



Grass Valley
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KUDOSPRO ULC2000

Dual Channel UHD Linear Frame Rate Converter

User Manual

13-06517-020 AA
2023-10-18

www.grassvalley.com

Patent Information

This product may be protected by one or more patents.

For further information, please visit: www.grassvalley.com/patents/

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Title	KudosPro ULC2000 User Manual
Part Number	13-06517-020 AA
Revision	2023-07-04, 19:30
Manufacturer	InSync
Responsible Vendor	Grass Valley

Important Safety Information

This section provides important safety guidelines for operators and service personnel. Specific warnings and cautions appear throughout the manual where they apply. Please read and follow this important information, especially those instructions related to the risk of electric shock or injury to persons.

Symbols and Their Meanings



Indicates that dangerous high voltage is present within the equipment enclosure that may be of sufficient magnitude to constitute a risk of electric shock.



Indicates that the user, operator or service technician should refer to the product manuals for important operating, maintenance, or service instructions.



This is a prompt to note the fuse rating when replacing fuses. The fuse referenced in the text must be replaced with one having the ratings indicated.



Identifies a protective grounding terminal which must be connected to earth ground prior to making any other equipment connections.



Identifies an external protective grounding terminal which may be connected to earth ground as a supplement to an internal grounding terminal.



Indicates that static sensitive components are present, which may be damaged by electrostatic discharge. Use anti-static procedures, equipment and surfaces during servicing.



Indicates that the equipment has more than one power supply cord, and that all power supply cords must be disconnected before servicing to avoid electric shock.



The presence of this symbol in or on Grass Valley equipment means that it has been tested and certified as complying with applicable Underwriters Laboratory (UL) regulations and recommendations for USA.



The presence of this symbol in or on Grass Valley equipment means that it has been tested and certified as complying with applicable Canadian Standard Association (CSA) regulations and recommendations for USA/Canada.



The presence of this symbol in or on Grass Valley equipment means that it has been tested and certified as complying with applicable Underwriters Laboratory (UL) regulations and recommendations for USA/Canada.



The presence of this symbol in or on Grass Valley equipment means that it has been tested and certified as complying with applicable Intertek Testing Services regulations and recommendations for USA/Canada.



The presence of this symbol in or on Grass Valley product means that it complies with all applicable European Union (CE) directives.

Warnings



A warning indicates a possible hazard to personnel, which may cause injury or death. Observe the following general warnings when using or working on this equipment:

- Appropriately listed/certified mains supply power cords must be used for the connection of the equipment to the rated mains voltage.
- This product relies on the building's installation for short-circuit (over-current) protection. Ensure that a fuse or circuit breaker for the rated mains voltage is used on the phase conductors.
- Any instructions in this manual that require opening the equipment cover or enclosure are for use by qualified service personnel only.
- Do not operate the equipment in wet or damp conditions.
- This equipment is grounded through the grounding conductor of the power cords. To avoid electrical shock, plug the power cords into a properly wired receptacle before connecting the equipment inputs or outputs.
- Route power cords and other cables so they are not likely to be damaged. Properly support heavy cable bundles to avoid connector damage.
- Disconnect power before cleaning the equipment. Do not use liquid or aerosol cleaners; use only a damp cloth.
- Dangerous voltages may exist at several points in this equipment. To avoid injury, do not touch exposed connections and components while power is on.
- High leakage current may be present. Earth connection of product is essential before connecting power.
- Prior to servicing, remove jewelry such as rings, watches, and other metallic objects.
- To avoid fire hazard, use only the fuse type and rating specified in the service instructions for this product, or on the equipment.
- To avoid explosion, do not operate this equipment in an explosive atmosphere.
- Use proper lift points. Do not use door latches to lift or move equipment.
- Avoid mechanical hazards. Allow all rotating devices to come to a stop before servicing.
- Have qualified service personnel perform safety checks after any service.

Cautions



A caution indicates a possible hazard to equipment that could result in equipment damage. Observe the following cautions when operating or working on this equipment:

- This equipment is meant to be installed in a restricted access location.
- When installing this equipment, do not attach the power cord to building surfaces.
- Products that have no on/off switch, and use an external power supply must be installed in proximity to a main power outlet that is easily accessible.
- Use the correct voltage setting. If this product lacks auto-ranging power supplies, before applying power ensure that each power supply is set to match the power source.
- Provide proper ventilation. To prevent product overheating, provide equipment ventilation in accordance with the installation instructions.
- Do not operate with suspected equipment failure. If you suspect product damage or equipment failure, have the equipment inspected by qualified service personnel.
- To reduce the risk of electric shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so. Refer all servicing to qualified service personnel.
- This unit may have more than one power supply cord. Disconnect all power supply cords before servicing to avoid electric shock.
- Follow static precautions at all times when handling this equipment. Servicing should be done in a static-free environment.
- To reduce the risk of electric shock, plug each power supply cord into separate branch circuits employing separate service grounds.

Electrostatic Discharge (ESD) Protection



Electrostatic discharge occurs when electronic components are improperly handled and can result in intermittent failure or complete damage adversely affecting an electrical circuit. When you remove and replace any card from a frame always follow ESD-prevention procedures:

- Ensure that the frame is electrically connected to earth ground through the power cord or any other means if available.
- Wear an ESD wrist strap ensuring that it makes good skin contact. Connect the grounding clip to an *unpainted surface* of the chassis frame to safely ground unwanted ESD voltages. If no wrist strap is available, ground yourself by touching the *unpainted* metal part of the chassis.
- For safety, periodically check the resistance value of the antistatic strap, which should be between 1 and 10 megohms.
- When temporarily storing a card make sure it is placed in an ESD bag.
- Cards in an earth grounded metal frame or casing do not require any special ESD protection.

Cautions for LCD and TFT Displays



Excessive usage may harm your vision. Rest for 10 minutes for every 30 minutes of usage.

If the LCD or TFT glass is broken, handle glass fragments with care when disposing of them. If any fluid leaks out of a damaged glass cell, be careful not to get the liquid crystal

fluid in your mouth or skin. If the liquid crystal touches your skin or clothes, wash it off immediately using soap and water. Never swallow the fluid. The toxicity is extremely low but caution should be exercised at all times.

Mesures de sécurité et avis importants

La présente section fournit des consignes de sécurité importantes pour les opérateurs et le personnel de service. Des avertissements ou mises en garde spécifiques figurent dans le manuel, dans les sections où ils s'appliquent. Prenez le temps de bien lire les consignes et assurez-vous de les respecter, en particulier celles qui sont destinées à prévenir les décharges électriques ou les blessures.

Signification des symboles utilisés



Signale la présence d'une tension élevée et dangereuse dans le boîtier de l'équipement ; cette tension peut être suffisante pour constituer un risque de décharge électrique.



Avertit l'utilisateur, l'opérateur ou le technicien de maintenance que des instructions importantes relatives à l'utilisation et à l'entretien se trouvent dans la documentation accompagnant l'équipement.



Invite l'utilisateur, l'opérateur ou le technicien de maintenance à prendre note du calibre du fusible lors du remplacement de ce dernier. Le fusible auquel il est fait référence dans le texte doit être remplacé par un fusible du même calibre.



Identifie une borne de mise à la terre de protection. Il faut relier cette borne à la terre avant d'effectuer toute autre connexion à l'équipement.



Identifie une borne de mise à la terre externe qui peut être connectée en tant que borne de mise à la terre supplémentaire.



Signale la présence de composants sensibles à l'électricité statique et qui sont susceptibles d'être endommagés par une décharge électrostatique. Utilisez des procédures, des équipements et des surfaces antistatiques durant les interventions d'entretien.



Le symbole ci-contre signifie que l'appareil comporte plus d'un cordon d'alimentation et qu'il faut débrancher tous les cordons d'alimentation avant toute opération d'entretien, afin de prévenir les chocs électriques.



La marque UL certifie que l'appareil visé a été testé par Underwriters Laboratory (UL) et reconnu conforme aux exigences applicables en matière de sécurité électrique en vigueur au Canada et aux États-Unis.



La marque C-CSA-US certifie que l'appareil visé a été testé par l'Association canadienne de normalisation (CSA) et reconnu conforme aux exigences applicables en matière de sécurité électrique en vigueur au Canada et aux États-Unis.



La marque C-UL-US certifie que l'appareil visé a été testé par Underwriters Laboratory (UL) et reconnu conforme aux exigences applicables en matière de sécurité électrique en vigueur au Canada et aux États-Unis.



La marque ETL Listed d'Intertek pour le marché Nord-Américain certifie que l'appareil visé a été testé par Intertek et reconnu conforme aux exigences applicables en matière de sécurité électrique en vigueur au Canada et aux États-Unis.



Le marquage CE indique que l'appareil visé est conforme aux exigences essentielles des directives applicables de l'Union européenne en matière de sécurité électrique, de compatibilité électromagnétique et de conformité environnementale.

Avertissements



Les avertissements signalent des conditions ou des pratiques susceptibles d'occasionner des blessures graves, voire fatales. Veuillez vous familiariser avec les avertissements d'ordre général ci-dessous :

- Un cordon d'alimentation dûment homologué doit être utilisé pour connecter l'appareil à une tension de secteur de 120 V CA ou 240 V CA.
- La protection de ce produit contre les courts-circuits (surintensités) dépend de l'installation électrique du bâtiment. Assurez-vous qu'un fusible ou un disjoncteur pour 120 V CA ou 240 V CA est utilisé sur les conducteurs de phase.
- Dans le présent manuel, toutes les instructions qui nécessitent d'ouvrir le couvercle de l'équipement sont destinées exclusivement au personnel technique qualifié.
- N'utilisez pas cet appareil dans un environnement humide.
- Cet équipement est mis à la terre par le conducteur de mise à la terre des cordons d'alimentation. Pour éviter les chocs électriques, branchez les cordons d'alimentation sur une prise correctement câblée avant de brancher les entrées et sorties de l'équipement.
- Acheminez les cordons d'alimentation et autres câbles de façon à ce qu'ils ne risquent pas d'être endommagés. Supportez correctement les enroulements de câbles afin de ne pas endommager les connecteurs.
- Coupez l'alimentation avant de nettoyer l'équipement. Ne pas utiliser de nettoyeurs liquides ou en aérosol. Utilisez uniquement un chiffon humide.
- Des tensions dangereuses peuvent exister en plusieurs points dans cet équipement. Pour éviter toute blessure, ne touchez pas aux connexions ou aux composants exposés lorsque l'appareil est sous tension.
- Avant de procéder à toute opération d'entretien ou de dépannage, enlevez tous vos bijoux (notamment vos bagues, votre montre et autres objets métalliques).
- Pour éviter tout risque d'incendie, utilisez uniquement les fusibles du type et du calibre indiqués sur l'équipement ou dans la documentation qui l'accompagne.

