Crystal Vision

SAFIRE 3 Xpress

3G/HD/SD chroma keyer

Safire 3 Xpress is a real-time chroma keyer ideal for weather, news bureaus and other single static camera applications that use simple backgrounds rather than a full virtual set.

Working with 3Gb/s, HD and SD sources (31 different video standards in fact), Safire 3 Xpress combines its affordable high quality processing with a simple features set, making control easy for even a less-technical operator. It provides instinctive operation of all functions from any web browser or by using a hardware control panel. Useful features such as input frame synchronisers and lighting compensation mean that it will always outperform your studio mixer.

Safire 3 Xpress is a module that fits in Crystal Vision's Indigo frames, saving you rack space by allowing up to 12 chroma keyers (or other modules) in 2U.

..Temperatures will be in the mid-20s... ...Now to our French correspondent.
...The fight for premiership survival continues this weekend...
..It's a chilly start across eastern areas... ...And this has been tonight's news..

WHY SHOULD I CHOOSE SAFIRE 3 XPRESS?

Lighting compensation

Uneven lighting? Get a uniform key signal across the image by using lighting compensation to boost the key

Masks

Don't have a perfect backdrop? Use the internal masks to remove unwanted areas

Easy to set up – by anyone

Need a quick and easy setup? Sample the brightness and hue of one representative point on the backdrop to set the range of colours to key on and automatically get the optimum chroma key values

Key Shrink

Camera feed causing unwanted outlines? You can shrink the edge by up to a pixel and remove these outlines

Use transparent and reflective objects

Does your virtual production include glass or smoke? You can still create an effective key: linear chroma keying allows the final picture to be a mixture of both Foreground and Background

Shadow Density

Need to make shadows appear or disappear? Use the Shadow Density control to increase or reduce the appearance of shadows

Freeze the input

Presenter unable to keep still? No problem – freeze the input and spend as long as you need tweaking the settings

Improve the picture

Want to make picture adjustments? Stick with the default settings, or make use of the fine-tuning tools – whether you want to eliminate key noise and transparency or manage colour spill

Add virtual objects, logos and sports graphics

Need to add virtual objects to your studio, or insert graphics on to a sporting surface? Use the flexible External Key to force part of the Background to appear in front of the Foreground subject, to linear key logos, or to restrict the chroma keying to the area that contains sports graphics

Easy system timing

Don't want to battle with system timing issues? A frame synchroniser on each input ensures the system will just work, even if you're using a PC-graphics card system to generate your Background

Choice of control

Like to control your chroma keyer in a particular way? Choose from a variety of methods, including touch screen control panel and a web browser running on any device

Simulated picture

WHY SAFIRE 3 XPRESS IS BETTER THAN YOUR STUDIO MIXER

Safire 3 Xpress is a real-time chroma keyer ideal for weather, news bureaus and other single static camera applications that use simple backgrounds rather than a full virtual set.

It's for chroma keying applications like this that people often turn to their studio mixer as the solution. However, Safire 3 Xpress will always produce better and more reliable results for live virtual productions – especially when the conditions aren't perfect, which is usually the case.

Studio mixers struggle to chroma key if the lighting isn't perfect, if you want to include shadows or if the foreground is similar to the key colour. Safire 3 Xpress overcomes these challenges with its lighting compensation, key shrink, shadow enhancement and better foreground suppression of the key colour.

So Safire 3 Xpress will clearly provide higher quality chroma keying than your mixer. There will also be less for both the mixer and mixer operator to do, with the mixer's resources able to be used elsewhere and another operator usually in charge of setting up the chroma keyer. The mixer operator will also be better informed by being able to view the keyed composite before selecting it.

Foreground

Suppressed Foreground

UNDERSTANDING CHROMA KEYING

Chroma keying is used to combine a virtual object (Background) with a real image (Foreground) by replacing a real colour (usually blue or green) with a virtual input.

