UHD-3901-UC

Dual-Channel 4K UHD Upconverter with Optional HDR Processor

User Manual

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www.grassvalley.com

Document History

Document Number	Date of Publication	Notes
3064-99M00-100	2017-07-18	Initial Release
3064-99M00-110	2017-10-13	Adds support for 3G output with HDR, additional dynamic range presets, and minimum delay operation in 3G-to-3G mode
3064-99M00-120	**2018-06-15**	**Updated the introduction and the HDR processing sections**

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- Ensure that the frame is electrically connected to earth ground through the power cord or any other means if available.
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Certification and Compliance

Safety of Laser Modules

This equipment incorporates modules containing Class 1 lasers. These modules are certified by the manufacturer to comply with:

- IEC/EN 60825-1 Safety of laser products
- IEC 60950-1 Safety of information technology equipment

Restriction on Hazardous Substances (RoHS)

UHD-3901 **部件名称** Part name	**有毒有害物**质或元素 (Toxic or Hazardous Substances and Elements)					
	铅 (Pb)	**汞**(Hg)	镉(Cd)	**六价**铬 (Cr6)	**多溴**联苯 (PBB)	**多溴二苯** (PBDE)
电缆及电缆组件 Cables and Cable Assemblies	O	O	O	O	O	O
电路模块 Circuit Modules	X	O	O	O	O	O
组装风扇 Fan Assemblies	X	O	O	O	O	O
UHD-3901-3DRP, UHD-3901-3TRP **部件名称** Part name	**有毒有害物**质或元素 (Toxic or Hazardous Substances and Elements)					
	铅 (Pb)	**汞**(Hg)	镉(Cd)	**六价**铬 (Cr6)	**多溴**联苯 (PBB)	**多溴二苯** (PBDE)
电路模块 Circuit Modules	X	O	O	O	O	O

O: **表示**该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006规定的限量要求以下。

O: Indicates that this toxic or hazardous substance contained in all of the homogeneous materials for this part is below the limit requirement in SJ/T11363-2006.

X: **表示**该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006规定的限量要求。

X: Indicates that this toxic or hazardous substance contained in at least one of the homogeneous materials for this part is above the limit requirement in SJ/T11363-2006.

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This equipment has been tested for verification of compliance with FCC Part 15, Subpart B requirements for Class A digital devices.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This equipment has been tested and found to comply with the requirements of the EMC directive 2004/108/CE:

- EN 55022 Class A radiated and conducted emissions
- EN 61000-3-2 Harmonic current emission limits
- EN 61000-3-3 Voltage fluctuations and flicker limitations
- EN 61000-4-2 Electrostatic discharge immunity
- EN 61000-4-3 Radiated electromagnetic field immunity – RF
- EN 61000-4-4 EFT immunity
- EN 61000-4-5 Surge immunity
- EN 61000-4-6 Conducted immunity
- EN 61000-4-8 EMP immunity
- EN 61000-4-11 Voltage-dips, short-interruption and voltage variation immunity

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1 UHD-3901-UC Dual-Channel 4K UHD Upconverter with Optional HDR Processor

1.1 Introduction

The Densité 3 UHD-3901-UC from Grass Valley, a Belden Brand, is a dual-channel Quald Link 3G/3G/HD SDI upconverter, which is designed to upconvert and process HD signals for both Full HD 1080p and 4K UHD 2160p broadcast production.

The XIP-3901-UC application features broadcast quality upconverts with a high-quality scaler, motion-adaptive de-interlacer and color space conversion from ITU-R BT.709 to ITU-R BT.2020. A frame buffer is provided to keep the Quad Link 3G and 3G SDI outputs aligned with respect to a reference signal. In 4K UHD mode, the signals generated are output on Quad Link 3G SDI as per SMPTE ST-425-5, as two sample interleave (2SI) or square division (SD) outputs, user selectable per channel. The 3G/HD embedded audio and metadata are delayed to maintain synchronization with video before re-embedding in the 3G output or on Quad Link 3G link 1 when in 4K UHD mode.

There are many benefits to adding the UHD-3901-UC to workflows, enhancing production capabilities. The UHD-3901-UC interfaces with Grass Valley HD cameras and K2 Dyno replay servers (at 6X) to create 4K UHD signals that can then be delivered to a 4K UHD production switcher in a very economical way, instead of using the switcher's mix effects banks. The optional HDR processor, XIP-3901-UDC-HDR, allows conversion between SDR and HDR formats, supporting HLG (ITU-R BT.2100), PQ (SMPTE ST 2084, ITU-R BT.2100) and S-log3/S-Gamut3 formats, with conversion between formats.

Based on the proven Densité modular framework of over 100 functional cards, the flexible, space-efficient UHD-3901-UC cards accommodate a gradual adoption of HD production elements into Full HD 1080p and 4K UHD broadcasting workflows and enables dual HDR/SDR production, while protecting investment in installed equipment. With flexibility to configure up to 12 UHD-3901-UC dual-channel upconverter modules per Densité 3+ FR4 frame, the Densité platform scales to a market-leading density of 24 UHD upconverters in a 4 RU frame. This means space and cost-efficient scaling, today and tomorrow. The Densité UHD-3901-UC dual-channel 4K UHD upconverter can be controlled by the proven iControl systems, iControl Solo and through the frame control panel.

1.2 Features

- Independent dual-channel broadcast quality upconverter
- HD 720p / 1080i and Full HD 1080p inputs
- Full HD 1080p and 4K UHD 2160p outputs
- Quad Link 3G in 2SI and Square Division
- 3G Level A & Level B Dual Link
- High-quality scaler and advanced de-interlacer
- Integrated frame buffer for output alignment
- External reference or URS frame reference
- High-quality scaler and advanced deinterlacer
- Minimum processing delay mode selected when input and output formats are in Full HD 1080p.
- Broadcast quality color conversion (between ITU-R BT.709 to ITU-R BT.2020)
- SDR/HDR optional processing support
- Embedded audio and metadata delay and synchronization

1.3 Supported Video Formats

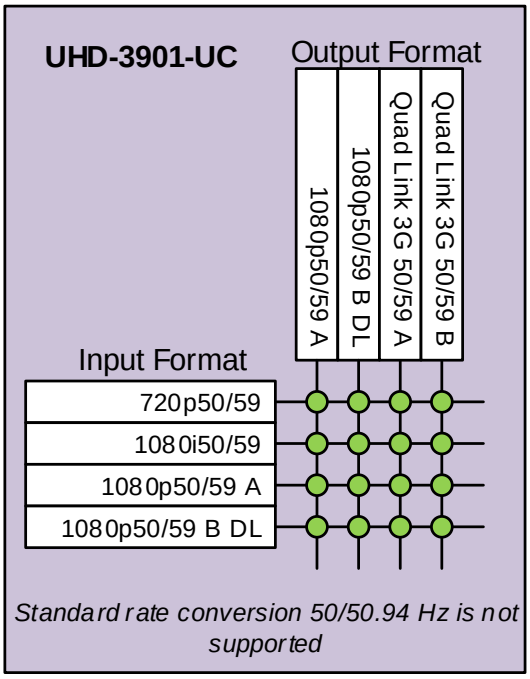


Figure 1-1 - *UHD-3901 Supported Video Formats*

1.4 Optional HDR Processing

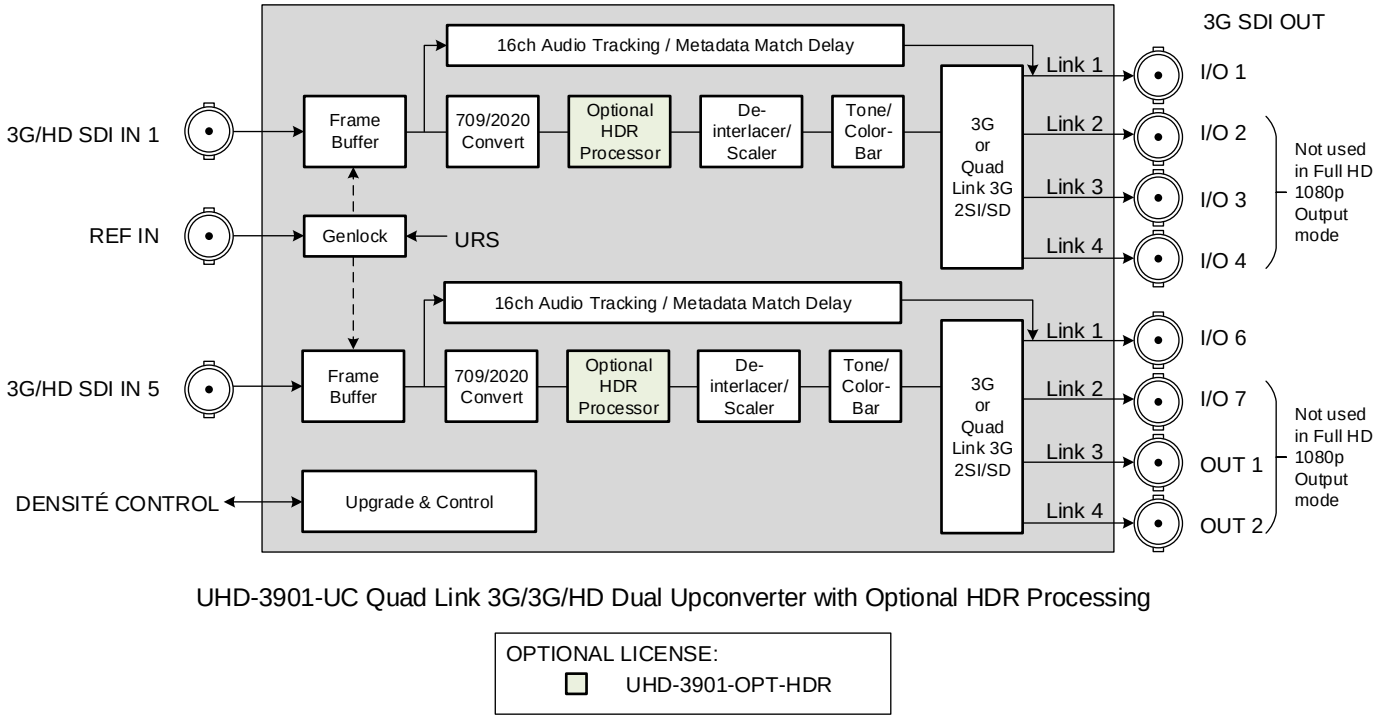
The UHD-3901-UC application includes ITU-R BT.709 and ITU-R BT.2020 color space conversions. The UHD-3901-OPT-HDR option adds HDR/SDR up-mapping and down-mapping capabilities, as summarized in the following table:

	Color Space and HDR conversions	UHD-3901-UC	
	Video Format	3G to 3G/UHD	HD to UHD/3G
Base	Bypass	√	√
Base	BT.709 to BT.2020	√	√
Option	SDR to HLG BT.2100 (BT.2020)	√	√
Option	SDR to PQ ST.2084 (BT.2020)	√	√
Option	HLG BT.2100 (BT.2020) to SDR	√	
Option	PQ ST.2084 (BT.2020) to SDR	√	
Option	PQ ST.2084 (BT.2020) to HLG BT.2100 (BT.2020)	√	
Option	HLG BT.2100 (BT.2020) to PQ ST.2084 (BT.2020)	√	
Option	S-Log3/S-Gamut3 to BT.709 800%	√	
Option	S-Log3/S-Gamut3 to HLG BT.2100 (BT.2020)	√	
Option	S-Log3/S-Gamut3 to PQ BT.2100 (BT.2020)	√	

Figure 1-2 - *HDR/SDR Up-mapping and Down-mapping Capabilities*

See 5.6 Options Panel for how to enable the options.

