NanEyeGS in Awaiba Viewer

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1 Introduction

This document describes the NanEyeGS specific options that can be used inside Awaiba Viewer software.

- Capture data from up to **2 NanEyeGS** sensor with **NanoUSB3** board
- Capture data from up to **2 NanEye GS IduleModule USB3** board, at the same time

For more information regarding the registers, please check the NanEye GS Full Spec.

2 NanEye GS for NanoUSB3

Figure 1, shows the interface for **NanEyeGS USB3 board**. In the stereo option, the interface is the same for both sensors.

For additional options please check Awaiba Viewer Quick Start document.

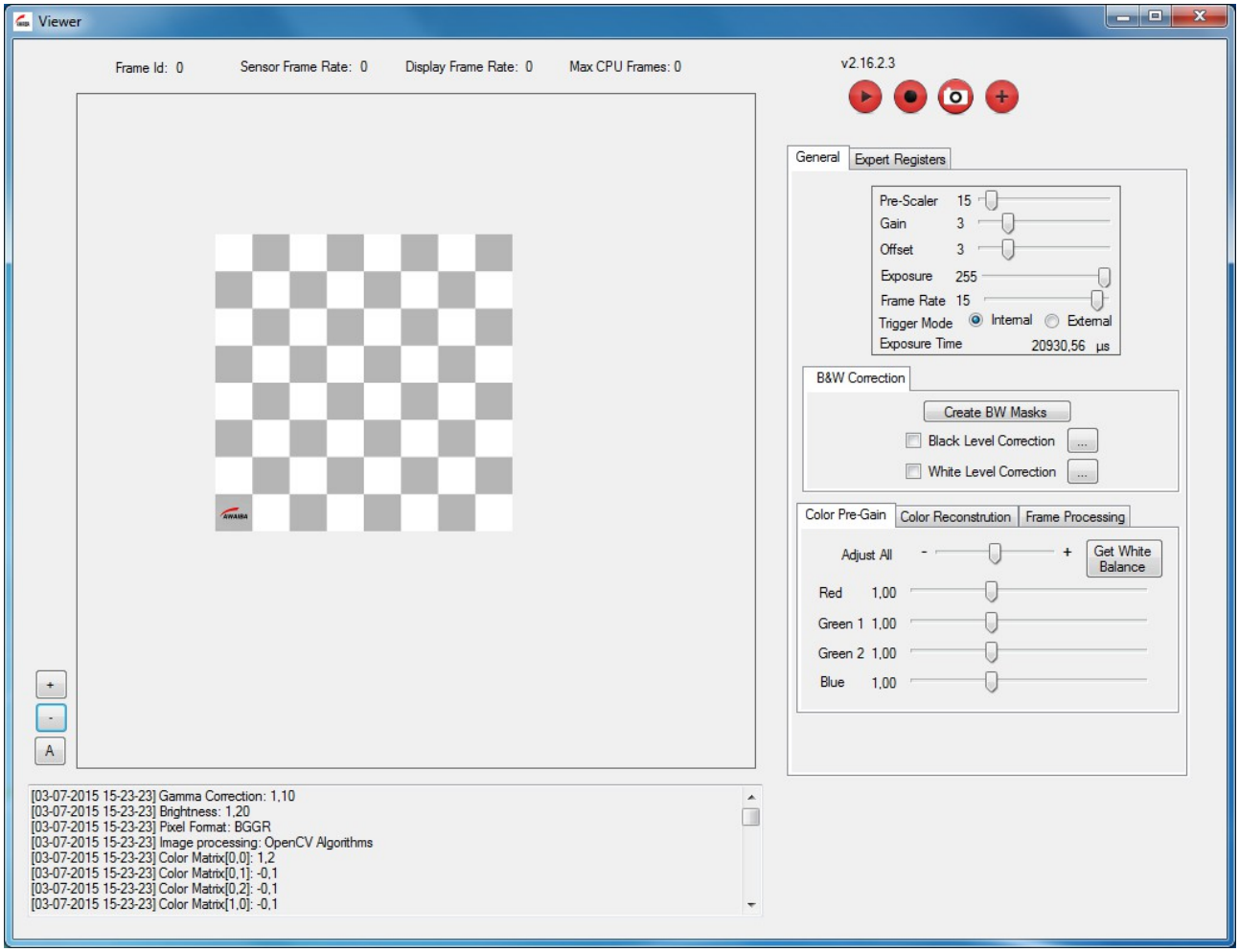

Figure 1: NanEyeGS interface for NanoUSB3

2.1 Sensor Control

2.1.1 General Tab

Figure 2 shows the general sensor registers that can be changed by the user.

