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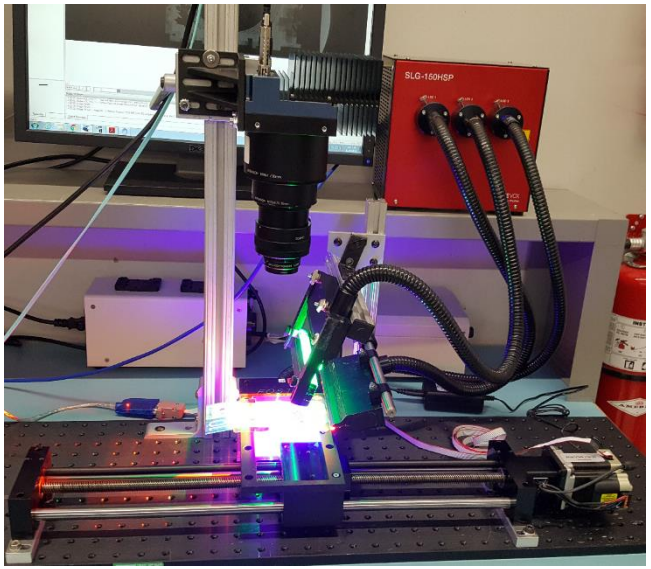
03-032-20279-00 Application Note for Linea Multiline Camera Sequential Mode

This application note specifically details how the camera sequential mode works with the Revox SLG-150HSP model light source



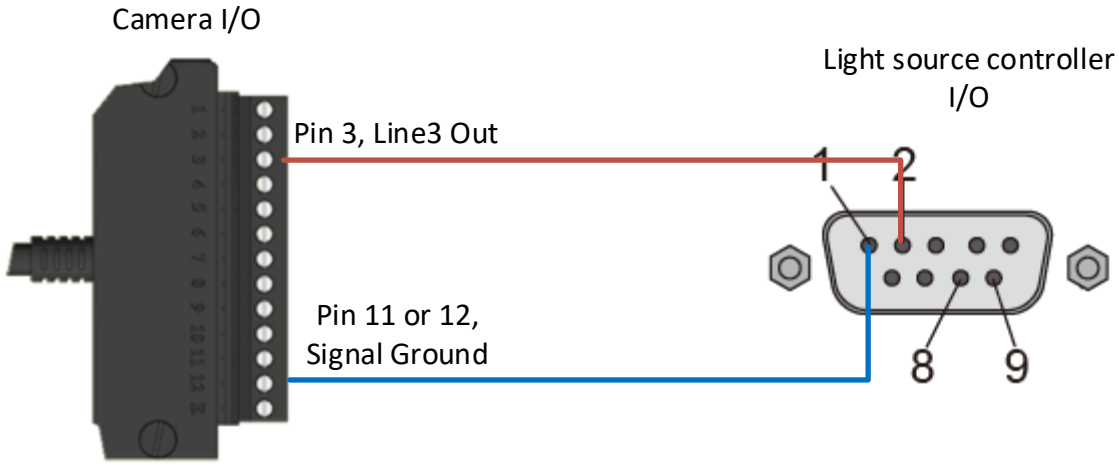
Linea multiline camera family's ML-FM-08K and ML-HM-16K models have a feature called sequential exposure, which enables users to scan multiple images within a single scan. This feature, combined with a sophisticated light source, improves inspection speeds by a factor of three to four times. A LED strobe light source, such as that from Revox (https://www.revox.jp/en/), SLG-150HSP, is one of the light sources suitable for this application. The following is two example configurations of the Linea ML cameras sequential exposure application in conjunction with the SLG-150HSP light source.

I. Multifield Application

A. Hardware Setup

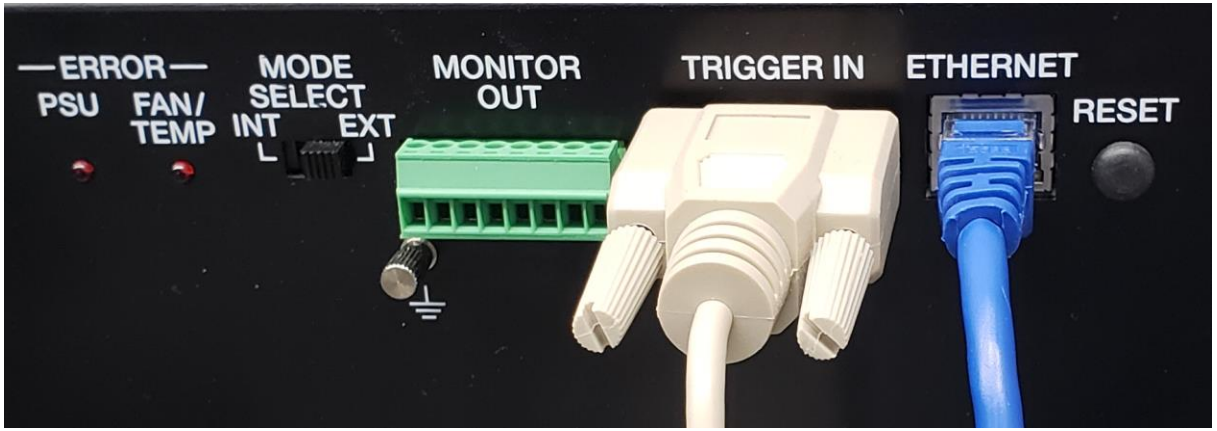
1. Camera I/O and Light Controller Connection

Use a DB9 female connector to connect the cameras I/O pin3(Line3 Out, the first trigger) and light controllers I/O pin2(trigger input); and connect the Cameras I/O pin 11 or pin 12(signal ground) to the light controllers I/O pin 1(input common).