In a typical chroma key the Foreground subject is shot against a well lit uniformly coloured backdrop. A Suppressed Foreground signal is produced in which the backdrop colour is removed and the signal is used to create a key to remove an area from the Background video that is identical in size to the Foreground subject.

The Suppressed Foreground is inserted into the backdrop 'hole', then masks can be added to remove any unwanted Foreground or Background and any fine-tuning can be applied.

CHROMA KEYING USING SAFIRE 3 XPRESS

Safire 3 Xpress's chroma keying uses an extremely sophisticated algorithm to determine how the key is derived, giving excellent results with minimal sensitivity to camera noise.

Safire 3 Xpress can key on any colour, including sporting surfaces such as grass. Best results are obtained from intense colours (with high chrominance) that do not occur in the Foreground subject.

Linear chroma keying avoids the hard switch associated with non-linear keying and allows areas of the final picture to be a mixture of both Foreground and Background, permitting the use of transparent and reflective objects (such as spectacles, a glass of water and smoke) and resulting in more convincing edges. Safire 3 Xpress features both additive and multiplicative keying to suit all types of situations. Additive keying relies on careful attention to the lighting of the Foreground, but should result in more convincing edges, shadows and transparent objects.

Keys can be faded to show the Background input only, while a final fade to black is available on both the main and auxiliary outputs.

SETTING UP IS EASY

Safire 3 Xpress's cursor-based auto setup makes it easy to quickly set up a chroma key, by sampling the brightness and hue of one representative point on the backdrop to set the range of colours to key on. The sample is optionally visible on the main or auxiliary outputs and can be repositioned.

The input can be frozen to make setup even easier – meaning your presenter doesn't have to stay still while you are making adjustments.

Background

Composite picture

PERFECTING THE PICTURE

Safire 3 Xpress's backdrop sampling will automatically generate a realistic chroma key which is suitable for most applications. A range of fine-tuning tools are additionally available to optimise the picture in more challenging conditions.

You can eliminate key noise and chroma key transparencies by using the Maximum Clip and Minimum Clip controls to adjust the key gain, the key Hue and Saturation controls to tune the backdrop key colour, and the key Acceptance control to increase or reduce the range of colour variation around the key colour.

You can manage colour spill by using the Foreground Hue, Acceptance and Suppression controls to determine the range and amount of colour spill to be removed.

With Safire 3 Xpress's additive processing, there should not normally be a requirement to shrink the key – good lighting and a camera that does not add artificial sharpness will give the best keying results. However, if one of these is compromised, Key shrink is a useful tool to reduce artificial borders between the camera feed and background. Key shrink is user adjustable in 0.001 pixel steps from 0 to 1 pixel.

LIGHTING COMPENSATION

A particularly powerful and useful tool is lighting compensation – a true differentiator between Safire 3 Xpress and a studio mixer.

Good lighting is essential for good chroma keying. Safire 3 Xpress has adjustments to help you achieve a uniform key signal across the image using two-dimensional lighting compensation for uneven illumination of the backdrop.

The lighting distribution of a spotlight is a bright centre that fades away to the edges in a circular pattern, and the Background key produced will reflect that lighting distribution. Safire 3 Xpress's lighting compensation makes it possible to minimise the effects of this lighting edge fade. For linear lighting problems, each edge can be adjusted. A radial gradient can also be applied to the chroma key gain.

MAKE SHADOWS APPEAR – OR DISAPPEAR!

The Shadow Density control can be used to increase or reduce the appearance of shadows. It can be used to remove any shadows that have been cast on to Background graphics by uneven lighting, something often required in news-type applications. For other virtual set applications, Shadow Density can be used to increase the shadows to make the composite image look more real – ideal for full length shots where shadows would be naturally cast on to the floor.

EASY SYSTEM TIMING

With Safire 3 Xpress, your system should just work. Any timing errors will be automatically corrected by the frame synchroniser on each input – synchronising sources up to one frame apart for easy system timing. Reference timing can be selected to come from the Foreground, Background or Key input or from SD Black and Burst or HD tri-level syncs. This gives you more flexibility in how you generate the background, even allowing you to use a PC-graphics card system which cannot be locked to the camera.

