS90UB953, DS90UB933, DS90UB935, DS90UB913 | - |
| DS90UB953/ 954 | FPD-Link III | Coax, STP | DS90UB953, DS90UB933, DS90UB935, DS90UB913 | DS90UB954, DS90UB960, DS90UB934, DS90UB914 |
| DS90UB9702 | FPD-Link IV | Coax | DS90UB971 | - |
| DS90UB971 4-times | FPD-Link IV | Coax | - | DS90UB9702, DS90UB9722 |
| DS90UB981 2-times | FPD-Link IV | STP | - | DS90UB984, DS90UB988 |
| DS90UB988 2-times | FPD-Link IV | STP | DS90UB981, DS90UB983 | - |
| INAP562T/ 562R | APIX3 | STP | INAP56xT, INAP59xT | INAP56xR, INAP59xR |
| MAX9295A 4-times | GMSL2 | Coax | - | MAX9296, MAX96712*, MAX96714*, MAX96716*, MAX96718*, MAX96722*, MAX96724*, MAX96784*, MAX96756 |
| MAX9296A 4-times | GMSL2 | Coax, STP | MAX9295 | - |
| MAX9295A/ 96A | GMSL2 | Coax, STP | MAX9295 | MAX9296, MAX96712*, MAX96714*, MAX96716*, MAX96718*, MAX96722*, MAX96724*, MAX96784*, MAX96756 |
| MAX96714 4-times | GSML2 | Coax | MAX96717, MAX96719 | - |
| MAX96737/ 760 | GSML2 | Coax, STP | MAX96735*, MAX96737, MAX96741, MAX96745, MAX96749AC*, MAX96751, MAX96755, MAX96759*, MAX86763*, MAX96767*, MAX96781*, MAX96785, MAX96789* | MAX96752, MAX96760, MAX96772*, M96776* |
| MAX96792 4-times | GSML3 | Coax, STP | MAX96793 | - |
| MAX96793 4-times | GSML3 | Coax | - | MAX96792, MAX96870*, MAX96878* |
| MAX96878 2-times | GSML3 | Coax | MAX96851* | - |

* limited use

4.1 Pin Assignment

The **Media Interface** modules are available with Coax and/ or STP connection. The connections supported by the individual **Media Interface** modules can be found in the corresponding paragraph.



Please always use the cables recommended by us.

The **Coax** connectors used depend on the **Media Interface** module and are explained in the respective chapter of the module.

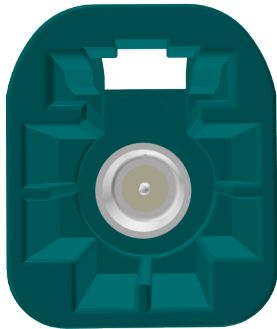


Figure 4.1: 1-Channel Coax connector (AMS29A-40MZ5 from Rosenberger)



Figure 4.2: 2-Channel Coax connector (AMS29B-40MZ5 from Rosenberger)

For the **STP** variant the used connector is type "ERI8-019-S-D-RA" from Samtec.

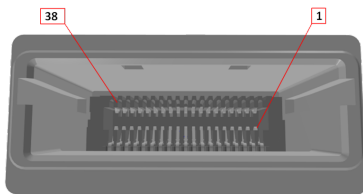


Figure 4.3: STP connector (ERI8-019-S-D-RA from Samtec)

For all **Media Interface** modules as STP variant the same pin assignment applies:

Table 4.2: Pin Assignment of the STP Connector

| Pin | Signal | Comment |
|-----|------------|----------------------------------|
| 1 | GND | Ground |
| 2 | LVDS Ch1 + | Pos. LVDS Signal of Channel 1 |
| 3 | LVDS Ch1 - | Neg. LVDS Signal of Channel 1 |
| 4 | GND | Ground |
| 5 | LVDS Ch0 - | Neg. LVDS Signal of Channel 0 |
| 6 | LVDS Ch0 + | Pos. LVDS Signal of Channel 0 |
| 7 | GND | Ground |
| 8 | LVDS Ch2 + | Pos. LVDS Signal of Channel 2 |
| 9 | LVDS Ch2 - | Neg. LVDS Signal of Channel 2 |
| 10 | GND | Ground |
| 11 | LVDS Ch3 - | Neg. LVDS Signal of Channel 3 |
| 12 | LVDS Ch3 + | Pos. LVDS Signal of Channel 3 |
| 13 | GND | Ground |
| 14 | LVDS Res + | Pos. LVDS Signal (reserved) |
| 15 | LVDS Res - | Neg. LVDS Signal (reserved) |
| 16 | GND | Ground |
| 17 | | For internal use only |
| 18 | | For internal use only |
| 19 | GND | Ground |
| 20 | GND | Ground |
| 21 | ETH MDI0 + | Ethernet MDI (only INAP562T/R) |
| 22 | ETH MDI0 - | Ethernet MDI (only INAP562T/R) |
| 23 | GND | Ground |
| 24 | ETH MDI1 + | Ethernet MDI (only INAP562T/R) |
| 25 | ETH MDI1 - | Ethernet MDI (only INAP562T/R) |
| 26 | GND | Ground |
| 27 | ETH MDI2 + | Ethernet MDI (only INAP562T/R) |
| 28 | ETH MDI2 - | Ethernet MDI (only INAP562T/R) |
| 29 | GND | Ground |
| 30 | ETH MDI3 + | Ethernet MDI (only INAP562T/R) |
| 31 | ETH MDI3 - | Ethernet MDI (only INAP562T/R) |
| 32 | GND | Ground |
| 33 | RES | Reserved |
| 34 | RES | Reserved |
| 35 | GND | Ground |
| 36 | 3.3V_Out | 3.3V voltage output (max. 200mA) |
| 37 | n.c. | |
| 38 | GND | Ground |

As shown in the table, there are up to five video channels on the connector. As a result, depending on the **Media Interface** module, several input and output signals can be transmitted in parallel.

Some earlier versions of the **Media Interface** module were equipped with a **DisplayPort** connector, which is why the pin assignment of the DisplayPort connector is listed below.

Attention: The signals themselves are not typical DisplayPort signals! Please note the pin assignment:

Table 4.3: Pin Assignment of the DisplayPort Connector (obsolete)

| Pin | Signal | Comment |
|-----|------------|--------------------------------|
| 1 | LVDS Ch0 + | Pos. LVDS Signal of Channel 0 |
| 2 | GND Ch0 | Ground for Channel 0 |
| 3 | LVDS Ch0 - | Neg. LVDS Signal of Channel 0 |
| 4 | LVDS Ch1 + | Pos. LVDS Signal of Channel 1 |
| 5 | GND Ch1 | Ground for Channel 1 |
| 6 | LVDS Ch1 - | Neg. LVDS Signal of Channel 1 |
| 7 | LVDS Ch2 + | Pos. LVDS Signal of Channel 2 |
| 8 | GND Ch2 | Ground for Channel 2 |
| 9 | LVDS Ch2 - | Neg. LVDS Signal of Channel 2 |
| 10 | LVDS Ch3 + | Pos. LVDS Signal of Channel 3 |
| 11 | GND Ch3 | Ground for Channel 3 |
| 12 | LVDS Ch3 - | Neg. LVDS Signal of Channel 3 |
| 13 | | For internal use only |
| 14 | | For internal use only |
| 15 | LVDS Ch4 + | Pos. LVDS Signal of Channel 4 |
| 16 | GND Ch4 | Ground for Channel 4 |
| 17 | LVDS Ch4 - | Neg. LVDS Signal of Channel 4 |
| 18 | 3.3V_Out | Supply the G Patch 6222 |
| 19 | GND | Ground |
| 20 | n.c. | |

4.2 Multi Functional Purpose Pins

On each **Media Interface** module 40 MFP (Multi Functional Purpose) pins are routed. Depending on the **Media Interface** module not all MFP pins are used. The MFPs are universal IOs, which are used as GPIOs, for sideband communication or as control signals. In addition, some MFP pins are used for internal purposes only and are not intended for the user.

The MFP pins, which are available to the user without restriction, are called SerDes GPIOs and are also addressed with this function. They lead directly to the serializer or deserializer and are connected to their GPIOs. The functions of the respective SerDes GPIOs can be taken from the data sheet of the serializer or deserializer. If necessary, the serializer or deserializer must be configured accordingly.

An overview of the MFP pins of the individual **Media Interface** modules can be found in the respective chapters.

4.3 Dependence of the Input Ports of the CSI Deserializer

In the CSI deserializers used on the MAX9295A/ 96A and DS90UB953/ 954 media interface modules, the two input ports are described as dependent. This statement results from the fact that the incoming data of both ports are routed via virtual channels (VCs) to a CSI output of the deserializer IC (MAX9296A or DS90UB954). Please note that the CSI interface supports a maximum transfer rate of 10 GBit/s. Thus, although 6 GBit/s are possible on the input ports of the MAX9296A, the 10 GBit/s cannot be exceeded when using both ports.

Since for the DS90UB954 the transfer rate of the input ports is only 4.16 GBit/s, the 10 GBit/s are not reached here.

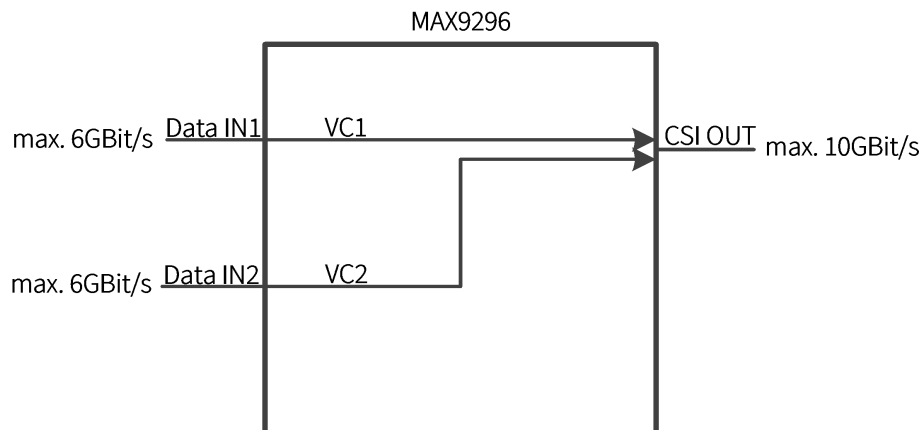


Figure 4.4: Input ports of the MAX9296A deserializer

4.4 DS90UB940 2-times

This interface module includes two deserializer ICs DS90UB940Q from Texas Instruments supporting the FPD-Link III (Flat Panel Display Link) standard.

