Phantom 65/PhantomHD Operations

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VISION RESEARCH

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Part

I

1 Important Notices

All Phantom camera's and peripherals have been designed and produced according to the relevant safety standards. Although the mechanical design is extremely rugged and stable, the content, high-tech micro electronics deserves a careful handling.

1.1 Safety Instructions

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1.1.1 General

Do not open the product; there are no user serviceable parts inside. All maintenance and service work should be performed by qualified service personnel. The camera's are intended to be used in restricted access areas.

1.1.2 Installation

Do not expose your cameras and peripherals to excessive heat, moisture or dirt. The Phantom cameras are intended to be used in a controlled environment, unless precautions have been taken for outdoor use.

The cameras and peripherals should only be powered from an appropriate DC power supply that fulfills the local safety and EMC (Electro-Magnetic Charge) demands or the appended AC adapter.

Do not install the Phantom camera in an excessively humid environment or near water.

Avoid liquids or any foreign object to get into the product.

The unit must be placed in a sufficiently ventilated area.

It is important that ventilation air can move freely around the unit.

1.1.3 Shipping

When shipping the Phantom camera's and accessories, use the carton in which the unit was originally delivered. If you must frequently ship your camera, you may wish to purchase an accessory carrying case that has been designed for this purpose.

1.1.4 Precautions

A laser beam focused on the sensor of a Phantom camera, either directly or by reflection, can cause permanent damage to the sensor. Any laser powerful enough to produce localized heating at the surface of the sensor will cause damage, even if the camera power is off. A sensor damaged by laser light is NOT covered by warranty.

1.2   Operational Instructions

1.2.1   Phantom 65/Phantom HD

Phantom 65/Phantom HD

1. It is important to note that making a single setup and recording parameter change via the Phantom Camera Control software will change all the setup and recording parameters, as defined in the Phantom Camera Control>Acquisition>Setup and Recording... dialogue window when either the OK or Update buttons are depressed.

   Conversely making changes to the setup and recording parameters via the On-Camera Control buttons will not change the settings in the Phantom Camera Control>Acquisition>Setup and Recording... dialogue window when a setup parameter is selected.

2. The Sample Rate will automatically be changed to the maximum allowable frame rate based on the selected Resolution when operating in Run/Stop Mode.

3. The color of the Phantom CineMag record cine files will be different that that of the cine files recorded in the cameras DRAM frame buffer.

4. Only the entire contents of the Phantom CineMag can be erased, the system does not allow a user to specified a single cine file to be erased.

5. The Erase Protect feature has not yet been enabled even though the Erase Protect Indicator is active, when the Erase Protect Switch, located underneath the Phantom CineMag, is in the locked position, indicating the CineMag is in Erase Protect Mode.

6. Presently both the Phantom 65 and Phantom HD only support the use of a color ViewFinder.

Part II

2   Product Overview

At the time of this writing, the members of the Cinematography and Broadcast Phantom product family include the Phantom 65 and Phantom HD camera models.

2.1   Phantom 65

Cinematography takes a giant step forward with the first digital camera that rivals 65mm film cameras!

Vision Research's newest camera, the Phantom 65, with its 4,096 x 2,440 pixel CMOS sensor is the first high speed digital camera to rival traditional 65mm film cameras.

This multi standard compliant camera will revolutionize the world of high speed cinematography recording 125 frames per second at full resolution. With features such as its ViewFinder with component video, on-camera controls, and "hot-swappable" Phantom CineMag memory magazine with docking station make this camera user-friendly in either on-set or post-production environments.

- Full frame 2.2:1 aspect ratio CMOS sensor composed of 4,096 x 2,440 pixels (51.2mm x 30.5mm) equivalent to 65mm film

- 140 frame per second full resolution with 14-bit image depth

- On-camera control

- Variable progressive shutter to 2 microseconds

- Multi-standard compliant camera; multiple HD-SDI output formats (720p, 1080p, 1080i, 1080psf)

- Linear or circular image storage buffer

- 8 Gigabyte DRAM memory (standard); 16 or 32 Gigabyte modules available

- 256, or 512 Gigabyte "Hot-Swappable" Phantom CineMag memory magazine w/docking station

- 645, 667, PL, Super-PL, and F-mount lens mount available

- ViewFinder port with component video, plus power

- Gigabit Ethernet control

2.2   PhantomHD

HD broadcast quality high speed digital imaging arrives!

Vision Research sets another standard with the design of their Phantom HD high speed digital camera. With its new 1,920 x 1,080 active pixel CMOS sensor users will experience the highest quality imaging capabilities of any high speed digital camera anywhere. The 24mm x 13.5mm active pixel area makes this camera fully compatible with all 35mm equipment as well.

Phantom HD users will find the "On-camera" controls easy to use, while it's ViewFinder with component video makes shooting any subject clear and precise. "Hot-swappable" Phantom CineMag memory magazine eliminates the need to download the recorded images before shooting consecutive takes.

- Full frame aspect ratio CMOS sensor composed of 2,048 x 2,048 pixels

- Allocated format for standard HD 16:9 (1920 X 1080 pixels) and 35mm mopic at 1.85:1 using an active pixel area of 25.6mm x 13.85mm (2048 X 1108 pixels) making this camera fully compatible with all 35mm equipment as well

- 1000 pictures per second HD (1920 X 1080) resolution with 14-bit image depth

- On-camera control

- Variable shutter to 2 microseconds

- Mutli-standard compliant camera; multiple HD-SDI output formats (720p, 1080p, 1080i, 1080psf)

- Linear or circular image storage buffer

- 8 Gigabyte DRAM memory (standard); 16 or 32 Gigabyte modules available

- 256, or 512 Gigabyte "Hot-Swappable" Phantom CineMag memory magazine w/docking station

- PL lens mount (standard) F-mount lens available

- ViewFinder port with component video, plus power

- Gigabit Ethernet control

2.3   Phantom CineMag

The Phantom CineMag is hot-swappable, non-volatile memory for the Phantom Digital Cinema cameras.

The Phantom CineMag comes in two sizes—256GB and 512GB. Record directly into a CineMag on the Phantom HD at speeds up to 450fps at 2048 x 1080. At higher speeds, record into the camera's RAM and "upload" to the Phantom CineMag in seconds. With the Phantom 65, record directly into a CineMag at up to 90fps. On both cameras, higher direct recording speeds are available at lower resolutions, see tables below.

Phantom HD

Phantom HD at 1920 x 1080, 14-bit depth, 16GB memory, into 256GB CineMag (double these times for a 512GB CineMag):

Frame Rate (fps)	Max Recording Time	CineMag Upload Time
24	69 min	N/A
100	16.5 min	N/A
400	4.1 min	N/A
700	16 shots of 6.3 sec. each	11 sec per. shot
1000	16 shots of 4.4 sec. each	11 sec per. shot

Phantom 65

Phantom 65 at 4096 x 2440, 14-bit depth, 16GB memory, into 256GB CineMag (double these times for a 512GB CineMag):

Frame Rate (fps)	Max Recording Time	CineMag Upload Time
24	15.25 min	N/A
60	6.1 min	N/A
90	4 min	N/A
120	16 shots of 11.4 sec. each	15.2 sec. per shot
140	16 shots of 9.8 sec. each	15.2 sec. per shot

Access of the data in the Phantom CineMag is done from the Phantom Software, just as if you were accessing recordings stored in a camera. All the familiar tools are available. You can view stored scenes, trim them, and save them onto a hard disk for later processing and conversion. Or, trim them, make image enhancements and "play" them out over dual HD-SDI.

2.4   Phantom 65/Phantom HD Operational Modes

2.4.1   Loop Mode

In the Loop Mode the camera stores the recorded image data into the camera's DRAM buffer. In this mode the Phantom CineMag operates like any other Flash card, after a cine file is recorded into the camera's DRAM frame buffer, you can manually save it into the CineMag using the "Flash Memory" dialogue window which can be accessed in either the Setup and Recording or ViewCine dialogue windows.

2.4.2   Run/Stop Mode

In Run/Stop Mode the image data is recorded, up to 450fps at HD resolution (2048 x 1080), directly into the Phantom CineMag.

Part III

3   Defining the Video Out Parameters

This section provides information related to various procedures that must be performed, via the Phantom Camera Control software, in order to properly use the On-Camera Controls on either the Phantom 65 or Phantom HD camera models with an attached compatible monitor or sending the analog video output to an analog video storage device, such as a tape drive. The information contained within this section can also be found in the Phantom Camera Control Software - Help File
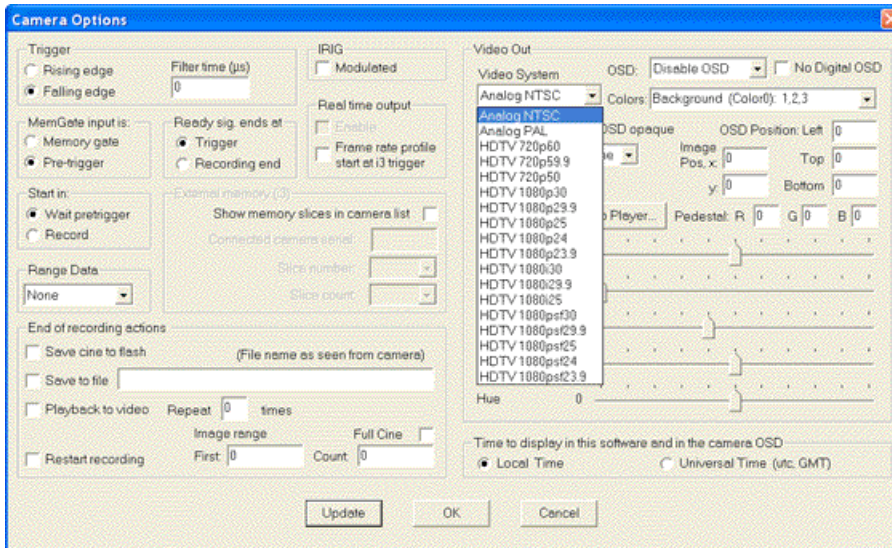
Example Acquisition>Camera Options Dialogue Window

3.1   Selecting the Video System

Clicking the Video System down arrow allows the user to specify the type of video signal format the camera will transmit to a monitor. Format types include:

Analog NTSC

When selected the camera will transmit the NTSC (National Television System Committee) video signal format; 59.94 half frames (called fields) per second and 525 lines per field, (480 lines in each field are the image, and the last 45 are the "vertical blanking interval" (VBI), designed to give the electron gun time to reposition itself from the bottom of the last field to the top of the next), to attached compatible monitor.

NOTE

NTSC is the analog television system in use in Canada, Japan, South Korea, the United States, and some other places, mostly in the Americas.

Analog PAL

When selected the camera will transmit the PAL (Phase Alternating Line) video signal format; 25 fields per second and 625 lines per field, to attached compatible monitor.

NOTE

PAL is the analog television system used in most of Western Europe, Australia and other countries.

HDTV 720p60

When selected the camera will transmit 720 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of of 1280 lines and a frame resolution of 1280 × 720 or about 0.92 million pixels; progressively scanned, (non-interlaced); at a frame rate of 60Hz to an attached HD compatible monitor.

HDTV 720p59.9

When selected the camera will transmit 720 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1of 1280 lines and a frame resolution of 1280 × 720 or about 0.92 million pixels; progressively scanned, (non-interlaced); at a frame rate of 59.94Hz to an attached HD compatible monitor.

HDTV 720p50

When selected the camera will transmit 720 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of of 1280 lines and a frame resolution of 1280 × 720 or about 0.92 million pixels; progressively scanned, (non-interlaced); at a frame rate of 50Hz to an attached HD compatible monitor.

HDTV 1080p30

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a frame resolution of 1920 × 1080 or over two million pixels; progressively scanned, (no-interlaced); at a frame rate of 30Hz to an attached HD compatible monitor.

HDTV 1080p29.9

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a frame resolution of 1920 × 1080 or over two million pixels; progressively scanned, (non-interlaced); at a frame rate of 29.97Hz to an attached HD compatible monitor.

HDTV 1080p25

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a frame resolution of 1920 × 1080 or over two million pixels; progressively scanned, (non-interlaced); at a frame rate of 25Hz to an attached HD compatible monitor.

HDTV 1080p24

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a frame resolution of 1920 × 1080 or over two million pixels; progressively scanned, (non-interlaced); at a frame rate of 24Hz to an attached HD compatible monitor.

HDTV 1080p23.9

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a frame resolution of 1920 × 1080 or over two million pixels; progressively scanned, (non-interlaced); at a frame rate of 23.976Hz to an attached HD compatible monitor.

NOTE

1080p is currently the digital standard for filming digital motion pictures.

HDTV 1080i30

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a field resolution of 1920 × 1080 or over two million pixels; interlaced scanned, at a field rate of 30Hz to an attached HD compatible monitor.