1.5 Functional Block Diagram



UHD-3901-UC Quad Link 3G/3G/HD Dual Upconverter with Optional HDR Processing

Figure 1-3 *UHD-3901 Functional Block Diagram*

1.6 Front Card-edge Interface

The front card-edge of the UHD-3901-UC incorporates two elements:

- Status LED (see section 3.2)
- Select Button (see section 4)

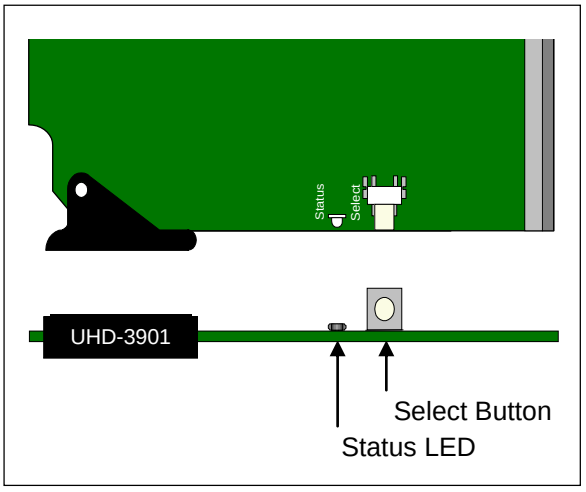


Figure 1-4 *Front card-edge layout*

2 Installation

2.1 Installation of Rear Connector Panels

Grass Valley Densité-series cards are each associated with a rear connector panel, which must be installed in the Densité frame before the card can be inserted.

The UHD-3901-UC card is designed to fit into Grass Valley's Densité-3 and Densité 3+ frames. Two different rear connector panels are available:

- UHD-3901-3TRP Triple-slot-width panel for Densité-3
- UHD-3901-3+DRP Double-slot-width panel for Densité-3+FR1 and Densité-3+FR4

See section 2.3 for details of the signal connections available on these panels.

All cards and rear panels can be installed with the frame power on. The card has connectors that plug into a mid-frame mother board for distribution of power and for connection to the controller card, and a second connector that plugs directly into the rear connector panel for input and output.

The rear connector panel must be installed with the card out of the frame.

- To remove an existing card from the slot, tilt the swivel handle on the front of the card to lever the connectors apart, then use the handle to pull the card straight out of the slot.

To install the connector panel:

1. If a card is installed in the slot whose rear panel is being changed, remove it as described above.
2. Remove the existing panel (either blank or belonging to an existing card that is being changed) by releasing the captive screw(s) at the bottom (Densité 3 or Densité 3+ FR4) or side (Densité 3+ FR1) of the panel.
3. Position the new panel and secure it in place with the captive screw(s) at the bottom or side.

2.2 UHD-3901-UC Card Installation

Once a matching rear connector panel is in place, install the UHD-3901-UC card as follows:

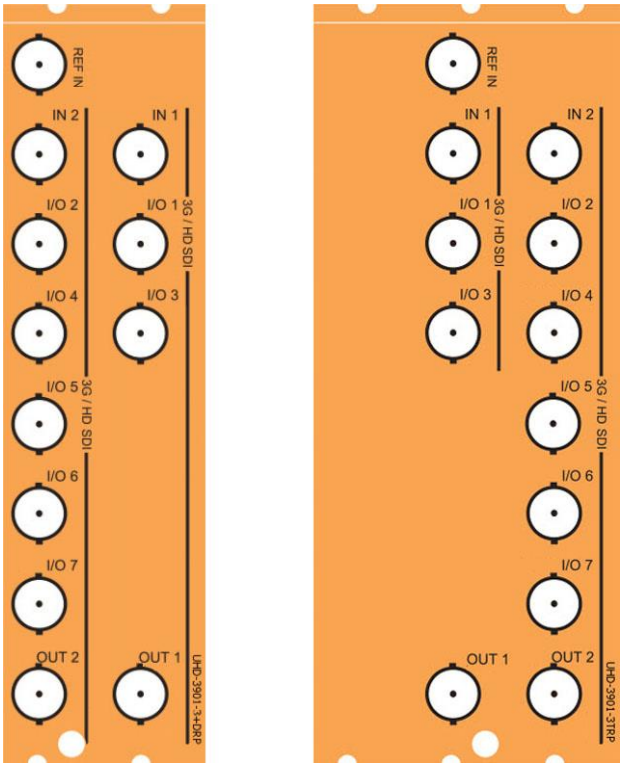
1. Open the front panel of the frame.
2. Slide the UHD-3901-UC card into the slot and push gently on the handle to seat the connectors.
   - When using a triple-slot-width rear panel in a Densité-3 frame, the card should be inserted into the rightmost of the three slots.
   - When using a double-slot-width rear panel in a Densité-3+ FR1 frame, the card should be inserted into the lower of the two slots.
   - When using a double-slot-width rear panel in a Densité-3+ FR4 frame, the card should be inserted into the rightmost of the two slots.

   Inserting the card into the wrong slot will not damage the card, and will be flagged by the on-card status LED flashing red to indicate that there is no connection to the rear panel.
3. Close the front door of the frame.

2.3 Rear Panels and Connectors

2.3.1 Images of Rear Panel Connectors

The two available rear panels are shown in the figure. Details of the inputs and outputs are described below.



UHD-3901-3+DRP **UHD-3901-3TRP**

Figure 2-1 *UHD-3901 Rear Panels*

2.3.2 Summary of rear panel connections

	UHD-3901-3+DRP	**UHD-3901-3TRP**
Double-slot-width panel for Densité 3+ FR1 and FR4 frames	♦	
Triple-slot-width panel for Densité 3 frame		♦
CONNECTORS		
Reference IN	**1**	**1**
3G/HD SDI IN	**2**	**2**
3G/HD SDI OUT	**2**	**2**
3G/HD SDI I/O	**7**	**7**

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2.3.3 Details of rear panel connections

REF IN – External reference

Connect an NTSC or PAL reference signal (SMPTE 170M / SMPTE 318M / ITU 624-4 black burst)

3G/HD SDI IN – Serial digital 3G/HD inputs

Connect serial digital video signals, conforming to SMPTE 425M for 3G input signals or SMPTE 292M for HD input signals to the connectors labeled **SDI IN 1** and **SDI IN 2**.

3G/HD SDI OUT and I/O – Upconverted Quad Link 3G outputs or 3G outputs

The eight Quad Link 3G output signals (four from each upconverter) appear on the rear panel connectors as shown in the table. In 3G output mode, only one output per converter is used:

Connector	Output signal UHD-4K	Output signal Full HD 1080p
SDI I/O 1	UC1 Quad Link 3G Link 1	UC 1 3G out
SDI I/O 2	UC1 Quad Link 3G Link 2	Not used
SDI I/O 3	UC1 Quad Link 3G Link 3	Not used
SDI I/O 4	UC1 Quad Link 3G Link 4	Not used
SDI I/O 5	Not used	Not used
SDI I/O 6	UC2 Quad Link 3G Link 1	UC 2 3G out
SDI I/O 7	UC2 Quad Link 3G Link 2	Not used
SDI OUT 1	UC2 Quad Link 3G Link 3	Not used
SDI OUT 2	UC2 Quad Link 3G Link 4	Not used

3 User Interface

3.1 Control options

The UHD-3901-UC can be controlled in two different ways:

- The local control panel and its push-buttons can be used to move through a menu of status reports (see section 4).
- Grass Valley's iControl system can be used to access the card's operating parameters from a remote computer, using a convenient graphical user interface (GUI) (see section 5).

3.2 Card-Edge Status LED

The status monitor LED is located on the front card-edge of the UHD-3901-UC, and is visible through the front access door of the DENSITÉ 3 frame. This multi-color LED indicates the status of the UHD-3901-UC by color, and by flashing/steady illumination.

The chart shows how the various error conditions that can be flagged on the UHD-3901-UC affect the LED status.

- If a cell is gray, the error condition cannot cause the LED to assume that status
- If more than one LED status is possible for a particular error condition, the status is configurable.
  See Alarm Config Panel for details.
- The factory default status, if available, is shown by a ✪

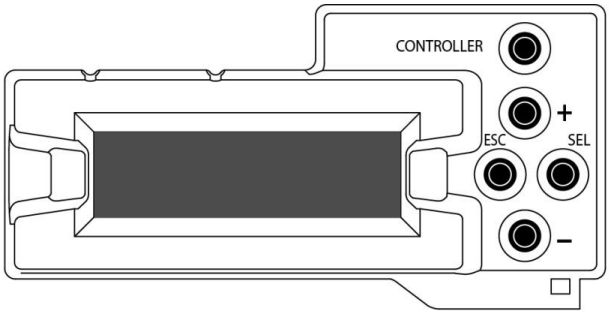
The LED will always show the most severe detected error status that it is configured to display, and in the chart error severity increases from left to right, with green representing no error/disabled, and flashing red the most severe error.

If the LED is Flashing Yellow, it means that the card is selected for local control using the Densité frame's control panel. See section 4 for details.

Error Condition	LED Status			
	Green	Yellow	Red	Flashing Red
Hardware failure				✪
Wrong or missing Rear				✪
Input 1 – No carrier			✪	
Input 1 – Unsupported format			✪	
Input 1 – Video/TRS error			✪	
Input 1 – Reference mismatch			✪	
Input 2– No carrier			✪	
Input 2 – Unsupported format			✪	
Input 2 – Video/TRS error			✪	
Input 2 – Reference mismatch			✪	
Reference presence	✪			
Reference Supported	✪			
Reference locked	✪			
Internal test pattern enabled		✪		

4 Local control using the Densité frame control panel

There are two types of local control panel:

Panel type	Frame models	Appearance
Physical	Densité-3, Densité-3+FR1,	
Touch screen	Densité 3+FR4, GV Node	

The local control panel is fastened to the front of the controller card.

- The physical panel is accessed by opening the front door of the frame.
- The touch screen panel is accessed through an aperture in the frame door.

The panel consists of a display capable of displaying two lines of text, each 16 characters in length, and four pushbuttons. The functionality of the pushbuttons is as follows:

[+] [–] Used for menu navigation and value modification

[SELECT] Gives access to the next menu level. When a parameter value is shown, pushing this button once enables modification of the value using the [+] and [–] buttons; a second push confirms the new value

[ESC] Cancels the effect of parameter value changes that have not been confirmed; pushing [ESC] causes the parameter to revert to its former value.

Pushing [ESC] moves the user back up to the previous menu level. At the main menu, [ESC] does *not* exit the menu system. To exit, re-push the [SELECT] button for the card being controlled.

If no controls are operated for 30 seconds, the controller reverts to its normal standby status, and the selected card's STATUS reverts to its normal operating mode.

To assign the local control panel to the UHD-3901-UC:

- Physical Panel: Push the SELECT button on the UHD-3901-UC card edge (see Section 1.6)
- Touch-screen panel: In the home screen, touch the virtual button corresponding to this UHD-3901-UC

The STATUS LED on the UHD-3901-UC flashes yellow.

Use the control panel buttons to navigate through the menu, as described above.

- The complete menu structure is shown in ANNEX 1 – Local Menu, beginning on page 32.

5 Remote control using iControl

The UHD-3901-UC can be remotely controlled using Grass Valley's iControl system.

- This manual describes the control panels associated with the UHD-3901-UC and their use.
- Please consult the iControl User's Guide for information about setting up and operating iControl.

In iControl Navigator or iControl Websites, double-click on the UHD-3901 icon to open the control panel.

5.1 The iControl graphic interface window

The basic window structure for the UHD-3901-UC is shown in figure 5.1. The window identification line gives the card type (UHD-3901) and the slot number where the card is installed in its Densité frame.