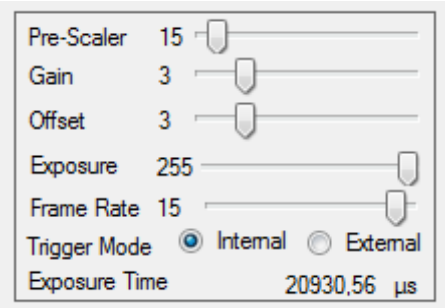

Figure 2: General registers

- Pre-Scaler
  - Has values between 0 and 255
  - This register changes the exposure time of the sensor
  - The higher this value, the brighter the image, however a high value will reduce the frame rate
- Gain
  - Has values between 0 and 15
  - 0 is the brightest and 15 the darkest
- Offset
  - Has values between 0 and 15
  - 0 is the darkest and 15 is the brightest
- Exposure
  - Has values between 0 and 255
  - 0 is the darkest and 255 the brightest
  - Generally, this value is set to 255, and the user changes the pre-scaler to adjust the image brightness
- Frame Rate
  - NanEye GS operating at 50MHz – 90FPS
  - NanEye GS with 20 cm cable operating at 25MHz – 50FPS

- Please do adjust the Frame Rate and the Pre-Scaler, such that the sensor frame rate is always below the indicated Maximum CPU Frame Rate for the chosen exposure time setting!

- Trigger Mode
  - By default is defined as Internal. To apply a external signal please have a look in the NanEye GS USB3 Evaluation Kit document.
- Exposure Time
  - Defined by Pre-Scaler and Exposure registers

2.1.2 Expert Registers

Expert Registers tab is displayed in figure 3, allowing the user to change all the sensors registers, according NanEyeGS specification document.

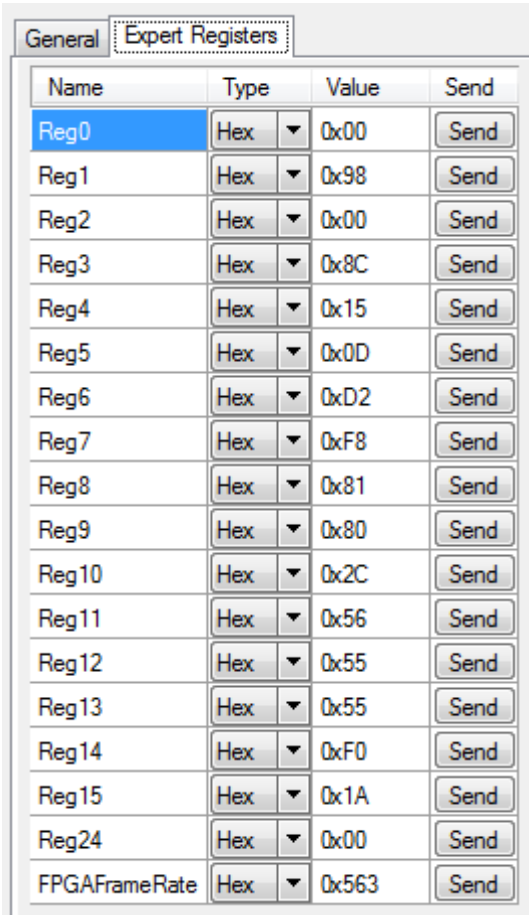

Figure 3: NanEye GS Expert Registers

The values can be represented in binary, decimal or hexadecimal, according to the user's needs.

The registers are name from **Reg0** to **Reg15** and its values are the same as defined in the specification file.

By means of the Tap "Expert Registers" the user can take direct control over the sensor Registers. It is mandatory to consult the **Sensor Specification** which explains each of the bit's in the sensor's I2C register bank's and their functionality to properly adjust the settings in this tap.

