**AVT Cameras**




# Hardware Installation Guide

V2.2.0

19 August 2008

Allied Vision Technologies GmbH
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D-07646 Stadtroda / Germany

ALLIED Vision Technologies

# Legal notice

### For customers in the U.S.A.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However there is no guarantee that interferences will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Use a different line outlet for the receiver.
- Consult a radio or TV technician for help.

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart B of Part 15 of FCC Rules.

### For customers in Canada

This apparatus complies with the Class B limits for radio noise emissions set out in the Radio Interference Regulations.

### Pour utilisateurs au Canada

Cet appareil est conforme aux normes classe B pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

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# Contacting Allied Vision Technologies

**Info**



- **Technical information:**
  support@alliedvisiontec.com
  phone (for Germany): +49 (0)36428 677-270
  phone (for USA): +1 978-225-2030
  outside Germany/USA: Please check the link for your local dealer.
  http://www.alliedvisiontec.com/partner.html

- **Ordering and commercial information:**
  customer-care@alliedvisiontec.com
  phone (for Germany): +49 (0)36428 677-230
  phone (for USA): +1 978-225-2030
  outside Germany/USA: Please check the link for your local dealer.
  http://www.alliedvisiontec.com/partner.html
  Please note order number/text given in the **AVT Modular Camera Concept**.

# Introduction

This **Hardware Installation Guide** describes the hardware installation procedures for all 1394 AVT cameras (Dolphin, Oscar, Marlin, Guppy, Pike, Stingray).

The **Hardware Installation Guide** answers questions about putting AVT cameras into operation, about safety warnings, pin assignments on I/O connectors and 1394a/b connectors. Learn how to get more information at the AVT website (accessories), how to get information about software applicable with AVT cameras and how to get deep information from the Technical Manual of each camera family.

**Note**



**Please read through this manual carefully before installing the hardware on your PC or laptop (FireWire card, cables) and operating the AVT cameras.**

## Document history

| Version | Date | Remarks |
|---|---|---|
| V2.0.0 | 31.03.08 | New Manual - RELEASE status |
| V2.1.0 | 21.05.08 | Schematics standardized in Chapter Cautions: Connecting a camera on page 17ff.<br>Marked Pin 1 with blue color in Figure 10: Board level camera (GUPPY): IEEE 1394 FireWire connector 1 (view on pins) on page 37 |
| **to be continued on next page** | | |

Table 1: Document history

| Version | Date | Remarks |
|---|---|---|
| | | **continued from last page** |
| V2.2.0 | 19.08.08 | Inserted Latching precautions for 1394a cables in Chapter Connecting camera to PC or laptop on page 31<br>Corrected ordering number in Figure 3: Removing IR cut filter/ protection glass using special tool (E9020001) on page 24<br>Restructuring Chapter Camera interfaces on page 33ff.<br>New measurements of inputs and outputs and standardized descriptions of I/Os for all AVT camera families in Chapter Camera interfaces on page 33ff.<br>New photo of Stingray camera with new screws on either side of the camera on title page<br>New photo of Stingray backside in Figure 8: Example: Rear view of STINGRAY camera (2x 1394b copper) on page 33<br>New photos of Dolphin, Oscar, Marlin, Guppy, Pike, Stingray (with HIROSE and 1394 copper) in Table 6: Rear view of AVT cameras (HIROSE and 1394 copper) on page 34<br>New photos Pike fiber and Stingray fiber (with HIROSE and 1394b GOF and 1394b copper) in Table 7: Rear view of AVT cameras (HIROSE and 1394b GOF/copper) on page 35<br>New photo of Pike fiber (with HIROSE and 1394b GOF and 1394b copper) in Figure 15: Rear view of PIKE camera (1394b: 1 x GOF, 1 x copper) (STINGRAY similar) on page 41<br>Deleted AVT Direct FirePackage in Chapter AVT software on page 11<br>Revised Chapter AVT software on page 11f.<br>New Stingray board level CAD drawings (1394b connectors are now (partially) visible):<br>in Figure 12: Board level camera (STINGRAY): two IEEE 1394b FireWire connectors on page 39 and<br>in Figure 21: STINGRAY board level camera: I/O pin assignment on page 51 |

Table 1: Document history

# Manual overview

The manual overview describes each chapter of this manual shortly.

- Chapter Contacting Allied Vision Technologies on page 6 lists AVT contact data for both: technical information / ordering and commercial information.

- Chapter Introduction on page 7 (this chapter) gives you the document history, a manual overview and conventions used in this manual (styles and symbols). Furthermore you learn how to get more information on **AVT accessories**, available **AVT software** and the **AVT Technical Manuals**.
- Chapter Safety instructions on page 13 describes safety instructions for AVT cameras in general and special safety instructions for camera families/models.
  - **Read this chapter carefully before operating any AVT camera.**
  - **Follow all safety instructions, especially the cautions when connecting cameras.**
  - **Take special care when operating board level cameras (Caution-ESD, general warnings, loading and dirty environments). Read all notes and safety instructions before operating any AVT board level camera.**
- Chapter AVT cameras: installing hardware on page 27 describes the hardware installation procedures. In this chapter you get links to the AVT website (accessories) and you learn how to get more information on installing software.
  - **Read this chapter before installing any hardware.**
  - **Read and follow the FireWire hot plug precautions.**
  - **Read and follow the caution when connecting a camera to PC or laptop.**
- Chapter Camera interfaces on page 33 describes the interfaces of all AVT cameras (I/O connector and IEEE 1394a and 1394b connectors).
  - **Read all notes and cautions carefully.**
- Chapter Firmware update on page 84 describes how to get information on firmware updates.

# Conventions used in this manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

## Styles

| Style | Function | Example |
|---|---|---|
| Bold | Programs, inputs or highlighting important things | **bold** |
| Courier | Code listings etc. | `Input` |
| Upper case | Register | REGISTER |

Table 2: Styles

| Style | Function | Example |
|---|---|---|
| Italics | Modes, fields | *Mode* |
| Parentheses and/or blue | Links | (Link) |

Table 2: Styles

### Symbols

**Note**

This symbol highlights important information.



**Caution**

This symbol highlights important instructions. You have to follow these instructions to avoid malfunctions.



**Caution-ESD**

This symbol highlights important ESD instructions. Only **qualified personnel** is allowed to install and operate components marked with this symbol.



**www**

This symbol highlights URLs for further information. The URL itself is shown in blue.



Example:

http://www.alliedvisiontec.com

# More information

In this chapter you get more information on **AVT accessories**, available **AVT software** and the **AVT Technical Manuals**.

## AVT accessories

**Note**

Allied Vision Technologies offers a wide range of **accessories** for the use of AVT Cameras and the easy integration in already existing applications.

- **IEEE 1394a** accessories (interface cards, hubs and repeaters, cables)
- **IEEE 1394b** accessories (interface cards, hubs and repeaters, cables)
- **Lenses** (for cameras with sensors of type 1/3, 1/2, 1, 2/3 and 1.2)

**www**

For **more information on accessories** go to:

www.alliedvisiontec.com/avt-products/accessories.html

To **order accessories online** visit the **AVT web shop** at:

http://shop.avt-cameras.com/avtshop.html

## AVT software

**Note**

AVT cameras are **compliant to IIDC V1.30/V1.31**. Moreover AVT cameras offer many more functions than specified in the IIDC V1.30/V1.31: so-called AVT SmartFeatures. These features are accessible via direct register access, or by using special functions provided in the following **AVT Software Packages**:

- AVT FirePackage
- AVT Fire4Linux

All software packages provided by AVT are **free of charge** and contain the following components:

- Drivers
- Software Development Kit (SDK) for camera control and image acquisition
- Examples based on the provided APIs of the SDK
- Documentation and release notes
- Viewer application to operate/configure the cameras and access/test the **AVT SmartFeatures**.

**www**

All software packages (including documentation and release notes) provided by AVT can be downloaded at:

www.alliedvisiontec.com/avt-products/software.html

All software packages are also on AVT's product CD.

**www**



In addition to the AVT Software Packages Allied Vision Technologies offers special **Integration Packages** to integrate AVT cameras into any third-party vision software that supports the IIDC standard.

For more information refer to the **Software Package Selector Guide**.

Go to:

www.alliedvisiontec.com/avt-products/software.html

Here you also find the **AVT Software Packages for download** and **additional software documentation**:

- FirePackage User Guide
- FirePackage64 User Guide
- Active FirePackage User Guide
- [tbd: Fire4Linux User Guide]
- [tbd: Fire4Linux Command Reference Guide]
- Release Notes
- Operating AVT cameras with SmartView

## AVT Technical Manuals

**Note**



Besides hardware installation procedures (this guide) and the software documentation there is an in-depth description of all AVT cameras in the so-called **Technical Manuals** (one for each AVT camera family):

- DOLPHIN Technical Manual
- OSCAR Technical Manual
- MARLIN Technical Manual
- GUPPY Technical Manual
- PIKE Technical Manual
- STINGRAY Technical Manual

Here you find: technical data, functional descriptions, features of the camera and how to use, register descriptions (IIDC V1.30/V1.31 and AVT advanced registers)

**www**



For **downloading the Technical Manuals** go to:

www.alliedvisiontec.com/downloads/avt-cameras.html

# Safety instructions

This chapter describes safety instructions/cautions valid for all AVT camera families and special safety instructions/cautions depending on the camera family/model used.

## General safety instructions

**Note**



- There are no switches or parts inside the camera that require adjustment. The guarantee becomes void upon opening the camera casing.
- If the product is disassembled, reworked or repaired by other than a recommended service person, AVT or its suppliers will take no responsibility for the subsequent performance or quality of the camera.
- The camera does **not** generate dangerous voltages internally. However, because the IEEE 1394a and 1394b standard permit cable power distribution at voltages higher than 24 V, **please note that various country-specific regulations apply**.

**Note**



- All **color models** are equipped with an **optical filter** to eliminate the influence of infrared light hitting the sensor. Please be advised that, as a side effect, this filter reduces sensitivity in the visible spectrum. The optical filter is part of the back focus ring, which is threaded into the C-Mount.
- **B/w models** are delivered with a **sensor protection glass** mounted in the back focus ring to ensure maximum sensitivity. In certain applications and depending on the lighting source and optics, the use of either IR blocking or IR passing filter may be required to improve the image quality.

# FireWire safety instructions

## FireWire hot-plug and screw-lock precautions

**Caution**



**Hot-plug precautions**

- Although FireWire devices can **theoretically** be hot-plugged without powering down equipment, **we strongly recommend turning the computer power off, before connecting a digital camera** to it via a FireWire cable.
- **Static electricity or slight plug misalignment during insertion may short-circuit and damage components.**
- The physical ports **may be damaged** by **excessive ESD** (electrostatic discharge), when connected under powered conditions. It is good practice to ensure proper grounding of computer case and camera case to the same ground potential, before plugging the camera cable into the port of the computer. This ensures that no excessive difference of electrical potential exists between computer and camera.
- It is **very** important **not** to exceed an inrush current of 18 mJoule in 3 ms. (This means that a device, when powered via 12 V bus power must **never** draw more than 1.5 A, even not in the first 3 ms.)
- **Higher inrush current may damage the physical interface chip of the camera and/or the phy chip in your PC.**
- Whereas inrush current is not a problem for one Pike/ Stingray camera, daisy chaining multiple cameras or supplying bus power via (optional) HIROSE power out to circuitry with unknown inrush currents needs careful design considerations to be on the safe side.

**Latching / screw-lock precautions**

- **1394a cameras**: We strongly recommend using **only 1394a cables with latch connectors**, to insure a tight electrical connection that is resistant to vibration and gravity.
- **1394b cameras:** All AVT 1394b camera and cables have **industrial screw-lock fasteners**, to insure a tight electrical connection that is resistant to vibration and gravity.
- **We strongly recommend using only 1394b adapter cards with screw-locks.**

# Changing filters safety instructions

**Caution**



- Mount/dismount lenses and filters in a **dust-free environment**, and **do not** use compressed air (which can push dust into cameras and lenses).
- Use only **optical quality tissue**/cloth if you must clean a lens or filter.

Ask your dealer if you are not familiar with these procedures.

## GUPPY: changing filters safety instructions

| Old CS-/C-Mounting | New CS-/C-Mounting<br>starting with serial no. 06/05-84312215 |
|---|---|
| **CS-Mount models** have the filter or protection glass mounted directly in front of the sensor. Taking out the filter or protection glass is not possible at customer site.<br>Ask your dealer for a camera with the respective filter already installed. | **All models** have the filter or protection glass mounted directly in the CS-Mount adapter. (Standard delivery is a CS-Mount camera). Taking out the filter or protection glass is not possible at customer site.<br>Ask your dealer for a camera with the respective filter already installed. |
| C-Mount models have the filter or protection glass mounted in the CS- to C-Mount extension adapter.<br>Ask your dealer for an extension adapter with the intended filter already mounted. | In order to get a C-Mount camera, screw the 5 mm C-Mount adapter onto the CS-Mount camera. Unscrew the 5 mm C-Mount adapter to get again a CS-Mount camera. |
| Removing the **C-Mount adapter** opens the front section of the camera. This greatly enhances the risk for dust or particles to migrate on the sensor's protection glass.<br>In order to remove the adapter:<br>Hold the camera so that the adapter points downwards while changing the adapter. Use optical cleaning tissues for cleaning the sensor's protection glass if needed. **Never use compressed air** for cleaning purposes.<br>Ask your dealer if you are not familiar with these procedures. | Removing the **CS-Mount adapter** opens the front section of the camera. This greatly enhances the risk for dust or particles to migrate on the sensor's protection glass.<br>In order to remove the adapter:<br>Hold the camera so that the adapter points downwards while changing the adapter. Use optical cleaning tissues for cleaning the sensor's protection glass if needed. **Never use compressed air** for cleaning purposes.<br>Ask your dealer if you are not familiar with these procedures. |

Table 3: Old and new CS-/C-Mounting of GUPPY cameras

## PIKE/OSCAR: changing filters safety instructions

**Note**



- **Pike/Oscar** models only: **Changing filters** is achieved by changing back focus rings with the appropriate filter already mounted. Please be advised that back focus adjustment will be necessary in order to match C-Mount distance of 17.526 mm. Ask your dealer for further information or assistance.

## MARLIN: changing filters safety instructions

**Note**



- For certain applications it may be recommended to take out the filter by means of a special tool which can be ordered from AVT under the following number: E9020001.
- Taking out the filter requires special care. Ask your dealer to help you if you are not confident with the procedure.