APPLYING MASKS AND LAYERS

Safire 3 Xpress offers two internal rectangular masks (Foreground and Background) and an External Key which can be used to overrule the keying process. These masks include adjustable edge softness which is useful for blending between masked and unmasked areas for a more natural-looking edge.

It's not always possible to have a perfect backdrop for your chroma key, but this isn't a problem with Safire 3 Xpress. Unwanted areas of the Foreground can easily be removed by forcing the Background with a Foreground mask. Similarly wanted areas of the Foreground can be forced with a Background mask. Used either together or independently, the Background and Foreground masks can be turned on or off, inverted and adjusted in position and size.

The flexible External Key should be used when a customised non-rectangular or moving shape is required and can force areas to be either Foreground or Background under the control of a key generated by a graphics system. It can force part of the Background to appear in front of the Foreground in the area of the supplied External Key – allowing a presenter to go behind a virtual desk, for example. It also allows Safire 3 Xpress to be used as a linear keyer and for sports graphics applications.

USE SAFIRE 3 XPRESS AS A LINEAR KEYER

Safire 3 Xpress can double as a linear keyer – keying captions, logos, scoreboards and other graphics over a video source. You can linear key either by using the key signal on the External Key input, or by turning on the Self Key where it creates the key based on the luminance of the Foreground signal.

SPORTS GRAPHICS

Safire 3 Xpress can be used for sports graphics keying, such as keying logos on to a pitch.

Sports graphics applications are, however, generally best served by the full Safire 3 due to its built-in ten frames video delay which will compensate for the processing delay caused by the sports graphics moving with the camera.

Safire 3 Xpress can be used in sports graphics applications where the camera is fixed or where the processing delays are dealt with by an external video delay line such as Crystal Vision's ViViD 3G range.

SELECT YOUR AUDIO

Safire 3 Xpress is easy to use in a system with embedded audio: the audio to be output with the final video can be selected from either the camera feed, the Background graphics or the External Key input. Alternatively all ancillary data including embedded audio can be blanked.

CHOICE OF CONTROL...

VisionPanel

SNMP

VisionWeb Control

CONTROLLING YOUR CHROMA KEYER

With a choice of options available, Safire 3 Xpress is easy to control by anybody – whether they consider themselves technical or not-so-technical.

VisionPanel is a stylish 3U control panel able to operate up to 16 Indigo frames containing Safire 3 Xpress chroma keyers (or other Crystal Vision products) over an Ethernet network, with the large, intuitive eight inch touch screen and physical controls making it ideal for live use. VisionPanel features eight hard buttons - F1 to F8. The four buttons on the left allow you to select which Safire 3 Xpress you want to control, with up to eight chroma keyers directly selectable by using these four buttons in combination with the Shift (F5) button. Should your system contain more than eight chroma keyers, you can easily select additional boards to control using the Device menu on the touch screen. The four buttons on the right are Shift (F5), Presets/Outputs/Chroma Key Enable (F6), Gain and Spill/Key Status (F7) and Back/Home (F8). F6 will jump directly into the Outputs and Presets menu, allowing you to quickly monitor your incoming and outgoing signals or recall or store a preset. When F6 is pressed with Shift (F5) also held down, it will toggle the chroma key on and off. Holding down F7 will immediately access the Gain and Spill menu. When F7 is pressed with Shift (F5) also held down, it will access the Key Status menu. F8 will take you back through your previous menus; with Shift (F5) held down, it will instead take you to Safire 3 Xpress's home screen, where all the top level menu options are available. 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. VisionPanel can sit on a desk stand, be fitted into a desk or be rack mounted using the included rack mount kit.

VisionWeb Control allows Safire 3 Xpress to be operated from a web browser running on any device which is connected to the same network - from PC to tablet. To access the control menus, simply type the IP address of the frame into any up-to-date web browser – it's an enjoyable and free-of-charge way to control your Safire 3 Xpress.