HDTV 1080i29.9

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a field resolution of 1920 × 1080 or over two million pixels, interlaced scanned at a field rate of 29.97Hz to an attached HD compatible monitor.

HDTV 1080i25

When selected the camera will transmit 1080 lines of vertical resolution, with a horizontal resolution of 1280 pixels and an aspect ratio of 16:9, implying a horizontal (display) resolution of 1920 dots across and a field resolution of 1920 × 1080 or over two million pixels, interlaced scanned at a field rate of 25Hz to an attached HD compatible monitor.

NOTE:

Progressive Segmented Frame (PSF) is a High Definition video format used to store progressive content on interlaced media.

Each progressive frame is segmented into two interlaced fields without inter-field motion, or combing. PSF is an alternative to 3:2 pull-down, wherein certain frames are pulled down across multiple fields, resulting in output with an irregular frame rate.

Motion picture film cameras produce progressive images, usually at 24 frames per second. In order to display those images on NTSC television, whose frame rate is 29.97 frames per second interlaced (59.94 fields per second), each frame must be split into alternating groups of 3 and 2 fields. This is known as 3:2 pull-down.

Certain high definition tape formats, such as HDCAM allow frame rates other than 29.97. It is therefore possible, using PSF, to store true 24 frames per second progressive images without pull-down, which then play back at the original frame rate. Thus the 24psf and 23.976psf (for compatibility with NTSC) formats were devised, which exist on tape as 48 (or 47.952) fields per second interlaced. When set up correctly, a progressive scan monitor will read these interlaced fields two at a time, and display each pair as a single progressive frame, temporally identical to the source. PSF content can also be played back on interlaced displays, but the image will flicker.

HDTV 1080psf30

Will scan at a frame rate of 30Hz.

HDTV 1080psf29.9

Will scan at a frame rate of 29.9Hz.

HDTV 1080psf25

Will scan at a frame rate of 25Hz.

3.2   OSD (On-Screen Display) Parameters

By clicking the down arrow next to the OSD (On Screen Display) field the user can select which of the following is to be displayed:

Disable OSD

No information will be displayed.

Name,status

Displays the name and current status of the camera

+acqui params

Displays the setting specified via the Acquisition menu, along with the name and current status of the camera

+time,playback

Displays the absolute time and the playback rate, along with the name and current status of the camera, and specified via the Acquisition menu

+range data

Displays the camera name, current status of camera, the acquisition parameters, and all range data information

Other OSD options includes:

No Digital OSD

When enabled, (checked), the OSD field will not be displayed on an attached monitor or viewfinder.

Colors

Allows the user to change the OSD background color by selecting one of the options from the pull-down selection list

OSD Opaque

Removes the background color (black) from the OSD informational fields when disabled, not checked.

OSD Position

Allows the user to move the OSD informational fields upward (top), left, and/or right. Increasing the number move the displayed OSD information in the opposite direction. Example increasing the Top entry field moves the OSD information downward.

Image Position

Allows the user to center the image by adjusting the x and y axis

3.3 Tone Control Parameters

Tone curves adjust the apparent image contrast without changing the black and white points of the image (and thus maintain the dynamic range of the image). There are currently three presets:

Tone 1

Applies a medium contrast

Tone 2

Applies a strong contrast

Tone 3

This is intended to be used for images that have a high ratio of highlight to mid-tones.

Tone 4

Maps to a linear function; it could be set by the user for a custom curve (not fully implemented at the time of this writing).

3.4 Image Adjustments

Defaults - Resets the following adjustment sliders back to their default settings:

- Brightness
- Gain
- Gamma
- Saturation

3.5 Video Player Control

The Video Output Control feature provides the user with the ability to control any Phantom Ethernet camera attached to a monitor. This feature will be extremely effective with the higher resolution cameras since most computer monitors do not refresh the screen images quickly enough to produce a smooth visual display.

By default the Video Output Control window will display a live image on the monitor. The user can also place the camera into capture mode and trigger it. The user may perform a quick edit of the recorded cine by easily selecting the range of images to be played back.

Once captured the user can playback the recorded cine file from the cameras memory, using the video play back buttons along with adjusting the speed of the playback.

When the Video Player button is select the Video Output Control window will be displayed.
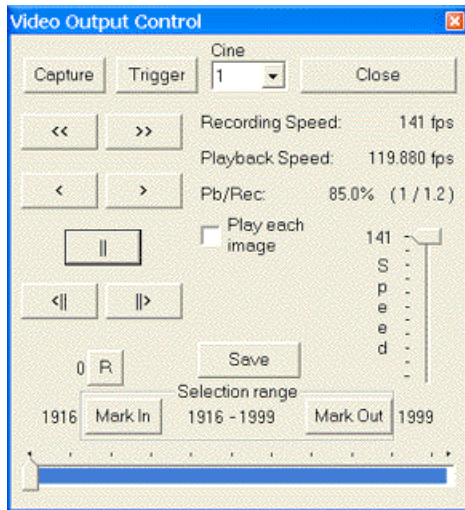
Example Video Output Control Dialogue Window

Below is a brief description of the Video Output Control buttons, pull-down menus, and entry fields.

Capture Button

This button puts the camera into the default recording mode. When the Capture button is clicked, images are continuously recorded in an endless loop to an image storage area until the camera has received one of the three different types of triggers.

1. If not, click the Capture button.

2. If the Capture buffer has retained a previous recorded file the following Warning message will be displayed: Cine(s) may already be stored in camera(s) memory and will be overwritten by this operation. Continue?

3. Click the Yes button to continue, No to cancel the instruction.

Trigger Button

When the camera is in Capture mode selecting the Trigger button provides a soft trigger to the camera that instruct the camera to stop capturing and recording images to the storage buffer. It is just one of three possible ways to trigger the Phantom cameras the other two, with the camera in Capture mode, include:

- Press Alt-T on the keyboard.

- Provide a dry switch closure or a low TTL pulse to the BNC connector marked Trigger on the Capture breakout cable attached to the rear panel of the camera.

NOTE:

When the camera is in Waiting for Pre-trigger mode, selecting the the trigger button provides a soft pre-trigger signal to the camera instructing the camera to start capturing and recording images to the storage buffer.

Video Control Buttons

Button	Name	Description
‹‹	Play Fast Reverse	Decrements every 10 images.
››	Play Fast Forward	Increments every 10 images.
‹	Standard Play Reverse	Decrements 1 image at a time.
›	Standard Play Forward	Increments 1 image at a time.
‖	Pause Playback	Stops/Pauses the playback process.
‹‖	Play Single Frame Reverse	Advance backwards 1 image only.
‖›	Play Single Frame Forward	Advance forward 1 image only.

Recording Speed

This informational field displays the speed at which the cine was recorded in fps (frames per second).

Playback Speed

This informational field displays the speed at which the cine in being played back at, in fps (frames per second). This field will automatically adjust as you change the playback rate using the Playback Speed Slider, described below.

Pb/Rec

This filed indicates the percentage rate the images are being played back at based on the frame rate used to record them. It also displays the ratio of the playback rate in parenthesis.

Play Each Image

Enabling (checking) this option instructs the camera to playback every image in the recorded cine.

Limit to Range

Presently enable.

Endless Loop

Presently disabled.

Playback Speed Slider

This slider is used to adjust the speed of the cine playback. This adjustment only applies when the Standard Play Forward and Standard Play Reverse buttons have been selected. It also displays the percentage of the playback speed.

Rewind Button

The image number next to the (R)ewind button specifies the number of the image being displayed on the monitor. Image number zero represents the moment of trigger.

The (R)ewind button to the right of the image box is used to rewind to the start of the cine.

Save Button

Provide the end user with the ability to save the cine file stored in the camera's DRAM.

Selection Range Edit

Many recorded cine files contain a lot of unnecessary information both before and after the actual motion of interest. The Selection Range can be used to edit unnecessary images from the beginning and the end of the recorded cine prior to playing back the cine. Editing the cine will create smaller files, reduce download times and make cine playbacks more interesting.

The blue area in the Cine Editor Bar represents the clip. The number displayed at the left end of the Selection Range refers to the first image in the entire cine sequence. The number at the right end refers to the last image in the entire cine sequence. The numbers in between the Begin and End buttons are the first and last image numbers in the cine clip to be displayed.

NOTE:

Frame number zero always refers to the moment in time when the trigger was received by the camera regardless of what sample rate or resolution settings where made in the Setup screen. All negative numbers represent Pre-trigger frames and all positive numbers represent the number of Post Trigger frames entered in the Setup and Recording screen.

Part IV

4 The Monitor/ViewFinder Display Screens

The information displayed in the OSD (On-Screen Display) can vary based on how the user defines what information he/she desires via the Phantom Camera Control>Acquisition>Camera Options... >Video Out>OSD pull-down selection list.

Below are the various display screen we will cover in this section:

- LIVE PRE Display Screen (without Phantom CineMag attached)
- LIVE Display Screen (with Phantom CineMag attached)
- Setup Display Screen (without/with Phantom CineMag attached)
- LIVE WTR Display Screen (without/with Phantom CineMag attached)
- LIVE TRG Display Screen (without/with Phantom CineMag attached)
- LIVE CST Display Screen (without/with Phantom CineMag attached)
- Select Cine for Playback Display Screen (without/with Phantom CineMag attached)
- PLAY CST Display Screen (without/with Phantom CineMag attached)

4.1   LIVE PRE/LIVE Display Screens

The LIVE PRE, (live image preview, waiting for pretrigger) mode, is the operational state the camera will startup in when it is first powered up when there is no Phantom CineMag attached to the camera. If a Phantom CineMag is attached to the camera when the camera is powered up, the camera will be placed into the LIVE mode. What this means, in either mode, the camera will display a live image on the monitor or viewfinder screen, however the camera is not yet recording any image data or frames to the camera memory buffer or Phantom CineMag.

In this state the user can:

- View a live image to focus in on the subject
- Zoom in 2x to assist in targeting the subject when attached to a 720p monitor or viefinder
- Define the recording parameters
- Determine if any image area is over exposed
- Examine the recording duration time and the number of frames that will be recorded within the recording time frame

4.1.1   The On-Screen Display Fields

4.1.1.1   Without an Attached Phantom CineMag
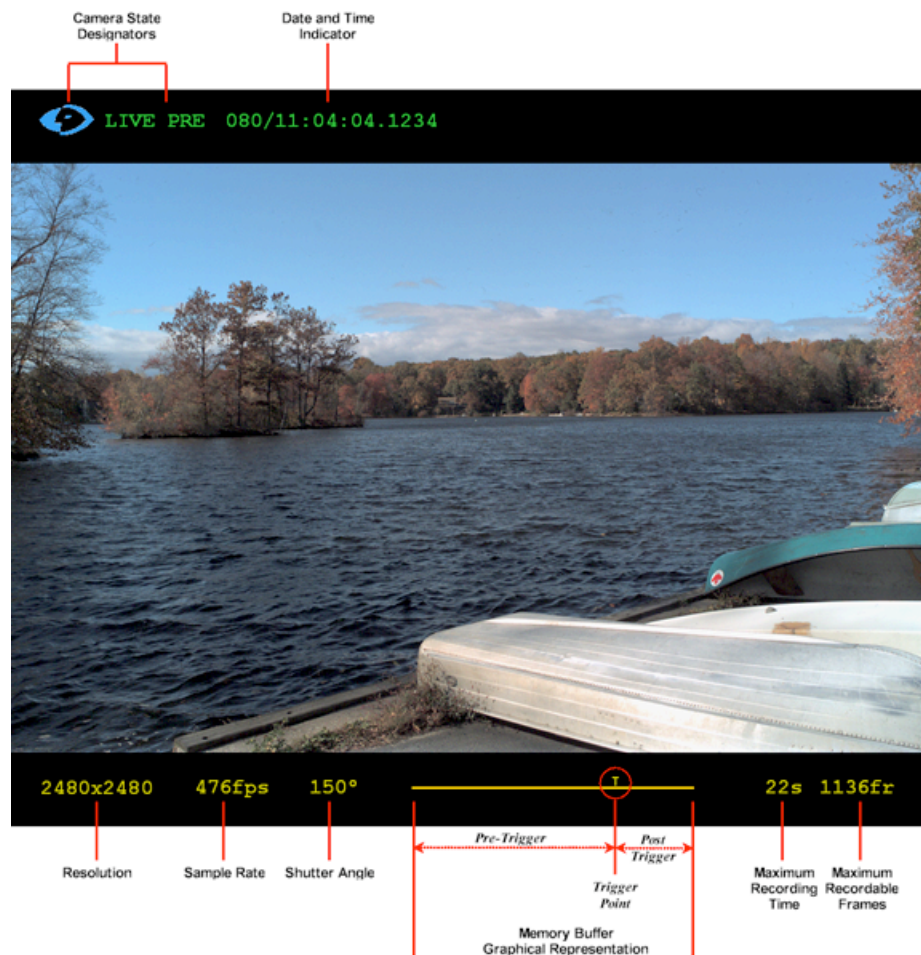
LIVE PRE - Live Preview Mode without an attached Phantom CineMag

Below is a brief description of the information that could be displayed in the LIVE PRE display screen:

Camera State Designators

The camera state designation is comprised of two items; the Phantom logo and text display. The color of the Phantom logo will change based on the state of the camera. The Phantom logo will be cyan (blue) when the camera is in the LIVE PRE mode. The text, to the right of the Phantom logo, indicates the present state or operational mode of the camera.

