The MotionMonitor xGen Hardware Guide: Configuring Basler Cameras

The MotionMonitor xGen can collect data from Basler cameras after settings are configured and saved in the Basler Pylon Viewer software. Many of the camera's settings will be preliminary. Information about how to improve the image quality and to make camera settings more suitable for a specific application appear throughout this guide.

Basler hardware setup

Many Basler camera models are supported, but this document will reference the ace camera type, specifically the a2A 1920-160ucBAS model camera. The camera body has two ports in the back and a threaded lens mount on the front. The wide flat port is where the included USB 3.0 cable attaches. The lens screws onto the front of the camera until it is tight. The lens will typically have adjustable zoom, aperture, and focus via adjustment rings on the lens. The thumbscrews lock down the adjustment rings to prevent accidental changes to lens settings. Zoom should be adjusted for optimal capture area, followed by aperture based on lighting conditions in the capture space. The focus is the final adjustment to improve image quality. These adjustments will be made once Pylon Viewer has been installed, so that the camera image can be viewed. The image below is only an example, not every lens will have these rings in the same order.
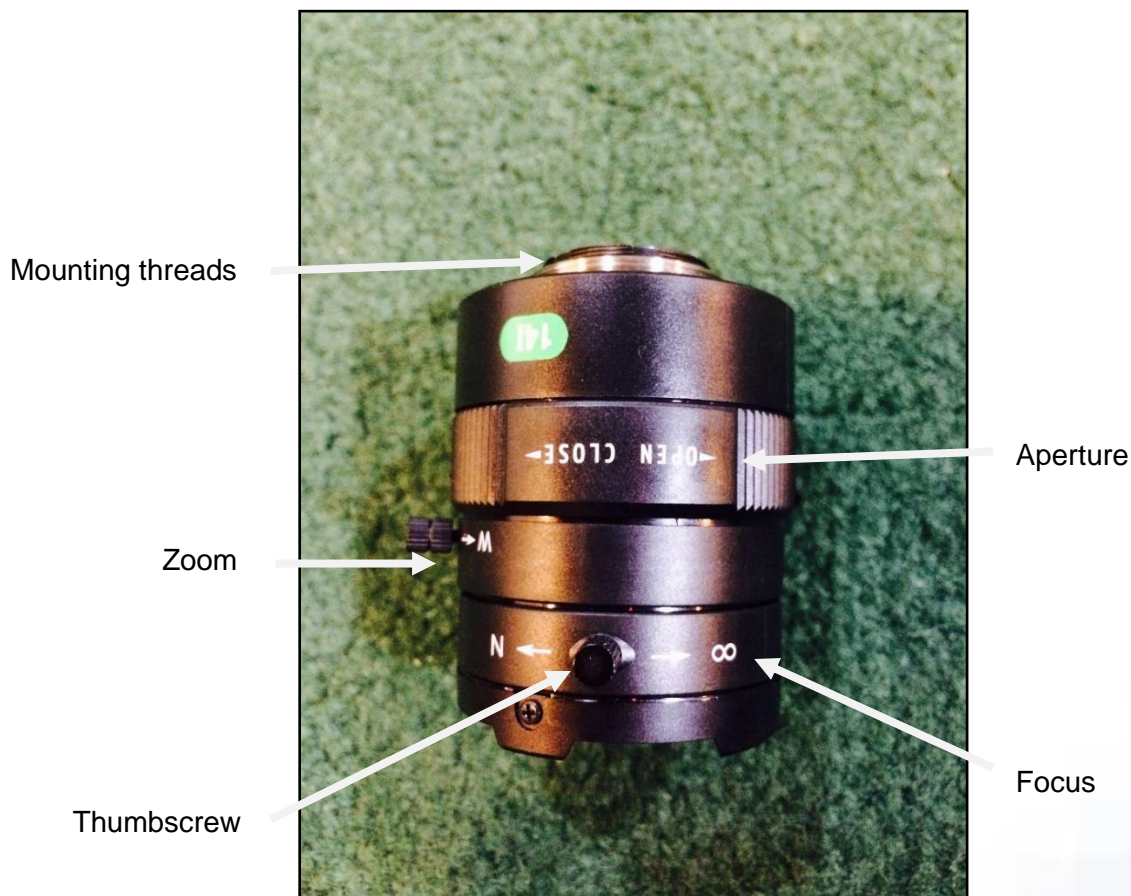
Installing Pylon Camera Software

