Infinity Software Manual

Version 1.5 - October 2017

Contents

Introduction

Our Infinity software application is engineered to provide incredible views of the universe in a near-real time environment. It features a number of integrated pre-sets to get you started with minimum set up, while ensuring you always remain in control.

Key features of the software include:

- Live continuous stacking
- Adjustable histogram and auto range selection
- Finder mode for easy sky search
- Session record and replay functions
- Live broadcast integration
- Second screen image pop-out
- Save in FITs, JPEG and PNG formats

Getting Started

Installing the Software

We recommend downloading the latest core installer for our software from our website. This can be found at:

www.atik-cameras.com/downloads

You can also install the software from the Software CD that comes with your camera.

Locate and run the SetUpArtemisUniversal file. The file name will also include the version number of the software.

The following screen allows you to choose which software you'd like to install. To install the Infinity software, ensure the Infinity check box is ticked.

When connecting the camera to the computer, an "Installing Device Drivers" message should pop up. Follow any prompts, clicking 'continue anyway' if asked.

Once the driver is installed, the camera is ready to use.

Connecting your Camera

After installing the software and drivers, you're ready to connect your camera. Simply connect the power cable to the camera and connect the camera to the computer. The software will automatically recognise when a camera is connected.

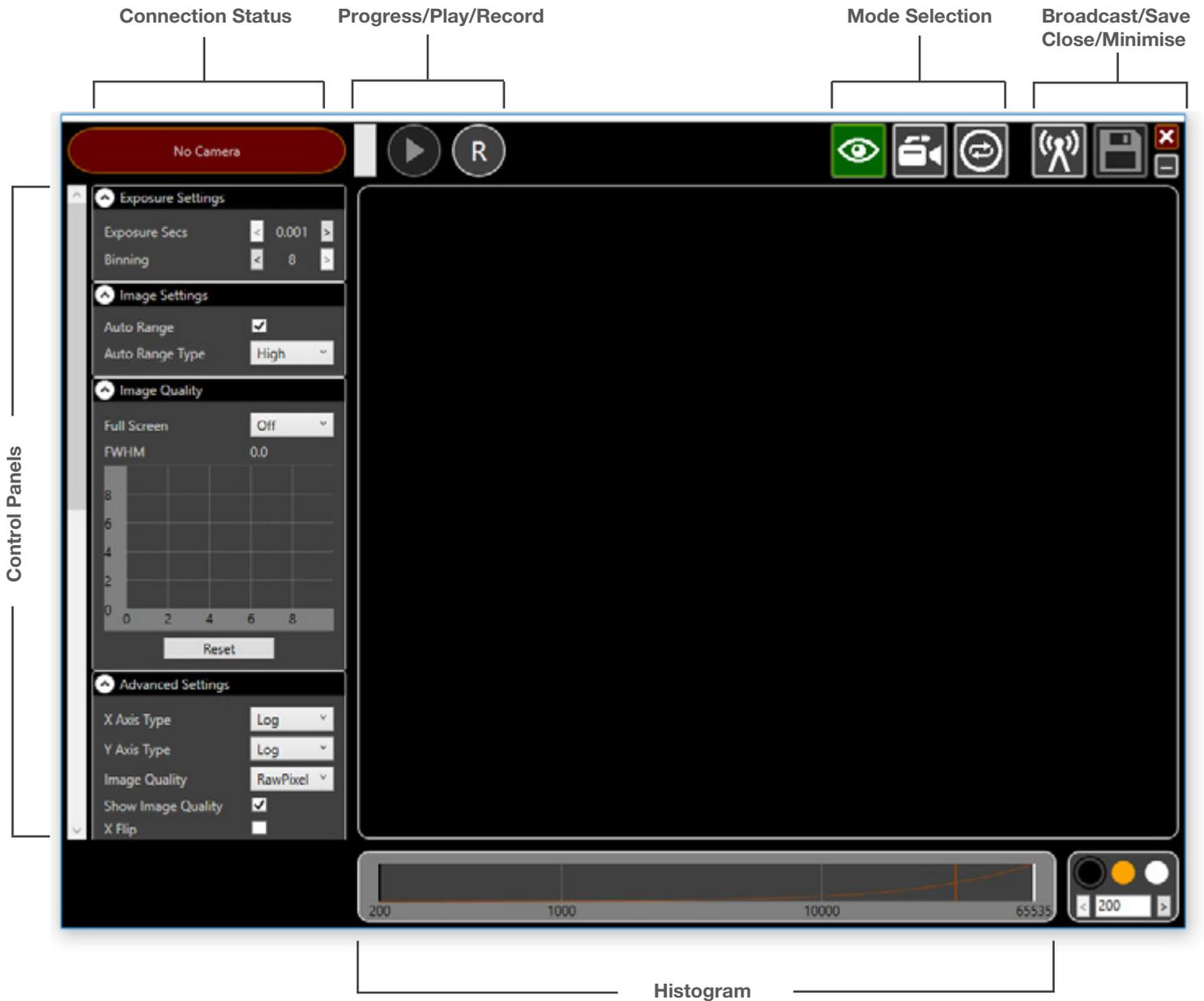The connection status of the camera will be displayed in the lozenge in the upper left corner. The green connection lozenge will contain the name of the camera Infinity is currently connected to.

> **Troubleshooting Tip:** If the camera is connected to the computer, but not showing in the lozenge, check the camera is powered on and showing in the device manager. If not, try reinstalling the latest camera drivers.

Main Screen

This is the main screen of Infinity.

Connection Status   **Progress/Play/Record**   **Mode Selection**   **Broadcast/Save Close/Minimise**

Control Panels

Histogram

Resizing the Window

Infinity will automatically load in full screen view and in Finder Mode. Use the Minimise button to shrink the window. To resize the window, simply double click anywhere in the black bar at the top of the screen. The window can then be resized as desired. Double click in the top black bar again to maximise the window.

Mode Selection

Infinity has three key operation modes optimised for different parts of your session.

Finder Mode

Finder mode is designed to help you find objects in the night sky with ease. This provides a fast, highly sensitive image to help you find objects easily. Exposure and binning settings can be changed as described later.

Note: This may produce noisy images – this mode is simply designed to help you move around the night sky and find objects as quickly as possible. You will notice a far lower noise level once in Video Mode.