# Cautions: Connecting a camera

**Caution**



**ALL CAMERAS**

- **Do not touch the shield of the camera cable** connected to a computer and the ground terminal of the lines at the same time.
- If you are charged: before touching the shield of the camera cable, make sure to discharge first (by touching the ground terminal of the lines).
- **Use only DC power supplies with insulated cases.** These are identified by having only **two** power connectors.
- Although IEEE 1394a and 1394b are functionally plug and play, the physical ports **may be damaged** by **excessive ESD** (electrostatic discharge), when connected under powered conditions. It is good practice to ensure proper grounding of computer case and camera case to the same ground potential, before plugging the camera cable into the port of the computer. This ensures that no excessive difference of electrical potential exists between computer and camera.
- If you feel uncomfortable with the previous advice or if you have no knowledge about the connectivity of an installation, **we strongly recommend powering down all systems before connecting or disconnecting a camera.**

## PIKE/STINGRAY GOF connectors

**Caution**



**Special warning for all PIKE/STINGRAY models with GOF connectors:**

GOF connectors are very sensitive. **Any dust or dirt may cause damage.**

- Always keep the GOF connector and optical fiber plug clean.
- If GOF connection is not in use, keep GOF dust cover on the GOF connector.
- Reduce mating cycles to a minimum to prevent abrasion.
- Please note that optical fiber cables have a very limited deflection curve radius.

# Safety instructions for board level cameras

**Note**



**Read the Guppy Technical Manual or Stingray Technical Manual and this safety instructions before use.**

**Abuse or misapplication of the camera may result in limited warranty or cancelation of warranty.**

**Caution-ESD**

**Board level cameras: ESD warnings**



- Only **qualified personnel** is allowed to install and operate the Board level cameras.
- Board level cameras are delivered without housing. Handle the sensor board and main board with care. Do not bend the boards. Do not touch the components or contacts on a board. Hold a board by its edges.
- Sensor board and main board are sensitive to electrostatic discharge. To avoid possible damage, handle all static-sensitive boards and components in a static-safe work area. Follow the procedures below.
- ESD (electrostatic discharge): Static electricity can damage the sensor board or the main board of your Board level cameras. To prevent static damage, discharge static electricity from your body before you touch any of your Board level cameras's electronic components, such as sensor board or main board. To do so, use a static-safe work area with static-dissipative mat and wear a static-dissipative wrist strap. Do not hold any components of your Board level cameras against your clothing. Even if you are wearing a wrist strap, your body is grounded but your clothes are not.
- Do not remove the sensor board and main board from its anti-static packaging unless your body is grounded.
- **ESD shielding**: To protect the boards from radiation of other modules or devices use a special ESD protective housing.

**Caution** **Board level cameras: General Warnings**



- Be sure that all power to your board level cameras is switched off, before mounting the sensor board or making connections to the camera.
- Do not connect or disconnect any cables during an electrical storm.
- Do not use your board level cameras during an electrical storm.
- To help avoid possible damage to the sensor board or main board, wait 5 seconds after power is switched off, before connecting or disconnecting any cable to the board level cameras.
- Ensure that nothing rests on the cables of your board level cameras.
- Keep your board level cameras away from radiators and heat sources.
- Do not spill food or liquids on your board level cameras.

**Caution** **Board level cameras: Loading**



- Avoid any mechanical forces to the board level cameras, the boards and its components, especially torsional, tensile and compressive forces. Any of these forces may result in damage of the board level cameras, the boards and its components.
- To avoid damages of the boards, provide cables with an external pull relief so that no force is applied to the connectors itself.

**Caution** **Board level cameras: Dirty environments**



- Always use clean boards.
- To protect the boards from dirt like dust, liquids or swarf always use the board level cameras only in clean room environment or use a protective housing.

# AVT camera cleaning instructions

This section describes safety instructions/cautions valid for all AVT camera families in case of cleaning lenses, optical filters/protection glass or sensors.

**Note**



- Please read these instructions before you contact your AVT camera dealer for assistance.
- Ask your AVT camera dealer if you are not familiar with the procedures described below.

## Warranty

**Caution**



**Warranty precautions**

- To ensure your warranty remains in force:
  - Do not open the camera housing.
  - Follow instructions described below.
  - Use only optical quality tissue/cloth if you must clean a lens or filter.
  - Use only optics cleaner (60% ethyl alcohol, 40% ether). Never use aggressive cleaners like benzine or spirit. Such cleaners may destroy the surface.
  - **Do not use compressed air which can push dust into camera and lens.**
- AVT does not warranty against any physical damage to the sensor/filter/protection glass or lenses caused by the user during the cleaning process.

**Caution**



**General warnings**

- Do not touch any optical component with bare fingers. Oil or other impurities may damage the surface.
- Only follow the processes described below if you are familiar with these procedures and if you have the necessary equipment.
- If you are uncomfortable with the outlined precautions, please return your camera to AVT for cleaning.

**Caution-ESD** **ESD warnings**



Image sensors are easily damaged by static discharge (ESD).

- Please use anti-static gloves, clothes and materials. Also use conductive shoes.
- Install a conductive mat on the floor and/or working table to prevent the generation of static electricity.

# Avoiding the necessity of camera cleaning

When changing camera lenses please follow these procedures:

- Simply hold the camera with the C-mount opening towards the floor, when removing the dust-cap or changing the lens:



Figure 1: Hold camera like this while changing the lens/removing the dust cap of a camera

- Thread the lens onto the camera while holding the camera in this position. This will minimize the possibility of any contaminants falling on the glass surface.
- Always store cameras and lenses with dust-caps installed.

# Is it an impurity? – Identifying impurities

If you observe any image artefacts in your video preview of your AVT camera you may have impurities either on the lens, filter/protection glass or, theoretically on the sensor protection glass, although every AVT camera gets cleaned prior to sealing and shipment.

Impurities (dust, particles or fluids) on the sensor or optical components (Figure 2: Image with tiny dust on the filter (left) and dust on the sensor (right) on page 22) will appear as a dark area, patch or spot on the image and will remain fixed in the preview window while you rotate the camera over the target.

Do not confuse this with a pixel defect which will appear as a distinct point. It is crucial to differentiate between dust (e.g. flakes of skin, particles) and other dirt (e.g. liquids, fingerprints, grease). Particles can either rest loosely or can be more or less stuck to the optical surface.

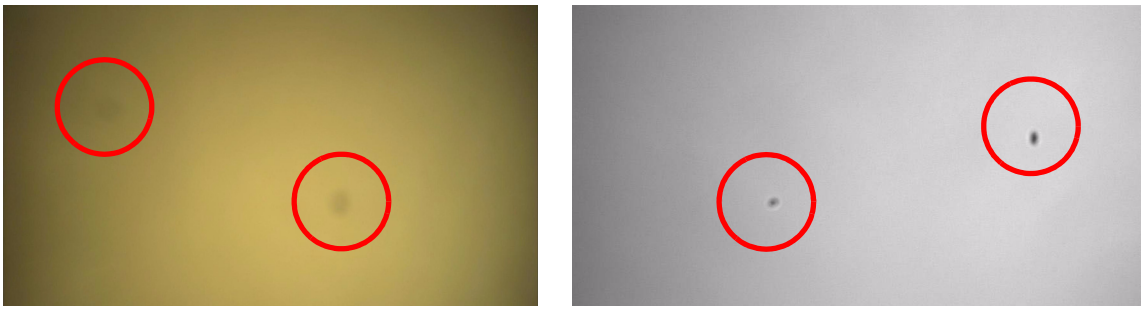


Figure 2: Image with tiny dust on the filter (left) and dust on the sensor (right)

# Where is the impurity? – Locating impurities

Before you dismount the lens you should find out if the impurity is on the filter, lens or sensor. Therefore you should view a uniform image (e.g. a white sheet of paper) with the camera. The affected optical surface is identified when a suspected optical component is moved and the dirt follows this movement.

1. If you move only the lens (not the camera) and the impurity moves as well, the impurity is on the lens.
2. If you move the IR cut filter/protection glass window and the impurity moves as well:

   Please carefully remove the filter/protection glass (for certain camera models, indicated below, requiring a special tool which can be ordered

under the following number: E9020001) and clean it on both sides using the techniques explained below.

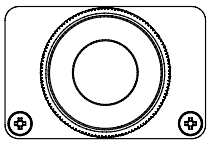
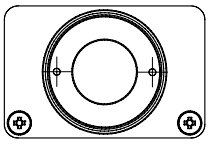
| Camera type | Tool to be used | Description |
|---|---|---|
| Dolphin | AVT order number E9020001 | Figure 3: Removing IR cut filter/protection glass using special tool (E9020001) on page 24 |
| Oscar | 1.3 mm hex key (Allen key) AVT order number K 9020411 | Loosen both countersunk screws. Remove chromatic flange: Take care, C-Mount adjustment spacers may fall out. Put them back carefully on chromatic flange and screw chromatic flange with adjustment spacers in camera. |
| Marlin | AVT order number E9020001 | Figure 3: Removing IR cut filter/protection glass using special tool (E9020001) on page 24 |
| Guppy | Pliers and leather | Carefully unscrew the knurled ring. |
| Pike | 1.3 mm hex key (Allen key) AVT order number K 9020411 | Loosen both countersunk screws. Remove chromatic flange: Take care, C-Mount adjustment spacers may fall out. Put them back carefully on chromatic flange and screw chromatic flange with adjustment spacers in camera. |
| Stingray | • Stingray cameras Rev. 1: see Guppy<br>• Stingray cameras Rev. 2: AVT order number E9020001 | • Stingray cameras Rev. 1: see Guppy<br>• Stingray cameras Rev. 2: Figure 3: Removing IR cut filter/protection glass using special tool (E9020001) on page 24<br> Stingray Rev. 1<br> Stingray Rev. 2 |

Table 4: How to remove the filter/protection glass

Not all camera types have the design to remove the filter/protection glass. See Chapter Changing filters safety instructions on page 15.

**Note**

- Taking out the filter requires special care.
- Ask your dealer to help you if you are not confident with the procedure.



Figure 3: Removing IR cut filter/protection glass using special tool (E9020001)

3. If the impurity is neither on the lens nor the IR cut filter/protection glass, it is probably on the sensor.

# Cleaning Instructions

Perform all cleaning operations (lenses, filter/protection glass, sensor in a **dust-free clean-room**. The optical components are very fragile so it is important to avoid touching them with your fingers or any hard material.

1. Unplug the camera from any power supply before cleaning.
2. Apply a small amount of optics cleaner (60% ethyl alcohol, 40% ether) to clean, new lens cleaning tissue.

   Acceptable material includes medical-grade sterile optical cotton, or lens tissue that is chemically pure and free from silicones and other additives.
   - **Do not** use cosmetic cotton.
   - **Do not** use consumer eyeglass cleaning cloths pre-treated with silicon.



Figure 4: Medical-grade sterile optical cotton

The cotton or lens tissue should be moist, but not dripping. Please hold the camera away from your body to avoid falling particles like flakes from skin on the sensor. Hold the camera sensor diagonally upwards.

3. Wipe the glass surface with a spiral motion from the centre to the rim. Normally several spiral wipes are recommended. Wipe only on glass avoiding contact to metal surfaces, because microscopic dirt could be released and could cause scratches on the glass.

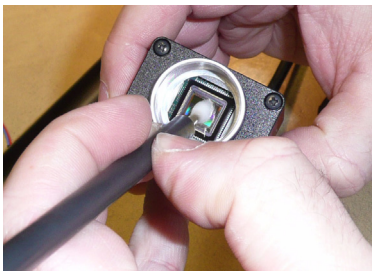


Figure 5: Sensor cleaning

4. When you've finished cleaning, examine the surface in a strong light. Take an out-of-focus picture of a flat, illuminated surface to see if any dirt or dust remains.
5. If dust spots remain, repeat this procedure using new clean lens tissue (as described above).

**Caution**

- Never wipe lenses with dry swabs or tissue - this causes scratches.
- Do not use any disposable cotton cosmetic swabs; they are not free from contamination.




Figure 6: Don’t use compressed air

6. If despite warnings you want to clean your camera with compressed air:

**Caution**



- Use an air blower/compressed air only if you are familiar with cleaning a camera with this instrument.
- **Compressed air may push dust into cameras and lenses**. Therefore keep the pressure at a moderate strength only:
  - The pressure at the tube should be less than 1 bar
  - operating distance: 5-30 cm

7. Please gently blow the impurities off with dust-filtered, oil-free air (< 1 bar). Using ionized air will help to remove any dirt stuck to the optical component because of static electricity.

**Note**



If dust spots remain after cleaning twice, please contact your AVT dealer.

# AVT cameras: installing hardware

This chapter describes the **hardware installation** of 1394a/b AVT cameras, 1394 adapters (PC or laptop) and the necessary cabling.

**Note**

For **software/driver installation** read the documentation of the AVT SoftwarePackages.

If you connect an AVT camera to your PC/laptop (before software/driver installation), the following window will appear:




Figure 7: Window: Found New Hardware Wizard

You have two choices:

- If you want to use an **AVT SoftwarePackage**, click **Cancel** to close the window. The necessary AVT driver will be installed during AVT SoftwarePackage installation process.
- If you want to use your **own image processing software**, ask your image processing vendor what to do now.

# Hardware conditions

- AVT IEEE 1394a or 1394b camera (1394a: Dolphin, Oscar, Marlin, Guppy; 1394b: Pike, Stingray) with corresponding lens
- 1394 cable (4.5 m)
- PC or laptop with built-in IEEE 1394 interface
- IEEE 1394 adapter (OHCI) card for PCI bus or PCI Express bus or PC card or ExpressCard with IEEE 1394 port(s)

**Note**



AVT offers a wide range of IEEE 1394 adapters, both 1394a or 1394b for different requirements.

**www**



For **more information on accessories** go to:

www.alliedvisiontec.com/avt-products/accessories.html

To **order accessories online** visit the **AVT web shop** at:

http://shop.avt-cameras.com/avtshop.html

# FireWire hot-plug and screw-lock precautions

**Caution**



**Hot-plug precautions**

- Although FireWire devices can **theoretically** be hot-plugged without powering down equipment, **we strongly recommend turning the computer power off, before connecting a digital camera** to it via a FireWire cable.
- **Static electricity or slight plug misalignment during insertion may short-circuit and damage components.**
- The physical ports **may be damaged** by **excessive ESD** (electrostatic discharge), when connected under powered conditions. It is good practice to ensure proper grounding of computer case and camera case to the same ground potential, before plugging the camera cable into the port of the computer. This ensures that no excessive difference of electrical potential exists between computer and camera.

