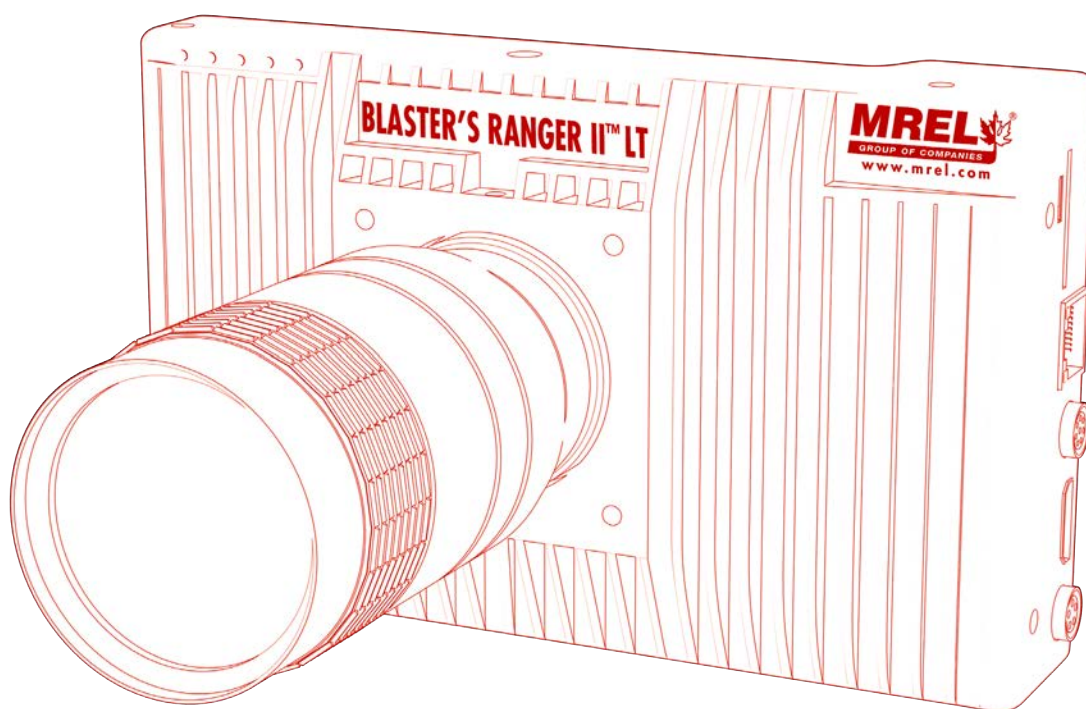




Operations Manual

Edition 1.1



MREL GROUP OF COMPANIES LIMITED

5-779 Sir John A MacDonald Blvd. Kingston, Ontario K7L 1H3 Canada

T: +1-613-545-0466

E: contact@mrel.com

www.mrel.com

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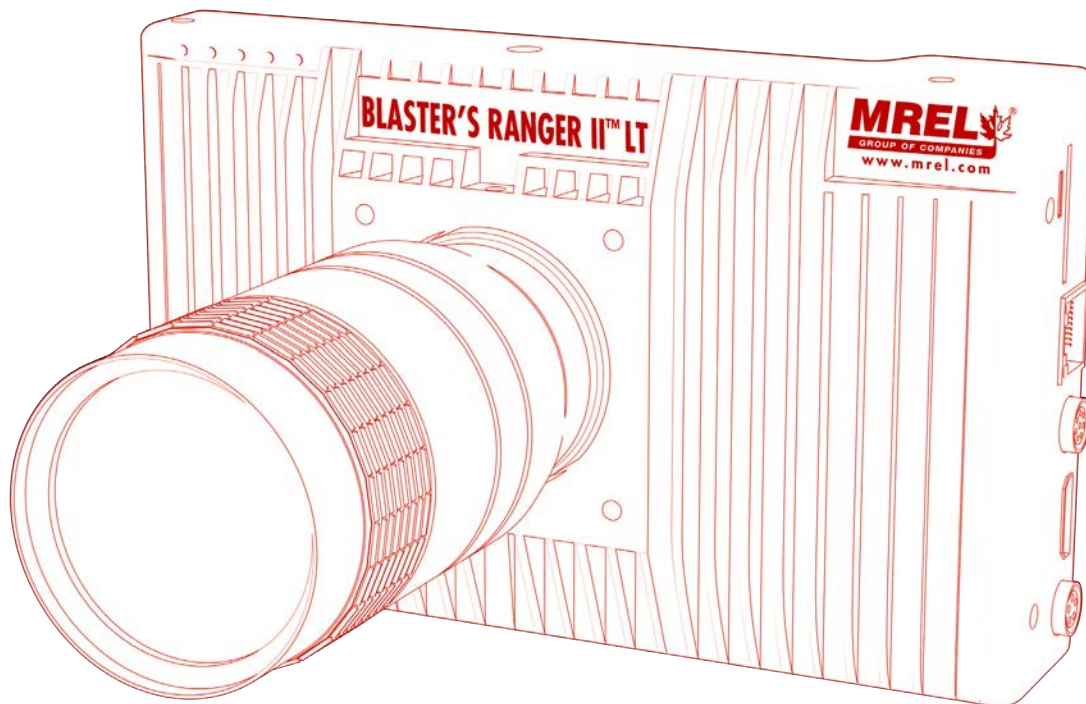
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Chapter 1

Introduction



Overview

This Chapter provides an introduction to high speed photography and to high speed photography of blasts.

1.1 Introduction

Congratulations on your purchase of a **Blaster's Ranger II™ Lt high speed digital video camera** system. This Operations Manual provides instructions on the use of the hardware supplied with the **Blaster's Ranger II™ Lt**.

1.2 High Speed Photography¹

High speed photography is the practice of recording photograph images in rapid succession for playback at a lower speed. The event can then be viewed in what is commonly referred to as "slow motion". Standard video plays at a rate of 33 frames per second (fps) because standard video cameras record at 30 frames per second. However, it is possible to magnify the time scale if the playback speed is slower than the recording speed. The following is a simple equation to express time scale magnification in terms of the recording and playback speeds:

$$(1) \quad \frac{\text{Camera Recording Rate (fps)}}{\text{Viewing Rate (fps)}}$$

For example, a blast is recorded at 500 fps and played back at 10 fps. The time scale is therefore magnified 50 times, and as such the event will appear to occur 50 times slower in playback. If the event took two seconds to occur, it will now run for 100 seconds in playback.

The human eye cannot accurately resolve motion that occurs in less than 1/4 of a second. Short duration events such as a blast cannot be visually analyzed without the use of high speed photography.

1.3 High Speed Photography of Blasts¹

High speed film cameras have been used by blasters to assist in optimizing blasts for many years. With the evolution of the high speed digital camera, blasters are now able to play, pause, and analyze a blast in perfect clarity as soon as the event has occurred!

It is the goal of the **Blaster's Ranger II™ Lt High Speed Digital Camera** to put the simplicity of digital video editing and analysis into your hands without sacrificing the resolution that has typically accompanied high speed film cameras of the past.

One of the major concerns of a surface mining operation is the high cost of drilling and blasting. In some mines operating in hard taconite-iron formations, this can account for 60% of the mining costs. In coal operations, blasting can be used to excavate nearly 50% of the overburden material. With the aim of reducing costs, mine personnel have been attempting to optimize blasting operations. In the past, blast designs have been based largely on the personal experiences of the blasting crew, and blast evaluations were done by visual observations - with changes being made on a trial and error basis. This traditional approach is gradually being replaced by a technology based on the concepts of energy input per ton of rock, fragmentation and rock movement, along with the use of high speed video for the analysis of the blast movement.

High speed video has two main uses in helping to optimize surface blasting results. The principal use is the direct photography of the blast, with the analysis of the resulting video and/or digital images representing the bulk of the optimization work. However, high speed video also can be used to analyze and inspect the performance of individual blast components, particularly the actual delay times for such accessories as detonating relays, down-the-hole delays and other delaying and initiating systems.

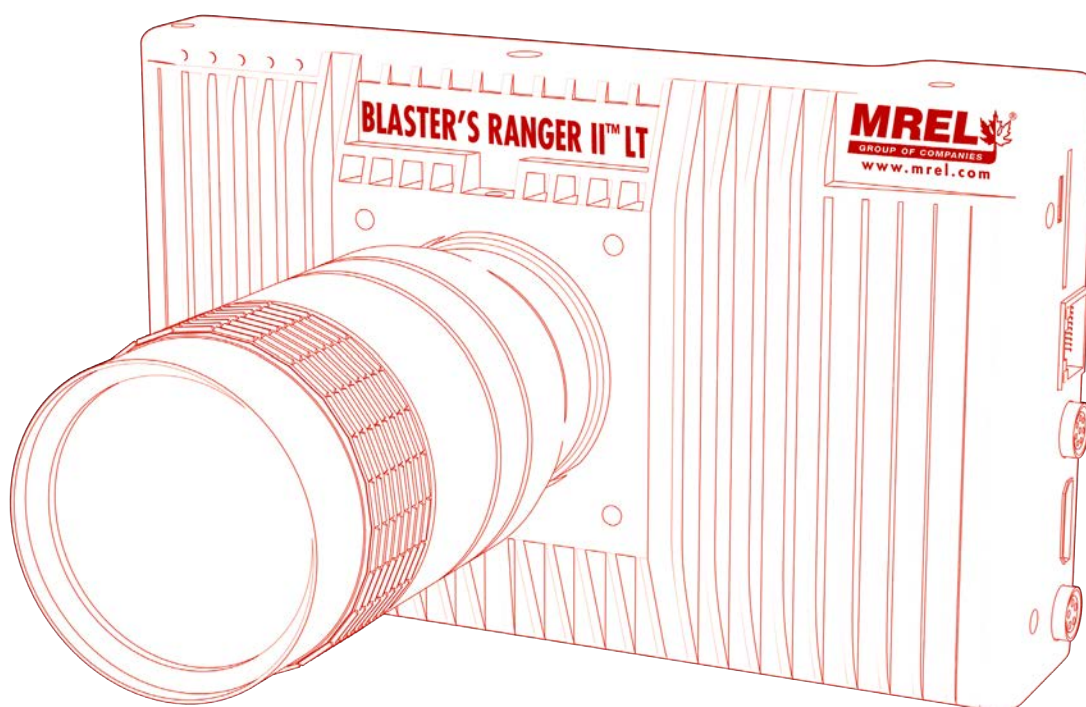
The information that may be obtained from high speed video includes: the firing sequence of the blast; the location of the first rock movement and the shape of the face movement; the occurrence of gas venting at the face; the degree of confinement due to stemming; the occurrence and location of misfires; the nature of the muck-pile formation; the onset time for rock movement (both at the face and at the top of the bench); the acceleration, velocity and direction of flyrock travel from the face and the top of the bench; the hole venting and stemming ejection velocities; the actual hole/deck delay times; and the casting range of the muck.

With proper preparation and care during the set-up, operation and analysis, considerable information may be obtained which can suggest where improvements may be required in the blasting operation. In addition, the video provides a permanent record of the event and allows any changes made between blasts to be easily and accurately analyzed. Before the introduction of high speed photography, what occurred during a blast had to be inferred from observing the results after the fact. With high speed digital video photography, many of these phenomena and occurrences can now be observed "as they happen".

1. "High Speed Photography in Open Pit Blasting" by Mining Resource Engineering Limited. March 1983. ISBN 0-9691314-0-2. Available from the International Society of Explosives Engineers (www.isee.org).

Chapter 2

Hardware



Overview

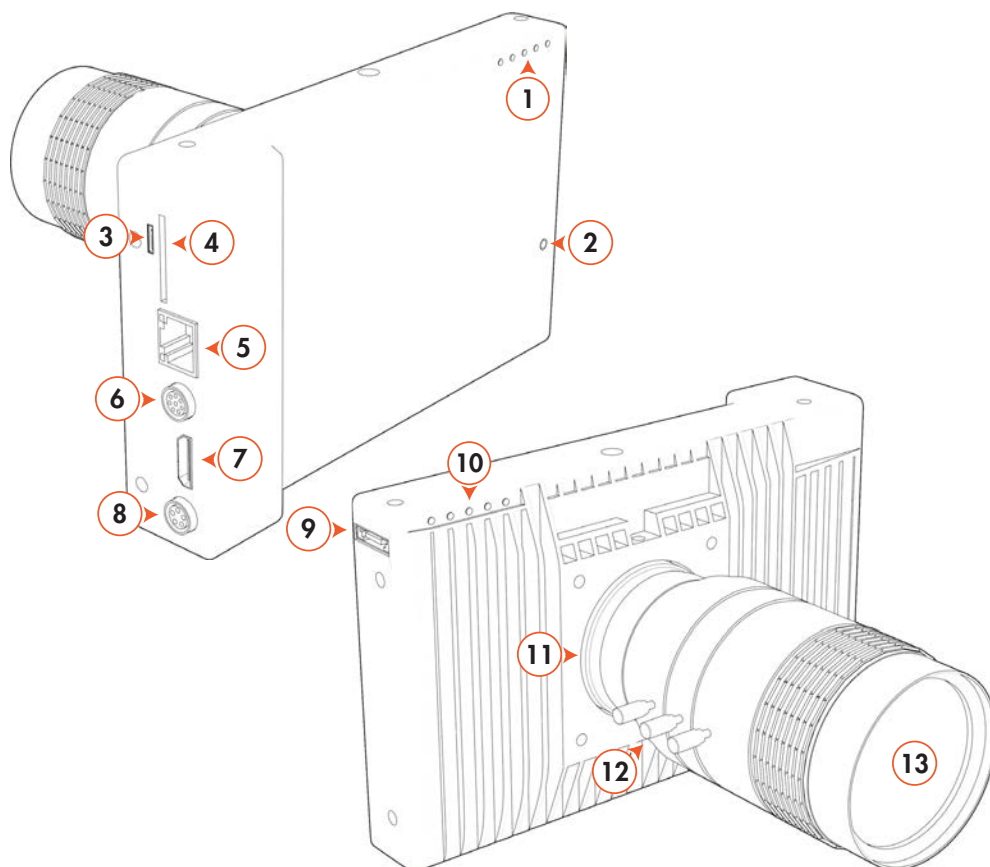
This Chapter describes all of the hardware components provided with the **Blaster's Ranger II™ Lt High Speed Digital Video Camera**.

2.1 Blaster's Ranger II™ Lt High Speed Digital Video Camera

The **Blaster's Ranger II™ Lt High Speed Digital Video Camera** is encased in a rigid steel housing. The housing is sealed to resist dirt and moisture and is equipped with many connection ports: the **Ethernet Communication** port and the **Blaster's Ranger II™ Lt I/O Cable** port. The **Blaster's Ranger II™ Lt I/O Cable** is comprised of a total of three connectors: **Sync In**, **Sync Out** and **Trigger In**.

Photographs of the **Blaster's Ranger II™ Lt** are shown below. The **Mounting Adapter** is attached to the bottom of the **Blaster's Ranger II™ Lt** to allow the **Blaster's Ranger II™ Lt** to be quickly mounted onto the **Tripod's Grip Action Ball Head** (shown in **Section 2.2.3**). The **Mounting Adapter** and the **Tripod's Grip Action Ball Head** are part of the **Blaster's Ranger II™ Lt Accessories Package**. The **Blaster's Ranger II™ Lt** is equipped to accept any standard **C-Mount** or **F-Mount Lens** depending on the resolution of the camera.

- | | |
|----------------------------------|------------------------------------|
| 1. Camera Function Lights - Back | 8. Power Port |
| 2. Power On / Off Button | 9. eSATA Port |
| 3. USB Port | 10. Camera Function Lights - Front |
| 4. SD Card Port | 11. C-Mount Connect |
| 5. Ethernet Port | 12. Camera Lens Focus Rings |
| 6. I/O Port | 13. C-Mount Lens |
| 7. HDMI Port | |



2.2 BLASTER'S Ranger II™ Lt ACCESSORIES

2.2.1 Protective Carry Case

The **Carry Case** is designed to contain, for transportation and storage all the components required for setup and use of the **Blaster's Ranger II™ Lt** in the field. The **Carry Case** is a pelican case which has water resistance capabilities.



2.2.2 Zoom Lens

The **Blaster's Ranger II™ Lt** is supplied with a **Zoom Lens** appropriate for imaging of blasts. The **Zoom Lens** (80-200 mm) is for the model of resolution of **1280X1024**, and shown to the right. **Zoom lens** (12.5 – 75 mm) is for the model of resolution of **800X600**.



2.2.3 Tripod and Grip ball Head

This is an all aluminum **Tripod** with a 3/8" mounting screw. This **Tripod** is designed to support the **Grip Action Ball Head** with the **Blaster's Ranger II™ Lt** attached. This is the only item that does not fit inside the **Protective Carry Case**.



2.2.4 Blaster's Ranger II™ Lt DC Power Cable

The **Blaster's Ranger II™ Lt DC Power Cable** is used to connect to a 12V DC battery, the external DC power supply with a range of 12-26 VDC



2.2.5 Blaster's Ranger II™ Lt I/O Cable

The **Blaster's Ranger II™ Lt I/O Cable** is comprised of a total of three connectors: **Sync In**(blue), **Sync Out** (green) and **Trigger In** (red).



2.2.6 Blaster's Ranger II™ Lt AC Adapter

The **Blaster's Ranger II™ Lt AC Power Cable** will connect to a 110V to 220V power source.



2.2.7 Trigger Switch Cable With Button

The trigger cable with switch allows the user to trigger the camera at a distance. The user can extend this cable with the appropriate BNC connectors and a reel of RG-58 coaxial cable.



2.2.8 SD Card

The **Blaster's Ranger II™ Lt** is shipped with a 16GB high performance **SD-Card**.



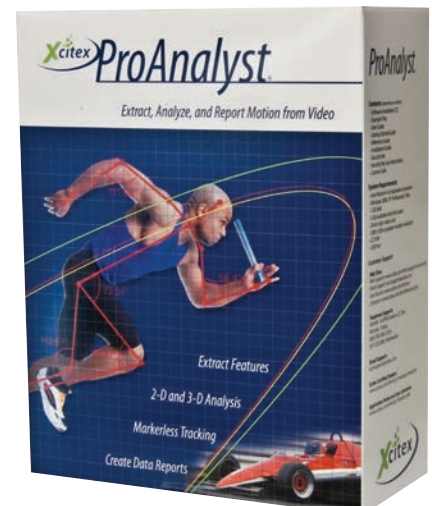
2.2.9 USB Communication Cable

It is a USB-A to USB-Micro-B cable. Once connected via the **Blaster's Ranger II™ Lt** OTG port to a PC, any mass storage device on the camera can be accessed by the PC. This includes an SD-Card, Solid State Drive, or thumb drive in the USB port.



