USER MANUAL

Indigo
SYSTEM

CoolFlow

Safire 3

3G/HD/SD real-time chroma keyer

Crystal Vision

Contents

R1.1	Major revision to whole manual, including addition of Safire 3 Controller and VisionWeb Control and removal of front panel and board edge control detailed descriptions. Statesman control moved to appendix.	02/04/14
R1.2	Safire 3 Controller renamed as VisionPanel. Updated panel operation and GUIs.	23/10/15
R1.3	Clarified GPI section.	29/07/16
R1.4	New 'FG Colour Compensate' and 'Presets & Outputs' menus.	20/02/17
R1.5	Updated VisionPanel button operation and images to reflect changes made in V1.6 VisionPanel, V5.7 Indigo and V1.9 Safire 3 software.	29/06/17
R1.6	Corrected "Max Clip set to zero" typo on page 59 – changed to Min Clip.	21/12/17
R1.7	Added note about removal of card edge control in 2019.	14/01/21

1 Introduction

Safire 3 is a modular real-time chroma keyer for 3Gb/s, HD and SD sources. Ideal for live virtual productions from studio to sport. It includes enhanced key processing features to create a realistic key as well as video delay and foreground colour correction. The main features are as follows:

- **Use with any source** – works with 3Gb/s, HD and SD.

- **Supports the following video standards:** 625i, 525i, 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94, 1080p60, 1080PsF23.98, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 2048x1080p23.98*, 2048x1080p24*, 2048x1080p25*, 2048x1080p29.97*, 2048x1080p30*, 2048x1080PsF23.98*, 2048x1080PsF24*, 2048x1080PsF25*, 2048x1080PsF29.97*, 2048x1080PsF30* (*= YUV 4:2:2 10 bit).

- **Key on any colour** – select any key colour including grass.

- **Auto setup** – cursor based auto setup produces optimal chroma key result.

- **Optimise the video** – video proc-amps allows adjustment of foreground and background video gains and black levels to provide the most realistic composite image after chroma keying. RGB gain and lift of the Foreground video signal.

- **Offset the graphic generator's delay** – up to ten frames of video delay for each input.

- **Correct timing errors automatically** – each input has a frame synchroniser timed to an external reference or selected input.

- **Internal mask generator** – to overrule the chroma keyer to force areas to be foreground or background. Use to prevent unwanted keying from reflective objects or to force keying if the backdrop is too small or damaged.

- **External key input** – use Safire 3 as a linear keyer to key graphics into a video source, or use as a chroma key mask.

- **Internal matte generator** – use as a fill for Foreground and Background keys.

- **Fade keys** – fade keys up and down with an auto-transition or manually.

- **Fade to Black** – fade main output to black with an auto-transition or manually.

- **Two video outputs** – independent Main and Aux outputs feature routable sources to display all inputs and outputs.

- **Control** of Safire 3 is most easily achieved by VisionPanel or VisionWeb Control web browser software. Control can additionally be from SNMP. Board edge control was also available prior to 2019.

- **GPI control** of configuration set-ups and key fade.

- **Supports the following rear module connectors:** RM50, RM73.

- **Compatible** with Crystal Vision standard frames available in 2U, 1U and desk top box.

- Passes all ancillary data.

Block Diagram
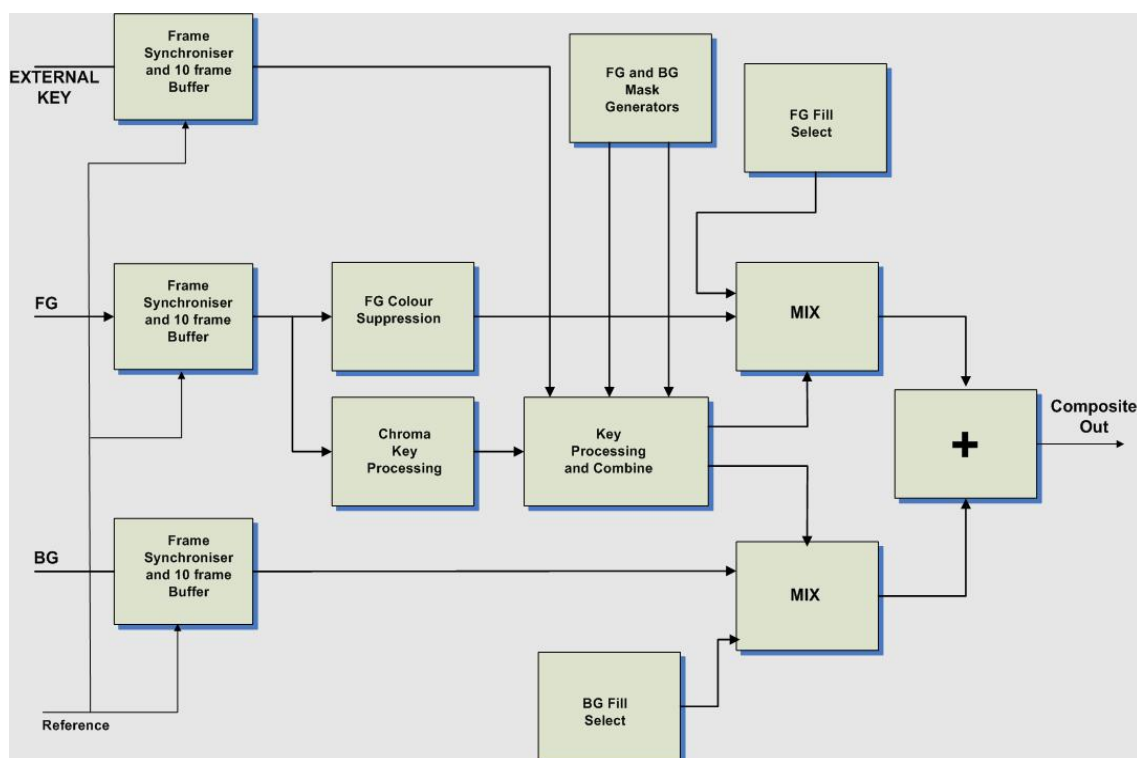
Safire 3 simplified block diagram

Block Diagram Description

The Foreground (FG), Background (BG) and External Key video inputs are firstly frame synchronised, delayed and timed to an external analogue Black and Burst or tri-level syncs reference, or to one of the other inputs.

The FG signal is then passed to the FG suppression block where, in Suppress Foreground mode, all colours in the FG acceptance window are de-saturated to shades of grey and any colour exactly the same as the FG hue colour will be suppressed to black. Luminance is subtracted from the suppressed signal to ensure that all the coloured backdrop area is black. In Multiply Foreground mode the suppression block is bypassed.

A key is derived from the chroma key processing block which is maximum for FG colours exactly the same as the Chroma Key Colour hue. All other colours within the Chroma Key Colour acceptance window will produce varying amounts of key from maximum in the centre to zero at the edges. The clipped chroma key is combined with other keys and masks to produce a single key which is used to cut a hole in the Background video – and in Multiply Foreground mode only, the inverse key cuts a hole in the FG signal as well.

The FG and BG signal are mixed with their selected video, matte or black fills before being added together to make the final composite output.

2 Hardware installation

Board configuration
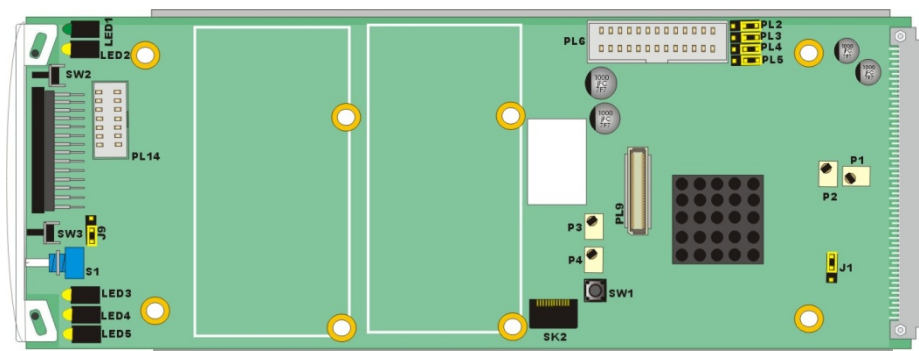
Safire 3 main board top-side

Link Configuration

There are four user-settable links on the Safire 3. These are PL2-5, all other links should be left in the position shown in the above picture. PL2-5 set whether the board's GPI inputs are used as GPIs or as an extra serial I/O port.

Link	Towards front of board or Up	Towards the rear of board or Down
J1	Sync input unterminated.	Sync input terminated by 75 ohms
J9	Debug mode – forces board's IP address to be 10.0.0.201	Normal mode (factory set, do not alter)
PL2	GPI 1 Input = RS422 Rx+	GPI 1 Input = GPI 1
PL3	GPI 2 Input = RS422 Rx-	GPI 2 Input = GPI 2
PL4	GPI 3 Input = RS422 Tx+	GPI 3 Input = GPI 3
PL5	GPI 4 Input = RS422 Tx-	GPI 4 Input = GPI 4

Front Edge LEDs		
PSU	HD	SD
On if power supply OK	On if reference signal is HD format	On if reference signal is SD format

3 Rear modules

The 2U Indigo 2 frame will house up to 12 single height modules and dual power supplies. The 1U Indigo 1 frame will house six single height modules and a single or dual power supply. The Indigo DT desk top boxes have a built-in power supply and will house up to two single height modules. All modules can be plugged in and removed while the frame is powered without damage.

Note: *For details of fitting rear connectors please refer to the appropriate frame manual.*

Safire 3 can support the following rear modules: RM50, RM73.

Rear module connections with RM50

The RM50 being a single height module will allow maximum packing density with the maximum number of inputs and outputs available.
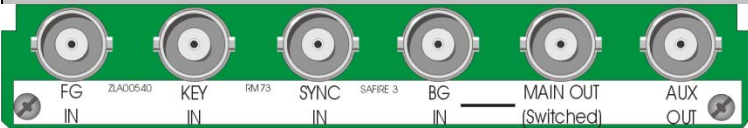
RM50 rear module connector	Description
	RM50 • 12 per Indigo 2 frame • Six per Indigo 1 frame • Two per Indigo DT • All frame slots can be used

BNC connections

BNC	I/O assignment
FG IN	3G/High Definition/Standard Definition serial digital input
KEY IN	3G/High Definition/Standard Definition serial digital input
SYNC IN	Analogue Black & Burst or tri-level syncs reference for video synchroniser
BG IN	3G/High Definition/Standard Definition serial digital input
MAIN OUT	3G/High Definition/Standard Definition serial digital output
AUX OUT	3G/High Definition/Standard Definition serial digital output

Rear module connections with RM73

The RM73 being a single height module will allow maximum packing density with the maximum number of outputs available. This module features relay bypass protection, automatically switching the main output to BG IN in the event of power failure.

RM73 rear module connector	Description
	RM73 • 12 per Indigo 2 frame • Six per Indigo 1 frame • Two per Indigo DT • All frame slots can be used

BNC connections

BNC	I/O assignment
FG IN	3G/High Definition/Standard Definition serial digital input
KEY IN	3G/High Definition/Standard Definition serial digital input
SYNC IN	Analogue Black & Burst or tri-level syncs reference for video synchroniser
BG IN	3G/High Definition/Standard Definition serial digital input
MAIN OUT (SWITCHED)	3G/High Definition/Standard Definition serial digital output
AUX OUT	3G/High Definition/Standard Definition serial digital output

4 General Purpose Interface

Introduction

Each frame slot has up to six connections 'a-f' for GPI control and monitoring. These connections are available at the rear of the frame on the 26-way D-Type remote connectors.

Safire 3 has six GPI inputs. Five recall one of 32 presets and the sixth is used to trigger an auto transition of the Key Fade (see GPI Fade Keys control description).

Each General Purpose Interface (GPI) input is fitted with a 10kΩ resistor connected to the internal +5V and in the following table, this equates to logic 'H'. With the GPI preset recall lines set to 'level' mode and no connections (logic 'HHHHH'), preset 1 will be selected. With the GPI preset recall lines set to 'pulse' mode, the GPI will be activated whenever a bit is pulled low but no change to the preset selection will occur when all bits return to logic 'HHHHH'. Note that preset 32 is not accessible in pulse mode.

Note: Because the GPI inputs are sampled in the vertical interval it is recommended that in 'pulse' mode, the GPI should be asserted at least 2mS before the start of vertical sync to ensure stability and held active for at least 40mS.

See *Presets, Resets & GPI/Os***Error! Reference source not found.** in this manual for details of inverting the GPI preset logic.

Each General Purpose Interface output has a 270Ω resistor in series with its output. This allows for an external LED to be driven, connected to a DC voltage of +5V.

The GPI inputs can be programmed to automatically recall a previously saved preset configuration. The 32 user preset configurations are selected using binary notation. Presets 33-40 are only accessible via VisionWeb or VisionPanel.

GPI			Low (<1V) High (+5V)
1	'a'	Recall preset bit 1	
2	'b'	Recall preset bit 2	See following table for user preset control
3	'c'	Recall preset bit 4	
4	'd'	Recall preset bit 8	
5	'e'	Recall preset bit 16	
6	'f'	Fade Key Autotrans	Trigger Autotrans (see GPI Fade Keys Setup)

Table showing the six GPI functions

GPI	Bit 16	Bit 8	Bit 4	Bit 2	Bit 1
Preset					
1	H	H	H	H	H
2	H	H	H	H	L
3	H	H	H	L	H
4	H	H	H	L	L
5	H	H	L	H	H
6	H	H	L	H	L

7	H	H	L	L	H
8	H	H	L	L	L
9	H	L	H	H	H
10	H	L	H	H	L
11	H	L	H	L	H
12	H	L	H	L	L
13	H	L	L	H	H
14	H	L	L	H	L
15	H	L	L	L	H
16	H	L	L	L	L
17	L	H	H	H	H
18	L	H	H	H	L
19	L	H	H	L	H
20	L	H	H	L	L
21	L	H	L	H	H
22	L	H	L	H	L
23	L	H	L	L	H
24	L	H	L	L	L
25	L	L	H	H	H
26	L	L	H	H	L
27	L	L	H	L	H
28	L	L	H	L	L
29	L	L	L	H	H
30	L	L	L	H	L
31	L	L	L	L	H
32	L	L	L	L	L

Binary coding of GPI inputs to recall preset configurations in level mode.

GPI	Bit 16	Bit 8	Bit 4	Bit 2	Bit 1
Preset					
No change					
1					⊔
2				⊔	
3				⊔	⊔
4			⊔		
5			⊔		⊔
6			⊔	⊔	
7			⊔	⊔	⊔
8		⊔			
9		⊔			⊔
10		⊔		⊔	
11		⊔		⊔	⊔
12		⊔	⊔		
13		⊔	⊔		⊔
14		⊔	⊔	⊔	
15		⊔	⊔	⊔	⊔
16	⊔				
17	⊔				⊔
18	⊔			⊔	
19	⊔			⊔	⊔
20	⊔		⊔		

21	⎍	‑‑‑‑	⎍	‑‑‑‑	⎍
22	⎍	‑‑‑‑	⎍	⎍	‑‑‑‑
23	⎍	‑‑‑‑	⎍	⎍	⎍
24	⎍	⎍	‑‑‑‑	‑‑‑‑	‑‑‑‑
25	⎍	⎍	‑‑‑‑	‑‑‑‑	⎍
26	⎍	⎍	‑‑‑‑	⎍	‑‑‑‑
27	⎍	⎍	‑‑‑‑	⎍	⎍
28	⎍	⎍	⎍	‑‑‑‑	‑‑‑‑
29	⎍	⎍	⎍	‑‑‑‑	⎍
30	⎍	⎍	⎍	⎍	‑‑‑‑
31	⎍	⎍	⎍	⎍	⎍
32	Not accessible in pulse mode				

Binary coding of GPI inputs to recall preset configurations in pulse mode.

Indigo DT desk top box GPI connections

GPI lines 'a' to 'f' of each card connect to two rear remote connectors as follows:

Slot no.	'a' pin	'b' pin	'c' pin	'd' pin	'e' pin	'f' pin
1	8 (1)	9 (1)	18 (1)	26 (1)	19 (2)	20 (2)
2	7 (1)	16 (1)	17 (1)	25 (1)	10 (2)	11 (2)

Table shows pin number (remote number)

Note: *Remote 1: 26-way high-density D-Type female socket. Frame ground is pin 2 and +5V @500mA is pin 1.*
Remote 2: 26-way high-density D-Type male plugs and frame ground is pin 6 and +5V @500mA is pin 15.
Note: The +5V output is protected by self-resetting thermal fuses, which limit the total output current available from Remotes 1-2 to approximately 1A.

1U frame GPI connections

GPI lines 'a' to 'f' of each card connect to two rear remote connectors as follows:

Slot no.	'a' pin	'b' pin	'c' pin	'd' pin	'e' pin	'f' pin
1	8 (1)	9 (1)	18 (1)	26 (1)	19 (2)	20 (2)
2	7 (1)	16 (1)	17 (1)	25 (1)	10 (2)	11 (2)
3	5 (1)	6 (1)	15 (1)	24 (1)	1 (2)	2 (2)
4	4 (1)	14 (1)	13 (1)	23 (1)	3 (2)	4 (2)
5	3 (1)	12 (1)	22 (1)	21 (1)	12 (2)	13 (2)
6	10 (1)	11 (1)	19 (1)	20 (1)	21 (2)	22 (2)

Table shows pin number (remote number)

Note: *Remote 1: 26-way high-density D-Type female socket. Frame ground is pin 2 and +5V @500mA is pin 1.*
Remote 2: 26-way high-density D-Type male plugs and frame ground is pin 6 and +5V @500mA is pin 15.
Note: The +5V output is protected by self-resetting thermal fuses, which limit the total output current available from Remotes 1-2 to approximately 1A.

