

# CARBONITE Ultra

## New Ultrachrome Chroma Keyer

### Basic Setup Instructions



## Overview

**The Ultrachrome chroma keyer includes two different key generators for independent or combined use, to achieve the very best result:**

The **Wedge Key** is purely chroma-based, discriminating between the color vector angle & level of the background color vs. the color vectors & levels in the foreground components. This key design is common in standard chroma keys and provides a good result under ideal conditions. However, if the content includes high-detail luma content in edge regions, these areas may be excluded in key generation.

The **Detail Key** adopts a different design, adding luminance dependency to a three-dimensional spherical color discriminator. This keyer can develop subtle key & fill shapes and discriminate high-detail luma content in edge transition areas. However, this design has challenges processing similar background and foreground levels within the fill itself.

**By combining these two key technologies, Ultrachrome can generate a composite key that includes the best qualities of each key type.**

Ultrachrome also includes unique **Automatic Background Analysis** to develop key edges with luma values consistent with those of the new background - eliminating light or dark key 'halos'. In addition, background color values are averaged and applied to spill areas, to add lighting realism to the final composition.

## General Comments:

High-quality chroma keying with a natural look is fully-achievable with the Ultrachrome keying system. However, as with any chroma key system, careful attention should be paid to the chroma key environment:

- The set should be evenly-lit, with a reasonable level of brightness, too bright or too dark will compromise the ability to produce a great result. High brightness generates high levels of reflected color background (Spill) into the foreground subject. When the camera output is viewed on a waveform monitor, the background set level should read between 50-75% of the overall image level. The foreground subject/s should be separately lit.
- Adjust camera shading using appropriate charts, ensuring that grey scale, lens flare, gamma and white/black balance correctly set. If using the ACID-H200 camera, it is recommended it be set in HDR mode - HLG1200. This mode is compatible with standard (non-HDR) signals and the wider dynamic range allows greater image separation in lower-light regions. Also, the camera should be set at its minimum gain to ensure the lowest noise levels, and detail levels should be kept at minimum to avoid sharp edge transitions.
- Real elements, presenters and props should not contain colors similar to the background. Clothing or props with high reflectivity should also be avoided to minimize color spill (colored light reflected from set onto foreground subject).

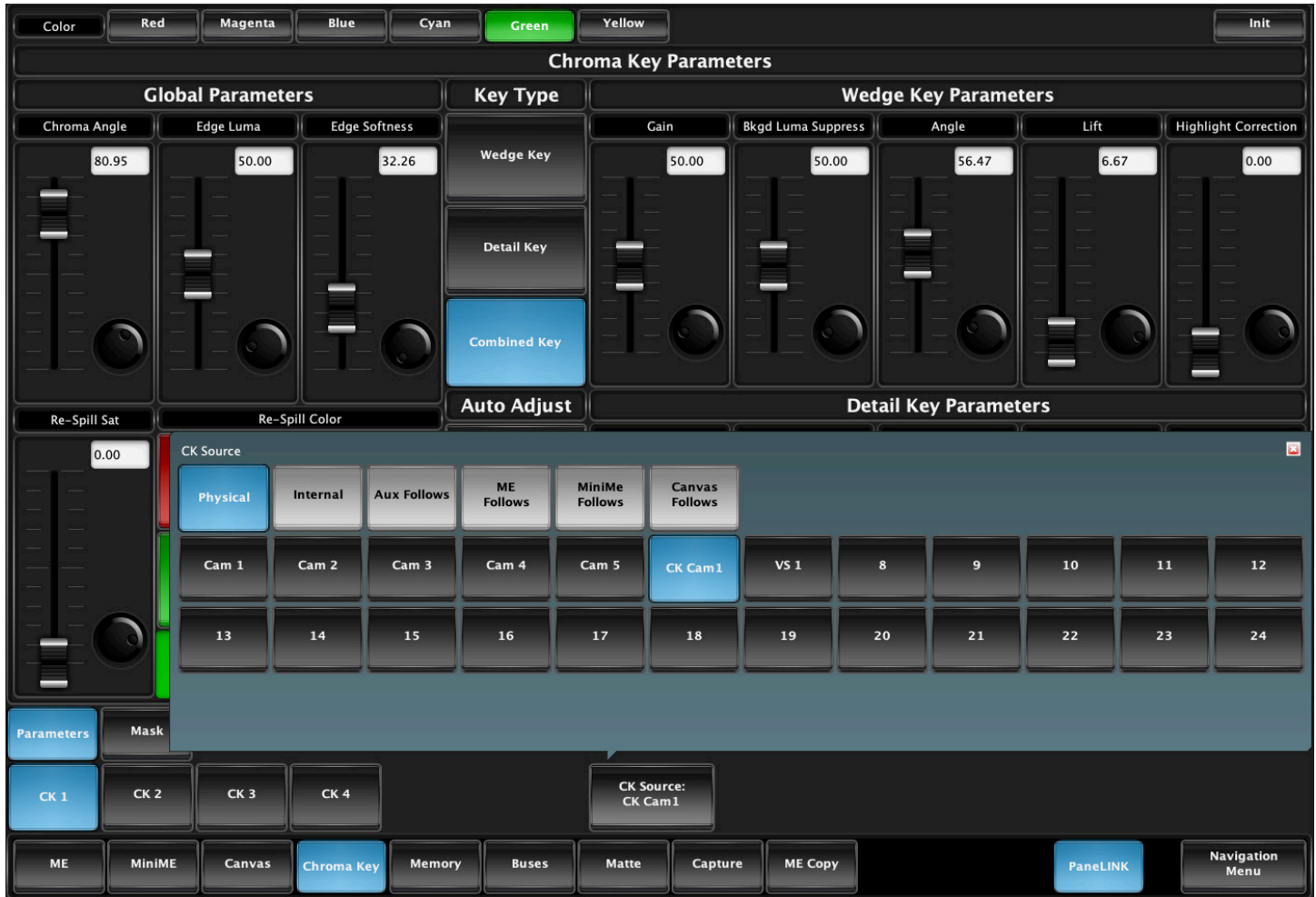
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### Getting Started:



1. Assign the chroma key camera source to an available chroma key channel (1, 2, 3 or 4)
2. Select the primary color of the chroma key background at the top of the menu.
3. Initialize the chroma keyer by pressing the **INIT** button in the top right.

This will automatically setup the chroma key, if the set lighting and camera shading are correct the keyer will only need minor adjustment to achieve perfect results. If the input is less than optimal, further adjustment will be necessary.

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### Chroma Key Adjustments:

By default, both *Wedge* and *Detail* keys are on after an *INIT* command, as indicated by the highlighted 'Combined Key' button. While adjustment can be made to either keyer while the combined output is selected, it is recommended that adjustments of either key be conducted with that key type selected only. This eliminates the possibility of the combined key hiding or concealing the result of adjustments.



*Note: The Detail key is layered over the Wedge key and has the largest contribution to the final key-edge quality.*

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After an initial **INIT** the recommended adjustment procedure is as follows:

#### 1. Adjust Detail Key Parameters:

##### Select “Detail Key” only

**Clip:** This controls clip level between the foreground and background key area, allowing you to achieve complete background removal. Ensure *Clip* level is set to where the background is just removed, as setting it too high will reduce the edge quality of the resultant image. Use *Clip* adjustment if the set background lighting is less than ideal.

**Gain:** This adjustment will ‘lift’ the fill image to achieve solid key content. Note that setting *Gain* too high will introduce undesirable dark boundaries. *Gain* will compensate for excess spill / low lighting on the foreground subject.

**Shadow Sensitivity:** Identifies the level of dark image regions to include in the key channel, particularly in cast shadow areas. *Shadow Sensitivity* can lift dark areas of detail to improve key-edge quality. Note that dark areas of an image can contain undesirable noise - depending on the quality of the camera / lens and gain settings.

**Shadow Density:** This control works in conjunction with *Shadow Sensitivity* and adjusts the apparent lightness of the dark / shadow areas.

**Highlight Sensitivity:** Use only for image areas with specular highlights such as reflective surfaces. Areas of high spill reflection may be detected as key areas and print through to the background, highlight sensitivity allows such areas to be filled in correctly.