The module has the following properties:

- Supports FPD-Link III up to 3.36 GBit/s in single-lane operation or up to 5.95 GBit/s in dual-lane operation
- 2 independent inputs (1 per DS90UB940)
- Pixel interface to mainboard: For each input 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- For display applications up to a resolution of 1920x1200 at 60 fps
- Pixel clock frequency up to 170MHz
- Sideband support for I²C
- Available as Coax and STP version

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of DS90UB953

4.4.1 MFP Pins of DS90UB940

Table 4.4: MFP pins of **Channel 1** of deserializer DS90UB940

| MFP | Signal | Function |
|-----|----------------|----------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SerDes GPIO 5 | GPIO 5 |
| 5 | SerDes GPIO 6 | GPIO 6 |
| 6 | SerDes GPIO 7 | GPIO 7 |
| 7 | SerDes GPIO 8 | GPIO 8 |
| 8 | SerDes GPIO 9 | GPIO 9 |
| 9 | SerDes GPIO 10 | D_GPIO 0 |
| 10 | SerDes GPIO 11 | D_GPIO 1 |
| 11 | SerDes GPIO 12 | D_GPIO 2 |
| 12 | SerDes GPIO 13 | D_GPIO 3 |
| 13 | SCL * | Sideband I2C * |
| 14 | SDA * | Sideband I2C * |
| 36 | DES_BISTEN_Ch1 | BIST Enable |
| 37 | DES_BISTC_Ch1 | BIST Control |

*use only after consultation with GÖPEL electronic if possible

Table 4.5: MFP pins of **Channel 2** of deserializer DS90UB940

| MFP | Signal | Function |
|-----|-----------------|----------------------|
| 15 | DES_Reset_Ch2 * | Deserializer Reset * |
| 16 | DES_Lock_Ch2 * | Deserializer Lock * |
| 17 | SerDes GPIO 0 | GPIO 0 |
| 18 | SerDes GPIO 1 | GPIO 1 |
| 19 | SerDes GPIO 2 | GPIO 2 |
| 20 | SerDes GPIO 3 | GPIO 3 |
| 21 | SerDes GPIO 5 | GPIO 5 |
| 22 | SerDes GPIO 6 | GPIO 6 |
| 23 | SerDes GPIO 7 | GPIO 7 |
| 24 | SerDes GPIO 8 | GPIO 8 |
| 25 | SerDes GPIO 9 | GPIO 9 |
| 26 | SerDes GPIO 10 | D_GPIO 0 |
| 27 | SerDes GPIO 11 | D_GPIO 1 |
| 28 | SerDes GPIO 12 | D_GPIO 2 |
| 29 | SerDes GPIO 13 | D_GPIO 3 |
| 30 | SCL * | Sideband I2C * |
| 31 | SDA * | Sideband I2C * |
| 38 | DES_BISTEN_Ch2 | BIST Enable |
| 39 | DES_BISTC_Ch2 | BIST Control |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.6: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|---------------|-----------------------|
| 34 | I2C_PATCH_EN# | only for internal use |

4.5 DS90UB947/ 948

This interface module includes the DS90UB947 serializer IC and the DS90UB948 deserializer from Texas Instruments supporting the FPD-Link III (Flat Panel Display Link) standard. The module has two inputs and one output, which means that received signals can also be forwarded. This allows the module to be connected between an existing system of transmitter and receiver without having to change the system itself.

The module has the following properties:

- Supports FPD-Link III up to 3.36 GBit/s in Single-Lane-Mode and 5.95 in Dual-Lane-Mode via 1 output port (DS90UB947) and 1 input port (DS90UB948)
- For display applications up to 2 MPixel / 60 fps or 4 MPixel / 30 fps
- Pixel clock frequency up to 170MHz (DS90UB947) and 192MHz (DS90UB948)
- Pixel interface to mainboard: dual openLDI with up to 4 lanes per interface and up to 96MHz openLDI clock
- Sideband support for I²C
- Available as STP version
- Single and dual lane mode

4.5.1 MFP Pins of DS90UB947/ 948

Table 4.7: MFP pins of deserializer DS90UB948

| MFP | Signal | Function |
|-----|---------------------|--------------------------|
| 0 | DES_BISTC / INTB_IN | BIST Control / Interrupt |
| 1 | DES_BISTEN 1 | BIST Enable |
| 2 | SerDes GPIO 10 | D_GPIO 0 |
| 3 | SerDes GPIO 11 | D_GPIO 1 |
| 4 | SerDes GPIO 12 | D_GPIO 2 |
| 5 | SerDes GPIO 13 | D_GPIO 3 |
| 6 | SerDes GPIO 0 | GPIO 0 |
| 7 | SerDes GPIO 1 | GPIO 1 |
| 8 | SerDes GPIO 2 | GPIO 2 |
| 9 | SerDes GPIO 3 | GPIO 3 |
| 10 | SerDes GPIO 5 | GPIO 5_REG |
| 11 | SerDes GPIO 6 | GPIO 6_REG |
| 12 | SerDes GPIO 7 | GPIO 7_REG |
| 13 | SerDes GPIO 8 | GPIO 8_REG |
| 14 | SerDes GPIO 9 | GPIO 9 |
| 15 | SCL * | Sideband I2C * |
| 16 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.8: MFP pins of serializer DS90UB947

| MFP | Signal | Function |
|-----|----------------|------------------|
| 17 | SER_INTB | Interrupt |
| 18 | SER_REM_INTB | Remote Interrupt |
| 19 | SerDes GPIO 10 | D_GPIO 0 |
| 20 | SerDes GPIO 11 | D_GPIO 1 |
| 21 | SerDes GPIO 12 | D_GPIO 2 |
| 22 | SerDes GPIO 13 | D_GPIO 3 |
| 23 | SerDes GPIO 0 | GPIO 0 |
| 24 | SerDes GPIO 1 | GPIO 1 |
| 25 | SerDes GPIO 2 | GPIO 2 |
| 26 | SerDes GPIO 3 | GPIO 3 |
| 27 | SerDes GPIO 5 | GPIO 5_REG |
| 28 | SerDes GPIO 6 | GPIO 6_REG |
| 29 | SerDes GPIO 7 | GPIO 7_REG |
| 30 | SerDes GPIO 8 | GPIO 8_REG |
| 31 | SCL * | Sideband I2C * |
| 32 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.9: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|--------------|-----------------------|
| 34 | I2C_PATCH_EN | only for internal use |
| 35 | I2C_BYP_EN# | only for internal use |

4.6 DS90UB953 4-times

This interface module includes four serializer ICs DS90UB953Q from Texas Instruments supporting the FPDLink III (Flat Panel Display Link) standard. The data is transmitted either in single-lane operation over one pair of lines, or in dual-lane operation over two pairs.

The module has the following properties:

- Supports FPD-Link III up to 4.16 GBit/s via 4 independent outputs (1 per DS90UB953)
- Pixel interface to mainboard: For each output 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- 1080p video resolution for camera applications up to 2 MPixel / 60 fps or 4 MPixel / 30 fps
- Sideband support for I²C
- Available as Coax version

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of DS90UB953

4.6.1 MFP Pins of DS90UB953

Table 4.10: MFP pins of **Channel 1** of serializer DS90UB953

| MFP | Signal | Function |
|-----|---------------|----------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SCL * | Sideband I2C * |
| 5 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.11: MFP pins of **Channel 2** of serializer DS90UB953

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 8 | SER_Reset_Ch2 * | Serializer Reset * |
| 9 | SerDes GPIO 0 | GPIO 0 |
| 10 | SerDes GPIO 1 | GPIO 1 |
| 11 | SerDes GPIO 2 | GPIO 2 |
| 12 | SerDes GPIO 3 | GPIO 3 |
| 13 | SCL * | Sideband I2C * |
| 14 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.12: MFP pins of **Channel 3** of serializer DS90UB953

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 17 | SER_Reset_Ch3 * | Serializer Reset * |
| 18 | SerDes GPIO 0 | GPIO 0 |
| 19 | SerDes GPIO 1 | GPIO 1 |
| 20 | SerDes GPIO 2 | GPIO 2 |
| 21 | SerDes GPIO 3 | GPIO 3 |
| 22 | SCL * | Sideband I2C * |
| 23 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.13: MFP pins of **Channel 4** of serializer DS90UB953

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 26 | SER_Reset_Ch4 * | Serializer Reset * |
| 27 | SerDes GPIO 0 | GPIO 0 |
| 28 | SerDes GPIO 1 | GPIO 1 |
| 29 | SerDes GPIO 2 | GPIO 2 |
| 30 | SerDes GPIO 3 | GPIO 3 |
| 31 | SCL * | Sideband I2C * |
| 32 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

4.7 DS90UB954 4-times

This interface module includes four deserializer ICs DS90UB954Q from Texas Instruments supporting the FPDLink III (Flat Panel Display Link) standard.

The module has the following properties:

- Supports FPD-Link III up to 4.16 GBit/s over 4 input ports (DS90UB954Q)
- Pixel interface to the mainboard: For each input 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- 1080p video resolution for camera applications up to 2 MPixel / 60 fps or 4 MPixel / 30 fps
- Sideband support for I²C
- Available as Coax version

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of DS90UB953

4.7.1 MFP Pins of DS90UB954

Table 4.14: MFP pins of **Channel 1** of deserializer DS90UB954

| MFP | Signal | Function |
|-----|---------------|----------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SerDes GPIO 4 | GPIO 4 |
| 5 | SerDes GPIO 5 | GPIO 5 |
| 6 | SCL * | Sideband I2C * |
| 7 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.15: MFP pins of **Channel 2** of deserializer DS90UB954

| MFP | Signal | Function |
|-----|-----------------|----------------------|
| 8 | DES_Reset_Ch2 * | Deserializer Reset * |
| 9 | DES_Lock_Ch2 * | Deserializer Lock * |
| 10 | SerDes GPIO 0 | GPIO 0 |
| 11 | SerDes GPIO 1 | GPIO 1 |
| 12 | SerDes GPIO 2 | GPIO 2 |
| 13 | SerDes GPIO 3 | GPIO 3 |
| 14 | SerDes GPIO 4 | GPIO 4 |
| 15 | SerDes GPIO 5 | GPIO 5 |
| 16 | SCL * | Sideband I2C * |
| 17 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.16: MFP pins of **Channel 3** of deserializer DS90UB954

| MFP | Signal | Function |
|-----|-----------------|----------------------|
| 18 | DES_Reset_Ch3 * | Deserializer Reset * |
| 19 | DES_Lock_Ch3 * | Deserializer Lock * |
| 20 | SerDes GPIO 0 | GPIO 0 |
| 21 | SerDes GPIO 1 | GPIO 1 |
| 22 | SerDes GPIO 2 | GPIO 2 |
| 23 | SerDes GPIO 3 | GPIO 3 |
| 24 | SerDes GPIO 4 | GPIO 4 |
| 25 | SerDes GPIO 5 | GPIO 5 |
| 26 | SCL * | Sideband I2C * |
| 27 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.17: MFP pins of **Channel 4** of deserializer DS90UB954

| MFP | Signal | Function |
|-----|-----------------|----------------------|
| 28 | DES_Reset_Ch4 * | Deserializer Reset * |
| 29 | DES_Lock_Ch4 * | Deserializer Lock * |
| 30 | SerDes GPIO 0 | GPIO 0 |
| 31 | SerDes GPIO 1 | GPIO 1 |
| 32 | SerDes GPIO 2 | GPIO 2 |
| 33 | SerDes GPIO 3 | GPIO 3 |
| 35 | SerDes GPIO 4 | GPIO 4 |
| 36 | SerDes GPIO 5 | GPIO 5 |
| 37 | SCL * | Sideband I2C * |
| 38 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

4.8 DS90UB953/ 954

This interface module includes the DS90UB953Q serializer IC and the DS90UB954Q deserializer from Texas Instruments supporting the FPD-Link III (Flat Panel Display Link) standard. The module has two inputs and one output, which means that received signals can also be forwarded. This allows the module to be connected between an existing system of transmitter and receiver without having to change the system itself.