**Screw-lock precautions**

- Also, all AVT 1394b camera and cables have **industrial screw-lock fasteners**, to insure a tight electrical connection that is resistant to vibration and gravity.
- **We strongly recommend using only 1394b adapter cards with screw-locks.**

| FireWire cable | Description | Ordering number |
|---|---|---|
| FireWire cable -2x Interlock | IEEE 1394a; (2x Interlock) 4.5 m with Ferrites, for Marlin / Oscar / Guppy | K1200064 |
| FireWire cable -2x Interlock | IEEE 1394a; (2x Interlock) 10 m with Ferrites, for Marlin / Oscar / Guppy | K1200163 |
| FireWire cable -2x Interlock | IEEE 1394a; (2x Interlock) 12.5 m with Ferrites, for Marlin / Oscar / Guppy | K1200165 |
| FireWire cable -2x Interlock | IEEE 1394a; (2x Interlock) 17.5 m with Ferrites, for Marlin / Oscar / Guppy | K1200162 |
| FireWire cable -1x Interlock | IEEE 1394a; (1x Interlock) 3.0 m, for Marlin / Oscar / Guppy | K1200167 |
| FireWire cable -1x Interlock | IEEE 1394a; (1x Interlock) 4.5 m, for Marlin / Oscar / Guppy | K1200091 |
| FireWire cable -1x Interlock | IEEE 1394a; (1x Interlock) 6.0 m, for Marlin / Oscar / Guppy | K1200160 |

Table 5: 1394 locking cables

| FireWire cable | Description | Ordering number |
|---|---|---|
| FireWire cable -1x Interlock | IEEE 1394a; (1x Interlock) 10 m,<br>for Marlin / Oscar / Guppy | K1200159 |
| Cable 0.5 m 9 pin - 6 pin, industrial | IEEE 1394b/a; 9 pin (screw lock)/6 pin (latch), 0.5 m | K1200198 |
| Cable 4.5 m 9 pin - 6 pin, industrial | IEEE 1394b/a; 9 pin (screw lock)/6 pin (latch), 4.5 m | K1200171 |
| Cable 0.5 m 9-pin - 9-pin, industrial | IEEE 1394b; 2x screw lock, 0.5 m, black, 2x ferrite | K1200201 |
| Cable 5.0 m 9-pin - 9-pin, industrial | IEEE 1394b; 2x screw lock, 5.0 m, black, 2x ferrite | K1200133 |
| Cable 7.5 m 9-pin - 9 pin, industrial | IEEE 1394b; 2x screw lock, 7.5 m, black, 2x ferrite | K1200134 |

Table 5: 1394 locking cables

# Overview hardware installation

- Install IEEE 1394 adapter (if PC or laptop does not have an IEEE 1394 port)
- Install software (FirePackage/Fire4Linux incl. viewer) and start the viewer: see **FirePackage/Fire4Linux User Guide**
- Connect camera to PC or laptop and ensure that the camera is powered

**Note**



Read the software manuals (**FirePackage/Fire4Linux User Guide**) to get information on licensing, acquiring your first image with viewer and troubleshooting.

# Installing IEEE 1394 adapter

1. **PC:** Install the IEEE 1394 adapter according to the instructions you got from your adapter manufacturer.
   **Laptop:** Insert the IEEE 1394 PC Card into your laptop. Connect external power supply to the adapter to power the camera or power the camera via Hirose connector.
2. Windows 2000/XP/VISTA will detect the hardware automatically and installs a Windows 1394 driver.

   Windows NT4 requires that you install the driver manually via a service install tool.

# Connecting camera to PC or laptop

1. Shut down your PC or laptop and **turn computer power off**.

**Caution**



- **Do not touch the shield of the camera cable** connected to a computer and the ground terminal of the lines at the same time.
- If you are charged: before touching the shield of the camera cable, make sure to discharge first (by touching the ground terminal of the lines).
- **Use only DC power supplies with insulated cases.** These are identified by having only **two** power connectors.
- If you feel uncomfortable with the previous advice or if you have no knowledge about the connectivity of an installation, **we strongly recommend powering down all systems before connecting or disconnecting a camera.**

**Caution**



**Hot-plug precautions**

- Although FireWire devices can **theoretically** be hot-plugged without powering down equipment, **we strongly recommend turning the computer power off, before connecting a digital camera** to it via a FireWire cable.
- **Static electricity or slight plug misalignment during insertion may short-circuit and damage components.**
- The physical ports **may be damaged** by **excessive ESD** (electrostatic discharge), when connected under powered conditions. It is good practice to ensure proper grounding of computer case and camera case to the same ground potential, before plugging the camera cable into the port of the computer. This ensures that no excessive difference of electrical potential exists between computer and camera.

**Screw-lock / Latching precautions**

- We strongly recommend using only 1394a cables with **latch connectors** / 1394b cables with **industrial screw-lock fasteners**, to insure a tight electrical connection that is resistant to vibration and gravity.
- **We strongly recommend using only 1394b adapter cards with screw-locks.**

2. Insert one end of the FireWire cable into your 1394 adapter or 1394 PC card.

3. Insert the other end of the FireWire cable into your camera.
4. Check that the camera is powered (green LED ON).

# Camera interfaces

Each AVT camera has the following interfaces:

- The 12-pin camera I/O connector (Guppy: 8-pin) provides different control inputs and output lines.
- One or two IEEE 1394a or 1394b connectors with screw lock mechanism provide access to the IEEE 1394 bus and thus makes it possible to control the camera and output frames.
  - DOLPHIN, OSCAR, MARLIN AND GUPPY provide one 1394a connector
  - PIKE and STINGRAY provide 2x 1394b connectors.

**Note** For information on **status LEDs** see the **Technical Manuals**.

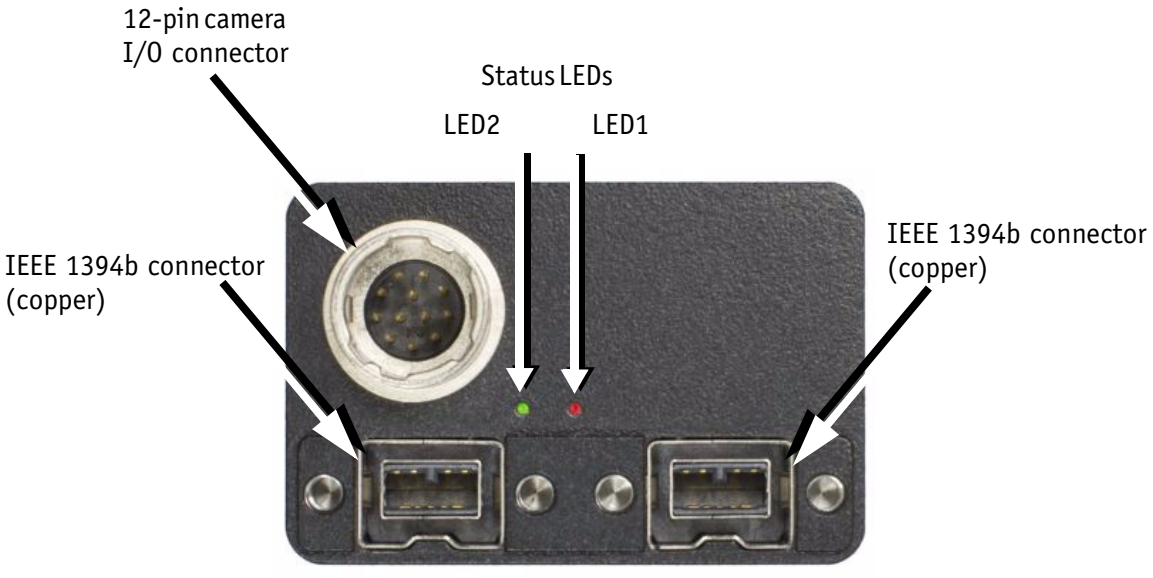



Figure 8: Example: Rear view of STINGRAY camera (2x 1394b copper)

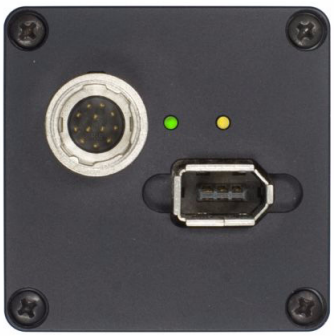
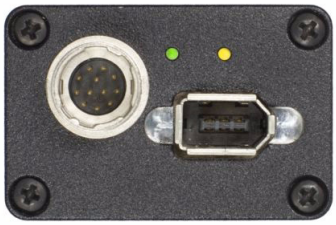
| DOLPHIN | OSCAR | MARLIN |
|---|---|---|
|  |  |  |
| HIROSE and 1x 1394a | HIROSE and 1x 1394a | HIROSE and 1x 1394a |
| **GUPPY** | **PIKE** | **STINGRAY** |
|  |  |  |
| HIROSE and 1x 1394a | HIROSE and 2x 1394b | HIROSE and 2x 1394b |

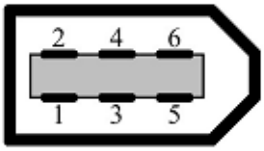
Table 6: Rear view of AVT cameras (HIROSE and 1394 copper)

| PIKE fiber | STINGRAY fiber | |
|---|---|---|
| <br>HIROSE and 1x 1394b GOF, 1x 1394b copper<br>GOF (marked with red line): 2x optical fiber on LCLC, dust cover off | <br>HIROSE and 1x 1394b GOF, 1x 1394b copper<br>GOF (marked with red line): 2x optical fiber on LCLC, dust cover off | |

Table 7: Rear view of AVT cameras (HIROSE and 1394b GOF/copper)

# IEEE 1394a port pin assignment (DOLPHIN, OSCAR, MARLIN, GUPPY)

The IEEE 1394a connector is designed for industrial use and has the following pin assignment as per specification:




| Pin | Signal |
|---|---|
| 1 | Cable power |
| 2 | Cable GND |
| 3 | TPB- |
| 4 | TPB+ |
| 5 | TPA- |
| 6 | TPA+ |

Figure 9: IEEE 1394a connector

**Note**

Cables with latching connectors on one or both sides can be used and are available with various lengths of 4.5 m or up to 17.5 m. Ask your local dealer for more details.

## Board level camera (GUPPY): IEEE 1394a port pin assignment

Board level Guppies have two 1394a ports to allow daisy chaining of cameras.

The IEEE 1394a pin header (2.54 mm connector: FireWire connector 1) is designed for adding a 1394a adapter cable of:

e.g. IEEE 1394 6 PIN - PANEL F TO 2X5 F (AVT#: K1200155)

It has the following pin assignment:

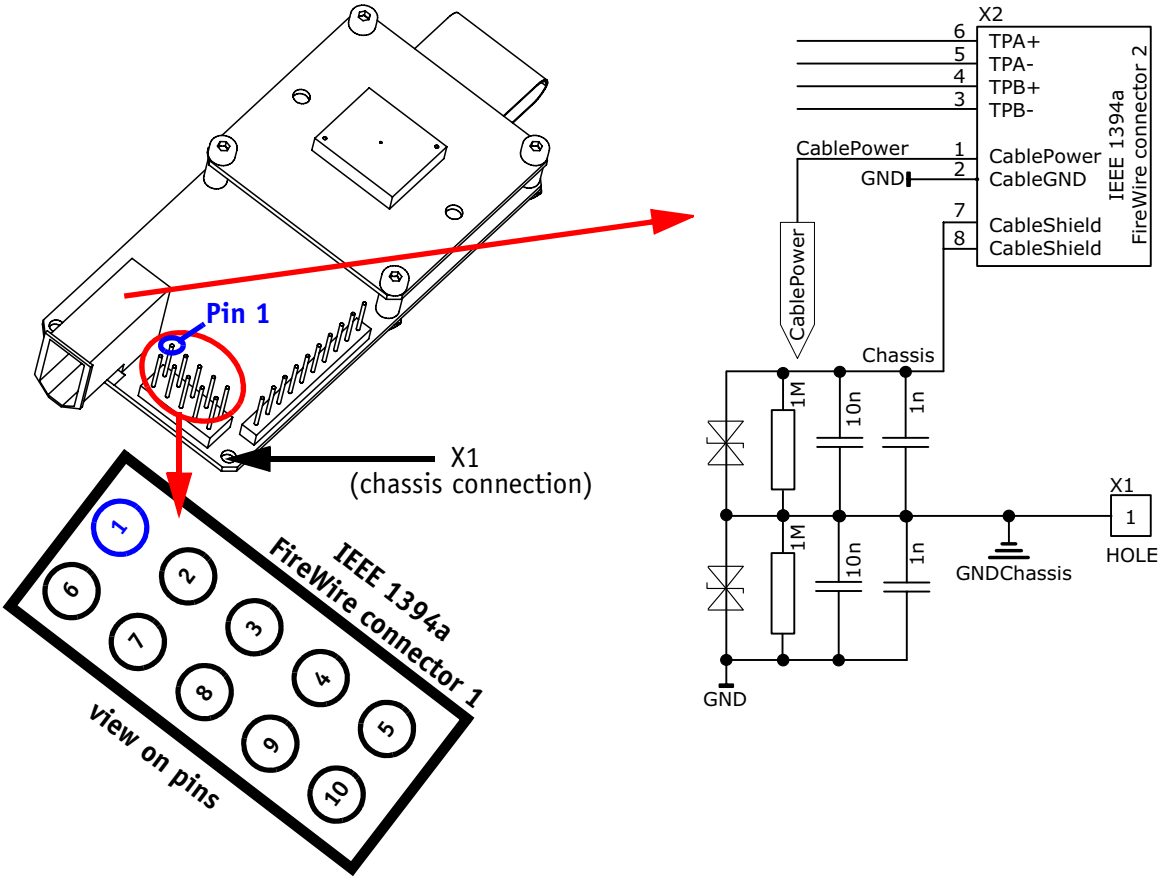



Figure 10: Board level camera (**GUPPY**): IEEE 1394 FireWire connector 1 (view on pins)

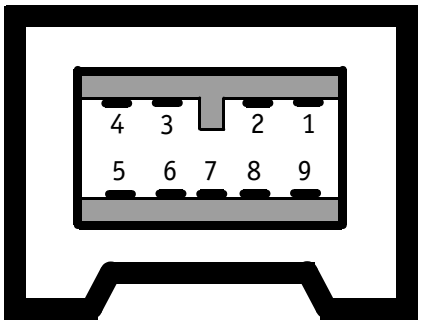
| Signal | Pin |
|---|---|
| TPA+ | **6** |
| - | **7** |
| TPB+ | **8** |
| - | **9** |
| - | **10** |

| Pin | Signal |
|---|---|
| **1** | TPA- |
| **2** | GND |
| **3** | TPB- |
| **4** | Cable power |
| **5** | Cable shield |

Table 8: Board level camera (**GUPPY**): IEEE 1394a pin assignment (FireWire connector 1)

# IEEE 1394b port pin assignment (PIKE, STINGRAY)

The IEEE 1394b connector is designed for industrial use and has the following pin assignment as per specification:




| Pin | Signal |
|---|---|
| 1 | TPB- |
| 2 | TPB+ |
| 3 | TPA- |
| 4 | TPA+ |
| 5 | TPA (Reference ground) |
| 6 | VG (GND) |
| 7 | N.C. |
| 8 | VP (Power, VCC) |
| 9 | TPB (Reference ground) |

Figure 11: IEEE 1394b connector

**Note**

- Both IEEE 1394b connectors with screw lock mechanism provide access to the IEEE 1394 bus and thus makes it possible to control the camera and output frames. Connect the camera by using either of the connectors. The other connector can be used to daisy chain a second camera.
- Cables with latching connectors on one or both sides can be used and are available with lengths of 5 m or 7.5 m. Ask your local dealer for more details.