Video Mode

Once you've found and positioned your object, switch to Video Mode for optimum display. Video mode will automatically be set to 1 second exposures at binning 1. The optimum exposure time will depend on the brightness of the object and the other equipment in use.

Replay Mode

Replay mode allows you to replay and review previous sessions. This can be particularly useful if you want to share a session after the event, or are looking to post-process the data you obtained. How to record a session is covered in the 'Recording and Saving Images' section of this manual.

Replay mode will automatically use the same exposure settings as were used in the original session. Histogram settings are not saved and remain fully adjustable throughout the replay. The progress bar shows you how far through the session you are, and shown above is the number of the image currently on screen.

Replay Navigation

The rewind and fast forward buttons can be used to skip between images. Clicking with the left mouse button moves backwards or forwards by a single image, while clicking with the right mouse button skips backwards or forwards by ten images. Hovering over the rewind and fast forward buttons gives you the option to 'Go To Start' or 'Go To End' of the session. You can also type in the number of the desired image directly where the image number is displayed.

Taking an Image

Play

To begin exposing, simply press the play button. The camera will continue to expose using the set exposure time when switching between Finder and Video mode. While exposing, the Play button will change to a Stop button. To stop the camera exposing, simply press the stop button. The camera will also stop exposing when entering or exiting Replay mode.

Exposure Progress

The remaining time of an exposure is shown in the progress bar next to the Play button. The progress may not be as apparent at exposures below 0.5 seconds due to their speed. If this is the case, the camera will still be exposing, as will be seen in the constantly updated images on the screen.

Exposure Settings

The Infinity software is capable of exposures from 0.001s to 600s (10 minutes). The default option allows you to set an exposure time between 0.001s and 120s.

To change the exposure time, use the Exposure Secs arrows in the Exposure Settings menu. The left arrow decreases the exposure time and the right arrow increases the exposure time.
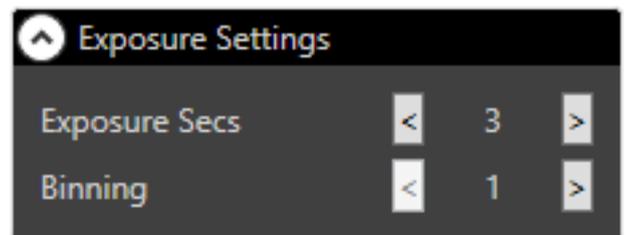
If you'd like to use exposures longer than 120s (2 minutes), then check the 'Long Exposure' option in the Advanced Settings menu. This will allow you to set longer exposures at intervals of 20s up to 300s, or intervals of 30s between 300s and 600s.

Please note: The Atik Infinity Camera is optimised for short exposures (up to 2 minutes). Using long exposures may lead to a decrease in image quality.

Tip: When first using Infinity, try experimenting with exposure times to find the best performance for your individual set up. Different types of mount will have different tracking abilities, so start viewing with short exposure times and build up to find what works best for you.

Binning

Binning is a process that combines a given number of adjacent pixels to create 'bigger' pixels. This enhances sensitivity at the expense of resolution.

Binning is particularly useful to increase sensitivity when finding objects, allowing you to use shorter exposures and find things faster.

To get the highest resolution from your camera, it's best to view at binning 1, which is the native resolution of the camera. However, for very faint objects, or when you're looking to maximise faint details on an object, using 2 binning is a good and easy way to boost the sensitivity.

To change the binning, use the Binning arrows in the Exposure Settings menu. The left arrow will decrease the binning level and the right arrow will increase the binning level.

Binning and Colour Cameras

Binning a colour camera will result in a black and white image. As colour cameras have individual red, green or blue filters over each pixel in a pattern called a Bayer matrix, binning essentially combines pixels of different colours. This then makes it impossible to extract colour information from the image. This may not be of concern when finding objects, but is not recommended for viewing objects with a colour camera.

Preset for Atik Horizon Cameras

If you are using Infinity with an Atik Horizon camera, you will also have a Preset option in the Exposure Settings window that allows you to set the gain and offset for the camera. We provide three presets, and the option to use your own custom settings.

The presets are:

Low - Best for normal imaging. It is the best setting for detail in brighter objects and when individual images have high dynamic range.

Medium - A compromise of low and high. It's very useful if your mount is unguided and you need to take a lot of shorter exposures.

High - Best for sensitivity on dim objects, but sacrifices detail in some of the brighter parts. It's good for imaging with narrow band filters.

Custom - You can also experiment with using your own gain and offsets. We find gain settings up to x30 are useful, depending on the situation, but above this the full well depth becomes incredibly low. Offset can be set between 0 and 511 - use a setting that ensures no pixels fall below zero.
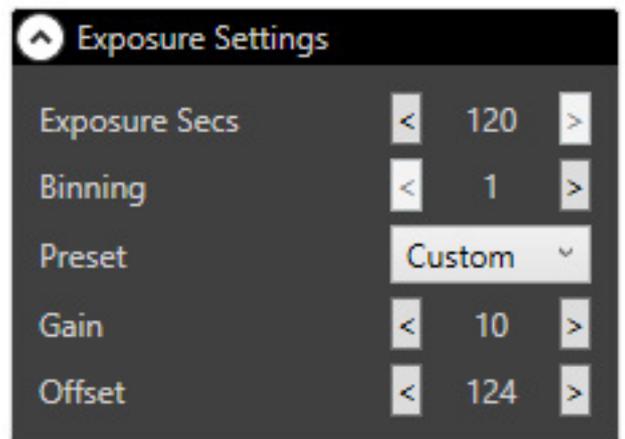
Image Display

Infinity contains a number of options to control how an image is displayed, making sure you get the most out of different types of object.

Histogram Function

The histogram is displayed across the bottom of the screen. This essentially shows you the saturation of your image, with 0 representing a black pixel, and 65,535 representing a fully saturated, white pixel.
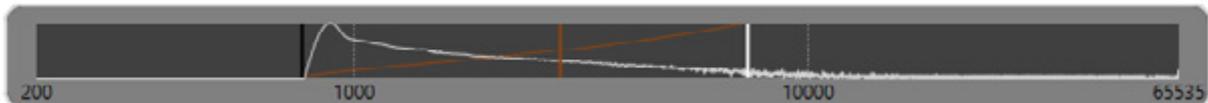
The histogram can be adjusted to get the best views of any object.

Adjusting the Histogram

The histogram can be manually adjusted using the levels sliders. There are black, grey and white level sliders to alter the different levels. These can be moved by clicking and dragging the desired slider to the desired position.