For convenience of the user, the bit groups more frequently accessed are grouped to an alias, that writes only to part of a register. Bit's exceeding the applicable bit field of the respective function are ignored when written to the sensor by the lower levels of the software.

Register 24 defines the trigger mode. The value 00 refers to the internal trigger and the value 01 is used for external trigger.

Also the user can change the **FPGAFrameRate**, that is the **frame rate value * 100**. For example, by default, the value is **1100**, that means that the user will get **11 frames per second**. If the user changes to **900**, it will start receiving **9 frames per second.**

2.2 Black and White Masks

To improve the image quality, the user can create a Black and a White Mask individually, as shown in figure 4.

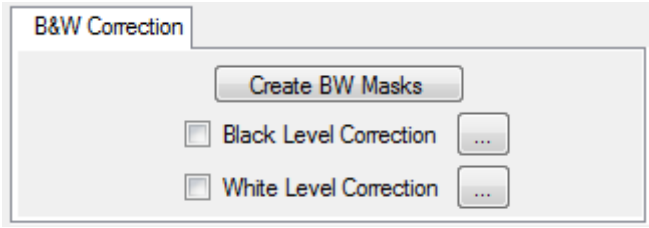

Figure 4: Create Black and White Masks

To load the files please press "..." button. Check the "checkbox" to apply the respective mask.

2.2.1 How to create Black Masks

- Press the **Create BW Masks** button
- Choose the File Name
- Cover the sensor and then the Software will create the Black Mask
- When finished, a message is displayed "Black Mask created successfully"

2.2.2 How to create White Masks

- Choose the File Name
- Adjust the light (using homogeneous light) to reach 90% of saturation
- When finished, a message is displayed “White Mask created successfully”

2.3 Image Processing

2.3.1 Color Pre-Gain

A Bayer Pattern is used as shown in figure 5.

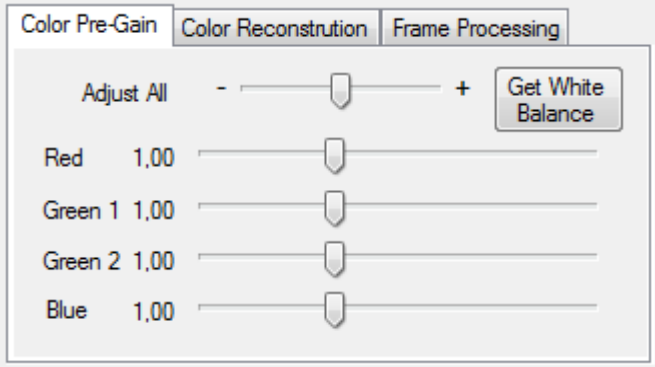

Figure 5: Image Processing - Color Pre-Gain tab

It is possible to adjust the pixel individually or through White Balance.

How to do White Balancing:

- Point the sensor to a white surface/object
- Press the button “Get White Balancing”
- The pixel values will adjust automatically

2.3.2 Color Reconstruction

Figure 6 shows the color reconstruction options.

Please check the Color Reconstruction “checkbox” to enable the demosaic algorithm.

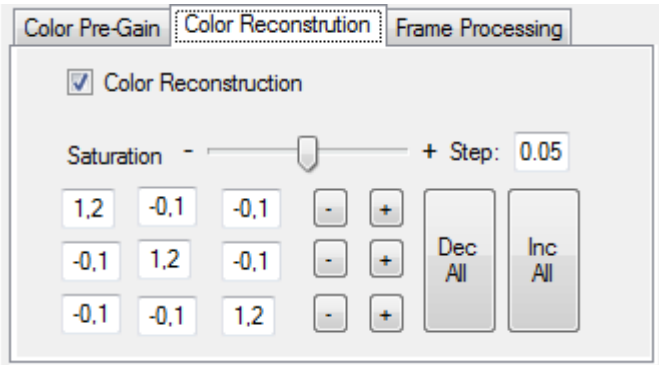

Figure 6: Image Processing - Color Reconstruction tab

It is also possible to tune the image saturation manually or through a color matrix for each channel (Red, Green or Blue respectively). Please note that the sum of all lines need to be "1" so the image overall brightness does not change.