#### 2. Adjust Wedge Key Parameters:

*Note: with a good source, wedge adjustment is generally unnecessary.*

##### Select “Wedge Key” only

**Gain:** Setting *Gain* is of primary importance; it is recommended that this be adjusted with the *Angle* control set to 100 and the *Lift* control set to 0. Adjust the *Gain* control until the background is fully removed, leaving a reasonable key-edge. Note that too much gain will produce hard and undesirable key edges. Adjust *Gain* in conjunction with the *Background Luma Suppress* control, to ensure the best compromise between background removal and key-edge quality. The fill portion of the signal may at this point contain semi-transparent areas; this can be corrected with the *Angle* and *Lift* controls.



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**Background Luma Suppress:** The auto *INIT* function should set this perfectly. If set color and lighting is uneven, use *Background Luma Suppress* to ensure full suppression of the chroma background.

**Angle:** Changes the color wedge angle (wedge shape) that is used to detect areas of foreground (fill) and background (key) based on the chosen color vector. Changing the detection angle will increase the density of the fill content. Dependent on subject matter, *Angle* helps 'fill in' areas of heavy spill without hardening edge detail. Adding *Lift* after this adjustment may still be required.

**Lift:** Amplifies the generated key signal to 'fill in' areas of key transparency. However, a large amount of lift can reduce key-edge quality. Adjust your *Angle* control before adjusting *Lift*, and keep the *Lift* value as low as possible.

**Highlight Correction:** Depending on lighting conditions, camera setup and subject – some areas of the image may contain high luminance levels at edge-boundaries, that may require additional *Lift*. *Highlight Correction* allows *Lift* to be selectively applied to those areas only.

### 3. Global Parameter Adjustment

**Set Key Output to *Combined*, *Wedge* or *Detail*.**

**Chroma Angle (Spill Suppression):** Controls color spill suppression and should always be set correctly by the *INIT* function, normally no adjustment is necessary. In images with excessive spill, this control will make minor adjustment to color hue in the spill regions.

**Edge Luma:** This unique control adjusts the luma value in the edge areas of the fill signal, to compensate for differences in the background luma level of the CK set and the new virtual background. This control may be operated manually, but is disabled if the Auto Edge Luma feature is enabled.

**Edge Softness:** Filters key-edges to eliminate undesirable hard edges and add realism to a scene by simulating depth of field characteristics. By default, a small amount of softness is always applied. Setting *Edge Softness* to 0 will produce a sharp edge if desired.

**Re-spill Color:** Adds the average color hue of the virtual background to areas of the fill that contain spill from the chroma set. Using the *Re-Spill Color* button, select a color that is near to the average color of the background/lighting conditions of the virtual environment. This color is then added into the areas of the fill that contain spill from the chroma set. Subtle amounts of spill replacement can make the resultant composition more realistic. If Auto Re-Spill Color is enabled, the average color hue of the new virtual background is calculated automatically, but the amount of color spill replacement remains under manual control.

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### Auto Adjustments

Another unique feature of the new Ultrachrome chroma keyer is the ability to continuously measure the replacement background used in the final composite, to automatically adjust the Edge Luma and Re-Spill Color

*Auto Adjustment* is enabled by selecting a measurement source from one of the switcher inputs, this can be a new virtual background that will be composited internally or a return feed from a downstream Virtual Set system such as the Ross Voyager.

Once a source is selected the system will continuously measure the new background source frame by frame and automatically adjust edge-luma transitions and color spill replacement.

### Masking

The main switcher has masks available for every key channel (including chroma keys), plus an additional masking system available to each chroma key channel. Chroma keys can utilize static 'box' masks or dynamic masks from an external source. Dynamic masks are fed from virtual set systems (such as Ross Voyager) and follow camera moves through camera-tracking data provided by robotic systems.

Physical Input Configuration											
	Text	Size	Color	Inverse	Alpha Source	Alpha Mode	Mask Source	GPO	Configure	TSL Address	TSL Tally
Input1	Cam 1	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input2	Cam 2	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input3	Cam 3	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input4	Cam 4	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input5	Cam 5	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input6	CK Cam1	Large	Green	No	--none--	--none--	VS1 MSK	--none--	SDI	--none--	--none--
Input7	VS 1	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input8	VS1 MSK	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--
Input9	9	Large	Green	No	--none--	--none--	--none--	--none--	SDI	--none--	--none--

Associate an external mask source with the chroma key input signal and it will automatically-select when the external mask is turned on in the chroma key mask settings.

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#### Adjustment Examples:

High-resolution images below, be sure to zoom-in to see the difference!