The black and white levels can also be adjusted by clicking in the desired place on the histogram. Clicking the left mouse button sets the black level and clicking the right mouse button sets the white level. The grey level is represented by the orange slider and adjusts the stretch that is applied between the black and white levels.

Clicking either mouse button on either the left of the black slider or the right of the white slider will adjust the corresponding slider. This is to ensure the black level can't be set above the white, or the white below the black.

Advanced Histogram Adjustment

In the Advanced Settings menu is a 'Fine Hist Control' option. When checked, this opens the fine histogram control to allow you to make smaller adjustments to the display. To use it, simply select the slider you would like to adjust (black level, grey level (orange slider), or white level) and then either use the control arrows in the panel, or type in your desired value to adjust the histogram. You can also use the arrows on the keyboard to adjust your selected slider.

While this option is selected, you can still control the histogram as normal by dragging the sliders with the mouse or clicking on the histogram.

Image Settings and the Auto Range Function

Within the Image Settings menu is an auto range function. When selected, this automatically sets the black, white and grey levels on the histogram and continues to adjust them as each new image comes in.

There are a number of different types of auto range designed to bring out different details on different types of object.

FullRange – displays from the lowest to highest pixel values

FullRangeMinus - displays the lowest to highest pixel values, minus around 0.01% of the pixels either side
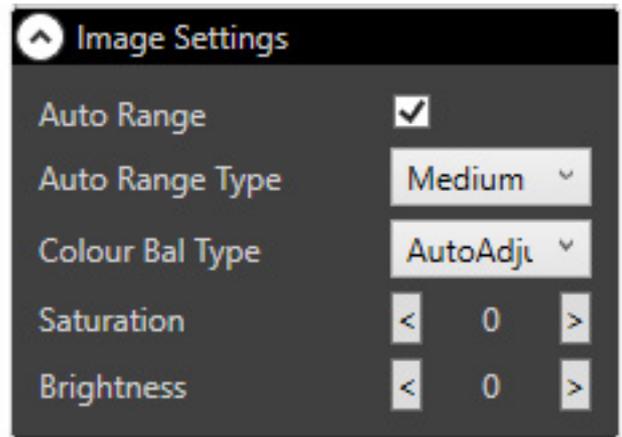
Low – large stretch, best for fainter objects

Medium – medium stretch, versatile for a range of objects

High – short stretch, best for finding and aligning objects

MeanSD – average pixel value plus the number of standard deviations, 'Bound To Range' ensures it won't go above or below the highest or lowest pixel values

MaxPeak – stretch based on highest peak

Colour Histograms

When using a colour camera, the histogram will display separate curves for the red, green and blue channels, and a colour selection box to the left of the histogram.

Colour Bal Type

The colour balance type is automatically set to 'AutoAdjust'. With this option selected, the colour channels are automatically aligned to produce an accurate colour balance.

Selecting 'None' will turn off automatic colour balancing.

Manual mode will automatically be selected if you make manual adjustments to the colour balance as described below.

Note: These controls are only available when a colour camera is connected, and will not appear when using a mono camera.

Manually Altering the Colour Balance

You can manually alter the colour balance using the colour selection box. Selecting the white circle allows you to control the black, grey and white levels as normal using the sliders.

Selecting one of the red, green or blue circles will allow you to adjust the corresponding colour channel. You can do this by dragging the channel on the histogram using the mouse, or by using the 'Offset' and 'Stretch' buttons in the colour selection box.
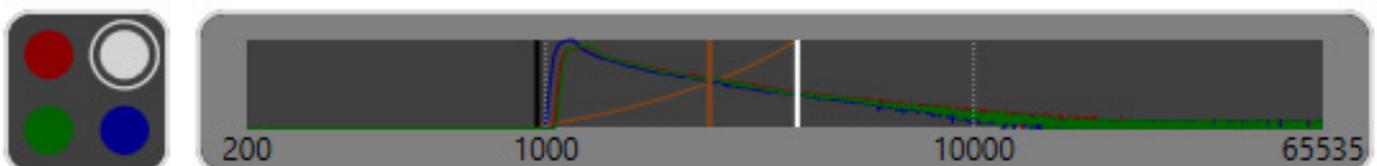
The stretch and offset values modify the all the pixel values for that particular colour channel. The offset adds the given value to each pixel, whereas the stretch multiplies each pixel by the given value. Multiplication happens first, so the final pixel value is given by:
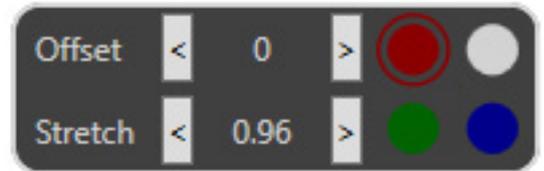
FinalPixelValue = (OriginalPixelValue * Stretch) + Offset

To reset the colour channels, reselect the AutoAdjust option from the Colour Bal Type menu at any time.

Alternative Colour Balance

In the advanced settings menu you have the option to 'Use Orig CB'. In the original version of Infinity, there was an 'Auto White Bal' option. This performed a similar task to the 'AutoAdjust' option in the 'Colour Bal Type' box. However, the method used to modify the pixel values was slightly different. The original method would simply modify the 'offset' value and set the 'stretch' to 1.0. The new method modifies the 'stretch' value, whilst setting the offset to 0.0. This is a more accurate way to modify the pixels and we think it produces better images. However, we have left this option in so that you can decide for yourself. When 'Use Orig CB' is checked, then 'AutoAdjust' will use the method in Infinity v1. When unchecked it will use the new method. The option is unchecked by default.

Note on Histogram Scale

The histogram is automatically set to a logarithmic scale as this is usually most effective when dealing with the faint signals associated with this kind of image capture. This prioritises signal at the lower end of the scale and provides control where you need it most.

However, if you'd rather use a linear scale, go to Advanced Settings and select 'Normal' for the Axis Types. This can be changed at any time.

