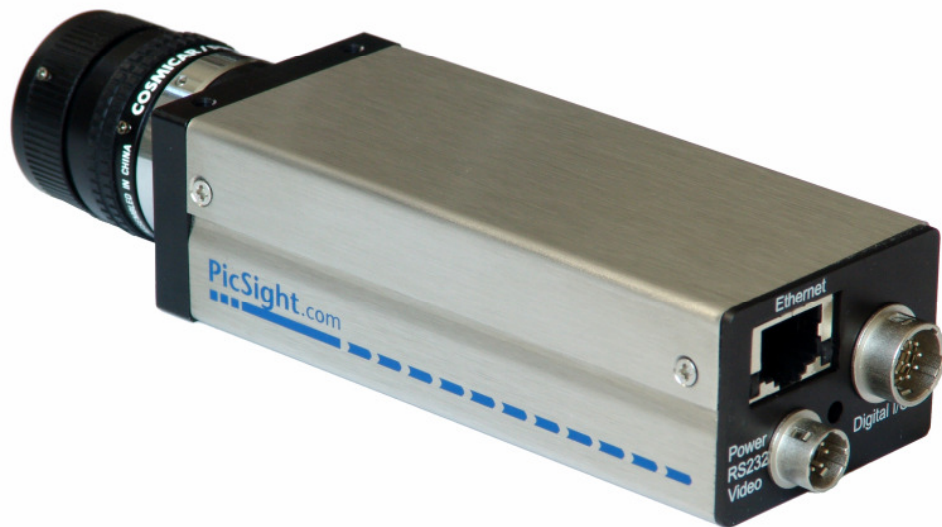




PicSight.com



## PicSight GigE Camera Series **Getting Started Guide**



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# 1. Product Package

The products of PicSight® series are available as an *OEM-Product* or as a *Standard Product*.

## 1.1. OEM Product

The OEM-product consists of the hardware only without any documentation or software. Thus every OEM must buy a standard product first.

## 1.2. Standard Product

The standard product consists of the following items:

1. **PicSight®** hardware
2. **LV-SDS**, software development tools for PicSight® hardware:
  - **Daisy**, C++ class library (DLL) for Borland- or MS-C++. Includes interactive Camera Editor to create own camera definitions, and DRAL libraries for handling special tasks. Daisy is available for Windows XP/2000/NT4, for Windows Me/98/95, and for Linux. The GigE cameras are supported in Windows 2000/XP only.
  - **Orchid**, high level library enabling fast and easy development of live-video applications in visual environments (MS Visual Basic, Borland C++ Builder, .Net Framework, etc.).
  - **PicSight Demo**, an interactive test program for demonstrating basic PicSight capabilities.
  - **Twain** driver which allows you to use PicSight® with most of the popular image processing and office software, e.g. CorelDRAW, MS Office etc.
  - Video for Windows and MCI drivers.
  - Support for various 3<sup>rd</sup> party image processing software.
  - LV-SDS Programmers Reference Manual in PDF format.
  - This manual (PicSight® Series - Getting Started)

**Important:** Please study carefully the release notes of the LV-SDS to see which features are not yet implemented.

**Important:** All software products mentioned above may be duplicated without further charge for OEM applications. If the product is just resold (distributed), every end user has to buy a standard product first.

## 1.3. Environment

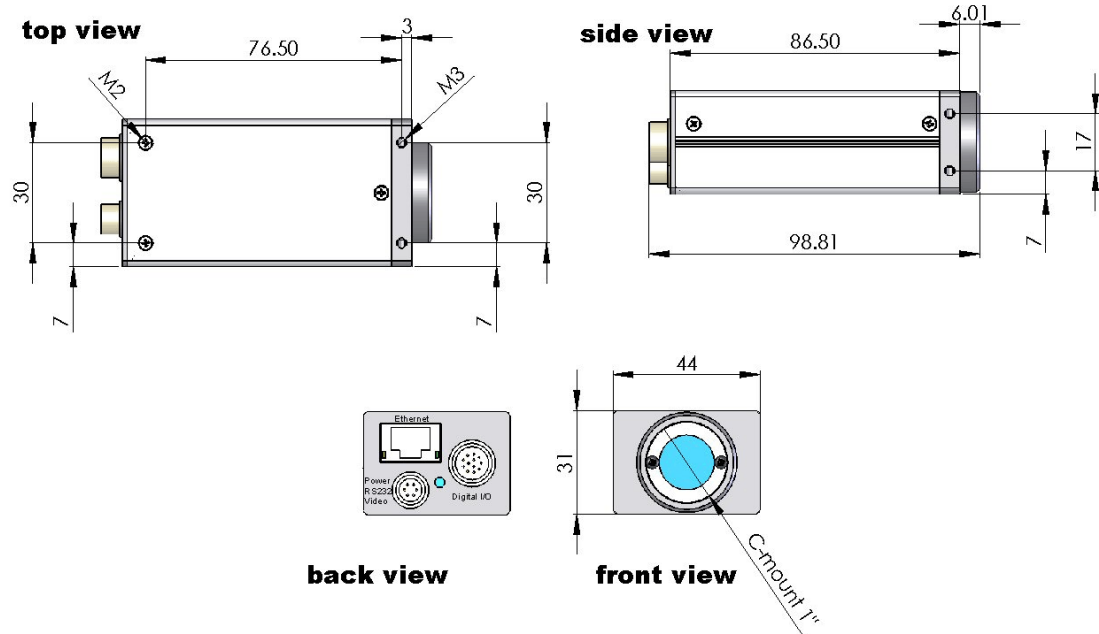
Our products are for use in industrial environment. Connected equipment like keyboard, cameras and cables must fulfil the CE and EMC (EN 55022, EN 55024) rules. Operating temperature and other environment parameters are stated in the data sheet for each camera type.

Please contact us if you need further information regarding the necessary equipment.

## 2. Hardware Description

Only features common for the whole family are described in this section. For features specific to a particular model, please refer to the *Specification Sheet* of the model.


### 2.1. Mechanical Description



### 2.2. Connector Description

#### 2.2.1. Digital I/O

Hirose 12-pin connector, male, HR10A-10R-12PB-71

	Pin	Signal
	1	Opto Output TAP (connect + 5-24 Volts)
	2	Opto Output Common (Emitter)
	3	Opto Output 0 (Collector)
	4	Opto Output 1 (Collector)
	5	reserved, do not connect
	6	reserved, do not connect
	7	reserved, do not connect
	8	Opto Input 1 (bidirectional)
	9	Opto Input 0 (bidirectional)
	10	Opto Input Common (bidirectional)
	11	Trigger Input TTL
	12	Ground

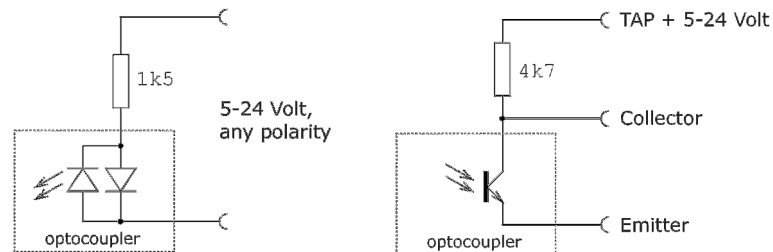
## 2.2.2. RS-232c, Power

**Hirose 6-pin connector male, HR10A-7R-6PB-73**

Pin	Signal
1	TXD Output
2	RXD Input
3	Ground
4	Reserved
5	Ground
6	10-15V DC Power Input (+)

## 2.3. The Optocoupler Interface

For use in industrial environment, PicSight® boards provide I/O signals isolated by use of optocouplers with variable 5V to 24V interface. To take full profit of this signal isolation, you have to connect the optocoupler to an external power supply. In the following figure is the common way, how to connect the optocoupler to an external power source of 5-24 Volt:



### 2.3.1. The Trigger Inputs

For triggering either the *optocoupler input* or the *TTL input* can be used. There is a difference in the way the trigger is handled:

The **TTL trigger** line goes directly to the camera module and therefore the pulse width on the TTL input defines the exposure time (if the module is set to the *pulse width triggered* mode). Note that the polarity of the TTL trigger cannot be configured by software; the trigger start is always the positive edge of the pulse on the Hirose TTL input. In LV-SDS the TTL trigger input on the Hirose connector has index **5** (the internal TTL inputs 0-4 are not connected to any connector).

The **Opto input** is not directly connected to the camera module. Therefore the pulse on the optocoupler generates internally an interrupt and the interrupt handler creates a TTL trigger with the length corresponding to the shutter time, which was preset by software. The interrupt is only raised upon a specific edge and thus the pulse width on the opto-input does not have any influence. So the trigger on the opto-input behaves like the *edge pre-select* trigger mode, regardless of the trigger mode actually set. The expected polarity on opto inputs can be configured by software on the host side.

