TN011: Using a CXP Uplink Trigger & FireBird Timers

Summary

This is a step-by-step guide to trigger area scan CoaXPress (CXP) compatible cameras from ActiveCapture using the CXP uplink trigger & FireBird internal timers A1 (period) and M1 (pulse width).
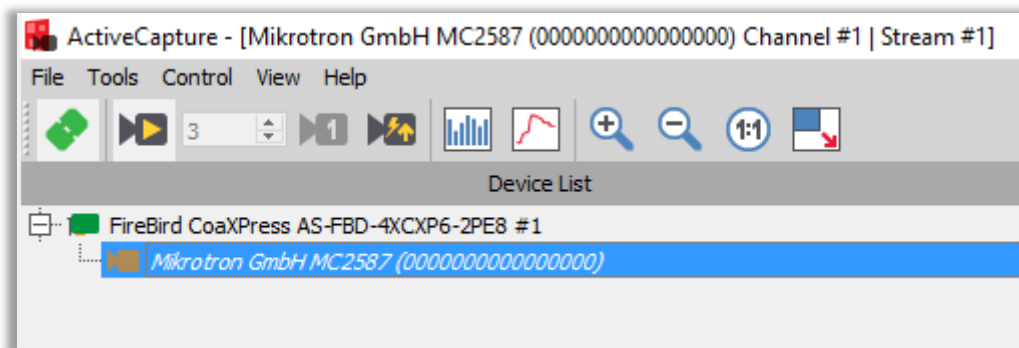
Compatibility: All FireBird CoaXPress boards
Software required: ActiveCapture v1.5.7 onwards
Windows installer required: All CoaXPress installers from v1.5.1 onwards

GenICam support for CXP cameras

This example uses a GenICam compatible camera and therefore the camera's name is displayed in the 'Device List', as shown below.

ActiveCapture connected to a CXP compatible Mikrotron MC2587 camera

GenICam support forms part of the CXP specification, so any GenICam compatible camera from CXP 1.0 onwards can be controlled via a GenICam client application, such as our own ActiveCapture application.

Get a live image

Connect to the camera in ActiveCapture as described in the FireBird QuickStart guide included with the Windows installer and available on our website. Once connected, live images should be obtained to check that the camera image is undistorted and correctly proportioned.

Also, make a note of the frame rate displayed at the bottom of the image window in frames per second (FPS), which is the acquired frame rate from the camera, whilst free running using the camera's own internal timing. The value shown below is 80.4 FPS for this 25MP camera using its internal trigger. This value will be used later when comparing to the externally triggered frame rate that we can control using the FireBird timers.

Frame rate display (capture rate) and bit depth/resolution information
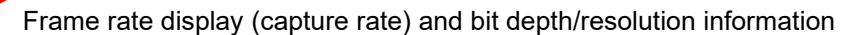
The configuration of both the FireBird frame grabber and the camera are set up by using the feature browser menus in the ActiveCapture GUI. The controls for the camera and FireBird board are shown in separate tabs in ActiveCapture, as indicated below.
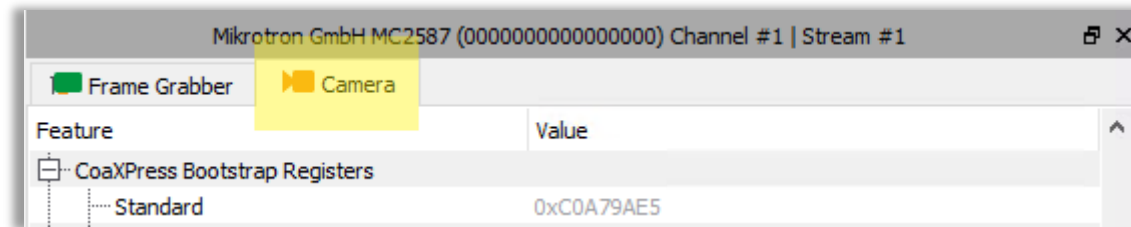

Feature browser 'Camera' tab when connected to a Mikrotron MC2587 CXP camera
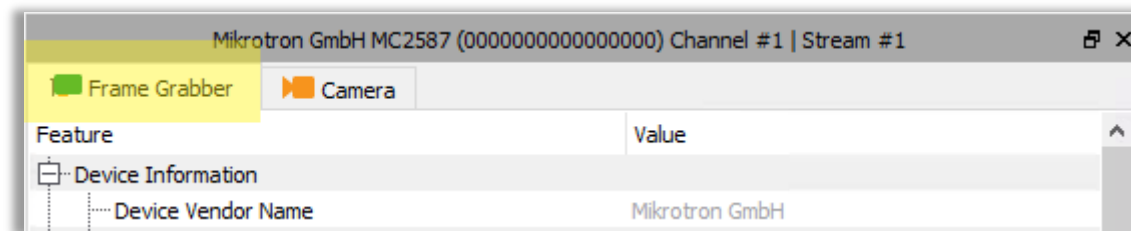
Feature browser 'Frame Grabber' tab when connected to a FireBird CXP board