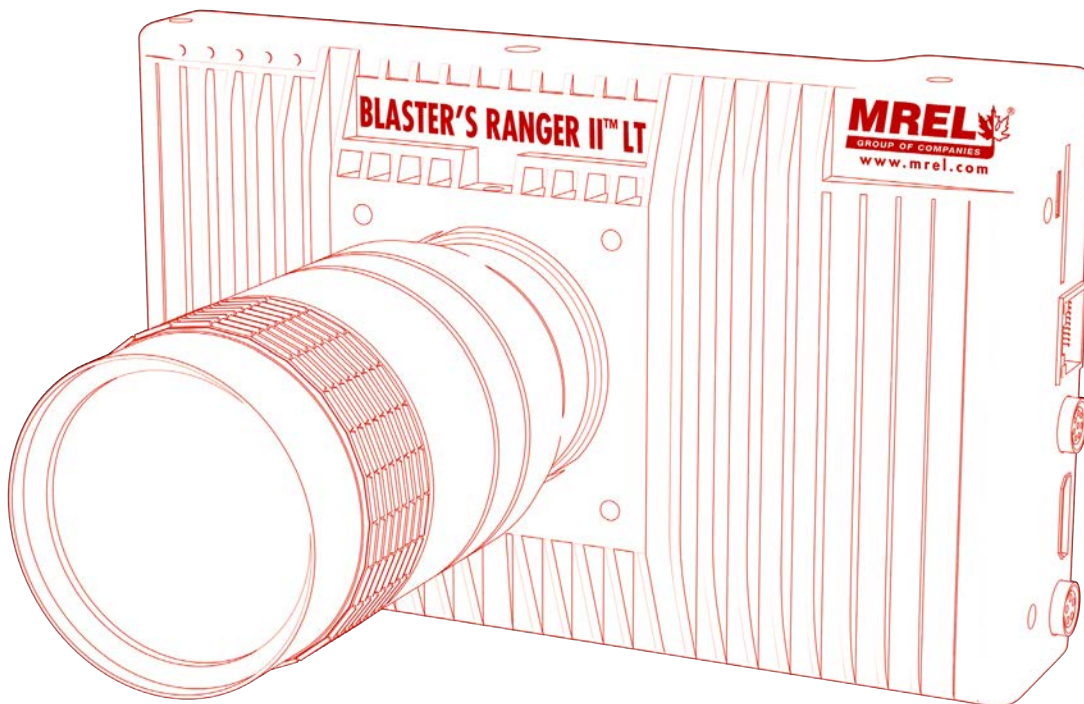
2.2.10 ProAnalyst® Introductory Edition Software

ProAnalyst® Introductory Edition allows auto-tracking of one feature, and manual tracking of up to 32 features. **ProAnalyst®** allows the user to export data to Excel or Matlab with ease for further analysis or graphing. This software is provided under licence from Xcitex, and as such requires the use of the included software key for installation. Instructions on using **ProAnalyst® Introductory Edition** are included in **Chapter 7**.



Chapter 3

Getting Started



Overview

This chapter provides an outline of how to setup the Blaster’s Ranger II™. This chapter assumes that the User will first want to unpack the Blaster’s Ranger II™ Lt and set it up in an office environment in order to learn the camera controls.

3.1 Introduction

This chapter provides a detailed description of the setup procedure for the **Blaster’s Ranger II™ Lt**. For instruction on using the **Blaster’s Ranger II™ Lt**, please refer to **Chapter 4** and **5**. For Instruction on using the **Blaster’s Ranger II™ Lt** in the field, please refer to **Chapter 6**.

Figure 1: Attaching the DC Power Supply

3.2 Powering Up

The **Blaster’s Ranger II™ Lt** is powered by the external **12V power supply cable** or the **AC adapter** provided, which is included with the camera.

3.2.1 Attaching the External DC Power Supply

The **12V DC Power Supply** operates on 100-240VAC, 50-60Hz. The socket is a standard IEC 13, used worldwide for all types of electronic equipment.

- 1. Attach a power cord to the power supply and connect it to an AC power outlet.
- 2. Attach the power supply output cord to the camera via LEMO connectors. The LEMO connector is keyed: the red dot on the connector will face the LCD side (back) of the camera.

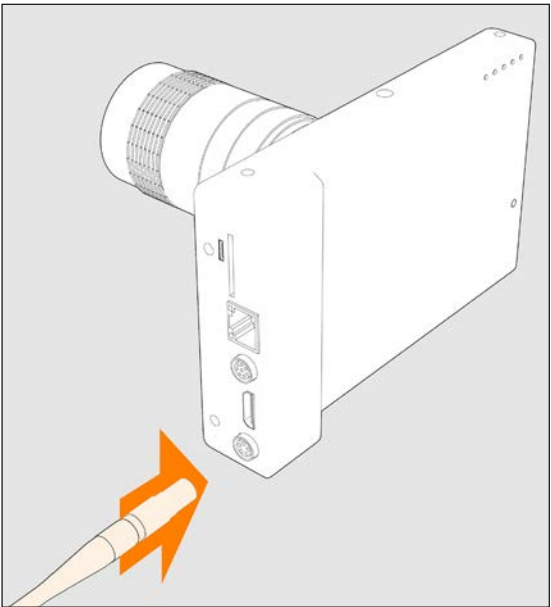


Table 1: Battery LED States

Operating / Charging	Charge Status	LED Behavior
Operating	>15%	Green
Charging	> 15%	Blinking Green
Operating	< 15% > 5%	Amber
Charging	<15% >5%	Blinking Amber
Operating	<5%	Blinking Red
Charging	<5%	Blinking Red
Operating	Not Installed	Blue

3.3 Camera Setup

There are several precautions that must be remembered prior to using the **Blaster’s Ranger II™ Lt**. The suggested procedure for assembly of the system is detailed in the following sections.

3.3.1 Blaster's Ranger II™ Lt Setup

Open and extend the **Tripod** legs. Attach the **Grip Action Ball Head** to the top of the **Tripod** using the 3/8" screw mount. Remove the **Mounting Adapter** from the top of the **Grip Action Ball Head** and connect the threaded screw of the **Mounting Adapter** to the bottom of the camera. Be sure that the **Lens** arrow is pointing towards the front of the Lens. Attach the **Mounting Adapter** to the **Grip Action Ball Head**. Secure the camera using the locking lever located on the **Grip Action Ball Head**. It is also good practice to utilize the locking camera.

DO NOT over tighten the lens! The lens should be "finger tight" only--just tight enough that you can adjust focus and aperture without unscrewing the lens. See **Figure 2: Mounting the lens**.

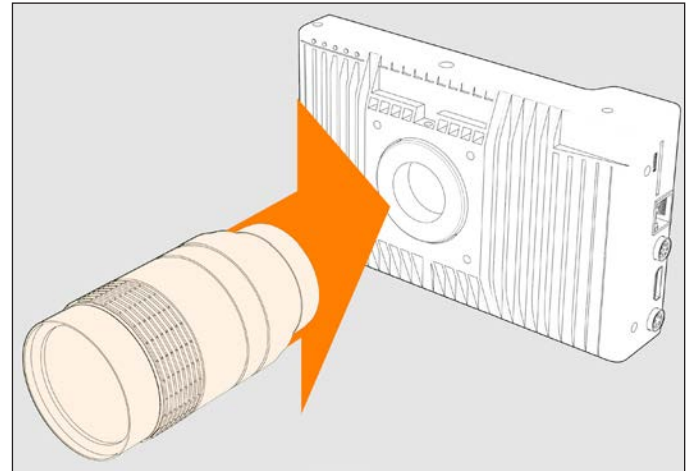


Figure 2: Mounting the lens

3.5.2 Mount the F-Mount Zoom Lens to the camera

If you have the high resolution 1280 X 1024 camera, it is a F-Mount with a 80-200 mm lens. Remove the lens receptacle cover from the camera's F-mount. This is a cover that is installed at the factory to protect the camera optics and sensor from dust contamination.

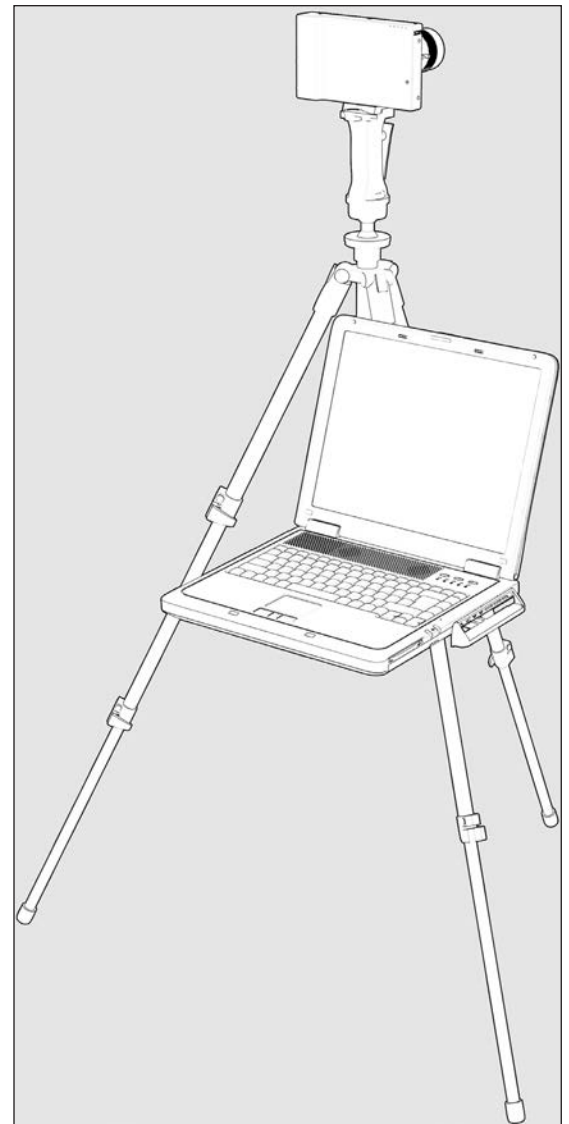
NOTE: Whenever threading lenses on or off the camera, face the camera lens down so that any contamination on the threads will tend to fall away from the camera rather than into it.

Thread the F-mount lens into the lens mount located in the front of the camera. **DO NOT** over tighten the lens! The lens should be "finger tight" only--just tight enough that you can adjust focus and aperture without unscrewing the lens.

3.3.3 Blaster's Ranger II™ Lt I/O Cable and Trigger Switch Cable

The **I/O Cable** has 8-pin LEMO camera connector and BNC connectors for **Sync-In**, **Sync-Out**, and **Trigger-In**. The **Trigger** switch cable is attached to the Trigger-In connector. See **Figure 4: I/O Cable and Trigger**.

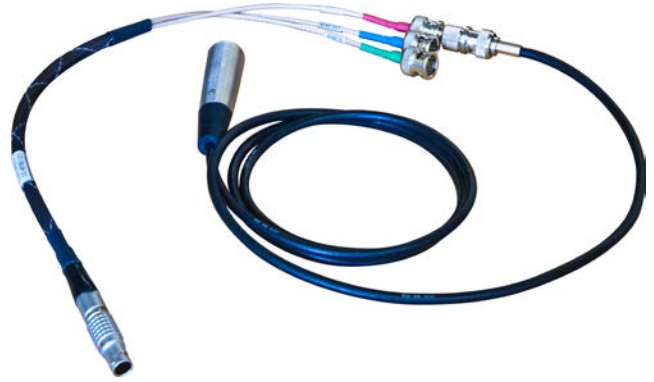
Figure 3: Blaster's Ranger II™ Lt Complete



3.3.4 DC Power Connection

The camera can be powered by a 12 V AC/DC adapter or the external 12V DC battery.

Figure 4: I/O Cable and Trigger

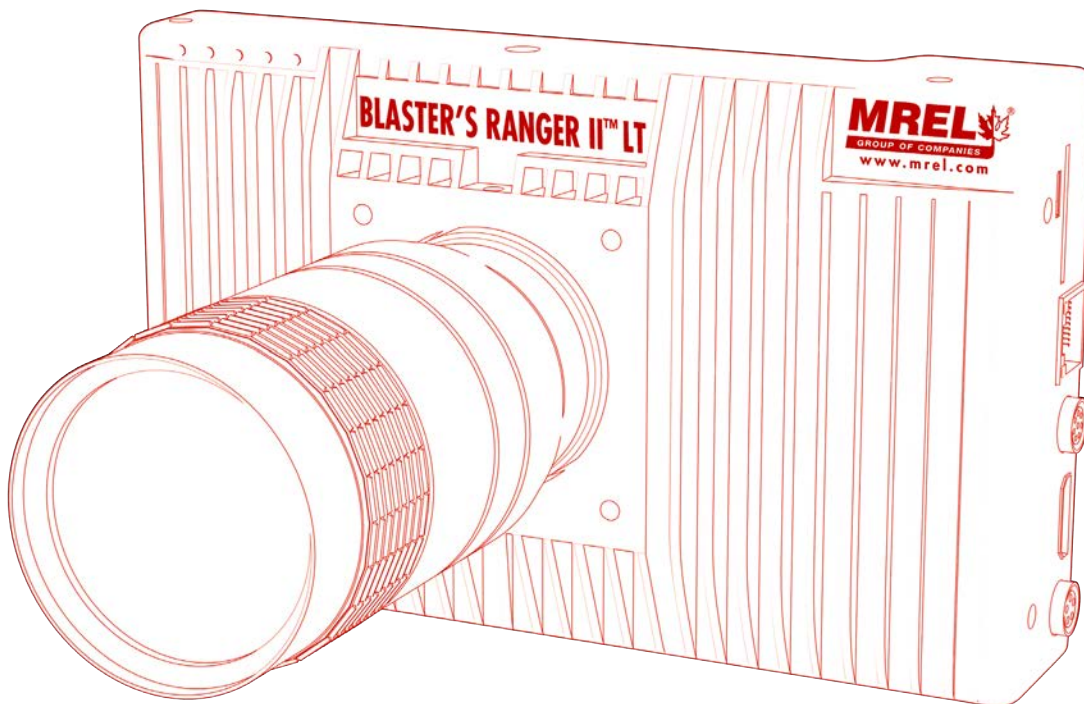


3.3.5 Ethernet connection

Connect the camera with your laptop, a computer or a network switch using one **cat5** or **cat6** straight through Ethernet cable.

Chapter 4

FasMotion



Overview

This chapter provides an outline of how to setup the Blaster's Ranger II™ Lt for recording, viewing, and saving events.

4.1 Install FasMotion Control Software on PC or Mac

Before we can begin setting up the camera, you must first install the Fastec FasMotion Controller software. The FasMotion software install program is available on the MREL USB thumb drive that shipped with your camera. With it you may configure all recording parameters including **Record Mode**, **Session Length**, **Resolution**, **Frame Rate**, **Exposure**, **Color Balance**, **Autosave**, **Trigger point**, and **Sync** options.

4.1.1 To install FasMotion on a Windows PC:

1. Run the FasMotion executable on your PC. The file will have the format: FasMotion<OSbit><version>.exe. For example, FasMotion64_2.1.13.exe would be version 2.1.13, on a 64 bit Windows machine. If your Windows is a 32 bit machine, then use the other one, FasMotion32_2.1.13. It is recommended that you copy the install file to the hard drive of your PC for safekeeping.
2. The Windows Account Control will display a message asking if you want to allow the installer to make changes to your computer. Answer "Yes."
3. The Installer Setup window will appear as shown informing you that the install process has begun. Click on "Next."
4. The next window allows you to choose a location for the program. Select a location and click on "Next."
5. The next window gives you the option on creating a shortcut for FasMotion in the directory of your choice. Select a directory for a shortcut or click the "Do not create shortcuts" check box. Click on "Install" to continue.
6. FasMotion will now be installed on the PC. A window with a progress bar will appear and inform you when the install is complete.
7. The final install window gives you the option to run FasMotion software and a link to the Fastec web page. Click on "Finish" when done to exit the install program.

4.1.2 To Install FasMotion on your Mac:

FasMotion software has been tested on Mountain Lion (10.8) and Mavericks (10.9). Some of the best file transfer performance we have seen has been using a MacBook Pro (2014 model: 8GB RAM, Intel (R) Core(TM) i7-4750HQ) with an SSD, running Mavericks and Windows 7 Professional (BootCamp).

1. Copy FasMotion.dmg to your Mac.
2. Double-click on FasMotion.dmg to run. A Window will open with icons for FasMotion and the Applications folder.
3. Drag the FasMotion icon into the Applications window.
4. If you are updating FasMotion it is recommended that you only use the version of FasMotion that matches the camera firmware version. Do not keep the old version of FasMotion unless you need it for cameras that are not on the same version as the FasMotion software you are loading.

4.2 Language Selection in FasMotion

To select a language in FasMotion:

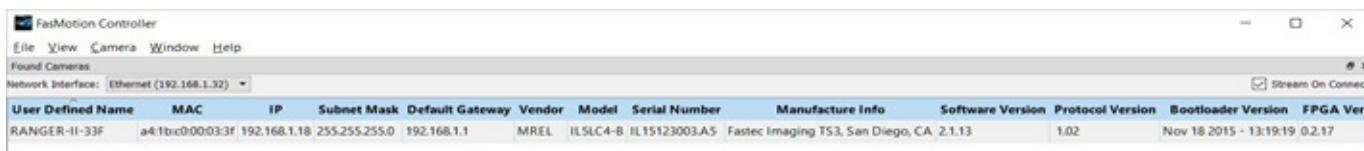
1. Open the FasMotion Application
2. Click on View
3. Select Language from the View Menu
4. Make your language selection

4.3 Connect the Camera to a Wired Network

The **Blaster's Ranger II™ Lt** requires a network connection for setup and control via FasMotion software or the built-in Web-App. This section addresses the use of FasMotion. The default network configuration for the **Blaster's Ranger II™ Lt** is static IP address 192.168.1.18.

To attach the **Blaster's Ranger II™ Lt** to a network:

1. Before connecting to power, connect the **Blaster's Ranger II™ Lt** to your network via a switch or router, or directly to your PC using CAT 5E or CAT 6 Ethernet cable.
2. Power up the **Blaster's Ranger II™ Lt**.
3. Watch the LEDs on the camera's RJ-45 connector. When the camera connects to the PC or local network the green LED will begin to blink in a pattern depending on connection speed.
4. Start the FasMotion software application.
5. Select a camera from the "Found Cameras" list in FasMotion. Double-click to open.



The screenshot shows the 'FasMotion Controller' window. The 'Found Cameras' section displays a table with the following data:

User Defined Name	MAC	IP	Subnet Mask	Default Gateway	Vendor	Model	Serial Number	Manufacture Info	Software Version	Protocol Version	Bootloader Version	FPGA Version
RANGER-II-33F	a41bxc00033f	192.168.1.18	255.255.255.0	192.168.1.1	MREL	IL5LC4-B	IL15123003A5	Fastec Imaging TS3, San Diego, CA	2.1.13	1.02	Nov 18 2015 - 13:19:19	0.2.17

Note: It is possible to use a wireless adapter on your PC, but it is not recommended because of performance issues.

6. Make sure the "Stream Video Upon Connection" box is checked if you wish to view live video when the camera connects.

Note: If the camera you are looking for does not appear on the list, you can click on the Find Manually button and enter its IP address.

4.4 Managing Camera Network Settings in FasMotion

The network settings of the **Blaster's Ranger II™ Lt** may be configured using the Network Configuration dialog in FasMotion:

1. Click on the camera you wish to manage (do not double-click) to highlight the selection.
2. Right click, Change IP Address...or from Camera...Configuration...Network...

From this dialog you may select DHCP if you wish for the camera to receive an IP address dynamically from your DHCP server or if you wish for the camera to establish a Local Link Address. Or you may select Static and edit the IP Address, Net Mask, and Gateway to work with your established network, as default: 192.168.1.18.

4.5 WiFi Setup

If you bought the WiFi option, you can configure the WiFi Config settings.

The "WiFi Config..." element in the FasMotion Configuration menu will only appear if the attached camera is in Live mode and has been factory licensed for WiFi and has its WiFi dongle attached via its USB port.

Note: The camera may not be operated via WiFi in FasMotion.