## 2.4. Hardware Installation

### 2.4.1. Ethernet Connection

---

The PicSight GigE is fully compatible with the industry-standard Ethernet LAN equipment.

It can be connected directly to the host PC (point-to-point connection). In such case a *cross-linked* cable must be used and the cable length can be up to 100 meters.

Or it can be connected to a network with one or more switches between the PicSight and the host PC. As the PicSight complies with the IP protocol standard, so it should work with all standard Ethernet switches. However, the functions and performance grade of the switch can significantly influence the performance of the image transfer and thus care must be taken in order to select an appropriate switch.

For optimal performance the network with the Gigabit Ethernet components should be used. In the host PC it is recommended to use a network adapter (NIC) with the **Intel PRO/1000** chipset.

The switch should be **non-blocking**, it should support **Jumbo Frames** and have **memory buffers** of sufficient size. See the chapter *Advanced Network Settings* for more details.

The PicSight cameras were successfully tested with the following switches:

- ❑ **Netgear GS116** ([www.netgear.com](http://www.netgear.com), jumbo frames are supported since serial number starting at 19E or 140x5B or 140x5C).
- ❑ **Longshine LCS-GS7108-A** ([www.longshine.de](http://www.longshine.de))
- ❑ **SMC 8508T EZ** ([www.smc.com](http://www.smc.com))

It is recommended to use a switch with the same specification as one of the specified above.

### 2.4.2. Power Supply

---

The power supply of 12V is to be connected to the Hirose 6-pin connector, according to the description of the connector. The power consumption is approximately 6 watts. In normal environment temperatures (up to 25°C) and open space the superfluous heat from the camera is deflected to the environment without need to add any additional cooling. However, in a small closed space you should assure that the superfluous heat is led away.

## 3. Software Installation

The Leutron Vision **Software Development Suite** (LV-SDS) is a unified set of libraries, which enable to work in the same way with cameras connected through a *frame grabber* as well as with GigE cameras, connected through the *NIC*.

The LV-SDS package contains:

- ❑ **Daisy** – basic software development tool, including Camera Editor, and DRAL.
- ❑ Other SW tools: **Orchid** – high level library for fast development, **PicSight Demo** - demonstration of the camera and LV-SDS features, **Multimedia Drivers** – interfaces for TWAIN, Video for Windows and MCI, Framegrabber **support for 3rd party software** – includes support for **HALCON/ActivVisionTools** of MVTec Software, **NeuroCheck** of DS GmbH, **VisionBlox** and **CommonVisionBlox** of Stemmer Imaging GmbH.

### 3.1.1. Daisy

---

The Daisy software package contains:

- ❑ The **Daisy library**, which is used as a programming interface in C++ for all Leutron frame grabbers and cameras. The library includes DLLs, import libraries, header files, source files of sample programs and complete documentation in form of a PDF file.
- ❑ **Camera editor**, which enables to create custom camera definitions.
- ❑ **DRAL**, set of libraries for handling time critical tasks like image sequence acquisition.

### 3.1.2. Other Tools

---

- ❑ **Orchid** is a high level library (sitting on the top of Daisy) enabling fast and efficient development with visual tools like MS Visual Basic, Borland Delphi or C++ Builder, .Net Framework, etc.
- ❑ **PicSight Demo** program is supplied to guide the novice users of LV-SDS and Leutron hardware through the functionality range of the products via an intuitive user interface. It is also a good tool for first test, whether the HW functions correctly.
- ❑ **TWAIN** interface can be used to acquire images directly to many third party software products, namely image editors (e.g. Windows Imaging or CorelDRAW family). MS Office also supports TWAIN for acquiring images to its documents.
- ❑ Other **multimedia drivers** include Video for Windows and MCI drivers.
- ❑ Frame grabber **support for 3rd party software** stands for software interface layers (usually DLL or OCX) assuring cooperation of PicSight with various 3rd party image processing software products (listed above).

After purchasing the LV-SDS, please send us completed registration form with License-Number label stuck on it. This will assure you the access to download area on our web-server ([www.leutron.com/download/](http://www.leutron.com/download/)) and you will be also entitled to get support from us.

## 3.2. Installing LV-SDS (Windows)

### 3.2.1. Running the Setup Program

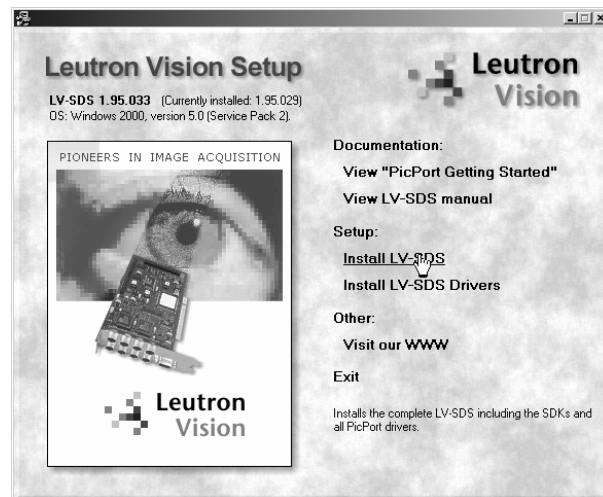
There are two ways to run the installation program: from the installation CD-ROM or using the files downloaded from internet ([www.leutron.com](http://www.leutron.com)).

### 3.2.2. Installation CD-ROM

If you are installing the LV-SDS from the installation CD, just insert it to your CD-ROM drive, the setup program is started automatically (in case that no program is started, please run the *LvAuto.exe* application from the root directory of the CD).

The setup program's main window appears. The program checks the components present on the CD and displays a list of corresponding links in the window.

Clicking the »Install LV-SDS« link will start the installation procedure. Please follow the instructions described in the next chapters. LV-SDS, including all the necessary drivers, will be installed to your computer.



*LV-SDS installation program*

### 3.2.3. Downloaded Files

To start the installation, just run the appropriate file downloaded from our WWW server, for example *lv196133.exe*. Please note that "196133" in the file name stands for LV-SDS version 1.96, build 133.

LV-SDS, including all the necessary drivers, will be installed to your computer.

**Important note:** the LV-SDS manual (consisting of multiple PDF files) is not included in the setup program described above. To install it together with LV-SDS, please download the required manual parts from our WWW server as well and put it to the directory with the setup program before starting the installation process.

### 3.2.4. Installation Process

The installation procedure is common for all supported versions of Windows operating system. The LV-SDS setup program inspects your system and allows

you to install the appropriate LV-SDS components. The installation procedure itself is described below:

After starting the installation, either from the installation CD-ROM or from the downloaded files, you will see two introduction windows informing you about the software you are going to install. Please click the Next button to proceed.



*LV-SDS installation: Welcome windows*

Next window allows you select the destination directory for the LV-SDS. The setup program inspects your system and if it finds an old version of LV-SDS, it offers its directory as the destination. If you are satisfied with the destination suggested by the setup program, just click Next to proceed. If you want to change it, please click the Browse button to specify correct location.

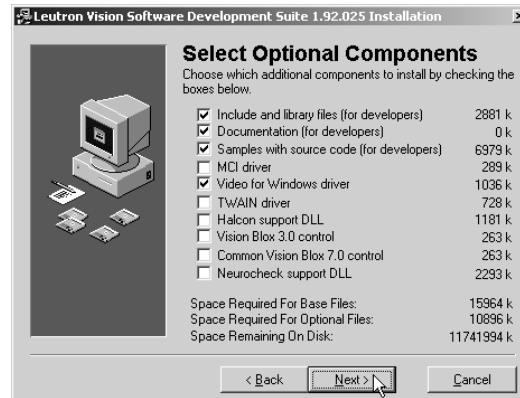
**Note:** If you are going to develop and compile own applications, it is better not to have spaces in the path to the LIB and INCLUDE files, so it is not recommended to install to *C:\Program Files\Leutron...*, otherwise you would have to use short paths and names in your compiler settings.



*LV-SDS installation: Destination directory*

After selecting the destination directory, you may choose the components that should be included in your installation. Please select the desired options and click the Next button. If some of the components may not be installed (e.g. because the component is not available for your operating system), the option will be disabled (grayed).

Please note that Vision Blox 3.0 and Common Vision Blox 7.0 support may not be installed both together. If you select both of them, only Common Vision Blox 7.0 control will be installed.