There are four main sections in the window itself, as identified in the figure:

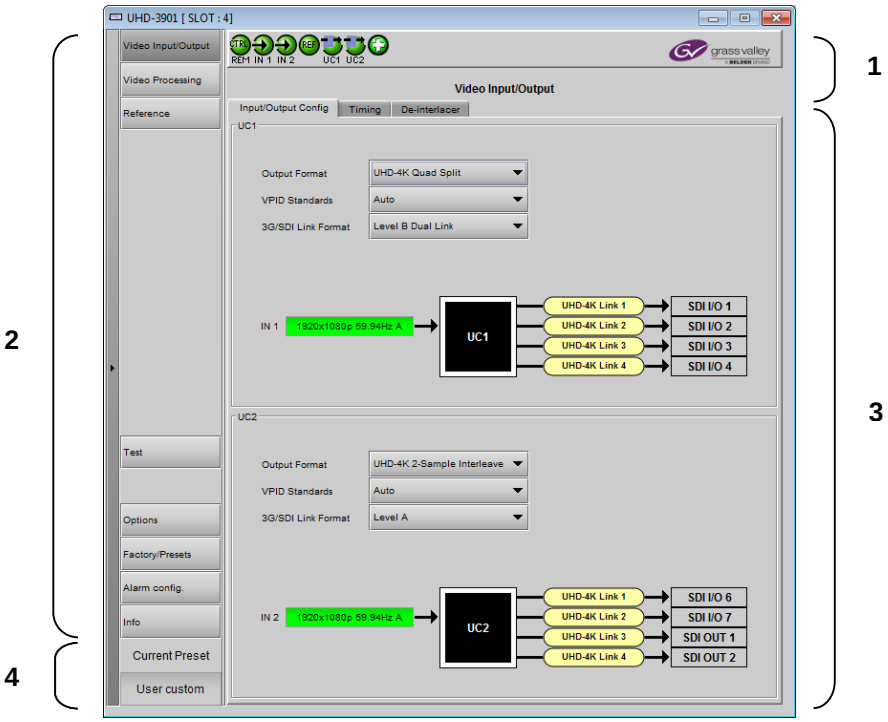


Figure 5-1 *UHD-3901 iControl graphic interface window*

Section 1. The top section displays seven icons on the left. These icons report different statuses such as card communication status, input status, health status, and card operation mode.

Icon # 1 2 3 4 5 6 7

Move the mouse over an icon and a status message appears below the icon providing additional information. If there is an error, the error status message appears in the message area without mouse-over.

- If there are multiple errors, the error messages cycle so all can be seen

- The icon whose status or error message is shown is highlighted with a mauve background

The table below describes the various status icons that can appear, and how they are to be interpreted.

- In cases where there is more than one possible interpretation, read the error message in the iControl window to see which applies.

Table – iControl Status Icon interpretation

Icon #1 – Manual Card Configuration	
 (green)	Remote card control activated. The iControl interface can be used to operate the card.
 (yellow)	Local card control active, The card is being controlled using the Densité frame control panel, as described in section 4. Any changes made using the iControl interface will have no effect on the card.
Icon #2 – SDI IN 1 status	
 (green)	SDI present and valid. The video format is indicated when there are no errors.
 (red)	SDI not present or SDI invalid or SDI unsupported or ref-mismatch.
Icon #3 – SDI IN 2 Status	
 (green)	SDI present and valid. The video format is indicated when there are no errors.
 (red)	SDI not present or SDI invalid or SDI unsupported or ref-mismatch.
Icon #4 – Reference Status	
 (green)	Reference present, supported and locked.
 (red)	Reference missing or invalid. Unsupported format or not locked

Icon #5 – Upconverter 1 Operation mode	
 (green)	Operation mode: Process.
 (red)	Operation mode: Test
Icon #6 – Upconverter 2 Operation mode	
 (green)	Operation mode: Process..
 (red)	Operation mode: Test
Icon #7 – Health Monitoring	
 (green)	Hardware OK.
 (red)	Hardware Health Monitoring (Hardware fault detected). If this icon appears flashing red, you need to call Technical Support

Section 2. The left portion of the window contains selection buttons for all of the individual panels, which become highlighted when they are selected. The main window section (3) then displays the selected panel, all of which are described in detail below.

Section 3. The main section displays the panel selected in section 2. It may contain multiple tabs to access any appropriate sub-panels.

Section 4. The lower left corner of the window identifies the Preset currently in use or “Custom” if none is applicable.

5.2 Video Input/Output panel

5.2.1 Config tab

This panel allows you to configure the settings for the two up-converters. Each can be configured independently.

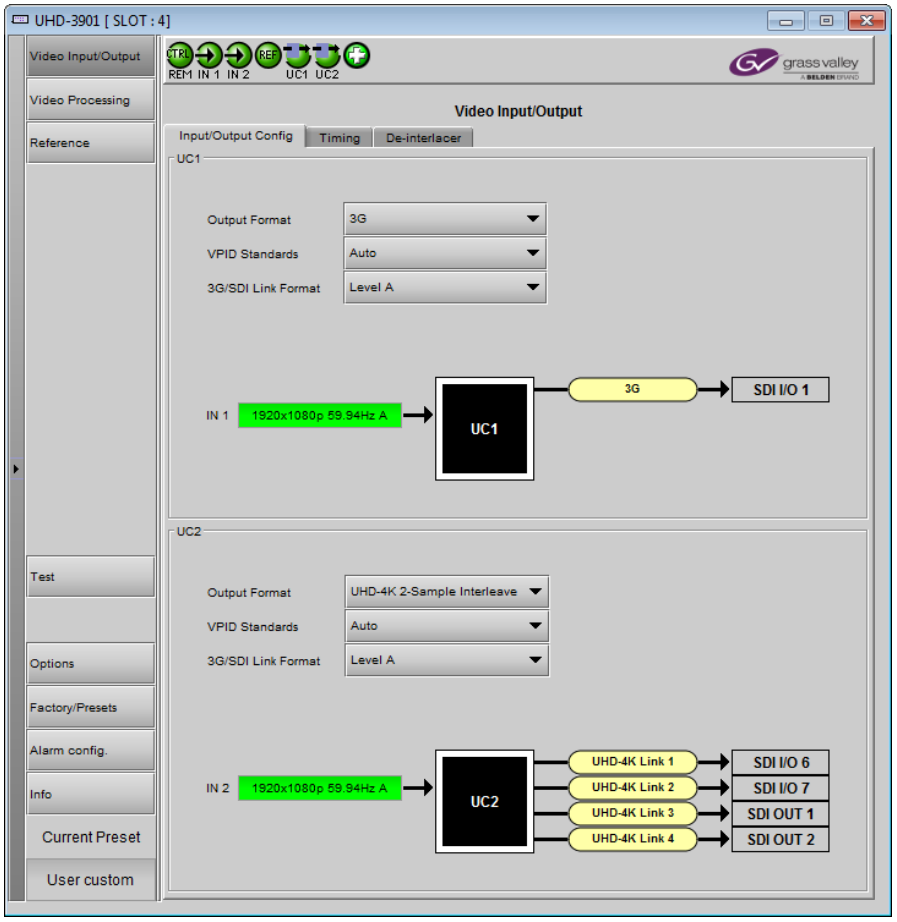


Figure 5-2 *Video I/O Config*

Use the pulldowns to configure these parameters:

Parameter	Note	Options	Default
Output Format	1	UHD-4K-2-Sample Interleave UHD-4K-Quad Split 3G	UHD-4K-2-Sample Interleave
VPID Standards	2	Auto 3Gb/s Legacy (SMPTE 425-1)	Auto
3G/SDI Link format	3	Level A Level B Dual Link	Level A

Note 1
For each upconverter, you must select the output format – either UHD-4K or 3G.

If you select UHD-4K, then you must choose the variant to be used. The choice will depend on the format used by the destination equipment:

- **Quad split** – (SDQS): the UHD 4K image is split into four full-resolution quadrants, each sent on a single 3G link. This is also reference as Quad Link 3G square division.
- **2-Sample Interleave** – (2SI): the 4K image is sub-sampled into four full-frame images, each at ½ the vertical and horizontal resolution. This is also reference as Quad Link 3G two sample interleave.

If you select 3G, then the input is upconverted to Full HD 1080p, and sent to a single 3G output. The remaining outputs are disabled.

Note 2

Usually, Two Sample interleave outputs have a different VPID on each link, per SMPTE 425-5. Some downstream equipment may not support this standard, so the use of SMPTE 425-1 VPIDs can be forced by selecting the *3Gb/s Legacy* option in the VPID Standards pulldown.

VPID Standards	**UHD-4K Mapping**	
	Quad Split	**2-Sample interleave**
Auto	SMPTE 425-1	SMPTE 425-5
3Gb/s Legacy	SMPTE 425-1	SMPTE 425-1

Note 3

UHD-3901-UC supports two of the mappings of video into the serial digital interface defined by SMPTE 424M.

- The Level A format is the direct mapping of uncompressed 1080p (up to 60 fps) video into a serial digital interface at the nominal 3 Gbit/s.
- The Level B-DL (dual-link) format is the mapping of dual-link HD-SDI/SMPTE 372M (i.e. 1080p up to 60 fps) in a single serial digital interface at the nominal 3 Gbit/s.

Select the one you require using the pulldown.

*However, note that when you have 3G IN and 3G out, and want to use **Minimum Delay** mode, you must ensure that the level selected at the output (A or B-DL) matches that arriving at the input.*

5.2.2 Timing Tab

For each Upconverter, you can adjust the timing relative to the reference. Use the slider, or type a value directly into the data box.

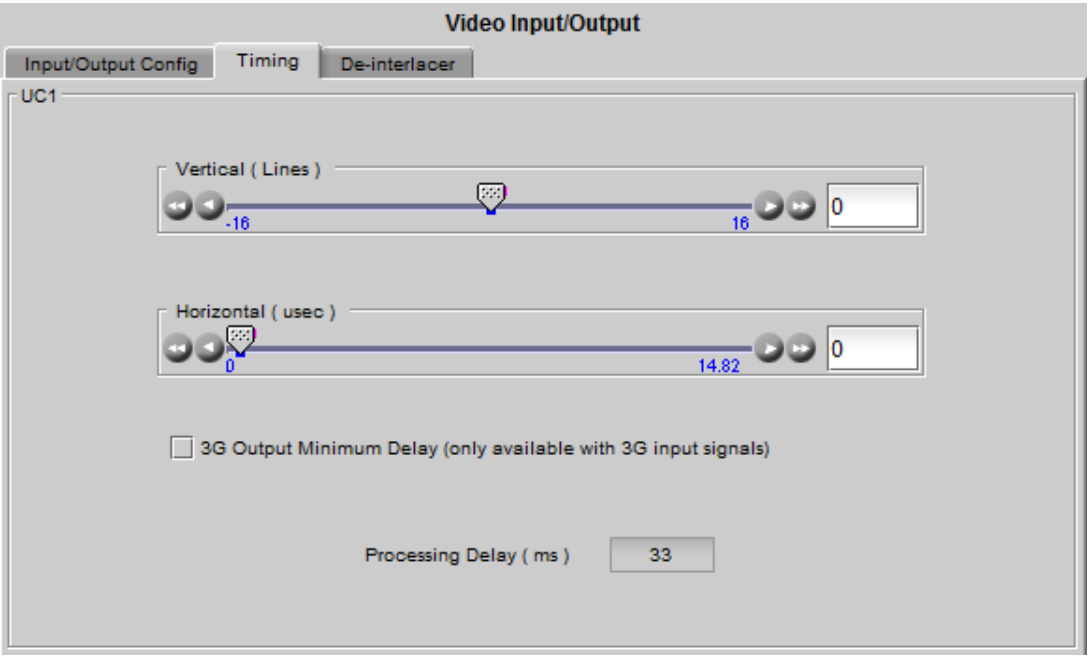


Figure 5-3 *Video I/O Timing*

Adjustment	Range
Vertical (lines)	-16 to +16
Horizontal (μsec)	Up to 1 line: 0 to 14.82 μsec (59 Hz) 0 to 17.77 μsec (50 Hz)

The total processing delay between the SDI input and the SDI output (in ms) is shown below the sliders for each upconverter.