2U frame GPI connections

GPI lines 'a' to 'f' of each card connect to two of four rear remote connectors as follows:

Slot no.	'a' pin	'b' pin	'c' pin	'd' pin	'e' pin	'f' pin
1	8 (1)	9 (1)	18 (1)	26 (1)	19 (2)	20 (2)
2	7 (1)	16 (1)	17 (1)	25 (1)	10 (2)	11 (2)
3	8 (3)	9 (3)	18 (3)	26 (3)	19 (4)	20 (4)
4	7 (3)	16 (3)	17 (3)	25 (3)	10 (4)	11 (4)
5	5 (1)	6 (1)	15 (1)	24 (1)	1 (2)	2 (2)
6	4 (1)	14 (1)	13 (1)	23 (1)	3 (2)	4 (2)
7	5 (3)	6 (3)	15 (3)	24 (3)	1 (4)	2 (4)
8	4 (3)	14 (3)	13 (3)	23 (3)	3 (4)	4 (4)
9	3 (1)	12 (1)	22 (1)	21 (1)	12 (2)	13 (2)
10	10 (1)	11 (1)	19 (1)	20 (1)	21 (2)	22 (2)
11	3 (3)	12 (3)	22 (3)	21 (3)	12 (4)	13 (4)
12	10 (3)	11 (3)	19 (3)	20 (3)	21 (4)	22 (4)

Table shows pin number (remote number)

Note: *Remote 1 and Remote 3 are 26-way high-density D-Type female sockets. Frame ground is pin 2 and +5V @500mA is pin 1 in each case.*
Remote 2 and Remote 4 are 26-way high-density D-Type male plugs and frame ground is pin 6 in each case and +5V @500mA is pin 15 on Remote 2.
Note: The +5V output is protected by self-resetting thermal fuses, which limit the total output current available from Remotes 1-4 to approximately 1A.

5 VisionPanel

Introduction

VisionPanel is a stylish 3U control panel for the hands-on control of up to 16 frames containing Crystal Vision products including the Safire 3 and Safire 3 Xpress chroma keyers. Multiple VisionPanels can be installed – allowing any device to be controlled from a number of locations. It can also be used alongside the VisionWeb web browser control for simultaneous operation of systems. VisionPanel features eight hard buttons that have the following function:

Button	Function
C 1/5	**Select Channel 1 as the device to control or Channel 5 if the 'Shift' button is held down.**
C 2/6	**Select Channel 2 as the device to control or Channel 6 if the 'Shift' button is held down.**
C 3/7	**Select Channel 3 as the device to control or Channel 7 if the 'Shift' button is held down.**
C 4/8	**Select Channel 4 as the device to control or Channel 8 if the 'Shift' button is held down.**
Shift	**Hold down to select alternate function. Hold down for fine knob adjustment.**
Presets Outputs/ CKey Enable	**Jump directly into the 'Presets & Outputs' menu or enable/disable chroma key if the 'Shift' button is held down.**
GainSpill/ Key Status	**Jump directly into the 'Gain & Spill' menu or into the 'Key Status' menu if 'Shift' is held down.**
Back/Home	**Go back a menu level, or jump to the 'Home' menu if the 'Shift' button is held down, where all the top level menu options are available.**
Knob click	**Press down on the knob to default the value of the slider being adjusted.**

Crystal Vision cards can be assigned to one of eight channels by using the card management menu (see below). The four buttons on the left of VisionPanel in conjunction with the 'Shift' button (top right) allow you to select which one of eight devices you want to control but should your system contain more than eight devices, you can easily select additional ones to control using the 'Cards List' menu (see below) on the touch screen.

Soft buttons on the touch screen are used in conjunction with physical knobs to access the various intuitive setup menus, which allow the key processing, masks and engineering settings to be configured with ease. Fades can be implemented using one of these soft buttons or by using a GPI.

VisionPanel is designed to operate the Safire 3 over Ethernet using standard CAT5 cables. Just plug the panel into your Ethernet network to connect to the Safire 3 chroma keyers set up on that network.

Panel Overview
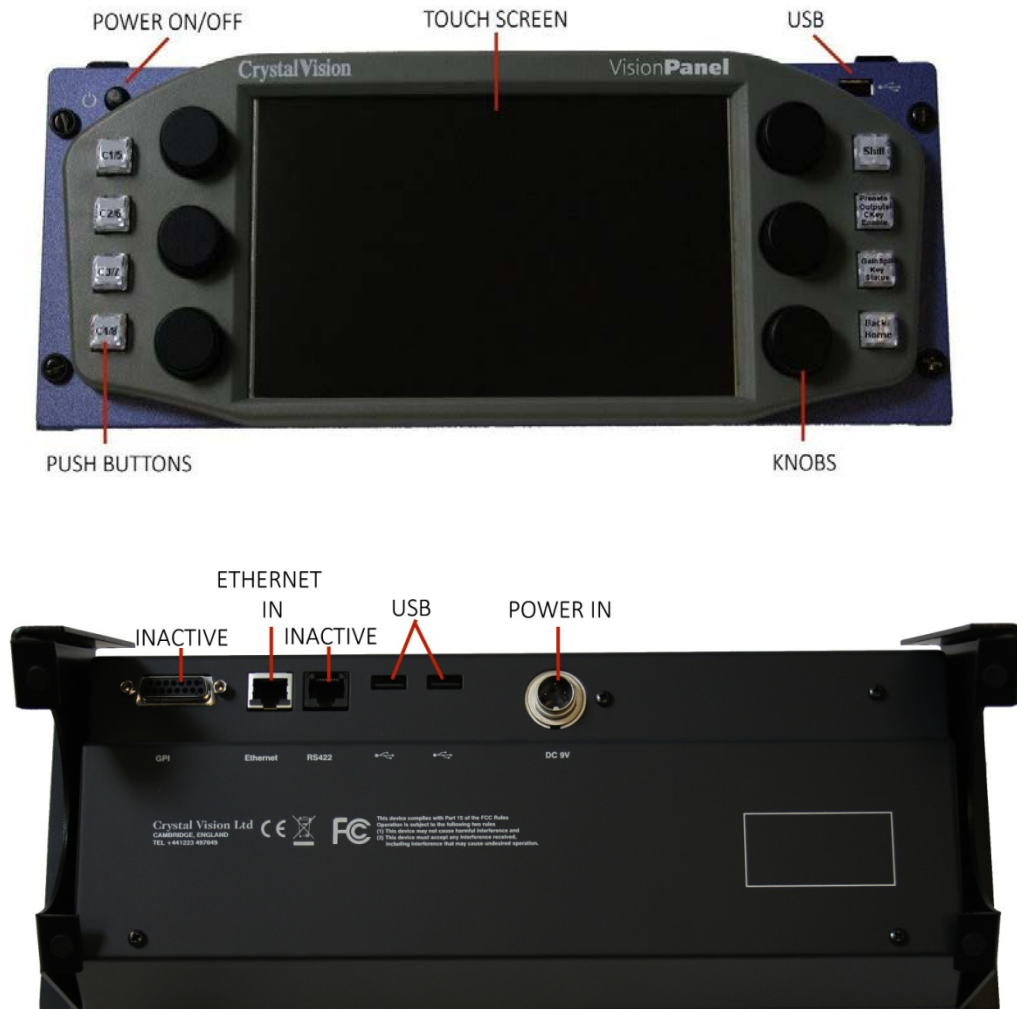
Mounting

VisionPanel can be mounted on a desk, inside a desk or in a 19" rack using the supplied mounting ears.

The desk stand brackets can be mounted in two orientations as shown below. The panel is shipped with the brackets pre-fitted to the shallower orientation. To change to the steep orientation undo the four fixing screws and reverse the

brackets so the left hand bracket is fitted to the right and vice versa.

Connecting

VisionPanel requires an Ethernet link to the Crystal Vision frame housing the Safire 3 chroma keyer. The Crystal Vision frame must therefore be Ethernet capable such as the Indigo 2SE/2AE or equivalent 1U or desk top models. See the frame specific manuals for details on how to assign an IP address to the frame.

Connect VisionPanel to the same network as the Crystal Vision frame using a standard CAT5 network cable. Direct connections from the panel to the frame are also supported and do not require a crossover cable.

Screw the supplied 9V External PSU onto the power connector on the rear of the VisionPanel.

VisionPanel Connections
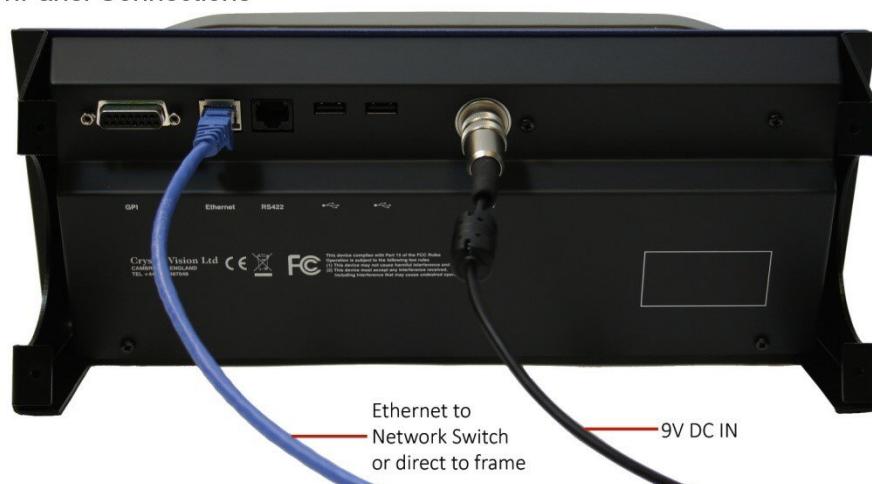
Setting Up
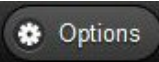
When first powering VisionPanel you will need to set the panel's network settings.

The procedure is as follows:

1. Turn VisionPanel on using the power button on the front of the control panel. The screen will display the 'Card List' menu which will eventually be filled by the names and locations of detected cards:
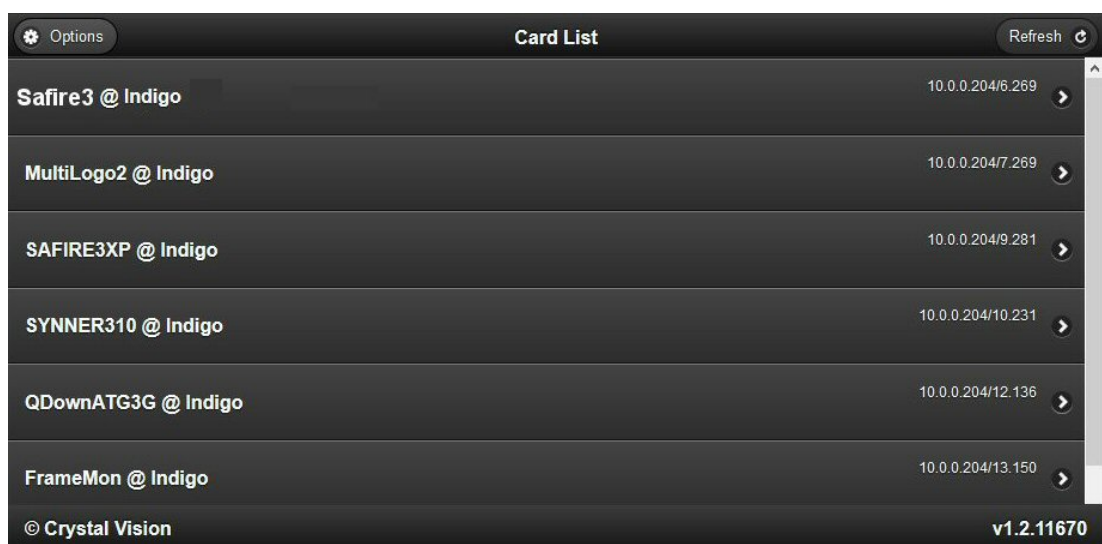
Example of Card List display showing a number of Crystal Vision cards

2. Press the "Options" button at the top left of the touch screen and the 'Network Settings' menu will be displayed:
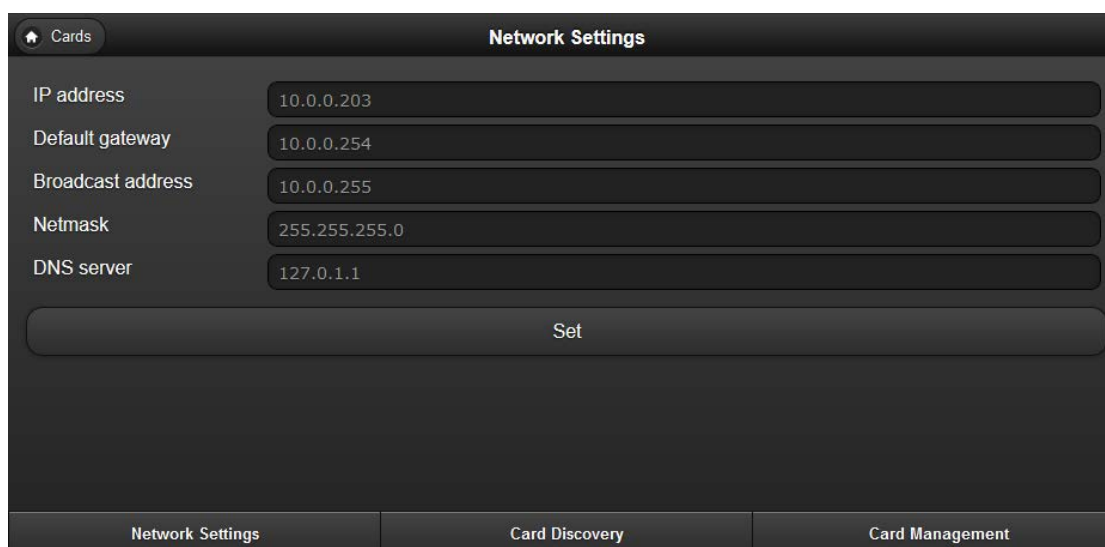
Example of Network Settings display

3. Using the pop-up on screen keyboard, enter the following address fields in 'dot-decimal' notation:

IP Address – the panel's IP Address.

Default Gateway – the address of any device that must be addressed in order to access devices within external networks, usually the router's IP address.

Netmask address – this selects the range of network addresses that are checked when identifying devices within a network. For instance a Netmask of 255.255.255.0 will only test the first 24 bits of IP addresses. So a panel with an IP address of 10.0.0.203 and with the netmask above will consider all devices with an IP address of 10.0.0.xx as part of the same network.

Broadcast address – the address that a packet uses to broadcast to the whole network and is usually the IP address of the panel but with all bits that are zero in the netmask set to 1. So the broadcast address in the above example would be 10.0.0.255.

DNS Server – this is the address of a server that translates domain names and IP addresses.

Note: The Broadcast address and DNS server information is not currently used so can be left at the default values.

4.   Press 'Set' when all the fields have been entered.

5.   Press the 'Card Discovery' tab to enter IP addresses of the frames you want to scan:

Example of 'Card Discovery' display

6.   Enter the IP addresses (e.g. 10.0.0.201) of all the frames you wish to control, up to a maximum of 16 frames. It is not necessary to add the port number. Press 'Add' to include an IP address or 'Delete' to remove it.

7.   Press 'Discover' to make the panel search the IP addresses in the list and create a new list of cards (the old card list will be deleted).

8.   Select 'Card Management' to assign different cards to the hard Card Select buttons on the panel (C1 to C8) by using the 'Move Up' buttons below. It also allows you to delete cards you don't want to show on the VisionPanel. You cannot rename cards on VisionPanel. However you can rename cards using VisionWeb (V5.1 or later) and this name will then propagate to the VisionPanel.
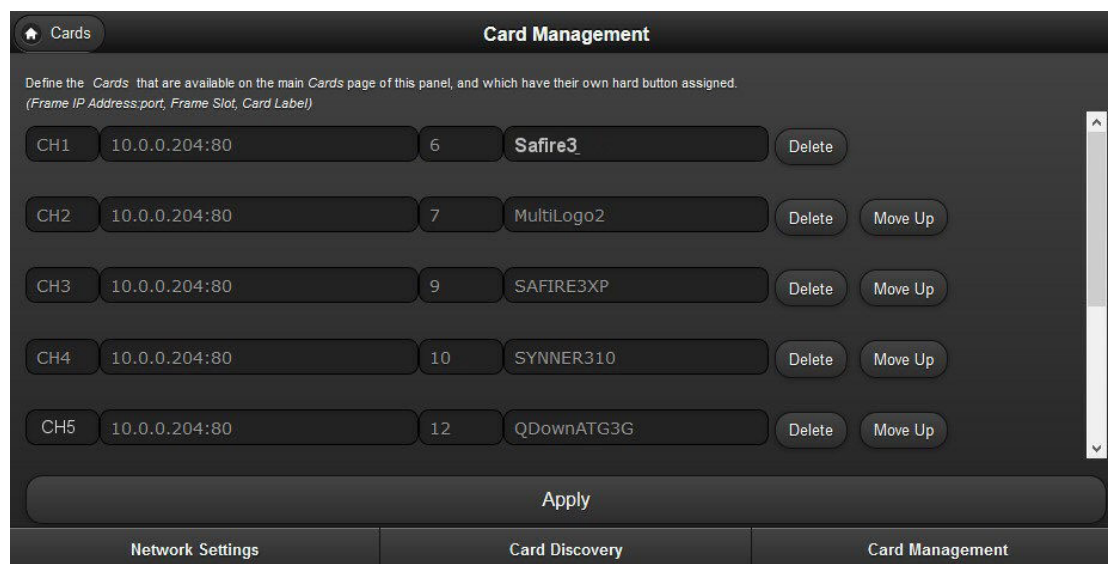
Example of 'Card Management' display

9. Returning to the 'Cards List' menu by pressing 'Cards' at the top left hand corner should now display a list of all the cards in all the frames detected by card discovery, except those cards specifically excluded by card management.