Note: If using the DB9 connector with built-in cables, make sure the proper pins are connected.

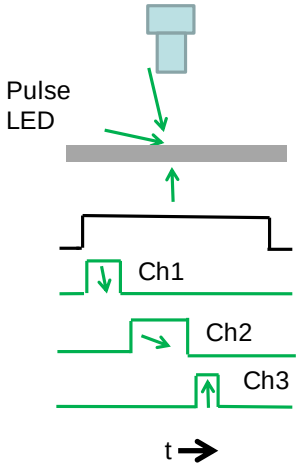
2. **Use an Ethernet cable connected to the host PC and the light source controller.**

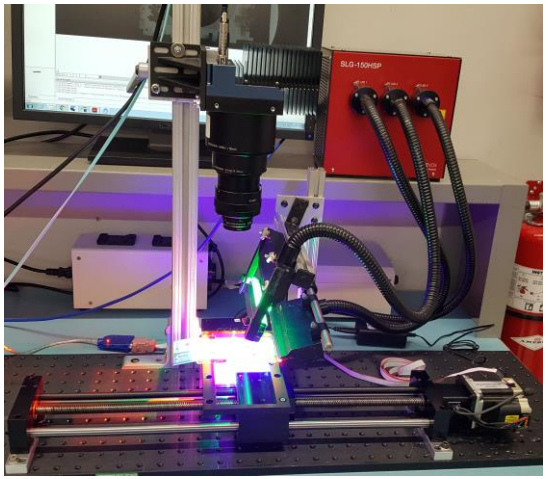


When the light source controller is powered on, , it will be automatically connected to the host PC. If there is no automatic connection, then a manual connection is required. (Refer to the light source manual)

3. **Light Guide Setup**

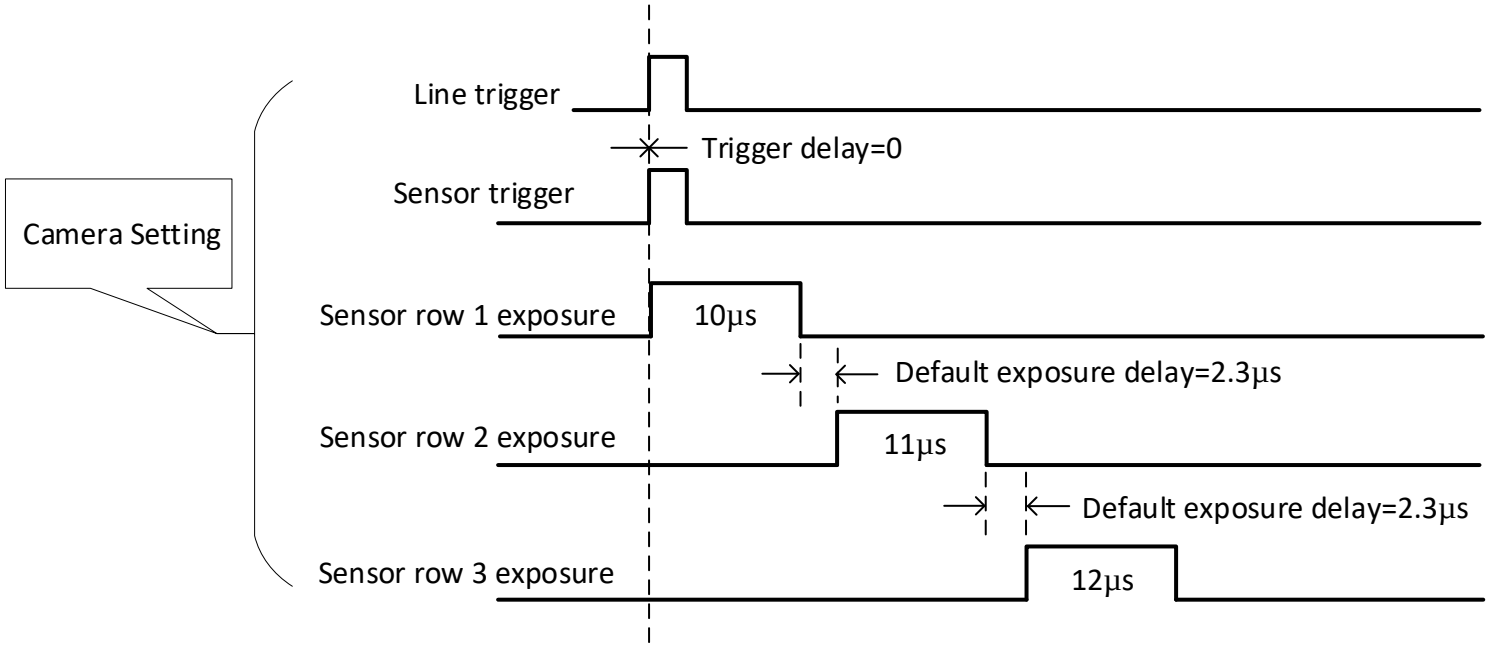
Mount light guides as bright field, dark field, and back field, respectively.