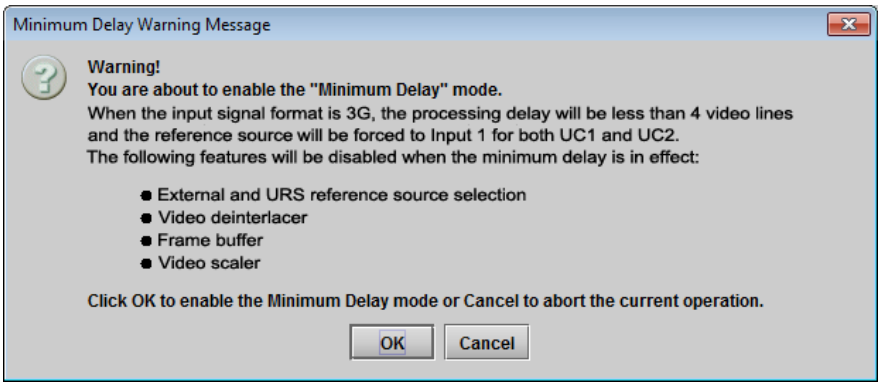
If your input and output are both 3G, then you can enable a minimum-delay signal path through the system by selecting the **3G Output Minimum Delay** checkbox.

When the UHD-3901 is in minimum delay mode:

- The processing delay will be less than 4 video lines
- The reference source will be forced to Input 1.
- The following features will be disabled:
  - External and URS reference source selection
  - Video deinterlacer
  - Frame buffer
  - Video scaler

A pop-up warning will remind you of these limitations when you select the Minimum Delay checkbox.

- In the warning box, select **OK** to enable the minimum delay mode, or **Cancel** to leave the mode unchanged.



You should also note that, when minimum delay is applied to UC1 **and/or** UC2;

- The card's current reference selection is overridden and forced to IN 1, so IN1 must be present and valid.
- UC1 and UC2 must be synchronous.
- The UC1 and UC2 outputs are no longer aligned to an external or URS reference.
- The Processing Delay data box will show the text "minimum delay" instead of a numerical value.

5.2.3 De-interlacer tab

For each Upconverter, select the appropriate de-interlacer mode using the two pulldowns.

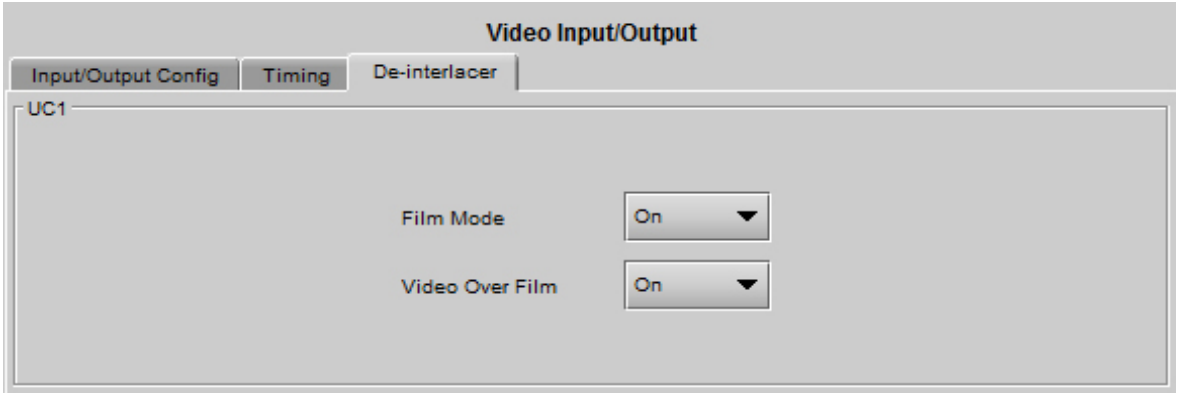


Figure 5-4 *Video I/O De-interlacer*

Control	Options	Note
Film Mode	Off On	1
Video Over Film	Off On	2

Note 1

Some interlaced video sources are film-based, originating from 24p film images. For optimum scaling performance, it is best to de-interlace this type of source by simply merging the source's fields to recreate the original 24p image, thereby introducing no de-interlacer artifacts prior to scaling and upconversion.

Film mode: When the *Film Mode* selection is set to ON, the UHD-3901-UC monitors the input for film-based sequences and applies the proper algorithm.

Film detection is provided for 3:2, 2:2 (59Hz and 50 Hz sources) and 5:5 sequences.

Note 2

Video Over Film: When the film mode is enabled, turn ON the Video-Over-Film (VOF) function to detect and bypass field-merging on certain video regions such as scrolling video characters over an entire film frame, thereby preventing any unwanted combing effects.

5.3 Video Processing Panel

Two types of video processing are available on the UHD-3901-UC:

- Color Space Conversion
- Dynamic Range Conversion

Select the desired options for each upconverter using the pulldowns.

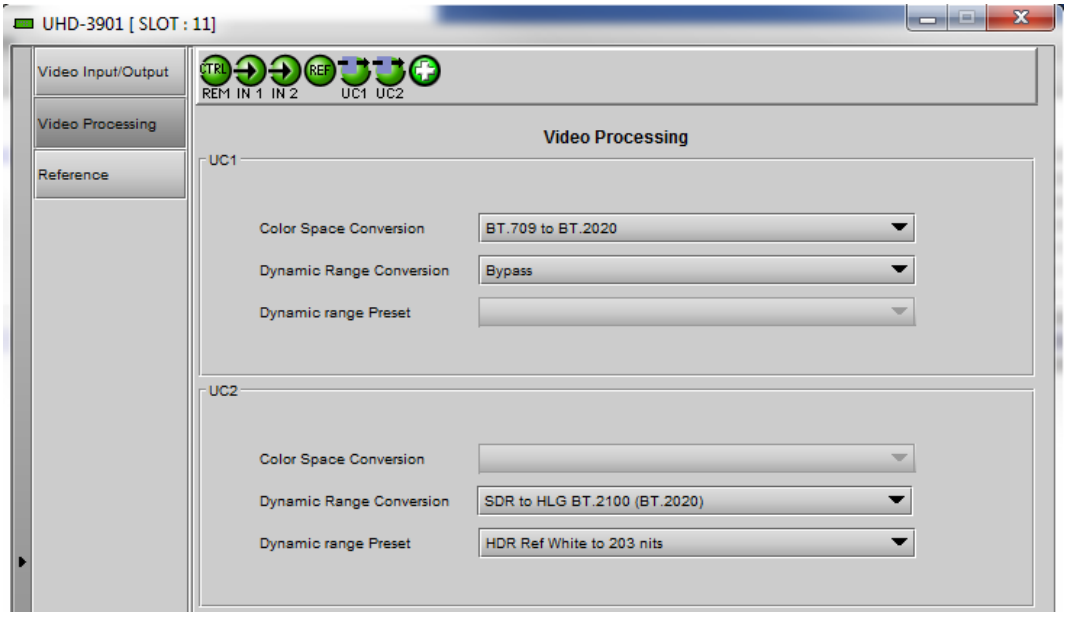


Figure 5-5 *Video Processing*

5.3.1 Color Space Conversion

The color gamut specified in **ITU-R Recommendation BT.2020** for ultra-high-definition TV is substantially wider than the SD/HD color gamut as specified in **ITU-R BT.709**. The UHD-3901 provides the option of converting the color space during the upconversion process, or passing through the incoming color space.

Use the *Color Space Conversion* pulldown to select the desired conversion function as shown in the table below.

Conversion	SDI Input Color Space	SDI Output Color Space
Bypass (default)	709	709
	2020	2020
Rec 709 to BT.2020 (ST 2087)	709	2020

The Default conversion is **Bypass**.

The UHD-3901 has no way of knowing what color space is represented on its inputs. The user should therefore be aware of the input color space, in order to avoid the *Not Valid* situation that results from attempting to apply the 709-to-2020 conversion to a 2020 input.

Note: **Color Space Conversion** will be ***disabled*** when any **Dynamic Range Conversion** options are selected other than bypass. The Color Space Conversion pulldown will be greyed-out in these cases. See the next section for details.

5.3.2 Dynamic Range Conversion

The dynamic range conversion can be selected using the **Dynamic Range Conversion** and **Dynamic Range Preset** selection pulldowns only if the UHD-3901-OPT-HDR has been purchased and activated on your card. Depending on the SDI output transport option selected, the following HDR processing options are available for 3G to 3G/UHD and HD to 3G/UHD applications:

UHD-3901-OPT-HDR Option	Processing	XIP-3901-UC	
		3G to 3G/UHD	HD to 3G/UHD
Not Required	BYPASS (disabled)	✓	✓
	BT.709 to BT.2020 (See Note)	✓	✓
Required	SDR to HLG BT.2100 (BT.2020)	✓	✓
	SDR to PQ BT.2100 (BT.2020)	✓	✓
	HLG BT.2100 (BT.2020) to SDR	✓	
	PQ BT.2100 (BT.2020) to SDR	✓	
	PQ BT.2100 to HLG BT.2100	✓	
	HLG BT.2100 to PQ BT.2100	✓	
	S-Log3 S-Gamut3	✓	

Note: The color gamut specified in ITU-R Recommendation BT.2020 for ultra-high-definition TV is substantially wider than the SD/HD color gamut as specified in ITU-R BT.709. The UHD-3901-UC upconverter provides the option of converting the color space during the upconversion process or passing through the incoming BT.709 color space. Only BT.709 to BT.2020 processing is available for a card without its option activated. See 5.6 Options Panel for details about how to activate the card options.

Dynamic range Preset: The following preset options are available for some HDR processing types. The HDR processing options not shown in the table below do not provide presets.

Dynamic Range Conversion	Dynamic range Preset
SDR to HLG BT.2100 (BT.2020),, HLG BT.2100 (BT.2020) to SDR	HDR Ref White to 128, 171, 203 (default), 235 and 380 nits
SDR to PQ BT.2100 (BT.2020), PQ BT.2100 (BT.2020) to SDR	HDR Ref White to 163, 173, 183, 193, 203 (default), 213, 223, 233, 243 and 263 nits
S-Log3/S-Gamut3	BT. 709 800%
	PQ BT.2100 (BT.2020)
	HLG BT.2100 (BT.2020)

5.4 Reference Panel

This panel allows the selection of the reference to be used by the UHD-3901-UC.

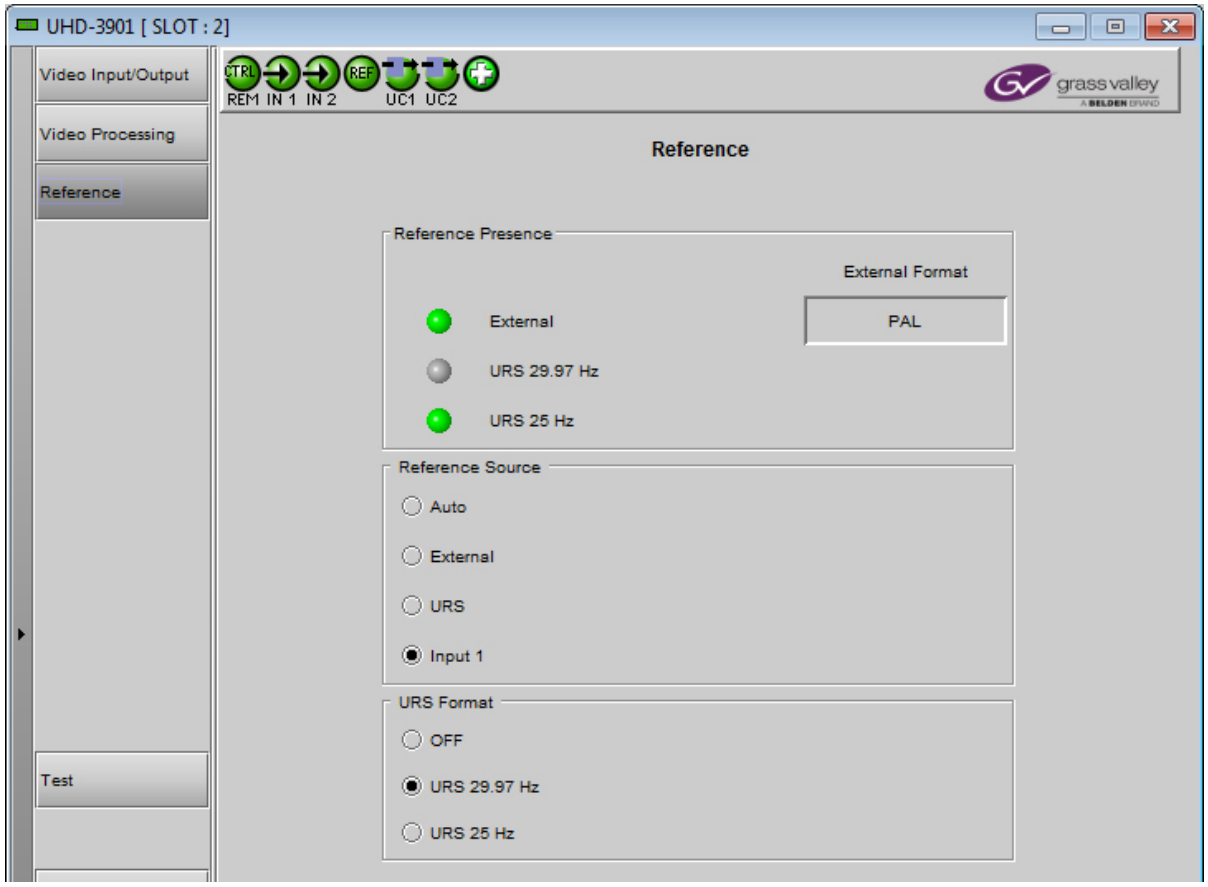


Figure 5-6 *Reference panel*

Reference Presence – the icons show the presence and status of the various reference sources. For the external reference, the format is shown in the External Format window.

