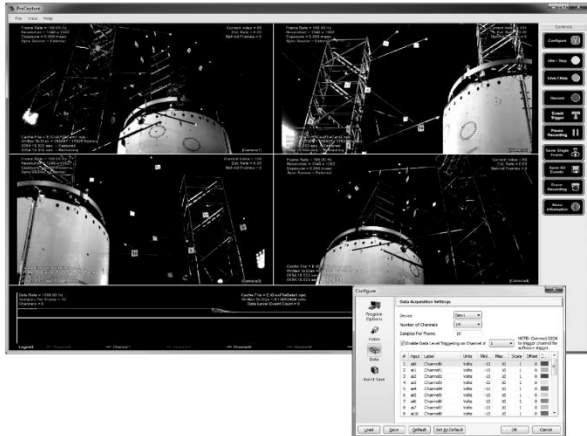


ProCapture

Complete High-Speed Motion Capture System

User Guide



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Table of Contents

Chapter 1. Introduction.....	1
How this User Guide is Organized.....	1
What is Included	2
Hardware Installation and Connections	3
Xcitex Cameras	3
Video Processing Unit (VPU)	3
Trigger Box and Hand Trigger Switch	3
Optional Data Collection Hardware	4
Connecting the Cameras.....	5
Connecting the Trigger Box and Hand Trigger Switch	6
Software	8
ProCapture Software.....	8
ProAnalyst Software	8
ProViewer Software.....	9
Product Updates	9
Check for Updates.....	9
Reinstalling ProCapture Software	10
Chapter 2. Quick Start Guide	13
Pre-Capture Considerations	13
Video Example.....	14
Video/Data Example	19
Additional References.....	23

Chapter 3. ProCapture Software Interface	25
ProCapture Window.....	25
Camera Views	26
Pop-out Camera Views.....	26
Panning and Zooming in the Camera Views	26
Color Correction in the Camera Views	27
Camera Gains	28
Image Processing.....	29
Event/Data View.....	30
Timeline.....	31
Toolbars.....	31
Title Bar	31
Status Bar.....	31
Menu Bar.....	32
Control Panel.....	34
Configure.....	35
Stop / Idle	35
Live / Arm	35
Record.....	35
Event Trigger.....	36
Pause Recording.....	36
Save Single Frame	36
Save All Events	37
Save Entire Recording.....	37
Erase Recording.....	37
Show Information	38
Touchscreen Controls.....	39
Panning and Zooming with Touchscreen Controls	40

Chapter 4. Configuring a Recording	41
Program Options	41
Record Mode	42
Buffer Style	42
Options	42
Video Acquisition Settings	43
Specifying Unique Settings for Each Camera	44
Data Acquisition Settings	45
Triggering Options	48
Event Save Settings	49
Save Folder	49
Save Range	49
Save Format	50
Options	50
Saving, Loading, and Default Settings	52
Chapter 5. Capturing Events	53
Duration Basics	53
Data Acquisition Basics	56
Triggering	57
Data Level Triggering	58
Set Up Data Level Triggering	58
Video Triggering	60
Triggering Events within the Timeline	63
Changing the Save Range after Recording Complete	64
Overlapping Event Saves	65
Select Events to Save	67
Chapter 6. Analyzing, Viewing, and Sharing Captured Events	69
How Events Are Saved	69
Viewing, Sharing, and Analysis	72

<u>Chapter 7. Advanced Topics</u>	<u>73</u>
<u>Capture Single Images for Calibration</u>	<u>73</u>
<u>Recover the Most Recent Recording Stored in Cache</u>	<u>74</u>
<u>Play Back the Most Recent Recording from the Cache</u>	<u>74</u>
<u>Chapter 8. Troubleshooting.....</u>	<u>75</u>
<u>Index</u>	<u>79</u>

Chapter 1. Introduction

ProCapture Motion Capture Solutions are built on Xcitex's award winning ProAnalyst® software. By adding a front-end motion capture system that can capture live video from up to 8 cameras and up to 32 channels of data collection from a variety of sensors and force plates, users can build a low-cost, high performance live video motion capture solution. With cameras controlled by the ProCapture video/data capture software, a complete motion event can be captured, downloaded and analyzed in ProAnalyst.

ProCapture systems include cameras, a video processing unit, and software. All cameras and data channels are automatically synchronized. Images and data are streamed directly to recording drives on the Video Processing Unit for up to 5 hours of continuous recording. Cameras are optimized for both visible and infrared applications. When each recording is complete, the ProCapture software creates ProAnalyst projects for analysis.

Highlights of the ProCapture system include:

- Up to 5 hours of continuous recording
- 5 to 1000 fps high resolution cameras
- Synchronize multiple cameras with up to 32 channels of data collection
- Suitable for 2-D and 3-D video-based motion analysis

How this User Guide is Organized

Chapter 1 – Introduction gives an overview of ProCapture and discusses the hardware and software components of the system.

Chapter 2 – Quick Start Guide provides typical examples of configuration, recording, event marking, reviewing, and saving videos.

Chapter 3 – ProCapture Software Interface describes the toolbars, menus, and functions of the ProCapture software interface.

Chapter 4 – Configuring a Recording details configuration settings and their effects on your recordings.

Chapter 5 – Capturing Events discusses conditions to consider before recording, triggering options, and the process of capturing events.

Chapter 6 – Analyzing, Viewing, and Sharing Captured Events gives an overview of how to work with your captured events using ProAnalyst.

Chapter 7 – Advanced Topics contains information on procedures that may be performed infrequently or only under special circumstances.

Chapter 8 – Troubleshooting contains solutions for specific problems.

What is Included

All ProCapture systems include the following items:

- ProCapture control software (pre-installed and keyed to VPU)
- User guide
- License agreement
- 1 - 8 cameras with power supplies
- Keyboard and mouse
- Video processing unit (VPU) with 6-foot power cable
- Trigger box
- Hand trigger switch
- 7-meter camera cables
- ProAnalyst Introductory Edition software installation kit
- ProViewer software (pre-installed)

If you purchased a ProCapture system with data collection, you also receive:

- Data acquisition hardware – 8, 16, or 32 channels

Your ProCapture system may also include some of the following accessories:

- Monitors (touch screen or conventional)
- Mounting arms, tripods, and brackets
- Storage drives
- Lenses
- Portable light kit
- Cable repeaters
- Fiber optic cables and converters
- Calibration fixture

Hardware Installation and Connections

This section describes the hardware components that are included with your ProCapture system and includes diagrams and procedures for connecting them.

Xcitex Cameras

The Xcitex XC-1 camera is ideal for the capture of human motion, animal locomotion, machinery, robotics and similar applications. Each camera measures 60 mm x 60 mm x 45 mm (2.4" x 2.4" x 1.4"), making it easy to install on walls, tripods, production lines, or into tight spaces. The 1248 x 1082 (1.3 Mpixels) sensor can achieve 170 frames per second recording speed at full resolution, with a maximum rate of 500 frames per second at reduced resolution.

The next-generation Xcitex XC-2 camera is available in color or monochrome versions and is even smaller than the XC-1, measuring 55 mm x 55 mm x 42 mm. Featuring a 2.1 Megapixel sensor, the XC-2M/C provides high definition with a maximum of 1000 fps and resolutions up to 1920 x 1080 pixels at 60 fps. Optimized for low-light situations, this camera is ideal for industrial applications where high sensitivity and high frame rates are required.

Video Processing Unit (VPU)

The Video Processing Unit (VPU) is a specialized computer containing frame grabbers, data acquisition hardware, and storage devices. The housing is sturdy and portable for use in the field or in the lab. The operating system (Windows 7, 64-bit version) and ProCapture, ProAnalyst, and ProViewer software packages are installed by default on the C: drive. Drives E: through L: are assigned to each camera included with your ProCapture system. Video and data recordings are streamed to these drives, which serve as caches. No files should be stored on the drives reserved for the cameras (E – L). The VPU also contains a 1 TB hard drive for image event storage and operating system.

When the power is on, the large power button on the front of the VPU changes color to indicate the current state of the ProCapture system. The light glows green when cameras are live, red when recording, and light blue when saving.

Trigger Box and Hand Trigger Switch

The trigger box and hand trigger switch are hardware devices that allow you to trigger events manually during a ProCapture recording session by using a handheld switch.

Optional Data Collection Hardware

ProCapture supports 8, 16, or 32 channels of data collection from sensors, force plates, EMG, gauges, accelerometers, etc. The data collection hardware includes PCI boards, dual shielded cables and BNC breakout boxes from National Instruments™, shown below.



PCI Board



Dual Shielded Cable



BNC Breakout Box

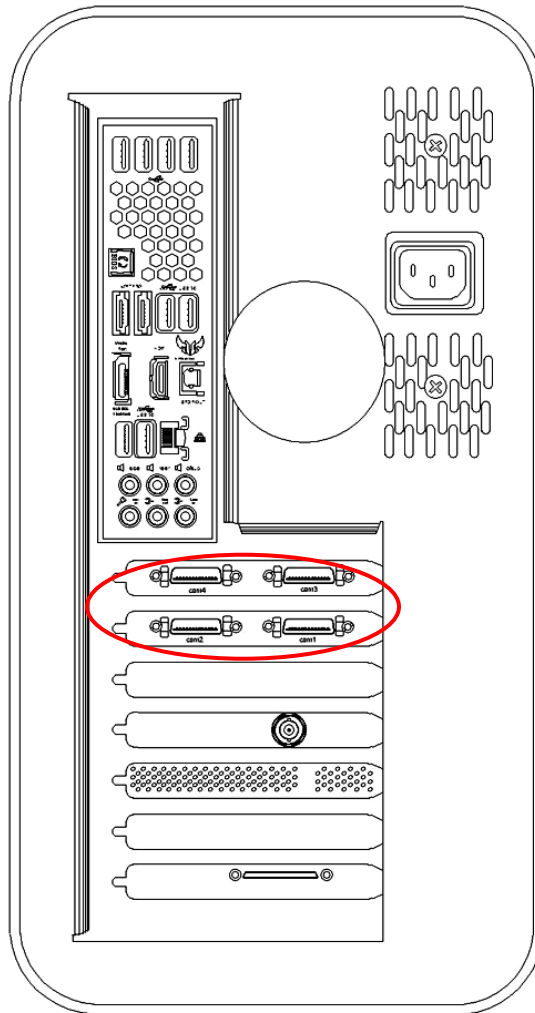
The following table shows the data collection hardware components that may be used with ProCapture for data acquisition.

Part Number	Differential Analog Inputs	Sample Rate per Channel	Resolution	Included Hardware
PC101-DAQ-8-1	8	250 kS/s	16 bit	BNC Breakout Box / PCIe card
PC101-DAQ-16-1	16	1.25 MS/s or 1.0 MS/s multichannel	16 bit	BNC Breakout Box & BNC Extended Breakout Box/ PCIe card
PC101-DAQ-32-1	32	1.25 MS/s or 750kS/s multichannel	16 bit	BNC Breakout Box & BNC Extended Breakout Box / PCI card
Additional configurations may be available upon request.				

Connecting the Cameras

Insert the camera cables into the labeled ports on the back of the VPU, as shown below.

Note: The arrangement of connection ports on the VPU may be subject to change. Please refer to the connection port labels to confirm connection locations on your system.



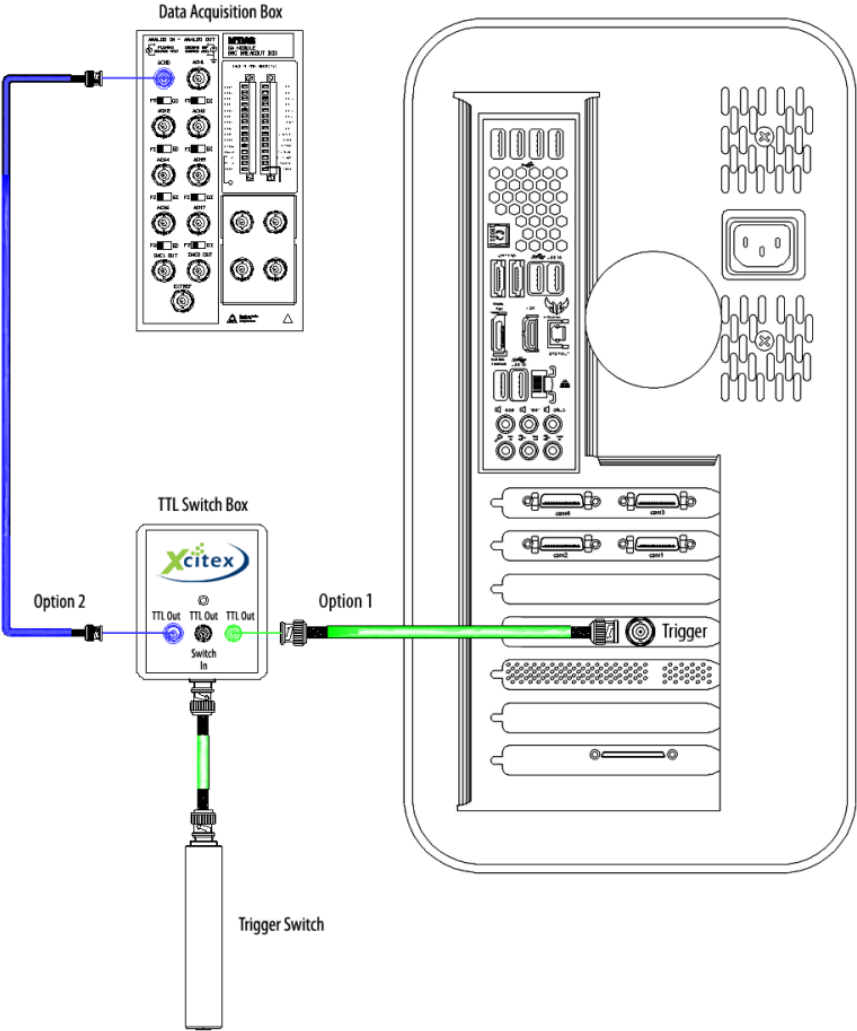
Connecting the Trigger Box and Hand Trigger Switch

The diagram on the following page illustrates two options for connecting the trigger box and hand trigger switch.

For Option 1 (standard configuration), connect the trigger box to the BNC connector labeled Trigger on the back of the VPU. This allows you to use the hand switch to trigger events. Use Option 1 when recording with video only, or when recording video and data without data level triggering.

Use Option 2 if you wish to use data level triggering to capture the trigger box signal. Connect the trigger box to one of the channels on the Data Acquisition box. (The diagram shows the trigger box connecting to Data Channel 1; however, you may connect it to any channel.) In this case, you should set the Data Level Trigger settings to detect a trigger condition where the rising edge voltage exceeds 3 volts.

Note: For more information, refer to "Triggering", "Data Acquisition Basics", and "Data Level Triggering" in Chapter 5.



Software

This section describes the ProCapture control software and the ProAnalyst and ProViewer software packages included with your ProCapture system. Procedures are provided for updating and reinstalling the software.

ProCapture Software

ProCapture control software is already installed on the VPU when you receive your ProCapture system. The ProCapture software captures live video and optionally collects analog and digital data. ProCapture control software provides the following features:

- Simple setup – all cameras automatically initialize after software launch
- Optional touch screen interface, easy to use control panel
- User-controlled configurations
- Create discrete, manageable events from long video streams
- Variety of event triggering methods
- Video and data automatically synchronized
- Automatically creates ProAnalyst projects for analysis
- Live view of up to 8 cameras simultaneously, spanning multiple monitors

ProAnalyst Software

ProAnalyst Introductory Edition software is included with your ProCapture system. ProCapture is designed to work with ProAnalyst, the world's premier software package for automatically measuring moving objects with video. ProCapture creates project files which can be viewed and analyzed with ProAnalyst. ProAnalyst Introductory Edition allows you to automatically track one feature and manually track 32 features. You can export the resulting track data to Excel or MATLAB for further analysis and graphing.

ProAnalyst software can be installed and licensed on multiple computers. The security key provided with ProAnalyst can be moved to the computer where you wish to use the software. ProAnalyst does not have to be installed on the ProCapture VPU.

