














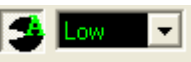
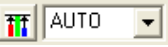
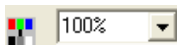

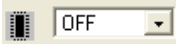




NAC Image Technology Inc  
**Hot Shot SC**

User Manual  
V 1.1(a)

Jan 2009

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# 1 Camera Hardware

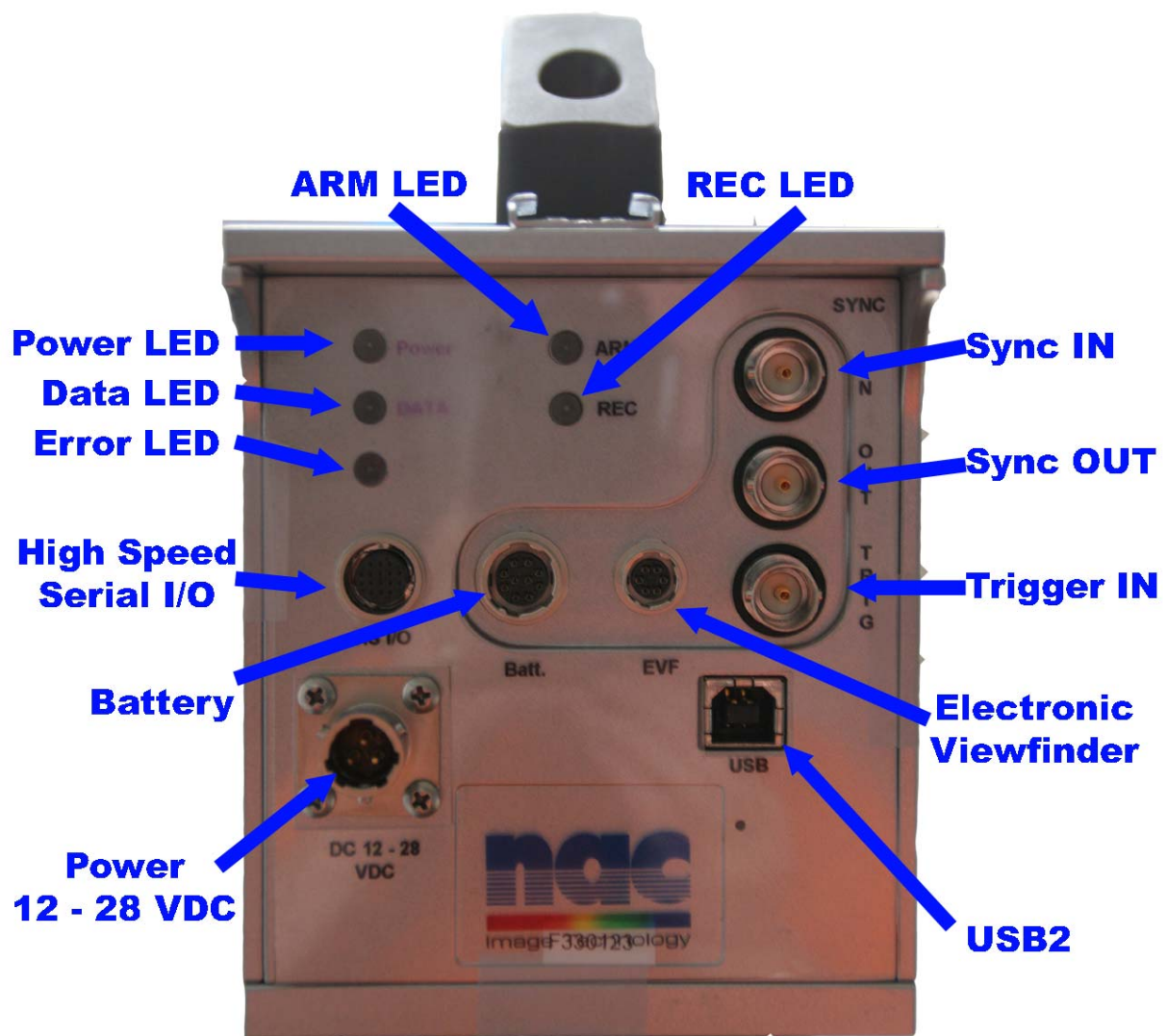
## 1.1 Compatibility

This manual and the HSSCLink software are compatible with the following cameras :

- HotShot 512 SC
- HotShot Mega SC

Any other cameras not listed are not supported.

## 1.2 Rear Panel



### 1.2.1 LED Indicators

The Rear Panel has five (5) LED indicators

- POWER LED – Indicated that the camera has Power. After camera boot up this should be solid Green.
- DATA LED – Indicates when Data is being transferred between the camera and the control PC. Lights Blue during Data Transfer
- STATUS LED – TBD
- ARM LED – Will light RED when the camera is in ARM Mode and recording into the memory loop
- REC LED – Will light ORANGE when the camera has received a trigger and is completing recording

### 1.2.2 BNC Connectors

There are Three BNC connectors on the rear panel of the camera

- SYNC IN – Used to slave the camera to an external Sync Pulse. Also can be used as a “Hardware ARM” input.
- SYNC OUT – Used to Master the camera for external equipment. Will provide a 5v TTL pulse High OR Low (user selectable) during each frame EXPOSURE
- TRIGGER IN – Used to trigger the camera. Can be a contact Closure OR a 5v **FALLING EDGE or RISING EDGE** TTL Pulse

### 1.2.3 Other Connectors

- USB – Connects to the control PC **USB2** socket via USB cable.
- POWER – Provides power to the camera from the supplied power supply. Input requirement is 12 – 28V DC.
- BATTERY – Connector for Battery Power – TBD
- EVF – Electronic Viewfinder. Provides NTSC video plus power to the external Viewfinder.
- HSIO – High Speed Input Output. Used for multi Channel wave inserter (MCWI) see chapter 6.

## 1.3 The Electronic View Finder

The EVF will ALWAYS show a live camera image. It can be used for initial setup of the camera view. A live image is also available on the PC via the Control Software (see later). The EVF live image is ALWAYS in monochrome regardless of the actual camera sensor (colour OR mono).

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## 4 Initial Setup, Software & Driver Installation

**IMPORTANT READ THIS COMPLETELY PRIOR TO INSTALLING SOFTWARE OR OPERATING THE CAMERA**

To install the software you should run the install program provided with the camera. The installer ALSO installs the drivers for the camera. So you should install the software BEFORE you make a connection to the camera. This way the camera will “plug and play”.

If you have an earlier version of the software installed you MUST un-install this software FIRST. You MUST do this *WITHOUT* a connection to a camera.

### 4.1 Un-installing Software

If you have previous version of HotShot SC Link installed you first un-install this. You can do this via the Windows Un-Install feature OR run the un-installer directly.

To run the uninstaller directly either :

- 1) Choose Un-Install from START|PROGRAMS|NAC|HOTSHOT SC {where available}

OR

- 2) Run “c:\program files\nac\hotshot sc\unwise.exe”

After un-install you should reboot the PC

### 4.2 Installing Software

The Installation CD should Auto-Run. If it does not then find the install program on the software CD supplied {HSSC Link Install x.x.x.x.EXE – the x will relate to the version number of the software}.

Follow the installation dialogs.

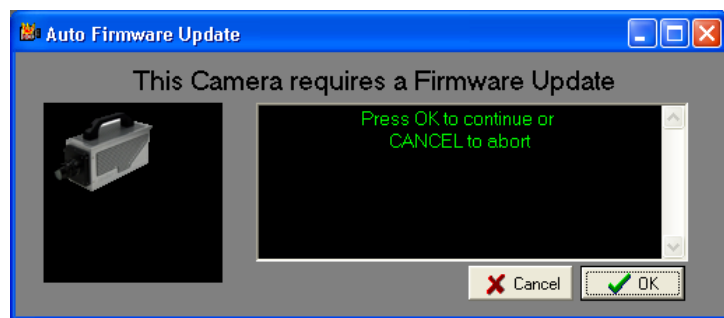
### 4.3 The **FIRST CONNECTION** to the CAMERA

The software and Hardware is configured such that the camera FIRMWARE version must match the SOFTWARE Version. During the First Time connection to the camera the Firmware version will be checked and will AUTOMATICALLY be upgraded.

**\*\*\* If you have Multiple Cameras you MUST connect only one at a time in the first instance in order for the FIRMWARE upgrade to be successful \*\*\***

The FIRMWARE upgrade is a two part process, the first Upgrades the cameras firmware and the second modified the Cameras Flash Memory (EEPROM).

If you see the Dialog right when you first connect to the camera then please refer to Chapter 6 of this manual ***immediately***.



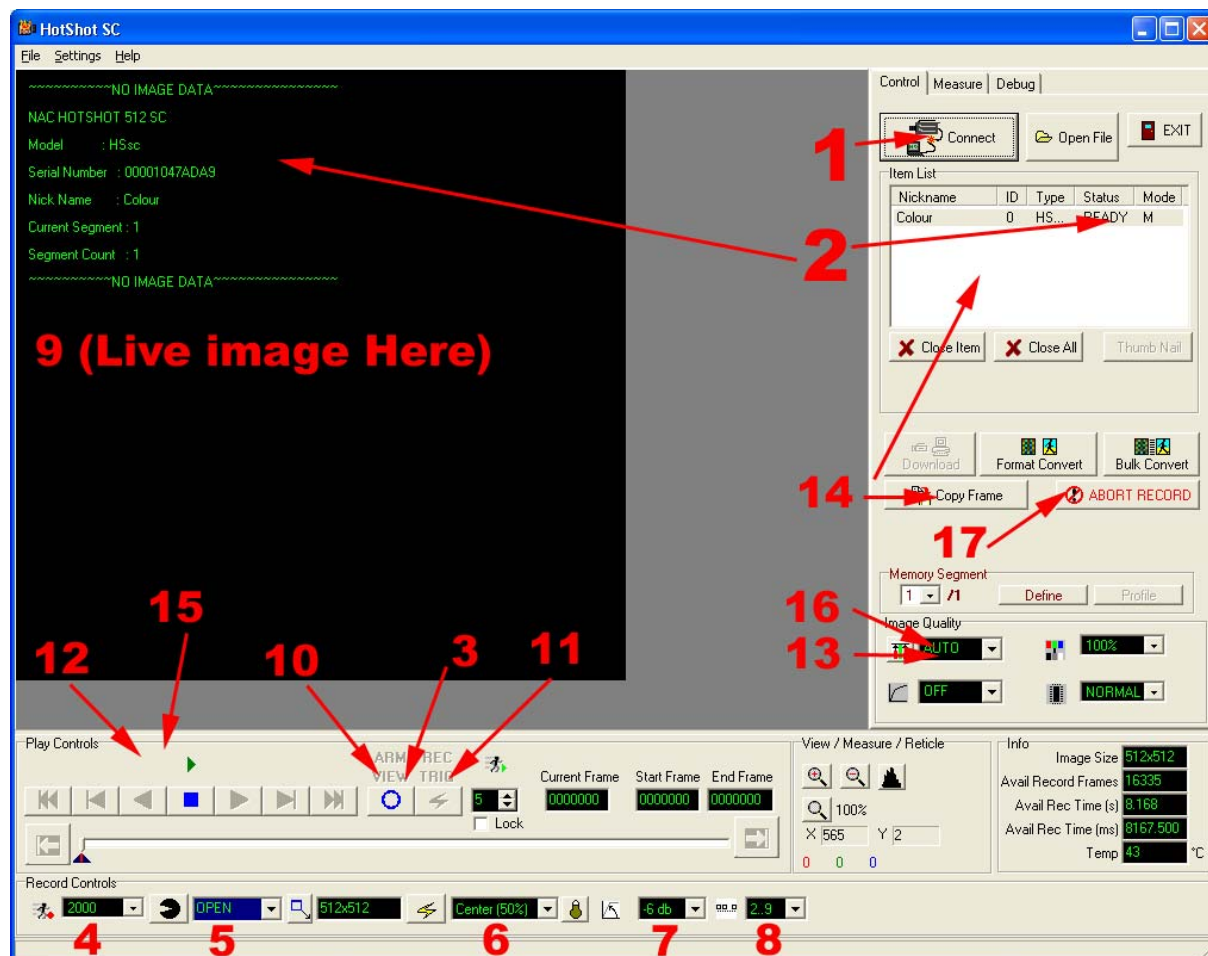
## **5 Control & Download Software : HotShot SC Link**

The software can be accessed from the following location :

START | Programs | NAC | HotShot SC | HotShot SC Link

A shortcut is also placed on the Windows Desktop.