Icon		Carrier	Format
	Grey	None or not valid	N/A
	Yellow	Present & valid	Valid, but not supported
	Green	Present & valid	Valid and supported

External Format	Supported
NTSC	Yes
PAL	Yes
1080i59Hz	No
1080i50Hz	No
720p59Hz	No
720p50Hz	No

Reference Source – use the radio buttons to select from the following options:

Reference Source	Description	Default
Auto	This mode selects the first source detected in this order of priority: 1. External Reference input 2. URS 3. Input 1 (SDI IN1)	Auto
External	Selects the signal connected to the rear-panel REF IN connector	
URS	Selects the Universal Reference Signal from the Densité frame's backplane	
Input 1	Lock on SDI IN1.	

Note 1 *– If the selected reference is missing (not present, or not valid) or not supported, the card will internally lock on Input 1, without changing the user configuration displayed here.*

Note 2 *– If the* ***3G Minimum Delay*** *mode is selected in the Timing tab, the card will internally lock on Input 1, without changing the user configuration displayed here.*

URS Format – use the radio buttons in the URS Format area to select the URS mode.

URS	Description	Default
OFF	URS cannot be selected as the reference source, and is ignored by the Auto detection mode. URS is grayed-out in the Reference Source section of the user interface URS is not available on the Reference Source section of the local menu.	OFF
URS 29.97 Hz	If *Reference Source* is set to URS, lock on 29.97 Hz	
URS 25 Hz	If *Reference Source* is set to URS, lock on 25 Hz	

5.5 Test panel

You may activate the *Color Bars and Tone* test signal for the two upconverters independently, by enabling the appropriate checkboxes.

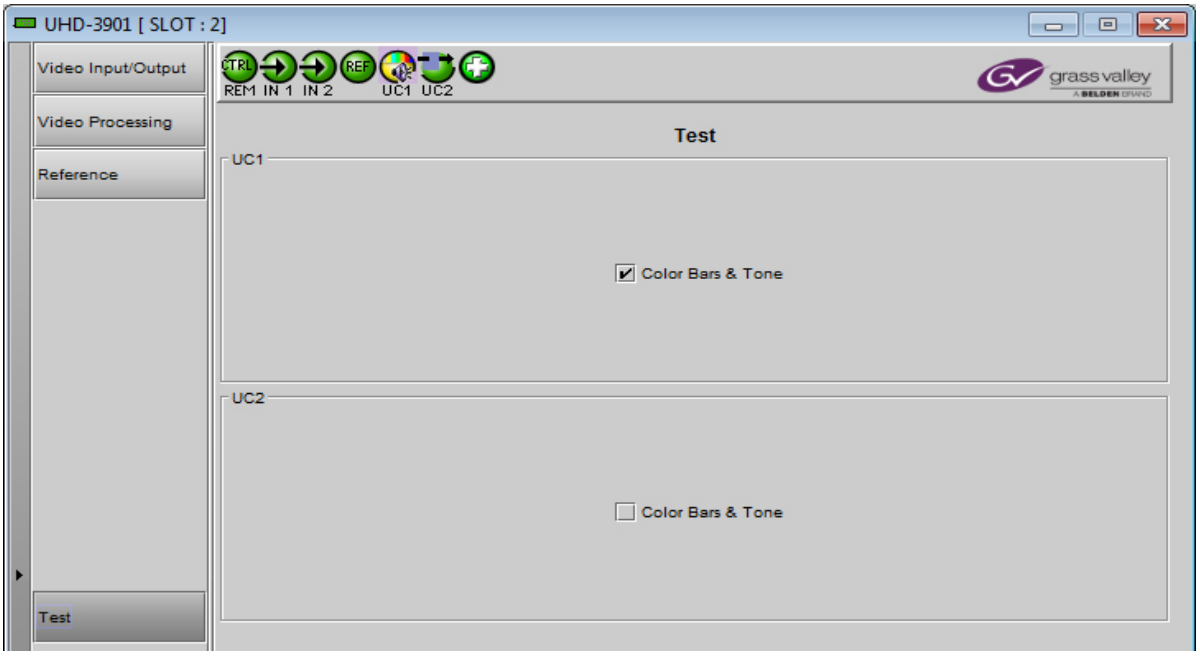


Figure 5-7 *Test panel*

Video Test Pattern:

- 75% color bar with 100% white.
- Inserted as 3G/SDI and upconverted to UHD-4K or 3G as per output format selection.

Audio test tone

- 1 KHz sine at -18dBFS
- Continuous tone on right channel; pulsed tone on left channel of every pair (250 ms pulse every 3 seconds).
- Audio inserted on UHD-4K link 1 only.
- Audio tones enabled on all 16 embedded audio channels.

Status

When **Test** mode is activated on an upconverter, the dashboard display for that converter will show the *Color Bar and Tone* icon

Test pattern	Operation Mode	Icon
Enabled	Color Bar and Tone	
Disabled	Process	

5.6 Options Panel

There are two options available for the UHD-3901-UC:

Option Name	Description
UHD-3901-OPT-UC	Enables the dual up-converter functionality of the card.
UHD-3901-OPT-HDR	Enables the SDR to HDR dynamic range conversion functionality of the card.

To activate an option, you must

- Obtain a license key for that option from Grass Valley.
- Open the *Options* panel and select the appropriate tab.
- Type the license key in the *Enter Key* box.
- Click on ENABLE OPTION to enable the option's features.
- Once the option is enabled, the status box beneath the *Enter Key* area will show the status as active, with a green background.

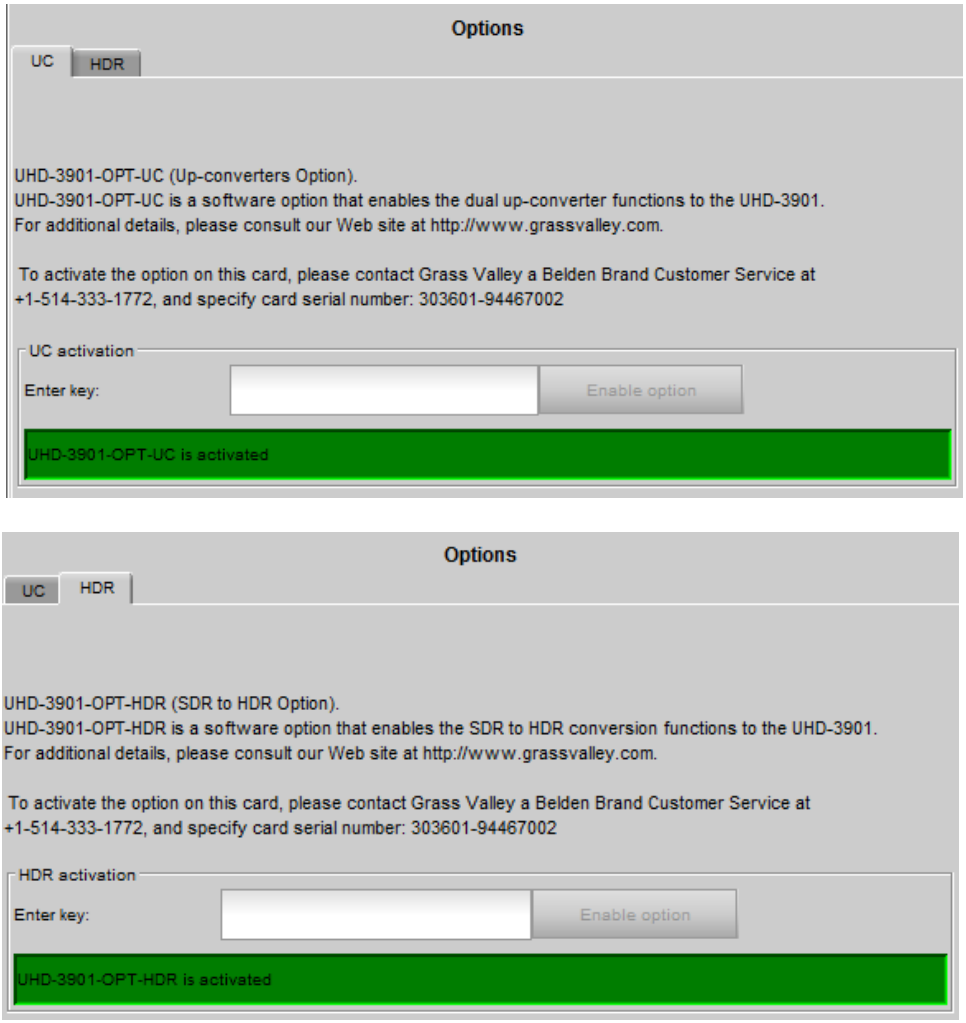


Figure 5-8 *Options panel tabs*

5.7 Factory/Presets Panel

This panel provides access to three functions:

- User Presets
- Factory reset
- Profile management

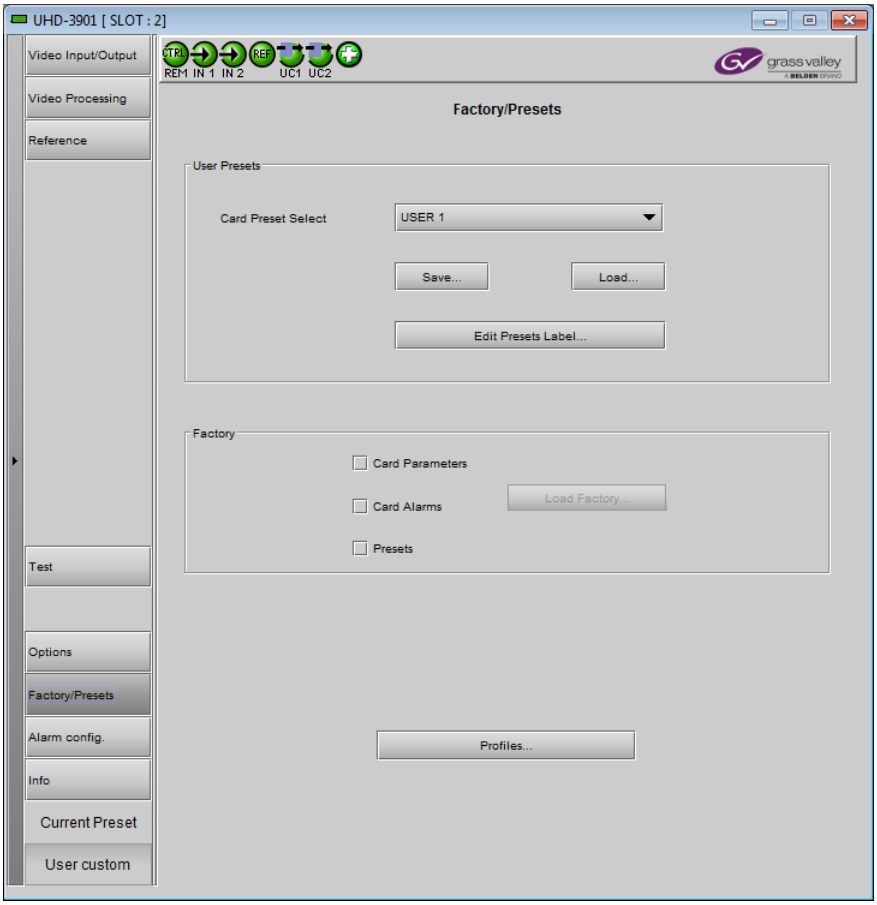


Figure 5-9 *Factory/Presets Panel*

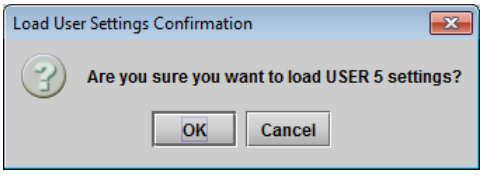
5.7.1 User Presets

The UHD-3901-UC has memory registers which can hold up to 5 user-defined parameter settings.