Date and Time

The date and time stamp field indicates; day number/hour:minute:second:microsecond.

Resolution

This field indicates the active pixel area, (Width x Height), of the sensor defined by the user.

Sample Rate

This field specifies the rate the Phantom camera will capture or record image data, (frames), into the camera's memory.

Shutter Angle

This field shows the current, user defined, Shutter Angle or exposure setting of the camera.

Memory Buffer Graphical Representation

This is a graphical representation of the camera's memory buffer. It acts as a memory gauge that consists of two basic components when the camera is in the LIVE PRE state.

The first component, of the graphical representation is the line which represents the total frames that can be stored in the camera,s buffer. The second component is a "T" on top of the line. The "T" represents a trigger point that is defined by the user. Any frames that are captured after a trigger signal is detected by the camera are referred to as Post Trigger frames, and the frames recorded prior to the trigger signal are referred to as Pre-Triggered frames.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.1.1.2 With an Attached Phantom CineMag

LIVE - Live Preview Mode with an attached Phantom CineMag

Below is a brief description of the information that could be displayed in the display screen:

Camera State Designator

The camera state designation is comprised of the Phantom logo. The color of the Phantom logo will change based on the state of the camera. The Phantom logo will be cyan (blue) when the camera is in the LIVE mode.

Phantom CineMag Status Indicator

The Camera State Designator indicates the operation state of the camera. Various states designators include:

MagInit

Indicates the Phantom CineMag has been detected either during camera power-up, or when a Phantom CineMag has been inserted onto the camera.

MagScan

Indicates that the Phantom CineMag is running through it power-up, self-diagnostics routines.

MagReady

Indicates that the Phantom CineMag has passes its power-up, self-diagnostices routines.

MagErase

Indicates that the Phantom CineMag has been instructed to erase its contents, and is performing the erasure procedure.

Number of Takes

This field indicates the number of takes or cine files, (movies), recorded to the Phantom CineMag. As takes are recorded the Number of Takes field will increment.

Memory Usage

This field indicates the amount of bytes used to store recorded frames. As takes are recorded the Memory Usage field will increment.

Memory Size

This field indicates the total number of bytes, or the memory size, of the Phantom CineMag.

Resolution

This field indicates the active pixel area, (Width x Height), of the sensor defined by the user.

Sample Rate

This field specifies the rate the Phantom camera will capture or record image data, (frames), into the camera's memory.

Shutter Angle

This field shows the current, user defined, Shutter Angle or exposure setting of the camera.

Memory Buffer Graphical Representation

This is a graphical representation of the camera's memory buffer. It acts as a memory gauge that consists of two basic components.

The first component, of the graphical representation is the line which represents the total frames that can be stored in the camera,s buffer. The second component is a "T" on top of the line. The "T" represents a trigger point that is defined by the user. Any frames that are captured after a trigger signal is detected by the camera are referred to as Post Trigger frames, and the frames recorded prior to the trigger signal are referred to as Pre-Triggered frames.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.2   Setup Display Screen

The Setup Display Screen can be access from either the LIVE PRE (w/o an attached Phantom CineMag), LIVE (with an attached Phantom CineMag), or LIVE WTR display windows. It is in this setup display window the user will select various camera setup and recording parameters to record image data or frames, using the cameras On-Camera Control buttons.

4.2.1   The On-Screen Display Fields

Looking at the Setup Screen you can see that various color schemes are used. For example the color of the Phantom logo will change based on the state of the camera. The Phantom logo will be cyan (blue) when the camera is in the LIVE PRE or LIVE modes, or red when it is in the LIVE WTR mode.

The text, to the right of the Phantom logo, which indicates the present state or operational mode of the camera, will be green, and the various setup and recording parameters will either be yellow, (not selected), or red, (selected). The selected parameter is the parameter you have selected to change or set.

4.2.1.1   Loop Mode
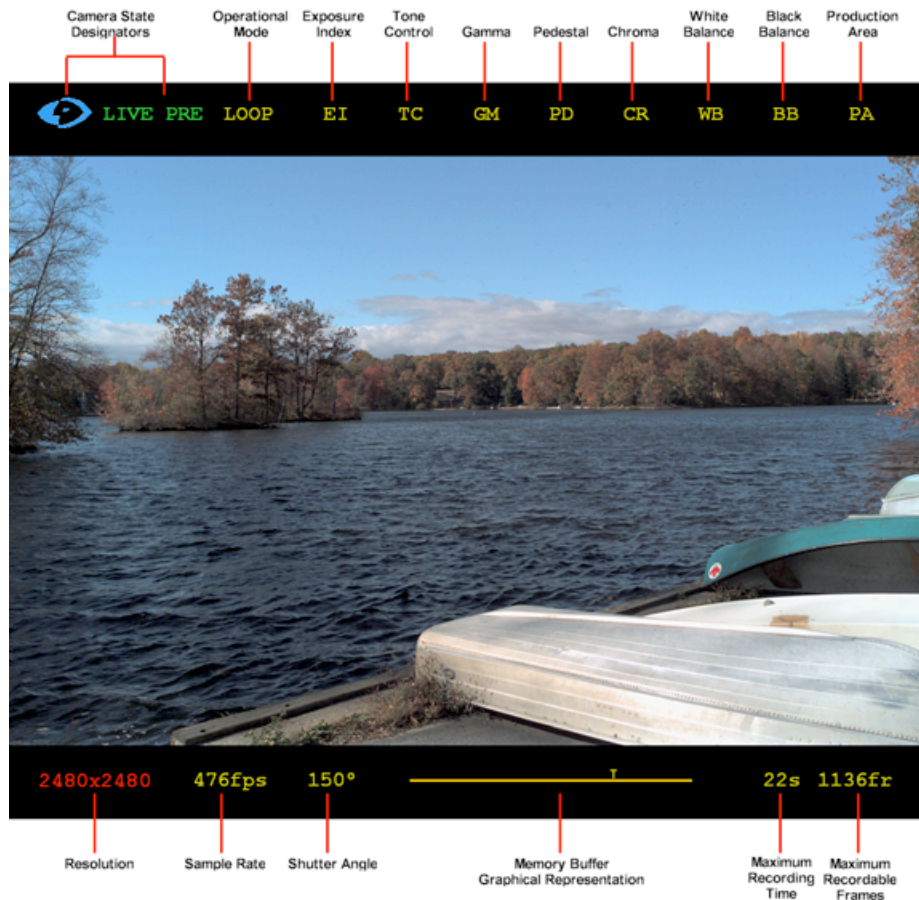
LIVE PRE Display - Setup Loop Mode

Below is a brief description of the fields that displayed on the screen:

   Camera State Designators

As mention in the "LIVE PRE Display Screen - The On-Screen Display Fields" topic, earlier in this document, the camera state designation is comprised of two items; the Phantom logo and text display.

The setup and recording parameters that can be set via the On-Camera Controls are:

Operational Mode

This filed is used to select if the camera is to run in either Loop or Run/Stop Mode.

In the Loop Mode the camera stores the recorded image data into the camera's DRAM buffer. In this mode the Phantom CineMag operates like any other Flash card, after a cine file is recorded into the camera's DRAM frame buffer, you can manually save it into the CineMag using the "Flash Memory" dialogue window which can be accessed in either the Setup and Recording or ViewCine dialogue windows.

In Run/Stop Mode the image data is recorded, up to 450fps at HD resolution (2048 x 1080), directly into the Phantom CineMag.

EI (Exposure Index)

An amount by which it is possible to over or underexpose a light sensitive material and, with standard processing, still produce acceptable results. By referring to the exposure index in the viewfinder and working in stops, you can fine tune your exposure.

TC (Tonal Curve)

GM (Gamma)

Gamma is the nonlinear relationship between signal level and brightness output of pixels, (a small signal level change at low voltage produces a larger variation in brightness than the same change in level at high voltage); gamma correction for monitors is the compensation for this non-linearity. In the Phantom camera gamma adjustment is used to bring out details of the image. One can think of that gamma adjustment as selective contrast adjustment.

PD (Pedestal)

Used to change the voltage level corresponding to black or to the maximum limit of black peaks.

CR - (Chroma)

Short for "chrominance", is the attributes of a color, which include its hue (frequency) and saturation (amount of black).

WB (White Balance)

This process is used to balance the active pixels of the image sensor to the overall color temperature of the lighting. The user only needs to perform a white balance at the beginning of the day or when a major change occurs in the lighting, such as going from indoors to outdoors , or using a different setup with color gel on the lights.

BB (Black Balance)

This process is used to remove any inconsistencies between pixels that make up the active pixel area of a cameras sensor. There are two common unwanted effects in all imaging sensors that can seriously reduce the quality of the images recorded they are:

Fixed Pattern Noise

Also known as spatial noise. It is the unwanted variation of the response of all pixels in the image. It is expressed as an offset in volts or in Analog-to-Digital Conversion (ADC) bits. It does not vary with time.

Photo Response Non-Uniformity

The fact that each individual photodiode or pixel has a different amplification factor or gain. It is a different flavor of FPN (Fixed Pattern Noise).

Both of these unwanted sensor byproducts are corrected, electronically, when a black balance is performed.

PA (Production Area)

The camera will highlight the production area specified by under exposing the area outside the production are by 1-stop, and changing it to monochrome. This production area can be though as the area of the captured image that will be used in the final production.

Resolution

Resolution refers to the shape of the captured area in pixels. It represents the number of pixels enabled to capture an image. For example, if 800 x 600 is set the full sensor space available it is called "Full Frame."

The Resolution setting allows the user to change the dimensions, or aspect ratio, of the sensors active pixel area. The aspect ratio is the width to height ratio of the image being recorded. Each type of camera has a specific maximum resolution.

Changing the Resolution settings to match the dimensions of the subject of interest allows the user the option of recording at higher sample rates, or longer recording times at the same sample rate. Smaller resolutions 'crop' the capture image by enabling a subset of pixels. This allows you to customize the shape of the capture area to the application. For example, if you are capturing a linear environment such as a rocket car, you do not need to capture the static sky above and ground below the subject.

Frame Rate

The Frame Rate is the rate at which images are recorded. The Sample Rate field selection list will change according to the Resolution selected. The larger the selection area the lower the maximum frame rate.

NOTE

Set the Resolution before setting the Sample Rate. To set high sample rates, or increase the recording time, reduce the selected Resolution (Width x Height).

Shutter Angle

Adjusting the shutter angle affects the amount of time that sensor is exposed to light. A larger shutter angle may result in increased motion blur on moving objects.

Post Trigger (via Memory Buffer Graphical Display)

The Post Trigger value represents how many pictures will be recorded after the trigger signal is detected by the Phantom camera. Since the memory is scrolling memory, the Post Trigger value also sets the number of pre-trigger images captured.

When a Post Trigger value is defined in the Phantom Camera Control software, the camera will continue to record and store, to the camera's DRAM buffer, image data after a trigger signal is detected for n fames, where n is the number of post trigger frames specified.

After the trigger signal is detected by the camera, recording continues for an exact number of frames, n, and stored in the image buffer, then recording stops; n will depend the number of post trigger frames defined by the user.

It's important to note that the camera can only store a finite number of images into the memory buffer based on the resolution, sample rate, image bit depth settings, and the memory size.

When a post trigger value has been defined the camera will only store the maximum image count allowed, for the particular capture settings. The camera will only display the frames stored in the memory buffer, the last x images, where x is the total number of images recorded or stored in the image buffer.