Brightness and Saturation

When using a colour camera, you can adjust the Brightness and Saturation of an image through the Image Settings menu. These can be set to a value between -100 to 100 by using the arrows.
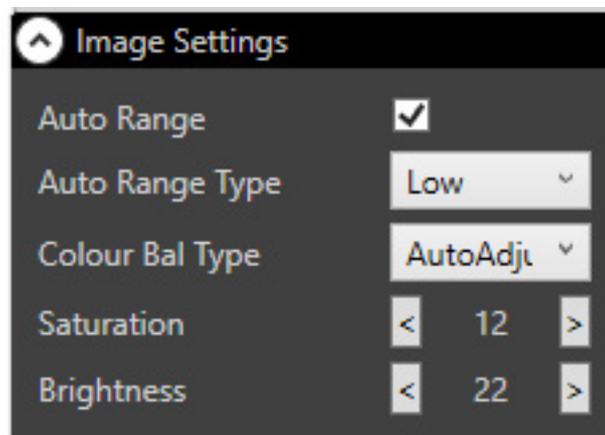
Image Navigation

Zoom

To help you get the most out of your camera's resolution, you can zoom in to get a closer look at certain details or regions of an image. This is also a useful way of getting a 'fuller' view of smaller objects. There are a few different ways to zoom in and out:

- Use the scroll wheel of the mouse

- Use the scroll feature of the trackpad on a laptop (if applicable)

- Double left-click on the image to zoom in

- Double right-click on the image to zoom out

You can alter the speed of the zoom function in the Advanced Settings menu.

To move around an image, simply click, hold and drag the image to the desired location.

Reset View

To reset the image to its original position, hover the mouse over the image area and press the reset button. This will re-centre the image and resize it to fit the viewing window.
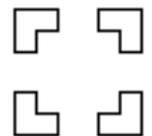
Full Screen

Full screen view maximises the image to the full size of the Infinity window. This means that once you've finished altering the controls for a particular object, you can get an uninterrupted view of the image as it continues to stack and faint details become more apparent over time.

To return to normal view and bring back the controls, simply click on the 'revert' button.
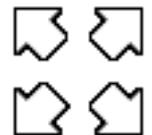
Second Screen Pop-Out

There are times when using Infinity that you might wish to display a duplicate of the image window on a second screen. This is particularly useful for outreach and educational events, so you can display only the image without the control settings.

The software will automatically detect when you have a second monitor attached to the computer when it starts up. If you add a second screen whilst the software is already running, it will not be detected. Restart the software to begin using the second screen.

When a second monitor is detected, you will see a screen pop-out button when hovering over the image window. Simply press this to create a second screen pop-out. This can then be moved and resized as necessary.

Image Orientation

There may be times when you want to alter the orientation of a particular object. This can be done in the Advanced Setting Menu.

To flip the image on a horizontal axis, check the X Flip box.

To flip the image on a vertical axis, check the Y Flip box.

These can be selected and unselected at any time, during either exposure or replay.

Image Stacking

Image stacking is a process which builds up a high quality image from a number of short exposures.

Stacking settings can be accessed through the Image Stacking menu, available in both Video and Replay Modes.

To begin stacking images, simply select the Stack Image check box. This can then be turned off at any point.

Stack Info shows how many individual images are in the current stack, along with the total combined exposure time for the images in the stack (s).

Reset resets the stack.

Revert removes the last image from the stack.

Note: Image rejection settings will be covered in the Image Quality section.
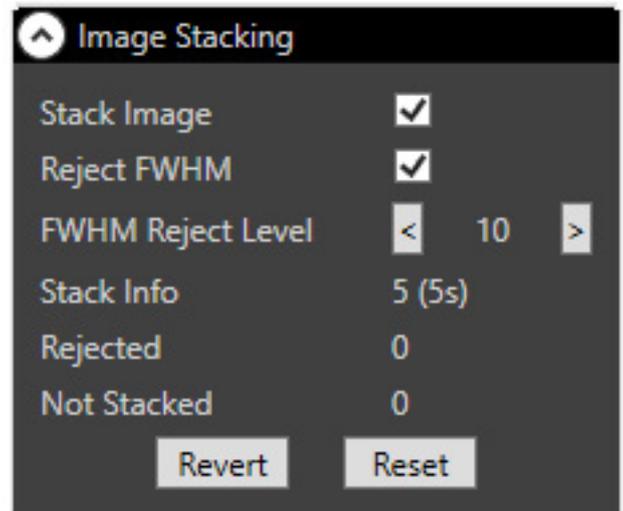
Advanced Image Stacking Settings

These can be found in the Advanced Settings menu.

Auto Reset Stack - Off by default

When this option is selected, the stacking will automatically reset if an object moves too far from its original position. When deselected, any images in which the object has moved from its original position will not be added to the stack and will be shown in the 'Not Stacked' section. You can reset the stack manually using the Reset button if you wish to begin a new stack with the object in this position.

Tip: We recommend deselecting Auto Reset Stack if you're building very large stacks of images. This will ensure that the stack isn't unexpectedly reset.

Calc Image Movement – On by default

When selected, our advanced algorithms will automatically calculate any movement between images and align the next image accordingly. We recommend leaving this option on in the vast majority of circumstances.

Deselecting this option means the next image will simply stack directly on top on the existing image, without accounting for any potential movement between images. This is mainly used in non-astronomical applications.

Image Quality

Infinity contains some advanced features to help improve the quality of your images. These can be accessed through the Advanced Settings Menu.

The Image Quality drop-down box allows you to select from RawPixels or BlendPixels. This controls the method used to display the image.

RawPixels simply displays each pixel as a standard square pixel.

BlendPixels effectively blurs the edges between pixels to create a 'smoother' image.

Zooming in using RawPixels until you can identify individual pixels and then switching between modes will clearly demonstrate the effect.

Image Quality Menu

Select the Show Image Quality check box to open the additional Image Quality Menu.

In the Image Quality Menu is a graph displaying Full Width at Half Maximum (FWHM) measurements for each image. This is the average width of the stars in the image and ideally we want this figure to be as low as possible and to remain at a consistent level. The FWHM is shown as a blue line on the graph.