4.5.1 WiFi Setup for an Existing Network

1. Select WiFi Config... from the Configuration Menu.
2. Click on the Scan button to see a list of local WiFi networks.
3. Select a network from the "Select WiFi Access Point" dialog. You will most likely wish to leave DHCP selected unless you are familiar with the network and wish to supply a valid IP address, net mask, and gateway.
4. Type in the password, if needed and then click on OK. The dialog will close.
5. If you selected DHCP, you can re-open the WiFi configuration dialog after a few minutes and you will see the assigned IP address for the camera.

4.5.2 WiFi Setup for an Ad Hoc Network

1. Select WiFi Config... from the Configuration Menu.
2. Click on the Manual button. This will allow you to edit the name in the SSID box. Make up a unique name for your network and enter it here.
3. Check the Ad Hoc checkbox and then, leaving the DHCP radio button selected, click on OK.
4. The dialog box will close. If you reopen it in a couple of minutes you will be able to read the IP address assigned to the camera.

4.5.3 Connecting to the Camera via WiFi

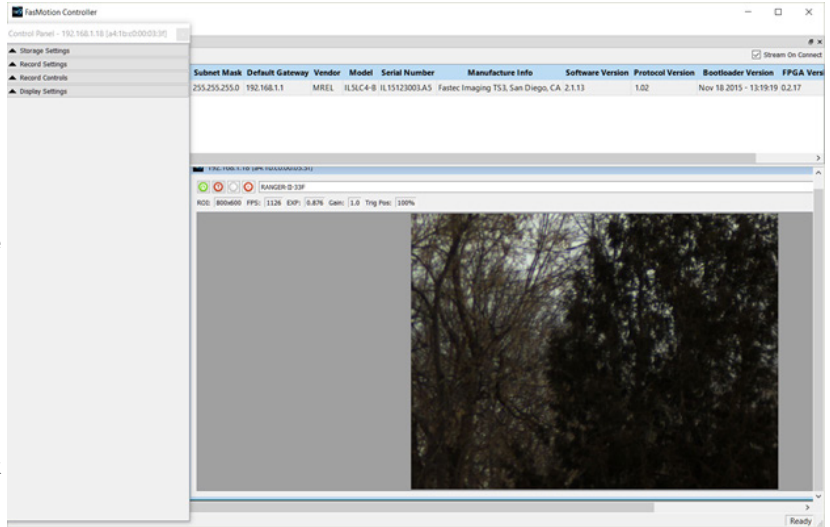
1. Open the Wireless network settings utility on your computer or mobile device. You will see a list of available wireless networks.
2. From this list, select the wireless network the **Blaster's Ranger II™ Lt** is using as seen in the WiFi line in the camera's System Menu.
3. Enter the password, if any.

The **Blaster's Ranger II™ Lt** and your computer or mobile device are now both connected to the same wireless network. Follow the instructions in "Connect to the **Blaster's Ranger II™ Lt** Outside FasMotion" to use the **Blaster's Ranger II™ Lt** wirelessly with the Web-App.

4.6 FasMotion Application Window

As soon as a camera is connected via FasMotion, two additional dockable windows appear. To the left, you see the Control Panel, which has five tabs: Storage Settings, Record Settings, Record Controls, Display Settings, and Autosave Setup. To the Right, you see the image window.

The Control Panel may remain docked to the left side of the FasMotion application window or be moved outside of the application window to any location on your desktop. If you use two displays, you may wish to move the Control panel to your extended desktop in order to give yourself a larger image window. The Control Panel detaches by clicking on the gray border at the top. To return the Control Panel back to the application window, just double-click on that same border. FasMotion...Window...tick Control Panel if you can not see the control window on left.



The Image Window may be detached and moved and/or resized, but it always stays within the bounds of the application window. To detach it, click on the "minimize" button in the upper right corner (circled in red). To restore the window, click on the "maximize" button (in the same location). The Video Controls pane will appear at the bottom of the Application Window whenever a video is open for review. This is another detachable pane that may be moved outside the application window by grabbing its top border. Double click on the same border to restore it to its original position.

4.7 Controlling the Image Displays

The View Menu contains zoom controls that are replicated at the top of the application window. These control the size and shape of the Image Window.

4.7.1 Setting Default Gamma:

User Preferences is in the Camera menu.

The Default Gamma setting is used to set the default output Gamma for displayed and saved images.

The default Gamma is 1.0 (linear). Many laptop computer displays have a Gamma of 1.0, while most larger flat panel LCD monitors have a Gamma of 2.2.

Note: Changing the Default Gamma setting does not change the current Gamma of the camera, it sets its reset value. To set the Gamma of the camera to a new default, navigate to the Display Settings tab and select "Reset Light and Color Settings."

Two screen shots of a high-contrast image to demonstrate the difference in appearance between Gamma 1.0 and 2.2. These images were displayed on a monitor with a 2.2 Gamma.

The first image, with Gamma set to 1.0, appears very dark on this display. If the lens is opened or the exposure increased, the dark areas will gain detail, but the brighter areas will saturate.

In the second image, with Gamma set to 2.2 to match the display, the detail in the shadows is evident.

Note: The opposite would happen if the display had a Gamma of 1.0: the first image would have looked good, while the second would have appeared washed out.

4.7.2 Display Rate for live images:

The display rate for live images in FasMotion may be adjusted using the spinner at the top of the Image Window. This number will automatically change according to the performance of the network and the PC.

There is also a pause/play button on the top of the Image Window. This may be used to temporarily start and stop the video stream.

4.7.3 Setting up the HDMI display:

The **Blaster's Ranger II™ Lt** has an HDMI output that can be used for displaying both live and recorded images. The HDMI port is located on the side of the camera between the Power and External I/O connectors.

To enable the HDMI output click on the HDMI button on the Display Settings Tab and select the resolution you wish to use.

Note: The images from the camera will be scaled to fit the HDMI display screen while maintaining aspect ratio. This means that there may be black borders on the sides or top and bottom of images, depending on aspect ratio and best fit.

4.8 Name the Camera

When the **Blaster's Ranger II™ Lt** leaves the factory its default name is **Blaster's Ranger II™ Lt -xx**, "xx" being the camera's serial number. The camera name can be used both for identification on a network and as part of the filename when saving images.

It may be beneficial to rename the camera according to its function, locality, field of view, etc. depending on how the camera is to be deployed.

To change the camera name simply edit the name as it appears in the box above the image window. There are some limitations in the character set that may be used for the camera name as it must be "legal" both as a filename and network device name. All numbers, and upper- and lower-case numbers may be used. The only punctuation character that may be used is the "-" (not "_").

4.9 Camera Time and Date

When your **Blaster's Ranger II™ Lt** is shipped, the time and date will need to be set to reflect your local time.

Access the Time and Date Configuration dialog from the camera menu in FasMotion. Once this is set, a rechargeable battery inside the **Blaster's Ranger II™ Lt** will maintain the correct time.

If your **Blaster's Ranger II™ Lt** is not powered up for a few weeks, the time and date may need to be reset.

4.10 Connect to the Camera Outside FasMotion

FasMotion software is the primary user interface for the **Blaster's Ranger II™ Lt**. It is the most flexible and efficient way to use the camera. There may be times, however when you may wish to access the **Blaster's Ranger II™ Lt** using its built-in Web-Application or through its USB OTG port.

4.10.1 To open the Networked Camera in a Web browser in the Web-Application:

The Web-application works with many web browsers, including Google Chrome, Mozilla Firefox, Apple Safari, and Microsoft Internet Explorer. It works on most PCs, Smartphones, and tablets:

1. Type the camera's IP address or camera name into the browser's Location bar. For example, using the information you would type 192.168.1.18 (IP address) or (the camera name) into the browser's Location bar.
2. A camera control application within the camera does the rest. A control menu will appear in your browser that will give a live camera view and complete control over the camera operation. Details on use of the camera's web browser appear in Chapter 6 of this manual.

Note: The Web-Application is useful for setting up and controlling the camera, but it does not have the display performance (refresh rate) of FasMotion and has no utility for saving video or image files on the host device (PC, Tablet, etc.).

You may also wish to open the camera in Windows Explorer in order to copy images from one of the cameras drives to your PC or network.

Note: This can be a convenient way to transfer a few files from your camera, but if you wish to transfer large numbers of images or video clips, the Save utility in FasMotion can be many times faster.

4.10.2 To open the Networked Camera in a Windows Explorer menu:

Type the camera name or IP address in the Location bar, preceded by \\. So, using the same information as in the example below, type in either \\192.168.1.18. When the camera is viewed in Explorer, you will see the camera name or IP address under Network. Opening that, you will see a directory called "media," which contains directories for each mass storage device installed on the camera.

4.10.3 USB OTG:

Another option for connecting to the **Blaster's Ranger II™ Lt** is via the USB OTG port.

4.1.1 Storage Setup

The FasMotion Storage Settings Tab gives the user access and control of the Camera memory and any installed media, including a Solid State Drive (SSD), SD Card, or USB drive.

The **Blaster's Ranger II™ Lt** has 4GB, or 8GB of internal high-speed memory used for capturing high-speed imagery (depending on model and option). You can elect to use all of this memory when recording, or a smaller amount. Total record time will depend on resolution, frame rate, and bit depth.

4.1.1.1 Configure Session (Standard Mode):

Use the Session Recording Capacity slider to select the amount of memory you wish to use to capture video. This slider has a granularity of 250MB.

Use the Format utility in the Storage Settings Tab to format any of the camera media. The SSD, SD Card, and USB drives are all accessible for formatting.

4.1.1.2 Formatting the SSD:

It is recommended that you format the SSD to delete all recordings and completely clean it off. This should be done often to keep performance as high as possible.

To format the SSD simply select the SSD radio button in the Storage Settings dialog and click on "Format."

When formatting the SSD on a **Blaster's Ranger II™ Lt** and many **Blaster's Ranger II™ Lt** cameras, you may be given an option of Sanitizing the drive. Sanitization is a low-level process that securely erases all data and renews the SSD for optimal performance.

4.1.1.3 Formatting SD Cards and USB drives:

Formatting SD Cards and USB drives is the easiest and most effective way of deleting all recordings.

When formatting SD Cards and USB drives, FasMotion will give the option of "Performance" or "Compatibility."

The Compatibility format is FAT32, which is recognized by most computers. The Performance format is EXT2, which is a Linux format and may require a 3rd-party driver or application (such as DiskInternals Linux Reader) on your Mac or PC. EXT2 will improve file Save times to the SD Card and USB. The improvement is only about 10% for very large images such as full-resolution TIFF and BMP images. The greatest improvement (as much as 6x) is seen when saving large numbers of very small files, such as saving thousands of low-resolution JPEGs.

4.1.1.4 Exploring Camera Media:

Open the FasMotion Camera Explore dialog by selecting the radio button for the SD Card, SSD, or USB and clicking on the Explore button.

Navigate to the Still, Stack or Video of interest.

You will notice that the information about the clip or still will be displayed, including the time stamp, resolution, frame count, frame rate, and file format. Any selected still or clip may be copied, moved or deleted. CAP files, which are proprietary Fastec raw image files, can be loaded back into the camera. When Cap files are loaded back into the camera, the camera may be operated in Review mode, just as when the imagery was originally taken. This will allow you to Save it in any format and to any camera or PC media.

4.12 Configurations

Blaster's Ranger II™ Lt Configurations, which include all camera settings (resolution, frame rate, session length, exposure, etc.), can be Saved, Reloaded, or Reset to factory defaults.

4.12.1 To Save the Current Configuration:

Click on Save Config... in the Camera Menu. This will open an Explore window. You will be able to give it a name and save it as a .cfg file in the folder of your choosing.

4.12.2 To Load a Saved Configuration:

Click on Load Config... in the Camera Menu. This will open an Explore window, which will allow you to navigate to the folder where you saved .cfg files and select the Configuration you would like to load.

4.12.3 To Load the Factory Configuration:

Click on Factory Config in the Camera Menu. This will load the factory default settings for the camera.

Note: This is not a routine operation as it rewrites your camera configuration. Always power cycle the camera after loading Factory Configs.

4.13 Reboot and Power Down

The camera may be Powered Down or Rebooted from the Camera Menu.

If you power the camera down it will turn off completely. To turn it back on, you will need to re-apply power by removing and restoring the power connector, or by pressing the power button on the back of the camera. (See "Figure 1-1: **Blaster's Ranger II™ Lt** Back View" on page 3.)

If you Reboot the camera, it will do a "warm boot." That is, it will disconnect from FasMotion, clear its memory, and restart its Operating System. Some of the electronics and logic will not be reset during a warm boot.

Note: Both Power Down and Reboot will erase any imagery in the cameras High-Speed internal memory, but it will not disturb any image data already saved to SSD, SD Card, or USB drives.

After a Reboot or Power Down, you will need to re-connect the camera to FasMotion by returning to the "Find Cameras" dialog and scanning for the camera after it boots up. See "3-3 Connect the **Blaster's Ranger II™ Lt** to a Wired Network".

4.14 Camera Information

Camera information is located in the “Find Cameras” window.

To open the Find Cameras window, click on the Find Cameras icon in FasMotion.

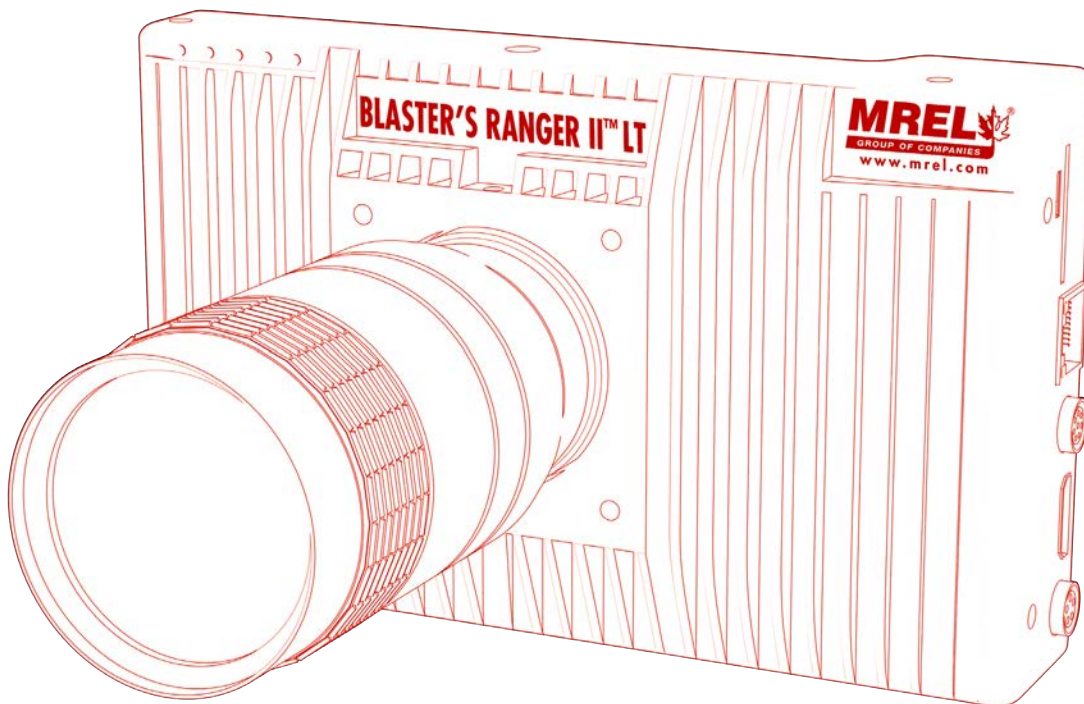
The information fields will populate as soon as you select a camera from the Found Cameras list.

Information Included:

- MAC address
- IP address
- Subnet Mask
- Default Gateway
- Vendor
- Model #
- Serial Number. Main Board Rev.
- Manufacture Info (location)
- Software Version
- GigE Protocol Version
- Bootloader Version
- FPGA Version
- Sensor Version

Chapter 5

Recording



Overview

This chapter provides an outline of how to setup the Blaster's Ranger II™ Lt for recording, viewing, and saving events.

5.1 Long Record and Standard Modes

Ranger II Lt cameras may be operated in either Standard mode or Long Record mode if you bought the Long Record mode upgrade.

5.1.1 Switching from Standard mode to Long Record Mode on the Camera in FasMotion:

1. With the camera in Live, go to Configuration / Preferences.
2. The User Preferences dialog will open. Select the Long Recording Mode check box. If you wish to use Event Markers or any other Metadata-related features, also make sure that the Auto-download Metadata box is selected as well.
3. Click on OK to accept the changes. A Mode Change message box will appear with the warning that Long Recording mode will overwrite data on the SSD.

Note: The format on the SSD will be overwritten as soon as it is accessed for streaming in LR mode. At that time any imagery on the SSD taken in Standard mode will be lost.

4. Click OK to continue. The camera will reboot in Long Recording Mode.

5.1.2 Switching Back to Standard Mode:

1. With the camera in Live, go to Configuration / Preferences.
2. The User Preferences dialog will open. De-select the Long Recording Mode check box.
3. Click on OK to accept the changes. The Mode Change dialog will appear again, but this time the text informs you that you will need to format the SSD before you will be able to write to it in Burst Mode.
4. Click OK to continue. The camera will reboot in Standard Basic mode.

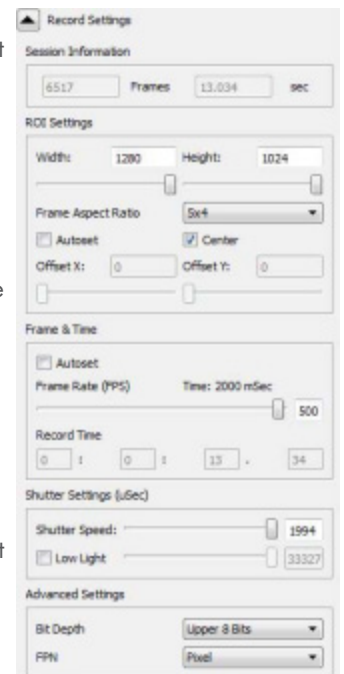
5.2 Setting Frame Rate and Resolution

The maximum frame rate of the camera is based on its resolution. Actual frame rates can be set to any value between 24 and the maximum in 1 fps increments.

In Long Recording Mode on the **Blaster's Ranger II™ Lt**, performance is limited by SSD speed.

To access Frame Rate and Resolution Settings, begin by opening the Record Settings tab in FasMotion.

ROI (Region of Interest) settings include Width (horizontal resolution), Height (vertical resolution), and Offset (pixel location on the sensor offset from the upper left corner of the image).



Record Settings are interactive:

- The Resolution you choose will define the maximum Frame Rate and number of frames that can be captured.
- The Frame Rate will define maximum Shutter Speed (exposure time in msec).
- The Frame Rate and number of Frames captured defines the duration of the recording (time in seconds).
- If you select Autoset in either Frame Rate or Resolution, that parameter will be selected automatically to its maximum allowable value, dependent on the other current settings

5.2.1 To set the Resolution of the Camera:

1. Select the Aspect Ratio you wish to use: choices are Custom, 5:4, 4:3, and 16:9.
2. Adjust the image Width (in pixels) you wish to use. This can be done either by editing the number in the Width edit box, or by moving the slider.

Resolutions can be refined to any even-numbered pair from 48 x 32 to 1280 x 1024 on **Blaster's Ranger II™ Lt** ; 48 x 32 to 800x 600. Minimum resolution in Long Recording Mode is 320 x 240.

Whenever any slider has focus, it turns blue. It may be then controlled by dragging it with the mouse or using the keyboard arrow keys. Often the best way to do this is by dragging it with the mouse until it is close to the value you want, then using the arrow keys to "zero in" on the exact value.

5.2.2 To set the Frame Rate of the Camera:

Either edit the number in the Frame Rate edit box, or move the Frame Rate slider to the desired position using the mouse and arrow keys.