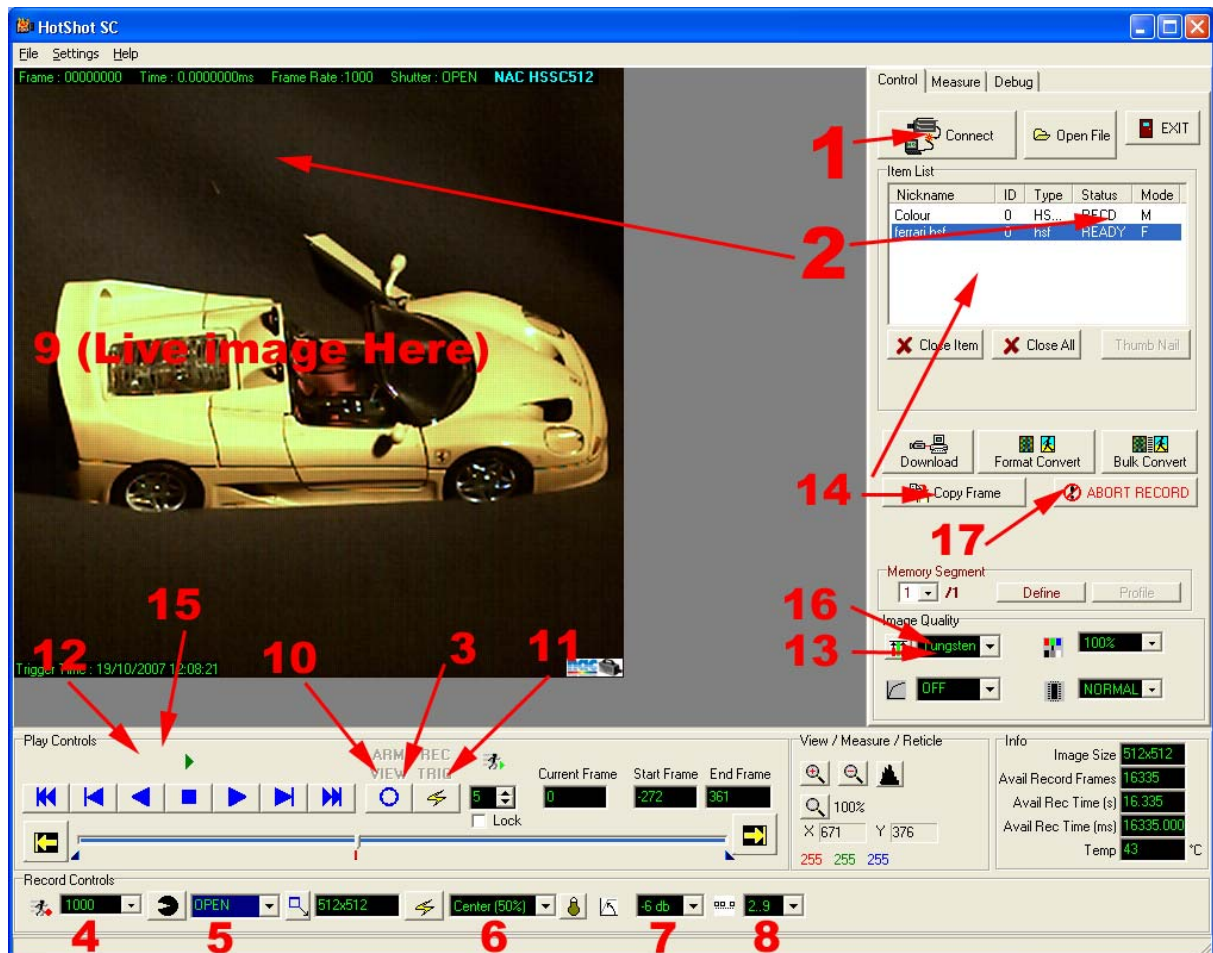
## 5.1 Quick Start Guide



Make Sure the camera is connected to the PC via the USB cable and has been powered up. The power light on the camera will show green.

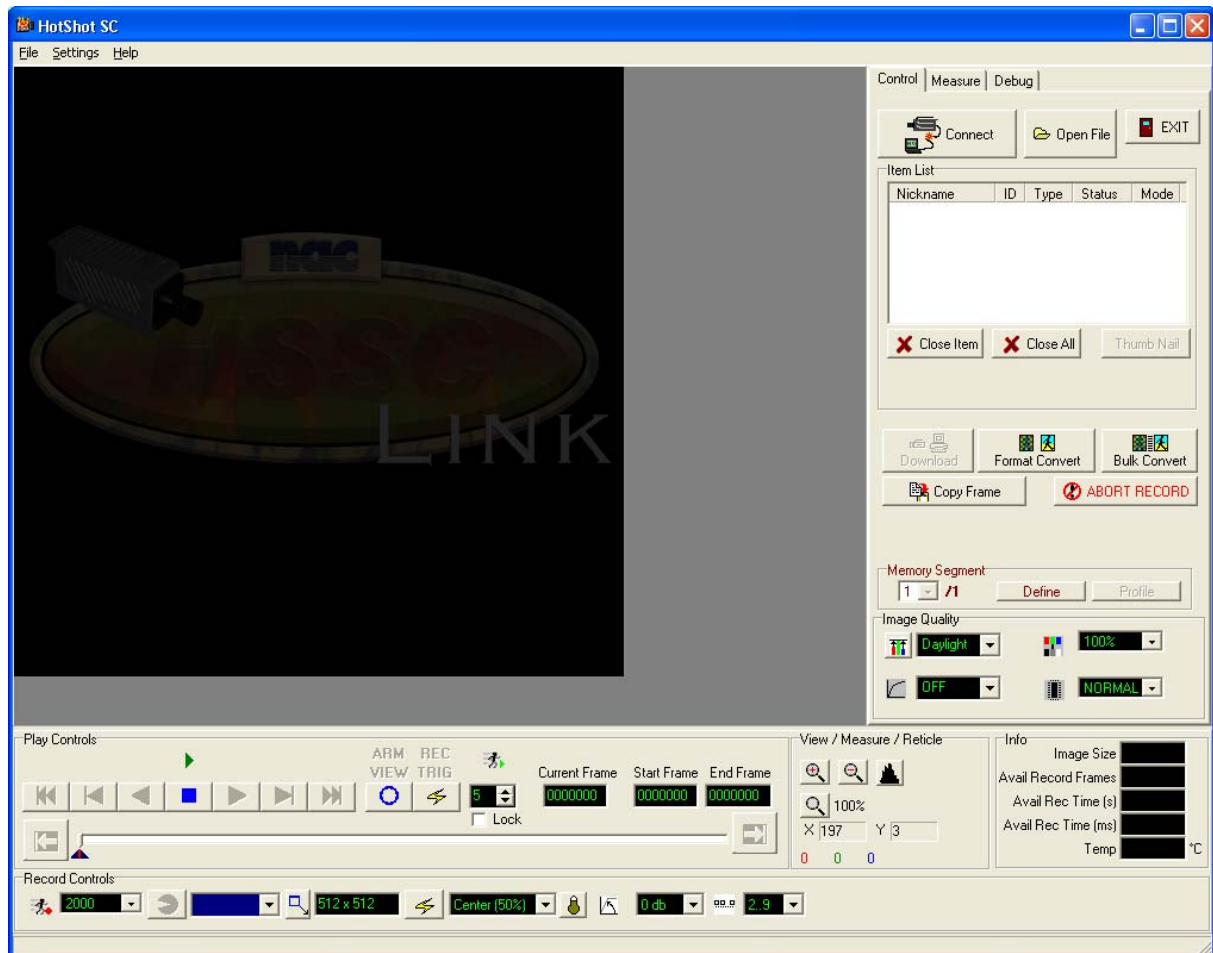
- 1) Click the **CONNECT** button.
- 2) WAIT for connection. You will see camera info appear in the image area when completed and the camera **STATUS** will show **READY** in the Item List.
- 3) Push the **VIEW** button (Now in VIEW MODE)
- 4) Select the required recording **FPS**
- 5) Select the required **Shutter** Speed (exposure)
- 6) Select the required **Trigger** Mode
- 7) Select the required **GAIN**
- 8) Select the required **DIGITAL SHIFT**
- 9) Set up the required Shot to be recorded
- 10) Push the **VIEW/ARM** Button (Now in ARM Mode)
- 11) Trigger a recording (use the Hardware Trigger OR the **TRIGGER** button)
- 12) Review the Images on the camera with the **PLAY CONTROLS**
- 13) Adjust the **IMAGE QUALITY** if required
- 14) Push the **DOWNLOAD** Button to Download the RAW data. The Raw Data File will Open in the Main Window

- 15) Review the Images in the file with the **PLAY CONTROLS**
- 16) Adjust the **IMAGE QUALITY** if required
- 17) Push the **FORMAT CONVERT** Button to save as AVI
- 18) Finished!



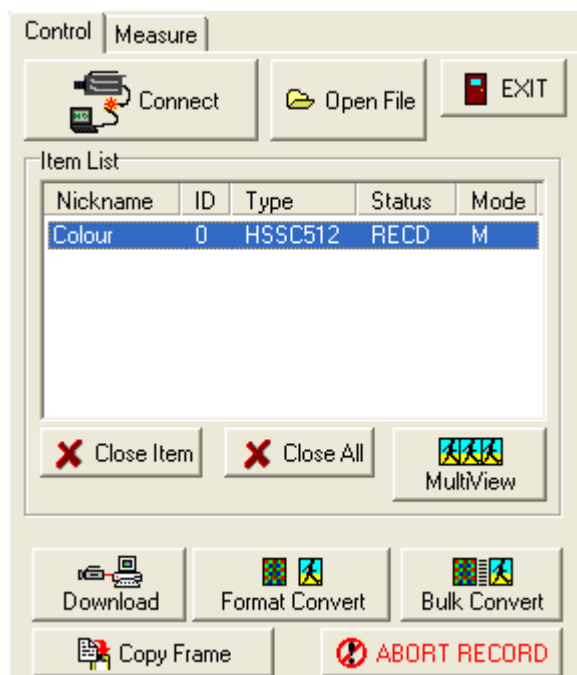
## 5.2 The Main Window












When the software starts it will look like the screen shot below :



The Screen is divided up into a number of areas.

## 5.3 Control Area



Use this ...		To do this...
 Connect	<b>Connect</b>	Connect to a Camera
 Open File	<b>Open File</b>	Open a File. The file can be a RAW camera File (.hsf) or an AVI File (.avi)
 Close Item	<b>Close Item</b>	Close the connection to the selected camera OR close the selected File
 Close All	<b>Close All</b>	Close ALL camera and Files in the Item List
 MultiView	<b>MultiView</b>	TOGGLE Display All Open Files & Connected Cameras as Thumbnail Windows
 Download	<b>Download</b>	Download the images from the Current Camera. The images will be stored in a RAW format (.hsf)
 Format Convert	<b>Format Convert</b>	Convert the images from the current <i>item</i> to an AVI or image file format. The <i>item</i> can be a Camera <b>OR</b> a File.
 Bulk Convert	<b>Bulk Convert</b>	Convert Multiple Files to and AVI or Image Format via the Bulk Convert Utility
 Copy Frame	<b>Copy Frame</b>	Copies the Currently Displayed Frame to the Windows Clipboard
 ABORT RECORD	<b>Abort</b>	Abort a Recording Operation
 EXIT	<b>EXIT</b>	Close All Open files AND Cameras and Exit the software

### 5.3.1 Connect

This will search the USB ports for a connected camera. If a camera is found then it will be added to the Item List. If the camera has NO recording then it will be set in **READY** status. This will be shown in the Item List.

Item List				
Nickname	ID	Type	Status	Mode
Colour	0	HSSC512	RECD	M

If the camera has a recording in Memory then the Status will show **RECD**. In this case the Playback tools will be enabled.

### 5.3.2 Open File

This will allow you to browse for a file to open. Currently you may open the following file formats :

Extension	Type
.hsf	HotShot RAW data File
.AVI	Windows AVI File
.tif	Tiff File
.jpg	Jpeg File
.bmp	Windows Bitmap File

Where an image file is selected, the software will search for an image sequence based on incremental numbering of the filename.

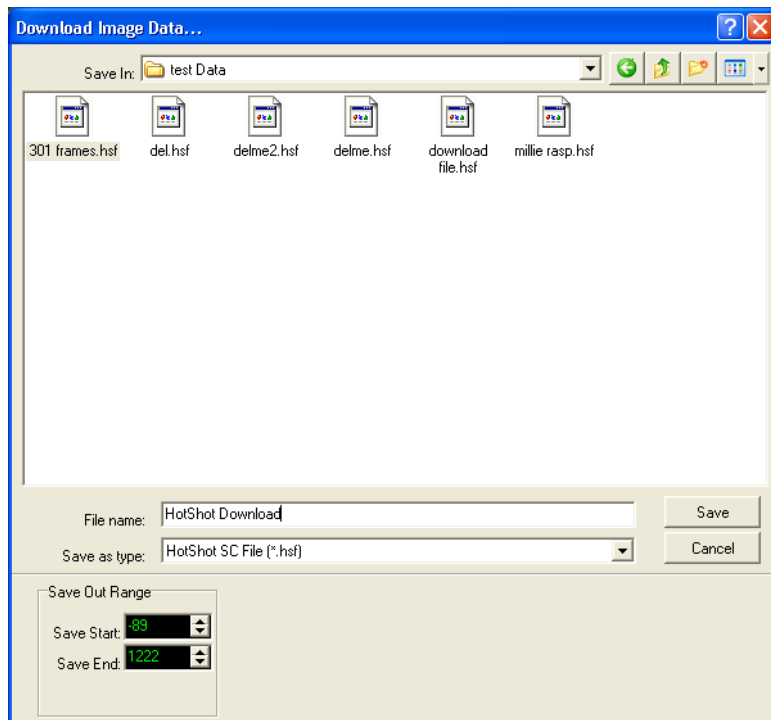
### 5.3.3 Close

Close the current camera OR File selected in the Item List.

### 5.3.4 Download

Use this to download images from the camera memory to the computer. If a camera is selected this will bring up the Download Dialog. By default the Download Range is as is set by the **Mark In** and **Mark Out** in the Play Controls.