Full Screen options

Hybrid – Overlays the image with the image quality graph

Graph only – displays only the graph in the image window

Number Only – displays the FWHM measurement in numerical form over the image
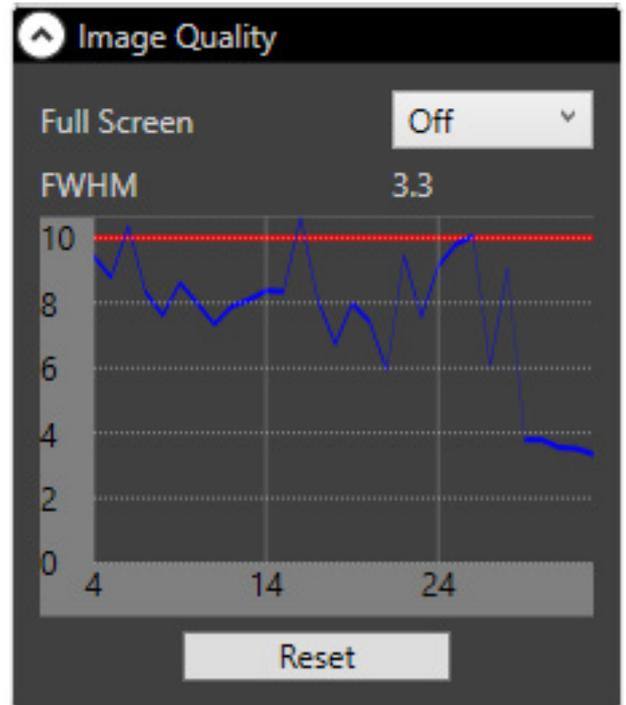
Focusing

You can use these FWHM figures and display options to help you with focusing, as well as image rejection. Adjust the focus on your telescope until the FWHM is at its lowest point, and the stars also appear visually sharp.

Image Rejection

Infinity is able to detect 'bad' quality images and leave them out of the stack.

If your conditions and your images are consistently of a very high quality, you may find you don't need to use the image rejection feature. However, if images are coming in that are blurry, unfocused or have other issues, you may want to turn image rejection on.

Reject FWHM sets the level at which images are to be rejected, using the FWHM measurement. If new images come in with a FWHM above the desired level, these will be rejected. The rejection level will be displayed on the Image Quality graph as a red line. You can then easily see how this corresponds to the blue line of the FWHM and use this to set a sensible rejection level for a given session.

Rejected shows how many images have been rejected from the stack. If more are being rejected than added, you may want to adjust the rejection level. It might be worth checking the FWHM of a visually 'bad' image and setting this as the rejection level.

Add Q to FWHM

In the Advanced Settings menu is an option to 'Add Q to FWHM'. The Infinity software gives stars a quality (Q) rating which by default it adds to the FWHM measurement to improve the accuracy and reliability of image rejection. If you are having difficulties with high numbers of images being rejected, try unchecking this option to see if it helps solve the problem.

Cooling

If you are using Infinity with the Atik Horizon, you can control the camera's cooling within the Infinity software through the Cooler Settings window. This will be automatically displayed when the software detects the Atik Horizon, and not shown when using an Atik Infinity camera.

Temperature shows the current temperature of the camera. To turn on the cooling, choose your desired Set Point using the arrows or by typing directly in the box, and press the Start Cooling button. Allow a few minutes for the camera to reach and stabilise at the set point.
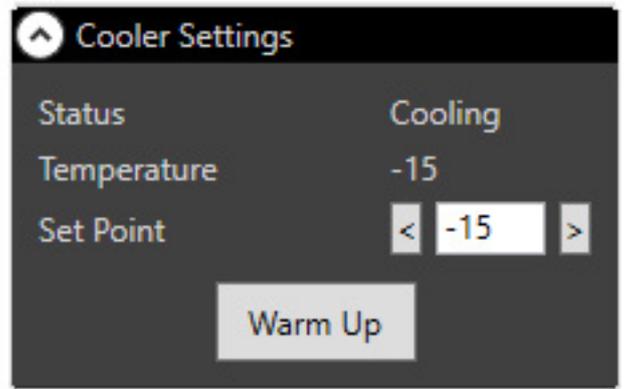
At the end of your session, press the Warm Up button and allow a few minutes before disconnecting the camera to allow it to complete its warm up sequence.

If you are planning on further processing your images, you may want to image at a stable, repeatable temperature for your environment rather than simply the maximum the camera can reach. This will make it easier to take corresponding calibration frames to use with your images.

Recording and Saving Images

Saving a Whole Session

To save a whole session, press the 'record' button displayed in the finder and viewer modes. This will record every image that comes in from the camera in FITs format for as long as record is selected.

This feature allows you replay entire sessions at a later date and be sure you'll never miss a detail.

Select a save directory by hovering over the record button and selecting Directory. The button will flash red when recording is enabled.

Saving Images

You can also save the currently displayed image by pressing the save button. You can save in FITs, PNG, JPEG and TIFF format for sharing the results of your session, or to go on and post-process the image.

Saving this way will save the whole stack as a single image. The Mode option allows you to choose between 'AsOnScreen' which saves the images as you currently see it with your chosen stretch, or 'Unprocessed' which saves the image without any pixel stretching.

By default, images will be saved as 16-bit, but you can also choose to save an 8-bit image by checking the 'Is 8 Bit' box. We generally recommend saving your images as 16-bit.

Please note: Saving in FITs format will always save a 16-bit, unprocessed image.

Even if using the session record feature, at times it's still worth saving the displayed image, particularly if you've built an impressive stack, or created a perfectly balance histogram.

Copy Image

You can copy the image display at any point either by right-clicking on the image and selecting 'Copy', or by pressing CTRL+C anywhere in the application window to copy the image to the clipboard.

Live Broadcasting

Infinity comes with an integrated live broadcast feature. This gives you the option to broadcast either through YouTube, Video Astronomy Live or RTMP. You can select which platform you'd like to broadcast to through the Broadcast menu, accessible through the broadcast button.
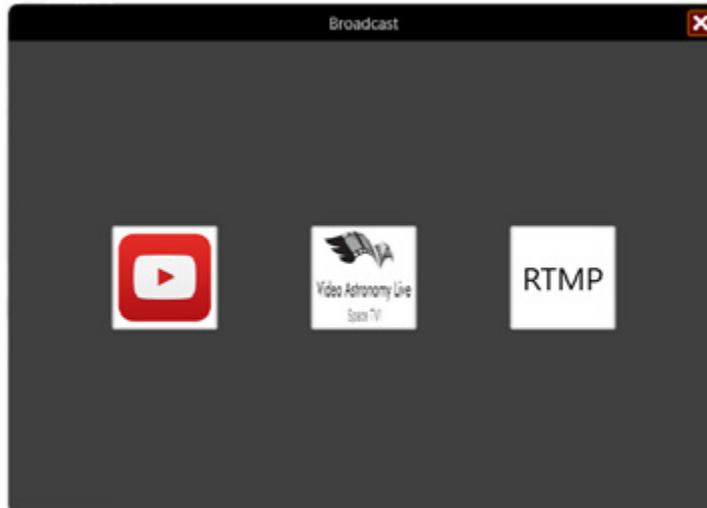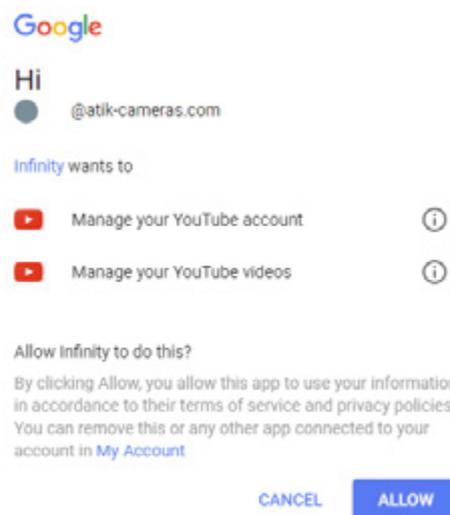