5.2.3 Offset Control:

Most of the time, to make use of the best resolving properties of your lens, you will want to center the image at the optical center, which corresponds to the center of the sensor. In this case you would make sure that the "Center" check box is checked.

It is also possible, that you will wish to shift your ROI (Region of Interest) without moving the camera. Let's say, for example, that you have captured images at 1024 x 1024 @ 500fps and are now interested in capturing a 512 x 512 portion of the scene, let's say the bottom right hand quarter @ 2000fps.

In this case, you would wish to add 512 to both the X and Y offset. For a 1024 x 1024 centered image the offsets will be 128 and 0. The resultant offsets for a 512 x 512 image (lower right quadrant) would be 740 and 512.

5.3 Setting Shutter Speed

The Shutter Speed is expressed in microseconds of exposure time.

Minimum Exposure:

Minimum exposure is 2msec (regardless of frame rate)

Maximum Exposure:

The maximum exposure time is dependent on the frame rate. It is always $(1/\text{Frame Rate}) - 6\text{msec}$

For example, at 500 fps, the maximum exposure is:

$$(1/500 \text{ sec}) - 6\text{msec} = 2000\text{msec} - 6\text{msec} = 1994\text{msec}$$

For those accustomed to using shutter angle, to convert that to degrees:

$$(\text{Exposure (in msec)} / \text{Frame Time}) \times 360^\circ$$

For example, at 500fps, an exposure time of 250msec is:

$$(250\text{msec} / 1/500 \text{ sec}) \times 360^\circ = (250 / 2000) \times 360^\circ = 45^\circ$$

5.3.1 Setting the Shutter Speed:

Shutter Speed is set using the slider or edit box in the "Shutter Settings" section of the Record Settings Tab.

5.3.2 Low Light Mode:

In some special circumstances, the light available for setting up the **Blaster's Ranger II™ Lt** for a high-speed event is not as bright as what will be used for event itself. You may, for example be using some lights that can only be switched on for a short time and are not available for camera set up.

The exposure for Low Light Mode is much longer than would be possible for a high frame rate. The default shutter speed for Low Light mode is 41.666ms, which is the "1X" shutter speed for 24fps. The shutter speed for Low Light may be adjusted via FasMotion by checking the Low Light box and moving the slider or editing the Low Light edit box.

To enter Low Light Mode:

Note: Be careful when using the Low Light feature! It is very easy to forget that it is on! Remember to set your exposure for the light that will be present during the image capture.

1. Set the Shutter Speed just as you need it for the high speed event.
2. Click on the Low Light check box. A check mark will appear in the box. The edit box and the slider will become active.
3. Adjust the slider or edit the box for the desired exposure.
4. Press the Arm Button.

The camera will begin recording. You will notice that the image is darker now than in Live Mode.

5. Press Arm again to quit recording. (Click "OK" on the Warning message to Cancel.)

5.4 Setting Bit Depth

The **Blaster's Ranger II™ Lt** can record and save 18- 10- or 12-bit data. The advantage of recording higher bit depths is that it gives more flexibility in post processing the imagery. The disadvantage is that it takes more memory to record or save 10- or 12-bit data.

When saving 10- or 12-bit data (to a mass storage device) in TIFF (RAW) format, the actual file type is a 16- bit file, so it is substantially larger than an 8-bit mono file. The 10-bit (RAW) color image, however is not colorized—it is a RAW Bayer image (not “colorized,” which would make it about 3x as large), so it is about 2/3 the size of the 24-bit color file (8 bits per each of 3 color channels).

To choose the recording bit depth:

1. Navigate to the Record Menu.
2. Select Bit Depth. There are lots choices, listed on Table below.
3. Select the desired bits. Note that selection of high bits (default) always presents the cleanest image, while selecting lower bits presents brighter images with added noise.

5.5 Configuring the Trigger

The **Blaster's Ranger II™ Lt** uses a fixed, selectable circular buffer to record into. The session length is determined by the user. This section explains how to set the trigger position within the buffer.

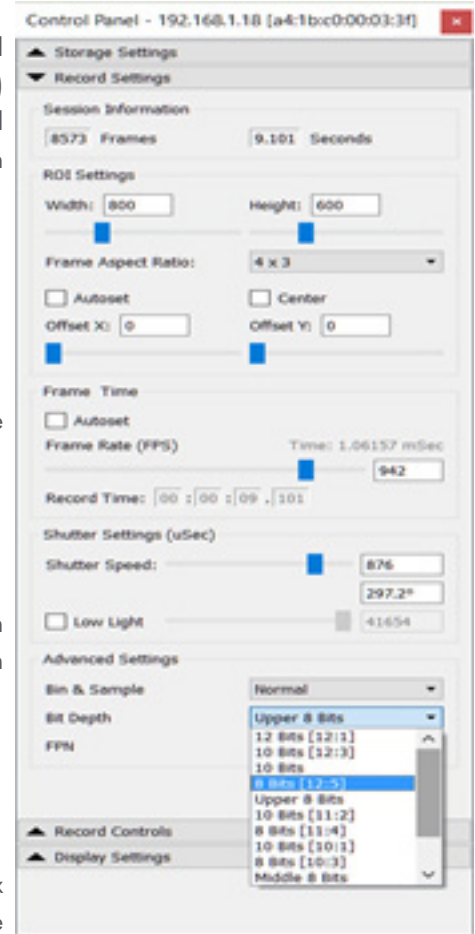
5.5.1 To Set the Trigger Position in the Camera:

1. Open the Record Controls Tab.
2. Select either the “Use Percent” or “Use Frames” radio button. The slider and edit box represent the session buffer, which is the camera memory you will be recording into. The trigger position, expressed either in % or frames.
3. Set the position by moving the slider or typing into the edit box or using the spinner buttons.

5.5.2 Enabling the External Trigger

There are times when you wish to activate the trigger electrically, either to sync the trigger with other cameras or signals, or to maintain greater precision than can be expected through the software trigger in FasMotion.

1. Open the Record Controls Tab.
2. Click on the pull-down in the External Trigger box to expose the choices, which are: Rising, Falling, or Disabled.
3. Choose “Rising” for rising signals or a switch opening and “Falling” for a falling signal or switch closure.



5.6 Configuring Sync and Arm I/O

5.6.1 IRIG Enable

The IRIG option is currently available for **Blaster's Ranger II™ Lt** cameras only. If you have an application that requires **Blaster's Ranger II™ Lt** with IRIG, please contact Fastec Imaging to explore options.

5.6.2 Enable Sync In / Sync Out

Sync In and Sync Out functions are used to synchronize the frame timing of a camera with another device or clock. These may include other cameras, strobe lighting, machinery, etc.

Sync In and Sync Out controls are somewhat interactive:

- When Sync In "Per Frame" is enabled, the Master Frame Rate and Rate divisor edit boxes are enabled, allowing you to set the frame rate lower than the Sync input.
- When Sync In "Per Sec" is enabled, the Delay edit box is enabled, allowing a shift in integration timing from 0 to 1000msec to fine-tune the phase relationship between cameras and other devices.
- When Sync Out "Per Frame" is enabled, the Shutter and Duty Cycle controls become active. Selecting "Shutter" makes the Sync Out pulse follow the shutter timing. Selecting "Duty Cycle" allows you to select the % of time the Sync Out pulse is "True." (This may be used in conjunction with polarity choices to establish the phase relationship between devices.)

For timing diagrams and a more detailed description of how these signals may be used for camera synchronization, please refer to "5 Synchronizing Cameras" on page 50.

5.6.3 Enable Arm In / Arm Out

The **Blaster's Ranger II™ Lt** may be Armed using the FasMotion Arm button, or using an "Arm In" signal via the camera's I/O connection (pin 6).

Note: the output signals float high, so if Arm In is set as a Level Rising/High, the camera will arm as soon as you Enable the signal, unless it is held down.

The Arm Out signal is used to pass the Arm signal to another camera or device, or to light an external LED to inform a user that the camera is Armed.

The Arm Out Signal can either follow the armed/unarmed state of the camera, or be a Pass Thru signal from "Arm In."

5.7 Black Level Calibration

Black level calibration does two things:

1. It sets the black level of the camera to ensure that, in the absence of all light, there is no offset or clipping (the "blackest" pixel will have a value of 0).
2. Dark frame data is saved for correcting Fixed Pattern Noise (FPN).

Note: Fixed Pattern Noise exists on every image sensor.

5.7.1 Calibrate Black Level:

The general rule is to do a Black Level Calibration if ever you believe the image looks noisy with Pixel FPN turned on. To be assured that you are getting the best possible images, perform a calibration:

- When you first boot the camera up.
- If you change Shutter Speed, Frame Rate, Resolution, or Offset.

5.7.2 To Calibrate the Camera

1. Set the camera to Live.
2. Shut out all light to the sensor: close the f-stop down all the way and put a lens cap on it or cover it securely.
3. From the Configuration menu, choose Black Level Calibration.
4. In the Advanced Settings section of the Record Settings Tab you will see an FPN selection dropdown menu. The items include Disabled, Column, or Pixel. Click on that button and select the FPN setting you wish to use, based on the following:
 - Pixel FPN is a per-pixel image correction that is done in the **Blaster's Ranger II™ Lt** 's image processor engine. It provides the cleanest images available. This is the setting that is most highly recommended.
 - Column FPN is an image correction done on the **Blaster's Ranger II™ Lt** 's sensor. It does not do as good a job cleaning up the images as Pixel FPN.
 - FPN Off means that there is no noise correction being used.

5.8 Record: Arm and Trigger

Lights Camera Action!

- Black Level Calibration has been done
- The scene is framed and focused
- The Resolution and Frame rate are set
- The Shutter Speed is set
- The Bit Depth is set
- The Trigger Point and Trigger Type is set

5.8.1 Take a Still JPEG

Still JPEG Image. It is optional, but recommended, to take a reference still of the scene:

With the **Blaster's Ranger II™ Lt** in Live Mode (not Recording or Reviewing a recording) either click on the Trigger Button or click on "Snapshot..." in the Camera menu.

A dialog box will appear asking where to store the image. Select the storage media you wish to use. (The image will be saved in <storage device>/dcim/100fastc.)

5.8.2 Standard Basic Mode Recording

Click the Arm Button. The Arm Button will turn from green to brown and the camera begins recording into its circular buffer. The Camera LED will change from Green (Live) to slowly flashing Red. It will record for an indefinite period of time until it gets a Trigger.

If the Arm Button is pressed a second time, the Recording will abort. The button and the LED will return to green. The Cancel Recording dialog gives the option to retain the images already recorded, discard them, or to continue recording.

The recording state is indicated by a progress bar at the bottom of the image window. Numbers to the right of the progress bar represent the number of recorded / post-trigger / total frames. When all of the pre-trigger frames have been recorded, the progress bar stops and flashes blue/red.

Note: If the **Blaster's Ranger II™ Lt** is triggered before the pre-trigger portion of the buffer is full, it will immediately cease taking pre-trigger frames, record frame "0" and progress to the post-trigger portion of the recording. When complete, the recording will have contiguous frames, with the full complement of post-trigger frames, but fewer pre-trigger frames.

5.8.3 To end Recording, Click the Trigger Button:

Click on the Trigger button, or send an electrical trigger signal.

When triggered, the **Blaster's Ranger II™ Lt** will capture frame "0" and the post-trigger frames. When the recording is complete, the progress bar will disappear, the Video Review Tab will open exposing the Save dialog, and the Video Control (Playback) pane will open.

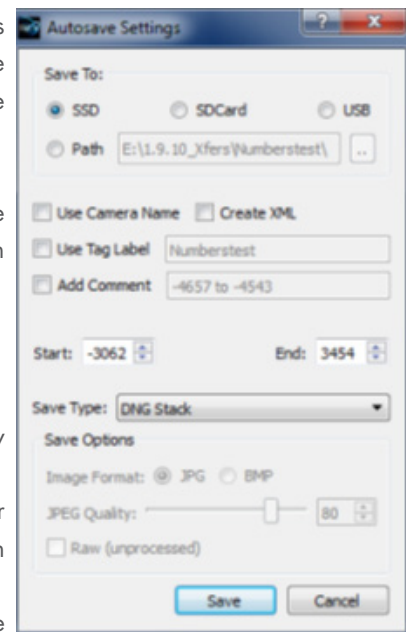
5.9 Autosave

The **Blaster's Ranger II™ Lt** may be used to capture many consecutive events. Using Autosave, this can be done unattended, that is, the camera may be left at a location to automatically Trigger, Save captured imagery, and then re-Arm itself indefinitely—constrained only by the mass storage space available.

Consider that an **Blaster's Ranger II™ Lt** with an optional 256GB SSD installed, depending on the resolution and download file format, could record and save hundreds or even thousands of events in a completely unattended mode! Even if using an SDHC, many events may be captured.

Advantages of using Autosave:

- Autosave is a good choice for multiple rapid events. When you are planning to save every capture and review later, the fastest way to get the job done is to use Autosave. .
- Autosave is also useful for production environments or in any scenario where it is used for multiple consecutive tests without any setup changes. Here it is preferred because it limits human intervention, thereby limiting both human effort and the possibility of human error.
- In an unattended event, especially in a remote location or when there is no easy access to the camera, Autosave is recommended because it is the quickest way to secure the image data. Saving the data to nonvolatile memory can be important if there is a possibility of power loss.
- Use Autosave for any unattended event where there is a possibility of a spurious trigger where the camera might trigger prematurely. If Autosave is used, there is a good chance that the camera will have returned back to Record mode in time to capture the planned event.



5.9.1 To set up Autosave:

To set up Autosave:

1. Select Autosave Setup from the Camera Menu or Camera Window context menu.
2. Select a file type from the "Save Type:" pull-down list. File type choices may change depending on the target drive. If you wish to save CAP files, you must save to the SSD. If you wish to save AVI files, you must save to a location other than SSD.
3. Set start and end points for your saved clips (only if you wish to save less than the full session).
4. Click on "Enable" to enable Autosave. If there are images presently in the buffer you will get a message asking if you would like to save that image data and re-arm the camera. If there are no images in the buffer you will just go back to Live mode until the camera is Armed.
5. Arm and trigger the camera. Autosave will continue re-arming itself, capturing images and downloading them until the target drive runs out of space. At this time it will progress to Review mode so the user can download manually to a different drive or clear space.

5.10 FasFire

The **Blaster's Ranger II™ Lt** is capable of recording images to one memory partition while saving images from another partition to non-volatile media such as an SSD, SD card, or USB device. Depending on the amount of high-speed DRAM memory (4GB or 8GB) on your camera and the Session Length (partition size) you set, the FasFire feature lets you capture up to 16 clips in quick succession without ever waiting for the camera to finish saving the last.

You will usually find that the camera has saved one or more partition before you get to the last one. Depending on the session size, the speed of the media, and the interval between events, you will often find that you will be able to keep recording clips at will until the space in the save media is exhausted.

5.10.1 Entering FasFire via FasMotion

The camera will operate in FasFire mode whenever there are at least two FasFire partitions, the camera is set to AutoSave, and the target drive is on the camera (the SSD, SD card, or USB device—not a drive on or connected to the PC). With Autosave active, as soon as the camera receives an Arm signal, FasFire will commence.

Note: there is no live streaming video in FasMotion while the camera is saving. If you need to see a Live image, you may connect the camera to an HDMI display.

Using the Gas Gauges in FasMotion Two gas gauges appear in the upper right corner of the image window during FasFire operation. The gas gauge indicates the number of available partitions for recording into. The gas gauge shows the progress of the current save.

As DRAM memory is filled the gauge on the left decrements its counter and the green level recedes. As partitions become available again, after video clips are saved to the target drive, the number will increment and the green level will grow upwards. If all but one of the partitions become full, the last segment of the gas gauge will turn red. And when the very last segment is used, you will see the normal Autosave progress bar until one partition is saved and the gauge begins to be restored again.

5.10.2 Cancelling FasFire

If you press the Arm button while recording, you will get a warning message asking if you wish to cancel. If you click on



"OK," the camera will continue to save images.

If you click on Arm and Trigger, the camera will make one more capture and go into Review/Playback.

The last recording will be available for Review/Playback and Save, as will any other recordings still in DRAM.

5.10.3 Video Review with Multiple Partitions

When there are multiple partitions with unsaved clips in DRAM, the FasMotion Video Review Tab will show the number of available clips.

In this example there are three clips available. They are always presented with the newest first. You may review the present clip and save it, and then to see the next, you click on "Free," which will free up the present partition for recording and allow you to review and save the next.

5.11 Long Recording Modes

Long Record Basic mode works much like Standard Basic mode:

1. Click on the Arm button to begin streaming pre-trigger frames into a circular buffer on the SSD.
2. Trigger the camera at the appropriate time. The trigger point may be set anywhere on the timeline.



- When triggered, the camera will record the trigger frame, plus all post-trigger frames on the onboard SSD, then proceed into Playback.
- The progress of the recording is displayed on the timeline very much as it is with Standard Basic mode.

Note: If you wish to stop recording before all of the post-Trigger frames are recorded, you may cancel the recording by clicking the Arm button, then select "Yes" to retain the current session in the Cancel Record dialog.

- The basic performance specifications vary depending on model, but generally Long Record allows for much longer recordings at slightly slower frame rates than Standard mode.
- Autosave is available in Standard, but not in Long Record Mode.
- Long Record mode recordings are written to the SSD, which is non-volatile media. The recording is not lost when the camera powers down.



FasCorder ROC mode is convenient if multiple recordings of various durations will be made or if there are pauses in the action that need not be recorded. FasCorder BROC mode records a specified number of frames with each trigger.

1. Once the camera is set to ROC or BROC mode, click on the Arm button. You will now see the recording timeline and a live image in the Camera Window.
2. Click on the Trigger button. The **Blaster's Ranger II™ Lt** is now recording and streaming images directly to the onboard SSD. The position indicator goes solid red. The Arm button will become a white "X" on red, while the Trigger button remains red.
3. ROC mode: Click on the trigger button again. The recording will now pause and the position indicator will alternate blue and red and the Arm button will turn brown. Repeated triggering will cause the camera to alternate between recording and paused states.

BROC mode: A specified number of frames will be recorded with each trigger, then the recording will pause. The buttons and position indicators will be the same as for ROC mode. If the camera is triggered before the specified number of frames have been recorded, the additional frames are appended to whatever number have frames have already been recorded.

4. Press the Arm button. A message will appear giving you the options of exiting to Review and Save, or to continue recording.

Note: Appending to ROC and BROC recordings upon returning from Playback or a Power cycle will cause a number of black frames (up to 128) to be inserted in the recording timeline.

It is possible to alternate FasCorder ROC and BROC recordings in any combination as they are compatible formats. Long Record basic recordings, however, are not compatible with FasCorder and cannot coexist on the SSD.

5.12 Reviewing Captured Imagery: Playback

Once the recording is complete, if Autosave is not enabled, the **Blaster's Ranger II™ Lt** will open the recording in Review Mode. There are several things to do in Review:

- Play the video—play it forward, backward, frame by frame, adjust the cut-in and cut-out points (find the interesting portion of the clip), etc.
- Adjust the image brightness, contrast, gamma, bit depth, color, etc.
- Save video to a mass storage device.
- Load a CAP file from SSD to memory for Review.

5.12.1 Searching for Interesting Parts:

Very often the first thing you will wish to do when reviewing a clip is to “scrub” through it using the playback slider looking for the most interesting moments.