The module has the following properties:

- Supports FPD-Link III up to 4.16 GBit/s via 1 output port (DS90UB953Q) and 2 dependent input ports (DS90UB954Q)
- Pixel interface to mainboard: For input and output 4 lanes each MIPI CSI-2 up to 1.5 GBit/s per lane
- 1080p video resolution for camera applications up to 2 MPixel / 60 fps or 4 MPixel / 30 fps
- Sideband support for I²C
- Available as Coax and STP version

The following connectors are used for the Coax version:

- 1x AMS29B-40MZ5-Z from Rosenberger for the 2 channels of DS90UB954
- 1x AMS29A-40MZ5-Z from Rosenberger for the 1 channel of DS90UB953

4.8.1 MFP Pins of DS90UB953/ 954

Table 4.18: MFP pins of deserializer DS90UB954

| MFP | Signal | Function |
|-----|---------------|----------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SerDes GPIO 4 | GPIO 4 |
| 5 | SerDes GPIO 5 | GPIO 5 |
| 6 | SerDes GPIO 6 | GPIO 6 |
| 7 | BIST_EN | BIST Enable |
| 8 | PASS | BIST PASS |
| 9 | SCL * | Sideband I2C * |
| 10 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.19: MFP pins of serializer DS90UB953

| MFP | Signal | Function |
|-----|---------------|----------------|
| 11 | SCL * | Sideband I2C * |
| 12 | SDA * | Sideband I2C * |
| 13 | SerDes GPIO 0 | GPIO 0 |
| 14 | SerDes GPIO 1 | GPIO 1 |
| 15 | SerDes GPIO 2 | GPIO 2 |
| 16 | SerDes GPIO 3 | GPIO 3 |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.20: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|---------------|-----------------------|
| 17 | I2C_BYP_EN# | only for internal use |
| 34 | I2C_PATCH_EN# | only for internal use |

4.9 DS90UB9702

This interface module includes the deserializer IC DS90UB9702 from Texas Instruments supporting the FPD-Link IV (Flat Panel Display Link) standard.

The module has the following properties:

- Supports FPD-Link IV up to 7.55 GBit/s in single-lane-mode
- 4 **dependent** inputs
- Pixel interface to mainboard: All 4 inputs share 2 MIPI CSI-2 ports with 4 lanes each up to 1.5 GBit/s per lane
- For camera applications up to 3840 x 2160 resolution at 30 fps with 24 bit color depth
- Sideband support for I²C
- Available as Coax version
- Backward compatible to FPD-Link III

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 2 channels of DS90UB9702

4.9.1 MFP Pins of DS90UB9702

Table 4.21: MFP pins of deserializer DS90UB9702

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 / INTB |
| 4 | SerDes GPIO 4 * | GPIO 4 / Lock * |
| 5 | SerDes GPIO 5 | GPIO 5 |
| 6 | SerDes GPIO 6 | GPIO 6 |
| 7 | SerDes GPIO 7 | GPIO 7 |
| 9 | I2C_SCL1 | GPIO 9 / I2C_SCL1 |
| 10 | I2C_SDA1 | GPIO 10 / I2C_SDA1 |
| 11 | I2C_SCL0 * | Sideband I2C * |
| 12 | I2C_SDA0 * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

4.10 DS90UB971 4-times

This interface module includes four serializer ICs DS90UB971 from Texas Instruments supporting the FPD-Link IV (Flat Panel Display Link) standard.

The module has the following properties:

- Supports FPD-Link IV up to 7.55 GBit/s via 4 independent outputs (DS90UB971)
- Pixel interface to mainboard: For each output 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- For camera applications with resolutions of about 8 MP
- Sideband support for I²C
- Available as Coax version
- Backward compatible to FPD-Link III

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of DS90UB971

4.10.1 MFP Pins of DS90UB971

Table 4.22: MFP pins of **Channel 1** of serializer DS90UB971

| MFP | Signal | Function |
|-----|---------------|----------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SCL * | Sideband I2C * |
| 5 | SDA * | Sideband I2C * |

*use only after consultation with GÖPEL electronic if possible

Table 4.23: MFP pins of **Channel 2** of serializer DS90UB971

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 8 | SER_Reset_Ch2 * | Serializer Reset * |
| 9 | SerDes GPIO 0 | GPIO 0 |
| 10 | SerDes GPIO 1 | GPIO 1 |
| 11 | SerDes GPIO 2 | GPIO 2 |
| 12 | SerDes GPIO 3 | GPIO 3 |
| 13 | SCL * | Sideband I2C * |
| 14 | SDA * | Sideband I2C * |

*use only after consultation with GÖPEL electronic if possible

Table 4.24: MFP pins of **Channel 3** of serializer DS90UB971

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 17 | SER_Reset_Ch3 * | Serializer Reset * |
| 18 | SerDes GPIO 0 | GPIO 0 |
| 19 | SerDes GPIO 1 | GPIO 1 |
| 20 | SerDes GPIO 2 | GPIO 2 |
| 21 | SerDes GPIO 3 | GPIO 3 |
| 22 | SCL * | Sideband I2C * |
| 23 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.25: MFP pins of **Channel 4** of serializer DS90UB971

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 26 | SER_Reset_Ch4 * | Serializer Reset * |
| 27 | SerDes GPIO 0 | GPIO 0 |
| 28 | SerDes GPIO 1 | GPIO 1 |
| 29 | SerDes GPIO 2 | GPIO 2 |
| 30 | SerDes GPIO 3 | GPIO 3 |
| 31 | SCL * | Sideband I2C * |
| 32 | SDA * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

4.11 DS90UB981 2-times

This interface module includes two serializer ICs DS90UB981 from Texas Instruments supporting the FPD-Link IV (Flat Panel Display Link) standard.

The module has the following properties:

- Supports FPD-Link IV up to 10.8 GBit/s in single-lane-mode or up to 21.6 GBit/s in dual-lane-mode
- 2 independent inputs (1 per DS90UB981)
- Pixel interface to mainboard: For each input 4 lanes MIPI DSI-2 1.5 GBit/s per lane
- For display applications up to a resolution of 3840 x 2160 at 30 fps with 24 bit color depth
- Pixel clock frequency up to 300 MHz
- Sideband support for I²C
- Available as STP version
- Backward compatible to FPD-Link III

4.11.1 MFP Pins of DS90UB981

Table 4.26: MFP pins of **Channel 1** of serializer DS90UB981

| MFP | Signal | Function |
|-----|----------------|------------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SerDes GPIO 4 | GPIO 4 |
| 5 | SerDes GPIO 5 | GPIO 5 |
| 6 | SerDes GPIO 6 | GPIO 6 |
| 7 | SerDes GPIO 7 | GPIO 7 |
| 8 | SerDes GPIO 8 | GPIO 8 |
| 9 | SerDes GPIO 9 | GPIO 9 |
| 10 | SerDes GPIO 10 | GPIO 10 |
| 11 | SerDes GPIO 11 | GPIO 11 |
| 12 | SerDes GPIO 12 | GPIO 12 |
| 13 | SerDes GPIO 13 | GPIO 13 |
| 14 | INTB_OUT | Interrupt Output |
| 15 | I2C_SCL0 * | Sideband I2C * |
| 16 | I2C_SDA0 * | Sideband I2C * |

*use only after consultation with GÖPEL electronic if possible

Table 4.27: MFP pins of **Channel 2** of serializer DS90UB981

| MFP | Signal | Function |
|-----|-----------------|--------------------|
| 19 | SER_Reset_Ch2 * | Serializer Reset * |
| 20 | SerDes GPIO 0 | GPIO 0 |
| 21 | SerDes GPIO 1 | GPIO 1 |
| 22 | SerDes GPIO 2 | GPIO 2 |
| 23 | SerDes GPIO 3 | GPIO 3 |
| 24 | SerDes GPIO 4 | GPIO 4 |
| 25 | SerDes GPIO 5 | GPIO 5 |
| 26 | SerDes GPIO 6 | GPIO 6 |
| 27 | SerDes GPIO 7 | GPIO 7 |
| 28 | SerDes GPIO 8 | GPIO 8 |
| 29 | SerDes GPIO 9 | GPIO 9 |
| 30 | SerDes GPIO 10 | GPIO 10 |
| 31 | SerDes GPIO 11 | GPIO 11 |
| 32 | SerDes GPIO 12 | GPIO 12 |
| 33 | SerDes GPIO 13 | GPIO 13 |
| 35 | INTB_OUT | Interrupt Output |
| 36 | I2C_SCL0 * | Sideband I2C * |
| 37 | I2C_SDA0 * | Sideband I2C * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.28: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|--------------|-----------------------|
| 34 | I2C_Patch_En | only for internal use |

4.12 DS90UB988 2-times

This interface module includes two deserializer ICs DS90UB988Q from Texas Instruments supporting the FPD-Link IV (Flat Panel Display Link) standard.