Alternatively there is GPI control, featuring three GPI inputs for preset recall (with up to five presets available) and one GPI input dedicated to fading keys up and down. The key can be switched on and off from GPI, allowing an automation system to simply control the key without needing complex protocols or controls.

Control is also available from the SBB-4 smart button box, SNMP or by using our ASCII or JSON protocols.

SAVE RACK SPACE – AND PROTECT YOUR OUTPUT

Safire 3 Xpress is a space-saving 100mm x 266mm module housed in Crystal Vision's Indigo frames, which are available in three different sizes to suit all applications. 12 chroma keyers or other boards will fit in 2U, six in 1U and two in a desk top box.

With Safire 3 Xpress the Foreground, Background and External Key inputs and one main output and one auxiliary output are accessed by using either the RM50 or RM73 frame rear modules. With both main and auxiliary outputs available you can easily monitor each stage of the keying process, looking at the various internal signals individually and making any changes – yet another feature designed to make operation easy.

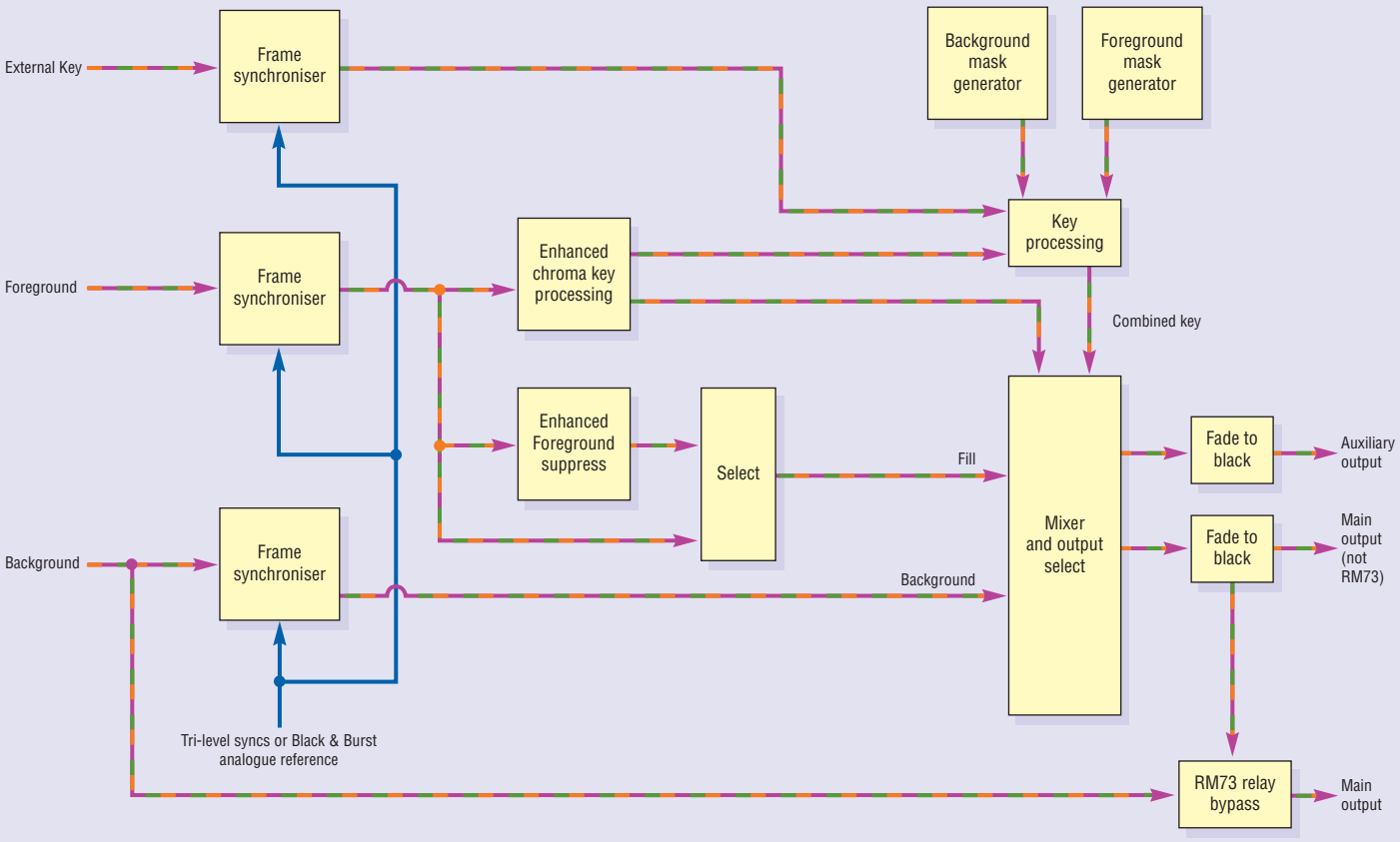
The RM73 rear module can provide relay bypass protection of the Background on power failure or board malfunction or removal – most useful for virtual studio applications such as weather. Relay bypass protection allows you to maintain programme output while maintenance is completed: it prevents signal loss by mechanically connecting the Background input to the main output whenever the supply to the rear module is interrupted.