1. Click on the Pause Play button. (Only necessary if you have already clicked on another of the playback buttons.) This will enable all of the playback buttons (they become black). (If any of the buttons become gray (inactive) you will not be able to scrub through the clip.
2. Move the Start Clip bumper all the way to the left (beginning of segment) and the End Clip bumper all the way to the end. (This is the default position when you enter Review.)
3. Click and hold the Playback Bug and move it along the progress bar. This will allow you to move to any point in the video that might be of interest.

5.12.2 Using the Slider

When selected the Playback Bug will turn blue. There are several mouse and keyboard strokes available when the bug is selected:

- Click on the slider bar to the left of the Playback bug to move 10 frames backward
- Click on the slider bar to the right of the Playback bug to move 10 frames forward
- Click on the left or down arrow on the keyboard to move 1 frame backward
- Click on the right or up arrow on the keyboard to move 1 frame forward
- Click on Page down to move 10 frames backward
- Click on Page up to move 10 frames forward

- Click on End to move to the end
- Click on Home to move to the beginning

5.12.3 Setting the Start Clip and End Clip points:

1. Click on the Pause play button. All buttons should now be active (black).
2. Click and drag the Playback Bug to the frame you wish to be the starting point. You can use the Current Frame edit box and/or spinner, or your PC keyboard <- and -> keys to zero-in on the correct frame.
3. Click on the Start Clip button. The Start Clip Bumper will move to that frame.
4. Move the Playback Bug to the frame you wish to be the ending point (as in #2, above).
5. Click on the End Clip button.

When playing, the video will start and end between the Start Clip and End Clip bumpers.

The Start and End Clips also define the range of frames that will be Saved.

5.12.4 Jumping to a Frame by Time

Click on the "Jump to Time" button in FasMotion to find a frame based on its time.

- Select the "Relative" radio button if you wish to jump to a frame based on the time relative to the trigger time.
- Select the "Absolute" radio button if you wish to jump to a frame based on the "time of day" clock, which is used for timestamps in the metadata.

Note that the Year, Day, Hour, Minute fields only become active according to the length of the captured video. For example, in Absolute mode, if you have a recording that begins at 6:56 am and ends at 7:01 am, the Hour, Minute and second fields will be active. In Relative Mode only the Minute and second fields will be active.

5.12.5 Jumping to Markers

Blaster's Ranger II™ Lt cameras have six LVTTL I/O ports that may be used for camera control or as event marker inputs, or some combination of the two. Note that the signal level for each I/O port is recorded in the per frame metadata independent of their use.

When used for camera control, these ports are defined as Trigger-in, Trigger-out, Sync-in, Sync-out, Arm-in, and Arm-out. When used as markers we refer to the same ports as T-I, T-O, S-I, S-O, A-I, and A-O, respectively.

Rec Start marks the beginning of an LR ROC or BROCC recording. This is a very useful marker to be used whenever FasCorder mode is used. When playing captured video on the **Blaster's Ranger II™ Lt**, event marker locations may be made visible as hatch marks on the timeline.

5.12.6 Setting up Event Markers

1. Open the Event Marker Control dialog: (in Review mode) click on the Events... button in the Video Review tab.
2. To make markers appear on the timeline, select the Enable Markers checkbox.
3. For each I/O signal you wish to use click on the associated button and select the state for which that signal will be defined as "true".
4. If you wish to create a mark whenever any of the signals are "true" select the "Or" radio button. If you wish to create a mark only when all of the signals are "true" select "And."

5. Click on “OK” to accept the Event Marker controls.

Note: The Event Marker setup is not associated or saved with the captured video, but it is saved in FasMotion settings and is saved along with the configuration using Configuration/Save Config...

5.12.7 Using the I/O Graph Display

I/O channel signal activity may be viewed in graphical form using the I/O Graph Display.

1. Click on the I/O Graph Display check box in the Event Marker Control dialog. An I/O graph will appear beneath the timeline in the Video Controls window.
2. Use the u/down arrows in the spinner box to the left of the I/O Graph Display to select the I/O channel you wish to view.
3. Additional charts may be added by clicking on the “Add Chart” button to the left of the bottommost I/O chart.

5.12.8 Zooming in on the Timeline

The timeline in the Video Controls window may span many thousands of images in a “Normal Mode” recording, and hundreds of thousands of images in “Long Recording Mode.” The timeline Zoom feature allows you to reduce the number of frames viewable across the timeline, making the task of finding specific events in the video much easier.

5.12.9 To Zoom In:

Double click on the timeline to zoom to 2x. A highlight mark will appear over the zoomed area of the Timeline and a “Zoomed Playback Line” that spans the highlighted area will appear below the Playback Line.

The highlighted portion of the Timeline may be moved by clicking and dragging it, so that any portion of the captured video may be accessed.

Zoom In and Zoom Out buttons appear at either end of the Zoomed Playback Line. Clicking on the Zoom-In button increases the Zoom 2x: to 4x, 8x, 16x, etc. to the maximum zoom of 4 frames.

Note: The I/O signal charts also expand when zoomed in. If there is a lot of activity on these channels, as in the examples shown here, zooming in is advantageous for seeing the signals clearly.

5.12.10 Viewing Per Frame Metadata in FasMotion

Whenever the **Blaster's Ranger II™ Lt** records imagery, it also records a timestamp for each frame. This timestamp may be displayed during playback and may also be saved to an XML file

Per Frame Metadata may always be viewed while playing unsaved images in camera memory and also may be viewed when playing back saved image files if they were saved with the XML file.

5.12.11 To View Per Frame Metadata:

Select Per Frame Metadata from the View menu while in Review.

The Per Frame Metadata includes a Timestamp, Marker information, IRIG status, Sync status, and Time source.

Timestamp Format

Time: YY:DDD:HH:MM:SS.xxxxxx

For the example shown in Figure 4-28 this is:

YY = Year: 13 = 2013

DDD = Day: 250 = Sept 7 (See "Appendix M: Day Number Calendar Conversion" on page 110.)

HH:MM= Hour:Minute: 13:43 = 1:43 pm

SS.xxxxxx = Seconds: = 06.798554 (granularity to msec)

Note: the Timestamp line is always available during playback from camera memory or from CAP files loaded into camera memory from an SSD. It is also seen in saved files played back via FasMotion, but only if they are accompanied by an XML file.

Markers: 00111111

The Timestamp line includes event markers.

IRIG: 0

In the example IRIG is not enabled (0). (IRIG is not currently an option for the **Blaster's Ranger II™ Lt**. If you have an application that requires IRIG on the **Blaster's Ranger II™ Lt**, please contact MREL.)

Sync: Internal

The Sync term can be Internal (internal camera clock used for frame timing), PPF (Sync-In pulse used for per-frame timing), or PPS (1Hz clock input at Sync in used to derive the camera frame timing).

Time: Internal

The Time is always set to Internal for the **Blaster's Ranger II™ Lt**.

5.13 Image Processing

5.13.1 Image Processing Pipeline.

The **Blaster's Ranger II™ Lt** image processing begins in the LUPA1300-2 sensor, where on-chip column FPN corrections occur (if enabled) and the Black level is set using data collected during calibration. Pixel data, also collected during calibration is used for Pixel FPN correction (if enabled). The **Blaster's Ranger II™ Lt** does more image processing internally, some of which can be controlled by the operator. To better understand how this works, please refer to "Jump to Time Relative".

The 10-bit sensor output goes to the Bit Selector, then to internal high-speed memory. This selection is made by the user when bit depth is selected.

The path for all images and the input to the histogram is: Sensor, to Bit Selector, to Image Processor, to Display / Histogram. It is always 8-bit

Mono or 24-bit Color. Live images pass through from high-speed memory to the image processor immediately. Captured images are saved in high-speed memory until the camera powers down or the images are written over.

- Images in the internal high-speed memory have not yet gone through the image processor. This means that the image processing settings have NO effect on the images in high-speed memory—they only affect the images as they are saved or displayed.
- Images in high-speed memory may be viewed or saved multiple times with different settings.
- Live images seen on the display ALWAYS go through the image processor.

5.13.2 User Control of Image Processor

- Bayer (Color) processing (color cameras only) is done in order to display a color image. The user may elect to save images that have not gone through Bayer colorization by choosing to download a RAW format (See “4-15 Saving Images to Mass Storage”).
- Color Correction is controlled via “White Balance” in the Display tab. You may choose from several color temperatures: Daylight (5600K), Tungsten (3200K), and Fluorescent (4100K) and Normal setting 1:1:1 (all channels at nominal gain). There is also a “Custom” setting used to white balance using a gray target and an RGB gain dialog for further manual adjustment. See “4-14 Custom Color Correction”.
- Brightness and Contrast are controlled via sliders and spinners. Users select levels from -100 to +100 (default = 0).
- Gamma is also adjusted in this dialog. Levels range from 0.20 to 5.00. Gamma 2.2 is the default as it is the most common display gamma for monitors. For a linear display choose a gamma of 1.00.

Note: Making a selection from this menu only affects the Displayed image and any (non-RAW) images saved to mass storage devices. It does not affect either the 8-bit or 10-bit images as they are recorded into the **Blaster's Ranger II™ Lt** 's high-speed internal memory. Adjustments made here may be done before and/or after the imagery is captured.

Note: All image processing is done using 16-bit math. If 8 bits are recorded, they will be used as the upper 8 bits of the 16-bit calculations by the image processor. The upper 8 bits of the results are then used as an output. Similarly, if 10 bits are recorded, they will be used as the upper 10 bits of the 16-bit calculations. This is true regardless of the output bit depth, thus the lower two bits of the 10 bits recorded are used when computing color corrections and image adjustments, even if you are viewing or downloading 8/24-bit formats.

5.14 Custom Color Correction

When the preset White Balance options, Daylight, Tungsten, and Fluorescent, do not give you the color reproduction you need, there are a couple of other options available:

The Custom item in the Display/White Balance menu allows you to set the color correction via a gray card or neutral gray object.

To use Custom White Balance:

1. Click on the “Custom” button in the White Balance menu. A rectangular reticle will appear in the middle of the image window and a special histogram will appear (See “Figure 4-31: Custom White Balance” on page 45.)
2. Center the reticle (the white box in the center of the image) on a neutral gray object in the field of view. In this instance we are using an 18% gray card, which is the recommended target. Most often the card will only fill a portion of the field of view—it only needs to fill the reticle. It is important that the card, or other neutral gray object is located close to the objects of interest and is exposed to the same light as the objects you are going to image.
3. Adjust the lens aperture so that the histogram shows the pixel values grouped high (to the right side of the box), but not saturated. It is important that the high pixel value is less than 255. Notice on the example here, that the RGB peaks are not well aligned and

that the Blue peak is farthest to the left. This means that the color is skewed slightly towards the yellow, the complement to blue.

Note: The histogram used with Custom White Balance represents only the area of the reticle, not the whole image.

4. Press the Trigger button. You will immediately notice a difference in the color.

5.14.1 Using RGB Gain Controls

Another option for addressing color correction is via RGB Gains. It is recommended that you use the RGB gains sparingly and as a final “tweak” to make subtle changes to the color. The best use of this is to get the color as close as possible using the White Balance presets or Custom options before adjusting the RGB gains.

To use RGB Gain:

1. Open the Display Settings Tab. You will notice sliders with edit boxes and spinners for Red, Green, and Blue.
2. For any color gain you wish to increase, move the slider to the desired position.

Note: Remember that in the Bayer pattern, 1/2 of the pixels are green, 1/4 are blue and 1/4 are red. Whenever you change gain values you will be adding some noise to the image. It is best to avoid using any more gain than you need to, and to take special care with the green channel as it represents half of the pixels in the image.

5.15 Saving Images to Mass Storage

Image sequences may be saved as CAP files (proprietary raw format, as AVI videos, in which one file contains all the frames of the sequence, or TIFF, JPEG, or BMP stacks, which are collections of files, one file per frame of imagery. The file save options change depending on whether 8-bit or 10-bit image data has been written to internal high-speed memory:

Calculating file sizes for TIFF and BMP images is very simple:

Resolution x Bit depth/8 = approximate BMP or TIFF file size in Bytes (to convert Bytes to KB divide by 1024) For example a 1280 x 1024 Mono BMP or TIFF is: $1280 \times 1024 \times 8 / 8 = 1,310,720 \text{ bytes} = 1,280\text{K}$

A 1280 x 1024 16-bit RAW TIFF/DNG is: $1280 \times 1024 \times 16 / 8 = 2,621,440 \text{ bytes} = 2,560\text{K}$

CAP files are always the size of the current buffer (session size).

The actual file size of a 1280 x 1024 mono BMP or TIFF is about 1281K (the additional 1K for the file header). The actual size of 16-bit RAW TIFF is 2561K (again add an additional 1K for the header).

Note: The RAW 16-bit TIFF saved from the camera actually has 10 bits of image data. The 16-bit format is used for compatibility reasons.

Calculating file sizes for AVI and JPEG images is much more difficult. The compression is often approximately 10x to 20x, but it can be much greater for images with little content, and it can be much less for very complex images.

RAW images are not colorized, so Mono and Color images are the same size. Colorization increases file size 3x because 8 bits are saved for each of red, green, and blue channels.

To Save a recording to a connected mass storage device on the **Blaster's Ranger II™ Lt** :

1. Make a recording and establish the Start Clip and End Clip points you wish to use

Note: that the frame numbers initially shown in the dialog box will be the actual start and stop frames for the entire capture unless the Start Clip and End Clip bumpers have been moved. If you are not sure what the actual beginning and end frame numbers for the clip are, you can find them on the far left / far right sides of the Clip bar.

2. Select a target drive using the "Save to Camera / Path" radio buttons. If you select "Path" the target drive and folder will be a folder on a drive accessible by the PC. The Path to that folder is shown at the bottom of the dialog. If you would like to change the path, click on the "Browse..." button and navigate to and/or create the folder you wish to save to.
3. Select a file type from the "Save Type:" pull-down list. File type choices may change depending on the target drive. If you wish to save CAP files, you must save to the SSD. If you wish to save AVI files, you must save to a location other than SSD.
 - The default file name format for the image stacks is Frame_000000.<TYPE>. If you would like the name to include the camera name, Select Use Name in the dialog. The resulting file name format for the example would become **Blaster's Ranger II™ Lt**-11_000000.<EXT>.
 - If you would like to add a tag to the name, select Tag. The Tag may be edited. Using the Tag in the example, the file name becomes 2011-10-11_000000.<EXT>.
 - Both the Name and the Tag may be used, in which case the file name becomes **Blaster's Ranger II™ Lt**-11_2011-10-11_000000.<TYPE> in the example.
 - If AVI files are saved, the default file name is 000000.AVI. The Use Name and Use Tag options are also valid for AVI files, in which case the resulting file names are **Blaster's Ranger II™ Lt**-11_000000.AVI, or 2011-10-11_000000.AVI, etc. If the file size exceeds the 4GB limit for 32-bit file systems, the **Blaster's Ranger II™ Lt** will make a second file for the remainder of the imagery. (MiDAS and other players will play the video as one.)
 - If CAP files are saved, they will not use either the camera name or the tag. CAP files are saved only to the SSD. They must be loaded back into high-speed memory in the camera to be reviewed, then converted into a downloadable file format

Note: CAP files load back into memory much faster than they are saved, taking approximately 45 seconds for a full 8GB load and proportionately shorter times for smaller ones.

When the **Blaster's Ranger II™ Lt** saves imagery to mass storage it creates the following:

- DCIM. This is an industry standard directory name for Digital Camera Images.
- 100fastc. This is a sub-directory under DCIM.
- 000000. This is the first sub-directory under DCIM/100fastc, used for storing image stacks.
- hs-video. This is the directory that all AVI files are written to.
- <filename>.txt. For each download, the camera creates this text file. In it are the camera setup values, including resolution, frame rate, camera name, time stamp for the capture, image processing values, color processing values, etc.
- <filename>.cfg files. This is a binary file used for MiDAS player so that it can properly play the image files as a movie.

Note: Image files may be saved multiple times using different formats, different start and stop points, and different image processing options (brightness, contrast, gamma, color, etc.). If 10-bit images have been captured, imagery may be saved multiple times using different bit-depths.

5.16 Transfers, Batch Transfers and Conversions

Stills, stacks, videos, and capture files (CAP), saved on camera media may be managed via Explore on the FasMotion Storage Settings tab.

Copy / Batch Copy Stills, videos, and stacks may be copied from any camera media (SD card, SSD, or USB device) to any other camera media or to a Path accessible via your computer (any media attached to your computer or networked drive, etc.).

1. Select the camera media you wish to copy from using the radio buttons in External Storage box on the Storage Settings tab.
2. Click on the Explore button. The media on the camera will be accessed and read at this point, which may take a minute or two, depending on the number of files and folders present.
3. Select the type of image data you wish to copy, (Stills, Stacks, Video or Capture).
4. You will be presented with a list of available files or folders to pick from. Pick one or more from this list. You may click on one, or Ctrl/click on multiple files, or Shift/click on the first and last of a sequence for a Batch Copy.
5. Once you have made your selection, click on Copy. A little dialog box will open that allows you to choose a destination.
6. Select from the list of available camera media to copy to another drive on the camera, or Path to copy to media attached to your computer.

5.16.1 Move

Move works exactly like Copy, except that the source files are deleted after they are copied.

WARNING: Although it is possible to delete files from the Camera's SSD, it is not wise to let the SSD become fragmented by deleting files, then recording and saving more to the SSD. You may wish to delete files as you save them off in order to keep track of what you have saved, but you should reformat the drive before using it again.

5.16.2 Convert JPEG or BMP Stacks to AVIs

JPEG and BMP stacks will be converted to AVI videos during transfers (copy or move) if the "Convert to AVI" box in the lower left corner of the explore window is checked. Refer to Figure 4-35 on page 48.

There is no additional compression used when converting JPEGs or BMPs to AVIs. Compression for JPEG/AVI files will be the same as the original JPEG, which was selected via JPEG Qfactor in camera Preferences when the JPEG was saved.

BMP/AVI files are uncompressed and may very large. Be aware that very large AVI files may take extra time to load and play on your computer.

5.16.3 Batch Copy and Convert CAP Files

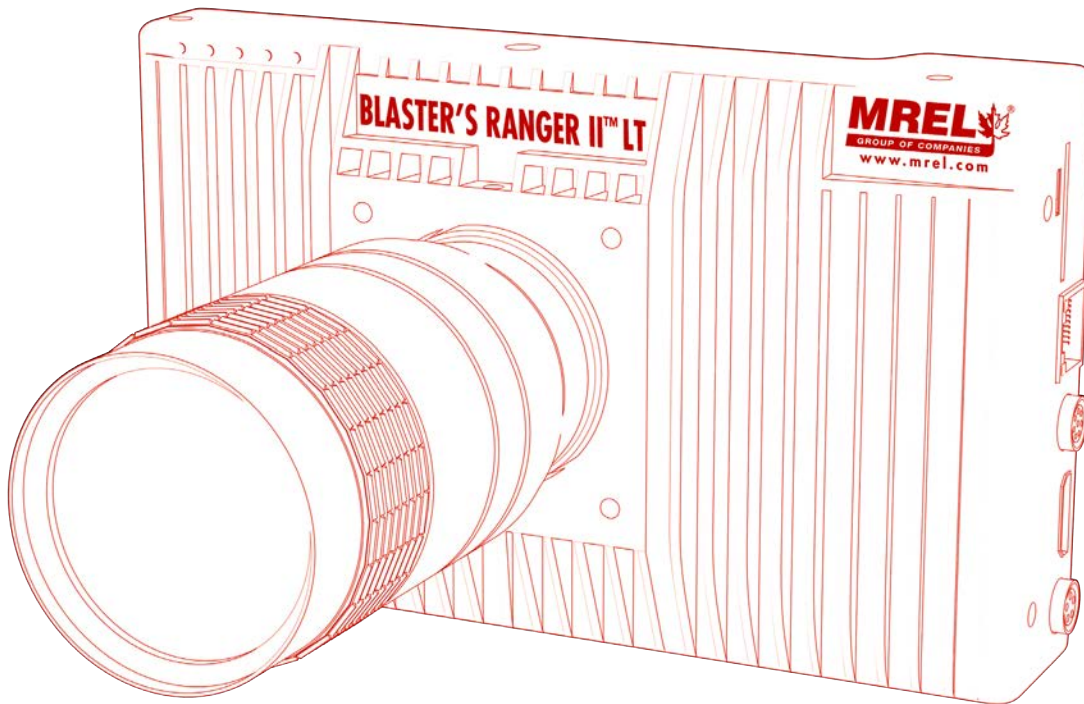
Note: CAP files are only present on cameras with SSDs. If you have an **Blaster's Ranger II™ Lt** without an SSD and would like to add this functionality, please contact your Fastec distributor and inquire about an upgrade.