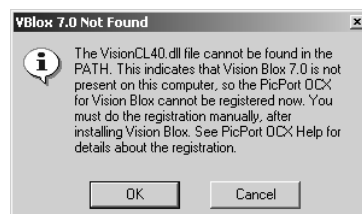
*LV-SDS installation: Selecting options*

The LV-SDS support both the frame grabbers and GigE cameras. In case you are using only one of these devices, you can disable the other device. In case you disable the frame grabbers, the library will not search for frame grabbers through the startup. In case you disable GigE, the library will not search on the subnet for connected PicSights, which can significantly speed up the startup. Note that these options influence only the *leutron.ini* file, so if you need to change them later on, there is no need to reinstall LV-SDS.



*LV-SDS installation: Devices Selection*

If you selected the »Vision Blox 3.0 control« or the »Common Vision Blox 7.0 control« installation option, but the Vision Blox software itself is not installed in your system yet, the message shown on Figure 3.3.6 will be turned up. It informs you that the setup program cannot register the control (due to missing Vision Blox installation). Thus, you will have to register the control manually later (using the RegSvr32 utility).



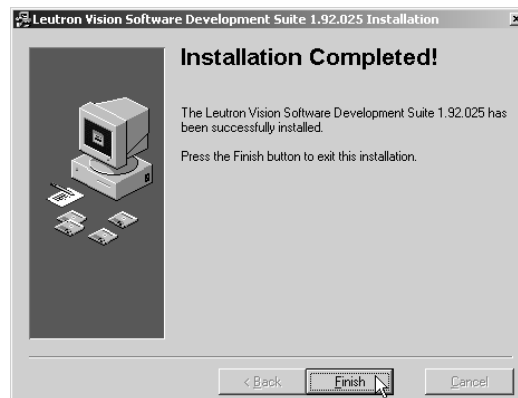
*LV-SDS installation: Registering Vision Blox control*

After fixing all the options, the setup program is ready to install LV-SDS to your computer. If you press the Next button, it will start copying all the needed files.



*LV-SDS installation: Ready to install*

After copying all the files to your system, the installation is completed. After pressing the Finish button in the last dialog, you will be asked whether the computer should be automatically restarted. After restarting, LV-SDS is ready to use.

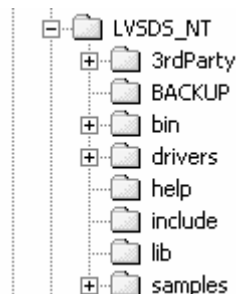


*LV-SDS installation: Installation completed*

### 3.2.5. Installation Results

A new LV-SDS menu is added to the *Start Programs* menu in Windows. It contains shortcuts for the Camera Editor application, for the LV-SDS manual, as well as for several compiled sample programs.

In the location, specified during installation (default is C:\), the folder structure with LV-SDS files is created. The main folder is named LVSDS\_NT.



*Folder structure in Windows XP/2000*

Under the destination folder the LV-SDS Setup program creates the

- **3rdParty** folder: supporting software for use of 3rd party vision tools with our frame grabber boards (e.g. HALCON/ActivVisionTools of MVTec Software,

NeuroCheck of DS GmbH, VisionBlox and CommonVisionBlox of Integral Vision).

- ❑ **Backup** folder: when you install a new version of LV-SDS, original files which could be modified by the user are copied there before they are overwritten by the new installation. Typically it is the *leutron.ini* file.
- ❑ **Bin** folder, containing DLLs, executables (Camera Editor, sample programs) and various data files belonging to Daisy/Orchid (camera definition files, real time application libraries etc.).
- ❑ **Drivers** folder, including setup programs of kernel drivers.
- ❑ **Help** folder, containing documentation to LV-SDS in form of a PDF file.
- ❑ **Include** folder, containing C++ header files for Daisy/Orchid.
- ❑ **Lib** folder, containing import libraries for Daisy/Orchid DLLs in versions for Borland C++ and Microsoft Visual C++.
- ❑ **Samples** folder, containing the source code of various samples of the SDK usage.
- ❑ The **Twain\_32** folder is created (if it did not exist) in the *Windows* folder. The **Daisy** folder is created in it and all appropriate files for TWAIN support are placed there.

The kernel device driver is updated with the new installation of LV-SDS.

## 4. Configuring and Testing the Camera

After powering-up the camera spends about 10-15 seconds by booting its firmware. The green LED diode is flashing irregularly. Finally the LED should start blinking regularly with a period of approx. 2 seconds. This blinking indicates the camera is live and ready for operation. The LED on the RJ-45 connectors should also start shining. The LED on the right side of the connector indicates a connection to a host and its color indicates the connection speed: green for 100 Mb/s, red for 1Gb/s. The yellow LED on the left side indicates the traffic. If any of both LEDs is not shining, you should recheck the cable connection.

### 4.1. Possible Impact of a Firewall

If the host PC has a *firewall* software running and you experience troubles with the connection or data transfer, the **firewall should be the first thing to check**.

The *firewall* is a software which filters packets coming from the network and thus it can block some of the communication channels used by PicSight. So it can happen, for example, that although the ping command succeeds, the PicSight is not accessible via the HTTP protocol (the firewall has disabled access to machines on local network for web browsers). Similarly, it can happen that you can access PicSight through HTTP, but when using the PicSight Demo, the images are not grabbed - this can happen when the firewall blocks the data sent from the camera through the UDP protocol.

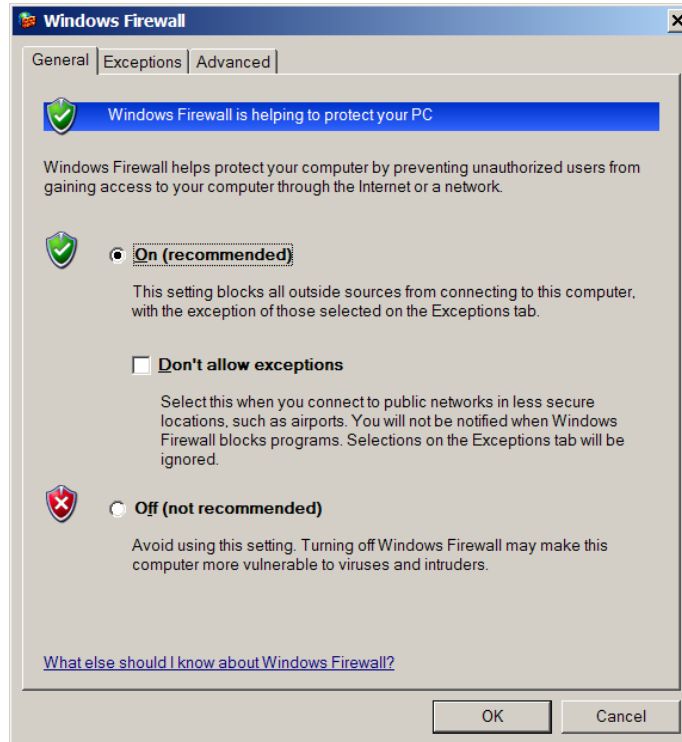
Note also that the usage of the firewall software adds some CPU overhead which might degrade the throughput of the LAN.

The easiest attitude is to switch the firewall fully off. However, this can be recommended only for debugging or in situations, when the PC is not vulnerable to network attacks (for example, if you use the PC's network interface only to connect the camera). If the PC is connected to a network and especially to the internet, switching the firewall off is not a good idea; you should rather configure the firewall so that it remains active, but enables the communication with PicSight.

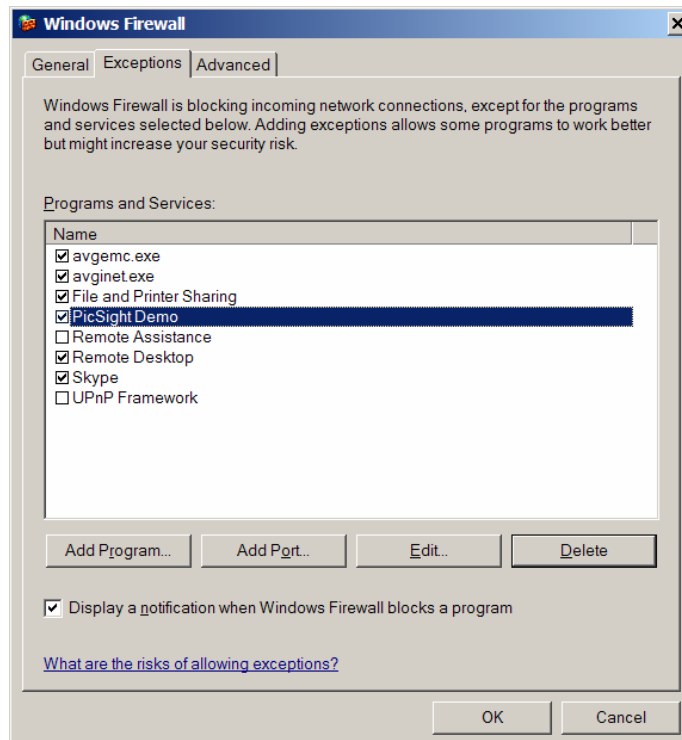
#### 4.1.1. Configuration of Windows XP Firewall

The example shown in this chapter describes the configuration of the Windows Firewall that is by default installed on Windows XP SP2.

