User manual
for FPA64x64-C test board

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ESD-precautions

A number of components on the board and also the InGaAs-sensor itself are sensitive to Electrostatic Discharge (ESD). Apply the regular ESD-precautions to not influence or destroy the board or the sensor.

General Description

The internal test board was created for driving/reading out the FPA64x64-C InGaAs-sensor.
It is a temporary construction that is only suitable for internal testing and setup-purposes and is not inclined for a commercial system.

The test board is powered via a USB-cable from the USB-socket of a WINDOWS 10 or WINDOWS 7 PC. The board drives the FPA64x64-C InGaAs-sensor by supplying a number of DC- and clock voltages to the right sensor pins. It also reads the analog video signal coming from the output pin of the sensor.

The lens mounted to the board focuses an environmental scene onto the sensor-surface.

It is a cheap, off-the-shelf component and not optimized for the spectral range of the InGaAs-sensor (0.9 µm – 1.7µm).

A FPA64x64-C InGaAs sensor is already plugged into the electrical socket situated below the lens and in the focal plane of the lens.

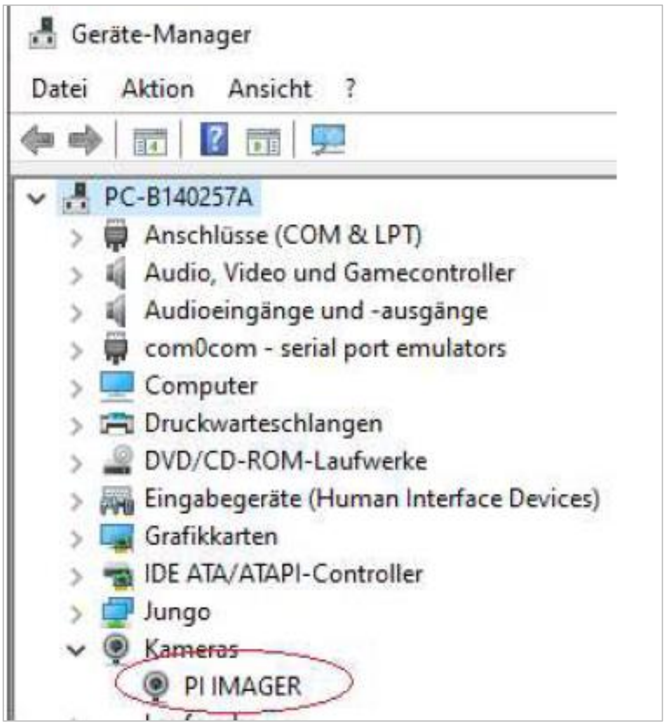
The board comes with a basic piece of software, which is free (no license required) for internal testing.

Further Information:

In fact, the board is a USB composite device with 2 interfaces: a UVC (USB video class) device to transmit the image data and an HID (Human Interface Device) to transmit control commands for setting the clock generator voltages. These two devices use standard drivers of the Windows computer (Windows 10 or Windows 7). The UVC device contains an internal image memory that can be read out very quickly (340 Hz image frequency) by the PC. The AD converted data is written to the same memory as it is available (actually it was multiple buffers used alternately). The actual image frequency of the InGaAs array depends on the set integration time, but is definitely lower than 340 Hz. The same image is therefore transmitted to the PC several times - until a new image is available, which is then also transmitted several times again.

Put the test board into operation

Unpack the test board incorporating the sensor by considering usual ESD-precautions.
The test board is supplied with voltage from a PC via USB and logs on to the PC as a "PI Imager".

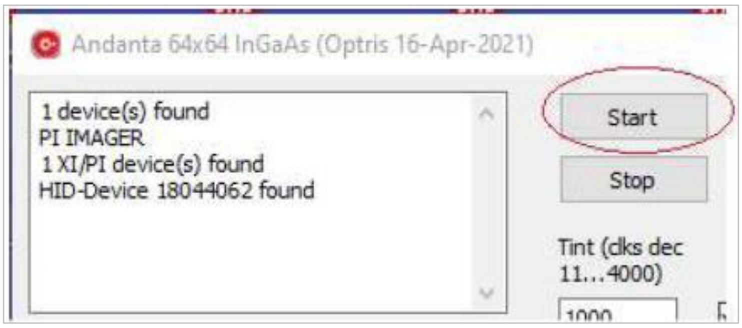


Plug the USB-cable of the board into the USB-socket of the computer.

The test program "ANDANTA_64_64.exe" does not have to be installed but can be started directly from a storage medium. However, two DLLs (Dynamic Link Libraries), "escapi.dll" and "msvcr110d.dll", must be in the same directory as "ANDANTA_64_64.exe".