##### Example 1



Original Image



Key Channel after INIT



Composite after INIT

Detail key adjustment only. Original has areas with dark detail in hair.

Lifted Shadow Sensitivity to 35 and adjusted Edge Softness to 0



Shadow Sensitivity ADJ

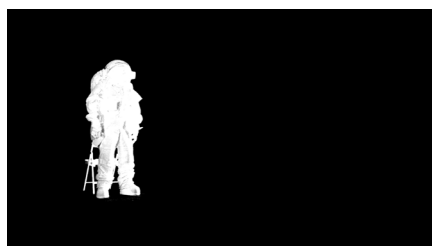


Composite after ADJ

##### Example 2



Original Image



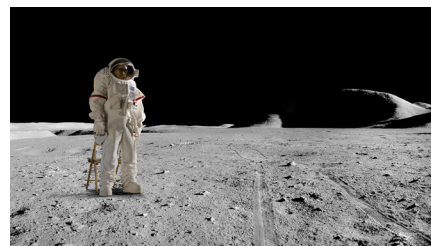
Key Channel after INIT



Detail Gain Adjust

Detail key adjustment only. Original subject is too dark with heavy green spill.

Lifted Detail Key Gain to 56 and added soft mask to remove unwanted background



Composite after ADJ



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### The Four Chroma Key Commandments:

#### 1. A Great Chroma Key is Made from a Great Original Source

Before attempting to setup the chroma keyer make sure lighting, background and talent all look great on the camera; and that camera *Gain* and *Detail* have been reduced to a necessary minimum.

#### 2. No Chroma Key is Ever the Same, Start Fresh with INIT

Every set has its own lighting conditions, camera & lens setups, CK wall-quality, consistency of paint, foreground talent clothing, colors and skin tones. The Ultrachrome automatic initialization (*INIT*) does not require color pickers or hue controls; once the general color vector has been selected, it will analyze the entire frame and determine the exact chroma vector & angle of the color background to be removed.

#### 3. INIT, Try, Re-INIT and Try Again

The fine-tuning required to get a great result is often minimal and frequently hinges on the adjustment of a single parameter. Changing the value of the wrong parameter can make it impossible to then make corrections with other controls. When learning the nuances of this chroma key, re-*INIT* after making a change that does not achieve the desired result and then try another. Also, all chroma key parameters are saved in the Carbonite Ultra memory system, so you can save a setup and then start over if necessary.

#### 4. No Last Minute Changes

Once the chroma set, lighting and cameras are tuned for best performance - don't change anything! On a normal set, it is common to make last minute tweaks & changes to lighting, iris settings, and even talent/wardrobe. When chroma keying, these changes will require the key to be reset and adjusted - which is fine if you have the time. Avoid change if you can, especially at the last minute, it can substantially lower operator blood pressure.



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## Chroma Key Tricks and Tips

### The Set:

In every set design, care must be taken to ensure there are no visible seams, joints or hard corners that will appear on camera. Paint should be chosen that is as close as possible to the exact color vector that will be used, typically Green or Blue. If the paint pigment is not precise and several batches of paint or repaint are required, the uneven color result will make the perfect key impossible. There are several vendors of chroma key specific paints and set materials you can work with. Ross Video works closely with ProCyc ([www.procyc.com](http://www.procyc.com)) in the USA, we whole-heartedly recommend their products.

The set should be sized to allow ample separation between foreground talent and the chroma background wall; ideally at least 6-to-8 feet of separation. The further the distance, the easier it is to reduce unwanted color spill and achieve good lighting separation.

### Lighting:

Lighting configuration will naturally vary with set design and choice of lighting equipment, but there are some simple rules that will help achieve the best results:

- Light the chroma set independent of the talent: light the walls and floor to achieve flat, even illumination.
- Light the talent independently: use back and side lighting to minimize color spill from the walls and floor. Use floor or stand mounted front 'fill' lights to eliminate areas of spill reflected from the floor.
- Don't light the background too brightly: it should ideally be half a stop or more below the level of the foreground subject (about 50 - 75% of the foreground on a waveform monitor).
- Don't rely on eyesight: when assessing the set lighting and background quality and finish - eyesight will mislead you. Look at the camera output on a waveform / vectorscope and ensure that the chroma background reads as an even signal without variation.