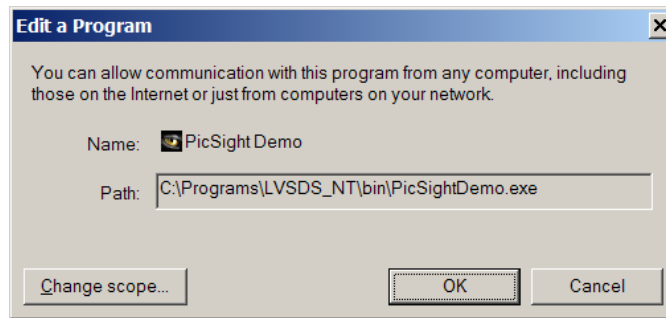
If you need to keep the firewall switched on, you have to configure it in a way that it does not block the communication with PicSight camera. In Windows Firewall this is done using "exceptions" (any incoming connections are prohibited, except those defined by the exceptions). To configure it, start the Windows Firewall applet in the *Menu Start -> Settings -> Control Panel*.



Make sure the "Don't allow exceptions" checkbox is *not* checked and switch to the Exceptions tab.

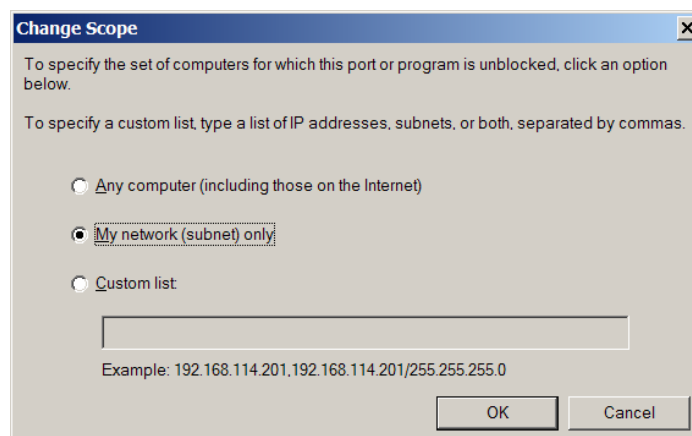


Click "Add Program..." button and locate the *PicSight Demo* program. Then click "OK" to add the PicSight Demo in the exceptions' list. Since now incoming communication will not be blocked for PicSight Demo. Repeat the same procedure for any other executables (including programs you compile yourself) you want to use for acquisition from the PicSight camera.



Note: for adding the *PPDemo* program to the list, the `...\bin\PPDemo.dll` should be stated, not the *PPDemo.exe*.

If you like to be more secure, you can restrict this exception to the subnet only or even to a specific list of IP addresses (corresponding with IP addresses of your PicSight cameras). Proper dialog for this configuration will appear after clicking the "Change scope..." button.



### 4.1.2. Configuration of Other Firewalls

If your system uses any other firewall, its configuration should be very similar to the XP one, depending on its design philosophy.

If you have a firewall that allows more detailed configuration, for example configuring also outgoing connections, make sure that no restrictions are made for outgoing HTTP connections (so that you are able to configure the PicSight camera using your web browser), for ping, and in case you will need to access PicSight over FTP, than make sure also that no restrictions apply for outgoing FTP.

## 4.2. Checking the Connection

The GigE camera default IP address is **192.168.1.55**.

First check the connection using the **ping** command on the Command Prompt (menu *Start -> Run*, type "Cmd", in the command prompt window type "ping 192.168.1.55").

A usual problem of an unreachable address can occur, depending on the configuration of your network:

```
C:\>ping 192.168.1.55

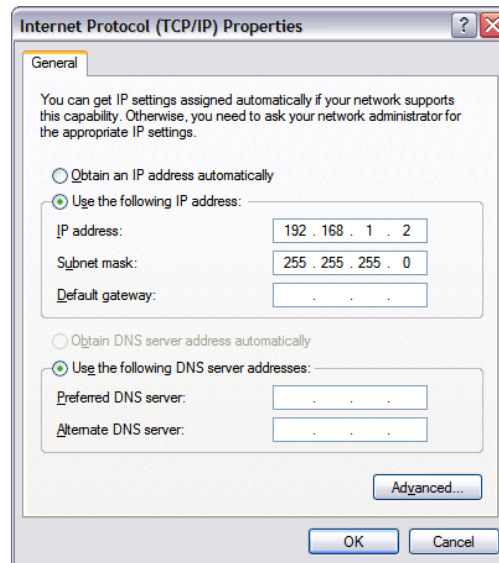
Pinging 192.168.1.55 with 32 bytes of data:

Reply from 213.246.64.229: Destination net unreachable.
Reply from 213.246.64.229: Destination net unreachable.
Reply from 213.246.64.229: Destination net unreachable.
Reply from 213.246.64.229: Destination net unreachable.

Ping statistics for 192.168.1.55:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>
```

In such case it is necessary to temporarily change the settings of your network, in *Start -> Settings -> Control Panel -> Network Connections -> Local Area Connection -> Properties -> Internet Protocol (TCP/IP) -> Properties*:



Specify the **subnet mask**: it typically looks like: **255.255.255.0**. Such a mask means that the first three numbers in the IP address must be identical for the whole subnetwork, and the fourth number is arbitrary. With this mask, you must assign to the host PC an **IP address** beginning with *192.168.1*. and an arbitrary number. In our example we use: **192.168.1.2** for the host, so it is then on the same subnetwork with PicSight having the default IP address **192.168.1.55**.

The **gateway** need not be set for this temporary TCP/IP settings (leave it empty).

Note that in case you do not want to touch your existing connection to the network, you would have to add additional Ethernet card (NIC) to your PC and configure the TCP/IP for the additional NIC.

After applying the changes (closing the Local Area Connection dialog) Windows change the IP address, usually without need to reboot. You can verify the change by the **ipconfig** command on the Command Prompt - it lists the current IP address.

Now you should test with **ping** again. It should succeed:

```
C:\>ping 192.168.1.55

Pinging 192.168.1.55 with 32 bytes of data:

Reply from 192.168.1.55: bytes=32 time=35ms TTL=128
Reply from 192.168.1.55: bytes=32 time=24ms TTL=128
Reply from 192.168.1.55: bytes=32 time=13ms TTL=128
Reply from 192.168.1.55: bytes=32 time=2ms TTL=128

Ping statistics for 192.168.1.55:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 2ms, Maximum = 35ms, Average = 18ms

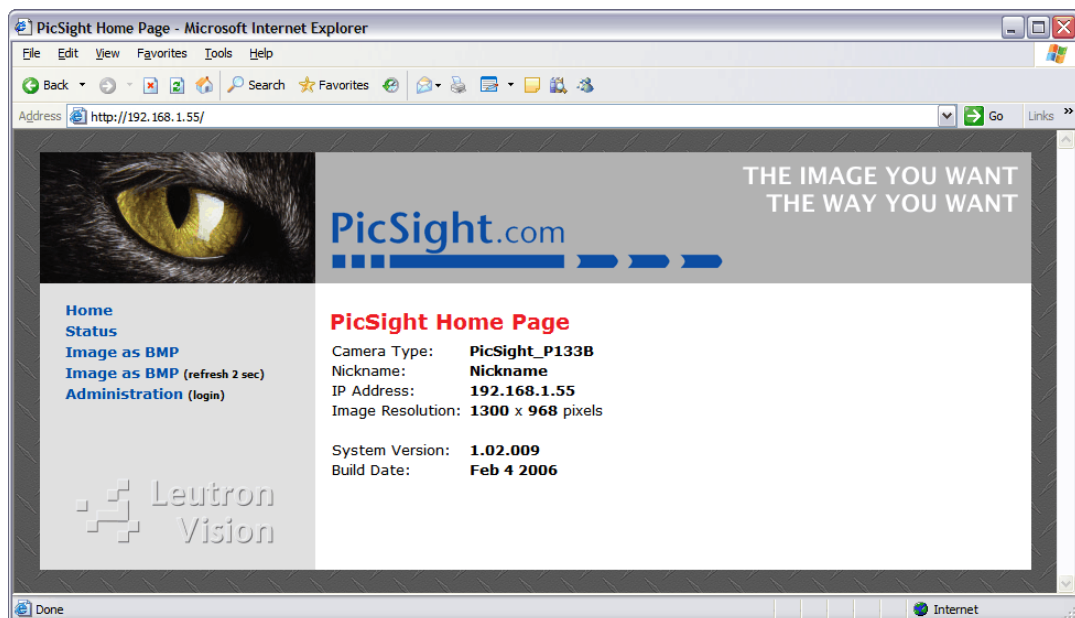
C:\>
```