- Ne pas utiliser cet appareil dans une atmosphère explosive.
- Présence possible de courants de fuite. Un raccordement à la masse est indispensable avant la mise sous tension.
- Après tout travail d'entretien ou de réparation, faites effectuer des contrôles de sécurité par le personnel technique qualifié.

Mises en garde



Les mises en garde signalent des conditions ou des pratiques susceptibles d'endommager l'équipement. Veuillez vous familiariser avec les mises en garde ci-dessous :

- L'appareil est conçu pour être installé dans un endroit à accès restreint.
- Au moment d'installer l'équipement, ne fixez pas les cordons d'alimentation aux surfaces intérieures de l'édifice.
- Les produits qui n'ont pas d'interrupteur marche-arrêt et qui disposent d'une source d'alimentation externe doivent être installés à proximité d'une prise de courant facile d'accès.
- Si l'équipement n'est pas pourvu d'un modules d'alimentation auto-adaptables, vérifiez la configuration de chacun des modules d'alimentation avant de les mettre sous tension.
- Assurez une ventilation adéquate. Pour éviter toute surchauffe du produit, assurez une ventilation de l'équipement conformément aux instructions d'installation.
- N'utilisez pas l'équipement si vous suspectez un dysfonctionnement du produit. Faites-le inspecter par un technicien qualifié.
- Pour réduire le risque de choc électrique, n'effectuez pas de réparations autres que celles qui sont décrites dans le présent manuel, sauf si vous êtes qualifié pour le faire. Confiez les réparations à un technicien qualifié. La maintenance doit se réaliser dans un milieu libre d'électricité statique.
- L'appareil peut comporter plus d'un cordon d'alimentation. Afin de prévenir les chocs électriques, débrancher tous les cordons d'alimentation avant toute opération d'entretien.
- Veillez à toujours prendre les mesures de protection antistatique appropriées quand vous manipulez l'équipement.
- Pour réduire le risque de choc électrique, branchez chaque cordon d'alimentation dans des circuits de dérivation distincts utilisant des zones de service distinctes.

Protection contre les décharges électrostatiques (DES)



Une décharge électrostatique peut se produire lorsque des composants électroniques ne sont pas manipulés de manière adéquate, ce qui peut entraîner des défaillances intermittentes ou endommager irrémédiablement un circuit électrique. Au moment de remplacer une carte dans un châssis, prenez toujours les mesures de protection antistatique appropriées :

- Assurez-vous que le châssis est relié électriquement à la terre par le cordon d'alimentation ou tout autre moyen disponible.

- Portez un bracelet antistatique et assurez-vous qu'il est bien en contact avec la peau. Connectez la pince de masse à une *surface non peinte* du châssis pour détourner à la terre toute tension électrostatique indésirable. En l'absence de bracelet antistatique, déchargez l'électricité statique de votre corps en touchant une surface métallique *non peinte* du châssis.
- Pour plus de sécurité, vérifiez périodiquement la valeur de résistance du bracelet antistatique. Elle doit se situer entre 1 et 10 mégohms.
- Si vous devez mettre une carte de côté, assurez-vous de la ranger dans un sac protecteur antistatique.
- Les cartes qui sont reliées à un châssis ou boîtier métallique mis à la terre ne nécessitent pas de protection antistatique spéciale.

Précautions pour les écrans LCD et TFT



Regarder l'écran pendant une trop longue période de temps peut nuire à votre vision. Prenez une pause de 10 minutes, après 30 minutes d'utilisation.

Si l'écran LCD ou TFT est brisé, manipulez les fragments de verre avec précaution au moment de vous en débarrasser. veillez à ce que le cristal liquide n'entre pas en contact avec la peau ou la bouche. En cas de contact avec la peau ou les vêtements, laver immédiatement à l'eau savonneuse. Ne jamais ingérer le liquide. La toxicité est extrêmement faible, mais la prudence demeure de mise en tout temps.

Environmental Information

European (CE) WEEE directive.



This symbol on the product(s) means that at the end of life disposal it should not be mixed with general waste.

Visit www.grassvalley.com for recycling information.

Grass Valley believes this environmental information to be correct but cannot guarantee its completeness or accuracy since it is based on data received from sources outside our company. All specifications are subject to change without notice.

If you have questions about Grass Valley environmental and social involvement (WEEE, RoHS, REACH, etc.), please contact us at environment@grassvalley.com.

Safety and EMC Standards

This equipment complies with the following standards:

IEC 62368-1: 2018

Audio/video, information and communication technology equipment Part 1: Safety requirements

CSA/UL 62368-1:2019

Audio/video, information and communication technology equipment Part 1: Safety requirements

EMC Standards

This unit conforms to the following standards:

EN55032:2015 (Class A)

Electromagnetic Compatibility of multimedia equipment - Emission requirements

EN61000-3-2:2014 (Class A)

Electromagnetic Compatibility - Limits for harmonic current emissions

EN61000-3-3:2013

Electromagnetic Compatibility - Limits of voltage changes, voltage fluctuations and flicker

EN55103-2:2009 (Environment E2)

Electromagnetic Compatibility, Product family standard for audio, video, audio-visual and entertainment lighting control apparatus for professional use. Part 2. Immunity

This equipment is compliant with Class A of CISPR 32. In a residential environment this equipment may cause radio interference.

FCC / CFR 47:Part 15 (Class A)

Federal Communications Commission Rules Part 15, Subpart B

Caution to the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.

EMC Performance of Cables and Connectors

Grass Valley products are designed to meet or exceed the requirements of the appropriate European EMC standards. In order to achieve this performance in real installations it is essential to use cables and connectors with good EMC characteristics.

All signal connections (including remote control connections) shall be made with screened cables terminated in connectors having a metal shell. The cable screen shall have a large-area contact with the metal shell.

SIGNAL/DATA PORTS

For unconnected signal/data ports on the unit, fit shielding covers. For example, fit EMI blanking covers to SFP+ type ports; and fit 75 Ω RF terminators to BNC type ports.

COAXIAL CABLES

Coaxial cables connections (particularly serial digital video connections) shall be made with high-quality double-screened coaxial cables such as Belden 8281 or BBC type PSF1/2M and Belden 1694A (for 3Gbps).

D-TYPE CONNECTORS

D-type connectors shall have metal shells making good RF contact with the cable screen. Connectors having indents which improve the contact between the plug and socket shells are recommended.

toc

Table of Contents

Patent Information	ii
Copyright and Trademark Notice.....	ii
Safety and EMC Standards	x
EMC Standards	x
1 Introduction	15
Description	15
Front Panel View	15
Rear Panel View	15
Product Features	16
Video Formats.....	16
Other Product Features.....	16
Block Diagram.....	17
Video Processing Diagram	17
Audio Processing Diagram	17
2 Technical Specifications.....	19
3 Installation.....	23
Unpacking the Unit.....	23
Rack Mounting the Unit	23
Ventilation	23
4 Connections.....	25
Input and Output Connections.....	25
Power Supply	26
5 Front Panel Features.....	27
Front Panel Layout	27
Front Panel Controls.....	27
Buttons.....	27
Numeric Input	29
Home Screen	29
Limitations	30
6 System Operation	31
Turning the Unit On	31

The Home Screen	31
Video Confidence Display	31
Entering Numeric Characters from the Rotary Control	32
Selecting an Action Using On/Off	32
Resetting Menu Options to Default Values	33
Front Panel Buttons	33
Home	33
Standby	33
Lock	33
Ch Select	33
Input	33
Output	34
Video	36
Audio	41
Enhance	45
Memory	50
Metadata	51
System	53
Operation Using RollCall	58
Template Pages	58
Setting Values	58
Input/Output	59
Video Processing	62
Convert Processing	66
SDR/HDR	69
Audio Input Routing	76
Audio Delay	80
Audio Gain	82
Audio Output Mapping	83
Enhance	85
Memory	92
Metadata	93
ANC Bridge	96
Timecode	98
Status	100
Network	103
SNMP	105
Genlock	107
.....	108
Operation Via Web Browser	109
Browser-only Operations	110

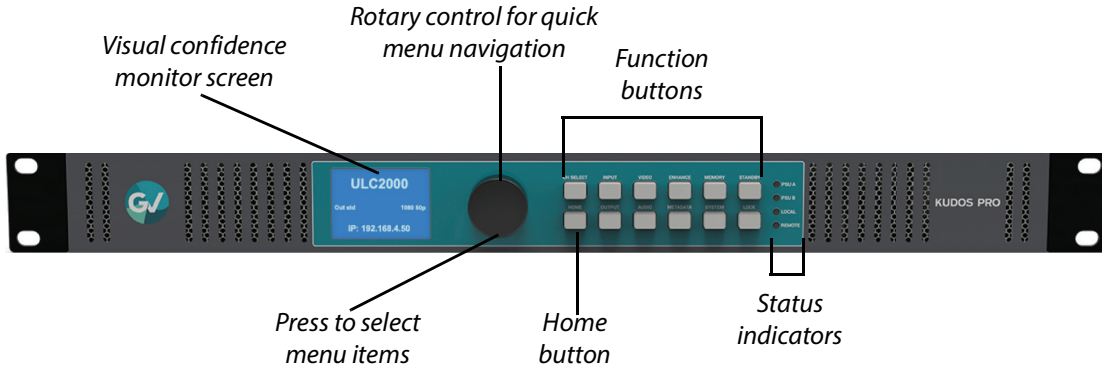
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1 Introduction

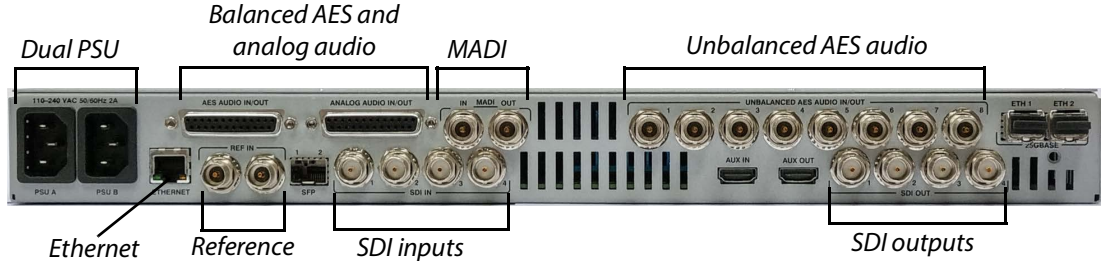
Description

The KudosPro ULC2000 is a dual-channel UHD 12G processing unit including independent HDR support and both format and frame-rate conversion for UHD/3G/HD signals. Providing processing for two independent signal paths allows both UHD and HD workflows to be catered for — ideal for applications that require UHD/HDR processing to be performed with simultaneous HD/SDR outputs, for example.

