

PCC 2.7 User Manual

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PHANTOM®
when it's too fast to see, and too important not to™

Table of Contents

Foreword	9
Part I EULA (End User License Agreements)	12
1 Phantom Camera Control Software EULA.....	12
2 Phantom (CV) CineViewer EULA.....	15
3 Vision Research Firmware EULA.....	18
Part II Camera Legends	34
Part III Welcome to PCC (Phantom Camera Control) Help	36
1 Getting Help.....	36
2 Other Useful Phantom Resources.....	37
Part IV Whats New in PCC 2.7	40
1 PCC (Phantom Camera Control).....	40
2 Phantom (PVP) Video Player.....	45
3 Camera Repair and Firmware Upgrade (Nucleus).....	45
4 Firmware Requirements.....	46
Part V Quick Start Guides	48
1 Phantom v-Series Cameras via Phantom Camera Control (PCC) Application	48
2 Phantom Miro M / R / LC-Series Cameras via Phantom Control Software	52
3 Phanrtom Miro C210J / C210 Cameras via PCC.....	54
Part VI Getting Started	60
1 Phantom Camera Control Unit Requirements.....	60
2 Preparing Your Computer.....	62
3 Installing the Phantom Camera Control Software.....	63
4 Installing the Phantom STG (Serial Tag Number) File.....	63
5 Define the Phantom Control Unit IP Address.....	65
6 IEEE 1394 Hardware and Driver Installation.....	66
7 Verify Camera Connection.....	69
Part VII Phantom (PCC) Camera Control Application - Help	72
1 The User Interface.....	73
Toolbar	75
Preview/Playback Panel	78
Status Bar	79

The Control Panels	80
Manager Panel Components.....	81
Live Panel Components.....	84
Play Panel Components.....	104
2 Step-by-Step Procedures.....	114
Toolbar Procedures	114
Open File	114
Batch Convert Files.....	114
Merging Images Into a Cine.....	116
Graphics	117
Image Tools.....	122
Adjustments	122
Advanced Adjustments.....	125
Tone	125
Color Matrix	126
Geometry	127
Image Tools Buttons.....	127
Video Out	128
Snapshot	128
Preview/Playback Panel Procedures	128
Performing a White Balance Adjustment.....	128
Manager Tab Procedures	129
Selecting a Camera.....	129
Viewing Camera Information.....	129
Rename a Camera.....	130
Selecting a Cine File.....	130
Adding a Simulated Camera.....	130
Deleting (Remove) Groups.....	131
Defining the (PCC) Application Preferences.....	131
General Preferences.....	131
Interface	131
Units	132
Snapshot	133
Imaging	133
Other Options	134
Preferences Buttons.....	134
Measurement Preferences.....	134
Units	135
Other Options	135
Logging Preferences.....	136
Camera Preferences.....	136
Accessing Camera Repair & Firmware Upgrade (Nucleus) Application.....	136
Live Tab Procedures	137
Selecting a Camera / Camera Group.....	137
Locking Multiple Camera.....	137
Copying Camera Parameters.....	137
Camera Settings.....	138
Set Image 'Time Stamp' Reference.....	138
Specify the Time Zone Reference.....	139
Define the Image Pixel Bit Depth	139
Specify the Cine Memory Partitions.....	139
Define the Automatic Lens Control.....	140
Backup & Restore Settings.....	140
Cine Settings.....	141

Define a Cine Name.....	141
Define the Resolution.....	142
Define the Sample Rate.....	142
Define the Exposure Time.....	143
Change the Exposure Index.....	144
Define an EDR Exposure Time.....	144
Perform a CSR	145
Low Light	146
Define an Image Range (Trigger Delay) or Trigger Position (Post Trigger) Value	146
Copy Capture Parameters to All Partitions.....	148
Flash Memory Settings.....	148
Erasing Flash Memory	148
Define the Phantom CineMag (Mode / Format).....	149
Advanced Settings.....	150
Define the Cine Advanced Options.....	150
Define the Start/End of Recording Actions Parameters.....	151
Define the External Sync Parameters.....	152
Enabling the Quiet Fans Feature	158
Define the Starts In Option.....	158
Define DAQ Signals.....	159
Define the Range Data Protocol.....	159
Define the National Instruments USB X or M Series Data Acquisition Signals.....	159
Define the Time Info Out Pin Format.....	161
Enable Audio (Phantom Flex4K Only).....	162
Camera Signals.....	162
Define the Trigger Characteristics.....	162
Define the Pretrigger Pin Is:.....	163
Using the Memory Gate Feature with a Pickle Switch.....	163
Using the Memory Gate Feature with a Pistol Grip Switch.....	165
Define the Ready Signal Ends At:.....	167
Define the Aux Pin Is:.....	167
Auto Exposure.....	167
Frame Rate Profile.....	169
Image-Based Auto-Trigger.....	173
Continuous Recording.....	174
Camera Info.....	180
Capture (Record) Image Data.....	180
Trigger / Abort Recording.....	181
Play Tab Procedures	181
Cine Selection.....	181
Cine Lock	182
Cine File Review.....	182
Cine Quick Search.....	183
Cine File Edit.....	184
Specify Play Speed & Options Settings.....	186
Saving Cine Procedures.....	186
Save Cine to File.....	187
Save All RAM to File (Partitions).....	188
Save All Flash Cines to File (Internal Flash / CineMag / Type 1 Compact Flash Card)	188
Save RAM to Flash (Internal / CineMag / CineFlash / Type 1 Compact Flash)	189
Select&Save Cines to File (Multi-camera / Partitions).....	190

Save Cine Dialogue Window Options	191
Range Options	191
Decimate By	191
Save Options	193
16 bpp	193
Split Quarters	193
XML Header	193
Packed	193
WAV Audio File	193
Lossy Compression Quality	194
Advanced Options.....	194
Border Data	194
Multihead Options.....	195
Frame Info.....	196
Cine Info	196
Measurements.....	198
Performing Time Measurements.....	199
Defining Measurement Units.....	200
Calibrating a Measurement Scale.....	201
Setting/Clearing the Origin Point.....	201
Coordinates Analysis.....	202
Instant Measurements.....	202
Create/Open a Report File.....	203
Closing a Report File.....	204
Distance & Angle & Speed: Origin + 1 Point.....	204
Distance & Angle & Speed: 2 Points.....	205
Angle & Angular Speed: 3 Points.....	206
Angle & Angular Speed: 4 Points.....	207
Collect Points (Tracking).....	208
Reviewing the Report and Collect Point Files.....	211
Distance & Angle & Speed: Origin + 1point.....	211
Distance & Angle & Speed: 2points.....	213
Angle & Angular Speed: 3points.....	215
Angle & Angular Speed: 4points.....	217
Collect Points - Points File.....	219
Collect Points - Compute Speed File.....	220
Collect Points - Compute Acceleration File.....	221
Image Search.....	222
Multi-Camera / Cine (Group) Procedures	224
Creating Groups.....	224
Delete (Remove) Groups.....	226
Selecting Camera Groups.....	227
Deselect (Unlock) Groups.....	227
Assigning Capture Parameters to Camera Group.....	227
Camera Group Cine Capture	228
Review Camera / Files Group Cines.....	229
Edit Camera / Files Group Cines.....	229
Save Camera / Files Group Cines.....	229
Deleting All RAM Files.....	232
Grouping Previously Saved Cine Files.....	232
Selecting Files Groups.....	232
Remove All Files	233
Converting Grouped Files.....	234

Part VIII Functional Descriptions	236
1 Black Reference/Current Session Reference Adjustments.....	236
2 Burst Mode Acquisition.....	238
3 Firmware Ordered Recording and Minimal GUI Refresh.....	243
4 Frame Rate Tables.....	244
5 Image-Based Auto-Trigger.....	257
6 Image Processing Effects and Filters.....	259
7 Performance Optimizations Using the GPU.....	268
8 Phantom Camera Control Application Polling Process.....	277
9 Phantom CineMag Operational Modes.....	278
10 Phantom File Naming Convention.....	279
Phantom File Naming Convention Examples	281
11 Phantom .stg (Serial Tag Number) File.....	284
12 Range Data Interface.....	286
13 SMPTE Time Code in Phantom Cameras.....	288
14 Supported File Formats.....	290
15 Supported Video System Formats.....	298
16 Sync to Video Mode.....	301
17 Versatile Dual HD-SDI.....	301
Part IX Service & Support	310
1 Service Centers.....	311
2 Phantom Certification Program.....	312
Part X Firmware Requirements	314
1 Current Cameras.....	315
2 Discontinued Cameras.....	317
3 Obsolete Cameras.....	318
4 Peripherals.....	319
Part XI Other Help Files	322

PCC User Manual

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by Vision Research

Thank you for using Phantom! You chose the most powerful and easiest camera to discover the potential of your ideas. Phantom is a totally digital high-speed imaging system capable of recording of high resolution images. If an ordinary photograph captures a moment in time, each high resolution Phantom image explores a remarkably unpredictable moment in time.

The Phantom Camera Control Software, and the On-Camera Control Buttons provides you with complete creative control over time. You can select any frame rate in increments of one frame per second or 0.000001 increments for ph16 cameras. Shift the frame rate a little and move a scene to a slightly future viewpoint. Or shift the frame rate a lot and move a scene to some long passing moment in time. You will enjoy the ability of having seamless control of the duration, speed and time of every element of the shot.

With its two main components of the system the Phantom imager with advanced CMOS technology, and the Phantom Camera Control software, they form a system that provides high speed, high resolution image capture in digital cine format, with communications across multiple digital and analog protocols. This operational guide has been meticulously designed to ease the anxieties associated with learning how to use your Phantom camera and its powerful features.

Enjoy the Phantom Experience!

Part

I

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pam_mkhomedir.c	libnsl-2.2.3.so**	libnss_nisplus-	-2.2.3.so**
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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**
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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 files)
chown.c	fuser.c	halt.c	less-382 (various files)
chown-core.c files)	grep, fgrep, egrep	hwclock.c	
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, smbmount
dd.c	mount, umount	insmod_ksymoops_cle	
,smbmount, smbmount			
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 files)	kernelversion	pwck.c
kill.c	sed-4.1.4 (various files)	killall5.c	telnetd
ln.c	setserial.c	klogd.c	lockd
ls.c	tar-1.15.1 (various files)	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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Version 2.1, February 1999

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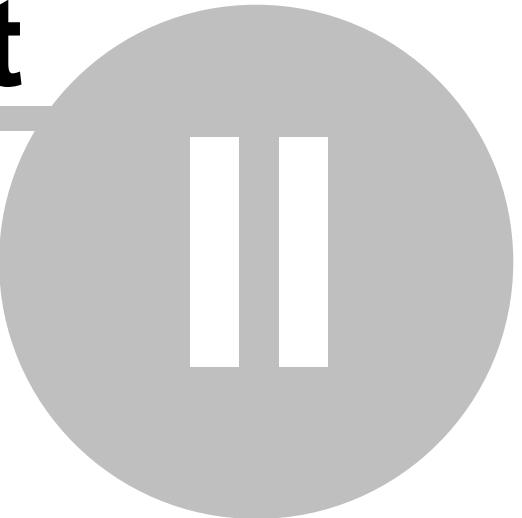
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Part



II

2 Camera Legends

The following tables shows the Phantom cameras referred to as ph16 and ph7 camera models.

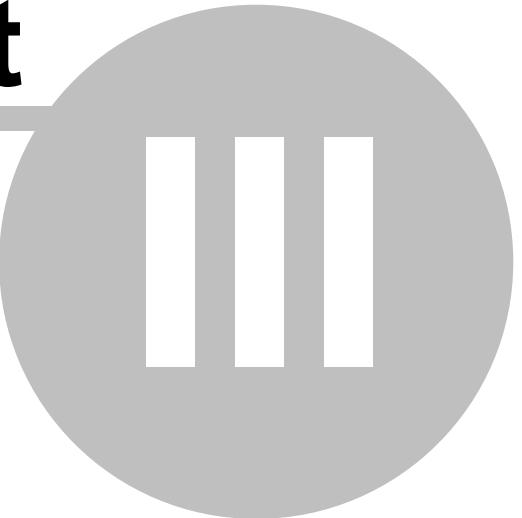
ph16fw Cameras

Broadcast / Cinematography Series	Ultrahigh Speed Series	Legacy v-Series	Miro Lab Series	Miro C Series	Miro M / R / LC Series	Miro (Legacy) Series
Flex4K	v2512, v2511, v2012, v2011, v1612, v1611, v1212, v1211, and v1210	N/A	LAB340, LAB320, LAB3a10, LAB310, LAB140, LAB120, and LAB110	C210J, and C210	M340, 320S, 310, M140, 120, and 110	N/A

ph7fw Cameras

Broadcast / Cinematography Series	Ultrahigh Speed Series	Legacy v-Series	Miro Lab Series	Miro C Series	Miro M / R / LC Series	Legacy Miro Series
Flex, P65, HD/HD Gold, and v642 Broadcast	N/A	v711, v710, v641, v640, v611, v411, v341, v311, v310, v211, v210, v12.1, v12.0, v10, v9.1, v9.0, v7.3, v7.2, v7.1, v7.0g, v6.2, v6.0, v5.2, v5.1, v5.0, v4.3, v4.2, 4.1, and v4.0	N/A	N/A	N/A	Airborne HD, Airborne HQ, eX4, 4, 3, eX2, 2, eX1, and 1

Part



III

3 Welcome to PCC (Phantom Camera Control) Help



Thank you for using Phantom! You chose the most powerful and easiest camera to discover the potential of your ideas. Phantom is a totally digital high speed imaging system capable of recording thousands of high resolution frames per second. If an ordinary photograph captures a moment in time, each high resolution Phantom image (frame) explores a remarkably unpredictable moment in time.

The new version of the Phantom Camera Control Software application offers everything that the earlier versions included and much more. Virtually, every aspect of the program has been overhauled and improved, without sacrificing intuitive ease of use. This Help file will reduce the learning curve, and ease the anxieties associated with learning how to use your Phantom camera and its powerful features quickly.

Enjoy the Phantom Experience!

3.1 Getting Help

As you would expect the Phantom Help File provides you with plenty of help on every aspect of using the Phantom Camera Control software application. In addition to this very comprehensive help file, which are actually a complete user manual, the Help File also has extensive context-sensitive help that you can access.

Using the help file

This help is designed to be used on-screen. It is extensively cross-linked so that you can find more relevant information to any subject from any location. If you prefer reading printed manuals a PDF version of the entire help has also been provided to you. This may be useful as a reference, but you will probably find that the active hyperlinks, cross-references and active index make the on-screen electronic version of the help much more useful.

Getting a printed help manual

Please don't try to print the HTML Help version of the help from the Microsoft help viewer, it would look terrible. You can find a formatted PDF version of the entire documentation designed for printing in the same directory the Phantom Camera Control application was installed.

As mentioned above, however, you will probably find that the on-screen version of the help is much more useful because of the hyperlinks and cross-references.

Quick Start Guides

See [Quick Start Guides](#) in the help for some basic tutorials to get you started using your Phantom camera.

3.2 Other Useful Phantom Resources



If you have any questions not answered by this help system, please don't hesitate to contact our [support center](#)!



Are you a member of the PhantomZone user forum? No, click the PhantomZone logo or the following link to sign up now: <http://www.visionresearch.com/phantomzone>.

This is a great source for additional information on Phantom cameras in general, alerts and FAQ's, product news, software and hardware suggestions, and various discussion groups in particular.

Already a member, check out 'What's New', just click the PhantomZone logo to sign in.



This web site, <http://focus.visionresearch.com>, offers news about Vision Research products and provides application notes, technical tips, FAQ's and general news of interest on the subject of high speed digital photography.



Phantom Operation Training

Vision Research proudly offers a hands-on, instructor-led Certification courses designed to expand your knowledge of Phantom Miro and v-Series camera operations using proven methodologies with Vision Research's award-winning Phantom Digital Imaging Systems. These courses covers a full range of training from the basics of the Phantom system and its graphical user interface (GUI) to many advanced analysis features.

After completing these courses, you will have the knowledge and practical understanding necessary to successfully utilize and deploy the Phantom Digital Imaging System to meet your imaging requirements. For more information please visit, <http://www.visionresearch.com/index.cfm?sector=htm/files&page=Training>

Part



IV

4 Whats New in PCC 2.7

The Phantom (PCC) Camera Control application offers everything that the earlier versions included and much more. Many of the users' requests have been implemented and many aspects of the various Phantom applications have been improved, without sacrificing familiarity and intuitive ease of use.

The question 'What's new in PCC 2.7' is not so easy to answer. The quickest answer would be that many new features have been added, some of them extremely powerful. We have listened to the feedback from our users and implemented all the most frequently-requested functions, plus many that you never even thought of but will not want to do without.

However, all these changes don't mean that the PCC applications have become unfamiliar – on the contrary. Our top design priority was to maintain the 'look and feel' of the programs and their highly-intuitive interfaces so that users upgrading will feel at home immediately.

This section outlines new features and improvements introduced in the software and various Help Files.

4.1 PCC (Phantom Camera Control)

The following changes have been made to the Phantom (PCC) Camera Control Application - Help (Software Version 2.7.756.0), including:

- **Change: PCC Help File Structure**

Previously all Phantom camera related help files were included in the PCC Help file. This information is still available but moved to the appropriate Help file. Each file can be accessed via a link in PCC Help, or by selecting the appropriate Help file from the Help toolbar button pull-down selection list.

Below is a list of the modules / topic that have been moved:

- Camera Repair and Firmware Upgrade (Nucleus) - Help (accessed in application)
- Phantom MultiCam - Help (accessed in application)
- Phantom Video Player - Help (accessed in application)
- Camera Hardware - Help (accessed via PCC Help Toolbar pull-down selection list), including:
 - Accessories, Peripherals, and Miscellaneous Features
 - Phantom CineMag - Help
 - Phantom CineFlash - Help
 - Back Focus Adjustments
 - Connectors, On-Camera Control, and Indicators
- Phantom Cine Control Panel - Help (accessed via PCC Help Toolbar pull-down selection list)
- Phantom Remote Control Unit - Help (accessed via PCC Help Toolbar pull-down selection list)

- **New: Camera Support**

Support for the Phantom Miro C210, Miro C210J, Miro 320 and Miro 3a10 camera models has been added to this version of PCC.

- **New: Multi-Camera Support**

- Camera Group Selection: The end-user can create a group of cameras by CTRL+click on each

group camera's window title bar.

When selecting the first camera in the group, a modeless dialog opens to set the group name and create the group after all the desired cameras have been entered in the Group items list. After creating the group, its name will be displayed in Live Camera list and in Manager panel.

When a group is selected in the Live>Camera list, all group cameras' windows will be opened with the name of the group displayed on the title bar of each group's camera, or right click on the group name in Manager panel and select the 'Show Images From This' from the popup selection list.

Selected group cameras' windows are bordered in red.

If a group is selected, all the cameras in that group will remain selected as a group no matter which camera window from that group is currently active.

When a group is selected, except the main Cameras group, if the end-user selects the preview window of a camera outside the current group, the first group that contains that camera will be selected.

- **Temporary Group Selection:** The end-user can create a temporary group by CTRL+click the desired cameras' or files' window title bar in Live or Play panel. As long as the Create Group' window is open the temporary group is valid. Temporary groups are not listed in the Camera list in Live panel, Files list in Play, nor in Manager panel. However, you can set acquisition values, or image processing values and use command buttons as for any other group. In order to get a camera or a file out of this temporary group, do CTRL+click again on its window title bar. Press Cancel to eliminate the temporary group, or press Create Group button to create a new group.
- **Rearrange Camera Windows Display:** If Window Auto Tile tool bar button is selected the end-user can move any camera window inside the Live or Play panel, over another window. When the cursor point gets over the covered window, the two windows will switch positions and all the windows will be re-tiled automatically.
- **Image Processing on Group Cameras:** Any change made in Image Tools will be set on all the associated group cameras. The 'Load' image preset can also be used for all the cameras in a group. The user can 'Save' a preset file containing the desired image processing values on a camera, and then 'Load' the values on all the cameras in a group.
- **Close Shutter on Group Cameras:** The 'Close Shutter' button will close all the group cameras' shutters, when the group is selected.
- **File Group Selection:** The end-user can create a group of files by CTRL+click on each group camera's window title bar.

• **New: Open File Feature**

The ability to open multiple saved supported file formats simultaneously has been added.

You can select multiple files in Open Cine(s) dialog box to be opened all at once. To select:

- A consecutive group of files, click the first item, press and hold down the Shift key, and then click the last item.
- Multiple files that are near each other, drag the mouse pointer to create a selection around the outside of all the items that you want to include.
- Non-consecutive files, press and hold down the Ctrl key, and then click each item that you want to select.

• **New: Image Tools Options**

The 'Image Tools' window for ph16 cameras added adjustment sliders for Red and Blue Gains, along with Temperature and Tint values that were previously displayed in 'White Balance' area.

When Temperature and Tint values are outside an acceptable range , they are grayed out.

Also, lefty / right keyboard arrows can be used to make small value changes to the Image Tools and Sensitivity trackbar (slider) values.

Image processing changes on ProRes CineMag Cines are now available. The changes made in Image Tools will not be saved in the ProRes Cine. The ProRes Cine file will contain the image parameters values at the moment the Cine was saved to the Phanom Cinemag from RAM.

- **New: Batch Convert Files Options**

Saving files from a Phantom CineMag, the 'Batch Convert Files' command, saves both Raw Packed 10 bit and Pro Res HQ 10 bit Cines from a Phantom Flex4K. The Cines listed from the CineMag will also be displayed with the Pro Res or Raw Packed format. Pro Res recordings will always be saved with the Pro Res format, while Raw Packed Cines can be saved to the format selected in the 'Save Cine' dialogue window.

The Save dialog will always display as available the Audio option. The end-user can select to write or not the audio information to Wav file(s), if audio is available in the Cine.

- **New: HotKey Commands**

When Image Tools dialogue window is open, Alt+D and Alt+C will enable/disable (display/clear) the grid and cross overlays, respectively.

- **New: Device Info Dialogue Window**

In Manager tab, a pop-up menu opens if you right click on a camera name including the option "Device Info". By selecting this option you will get the information about the camera name, camera serial, IP address, hardware version, CineMag version, firmware version, FPGA version, kernel version, RAM capacity and Flash capacity.

- **New: Cine Settings > Description Field**

A 'Description' field (up to 4,096 characters) of the current Cine has been added in the 'Cine Settings' selector. It is inherited in the recorded Cines and can be modified later if desired.

- **Change: Relocated Recording Indicator**

The Recording indicator has been re-positioned to the lower-left portion of the Preview/Playback Status Bar .

- **New: Fractional Sample Rate**

All ph16 camera models allow the end-user to set the 'Sample Rate' acquisition parameter to a fractional value (up to six decimal places).

- **New: Recording Progress**

The Image Delay/Trigger Position bar in Live>Cine Settings panel displays the recording progress for ph16 cameras pre trigger and post trigger images, similar to a camera's video-out 'Live' recording display.

- **New: DAQ Signals Sub-Panel**

The Advanced Settings>Signals field has been moved to DAQ Signals. The old Signals button under the Advanced settings sub-panel was replaced by the DAQ Signals sub-panel to define 'Range Data' and/or DAQ signal acquisition configurations. The DAQ Signals sub-panel is located under the Advanced Settings options.

- **New: Signals Sub Panel**

A new Camera Signals sub panel was added containing the options for configuring a camera's signals and Aux pins. These options can set the pin functions (camera model dependent) for

Fischer 12-pin Capture Ports. The Advanced Settings> Trigger, Pretrigger Pin Is, and Ready Signal Ends At options have also been moved under this sub panel.

- **New: Tooltip Image**

A 'Tooltip' image will be displayed when the cursor is placed over the Cine Editor Bar in the Play panel. PCC only displays the 'Tooltip' images inside the 'Mark-In' and 'Mark-Out' points when the 'Cine Slider Tooltip' enable box, in Manager>Preferences>General dialogue window, is checked.

- **New: Saving Border Data Features**

- Measurement and Signal Information: the 'measurement' and 'signal' information displayed in the opened 'Graphic' window (required) of a Cine can be saved to and displayed during the playback of the saved file.
- Preview Button: a button has been added allowing the end-user to display a preview of the image that will be saved in the Cine file.
- Display Logo: the end-user can choose the Logo position, width, height and transparency. This option is only available when a border style is selected. Presently the Logo option is not available when destination file is CineRaw.
- Advanced Positioning: the end-user can set the final image resolution, the position of the main image relative to the final saved image and the position of the Annotation text relative to the destination resolution (coordinates 0,0 mean the upper left corner). All values must be manually correlated. The preview image can help determine the positions to be saved.
- Inside Image Time Stamp Option: the old 'Inside Image Time stamp' option is no longer available. It has been replaced by selecting the time format and the Advanced positioning values for Annotation text to position the time stamp somewhere over the image.

- **New: Camera Info Field**

10Gb network connection information will be displayed in the Live>Camera Info fields. If the Wincap 10Gb driver is used 'Wincap' is displayed, or it will display 'Ph10g'. This information will be found next to the camera's IP address.

- **New: Frame Info Fields**

Azimuth and elevation will be displayed in the Play>Frame Info drop-down panel, (visible only for Cines that have Range Data).

- **New: Cine Info Fields**

A 'Serial' field has been added to CineInfo indicating the serial number of the saving device and / or CineMag. Cine files now contain, in CineInfo, the serial number of the camera on which it was recorded, the serial number of the CineMag on which it was saved, and / or the serial number of the device from which it has been saved if other than the camera, for example a CineStation. No serial number will be contained or displayed in the CineInfo if the Cine was saved from a CineFlash.

Also a 'Audio Data Availability' field has been added, When the recorded Cine contains audio data, this field in Cine Info displays 'Available', both for RAM and Phantom CineMag Cines.

- **New: Audio Option for Phantom Flex4K**

Added audio file saving in WAV format for Phantom Flex4k. To save the audio a new 'Enable Audio' option has been added to the Live>Advanced Settings selector.

- **New: Phantom CineMag ProRes Support**

Added CineMag ProRes support on Phantom Flex 4K camera and Phantom CineStation IV.

- **Change: IBAT (Image-Based Auto-Trigger) Functionality**

IBAT - full area will not set to full: Phantom cameras can not accept IBAT areas greater than 1MB. When the "Full" area option is selected, PCC will set a 1MB centered area. If the operator enters an area greater than 1MB, PCC will set a 1MB area having the same selected center.

- **Fix: Cine Info**

The issue of the Cine 'Name' field not being persistent, when modified via the Play panel> Cine Info has been resolved.

Resolves Ticket #: 96939

- **Fix: Image Processing**

The issue of setting specific saving/loading color matrix settings, associated with a Phantom v711 camera, has been resolved.

Resolves Ticket #: 98434

The issue associated with the video temperature when adjusting the 'Gamma' setting has been resolved.

Resolves Ticket #: 98540

- **Fix: On-Screen Display Information**

The issue of redundant OSD (On-Screen Display) information, in the video playback screens, of a Phantom Flex4K or Miro LC320S has been resolved.

Resolves Ticket #: 98557

- **Fix: CSR (Current Session Reference)**

The issue of not being able to perform a CSR (Current Session Reference) consistently with Phantom v7.1 camera models has been resolved.

Resolves Ticket #: 98815

- **Fix: White Balance**

The issue of performing a White Balance with a Phantom v7.1 camera has been resolved.

Resolves Ticket #: 98812

The issue of not being able to perform a White Balance, with legacy (ph7 model) cameras, when the camera status is in 'Waiting for Trigger' mode has been resolved.

Resolves Ticket #: 99020

- **Fix: Border Data**

Selecting the ' Name' option in the Border Data dialogue window will name the preview images BDPreview.bmp when saving a Cine from a simulated camera.

Resolves Ticket #: 99806

- **Fix: Low Light Feature**

The issue of the initial capture parameters not being restored when changes are made when the 'Low Light' feature is active has been resolved.

Resolves Ticket #: 99836

- **Fix: Save Dialog / Percentage**

The issue of the Save dialogue / percentage of the file save timeline missing in PCC installed on

Windows 7 and Windows XP operating systems has been resolved.

Resolves Ticket #: 101144

- **Fix: White Balance**

The issues associated with White Balance during FBM playback and Phantom CineMag IV playback from a Flex4K. Also, the White Balance issue associated when playing back from a Phantom v1610 CineMag II on a Phantom CineStation has been resolved.

Resolves Ticket #: 100715 and #: 43048, respectively.

- **Fix: Erasing Flash**

Not all flash Cine files will be deleted when the 'erase all' command is selected before the file list has propagated.

Resolves Ticket #: 102050

- **Fix: Signals Data Export**

The header of a 'Signals.csv' (report) file now contains the signal name, if it exists instead of ch00; also the column headers are now correctly aligned.

Resolves Ticket #: 103532

- **Fix: Playback Speed**

- The Live image refresh speed is now independent of the playback speed in 'Play' mode. Small values of playback speed in Play mode will no longer affect the image refresh in 'Live' mode.
- The 'Play Rec Speed' option in 'Play' mode will keep the value set using the text 'fps' field or the 'Min/Max' slider when selecting different Cines.

4.2 Phantom (PVP) Video Player

The following change has been made to the Phantom (PVP) Video Player Application (Software Version 2.7.756.0):

- **New: Camera Support**

In PVP > Settings, Genlock has three options for ph16 cameras, including the Time Code option.

- **Fix: Image Processing**

The issue of not being able to change the 'Cine' field from 'Live' preview mode to Cine '1' playback mode, has been resolved.

Resolves Ticket #: 99826

4.3 Camera Repair and Firmware Upgrade (Nucleus)

The following change has been made to the Camera Repair and Firmware Upgrade (Nucleus) Application (Software Version 2.7.756.0):

- **Fix: Firmware Loader**

Changes in Camera Repair and Firmware Upgrade (Nucleus) firmware loader that should mainly solve ph16 cameras firmware update.

Resolves Ticket #: 100847

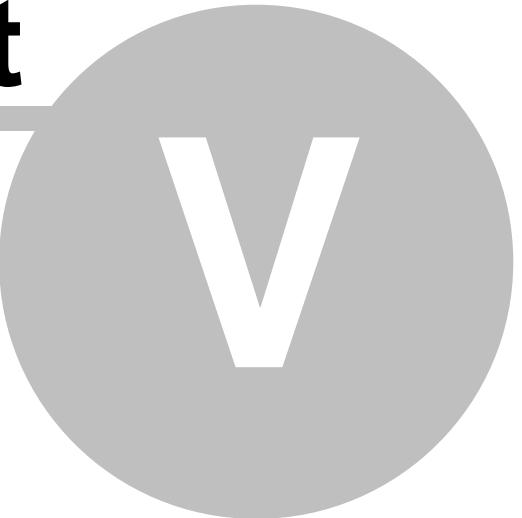
4.4 Firmware Requirements

The Firmware Requirements has been updated to reflect:

- **Change: Current Production Firmware**

The [Current Production Firmware](#) dated 22-SEPT-2015 Rev.A.

Part



V

5 Quick Start Guides

Updated: 09/17/2104

Welcome to the Quick Start Guides for your Phantom camera.

The Quick Start Guides in this section are designed to provide a quick introduction on using a Phantom camera with the Phantom Camera Control application, Touch-Sensitive LCD Screens, and On-Camera Control Buttons. They are intentionally kept brief so that you can start using your camera as quickly as possible. The objective of these Quick Start Guides is not to teach you every single detail of the Phantom Camera Control applications, Touch-Sensitive LCD Screens, or On-Camera Control Buttons, but familiarize you with the basic procedures necessary to use your camera.

5.1 Phantom v-Series Cameras via Phantom Camera Control (PCC) Application

This Quick Start Guide aims to provide 6 easy steps to get started using your Phantom camera.

For full details on the procedures described in the guide, please refer to the Step-by-Step Procedures section.

STEP-BY-STEP PROCEDURES

▼ Pre-Installation Check

The Phantom cameras have a few requirements, which must be met before you are able to use it.

1. The Phantom Control Unit must have either the Microsoft Windows NT, Window XP Pro, VISTA Business Edition or Windows 7 operating system installed.
2. The Phantom Control Unit's Firewalls must be turned off. (Contact your IT Group if necessary.)
3. The Phantom Control Unit must be set to IP Address: 100.100.h.h; (where h.h is a unique host identifier, i.e., 100.100.100.1) with a Sub-network Mask set to: 255.255.0.0.

For step by step instructions to change IP Address, go to: [Changing IP Address on the Phantom Control Unit](#).

▼ Connecting Camera and Controller Unit Operation

1. Connect the Power Supply to Phantom camera.
2. Connect the Ethernet cable to Phantom camera and the Phantom Control Unit.
3. Connect Capture Cable to Phantom camera.
4. If using an external trigger, connect it to Trigger BNC, (Red), of the Capture Cable.
5. Attach the lens to the Phantom camera.
6. Boot Up the Phantom Camera Control Software on Phantom Control Unit, then
7. Wait for the "Ethernet Connected" message window to appear just above the Phantom Control Unit's Taskbar.

8. Setup and record a Cine file, (image data).

▼ Capturing Video via the Phantom Camera Control Application

1. If the Manager Panel is not the active dialogue window,
2. Click on the Manager tab, then
3. Double mouse-click on the Phantom camera to be used to record with from the Cameras Group.
4. Open the Live Panel by clicking on the Live tab.
5. Under Cine Settings define the:
 - a. Set the Resolution, 800x600 by selecting the option from the pull-down selection list.
 - b. Sample Rate, (also referred to as the Frame Rate or Recording Rate), i.e., 200pps by selecting the option from the pull-down selection list.
 - c. Set the Exposure Time to the maximum available in the selectable pull-down list.
 - d. Set the EDR, (Extreme Dynamic Range) exposure time to zero (0) by selecting the option from the pull-down selection list.
 - e. Post Trigger to one (1) by:
 - 1) Enter a 1 into the Post Trigger entry field, alternatively
 - 2) Move the Trigger Position slider to the right.
5. Under Advance Settings set the External Sync>Sync Imaging parameter to Internal by selecting the option from the pull-down selection list.
6. Click on the Camera Settings selector, and
7. Click on the CSR button to perform a Current session Reference.



8. Using the Toolbar buttons, click on the Zoom Actual Size, button.
9. View the preview image in selected Phantom camera's Preview Panel, and adjust the Resolution, Sample Rate, and Exposure Time for optimum viewing.

NOTE

The Live Status display is active indicating the camera is Preview Mode and is not recording any image data.

10. Click on the Capture button to put selected Phantom camera into Record Mode.

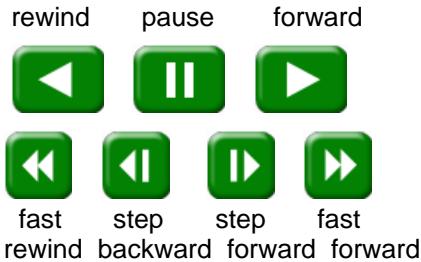
NOTE

The Live and Rec Status displays are both active indicating the camera is still in Preview Mode and is also in Record Mode, (capturing image data).

11. Trigger the Phantom camera, to stop recording, using any of the methods below:
 - a. Click on the Trigger or Stop Recording button, alternatively
 - b. Provide a switch closure or an external trigger signal, (a TTL pulse), to the Trigger BNC connector of the Capture Cable.
12. Playback the recorded Cine, (image data), file.

▼ Playback Operation

1. Open the Play Panel by clicking on the Play tab.
2. Use the Playback controls to view recorded images:



3. Edit the record Cine file:
 - a. Locate the first image of the Cine file to be saved, and
 - b. Click on the Mark-In  button.
 - c. Locate the last image of the Cine to be saved, then
 - d. Click on the Mark-Out  button.
4. Click the Play Speed & Options sub-panel, and
 - a. Select, (check), Limit to Range.
 - b. Deselect, (uncheck), Repeat.
5. Playback the preferred, (edited), Cine.
6. Save, (download), the edited Cine to the hard drive of the Phantom Control Unit.

▼ Save Cine File to the Controller Unit

1. After completing the Playback Operations procedure,
2. Click the Save Cine... button at the bottom of the Play Panel.
3. In the Save Cine dialogue window:
 - a. Create a Windows Folder to store the Cine file(s) into.
 - b. Enter a distinct/unique file name for each Cine file in the File name: entry field.
 - c. From the Save as type pull-down selection list select the Cine Raw, *.Cine file format.
 - d. Click the Border Data... button, (optional), and select the desired information to be displayed.
 - e. Click the Save button to begin downloading the Cine file from the Phantom camera to the Phantom Control Unit's hard drive.
4. Ensure the Cine file you just downloaded, has been stored in the Phantom Control Unit, and is not corrupted before deleting the Cine file from the camera:
 - a. Select the Open File command.
 - b. In the Open Cine dialogue window:
 - 1) Navigate to the Windows Folder containing the Cine file you just downloaded.
 - 2) Highlight the Cine file to be opened.
 - 3) Click the Open button.

- c. From the Play Panel, play the saved Cine file.

▼ Get Ready to Record Again

After ensuring the Cine file you just downloaded, has been saved to the Phantom Control Unit's hard drive, and was not corrupted:

1. Via Manager Panel:
 - a. Open the Manager Panel by clicking on the Manger tab.
 - b. Highlight the recorded Cine under the selected Phantom camera, then
 - c. Click the Remove From Tree  button to erase the image data stored in the camera's RAM.
 - d. Click the OK button when the 'Delete Cines from camera?' warning message appears.

RESULT: Camera is now in Live Mode as indicated by the Live Status displays below the selected Phantom camera's Preview Panel.

2. Via Live Panel:
 - a. Open the Live Panel by clicking on the Live tab.
 - b. Click on the Capture button.
 - c. Click the OK button when the 'Delete existing RAM Cines and proceed to new recording?' warning message appears.

RESULT: Camera is now in Live Mode as indicated by the Live Status displays below the selected Phantom camera's Preview Panel.

3. Go back and follow directions for Capturing Video via the Phantom Camera Control Application and Playback Operations.

IMPORTANT OPERATIONAL NOTES

1. Do NOT disconnect the Ethernet cable from the Phantom Control Unit or the Phantom camera while in operation. If the Ethernet connection is disrupted, the camera may lock up. Be sure to close the Phantom Camera Control application completely on the control unit before disconnecting the Ethernet cable.
2. ALL images will be LOST in camera if power to the camera is removed.
3. Insure the lens is clean before recording.

RELATED PROCEDURE

▼ Changing IP Address on the Phantom Control Unit

1. Click the Start button in the Windows Taskbar, then
2. Open the Control Panel.
3. Double-click on the Network Connections option.
4. In the Network Connections window:
 - a. Right-mouse click on appropriate Ethernet Connection, then

- b. Select the Properties command.
5. In the connection's Properties dialogue window:
 - a. Highlight the Internet Protocol (TCP/IP) option, then
 - b. Click the Properties button.
6. In the Internet Protocol (TCP/IP) Properties dialogue window:
 - a. Enable the "Use Follow IP Address automatically" radial button.
 - b. Enter IP Address : 100.100.100.1
Subnet: 255.255.0.0
7. Click OK and close all open windows and return to Pre-Installation Check.

5.2 Phantom Miro M / R / LC-Series Cameras via Phantom Control Software

Welcome to the Quick Start Guide for a Phantom Miro M-Series camera. This Quick Start Guide aims to provide 4 basic steps to get started.

▼ Hardware Setup

1. Carefully unpack the contents of the camera package, and check the contents.
2. Insert The Phantom Camera Control Installation Disk into the Phantom Control Unit (lap/PC) and follow the on-screen instructions.
3. Open the Phantom CineFlash compartment door, and then carefully insert the Phantom CineFlash into the compartment, by aligning the CineFlash insertion guide slots, until it is securely seated.
4. Attach the following cables: the
 - a. Ethernet
 - 1) Insert the Ethernet cable, RJ45 connector, to the Ethernet interface of the Phantom Control Unit (laptop/PC), then
 - 2) Insert the Ethernet cable, Fischer connector, to the Ethernet port of the Phantom camera.
 - b. Phantom CineFlash Dock eSATA
 - 1) Insert the eSATA connector to the Phantom CineFlash Card Reader docking station, then
 - 2) Insert the eSATA, and USB connectors to the PC/MAC computer's eSATA and USB interfaces.
 - c. Capture

The Capture Cable can be used to provide/access the following input/output signals; Trigger (Red), Strobe/IRIG Out (Blue), Ready (Green), Image-Based Auto-Trigger (Black – marked FSYNC), IRIG-In (White), and Video (Yellow).

 - 1) Connect the appropriate Capture cable BNC connector to the BNC connector of the connected device, i.e., trigger mechanism, video, Image-Based Auto-Trigger, IRIG clock, etc. A BNC gender-bender, customer supplied, may be required to connect the two BNC connectors together.
 - 2) Connect the Capture cable BNC connector to the Capture port of the Phantom camera.

7. Carefully slide the rechargeable battery downward, onto the rear of the camera, to lock the battery into place.
8. Use of the AC power adapter allows you to capture and playback Cines without worrying about depleting the battery.
 - a. Plug the AC power adapter connector into the Power port on the rear of the camera, then
 - b. Plug the AC power adapter cord into the power outlet.
9. Set the Power Mode

The Phantom Miro M-Series camera can be set to one of three power-up modes:

 - a. OFF - When the switch is in the OFF position, the camera is off.
 - b. AUTO - When the switch is set to AUTO, it works exactly like any previous Phantom Camera. Providing power to the Primary DC Input will power up (boot) the camera and it will be ready for use.
 - c. ON - When the switch is moved to the ON position, the camera will power-up immediately provided there is power connected to the primary power port OR a battery is connected to the camera.

▼ Capturing a Cine via the PCC (Phantom Camera Control) Software

1. Double mouse-click on the PCC (Phantom Camera Control) application icon.
2. Select the camera for use:
 - a. Click on the Manager tab, then
 - b. Double mouse-click on the Phantom camera to be used to record with from the Cameras Group.
3. Set the required recording parameters and place the camera into the capture, recording, mode:
 - a. Under Cine Settings define the required:
 - 1) Resolution, by selecting an option from the pull-down selection list.
 - 2) Sample Rate, (also referred to as the frame/recording rate), by selecting the option from the pull-down selection list.
 - 3) Exposure Time to the maximum available in the pull-down list.
 - 4) EDR, (Extreme Dynamic Range), exposure time to zero by selecting the option from the pull-down selection list.
 - 5) Post-Trigger value, by selecting an value from the Last pull-down selection list, entering a value into the Last data entry field, or sliding the T (Trigger) slider to the desire value. The value defined determines the number of post-trigger frames to be recorded, for example:
 - 0 (zero) fills the RAM with all pre-trigger frames.
 - The maximum value fills the RAM with post-trigger frames only.
 - Any value between 0 and the maximum fills the buffer with both pre-and post-trigger frames. This value equals the number of post-trigger frames to be recorded.
 - 6) Perform a Current Session Reference by clicking on the CSR button in the PCC software, or depressing the AUTOBREF button on the front of the camera.

- b. At the bottom of the Live control panel, click on the Capture button.
- c. Apply a trigger signal:
 - a) Click on the Trigger button located at the bottom of the Live control panel, or
 - b) Depress the Trigger button on the front of the camera, or
 - c) Apply a switch closure or TTL pulse via the Trigger BNC connector.

▼ **Edit, the Captured Cine**

1. Click the Play control panel tab.
2. Click the Play Forward button, and
3. Locate the first image of the Cine you wish to set as the Mark-In point of the Cine, then
4. Click the Pause button.
5. Set the Mark-In point by clicking the Mark-In button.
6. Click the Play forward button, and
7. Locate the last image of the Cine you wish to set as the Mark-Out point of the Cine, then
8. Click the Pause button.
9. Set the Mark-Out point by clicking the Mark-Out button.
- 10.Under the Play Speed & Options selector, enable (check) the Limit to Range option, then
- 11.Click on the Jump to Start button to rewind the Cine to the Mark-In point.
- 12.Click the Play Forward button to review the edited Cine.

▼ **Save the Cine**

1. Click the down-arrow in the Save Cine button to save the edited Cine to:
 - a. A designated location on an external hard-drive, i.e., control unit laptop/PC, or
 - b. The Phantom CineFlash

5.3 Phanrtom Miro C210J / C210 Cameras via PCC

Welcome to the Quick Start Guide for a Phantom Miro C310J or Miro C310 camera. This Quick Start Guide aims to provide the basic steps to get started.

▼ **Prepare Your Computer**

Camera controlling computers:

1. Must have either the Microsoft Windows XP Pro, VISTA Business Edition or Windows 7 or 8 operating system installed.

2. Firewalls must be turned off. (Contact your IT Group if necessary)
3. Using the 'Windows Control Panel' set the IP address of your computer's network card to 100.100.100.1 with a 255.255.0.0 subnet mask.

If working with a 10Gb Ethernet connection the computer's IP address should be set to 172.16.0.1 with a 255.255.0.0 subnet mask.)

▼ **Install PCC Software**

Install the latest version of Phantom Camera Control (PCC) software from the accompanying CD or USB key

▼ **Cable the Camera**

Connect the 16-28VDC power supply to the camera's power connector (Miro C210), or to the power connector of a Miro JBox (Miro C210J: required / Miro C210: optional).

Attach the supplied Ethernet cable between the Phantom camera and the computer (Miro 210C), or the Miro JBox (Miro C210J: required / Miro C210: optional)

Connect a Miro MiniBob or Capture cable to the Phantom camera (Miro C210).

If an external trigger is being used to trigger the camera, connect it to the Trigger connector of the Miro MininBob , Capture cable (Miro C210), or Control Break Out Box (Miro C210J)

▼ **Select Camera for Use**

In the Manager Control Panel double mouse-click on the Phantom camera to be used from the 'Cameras' group folder.

▼ **Define Recording Parameters**

Click the 'Live' tab.

Click 'Cine Settings' and define the following parameters by either selecting the required value from the pull-down selection list, or typing the value into the respective data entry field.

1. Set 'Resolution' to the required Width x Height.
2. Choose the required 'Sample Rate' and 'Exposure Time'.
3. Post Trigger to zero (0) by:
 - a. Moving the 'T' (Trigger Position) slider to the right, or
 - b. Enter zero (0) into the 'Last' data entry field.

Cover the camera lens first, then click on the CSR button to perform a Current Session Reference.

▼ **'Arm' Camera**

Click the 'Capture' button to start recording to the camera's internal memory (circular buffer).

▼ Trigger

At the end of the action, click the action 'Trigger' button at the bottom of the 'Live' panel, or
Provide a switch closure or an external trigger signal (TTL pulse) via the Trigger connector.

▼ Edit Cine

Click the 'Play' tab.

Using the following Video Control Buttons to locate the first image of the Cine to be saved.



Rewind



Pause



Play



Fast Rewind



Rewind 1 Frame



Advance 1 Frame



Fast Forward

Locate the first image of the Cine to be saved.

Click the 'Mark-In' button. A green square button with a white bracket symbol [].

Locate the last image of the Cine to be saved.

Click the 'Mark-Out' button. A green square button with a white bracket symbol] .

Select 'Play, Speed, & Options' and enable (check) 'Limit to Range'.

Under the Video Control Buttons click the 'Jump to Start' button. A green square button with a white double horizontal bar and a small arrow.

▼ Review Edited Cine

Review the edited Cine using the Video Control Buttons.

Click the 'Save Cine...' button at the bottom of the 'Play' panel.

▼ Save to Computer

In the 'Save Cine' window:

1. Navigate to the folder where you want to save the Cine file.
2. Enter a file name for the Cine file in the 'File name:' data entry field.
3. From the Save as type pull-down selection list select the 'Cine Raw, *.Cine' file format.
4. Click the Save button to begin downloading the Cine file from the camera to the computer's hard drive.

▼ Save to Phantom CineFlash

Click the down-arrow of the 'Save Cine...' button.

Select 'Save RAM Cine to Flash' (in popup window).

Click the Save button to save the Cine file onto the Phantom CineFlash.

▼ Confirm Computer Save



Click the 'Open File' button.

In the 'Open Cine' window:

1. Navigate to the folder containing the saved Cine file.
2. Highlight the Cine file to be opened.
3. Click the Open button.

Using the Video Control Buttons review the saved Cine file.

▼ Confirm CineFlash Save

Click the 'Manager' tab.

Double-click on the 'Cine F#' file under the camera used to record the Cine.

Using the Video Control Buttons review the saved Cine file.

Part

VI

6 Getting Started

All Phantom high speed imaging systems come with all the software installed and ready for use, if you purchased your Phantom Control Unit, (PC/Laptop), from Vision Research. The topics in this section provide recommendations and instructions if:

- You're upgrading to a new software version.
- You've purchased an additional software licence for installation on another computer,
- You've purchased a Phantom Control Unit from a vendor other than Vision Research.

These instructions detail the minimum system recommendations and preparation, program and Serial Tag Number (.stg) file installations, and how to verify your controller is connecting properly to the Phantom camera.

6.1 Phantom Camera Control Unit Requirements

In this topic we will detail the minimum system requirements:

NOTE

PCC requires latest version 1.2 of OpenGL

	FOR CONTROL OF		
	PHANTOM UHS-SERIES, MIRO LAB SERIES, MIRC SERIES, AND V-SERIES CAMERAS	PHANTOM MIRO-SERIES V7-SERIES, V6-SERIES, V SERIES, OR V4-SERIES CAMERAS	PHANTOM CAMERA CONTROL SOFTWARE SUPPORT ONLY
SYSTEM TYPE	IBM-PC or compatible	IBM-PC or compatible	IBM-PC or compatible
MICROPROCESSOR	Pentium-class 1.7GHz or higher	Pentium-class 1.4GHz or higher	Pentium-class 1.7GHz or higher; (Phantom UHS-Series, v-Series, Miro Lab, and Miro C-Series) Pentium-class 1.4GHz or higher; (Phantom Miro, v4, v5, v6, and v7 Series)
OPERATING SYSTEM ⁽¹⁾	Microsoft Windows XP Pro + Service Pack3 (32 & 64 Bit) Windows XP Tablet Edition, Microsoft Windows Vista Business Edition (32 & 64 Bit) Microsoft Windows Vista Enterprise Edition (32 & 64 Bit) Microsoft Windows Vista Ultimate Edition (32 & 64 Bit)	Microsoft Windows XP Pro + Service Pack3 (32 & 64 Bit) Windows XP Tablet Edition, Microsoft Windows Vista Business Edition (32 & 64 Bit) Microsoft Windows Vista Enterprise Edition (32 & 64 Bit) Microsoft Windows Vista Ultimate Edition (32 & 64 Bit)	Microsoft Windows XP Pro + Service Pack3 (32 & 64 Bit) Windows XP Tablet Edition, Microsoft Windows Vista Business Edition (32 & 64 Bit) Microsoft Windows Vista Enterprise Edition (32 & 64 Bit) Microsoft Windows Vista Ultimate Edition (32 & 64 Bit)

	Bit)	Bit)	Bit)
	Microsoft Windows 7 (32 & 64 Bit)	Microsoft Windows 7 (32 & 64 Bit)	Microsoft Windows 7 (32 & 64 Bit)
	Microsoft Windows 8.1 (32 & 64 Bit)	Microsoft Windows 8.1 (32 & 64 Bit)	Microsoft Windows 8.1 (32 & 64 Bit)
	Microsoft Windows 10 (32 & 64 Bit; limited to UHS-vxx12, LAB and C-Series)	Microsoft Windows 10 (32 & 64 Bit; no supported)	Microsoft Windows 10 (32 & 64 Bit; limited to UHS-vxx12, LAB and C-Series)
ADMINISTRATIVE PRIVILEGES	Required for all Microsoft Operating Systems	Required for all Microsoft Operating Systems	Required for all Microsoft Operating Systems
RAM MEMORY	4.0GB	512MB	4.0 gigabytes recommended
HARD DRIVE SIZE	80 Gigabytes Minimum	40 Gigabytes Minimum	80 gigabytes
HARD DRIVE FORMAT ⁽²⁾	NTFS	NTFS	NTFS
CD-ROM DRIVE	Read/Write Any Speed	Read/Write Any Speed	Read/Write Any Speed
MONITORS	UltraXGA 1284x1024x24bit Large Fonts	SVGA 1024x768x24bit Small Fonts (Phantom v4 Series) UltraXGA 1284x1024x24bit Large Fonts (Phantom v5 Series, v6 Series, and v7 Series)	UltraXGA 1284 x 1024 x 24bit large fonts; (Phantom v5, v6, v9, v10, v12 (Phantom UHS- Series, v-Series, Miro Lab, and Miro C-Series) SVGA 1024 x 768 x 24bit color small fonts; (Phantom Miro and v4 Series)
ETHERNET	Gigabit Ethernet NIC with Jumbo Frame Support	10/100Mb Ethernet NIC (Phantom v4 Series, v5 Series, v6 Series, v7.0, and v7.1) Gigabit Ethernet NIC with Jumbo Frame Support	Gigabit Ethernet Jumbo Frame Support; (Phantom v7.2, v7.3, v9, v10, and v12 Series, v710, v640, v310, v210) NIC 10/100 or higher card installed; (Phantom Miro, v4, v5, v6 Series, v7.0, v7.1)
eSATA	N/A	Required to attach the Phantom CineFlash Docking Station to the control computer. Used with the Phantom Miro M / LC Series cameras.	N/A
IEEE 1394 (OBSOLETE) (Phantom v4.0, 4.1, v5.0, v6.0, and v6.1)	N/A	OHCI IEEE 1394 Host Controller with NEC chipset, PCI card (desktops) or PCMCIA card (laptops)	OHCI IEEE 1394 Host Controller with NEC chipset, PCI card (desktops) or PCMCIA card (laptops)

(1) All Microsoft Windows Operating System must be English Versions.

(2) Required for saving Cine files over 4 gigabits.

NOTE

A more powerful computer will deliver faster display and playback, as well as shorter save and download times.

6.2 Preparing Your Computer

In this topic, we will be detail the recommended hardware preparations for:

▼ Recommended for Desktop and Notebook Phantom Control Units

Maintenance of your system's hard drive is recommended for all software installations. Cine files captured by your Phantom camera are large. For best system performance, run the following routine maintenance tasks before installing the Phantom software.

1. Backup all data files. Archive (off-load) Cine files that are rarely accessed.
2. From Windows System Tool, run Disk Cleanup on all installed hard drives.
3. From Windows System Tool, run ScanDisk on all installed hard drives.
4. From Windows System Tool, run Disk Defrag on all installed hard drives.
5. From Windows Outlook, set a reminder to routinely run ScanDisk & Disk Defrag.
6. Disable virus protection software and close all open programs during the installation process.

▼ Recommended for Recently Serviced Cameras

Are you re-installing your camera on your system after factory service, upgrade, or repair, if so, you received the latest release version of software? Before you can use the new version of the software, you must first completely remove all earlier versions of the Phantom Camera Control Software, on all the computers used to control this camera.

1. From Windows Control Panel, run Add & Remove Programs.
2. Uninstall all earlier versions of Phantom software from all installed hard drives. If you've created a Desktop shortcut for Phantom, delete it manually.
3. From Windows Explorer, find and delete the following files from all installed hard drives:
 - ph1394.sys
 - ph1394.dll
 - ph1394.inf
 - phcon.dll
 - phint.dll
4. From Windows Explorer, find and delete all earlier .stg files for this camera from all installed hard drives. (*.stg). When the camera is first connected to the controller, it will automatically

download the updated ',stg' file.

▼ Recommended for Software Upgrades

Are you just upgrading from an earlier version of Phantom software? If so you must first completely remove all earlier versions of the Phantom Camera Control Software.

1. From Windows Control Panel, run Add & Remove Programs.
2. Uninstall all earlier versions of Phantom software from all installed hard drives. If you've created a Desktop shortcut for Phantom, delete it manually.
3. From Windows Explorer, find and delete the following files from all installed hard drives:
 - ph1394.sys
 - ph1394.dll
 - ph1394.inf
 - phcon.dll
 - phint.dll

6.3 Installing the Phantom Camera Control Software

After verifying your system meets the system recommendations and preparing your computer requirements, you are ready to install the Phantom Camera Control Software. The Phantom installation CD contains all the files required for installation and operation of the Phantom camera. It also includes the 'stg' file for your camera.

1. Disable virus protection software and close all open programs during the installation process.
2. Place the Phantom installation CD in the CD-ROM drive. If AutoStart is enabled on your system, the setup begins automatically. If AutoStart is not enabled, go to next step.
3. Using Windows Explorer browse to the CD and double-click autorun.exe.
4. The Phantom InstallShield will automatically start and guide you through the software installation process.
5. If you are asked to add the Phantom Application to a list of firewall approved applications, do so, or you will not be able to connect to a camera.

CAUTION

Do not open the Phantom Camera Control software until all installation procedures have been completed.

6.4 Installing the Phantom STG (Serial Tag Number) File

Phantom cameras have been categorized into two types; ph16 and ph7 cameras.

The ph16 camera models include the Phantom Flex4K, v16i0, v1210, and Miro M / LC-Series cameras, while the ph7 camera models include all other Phantom cameras.

ph16 Camera Models

With the introduction of ph16 cameras, the Phantom .stg (Serial Tag Number) file is no longer required for these cameras to operate. Therefore, there will be no Phantom .stg files associated with ph16 camera models. All of the factory settings, calibrations and all important system operating settings will be stored into both an active non-volatile memory area of the camera, and a backup non-volatile memory area.

ph7 Camera Models

The ph7 Phantom camera model still require a unique serial tag number file to operate. This file is known as the camera's '.stg' file. The .stg file contains factory calibrations and settings essential for the proper operation of your Phantom camera. The Phantom installation CD, supplied with each new or newly serviced camera, includes the '.stg' file for your camera.

Serial Tag Files use the file extension .stg and reside in the Phantom directory on the controlling computer's hard drive. These files are specific to each camera manufactured and store the factory settings and various lookup tables for the image sensor based on the 4-Digit Camera ID number. The information in this file is also stored (duplicated) in the camera's non-volatile flash memory. Under normal camera operation, this information is read by the Phantom application each time the software is started or each time a camera is accessed over the network. When started, the application first tries to read the factory settings from the computer .stg file. If it doesn't find the appropriate .stg file on the computer, it reads the settings from the camera.

On the flip side, if the Phantom application is started or if the camera is accessed over the network and no .stg file resides on the hard drive, the Phantom application will automatically create the .stg file on the controlling computer's hard drive using the information residing in the camera flash memory.

If for any reason the Phantom application cannot read the .stg information from the camera flash or from a file in the Phantom directory on the hard drive then the software will prompt the user for intervention. If the proper .stg file is not available the application can load a default set of information. If the default information is written to the flash the camera will still operate but the image quality will be less than optimum.

CAUTION

Never use an outdated .stg file. Never mix .st files. Using .stg files from other cameras may cause serious damage.

Vision Research keeps copies of .stg files on record and if needed a copy can be obtained via email by contacting us.

Vision Research recommends making a backup copy of your camera's .stg file to store in a safe place. We also recommend placing a copy of this file in a temporary folder somewhere on your hard drive in the event you need to restore the camera's factory calibration settings quickly .

When the camera is first connected to the controller, it will automatically download the '.stg' file to a default .stg file path, used by the PhantomCamera Control software. This path matches the path used in by the Phantom (PCC) Camera Control application, CommonApplicationData, (see the table below).

WINDOWS OS	.STG AND PHCON.LOG COMMONAPPLICATIONDATA	USER SETTINGS LOCALAPPLICATIONDATA
Windows 8.1	ProgramData\Phantom\Phantom version	Users\Current user name\AppData\Local\Phantom
Windows 7	ProgramData\Phantom\Phantom	Users\Current user

	version	name\AppData\Local\Phantom
Windows Vista	ProgramData\Phantom\Phantom version	Users\Current user name\AppData\Local\Phantom
Windows XP	C:\Documents and Settings\All Users\Application Data\Phantom\Phantom version	C:\Documents and Settings\User name\Local Settings\Application Data\Phantom

Therefore, you should copy the file from the CD, and use Windows Properties to disable the READ ONLY attribute of the .stg file after it's copied to the hard drive.

6.5 Define the Phantom Control Unit IP Address

In this topic we will describe the process to:

▼ Define an IP Address to the Phantom Control Unit

1. From Windows' Start button, go to Settings>Network and Dialup Connections.
2. Right-click Local Area Connections>Properties to view a list of components used by your system.
3. Select Internet Protocol (TCP/IP).
4. Click the Properties button.
5. When the Internet Protocol (TCP/IP) properties' box opens:
 - a. Select Use the Following IP Address and enter the following:
 - 1) IP Address: 100.100.100.1

NOTE

If multiple Phantom Control Units will be used to access the same Phantom cameras, each controller unit requires a unique IP Address. For example: Controller 1: 100.100.100.1 (255.255.0.0); Controller Unit 2: 100.100.100.2 (255.255.0.0), etc.

- 1) Subnet mask: 255.255.0.0 or (255.255.255.0 for v7.0 only)
- b. Select Use the Following DNS and leave the entry blank.
- c. Click OK to complete the setup.

▼ Connect the Phantom Camera to the Control Unit via Ethernet

1. Connect one end of the Ethernet cable to the 8- or 6-pin Ethernet connector on the camera's rear panel.

NOTE

On a Phantom v7.0 camera this is a 6-pin connector is labeled IOIOI .

2. Connect the other end of the Ethernet cable to the RJ-45 Ethernet interface on the control computer.

NOTE

Most Ethernet Hubs do not permit the use of crossover cables. Therefore, a straight-thru cable is required. However, some Ethernet Layer 2 and Layer 3 switches have the capability of automatically detecting the cable type and adjust their pin-outs internally.

3. Connect 24-36VDC power to the camera. You may use the AC adapter supplied with your camera, a battery pack, or other DC power supply. Wait for the Power LED and the Capture LED on the camera's rear panel to stop flashing and remain lit.
4. Observe the Ethernet Link LED on the camera and the controller. They indicate the camera and the controller are communicating.
5. You may now start the Phantom software by double-clicking the Phantom icon on the Windows' Desktop.

▼ **Verify the Communication Between the Controller Unit and the Camera Over Ethernet**

1. Click the Windows Start button and select the Run command.
2. Type: cmd, and click the OK button.
3. Type: ping <IP Address of the camera> at the C:\ prompt in the C:\Windows\system32\cmd.exe window.
4. Click Enter.
 - a. When properly installed the camera replies to the Ping Request.
 - b. Should Phantom Control Unit fail to detect the camera:
 - 1) Unplug the Cat-5 cable from the Phantom Control Unit computer, and ensure the proper cable type is being used.
 - 2) Re-insert the proper cable.
 - 3) Verify the TCP/IP Addressing information is correct.
 - 4) Shutdown the Phantom Control Unit computer.
 - 5) Remove power from the camera.
 - 6) Restart the Phantom Control Unit computer, then
 - 7) Re-apply power to the camera.
 - 8) Ping the camera again to verify the Phantom camera replies to the Ping Request.

NOTE

If you still are unable to establish and verify the connection, please contact Vision Research Technical Support.

6.6 IEEE 1394 Hardware and Driver Installation

For obsolete Phantom v4.0, v4.1, v5.0, v6.0, and v6.1 cameras only

Required Hardware for Desktop and Notebook Computers: If you plan to use an existing desktop or

notebook computer to control a Phantom camera, you must first install and configure an IEEE 1394 card into your desktop or notebook computer. Please contact Technical Support for the latest compatible IEEE 1394 card recommendations, and current drivers.

You may often hear IEEE 1394 referred to as FireWire™; Apple Inc.'s trademarked name for this communication standard.

CAUTION

The IEEE 1394 card and drivers must be installed before installing the Phantom Camera Control software on your computer.

In this topic we will describe the process to:

▼ Installing the IEEE 1394 Card

1. Following your computer manufacturer's instructions for installing additional cards, insert a PCI OHCI Compliant IEEE 1394 card in any open PCI card-slot on the motherboard, or insert the PCI OHCI Compliant IEEE 1394 PCMCIA 2 card in the PCMCIA slot of your notebook computer.
2. Click the Windows' Start button, and select Settings>Control Panel>System Hardware>Device Manager option.
3. Scroll down through the Device Manager list to locate PCI OHCI Compliant IEEE 1394 Host Controller.
4. Double-click Host Controller. From the display tabs, select the Driver tab, then click the Update Driver button.
5. Locate and install the Windows' PCI OHCI Compliant IEEE 1394 Host Controller driver.

CAUTION

Do not use the drivers supplied with the card. Do not use Window's Install Wizards' feature.

6. Notebooks generally have two PCMCIA slots. Repeats Steps 3-5 for the second slot.

▼ Installing the Phantom Camera Driver (IEEE 1394 Cameras Only)

1. Connect 24VDC power to the camera. Before proceeding, wait for the Power LED and the Capture LED to stop flashing and stay lit.
2. Connect one end of the FireWire cable to the controller, then connect the other end of the cable to the six-pin connector marked IEEE 1394 on the cameras rear panel. (Phantom v4.0, v4.1, v5.0, v6.0, and v6.1 Cameras only)
3. From Windows, right click My Computer, select Properties.
4. Click Device Manager button.
5. Scroll down through the Device Manager list to locate: Other Device - Unknown Device.
6. Double-click Unknown Device. Select the Driver tab, from the display of tabs, then click the Update Driver button.

7. When the Wizard opens, click Next.
 - a. From the list that appears, select: Display a list of all drivers in a specific location so you can select the driver you want.
 - b. Click Next. From the list of hardware that appears, scroll down to select: Sound, video and game controllers.
 - c. Click Next. From the list that appears, click the Have Disk button.
 - d. For Windows 2000 Pro, when prompted for location, enter C:\Program Files\Phantom\Win2K Drivers; click OK. For Windows XP Pro when prompted for location, enter C:\Program Files\Phantom\WinXP Drivers; click OK.
 - e. Select PH1394.inf, from the list that appears, then click OK.
 - f. Select Phantom Camera when the Select Device opens, click OK.
 - g. Click Next to install the driver. When prompted, click Finished.
 - h. Reboot your computer.

NOTE

These Phantom Camera Driver must be installed via the Device Manager. If Windows auto-detection of New Hardware starts, close the dialogue box and proceed with Step 3 above.

▼ Verifying the IEEE 1394 Communication Connection

1. Open the Windows Device Manager and locate the “Sound, video and game controllers” entry, and click on the Plus (+) sign to the left of the entry.
 - a. If the Phantom camera is in the “Sound, video and game controllers” list, then installation is complete and the connection to the Phantom Control Unit has been verified. Exit the Device Manager.
You can now start the Phantom Camera Control software by double-clicking the Phantom icon on your windows desktop.
 - b. If the Phantom camera is not in the “Sound, video and game controllers” list, then installation is not complete and the connection to the Phantom Control Unit has failed.
 - 1) Unplug the network connection cable from the Phantom Control Unit computer, then re-insert it.
 - 2) Check the list again to verify if the Phantom camera appears.
 - c. If the Phantom camera is still not detected:
 - 1) Shutdown the Phantom Control Unit computer.
 - 2) Remove power from the camera.
 - 3) Restart the Phantom Control Unit computer, then
 - 4) Re-apply power to the camera.
 - 5) Check the list again to verify if the Phantom camera appears.

CAUTION

If the Phantom Camera still does not appear on the list, do not start the Phantom Camera

Control software.

NOTE

If you are still unable to establish and verify the connection, please contact Vision Research Technical Support.

6.7 Verify Camera Connection

▼ **Ethernet Camera Models**

1. Click the Windows Start button and select the Run command.
2. Type: cmd, and click the OK button.
3. Type: ping <IP Address of the camera> at the C:\ prompt, in the C:\Windows\system32\cmd.exe window,
4. Click Enter.

NOTE

The camera will reply to the Ping Request if properly installed.

Phantom Camera Not Detected via Ethernet Connection

If the Phantom Control Unit fails to detect the camera:

1. Unplug the Cat-5 cable from the Phantom Control Unit computer, and ensure the proper cable type is being used.
2. Re-insert the proper cable.
3. Verify the TCP/IP Addressing information is correct.
4. Shutdown the Phantom Control Unit computer.
5. Remove power from the camera.
6. Restart the Phantom Control Unit computer.
7. Re-apply power to the camera.
8. Ping the camera again to verify the Phantom camera replies to the Ping Request.

NOTE

If you still are unable to establish and verify the connection, please contact Vision Research Technical Support.

▼ **IEEE 1394 Camera Models**

1. Open the Windows Device Manager and locate the “Sound, video and game controllers” entry, and click on the Plus (+) sign to the left of the entry.

Phantom Camera Detected via IEEE 1394 Connection

If the Phantom camera is in the “Sound, video and game controllers” list, then installation is

complete and the connection to the Phantom Control Unit has been verified.

You will now have to:

1. Exit the Device Manager.
2. Remove power from the Phantom camera.
3. Restart the Phantom Control Unit computer, then
4. Re-apply power to the camera.

Phantom Camera Not Detected via IEEE 1394 Connection

If the Phantom camera is not in the “Sound, video and game controllers” list, then installation is not complete and the connection to the Phantom Control Unit has failed.

You will now have to:

1. Unplug the network connection cable from the Phantom Control Unit computer, then re-insert it.
2. Check the list again to verify if the Phantom camera appears.
3. Shutdown the Phantom Control Unit computer.
4. Remove power from the camera.
5. Restart the Phantom Control Unit computer.
6. Re-apply power to the camera.

NOTE

If Windows detects the Phantom camera as a “New Hardware Device Found” follow the Phantom Camera Installation process.

7. Check the list again to verify if the Phantom camera appears.

NOTE

If you are still unable to establish and verify the connection, please contact Vision Research Technical Support.

Part



VII

7 Phantom (PCC) Camera Control Application - Help



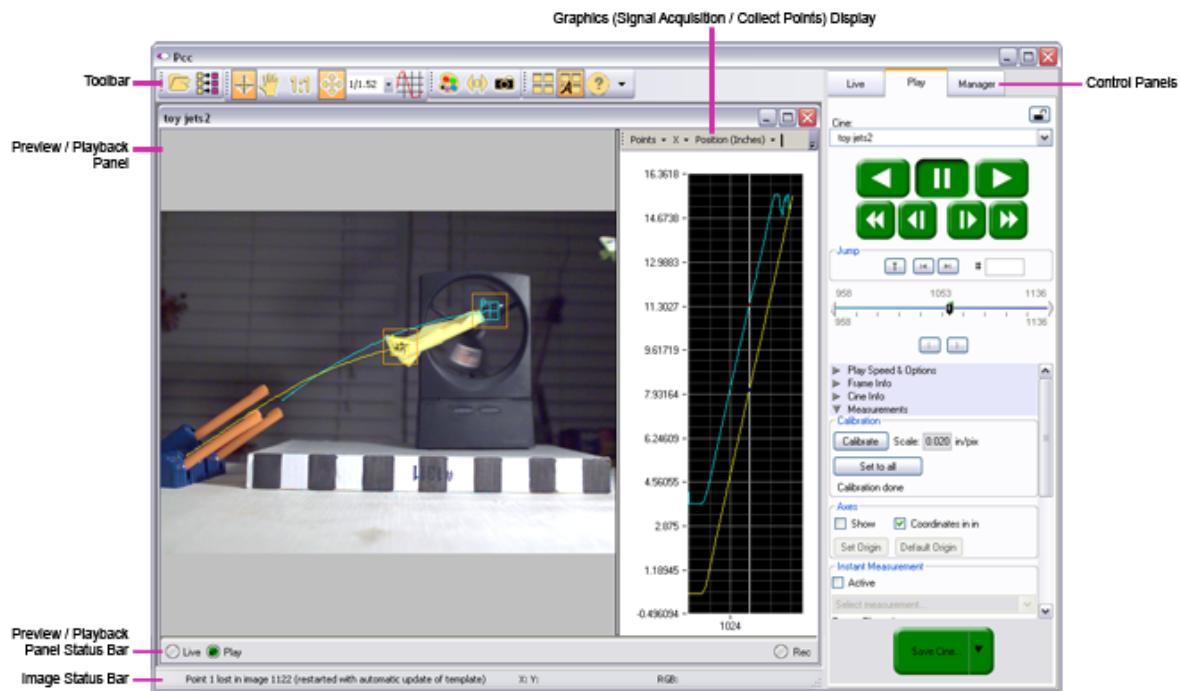
Software Version 2.7.756.0
Updated: Monday, November 30, 2015

The Phantom (PCC) Camera Control application provides you with complete creative control over time. You can shift the frame rate a little and move a scene to a slightly future viewpoint. Alternatively, shift the sample rate a lot and move a scene to some long passing moment in time. You will enjoy the ability of having seamless control of the duration, speed and time of every element of the shot.

With its two main components of the system, the Phantom imager with advanced CMOS technology, and the Phantom (PCC) Camera Control application , they form a system that provides high speed, high resolution, image capture in a digital Cine format, with analytical Cine playback, and communications across multiple digital and analog protocols.

7.1 The User Interface

The Phantom (PCC) Camera Control application user-friendly Windows based software application, supplied with each camera, provides an intuitive graphical user interface.



The software is built around multi-layered work areas, including:

▼ Toolbar

The Toolbar buttons provide quick access to the most frequently used functions. Positioning the cursor over a Toolbar button will display the button's associate function.

▼ |Preview / Playback Panel

Preview Panels display what their associated Phantom camera is imaging, while Playback Panels display Cine files for review, editing, saving, and/or analysis.

The panel type (Preview / Playback) that displays / opens varies based on the control panel tab used to access the panel, as follows:

- Manager Panel Tab: can be used to display / open both Preview (one for each user-selected Phantom camera to provide live camera images) and Playback Panels (one for each Cine file to be reviewed, edited, saved or analyzed).
- Live Panel Tab: display / open Preview Panels only.
- Play Panel Tab: display / open Playback Panels only.