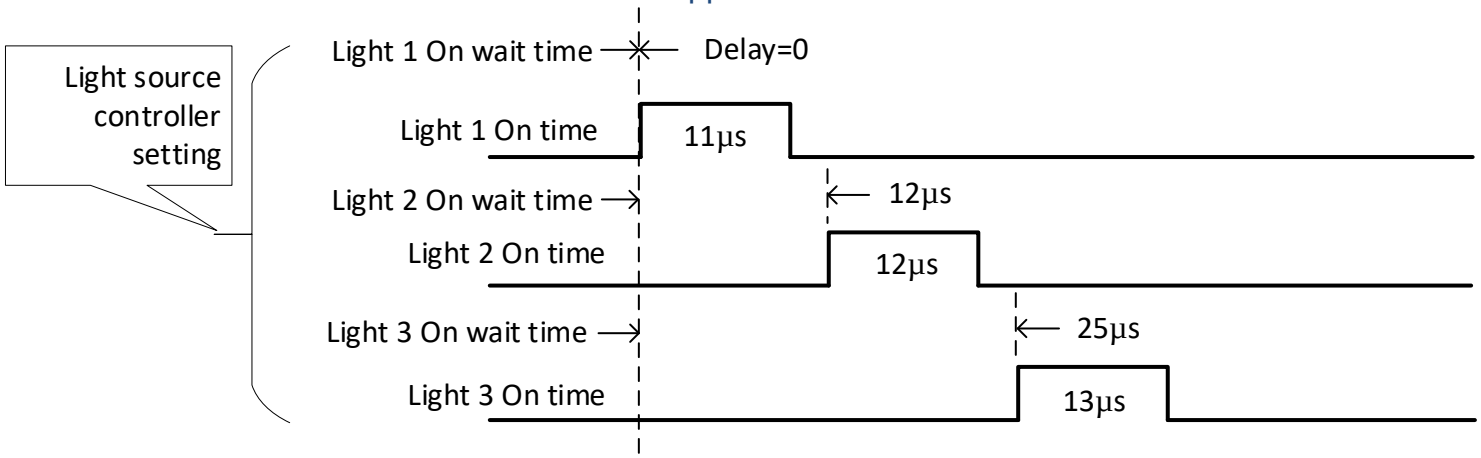


4. Light Controller Setup

Assume we set the sequential exposure as following:

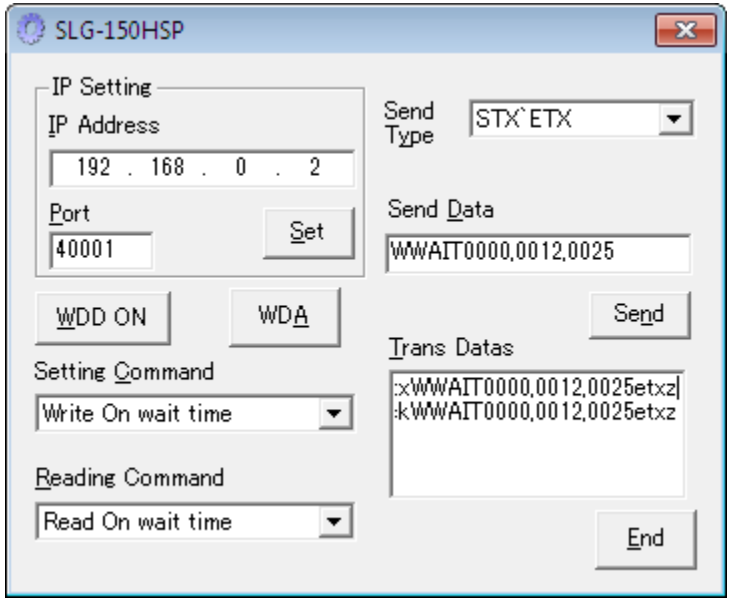


Then the light source controller can be set as following:

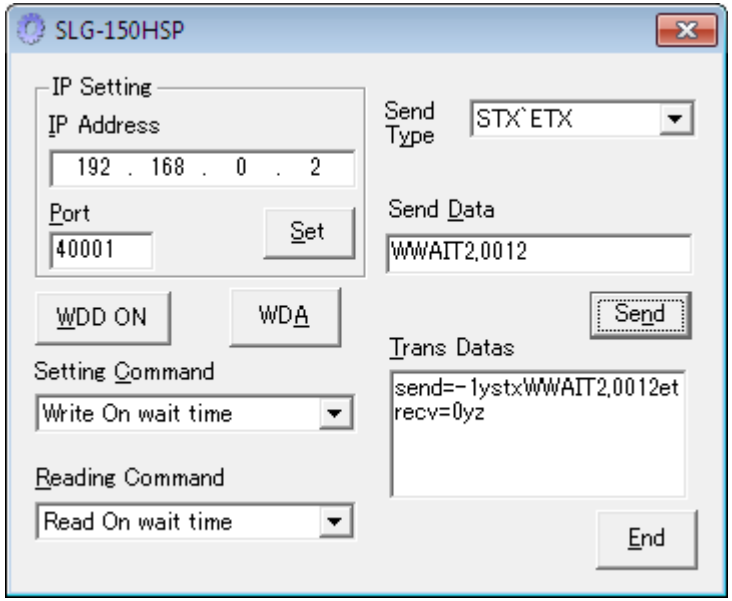


Set Light Delay time

Save the Revox light control program to any folder in you host machine and double click the icon HSP_CMD to run the program. Select 'Write On wait time' from Setting Command and type 'WWAIT0000,0012,0025' in the Send Data dialog box, then click Send button.