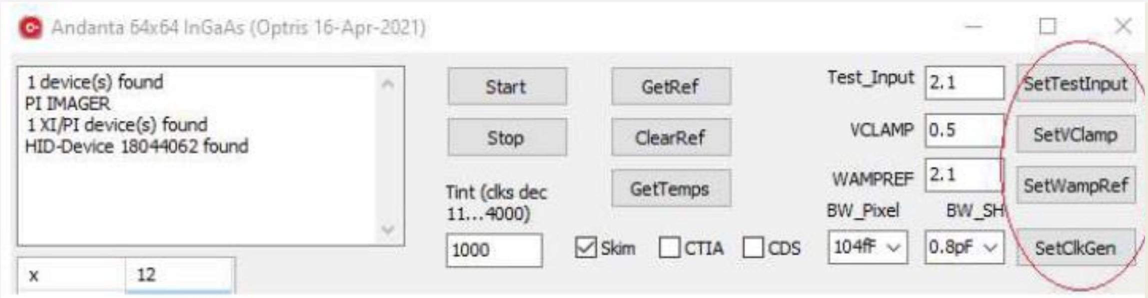
After starting the program, the "Start" button must be pressed with the test circuit included.

The program should produce a message similar to the one shown here:



Further Information:

All UVC devices are enumerated and those that have the character string "PI-Imager" or "XI-Imager" in their name are identified. There can be several UVC devices (e.g. web cameras), but only one and exactly one "XI/PI device". Pressing the start button sends commands to this device to set various DC voltages and to set the clock generator, so the 4 buttons on the right side of the screen are automatically pressed.



An image should be visible immediately. On the left the image from the AD values (“raw data”), on the right an image formed from the same data but smoothed by interpolation.

Reference image (dark image)

A reference image can be taken with the lens covered ("GetRef" button). The AD values of each pixel are then reduced by the AD value of the same pixel in the reference image when the images are displayed.

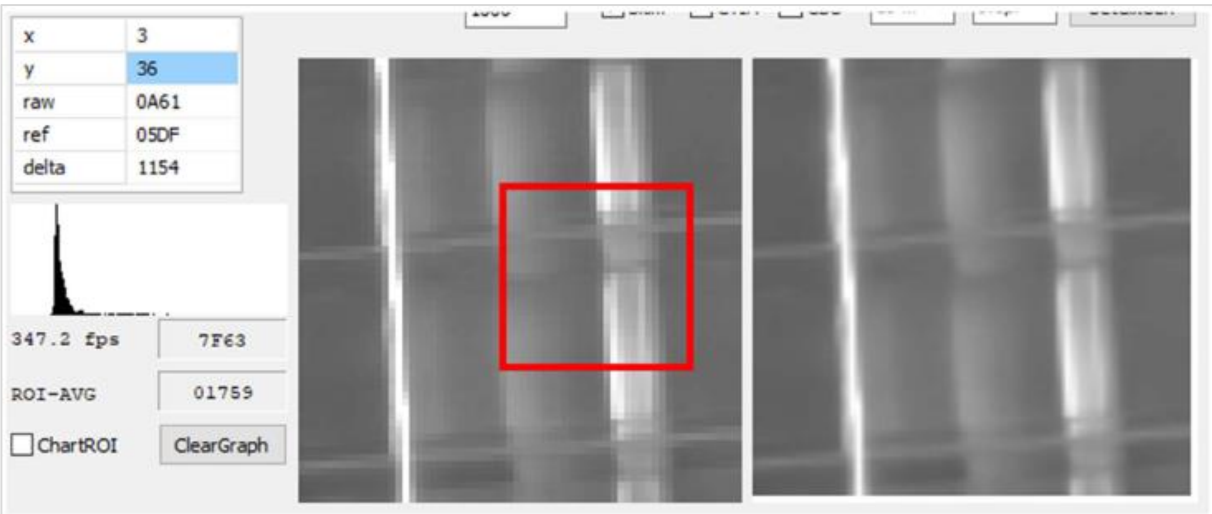
A small table shows the position of the mouse pointer in the left image in terms of the x and y coordinates, the AD value for this pixel as a hexadecimal number ("raw"), as well as the stored reference value ("ref") as a hexadecimal number and the difference ("delta") between these two numbers as a decimal number.

x	4
y	35
raw	09C1
ref	05AF
delta	1042

The reference image can be deleted with the "ClearRef" button. A histogram of the raw AD values is displayed below the table. The reading speed into the PC (~340fps) and the (hexadecimal) frame counter of the test circuit is displayed under the histogram.

Average Signal over Region of Interest (ROI-AVG)