ProViewer Software

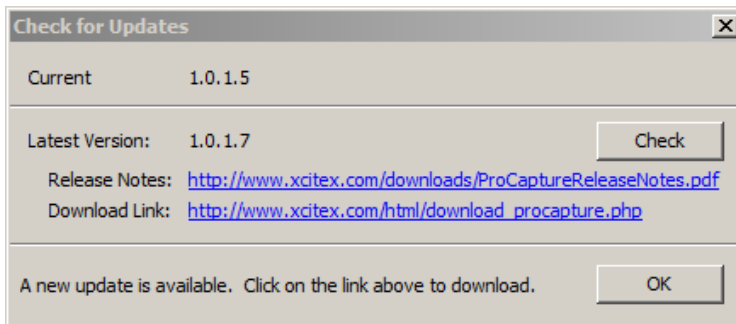
ProViewer software is pre-installed on your ProCapture system. Ideal for presentations and quick review, ProViewer allows you to open project files, play videos, and share them with others.

Product Updates

As ProCapture, ProAnalyst, and ProViewer are continually updated and improved, be sure to obtain free downloads of the most current software versions from our website at www.xcitex.com. Updates typically contain new features as well as bug fixes.

Check for Updates

To help you keep up to date with new software releases, we have provided a tool to check for recent software updates. Select **Check For Updates...** from the **Help** menu. The Check for Updates dialog will appear, listing the software version currently installed on your computer. Click the **Check** button to contact the Xcitex server and check for the latest software version available for download.



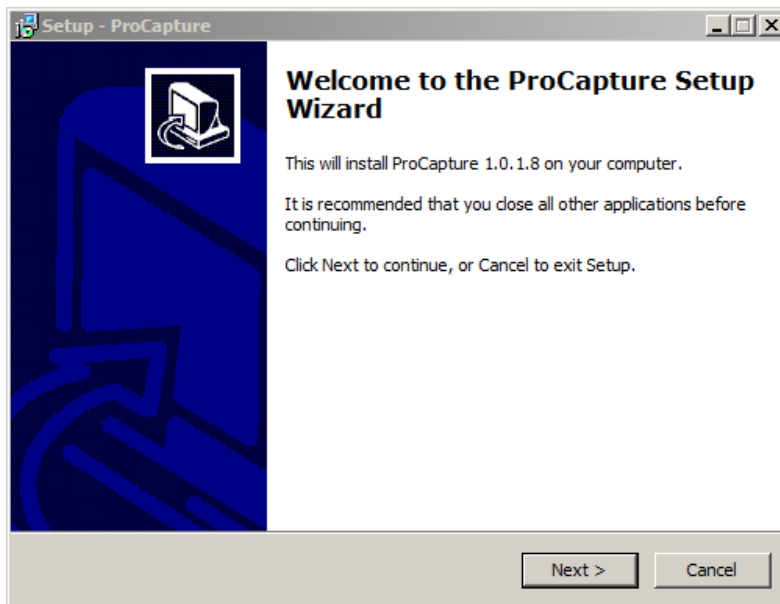
If version information is successfully obtained from our server, the dialog will display links to the release notes and the download page for the latest available version. You may review the release notes by clicking on the **Release Notes** link. To download the latest version, click on the **Download** link and follow the instructions on the web page that appears.

Reinstalling ProCapture Software

ProCapture software is pre-installed on the VPU when you receive it. You can upgrade to the latest version of the software by using the Check For Updates feature on the Help menu.

To install the software, perform the following steps:

1. From the Help menu, select **Check for Updates**. Click **Check** in the dialog box, then click the **Download Link** to download ProCapture software from the Xcitex website. If your software is up to date, the message "This is the most recent version, you do not need to update at this time" appears at the bottom of the dialog box.
2. The ProCapture Setup Wizard screen will appear. Click **Next**.

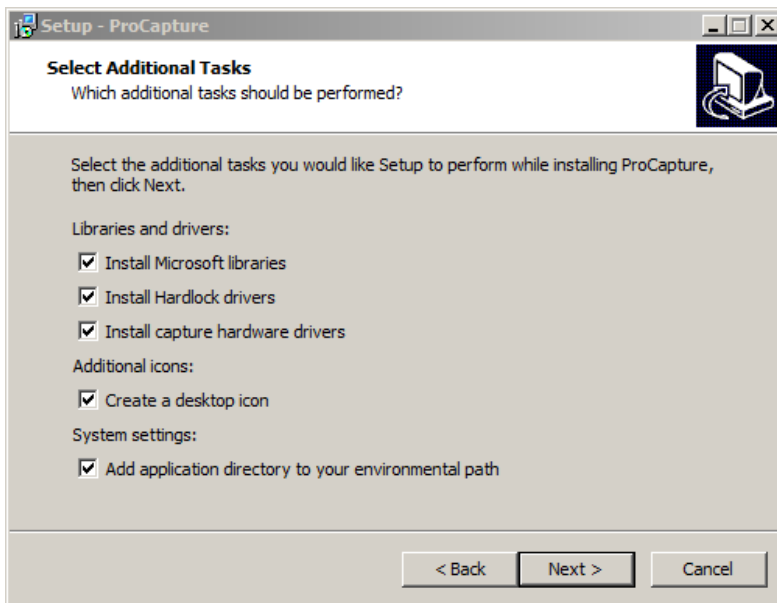


3. On the License Agreement screen, select **I accept the agreement** and click **Next**.

4. Select the destination folder for your ProCapture files. Click **Next**.

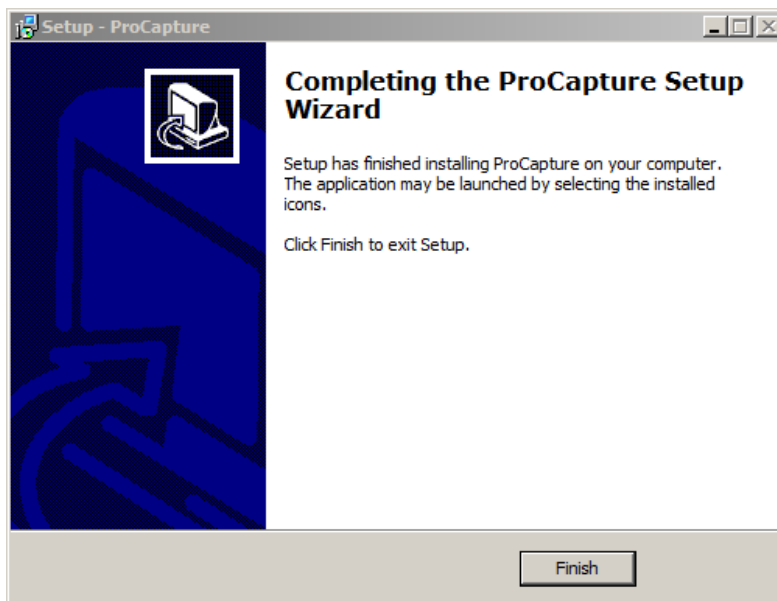
Note: The default folder is C:\Program Files\Xcitex\ProCapture. You are advised to use this folder for automatic updates.

5. The Select Start Menu Folder screen will appear with **ProCapture** selected. The program's shortcuts will be created in this folder. Click **Next**.
6. The Select Additional Tasks screen appears, with all tasks selected. You may deselect tasks by clicking to clear the checkboxes. ProCapture Setup will not perform any tasks that are not selected. If you are updating an existing installation, all checkboxes can usually be unchecked to speed the installation.



7. Click **Install** at the Ready to Install screen to begin installing ProCapture software. A status bar will appear during the installation process.

8. Install or repair Microsoft Visual C++ runtime libraries, if requested.
9. Install or repair the SafeNet Sentinel HASP application, if requested.
10. Install device drivers, if necessary.
11. Click **Finish** at the Completing the ProCapture Setup Wizard screen to complete the installation.



Chapter 2. Quick Start Guide

This chapter provides a walk-through for configuration, recording, event marking, reviewing, and saving videos. Two examples are provided: video only and video with data. Factors to consider before recording video are also discussed.

Pre-Capture Considerations

Several factors affect the quality and usability of the videos that you record with ProCapture. When recording your video, be aware of the following:

- Lighting, shadows, shiny objects
- Markers (white on black or vice versa)
- Contrast
- Movement in background
- Frame rate
- Resolution
- Shutter speed

After videos are downloaded to ProAnalyst, you can use image processing and filtering to improve the video images for tracking. For more information, please refer to the *ProAnalyst User Guide*.

Video Example

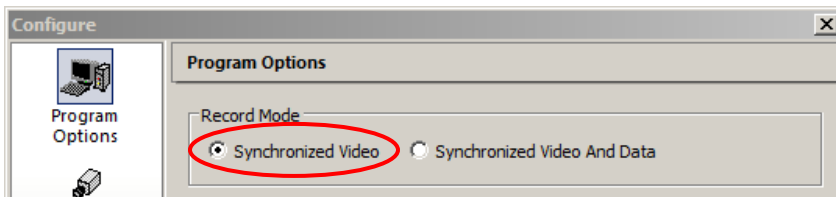
The following example shows how to use ProCapture to acquire high-speed video of a test subject jumping. We will record the subject at 150 frames per second (fps) and save 3-second segments of video around each event of interest.

1. Double-click the **ProCapture** shortcut on your desktop to launch the program. The cameras start up automatically, ready to record.

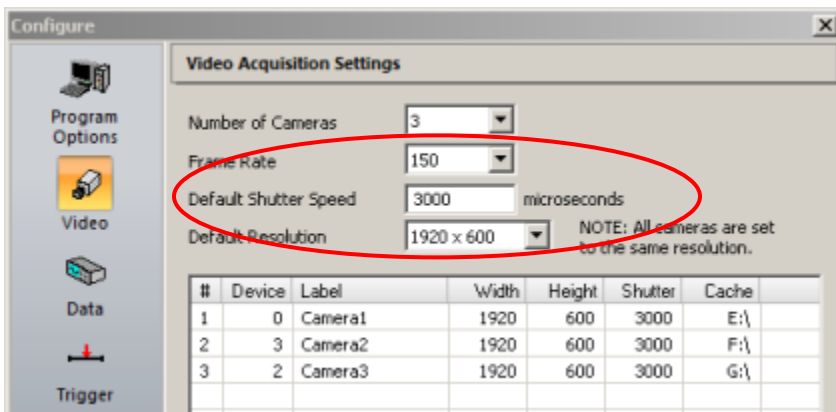


2. In the Control panel on the right, click **Configure**.

- Since we are only recording video in this example, select **Synchronized Video** from the Program Options control panel.

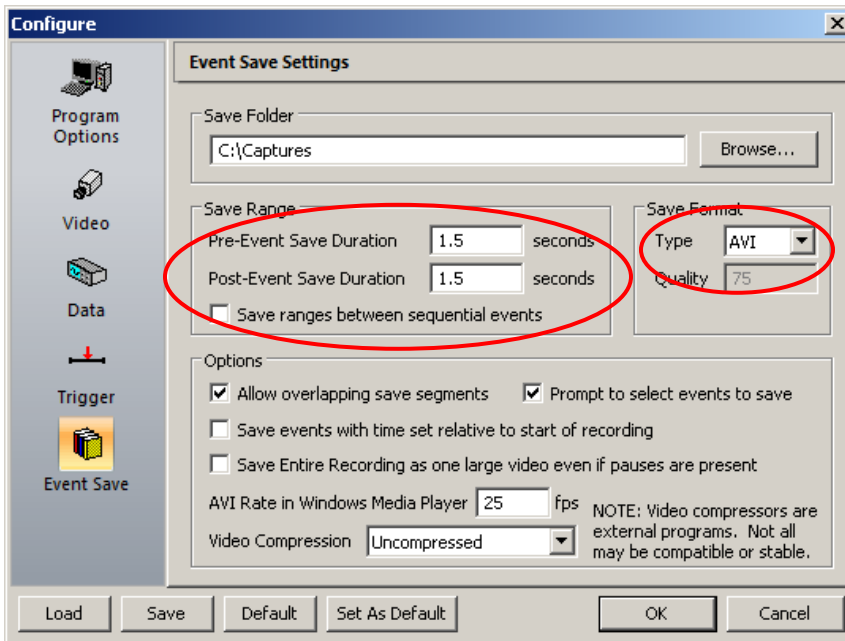


- Click **Video** to display the Video Acquisition Settings panel. Select **150** as the Frame Rate, enter **3000** microseconds as the Default Shutter Speed, and select the highest resolution available as the Default Resolution.

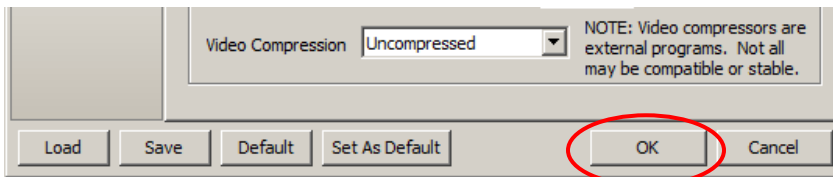


- In our example, we expect that interesting events would last approximately 3 seconds. We also plan to mark each event (click the trigger button) in the middle of the event, so click **Event Save** and enter **1.5** seconds as the Pre-Event Save Duration and Post-Event Save Duration. We could also mark each event after it has completed, in which case we might want to increase the Pre-Event Save Duration to 3 seconds and decrease the Post-Event Save Duration to 0 seconds.

6. Select **AVI** from the Type dropdown menu. Leave all other options at their default settings.



7. Using the settings shown above, ProCapture will bookmark each triggered event and save a total of 3 seconds of video: 1.5 seconds before the event, and 1.5 seconds after it when saving all events after the recording has completed.
8. Click **OK** at the bottom of the window to save the configuration settings for all panels.



9. Now you are ready to record the video. Click **Record** and have the test subject begin jumping in view of the cameras.



10. Click the **Event Trigger** button (or press the hand trigger switch if connected to your system) when something interesting occurs. You can click **Event Trigger** as many times as you wish. The Event Count on the screen will increase each time the trigger is pressed.



11. When you have finished recording, click **Stop/Idle**. The entire test period from when you began recording is now stored on the local camera drives. You can either save the entire recording or only save the time around each event of interest. Saving the entire recording can generate very large video files and is not recommended in general.

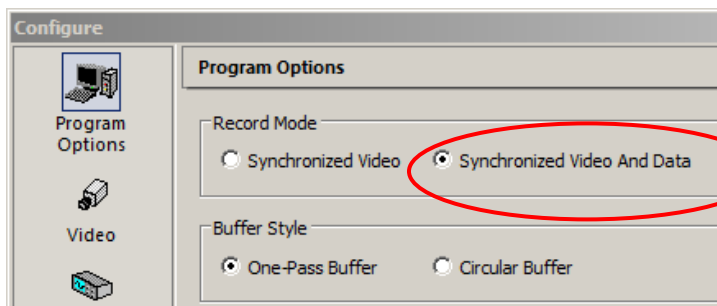
12. Click **Save All Events** to create 3-second .avi video files for each camera view of each triggered event. The 3-second duration is set from the Event Save Settings configuration panel. To save more or less time around each triggered event, click **Configure**, update the save values, and click **Save All Events** again.

13. To verify that your events were recorded, run ProAnalyst or ProViewer to view the video captures. Double-click the **ProAnalyst** or **ProViewer** shortcut on your desktop to launch the program.
14. In ProAnalyst or ProViewer, use the File menu and select **Open from ProCapture** to see the recently saved events. Review the saved events to ensure that the events of interest were successfully captured. If you need to change the amount of time saved before and/or after each event marker, see "Changing the Save Range after Recording" in Chapter 5.