## Board level camera (STINGRAY): IEEE 1394b port pin assignment

Board level STINGRAY cameras have two 1394b ports to allow daisy chaining of cameras.

They have the same pin assignment as the STINGRAY housing cameras.

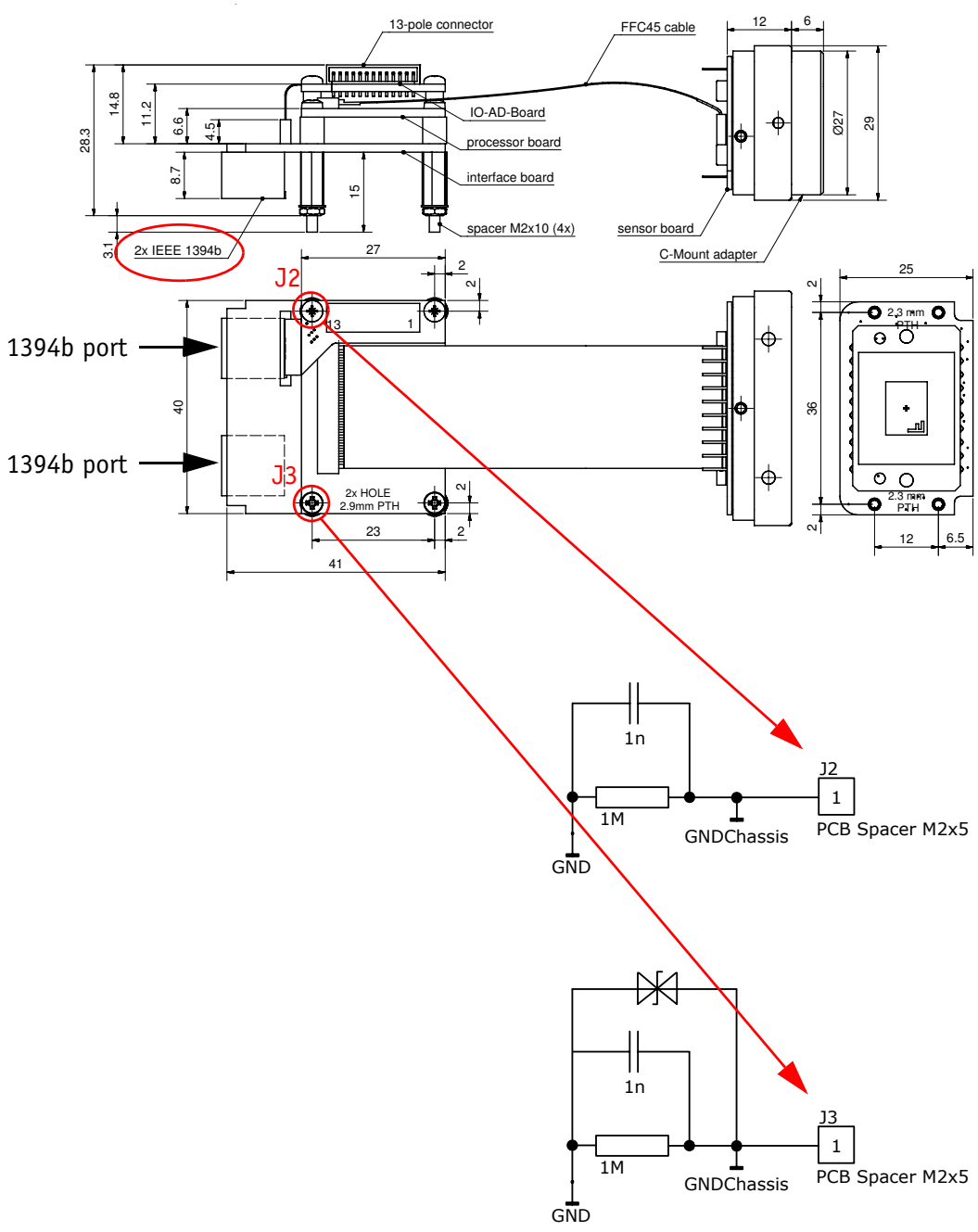



Figure 12: Board level camera (**STINGRAY**): two IEEE 1394b FireWire connectors

# PIKE/STINGRAY fiber infos and cautions

All PIKE and STINGRAY cameras are also available as **fiber version** with **1 x GOF connector and 1x copper connector**.

The GOF connector is of the following type: **2 x optical fiber on LCLC**

The GOF transmission uses **MMF (multi-mode fiber at 850 nm)**.

Connect the camera by using either of the connectors. The other connector can be used to daisy chain a second camera. In case of long distances between PC and camera, use the GOF connector for the long distance and the IEEE 1394b connector for optional daisy-chaining. Please ensure that you use a GOF hub on the PC side for reconversion from GOF to copper (order number E3000074 (with mounting plate) or E3000084 (with top-hat rail)). Alternatively use PCI or PCIExpress cards with built in GOF port. Ask your dealer for availability and details of these cards.

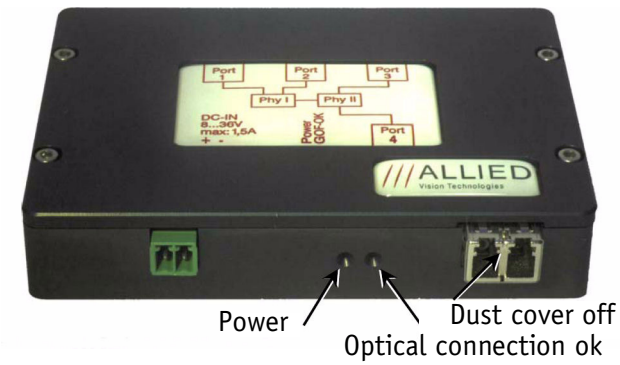



Figure 13: GOF hub

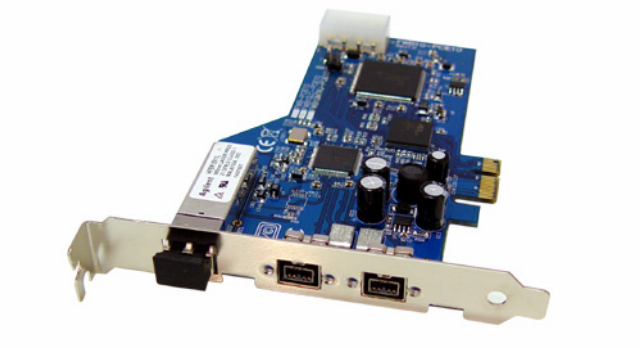


Figure 14: PCI Express card (1 x GOF, 2 x 1394 bilingual)

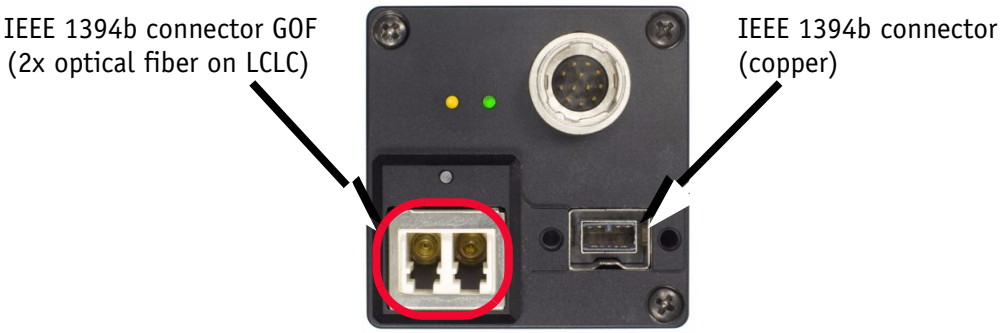



Figure 15: Rear view of PIKE camera (1394b: 1 x GOF, 1 x copper) (STINGRAY similar)

**Caution**

**Special warning for all PIKE/STINGRAY models with GOF connectors:**

GOF connectors are very sensitive. **Any dust or dirt may cause damage.**

- **Always keep the GOF connector and optical fiber plug clean.**
- If GOF connection is not in use, **keep GOF dust cover on the GOF connector.**
- **Reduce mating cycles to a minimum** to prevent abrasion.
- Please note that optical fiber cables have a **very limited deflection curve radius.**

# Camera I/O connectors (12 pin) order numbers and cables: STINGRAY, PIKE, MARLIN, OSCAR, DOLPHIN

The 12-pin camera I/O connector (STINGRAY, PIKE, MARLIN, OSCAR, DOLPHIN) is also designed for industrial use and, in addition to providing access to the inputs and outputs on the camera, it also provides a serial interface for e.g. the firmware update.

The connector is available in straight and angled version under the following numbers:

| Order text | Order number |
|---|---|
| PC-12P 12-Pin<br>HR10A-10P-12S<br>cable connector female | K7600040 |
| PC-12PW 12-Pin<br>HR10A-10LT-12S<br>angled cable connector female | K7600044 |

Table 9: Order numbers: I/O connector

**Note**

AVT supplies suitable I/O cables of different lengths (up to 10 m) as shown below.

| Order text | Length | Order number |
|---|---|---|
| Trigger cable<br>12-pin HIROSE female to BNC | 2.0 m | E1000648 |
| Trigger cable<br>12-pin HIROSE female to BNC | 5.0 m | E1000772 |
| Trigger cable<br>12-pin HIROSE female to open end | 2.0 m | E1000728 |
| Trigger cable<br>12-pin HIROSE female to open end | 10.0 m | E1000736 |
| I/O cable<br>12-pin HIROSE female to open end | 2.0 m | K1200191 |
| I/O cable<br>12-pin HIROSE female to open end | 3.0 m | K1200192 |

Table 10: Order numbers: trigger and I/O cables

| Order text | Length | Order number |
|---|---|---|
| I/O cable<br>12-pin HIROSE female to open end | 5.0 m | K1200193 |
| I/O cable<br>12-pin HIROSE female to open end | 10.0 m | K1200194 |

Table 10: Order numbers: trigger and I/O cables

**Note**

For pinning of the I/O connectors as viewed in pin direction see:

- Chapter STINGRAY camera I/O connector pin assignment on page 45
- Chapter PIKE camera I/O connector pin assignment on page 52
- Chapter MARLIN camera I/O connector pin assignment on page 67
- Chapter OSCAR camera I/O connector pin assignment on page 73
- Chapter DOLPHIN camera I/O connector pin assignment on page 79

# Camera I/O connectors (8 pin) order numbers and cables: GUPPY

The 8-pin camera I/O connector (only Guppy cameras) is designed for industrial use.

It provides:

- access to the inputs and outputs on the camera
- a serial interface

**Note**



The part number of the appropriate straight I/O connector is:

- HIROSE HR25-7TP-8S, AVT article number K7600503

AVT also supplies various I/O cables of different lengths, a selection is listed below:

- I/O cable, open 8-pin HIROSE female to open end, 2.0 m E1000842
- I/O cable, open 8-pin HIROSE female to open end, 5 m E1000843

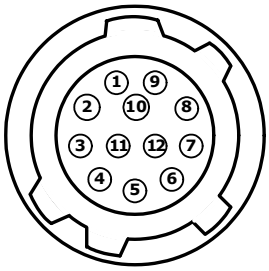
**Note**



For pinning of the I/O connectors as viewed in pin direction see Chapter GUPPY camera I/O connector pin assignment on page 60.

# STINGRAY camera I/O connector pin assignment

(For board level see Chapter STINGRAY board level camera: I/O pin assignment on page 51)




| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | External GND | | GND for RS232 and ext. power | External Ground for RS232 and external power |
| 2 | External Power | | +8 ... +36 V DC | Power supply |
| 3 | Camera Out 4 | Out | Open emitter | Camera Output 4 (GPOut4) default: - |
| 4 | Camera In 1 | In | $U_{in}$(high) = 3 V...24 V $U_{in}$(low) = 0 V...1.5 V | Camera Input 1 (GPIn1) default: Trigger |
| 5 | Camera Out 3 | Out | Open emitter | Camera Output 3 (GPOut3) default: Busy |
| 6 | Camera Out 1 | Out | Open emitter | Camera Output 1 (GPOut1) default: IntEna |
| 7 | Camera In GND | In | Common GND for inputs | Camera Common Input Ground (In GND) |
| 8 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 9 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 10 | Camera Out Power | In | Common VCC for outputs max. 36 V DC | Camera Output Power for digital outputs (OutVCC) |
| 11 | Camera In 2 | In | $U_{in}$(high) = 3 V...24 V $U_{in}$(low) = 0 V...1.5 V | Camera Input 2 (GPIn2) default: - |
| 12 | Camera Out 2 | Out | Open emitter | Camera Output 2 (GPOut2) default: Follow CameraIn2 |

Figure 16: STINGRAY: Camera I/O connector pin assignment

# STINGRAY input description

## STINGRAY input block diagram

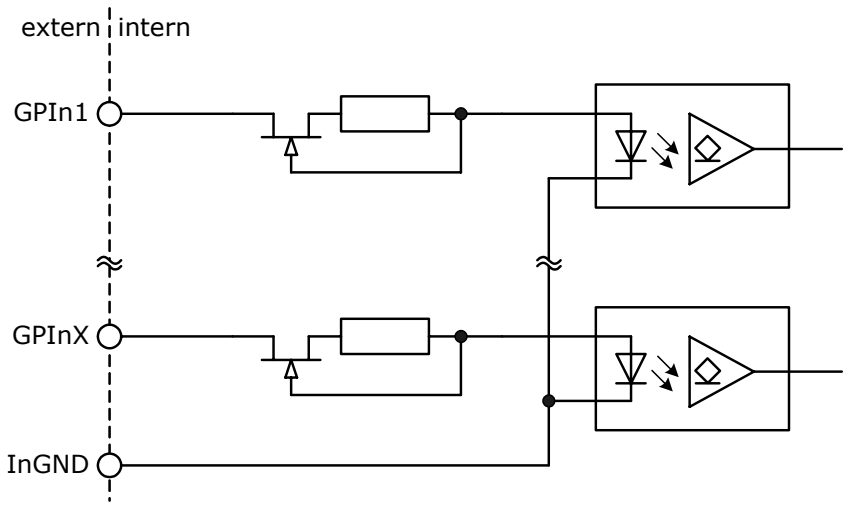



Figure 17: STINGRAY input block diagram

The inputs can be connected directly up to max. +24 V. If you want to use voltages from +24 V...+36 V you have to place an external resistor of 1.5 kΩ (1/10 Watt) in series with your voltage source.