10. Selecting any Safire 3s will display the card's home page:
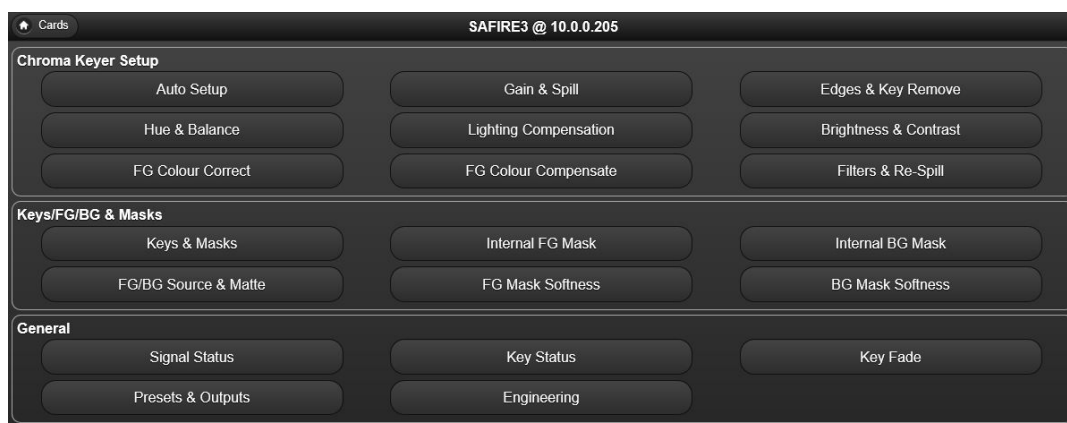
Safire 3's home page

The Safire 3's home page is split into three panels: Chroma Keyer Setup, Keys/FG/BG & Masks and General. Within each panel are a number of buttons, each one reveals a number of controls. These controls are documented in the 'Controls' section of this handbook.

Operation

Left hand side panel buttons

Use the push buttons on the left hand side of the VisionPanel to quickly select which device is to be controlled.

For systems containing more than eight keyers, the touch screen 'Cards List' menu can be used for accessing additional channels.

Right hand side panel buttons (V1.6 software and later)

Use the push buttons on the right hand side for the following actions:

Shift – Hold down to select the alternate function.

Presets Outputs/CKey Enable – jump directly into the 'Presets & Outputs' menu or enable/disable the chroma key if the 'Shift' button is held down.

GainSpill/Key Status – jump directly into the 'Gain & Spill' menu or into the 'Key Status' menu if the 'Shift' button is held down.

Back/Home – return the touch screen to the previous menu, or if 'Shift' is held down, quickly return the touch screen to the keyer's 'Home' menu.

Knobs
(V1.6 software and later)

The six knobs allow easy adjustment of the touch screen slider controls.

For fine adjustment hold down the 'Shift' button and turn the knob.

To default the value of the slider being adjusted, press down on the knob.

6 VisionWeb Control

Introduction

VisionWeb Control is the web interface for controlling Crystal Vision boards. Just by connecting the Indigo frame containing Safire 3 to a PC via an Ethernet connector, and browsing to the IP address of the frame, a similar page to below will be displayed, showing all the controllable boards fitted in the frame:

By selecting Safire 3 the board's home page will be displayed:

All of Safire 3's controls are accessible from here. Click on each tab to reveal more controls. All controls are documented in the 'Controls Descriptions' section of this handbook.

Connecting

Connect the Indigo frame to the PC via an Ethernet cable. Some older PCs may require a crossover cable. Enter the IP address of the frame into the browser to load the home page. Indigo frames have a default IP address of 10.0.0.201.

See the relevant frame user manual for more information on VisionWeb Control and setting up of the frame IP address and connecting to a computer.

Menu Tree

The following menu structure is the means to access the various Safire 3 controls and status. A more detailed description is in section – 'Control Descriptions'. The basic menu structure for VisionPanel, VisionWeb and front panel access is identical and consists of the following groups and sub-groups:

Chroma Key
Setup

    Auto Setup

        Sample Setup

            Grab
            Background
            Foreground

        Show Samples

            Show samples on Main
            Show samples on Aux
            Freeze Input

        Sample Positions

            Reset Samples
            Sample Select
            Horizontal
            Vertical

        Auto Settings

            Reset Chroma Keyer
            Auto Lighting
            Auto Respill

    Gain and Spill

        Chroma Key

            Min Clip
            Max Clip
            Acceptance

        Foreground

            Suppression
            Acceptance

        Chroma Key Control

            Enable
            Suppress Foreground
            Multiply Foreground
            Invert

    Edges & Key
    Remove

        Chroma Key Removal

            Black
            Greys
            White

        Edges & Shadows

            Edge Processing
            Shadow Density
            Key Shrink

    Hue & Balance

        Key Colour Tune

            Key Hue
            Background Saturation

        Balance & Tints

            Suppression Hue
            Foreground Balance
            Foreground Tints

    Lighting
    Compensation

        Lighting Compensation

            Enable
            Aspect Ratio
            Left
            Right
            Top
            Bottom
            Radial

    Brightness &
    Contrast

        Foreground Adjust

            FG Lift
            FG Gain

```
                                              FG Chroma
                          Background Adjust
                                              BG Lift
                                              BG Gain
          FG Colour                           BG Chroma
          Correct
                          Foreground RGB Gain
                                              Red
                                              Green
                                              Blue
                          Foreground RGB Lift
                                              Red
                                              Green
                                              Blue
          FG Colour
          Compensate
                          Pre-Key RGB Lift
                                              Red
                                              Green
                                              Blue
          Filters &
          Re-spill
                          Filters
                                              Ring Suppression
                                              Noise Reduction
                                              Edge Softening
                          Foreground Re-spill
                                              Re-spill enable
                                              Red
                                              Green
  Keys                                        Blue
  FG/BG &
  Masks
          Keys & Masks
                          External Key Control
                                              Enable
                                              Multiply
                                              Invert
                                              Min Clip
                                              Max Clip
                          External Mask Control
                                              Enable
                                              Multiply
                                              Invert
                                              Min Clip
                                              Max Clip
                          Self Key Control
                                              Enable
                                              Multiply
                                              Invert
                                              Min Clip
          Internal FG Mask                    Max Clip
                          FG Mask Control
                                              Enable
                                              Invert
                          FG Mask Window
                                              Left
                                              Right
                                              Top
                                              Bottom
          Internal BG Mask
                          BG Mask Control
                                              Enable
```

```
                                              ┌─ Invert
                          BG Mask Window ──────┤
                                              │  Left
                                              │  Right
                                              │  Top
        FG/BG Source                          └─ Bottom
        & Matte
                          Foreground Matte ────┐
                                              │  Red
                                              │  Green
                                              └─ Blue
                          Background Matte ────┐
                                              │  Red
                                              │  Green
                                              └─ Blue
                          FG/BG Source ────────┐
        FG Mask                               │  Foreground
        Softness                              └─ Background
                          FG Softness ─────────┐
                                              │  Left
                                              │  Right
                                              │  Top
        BG Mask                               └─ Bottom
        Softness
                          BG Softness ─────────┐
                                              │  Left
                                              │  Right
                                              │  Top
General                                       └─ Bottom

        Signal Status
                          FG Input ────────────┐
                                              │  Standard
                                              │  Input Present
                                              │  Input Black
                                              │  Input Frozen
                                              └─ Input ATC Present
                          BG Input ────────────┐
                                              │  Standard
                                              │  Input Present
                                              │  Input Black
                                              │  Input Frozen
                                              └─ Input ATC Present
                          Key Input ───────────┐
                                              │  Standard
                                              │  Input Present
                                              │  Input Black
                                              │  Input Frozen
                                              └─ Input ATC Present
                          Reference Input ─────┐
                                              │  Standard
                                              └─ Input Present
                          Output ──────────────┐
                                              │  Standard
                                              │  Input Freeze Enabled
        Key Status                            └─ Output Faded to Black
                          Chroma Key ──────────┐
                                              │  Enabled
                                              └─ Faded Down
                          Self Key ────────────┐
                                              └─ Enabled
```

```
                                              │ Faded Down
                    External Key
                                              │ Enabled
                                              │ Faded Down
                    Masks Enabled
                                              │ External
                                              │ FG
                                              │ BG
Key Fade
                    Fade Keys
                                              │ Autotrans
                                              │ Fades Up
                                              │ Fades Down
                                              │ Fade Time
                                              │ Fade
                    Fade to Black
                                              │ Autotrans
                                              │ Fades Up
                                              │ Fades Down
                                              │ Fade Time
Presets & Outputs                             │ Fade
                    Presets
                                              │ Store
                                              │ Preset Select
                                              │ Recall
                    Main Output
                                              │ Main
                    Aux Output
                                              │ Aux


Delay & Timing
                    Genlock
                                              │ Source
                                              │ Reference
                                              │ Foreground Input Delay
                                              │ Background Input Delay
                                              │ Key Input Delay
                                              │ Short Delay
                    Output Delay
                                              │ Pixel Timing
                                              │ Line Timing
                    Frame Delays
                                              │ FG
                                              │ BG
                                              │ Key
Engineering
                    Output
                                              │ Format
                                              │ Ancillary Data
                                              │ Invert Output Key
                    GPI Preset Recall
                                              │ Enable
                                              │ GPI Active level
                                              │ GPI Trigger
                    GPI Fade Keys
                                              │ Enable
                                              │ GPI Active level
                                              │ GPI Trigger
                    Progressive Frames
                                              │ Lock Frames to ATC
                                              │ Swap FG Input
                                              │ Swap BG Input
```

```
                                              Swap Key Input
                                              Swap Output Frames
                      Reset
                                              Defaults
                                              Erase Presets
```

7 Control Descriptions

The controls of Safire 3 are accessible from VisionPanel, the VisionWeb Control software or the board edge. *Board edge control was removed from the Safire 3 in 2019 and therefore the card edge control information is only relevant for older versions of the product.*

The screen grabs of controls used in this manual are from VisionPanel but are similar to VisionWeb Control with a few minor differences. The path to locate controls via VisionWeb Control or board edge follows similar logic. For instance, in the VisionPanel display, an 'Input Frozen' indicator is accessed via the '**General'** panel, **'Signal Status'** tab and '**FG Input'** group where it can also be found in VisionWeb Control. To find the same control using the card edge follow the path **General->Signal Status->FG Input** to the **Input Frozen** indicator.

VisionWeb GUI controls are located in a number of tabs each containing panels which mostly contain the controls. Some controls are LEDs that are used to show status, others are check boxes, buttons or sliders which change various Safire 3 settings. (*Note: Slider controls in VisionWeb Control, once selected, can be moved by the keyboard up and down arrow keys to give finer control than possible with a mouse.*)

The description of the tabs are in the order shown in the GUI i.e.

AUTO SETUP, GAIN & SPILL, EDGES & KEY REMOVE, HUE & BALANCE, LIGHTING COMPENSATION, BRIGHTNESS & CONTRAST, FG COLOUR CORRECT, FG COLOUR COMPENSATE, FILTERS & RE-SPILL, KEYS & MASKS, INTERNAL FG/BG MASK, FG/BG SOURCE & MATTE, FG/BG MASK SOFTNESS, SIGNAL STATUS, KEY STATUS, KEY FADE, PRESETS & OUTPUTS, DELAY & TIMING, ENGINEERING.

Each tab is shown with a screen grab and description of each control's function:

Auto Setup

Set up chroma key auto-sampling. Enable Auto Lighting and Re-Spill. Select the number and position of samples and grab samples to create a composite image.
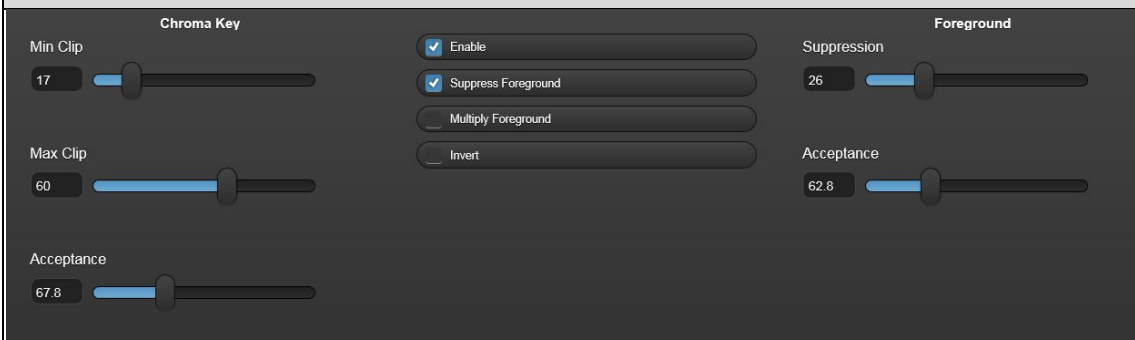
Auto Settings	**Reset Chroma Keyer**		Return Safire 3 to its calibrated settings.
	Auto Lighting		Select to automatically compensate for lighting fade-off towards the edges when grab samples is selected. See 'Lighting Compensation'.
	Auto Re-Spill		Select to automatically compensate for any backdrop colour spill on FG objects when grab samples is selected. See Colour Adjust tab->FG Re-Spill.
Sample Setup	**Grab**		Set up Safire 3 using FG samples taken from the backdrop and foreground areas. The following parameters are automatically adjusted: Max Clip, Chroma Key Colour – Hue, Foreground Suppression – Hue, Acceptance & Suppression, Chroma Key Tune – Key Saturation.
	Background	BG [1 5 12]	Select 1, 5 or 12 samples from the backdrop area of the FG picture to use for auto setup. Samples are (optionally) visible on the main and/or aux outputs and can be re-positioned. These samples are used to automatically select optimum chroma key values to allow for variations in chroma key backdrop hue and saturation. Usually the more samples chosen, the more accurate the result.
	Foreground	FG [0 1 4]	Select 0,1 or 4 samples from the foreground area of the FG picture to use for auto setup. These samples are (optionally) visible on the main and/or aux outputs and can be re-positioned as necessary. These samples are used to amend the settings of the chroma keyer to isolate regions in foreground areas that may cause unwanted keying by forcing the key signal to zero at these points.
Show Samples	**Show Samples on Main**		Select this to display the sample positions as small rectangles on the Main output.
	Show Samples on Aux		Select this to display the sample positions as small rectangles on the Aux output.
	Freeze Input		Select this to freeze the FG input signal. This is useful to enable accurate positioning of the backdrop and foreground samples when the subject is moving.

Sample Positions	**Horizontal/Vertical**	**Adjust the sample's position horizontally and vertically to the desired location.**
	Reset Samples	**Return sample positions to their default locations.**
	Sample Select	**Select which sample to re-position – the selected sample will slowly flash on the main and/or aux output.**

Sample Select list:
- Background 1
- Background 2
- Background 3
- Background 4
- Background 5
- Background 6
- Background 7
- Background 8
- Background 9
- Background 10
- Background 11
- Background 12
- Foreground 1
- Foreground 2
- Foreground 3
- Foreground 4

Gain & Spill

Manual adjustment of chroma key controls including key clip and gain. Control key and FG suppression acceptance angles, and FG suppression gain. Setup chroma key suppression modes.

Chroma Key

Min Clip: 17
Max Clip: 60
Acceptance: 67.8

☑ Enable
☑ Suppress Foreground
☐ Multiply Foreground
☐ Invert

Foreground

Suppression: 26
Acceptance: 62.8

Chroma Key	**Min Clip**	Adjust the offset of the key signal that will cut a hole in the new Background video signal. Increasing the min clip value will force lower key levels to zero. This is mainly used when small amounts of key level remain in foreground object areas causing breakthrough of the new background. Any increase in min clip value will have to be compensated for by reducing the max clip value to restore the key in other areas. Note that shadows and scuffs appear as high to mid level key values and that increasing the min clip setting and reducing the max clip setting will tend to accentuate these. The effect of this control is best observed by monitoring the Output Key. The default level for this control is 0.
	Max Clip	Adjust the gain of the key signal that will cut a hole in the new Background video signal. Reducing the max clip level value will force variations in key level to full key value by amplifying and clipping. Use this control to compensate for uneven chroma key backdrop illumination. Adjusting this control is a compromise between removing key variations and retaining key edge detail. The effect of this control is best observed by monitoring the Output Key. The default level for this control is 50.
	Acceptance	Adjust this control to change the range of colours about the hue colour (acceptance angle) used by the new Background key circuitry. Monitor the output key and with the min and max clip controls set to default values, adjust this control to give the best overall key. Note: It may help to invert the key output in the Engineering menu so that full key level is peak white and no key is black. Setting the acceptance value too small may result in an uneven key in the chroma key backdrop area. Too large a value may cause keying in foreground areas resulting in the new background breaking through to the foreground.
Chroma Key Control	**Enable**	Select this to enable chroma key operation on the foreground.
	Suppress Foreground	Select this to enable FG suppression. This is usually always selected if 'Multiply Foreground' is NOT selected. If 'Multiply Foreground' IS selected then deselecting this option can sometimes give better results if FG suppression has altered foreground colours.
	Multiply Foreground	Select this to multiply the Foreground by the inverse of the new Background key. If de-selected, the FG is added to the keyed background. With good lighting and a high quality chroma key backdrop it is usually better to not select 'Multiply Foreground' as FG Suppression and non-multiply mode give better results particularly

Foreground		with fine detail such as hair. However sometimes it is not possible to fully suppress all backdrop detail from the FG picture and that can show in the final composite. In this case multiply mode will cut out the backdrop entirely, but at the expense of fine detail. The different modes should be tried to see what gives the best result.
	Invert	In Multiply Foreground mode this control will invert the generated key – thereby swapping the FG and BG pictures in the final composite.
	Suppression	Adjust this control to set the suppressed backdrop area to black. Monitor the keyed FG signal and set the control to the minimum level necessary to give a solid black in the chroma key backdrop area. This control is best adjusted after the hue and acceptance controls have been set and – because because of their interactive nature – the min and max clip controls set to their default values. Note that when the suppressed FG signal and keyed Background signal are added together to form a final composite, any luminance in the FG backdrop area will be added to the new background. This can sometimes be compensated for with BG lift reduction in the BG Match sub menu of the Colour Adjust tab, but every attempt should be made to achieve as close to black as possible. Over-suppressing will distort edges possibly causing a black halo around FG objects.
	Acceptance	Adjust this control to change the range of colours about the hue colour (acceptance window) suppressed by the Foreground suppression circuitry. Monitor the Keyed FG signal and adjust this control to entirely suppress the chroma key backdrop colour. If the acceptance angle is set too small, then due to variations in backdrop colour, a colour tint may remain in places. If the angle is set too large then unwanted suppression may occur on foreground objects. Adjust the hue control as well to get the best compromise if there are large variations in backdrop colour. This control is best adjusted with the suppression control set mid-way to see the effect most clearly.