The module has the following properties:

- Supports FPD-Link IV up to 13.5 GBit/s in single-lane-mode or up to 27.0 GBit/s in dual-lane-mode
- 2 independent inputs (1 per DS90UB988) and 2 daisy-chain outputs (1 per DS90UB988) for forwarding the input data
- For display applications up to 4k resolution at 30fps
- Pixel interface to mainboard: dual openLDI with up to 5 lanes per interface and up to 150 MHz openLDI clock
- Pixel clock frequency up to 300 MHz
- Sideband support for I²C
- Available as STP version
- Backward compatible to FPD-Link III

4.12.1 MFP Pins of DS90UB988

Table 4.29: MFP pins of **Channel 1** of deserializer DS90UB988

| MFP | Signal | Function |
|-----|-------------------|--------------------------|
| 0 | SerDes GPIO 0 | GPIO 0 |
| 1 | SerDes GPIO 1 | GPIO 1 |
| 2 | SerDes GPIO 2 | GPIO 2 |
| 3 | SerDes GPIO 3 | GPIO 3 |
| 4 | SerDes GPIO 4 | GPIO 4 |
| 5 | SerDes GPIO 5 | GPIO 5 |
| 6 | SerDes GPIO 6 | GPIO 6 * |
| 7 | SerDes GPIO 7 | GPIO 7 |
| 8 | SerDes GPIO 8 | GPIO 8 |
| 9 | WakeUp_Ctrl_Ch1 * | Wake Up Control Output * |
| 10 | WakeUp_Det_Ch1 * | Wake Up Detect Input * |
| 11 | SerDes GPIO 11 | GPIO 11 |
| 12 | SerDes GPIO 12 | GPIO 12 |
| 13 | SerDes GPIO 13 | GPIO 13 |
| 14 | INTB_IN | Interrupt Input |
| 15 | SCL0 * | Sideband I2C * |
| 16 | SDA0 * | Sideband I2C * |
| 17 | SCL1 | Sideband I2C |
| 18 | SDA1 | Sideband I2C |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.30: MFP pins of **Channel 2** of deserializer DS90UB988

| MFP | Signal | Function |
|-----|-------------------|--------------------------|
| 19 | SER_Reset_Ch2 * | Serializer Reset * |
| 20 | SerDes GPIO 0 | GPIO 0 |
| 21 | SerDes GPIO 1 | GPIO 1 |
| 22 | SerDes GPIO 2 | GPIO 2 |
| 23 | SerDes GPIO 3 | GPIO 3 |
| 24 | SerDes GPIO 4 | GPIO 4 |
| 25 | SerDes GPIO 5 | GPIO 5 |
| 26 | SerDes GPIO 6 | GPIO 6 * |
| 27 | SerDes GPIO 7 | GPIO 7 |
| 28 | SerDes GPIO 8 | GPIO 8 |
| 29 | WakeUp_Ctrl_Ch2 * | Wake Up Control Output * |
| 30 | WakeUp_Det_Ch2 * | Wake Up Detect Input * |
| 31 | SerDes GPIO 11 | GPIO 11 |
| 32 | SerDes GPIO 12 | GPIO 12 |
| 33 | SerDes GPIO 13 | GPIO 13 |
| 35 | INTB_IN | Interrupt Input |
| 36 | SCL0 * | Sideband I2C * |
| 37 | SDA0 * | Sideband I2C * |
| 38 | SCL1 | Sideband I2C |
| 39 | SDA1 | Sideband I2C |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.31: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|--------------|-----------------------|
| 34 | I2C_Patch_En | only for internal use |

4.13 INAP562T/ 562R

This interface module includes the INAP562T serializer IC and the INAP562R deserializer from Inova Semiconductors supporting the APIX3 (Automotive Pixel Link) standard. The module has one input and one output, which means that received signals can also be forwarded. This allows the module to be connected between an existing system of transmitter and receiver without having to change the system itself.

The data is transmitted either in single-lane operation over one pair of lines, or in dual-lane operation over 2 pairs.

The module has the following properties:

- Supports APIX3 up to 6 GBit/s in single-lane operation or up to 12 GBit/s in dual-lane operation
- 1 output (INAP562T) and 1 input (INAP562R)
- UHD video resolution and pixel clock frequency up to 340 MHz
- Sideband support for SPI and MII(Ethernet) up to 100 MBit/s
- Decoupling of the MII(Ethernet) sideband possible via **G Patch 6222** STP Var. 1
- Available as STP version
- Backward compatible to APIX2

4.13.1 MFP Pins of INAP562T/ 562R

Table 4.32: MFP pins of deserializer INAP562R

| MFP | Signal | Function |
|-----|---------------|------------------|
| 0 | SPI_S_CS 0 * | SPI Slave CS 0 * |
| 1 | SPI_S_CS 2 * | SPI Slave CS 2 * |
| 2 | SPI_S_SCK * | SPI Slave SCK * |
| 3 | SPI_S_SDI * | SPI Slave SDI * |
| 13 | SerDes GPIO 0 | AP 00 |
| 14 | SerDes GPIO 1 | AP 01 |
| 15 | SerDes GPIO 2 | AP 10 |
| 16 | SerDes GPIO 3 | AP 11 |
| 36 | SPI_S_SDO * | SPI Slave SDO * |
| 39 | DES_Touch_INT | |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.33: MFP pins of serializer INAP562T

| MFP | Signal | Function |
|-----|---------------|-------------------|
| 7 | SPI_M_CS 1 * | SPI Master CS 1 * |
| 8 | SPI_S_CS 0 * | SPI Slave CS 0 * |
| 9 | SPI_S_CS 1 * | SPI Slave CS 1 * |
| 10 | SPI_S_CS 2 * | SPI Slave CS 2 * |
| 11 | SPI_S_SCK * | SPI Slave SCK * |
| 12 | SPI_S_SDI * | SPI Slave SDI * |
| 17 | SerDes GPIO 0 | AP 00 |
| 18 | SerDes GPIO 1 | AP 01 |
| 19 | SerDes GPIO 2 | AP 10 |
| 20 | SerDes GPIO 3 | AP 11 |
| 37 | SPI_S_SDO * | SPI Slave SDO * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.34: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 4 | RGMII_MB_TX_D2 | only for internal use |
| 5 | SPI_OE | only for internal use |
| 6 | SPI_SW | only for internal use |
| 21 | FPGA_SPI_CS | only for internal use |
| 22 | FPGA_SPI_MOSI | only for internal use |
| 23 | FPGA_SPI_CLK | only for internal use |
| 24 | RGMII_MB_RX_CLK | only for internal use |
| 25 | RGMII_MB_RX_CTL | only for internal use |
| 26 | RGMII_MB_RX_D0 | only for internal use |
| 27 | RGMII_MB_RX_D1 | only for internal use |
| 28 | RGMII_MB_RX_D2 | only for internal use |
| 29 | RGMII_MB_RX_D3 | only for internal use |
| 30 | RGMII_MB_TX_CLK | only for internal use |
| 31 | RGMII_MB_TX_CTL | only for internal use |
| 32 | RGMII_MB_TX_D0 | only for internal use |
| 33 | RGMII_MB_TX_D1 | only for internal use |
| 34 | I2C_PATCH_EN | only for internal use |
| 35 | RGMII_MB_TX_D3 | only for internal use |
| 38 | FPGA_SPI_MISO | only for internal use |

4.14 MAX9295A 4-times

This interface module includes four serializer ICs MAX9295A from Analog Devices supporting the GMSL2 (Gigabit Multimedia Serial Link) standard. The data is transmitted either in single-lane operation over one pair of lines, or in dual-lane operation over two pairs.

The module has the following properties:

- Supports GMSL2 to 6 GBit/s via 4 independent outputs
- Pixel interface to mainboard: For each output 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- Sideband support for I²C or UART
- Available as Coax version

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of MAX9295A

4.14.1 MFP Pins of MAX9295A

Table 4.35: MFP pins of **Channel 1** of serializer MAX9295A

| MFP | Signal | Function |
|-----|---------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 3 | MFP 3 |
| 2 | SerDes GPIO 4 | MFP 4 |
| 3 | SerDes GPIO 5 | MFP 5 |
| 4 | SerDes GPIO 6 | MFP 6 |
| 5 | SerDes GPIO 7 | MFP 7 |
| 6 | SerDes GPIO 8 | MFP 8 |
| 7 | SCL / TX * | Sideband I2C / UART * |
| 8 | SDA / RX * | Sideband I2C / UART * |

*use only after consultation with GÖPEL electronic if possible

Table 4.36: MFP pins of **Channel 2** of serializer MAX9295A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 9 | SER_Reset_Ch2 * | Serializer Reset * |
| 10 | SerDes GPIO 0 | MFP 0 |
| 11 | SerDes GPIO 3 | MFP 3 |
| 12 | SerDes GPIO 4 | MFP 4 |
| 13 | SerDes GPIO 5 | MFP 5 |
| 14 | SerDes GPIO 6 | MFP 6 |
| 15 | SerDes GPIO 7 | MFP 7 |
| 16 | SerDes GPIO 8 | MFP 8 |
| 17 | SDA / RX * | Sideband I2C / UART * |
| 18 | SCL / TX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.37: MFP pins of **Channel 3** of serializer MAX9295A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 19 | SER_Reset_Ch3 * | Serializer Reset * |
| 20 | SerDes GPIO 0 | MFP 0 |
| 21 | SerDes GPIO 3 | MFP 3 |
| 22 | SerDes GPIO 4 | MFP 4 |
| 23 | SerDes GPIO 5 | MFP 5 |
| 24 | SerDes GPIO 6 | MFP 6 |
| 25 | SerDes GPIO 7 | MFP 7 |
| 26 | SerDes GPIO 8 | MFP 8 |
| 27 | SDA / RX * | Sideband I2C / UART * |
| 28 | SCL / TX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.38: MFP pins of **Channel 4** of serializer MAX9295A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 29 | SER_Reset_Ch4 * | Serializer Reset * |
| 30 | SerDes GPIO 0 | MFP 0 |
| 31 | SerDes GPIO 3 | MFP 3 |
| 32 | SerDes GPIO 4 | MFP 4 |
| 33 | SerDes GPIO 5 | MFP 5 |
| 34 | SerDes GPIO 6 | MFP 6 |
| 35 | SerDes GPIO 7 | MFP 7 |
| 36 | SerDes GPIO 8 | MFP 8 |
| 37 | SDA / RX * | Sideband I2C / UART * |
| 38 | SCL / TX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

4.15 MAX9296A 4-times

This interface module includes four deserializer ICs MAX9296A from Analog Devices supporting the GMSL1 and GMSL2 (Gigabit Multimedia Serial Link) standard.

The module has the following properties:

- Supports GMSL2 to 6 GBit/s
- Pixel interface to mainboard: For each input 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- Sideband support for I²C or UART
- Available as Coax and STP version
- Backward compatible to GMSL1

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of MAX9296A

4.15.1 MFP Pins of MAX9296A

Table 4.39: MFP pins of **Channel 1** of deserializer MAX9296A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 2 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 3 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 4 | SerDes GPIO 4 | MFP 4 |
| 5 | SerDes GPIO 5 | MFP 5 |
| 6 | SerDes GPIO 6 | MFP 6 |
| 7 | SCL / TX * | Sideband I2C / UART * |
| 8 | SDA / RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.40: MFP pins of **Channel 2** of deserializer MAX9296A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 9 | DES_Reset_Ch2 * | Deserializer Reset * |
| 10 | SerDes GPIO 0 | MFP 0 |
| 11 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 12 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 13 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 14 | SerDes GPIO 4 | MFP 4 |
| 15 | SerDes GPIO 5 | MFP 5 |
| 16 | SerDes GPIO 6 | MFP 6 |
| 17 | SCL / TX * | Sideband I2C / UART * |
| 18 | SDA / RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.41: MFP pins of **Channel 3** of deserializer MAX9296A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 19 | DES_Reset_Ch3 * | Deserializer Reset * |
| 20 | SerDes GPIO 0 | MFP 0 |
| 21 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 22 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 23 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 24 | SerDes GPIO 4 | MFP 4 |
| 25 | SerDes GPIO 5 | MFP 5 |
| 26 | SerDes GPIO 6 | MFP 6 |
| 27 | SCL / TX * | Sideband I2C / UART * |
| 28 | SDA / RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.42: MFP pins of **Channel 4** of deserializer MAX9296A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 29 | DES_Reset_Ch4 * | Deserializer Reset * |
| 30 | SerDes GPIO 0 | MFP 0 |
| 31 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 32 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 33 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 34 | SerDes GPIO 4 | MFP 4 |
| 35 | SerDes GPIO 5 | MFP 5 |
| 36 | SerDes GPIO 6 | MFP 6 |
| 37 | SCL / TX * | Sideband I2C / UART * |
| 38 | SDA / RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

4.16 MAX9295A/ 96A

This interface module includes the MAX9295A serializer IC and the MAX9296A deserializer from Analog Devices supporting the GMSL2 (Gigabit Multimedia Serial Link) standard. The module has two inputs and one output, which means that received signals can also be forwarded. This allows the module to be connected between an existing system of transmitter and receiver without having to change the system itself.