**Caution** **STINGRAY**

- **Voltages above +24 V (without external resistor) may damage the camera.**
- **Voltages above +36 V (with an external resistor of 1.5 kΩ) may damage the camera.**

| Parameter | Value |
|---|---|
| $U_{in}$ (low) | 0 V ... 1.5 V |
| $U_{in}$ (high) | 3 V ... 24 V |
| Current (constant current source within the camera) | 8 mA |
| Flux voltage of the LED (@ 10 mA) | 1.5 V |

Table 11: STINGRAY input parameters

## STINGRAY delay

The cycle delay for all STINGRAY cameras is:
tpdLH < 1.0 µs and tpdHL < 1.5 µs

### Test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND.

# STINGRAY output description

## STINGRAY block diagram

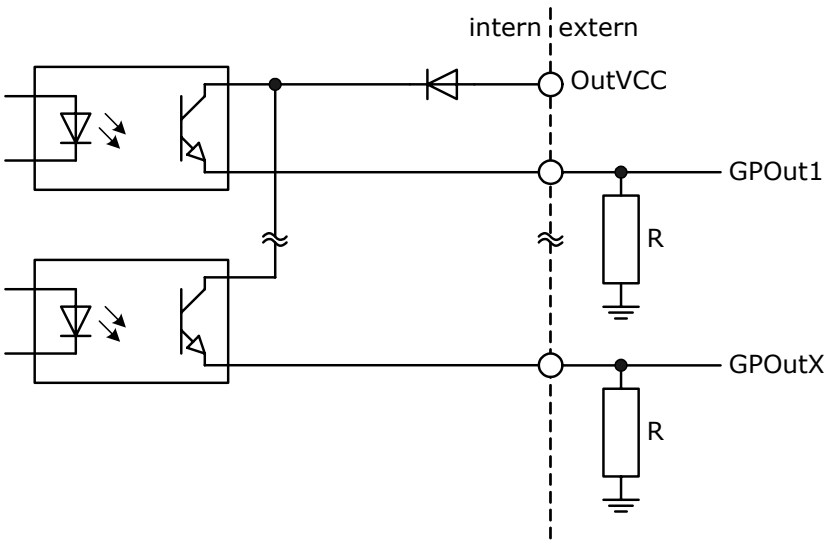



Figure 18: STINGRAY: output block diagram

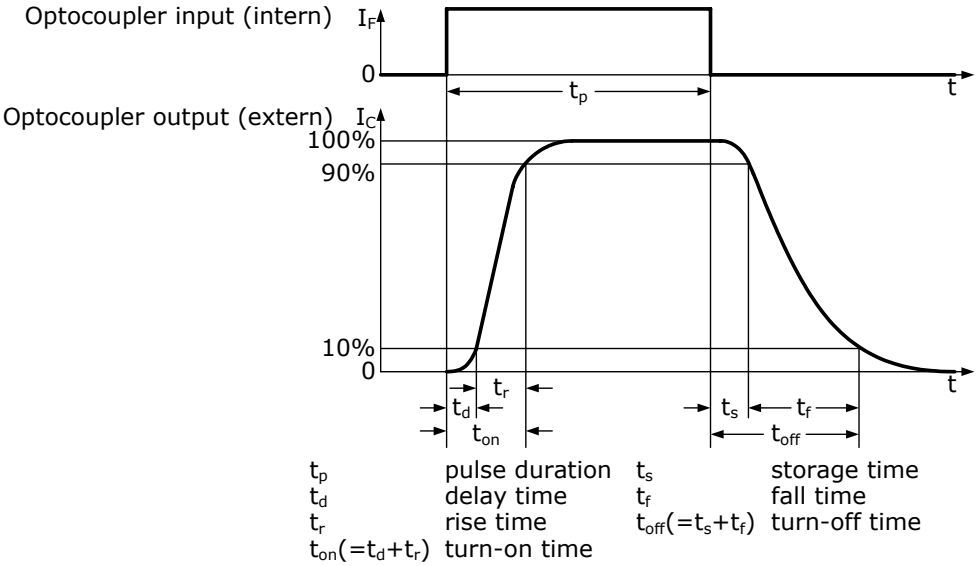
**Caution** **STINGRAY**

- **Max. 15 mA per output**
- **OutVCC > 36 V may damage the camera.**

| OutVCC | Resistor value | |
|---|---|---|
| 5 V | 1 kΩ | ~ 5 mA load recommended |
| 12 V | 2.4 kΩ | |
| 24 V | 4.7 kΩ | |
| | | |
| 5 V | 0.33 kΩ | ~ 15 mA load absolute maximum |
| 12 V | 0.82 kΩ | |
| 24 V | 1.6 kΩ | |

Figure 19: STINGRAY: OutVCC and external resistor

# STINGRAY delay




| Model | $t_p$ [µs] | Min. shutter [µs] |
|---|---|---|
| Stingray F-033 | 31 | 4 |
| Stingray F-046 | 31 | 4 |
| Stingray F-080 | 49 | 4 |
| Stingray F-145 | 74 | 4 |
| Stingray F-146 | 39 | 4 |
| Stingray F-201 | 48 | 4 |

Figure 20: STINGRAY output switching times

For all STINGRAY models:

$t_d \approx 1$ µs

$t_r \approx 1$ µs

$t_{on} = t_d + t_r \approx 2$ µs

$t_s \approx 26$ µs

$t_f \approx 21$ µs

$t_{off} = t_s + t_f \approx 47$ µs
($t_{off}$ can deviate by $\pm$ 5 µs)

## Test conditions

Camera: Format_7 Mode_0, Mono8, S800, extended shutter set to minimum

Output: external 2.4 kΩ resistor to GND, power input for output ports set to 12 V

# STINGRAY data

The RS232 data interface has a typical output voltage from ± 4.2 V.

# STINGRAY power

In accordance to IEEE 1394b specification the power supply (+8 V ... +36 V) should deliver a current of at least 1.5 A.

**Note**

If using daisy chain the camera has to supply further components with also 1.5 A.

In such cases your power supply should be able to deliver 3.0 A.

# STINGRAY board level camera: I/O pin assignment

The following diagram shows the 13-pole I/O pin connector of a STINGRAY board level camera:

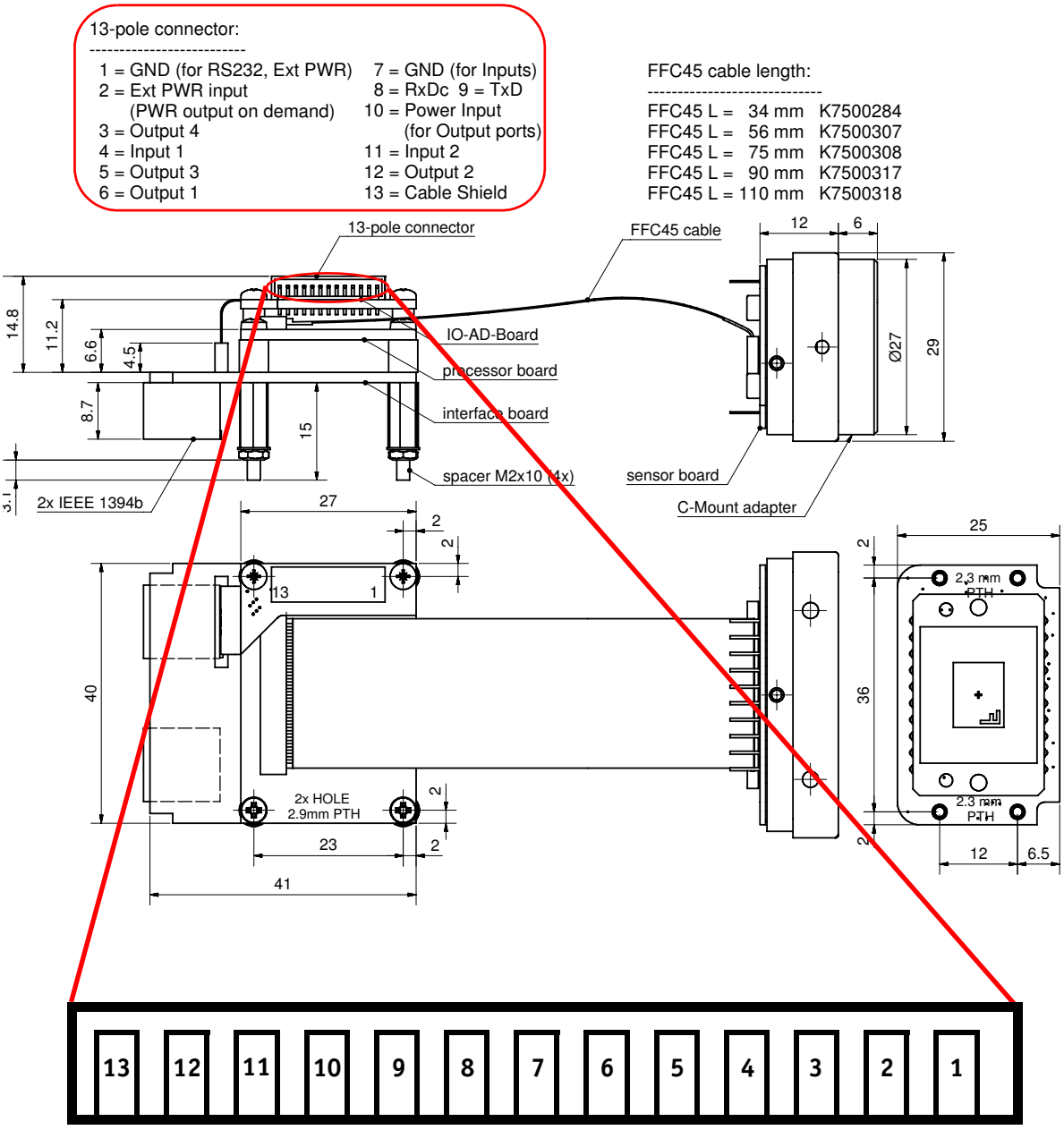
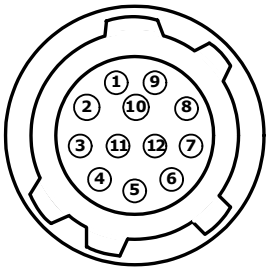



Figure 21: STINGRAY board level camera: I/O pin assignment

# PIKE camera I/O connector pin assignment




| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | External GND | | GND for RS232 and ext. power | External Ground for RS232 and external power |
| 2 | External Power | | +8 ... +36 V DC | Power supply |
| 3 | Camera Out 4 | Out | Open emitter | Camera Output 4 (GPOut4) default: - |
| 4 | Camera In 1 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$ $U_{in}$(low) = 0 V...0.8 V | Camera Input 1 (GPIn1) default: Trigger |
| 5 | Camera Out 3 | Out | Open emitter | Camera Output 3 (GPOut3) default: Busy |
| 6 | Camera Out 1 | Out | Open emitter | Camera Output 1 (GPOut1) default: IntEna |
| 7 | Camera In GND | In | Common GND for inputs | Camera Common Input Ground (In GND) |
| 8 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 9 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 10 | Camera Out Power | In | Common VCC for outputs max. 36 V DC | Camera Output Power for digital outputs (OutVCC) |
| 11 | Camera In 2 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$ $U_{in}$(low) = 0 V...0.8 V | Camera Input 2 (GPIn2) default: - |
| 12 | Camera Out 2 | Out | Open emitter | Camera Output 2 (GPOut2) default: Follow CameraIn2 |

Figure 22: PIKE: Camera I/O connector pin assignment

# PIKE input description (not PIKE F-505)

(for PIKE F-505 see Chapter Input description of PIKE F-505 on page 55)

## PIKE input block diagram

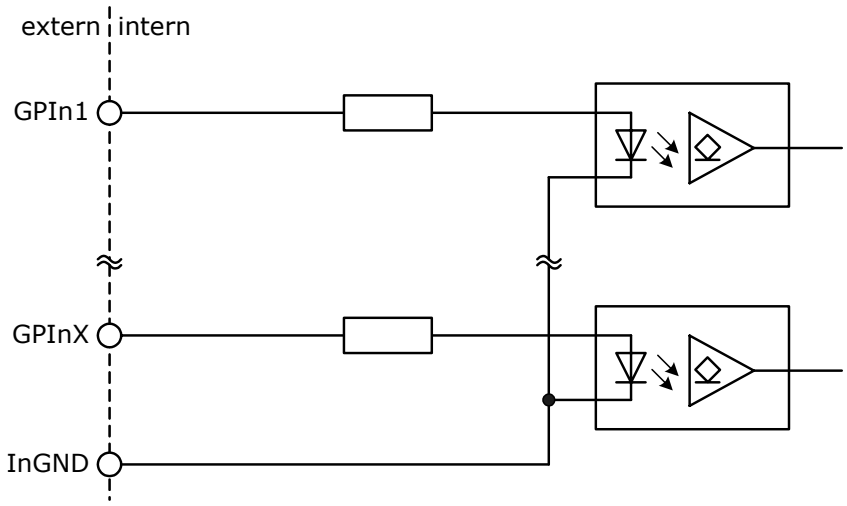



Figure 23: PIKE input block diagram

The inputs can be connected directly to +5 V. If a higher voltage is used, an external resistor must be placed in series.

**Caution** **PIKE**

**Voltages above +36 V may damage the camera.**

| Used input voltage ($U_{inVCC}$) | External series resistor |
|---|---|
| 5 V | none |
| 12 V | 0.82 kΩ |
| 24 V | 2.2 kΩ |
| 36 V | 3.3 kΩ |

Table 12: PIKE: external resistors for voltages higher than 5 V

| Parameter | Value |
|---|---|
| Initial on-current | 5 mA |
| Flux voltage of the LED (@ 10 mA) | 1.5 V |
| Maximum off-current | 0.25 mA |
| Maximum input current | 15 mA |

Table 13: PIKE: input parameters

## PIKE delay

The cycle delay for all PIKE cameras (except PIKE F-505) is:
tpdLH < 2.2 µs and tpdHL < 2.9 µs

### Test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND.

# Input description of PIKE F-505

PIKE F-505 has a different input wiring compared to the other PIKE models.

The Inputs of PIKE F-505 are the same as the inputs of STINGRAY.

## PIKE F-505 input block diagram

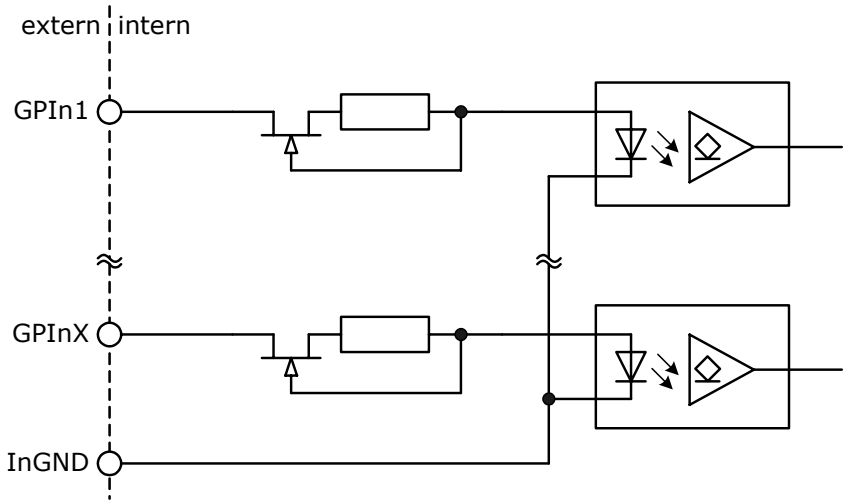



Figure 24: PIKE F-505 input block diagram

The inputs can be connected directly up to max. +24 V. If you want to use voltages from +24 V...+36 V you have to place an external resistor of 1.5 kΩ (1/10 Watt) in series with your voltage source.