## 4.3. HTTP-based Configuration

There is an HTTP server running on the PicSight camera, so after verifying the TCP/IP connection is correct, you can connect to it using a web browser, for example *Internet Explorer*, *Firefox* etc. To connect, type as the URL the following:

http://192.168.1.55

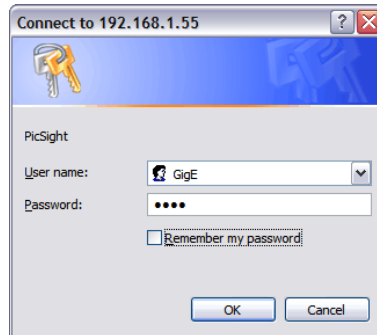
The following page should appear:



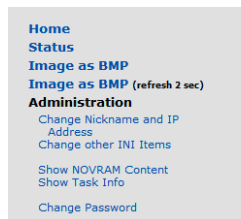
Note that if you still cannot access this page, although the *ping* command succeeds, the problem might be in the *firewall* configuration on your PC - see previous chapters.

### 4.3.1. Logging In, Setting the IP Address and Nickname

The first step you probably will need to do, is to set new IP address. To do so, you must first log in. Click on the **Administration** link. A login dialog box will pop-up:

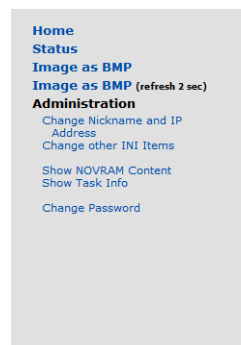


From the factory the *User name* is set to **GigE** and the *Password* to **gige**. The password can be changed (see the next chapter). After successful login you will see additional links on the left side:



**Login Successful**  
Welcome!  
You are logged in with **GigE User** rights.

Click on the **Change Nickname and IP Address**. The following form will be displayed:



### Set Nickname and IP Address

Nickname:	<input type="text" value="Dahlia"/>
IP Address:	<input type="text" value="10.0.2.6"/>
IP Gateway:	<input type="text" value="10.0.2.100"/>
IP Net Mask:	<input type="text" value="255.255.255.0"/>
	<input type="button" value="OK"/> <input type="button" value="Reset"/>

**Note:** Set the IP Address to 0.0.0.0 if you want PicSight to get IP address dynamically from a DHCP server.

Here you can set the desired IP address. The IP Gateway can be set to 0.0.0.0.

In case you have a **DHCP** server in your network and want the PicSight to get the IP address assigned automatically from the DHCP server during the boot, set the IP address to **0.0.0.0**. Note that if the DHCP server is not available, the PicSight will not be then accessible at all! If you will want to access the PicSight via the HTTP protocol, you will need to find the assigned IP address on the DHCP server.

You can also assign a **Nickname** to the camera. **It is highly recommended.** The Nickname becomes an identifier of the camera in the LV-SDS, so if you use nicknames, your application will be independent on IP addresses.

After confirming the changes by the OK button, the values are checked for validity. If not valid, an error message is displayed. If valid, the same page is displayed, with additional message below the red header: "*Parameters successfully stored. Changes will become active after PicSight reset*".

To reset PicSight, disconnect it from the power supply for a short time or use the *Reset PicSight* link in menu on the left side.

After reset, you can restore your network settings (if you changed them) and access the PicSight with a new IP address; in our example <http://10.0.2.6>:

<a href="#">Home</a> <a href="#">Status</a> <a href="#">Image as BMP</a> <a href="#">Image as BMP (refresh 2 sec)</a> <a href="#">Administration (login)</a>	<h3>PicSight Home Page</h3> <p>Camera Type: <b>PicSight_P133B</b>          Nickname: <b>Dahlia</b>          IP Address: <b>10.0.2.6</b>          Image Resolution: <b>1300 x 968</b> pixels</p> <p>System Version: <b>1.02.009</b>          Build Date: <b>Feb 4 2006</b></p>
--	---

### 4.3.2. Changing the Password

In case your camera is on a common network, to which other users have access, it is important to change the password, so that it is better protected against an unauthorized access. To change the password, click on the **Change Password** link:

<a href="#">Home</a> <a href="#">Status</a> <a href="#">Image as BMP</a> <a href="#">Image as BMP (refresh 2 sec)</a> <b>Administration</b> <a href="#">Change Nickname and IP Address</a> <a href="#">Change other INI Items</a> <a href="#">Show NOVRAM Content</a> <a href="#">Show Task Info</a> <a href="#">Change Password</a>	<h3>Change Password</h3> <p>You are currently logged in as GigE.</p> <p>Current password: <input type="password"/></p> <hr/> <p>New password: <input type="password"/></p> <p>Retype new password: <input type="password"/></p> <p style="text-align: right;"><input type="button" value="OK"/></p>
---	---

### 4.3.3. Getting an Image in a Web Browser

When you click on the **Image as BMP**, the browser will display the last image acquired by the camera. In the second option, **Image as BMP (refresh 2 sec)** the browser asks for the image every 2 seconds, so you can have a simulation of live on the screen. You can stop it by pressing the **Back** button in the browser.

### 4.3.4. Logging Out

The authentication scheme does not enable explicit logging out. The authentication data are kept by browser, so the if you want to log out, simply close the browser window.

## 4.4. Advanced Network Settings

### 4.4.1. Understanding the LAN Traffic Issues

The image data are streamed from the host (PicSight) to client (PC) using the UDP protocol. In case some of the packets is not delivered in time, it is lost; the client does not ask for it again, because such handshaking would increase significantly the network traffic and would introduce unwanted delays.

Normally, the packets are lost only in case there is some bottleneck or overflow on the network path.

One typical example is a wireless connection on the path. It has a lower bandwidth than the rest of the LAN. However, the host (PicSight) is not aware of it (it can determine only the speed to the nearest port), so it simply tries to stream out the data as fast as possible, which can lead to the buffer overflow on the wireless gate. This kind of problem can be fixed by introducing an **inter-packet delay**, which reduces the bandwidth.

Note that the streaming with the reduced bandwidth need not have an impact to the image data delivery if the transfer is still fast enough to transfer all the image data before the next image is acquired. For example, if the camera is triggered, and thus has long time gaps between frames, the increase of the inter-packet delay can solve the problem without any side effects.

Another problem can occur when acquiring simultaneously from multiple cameras connected to single NIC through a switch, namely if they are all triggered at the same time. When the cameras start stream out the packets at the same time, the switch must serialize the packets to one output line. The capability of doing this depends on the switch internal construction and thus is different for various manufacturers and models. The main factor influencing this is the *size of the memory buffer* dedicated for each port. The higher is the amount of the memory, the better.

For example, the 8-port switch has 144 kBytes of memory equally split between the ports, so one port has 18 kBytes of memory. When using a **streaming packet size** of 9 kBytes, only 2 packets fit to the buffer. In case 3 cameras send a packet to the input ports at the same time, the switch must transfer 3 packets to the output port, and this (depending on the switch construction) can fail due to the memory on the output port not capable to hold all 3 packets (=27 kBytes). The solution in such case would be to use a smaller packet size, for example 5.9 kBytes, so that all 3 packets fit in. Another problem can happen, if the outgoing line is too slow to send out all the packets before new 3 packets come from the cameras; then it is necessary to reduce the bandwidth by increasing the **inter-packet delay**, as already explained.

As mentioned, due to the internal construction of the switches, the capability of the switches to manage such critical situations differs from switch to switch. See the *Hardware Installation* chapter for list of switches which have been successfully tested with PicSights.

#### 4.4.2. Packet Sizes

---

The size of the packets sent over the network can influence significantly the effectiveness of sent data.

##### **The Maximum Transmission Unit (MTU)**

Represents the maximum amount of data that can be sent across an interface without being broken up into more than one packet. The standard for Ethernet network is 1500 bytes. Newer hardware implementations support so called *jumbo frames* which accept frames up to 16 kBytes.

The MTU has to be set on both sides to the same value, on the host (PC) side as well as on the PicSight side. Also, all devices along the network path from the host to the client (switches etc.) must support the used frame size.