The module has the following properties:

- Supports GMSL2 to 6 GBit/s via 1 output port (MAX9295A) and 2 [dependent](#) input ports (MAX9296A)
- Pixel interface to mainboard: For input and output 4 lanes each MIPI CSI-2 up to 1.5 GBit/s per lane
- Sideband support for I²C or UART
- Available as Coax and STP version

The following connectors are used for the Coax version:

- 1x AMS29B-40MZ5-Z from Rosenberger for the 2 channels of MAX9296A
- 1x AMS29A-40MZ5-Z from Rosenberger for the 1 channel of MAX9295A

4.16.1 MFP Pins of MAX9295A/ 96A

Table 4.43: MFP pins of deserializer MAX9296A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 2 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 3 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 4 | SerDes GPIO 4 | MFP 4 |
| 5 | SerDes GPIO 5 | MFP 5 |
| 6 | SerDes GPIO 6 | MFP 6 |
| 7 | SerDes GPIO 7 | MFP 7 |
| 8 | SerDes GPIO 8 | MFP 8 |
| 9 | SerDes GPIO 9 | MFP 9 |
| 10 | SerDes GPIO 10 | MFP 10 |
| 11 | SDA / RX * | Sideband I2C / UART * |
| 12 | SCL / TX * | Sideband I2C / UART * |

*use only after consultation with GÖPEL electronic if possible

Table 4.44: MFP pins of serializer MAX9295A

| MFP | Signal | Function |
|-----|-----------------|-----------------------|
| 16 | SerDes GPIO 0 | MFP 0 |
| 17 | SerDes GPIO 1 * | MFP 1 / CFG 0 * |
| 18 | SerDes GPIO 2 * | MFP 2 / CFG 1 * |
| 19 | SerDes GPIO 3 | MFP 3 |
| 20 | SerDes GPIO 4 | MFP 4 |
| 21 | SerDes GPIO 5 | MFP 5 |
| 22 | SerDes GPIO 6 | MFP 6 |
| 23 | SerDes GPIO 7 | MFP 7 |
| 24 | SerDes GPIO 8 | MFP 8 |
| 25 | SDA / RX * | Sideband I2C / UART * |
| 26 | SCL / TX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.45: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|------------------|-----------------------|
| 30 | I2C_UART_BYP_EN# | only for internal use |
| 31 | I2C_UART_SW | only for internal use |
| 32 | I2C_1_BYP_EN# | only for internal use |
| 34 | I2C_PATCH_EN | only for internal use |

4.17 MAX96714 4-times

This interface module includes four deserializer ICs MAX96714 from Analog Devices supporting the GMSL1 and GMSL2 (Gigabit Multimedia Serial Link) standard.

The module has the following properties:

- Supports GMSL2 to 6 GBit/s, GMSL RoR and CSI Tunneling
- Pixel interface to mainboard: For each input 4 lanes MIPI CSI-2 up to 1.5 GBit/s per lane
- Sideband support for I²C
- Available as Coax version
- Backward compatible to GMSL1

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 4 channels of MAX9296A

4.17.1 MFP Pins of MAX96714

Table 4.46: MFP pins of **Channel 1** of deserializer MAX96714

| MFP | Signal | Funktion |
|-----|-----------------|----------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 1 | MFP 1 |
| 2 | SerDes GPIO 2 | MFP 2 |
| 3 | SDA * | Sideband I2C * |
| 4 | SCL * | Sideband I2C * |
| 5 | SerDes GPIO 5 * | MFP 5 * |
| 6 | SerDes GPIO 6 | MFP 6 |
| 7 | SerDes GPIO 7 | MFP 7 |
| 8 | SerDes GPIO 8 | MFP 8 |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.47: MFP pins of **Channel 2** of deserializer MAX96714

| MFP | Signal | Funktion |
|-----|-----------------|----------------------|
| 9 | DES_Reset_Ch2 * | Deserializer Reset * |
| 10 | SerDes GPIO 0 | MFP 0 |
| 11 | SerDes GPIO 1 | MFP 1 |
| 12 | SerDes GPIO 2 | MFP 2 |
| 13 | SDA * | Sideband I2C * |
| 14 | SCL * | Sideband I2C * |
| 15 | SerDes GPIO 5 * | MFP 5 * |
| 16 | SerDes GPIO 6 | MFP 6 |
| 17 | SerDes GPIO 7 | MFP 7 |
| 18 | SerDes GPIO 8 | MFP 8 |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.48: MFP pins of **Channel 3** of deserializer MAX96714

| MFP | Signal | Funktion |
|-----|-----------------|----------------------|
| 19 | DES_Reset_Ch3 * | Deserializer Reset * |
| 20 | SerDes GPIO 0 | MFP 0 |
| 21 | SerDes GPIO 1 | MFP 1 |
| 22 | SerDes GPIO 2 | MFP 2 |
| 23 | SDA * | Sideband I2C * |
| 24 | SCL * | Sideband I2C * |
| 25 | SerDes GPIO 5 * | MFP 5 * |
| 26 | SerDes GPIO 6 | MFP 6 |
| 27 | SerDes GPIO 7 | MFP 7 |
| 28 | SerDes GPIO 8 | MFP 8 |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.49: MFP pins of **Channel 4** of deserializer MAX96714

| MFP | Signal | Function |
|-----|-----------------|----------------------|
| 29 | DES_Reset_Ch4 * | Deserializer Reset * |
| 30 | SerDes GPIO 0 | MFP 0 |
| 31 | SerDes GPIO 1 | MFP 1 |
| 32 | SerDes GPIO 2 | MFP 2 |
| 33 | SDA * | Sideband I2C * |
| 35 | SCL * | Sideband I2C * |
| 36 | SerDes GPIO 5 * | MFP 5 * |
| 37 | SerDes GPIO 6 | MFP 6 |
| 38 | SerDes GPIO 7 | MFP 7 |
| 39 | SerDes GPIO 8 | MFP 8 |

*use only after consultation with **GÖPEL electronic** if possible

4.18 MAX96737/ 760

This interface module includes the MAX96737A serializer IC and the MAX96760 deserializer from Analog Devices, which support the GMSL2 (Gigabit Multimedia Serial Link) standard. The module has an input and an output, which means that received signals can also be forwarded. This allows the module to be connected between an existing system of transmitter and receiver without having to change the system itself.

The module has the following properties:

- Supports GMSL2 to 6 GBit/s via 1 output port (MAX96737A) and 1 input port (MAX96760)
- Pixel interface to the mainboard: One dual openLDI interface (2x 4 lanes) with up to 150MHz openLDI clock for input and output
- Pixel clock frequency up to 215MHz on the MAX96737 and 300MHz on the MAX96760
- Für Displayanwendungen bis zu einer Auflösung von 2880 x 1080 bei 60 fps bei 24 bit Farbtiefe
- Sideband support for I²C or UART
- Available as Coax and STP version

The following connectors are used for the Coax version:

- 1x AMS29A-40MZ5-Z from Rosenberger for the output channel of MAX96737A
- 1x AMS29A-40MZ5-Z from Rosenberger for the input channel of MAX96760

4.18.1 MFP Pins of MAX96737/ 760

Table 4.50: MFP pins of deserializer MAX96760

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 1 | MFP 1 |
| 2 | SerDes GPIO 2 | MFP 2 |
| 3 | SerDes GPIO 4 | MFP 4 |
| 4 | SerDes GPIO 5 | MFP 5 |
| 5 | SerDes GPIO 6 * | MFP 6 / CFG 0 * |
| 6 | SerDes GPIO 8 * | MFP 8 / Lock * |
| 7 | SerDes GPIO 9 | MFP 9 |
| 8 | SerDes GPIO 10 * | MFP 10 / CFG 1 * |
| 9 | SerDes GPIO 11 | MFP 11 |
| 10 | SerDes GPIO 16 | MFP 16 |
| 11 | SerDes GPIO 17 | MFP 17 |
| 12 | SerDes GPIO 18 | MFP 18 |
| 13 | SerDes GPIO 19 | MFP 19 |
| 14 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 15 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.51: MFP pins of serializer MAX96737A

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 16 | SerDes GPIO 0 | MFP 0 |
| 17 | SerDes GPIO 1 | MFP 1 |
| 18 | SerDes GPIO 2 | MFP 2 |
| 19 | SerDes GPIO 4 | MFP 4 |
| 20 | SerDes GPIO 5 | MFP 5 |
| 21 | SerDes GPIO 6 * | MFP 6 / CFG 0 * |
| 22 | SerDes GPIO 7 * | MFP 7 / CFG 1 * |
| 23 | SerDes GPIO 9 | MFP 9 |
| 24 | SerDes GPIO 10 * | MFP 10 / CFG 2 * |
| 25 | SerDes GPIO 11 * | MFP 11 / LMN 0 * |
| 26 | SerDes GPIO 12 * | MFP 12 / LMN 1 * |
| 27 | SerDes GPIO 13 | MFP 13 |
| 28 | SerDes GPIO 14 | MFP 14 |
| 29 | SerDes GPIO 15 | MFP 15 |
| 30 | SerDes GPIO 16 | MFP 16 |
| 31 | SerDes GPIO 17 | MFP 17 |
| 32 | SerDes GPIO 18 | MFP 18 |
| 33 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 34 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.52: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|------------------|-----------------------|
| 35 | I2C_UART_BYP_EN# | only for internal use |
| 36 | I2C_UART_1_SW | only for internal use |
| 37 | I2C_UART_BYP_EN# | only for internal use |
| 38 | I2C_UART_SW | only for internal use |
| 39 | I2C_PATCH_EN | only for internal use |

4.19 MAX96792 4-times

This interface module includes four MAX96792 deserializer ICs from Analog Devices, which support the GMSL3 (Gigabit Multimedia Serial Link) standard.