2.3.3 Frame Processing

Figure 7 shows the frame processing tab options.

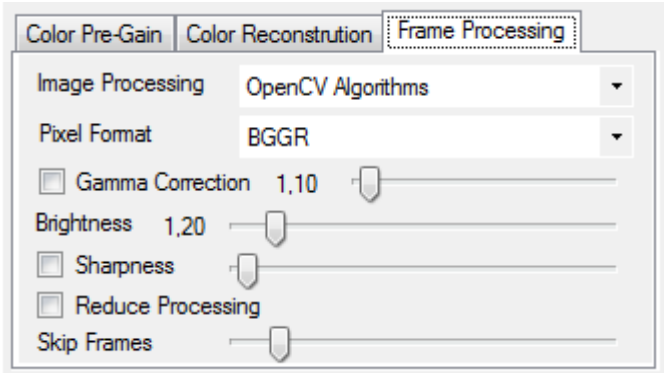

Figure 7: Image Processing - Frame Processing tab

- Image Processing
  - Awaiba Algorithms
  - Open CV Algorithms
- Choose pixel format
  - RGGB
  - GRBG
  - GBRG
  - BGGR (defined as default value to show the image color correctly)

- Gamma Correction
  - Applies a gamma function to the image
- Brightness
  - Applies linear gain to the image
- Sharpness
  - Allows to clean the image
- Reduce Processing
  - Used when the PC can not handle the data the sensor is sending
  - Only Masks are applied
- Skip Frames
  - Used when the PC can not handle all the frames the sensor is sending
  - Increasing the trackbar allows to skip more frames

3 NanEye GS for Idule Module USB3

Figure 8 shows NanEye GS interface to operate two Idule Module at the same time.

For additional options please check Awaiba Viewer Quick Start document.