The Basler Pylon Camera Software Suite needs to be installed before use of the Basler camera. This will ensure that the necessary drivers are installed and will allow for adjusting the camera settings. The Pylon software can be downloaded from the Basler website, at the following address: http://www.baslerweb.com/en/support/downloads/software-downloads. Pylon version 6.2.0 or later is recommended.

Run the program, which will take the user through the steps of an installation wizard.
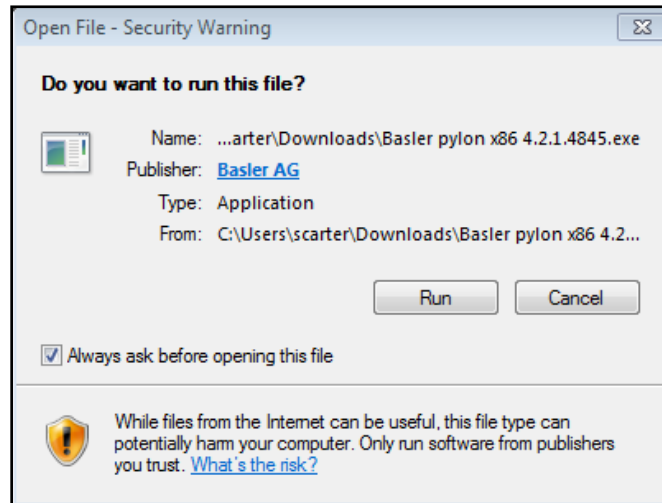

Once the setup is completed, click Finish. Three icons will appear on the Desktop. Double-click on "pylon Viewer" to access the software used to set up the cameras.

Setting up cameras in Pylon Viewer

Basler cameras that are connected to the computer through a USB 3.0 port will be recognized by the Pylon software and can be found listed within the Devices tree. To work with the settings on a particular camera, double click on it to bring up the Features list containing the editable parameters.
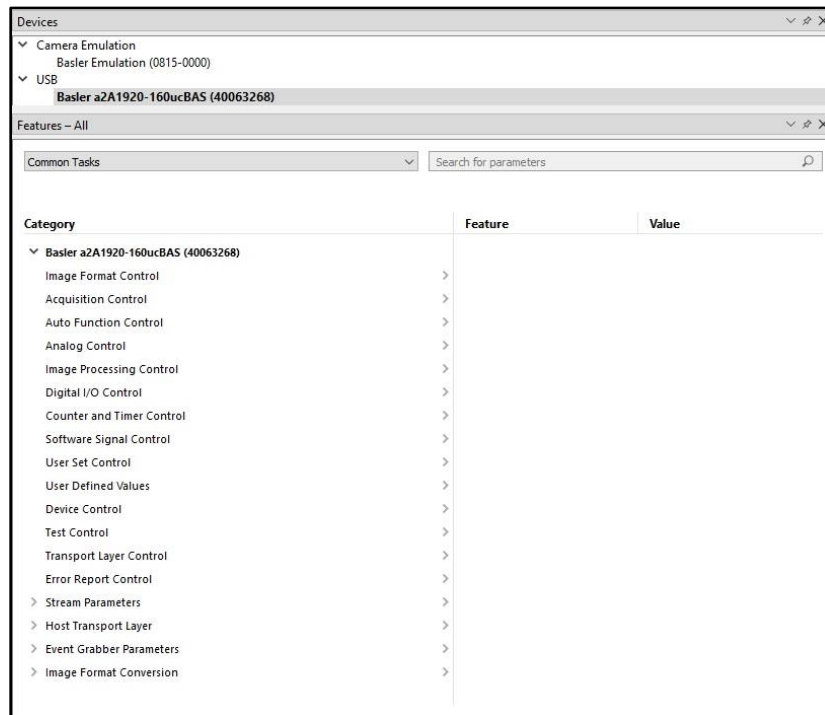

A description of what is contained in each of the menu items used to configure cameras to interface with **_The MotionMonitor_** follows. For a live view of the camera, double click on the camera name to activate it. Right click on the camera and go to 'Continuous Shot' to access the camera view for camera aiming, lens adjustment, and adjusting digital camera settings.