Configuring the camera for external trigger input

Referring to the documentation supplied by the manufacturer of your camera, including that listed in the help built into the feature browser (see the screenshot on the next page), find the available options for external trigger input via the CoaXPress interface. Options could be to trigger on a rising edge signal, falling edge or on both edge types at the same time, i.e. any edge will initiate a trigger event in the camera.
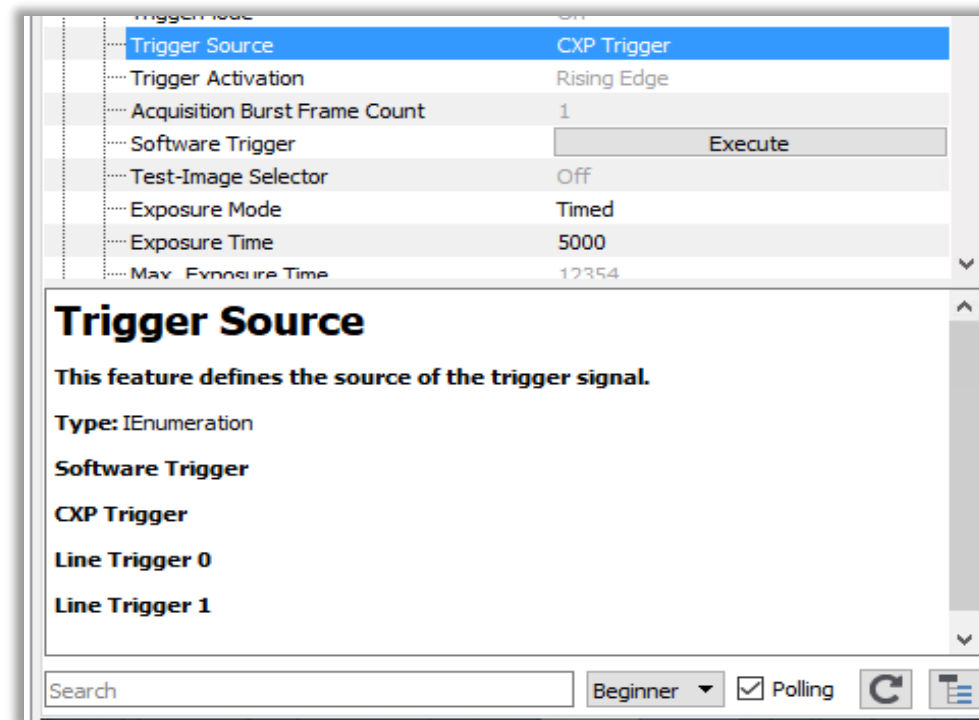
Feature browser built-in help for 'Trigger Source' menu item.

Make a note of these settings, as they will be used next to configure the FireBird board's output to match the camera trigger input and enable triggering via the FireBird board using the CoaXPress cable uplink.

Configuring the FireBird board in the Frame Grabber tab

The next step is to set up the FireBird board to output a trigger signal to the camera via the CoaXPress cable. The period of the signal must be defined to control the pulse repetition rate supplied to the camera and in turn to control its frame capture rate. See the screenshot on the next page.