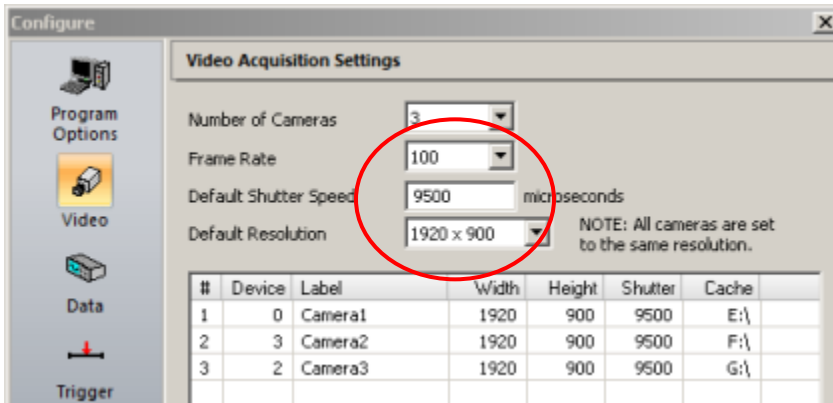
Video/Data Example

This example demonstrates the value of using ProCapture to acquire high-speed video and sensor data at the same time. In this example, an accelerometer measures forces, while video captures the amount of motion. You will use ProCapture to capture and display video motion of a moving object in conjunction with sensor data.

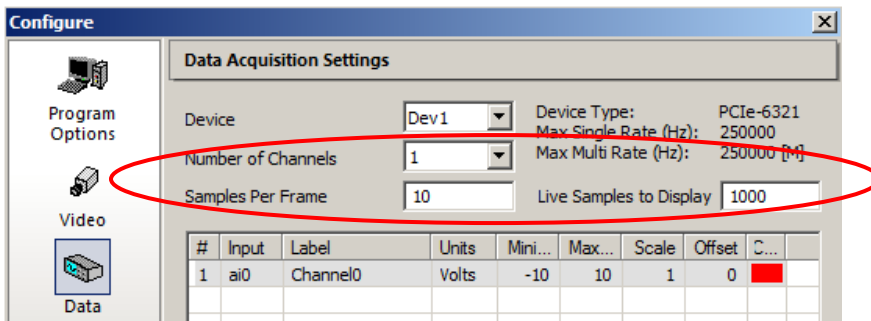
1. Double-click the **ProCapture** shortcut on your desktop. The cameras start up automatically, ready to record.
2. Click **Configure** and select **Synchronized Video and Data** from the Program Options panel.



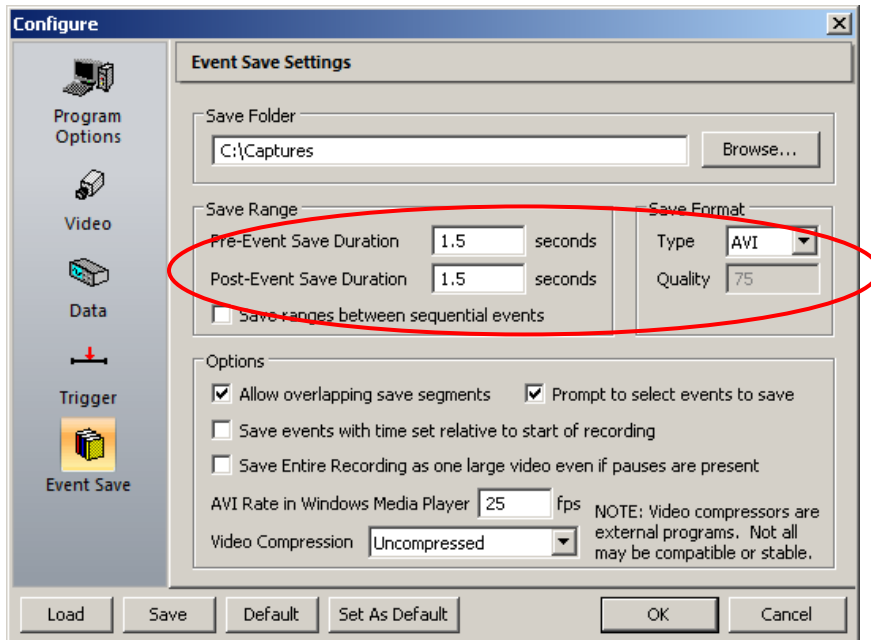
- Click **Video** and select **100** as the Frame Rate, enter **9500** microseconds as the Default Shutter Speed, and select the highest resolution available as the Default Resolution.



- Click **Data** to configure a data channel for the accelerometer.
- Set the Number of Channels to **1**.
- Enter **10** for Samples Per Frame and **1000** for Live Samples to Display.



- Click **Event Save** and enter **1.5** seconds as the Pre-Event Save Duration and Post-Event Save Duration. Select **AVI** from the Type dropdown menu. Leave all other options at their default settings.



- Click **OK** at the bottom of the window to save all the configuration settings.

9. For this example, we have attached the accelerometer to a long, flexible ruler.



10. The cameras are now in Live mode. Hold the ruler at the end and bend it downward and release. The ruler will spring back up and oscillate. Check to see that the ruler is in the view of each camera, and that data is being read from the accelerometer.
11. Click **Record**. Resume moving the ruler, and click **Event Trigger** to create an event marker. You may create as many event markers as you wish.
12. When you are finished recording, click **Stop/Idle**.
13. Click **Save All Events** to create .avi video files for each camera view of the single event.
14. Launch ProAnalyst or ProViewer and select **Open from ProCapture** from the File menu to view the videos of your recorded events.

Additional References

You now know how to conduct a simple recording session and save the resulting videos. For more information about the following topics, please refer to the chapters listed below.

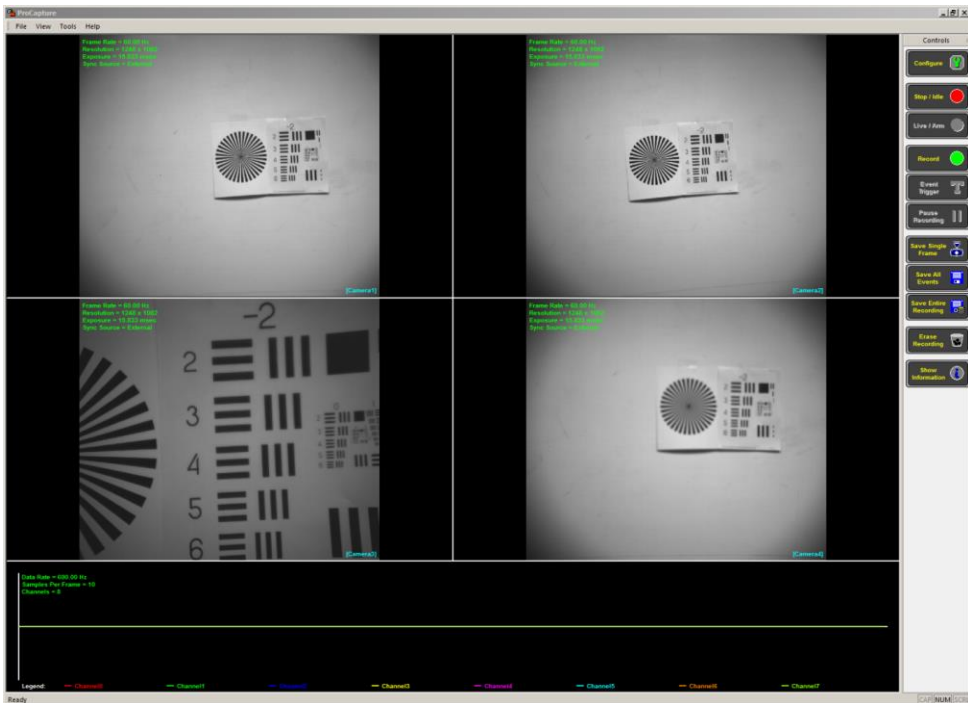
Configuration	Chapter 4
Triggering	Chapter 5
Recording	Chapter 5
Data Recording	Chapter 5
Data Level Triggering	Chapter 5
Event Saving	Chapter 5
Changing Save Range after Recording	Chapter 5
Video Triggering	Chapter 5
Calibration	Chapter 7

Chapter 3. ProCapture Software Interface

The ProCapture interface is similar to many other Windows-based programs. This chapter covers the functions of the windows, toolbars, and on-screen information of the program in detail. This chapter also describes the functions available from the ProCapture control panel.

ProCapture Window

The ProCapture window displays a view from each camera. There is a panel at the bottom of the window that either updates the event count as events are triggered during a recording session (if recording video only) or displays live data graphs and channels (if recording video with data).



Camera Views

These panels show the live view from each camera. Double clicking in any camera view allows you to display only the view from that camera. While in this single camera display mode, you can pan and zoom to ensure good focus. To go back to the multi-camera display, double-click in the window.

The data graph behaves similarly. Double-clicking in the data graph will enlarge the graph display to occupy one quarter, one half, or three quarters of the display area; however, you cannot zoom and pan the data display.

Pop-out Camera Views

To open a separate window displaying the view from any camera, select **View ► Pop-out Camera View ► (desired camera)** from the Menu bar at the top of the screen. You can maximize, minimize, or close this window at any time. You can also pan and zoom the view in each of these pop-out views.

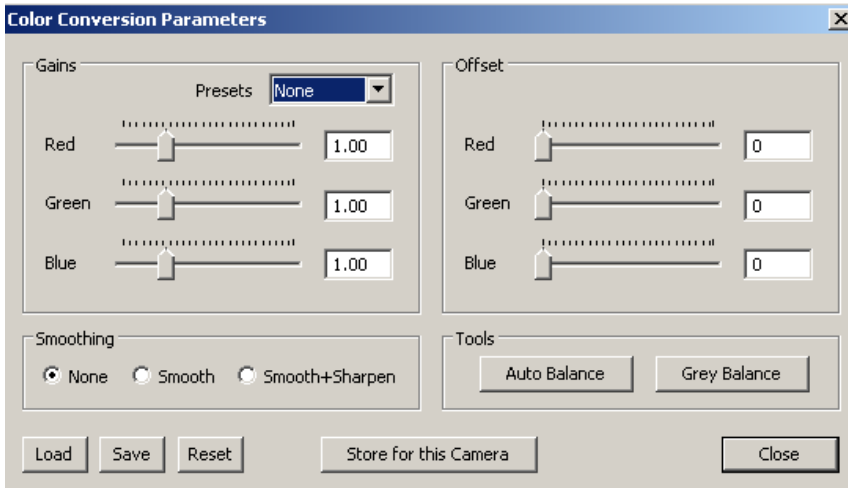
Panning and Zooming in the Camera Views

Zoom, pan, and full screen display functions are available for any camera view, including pop-out views. Double-click on any pop-out window to display a full-screen view from that camera. Within each window, you can do the following:

- Use the mouse wheel to zoom in and out.
- Click the left mouse button while dragging to pan.
- Double-click to reset the display after zooming/panning or return to the multiple-camera display.
- Hold down the **Ctrl** key and double-click to display a pop-out camera view in a separate window.
- In a pop-out window, you can set the display to occupy the full-screen by double-clicking. To exit from the full screen mode, double-click again.

Color Correction in the Camera Views

Several functions are available for adjusting color cameras. To display the Color Conversion Parameters dialog as shown below, select **Tools ► Color Correction ► (desired color camera)** from the Menu bar at the top of the screen.



The Presets dropdown menu allows you to load a group of preset parameters: Tungsten, Halogen, Daylight, Xenon, Metal, or None. Use the sliders to adjust Red, Green, and Blue gains and offset values, or enter the desired value into the box to the right of each slider. Apply Smoothing and/or Sharpening if desired. Two tools are available to assist in setting gains and offsets: Auto Balance and Grey Balance. For Auto Balance, simply click the **Auto Balance** button. For Grey Balance, place a grey object within the camera's field of view and click the **Grey Balance** button.

The buttons at the bottom allow you to load a previously saved set of parameters, save a set of parameters, or reset to the default values. Click **Store for this Camera** to save this set of parameters so that it is automatically reloaded every time the camera is initialized.

Camera Gains

ProCapture allows you to set digital and analog gain values for supported camera models. Analog gain occurs at the camera sensor, before image capture. Analog gain is available only for the XC-2 camera. Digital gain occurs after the image is captured. Digital gain may be set for both the XC-1 and XC-2 model cameras. To display the Camera Gains dialog as shown below, select **Tools ► Camera Gains ► (desired camera)** from the Menu bar at the top of the screen.

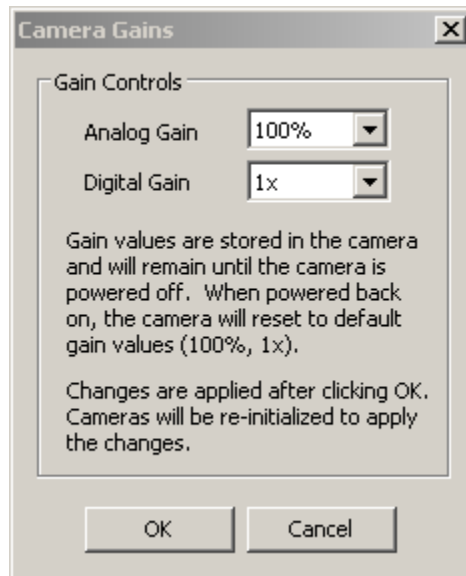
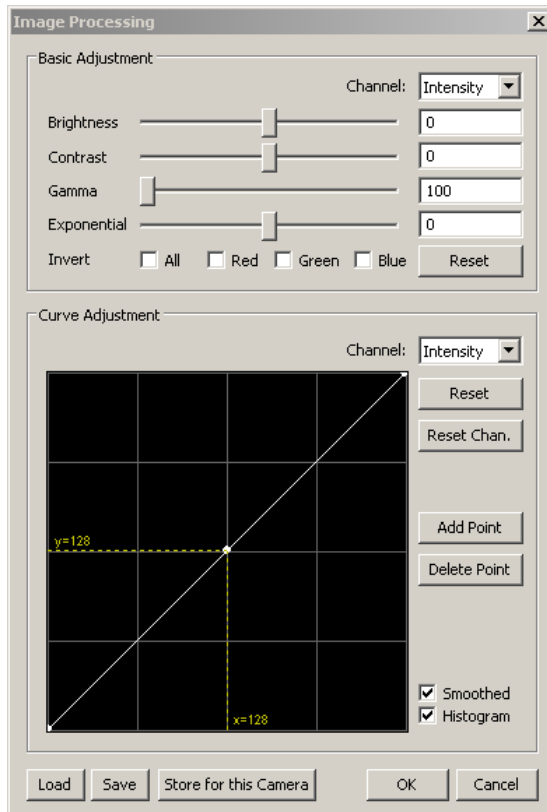


Image Processing

ProCapture allows you to perform image processing to correct and enhance images for color and monochrome cameras. You can make basic adjustments to standard values such as brightness and contrast, or perform advanced adjustments by editing the input/output curves for each channel.

To display the Image Processing dialog as shown below, select **Tools ► Image Processing ► (desired camera)** from the Menu bar at the top of the screen.



Basic Adjustment

The Channel dropdown menu allows you to choose one of these options: Intensity, Red, Green, or Blue. Use the sliders to adjust Brightness, Contrast, Gamma, and Exponential, or enter the desired value in the box to the right of each slider. You can also invert Red, Green, Blue, or All values. Click the **Reset** button to return to the default values.

Curve Adjustment

The Channel dropdown menu allows you to select Intensity, Red, Green, or Blue. Only the Intensity option is available for monochrome cameras. For color cameras, the Intensity channel applies changes to the Red, Green, and Blue channels simultaneously.

To adjust the curve, click and drag on the point. You can add one or more points by clicking the desired position on the line and clicking the **Add Point** button. Remove points by clicking them and then clicking the **Delete Point** button.

If the Smoothed checkbox is not checked, the input/output curve is generated using straight lines between the control points. If the Smoothed option is checked, a smooth spline is generated between the control points. When checked, the Histogram checkbox displays a histogram that changes as you adjust the curve. The Reset and Reset Chan. Buttons restore the default values.

The buttons at the bottom allow you to load a previously saved set of parameters or save a set of parameters. Click **Store for this Camera** to save this set of parameters so that it is automatically reloaded every time the camera is initialized.

Event/Data View

This panel above the timeline displays the total number of events and the number of specific event types (software, external, video, keyboard, and data) triggered during a recording session. If your ProCapture system includes data acquisition, this panel displays a graph of the data and the available data channels. The amount of text displayed can be toggled with the Show Information button.