At this point the recorded images can be viewed or saved into a file on the Phantom Camera Phantom Control Unit or, optionally saved to Phantom CineMag memory magazine.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.2.1.2 R/S (Run/Stop) Mode
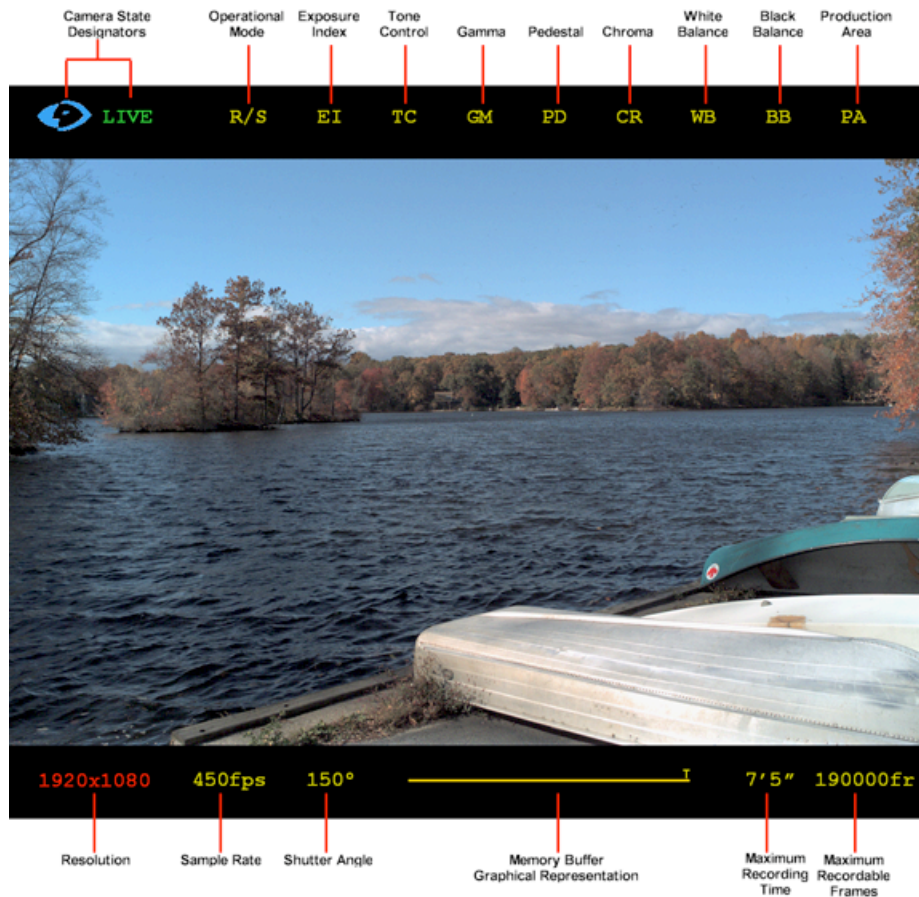
LIVE Display - Setup R/S (Run/Stop) Mode

Below is a brief description of the fields that displayed on the screen:

Camera State Designator

As mention in the "LIVE PRE Display Screen - The On-Screen Display Fields" topic, earlier in this document, the camera state designation is comprised of two items; the Phantom logo and text display.

The setup and recording parameters that can be set via the On-Camera Controls are:

Operational Mode

This filed is used to select if the camera is to run in either Loop or Run/Stop Mode.

In the Loop Mode the camera stores the recorded image data into the camera's DRAM buffer. In this mode the Phantom CineMag operates like any other Flash card, after a cine file is recorded into the camera's DRAM frame buffer, you can manually save it into the CineMag using the "Flash Memory" dialogue window which can be accessed in either the Setup and Recording or ViewCine dialogue windows.

In Run/Stop Mode the image data is recorded, up to 450fps at HD resolution (2048 x 1080), directly into the Phantom CineMag.

EI (Exposure Index)

An amount by which it is possible to over or underexpose a light sensitive material and, with standard processing, still produce acceptable results. By referring to the exposure index in the viewfinder and working in stops, you can fine tune your exposure.

TC (Tonal Curve)

GM (Gamma)

Gamma is the nonlinear relationship between signal level and brightness output of pixels, (a small signal level change at low voltage produces a larger variation in brightness than the same change in level at high voltage); gamma correction for monitors is the compensation for this non-linearity. In the Phantom camera gamma adjustment is used to bring out details of the image. One can think of that gamma adjustment as selective contrast adjustment.

PD (Pedestal)

Used to change the voltage level corresponding to black or to the maximum limit of black peaks.

CR - (Chroma)

Short for "chrominance", is the attributes of a color, which include its hue (frequency) and saturation (amount of black).

WB (White Balance)

This process is used to balance the active pixels of the image sensor to the overall color temperature of the lighting. The user only needs to perform a white balance at the beginning of the day or when a major change occurs in the lighting, such as going from indoors to outdoors , or using a different setup with color gel on the lights.

BB (Black Balance)

This process is used to remove any inconsistencies between pixels that make up the active pixel area of a cameras sensor. There are two common unwanted effects in all imaging sensors that can seriously reduce the quality of the images recorded they are:

Fixed Pattern Noise

Also known as spatial noise. It is the unwanted variation of the response of all pixels in the image. It is expressed as an offset in volts or in Analog-to-Digital Conversion (ADC) bits. It does not vary with time.

Photo Response Non-Uniformity

The fact that each individual photodiode or pixel has a different amplification factor or gain. It is a different flavor of FPN (Fixed Pattern Noise).

Both of these unwanted sensor byproducts are corrected, electronically, when a black balance is performed.

PA (Production Area)

The camera will highlight the production area specified by under exposing the area outside the production are by 1-stop, and changing it to monochrome. This production area can be though as the area of the captured image that will be used in the final production.

Resolution

Resolution refers to the shape of the captured area in pixels. It represents the number of pixels enabled to capture an image. For example, if 800 x 600 is set the full sensor space available it is called "Full Frame."

The Resolution setting allows the user to change the dimensions, or aspect ratio, of the sensors active pixel area. The aspect ratio is the width to height ratio of the image being recorded. Each type of camera has a specific maximum resolution.

Changing the Resolution settings to match the dimensions of the subject of interest allows the user the option of recording at higher sample rates, or longer recording times at the same sample rate. Smaller resolutions 'crop' the capture image by enabling a subset of pixels. This allows you to customize the shape of the capture area to the application. For example, if you are capturing a linear environment such as a rocket car, you do not need to capture the static sky above and ground below the subject.

Frame Rate

The Frame Rate is the rate at which images are recorded. The Sample Rate field selection list will change according to the Resolution selected. The larger the selection area the lower the maximum frame rate.

NOTE

Set the Resolution before setting the Sample Rate. To set high sample rates, or increase the recording time, reduce the selected Resolution (Width x Height).

Shutter Angle

Adjusting the shutter angle affects the amount of time that sensor is exposed to light. A larger shutter angle may result in increased motion blur on moving objects.

Post Trigger (via Memory Buffer Graphical Display)

The Post Trigger value represents how many pictures will be recorded after the trigger signal is detected by the Phantom camera.

NOTE

Since the Phantom CineMag memory is linear memory buffer, the Post Trigger value must be set to 1.

Total Time Available

This field indicates the the length of recording time left. The recording duration is based on the amount of memory in the camera, along with the resolution and frame rate settings. This field will change based on these variables. As takes are recorded the Total Time Available will decrease in real time.

Total Frames Available

This field indicates how many images or frames can still be recorded into the Phantom CineMag. As takes are recorded the Total Frames Available will decrease in real time.

4.3 LIVE WTR Display Screen

The LIVE WTR, (live image preview, waiting for trigger) mode, is the operational state the camera will be in once the camera has been instructed to capture or record the image data or frames to the cameras memory buffer or directly into the Flash memory of an attached Phantom CineMag.

When the camera is set to the Loop Operational Mode, the camera continues to display a live image on monitor or viewfinder screen, just as it did when the camera was in the LIVE PRE mode. The camera will continue to capture or write image data into the camera scrolling memory buffer locations until a trigger signal has been sent and detected by the camera.

When set to the R/S (Run/Stop) Mode, the camera displays a live image on monitor or viewfinder screen, and starts writing image data directly into the Phantom CineMag linear buffer.

4.3.1 The On-Screen Display Fields

LIVE WTR Display - Recording, Waiting for Trigger Mode without an attached Phantom CineMag
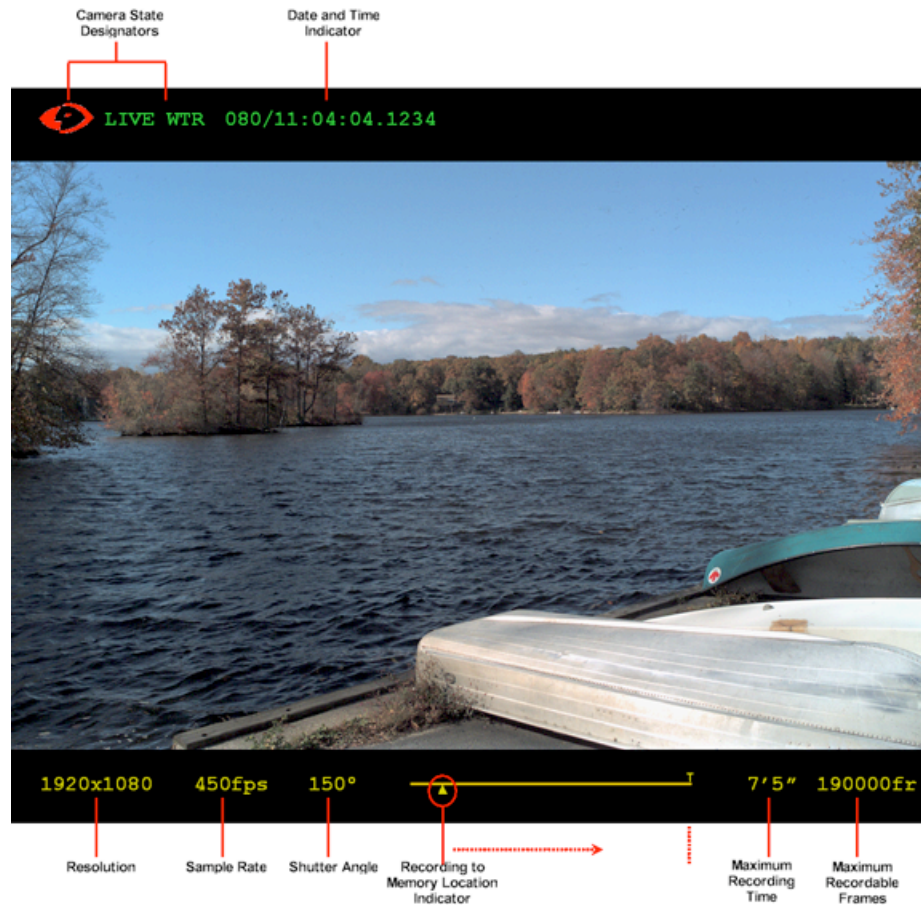
LIVE WTR Display - Recording, Waiting for Trigger Mode with an attached Phantom CineMag

Below is a brief description of the fields that displayed on the screen:

Camera State Designators

The Phantom logo will be red when the camera is in the LIVE WRG mode.

Date and Time

The date and time stamp field indicates; day number/hour:minute:second:microsecond.

Resolution

This field indicates the active pixel area, (Width x Height), of the sensor defined by the user.

Sample Rate

This field specifies the rate the Phantom camera will capture or record image data, (frames), into the camera's memory.

Shutter Angle

This field shows the current, user defined, Shutter Angle or exposure setting of the camera.

Memory Buffer Graphical Representation

The graphical representation of the cameras memory buffer, which acts as a memory gauge will display a Recording to Memory Location Indicator, (an up-arrow), that will scroll backwards from

the trigger point, (T), indicating that the memory buffer is in the process of being filled the moment the camera has been placed into the LIVE WTR mode.

When the indicator reaches the beginning of the line the cameras memory buffer is full. This does not mean that the camera stops recording since the camera utilizes a scrolling buffer technique to fill the buffer. What this means is that the camera writes the captured image data or frame into the first available memory location, the second frame into the second available memory location, and so on until all available memory locations have been written into with image data or frames. Once all the memory locations have been written into the next frame that is captured will overwrite the image data that is presently stored in that first memory location, the next frame overwrites the next location and so on. This process of overwriting memory locations will continue until a trigger signal has been detected by the camera and any user defined post trigger frame requirements have been recorded. It is only at this point the camera will stop overwriting the captured images or frame stored in the memory buffer.

Recording to Memory Location Indicator

The up arrow is a graphical representation of the memory location the displayed image will be stored into.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.4 LIVE TRG Display Screen

The LIVE TRG, (live image preview, camera triggered) mode, is the operational state the camera will be in when once the camera has detected a valid trigger signal. The camera continues to display a live image on monitor or viewfinder screen, just as it did when the camera was in the LIVE PRE or LIVE WTR modes.

In Loop Mode the camera will stop capturing or writing image data into the camera scrolling memory buffer locations upon receipt of the trigger signal once the user defined post trigger definition, if any, has been satisfied.

In R/S (Run/Stop) Mode the camera will immediately stop capturing or writing image data into the Phantom CineMag Flash memory locations upon the receipt of the trigger signal.

4.4.1 The On-Screen Display Fields

LIVE TRG Display - Camera Triggered Mode without an attached Phantom CineMag

LIVE TRG Display - Camera Triggered Mode with an attached Phantom CineMag

Below is a brief description of the fields that displayed on the screen:

Camera State Designators

The Phantom logo will be yellow when the camera is in the LIVE TRG mode.

Date and Time

The date and time stamp field indicates; day number/hour:minute:second:microsecond.

Resolution

This field indicates the active pixel area, (Width x Height), of the sensor defined by the user.

Sample Rate

This field specifies the rate the Phantom camera will capture or record image data, (frames), into the camera's memory.