Front Panel View



Rear Panel View



Product Features

- UHDTV linear frame rate conversion
- Inputs
 - Up to 4K 12G-SDI
 - Up to 4K SMPTE.2110 (25G Ethernet, option)
- Input / Output frame rates
 - Up to 60p
- Outputs
 - Up to 4K 12G-SDI
 - Up to 4K SMPTE.2110 (25G Ethernet, option)
- Automatic input detection
 - Input detection of SMPTE ST2082-12 (2SI)
 - Input detection of BT.2020 colorimetry
- Auto detection of PID, with pass-through

Video Formats

- 2160 50p, 59p, 60p (3840 x 2160 4:2:2 YCbCr 10-bit)
- 1080 23p, 24p, 25p, 29p, 30p, 50p, 59p, 60p (1920 x 1080 4:2:2 YCbCr 10-bit)
- 1080 50i, 59i, 60i (1920 x 1080 4:2:2 YCbCr 10-bit)
- 1080 23psf, 24psf, 25psf, 29psf, 30psf (1920 x 1080 4:2:2 YCbCr 10-bit)
- 720 23p, 24p, 25p, 29p, 30p, 50p, 59p, 60p (1280 x 720 4:2:2 YCbCr 10-bit)

Other Product Features

- Passes up to 32 channels of Embedded PCM audio (link 1 streams 1-2) with a delay matched to the video delay
- Loop through reference input with genlock phase control. Bi/Tri-sync.
- SMPTE.2059 (IEEE1588 / PTP) reference (with 2110 option)
- Audio tone and silence (mute) insertion
- HDR/SDR conversion: PQ/HLG/Slog-3/SDR
- Timecode handling
- Ancillary data bridge
- Front panel control with display and rotary encoder

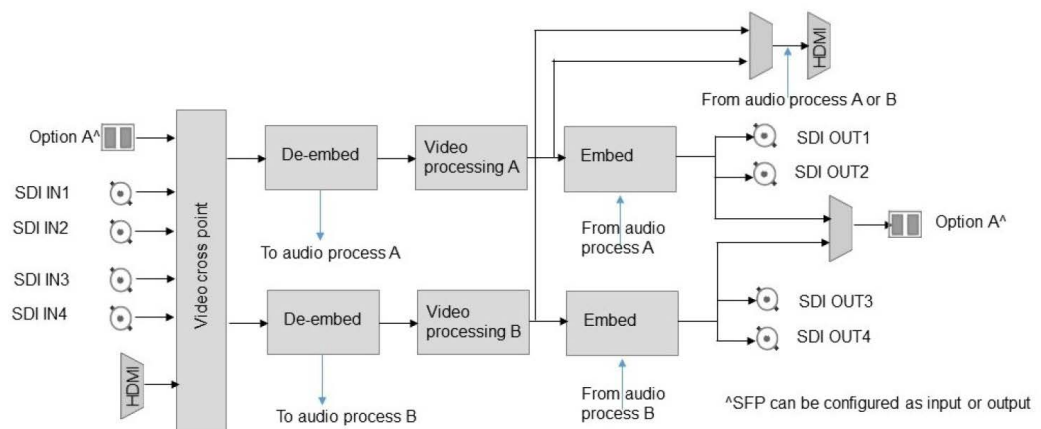
Short cut keys:

- HOME
- INPUT (Selector)
- OUTPUT (Output standard, patterns, etc.)
- VIDEO (Input colorimetry status)
- AUDIO (Audio status, remapping, delay)
- MEMORY
- ENHANCE (Video enhancements)

- GENLOCK
- METADATA (Timecode)
- SYSTEM (Network etc.)
- Web control (built in web page)
- Dual redundant PSUs
- Front panel standby control
- Power consumption <70W
- Front to back cooling
- 1RU chassis (depth 325mm) with rack mount

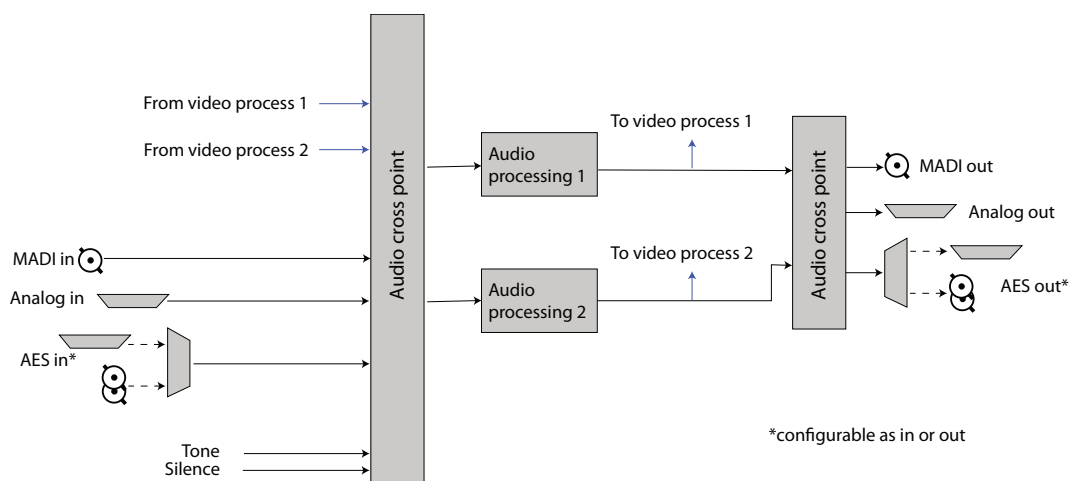
Block Diagram

Video Processing Diagram



Dual Channel Products Video Processing Path

Audio Processing Diagram



Dual Channel Products Audio Processing Path

Technical Specifications



Inputs and Outputs	
Signal Inputs	
Serial Digital Inputs	4 x 75 Ohm UHD 12G/UHD 6G/HD/3Gb/s serial digital with embedded audio
Input Standards	UHDTV1 video interfaces 12 Gb/s 4K UHD-1 single link to SMPTE ST 2082-10 6 Gb/s 6G-SDI UHD SMPTE ST 2081-10 Mode 1 (Level B-DS) 3 Gb/s HD-SDI, SMPTE ST 425 level A, dual-link level B 1.5 Gb/s HD-SDI SMPTE ST 292/SMPTE ST 299
Reference	1 x loop-through HDTV Tri-/SD Bi- (black and burst) SMPTE 240M/274M, with auto selection dependent on output standard
Audio AES	Up to 8 ¹ balanced AES inputs/outputs via 25-way D-type Up to 8 ¹ unbalanced AES inputs/outputs via BNC ¹ AES audio connectors may be configured as input or output.
Audio Analog	2 x stereo analog inputs via 25-way D-type
MADI Serial Interface	AES10, 64 channels selectable from channels 1-64
Optical	<ul style="list-style-type: none"> • 12 Gb/s UHD-SDI • 6 Gb/s UHD-SDI • 3 Gb/s HD-SDI • 1.485 Gb/s HD-SDI
Signal Outputs	
Serial Digital Outputs	4 x 75 Ohm UHD 12G/UHD 6G/HD/3Gb/s serial digital with embedded audio
Output Standards	UHDTV1 video interfaces 12 Gb/s 4K UHD-1 single link to SMPTE ST 2082-10 6 Gb/s 6G-SDI UHD SMPTE ST 2081-10 Mode 1 (Level B-DS) 3 Gb/s HD-SDI, SMPTE ST 425 level A, dual-link level B 1.5 Gb/s HD-SDI SMPTE ST 292/SMPTE ST 299
Audio AES	Up to 8 ¹ balanced AES inputs/outputs via 25-way D-type Up to 8 ¹ unbalanced AES inputs/outputs via BNC ¹ AES audio connectors may be configured as input or output.
Audio Analog	2 x stereo analog outputs via 25-way D-type

Standards		
Input/Output Standards Supported	720 23.98p 720 24p 720 25p 720 29.97p 720 30p 720 50p 720 59.94p 720 60p 1080 23.98p 1080 24p 1080 25p 1080 29.97p 1080 30p 1080 50i 1080 59.94i 1080 60i 1080 23.98psf 1080 24psf	1080 25psf 1080 29.97psf 1080 30psf 1080 50p-A 1080 59.94p-A 1080 60p-A 1080 50p-B 1080 59.94p-B 1080 60p-B 2160 23.98p 2160 24p 2160 25p 2160 29.97p 2160 30p 2160 50p 2160 59.94p 2160 60p
MADI Serial Interface	AES10, channels 1-64 input, 1-32 output	
Optical	<ul style="list-style-type: none"> • 12 Gb/s UHD-SDI • 6 Gb/s UHD-SDI • 3 Gb/s HD-SDI • 1.485 Gb/s HD-SDI 	
Interface Formats		
HD	720p, 1080i, 1080p	
3G Level A	1080p	
3G Level B	1080p	
6G	2160p	2-sample interleaved ST.2081
12G	2160p	2-sample interleaved ST.2082-10
Input Capabilities		

Input	HD 720p (23-60) 1080i (50-60) 1080p (<=30)	3G 1080p-A 1080p-B	6G 2160p (<=30)	12G 2160p (>30)
SDI 1	✓	✓	✓	✓
SDI 2	✓	✓	✓	✓
SDI 3	✓	✓	✓	✓

Input	HD 720p (23-60) 1080i (50-60) 1080p (<=30)	3G 1080p-A 1080p-B	6G 2160p (<=30)	12G 2160p (>30)
SDI 4	✓	✓	✓	✓
Option A1 (Rx)	✓	✓	✓	✓
Option A2 (Rx)	✓	✓	✓	✓

Output Capabilities

Output	HD 720p (23-60) 1080i (50-60) 1080p (<=30)	3G 1080p-A 1080p-B	6G 2160p (<=30)	12G 2160p (>30)
SDI 1	✓	✓	✓	✓
SDI 2	✓	✓	✓	✓
SDI 3	✓	✓	✓	✓
SDI 4	✓	✓	✓	✓
Option A1 (Tx)	✓	✓	✓	✓
Option A2 (Tx)	✓	✓	✓	✓

Note: SFP inputs will show as available if any module is fitted, although will only report the detection of video if an Rx module is fitted.