Mikrotron GmbH MC2587 (0000000000000000) Channel #1 | Stream #1

Frame Grabber | Camera

Feature	Value
PHX_CameraTriggerControl	
PHX_CAMTRIG_SRC	PHX_CAMTRIG_SRC_TIMERA1_CH1
PHX_EXPOSE	Execute
PHX_CAMTRIG_FILTER_NS	200
PHX_CAMTRIG_ENCODER_MODE	PHX_CAMTRIG_ENCODER_MODE1
PHX_CAMTRIG_ENCODER_SRC	PHX_CAMTRIG_SRC_422IN_CHX_0
PHX_CAMTRIG_ENCODER_FILTER_NS	0
PHX_CAMTRIG_MULTIPLIER	1
PHX_CAMTRIG_DIVIDER	1
PHX_CAMTRIG_DELAY_MODE_D1CAM	PHX_CAMTRIG_DELAY_NONE
PHX_CAMTRIG_DELAY_MODE_D2CAM	PHX_CAMTRIG_DELAY_NONE
PHX_CAMTRIG_CXPTRIG_SRC	PHX_CAMTRIG_CXPTRIG_TIMERM1_CH1
PHX_CAMTRIG_CXPTRIG_MODE	PHX_CAMTRIG_CXPTRIG_RISEFALL
PHX_FrameGrabberTriggerControl	
PHX_FGTRIG_SRC	PHX_FGTRIG_SRC_TIMERA1_CHX
PHX_FGTRIG_MODE	PHX_FGTRIG_FREERUN
PHX_FGTRIG_DELAY_MODE	PHX_FGTRIG_DELAY_NONE
PHX_FGTRIG_FILTER_NS	200
PHX_CounterTimer	
PHX_TIMERA1_PERIOD_NS	100000000
PHX_TIMERA1_MODE	PHX_TIMERA1_MODE_RUN
PHX_TIMERA1_PULSE_COUNT	1
PHX_TIMERD1FG_VALUE_NS	0
PHX_TIMERD1FG_COUNT	0
PHX_TIMERD1CAM_VALUE_NS	1000
PHX_TIMERD2CAM_VALUE_NS	1000
PHX_TIMERM1_WIDTH_NS	10000
PHX_TIMERM2_WIDTH_NS	0
PHX_IO_IN	

This feature sets the camera trigger source to be the FireBird's internal timer A1. It is this timer that will be used to control the camera frame rate via its period setting.

In addition, the CXP trigger source also needs to be defined so that a pulse is sent to the camera via the uplink. In this case it is set for a positive pulse width, with a rising edge followed by a falling edge.

This feature ensures that frame grabber triggers are ignored. By setting this to "Free Run" mode, its settings will have no effect on the acquisition and only the camera trigger is used with the frame grabber slaved to the camera's output timing.

The timer period A1 is set to output a square wave at 10Hz (period 100ms/1E8ns), which is the target frame rate we want to achieve in this example. Note: This can only be obtained however, if the camera is capable of at least this frame rate with the current CXP data rate selected. If the camera is first tested in Free Run mode without any external trigger input using its own internal triggering reference and it runs at a greater frame rate than the trigger rate required from the A1 timer, then this will work. In the example discussed here, the camera in Free Run mode produces live images at ~80Hz and so the 10Hz external trigger is well within that limit.

This feature sets the pulse width (in nanoseconds) sent to the camera with a 10Hz pulse repetition frequency. In this case the pulse width is fixed to 10□sec (1E4ns) using the additional timer M1. This value should be equal to or greater than the minimum required by the camera, but not so large as to restrict the frame period.

Camera setup via the Camera tab

The camera must be configured to be externally triggered via the CXP trigger input, which is controlled via the Camera tab of the feature browser, as shown below. The GUI setup will vary slightly between camera models and different manufacturers, but it will follow a similar layout. Refer back to the documentation supplied by the manufacturer of your camera, including that listed in the help built into the feature browser.
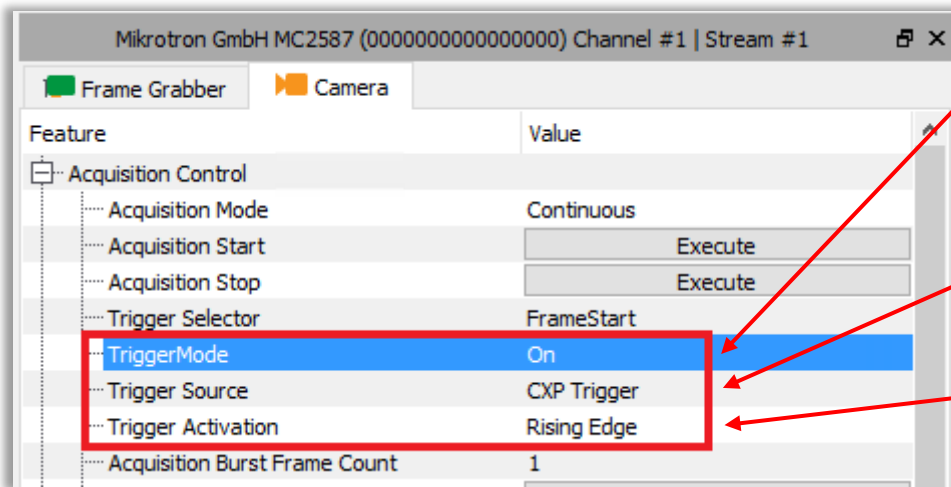
This feature sets the camera's trigger to accept external input and is set to ON. It should be noted that if no valid external trigger signal is received, either via the CXP cable or directly into the camera head (for some models that support this), the camera will not output any video and no live image can be obtained.

In this line, we define the source of the external trigger input to the camera to be the CXP uplink from the FireBird frame grabber to the camera via the CXP cable.