Timeline

The timeline is displayed at the bottom of the ProCapture window. It represents the time from the start to finish of recording, or start to current time if recording is still going on. If events have been triggered during the recording session, a segment of the timeline is displayed in a specific color with a letter above the segment indicating the type of triggering mechanism. Pauses in the recording, data updates, and saved ranges between sequential events are also displayed in the timeline. Pauses are indicated by grey bars and ranges between sequential events are indicated by magenta bars.

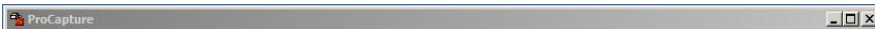
Note: For information on triggering events from the timeline, please refer to Chapter 5.

Toolbars

ProCapture software includes several toolbars. Some of them may be hidden by removing the checkmark next to the toolbar in the View menu.

Title Bar

The ProCapture title bar controls the ProCapture window. Use the controls of the title bar to let ProCapture run in the background (minimize it), to close the program, or to move the window or change its size.



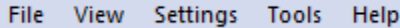
Status Bar

At the bottom of the window, the right side of the Status bar indicates whether the Caps Lock, Num Lock, and Scroll Lock keys are enabled. Status messages are displayed on the left side.



Menu Bar

The ProCapture Menu bar allows you to access universal controls and common functions such as configuration and changing the look of the window display.



File View Settings Tools Help

The following options are available from the Menu bar:

File

Configure -- Configure your ProCapture system with settings for Program Options, Video Acquisition, Data Acquisition, and Event Save.

Exit -- Exit ProCapture.

Note: Configuration settings are discussed in detail in Chapter 4.

View

Status Bar – Toggles the display of the Status bar at the bottom of the window.

Controls – Toggles the display of the Control panel at the right side of the window.

Timeline – Toggles the display of the Timeline at the bottom of the window.

Pop-Out Camera View -- A dropdown menu allows you to display the view from the selected camera in a separate window. In this window, you can zoom in or out with the mouse wheel, pan by holding down the left mouse button while dragging the mouse, or reset the view and display full screen by double-clicking.

Application Look -- The appearance of the ProCapture window can be changed to a variety of looks. In the Menu Bar, click on **View** and select **Application Look** from the dropdown menu. Select the desired window style from the list.

Settings **Show State Using Background** – Enable/disable background screen coloring. When enabled, the screen background is red when recording, green when cameras are live or recording is paused, and blue when saving.

Show Bayer in Live Images – Display live images from color cameras with the Bayer filter applied for faster refresh rate.

Tools **Lens Calculator** -- Compute focal length, magnification, object distance, and field width for each camera.

FPN & Black Level Correction – Recalibrate an XC-1 camera to automatically set the black level and correct fixed pattern noise (FPN).

Note: FPN & Black Level correction is not required for XC-2 cameras.

Color Correction – Select a camera, choose from preset values, adjust and store color conversion parameters, red-green-blue gains and offsets, smoothing functions, Auto Balance, and Grey Balance.

Camera Gains -- Set digital and analog gain values for XC-2 model cameras.

Image Processing – Set values for brightness, contrast, gamma, and exponential, or adjust input/output curves to improve video image quality.

Help **Check for Updates** – Check with the Xcitex website for the newest version of ProCapture software and download if necessary.

Note: The Check for Updates feature is described in detail in Chapter 1.

About ProCapture -- Provides information about the software version, licensing terms, and technical support available for ProCapture. This dialog box also indicates the number of camera and data channels included with your ProCapture system.

Control Panel

The ProCapture Control panel contains a series of buttons which define the configuration of your ProCapture system and determine whether or not the system is recording and what information is saved.

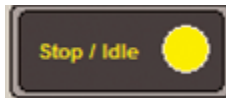




Configure

Clicking the Configure button allows you to define program options, video and data acquisition settings, triggering options, and event save parameters.

Note: Configuration settings are described in detail in Chapter 4.



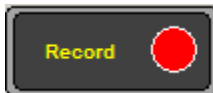
Stop / Idle

Clicking the yellow button stops the current behavior of the cameras (recording or live display) and places the cameras into Idle mode. This button is only available if the system is currently in Live mode or recording. If Show Information is enabled, yellow text displayed in the camera panels indicates that the system is idle and recording is not taking place.



Live / Arm

Clicking the green button activates Live mode and arms the system to be ready to record. This button is disabled if the cameras are already in Live mode or Record mode. When in Live mode, the cameras stream live video to the screen, displaying real time events. Data acquisition devices are also live and displaying data on the screen. Green text displayed in the camera panels indicates that the system is live. Live images and data are not saved.



Record

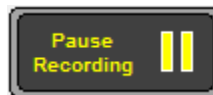
Clicking the red button instructs ProCapture to start recording video. Red text displayed on the screen in the camera panels indicates that recording is taking place. The Event Trigger, Pause Recording, and Show Information controls are active while ProCapture is recording.

Event Trigger



Clicking the Event Trigger button marks the spot on the video where an event has occurred. Each click increases the Event Count value in the Event window. If your system has data acquisition, each event trigger occurrence is indicated in the data window. Events can also be placed after a recording has already been completed. When in Idle mode, click in the timeline location where you would like an event, then click the Event Trigger button.

Pause Recording



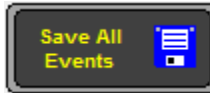
Clicking the Pause Recording button pauses the recording. The cameras continue to display a live image; however, frames are not stored to memory. Pauses in the recording are displayed as grey segments in the timeline. This can be used to create a single recording that spans a long duration with some down time in between (for instance to reset equipment or prepare another test). If you use the Save Entire Recording function for a recording that contains pauses, the recording will be saved in parts to ensure precise video/data alignment when played back. You can also save a recording containing pauses as one large video by selecting this option when configuring your Event Save Settings.

Save Single Frame



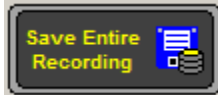
Clicking this button saves the current live frame from each camera view to a file. This function is typically used to capture single-frame images to be used for scene calibration. This function is enabled in Live mode.

Save All Events



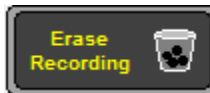
Save All Events creates a project file and folder in the Captures folder for each event. For each triggered event, a fixed amount of time will be saved before and after each event marker. Each folder will contain two files for each camera, plus one additional file if your system includes data acquisition. If the "Prompt to select events to save" option is configured, clicking this button displays a list of events triggered during the recording session, each labeled with the event time and trigger type used. Checkboxes allow you to select/deselect the event(s) to be saved. You can also save the range between sequential events, displayed as magenta bars in the timeline, if you select the option "Save ranges between sequential events" when configuring Event Save Settings.

Save Entire Recording



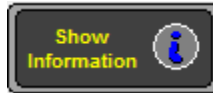
Clicking this button saves the entire buffer containing all recorded video and data since the record button was pressed. A dialog box reminds you that these files can potentially be very large. If you clicked the Pause Recording button during the recording, the video and data are saved in parts. The end of each part is determined by the location where the Pause Recording button was clicked. Optionally, you can save a recording containing pauses as a single video if you select "Save Entire Recording as one large video even if pauses are present" when configuring Event Save Settings.

Erase Recording

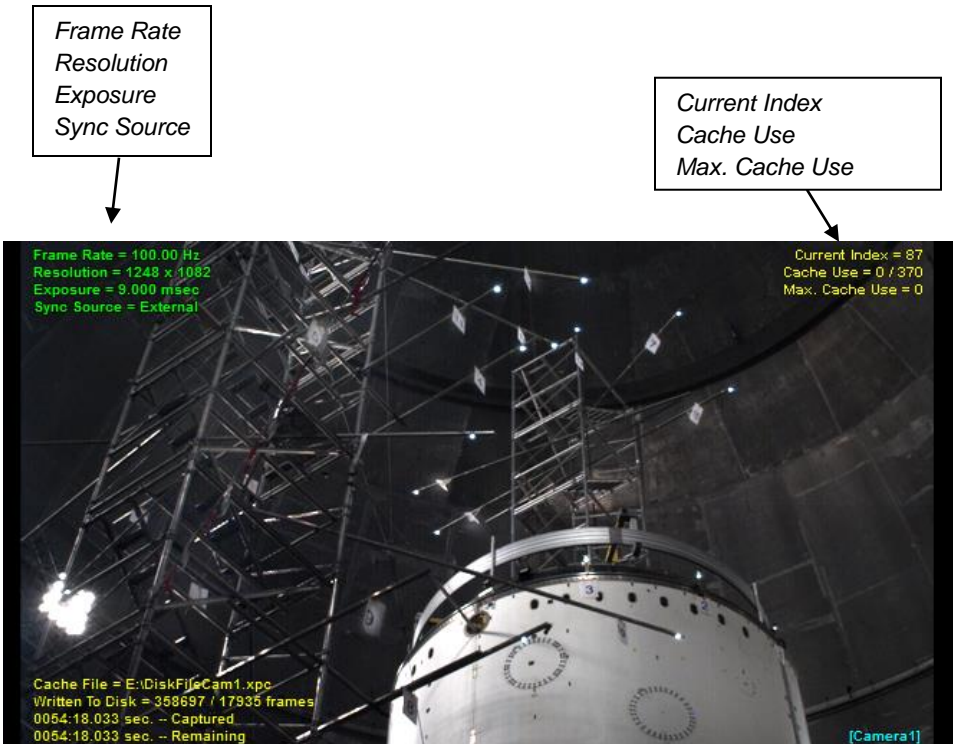


Clicking this button erases the cache files containing the current recording. Any events that have not been saved will be erased. Unsaved events are also erased automatically when a new recording is started.

Show Information



Toggles the amount of information displayed as text on the screen in each panel. Text in each camera panel is displayed in green when cameras are live, yellow when idle, red when recording.



Cache File ____
 Written to Disk ____ / ____ frames
 ____ -- Captured
 ____ -- Remaining

Displays the name of the cache file and disk where the video from this camera is being saved, as well as the elapsed recording time and time remaining for recording.

Camera label

Touchscreen Controls

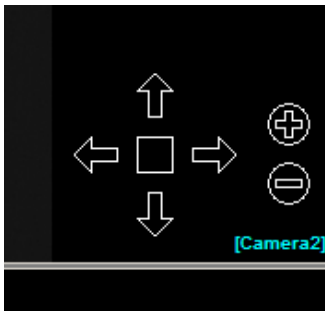
ProCapture provides a set of controls specifically designed for touchscreen devices. To use the controls, start ProCapture using the **ProCapture Touch** shortcut on the desktop. For ease of use, the various buttons are arranged in a series of nested menus; however, they function in the same way as the standard controls. An arrow (➡) indicates that there are additional menus nested under a function button. Touch the **Back Arrow** (⬅) button at the bottom to return to the previous level of menus at any time. Touch **Exit** to exit the program.



Panning and Zooming with Touchscreen Controls

In the Touchscreen version of the software, the zoom, pan, and full screen display functions are performed with controls visible in the bottom right corner of the camera view. With these controls, you can do the following:

- Touch the + and – to zoom in and out.
- Touch the arrows (↑ ⇒ ↓ ⇐) to pan.
- Click the square (□) to reset the display after zooming/panning.

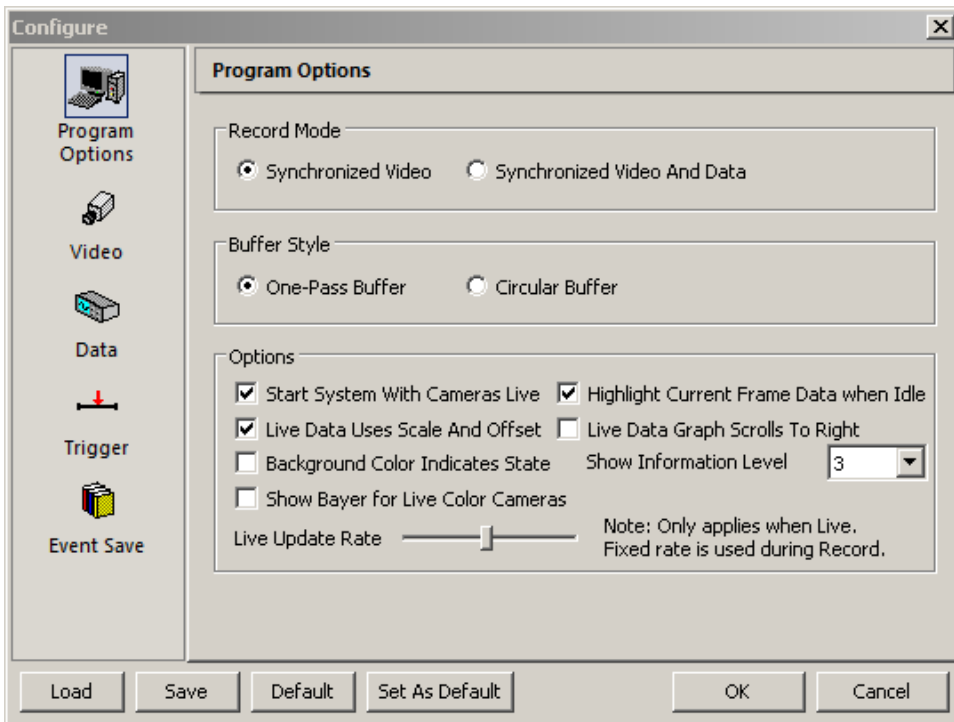


Chapter 4. Configuring a Recording

Configure can be selected either from the File dropdown on the Menu bar or the Control panel. This selection gives you access to five panels where you can define specific parameters for your recording session: Program Options, Video Acquisition Settings, Data Acquisition Settings, Triggering Options, and Event Save Settings. You may also create and save customized configurations for specific users or testing situations.

Program Options

The Program Options panel is automatically displayed when you select Configure from the Control panel.



Record Mode

Choose **Synchronized Video** or **Synchronized Video And Data** (if your ProCapture system includes data acquisition).

Buffer Style

One-Pass Buffer -- When ProCapture is recording, video frames and data are streamed directly to the Video Processing Unit. The finite amount of memory reserved for this purpose is called the one-pass buffer. When the buffer is full, the recording session ends.

Circular Buffer – Unlike one-pass buffering which ends the recording session when the buffer is full, circular buffering continuously overwrites the oldest video and data so that the most recently recorded information is always available (first-in first-out principle). This process of recording in a continuous loop is called a circular buffer. As video and data are overwritten, events that occurred at the beginning of the recording session may be lost. For example, if you record for 2 hours, but your recording duration buffer equals 1 hour, only the events that occurred during the second hour will remain. Events that occurred during the first hour will have been overwritten.

Options

Start System With Cameras Live – If checked, system will start up with cameras in Live mode.

Live Data Uses Scale And Offset -- If checked, data is displayed in the units specified for that channel using the scale and offset values specified for each channel. If not checked, data is displayed as raw voltage.

Highlight Current Frame Data when Idle – If checked, a vertical green bar is displayed at the position in the timeline and data window indicating the current frame when ProCapture is in Stop/Idle mode.

Live Data Graph Scrolls To Right – If checked, changes the direction in which the data graph scrolls. The default value is an unchecked box: newest data is typically shown on the right and the graph scrolls to the left.

Background Color Indicates State – If checked, the screen background indicates the current state of the system: red when recording, green when cameras are live or recording is paused, and blue when saving.