The module has the following properties:

- Supports GMSL3 up to 12 GBit/s over 4 independent inputs
- Pixel interface to mainboard: For each input one MIPI CSI-2 port with 4 lanes up to 1.5 GBit/s per lane
- For camera applications up to 3840 x 2160 resolution at 30 fps with 24 bit color depth
- Pixel clock frequency up to 300 MHz depending on color depth
- Sideband support for I²C or UART
- Available as Coax version
- Backward compatible to GMSL2

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 2 channels of MAX96792

4.19.1 MFP Pins of MAX96792

Table 4.53: MFP pins of **Channel 1** of deserializer MAX96792

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 2 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 3 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 4 | SerDes GPIO 4 | MFP 4 |
| 5 | SerDes GPIO 5 | MFP 5 |
| 6 | SerDes GPIO 6 | MFP 6 |
| 7 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 8 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.54: MFP pins of **Channel 2** of deserializer MAX96792

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 9 | DES_Reset_Ch2 * | Deserializer Reset * |
| 10 | SerDes GPIO 0 | MFP 0 |
| 11 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 12 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 13 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 14 | SerDes GPIO 4 | MFP 4 |
| 15 | SerDes GPIO 5 | MFP 5 |
| 16 | SerDes GPIO 6 | MFP 6 |
| 17 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 18 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.55: MFP pins of **Channel 3** of deserializer MAX96792

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 19 | DES_Reset_Ch3 * | Deserializer Reset * |
| 20 | SerDes GPIO 0 | MFP 0 |
| 21 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 22 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 23 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 24 | SerDes GPIO 4 | MFP 4 |
| 25 | SerDes GPIO 5 | MFP 5 |
| 26 | SerDes GPIO 6 | MFP 6 |
| 27 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 28 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.56: MFP pins of **Channel 4** of deserializer MAX96792

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 29 | DES_Reset_Ch4 * | Deserializer Reset * |
| 30 | SerDes GPIO 0 | MFP 0 |
| 31 | SerDes GPIO 1 * | MFP 1 / Lock * |
| 32 | SerDes GPIO 2 * | MFP 2 / CFG 0 * |
| 33 | SerDes GPIO 3 * | MFP 3 / CFG 1 * |
| 34 | SerDes GPIO 4 | MFP 4 |
| 35 | SerDes GPIO 5 | MFP 5 |
| 36 | SerDes GPIO 6 | MFP 6 |
| 37 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 38 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

4.20 MAX96793 4-times

This interface module includes four MAX96793 serializer ICs from Analog Devices, which support the GMSL3 (Gigabit Multimedia Serial Link) standard.

The module has the following properties:

- Supports GMSL3 up to 12 GBit/s over 4 independent outputs
- Pixel interface to mainboard: For each output one MIPI CSI-2 port with 4 lanes up to 1.5 GBit/s per lane
- For camera applications up to 3840 x 2160 resolution at 30 fps with 24 bit color depth
- Pixel clock frequency up to 300 MHz depending on color depth
- Sideband support for I²C or UART
- Available as Coax version
- Backward compatible to GMSL2

The following connectors are used for the Coax version:

- 2x AMS29B-40MZ5-Z from Rosenberger for the 2 channels of MAX96793

4.20.1 MFP Pins of MAX96793

Table 4.57: MFP pins of **Channel 1** of serializer MAX96793

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 3 | MFP 3 |
| 2 | SerDes GPIO 4 | MFP 4 |
| 3 | SerDes GPIO 5 | MFP 5 |
| 4 | SerDes GPIO 6 | MFP 6 |
| 5 | SerDes GPIO 7 | MFP 7 |
| 6 | SerDes GPIO 8 | MFP 8 |
| 7 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 8 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with GÖPEL electronic if possible

Table 4.58: MFP pins of **Channel 2** of serializer MAX96793

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 9 | SER_Reset_Ch2 * | Serializer Reset * |
| 10 | SerDes GPIO 0 | MFP 0 |
| 11 | SerDes GPIO 3 | MFP 3 |
| 12 | SerDes GPIO 4 | MFP 4 |
| 13 | SerDes GPIO 5 | MFP 5 |
| 14 | SerDes GPIO 6 | MFP 6 |
| 15 | SerDes GPIO 7 | MFP 7 |
| 16 | SerDes GPIO 8 | MFP 8 |
| 17 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 18 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.59: MFP pins of **Channel 3** of serializer MAX96793

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 19 | SER_Reset_Ch3 * | Serializer Reset * |
| 20 | SerDes GPIO 0 | MFP 0 |
| 21 | SerDes GPIO 3 | MFP 3 |
| 22 | SerDes GPIO 4 | MFP 4 |
| 23 | SerDes GPIO 5 | MFP 5 |
| 24 | SerDes GPIO 6 | MFP 6 |
| 25 | SerDes GPIO 7 | MFP 7 |
| 26 | SerDes GPIO 8 | MFP 8 |
| 27 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 28 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.60: MFP pins of **Channel 4** of serializer MAX96793

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 29 | SER_Reset_Ch4 * | Serializer Reset * |
| 30 | SerDes GPIO 0 | MFP 0 |
| 31 | SerDes GPIO 3 | MFP 3 |
| 32 | SerDes GPIO 4 | MFP 4 |
| 33 | SerDes GPIO 5 | MFP 5 |
| 34 | SerDes GPIO 6 | MFP 6 |
| 35 | SerDes GPIO 7 | MFP 7 |
| 36 | SerDes GPIO 8 | MFP 8 |
| 37 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 38 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.61: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|--------------|-----------------------|
| 39 | I2C_PATCH_EN | only for internal use |

4.21 MAX96878 2-times

This interface module includes two MAX96878 deserializer ICs from Analog Devices, which support the GMSL3 (Gigabit Multimedia Serial Link) standard.

The module has the following properties:

- Supports GMSL3 up to 12 GBit/s over 4 independent outputs and 2 daisy-chain outputs for forwarding the incoming video signals
- Pixel interface to mainboard: One dual openLDI interface (2x 4 lanes) with up to 150MHz openLDI clock for each output
- For display applications up to 3840 x 2160 resolution at 60 fps with 24 bit color depth
- Pixel clock frequency up to 300 MHz
- Sideband support for I²C or UART
- Available as STP version
- Backward compatible to GMSL2

4.21.1 MFP Pins of the MAX96878

Table 4.62: MFP pins of **Channel 1** of deserializer MAX96878

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 0 | SerDes GPIO 0 | MFP 0 |
| 1 | SerDes GPIO 1 | MFP 1 |
| 2 | SerDes GPIO 2 | MFP 2 |
| 3 | SerDes GPIO 4 * | MFP 4 / LMN 0 * |
| 4 | SerDes GPIO 5 * | MFP 5 / LMN 1 * |
| 5 | SerDes GPIO 6 * | MFP 6 / CFG 0 * |
| 6 | SerDes GPIO 8 * | MFP 8/ Lock * |
| 7 | SerDes GPIO 9 | MFP 9 |
| 8 | SerDes GPIO 10 * | MFP 10 / CFG 1 * |
| 9 | SerDes GPIO 11 | MFP 11 |
| 10 | SerDes GPIO 12 | MFP 12 |
| 11 | SerDes GPIO 13 | MFP 13 |
| 12 | SerDes GPIO 14 | MFP 14 |
| 13 | SerDes GPIO 15 | MFP 15 |
| 14 | SerDes GPIO 16 | MFP 16 |
| 15 | SerDes GPIO 18 | MFP 18 |
| 16 | SerDes GPIO 19 | MFP 19 |
| 17 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 18 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.63: MFP pins of **Channel 2** of deserializer MAX96878

| MFP | Signal | Function |
|-----|---------------------|-----------------------|
| 19 | DES_Reset_Ch1 * | Deserializer Reset * |
| 20 | SerDes GPIO 0 | MFP 0 |
| 21 | SerDes GPIO 1 | MFP 1 |
| 22 | SerDes GPIO 2 | MFP 2 |
| 23 | SerDes GPIO 4 * | MFP 4 / LMN 0 * |
| 24 | SerDes GPIO 5 * | MFP 5 / LMN 1 * |
| 25 | SerDes GPIO 6 * | MFP 6 / CFG 0 * |
| 26 | SerDes GPIO 8 * | MFP 8/ Lock * |
| 27 | SerDes GPIO 9 | MFP 9 |
| 28 | SerDes GPIO 10 * | MFP 10 / CFG 1 * |
| 29 | SerDes GPIO 11 | MFP 11 |
| 30 | SerDes GPIO 12 | MFP 12 |
| 31 | SerDes GPIO 13 | MFP 13 |
| 32 | SerDes GPIO 14 | MFP 14 |
| 33 | SerDes GPIO 15 | MFP 15 |
| 34 | SerDes GPIO 16 | MFP 16 |
| 35 | SerDes GPIO 18 | MFP 18 |
| 36 | SerDes GPIO 19 | MFP 19 |
| 37 | I2C_SCL / UART_TX * | Sideband I2C / UART * |
| 38 | I2C_SDA / UART_RX * | Sideband I2C / UART * |

*use only after consultation with **GÖPEL electronic** if possible

Table 4.64: MFP pins only for **internal** use

| MFP | Signal | Function |
|-----|--------------|-----------------------|
| 39 | I2C_PATCH_EN | only for internal use |

5 Sideband Communication

The data channel, which transmits control data of the configurations in parallel to the image transmission, is called sideband. Depending on the **Media Interface** module, the **Video Dragon 6222** supports I²C, SPI, UART and MII (Ethernet). With appropriate commands, the registers of the chips of both the **Video Dragon 6222** and the remote station can be read or written. For some hardware, it is mandatory that e.g. a display must receive a "wake-up" command via sideband to start communication or to receive and process image data.



Sideband communication is only available when the sideband functions are enabled. The unlockings can be obtained from GÖPEL electronic [sales department](#).

6 Software

The following options are available for integrating the **Video Dragon 6222** into your test environment:

- Using the easy-to-use software interface [Dragon Suite](#)
- Create your own applications by programming with [G-API](#)
- Create your own applications by programming with [LabVIEW](#)

6.1 User Interface Dragon Suite

The **Dragon Suite** serves as a user-friendly tool for configuring the **Video Dragon 6222**. Based on the Goepel API ([G-API](#)), it helps **GÖPEL electronic** LVDS hardware users get started in the multi-layered LVDS world, configure the hardware with just a few clicks, and implement more complex projects using sequences, scripts and sideband communication.

Using the **Dragon Suite** software, you can configure the generator and grabber according to your specifications and set its Signal Routing. It gives an overview of the frames stored on the Video Generator and offers the possibility to send video data stored on the PC/ Laptop. The receipt of frames with the Video Grabber as well as the additional saving or comparison of the video data is supported by the **Dragon Suite**. The software can also be used very well for Sideband- and CAN communication as well as File Systems and I/O Interfaces. In addition, it allows working from the command line. The **Dragon Suite** is constantly being developed so that it offers more and more extensions and functions. The free tool can be downloaded from genesis.goepel.com.