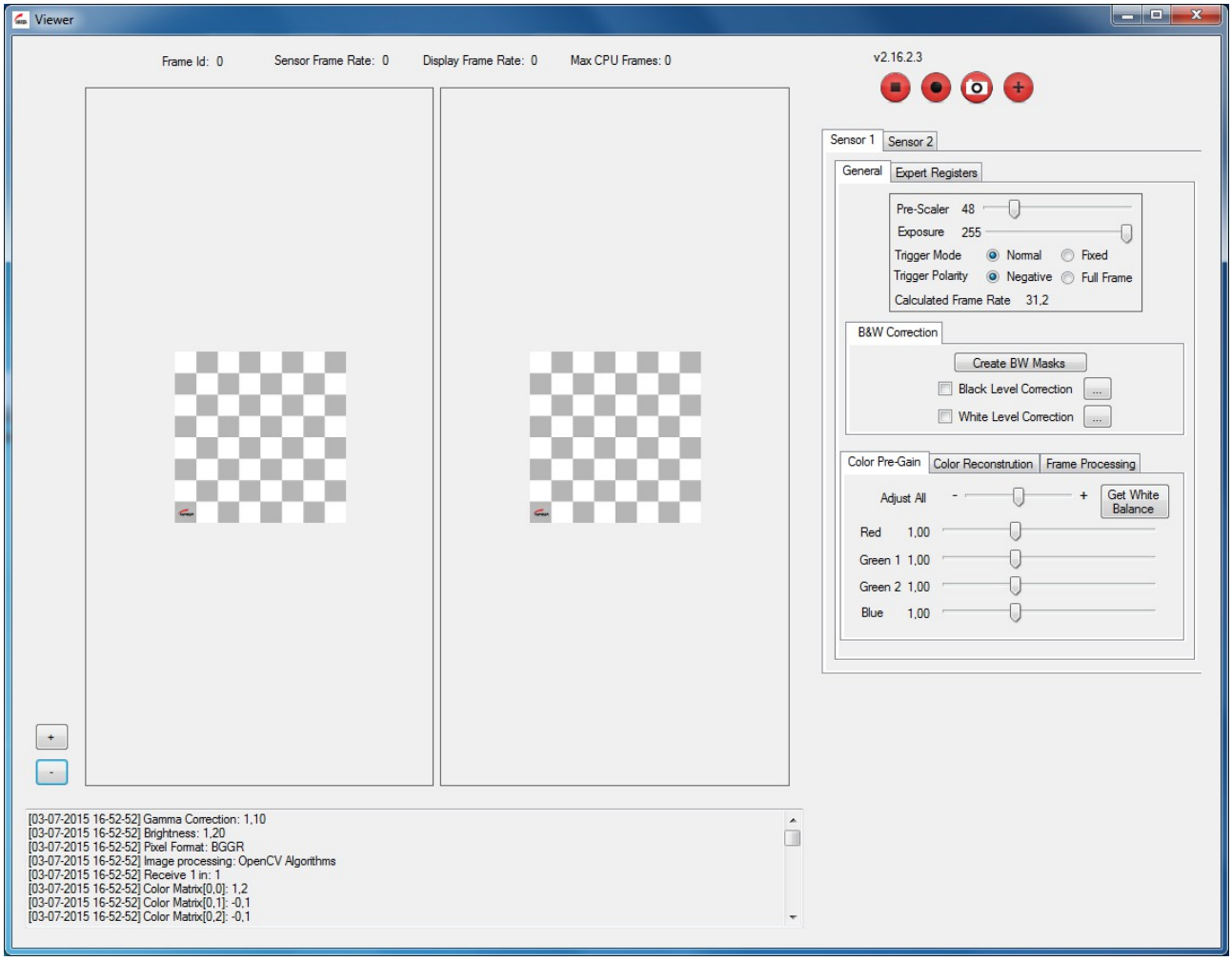

Figure 8: NanEye GS interface for two Idule Module operating at the same time

For **NanEyeGS in IduleModule**, the user can change the Pre-Scaler and the Exposure registers. There is also the possibility to choose between Internal and External Trigger.

The user can get 90FPS with NanEye GS Idule Module.

4 How to enable the high dynamic range mode

The dynamic range mode provides a piece wise linear response (PWL) with a programmable compression threshold and slope. Figure 9 explains the working principle of the Piece Wise Linear response mode. For low illumination intensities, the pixels response is left unchanged, and behaves like a standard integrating pixel. It's slope is defined by the total Exposure time (also referred to as “integration time”). After the pixel signal reaches a certain threshold, which is programmed by means of the bits 7:2 of the register 0x08, the response curve of the pixel is flattened.