Conversion Functions

Modes	HD/3G/UHDTV Up, Down, and Cross Conversion
Conversion	Linear frame rate and Motion Adaptive de-interlacing
HD Aspect Ratio Conversion (Manual control)	

Audio	
Embedded Audio	Each processing channel includes up to 32-channel embedded audio processing. PCM audio processing includes channel level gain and delay compensation, as well as pair level routing with L/R swap and phase invert feature.

Throughput Delay			
Input	Output	Min Delay	Max Delay
UHD 2SI	UHD 2SI	2 Frames	Min Delay plus 1 frame
UHD 2SI	3G/HD	2 Frames	Min Delay plus 1 frame
3G/HD	UHD 2SI	2 Frames	Min Delay plus 1 frame

With frame rate conversion, the average delay is 63ms when converting 50Hz to 59.94Hz and 70ms when converting 59.94Hz to 50Hz.

The equation for average throughput delay when linear frame rate converting is as below:
1 x input frame period + 1.5 x output frame period

For example; converting 50Hz to 59.94Hz is **20ms + 50ms = 70ms** (the average throughput delay)

Audio Processing Delay	Automatically tracks video processing delay.
------------------------	--

Power	
Input voltage range (primary & secondary)	100 to 240VAC, 47 to 63Hz, 1A, via three-pin IEC power socket
Power Consumption	60W

Mechanical	
Temperature Range	0 to 40°C operating
Cooling	Internal fans, front to back cooling with front, rear and side venting
Weight	4.2 kg
Case Type	1RU, rack mounting
Dimensions	44mm x 430mm x 325mm (H x W x D)



Note

The AES audio connector may be assigned as either input or output.

3 Installation

**Note**

This equipment is intended for indoor use only.

**Note**

Refer to [Important Safety Information](#), on page iii before installing and connecting to power.

Unpacking the Unit

The unit is packed in a single cardboard box. Unpack the box carefully and check for any shortages or shipping damage. Report any shortages or shipping damage to Grass Valley immediately.

The box contains the following item:

- 1 x KudosPro ULC2000 unit.

**Note**

Retain the product packaging. It may be required if returning the unit to Grass Valley.

Rack Mounting the Unit

Ensure that sufficient space is available for the unit.

When installing the unit, place on a suitably specified and installed rack shelf and secure the unit using the front rack ears.

Ventilation

Ensure that there is a free flow of air at the front, rear, and sides of the unit in order to dissipate the heat produced during operation. Installations should be designed to allow for this.

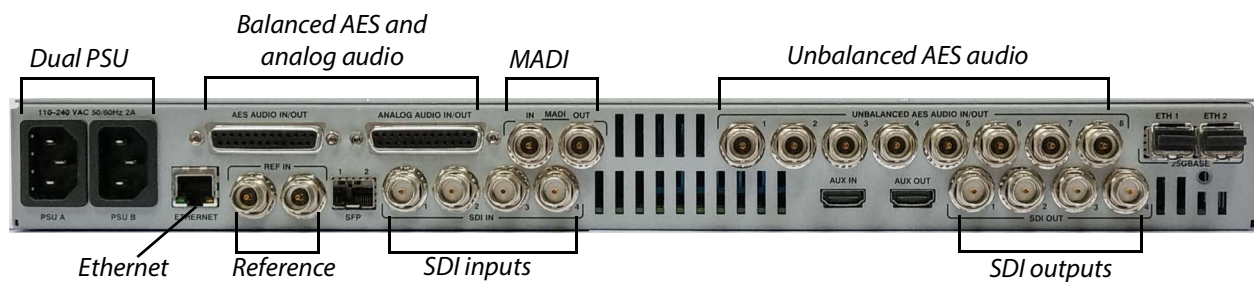
**WARNING**

Do not obstruct any of the ventilation holes on the unit. Damage to the equipment may result.

4 Connections

This section describes the physical input and output connections provided by the KudosPro range.

The rear panel accommodates a variety of different connections, depending on the model. The illustration below shows the ULC2000 model with the AES audio option.



Input and Output Connections

Label	Description	Connector
MADI in	MADI input	1 x BNC
MADI out	MADI output	1 x BNC
SDI in 1, 2, 3, 4	SDI inputs	4 x BNC
SDI out 1, 2, 3, 4	SDI outputs	4 x BNC
Ethernet	10/100/1000 BaseT Ethernet connection	1 x RJ45
Reference	Reference loop	2 x BNC
SFP 1, 2	Signal input/output	1 x dual SFP compatible
Unbalanced AES I/O (option)	Unbalanced AES audio input/output	8 x BNC
AES I/O (option)	Balanced AES audio input/output	1 x 25-way D-type
Analog Audio (option)	Analog audio input/output	1 x 25-way D-type
PSU A, B	PSU inputs (primary, secondary)	2 x 3-pin IEC

Label	Description	Connector
AUX I/O	Auxiliary Video/Audio input/output	
ETH 1, 2	25G Ethernet for ST.2110 inputs and outputs (option)	SFP+



Note

If one of the reference connectors is not in use, it must be fitted with a 75 Ohm BNC terminating plug. If not terminated correctly, genlock performance may be degraded.



Note

The option sockets allow for one dual Small Form Factor Pluggable (SFP) transceiver modules. The SFP modules can be used to add optional fiber connectivity, or optional I/O using HD BNC connectors.

Power Supply

The KudosPro ULC2000 has two power supply unit connectors on the rear panel as follows:

- One primary and one secondary PSU (PSU A and PSU B)

Power to the unit must be supplied via suitable power cables, appropriate to the country of operation.



WARNING

This equipment must be earthed, through the power cable.



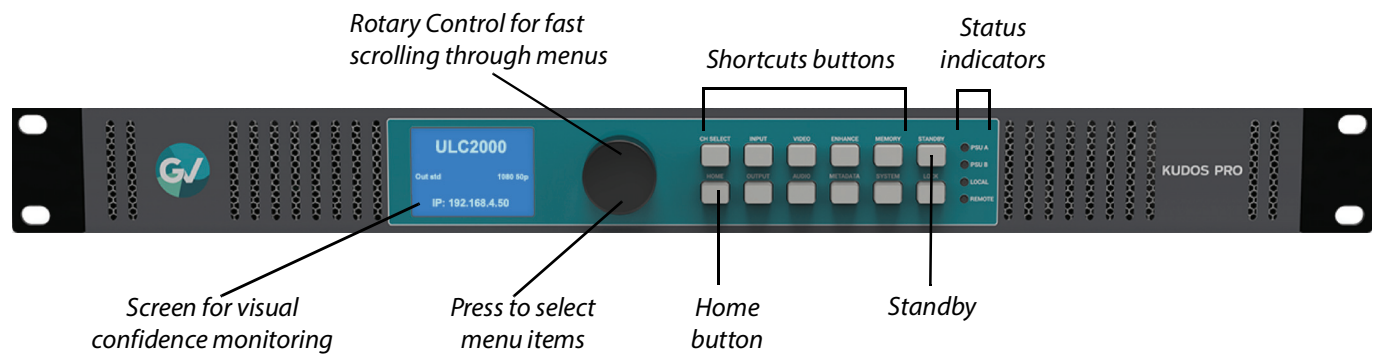
Note

This equipment has more than one power supply cord. To reduce the risk of electric shock, disconnect all power supply cords before servicing.

5 Front Panel Features

The front panel provides a user-friendly interface for complete control of the unit. Various buttons provide easy access to the unit's features.

Front Panel Layout



Front Panel Controls

Buttons

Item	Description
Shortcuts buttons	Navigate to the appropriate menu level e.g. Audio navigates the user to the top-level audio menu. Shortcuts buttons are; <ul style="list-style-type: none"> • Ch Select • Home • Input • Output • Video • Audio • Enhance • Memory • Metadata • System
Home button (HOME)	Press to return to the default Home screen at any time. When on the Home screen, the user may access the full menu structure via one press of the rotary control.

Item	Description
Standby button (STANDBY)	<p>Puts the unit into power saving mode.</p> <ul style="list-style-type: none"> When the unit is in normal operation, press and hold for 3 seconds to put the unit into power saving mode. To return the unit to operational use from standby mode, press and hold the Standby button for 3 seconds.
Lock button (LOCK)	<p>Render the front panel non-operational if long pressed when the unit is in normal operation.</p> <p>The front panel becomes operational again if long pressed when the unit is locked.</p>
Ch Select button (CH SELECT)	<p>Cycle through the available channels. The button toggles between channel 1 and channel 2.</p> <p>If the user changes channel at any menu level, the menu level and position will stay the same, but will be displayed for the new channel in the sequence.</p>
Display	Shows either the output video or the menu options.
Rotary control	<p>Scrolls through the menu lists, selects menu options, and adjusts values.</p> <ul style="list-style-type: none"> Rotate clockwise or anti-clockwise to scroll down or up through a menu list or to adjust values on a menu option. Press to select a menu option or confirm changes. Press and hold to jump to the Back option under a menu list. Press and hold when entering parameter values to return the parameter to default value. When at the Home screen, press to toggle between status display and video monitoring.
PSU Status LEDs	<p>Shows the status of the dual PSUs.</p> <ul style="list-style-type: none"> PSU A illuminated green: PSU A (primary) in use. PSU B illuminated green: PSU B (secondary) in use. PSU illuminated red: unit in standby (power saving) mode.
Control Status LEDs	<p>Shows the monitoring status.</p> <ul style="list-style-type: none"> Local illuminated: local control enabled. Remote illuminated: browser-based UI may be in use.

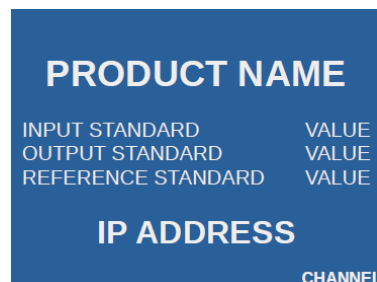
Numeric Input

Item	Description
Single-number Input	Single-number entries are input using the rotary control.
Multi-number Input	<p>Multi-number entries (such as IP Address, Timecode etc.) are input using the rotary control and a cursor.</p> <p>The user should rotate the rotary control to move the cursor to the desired position. Once at the desired position, the user should press the rotary control to enter field view.</p> <p>Once in field view, the user should rotate the rotary control in order to increment (clockwise) and decrement (anticlockwise) the field. Clicking the rotary encoder control leaves field view, allowing the cursor to be moved again. The entry can then be committed using the Confirm button, or aborted using the Cancel button. Selecting either returns the user to the previous menu.</p>

Home Screen

The Home screen shows the following status information of the unit for each processing channel:

- Product name
- Input and Output standard
- Reference standard
- IP address
- Channel



You can return to the Home screen at any time by pressing the **HOME** button.