▼ Manager Panel

The Manager Panel Tab is used to control up to 63 Phantom cameras, and / or previously opened saved Cine files.

▼ Live Panel

The Live Panel Tab is used to:

- Create groups of cameras
- Access a specific Phantom camera (standalone camera environments) or 'Group' of Phantom cameras (multi-camera environments).
- Define camera capture parameters individually (standalone cameras) or simultaneously (Camera Group).
- Place the camera into the Capture (recording) mode, individually or simultaneously
- Stop the Capture process, individually or simultaneously
- Delete image data recorded from a selected camera RAM or 'Group' (multiple) cameras' RAM.
- Send a soft-trigger to Phantom cameras individually or simultaneously.
- Display / Open Preview Panels.

▼ Play Panel

The Play Panel Tab is used to:

- Display / Open Playback Panels to review, edit, save and / or analyze Cines that are stored in camera RAM, Phantom CineMag, CineFlash, or CompacFlash, or Cine files that have been previously saved and opened,
- Specify playback options.
- Provide 'Frame' and 'Cine' Information about the active Cine file under review.
- Do measurements on Cine files.
- Perform an 'Image Search'.

▼ Status Bars

There are two status bars located below the Preview / Playback panels. The top bar displays status information about the associated camera's operational state, while the lower status bar displays XY coordinates and RGB, (Red, Green, Blue), values of a specific pixel (the center of the cross-hair cursor pixel).

▼ Graphics Display

The Graphics display used to display signal acquisition information or position/speed/acceleration and the coordinate X or Y of tracked collect points. The displayed values take into account the

global measurement preferences for position / speed / acceleration. Only windows for the type of signals that are present in the Cine file will be visible.

7.1.1 Toolbar

The Toolbar buttons provide various functions. The availability of these functional buttons is dependent upon the active control panel.



Toolbar Example

The Toolbar contains the following buttons:



Open File

The Open File button is used to open a previously saved Cine file. The opened file will be added under the Files group in the Manager Panel, and will be displayed in a Playback Panel when selected in the Manager or Play Control panels.



Batch Convert Files

The Batch Convert Files button, when selected, allows the end-user to select and convert a single or multiple Cine files to one of the many supported file formats.

For a brief description of the various file formats, a Cine file can be converted to, see [Functional Descriptions>Supported File Formats](#).



Merge Images to Cine

The Merge Images to Cine toolbar button allows the user to import and convert a series of images such as .tif, .bmp, etc. to the Phantom Cine format. This can be very useful if you have an imaging system manufactured by another manufacturer and want to use the many measurement and image processing tools found in the Phantom software.



CrossHair

The CrossHair button, when selected changes the mouse pointer to a CrossHair mouse pointer. The size of the CrossHair mouse pointer is 32x32 pixels.



Pan

The Pan button changes the mouse pointer to a Hand mouse pointer. It allows the end-user to

pan a Preview/Playback Panel, quickly, on images that are larger than the display area. By selecting and placing the cursor over the displayed image, then holding down the left-mouse key while moving the mouse, the displayed image moves in the direction the button is being moved.



Zoom Actual Size

The Zoom Actual Size button, when selected, resizes the images being displayed in the Preview/Playback Panel to their original size.



Zoom Fit

The Zoom Fit button is used to resize the images being displayed to fit within the Preview/Playback Panel. The images will either be digitally zoomed in or out depending on the size of the Preview/Playback Panel.



Zoom Selection List

The Zoom Selection List button allows the end-user to select the amount of digital zoom, in or out, will be applied to the images being displayed in the Preview/Playback Panel. Images can be digitally zoomed up to 16x or reduced to 1/16 the original image size.



Graphics

The Graphics button allows the user to open a Signals or Collect Point graphical interface (displayed to the right of the Cine image). It is used to display signal acquisition information or position/speed/acceleration and the coordinate X or Y of tracked collect points. The displayed values take into account the global measurement preferences for position/speed/acceleration. Only windows for the type of signals that are present in the .Cine file will be visible.



Image Tools

The Image Tools button, when selected, opens the Image Tools dialogue window used to:

- Display an image Histogram.
- Perform image processing adjustments.
- Apply various image processing effects.
- Crop and Resample Images.
- Load and Save Image Adjustment Settings.



Video Out

The Video Out button, when selected, initiates the Phantom (PVP) Video Player application. PVP provides the end-user with the ability to control any Phantom Ethernet camera attached to an external 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 PVP window is set to display a live image on the monitor. The user can quickly perform an edit of the recorded a Cine file by easily selecting the range of images to be played back.

Once edited the user will be able to playback and save the recorded Cine file from the camera's memory, using the video playback buttons along with adjusting the speed of the playback.

For details on how to utilize the Phantom Video Play see: [Phantom Video Player Help File](#).

NOTE

This Video Output Control feature is only accessible with Ethernet model cameras, the player has not been implemented for the IEEE 1394 camera models, or the Image³.



SnapShot

The SnapShot button, when selected, opens the Snapshot application, defined via the Manager> Application Preferences dialogue window, with the image that was being displayed in the Preview/Playback Panel when the SnapShot button was selected.

Refer to the Snapshot Application Manufactures Help File for details on using the specified application.



Window Tile

The Window Tile button, when selected, instructs the Phantom Camera Control application to display side-by-side all selected Phantom cameras live, preview images, or all selected RAM/Flash/CineMag Cines and open Cine files in Play panel, or in Manager panel. The Tile display format is extremely useful when making comparisons of Cine files, or when judging the effectiveness of various image-processing techniques. The images being displayed may be cropped on the screen: drag the scroll buttons, located on the right side and bottom of the panels, to display more of the image.



Window Auto Tile

The Window Auto Tile button, when selected, instructs the Phantom Camera Control application to automatically display any newly opened Preview/Playback Panel side-by-side (tiled), with any previously opened display panel.



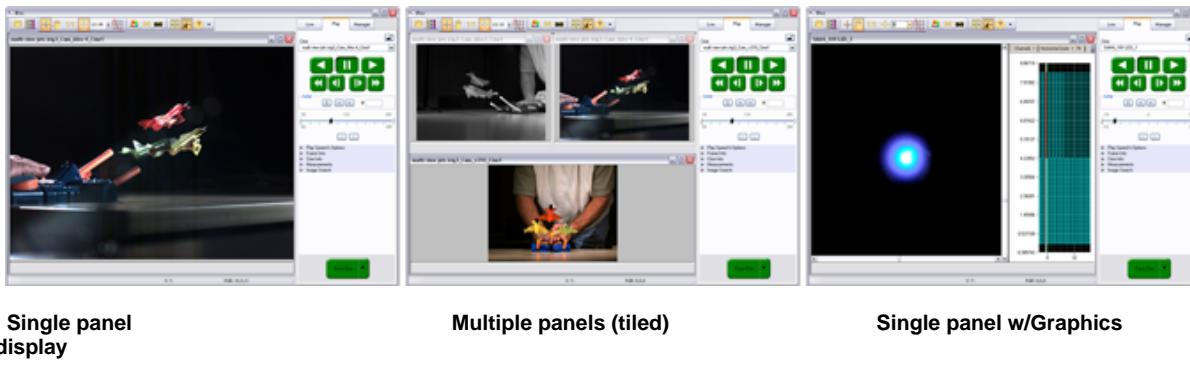
Help

The Help button, when selected, opens this PCC Help File. The down arrow to the right of the Help button, when selected, displays a pull-down selection list of various Help files, including:

- PCC Help: when selected, opens this Phantom Help File.
- Camera Hardware: when selected, opens the Phantom Camera Hardware Help File.
- Camera Control Panels: when selected, opens the Phantom Cine Control Panel Help File.
- Remote Control: when selected, opens the Phantom Camera Control via Remote Control Unit Help File.
- About: when selected, the 'About' window displays the Phantom Camera Control version information.

7.1.2 Preview/Playback Panel

Preview Panels displays exactly what the Phantom cameras are imaging, while the Playback Panels display recorded Cine files for review and/or editing.



Single panel display

Multiple panels (tiled)

Single panel w/Graphics

The type of panel that will be displayed varies based on the active control panel. From the:

▼ Manager Panel

Both the Preview and Playback Panels can be displayed when the Manager Panel is active. In single camera environments, the Preview Panel of the connected camera can be displayed, and/or the user can open Cine files stored in camera memory, attached Phantom CineMag and/or previously recorded Cine files each in their own independent Playback Panel. Each of these panels can be viewed separately or simultaneously by selecting the Tile button from the Toolbar.

▼ Live Panel

The Live Panel permits multiple Preview Panels to be opened providing live camera images. Preview Panels also allow the end-user to perform automatic White Balance and define an area, or region of interest, when using the Auto Exposure, Image-Based Auto-Trigger, and/or Crop features.

▼ Play Panel

The Play Panel permits multiple Playback Panels to be opened, (one for each recorded Cine in camera's RAM, Phantom CineMag or previously saved open Cine file to be reviewed or edited), review multiple Cine files simultaneously, perform automatic White Balance adjustments, and 2D motion analysis, and define an area, or region of interest, when using the Crop feature.

NOTE:

Phantom CineMag files can only be read from one source at a time. For example, if a Cine stored in an attached Phantom CineMag is opened in a Playback Panel it cannot be opened in any other viewer, such as the Phantom Video Player (PVP) application until file is closed in the Playback Panel.

Conversely, if a Phantom CineMag Cine is being reviewed using PVP it cannot be opened in a Playback Panel. The Phantom CineMag only allows one operation at a time. Therefore, if you attempt to do view a Phantom CineMag Cine in more than one application the Phantom Camera Control application will revert back to a live image.

7.1.3 Status Bar

A unique Status Bar is displayed as part of the Phantom Camera Control application, along with a Status Bar for all Preview Panels and Playback Panels. The type of information displayed in the status bars vary based on the panel type, as follows:

▼ Phantom Camera Control Status Bar Information

The Phantom Camera Control Status Bar displays status information for the active Preview/Playback Panel, including:

XY:

XY: indicates the XY: coordinate of a pixel when the cursor is placed over the active Preview/Playback/Manager Control Panel. The XY coordinates represents the pixel located in the center of the cross-hair cursor. The XY coordinates will be displayed in the following format: X: coordinate value Y: coordinate value. For example: X:426 Y:324.

When performing coordinate measurements the end-user can instruct the software to display the XY coordinate in a user specified measurement unit.

RGB:

RGB: indicates the RGB, (Red, Green, Blue), values of a pixel when the cursor is placed over the active Preview/Playback/Manager Panel. These RGB values represent the color value of the pixel located in the center of the cross-hair cursor. The RGB: values will be displayed in the following format: <red value>, <green value>, <blue value>. For example: 12, 823, 1525.

The range of values is dependent upon the pixel image bit depth and the value of "Pixel values" field in Manager>General, as follows:

- 8-bit pixel image depth has 255 values.
- 10-bit pixel image depth has 1023 values.

- 12-bit pixel image depth has 4095 values.
- 14-bit pixel image depth has 16383 values.

▼ Preview/Playback Panel Status Bar Information

The type of status information displayed varies based on operational state of the selected Phantom camera, as follows:

Live Status Indicator

When active, (Blue), the Live status indicator informs the end-user that the selected Phantom camera is not in the process of recording image data to the camera's RAM (circular buffer) or attached Phantom CineMag. What this means is, the camera is in an idle state, formally referred to as 'Waiting for Pre-trigger'. In this state, the camera has a lower power consumption requirement.

Rec Status Indicator

When active, (Red), the Rec status indicator informs the end-user that the selected Phantom camera is in the Capture (recording) mode, displaying the images in the Preview Panel, while recording the image data into the camera's RAM. The recording process will stop when a trigger signal is detected by the camera and all the post trigger frames have been recorded.

Play Status Indicator

The Play Status Indicator will be active, (Green), when a Playback Panel of a Cine file stored in the selected camera's DRAM or attached Phantom CineMag or previously saved on the computer has been selected.

NOTE:

Phantom CineMag files can only be read from one source at a time. For example, if a Cine stored in an attached Phantom CineMag is opened in a Playback Panel it cannot be opened in any other viewer, such as the Phantom Video Player (PVP) application until file is closed in the Playback Panel.

Conversely, if a Phantom CineMag Cine is being reviewed using PVP it cannot be opened in a Playback Panel. The Phantom CineMag only allows one operation at a time. Therefore, if you attempt to do view a Phantom CineMag Cine in more than one application the Phantom Camera Control application will revert back to a live image.

7.1.4 The Control Panels

The Phantom Camera Control application graphical user interface incorporates three uniquely functional control panels, including the:

▼ Manager Panel

The Manager panel is used to:

- Manage up to 63 Phantom cameras for use.
- Display information about the cameras (type, serial, firmware version).

- Manage previously saved Cine files.
- Add simulated cameras.
- Remove a specific camera from the Manager Panel.
- Delete image data recorded into a selected Phantom camera's RAM, internal Flash, or attached Phantom CineMag.
- Group cameras for control of multiple Phantom cameras.
- Group Cine files for simultaneous playback.
- Define Phantom Camera Control application preferences:
 - General preferences
 - Units of Measure
 - Logging
 - Camera Visibility options
- Restore factory calibrations
- Update camera firmware.
- Assign Phantom camera secondary IP Address.
- Restore Phantom camera IDs.

▼ Live Panel

The Live panel is used to:

- Access a specific Phantom camera (single camera environment), or group of cameras (in multi-camera environments).
- View live preview images.
- Group cameras for control of multiple Phantom cameras.
- Define camera capture parameters.
- Place the camera, or camera group, into the Capture (recording) state.
- Stop the capture process.
- Send a soft-trigger to the camera, or group of cameras.

▼ Play Panel

The Play Control panel is used to:

- Review, edit, save, and/or analyze a recorded Cine file.
- Group Cine files for simultaneous playback.

7.1.4.1 Manager Panel Components

The Manager panel is used to manage up to 63 Phantom cameras for use, and all previously opened saved Cine files and consist of the following components:

▼ New Group Button



The New Group button instructs the software to add a sub-group, (folder), under the highlighted group in the tree structure. The new group can contain multiple Phantom cameras, (under the Camera Group), that can be accessed in the Live panel to control multiple Phantom cameras simultaneously, or it can contain multiple Cine files, (under the Files Group), that can be accessed in the Play panel to review multiple Cine files simultaneously.

NOTE

Phantom cameras and Cine files cannot be associated with multiple groups. However, any Phantom camera or Cine file under the sub-group tree can be controlled or reviewed respectively. For example, Files Sub-Group1 contains; cine1, cine2, and cine3, along with another sub-group File Sub-Group2. Files Sub-Group2 contains cine4, cine5, and cine6, etc. When Files Sub-Group2 is selected in the Play Panel; cine4, cine5, and cine6 can be reviewed simultaneously, if Files Sub-Group1 is selected all six Cine files can be reviewed simultaneously.

▼ Add Simulated Camera



The 'Add Simulated Camera' button is used to simulate a Phantom camera model. This feature can be very useful to determine recording times and the number of images that can be recorded for various camera models prior to purchasing a camera or memory upgrades. You can simulate a camera with or without using an existing .stg file resulted from a camera with the same serial.

For a brief explanation of a .stg, (Serial Tag Number), file, see: [Functional Descriptions>Phantom STG, \(Serial Tag Number\), File.](#)

▼ Remove From Tree Button



The Remove From Tree button is used to remove a specific camera, Cine file or sub-group, along with any objects under the sub-group tree.

▼ Cameras Group

The Camera group contains a list of all Phantom cameras that are presently connected to the Phantom Camera Control application, (indicated by the camera present icon). If the option 'See only previous camera list' has been set via the Application Preferences button and a camera had been connected to the Phantom Camera Control application in the past but is not connected presently, it will be indicated by the camera not present icon.

Phantom cameras that have a Cine file stored in its' image memory buffer, (indicated by

(Cine 1), and/or non-volatile Flash memory, (indicated by (Cine F1) will have Cine sub-items under the camera tree.

For details on how to utilize the Camera Group see: [Step-by-Step Procedures>Multi-Camera / Cine \(Group\) Procedures](#).

Right click on a camera name and select Device info to get details about the type, serial and firmware version on that device.

▼ Files Group

The Files Group contains a list of available saved Cine files that have been opened by the Phantom Camera Control application for review.

For details on how to utilize the Files Group see: [Step-by-Step Procedures>Multi-Camera / Cine \(Group\) Procedures](#).

▼ Application Preferences



The Application Preferences button, when selected, opens the Preferences dialogue window used to define the following:

- General:
 - Phantom (PCC) Camera Control Application Interface options
 - Exposure, EDR (Extreme Dynamic Range™), and PostTrigger Units
 - Snapshot settings
 - Imaging options
 - Other options
- Measurement
 - Distance Unit
 - Speed Unit
 - Acceleration Unit
 - Angle Unit
 - Angular Speed Unit
 - Unique Scale per Application
 - Auto Advance to next image during Collect Points (99 points max.)
 - Auto Update graphics during Collect Points
- Logging
 - Mask Definition
- Camera
 - Camera Visibility preferences

▼ Camera Repair and Firmware Upgrade (Nucleus)



The Camera Repair and Firmware Upgrade (Nucleus) button, when selected, initiates the Camera Repair and Firmware Upgrade (Nucleus) application that allows the end user to, in one simple operation, load firmware FPGA, (Field Programmable Gate Array), Flash FPGA, Cinemag, and Kernel firmware. It allows the end user to load firmware files into the selected visible camera, or in a camera which responds to a ping command, by introducing its IP address and a value for camera version.

Using this Firmware Control command provides for the upload of the firmware files to your camera. After loading the firmware files, the program tries to reconnect the camera. It may be necessary to power the camera off then on again for Phantom to reconnect to the camera.

NOTES

1. ***You should never do a firmware upgrade when running on battery power.***
2. ***Prior to performing a firmware upgrade to a Phantom camera, make sure it is connected to AC power. Vision Research highly recommends that you contact our Technical Support staff before performing an upgrade to any camera.***
3. ***The upgrade process should never be used to load an earlier version firmware that has already loaded into the camera, and must never be used with an IEEE1394 camera model.***

If the application cannot automatically identify the camera, you will have to specify the IP address and the camera version.

It also allows the end-use to reset the connected Phantom camera back to factory calibration settings, or add a secondary IP address to the camera.

7.1.4.2 Live Panel Components

The Live Panel is used to define the recording parameters for the selected Phantom camera, and consist of the following components:

▼ Group Lock Button



The Group Lock button is used to control and apply settings made to one camera to all cameras in the selected group, opened in a Preview panel, automatically.

▼ Set To.. Selection List

The Set To.. selection list is used to copy all setup parameters from one camera to a specific camera or camera group in the pull-down selection list.

▼ Camera: (Pull-Down Selection List)

The Phantom Camera Control application is capable of supporting up to 63 Phantom cameras. This selection list window displays any user-defined Cameras group (sub-group), and the names of the Phantom cameras presently connected to the Phantom Control Unit. Any changes made in the Live panel will be applied only to the Phantom camera or group of cameras specified in this field, unless the Group Lock button or Set To options have been selected.

▼ Camera Settings Selector

The Camera Settings fields are used to display, reset, or synchronize the time stamp clock information, set the bit depth of the active pixels, partition (segment) the memory of the camera, or remotely control a Canon EOS lens attached to the camera.

The following is a brief description of the setup parameters associated with the Camera Settings:

Current Time

The Current Time field displays the date and time, an image will be time stamped with, in the following format: Weekday Month Day Year hh:mm:ss

Set Time.. Button

The Set button, when selected, opens the Set Camera Time dialogue window that incorporates the following:

Computer Time

The fields associated with the Computer Time display the date, time, and time zone of the attached control unit computer. The active camera or group of cameras synchronize the time stamp to this control unit's local time setting, unless an IRIG-B time source is being used as the clock reference.

The Computer Time is displayed in the following format: Field 1: Weekday , Month Day, Year; Field 2: hh:mm:ss; Field 3: Time Zone, (The time difference from UTC - Universal Time Code, formally GMT - Greenwich Means Time).

Current Camera Time

The fields associated with the Current Camera Time display the date, time, and time zone of the selected Phantom Camera. The Current Camera Time and the Computer Time should be synchronized when there is no IRIG-B clock source attached to the camera. If an IRIG-B clock source is attached the Current Camera Time, should be synchronized to the IRIG-B clock and will display the IRIG-B reference time.

The Current Camera Time is displayed in the following formats: Field 1: Weekday , Month Day, Year; Field 2: hh:mm:ss; Field 3: Time Zone (The time difference from UTC - Universal Time Code, formally GMT - Greenwich Means Time).

New Camera Time

New Camera Time allows the end-user to change the Current Camera Time when the Set or Update and Set buttons are selected.

DayOfYear

This informational field indicates the day number from the start of the year, January 1.

Set Button

The Set Button allows the end-user to edit the Current Cameras date and time fields manually, and apply these values by updating the camera's internal time stamp clock.

NOTE

If the camera is connected to an IRIG-B clock source the Current Camera Time will immediately revert back to the time stamp supplied by the IRIG-B signal when the Set button is selected.

Update and Set Button

The Update and Set button, when selected, will automatically synchronize and set the camera's internal clock, (Current Camera Time), to the local date and time of the Windows operating system, (Computer Time), of the attached Phantom control unit computer.

NOTE

If the camera is connected to an IRIG-B clock source the Current Camera Time will immediately revert back to the time stamp supplied by the IRIG-B signal when the Set button is selected.

Close Button

The close button closes the Set Camera Time dialogue window.

Local Radial Button

The attached Phantom control unit computer's date and time settings are used as the time reference when the Local radial button is selected.

utc (GMT) Radial Button

When selected the date and time reference will be adjusted to UTC (Universal Time Clock), formally referred to as Greenwich Mean Time (GMT). The adjustment will be the time difference from the date and time settings of the attached Phantom control unit computer to the universal time clock. The Universal Time Clock option will append the nomenclature *utc* to the Camera Settings>Time information.

GPS (Information)

GPS information is included in the Live/Camera settings and in Play/Cine Info sections for the Phantom v1610 and v1210 camera models. GPS information may include for GPS timing, longitude & latitude. The GPS (Global Positioning System) information and a copy of the UUID (Universal Unique Identifier) field are kept inside the Cine file, and can be found in the Cine file header, at the end of Setup structure.

Bit Depth (Pull-down Selection List Window)

A variety of the Phantom camera sensors have the ability to record and save 8-, 10-, 12-, or 14-bit values, (gray scale image levels), that are transferred to the Phantom control unit computer as either 16- or 8-bit words. By default Phantom cameras display 8-bit, (256 gray scale level), images. The 8-bits used to display these images are the most significant, or high order, bits of 14-bit values.

This Bit Depth feature makes it possible to increase contrast and see images with less light simply by selecting which region of the total dynamic range of the image is to be displayed on-screen. The display outputs 8-bits even though the image may have up to 14-bits. This is because each of the 8-bits of data selected, by the end-user, is split into 16-bits where the high order bits are used with well lit subjects and the low order bits for dimly lit subjects.

NOTE

8-bit to 14-bit images need exactly the same amount of light to saturate the sensor, what

differs is the fineness in the number of gray scale levels recorded.

The Bit Depth pull-down selection list allows the end-user to specify the Bit Depth for the user specified Phantom camera.

Partitions (Pull-down Selection List Window)

Partitions allow the end-user to specify the number of memory segments (partitions) the selected camera's RAM (internal circular buffer) will be evenly divided into.

NOTE

The MultiCine feature is not available with the Phantom v4.1, v4.2, v5.0, v6.0, or v6.1 camera models.

Lens Control

The Lens Control option allows the end-user to control an attached Canon EOS lens when used with the Automatic Lens Control Mount remotely . The end user can adjust/set the:

- Aperture (f-stop), and/or
- Focus

Backup & Restore Settings

The Backup & Restore Setting features are used to save or load a camera's capture parameters.

NOTE

To restore a camera's factory calibrations settings, the end-user needs to perform the Restore Settings process, using the Camera Repair and Firmware Upgrade (Nucleus) button.

Load...

The Load... button is used to restore a previously saved camera configuration.

Save...

The Save... button is used to save the present configurations of the camera to one of six camera non-volatile memory slots, or to a user-specified drive location.

Erase...

The Erase... button is used to delete a previously saved camera configuration from its' stored memory slot or file location.

▼ Cine Settings Selector

The Cine Settings fields are used to define the Cine recording profile. The following is a brief description of the setup parameters associated with the Cine Settings:

Cine

The Cine field activates when the MultiCine feature is defined. By default the system places the camera into Preview mode, allowing the user to view a live image in the Preview Panel. Once the camera is placed into the capture (recording) mode, the Cine field will automatically change from Preview to the Cine Number. Initially, the Cine number will be 1 because the system automatically writes image data into the first unused memory segment,

unless otherwise instructed by the end-user.

Selecting a Cine number, from the list, will place the camera into the capture (recording) mode.

Selecting Preview will place the camera into the 'Preview, Waiting for pre-trigger...' mode. It is in this mode that you can specify setup parameters that can be applied to all memory segment profiles when the 'Set All' button is pressed. When Preview is selected the camera is instructed to send a live image to the control unit and/or attached monitor, and set the camera to the idle state.

Pressing the 'Set All' button changes the Live panel settings for all Cines to the values currently displayed. Selecting this option will delete any recorded Cine files in the camera's RAM. This system will, however, verify this process by displaying a Warning message for every recorded Cine prior to deleting the image data.

Lock All Button

By selecting the Lock All  button all Cine partitions will synchronize any changes made to the Resolution, Sample Rate, Exposure, EDR exposure, and Post Trigger, of any Cine partition. The changes will be applied to all Cine partitions in the selected camera.

Set All Button

By using the Set All buttons, the selected camera is instructed to change the capture parameters of all Cine partitions to the values set for the current partition or Preview.

NOTE

If the camera is associated with a camera group, the settings will not be applied to any of the other cameras associated with the group. This option will not change any Cine settings for recorded (stored) partitions.

Using this option after a Cine or Cines have been stored in a memory partition will not delete the recorded Cine or Cines from the camera memory buffer.

NOTE

The Cine Settings>Lock All and Set All features are only applicable when a Phantom camera is in MultiCine mode.

Name

The Name field allows the end-user to assign a name to the Cine stored in the camera's RAM and is written to the camera Cine-structure meta-data. This name entered can be viewed in the Play>Cine Info selector.

Description

The Name field allows the end-user to enter text to describe the current Cine. It can be modified in Play RAM Cine and the Cine file Save and will contain the final description text. The CineMag Cine save description text is identical to the text in Live tab at recording time. If in MultiCine mode, all partitions will have the same description text.

Resolution

The Resolution setting allows the user to change the dimensions of the images. The Resolution is the width to the height ratio of the image to be 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.

Phantom cameras can be mounted in any position allowing great flexibility in matching the shape of the subject of interest.

To define the desired Resolution, click the down-arrow to the right of the Resolution field to view a list of predefined aspect ratios. If the end-user wishes to use a resolution not displayed within the list simply enter the desired Resolution, and hit the enter key, the system will select the closest, allowable, Resolution for the camera's sensor.

Using the CAR (Continuous Adjustable Resolution) feature, provides for resolution adjustments between the minimum and maximum drop-down list values as follows:

- Phantom 65 in 4096 x 8 pixel increments.
- Phantom Flex4K in 4096 x16, or 2048 x 16 pixel increments
- Phantom Flex, v642 Broadcast, v641, and v341 in 256 x 8 pixel increments.
- Phantom Miro Airborne HD in 1920 x 8 increments.
- Phantom HD Gold, HD in 2048 x 8 pixel increments.
- Phantom v2511,v2011, v1611, v1211, v2010, v1610, and v1210 in 128 x 16 increments
- Phantom Miro M / R / LC320S, Miro M / R / LC310, Miro M140, Miro M340, Miro M / R / LC120, and Miro M / R / LC110 in 64 x 8 increments
- Phantom Miro M310, M120, M110, v710, v640, v310, v210, and v12 Series in 128 x 8 pixel increments.
- Phantom v10 and v9.1 in 96 x 8 pixel increments.
- Phantom v9.0 in 48 x 8 pixel increments.
- Phantom v7.3 in 32 x 8 pixel increments
- Phantom v7.2, v7.1, v7.0, v6.2e, v4.3, and v4.2 in 16 x 8 pixel increments.
- Phantom v5.1 in 64 x 4 pixel increments.
- Phantom v6.0, v5.0, v4.1, and v4.0 in 8 x 8 pixel increments.
- Phantom Miro eX4, Miro 4, Miro eX3, Miro 3, Miro Airborne, Miro eX2, Miro 2 in 32 x 8 pixel increments.

Sample Rate

The Sample Rate specifies the rate (speed) at which images are to be recorded. The sample rate is depended upon the defined Resolution, (width-to-height ratio), of the images being captured.

For actual Sample Rates refer to: [Functional Descriptions>Frame Rate Tables](#).

Exposure Time

The default setting is nominally, the reciprocal of the sample rate less 20 microseconds of overhead. Click the down-arrow to display a drop down list box and select one of the preset exposure times in the pull down list box. If the desired exposure time is not listed an exposure time may be entered. The Phantom Camera Control application allows the end-user to enter exposure times in one-microsecond increments between the minimum and maximum exposure time in the drop down list.

If the Exposure Time is defined in degrees (shutter angle) 360° equal full shutter; 180° half shutter. The shutter angle equals 1/frame rate, so if shooting at 100 fps the exposure will be brighter than shooting at 1000fps (exposure=1/frame rate).

EDR

The EDR, (Extreme Dynamic Range™), exposure time feature is very useful when the subject contains very bright areas as well as darker areas and both must be exposed properly throughout the Cine file. The EDR function permits the end-user to expose for darker areas in the subject via the Sample Rate and Exposure time settings and then set a separate and independent pixel level EDR exposure for all the portions of the image that might become saturated, (over exposed). The EDR feature is automatically enabled when any value, other than zero, is entered in the EDR Exposure field.

NOTE

EDR Exposure times should be set at approximately 1/2 of the Exposure time as a starting point. By setting the EDR Exposure to 1/2 of the Exposure time the brightest pixels in the images will be exposed for one stop less than the darker pixels. The EDR feature cannot be used in conjunction with the Auto Exposure feature and should not be enabled while performing a CSR, (Current Session Reference), or Black Reference calibration adjustment. Phantom Flex4K cameras do not support EDR.

Exposure Index

EI (Exposure Index) is a reference value for the ISO level at the current image settings. This EI value is referenced after the image processing (Image Tools) settings are dialed in. Not all Phantom camera support this feature.

CSR Button

The CSR Button initiates the CSR (Current Session Reference) calibration process when selected.

For a brief explanation of CSR (Current Session Reference), see: [Functional Descriptions>Black Reference/Current Session Reference Adjustments](#).

NOTE

A CSR (Current Session Reference) calibration adjustment should not be performed if the EDR, (Extreme Dynamic Range), or Auto Exposure features have been enabled.

Low Light Button

Using the Low-Light feature automatically sets the camera exposure to a pre-defined level. This exposure level is based on the camera's auto-exposure settings.

Close Shutter Button

The 'Close Shutter' button (requires camera with internal or external mechanical shutter) closes the internal shutter. This feature is extremely useful when a lens changed is required in dusty and dirty environments. When a group of cameras is selected, this command will close the shutters of all group's cameras.

The shutter can be reopened by pressing the 'Open Shutter' button in the new 'Shutter Closed' window.

Image Range and Trigger Position Options

The Image Range and Trigger Position (formally the Trigger Position) group is a double cursor slider; option include:

Last Pull-Down Selection List/Entry Field

The Last Pull Down Selection List/Entry Field can be used to set an Image Range value (Trigger Delay) or a Post Trigger value. Only one value can be set a time.

T (Trigger Position) Slider

Sets the number of images or frames to be saved after a trigger has been detected and automatically changes the value in the Last entry box. Moving the slider to the left increases the number of post trigger frames, while sliding it to the right reduces the number of post trigger frames.

I (Image Range) Slider

This slider is only available when Trigger slider is set to the leftmost end of the image range. This feature allows end-users to add a delay between the trigger command, (via Phantom Camera Control application, or hardware), and the actual recording into the camera's image buffer RAM. After the trigger signal is detected, the Phantom camera will loop-record into RAM the specified number of frames. The effect of this is a delay, because the frames that will actually be kept into the camera's image buffer will be the images recorded after this delay.

Moving the slider to the left decrease the number of Image Range frames, while sliding it to the right will increase the number of Image Range Frames frames. Either way will automatically change the value in the Last entry box.

Duration:

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 sample rate setting. This field will change based on these variables. This field should be referred to when determining the required number of Post Trigger frames to set.

Frames:

This field indicates how many images (the number of pictures – p – mentioned after Duration value within brackets) will be recorded within the camera's recording Duration time. This field will change based on the amount of memory in the camera, and how the resolution is set, and will change accordingly. This field should be referred to when determining the required number of Post Trigger frames to set.

Delay:

This field indicates the trigger delay time in seconds. This field will only be visible when an Image Range value is specified (using the I slider).

▼ Flash Memory

Erase Button

The Erase button, when selected, purges all Cines saved in non-volatile Flash memory.

Flash Memory Usage Status Bar

The Flash Memory Usage Status Bar indicated the amount of used and free non-volatile Flash memory of the active camera.

Direct recording to CineMag Enable Box

By default Phantom cameras will write the image data into its' RAM image buffer prior to writing it into the non-volatile Flash memory of a Phantom CineMag. When enabled, (checked), the Direct recording to CineMag feature (called Run/Stop mode) instructs the Phantom camera to write the image data directly into the non-volatile Flash memory of the mounted Phantom CineMag. The camera memory will retain in this case only the last images, no more than a number equal to 'Frames' value. This option is used also to record in CineMag Cines with more images than 'Frames' value.

For a brief description of the operational modes defined by the Direct Recording to a

Phantom CineMag feature, see: [Functional Descriptions>Phantom CineMag Operational Modes](#).

Format

Only for Flex 4k cameras: Raw packed 10 bit or ProRes HQ 10bit format can be chosen for the Cines saved in the CineMag.

▼ Advanced Settings Selector

The Advance Settings fields are used to define End of recording actions, frame synchronization clock parameters, Real Time Out parameters, temperature thresholds, and signal acquisition parameters, and more. The following is a brief description of the setup parameters associated with the Advanced Settings:

Cine Advanced

High Quality Image Mode

The High Quality Image Mode feature instructs a Phantom Flex camera to use a proprietary multi-sampling technology to enhance each frame. Each frame is analyzed for noise and image artifacts that can occur under continuously changing shooting environments.

Using High Quality Image Mode ensures the best images possible will be recorded even when changing frame rates, exposure settings, resolution, or if ambient and camera temperatures are changing.

NOTE

High Quality Image Mode reduces maximum frame rates by ½ and each frame requires twice the internal camera memory. However, saved Cine files are the same size as in Standard Mode and recording directly to a Phantom CineMag has the same speed and size specifications as Standard Mode.

Exposure in PIV Mode

This feature has been designed for use in PIV (Particle Imaging Velocimetry) applications. When enabled the Phantom v711 and v12.1 will be instructed to reduce the Frame Straddle Time to 500 nano-seconds, the Phantom v311 is instructed to reduce the Frame Straddle Time to 660 nano-seconds, the Phantom v211 to 700 nano-seconds, the Phantom v642 Broadcast and Miro M320S to 1.4 micro-seconds, a Phantom v641 to 1.2 micro-seconds, and the Phantom v10, v9.1, v7.3, and v5.2 to 1.5 micro-seconds.

Burst Period

The Burst Period is one of two parameters use to define Burst Mode Acquisition, the other parameter is the Burst Count described below. It sets the interval between two frames in a burst, in microseconds.

For a brief explanation of Burst Mode Acquisition, see: [Functional Descriptions>Burst Mode Acquisition](#).

Burst Count

The Burst Count is one of two parameters use to define Burst Mode Acquisition, the other parameter is the Burst Period described above. The Burst Count sets the number of frames in a burst, (a value of zero disables Burst Mode Acquisition completely).

For a brief explanation of Burst Mode Acquisition, see: [Functional Descriptions>Burst Mode Acquisition](#).

NOTE

The Burst Count and Burst Period parameters will be validated by the camera and clamped to ensure valid values. When clamping occurs, the Burst Count has priority over Burst Period, and both will have priority over the exposure time.

Behavior of the camera will be modified in the following way, when viewing live images, with a Burst Count larger than one the camera will retrieve images from the most recent burst, starting with the first frame in the burst.

Start/End of recording actions

The End of recording action parameters instruct the selected Phantom camera to perform various tasks prior to or immediately after a Cine file has been recorded into the camera's RAM, including:

Auto Black Reference

When a Cine file starts recording, a CSR slot is allocated to the Cine file and a black reference operation is performed with the results being saved into the slot. During the lifetime of the recording in RAM, the CSR slot is kept and all images from the Cine file are corrected using the black reference data within. CSR slots are freed when a stored Cine file is specifically deleted or reused when the Cine file itself is reused.

For cameras having an attached Phantom CineMag operating in the Live recording mode, recording into the Phantom CineMag is delayed until the black reference operation has completed. All frames saved to the Phantom CineMag will be corrected with the obtained CSR (Current Session Reference).

NOTE

This automatic CSR, (Current Session Reference), mode is available for Phantom cameras equipped with the Automatic Shutter feature only.

Auto save to CineMag/built-in Flash Enable Box

When enabled, (checked), the:

- Images captured in the selected camera's RAM will automatically be stored into the camera's non-volatile memory, or
- The camera will be instructed to automatically save the image data into its' mounted Phantom CineMag after the end of recording.

Auto save to CineFlash/CardFlash Enable Box

This feature has been designed to save the captured images:

- In Phantom Miro LC- / M-Series camera's RAM, to an attached Phantom CineFlash or
- In a Miro3 or Miro4 cameras' RAM to the inserted Type 1 Compact Flash card.

Auto play Video Out Enable Box

When enabled, (checked), the Cine file will automatically be displayed on an attached video monitor for review.

Times

Times specifies the number of times the recorded Cine file will play back (repeat) on an attached monitor. Entering a zero, (0), instructs the Cine file to loop indefinitely when the Playback to video feature is enabled.

Range:**FullCine Enable Box**

When enabled, (checked), the option instructs the software to playback every image in the recorded Cine file. It will also disable the First and Last image range fields.

First

Firsts defines the image number of the first Cine image to be used to create the Cine file to be saved or viewed.

Last

Last defines the image number of the last Cine image to be used to create the Cine file to be saved or viewed.

Restart Recording

When enabled the camera will automatically reset to the recording state.

NOTE

Do not enable, check, the Restart Recording feature when using Continuous Recording.

External Sync

The External Sync parameters are used to define the frame sync clock source, specify the master camera supplying the frame sync clock source to other Phantom cameras, and define how long to delay the recording of image data from the frame sync clock pulse. The External Sync parameters include the:

Sync Imaging (Selection List Window)

This entry field instructs the selected camera to utilize one of the following four frame sync clock sources:

Internal

This mode instructs the camera to utilize its' internal crystal oscillator to drive the camera's sample rate.

External

This mode should be selected when an externally supplied frame sync clock pulse is supplied to drive the camera's sample rate. The external input must be a TTL pulse, with a frequency up to the maximum sample rate. (Example: 1000Hz @ 512 x 512 resolution, 2000Hz @ 256 x 512 resolution.) The TTL input pulse must be connected to the BNC, (Bayonet Neill-Concelman), connector marked F-Sync or Sync on the back of the camera, or Capture breakout-cable/box.

NOTE

When External sync imaging is selected the Sample Rate option will be disabled.

Lock to IRIG

This mode should be selected when an IRIG-B signal is supplied through the marked IRIG Input BNC, (Bayonet Neill-Concelman), connector on the Timecode connector on the rear of the camera or the Capture breakout-cable/box.

NOTE

When Lock to IRIG sync imaging is selected the Sample Rate option will be disabled.

Refer to the [Functional Descriptions>Frame Rate Tables](#) for a list of frame rates a Phantom camera will lock to.

Lock to Video (ph16 camera models only)

In this mode, the camera captures frames at a rate that is a multiple of the video frame rate, with a defined phase relationship to the video signal. This mode bring the following benefits: when both recording and play-back needs to be synchronized (such as in stereoscopy applications), a FSYNC connection between cameras is no longer needed Genlock will suffice; the cameras can capture at the "fractional" frame rates of 23.98, 29.97 and their multiples; the live output of the camera maintains a stable phase in relation to frame capture. Refer to [Functional Descriptions>Sync to Video Mode](#) for more details on this feature.

Master camera serial (0=none)

The Master camera serial parameter specifies the serial number of Phantom camera providing the frame sync clock source to other Phantom cameras. If set to zero, (0), no external sync will be applied.

This field MUST be defined when synchronizing multiple Phantom cameras using one Phantom camera as the primary clock source.

Frame Delay μ s

The Frame Delay parameter field can be used in one of two ways:

- If the camera is being clocked via another camera the delay MUST be set to a minimum of 1 μ s greater than that defined in the clock source camera (when using a Capture breakout-cable/box), or
- If a delay is required between the clock source pulse and the frame capture to provide a phase shift in the timing.

This field MUST be defined when synchronizing multiple Phantom cameras using one Phantom camera as the primary clock source.

Temperature

The Temperature informational fields indicate the operating temperatures of the selected camera and its' sensor.

Cam:

This informational field displays the operating temperature of the camera.

NOTE

If the temperature of the Cam:, (camera), exceeds the camera's factory set threshold setting the camera's cooling system will work harder to reduce the camera's operating temperature.

Sensor:

This informational field displays the operating temperature of the sensor.

NOTE

If the Sensors temperature rises above the sensor's factory set threshold setting, the sensor's thermal expansion diodes will reduce the temperature of the sensor. If the sensor temperature dips below the (sensor) factory set threshold setting, the sensor's thermal expansion diodes will increase the temperature of the sensor.

Quiet Fans:

When selected, the camera will turn off the fans or set it to its' minimum speed.

DAQ Signals

The DAQ Signals C button opens the Range Data and Signal Acquisition dialogue window used to define the parameters necessary for the Phantom Camera Control application to process the range data, and/or acquired signal information.

Start In

The Start In command allows the end-user to specify the default operational state of a Phantom camera when power is applied to it. The possible states include:

Idle

When selected this radio button instructs the camera to start in the 'Preview Waiting for pre-trigger...' mode. This means the end-user will have to place the camera into the recording mode by clicking the Capture button, in the Live Panel or apply a TTL pulse to the Capture breakout-cable/box 'Pre-Trigger' connector, to place the camera into the Preview + Recording... waiting for trigger mode.

Capture

When selected this radio button instructs the camera to start in the 'Preview + Recording...' waiting for trigger mode.

NOTE

The Start in options are not available with the Phantom v4.1, v5.0, or v6.0 camera models.

Time info out pin format

The Time info out pin specifies the type of time code to be transmitted from the Time Code Out Connector on the rear panel of various Phantom camera models. The types of time codes include:

IRIG

When selected the IRIG radial button to instruct the connected-to-camera to output an un-modulated IRIG time code.

SMPTE

When selected the SMPTE radial button to instruct the connected-to camera to output a SMPTE linear time code.

Audio

The Enable option enables the audio signal acquisition during the image acquisition.
(Phantom Flex4k only)

▼ Camera Signals Selector

The Signals fields are used to define the TTL pulse trigger edge, the associated Pre-trigger interface signal, and when to stop transmission of the cameras 'Ready' signal, and , and more. The following is a brief description of the setup parameters associated with the Signals settings:

Trigger

To understand what the Trigger parameters set, you must first understand that Vision Research holds the trigger signal 'High' in all Phantom cameras.

Rising/Falling Edge

Selects whether the leading edge or trailing edge of a TTL supplied input trigger signal is to be used to trigger the camera. If 'Falling Edge' is selected the camera will be triggered once the trigger pulse is held low for the duration set in 'Filter Time'. However, when Rising Edge is selected the trigger pulse must be held low for a duration of 10x the 'Filter Time', then be return high for the 'Filter Time' to be a valid signal.

To select the leading or falling edge click the Rising Edge or Falling Edge radio button respectively.

Filter Time (ms)

Filter Time instructs the Phantom camera to ignore a trigger signal if it is detected before the specified Filter Time parameter. If the trigger position is set to the 'Falling Edge' it specifies the length of time the trigger signal must be held 'Low' for it to be a valid trigger signal.

If the trigger position is set to the 'Rising Edge' the trigger signal must be held 'Low' for ten times the 'Filter Time', then must be 'High' for the specified time.

NOTE

Trigger options are not available with the Phantom v4.1, v5.0, or v6.0 cameras.

Pre-trigger pin is:

Pre-Trigger Pin Is specifies whether a TTL supplied input signal is to be used to toggle Memory Gate or as a pre-trigger input signal.

Ready signal ends at:

Ready signal ends at instructs the connected-to camera to toggle off its READY signal the moment a Trigger signal has been detected by the camera or when the allocated memory, in the selected camera, has completed capturing all the images to be recorded.

NOTE

The MemGate options are not available with Phantom v4.1, v5.0, or v6.0 cameras.

Aux 1 / Aux 2 / Aux 3 pin is:

Various Phantom camera models support the ability to program I/O signals and specific 'Auxiliary' ports they will be activated through; see [Define the Aux Pin Is:](#)

▼ Auto Exposure Selector (ph7 camera models)

In all Phantom v-Series and Miro cameras released prior to 2012, the Auto Exposure area and

threshold needs to be defined manually. This is done in PCC software by setting your desired exposure level, and then using your cursor to draw a rectangle on the live image in which to judge the light level for the exposure.

AutoExposure Enable Box

The Auto Exposure feature is extremely useful when conditions adversely effect setting the camera's exposure to a fixed variable, such as capturing outdoors where clouds may change the light conditions. The system will adjust the Exposure using the information from the defined area. The defined pixel area should be the focus of interest or the area of interest, in other words, the subject matter.

NOTE

The Auto Exposure feature cannot be used in conjunction with the EDR, (Extreme Dynamic Range), feature and should not be enabled while performing a CSR, (Current Session Reference), or Black Reference calibration adjustment.

For a brief explanation of Black Reference, see: [Functional Descriptions>Black Reference/Current Session Reference Adjustments](#).

Level

Level defines the average gray scale level for the specified area, to be realized by the automatic exposure system. For example, for an 8-bit pixel image depth a mid gray: 128.

Rectangle

Rectangle defines the region of interest where the auto-exposure measures the average pixel level. The larger the area the slower the process becomes.

The Rectangle, or region of interest to be auto exposed, is defined by entering the following parameters:

Top

Specifies the y-coordinate of the top row of pixels.

Left

Specifies the x-coordinates of the left column pixels.

Right

Specifies the x-coordinates of the right column pixels.

Bottom

Specifies the y-coordinate of the bottom row of pixels.

Show On Image Enable Box

When enabled, (checked), a red box, indicating the region of interest where the auto-exposure measures the average pixel level, will be displayed over the area specified by the end-user in the Preview Panel, and will not be recorded with the image data.

Full Button

When enabled, (checked), instructs the software to auto expose the entire image area.

TECH TIP

A user-friendly technique as been incorporated into the Phantom Camera Control Software to define the Rectangle. Simply, identify the area of interest in the Live Preview Panel and

place a box around the area of interest. This can be accomplished by placing the cursor just above the upper left hand corner of the area of interest, the hold down the left mouse key and drag the cursor just below the lower-right-hand corner of the area of interest, (the subject matter to be auto-exposed), and release the mouse key. The Rectangle parameters will automatically be changed to the pixel area selected.

▼ Auto Exposure Selector (ph16 camera models)

Phantom cameras released since late 2011, such as the Phantom v1210, v1610, and Miro M or LC-series, run on a new protocol which enables a different method of setting Auto Exposure. The control is much simpler with fewer variables.

AutoExposure Enable Box

The Auto Exposure feature is extremely useful when conditions adversely effect setting the camera's exposure to a fixed variable, such as capturing outdoors where clouds may change the light conditions. The system will adjust the Exposure using the information from the 'Mode' parameter. The defined pixel area should be the focus of interest or the area of interest, in other words, the subject matter.

NOTE

The Auto Exposure feature cannot be used in conjunction with the EDR, (Extreme Dynamic Range), feature and should not be enabled while performing a CSR, (Current Session Reference), or Black Reference calibration adjustment.

For a brief explanation of Black Reference, see: [Functional Descriptions>Black Reference/Current Session Reference Adjustments](#).

Mode

Mode defines the region of interest where the auto-exposure measures the average pixel level. The larger the area the slower the process becomes. The region of interest to be auto exposed, is defined by selecting one of the following 'Modes':

Average

When selected the full image will be auto-exposed.

Spot

When selected a small area in the center of the image will be auto-exposed.

Center Weighted

Averages a larger area in the center of the live image to auto-expose.

Compensation

Compensation defines the average gray scale level for the specified 'Mode' area, to be realized by the automatic exposure system. For example, a compensation of 0 would be an average 50% grey level. The compensation can then expand to +2 or -2 f/stops.

▼ Frame Rate Profile Selector (not available with ph16 camera models)

This Frame Rate Profile feature allows the end-user to define up a number of different frame rates that automatically change, at specified points, during the capturing process of post trigger frames. The number of profiles varies based on the camera model this feature is being used

with, the amount of memory associated with the camera, the resolution the images will be recorded at, and the number of post-trigger frames defined. The first profile is the profile defined under Live Panel>Cine Settings Selector. The remaining profiles will be applied to Post Trigger frames only.

The profiles are inheritable defined to Ramp up or down to the next defined frame rate for most Phantom cameras but not all. The user can set the frame rates so that they change immediately (Step) to the next frame rate. This method is the inherit method for other Phantom cameras.

NOTE

This Frame Rate Profile feature is not available with all Phantom cameras, and the actual frame rate changes will only be applied to Post Trigger frames.

Active Enable Box

The Active enable box is used to turn the Frame Rate Profile feature on and off.

PT Duration

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

Image#/Time Selection List

This selection list is used to specify the desired variable used to define the profile(s). The selection list includes the following options:

Image#

The Image# specifies the first frame or image number the defined profile will change.

Time(s)

Specifies the time from trigger.

Image%

Specifies the image number percentage from post trigger frames.

Time%

Specifies the time percentage from post trigger duration.

NOTE

If the header variable is changed for the first column the remaining values will be updated according to selected variable. Small changes can occur, because of the rounding process, when switching from, then back to the Image# option.

Image #/Time/ImNrPerc/ime Perc

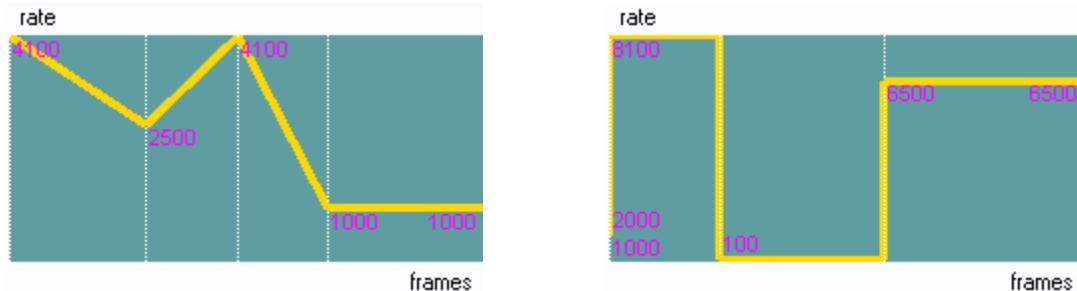
The nomenclature for this data entry field will be set to match the user selected Image#/Time selection. It is in the date entry field that the end-user specifies when the frame rate is to change.

Rate

The Rate entry fields define the sample rate or frame rate the images will be recorded at. The rates will be updated in order to be compatible with the exposure value set in Live Panel – Cine Settings.

Rate Profile Graph

The Rate Profile Graph displays an active graphical representation of the defined profiles.



Frame Rate Profile Graph Example with 5 profiles defined. The first image depicts Ramp Profile Change, the second Step Profile Change

The yellow line indicates the defined frame rates for each of the profiles. The starting point of the line represents the Sample Rate set, and used by Profile 1, under Live Panel>Cine Settings Selector.

The white dotted lines represent the beginning of the specified Image or Time variables starting with Profile 2.

▼ Image-Based Auto-Trigger Selector

WARNING:

The Image-Based Auto-Trigger feature should never be used in applications where missed or false triggers cannot be tolerated or where a false trigger could cause harm to people or property.

The hardware signaling available in some Image-Based Auto-Trigger modes should be used only to synchronize multiple Phantom cameras together and should never be used to trigger or control any other external device or event.

CONSEQUENCES RESULTING FROM SYSTEM FAILURE, FALSE TRIGGERING OR MISUSE OF THIS FEATURE ARE THE SOLE RESPONSIBILITY OF THE USER.

The feature allows the end-user to trigger the camera from the motion detected in the live image. The camera may also provide an external trigger signal based on the Image-Based Auto-Trigger to be used for synchronizing multiple Phantom cameras. The defined pixel area should be the area of the image changes are analyzed to auto-trigger the camera.

For a brief explanation of Image-Based Auto-Trigger, see: [Functional Descriptions>Image-Based Auto-Trigger](#).

Image-Based Auto-Trigger Enable Box

When selected, (checked), the Image-Based Auto-Trigger feature will be enabled.

Only Output Signal Enable Box

When enabled, (checked), The image changes are analyzed, and when an auto-trigger condition has been detected, the auto-trigger signal will be pulled low. However, the camera will not trigger itself. An external device pulling the auto-trigger signal low will not trigger the camera either.

This option is useful when external control of the auto-trigger is desired, for instance, it is

required that the auto-trigger feature is disabled for some known transient event. The auto-trigger signal from the camera will be routed through some external device and back into the trigger input of the camera.

Sensitivity

The Sensitivity parameter defines the:

Threshold

The Threshold specifies the amount a pixel value must change in order to be counted as an active pixel for auto-trigger purposes. A value of 100 would require a change of approximately half of the full swing of the camera. A typical threshold setting would be 10.

Area %

The Area % specifies the percentage of the auto-trigger region that must be active in order for an auto-trigger event to be generated. A typical percentage value is 10.

Check Interval (ms)

The Check Interval parameter specifies the speed between updates the auto-trigger region is checked.

Area

Area defines the auto-trigger region, and is defined by entering the following parameters:

Top

Specifies the y-coordinate of the top row of pixels.

Left

Specifies the x-coordinates of the left column pixels.

Right

Specifies the x-coordinates of the right column pixels.

Bottom

Specifies the y-coordinate of the bottom row of pixels.

Show On Image Enable Box

When enabled, (checked), a yellow dotted box, indicating the auto-trigger region, where image changes are analyzed, will be displayed over the area specified by the end-use in the Preview Panel, and will not be recorded with the image data.

Full Button

When enabled, (checked), instructs the software to analyze the entire image area.

▼ Continuous Recording Selector

Continuous Recording is a functionality to record into a camera's RAM continuously and auto-save the stored Cines. If the camera is in MultiCine mode the camera will record sequentially in Cine slots.

When the RAM is full the needed Cine RAM slot will only be deleted and captured if it was saved, otherwise there will be a wait until this action completes.

NOTE

Only one save at a time can be performed from any one camera.

On every start and stop the current Continuous Recording settings will be serialized and saved in a XML file. These settings will be loaded at application startup and the Continuous Recording will auto-start accordingly to the last saved settings.

Active:

Check this box to start Continuous recording. The camera will get into: "Waiting for trigger" status. Uncheck it to stop Continuous recording.

Cine file paths & save parameters:

This field should contain the path and file name necessary for saving recorded Cines.

Auto Trigger:

Use this checkbox to auto trigger every Cine immediately after capture.

Firmware Ordered Recording:

Use this feature to reduce the time between takes by instructing a Phantom camera to erase a MultiCine segment upon completion saving its stored image data to a specified hard-drive then making it available for recording again.

Minimal GUI Refresh:

Use this feature to accelerate the Cine save process by disabling the save progress indicators from being displayed in the Graphical User Interface. Enabling this command also instruct the Phantom software to stop displaying a live images in the Preview Panel during the save Cine procedure.

Calibration Snapshot:

Used to capture multiple calibration images from two or more synchronized Phantom cameras. This process will result in several matched images to be used as calibration frames for 3rd party software that processes data from two or more synchronized cameras. These frames can be saved in the user's chosen format.

Save count:

Counts the files saved in the current session.

Error count:

Reports the number errors that rarely occur while using the Continuous Recording feature, for example; loss of camera power, firmware crash, disconnect Ethernet, etc.

Error Log:

To avoid user intervention with a blocking dialogue window, the errors are collected in a log file for review later.

For a brief explanation of Firmware Ordered Recordings, and No GUI Refresh, see: [Functional Descriptions>Firmware Ordered Recording and Minimal GUI Refresh](#)

▼ Camera Info Selector

The Camera Info Selector provides information about the active, (selected), Phantom camera, including the Camera Name, Serial Number, IP Address, Hardware Code and (Camera Model),

of the connected camera. It also displays the CineMag, Firmware, FPGA, and Kernel versions loaded in the camera's non-volatile memory, the size of RAM image memory and non-volatile Flash memory integrated in the active Phantom camera.

NOTE

The Camera Name field can also be used to change the name of the active camera.

▼ Capture Button

The Capture button puts the camera into the recording mode. When the Capture button is clicked, image data will be continuously recorded, in an endless loop, to an image storage area until the camera has received one of the three different types of trigger signals. When the Record button is clicked it will change to the Abort Recording button.

NOTE

In Run/Stop mode (Direct Recording to CineMag), the Capture button will become a Record button. When clicked the Record button will change to a Stop Recording button.

▼ Trigger Button

Selecting the Trigger button provides a “soft” trigger to the camera, when the camera is in Capture mode, that instructs the camera to stop capturing and recording images to the storage buffer. It is just one of five possible ways to trigger the Phantom cameras, the other four, with the camera in Capture mode, include:

- Press 'Ctrl T' on the keyboard.
- Provide a dry switch closure to the BNC connector marked Trigger on the Capture breakout cable attached to the rear panel of the camera.
- Provide a low TTL pulse to the BNC connector marked Trigger on the Capture breakout cable attached to the rear panel of the camera.
- Provide a low TTL pulse to the BNC connector marked Trigger on the Breakout Box that attached to the rear panel of the camera.

After the camera gets triggered, the camera will continue to record a number of images equal to post trigger frames value set in Live Panel – Cine settings.

NOTE

In Run/Stop mode (Direct Recording to CineMag), the Trigger button is removed.

7.1.4.3 Play Panel Components

The Play Panel is used to review, edit, and/or save recorded Cine files, and consist of the following components:

▼ Group Lock Button

The Group Lock  button is used to instruct the Phantom Camera Control Application to simultaneously control all cameras' playback, associated with the first group that contains the currently selected camera or to control all Cine files' playback associated with the first group that contains the currently selected file.

▼ Cine: (Pull-Down Selection List Window)

The Cine: field displays a list of the Cine files, that the end-user can select to review, edit, and/or save. The list contains all the Cine files listed under the:

- Cameras Group Tree which contains a list of connected Phantom cameras. A list of Cines will also be displayed under any connected Phantomcamera that has a Cine stored in the RAM of the camera or in the Flash/CineMag memory.
- Files Group Tree, which contains a list of all open and previously opened Cine files.

▼ Playback Buttons



Play Fast Rewind decrements images: the total number of Cine frames /1000, no less than 10 frames, auto adjusting to Cine size.



Play Fast Forward increments images: the total number of Cine frames /1000, no less than 10 frames, auto adjusting to Cine size.



Standard Rewind decrements 1 step at a time.



Standard Play Forward increments 1 step at a time.



Pause Playback stops or pauses the playback process.



Play Step Backward rewinds 1 step only.



Play Step Forward advances forward 1 step only.

▼ Jump Field

The Jump fields can be used to quick search through the Cine file. Use the:

Trig Button

The T, (trigger),  button, when selected, instructs the software to jump to the recorded image when the trigger signal was detected by the camera, the T_0 frame, if available.

Jump to Start Button

The Jump to Start  button, when selected, returns the Cine file to the beginning of the selected Cine file. If the Limit to Range mode is:

- Selected, the Cine file returns to the Mark-In point specified by the end-user during the edit Cine process.
- Not selected, the Cine file immediately returns to the first image of the full Cine file.

Jump to End Button

The Jump to End  button, when selected, jumps to the end of the selected Cine. Similar to the Jump to Start Button, if the Limit to Range mode is:

- Selected, the Cine file will jump to the Mark-Out point specified by the end-user during the edit Cine process.
- Not selected, the Cine file immediately jumps to the last image of the full Cine file.

(Image) Entry Field

The image number entry field is used to enter an image number, in the Cine file, to jump to.

▼ Cine Editor Bar

Many recorded Cine files contain a lot of unnecessary information both before and after the actual motion of interest. The Cine editor bar is used to edit unnecessary images from the beginning and the end of the recorded Cine file prior to saving the Cine file. Editing the Cine file will create smaller files, reduced to save times, and make reviewing the Cine file more interesting.



The blue portion of the line, in the Cine editor bar, represents the edited Cine file. The number displayed at the left end of the Cine editor bar refers to the first image in the entire Cine sequence. The number at the right end of the bar refers to the last image in the entire Cine sequence. The number just above the editor bar, in the center of the bar, indicates the number of the image presently being displayed in the playback panel.

The numbers below the editor bar indicate the first and last image numbers of the edited Cine file, respectively.

Zero represents the first image after the moment of trigger was detected by the camera regardless of what sample rate or resolution settings were set to in the Live Panel. Negative numbers represent pre-trigger frames and positive numbers represent post trigger frames.

▼ Mark-In/Mark Out Buttons

The Mark-In  button, when selected, defines the new starting point of the selected Cine file,

while the Mark-Out  button defines the new end point of the selected Cine file.

▼ Play Speed & Options Selector

The Play Speed selector incorporates the following:

Loop Options

The Loop Options are used to specify how the Cine file is to be reviewed. The Loop Options, include:

Limit to Range

When selected, (checked), the Limit to Range option forces the playback controls to play only the images between the Mark-In and Mark-Out entry points specified by the end-user.

Repeat

When selected, (checked), repeat will allow the Cine file to be played in an endless loop. If the Limit to Range command is also selected, (checked), the loop will be limited to the range specified by the end-user during the edit Cine process.

Ping Pong

Ping Pong instructs the software to play the selected Cine file forward and then backward repeatedly when enabled, (checked).

NOTE

The software allows for multiple Loop Options to be selected at the same time.

Player Step

The 'Player Step' data entry field specifies the number of images the Cine playback will jump when reviewed.

Group Play Option

Sync to Frame # Enable Box

When the Sync to frame # option is enabled, checked, Cine files associated with a specific sub-group (also a temporary group) will synchronize their playback.

Play Rec Speed (Enable Box)

When enable, (check), the Play Rec Speed command instructs the Phantom Camera Control application to playback the Cine at the rate it was recorded at. Essentially it plays the Cine back in real time.

Play Each Image (Enable Box)

When enable, (check), the Play Each Image command instructs the Phantom Camera Control application to display every frame, (image), in the Cine file, and restrict the playback rate.

fps (Frames Per Second Playback Speed) Entry/Slider

The fps, (frames per second), slider is used to adjust the speed of the Cine playback. This adjustment only applies when the Standard Play Forward and Standard Play Rewind buttons have been selected. The fps entry field allows the end-user to specify a playback frame rate within the minimum/maximum range indicated on the fps slider.

▼ Frame Info Selector

The Frame Info(rmation) selector, when selected, displays information about the image being displayed. The frame information includes following information about the image being displayed:

Time

This informational field indicates the absolute time and date the image was recorded, displayed in hh:mm:ss:ms:μs; Day Mon dd yyyy. A tag may be appended at the end of time displays, as follows:

E - Provided as an event marker.

S - Designates that the time displayed was synchronized to an IRIG-B time source.

NOTE

If the camera had an IRIG-B input clock at the time of recording, the IRIG-B time base will be displayed. If an IRIG-B timing source was not connected at the time of recording the 'S' tag will not be displayed.

Local/utc/Time Code Pull-down Selection List

When the Local option is selected all displayed time references are based on the time difference, of the Phantom Control Unit computer from UTC, (Universal Time Code), formally referred to as GMT, (Greenwich Means Time).

When the utc option is selected all displayed time references are based on UTC, (Universal Time Code), formally referred to as GMT, (Greenwich Means Time).

Finally, when the Time option is selected an SMPTE Time Code will be used.

Each Cine stored in the camera's RAM, or from a file, contains an initial time code, that can be viewed, edited, and saved by the user. The RAM Cines have an initial value that is read from the camera. The camera time code value is generated by an algorithm that depends on trigger time, acquisition frame rate and video playback frame rate.

The fields that compose a time code define the hour, the minute, the second and the image index in a second interval, based on the Time Code frame rate value.

Interval

The interval information, displayed in micro-seconds, indicates the image interval or the time between frames for the recorded Cine file.

Exposure

The exposure information, displayed in micro-seconds, indicates the image exposure time for the image being displayed in the Playback Panel.

Elapse Time from:

This informational field indicates the elapsed time from:

Trigger

This field, displayed in micro-seconds, indicates the elapsed time from the trigger point to the image currently being displayed in the Playback Panel.

Image#

This field, displayed in micro-seconds, indicates the elapsed time from the specified image number in this box and the image currently being displayed.

Azimuth and Elevation values for Cines that have range data.

▼ Cine Info Selector

To display the setup parameters for the active Cine file click the Cine Info down-arrow. Below is a brief of descriptions of informational fields, including:

Source

Source indicates the camera name or file path of the active Cine file.

Name

Cine name is the information found in camera Cine structure meta-data, that was defined in Live panel>Cine settings.

Description

The Description field allows the end-user to add a description after the Cine file has been recorded via the Play>Cine Info>Description entry field. If the description multiple lines, open the multi-line viewer by pressing the drop button at the right of Description label. The description will be saved to the file together with the images and all other Cine info.

The Description could be any name, project number, test sequence number, etc. It could be any combination of letters, numbers, or spaces, up to a maximum of 4,096 characters.

Format

Format displays the file format of the saved Cine file.

Saved Range

Saved Range indicates the first and last image number of the images contained within the edited Cine file.

Recorded Range

Recorded Range indicates the first and last image number of all the images recorded.

Color

Color indicates if the Cine was captured using a color sensor (Yes) or a monochrome sensor (No).

Signals

Signals indicate if any external analog or binary signal measurements have been tagged to the recorded images by a National Instruments USB X or M Series Data Acquisition Unit.

Audio (Phantom Flex4K only)

When this indicates "Available" it means that an audio signal has been recorded at the same time with the Cine. Otherwise it is mentioned "Not recorded".

Image Time

Image Time indicates if the image timing information, for the active Cine file, is available or not.

Image Exposure

Image Exposure indicates if the image exposure information, for the active Cine file, is available or not.

Camera Version

Camera Version specifies the camera version code used to capture the Cine file along with the camera model.

Serial

Serial specifies the serial number of the camera used to capture the Cine file.

Resolution

Resolution displays the width x height of images saved in a file. The images may contain a border so the Resolution may be greater than Acq Resolution.

Acq Resolution

Acq Resolution displays the width x height the images, in the Cine file, were acquired at.

Post Trigger

Post Trigger indicates the number of Post Trigger frames captured during the recording process.

Bits per color

Bits per color displays the active pixel's bit depth of the recorded images.

Acquisition bpc

The Acquisition bpc (bits per color) value indicates the pixel bit depth the Cine was recorded at.

Sample Rate (fps)

Sample Rate displays what the Sample Rate, or frame rate, was set to record at.

Real

Real indicates the actual frame rate the images were recorded at.

Period

Period indicates the time necessary to record each of the images.

Exposure (μs)

Exposure displays the Exposure setting at the time the images were recorded.

EDR (μs)

EDR indicates the Extreme Dynamic Range exposure time setting at the time the images were recorded. 0.000 indicates the EDR was disabled.

Frame Delay (μs)

Frame Delay indicates the amount of time, the end-user specified, each image is delayed from the frame rate clock pulse.

Sync

Sync indicates the sample rate clock source.

AutoExp.

AutoExp. indicates whether or not the Auto Exposure feature was used during the recording process, and if the auto exposure is to be 'Lock at Trigger'.

Compensation (ph16 camera models only)

Compensation displays the Auto Exposure compensation level (-2 is equivalent to closing down the aperture 2 f-stop; 2 is equivalent to opening the aperture 2 f-stops).

AutoExp. Level (ph7 camera models only)

AutoExp. Level displays the Auto Exposure grayscale level defined by the end-user.

AutoExp. Rect (ph7 camera models only)

AutoExp. Rect displays the area, in pixels, the end-user specified to automatically adjust exposure for, when defining the Auto Exposure parameters.

Lens Description

The Lens Description indicates the manufacturer's focal length (mm), along with the speed of lens (f-stop range) of the attached lens.

Lens Aperture

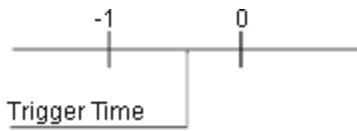
The Lens Aperture indicates the aperture setting defined via the Live Panel>Camera Settings>Lens Control>Aperture setting.

Lens Focal Length

The Lens Focal Length indicates the focal length set via attached lens hardware.

Trigger Time

Trigger Time indicates the moment in time after the last pre-trigger image (-1) and before image 0.



Graphical representation of Trigger Time

Time Zone

Time Zone displays the time difference, in hours, from UTC, (Universal Time Code), formally referred to as GMT, (Greenwich Mean Time).

Frame Rate Profile

Frame Rate Profile displays the Frame Rate Profile setting defined by the end-user during the Cine files' capture process. If the Frame Rate Profile feature was not used this field will be left blank.

▼ Measurements Selector

The Measurements Selector allows the end-user to:

- Define a calibration scale.
- Set a new origin point.
- Perform Coordinate measurements.
- Perform Instant Measurements and generate report files for:
 - Distance and angle and speed: Origin + 1 point measurements.
 - Distance and angle and speed: 2 points measurements.
 - Angle and angular speed: 3 points measurements.
 - Angle and angular speed: 4 points measurements.
- Perform Collect Point Measurements (manually or automatically) and generate report files for the specified points:
 - Collect Point (Coordinates) Report.
 - Speed Report.
 - Acceleration Report.

▼ Image Search Selector

This Image Search feature is extremely useful in reducing the time it takes to locate an event of interest that, in some cases, may be difficult to find within a recording by manual search. This feature can be used to search through a Cine stored in the camera's RAM, attached CineMag, or Cine files that have been previously saved.

The goal is to search is to find an image change in the recording, based on the difference between image content, triggered by the change of a certain percentage of the pixels. A pixel is considered changed if its value in the current image is different from the value in the reference image by an amount called threshold. This allows the search to tolerate a certain amount of image noise.

Besides image content changes, Image Search can look for images that are tagged as event images based on a change in the Event binary input signal.

In addition, of course, one can jump directly to the first image recorded after the camera was triggered (Image 0).

Difference Method

The Difference Method compares the difference between two images to calculate the image's, user-specified, modified area called the Change Area. A pixel is considered modified when the difference between its values in the two images is greater than a Threshold value, which is also user defined.

Correlation Method

The Correlation Method is based on the Normalized Cross Correlation (NCC) coefficient between two images. NCC has values between 0.0 and 1.0. This coefficient measures image similarity. When NCC is 1.0, the current image matches exactly the reference image. The stop condition is NCC being below a threshold. To have a parameter similar to first case we define the image difference as: $(1 - NCC) * 100\%$. When the difference between two images is greater than this value a stop condition will be generated.

The search results are based on the following user-specified parameters:

Threshold percentage value

Threshold specifies the amount a pixel value must change in order to be counted as a changed pixel. The value is calculated as a percentage from the maximum possible pixel value. A higher value for this parameter is useful for noisy images. 8-bit images require a higher threshold than 16-bit images.

Changed areas percentage value

Change area specifies the percentage of image pixels that must change in order to recognize an image change and generate a player stop condition.

Search Step

Search Step specifies the difference between the image numbers to be compared when running the search. This parameter helps to accelerate the search by processing fewer images.

Incremental search

If disabled, unchecked, the search is done by comparing the current image with the reference image, the image that was displayed when you initiated the search.

If enabled, the comparison will be done between the current image and the previous image, (separated by the step increment).

▼ **Save Cine.. Button**

The Save Cine.. button, when selected, allows the end-user to save the selected Cine file.

▼ **Save Cine.. Button Down-Arrow**

When the Save Cine.. Button down-arrow is clicked, a pop-up selection window will be displayed allowing the end-user to select the save method desired, choices include:

Save Cine to File

The Save to File command is used to save image data recorded in a cameras' RAM to a user specified location, (for example, your system's hard drive, a networked drive or to some peripheral drive such as a floppy drive, Zip drive, or tape drive).

Update RAW File Metadata

The Update RAW File Metadata command instructs the software to update the active Cine file with any changes in it's metadata, for example; filename, image adjustments, etc.

Save All RAM Cines to File

The Save All RAM to File command is used to save all Cine image data recorded in a cameras' RAM to a user specified location, (for example, your system's hard drive, a networked drive or to some peripheral drive such as a floppy drive, Zip drive, or tape drive). This feature is extremely useful when the MultiCine feature has been implemented in the camera as it will save all memory segments, with image data stored into it, to the specified location.

The Phantom Camera Control application will save the Cine files from each of the memory segments, of the selected camera, with a user specified file name along with an appended extension (Cine#) for each of the Cine files.

Save All Flash Cines to File

The Save All Flash to File command is used to save all Cine files stored in the non-volatile Flash memory or an attached Phantom CineMag, of the selected camera. The files are saved with a user specified file name along with an appended extension, (camera_name_FlashCine#.ext), to a user specified location, (for example, your system's hard drive, a networked drive or to some peripheral drive such as a floppy drive, Zip drive, or tape drive).