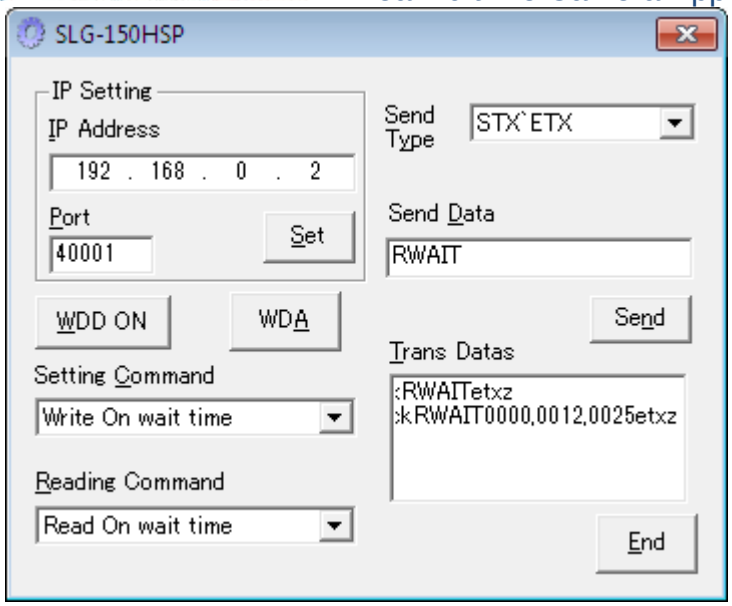


By this setting, the light 1, 2, and 3 will get a delayed trigger and it will be delayed by 0 µs, 12 µs, and 25 µs, respectively, so that the firing time match to the sequential exposures. You can input them one by one, e.g. WWAIT1,0000, WWAIT2,0012, etc. refer to following screenshot.

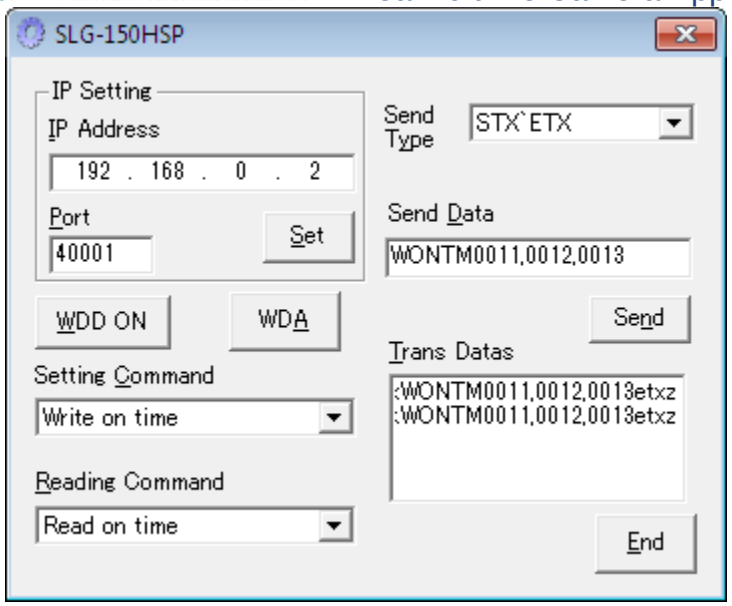


Set Light On Time

Select 'Read On wait time' from Reading Command and click the Send button to check if the delaying parameters have been set properly or not.



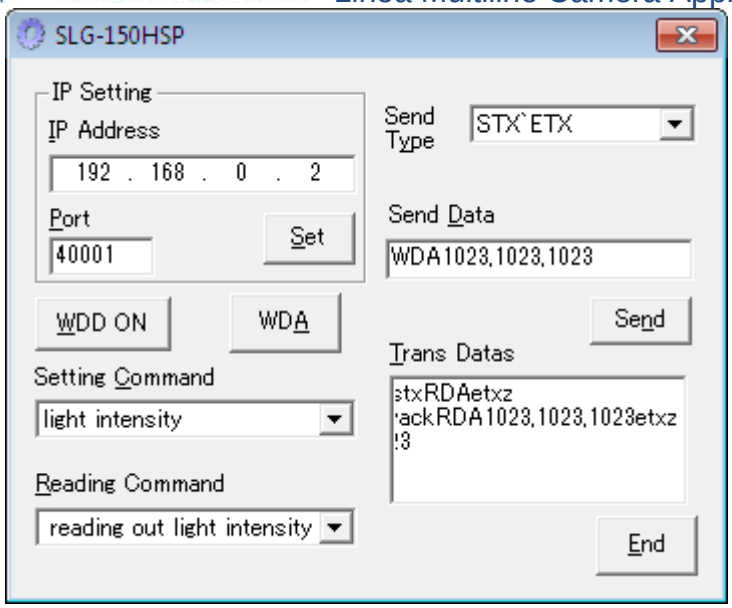
Select ‘Write on time’ from Setting Command drop-down menu and type WONTM0010,0011,0012 in the Send Data dialog box and click the Send button.