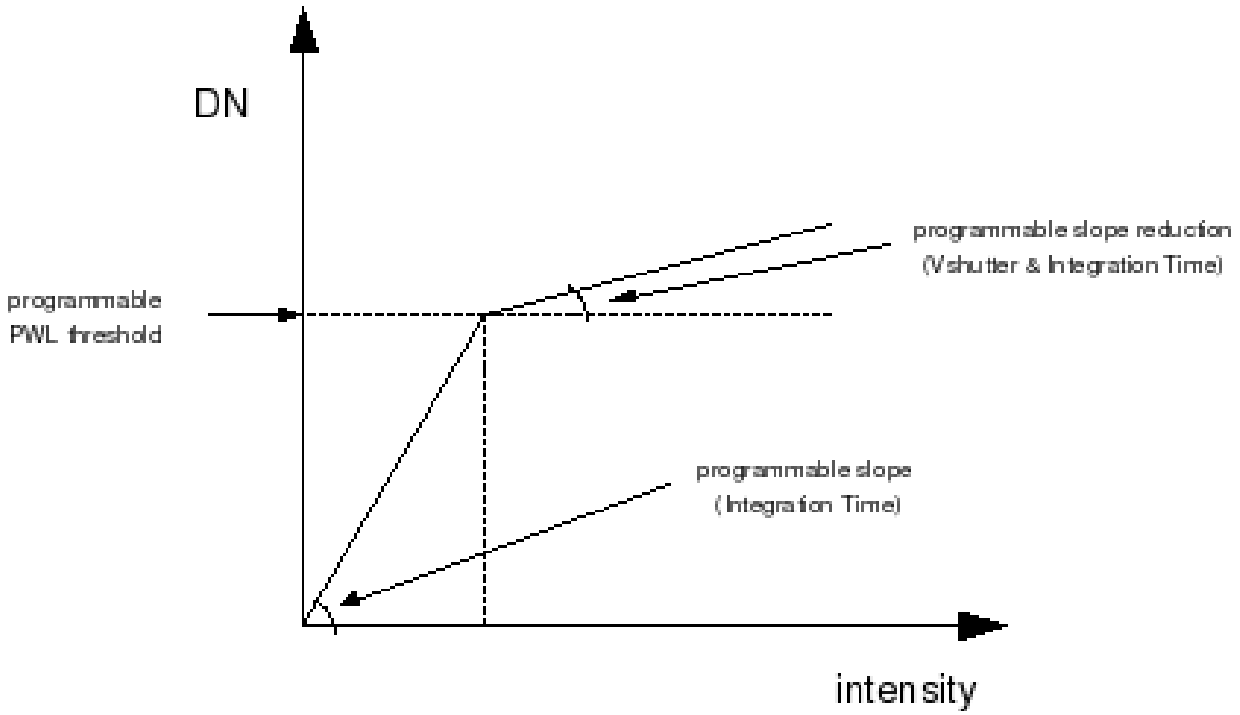

Figure 9: Piece wise linear programmable response function

The response slope beyond the threshold is a linear function of the difference between (Reg 0x06) - (Reg 0x07). The registers for Exposure and PWL time respectively. The signal level of the threshold is set by Register 0x08 bits 7:2.

The higher the value of the bits 7:2 in Register 0x08 is set, the lower in signal range the compression threshold is set.

Finally, the pixel reset voltage, which can be set by register 0x0A bits 2:0 should preferably be set at it's highest value to allow the maximum analogue swing of the pixel.

A good starting combination of values to enable work with the High Dynamic Range mode are:

- **Reg6** = 0xFF
- **Reg7** = 0xFA
- **Reg8** = 0xE5

To enable the PWL mode, finally bit 1 of register 0x03 has be set to 1.

- **Reg3** = 0x8E

The overall exposure time is then adjusted by means of the pre-scalar value, **Reg5** or the **Pre-scalar slider** in the General tap.
As a result, an image which can cover a wide dynamic range between shades and bright part's can be captured within the same frame.

Image in PWL response mode, showing an office desk with mostly closed sun shields and bright sun illuminated outside, in figure 10.