Save RAM Cine to Flash

Non-volatile Flash Memory is an optionally installed solid-state flash storage module located in a Phantom camera. This feature helps protect data loss caused by a power interruption to the camera after recording one or more Cine files.

The Save RAM Cine to Flash command is used to save image data recorded in a cameras' RAM to the Phantom cameras' optionally installed integrated non-volatile Flash memory or in the CineMag.

Select&Save Cines to File

The Select&Save Cines to File feature allows the end-user to specify specific Cines, or MultiCine memory segments, or Cines stored in Flash/CineMag memory, from one or more attached Phantom cameras to save.

7.2 Step-by-Step Procedures

This module describes the most common tasks you will use when working with your Phantom camera. It is designed as a 'How-To' guide. Some of the procedures contain links to background information and other relevant subjects so you can just pick out the task you need to perform and begin.

The procedures in this module are intentionally kept as brief as possible. The focus is on how to use the menu bar commands, toolbar buttons, and control panel options, to effectively use your Phantom imaging system.

7.2.1 Toolbar Procedures

This topic describes the Step-by-Step procedures that can be performed via the 'Toolbar' buttons.

7.2.1.1 Open File

To open previously saved Cine files stored on an external storage device, i.e., laptop / computer, network drive, etc.:

STEP-BY-STEP PROCEDURES

1. Click on the Open File toolbar button.
2. In the Open Cine dialogue window:
 - a. Navigate to the folder, or directory, containing the Cine file to be opened, then
 - b. Select the Cine file(s) to be opened:
 - 1) Individual: highlight file
 - 2) Consecutive: highlight first file, then hold Shift key to select last file
 - 3) Non-consecutive: highlight first file, then hold CTRL key to select additional files
 - 4) Contained in a Single Folder: drag the mouse pointer to create a selection around the files you want to include
 - c. Click the Open button.

7.2.1.2 Batch Convert Files

The Batch Convert button can be used to convert a single saved Cine file to any of the supported file formats, or multiple Cine files to any of the supported file formats.

Cine files may also be parsed out as a series of still images for analysis. Many third party imaging applications can import a series of individual images for use in the image analysis process. This option provides a means to convert Cine files created with Phantom cameras to any of the supported image formats such as .bmp, tif, .gif etc.

NOTE

If a third party imaging application requires a format that Vision Research does not currently support, please contact us. In most cases, we can provide a conversion to the format needed at little or no cost.

STEP-BY-STEP PROCEDURES

1. Click on the Batch Convert toolbar button.
2. In the Open Cine(s) dialogue window:
 - a. Navigate to the folder containing the file(s) to be converted.
 - b. Select the Cine file(s) to be opened:
 - 1) Individual: highlight file
 - 2) Consecutive: highlight first file, then hold Shift key to select last file
 - 3) Non-consecutive: highlight first file, then hold CTRL key to select additional files
 - 4) Contained in a Single Folder: drag the mouse pointer to create a selection around the files you want to include
 - c. Click the Open button.
3. In the Multifile Convert Destination dialogue window:
 - a. Navigate to the folder the file(s) are to be saved into.
 - b. Enter a filename in the 'File' data entry field.

NOTE

PCC will replace the name entry with the original file name of the file being converted.

- c. Select the file format from the 'Save As Type' pull-down selection list. For details on the various supported file formats see [Functional Descriptions>Supported File Formats](#), including:
 - 1) Compressed (Cine JPEG):
 - a) Select 'Cine JPEG, *.cc1' from the 'Save As Type' pull-down selection list.

Phantom uses a JPEG compression method that allows you to choose either loss-less compression, or compression with some loss of detail. Use a Lossy compression, (1-99%), if an even more compact file is required. The default value of 100% quality compresses the file with no loss of detail; a quality value of 75% compresses the file 25% while retaining 75% of the original details.
 - b) Specify the compression 'Quality (1...100)' under the 'Save Options'.

The value entered represents the amount of quality retained in the compressed images, not the amount of reductions in file size. The reduction in file size will vary depending on the image contents.
 - 2) Movie Format (AVI, Multipage TIFF, H264, ProRes, QuickTime Uncompressed):

If the AVI, *.avi file format has been selected, you will need to specify the following options in the 'AVI Options' dialogue window specify the 'Frame Rate', 'Video Compressor', and 'Compression Quality'.

NOTE

Some video codecs (coder/decoder) can be further configured by clicking on the Configure button in the 'Video Compressor' dialogue window, if available. This user-manual does not detail the various video compressors or their specifics.

- 3) Image Stack (Windows BMP, OS/2 BMP, PCX, TGA, TIFF, LEAD, LEAD JIFIF, LEAD JTIF, JPEG, JTIF, RAW, DNG, DPX, EXR)
 - a) Single File Conversion: Enter the special [Phantom File Naming Convention](#) characters, i.

e., image+4, in the 'File' name data entry field. The system will automatically add the appropriate filename extension for you when you select the 'Save as type'.

b) Multiple File Conversion: Enter the special [Phantom File Naming Convention](#) characters, i.e., +4, in the 'File' name data entry field. The system will automatically add the appropriate filename extension for you when you select the 'Save as type'.

d. Select the 'Range Option' from the pull-down selection list:

[Mark-In, Mark-Out], Full Cine, User Defined

e. Specify the desired 'Save Options'

f. Click the 'Convert' button. The system will display a Batch File Conversion window indicating the progress of the conversion process. When completed the Batch File Conversion window will read 100%.

NOTE

If the 'Close' button is depressed before the file has finished being converted, the system will display the Abort? dialogue window. If Yes is selected the conversion process will cease, however any portion of the file that has been process will be converted to the specified location.

7.2.1.3 Merging Images Into a Cine

The Merge Images to Cine toolbar button allows the user to import and convert a series of images such as .tif, .bmp, etc. to the Phantom Cine format. This can be very useful if you have an imaging system manufactured by another manufacturer and want to use the many measurement and image processing tools found in the Phantom software.

STEP-BY-STEP PROCEDURE

CAUTION:

The image file names must be sequentially numbered from first to last for PCC to correctly merge the images to a Cine file. If they are not sequential they will be merged in the order they are shown in the directory listing.

To merge a series of individual image files to the Cine format:

1. Click the 'Merge Images to Cine' toolbar button.
2. Navigate to the directory the individual images to be imported are stored in, from the 'Open Image File' dialog box, and highlight the first image file in the sequence.
3. Click the 'Open' button.
4. The system now prompts the user to specify whether or not to merge all image files (Yes) in the directory to the new Cine file, or only the images numbered in succession (No).
5. Click Yes to proceed to the 'Merge and Resample Images' dialog box.
6. Define the 'Merge and Resample Images' dialog box parameters. The following is a brief description of the Merge and Resample dialogue window:
 - a. All Files Count - the number of individual files in the directory selected.

- b. Width & Height - Reports the dimensions of images in the selected directory.
 - c. BPP (Bits Per Pixel) - Reports the bit depth of the images in the directory, usually 8BPP or 24BPP.
 - d. Output File Name – indicates where the path to the first image being merged.
 - e. Clip – allows the user to crop the image.
 - f. Resample – specifies the aspect ratio size of the file being created.
7. If a header (.chd) file already exists within the specified directory the system prompts the user to specify if the existing header file is to be used.
8. Click Yes to create the new Cine file.

7.2.1.4 Graphics

The Graphics button allows the user to open a graphical interface (displayed to the right of the Cine image). It is used to display signal acquisition information or position/speed/acceleration and the coordinate X or Y of tracked collect points. The displayed values take into account the global measurement preferences for position/speed/acceleration.

Only windows for the type of signals that are present in the .Cine file will be visible.

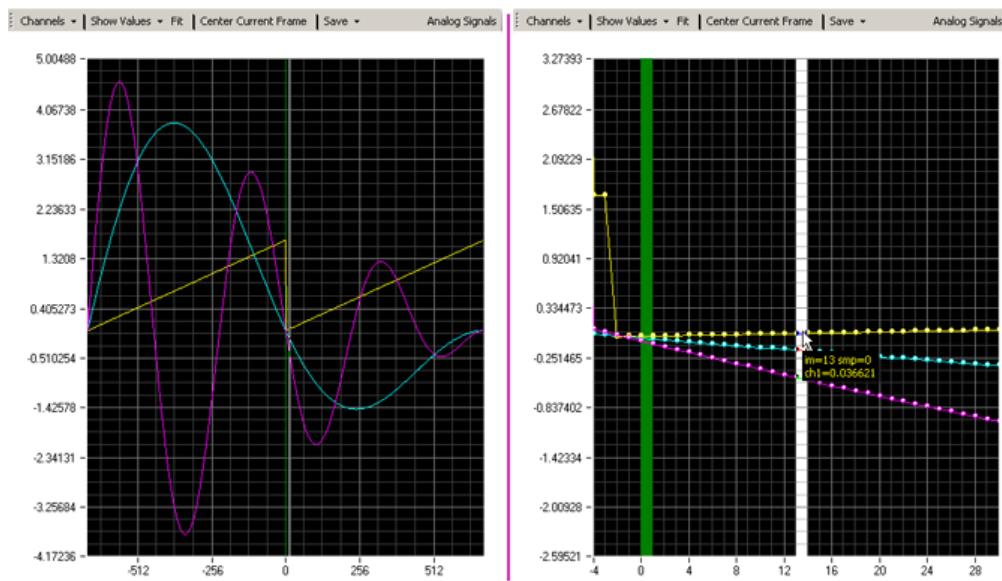
STEP-BY-STEP PROCEDURES

► Common Steps

1. Select a Cine file 'Signal Acquisition' or 'Collect Points' data has been recorded with.
2. Click the 'Graphics' toolbar button.

▼ Signal Acquisition (Analog Channels)

By default the chart displays a graph of all measurement values for all analog signals specified by the user in the Live>Advanced Settings>DAQ Signals Configure dialogue window. The software assigns each channel a unique color. The numbers below the chart are the frame numbers of the Cine file; numbers to the right represent the measurement value. The green line, visible in the zoomed view, represents the position of the trigger frame; the white line is the current frame position. The dots on each channel are the acquired signal values (measurements). Placing the cursor over an analog sample will display the following information:

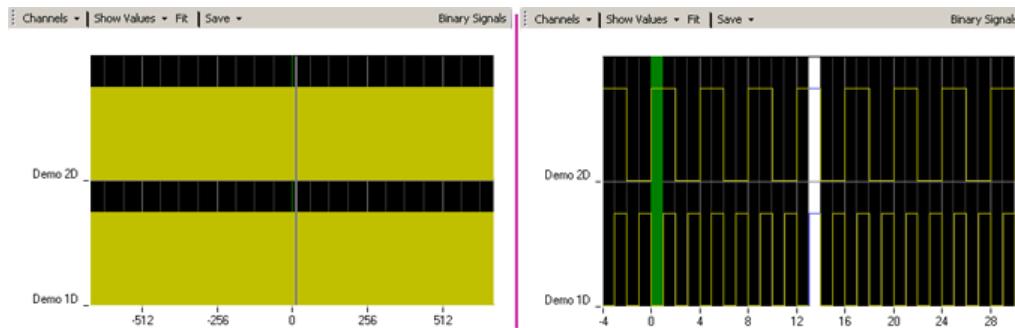


Signal Acquisition Chart displaying three analog acquisition signals (left); zoomed view (right)

- im (image) - indicates the image number the specified reference point of the signal is associated with.
 - smp (sample) - indicates the sample number of the specified reference point for the associated image.
 - ch (number) - indicates the associated value (dependent on what the signal represents) of the reference point.
1. Click the Channels pull-down selection list to specify the channel(s) to be displayed (by default all channels are displayed).
 2. Click Show Values / Zoom pull-down selection list to:
 - a. Show Values - used to display a signal value by moving the cursor over the analog signal(s) in the chart.
 - b. Window / Horizontal / Vertical Zoom - used to drill down into the graphical display to view measurement points.
 - c. Zoom In Around Point / Zoom Out Around Point - used to zoom in to / out of the display by holding down the left mouse button until the desired level of zoom is reached or right mouse click on display and select the 'Zoom In / Out Around Point one time.
 - d. Pan - moves the chart around by holding in the left mouse button and moving the mouse in the direction you wish to move the chart.
 3. Click 'Fit' to reset the display window to its' original size to display the entire signal range for all frames.
 4. Click 'Center Current Frame' to center the chart so the current frame is displayed in the center of the chart.
 5. Click 'Save' to create a comma separated text file and select the type of file to be saved from the pull-down selection list:
 - a. All - creates a report file for all the analog channels visible or not.

- b. Visible - creates a report file for the visible analog channels only.
- 6. In the 'Save Signal(s)' dialogue window navigate to the folder the report file is to be saved to.
- 7. Enter a filename for the report file being saved in the 'File name:' field (software will automatically add the .cvs file extension).
- 8. Click 'Save' to create file; 'Cancel' to abort.

▼ Signal Acquisition (Binary Channels)



Signal Acquisition Chart displaying two digital signal acquisition channels (left); zoomed view (right)

By default the chart displays a graph of all measurement values for all digital signals specified by the user in the Live>Advanced Settings>DAQ Signals Configure dialogue window. The numbers below the chart are the frame numbers of the Cine file. The green line, visible in the zoomed view, represents the position of the trigger frame; the white line is the current frame position.

1. Click the Channels pull-down selection list to specify the channel(s) to be displayed (by default all channels are displayed).
2. Click Show Values / Zoom pull-down selection list to:
 - a. Show Values - used to display a signal value by moving the cursor over the analog signal(s) in the chart.
 - b. Horizontal Zoom - used to drill down into the graphical display to view measurement points.
 - c. Zoom In Around Point / Zoom Out Around Point - used to zoom in to / out of the display by holding down the left mouse button until the desired level of zoom is reached or right mouse click on display and select the 'Zoom In / Out Around Point one time.'
 - d. Pan - moves the chart around by holding in the left mouse button and moving the mouse in the direction you wish to move the chart.
3. Click 'Fit' to reset the display window to its' original size to display the entire signal range for all frames.
4. Click 'Save' to create a comma separated text file and select the type of file to be saved from the pull-down selection list:
 - a. All - creates a report file for all the analog channels visible or not.
 - b. Visible - creates a report file for the visible analog channels only.
5. In the 'Save Signal(s)' dialogue window navigate to the folder the report file is to be saved to.

6. Enter a filename for the report file being saved in the 'File name:' field (software will automatically add the .cvs file extension).

7. Click 'Save' to create file; 'Cancel' to abort.

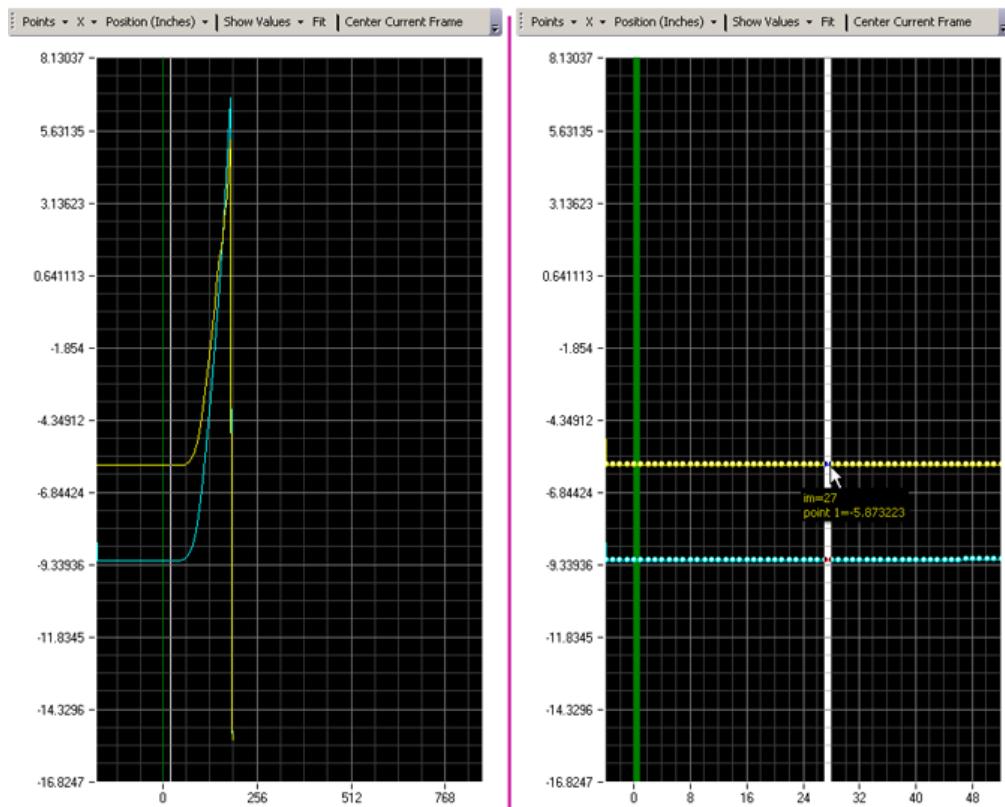
▼ Signal Acquisition (Range Data)



Az24El24 Protocol Signal Acquisition Example

Displays the 'Range Data' measurement values.

▼ Collect Points



Collect Points Chart displaying two 'X' coordinate points (left); zoomed view (right)

By default the chart displays a graph of all measurement values for all collected track points specified by the user in the Play>Measurement>Collect Points group. The software assigns each tracked point a unique color. The numbers below the chart are the frame numbers of the Cine file, the numbers to the right represent the tracked point values (defined in the

Manager>Application Preferences>Measurement>Units Group). The green line, visible in the zoomed view, represents the position of the trigger frame; the white line is the current frame position. The dots are the tracked points. Placing the cursor over a tracked point displays the following information:

- im (image) - indicates the image number the specified reference point of the signal is associated with.
 - point (number) - indicates the associated tracked point value dependent on the chart type (position / speed / acceleration).
1. Click the Points pull-down selection list to select the Tracked Point(s) to be displayed (by default all tracked points are displayed).
 2. Click the X or Y pull-down selection list and select the coordinate (X / Y) of the Tracked Point (s) to be displayed.
 3. Click the Position or Speed or Acceleration pull-down selection list and select the type of chart to display:
 - a. Position
 - b. Speed
 - c. Acceleration
 4. Click Show Values / Zoom pull-down selection list to:
 - a. Show Values - used to display a collect point value by moving the cursor over the point in the chart.
 - b. Window / Horizontal / Vertical Zoom - used to drill down into the graphical display to view measurement points.
 - c. Zoom In Around Point / Zoom Out Around Point - used to zoom in to / out of the display by holding down the left mouse button until the desired level of zoom is reach or right mouse click on display and select the 'Zoom In / Out Around Point one time.
 - d. Pan - moves the chart around by holding in the left mouse button and moving the mouse in the direction you wish to move the chart.
 5. Click 'Fit' to resets the display window to its' original size to display the entire signal range for all frames.
 6. Click 'Center Current Frame' to center the chart so the current frame is displayed in the center of the chart.
 7. Click 'Save' to create a comma separated text file and select the type of file to be saved from the pull-down selection list:
 - a. All - creates a report file for all the analog channels visible or not.
 - b. Visible - creates a report file for the visible analog channels only.
 8. In the 'Save Signal(s) dialogue window navigate to the folder the report file is to be saved to.
 9. Enter a filename for the report file being saved in the 'File name:' field (software will automatically add the .cvs file extension).
 10. Click 'Save' to create file; 'Cancel' to abort.

7.2.1.5 Image Tools

The Image Tools options are used to display an image Histogram, perform image processing adjustments, or apply various image processing effects to the images displayed in either the Preview or Playback Panels.

The image processing techniques can be applied to the entire recording, alone or in combinations, to bring out hidden features and details. The type of effects available will be depended on the camera model the Cine or images were recorded from, (color or monochrome, 8-, 10-, 12-, 14-bit pixel image bit depth).

NOTE

Not all image processing techniques are appropriate for every image. Vision Research recommends the user experiment with the image processing effects to find the best enhancements for their needs.

The options will vary based on the camera model, and image characteristics (color/monochrome). For a brief description of the supported image processing effects and filters, see; [Functional Descriptions>Image Processing Effects and Filters](#).

CAUTION

When using a monitor to apply image processing effects, the White Balance control, and all brightness, contrast, gamma, and color adjustments should be changed only when using a monitor that is in correct adjustment. Occasionally, an operator will over adjust the monitor settings in extreme lighting conditions, such as in direct sunlight, in an attempt to get a better look at what he is trying to image. 'Correcting' the appearance of images on a poorly adjusted monitor will have a negative result on Cine recordings that will later be viewed on a properly adjusted monitor under normal conditions.

7.2.1.5.1 Adjustments

STEP-BY-STEP PROCEDURES

1. Click on the 'Image Tools' toolbar button.
2. Select Standard curves (Gamma & Log Mode) for cameras that have 'log' in info.features (Phantom Flex4K) from the the Standard Curves Selector.

The Flex4K video outputs can be switched between Rec709 and a factory installed log curve. By exposing in the Phantom log mode, you get a 1.8 stop exposure index (EI) boost, which takes advantage of the sensor's low noise floor and maximizes the dynamic range.

When in Log mode, the camera's gamma, gain and other image tools settings no longer apply. EI (Exposure Index) is a reference value for the ISO level at the current image settings. The EI can be set to one of the available pre-sets, or simply referenced after the image processing settings are dialed in

3. Move the appropriate 'Adjustments' slider to the desired settings to adjustment:
 - a. Brightness (%) - adjusts the brightness of monochrome or color images. The factory default value is set to 0.00 percent. Moving the slide bar to the left, in the negative direction from 0.00 percent, results in the images being displayed darker, while moving the slide bar to the right or in a positive direction from 0.00 percent results in the images being displayed lighter.
 - b. Gain - adjusts the contrast of monochrome or color images. The factory default value is set

to 1.000. Moving the slide bar to the left from 1.000 results in the images being displayed with less contrast, while moving the slide bar to the right from 1.000 result in the images being displayed with greater contrast.

- c. Gamma - adjusts the gamma correction of monochrome or color images. The factory default value is set to 2.222. Moving the slide bar to the left from 2.222, results in the images being displayed with fewer gamma corrections, while moving the slide bar to the right from 2.222 results in the images being displayed with greater gamma correction.
- d. Toe - adjusts the lower portion of the gamma curve only. Lowering the toe value will lift the shadow detail without affecting the highlights. By default, this setting is 1.0, however a change in Exposure Index (E.I.) can change this value, so it will commonly display a value between 0.1 and 1.0.
- e. Saturation (Color Cameras Only) - adjusts the color saturation of the images being displayed. The factory default value is set to one. Moving the slide bar to the left, results in the images being displayed with less brilliant color, while moving the slide bar to the right results in the images being displayed with more brilliant color.
- g. White Balance - Because of the different 'colors' of various types of light sources, a color cameras' preview images may have a color tint that may not appear quite right during setup. Phantom cameras' have several adjustments methods to assist in correcting image color. Using the fast and easy to use White Balance control should be the first step in color adjustment.

White Balance adjustments can be made manually by moving the sliders or automatically by right click on a region in the displayed image that represent white.

The camera model, the live or recorded images are from, determine the available options are including:

- 1) Gain Red
- 2) Gain Blue
- 3) Temp (K) - the color temperature in Kelvin; adjusts the red and blue color components.
- 4) Tint - adjusts the magenta and green on top of the color temperature.
- 5) Default White Balance - resets the 'White Balance' settings back to factory default.

h. Color Interpolation Algorithm

To reconstruct a full-color image from the data collected using a color filtering array (CFA), a form of interpolation is needed to fill in blanks. The mathematics here is subject to individual implementation, and is called demosaicing. The aim of a demosaicing algorithm is to reconstruct a full-color image (i.e. a full set of color triples) from the spatially under-sampled color channel's output from the CFA.

PCC allows the end-user to choose a desirable algorithm that will be applied to the image or Cine file in an active Preview/Playback Panel, from a Color Interpolation Algorithm pull-down selection list, including:

- 1) Fastest
- 2) Fast
- 3) Medium (Default)
- 4) Good
- 5) Best
- 6) None

i. Filter - selects the desired image filtering algorithms from the pull-down selection list, including:

- 1) None -displays the images as they were originally recorded, prior to applying any of the

other filtering techniques.

- 2) Smooth Gauss 3x3 or 5x5 - uses a 3-by-3-, or 5-by-5-pixel Gaussian filter to blur or 'smooth' the images.
- 3) Sharpen -use to emphasize the edges within an image. The result is that the image appears to have increased sharpness.
- 4) Edge Hipass 3x3 or 5x5 - use to enhance, or isolate, 3-by-3- or 5-by-5-pixel transition areas / edges of an image by enhancing the high-frequency detail.
- 5) Edge Laplacian 3x3 or 5x5

The 5x5 Laplacian used is a convoluted mask to approximate the second derivative, unlike the Sobel method which approximates the gradient. And instead of two 3x3 Sobel masks, one for the x and y directions, Laplace uses one 5x5 mask for the 2nd derivative in both the x and y directions. However, because these masks are approximating a second derivative measurement on the image, they are very sensitive to noise.

6) Edge Prewitt Horizontal or Vertical

Prewitt is a method of edge detection in computer graphics, which calculates the maximum response of a set of convolution kernels to find the local edge orientation for each pixel. Various kernels can be used for this operation. The whole set of 8 kernels is produced by taking one of the kernels and rotating its coefficients circularly. Each of the resulting kernels is sensitive to an edge orientation ranging from 0° to 315° in steps of 45°, where 0° corresponds to a vertical edge.

The maximum response for each pixel is the value of the corresponding pixel in the output magnitude image. The values for the output orientation image lie between 1 and 8, depending on which of the 8 kernels produced the maximum response.

This edge detection method is also called edge template matching, because a set of edge templates is matched to the image, each representing an edge in a certain orientation. The edge magnitude and orientation of a pixel are then determined by the template that matches the local area of the pixel the best.

The Prewitt edge detector is an appropriate way to estimate the magnitude and orientation of an edge. Although differential gradient edge detection needs a rather time-consuming calculation to estimate the orientation from the magnitudes in the x- and y-directions, the Prewitt edge detection obtains the orientation directly from the kernel with the maximum response. The set of kernels is limited to 8 possible orientations. However, experience shows that most direct orientation estimates are not much more accurate. On the other hand, the set of kernels needs 8 convolutions for each pixel, whereas the set of the kernel in gradient method needs only 2, one kernel being sensitive to edges in the vertical direction and one to the horizontal direction. The result for the edge magnitude image is very similar with both methods, provided the same convolving kernel is used.

7) Edge Sobel Horizontal or Vertical

The Sobel operator is an operator used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector.

In simple terms, the operator calculates the gradient of the image intensity at each point, giving the direction of the largest possible increase from light to dark and the rate of change in that direction. The result, therefore, shows how 'abruptly' or 'smoothly' the image changes at that point, and therefore, how likely it is that part of the image represents an edge, as well as how that edge is likely to be oriented. In practice, the magnitude (likelihood of an edge) calculation is more reliable and easier to interpret

than the direction calculation.

Mathematically, the gradient of a two-variable function (here the image intensity function) is at each image point a 2D vector with the components given by the derivatives in the horizontal and vertical directions. At each image point, the gradient vector points in the direction of the largest possible intensity increase, and the length of the gradient vector corresponds to the rate of change in that direction. This implies that the result of the Sobel operator at an image point which is in a region of constant image intensity is a zero vector and at a point on an edge is a vector which points across the edge, from darker to brighter values.

For examples the various supported image processing effects and filters, see [Functional Descriptions>Image Processing Effects and Filters](#).

- j. Sensitivity (bit-depth) - adjusts the dynamic range of the image, (the desired number of bits per pixel), displayed on-screen. This feature will only be available if the camera has been set to record at bit depth greater than 8-bits via the Camera Settings>Bit Depth pull-down selection list and if the option 'Transfer format for Play' in Manager>Preferences>General dialogue window is set to a value greater than 8.

For details on setting the camera's bit-depth see; [Step-by-Step Procedures>Live Panel>Camera Settings>Define the Image Pixel Bit Depth](#).

7.2.1.5.2 Advanced Adjustments

STEP-BY-STEP PROCEDURES

1. Click on the 'Image Tools' toolbar button.
2. Specify the 'Advance Adjustments'

The camera model, the live or recorded images are from, determine the available options are including:

- a. Flare (%) - adjusts the 'Flare' video adjustment.
- b. Pedestal - adjusting the pedestal values redefines separate video monitor RGB (Red, Green, Blue) brightness adjustments by adjusting a percentage of the:
 - 1) Red Pedestal
 - 2) Green Pedestal
 - 3) Blue Pedestal
- c. Gain - used to increase or decrease the individual R G, B (Red, Green, Blue) levels. Different devices detect or reproduce a given R G, B value differently, since the color elements (such as phosphors or dyes) and their response to the individual R, G, and B levels vary from manufacturer to manufacturer, or even in the same device over time.
- d. Gamma - used to bring out details of the images by adjusting the non-linear relationships between the R G, B, signal levels and the brightness of their output, (a small signal level change at low voltage produces a larger variation in brightness than the same change in level at high voltage. Adjusting these gamma settings is the compensation for this non-linearity. Only available when Gamma value in Adjustments sub panel is equal to 1.

7.2.1.5.3 Tone

STEP-BY-STEP PROCEDURES

1. Click on the 'Image Tools' toolbar button.

2. Adjust 'Tone'

Tone is a lookup table that is applied to all three color (R, G, B) components, which allow the end-user to convert any input value to any output value to create a tone curve applied to the images being transmitted from the camera. The horizontal input is on the O_x axis while the vertical input is on the O_y axis. Both inputs are assumed to have conventional values set from 0.0 to 1.0, (1.0 correspond to the maximum pixel value, i.e., 255 on 8-bits or 4095 on 12-bits).

The end-user only needs to specify a few intermediate points to create a unique tone curve. The software fills the intervals between the points using spline functions. As the point coordinates are entered into a table, the software updates the tone curve and provides the end-user with visual feedback of the tone curve shape.

- a. To create a Tone Table (tone curve) right mouse click along the curve, then drag the point(s) to change the position.
 - The XY graph represents the tonal range from shadows (left) to highlights (right).
 - Points above the line increase brightness; points below decrease it.
- b. To delete a point in the Tone Table:
 - 1) Click the down-arrow to the left of the Tone Table select, then
 - 2) Highlight the point to be removed in the Tone Table, then
 - 3) Press the Delete key.
- c. To reset the tone curve back to the tone curves' conventional values (0.0 to 1.0) click the Reset button.
- d. To Save the tone curve along with other image adjustments:
 - 1) Enter a name for the tone curve in the Label entry field, then
 - 2) Click the Save button located at the bottom of the Image Tool dialogue window.

NOTE

Cines saved with tone curve adjustments will retain the tone curve as part of the Cine file meta-data. The tone curve associated with an opened saved Cine file can be redefined has per the end-user preference.

Alternatively you can create a tone curve by filling the numeric table with point-coordinates with values between 0.0 and 1.0:

- a. Click on the data entry field in the row just below the X column to adjust the vertical input, then enter a value between 0.0 and 1.0.
- b. Click on the data entry field in the row just below the Y column to adjust the horizontal input, then enter a value between 0.0 and 1.0.
- c. Press the Enter key to apply the curve.

7.2.1.5.4 Color Matrix

STEP-BY-STEP PROCEDURES

1. Click on the 'Image Tools' toolbar button.
2. Apply a 'Color Matrix'

There are maximum five color matrices that can be created or edited. The matrix drop-down is used to select a matrix.

The associated G-R, B-R, R-G, B-G, R-B, and G-B fields, below the matrix number field, are the

specific color matrix variables. G-R represents green into red, B-R represents blue into red and so forth.

7.2.1.5.5 Geometry

STEP-BY-STEP PROCEDURES

1. Click on the 'Image Tools' toolbar button.
2. Select the desired Geometry & Overlays.
 - a. Geometry:
 - 1) Flip H - displays the image as a mirrored image, the image flips horizontally.
 - 2) Flip V - displays the image upside-down, the image flips vertically
 - 3) Rotate - rotates and displays the image 90° counter-clockwise from the original image.
 - 4) Clockwise - rotates and displays the image 90° clockwise from the original image.
 - b. Overlays:
 - 1) Grid - places a grid pattern over the image. This pattern is not recorded with the image data.
 - 2) Cross - places a cross-hair over the center of the image. The cross-hair will not be recorded with the image data.
 - c. Crop and Resample:
 - 1) Crop:
 - a) Enter the X Y coordinates. These coordinates represent the rectangle's top left pixel.
 - b) Enter the desire Crop Width and Height into the entry fields, then enable, check the Crop enable box, or
 - c) Place the cursor over the image, hold down the left mouse key, to draw a rectangle over the image area of interest. Release the mouse key and select the Crop option from the pop-up selection window.
 - 2) Resample:
 - a) Enter the desired Resample Width and Height into the entry fields, then enable, check the Resample enable box, or
 - b) Click the down arrow to the right of the custom entry field and select a predefined resample size from the pull-down selection list.
 - 3) Production Area:
 - a) Size - used to specify the size of the 'Production Area' rectangle (Width x Height) by selecting a predefined size from the pull-down selection list, or enter a custom size in the 'Size' data entry field. The production area can be thought of as 'the area of the captured image that will be used in the final production'.
 - b) Offset - moves the 'Production Area' rectangle to the specified X-Y 'Offset' coordinates.

7.2.1.5.6 Image Tools Buttons

STEP-BY-STEP PROCEDURES

1. Click the following 'Image Tools Buttons' to:
 - a. Disable - temporarily turns off any image adjustments; click it again to re-enable the image adjustments.

- b. Save - save the 'Image Tools' settings to a file.
- c. Load - recalls and applies previous saved 'Image Tools' settings to the selected camera or Cine file, or, to the selected group of cameras or files.
- d. Default - resets all 'Image Tools' options back to the factory default settings, except for 'White Balance', and 'Color Matrix' settings.

7.2.1.6 Video Out

The 'Video Out' toolbar button initiates the PVP (Phantom Video Player) application.

PVP can be used to control (capture, review, edit, and/or save a Cine recorded into the cameras' RAM to a hard drive, or attached Phantom CineMag.) a Phantom cameras' and/or Phantom CineStations' video output parameters. PVP requires the use of the Phantom cameras' or CineStations' video output, attached to a monitor or Viewfinder), to view live preview images or review the recorded Cine images.,.

STEP-BY-STEP PROCEDURES

1. Click on the 'Video Out' toolbar button.
2. Click the Settings button in the PVP.
3. Apply the desired video options.

For details on how to utilize the PVP (Phantom Video Play) see: [Phantom Video Player Help File](#).

7.2.1.7 Snapshot

The SnapShot feature opens the image displayed in the Preview/Playback Panel, in the user-specified screen capture (default MSPaint) application defined via the [Manager>Application Preferences](#) dialogue window.

STEP-BY-STEP PROCEDURES

To create an image file of the image presently being displayed in the Preview/Playback Panel when the SnapShot button is selected.

1. Click on the 'Snapshot' toolbar button, then
2. Refer to the Manufacture's Help File, for application specified in the Preferences>Snapshot>Application entry field, for details on using the application to edit and save the captured image.

7.2.2 Preview/Playback Panel Procedures

This topic describes the Step-by-Step procedures that can be performed via the 'Preview' or 'Playback' panels.

7.2.2.1 Performing a White Balance Adjustment

Because of the different 'colors' of various types of light sources, a color cameras' preview images may have a color tint that may not appear quite right during setup. The Phantom camera has several adjustment methods to assist in correcting image color. Utilizing the fast and easy-to-use White Balance control should be the first step in color adjustment. Failure to perform a white balance could

result in an unsightly, unnatural color cast.

White balance adjustment can be performed, in a Preview or a Playback Panel, on any live or RAM, internal Flash, Phantom CineMag, or CineFlash playback image.

STEP-BY-STEP PROCEDURE

1. Place the cursor in the center of a region, in the Preview / Playback Panel, you chosen as the white reference area, and right mouse click.
2. Select 'White Balance' in the pop-up window to perform a White Balance calibration adjustment, or
3. Click anywhere, other than on the 'White Balance' command, in the Preview / Playback Panel to cancel the White Balance process.

CAUTION

White Balance adjustments are not reliable if performed over an area with any saturated pixels.

7.2.3 Manager Tab Procedures

This section describes the Step-by-Step procedures that can be performed via the 'Manager' tab.

7.2.3.1 Selecting a Camera

STEP-BY-STEP PROCEDURE

To open a 'Preview Panel' for a specific camera:

1. Double-click the camera for use from the 'Cameras' list, or
2. Right-click the camera, and select 'Show Only Images From This' in the pop-up window.

NOTE

PCC allows multiple cameras, and multiple Cine files to be accessed and controlled. However, when using the steps described above you must select each Phantom camera or Cine file to be controlled.

For details on controlling multiple Phantom Cameras simultaneously, see: [Step-by-Step Procedures>Simultaneous Multi-Camera Control Procedures](#).

7.2.3.2 Viewing Camera Information

The 'Camera Info' dialogue window eases the process of gathering details about, or changing the name of a specific camera.

STEP-BY-STEP PROCEDURE

1. Right-click the camera, and select 'Device Info' in the pop-up window. The 'Camera Info' dialogue window opens, including:
 - a. Camera Name - displays the assigned name of the camera. To change enter a new name in

- the data entry field, and press the 'Enter' key to apply the name change.
- b. Serial - displays the 'Serial Number' of the camera.
 - c. IP - displays the Vision Research assigned IP Address of the camera.
 - d. Hardware Version - displays the Hardware Code and the Type of the camera.
 - e. PhFW Version - displays the Firmware version installed in the camera.
 - f. RAM (FBM) (MB) - display the size of the 'Frame Buffer Memory' (in Mega-Bytes).
 - g. Flash (MB) - displays the size of Flash (internal, CineMag, CineFlash, CompactFlash) memory (in Mega-Bytes) available.

7.2.3.3 Rename a Camera

To help identify multiple cameras listed under the 'Cameras' group (folder), in the 'Manager' tab, PCC provides three methods the end-user to rename them.

STEP-BY-STEP PROCEDURE

1. Right-click the camera, and select 'Device Info' in the pop-up window, then enter the new name in the data entry field, and press the 'Enter', or
2. Slowly click twice on the camera listed under the Cameras' list, then enter it's new name.
3. Enter the new name in the [Live>Camera Info>Camera Name](#) data entry field.

7.2.3.4 Selecting a Cine File

STEP-BY-STEP PROCEDURE

To open a Cine from a camera (Cameras list) or Files list:

1. Double-click the Cine to be reviewed, or
2. Right-click the Cine, and select 'Show Only Images From This' in the pop-up window.

NOTE

PCC allows multiple cameras, and multiple Cine files to be accessed and controlled. However, when using the steps described above you must select each Phantom camera or Cine file to be controlled.

For details on controlling multiple Phantom Cameras simultaneously, see: [Step-by-Step Procedures>Simultaneous Multi-Camera Control Procedures](#).

7.2.3.5 Adding a Simulated Camera

The 'Add Simulated Camera' toolbar button is used to specify a Phantom camera model to simulate.

STEP-BY-STEP PROCEDURE

1. Click the 'Add Simulated Camera' toolbar button.
2. In the 'Add Simulated Camera' dialogue window appears:

- a. Click on the down-arrow to the right of the 'Camera Model' data entry field, and select the camera model you wish to simulate from the pull-down selection list, then
- b. Enter the serial number of the Phantom camera being simulated in the Serial field. If you are not trying to simulate an actual Phantom camera, and are simply simulating a Phantom camera model, assign any serial number for the simulated camera.
- c. Click the 'Add Simulated Camera' button. The simulated camera will be displayed under the Cameras group tree in the Manager Panel.
- d. Click the Close button.

7.2.3.6 Deleting (Remove) Groups

STEP-BY-STEP PROCEDURE

1. Highlight the previously created sub-group, then click the 'Delete' button. The selected sub-group will be removed from the Manager Panel, however, the cameras or Cine files associated with the deleted sub-group will not be deleted, they will be moved into the tree root.

CAUTION

Removing Cines stored in the camera's internal Flash memory module or attached Phantom CineMag will delete all the Cines, unlike those stored in a Phantom CineFlash where the end-user can select to delete a single Cine, all the Cines, or format the Phantom CineFlash unit.

7.2.3.7 Defining the (PCC) Application Preferences

The Preferences dialogue window is used to define general, end-user preferred, Phantom Camera Control GUI, (Graphical User Interface), settings, the Units of Measure that will be reported when performing measurements, Logging functions (used in conjunction with Vision Research Technical Support, and camera visibility options.

7.2.3.7.1 General Preferences

STEP-BY-STEP PROCEDURE

1. Click on the 'Application Preferences' toolbar button.
2. Click on the 'General Tab', if it is not already selected.

7.2.3.7.1.1 Interface

STEP-BY-STEP PROCEDURE

1. Specify the desired 'Interface' options:
 - a. Start Maximized - used to instruct the PCC software to open full screen, 'Start Maximized', or open in a standard window (disabled).
 - b. BackGround Color - allows you to change the background color of the 'Preview' and Playback' panels as follows:
 - 1) Click the 'Color' button, then
 - 2) Select a 'Basic color' from the predefined color pallid, or click the 'Define Custom Colors>>' button.

button and specify the desired color.

a) Click on an unused "Color customs' box, then

b) Move the cross-hair cursor to the desired color and select it, or

c) Enter the Red, Green, and Blue values to specify the color.

d) Click the 'Add to Custom Colors' button once the desired color has been determined, then

e) Click the OK button.

3) Click the OK button in the 'Preference' dialogue window for the change to take effect in the Preview and Playback panels.

2. Show Images during Continuous Recording - when selected will instruct the Phantom camera to continue to provide a live image display in the Preview Panel during the Continuous Recording process.

3. Persistent Border Data at Cine Save - when enable (checked) the border data set at Cine save will be persistent during the current session and in the next sessions too. It can be modified several times during the same session.

7.2.3.7.1.2 Units

The 'Units' options are used to specify the parameters' setup value when defining an associated parameter in the 'Live' tab.

These units can be specified using a set of predefined setting by clicking the 'Preset' buttons, (see Units Presets Table), or you can select a unit value from the associated pull-down selection list. EXP defines the exposure unit, EDR the Extreme Dynamic Range exposure unit, and the PTF specifies the post trigger frame unit.

STEP-BY-STEP PROCEDURE

1. Select the desired Units option from the pull-down selection lists or use the Presets buttons, (see 'Units Presets Table' below), to specify the parameters' setup value when defining the associated setting in the Live Panel>Cine Settings.

Units Presets Table

PRESETS	UNITS			DESCRIPTION
	EXP	EDR	PTF	
Scientific	MicroSec	MicroSec	Frames	The values of Exposure and EDR, (Extreme Dynamic Range), will be specified in microseconds. The maximum value of the Exposure Time depends on the period of the images, that is 1/Sample Rate value. The EDR maximum value is equal to the defined Exposure value. The PTF, (Post Trigger Frames), value is the number of frames, after a trigger signal has been detected by, the selected Phantom camera continues to capture before the recording process stops. The maximum value of Post Trigger Frames in the drop down list depends on the resolution and bit depth set, and on the memory capacity. If PTF value is set to the

				maximum value in the list, all images in camera's memory will be post trigger frames.
Percent	Percent	Percent	Percent	The Exposure value is a percentage of the maximum value. The EDR, (Extreme Dynamic Range), value is a percentage of the Exposure value chosen. The PTF, (Post Trigger Frames), value is a percentage of the maximum value described in the Scientific description.
Cinematography	Degree	Percent	Frames	Value of Exposure is in degrees, (shutter angle). It represents the degree of the open segment of the shutter. The maximum value, 360°, corresponds to a full period of the frame. The EDR, (Extreme Dynamic Range), value is a percentage from the exposure value you choose. The PTF, (Post Trigger Frames), value is the same as what was described in value Scientific description.

7.2.3.7.1.3 Snapshot

The 'Snapshot' options are used to create an image file, of the the image presently being display in the active preview or playback panel.

STEP-BY-STEP PROCEDURE

1. Specify the desired 'Snapshot' options:
 - a. Application - is used to specify the full path of the application that will be used to create an image file of the image being displayed on in the active preview/playback panel. For example, C:\Program Files\TechSmith\SnagIt 7\SnagIt32.exe.
 - b. File Name - specifies the file name that will be assigned to the image file being created in the step above.
 - c. File Path - is where you will need to specify the complete path where the file being created will be written into, by
 - 1) Entering the complete path, or
 - 2) Click the Browse button and either:
 - a) Navigate to the Windows folder where the file is to be saved, alternatively
 - b) Click the 'Make New Folder' button, where the file is to be saved.
 - 3) Click the OK button to accept the save location; Click Cancel to ignore the location.

7.2.3.7.1.4 Imaging

STEP-BY-STEP PROCEDURE

1. Specify the 'Imaging' options.
 - a. Smooth Zoom - applies a Smooth Gaussian algorithm to the images being displayed in either the Preview or Playback Panels when enabled (checked).

- b. Use GPU for Processing - when enabled (checked) the graphics card processor will be used to accelerate processing and displaying Cines images, or accelerate processing Cine images during save/convert operations. Before enabling this feature see [Functional Descriptions>Performance Optimization Using the GPU](#).
- c. Image Display Transfer - selects the "Bit Depth" used for transferring images from the camera. This option has effect only for images that are going to be displayed, it has no effect on Cine images being saved from camera to a file. Options include:
 - 1) Bit Depth - preserves the behavior from previous versions of PCC software.
 - 2) 8 / 10P - reduces the data transferred and increase the transfer speed but will reduce or disable at the same time, the availability of the lower bits of pixels, to be used for increasing the apparent "Sensitivity" of the camera. (Used to reduce the image data size and to accelerate the image transfer on the network. The information stored in the camera and saved to Cine files is not affected.)

7.2.3.7.1.5 Other Options

STEP-BY-STEP PROCEDURE

1. Specify all 'Other Options'.
 - a. Language - presently Window Settings, English, Japanese, Spanish are supported.
 - b. Pixel Value- how the RGB (Red, Green, Blue) value is displayed in the 'Status Bar'.
 - 1) 0-255 - displays the value between 0 (black) and 255 (saturated) regardless of the pixel bit depth
 - 2) 0.0 - 1.0 - displays the value between 0.0000 (black) and 1.0000 (saturated) regardless of the pixel bit depth
 - 3) 0 - max. - the value displayed will be dependent upon the pixel bit depth (i.e., 0 to 255; 8-bits, 0 to 1023; 10-bits, 0 to 4095; 12-bits, etc.)
 - c. Ignore Data Acquisition Boards - when enabled (checked) PCC ignores any attached signal acquisition capture boards and used simulated signals for capture.
 - d. Cine Slider Tooltip - when the cursor is placed over the Cine Editor Bar in the Play panel the associated image (inside the 'Mark-In' and 'Mark-Out' points only) is displayed.

7.2.3.7.1.6 Preferences Buttons

1. Default - resets the 'General' preference parameters back to factory default settings.
2. OK - applies the changes specified in the 'Preferences' dialogue window.
3. Cancel instruct PCC to ignore any changes specified in the 'Preferences' dialogue window.

7.2.3.7.2 Measurement Preferences

The 'Measurement' tab defines the 'Unit of Measure' reported when performing motion analysis on a Cine. It also specifies if :

- A user-specified measurement 'scale' needs to be calibrated for each Cine file or applied to all Cine files.
- PCC will automatically advance to the next image when manually performing 'Collect Point' (tracking) measurements.

- A line graph will be overlayed on the images, of a Cine file, automatically (Autoratcking) performing 'Collect Point' measurements.

7.2.3.7.2.1 Units

The 'Units' options specify what the motion analysis results will report in. There are basically two methods to specify the measurement units:

STEP-BY-STEP PROCEDURE

1. Select the 'Measurement' tab in the 'Preference' dialogue window.
2. Select the 'Measurement' tab in the 'Preference' dialogue window. Click on the desired Presets:
 - a. U.S. Units - Selecting the U.S. Units preset option changes the:
 - 1) Distance Unit to Feet
 - 2) Speed Unit to Feet per Second
 - 3) Acceleration Unit to Feet per Second per Second
 - b. S.I. Units - Selecting the S.I. Units preset option changes the:
 - 1) Distance Unit to Meters
 - 2) Speed Unit to Meters per Second
 - 3) Acceleration Unit to Meters per Second per Second
2. Alternatively, select the desired unit of measure from the pull-down select list.

7.2.3.7.2.2 Other Options

The 'Units' options specify what the motion analysis results will report in. There are basically two methods to specify the measurement units:

STEP-BY-STEP PROCEDURE

1. Select the 'Measurement' tab in the 'Preference' dialogue window.
2. Specify all 'Other Options'.
 1. 'Unique scale per application' - when enabled (checked) the user-defined calibration scale will be applied to all Cine files measurements will be performed on. If unchecked, disable, the end-user will need to perform the calibration scale process on each file measurements are being taken on.
 2. 'Auto advance to next image during collect points' - when enabled (checked) the software automatically advances to the next image after all the points defined for one image have been manually collected.
 3. 'Auto update graphics during collect points' - when enabled (checked) the software displays a graphical trace of the points being tracked when performing 'Collect Point' measurements. This will slow down the tracking process.
2. Click the OK button to accept the selections, or Cancel button to ignore any changes specified in the Preference dialogue window.

7.2.3.7.3 Logging Preferences

When the Logging> Masks for selective dumps are defined the system will generate a PhCon.log file used primarily used by Vision Research and should only be used in conjunction with Vision Research Technical Support.

Vision Research's Technical Support Staff or Engineers will advise you how to use the feature and instruct you where to e-mail the results.

7.2.3.7.4 Camera Preferences

The Camera Visibility dialogue window is used to:

- Verify camera detection by viewing the cameras listed in the 'All Network Cameras' list.
- Add or Remove a camera in the 'Visible Cameras' list.

For details on how the 'All Network Cameras' list is built, see: [Functional Descriptions>Phantom Camera Control Application Polling Process](#)

STEP-BY-STEP PROCEDURE

1. Select the 'Camera' tab in the 'Preference' dialogue window.
2. Specify the 'Camera Visibility' parameters:
 - a. Select 'See all available cameras' - detect connected cameras and their IP addresses automatically, or
 - b. Select 'See only previous camera list' - to build a static IP address list of the cameras list as follows:
 - 1) Define the 'Visible Cameras' list:
Method 1: Adding a camera from the 'All network cameras' list
 - a) Verify all networked Phantom cameras have been detected via the polling process.
 - b) Click the camera to be added in the 'All network cameras' list.
 - c) Click the 'Add to visible list' button.Method 2: Manually adding a camera (not listed)
 - a) Click the 'Add IP Cam..' button.
 - b) Enter the IP address of the Phantom camera to be added in the 'Add Camera IP' dialogue window.
 - c) Click OK
 - 2) Remove a Phantom camera from the 'Visible Cameras' list
 - a) Click the camera to be removed in the 'All network cameras' list.
 - b) Click the 'Add to visible list' button.

7.2.3.8 Accessing Camera Repair & Firmware Upgrade (Nucleus) Application

The Camera Repair and Firmware Upgrade (Nucleus) application allows the end user to, in one simple operation, load firmware FPGA, (Field Programmable Gate Array), Flash FPGA, Cinemag, and Kernel firmware for ph7 cameras or a .phfw file for ph16 cameras. It allows the end user to load firmware files into the selected visible camera, or in a camera which responds to a ping command, by introducing its IP address and a value for camera version.

The Camera Repair and Firmware Upgrade (Nucleus) can also be used to restore a Phantom camera's unique Serial Number, and assign a secondary IP Address to a Phantom camera.

In Restore Settings tab, there are two possibilities to restore factory camera settings: from an .stg file (Load Factory Stg...) or from the camera's nonvolatile memory (Reload Factory Settings).

STEP-BY-STEP PROCEDURE

For step-by-step instructions on how to use Camera Repair & Firmware Upgrade (Nucleus), refer to the Phantom Camera Repair & Firmware Upgrade (Nucleus) - Help.

7.2.4 Live Tab Procedures

This section describes the Step-by-Step procedures that can be performed via the 'Live' tab.

7.2.4.1 Selecting a Camera / Camera Group

STEP-BY-STEP PROCEDURE

1. Select the camera or camera group from the 'Cameras' list.

For details on controlling multiple Phantom Cameras simultaneously, see: [Step-by-Step Procedures>Simultaneous Multi-Camera Control Procedures](#).

7.2.4.2 Locking Multiple Camera

Locking cameras together allows the end-user to control multiple Phantom cameras simultaneously.

For details on controlling multiple Phantom Cameras simultaneously, see: [Step-by-Step Procedures>Simultaneous Multi-Camera Control Procedures](#).

STEP-BY-STEP PROCEDURE

With the 'Live>Camera: Lock' button unlocked:

1. Select the desired 'group' from the Live>Camera pull-down selection list. A Preview Panel, for each camera, associated with the selected group, connected to PCC opens in the Locked (Group) state, indicated by a red border around the Preview Panel, or
2. With multiple camera opened (in a 'Preview Panel') click the 'Camera: Lock' button.

The open Preview Panels for each camera will be placed in the Locked (Group) state, indicated by a red border around the Preview Panel.

CAUTION

Locking any camera associated with a 'Cameras' group will apply any changes made to the opened (in a 'Preview Panel') camera and all the cameras associated with that camera's group / subgroup even if those cameras are not opened in a 'Preview Panel'.

7.2.4.3 Copying Camera Parameters

Camera parameters are automatically copied to all locked (grouped) cameras and their associated 'Cameras' group even if it is not open in a Preview Panel. It is, however, possible to copy the

parameters from one camera to a specific camera or 'Cameras' group by using the 'Live>Set to' button.

STEP-BY-STEP PROCEDURE

With the 'Live>Camera: Lock' button unlocked:

1. Define the required parameters to the camera the settings will be copied from.
2. Select the camera or 'Camera' group / subgroup, the parameters are to be copied to from the 'Set to' pull-down selection list.
3. Click OK in the 'Copy?' confirmation window to proceed, or 'Cancel' to stop the copy process.
Upon completion PCC displays a 'Parameters copied to All Cameras!' message.

7.2.4.4 Camera Settings

This topic describes the Step-by-Step procedures that can be performed under the 'Camera Settings' selector.

The 'Camera Settings' fields are used to display, reset, or synchronize the time stamp clock information, set the bit depth of the active pixels, partition (segment) the memory of the camera, or remotely control a Canon EOS lens attached to the camera.

7.2.4.4.1 Set Image 'Time Stamp' Reference

PCC displays the 'Current Time' in the following format: Weekday Month Day Year hh:mm:ss. The time is tagged to the end of each image recorded from the camera, this process is referred to as a 'time stamping'. The 'Current Camera Time' and the 'Computer Time' should be synchronized when there is no IRIG-B (Inter-Range Instrumentation Group) time code clock source attached to the camera. If an IRIG-B time code clock source is attached the 'Current Camera Time', should be synchronized to the IRIG-B clock and will display the IRIG-B reference time.

STEP-BY-STEP PROCEDURE

▼ Synchronize Time Stamp Clock Procedure

1. Click the 'Set Time' button under the 'Camera Settings' selector.
2. Click the 'Update and Set' button to synchronize the 'Current Camera Time' with the 'Computer Time' in the 'Set Camera Time' dialogue window. The 'Current Camera Time' and the 'Computer Time' should now be synchronized (identical).
3. Click the 'Close' button.

▼ Set Time Stamp Clock Procedure

1. Click the 'Set Time' button under the 'Camera Settings' selector.
2. In the 'Set Camera Time' dialogue window:
 - a. Click the down-arrow to the right of the 'New Camera Time' entry window, then

- b. Navigate to, and select the desired date from the pop-up calendar window.
 - c. Edit or use the up/down arrows next to the 'Time' entry window, to enter the desired time.
 - d. Click the 'Set' button to temporarily adjust the time stamp clock to the date and time specified. The 'Current Camera Time' adjusts to the date and time specified.
3. Click the Close button.

NOTE

In either case, if the camera is connected to an IRIG-B clock source the 'Current Camera Time' will immediately revert back to the time stamp supplied by the IRIG-B signal when the 'Set' button is selected.

7.2.4.4.2 Specify the Time Zone Reference

STEP-BY-STEP PROCEDURE

1. Select the desired 'Time Zone Reference' radial button under the 'Camera Settings' selector.
 - a. Local - when Local is selected, the attached Phantom Control Units; date and time settings are used as the time reference.
 - b. utc (GMT) - when utc is selected the date and time reference will be adjusted to Universal Time Clock (utc), formally referred to as Greenwich Mean Time (GMT). The adjustment will be the time difference from the date and time settings of the attached Phantom Control Unit to the universal time clock. The Universal Time option will append 'utc' text to the Camera Settings>Time information.

7.2.4.4.3 Define the Image Pixel Bit Depth

A variety of the Phantom camera sensors have the ability to record and save 8-, 10-, 12-, or 14-bit values, (gray scale level images), that are transferred to the computer as either 16-bit or 8-bit words. By default these Phantom cameras display 8-bit, (256 gray scale level), images. The 8-bits used to display these images are the most significant, or high order, bits of 14-bit values.

NOTE

Both 8-bit to 14-bit images need exactly the same amount of light to saturate the sensor. What differs is the fineness in the number of levels recorded.

STEP-BY-STEP PROCEDURE

1. Select the desired image pixel 'Bit Depth' to record image data, (images stored in the camera RAM), and save image data, (images to be transferred from the cameras RAM to an external storage device i.e., the control computer/laptop hard drive) from the 'Bit Depth' pull down selection list. The image data being recorded and saved will be at the image pixel bit depth selected.

7.2.4.4.4 Specify the Cine Memory Partitions

'Partitions' (formally called 'MultiCine') specifies the number of memory segments (partitions) a camera or camera group's RAM will be divided into. Each partition will be allocated with an equal percentage of the total memory buffer.

NOTE

This feature is not available with all Phantom camera models.

STEP-BY-STEP PROCEDURE

1. Select the number of RAM memory segments desired from the 'Partitions' pull-down selection list under the 'Camera Settings' selector.
2. In the 'Changing partitions count will erase all Cines from camera volatile memory, Proceed?' confirmation window:
 - a. Click the 'OK' button to partition the selected Phantom camera's RAM, alternately
 - b. Click the Cancel button to leave the selected camera's RAM as is.

7.2.4.4.5 Define the Automatic Lens Control

The Lens Control option allows the end-user to control a Canon EOS attached lens remotely when used with the 'Automatic Lens Control Mount'. The end user can adjust / set:

- Aperture (f-stop)
- Focus

STEP-BY-STEP PROCEDURE

1. Select the desired f-stop for the attached lens from the 'Aperture' pull-down selection list under the 'Camera Settings' selector.
2. Adjust the lens focus:
 - a. Click the +, (plus), button to focus the lens to its limit location respectively corresponding to infinity, or
 - b. Click the -, (minus) button to focus to the minimum-focusing-point of the lens, alternately
 - c. Slide the Lens Control Slider upward, (Fast+), to focus the lens to its limit location respectively corresponding to infinity, or
 - d. Slide it downward, (Fast-) to focus to the minimum-focusing-point of the lens.

7.2.4.4.6 Backup & Restore Settings

The 'Backup & Restore Setting' features are used to save or load a camera's capture parameters.

STEP-BY-STEP PROCEDURE**▼ Backup ('Save' Camera Settings)**

1. Click the 'Save...' button under the 'Camera Settings' selector.
2. Save the camera configurations to:
 - a. Non-volatile memory slot (1 - 6)
 - 1) Select the non-volatile memory slot (1 - 6), and click the 'Save' button in the 'Camera

- Settings' popup window.
- 2) Enter a name for the file in the 'Set Camera Settings Name' dialogue window.
 - 3) Click 'OK' to save the configuration file name, or 'Cancel' to simply store the configuration file without a file name.
- b. User specified drive / folder location (To file..)
- 1) Select 'To File...', and click the 'Save' button in the 'Camera Settings' popup window.
 - 2) Navigate to the folder the camera configuration file is to be saved to in the 'Save Camera Settings' dialogue window.
 - 3) Enter the filename for the camera configuration file being saved in the File name: field.
(By default PCC will assign the a filename consisting of the serial number of the camera, the present resolution, sample rate, exposure time, and edr exposure setting. It will also automatically apply the .STP file extension to the filename.)
 - 4) Click 'Save' to save the configuration file, or 'Cancel' to top the save process.

▼ Restore ('Load' Camera Settings)

1. Click the 'Load...' button under the 'Camera Settings' selector
2. Load the camera configurations from:
 - a. Non-volatile memory slot (1 - 6)
 - 1) Select the non-volatile memory slot (1 - 6)
 - 2) Click the 'Load' button in the 'Camera Settings' popup window.
 - b. To file... (user specified drive / folder location)
 - 1) Click the 'Load' button in the 'Camera Settings' dialogue window.
 - 2) Navigate to the folder the camera configuration file have been saved to and select the configuration file to be reloaded.
 - 3) Click the 'Open' button.

▼ Erase (Camera Settings Slot)

1. Click the 'Load...' or 'Save...' button under the 'Camera Settings' selector
2. Select the non-volatile memory slot (1 - 6) of the configuration file to be deleted.
3. Click the 'Erase' button.

7.2.4.5 Cine Settings

This topic describes the Step-by-Step procedures that can be performed under the 'Cine Settings' selector.

7.2.4.5.1 Define a Cine Name

The Name field is used to assign a name to the Cine stored in the cameras RAM, and is written to the camera Cine structure meta-data. This name can be viewed in the 'Play>Cine Info' selector.

STEP-BY-STEP PROCEDURE

1. Enter the desired name for the Cine in the 'Name' data entry field under the 'Cine Settings' selector.

7.2.4.5.2 Define the Resolution

The 'Resolution' setting allows the user to change the dimensions, width to the height ratio, of the image to be 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.

Using the CAR (Continuous Adjustable Resolution) feature, provides for resolution adjustments between the minimum and maximum drop-down list values, in the following pixel increments:

- Phantom 65 in 4096 x 8 pixel increments.
- Phantom Flex4K in 4096 x16, or 2048 x 16 pixel increments
- Phantom Flex, v642 Broadcast, v641, v341, Miro 340, and Miro 140 in 256 x 8 pixel increments.
- Phantom Miro Airborne HD in 1920 x 8 increments.
- Phantom HD Gold, HD in 2048 x 8 pixel increments.
- Phantom v2512, v2012, v1612, and v1212, v2511,v2011, v1611, v1211, v2010, v1610, v1210, Miro C210J and Miro C210 in 128 x 16 increments.
- Phantom Miro 3a10, M / R / LC320S, Miro M / R / LC310, Miro M140, Miro M340, Miro M / R / LC120, and Miro M / R / LC110 in 64 x 8 increments.
- Phantom Miro 320, M310, M120, M110, v710, v640, v310, v210, and v12 Series in 128 x 8 pixel increments.
- Phantom v10 and v9.1 in 96 x 8 pixel increments.
- Phantom v9.0 in 48 x 8 pixel increments.
- Phantom v7.3 in 32 x 8 pixel increments
- Phantom v7.2, v7.1, v7.0, v6.2e, v4.3, and v4.2 in 16 x 8 pixel increments.
- Phantom v5.1 in 64 x 4 pixel increments.
- Phantom v6.0, v5.0, v4.1, and v4.0 in 8 x 8 pixel increments.
- Phantom Miro eX4, Miro 4, Miro eX3, Miro 3, Miro Airborne, Miro eX2, Miro 2 in 32 x 8 pixel increments.

STEP-BY-STEP PROCEDURE

1. Select a predefined 'Resolution' from the pull-down selection list, or
2. Enter the desired 'Resolution' (width x height) in the data-entry field to use a resolution that is not displayed within the list. PCC adjusts and displays the resolution to the closest available resolution allowed in the 'Resolution' data-entry field.

7.2.4.5.3 Define the Sample Rate

The 'Sample Rate' parameter specifies the rate (speed) at which images (frames) are to be recorded. The 'Sample Rate' determines the minimum to maximum 'Exposure Time' available, and the range of the 'Sample Rate' is depended upon the defined 'Resolution' (width to height ratio) of the images

being captured..

STEP-BY-STEP PROCEDURE

1. Select a predefined 'Sample Rate' from the pull-down selection list, or
2. Enter the desired 'Sample Rate' in the data-entry field to use a sample rate that is not displayed within the list. PCC adjusts and displays the sample rate to the closest available sample rate allowed in the 'Sample Rate' data-entry field.

For actual sample rates refer to: [Functional Descriptions>Frame Rate Tables](#).

The sample rates listed below are typical values intended for illustrative purposes only. They are subject to wide variations in practice depending upon the specific analytical requirements and test conditions.

EVENT	TYPICAL SAMPLE RATE	EVENT	TYPICAL SAMPLE RATE
Man Walking	30fps	Cutting Action of a Dental Drill	16,000fps
Bottle-Filling Machine	60fps	Shot-Gun Pellets in Flight	32,000fps
13-Ton Punch Press	120fps	Bursting a Toy Balloon	64,000fps
Blink of an Eye	240fps	30/06 Rifle Bullet in Flight	125,000fps
Pouring of Liquid	500fps	Crack Propagation in Glass	250,000fps
Driving a Nail	1,000fps	Liquid Cavitation Phenomena	500,000fps
Wing Beat of a Honey Bee	2,000fps	High Explosive Detonation	1,000,000fps
Contact Chatter in a Switch	4,000fps	Electrical Spark Discharges	>2,000,000fps
Circular Saw Cutting Wood	8,000fps		

7.2.4.5.4 Define the Exposure Time

In photography, exposure is the total amount of light allowed to fall on the photographic medium, (photographic film or image sensor), during the process of capturing an image. However, unlike adjusting the aperture (exposure) of a lens, the depth of field will not be affected when the 'Exposure Time' is set using the PCC. Decreasing the Exposure time in PCC can help reduce the amount of motion blur that might occur if the 'Sample Rate' is not set to a speed that is adequate for capture.

The range of valid exposure times is dependent upon the defined 'Sample Rate'.

STEP-BY-STEP PROCEDURE

1. Select a predefined 'Exposure Time' from the pull-down selection list, or
2. Enter the desired 'Exposure Time' in the data-entry field to use an exposure time, between the minimum and maximum times displayed in the drop-down list, in 1 μ s increments, percentage, or degrees, that are not displayed within the list. For details on changing the Exposure Time (Exp) Unit to μ s, degree, or percent, see, Step-by-Step Procedures>Manager Tab

Procedures>Defining the (PCC) Application Preferences.

The table below depicts how the micro-seconds exposure setting equates to seconds and degrees (shutter angle).

MICRO-SECONDS	SECONDS	DEGREES	MICRO-SECONDS	SECONDS	DEGREES
16,666	1/60	53.998	200	1/5,000	0.72
10,000	1/100	36	100	1/10,000	0.36
8,000	1/125	28.8	66	1/15,000	0.238
4,000	1/250	14.4	40	1/25,000	0.144
2,000	1/500	7.2	20	1/50,000	0.072
1,000	1/1,000	3.6	10	1/100,000	0.036
800	1/1,250	2.88	1	1/1,000,000	0.0036
400	1/2,500	1.44			

7.2.4.5.5 Change the Exposure Index

EI (Exposure Index) is a reference value for the apparent light sensitivity determined by the current image processing settings. For camera's where the video output can be set to 'Log' mode, the EI can not be adjusted, and must be used as a reference only.

STEP-BY-STEP PROCEDURE

The EI value can change based on the gamma, toe, gain, ped, tone curve, and other settings of the camera, see [Step-by-Step Procedures>Toolbar Procedures>Image Tools](#) for adjusting the settings.

7.2.4.5.6 Define an EDR Exposure Time

The 'EDR' (Extreme Dynamic Range) exposure time feature is very useful when the subject contains extremely bright areas as well as darker areas and both must be exposed properly throughout the Cine file. The 'EDR' function permits the end-user to expose for darker areas in the subject via the 'Sample Rate' and 'Exposure Time' settings and then specify a separate and independent pixel level EDR exposure for the portions of the image that might become saturated, (over exposed).

EDR is automatically enabled when any value, other than zero, is entered in the EDR data-entry field. This feature cannot be used in conjunction with the 'Auto Exposure' feature and should not be enabled while performing a 'CSR' (Current Session Reference) or 'Black Reference' calibration adjustment. EDR exposure times should be set at approximately 1/2 of the 'Exposure Time' as a starting point. By setting the EDR exposure to 1/2 of the 'Exposure Time' the brightest pixels in the images will be exposed for one f-stop less than the darker pixels.

EDR is not supported in all Phantom camera models.

CAUTION

EDR should not be used on Phantom cameras that use an intensifier. Using this feature can cause harm to the intensifier.

STEP-BY-STEP PROCEDURE

1. Select a predefined 'EDR' exposure time from the pull-down selection list, or
2. Enter the desired 'EDR' exposure time in the data-entry field to use an 'EDR' exposure time, between the minimum and maximum times displayed in the drop-down list, in 1 μ s increments, percentage, or degrees, that are not displayed within the list. For details on changing the EDR exposure time (EDR) Unit to μ s, degree, or percent, see, Step-by-Step Procedures>Manager Tab Procedures>Defining the (PCC) Application Preferences.

7.2.4.5.7 Perform a CSR

Use CSR' (Current Session Reference) to calibrate the image for current 'Cine Settings' parameters. PCC will compute the offsets specific to the currently defined parameters, obtaining a more precise compensation of the pixel errors. The CSR process is similar to a 'Black Reference' calibration adjustment.

Vision Research recommends that the CSR calibration adjustment process be performed before recording a single Cine configuration or a Partitions (MultiCine) configuration with all Cine segments having the same acquisition parameters. If the partitions have different setup values and the 'Advanced Settings>Auto Black Reference' option is not enabled, because the camera does not employ an internal or external automatic mechanical shutter, the end-user should perform a CSR calibration adjustment on each Cine partition separately, just before each Cine is recorded.

For details on the 'Automatic Shutter Lens Mount' see: Accessories, Peripherals, and Miscellaneous Features>Automatic Shutter Lens Mount Installation.

STEP-BY-STEP PROCEDURE

1. Specify the 'Resolution', 'Sample Rate', and 'Exposure Time' parameters.
2. Ensure the 'EDR' exposure time is disabled (set to zero).
3. Ensure the 'Auto-Exposure' and 'Image-Based Auto-Trigger' features are disabled.
4. Click the 'CSR' button under the 'Cine Settings' selector.
 - a. If the camera is equipped with an internal / external mechanical auto-shutter mechanism a 'Current Session Reference...' message along with a 'Current Session Reference' status indicator will be displayed in the Preview Panel of the camera the CSR calibration adjustments are being performed on.
 - b. If the camera does not have an internal or external automatic shutter mechanism, when the Current Session Reference informational window instructing you to 'Please, cover the camera lens.' appears, cover the lens with a lens cap to ensure the sensor is in complete darkness, then click the 'OK' button to start the CSR calibration adjustment, or click the 'Cancel' button to cancel the CSR process.

7.2.4.5.8 Low Light

Using the Low-Light feature automatically sets the camera exposure to a pre-defined level. This exposure level is based on the camera's 'Resolution' and 'Sample Rate' settings along with the 'Auto Exposure' settings.

STEP-BY-STEP PROCEDURE

1. Click on the 'Low Light' button under the 'Cine Settings' selector to turn on the 'Low Light' feature. When enabled (On) PCC will automatically decrease the 'Sample Rate', and increase the 'Exposure Time'. It also enables the 'Auto Exposure' feature. The end-user may need to adjust the 'Auto Exposure>Compensation or Level (depending on the camera model) for the Low Light feature to work effectively.
2. Click on the 'Undo Low Light' button to turn off the 'Low Light' feature. Turning the feature off returns the 'Sample Rate' and 'Exposure Time' parameters back to the user-specified settings, (unless they were changed while the 'Low-Light' feature was enabled), and disables the 'Auto Exposure' feature.

7.2.4.5.9 Define an Image Range (Trigger Delay) or Trigger Position (Post Trigger) Value

The 'Image Range and Trigger Position' (formally the 'Trigger Position') options are used to specify a 'Trigger Position' (Post Trigger) / Image Range (Trigger Delay) values.

The 'T' (Trigger Position) value represents how many frames will be recorded after the trigger signal has been detected by the Phantom camera. Since the memory is a circular (FIFO [First-In First-Out]) memory buffer, the Post Trigger value also sets the reciprocal number of pre-trigger images captured.

The 'I' (Image Range) value is used to add a delay between the trigger command, (via Phantom Camera Control application or hardware), and the actual recording into the camera's image buffer RAM. After the trigger signal is detected, the Phantom camera will loop-record into RAM the specified number of frames. The effect of this is a delay, since the frames that will actually be kept into the camera's image buffer will be the images recorded after the delay (after the buffer has been filled greater than one time).

NOTE:

Only one of the values can be set at any one time. Both sliders need to be to the left to select the alternate slider.

STEP-BY-STEP PROCEDURE

▼ Determining the Image Range / Trigger Position

To properly set the 'Image Range and Trigger Position' value you must first determine the number of 'pre-trigger (indicated by a red bar)', 'post-trigger' indicated by a green bar), or both types of frames (indicated by a portion of the bar being red [pre-trigger portion] and green [post-trigger] portion saved into camera RAM (circular buffer), or the number of frames required to introduce a delay of the images being saved (indicated by a white bar).

To calculate the number of frame required to equate to a specific duration for:

1. Image Range (trigger delay) - multiply the 'Sample Rate' times the Required Delay (in seconds), or divide the desired delay time by the image interval time, (the reciprocal of the sample rate), to get a number of images.
2. Trigger Position (post-trigger frames) - multiply the 'Sample Rate' times the Post-Trigger Duration (in seconds) to get a number of images.
3. Trigger Position (pre-trigger frames) - multiply the 'Sample Rate' times the Pre-Trigger Duration' (in seconds), then subject the result from number in parenthesis, directly after the 'Duration' field to get a number of images.