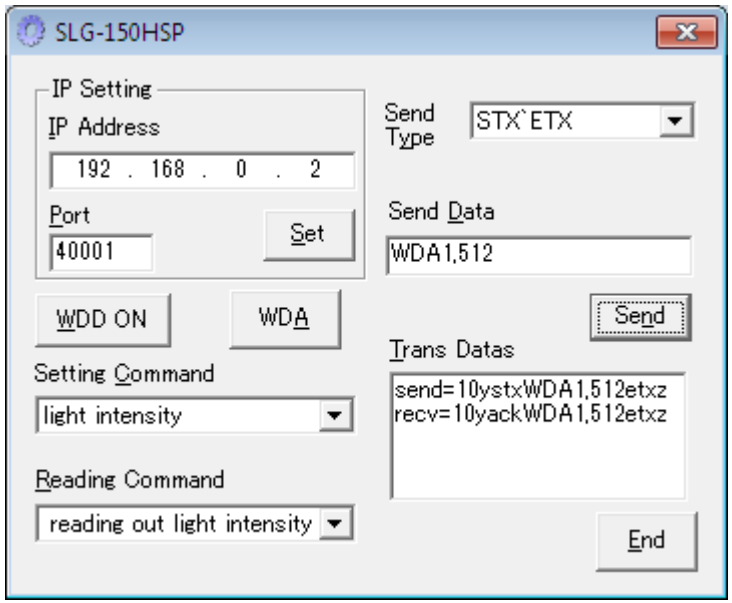
0011, 0012, and 0013 represent LED on time of light 1, 2, and 3, respectively. These also can be set one by one, for example, command ‘WONTM1,0011’ will set the light1 on time to 11µs.

Set Light Intensity

Select ‘light intensity’ from Setting Command drop-down menu and type ‘WDA1023,1023,1023’ in the Send Data dialog box and click the Send button. This sets the all three light source outputs to maximum.

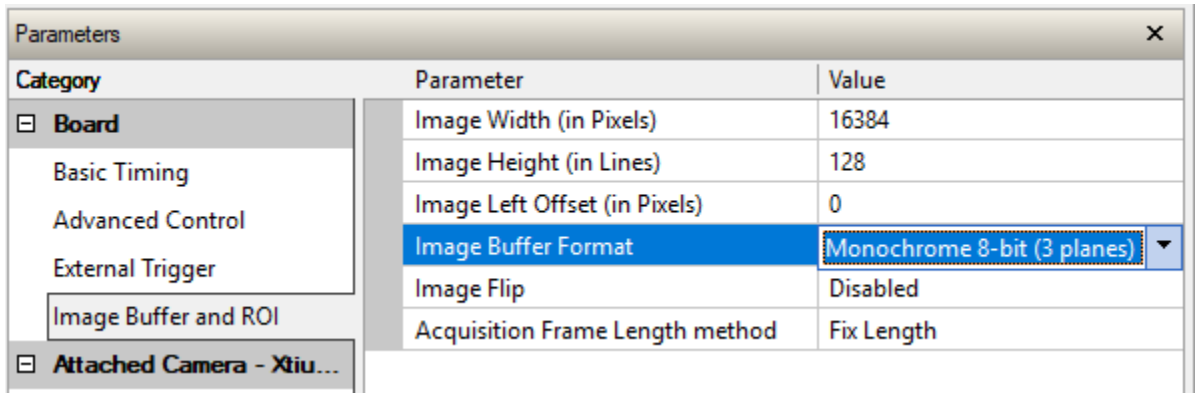


You can adjust them one by one, for example, command ‘WDA1,512’ sets the light 1 intensity to half of its maximum.