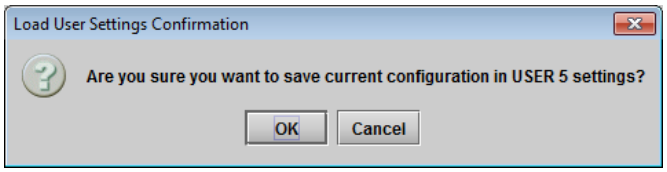
Select any one of the five presets using the Card Preset Select pull-down.

Click **Load** to load the contents of the selected User Preset into the UHD-3901-UC. All parameter settings and values will be replaced by the contents of the selected User Preset.

A confirmation box will pop up to allow you to proceed or cancel the load.



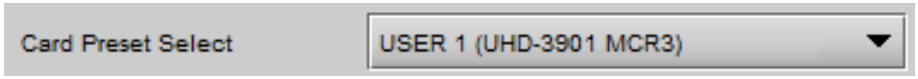
Click **Save** to store the current parameter settings and values from the UHD-3901-UC into the selected User Preset. The existing contents of the preset will be overwritten. A confirmation box will pop up to allow you to proceed or cancel the save.



You can edit the name assigned to each user preset.

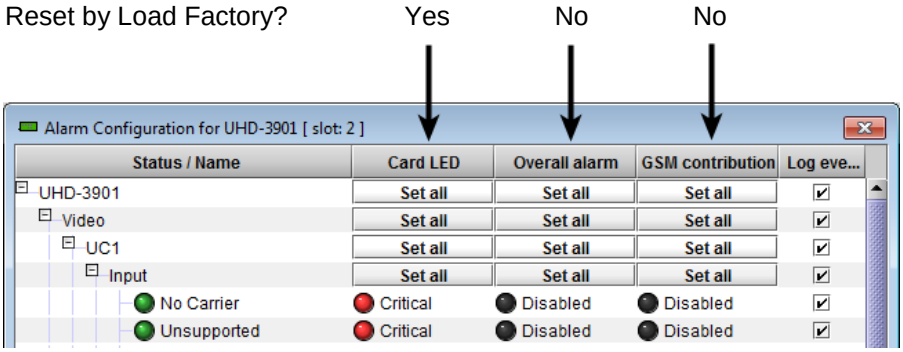
- Click Edit Presets Label to open the Presets window.
- Double-click on a name in the Label column
- Type a new name in the window.
- Click OK

The text you have entered (up to 16 characters) will be appended to the label name in the selection pulldown



5.7.2 Factory

Clicking the Load Factory button will restore the card to a factory default state. Three checkboxes enable the user to choose whether to include Card Parameters, Card Alarms and Presets in the restoration process
Note – Card Alarms only are reset to factory values; iControl Alarms and GSM alarms are not reset. With reference to the Alarm Configuration panel:



5.7.3 Profiles

Use *Profiles* to save or recover the entire card configuration (including user presets if desired) on an external disk, or to copy it to another UHD-3901-UC card.

Click on *Profiles* to open the Profile Copy window.

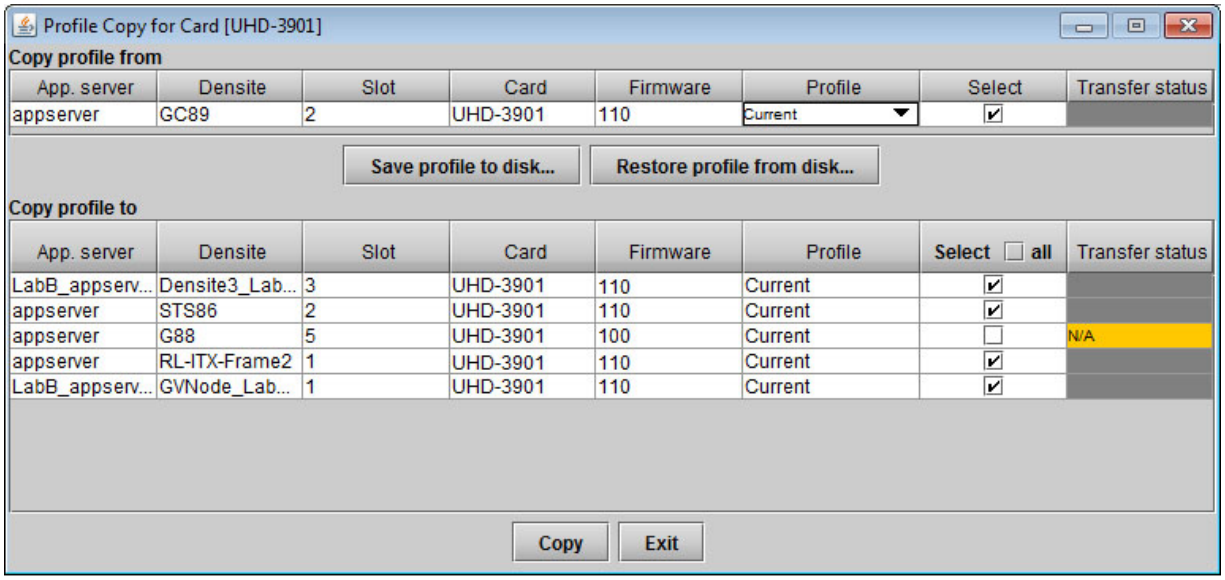


Figure 5-10 *Profile Copy for Card*

Copy profile from

This line shows this UHD-3901-UC card, and identifies it by App server, Densité frame and slot number, card type and firmware version.

The *Profile* column has a pulldown that allows you to select which profiles you will work with, and gives these choices:

- All, Current, User1, User2, User3, User4, User5

Profile	Values	Default
ALL	Current configuration of the card and all presets will be copied or saved on disk	ALL
Current	Only the current configuration of the card is copied or saved on disk	
User1 ...User5	Only the selected preset will be copied or saved on disk	

The *Select* column includes a checkbox (preselected checked) to confirm that you want to work with the current card.

Save Profile to Disk…

After selecting which profiles you want to save, click this button to open a Save dialog allowing you to specify a file name and location to which the selected profiles for this card will be saved.

Hint - It is a good idea to create a folder for these files, because they are not explicitly identified as UHD-3901-UC profiles, and will be difficult to find and identify if not clearly named and conveniently located.

- Click the save button once the name and location have been identified in the Save box. The Transfer Status box on the right of the *Copy profile from* line will indicate *In progress* against a yellow background.

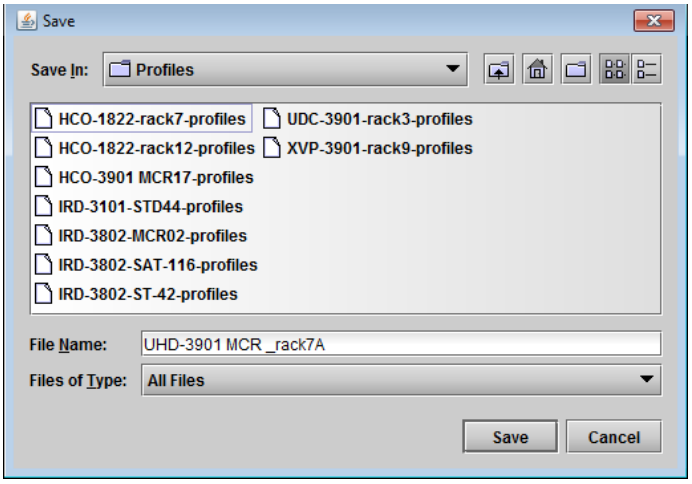
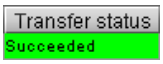
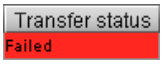


Figure 5-11 *Save Profile to Disk dialog*

- If the file is saved correctly, the Transfer Status box will indicate *Succeeded* against a green background.



- If the file was not saved for some reason, the Transfer Status box will indicate *Failed* against a red background.



Restore profile from disk…

Click this button to open an *Open* dialog box within which you can locate and select a valid UHD-3901-UC profile file.

- Click Open to read the contents of the file and to reconfigure this UHD-3901-UC's profiles according to its contents
- While the reconfiguration is in progress, the Transfer Status box on the right of the *Copy profile from* line will indicate *Working* against a yellow background
- When the reconfiguration is complete, the Transfer Status box will indicate *Succeeded* against a green background

On a restore profile from disk, there is no need to select a profile type (ALL, Current, User1 to User5). All the profile contents of the file will be restored.

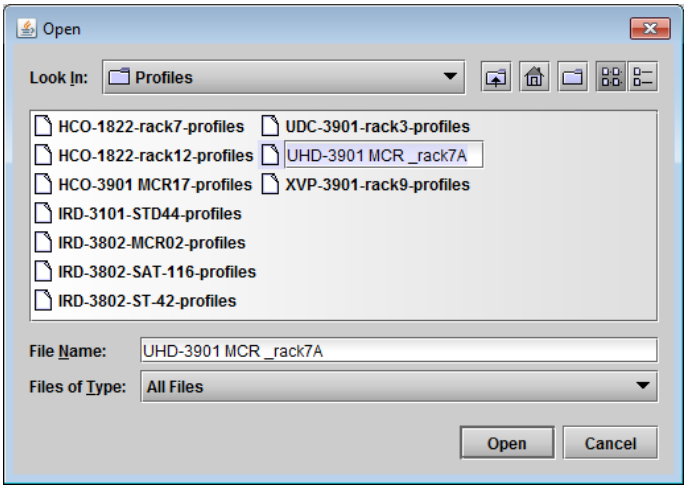


Figure 5-12 *Restore Profiles from Disk dialog*

Copy profile to

This section shows other UHD-3901-UC cards that are available on the iControl network, each identified by App server, Densité frame and slot number, card type and firmware version.

The *Profile* column shows the same information as is shown for the current card in the Copy profile from line, i.e. one of the following:

- All, Current, User1, User2, User3, User4, User5

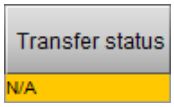
The *Select* column includes a checkbox to identify which UHD-3901-UC cards you wish to copy profiles into from the current card.

- For convenience, a *Select all* checkbox is provided in the column header

Click *Copy* to copy the selected profiles from this card into the selected other UHD-3901-UC cards

- While the profile copy operation is in progress, the Transfer Status box on the right of the *Copy profile to* line will indicate *Working* against a yellow background
- When the profile copy operation is complete, the Transfer Status box on the right of the *Copy profile to* line will indicate *Succeeded* against a green background

Note – the source and destination cards must have the same firmware version, so any destination cards with a different firmware version that are shown in the *Copy profile to* list cannot be selected, and their transfer status is always N/A on a yellow background.