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#### Camera & Lens:

**Resolution:** Cameras naturally vary in performance; the ideal camera has a high-resolution imager with very low noise. This is critical for an excellent final result. Medium resolution imagers can produce great results in normal video productions, but rely on relatively high-detail settings to enhance image edges. Detail-enhanced edges are undesirable in chroma keying. These edges will appear as bright or dark key halos, which cannot be removed without compromising overall key quality.

**Imager/Sensor Noise:** Noise is always present in the video image but can be minimized by choice of sensor type and gain settings. Image noise has a significant effect on chroma keying as the chroma levels in a normal video image are much lower than the luma levels - as a result, the chroma information contains proportionately more noise. High noise-levels will be most obvious in dark areas of a developed chroma key and can be very difficult to remove without compromising key quality. The better the noise performance of the camera - the better the end result.

**Lens:** Select a camera lens based on the set size and production needs. Some lower-cost lenses can exhibit chromatic aberration - colored halos - around edge transitions in certain lens regions. This has a highly undesirable effect on edge quality.

**Detail:** Avoid high levels of detail regardless of camera type; if detail is necessary to achieve the image-quality desired, then the best choice is to use the chroma key *Edge Softness* control to soften the edge and conceal the aberrations caused by detail setting.

#### Shadow Trick:

Developing a shadow from the chroma key set can give you a more realistic final output, but this is very difficult to do. As previously mentioned, noise lurks in the shadows and can look quite nasty. But all is not lost, very acceptable shadows are achievable with a nifty keying trick.

Here is how it works:

**Step 1.** Setup the chroma key as usual; don't worry about resolving the shadow, just make the best key you can. Assign the key to an ME or MiniME keyer, with an empty keyer below it (Example: chroma key on Key 2, with Key 1 unassigned).

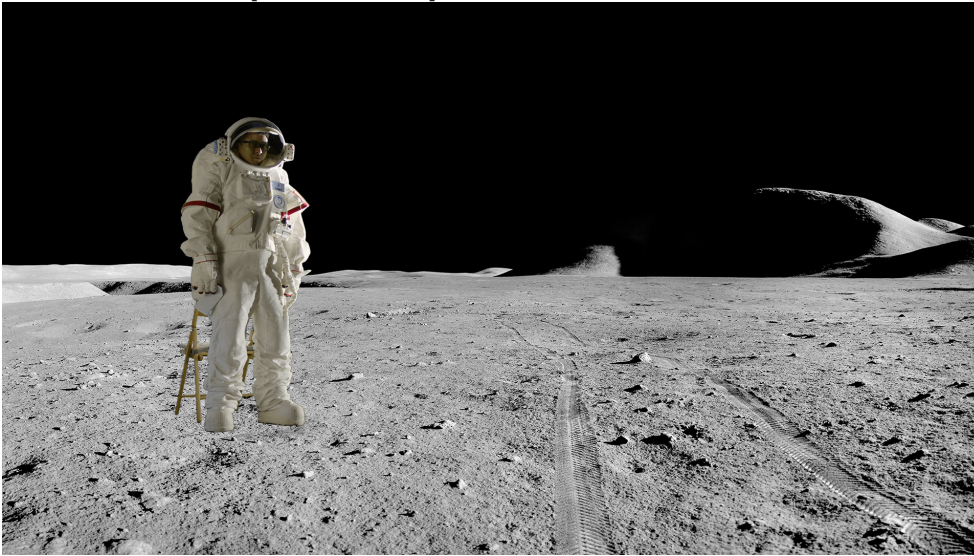
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## Shadow Trick: (continued)



Chroma key setup and applied to key 2.

No attempt made to resolve any shadows as they are weak and indistinct. Raising the shadow sensitivity would bring up other set errors.



**Step 2.** Set Key 1 type as Auto Select then select Black as the Key Fill and the chroma key source camera (in this example: Media Store 1) as the Key Alpha source. Turn on Key Invert and leave the keyer in Normal Mode.





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## Shadow Trick: (continued)

**Step 3.** Now adjust the key *Clip* and *Gain* until the shadow area has the look you desire (you can ignore the rest of the image as it will be concealed by the chroma key above it).



**Step 4.** Now adjust *Key Transparency* for the most realistic shadow look.



**Step 5.** Turn on the chroma key in *Key 2* - Voila! Great looking shadow from a poor image. Good trick!