When one or more CAP (Partition Capture) files are selected for Copy or Move, an additional dialog box will appear that will give you all the available options for naming the saved images, inclusion of the per frame metadata XML file, file type and Path.

Note: the display properties, including color balance, gamma, etc. of the saved imagery will be those set in the camera when the CAP files were captured. If you would like to make any changes, you will want to load the CAP files individually and save them via the Review/Save Tab after making any changes.

Chapter 6

Using the Web App



Overview

This chapter provides an outline of how to use the Web App.

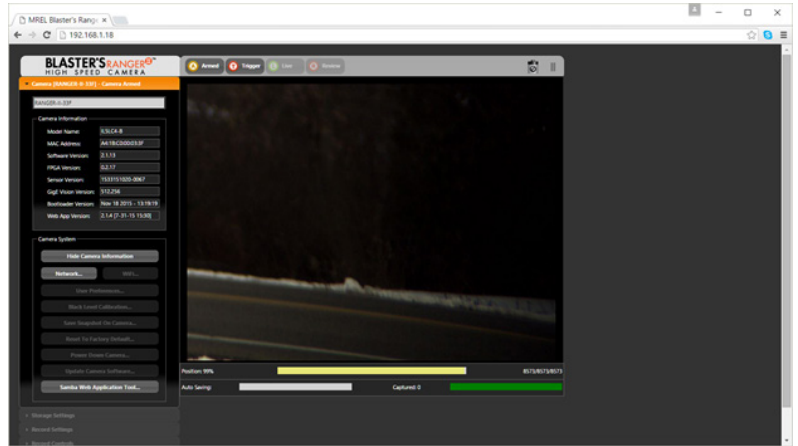
6.1 Web App Overview

The Web Application is a utility built into the **Blaster's Ranger II™ Lt** which makes control of the camera possible by any networked computer running an Internet Browser. No software needs to be loaded on the computer.

Enter the Web App by typing either the network-connected **Blaster's Ranger II™ Lt**'s camera name or IP address into the address bar of an internet browser.

The Application Window is comprised of:

- A Control Bar at the top, which includes Arm and Trigger buttons as well as the Battery Icon
- 6 Application Tabs, including the Camera Tab, Storage Settings Tab, Record Settings Tab, Record Control Tab, Display Settings Tab, and the Video Review Tab, which is present only when there is captured video available for Review.
- The Tabs Pane. When you click on a Tab it will open vertically along this pane. Tabs beneath the opened one will slide down the pane.
- The image area. This is where Live or Captured imagery appears.



In the figure below, **Blaster's Ranger II™ Lt** is connected in Live Mode.

Notice that the Camera Name is displayed in brackets [] on the Camera Tab and that the camera's mode of operation (in this case "Live View" is listed there as well. The Trigger Button is absent because the camera has not yet been armed. The Review Tab is also absent as there is no video to review.

6.2 Camera Tab

Clicking on the Camera Tab exposes its contents and shifts the other tabs down the Tabs Pane below it.

All tabs are always accessible, with the exception of the Review tab, which is only available in Review Mode (after video has been captured). Clicking on the Camera Tab a second time closes it. Opening another tab will also close the current one.

The Camera Tab always displays the Camera's current Mode of operation.

These modes include:

- Camera Live View, in which a live image is displayed in the Image Area.
- Camera Armed. This is the state of capturing pretrigger frames.
- Camera Triggered. The camera is capturing posttrigger frames.
- Camera Video Review. The camera has finished recording. The captured video appears on the screen. Playback controls appear beneath the image window.

You will also notice that when the camera is controlled via the Web App, the Mode script will say, "Waiting for Camera to Arm" or "Waiting for camera Trigger," etc. for a very short time until the app gets confirmation back from the camera that its state has changed.

If the computer loses communication with the camera, the Mode script will say "Camera Load Failure."

To change the camera name: highlight the camera name in the Edit Box and type in the new name. Press "tab" to accept.

The Camera Configuration may be loaded or saved via the Configuration Dialog. It may be reset using The "Reset to Factory Default..." button.

The Network Configuration of the camera may be accessed by clicking on the "Network..." button. Here you may setup either a DHCP or Static configuration.

WiFi Configuration gives the user the options of scanning for an SSID to connect with or using the Manual button to create an SSID for an ad hoc network.

Note: A wired connection is needed to initially configure WiFi.

Settings accessed via the User Preferences dialog:

- JPEG QFactor sets the quality of the compression used by the camera for streaming (display via Web-GUI and FasMotion), Stills, JPEG stacks and compressed AVI files. The default value is 80, which produces a very good balance between size and quality. For larger, higher quality images, use a higher QFactor. For smaller, lower quality images and faster refresh rates, use a lower QFactor.
- Default Gamma setting is used both to set the default output Gamma for displayed and saved images, and to set the Gamma for the LCD display. Gamma of 1.0 (linear) is recommended unless you intend to encode your images with 2.2 Gamma.
- Long Recording Mode setting puts the **Blaster's Ranger II™ Lt** camera in its Long Recording Mode. Changing this setting, then clicking on Save User Preferences will reboot the camera.

6.3 Storage Settings Tab

The Storage Tab is used to Browse or Format storage devices connected to or installed in the camera and also to set the session length (internal high-speed memory used for capturing video).

Browsing:

1. Use the radio buttons to choose the storage device to manage- SD Card (SDHC), SSD (only browsable when operating in Standard Mode), or USB Drive.
2. Click on Browse Media... to open an Explore window for the device.
3. If you wish to explore another device from the explore window, click on "Parent Directory" to see the list of other devices.

The Explore window will look slightly different depending on the web browser and operating system you are using, but the content will be the same for all.

Notice that in the example, we are looking at the directory of the SD Card: .../media/sdcard. Click on "hs_video/" to find the stored video files. Click on "dcim/" then "100fastc/" to find stored stills and video stacks.

To play a video, click on the file name and the video will open in the default media player. Large stored videos may play slowly when opened this way. You may wish to copy them to a computer drive first, and play them from there. To open a still, click on the file name and the still will open in the explore window. To return to the last directory, right click in the window (but not on the image) and select "back." To copy a video or still to a computer drive:

1. Right click on the file you wish to open. A context menu will open with a list of actions. The list varies depending on the browser you are using.
2. If using Chrome, Firefox, or Safari, select "save link as..." or, if using Windows Internet Explorer, select "save target as..." This will open a dialog box allowing you to navigate to the drive and directory you wish to save the file to.

Note: This is recommended for stills and AVI files only. Only one file may be copied at a time. No files may be either deleted or moved via the Web App. In order to copy groups of files and directories (file stacks, etc.) open the camera in a separate Explore window.

6.3.1 Formatting

1. Use the radio button to choose the storage device to format-SD Card (SDHC), SSD (internal drive), or USB Drive.
2. Click on Format...
3. Select the format type you wish to use.

Note: Format choices vary depending on media type and camera version.

6.3.2 Setting the Session Length

Session select the amount of memory to be used for capturing imagery on the **Blaster's Ranger II™ Lt** (not in Long Recording Mode). Session length dictates the number of frames captured as well as the capture time.

1. Move the Session Length Adjustment slider to the desired position. You will see the Time and # of Frames change as well as the Space in GB.
2. Click on the blue "Set Session Length" button to send the change to the camera.
3. To set the camera in FasFire mode, the session length will need to be set at less than half the memory size. When the slider is moved to where the camera may be operated in FasFire mode, the text below the Session Length Adjustment slider will become red.

Note: that Autosave must be enabled in order to operate in FasFire Mode.

6.3.3 Long Recording Mode

When the **Blaster's Ranger II™ Lt** is operated in Long Recording mode, the Session Length Adjustment slider becomes disabled and the Session Recording Capacity changes to "LR Mode."

6.4 Record Settings

The Record Settings Tab is analogous to the Record tab in FasMotion. It contains the controls for setting ROI (Region of Interest), record Rate and Time (Frame Rate and Record Time), Shutter Speed, and Bit Depth, and FPN Control.

For the **Blaster's Ranger II™ Lt** operating in Long Record (LR) mode, the Basic and FasCorder options are selectable via this tab.

6.4.1 Setting ROI:

1. If you wish to use one of the standard aspect ratios: 4:3, 5:4, or 16:9, click on the Frame Aspect Ratio bar and make your selection from those choices. If wish to select a custom aspect ratio, select that choice from the same pull down menu.
2. If you are using anything but a "Custom" for aspect ratio, you can adjust either width or height and the other will adjust automatically. You can either use the sliders or the edit boxes to make your selection. If you use the edit box, hit the "Tab" key on your computer keyboard or click outside the box to complete your entry. Select the "Autoset" box if you wish the camera ROI set automatically for the largest resolution possible at the selected frame rate.
3. Select the "Center" box to center the ROI to the optical center. If this is unchecked, you may set the ROI offset using the Offset X and Y edit boxes.

6.4.2 Setting the Frame Rate:

Either move the Frame Rate slider or edit the associated text box to change the frame rate.

The frame rate is limited by the resolution. There is a Max frame rate number next to the edit box letting you know what the maximum frame rate is for the current resolution. Clicking on the "Autoset" button will set the frame rate to that maximum number possible with the current resolution setting.

6.4.3 Setting the Shutter Speed:

Set the shutter speed by moving the slider. The minimum shutter speed (maximum sensor integration time) is limited by the frame rate. It is .006ms less than 1 frame time or $1/(\text{frame rate} - .006\text{ms})$. The maximum shutter speed (minimum sensor integration time) is always .002ms.

6.4.4 Low Light:

The Low light feature lets you use shutter speeds up to 33.326ms for framing and focusing the camera prior to image capture. (During image capture the shutter speed will revert to its normal setting.) Click on the Low Light check box to enable it. Use the slider to set the shutter speed.

The Record Settings Tab, Advanced Settings box has one Advanced Settings drop-down menu for Record Bit Depth and another for Fixed Pattern Noise.

6.4.5 Select Bit Depth for Recording:

Note that if 10 bits are selected for the recording, the recording time will be shorter, but you will have the added flexibility of selecting which 8 bits to view in Review or Save. (The bit selection drop down menu will appear in the Display Settings Tab.

6.4.6 Select FPN Setting:

FPN selection (Disabled / Column FPN / Pixel FPN) can be done from the Web-Application via the Advanced Settings menu. Black Frame Calibration may be done from the Camera Systems section of the Camera tab.

6.5 Record Controls

The Record Controls Tab of the Web-App with the External Trigger, Sync In and Sync Out pull down menus open.

6.5.1 Setting the Trigger Position:

The trigger position is set via slider. There is much finer control of the trigger position using the Web-App than can be had on the camera GUI. External Trigger:

Select Rising Edge, or Falling Edge to enable the External Trigger. Use Falling Edge for a simple switch closure.

6.5.2 Sync In and Sync Out:

NOTE: If Sync in is enabled you will not see any Live or captured imagery unless there is a valid Sync In signal. All of the options for camera synchronization are selectable on this menu.

6.6 Display Settings Tab

Settings in this tab control displayed images, both Live and in Review, and all saved images except the RAW formats.

The Display Bit Depth selection box will only be present when the camera has been placed in 10-bit mode in the Record Settings Tab.

Select White Balance* preset according to the available light.

The sliders used for Brightness, Contrast, and Gamma you control over the same range as with the presets in the camera, but it is a much finer control.

The color sliders* give you control over the RGB gains. It is advisable to use the color sliders with a grey card to get good color balance:

1. Frame the camera image on a neutral gray object. (A gray card, piece of white paper, white wall etc.)
2. Turn on the histogram on the camera display.
3. Adjust the light or F-stop so that the histogram shows most pixel values in mid range. You will see a separate peak for Red, Green, and Blue. Green will likely be highest.
4. Adjust the gains for Blue and Red up so that the peaks match the Green. (* Color cameras only.)

Use the HDMI dropdown menu to disable or set the HDMI output from the **Blaster's Ranger II™ Lt**.

6.7 Arm, Trigger, Live, and Review Buttons

Use the Arm, Trigger, Live, and Review Buttons above the image window to control the state of the camera:

When the camera is in Live mode with no captured images in its buffer, the Arm and Live buttons will be enabled (bright) and the Trigger and Review buttons will be disabled (grayed).

Click on the Arm button whenever it is enabled and to go into Record mode. This will arm the camera, recording the pre-trigger frames.

The Arm button will now turn Brown and change to "Armed." The Trigger button will become enabled. Clicking on the Armed (brown) button, will de-arm the camera (after a warning message).

Trigger button function is dependent on the camera state and recording mode. In Basic mode the Trigger will initiate a record cycle on an Armed camera, which will end with the camera saving or playing back the recording. On the **Blaster's Ranger II™ Lt** In Long Record ROC mode, the Trigger will toggle the camera between Recording and Armed. In Long Record BROC mode, the Trigger will capture a specified number of frames then return to Armed.

The Live button returns you to Live mode. If the camera is currently recording, there will be a warning message that proceeding will result in loss of unsaved video. If the camera is in Review mode, pressing the Live button will bring up an information box telling you that you are leaving Review and entering Live mode, but that captured video will remain in the camera until it is re-armed.

When in Review Mode, the Live and Review buttons act as a toggle between Live and Review. The current recording is not deleted until the camera is Armed or powered down.

6.8 Review Tab

When in Review Mode, the Review Tab will open and the Playback controls will appear beneath the Image window.

Note: While in Review, the image may be adjusted using the controls in the Display Settings Tab.

The Play buttons, which only appear when the mouse cursor is brought over them, have the same functions as on FasMotion, except that the Cut-In and Cut-Out points are entered by editing the Clipping Range boxes or by adjusting the slider between them. The clipping range is then used, as it is on the camera GUI for both playback and while saving to mass storage.

You may jump to the beginning of the clip (|<); to the end (>|) or to the Trigger frame (T). You may also move to any frame by editing the Current Frame box, or by moving the slider beneath it.

The Playback Frame Rate box may be edited directly or controlled via slider. The Playback Rate governs the speed at which the clip is played back both forward and reverse.

The skip forward >> and reverse << buttons skip at 1/10th the Playback Frame Rate. If you set the Playback Rate at 30, the >> and << buttons will skip forward or back 3 frames; if you set it to 300, they will skip 30, etc.

Video clips may be saved to mass storage devices attached to or installed in the camera (SD Card, SSD, or USB Drive).

6.8.1 To save a video clip:

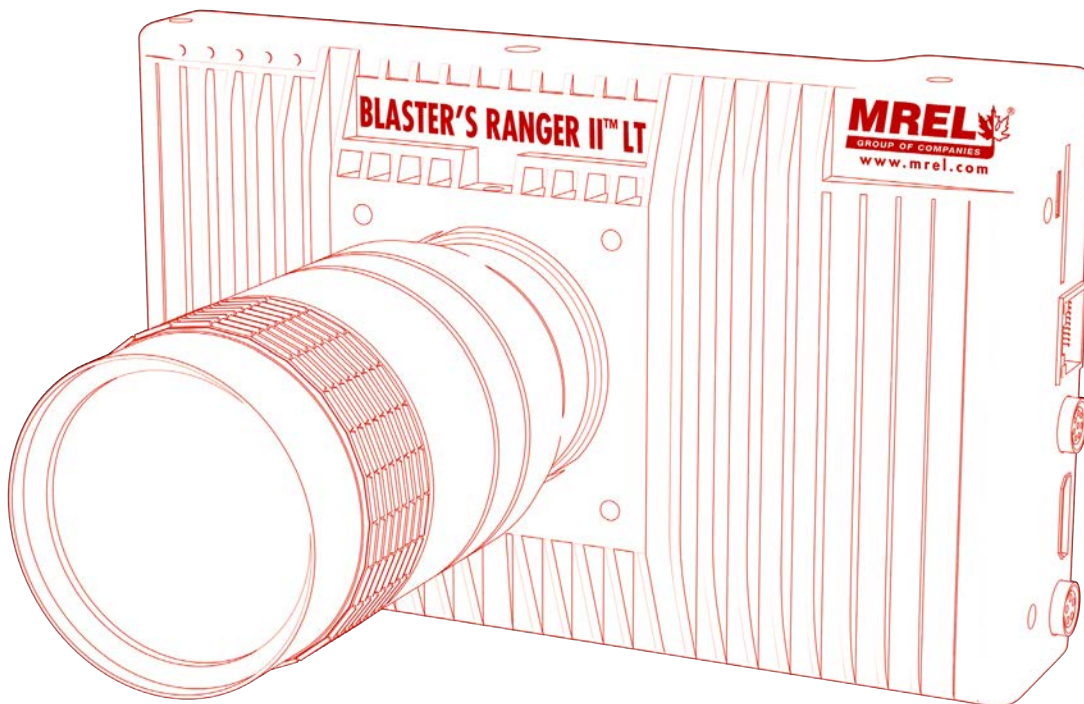
1. Adjust the Clipping Range (edit the boxes or move the sliders) to include the portion of the clip you wish to save.
2. Use the "Use Camera Name" and/or "Use Tag Label" check boxes and the Tag Label edit box to set up the file name prefix you wish to use.
3. Click on the File Type bar to select the file type.
4. Use the "Add a Comment" check box to add a comment to your video. This comment will appear in the camera metadata.
5. Select or deselect "Use Raw Format." This check box will be active or grayed depending on the bit depth recorded and the file type selected.

6. Select the destination drive using the "SD Card," "SSD," and "USB Drive" radio buttons.
7. Click on "Save Partition."

A Progress Bar will appear beneath the image window showing the download status. When finished, an information window will appear.

Chapter 7

Field Operations



Overview

This chapter provides instructions on using the Blaster's Ranger II™ Lt to record blasts in the field.

7.1 Introduction

High speed photography has proven to be a very useful tool in the field. High speed photography can provide valuable information for troubleshooting and feedback for blast design.

Typical **Frame Rates** for capturing open pit blasts range from **250 - 1000 fps** for the reason that satisfactory

- Immediate availability of the blast for review
- Confirmation of the firing sequence of holes
- Measurement of the firing time and scatter in detonators
- Assessment of the degree of confinement, stemming blowouts, and flyrock zones
- Confirmation of the functioning of explosives, primers, and accessories
- Determination of the location, time, and duration of gas venting
- Assessment of the locations responsible for flyrock or other projectiles
- Evaluation of the extent of backbreak
- Determination of the location, time, and duration of nitrogen oxide emissions
- **Sensor Fusion™** Combinatory analysis of video data with VOD data or other sensors allows live visualization of issues perceived from other data acquisition methods such as those captured by the **MREL DataTrap II™** or **MREL MicroTrap™**.

The Figure on the following page illustrates the various high speed video photography applications.