Edges and Key Remove

Adjust chroma key settings to remove unwanted keying in black, grey or white areas. Adjust key levels to remove or enhance shadows. Alter key shape to improve effect.

Chroma Key Removal

Black
19

Greys
30

White
40

Edges & Shadows

Edge Processing
0

Shadow Density
0

Key Shrink
15

Chroma Key Removal	**Black/Greys/White**	**Use these controls to attenuate the new background key in foreground areas of black, grey or white. This is useful where colour spill from the chroma key backdrop onto foreground objects are causing unwanted keying of the background.**
Edges and Shadows	**Edge Processing**	**Adjust the level of the key in the edge areas. This control changes the gain of the key at the edges and other low value areas such as shadows.**
	Shadow Density	**This control changes the appearance of shadows. Increasing the value of this control will make shadows appear more prominent and decreasing less prominent.**
	Key Shrink	**Adjust the shape of the key. If a black line appears around foreground objects when the new background is added, adjust the key shrink control to help compensate for this.**

Hue and Balance

Manually set the chroma key colour, compensate for under-saturated backdrop colour and fine-tweak the balance between FG suppression window.

Key Colour Tune	Key Hue	Set the colour that will be used by the new Background key circuitry. Monitor the output key, and with the acceptance control set to 90 degrees, and the min and max clip controls set to default values, adjust the control to give the best overall key. Note: it may help to invert the key output in the Engineering menu so that full key level is peak white and no key is black. Note also: this control rarely needs adjusting after auto setup.
	Background Saturation	This control helps compensate for a poorly saturated camera output in FG backdrop areas. Ideally, a well lit backdrop would produce a 100% saturated colour output from the camera - but this is rarely the case. While monitoring the output key and with max clip set to 100, adjust this control to provide an even and low noise key in the backdrop area. The max clip control can then be adjusted to amplify the key to full level. This control is automatically set by quick setup.
Balance and Tints	Suppression Hue	Set the colour that will be used by the Foreground suppression circuitry. Monitor the Keyed FG signal and adjust this control to suppress the chroma key backdrop colour. Note that often there is a variation in backdrop colour caused by lighting etc. so adjust this control to give the best suppression in the most noticeable areas. This control is best adjusted with the suppression control set mid-way and the acceptance control set to 90 degrees to see the effect most clearly. Note also: this control rarely needs adjusting after auto setup.
	Foreground Balance	This control moves the acceptance window of the FG suppressor circuitry about the selected backdrop hue. This control is useful when the FG objects contain colours close to the backdrop

		colour and so can help minimise desaturation of some FG colours while maintaining good backdrop colour suppression. Remaining colour spill may be removed with the FG Colour Compensate controls.
	Foreground Tints	This control allows areas of the foreground that contain low saturation levels of the backing colour to be passed without being suppressed.

Lighting Compensation

Compensate for a poorly lit backdrop.

Left/Top/Right/Bottom	These controls help compensate for uneven backdrop lighting. By monitoring the output key and adjusting the lighting compensation controls it is possible to minimise the effects of lighting edge fade. With max clip set to 100, adjust the position controls to provide as even a key distribution in the backdrop area as possible. These controls are automatically set if 'auto lighting' is selected in quick setup.
Radial	The lighting distribution of a spotlight is a bright centre that fades away to the edges in a circular pattern. The Background key produced when a spotlight is used to illuminate a chroma key backdrop will reflect that lighting distribution. Increasing key gain (max clip) will help compensate for that but at the expense of fine detail. By monitoring the output key and adjusting the lighting compensation controls it is possible to minimise the effects of lighting edge fade. With max clip set to 100, adjust the radial and control to provide as even a key distribution in the backdrop area as possible. These controls are automatically set if 'auto lighting' is selected in quick setup.
Aspect Ratio	Select the aspect ratio of the radial lighting compensation to match the image.

Brightness & Contrast

Adjust the lift and gain of the keyed FG and BG signals to produce a more realistic composite.

Foreground Adjust	FG Lift/Gain/Chroma	These controls modify the FG video signal so it matches the keyed Background in the final composite. Monitor the output video and use the lift, gain and chroma controls to achieve the best results.
Background Adjust	BG Lift/Gain/Chroma	These controls modify the BG video signal so it matches the keyed Background in the final composite. Monitor the output video and use the lift, gain and chroma controls to achieve the best result. These controls are left untouched by quick setup. BG lift control can help reduce any luminance added to the composite by the suppressed FG if some luminance remains in the FG backdrop areas.

FG Colour Correct

RGB Lift and Gain correction of the keyed foreground signal.

Foreground RGB Gain	These controls adjust the individual red, green and blue gains of the suppressed FG signal between 80% - 120%.
Foreground RGB Lift	These controls give positive and negative lift to the individual red, green and blue channels of the suppressed FG signal.

FG Colour Compensate

RGB Lift and Gain correction of the foreground signal before keying.

Pre-Key RGB Lift	These controls lift the individual red, green and blue components of the FG signal before suppression by +/- 20% to help compensate for any colour loss resulting from high levels of spill suppression.

Filters & Re-Spill

Filter FG input for noise and ring removal and soften keyed edges. Add colour tint to suppressed FG edges to match new background.

Filters	**Ring Suppression**	This control helps minimise ringing introduced by the camera.
	Noise Reduction	This control adds a variable amount of filtering to the Background key signal to help minimise noise while maintaining fine edge detail.
	Edge Softening	This control adds a variable amount of filtering to the Background key signal to smooth jagged edges caused by high levels of key gain and to minimise noise.

Foreground Re-Spill	**Red/Green/Blue**	**These controls add a colour tint to the backdrop spill areas of the suppressed FG picture to counteract any noticeable colourisation. When an object is placed in front of a green backdrop, say, it will experience a green spill around its edges and reflecting surfaces, but if a blue background (i.e. sky) was chroma keyed behind, the green spill would look unnatural. Adding a blue FG re-spill in this case would produce a more realistic composite. These controls are automatically set if 'auto re-spill' is selected in quick setup.**
	Enable	**Enable the Re-Spill feature**

Keys & Masks

Set clip and gain levels for the External Key, External Mask and Self Key. Enable all keys, set key operation to Multiply and enable key inversion.

External Key Control — Min Clip: 21 — Enable ☑ — Multiply ☑ — Invert ☐ — Max Clip: 12

External Mask Control — Min Clip: 23 — Enable ☐ — Multiply ☐ — Invert ☑ — Max Clip: 42

Self Key Control — Min Clip: 35 — Enable ☐ — Multiply ☑ — Invert ☐ — Max Clip: 76
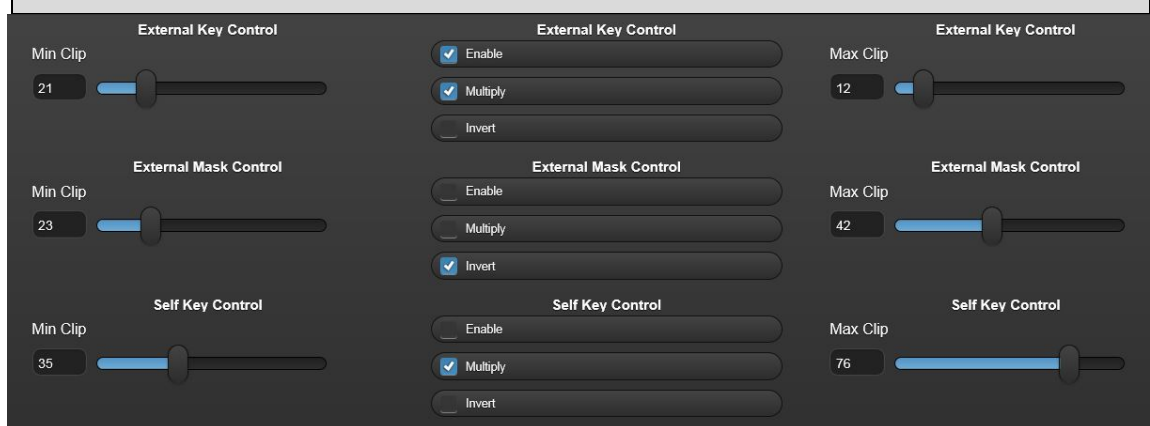
External Key Control	**Min Clip**	**Use this control to clip all key signals below the threshold set by the control – i.e. if the control is set to 20 then all key levels up to 20% of max will be removed.**
	Max Clip	**Use this control to amplify and clip all key signals above the threshold set by the control – i.e. if the control is set to 80, then all key levels above 80% of max will be clipped and amplified to full scale.**

	Enable	Select to enable the External Key signal as a key. The BG picture is keyed and filled with the FG source. Use this control to key a caption into the Background video and fill with matte, black or video. This key augments the chroma key and self key in its active areas. In chroma key mode this key will force the FG video to mask chroma keying in unwanted regions. The external key combines with the self key to extend the size of the key.
	Multiply	Select to key the FG signal before adding to the keyed BG signal. Select if the FG signal is not black outside of the caption fill area.
	Invert	Select to invert the clipped key.
External Mask Control	**Enable**	Select to enable the external key signal as a mask. The mask signal disables the self key and chroma key in its active areas. If the chroma key is enabled the mask will force the final composite to Background and this can be used to compensate for missing backdrop areas or to promote an area of Background to the front of the composite.
	Multiply	Multiply mode is the normal way of using the external mask; the suppressed FG signal is keyed with the mask prior to adding to the BG. In non-multiply mode the FG signal is not keyed and added to the BG signal.
	All other controls	As External Mask.
Self Key Control	**Enable**	Select to use the luminance of the FG signal as a key. The BG is keyed and filled with the FG source. Use this control to key a caption derived from the FG video into the Background video and fill with a matte, black or video. Usually chroma key mode would be disabled if self key mode is enabled.
	Multiply	Select to key the FG signal before adding to the keyed BG signal. Select if the FG signal is not black outside of the caption fill area.
	All other controls	As External Mask.

Internal FG Mask

Enable and set rectangle size for internal FG mask.

Left/Top/Right/Bottom	Use these controls to position the mask rectangle.
Enable	Select this control to enable the FG mask. This user-positionable mask will override the chroma key in its active area to force the BG signal. Use this mask if the chroma key backdrop is too small or damaged, or badly lit at the edges.
Invert	Select this control to invert the mask.

Internal BG Mask

Enable and set rectangle size for internal BG mask.

Left/Top/Right/Bottom	Use these controls to position the mask rectangle.
Enable	Select this control to enable the BG mask. This user-positionable mask will override the chroma key in its active area to force FG video. Use this mask to disable the chroma key in FG non-backdrop areas containing the key colour, or reflective objects. Note that the BG mask does not override FG suppression, only the BG key.
Invert	Select this control to invert the mask.

FG/BG Source & Matte

Set FG and BG matte colour. Select FG and BG video sources.
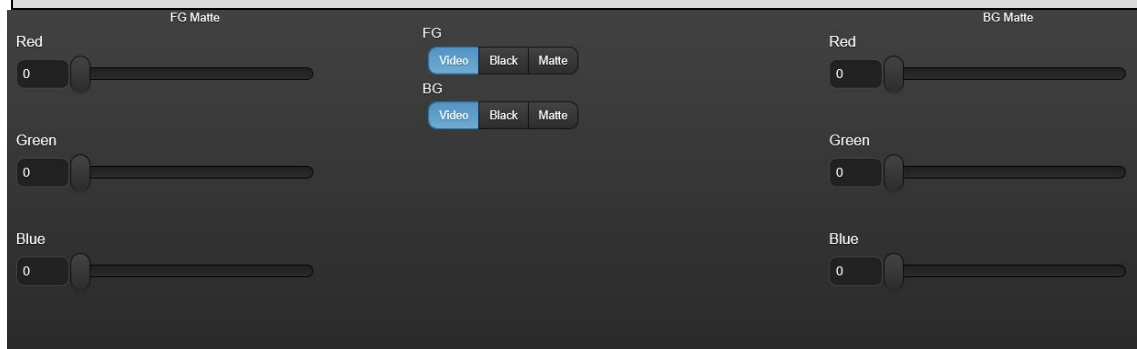
Foreground Matte	Red/Green/Blue	Use these controls to set the colour of the FG matte that will be used when the FG source is set to 'matte'.
Background Matte	Red/Green/Blue	Use these controls to set the colour of the BG matte that will be used when the BG source is set to 'matte'.
Foreground		Use these controls to select the source of the FG signal. Select either video, black or the colour matte – usually video for chroma keying.
Background		Use these controls to select the source of the BG signal. Select either video, black or the colour matte – usually video for chroma keying.

FG Mask Softness

Set the amount of softness for each edge of the FG mask rectangle.
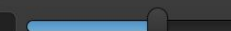
FG Softness	Left/Top/Right/Bottom	Use these controls to soften the four edges of the mask to make the mask less noticeable. The internal masks can be configured and positioned as a rectangular wipe and added softness can be used as an artistic effect.

BG Mask Softness

Set the amount of softness for each edge of the BG mask rectangle.

BG Softness	Left/Top/Right/Bottom	Use these controls to soften the four edges of the mask to make the mask less noticeable. The internal masks can be configured and positioned as a rectangular wipe and added softness can be used as an artistic effect.

Signal Status

Monitor the status of all inputs and outputs.

	Standard	Shows input video standard i.e "1920x1080/50i" or "missing" if none detected.
FG /BG/ Key Input	**Input Present**	Lights green if input video present.
	Input Black	Lights yellow if input video at black level.
	Input Frozen	Lights yellow if input video frozen.
	Input ATC Present	Lights green if audio timecode is detected.
Reference Input	**Standard**	Shows input video reference standard i.e "1080/50i" or "missing" if none detected.
	Input Present	Lights green if reference video present.
Output	**Standard**	Shows output video standard i.e 1920x1080/50i".
	Input Freeze Enabled	Lights yellow if FG input freeze selected in 'Auto Setup'.
	Output Faded to Black.	Lights yellow if output faded to black in 'Key Fade'.

Key Status

Monitor the status of Chroma Key, External Key, Self Key and External Mask.

Chroma Key	Self Key	External Key	Masks Enabled
● Enabled	○ Enabled	○ Enabled	○ External
○ Faded Down	○ Faded Down	○ Faded Down	○ FG
			● BG

Chroma/Self/External Key	**Enabled**	**Lights yellow if key is enabled.**
	Faded Down	**Lights yellow if key is faded down.**
Masks Enabled	**External**	**Lights yellow if External mask enabled in 'Keys & Mask'.**
	FG	**Lights yellow if FG mask enabled in 'Internal FG Mask'.**
	BG	**Lights yellow if BG mask enabled in 'Internal BG Mask'.**

Key Fade

Fade all keys up and down – fade outputs to and from black.
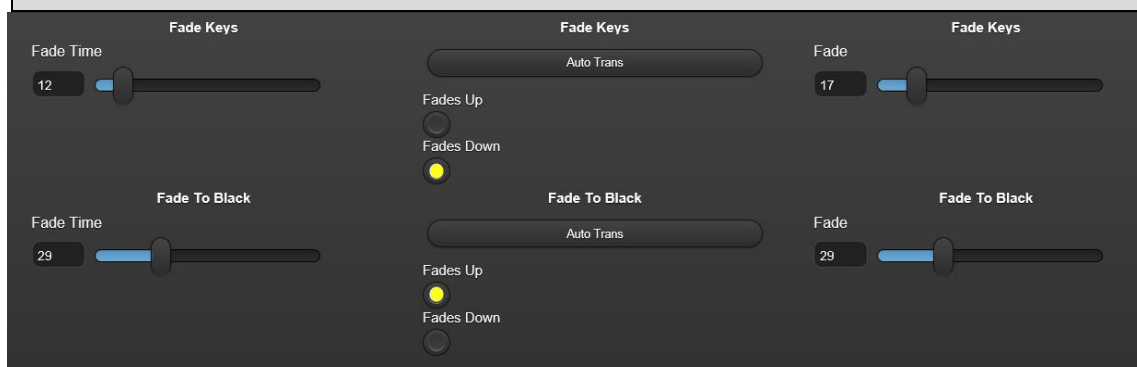
Fade Keys	**Fade Time**	Use this control to set an autotrans fade time of 0-100 seconds.
	Fade	Use this control to manually fade keys up and down.
	Auto Trans	Use this control to automatically fade enabled keys up and down at the rate set by the Fade Time control. In chroma key mode the FG image will be faded up and down but masks are unaffected. External and self key will fade up and down.
	Fades Up/Down	These indicate which direction the autotrans operation will take.
Fade to Black	**Fade Time**	Use this control to set an autotrans fade time of 0-100 seconds.
	Fade	Use this control to manually fade outputs to and from black.
	Auto Trans.	Use this control to automatically fade main and aux outputs to and from black at the rate set by the Fade Time control.
	Fades Up/Down	These indicate which direction the autotrans operation will take.

Presets & Outputs

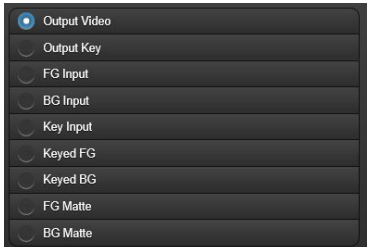Select which preset memories to save to or recall from. Select output signal for Main and Aux video outputs.