The trigger can occur on either a rising or falling edge on the CXP uplink or both (either edge) and here it is set to use a rising edge. Note: if both edges is selected, then any edge is used and this will lead to a doubling of the trigger rate obtained.

The camera will now trigger from the CXP trigger input using the FireBird's internal timer A1 (signal period) and using M1 for its pulse width.

Selecting 'Live Acquisition' from ActiveCapture's ribbon will show the camera operating at 10Hz, as shown below.
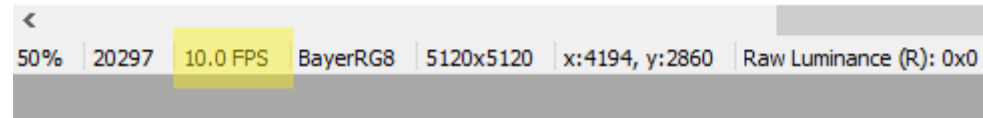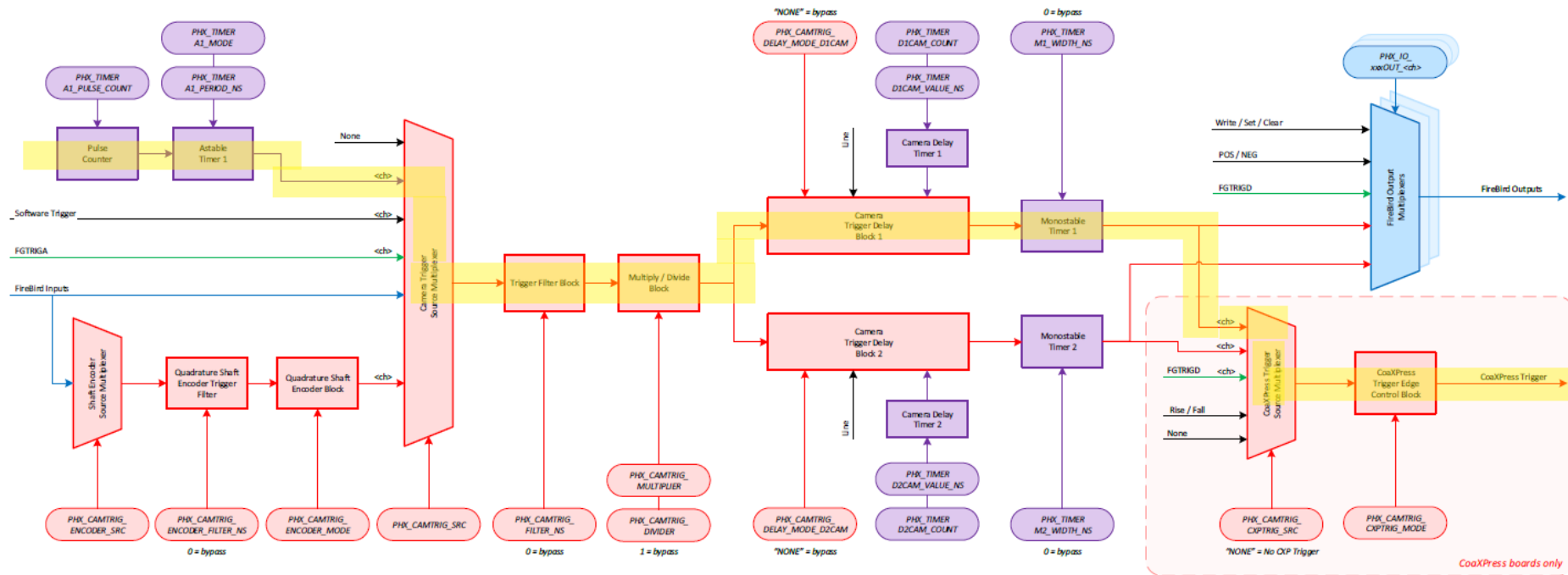

ActiveCapture running with the camera acquiring images at 10Hz (10 FPS) triggered via FireBird's internal timer

For more information on trigger scenarios, please refer to the 'FireBird System Manual' included in the installed documentation.

Trigger configuration path indicated in yellow:

Camera Trigger Block Diagram per Channel

![Active Silicon logo]

Headquarters:

Active Silicon Ltd
1 Waterside Court, Waterside Drive,
Langley, Berks, SL3 6EZ, UK.

Tel: +44 (0)1753 650600
Email   info@activesilicon.com
Website: www.activesilicon.com

North America:

Active Silicon, Inc.
479 Jumpers Hole Road, Suite 301,
Severna Park, MD 21146, USA.

Tel: +1 410-696-7642
Email: info@activesilicon.com
Website: www.activesilicon.com