##### **The Streaming Packet Size**

Besides the MTU size setting, the *streaming packet size* can be set independently. This setting determines the size of the streaming packets during an image acquisition. This packet size must always be smaller than the MTU size, and as this packet size does not include the header size for UDP/IP, it should be always smaller by at least *50 bytes* than the MTU size. While the *MTU* represents the maximum possible size, the *streaming packet size* represents the size actually used in the transmission.

## Impact to the Network Performance

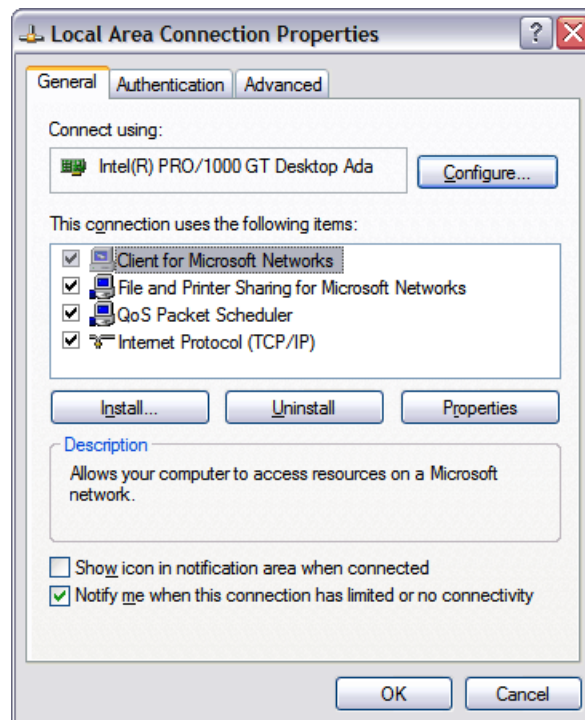
The *streaming packet size* has a major impact to the network performance. The higher is the size of the packets, the smaller is the overhead which has to be sent for each packet. Less overhead means fewer data sent over the network and therefore smaller CPU utilization on both sides.

However, a disadvantage of larger packets is that the partition of the overall network bandwidth is no more guaranteed. If multiple devices are streaming at the same time using large packets, the network bus may become overloaded and packets are getting lost, as explained in the previous chapter.

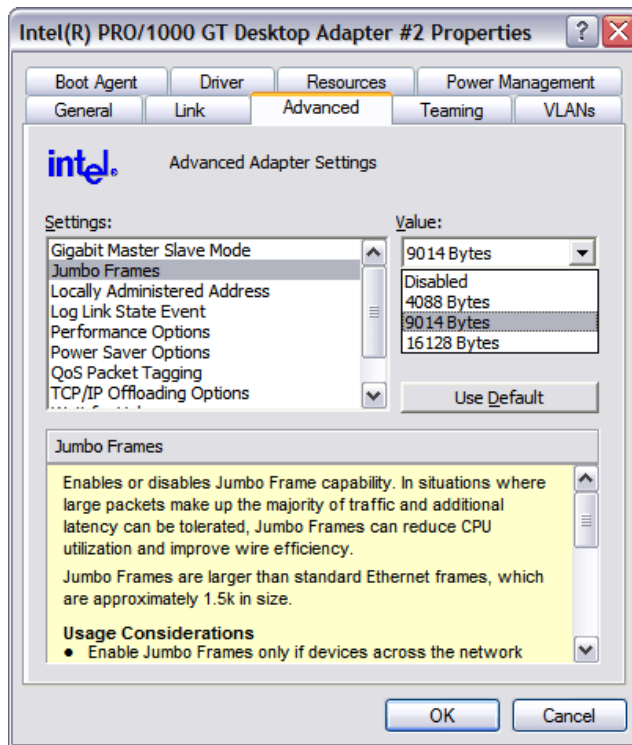
Thus using the larger packet size is highly recommended for a high performance transmission with a few network members only. If multiple cameras have to stream at the same time, a smaller packet size has to be set.

### 4.4.3. Setting the MTU

On the **PC side** the setting is usually available in the NIC Driver settings, which is available under menu *Start -> Settings -> Control Panel -> Network Connections -> Local Area Connection -> Properties*:

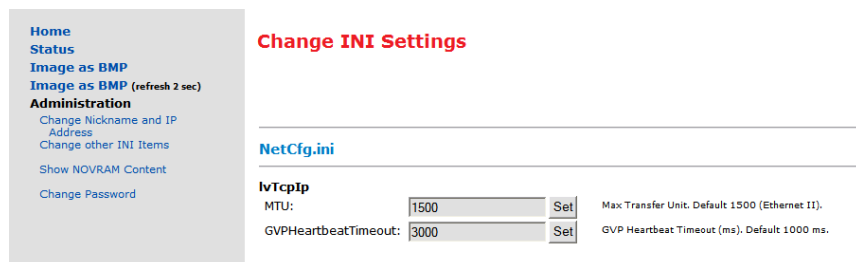


After pressing the *Configure* button, a driver dependent dialog box appears. The one in our example below is from the Intel PRO/1000 adapter:



The MTU settings is here available under the *Jumbo Frames* option, with a possibility to select from predefined values.

On the **PicSight side** the MTU settings is available in the HTTP based configuration, in the *Change Other INI Items* page after successful login.



The number set here should be the same as on the PC side.

#### 4.4.4. Setting the Streaming Packet Size

The desired streaming packet size can be set on the host side in the **leutron.ini** file, Section LvGvp:

```
[LvGvp]
DefGvspPktSize=1400
```

Note that this size has to be always **at least by 50 bytes smaller** than the MTU setting.

#### 4.4.5. Setting the Inter-Packet Delay

You can increase the inter-packet delay by setting the entry in the **leutron.ini** on the host side:

```
[LvGvp]
InterPktDelay=xxx
```

where xxx is the delay in microseconds. Note that increasing the inter-packet delay may slow down the streaming. See the “*Understanding LAN Traffic Issues*” chapter for details about this value.

#### 4.4.6. Accessing PicSight on a Different Subnet

---

The PicSights in the local network are found at LV-SDS start-up by issuing a broadcast message *in the local subnet*. This only works for the PicSights with the IP addresses in the *same subnet range* as is the IP address of the host.

If PicSights have to be accessed across the network boundaries of the local subnet, their IP addresses have to be defined as the *FixDiscoverIP* item in the *LEUTRON.INI* file, in the *LvBusCamNet* section.

For example:

```
[LvBusCamNet]
FixDiscoverIP =10.0.0.23
```

For multiple PicSights write the IP addresses separated by a semicolon, for example:

```
[LvBusCamNet]
FixDiscoverIP=10.0.0.23;10.0.0.27;10.0.5.15
```

Note that the *FixDiscoverIP* address of the PicSight cannot be arbitrary; it must be in a *valid remote subnet*, that means a subnet, to which the routing device of your LAN (the gateway) is able to redirect the packets.

In other words, if you want to access PicSight with the default IP address 192.168.1.55, which is out of your local subnet range, it is not enough to set it as *FixDiscoverIP*.

If a non-standard frame size is configured, the routing device must support this frame size as well. Note also that the routers are often configured with firewall mechanisms, which may block the streaming traffic.

**Note:** In LV-SDS till version 1.96.159 this option had to be set in the WIN.INI file:

```
[Leutron Vision]
LvCamNet=10.0.0.23;10.0.0.27;10.0.5.15
```

### 4.5. Testing the Camera with PicSight Demo

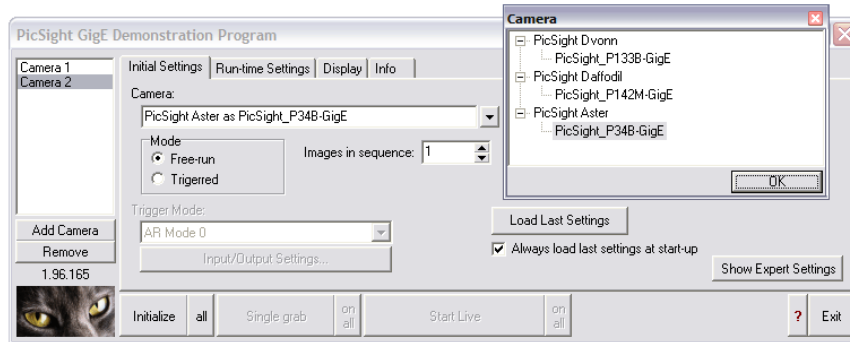
PicSight Demo is an application enabling to test some of the camera features. After connecting the camera for the first time, it is recommended tool for testing the camera functionality.