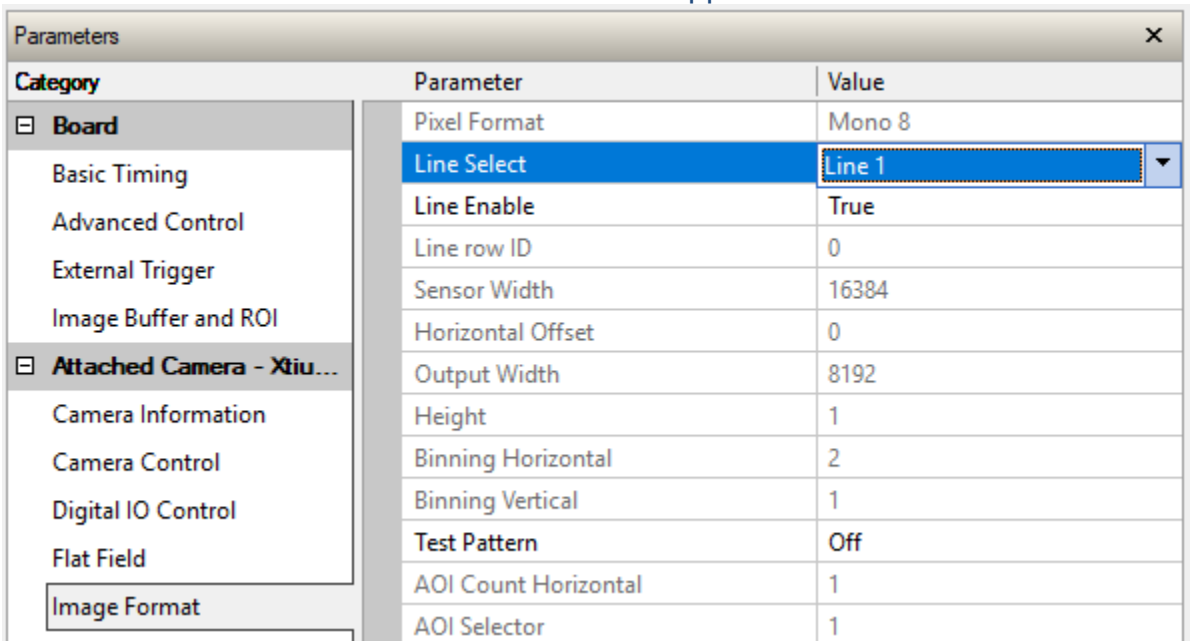


B. CamExpert Setup

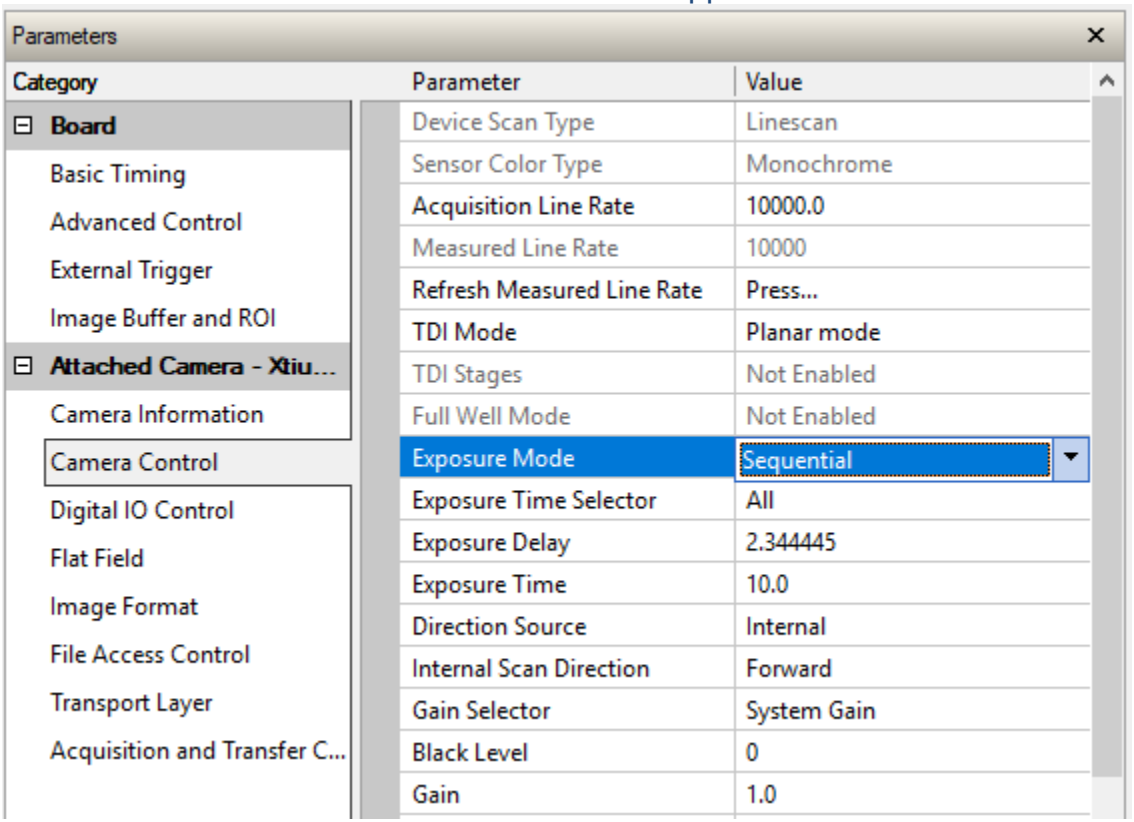
Select Monochrome 8-bit(3 planes) from frame grabber interface.