Note: If the objects you want to image are located at different distances from the camera, you must consider depth of focus. You can change the depth of focus by turning the aperture ring on the lens. Closing the lens aperture increases the depth of focus but decreases the amount of light reaching the camera's sensor, resulting in a darker image.

Note: Some settings may not be enabled for modification while the camera is in Continuous mode.

1. Image Format Control
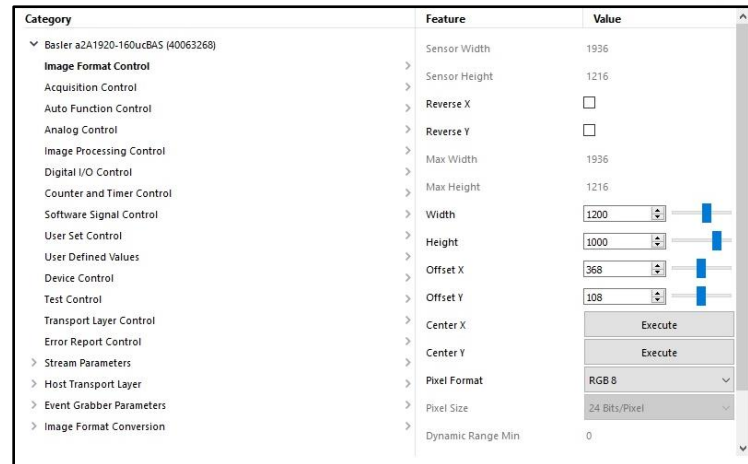
The width and height as well as the X and Y offset (in pixels) of the camera's AOI (area of interest) can be set within this menu item. The "Center X" and "Center Y" "Execute" buttons will center the image. The standard pixel format is typically selected as RGB 8.

2. Analog Control
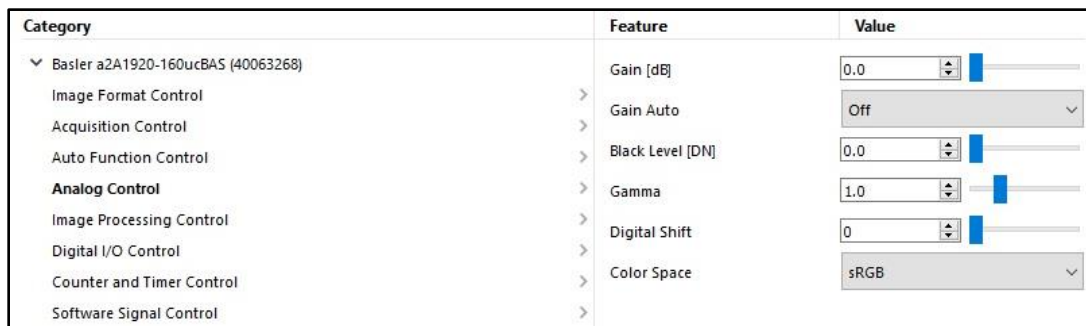
Adjust the gain, black level, and gamma correction of pixel intensity using items in this menu.

Note: Make sure that detail is still visible in the brightest parts of the image. Increasing the gain too much can cause the brightest parts of the image to lose detail and can also increase the noise in the acquired image.

Note: Making fine adjustments to the Black Level can be made to ensure that detail is still visible in the darkest parts of the acquired images.

3.   Image Processing Control

4.   Acquisition Control

The exposure time setting determines the time interval during which the sensor is exposed to light. If the object is moving, choose a low exposure time setting to prevent motion blur. As a general rule, choose a short enough exposure time to make sure that the image of the object does not move by more than one pixel during exposure.