Please use the **Dragon Suite** documentation for more information.



Figure 6.1: User Interface Dragon Suite

6.2 Programming via G-API

The **G-API** (GÖPEL-API) is the C-based user interface for **GÖPEL electronic** hardware under Windows and Linux. It provides a comprehensive, hardware-independent instruction set for CAN, CAN FD, LIN, K-Line, MOST, FlexRay, Ethernet, LVDS, SENT, analog and digital I/O, and diagnostic services. No matter if a PXIe/ PCIe, USB or Ethernet device is used - the commands are the same. The hardware abstraction associated with the **G-API** allows the test application parallel access to the hardware. This allows an application to access multiple hardware interfaces. On the other hand, several applications can access the same hardware interface in parallel. Another feature of the **G-API** is asynchronous hardware access. This means: No execution restrictions for waiting firmware commands. The command acknowledgment is delivered via a callback mechanism.

With the **Hardware Explorer**, **GÖPEL electronic** provides a hardware configuration and management tool that gives users a convenient way to manage their hardware configurations and access logical names to each hardware interface (see [Network Configuration](#)). Using logical names eliminates the need to recompile the application when switching to another interface or controller board: The interfaces can be easily reassigned in the **Hardware Explorer**.



Please use the **G-API** documentation for more information. This documentation and the installation software can be found in the **G-API** folder of the supplied "Product Information" CD.

6.3 Programming via LabVIEW

The supplied CD contains a VI collection that can be used to access the **Video Dragon 6222** under LabVIEW. The LabVIEW VIs use the functions of the **G-API**.

6.4 Additional Software Interfaces

6.4.1 File System

The software interface "FS" (File System) allows, among others, to create, copy, delete, run, and finding files on the hardware. It thus provides unified access to the onboard file system.

6.4.2 Sequence

The software interface "Sequence" enables the recording and playback of firmware commands as a command sequence, in short "Sequence". A sequence can also be stored permanently under any name on the device. By specifying the name, this sequence can be reloaded and played. The automatic loading of a sequence after switching on the device allows e.g. starting a CAN command sequence to configure a display (if the sequence contains the necessary commands).

6.5 Reset the Device

The **Video Dragon 6222** starts automatically when the power is turned on.

During operation, a software reset of the device may be performed via the **G-API** to reset the configurations to their default values. Each interface can be initialized individually or all interfaces together. To initialize an interface, the command **G_Common_InitInterface** can be used. With **G_Common_SoftwareReset** all interfaces are reset. The reset is also possible with the **Hardware Explorer**. To do this, right-click on the desired device (for resetting all interfaces) in the **Hardware Explorer** or on a single interface and select "Reset".

7 First Steps

Prerequisite for these steps is a successful installation of the [G-API](#) and the [Dragon Suite](#) (see also separate manuals).



The **Video Dragon 6222** can be used with different **Media Interface** modules. For this chapter it is assumed that a **Media Interface** module with DS90UB954 deserializer is installed in a **G PCIe 6222** plug-in card and a compatible video source is already set up and ready for use.

7.1 System Configuration

1. Check if the corresponding media interface module (here DS90UB953/ 954) is on the mainboard. (Typically, the module is already installed.)
2. [Install](#) the **G PCIe 6222** plug-in card in your (switched off) test system or your PC.
3. Connect your video source to the input connector on the **G PCIe 6222** plug-in card using the supplied video cable.
4. Switch on the test system and thus the **G PCIe 6222** plug-in card. s soon as the board is ready, LED2 starts flashing.

7.2 Registration

Before you can use the **G PCIe 6222** plug-in card for the first time, the device must have been registered in the **G-API**. The **G-API** is responsible for all communication between the control PC or laptop and the **G PCIe 6222**. This registration is easy with the launch of the **Hardware Explorers**. The following figure shows a **G PCIe 6222** plug-in card with four interfaces:

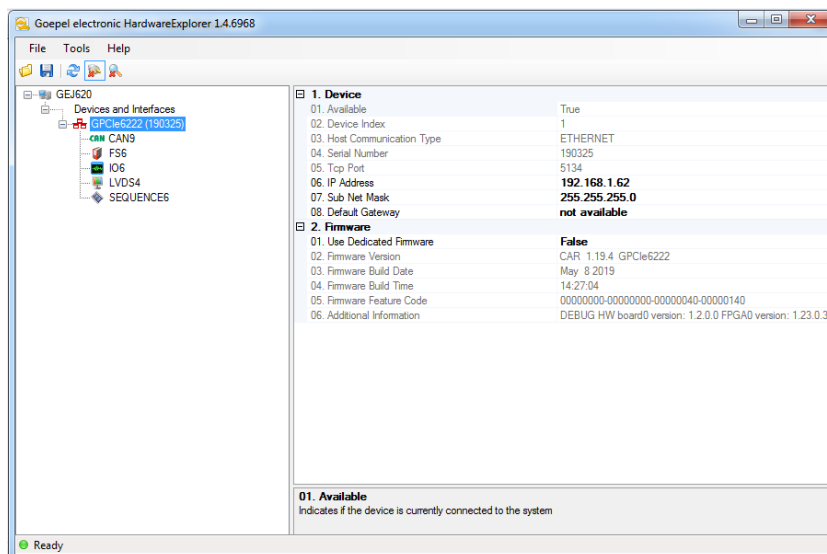


Figure 7.1: Hardware Explorer with **G PCIe 6222** plug-in card

The **G PCIe 6222** board can be seen in the left column with all available software interfaces. If several devices are connected, the corresponding device can be identified by its serial number, which is shown in parentheses. The name of the LVDS interface (e.g. "LVDS1") is important to the following steps.



For more information about the **G-API**, its installation and **Hardware Explorer**, see the **G-API Quickstart Guide**.

7.3 Configuration

Before the capturing of frames is possible, the **G PCIe 6222** plug-in card board must be configured according to the currently transmitted video signal.

1. Start the **GÖPEL electronic Dragon Suite** software. On the left side in the (**Interface Tree**) the **G PCIe 6222** plug-in card and its interfaces appear, similar to the **Hardware Explorer**.



2. The icon opens the (**Settings Window**) for the Frame Grabber. Select the corresponding LVDS interface as Interface Name from the preselection of the drop-down list (here "LVDS1").

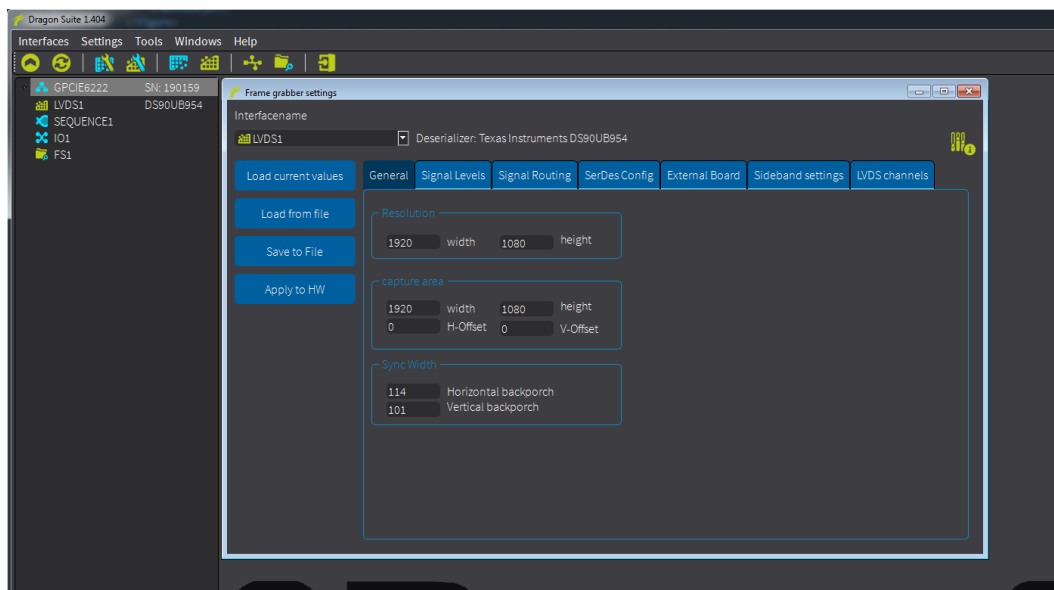


Figure 7.2: Frame Grabber configuration

3. After selecting the LVDS interface, the values in the configuration window are overwritten with the current values of the **G PCIe 6222** plug-in card automatically. The current configuration parameters can also be loaded into the settings window via the button "Load current values".
4. Enter the desired resolution in "Capture Area". This must not be higher than the resolution of the incoming frame. Confirm this entry with the button "Apply to HW".

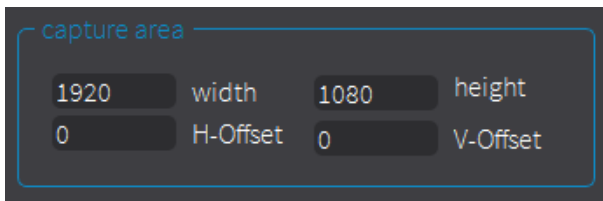


Figure 7.3: Frame Grabber Capture Area

5. Switch to the **LVDS Channels** tab and adjust the parameters of the physical channels according to your test requirements. Confirm this entry with "Apply" in the lower right corner of the dialog box.

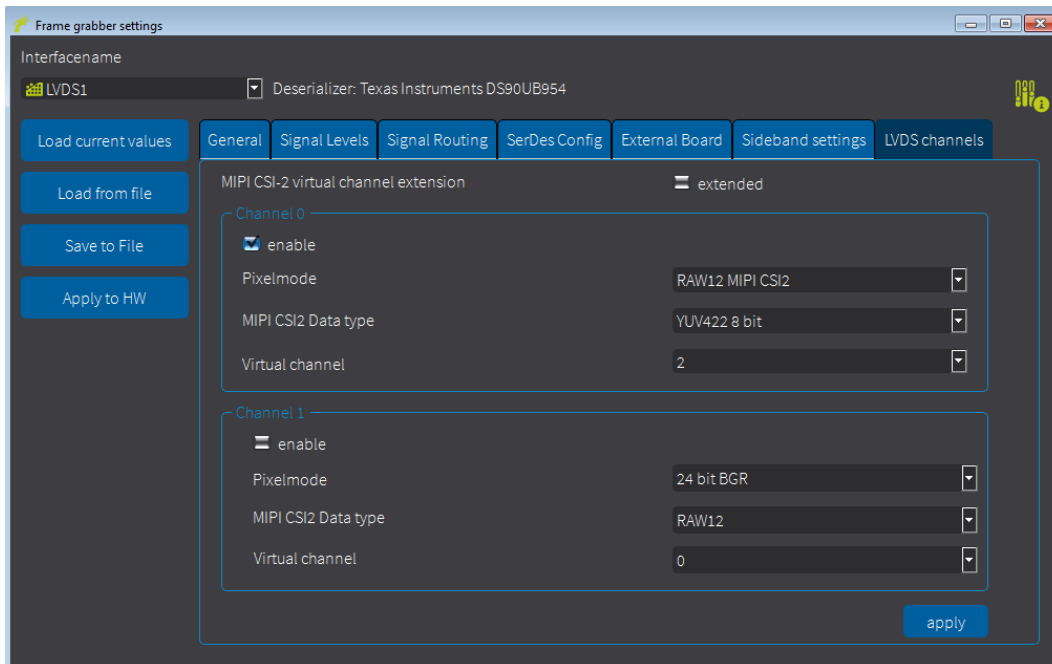


Figure 7.4: Frame Grabber LVDS Channels

6. In most cases, the configuration registers of the deserializer must be adapted to the test environment. In this example, the registers are written using I²C communication. Switch to the **Sideband Settings** tab and change the Data Mode to "I²C Master to Deserializer". Adjust the other parameters (baud rate etc.) according to your test requirements. Confirm this entry with the button "Apply to HW".