5.8 Alarm Config Panel

This panel allows the alarm reporting of the UHD-3901-UC to be configured. The panel opens in a new window when the button is clicked, and can be resized if needed.

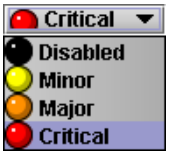
The panel is organized in columns.

Status/Name
This contains an expandable tree listing all the alarms reported by this UHD-3901-UC card.

- Each alarm name includes an icon that shows its current status
- Some alarms may be text-only and the alarm status is shown in the name and not by a status icon

The **Card LED**, **Overall Alarm and GSM Contribution** columns contain pulldown lists that allow the level of contribution of each individual alarm to the alarm named in the column heading to be set.

➢ Click on the alarm icon to see the available levels; then click on one to select it.



Card LED
This column allows configuration of the contribution of selected individual alarms to the status LED located on the front card edge. The Card LED status is shown at the bottom of the alarm tree in the Status/Name column.

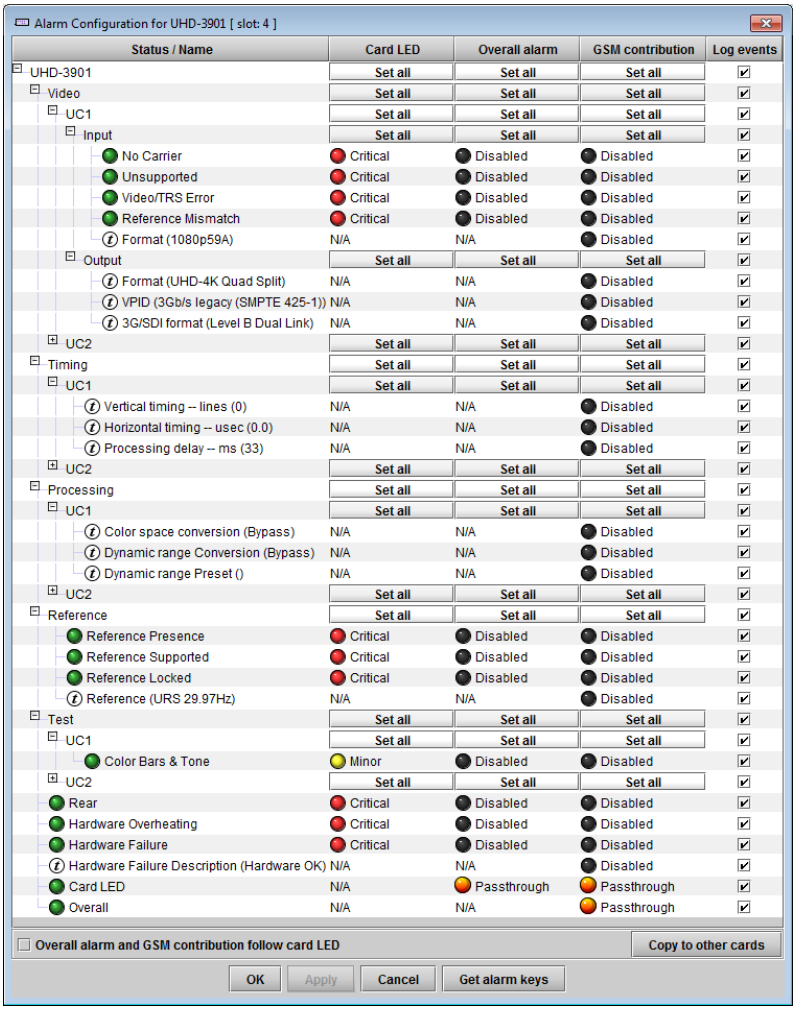


Figure 5-13 *Alarm Configuration*

Overall Alarm
This column allows configuration of the contribution of each individual alarm to the Overall Alarm associated with this card. The Overall Alarm is shown in the upper left corner of the iControl panel, and also appears at the bottom of the Status/Name column.

GSM Contribution
This column allows configuration of the contribution of each individual alarm to the GSM Alarm Status associated with this card. GSM is a dynamic register of all iControl system alarms, and is also an alarm provider for external applications. The possible values for this contribution are related to the Overall alarm contribution:

- If the Overall alarm contribution is selected as Disabled, the GSM alarm contribution can be set to any available value
- If the Overall alarm contribution is selected as any level other than disabled, the GSM contribution is forced to follow the Overall Alarm.

Log Events
iControl maintains a log of alarm events associated with the card. The log is useful for troubleshooting and identifying event sequences. Click in the checkbox to enable logging of alarm events for each individual alarm.

Levels associated with these alarms:

The pulldown lists may contain some or all of the following options:

Disabled	The alarm makes no contribution (black icon)
Minor	The alarm is of minor importance (yellow icon)
Major	The alarm is of major importance (orange icon)
Critical	The alarm is of critical importance (red icon)
Passthrough	The alarm exists but has no effect (used for text and composite alarms)

Shortcut: *if you click in one of the Set All boxes beside a section heading, you will open a pulldown that lets you assign a level to all alarms in that section of the column simultaneously.*

Once the alarms are configured, you may accept the changes or discard them:

Overall alarm and GSM contribution follow card LED

Click in the checkbox to force the Overall alarm and GSM contribution to be identical to the Card LED status

- All Overall alarms and GSM contributions for which there is a Card LED alarm will be forced to match the Card LED alarm
- All Overall Alarms and GSM contributions for which there is no Card LED alarm will be forced to Disabled

A warning box will open allowing you to confirm the action, since it will result in changes to the configuration and there is no *undo* function.

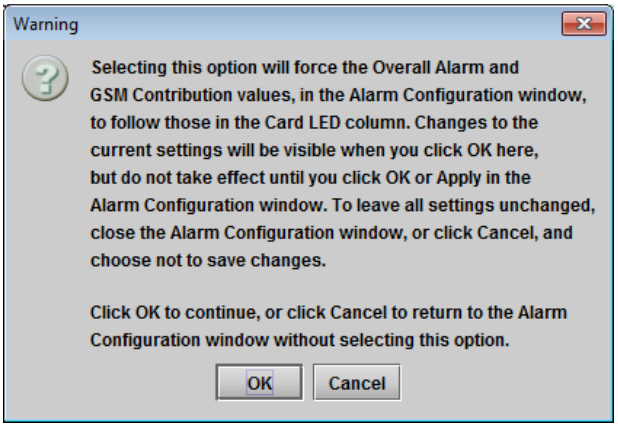


Figure 5-14 *Warning for Follow LED change*

Copy to other cards

Click this button to open a panel that allows the alarm configuration set for this card to be copied into another UHD-3901-UC card.

- Select one or more destination cards from the list in the window by clicking in the checkboxes, or all of them by clicking in the *All* checkbox
- Note that when you Copy a profile for this UHD-3901-UC card (see page 23), the alarm configuration is copied along with all the other settings.

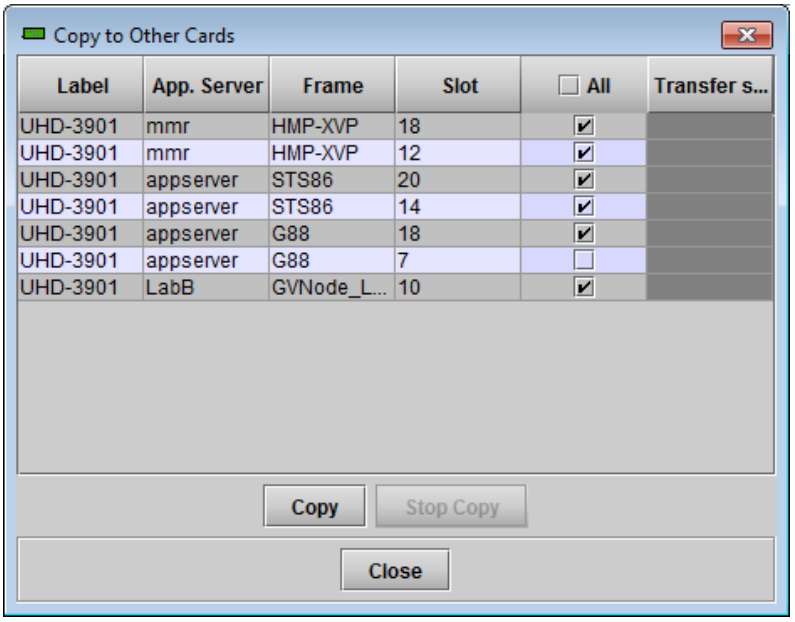


Figure 5-15 *Copy to Other Cards window*

Get alarm keys

Click this button to open a save dialog where you can save a file containing a list of all alarms on this card and their current values, along with an Alarm Key for each. The alarm keys are useful for system integration and troubleshooting.

- The file is saved in .csv format

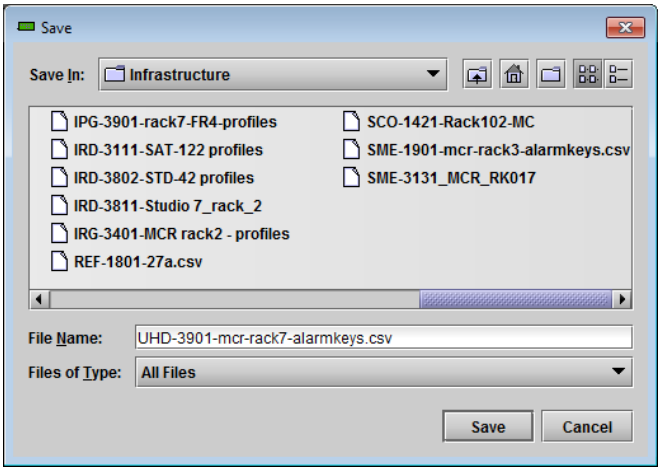


Figure 5-16 *Get Alarm Keys dialog*

OK, Apply, Cancel

- ***OK*** accepts the settings and closes the window once the card confirms that there are no errors.
- ***Apply*** accepts the settings, but leaves the window open
- ***Cancel*** closes the window without applying any changes, and leaves the previous settings intact.

5.9 Info Panel

5.9.1 Info Panel – Info tab

When the UHD-3901-UC is included in an iControl environment, certain information about the card should be available to the iControl system. The user can enter labels and comments that will make this card easy to identify in a complex setup. This information is entered into data boxes in the Info control panel.

Label: Type the label that is shown for this UHD-3901-UC when it appears in iControl applications

Short Label Type the short-form label that iControl uses in some cases (8 characters)

Source ID Type a descriptive name for this UHD-3901-UC

Comments: Type any desired text

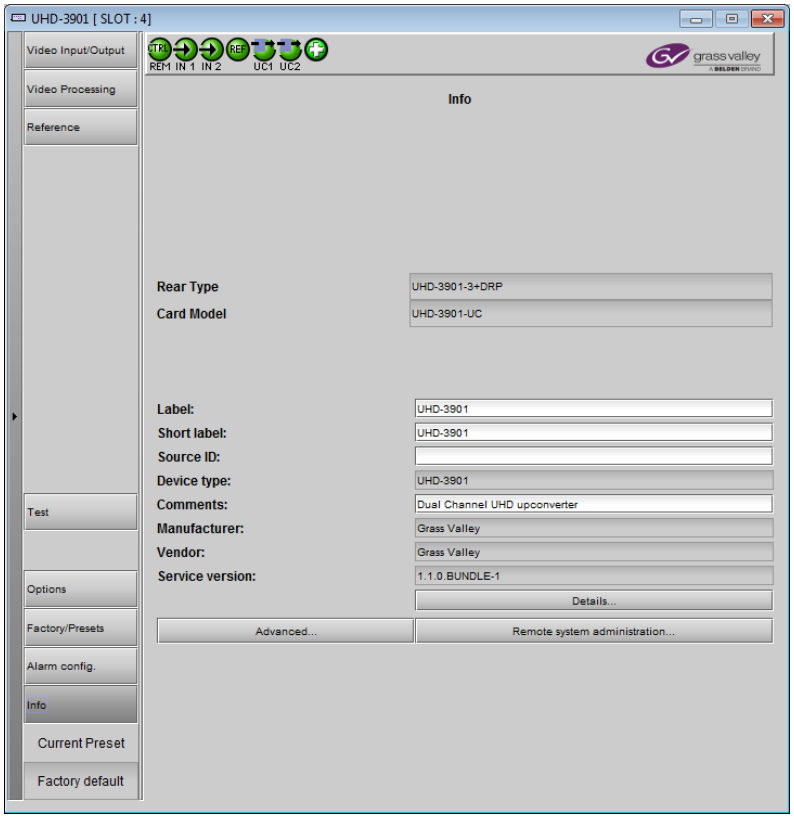


Figure 5-17 *Info Panel*

The remaining data boxes show manufacturing information about this card.