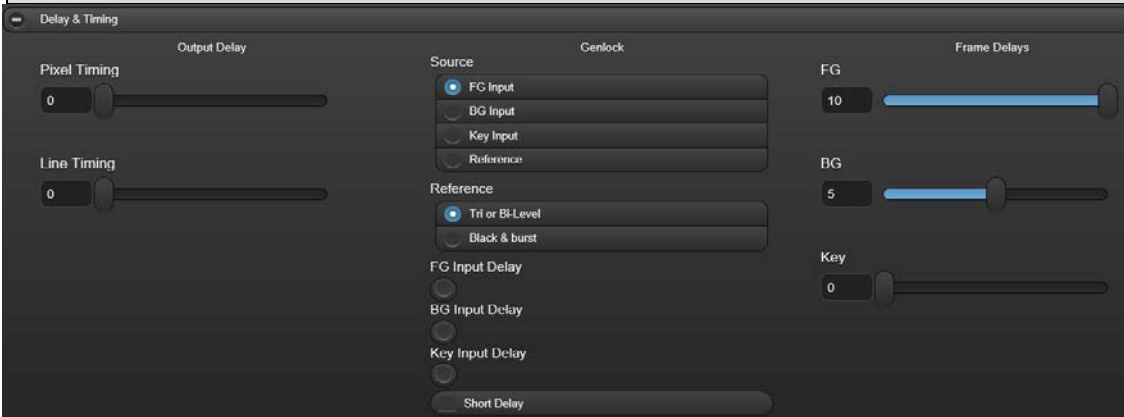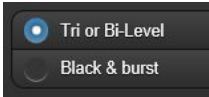| Store	Store Safire 3 settings as one of 40 presets.
Preset Select	**Select preset number 1-40 to store or recall.**
Recall	**Recall one of 40 previously stored settings.**

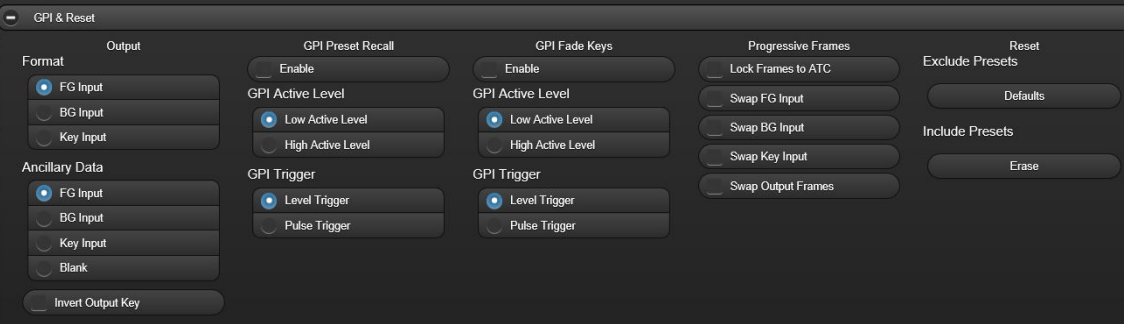|	
Main/Aux Outputs	Select which signals are routed to the Main and Aux video outputs: **Output video: the composite chroma keyed result.** **Output key: the key signal, as a monochrome image, produced by the combination of the chroma keyer, other keys and masks.** **FG input: the Foreground video input.** **BG input: the Background video input.** **Key input: the external key input signal.** **Keyed FG: the suppressed Foreground image after chroma keying. This signal is useful for fine adjustment of the various controls to optimise the removal of the key colour from the subject.** **Keyed BG: the Background signal after keying. This signal is useful in fine adjusting the key gain and other controls.** **FG Matte: display the matte colour set by the keyers and effects/FG source and matte controls.** **BG Matte: display the matte colour set by the keyers and effects/BG source and matte controls.**

Engineering - Delay & Timing

Select genlock source, output timing with respect to reference and video delays for all inputs.

Output Delay	**Pixel Timing**	**Delay output video horizontally by 0 to 2640 pixels with respect to reference. (See note below.)**
	Line Timing	**Delay output video vertically by 0 to 1125 lines with respect to reference. See note above for max delay. *Note: the total Pixel + Line delay cannot***

			exceed one frame for any output standard. E.g. 720 lines is the maximum delay for 720p standard.
Genlock	**Source**	FG Input / BG Input / Key Input / Reference	Select which input Safire 3 will use as its reference source.
	Reference	Tri or Bi-Level / Black & burst	Select whether the external analogue reference input is Tri-Level or Black & Burst. No reference needs to be applied unless 'Reference' is selected as the genlock source.
	Foreground, Background, Key, Input Delay		Indicates whether the output signal is more than one whole frame delayed with respect to each input.
	Short Delay		Select this to disable the Noise Reduction and Edge Softening filters to minimise propagation delay. Short Delay for SD = 85uS, HD = 18uS, 3G = 10uS. Without Short Delay selected, add 5 lines delay to the above values.
Frame Delays	**FG/BG/Key Delay**		These controls delay the selected signal by up to ten frames at the Safire 3's input frame synchroniser.

Engineering – GPI & Reset

Control Engineering functions such as Ancillary data, GPI preset recall, GPI fade keys, swap field sequences and reset Safire 3.

Output	**Format**	FG Input / BG Input / Key Input	Select which input video should be used as the format for the video output.

	Ancillary Data	FG Input BG Input Key Input Blank	**Select which video input is the source of output ancillary data, or blank it.**
	Invert Output Key		**Select this to invert the output key. Use this to match the key polarity with other equipment or for monitoring purposes to make the key more visible.**
GPI Preset Recall	**Enable**		**Select to enable recall of presets by GPI. Presets 1-32 can be selected from the binary coding of the external GPI inputs.**
	GPI Active Level	Low Active Level High Active Level	**Select low or high level as the active level for the GPI.**
	GPI Trigger	Level Trigger Pulse Trigger	**Select whether GPI recall should be triggered by a change in level or a pulse.**
GPI Fade Keys	**Enable**		**Select to enable fading of keys by GPI.**
	GPI Active Level	Low Active Level High Active Level	**Select low or high level as the active level for the GPI.**
	GPI Trigger	Level Trigger Pulse Trigger	**Select whether GPI triggering should be triggered by a permanent change in level or a transition.**
Progressive Frames	**Lock Frames to ATC**		**Lock the HD progressive video output to Ancillary Timecode.**
	Swap FG/BG/Key Input		**Swap field sequence of the selected progressive video input.**
	Swap Output frames		**Swap field sequence of the progressive video output.**
Reset	**Defaults**		**Select to restore Safire 3 to default conditions without erasing stored presets.**
	Erase Presets		**Select to restore Safire 3 to default conditions AND erase stored presets.**

8 Using Safire 3

In this section, when we refer to 'FG' and 'BG' we are referring to the FG and BG input video signals. FG is the signal with objects placed in front of a coloured backdrop. BG is the signal that will replace the coloured backdrop in the final composite. Whereas, to avoid confusion, 'foreground' and 'backdrop' refers to parts of the FG image.

Here is an example of a FG image:

The model is sitting in front of a green backdrop. The backdrop can be of any uniform colour provided the foreground objects don't contain exactly the same colour. The backdrop must be well and uniformly lit and the foreground objects placed at least 2m in front to reduce colour tinting from backdrop reflections (see section - Chroma Key Tips).

The BG image will appear behind the foreground objects in place of the backdrop. Here is an example of a BG picture:

With *Suppress Foreground* in the Gain & Spill menu selected, the chosen hue set by the *Suppression Hue* control in the Hue & Balance menu is subtracted from the FG signal to replace the backdrop colour with black:

Above, the green backdrop has been replaced by black and other foreground colours remain largely unaffected. A similar process is used to create a 'key' to cut a hole in the BG signal. In this case the *Key Hue* control in the Hue & Balance menu sets the key colour:
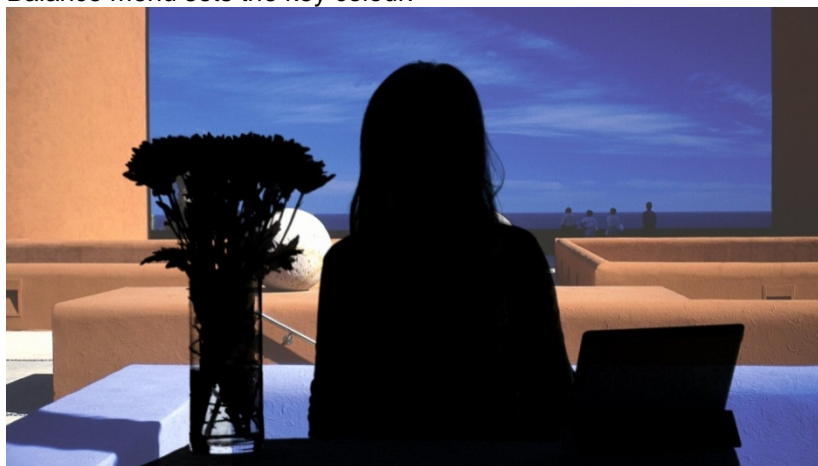
The two images are then added together to create a high-quality composite:

If **Multiply Foreground** is selected, the FG signal is keyed before adding to the keyed BG. Normally this is left de-selected but can be used if it otherwise proves impossible to create a realistic effect. In this mode, **Suppress Foreground** can still be selected to suppress any colour tinting on foreground objects.

Selecting 'Suppress Foreground' and de-selecting 'Multiply Foreground' helps retain fine foreground detail and generally gives the most realistic results with a well-lit backdrop.

Safire 3 is capable of producing a very realistic composite chroma key image, but to get the best results, attention must be paid to the lighting and quality of the coloured backdrop, the lighting of the foreground objects and colour and reflectivity of foreground objects. If all of the above have been considered, then the Auto Setup feature of Safire 3 will give excellent results.

Auto Setup

For most well lit scenes, **Auto Setup** provides an acceptable chroma keyed result. Not all of Safire 3's controls are adjusted automatically so some knowledge of the other controls is essential. Each control is explained in detail in the 'Controls' section but the following brief explanation with pictorial examples will help aid understanding.

Auto Setup works by using up to 12 samples from the backdrop area and up to four samples of the foreground to automatically adjust most of Safire 3's settings to achieve the best result by taking into account variations in illumination and saturation. Auto Setup allows the number and position of samples to be adjusted and it also offers the option of freezing the FG input video to make positioning the samples easier.

In the above example, the 12 grab samples can be seen distributed around the model. With perfect lighting, only one sample might be necessary. In this example no foreground samples were used and the **Auto Lighting** and **Auto Re-Spill** options were selected. Auto Lighting compensates for variations in lighting intensity across the backdrop, and Auto Re-Spill replaces any backdrop colour that may be reflected onto foreground objects with another more realistic colour derived from the BG signal.

The *Grab Samples* control automatically produced the following composite image:

Here we can see a realistic result; notice that hair detail and glass transparency has been retained. No foreground samples were necessary here but would be used if small amounts of BG image broke through to the foreground. Selecting foreground samples will automatically adjust the key *Min Clip* setting to force the key to zero at these points. Not all FG images are as well lit as the above example and it may be necessary to fine tune Safire 3's settings after Auto Setup.

Foreground Suppression

Safire 3 works by suppressing the colours of foreground objects within a range of hues set by a combination of the *Suppression Hue* control in the Hue & Balance menu and the Foreground *Acceptance* control in the Gain & Spill menu. Foreground colours that are exactly the same as the selected hue are suppressed to black and other colours close to that are suppressed to varying shades of grey. The Foreground *Suppression* control in the Gain & Spill menu adjusts the result to provide an even black backdrop – this control is set automatically by Auto Setup. The following picture shows the Keyed FG output where all the backdrop area has been suppressed to black prior to adding to the keyed BG signal.

If we manually adjust the FGS *Suppression* control away from ideal to show a grey backdrop, it shows more clearly the effects of colour suppression. In the next picture you can see residual green backdrop colour around the model's hair – this is because the FGS *Acceptance* control, which adjusts the range of colours that are suppressed, has been set at too narrow an angle.

This control is set automatically by Auto Setup but may need adjusting for best results. In the next picture the FGS *Acceptance* control has been set at too large an angle and has noticeably changed the colour of the leaves of the flowers in the vase.
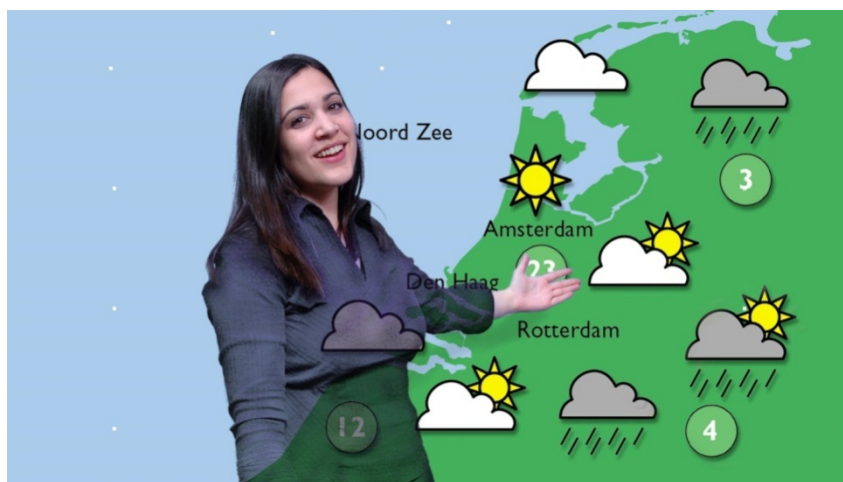

Adjustment of the FGS *Acceptance* control is a compromise between removing residual backdrop colour and leaving wanted foreground colours unaffected.
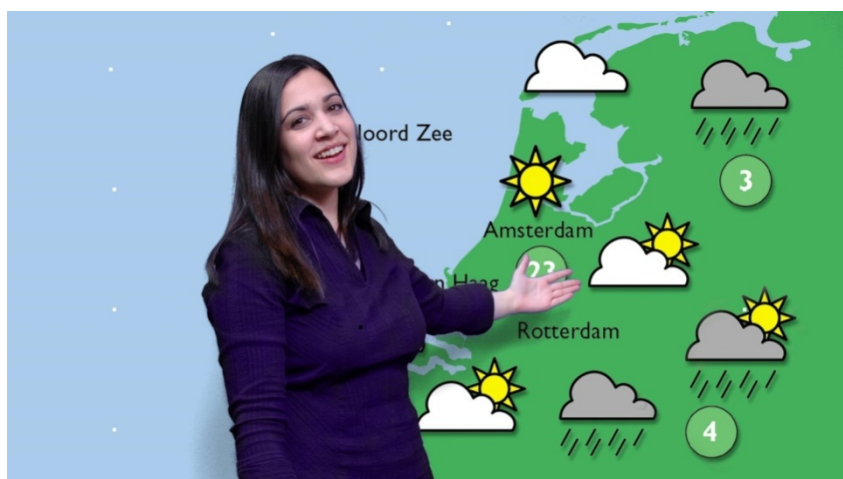
Another example in the picture below shows the model wearing a top of similar colour to the blue backdrop:

Auto Setup without a foreground sample produces the following result:

Some key remains, which causes the BG signal to be visible on foreground areas – but with a single foreground sample the Min Clip control is automatically adjusted to resolve this:

Notice how the model's top now appears purple as suppression has removed some blue from it, but this can be improved by minimising the FG *Acceptance* angle:

This an area where ***Multiply Foreground*** mode can sometimes be advantageous. De-selecting ***Suppress Foreground*** ensures that there can be no colour change to foreground objects of similar colour to the backdrop.

Background Key

The key that cuts the hole in the new BG is derived from ***Key Hue*** in the Hue & Balance menu and Chroma Key ***Acceptance*** in the Gain & Spill menu, and modified by the Chroma Key controls, ***Min Clip*** and ***Max Clip***. The ***Key Hue*** and ***Acceptance*** controls are independent of those that produce Foreground suppression and are automatically set by Auto Setup, but may need adjusting.

The following picture is the Output Key signal produced by Auto Setup. This is the level of quality of key to aim for: solid blacks and whites with no noise and fine detail retained.

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The Chroma Key Gain (CKG) *Min Clip* and *Max Clip* controls are used to clip the key at its minimum and maximum levels. Both these controls are set automatically by Auto Setup but may need adjusting. *Min Clip* is mainly used to reduce any small amounts of key level in foreground object areas causing breakthrough of the BG picture. Increasing the *Min Clip* value will force lower key levels to zero. Shadows can also be accentuated by raising *Min Clip*.

Max Clip is used to increase the overall gain of the key signal, removing variations to give an even result. The following picture is the Output Key with *Max Clip* set to a low value – although there are no variations in key in backdrop areas, fine hair detail has been lost. Set *Max Clip* to as high a value as possible.

Low values of *Max Clip* also change the shape of the key causing edges to be more noticeable in the composite output.

Additional Controls

To illustrate more advanced Safire 3 features it is necessary to use a more challenging FG signal. The backdrop is unevenly lit and has shadows and reflections that may or may not be wanted. The model is also wearing a shiny black jacket that tends to reflect and cause an unwanted key.

Auto Setup produces a key with signs of breakthrough in the black jacket and skirt. The reflective floor is also producing a key. The Key Output in the picture below shows unwanted keying in the model's jacket:

To illustrate the importance of good lighting and backdrop quality, in the following picture the *Max Clip* value has been deliberately raised above the Auto Setup value to show the raw key signal:

The variations in backdrop illumination can clearly be seen, as can scuff marks on the floor.

Should Auto Setup fail to produce a satisfactory result, these imperfections can be minimised by manually adjusting the key gain controls:

With *Min Clip* set to zero and *Max Clip* set to 40, adjust the *Background Saturation* control in the Hue & Balance menu to give as best a 'noise' free key signal possible – aim for consistent greys.

Now adjust *Min Clip* sparingly to remove any residual key noise.

The **Chroma Key Removal** tools in the Edges & Key Remove menu allows key to be removed from areas where the foreground picture is black, grey or white. Slightly adjusting the **Greys** control removes the key from the jacket. The **Max Clip** control will need adjusting to compensate. The following picture shows the improved Key Output after Chroma Key Removal:

Notice that the floor reflections still remain in the key signal. Increasing key gain by reducing the **Max Clip** value will certainly remove the keying in the floor area but at the expense of key quality. Increasing the **Min Clip** value will have the opposite effect by emphasising low key levels. The following picture shows just that:

The key on the floor area has been exaggerated. This can be useful when shadows need to be emphasised, but not in this case. The **Shadow Density** control in the Edges & Key Remove menu changes the density of the key signal in shadow areas to enhance or reduce shadows:

The final composite shows a realistic scene with shadows removed and some fine hair detail remaining:

Even better results can be obtained with careful lighting and non-reflecting and unmarked backdrop surfaces.

Re-Spill

Spill is the effect where backdrop colour appears on the foreground objects usually by reflection off skin or clothes. This can make foreground objects appear unnatural when chroma keyed over a different colour background. The *Re-Spill* controls in the Filters & Re-spill menu add a colour tint to those foreground objects containing some residual backdrop colour. Auto *Re-Spill* uses the same sample positions to sample the BG image as is used for the FG.