Exceeding the maximum exposure time for a given frame rate will cause the camera to slow down, i.e. it will cause the camera to operate at a lower frame rate. The maximum exposure time for a given frame rate is determined by the following formula:

(1/frame rate) = maximum exposure time

The exposure time can be set through the "Exposure Time [us]" edit field, in microseconds. Checking the "Enable Acquisition Frame Rate" box allows for the acquisition frame rate to be set by the user (in Hz) through the "Acquisition Frame Rate" edit field; otherwise, the camera will run a default rate.

Note: Confirmation should be made that the "Resulting Frame Rate" and "Resulting Transfer Frame Rate" match the specified "Acquisition Frame Rate". Otherwise, the desired measurement rate might not be compatible with settings such as the image format width and height and acquisition control exposure time. These settings may need to be adjusted to accommodate the desired measurement rate.

5.   User Set Control

A configuration set is a group of values that contains all of the register settings needed to control the camera. There are two types of configuration sets: the work configuration set and the factory configuration set. The work configuration set contains the camera's current register settings and thus determines the camera's performance. When you change settings, you are making changes to the work configuration set. The work configuration set is located in the camera's volatile memory and the settings are lost if the camera is reset or if power is switched off. However, cameras can save the current work set values in the volatile memory to reserved areas in the camera's non-volatile memory called "memory channels." There are three memory channels available for saving configuration sets; these are commonly referred to as a "user configuration set" or "user set." Saving a configuration set to one of the memory channels will overwrite any set that was previously saved to the selected channel and can be done with the following steps:

- Make changes to the camera's settings until the camera is operating in a manner that you would like to save.
- Use the "User Set Selector" dropdown menu to choose the memory channel where the configuration will be saved. These are the settings which will be passed to The MotionMonitor.
- Save the configuration settings by going to Camera|Save Features.
- Press **Execute** by the "User Set Save" item.

Whenever a camera is powered on or is reset, by default, it copies the factory set settings in memory channel 0 into the work set. Cameras have a "startup channel" feature that lets you change this behavior. This can be accomplished by selecting the channel you wish to see as the default through the "User Set Default" dropdown menu.

To test the camera settings in Pylon Viewer, before moving to **The MotionMonitor xGen**, a recording can be captured within Pylon Viewer under Window|Recording Settings.
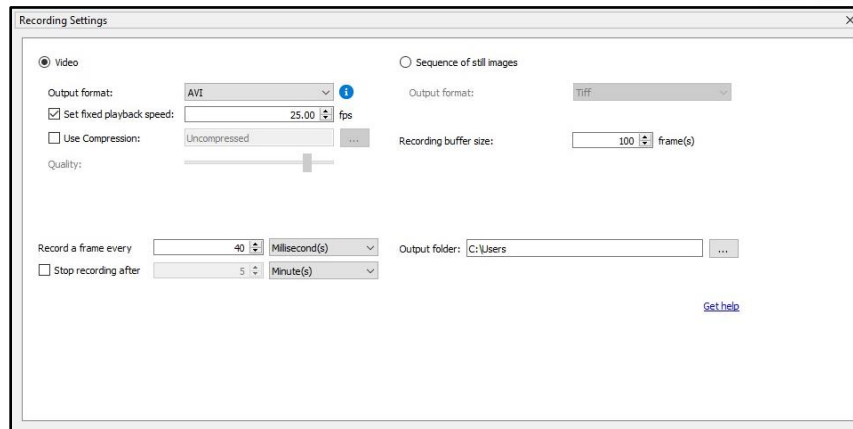

The playback speed (in frames per second), a method for compressing files, directory for saving the files and measurement rate ("Record a frame for every" x Millisecond(s) dialog) can be specified in this dialog.

Note: The collection parameters set in **The MotionMonitor xGen** will trump whatever is placed in the Window|Recording Settings dialog. These settings are only used for testing and are software dependent.

Close Pylon viewer and proceed to **The MotionMonitor xGen**.