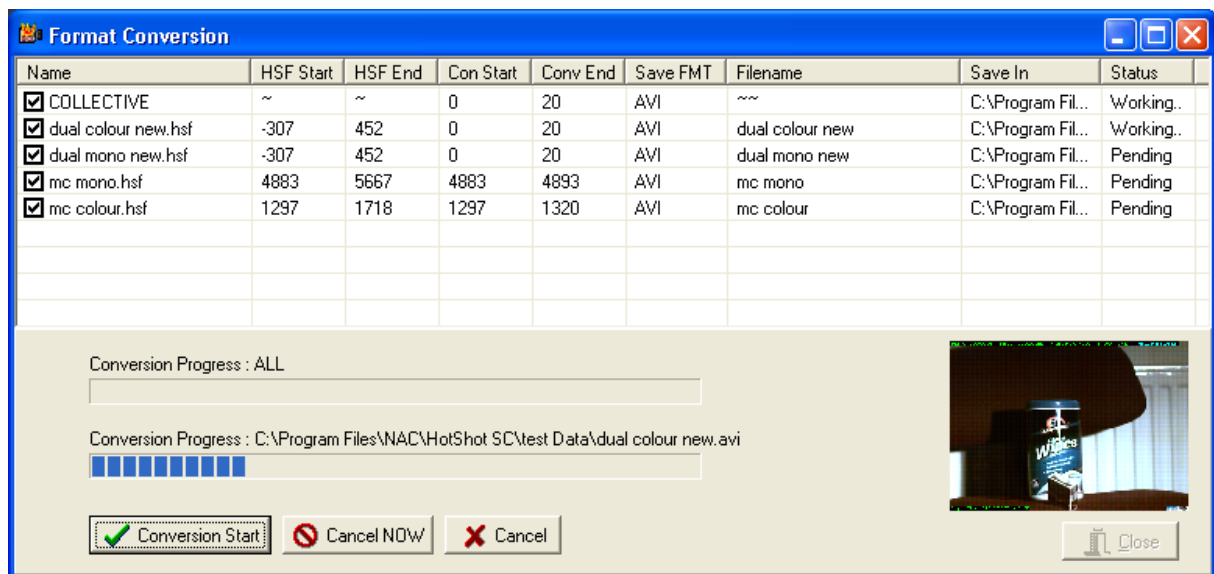
You can adjust the download range using the Spin Controllers in the **Save Out Range** area.

### 5.3.5 Format Convert

Use this to convert RAW data to standard Image Files. You can use this to convert a RAW (.hsf) file OR to download and convert directly from the camera. If this is done directly from the camera then a *raw* (.hsf) file is NOT created. The Convert DIRECTLY from the camera will take LONGER to perform than a RAW data Download. It is recommended that RAW data is downloaded and then converted.

### 5.3.6 Bulk Convert

Where Multiple RAW (.hsf) files need converting to image files, this can be done via the Bulk Convert Option. This will bring up the dialog shown below :



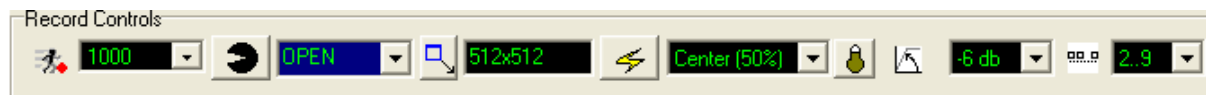
Before starting the Bulk Conversion you can modify the parameter of the output files as follows :

Conversion Start  
 Conversion End  
 Format  
 Filename  
 Save Folder

To modify the parameter for an individual item, click the parameter in the table.  
 To modify the parameter for ALL items in the table, click the parameter in the COLLECTIVE entry in the table, this is the FIRST Row in the table.

## 5.4 Record Controls

The Record Controls become active ONLY when the current camera is in **VIEW** Mode. Use the Record Controls to specify the record parameters.



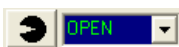
Use this ...	To do this...	
	<b>FPS</b>	Specify the recording Frames Per Second
	<b>Shutter</b>	Specify the recording Shutter Time (Exposure Time).
	<b>AOI</b>	Set the AREA of Interest
	<b>Trigger</b>	Specify the position of the trigger in the recorded images
	<b>Low Light</b>	Toggle Low Light Mode
	<b>Gain</b>	Specify the Gain Setting
	<b>Digital Shift</b>	Specify the Digital Shift Setting
	<b>Auto Exposure</b>	Set the Auto Exposure Control

### 5.4.1 Recording FPS



The available recording Frames (pictures) per second are given on the Selection Combo. To change the recording FPS select the required value from the Combo. If a reduced image size is required for the selected FPS this will be automatically adjusted.

### 5.4.2 Shutter



The shutter time (or exposure time) is set using this Selection Combo. The Shutter time is specified in fractions of seconds. e.g., 1/2000.

When the FPS is changed the available options for the Shutter are modified to reflect the FPS.

An OPEN Shutter is equivalent to 1/FPS. This is the Maximum exposure allowed.

A Custom Exposure time, specified in  $\mu$ s can be specified by selecting **CUSTOM** from the Combo OR by clicking the Icon

This will bring up the Custom Shutter Dialog as shown below :

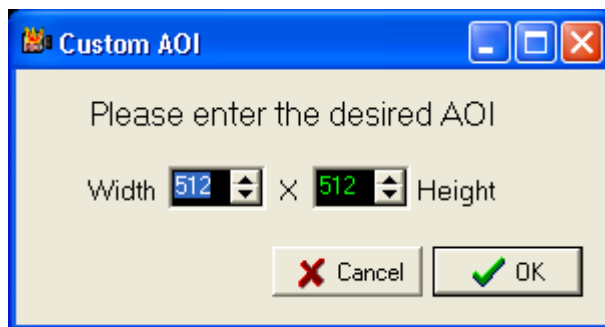


### 5.4.3 AOI 512x512 {Area of Interest}

When the FPS is modified the default AOI (maximum allowed) is set for the selected FPS. By reducing the AOI you can increase the available record time. To set a Custom AOI push the Button next the the AOI indicator.



You will see the AOI selection screen as below :



You can enter the desired AOI by changing the value for width and height.

### Special Considerations & Limitations

The AOI must conform to the following restrictions :

- 1) Width (W) must be a multiple of 8
- 2) Height (H) must be a multiple of 8
- 3) Total area (pixels) i.e., W x H must be a multiple of 1024

The software will AUTOMATICALLY adjust your input to meet these criteria. To meet Criteria 3 it will adjust the width or height that you are NOT currently specifying. For Example, if you change the width to a value that does not meet criteria 3 then the **HEIGHT** will be automatically adjusted to meet this criteria.

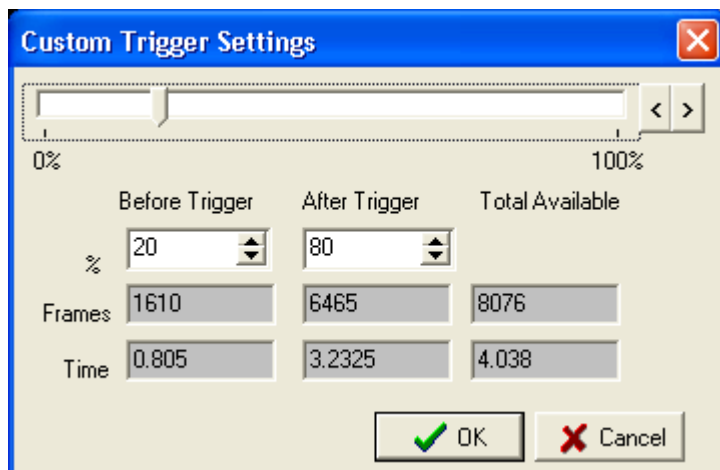
### 5.4.4 Trigger Center (50%)

The Trigger Position is set using the Trigger Selection Combo. The Options available are **START**, **CENTRE**, **END** and **CUSTOM**. **See section for an explanation of how the triggering operates.**

A **START** trigger allows a 5% pre-trigger.

An **END** trigger allows a 5% post-trigger.

For a **TRUE START** or **END** trigger use the **CUSTOM** option. Select **CUSTOM** from the Selection Combo OR Click the icon.



From this dialog you can select a precise trigger location, either as a percentage of memory OR as a number of frames.

#### 5.4.5 Low Light Mode

Where a lot of illumination is needed for the recording (usually HIGH FPS or Shutter) , it is not always convenient to have the light available for setting up the recording (focus, field of View etc). In these cases you can turn on LOW LIGHT MODE by pressing this toggle button. With low light mode ON, the camera will operate at a lower FPS and shutter for the purpose of setting up the shot. The Low Light Mode will be automatically disabled when the camera is put into ARM mode.

The Effective FPS in LOW LIGHT MODE is specified in the camera preferences in software Settings (see ).

NOTE : If you choose a low light mode < 500fps, then the View Finder Image will NOT be available.

#### 5.4.6 Gain

This sets the gain on the camera sensor. A higher gain will increase light sensitivity **BUT** will also introduce noise into the image.

The Gain settings available are :

0dB  
3dB  
6dB  
12dB

The ideal setting is 0dB. This gives the minimum amount of noise. Values of 3, 6 and 12 dB Will compensate for inadequate lighting BUT will suffer from noise.

### 5.4.7 Digital Shift

(camera dependant)

Some HSSC camera types will only store 8 bits of image data regardless of the sensor Bit Depth. For cameras where this is the case, the **bit significance** of the 8 bits can be specified. Adjusting the Digital Shift is another method of adjusting the light sensitivity, separate from the GAIN function above.

### 5.4.8 Auto Exposure Control

Auto Exposure Control will automatically adjust the exposure time (shutter Speed) to give a correctly exposed image. This is particularly useful when recording outside where clouds might affect the light levels in an unknown manner.

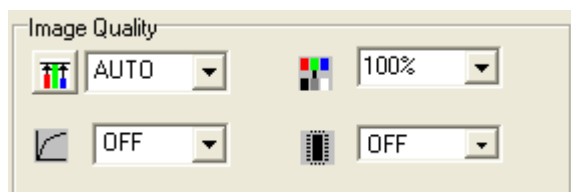
To Switch Auto Exposure Mode ON click the Button. 





You can select from three PRESET exposure levels (LOW , MEDIUM and HIGH). Low will give the darkest image and High will give the lightest image. The exposure level is calculated on the center 80% of the current AOI of the camera.

The Auto Exposure setting will NEVER exceed the user specified Exposure (Shutter) value.

There will be some latency in the changes to exposure. To minimize this latency when using a colour camera, in particular a colour HotShot MEGA camera, it is recommended that you make use of the SPEED BOOST function (see 5.7.1).

## 5.5 Image Quality Controls



Use this ...		To do this...
 AUTO	<b>White Balance</b>	Select the White Balance
 100%	<b>Chroma</b>	Select the Chroma (Colour) level
 OFF	<b>Gamma</b>	Select the Gamma level
 OFF	<b>Enhance</b>	Select the Enhance level


The Image Quality controls can be applies to image data still in the camera OR to RAW data files.

### 5.5.1 White Balance

The White Balance will adjust the White Point of the Image depending on the lighting used. The options available are :

OFF  
TUNGSTEN  
DAYLIGHT  
FLOURESCENT  
AUTO  
USER DEFINED

Selecting AUTO will do an AUTO White Balance on the **CURRENT FRAME**.

To define the White Point, select USER Defined. Then click the White Balance Button . Click a White Point in the image to set the White Balance. The system will continue to modify the White Point as the image is clicked until the White Balance Button is Depressed (click it again!).

When Using AUTO mode, the camera will calculate the AUTO White Balance Level on the Current Frame or the FIRST Frame if a live image (VIEW MODE). If this first frame is not correctly illuminated it might be necessary to reselect AUTO in order to recalculate the AUTO Levels.

### 5.6 Chroma

Use the Chroma Combo to select the level of colour in the image. The level can range from 0% (monochrome) to 200% (colour boost). The default value is 100%.

#### 5.6.1 Gamma

Use the Gamma setting to adjust the GAMMA curve of the image. Increasing the GAMMA will brighten up the dark (shadows) areas in the image without affecting the bright areas.

Gamma Settings available are :

OFF  
LOW  
NORMAL

#### 5.6.2 Enhance

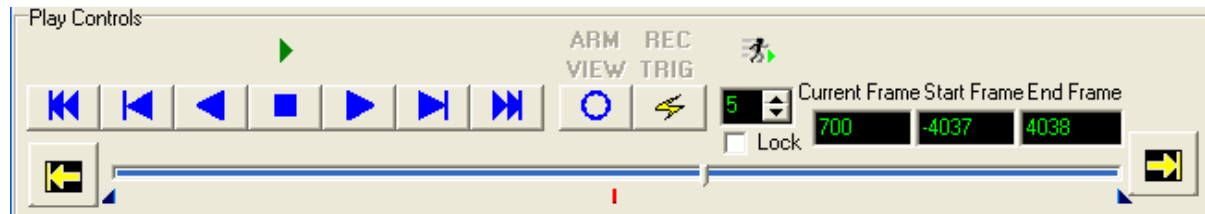
The Enhance Option will perform an Edge Enhance image processing function on the image. Enhance Settings available are :

OFF; LOW; NORMAL; HIGH



## 5.7 Play Controls

The play controls are used to control image playback either on the camera OR from a File.