7.2 Selecting a Camera Position

The position of the **Blaster's Ranger II™ Lt** is very important. It can sometimes be difficult to select an ideal location due to a lack of suitable elevation above the height of the blast, or obstructions in the line of sight. This can usually be overcome by careful combination of a suitable location and **Lens** parameters. When selecting a location it is of utmost importance to ensure the safety of all personnel on-site, and to ensure the survivability of instrumentation.

MREL always recommends the use of proper sheltering from flyrock to protect the **Blaster's Ranger II™ Lt** from damage. The User has the option of using a **Remote Trigger**, triggering, or a trigger that is associated with the blast event (i.e. a **Make Trigger** wrapped over the end of a detonator). If the User intends to trigger the recording manually, the push-button trigger device is available from MREL with any desired length of cabling.

Finally, the location should also ensure that during the blast, the first boreholes to fire do not obscure the line of sight of other boreholes. For this reason, it is best to choose a location so that the first boreholes are at the opposite end of the blast from the **Blaster's Ranger II™**.

For observation of surface movement, the **Blaster's Ranger II™ Lt** should be positioned behind the blast so that rock movement does not obstruct the view of the surface of the bench. For observation of the free face of the bench, position the **Blaster's Ranger II™ Lt** directly in front of the face, at a safe distance and preferably at an elevated location. For typical overall analysis of a bench blast, position the camera in front and to the side of the blast, at an elevated location a safe distance from the free face.

To analyze face velocities, the **Blaster's Ranger II™ Lt** should be located to the side of the blast, parallel with the free face. Brightly coloured targets should be used as reference points for measuring distance in the **ProAnalyst® Introductory Edition Motion Analysis Software** when the sequence is being analyzed. These markers should be positioned exactly perpendicular to the line of sight of the **Blaster's Ranger II™ Lt** and the distance of separation from marker to marker should also be known exactly. This will allow for convenient and accurate velocity measurement. Remember to use markers that are easily visible at distance (vivid colours, generally one square foot or larger). Targets should be three-dimensional as they are likely to rotate out of orientation during the blast. Pay special attention to targets that are lowered from the free face, so as they are correctly positioned and are able to snap free from their suspension when the face begins to heave.

7.3 Field Setup

7.3.1 System Setup

The **Blaster's Ranger II™ Lt** has been designed to assemble quickly and easily in the field. The complete setup of the system is detailed in **Chapter 3**.

1. Setup the **Tripod**.
2. Connect the **Mounting Adapter** to the Lens and attach the assembly to the **Grip Action Ball Head**.
3. Attach the **Lens** to the **Blaster's Ranger II™**.
4. Attach the **Trigger Switch** (or other trigger) to the **Trig In** connector of the **Blaster's Ranger II™ Lt** through the **Blaster's Ranger II™ Lt I/O cable**.
5. Attach the appropriate power supply adapters (AC or DC) to the **Blaster's Ranger II™ Lt** through the power supply source (120/240 VAC, or 12 VDC battery).
6. Connect the camera to a laptop using the Ethernet cable.

If the **Tripod** is unstable, it is suggested that a weighted object be suspended from the center of the **Tripod**. The **Tripod** legs should be set as short as possible to increase stability and to mitigate camera movement as a result of ground vibration.

7.3.2 Power Supply Options

If no AC power is available, the **Blaster's Ranger II™ Lt DC Power Adaptor** has been provided with alligator clips to connect to a typical **12 VDC Lead-Acid Battery**. These batteries are very common and can be found in most passenger vehicles.

If AC power, such as a generator or a power inverter is used, then the **Blaster's Ranger II™ Lt** can be powered through the **Blaster's Ranger II™ Lt AC Power Adapter**.

7.3.3 Camera Setup

Set up the **Resolution, Recording Speed, Shutter Time** and other parameters.

NOTE: Changes of **Resolution** or **Frame Rate** may alter the quality of recorded images. Now the new parameters will be sent to the **Blaster's Ranger II™ Lt**. All other parameters e.g. shutter time or analog gain, will be sent immediately to the **Blaster's Ranger II™ Lt** after entering. If there is no connection to the **Blaster's Ranger II™ Lt**, an error message will appear. Please make sure the **Blaster's Ranger II™ Lt** is connected correctly.

1. Connect your laptop to the camera using one Ethernet cable
2. Open FasMotion or any browser to connect to the camera
3. Navigate to the **Record Settings**, select **Settings Sub-Menu** and set the resolution and speed desired. At 1000 fps, the resolution needs to be **1280X516** or **800X600**, can not be set to **1280X1024**. If the resolution was **1280X1204**, and you want to set the speed to 1000 fps, you need set the resolution lower first, then set the recording speed.
4. Navigate to the **Record Shutter Speed** Sub-Menu and set the desired exposure.
5. Navigate to the **Control Menu, Trigger Position** Sub-Menu and set the desired **Trigger point**. Select **Ext. Trigger**. Make sure it is **Enabled**. If **Disabled**, click on the **Disabled** button. It will turn green and the text will change to **Enabled**.
6. Frame and focus the scene.
7. Press the **Arm Button** to begin recording pre-trigger frames. The camera settings will be locked in. If you wish to abort the recording to change settings, press the **Arm Button** again.

NOTE: The camera may remain Armed for an indefinite period of time because it is overwriting its circular buffer, it never runs out of space, but only retains the newest images.

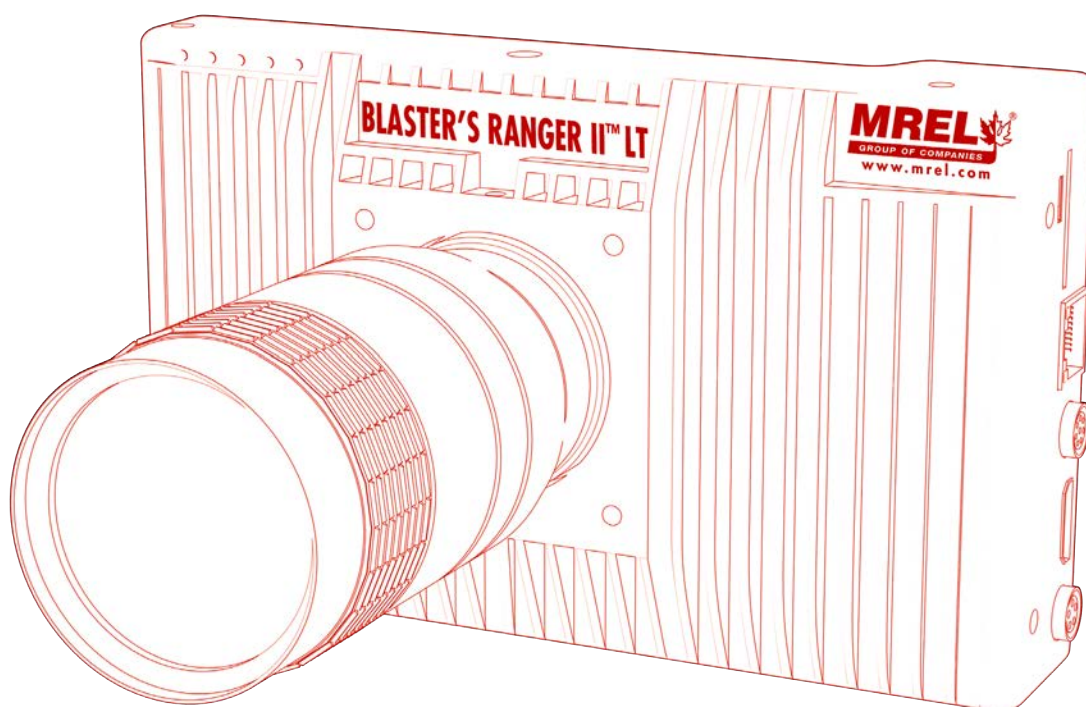
8. Trigger the camera via the **Triggerswitch** cable attached to complete the recording. The **Blaster's Ranger II™ Lt** will enter **Review mode** when finished recording unless it is set to **Autosave**, in which case the camera will download the recording, then revert to **Armed Mode**.
9. Use the playback icons to play forward, backward, or jump to points of interest in the movie. Use the **Cut In** and **Cut Out** icons to select a portion of the movie to review or save.
10. Save video from **Image Memory**. Select the **Save Icon** from the playback controls. This will bring up a dialog that allows selection of the following: Start and Stop points of the clip.
11. Select the destination to save the movie. Choices include the optional built-in **SSD**, an **SD card** or a **USB drive**.
12. Set the file Format to **AVI**. When the movie clip is set up as desired, press the **Save** icon on the **Save** dialog. A new dialog will open with the heading **Copy** in Progress. This dialog indicates the status of the file save operation.
13. When the file save is complete, the dialog will display a message indicating **Copy** completed successfully.
14. Press the **OK** icon to set the camera back into **Review Mode**.
15. Click on the **Live button** to put the camera back into Live Mode. From here a new recording can be made or the camera's configuration can be changed.

IMPORTANT

The **Blaster's Ranger II™ Lt Camera** image memory is volatile memory and images will be lost if a new recording is initiated or the **Blaster's Ranger II™ Lt Camera** is powered off . Be sure to save important videos before initiating a new recording or turning off the **Blaster's Ranger II™ Lt Camera**.

Chapter 8

ProAnalyst® Introductory Edition Software



8.1 About ProAnalyst® Introductory Edition

ProAnalyst® Introductory Edition allows auto-tracking of one feature and/or manually tracking of up to 32 features. Will allow the User to quickly export to Excel or Matlab for further analysis and graphing. If you need to track more than one point at the same time, please contact MREL to upgrade to **ProAnalyst® Professional Edition**. **ProAnalyst® Professional Edition** includes all the analysis features and engines for **Auto Tracking** objects in 1-D and 2-D, data reduction and report generation. Optional toolkit **Image Stabilization** can work with the **ProAnalyst® Professional Edition**.

Please follow the **ProAnalyst® Introductory Edition Installation Guide** to install **ProAnalyst® Introductory Edition** software on your computer. The **ProAnalyst® Introductory Edition Installation Guide** is in the box of the **ProAnalyst®**.

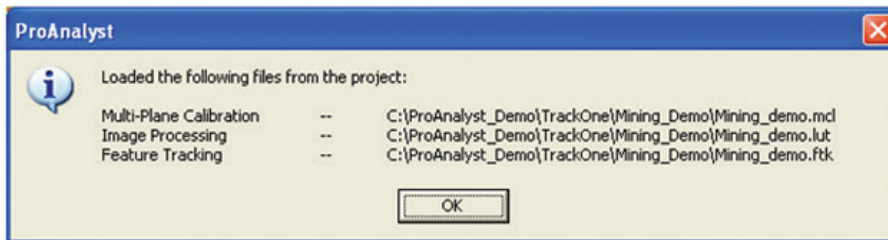
Now you can open **ProAnalyst® Introductory Edition**, and find the **ProAnalyst® Introductory Edition Reference Guide** from the menu **Help**, or the User can follow the instructions in the **Getting Started Guide** and **User Guide** to do the video analysis.

8.2 Example Demonstration File Explanation – Mining Example

This Mining example is for the purpose of learning **ProAnalyst® Introductory Edition**. The example file can be found in the Mining_Demo directory.

This example file was captured at **250** frames per second. The calibration of the video is as shown in the calibration tab with the distance between the two green markers is **12** meters. This summary is **ONLY** describing the items directly used for this example. All other functions within the software, please refer to the manual that came with the software.

- Open **ProAnalyst® Introductory Edition**. Select File, Open Project...
- Navigate to the directory where the files are stored and select Mining_Demo.mpj then click Open.
- The project file will open into its window with the file called Mining_Demo.
- Right click on the video file and the window below will open.



- Click on **=== Load All Associated Files for This Video ===**
- This will load all of the data files associated with the example. When the file opens, it will have loaded a **Multi-Plane Calibration** file (.mcl), **Image Processing file** (.lut) and a **Feature Tracking file** (.ftk) as shown below with the directory tree.
- Once the operator clicks **OK**, the window can be maximized with the video.
- To confirm the frame rate in entered into the software correctly, right click on the video and select **Modify Recorded Parameters**. This will allow the user to calibrate the time of the video. The user can also modify in this menu the used shutter speed and the modification of the zeroth frame.
- With the window maximized, the user will notice along the left edge of the video there are three tabs: **Raw**, **Processed** and **Thumbnail**.
 - The **Raw** tab is the original video with no modification which will be, in this example, the original coloring.

- The **Processed** tab is same video with the Image Processing applied.
- The **Thumbnail** tab is the video with thumbnails at particular points in the video.
 - Pressing **Z** decreases the size of the thumbnail while **A** increases the size.
 - Pressing **X** decreases the time between thumbnails while **S** increases the time.
- On the right side of the frame is a vertical tab of items to be used to perform the measurements required.

In order from the top to bottom: **Image Processing, Image Filtering, Multi-Plane Calibration, Display Layers, Notes, Annotations, Feature Tracking, Graph Configuration, Save All Associated Toolkits**. All of the changes will only be visible in the **Processed** tab because the **Raw** tab will remain unchanged.

In **Introductory Edition**, only some of the tabs can be used to manipulate the video, but can open all of the modifications from other versions of **ProAnalyst®**.

8.2.1 Image Processing



Allows the operator to change the color of the video which includes the **Brightness, Contrast, Gamma and Exponential / Logarithmic**.

Below the sliders, the buttons can invert (reverse) the individual colors.

The **Convert to B&W** (Black and White) can change the color image to a grey scale. The sliders above the button can change the intensity of the individual colors. Once in **B&W**, the sliders below will be able to be changed as above.

The **Load** and **Save** buttons will load a previously saved **Image Processing file (*.lut)** while **Save** will generate a lut file from the current settings.

The Reset All will return all of the setting to the default location.

8.2.2 Multi-Plane Calibration



This tab will allow the user to calibrate the video file.

The software needs to relate the number of pixels to a known distance. The **Introductory Edition** can not use a perspective calibration as can the other versions of the software.

The Normal calibration can be performed within **Introductory**. A Normal calibration is able to measure items that move at right angles to the camera view.

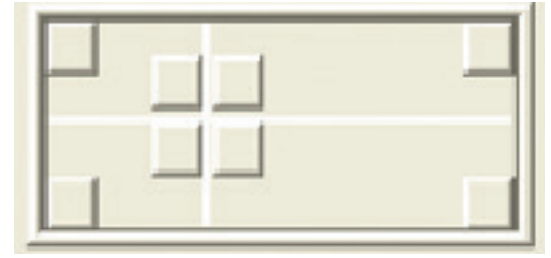
To add a calibration, click on **Add Normal** and another line item will appear on the screen. Throughout this software package a standard convention will repeat. For example, on the calibration line on the right, there is an eye either open or closed. If the eye is open, the object is visible on the screen. If the eye is closed, the object will not be shown on the screen.

The wrench to the right of the eye will open a configuration menu. In the calibration wrench menu, it is labeled as Calibration # Settings where # is the number of the calibration. When the operator clicks on the screen, the reticle (cross hair) will move to the position clicked. If the operator then clicks on **Set Point #1**, the first point of the calibration will be set. The second point can be selected in a similar method. After the two points are selected, the user can enter the value between the two points selected and then select the units of measurement of the number from the pull down menu. After the units are selected, the **Apply Scale >>** button **MUST** be clicked. This will change the box beside the button to xx pixels/"units selected".

The origin of the coordinate system can be set in a similar method. Point the reticle to point where the operator requests the coordinate origin to be (0,0). This will be the reference point for all of the measurements. After the origin is set, the orientation of the axes must be set. As shown below, each of the buttons in the picture will set the orientation of the axes.

Each of the corner buttons will set the origin of the coordinate system in the respective corner. The positive orientation of the two axes will be along the edge of the frame. For example, the top left button will set positive X direction to the right and the positive Y direction down while the bottom right button will set the positive X direction to the left and the positive Y direction up. The four buttons around the reticle will set the positive orientation around the button pressed from the reticle position. If the orientation of the X axis is not horizontal, from the origin of the coordinate system place the reticle on the horizontal line and then click Set X Direction. Once the Origin and positive axes are set, the user **MUST** click **Apply**

Origin and Tilt >> button. After the button is clicked, the pixels (origin) will be displayed as well as the degrees (tilt).



The user **MUST** then click **Apply** to set the changes and then **Close**. The user can then remove calibrations if they were made in error.

8.2.3 Display Layers



This menu allows the user to change which layers are displayed and the information displayed on the screen.

8.2.4 Notes



This will allow the user to make notes on the video file. The area labeled Video Notes is information about the displayed frame while the Global Notes area pertains to the whole video.

8.2.5 Annotations



The tab allows the user to draw and place text on the video frame.

8.2.6 Feature Tracking



This tab will allow the user to track a point on the video.

In the top left of the tab, **Feature Tracking** must be enabled. If user can not change any other part of the menu structure, click on **Enable**.

The user needs to decide whether a **Manual** or **Automatic mode** will be used to track an object.

In **Manual Mode**, the operator will manually select each and every point that will be used in the calculations. In **Manual Mode**, less video manipulation (Image Processing) is required because the human eye can distinguish the difference when tracking an object better than a computer algorithm. The operator can switch between **Manual** and **Automatic** while tracking a single object. When the user is in **Manual mode**, the user can click on **Add** and add a feature that can be used to track an object. This is the simplest way to track. Click to place the reticle on the object the user wishes to track and click **Set Point**. This needs to be done in every frame the operator wishes to track. This can be a long and tedious task if a lot of frames need to be

In **Automatic Tracking**, a feature can be added just as in Manual tracking but now the user needs to define a region of the video that

they wish to track by clicking **Define Region** and drawing a rectangle around the object. The way that the user can select an area, the computer is looking for that exact defined area in the next frame. Therefore, the user should try to select an object that stays defined throughout the time of interest. This is where the Image Processing is very important to help distinguish the tracking object from the background image.

Within **Introductory**, the user only can use the **Image Processing** while **Image Filtering** is not available. Once the user can separate the tracked object from the background and the area around the object has been defined and set, the grey box will turn a shade of cyan.

After the user clicks of the wrench, the settings box opens. The operator needs to give the **Feature** a name that makes sense for future reference. Then the correct **Calibration** needs to be selected from the pull down menu.

Within the Search Parameters section, the **Search Region Multiplier (%)** is the increased search area around the defined region. This area can be displayed around the defined area by right clicking on the video, **Feature Tracking> Show Search Regions**. This is the area that the **Defined Region** is looked for in the next frame of the video.

The larger the area, the larger the possibilities of the Automatic Tracking will follow something else in the area.

Too small of an area and the tracked object may not be within the area in the next frame.

The **Threshold Tolerance (0.0 – 1.0)** is the type of match from frame to frame where 1.0 is a perfect match. Normally, the tolerance is between 0.75 and 0.95. The **Frames to Search After Loss** is the number of frames the software will look ahead if it has lost the tracked object. Normally, it is set to 0.

The other important setting is the **Feature Rotation**. If the tracked object is rotating in the frame the software can loose the Automatic Track on the object. The operator can Enable and set the **Angular Range (deg)** to the maximum expected rotation between two frames. This is a positive as well as the negative rotation angle. The **Step Size (deg)** is the number of degrees between the iterations. The larger the number, the higher the possibility of missing the object, while too small of a number will take a long time to process.

The **Show Points** selection will display on the video the points.

8.2.6.1 Show All

Display every point created.

8.2.6.2 Show Past

Display only past point created in the video.

8.2.6.3 Show Current

Display only the current point.

8.2.6.4 Show None

This will not display any points.