Foreground Tints

If the foreground objects contain similar colours to the backdrop colour there is a likelihood of those colours being de-saturated by the suppression process. The FG *Acceptance* window control can be narrowed to minimise this effect but sometimes a wider acceptance angle is necessary to suppress all the backdrop colour. In that case the *Foregrounds Tints* control in the Hue & Balance menu can add colour back to the suppressed FG.

Lighting Compensation

The light output from a studio light often fades towards the edges which results in a non-uniform key signal requiring more key gain to even it out. The *Lighting Compensation* controls in the Lighting Compensation menu boost the key at the edges, or radially. Auto Setup will automatically adjust these controls if enabled.

Colour Adjust

In the Brightness & Contrast menu, Safire 3 has controls that enable the final composite image to be as realistic as possible. These include individual Lift, Gain and Chroma level control of both FG and BG signals. Also available in the Foreground Colour Correct menu are *FG RGB Gain/Lift* controls. Here the BG has been darkened and the FG red gain increased slightly to give a sunset feel:

Keys and Masks

See section - 'Key Signals' for more information on how keys and masks combine.

In addition to chroma keying, Safire 3 can generate an internal linear self key derived from the luminance of the FG signal. Enabled in the Keys & Mask menu, this can be used to key a caption into the background video and fill with a matte, black or video. In the picture below the Crystal Vision logo signal is the FG input and is self keyed into the BG signal using the FG signal as both key and fill. (Note: The model in front of the green backdrop is the BG signal in this setup).

The Self Key*, Max Clip* and ***Min Clip*** controls are adjusted to give the best result.

In the picture below with a different BG and key signal, ***Matte*** is selected as the FG key fill in the FG/BG Source & Matte menu.
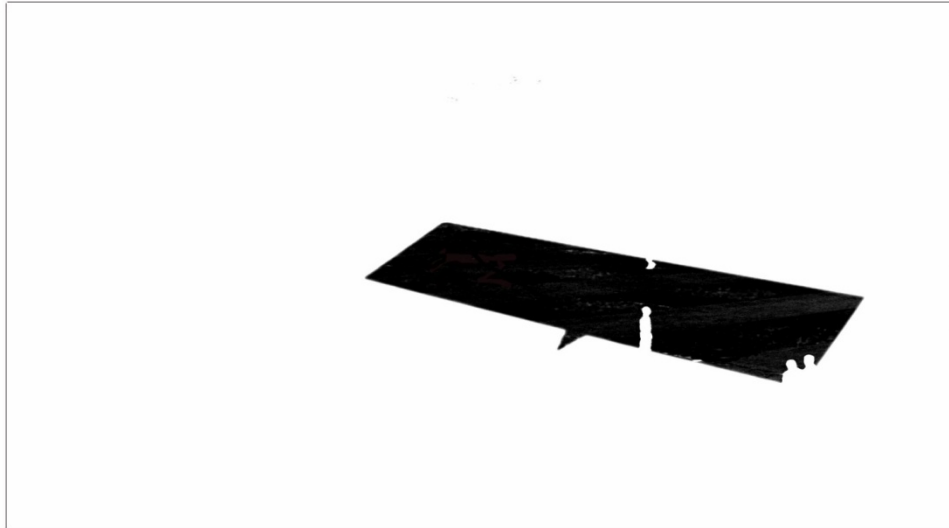

External Key

The ***External Key*** input can be used as a linear key to cut a hole into the BG signal. Logos often have two separately generated components – a key and a fill. To create the picture below, the model in front of the green backdrop is the BG signal, the logo key signal is fed to the External Key input and the logo fill signal to the FG input:

The External Key can also be used as a FG force signal during chroma keying to prevent unwanted keying on foreground objects. In the example below, the chroma keyer has been set to key off the pitch colour in Multiply Foreground mode. The logo signal here is both the External Key input and BG signal. The logo needs to appear as though it is painted onto the pitch with players apparently able to walk over it, and it is possible to combine the chroma key and External Key to limit chroma keying to the External Key area only:


Because, in this case, the key and fill signals are the same signal, the External Key *Inversion* control needs selecting to disable chroma keying in the non-logo key areas by forcing the FG signal (See Section – Key Signals). Below is the Key Output:

The white outline of players and spectators produced by the chroma key can be seen, but note that there is no other chroma keying outside of the logo key area. The External Key can also be used to prevent unwanted keying on foreground objects during normal studio chroma key operation. For example, if the foreground contained an object of exactly the same colour as the backdrop, or a highly reflective object was causing unwanted keying, then a well placed key could be input to prevent this.

External Mask

During chroma keying, the ***External Mask*** combines with the chroma key to force the BG signal. In the following example, an External Key input signal is selected as External Mask:
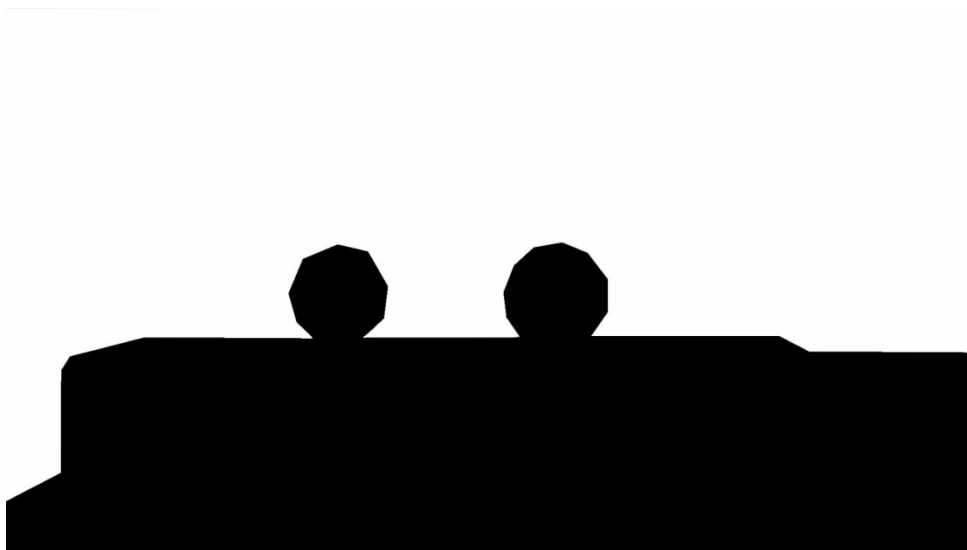
The External Mask signal combines with the key produced by the chroma keyer, as can be seen in the following Key Output:

The result is that the BG signal appears to be in front of the FG image:

This technique is commonly used to promote architectural features such as pillars from the background to the foreground so actors appear to be walking behind them.

Internal Masks

Safire 3 has two independent internal rectangular mask generators to remove unwanted foreground keying and to force keying in areas where the backdrop is too small or badly illuminated. These masks can be re-sized, inverted or not and moved to the ideal position. The following are examples of where FG and BG mask generators could be useful:

In this example the backdrop is torn either side and features a discoloured patch.

Without the *FG Mask* the tears are clearly visible. The patch can be keyed out by widening the FG *Acceptance* window control and adjusting the key controls:

With the FG Mask, the left hand side and some of the right hand side tears are removed by correct positioning of the FG Mask rectangle:

As part of the right hand side tear is within the wanted foreground image area it cannot be totally masked without losing some part of the foreground. To remove this entirely would require an external key signal set up as a mask. The second example shows the FG model wearing a badge of identical colour to the backdrop. Normally this would cause an unavoidable key.

After chroma keying the BG image can be seen in the badge:

Using the **BG Mask** controls, a rectangle can be placed over the badge to disable keying in that area. Note that FG suppression would still be acting, so the chroma keyer must be set to Multiply Foreground mode to retain the original colour:
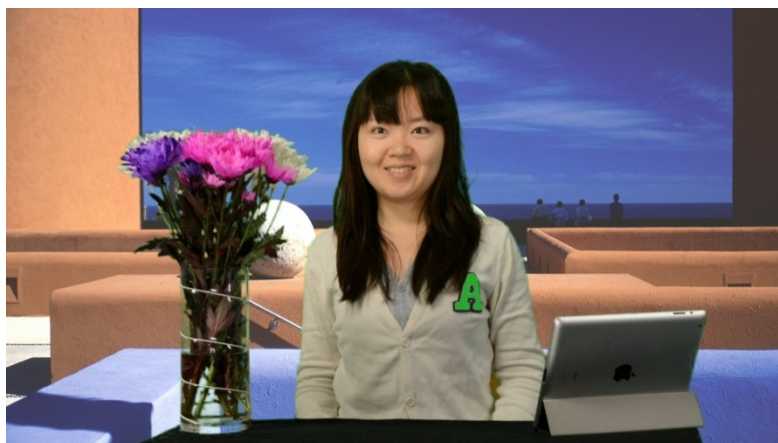
9 Key Signals

All the keys in Safire 3 combine to form a single key which is used to cut a hole in the BG picture. The keys combine as a logical 'OR' such that high level (white) areas take priority. All keys can be individually inverted from VisionWeb or VisionPanel.

The following is a pictorial description of key polarities for common Safire 3 key operations. The **White** (high level key) is the part of the key signal that will show the FG picture and **Black** (low level key) the BG picture.
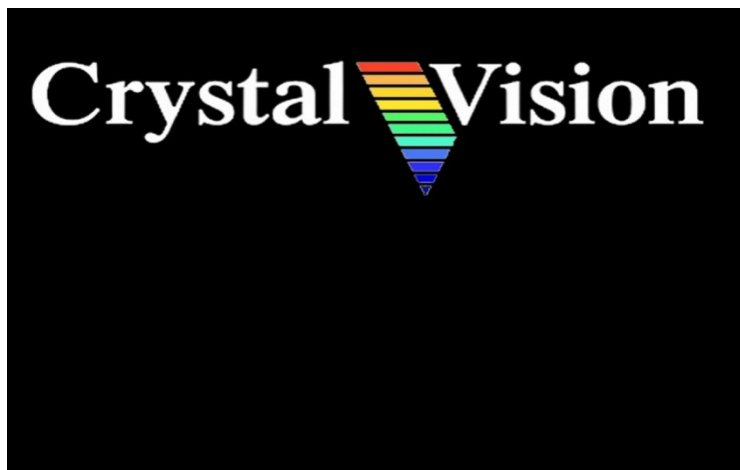
Chroma key

Generated by Safire 3 to cut a hole in the BG signal. The white areas will show the selected FG source, usually the suppressed or keyed FG picture:

Self Key

To cut a caption derived from the FG signal into the BG and fill with same FG video, matte or black:
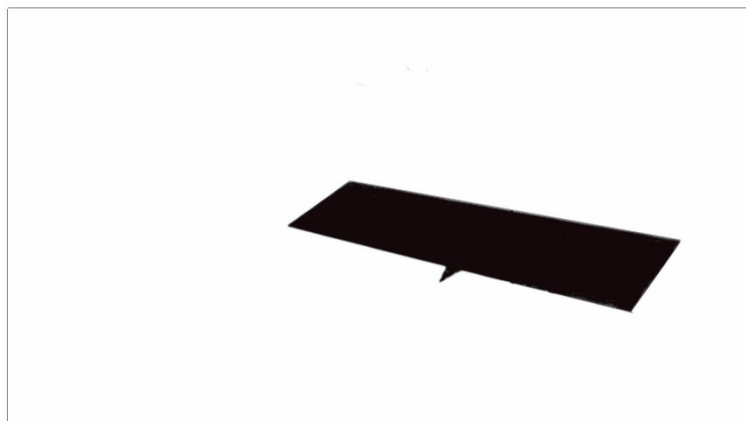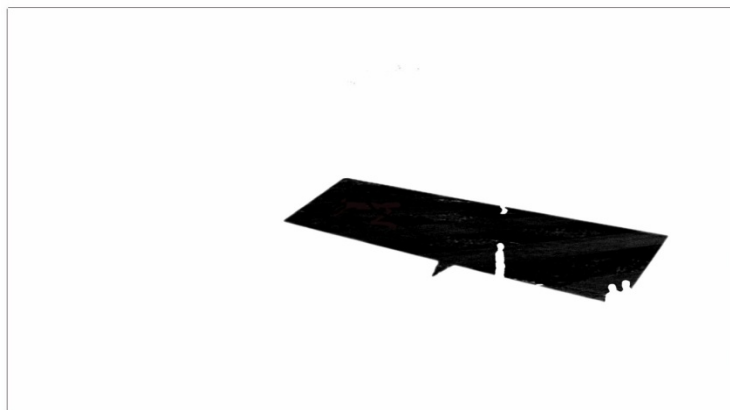
External Key

To cut a caption using the external key input into the BG signal and fill with FG video, matte or black:

To force the FG picture to override the chroma key:

This key shape would limit chroma keying to the black area only and force the FG picture to stay unaffected in the white areas.

External Mask

The External Key input when used as an External Mask combines with the other keys as a logical 'AND' such that black areas take priority.

To force the BG picture to override the chroma key using the external key input as a mask:
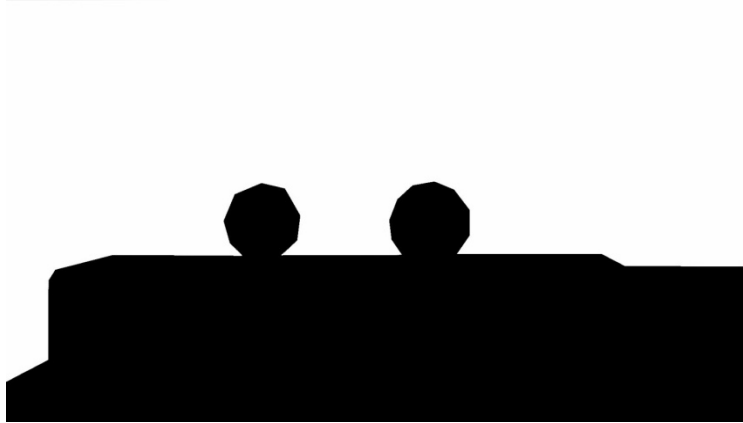
The mask signal above combines with the chroma key to force the composite to BG in the black areas:

Or to override the chroma key in areas where the backdrop is missing, damaged or poorly lit – typically the edges:

10 Chroma Key Tips

Lighting

Proper set lighting is essential for realistic chroma keying and can help to minimise the amount of time required to set up Safire 3.

The coloured backdrop must be as evenly illuminated as possible over its entire useable surface. Variations in lighting cause chroma key level variations which require extra key gain to remove. As key gain is increased, the shape of the key edges change making the composite result less realistic. Lighting Compensation controls can help minimise the effects of uneven lighting.

Wherever possible use the same type of lighting on the backdrop – all tungsten, all LED etc. Try to avoid mixing light types as they have different colour temperatures and will produce a variable key signal.

The lighting on the backdrop should be diffused and as low level as possible to minimise spill – that is the reflection of the backdrop colour onto the foreground – but bright enough to produce a low-noise camera output. Ideally, the backdrop lighting should have roughly the same incident light level as the subject's key light.

Subject Placement

To minimise spill, the foreground subjects should be as far away as possible from the backdrop, at least 2m. This may not be possible with weather maps, for example, but some lighting techniques can minimise the effect of spill: up or down lighting the vulnerable areas with white light can help, as can using a gel of a complementary colour – i.e. a magenta gel when using a green backdrop.

Background

The backdrop itself should be of a consistent quality: scuff marks, patches etc. also require increased key gain. Use an internal or external mask signal to force the composite to BG in difficult areas.

The backdrop should be of a non-reflective nature as should the floor surface. It is very difficult to avoid keying on foreground reflections from a shiny floor.

Clothing

The colour of foreground objects should be chosen to be dissimilar, wherever possible, to the backdrop colour. Narrowing the acceptance angle to avoid keying on foreground objects makes it harder to achieve a good key on variations in backdrop colour.

Reflective Foreground Objects

Any Foreground object that is reflective may reflect some of the backdrop colour causing unwanted keying. Use the internal BG mask or external key to prevent keying on glass table tops etc. unless wanted, but consider that natural reflections often mirror image the reflected scene.

11 Troubleshooting

Card edge monitoring

The front edge of the card provides useful power rail monitoring and input status.

Safire 3 front edge view

The card edge LEDs and 10-digit display may be used in conjunction with status information from any connected remote status panel display or from VisionWeb if available.

Board edge control was removed from Safire 3 in 2019. Therefore the card edge control information is only relevant for older versions of the product.

Basic fault finding guide

The Power OK LEDs are not illuminated

Check that the frame PSU is functioning – refer to the appropriate frame manual for detailed information

There is no video output

Check that a valid SDI input is present and that any cabling is intact

The video output exhibits jitter

Check that the input SDI stability is within normal limits

The card no longer responds to front panel control

Check that the card is seated correctly and that the Power OK LEDs are lit

Check any active control panel cabling

Check if the control panel can control another card in the same rack

If necessary reset the card

Resetting the card

If required, the card may be reset by removing the card from the rack and then re-inserting it

It is safe to re-insert the card whilst the rack is powered. Any previous configuration will be retained, use a factory reset to erase any configurations stored in the card

12 Specification

Safire 3

General

Dimensions	100mm x 266mm module with DIN 41612 connector.
Weight	200g.
Power consumption	11.9 Watts.

Inputs

Video	HD or SD SDI 270 Mb/s to 2.970 Gb/s serial digital compliant to EBU 3267-E, SMPTE 259, SMPTE 292-1 and SMPTE 424/425-A. Cable Equalisation: 3G (2.970Gb/s) – 80 metres, Belden 1694A or equivalent. HD (1.485Gb/s) – 140 metres, Belden 1694A or equivalent. SD (270Mb/s) >250 metres, Belden 8281A or equivalent. Automatic de-embedding to SMPTE 272M or SMPTE 299M.
Video standards supported	625i, 525i, 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94, 1080p60, 1080PsF23.98, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 2048x1080p23.98*, 2048x1080p24*, 2048x1080p25*, 2048x1080p29.97*, 2048x1080p30*, 2048x1080PsF23.98*, 2048x1080PsF24*, 2048x1080PsF25*, 2048x1080PsF29.97*, 2048x1080PsF30* (*= YUV 4:2:2 10 bit). Input format auto selected.
Delay through board	Selectable ten frame video delay on all inputs can be used to compensate for delays in graphic generators. Minimum delay with Short Delay 'ON': SD=85uS, HD=18uS, 3G=10uS. Short Delay Mode 'OFF': as for 'ON', but plus five video lines.