If performing data collection on a laptop system, the following settings must also be confirmed to ensure optimal video performance. These settings should be reviewed before each data collection session, as they may not be retained when Windows Updates are performed.
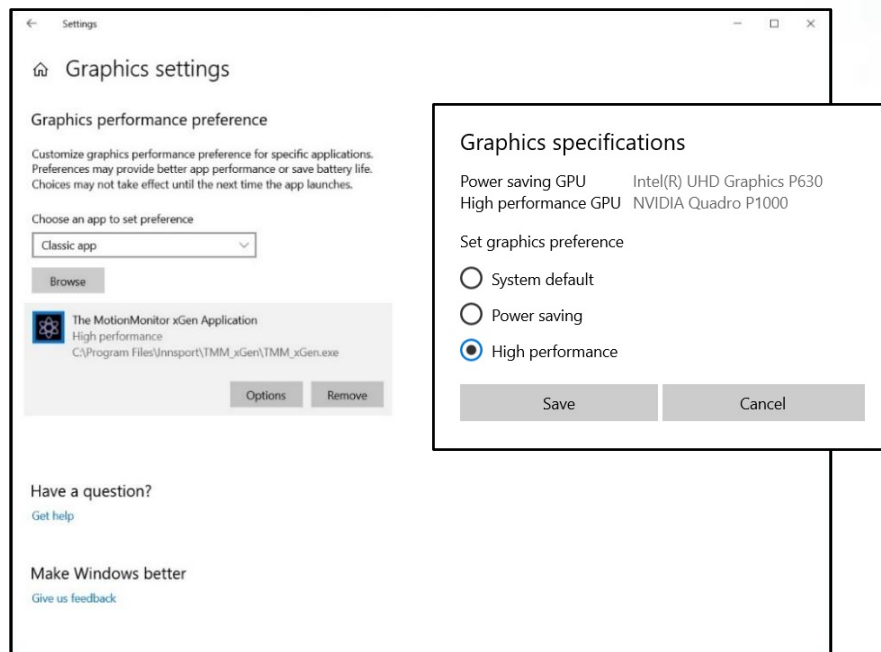
6.   Right click on the desktop and select Display settings.
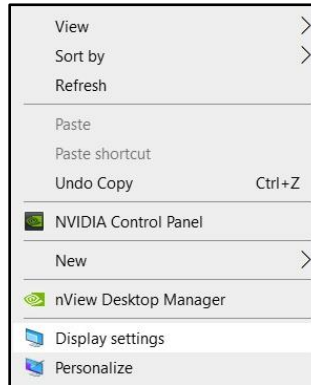

7.   Select Graphics settings.
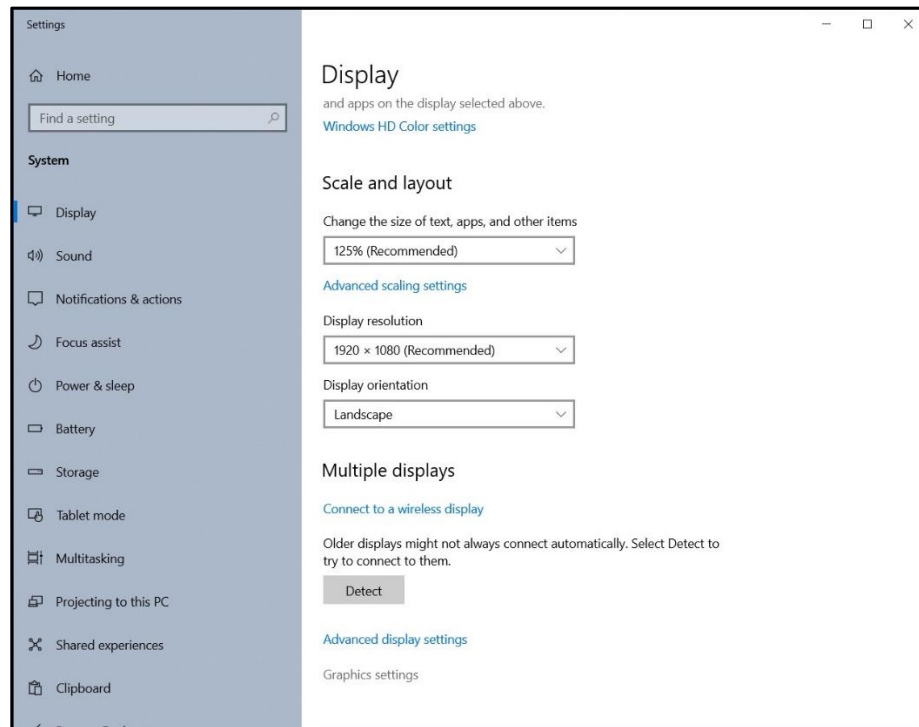
8. Confirm that The MotionMonitor xGen Application is set to "High performance", as shown below. The installer version 3.74 and later versions of The MotionMonitor xGen will automatically set this value for the application.