8.2.7 Under the Tracking box

The buttons from left to right are: **Track Backwards**, **Track One Frame Backwards**, **Stop**, **Track One Frame Forward** and **Track Forward**.

The software takes an image of the **Defined Region** when the **Set Region** button is pressed. At some points, the **Automatic Tracking** may lose the item of interest, the user **MUST** stop the tracking by pressing the middle Tracking button and play the video back (not track backwards) to the point of the tracking failing and reset the **Set Region**.

The operator can then continue the track in the same direction (forward or backwards) and the previously tracked points will move to the new location.

Once the object is tracked, the lock between the eye and the wrench should then be closed (to the locked position) to avoid any changes to the points.

The **Units & Export** section will allow the user to select the units to export the data to as well as the form that the file will be.

In this example, the setup was Meters and Text. The text file was placed in the same directory labeled **ProAnalyst_Demo.txt**.

The Introductory Edition does not offer graphing, therefore, for this example the data was imported and graphed in Excel. The file is labeled as **ProAnalyst_Demo.xls**.

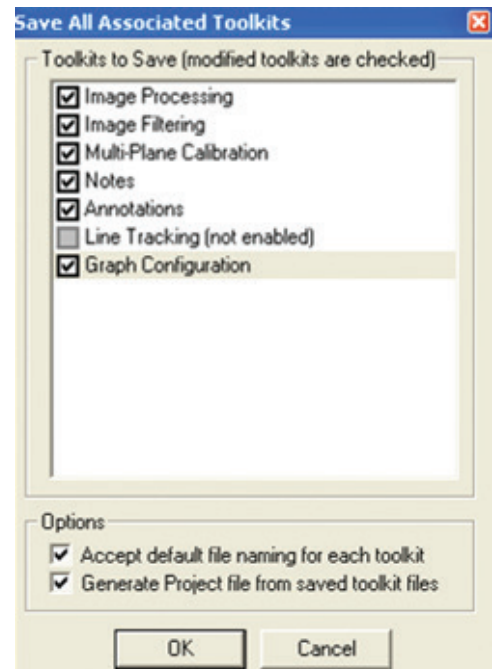
8.2.8 Save All Toolkits



After all of the analysis has been performed, it is very important to associate the files to the video. This will allow in the future, opening the analyzed video as easily as this example. It is important to select all of the boxes because the software will save everything.

The bottom two boxes under **Options** are also very important because the file names will be the same as the video file name. This will make it easier for the user in the future.

The Generate Project is also very important because it will be the overall association. This is the *.mpj file which will keep everything neat and tidy.



8.3 Excel Spreadsheet – Mining_Demo.xls

This spreadsheet was generated from the exported file from **ProAnalyst® Introductory**. On the first sheet (Mining_demo) displays the data from the text file with a Red shading. Everything with the Red shading of the cell was imported from the **ProAnalyst®** text file. All of the white (unshaded) cells were calculated within Excel.

8.3.1 Explanation of the Unshaded Cells

Feature 1 Values:

Since the values of X and Y start at zero, there is no requirement to correct them back to zero as in the Disruptor Demo.

Feature 1 (Top_Marker) Vector (column E): This column is the vector sum of the X and Y.

Equation: $E\# = \sqrt{C\#^2 + D\#^2}$ where # is the current cell in the E column

The Graphs tab has all of the measurements in a graphical solution.

The graph on the left is the final solution produced by MREL to show the user what a completed graph could look like. The two white lines and text boxes were manually generated by hovering the cursor over the graph to record the values. This can be done on the graph on the right.

The points used in this example are:

Lower Line:

Point #1: (0.984, 2.034001316)

Point #2: (1.600, 9.266355494)

Therefore, the average velocity between these two points is:

$$\text{Velocity} = (9.266355494 - 2.034001316) \text{ meters} / (1.600 - 0.984) \text{ second} = 7.232254178 / 0.616 = 11.74 \text{ m/s}$$

Upper Line:

Point #1: (1.656, 9.650500598)

Point #2: (2.956, 23.96412087)

Therefore, the average velocity between these two points is:

$$\text{Velocity} = (23.96412087 - 9.650500598) \text{ meters} / (2.956 - 1.656) \text{ second} = 14.3162027 / 1.300 = 11.01 \text{ m/s}$$

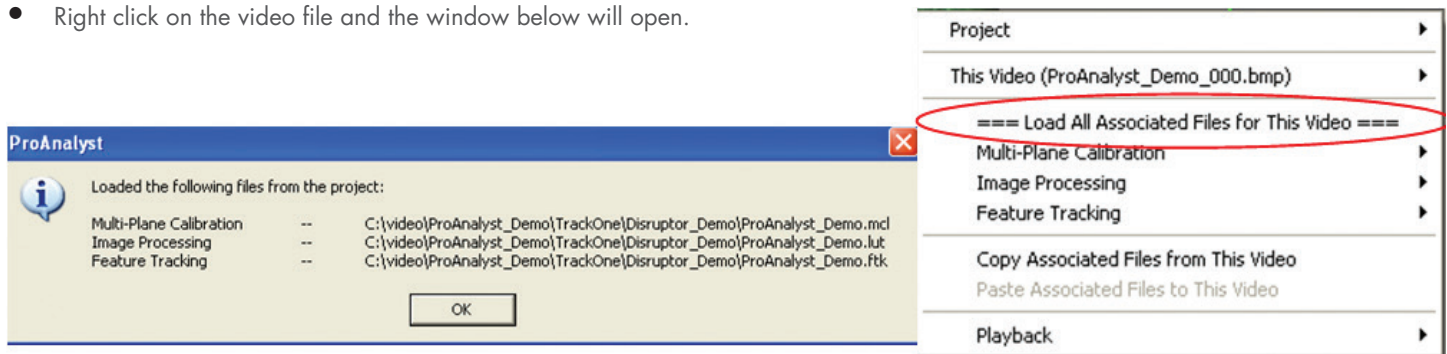
Two lines were chosen because of the 'bump' in the data graph near 1.6 seconds. As well, the slope of the line needs to match the data.

8.4 Example Demonstration File Explanation – Disrupter Example

This Mining example is for the purpose of learning **ProAnalyst® Introductory Edition**. The example file can be found in the Disrupter_Demo directory.

This example file was captured at 1000 frames per second. The calibration of the video is as shown in the calibration tab with the distance from the edge of the blue container to the third sensor (which is a third of the distance from the tip to the pole) is 5 meters. This summary is ONLY describing the items directly used for this example. All other functions within the software, please refer to the manual that came with the software.

- Open **ProAnalyst® Introductory Edition**. Select File, Open Project...
- Navigate to the directory where the files are stored and select ProAnalyst_Demo.mpj then click Open.
- The project file will open into its window with the file called ProAnalyst_Demo_000.bmp.
- Right click on the video file and the window below will open.



- Click on === Load All Associated Files for This Video ===
- This will load all of the data files associated with the example. When the file opens, it will have loaded a **Multi-Plane Calibration** file (.mcl), **Image Processing file** (.lut) and a **Feature Tracking file** (.ftk) as shown below with the directory tree.
- Once the operator clicks **OK**, the window can be maximized with the video.
- To confirm the frame rate in entered into the software correctly, right click on the video and select **Modify Recorded Parameters**. This will allow the user to calibrate the time of the video. The user can also modify in this menu the used shutter speed and the modification of the zeroth frame.
- With the window maximized, the user will notice along the left edge of the video there are three tabs: **Raw**, **Processed** and **Thumbnail**.
 - The **Raw** tab is the original video with no modification which will be, in this example, the original coloring.
 - The **Processed** tab is same video with the Image Processing applied.
 - The **Thumbnail** tab is the video with thumbnails at particular points in the video.
 - Pressing **Z** decreases the size of the thumbnail while **A** increases the size.
 - Pressing **X** decreases the time between thumbnails while **S** increases the time.
- On the right side of the frame is a vertical tab of items to be used to perform the measurements required.

In order from the top to bottom: **Image Processing, Image Filtering, Multi-Plane Calibration, Display Layers, Notes, Annotations, Feature Tracking, Graph Configuration, Save All Associated Toolkits**. All of the changes will only be visible in the **Processed** tab because the **Raw** tab will remain unchanged.

In **Introductory Edition**, only some of the tabs can be used to manipulate the video, but can open all of the modifications from other versions of **ProAnalyst®**.

8.4.1 Image Processing



Allows the operator to change the color of the video which includes the **Brightness, Contrast, Gamma and Exponential / Logarithmic**.

Within this example, the user will notice that the individual colors can be adjusted by double clicking on the slider in question.

Below the sliders, the buttons can invert (reverse) the individual colors.

The **Convert to B&W** (Black and White) can change the color image to a grey scale. The sliders above the button can change the intensity of the individual colors. Once in **B&W**, the sliders below will be able to be changed as above.

The **Load** and **Save** buttons will load a previously saved **Image Processing file (*.lut)** while **Save** will generate a lut file from the current settings.

The **Reset All** will return all of the setting to the default location.

8.4.2 Multi-Plane Calibration



This tab will allow the user to calibrate the video file.

The software needs to relate the number of pixels to a known distance. The **Introductory Edition** can not use a perspective calibration as can the other versions of the software.

The Normal calibration can be performed within **Introductory**. A Normal calibration is able to measure items that move at right angles to the camera view.

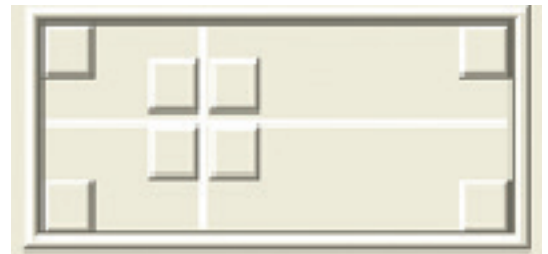
To add a calibration, click on **Add Normal** and another line item will appear on the screen. Throughout this software package a standard convention will repeat. For example, on the calibration line on the right, there is an eye either open or closed. If the eye is open, the object is visible on the screen. If the eye is closed, the object will not be shown on the screen.

The wrench to the right of the eye will open a configuration menu. In the calibration wrench menu, it is labeled as Calibration # Settings where # is the number of the calibration. When the operator clicks on the screen, the reticle (cross hair) will move to the position clicked. If the operator then clicks on **Set Point #1**, the first point of the calibration will be set. The second point can be selected in a similar method. After the two points are selected, the user can enter the value between the two points selected and then select the units of measurement of the number from the pull down menu. After the units are selected, the **Apply Scale >>** button **MUST** be clicked. This will change the box beside the button to xx pixels/"units selected".

The origin of the coordinate system can be set in a similar method. Point the reticle to point where the operator requests the coordinate origin to be (0,0). This will be the reference point for all of the measurements.

After the origin is set, the orientation of the axes must be set. As shown below, each of the buttons in the picture will set the orientation of the axes.

Each of the corner buttons will set the origin of the coordinate system in the respective corner. The positive orientation of the two axes will be along the edge of the frame. For example, the top left button will set positive X direction to the right and the positive Y direction down while the bottom right button will set the



positive X direction to the left and the positive Y direction up. The four buttons around the reticle will set the positive orientation around the button pressed from the reticle position. If the orientation of the X axis is not horizontal, from the origin of the coordinate system place the reticle on the horizontal line and then click Set X Direction. Once the Origin and positive axes are set, the user **MUST** click **Apply Origin and Tilt >>** button. After the button is clicked, the pixels (origin) will be displayed as well as the degrees (tilt).

The user **MUST** then click **Apply** to set the changes and then **Close**. The user can then remove calibrations if they were made in error.

8.4.3 Display Layers



This menu allows the user to change which layers are displayed and the information displayed on the screen.

8.4.4 Notes



This will allow the user to make notes on the video file. The area labeled Video Notes is information about the displayed frame while the Global Notes area pertains to the whole video.

8.4.5 Annotations



The tab allows the user to draw and place text on the video frame.

8.4.6 Feature Tracking



This tab will allow the user to track a point on the video.

In the top left of the tab, **Feature Tracking** must be enabled. If user can not change any other part of the menu structure, click on **Enable**.

The user needs to decide whether a **Manual** or **Automatic mode** will be used to track an object.

In **Manual Mode**, the operator will manually select each and every point that will be used in the calculations. In **Manual Mode**, less video manipulation (Image Processing) is required because the human eye can distinguish the difference when tracking an object better than a computer algorithm. The operator can switch between **Manual** and **Automatic** while tracking a single object. When the user is in **Manual mode**, the user can click on **Add** and add a feature that can be used to track an object. This is the simplest way to track. Click to place the reticle on the object the user wishes to track and click **Set Point**. This needs to be done in every frame the operator wishes to track. This can be a long and tedious task if a lot of frames need to be

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Within the Search Parameters section, the **Search Region Multiplier (%)** is the increased search area around the defined region. This area can be displayed around the defined area by right clicking on the video, **Feature Tracking> Show Search Regions**. This is the area that the **Defined Region** is looked for in the next frame of the video.

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The **Show Points** selection will display on the video the points.

8.4.6.1 Show All

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8.4.6.3 Show Current

Display only the current point.

8.4.6.4 Show None

This will not display any points.

8.4.7 Under the Tracking box

The buttons from left to right are: **Track Backwards**, **Track One Frame Backwards**, **Stop**, **Track One Frame Forward** and **Track Forward**.

The software takes an image of the **Defined Region** when the **Set Region** button is pressed. At some points, the **Automatic Tracking** may lose the item of interest, the user **MUST** stop the tracking by pressing the middle Tracking button and play the video back (not track backwards) to the point of the tracking failing and reset the **Set Region**.

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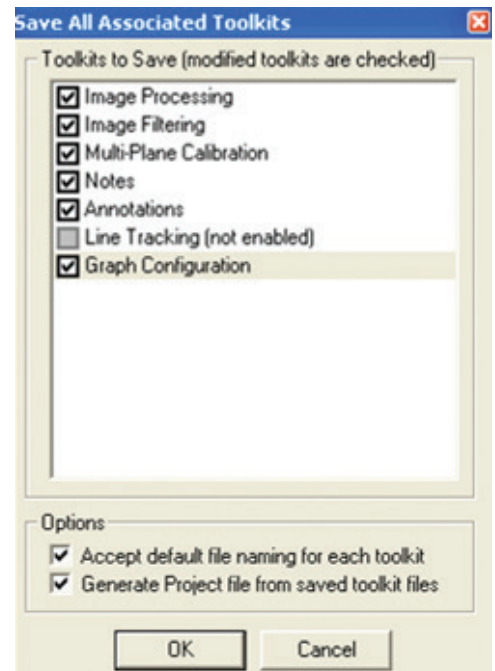
8.4.8 Save All Toolkits



After all of the analysis has been performed, it is very important to associate the files to the video. This will allow in the future, opening the analyzed video as easily as this example. It is important to select all of the boxes because the software will save everything.

The bottom two boxes under **Options** are also very important because the file names will be the same as the video file name. This will make it easier for the user in the future.

The Generate Project is also very important because it will be the overall association. This is the *.mpj file which will keep everything neat and tidy.



8.5 Excel Spreadsheet – ProAnalyst_Demo.xls

This spreadsheet was generated from the exported file from **ProAnalyst® Introductory**. On the first sheet (ProAnalyst_Demo) displays the data from the text file with a Red shading. Everything with the Red shading of the cell was imported from the **ProAnalyst®** text file. All of the white (unshaded) cells were calculated within Excel.

8.5.1 Explanation of the Unshaded Cells

Feature 1 Values:

Feature 1 (Right_Side) X (corrected) (column D): This column is used to correct the offset of the data points from the origin of the coordinate system. Equation: $D\# = (C\# - C12)$ where # is the current cell in the D column.

Feature 1 (Right_Side) Y (corrected) (column F): This is the same process as X (corrected).

Feature 1 (Right_Side) Vector (column G): This column is the vector sum of the X (corrected) and Y (corrected). Equation: $G\# = \sqrt{(D\#^2 + F\#^2)}$

Feature 2 Values:

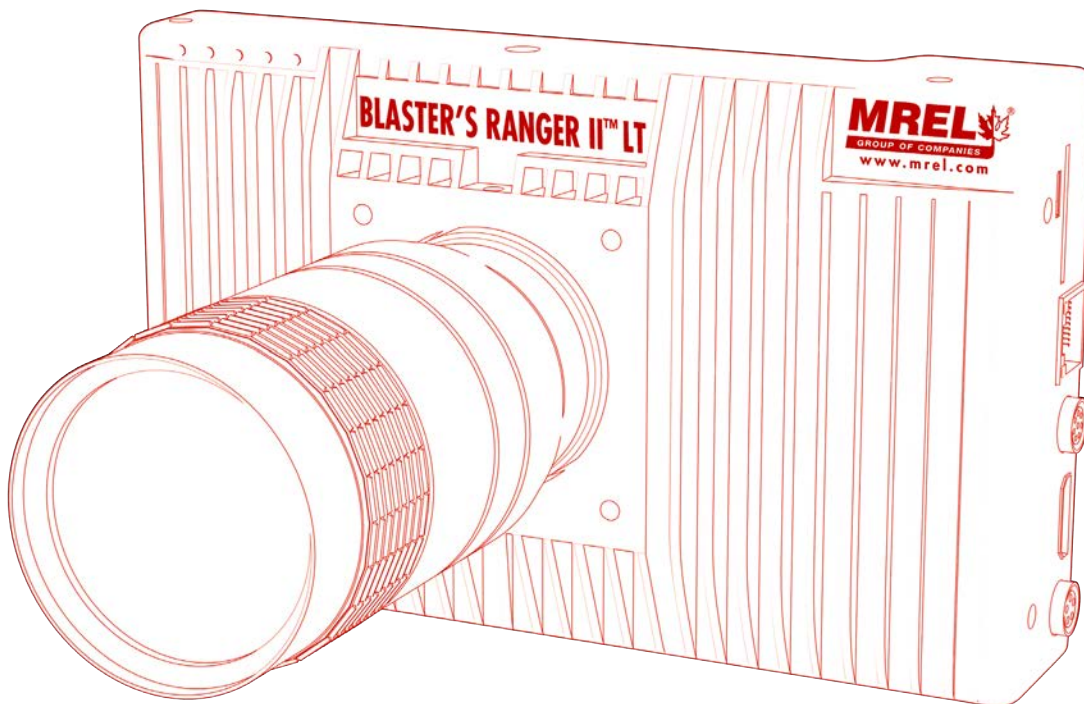
Feature 2 (Left_Side) X (corrected) (column J): This column is used to correct the offset of the data points from the origin of the coordinate system. Equation $J\# = (I\# - 112) * (-1)$ where # is the current cell in the J column. The values are required to be multiplied by negative 1 (-1) because the coordinate system was defined with Positive X to the right, the left side positive motion is to the left. The other solution is to define another calibration for the Left_Side measurement.

All of the other measurements are as described above.

The Graphs tab has all of the measurements in a graphical solution.

Chapter 9

Contacting MREL for Technical Support



9.1 Contacting MREL

MREL Group of Companies Limited

Blasting Instrumentation Team

5-779 Sir John A MacDonald Blvd.
Kingston, Ontario K7L 1H3
Canada

Toll Free Canada/USA: +1-877-544-MREL

Tel: +1-613-545-0466

Email: support@mrel.com

Webpage Support: www.mrel.com/contact.html

MREL looks forward to providing you with assistance.



MREL is committed to product innovation; accordingly product may undergo specification improvements without notice.

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MREL GROUP OF COMPANIES LIMITED

5-779 Sir John A MacDonald Blvd. Kingston, Ontario K7L 1H3 Canada

T: +1-613-545-0466

E: contact@mrel.com

www.mrel.com