SBIG

ASTRONOMICAL
INSTRUMENTS

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Application Note
Trigger Signals on the USB Cameras
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This Application Note describes how you can utilize both a **Trigger In** and **Trigger Out** capability with the USB cameras like the ST-7/8/9/… and the STL-11000… The **Trigger Out** can be used to synchronize an external light source for example and the **Trigger In** can be used to start the exposure after an external trigger event.

Trigger Out

The USB cameras produce an active low **Trigger Out** signal on pin 7 on the **I2C-AUX** port if the following conditions are met:

1. The camera is an STL series camera, or if an ST-7/8/9… was manufactured after May 2004. SBIG can modify an older ST-7/8/9 to provide this function.

2. You are using SBIGULDR.SYS Version 1.0 Build 29 or later and have rebooted the camera since upgrading this driver. Run the SBIGDriverChecker.exe utility to verify the version. If you need the new version use the Download and Update functions.

3. The trigger out is available on pin 7 of the **I2C-AUX** connector but the signal is an open-collector transistor. If your external circuitry needs a pull-up resistor then a 1 K Ohm resistor can be soldered between pin 7 (trigger out) and pin 1 (+5V) for a TTL trigger or between pins 7 and pin 9 (+3.3V) for a 3.3V trigger. For your reference Signal Ground is available on pin 5.
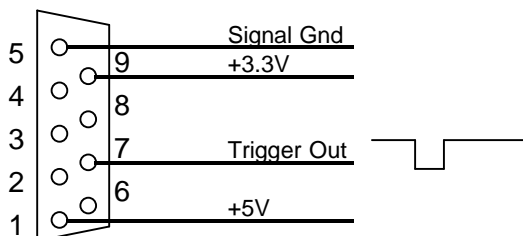

4. The low going trigger out is only produced on light exposures (not on dark exposures) and goes low when the mechanical shutter is completely open and returns back high when the shutter starts to close. In this way you are assured the shutter is fully open when the trigger out comes. Note that as the shutter takes 120ms total to open and close the width of the trigger out pulse will be equal to the exposure time minus 120ms. For a 120ms exposure (the minimum) the trigger out pulse is microseconds wide. We recommend using an exposure that is long enough to allow your external equipment to trigger and finish prior to the shutter closing. For example if your equipment takes 500ms to trigger and finish a 620ms exposure is the shortest you could use.

5. As the trigger pulse is generated in the camera firmware it will be available with any software that supports the SBIG USB cameras.

Trigger In

The USB cameras can recognize a **Trigger In** signal on Pin 1 of the **AO/CFW/Scope** connector as shown in the figure below.
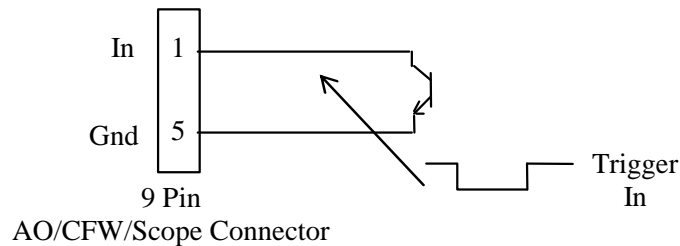

The trigger input can be driven directly off a 3.3V or 5V TTL signal or when used with a CFW-8 should be driven with an open-collector. The open-collector driver does not need an external pull-up resistor as the camera provides one. Finally, the trigger input is recognized when the pin 1 is low (connected to ground) and the trigger pulse should be at least 50ms wide to be recognized by the camera.

In addition to providing the **Trigger In** signal you must setup **CCDOps**[1] to wait for the **Trigger In** signal before starting light exposures (it never waits for triggers on dark frames). The **Trigger In** feature of CCDOps is a command-line option and to obtain it you must run CCDOps from the command line with the following:

```
ccdops /trigger
```

You can make a shortcut to CCDOps on your desktop and then add the "/trigger" to the target field to simplify this process. After running CCDOps with the /trigger option, establish a link to the camera then at the bottom of the **Camera Setup** dialog select "In" for the Trigger mode item:
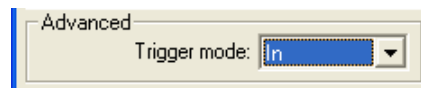
Finally note that there is some latency between the start of the trigger input pulse and the actual start of the integration and that this latency includes the time required to clear the CCD (depends on the particular model of camera) and includes the 120ms for the shutter to open. How this works is that CCDOps is constantly monitoring the trigger input. As soon CCDOps recognizes the **Trigger In** signal it clears the CCD and tells the camera to start the exposure which starts opening the shutter.

You'll need to advance the **Trigger In** pulse to the camera (or delay the trigger to the external equipment) by this amount to make sure the exposure captures the event. You can measure the latency on your particular camera by configuring the camera for trigger inputs and measuring the delay between the **Trigger Input** and the **Trigger Output**.

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[1] Only version 5.35 Build 3 and later of CCDOps supports Trigger In programming. Download the latest from our website if you have an earlier version.