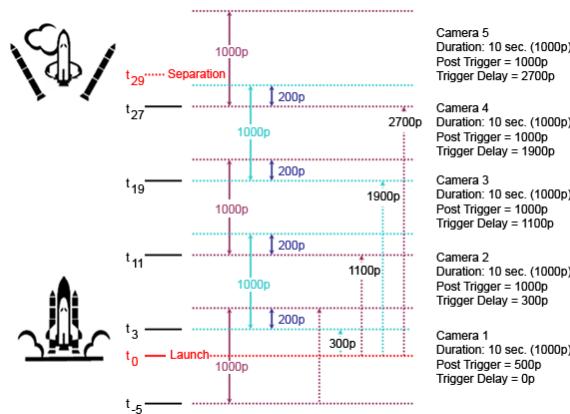
The 'Duration' field (determined by the 'Sample Rate') below the slider bar indicates the amount of time it will take to fill the camera RAM (memory buffer). The number in parenthesis, directly after the 'Duration' which indicates the number of pictures (frames / images) the camera RAM can store (determined by the 'Resolution' setting).

NOTE

A Phantom camera can only store a finite number of images into its' memory buffer based on the Resolution, Image Bit Depth settings, and the buffer, (amount of RAM memory), size.

▼ Image Range and Trigger Position Application Example

The user needs to record 35 seconds of event time at a required sample rate that will only allow the camera to record 10 seconds of the event. The good news is the user has multiple cameras that he/she can network to together to record the event. The cameras are synchronized, and will be provided with the same hard trigger, so that to will be the same for all cameras.



▼ Defining an Image Range (Trigger Delay)

1. Move the Image Range (I) slider right to increase the number of Image Range frames, or left decrease the Image Range frames. Either way will automatically change the value in the 'Last' entry box.
2. Enter an Image Range value, (999,999,999 frames maximum).

▼ Defining a Trigger Position

1. Pre-Trigger Frames Only (indicated by a red bar)
 - a. Move the Trigger Position (T) slider to the far right.
 - b. Select 0 (zero) from the 'Last' pull-down selection list.
 - c. Enter 0 (zero) in the 'Last' data-entry field.
2. Post-Trigger Frame Only (indicated by a green bar)
 - a. Move the Trigger Position (T) slider to the far left.
 - b. Select the maximum number from the 'Last' pull-down selection list.
 - c. Enter the number in parenthesis (directly after the 'Duration' field below the Image Range and Trigger Position' sliders) minus one in the 'Last' data-entry field.
3. Pre-Trigger and Post-Trigger Frames (indicated by a partial red and green bar)
 - a. Move the Trigger Position (T) slider to the desired location.
 - b. Select the desired Trigger Position from the 'Last' pull-down selection list.
 - c. Enter a value between one (1) and the the number in parenthesis (directly after the 'Duration' field below the Image Range and Trigger Position' sliders) minus two in the 'Last' data-entry field.

7.2.4.5.10 Copy Capture Parameters to All Partitions

The following describes the steps to copy the current settings displayed in the 'Live' tab to all memory partitions, when the selected camera has been configured to use the 'Partitions' (MultiCine) feature.

STEP-BY-STEP PROCEDURE

1. Select the partition from the 'Live>Cine Settings>Cine' pull-down selection list with the capture parameters to be copied and applied to all partitions.
2. Click the 'Cine Lock' button to copy and apply the selected partition's capture parameters to all partitions, or
3. Click the 'Cine Set All' button to copy and apply the selected partition's capture parameter to partitions without image data stored in them.
 - a. When the 'Copy...?' confirmation window appears, click 'OK' to proceed or 'Cancel' to disregard. The 'Parameters copied to All Cines!' informational window will be displayed upon completion of the process.
 - b. Click 'OK' in the 'Parameters copied to All Cines!' informational window.

7.2.4.6 Flash Memory Settings

This topic describes the Step-by-Step procedures that can be performed under the 'Flash Memory' selector.

7.2.4.6.1 Erasing Flash Memory

The 'Erase' Flash Memory option is used to delete all Cine files stored in a Phantom camera's optionally installed integrated non-volatile Flash memory module (Phantom CineMag / CineFlash).

When this option is selected to erase a Phantom CineMag, all Cine files stored in the CineMag will be erased, unlike erasing Cine files from a Phantom CineFlash where the software provides the end-user with the ability to delete individual Cine files.

STEP-BY-STEP PROCEDURE

1. Click the Erase button under the 'Flash Memory' selector.
2. For cameras with a Phantom CineFlash the 'Delete Flash Cines' dialog box will appear with a list of the Cines stored in the CineFlash. The end-user can select to:
 - a. Delete a selected Cine by:
 - 1) Highlighting the Cine(s) to be deleted, then
 - 2) Click the Erase Selected button.
 - 3) Click Yes in the Erase Flash confirmation window.
 - b. Erase All to delete all the Cines stored on the Phantom CineFlash, or
 - c. Format the Phantom CineFlash.

RESULT: The Preview/Playback Panels will display an Erasing Flash message along with an Erasing Flash progress indicator. Any Cine file stored in the selected camera's integrated non-volatile Flash memory, Phantom CineMag, or Phantom CineFlash will be removed from the Cameras group in the Manager Control Panel.

7.2.4.6.2 Define the Phantom CineMag (Mode / Format)

Phantom cameras that support a Phantom CineMag can operate in one of two operational mode, including:

- Loop Mode - Phantom camera stores, the recorded image data into the camera's RAM buffer. In this mode, the Phantom CineMag operates like any other Flash card, after a Cine file, (image data), is recorded into the camera's RAM frame buffer, the end-user manually saves the image data it into the Phantom CineMag by initiating the Save to Flash command window, which can be accessed via the Cine Pull-down Menu.
- Run/Stop Mode - image data is recorded directly into the Phantom CineMag. In this mode the cameras maximum 'Sample Rate' (recording speed) for the defined 'Resolution' might not be achievable.

Vision Research chose to enable ProRes 422 HQ as the initial format, based on the inherent quality and compression value when compared to Cine RAW files.

Some of the differences between the RAW and ProRes workflow, include:

- Resolution - when working with ProRes, the camera must be set to full sensor resolution 4096 x 2304 only. The CineMag IV will not support any other resolution to record when set to ProRes. However, in Loop mode, the end-user can still capture to RAM at other resolutions, but the recording will default to RAW when saved to the CineMag.
- Frame rates and Save Times - in Run/Stop (RS) mode the camera will allow up to 30 fps direct to the CineMag. In LOOP mode, the camera will allow up to 938 fps to RAM, before the file is saved to the CineMag. Saving in ProRes HQ mode takes about 3 times longer to the CineMag than saving RAW. The files in the CineMag are about 2.5X smaller than the un-interpolated RAW files, and take that much shorter to save from the camera or CineStation IV. Over 5 hours of 24 fps ProRes HQ footage can be stored on a 2TB CineMag IV.

- Video Playback from the Camera body: The camera body will allow for HDSDI video playback of the ProRes files, however it's a little different than working with RAW. The camera must load the files for playback, which takes about 5 seconds. During this 5 second 'switchover' the word 'loading' is on the camera menu. This process will happen automatically each time a ProRes file is recorded into the CineMag or playback is initiated.

Also unique to ProRes playback are the supported video formats. 1080p, 1080psf and 4Kp video modes allow for playback at ZOOM: fit and ZOOM: 1 settings. 1080psf playback actually switches to 1080p during ProRes playback, then switches back to psf for live monitoring and RAW playback.

Not supported are 1080i, 720p modes, anamorphic settings and larger zoom settings.

STEP-BY-STEP PROCEDURE

1. Enable, (check), the 'Direct recording to CineMag' feature, under the 'Flash Memory' selector, to write each image data directly into the attached Phantom CineMag.
2. Selectable with Phantom Flex4K models only:
 - a. Raw packed 10 bit (default)
 - b. ProRes HQ 10 bit (requires a Phantom CineMag IV to record to)

7.2.4.7 Advanced Settings

This topic describes the Step-by-Step procedures that can be performed under the 'Advanced Settings' selector.

7.2.4.7.1 Define the Cine Advanced Options

STEP-BY-STEP PROCEDURE

1. Specify the 'Cine Advanced' options' under the 'Advance Settings' selector.
 - a. High Quality Image Mode - instructs a Phantom Flex camera to use a proprietary multi-sampling technology to enhance each frame when enabled (checked). Each frame is analyzed for noise and image artifacts that can occur under continuously changing shooting environments.

Using 'High Quality Image Mode' ensures the best images possible will be recorded even when changing frame rates, exposure times, resolution, or if ambient and camera temperatures are changing.

NOTE

High Quality Image Mode reduces maximum frame rates by ½, and each frame requires twice the internal camera memory. However, saved Cine files are the same size as in Standard Mode and recording directly to a Phantom CineMag has the same speed and size specifications as Standard Mode.

- b. Exposure in PIV Mode - reduced the Frame Straddle Time when enabled (checked), and was designed for use in PIV (Particle Imaging Velocimetry) applications. The following table displays the 'reduced to' Frame Straddle Times.

CAMERA MODEL	STRADDLE TIME
Phantom v2512	375 nano-seconds
Phantom v2012	400 nano-seconds
Phantom v1612	425 nano-seconds
Phantom v2511, v2011, v2010, v1610, v1210, v711, v710, v611, v411, v311, v12.1, Miro M / R / LC310, Miro M / R / LC110	500 nano-seconds
Phantom v1611	525 nano-seconds
Phantom v1212	550 nano-seconds
Phantom v310	660 nano-seconds
Phantom v210, v211	700 nano-seconds
Phantom v1211	725 nano-seconds
Phantom v640	1.2 micro-seconds
Phantom v642 Broadcast, v641, v341, Miro M / R / LC320S, Miro M340, Miro M140, Miro M / R / LC120, Miro 320, Miro 3a10	1.4 micro-seconds

- c. Burst Period - one of two parameters use to define 'Burst Mode'. It sets the interval between two frames in a burst, in microseconds. The other parameter is the 'Burst Count' described below. For a brief explanation of Burst Mode Acquisition, see: [Functional Descriptions>Burst Mode Acquisition](#).
- d. Burst Count - one of two parameters use to define 'Burst Mode Acquisition'. It sets the number of frames in a burst, (a value of zero disables 'Burst Mode Acquisition' completely). The other parameter is the 'Burst Period' described above. For a brief explanation of Burst Mode Acquisition, see: [Functional Descriptions>Burst Mode Acquisition](#).

NOTE

The 'Burst Period' and 'Burst Count' parameters will be validated by the camera and clamped to ensure valid values. When clamping occurs, the 'Burst Count' has priority over 'Burst Period', and both will have priority over the 'Exposure Time'.

Behavior of the camera will be modified in the following way, when viewing live images, with a 'Burst Count' larger than one the camera will retrieve images from the most recent burst, starting with the first frame in the burst.

7.2.4.7.2 Define the Start/End of Recording Actions Parameters

The End of recording actions parameters instruct the selected Phantom camera to perform various tasks immediately after the image data, or Cine file, has been recorded into the camera's RAM.

STEP-BY-STEP PROCEDURE

1. Specify the 'Cine Advanced' options' under the 'Advance Settings' selector.
 - a. Auto Black Reference - when enabled (checked) a black calibration (CSR - Current Session

Reference) will be performed whenever the camera, with an Internal Automatic Mechanical Shutter, is placed into the 'Capture' (recording) mode.

- b. Auto Save to CineMag/Built-In Flash - when enabled (checked) the recorded image data, in the camera's RAM buffer, will be written into a mounted Phantom CineMag, or automatically into the camera's internal non-volatile Flash memory when the recording process has been completed.
- c. Auto Save to CineFlash/CardFlash - when enabled (checked) the recorded image data, in the camera's RAM buffer, will be written into a mounted Phantom CineFlash, or installed Type 1 Compact Flash Card when the recording process has been completed.
- d. Auto Play Video Out - when enabled (checked) the camera automatically plays the recorded image data, in the camera's RAM buffer, to an attached monitor when the recording process has completed.
 - 1) Times - specifies the number of times the recorded Cine file is to playback on the attached monitor. Entering a 0 (zero) instructs the Cine file to loop indefinitely.
- e. Range - used to specify the range of images to be saved to Flash memory, and / or play to an attached video monitor as follows:
 - 1) Full - when enabled (checked) the entire Cine will be saved to Flash / reviewed on an attached monitor when the recording process has been completed.
 - 2) First / Last - used to edit (Mark-in / Mark-out) the Cine to be saved to Flash / reviewed on an attached monitor when the recording process has been completed, by entering the first / last image numbers in their respective data entry fields.
- f. Restart Recording - when enabled (checked) the camera is immediately placed into the capture (recording) mode once all the specified 'Start/End of Recording Actions' have completed.

NOTE

'Restart Recording' must be disabled (unchecked) if 'Continuous Recording' is enabled.

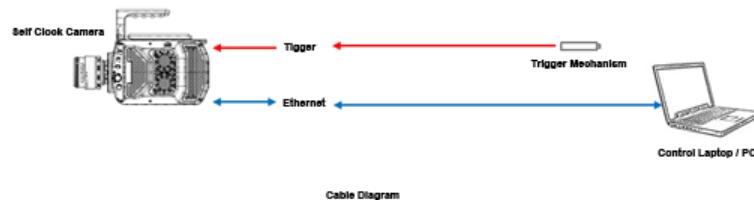
7.2.4.7.3 Define the External Sync Parameters

This field instructs the selected Phantom camera(s) to utilize any one of three sync imaging clock sources. The External Sync Parameters will vary based on how the selected Phantom camera(s) are to be utilized, (i.e., as a standalone camera, or in a multi-camera network). The following Step-by-Step Procedures describe the setup process to use the camera in the following scenarios:

- Synchronizing a standalone Phantom camera to its' internal oscillator
- Synchronizing multiple (slave) cameras to a Phantom (master) camera's internal IRIG clock
- Synchronizing multiple (slave) cameras to a Phantom (master) camera's internal clock
- Synchronizing multiple (slave) cameras to an external clock source
- Synchronizing multiple (slave) cameras to an IRIG clock source
- Synchronizing a standalone Phantom camera to video signal

STEP-BY-STEP PROCEDURE

▼ Synchronizing a standalone Phantom camera to its' Internal oscillator



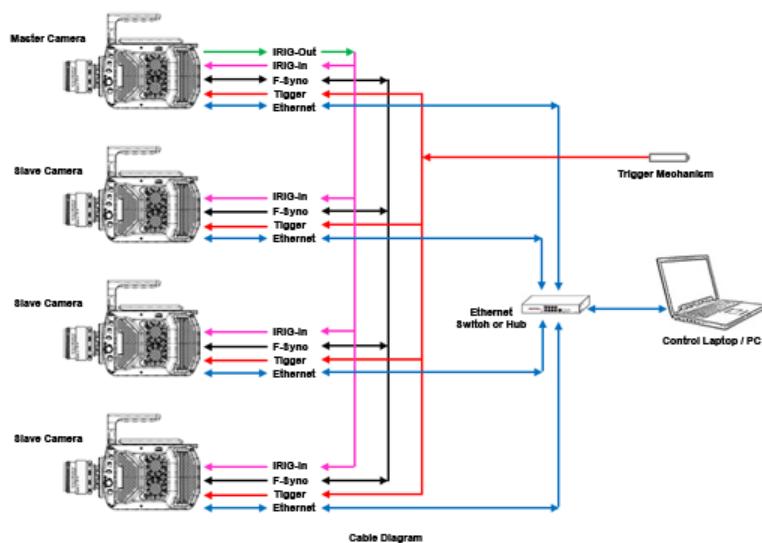
Cable Diagram

1. Specify the External Sync' options under the 'Advance Settings' selector.

- Sync Imaging - select 'Internal' as the framing (sample rate) clock source from the 'Sync Imaging' pull-down selection list. 'Internal' instructs the camera to use the camera's internal crystal oscillator to drive the camera's sample rate.
- Frame Delay - entering a value greater than the default 0 μ s (no delay) specifies a delay time between the clock source pulse and the frame capture, essentially providing a phase shift in the capture timing.

▼ Synchronizing multiple (slave) cameras to a Phantom (master) camera's internal IRIG clock

The application shown below is that of the master camera forwarding its' internal IRIG clock signal, serially, to itself and the slave cameras.



Cable Diagram

CAUTION

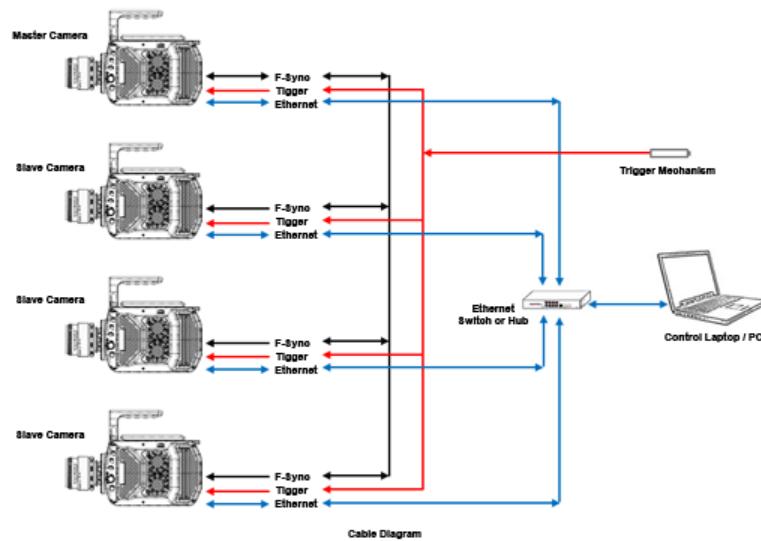
When utilizing this type of application, all cameras must be supplied an external trigger. If a

soft-trigger is used to trigger the cameras, Vision Research cannot guarantee that the cameras will remain synchronized. The maximum number of cameras that can be synchronized for this application is four, and the maximum distance of the cameras (end-to-end) is limited to 10 meters (32.81 feet).

1. Click the 'Cine Settings' selector and ensure (for all the cameras being synchronized) the:
 - a. 'Sample Rate' setting is identical for all cameras
 - b. 'Trigger Position' (post-trigger ['Last'] value) is the same for all cameras
 - c. 'Exposure Time' setting of the slave camera(s), does not exceed the maximum 'Exposure Time' of the master camera
2. Specify the External Sync' options under the 'Advance Settings' selector.
 - a. Sync Imaging - select 'LockToTrig' as the framing (sample rate) clock source from the 'Sync Imaging' pull-down selection list.
 - b. Frame Delay - entering a value greater than the default 0 μ s (no delay) specifies a delay time between the clock source pulse and the frame capture, essentially providing a phase shift in the capture timing.

▼ Synchronizing multiple (slave) cameras to a Phantom (master) camera's Internal clock

The application shown below is that of the master camera providing a framing (sample rate) clock, serially, to the slave cameras using its' F-sync signal as the clock source.



CAUTION

When utilizing this type of application, all cameras must be supplied an external trigger. If a soft-trigger is used to trigger the cameras, Vision Research cannot guarantee that the cameras will remain synchronized. The maximum number of cameras that can be synchronized for this application is four, and the maximum distance of the cameras (end-to-end) is limited to 10 meters (32.81 feet).

1. Click the 'Cine Settings' selector and ensure (for all the cameras being synchronized) the:
 - a. 'Sample Rate' setting is identical for all cameras
 - b. 'Trigger Position' (post-trigger ['Last'] value) is the same for all cameras
 - c. 'Exposure Time' setting of the slave camera(s), does not exceed the maximum 'Exposure Time' of the master camera

NOTE

After the 'External' Sync Imaging option is selected the 'Cine Settings>Sample Rate' field will be disabled.

2. Specify the External Sync' options under the 'Advance Settings' selector:
 - a. Sync Imaging - selected the 'Sync Imaging' clock sources as follows:
 - 1) Internal (for the master clock source Phantom camera) - uses the camera's internal crystal oscillator to drive the camera's sample rate.
 - 2) External (for all other slave clock source Phantom cameras) - uses an externally supplied pulse (in the scenario the crystal oscillator of the master camera) to drive the camera's sample rate. The external input must be a TTL pulse, with a frequency up to the maximum sample rate for the defined resolution. The TTL input pulse must be connected to the BNC (Bayonet Neill-Concelman) connector marked 'Sync', 'Time Code In', or 'TC In' on the rear of the camera, attached capture cable, breakout box, or mini-breakout box.
 - b. Serial Number - enter the serial number of the master clock source camera in the 'Master Camera Serial (0=none)' field for all cameras being clocked by the master camera.

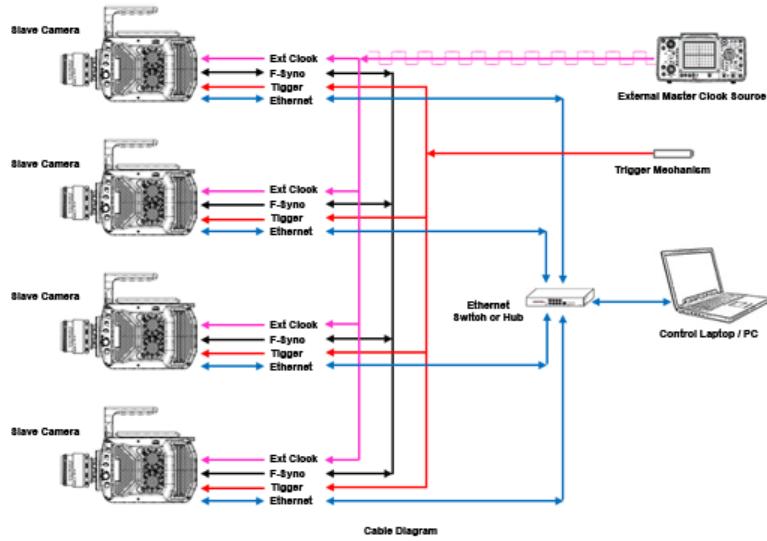
NOTE

The serial number of a camera can be found on the side / bottom of the camera.

- c. Frame Delay - entering a value greater than the default 0 μ s (no delay) specifies a delay time between the clock source pulse and the frame capture, essentially providing a phase shift in the capture timing.
 - 1) If the camera has an independent F-Sync connector on the rear of the camera, then the 'Frame Delay' can be set equal to that of the master camera.
 - 2) If the camera does not have an independent F-Sync connector on the rear of the camera and requires the use of a capture cable, break-out-box, or mini breakout box, then the 'Frame Delay' must be set to a minimum of 1 μ s greater than that of the master camera's setting.

▼ Synchronizing multiple (slave) cameras to an External clock source

The application shown below is that of the external clock source providing a framing (sample rate) clock to the slave cameras independently.



CAUTION

When utilizing this type of application, all cameras must be supplied an external trigger. If a soft-trigger is used to trigger the cameras, Vision Research cannot guarantee that the cameras will remain synchronized.

1. Click the 'Cine Settings' selector and ensure (for all the cameras being synchronized) the:
 - a. 'Sample Rate' setting matches the provided external clock rate for all cameras
 - b. 'Trigger Position' (post-trigger ['Last'] value) is the same for all cameras
 - c. 'Exposure Time' setting of the slave camera(s), does not exceed the maximum 'Exposure Time' of the master camera

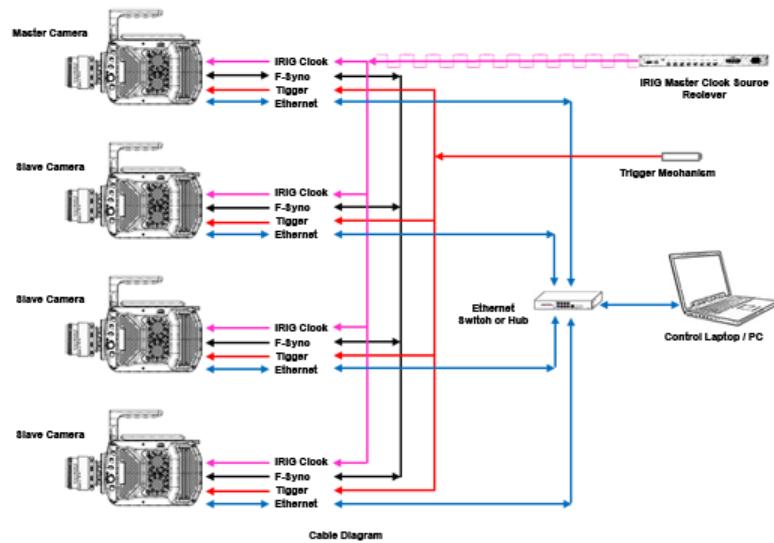
NOTE

After the 'External' Sync Imaging option is selected the 'Cine Settings>Sample Rate' field will be disabled.

2. Specify the External Sync options under the 'Advance Settings' selector.
 - a. Sync Imaging - select 'External' to use an externally supplied pulse to drive the camera's sample rate from the 'Sync Imaging' pull-down selection list. The external input must be a TTL pulse, with a frequency up to the maximum sample rate for the defined resolution. The TTL input pulse must be connected to the BNC (Bayonet Neill-Concelman) connector marked 'Sync', 'Time Code In' or 'TC In' on the rear of the camera, attached capture cable, breakout box, or mini-breakout box.
 - b. Serial Number - set the serial number of the 'Master Camera Serial (0=none)' field for all cameras to 0 (zero).
 - c. Frame Delay - entering a value greater than the default 0 μ s (no delay) specifies a delay time between the clock source pulse and the frame capture, essentially providing a phase shift in the capture timing.

▼ Synchronizing multiple (slave) cameras to an IRIG clock source

The application shown below is that of an IRIG-B clock source providing a framing (sample rate) clock to the slave cameras independently.



CAUTION

When utilizing this type of application, all cameras must be supplied an external trigger. If a soft-trigger is used to trigger the cameras, Vision Research cannot guarantee that the cameras will remain synchronized.

1. Click the 'Cine Settings' selector and ensure (for all the cameras being synchronized) the:
 - a. 'Sample Rate' setting matches the provided IRIG-B clock rate for all cameras
 - b. 'Trigger Position' (post-trigger ['Last'] value) is the same for all cameras
 - c. 'Exposure Time' setting of the slave camera(s), does not exceed the maximum 'Exposure Time' of the master camera

NOTE

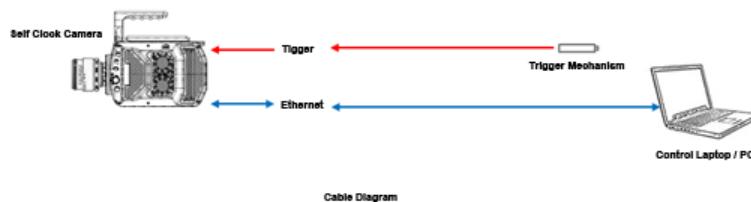
After the 'External' Sync Imaging option is selected the 'Cine Settings>Sample Rate' field will be disabled.

2. Specify the External Sync options under the 'Advance Settings' selector.
 - a. Sync Imaging - select 'LockToIrig' to use an IRIG-B supplied pulse to drive the camera's sample rate from the 'Sync Imaging' pull-down selection list. The IRIG-BI input must be a TTL pulse, with a frequency up to the maximum sample rate for the defined resolution. The TTL input pulse must be connected to the BNC (Bayonet Neill-Concelman) connector marked 'Sync', 'Time Code In' or 'TC In' on the rear of the camera, attached capture cable, breakout box, or mini-breakout box.

Refer to the [Functional Descriptions>Frame Rate Tables](#) for a list of frame rates (fps) the camera will lock to.

- b. Frame Delay - entering a value greater than the default 0 μ s (no delay) specifies a delay time between the clock source pulse and the frame capture, essentially providing a phase shift in the capture timing.

▼ **Synchronizing a standalone Phantom camera using Video Signal (ph16 camera models only)**



1. Click the 'Cine Settings' selector and ensure (for all the cameras being synchronized) the:
 - a. 'Sample Rate' setting is identical for all cameras
 - b. 'Trigger Position' (post-trigger ['Last'] value) is the same for all cameras
2. Specify the External Sync' options under the 'Advance Settings' selector.
 - a. Sync Imaging - select 'LockToVideo'. In this mode, the camera captures frames at a rate that is a multiple of the video frame rate, with a defined phase relationship to the video signal. This mode brings the following benefits: when both recording and play-back needs to be synchronized (such as in stereoscopy applications), a FSYNC connection between cameras is no longer needed Genlock will suffice; the cameras can capture at the "fractional" frame rates of 23.98, 29.97 and their multiples; the live output of the camera maintains a stable phase in relation to frame capture.
Refer to [Functional Descriptions>Sync to Video Mode](#) for more details on this feature.
 - b. Frame Delay - entering a value greater than the default 0 μ s (no delay) specifies a delay time between the clock source pulse and the frame capture, essentially providing a phase shift in the capture timing.

7.2.4.7.4 Enabling the Quiet Fans Feature

To turn off the camera's fans or instructs the fan run at its' minimum speed.

STEP-BY-STEP PROCEDURE

1. Click the 'Quiet Fans' button under the 'Advanced Settings>Temperature' option.

7.2.4.7.5 Define the Starts In Option

The Start In command allows the end-user to specify the default operational state of a Phantom camera when power is applied to it.

STEP-BY-STEP PROCEDURE

1. Select the desired the camera startup state from the 'Advanced Settings>Start In' options.

- a. Idle - when enabled (selected) the camera is not recording and a live image is displayed. Generally, this is the state when camera first booted up.
- b. Capture - when enabled (selected) the camera is recording to internal memory (RAM), and awaiting a trigger signal.

7.2.4.7.6 Define DAQ Signals

The 'DAQ Signals' Configure button, when selected, opens the 'Range Data and Signal Acquisition' dialogue window used to define the parameters necessary for the Phantom Camera Control application to process the range data, and/or acquired signal information.

NOTE

This feature is not supported by all Phantom cameras.

7.2.4.7.6.1 Define the Range Data Protocol

The 'Range Data' feature provides a mechanism that can be used to tag image frames with data supplied over the range data interface. This mechanism is an extension of the time stamp storage system; range data tags are treated very much like timestamps and the event signal.

While primarily intended for acquisition of altitude/azimuth/range information from tracking mounts, the range data input does not impose any formatting on the actual data recorded; as such, it can be used to record arbitrary digital data, of up to 128-bits/frame.

Range Data supports two protocols, Az24EI24 or MLAIR. This feature is not supported by all Phantom camera models.

STEP-BY-STEP PROCEDURE

1. Select the desired Range Data protocol from the 'Advanced Settings>DAQ Signals Configure>Range Data' pull-down selection list.
 - a. Az24EI24
 - b. MLAIR

7.2.4.7.6.2 Define the National Instruments USB X or M Series Data Acquisition Signals

A Phantom camera and the Phantom Camera Control application can utilize a NI (National Instruments) USB X or M Series Data Acquisition Unit to tag image frames with signal information supplied through the data acquisition unit. This mechanism is an extension of the time stamp storage system; these data tags are treated very much like time stamps and the event signal.

As of this writing the following National Instruments USB X or M Series Data Acquisition Unit models supported are:

NI (NATIONAL INSTRUMENTS) USB X SERIES DATA ACQUISITION UNITS	NI (NATIONAL INSTRUMENTS) USB M SERIES DATA ACQUISITION UNITS
NI USB-6341	NI USB-6212 BNC
NI USB-6343	NI USB-6216 BNC
NI USB-6351	NI USB-6218 BNC
NI USB-6353	NI USB-6221

NI USB-6356	NI USB-6221 BNC
NI USB-6361	NI USB-6229
NI USB-6363 BNC	NI USB-6229 BNC
NI USB-6366	NI USB-6225
	NI USB-6251 BNC
	NI USB-6259 BNC

To use a National Instruments USB X or M Series Data Acquisition Unit with a Phantom camera and the Phantom Camera Control application the National Instruments software and device drivers must be loaded into the Phantom Control Unit computer.

The following process only describes the steps necessary to define the Phantom Camera Control application signal inputs, for the National Instruments software, device driver installation and cable connection information see, [Accessories, Peripherals, and Miscellaneous Features>National Instruments USB X or M Series Data Acquisition Unit Installation](#).

STEP-BY-STEP PROCEDURE

1. Configure all required capture (recording) parameters (i.e., 'Camera Settings', 'Cine Settings', 'Advanced Settings' etc.) in the 'Live' tab.
2. Define the following 'Camera Signals' options.
 - a. Rec End - when this option is enabled (required) the camera deactivates the 'Ready' output signal, when the camera finishes recording image data to RAM. The 'Ready' signal tells the DAQ (Data Acquisition Unit) that the camera is 'ready' to receive the data it sampled.
 - b. Aux 1 / Aux 2 / Aux 3 Pin Is - when a supporting Miro camera is to be used, select 'Strobe' from one of the available 'Aux Pin Is' pull-down selection list. The 'Strobe' signal informs the DAQ (Data Acquisition Unit) when to send the sampled data to the camera so it can be tagged (embedded) into the frame / image meta-data they were sampled at.
3. Click the 'Advanced Settings>DAQ Signals>Configure' button to define the required signal acquisition parameters in the 'Range Data and Signal Acquisition' dialogue window, including:
 - a. Board - used to verify the board (unit) is communicating and providing the measured data acquisition samples.
 - b. Channel Counts - used to specify the number 'analog' / 'binary' channels by selecting them from their respective 'Used' pull-down selection list.
 - 1) Binary - specifies the number of binary input signals to be used, (tagged), and/or
 - 2) Analog - specifies the number of analog input signals to be used, (tagged).
 - a. Samples - specifies the number of 'samples-per-image' will be tagged to each frame of the Cine.
 - 1) 1 Sample - when enabled (selected) PCC embeds one measured DAQ (Data Acquisition Unit) sample to each post-trigger frame (image).
 - 2) Max Samples per Image - when enabled (selected), PCC automatically calculates, defines, and tags the maximum number of measured DAQ samples (255 maximum) to each post-trigger frame. However, the number of maximum DAQ samples per image may be restricted to less than 255. The reason for this is the number of samples per image is determined by the frame interval and the number of channels being sampled.
 - 3) Sample per Image - this data entry field allows the end-user to define the number of measured DAQ samples (up to the maximum allowed) that will be tagged to each post-

- trigger frame (image).
- b. Analog Channels (ACh₀ - ACh_n) - represent the analog channel inputs connected to the DAQ module and define, including:
- 1) Bipolar Range - enable (checked) this option if the value was sampled via two inputs; one positive / one negative.
 - 2) Differential Inp(ut) - enable (checked) this option if the value was sampled via a differential input a method for electrically transmitting information using two complementary signals. The technique sends the same electrical signal as a differential pair of signals, each in its own conductor. The receiving circuit responds to the electrical difference between the two signals, rather than the difference between a single wire and ground.
 - 3) Name - allows the end-user to enter a name / nomenclature to the respective analog channel for ease of reference.
 - 4) Ana(log)Gain - adjusts the analog gain value from a list of preset values in a pull-down selection list for the corresponding analog n.
 - 5) Gain - adjust the value to the required measurement value by entering it in the 'Gain' data-entry field for the corresponding analog channel.
 - 6) Current Value - displays the measured value sampled for the associate analog channel.
 - 7) Unit - specified the 'unit of measure' (i.e., psi, mph, etc.)
 - 8) ACh - instructs PCC to display the measured value sampled for the analog channels selected from the 'ACh' pull-down selection window.
- c. Binary Channel (BCh₀ - BCh_n) - represent the binary channel inputs connected to the DAQ module and define, including:
- 1) Name - allows the end-user to enter a name / nomenclature to the respective binary channel for ease of reference.
 - 2) Val(ue) - displays the measured value sampled for the associated binary channel.
 - 3) BCh - instructs PCC to display the measured value sampled for the binary channels selected from the 'BCh' pull-down selection window.
- d. Click 'OK' to synchronize the measured DAQ samples with the captured post-trigger frame, or click 'Cancel' to abort the process.
4. Click the 'Live>Capture' button to place the camera into the recording mode.
5. Apply a Trigger signal to the camera.

7.2.4.7.7 Define the Time Info Out Pin Format

To specify if the type of time code to be transmitted from the Time Code Connector on the rear panel of various Phantom camera models:

STEP-BY-STEP PROCEDURE

1. Specify the type of 'time code', under the 'Advanced Settings>Time Info Pin' options, to be transmitted from the 'Time Code Out' connector on the rear panel of various camera models, capture cable, break-out box, or a mini break-out box. The types of time codes include:
 - a. IRIG - when enabled (selected) the connected-to-camera outputs an un-modulated IRIG time code.
 - b. SMPTE - when enabled (selected) the connected-to camera outputs a SMPTE linear time code.

7.2.4.7.8 Enable Audio (Phantom Flex4K Only)

Working with Audio requires the use of a digitizer, such as the Sound Devices MixPre-D, to supply an AES/EBU signal to the camera.

Currently, all ProRes HQ 10 bit and 'Audio' files on a CineMag IV must be downloaded using Windows-based Phantom PCC software. If you are working with a Mac, we recommend running PCC via Bootcamp.

How does audio recording work?

An AES/EBU signal is fed into the AES input on the MiniBob or Sync/Capture cable that came with the original Flex4K purchase. Audio works at sync-sound frame rates and above. Audio must be converted from analog to digital AES/EBU using a digitizer, such as the Sound Devices MixPre-D.

The feature can be enabled via the 'Advanced Settings> Audio' option in PCC, or the 'Audio' menu on the camera body. Audio levels are not provided in PCC, however they are provided on the camera menu by scrolling right with the select knob.

Audio can be monitored from the camera live using the headphone jack on the camera body or, more accurately, with the AES out via the Aux2 port on the Minibob. At sync-sound frame rates (matching with video rates) the camera will play back the audio from the camera RAM. When not matched the camera will not provide audio playback. Audio playback is not supported from the CineMag at this time.

STEP-BY-STEP PROCEDURE

1. Enable (check) 'Audio' under the 'Advanced Settings>Audio' option, to record as a separate audio file with each Cine, in both RAM and PhantomCineMag. The files are downloaded from PCC as uncompressed .wav files which can be matched with the video in post processing. The wav files are 48KHz at 24-bit, and the camera supports re-sampling of other frequencies.

7.2.4.8 Camera Signals

This topic describes the Step-by-Step procedures that can be performed under the 'Camera Signals' selector.

7.2.4.8.1 Define the Trigger Characteristics

To determine the appropriate trigger signaling characteristics to assign, the end-user must first understand that Vision Research holds the trigger signal 'high' in all Phantom cameras, and the type of trigger being used.

STEP-BY-STEP PROCEDURE

1. Define the 'Trigger' options under the 'Camera Signals' selector:
 - a. Rising Edge - when enabled (checked) the leading edge of the supplied TTL pulse will be used to trigger the camera once the specified 'Filter Time' has been satisfied.
 - b. Falling Edge - when enabled (checked) the falling edge of the supplied TTL pulse will be used to trigger the camera once the specified 'Filter Time' has been satisfied...
 - c. Filter Time (μ s) - instructs the Phantom camera to ignore the detected trigger signal in the event the 'Rising Edge' of the TTL pulse isn't held high for the required duration. If the 'Filter Time' criteria isn't met the camera will consider the detected trigger pulse to be a false trigger and ignore it.

When the trigger position is set to the 'Rising Edge' the trigger signal must be held 'Low' for ten (10) times the 'Filter Time', then must return 'High' for the specified 'Filter Time' to be considered a valid trigger signal.

When the trigger position is set to the 'Falling Edge' the trigger signal only needs to be pulled 'Low' for the specified 'Filter Time' to be considered a valid trigger signal.

NOTE

'Trigger' options are not available with all Phantom cameras.

7.2.4.8.2 Define the Pretrigger Pin Is:

Pre-Trigger Pin Is specifies whether a TTL supplied input signal is to be used to toggle Memory Gate or as a pre-trigger input signal.

STEP-BY-STEP PROCEDURE

1. Select the desired 'Pretrigger Pin Is' options under the 'Camera Signals' selector:
 - a. Memory Gate - when enables (selected) the shared capture cable pin / Aux connector is used to accept signal, that when activated, prevents the storing of the sensor produced image data, by disabling write-access to memory. This option is not available with all Phantom camera models.
 - b. Pre-Trigger - when enabled (selected) the shared capture cable pin / Aux connector places the camera into the capture (recording) mode when a TTL pulse is detected.

7.2.4.8.2.1 Using the Memory Gate Feature with a Pickle Switch

The following setup procedures can be used to capture images using Memory Gate signaling to the Phantom camera.

STEP-BY-STEP PROCEDURES

1. Attach the Capture cable, break-out box, or Miro break-out box to the 'Capture' connector on the rear of the Phantom camera; otherwise the video signal will be garbled.
2. Attach a pickle switch to the Capture cable; break-out box, or Miro break-out box, Pre-Trigger BNC connector.
3. Ensure the 'Camera Settings>Partitions>' parameter is set to one (1). Segmented memory can not be used in this application.
4. Set the following 'Advanced Settings' options as follows:
 - a. Enable 'Auto save to CineMag/built-in Flash' and 'Full Cine' under the 'Start/End of Recording Actions' options.
 - b. Select the required frame clock source from the 'Sync Imaging' pull-down selection list from the 'External Sync' options.
 - c. Enable 'Capture' under the Starts In' options.
5. Set the following 'Camera Signals' options as follows:
 - a. Enable 'Rising Edge' under the 'Trigger' options.
 - b. Enable 'Memory Gate' under the 'Pretrigger Pin Is' options..

6. Set the following 'Cine Settings':
 - a. Resolution, Sample Rate, and Exposure Time as desired.
 - b. Slide the 'Trigger Position' slider to the far left to define the Post Trigger value to the maximum frames allowed.
7. Click the 'Capture' button.

NOTE

You must hold the pickle switch closed before performing the next step.

8. Apply a 'Trigger' signal to the camera. DO NOT RELEASE THE PICKLE SWITCH TRIGGER...
9. When you are ready release the pickle switch trigger to open the Memory Gate allowing images to be written to RAM.

NOTE

As long as the pickle switch trigger is released, the camera will record images to RAM. However, this does not affect the trigger itself. Closing the pickle switch trigger opens the Memory Gate, stopping images from being recorded to RAM.

10. Continue to release the pickle switch trigger as necessary to record images to RAM, until the buffer is full. This will be indicated by the red capture indicator no longer being active.

NOTE

If the images are to be saved into non-volatile Flash memory, the camera will write the contents from RAM to non-volatile FLASH memory, once the buffer is full.

When the save is finished, (could be up to ten - fifteen minutes), the camera returns to the recording mode.

There is no output on the camera that indicates the flash memory is full, you will need to keep track how many times you saved to it. You should experiment with it before using this feature first.

If you are using the Phantom camera model that supports an image bit depth greater than 8-bits you need to think about this. With the larger bit depth option turned off, the cameras will operate in 8-bit mode; you should be able to save about five or six full length 8 Gigabyte movies into a 24 Gigabyte Flash card. However, with it is enabled you can only save about two and a half 8 Gigabyte movies, at 12-bit image depth.

Here is why; the RAM is encoded at 12-bits, the flash card at 16-bits. When running at the 8-bit level, you can write two RAM bits to one flash bit ($8+8 = 16$). However, at the 12-bit level you can only write one RAM bit to one flash bit ($12 + 12 = 24$).

There is no way to break up a 12-bit piece of information. So basically the last 4-bits of the 16 available are unused. Vision Research highly recommends using only 8-bit pictures for this, thereby providing much more flash footage available to you.

11. Select the 'Save to File' command from the 'Cine Menu' to save the recorded image data.

7.2.4.8.2.2 Using the Memory Gate Feature with a Pistol Grip Switch

The following setup procedure can be used to capture images via a chase plane using a pistol grip trigger to initiate both Trigger and Memory Gate signaling to the Phantom camera.

The following describes the setup for this application for use with a Phantom camera.

STEP-BY-STEP PROCEDURE

1. Attach the Capture cable, break-out box, or Miro break-out box to the 'Capture' connector on the rear of the Phantom camera; otherwise the video signal will be garbled.
2. Attach a pistol grip switch to the Capture cable, break-out box, or Miro break-out box, Pre-Trigger BNC connector.
3. Ensure the 'Camera Settings>Partitions>' parameter is set to one (1). Segmented memory can not be used in this application.
4. Set the following 'Advanced Settings' options as follows:
 - a. Enable 'Auto save to CineMag/built-in Flash' and 'Full Cine' under the 'Start/End of Recording Actions' options.
 - b. Select the required frame clock source from the 'Sync Imaging' pull-down selection list from the 'External Sync' options.
 - c. Enable 'Capture' under the Starts In' options.
5. Set the following 'Camera Signals' options as follows:
 - a. Enable 'Rising Edge' under the 'Trigger' options.
 - b. Enable 'Memory Gate' under the 'Pretrigger Pin Is' options..
6. Set the following 'Cine Settings':
 - a. Resolution, Sample Rate, and Exposure Time as desired.
 - b. Slide the 'Trigger Position' slider to the far left to define the Post Trigger value to the maximum frames allowed.
7. Exit the Phantom Camera Control Application.
8. Power down the Phantom camera and relocate the camera to the aircraft.
9. Climb into the cockpit, and apply power to both the camera and monitor.
10. Attach the Capture cable, break-out box, or Miro break-out box to the Capture connector on the rear of the Phantom camera; otherwise the video signal will be a garbled.

NOTE

When the trigger on the pistol grip is released both the Trigger and Memory Gate signals are held low, (shorted out). When the trigger is pressed, both signals will go high.

12. Pull the pistol grip. The first pull will trigger the camera, (remember setting trigger to rising edge in the software), and the Memory Gate circuit will open allowing the images to be written into RAM.

NOTE

As long as the pistol grip trigger is held down, the camera will record images to RAM. Releasing the trigger closes the Memory Gate, stopping images from being recorded to RAM, however, does not affect the trigger itself.

13. Pull the pistol trigger, as necessary, to record images to RAM, until the buffer is full, indicated by the red capture no longer being active.

NOTE

Once the buffer is full, the camera will write the contents from RAM to non-volatile FLASH memory.

14. When the save is finished (could be up to ten - fifteen minutes) the red capture led will come back on, and the trigger process starts over, with the first pull triggering the camera and opening the memory gate, the red led will begin to flash again.

NOTE

There is no output on the camera that indicates the flash memory is full, you will need to keep track how many times you saved to it. You should experiment with it on the ground first.

If you are using the Phantom v7 model cameras you may have the 12-bit option to think about also. With it turned off, the camera operates in 8-bit mode; you should be able to save about five or six full length 8 Gigabyte movies into a 24 Gigabyte Flash card. However, with it is enabled you can only save about two and a half 8 Gigabyte movies.

Here is why; the RAM is encoded at 12-bits, the flash card at 16-bits. When running at the 8-bit level, you can write two RAM bits to one flash bit ($8+8 = 16$). However, at the 12-bit level you can only write one RAM bit to one flash bit ($12 + 12 = 24$).

There is no way to break up a 12-bit piece of information. So basically the last 4-bits of the 16 available are unused. Vision Research highly recommends using only 8-bit pictures for this, thereby providing much more flash footage available to you.

15. Power down the camera, once the plane lands.

NOTE

This step is not necessary if you are connected to a battery.

16. Attach the control computer to the camera and start the Phantom Camera Control Software application.
17. Select the 'Save All Flash to File' command from the 'Cine Menu' to save the recorded image data.
18. Select the 'Erase Flash Memory' command from the 'Flash Memory' selector.
19. Fly again...

7.2.4.8.3 Define the Ready Signal Ends At:

The 'Ready Signal Ends At' option instruct the connected-to camera when to deactivate the 'Ready' signal:

STEP-BY-STEP PROCEDURE

1. Define the 'Ready Signal Ends At' options under the 'Camera Signals' selector:
 - a. Trigger - when enabled (selected) the connected-to camera is instructed to deactivate its 'Ready' signal the moment the camera has been triggered.
 - b. Rec(ord) End - when enabled (selected) the connected-to camera is instructed to deactivate its 'Ready' signal when the Cine capture has been completed.

7.2.4.8.4 Define the Aux Pin Is:

Various Phantom camera models support the ability to program I/O signals and specific 'Auxiliary' ports they will be activated through; see the table below:

CAMERA MODELS	AUX 1	AUX 2	AUX 3
Miro (Legacy) Series ¹	FSync I/O	Ready	N/A
Miro M / R / LC Series ²	Strobe / Event / Memgate / FSync	Ready / Strobe	N/A
Miro C Series ³	Strobe / Event / Memgate / FSync	Ready / Strobe	N/A
Miro LAB Series ⁴	Strobe / Event / Memgate / FSync	Ready / Strobe	IRIG Out / Strobe
Phantom Flex 4k	Strobe / Event / Memgate / FSync	Ready / Strobe / AES Out	N/A

¹ Miro (Legacy) Series includes; Miro 1, Miro 2, Miro3, Miro 4, Miro eX1, Miro eX2, Miro eX4, Miro Airborne, Miro HD

² Miro (M / R / LC Series includes); Miro M / R / LC110, Miro M / R / LC310, Miro M / R / LC120, Miro M / R / LC320S, Miro M140, Miro M340

³ Miro C Series includes; Miro C210, Miro C210J

⁴ Miro LAB Series includes; Miro LAB110, Miro LAB310, Miro LAB3a10, Miro LAB120, Miro LAB320, Miro LAB140, Miro LAB340

STEP-BY-STEP PROCEDURE

1. Select the signal type to be used from the 'Aux Pin Is' pull-down selection lists under the 'Camera Signals' selector. The selectable signal types, and the number of programmable 'Aux pins' vary based on the camera model.

7.2.4.9 Auto Exposure

This topic describes the Step-by-Step procedure to define the use of the 'Auto Exposure' for both ph16fw and p7fw camera models. For more information on ph camera versions, see [Camera Legends](#).

'Auto Exposure' is extremely useful when conditions adversely effect the camera's exposure setting

to a fixed variable, such as capturing outdoors where clouds may change the light conditions. The system will automatically adjust the 'Exposure Time' using the information from a user-defined area. This area should be the area of interest (the subject matter).

The Auto Exposure feature cannot be used in conjunction with EDR (Extreme Dynamic Range). Once the 'Auto Exposure' is enabled 'EDR' will automatically be disabled. Also, 'Auto Exposure' should not be enabled while performing a CSR (Current Session Reference) or Black Reference calibration adjustment. For a brief explanation of Black Reference), see: [Functional Descriptions>Black Reference/Current Session Reference Adjustments](#).

CAUTION

The Auto Exposure feature should not be used on Phantom cameras that use an intensifier. Using this feature can cause harm to the intensifier.

STEP-BY-STEP PROCEDURE

▼ Auto Exposure (for ph16 camera models)

Phantom cameras released since late 2011 run on a protocol which, enable a different method of setting 'Auto Exposure'. The control is much simpler with fewer variables.

1. Define the 'Auto Exposure' parameters under the 'Auto Exposure' selector.
 - a. Auto Exposure - when enabled (checked) the 'Auto Exposure' feature and associated parameters are activated. If the 'Show On Image' option is enabled (checked) a red 'AutoExp' rectangle (not recorded with the image data) displays over the image in the selected camera's Preview Panel. The 'Cine Settings>EDR' feature will automatically be disabled.
 - b. Lock at Trigger - always enabled (checked) locks the exposure when a trigger signal is detected by the camera.
 - c. Mode - specifies the 'area' used to calculate the light level of exposure.
 - 1) Average - averages the full image.
 - 2) Spot - averages a small area in the center of the image.
 - 3) Center Weighted - averages a larger area in the center of the image.

NOTE

The larger the auto-exposure area is the slower the auto exposure process becomes.

- d. Compensation - specifies the average gray-scale level to be realized by the automatic exposure process, for the specified 'Mode' (area). A compensation of 0 (zero) would be an average 50% gray level. The compensation can be contracted / expanded (-2 or +2 f/stops) by moving the slider left / right, respectively.

▼ Auto Exposure (for ph7 camera models)

Phantom cameras released since prior to 2012 run on a protocol which, require an 'area' and 'threshold' to be defined manually. This is accomplished by setting a desired exposure' level', and using the cursor to draw an 'area' rectangle, on the live image, used to calculate the light level for the exposure.

1. Define the 'Auto Exposure' parameters under the 'Auto Exposure' selector.

- a. Auto Exposure - when enabled (checked) the 'Auto Exposure' feature and associated parameters are activated. If the 'Show On Image' option is enabled (checked) a red 'AutoExp' rectangle (not recorded with the image data) displays over the image in the selected camera's Preview Panel. The 'Cine Settings>EDR' featurer will automatically be disabled.
- b. Lock at Trigger - when enabled (checked) locks the exposure when a trigger signal is detected by the camera.
- c. Level - specifies the average gray-scale level, to be realized by the automatic exposure process, for the specified area. The 'Level' is set by:
 - 1) Entering a value (i.e., for an 8-bit pixel image depth a mid-gray level is 128, black is 0, and saturation is 255) in the 'Level' data-entry field, or
 - 2) Click the 'up / down' arrows next to the 'Level' data entry field.
- d. Rectangle - specifies an 'area' used to calculate the light level of exposure.
 - 1) Top / Left / Bottom / Right - specify the XY coordinates of the pixels representing the upper-left / bottom-right corner o fthe area rectangle, respectively.
 - a) Draw a rectangle around the area and select 'Auto Exposure' in the popup window. The 'Top', 'Left', 'Bottom', and 'Right' data-entry fields populate automatically.
 - b) Enter the XY coordinates of the upper-left pixel, and the XY coordinates of the lower-right pixel of the area rectangle in the appropriate data-entry field. The XY coordinates can be determined by placing the cursor over the image at the required locations and noting the respective XY coordinates displayed in the 'Status Bar', or
 - c) Click the 'up / down' arrows next to the 'Top' / 'Left' and 'Bottom' / 'Right' data entry fields to define the XY coordinates of the upper-left and lower-right hand corners of the area rectangle, respectively.
 - e. Full - when this button is clicked, PCC uses the entire image area (full resolution of the image) to calculate the light level of exposure.

NOTE

The larger the auto-exposure area rectangle, the slower the 'Auto Exposure' process becomes.

- f. Show On Image - when enabled (checked) a red 'AutoExp' rectangle (not recorded with the image data) displays over the image in the selected camera's Preview Panel indicating the area being used to calculate the light level of exposure.

7.2.4.10 Frame Rate Profile

This topic describes the Step-by-Step procedure to define the use of the 'Frame Rate Profile' feature.

Frame Rate Profile allows the end-user to define different frame rates (user-defined) that automatically change, at specified points, during the capturing process of post trigger frames. The number of profiles varies based on the camera model, the amount of memory associated with the camera, the resolution the images will be recorded at, and the number of post-trigger frames defined. The first profile is the profile defined in the 'Live>Cine Settings' selector. The remaining profiles will be applied to 'post trigger' frames only.

Some Phantom camera models, by default, 'Ramp' (change gradually) to the next defined frame rate profile but not all. Other camera model, by default, 'Step' (change immediately) to the next frame rate profile. Cameras that 'Ramp' frame rates from one rate to the next (by default) can be configured to 'Step' (maintain the frame rate changes until the next rate change), however cameras that 'Step' frame rates cannot be configured to 'Ramp'.

Frame Rate Profile is not supported by all Phantom camera models.

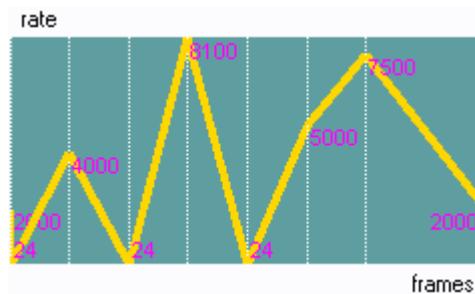
STEP-BY-STEP PROCEDURE

▼ Ramp Profile Model Cameras

The process detailed below depicts the steps necessary to configure frame rate changes that will 'Ramp' (up / down) to the next rate. This procedure does not account for sample rate that needs to be maintained for a period of time.

1. Define the initial 'Cine Settings' via the 'Cine Settings' selector, and note the 'Duration' time. However, to properly set the 'Exposure Time', set the 'Sample Rate' to fastest rate, the Frame Rate Profile feature will record at, then define the 'Exposure Time'. Now you can readjust the 'Sample Rate' to initial recording speed.
2. Define the 'Frame Rate Profile' parameters under the 'Frame Rate Profile' selector:
 - a. Active - when enabled (checked) the Frame Rate Profile' feature and associated parameters are activated.
 - b. Header - specifies the method used to define when a profile change occurs, and changes the 'Profile Table' header field. If the header variable is changed for the first column, the remaining values will be updated according to the selected variable. Small changes can occur because of a rounding process when switch from / back to the previous variable.
 - 1) Image # - specifies the image number, of the post trigger frame, the profile needs to change.
 - 2) Time (s) - specifies the amount of time (in seconds), that needs to pass, from the moment a trigger signal is detected, before changing to the next profile in the table.
 - 3) Image % - specifies a percentage of the images from the number of post trigger frames specified.
 - 4) Time % - specifies a percentage of time from the PT (post trigger) Duration.
 - c. Profile Table - defines when the frame rate changes need to occur, and the frame rates to change to. Enter the header (image or time) variable, and the frame rate the camera will change to in the date-entry fields of the last row (indicated by the asterisk). Repeat this step until all the profile changes have been defined.

With each entry the 'PT Duration' will change indicating the time it will take to record all the post trigger frames, and the graph will display an active representation of the defined profiles as shown in the example here.



Frame Rate Profile Graph Example with Eight Profiles

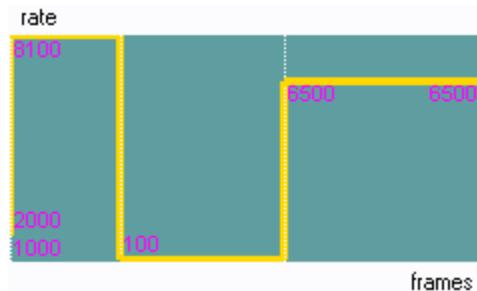
The yellow line indicates the defined frame rates for each of the profiles. The starting point of the line represents the Sample Rate set, and used by Profile 1, defined by the 'Live>Cine Settings' selector. The white dotted lines represent the beginning of the

specified image or time variables starting with Profile 2.

▼ Step Profiles on Ramp Model Cameras

The process detailed below depicts the steps necessary to configure frame rate changes that would normally 'Ramp' (up / down) to the next rate, yet require that the frame rate be maintained for a period of time then 'Step' (immediately change) to the next frame rate.

1. Define the initial 'Cine Settings' via the 'Cine Settings' selector, and note the 'Duration' time. However, to properly set the 'Exposure Time', set the 'Sample Rate' to fastest rate, the Frame Rate Profile feature will record at, then define the 'Exposure Time'. Now you can readjust the 'Sample Rate' to initial recording speed.
 2. Define the 'Frame Rate Profile parameters under the 'Frame Rate Profile' selector:
 - a. Active - when enabled (checked) the Frame Rate Profile' feature and associated parameters are activated.
 - b. Header - specifies the method used to define when a profile change occurs, and changes the 'Profile Table' header field. If the header variable is changed for the first column, the remaining values will be updated according to the selected variable. Small changes can occur because of a rounding process when switch from / back to the previous variable.
 - 1) Image # - specifies the image number, of the post trigger frame, the profile needs to change.
 - 2) Time (s) - specifies the amount of time (in seconds), that needs to pass, from the moment a trigger signal is detected, before changing to the next profile in the table.
 - 3) Image % - specifies a percentage of the images from the number of post trigger frames specified.
 - 4) Time % - specifies a percentage of time from the PT (post trigger) Duration.
 - c. Profile Table - defines when the frame rate changes need to occur, and the frame rates to change to.
 - 1) Enter the header (image or time) variable, and the frame rate the camera is to maintain the rate at in the date-entry fields of the last row (indicated by the asterisk). Repeat this step until all the profile changes have been defined.
 - 2) Repeat the previous step, however slightly increase the header image / time variable (a few frames / hundredth of a second, respectively), and enter the frame rate the camera will change to in the date-entry fields of the last row (indicated by the asterisk).
 - 3) Repeat the last two steps until all the required frame rates have been defined.
 - 4) Set the frame rate of the 'last' image or time variable, on the row indicated with a right arrow, and set the frame rate to match the last frame rate entered
- With each entry the 'PT Duration' will change indicating the time it will take to record all the post trigger frames, and the graph will display an active representation of the defined profiles as shown in the example here.



Frame Rate Profile Graph Example with Five Profiles

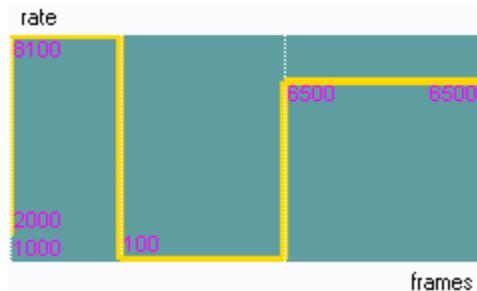
The yellow line indicates the defined frame rates for each of the profiles. The starting point of the line represents the Sample Rate set, and used by Profile 1, defined by the 'Live>Cine Settings' selector. The white dotted lines represent the beginning of the specified image or time variables starting with Profile 2.

▼ Step Profile Camera Models

The process detailed below depicts the steps necessary to configure frame rate changes that will 'Step' (up / down) to the next rate only. This procedure does not account for sample rate that needs to 'Ramp' (up / down) to the next frame rate. Ramping to the next sample rate for these camera models can not be achieved.

1. Define the initial 'Cine Settings' via the 'Cine Settings' selector, and note the 'Duration' time. However, to properly set the 'Exposure Time', set the 'Sample Rate' to fastest rate, the Frame Rate Profile feature will record at, then define the 'Exposure Time'. Now you can readjust the 'Sample Rate' to initial recording speed.
2. Define the 'Frame Rate Profile' parameters under the 'Frame Rate Profile' selector:
 - a. Active - when enabled (checked) the Frame Rate Profile' feature and associated parameters are activated.
 - b. Header - specifies the method used to define when a profile change occurs, and changes the 'Profile Table' header field. If the header variable is changed for the first column, the remaining values will be updated according to the selected variable. Small changes can occur because of a rounding process when switch from / back to the previous variable.
 - 1) Image # - specifies the image number, of the post trigger frame, the profile needs to change.
 - 2) Time (s) - specifies the amount of time (in seconds), that needs to pass, from the moment a trigger signal is detected, before changing to the next profile in the table.
 - 3) Image % - specifies a percentage of the images from the number of post trigger frames specified.
 - 4) Time % - specifies a percentage of time from the PT (post trigger) Duration.
 - c. Profile Table - defines when the frame rate changes need to occur, and the frame rates to change to. Enter the header (image or time) variable, and the frame rate the camera will change to in the date-entry fields of the last row (indicated by the asterisk). Repeat this step until all the profile changes have been defined.

With each entry the 'PT Duration' will change indicating the time it will take to record all the post trigger frames, and the graph will display an active representation of the defined profiles as shown in the example here.



Frame Rate Profile Graph Example with Five Profiles

The yellow line indicates the defined frame rates for each of the profiles. The starting point of the line represents the Sample Rate set, and used by Profile 1, defined by the 'Live>Cine Settings' selector. The white dotted lines represent the beginning of the specified image or time variables starting with Profile 2.

7.2.4.11 Image-Based Auto-Trigger

This topic describes the Step-by-Step procedure to define the use of the 'Image-Based Auto-Trigger' feature.

WARNING:

The Image-Based Auto-Trigger feature should never be used in applications where missed or false triggers cannot be tolerated or where a false trigger could cause harm to people or property.

The hardware signaling available in some Image-Based Auto-Trigger modes should be used only to synchronize multiple Phantom cameras together and should never be used to trigger or control any other external device or event.

CONSEQUENCES RESULTING FROM SYSTEM FAILURE, FALSE TRIGGERING OR MISUSE OF THIS FEATURE ARE THE SOLE RESPONSIBILITY OF THE USER.

Not all camera models support this feature.

The feature allows the end-user to trigger a camera from motion detected in the live image. It can also be used to provide an external trigger signal to multiple Phantom cameras. For a brief explanation of Image-Based Auto-Trigger, see: [Functional Descriptions>Image-Based Auto-Trigger](#).

NOTE

Performing a 'CSR' (Current Session Reference), or enabling the 'Auto Black Reference' feature will cause 'Image-Based Auto-Trigger' to false trigger the camera.

STEP-BY-STEP PROCEDURE

1. Define the 'Image-Based Auto-Trigger' parameters under the 'Image-Based Auto-Trigger' selector.
 - a. Auto Exposure - when enabled (checked) the 'Image-Based Auto-Trigger' feature and associated parameters are activated. If the 'Show On Image' option is enabled (checked) a yellow 'Image Trigger' rectangle (not recorded with the image data) displays over the image in the selected camera's Preview Panel indicating the area being used to evaluate the Image-Based Auto-Trigger criteria.

- b. Only Output Signal (don't auto-trigger this camera) - when enabled (checked) the auto trigger feature generates a 'Trigger Output' signal used to trigger multiple networked cameras. However, the auto-trigger feature is disabled for the camera for some known transient event. Therefore, the auto-trigger signal from the camera is to be routed through some external device and back into the trigger input of the camera.
- c. Sensitivity - specifies the auto trigger criteria.
 - 1) Threshold - specifies the value (amount) a pixel must change in order to be counted as an active pixel for auto-trigger purposes. A value of 100 would require a change of approximately half of the full swing of the camera. A typical threshold setting would be 10. Any one of three methods can be used to specify the pixel 'threshold':
 - a) Enter a value in the data-entry field.
 - b) Click the 'up / down' arrows to, respectively, increase / decrease the value.
 - c) Move the slider right / left to, respectively, increase / decrease the value.
 - 2) Area % - specifies the percentage of the auto-trigger region that must be active in order for an auto-trigger event to be generated. A typical percentage value is 10. Any one of three methods can be used to specify the pixel 'threshold':
 - a) Enter a value in the data-entry field.
 - b) Click the 'up / down' arrows to, respectively, increase / decrease the value.
 - c) Move the slider right / left to, respectively, increase / decrease the value.
 - 3) Check Interval (ms) - specifies the speed (in milliseconds) between updates the auto-trigger region is checked. Use one of two methods can be used to specify the pixel 'threshold':
 - a) Enter a value in the data-entry field.
 - b) Move the slider right / left to, respectively, increase / decrease the value.
- d. Area - specifies an 'area' used to evaluate the Image-Based Auto-Trigger criteria.
 - 1) Top / Left / Bottom / Right - specify the XY coordinates of the pixels representing the upper-left / bottom-right corner of the area rectangle, respectively.
 - a) Draw a rectangle around the area and select 'Auto Trigger' in the popup window. The 'Top', 'Left', 'Bottom', and 'Right' data-entry fields populate automatically.
 - b) Enter the XY coordinates of the upper-left pixel, and the XY coordinates of the lower-right pixel of the area rectangle in the appropriate data-entry field. The XY coordinates can be determined by placing the cursor over the image at the required locations and noting the respective XY coordinates displayed in the 'Status Bar', or
 - c) Click the 'up / down' arrows next to the 'Top' / 'Left' and 'Bottom' / 'Right' data entry fields to define the XY coordinates of the upper-left and lower-right hand corners of the area rectangle, respectively.
 - e. Full - when this button is clicked, PCC uses the entire image area (full resolution of the image) to evaluate the Image-Based Auto-Trigger criteria.
 - f. Show On Image - when enabled (checked) a yellow 'Image Trigger' rectangle (not recorded with the image data) displays over the image in the selected camera's Preview Panel indicating the area being used to evaluate the Image-Based Auto-Trigger criteria.

7.2.4.12 Continuous Recording

This topic describes the Step-by-Step procedures to define various use models of the 'Continuous Recording' feature.

This feature is perfect where repetitive testing is required. It allows the end-user to define a specific range of images that will be saved automatically to a user specified location (i.e., control computer hard drive, network drive, etc.) the moment the RAM (buffer memory) is full. The camera will then return to recording awaiting another trigger signal to repeat the process.

The setup procedures vary based on the features used (i.e, Partitions, Image-Based Auto-Trigger, etc.) in conjunction with the Continuous Recording feature.

STEP-BY-STEP PROCEDURES

▼ Continuous Recording - Native Mode

Native Mode simply means that the camera has not been configured to use Partitions (MultiCine segments), Direct Recording to CineMag, Auto Save to CineMag / Built-In Flash / CineFlash / CardFlash, or Image-Based Auto-Trigger, and / or some of the Continuous Recording options (Auto Trigger, Firmware Ordered Recording, and / or Calibration Snapshot). In this application the camera returns to recording mode after the save process has been completed. If a trigger signal is detected before the save process completes the trigger will be ignored.

1. Define all the required recording parameters; 'Camera Settings', 'Cine Settings', 'Advance Settings', etc.
2. Define the 'Continuous Recording' parameters in the following order:
 - a. Browse - when clicked the 'Save Cine' dialogue window opens to define the 'Save' parameters:
 - 1) Save In - used to navigate to the destination folder the file(s) are to be saved in. Enter the full path for the folder the file(s) is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - 2) File Name - assigns names to the file(s) being saved using special naming convention to. Enter the <root_file_name><special_character><single_digit_range>, where <root_file_name> is the root name (that is consistent for all files created during the session; <special character> signifies the type of file(s); <single_digit_range> specifies the number of digits(file counters) appended to the root file names being created.
For details on the Phantom File Naming Convention see; [Functional Descriptions>Phantom File Naming Convention](#).
 - 3) Save As Type - defines the file format the file(s) are saved as. Select the format from the 'Save as Type' pull-down selection list.
To determine the file format that best meets your requirements see, [Functional Descriptions>Supported File Formats](#).
 - 4) Range Options - used to define the range of images to save via the pull-down selection list.
 - a) [Mark-In, Mark-Out] - saves only the images between the Mark-In / Mark-Out pointers specified by the 'Play>Cine Editor Bar'. If this option is selected the Continuous Recording feature will save the full Cine since the recorded image can not be edited by the end-user.
 - b) Full Cine - saves the entire image range stored in the camera RAM (memory buffer).
 - c) User Defined - saves the image range specified in the '[first, last]' data entry field.
 - d) Decimate By - used to reduce the number of images saved by the specified factor, for details about this option refer to [Functional Descriptions>Decimate Factor](#).

- 5) Save Options - define the desired 'Save Options'.
 - 6) Save - accepts the save configurations. PCC displays 'Cine file path & save parameters' and the 'Range:' of images being saved.
 - b. Minimal GUI Refresh - when enabled (checked) the feature accelerates the Cine save process by disabling the save progress indicators from being displayed in the Graphical User Interface. Enabling this command also instructs PCC to stop displaying live images in the Preview Panel during the save procedure.
For more details on Minimal GUI Refresh see: [Functional Descriptions>Firmware Ordered Recording and Minimal GUI Refresh](#).
 - c. Active - when enable (check) activate Continuous Recording and places the camera into the capture (recording) mode.
 - d. Save Count - indicates the number of files saved using Continuous Recording during this session of PCC.
 - e. Error Count - indicates the number of files that could not be saved using Continuous Recording during this session of PCC.
3. Apply a trigger to the camera. The camera finishes filling the RAM buffer, edits the image data to the user-specified range, saves the file, then places the camera back into the capture (recording) mode once the save process has completed, and awaits another trigger.
 4. Continue applying trigger(s) until all takes have been completed.
 5. When finished disable (uncheck) the Active enable box.

▼ **Continuous Recording to Multiple Camera Partitions (Multi-Cine)**

In this application, PCC will automatically save the captured image data (files), and immediately start capturing images to the next available unused partition (MultiCine segment) without having to wait for the previously recorded file(s) to be saved to the user-specified destination. This process will continue until; either all the partitions are full, or a previously used partition is freed up for use again.

For this application 'Camera Settings>Partitions', and 'Continuous Recording>Firmware Ordered Recording' will be used in conjunction with Continuous Recording.

1. Define all the required recording parameters; 'Camera Settings', 'Cine Settings', 'Advance Settings', etc.
 - a. Camera Settings - ensure the required number of 'Partitions' has been selected.
 - b. Cine Settings - ensure 'Image Range and Trigger Position' is correct and the 'Cine Settings' have been copied to all 'Cine' partitions.
2. Define the 'Continuous Recording' parameters in the following order:
 - a. Browse - clicked to open the 'Save Cine' dialogue window and define the 'Save' parameters:
 - 1) Save In - enter the full path of the folder the Cine is to be saved in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - 2) File Name - enter a name for the Cine being saved using the special file naming convention, then
 - 3) Save As Type - select the format from the 'Save as Type' pull-down selection list.

- 4) Range Options - define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list.
 - 5) Save Options - define all desired 'Save Options'
 - 6) Save - click the 'Save' button.
- b. Firmware Ordered Recording - when enabled (checked) PCC is instructed to save the files in the order they were captured regardless of the partition they were recorded into.
For more details on Firmware Ordered Recording and Minimal GUI Refresh see: [Functional Descriptions>Firmware Ordered Recording and Minimal GUI Refresh](#).
- c. Minimal GUI Refresh - enable to accelerate the Cine save process.
 - d. Active - enable Continuous Recording and place the camera into the capture (recording) mode.
3. Apply a trigger to the camera. The camera finishes filling the RAM partition, edits the image data to the user-specified range, saves the file. However, the camera immediately starts capturing (recording) image data into the first available partition, and awaits another trigger. If all partitions are full, an applied trigger signal will be ignored until a partition's information has been saved and cleared automatically by PCC.
If there are problems at Cine save, the application is trying again and again to save the Cine. The Cine is not deleted if it has not been saved. Each missed save event is recorded as an error into a log file CR_Log_0.log saved in ProgramData>Phantom>PCCversion. There is also an Error count updated in the Continuous Recording sub-panel, besides the Save count.
 4. Continue applying trigger(s) until all takes have been completed.
 5. When finished disable (uncheck) the Active enable box.