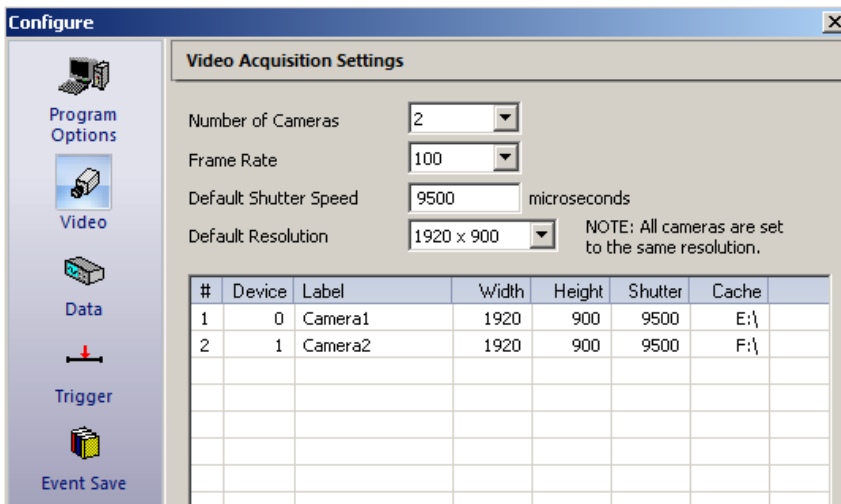
Show Information Level -- This option controls how much text is displayed in the camera panels. This dropdown menu allows you to select values ranging from 0 to 3. If you select 0, no text will be displayed. The information level can also be changed while the program is running by clicking the **Show Information** button on the Control panel.

Show Bayer for Live Color Cameras – If checked, displays live images from color cameras with the Bayer filter applied for faster refresh rate.

Live Update Rate – This slider controls the speed at which live images are updated on the screen. On slower systems the program may become unresponsive if the Live Update Rate is set too high. If this occurs, restart the program and immediately lower this setting.

Video Acquisition Settings

Click the **Video** icon from the Configure window to display the Video Acquisition Settings panel.



Number of Cameras -- Allows you to select values ranging from 1 to the maximum number of cameras included with your ProCapture system.

Frame Rate -- Allows you to select values ranging from 5 to either 500 or 1000 frames per second, depending on camera model. The default is 100. The frame rate affects the available resolutions and the maximum recording time. A low frame rate is recommended if your testing requires a long recording time. A higher frame rate results in a reduced recording time and also may reduce your maximum resolution.

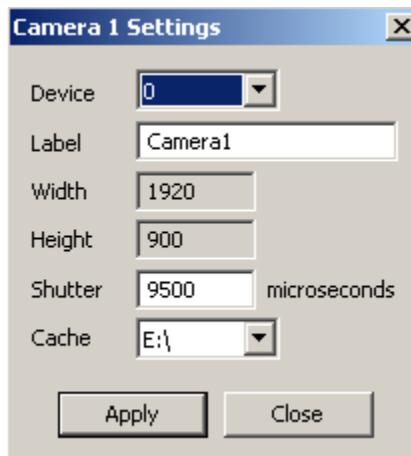
Default Shutter Speed -- Determines the amount of time that the electronic shutter of the camera remains open during each frame. Shorter exposure times reduce blur within each frame, but at the expense of light collecting ability. The default value is slightly lower than 1/frame rate microseconds. The value that you enter will apply to all cameras in the system. A procedure to set different shutter speeds for individual cameras will be detailed below.

Default Resolution -- Allows you to select the default resolution for all cameras. Currently, all cameras in the system must have the same resolution. For each frame rate chosen, only certain resolutions may be available. Lower resolutions typically result in longer recording times and more video frames.

Specifying Unique Settings for Each Camera

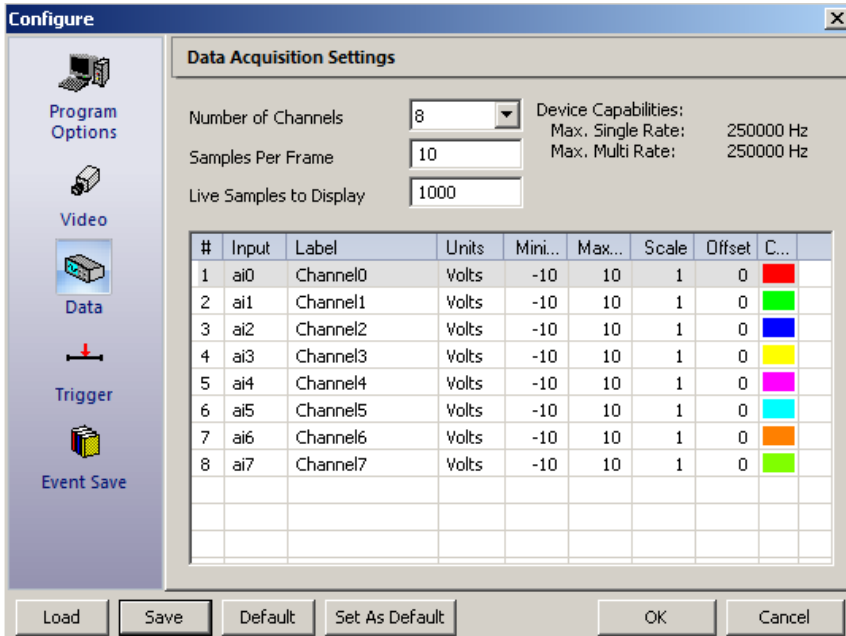
The Video Acquisition Settings panel also contains a section with specific information for each camera connected to your ProCapture system. This listing allows you to configure each camera individually. Double-click on the camera whose settings you wish to change. In the Camera Settings dialog box you may change the device number, label, resolution width and height, shutter speed, and cache designation for that camera. Click **Apply** to update the settings, and then click **Close**.

Note: ProCapture requires all cameras to have the same resolution, which is why the width and height may not be changed in this dialog box.



Data Acquisition Settings

Click the **Data** icon from the Configure window to display the Data Acquisition Settings panel (if your system is enabled for data acquisition). The data acquisition hardware can record data from several sources during a data recording. The channels represent different streams of incoming data.



Device Capabilities – Most configurations of ProCapture will only have a single data device installed. If multiple devices are installed in your system, more than one device will be listed here. Information about your selected device is shown on the right.

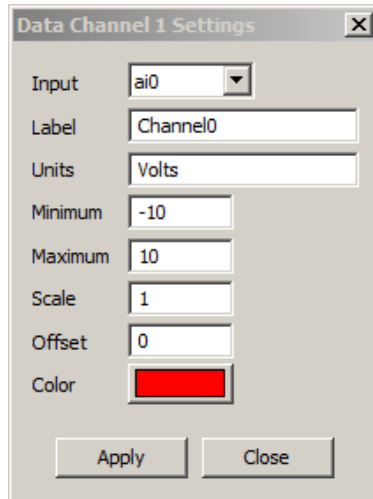
Number of Channels -- Allows you to select values ranging from 1 to 32. The default is 8.

Samples Per Frame -- The value entered here determines the number of data samples to take per frame of video. For example, if the video record rate is 100 frames per second, and the samples per frame is set to 10, then 1000 samples per second will be captured.

Note: The product of samples/frame x frame rate x the number of data channels cannot exceed the maximum data sampling rate of your ProCapture system.

Live Samples to Display – The value entered here determines the number of samples that will be displayed in the live data view at the bottom of the main window. The default is 1000. If the live data graph appears to move too quickly, increase this value. If it moves too slowly, decrease this value.

Individual Data Channels -- This list shows the configured analog input data channels. Double-clicking each line in the list displays the Data Channel Settings popup menu, allowing you to customize the settings for each data channel.



- **Input:** Specifies the hardware input that is associated with the channel.
- **Label:** Allows you to name each channel. Assigning descriptive names (e.g., left wall, or strain) to the channels makes reviewing data easier.
- **Units:** Engineering units after scaling (volts, g, psi, etc.)
- **Minimum:** The lower limit, in volts, that you expect to see from your sensor. Using the tightest range that includes all possible sensor values you expect to encounter will improve your results.
- **Maximum:** The upper limit, in volts, that you expect to see from your sensor. Using the tightest range that includes all possible sensor values you expect to encounter will improve your results.

- **Scale:** ProCapture applies a scale factor to convert the input volts to a meaningful number in engineering units. The scale factor is multiplied with the input voltage.
- **Offset:** In units, the offset to be applied by ProCapture to account for offsets in the input. The offset is added to the scale factor-multiplied input voltage.
- **Color:** The color that will represent the data channel in graphs can be changed by clicking on the current color and selecting from the color palette window.

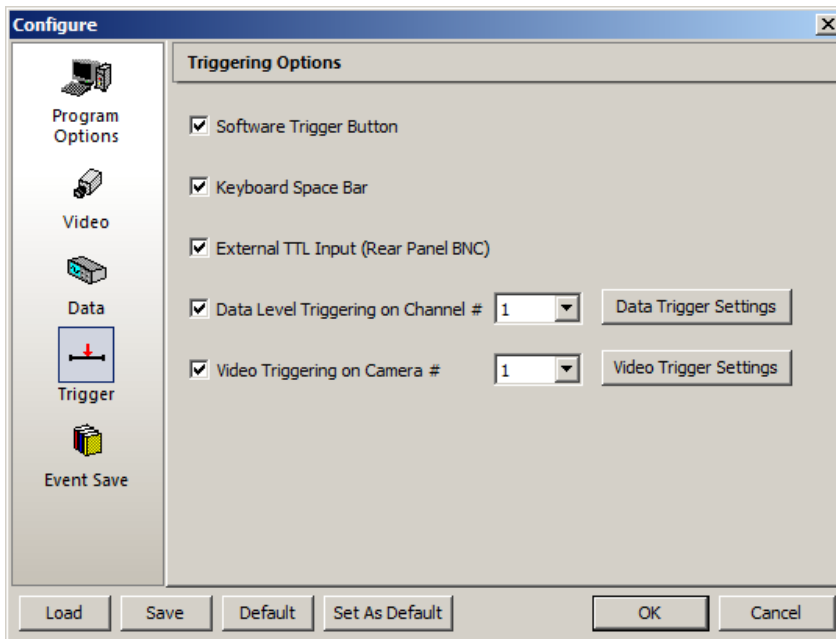
The maximum and minimum field values can range from -10 to 10. These specify the range of volts expected of the input. The closer this range is to the actual values, the better the digitization will be.

The Scale and Offset values provide the parameters for a linear scale that is applied to input voltages on each channel. Each voltage value in the input data is multiplied by the factor, and then the offset value is added. Use the appropriate scale factor and offset for the sensor attached to the channel so that incoming raw values will be automatically scaled to engineering units.

In the live view, each data channel is displayed at the bottom of the screen in text corresponding to the assigned color.

Triggering Options

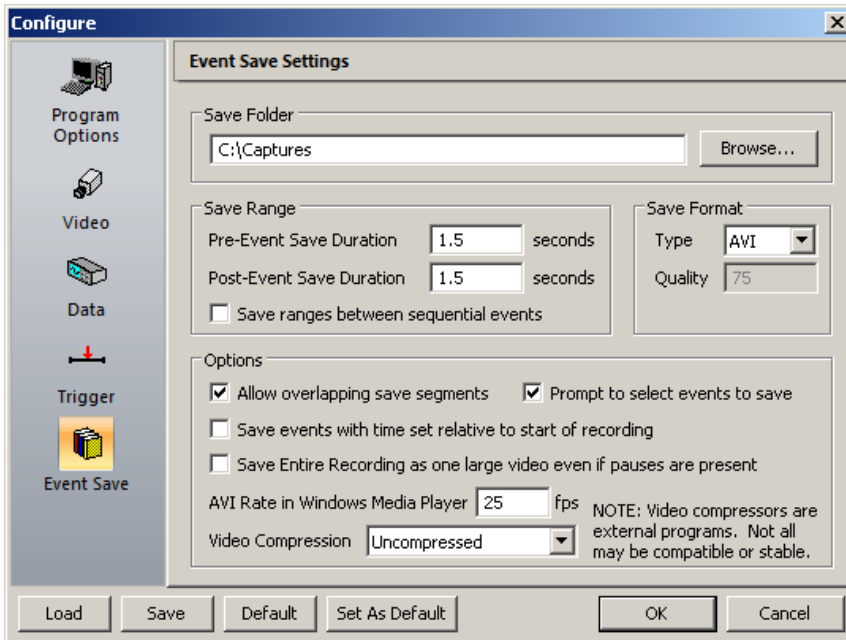
Click the **Trigger** icon to display the Triggering Options panel. ProCapture features five methods for triggering an event – the software Event Trigger button, the Space Bar key on the keyboard, external TTL trigger, data level triggering, and video triggering. The Triggering Options panel allows you to select and configure each triggering mechanism you wish to use during your ProCapture recording session.



Note: Please refer to Chapter 5 for more information on Triggering Options.

Event Save Settings

Click the **Event Save** icon to display the Event Save Settings panel.

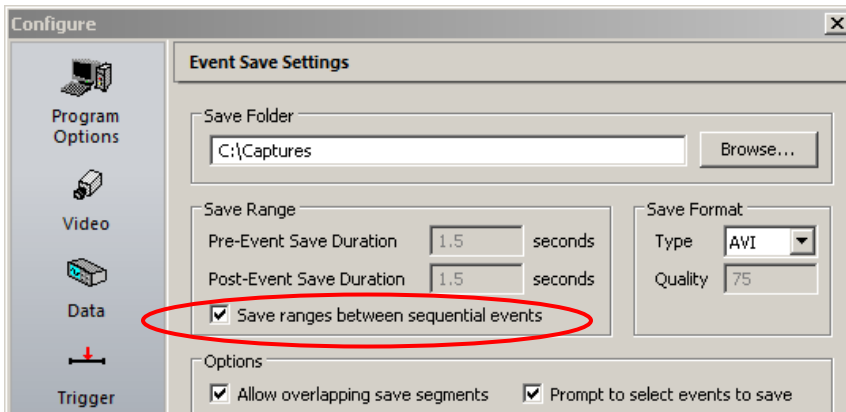


Save Folder

Saves all captured events (video and data) to one folder. The Captures folder on the C:\ drive is the default; however, you may select a different folder to receive your captured events. The folder must exist on the system for the save operation to be successful.

Save Range

These values specify the number of seconds of video to save before and after each event (Pre-Event Save Duration and Post-Event Save Duration). They dictate the amount of time prior to the trigger and after the trigger is received that will be saved when saving all events. These values do not have to be the same. The default is 1.5 seconds for each.



The option **Save ranges between sequential events** allows you to save the segments of the recording that lie between sequential triggered events. This is useful if you want to press the trigger before and after an expected event occurs and save the entire duration between each pair of event triggers. If you select this option, the Pre-Event Save Duration and Post-Event Save Duration fields are grayed out.

Save Format

Type -- Allows you to choose from several standard file formats for your captures. The Type dropdown menu displays AVI, BMP, JPEG, TIFF, and PNG. Select **AVI** to save as a single video file; the other formats save a sequence of images. Compression for AVI files can be selected in the Options section below.

Quality – The value entered here determines the compression rate for files in *.jpeg* format. The default is 75.

Options

Allow overlapping save segments (default) -- When this box is checked, ProCapture will save all event segments with the full pre- and post-save duration, even if the time gap between the events is smaller than the set pre- and post- save duration values. If the box is not checked, the length of some segments may be shorter than the specified values to avoid overlapping saved segments. Allowing overlapping save segments may consume a larger amount of disk space since some frames may be saved more than once into multiple overlapping events.

Prompt to select events to save – When this box is checked, ProCapture will display a list of events that occurred during the recording when the Save All Events button is clicked. Events are displayed in chronological order and each is labeled with time and trigger type information. Each event has a checkbox that may be cleared if you do not wish to save that particular event. If you elected to save ranges between sequential events, some event checkboxes are not selectable, because the "event" available to select actually represents the range between two sequential events.

Save events with time set relative to start of recording (default) -- When this box is checked, ProCapture measures the elapsed time between events by referring back to the beginning of the recording session as $t = 0$. A checked box is the default for this option.