Three buttons in the panel give access to other information.

- Details…: Reports the Firmware version, service version, and panel version for this card

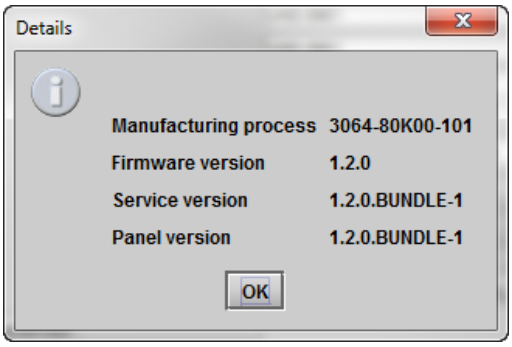


Figure 5-18 *Details window*

- Advanced…: Shows the Long ID for this card. The Long ID is the address of this UHD-3901-UC in the iControl network.

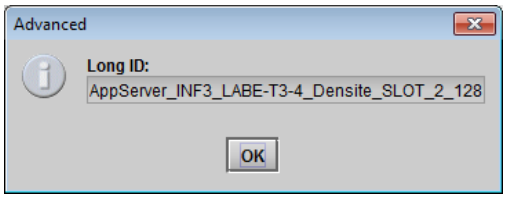


Figure 5-19 *Advanced window*

- Remote System Administration – opens the *Joining Locators* window, which lists remote lookup services to which this UHD-3901-UC is registered

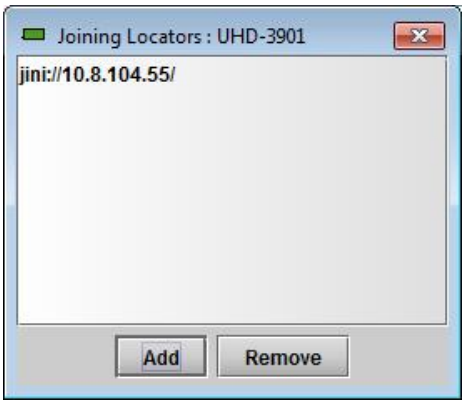
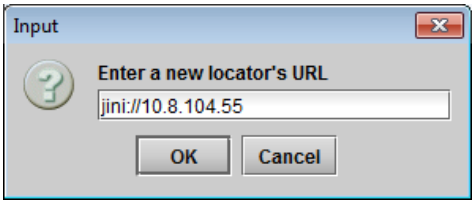


Figure 5-20 *Joining Locators window*

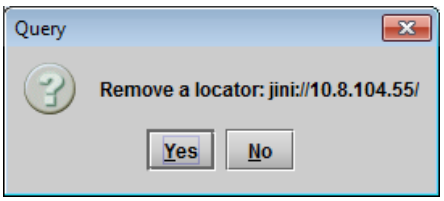
Add: Force the iControl service for this UHD-3901-UC to register itself on a user-specified Jini lookup service, using the following syntax in the data box:

jini://<ip_address>

where <ip_address> is the ip address of the server running the lookup service, e.g.:



Remove: select one of the services listed in the window by clicking on it, and click *Remove* to open a query box allowing you to delete it from the window.



6 Specifications

SDI (Inputs/Outputs)

Physical:	10 BNC connectors: 2 IN, 8 OUT.
SDI Standard:	SMPTE-292M (1.485, 1.485/1.001 Gb/s) SMPTE-424M (2.970, 2.970/1.001Gb/s)*
Supported formats:	HD: SMPTE-274M: 1080i59.94, 1080i50 HD: SMPTE-296M: 720p59.94, 720p50 3G: SMPTE-425M level A (mapping 1), level B: 1080p59.94, 1080p50 4K UHD: Quad link 3 Gb/s SMPTE ST 425-5: 1080p59.94, 1080p50
Cable length (Belden 1694A):	HD: 150m (492 ft.) at 1.485 Gb/s 3G: 100m (393 ft.) at 2.970 Gb/s
Return loss:	>15 dB up to 1.5 GHz >10 dB up to 3 GHz
Jitter:	HD: <0.2 UI (alignment jitter) 3G: <0.3 UI (alignment jitter)

Reference Input

Signal**:**	SMPTE ST 170 / SMPTE ST 318M / ITU 624-4 blackburst.
Return loss:	>30 dB up to 5.75 GHz

Video Processing Performance

Signal path:	10 bits minimum	
Latency:	No reference:	33 ms (59Hz) 40 ms (50Hz)
	With reference:	28 ms to 61 ms (59Hz) 32 ms to 72 ms (50Hz)
	3G Output Minimum Delay	less than 4 video lines

Electrical

Power:	37.5W maximum

7 Contact Us

Grass Valley Technical Support

For technical assistance, contact our international support center, at
1-800-547-8949 (US and Canada) or +1 530 478 4148.

To obtain a local phone number for the support center nearest you, please consult the *Contact Us* section of Grass Valley's website (www.grassvalley.com).

An online form for e-mail contact is also available from the website.

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ANNEX 1 – Local Menu

1st level	2nd level	3rd level	4th level	Default Value / *Comments*
STATUS	GENERAL	REAR TYPE	UHD-3901-3TRP UHD-3901-3+DRP INVALID REAR NO REAR	
		SERIAL NUMBER	303601-XXXXXXXX	
		MODEL	UHD-3901-UC	
	VIDEO STATUS	INx <video format> INx REF MISMATCH INx TRS ERROR INx NO CARRIER INx UNSUPPORTED REF MISSING REF UNSUPPORTED REF MISMATCH REF NOT LOCKED REF INPUT 1 REF URS 29.97 Hz REF URS 25 Hz REF NTSC REF PAL REF 1080i/59.97 Hz REF 1080i/50 Hz REF 720p/59.97 Hz REF 720p/50 Hz		*Displayed in the following order:* *IN1 video format* *IN1 error status* *IN2 video format* *IN2 error status* *REF status* *REF format*
	HEALTH	HARDWARE x FAN x TEMP x		*x is OK or FAILURE*
UC1 UC2	VIDEO OUTPUT	FORMAT	UHD-4K 2SI UHD-4K QUAD 3G	2SI
		VPID	AUTO LEGACY	AUTO
		LINK FORMAT	LEVEL A LEVEL B DL	LEVEL A
	TEST	OFF ON		OFF
	DEINTERLACER	FILM MODE	OFF ON	ON
		VIDEO OVER FILM	OFF ON	ON
	COLOR SPACE	BYPASS 709 TO 2020		BYPASS *When CONVERSION is BYPASS or SDR TO PQ*
	DYNAMIC RANGE	CONVERSION	BYPASS SDR TO HLG HLG TO SDR SDR TO PQ PQ TO SDR PQ TO HLG HLG TO PQ S-LOG3/S-GAMUT3	BYPASS *Option UHD-3901-OPT-HDR must be activated*

		PRESET	OUT 128 NITS OUT 171 NITS OUT 203 NITS OUT 235 NITS OUT 380 NITS	OUT 203 NITS *When CONVERSION is SDR TO HLG*
		PRESET	IN 128 NITS IN 171 NITS IN 203 NITS IN 235 NITS IN 380 NITS	IN 203 NITS *When CONVERSION is HLG TO SDR*
		PRESET	OUT 163 NITS OUT 173 NITS OUT 183 NITS OUT 193 NITS OUT 203 NITS OUT 213 NITS OUT 223 NITS OUT 233 NITS OUT 243 NITS OUT 263 NITS	OUT 163 NITS *When CONVERSION is SDR TO PQ*
		PRESET	IN 163 NITS IN 173 NITS IN 183 NITS IN 193 NITS IN 203 NITS IN 213 NITS IN 223 NITS IN 233 NITS IN 243 NITS IN 263 NITS	IN 163 NITS *When CONVERSION is PQ TO SDR*
		PRESET	HLG (BT.2100)	HLG (BT.2100) *When CONVERSION is PQ TO HLG*
		PRESET	PQ (BT.2100)	PQ (BT.2100) *When CONVERSION is HLG TO PQ*
		PRESET	REC.709 800% PQ (BT.2100) HLG (BT.2100)	REC.709 800% *When CONVERSION is S-LOG3/S-GAMUT3*
	VIDEO TIMING	VERTICAL	-16, -15, …, 0, …15, 16	0 lines *When VIDEO OUTPUT, FORMAT is **not** 3G*
		HORIZONTAL	0.00, 0.01, …, 14.82 usec 0.00, 0.01, …, 17.77 usec	59.97 Hz 50 Hz 0.00 microseconds *When VIDEO OUTPUT, FORMAT is **not** 3G*
		MINIMUM DELAY	OFF ON	OFF *When VIDEO OUTPUT, FORMAT is 3G*
REFERENCE	SOURCE	AUTO EXTERNAL URS INPUT 1		AUTO
	URS	OFF		OFF

		URS 29.97 Hz URS 25 Hz		
VERSION	X.Y.Z.B			*X major* *Y minor* *Z revision* *B build*
	FPGA: X.Y.Z.B			
	HW: X.Y			
	303601-XXXXXXXXX			*Serial number*
OPTIONS	HDR OFF HDR ON	XXXXXXXX		*8-character key when OFF*
CARD PRESET	LOAD	USER 1 USER 2 USER 3 USER 4 USER 5		*Default names, can be modified*
	SAVE	USER 1 USER 2 USER 3 USER 4 USER 5		*Default names, can be modified*
FACTORY DEFAULT	CARD PARAMETERS	NO YES		
	CARD LED ALARMS	NO YES		

ANNEX 2 – Firmware upgrade

The method for upgrading the UHD-3901 firmware depends on the controller version in use in the frame in which the card is installed:

Frame & Controller	Upgrade strategy
• Densité 3 with CPU-ETH2 controller. • Densité 3+ FR4 with CPU-ETH3 base Controller.	Upgrade the firmware manually by installing the upgrade file on the UHD-3901's SD Card using the procedure described in this Annex, and upgrade the iControl service using the Densité Upgrade Manager (DUM).
• Densité 3+FR4 with CPU-ETH3 standard or advanced controller. • GV Node.	Upgrade both firmware and IControl service using the Densité Upgrade Manager (DUM).
Please consult the iControl User's Guide for information about the iControl Densité Upgrade Manager.	

Manual firmware update by installing the upgrade file onto the UHD-3901's SD card.

- You will need an SD card reader connected to your PC.

Proceed as follows:

1. Remove the UHD-3901 from its Densité frame.
2. Remove the SD card from the UHD-3901 board and place it in the SD card reader.
3. On your PC, unzip the iControl upgrade package.
4. Copy the "firmware-x.x.x.xx.zip" file from the "card" folder in the upgrade package and drop it onto the SD card.
5. Locate the firmware file from Step 4 in the Update partition of the SD card, and rename it "uhd3901-upgrade-vx.x.x.zip".

   e.g. "firmware-1.2.0.267.zip" should be changed to "uhd3901-upgrade-v1.2.0.267.zip"
6. Remove the SD card from the card reader, and re-install it on the UHD-3901 card.
7. Insert the UHD-3901 back into its slot in the Densité frame.
8. The card will automatically install the new firmware and re-boot.

If you using an appserver with iControl to control and monitor the UHD-3901 card, you will be required to install the new iControl service package on the appserver, once again using the (DUM).

Verify that the card has been updated with the correct firmware as described above, and select the "Upgrade" option on (DUM), that will upgrade the iControl service only.