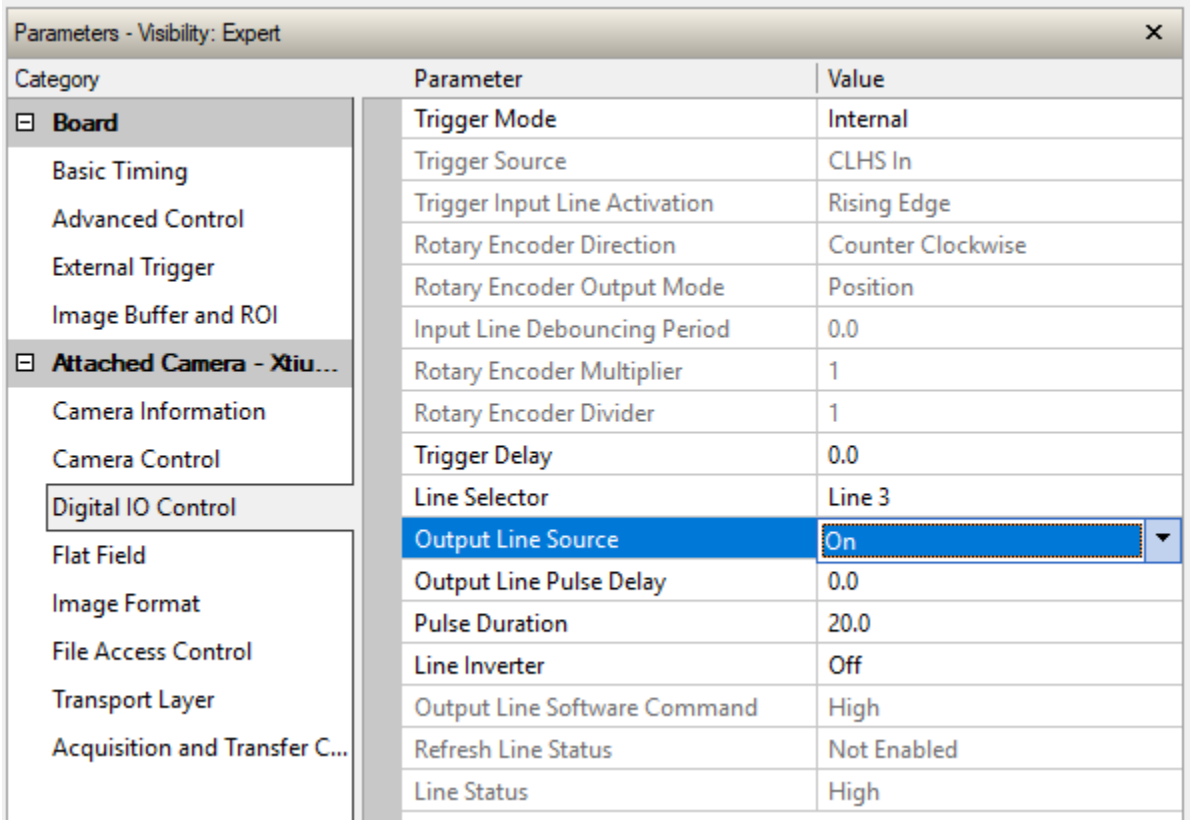
Set Line 0 to False, and set all Line 1, Line 2, and Line 3 to True.



Select sequential from Exposure Mode, and select Planar Mode from TDI Mode. Ensure the default exposure delays(2.34445µs) are unchanged for all three rows. Set sensor row 1, row 2, and row 3 exposure time to 10, 11, and 12 µs, respectively.

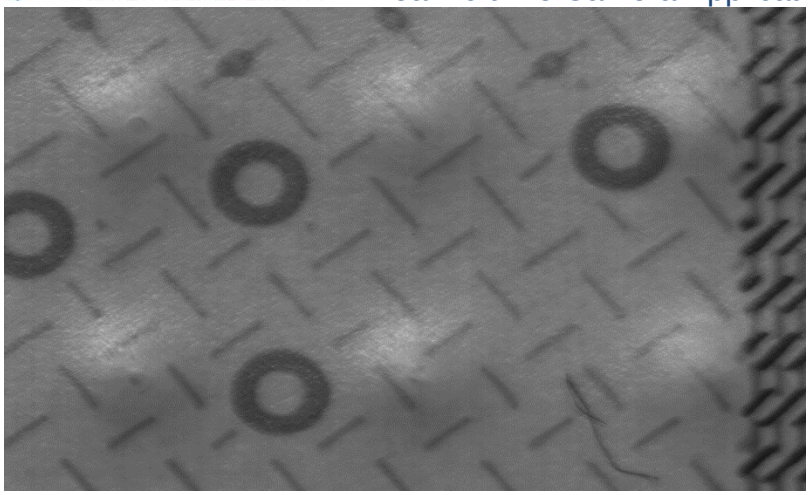


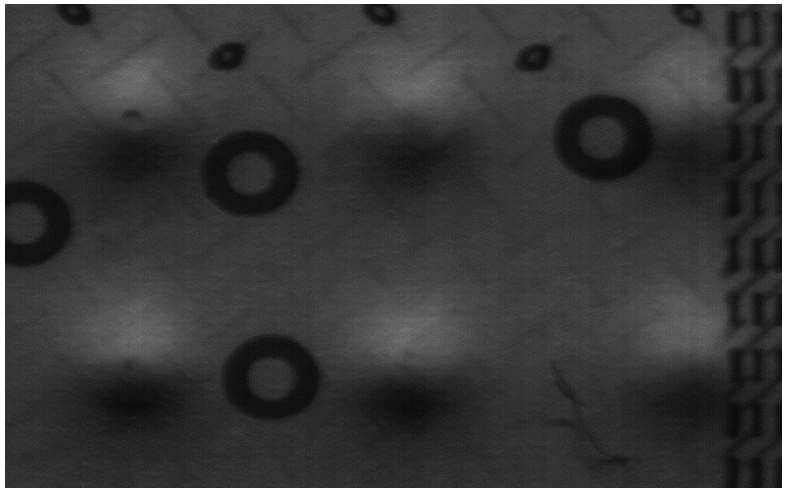
Select Line 3 from Line Selector and choose On from Output Line Source. This enables the GPIO Pin3 to sends out line trigger signals to the outside world of the camera, in this case, it is sent to the light source controller. Set the Output Line Pulse Delay to 0, and set the Pulse Duration to an appropriate number, for example, 20µs. In general, 1+µs works fine, but for the sake of antinoise, we recommend that you set it to a larger value as long as the line period allows.