Broadcasting through YouTube

YouTube allows you to take advantage of a well-established and open platform. The only thing you need to begin broadcasting is a Google account and associated YouTube channel. These are free and readily available, and require no further commitment.

Before you begin broadcasting, you'll need to enable Live Broadcasting in your YouTube account. See Appendix A for instructions on how to do this.

After selecting YouTube, you'll be required to Log In to your Google Account and allow Infinity permission to manager your YouTube account and videos – this is needed simply to set up, stream and save new videos as directed by you and won't be used for any other purpose. Pressing the Log In button will open your browser and allow you to sign in to your account and grant this permission.

Once live streaming is enabled and you have signed in through the Infinity software, you will be able to create a new broadcast.

To create a new broadcast, select Create in the YouTube menu. This will take you to a screen where you can change the Title and Description of your video. When you're happy with these, click OK.
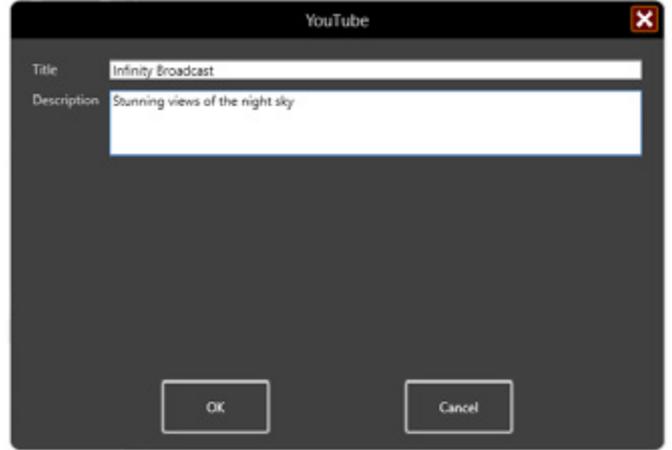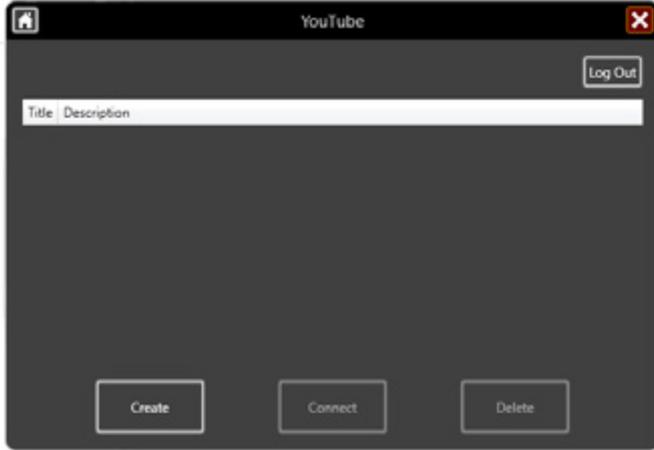
Once you've created your Video, it should appear in the Infinity YouTube Menu. Select the stream you'd like to broadcast to, and click Connect. The broadcast button will turn orange while Infinity is connecting to YouTube, and then green once it's connected.
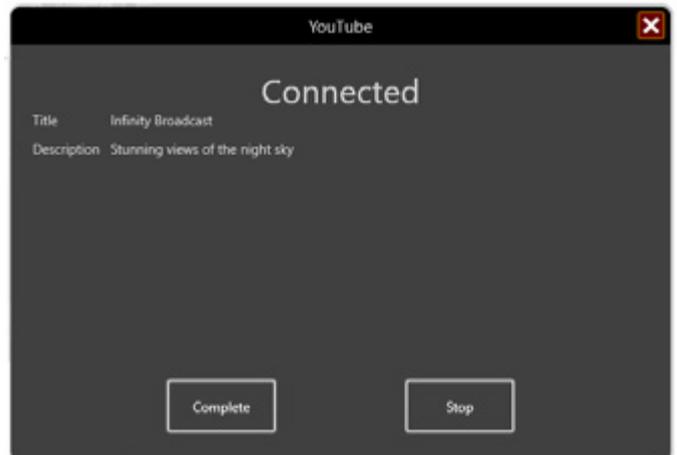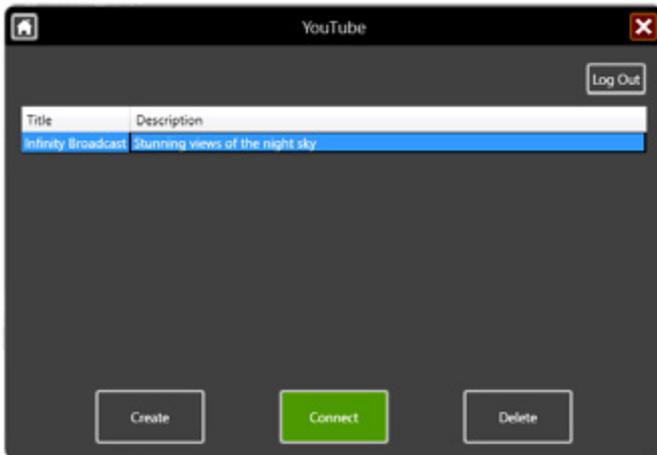
A whole screen capture is used for the broadcast, so first check you don't have anything on screen you wouldn't want to be shared.