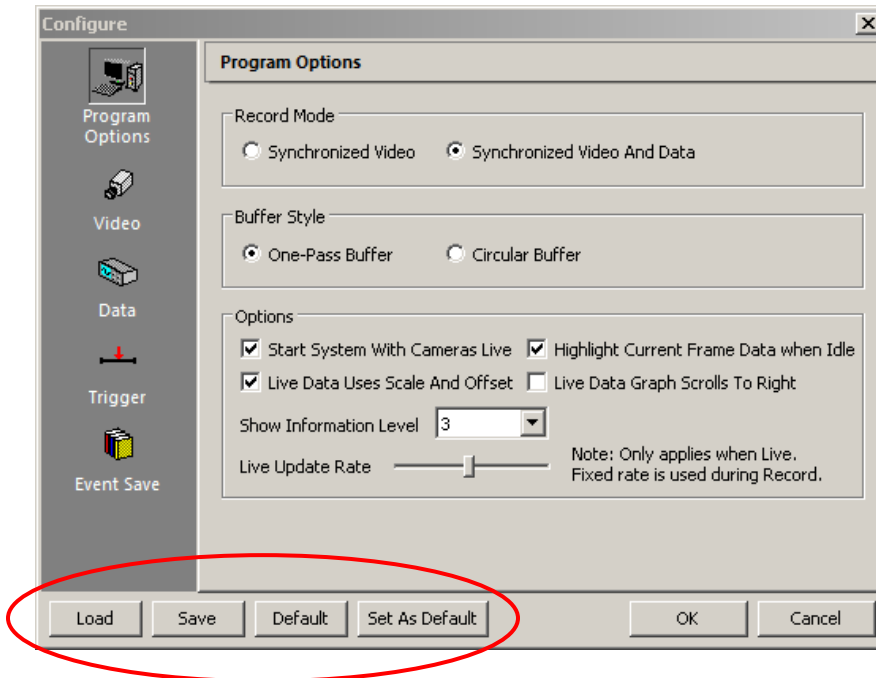
Save Entire Recording saves as one large video – When this box is checked, recordings containing pauses are saved as one large file, rather than divided into parts coinciding with the times that the Pause Recording button was clicked.

AVI Playback Rate in Windows Media Player -- The value you enter determines the playback speed of your video when played in conventional video players, such as Windows Media Player. The default is 25 frames per second.

Video Compression -- This dropdown menu allows you to select from a number of compression codecs for AVI saving. Since all players may not be compatible with some video compressors, and compression can result in loss of quality, we recommend that videos be saved as **Uncompressed** (default). The codecs listed here are installed on your computer. These codecs are not a part of ProCapture, and some may be incompatible.

Saving, Loading, and Default Settings

When you launch ProCapture, the program uses the values that were set in each configuration panel during the previous session. If you would like to set up different configurations for specific users or various types of testing, you can create, save, and load customized configurations for these situations. The buttons at the bottom of the Configure panel allow you to change the default values or save configuration settings.



Load -- Load a ProCapture configuration from an existing file.

Save -- Save the current ProCapture configuration as a file.

Default -- Sets the current configuration of ProCapture to use the default settings defined at the last use of "Set As Default."

Set As Default -- Applies your changes; sets them as new default values to be used when the Default button is pressed.

Chapter 5. Capturing Events

An event is a section of a video that is marked by a triggering mechanism (external hardware hand switch trigger, video trigger, data level trigger, software Event Trigger button, Space Bar key). ProCapture allows you to determine the amount of video to save before and after each triggered event.

This chapter discusses all the processes involved in event capture. Topics include:

- Configuring your ProCapture system for long recording
- How ProCapture collects data
- ProCapture's five triggering mechanisms
- Triggering an event from the timeline
- How ProCapture saves events
- Changing the amount of video included before and after a saved event.

Duration Basics

The maximum duration of your recording is determined by the frame rate and resolution you select when configuring your recording.

Frame Rate, or frames per second (fps), indicates the number of frames in each second of recorded video.

Resolution indicates the number of pixels (width x height) contained in a digital image. A higher resolution creates a sharper and more detailed image.

Under certain conditions, ProCapture can record for up to 5 hours. The charts on the following pages show some examples that illustrate the relationship between the length of ProCapture's recording time, frame rates, and resolutions for a standard system. Special configurations may have different record times.

Frame Rate	Resolution	Record Time (minutes)
30 frames/sec	1240 x 1080	203
	1240 x 900	240
	1240 x 720	300
	1150 x 960	251
	1050 x 1000	255
60 frames/sec	1240 x 1080	102
	1240 x 900	120
	1150 x 960	125
	1050 x 1000	131
100 frames/sec	1240 x 1080	61
	1240 x 900	72
	1150 x 960	75
	1050 x 1000	79
150 frames/sec	1240 x 1080	41
	1150 x 1080	44
	1050 x 960	54
	960 x 1080	53
200 frames/sec	1240 x 900	37
	1150 x 960	37
	1050 x 960	41
	960 x 960	45
300 frames/sec	1240 x 600	37
	1150 x 640	37
	1050 x 700	37
	960 x 770	37
400 frames/sec	1050 x 520	37
	960 x 570	37
	860 x 630	37
	760 x 710	37
500 frames/sec	1050 x 410	38
	960 x 450	38
	860 x 500	38
	760 x 560	38

XC-1 Camera -- Sample Frame Rates, Resolutions, and Record Times

Frame Rate	Resolution	Record Time (minutes)
60 frames/sec	1920 x 1080	64
	1680 x 1080	74
	1152 x 864	135
	900 x 900	166
	720 x 1080	173
100 frames/sec	1920 x 900	46
	1260 x 1080	59
	1152 x 900	77
	900 x 900	99
	720 x 1080	103
150 frames/sec	1920 x 600	46
	1260 x 1080	39
	1152 x 864	54
	720 x 720	103
250 frames/sec	1920 x 360	46
	1152 x 720	38
	720 x 360	124
500 frames/sec	1920 x 180	46
	1260 x 360	35
	600 x 720	37
1000 frames/sec	1920 x 84	50
	900 x 174	51
	600 x 350	38

XC-2 Camera -- Sample Frame Rates, Resolutions, and Record Times

Data Acquisition Basics

ProCapture data acquisition has been designed to work with a large number of different types of transducers. These sensors convert force, rate of flow, pressure, temperature, etc. into a voltage (volts) that is proportional to the physical parameters being monitored.

Typical sensors include:

- Accelerometers
- Microphones
- Strain Gauges
- Flow Sensors
- Pressure Sensors
- Thermistors
- Hydrophones
- Dynamometers
- Speedometers
- Tachometers

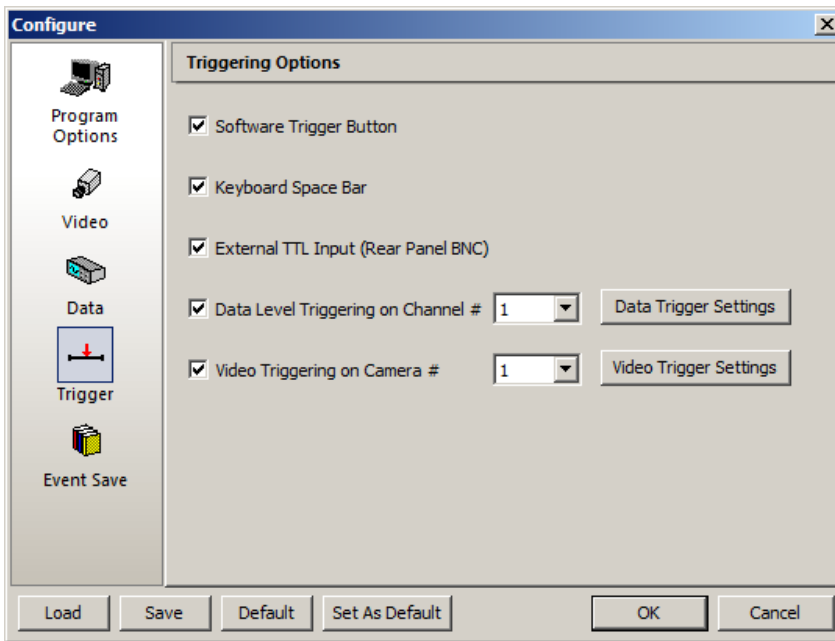
Often, signals from these sensors must be amplified, filtered, biased, converted from current to voltage, or processed in other similar ways. Therefore, each sensor type typically uses a signal conditioner, designed specifically for that type of sensor, to produce signals recognized by the ProCapture data acquisition hardware. ProCapture uses voltage variations on the data lines to determine data values, so any signal conditioner that outputs a voltage can be used.

Note: For more information on data acquisition, refer to the National Instruments website: www.ni.com.

Triggering

Events are triggered with one of the following five methods: the software Event Trigger button, the Space Bar key on the keyboard, external hand trigger device, data level triggering, or video triggering. Triggering with any of these mechanisms produces an event marker on your video. The Triggering Options panel displays all of the triggering options available for your ProCapture recording session.

ProCapture creates video clips of each event using the Pre-Event and Post-Event Save Duration values you configured in the Event Save Settings. Typically, an experiment may cover a long period of time, with events of interest only occurring here and there. The combination of triggering and save duration settings lets you view the events without having to view or save the entire recording.



Software Trigger Button – Trigger an event by clicking the Event Trigger button on the Control panel.

Keyboard Space Bar – Trigger an event by pressing the Space Bar key on the keyboard.

External TTL Input (Rear Panel BNC) – Trigger an event with an external device, such as a hand switch routed through a trigger box.

Data Level Triggering on Channel # -- If the box is checked, this dropdown menu allows you to select values ranging from 1 to the number of channels being recorded. An event is automatically triggered if the data being recorded meets the voltage limits configured for data level triggering on the selected channel. If the box is not checked, the signal on any data line will not trigger an event.

Data Level Trigger Settings – Clicking this button displays the Data Trigger Settings dialog, allowing you to specify limits for voltage and elapsed time before another event is triggered.

Video Triggering on Camera # -- Checking this box activates the dropdown menu, allowing you to select the camera view where video triggering will take place. Only one camera may be selected.

Video Trigger Settings – Clicking this button displays the Video Trigger Settings dialog, allowing you to specify the size of the video trigger region, the conditions that must be met for triggering in the selected camera view, and the minimum amount of time that must elapse before the next triggered event.

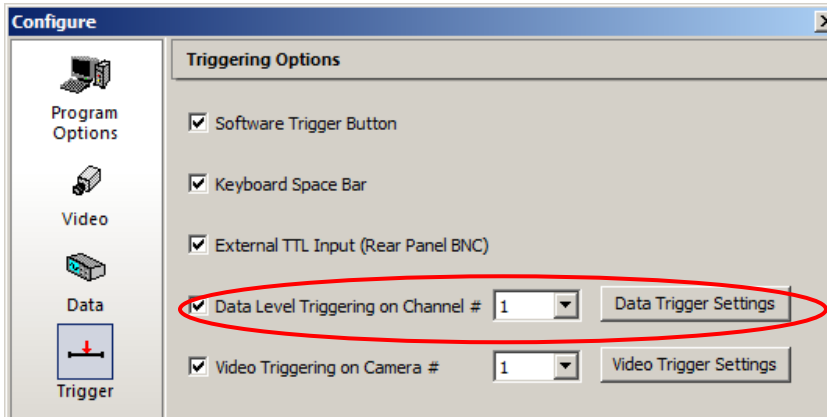
Data Level Triggering

ProCapture can be configured to automatically trigger itself based on the voltage value on a specified data line. You might use this to automatically trigger your system when the force on a force plate exceeds a certain value or if a line break sensor was tripped, for example. A data level event is automatically triggered if the data being recorded from a sensor meets the user-specified requirements for Data Trigger Settings.

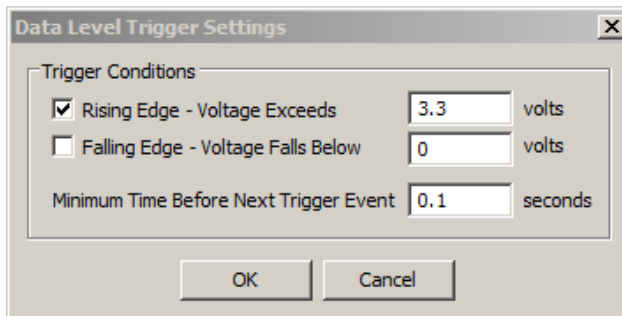
Set Up Data Level Triggering

ProCapture can automatically mark event triggers using the voltage readings from one of the recorded analog channels. This is called “Data Level Triggering”, since the system is triggered by data values that exceed or fall below a certain level. ProCapture can be configured to look for rising or falling edge signals at user-configurable voltage levels. A minimum time value between trigger events can also be set in order to prevent multiple triggers within a short period of time.

To set up a channel for data level triggering, check the box labeled **Data Level Triggering on Channel #** in the Triggering Options panel. The channel used for data level triggering must be configured as one of the recorded channels. Select the channel to enable for data level triggering from the dropdown menu next to the checkbox.



Click the **Data Trigger Settings** button to set the parameters for determining when a trigger event occurs. The Data Level Trigger Settings window appears, allowing you to specify specific voltage values for event triggering and a minimum time that must elapse before another event is triggered.

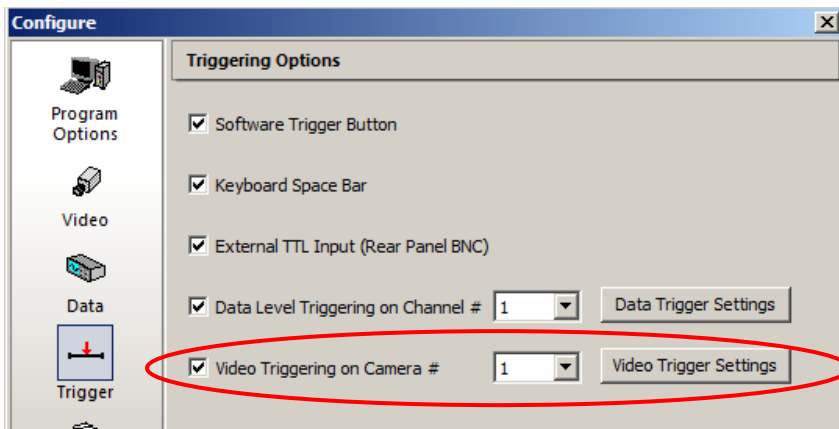


If you wish to trigger on rising edge signals, check the **Rising Edge – Voltage Exceeds** checkbox and enter a voltage value in the box to the right. If you wish to trigger on falling edge signals, check the **Falling Edge – Voltage Falls Below** checkbox and enter a voltage value in the box to the right. Both rising edge and falling edge can be used simultaneously and ProCapture will trigger on both conditions. Enter a value for **Minimum Time Before Next Trigger Event** to prevent additional trigger events from occurring too close together.

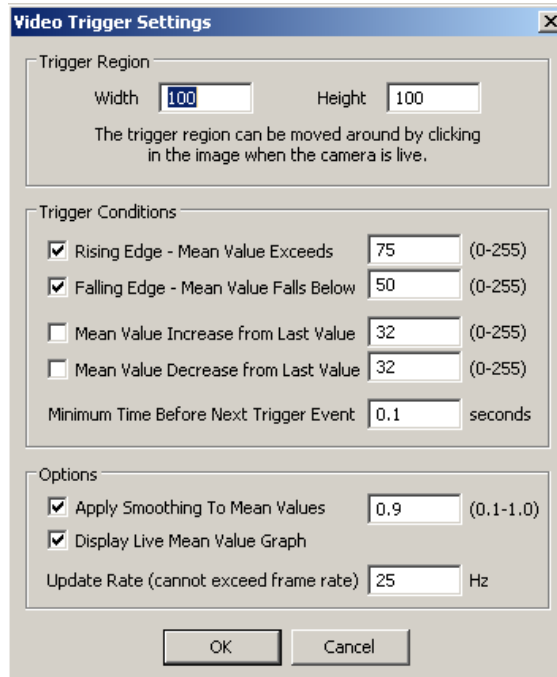
Video Triggering

ProCapture can automatically mark event triggers in response to changes in the view of a single camera. With video triggering, the system is triggered by conditions that exceed or fall below a certain average intensity level. ProCapture can be configured to look for rising or falling edge conditions and increasing or decreasing intensities at user-configurable levels. A minimum time value between triggered events can also be set in order to prevent multiple triggers within a short period of time. Optional smoothing may be applied to the triggering values to smooth out noise and a live graph may be displayed.