II. Sample Images

Hardware and software settings above allow you to scan three fields: bright field, dark field, and back field, images within single scan. The following images are sample images of a 10-dollar Canadian banknote.



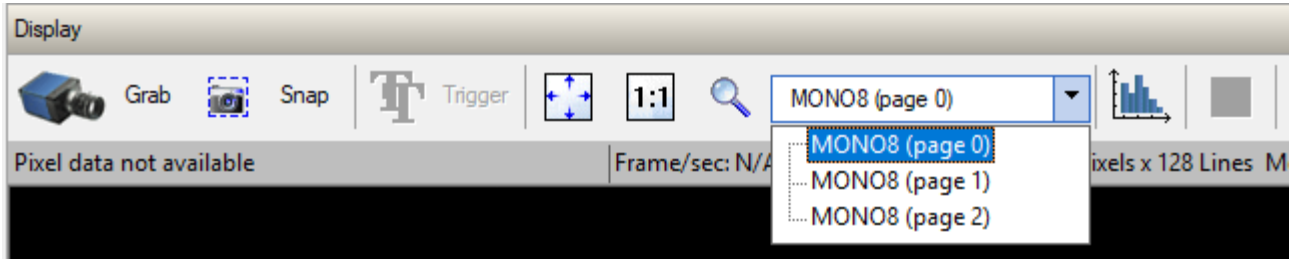


Upper-left: bright field image of a Canadian banknote.

Upper-right: dark field image of a Canadian banknote.

Left: back field image of a Canadian banknote

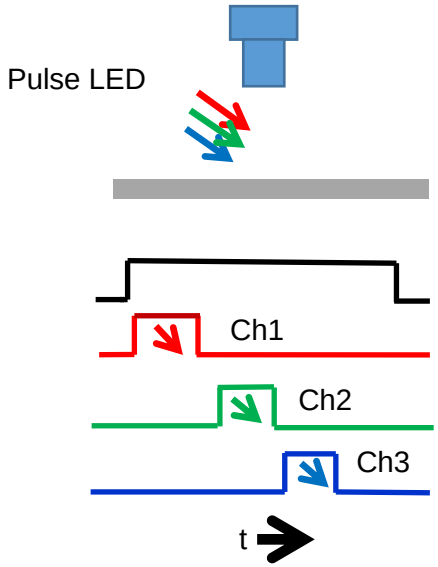
You can switch views with the planar dropdown selector in the CamExpert.

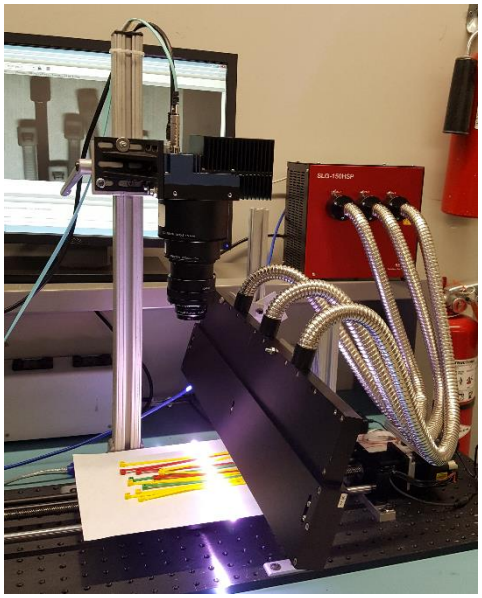


With current CamExpert version 8.4x, Users cannot save multi-plane image as the standard formats, such as .tiff, .bmp, etc., but can only save as .crc format which can then be loaded by the CamExpert 8.4x. We provide the CRC format to Users, so that Users can write their own code to interpret the images. Please contact your local Teledyne DALSA Technical Support Department for further details.

II. Multispectral Application

A Multispectral application system is very similar to multifield application system where the only difference is the illumination method. Other than three-field illumination, multispectral imaging requires all lights' incident angles to be equal or very close in alignment. The Revox light source, SG-150HSP with a 3-in-1 light guide makes this task very easy to accomplish..





The light source can provide red, green, and blue lights. With exactly the same settings in above multifield application, the three lights will illuminate the object in RGB order and therefore, the User can get three spectral images within a single scan like below (from left R, G, and B).

Image from the red light channel

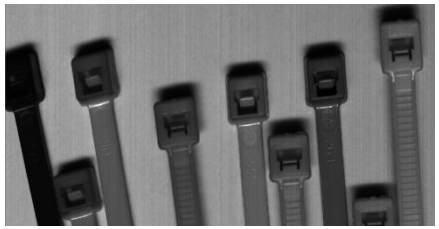


Image from the green light channel

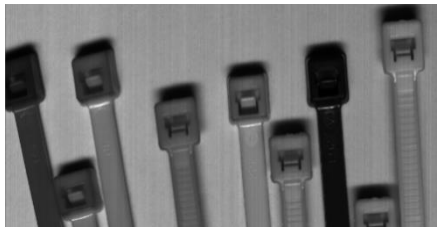


Image from the blue light channel