Shutter Angle

This field shows the current, user defined, Shutter Angle or exposure setting of the camera.

Memory Buffer Graphical Representation

The graphical representation of the cameras memory buffer, which acts as a memory gauge will display a Recording to Memory Location Indicator, (an up-arrow), will scroll forward from the

trigger point, (T), indicating that the post trigger frames are being written into the cameras memory buffer.

When the indicator reaches the end of the line the cameras memory buffer is full, and the users defined post trigger frame requirements as been satisfied the camera stops recording image data or frames. Once this process has completed the camera will go into the LIVE CST, (live image preview, cine stored), mode.

Recording to Memory Location Indicator

The up arrow is a graphical representation of the memory location the displayed image will be stored into.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.5 LIVE CST Display Screen

As mentioned in the "LIVE TRG Display Screen - The On-Screen Display Fields" topic, when the camera's memory buffer is full, and the user's defined post trigger frame requirements as been satisfied the camera stops recording image data or frames. Once this process has completed the camera will be placed into the LIVE CST, (live image preview, cine stored), mode, indicating that the camera has recorded a cine in its memory buffer for review, editing, and saving.

4.5.1 The On-Screen Display Fields

LIVE CST Display - Cine Stored Mode without an attached Phantom CineMag

LIVE CST Display - Cine Stored Mode with an attached Phantom CineMag

Below is a brief description of the fields that displayed on the screen:

Camera State Designators

The Phantom logo will be green when the camera is in the LIVE CST mode.

Date and Time

The date and time stamp field indicates; day number/hour:minute:second:microsecond.

Resolution

This field indicates the active pixel area, (Width x Height), of the sensor defined by the user.

Sample Rate

This field specifies the rate the Phantom camera will capture or record image data, (frames), into the camera's memory.

Shutter Angle

This field shows the current, user defined, Shutter Angle or exposure setting of the camera.

Memory Buffer Graphical Representation

The graphical representation of the cameras memory buffer, which acts as a memory gauge will display a Mark In Point, (the vertical line on the far left of the line), and a Mark Out Point, (the

vertical line on the far right of the line). The Recording to Memory Location Indicator, (the up-arrow), will be placed just below the Mark In Point. The the trigger point, (T), indicates the image or frame the trigger signal was sent to and detected by the camera.

Image Location Reference Point

The up arrow is a graphical representation of the stored memory location of the displayed image within the camera's DRAM or non-volatile Flash location within an attached Phantom CineMag.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.6   Select Cine for Playback Display Screen

The "SELECT Display Screen" is used to select which cine to be reviewed, edited, or saved, and the location of the image data (RAM or Phantom CineMag). Cine file stored in a Phantom CineMag will be displayed numerically, while a cine file stored in the camera's DRAM will be displayed with the nomenclature RAM.

4.6.1   The On-Screen Display Fields

SELECT Mode Display Screen without an attached Phantom CineMag

SELECT Mode Display Screen with an attached Phantom CineMag

Below is a brief description of the fields that displayed on the screen:

Camera State Designators

The Phantom logo will be green when the camera is in the SELECT mode.

Date and Time

The date and time stamp field indicates; day number/hour:minute:second:microsecond.

Displayed Image Number

The Displayed Image Number field specifies the number of the image being displayed in the playback window. Zero represents the first image or the trigger point frame. Pre-trigger frames will be represented in negative numbers, while post trigger frames will be positive numbers.

Display Cine Indicator

This field indication where the image data to be reviewed, edited, or saved has been stored. Cine file stored in a Phantom CineMag will be displayed numerically, while a cine file stored in the camera's DRAM will be displayed with the nomenclature RAM.

Resolution

This field indicates the active pixel area, (Width x Height), of the sensor defined by the user.

Sample Rate

This field specifies the rate the Phantom camera will capture or record image data, (frames), into the camera's memory.

Shutter Angle

This field shows the current, user defined, Shutter Angle or exposure setting of the camera.

Memory Buffer Graphical Representation

The graphical representation of the cameras memory buffer, which acts as a memory gauge will display a Mark In Point, (the vertical line on the far left of the line), and a Mark Out Point, (the vertical line on the far right of the line). The Recording to Memory Location Indicator, (the up-arrow), will be placed just below the Mark In Point. The the trigger point, (T), indicates the image or frame the trigger signal was sent to and detected by the camera.

Edited/Recorded Cine Duration

In this mode the Maximum Recording Time field change from a single number to two. The first of the two numbers represents the duration of the cine contained within the Mark In and Mark Out points. The second number represents the duration or length of the cine file stored in the camera memory buffer.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

4.7   PLAY CST Display Screen

It is from the PLAY CST, (playback, cine stored), mode the user can playback the captured cine file, or set desired Mark In and Mark Out Points to review the capture cine file prior to saving the file to an external storage device. The user can play the cine file forward or in reverse, or pause the playback, using the On-Camera Control buttons.

4.7.1   The On-Screen Display Fields

PLAY CST - Playback Cine Stored in Camera DRAM

PLAY CST - Playback Cine Stored in Phantom CineMag

Below is a brief description of the fields that displayed on the screen:

Camera State Designators

The Phantom logo will be green when the camera is in the SELECT mode.

Date and Time

The date and time stamp field indicates; day number/hour:minute:second:microsecond.

Displayed Image Number

The Displayed Image Number field specifies the number of the image being displayed in the playback window. Zero represents the first image or the trigger point frame. Pre-trigger frames will be represented in negative numbers, while post trigger frames will be positive numbers.

Display Cine Indicator

This field indication where the image data to be reviewed, edited, or saved has been stored. Cine file stored in a Phantom CineMag will be displayed numerically, while a cine file stored in the camera's DRAM will be displayed with the nomenclature RAM.

Edit Cine Selector

This field is used to define and save the Mark In and/or Mark Out Points of the cine, and/or save the cine file stored in the camera's DRAM to the non-volatile Flash memory of an attached Phantom CineMag.

Memory Buffer Graphical Representation

The graphical representation of the cameras memory buffer, which acts as a memory gauge will display a Mark In Point, (the vertical line on the far left of the line), and a Mark Out Point, (the vertical line on the far right of the line). The Recording to Memory Location Indicator, (the up-arrow), will be placed just below the Mark In Point. The the trigger point, (T), indicates the image or frame the trigger signal was sent to and detected by the camera.

Selectable Mark In Point

Indicates the user defined Mark In Point defined using the Edit Cine Selector field.

Image Location Reference Point

The up arrow is a graphical representation of the stored memory location of the displayed image within the camera's DRAM or non-volatile Flash location within an attached Phantom CineMag.

Selectable Mark Out Point

Indicates the user defined Mark Out Point defined using the Edit Cine Selector field.

Edited/Recorded Cine Duration

In this mode the Maximum Recording Time field change from a single number to two. The first of the two numbers represents the duration of the cine contained within the Mark In and Mark Out points. The second number represents the duration or length of the cine file stored in the camera memory buffer.
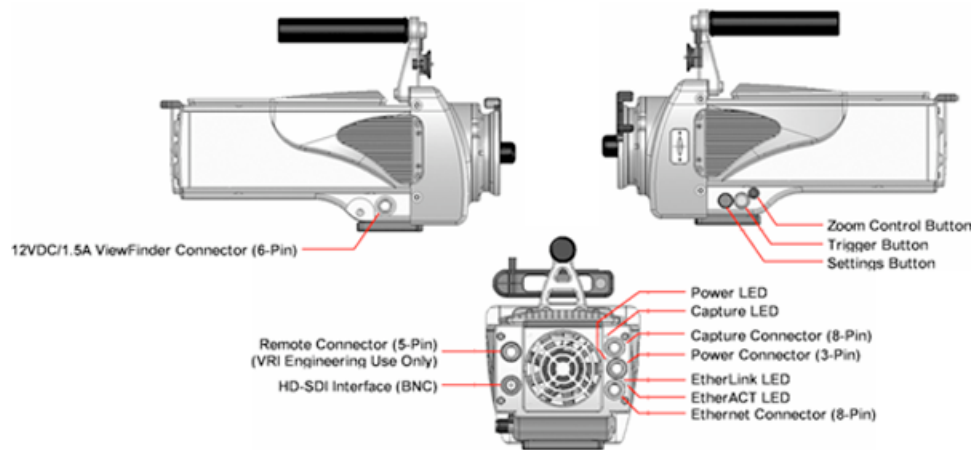
Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

Part V

5   The Control Buttons

Both the Phantom 65 and Phantom HD cameras can be controlled via On-Camera Control buttons. Below are the On-Camera Control buttons we will cover in this section:

- Zoom Button
- Trigger Button
- Select Setup Button

5.1   Zoom

This button is used to toggle through live preview, zoom, and threshold modes, when the camera is in the Preview, Waiting for Pre-Trigger (LIVE PRE) and Preview, Waiting for Trigger (LIVE WTR) or Capture modes.

NOTE

The zoom mode is only applicable with 720p.

When the camera is in the cine recorded, stored in memory, (LIVE CST) state the Zoom button will be used to place the camera into the playback (PLAY CST) mode. When the camera is in the playback, PLAY CST, mode the Zoom button will be used to play and/or stop the playback of the recorded/ stored cine file.

5.2   Trigger

The Trigger button is used to change the camera's operational state when the camera is in either the; Pre-Trigger LIVE PRE (Preview, Waiting for Pre-Trigger), and Capture, LIVE WTR (Preview, Waiting for Trigger), modes. It is also used to access the cine SELECT screen, and provide a soft-trigger to the camera when the camera is in the Capture, LIVE WTR (Preview, Waiting for Trigger) mode.

When the camera is in the playback, PLAY CST, mode the Trigger button is used to play and/or stop the playback of the recorded/stored cine file.

5.3   Select Setup

This button is used to select the camera,s setup and recording parameters. The camera's parameters can be defined when the camera is in either the Pre-Trigger LIVE PRE (Preview, Waiting for Pre-Trigger), and Capture, LIVE WTR (Preview, Waiting for Trigger), modes.

It also allows you to scroll through the cine file stored in the camera's DRAM image buffer and the Phantom CineMag Flash memory for playback.

The Setup Select button can also be used to scroll through a recorded cine file to easily find images that you wish to define as Mark-In and Mark-Out points of the file.

Part

VI

6 Step-by-Step Processes

6.1 Preview, Zoom, Threshold

The Zoom button is used to toggle through live preview, zoom, and threshold modes, when the camera is in the; LIVE PRE (Preview, Waiting for Pre-Trigger), and LIVE WTR (Preview, Waiting for Trigger), modes.

By default the camera displays a live preview on the attached monitor or viewfinder.

1. Depressing this button one time will instruct the camera to zoom in on the subject area with a 2x zoom to help in the focusing process when attached to a 720p monitor or viewfinder otherwise the display skips to the Threshold mode.

2. Depressing the button a second time place the camera into Threshold mode. This field is used to display the areas of the image that are overexposed.

3. Depressing the button a third time return the camera to it default preview mode.

6.2 Defining the Operational Mode

6.2.1 Via the Phantom Camera Control Software

1. Start the Phantom Camera Control Software application

2. Open the Acquisition pull-down menu

3. Select the Setup and Recording... command from the Acquisition menu

4. Select the Phantom CineMag Operational Mode

   a. In the Setup and Recording dialogue window click on the Flash mem... button

   b. In the Flash memory dialogue window:

   1) Disable, (uncheck), the "Record to magazine" enable box to operate in Loop Mode.

   2) Enable, (check), the "Record to magazine" enable box to operate in Run/Stop Mode.

   3) Click the Update button.

   4) Click the OK button.

6.2.2 Via the On-Camera Control Buttons

1. From the LIVE PRE (Preview, Waiting for Pre-Trigger), or LIVE display screen:

   a. Press the Select Setup button one time, then

   b. Rotate the button to the Operational Mode field parameter. The field will change from yellow to red indicating the field has been selected for changed.

2. Once the Operational Mode field has been selected selected:

a. Hold in the Select Setup button, and

b. Rotate the button to the desired operational mode:

Loop

In the Loop Mode the camera stores the recorded image data into the camera's DRAM buffer. In this mode the Phantom CineMag operates like any other Flash card, after a cine file is recorded into the camera's DRAM frame buffer, you can manually save it into the CineMag using the "Flash Memory" dialogue window which can be accessed in either the Setup and Recording or ViewCine dialogue windows.

R/S (Run/Stop)

In Run/Stop Mode the image data is recorded, up to 450fps at HD resolution (2048 x 1080), directly into the Phantom CineMag.

6.3 Changing the Cameras Operational States

The Trigger button is used to change the cameras operational state.

By default a camera will start in the LIVE PRE (Preview, Waiting for Pre-Trigger) state.

Depressing the Trigger button one time will place the camera into the LIVE WTR (Preview, Waiting for Trigger) or capture/recording mode.