To set up video triggering, click the **Trigger** icon to display the Triggering Options panel. Check the box labeled **Video Triggering on Camera #**. Select the camera to enable for video triggering from the dropdown menu next to the checkbox.



Click the **Video Trigger Settings** button to set the parameters for determining when a trigger event occurs. The Video Trigger Settings window appears.



The screenshot shows the "Video Trigger Settings" dialog box with the following configuration:

- Trigger Region:** Width: 100, Height: 100. A note states: "The trigger region can be moved around by clicking in the image when the camera is live."
- Trigger Conditions:**
 - Rising Edge - Mean Value Exceeds: 75 (0-255)
 - Falling Edge - Mean Value Falls Below: 50 (0-255)
 - Mean Value Increase from Last Value: 32 (0-255)
 - Mean Value Decrease from Last Value: 32 (0-255)
 - Minimum Time Before Next Trigger Event: 0.1 seconds
- Options:**
 - Apply Smoothing To Mean Values: 0.9 (0.1-1.0)
 - Display Live Mean Value Graph
 - Update Rate (cannot exceed frame rate): 25 Hz

Buttons: OK, Cancel

Specify the **Width** and **Height** (in pixels) of the region that ProCapture will search for video triggers.

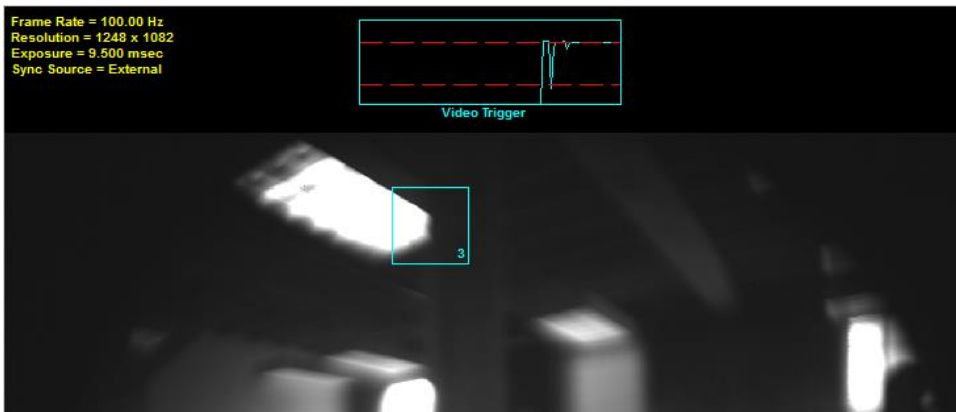
If you wish to trigger on rising edge conditions, check the **Rising Edge – Mean Value Exceeds** checkbox and enter a mean value (0 – 255) in the box to the right. If you wish to trigger on falling edge conditions, check the **Falling Edge – Mean Value Falls Below** checkbox and enter a value in the box to the right. Both rising edge and falling edge can be used simultaneously, and ProCapture will trigger on both conditions.

If you wish to trigger on changes in intensity, check the **Mean Value Increase from Last Value** checkbox and/or the **Mean Value Decrease from Last Value** checkbox and enter a value in the box to the right. Both increase and decrease can be used simultaneously, and ProCapture will trigger on both conditions. Enter a value for **Minimum Time Before Next Trigger Event** to prevent additional trigger events from occurring too close together.

If the video intensity values are noisy and you need a smoothed value to ignore the noise, check the **Apply Smoothing To Mean Values** checkbox in the Options panel and enter a smoothing value if desired. A value of 0.1 applies heavy smoothing; a value of 1.0 applies no smoothing. If you would like to see a live graph of the mean values, click the **Display Live Mean Value Graph** checkbox. Enter the Update Rate for the graph. The update rate cannot exceed the frame rate configured for recording. The recommended update rate is 25 Hz.

After you have finished entering all video trigger settings, click **OK**. A box will appear in the selected camera view. The box can be repositioned anywhere in the camera panel to achieve best placement for video triggering. In Live mode, reposition the region by holding down the **Ctrl** key and clicking the left mouse button.

When video triggering occurs during recording, the graph displays the trigger event. The red lines in the graph represent the trigger threshold values entered in the Video Trigger Settings window, and the blue graph line shows the triggering data. The number of video-triggered events during the most recent recording session appears in the lower right corner of the video trigger region. A video trigger event appears on the timeline as a cyan segment with the letter V above the segment.



Triggering Events within the Timeline

The timeline displays the time from start to finish of the recording. If events have been triggered during the recording session, a segment of the timeline is shown in a specific color with a letter above the segment indicating the triggering method. The table below shows the types of triggered events displayed on the timeline.

Letter	Segment Color	Trigger Type
S	Green	Software (control panel)
K	Orange	Keyboard (Space Bar)
E	Magenta	External (hand switch)
D	Yellow	Data Level
V	Cyan	Video

When recording is finished, you can click in the timeline. You will see the frames corresponding to the current location in the video for the current time displayed in the timeline. If events were missed during the recording, you can now create additional trigger events within the timeline by moving the cursor to the desired location and clicking **Event Trigger**. A dialog box requests confirmation that you would like to add a software event at that location. Click **Yes**. A green segment with the letter S above it appears at the timeline location.

If you notice that something of interest occurred outside of a saved event segment, click on the location of interest in the timeline. Click **Configure** and **Event Save** and add the additional time to the pre- or post- event save duration.

Events cannot be removed from the timeline.

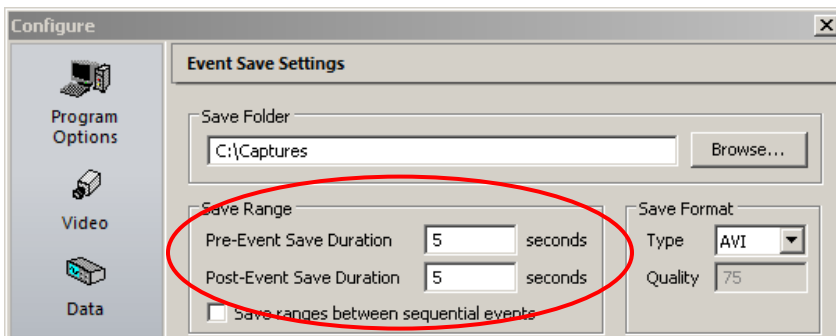
Note: The live data graph is updated to show the corresponding data.



Changing the Save Range after Recording Complete

After viewing your captured events you may decide you would like to save more or less video before and/or after each event marker.

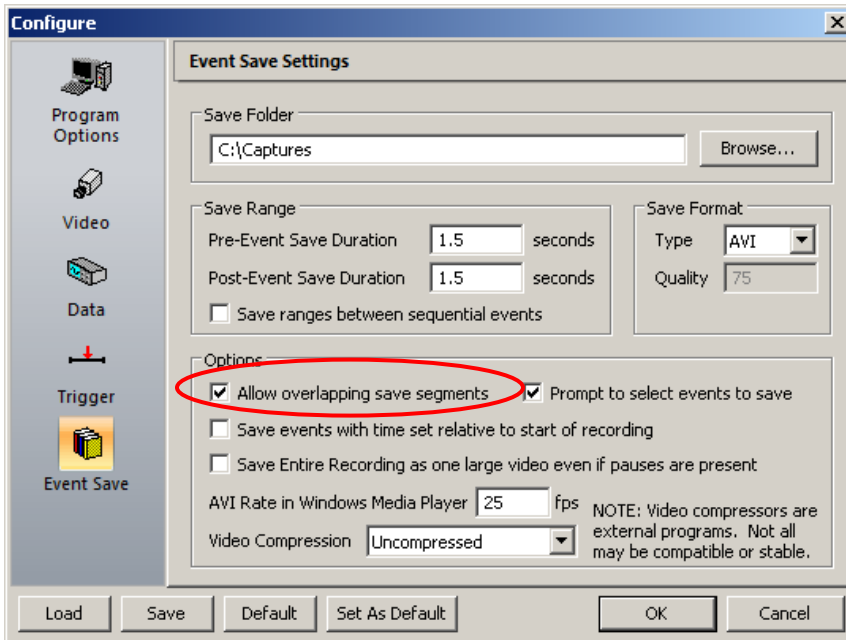
1. Click **Configure** and then **Event Save**.
2. Under Save Range, change the number of seconds for **Pre-Event** and/or **Post-Event Save Duration** as desired.
3. Click **OK**.



4. If no other configuration settings were changed, the system will not prompt to reinitialize the cameras. If you are prompted to reinitialize the system, click **No**.
5. From the Control panel, click **Save All Events**.
6. When you return to ProAnalyst or ProViewer to view your events, the newly saved events will include the updated save duration.

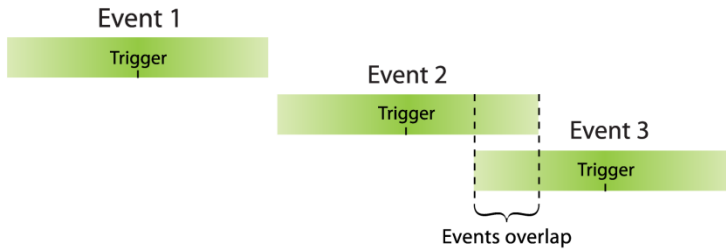
Overlapping Event Saves

Because some captured events may occur within a brief timeframe, ProCapture allows you to save overlapping events using the pre- and post-event save durations you specified on the Event Save Settings panel by checking the box for the **Allow overlapping save segments** option. If this option is not enabled, the save durations of some video segments will be truncated if the events occur close together.

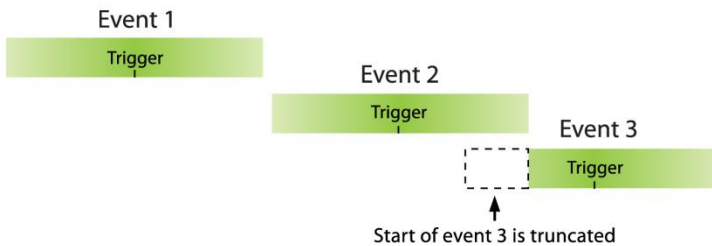


The graphic on the following page shows three events. The horizontal axis is time. The colored areas are the pre- and post-event save times. You can see that the triggered events and save durations cause Events 2 and 3 to overlap.

Overlapping save segments



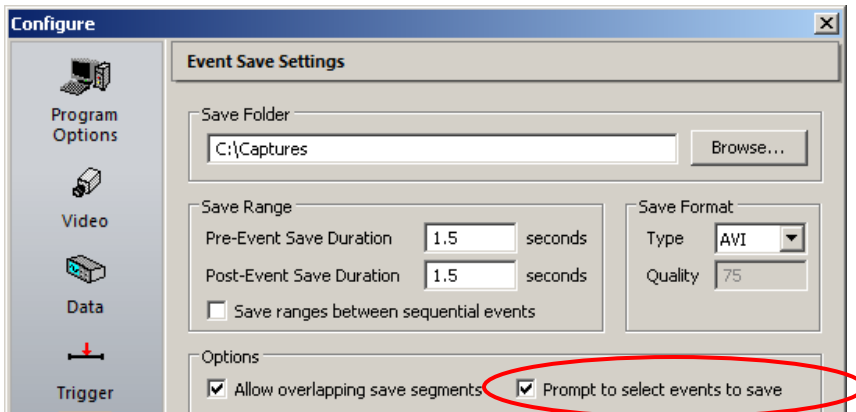
Non-overlapping save segments



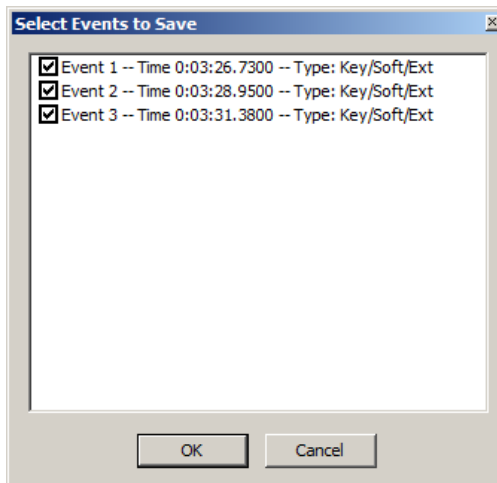
When saving with overlapping save segments, the frames from the overlapping portions are saved twice, once in Event 2 and once in Event 3.

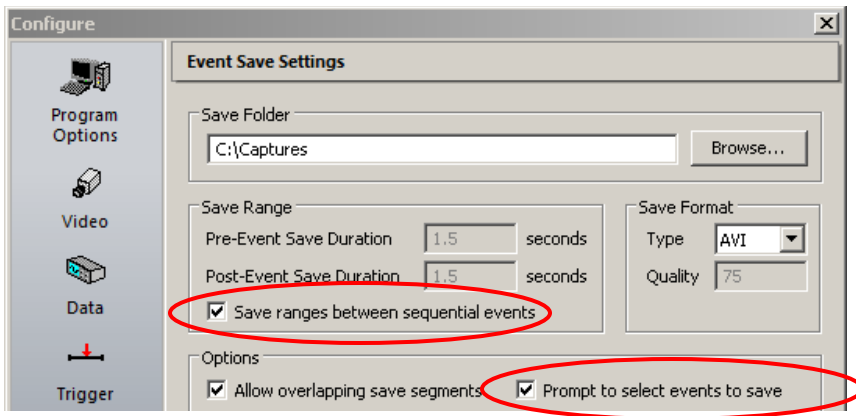
Select Events to Save

ProCapture provides a configuration option to select some or all of your triggered events to save when a recording is completed. In Event Save Settings under Options, click the checkbox next to "Prompt to select events to save."

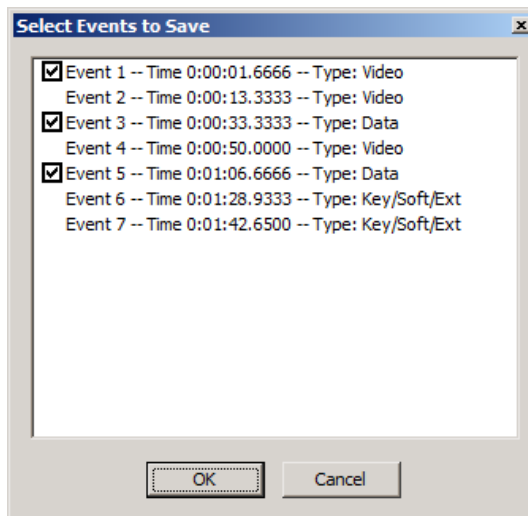


If this option is selected, clicking the **Save All Events** button after recording displays the Select Events to Save dialog, as shown below. Click the appropriate checkbox(es) to select the listed events, which are labeled with the time and trigger type. Click **OK** to confirm the selection. If you would like to add more events at this time, you can click in the timeline to trigger, then click **Save All Events** again to view the updated list of events.





If you also selected the **Save ranges between sequential events** option along with **Prompt to select events to save**, some events in the Select Events to Save dialog are not selectable. The "events" that are available for saving actually represent the ranges between two sequential events, not the events themselves.



Chapter 6. Analyzing, Viewing, and Sharing Captured Events

After you have successfully recorded and saved events, you can review them and perform analysis using the ProAnalyst software included with your ProCapture system. You can also view and share your results using ProViewer software.

How Events Are Saved

ProCapture creates ProAnalyst project files with the extension *.mpj* for each saved event (or range between sequential events). These project files contain links to videos from each camera (*.avi*, *.bmp*, *.jpeg*, *.tiff*, or *.png*). The project files are saved in the Captures folder. In addition to the project files, there is an *.ini* information file and folder for each event. Each folder contains a video file, a configuration file, plus one data file if your ProCapture system includes data acquisition.

The project files, event folders and files are named as follows:

<Date>_<Time>_Evtxx

where "xx" represents a specific event number. For example, the event folder named:

2012-05-23_09-15_Evt03

contains the files for event number 3, captured at 9:15 a.m. on May 23, 2012.

For single frame captures, the folder and file names appear as:

<Date>_<Time>_Single

For example: *2012-05-23_09-15-32_Single*

Note that the single frame capture filenames also include seconds in the time portion of the name.