Use this ...		To do this...
	<b>Rewind</b>	Go to Start Frame OR Mark In Frame
	<b>Step Back</b>	Step ONE frame Backwards
	<b>Play Backwards</b>	Play the images backwards
	<b>Loop Backwards</b>	Loop Playback Backwards (push button 2x)
	<b>STOP</b>	<ul style="list-style-type: none"> <li>• Stop Playback / Loop Playback</li> <li>• Abort Recording</li> <li>• Exit View Mode</li> </ul>
	<b>Play Forwards</b>	Play the images forwards
	<b>Loop Forwards</b>	Loop Playback Forwards (push button 2x)
	<b>Step Forwards</b>	Step ONE Frame Forwards
	<b>Fast Forward</b>	Go to the End frame OR the Mark Out Frame
	<b>VIEW ARM</b>	<ul style="list-style-type: none"> <li>• Go To VIEW Mode (if READY)</li> <li>• Go to ARM Mode (if VIEW)</li> </ul>
	<b>TRIGGER</b>	<ul style="list-style-type: none"> <li>• Software Trigger the Camera (if ARMED)</li> <li>• Go to Trigger Frame</li> </ul>
	<b>Play Back Speed</b>	Select the Requested Play Back Speed
<input type="checkbox"/> Lock	<b>LOCK</b>	Lock the Play Back Speed
	<b>Mark IN</b>	Mark the current frame as the Start Frame. This mark is used for : <ul style="list-style-type: none"> <li>• Loop Playback</li> <li>• Rewind Command</li> <li>• Setting the Download / Format Conversion Range</li> </ul>
	<b>Mark Out</b>	Mark the current frame as the End Frame. This mark is used for : <ul style="list-style-type: none"> <li>• Loop Playback</li> <li>• Rewind Command</li> <li>• Setting the Download / Format Conversion Range</li> </ul>
	<b>SPEED BOOST</b>	Speed up the processing and display of colour images

### 5.7.1 Speed Boost

The Speed boost is especially useful when working with a HotShotMEGA colour camera. Rather than process the entire image as normal, with the speed boost on, the software “BINS” squares of four pixels together. While this leads to a slightly pixilated image, it increases the speed of the image display dramatically. The Speed Boost image is only the displayed image, the full quality image is always available by turning off the speed boost.

It is recommended to use the speed boost when using the Auto Trigger and Auto Exposure functions. It is also useful to use when setting up a shot with the HSMega Colour camera.

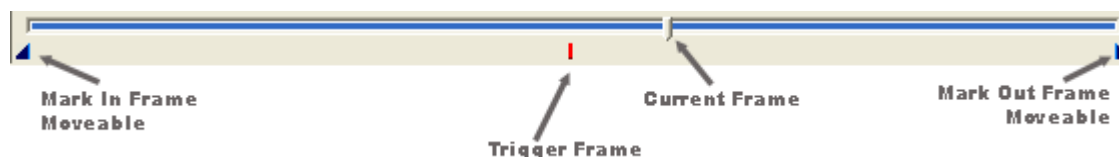
### 5.7.2 Loop Playback

Loop playback will repeat play the images within the selected range. The range is defined by the **Mark In** and **Mark Out** Buttons.

### 5.7.3 Play Back Speed

The Play Back Speed setting is used to request a playback speed for the images. The software will attempt to match this speed. However, the actual speed will depend on the source of the images (e.g., camera or file) the size of the images, the image processing required and the speed of the host PC. If the speed cannot be matched then the system will play back at the fastest possible. Selecting the LOCK option will force the system to maintain the requested playback speed, even if this means “skipping” frames during the playback operation.

### 5.7.4 The Scroll Bar



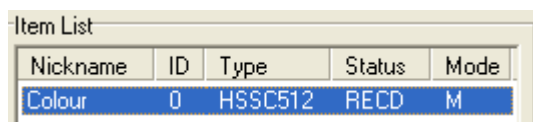
The Scroll bar indicates the frames available on the camera or in the file. The mark **IN** and **OUT** frames are shown by the triangles as indicated above. These triangles CAN be dragged to adjust the mark **IN** and **Out** Frames. The current frame is indicated by the Slider. This can be dragged to change the current frame. The Trigger frame is indicated by the RED mark.

## 5.8 Synchronization Modes

Synchronisation Mode of the connected camera/s is initially determined by the Default Sync Modes as defined in the Software Preferences. (See 5.16.1).

## 5.8.1 Sync In

The Sync In mode of the camera determines how the signal input to the Sync In BNC Connector (see 1.2.2) is interpreted. The Sync In mode is also displayed in the “MODE” column of the Item List.

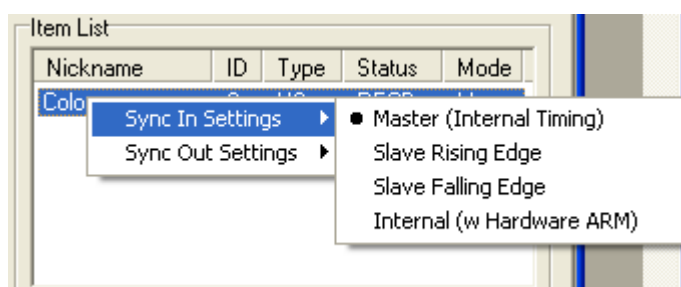


Nickname	ID	Type	Status	Mode
Colour	0	HSSC512	RECD	M

There are FOUR possible States for the Sync In.

- MASTER (Internal Timing) “M”
- SLAVE Rising Edge “SR”
- SLAVE Falling Edge “SF”
- Internal (with Hardware Arm) “MA”

To change the Sync In Mode of a specific camera you should select the camera in the item list and RIGHT CLICK to show a pop up menu.



Use this ...	To do this...
<b>MASTER (Internal Timing)</b>	Ignore the Sync In Signal and use an internal clock to determine the Frame Timing
<b>SLAVE Rising Edge</b>	Frame at each rising Edge of the Signal
<b>SLAVE Falling Edge</b>	Frame at each falling Edge of the Signal
<b>Internal (Harware Arm)</b>	Use an internal clock to determine the Frame Timing BUT Set the Camera to ARM MODE if this input goes HIGH

## 5.8.2 Sync Out

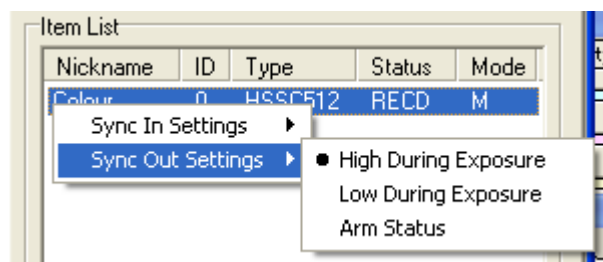
The Sync OUT mode of the camera determines how the signal input to the Sync OUT BNC Connector (see 1.2.2) is interpreted.

There are THREE possible States for the Sync OUT.

- HIGH During Exposure
- LOW During Exposure

- ARM STATUS

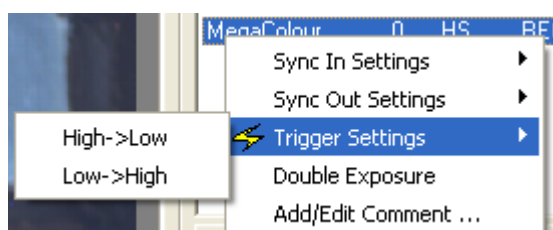
To change the Sync OUT Mode of a specific camera you should select the camera in the item list and RIGHT CLICK to show a pop up menu.



Use this ...	To do this...
<b>HIGH During Exposure</b>	Set the Sync Out signal to be HIGH (5v) when the camera is Exposing a frame and LOW (0v) at all other time
<b>LOW During Exposure</b>	Set the Sync Out signal to be LOW (0v) when the camera is Exposing a frame and HIGH (5v) at all other time
<b>ARM Status</b>	Set the Sync Out signal to be HIGH (5v) when the camera is in ARM status

## 5.9 Trigger Setting

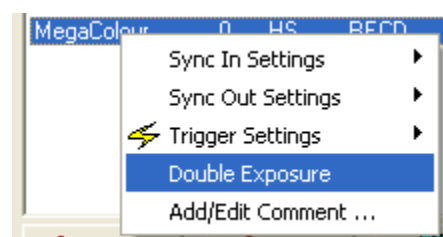
You can define the TTL state used to trigger the camera via the Trigger BNC connector.



For a Make Switch you should use HIGH to LOW, which is the default setting.

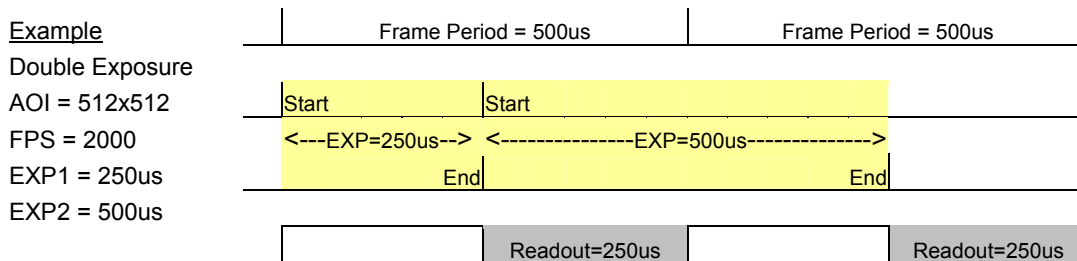
## 5.10 Double Exposure Mode

The HotShot SC Cameras can operate a Double Exposure Mode. In this mode the camera will take pictures in "pairs" with the inter frame time between the pairs being very SMALL. This is particularly useful for Particle image velocimetry (PIV) applications. To Enable / Disable Double Exposure Mode right click



the camera in the item list and click Double Exposure. If Double Exposure is ON then a TICK will be displayed next to the menu item.

In Double Exposure mode, the first image is exposed with for the time specified by the exposure setting. The second image is exposed for the duration of the specified Frame Period. The Time period between the two exposures is < 15 nano seconds. The operation is illustrated below :



When Double Exposure Mode is used you can see a 'DX' indicator in the Frame Annotation next to the Shutter Speed indication.

Frame : 00000000 Time : 0.0000000ms Frame Rate :500 Shutter : 1/1000 DX NAC HSMegaSC

## 5.11 Comments

You can assign a comment to a camera by selecting the ADD/EDIT Comment Menu. This comment will be displayed in the Frame Information superimposed on the image.

## 5.12 Memory Segmentation

The available memory in the HotShot camera can be split into up to EIGHT segments. Each segment can be recorded separately. Each segment can have different recording parameters.



### 5.12.1 Defining Segments

To initialize the memory segments push the Define Button whilst in **READY** mode. WARNING : THIS WILL DESTROY ANY EXISTING RECORDINGS IN MEMORY.

Select the desired number of segments. The camera memory will be divided equally between the selected number of memory segments.

The “default setting” for each of these segments will be the current settings. This includes FPS, Exposure/Shutter, Gain, Digital Shift. It does not currently include a custom AOI.

To change the current segment use the selection Drop Down.

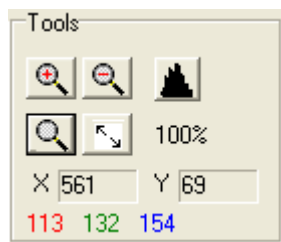
### **5.12.2      Auto-ReArm**

If the Auto ReArm is checked then after a segment is recorded the system will advance to the next segment and Re-Arm the camera in that segment. This process will continue until All segments are recorded OR the next segment is ALREADY recorded.






### **5.12.3      Allow Overwrite**

If Allow Overwrite is Checked then the Auto RE-Arm function will REARM in the next segment EVEN IF that segment has a recording in it. In this case the existing recording will be lost.

## 5.13 View / reticle Controls



Use these tools to “drill Down” into the image.

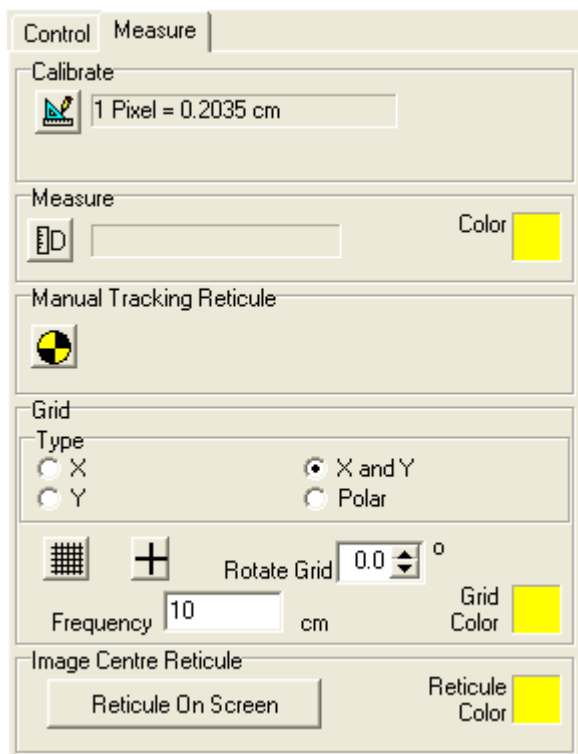
Use this ...	To do this...
	<b>Zoom In</b> Zoom in to the image by 10% (each Click)
	<b>Zoom Out</b> Zoom out of the image by 10% (each Click)
	<b>Reset Zoom</b> Reset the Zoom to 100% (No Zoom)
	<b>Fit to Screen</b> Zoom the image to fit the screen
	<b>Histogram</b> Show the Image Histogram (see 5.16.5 )

The X and Y indicate the image co-ordinate of the Mouse Pointer


The Coloured Number Values indicate the Red, Green and Blue levels of the Pixel under the mouse pointer.

## 5.14 Measure Tools

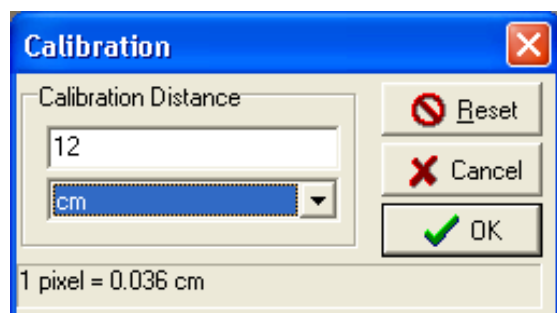
HotShot SC Link is equipped with some basic measurement tools.