Note

This information is also available on the web and RollCall interface.

Video Confidence Display

Clicking the rotary control when on the home screen enables the video confidence monitoring

display. In this mode, the display shows the output video from “SDI out” of the channel selected using the **Ch Select** button.

Once selected, the video confidence display remains on screen.

To revert to menus when video confidence monitoring is selected:

- Press the rotary control again to return the user to the home screen
- Press any shortcut button to navigate to that menu

Limitations

The front panel does not support text entry.

6 System Operation

The KudosPro ULC2000 can be controlled directly, using the front panel hardware buttons, or remotely, using either RollCall or a software UI in an HTML5-compliant browser window.

The operating instructions given here focus on operation via the front panel. Operation via the browser-based UI follows the same basic control sequences, and should be self-explanatory. See [Operation Using RollCall](#) on page 58 for information on using the unit with RollCall.

Turning the Unit On

- Press and hold the **Standby** button.

The PSU LED turns green and the splash screen is shown on the display. After a short period, the Home screen is displayed.

The Home Screen

The Home screen shows the following status information:

- Unit name;
- IP address;
- Input and output standard;
- Reference standard.

The Home screen can be displayed at any time by pressing the **Home** button.



Note

If no controls are used, the unit will automatically return to the Home screen after a few minutes.

Video Confidence Display

To view the output video on the front panel monitor screen, first press the **Home** button to return to the Home screen. From here, pressing the rotary control or the Home button enables the video confidence monitoring display. In this mode, the display shows the output video from **SDI out** of the channel selected using the **Ch Select** button.

Once selected, the video confidence display remains on screen. To revert to menus when video confidence monitoring is selected:

- Press the rotary control again to return the user to the home screen
- Press any shortcut button to navigate to that menu

Using the Front Panel - Basics

The front panel buttons provide access to the KudosPro ULC2000 control menus.

- Turn the rotary control clockwise to scroll down through a menu list, or anti-clockwise to scroll up.
- When on the required menu item, press the rotary control to select it.
- When a menu option that offers adjustment is selected, such as audio gain, the value can be adjusted by turning the rotary control. This allows control for fine-tuning values in small increments. When the desired value has been entered, press the rotary control to set the value.
- Select **Back** at the bottom of each menu page go back up a level, or simply select another front panel button to change to a different menu.
- To return to the Home screen, press the **Home** front panel button.



Note

Press and hold the rotary control for a few seconds to jump to the **Back** option when in any menu list.

To reset any parameter back to its default value: from the parameter selected, press and hold the rotary control for a few seconds.

Entering Numeric Characters from the Rotary Control

Where a parameter may be set from a range of values with only certain specific steps, numeric entry is via the rotary control:

- 1 Press the rotary control to show the current value, e.g. contrast.
- 2 Rotate the control clockwise to increment the value by each step, e.g. contrast increments in steps of 0.2 dB. Likewise, rotate the control counter-clockwise to decrement the value.
- 3 The value will not pass beyond its defined range, e.g. valid contrast adjustments are from -6.0 dB to 6.0 dB.
- 4 To return to default, press and hold the rotary control. The values are reset.
- 5 When the value is set as required, press the rotary control again to confirm and return to the last menu.

Selecting an Action Using On/Off

Where an action is available to turn a feature on or off using the rotary control:

- 1 Scroll the rotary control to the required item, e.g. **Video > Enable proc amp**.
- 2 Press the rotary control to view the current status, e.g. **On**.
- 3 To change the action, turn the rotary control until the desired action is visible, e.g. **Off**. Press the rotary control to select.

Resetting Menu Options to Default Values

To reset a menu option to its default value:

- With the menu option selected, press and hold the rotary control for a few seconds.

Front Panel Buttons

Home

Home always results in a return to the Home screen. When in the Home screen, the user may access the full menu structure via one press of the rotary control.

Standby

Put the unit into power saving mode if pressed and held for 3 seconds when the unit is in normal operation. The unit will recover to operational use when in standby if the Standby button is pressed and held for 3 seconds.

Lock

Render the front panel non-operational if long pressed when the unit is in normal operation. The front panel becomes operational again if long pressed when the unit is locked.

Ch Select

Cycle through the available channels. The button toggles between channel 1 and channel 2. If the user changes channel at any menu level, the menu level and position will stay the same, but will be displayed for the new channel in the sequence.

Input

Press **Input** to specify a video input source. Available functions are:

Menu Option	Operation
Input select	<p>Selects BNC, HDMI or SFP input. Status shown next to the radio button (e.g. loss, current detected standard)</p> <p>Choose from:</p> <ul style="list-style-type: none"> • SDI 1 (Default) • SDI 2 • SDI 3 • SDI 4 • AUX • Option A1* • Option A2* <p>The currently selected input is highlighted.</p> <p>*Available only if an Rx module is fitted to the SFP slot.</p>
Input status	<p>Reports presence of video on each of the inputs.</p> <p>Valid values are:</p> <ul style="list-style-type: none"> • Detected format • Loss • Invalid: Indicates unsupported standard

Output

Press **Output** to make settings and adjustments to the video output signal. Available functions are:

Menu Option	Operation
Output standard	<p>Use this control to select the required output standard for the active channel. Available options are listed on Standards, on page 20.</p> <p>Scroll through the list until the required output standard is reached, then press to select. Press the rotary control again to confirm and return to the Output menu.</p> <p>Note: Only allowed standards will be active.</p>
Current output standard	Reports the selected output standard.
Legalization	<p>The Legalizer ensures that the output video stays within the legal RGB gamut limit, making it suitable for the broadcast signal chain. To achieve this, the legalizer reduces the gain equally on all channels. Anything in the RGB space above the selected value (e.g. 700mV) is scaled down to that value. Anything in the RGB space below 0mV is clipped to 0mV. This is a good compromise between minimizing hue change and raising apparent brightness.</p> <p>Legalizer choices are:</p> <ul style="list-style-type: none"> • Off (Default) • 0 to 700mV • -21 to 721mV • -35 to 735mV • -46 to 746mV
Luma clipper	<p>The Luma clipper limits the luminance of the signal at the output.</p> <p>Enable - Luma clipper enabled</p> <p>Disabled - Luma clipper disabled (default)</p> <ul style="list-style-type: none"> • White max: The upper limit (hard clip point) of the clipper. Choose between 90% to 109% in 1% steps. Default is 103%. • White knee: Sets a "soft" clip from the knee to the hard white clip point. Choose between 60% to 109% in 1% steps. Default is 100%. • Black knee: Sets a "soft" clip from the knee to the hard black clip point. Choose between -7% to 60% in 1% steps. Default is 0%. • Black min: The lower limit (hard clip point) of the clipper. Choose between -7% to 60% in 1% steps. Default is -1%.
Test pattern	<p>Set a test pattern on the output.</p> <p>Choose from:</p> <ul style="list-style-type: none"> • Off (Default) • Black • Ramp • Bars
Default output	<p>Defines the output in case of input loss.</p> <p>Choose from:</p> <ul style="list-style-type: none"> • Test Pattern (Default) • Freeze • Mute - mutes SDI output

Menu Option	Operation
Additional A/V delay	<p>For progressive sources, this control adds additional video delay from 0 to 8 frames in steps of 1 frame. Preset = 0 frame.</p> <p>For interlaced sources, this control adds additional video delay from 0 to 8 fields in steps of 1 field. Preset = 0 field.</p>
HD ARC	<p>Enable HD ARC (Aspect Ratio Control) to apply post scaling to HD output.</p> <ul style="list-style-type: none">• Size: Adjusts the size of the whole output image while maintaining the aspect ratio. Range is 80% to 120% in steps of 1%. Default is 100%.• Aspect: Adjusts the aspect ratio of the output image. Range is 70% to 150% in steps of 1%. Default is 100%.• Pan: Adjusts the horizontal position of the output image. Range is -50 to +50 pixels in steps of 1 pixel. Default is 0 pixel.• Tilt: Adjusts the vertical position of the output image. Range is -50 to +50 lines in steps of 1 line. Default is 0 line.

Video

Press **Video** for controls allowing various types of signal processing to be applied to the signal being converted. Available functions are:

Menu Option	Operation
Enhanced film mode	Enable enhanced film mode Disable enhanced film mode (default)
Cadence	Management of input and output cadence. See Input cadence on page 67 and Output cadence , on page 68 for more information.

Pre-processing

Allows video inconsistencies to be corrected. To be applied before any other color processing.

Process Amplifier (Proc Amp)

Menu Option	Operation
Enable proc amp	Select Enable proc amp to activate Proc Amp functions.
Master gain	Adjusts the contrast and saturation together from -6dB to 6dB in 0.1dB steps. Default is 0.0dB.
Contrast	Adjusts the contrast from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Saturation	Adjusts the color saturation from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Black level	Adjusts the black level from -100mV to +100mV in 0.8mV steps. Default is 0mV.
Gamma	Adjusts the luma gamma from 0.4 to 1.7 in 0.1 steps. Preset is 1.0.
YC offset	Adjusts the horizontal chroma shift, for use when correcting upstream luma-chroma displacement. The adjustment range is -20 to 20 in steps of 2 luma clocks At the input picture edge, zero chroma is shifted into the active picture area. If the ARC is set to show less than the full width of the input picture, valid input picture chroma is shifted into the output picture area. Default is 0.

Color Correct

Menu Option	Operation
Enable correct	Select Enable pre color correction to activate Color correct functions.
Red lift	Red channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Red gain	Red gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Red gamma	Red gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Green lift	Green channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Green gain	Green gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Green gamma	Green gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Blue lift	Blue channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Blue gain	Blue gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Blue gamma	Blue gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.