A note on audio: The broadcast will automatically include a live audio stream, allowing you to talk through your session and comment on what you are seeing. This will be done using your default recording device.

Comments

When broadcasting through YouTube, it's possible to see and respond to the comments being made on your video from within the Infinity software. Press the comments button to display the comments window, and select the cog if you need to return to the settings menus.

Stopping a Broadcast

You can pause a broadcast at any time by selecting 'Stop' from the broadcast menu. Stopping the broadcast will allow you to reconnect to the same broadcast at a later time. This is particularly useful for short stops, for example, if you need to change something with your equipment, or adjust your location.

When you have finished a broadcast, select Complete from the menu. This will end the current broadcast.

You must be connected to the broadcast and select Complete to end it otherwise the broadcast may continue.

YouTube will then automatically process the broadcast and make it available as an MP4 video. Videos under 2 hours in length can then be edited in the YouTube Video Editor, accessible through the Creator Studio. You can also download the video if required, whether to keep as a record, process in external video editing software, or to edit a video over 2 hours in length.

A note on delay: When broadcasting, you might notice that there's a delay of up to around 30 seconds between what you are seeing on your computer screen and what's being displayed in the live stream. This is worth bearing in mind when interacting and responding vocally to comments in the live chat.

Upload Speed

There is a recommended upload speed of 1Mb/s to provide a consistently strong and reliable signal for live broadcasting, though it may be possible to broadcast successfully below this.

Privacy Settings

By default, videos and live streams on YouTube will be set to public. This means anyone can find and view your videos. However, you can change the status of videos to either unlisted or private. Unlisted means that only people with a link to the video can view it while private videos can only be seen by people you choose to share them with using a Google+ profile. The privacy settings for a video can be changed at any point.

Broadcasting with Video Astronomy Live

Video Astronomy Live (VAL) is a free, open website set up and run by amateur astronomers to provide a friendly platform for video astronomy broadcasting. It's open to all levels of experience, and has a strong emphasis on helping beginners to get the most out of the hobby. Each broadcaster has their own personalised channel, which is all you need to begin streaming on Video Astronomy Live.

If you'd like a channel, simply send VAL a message through the website contact page at http://www.videoastronomylive.co.uk/#!contact/c24vq and they'll be in touch with everything you need to get up and running. They will also send you a Stream Name, which is what you'll need to broadcast directly from inside the Infinity software.

To begin broadcasting on VAL, select Video Astronomy Live from the Broadcast menu, input your Stream Name in the Video Astronomy Live menu, and press connect. You are now broadcasting to Video Astronomy Live. Live chat is available during your broadcast by visiting your channel at www.videoastronomylive.co.uk
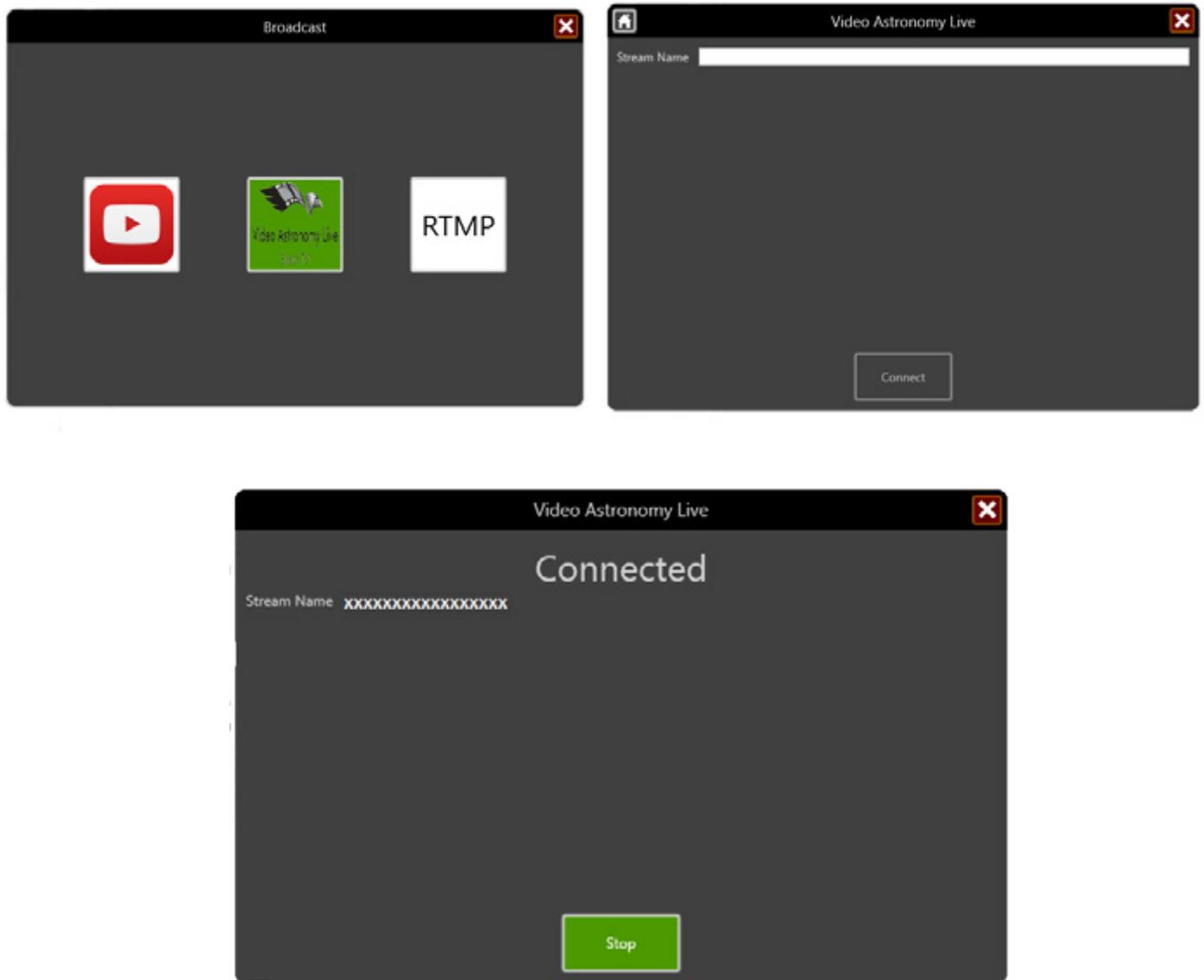
To stop broadcasting on VAL, simply press the Stop button in the VAL broadcasting menu.