### 5.14.1 Calibration

To calibrate an image, in order to get a “pixels per unit” value Click the [calibrate](#) button .

You should then click on two known points in the image in turn. After the second point has been specified you will be presented with a calibration dialog as below :



Enter the know distance between the two calibration points together with the units of measurement.


To reset the calibration back to “1 pixel = 1 Pixel” click the [Reset](#) Button.



To cancel the calibration click **Cancel**.

To accept the calibration click **OK**.

### 5.14.2 Measure Distance

To make a distance measurement in the image press down the **Measure** Button . Now **Click and Drag** in the image. The length of the dragged line is displayed next the the measure button. The units of measurement will be the same as the calibration units. You can keep making measurements unit you click the **Measure** Button Again.

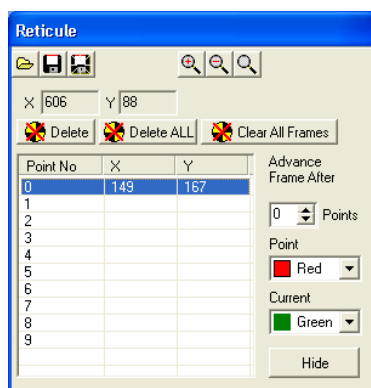
The **measure** button is a TOGGLE button.









### 5.14.3 Manual Tracking Reticule



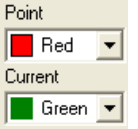
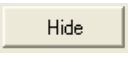

The Manual Tracking tool will allow you to manually track up to ten (10) points in the image. The results are stored in an CSV file that can easily be opened in a spreadsheet application.

To begin manual tracking click the Manual Tracking Button

A floating window will appear as shown below :



Use this ...		To do this...
	<b>Open File</b>	Open a previously saved Reticule File (WARNING : Will overwrite and current data)
	<b>Save File</b>	Save the Current reticule data to the file
	<b>Save as new File</b>	Save the Current Reticule data to a NEW file
	<b>Zoom In</b>	Zoom in the Image
	<b>Zoom Out</b>	Zoom out the image
	<b>Undo Zoom</b>	Undo the Zoom (return to original size)
	<b>Delete</b> <b>Current</b>	Delete the coordinate data for the current point
	<b>Delete</b> <b>All</b> <b>Point</b>	Delete the current coordinate data for ALL Points
	<b>Data</b>	(on

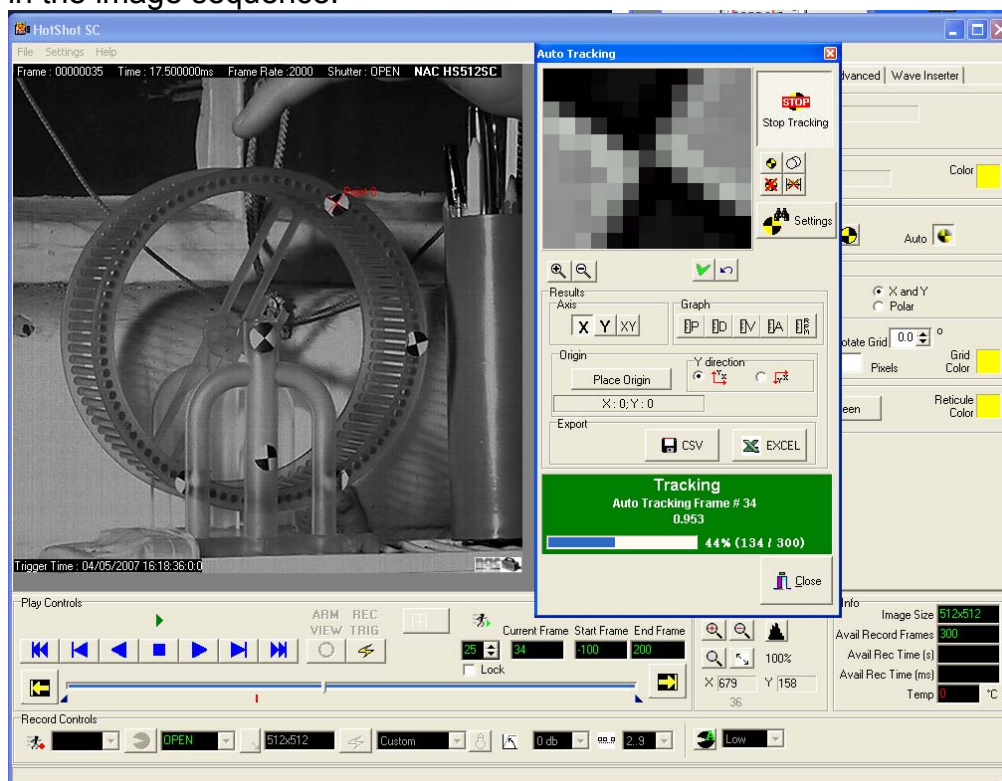
	<b>Delete All Data</b>	this frame) Delete ALL coordinate data for all points on ALL frames
	<b>Auto Advance Frame</b>	Set the Auto Advance point count. The image data will move on ONE frame when this number of point coordinated have been specified.
	<b>Set Point Colour</b>	Set the Display colour of the Points
	<b>Set Selected Point colour</b>	Set the Display colour of the selected point
	<b>Hide Tracking Window</b>	Hide the Reticule window (and stop manual tracking)

### 5.14.3.1 Quick Guide to Manual Tracking

1. Click the Manual Tracking button to open the manual tracking tool window
2. Set the Auto Advance spin edit to the number of points you wish to track
3. Click the points, in the image, in turn
4. The frame advances automatically after the set number of points is positioned
5. When tracking is completed click the Save, or save as button.

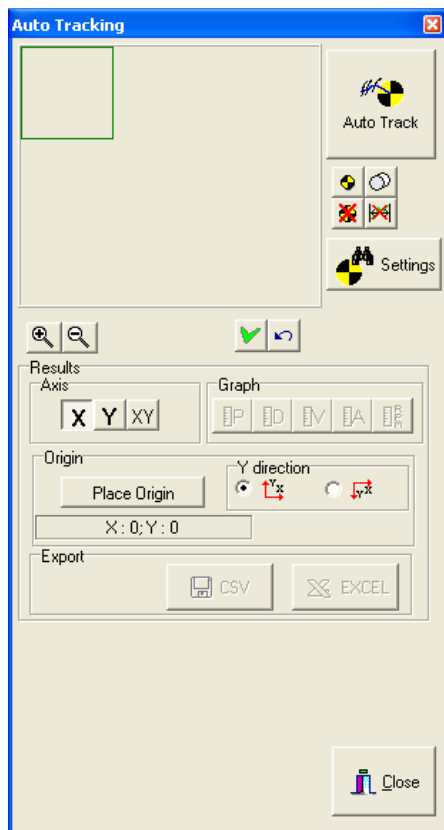
### 5.14.4 Automatic Tracking Reticule

In addition to Manual Tracking, it is possible to AUTOMATICALLY track a *single point* in the image sequence.



To Start Automatic Tracking click the Auto Tracking Button.

You will see the following window appear.



#### Use this ...

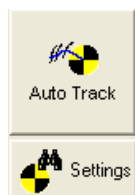


**Quadrant Target**

**Correlation Target**

**Delete Target**

**Delete Tracked Data**



**Begin Tracking**

**Target Settings**

**Zoom In**

**Zoom Out**

**Confirm Point**

**Undo Move Point**

#### To do this...

Define a target as a Quadrant Type

Define a target as a Correlation Type

Delete the current Target

Delete the tracked data for the current target

Start Automatic Tracking

View / Edit the Target Settings

Zoom in on the target Window

Zoom Out of the target Window

Confirm a point (if requested)

Undo a manual Move of a point

### 5.14.4.1 Getting Started with Auto Tracking

Start by deciding which target type you wish to track, either a Quadrant shape or correlation (no specific shape). Click the appropriate button. Then click in the image in the center of the target to be tracked. For a Quadrant shape the software will "auto-center" on the target.

Next check the target settings by clicking the Target Settings Button (see 5.14.4.2). Now click Start tracking. The software will track the target over from the defined frame to the end of the sequence (or until stopped by the user).

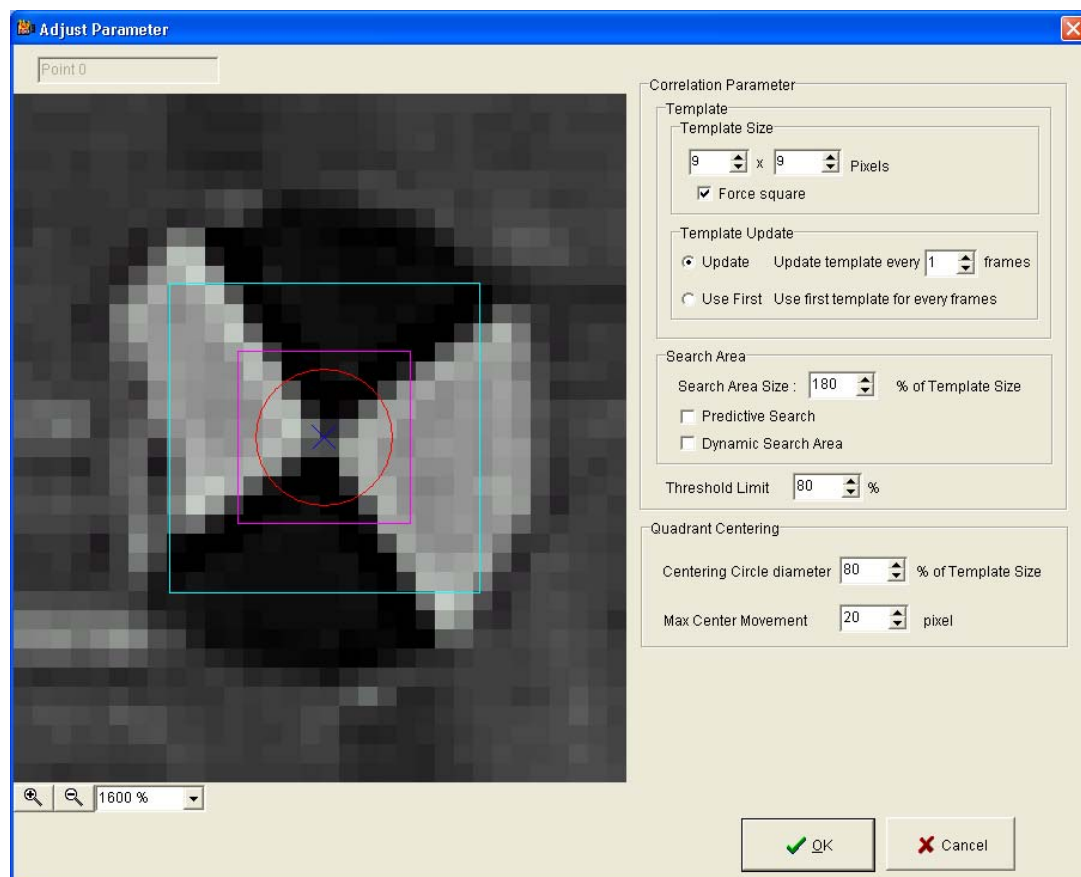
If the target is lost, or the software is unsure of it's location then it will stop and ask for user confirmation. You can confirm the suggested location by clicking the CONFIRM POINT button OR move the target indicator to the correct location and then click the CONFIRM POINT button. If you move the point by mistake you can click the UNDO MOVE button and then click CONFIRM POINT.

Once tracking is completed then you can look at the results

#### 5.14.4.2 Target Settings

The Tracking point parameters form has a different layout depending on what point type is selected. Some of the setting are common while others relate to the target type.

##### For Quadrant Targets



**Figure 1 Point Properties**

#### 5.14.4.2.1 Template Size

The template size is the size of the pixel pattern the software will try to find. A smaller the template size is usually better and faster to track, but it depends on the image and image quality. The template size is show as the PINK square in

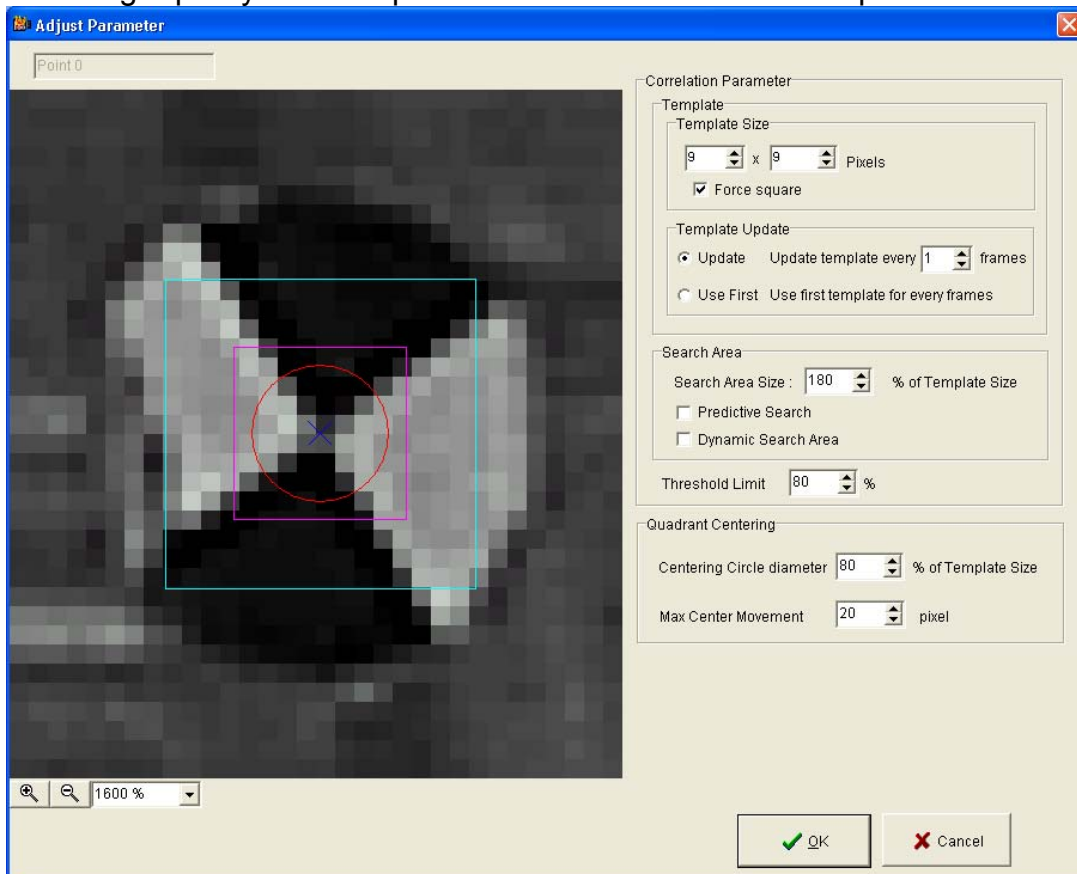


Figure 1.