**Caution** **PIKE F-505**

- **Voltages above +24 V (without external resistor) may damage the camera.**
- **Voltages above +36 V (with an external resistor of 1.5 kΩ) may damage the camera.**

| Parameter | Value |
|---|---|
| $U_{in}$ (low) | 0 V ... 1.5 V |
| $U_{in}$ (high) | 3 V ... 24 V |
| Current (constant current source within the camera) | 8 mA |
| Flux voltage of the LED (@ 10 mA) | 1.5 V |

Table 14: STINGRAY input parameters

## PIKE F-505 delay

The cycle delay for the PIKE F-505 is:

tpdLH < 2.2 µs and tpdHL < 2.8 µs

### Pike F-505 test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND.

# PIKE output description

## PIKE output block diagram

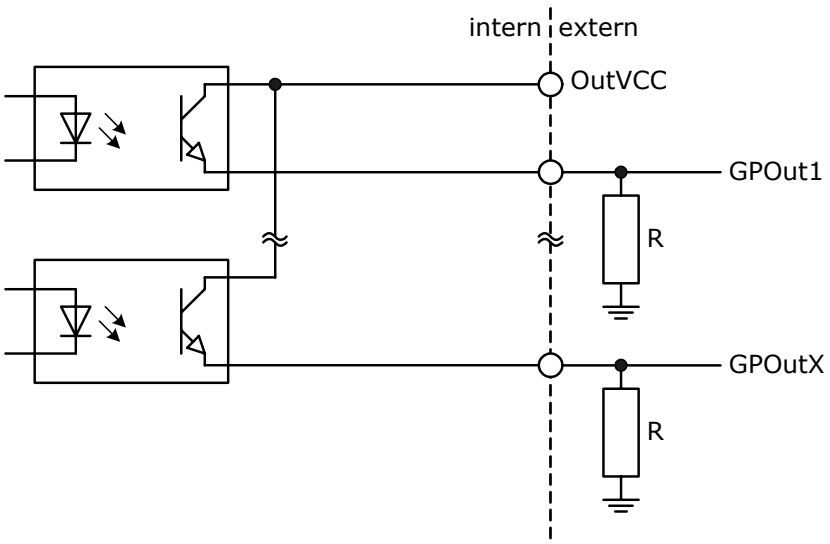



Figure 25: PIKE: output block diagram

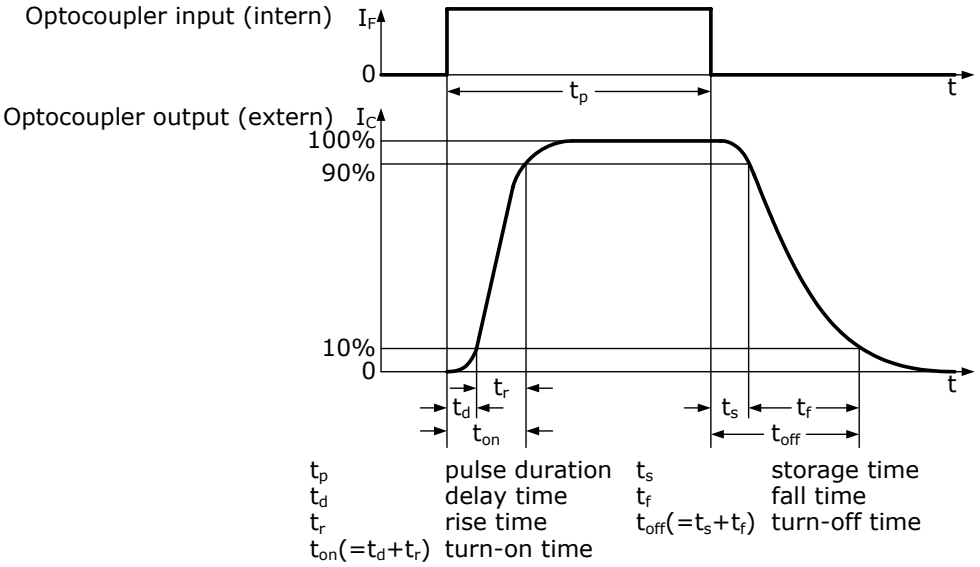
**Caution** **PIKE**

- **Max. 20 mA per output**
- **OutVCC > 36 V may damage the camera.**

| OutVCC | Resistor value | |
|---|---|---|
| 5 V | 1 kΩ | ~ 5 mA load recommended |
| 12 V | 2.4 kΩ | |
| 24 V | 4.7 kΩ | |
| | | |
| 5 V | 0.27 kΩ | ~ 20 mA load absolute maximum |
| 12 V | 0.62 kΩ | |
| 24 V | 1.2 kΩ | |

Figure 26: PIKE: OutVCC and external resistor

## PIKE delay




| Model | $t_p$ [µs] | Min. shutter [µs] |
|---|---|---|
| Pike F-032 | 18 | 1 |
| Pike F-100 | 43 | 1 |
| Pike F-145 (15 fps) | 71 | 1 |
| Pike F-145 (30 fps) | 39 | 1 |
| Pike F-210 | 43 | 1 |
| Pike F-421 | 70 | 1 |
| Pike F-505 | 27 | 1 |

Figure 27: PIKE: output switching times

For all PIKE models:

$t_d \approx 1$ µs

$t_r \approx 1$ µs

$t_{on} = t_d + t_r \approx 2$ µs

$t_s \approx 30$ µs

$t_f \approx 25$ µs

$t_{off} = t_s + t_f \approx 55$ µs
($t_{off}$ can deviate by ± 5 µs)

### Test conditions

Camera: Format_7 Mode_0, Mono8, S800, extended shutter set to minimum

Output: external 2.4 kΩ resistor to GND, power input for output ports set to 12 V

# PIKE data

The RS232 data interface has a typical output voltage from ± 4.2 V.

# PIKE power

In accordance to IEEE 1394b specification the power supply (+8 V...+36 V) should deliver a current of at least 1.5 A.

**Note**

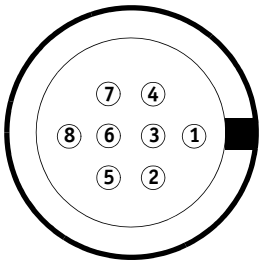


If using daisy chain the camera has to supply further components with also 1.5 A.

In such cases your power supply should be able to deliver 3.0 A.

# GUPPY camera I/O connector pin assignment

## GUPPY (housing)

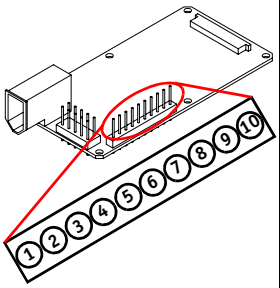



| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | Camera Out 1 | Out | $U_{out}$(high) = 2.4 V...5 V<br>$U_{out}$(low) = 0 V...0.4 V | Camera Output 1 (GPOut1)<br>default: IntEna |
| 2 | Camera Out 2 | Out | $U_{out}$(high) = 2.4 V...5 V<br>$U_{out}$(low) = 0 V...0.4 V | Camera Output 2 (GPOut2)<br>default: - |
| 3 | Camera Out 3 | Out | $U_{out}$(high) = 2.4 V...5 V<br>$U_{out}$(low) = 0 V...0.4 V | Camera Output 3 (GPOut3)<br>default: Busy |
| 4 | Camera In 1 | In | $U_{in}$(high) = 2 V...5 V<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 1 (GPIn1)<br>default: Trigger |
| 5 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 6 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 7 | External Power | | +8 ... +36 V DC | Power supply |
| 8 | External GND | | GND for RS232, GPIOs and ext. power | External Ground for RS232, GPIOs and external power |

Figure 28: GUPPY (housing): Camera I/O connector pin assignment

## GUPPY (board level)

The following diagram shows the I/O pin header (2.54 mm connector) of a board level camera as viewed in pin direction:




| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | External GND | | GND for RS232, GPIOs and ext. power | External Ground for RS232, GPIOs and external power |
| 2 | External Power | | +8...+36 V DC | Power supply |
| 3 | GND | | | |
| 4 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 5 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 6 | GND | | | |
| 7 | Camera In/Out 4 | In/Out | $U_{in}$(high) = 2 V...5 V<br>$U_{in}$(low) = 0 V...0.8 V<br><br>$U_{out}$(high) = 2.4 V...5 V<br>$U_{out}$(low) = 0 V...0.4 V | Camera Input/Output 4 (GPInOut4)<br>default: - |
| 8 | Camera In/Out 3 | In/Out | | Camera Input/Output 3 (GPInOut3)<br>default: - |
| 9 | Camera In/Out 2 | In/Out | | Camera Input/Output 2 (GPInOut2)<br>default: - |
| 10 | Camera In/Out 1 | In/Out | | Camera Input/Output 1 (GPInOut1)<br>default: - |

Figure 29: GUPPY (board level): Camera I/O connector pin assignment

# GUPPY input description

## GUPPY (housing) input block diagram

(For board level see Chapter STINGRAY board level camera: I/O pin assignment on page 51)

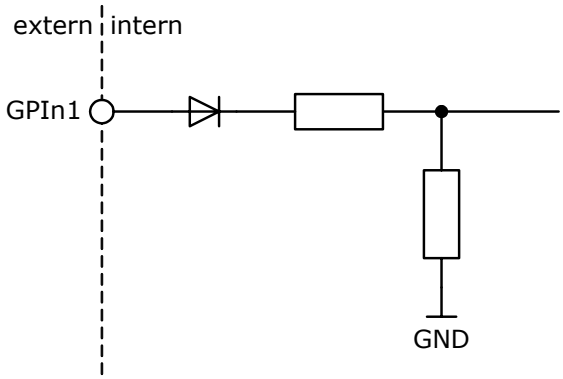



Figure 30: GUPPY (housing) input block diagram

The inputs can be connected directly to +5 V. If a higher voltage is used, an external resistor must be placed in series.

**Caution** **GUPPY**

**Voltages above +36 V may damage the camera.**

| Used input voltage | External series resistor |
|---|---|
| 5 V | none |
| 12 V | 22 kΩ |
| 24 V | 56 kΩ |
| 36 V | 91 kΩ |

Table 15: GUPPY: external resistors for voltages higher than 5 V

## GUPPY delay

The cycle delay for all GUPPY cameras is:
tpdLH < 3.0 µs and tpdHL < 1.5 µs

### Test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND and a 22 kΩ series resistor.

# GUPPY output description

## GUPPY output block diagram

(For board level see Chapter GUPPY (board level) IO block diagram on page 66)

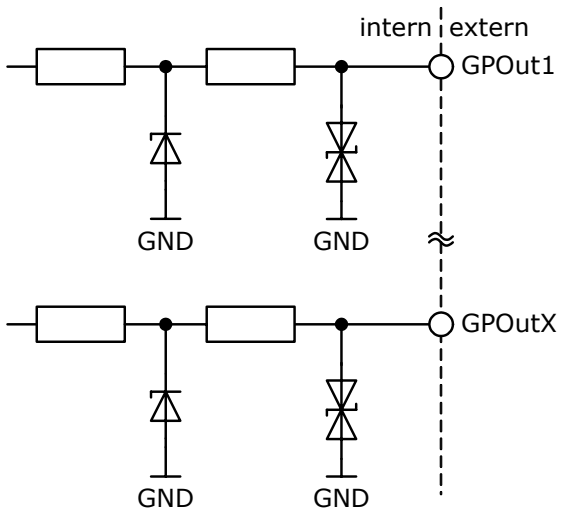



Figure 31: GUPPY: output block diagram

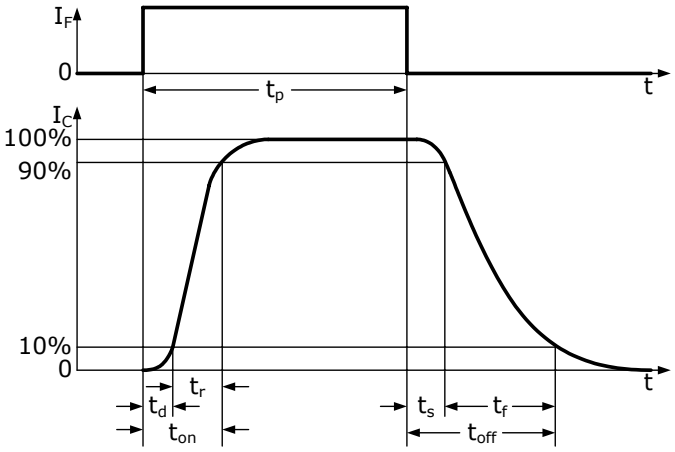
**Caution** **GUPPY**

**Max. 20 mA per output**

| OutVCC | Resistor value | |
|---|---|---|
| 5 V | 1 kΩ | ~ 5 mA load recommended |

Figure 32: GUPPY: OutVCC and external resistor

## GUPPY delay




| | | | |
|---|---|---|---|
| $t_p$ | pulse duration | $t_s$ | storage time |
| $t_d$ | delay time | $t_f$ | fall time |
| $t_r$ | rise time | $t_{off}(=t_s+t_f)$ | turn-off time |
| $t_{on}(=t_d+t_r)$ | turn-on time | | |

| Model | $t_p$ [µs] | Min. shutter [µs] |
|---|---|---|
| Guppy F-025 | 62 | 20 |
| Guppy F-029 | 62 | 20 |
| Guppy F-033 | 129 | 20 |
| Guppy F-036 | 179 | 200 |
| Guppy F-038 | 62 | 20 |
| Guppy F-044 | 62 | 20 |
| Guppy F-046 | 42 | 20 |
| Guppy F-080 | 54 | 20 |
| Guppy F-146 | 40 | 20 |

Figure 33: GUPPY: output switching times

For all GUPPY models:

$t_d < 0.5$ µs $\quad t_s < 0.5$ µs

$t_r < 0.5$ µs $\quad t_f < 0.5$ µs

$t_{on} = t_d + t_r < 1$µs $\quad t_{off} = t_s + t_f < 1$ µs

### Test conditions

Camera: Format_7 Mode_0, Mono8, S400, extended shutter set to minimum

Output: external 2.4 kΩ resistor to GND

# GUPPY (board level) IO block diagram

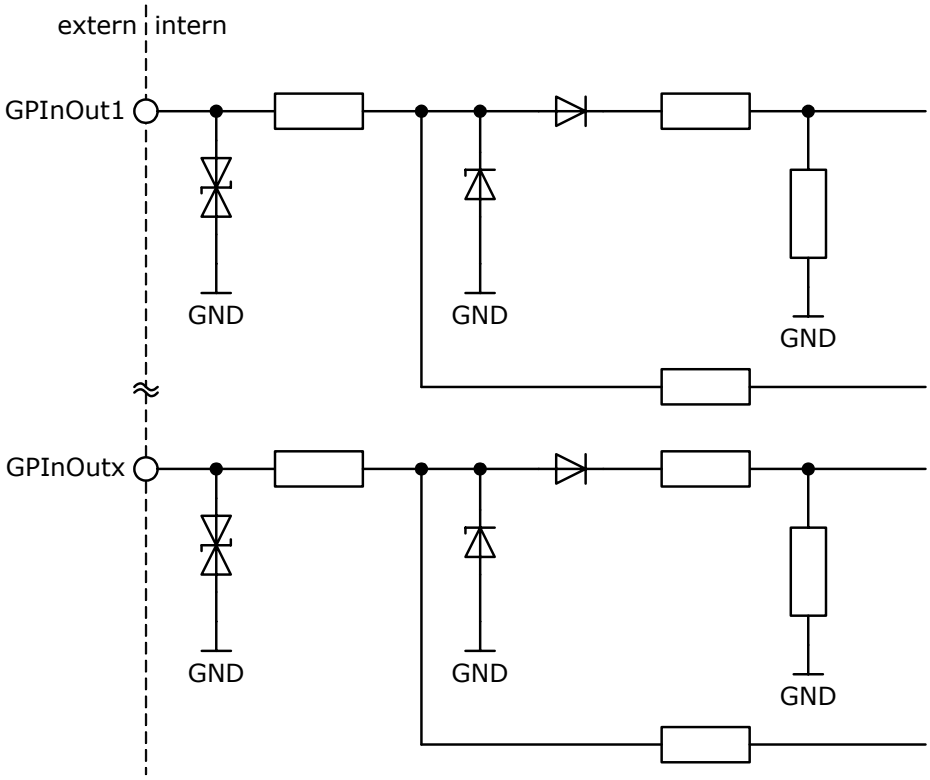



Figure 34: GUPPY (board level) input block diagram

The GPIOs of the board level GUPPY have the same electrical characteristics as the GPIOs of the standard (housing) GUPPY.

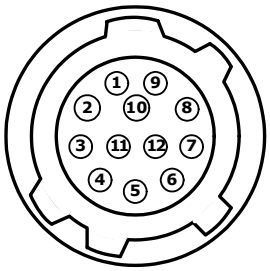
# GUPPY data

The RS232 data interface has a typical output voltage from ± 4.2 V.

# GUPPY power

In accordance to IEEE 1394a specification the power supply (+8 V ... +36 V) should deliver a current of at least 1.5 A.

# MARLIN camera I/O connector pin assignment




| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | External GND | | GND for RS232 and ext. power | External ground for RS232 and external power |
| 2 | External Power (CCD models only) | | +8 ... +36 V DC | Power supply |
| 3 | | | | |
| 4 | Camera In 1 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 1 (GPIn1)<br>default: Trigger |
| 5 | | | | |
| 6 | Camera Out 1 | Out | Open collector | Camera Output 1 (GPOut1)<br>default: IntEna |
| 7 | Camera In GND | In | Common GND for inputs | Camera Common Input Ground<br>(In GND) |
| 8 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 9 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 10 | Camera Out Power | In | Common VCC for outputs<br>max. 36 V DC | Camera Output Power for digital outputs<br>(OutVCC) |
| 11 | Camera In 2 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 2 (GPIn2)<br>default: - |
| 12 | Camera Out 2 | Out | Open collector | Camera Output 2 (GPOut2)<br>default: - |

Figure 35: MARLIN: Camera I/O connector pin assignment

# MARLIN input description

## MARLIN input block diagram

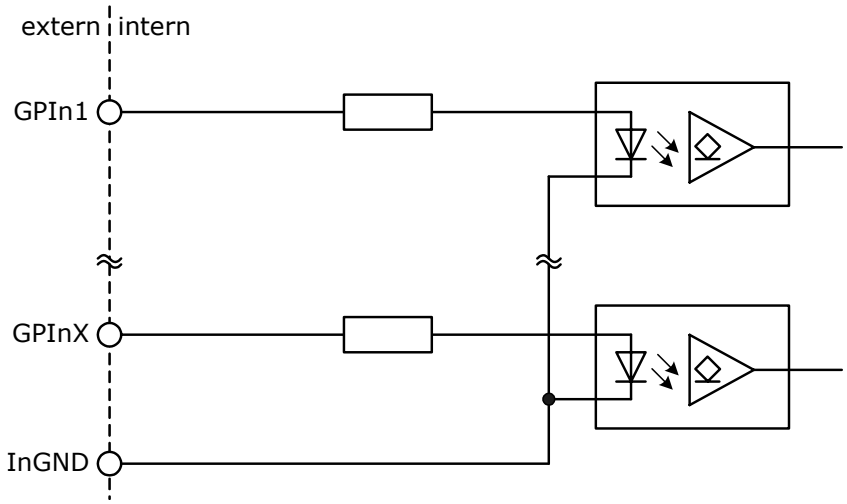



Figure 36: MARLIN: input block diagram

The inputs can be connected directly to +5 V. If a higher voltage is used, an external resistor must be placed in series.

**Caution** **MARLIN**

**Voltages above +36 V may damage the camera.**

| Used input voltage ($U_{inVCC}$) | External series resistor |
|---|---|
| 5 V | none |
| 12 V | 0.82 kΩ |
| 24 V | 2.2 kΩ |
| 36 V | 3.3 kΩ |

Table 16: MARLIN: external resistors for voltages higher than 5 V

| Parameter | Value |
|---|---|
| Initial on-current | 5 mA |
| Flux voltage of the LED (@ 10 mA) | 1.5 V |

Table 17: MARLIN: input parameters

| Parameter | Value |
|---|---|
| Maximum off-current | 0.25 mA |
| Maximum input current | 15 mA |

Table 17: MARLIN: input parameters

## MARLIN delay

The cycle delay for all MARLIN cameras is:
tpdLH < 1 µs and tpdHL < 1 µs

### Test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND.

# MARLIN output description

## MARLIN output block diagram

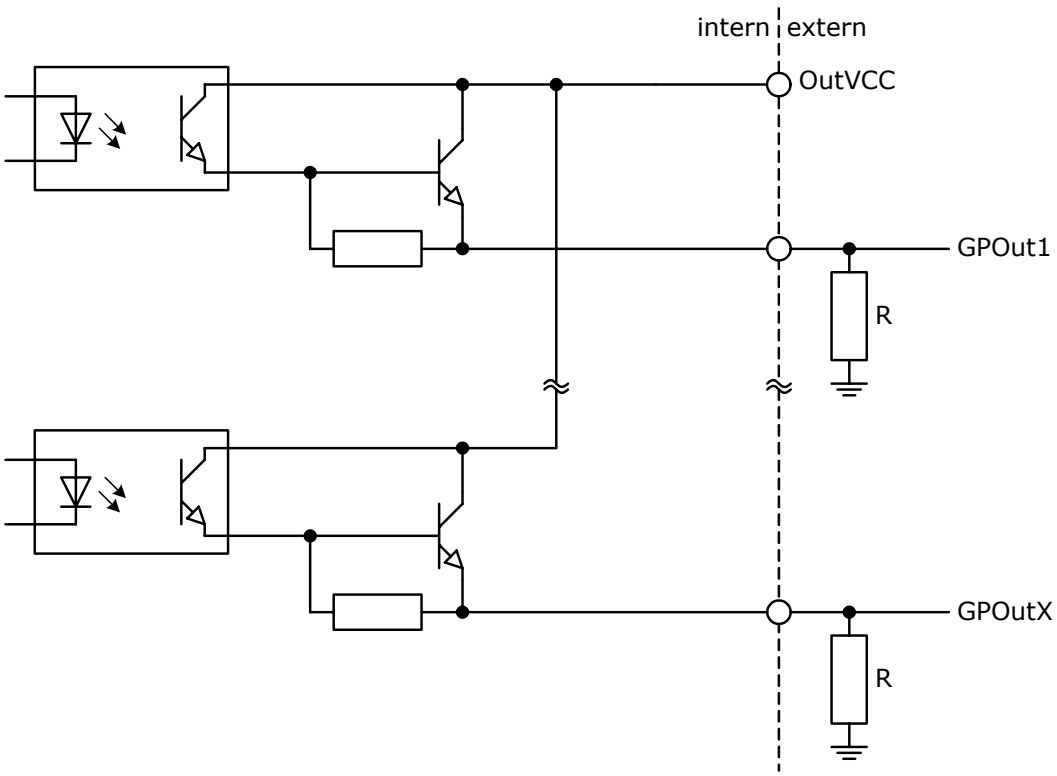



Figure 37: MARLIN: output block diagram

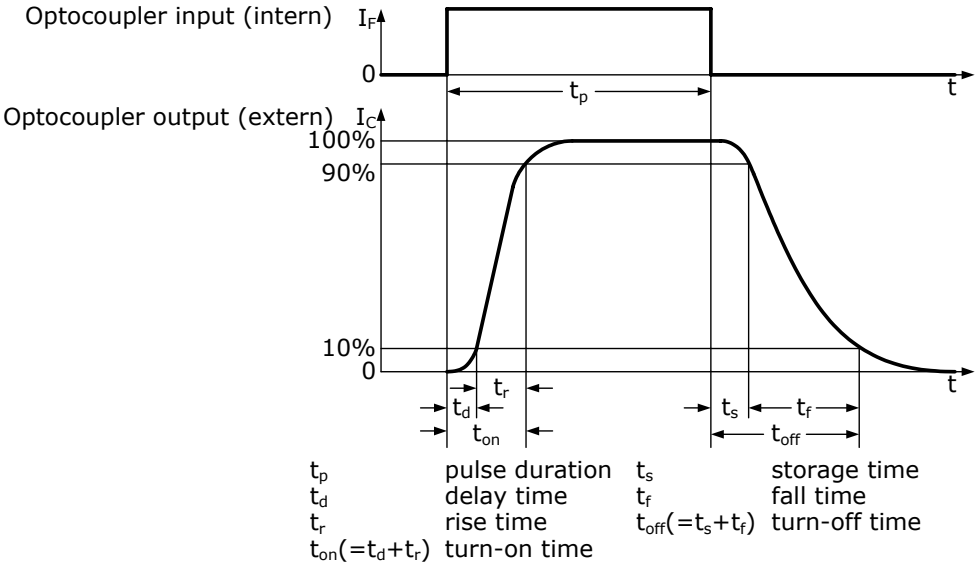
**Caution** **MARLIN**

- **Max. 200 mA per output**
- **OutVCC > 36 V may damage the camera.**

| OutVCC | Resistor value | |
|---|---|---|
| 5 V | 1 kΩ | ~ 5 mA load recommended |
| 12 V | 2.4 kΩ | |
| 24 V | 4.7 kΩ | |

Figure 38: MARLIN: OutVCC and external resistor

## MARLIN delay




| Model | $t_p$ [µs] | Min. shutter [µs] |
|---|---|---|
| Marlin F-033 | 32 | 20 |
| Marlin F-046 | 32 | 20 |
| Marlin F-080 | 50 | 20 |
| Marlin F-080 (30 fps) | 37 | 20 |
| Marlin F-131 | 10 | 10 |
| Marlin F-145 | 38 | 12 |
| Marlin F-146 | 46 | 20 |
| Marlin F-201 | 59 | 20 |

Figure 39: MARLIN: output switching times

For all MARLIN models:

$t_d \approx 1$ µs

$t_r \approx 1$ µs

$t_{on} = t_d + t_r \approx 2$ µs

$t_s \approx 55$ µs

$t_f \approx 75$ µs

$t_{off} = t_s + t_f \approx 130$ µs
($t_{off}$ can deviate by $\pm$ 5 µs)

### Test conditions

Camera: Format_7 Mode_0, Mono8, S400, extended shutter set to minimum

Output: external 2.4 kΩ resistor to GND, power input for output ports set to 12 V

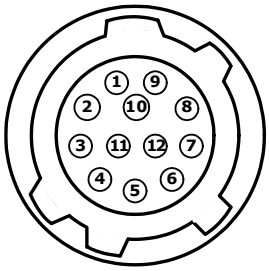
# MARLIN data

The RS232 data interface has a typical output voltage from ± 4.2 V.

# MARLIN power

In accordance to IEEE 1394a specification the power supply (+8 V ... +36 V) should deliver a current of at least 1.5 A.

# OSCAR camera I/O connector pin assignment




| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | External GND | | GND for RS232 and ext. power | External ground for RS232 and external power |
| 2 | External Power | | +8 ... +36 V DC | Power supply |
| 3 | | | | |
| 4 | Camera In 1 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 1<br>(GPIn1)<br>default: Trigger |
| 5 | | | | |
| 6 | Camera Out 1 | Out | Open emitter | Camera Output 1<br>(GPOut1)<br>default: IntEna |
| 7 | Camera In GND | In | Common GND for inputs | Camera Common Input Ground<br>(In GND) |
| 8 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 9 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 10 | Camera Out Power | In | Common VCC for outputs<br>max. 36 V DC | Camera Output Power for digital outputs<br>(OutVCC) |
| 11 | Camera In 2 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 2<br>(GPIn2)<br>default: - |
| 12 | Camera Out 2 | Out | Open emitter | Camera Output 2<br>(GPOut2)<br>default: - |

Figure 40: OSCAR: Camera I/O connector pin assignment

# OSCAR input description

## OSCAR input block diagram

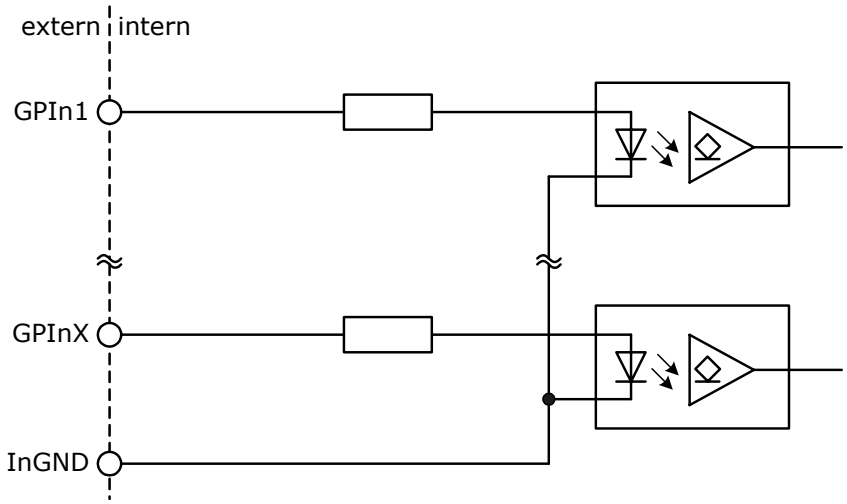



Figure 41: OSCAR: input block diagram

The inputs can be connected directly to +5 V. If a higher voltage is used, an external resistor must be placed in series.