The **PicSight Demo** is available in menu *Start -> Programs -> Leutron Vision*.

#### 4.5.1. Initial Settings

---

If you have only single camera connected, it will be automatically set in the Camera box. If you have multiple cameras, you must select the camera in the tree, that is displayed after clicking to the button with arrow.



Note that if you connect the camera *after* the PicSight Demo was started, it will not be visible, until you restart the demo.

If you want to test multiple cameras simultaneously, press the *Add Camera* button. Then you will have multiple cameras in the left list box and you can switch between them by clicking in this list box, or by clicking on each camera's window. You can perform an action on multiple cameras by clicking on the "all" or "on all" buttons on the right side of the buttons, which apply to the selected camera only.

### Free-run Mode

In the free-run mode the camera works in *live* mode, i.e. it is continuously delivering images.

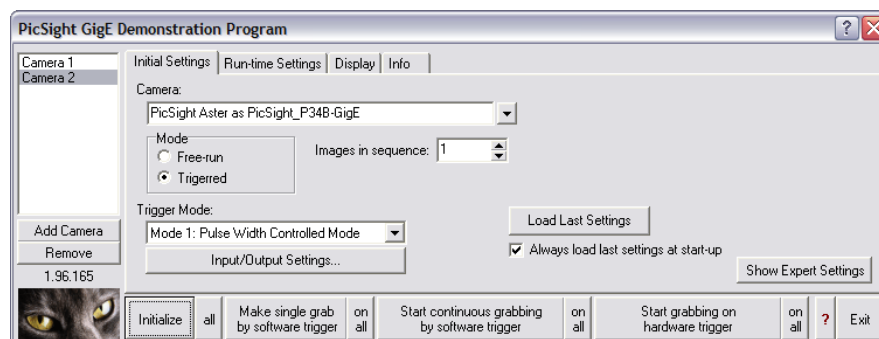
### Triggered Mode

In the triggered mode the camera waits for the trigger signal, by default on the opto-input 0. After each trigger the image is grabbed and transferred to host. In the *Triggered mode* you can either force the grabbing by sending software triggers or control the grabbing by real (hardware) triggers on selected input.

The *Make single grab by software trigger* button sends one software trigger to the camera, so that it acquires one frame.

The *Start continuous grabbing by software trigger* button switches to a mode, in which software triggers are sent continuously to the camera, so that you can see a live image.

The *Start grabbing on hardware trigger* button switches to a mode, in which the camera grabs a frame on each received trigger on selected input.



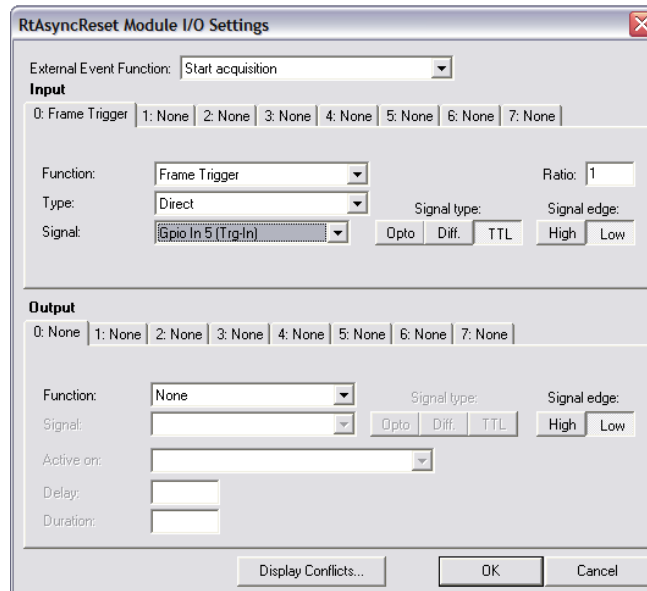
In the *Trigger Mode* combo box you can select the mode of triggering.

In the **Edge Preselect Mode** only the *edge* of the trigger pulse is important. The shutter time is static and is controlled from the application (see the *Run-time Settings* tab).

In the **Pulse Width Controlled Mode** the shutter time is determined by the width of the trigger pulse. As is explained in the chapter *The Trigger Inputs*, only the TTL trigger input can be used for this mode; when the opto-input is used for trigger, it behaves like in the *Edge Preselect Mode*.

## I/O Settings

By pressing the *Input/Output Settings* button the **I/O Settings Dialog** can be displayed.



Here you can select the trigger input. Note that the dialog is designed to be more universal (also for frame grabbers), so not all options apply to PicSight GigE. In the *Function* combo box select *Frame Trigger*, in the *Type* select *Direct*. Then you can select the trigger input:

After pressing the *Opto* button you can select between *Opto In 0* and *Opto In 1*. Or after pressing the *TTL* button you can select the TTL input - although there are internally 6 TTL inputs available, only one is available on the Hirose connector in the standard HW configuration. This one is marked in the list as *Gpio In 5 (Trg-In)*. Note that the polarity on the TTL input cannot be configured - the pulse must always be positive (see *The Trigger Inputs* chapter for details).

You can also select the *Signal Edge* (*High* = raising edge, *Low* = falling edge).

## Sequence of Images

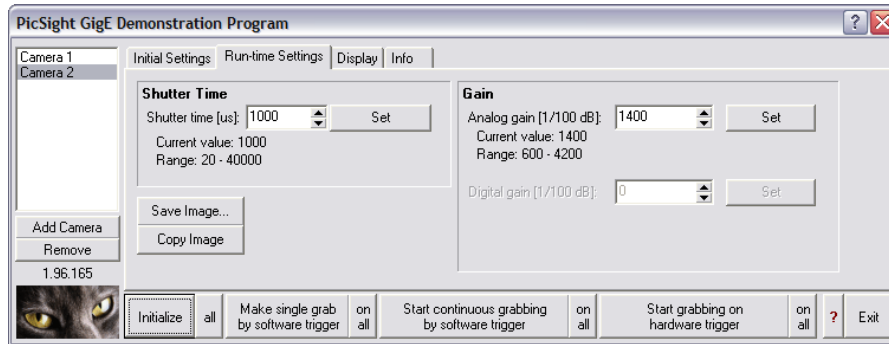
The received images can be stored in a **circular buffer**. In the *Images in a sequence* field you can set the number of images in the buffer. You can browse the images in the sequence using the controls in the *Display* tab.

## Initializing

When the configuration is complete, press the *Initialize* button.

### 4.5.2. Run-time Settings

After successful initialization, during the run-time you can set the *gain* and the *shutter time* in the *Run-time Settings* tab.



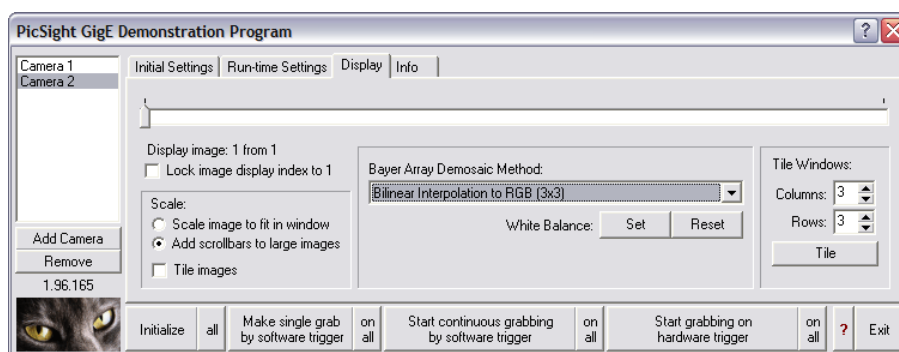
## Shutter Time

Type in the required value and press the *Set* button. In the *Triggered* mode you can see the permitted shutter range. The time is specified in microseconds. In case of *Triggered Pulse Width Controlled Mode* the shutter time is determined by the pulse width instead of this settings. Note that this applies only to the TTL input.

## Gain

Depending on the chip type, up to 2 types of gain - *analog* and *digital* - can be set. The gain is expressed in 1/100 of dB, so for example 2450 can be read as 24.5 dB.

### 4.5.3. Display



In the *Display* tab you can select between 3 types of display:

- 1) If *Tile images* is checked, all images from the sequence are displayed scaled down so that they fit in the display window.
- 2) If the *Tile images* is not checked, the selected image is displayed. You can select the image by the track bar on the upper part.

In case the *Scale image to fit in window* is selected, the image is scaled down to be fully visible. The other option - *Add scroll bars to large images* - causes display in 100%, with additional scroll bars in the image window.

The same functionality is available on the left and right mouse buttons when you click in the image window area.