Outputs

Video	Serial output: 270Mb/s to 2.970Gb/s serial compliant to EBU 3267-E, SMPTE 259, SMPTE 292-1 and SMPTE 424/425-A. Output follows the input format. Audio is embedded to SMPTE 272M or SMPTE 299M.

Rear Module I/O

RM50	Three serial video inputs, one analogue sync input. Two BNC video outputs.

RM73	Three serial video inputs, one analogue sync input. Two BNC video outputs – Main Output relay bypassed in the event of power failure.

Status monitoring

LEDs	Front of card edge LED indicators to indicate: PSU rails present. SDI input HD/SD.

GPI inputs

Number and type:	6 x GPI inputs. For recall of 32 presets and trigger of auto key transition. Active pull to ground, pulled up to +5V through 10 kohm. Pulse mode GPI to be asserted for min. of 40mS and at least 2mS before vertical interval.

GPI outputs

Number and type:	None.

Input fail output

Type:	Dark Blue.

Control

Remote:	Control from VisionWeb Control web browser software. Control from VisionPanel 3U touch screen control panel. SNMP control and monitoring via frame CPU and Ethernet connection.

VisionPanel

General

Dimensions:	3U touch screen. 344mm wide, 133.5mm high (3U), 44mm deep (rear connector to mounting plate); 65mm deep (rear connector to display bezel). Weight 1.64kg without stand; 1.97kg with stand.

Control

| Connectors:	RJ45 Ethernet connection. USB2 x 2 DC power connector.
Power	9v dc external mains power supply, 100-240Vac.50/60Hz 1A.

13 Appendix 1

Statesman Control

Statesman software control of Safire 3 is no longer supported. The following is included for users of Statesman up to v 4.51.

The Crystal Vision Statesman PC control software is designed to control a range of Crystal Vision modules via Ethernet control from a PC. Statesman provides a user friendly means of configuring and operating Crystal Vision modules with the benefit of "see-at-a-glance" status monitoring.

The main Statesman application communicates with each module in a frame through a Statesman-capable front panel CPU or full active control panel. Either of these must be fitted to the frame to allow Statesman control.

Statesman operation

The initial view will show an Explorer style view of the connected frames and modules. Double clicking on a module will enable the display of the main application menus.
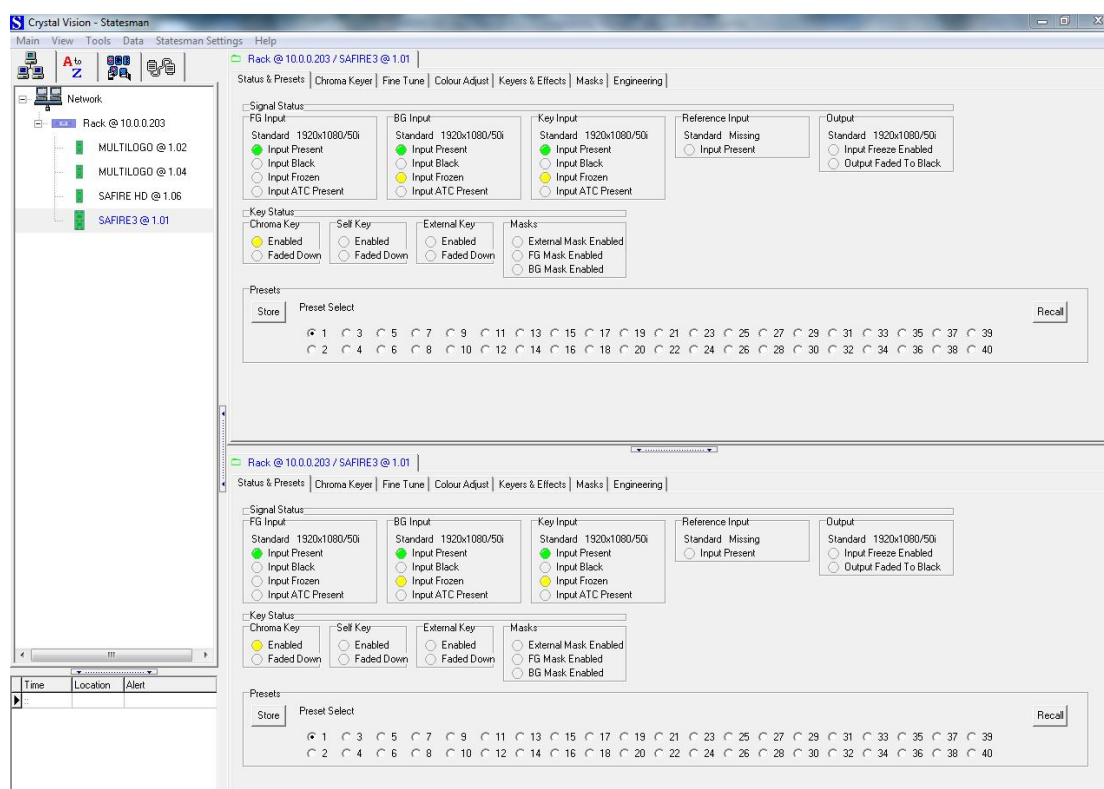
The two large control panes shown in the upper and lower halves of the window may display different menus for the same card, or controls for different cards. Click on the horizontal button-bar between the two panes to close the lower pane or drag the button to vary the size of the panes.

Statesman GUI controls are located in a number of tabs each containing panels which mostly contain the controls. Some controls are LEDs that are used to show status, others are check boxes, buttons or sliders which change various Safire 3 settings. (*Note: Slider controls, once highlighted, can be moved by the keyboard up and down arrow keys to give finer control than possible with a mouse.*)

The description of the tabs are in the order shown in the GUI i.e.

STATUS & PRESETS, CHROMA KEYER, FINE TUNE, COLOUR ADJUST, KEYERS & EFFECTS, MASKS, ENGINEERING.

Each tab is shown with a screen grab and description of each control's function:
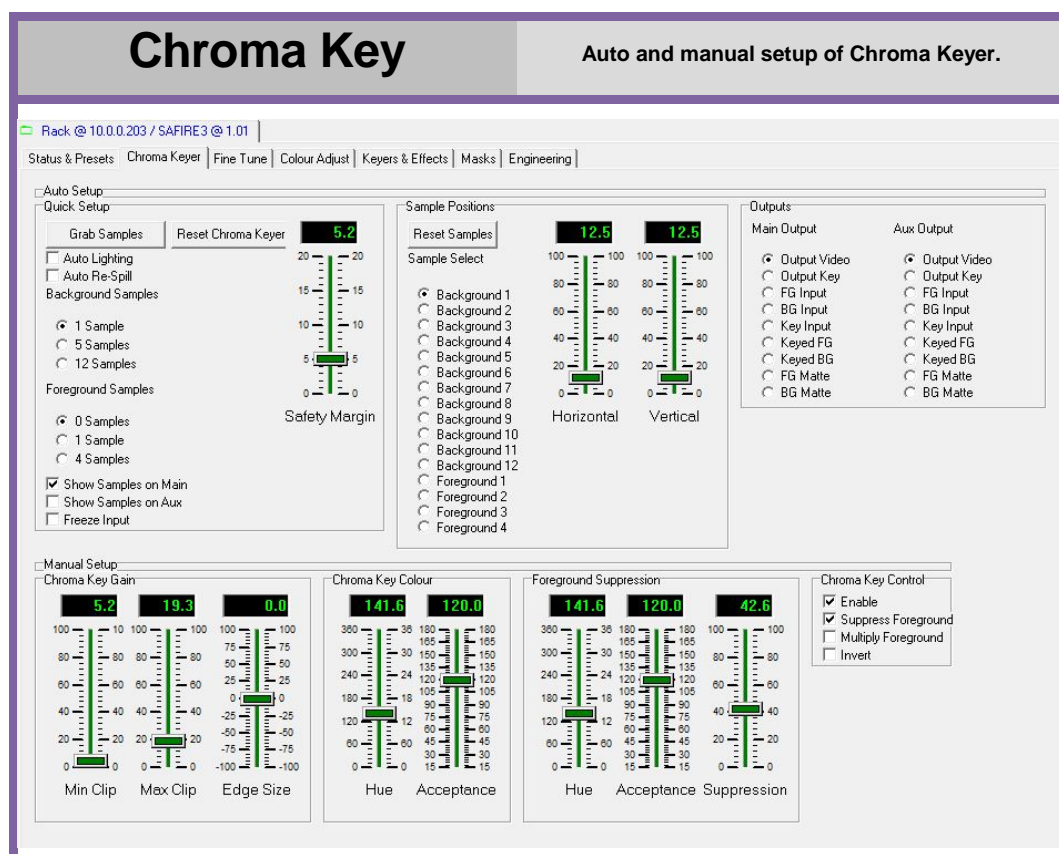
Status & Presets	The board status is shown using a mixture of simulated LEDs and text information. As a general rule a green LED shows a good condition such as input present. An amber LED will give a warning as with video black or video frozen. If a LED turns red this is a fault condition. A greyed LED will indicate an absence such as non-alarm or non-warning status.

Signal Status		
FG/BG/Key Input	**Standard**	Displays input video standard e.g. 1920x1080/50i.
	Input Present	On when video input present.
	Input Black	On when input video is black level.
	Input Frozen	On when input video is frozen.
	Input ATC Present	On when ancillary timecode is present in input video.
Reference Input	**Standard**	Displays ref video standard e.g. 1080/50i.
	Input Present	On when reference video present.
Output	**Standard**	Displays output video standard e.g. 1920x1080/50i.

	Input Freeze Enabled	**On if input video freeze selected.**
	Output Faded to Black	**On if main output faded to black.**

Key Status	
Chroma Key	**Enabled**	**On when chroma key mode is enabled. See Chroma Key tab->Chroma Key Control.**
	Faded Down	**On when key is faded down. See Keyers & Effects tab->Fade Keys.**
Self Key	**Enabled**	**On when Self Key is enabled. See Keyers & Effects tab->Self Key Control.**
	Faded Down	**On when self key is enabled and faded down. See Keyers & Effects tab ->Fade Keys.**
External Key	**Enabled**	**On when External Key is enabled. See Keyers & Effects tab-> External Key Control.**
	Faded Down	**On when external key is enabled and faded down. See Keyers & Effects tab->Fade Keys.**
Masks	**External Mask Enabled**	**On when External Mask is enabled. See Keyers & Effects tab->External Mask Control.**
	FG Mask Enabled	**On when FG Mask is enabled. See Masks tab->FG Mask Control.**
	BG Mask Enabled	**On when BG Mask is enabled. See Masks tab->BG Mask Control.**

Presets	
Store	**Store Safire 3 settings as one of 40 presets.**
Preset Select	**Select preset to store or recall.**
Recall	**Recall one of 40 previously stored settings.**

Chroma Key — Auto and manual setup of Chroma Keyer.

Auto Setup		
Quick Setup	**Grab Samples**	Set up Safire 3 using FG samples taken from the backdrop and foreground areas. The following parameters are automatically adjusted: Max Clip; Chroma Key Colour - Hue; Foreground Suppression - Hue, Acceptance & Suppression; Chroma Key Tune - Key Saturation.
	Reset Chroma Keyer	Return Safire 3 to its calibrated settings.
	Auto Lighting	Select to automatically compensate for lighting fade-off towards the edges when grab samples is selected. See Fine Tune tab->Lighting Compensation.
	Auto Re-Spill	Select to automatically compensate for any backdrop colour spill on FG objects when grab samples is selected. See Colour Adjust tab->FG Re-Spill.
	Background Samples	Select 1, 5 or 12 samples from the backdrop area of the FG picture to use for auto setup. Samples are (optionally) visible on the main and/or aux outputs and can be re-positioned. These samples are used to automatically select optimum chroma key values to allow for variations in chroma key backdrop hue and saturation. Usually the more samples chosen, the more accurate the result.

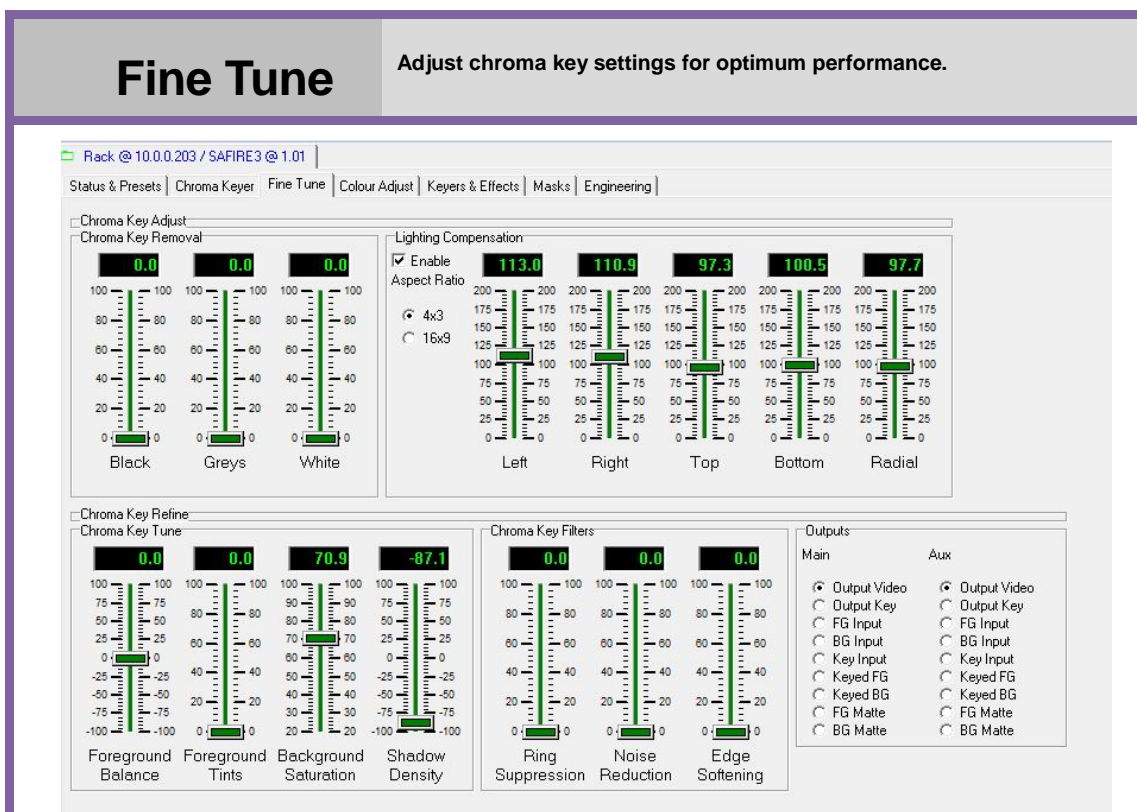| Auto Setup (contd.)		
Quick Setup (contd.)	**Foreground Samples**	Select 0,1 or 4 samples from the foreground area of the FG picture to use for auto setup. These samples are (optionally) visible on the main and/or aux outputs and can be re-positioned as necessary. These samples are used to amend the settings of the chroma keyer to isolate regions in foreground areas that may cause unwanted keying by forcing the key signal to zero at these points.
	Show samples on Main	Select this to display the sample positions as small rectangles on the Main output.
	Show samples on Aux	Select this to display the sample positions as small rectangles on the Aux output.
	Freeze Input	Select this to freeze the FG input signal. This is useful to enable accurate positioning of the backdrop and foreground samples when the subject is moving.
	Safety Margin	Adjust this control to minimise the effect of noisy samples on the auto setup. As auto setup parameters are calculated from a single frame, a noisy picture may give false samples. This control adjusts the levels of the samples to compensate.
Sample Positions	**Reset Samples**	Return sample positions to their default locations.
	Sample Select	Select which sample to re-position - the selected sample will slowly flash on the main and/or aux output.
	Horizontal/Vertical	Adjust the sample's position horizontally and vertically to the desired location.
Outputs	**Main Output**	Select which signal is routed to the Main output: Output video: the composite chroma keyed result. Output key: the key signal, as a monochrome image, produced by the combination of the chroma keyer, other keys and masks. FG input: the Foreground video input. BG input: the Background video input. Key input: the external key input signal. Keyed FG: the suppressed Foreground image after chroma keying. This signal is useful for fine adjustment of the various controls to optimise the removal of the key colour from the subject. Keyed BG: the Background signal after keying. This signal is useful in fine adjusting the key gain and other controls. FG Matte: display the matte colour set by the keyers and effects/FG source and matte controls. BG Matte: display the matte colour set by the keyers and effects/BG source and matte controls.
	Aux Output	Select which signal is routed to the Aux output.

Manual Setup		
Chroma Key Gain	**Min Clip**	Adjust the offset of the key signal that will cut a hole in the new Background video signal. Increasing the min clip value will force lower key levels to zero. This is mainly used when small amounts of key level remain in foreground object areas causing breakthrough of the new background. Any increase in min clip value will have to be compensated for by reducing the max clip value to restore the key in other areas. Note that shadows and scuffs appear as high to mid level key values and that increasing the min clip setting and reducing the max clip setting will tend to accentuate these. The effect of this control is best observed by monitoring the Output Key. The default level for this control is 0.
	Max Clip	Adjust the gain of the key signal that will cut a hole in the new Background video signal. Reducing the max clip level value will force variations in key level to full key value by amplifying and clipping. Use this control to compensate for uneven chroma key backdrop illumination. Adjusting this control is a compromise between removing key variations and retaining key edge detail. The effect of this control is best observed by monitoring the Output Key. The default level for this control is 50.
	Edge Size	Adjust the shape of the key. When the key signal is amplified it loses its original shape and this can cause a black line around foreground objects when the new background is added. Adjusting the key edge shape can help to compensate for this. Note that changing the key shape can also be used in conjunction with the min clip control to subtly change the appearance of shadows. The default level for this control is 0.
Chroma Key Colour	**Hue**	Set the colour that will be used by the new Background key circuitry. Monitor the output key and with the acceptance control set to 90 degrees and the min and max clip controls set to default values adjust the control to give the best overall key. Note: it may help to invert the key output in the Engineering menu so that full key level is peak white and no key is black. Note also: this control rarely needs adjusting after auto setup.
	Acceptance	Adjust this control to change the range of colours about the hue colour (acceptance angle) used by the new Background key circuitry. Monitor the output key and with the min and max clip controls set to default values, adjust this control to give the best overall key. Note: It may help to invert the key output in the Engineering menu so that full key level is peak white and no key is black. Setting the acceptance value too small may result in an uneven key in the chroma key backdrop area. Too large a value may cause keying in foreground areas resulting in the new background breaking through to the foreground.