#### 5.14.4.2.2 Force Square

This check box will force the template to be square

#### 5.14.4.2.3 Template Update

During tracking, the template which the software looks for during the target search process can be updated. The default is that it updates every frame. This means tat in each frame the software will search for the target as it appeared in the previous frame. By doing this, the software can automatically adjust for small changes in the shape or orientation of the target.

In some special cases it may perform better of the template is updated less frequently or not at all. The template update settings allow you to set these parameters.

#### 5.14.4.2.4 Search Area

The search area defines the size of the area in which the software will look for the target. The Size of the search areas should be set in relation to the distance moved

by the target from frame to frame. The search area is shown by the Cyan square in

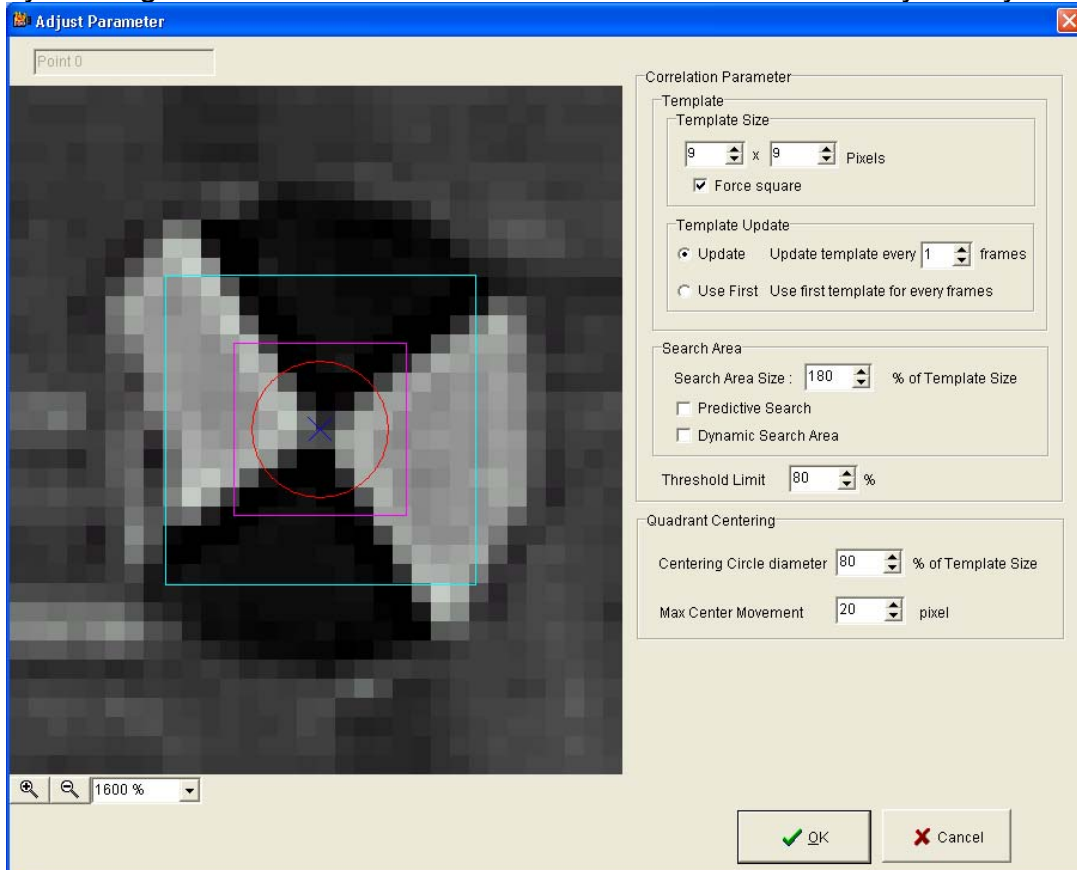


Figure 1. The smaller the search area, the faster the tracking process. If the software consistently fails to find the target then it might be because the search area is too small.

Using **Predictive Search**, the software will first predict the position of the target before setting the Search Area. By default this is activated.

Using **Dynamic Search Area** will allow the software to automatically **decrease** the search area size if it is useful to do so.

#### 5.14.4.2.5 *Threshold Limit*

The Threshold Limit is the measure of “Pattern Match Accuracy”. If during searching the pattern match accuracy drops below this level then the software will request user confirmation. The default is a 90% match. In some cases it may be helpful to reduce this. HOWEVER, the more the reduction, the more likely it will be that the software could start “drifting” in its tracking results.

#### 5.14.4.2.6 *Quadrant Centring*

When tracking a Quadrant Target, the software will perform Auto centering function. It does this by looking for edges around the Quadrant Centre Circle. This is shown as the red circle in

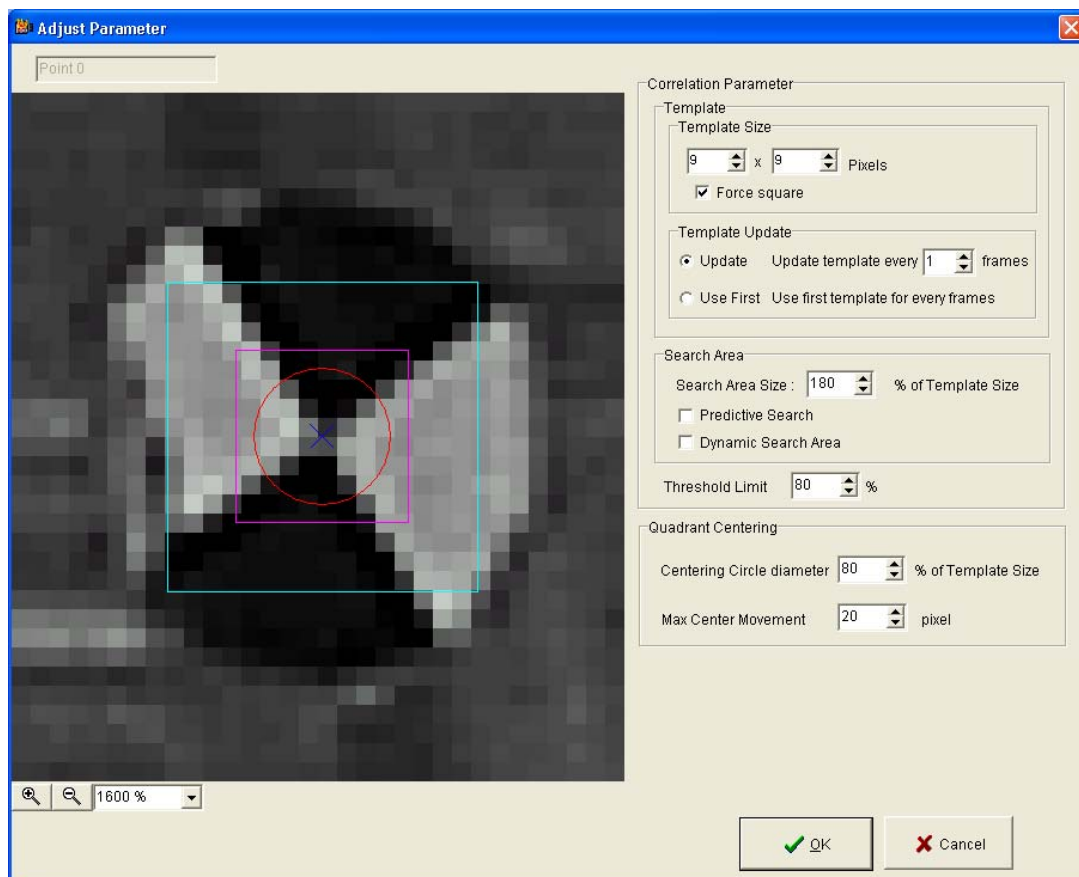


Figure 1.

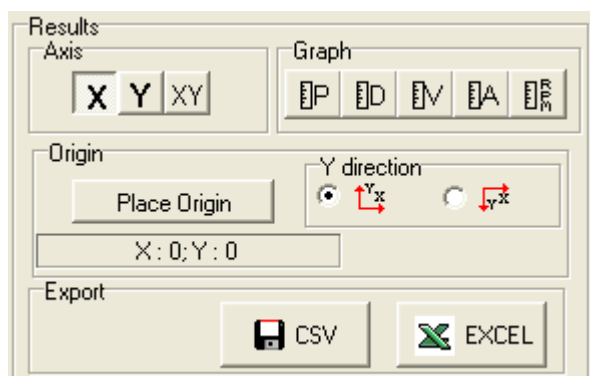
If Auto Centering continually fails you should adjust the diameter of the Quadrant Centering Circle.

As a further check, the software will limit the amount of movement allowed for the Centre of the target (similar to the search area). If the centre moved more than the value in **Max Centre Movement** then the software will stop for user confirmation.

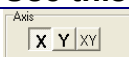
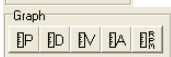





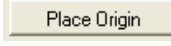
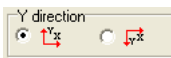
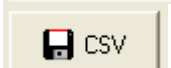
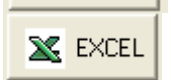
### 5.14.4.3 Tracking Results

Once Auto Tracking is completed you can view the results by making selection in the RESULTS part of the auto tracking screen.

The measurements will be base on the image CALIBRATION if conducted (see 5.14.1), otherwise they will be based on image Pixels.









Use this ...		To do this...
	<b>Select Axis</b>	Select the axis direction to graph
	<b>Graph Results</b>	Draw a graph
	<b>Position</b>	Graph the position of the point from the Origin
	<b>Displacement</b>	Graph the Displacement of the point
	<b>Velocity</b>	Graph the Velocity of the point
	<b>Acceleration</b>	Graph the Acceleration of the point
	<b>RPM</b>	Graph the Revs per minute of the point (where applicable)
	<b>Origin</b>	Place the origin of measurements. Tracked data will be measured from this point. Default is top left or bottom left of the image (depending on the <b>Y Direction</b> )
	<b>AXIS</b>	Select the Y axis direction
	<b>Export to CSV</b>	Export the tracking data to a Coma Separated Data File
	<b>Export To Excel</b>	Start Microsoft Excel and post the data into a worksheet (MS Excel must be installed on the PC)

## 5.14.5 Grid Overlay

You can overlay a grid onto the images. The grid lines can be horizontal, vertical, both horizontal AND vertical, or a Polar Grid.  
The Starting point of the grid, and the grid size and rotation can be defined.

Use this ...		To do this...
<b>Type</b>	<b>X,Y,Y&amp;X,POLAR</b>	Specify the type of grid to overlay onto the image
		Toggle the Grid Display ON and Off
		Specify the "Origin" of the grid
	<b>Rotate Grid</b>	Rotate the grid by the specified Degrees
	<b>Frequency</b>	Specify the frequency of the grid lines. This will be in "calibrated Units" intervals or in Pixels if the image is not calibrated.
	<b>Colour</b>	Specify the colour of the grid lines

## 5.14.6 Image Centre Reticule



This will put a Cross Hair in the center of the image. This can be used to assist in aligning multiple cameras onto the same target object.