SDR/HDR

Menu Option	Operation
Detected input	Reports the detected SDR/HDR transfer function. Valid values are: <ul style="list-style-type: none"> • SDR-TV • HLG HDR-TV • PQ HDR-TV • Unspecified
Bypass LUT	Allows the user to bypass the LUT i.e. no HDR/SDR or color. <ul style="list-style-type: none"> • Disable bypass 3D LUT (Default) • Enable bypass 3D-LUT
Conversion type	Options are: <ul style="list-style-type: none"> • Display (Default) • Scene
Input format	Select the input transfer characteristic function (not automatically detected). Options are: <ul style="list-style-type: none"> • SDR (Default) • HLG • PQ • S-Log3

Menu Option	Operation
Output format	Set the output format. Options are: <ul style="list-style-type: none"> • SDR (Default) • HLG • PQ • S-Log3
PQ level	Sets the grading level (Lw) of the input (PQ > HLG) or output (PQ > PQ). Options are: <ul style="list-style-type: none"> • 1k (1000cd/m2) (Default) • 2k • 4k • 10k (10000cd/m2)
Clipping	For some HDR conversions where the maximum supported output level is less than the source level clipping or limiting is applied. <ul style="list-style-type: none"> • Hard (Default): High brightness levels not supported in the selected output format are hard clipped to the maximum supported brightness level • Soft: Brightness levels close to the maximum supported in the selected output format are progressively attenuated to avoid an abrupt cut-off A soft clip is a non-reversible process
White clip level	Determines the output clip level for those conversions in which the output range is clipped, i.e. <ul style="list-style-type: none"> • HLG > SDR • PQ > SDR/HLG/PQ/SLog3 • SLog3 > SDR/HLG/PQ Note: For all other conversions it has no effect White clip level can be adjusted from 80% to 109% in steps of 1%. Default is 100%.
White clip preset	Manual takes the value from the slider. In narrow (100%) and full (109%) the slider value is ignored. Options are: <ul style="list-style-type: none"> • Manual • Narrow (Default) • Full
Display mapping mode	Choice of display mapping function as defined in BT.2390. Choices are: <ul style="list-style-type: none"> • YRGB (method 3) • RGB (method 4) (Default)
Scale and gamma	Scale and gamma adjustments. <ul style="list-style-type: none"> • Gamma adjust: Adjusts the gamma from -0.20 to +0.20 in 0.01 steps. Default is 0.00. • Gamma adjust mode: Choose between YRGB or RGB. Default is RGB. • Scale adjust: Adjusts the scale from 0.70 to 1.30 in 0.01 steps. Default is 1.00. Note: User is recommended to leave these at preset values

Menu Option	Operation
SDR enhancement	Variable enhancement for SDR output (only active when SDR input is selected).
SDR enhance threshold	Specifies threshold at which enhancement starts (No enhancement is applied below this threshold). Adjusts threshold from 0.2 to 0.8 in 0.7 steps. Default is 0.7.
SDR enhance gain	Provides gain for input values above the linear threshold (as set by Threshold control). Adjusts gain from 1.0 to 4.0 in 0.1 steps. Default is 1.5. Note: The gain corresponds to the gain for a unity input.
SDR enhance presets	Options are: <ul style="list-style-type: none"> • Manual • Low (default) (threshold=0.7, gain=413) • Medium (threshold=0.6, gain=1.8) • High (threshold=0.5, gain=2.5)
SDR enhance mode	RGB mode applies the enhancement independently to each of the RGB components, whereas YRGB mode calculates it from the luma and then applies it equally to each of the RGB components, thereby preserving hue. Options are: <ul style="list-style-type: none"> • RGB (default) • YRGB
SDR OE mode	Adjustment to linear section of the gamma function specified in BT.709. Options are: <ul style="list-style-type: none"> • True BT.709 (default) • Gamma 0.5
Use imported LUT	Enable check box if an internal or imported 3D-LUT is to be used. If check box is enabled, but no LUT has been loaded by user, the unity pass-through LUT is used.
Pre-load	Shows all currently imported 3D-LUT files and allows user to select one of them.
Delete LUT	Click to delete the LUT currently selected on the Pre-load List . Select Confirm to delete or Cancel to abandon the deletion.
LUT type	Selects input and output scaling of imported LUTs. Options are: <ul style="list-style-type: none"> • Type 1 • Type 2 • Type 3 (Default)
Colorimetry	Allow the user to specify the colorimetry. See on page 74 for more information.

Post-processing

To be applied at the end of the processing chain.

Process Amplifier (Proc Amp)

Menu Option	Operation
Enable proc amp	Select Enable proc amp to activate Proc Amp functions.
Master gain	Adjusts the contrast and saturation together from -6dB to 6dB in 0.1dB steps. Default is 0.0dB.
Contrast	Adjusts the contrast from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Saturation	Adjusts the color saturation from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Black level	Adjusts the black level from -100mV to +100mV in 0.8mV steps. Default is 0mV.
Gamma	Adjusts the luma gamma from 0.4 to 1.7 in 0.1 steps. Preset is 1.0.

Color Correct

Menu Option	Operation
Enable correct	Select Enable pre color correction to activate Color correct functions.
Red lift	Red channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Red gain	Red gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Red gamma	Red gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Green lift	Green channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Green gain	Green gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Green gamma	Green gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Blue lift	Blue channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Blue gain	Blue gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Blue gamma	Blue gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.

Audio

The **Audio** button allows you to access audio routing, shuffling and control menus.



Note

Embedded audio, MADI, Analogue and AES are supported by all models.

Terminology in this section:

- **Source audio** (input pairs or channels) refers to audio associated with the incoming source material, which could be embedded audio, balanced or unbalanced AES (audio option only) or analog audio (audio option only);
- **Process pairs or channels** (sometimes abbreviated to *process pr* in the menus) refer to audio processing channels, to which input audio pairs may be assigned;
- **Output pairs or channels** refer to audio coming from the processing channels which is routed to the unit outputs. Output audio can be embedded, balanced or unbalanced AES (audio option only) or analog (audio option only).

Audio menus are:

- Audio input routing (process pair routing)
- Audio delay
- Audio gain
- Audio output mapping

These are described in the sections below.

Audio Input Routing (Process Pair Routing)

Routes the audio pair from the relevant input to the required process pair. To select the audio source to be passed to each audio processor, first select the process channel from the list of process pairs (1 to 16), then select the input audio pair from the list below to assign to the chosen channel.

Source Audio	Available Choices
Embedded audio	Embedded 1 - 16
AES	AES 1 - 8 Note: AES 1 to 8 will only be selectable if the user has set those ports to be inputs
Analog	Analog 1 - 2
MADI	MADI Ch 1 & 2 - 63 & 64

For example, to use source audio from SDI Embedded 3 in audio processing channel 2:

- Press the **Audio** button on the front panel.
- Scroll to **Audio routing** then press the rotary control.
- Scroll to **Process pair 2** in the process pair list, then press the rotary control.
- Scroll to **Embedded 3** in the input pair list, then press the rotary control.
- Press the rotary control again to return to the previous menu.

- Scroll to the **Back** menu item and press the rotary control to return to the **Audio** menu.



Note

AES, Analog and MADI output are defined under common controls as they can only come from one of the channels in a multi-channel product.

Audio Delay

Audio delay enable the user to adjust the delay of all audio channels.

Audio Control	Available Choices
Audio delay	Audio delay can be adjusted for each of the 32 audio channels. The adjustment range is -42ms to +500ms in 1ms steps. The default value is 0ms. To adjust delay offset, first select the process channel from the process channel list (Process channel 1 to Process channel 32) then select the required delay offset using the rotary control. Alternatively, use the Master control to adjust the delay for all pairs at once: individual pair delay offsets are preserved and limited at the maximum and minimum delay values. With delay set to zero, the audio will be co-timed with the video.
Audio delay status	Shows the total delay per channel in ms.
Global delay status	Shows the current total video delay through the unit in ms.
Tone freq	Tone frequency can be selected from 100Hz to 10000Hz in steps of 100Hz. Default is 1000Hz.
Dolby E align	Dolby E alignment offset can be selected from -10 lines to +10 lines in steps of 1 line. Default is 0 lines.



Note

1 Global delay is applied to all channels. Individual channel delays are added/subtracted from this delay.

2 Channel delay is added instantaneously and will produce an audible disturbance.

3 Global delay is added or subtracted at the rate of 2ms/s and does not produce an audible disturbance. Allow time for the global delay to settle to the desired value.

4 The maximum audio delay (video processing delay + added audio delay) is limited to 500ms.

Audio Gain

Audio delay enable the user to adjust the audio gain per audio process channel prior to output mapping.

Audio gain can be adjusted from -18dB to +18dB in steps of 0.1dB. Default is 0dB.

Select the required output channel from the list of channels (Out Ch 1 to Out Ch 32), then adjust the gain using the rotary control. Alternatively, use the **Master** control to adjust the gain for all channels at once: individual channel gain offsets are preserved and limited at the maximum and minimum gain values.

Audio Output Mapping

Audio output mapping allows routing from each audio process channel or audio mixer channel to the output audio channel. Facilities to invert audio phase and insert tone or silence are also available from this menu.

Assigning an Output from a Processing Channel

Select the embedded output channel from the list of channels (Channel 1 to Channel 32).

A menu of choices for the selected channel is displayed. For example, if Channel 1 is selected, the menu choices are:

Audio Output Mapping	Available Choices
Process channel	Select process channel from 1 to 32.
Invert phase	Causes the phase of left and right audio channels to be inverted. This is useful for dealing with input audio discrepancies. Choices are: <ul style="list-style-type: none"> • Disable (default) • Enable
Routing	Selects the source of the final channel output router. Choices are: <ul style="list-style-type: none"> • Routing (default). • Tone (inserts tone into the chosen audio channel). • Silence (mutes the chosen audio channel).

Selecting **Process channel** displays the available process pairs. From the list of process channels, choose the process channel to route to the chosen output channel (1 to 32):

Example 1: To assign process channel 2 to output SDI embedded channel 8:

- Press the **Audio** button on the front panel.
- Scroll to **Audio Output Mapping** then press the rotary control.
- Scroll to **Channel 8** in the output pair list, then press the rotary control.
- Scroll to **Ch 8 source** in the list, then press the rotary control.
- Scroll to **2** in the list, then press the rotary control.
- Scroll to the **Back** button, then press the rotary control again to return to the **Audio Output Mapping** main menu.

Example 2: To invert phase for a chosen audio channel:

- Select the required output channel from the list of channels (Channels 1 to 32)
- Turn **Invert phase** to **On**.



Note

Phase invert is available for PCM audio only.



Note

The **Audio Output Mapping** menu allows any configuration of audio channels to be routed to the output. Illegal combinations will result in the output being forced to silence.

Enhance

The **Enhance** button provides horizontal and vertical enhancement tools. The main uses of the enhancer functions are to control aliasing in down-conversion, and to add a subjective impression of sharpness in up-conversion. Individual controls are available to make separate adjustments to horizontal and vertical detail, over different frequency bands, in order to achieve the desired subjective effect.

If no enhancement is required, ensure that **Preset** is selected.



Note

With the web browser interface, Enhancer controls are available from the **Enhance** menu.