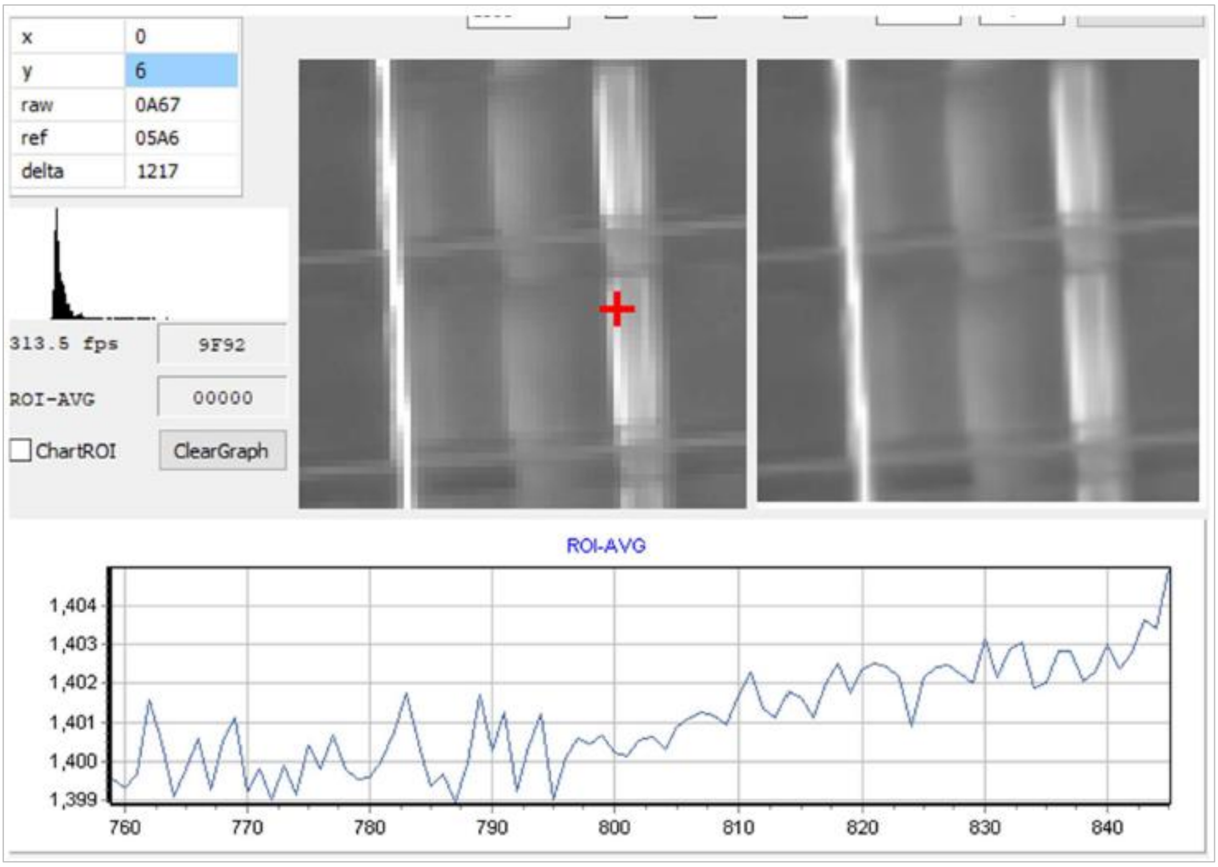
In the image on the left, a rectangular "Region of Interest" (ROI) can be defined with the mouse while holding down the left mouse button, which is indicated by a red frame. The difference values (or raw values if the reference image is deleted) of all pixels belonging to the ROI are averaged and displayed as "ROI-AVG" decimal.



The course of this ROI-AVG value over time can be displayed in a diagram if the "ChartROI" checkbox is checked. The diagram can be deleted at any time with "ClearGraph".

Signal of one single pixel over time

If the mouse is positioned in the left image and the right mouse button is pressed, no ROI is defined, but only a single pixel is marked with a red cross. The time course of the AD values of this one pixel can then be displayed in the diagram.



You can zoom within the diagram if the desired zoom area is defined by drawing a rectangle from top left to bottom right while holding down the left mouse button. With the right mouse button pressed, the displayed zoomed area can be moved.

If a rectangle is drawn from top right to bottom left with the left mouse button pressed, the zoom function is switched off again.

Setting ranges for voltages and integration time:

The voltages "TestInput" and "VClamp" can be set in the range of 0...3.3V and the voltage in "WampRef" in the range of 0...3.6V via the respective input fields and the buttons.

The "SetClkGen" button is used to define the integration time between 11 and 4000 clock cycles and the flags in the control word for the InGaAs array. The input field for the integration time is situated right above the left image.

Each clock cycle has a length of 0.5µs.

Temperature-Measurement

With the "GetTemps" button, 2 temperature sensors on the test circuit are read in as "flag" and "box" in °C (degrees Celsius) and the DC voltage on the integrated temperature sensor of the InGaAs-array as "chip" in volts and displayed.

Optimizing the image

- Illuminate the object with artificial light (e.g. a halogen lamp, a SWIR-LED-array) and darken the lab (prevent ambient light).
- Focus on the object/the scene using the distance setting on the lens. Note, the lens is not optimized for the SWIR (Short-Wave-Infrared) spectral range.
- Protect the area between lens and image sensor from stray light.
- Fine tune the integration time together with the illumination intensity of the lamp.
- Subtract a dark image from the bright image, see chapter “Reference image (dark image)” above.

Change of InGaAs-sensor

To make it easier to change the InGaAs-sensor, a hole has been made in the circuit board, which is located directly under the sensor.