Additionally, to ensure optimal video performance and the identification of your device on all systems, it is recommended that any Windows power management functions for USB devices be disabled in Device Manager and through the Advanced Power settings for your Windows power plan.
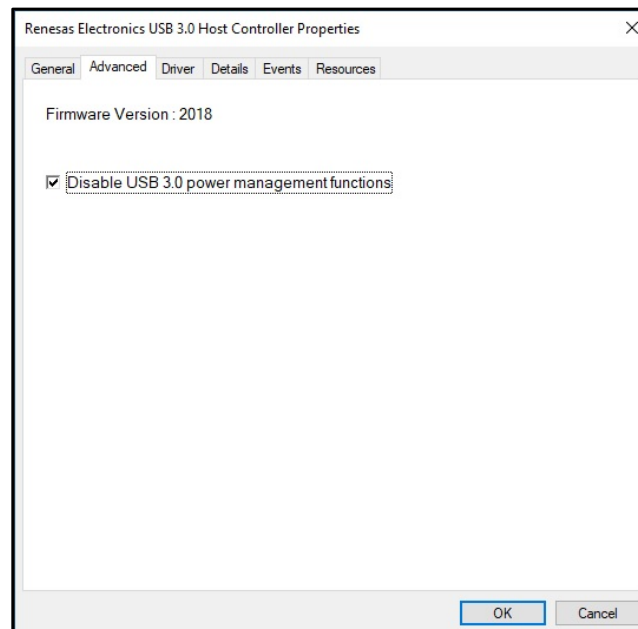
After your Basler device has been configured in Pylon Viewer and your computer has been optimized for use with a Basler device, proceed through the following steps to configure your Basler device within The MotionMonitor xGen.

9.   Start The MotionMonitor xGen and go to the Setup Components Window.

10.   From the Hardware node in the Setup Components window add the Camera device through the Add button at the bottom of the Components window or right-click on the Hardware node to add the device.
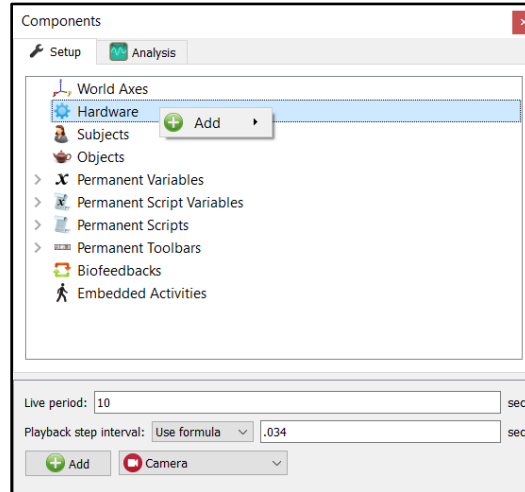
Note that the Playback step interval in the Hardware parameters panel has been set to 0.034 seconds. This interval controls the number of frames that the playback cursor is advanced when clicking on the slider bar with the mouse within an activity. In this example, the step interval was set to 0.034 seconds, which would correspond to a 30 frames per second measurement rate.

11.   From the Camera Device parameters panel, click on the Setup and Advanced arrows to expand the parameters for the Camera device.   Based on the software release key, you may see all or only some of the following features. Typically, the Setup and Advanced sections will only need to be modified during the initial configuration.

Under the Setup section, select "Basler" for the camera type and enter or select the camera Serial Number from the "Select" button. The "Transformation type" can be selected from the drop-list if a particular video image orientation is desired.