UHD Up Convert



Note

These settings apply only when converting from HD to UHD.

Preset

- **Confirm** to set all enhancers to default preset values.
- **Cancel** to leave enhancers at the current values.

Vertical Filter

- **Normal** (default): Passes all source vertical frequencies without attenuation or boost.
- **Boost 1**: Applies a small amount of boost within the HD frequency band. This can increase the visual sharpness of the up-converted image.
- **Boost 2**: Applies a larger amount of boost beginning at a lower frequency.

Horizontal Filter

- **Narrow 2**: Reduces horizontal bandwidth of HD source prior to up-conversion. May be useful when HD source contains excessive enhancement (ringing), which may be unacceptable in UHD.
- **Narrow 1**: Applies a small reduction in horizontal bandwidth of HD source prior to up-conversion. May be useful when HD source contains some enhancement, which may be unacceptable in UHD.
- **Normal** (default): Passes all source horizontal frequencies without attenuation.

Horizontal Enhance

Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures.

- **Off** (default)
- **1**
- **2**
- **3**
- **4**

- **5**
- **6**

Horizontal Enhance Frequency Band

Selects the frequency band to which the **Horizontal enhance** filter is applied. Boost can be set to operate on either the highest or mid frequencies.

- **Mid**
- **High** (default)

UHD Noise Reduce

Multi-band noise reduction reduces noise visibility in up-converted images, without introducing visual artifacts.

This process will not reduce noise that is already visible in the HD source.

- **Off** (default)
- **1**
- **2**

Clean Edge

Adaptive processing to remove 'ringing' often evident in up-conversion processing. Normally enabled.

- **Disable**
- **Enable** (default)

Horizontal Transient Enhance

Sharp vertical edge detail in the HD source, such as captions and graphics, is identified. The gradient of these transients is increased to occupy the full UHD bandwidth. Adaptive processing ensures that textures are preserved.

- **Off** (default)
- **1**
- **2**
- **3**

Vertical Transient Enhance

Sharp horizontal edge detail in the HD source, such as captions and graphics, is identified. The gradient of these transients is increased to occupy the full UHD bandwidth. Some degradation of fine textures may be evident when using higher settings.

- **Off** (default)
- **1**
- **2**
- **3**

UHD Down Convert



Note

These settings apply only when converting from UHD to HD.

Preset

- **Confirm** to set all enhancers back to default preset values.
- **Cancel** to leave enhancers at the current values.

Vertical Filter

- **Narrow 3**: Reduces vertical bandwidth of the down-conversion process. May be useful when the UHD source contains high levels of mid-frequency content.
- **Narrow 2**: As above, but with less bandwidth reduction.
- **Narrow 1**: As above, but with minimal bandwidth reduction.
- **Normal** (default): Optimized bandwidth setting. Passes all vertical frequencies compatible with the HD output.
- **Wide 1**: Allows some alias frequencies to pass, which may give an apparent increase in picture sharpness.
- **Wide 2**: Allows a wider band of alias frequencies to pass.
- **Boost 1**: Applies a small amount of boost within the HD frequency band. This can increase the visual sharpness of the down-converted image.
- **Boost 2**: Applies a larger amount of boost beginning at a lower frequency.

Horizontal Filter

- **Narrow 2**: Reduces horizontal bandwidth of the down-conversion process. May be useful when the UHD source contains high levels of mid-frequency content.
- **Narrow 1**: As above, but with less bandwidth reduction.
- **Normal** (default): Optimized bandwidth setting. Passes all horizontal frequencies compatible with the HD output.
- **Wide 1**: Allows some alias frequencies to pass, which may give an apparent increase in picture sharpness.
- **Wide 2**: Allows a wider band of alias frequencies to pass.

Horizontal Enhance

Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures.

- **Off** (default)
- **1**
- **2**
- **3**
- **4**
- **5**
- **6**

Horizontal Enhance Frequency Band

Boost can be set to operate on either the highest or mid frequencies.

- **Mid**
- **High** (default)

UHD/UHD Convert

Menu Option	Operation
Preset	Click to set all enhancers to default preset values.
Vertical filter	Select as required: <ul style="list-style-type: none"> • Narrow 2: Reduces the vertical bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction. • Normal (default): Optimized bandwidth setting. Passes all vertical frequencies. • Wide: For some down conversion modes, Wide allows extended bandwidth to pass. This may give an apparent increase in picture sharpness. In up conversion modes, this setting is the same as Normal. • Boost 1: Boosts high frequencies with UHD -UHD conversions. • Boost 2: As Boost 1, but giving greater boost or more alias.
Horizontal filter	Select as required: <ul style="list-style-type: none"> • Narrow 2: Reduces the horizontal bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction • Normal: Optimized bandwidth setting. Passes all horizontal frequencies compatible with the output format. • Wide 1: Will have limited effect in UHD to UHD conversion. • Wide 2: Will have limited effect in UHD to UHD conversion.

Menu Option	Operation
Horizontal enhance	<p>Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures.</p> <p>Select a level as required.</p> <ul style="list-style-type: none"> • Off (default) • 1 • 2 • 3 • 4 • 5 • 6
Frequency band	<p>Boost can be set to operate on either the highest or mid frequencies. Select a level as required.</p> <ul style="list-style-type: none"> • Mid • High (default)

HD/HD Convert

Menu Option	Operation
Preset	Click to set all enhancers to default preset values.
Vertical filter	<p>Select as required:</p> <ul style="list-style-type: none"> • Narrow 2: Reduces the vertical bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction. • Normal (default): Optimized bandwidth setting. Passes all vertical frequencies. • Wide: For some down conversion modes, Wide allows extended bandwidth to pass. This may give an apparent increase in picture sharpness. In up conversion modes, this setting is the same as Normal. • Boost 1: Boosts high frequencies with HD-HD conversions. • Boost 2: As Boost 1, but giving greater boost or more alias.
Horizontal filter	<p>Select as required:</p> <ul style="list-style-type: none"> • Narrow 2: Reduces the horizontal bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction • Normal (default): Optimized bandwidth setting. Passes all horizontal frequencies compatible with the output format. • Wide 1: Will have limited effect in HD to HD conversion. • Wide 2: Will have limited effect in HD to HD conversion.

Menu Option	Operation
Horizontal enhance	Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures. Select a level as required. <ul style="list-style-type: none"> • Off (default) • 1 • 2 • 3 • 4 • 5 • 6
Frequency band	Boost can be set to operate on either the highest or mid frequencies. Select a level as required. <ul style="list-style-type: none"> • Mid • High (default)

Memory

The **Memory** button allows the unit to be reset to one of 10 previously saved configurations. Available functions are:

Menu Option	Operation
Memory Select	Selects the required memory to recall, save or clear.
Recall Memory	Press to load the contents of the selected memory.
Save Memory	Press to save current configuration to the selected memory. Please note network settings are NOT saved.
Clear Memory	Press to clear the selected memory.
Last Recalled Memory	Reports the name of the last recalled user memory.

Metadata

The **Metadata** menu allows control of all closed caption and teletext information.

WST origin & status

The unit can pass World System RDD-08 teletext for HD and UHD. Teletext output can be enabled or disabled, and the input and output lines to be used specified.

SMPTE RDD08 - Up to 15 lines can be encoded in the OP47 packet. A maximum of three packets are allowed on the output, each with individual line number controls. The number of output OP47 packets is decided by the number of valid WST lines decoded on the input. The first five WST lines are encoded in the first OP47 packet, the next five in the second OP47 packet, and so on.

SMPTE 2031 - Up to 5 SMPTE 2031 packets are allowed to be inserted on the output, with each packet containing data from one SD teletext line. The first five lines selected on the input are encoded in the 2031 packet. All packets will be placed on the line selected by the **Out line** controls.

Menu Option	Sub-Option	
WST Origin & Status		WST origin line selection. Choose: <ul style="list-style-type: none"> • Off (default) • On for each of Line 7 - Line 22. The line number corresponds to the line number encapsulated within the RDD08 (OP47)/S2031 packet and not the line number on which the packets are present.
SMPTE RDD08/ST2031	In Packet Type	<ul style="list-style-type: none"> • SMPTE RDD08 (default) • SMPTE 2031
	Out Packet Enable	<ul style="list-style-type: none"> • Off (default) • On
	Out Packet Type	<ul style="list-style-type: none"> • SMPTE RDD08 (default) • SMPTE 2031
	RDD08	<p>Out line pkt 1: select line from 8 to 20. Default is line 10.</p> <p>Out line pkt 1 status: reports selected output line number.</p> <p>Out line pkt 2: select line from 8 to 20. Default is line 10.</p> <p>Out line pkt 2 status: reports selected output line number.</p> <p>Out line pkt 3: select line from 8 to 20. Default is line 10.</p> <p>Out line pkt 3 status: reports selected output line number.</p>
	ST2031	<p>Data UID select: for each out packet, 1 to 5, select from:</p> <ul style="list-style-type: none"> • Teletext subtitle • Teletext non-subtitle • Inverted teletext

CEA-708 captions

The **CEA-708 captions** controls allow closed captions to be enabled or disabled, and the input and output lines used to be specified.

Menu Option	Operation
Input status	Reports the captions that have been detected.
Output line	Selects the output line on which to insert CEA-708 packets; the range is from line 8 to line 20 in one-line steps. The default is line 10.
Output status	Reports on which output line the captions are being inserted.

System

The **System** button enables you to access the unit's genlock, metadata and system parameters, such as network and RollCall settings.

Menu Option	Operation
AES Audio Input/Output	Allows AES output audio pairs to be mapped to the defined AES output pairs. See AES Audio I/O on page 53.
Analog Audio Input/Output	Allows output audio pairs to be mapped to the outgoing analog pairs. See Analog Audio I/O on page 54.
MADI Audio Output	Maps the selected audio process channels 1 to 32 (pairs 1 to 16) to the defined MADI output pair. See MADI Audio Output on page 54.
AUX Video Output	Maps the required channel to the AUX output. See AUX Video Output on page 55.
Genlock	Locks the output video clock to the genlock source. See Output, any of Ch1/Ch2 Pair 1 to Pair 16. on page 53.
Network	Controls network settings. See Serial Number on page 57.
Unit Status	Displays information about the status of the unit. See Unit Status on page 57.