▼ Auto Trigger

The 'Auto Trigger' feature instructs the camera to immediately return to the capture (recording) mode, refill the RAM (memory buffer), trigger itself, then edit / save the new file to the user-specified destination without any user intervention (except to apply an initial trigger). This process continues until the feature is disabled.

When applied with a delay defined via the 'Cine Setting>Image Range and Trigger Position' field the camera can be used to capture a Cine file at user-specified intervals (i.e., every 30-minutes, hour, etc.).

1. Define all the required recording parameters; 'Camera Settings', 'Cine Settings', 'Advance Settings', etc. If using this feature to record at specific time intervals, ensure 'Image Range and Trigger Position' have been defined properly; refer to [Cine Settings>Define an Image Range \(trigger Delay\) or Trigger Position \(Post Trigger\) Value](#).
2. Define the 'Continuous Recording' parameters in the following order:
 - a. Browse - clicked to open the 'Save Cine' dialogue window and define the 'Save' parameters:
 - 1) Save In - enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - 2) File Name - enter a name for the Cine being saved using the special file naming convention, then
 - 3) Save As Type - select the format from the 'Save as Type' pull-down selection list.

- 4) Range Options - define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out] , Full Cine, or User Defined) pull-down selection list.
 - 5) Save Options - define all desired 'Save Options'
 - 6) Save - click the 'Save' button.
- b. Auto-Trigger - when enabled (checked) instructs the camera to use this feature once 'Continuous Recording' is enabled.
- c. Minimal GUI Refresh - enable to accelerate the Cine save process. For more details on Firmware Ordered Recording and Minimal GUI Refresh see: [Functional Descriptions>Firmware Ordered Recording and Minimal GUI Refresh](#).
- d. Active - enable Continuous Recording and place the camera into the capture (recording) mode.
3. Apply an initial trigger to the camera. The camera finishes filling the RAM (memory buffer), edits / saves the user-specified range. Once the file is saved, the camera is automatically placed into the capture (recording) mode. Once the buffer is full the camera automatically triggers itself and repeats the process until the 'Continuous Recording' feature is disabled.
 4. When finished disable (uncheck) the 'Active' and 'Auto Trigger' enable boxes.

▼ **Continuous Recording - Calibration Snapshot**

The following describes the process of capturing calibration images from two or more synchronized Phantom cameras. This process will result in several matched images to be used as calibration frames for third-party software that processes data from two or more synchronized cameras. These frames can be saved in the user's chosen format (Tiff in this example). The saving path and the file name defined in 'Browse – Save Cine' dialogue window will be used to compose the folder name and counting for each camera along with the files names. The range and file format will be set by the user according to his/her calibration needs.

1. Configure hardware connections, of the cameras, using one of the camera synchronization techniques described in the [Step-by-Step Procedures>Live Tab Procedures>Advanced Settings>Define the External Sync Parameters](#) procedure, and ensure the:
 - a. F-sync connectors between all cameras are connected.
 - b. Trigger lines are connected together to an external triggering device (i.e., pickle switch, sound trigger, etc).
2. Assign the cameras to be used to a 'Cameras' group / sub-group. For details on using cameras in multi-camera environments, refer to the ['Multi-Camera / Cine \(Group\) Procedures'](#).
3. Open / Lock the cameras to be used.
 - a. Double mouse--click the camera, or right mouse click the 'Cameras' group / subgroup, and select 'Show Only Images From This' in to popup window in the 'Manager' tab, or
 - b. Select the cameras to be used from the 'Camera:' pull-down selection list in the 'Live' tab.
 - c. Select the associated 'Cameras' group / sub-group from the 'Play>Camera:' pull-down selection list. A 'Preview Panel' for each camera, associated with that group / sub-group will be opened and placed in the Locked (Group) state, indicated by a red border around the Preview Panel.
4. Set the required capture parameters 'Camera Settings', 'Cine Settings', 'Advance Settings', etc. Ensure the:

- a. 'Camera Settings>Partitions' is set to 1.
 - b. 'Cine Settings>Sample Rate' are the same.
 - c. 'Cine Settings>Image Range and Trigger Position' is set to 1 (one).
 - d. 'Advanced Settings>External Sync' parameters are correctly defined for each camera.
(Unlock the cameras will need to be unlocked if the 'External Sync' clock source is different for the cameras. After defining the clock source lock the cameras together again.)
4. Perform a CSR (Current Session Reference) on all cameras being used.
 5. Define the 'Continuous Recording' parameters in the following order:
 - a. Browse - clicked to open the 'Save Cine' dialogue window and define the 'Save' parameters:
 - 1) Save In - enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - 2) File Name - enter a name for the Cine being saved using the special file naming convention (i.e., stereo). The resulting files will all have this word as the 'root' of the file name structure, followed by the shot number, such as: 'stereo_00.tif'.
 - 3) Save As Type - select the format from the 'Save as Type' pull-down selection list. This includes saving the captured images in one of many image formats. To determine the file format that best meets your requirements see, [Functional Descriptions>Supported File Formats](#).
 - 4) Range Options - define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list.
 - 5) Save Options - define all desired 'Save Options'
 - 6) Save - click the 'Save' button.
 - b. Calibration Snapshot - when enabled (checked) instructs the camera to use this feature once 'Continuous Recording' is enabled.
 - c. Minimal GUI Refresh - enable to accelerate the Cine save process. For more details on Firmware Ordered Recording and Minimal GUI Refresh see: [Functional Descriptions>Firmware Ordered Recording and Minimal GUI Refresh](#).
 - d. Active - enable Continuous Recording and place the camera into the capture (recording) mode.

CAUTION

All cameras associated with a locked camera group will be placed into the capture mode even if the camera is not displayed in a Preview Panel.

6. Apply an initial trigger to the camera. A folder, containing an image file and a .chd file for each capture (trigger), will be placed in the Windows folder specified for each camera. The .chd files can be deleted if they are not necessary.

CAUTION

All cameras associated with a locked camera group will be triggered even if the camera is not displayed in a Preview Panel.

7. When finished disable (uncheck) the 'Active' and 'Calibration Snapshot' enable boxes.

▼ Verify Continuous Recording Session

1. When the 'Continuous Recording' session is complete:
 - a. Click on the 'Open File' button.
 - b. Navigate to the destination folder, then
 - c. Verify the file listings.

7.2.4.13 Camera Info

The 'Camera Info' provides important information about the active (selected) camera. It also allows the end-user to change the name of the active, connected-to camera.

STEP-BY-STEP PROCEDURE

1. Click on the 'Camera Info' selector. The following types of information are displayed:
 - a. Camera Name - indicates the user-assigned name of the camera. This field can also be used to change the name of the active camera.
 - b. Serial - indicates the serial number of the camera.
 - c. IP - indicates the Vision Research assigned IP Address.
 - d. Hardware Version - indicates the Vision Research syntax used to identify the camera model type. The camera type is displayed in the parentheses.
 - e. CineMag Version - the CineMag firmware version installed in a Phantom ph7 camera.
 - f. Firmware Version - indicates is the ph16 / ph7 camera dependent firmware, (the programs/data structures that internally control the various electronic components of the camera), version file installed in the camera.
 - g. FPGA Version - indicates the camera dependent, installed FPGA (Field Programmable Gate Array) version (ph7.bin) file. An FPGA is a type of logic chip that can be programmed to perform complex functions via the support thousands of gates hardwired in the chip sets to produced faster performance.
 - h. Kernel Version - indicates the kernel version installed in the Phantom ph7 camera. An operating system kernel is the piece or pieces of software that is responsible for servicing resource requests from applications and the management of resources. A kernel has facilities to receive resource requests and grant access to resources such as allocating space for a new file or creating a network connection.
 - i. RAM (FBM) (MB) - displays the size of the FBM (Fame Buffer Memory) of the camera in megabytes (MB).
 - j. Flash (MB) - displays the size of Flash memory associated with the camera in megabytes (MB).

7.2.4.14 Capture (Record) Image Data

This topic describes the Step-by-Step procedure to place the selected Phantom into the Capture state via the Live Panel>Capture, or Record button.

By default Vision Research initially sets all Phantom cameras to start in the 'Live', (Preview... Waiting for Pre-Trigger) operational state. In other words, the camera is capturing live image data and transmitting them to an attached control computer / laptop, or attached monitor. The image data is not being recorded into the camera's RAM (memory buffer). The camera waits until a command (pre-

trigger signal) instructing it to start recording to its' RAM is received.

The end-user can determine that the camera is in this 'Live' state by looking at the selected camera's 'Preview Panel Status Bar' and see that only the 'Live' (blue) indicator is active, and the 'Capture' or 'Record' button is active while the 'Trigger' button is inactive.

STEP-BY-STEP PROCEDURE

1. Click on the 'Capture' button. The selected Phantom camera starts recording image data into the cameras' RAM, and the 'Rec' indicator, located in the 'Status Bar' of the 'Preview Panel' will be active (red) along with the 'Trigger' button. The 'Capture' button becomes an 'Abort Recording' button.

If the camera has been set in 'Direct recording to CineMag' (or Run/Stop mode) via 'Live>Flash Memory', the selected Phantom camera starts recording image data directly into the attached CineMag bypassing the camera's RAM, and the 'Rec' indicator will be active (red). However, since there is no 'Trigger' button the 'Record' button changes into a 'Stop Recording' button.

7.2.4.15 Trigger / Abort Recording

Triggering a camera can be accomplished either by applying a 'soft' trigger or 'hard' trigger to the camera. Upon detection of the 'Trigger' signal the camera will stop recording images into the cameras RAM immediately, unless otherwise configured to capture a user specified number of Post Trigger frames.

STEP-BY-STEP PROCEDURE

1. Trigger the camera:
 - a. Click on the 'Trigger' button, in PCC, to apply a soft-trigger to the camera, or
 - b. Apply a switch closure or TTL ('rising / falling edge') pulse to the 'Trigger' port:
 - 1) On the rear of the camera, or
 - 2) 'Capture Cable', 'Break-out Box', or 'Mini Break-out Box' connected to the 'Capture' port on the rear of the camera.
 - c. Use the 'Image-Based Auto-Trigger' feature to apply a trigger to the camera.
- Triggering a camera stops recording image data into the cameras' RAM once the user specified 'post trigger' value has been satisfied. The Preview Pane>Status Bar> 'Rec' indicator will be inactive (gray) when the capture process is completed.
2. Click 'Abort Recording' to cancel recording.

7.2.5 Play Tab Procedures

This section describes the Step-by-Step procedures that can be performed via the 'Play' tab.

7.2.5.1 Cine Selection

The 'Plat>Cine:' pull-down selection list displays a list of the Cine files, that the end-user can select to review, edit, and/or save. The list contains all the Cine files listed under the:

- 'Cameras' group - contains a list of Cine(s) stored in the individual camera's RAM (memory buffer) and/or Flash memory (internal, Phantom CineMag, or CineFlash).

- 'Files' group - contains a list of all previously opened saved Cine files.

STEP-BY-STEP PROCEDURE

▼ Selecting RAM / Flash Cine(s)

1. Double-click the Cine to open from the 'Manager>Cameras' group, or
2. Select the Cine to open from the 'Play>Cine' pull-down selection list. If a Cine: group / sub-group is selected from the pull-down selection list, only the first Cine listed opens in a 'Preview' panel.

Only one Cine can be opened in a Play' panel from any one camera, at any given time. However, PCC does allow for the opening a Cine from multiple cameras.

▼ Selecting Previously Opened Saved Cine(s)

1. Double-click the Cine file to be opened from the 'Manager>Files' group. The file opens in a 'Play' panel. This method allows multiple files to be opened in 'Play' panels simultaneously, or
2. Right-click the file, to be opened and select the 'Show Only Images From This' in the popup window. This method only allows one file to be opened in a Play panel at any given time, or
3. Right-click the 'Manager>Files' group / sub-group, and select the 'Show Only Images From This' to open all the files associated with the group / sub-group in a 'Play' panel simultaneously, or
4. Select the Cine file, from the 'Play>Cine:' pull-down list to open individual files in 'Play' panels simultaneously. If a 'Files' group / sub-group is selected only the first Cine file listed in that group / sub-group opens in 'Play' panel.

7.2.5.2 Cine Lock

Cine files not associated with a 'Files' group / sub-group can be temporarily 'locked' (grouped) together to synchronize their playback.

STEP-BY-STEP PROCEDURE

1. Open the Cine files to be reviewed.
2. Click the 'Play>Cine: Lock' button. The open 'Play' panels are now temporarily placed into a 'lock' (group) mode, indicated by a red border around the 'Play' panels. The locked files can now be reviewed simultaneously.

For more details on locking Cine files, see ['Multi-Camera / Cine \(Group\) Procedures>Grouping Previously Saved Cine Files'](#).

7.2.5.3 Cine File Review

The PCC (Phantom Camera Control) application uses common video control buttons to play, pause (stop) the playback of Cine(s), from a Phantom camera's RAM, non-volatile Flash (internal, Phantom CineMag,or CineFlash).

STEP-BY-STEP PROCEDURE

1. Select the Cine file to be reviewed.
2. Use the video control buttons to:



Play Fast Rewind button to decrement the images being reviewed. The Cine file will play backwards the total number of Cine frames/1000, no less than 10 frames, auto adjusting to Cine size.



Play Fast Forward button to increment the images being reviewed. The Cine file will play forward the total number of Cineframes/1000, no less than 10 frames, auto adjusting to Cine size.



Standard Play Rewind button to play the Cine file in reverse. The Cine file will play backwards one step at a time.



Standard Play button to play the Cine file. The Cine file will play forward one step at a time.



Pause Playback button to stop or pause the playback process.



Step Backward button to rewind only one step. The Cine file will move backward one step and stop.



Step Forward button to advance forward one image step. The Cine file will move forward one step and stop.

7.2.5.4 Cine Quick Serach

Scrubbing or jumping through a Cine file will greatly reduce post-production time when editing a Cine file. There are several methods to 'Jump' through a Cine file.

Before we describe the procedures for each of these methods, let's review the components that make up the 'Cine Editor Bar'.



The blue portion of the 'Cine Editor Bar' represents the edited Cine file. The numbers displayed above the bar indicate the first image (left), and the last frame (right) of the unedited Cine. The center number represents the displayed in the playback panel. The numbers below the editor bar represent the numbers of the first (left) / last (right) images (frames) of the edited Cine file. Negative numbers represent frames captured before the t_0 (trigger) frame, while positive image numbers represent frame recorded after it. The t_0 (trigger) frame (the frame recorded the moment a trigger signal was detected) will be 0 (zero).

A 'Tooltip' image will be displayed when the cursor is placed over the Cine Editor Bar in the Play panel. PCC only displays the 'Tooltip' images inside the 'Mark-In' and 'Mark-Out' points when the 'Cine Slider Tooltip' enable box, in Manager>Preferences>General dialogue window, is checked.

The following describes each of the methods, including:

STEP-BY-STEP PROCEDURE

▼ Using the Edit Bar

1. Select the Cine to be reviewed.
2. Click 'Cine Editor Bar' (each click will jump to associated image), alternatively
3. Drag (scrub) the slider left / right to scrub backward / forward respectively.

The Cine(s) displays the image (frame), in its' Play' panel, specified above the center of the bar.

▼ Using the Playback Speed Slider

1. Click the Play Panel Tab.
2. Click on the down-arrow to the right of the Cine: field.
3. Select the Cine to be reviewed.
4. Under the 'Play Speed & Options' selector:
 - a. Disable (uncheck) 'Play Each Image'
 - b. Adjust the slide up/ down to increase / decrease the playback rate. (the number in the 'fps' field indicates the playback speed), or
 - c. Type the desired playback rate in the 'fps' field, and hit the enter key.
5. Use the video control buttons to search the Cine.

The Cine(s) displays the specified image (frame), in its' Play' panel, specified above the center of the bar.

▼ Using the Jump: Field

1. Select the Cine to be reviewed.
2. Type the desired image (frame) number to jump to image number in the 'Jump:' field, and hit the enter key.

The Cine Editor Bar slider moves to the image number above the center of the bar, indicates the number of the image the slider is at, and is presently being displayed in the playback panel.

▼ Image Search

For detail on how to use the 'Image Search' feature, see [Step-by-Step Procedures>Play Panel Procedures>Image Search](#).

7.2.5.5 Cine File Edit

Many recorded Cine files contain a lot of unnecessary information both before and after the actual motion of interest. The Cine editor Bar is used to edit unnecessary images from the beginning and

the end of the recorded Cine file prior to saving the Cine file to an external hard drive. Editing the Cine file will create smaller files, reduce file save times, and make Cine file playbacks more interesting.

STEP-BY-STEP PROCEDURE

▼ Initial Edit

1. Select the Cine file to be edited.
2. Edit the Cine file.
3. Use the video control buttons to locate the first image (frame) to be saved, then 'pause' the playback.
4. Click the  'Mark In' button. The Cine Editor Bar turns gray left of the selected image (frame), and the edit bar slider moves to the specified image.
5. Use the video control buttons to locate the last image (frame) to be saved, then 'pause' the playback.
6. Click the  'Mark Out' button. The Cine Editor Bar turns gray right of the selected image (frame), and the edit bar slider moves to the specified image.

▼ Review the Edited Cine File

1. Enable (check) 'Limit to Range' in the 'Play Speed & Options' selector. When selected, (checked) only the images between the 'Mark-In' and 'Mark-Out' points are available for playback.
2. Enable, (check), the 'Play Each Image' to ensure PCC plays doesn't skip frames unless specified (to a number greater than 1) in the 'Play Step' field. If disabled (unchecked) PCC can playback the Cine file at faster rates, which may require PCC to skip images depending on the speed specified in the 'fps' field, or by the slider below it.
3. Click the  'Jump to Start' button. Jumps the edited Cine file to the first image (frame).
4. Use the video control buttons to review the edited Cine file.
5. Save the edited Cine file if the edit is correct, if not re-edit the Cine file.

▼ Re-Editing the Cine File

1. Disable, (uncheck), the Limit to Range option in the 'Play Speed & Options' selector.
2. Click the  'Jump to Start' of Cine button. The selected Cine file will jump back to first image of the unedited Cine file.
3. Use the video control buttons to locate the first image (frame) to be saved, then 'pause' the playback.

4. Click the  'Mark In' button. The Cine Editor Bar turns gray left of the selected image (frame), and the edit bar slider moves to the specified image.
5. Use the video control buttons to locate the last image (frame) to be saved, then 'pause' the playback.
6. Click the  'Mark Out' button. The Cine Editor Bar turns gray right of the selected image (frame), and the edit bar slider moves to the specified image.
7. Review the newly edited file.

7.2.5.6 Specify Play Speed & Options Settings

STEP-BY-STEP PROCEDURE

1. Specify the 'Loop Options' in the 'Play Speed & Options' selector:
 - a. Limit to Range - when enabled (checked) only the images between the user-specified 'Mark-In' / 'Mark-Out' points can be reviewed.
 - b. Repeat - when enabled (checked) the Cine file will play in an endless loop. If 'Limit to Range' is enabled, (checked) the loop will be restricted to edit Cine file.
 - c. Ping Pong - when enabled (checked) the Cine file plays forward then backward, repeatedly.
2. Enable (check) 'Play Rec Speed' to playback the Cine file at the rate it was recorded (real time speed).
3. Enable, (check) the 'Play Each Image' to ensure PCC plays doesn't skip frames unless specified (to a number greater than 1) in the 'Play Step' field. If disabled (unchecked) PCC can playback the Cine file at faster rates, which may require PCC to skip images depending on the speed specified in the 'fps' field, or by the slider below it.
 - a. fps - enter the desired playback rate, and hit the enter key, or
 - b. Adjust the slide up/ down to increase / decrease the playback rate. (the number in the 'fps' field indicates the playback speed),
4. Move the Playback Slider up to increase the playback speed, or down to reduce the playback speed, or type the fps, (frame per second), playback rate desired in the fps entry window, and hit the Enter key.
5. Specify the 'Player Step' to skip the number of 'frames' entered to increase the speed of the Cine file playback.
6. Enable (check) the 'Sync to Frame #' option in the 'Group Play' area to force locked Cine files play the identical range of frames. If a non-valid range is attempted to be select PCC provide a warming prompted.

7.2.5.7 Saving Cine Procedures

The following procedures are used to save captured Cines that have been recorded into Phantom camera memory buffers to a control computer hard drive, a networked drive, some peripheral device (internal Flash, Phantom CineMag, Phantom CineFlash, or Type1 Compact Flash Card).

STEP-BY-STEP PROCEDURE

1. Select the Cine file to be saved.
 - a. Click the Play Panel Tab.
 - b. Click on the down-arrow to the right of the Cine: field, then
 - c. Select the Cine file, from the pull-down list, to open it in its own Playback Panel.
 - d. Edit the Cine. See [Step-by-Step Procedures>Play Panel Procedures>Edit a Cine File](#). The range of the edited Cine (images between Mark In and Mark Out) will be used in Save Cine window to get the first image and image count values.
2. Click the 'Save' button or the down-arrow in the Save Cine button, and select the desired save option from the pop-up selection list:
 - a. Save Cine to File
 - b. Save All RAM to File
 - c. Save All Flash Cines to File
 - d. Save RAM to Flash
 - e. Select&Save Cine to File

7.2.5.7.1 Save Cine to File

This method allows the end-user to save Cine files, on an individual basis, to an external storage device (typically the control computer hard drive).

STEP-BY-STEP PROCEDURE

1. Click the 'Save Cine../' button, or the down-arrow in the 'Save Cine' and select the 'Save to File' option from the pop-up selection list
2. In the 'Save In' data entry field of the Save Cine dialogue enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
3. Enter a 'Filename' for the Cine being saved, see: [Functional Descriptions>Phantom File Naming Convention](#) for a description of the various PhantomFile Naming Conventions.
4. Select the format from the 'Save as Type' pull-down selection list, see [Functional Descriptions>Supported File Formats](#) for a description of the supported file formats.
5. Define the range of images / frames to save using the 'Range Option' pull-down selection list, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Range Options](#) for details.
6. Specify the 'Decimate by' factor, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Decimate By](#) for details on this feature.
7. Define all desired 'Save Options', see [Saving Cine Procedures>Save Cine Dialogue Window Options>Save Options](#) for details on the various 'Save Options'.
8. Click the 'Save button'.
9. Repeat until all Cine files have been saved.

7.2.5.7.2 Save All RAM to File (Partitions)

The 'Save All RAM to File' command is used to save all Cine image data recorded in a cameras' RAM to a user specified location. This feature is extremely useful when the 'Partitions' (MultiCine) feature has been implemented in the camera as it will save all memory segments, with image data stored into it, to the specified location.

The command will only be available when the:

- Camera has a Cine file stored in its' RAM.
- 'Play' panel has been selected, or
- 'Manager' tab has been selected and a Cine file, for a specific camera, has been selected.

It also allows the end-user to save the RAM Cine files of all cameras in the selected camera group to an external storage device simultaneously.

STEP-BY-STEP PROCEDURE

1. In the 'Save In' data entry field of the Save Cine dialogue enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
2. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process, see: [Functional Descriptions>Phantom File Naming Convention](#) for a description of the various Phantom File Naming Conventions.
3. Select the format from the 'Save as Type' pull-down selection list, see [Functional Descriptions>Supported File Formats](#) for a description of the supported file formats..
4. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out] , Full Cine, or User Defined) pull-down selection list, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Range Options](#) for details.
5. Specify the 'Decimate by' factor, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Decimate By](#) for details on this feature.
6. Define all desired 'Save Options', see [Saving Cine Procedures>Save Cine Dialogue Window Options>Save Options](#) for details on the various 'Save Options'.
7. Click the 'Save button'. PCC displays a 'Saving Cine' message (center of Play Panel) along with a 'Save Cine' progress indicator' (lower left corner of Play Panel). The files will append to the root filename the Camera Name and Cine Number. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).

7.2.5.7.3 Save All Flash Cines to File (Internal Flash / CineMag / Type 1 Compact Flash Card)

The 'Save All Flash Cines to File' command is used to save all Cine files stored in the non-volatile Flash memory, an attached Phantom CineMag, CineFlash, or Type 1 Compact Card of the selected camera. The files will be saved with a user-specified file name along with an appended extension, (camera_name_FlashCine#.ext), to a user-specified location, (for example, your system's hard drive, a networked drive or to some peripheral drive such as a DVD drive, Zip drive, or tape drive).

It also allows the end-user to save the Flash Cine files, of all cameras in the selected camera group, to an external storage device simultaneously.

STEP-BY-STEP PROCEDURE

1. In the 'Save In' data entry field of the Save Cine dialogue enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
2. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process, see: [Functional Descriptions>Phantom File Naming Convention](#) for a description of the various Phantom File Naming Conventions.
3. Select the format from the 'Save as Type' pull-down selection list, see [Functional Descriptions>Supported File Formats](#) for a description of the supported file formats..
4. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Range Options](#) for details.
5. Specify the 'Decimate by' factor, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Decimate By](#) for details on this feature.
6. Define all desired 'Save Options', see [Saving Cine Procedures>Save Cine Dialogue Window Options>Save Options](#) for details on the various 'Save Options'.
7. Click the 'Save button'. PCC displays a 'Saving Cine' message (center of Play Panel) along with a 'Save Cine' progress indicator' (lower left corner of Play Panel).
8. The files will append to the root filename the Camera Name and Cine Number. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).

7.2.5.7.4 Save RAM to Flash (Internal / CineMag / CineFlash / Type 1 Compact Flash)

As mentioned earlier in this document, the 'Save RAM Cine to Flash' command is used to save image data recorded in a camera's RAM to the Phantom camera's optionally installed integrated non-volatile Flash memory, Phantom CineMag, CineFlash, or Type1 Compact Flash Card, and will only be available when the:

- Phantom camera has the integrated non-volatile Flash memory installed, an attached Phantom CineMag, CineFlash, or a Type1 Compact Flash Card inserted.
- Camera has a Cine file stored in its' RAM.
- 'Play' panel has been selected, or the
- 'Manager' tab has been selected, and a Cine file for a specific camera has been selected.

STEP-BY-STEP PROCEDURE

1. Simply click the down-arrow in the 'Save Cine' button, and select the Save RAM Cine to Flash option from the pop-up selection list The Preview Panel will display a 'Saving to Flash..' message, and the Preview Panel Status Bar will display a 'Saving to Flash..' progress indicator.

7.2.5.7.5 Select&Save Cines to File (Multi-camera / Partitions)

This method allows the end-user to select the Cine (RAM / Flash) files of all cameras to save to an external storage device simultaneously. This method is extremely useful to select specific Cine file to save when using the MultiCine (memory partitioning) feature.

STEP-BY-STEP PROCEDURES

1. In the Multi Cine dialogue window enable, check, the desired location(s) of the Cine files to be saved and their type:
 - a. All cameras – when enabled a camera tab will be displayed for all connected to Phantom cameras.
 - b. All group cameras – when enabled a tab will be displayed for all the cameras associated with the selected and locked group.
 - c. RAM Cines -when enabled only RAM Cine files will be displayed in the Phantom camera's tab window.
 - d. Flash Cines - when enabled only Cine files stored on the camera's attached Phantom CineMag,\CineFlash, or internal Flash will be displayed in the Phantom camera's tab window.
 - e. For each camera highlight the Cine to be saved.
 - f. Click the OK button.
2. In the Save Cine dialogue window:
 - a. Enter the full path (in the 'Save In' data entry field) of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - b. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process. If saving as an image stack enter a root filename followed by the plus (+) sign along with a digit (1 through 8) to append sequentially 1 digit through 8 digits starting at 0. See: [Functional Descriptions>Phantom File Naming Convention](#) for a description of the various Phantom File Naming Conventions.
 - c. Select the format from the 'Save as Type' pull-down selection list, see [Functional Descriptions>Supported File Formats](#) for a description of the supported file formats.
 - d. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Range Options](#) for details.
 - e. Specify the 'Decimate by' factor, see [Saving Cine Procedures>Save Cine Dialogue Window Options>Decimate By](#) for details on this feature.
 - f. Define all desired 'Save Options', see [Saving Cine Procedures>Save Cine Dialogue Window Options>Save Options](#) for details on the various 'Save Options'. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).
 - g. Click the 'Save button'. PCC displays a 'Saving Cine' message (center of Play Panel) along with a 'Save Cine' progress indicator' (lower left corner of Play Panel).
 - h. The files will append to the root filename the Camera Name and Cine Number. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).

7.2.5.7.6 Save Cine Dialogue Window Options

It is from the 'Save Cine' dialogue window that we specify the destination location, the file name and format, along with other parameters of the file(s) being saved. Following is brief descriptions of the various options, including:

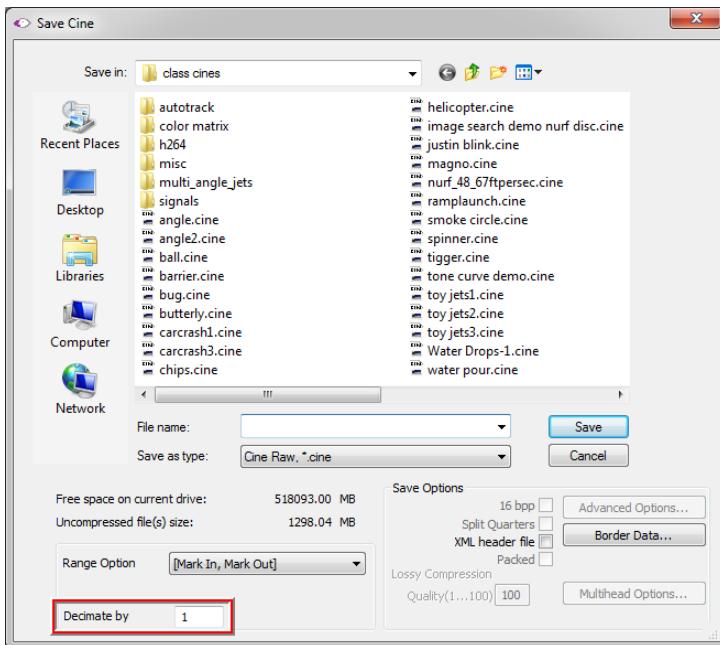
7.2.5.7.6.1 Range Options

The 'Range Options' are used to specify the range of images (frames) to be saved. Options included:

1. [Mark-In, Mark-Out] - save the edited Cine images.
2. Full Cine - saves all frames in camera RAM (memory buffer).
3. User Defined - saves a user-defined range of images in the [first , last] fields. These fields specify the [first, last] image numbers to be saved. For example, if the event begins at image number -507 and ends at 10,832, any images prior to -507, and / or after 10,832 will be discarded (unsaved).

7.2.5.7.6.2 Decimate By

The decimation factor is an integer number greater than or equal to 1. It can be configured from the Save Dialog Window, under the Range Option.



It allows reducing the number of images that will be saved to file by the specified factor. The default, neutral value is 1. It means each image from the specified range will be saved to file. A decimation factor of 2 means that one in two consecutive images will be saved to file, the other one will be dropped.

The table below shows which images will be selected to be saved to file for various decimation factors and for the input range [0, 18]. The red numbers correspond to frames which will be dropped. For example, if using the decimation factor 3, the images that will be saved to file will be images with numbers: 0, 3, 6, 9, 12, 15, 18.

DECIMATION FACTOR	IMAGE NUMBERS																		
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
2	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
3	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
6	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18

Image Numbering for the Decimated Cine Files

Consecutive Cine images are always identified by consecutive image numbers. The same rule must be obeyed by decimated files. For non-neutral decimation factors, some images will be dropped during the save to file operation. Therefore a new method of numbering the images must be employed.

The basic rule is:

input image number i will have number i / decimation on output.

In other words, the images of the destination file are numbered based on the following rules:

- the numbering begins from input image 0
- the input image 0 corresponds to the output image 0
- the first input image to the right of image 0 that will be selected considering the decimation factor will have the number 1
- the second input image to the right of image 0 that will be selected considering the decimation factor will have the number 2
- similar to the left of image 0 (-1, -2, etc)

The following table illustrates how the destination file images will be numbered.

	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	SRC IMG NUMBER
2	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Selected Img Number
		-4		-3		-2		-1		0		1		2		3		4		Destination Img Number
3	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Selected Img Number
		-3		-2		-1				0		1		2			3		3	Destination Img Number
4	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Selected Img Number
		-2			-1					0		1					2		2	Destination Img Number
5	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	Selected Img Number
					-1					0			1				1			Destination Img Number

If the save range does not contain the image 0 the algorithm previously described advances to the left or to the right of 0 until it reaches the input save range.

NOTE

The first and the last images to be saved, as specified in the save dialog window, may not always actually get saved, depending on the decimation factor. Considering the examples in the table above, if the decimation factor is 5 and the save range is [-8, 6] the actual range of images that will be saved will be [-5, 5] with the decimation 5, meaning images: -5, 0, 5. As it can be seen, images -8 and 6 will not be saved in the destination file.

7.2.5.7.6.3 Save Options

The following briefly describes the various 'Save Options'.

This feature will automatically be enabled (checked) when the 'Bit Depth' option is set to greater than 8-bits. For step-by-step procedure to set the Image Pixel Bit Depth see, [Step-by-Step Procedures>Live Tab Procedures>Camera Settings>Define the Image Pixel Bit Depth](#).

Applicable for Phantom v5 / v6 Series camera only. Presently disabled.

When enabled (checked) to created an XML file, which can be used as can be a source of data for other applications, describing the header along with the Cine image information.

To view this XML language file afterwards, double-click the file name in Windows Explorer.

When enabled (checked) the Cine file (from a ph16 camera, Phantom CineMag, CineFlash or 10Gb connected camera) will be saved in a Packed RAW Cine file format.

When enabled (checked) an audio.WAV file will be saved along with Raw packed 10 bit (default), or ProRes HQ 10 bit (requires a Phantom CineMag IV to record to) Cine files.

This option is only applicable with Phantom Flex4k camera model if the Audio option is enabled in Advanced Settings.

These fields are used to specify the 'Lossy Compression Quality' when saving a Cine file in one of the following file formats; Cine JPG, JPEG, LEAD, LEAD JFIF, LEAD JTIF, JPEG, or JTIF.

This option is only available if the file format selected is an interpolated one (other than RAW). It allows the end-user to select one of five color interpolation algorithms (Best, Good, Medium, Fast, Fastest) to apply to the Cine file during the save process.

NOTE

Once a Cine file has been saved with a interpolated format (non-RAW) another algorithm cannot be re-applied to it by saving it again. In this case, the algorithm's options will be ignored.

PCC allows the end-user to add information about the Cine file being saved / converted into a border area outside the Cine(s).

STEP-BY-STEP PROCEDURES

1. Specify the 'Style' (the area the border information is displayed):
 - a. None - no border data is displayed; however, if the Cine has a 'measurements' or 'signals' graph associated with it will be included.
 - b. Standard - when selected the specified 'Common Options' will be displayed just below the image area.
 - c. Military - when selected the specified 'Common Options' will be displayed to the right the image area, along with a user-entered 'header' (displayed above and below image area), and footer (displayed below the image area).
 - d. Car Engine - when selected the specified 'Common Options' will be displayed above the image area, along with the user-defined 'Car Engine' data / text.
 - e. Include the Displayed Measurements and Signals - when select any 'collect point (tracking) measurements or signal (Range Data / Data Acquisition Unit) sampled values associated with the file will be saved as a 'Graphic' chart.
2. Select the desired 'Common Options' (the information displayed in the border area):
 - a. Font Size - specifies the font size the 'Annotation Text' fields will be displayed at.
 - b. Annotation Text - specifies the information included in the border data when selected.
 - 1) Time Format - indicates the type of time stamp information to be displayed:
 - a) No Time Stamp - no time stamp information will be displayed.
 - b) Absolute Time - display date and time (to the nano-second) the image was recorded.
 - c) From Trigger - displays time difference from when displayed image was recorded to when the camera was triggered.
 - d) From Image - displays time difference from when displayed image was recorded to the image number specified in the 'From First Image' data entry field (by default the first full image after trigger, the trigger (t_0) frame).
 - e) From First Image - displays the time difference from when the displayed image was

recorded to when the first image of the Cine was recorded.

- 2) File Name - displays the name of the file / image specified in the 'File Name' data entry field, in the 'Save Cine' dialogue window.
 - 3) Image Number - indicates the image number of the image being displayed.
 - 4) Image Number From First - indicates the number images, the image being displayed is, from the first image being saved.
 - 5) Camera Version - indicates the 'Hardware Version' (camera model) used to record the file being saved.
 - 6) Acquired Resolution - displays the width x height the file was recorded at.
 - 7) Rate - indicates the 'Sample Rate' setting the displayed image was recorded at.
 - 8) Exposure - indicates the 'Exposure' setting the displayed image was recorded at.
 - 9) EDR Exposure - indicates the 'EDR' (Extreme Dynamic Range) exposure setting the displayed image was recorded with.
 - 10) First and Last Image - indicates the 'first / last' image numbers of the images contained within the saved file.
 - 11) Duration - indicates the duration of the saved file.
 - 12) Signals - displays the values of all signals sampled by an attached Data Acquisition Unit for the displayed image.
 - 13) Range Data - displays range data (i.e. azimuth / elevation) information embedded in the file being saved.
 - 14) Description - displays the description entered in the 'Play>Cine Info.>Description' field.
- c. Display Logo - used to embed a 'Logo Image File' (watermark) to the images being saved.
- 1) Position - specifies the X - Y coordinates (placement) of the 'Logo File Image'.
 - 2) Transparency (range 0 - 1) - specifies the degree of 'Transparency' of the 'Logo File Image'.
 - 3) Logo File Name - used to specify the location / name of the 'Logo File Image'.
- d. Advanced Positioning
- 1) Destination Resolution - specifies the Width x Height (size) of the 'Border Data' window.
 - 2) Source Image Position - specifies the X - Y coordinates (placement) of the images in the "Border Data" window.
 - 3) Annotation Text - specifies the X - Y coordinates (placement) of the selected "Annotation Text" fields in the "Border Data" window.
3. Preview - click the 'Preview' button to display a preview image of the 'border data' settings.
4. Ok / Cancel - click the 'OK' button to apply save the 'border data' with the file(s) being saved, or 'Cancel' to not apply 'border data'.

Applicable for Phantom v5 / v6 Series camera only.

When saving Cine files from Phantom v5 / v6 Series cameras the system will (by default) save the images from all four imaging heads into a single Cine file. Unique Cine files, for each of the imaging head, can be saved by selecting which camera 'Head(s)' to save in the Multihead Options dialogue window.

7.2.5.8 Frame Info

The 'Frame Info' selector displays the timing information for the image (frame) displayed in the active 'Play' panel.

STEP-BY-STEP PROCEDURE

1. Click on the 'Frame Info' selector to select / display the following:
 - a. Time - select the type of 'Time' information displayed from the pull-down selection list (below the 'Time' display field:
 - 1) Local - displays the absolute time and date (the time stamp time stamp generated by the attached Phantom Control Unit's (PC / laptop) date and time reference) the image was recorded, displayed in hh:mm:ss:ms:μs; Day Mon dd yyyy. A tag may be appended to time displays, as follows:
 - E - Provided as an 'event' marker.
 - S - Designates that the time displayed was synchronized to a time source.
 - 2) utc (GMT) - displays the date and time reference will be adjusted to utc (Universal Time Clock), formally referred to as GMT (Greenwich Mean Time). The adjustment will be the time difference from the date and time settings of the time stamp will be adjusted from the time stamp generated by the attached Phantom Control Unit (PC / laptop) to utc (Universal Time Clock). The utc (GMT) option appends utc to the time stamp reference.
 - 3) Time Code - displays the SMPTE time code of the image is displayed. The SMPTE time code output is generated based on a reference moment of each recorded Cine. For 'round' frame rates the time base will lock to the exact same time received (for instance, the reference moment of the frame with time code '01:00:00:00' will occur at the 01:00:00.000000 'true time').
For detailed description on the 'SMPTE Time Code', see: [Functional Descriptions>SMPTE Time Code in Phantom Cameras](#).
 - b. Interval - indicates the image interval (duration of a frame) of the image being displayed in the active 'Play' panel (displayed in micro-seconds).
 - c. Exposure - indicates the exposure time of the image being displayed in the active 'Play' panel (displayed in micro-seconds).
 - d. Elapse Time From - used to perform various timing measurements:
 - 1) Trigger - indicates the elapsed time of the image being displayed in the active 'Play' panel, and trigger (displayed in micro-seconds).
 - 2) Image# - indicates the elapsed time of the specified image number in the data entry field and the image currently being displayed in the active 'Play' panel (displayed in micro-seconds).
 - e. Azimuth and Elevation values for Cines that have range data.

7.2.5.9 Cine Info

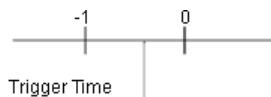
Selecting the Cine Info selector displays all the setup parameters for the Cine being viewed.

STEP-BY-STEP PROCEDURE

1. Click on the 'Cine Info' selector to display / specify the following information for the selected (active) Cine file:
 - a. Source - indicates the camera name or file path of the Cine file.

- b. Name - indicates the information found in, or specify to, the camera's Cine structures meta-data, that was defined in 'Live>Cine Settings'.
- c. Description - used to add a description after the Cine file. If multiple lines are required (up to a maximum of 4,096 characters), click the right-arrow button to the right of 'Description' label. The description will be saved to the file together with the images and all other Cine info.
- d. Format - displays the file format of a saved Cine file. If the Cine is from the camera's RAM memory, PCC displays N/A (not available). For details on the supported file formats, see [Function Descriptions>Supported File Formats](#).
- e. Saved Range - indicates the first / last image numbers of the edited Cine file.
- f. Recorded Range - indicates the first / last image number of the recorded Cine file.
- g. Color - indicates if the Cine was captured using a color sensor (Yes) or a monochrome sensor (No).
- h. Signals - indicate if any external analog or binary signal measurements, sampled by a National Instruments USB X or M Series Data Acquisition Unit, are 'Available' / 'Not Recorded'
- i. Audio - indicates if 'Audio', for the Cine file, is Available or not recorded.
- j. Image Time - indicates if the image timing information, for the Cine file, is Available or N/A (not available).
- k. Image Exposure - indicates if the image exposure information, for the active Cine file, is Available or N/A (not available).
- l. Camera Version - displays the camera 'Hardware Version' number for the '(Camera Model)' used to capture the Cine file.
- m. Serial - specifies the serial number of the camera used to 'Rec' (record) the Cine file or Cine 'Mag' if applicable.
- n. Resolution - displays saved image size (width x height). If the images contain 'Border Data' the 'Resolution' may be greater than 'Acq. Resolution'.
- o. Acq. Resolution - displays the size (width x height) the images were recorded at (acquisition resolution).
- p. Post Trigger - indicates the number of Post Trigger frames recorded.
- q. Bits per color - displays the pixel bit-depth of the Cine.
- r. Acquisition bpc (bits per color) - displays the pixel bit-depth the Cine was recorded at.
- s. Sample Rate (fps) - displays the rate in fps (frames per second), the Cine was recorded at, including:
 - 1) Real - the actual frame rate (fps) the images were recorded at.
 - 2) Period - the time (μ s) required to record each of the images.
- t. Exposure (ms) - displays the 'Exposure Time' setting at the time the Cine was recorded at.
- u. EDR (ms) - indicates the 'EDR' (Extreme Dynamic Range) exposure time setting the Cine was recorded with. 0.000 indicates EDR was disabled.
- v. Frame Delay (ms) - indicates the amount of time (end-user specified) each image is delayed from the frame rate clock pulse before it was recorded.
- w. Sync - indicates the 'Sample Rate' clock source the Cine was recorded with.
- x. Auto Exposure - indicates whether or not the 'Auto Exposure' feature was used during the recording process, and if the 'Lock at Trigger' option.
 - 1) Compensation (ph16 camera models only) - displays the 'Auto Exposure' compensation level (-2 is equivalent to closing down the aperture two (2) f-stop; 2 is equivalent to opening the aperture two (2) f-stops).

- 2) AutoExp. Level (ph7 camera models only) - displays the 'Auto Exposure' grayscale level defined by the end-user.
- 3) AutoExp. Rect (ph7 camera models only) - displays the the end-user specified rectangular area (in pixels) used to base 'Auto Exposure' adjustments on.
- y. Lens Description - indicates the manufactures focal length (mm), along with the speed of lens (f-stop range) of the Canon EOS lens used to recorded the Cine
- z. Lens Aperture - indicates the aperture setting, defined via the Live Panel>Camera Settings>Lens Control>Aperture setting, of the aCanon EOS lens used to recorded the Cine.
- aa.Lens Focal Length - indicates the focal length set via attached Canon EOS lens used to recorded the Cine.
- ab.Trigger Time - indicates that moment in time just after the last pre-trigger image (-1) and before image 0 as shown here in the graphical representation below.



- ac.Time Zone - displays the time difference from utc (Universal Time Code) formally referred to as GMT (Greenwich Means Time) in hours.
- ad.Frame Rate Profile (supporting ph7 camera model only) - displays the 'Frame Rate Profile' setting defined by the end-user during the Cine files' capture process. If the feature was not used this field will be left blank.

7.2.5.10 Measurements

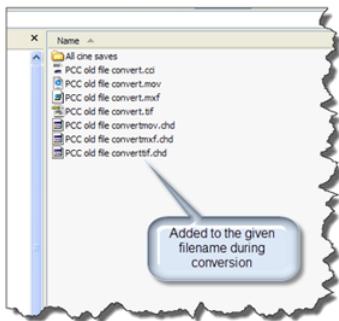
In this module, you will learn to do basic measurements on the images to calculate coordinates, distance and speed, angle and angular speed, and collect points with the Phantom Camera Control application.

And finally, you will learn how to generate various reports using both software applications.

Important Note

An important note about performing measurements in PCC 2.0 and going forward; there is a naming convention change that needs to be addressed. In the new versions of the PCC (phantom Camera Control) software when you convert Cine files into any other non-Phantom Cine format a .chd file is also created, which contains the 'Cine Header' information so PCC can display all the goodies when playing it back. The new versions also adds a designator after the given filename as well before the .chd that corresponds to the format the file is being converted to.

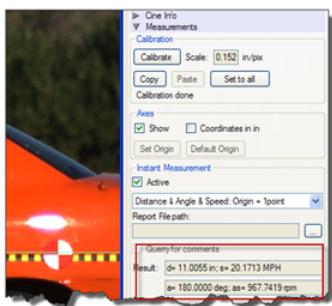
In this graphic you can see the extra addition made to the files.



Now here is the twist. If you have a file that was converted with older software that does not add this

to the filename, the information in the .chd file is not loaded into PCC. This will result in inaccurate measurements.

Here is an example of the issue, we have a Cine; we're doing speed measurements on. We have already known, for a fact, that the car is moving at 50 MPH. The original Cine file was taken in Phantom v663 and converted to an AVI file in Phantom v675.2. The resulting .chd file does not have the extra avi added. The resulting calculation made in measurements comes up with 20 MPH. If we convert the file in PCC 2.0 the converted .chd file has the added avi in the filename and the resulting measurement results in 50 MPH.



There is also a lot of other information that will be inaccurate in the Cine as well.

So here we go. If you have converted files with an older version of the Phantom Camera Control software, and you wish to do measurements in the new PCC software you will have to add the conversion type avi, mov, tif or mxf to the filename manually. Once this is done and PCC restarted, the measurements will be accurate.

This does not affect native Cine formats.

7.2.5.10.1 Performing Time Measurements

Vision Research embeds a time stamp at the end of every frame captured. The time stamp, (date and time), clock source can be the Phantom Control Unit computer's clock, an IRIG-B clock, or a GPS clock (camera dependent).

STEP-BY-STEP PROCEDURES

1. Click on the 'Frame Info' selector. PCC will display the following information about the present frame:
 - a. Time - select the type of 'Time' information displayed from the pull-down selection list (below the 'Time' display field):
 - 1) Local - displays the absolute time and date (the time stamp time stamp generated by the attached Phantom Control Unit's (PC / laptop) date and time reference) the image was recorded, displayed in hh:mm:ss:ms:us; Day Mon dd yyyy. A tag may be appended to time displays, as follows:
 - E - Provided as an 'event' marker.
 - S - Designates that the time displayed was synchronized to a time source.
 - 2) utc (GMT) - displays the date and time reference will be adjusted to utc (Universal Time Clock), formally referred to as GMT (Greenwich Mean Time). The adjustment will be the time difference from the date and time settings of the time stamp will be adjusted from the time stamp generated by the attached Phantom Control Unit (PC / laptop) to utc (Universal Time Clock). The utc (GMT) option appends utc to the time stamp reference.

3) Time Code - displays the SMPTE time code of the image is displayed. The SMPTE time code output is generated based on a reference moment of each recorded Cine. For 'round' frame rates the time base will lock to the exact same time received (for instance, the reference moment of the frame with time code '01:00:00:00' will occur at the 01:00:00.000000 'true time').

For detailed description on the 'SMPTE Time Code', see: [Functional Descriptions>SMPTE Time Code in Phantom Cameras](#).

- b. Interval - indicates the image interval (duration of a frame) of the image being displayed in the active 'Play' panel (displayed in micro-seconds).
- c. Exposure - indicates the exposure time of the image being displayed in the active 'Play' panel (displayed in micro-seconds).
- d. Elapse Time From - used to perform various timing measurements:
 - 1) Trigger - indicates the elapsed time of the image being displayed in the active 'Play' panel, and trigger (displayed in micro-seconds).

NOTE

If a trigger signal is detected in the middle of the T_0 frame the T_0 frame will indicate the time difference from the time the signal was detected to the time the T_0 frame was time stamped.

- 2) Image# - indicates the elapsed time of the specified image number in the data entry field and the image currently being displayed in the active 'Play' panel (displayed in micro-seconds).

7.2.5.10.2 Defining Measurement Units

STEP-BY-STEP PROCEDURES

1. Click on the 'Application Preferences' (wrench) button in the Manager' tab.
2. Click on the 'Measurement' tab in the 'Preference' dialogue window.
3. Define the Units:
 - a. Select the required Units (distance, speed, acceleration, angle, and angular speed) from the pull-down selection lists, or
 - b. Click the appropriate 'Presets' buttons to use a pre-defined set of 'Units' (U.S. Units / S.I. Units).
4. Select the desired 'Other Options':
 - a. Unique Scale per Application - when enabled (checked) the defined measurement scale will be applied to all subsequently opened Cines.
 - b. Auto Advance to Next Image During Collect Points - when enabled (checked) the Cine advances to the next image automatically once all the collect points have been manually specified on the displayed image. This option should be disabled (unchecked) if auto tracking points is to be used.
 - c. Auto Update Graphics During Collect Points - when enabled (checked) a graphical display of the tracked points will overlay the images during the collect (tracking) point process.
5. Click the 'OK' button to accept the specified parameter and close the 'Preferences' dialogue window, or 'Cancel' to disregard any changes and close the 'Preferences' dialogue window.

NOTE

Using the 'Presets' buttons will change the 'Distance Unit', 'Speed Unit', and 'Acceleration Unit' as follows:

- **U.S. Units sets the Units to Feet, Feet per Second, Feet per Second per Second, respectively, and the**
- **S.I. Units set the Units to Meters, Meters per second, and Meters per Second per Second, respectively.**

7.2.5.10.3 Calibrating a Measurement Scale

Since a Cine is typically recorded and viewed at some reduction in size to the original scene, you must establish the reduction value or perform a 'Calibration' to measure actual distances, speeds, or accelerations.

There are two methods for defining a measurement scale; you can mark two ends of a scale and specify the length between them, or if you know the scale (unit per pixel) you can enter that value in the 'Scale' data entry field.

STEP-BY-STEP PROCEDURES

After the measurement units have been defined, 'Calibrate' a measurement scale by:

1. Click the 'Calibrate' button under the 'Measurements' selector. A status line, just below the 'Calibrate' button, will prompt you to click the one end of the object to be selected as the gauge. Basically, what the system is asking for is for the user to mark, on a known given scale, one end of the scale.
2. Click a point on the image being displayed, which represents one end of a known given scale. The status line, will now prompt you to click the other end of the object to be selected as the gauge (the other end of the scale).
3. It may be necessary to use the 'Image Tools>Zoom' function for accuracy.
4. Click a second point on image, which represents the other end of a known given scale.
5. Enter the 'Gauge Length' (a known dimension of any object or space in the image) in the 'Set Gauge' dialogue window. The status line reports 'Calibration done', and the 'Scale' data entry field is populated with the unit per pixel scale.PCC automatically applies this calibration to the entire Cine, or to any image extracted from the Cine.

Vision Research recommends that select a larger object in the image for the scale (gauge) process. The gauge length must be entered in the same unit of measure specified in the 'Manager>Preferences>Units' parameters.

6. Optionally, enter the 'unit per pixel scale' value, if known, in the 'Scale' data entry field.
7. Optionally, click the 'Set to All' button to apply the calibration scale to all open files displayed in 'Play' panel.

7.2.5.10.4 Setting/Clearing the Origin Point

By default the Phantom control software identifies the first pixel, located in the upper left image corner of the Playback Panel, as the origin point for all measurements.

To measure position, distance, displacement, speed or acceleration from an origin, a reference point must be established. Any point in the image may be selected as the reference point or point of origin. Your choice of origin will be largely dependent on the subject and the type of motion being studied.

STEP-BY-STEP PROCEDURES

After the measurement units have been defined:

1. Click the 'Set Origin' button under the 'Measurement' selector.
2. Click the point, in the displayed image, to be set as the new origin.
3. Optionally, enable (check) the 'Show' option to view the position of the newly defined origin axes (cross-hair).

To clear the user defined origin and reset it back to the default position, the upper left image corner of the Playback Panel:

1. Click the 'Default Origin' button.

NOTE

The 'Default Origin' and 'Set Origin' buttons will be disabled if any of the 'Instant Measurement' or 'Collect Points' options are active (enabled).

7.2.5.10.5 Coordinates Analysis

STEP-BY-STEP PROCEDURES

After the measurement units, calibration scale, and origin point have been defined:

1. Click the 'Coordinates in [distance unit]' button in the Axes' options under the 'Measurement' selector.
2. Click location (point) a coordinate measurement is to be taken for. The X-Y coordinates for that point are displayed in the PCC 'Status' bar (below the open 'Play' panels).

7.2.5.10.6 Instant Measurements

Instant Measurements consists of four unique motion analysis tasks, including:

1. Distance & Angle & Speed: Origin + 1Point

The Distance & Angle & Speed: Origin + 1Point option can be used to measure the distance and speed of linear motions with respect to a fixed point of origin, the angle formed with respect to the x-axis, or the speed of a rotational motion (computed with respect to the horizontal axis of the picture screen), when only one point is known.

2. Distance & Angle & Speed: 2Points

The Distance & Angle & Speed: 2Points option can be used to measure the dimensions of an object or space, the displacement and speed of an object in one image with respect to its new position in any subsequent image, angular speed (computed with respect to the horizontal axis of the picture screen), or the speed of a rotational motion, when two points are known.

3. Angle & Angular Speed: 3Points

Use the Angle & Angular Speed: 3Points option to measure angles when the vertex and the two end points of the angle are visible (the most common angle description).

4. Angle & Angular Speed: 4Points

Use the Angle & Angular Speed: 4Points option when the vertex or the center point of rotation are unknown or lay outside the image area, the angular speed can be found by comparing the position of an object in one image to its position in the next image.

All Instant Measurements can be used in conjunction with a Report File or without. With a report file opened, the image number, elapsed time from trigger, unit of measurement, distance (or dimension) speed and any comments are automatically saved in the open report file. Report files are saved are identified by the file extension .rep. You can use any of the Instant Measurement options without opening a report file whenever you want to measure just a few key points in a Cine quickly. It will not be possible to attach comments and these measurements will not be saved to a file.

The measurement results will be displayed in the Results field of the Instant Measurements options.

NOTE

Before using any of the Instant Measurement functions, check that you have already assigned units of measurements, and established a scale for your file. If a report file will be generated from measurements collected during the motion analysis session, check that you have completed the report file setup.

7.2.5.10.6.1 Create/Open a Report File

Optionally you can create a Report File to simultaneously create a data file as you measure distance, speed, angles, and angular speed, that can be viewed in many text editors and word processor programs; some additional formatting may be required.

STEP-BY-STEP PROCEDURES

1. Click on the 'Measurements' selector in the 'Play' tab.
2. Click on the '...' button to the right of the 'Report File Path' data entry field.
3. In the Open dialogue window:
 - a. Navigate to the folder the Report File is to be, or has been saved in.
 - b. Enter the filename of the Report File in the 'File Name' entry field, then
 - c. Click on the 'Open' button.
4. In the 'Setup for Measurement Report File' dialogue window, enter the report files header information:
 - a. 'Title' of the report
 - b. Name of the 'Analyst'
 - c. 'Station' or camera used to record the images being analyzed.
 - d. 'Camera' model used to record the images
 - e. Information about the 'Lens' used, i.e., manufacture, type, f-stop, etc.
 - f. Click the 'OK' button.
5. Optionally enable (check) the 'Query for Comments' to enter a comment for each measurement taken.

6. Select the type of 'Instant Measurements' to be performed.

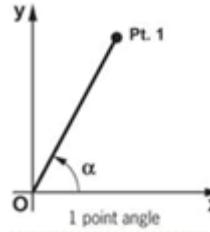
7.2.5.10.6.2 Closing a Report File

STEP-BY-STEP PROCEDURES

1. Click the 'Measurements' selector in the 'Play' tab.
2. Click the '...' button to the right of the 'Report File Path' entry field, then
3. Click on the 'Cancel' button in the 'Open' dialogue window.

7.2.5.10.6.3 Distance & Angle & Speed: Origin + 1 Point

Distance and Angle and Speed: Origin + 1 point measures:

1. Distance from the origin point to a selected point.
 2. Angle made by the selected point with Origin and Ox axis.
 3. $\text{speed} = \frac{\text{distance}}{\text{dt}}$, where distance = measured distance, dt = [time of the point frame] – [time of the origin frame] if point and origin are on different frames.
 4. $\text{angular speed} = \frac{\text{angle}}{\text{dt}}$, where angle = measured angle, dt = [time of the point frame] – [time of the origin frame] if point and origin are on different frames.
- 

STEP-BY-STEP PROCEDURES

After the measurement units, calibration scale, and origin point have been defined:

1. Enable (check) the 'Active' box in the 'Instant Measurements' options in the 'Measurements' selector.
2. Select the 'Distance & Angle & Speed: Origin + 1point' option from the 'Select Measurement...' pull-down selection list.
3. Optionally, create or open a Report File to record the measurements, see the ['Create/Open a Report File'](#).
4. Locate the image measurements are to be performed on.
5. Click on the 'point' (Pt.1) to be measured.
6. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately 40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.

The results are displayed in the 'Results' fields. If the origin and the point are on the same image only the distance (d=) and angle (a=) from the origin will be calculated and displayed. If the origin and the point are on different images, PCC calculates and displays the distance (d=), speed (s=), angle (a=), and angular speed (as=) form the origin.

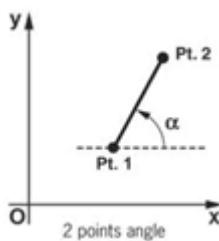
In either scenario, PCC displays a graphical representation of the angle (magenta) measured over the image.

7. Repeat until all additional distance & angle & speed measurements, for the current image have been completed, then advance the Cine to the next image measurements are to be calculated in and repeat.
8. Disable (unchecked) the 'Query for Comments', close the 'Report File' (see the '[Closing a Report File](#)'), and disable the 'Instant Measurements>Active' option, once all measurements have been performed.

7.2.5.10.6.4 Distance & Angle & Speed: 2 Points

Distance and Angle and Speed: 2points measures:

1. Distance between the two selected points.
2. Angle made by the line formed by the two selected points with Ox axis.



3. $\text{speed} = \frac{\text{distance}}{\text{dt}}$, where distance = measured distance, dt = [time of the second point frame] – [time of the first point frame] if the two points are on different frames.
4. $\text{angular speed} = \frac{\text{angle}}{\text{dt}}$, where angle = measured angle, dt = [time of the second point frame] – [time of the first point frame] if the two points are on different frames.

STEP-BY-STEP PROCEDURES

After the measurement units, and calibration scale have been defined:

1. Enable (check) the 'Active' box in the 'Instant Measurements' options in the 'Measurements' selector.
2. Select the 'Distance & Angle & Speed: 2points' option from the 'Select Measurement...' pull-down selection list.
3. Optionally, create or open a Report File to record the measurements, see the '[Create/Open a Report File](#)'.
4. Locate the image measurements are to be performed on.

For Distance and Angle Measurements Only:

5. Click on the two 'points' to be measured.
6. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately 40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.

The results are displayed in the 'Results' fields. Since both points are on the same image only the distance (d=) and angle (a=) between the two points will be calculated and displayed, along with a graphical representation of the angle (magenta) measured over the image.

7. Repeat until all additional 'Distance & Angle & Speed' measurements, for the current image have been completed, then advance the Cine to the next image measurements are to be calculated in and repeat.

For Distance, Angle, and Speed Measurements:

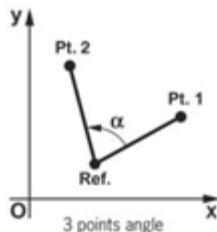
5. Click a specific point (Pt.1) on the object being measured, then
 6. Advance the Cine to the next image measurements are being performed on, then
 7. Click the same point (Pt.2) on the object.
 8. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately 40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.
- The results are displayed in the 'Results' fields. Since the points are on different images the distance (d=), speed (s=), angle (a=), and angle speed (as=) measurement between the two points will be calculated and displayed, along with a graphical representation of the angle (magenta) measured over the image.
9. Repeat these steps until all additional measurements have been taken.

Once all measurements have been performed:

- 8/10. Disable (uncheck) the 'Query for Comments', close the 'Report File' (see the '[Closing a Report File](#)'), and disable the 'Instant Measurements>Active' option, once all measurements have been performed.

7.2.5.10.6.5 Angle & Angular Speed: 3 Points

Angle and Angular Speed: 3points measures:



1. Angle formed by three points.
2. $\text{angular speed} = \frac{\text{angle}}{\text{dt}}$, where angle = measured angle, dt = [time of the last point frame] – [time of the first point frame] if first and last points are on different frames.

STEP-BY-STEP PROCEDURES

After the measurement units have been defined:

1. Enable (check) the 'Active' box in the 'Instant Measurements' options in the 'Measurements' selector.
2. Select the 'Angle & Angular Speed: 3points' option from the 'Select Measurement...' pull-down selection list.
3. Optionally, create or open a Report File to record the measurements, see the '[Create/Open a Report File](#)'.
4. Locate the image measurements are to be performed on.

For Angle Measurements Only:

5. Click all three 'points' to be measured.
6. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately

40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.

The results are displayed in the 'Results' fields. Since all points are on the same image only the angle ($a=$) made between the three points will be calculated and displayed, along with a graphical representation of the angle (magenta) measured over the image.

7. Repeat until all additional 'Angle & Angular Speed' measurements, for the current image have been completed, then advance the Cine to the next image measurements are to be calculated in and repeat.

For Angle and Angular Speed Measurement:

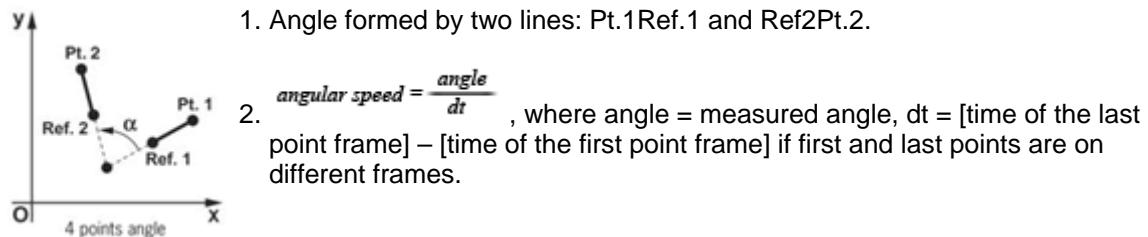
5. Click a specific point (Pt.1) for the subject being measured, then
 6. Advance the Cine to the next image measurements are being performed on, then
 7. Click the reference point (Ref.) for the subject being measured.
 8. Advance the Cine to the next image measurements are being performed on, then
 9. Click a specific point point (Pt.2) for the subject being measured.
 10. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately 40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.
- The results are displayed in the 'Results' fields. Since the points are on different images the angle ($a=$), and angle speed ($as=$) measurement between the three points will be calculated and displayed, along with a graphical representation of the angle (magenta) measured over the image.
11. Repeat these steps until all additional measurements have been taken.

Once all measurements have been performed:

- 8/12. Disable (uncheck) the 'Querry for Comments', close the 'Report File' (see the '[Closing a Report File](#)'), and disable the 'Instant Measurements>Active' option, once all measurements have been performed.

7.2.5.10.6.6 Angle & Angular Speed: 4 Points

Angle and Angular Speed: 4 points measures:



STEP-BY-STEP PROCEDURES

After the measurement units have been defined:

1. Enable (check) the 'Active' box in the 'Instant Measurements' options in the 'Measurements'

selector.

2. Select the 'Angle & Angular Speed: 4points' option from the 'Select Measurement...' pull-down selection list.
3. Optionally, create or open a Report File to record the measurements, see the '[Create/Open a Report File](#)'.
4. Locate the image measurements are to be performed on.

For Angle Measurements Only:

5. Click all four 'points' to be measured.
6. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately 40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.
The results are displayed in the 'Results' fields. Since all points are on the same image only the angle ($a=$) made between the the four points will be calculated and displayed, along with a graphical representation of the angle (magenta) measured over the image.
7. Repeat until all additional 'Angle & Angular Speed' measurements, for the current image have been completed, then advance the Cine to the next image measurements are to be calculated in and repeat.

For Angle and Angular Speed Measurement:

5. Click a specific point (Pt.1) and the first reference (Ref.1) point for the subject being measured, then
6. Advance the Cine to the next image measurements are being performed on, then
7. Click the same two points (Pt.2 and Ref.2) for the subject being measured (the same points on the subject selected in Step 5).
8. Optionally, if 'Query for Comments' was enabled, enter a description or comment (approximately 40 words maximum) in the 'Comment for Measurement' pop-up dialogue window, then click 'OK' to accept.

The results are displayed in the 'Results' fields. Since the points are on different images the angle ($a=$), and angle speed ($as=$) measurement between the four points will be calculated and displayed, along with a graphical representation of the angle (magenta) measured over the image.

11. Repeat these steps until all additional measurements have been taken.

Once all measurements have been performed:

- 8/12. Disable (uncheck) the 'Query for Comments', close the 'Report File' (see the '[Closing a Report File](#)'), and disable the 'Instant Measurements>Active' option, once all measurements have been performed.

7.2.5.10.6.7 Collect Points (Tracking)

Collect Point data for up to 99 points-per-image maximum can be tracked (collected) imported by third party programs. This feature creates a separate data file for point coordinates, speed and / or acceleration files that can also be imported by third party programs. The point data can be collected two ways:

1. Manual Track - used to track point positions (coordinates) from one image to the next once its starting point is defined for up to 99 points per image manually.

2. Auto Track - used to track point positions (coordinates) from one image to the next once its starting point is defined for up to 99 points per image automatically.

Auto Tracking is done during the play of the Cine (step forward, step backward, play forward, play reverse). It is very important that the images be in succession; Auto tracking will self-disable if they are not. To avoid this from occurring 'Play Speed & Options>Play each image' is forced on. It will also disable itself when jumping from the last image to the first. However, the points will remain attached to those areas in the image as they are stored in the user-specified '.ppf' (pictures-per-frame) file. This allows the end-user to reopened Cine and / or pictures-per-frame file to overlay the points, or export the file to a spreadsheet (i.e., Microsoft Excel).

STEP-BY-STEP PROCEDURES

After the measurement units, calibration scale, and origin point have been defined:

1. Locate the first frame with the points to be tracked.
2. Click the '...' button in the 'Collect Points' options under the 'Measurements' selector.
3. Navigate to the folder the '.ppf' (Picture-Per-Frame) file is to be, or has been, saved in; enter the name of the file in the 'File Name' data entry field, then click on the 'Open' button.
4. Specify the number of points to be collected (tracked) in the 'PPF' field (99 maximum).
5. Enable (check) the 'Active' enable box.
6. Click the center of the point(s) to be tracked.
 - a. Delete - to delete a point; select the point from the 'Current Point' pull-down selection list, and click the 'X' button just to the right.
 - b. Relocate - to relocate a point; select the point from the 'Current Point' pull-down selection list, and click the center of the point.

Manual Track

7. Repeat 'Step 6' until all points, on all images, have been manually specified. If the 'Auto Advance to Next Image During Collect Points' has not been enabled (checked) in the 'Preferences>Measurement tab you will need to advance the file to the next image.

Auto Track

7. Click the 'Options' button to define the point (displayed in the 'Current Point' field) tracking parameters:
 - a. Autotrack Active - turns on (check) / off (uncheck) tracking of the selected point.
 - b. Show Rectangles - displays the 'Target Area' and 'Search Area' rectangles for the point. The region sizes are defined by the 'Template Area Size' and 'Search Area Size' parameters.
 - c. Draw Point Trajectory - turns on (check) / off (uncheck) the ability to graph and display the track point path over the image area.
 - d. Template Area Size - defines the width and height (in pixels) of the 'Template Image' to search for and track. The center of the 'Template Image' was determined when the point was specified (Step 6).

e. Search Area Size - defines how large of an area to search, in the next image, for 'Template Image' matches. Essentially this is a percentage of the defined 'Template Area Size'. A value equal to the 'Template Area Size' indicates that the tracking algorithm should search in a region as large as the initial template image region size. Larger values will result in larger search areas, which will take a longer time to search.

Typically these values are set to two to three times the size of the initial image template (defined in pixels).

f. Tracking Sensitivity - defines the acceptable level of difference between the template and the occurrence in the new image. A strict matching algorithm is used to avoid false matches; however this may lead to more frequent loss of targets during tracking. To compensate for this, you can adjust the 'Tracking Sensitivity' to be more tolerant.

g. Template Image - displays an image of the tracking template. Templates can be dedicated markers (crosses, quarter of circles in opposition black- white, white-black) or any objects in image that has something different on two orthogonal directions. The middle of the straight line is not good but an isolated spot, a corner or an angle are ok.

h. Set to All Points Button - used to apply the above settings to all currently defined points.

8. Close the 'Point Options' dialogue window.

9. Enable (check) 'Autotracking' to turn the feature on. In the event a 'Template Image' (tracking point) can not be tracked or is lost the 'Autotracking' feature will disable itself.

10. Optionally, enable (check) 'Update Template' to update (change) the 'Template Image' to the image (point) presently marked by the 'Template Area Size' rectangle. Due to rotations, shadows, etc. the point can be lost. If 'Auto update' is enable, PCC will attempt to restrict the selective disabling of the feature.

11. Optionally, click the 'Graphics' toolbar button to view a chart of the tracked points; see [Step-by-Step Procedures>Toolbar Procedures>Graphics>Collect Points](#) for chart use / details.

12. Play the Cine using the video play buttons. In the event a tracked point is lost:

- a. Step backwards to the image the point first disappears.
- b. Select the lost point from the 'Current Point' pull-down selection list.
- c. Reselect the point in the image.
- d. Play the Cine.

Finishing Steps

8/13. Deactivate (uncheck) Collect Points.

9/14. Click the 'Save' button to :

- a. Save the 'Collect Points' (.ppf) file.
- b. Compute / save a 'Speed' (.psp) file.
- c. Compute / save an 'Acceleration' (.pac) file.

(You will need to navigate to the destination folders and enter the file names to complete b. and c.)

NOTE

If the 'Collect Points' file is not saved when PCC is closed, PCC will display 'There is unsaved data for Collect Points file <path\file name>' dialogue window when the application is closed. You will need to specify whether to save the file or not before PCC will close.

7.2.5.10.6.8 Reviewing the Report and Collect Point Files

The contents of a report file can be viewed in many text editors and word processor programs; some additional formatting may be required.

In addition to measurement data files, a report file can include information about the test event such as camera, camera position or station, lens and f-stop, the name of the analyst or team that recorded the test, and the Cine file name. The report file will also include the day, date, and time of the test, unit of measurement, scale factors, and the (x y,) coordinates if the origin. Finally, the report file format allows you to include a description or comment about each point selected for measurement.