You can save the selected image to a file, or copy it to the Clipboard.

## Bayer Demosaic

In case the PicSight has the Bayer Array color matrix, the *Bayer Array Demosaic Method* becomes available. Here you can select one of the methods to decode

the colors from the Bayer Array. You can select from the following demosaic methods:

- ❑ **None.** Image displayed as it comes from the camera
- ❑ **Green to Greyscale.** Only the green is used to convert the image to greyscale. Missing pixels are calculated by linear interpolation.
- ❑ **Nearest Neighbour Interpolation to Greyscale.** Each pixel is converted to color one by the Nearest Neighbour method (see below) and then a grey value is calculated as a sum of RGB/3.
- ❑ **Bilinear Interpolation to Greyscale.** Each pixel is converted to color one by the Bilinear Interpolation method (see below) and then a grey value is calculated as a sum of RGB/3.
- ❑ **Show Bayer Mosaic as RGB.** The Bayer pattern is shown in color.
- ❑ **Nearest Neighbour Interpolation to RGB.** Nearest Neighbour method uses the nearest pixel of desired color in the direction left or top. It is the fastest method, giving rough results.
- ❑ **Bilinear Interpolation to RGB.** Missing colors are linearly interpolated from nearest 2 or 4 pixels of the desired color. Fast method, which gives reasonable results, images are smoother, but less sharp.
- ❑ **Variable Number of Gradients to RGB.** Method, which is commonly referred as the one giving the best results. First an 5x5 environment of the pixel is evaluated and a sum of gradients is calculated. Then gradients not higher than calculated threshold are used for color calculation. This algorithm is the slowest, approx. 40x slower than bilinear interpolation.
- ❑ **Pixel Grouping to RGB.** It is about 5x faster than Variable Number of Gradients, but giving about the same results - on some places even slightly better, on some places slightly worse. It also takes the 5x5 environment, but the evaluation of the gradients is simpler and thus faster.

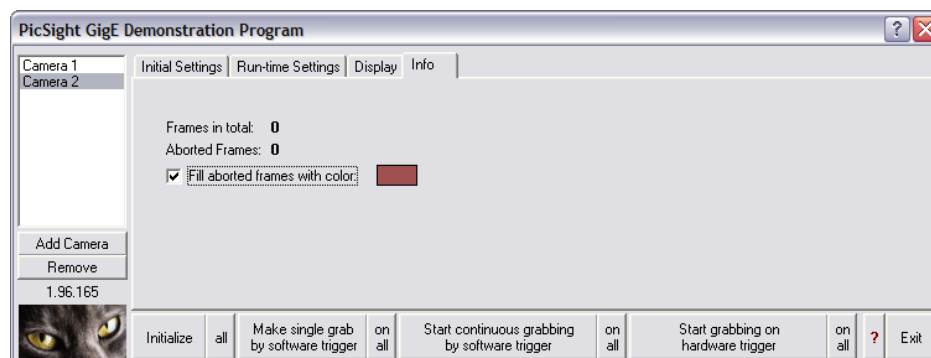
### White Balance

By pressing this button the current image is taken as a reference for white balance and a lookup table is calculated, which is applied to subsequent acquired images.

Note that the decoding is done by software, in PicSight demo.

## 4.5.4. Info

This tab is useful in case you are testing the transfer bandwidth of your LAN connection. In case there is too high traffic on the networks, some frames may be aborted. The number aborted frames since the acquisition was initialized is shown here.



In case you experience aborted frames, the network traffic is too high and is not suitable for reliable operation.

## 4.5.5. Expert Settings

When the *Expert Settings* button on the first tab is pressed, additional options are displayed, intended for experienced users only.

### Initial Settings Tab

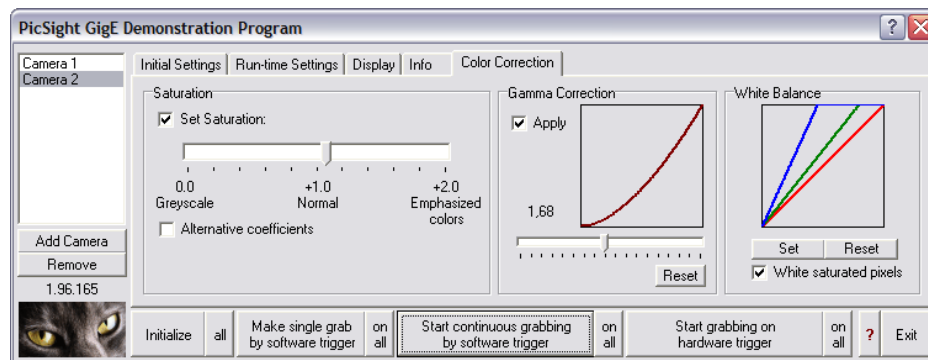
*Use Live Mode for Free-run* – the normal single buffer mode is used, i.e. not using a real-time module (see the documentation for programmers for details).

*PauseOnRequest mode for Free-run* – the real-time module uses acquisition without software triggering each image.

*Reload Camera Definitions* – when you make changes in the database of camera definitions by the *Camera Editor*, you can reload the database without need to restart the PicSight demo program. This helps to see immediately the impact of changes you made.

### Color Correction Tab

This tab shows additional possibilities of conversion of color images.



Note that some of the functions demonstrated here may not be supported in our libraries yet and will be available gradually.

## 4.6. Firmware Update and Recover Mode

### 4.6.1. The Firmware Update

The camera firmware can be updated from a PC with Windows. The update tool is included with LV-SDS since the version 1.96.169. It is located in the BIN folder of LV-SDS and its name is **PicSightGigEUpdater.exe**. The packages with the updated software can be downloaded from **www.leutron.com**.

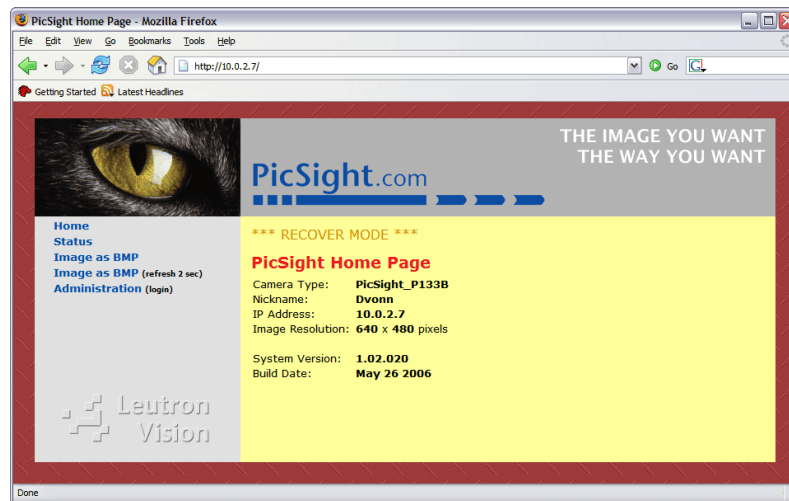
During the update process the needed files are first fully uploaded to the PicSight flash memory, and then, after successful upload, the system is switched from the previous version to the new one. Thus, if the upload of files fails for any reason, the original system remains untouched and the firmware update can be done again after PicSight reboot. However, in case the failure in communication would happen during the system switching (which takes only a very small part of the update process, so the probability that it happens is also small), the PicSight may get into a status, in which it is not able to boot anymore. In such case the **Recover Mode** must be used to boot.

## 4.6.2. The Recover Mode

For the case the PicSight system fails to load, a recover copy of the system is available in the PicSight flash memory. This system is limited in functionality (does not enable acquisition and streaming) and serves only for fixing the normal system.

To boot the recover system, you must create a special connector, where you connect the RX and TX of the RS-232 (pins 1 and 2 on the small Hirose connector, see the *Connector Description* chapter).

When the RX and TX are connected during the boot process (i.e. after power up), the recover system is loaded. The LED light blinks slower than with the normal system. You can also check the system on the home page of PicSight, which is colored differently and displays additional **\*\*\*\* RECOVER MODE \*\*\*\*** label:



Note that the check of the RX-TX connection is not reliable, you may need to repeat the boot to load the recover system successfully.

The recover system enables the firmware update tool to communicate with the camera in the same way as with the normal system. So you can then use the firmware update tool to fix the broken system.

Note that the recover system has its own network configuration; unless this was changed, the recovery system uses the default IP address 192.168.1.55 for the PicSight. Thus you may need to adapt your local subnet configuration to access it, see the *Checking the Connection* chapter for details.

The changes in the configuration, made through the HTTP-based configuration when the recover system is loaded, are made to the normal system, not to the recover system.