DO YOU NEED SAFIRE 3 XPRESS OR SAFIRE 3?

Safire 3 Xpress is a simpler and lower cost version of Safire 3, with less options resulting in simpler controls for easy operation.

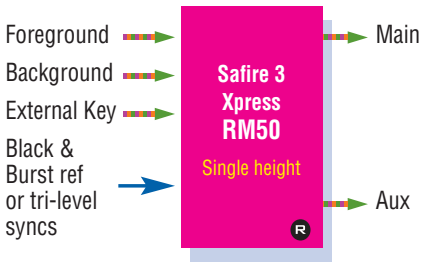
The top-end Safire 3 is ideal for multiple camera applications using full virtual environments, with its additional features including powerful multi-point sampling for automatic setup, built-in video delay, and an extensive range of fine-tuning tools including filters, colour correction, colour re-spill and individual black, grey and white chroma key removal. Discover more about it at www.crystalvision.tv.

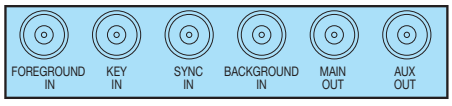
THE INPUTS AND OUTPUTS



REAR MODULE CONNECTIONS

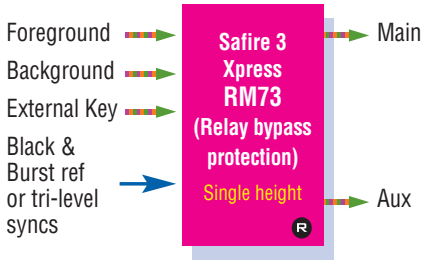
For standard applications

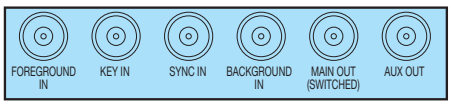




RM50

For relay bypass protection applications





RM73

SPECIFICATION

MECHANICAL
Standard Crystal Vision module 266mm x 100mm
Weight: 200g
Power consumption: 12 Watts