NOTE

If the camera is set to record pre-trigger images the Memory Buffer Graphical Display will show the memory allocation progress, indicating how much of the memory buffer has been filled with image data or frames. It does not however display the cameras ability to continuously re-allocate newer images into its scrolling buffer.

6.4 Defining Setup and Recording Parameters

The Select Setup button is used to set the camera's recording parameters. The process to set the various recording parameters are as follows:

1. Select the parameter to be configured

a. Depress the Select Setup button one time, then

b. Rotate the button to the desired parameter to be set. The parameter field color will change from yellow to red indicating the selected field to be changed.

2. Define the selected parameters setting

a. Hold in the Select Setup button, and

b. Rotate the button to the desired settings

Below is a brief description of the available parameters

Operation Mode

Loop

In the Loop Mode the camera stores the recorded image data into the camera's DRAM buffer. In this mode the Phantom CineMag operates like any other Flash card, after a cine file is recorded into the camera's DRAM frame buffer, you can manually save it into the CineMag using the "Flash Memory" dialogue window which can be accessed in either the Setup and Recording or ViewCine dialogue windows.

Run/Stop

In Run/Stop Mode the image data is recorded, up to 450fps at HD resolution (2048 x 1080), directly into the Phantom CineMag.

EI (Exposure Index)

To increase the Exposure Index hold in Select Setup button and rotate clockwise, to decrease the Exposure Index hold in and rotate counter clockwise.

TC (Tonal Curve)

To select a Tonal Curve setting hold in Select Setup button and rotate clockwise to step up in Tonal Curve choices or rotate counter clockwise to step down.

GM (Gamma)

To increase the Gamma value hold in Select Setup button and rotate clockwise, to decrease the Gamma hold in and rotate counter clockwise.

PD (Pedestal)

To increase the Pedestal value hold in Select Setup button and rotate clockwise, to decrease the Pedestal hold in and rotate counter clockwise.

CR - (Chroma)

To increase the Chroma value hold in Select Setup button and rotate clockwise, to decrease the Chroma hold in and rotate counter clockwise.

WB (White Balance)

To perform a White Balance Adjustment hold in the Select Setup button and rotate the button to the OK setting. Ensure that the area to calculate the White Balance adjustment on is not saturated and is completely over a white reference. Release the Select Setup button.

The camera will indicate a display counter next to the WB (White Balance) field indicating that it is performing the White Balance Adjustment.

BB (Black Balance)

To perform a Black Balance or Black Reference Adjustment, place the lens cover on the lens, then hold in the Select Setup button and rotate the button to the OK setting, and release.

The camera will indicate replaces the BB (Black Balance) field with a counter indicating that it is performing the Black Balance Adjustment.

PA (Production Area)

To increase the Production Area hold in Select Setup button and rotate clockwise, to decrease the

Production Area hold in and rotate counter clockwise.

Resolution

To increase the Resolution hold in Select Setup button and rotate clockwise, to decrease the Resolution hold in and rotate counter clockwise.

The image aspect ratio will be displayed with the defined Resolution setting.

Sample Rate

To increase the Sample Rate hold in Select Setup button and rotate clockwise, to decrease the Sample Rate hold in and rotate counter clockwise.

Shutter Angle

To increase the Shutter Angle hold in Select Setup button and rotate clockwise, to decrease the Shutter Angle hold in and rotate counter clockwise.

Post Trigger (via Memory Buffer Graphical Display)

To decrease the the number of Post Trigger frames to be recorded hold in Select Setup button and rotate clockwise, to increase the number of Post Trigger frames to be recorded hold in and rotate counter clockwise.

Maximum Recording Time

This field indicates the total length of recording time. The recording duration is based on the amount of memory in the camera, along with the resolution and sample rate settings. This field will change based on these variables.

Maximum Recordable Frames

This field indicates how many images or frames will be recorded within the Duration time. This field will also change based on how the amount of memory in the camera, and how the resolution and sample rate are set and will change accordingly.

6.5   Providing a Soft Trigger

Depressing the Trigger button when the camera is in the LIVE WTR mode will provide a soft trigger to the camera.

If the camera was set to capture post trigger frames, (Loop Mode only), the camera will be placed into the LIVE TRG (Recording, Cine Triggered) state. When the camera stops recording the desired number of user defined post trigger frame into the cameras memory, the camera will be placed into the LIVE CST (Cine Stored or ready for playback) state.

6.6   Play/Pause a Stored Cine File

Once a cine file has been recorded the camera will be placed into the LIVE CST mode.

6.6.1   Selecting a Cine for Playback

With the camera is in the playback, PLAY CST, mode

1. Hold the Trigger button in for 1 second to display the cine SELECT screen.

2. Hold in and rotate the Select Setup button until the desired cine is displayed.

3. Release the Select button.

6.6.2   Placing the Camera into the PLAY CST Mode

Depressing the Zoom button one time it will place the camera into the PLAY CST (ViewCine) state.

6.6.3   Play/Pause Stored Cine Forward

With the camera in the PLAY CST mode:

1. Depressing the Zoom button a one time to instruct the camera to forward through the memory buffer or play the images stored in the memory buffer one image at a time until the end of the recording as been reach or the user pauses the playback process.

2. Depressing the button a second time to pause the playback process.

6.6.4   Play/Pause Stored Cine Reverse

With the camera in the PLAY CST mode:

1. Depressing the Trigger button one time instructs the camera to play the image in reverse, continuously one image at a time.

2. Depressing the button a second time will pause the playback process.

6.6.5   Step Through Stored Cine File

With the camera in the PLAY CST mode:

1. Rotate the Select Setup button clockwise will step forward through the recorded images one image at a time.

2. Rotating the button counter-clockwise will step backwards through the recorded images one image at a time.

6.7   Defining Mark In and End Mark Points

To mark the beginning of a recorded cine file the camera must be in the PLAY CST, (playback cine stored), mode.

6.7.1   Setting the Mark In Point

To mark the beginning of the cine file:

1. Rotate the Select Setup button to the Memory Buffer Graphical Representation field, the

2. Hold in and rotate the Select Setup button until the desired starting image is displayed on the monitor or in the viewfinder, then

3. Release the Select Setup button

4. Rotate the Setup Select button to the Edit field, and

5. Hold in the Select Setup button, and

6. Rotate it until the MARK IN option is displayed on the monitor or viewfinder, and

7. Release

NOTE

The graphical representation of the memory buffer will now display a vertical line marking the starting point for the cine file to be played back.

6.7.2   Setting the End Mark Point

To Mark the End of a recorded cine:

1. Rotate the Select Setup button to the Memory Buffer Graphical Representation field, the

2. Hold in and rotate the Select Setup button until the desired starting image is displayed on the monitor or in the viewfinder, then

3. Release the Select Setup button

4. Rotate the Setup Select button to the Edit field, and

5. Hold in the Select Setup button, and

6. Rotate it until the MARK OUT option is displayed on the monitor or viewfinder, and

7. Release

NOTE

The memory buffer graphical representation will now display a vertical line marking the end point of the cine file to be played back.

## 6.8   Retuning the Camera to the Capture Mode

To return to the LIVE WTR, (Preview, Waiting for Trigger), mode hold the button in for 5 seconds.

6.9   Phantom CineMag Procedures

6.9.1   Recording to the Phantom CineMag in Loop Mode

Use this option when you wish to manually edit and save a cine file stored in the cameras DRAM frame buffer to the optional Phantom CineMag non-volatile Flash memory unit.

1. Start the Phantom Camera Control Software application

2. Open the Acquisition pull-down menu

3. Select the Setup and Recording... command from the Acquisition menu

4. Manually Save the camera stored cine file to Flash

    a. Click on the Flash Mem... button to open the Flash Memory dialogue window after a cine has been recorded to the dynamic memory of the camera
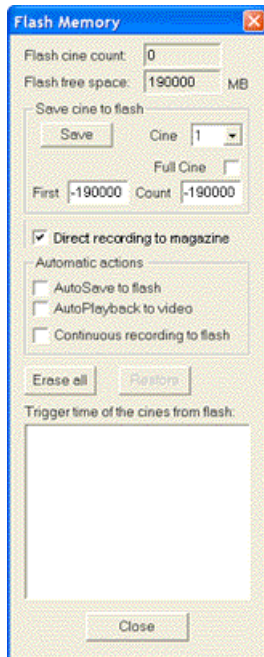

    1) Specify the image range to be saved to Flash

       a) Enter the image number of the first image to be saved in the First field
       b) Enter the number of images to be saved in the Count field

    2) Click on the Save button

NOTE

After clicking the Save button a status window will pop up and a status bar will show the progress and estimated time remaining in the save.
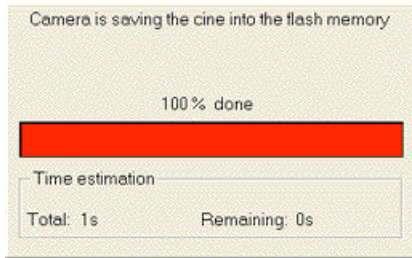
When the save is complete the Flash Memory dialogue window will list the file(s) stored in non-volatile flash memory identified by the trigger time of each file. There will also be a small box that displays the Flash Cine Count; the number of files stored in Flash memory.
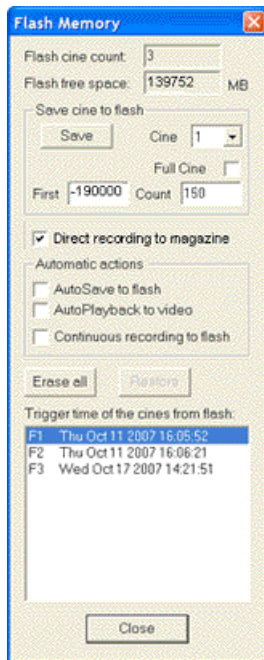
NOTE

The file stored in the cameras memory buffer will remain untouched in the cameras memory buffer until power is removed from the camera, or the instructed by you to delete the cine file.

3) Click the Close button to exit the Flash Memory dialogue window

6.9.2   Start/Stop Recording to the Phantom CineMag in Run/Stop Mode

1. Place the camera into Capture (Record) Mode

a. Push the on-camera control Trigger button for one second to start recording directly into the Phantom CineMag.

b. Notice that the Activity and Record indicators are active, and the Total Time Available and Number of Frames Available fields, on the On-Screen Display, are decrementing.

2. Trigger the Camera

a. Push the on-camera control Trigger button again to stop recording.

b. Take note of the Phantom CineMag indicators, and the On-Screen Display information.

NOTE

If you prefer to not to use the on-camera control button, you can use the Capture and Trigger buttons located in the Setup and Recording dialogue window.

6.9.3   Viewing a Cine File Stored in Phantom CineMag

6.9.3.1   Via the Phantom Camera Control Software

To view or save cine files stored in the Phantom CineMag:

1. Open the ViewCine playback display window.

2. Click the Camera radio button located in the Cine Source fields.

3. Click the down arrow to the right of the Cine# field, and select the cine #, stored in flash, to be viewed. The file stored in non-volatile flash will be indicated by the letter "F" preceding the cine file count, i.e., F1, F2, F3, etc.

4. Edit the selected cine file.

5. Click the Save button to save the selected cine.

NOTE

The color of the Phantom CineMag record cine files will be different that that of the cine files recorded in the cameras DRAM frame buffer.

6.9.3.2   Via the On-Camera Control Buttons

To view how to select and view cine files stored in a Phantom CineMag refer to: "Step-by-Step Processes>Play/Pause a Stored Cine File".

## 6.9.4 Erasing Files from the Phantom CineMag

CAUTION

Be sure to Save all of the cine files stored in Phantom CineMag you want to keep before erasing the Phantom CineMag Flash memory. This is an all-or-nothing selection, the memory can only be erased in its entirety, individual files cannot be purged separately.

Also the Erase Protect feature has not yet been enabled even though the Erase Protect Indicator is active, when the Erase Protect Switch, located underneath the Phantom CineMag, is in the locked position, indicating the CineMag is in Erase Protect Mode.