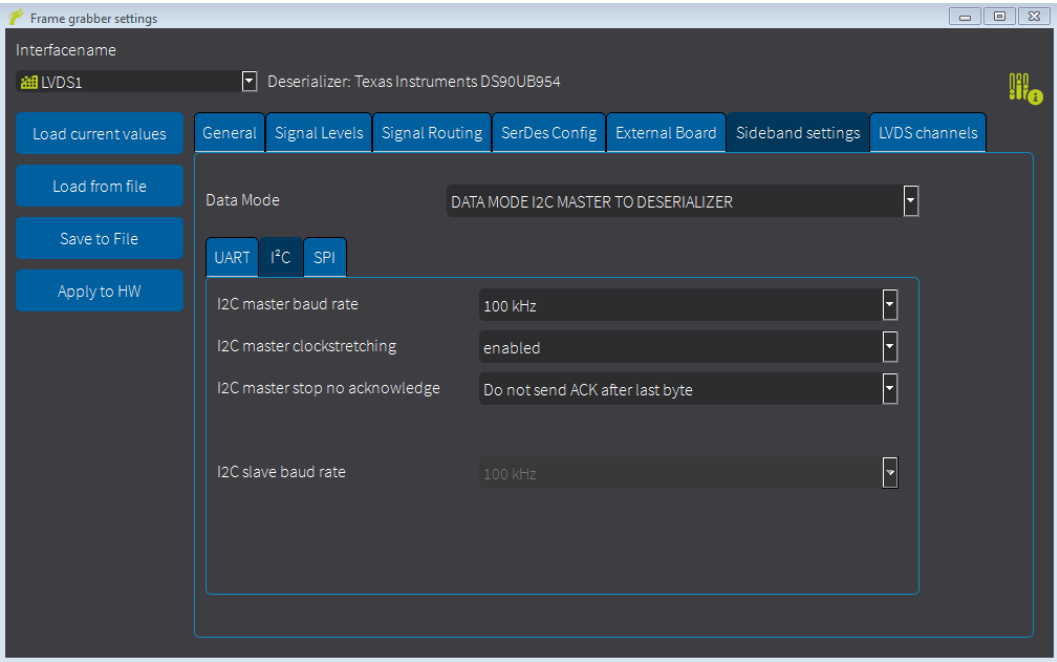



Figure 7.5: Frame Grabber Sideband Settings

7. Open the (Sideband Communication Window) with the icon . Also select the LVDS interface here ("LVDS1"). The tab for I²C opens automatically if the Data Mode was successfully overwritten before.

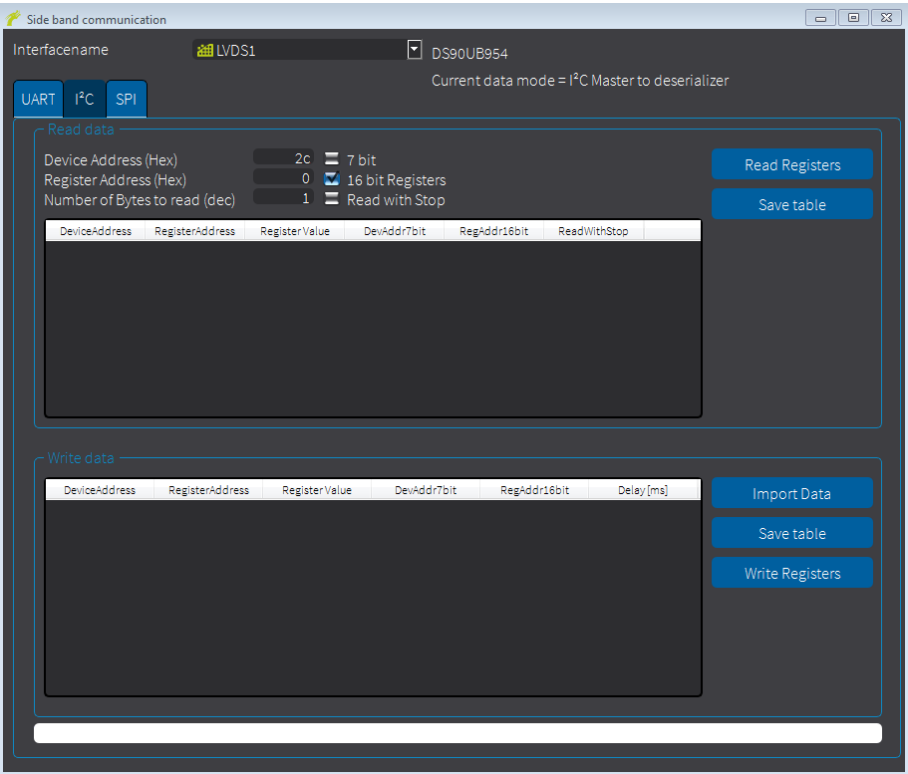



Figure 7.6: Frame Grabber Sideband Communication



Here, the configuration registers of the deserializer can be read out and overwritten. Reading is done by entering the device address and register address and the "Read Registers" button. Save the table with "Save Table". Now you can change the desired tabs in the saved text file. With "Import Data" the changed list is

imported again and by clicking on "Write Registers" the registers of the deserializer are changed.

The device is now configured and ready to capture frames.

7.4 Capturing

The icon  opens the (**Frame Grabber Dialog Window**). It is possible to capture both single frames and a sequence of frames.

The icon  captures a single frame from the video stream and displays it in the dialog window. The capturing of a sequence of frames is started by pressing the icon . After each captured frame of the sequence, the dialog window is updated to show the frame being captured.



Your **G PCIe 6222** plug-in card and also the **Dragon Suite** offers a multitude of additional functions. In this chapter, only general instructions for working with the device could be given by way of example.

8 Service and Support

8.1 Spare Parts and Accessories

If necessary, please contact our sales department:

GÖPEL electronic GmbH

ATS-Vertrieb

Göschwitzer Str. 58 / 60

D-07745 Jena

Tel.: +49-3641-6896-508

E-Mail: ats.sales@goepel.com

<http://www.goepel.com>

8.2 Warranty and Repair

8.2.1 Conditions

We guarantee the accuracy of the test system for a period of 24 months from the date of sale. The warranty does not apply to errors that are based on improper interventions or changes or improper use.

8.2.2 Identification

Furthermore, we ask you to announce possible warranty cases as such. Repair orders without reference to an existing warranty claim will in any case initially be paid. If the warranty has expired, we will of course also repair your test system in accordance with our general installation and service conditions.

If necessary, please contact our support service:

GÖPEL electronic GmbH

ATS-Support

Göschwitzer Str. 58 / 60

D-07745 Jena

Tel.: +49-3641-6896-597

E-Mail: ats.support@goepel.com

<http://www.goepel.com>

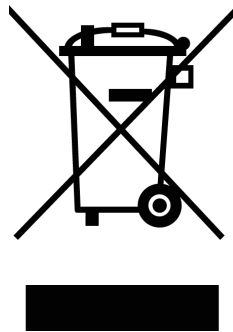
9 Disposal

9.1 Disposal of used Electrical / Electronic Equipment

The device implements the following EU directives:

- 2012/19/EU (WEEE) Waste Electrical and Electronic Equipment and
- 2011/65/EU on the restriction of the use of certain hazardous substances in electronic equipment (RoHS directive)

At the end of the life of the device, this product must not be disposed of with other household waste. The improper disposal of this type of waste can have a negative impact on the environment and health due to the potential hazardous substances in electrical and electronic equipment. Dispose of the product at a suitable collection point.



When disposing of the device in countries outside the EU, local laws and regulations must be observed.

9.2 Disposal of used Disposable Batteries / Rechargeable Batteries

At the end of the service life of disposable batteries / rechargeable batteries, these must not be disposed of with the normal household waste. Dispose of the disposable batteries / rechargeable batteries at a recycling center for disposable batteries and rechargeable batteries.

Please dispose of only discharged disposable batteries / rechargeable batteries.

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Anhang A Konformitätserklärung



EU-Konformitätserklärung EU Declaration of Conformity

GÖPEL electronic GmbH, Göschwitzer Straße 58-60, D-07745 Jena

Wir erklären hiermit die Übereinstimmung des genannten Produktes mit der Richtlinie 2014/35/EU – Niederspannungsrichtlinie, der Richtlinie 2014/30/EU über die elektromagnetische Verträglichkeit und der Richtlinie 2011/65/EU über Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten (RoHS). Bei Änderungen am Produkt, die nicht von uns autorisiert wurden, verliert diese Erklärung ihre Gültigkeit.

We declare the compliance of the product with the requirements of the Directive 2014/35/EU – Low-Voltage Directive, with the Directive 2014/30/EU about the Electromagnetic Compatibility and the Directive 2011/65/EU on the use of certain dangerous substances in electrical and electronic equipment (RoHS). Any modification to the product, not authorized by us, will invalidate this declaration.

Produktbezeichnung / Product name:

PCIe 6222 Video Dragon

Normen / Standards:

**EN 61326-1:2013 (IEC 61326-1:2012), Industrial
EN 61000-4-2:2009 (IEC 61000-4-2:2008)
EN 61000-4-3:2010 (IEC 61000-4-3:2010)
IEC 61000-4-4:2010 (IEC 61000-4-4:2010)
IEC 61000-4-6:2009 (IEC 61000-4-6:2008)
EN 50581:2012**

Das Produkt ist gekennzeichnet mit / The product is marked with



Jena, 15.07.2019

GÖPEL electronic GmbH


Jörg Schneider
Geschäftsführer

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Geschäftsführer: Alice Göpel, Jörg Schneider, Thomas Wenzel
Sitz der Gesellschaft: Jena • Ust.-Id.-Nr.: DE 150520615 • Registergericht: Amtsgericht Jena, HR B 20 1550