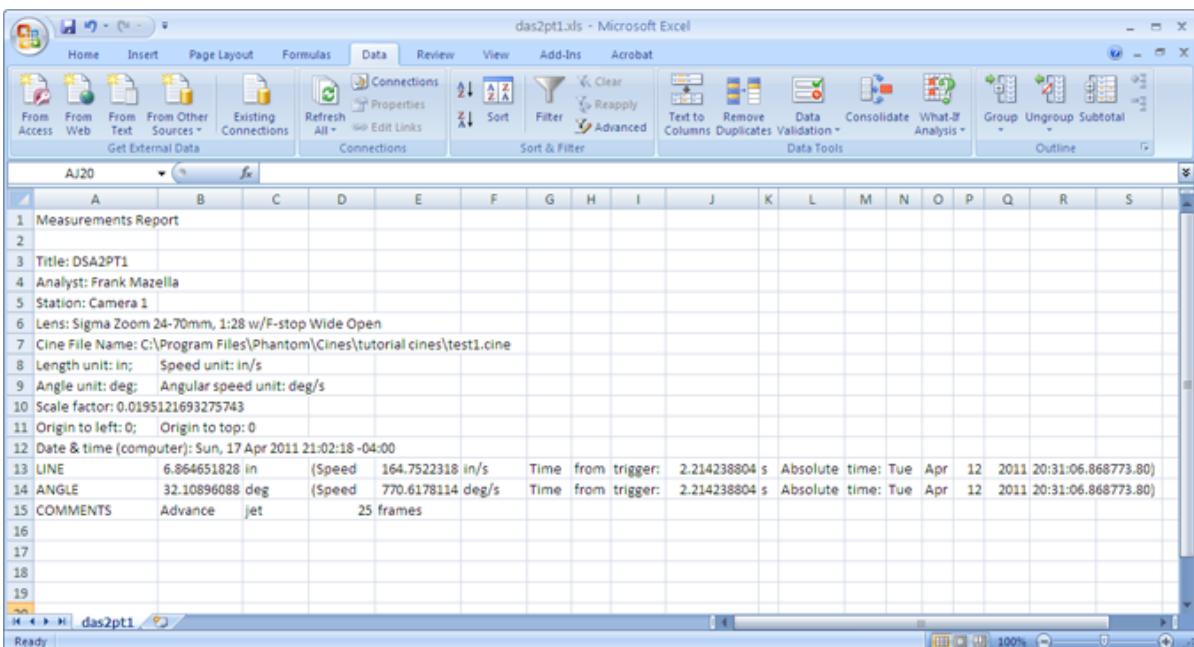
dsao1pt1.xls - Microsoft Excel																	
Home Insert Page Layout Formulas Data Review View Add-Ins Acrobat																	
Clipboard		Font		Alignment		Number		Conditional Formatting		Cell Styles		Cells		Editing			
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1 Measurements Report																	
2																	
3 Title: DSAO1PT1																	
4 Analyst: Frank Mazella																	
5 Station: Camera 1																	
6 Lens: Sigma Zoom 24-70mm, 1:2.8 w/F-stop Wide Open																	
7 Cine File Name: C:\Program Files\Phantom\Cines\Tutorial Cines\test1.cine																	
8 Length unit: in; Speed unit: in/s																	
9 Angle unit: deg; Angular speed unit: deg/s																	
10 Scale factor: 0.0195121693275743																	
11 Origin to left: 265; Origin to top: 305																	
12 Date & time (computer): Sun, 17 Apr 2011 20:56:00 -04:00																	
13 LINE 0 in (Speed NaN in/s Time from trigger: 2.132572428 s Absolute time: Tue Apr 12 2011 20:31:06.787107.43)																	
14 ANGLE 0 deg (Speed NaN deg/s Time from trigger: 2.132572428 s Absolute time: Tue Apr 12 2011 20:31:06.787107.43)																	
15 COMMENTS Orange Jet Origin																	
16 LINE 2.024005516 in (Speed 44.97806055 in/s Time from trigger: 2.177572268 s Absolute time: Tue Apr 12 2011 20:31:06.832107.27)																	
17 ANGLE 33.99645915 deg (Speed 755.4795605 deg/s Time from trigger: 2.177572268 s Absolute time: Tue Apr 12 2011 20:31:06.832107.27)																	
18 COMMENTS Advance 25 frames																	
19																	

The above example of a Distance & Angle & Speed: Origin +1point Report File provides the following information:

LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is.
2	Blank
3	Displays the title of the report entered during the Create Report File process.
4	Displays the analyst who performed the measurements entered during the Create Report File process.
5	Display station information, (camera name or number), of the camera used to create the Cine file measurements are being performed on, entered during the Create Report File process.
6	Displays lensing information, about the lens used during the Cine capture, that was entered during the Create Report File process.
7	The Cine File Name specifies the path and name of the file the report file was generated on

	when performing motion analysis on the file.
8	Displays the length and speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
9	Displays the angle and angular speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
10	Indicates the scale factor that was used to calculate the measurements. The scale factor was calculated during the Calibrating a Measurement Scale procedure.
11	Specifies the location of the origin point in the number of pixels to the left of, and number of pixel down from the upper-left pixel of the image, (the first image pixel). This origin was specified using the Set Origin process.
12	The Date and Time indicate where the time reference came from and what the Day, Date and Time was the report file was generated. It also displays the time difference from utc (GMT).
13	<p>Display the Line (Distance) of the first measurement point from the origin and the Speed at which the software has calculated the point has moved from the origin.</p> <p>In this example, the analyst selected the origin point of the object being measured, so the point on the object being measured had not yet moved.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
14	<p>Display the Angle of the first measurement point from the origin and the Angular Speed at which the software has calculated the point has moved from the origin.</p> <p>In this example, the analyst selected the origin point of the object being measured, so the point on the object being measured had not yet moved.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
15	Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the measurement was of the origin point of an orange toy jet.
16	<p>Display the Line (Distance) of the second measurement point from the origin and the Speed at which the software has calculated that point has moved from the origin.</p> <p>In this example, the analyst had advanced the Cine file 25 images so that the object has moved some distance from the origin, at some speed. Notice the PCC software has calculated that the object had moved 2.024005516 inches from the origin at a speed of 44.97806055 inches per second.</p> <p>This line also displays the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was captured.</p>
17	Display the Angle of the second measurement point from the origin and the Angular Speed at which the software has calculated the point has moved from the origin.

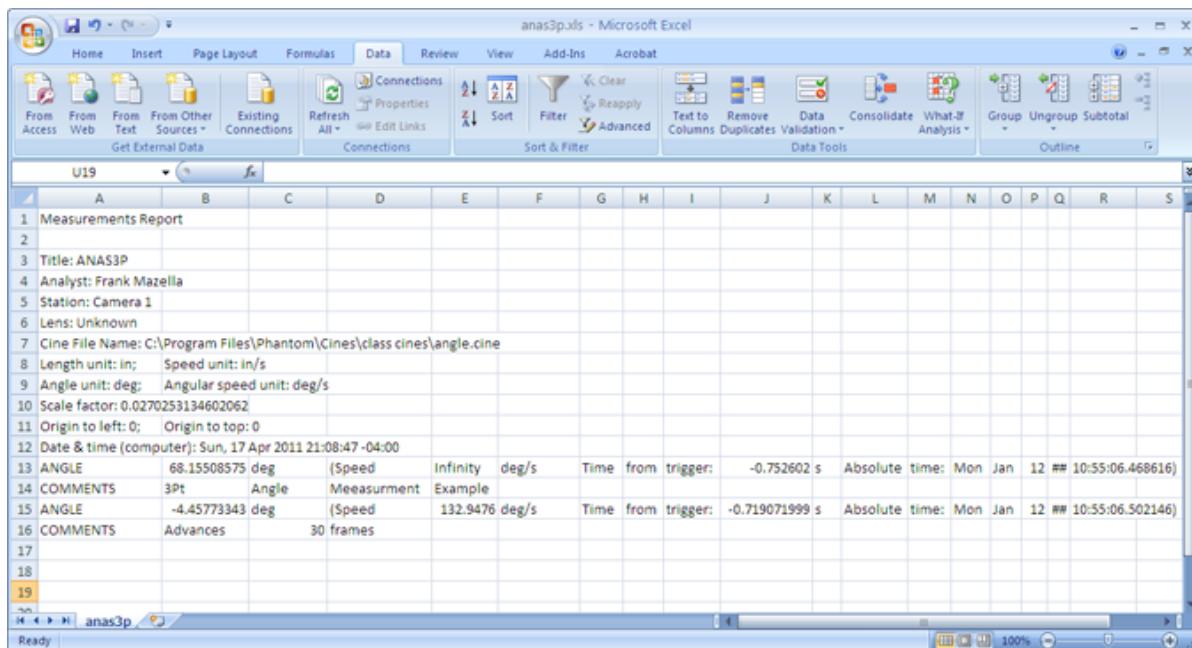
	<p>In this example, the analyst had advanced the Cine file 25 images so that the object has moved at an angle from the origin, at some angular speed. Notice the PCC software has calculated that the object had moved 33.99645915 degrees from the origin at an angular speed of 755.4795605 degrees per second.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
18	Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the measurement was taken on the same point of an orange toy jet 25 frames later.



The above example of a Distance & Angle & Speed: 2points Report File provides the following information:

LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is.
2	Blank
3	Displays the title of the report entered during the Create Report File process.
4	Displays the analyst who performed the measurements entered during the Create Report File process.
5	Display station information, (camera name or number), of the camera used to create the Cine file measurements are being performed on, entered during the Create Report File process.
6	Displays lensing information, about the lens used during the Cine capture, that was entered

	during the Create Report File process.
7	The Cine File Name specifies the path and name of the file the report file was generated on when performing motion analysis on the file.
8	Displays the length and speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
9	Displays the angle and angular speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
10	Indicates the scale factor used to calculate the measurements. The scale factor was calculated during the Calibrating a Measurement Scale procedure.
11	Specifies the location of the origin point in the number of pixels to the left of, and number of pixel down from the upper-left pixel of the image, (the first image pixel). In this example, since no origin point was necessary, the default origin point was used the upper-left pixel of the image, (the first image pixel).
12	The Date and Time indicate where the time reference came from and what the Day, Date and Time was the report file was generated. It also displays the time difference from utc (GMT).
13	Display the Line (Distance) and the Speed which the software has calculated a point has moved from its original measurement position to its next measuring point. In this example, the analyst had already advanced the subject being measured, a toy jet, 25 frames and marked the tip of the toy jet as the first measuring point, the reference point. The analyst then advanced the Cine 25 more frames and marked same point on the toy jet. For this example, the software has calculated that the toy jet traveled distance (Line) of 6.86465182751095 inches, at a Speed of 164.752231832658 inches per second. This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.
14	Display the Angle and Angular Speed which the software has calculated a point has moved from its original position to its next measuring point. As previously mention, for this example, the analyst had already advanced the subject being measured, a toy jet, 25 frames and marked the tip of the toy jet as the first measuring point, the reference point. The analyst then advanced the Cine 25 more frames and marked same point on the toy jet. For this example, the software calculated that the toy jet traveled at an Angle of 32.1089608828617 degrees, at an Angular Speed of 770.617811391185 degrees per second. This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.
15	Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the object was advanced 25 frames from its original position.



The above example of a Angle & Angular Speed: 3points Report File provides the following information:

LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is.
2	Blank
3	Displays the title of the report entered during the Create Report File process.
4	Displays the analyst who performed the measurements entered during the Create Report File process.
5	Display station information, (camera name or number), of the camera used to create the Cine file measurements are being performed on, entered during the Create Report File process.
6	Displays lensing information, about the lens used during the Cine capture, that was entered during the Create Report File process.
7	The Cine File Name specifies the path and name of the file the report file was generated on when performing motion analysis on the file.
8	Displays the length and speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
9	Displays the angle and angular speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
10	Indicates the scale factor used to calculate the measurements. The scale factor was calculated during the Calibrating a Measurement Scale procedure.

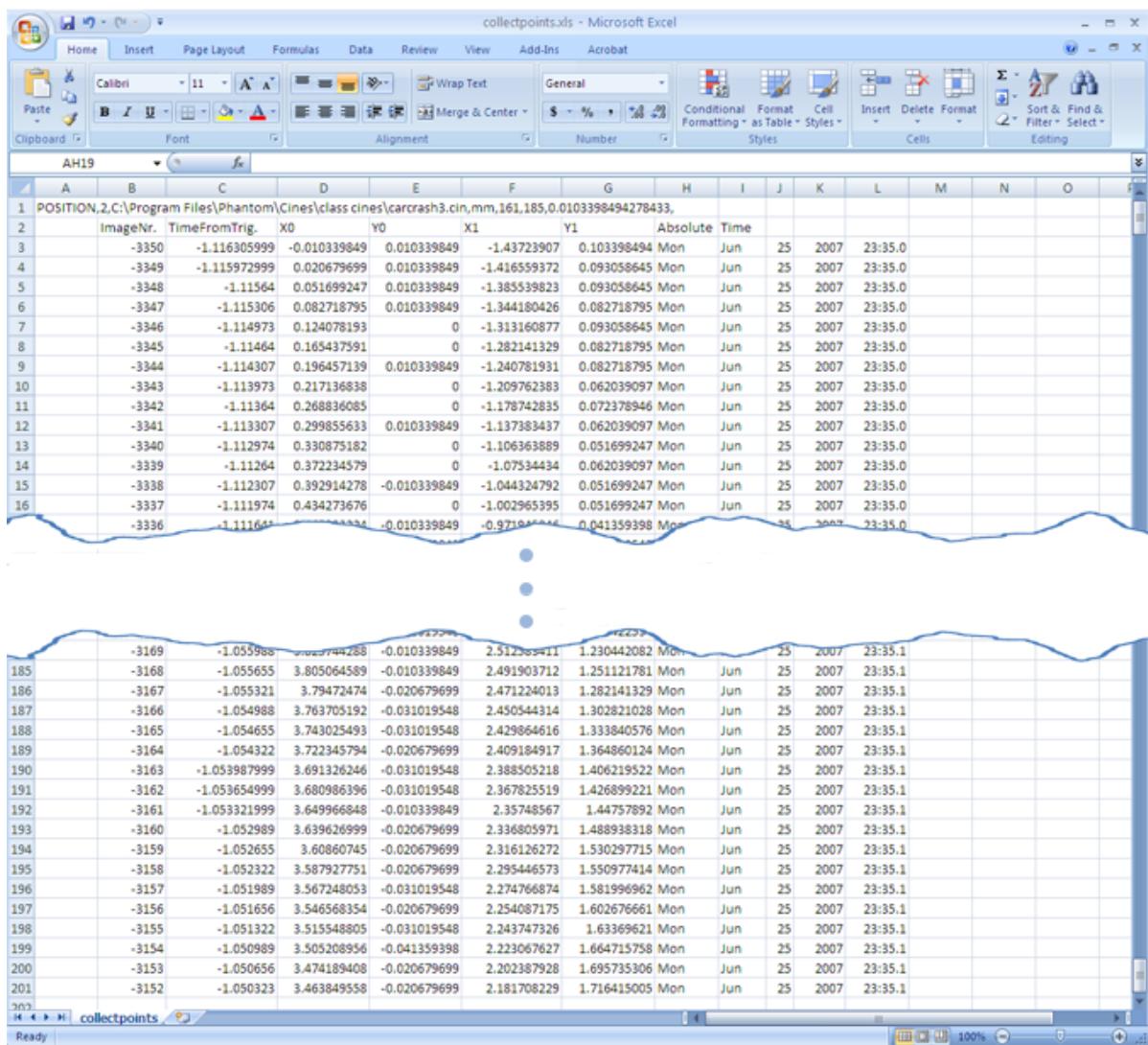
11	<p>Specifies the location of the origin point in the number of pixels to the left of, and number of pixel down from the upper-left pixel of the image, (the first image pixel).</p> <p>In this example, since no origin point was necessary, the default origin point was used the upper-left pixel of the image, (the first image pixel).</p>
12	<p>The Date and Time indicate where the time reference came from and what the Day, Date and Time was the report file was generated. It also displays the time difference from utc (GMT).</p>
13	<p>Display the Angle and Angular Speed which the software has calculated.</p> <p>In this example, the analyst had already advanced the subject being measured to point where he/she wised to measure the angle two boxes created when falling away from one another.</p> <p>For this example, the software has calculated that the boxes created an angle of 68.1550857539656 degrees, at an Angular Speed of Infinity degrees per second. The reason the Angular Speed was calculated at Infinity was the measurement only measured the angle the two boxes created. It wasn't measuring the angle and angular speed one of the boxes fell.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
14	<p>Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the analyst commented that he/she was simply taking a three-point angle measurement.</p>
15	<p>Display the Angle and Angular Speed which the software has calculated a point one of the boxes has moved from its original position to its next measuring point.</p> <p>As previously mention, for this example, the analyst had already advanced the subject being measured to a point where he/she wished to start the motion analysis.</p> <p>After marking the starting point of the box and a reference point, the analyst advanced the Cine to a point where he/she wanted to find out the angle at which the box was falling and the angular speed at which it was falling. The analyst then clicked the same point on the box that he/she clicked on when he/she marked as the starting point.</p> <p>For this example, the software calculated that the box fell at an Angle of - 4.45773343026414 degrees, at an Angular Speed of 132.94760962907 degrees per second.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
16	<p>Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the object was advanced 30 frames from its original position.</p>

anasa4p.xls - Microsoft Excel																	
anasa4p.xls - Microsoft Excel																	
	Home	Insert	Page Layout	Formulas	Data	Review	View	Add-Ins	Acrobat								
	From Access	From Web	From Text	From Other Sources	Existing Connections	Refresh All	Connections	Properties	Edit Links	Z A	Sort	Filter	Advanced	Text to Columns	Remove Duplicates	Data Validation	Clear
										A Z							
1	Measurements Report																
2																	
3	Title: ANAS4P																
4	Analyst: Frank Mazella																
5	Station: Camera 1																
6	Lens: Sigma Zoom 24-70mm 1:2.8 w/F-stop Wide Open																
7	Cine File Name: C:\Program Files\Phantom\Cines\class cines\toy jets3.cine																
8	Length unit: in:	Speed unit: in/s															
9	Angle unit: deg:	Angular speed unit: deg/s															
10	Scale factor: 1																
11	Origin to left: 0:	Origin to top: 0															
12	Date & time (computer): Sun, 17 Apr 2011 21:16:10 -04:00																
13	ANGLE	17.69303831 deg	(Speed	Infinity	deg/s	Time	from	trigger:	0.00899809 s	Absolute	time:	Tue	Apr	S	2011 15:35:12.865958.09)		
14	COMMENTS	4 Point	Angle	Measurement	Example												
15	ANGLE	-1.02190009 deg	(Speed	40.87600455 deg/s	Time	from	trigger:	0.03399809 s	Absolute	time:	Tue	Apr	S	2011 15:35:12.890958.09)			
16	COMMENTS	Advanced	25 frames														
17																	
18																	
19																	
20																	

The above example of a Angle & Angular Speed: 4points Report File provides the following information:

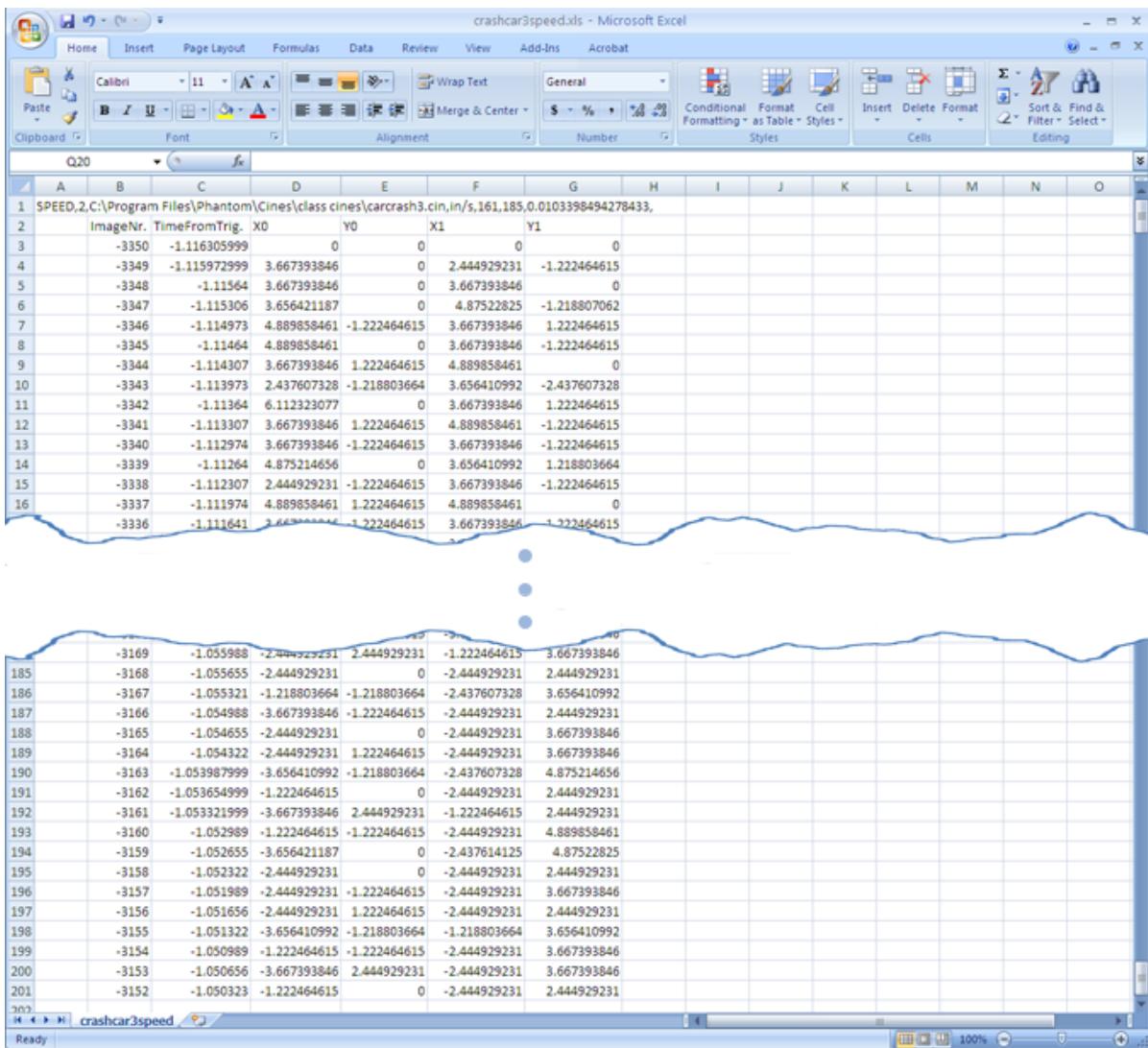
LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is.
2	Blank
3	Displays the title of the report entered during the Create Report File process.
4	Displays the analyst who performed the measurements entered during the Create Report File process.
5	Display station information, (camera name or number), of the camera used to create the Cine file measurements are being performed on, entered during the Create Report File process.
6	Displays lensing information, about the lens used during the Cine capture, that was entered during the Create Report File process.
7	The Cine File Name specifies the path and name of the file the report file was generated on when performing motion analysis on the file.
8	Displays the length and speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
9	Displays the angle and angular speed units of measure specified during the Defining the PCC Application Preferences>Measurement Preference procedure.
10	Indicates the scale factor used to calculate the measurements. The scale factor was calculated during the Calibrating a Measurement Scale procedure.

11	<p>Specifies the location of the origin point in the number of pixels to the left of, and number of pixel down from the upper-left pixel of the image, (the first image pixel).</p> <p>In this example, since no origin point was necessary, the default origin point was used the upper-left pixel of the image, (the first image pixel).</p>
12	<p>The Date and Time indicate where the time reference came from and what the Day, Date and Time was the report file was generated. It also displays the time difference from utc (GMT).</p>
13	<p>Display the Angle and Angular Speed which the software has calculated.</p> <p>In this example, the analyst had already advanced the subject being measured to point where he/she wised to measure the angle two toy jets flying away from one another created.</p> <p>For this example, the software has calculated that the toy jets created an angle of 17.6930383052922 degrees, at an Angular Speed of Infinity degrees per second. The reason the Angular Speed was calculated at Infinity was the measurement only measured the angle the two toy jets created. It wasn't measuring the angle and angular speed one of the toy jets created as it traveled across the field of view.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
14	<p>Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the analyst commented that he/she was simply taking a four-point angle measurement.</p>
15	<p>Display the Angle and Angular Speed which the software has calculated one of the toy jets has moved from its original position to its next measuring point.</p> <p>As previously mention, for this example, the analyst had already advanced the subject being measured to a point where he/she wished to start the motion analysis.</p> <p>After marking the starting point of the toy jet with a positional point and a reference point, the analyst advanced the Cine to a point where he/she wanted to find out the angle at which the toy jet was traveling and the angular speed at which it was traveling. The analyst then clicked the same two points on the toy jet that he/she clicked on when he/she marked them prior to advancing the Cine 25 frames.</p> <p>For this example, the software calculated that the box fell at an Angle of - 1.02190009093377 degrees, at an Angular Speed of 40.8760045510006 degrees per second.</p> <p>This line also reports the Time from Trigger this image was recorded (in seconds), and the Absolute time (Day of Week, Month, Day, Year, hh:mm:ss down to the nano-second); the image was capture.</p>
16	<p>Displays the analyst comment, he/she entered, about the measurement reported in the line above. In this example, the object was advanced 25 frames from its original position.</p>



The above example of a Collect Points File provides the following information:

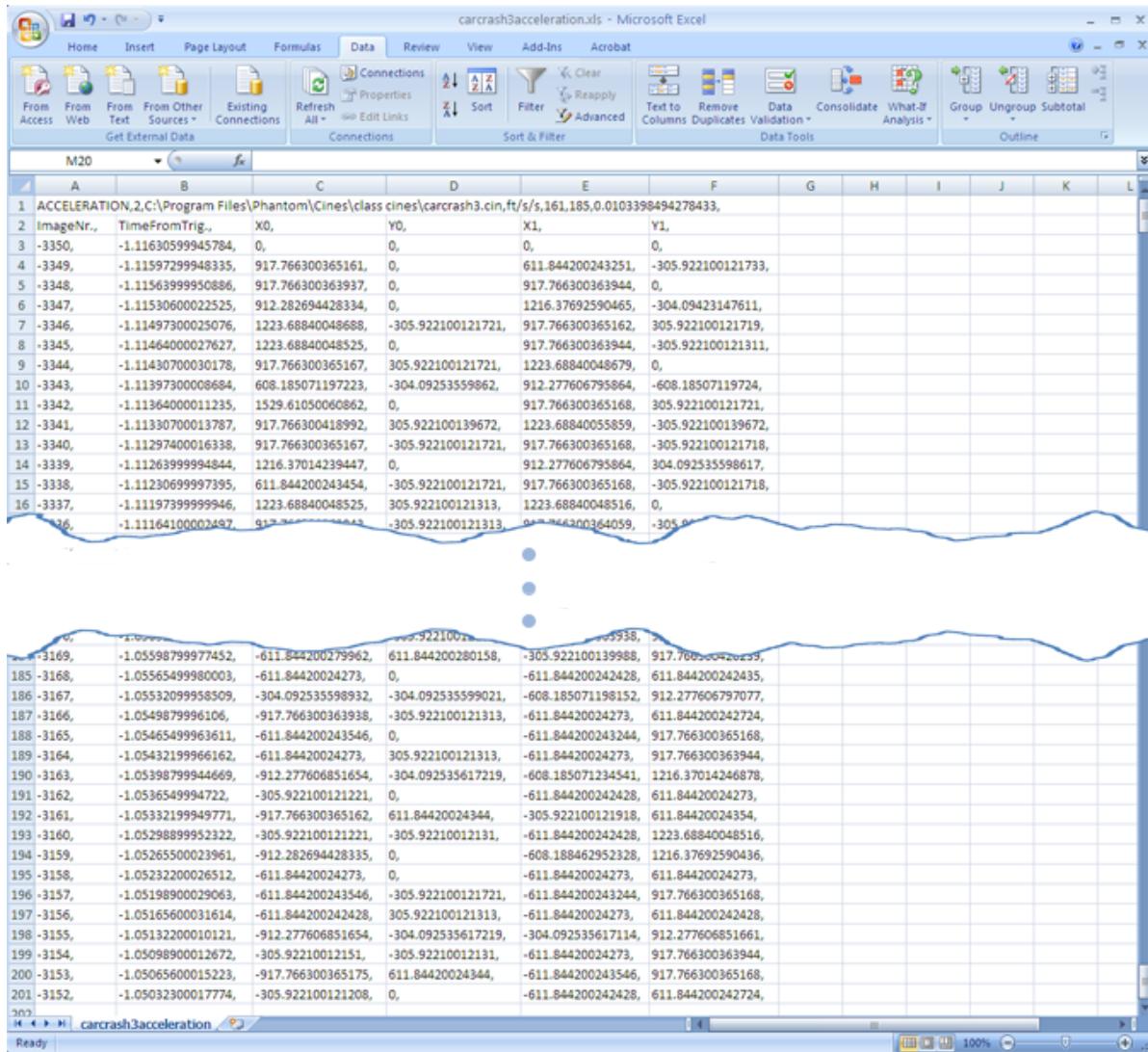
LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is, the number of points per image being tracked, the location of the file the measurements are being performed on, the unit of measure, the origin coordinates, and a scale factor used to calculate the results. The scale factor was calibrated when the analyst performed the calibrating a measurement scale process.
2	Indicates the column headers, including; the ImageNr. (image number) the tracking points were taken on, the TimeFromTrig. (time from trigger) the image was taken, the X, Y position of the first point (X0, Y0), the X, Y position of the second point (X1, Y1), and the absolute time the image was recorded.
3	The remaining lines specify image number, time from trigger, the calculated position of the track points from the analyst specified origin point, and the time the image was recorded. For the example shown here a toy car was used that moved from left to right until it hits a wall. At that point, the car moves backwards a short distance.



The above example of a Collect Points - Compute Speed Report File provides the following information:

LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is, the number of points per image being tracked, the location of the file the measurements are being performed on, the unit of measure, the origin coordinates, and a scale factor used to calculate the results. The scale factor was calibrated when the analyst performed the calibrating a measurement scale process.
2	Indicates the column headers including; the ImageNr. (image number) the tracking points were taken on, the TimeFromTrig. (time from trigger) the image was taken, the speed the first track point traveled at on the X-, and Y-axis, and the speed the second track point traveled at on its' X-, and Y-axis.
3	The remaining lines specify image number, time from trigger, the calculated speed the subject traveled for each of the tracked points from the analyst specified origin point, and the time the image was recorded. For the example shown here a toy car was used that

moved from left to right until it hits a wall. At that point, the car moves backwards a short distance.



The above example of a Collect Points - Compute Acceleration Report File provides the following information:

LINE	DISPLAYED INFORMATION
1	Indicates the type of report file this is, the number of points per image being tracked, the location of the file the measurements are being performed on, the unit of measure, the origin coordinates, and a scale factor used to calculate the results. The scale factor was calibrated when the analyst performed the calibrating a measurement scale process.
2	Indicates the column headers, including; the ImageNr. (image number) the tracking points were taken on, the TimeFromTrig. (time from trigger) the image was taken, the amount of acceleration the first track point traveled at on the X-, and Y-axis, and the acceleration the

	second track point traveled at on its' X-, and Y-axis.
3	<p>The remaining lines specify image number, time from trigger, the calculated acceleration rate of the subject for each of the tracked points from the analyst specified origin point, and the time the image was recorded.</p> <p>For the example shown here a toy car was used that moved from left to right until it hits a wall. At that point, the car moves backwards a short distance.</p>

7.2.5.11 Image Search

This Image Search feature is extremely useful in reducing the time it takes to locate an event of interest that, in some cases, may be difficult to find within a recording by manual search. This feature can be used to search through a Cine stored in the camera's RAM, attached CineMag, or Cine files that have been previously saved.

The goal is to search is to find an image change in the recording, based on the difference between image content, triggered by the change of a certain percentage of the pixels. A pixel is considered changed if its value in the current image is different from the value in the reference image by an amount called threshold. This allows the search to tolerate a certain amount of image noise.

Besides image content changes, Image Search can look for images that are tagged as event images based on a change in the Event binary input signal.

In addition, of course, one can jump directly to the first image recorded after the camera was triggered (Image 0).

STEP-BY-STEP PROCEDURES

▼ Difference Method

The Difference Method compares the difference between two images to calculate the image's, user-specified, modified area called the Change Area. A pixel is considered modified when the difference between its values in the two images is greater than a Threshold value, which is also user defined.

1. Select the Cine the Image Search is to be performed on.
2. Click on the Play Panel tab, then
3. Click the Image Search selector.
4. Click the down arrow next to the Method entry field, then
5. Select Difference from the pull-down selection list.
6. Define the search parameters:

a. Threshold

Threshold specifies the percentage a pixel value must change in order to be counted as a changed pixel. The value is calculated as a percentage from the maximum possible pixel value. A higher value for this parameter is useful for noisy images. 8-bit images require a higher threshold than 16-bit images.

b. Changed Area

The Changed area specifies the percentage of image pixels that must change in order to recognize an image change and generate a player stop condition.

c. Search Step

Search Step specifies the difference between the image numbers to be compared when running the search. This parameter helps to accelerate the search by processing fewer images.

NOTE

If the number of images to jump is greater than the number of image it took to record the event the software might not detect any difference in the images it is comparing. Some experimentation may be required to define these parameters correctly.

7. Enable Incremental Search (optional)

- a. If disabled, unchecked, the search is done by comparing the current image with the reference image, the image that was displayed when you initiated the search.
- b. If enabled, the comparison will be done between the current image and the previous image, (separated by the step increment).

8. Start the search process:

- a. Right mouse click on the Play Forward video button to search the file in the forward direction, or right mouse click on the Play Reverse video button to search the file backwards, then
- b. Select Skip to Image Change from the popup selection window to search on image differences, or
- c. Select Skip to Event, to search for images that are tagged as event images, then
- d. Select the event the software is to search for from the popup selection list:
 - 1) Event 0 means there is an event (input Event In is low)
 - 2) Event 1 means there is not an event (input Event In is high)
 - 3) Event change means the input Event In passes from 0 to 1 or from 1 to 0.

RESULT: The software will search through the Cine until it detects image difference that match the define search parameters.

▼ **Correlation Method**

The Correlation Method is based on the Normalized Cross Correlation (NCC) coefficient between two images. NCC has values between 0.0 and 1.0. This coefficient measures image similarity. When NCC is 1.0, the current image matches exactly the reference image. The stop condition is NCC being below a threshold. To have a parameter similar to first case we define the image difference as: $(1 - NCC) * 100\%$. When the difference between two images is greater than this value a stop condition will be generated.

1. Select the Cine the Image Search is to be performed on.
2. Click on the Play Panel tab, then
3. Click the Image Search selector.
4. Click the down arrow next to the Method entry field, then
5. Select Correlation from the pull-down selection list.
6. Define the search parameters:
 - a. Difference

Difference specifies the percentage of images that must change.

b. Search Step

Search Step specifies the difference between the image numbers to be compared when running the search. This parameter helps to accelerate the search by processing fewer images.

NOTE

If the number of images to jump is greater than the number of image it took to record the event the software might not detect any difference in the images it is comparing. Some experimentation may be required to define these parameters correctly.

7. Enable Incremental Search (optional)

- a. If disabled, unchecked, the search is done by comparing the current image with the reference image, the image that was displayed when you initiated the search.
- b. If enabled, the comparison will be done between the current image and the previous image, (separated by the step increment).

8. Start the search process:

- a. Right mouse click on the Play button to search the file in the forward direction, or right mouse click on the Rewind button to search the file backwards, then
- b. Select Skip to Image Change from the popup selection window to search on image differences.

RESULT: The software will search through the Cine until it detects image difference that match the define search parameters.

7.2.6 Multi-Camera / Cine (Group) Procedures

This section describes Step-by-Step procedures to group and control multiple Phantom cameras simultaneously.

7.2.6.1 Creating Groups

The Group feature allows for control of user-defined group(s) of cameras or .Cine files, and includes the ability to:

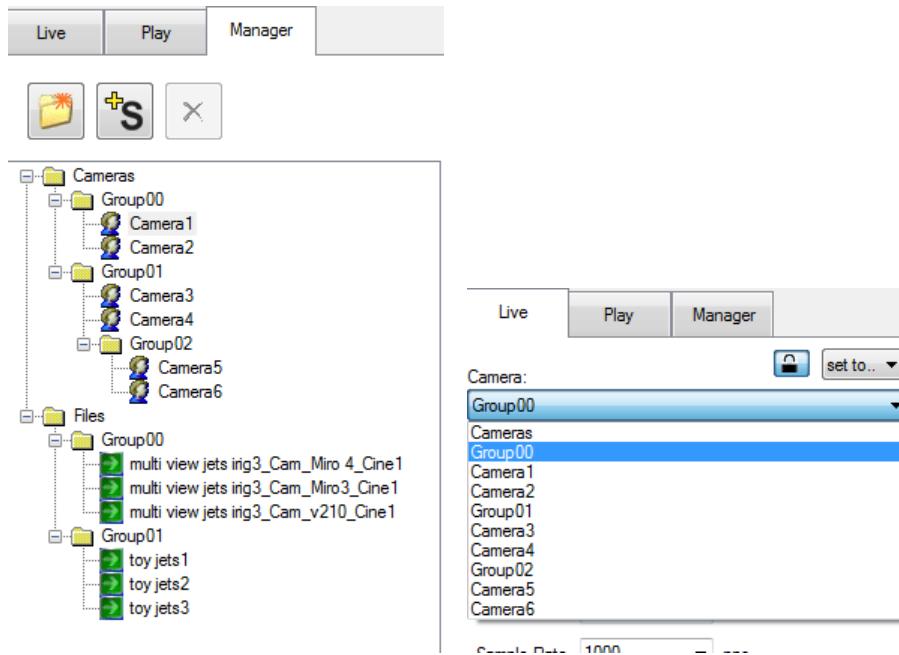
- Define the capture (recording) parameters of a group of cameras.
- Place a camera group into the capture (recording) mode.
- Trigger a group of cameras.
- Review, Edit, and Save Cine files from a group of cameras; individually or simultaneously.
- Apply image adjustment via PCC's Image Tools options.
- Group previously saved Cines for playback.

A group / sub-group can contain multiple Phantom cameras that can be controlled simultaneously via the Live tab.

A group / sub-group can also be created containing multiple previously saved and opened Cine files that can be controlled via the Play tab.

NOTE

One Phantom camera cannot be associated with multiple groups at the same time.

**Manager and Live Tab Camera Group Examples**

For this example (shown here) notice that all cameras, by default, are associated with the 'Cameras' group and all end-user created groups are a sub-group of the root 'Cameras' group. This includes 'Group00' which consists of 'Camera1' and 'Camera2', and 'Group01' consisting of 'Camera3', 'Camera4', and 'Group02' (which is a sub-group) made up of 'Camera5' and 'Camera6'.

Therefore, if the 'Cameras' group is selected, via the 'Live>Camera' pull-down selection list, all six cameras will be locked (displayed with a red border around the Preview Panel) and controlled simultaneously. If 'Group00' is selected, only 'Camera1' and 'Camera2' will be locked. However when 'Group01' is selected, not only are 'Camera3', and 'Camera4' locked but 'Camera5' and 'Camera6' will also be locked even though they are under the 'Group02', since 'Group02' is a sub-group of 'Group01'. Lastly, selecting 'Group02' locks only 'Camera5' and 'Camera6'.

STEP-BY-STEP PROCEDURES**▼ All Cameras via the Live Tab**

1. By default all cameras connected to PCC are placed into the 'Cameras' group.
2. Select the 'Cameras' option from the Live>Camera pull-down selection list. A Preview Panel, for each camera connected to PCC opens in the Locked (Group) state, indicated by a red border around the Preview Panel.

▼ Specific Cameras via the Live Tab

1. Select the 'Cameras' option from the Live>Camera pull-down selection list. A Preview Panel, for each camera connected opens in the Locked (Group) state, indicated by a red border around the Preview Panel.
2. Click the Camera: Lock button to unlock all cameras from the locked (Group) state.
3. CTRL + Click over the 'Title Bar', of the first camera to be grouped. A red border around the Preview Panel and a 'Create Group' pop-up window will appear.
4. CTRL + Click over the 'Title Bar', of the next camera to be grouped
5. Continue this process until all cameras to be grouped together have been selected. Only the Preview Panels of the cameras associated with the 'Group' will be displayed in a red border, and listed in the 'Group Items' list in the 'Create Group' dialogue window.
6. Enter a name for the group (optional) in the Create Group>Group Name field, then
7. Select the Create Group button.

NOTE

If you do not select the Create Group button, the group is temporary.

▼ Specific Cameras via the Manager Tab

1. Highlight the 'Cameras' group (or previously created sub-group), then click the 'New Group' button.
2. Enter the desired name for the new group. A 'Cameras' sub-group folder will be created.
3. Drag the desired Phantom cameras from the list, to the appropriate group.

7.2.6.2 Delete (Remove) Groups

STEP-BY-STEP PROCEDURE

1. Highlight the previously created sub-group, then click the 'Delete' button. The selected sub-group will be removed from the Manager Panel, however, the cameras or Cine files associated with the deleted sub-group will not be deleted, they will be moved into the tree root.

CAUTION

Removing Cines stored in the camera's internal Flash memory module or attached Phantom CineMag will delete all the Cines, unlike those stored in a Phantom CineFlash where the end-user can select to delete a single Cine, all the Cines, or format the Phantom CineFlash unit.

7.2.6.3 Selecting Camera Groups

STEP-BY-STEP PROCEDURES

▼ All Cameras Group via the Live Tab

By default all cameras connected to PCC are places into the 'Cameras' group.

1. Select the 'Cameras' option from the Live>Camera pull-down selection list. A Preview Panel, for each camera connected to PCC opens in the Locked (Group) state, indicated by a red border around the Preview Panel.

▼ Specific Cameras

With the Camera: Lock button unlocked:

Method 1:

1. Select the desired group option from the Live>Camera pull-down selection list. A Preview Panel, for each camera, associated with the selected group, connected to PCC opens in the Locked (Group) state, indicated by a red border around the Preview Panel.

Method 2:

1. Select a camera's Preview Panel of a camera associated with the specific group, then click the Camera: Lock button.

The Preview Panels for each camera associated with the selected group, connected to and displayed in PCC, will be placed in the Locked (Group) state, indicated by a red border around the Preview Panel.

Method 3:

1. From the Manger tab right mouse click on the Group/Sub-group folder containing the cameras to be open.
2. Select the 'Show Only Images From This' command in the associated pop-up window. PCC will displays the Preview Panels for each connected camera associated with the selected group only, all other opened panels will be closed.
3. Click the Live tab. The associated of connected group cameras are placed into the Locked (Group) state, indicated by a red border around the Preview Panel.

7.2.6.4 Deselect (Unlock) Groups

STEP-BY-STEP PROCEDURES

Method 1: In the Live tab unlock the Cameras: Lock button.

Method 2: In the Live tab select an individual camera from the Cameras: pull-down selection list.

7.2.6.5 Assigning Capture Parameters to Camera Group

The end-user can instruct specific Phantom cameras, in the camera network, to change their Live Panel settings to match the setting of an active camera in a multi-Phantom camera environment. The end-user could also instruct the camera to change the settings, in all memory partitions, to match the settings currently displayed in the Live Panel, when the selected Phantom camera has been

configured to use the MultiCine feature.

STEP-BY-STEP PROCEDURES

▼ Via Group Association

1. Any changes made to the capture (recording) parameters will be applied to all locked cameras including any camera associated with a locked camera's assigned group even if the camera is not displayed in a Preview Panel.

▼ Via Camera: Set To Selection List

1. The 'Live>Set To' selection list is used to copy all setup parameters from one camera to a specific camera or camera group in the pull-down selection list.
2. When the 'Copy?' prompt is displayed click 'OK' to copy the parameters or 'Cancel' to discard the copy process. PCC will display an information window indicating the parameters were copied.

NOTE

Ensure the Sample Rate and Trigger Position (post-trigger [Last] value) settings are the same for all cameras to properly synchronize multiple cameras.

7.2.6.6 Camera Group Cine Capture

STEP-BY-STEP PROCEDURES

1. Select the desired camera 'Group' being used to record from the Live>Camera pull-down selection list. A Preview Panel, for each camera, associated with the selected group, connected to PCC opens in the Locked (Group) state, indicated by a red border around the Preview Panel.
2. Click the Capture button in the Live tab. The 'Rec' indicator in the Preview Panel will turn red indicating the cameras are in the recording mode.

CAUTION

All cameras associated with the locked camera group will be placed into the capture mode even if the camera is not displayed in a Preview Panel.

3. Apply a hard trigger to the cameras. If the cameras are recording post-trigger frames the 'Rec' indicator will flash until the cameras RAM (circular buffer) is full.

CAUTION

All cameras associated with the locked camera group will be triggered even if the camera is not displayed in a Preview Panel.

NOTE

Ensure all cameras being synchronized are supplied a shared external trigger. Vision Research cannot guarantee that the cameras will remain synchronized if a soft-trigger is used to trigger the cameras.

7.2.6.7 Review Camera / Files Group Cines**STEP-BY-STEP PROCEDURES**

1. Open the Cines to be reviewed.
2. Click the Play tab.
3. Click on the Lock Cines button, or select the associated Files group from the Cine pull-down selection list in the Play tab. The Playback Panels, for the Cine files associated with the selected group, are displayed in the Locked (Group) state, indicated by a red border around it.

NOTE

When reviewing Cine file not associated with a Camera / Files group select the 'Files' group from the Cine pull-down selection list.

4. Use the video control buttons, jump options, or Cine Editor Bar, to review, jump through, or scrub through the files simultaneously.

7.2.6.8 Edit Camera / Files Group Cines**STEP-BY-STEP PROCEDURES**

1. With the associated Files group selected, and in the Locked state:
2. Locate the first image / frame of the Cine to be saved, and
3. Click the Mark-In button.
4. Locate the last image / frame of the Cine to be saved, and
5. Click the Mark-Out button.

7.2.6.9 Save Camera / Files Group Cines

The Save Cine Process depends on the saving method chosen, as follows:

STEP-BY-STEP PROCEDURES**▼ via 'Save Cine...' button or 'Save Cine to File' option**

When either of these methods are used to save a camera group's Cine files the "Save Cine" dialogue window will appear sequentially for each camera associated with the selected group. This method allows the end-user to save the Cine files on an individual basis for a camera group to an external storage device.

1. In the 'Save In' data entry field of the Save Cine dialogue enter the full path of the folder

the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.

2. Enter a 'Filename' for the Cine being saved, then
3. Select the format from the 'Save as Type' pull-down selection list.
4. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list.
5. Specify the 'Decimate by' factor.
6. Define all desired 'Save Options'.
7. Click the 'Save button'.
8. Repeat until all Cine files have been saved.

▼ via Save All RAM Cines

This method allows the end-user to save the RAM Cine files of all cameras in the selected camera group to an external storage device simultaneously.

1. In the 'Save In' data entry field of the Save Cine dialogue enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
2. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process.
3. Select the format from the 'Save as Type' pull-down selection list.
4. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list.
5. Specify the 'Decimate by' factor.
6. Define all desired 'Save Options'
7. Click the 'Save button'. PCC displays a 'Saving Cine' message (center of Play Panel) along with a 'Save Cine' progress indicator' (lower left corner of Play Panel).
8. The files will append to the root filename the Camera Name and Cine Number. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).

▼ via Save All Flash Cine to File

This method allows the end-user to save the Flash Cine files of all cameras in the selected camera group to an external storage device simultaneously.

1. In the 'Save In' data entry field of the Save Cine dialogue enter the full path of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
2. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process.
3. Select the format from the 'Save as Type' pull-down selection list.
4. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list.
5. Specify the 'Decimate by' factor.

6. Define all desired 'Save Options'
7. Click the 'Save button'. PCC displays a 'Saving Cine' message (center of Play Panel) along with a 'Save Cine' progress indicator' (lower left corner of Play Panel).
8. The files will append to the root filename the Camera Name and Cine Number. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).

▼ via Save RAM Cine to Flash

This method allows the end-user to save the RAM Cine files of all cameras in the selected camera group, to their attached Phantom CineMag, CineFlash, or internal Flash simultaneously.

NOTE

When using this method to save MultiCine partitions, PCC saves the active camera's selected Cine segment (the Cine stored in the partition opened and displayed in the Play Panel) and the same segments for any cameras assigned to that camera group even if the Cines are not opened in a Play Panel.

▼ via Select and Save

This method allows the end-user to select the Cine (RAM / Flash) files of all, grouped, or individual cameras to save to an external storage device simultaneously. This method is extremely useful to select specific Cine file to save when using the MultiCine (memory partitioning) feature.

1. In the Multi Cine dialogue window enable, check, the desired location(s) of the Cine files to be saved and their type:
 - a. All cameras – when enabled a camera tab will be displayed for all connected to Phantom cameras.
 - b. All group cameras – when enabled a tab will be displayed for all the cameras associated with the selected and locked group.
 - c. RAM Cines -when enabled only RAM Cine files will be displayed in the Phantom camera's tab window.
 - d. Flash Cines - when enabled only Cine files stored on the camera's attached Phantom CineMag,\CineFlash, or internal Flash will be displayed in the Phantom camera's tab window.
 - e. For each camera highlight the Cine to be saved.
 - f. Click the OK button.
2. In the Save Cine dialogue window:
 - a. Enter the full path (in the 'Save In' data entry field) of the folder the Cine is to be save in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - b. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process. If saving as an image stack enter a root filename followed by the plus (+) sign along with a digit (1 through 8) to append sequentially 1 digit through 8 digits starting at 0.
 - c. Select the format from the 'Save as Type' pull-down selection list.

- d. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out], Full Cine, or User Defined) pull-down selection list.
- e. Specify the 'Decimate by' factor.
- f. Define all desired 'Save Options'. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).
- g. Click the 'Save button'. PCC displays a 'Saving Cine' message (center of Play Panel) along with a 'Save Cine' progress indicator' (lower left corner of Play Panel).
- h. The files will append to the root filename the Camera Name and Cine Number. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio in is available (presently used with Phantom Flex4K models only).

7.2.6.10 Deleting All RAM Files

This option is used to delete the RAM files from all cameras associated with the camera group or sub-group.

STEP-BY-STEP PROCEDURES

1. Right mouse click on the 'Files' group in the Manager tab, and
2. Select the 'Delete All RAM Cines' command from the popup selection list.
3. In the confirmation window click the 'OK' button.

7.2.6.11 Grouping Previously Saved Cine Files

STEP-BY-STEP PROCEDURES

By default all previously saved and opened Cine files are places into the 'Files' group similar to that of cameras of the 'Cameras' group. To create a Files sub-group:

1. Highlight the 'Files' group (or previously created sub-group), then click the 'New Group' button.
2. Enter the desired name for the new group. A 'Files' sub-group folder will be created.
3. Drag the desired Cine files from the list, to the appropriate group.

7.2.6.12 Selecting Files Groups

STEP-BY-STEP PROCEDURES

NOTE

Selecting a Cine group from the Play Tab>Cine pull-down selection list only opens the first Cine file associated with the group. The end-user needs to open the Cine file individually, then select the group from the Play Tab>Cine pull-down selection list, or click the Cine: Lock button to lock the opened Cine files.

▼ All Files Group via the Manager Tab

1. By default all previously opened saved Cine files are placed into the 'Files' group.
2. To open a Files Group, right mouse click on the desired group, and
3. Select the 'Show Only Images From This' from the popup selection list in Play panel, select the Files group from the Cine: list.
4. The Playback Panel, for each Cine file associated with the selected group will go into the Locked (Group) state, indicated by a red border around the Playback Panel.

▼ Specific Cine Groups

With the Camera: Lock button unlocked:

Method 1:

1. Select the desired group option from the Play>Cine pull-down selection list. The already open Playback Panel, for each Cine file associated with the selected group will be placed into the Locked (Group) state, indicated by a red border around the Preview Panel.

Method 2:

1. Select a Playback Panel of a Cine file associated with the specific group, then
2. Click the Cine: Lock button.

The Playback Panels for each opened Cine file associated with the selected group will be placed into the Locked (Group) state, indicated by a red border around the Preview Panel.

Method 3:

1. From the Manager tab right mouse click on the Group/Sub-group folder containing the files to be open.
2. Select the 'Show Only Images From This' command in the associated pop-up window. PCC will display the Playback Panels for each Cine file associated with the selected group only, all other opened panels will be closed.
3. Click the Play tab and select the desired files group from the Cine: list. The associated Cine files are placed into the Locked (Group) state, indicated by a red border around the Playback Panel.

7.2.6.13 Remove All Files

This option is used to remove all previously opened Cine file from the Manager> Files group and sub-groups. The original Cine files are not deleted from the hard drive.

STEP-BY-STEP PROCEDURES

1. Right mouse click on the 'Files' group in the Manager tab, and
2. Select the 'Remove All File' command from the popup selection list.
3. In the confirmation window click the 'OK' button.

CAUTION

PCC does not ask for confirmation before performing this command.

7.2.6.14 Converting Grouped Files

This option is used to batch convert all Cine files from a group or sub-group.

STEP-BY-STEP PROCEDURES

1. In the Manager tab:
2. Right mouse click on the group or sub-group containing the Cine files to be converted, and
3. Select the 'Convert All File' command from the popup selection list.
4. In the Multi Convert Destination dialogue window:
 - a. Enter the full path (in the 'Save In' data entry field) of the folder the Cine is to be saved in, or use the navigation buttons (right of the 'Save In' data entry field) to locate the folder.
 - b. Enter a root 'Filename' for the Cine files being saved. PCC will automatically append the camera's name and Cine number to the root filename during the save process. If saving as an image stack enter a root filename followed by the plus (+) sign along with a digit (1 through 8) to append sequentially 1 digit through 8 digits starting at 0.
 - c. Select the format from the 'Save as Type' pull-down selection list.
 - d. Define the range of images / frames to save using the 'Range Option' ([Mark-In, Mark-Out] , Full Cine, or User Defined) pull-down selection list.
 - e. Specify the 'Deminiate by' factor.
 - f. Define all desired 'Save Options'. If the 'WAV audio file' save option was enabled a .wav file will also be created. This option should only be selected if the audio is available (presently used with Phantom Flex4K models only).
 - g. Click the 'Convert button'. PCC displays a 'Batch File Conversion' progress window.
 - h. Click the 'Close' button upon completion.

Part

VIII

8 Functional Descriptions

The purpose of this module is to specify the functionality of various features and options associated with a Phantom camera, and all related the Phantom Camera Control applications.

8.1 Black Reference/Current Session Reference Adjustments

After a camera comes up to its operating temperature, or after changing camera settings, calibrating the camera to a black reference will help ensure you get the best possible images from your Phantom camera.

A black reference measures the value of each pixel with no light on it (black) and stores the values in a calibration file (called an "STG"). Later, the camera firmware can use those values to ensure that all sensor pixels are providing the same value for equivalent amounts of light.

There are two types of black references on Phantom cameras, they are a:

▼ Current Session Reference (CSR)

"Current Session Reference" is a calibration procedure similar to Black Reference except the fact that it computes the pixel offsets only on the part of the sensor that the resolution set in acquisition parameters.

This way, the offsets can be computed for any frame rate, exposure or resolution, giving a more precise compensation of the pixel errors, dependent on the acquiring parameters and on temperature. Of course, if the acquisition parameters change, you may get worse results than using the universal Black Reference procedure. The CSR is applied correctly only for the set of acquisition parameters used when this reference was calculated.

This black reference is available for any image resolution. When the acquisition parameters, (resolution, frame rate, exposure time), have certain values, (for example, the frame rate is high or the set of values forces the camera performances), it is recommended to do a CSR for that specific set of parameters in order to obtain a better image.

After executing a CSR, if you change the acquisition parameters, the calibration calculated during the Current Session Reference will apply partially correct on the new setup. For example, if you use a bigger resolution than the one used when the CSR was calculated, the CSR adjustments will be applied only on that part of image and for the rest of the image the black reference calibration calculated in the Options window will be used.

The CSR calibration can be saved in a .stg file, for example:
1009_res256x256_rate80_exp12000_edr0..stg.

Thus, you can easily choose a .stg according to the acquisition you are currently using. This .stg file will be opened automatically at the program restart if you rename it by the serial number of the camera: 1009.STG in this example.

▼ **Black Reference (BR).**

Performing a Black Reference ensures the best possible images are being captured and recorded by the camera's sensor.

	AREA EFFECTED	USE WHEN	SAVES TO
Black Reference (BR)	Entire sensor.	Shooting at full resolution and after adjusting frame rate or exposure. Any time the operating temperature of the camera changes more than a few degrees.	Default STG file on the computer and/or in the camera non-volatile memory.
Current Session Reference (CSR)	The part of the sensor that is resolution set in acquisition parameters.	When shooting at less than full resolution and after adjusting resolution, frame rate or exposure.	Separate, re-loadable, STG file and/or the camera non-volatile memory.

NOTE

Before performing either a Black Reference or Current Session Reference Adjustment ensure that the EDR, Extreme Dynamic Range), Exposure setting is set to zero, and the Auto Exposure and Image-Based Auto-Trigger features are disabled.

8.2 Burst Mode Acquisition

The best way to understand burst mode is that it allows the end-user to increase the effective frame rate of the camera for a short duration by having the camera take multiple exposures within one FSYNC cycle. Burst mode works in internal and external SYNC modes, as well as in shutter off modes. Probably, the best implementation of the feature involves providing the camera an external FSYNC pulse, thereby triggering a specific number of images at a frame rate greater than the external FSYNC rate.

Naturally, the user wants to maintain good image quality, so there are rules for how burst mode operates. The rules involve the camera's maximum frame rate, the burst count and the burst period. Let's start with some definitions.

- Burst Period is defined as the time between successive falling edges of STROBE signal.
- Burst Count is the number of images that can be taken between successive falling edges of FSYNC.

Let's say I have a Phantom v12.1 camera set as follows:

- Resolution: 1280 x 800
- Frame Rate: 1000 fps
- Exposure: 50 usec

The maximum frame rate for this camera at 1280 x 800 is 6273 fps.

So, the first rule for understanding burst mode is that for any given resolution, the burst period cannot exceed a camera's maximum frame rate.

$$\text{Max Frame Rate or Min Burst Period} = 1/6273 = 159.41 \text{ usec}$$

The second rule is that maximum burst count for a given frame rate is the integer value of the max frame rate of the camera resolution divided by FSYNC rate.

As a result of these rules, burst mode only works at frame rates that are less than or equal to $\frac{1}{2}$ of the maximum frame rate for a given resolution because you cannot get a burst count of less than 1. In the example above, burst mode is available at all frame rates from 24 fps to a maximum frame rate of 3136 fps.

By knowing the max frame rate and the number of burst counts you calculate the burst period.

Using the Phantom v12.1 example from above and setting the camera's frame rate to 1000 fps results in a maximum burst count of six, ($6273/1000 = 6$). Thereby allowing the end-user to choose a burst count value from 0 to 6. 0 will disable burst mode and there is no burst period. As the burst count decreases the burst period increases.

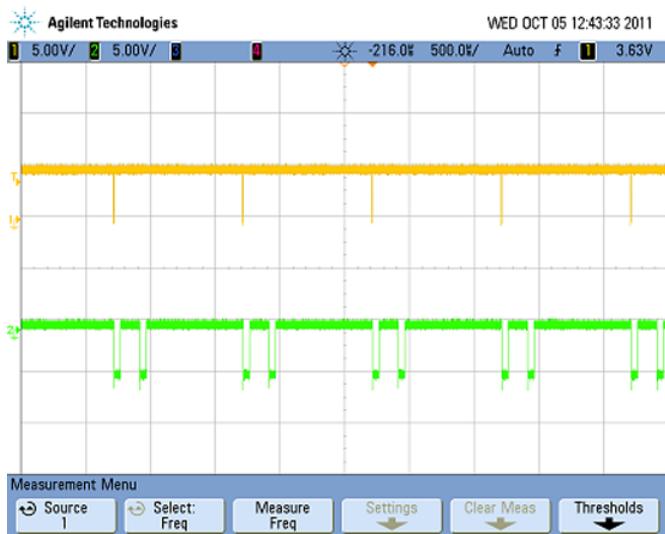
The following figures, taken using an oscilloscope, show the effects of the parameters of burst mode:

- Resolution: 1280 x 800
- Frame Rate: 1000 fps
- Channel 1 is FSYNC
- Channel 2 is STROBE

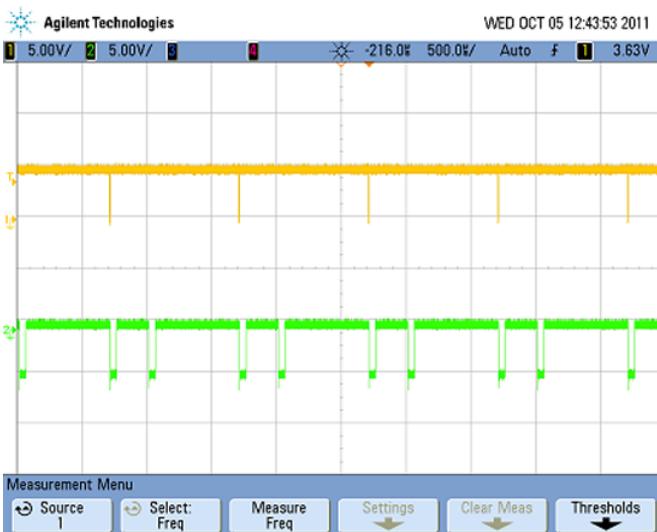
SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	50	0	N/A	Burst Mode Disabled using internal frame rate generator



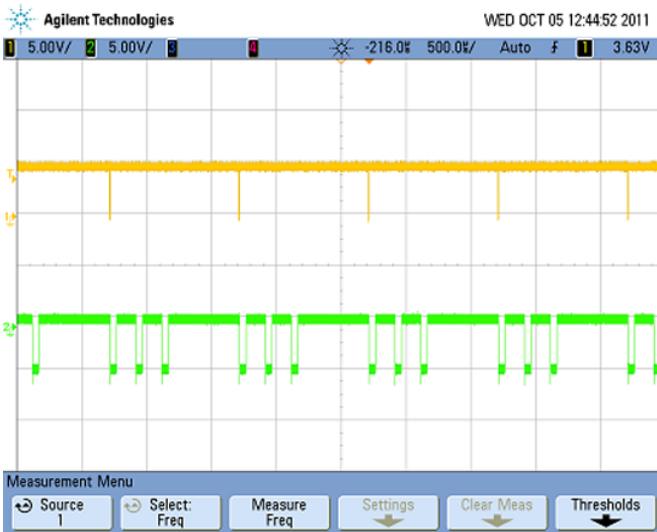
SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	50	2	200	Two image burst using internal frame rate generator. Each burst has a 50 μsec exposure and the burst images are at an effective frame rate of 5000 fps.



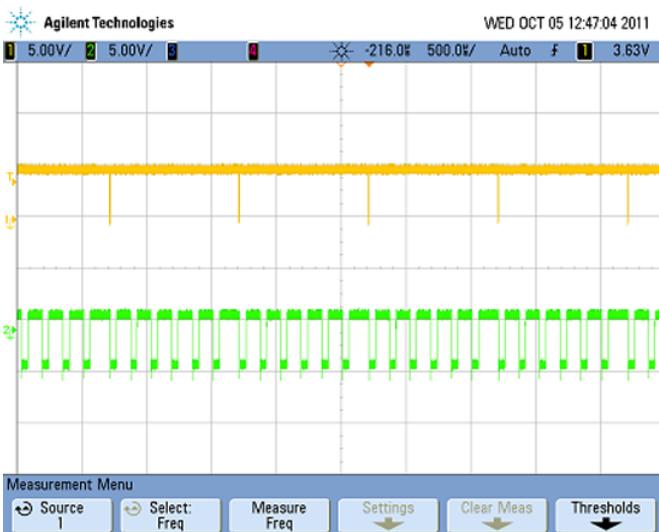
SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	50	2	300	Two image burst using internal frame rate generator. Each burst has a 50 μsec exposure and the burst images are at an effective frame rate of 3333 fps.



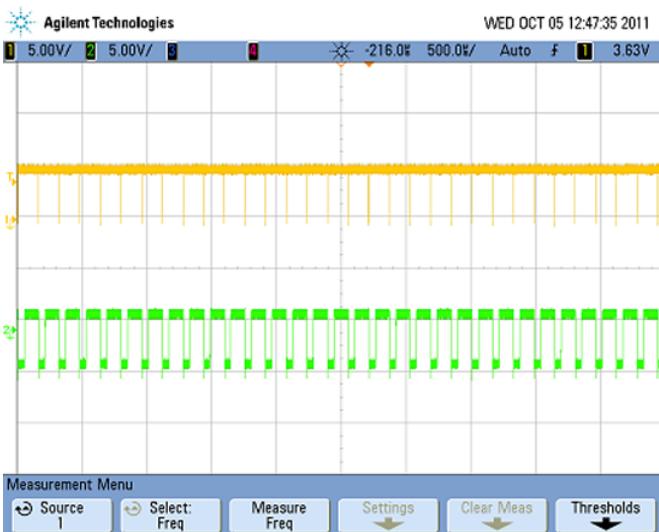
SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	50	3	200	Two image burst using internal frame rate generator. Each burst has a 50 μsec exposure and the burst images are at an effective frame rate of 5000 fps.



SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	50	6	159.41	Six image burst using internal frame rate generator. Each burst has a 50 μsec exposure and the burst images are at an effective frame rate of 6273 fps.



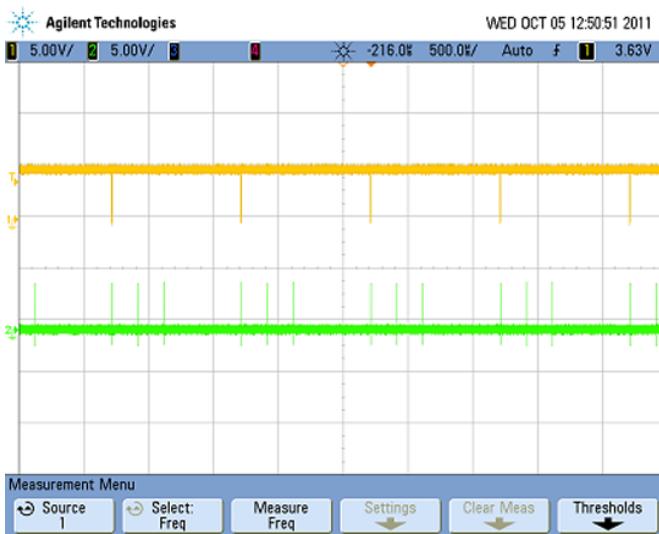
SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	6273	50	0	0	Burst Mode Disabled using internal frame rate generator at a frame rate of 6273 fps.



SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	PIV	0	N/A	Burst Mode Disabled in PIV mode using internal frame rate generator.



SYNC	FRAME RATE (FPS)	EXPOSURE (μSEC)	BURST COUNT	BURST PERIOD (μSEC)	COMMENTS
Internal	1000	PIV	3	200	Three image burst using internal frame rate generator, Camera is in PIV mode and burst images are at an effective frame rate of 5000 fps.



8.3 Firmware Ordered Recording and Minimal GUI Refresh

The ability to Continuously Record events that occur in short burst, such as lightening strikes, to a Phantom camera with MultiCine partitions defined has been greatly enhanced with the addition of the Firmware Ordered Recording and Minimal GUI Refresh features, by significantly increasing the speed at which these events can be recorded and saved to a user-specified hard-drive.

The Firmware Ordered Recording feature reduces the time between takes by instructing a Phantom camera to erase a MultiCine segment upon completion saving its stored image data to a specified hard-drive then making it available for recording again.

The Minimal GUI Refresh feature accelerating the Cine save process by disabling the save progress indicators from being displayed in the Graphical User Interface. Enabling this command also instructs the Phantom software to stop displaying live images in the Preview Panel during the save Cine procedure.

When a Phantom camera utilizes the MultiCine and Continuous Recording features simultaneously and the camera has finished recording image data to a MultiCine partition, the camera will look for the next empty Cine segment to start recording into. The camera will not erase any Cine from the camera's RAM, unless the Cine was saved to a user-specified file.

Assuming there are twelve MultiCine partitions and Continuous Recording is enabled;

When the camera is placed into the capture mode the camera will start recording into the first available Cine partition, Cine 1. Once the camera is triggered, and the post-trigger frame requirement has been met, the camera will stop recording to that Cine partition and immediately start recording into the next available partition, Cine 2, and so on until all MultiCine segments have been written into.

As long as at least one Cine segment is empty, the camera will jump to the next available unused partition. After it finishes recording, and all MultiCine partitions are full, the camera will jump to Preview mode and stay in the Preview mode until the camera is told to do something else or the save process for the last MultiCine partition has completed.

With Firmware Ordered Recording enabled, when a recording is finished, the software will save that image data to the specified hard-drive then it deletes it from the camera. Once it is deleted, the camera will re-use that partition for the next recording.

Whenever the camera has an empty Cine segment at the end of a recording, jumping to it should take about the same time (20-30ms). it doesn't matter if it's the first jump or the 1000-th.

When the camera looks for a Cine to start recording into it always starts from Cine 1 and searches upward, so if the camera receives three quickly triggers, Cine 1, Cine 2, and Cine 3 are filled, and the camera will then start recording into Cine 4. If Cine 1 is saved and deleted, by the software, after Cine 4 is triggered and the post-trigger frame requirements are met, the camera will jump to the first available MultiCine partition, which is Cine 1. As a result, if the saves are fast enough, you may never reach the last MultiCine partition.

Without Firmware Ordered Recording enabled, the software records and saves segments in order 1, 2, 3, etc. When all the partitions are stored it will check if the first partition has been saved and if it is saved it will delete it in order to continue the recording. It does the same with the next partitions, deleting them one by one to get empty space for the following recordings.

8.4 Frame Rate Tables

NOTE

- For ph7 cameras each value has to be truncated to an integer when selected in the Live Panel. ph16 cameras support fractional values for the frame rate acquisition parameter, allowing 6 decimal places.
- Each camera works on a reduced interval of frame rates ,(e.g., the v7 is from 100 to 160,000fps).
- The tables shown are for the Ethernet cameras based on 4MHz internal clock.