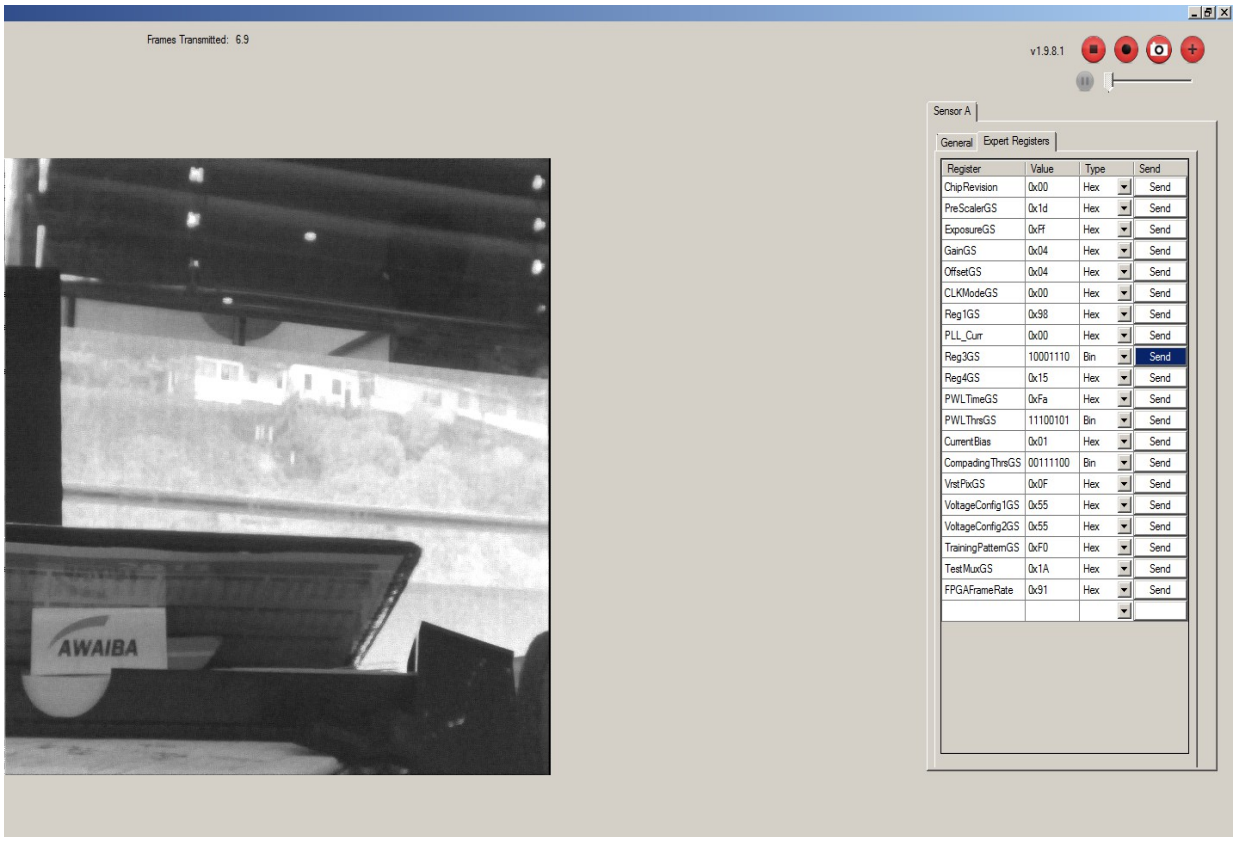

Figure 10: Nan Eye GS Viewer – Office desk

Linear mode with same exposure time, in figure 11:

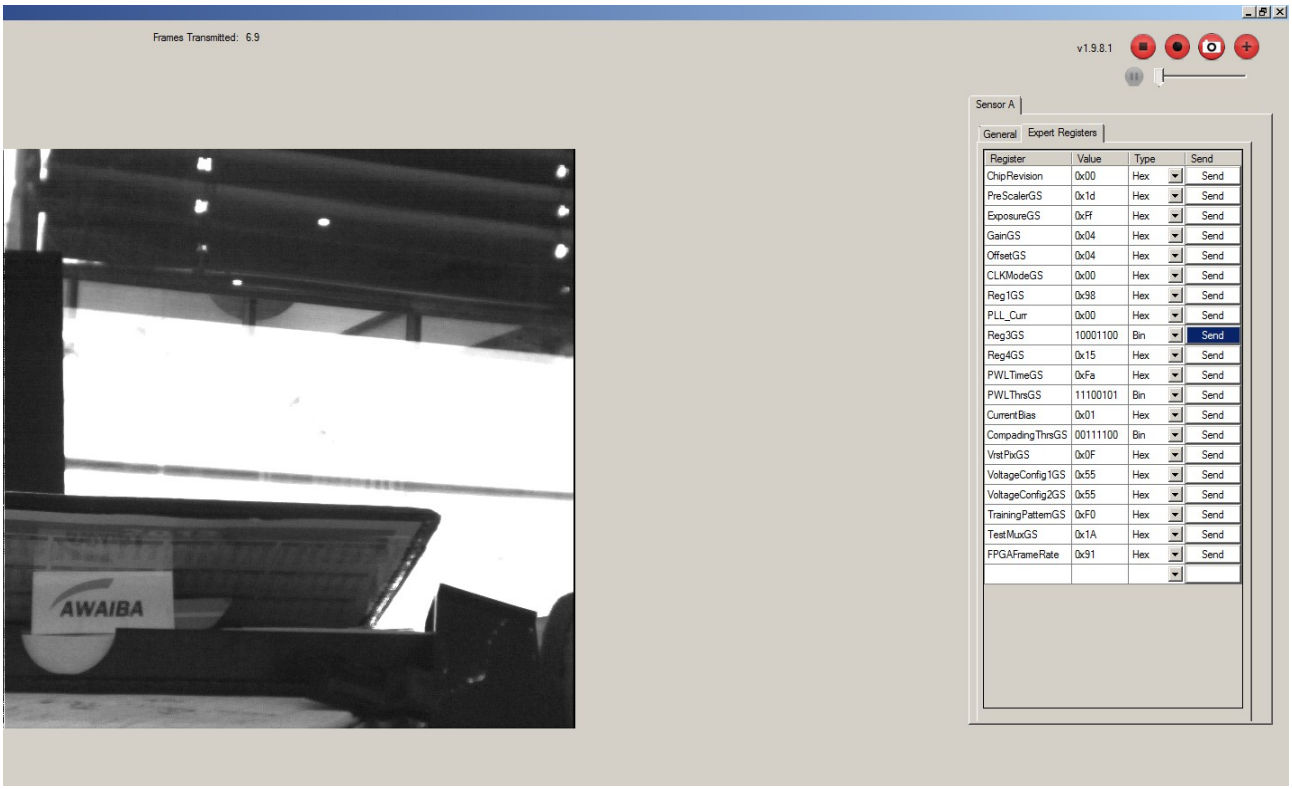

Figure 11: Nan Eye GS Viewer - High Dynamic Range office desk - linear mode

Linear mode short exposure time, in figure 12.

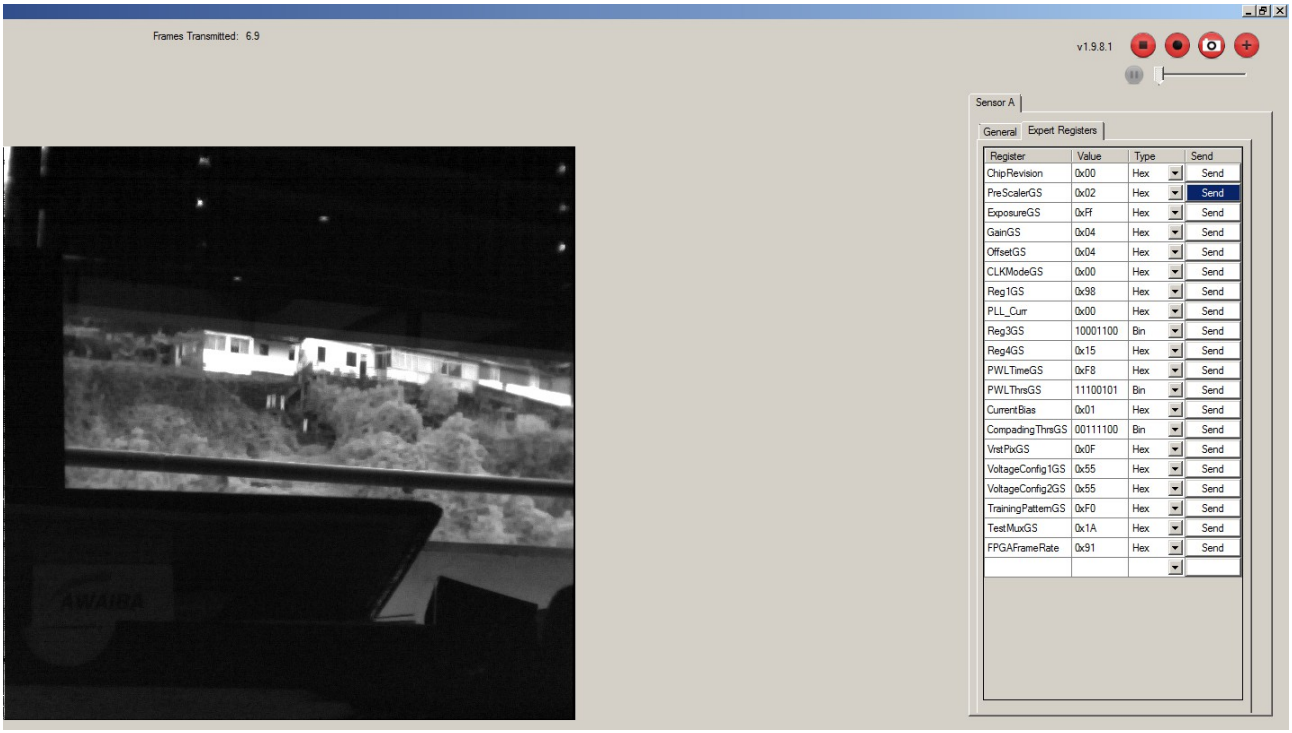

Figure 12: Nan Eye GS Viewer - High Dynamic Range linear mode office desk - short exposure time

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