1. Start the Phantom Camera Control Software application

2. Open the Acquisition pull-down menu

3. Select the Setup and Recording... command from the Acquisition menu

4. Erase All the files stored in Flash memory

    a. Click on the Flash Mem... button to open the Flash Memory dialogue window after a cine has been recorded to the dynamic memory of the camera

        1) Ensure that the Continuous record to Flash feature is disabled (unchecked).
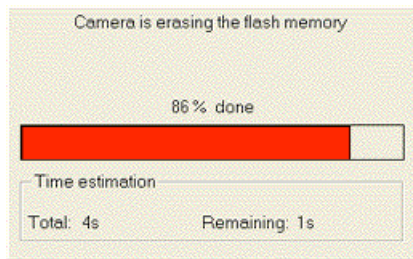
        2) Click the Erase All button
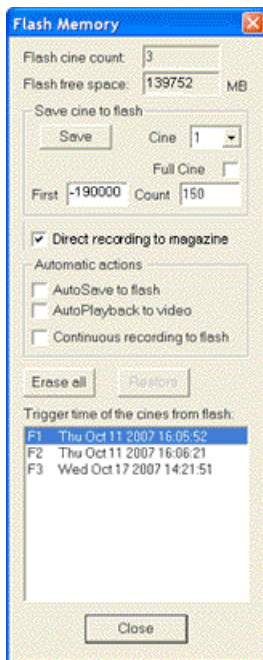
        3) When the following Warning message appears, click the Yes button to erase all the file stored in non-volatile Flash memory.
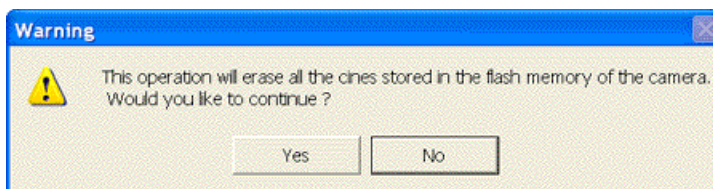
Result:

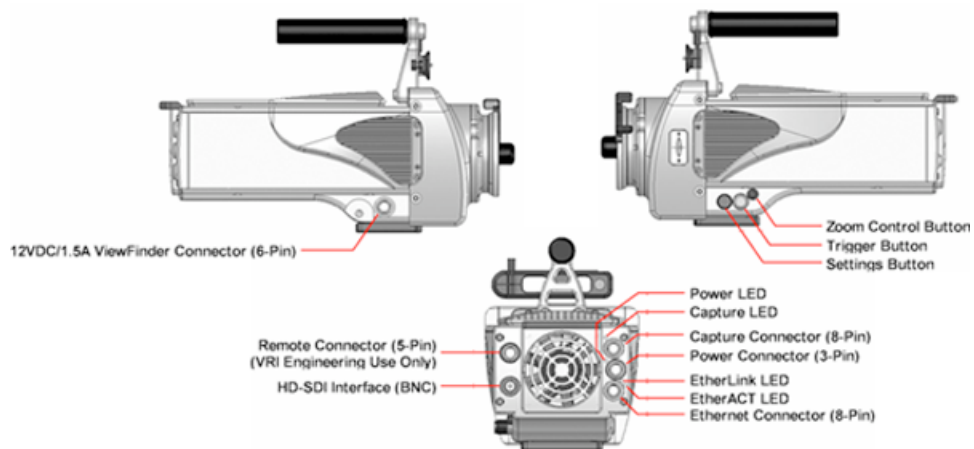The system will display the status of the erasing procedure.

4) When the deletion process is complete, click the Close button.

Part VII

7   Appendix A: Connectors and Indicators

7.1   Phantom 65

For details refer to:

- Phantom 65/HD Ethernet Connector (8-Pin Female)
- Phantom 65/HD Capture Connector (8-Pin Male)
- Phantom 65/HD Power Connector (3-Pin Male)
- Phantom 65/HD ViewFinder Connector (7-Pin Female)
- Phantom 65/HD Remote Connector (5-Pin Female)
- Phantom HD/SDI Connector (BNC)
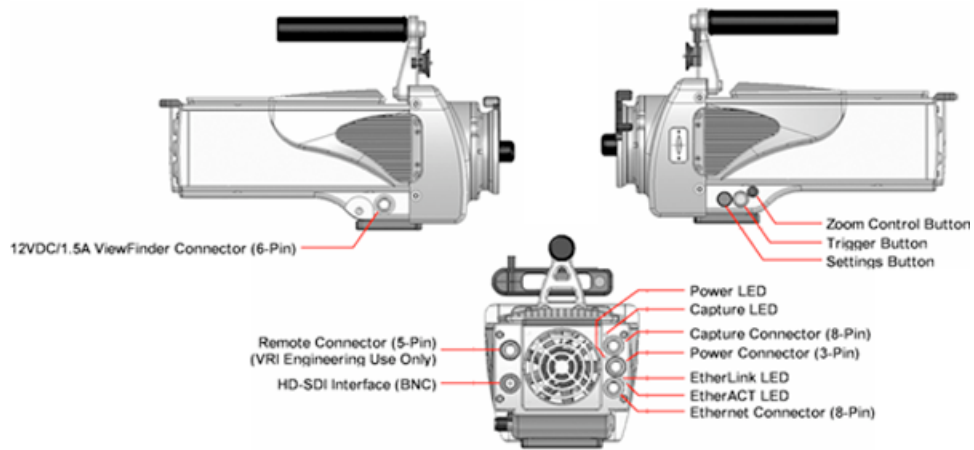- Phantom 65/HD Control Buttons and Indicators

7.2   Phantom HD

For details refer to:

- Phantom 65/HD Ethernet Connector (8-Pin Female)
- Phantom 65/HD Capture Connector (8-Pin Male)
- Phantom 65/HD Power Connector (3-Pin Male)
- Phantom 65/HD ViewFinder Connector (7-Pin Female)
- Phantom 65/HD Remote Connector (5-Pin Female)
- Phantom HD/SDI Connector (BNC)
- Phantom 65/HD Control Buttons and Indicators

7.3   Phantom CineMag

The Phantom CineMag consist of two groups of indicators. A group of five indicators on the rear-left of the unit, from left to right, Power, Erase Protect, Activity, FPGA Loaded, and Recording. The of eight LEDs on the rear-right of the unit indicate the amount of non-volatile memory storage area used/ available in the Phantom CineMag.
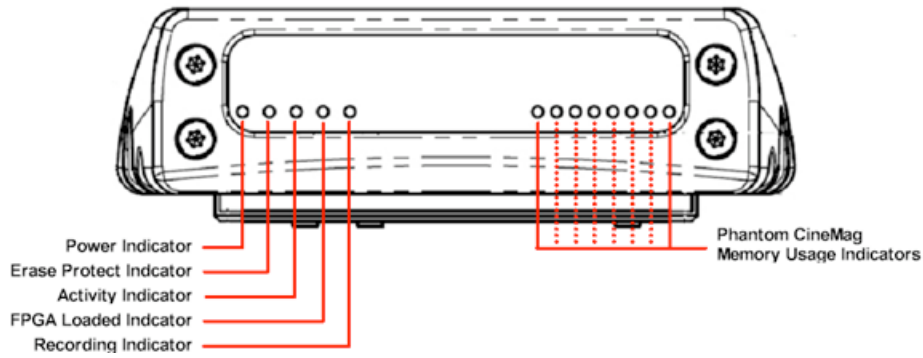
Phantom CineMag (rear view)

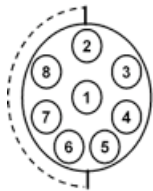For details refer to Phantom CineMag Indicators.

7.4   Connector Reference

The Phantom camera models listed below are described within this topic:

- Phantom 65
- Phantom HD

7.4.1   Phantom 65/HD Capture Connector

This connector provides all I/O connectivity such as trigger, Ready, Frame Sync, IRIG-In, IRIG-Out, and Strobe.

The pin out for this connector is as follows:

|		
1	**ISOGND**	Ground/Shield
2	**IRIG-In**	Phantom 65 and Phantom HD cameras provide unmodulated IRIG B time code input. The input withstands signals of up to +/- 15v. The input threshold is 1.5V, so the input is also compatible with TTL levels.
		All IRIG i/os are not isolated.
3	**PGND**	The power input and the acquisition control signals are isolated from the camera system ground. This isolation is designed to avoid system ground loops only, and should not be subject to high voltages.
4	**IRIG-Out**	Phantom 65 and Phantom HD cameras provide unmodulated IRIG B time code output. The output swings to RS-232 levels of +/-9V.
		All IRIG i/os are not isolated.
5	**FSYNC**	Frame Sync is a bi-directional isolated signal.
6	**Ready-Out**	Isolated open collector output, with 1k pull-up. When high, indicates that the camera is in capture mode. In a multiple camera system, the READY outputs of up to 4 cameras can be connected together; the resulting signal will be high when all the cameras in the system are in capture mode.
7	**Strobe-Out**	Isolated open collector output, with 1k pull-up. When asserted (low) Strobe indicates that the camera integrates (the shutter is open). Strobe is low for the duration of the exposure.
8	**Trigger-In**	Isolated input. Active low. Can be activated by a switch to ground. On early cameras the trigger was level-sensitive, and was accepted if asserted (low) at the end of an exposure. As such, the trigger signal should have lasted at least as much as the reciprocal of the frame rate to guarantee it was recognized.
		Now the trigger is edge-sensitive, and the exact time of the trigger edge is recorded. The trigger pulse needs to be at lest 3µs long.

7.4.2 Phantom 65/HD Ethernet Connector

This connector provides a means to connect the controlling laptop or PC to the camera. The Ethernet connector provides connectivity to other cameras in a multi-camera setup.
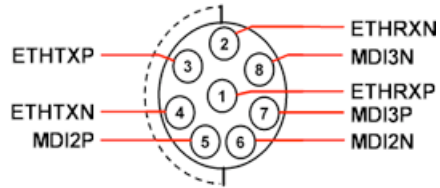
The pin out for this connector is as follows:

1	**ETHRXP**	10/100/1000BASE-T Ethernet Receive (positive)
2	**ETHRXN**	10/100/1000BASE-T Ethernet Receive (negative)
3	**ETHTXP**	10/100/1000BASE-T Ethernet Transmit (positive)
4	**ETHTXN**	10/100/1000BASE-T Ethernet Transmit (negative)
5	**MDI2P**	10/100/1000BASE-T Media Dependent Interface 2 (positive)
6	**MDI2N**	10/100/1000BASE-T Media Dependent Interface 2 (negative)
7	**MDI2P**	10/100/1000BASE-T Media Dependent Interface 3 (positive)
8	**MDI3N**	10/100/1000BASE-T Media Dependent Interface 3 (negative)

7.4.3   Phantom 65/HD Power Connector

This connector is used to provide the necessary power (+24VDC) to the camera.
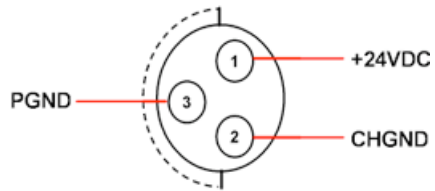
The pin out for this connector is as follows:

1   **+24VDC**   Provides +24VDC (Direct Current) positive power to the Phantom camera.

2   **CHGND**   Chassis Ground

3   **PGND**   Power Ground
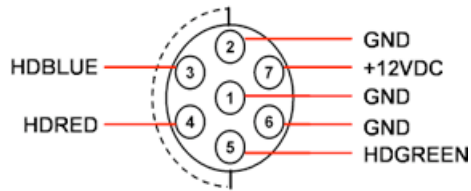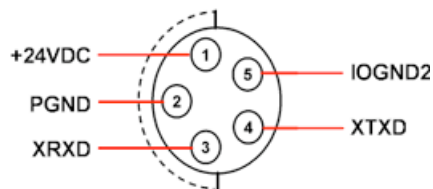
7.4.4 Phantom 65/HD +12VDC/1.5A max ViewFinder Connector

This Viewfinder connector is only available on the Phantom 65 and Phantom HD camera models.

7.4.5 Phantom 65/HD Remote Connector

This connector is for use by VRI Engineering Only.

7.4.6 Phantom HD/SDI Connector

The HD/SDI (High-Definition/Serial Digital Interface) connector is available on the Phantom 65, HD, v10, v9.1, and v7.3 camera models.
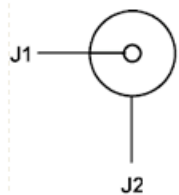
The pin out for this connector is as follows:

1   SDI OUT1   The serial digital interface coaxial cable with BNC connector has a nominal impedance of 75 ohms. This is the same type of cable used in analog video setups, which potentially makes for easier upgrades (though higher quality cables may be necessary for long runs at the higher bit rates). The specified signal amplitude at the source is 800 mV (±10%) peak-to-peak; far lower voltages may be measured at the receiver owing to attenuation. Using equalization at the receiver, it is possible to send 270 Mbit/s SDI over 300 meters without use of repeaters, but shorter lengths are preferred. The HD bit rates have a shorter maximum run length, typically 100 meters.

2   CHGND   Chassis Ground

7.5 On-Camera Control Buttons and Indicators

7.5.1 Control Buttons

The **Phantom 65** and Phantom HD camera model provide on camera control via the following set of buttons:

Zoom

This button is used to toggle through live preview, zoom, and threshold modes, when the camera is in the Preview, Waiting for Pre-Trigger (LIVE PRE) and Preview, Waiting for Trigger (LIVE WTR) or Capture modes.

When the camera is in the cine recorded and stored in memory (LIVE CST) state the Zoom button will be used to place the camera into the playback (PLAY CST) mode. It also instruct the camera to play the recorded or stored cine file forward.