Manual Setup (contd.)		
Foreground Suppression	**Hue**	Set the colour that will be used by the Foreground suppression circuitry. Monitor the Keyed FG signal and adjust this control to suppress the chroma key backdrop colour. Note that often there is a variation in backdrop colour caused by lighting etc. so adjust this control to give the best suppression in the most noticeable areas. This control is best adjusted with the suppression control set mid-way and the acceptance control set to 90 degrees to see the effect most clearly. Note also: this control rarely needs adjusting after auto setup.
	Acceptance	Adjust this control to change the range of colours about the hue colour (acceptance window) suppressed by the Foreground suppression circuitry. Monitor the Keyed FG signal and adjust this control to entirely suppress the chroma key backdrop colour. If the acceptance angle is set too small, then due to variations in backdrop colour, a colour tint may remain in places. If the angle is set too large then unwanted suppression may occur on foreground objects. Adjust the hue control as well to get the best compromise if there are large variations in backdrop colour. This control is best adjusted with the suppression control set mid-way to see the effect most clearly.
	Suppression	Adjust this control to set the suppressed backdrop area to black. Monitor the keyed FG signal and set the control to the minimum level necessary to give a solid black in the chroma key backdrop area. This control is best adjusted after the hue and acceptance controls have been set and – because because of their interactive nature – the min and max clip controls set to their default values. Note that when the suppressed FG signal and keyed Background signal are added together to form a final composite, any luminance in the FG backdrop area will be added to the new background. This can sometimes be compensated for with BG lift reduction in the BG Match sub menu of the Colour Adjust tab, but every attempt should be made to achieve as close to black as possible. Over-suppressing will distort edges possibly causing a black halo around FG objects.

Manual Setup (contd.)		
Chroma Key Control	**Enable**	Select this to enable chroma key operation on the foreground.
	Suppress Foreground	Select this to enable FG suppression. This is usually always selected if 'Multiply Foreground' is NOT selected. If 'Multiply Foreground' IS selected then deselecting this option can sometimes give better results if FG suppression has altered foreground colours.
	Multiply Foreground	Select this to multiply the Foreground by the inverse of the new Background key. If de-selected, the FG is added to the keyed background. With good lighting and a high quality chroma key backdrop it is usually better to not select 'Multiply Foreground' as FG Suppression and non-multiply mode give better results particularly with fine detail such as hair. However sometimes it is not possible to fully suppress all backdrop detail from the FG picture and that can show in the final composite. In this case multiply mode will cut out the backdrop entirely, but at the expense of fine detail. The different modes should be tried to see what gives the best result.
	Invert	In Multiply Foreground mode this control will invert the generated key – thereby swapping the FG and BG pictures in the final composite.

Fine Tune	**Adjust chroma key settings for optimum performance.**	

Chroma Key Adjust		
Chroma Key Removal	**Black/Greys/White**	Use these controls to attenuate the new background key in foreground areas of black, grey or white. This is useful where colour spill from the chroma key backdrop onto foreground objects are causing unwanted keying of the background.
Lighting Compensation	**Enable**	Select this to activate lighting compensation. This feature is enabled if 'auto lighting' is selected in quick setup.
	Aspect Ratio	Select aspect ratio of radial lighting compensation parameter. Note that quick setup assumes 4x3 which is primarily for Standard Definition.
	Left/Right/Top/Radial	These controls help compensate for uneven backdrop lighting. The lighting distribution of a spotlight is a bright centre that fades away to the edges in a circular pattern. The Background key produced when a spotlight is used to illuminate a chroma key backdrop will reflect that lighting distribution. Increasing key gain (max clip) will help compensate for that but at the expense of fine detail. By monitoring the output key and adjusting the lighting compensation controls it is possible to minimise the effects of lighting edge fade. With max clip set to 100, adjust the radial and position controls to provide as even a key distribution in the backdrop area as possible. These controls are automatically set if 'auto lighting' is selected in quick setup.

Chroma Key Refine		
Chroma Key Tune	Foreground Balance	This control moves the acceptance window of the FG suppressor circuitry about the selected backdrop hue. This control is useful when the FG objects contain colours close to the backdrop colour and so can help minimise desaturation of some FG colours while maintaining good backdrop colour suppression.
	Foreground Tints	This control allows areas of the foreground that contain low saturation levels of the backing colour to be passed without being suppressed.
	Background Saturation	This control helps compensate for a poorly saturated camera output in FG backdrop areas. Ideally, a well lit backdrop would produce a 100% saturated colour output from the camera; but this is rarely the case. While monitoring the output key and with max clip set to 100, adjust this control to provide an even and low noise key in the backdrop area. The max clip control can then be adjusted to amplify the key to full level. This control is automatically set by quick setup.
	Shadow Density	This control changes the appearance of shadows. Increasing the value of this control will make shadows appear more prominent and decreasing less prominent.
Chroma Key Filters	Ring Suppression	This control helps minimise ringing introduced by the camera.
	Noise Reduction	This control adds a variable amount of filtering to the Background key signal to help minimise noise while maintaining fine edge detail.
	Edge Softening	This control adds a variable amount of filtering to the Background key signal to smooth jagged edges caused by high levels of key gain and to minimise noise.
Outputs	Main/Aux Outputs	Select which signal is routed to the main and aux outputs. See Chroma Keyer tab for details.

Colour Adjust

Adjust FG and BG video levels to match each other to give best composite image. Colour correct FG signal. Colour adjust in areas tinted by backdrop colour.

FG & BG Colour Match

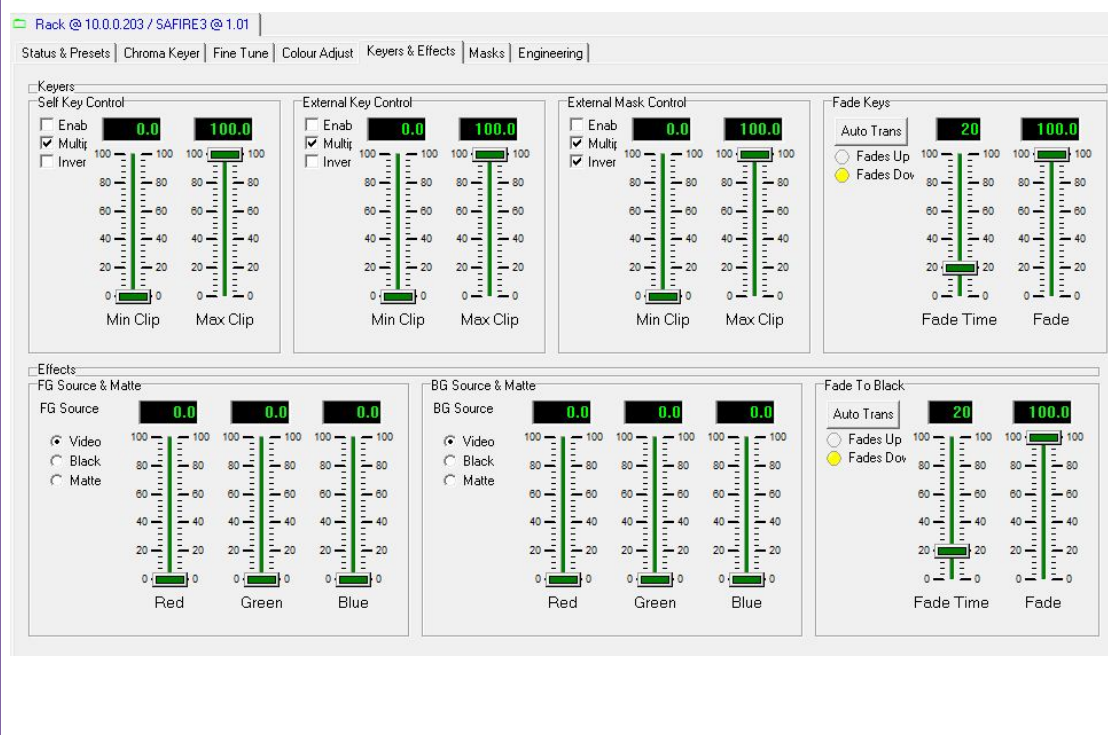| FG Match	FG Lift/Gain/Chroma	These controls modify the FG video signal so it matches the keyed Background in the final composite. Monitor the output video and use the lift, gain and chroma controls to achieve the best results.
BG Match	BG Lift/Gain/Chroma	These controls modify the BG video signal so it matches the keyed Background in the final composite. Monitor the output video and use the lift, gain and chroma controls to achieve the best result. These controls are left untouched by quick setup. BG lift control can help reduce any luminance added to the composite by the suppressed FG if some luminance remains in the FG backdrop areas.

FG & BG Colour Match (contd.)

FG Re-Spill	Enable	Select this to enable FG re-spill in areas of the foreground that were tinted by the backing colour. This control is selected if 'auto re-spill' is selected in quick setup.
	Red/Green/Blue	These controls add a colour tint to the backdrop spill areas of the suppressed FG picture to counteract any noticeable colourisation. When an object is placed in front of a green backdrop, say, it will experience a green spill around its edges and reflecting surfaces, but if a blue background (i.e. sky) was chroma keyed behind, the green spill would look unnatural. Adding a blue FG re-spill in this case would produce a more realistic composite. These controls are automatically set if 'auto re-spill' is selected in quick setup.

FG Colour Correct

FG Gain	Red/Green/Blue Gain	These controls adjust the individual red, green and blue gains of the suppressed FG signal between 80% - 120%.
FG Lift	Red/Green/Blue Lift	These controls give positive and negative lift to the individual red, green and blue channels of the suppressed FG signal.

<table>
<tr><td colspan="2"><h1>Keyers & Effects</h1></td><td>Enable and adjust self key. Set up external key input as key and mask. Fade keys in and out, automatically and manually. Select sources for FG and BG. Adjust FG and BG matte colours. Fade output to and from black.</td></tr>
</table>

<table>
<tr><th colspan="3">Keyers</th></tr>
<tr><td rowspan="5">Self Key Control</td><td>Enable</td><td>Select to use the luminance of the FG signal as a key. The BG is keyed and filled with the FG source. Use this control to key a caption derived from the FG video into the Background video and fill with a matte, black or video. Usually chroma key mode would be disabled if self key mode is enabled.</td></tr>
<tr><td>Multiply</td><td>Select to key the FG signal before adding to the keyed BG signal. Select if the FG signal is not black outside of the caption fill area.</td></tr>
<tr><td>Invert</td><td>Select to invert the clipped key.</td></tr>
<tr><td>Min Clip</td><td>Use this control to clip all key signals below the threshold set by the control – i.e. if the control is set to 20 then all key levels up to 20% of max will be removed. Monitor the keyed FG to adjust this control.</td></tr>
<tr><td>Max Clip</td><td>Use this control to amplify and clip all key signals above the threshold set by the control – i.e. if the control is set to 80, then all key levels above 80% of max will be clipped and amplified to full scale. Monitor the keyed FG to adjust this control.</td></tr>
</table>

Keyers (contd.)		
External Key Control	**Enable**	Select to enable the External Key signal as a key. The BG picture is keyed and filled with the FG source. Use this control to key a caption into the Background video and fill with matte, black or video. This key augments the chroma key and self key in its active areas. In chroma key mode this key will force the FG video to mask chroma keying in unwanted regions. The external key combines with the self key to extend the size of the key.
	Multiply	Select to key the FG signal before adding to the keyed BG signal. Select if the FG signal is not black outside of the caption fill area.
	Invert	Select to invert the clipped key.
	Min Clip	Use this control to clip all key signals below the threshold set by the control – i.e. if the control is set to 20 then all key levels up to 20% of max will be removed.
	Max Clip	Use this control to amplify and clip all key signals above the threshold set by the control – i.e. if the control is set to 80, then all key levels above 80% of max will be clipped and amplified to full scale.
External Mask Control	**Enable**	Select to enable the external key signal as a mask. The mask signal disables the self key and chroma key in its active areas. If the chroma key is enabled the mask will force the final composite to Background and this can be used to compensate for missing backdrop areas or to promote an area of Background to the front of the composite.
	Multiply	Multiply mode is the normal way of using the external mask; the suppressed FG signal is keyed with the mask prior to adding to the BG. In non-multiply mode the FG signal is not keyed and added to the BG signal.
	Invert	Select to invert the clipped mask.
	Min Clip	Use this control to clip all key signals below the threshold set by the control – i.e. if the control is set to 20 then all key levels up to 20% of max will be removed.
	Max Clip	Use this control to amplify and clip all key signals above the threshold set by the control – i.e. if the control is set to 80, then all key levels above 80% of max will be clipped and amplified to full scale.

Keyers (contd.)		
Fade Keys	Auto Trans	Use this control to automatically fade enabled keys up and down at the rate set by the Fade Time control. In chroma key mode the FG image will be faded up and down but masks are unaffected. External and self key will fade up and down.
	Fades Up/Down	These indicate which direction the autotrans operation will take.
	Fade Time	Use this control to set an autotrans fade time of 0-100 seconds.
	Fade	Use this control to manually fade keys up and down.

Effects		
FG Source and Matte	FG Source	Use these controls to select the FG signal. Select either FG video, black or the colour matte – usually FG video for chroma keying.
	Red/Green/Blue	Set the FG colour matte using these controls.
BG Source and Matte	BG Source	Use these controls to select the BG signal. Select either BG video, black or the colour matte – usually BG video for chroma keying.
	Red/Green/Blue	Set the BG colour matte using these controls.
Fade to Black	Autotrans	Use this control to start an automatic fade to black transition of the video output at a rate set by the Fade Time control.
	Fades Up/Down	These indicate which direction the autotrans operation will take.
	Fade Time	Use this control to set an autotrans fade time of 0-100 seconds.
	Fade	Use this control to manually fade to/from black.

| **Masks** | The FG and BG masks are used to override the chroma key to either force the BG image in areas of poor backdrop quality or to disable in unwanted areas. Note that the masks also have an effect on the self key and external key signals. |

FG Mask		
FG Mask Control	**Enable**	Select this control to enable the FG mask. This user-positionable mask will override the chroma key in its active area to force the BG signal. Use this mask if the chroma key backdrop is too small or damaged, or badly lit at the edges.
	Invert	Select this control to invert the mask.
FG Mask Window	**Left/Right/Top/Bottom**	Use these controls to position the mask rectangle.
FG Mask Softness	**Left/Right/Top/Bottom**	Use these controls to soften the four edges of the mask to make the mask less noticeable.

<table>
<tr><td colspan="3" align="center">BG Mask</td></tr>
<tr>
<td rowspan="2">BG Mask Control</td>
<td align="center">Enable</td>
<td>Select this control to enable the BG mask. This user-positionable mask will override the chroma key in its active area to force FG video. Use this mask to disable the chroma key in FG non-backdrop areas containing the key colour, or reflective objects. Note that the BG mask does not override FG suppression, only the BG key.</td>
</tr>
<tr>
<td align="center">Invert</td>
<td>Select this control to invert the mask.</td>
</tr>
<tr>
<td>BG Mask Window</td>
<td align="center">Left/Right/Top/Bottom</td>
<td>Use these controls to position the mask rectangle.</td>
</tr>
<tr>
<td>BG Mask Softness</td>
<td align="center">Left/Right/Top/Bottom</td>
<td>Use these controls to soften the four edges of the mask to make the mask less noticeable.</td>
</tr>
</table>

Engineering

Control engineering functions such as genlock, timing and board reset.

Signals		
Genlock	Source	Select which source Safire 3 will use as its reference.
	Reference	Select whether the external analogue reference input is Tri-Level or Black & Burst. No reference needs to be applied unless 'Reference' is selected as the genlock source.
Output	Format	Select which input video format should be used for the video output.
	Ancillary Data	Select which video input is the source of output ancillary data.
	Invert Output Key	Select this to invert the output key. Use this to match the key polarity with other equipment or for monitoring purposes to make the key more visible.
GPI Preset Recall	Enable	Select to enable recall of presets by GPI. Presets 1-32 can be selected from the binary coding of the external GPI inputs.
	GPI Active Level	Select low or high level as the active level for the GPI signals.
	GPI Trigger	Select whether GPI recall should be triggered by a change in level or a pulse.
GPI Fade Keys	Enable	Select to enable fading of keys by GPI.
	GPI Active Level	Select low or high level as the active level for the GPI.
	GPI Trigger	Select whether GPI triggering should be triggered by a permanent change in level or a transition.
Board Reset	Defaults	Select to restore Safire 3 to default conditions without erasing stored presets.
	Erase Presets	Select to restore Safire 3 to default conditions AND erase stored presets.

Timing		
Frame Delays	FG/BG/Key Delay	These controls delay the selected video by up to ten frames at the Safire 3's inputs.
Output Delay	FG Short Delay	Select this to disable the Noise Reduction and Edge Softening filters to minimise propagation delay. Short Delay for SD = 85uS, HD = 18uS, 3G = 10uS. Without Short Delay selected, add 5 line delay to the above values.
	FG/BG/Key Frame Delay	Indicates whether the output signal is more than one whole frame delayed with respect to each input.
	Pixel Timing	Delay output video horizontally by 0 to 2640 pixels with respect to reference. (See note below)
	Line Timing	Delay output video vertically by 0 to 1125 lines with respect to reference. See note above for max delay. *Note: the total Pixel + Line delay can not exceed one frame for any output standard. E.g. 720 lines is the maximum delay for 720p standard.*

Timing (contd.)		
Progressive Frames	**Lock Frames to ATC**	**Lock the HD progressive video output to Ancillary Timecode.**
	Swap FG/BG/Key Input	**Swap field sequence of the selected progressive video input.**
	Swap Output Frames	**Swap field sequence of the progressive video output.**