When entire recordings are saved, the folder and file names will be:

<Date>_<Time>_Entire

For example: *2012-05-23_09-15_Entire*

When an entire recording has been saved and the recording contains pauses, ProCapture saves the recording in parts. The folder and file names appear as:

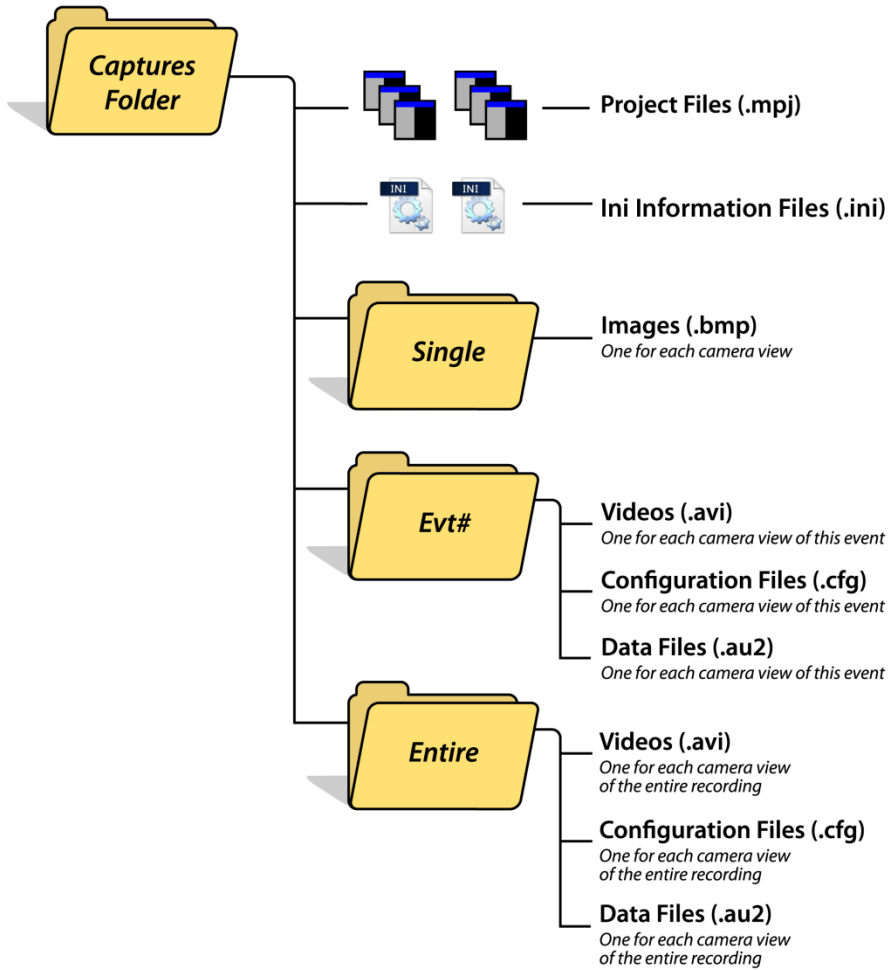
<Date>_<Time>_Entire-Partx

where "x" represents a part of the recording between pauses.

For example: *2012-05-23_09-15_Entire-Part1*

The chart below and the illustration on the next page show the Captures folder naming conventions and layout.

Save Method	Name Format	Example Name
Event	<i><Date>_<Time>_Evtxx</i>	<i>2012-05-23_09-15_Evt01</i>
Single	<i><Date>_<Time>_Single</i>	<i>2012-05-23_09-15-32_Single</i>
Entire	<i><Date>_<Time>_Entire</i>	<i>2012-05-23_09-15_Entire</i>
Entire with pauses	<i><Date>_<Time>_Entire-Partx</i>	<i>2012-05-23_09-15_Entire-Part1</i>

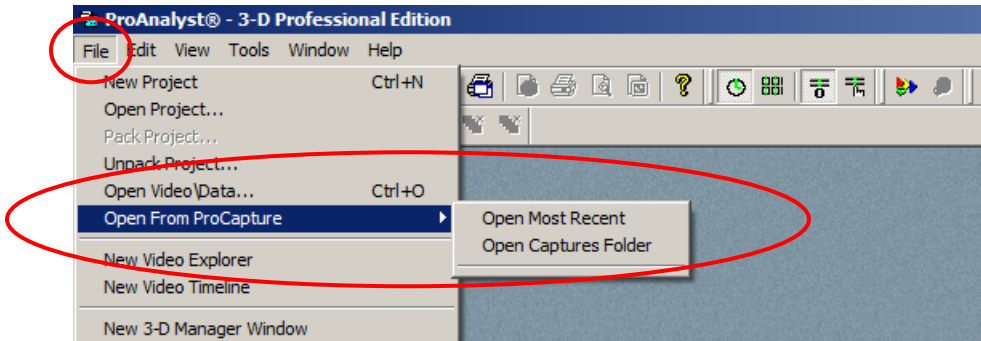


Viewing, Sharing, and Analysis

Run ProAnalyst if you wish to view and analyze the project files of your captured events.

To view and/or share the videos, use ProViewer software. ProViewer allows you to open and play back ProAnalyst project files; however, you cannot perform tracking or measurements on the videos. ProViewer is available as a free download from the Xcitex website.

ProAnalyst and ProViewer allow you to open ProCapture files directly from the File menu by selecting **Open from ProCapture**, as shown below.



Note: For more information, please refer to the ProAnalyst User Guide.

Chapter 7. Advanced Topics

This chapter explains some procedures that you may perform infrequently or only when setting up ProCapture for the first time.

Capture Single Images for Calibration

Performing 2-D or 3-D calibration in ProAnalyst requires a single image of a calibration object from each camera. The **Save Single Frame** button in ProCapture allows you to easily capture a single frame from each camera and save the results in a ProAnalyst project.

To capture calibration images, put the cameras into Live mode by clicking on the **Live/Arm** button. For 2-D calibration, place an object of known length into the field of view of each camera. The object should be placed so that it lies in the same plane of motion as the action you will be recording. The calibration object should be as large as possible and occupy as much of the field of view of each camera, while still being completely visible. When the object is entirely visible by all cameras, click on the **Save Single Frame** button. For 3-D calibration, place a calibration fixture into the field of view of each camera. Make sure that all points on the calibration fixture are visible in each camera's field of view. Click **Save Single Frame** to save the current live images.

The resulting single frames will be placed into a folder within the Captures folder that you set in the Event Save Settings panel of the Configure window. The folder will be named using the format *<Date>_<Time>_Single* (for example, *2012-09-12_09-15-32_Single*), and a ProAnalyst project file with the same name as the folder will be created in the Captures folder.

Recover the Most Recent Recording Stored in Cache

The most recently completed recording is stored on the cache drive(s) until another recording is started or the **Erase Recording** button is clicked. It is possible to retrieve events from the last recording or the entire last recording even if you have exited the ProCapture program or shut down the computer.

To save portions of the most recent recording, the video and data configuration settings should be the same as when the recordings in the cache were captured. As long as you have not modified the configuration since the last recording, ProCapture should restart with the same settings you had last used. If you have recently changed the configuration, change the values back before attempting to recover the last recording. If you do not remember the settings that you used, you can try to recover frames by playing back directly from the cache files, as described in the next section.

If you are certain that the configuration is the same as when the recording was performed when restarting ProCapture, click **Stop/Idle** and the timeline should reflect the last captured recording. Now you can click **Save Entire Recording** or **Save All Events** to recover the last recording.

Play Back the Most Recent Recording from the Cache

ProAnalyst and ProViewer are capable of reading the ProCapture cache files directly. Although not recommended, this method can be used to recover portions of your recording in case of an unexpected failure. Some triggering and buffering information may be lost when reading the cache directly, especially if you are using circular buffering.

To open the cache file, run ProAnalyst or ProViewer and select **File ► Open Video\Data** from the main toolbar. Navigate to one of the camera cache drives (drive letters E: - L:) and open the *.xpc file. If the last recording was also recording analog data, the data will be stored in the same cache drive as the first camera. Opening the camera *.xpc file for the first camera will also open the associated data, if present.

Note: If the recording was paused or if the last recording was configured to use circular buffering, gaps from pausing or the looping from circular buffering will not be reflected in the frame numbering shown by ProAnalyst or ProViewer.

Chapter 8. Troubleshooting

This chapter provides solutions to some problems that you may encounter when using ProCapture.

Data acquisition is not working

Verify that the Data Acquisition hardware is working properly. Go to the Start menu and select **All Programs ► National Instruments ► Measurement & Automation**. In the window that appears, expand **Devices and Interfaces**. Find the device that you are trying to use for recording and right-click on the device. Select **Test Panels** from the dropdown menu. In the Test Panels window, perform the basic test of analog data acquisition to ensure that the device is working properly. If your device does not show up in the list of Devices and Interfaces or fails the recording test in the Test Panels, please contact Xcitex for support.

If you have more than one data device, verify that the device selected in the Data Acquisition Settings configuration panel in ProCapture is the same device you intend to use for acquisition.

System is not registering event trigger signals

If you are using a hardware trigger switch, make sure that the trigger is connected to the proper location on the system. Refer to the "Connecting the Trigger Box and Hand Trigger Switch" diagram in Chapter 1.

If you are recording video only, the system expects to receive a rising edge signal that goes from 0V to at least 3.3V. The ProCapture system is supplied with a trigger box that converts a hand-switch trigger to a voltage signal. The hand trigger switch should be connected to the input of the Trigger box. The output from the Trigger box should be connected to the back of the computer as described in Chapter 1.

If you are recording video and data without Data Level Triggering, the trigger switch should be connected in the same way as described for recording video only above.

If you are recording video and data with Data Level Triggering, the voltage values you entered in the Data Level Trigger Settings window for the data channel you have selected will cause trigger events to occur.

If you are clicking the **Event Trigger** button in the software Control panel or pressing the **Space Bar** key, and the Event Count does not increase, please contact Xcitex for support.

Error message: “An error occurred while starting live preview.” or “An error occurred while waiting for frame from camera.” occurs when cameras are going live

This error may occur infrequently when starting up your ProCapture system. If you see this message, click on **Stop / Idle** and then **Live / Arm** and the cameras should display a live image without an error message. If the error message occurs again, verify that all camera cables are connected securely and that all cameras are powered. If you are using fewer than the maximum number of cameras possible, please ensure that the cameras you are trying to use are connected to the proper ports on the back of the system. Refer to the "Connecting the Cameras" diagram in Chapter 1. If you continue to see these error messages, contact Xcitex for support.

Error message: “Hardlock not found. Unable to start program. Please ensure the proper hardlock is attached.” on startup

The ProCapture system requires a security key (hardlock) or a software license to operate. If you see this message, please verify that the security hardlock supplied with your system is plugged into a functioning USB port on the computer. If the hardlock and drivers are loaded properly, the red LED light inside the hardlock should be on. If the light is not on, try unplugging the hardlock and re-plugging it back into a different USB port on the computer. If the hardlock light is still not on, contact Xcitex for support.

If your system did not come with a USB hardlock, it is using a software security key. If ProCapture will not start when using a software security key, please contact Xcitex for support.

Error message: “The previous recording resulted in a high additional cache use for Camera xx. This may indicate that frames were dropped during the recording. Please verify that the cache drives are set properly and exit and other programs that may be running in the background that may affect system performance.”

This error indicates that at some moment in the recording, the system was not able to store images fast enough. At one or more points in the recording, there may be missing frames. Your saved events may not be affected. Save All Events will function properly as long as the missing frames do not overlap with your save event ranges.

To remedy this situation, ensure that your system is configured properly so that each camera is streaming to one of the cache drive letters (E: - L:). Also, please close any other programs that are running while performing a recording. If the problem persists, please contact Xcitex for support.

Index

A

About ProCapture, 33
Application Look, 32
Auto Balance, 27, 33

B

Bayer filter, 33, 43
Buffer style, 42

C

Caches, 3, 44, 74, 77
Calibration, 36, 73
Camera connections, 5
Camera gains, 28, 33
Camera settings, 44
Camera views, 26
Cameras, 1, 3, 5, 43, 44
Captures folder, 37, 49, 69–72, 73
Check for Updates, 9, 10, 33
Circular buffer, 42, 74
Codecs, 51
Color Conversion Parameters, 27, 33
Color Correction, 27, 33
Compression, 50, 51
Configuration, 41–52
Configure, 14, 32, 35, 41, 52, 64
Control Panel, 34–38

D

Data Acquisition, 3, 4, 30, 45, 56, 69, 75
Data Acquisition settings, 45–47
Data Channel settings, 45–47
Data channels, 30, 45, 46
Data Collection hardware, 2, 4, 45, 56
Data graph, 26, 30, 42
Data Level Trigger settings, 58, 59, 76

Data Level Triggering, 58–60, 75
Defaults, 52

E

Erase Recording, 37
Error messages, 75–77
Event count, 17, 25, 30, 36, 76
Event Save duration, 15, 21, 49, 57, 64
Event Save settings, 15, 18, 64–67, 64–67
Event Trigger, 17, 36
Event types, 57, 63
Examples
 Video, 14–19
 Video/Data, 19–22

F

File formats, 50
File naming conventions, 71
FPN & Black Level Correction, 33
Frame rate, 15, 20, 43, 44, 45, 53

G

Grey Balance, 27, 33

H

Hand trigger switch, 3–7, 75
Hardlock, 76
Hardware connections, 3–7
Highlight Current Frame Data when Idle, 42

I

Idle mode, 35
Image Processing, 29–30, 33

Input/Output curve, 30
Installation, 10–12

L

Lens calculator, 33
Live Data Graph Scrolls To Right, 42
Live Data Uses Scale And Offset, 42
Live mode, 22, 35, 42
Live Samples to Display, 46
Live Update Rate, 43
Load, 52

M

Menu bar, 32

N

Non-overlapping Save Segments, 66

O

Offset, 47
One-Pass buffer, 42
Overlapping Event Saves, 65–66
Overlapping Save Segments, 50, 65, 66

P

Pan, 26, 32, 40
Pause Recording, 36
Play Back recording from cache, 74
Playback rate, 51
Pop-out Camera View, 26, 32
Post-Event Save duration. *See* Event Save duration
Pre-capture considerations, 13
Pre-Event Save duration. *See* Event Save duration
ProAnalyst software, 1, 2, 3, 8, 13, 69, 72
ProCapture software, 1, 3, 8, 10, 25–38

ProCapture window, 25
Program Options, 15, 41–43
ProViewer software, 2, 9, 69, 72

R

Record, 17, 35
Record mode, 42
Recording duration, 53–54
Recover recording from cache, 74
Reinstalling ProCapture software, 10–12
Resolution, 3, 15, 20, 43, 44, 53

S

Samples Per Frame, 45
Save, 52
Save All Events, 18, 37, 67, 77
Save Entire Recording, 37
Save folder. *See* Captures folder
Save Range, 19, 64
Save ranges between sequential events, 31, 37, 50, 51, 68
Save Single Frame, 36, 73
Scale factor, 47
Select Events to Save, 51, 67
Sharpening, 27
Show Information, 35, 38, 42
Show state using background, 33, 42
Shutter speed, 15, 20, 44
Smoothing, 27, 30, 33
Software, 8–12
Start System With Cameras Live, 42
Status bar, 31

T

Test Panels, 75
Timeline, 31, 32, 36, 42, 63, 74
Title bar, 31
Toolbars, 31–33
Touchscreen controls, 39–40
Trigger box, 3–7, 75

Trigger types, 57, 63
Triggering, 31, 53, 57–63
Triggering in Timeline, 63, 67
Triggering options, 48
Troubleshooting, 75–77

U

Updates, 9, 11

V

Video Acquisition settings, 15, 43–44
Video example, 14–19
Video Processing Unit (VPU), 3–7, 8
Video Trigger settings, 58, 61–62

Video Triggering, 58, 60–62
Video/Data example, 19–22
Voltage, 6, 42, 45–47, 56, 58–60, 75
VPU. See Video Processing Unit (VPU)

X

xpc file, 74

Z

Zero time, 51
Zoom, 26, 32, 40