Trigger

The Trigger button is used to change the cameras operational state when the camera is in either the; Pre-Trigger LIVE PRE (Preview, Waiting for Pre-Trigger), and Capture, LIVE WTR (Preview, Waiting for Trigger), modes. It also provides a soft-trigger to the camera when the camera is in the Capture, LIVE WTR (Preview, Waiting for Trigger) mode.

When the camera is in the playback, PLAY CST, mode the Zoom button will be used to play the recorded/stored cine file in reverse.

Select Setup

This button is used to select the cameras setup and recording parameters. The cameras parameters can be defined when the camera is in either the Pre-Trigger LIVE PRE (Preview, Waiting for Pre-Trigger), and Capture, LIVE WTR (Preview, Waiting for Trigger), modes.

7.5.2 Power Indicator

The Power LED provides a visual indication of camera power status and firmware integrity. If power is being supplied to the camera, and this LED is not lit, it indicates an error has occurred in the camera firmware. If this happens it is best to reboot the camera to correct the error.

7.5.3 Capture Indicator

The Capture LED provides a visual indication of the cameras operational states. By factory default, the camera is placed into the Preview - Waiting for Pre-trigger mode when the camera is powered on, unless it has otherwise been user configured to start in the Recording waiting for trigger (capture) mode. Once in the Capture mode the camera starts recording images into the cameras circular memory buffer (DRAM). Upon detection of a trigger signal the camera is instructed to stop writing to the cameras internal memory buffer, once the number of specified Post Trigger frames has been reached, and the camera will be placed into the Preview mode. If the camera has been configured to automatically save the images to Flash the camera will, at this point write the images stored in the cameras DRAM to the Phantom CineMag memory module.

User intervention is required to either save the cine to an external drive, or to put the camera back into capture mode from the Setup and Recording screen.

The following will indicate the camera's operational state described above:

Off   Preview or Preview - Waiting for Trigger

On   Recording waiting for trigger (capture)

7.5.4   Ethernet Activity Indicator

When active the LED indicates data is being transferred between the camera and the Phantom Control Unit computer.

7.5.5   Ethernet Link Indicator

When active the LED indicates that the camera is detected and is connected to an Ethernet network.

7.6   Phantom CineMag Indicators

7.6.1   Power Indicator

The Power LED, (when ON), provides a visual indication that power is being supplied to the Phantom CineMag.

7.6.2   Erase Protect Indicator

The Erase Protect LED, (when ON), indicates that the Erase Protect Switch, located underneath the Phantom CineMag, is in the locked position.

7.6.3   Activity Indicator

When active, (ON), the LED indicates data is being transferred to/from the camera and the Phantom CineMag.

7.6.4   FPGA Loader Indicator

The FPGA Loader LED will be:

- ON during power-up diagnostics

- OFF when Phantom CineMag FPGA's, (Field Programmable Gate Arrays), are programmed properly

7.6.5   Recording Indicator

When active the LED indicates data is being transferred into the Phantom Phantom CineMag.

7.6.6   Phantom CineMag Memory Usage Indicators

The Phantom CineMag Memory Usage Indicators consist of a group of eight LEDs.

- When the Phantom CineMag is empty all the LEDs will be ON.

- As the Phantom CineMag fills up, the LEDs will turn OFF from right to left.

- The left LED will be the last to turn OFF and will blink 10 seconds before the Phantom CineMag is full.

Part

VIII

8 Appendix B: EULA (End User License Agreement)

8.1 Phantom Camera Control Software EULA

PHANTOM END USER LICENSE AGREEMENT

This run-time copy of Phantom ("the Software Product") and accompanying documentation are licensed and not sold. The Software Product is protected by copyright laws and treaties, as well as laws and treaties related to other forms of intellectual property. Vision Research, Inc. or its subsidiaries, affiliates, and suppliers (collectively "VRI") own intellectual property rights in the Software Product. The licensee's ("you" or "your") ability to download, use, or copy the Software Product is subject to and governed by the terms and conditions of this End User License Agreement ("Agreement").

1.   Acceptance
        YOU ACCEPT AND AGREE TO BE BOUND BY THE TERMS AND CONDITIONS OF THIS AGREEMENT BY SELECTING THE "ACCEPT" OPTION AND DOWNLOADING THE SOFTWARE PRODUCT OR BY INSTALLING, USING, OR COPYING THE SOFTWARE PRODUCT. YOU MUST AGREE TO ALL OF THE TERMS AND CONDITIONS OF THIS AGREEMENT BEFORE YOU WILL BE ALLOWED TO DOWNLOAD THE SOFTWARE PRODUCT. IF YOU DO NOT AGREE TO ALL OF THE TERMS OF THIS AGREEMENT, YOU MUST SELECT "DECLINE" AND YOU MUST NOT INSTALL, USE, OR COPY THE SOFTWARE PRODUCT.

2.   License Grant
        Subject to the terms and conditions hereof, VRI grants you a non-exclusive and non-transferable right to (a) install and execute on a single central processing unit within a computer one copy of the Software Product and (b) make one additional copy of the Software Product for backup and archival purposes only. The archival copy must be on a storage medium other than a hard drive, and may only be used for the reinstallation of the Software Product. This Agreement does not permit the installation or use of multiple copies of the Software Product, or the installation of the Software Product on more than one computer at any given time, on a system that allows shared used of applications, on a multi-user network, or on any configuration or system of computers that allows multiple users. Multiple copy use or installation is only allowed if you obtain an appropriate licensing agreement for each user and each copy of the Software Product. Except as expressly set forth herein or in a separate written agreement, you shall be solely responsible for the entire installation, supervision, training, management, support, maintenance and control of the Software Product, including all responsibility for installation and for maintenance of hardware and proper machine configuration. The Software Product, including any and all updates and upgrades, shall be deemed accepted by you immediately upon download, copying, or receipt from VRI. The rights granted to you under this Agreement are rights that may be exercised solely by you.

3.   Restrictions

        3.1 Restrictions on Transfer
        Without first obtaining the express written consent of VRI, you shall not assign your rights or obligations under this Agreement, or redistribute, encumber, sell, rent, lease, sublicense, or otherwise transfer your rights to the Software Product. Subject to the foregoing, this Agreement will be binding upon and inure to the benefit of the parties, their respective successors and permitted assigns.

        3.2 Restrictions on Use
        You may use the Software Product only as expressly provided in Section 2. Without limiting the foregoing, you shall not: use, copy, or install the Software Product on any system with more than one computer, or permit the use, copying, or installation of the Software Product by more than one user or on more than one computer. If you hold multiple, validly licensed copies, you may not use, copy, or install the Software Product on any system with more than the number of computers permitted by license, or permit the use, copying, or

installation by more users, or on more computers than the number permitted by license.

You shall not decompile, "reverse-engineer", disassemble, or otherwise attempt to derive the source code for the Software Product.

You shall not use the database portion of the Software Product in connection with any software other than the Software Product

3.3 Restrictions on Alteration

You shall not modify the Software Product, or any portion thereof, or create any derivative work of the Software Product or its accompanying documentation. Derivative works include but are not limited to translations. You may not alter any files or libraries in any portion of the Software Product. You may not reproduce the database portion or create any tables or reports relating to the database portion. You shall not change any proprietary rights notices which appear in the Software Product.

3.4 Restrictions on Copying

You shall not copy any part of the Software Product (digitally, electronically, in writing or otherwise), except to the extent that licensed use inherently demands the creation of a temporary copy stored in computer memory and not permanently affixed on a storage medium. You may make one archival copy which must be stored on a medium other than a computer hard drive.

4. Proprietary Rights

You agree that the copyright(s), patent(s), trademark(s), trade secret(s) and all other intellectual proprietary rights of whatever nature in the Software Product and related documentation, including derivative works, are and shall remain the exclusive property of VRI and any third party suppliers. Nothing in this Agreement should be construed as transferring any aspects of such rights to you or any third party. VRI reserves any and all rights not expressly granted herein. PHANTOM is a trademark of Vision Research, Inc., and shall not be used by you without VRI's express written authorization.

5. Limited Software Product Warranty

For a period of sixty (60) days from the date of shipment, VRI warrants that when properly installed and used under normal conditions, the Software Product will perform in accordance with VRI's specifications

6. Limited Storage Medium Warranty

For a period of ninety (90) days from the date of shipment, VRI warrants that when properly installed and used under normal conditions, the storage medium on which the Software Product is shipped will be free of material defects in material and workmanship.

7. Disclaimer of Warranties and Limitation of Liability

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8.2   VRI Firmware EULA

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10.   Miscellaneous

If any provision of this Agreement shall be held to be invalid or unenforceable, the remainder of this Agreement shall remain in full force and effect, and such provision shall be deemed modified to the minimum extent necessary to make such provision consistent with applicable law and, in its modified form, such provision shall be enforceable and enforced. VRI's failure to exercise any right or remedy shall not be deemed a waiver of such right or remedy. Unless otherwise agreed to in writing, any notice under this Agreement shall be delivered and addressed to you at the address to which the is shipped, and to VRI at 100 Dey Road, Wayne, New Jersey 07470. Notice shall be deemed received by any party: (a) on the day given, if personally delivered or if sent by confirmed facsimile transmission, receipt verified; (b) on the third day after deposit, if mailed by certified, first class, postage prepaid, return receipt requested mail, or by reputable, expedited overnight courier; or (c) on the fifth day after deposit, if sent by reputable, expedited international courier. Either party may change its address for notice purposes upon notice in accordance with this Section. This Agreement comprises the entire agreement between the parties relating to the subject matter hereof and may be amended or modified only in a writing executed by both parties. **In addition, if you are located in Quebec, Canada, the following clause applies: The parties hereby confirm that they have requested this Agreement be drafted in English. Les parties contractantes confirment qu'elles ont exigé quele présent contrat et tous les documents associés soient redigés en** anglais.

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pam_mkhomedir.c	libnsl-2.2.3.so**	libnss_nisplus-	-2.2.3.so**
ldconfig.c	libnss_compat-	2.2.3.so**	libcrypt-2.2.3.so**
sysctl.c	2.2.3.so**	libpthread-0.9.so**	libpcprofile.so*
ld-2.2.3.so**	libnss_dns-2.2.3.so**	libthread_db-1.0.so**	libresolv-2.2.3.so**
libc-2.2.3.so**	libnss_files-2.2.3.so**	libSegFault.so**	librt-2.2.3.so**
libdl-2.2.3.so**	libnss_hesiod-	libanl-2.2.3.so**	libutil-2.2.3.so**
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cat.c	true.c	fsck.c (and others)	swapon.c
chgrp.c	umount.c	genksyms.c	tune2fs.c
chmod.c	uname.c	agetty.c	gawk-3.1.5 (various
chown.c	fuser.c	halt.c	files)
chown-core.c	grep, fgrep, egrep	hwclock.c	less-382 (various files)
chroot.c	(various files)	ifconfig.c,ifdown,ifup	mesg.c
cp.c	gzip/gunzip,uncompr	ifinit	passwd.c
cpio (various)	ess,zcat	insmod.c,	rgrep (various files)
date.c	loadkeys.c	insmod.static	smbclient ,smbmnt
dd.c	mount, umount	insmod_ksymoops_cle	,smbmount,smbumou
df.c	(various files)	an	nt(various files)
dmesg.c	netstat.c	install-info.pl	arp.c
echo.c	pstree.c	ipmaddr.c	exportfs.c
false.c	runparts.c	iptunnel.c	grpck.c

hostname.c	sed-4.1.4 (various	kernelversion	pwck.c
kill.c	files)	killall5.c	telnetd
ln.c	setserial.c	klogd.c	lockd
ls.c	tar-1.15.1 (various	lspci.c	mountd
mkdir.c	files)	mii-tool.c	nfsd
mknod.c	tempfile.c	mke2fs.c	statd
mv.c	ls-vdir.c	mkfs.c	kbdrate
ping.c	cut.c	modinfo.c	libconsole.so.0.0.0
pivot_root.c	du.c	plipconfig.c	libcfont.so.0.0.0
pwd.c	find.c	rarp.c	libctutils.so.0.0.0
readlink.c	id.c	resize2fs.c	libe2p.a
rm.c	su.c	route.c	losetup[?]
rmdir.c	badblocks.c	runlevel.c	libe2p.so.2.3
sleep.c	depmod.c	setpci.c	libext2fs.a
stty.c	devfsd.c	shutdown.c	libext2fs.so.2.4
su.c	dumpe2fs.c	slattach.c	mkswap.c
sync.c	e2fsck.c	sln.c	

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pam_motd.c (© Ben Collins)	ssh-keygen.c (© 1994 Tatu Ylonen)	libssl.a 1998-1999 The OpenSSL Project, © 1995-1998 Eric Young,	libpthread-0.9.so (© 1991Regents of Univ. of California)
pam_nologin.c (© 1996 Michael K. Johnson)	sftp-server.c (© 2000, 2001, 2002 Markus Friedl)	Tim Hudson)ld-2.2.3.so (© 1991Regents of Univ. of California)	libthread_db-1.0.so (© 1991Regents of Univ. of California)
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