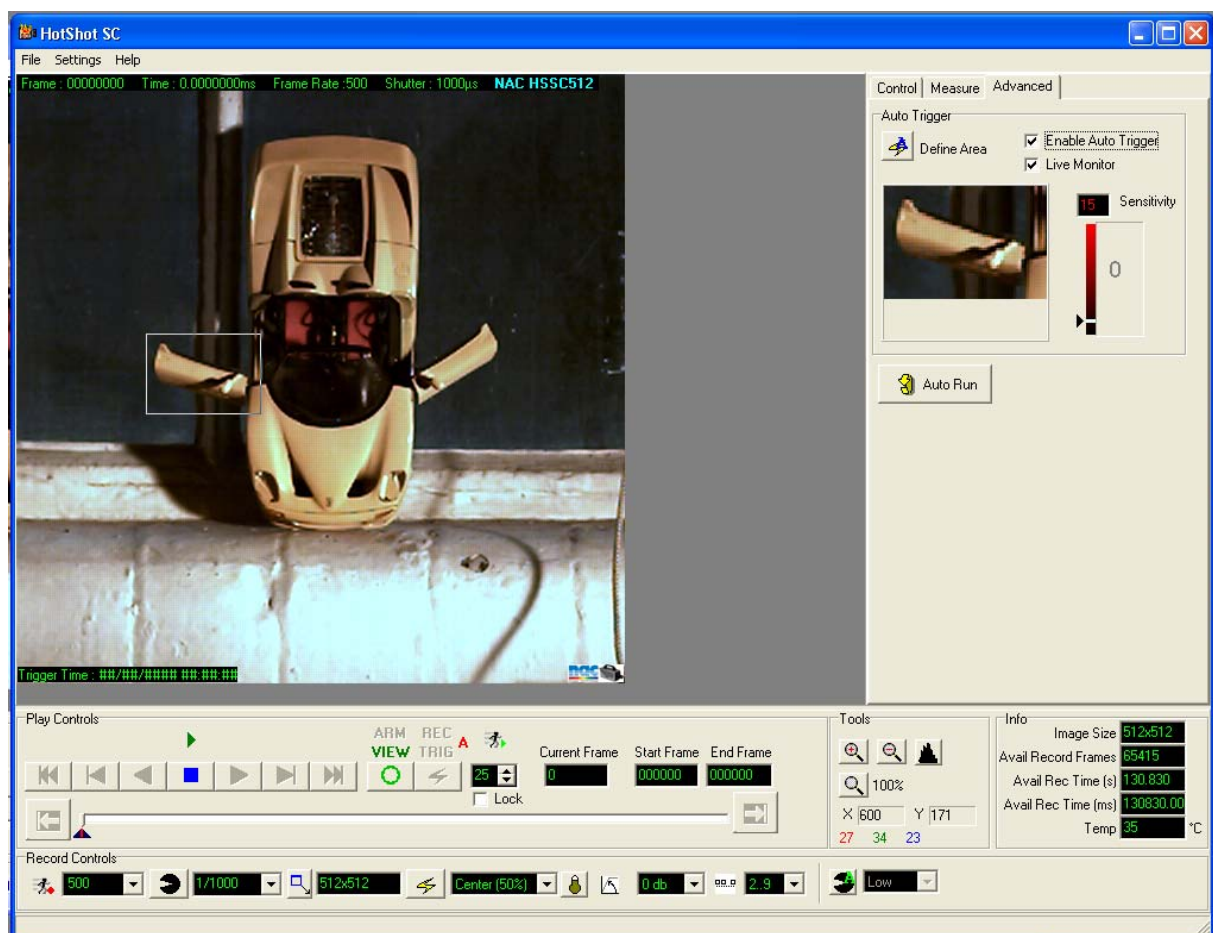
## 5.15 Advanced Tools


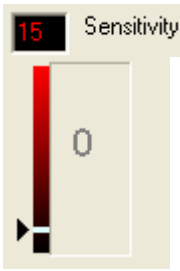
### 5.15.1 Auto Trigger

Auto Trigger allows you to specify a region in the live image from the camera which will be monitored by the software. If this portion of the image changes above a defined threshold level, it will cause the camera to automatically TRIGGER a recording.

**NOTE :** There will be some **latency** between the image change and the trigger command. This tool should be used **ONLY** when an approximate trigger time is required. For an accurate Trigger you should use the trigger IN BNC connection.

To minimize this latency when using a colour camera, in particular a colour HotShot MEGA camera, it is recommended that you make use of the SPEED BOOST function (see 5.7.1).



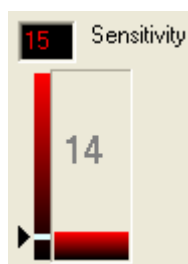
Use this ...		To do this...
	<b>Define Area</b>	Define the area to be monitored by the Auto Trigger Function.
<input checked="" type="checkbox"/> Enable Auto Trigger	<b>Enable Auto Trigger</b>	Activate The Auto Trigger Function
<input checked="" type="checkbox"/> Live Monitor	<b>Live Monitor</b>	Show Live results of the Auto Trigger Threshold
	<b>Sensitivity Threshold</b>	<p>Show the Threshold at which the Trigger Will be Applied</p> <p>Change the Trigger Threshold Level by moving the Arrow up or down</p>

#### 5.15.1.1 Define Area

To Define the Auto Trigger area, depress this button and then drag a rectangle on the Main Image. The Camera should be in VIEW mode when this is done. The selected area will appear in the area below the Define Area Button as shown in the above Screen Shot.

#### 5.15.1.2 Live Monitor

Checking the Live Monitor will allow the current threshold level of the target area to be displayed in the Threshold monitor.



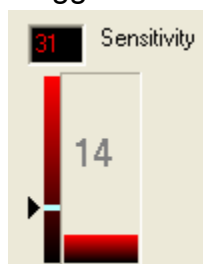
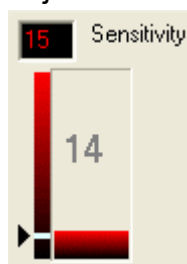
In the example left, the image in the auto trigger area has changed by a nominal value of 14. The threshold (sensitivity) for the Auto Trigger is set to 15. If the image changes slightly more then the camera will trigger.

#### 5.15.1.3 Enable Auto Trigger

This must be checked for the auto trigger to be active. You should check this just prior to putting the camera into ARM Mode.

### 5.15.1.4 Adjusting the Auto Trigger Threshold

The Arrow to the left of the threshold monitor can be moved up and down the bar to adjust the Auto Trigger Threshold.



5.15.2

Auto Run



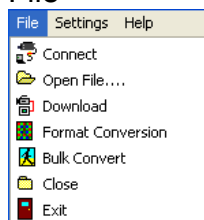
This button will activate / De-Activate the Auto Run function (see section 5.16.2).

## 5.16 Main Menus

File Settings Help

### Use this ...

#### File

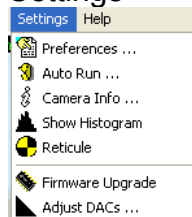


Connect  
Open file  
Download  
Format Conversion  
Bulk Convert  
Close  
Exit

### To do this...

See Control Area for More information  
Connect to a Camera  
Open an Image File  
Download Images From Camera  
Convert RAW data to image files  
Convert Multiple HSF files to Image Files  
Close the current File or Camera  
Quit the Application

#### Settings



Preferences  
Auto Run  
Camera Info  
Show Histogram  
Reticule  
Firmware Upgrade  
Adjust DACs

Define Software & Camera Preferences  
Specify Auto Run Settings  
View Connected Camera Information  
Show the live Image Histogram Window  
Open the Manual Tracking Reticule Window  
Manually update camera Firmware  
**(\*\* CAUTION \*\*)**  
Adjust camera DAC Settings  
**(\*\* CAUTION \*\*)**

#### Help

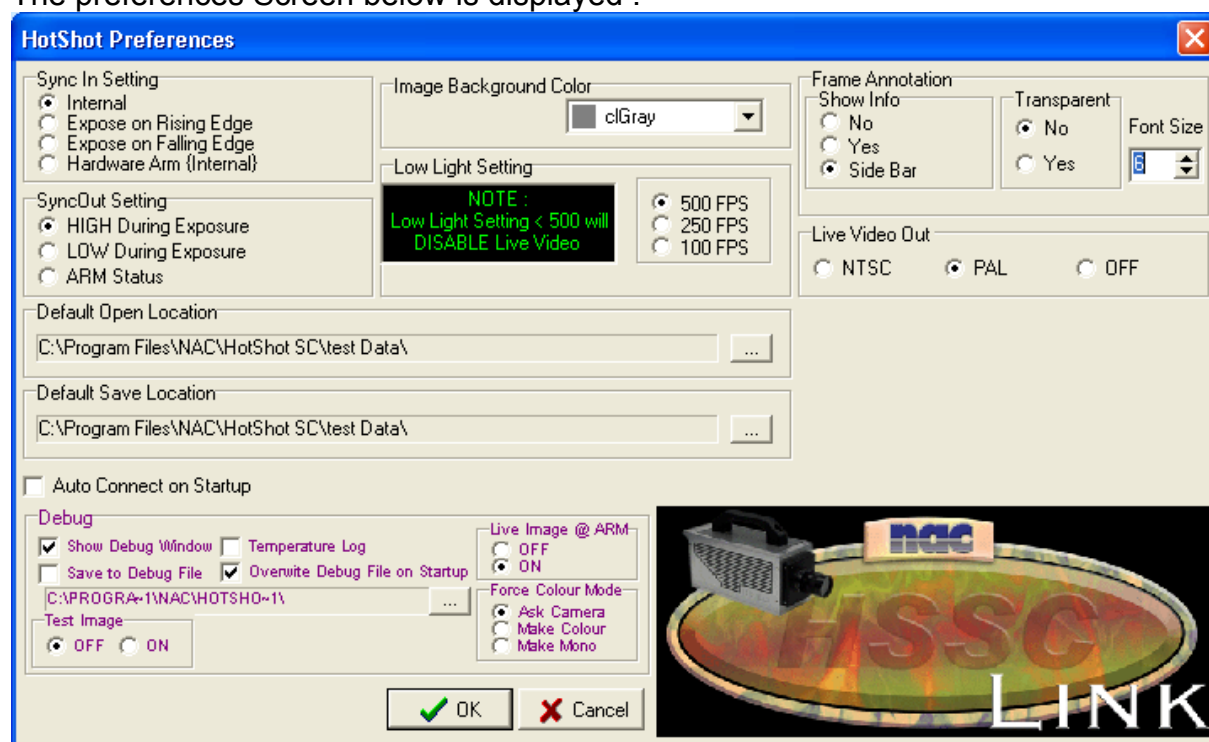


Hot Keys  
User Manual  
About

Show available Hot Key Commands  
Open the Ser Manual  
Show the About Screen

## 5.16.1 Settings | Preferences

The preferences Screen below is displayed :



### 5.16.1.1 Sync In Setting

This sets the DEFAULT Sync In Mode of the camera see 5.8.1

### 5.16.1.2 Sync Out Setting

This sets the DEFAULT Sync In Mode of the camera see 5.8.2

### 5.16.1.3 Image Background Colour

Sets the colour of the window behind the image

### 5.16.1.4 Low Light Setting

Sets the effective Frames Per Second when the camera is put into LOW LIGHT MODE (See 5.4.5). **NOTE : If the setting is less than 500 then the LIVE VIDEO OUT will be disabled in Low Light Mode.**

### 5.16.1.5 Frame Annotation

Specifies how image “meta data” is displayed in the image.

### 5.16.1.6 Live Video Out

Sets the Live Video Out (from EVF connector, see 1.3) mode.

### 5.16.1.7 Default Open Location

Specifies the folder which is first opened when a File Open is requested

### 5.16.1.8 Default Save Location

Specifies the folder which is first opened when a File Save is requested

### 5.16.1.9 Auto Connect on Startup

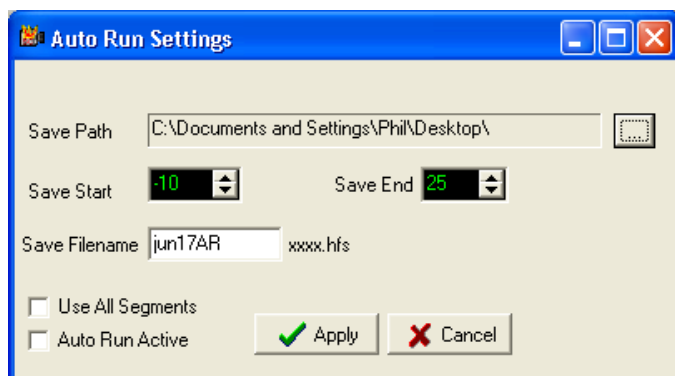
If this is selected then when the software starts it will immediately connect to any available cameras

### 5.16.1.10 Debug

The settings should not be modified unless instructed to do so by a NAC representative.

## 5.16.2 Settings | Auto Run




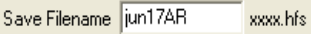
This menu takes you to the Auto Run Setup Screen  
You can use AUTO Run to put the camera into Semi Automatic Operation.



In Auto Run Mode, after the camera recording is finished it will automatically download the specified number of frames and then Re-ARM the camera ready for a subsequent recording. The Auto Run will continue until it is interrupted by the user (Press STOP key in ARM Mode) OR there

is no longer sufficient storage space for the download.

**NOTE :** AUTO RUN can be **COMBINED** with Auto Segment Increments such that the Auto Run Download will begin AFTER the last segment has been recorded. In this case ALL segments can be downloaded (check all segments check box) one after the other.

Use this ...		To do this...
	<b>Save Path</b>	Specify the Path to save the files to
Save Start 	<b>Save Start</b>	Specify the Start Frame to save from
Save End 	<b>Save End</b>	Specify the End Frame to Save To
Save Filename 	<b>Save Filename</b>	Specify the Save File name
<input type="checkbox"/> Use All Segments	<b>All Segments</b>	Specify that ALL segments should be downloaded
<input type="checkbox"/> Auto Run Active	<b>Activate</b>	Switch ON / OFF Auto Run Process (see also 5.15.2)

### 5.16.2.1 Auto Run Filenames

The filename use to store auto run downloads will start wit the value specified in the autorun Setup Display above. If Multiple Segments (see section 5.12) are used then the filename will be appended with “[Sx]” where x indicates the segment number. Finally the filename will be numbered starting from 0000.