Following are two tables of possible frame rates, (in frames per second), for the Phantom camera family:

▼ Lock to IRIG Mode Table

100.00	200.00	400.00	500.00	800.00
1000.00	1600.00	2000.00	2500.00	3200.00
4000.00	5000.00	6400.00	8000.00	10000.00
12500.00	16000.00	20000.00	25000.00	32000.00
40000.00	50000.00	62500.00	80000.00	100000.00
125000.00	160000.00	200000.00	250000.00	400000.00
500000.00	800000.00	1000000.00	2000000.00	4000000.00

▼ Sync to Internal Clock Mode Table

Below are the possible frame rates, (in frame per second), for the Phantom V-Series camera family when clocked via the camera's internal oscillator:

1.00	2.00	3.00	4.00	5.00	6.00
7.00	8.00	9.00	10.00	11.00	12.00
13.00	14.00	15.00	16.00	17.00	18.00
19.00	20.00	21.00	22.00	23.00	24.00
25.00	26.00	27.00	28.00	29.00	30.00
31.00	32.00	33.00	34.00	35.00	36.00
37.00	38.00	39.00	40.00	41.00	42.00
43.00	44.00	45.00	46.00	47.00	48.00
49.00	50.00	51.00	52.00	53.00	54.00
55.00	56.00	57.00	58.00	59.00	60.00
61.00	62.00	63.00	64.00	65.00	66.00
67.00	68.00	69.00	70.00	71.00	72.00
73.00	74.00	75.00	76.00	77.00	78.00
79.00	80.00	81.00	82.00	63.00	84.00
85.00	86.00	87.00	88.00	89.00	90.00
91.00	92.00	93.00	94.00	95.00	96.00
97.00	98.00	99.00	100.00	101.00	102.00
103.00	104.00	105.00	106.00	107.00	108.00
109.00	110.00	111.00	112.00	113.00	114.00
115.00	116.00	117.00	118.00	119.00	120.00
121.00	122.00	123.00	124.00	125.00	126.00
127.00	128.00	129.00	130.00	131.00	132.00
133.00	134.00	135.00	136.00	137.00	138.00
139.00	140.00	141.00	142.00	143.00	144.00

145.00	146.00	147.00	148.00	149.00	150.00
151.00	152.00	153.00	154.00	155.00	156.00
157.00	158.00	159.00	160.00	161.00	162.00
163.01	164.00	165.00	166.00	167.00	168.00
169.00	170.00	171.01	172.01	173.00	174.00
175.00	176.00	177.01	178.01	179.00	180.00
181.00	182.00	183.01	184.00	185.01	186.00
187.00	188.01	189.00	190.01	191.00	192.00
193.00	194.01	195.01	196.00	197.01	198.00
199.00	200.00	201.01	202.01	203.00	204.01
205.00	206.01	207.01	208.01	209.01	210.01
211.00	212.01	213.00	214.01	215.01	216.01
217.00	218.01	219.01	220.01	221.01	222.00
223.00	224.00	225.01	226.00	227.00	228.01
229.00	230.00	231.00	232.01	233.01	234.00
235.00	236.00	237.01	238.01	239.01	240.01
241.01	242.01	243.01	244.01	245.01	246.00
247.00	248.00	249.00	250.00	251.00	252.00
253.00	254.00	255.00	256.00	257.00	258.01
259.00	260.01	261.01	262.00	263.00	264.01
265.01	266.01	267.00	268.01	269.02	270.01
271.00	272.02	273.00	274.01	275.01	276.01
277.01	278.01	279.02	280.01	281.02	282.01
283.01	284.01	285.00	286.00	287.01	288.02
289.02	290.00	291.01	292.01	293.02	294.01
295.01	296.01	297.00	298.02	299.02	300.01
301.00	302.00	303.01	304.02	305.02	306.02
307.01	308.00	309.02	310.00	311.02	312.01
313.01	314.02	315.01	316.01	317.01	318.02
319.00	320.00	321.00	322.01	323.02	324.02
325.02	326.02	327.01	328.00	329.00	330.01
331.02	332.01	333.00	334.00	335.01	336.02
337.01	338.01	339.01	340.02	341.01	342.03
343.02	344.03	345.01	346.02	347.01	348.01
349.01	350.02	351.00	352.02	353.01	354.01
355.02	356.03	357.02	358.01	359.00	360.00
361.01	362.02	363.01	364.00	365.03	366.03
367.01	368.02	369.00	370.03	371.02	372.02
373.03	374.01	375.02	376.01	377.00	378.00
379.00	380.01	381.02	382.01	363.03	384.02
385.02	386.03	387.03	388.01	389.03	390.02
391.01	392.00	393.00	394.01	395.02	396.00
397.02	398.01	399.00	400.00	401.00	402.01
403.02	404.04	405.02	406.01	407.00	408.04
409.04	410.00	411.02	412.03	413.01	414.04
415.02	416.02	417.01	418.02	419.02	420.04
421.01	422.03	423.01	424.04	425.03	426.03
427.03	428.04	429.00	430.02	431.03	432.01
433.04	434.03	435.02	436.01	437.02	438.02
439.03	440.04	441.01	442.04	443.02	444.00
445.04	446.03	447.03	448.03	449.03	450.05
451.01	452.03	453.00	454.03	455.01	456.05
457.04	458.03	459.03	460.03	461.04	462.00
463.02	464.04	465.01	466.04	467.02	468.00
469.04	470.04	471.03	472.03	473.04	474.05
475.00	476.02	477.04	478.01	479.04	480.02

481.00	482.04	483.03	484.03	485.02	486.03
487.03	488.04	489.06	490.02	491.04	492.00
493.04	494.01	495.05	496.03	497.02	498.01
499.00	500.00	501.00	502.01	503.02	504.03
505.05	506.01	507.04	508.00	509.04	510.01
511.05	512.03	513.02	514.01	515.07	516.06
517.06	518.00	519.01	520.02	521.04	522.06
523.01	524.04	525.00	526.04	527.01	528.05
529.03	530.01	531.07	532.06	533.05	534.05
535.05	536.05	537.06	538.07	539.01	540.03
541.05	542.01	543.04	544.07	545.03	546.00
547.05	548.02	549.07	550.06	551.04	552.03
553.02	554.02	555.02	556.02	557.03	558.04
559.05	560.07	561.01	562.03	563.06	564.02
565.05	566.01	567.05	568.02	569.07	570.04
571.02	572.00	573.07	574.05	575.04	576.04
577.03	578.03	579.04	580.05	581.06	582.07
583.01	584.03	585.05	586.08	587.03	588.06
589.01	590.06	591.02	592.07	593.03	594.00
595.06	596.04	597.01	598.09	599.07	600.06
601.05	602.05	603.05	604.05	605.05	606.06
607.07	608.09	609.01	610.04	611.06	612.09
613.03	614.06	615.01	616.05	617.09	618.05
619.00	620.06	621.02	622.08	623.05	624.02
625.00	626.08	627.06	628.04	629.03	630.02
631.01	632.01	633.01	634.01	635.02	636.03
637.04	638.06	639.08	640.00	641.03	642.05
643.09	644.02	645.06	646.10	647.04	648.09
649.03	650.09	651.04	652.10	653.06	654.02
655.09	656.06	657.03	658.00	659.09	660.07
661.05	662.03	663.02	664.01	665.00	666.00
667.00	668.00	669.01	670.02	671.03	672.04
673.06	674.08	675.11	676.02	677.05	678.08
679.00	680.04	681.08	682.01	683.06	684.11
685.05	686.11	687.05	688.11	689.06	690.01
691.09	692.04	693.00	694.08	695.05	696.02
697.11	698.08	699.06	700.04	701.02	702.00
703.11	704.10	705.09	706.09	707.09	708.09
709.09	710.10	711.11	712.12	713.01	714.03
715.05	716.08	717.10	718.00	719.04	720.07
721.11	722.02	723.07	724.11	725.03	726.08
727.01	728.07	729.13	730.06	731.13	732.06
733.00	734.08	735.02	736.11	737.06	738.01
739.10	740.06	741.02	742.12	743.08	744.05
745.02	746.13	747.10	748.08	749.06	750.05
751.03	752.02	753.01	754.01	755.00	756.00
757.00	758.01	759.01	760.02	761.04	762.05
763.07	764.09	765.11	766.14	767.02	768.05
769.08	770.12	771.01	772.05	773.10	774.14
775.04	776.10	777.00	778.06	779.12	780.03
781.10	782.01	783.09	784.01	785.08	786.01
787.09	788.02	789.11	790.05	791.14	792.08
793.02	794.12	795.07	796.02	797.13	798.08
799.04	800.00	801.12	802.09	803.05	804.02
805.15	806.13	807.10	808.08	809.06	810.04
811.03	812.02	813.01	814.00	815.16	816.16

817.16	818.16	819.00	820.01	821.02	822.03
823.05	824.06	825.08	826.10	827.13	828.16
829.02	830.05	831.08	832.12	833.16	834.03
835.07	836.12	837.17	838.05	839.10	840.16
841.04	842.11	843.17	844.06	845.13	846.02
847.10	848.18	849.08	850.16	851.06	852.15
853.06	854.15	855.07	856.16	857.08	858.00
859.11	860.03	861.14	862.07	863.19	864.12
865.05	866.18	867.11	868.06	869.19	870.13
871.08	872.03	873.17	874.13	875.08	876.04
877.00	878.16	879.12	880.09	881.06	882.03
883.00	884.17	885.15	886.13	887.11	888.10
889.09	890.08	891.07	892.06	893.06	894.05
895.05	896.06	897.06	898.07	899.08	900.09
901.10	902.12	903.14	904.16	905.18	906.00
907.03	908.06	909.09	910.13	911.16	912.20
913.03	914.08	915.12	916.17	917.01	918.06
919.12	920.17	921.02	922.08	923.15	924.00
925.07	926.14	927.21	928.07	929.15	930.02
931.10	932.18	933.05	934.14	935.02	936.11
937.21	938.09	939.19	940.07	941.18	942.06
943.17	944.06	945.18	946.07	947.19	948.09
949.22	950.12	951.02	952.15	953.06	954.20
955.11	956.02	957.17	958.08	959.00	960.15
961.08	962.00	963.16	964.09	965.02	966.18
967.12	968.05	969.23	970.17	971.11	972.05
973.24	974.18	975.13	976.09	977.04	978.23
979.19	980.15	981.11	982.08	983.04	984.01
985.22	986.19	987.17	988.14	989.12	990.10
991.08	992.06	993.05	994.04	995.02	996.02
997.01	998.00	999.00	1000.00	1001.00	1002.00
1003.01	1004.02	1005.03	1006.04	1007.05	1008.06
1009.08	1010.10	1011.12	1012.15	1013.17	1014.20
1015.23	1016.00	1017.04	1018.07	1019.11	1020.15
1021.19	1022.23	1023.02	1024.07	1025.12	1026.17
1027.22	1028.01	1029.07	1030.13	1031.19	1032.26
1033.06	1034.13	1035.20	1036.00	1037.08	1038.15
1039.23	1040.04	1041.12	1042.21	1043.02	1044.11
1045.21	1046.03	1047.12	1048.22	1049.04	1050.14
1051.25	1052.08	1053.19	1054.02	1055.13	1056.25
1057.08	1058.20	1059.04	1060.16	1061.01	1062.13
1063.26	1064.11	1065.25	1066.10	1067.24	1068.09
1069.23	1070.09	1071.24	1072.10	1073.25	1074.11
1075.27	1076.14	1077.01	1078.17	1079.04	1080.21
1081.08	1082.25	1083.13	1084.01	1085.19	1086.07
1087.25	1088.14	1089.03	1090.22	1091.11	1092.00
1093.19	1094.09	1095.29	1096.19	1097.09	1098.30
1099.20	1100.11	1101.02	1102.23	1103.14	1104.06
1105.28	1106.19	1107.11	1108.03	1109.26	1110.19
1111.11	1112.04	1113.28	1114.21	1115.14	1116.07
1117.01	1118.26	1119.19	1120.13	1121.08	1122.02
1123.28	1124.23	1125.18	1126.13	1127.08	1128.03
1129.31	1130.26	1131.22	1132.18	1133.14	1134.11
1135.07	1136.04	1137.01	1138.30	1139.28	1140.25
1141.23	1142.20	1143.18	1144.16	1145.15	1146.13
1147.12	1148.11	1149.10	1150.09	1151.08	1152.07

1153.07	1154.07	1155.07	1156.07	1157.07	1158.08
1159.08	1160.09	1161.10	1162.12	1163.13	1164.14
1165.16	1166.18	1167.20	1168.22	1169.25	1170.28
1171.30	1172.33	1173.02	1174.05	1175.09	1176.12
1177.16	1178.20	1179.25	1180.29	1181.33	1182.03
1183.08	1184.13	1185.19	1186.24	1187.30	1188.00
1189.06	1190.12	1191.19	1192.25	1193.32	1194.03
1195.10	1196.17	1197.25	1198.32	1199.04	1200.12
1201.20	1202.28	1203.01	1204.09	1205.18	1206.27
1207.00	1208.09	1209.19	1210.29	1211.02	1212.12
1213.22	1214.33	1215.07	1216.18	1217.29	1218.03
1219.14	1220.26	1221.00	1222.12	1223.24	1224.36
1225.11	1226.24	1227.37	1228.12	1229.26	1230.01
1231.15	1232.29	1233.05	1234.19	1235.33	1236.09
1237.24	1238.01	1239.16	1240.31	1241.08	1242.24
1243.01	1244.17	1245.33	1246.11	1247.27	1248.05
1249.22	1250.00	1251.17	1252.35	1253.13	1254.31
1255.10	1256.28	1257.07	1258.26	1259.05	1260.24
1261.03	1262.23	1263.02	1264.22	1265.02	1266.22
1267.03	1268.23	1269.04	1270.24	1271.05	1272.26
1273.07	1274.29	1275.10	1276.32	1277.14	1278.36
1279.18	1280.00	1281.23	1282.05	1283.29	1284.11
1285.35	1286.17	1287.00	1288.24	1289.08	1290.32
1291.16	1292.41	1293.24	1294.08	1295.34	1296.18
1297.02	1298.28	1299.12	1300.39	1301.24	1302.08
1303.36	1304.21	1305.06	1306.34	1307.19	1308.04
1309.33	1310.19	1311.05	1312.34	1313.20	1314.06
1315.36	1316.22	1317.09	1318.39	1319.26	1320.13
1321.00	1322.31	1323.19	1324.06	1325.38	1326.26
1327.14	1328.02	1329.35	1330.23	1331.11	1332.00
1333.33	1334.22	1335.11	1336.01	1337.35	1338.24
1339.14	1340.03	1341.38	1342.28	1343.18	1344.09
1345.44	1346.35	1347.25	1348.16	1349.07	1350.44
1351.35	1352.27	1353.18	1354.10	1355.01	1356.39
1357.31	1358.23	1359.16	1360.08	1361.01	1362.40
1363.33	1364.26	1365.19	1366.12	1367.05	1368.46
1369.39	1370.33	1371.27	1372.21	1373.15	1374.10
1375.04	1376.46	1377.41	1378.36	1379.31	1380.26
1381.22	1382.17	1383.13	1384.08	1385.04	1386.00
1387.44	1388.41	1389.37	1390.34	1391.30	1392.27
1393.24	1394.21	1395.19	1396.16	1397.14	1398.11
1399.09	1400.07	1401.05	1402.03	1403.02	1404.00
1405.48	1406.47	1407.46	1408.45	1409.44	1410.44
1411.43	1412.43	1413.43	1414.43	1415.43	1416.43
1417.43	1418.44	1419.45	1420.45	1421.46	1422.48
1423.49	1424.50	1425.01	1426.02	1427.04	1428.06
1429.08	1430.10	1431.13	1432.15	1433.18	1434.21
1435.24	1436.27	1437.30	1438.33	1439.37	1440.40
1441.44	1442.48	1443.00	1444.04	1445.09	1446.13
1447.18	1448.23	1449.28	1450.33	1451.38	1452.43
1453.49	1454.02	1455.07	1456.13	1457.19	1458.26
1459.32	1460.39	1461.45	1462.52	1463.06	1464.13
1465.20	1466.28	1467.35	1468.43	1469.51	1470.05
1471.13	1472.21	1473.30	1474.38	1475.47	1476.01
1477.10	1478.20	1479.29	1480.38	1481.48	1482.03
1483.13	1484.23	1485.33	1486.44	1487.54	1488.10

1489.20	1490.31	1491.42	1492.54	1493.09	1494.21
1495.33	1496.45	1497.01	1498.13	1499.25	1500.38
1501.50	1502.07	1503.19	1504.32	1505.46	1506.02
1507.16	1508.30	1509.43	1510.00	1511.14	1512.29
1513.43	1514.00	1515.15	1516.30	1517.45	1518.03
1519.18	1520.33	1521.49	1522.07	1523.23	1524.39
1525.55	1526.14	1527.30	1528.47	1529.05	1530.22
1531.39	1532.57	1533.15	1534.33	1535.51	1536.10
1537.28	1538.46	1539.05	1540.24	1541.43	1542.02
1543.21	1544.40	1545.60	1546.19	1547.39	1548.59
1549.19	1550.39	1551.59	1552.19	1553.40	1554.00
1555.21	1556.42	1557.03	1558.24	1559.45	1560.06
1561.28	1562.50	1563.11	1564.33	1565.56	1566.17
1567.40	1568.01	1569.24	1570.48	1571.09	1572.33
1573.56	1574.18	1575.42	1576.04	1577.29	1578.53
1579.16	1580.40	1581.03	1582.28	1583.53	1584.16
1585.41	1586.04	1587.30	1588.56	1589.19	1590.46
1591.09	1592.36	1593.63	1594.26	1595.53	1596.17
1597.44	1598.08	1599.36	1600.00	1601.28	1602.56
1603.21	1604.49	1605.14	1606.43	1607.07	1608.36
1609.01	1610.31	1611.60	1612.25	1613.55	1614.21
1615.51	1616.16	1617.47	1618.12	1619.43	1620.09
1621.40	1622.06	1623.38	1624.04	1625.36	1626.02
1627.34	1628.00	1629.33	1630.66	1631.32	1632.65
1633.32	1634.65	1635.32	1636.66	1637.33	1638.00
1639.34	1640.02	1641.36	1642.04	1643.39	1644.06
1645.41	1646.09	1647.45	1648.13	1649.48	1650.17
1651.53	1652.21	1653.58	1654.26	1655.63	1656.31
1657.00	1658.37	1659.06	1660.44	1661.13	1662.51
1663.20	1664.59	1665.28	1666.67	1667.36	1668.06
1669.45	1670.15	1671.54	1672.24	1673.64	1674.34
1675.04	1676.45	1677.15	1678.56	1679.26	1680.67
1681.38	1682.09	1683.50	1684.21	1685.63	1686.34
1687.05	1688.48	1689.19	1690.62	1691.33	1692.05
1693.48	1694.20	1695.63	1696.35	1697.07	1698.51
1699.24	1700.68	1701.40	1702.13	1703.58	1704.30
1705.03	1706.48	1707.21	1708.67	1709.40	1710.13
1711.60	1712.33	1713.06	1714.53	1715.27	1716.00
1717.48	1718.21	1719.69	1720.43	1721.17	1722.65
1723.40	1724.14	1725.63	1726.37	1727.12	1728.61
1729.36	1730.10	1731.60	1732.35	1733.10	1734.61
1735.36	1736.11	1737.62	1738.37	1739.13	1740.64
1741.40	1742.16	1743.68	1744.44	1745.20	1746.72
1747.49	1748.25	1749.02	1750.55	1751.31	1752.08
1753.62	1754.39	1755.16	1756.70	1757.47	1758.24
1759.01	1760.56	1761.34	1762.11	1763.67	1764.45
1765.23	1766.00	1767.57	1768.35	1769.13	1770.69
1771.48	1772.26	1773.05	1774.62	1775.41	1776.20
1777.78	1778.57	1779.36	1780.15	1781.74	1782.53
1783.33	1784.12	1785.71	1786.51	1787.31	1788.11
1789.71	1790.51	1791.31	1792.11	1793.72	1794.53
1795.33	1796.14	1797.75	1798.56	1799.37	1800.18
1801.80	1802.61	1803.43	1804.24	1805.05	1806.68
1807.50	1808.32	1809.14	1810.77	1811.59	1812.42
1813.24	1814.06	1815.71	1816.53	1817.36	1818.18
1819.01	1820.66	1821.49	1822.32	1823.15	1824.82

1825.65	1826.48	1827.32	1828.15	1829.83	1830.66
1831.50	1832.34	1833.18	1834.02	1835.70	1836.55
1837.39	1838.24	1839.08	1840.77	1841.62	1842.47
1843.32	1844.17	1845.02	1846.72	1847.58	1848.43
1849.28	1850.14	1851.85	1852.71	1853.57	1854.43
1855.29	1856.15	1857.01	1858.74	1859.60	1860.47
1861.33	1862.20	1863.06	1864.80	1865.67	1866.54
1867.41	1868.29	1869.16	1870.03	1871.78	1872.66
1873.54	1874.41	1875.29	1876.17	1877.05	1878.82
1879.70	1880.58	1881.47	1882.35	1883.24	1884.13
1885.01	1886.79	1887.68	1888.57	1889.47	1890.36
1891.25	1892.15	1893.04	1894.84	1895.73	1896.63
1897.53	1898.43	1899.34	1900.24	1901.14	1902.04
1903.86	1904.76	1905.67	1906.58	1907.49	1908.40
1909.31	1910.22	1911.13	1912.05	1913.88	1914.79
1915.71	1916.63	1917.55	1918.47	1919.39	1920.31
1921.23	1922.15	1923.08	1924.00	1925.85	1926.78
1927.71	1928.64	1929.57	1930.50	1931.43	1932.37
1933.30	1934.24	1935.17	1936.11	1937.05	1938.92
1939.86	1940.81	1941.75	1942.69	1943.63	1944.58
1945.53	1946.47	1947.42	1948.37	1949.32	1950.27
1951.22	1952.17	1953.13	1954.08	1955.03	1956.95
1957.91	1958.86	1959.82	1960.78	1961.75	1962.71
1963.67	1964.64	1965.60	1966.57	1967.54	1968.50
1969.47	1970.44	1971.41	1972.39	1973.36	1974.33
1975.31	1976.28	1977.26	1978.24	1979.22	1980.20
1981.18	1982.16	1983.14	1984.13	1985.11	1986.10
1987.08	1988.07	1989.06	1990.05	1991.04	1992.03
1993.02	1994.02	1995.01	1996.01	1997.00	1998.00
1999.00	2000.00	2001.00	2002.00	2003.00	2004.01
2005.01	2006.02	2007.02	2008.03	2009.04	2010.05
2011.06	2012.07	2013.09	2014.10	2015.11	2016.13
2017.15	2018.16	2019.18	2020.20	2021.22	2022.24
2023.27	2024.29	2025.32	2026.34	2027.37	2028.40
2029.43	2030.46	2031.49	2032.52	2033.55	2034.59
2035.62	2036.66	2037.70	2038.74	2039.78	2040.82
2041.86	2042.90	2043.94	2044.99	2046.04	2047.08
2048.13	2049.18	2050.23	2051.28	2052.33	2053.39
2054.44	2055.50	2056.56	2057.61	2058.67	2059.73
2060.79	2061.86	2062.92	2063.98	2065.05	2066.12
2067.18	2068.25	2069.32	2070.39	2071.47	2072.54
2073.61	2074.69	2075.77	2076.84	2077.92	2079.00
2080.08	2081.17	2082.25	2083.33	2084.42	2085.51
2086.59	2087.68	2088.77	2089.86	2090.96	2092.05
2093.14	2094.24	2095.34	2096.44	2097.54	2098.64
2099.74	2100.84	2101.94	2103.05	2104.16	2105.26
2106.37	2107.48	2108.59	2109.70	2110.82	2111.93
2113.05	2114.16	2115.28	2116.40	2117.52	2118.64
2119.77	2120.89	2122.02	2123.14	2124.27	2125.40
2126.53	2127.66	2128.79	2129.93	2131.06	2132.20
2133.33	2134.47	2135.61	2136.75	2137.89	2139.04
2140.18	2141.33	2142.47	2143.62	2144.77	2145.92
2147.07	2148.23	2149.38	2150.54	2151.69	2152.85
2154.01	2155.17	2156.33	2157.50	2158.66	2159.83
2160.99	2162.16	2163.33	2164.50	2165.67	2166.85
2168.02	2169.20	2170.37	2171.55	2172.73	2173.91

2175.10	2176.28	2177.46	2178.65	2179.84	2181.03
2182.21	2183.41	2184.60	2185.79	2186.99	2188.18
2189.38	2190.58	2191.78	2192.98	2194.19	2195.39
2196.60	2197.80	2199.01	2200.22	2201.43	2202.64
2203.86	2205.07	2206.29	2207.51	2208.72	2209.94
2211.17	2212.39	2213.61	2214.84	2216.07	2217.29
2218.52	2219.76	2220.99	2222.22	2223.46	2224.69
2225.93	2227.17	2228.41	2229.65	2230.90	2232.14
2233.39	2234.64	2235.89	2237.14	2238.39	2239.64
2240.90	2242.15	2243.41	2244.67	2245.93	2247.19
2248.45	2249.72	2250.98	2252.25	2253.52	2254.79
2256.06	2257.34	2258.61	2259.89	2261.16	2262.44
2263.72	2265.01	2266.29	2267.57	2268.86	2270.15
2271.44	2272.73	2274.02	2275.31	2276.61	2277.90
2279.20	2280.50	2281.80	2283.11	2284.41	2285.71
2287.02	2288.33	2289.64	2290.95	2292.26	2293.58
2294.89	2296.21	2297.53	2298.85	2300.17	2301.50
2302.82	2304.15	2305.48	2306.81	2308.14	2309.47
2310.80	2312.14	2313.48	2314.81	2316.16	2317.50
2318.84	2320.19	2321.53	2322.88	2324.23	2325.58
2326.93	2328.29	2329.64	2331.00	2332.36	2333.72
2335.08	2336.45	2337.81	2339.18	2340.55	2341.92
2343.29	2344.67	2346.04	2347.42	2348.80	2350.18
2351.56	2352.94	2354.33	2355.71	2357.10	2358.49
2359.88	2361.28	2362.67	2364.07	2365.46	2366.86
2368.27	2369.67	2371.07	2372.48	2373.89	2375.30
2376.71	2378.12	2379.54	2380.95	2382.37	2383.79
2385.21	2386.63	2388.06	2389.49	2390.91	2392.34
2393.78	2395.21	2396.64	2398.08	2399.52	2400.96
2402.40	2403.85	2405.29	2406.74	2408.19	2409.64
2411.09	2412.55	2414.00	2415.46	2416.92	2418.38
2419.84	2421.31	2422.77	2424.24	2425.71	2427.18
2428.66	2430.13	2431.61	2433.09	2434.57	2436.05
2437.54	2439.02	2440.51	2442.00	2443.49	2444.99
2446.48	2447.98	2449.48	2450.98	2452.48	2453.99
2455.49	2457.00	2458.51	2460.02	2461.54	2463.05
2464.57	2466.09	2467.61	2469.14	2470.66	2472.19
2473.72	2475.25	2476.78	2478.31	2479.85	2481.39
2482.93	2484.47	2486.02	2487.56	2489.11	2490.66
2492.21	2493.77	2495.32	2496.88	2498.44	2500.00
2501.56	2503.13	2504.70	2506.27	2507.84	2509.41
2510.99	2512.56	2514.14	2515.72	2517.31	2518.89
2520.48	2522.07	2523.66	2525.25	2526.85	2528.45
2530.04	2531.65	2533.25	2534.85	2536.46	2538.07
2539.68	2541.30	2542.91	2544.53	2546.15	2547.77
2549.39	2551.02	2552.65	2554.28	2555.91	2557.54
2559.18	2560.82	2562.46	2564.10	2565.75	2567.39
2569.04	2570.69	2572.35	2574.00	2575.66	2577.32
2578.98	2580.65	2582.31	2583.98	2585.65	2587.32
2589.00	2590.67	2592.35	2594.03	2595.72	2597.40
2599.09	2600.78	2602.47	2604.17	2605.86	2607.56
2609.26	2610.97	2612.67	2614.38	2616.09	2617.80
2619.52	2621.23	2622.95	2624.67	2626.40	2628.12
2629.85	2631.58	2633.31	2635.05	2636.78	2638.52
2640.26	2642.01	2643.75	2645.50	2647.25	2649.01
2650.76	2652.52	2654.28	2656.04	2657.81	2659.57

2661.34	2663.12	2664.89	2666.67	2668.45	2670.23
2672.01	2673.80	2675.59	2677.38	2679.17	2680.97
2682.76	2684.56	2686.37	2688.17	2689.98	2691.79
2693.60	2695.42	2697.24	2699.06	2700.88	2702.70
2704.53	2706.36	2708.19	2710.03	2711.86	2713.70
2715.55	2717.39	2719.24	2721.09	2722.94	2724.80
2726.65	2728.51	2730.38	2732.24	2734.11	2735.98
2737.85	2739.73	2741.60	2743.48	2745.37	2747.25
2749.14	2751.03	2752.92	2754.82	2756.72	2758.62
2760.52	2762.43	2764.34	2766.25	2768.17	2770.08
2772.00	2773.93	2775.85	2777.78	2779.71	2781.64
2783.58	2785.52	2787.46	2789.40	2791.35	2793.30
2795.25	2797.20	2799.16	2801.12	2803.08	2805.05
2807.02	2808.99	2810.96	2812.94	2814.92	2816.90
2818.89	2820.87	2822.87	2824.86	2826.86	2828.85
2830.86	2832.86	2834.87	2836.88	2838.89	2840.91
2842.93	2844.95	2846.98	2849.00	2851.03	2853.07
2855.10	2857.14	2859.19	2861.23	2863.28	2865.33
2867.38	2869.44	2871.50	2873.56	2875.63	2877.70
2879.77	2881.84	2883.92	2886.00	2888.09	2890.17
2892.26	2894.36	2896.45	2898.55	2900.65	2902.76
2904.87	2906.98	2909.09	2911.21	2913.33	2915.45
2917.58	2919.71	2921.84	2923.98	2926.12	2928.26
2930.40	2932.55	2934.70	2936.86	2939.02	2941.18
2943.34	2945.51	2947.68	2949.85	2952.03	2954.21
2956.39	2958.58	2960.77	2962.96	2965.16	2967.36
2969.56	2971.77	2973.98	2976.19	2978.41	2980.63
2982.85	2985.07	2987.30	2989.54	2991.77	2994.01
2996.25	2998.50	3000.75	3003.00	3005.26	3007.52
3009.78	3012.05	3014.32	3016.59	301887	3021.15
3023.43	3025.72	3028.01	3030.30	3032.60	3034.90
3037.21	3039.51	3041.83	3044.14	3046.46	3048.78
3051.11	3053.44	3055.77	3058.10	3060.44	3062.79
3065.13	3067.48	3069.84	3072.20	3074.56	3076.92
3079.29	3081.66	3084.04	3086.42	3088.80	3091.19
3093.58	3095.98	3098.37	3100.78	3103.18	3105.59
3108.00	3110.42	3112.84	3115.26	3117.69	3120.12
3122.56	3125.00	3127.44	3129.89	3132.34	3134.80
3137.25	3139.72	3142.18	3144.65	3147.13	3149.61
3152.09	3154.57	3157.06	3159.56	3162.06	3164.56
3167.06	3169.57	3172.09	3174.60	3177.12	3179.65
3182.18	3184.71	3187.25	3189.79	3192.34	3194.89
3197.44	3200.00	3202.56	3205.13	3207.70	3210.27
3212.85	3215.43	3218.02	3220.61	3223.21	3225.81
3228.41	3231.02	3233.63	3236.25	3238.87	3241.49
3244.12	3246.75	3249.39	3252.03	3254.68	3257.33
3259.98	3262.64	3265.31	3267.97	3270.65	3273.32
3276.00	3278.69	3281.38	3284.07	3286.77	3289.47
3292.18	3294.89	3297.61	3300.33	3303.06	3305.79
3308.52	3311.26	3314.00	3316.75	3319.50	3322.26
3325.02	3327.79	3330.56	3333.33	3336.11	3338.90
3341.69	3344.48	3347.28	3350.08	3352.89	3355.70
3358.52	3361.34	3364.17	3367.00	3369.84	3372.68
3375.53	3378.38	3381.23	3384.09	3386.96	3389.83
3392.71	3395.59	3398.47	3401.36	3404.26	3407.16
3410.06	3412.97	3415.88	3418.80	3421.73	3424.66

3427.59	3430.53	3433.48	3436.43	3439.38	3442.34
3445.31	3448.28	3451.25	3454.23	3457.22	3460.21
3463.20	3466.20	3469.21	3472.22]	3475.24	3478.26
3481.29	3484.32	3487.36	3490.40	3493.45	3496.50
3499.56	3502.63	3505.70	3508.77	3511.85	3514.94
3518.03	3521.13	3524.23	3527.34	3530.45	3533.57
3536.69	3539.82	3542.96	3546.10	3549.25	3552.40
3555.56	3558.72	3561.89	3565.06	3568.24	3571.43
3574.62	3577.82	3581.02	3584.23	3587.44	3590.66
3593.89	3597.12	3600.36	3603.60	3606.85	3610.11
3613.37	3616.64	3619.91	3623.19	3626.47	3629.76
3633.06	3636.36	3639.67	3642.99	3646.31	3649.64
3652.97	3656.31	3659.65	3663.00	3666.36	3669.72
3673.09	3676.47	3679.85	3683.24	3686.64	3690.04
3693.44	3696.86	3700.28	3703.70	3707.14	3710.58
3714.02	3717.47	3720.93	3724.39	3727.87	3731.34
3734.83	3738.32	3741.81	3745.32	3748.83	3752.35
3755.87	3759.40	3762.94	3766.48	3770.03	3773.58
3777.15	3780.72	3784.30	3787.88	3791.47	3795.07
3798.67	3802.28	3805.90	3809.52	3813.16	3816.79
3820.44	3824.09	3827.75	3831.42	3835.09	3838.77
3842.46	3846.15	3849.86	3853.56	3857.28	3861.00
3864.73	3868.47	3872.22	3875.97	3879.73	3883.50
3887.27	3891.05	3894.84	3898.64	3902.44	3906.25
3910.07	3913.89	3917.73	3921.57	3925.42	3929.27
3933.14	3937.01	3940.89	3944.77	3948.67	3952.57
3956.48	3960.40	3964.32	3968.25	3972.19	3976.14
3980.10	3984.06	3988.04	3992.02	3996.00	4000.00
4004.00	4008.02	4012.04	4016.06	4020.10	4024.14
4028.20	4032.26	4036.33	4040.40	4044.49	4048.58
4052.68	4056.80	4060.91	4065.04	4069.18	4073.32
4077.47	4081.63	4085.80	4089.98	4094.17	4098.36
4102.56	4106.78	4111.00	4115.23	4119.46	4123.71
4127.97	4132.23	4136.50	4140.79	4145.08	4149.38
4153.69	4158.00	4162.33	4166.67	4171.01	4175.37
4179.73	4184.10	4188.48	4192.87	4197.27	4201.68
4206.10	4210.53	4214.96	4219.41	4223.86	4228.33
4232.80	4237.29	4241.78	4246.28	4250.80	4255.32
4259.85	4264.39	4268.94	4273.50	4278.07	4282.66
4287.25	4291.85	4296.46	4301.08	4305.71	4310.34
4314.99	4319.65	4324.32	4329.00	4333.69	4338.39
4343.11	4347.83	4352.56	4357.30	4362.05	4366.81
4371.58	4376.37	4381.16	4385.96	4390.78	4395.60
4400.44	4405.29	4410.14	4415.01	4419.89	4424.78
4429.68	4434.59	4439.51	4444.44	4449.39	4454.34
4459.31	4464.29	4469.27	4474.27	4479.28	4484.30
4489.34	4494.38	4499.44	4504.50	4509.58	4514.67
4519.77	4524.89	4530.01	4535.15	4540.30	4545.45
4550.63	4555.81	4561.00	4566.21	4571.43	4576.66
4581.90	4587.16	4592.42	4597.70	4602.99	4608.29
4613.61	4618.94	4624.28	4629.63	4634.99	4640.37
4645.76	4651.16	4656.58	4662.00	4667.44	4672.90
4678.36	4683.84	4689.33	4694.84	4700.35	4705.88
4711.43	4716.98	4722.55	4728.13	4733.73	4739.34
4744.96	4750.59	4756.24	4761.90	4767.58	4773.27
4778.97	4784.69	4790.42	4796.16	4801.92	4807.69

4813.48	4819.28	4825.09	4830.92	4836.76	4842.62
4848.48	4854.37	4860.27	4866.18	4872.11	4878.05
4884.00	4889.98	4895.96	4901.96	4907.98	4914.00
4920.05	4926.11	4932.18	4938.27	4944.38	4950.50
4956.63	4962.78	4968.94	4975.12	4981.32	4987.53
4993.76	5000.00	5006.26	5012.53	5018.82	5025.13
5031.45	5037.78	5044.14	5050.51	5056.89	5063.29
5069.71	5076.14	5082.59	5089.06	5095.54	5102.04
5108.56	5115.09	5121.64	5128.21	5134.79	5141.39
5148.01	5154.64	5161.29	5167.96	5174.64	5181.35
5188.07	5194.81	5201.56	5208.33	5215.12	5221.93
5228.76	5235.60	5242.46	5249.34	5256.24	5263.16
5270.09	5277.04	5284.02	5291.01	5298.01	5305.04
5312.08	5319.15	5326.23	5333.33	5340.45	5347.59
5354.75	5361.93	5369.13	5376.34	5383.58	5390.84
5398.11	5405.41	5412.72	5420.05	5427.41	5434.78
5442.18	5449.59	5457.03	5464.48	5471.96	5479.45
5486.97	5494.51	5502.06	5509.64	5517.24	5524.86
5532.50	5540.17	5547.85	5555.56	5563.28	5571.03
5578.80	5586.59	5594.41	5602.24	5610.10	5617.98
5625.88	5633.80	5641.75	5649.72	5657.71	5665.72
5673.76	5681.82	5689.90	5698.01	5706.13	5714.29
5722.46	5730.66	5738.88	5747.13	5755.40	5763.69
5772.01	5780.35	5788.71	5797.10	5805.52	5813.95
5822.42	5830.90	5839.42	5847.95	5856.52	5865.10
5873.72	5882.35	5891.02	5899.71	5908.42	5917.16
5925.93	5934.72	5943.54	5952.38	5961.25	5970.15
5979.07	5988.02	5997.00	6006.01	6015.04	6024.10
6033.18	6042.30	6051.44	6060.61	6069.80	6079.03
6088.28	6097.56	6106.87	6116.21	6125.57	6134.97
6144.39	6153.85	6163.33	6172.84	6182.38	6191.95
6201.55	6211.18	6220.84	6230.53	6240.25	6250.00
6259.78	6269.59	6279.43	6289.31	6299.21	6309.15
6319.12	6329.11	6339.14	6349.21	6359.30	6369.43
6379.59	6389.78	6400.00	6410.26	6420.55	6430.87
6441.22	6451.61	6462.04	6472.49	6482.98	6493.51
6504.07	6514.66	6525.29	6535.95	6546.64	6557.38
6568.14	6578.95	6589.79	6600.66	6611.57	6622.52
6633.50	6644.52	6655.57	6666.67	6677.80	6688.96
6700.17	6711.41	6722.69	6734.01	6745.36	6756.76
6768.19	6779.66	6791.17	6802.72	6814.31	6825.94
6837.61	6849.32	6861.06	6872.85	6884.68	6896.55
6908.46	6920.42	6932.41	6944.44	6956.52	6968.64
6980.80	6993.01	7005.25	7017.54	7029.88	7042.25
7054.67	7067.14	7079.65	7092.20	7104.80	7117.44
7130.12	7142.86	7155.64	7168.46	7181.33	7194.24
7207.21	7220.22	7233.27	7246.38	7259.53	7272.73
7285.97	7299.27	7312.61	7326.01	7339.45	7352.94
7366.48	7380.07	7393.72	7407.41	7421.15	7434.94
7448.79	7462.69	7476.64	7490.64	7504.69	7518.80
7532.96	7547.17	7561.44	7575.76	7590.13	7604.56
7619.05	7633.59	7648.18	7662.84	7677.54	7692.31
7707.13	7722.01	7736.94	7751.94	7766.99	7782.10
7797.27	7812.50	7827.79	7843.14	7858.55	7874.02
7889.55	7905.14	7920.79	7936.51	7952.29	7968.13
7984.03	8000.00	8016.03	8032.13	8048.29	8064.52

8080.81	8097.17	8113.59	8130.08	8146.64	8163.27
8179.96	8196.72	8213.55	8230.45	8247.42	8264.46
8281.57	8298.76	8316.01	8333.33	8350.73	8368.20
8385.74	8403.36	8421.05	8438.82	8456.66	8474.58
8492.57	8510.64	8528.78	8547.01	8565.31	8583.69
8602.15	8620.69	8639.31	8658.01	8676.79	8695.65
8714.60	8733.62	8752.74	8771.93	8791.21	8810.57
8830.02	8849.56	8869.18	8888.89	8908.69	8928.57
8948.55	8968.61	8988.76	9009.01	9029.35	9049.77
9070.29	9090.91	9111.62	9132.42	9153.32	9174.31
9195.40	9216.59	9237.88	9259.26	9280.74	9302.33
9324.01	9345.79	9367.68	9389.67	9411.76	9433.96
9456.26	9478.67	9501.19	9523.81	9546.54	9569.38
9592.33	9615.38	9638.55	9661.84	9685.23	9708.74
9732.36	9756.10	9779.95	9803.92	9828.01	9852.22
9876.54	9900.99	9925.56	9950.25	9975.06	10000.00
10025.06	10050.25	10075.57	10101.01	10126.58	10152.28
10178.12	10204.08	10230.18	10256.41	10282.78	10309.28
10335.92	10362.69	10389.61	10416.67	10443.86	10471.20
10498.69	10526.32	10554.09	10582.01	10610.08	10638.30
10666.67	10695.19	10723.86	10752.69	10781.67	10810.81
10840.11	10869.57	10899.18	10928.96	10958.90	10989.01
11019.28	11049.72	11080.33	11111.11	11142.06	11173.18
11204.48	11235.96	11267.61	11299.44	11331.44	11363.64
11396.01	11428.57	11461.32	11494.25	11527.38	11560.69
11594.20	11627.91	11661.81	11695.91	11730.21	11764.71
11799.41	11834.32	11869.44	11904.76	11940.30	11976.05
12012.01	12048.19	12084.59	12121.21	12158.05	12195.12
12232.42	12269.94	12307.69	12345.68	12383.90	12422.36
12461.06	12500.00	12539.18	12578.62	12618.30	12658.23
12698.41	12738.85	12779.55	12820.51	12861.74	1903.23
12944.98	12987.01	13029.32	13071.90	13114.75	13157.89
13201.32	13245.03	13289.04	13333.33	13377.93	13422.82
13468.01	13513.51	13559.32	13605.44	13651.88	13698.63
13745.70	13793.10	13840.83	13888.89	13937.28	13986.01
14035.09	14084.51	14134.28	14184.40	14234.88	14285.71
14336.92	14388.49	14440.43	14492.75	14545.45	14598.54
14652.01	14705.88	14760.15	14814.81	14869.89	14925.37
14981.27	15037.59	15094.34	15151.52	15209.13	15267.18
15325.67	15384.62	15444.02	15503.88	15564.20	15625.00
15686.27	15748.03	15810.28	15873.02	15936.25	16000.00
16064.26	16129.03	16194.33	16260.16	16326.53	16393.44
16460.91	16528.93	16597.51	16666.67	16736.40	16806.72
16877.64	16949.15	17021.28	17094.02	17167.38	17241.38
17316.02	17391.30	17467.25	17543.86	17621.15	17699.12
17777.78	17857.14	17937.22	18018.02	18099.55	18181.82
18264.84	18348.62	18433.18	18518.52	18604.65	18691.59
18779.34	18867.92	18957.35	19047.62	19138.76	19230.77
19323.67	19417.48	19512.20	19607.84	19704.43	19801.98
19900.50	20000.00	20100.50	20202.02	20304.57	20408.16
20512.82	20618.56	20725.39	20833.33	20942.41	21052.63
21164.02	21276.60	21390.37	21505.38	21621.62	21739.13
21857.92	21978.02	22099.45	22222.22	22346.37	22471.91
22598.87	22727.27	22857.14	22988.51	23121.39	23255.81
23391.81	23529.41	23668.64	23809.52	23952.10	24096.39
24242.42	24390.24	24539.88	24691.36	24844.72	25000.00

25157.23	25316.46	25477.71	25641.03	25806.45	25974.03
26143.79	26315.79	26490.07	26666.67	26845.64	27027.03
27210.88	27397.26	27586.21	27777.78	27972.03	28169.01
28368.79	28571.43	28776.98	28985.51	29197.08	29411.76
29629.63	29850.75	30075.19	30303.03	30534.35	30769.23
31007.75	31250.00	31496.06	31746.03	32000.00	32258.06
32520.33	32786.89	33057.85	33333.33	33613.45	33898.31
34188.03	34482.76	34782.61	35087.72	35398.23	35714.29
36036.04	36363.64	36697.25	37037.04	37383.18	37735.85
38095.24	38461.54	38834.95	39215.69	39603.96	40000.00
40404.04	40816.33	41237.11	41666.67	42105.26	42553.19
43010.75	43478.26	43956.04	44444.44	44943.82	45454.55
45977.01	46511.63	47058.82	47619.05	48192.77	48780.49
49382.72	50000.00	50632.91	51282.05	51948.05	52631.58
53333.33	54054.05	54794.52	55555.56	56338.03	57142.86
57971.01	58823.53	59701.49	60606.06	61538.46	62500.00
63492.06	64516.13	65573.77	66666.67	67796.61	68965.52
70175.44	71428.57	72727.27	74074.07	75471.70	76923.08
78431.37	80000.00	81632.65	83333.33	85106.38	86956.52
88888.89	90909.09	93023.26	95238.10	97560.98	100000.00
102564.10	105263.16	108108.11	111111.11	114285.71	117647.06
121212.12	125000.00	129032.26	133333.33	137931.03	142857.14
148148.15	153846.15	160000.00	166666.67	173913.04	181818.18
190476.19	200000.00	210526.32	222222.22	235294.12	250000.00
266666.67	285714.29	307692.31	333333.33	363636.36	400000.00
444444.44	500000.00	571428.57	666666.67	800000.00	1000000.00
1333333.33	2000000.00	4000000.00			

8.5 Image-Based Auto-Trigger

The Image-Based Auto-Trigger feature allows selected Phantom camera models to trigger themselves when the image changes in a selectable region of the frame. For the v-Series implementation, there will also be a mode which allows this feature to generate a hardware trigger signal for multi-camera installations.

A few user definable parameters allow the auto-trigger behavior to be adjusted to operating conditions, filtering out unintended triggers due to vibration, changes in illumination, slow-moving shadows, etc.

The Auto-Trigger operation begins by the user selecting a rectangular area within the image, similar to the region used for auto-exposure, the Auto-Trigger region.

As each frame is captured, the image in the Auto-Trigger region is compared to an earlier copy of the same region that has been stored in a dedicated memory. After the comparison is made, the image in memory is updated to the current image, to be used in the future.

The result of the comparison determines if a trigger is generated. A pixel being compared is considered "active" if its level has changed, (brightened or darkened), by more than a preset threshold. The number of active pixels for a given frame is counted, and if it exceeds a set number, a trigger is generated. The required number of active pixels is specified as a percentage of the area of the Auto-Trigger region.

When an Auto-Trigger condition is detected, the Auto-Trigger signal of the camera is pulled low. The Auto-Trigger signal is available on Pin-N of the Capture connector.

IMAGE-BASED AUTO-TRIGGER OPERATING MODES

Several operating modes are possible for the Image-Based Auto-Trigger system:

MODE	FUNCTIONAL DESCRIPTION
Mode 0	Image-Based Auto-Trigger is disabled.
Mode 1	Camera will drive both the auto-trigger and trigger itself when an auto-trigger is detected. If the auto-trigger signal is pulled low by an external device, the camera will be triggered.
Mode 2	The image changes are analyzed, and when an auto-trigger condition has been detected, the auto-trigger signal will be pulled low, as in Mode 1. However, the camera will not trigger itself. An external device pulling the auto-trigger signal low will not trigger the camera either. Mode 2 is useful when external control of the auto-trigger is desired, for instance, it is required that the auto-trigger feature is disabled for some known transient event. The auto-trigger signal from the camera will be routed through some external device and back into the trigger input of the camera.

MULTI-CAMERA IMAGE-BASED AUTO-TRIGGER

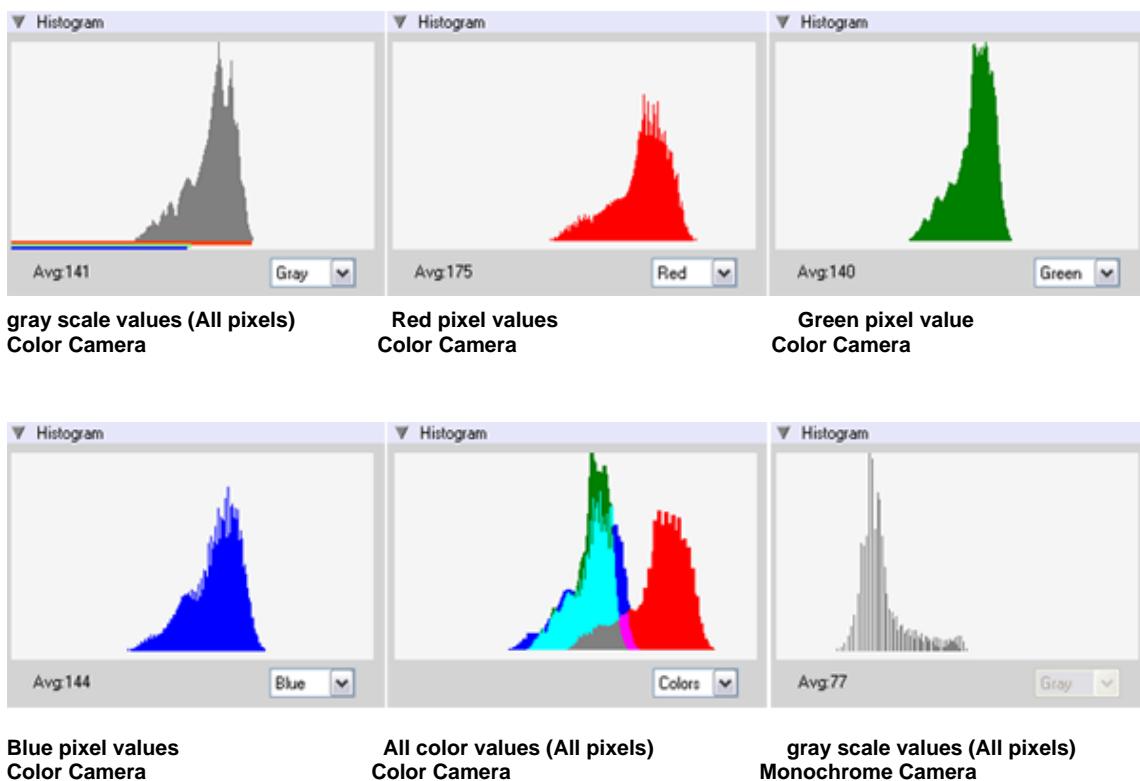
When multiple cameras are used to capture an event, it is usually desirable to trigger all cameras simultaneously. This can be achieved in two basic ways:

OPTION	DESCRIPTION	SETUP
Option 1	All the cameras will be triggered when either of the cameras detects an auto-trigger event.	<ol style="list-style-type: none">1. Set all cameras to Mode 1.2. Connect the auto-trigger signal of all cameras together.
Option 2	Only when the primary camera detects an auto-trigger event it will trigger itself and simultaneously trigger all the secondary cameras.	<ol style="list-style-type: none">1. Set Primary camera to Mode 1.2. Set all secondary cameras to Mode 0, (auto-trigger disabled).3. Connect the auto-trigger signal of the primary camera to the trigger inputs of the secondary cameras.

8.6 Image Processing Effects and Filters

▼ Histogram

When the Image Tools dialogue window appears, an image histogram will be displayed in the window. The image histogram is a graphical representation of the distribution of RGB and/or luminance values in an image. Each of the values appear on the horizontal axis from dark to light, (left to right), as shown in the Histogram graphics below. The vertical axis indicates the number of pixels of that value at each point. At a point where there are many pixels of a value, the corresponding line spikes; where there are no pixels, it lies at the bottom of the graph.



▼ Adjustments (Image Processing Effects)

Move the appropriate slider, to apply the desired image processing adjustment to the images being displayed in the active Preview or Playback Panel. The sliders can be used to adjust the following image processing adjustments:

Brightness

This slide bar is used to adjust the brightness of monochrome or color images. The factory default value is set to 0 (zero). Moving the slide bar to the left, in the negative direction from 0, results in the images being displayed darker, while moving the slide bar to the right or in a positive direction from 0 results in the images being displayed lighter.



Image above set to: (0 - Default)



(-33)



(33)

Selectable Range: -100 to 100

Contrast

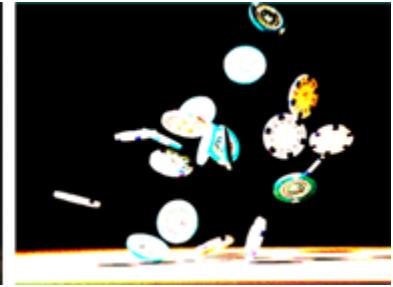
This slide bar is used to adjust the contrast of monochrome or color images. The factory default value is set to 1. Moving the slide bar to the left from 1, results in the images being displayed with less contrast, while moving the slide bar to the right from 1 result in the images being displayed with greater contrast.



Image above set to: (1.00 - Default)



(0.50)



(50.00)

Selectable Range: 0 to Infinite

NOTE

By increasing the contrast setting the noise level will increase as well, so only increase as much as necessary to get a satisfactory image. Being a subjective setting only the user can determine what satisfactory is.

Gamma

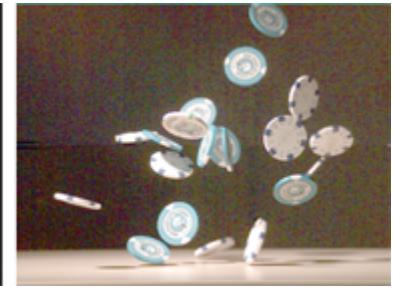
This slide bar is used to adjust the gamma correction of monochrome or color images. The factory default value is set to 2.22. Moving the slide bar to the left from 2.22, results in the images being displayed with fewer gamma corrections, while moving the slide bar to the right from 2.22 results in the images being displayed with greater gamma correction.



Image above set to: (2.22 - Default)



(0.25)



(5.01)

Selectable Range: 0.10 to 10.0

Saturation (Color Cameras Only)

This slide bar is used to adjust the color saturation of the images being displayed. The factory default value is set to 1. Moving the slide bar to the left results in the images being displayed with less brilliant color, while moving the slide bar to the right results in the images being displayed with more brilliant color.



Image above set to: (0 - Default)



(-100)



(100)

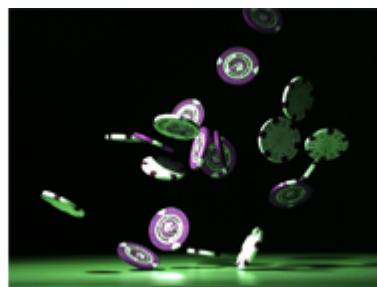
Selectable Range: -100 to 100

Hue (Color Cameras Only)

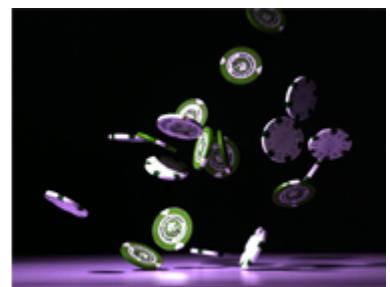
This slide bar is used to adjust the color hue of the images being displayed. The factory default value is set to 0 (zero). Moving the slide bar to the left, in the negative direction from 0, results in the images being displayed with fewer color hues, while moving the slide bar to the right or in a positive direction from 0 results in the images being displayed with more color hue.



Image above set to: (0 - Default)



(-100)



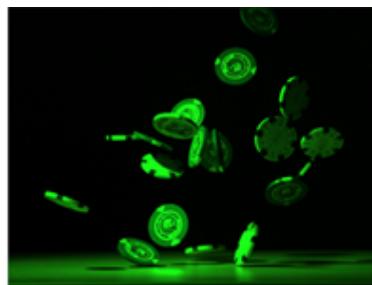
(100)

Selectable Range: -180 to 180

▼ White Balance

Move the appropriate slider manually to apply the desired white balance adjustment to the images displayed in the active Preview or Playback Panel. These slide bars are used to perform a manual white balance to obtain a white color on an area you know should be white, or, simply to vary the values of red and blue in the image for ph7 cameras or the values of Temp (K) and Tint for ph16 cameras.

Selectable Range: 0.10 to 10.0 for red and blue and 2000 to 40000 for Temp (K) and -100 to +100 for Tint.

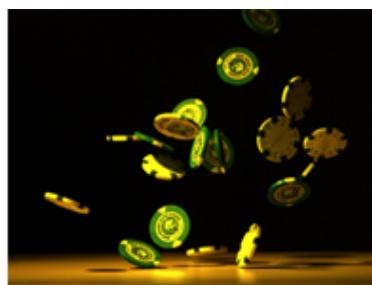


Above:

Red set to: (1.00 - Default)
Blue set to: (1.00 - Default)

(0.10)
(0.10)

(0.10)
(1.00)



Above:

Red set to: (0.10)
Blue set to: (10.0)

(1.00)
(0.01)

(1.00)
(10.0)



Above:

Red set to: (10.0)
Blue set to: (0.10)

(10.0)
(1.00)

(10.0)
(10.0)

Selectable Range: 0.100 to 10.00

For an instruction on how to perform a White Balance Adjustment automatically, see: [Step-by-Step Procedures>Preview/Playback Panel Procedures/Performing a White Balance Adjustment](#).

▼ Sensitivity

This slider is used to select the dynamic range of the image when a conversion to 8bits is active. Such a conversion takes place when displaying images stored on more than 8bits (as the display is always done on 8bits) or when converting from a 10bit/12bit/14bit format to an 8bit format.

If the “Transfer format for play” option in Manager>Preferences>General is set to 8, there is no need for this parameter (the pixel values are already on an 8 bit format) and it is not available in Image Tools.

When on a neutral value (1) the usual conversion to 8 bits is done and the most significant bits of the information are used for the pixel values to be displayed or converted. That means that the lower values of pixels (dark areas) will be set to zero (black).

By increasing the Sensitivity value, more least significant bits are used, but the values larger than 255 will be set to 255. That means that lower values of pixels (dark areas) will be better displayed, but larger values of pixels will get white.

The maximum value for Sensitivity depends on the bit depth set on camera:

- 4 when the bit depth is 10
- 16 when the bit depth is 12.

The histogram displayed in Image Tools contains a graphic that illustrates the values that are set to 255 while increasing the Sensitivity value.

▼ Rotate Image

Placing a check mark in this enable box will rotate the image as follows:

Flip H

Displays the image as a mirrored image, the image flips horizontally.



Original



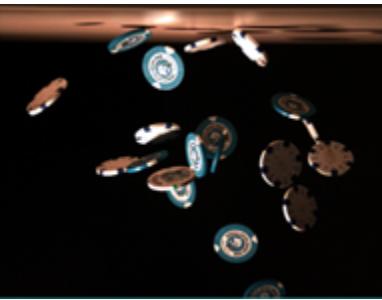
Flip H

Flip V

Displays the image upside-down, the image flips vertically.



Original



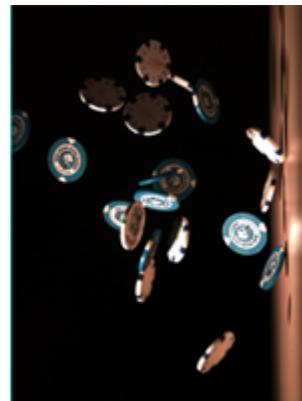
Flip V

Rotate

Rotates and displays the image 90° counter-clockwise from the original image.



Original



Flip H

Clockwise

Rotates and displays the image 90° clockwise from the original image.



Original



Flip H

▼ Filter

Select the desired filter, to be applied to the image or Cine file in the active Preview/Playback Panel, from the Filter pull-down selection list. The Phantom Camera Control application provides the following image filtering algorithms:

None

Used to display the images as they were originally recorded, prior to applying any of the other filtering techniques to the images.

Smooth Gauss 3x3 or 5x5

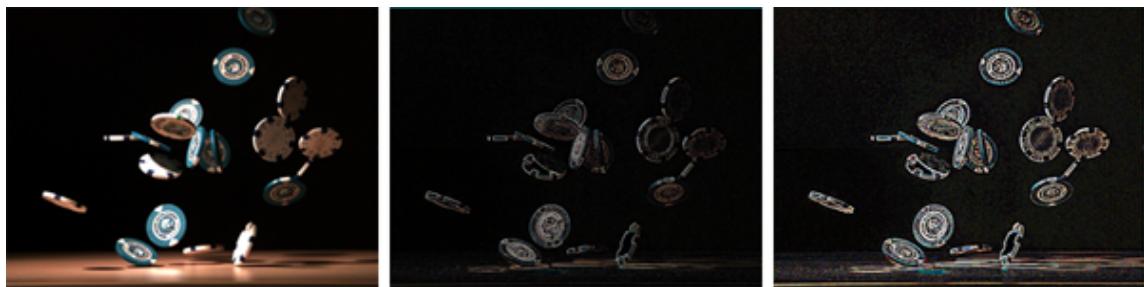
Used to blur or "smooth" the images based on a 3-by-3-, or 5-by-5-pixel Gaussian filter.

Sharpen

Used to emphasize the edges within an image. The result is that the image appears to have increased sharpness.

Edge Hipass 3x3 or 5x5

Used to enhance or isolate 3-by-3-, or 5-by-5-pixel transition areas, or 'edges,' in an image by enhancing the high-frequency detail.



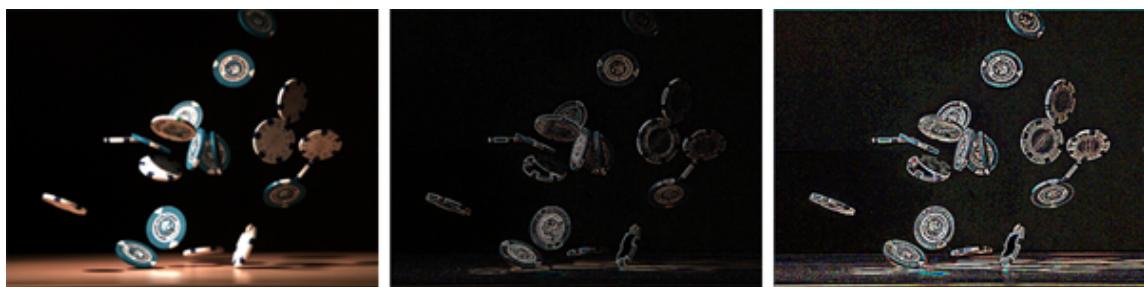
Applied filter: None

Edge Hipass 3x3

Edge Hipass 5x5

Edge Laplacian 3x3 of 5x5

The 5x5 Laplacian used is a convoluted mask to approximate the second derivative, unlike the Sobel method which approximates the gradient. And instead of two 3x3 Sobel masks, one for the x and y directions, Laplace uses one 5x5 mask for the 2nd derivative in both the x and y directions. However, because these masks are approximating a second derivative measurement on the image, they are very sensitive to noise.



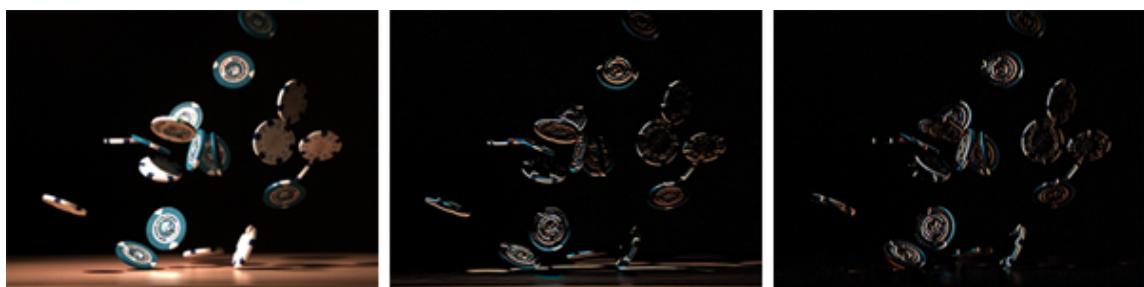
Applied filter: None

Edge Laplacian 3x3

Edge Laplacian 5x5

Edge Prewitt Horizontal or Vertical

Prewitt is a method of edge detection in computer graphics, which calculates the maximum response of a set of convolution kernels to find the local edge orientation for each pixel. Various kernels can be used for this operation. The whole set of 8 kernels is produced by taking one of the kernels and rotating its coefficients circularly. Each of the resulting kernels is sensitive to an edge orientation ranging from 0° to 315° in steps of 45° , where 0° corresponds to a vertical edge.



Applied filter: None

Edge Prewitt Horizontal

Edge Prewitt Vertical

The maximum response for each pixel is the value of the corresponding pixel in the output magnitude image. The values for the output orientation image lie between 1 and 8, depending on which of the 8 kernels produced the maximum response.

This edge detection method is also called edge template matching, because a set of edge templates is matched to the image, each representing an edge in a certain orientation. The edge magnitude and orientation of a pixel are then determined by the template that matches

the local area of the pixel the best.

The Prewitt edge detector is an appropriate way to estimate the magnitude and orientation of an edge. Although differential gradient edge detection needs a rather time-consuming calculation to estimate the orientation from the magnitudes in the x- and y-directions, the Prewitt edge detection obtains the orientation directly from the kernel with the maximum response. The set of kernels is limited to 8 possible orientations. However, experience shows that most direct orientation estimates are not much more accurate. On the other hand, the set of kernels needs 8 convolutions for each pixel, whereas the set of the kernel in gradient method needs only 2, one kernel being sensitive to edges in the vertical direction and one to the horizontal direction. The result for the edge magnitude image is very similar with both methods, provided the same convolving kernel is used.

Edge Sobel Horizontal or Vertical

The Sobel operator is an operator used in image processing, particularly within edge detection algorithms. Technically, it is a discrete differentiation operator, computing an approximation of the gradient of the image intensity function. At each point in the image, the result of the Sobel operator is either the corresponding gradient vector or the norm of this vector.



Applied filter: None

Edge Sobel Horizontal

Edge Sobel Vertical

In simple terms, the operator calculates the gradient of the image intensity at each point, giving the direction of the largest possible increase from light to dark and the rate of change in that direction. The result, therefore, shows how 'abruptly' or 'smoothly' the image changes at that point, and therefore, how likely it is that part of the image represents an edge, as well as how that edge is likely to be oriented. In practice, the magnitude (likelihood of an edge) calculation is more reliable and easier to interpret than the direction calculation.

Mathematically, the gradient of a two-variable function (here the image intensity function) is at each image point a 2D vector with the components given by the derivatives in the horizontal and vertical directions. At each image point, the gradient vector points in the direction of the largest possible intensity increase, and the length of the gradient vector corresponds to the rate of change in that direction. This implies that the result of the Sobel operator at an image point which is in a region of constant image intensity is a zero vector and at a point on an edge is a vector which points across the edge, from darker to brighter values.

User Filter

Presently disabled.

▼ Grid

Enable, (check), the Grid enable box to super-impose 7 horizontal lines and 7 vertical line, evenly spaced over the Preview or Playback Panels to form an 8-row; 8-column grid.

▼ Cross

Enable, (check), the Cross enable box to super-impose a horizontal line in the middle, and a vertical line in the center, of the Preview or Playback Panels.

▼ Default Button

Click the Default button to reset all the image processing Tools back to factory default settings.

8.7 Performance Optimizations Using the GPU

Introduction

Graphics cards today have a programmable processor unit which can be exploited as a general processing device. This programmable unit is called Graphic Processor Unit or GPU. Given their highly parallel multicore architecture, many GPUs show a great computational power and are often used as co-processors.

If your graphics card is listed at <http://www.khronos.org/conformance/adopters/conformant-products> please remember to also update the driver. Go to your GPU producer (NVIDIA, Intel, AMD/ATI) website to get the latest driver.

Features

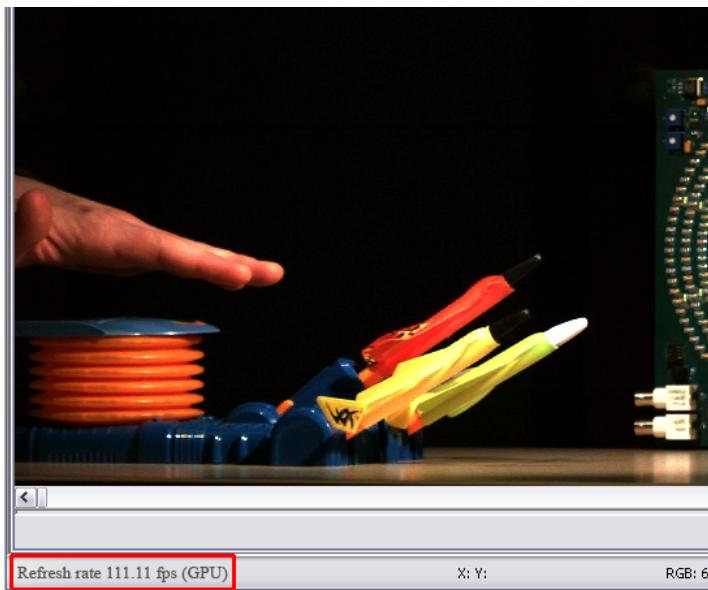
The following features have been added to Phantom dlls, Phantom and PCC applications:

- Using the GPU to accelerate processing and displaying Cines images
- Using the GPU to accelerate processing Cine images during save/convert operations

Both features are available only if the Cine fulfills the conditions under Cines Processed on GPU.

Cines Processed on GPU

When the GPU is used for processing and rendering a Cine, a "GPU" text label will be inserted in the status bar as shown below.

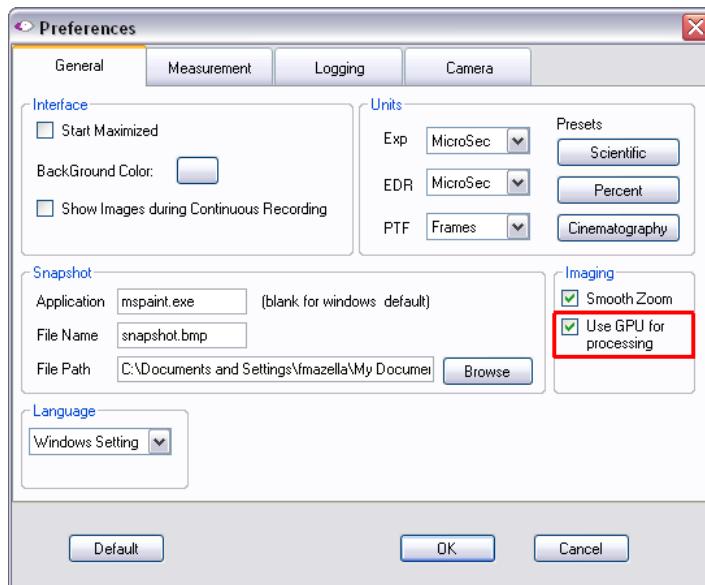


The following conditions have to be met in order for a GPU to be used for accelerating a Cine processing:

- GPU usage must be enabled as described in 'Enable GPU Usage'
- A physical GPU must be available as described in 'Establishing GPU Availability for Processing and Rendering Cines'

- All of the following must be met for the input Cine:
 - a ph16 camera Cine
 - a raw Cine
 - a color Cine
 - a 16bit Cine
 - a Cine with width \geq 256 and height \geq 256
 - a CFA_BAYER Cine
- Color interpolation must be enabled and set to one of the following:
 - Fast or
 - Fastest or
 - Best
- None of the following processing operations should be active:
 - flip
 - rotate
 - filter
 - resample
 - crop
 - border
- Sensitivity should be set to its default value 1.0

Enable GPU Usage



In PCC go to Preferences>General>Imaging, and enable (check) 'Use GPU for processing'.

Leaving this option unchecked no attempt to accelerate Cine processing on GPU will take place. GPU usage option is persistent.

Establishing GPU Availability for Processing and Rendering Cines

Once the option to use the GPU has been enabled, the software goes through the following steps:

- Selects the GPU currently attached to the display
- Searches and loads the following files:
 - opencl.dll
 - opengl32.dll

These files typically reside on System32/SysWOW64 folders and come with the display driver. However, since OpenCL is a relative new technology, it may be necessary to update the driver for the display adapter.

- Checks if the selected GPU supports OpenCL. Graphics card supporting OpenCL are enumerated at <http://www.khronos.org/conformance/adopters/conformant-products>.
- Checks if the specifications of the selected GPU fulfill a set of minimum requirements.

If any of these steps is not successful, the software will not use the graphics card for accelerations.

Other Known Restrictions

- Processing and rendering Cines using Amd graphics cards is not currently working. This is a driver issue expected to be solved in future versions.
- Our applications have not been run yet on any Intel graphics card. However, no reasons for this scenario to be unsuccessful are known.

Expected Performance Improvements

For ph16 source Cines meeting all the conditions under Cines Processed on GPU, the main operations expected to benefit from using the GPU are:

- Live mode
- Play from Ram/CineMag
- Play from file

The performance in all of the above three cases is also determined by the data transfer rate from camera/file and it cannot exceed a certain maximum frame rate. To obtain this maximum frame rate follow these steps:

- disable all image processing (Disable button pressed in Image Tools)
- make sure Smooth Zoom from Preferences/General is unchecked
- close the Image Tools dialog
- set zoom 1 (actual size)
- Save/Convert from Cine raw to any color interpolated format.

The performance in this situation is limited by the performance of the device the data is written to. The duration of such a save/convert operation cannot be much lower than when saving
 - without GPU and
 - using Fastest color interpolation

“Best” color interpolation is the color interpolation for which the greatest performance improvement has been observed.

If GPU acceleration is enabled, there should be no performance penalty when enabling Smooth Zoom or setting the Zoom level to a value other than 1.

Notes on Testing the New GPU Features on NVIDIA Graphics Cards

In terms of OpenCL features and technical specifications, NVIDIA GPUs can be divided in several categories. All graphics cards belonging to a certain category share the same OpenCL capabilities. To test our applications' correct functioning it should be enough to take any card from each category.

The term Compute Capability denotes one such category and it can be: 1.0, 1.1, 1.2, 1.3, 2.x, 3.0 or 3.5. Go to <https://developer.nvidia.com/cuda-GPUs> to find the compute capability for an NVIDIA GPU.

Please note that while all GPUs belonging to a certain Compute Capability group should have the same compute features they have different technical specifications and reach different performance levels.

The tables below group desktop and notebook GPUs based on Compute Capability and suggests graphics cards with minimum, medium and maximum performance gains for our applications.

The minimum, medium, maximum performance classification is based on technical specifications and a complete benchmarking has not been performed for these cards. Also, the classification is relative to a certain Compute Capability group. A card with “Maximum Performance” with Compute Capability 1.0 may have lower performances than a “Minimum Performance” card with Compute Capability 3.0.