RTMP

You can also broadcast through RTMP (Real-Time Messaging Protocol) by selecting the RTMP option and entering the URL and Stream Name for the feed.

Additional Information

Cross Hairs

In the Advanced Settings menu is an option to 'Show Cross Hairs'. This will add cross hairs to your image to help with alignment and composition.

Reset All Settings

In the Advanced Settings menu you can Reset All Settings. This will reset everything, including any directories set in the record and replay options.

Tool Tips

Infinity contains a number of 'Tool Tips' which tell you the function of a button when hovering over it to help you learn your way around. These can be turned off at any time by unchecking the 'Show Tool Tips' box in the Advanced Settings Menu.

FITS Settings

In the Advanced Settings menu, there's an option to Show FITS Settings. This allows you to add a prefix to the FITS files that get saved when using the record feature.

Use Fast Display

When selected, the image is drawn in a faster way. This can be useful when using the Atik Horizon. The image may appear slightly lower quality when zoomed out.

Show Updating

When selected, an Updating label shows when a new image is being processed and stacked. This can be useful when using an Atik Horizon camera in Infinity, as the large size of the images can mean a slight delay before they are added to the stack.

Show Colour Type

When selected, the sensor colour type of your camera (mono or colour) will be displayed as part of the camera name in the connection lozenge.

Technical Camera Information

Technical information about your camera can be found in the camera manual, a copy of which will have been copied to your computer during the installation process.

Disconnecting Your Camera

Because the Atik Infinity camera is uncooled, it doesn't require any special disconnection process. Simply close the software and power down the camera, then get ready for the next clear night!

If you are using a camera with cooling, allow the camera to complete its warm up sequence after pressing the Warm Up button before disconnecting.

Appendix A

Enabling Live Streaming in your YouTube Account

Before broadcasting with Infinity, you will need to enable Live Streaming in your YouTube account. To do this, first access the Creator Studio through your avatar button in the top right hand corner of the screen.
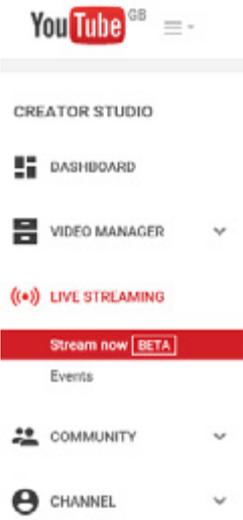
This will take you to your Creator Studio, where you can access the Live Streaming menu.

From the Live Streaming menu you can then enable live streaming. This will require a two-step verification process where YouTube will send a verification code to your phone and you can then enter this code to verify your account.
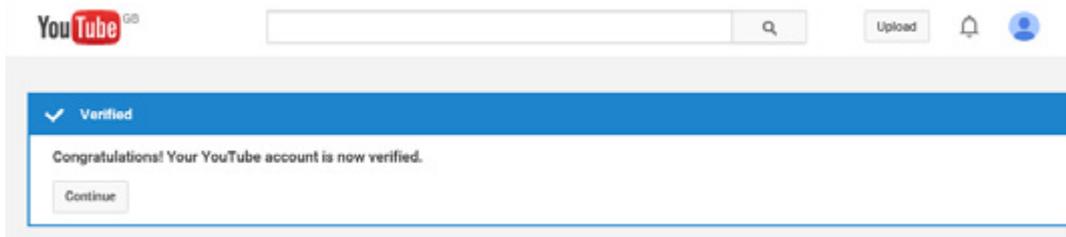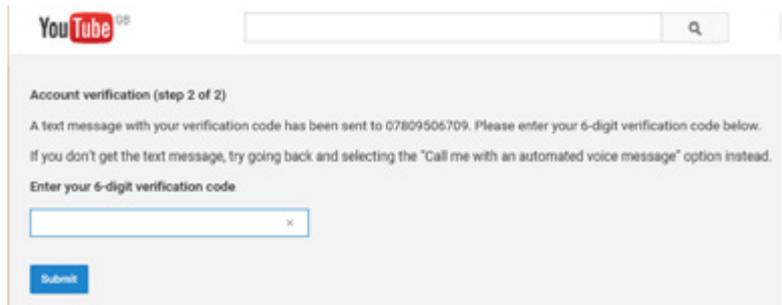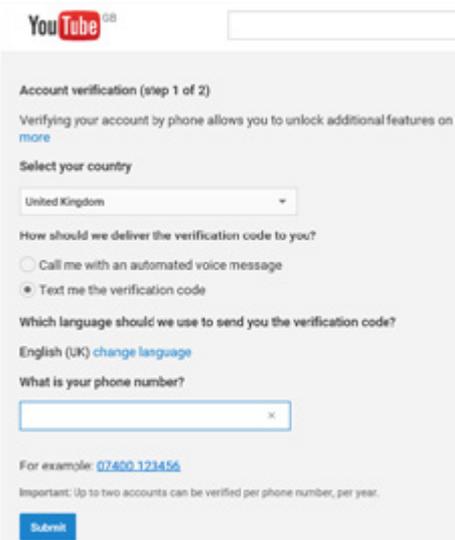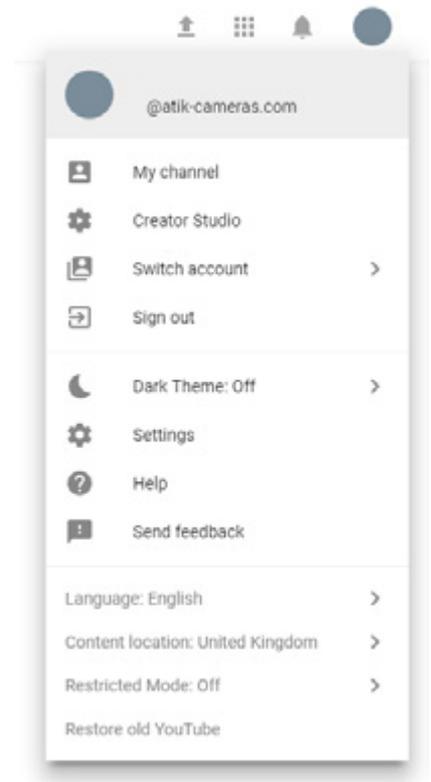
Once you have completed the verification process, you will then be able to broadcast live through the Infinity software.