For example if JUN17Ar is specified as the filename (as above) then the output files will be called :

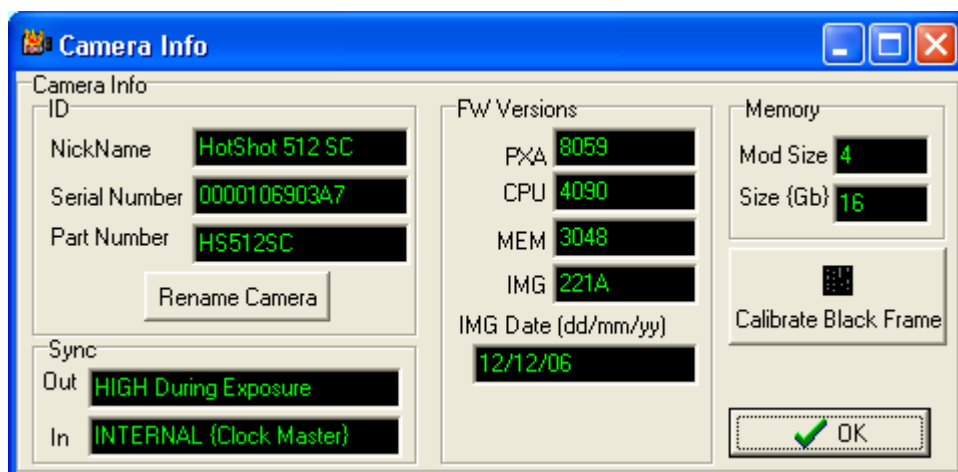
JUN17Ar[S1]0000.HSF  
 JUN17Ar[S2]0000.HSF  
 JUN17Ar[S3]0000.HSF  
 JUN17Ar[S4]0000.HSF

JUN17Ar[S1]0001.HSF  
 JUN17Ar[S2]0001.HSF  
 JUN17Ar[S3]0001.HSF  
 JUN17Ar[S4]0001.HSF

Assuming that there are FOUR segments specified in segmentation setup (see section 5.12)

### 5.16.3 Settings | Camera Info

This menu will bring up the following screen.



### 5.16.3.1 Rename Camera

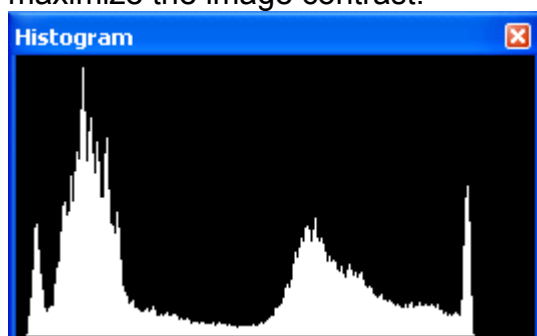
Push this button to rename the camera. The camera name is used in the item list to identify the camera and is also used as the default save name for downloaded image files.

### 5.16.3.2 Calibrate Black Frame

Use this button to re-calibrate the Black Frame. The black frame calibration will reduce Fixed Pattern Noise in the image. Black Frame calibration is performed before the camera leave the factory, but it is worth re-calibrating every 12 Month or so or if FPN noise becomes more visible in the images. To calibrate the black frame, click the button and follow the on screen instructions. You will be required to CLOSE the lens or put on the lens cap. If you fail to do this the black frame calibration will not work properly and you will introduce noise into your images.

### 5.16.4 Settings | Show Histogram

This will toggle the view of an image intensity histogram. This shows a live histogram of the camera image. Yu can use this information during set up of a recording to maximize the image contrast.



### **5.16.5        Settings | Reticule**

See section 5.14.3.

### **5.16.6        Settings Firmware Upgrade**

This menu allows for manual Firmware Upgrade of the camera. Under normal operation, any firmware upgrades are performed automatically. You will not normally need to use this function. This function is Password Protected and you will be talked through using this by a NAC engineers should It be necessary.

### **5.16.7        Settings | Adjust DACs**

This menu allows for manual modification of the camera DAC's. Under normal operation, any modifications are performed automatically. You will not normally need to use this function. This function is Password Protected and you will be talked through using this by a NAC engineers should It be necessary.

### **5.16.8        About**

Choosing the About Menu Option display the About Dialog.

This dialog indicates version information about the connected camera and the software. This information is useful in case you need to contact Technical Support regarding this system. Please make a note of this information before contacting NAC technical Support. In particular you should note the FW Versions numbers and the Software build number. In the example below the software build number is 0.1.8.2.





## 6 Multi Channel Wave Inserter

An accessory to the HotShot camera is the Multi Channel Wave Inserter.



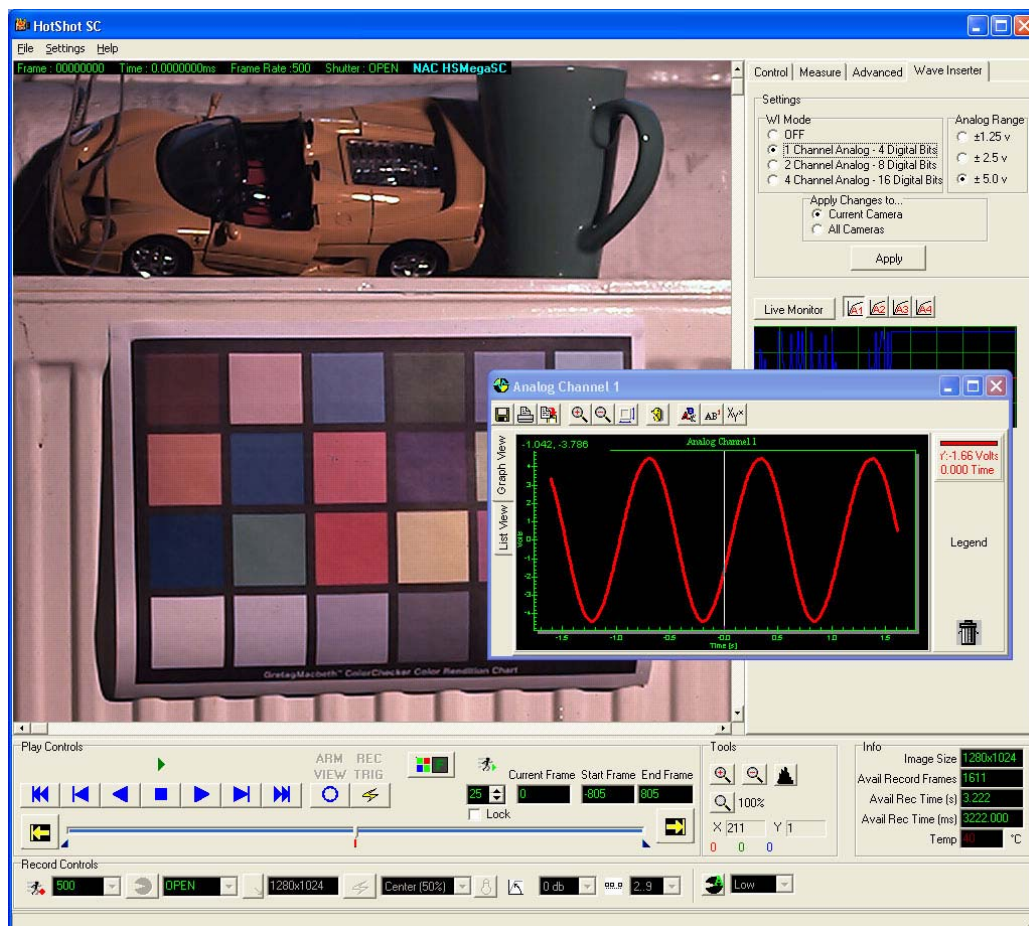
The Multi-Channel Wave Inserter (MCWI) connects to the camera via the High Speed Serial IO port. It has FOUR (4) analog and Sixteen (16) digital Channels. The sampling rate is determined by the FPS used on the camera and can be as many as 40 samples PER frame Period.

You may choose to use 1,2 or 4 of the analog inputs. Using more inputs will decrease the sampling rate.

The sampled data is stored in the camera memory together with the recorded images. It is also stored in the downloaded data files (.hsf files). The data can be reviewed directly from the camera and also from a saved file.

The recorded MCWI data is displayed with a synchronised cursor which will scroll along the data as the image sequence plays.

If the MCWI unit is detected then the Wave Inserter Tab will be displayed in the software.



## 7 Automatic Firmware Upgrade

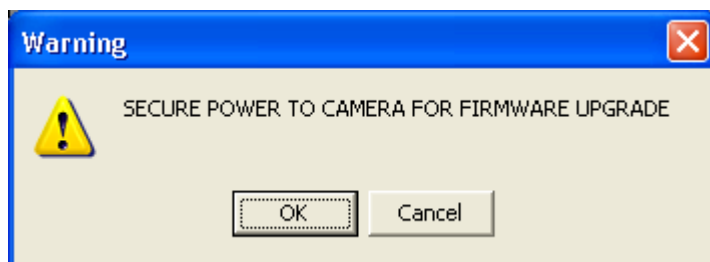
When you connect (see section 5.3.1) to the camera for the First time after installing new software it may also be necessary for some, or all, of the camera FIRMWARE to be upgraded. If this is the case then you will see the Firmware Upgrade window appear as shown below :



To proceed with the Firmware Upgrade you should press OK. If you CANCEL the process at this stage then the camera may not function correctly. In most cases, unless instructed otherwise by a NAC engineer, you should press OK.

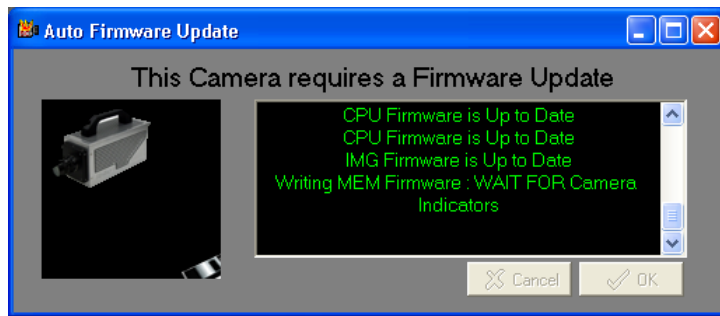
The Software will now check which firmware requires and update and will also verify that the correct firmware upgrade is available.

Once it is ready to perform the upgrade you will see a confirmation message. This is the final opportunity to cancel the Firmware Upgrade. The Confirmation message is shown below.

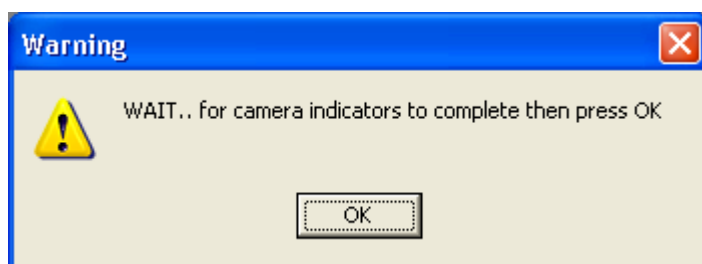


At this point you **MUST** make sure the power to the camera is secure. If you are using BATTERY power you should **NOT PROCEED** with the upgrade and should restart the process using MAINS power.

After Clicking OK the Upgrade process begins



During the firmware upgrade the ARM and REC LED indicators, on the rear panel of the camera will flash. After approx 90 seconds you will get a WARNING message as below :



**NOTE : For Software Versions after Version 1.0.0.4 this message is NOT displayed. The process continues Automatically.**

You MUST confirm that the ARM and REC LED have STOPPED FLASHING before you press OK. When the ARM and REC LED' have stopped flashing you should only see the POWER LED illuminated GREEN.

WARNING : IF THE LED'S are ANY OTHER STATE then you should keep power to the camera and call NAC Technical Support immediately.

There are FOUR parts to the Firmware. The number parts requiring and UPGRADE will vary depending on your current system.

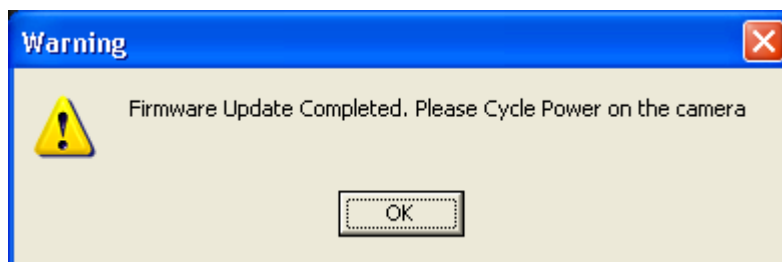
IMPORTANT : The FINAL Firmware is known as the PXA. The PXA upgrade takes MUCH LESS TIME than the other parts. For this you WILL NOT see the ARM and REC Lights flashing. You might see the DATA LED Flash once.

Once all the Firmware has been updated you will see the message below :



Press OK.

You will see the Warning message Below.



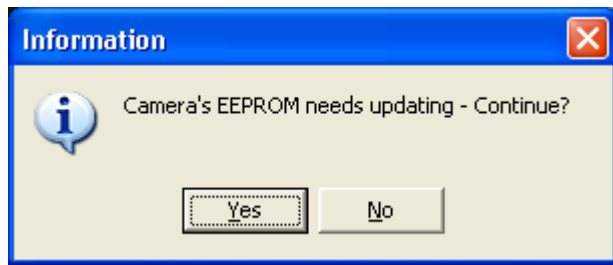
Click OK

Cycle the power on the camera. (Unplug & Reconnect). NOTE : For Software Version after 1.0.0.4 the camera will RE-Boot Automatically.

## **7.1 EEPROM Update**

When you connect to the camera again, it may be that the cameras Flash Memory might need to be updated.

If this is the case you will see the message below



You should Select "YES" unless otherwise instructed by a NAC Technical Engineer.

The Firmware Upgrade is now COMPLETE and you can continue to use the camera.

## **8 Disclaimer**

We reserve the right to modify the function of the software, without notice, to allow for continuous improvement to our software and Hardware systems. Due to this, this manual may not exactly match the software version that you have.



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