NVIDIA Desktop GPUs Table

COMPUTE CAPABILITY	GPUs	MINIMUM PERFORMANCE	MEDIUM PERFORMANCE	MAXIMUM PERFORMANCE
1.0	GeForce GT 420 GeForce 8800 Ultra GeForce 8800 GTX GeForce GT 340 GeForce GT 330 GeForce GT 320 GeForce 315 GeForce 310 GeForce 9800 GT GeForce 9600 GT GeForce 9400 GT	GeForce 9400 GT	GeForce GT 320	GeForce 8800 Ultra GeForce GT 340 GeForce 8800 GTX GeForce 9600 GT
1.1	GeForce GTS 250 GeForce GTS 150 GeForce GT 130 GeForce GT 120	GeForce G100	GeForce 9600 GSO GeForce 9500 GT	GeForce GTS 250 GeForce 9800 GTX+ GeForce 9800 GX2

	GeForce G100 GeForce 9800 GX2 GeForce 9800 GTX+ GeForce 9800 GTX GeForce 9600 GSO GeForce 9500 GT GeForce 8800 GTS GeForce 8800 GT GeForce 8800 GS GeForce 8600 GTS GeForce 8600 GT GeForce 8500 GT GeForce 8400 GS GeForce 9400 mGPU GeForce 9300 mGPU GeForce 8300 mGPU GeForce 8200 mGPU GeForce 8100 mGPU			
1.2	GeForce GT 240 GeForce GT 220 GeForce GT 210	GeForce GT 220	GeForce GT 220 GeForce GT 240	GeForce GT 240
1.3	GeForce GTX 295 GeForce GTX 285 GeForce GTX 280 GeForce GTX 275 GeForce GTX 260	GeForce GTX 260	GeForce GTX 280 GeForce GTX 275 GeForce GTX 285	GeForce GTX 295
2.x	GeForce GTX 560 Ti GeForce GTX 550 Ti GeForce GTX 460	GeForce GT 610 GeForce GT 520	GeForce GTX 550 Ti	GeForce GTX 590 GeForce GTX 580

	GeForce GTS 450 GeForce GTX 590 GeForce GTX 580 GeForce GTX 570 GeForce GTX 480 GeForce GTX 470 GeForce GTX 465 GeForce GT 640 GeForce GT 630 GeForce GT 620 GeForce GT 610 GeForce GT 520 GeForce GT 440 GeForce GT 430			
3.0	GeForce GTX 690 GeForce GTX 680 GeForce GTX 670 GeForce GTX 660Ti GeForce GTX 660 GeForce GTX 650Ti GeForce GTX 650	GeForce GTX 650	GeForce GTX 660 Ti GeForce GTX 670 GeForce GTX 660	GeForce GTX 690
3.5	-			

NVIDIA Notebook GPUs Table

COMPUTE CAPABILITY	GPUs	MINIMUM PERFORMANCE	MEDIUM PERFORMANCE	MAXIMUM PERFORMANCE
1.0	-			
1.1	GeForce GTX 285M GeForce GTX 280M GeForce GTX 260M GeForce 9800M GTX GeForce 8800M GTX GeForce GTS 260M	GeForce G105M GeForce 9100M G GeForce 9200M GS GeForce 9300M GS	GeForce 8800M GTS GeForce GTS 250M GeForce 9800M GT GeForce GTS 260M GeForce 9800M GT GeForce 8800M GTX	GeForce GTX 280M GeForce GTX 285M

	GeForce GTS 250M GeForce 9800M GT GeForce 9600M GT GeForce 8800M GTS GeForce 9800M GTS GeForce GT 230M GeForce 9700M GT GeForce 9650M GS GeForce 9700M GT GeForce 9650M GS GeForce 9600M GT GeForce 9600M GS GeForce 9500M GS GeForce 8700M GT GeForce 8600M GT GeForce 8600M GS GeForce 9500M G GeForce 9300M G GeForce 8400M GS GeForce G210M GeForce G110M GeForce 9300M GS GeForce 9200M GS GeForce 9100M G GeForce 8400M GT GeForce G105M			
1.2	GeForce GTS 360M GeForce GTS 350M GeForce GT 335M GeForce GT 330M GeForce GT 325M GeForce GT 240M GeForce G210M	GeForce 305M GeForce G210M GeForce 310M	GeForce GT 325M GeForce GT 330M GeForce GT 240M	GeForce GTS 350M GeForce GTS 360M

	GeForce 310M GeForce 305M			
1.3	-			
2.x	GeForce GTX 675M GeForce GTX 670M GeForce GT 635M GeForce GT 630M GeForce GT 625M GeForce GT 620M GeForce 610M GeForce GTX 580M GeForce GTX 570M GeForce GTX 560M GeForce GT 555M GeForce GT 550M GeForce GT 540M GeForce GT 525M GeForce GT 520MX GeForce GT 520M GeForce GTX 485M GeForce GTX 470M GeForce GTX 460M GeForce GT 445M GeForce GT 435M GeForce GT 420M GeForce GT 415M GeForce GTX 480M	GeForce GT 415M GeForce GT 520M GeForce 610M GeForce GT 520MX	GeForce GT 555M GeForce GT 635M GeForce GT 445M	GeForce GTX 675M GeForce GTX 670M GeForce GTX 570M GeForce GTX 485M GeForce GTX 580M
3.0	GeForce GTX 680MX GeForce GTX 680M GeForce GTX 675MX GeForce GTX 670MX GeForce GTX 660M	GeForce GT 640M LE GeForce GT 640M GeForce GT 645M GeForce GT 650M GeForce GTX 660M	GeForce GTX 670MX GeForce GTX 675MX	GeForce GTX 680M GeForce GTX 680MX

	GeForce GT 650M GeForce GT 645M GeForce GT 640M GeForce GT 640M LE			
3.5	-			

8.8 Phantom Camera Control Application Polling Process

The Phantom Camera Control application uses a broadcast message mechanism to detect connected cameras and their IP addresses automatically. In some earlier version of the software only the networked cameras that responded to the broadcast message would be available for use by the Phantom Control Unit. This broadcast mechanism utilizes UDP, (User Datagram Protocol), packets to deliver the broadcasting messages. However, some encrypting systems will not support the transfer of UDP packets.

Furthermore, some networking environments prohibit UDP, (User Datagram Protocol), packets from being transmitted across the network. When Phantom cameras are placed in these types of networking environments the Camera Visibility - All Network Cameras List will not be able to populate the list with the camera name, serial number, and IP address of each of the cameras in the camera network. With these types of networking environments the end-user will need to essentially build a static IP address list of the cameras within the network and add them to the 'Visible Cameras List'.

In networking environments that allow UDP, (User Datagram Protocol), packets to be broadcast across the network the Camera Visibility - All Network Cameras List should automatically populate the list with the camera name, serial number, and IP address, of each of the cameras in the network.

This version of the software has been designed to:

- Allow access to Phantom cameras, without using the UDP broadcast mechanism, by utilizing an 'Add to Visible List' button in the Camera tab in Manager > Preferences window, and
- Manage the list of Visible Cameras for each Phantom Control Unit computer, especially when there are multiple computers and cameras in the network, and you want to dedicate them. We will use the term "connect" referring to the logically connected cameras (visible) and not to the physically connected cameras.

When multiple controller units are networked together to control multiple Phantom cameras, each controller unit will display, in its' All Network Cameras List, all the Phantom cameras that replied to the broadcast poll process, even if a camera has been added to the Visible Cameras List of another Phantom Controller Unit.

NOTE

The software will not provide any indication that another Phantom Controller Unit has already added the camera to its Visible Cameras List. Therefore, multiple Phantom Control Units could essentially add the same camera to their own Visible Cameras List.

8.9 Phantom CineMag Operational Modes

Phantom cameras that support a Phantom CineMag can operate in one of two operational mode, including:

Loop

When the camera is in the Loop Mode, the Phantom camera stores the recorded image data into the camera's RAM buffer. In this mode, the Phantom CineMag operates like any other Flash card, after a Cine file, (image data), is recorded into the camera's RAM frame buffer, the end-user manually saves the image data it into the Phantom CineMag by initiating the Save to Flash command window, which can be accessed via the Cine Pull-down Menu.

NOTE

This mode supports recording up to the maximum Sample rate.

R/S (Run/Stop)

In Run/Stop Mode the image data is recorded directly into the Phantom CineMag. For example, a Phantom HD will store the image data at a rate up to 450fps at the HD resolution of 2048 x 1080.

8.10 Phantom File Naming Convention

Even a relatively short movie result in a very large number of image files that later ought to be individually retrievable; naming these files by hand is impractical. The unique file naming in the Phantom camera is automatic. In order to provide this function in the Phantom software it was necessary for Vision Research to develop a small 'language' for specifying file names using a few special characters that are legal for filenames but seldom used. The Phantom software recognizes these characters and substitutes them with different counters from the software.

▼ Insert the Cine File Number into the Path and/or File Name(s)

Description

Used to insert the Cine file number to the path and/or file names. The single digit number specifies the number of digit places appended to the root file name.

The @ character can be used within both path names and file names. The Cine number counter is initialized to zero each time the software is started and incremented by 1 each time a Cine is saved to a drive.

Syntax

@ followed by a single digit

Single Digit Range

1 through 8

▼ Denote a Session Number into the Path and/or File Name(s)

Description

Used to denote a session number, if desired, in the path and/or file names. The single digit number specifies the number of digit places appended.

Syntax

\$ followed by a single digit

Single Digit Range

1 through 8

▼ Insert the Current Date and Time within the File Name(s) Only

Description

The ~ character previously use to insert the current date and time within the file names has been enhanced as follows:

- Placing the ~ character, followed by anything else other than the number 8, after the root file name, will append the Cine full trigger time string which includes the day of the week, year, month, day, hour, minute, seconds and fractions of seconds.

Example: test~5 where test is the root file name, ~ is the special file naming convention character, and 5 is a required variable other than 8 .

Result: testMon Dec 13 2010 18 46 59.814 133.125.Cine.

- Placing the ~ character, followed by the number 8 only, after the root file name, will append part of the Cine full trigger time string including the first two character from the months name, the day, the hour, and the minute.

Example: test~8 (where test is the root file name, ~ is the special file naming convention character and 8 is the required variable.

Result: testDE131847.Cine

▼ Inserts an Image Number into the File Name (Starting from One)

Description

Used to inserts the image number in the file name. The single digit number specifies the number of digit places appended to the root file name.

Use a separate folder for each recording sequence to prevent the single images of future recording from overwriting your stored images because of duplicate file names.

CAUTION

When saving your files as a series of still images, you must follow this naming convention or the individual images will be overwritten every time the camera stores additional Images.

Syntax

+ followed by a single digit

Single Digit Range

1 through 8

▼ Insert an Image Number in the File Name (Starting with the First Frame's Image Number)

Description

Used to insert the image number in the file name, starting from the first frame's number. The single digit number specifies the number of digit places appended to the root file name. Remember to consider the minus sign in the image number, too.

Syntax

! followed by a single digit

Single Digit Range

1 through 8

▼ Automatically Group Individual Still Image Series into Individual Folders with Unique Folder Names

Description

Use this procedure to automatically group your individual still image series in individual folders with unique names. Using a separate folder for each recording sequence prevents the single

images of future recording from overwriting your stored images because of duplicate file names.

CAUTION

When saving your files as a series of still images, you must follow this naming convention or individual images will be overwritten every time the camera stores additional Images.

Syntax

+ followed by a single digit

Single Digit Range

1 through 8

8.10.1 Phantom File Naming Convention Examples

▼ **Create a Directory to Hold Individual Images Extracted from the Original Cine**

If the file name pattern is NewDir\Img+5.tif

Upon execution, this simple file name entry will create a new directory on your C:\current drive or folder named 'NewDir' to hold the individual .tif images that will be extracted from the original Cine file. You may change the name 'NewDir' to any name you like.

The Img+5.tif portion of the naming structure will instruct the Phantom software to save the files in the order, they were taken adding a number starting at 1. 'Img' in the name is the root designator for the images. You may change 'Img' to Pic for picture, Frm for frame or any other characters that fit your needs. The '+5' instructs the application to append 5 character places to each image.

Upon completion, you will find a directory on your current drive/folder named 'NewDir' and the files in that directory will look as follows:

Img00001.tif
Img00002.tif
Img00003.tif

▼ **Create Multiple Image Files from a Cine (Starting with the First Frame's Image Number)**

To create multiple images from a Cine file – let's say cine1.Cine – containing a range of frames from -10 to 2, you can specify the generic file name like this:

Example: imag!4

The images will be saved in the same folder with the one in which the Cine file 'cine1.Cine' is in:

imag-0010
imag-0009
imag-0008
...

imag0000
imag0001
imag0002

▼ **Create Multiple Image Files (Starting with the First Frame's Image Number) into Sub-folders within the Original Folder Location**

You can indicate, not only file names, but also a new directory, using the language described. For example, when converting several Cine files – cine1.cin, avi1.avi – containing a range of frames from -10 to 2, you can specify the following Files in the Multiple Convert Destination dialog box:

Example: Cines\imag!4

Phantom will create a Cines file folder in the current drive / folder if it does not already exist, and images will be saved like this:

Cines\cine1\imag-010
Cines\cine1\imag-009
...
Cines\cine1\imag0001
Cines\cine1\imag0002
Cines\avi1\imag-010
Cines\avi1\imag-009
...
Cines\avi1\imag0001
Cines\avi1\imag0002

▼ **Create Multiple Cine Files into Sub-folders within the Original Folder Location**

You can also introduce a counter of Cine files, using the @ sign. Using the same convention as the one just mentioned, if you specify:

Example: Cine@2\imag!4

Results in:

Cine00\cine1\imag-010
Cine00\cine1\imag-009
...
Cine00\cine1\imag0001
Cine00\cine1\imag0002
Cine01\avi1\imag-010
Cine01\avi1\imag-009
...
Cine01\avi1\imag0001

Cine01\avi1\imag0002

▼ **Create Multiple Image Files (Starting from One)**

If you prefer a counting of images starting from 1, here is an example for converting the file cine1.Cine with the frame range from -10 to 2:

Example: Cines\imag+4, and you will get:

Cines\imag0001

Cines\imag0002

...

Cines\imag0012

Cines\imag0013

8.11 Phantom .stg (Serial Tag Number) File

Phantom cameras have been categorized into two types; ph16 and ph7 cameras.

The ph16 camera models include the Phantom v160, v1210, and Miro M-Series cameras, while the ph7 camera models include all other Phantom cameras.

ph16 Camera Models

With the introduction of ph16 cameras, the Phantom .stg (Serial Tag Number) file is no longer required for these cameras to operate. Therefore, there will be no Phantom .stg files associated with ph16 camera models. All of the factory settings, calibrations and all important system operating settings will be stored into both an active non-volatile memory area of the camera, and a backup non-volatile memory area.

ph7 Camera Models

The ph7 Phantom camera model still require a unique serial tag number file to operate. This file is known as the camera's '.stg' file. The .stg file contains factory calibrations and settings essential for the proper operation of your Phantom camera. The Phantom installation CD, supplied with each new or newly serviced camera, includes the '.stg' file for your camera.

Serial Tag Files use the file extension .stg and reside in the Phantom directory on the controlling computer's hard drive. These files are specific to each camera manufactured and store the factory settings and various lookup tables for the image sensor based on the 4-Digit Camera ID number. The information in this file is also stored (duplicated) in the camera's non-volatile flash memory. Under normal camera operation, this information is read by the Phantom application each time the software is started or each time a camera is accessed over the network. When started, the application first tries to read the factory settings from the computer .stg file. If it doesn't find the appropriate .stg file on the computer, it reads the settings from the camera.

On the flip side, if the Phantom application is started or if the camera is accessed over the network and no .stg file resides on the hard drive, the Phantom application will automatically create the .stg file on the controlling computer's hard drive using the information residing in the camera flash memory.

If for any reason the Phantom application cannot read the .stg information from the camera flash or from a file in the Phantom directory on the hard drive then the software will prompt the user for intervention. If the proper .stg file is not available the application can load a default set of information. If the default information is written to the flash the camera will still operate but the image quality will be less than optimum.

CAUTION

Never use an outdated .stg file. Never mix .st files. Using .stg files from other cameras may cause serious damage.

Vision Research keeps copies of .stg files on record and if needed a copy can be obtained via email by contacting us.

Vision Research recommends making a backup copy of your camera's .stg file to store in a safe place. We also recommend placing a copy of this file in a temporary folder somewhere on your hard drive in the event you need to restore the camera's factory calibration settings quickly .

When the camera is first connected to the controller, it will automatically download the '.stg' file to a default .stg file path, used by the Phantom Camera Control software. This path matches the path used in by the Phantom (PCC) Camera Control application, CommonApplicationData, (see the table below).

WINDOWS OS	.STG AND PHCON.LOG COMMONAPPLICATIONDATA	USER SETTINGS LOCALAPPLICATIONDATA
Windows 7	ProgramData\Phantom\Phantom version	Users\Current user name\AppData\Local\Phantom
Windows Vista	ProgramData\Phantom\Phantom version	Users\Current user name\AppData\Local\Phantom
Windows XP	C:\Documents and Settings\All Users\Application Data\Phantom\Phantom version	C:\Documents and Settings\User name\Local Settings\Application Data\Phantom

Therefore, you should copy the file from the CD, and use Windows Properties to disable the READ ONLY attribute of the .stg file after it's copied to the hard drive.

8.12 Range Data Interface

Introduction

Some Phantom v-Series cameras provide a mechanism that can be used to tag image frames with data supplied over the range data interface. This mechanism is of the time stamp storage system; range data tags are treated very much like timestamps and the event signal.

While primarily intended for acquisition of altitude/azimuth/range information from tracking mounts, the range data input does not impose any formatting on the actual data recorded; as such, it can be used to record arbitrary digital data, of up to 128-bits/frame.

The following contains a preliminary description of the interface, and is subject to change.

Electrical Interface

The range data interface consists of 2 differential pairs. The differential pairs use RS422 signaling levels, and are intended to be used in point-to-point connections. The signals are:

SIGNAL	FUNCTION	DESCRIPTION
corrp+, corrp-	Correlation pulse output	A 4µs correlation pulse is output at the end of each exposure, synchronous with the time acquisition pulse.
data+, data-	Serial data input.	A 100 ? termination resistor is placed across the serial data input pair.

The signals are made available on a 6-pin circular connector, with the pin out as shown in the table below:

PIN	SIGNAL
A	Correlation pulse output.
B	Serial Data Input +
C	Serial Data Input -
D	Correlation Pulse Output +
E	Correlation Pulse Output -
F	Signal Ground

Interface Timing



Correlation Pulse: At the end of the exposure of each frame (the moment time stamps are taken), a pulse is output on the corrp signal. The pulse is 4 µs in duration and has positive polarity.

Data Input: The data input carries an asynchronous data stream with the following characteristics:

PIN	SIGNAL
Data Rate	5 MHz
Bit Encoding	NRZ (Non-Return to Zero)
Bit Sequence	LSB (Least Significant Bit) transmitted first
Logic Levels	Positive

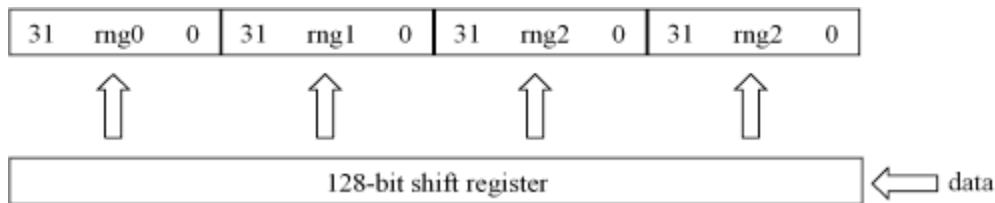
After the end of correlation pulse, the camera expects the data line to be in the idle state for a period not exceeding 100µs, followed by a 32 or 64 bit preamble and 128 bits of data.

The preamble consists of between 31 and 63 contiguous '1' bits, followed by a single '0' bit. The falling edge of the preamble's '0' bit is used to synchronize the receiver clock.

After the preamble is detected, the 128 data bits following are shifted into a shift register. At the rising edge of the next correlation pulse, the data from the shift register is combined with the current time, and sent to the recording system. After that, the shift register is cleared and made ready for shifting in more data.

Data Storage

The range data acquired for each frame is stored in four 32-bit words inside the time stamps. The current value can be obtained by examining the variables `irig.rng0` ... `irig.rng4`. The serial data stream is mapped to these variables as shown in below:



The 128 data bits recorded typically contain time, azimuth, elevation, range and status information. The camera does not interpret the data fields in any way.

The range data stamp stored for each frame is the one that has been clocked since the end of exposure of the previous frame. If no data is clocked for a specific frame, the range data words will all be zero.

The space for storing range data stamps is allocated when the camera memory is partitioned. For some combinations of camera memory size and resolutions, storage limitations may make storage of range stamps impossible: this will happen when the largest sizes of camera memory (e.g. 8Gb) are used with small frame sizes. In these cases, because of the excessive storage requirements, range data recording will be disabled.

8.13 SMPTE Time Code in Phantom Cameras

Introduction

The widely used SMPTE (Society of Motion Picture and Television Engineers) time code is deeply rooted in a broadcast environment where the frame rates are ever constant. The standard ways in which 'normal' cameras use time code does not have an obvious correspondent in the high-speed camera world, so a somewhat different way of using time code is required.

The implementation of SMPTE time code support in Phantom cameras tries to balance the 'high-speed' characteristics of the cameras with the common use of time code, by working towards the following goals:

1. When the camera is used at a standard frame rate, the time code should work as expected from a 'normal' camera;
2. The resolution and precision of the camera's time stamps are retained for high-speed applications;
3. Even when the camera is used at high-speed, it will generate sequential time code on playback; the playback time code can be correlated back to the images in the files the camera saves.

Time System Structure

The time system of the camera consists of the following parts: a time code receiver that can accept SMPTE or IRIG time codes; a high-resolution internal time base, that can lock to the incoming time code; a time stamp system for recording the exact time, according to the internal time base, when each frame is captured; an output section.

The time code receiver accepts IRIG B (modulated or unmodulated), or SMPTE linear time code. The linear time code can be at 23.97, 24, 25, 29.97 or 30 fps, drop or non-drop. The receiver will automatically detect the type of time code that it sees at the input, and switch to the proper decoder.

When a proper time code, incrementing in the correct sequence is received, the internal time base of the camera will lock to the true 'wall clock' time implied by that time code, and follow that true time uniformly and with sub-microsecond precision.

When SMPTE time code is received, the 'true time' is calculated in the following way: for the given time code, the number of frames from the start of the day is calculated (taking drop frames into account if needed), then the number of frames is divided by the exact TC frame rate (23.97, 24, 25, 29.97 or 30 Hz). The resulting time is used as the reference to which the time base locks.

For 'round' frame rates, the time base will lock to the exact same time received (for instance, the reference moment of the frame with time code '01:00:00:00' will occur at the 01:00:00.000000 'true time').

When the fractional rates 29.97 and 23.97 are used, this correlation cannot exist, and the true time will lead the applied time code by 3.6 seconds every hour.

When a 29.97 drop time code is applied, the internal time is closer to the applied time code (within about 84ms / day), but will still wander from the applied time code, as it has to run uniformly, without the drop frame jumps.

The internal time base completely separates the input and output sides of the time system, so the camera can output SMPTE time while reading IRIG time or vice-versa. Furthermore, the input TC rate can be independent of the video system or frame rate - the camera is always 'gear-boxing' using 'wall clock' time as a bridge between input and output.

Time Code Outputs

The camera has an analog time code output that can generate either un-modulated IRIG, or SMPTE linear time code. When the time code output is set to IRIG, that output always follows the internal time base (as the IRIGout of all phantom cameras has always done).

In addition, the camera embeds SMPTE time code in the ancillary data of the HDSDI outputs. The same time code is replicated in the LTC, VITC1 and VITC2 areas. The embedded SMPTE time code is generated even when the TC output is set to IRIG. When the TC output is set to SMPTE, the time code that is output there and the one embedded in the HDSDI are always identical (both rate and content).

When the camera is showing a live picture, the SMPTE outputs contain a SMPTE representation of the 'true time' of the internal time base. The method used to convert SMPTE time code to true time in the receiver is used in reverse for this conversion.

The SMPTE time code output always runs at the same rate as the video output, and always in non-drop mode. The reference moment of the LTC is aligned with the vertical sync of the video signal, as specified by SMPTE12M. Since the internal time base runs independently of the video signal generator (and the latter can also be genlocked), there can be a difference of up to 1 frame between the internal time base, and the SMPTE output even when the two are supposed to output the same data.

Time Code Output in Playback

When playing back recorded images, the SMPTE time code output is generated based on a reference moment of each recorded Cine. A particular time code is assigned to frame #0 (the trigger frame) of each Cine when the respective recording ends. This 'trigger time code' is calculated based on the true time of that frame, the playback rate (determined by the video mode), and the camera's capture frame rate.

When the capture frame rate equals the playback rate, the assigned time code is the equivalent of the true time of the trigger frame (rounded to the nearest frame number). This makes the camera output the same time code that was input at the time of the recording if running at a standard rate. When the capture rate is different from the capture frame rate (i.e. there is a speedup or slow down on playback), the time code of the trigger frame is more or less arbitrary (see the calculation method below).

Whenever a Cine is played back, the time code outputs will be at N frames from the trigger time code, where N is the frame number being played back. A playback at '1x' speed, i.e. one which outputs recorded frames sequentially will result in sequential time code being output. Any 'trick mode' play back (reverse, reduced speed, stop frame, etc) will generally show non-sequential time code, as the time code will follow the displayed image number. If a Cine is played back several times, even if from a different in point, or from a different device (say, from a cinestation), then as a given frame is output, the time code will be the same as on the other playbacks.

The trigger time code follows the Cine in the cinemag recording and in the file metadata, so a recording of the camera's output that included the SMPTE time code can be correlated back to frame numbers in the Cine files.

The trigger time code is calculated as follows: from the true time (the time stamp) of the trigger frame, the number of frames from the start of the current day, at the camera's capture frame rate is calculated. This number of frames is converted to a time code at the video output rate, modulo 1 day. So if, for instance, the camera is capturing at 120fps and playing back at 30, and the time of the trigger frame is 01:00:00.000000, the assigned trigger time code will be 04:00:00.00.

8.14 Supported File Formats

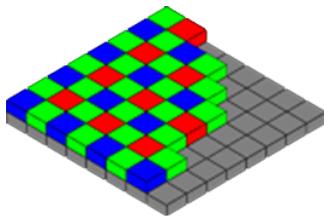
A Cine file, or movie, may contain hundreds of pictures, while an image file contains a single picture extracted from a Cine file. Vision Research recommends that you use the Cine RAW format, unless there is a real need to use one of the other formats. Following are brief descriptions of the advantages and disadvantages of the various supported file formats.

IMPORTANT DEFINITIONS

Color interpolation (Demosaicing)

Color images usually contain three color components for each pixel (Red, Green, Blue). In order to produce color images, digital cameras should be able to measure color levels for all three components in each pixel of the image. Hence, three different sensors would be required.

Since this approach is expensive and very complicated to implement, most cameras use only one sensor plus a Color Filter Array (CFA). The CFA is a grid that selectively filters the light by wavelength range. The image below contains such a filter, called the Bayer CFA.



Bayer Color Filter Array

Thus, the camera sensor will produce an array of values with one value per pixel. Each value represents a specific color level (red, green or blue). Such an image is usually called uninterpolated or RAW image.

In order to obtain a full color image from the RAW image, a special processing is required, called color interpolation or demosaicing. Analyzing each pixel and its neighbors, a color interpolation algorithm basically reconstructs the missing color components and produces the desired color image.

Raw

The term “RAW” generally refers to something unprocessed, unrefined. In digital video and digital photography, there are two contexts RAW is most often used:

- When referring to how data is stored in an image file.

In this context, a RAW file generally stores an image as a stream of bytes without using any compression or special technique. By default, the file contains no additional data. However, some RAW files may support adding a header with minimal information such as image size or bit depth. Vision Research .RAW format is an example for this category.

- When referring to what kind of data is stored in an image file.

A RAW file format may also refer to a file format that contains the original, unprocessed data from the image sensor of a digital camera. A RAW file is not immediately ready for use, but it contains all additional information for processing it and further using the captured image. DNG is an example of a RAW file format.

SUPPORTED FILE FORMATS

▼ Cine (*.Cine)

Advantage:

The Cine format is a Vision Research proprietary file format very similar to the Cine RAW format except that the colors are interpolated and every pixel holds all three color components RGB. It will store 8 or 16-bit images. The playback speeds are faster than Cine RAW because the colors are already interpolated.

Disadvantage:

It is usually about three times the size of Cine RAW file and takes a bit longer to save.

▼ Cine JPEG (*.ccj)

Advantage:

The Cine JPEG format uses a lossy compression routine to compress the images from the Cine file while retaining the timing and other information within the file. It will store only 8 bit images. It results in the smallest file size but there is a loss in the image quality, depending on the quality factor you chose at save.

Disadvantage:

It takes a bit more time to save the Cine file as the JPEG compression is performed. Not all third party software analysis packages will work with this format, image is altered and some details can be lost.

▼ Cine RAW (*.Cine)

Advantage:

The Cine RAW format is a Vision Research proprietary file format that has all the settings and timing information stored within the file. It will store 8 or 16-bit images. The images stored on 16 bits can have a smaller number of used bits: 10, 12 or 14. The images are saved as read from a sensor and the format is very compact. The save time is the best of all the formats offered in the Phantom application. Cine RAW files are uninterpolated, every pixel stores information about one color.

Disadvantage:

Each image needs to be interpolated on the fly during playback, that is, the missing two colors are computed by interpolating the neighbor colors, so the playback speed is slightly slower than some of the other formats and is dependent on the configuration of your computer system.

▼ Cine RAW Packed

The packed Cine files are smaller and faster to save. Packed files can be converted in unpacked RAW Cine files or in DNG format (packed or unpacked).

NOTE

You can save a packed RAW Cine file can only be saved from a Phantom CineMag by checking the Packed option in the Save Cine dialog box.

▼ AVI (*.avi)

Advantage:

The Audio Video Interleaved (AVI) format uses the AVI CODECS to save the file in a universal format used by several video playback packages. This universal format makes it easy to pass along to the end user for viewing since almost every PC has a viewer built into the operating system. The timing and setting information ("metadata") is stored in a separate file known as the Cine header file (.chd) or in a XML file. The AVI file can be played back within the Phantom application with the information intact.

Disadvantage:

Files saved in the AVI format are converted to 8-bit.

▼ Multipage TIFF (*.tif)

Advantage:

Some branches of the military use primarily the multipage TIFF format, and there are third party software packages that use this format for image analysis. The timing and setting information is stored in a Cine header file (.chd) or in a XML file and the TIFF file can be played back within the Phantom application with the information intact. The file size is the same as the Phantom Cine format.

Disadvantage:

The Multipage TIFF format has a 2 gigabyte file size limit, so on large memory cameras the customer will need to save the large Cine files in segments. Files saved in the multipage TIFF format are converted to 8 bits.

▼ MXF (*.mxf)

Advantage:

The MXF format, both NTSC and PAL, are used to save the camera Cine images in a format that several common video editing suites use. This allows the camera images to be easily edited into

standard video productions. The images are lossy compressed. Care must be taken to set the aspect ratio to that of the video display that the images will be viewed on. The timing and setting information is stored in a Cine header file (.chd) or in a XML file.

Disadvantage:

Files are converted to 8 bits. The MXF format will not playback in the Phantom application. The resulting files have the extension of .mxf and there is no distinction in the filename between

NTSC and PAL.

▼ H.264 (*.mp4)

Advantage

H.264 video encoding provides efficient compression, delivering considerably more detail at a lower bit-rate compared to other compression methods. H.264 was Developed for use in high definition systems such as HDTV, Blu-ray and HD DVD as well as low resolution portable devices such as Sony's PSP and Apple's iPod, H.264 offers better quality at lower file sizes than both MPEG-2 and MPEG-4 ASP (DivX or XviD).

Apple has officially adopted H.264 as the format for QuickTime. It is also one of the formats chosen to be supported by both high definition DVD standards, and is destined to be the future standard format for Blu-ray.

H.264 is also sometimes referred to as MP4, this is technically incorrect. MP4 is a container format much like AVI and it can be used to "house" many different types of compression codecs, not just H.264. It is true though that MP4 is a very popular choice for the H.264 format. MP4 should not be confused with MPEG-4 video either..

Disadvantage

Two major disadvantages of H.264 in energy constrained environment are encoder complexity and low resiliency to channel error.

▼ ProRes (*.mov)

The Apple ProRes allows both Mac and Windows users to play Apple ProRes files through QuickTime. Apple ProRes is a visually lossless format that provides uncompressed HD quality at SD data rates.

It is an excellent choice for mastering and can easily be transcoded to distribution formats like H.264. With new support for playback on both Mac and Windows computers, Apple ProRes can also be used for review and approval of Final Cut Studio sequences.

▼ QuickTime (*.mov)

Advantage:

This is a universal file format that can be played back in several third party software packages that are commonly used by the Apple computers end users. The file size is the same as the Cine format. Only the uncompressed version of this format was implemented. The timing and setting information is stored in a Cine header file (.chd) or in a XML file.

Disadvantage:

Files are converted to 8-bit. The MOV format will not play back in the Phantom application.

▼ Windows BMP (*.bmp)OS/2 BMP (*.bmp) - one image per file

Advantage:

All still or video cameras produce raster images. Bitmap (or raster) images are made up of pixels in a grid. Each pixel is assigned a color value. All these tiny dots of color come together to form the images you see. Bitmap images are literally maps of the grid of pixels and their color assignments. Bitmap files easily convert to other formats. BMP is the built-in format of Windows operating system.

Disadvantage:

BMP supports only 8 bits per pixel (24 bits per pixel on color images).

▼ PCX (*.pcx)

Advantage:

The PCX image format is one of the oldest raster formats. It was originally designed by ZSoft to be used by PC Paintbrush for MS-DOS. Microsoft later acquired the right to use the PCX format for Microsoft Paintbrush for Windows indirectly increasing the format's popularity. PCX can be used for graphic data operations.

Disadvantage:

PCX does not compress images very effectively, but it retains all image information. As such, PCX files are usually very large and are unsuitable for very large details. Due to its inefficient compression scheme and the advent of other image formats, PCX has lost some of its popularity.

▼ TGA (*.tga)

Advantage:

This format (Targa or TGA) supports any image dimensions and color depth of 1 to 32 bits. As the image format's popularity increased, this format, TGA (Targa), has been migrated to many other platforms and applications. The Targa format is used by several high-end paint and CAD programs.

The TGA format is a format for defining raster or bitmap images. Targa supports color maps, alpha channel, gamma value, postage stamp image, textual information and developer-definable data. Unlike other image formats, there are relatively few variations. Various compression models are supported. Targa images exist in both compressed and uncompressed formats.

The TGA format is probably the most universally supported 24-bit and 32-bit file format for PC applications. The 32-bit Targa format contains 24 bits of color data and 8-bits of transparency data. Color support ranges from black and white, indexed and RGB color.

Disadvantage:

Since Windows does not recognize 16-bit and 32-bit depths, some applications may treat them as 24-bit images. A 16-bit image will be up-graded to a 24-bit image while a 32-bit image will be downgraded to a 24-bit image.

▼ TIFF (*.tif)

Advantage:

TIFF (Tagged Image File Format) is one of the most popular and flexible of the current public domain raster file formats. TIFF is primarily designed for raster data interchange. TIFF's main strengths are a highly flexible and platform-independent format that is supported by numerous image processing applications. Since developers of printers, scanners and monitors designed it, it has a very rich space of information elements for colorimetry calibration, gamut tables, etc. Such information is also very useful for remote sensing and multi-spectral applications.

Another feature of TIFF that is also useful is the ability to decompose an image by tile rather than scan lines. This permits much more efficient access to very large imagery, which has been compressed (since one does not have to decompress an entire scan line).

Disadvantage:

There is no provisions in TIFF for storing vector graphics, text annotation, etc. (although such items could be easily constructed using TIFF extensions TIFF.). TIFF is based on file-offsets, so that it is not easily 'streamable' in the way JPEG JFIF streams are.

A common complaint of TIFF is rooted in its flexibility. TIFF uses a 4-byte integer file offset to store image data, with the consequence that a TIFF file cannot have more than 4 Gigabytes of raster data (and some files have begun to approach this boundary).

▼ LEAD (*.cmp)

The LEAD CMP format was created by LEAD Technologies, Inc., and it utilizes the patented CMP compression. CMP compression delivers a much smaller file size and better image quality than other compression techniques.

▼ LEAD JTIF (*.jtf)

Refer to LEAD and JTIF.

▼ LEAD JFIF (*.jff)

Refer to LEAD.

▼ JPEG (*.jpg)

Advantage:

The Joint Photographic Experts Group Format (JPEG) format allows for control on the compression quality. This means that you can opt for a smaller image with less detail or a larger image with more detail. JPEG handles gradients well and is useful for images with subtle color borders such as photographs.

Disadvantage:

JPEG files are typically large files, and the JPEG formatted images lose quality rapidly as they are compressed, usually introducing 'noise' and distortion into the image. The loss of image quality is usually not worth the reduction of file size.

▼ **JTIF (*.jpg)**

JTIF (JPEG File Interchange Format) is just a file format for a compressed JPEG image. TIFF can actually store its pixels compressed in a wider variety of ways, including JPEG. JTIF is the common JPEG file format seen in *.jpg files.

▼ **RAW (*.RAW)**

Images saved using the RAW file format contain only an array of pixel values. There is also an option whereby the user may create a very small header file that contains dimensions and bit depth information. (Refer to the second dialog box that appears during the save process). RAW files can be written as binary values or ASCII text values (readable in MS Notepad).

They cannot be read in the customer version of the Phantom application, however, the Phantom 'Legacy' application does contain a function labeled 'ReadRAWImage' that becomes available once the factory mode of the software is enabled. This tool allows the user to decode any binary file into an image and allows the user, for example, to look into fragments of Cine files to find the image dimensions and the images themselves.

Historically, this format was used in the 1990s for "in house" image processing or analysis on known resolution images. Some users preferred to read this RAW image format to avoid spending time to write a program to analyze the file header. For example, the user would have known that the images are 512x512x8 bits and would only write code to read the pixels from the RAW file and subsequently process them. In general, the RAW format was designed for users that write their own (simple) applications.'

▼ **DNG (*.dng)**

DNG (Digital Negative) is a non-proprietary file format developed by Adobe Systems and used for storing RAW images. DNG is TIFF/EP standard compatible.

A DNG file contains unprocessed, uninterpolated data. Additional information about acquisition and processing parameters is stored separately in the file as metadata.

One great advantage of the DNG file format is its flexibility: the end-user has access to the original sensor data and can modify a wide range of parameters such as color interpolation, white balance, black level, contrast, saturation, etc.

On the other hand, each DNG needs to be processed before being used, which not only is time consuming, but also requires specialized software tools for handling DNG files.

▼ **DPX (*.dpx)**

Digital Picture Exchange (DPX) is a common file format for digital film work and is an

ANSI/SMPTE standard (268M-2003). The file format is most commonly used to represent the density of each color channel of a scanned negative in a 10-bit log format where the gamma of the original camera negative is preserved as taken by a film scanner. Other common video formats are also supported. DPX provides a great deal of flexibility in storing color and other information for exchange between production facilities. Multiple forms of packing and alignment are possible.

The DPX file format was originally derived from the output file format (.cin) of the Kodak Cineon 'FIDO' film scanner, and has been published by SMPTE as ANSI/SMPTE 268M-2003 (originally was version 1 268M-1994).

▼ Packed

Packed Cine files are smaller and faster to save. You can save a packed RAW Cine file from a Phantom CineMag or from a ph16 camera. Packed files can be converted as unpacked RAW Cine files or in DNG format,(packed or unpacked).

When playing back a Packed Cine file, the Play>Cine Info>Bits per color value will always be displayed as 10 P.

NOTE

In order to get packed Cine files compatible with previous versions of the Phantom Camera Control application, convert the packed Cines and uncheck the Packed option in Save Cine dialog box.

8.15 Supported Video System Formats

The types of video signal formats Phantom camera's will transmit to a monitor, 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 an attach 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 an 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 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 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 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 x 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 x 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. Therefore, it's possible when 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.

8.16 Sync to Video Mode

Introduction

In Sync to Video Mode, the camera captures frames at a rate that is a multiple of the video frame rate, with a defined phase relationship to the video signal.

This mode bring the following benefits: when both recording and play-back needs to be synchronized (such as in stereoscopy applications), a FSYNC connection between cameras is no longer needed - Genlock will suffice; the cameras can capture at the fractional" frame rates of 23.98, 29.97 and their multiples; the live output of the camera maintains a stable phase in relation to frame capture.

Operation

When sync to video is selected, the capture of frames is triggered by F-sync pulses generated by the video raster generator. the first F-sync pulse of a video frame is coincident with the start of vertical sync, and further pulses are spread through the frame at equal intervals in order to obtain the desired frame rate.

When in sync to video mode, the camera will only accept frame rates that are a multiple of the video frame rate. if other values are requested, they will be rounded to the nearest multiple.

For the purpose of this calculation and setting, "round" frame rates are used (24, 25, 30, 50 or 60), even when the camera is set to a fractional rate such as 23.98 or 29.97. However, when the frame sync pulses are generated, the real, possibly fractional frame rate is used.

For example, if the camera is set to 1080psf23.98, and a frame rate of 100fps is requested, the camera will round the 100fps to 96 (the nearest multiple of 24). The true frame rate of the camera will be 95.904 fps, four times 23.976.

8.17 Versatile Dual HD-SDI

The Video Outputs parameters, in the Phantom Video Player Settings dialogue window, are used to define the video feed mode. Presently there are four feed modes supported, including:

- Single-Feed (4:2:2)
- Single-Feed Mode with Dual Link 4:4:4
- Dual Feed Mode (4:2:2)
- Dual-Feed with 4:4:4

The Versatile Dual HD-SDI feature allows maintaining a live video feed while simultaneously playing back recorded images from the camera memory. The feature has also improved the handling of active metadata, or video image adjustments, to allow proper handling during pipelined recording/playback operations.

NOTE

Not all Phantom cameras supports this feature.

Also, the handling of video adjustments has changed. Previously, when changing any of the values, they would apply to the video image, both live and playback. Now, changing a video adjustment value will only apply to the live image out of the camera, in either single-feed or dual-feed mode. For

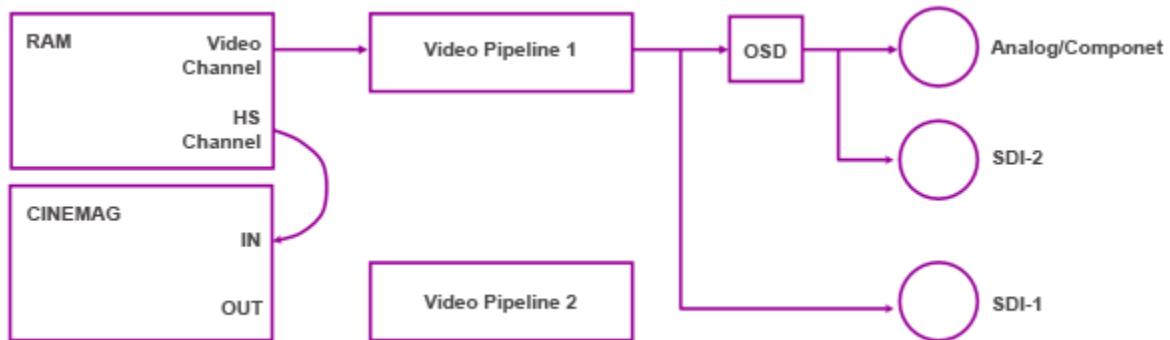
playback, the values that were active when the Cine was recorded will be used.

Below is a description of each of the video feed operational modes:

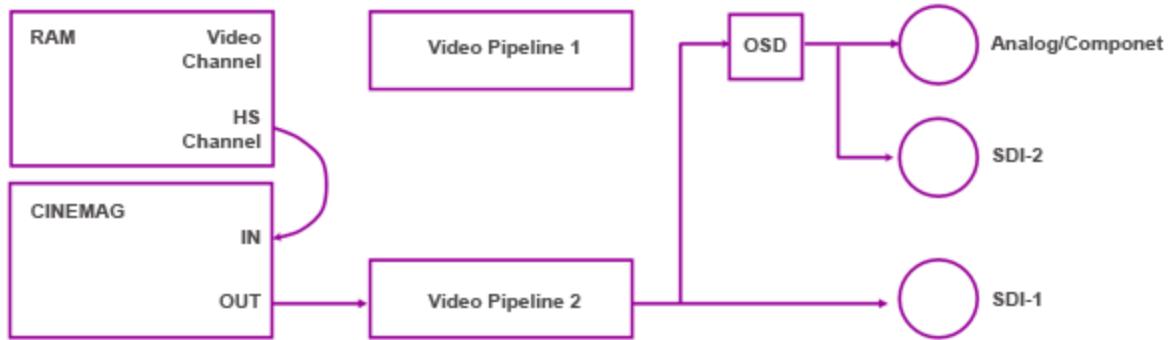
▼ Single-Feed Mode (4:2:2)

This mode provides both the live and playback feeds, from the RAM, over the video memory channel. This is exactly how the video feeds were handled previously. The high-speed channel is used as the recording source for the Phantom CineMag, if fitted.

Only one video pipeline is used at a time.



Routing of image data when outputting images from the camera's RAM



Routing of image data when outputting images from Phantom CineMag

When the camera is placed into the Single-Feed (4:2:2) Mode images can be read from the camera's RAM over two totally independent channels, the:

- Video Memory Channel
- High-Speed Memory Channel

The camera has two identical video pipelines used to handle image debayering, and all color adjustments. The video output of these pipelines can be routed to three outputs:

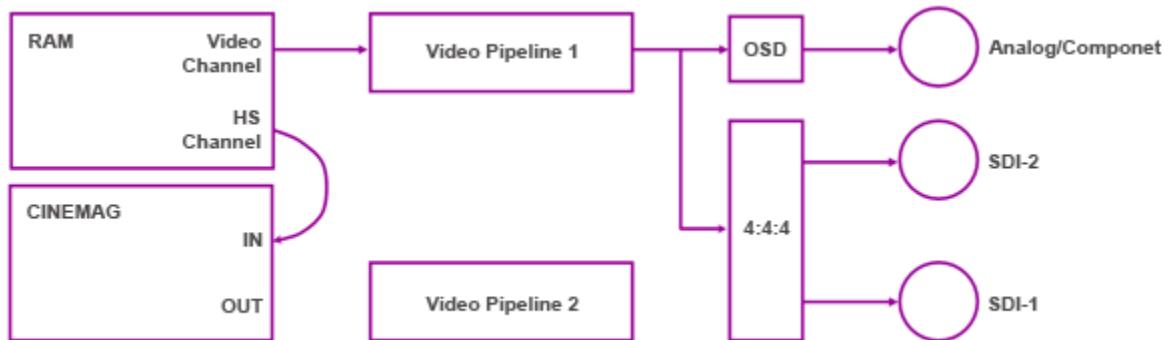
- One analog/component

- SDI-1, (Serial Digital Interface)
- SDI-2, (Serial Digital Interface)

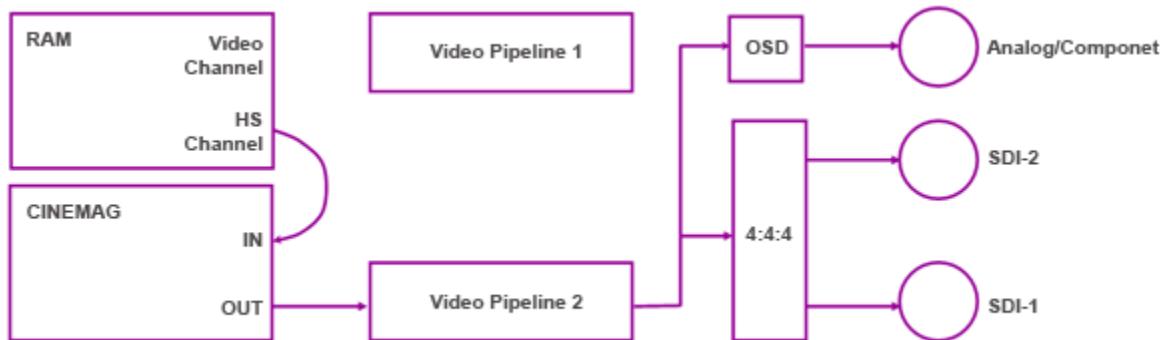
On-screen annotations can be inserted on the signal going to the analog/component output and/or SDI-2. There is no OSD, (On-Screen Display), for SDI-1.

▼ Single-Feed Mode with Dual Link 4:4:4

In this mode the SDI, (Serial Digital Interface), Outputs are used together as a dual-link output, allowing 4:4:4 image sampling.



Routing of image data when outputting images from the camera's RAM



Routing of image data when outputting images from Phantom CineMag

When the camera is placed into the Single-Feed with Dual Link (4:4:4) Mode images can be read from the camera's RAM over two totally independent channels, the:

- Video Memory Channel
- High-Speed Memory Channel

The camera has two identical video pipelines used to handle image debayering, and all color adjustments. The video output of these pipelines can be routed to three outputs:

- One analog/component
- SDI-1, (Serial Digital Interface)
- SDI-2, (Serial Digital Interface)

On-screen, (OSD - On-Screen Display), annotations can only be inserted into the analog/component signal.

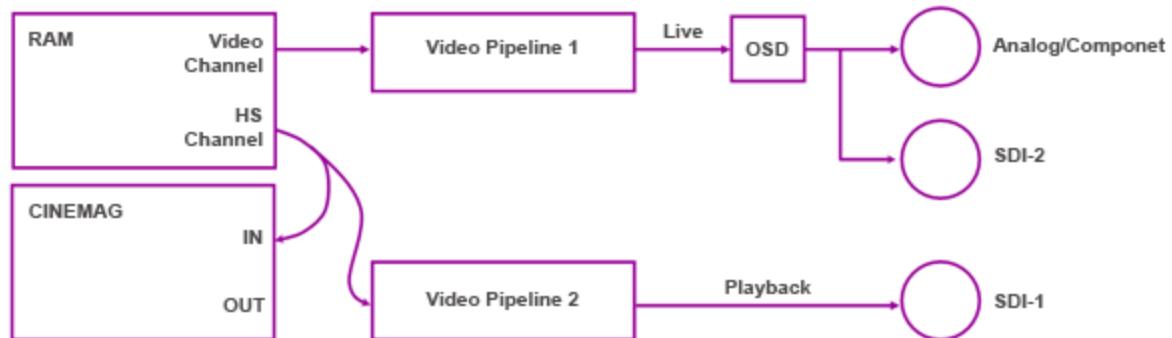
▼ Dual-Feed Mode (4:2:2)

When the camera is placed into the Dual-Feed Mode the two video pipelines are used simultaneously. The video memory channel is used to source a live video feed, while either the high-speed memory channel or the Phantom CineMag is used to source the playback feed.

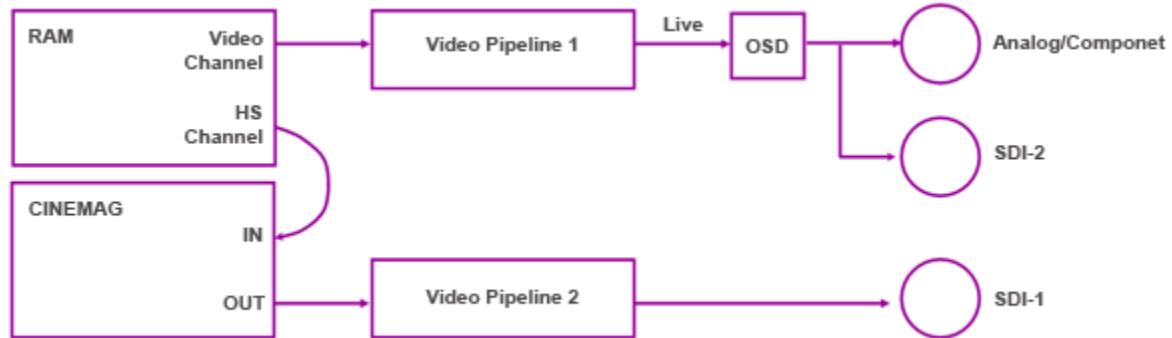
Both the analog/component output and the SDI-2, (Serial Digital Interface-2), outputs always carry the uninterrupted live feed. OSD, (On-Screen Display), information can be inserted on either of these outputs. SDI-1 is reserved for the playback feed.

NOTE

If no playback is taking place, a black image is outputted.



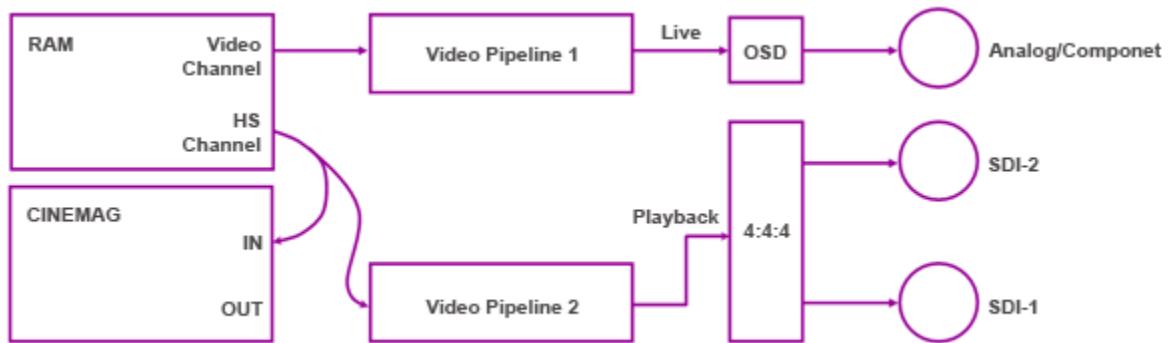
Routing of image data when outputting images from the camera's RAM



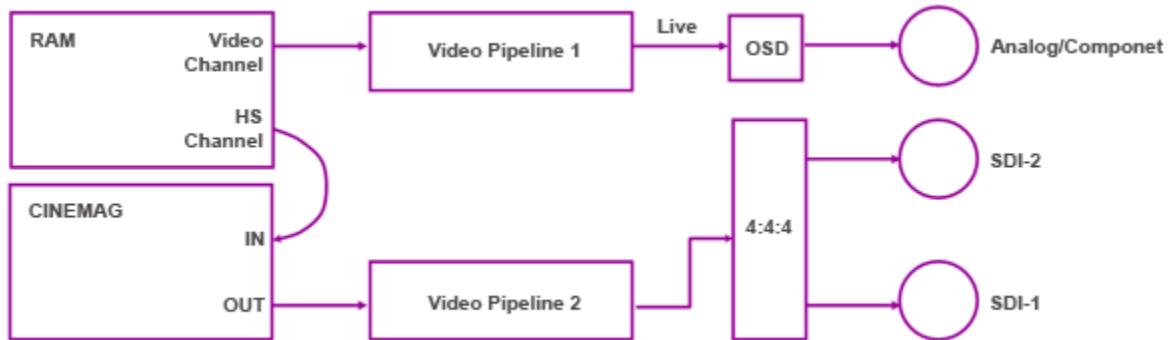
Routing of image data when outputting images from Phantom CineMag

▼ Dual-Feed Mode with 4:4:4

In the Dual-Feed Mode with 4:4:4 the two SDI, (Serial Digital Interface), outputs are used together as a dual-link output allowing 4:4:4 image sampling. The live feed, and optional On-screen Display, (OSD), annotations are sent to the analog/component output, while the playback feed uses the dual-SDI outputs.



Routing of image data when outputting images from the camera's RAM



Routing of image data when outputting images from Phantom CineMag

▼ Important System Interactions

Various interactions between the functional block depicted in the video feed operational mode descriptions require the following rules to be put into place:

- All outputs are set to the same video format.
- Test bars are sent on all outputs at the same time.
- OSD, (On-Screen Display), information can be inserted only on the analog/component out and SDI-2, (Serial Digital Interface-2).
- In dual-feed modes, only one of the following operations can take place at any given time:
 - A Playback from RAM
 - A playback from the Phantom CineMag
 - Recording or Saving to the Phantom CineMag
 - Downloading from the Phantom CineMag via Ethernet

Video-Feed Mode Selection Table

Video-Feed Mode definition is performed in the Phantom Video Play>Pvp Settings dialogue window.

VIDEO- FEED MODE	VIDEO OUTPUTS		
	4:4:4	ALL OUTPUTS PLAY SELECTED CINE	SDI2 PLAYS SELECTED CINE ANALOG AND SDI1 PLAY LIVE
Single-Feed Mode (4:2:2)	Disabled	Enabled	Disabled
Single Feed Mode with Dual-Link 4:4:4	Enabled	Enabled	Disabled
Dual-Feed Mode	Disabled	Disabled	Enabled
Dual-Feed Mode with 4:4:4	Enabled	Disabled	Enabled

Part



IX

9 Service & Support



AMECARE Service Offerings

Maintenance, Support and Education that delivers ultimate satisfaction and operational confidence for the user

Product and operator performance directly impact your goals and objectives. To ensure maximum product uptime and operator success, Vision Research offers a complete line of service programs, extended warranties and training classes to meet your specific product or operational needs. Our professional, factory trained service engineers and educators will deliver this training and support through a network of service centers, on-line/self-serve content and user community forums that will help you achieve the results you need.

Customer Service – General inquires, technical troubleshooting or ‘how to’ questions? We’re here to help. Our support centers are staffed from 8:00 AM to 5:00 PM Local Time.

- Professional Repair Services – Fast, accurate and competitively priced repairs for all of your product needs
- Extended Warranties – Designed to add peace of mind and extend the factory warranty coverage that eliminates unexpected out of pocket expenses
- Customer Training – Delivered in a Basic and Advanced format designed to get you quickly using our cameras or to explore the depths of our comprehensive feature set
- On-Site Predictive Support and Training – is designed for customers who have 5 or more cameras. This optional service program offers our customers the opportunity to receive a 1 day visit for refresher training, camera inspection, firmware upgrades and general maintenance
- Loaner Product – Minimizes lost productivity by minimizing project downtime. Should an unexpected camera failure occur, a loaner camera will be dispatched to a customer’s site to restore business continuity while your product is in for servicing

[View](#) a list of AMECare documents available for download

9.1 Service Centers



Updated: 11/08/2013

Contacting Vision Research Service Centers

GLOBAL HEADQUARTERS

Vision Research, Inc. - Wayne, New Jersey

100 Dey Road
Wayne, New Jersey 07470 USA
T: +1.973.696.4500
F: +1.973.696.0560

For answers to most questions, please visit us at:

www.visionresearch.com

For general product, account, order/RMA status inquires and other non-technical questions please e-mail us at:

customer.support@visionresearch.com

For technical product support, product operation or applications support please e-mail us at:

technical.support@visionresearch.com

LIVE CUSTOMER AND TECHNICAL SUPPORT

Serving the Americas and Asia Pacific:

M-F 8:00 AM to 5:00 PM EST (GMT-4:00)

Vision Research, Inc. - Stuart, Florida

1002 Monterey Commons, Suite 200
Stuart, Florida 34996 USA

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F: +1.973.696.0560

Customer Support, extension 4002
Technical Support, extension 4003

Serving Europe, the Middle East and Africa:

M-F 9:00 AM to 6:00 PM GMT +3:00

Vision Research, Inc. - Bucharest, Romania

Str. Eugen Botez Nr. 1
Bucharest, Romania, 020232
T: +40 21 210 8587
F: +40 21 210 8587

9.2 Phantom Certification Program

Vision Research proudly offers a new program that delivers a comprehensive training solution for users of Phantom cameras. The Phantom v-Series Camera Certification Training Program is a two-tiered training program that can reduce in-house training expenses and enhance your workforces' productivity.

Our Phantom v-Series Camera Certification Training Program helps engineers and technicians better understand Phantom cameras, as well as the use of Phantom software, accessories, and applications for high-speed imaging; that will deliver high quality technical and product education you require.

Our instructors provide an in-depth customer-focused hands-on learning experience for our Phantom products as well as the basics in photography through a combination of lectures; exercises, labs, and training solutions. Class size is limited to eight students per session to ensure that each student receives the individual attention he or she may need.



"Our Phantom v-Series Camera Certification Training Program helps engineers and technicians better understand Phantom implementations, use of Phantom software and hardware, and applications," says Frank Mazella, Chief Instructor for Vision Research, " and delivers high quality technical and product education our customers' require. We believe this will allow them to maximize the use of our products and the effectiveness of their personnel."

If you are interested in attending, or have any question regarding the training, please contact your local Vision Research sales representative; or, use our "[Contact Us](#)" form (<http://www.visionresearch.com/Contact-Us/Contact-Form/>) to request more information.

For a schedule of our training classes go to: <http://www.visionresearch.com/News--Events/Events/Training/>

If you are in need of training for television or motion picture production applications, please contact [AbelCine](#) if you are in the US or Canada, or your local Phantom sales representatives worldwide.

Part



X

10 Firmware Requirements

Below are the step necessary to find the cameras installed firmware.

STEP-BY-STEP PROCEDURES

▼ Via Phantom Camera Control (PCC) Application

1. Connect the camera; open the current version of the Phantom software.
2. Click on the Camera Info Selector, in the Live Panel.

▼ Via Phantom Remote Control Unit

1. Connect the camera; start the Phantom Remote Control Unit.
2. Gently press Setup>Tools>About.

▼ Via Phantom MultiCam Application

1. Connect the camera; open the current version of the Phantom MultiCam application.
2. Click on the Cameras Tab.

▼ Via Camera Repair and Firmware Upgrade (Nucleus) Application

1. Connect the camera; open PCC application, go to Manager panel and press Camera Repair and Firmware Upgrade button .
2. Click the down-arrow to the right of the Select Camera>Camera field, then
3. Select the camera firmware is being verified for.

10.1 Current Cameras

The minimum firmware required for cameras currently in production, as of 22-SEPT-2015 Rev.A, is:

CAMERA	DESIGNATOR	PHFW	FIRMWARE		FPGA (PH.BIN)	KERNE	RELEASED PCC SOFTWARE	RELEASED LEGACY SOFTWARE	DISCONTINUED DATE	OBSOLETE DATE
			PH7	PH16						
v411	127		797	-	596255	16140	PCC 2.6.749.0	Phantom 749		
v611	120		797	-	596255	16140	PCC 2.6.749.0	Phantom 749		
v711	120		797	-	596255	16140	PCC 2.6.749.0	Phantom 749		
v341	132		797	-	578252	16140	PCC 2.6.749.0	Phantom 749		
v641	131		797	-	578252	16140	PCC 2.6.749.0	Phantom 749		
v642	133		776b	-	607252	16140	PCC 2.6.749.0	Phantom 749		
Flex	135		797	-	573244	16140	PCC 2.6.749.0	Phantom 749		
Flex4K	4001	pFlex4K-53	-	167360191	1200700	563	PCC 2.7.756.0	Phantom 756		
Flex4K - 128G	4001	pFlex4K-53	-	167360191	1200700	563	PCC 2.7.756.0	Phantom 756		
v1211	16001	ph-v1211-39	-	14967	580555	563	PCC 2.6.749.0	Phantom 749		
v1212	25001	ph-v1212-52	-	17031	638625	563	PCC 2.7.756.0	Phantom 756		
v1611	16001	ph-v1611-42	-	13985	580555	563	PCC 2.6.749.0	Phantom 749		
v1612	25001	ph-v1612-52	-	17031	638625	563	PCC 2.7.756.0	Phantom 756		
v2011	16001	ph-v2511-42	-	13985	580555	563	PCC 2.6.749.0	Phantom 749		
v2012	25001	ph-v2012-52	-	17031	638625	563	PCC 2.7.756.0	Phantom 756		
v2511	16001	ph-2511-42	-	13985	58055	563	PCC 2.6.749.0	Phantom 749		
v2512	25001	ph-v2512-52	-	17031	638625	563	PCC 2.7.756.0	Phantom 756		
Miro M310	8001	ph-m310-42	-	16416	916	563	PCC 2.6.749.0	Phantom 749		
Miro M110	8002	ph-m110-	-	16416	916	563	PCC	Phantom 749		

		42					2.6.749.0			
Miro M120	8012	ph-m120-42	-	16416	915	563	PCC 2.6.749.0	Phantom 749		
Miro M140	8032	ph-m140-42	-	16416	915	563	PCC 2.6.749.0	Phantom 749		
Miro M320S	8021	ph-m320S-42	-	16416	917	563	PCC 2.6.749.0	Phantom 749		
Miro M340	8031	ph-m340-42	-	16416	915	563	PCC 2.6.749.0	Phantom 749		
Miro LC310	8001	ph-lc310-42	-	16416	916	563	PCC 2.6.749.0	Phantom 749		
Miro LC110	8002	ph-lc110-42	-	16416	916	563	PCC 2.6.749.0	Phantom 749		
Miro LC120	8012	ph-lc120-42	-	16416	915	563	PCC 2.6.749.0	Phantom 749		
Miro LC320s	8021	ph-lc320S-42	-	16416	917	563	PCC 2.6.749.0	Phantom 749		
Miro R310	8001	ph-r310-42	-	16416	916	563	PCC 2.6.749.0	Phantom 749		
Miro R110	8002	ph-r110-42	-	16416	916	563	PCC 2.6.749.0	Phantom 749		
Miro R120	8012	ph-r120-42	-	16416	915	563	PCC 2.6.749.0	Phantom 749		
Miro R320S	8021	ph-r320S-42	-	16416	917	563	PCC 2.6.749.0	Phantom 749		
Miro LAB3a10	8013	ph-lab3a10-51	-	16568	915	563	PCC 2.7.756.0	Phantom 756		
Miro LAB320	8011	ph-lab320-51	-	16568	915	563	PCC 2.7.756.0	Phantom 756		
Miro LAB340	8031	ph-lab340-51	-	16568	915	563	PCC 2.7.756.0	Phantom 756		
Miro LAB310	8001	ph-lab310-51	-	16568	915636	563	PCC 2.7.756.0	Phantom 756		
Miro LAB110	8002	ph-lab110-51	-	16568	916	563	PCC 2.7.756.0	Phantom 756		
Miro LAB120	8012	ph-lab120-51	-	16568	915	563	PCC 2.7.756.0	Phantom 756		
Miro LAB140	8032	ph-lab140-51	-	16568	915	563	PCC 2.7.756.0	Phantom 756		
Miro C210	2001	ph-c210-47	-	16717	736	254	PCC 2.6.749.0	Phantom 749		
Miro C210J	2001	ph-c210j-47	-	16717	736	254	PCC 2.6.749.0	Phantom 749		

Miro eX4	84	-	797	-	1246	1578	PCC 2.6.749.0	Phantom 749		
CineStation	-	-	781	-	50179	16140	PCC 2.6.749.0	Phantom 749		
CineStation IV	-	ph-csiv-53	-	167360 191	155	563	PCC 2.7.756.0	Phantom 756		

10.2 Discontinued Cameras

The minimum firmware required, for discontinued camera models, (firmware is fixed however Phantom support for five years), as of 22-SEPT-2015 Rev.A, is:

CAMERA	DESIGNATOR	PHFW	FIRMWARE		FPG A (PH.B IN)	KERNE	RELEASED PCC SOFTWARE	RELEASED LEGACY SOFTWARE	DISCONTINUED DATE	OBSOLET DATE
			PH7	PH16						
v12.1	120		756		5962 40	16140	PCC 1.3.697.0	Phantom 697	07-Sep-2011	07-Sep-2016
v10	10		725		3430 58	16053	PCC 2.14.727.0	Phantom 727	31-Dec-2012	31-Dec-2017
v9.1	91		725		3430 58	16053	PCC 2.14.727.0	Phantom 727	31-Dec-2012	31-Dec-2017
Miro eX1	81		670		1246	1578	PCC 1.3.697.0	Phantom 697	14-Nov-2011	14-Nov-2016
Miro eX2	82		797		1246	1578	PCC 2.6.749.0	Phantom 749	18-Feb-2015	17-Feb-2020
Miro 3 (800x600)	83		797		1110	1578	PCC 2.6.749.0	Phantom 749	10-Jul-2015	10-Jul-2020
Miro 3 (512x512)	83		543		1068	916	PCC 2.6.749.0	Phantom 749	10-Jul-2015	10-Jul-2020
Miro AO	84		797		1246	1578	PCC 2.6.749.0	Phantom 749	10-Jul-2015	10-Jul-2020
Miro HD 512M Nand	802		797		1141	1578	PCC 2.6.749.0	Phantom 749	10-Jul-2015	10-Jul-2020
Miro HD 1Gig Nand	802		797		1141	1578	PCC 2.6.749.0	Phantom 749	10-Jul-2015	10-Jul-2020
v211	120		797		5962 55	16140	PCC 2.6.749.0	Phantom 749	04-Apr-2014	04-Apr-2019
v311	120		797		5962 55	16140	PCC 2.6.749.0	Phantom 749	14-Apr-2014	14-Apr-2019
v210	126		761		5962 40	16140	PCC 1.3.697.0	Phantom 697	07-Sep-2011	07-Sep-2016
v310	125		761		5962 40	16140	PCC 1.3.697.0	Phantom 697	07-Sep-2011	07-Sep-2016

v640	120		760	3902 53	16140	PCC 1.3.697.0	Phantom 697	07-Sep-2011	07-Sep-2016
v710	122		756	5962 40	16140	PCC 1.3.697.0	Phantom 697	07-Sep-2011	07-Sep-2016
v1210	16001	ph-v12 10-32		139 85	5805 55	563	PCC 2.5.744.0	Phantom 744	31-Dec-2014
v1610	16001	ph-v16 10-32		139 85	5805 55	563	PCC 2.5.744.0	Phantom 744	31-Dec-2014
v2010	16001	ph-v20 10-32		139 85	5805 55	563	PCC 2.5.744.0	Phantom 744	31-Dec-2014
v7.3	73		730	7406 2	16053	PCC 2.5.744.0	Phantom 744	14-Aug-2014	14-Aug-2019
HD	660		763	8570 66	16092	PCC 2.0.723.0	Phantom 723	31-Dec-2011	31-Dec-2016
HD Gold	660		797	8570 66	16092	PCC 2.6.749.0	Phantom 749	31-Dec-2011	31-Dec-2016
P65	650		797	8690 84	16092	PCC 2.6.749.0	Phantom 749	15-Apr-2013	14-Apr-2018

10.3 Obsolete Cameras

The minimum firmware required, for obsolete camera models, (no more development, firmware is fixed), as of 22-SEPT-2015 Rev.A, is:

CAMERA	DESIGNATOR	FIRMWARE		FPGA (PH.BIN)	KERNEL	RELEASED PCC SOFTWARE	RELEASED LEGACY SOFTWARE	DISCONTIN ED DATE	OBSOLETE DATE
		PH7	PH16						
v4.0	4	-		-	-		-		18-Jun-2010
v4.1	4	-		-	-		Phantom 607		18-Jun-2010
v4.2	42	502		6749	757		Phantom 663		31-Mar-2011
v4.3	43	502		6749	757		Phantom 663		31-Mar-2011
v5.0	5	-		-	-		Phantom 607		18-Jun-2010
v5.1	50	502		14842	757		Phantom 663		20-Feb-2013
v5.2	52	655		343058	16503		Phantom 675.2		22-Aug-2014
v6.1	6	-		-	-		Phantom 607		23-Oct-2010
v6.2	62	322		23836	757		Phantom 663		23-Oct-2010
v6.2	62	322		24844	757		Phantom 663		23-Oct-2010
v7.0g	7	381		6749	757		Phantom 663		26-May-2010
v7.1	71	381		6758	757		Phantom 663		26-May-2012

v7.2	72	486		47549	757		Phantom 663		26-May-2012
v9.0	9	381 b		34842	757		Phantom 663		27-May-2012
v12.0 (8G and 16G)	120	567		47805	275		Phantom v663		30-Dec-2011
v12.0 32G	120	567		47805	275		Phantom 663		30-Dec-2011
Miro 1	81	670		1246	1578	PCC 1.3.697.0	Phantom 697		09-Feb-2015
Miro 2	82	670		1246	1578	PCC 1.3.697.0	Phantom 697		09-Feb-2015
Miro 4	84	670		1246	1578	PCC 1.3.697.0	Phantom 697		09-Feb-2015
Image3/v7. 2	n/a	313		11095	-		Phantom 663		25-Jan-2013
Image3/v9. 0	39	354		11093	-		Phantom 663		25-Jan-2013
Image3.v7. 3	39	437		V73.101 00	-		Phantom 675.2		25-Jan-2013
Image3/v9. 1	n/a	437		v10.101 00	-		Phantom 675.2		25-Jan-2013
Image3/v1 0	31	437		v10.101 00	-		Phantom 675.2		25-Jan-2013

10.4 Peripherals

The minimum firmware required for these peripherals that are currently in production, as of 26 -SEPT-2014 Rev.A, is:

Current

PERIPHERAL	FIRMWARE			DISCONTINUED DATE	OBSOLETE DATE
ABOB	2.0.0				
RCU-2	5.5				
V-Series Canon Mounts	5.69				
Miro M L-Data	5.69				
V-Shutter	3.05				
Flex4K Fcon	5.69				
Flex4K Canon Mount	5.69				

Discontinued

PERIPHERAL	FIRMWARE			DISCONTINUED DATE	OBSOLETE DATE
RCU-1	5.5				

Part



XI

11 Other Help Files

Prior to PCC 2.7 Help, all Phantom camera related Help files were included as part of the PCC Help file. Any information previously incorporated in PCC Help is still available in its appropriate Help file.

The Help files can be accessed, and opened as a separate file, using any one of the methods below:

1. Select the appropriate Help file from the 'Help' button pull-down selection list.
2. Click 'Help' button in the associated application.

Following are the links and a brief description of the accessible Help files:

- Camera Repair and Firmware Upgrade (Nucleus) - Help (accessed in application)

The Camera Repair and Firmware Upgrade (Nucleus) application allows the end user to, in one simple operation, load firmware FPGA, (Field Programmable Gate Array), Flash FPGA, Cinemag, and Kernel firmware. It allows the end user to load firmware files into the selected visible camera, or in a camera which responds to a ping command, by introducing its IP address and a value for camera version.

The Camera Repair and Firmware Upgrade (Nucleus) can also be used to restore camera's settings, and assign a secondary IP Address to a Phantom camera.

- Phantom MultiCam - Help (accessed in application)

The Phantom MultiCam application is a data sheet utility that allows for the controlling of connected Phantom cameras and their corresponding Cine files. It is a utility which allows the end-user to manage one or more cameras by viewing and editing parameters for recording or viewing Cine files to and from the cameras integrated memory. It is mainly focused on handling acquisition and set up camera parameters with straightforward image feedback.

The Phantom MultiCam can be run as an independent software application aiming to offer easy control over connected cameras and their corresponding Cine files.

- Phantom Video Player - Help (accessed in application)

The Phantom Video Player (PVP) application can be used to control a Phantom camera and/or Phantom CineStations' video output parameters. It can also be used to capture, review, edit, and/or save a Cine recorded into the cameras' RAM to a hard drive, or attached Phantom CineMag. To view live preview images or review the recorded Cine images, PVP will require the use of the video output, (TV monitor/Viewfinder), of the Phantom camera or Phantom CineStation.

- Camera Hardware - Help (accessed via PCC Help Toolbar pull-down selection list), including:

- Accessories, Peripherals, and Miscellaneous Features
- Phantom CineMag - Help
- Phantom CineFlash - Help
- Back Focus Adjustments
- Connectors, On-Camera Control, and Indicators

- Phantom Cine Control Panel - Help (accessed via PCC Help Toolbar pull-down selection list)

The Phantom Cine Control Panel utility can be used to simultaneously play multiple Cine files opened via the New View button in the Phantom Camera Control, ViewCine dialogue window. It allows the end user to view multiple saved Cine files that were captured from multiple cameras, networked together, recording the same event from different camera angles.

- Phantom Remote Control Unit - Help (accessed via PCC Help Toolbar pull-down selection list)

The Phantom Remote Control Unit is a small, lightweight, handheld controller, that doubles as a monitor, allowing the end-user to control most of the setting for a variety of Phantom camera.

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