VIDEO INPUTS
Three 3Gb/s, HD or SD inputs (Foreground, Background and Key)
270Mb/s or 1.5Gb/s or 3Gb/s serial compliant to EBU 3267-E, SMPTE 259, SMPTE 292-1 and SMPTE 424/425-A
Works with the following video standards: 1080p23.98, 1080p24, 1080p25, 1080p29.97, 1080p30, 1080p50, 1080p59.94, 1080p60, 1080PsF23.98, 1080PsF24, 1080PsF25, 1080PsF29.97, 1080PsF30, 720p50, 720p59.94, 720p60, 1080i50, 1080i59.94, 1080i60, 2048x1080p23.98*, 2048x1080p24*, 2048x1080p25*, 2048x1080p29.97*, 2048x1080p30*, 2048x1080PsF23.98*, 2048x1080PsF24*, 2048x1080PsF25*, 2048x1080PsF29.97*, 2048x1080PsF30*, 625i and 525i (*= YUV 4:2:2 10 bit)
3Gb/s cable equalisation up to 75m using Belden 1694A. HD cable equalisation up to 100m with Belden 1694A or equivalent. SD cable equalisation >200m Belden 8281 or equivalent
Input return loss: -15dB for 50MHz to 1.5GHz

VIDEO OUTPUTS
One main output and one auxiliary output accessed by using RM50 or RM73 frame rear modules. Relay bypass protection of Background with RM73
270Mb/s or 1.5Gb/s or 3Gb/s serial compliant to EBU 3267-E, SMPTE 259, SMPTE 292-1 and SMPTE 424/425-A
Output frame rate same as input frame rate
Both main and auxiliary outputs can be used to show Output Video, Output Key, Foreground Input, Background Input, Key Input, Keyed Foreground and Keyed Background

DELAY THROUGH BOARD
SD: 5 lines plus 85us min
HD: 5 lines plus 18us min
3Gb/s: 5 lines plus 10us min

TIMING ADJUSTMENTS
Reference timing can be selected to come from Foreground, Background or Key input or from SD Black and Burst or HD tri-level syncs. 3Gb/s, HD or SD source can use either type of reference. When cross-locking it is necessary for both the video input and reference to share the same frame rate
A frame synchroniser on each input will automatically synchronise sources up to one frame apart in timing for automatic correction of any timing errors
Amplitude of syncs 150mV to 600mV
Link on PCB selects 75 ohm termination or high impedance

CHROMA KEY AUTO SETUP
Cursor-based auto setup samples the colour at one point on the backdrop to generate the optimum default settings and is suitable for most applications. It automatically sets the parameters for the Chroma Key Gain (Max Clip), Chroma Key Colour (Hue), Foreground Suppression (Hue and Suppression) and Chroma Saturation
The Freeze Input control allows the Foreground input to be frozen during the backdrop sampling, useful when the Foreground object is a moving person

CHROMA KEY ADJUSTMENTS
Chroma Key Gain: Minimum Clip sets the key value below which the Foreground will be fully opaque. Any chroma key values below this are taken to zero and the Background is not keyed on. Maximum Clip sets the key value above which the Foreground will be fully transparent. As the Minimum Clip and Maximum Clip get closer together, the gain applied to the chroma key signal increases resulting in a stronger key signal
Chroma Key Colour: Hue sets the RGB value of the backdrop colour to be used for generating the key. Acceptance Angle widens or narrows the range of colours around the hue value considered to be within the backdrop colour
Foreground Suppression: This removes the backdrop colour from the Foreground video signal. The option to have a slight variation from the keying colour can be useful for colour spill and colour edge effects. Hue sets the RGB value of the backdrop colour to be suppressed from the Foreground. Acceptance Angle widens or narrows the range of colours around the hue value to be suppressed. Suppression sets the amount of suppression applied
Chroma Key Control: Enable turns the chroma keying on and off. When Suppress Foreground is enabled, the processed Foreground is used. Additive keying produces best results for semi-transparent objects and shadows
Keyed Background is combined with Foreground or Suppressed Foreground

CHROMA KEY FINE-TUNING TOOLS
Key Shrink: Allows the key size to be reduced by an adjustable amount. Used to remove any hard outlines around the key as a result of ringing or spill present in the Foreground signal
Shadow Density: Used to enhance or remove the appearance of Foreground shadows
Lighting compensation: Two-dimensional compensation for uneven illumination of the backdrop will achieve a uniform key signal across the image. For linear lighting problems, each edge can be adjusted. A radial gradient can also be applied to the chroma key gain