The features available under the Advanced section will depend on how your software is released.

The Strategy and Encoder refer to the method and GPU used for encoding the video. The Classic strategy will use CPU and the Fast method will use GPU for encoding and is capable of processing images into video at a much higher rate. The JPEG quality, Bitrate, GOP Size and Container type are all parameters that determine how the video file will be generated and determine the quality of the resulting video file.

The Frame rate field is not editable and will display the measurement rate for the device, which would have been previously set through the Pylon Viewer application.

The "Calibration grid to use" and other Calibration edit fields under it, allow for the camera to be aligned with other hardware devices for video overlay purposes or for use when performing video collections for Markerless motion capture AI's. Please refer to the software guide for performing digital video camera calibrations for details on these settings.

The "Selected audio source" settings are for future development use and should not be modified.

The "Viewfinder" checkbox allows for the display of video in the Live window to be toggled on and off. It is recommended to disable the viewfinder when multiple video devices are being used during data collection. This will reduce computer resources in use while performing critical data collection and data alignment procedures. The Viewfinder can be disabled/enabled with a script command, so toggling the Viewfinder before and after each recording would not need to be performed manually. More RAM will also be used when performing recordings with the Viewfinder enabled.

Click the "Activate" button when the desired settings have been selected and to view the real time display of the camera or to perform recordings.

12. The time required for processing and alignment of video files can vary depending on the video length, frame rate, and resolution as well as the encoding Strategy selected and computer specifications. The method in which video files are processed for alignment can be selected from the Edit Recording Parameters dialog. Click on the Record|Edit Recording parameters menu or Edit Recording parameters icon.
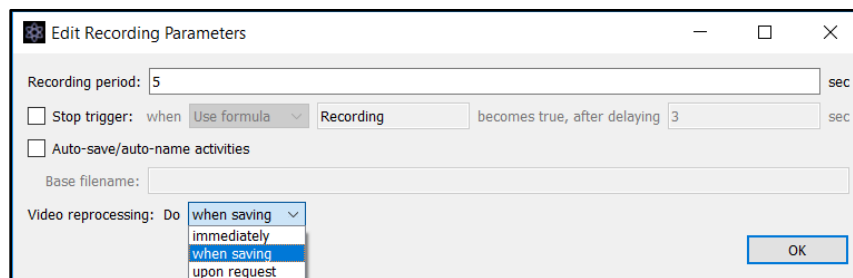

Video files can be processed "immediately" after the recording has completed, "when saving" the activity file or "upon request", which results in the software prompting the user to run the reprocessing each time the activity is opened, until the reprocessing has been performed.

Batch processing of activity files with the video reprocessing set to "upon request" can be performed through the File|Reprocess Video menu in the Live Workspace window or File|Reprocess in Background menu.
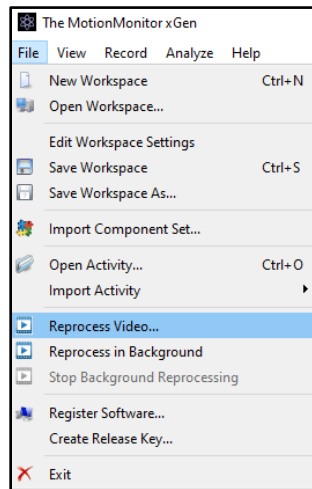
The Reprocess in Background option allows for video files to be reprocessed in the background while subsequent Activities are being recorded or while performing other tasks. It is typically recommended to run this feature from another instance of The MotionMonitor xGen software on the same computer or on a networked computer where you would be selecting the same User ID as where the saved Activities are located. Running from a separate instance will help ensure that any data collection threads aren't interfered with by the background processing threads.
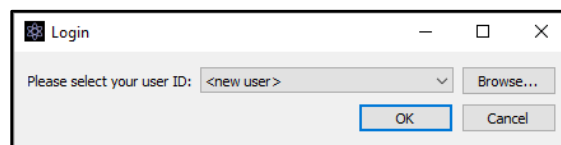
13. When opening an activity with camera data, the camera window will display the current time in the activity playback, a progress bar for the current time, and the total time of the video file at the bottom.