**Caution** **OSCAR**

**Voltages above +36 V may damage the camera.**

| Used input voltage ($U_{inVCC}$) | External series resistor |
|---|---|
| 5 V | none |
| 12 V | 0.82 kΩ |
| 24 V | 2.2 kΩ |
| 36 V | 3.3 kΩ |

Table 18: OSCAR: external resistors for voltages higher than 5 V

| Parameter | Value |
|---|---|
| Initial on-current | 5 mA |
| Flux voltage of the LED (@ 10 mA) | 1.5 V |

Table 19: OSCAR: input parameters

| Parameter | Value |
|---|---|
| Maximum off-current | 0.25 mA |
| Maximum input current | 15 mA |

Table 19: OSCAR: input parameters

## OSCAR delay

The cycle delay for all OSCAR cameras is:
tpdLH < 1 µs and tpdHL < 1 µs

### Test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND.

# OSCAR output description

## OSCAR output block diagram

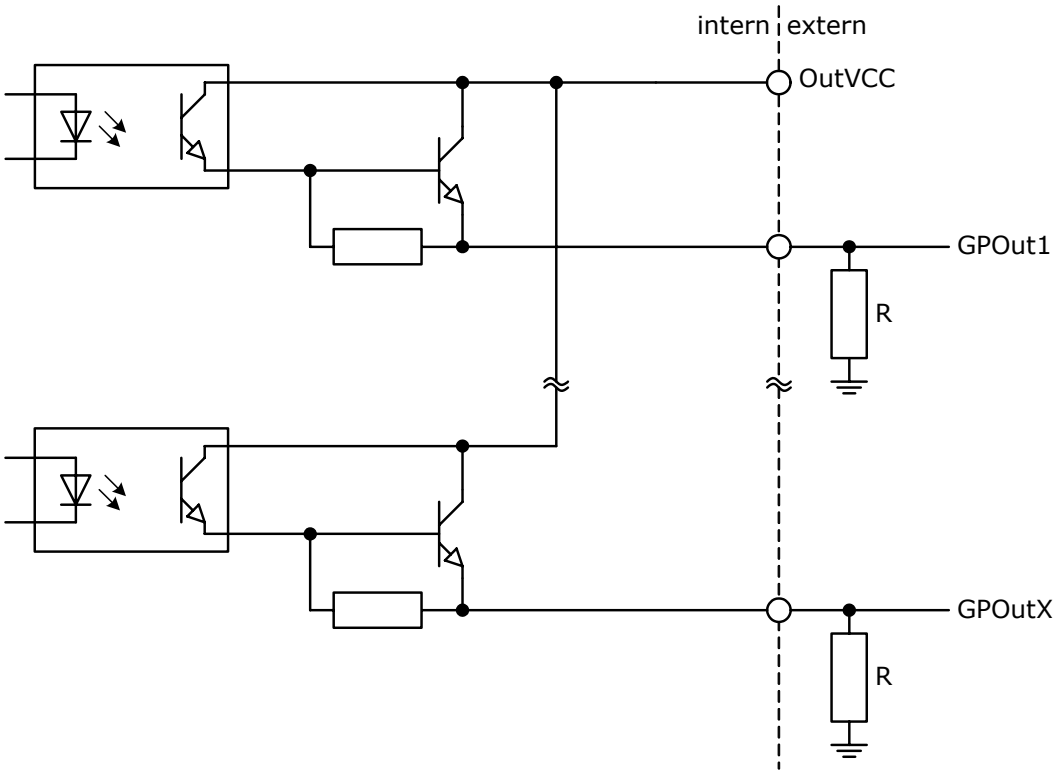



Figure 42: OSCAR: output block diagram

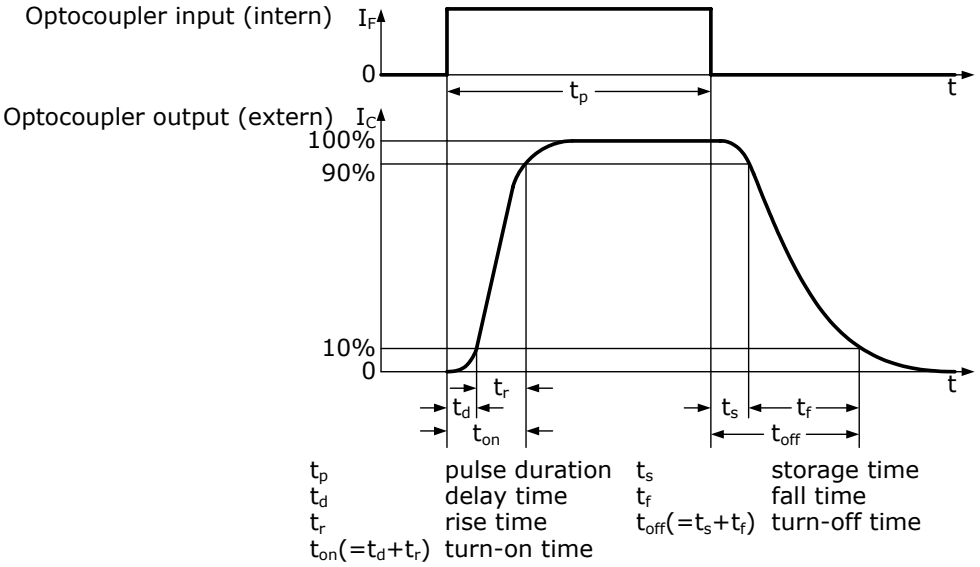
**Caution** **OSCAR**

- **Max. 200 mA per output**
- **OutVCC > 36 V may damage the camera.**

| OutVCC | Resistor value | |
|---|---|---|
| 5 V | 1 kΩ | ~ 5 mA load recommended |
| 12 V | 2.4 kΩ | |
| 24 V | 4.7 kΩ | |

Figure 43: OSCAR: OutVCC and external resistor

## OSCAR delay




| Model | $t_p$ [µs] | Min. shutter [µs] |
|---|---|---|
| Oscar F-320 | 66 | 20 |
| Oscar F-510 | 94 | 20 |
| Oscar F-810 | 118 | 20 |

Figure 44: MARLIN: output switching times

For all OSCAR models:

$t_d \approx 1$ µs

$t_r \approx 1$ µs

$t_{on} = t_d + t_r \approx 2$ µs

$t_s \approx 55$ µs

$t_f \approx 75$ µs

$t_{off} = t_s + t_f \approx 130$ µs
($t_{off}$ can deviate by ± 5 µs)

### Test conditions

Camera: Format_7 Mode_0, Mono8, S400, extended shutter set to minimum

Output: external 2.4 kΩ resistor to GND, power input for output ports set to 12 V

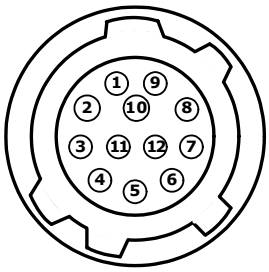
# OSCAR data

The RS232 data interface has a typical output voltage from ± 4.2 V.

# OSCAR power

In accordance to IEEE 1394a specification the power supply (+8 V ... +36 V) should deliver a current of at least 1.5 A.

# DOLPHIN camera I/O connector pin assignment




| Pin | Signal | Direction | Level | Description |
|---|---|---|---|---|
| 1 | External GND | | GND for RS232 and ext. power | External ground for RS232 and external power |
| 2 | External Power | | +8 ... +36 V DC | Power supply |
| 3 | Camera In 3 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 3<br>(GPIn3)<br>default: - |
| 4 | Camera In 1 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 1<br>(GPIn1)<br>default: Trigger |
| 5 | Camera Out 3 | Out | Open collector | Camera Output 3<br>(GPOut3)<br>default: - |
| 6 | Camera Out 1 | Out | Open collector | Camera Output 1<br>(GPOut1)<br>default: IntEna |
| 7 | Camera In GND | In | Common GND for inputs | Camera Common Input Ground<br>(In GND) |
| 8 | RxD RS232 | In | RS232 | Terminal Receive Data |
| 9 | TxD RS232 | Out | RS232 | Terminal Transmit Data |
| 10 | Camera Out GND | In | Common GND for outputs | Camera Common Output Ground<br>(Out GND) |
| 11 | Camera In 2 | In | $U_{in}$(high) = 2 V...$U_{inVCC}$<br>$U_{in}$(low) = 0 V...0.8 V | Camera Input 2<br>(GPIn2)<br>default: - |
| 12 | Camera Out 2 | Out | Open collector | Camera Output 2<br>(GPOut2)<br>default: - |

Figure 45: DOLPHIN: Camera I/O connector pin assignment

# DOLPHIN input description

## DOLPHIN input block diagram

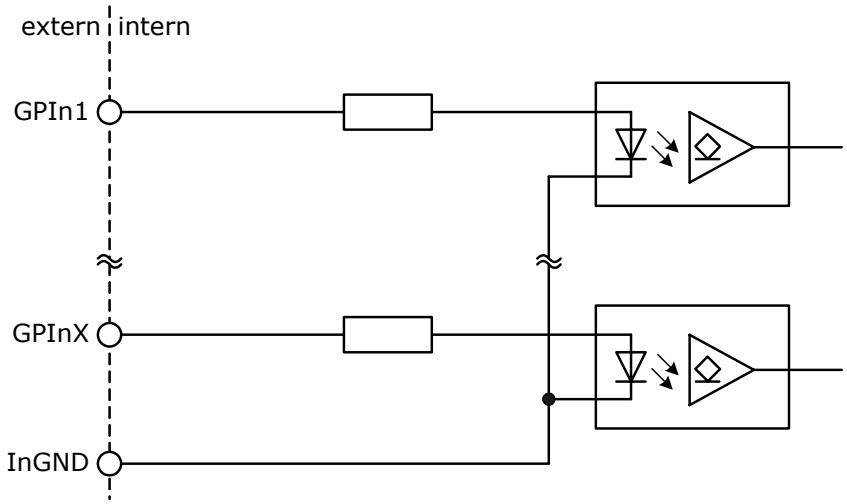



Figure 46: DOLPHIN: input block diagram

The inputs can be connected directly to +5 V. If a higher voltage is used, an external resistor must be placed in series.

**Caution** **DOLPHIN**

**Voltages above +36 V may damage the camera.**

| Used input voltage ($U_{inVCC}$) | External series resistor |
|---|---|
| 5 V | none |
| 12 V | 0.82 kΩ |
| 24 V | 2.2 kΩ |
| 36 V | 3.3 kΩ |

Table 20: DOLPHIN: external resistors for voltages higher than 5 V

| Parameter | Value |
|---|---|
| Initial on-current | 5 mA |
| Flux voltage of the LED (@ 10 mA) | 1.5 V |

Table 21: DOLPHIN: input parameters

| Parameter | Value |
|---|---|
| Maximum off-current | 0.25 mA |
| Maximum input current | 15 mA |

Table 21: DOLPHIN: input parameters

## DOLPHIN delay

The cycle delay for all DOLPHIN cameras is:
tpdLH < 2.0 µs and tpdHL < 2.0 µs

### Test conditions

The input signal was driven with 12 V and a 2.2 kΩ pull down resistor to GND.

# DOLPHIN output description

## DOLPHIN output block diagram

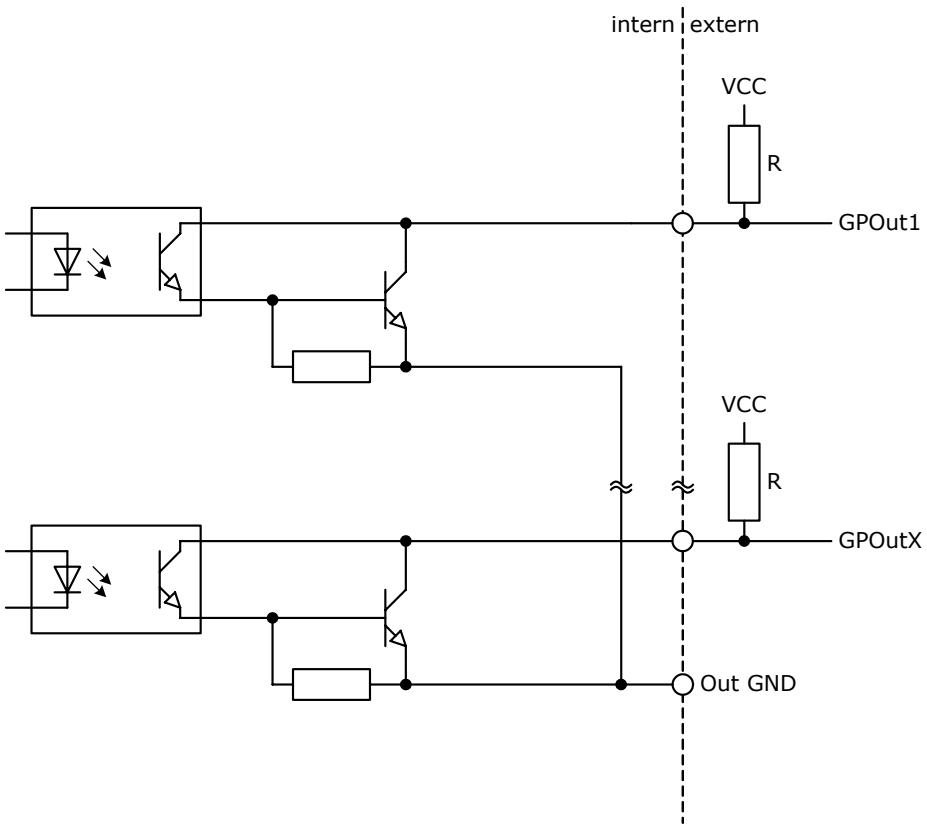



Figure 47: DOLPHIN: output block diagram

**Caution** **DOLPHIN**

- **Max. 200 mA per output**
- **OutVCC > 36 V may damage the camera.**

| OutVCC | Resistor value | |
|---|---|---|
| 5 V | 1 kΩ | ~ 5 mA load recommended |
| 12 V | 2.4 kΩ | |
| 24 V | 4.7 kΩ | |

Figure 48: DOLPHIN: OutVCC and external resistor

# DOLPHIN data

The RS232 data interface has a typical output voltage from ± 4.2 V.

# DOLPHIN power

In accordance to IEEE 1394a specification the power supply (+8 V ... +36 V) should deliver a current of at least 1.5 A.

# Firmware update

Firmware updates can be carried out without opening the camera.

**Note**



For further information:

- Read the application note: **How to update Guppy/ Pike/Stingray firmware** at AVT website or
- Contact your local dealer.

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