FADES
Fade keys control can be used to fade all enabled keys (Chroma, External, Self) to show the Background input only
Fade to black active on main and auxiliary outputs

EXTERNAL KEY AND EXTERNAL MASK
External Key and External Mask can be combined with the chroma key to force areas of Foreground or Background. External Key mode can also be used by itself for linear keying applications. Controls here include:
External Key: On/Off, Invert, Max Clip and Min Clip, Multiplicative/Additive mode
External Mask: On/Off, Invert, Max Clip and Min Clip, Multiplicative/Additive mode

SELF KEY (LUMINANCE KEY)
With Chroma and External Key modes disabled Self Key mode can be used which uses the luminance value in the Foreground to key over the Background
Adjustable Key Max, Key Min, Self Key (On/Off, Invert, Max Clip and Min Clip) and Multiplicative/Additive mode

INTERNAL MASK GENERATOR
Two internal masks (Foreground and Background) can be applied to mask out areas of foreground or background. Controls here include:
Foreground and Background masks: On/Off, Invert, Window Adjust (horizontal and vertical position, horizontal and vertical size)
The internally generated Foreground and Backgrounds masks have edge softness controls to prevent hard edge on mask

MIX
Mix between Foreground and Background by pressing the Fade Keys auto transition button when no keys are enabled

EMBEDDED AUDIO
Embedded audio is taken from any chosen input, allowing selection of audio from either the camera feed, the background graphics or the External Key input to output with the final video
All ancillary data including embedded audio can be blanked

PRESETS
The current board settings can be saved in one of five locations to be recalled as required

GPI INPUT LEVELS
Active: pull to ground, pulled up to +5V through 10 kohm

GPI INPUTS
Four GPI inputs
Three are used for preset recall and one for fading keys up and down

REMOTE CONTROL
Software:
VisionWeb Control is available via the web server on the frame and allows operation using a standard web browser on a computer, tablet or phone
SNMP monitoring and control available as a frame option
Control using ASCII and JSON protocols
Hardware:
VisionPanel touch screen control panel operates up to 16 frames containing Safire 3 Xpress or other modules over an Ethernet network
SBB-4 smart button box connects to the frame via Ethernet and provides four programmable LCD switches (which are configured for each order). The SBB-4 uses information from VisionWeb for settings. Uses Power over Ethernet so must be used with PoE enabled switch

ORDERING INFORMATION

Safire 3 Xpress	3G/HD/SD real-time chroma keyer
Safire 3	3G/HD/SD real-time chroma keyer with built-in video delay and colour corrector
Indigo 2SE	2U frame with active front panel featuring smart CPU for up to 12 Crystal Vision modules
Indigo 1AE-DP	1U frame with active front panel featuring smart CPU and integrated control panel for up to six Crystal Vision modules, with included power supply redundancy
Indigo 1SE-DP	1U frame with active front panel featuring smart CPU for up to six Crystal Vision modules, with included power supply redundancy
Indigo DT	Desk top box with passive front panel for up to two Crystal Vision modules
Indigo DTSE	Desk top box with active front panel featuring smart CPU for up to two Crystal Vision modules
RM50	Single slot frame rear module. Allows 12 Safire 3 Xpress in 2U, six in 1U and two in desk top box. Gives access to Foreground, Background, External Key and analogue reference inputs, one main output and one auxiliary output
RM73	Single slot frame rear module. Allows 12 Safire 3 Xpress in 2U, six in 1U and two in desk top box. Provides relay bypass protection of the Background. Gives access to Foreground, Background, External Key and analogue reference inputs, one main output and one auxiliary output
VisionPanel	3U Ethernet remote control panel with touch screen
SBB-4	Smart button box with four programmable LCD switches. It is powered by PoE (Power over Ethernet) and therefore needs to be connected to a PoE enabled switch
VisionWeb Control	VisionWeb web browser control included within frame software
SNMP	SNMP monitoring and control

Crystal Vision

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