AES Audio I/O

Menu Option	Operation
AES port control	AES port control enables AES output ports or use as input and maps the selected embedded audio pair to the defined AES output pair. Each AES port can be selected from the AES port list (AES 1 to AES 8), and then be assigned as: <ul style="list-style-type: none"> • Use as input (default), or • Output, any of Ch1/Ch2 Pair 1 to Pair 16.
AES bal/unbal	This selection applies only to the AES port controls which are set as inputs. Balanced or Unbalanced audio is selected from the Audio menu. Select AES I/O , then select AES bal/unbal . Select Balanced or Unbalanced as required. Default is balanced.
AES status	Reports the present AES input packet when the respective AES port is assigned to "Use as input". For any other AES port selection the status control will display "Used as output".

Analog Audio I/O

Analog I/O	Available Choices
Analog output mapping	Analog out 1: Ch1 Pair 1 to Pair 16 Ch2 Pair 1 to Pair 16
	Analog out 2: Ch1 Pair 1 to Pair 16 Ch2 Pair 1 to Pair 16
Analog DAC line-up level	Adjusts the analog audio DAC line-up level for analog audio Out Pair 1 , from 12dB to 24dB in steps of 0.5dB. Default is 18dB.
	Adjusts the analog audio DAC line-up level for analog audio Out Pair 2 , from 12dB to 24dB in steps of 0.5dB. Default is 18dB.
Analog ADC headroom	Adjusts the analog audio ADC headroom level for analog audio In Pair 1 , from 12dB to 24dB in steps of 0.5dB. Default is 18dB.
	Adjusts the analog audio ADC headroom level for analog audio In Pair 2 , from 12dB to 24dB in steps of 0.5dB. Default is 18dB.
Analog audio status	Reports the present of analog input pair status for Out Pair 1 and Out Pair 2 .

MADI Audio Output

The **MADI I/O** menu maps the selected audio process channels 1 to 32 (pairs 1 to 16) to the defined MADI output pair. MADI channels 33 to 64 (pairs 17 to 32) will be flagged as inactive as per MADI specifications.

MADI I/O	Available Choices
MADI output mapping	MADI out 1-16: Ch1 Pair 1 to Pair 16 Ch2 Pair 1 to Pair 16
MADI input status	Reports the present of MADI input pair status for MADI out 1 to MADI out 32 .



Note

MADI router allows the user to select the first 32 channels from any of the Process channels. MADI out 33 to 64 will be set as inactive channels and muted.

AUX Video Output

The **AUX Output (Video)** menu maps the required channel to the AUX output.

Video AUX Output	Available Choices
AUX Output	List of channels: <ul style="list-style-type: none"> • Channel 1 • Channel 2

Genlock

Genlock locks the output video clock to the genlock source (input or reference), regardless of the video standard. If the genlock source and the video output are the same frame rate, for example, 50 Hz or 59.94 Hz, Genlock locks the output to the vertical phase of the genlock source, giving consistent and repeatable delay. If the video output frame rate differs from the genlock source frame rate, the output will 'clock lock' to the genlock source. Clock lock ensures that the output audio 48kHz clock remains locked to the genlock source.

When attempting to pass non-PCM audio (other than Dolby-E), ensure that Genlock is enabled. If using an external reference, it must be clock-locked to the input video.

Menu Option	Operation
Genlock source	<ul style="list-style-type: none"> • Reference (default): locks to the incoming reference. • Channel 1 • Channel 2 • Free run: locks the output video to an internal reference clock.
Reference standard	Shows the standard detected on the reference input
Genlock status	Shows the status of the currently assigned reference for each channel. List of channels: <ul style="list-style-type: none"> • Channel 1 • Channel 2 Status: <ul style="list-style-type: none"> • Free run • Genlock • Clock lock
Vertical timing	Adjusts the vertical timing of the output signal with respect to the reference signal, from line -562 to line 562 in steps of 1 line. Default = 0 line
Horizontal timing	Adjusts the horizontal timing of the output signal with respect to the reference signal, from pixel -2640 to pixel 2640 in steps of 1 pixel. Default = 0 pixel



Note

Genlock timing adjustments will take effect only when the Genlock source is set to **Reference**.

Network

Control	Function
IP configuration	Select: <ul style="list-style-type: none"> • Fixed Address for the unit to use a fixed IP address. • DHCP for the unit to use an IP address assigned by DHCP.
Current IP configuration	Displays the current IP status. Possible values are: <ul style="list-style-type: none"> • Fixed Address • DHCP
Current IP address	Reports the IP address currently assigned to the unit.
Current IP gateway	Reports the IP address of the gateway currently used by the unit.
Current IP netmask	Reports the IP netmask currently used by the unit.
Set IP address	To manually assign an IP address: <ul style="list-style-type: none"> • Press the rotary control to select Set IP address; an input field is displayed. • Enter the required IP address, using the rotary control to move the cursor and the front panel buttons to enter numbers. • Press the rotary control when complete. <p>Note: this will not take effect until Apply IP changes is selected.</p>
Set IP gateway	To specify the IP gateway which the unit is to use: <ul style="list-style-type: none"> • Press the rotary control to select Set IP gateway; an input field is displayed. • Enter the IP address of the required gateway, using the rotary control to move the cursor and the front panel buttons to enter numbers. • Press the rotary control when complete. <p>Note: this will not take effect until Apply IP changes is selected.</p>
Set IP netmask	To specify the IP gateway which the unit is to use: <ul style="list-style-type: none"> • Press the rotary control to select Set IP netmask; an input field is displayed. • Enter the netmask to be used, using the rotary control to move the cursor and the front panel buttons to enter numbers. • Press the rotary control when complete. <p>Note: this will not take effect until Apply IP changes is selected.</p>
Apply IP changes	Select: <ul style="list-style-type: none"> • Confirm to commit the changes made to IP settings. • Cancel to leave IP settings at the current values.
Interface status	Reports network connection status.
MAC address	Reports the MAC number of the unit.

Unit Status

Menu Option	Operation
Serial number	Displays the unit serial number.
Software version	Displays version number of the software installed on the unit.
PSU A	State and measured voltage (e.g. OK: 12Vdc; or FAIL:missing) of PSU A.
PSU B	State and measured voltage (e.g. OK: 12Vdc; or FAIL:missing) of PSU B.
Up time	Indicates the duration, in days, hours, and minutes, since the previous power cycle.
Temperature	Displays the internal temperature, measured at the hottest point.
Fans 1 ... 3	Displays the status of the fans.
Restart	Reboots the unit.

Operation Using RollCall

This section contains information on using the KudosPro ULC2000 with RollCall.

Template Pages

The following pages are available for KudosPro ULC2000. Please note that what is displayed on these pages is dependent on the unit's capabilities. So, the illustrations in this manual may differ somewhat from what is seen in your environment.

- **Input/Output** - see [page 59](#).
- **Video Processing** - see [page 62](#).
- **Convert Processing** - see [page 66](#).
- **SDR/HDR** - see [page 69](#).
- **Audio Input Routing** - see [page 76](#).
- **Audio Delay** - see [page 80](#).
- **Audio Gain** - see [page 82](#).
- **Audio Output Mapping** - see [page 83](#).
- **Enhance** - see [page 85](#).
- **Memory** - see [page 92](#).
- **Metadata** - see [page 93](#).
- **ANC Bridge** - see [page 96](#).
- **Timecode** - see [page 98](#).
- **Status** - see [page 100](#).
- **Network** - see [page 103](#).
- **SNMP** - see [page 105](#).
- **Front Panel** - see [page 110](#).
- **Genlock** - see [page 107](#).

Setting Values

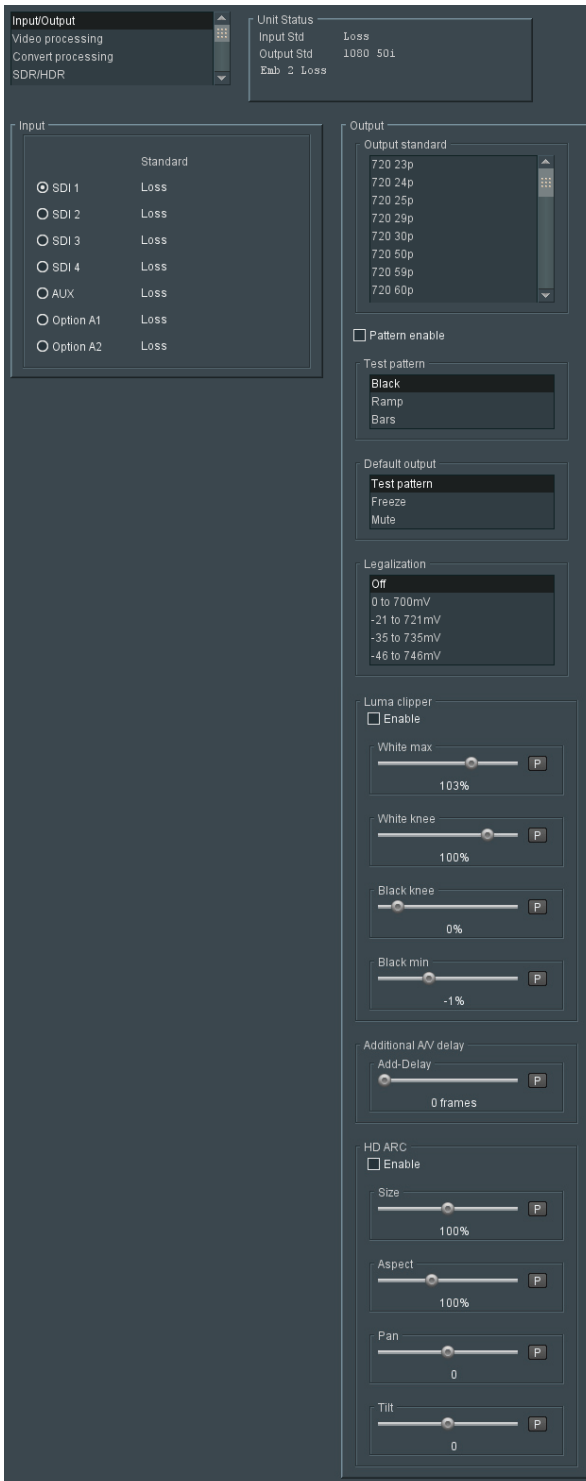
Many of the settings within the templates have values, either alpha or numeric.

When setting a value in a field, the value, whether text or a number, must be set by pressing the ENTER key, or clicking the **S Save Value** button.

Clicking an associated **P Preset Value** button returns the value to the factory default setting.

Input/Output

The Input/Output page allows input sources and output destinations to be selected.



Input/Output Page

The following facilities are available from this page:

Option	Operation
Input	<p>Selects BNC, HDMI or SFP input. Status shown next to the radio button (e.g. loss, current detected standard)</p> <p>Choose from:</p> <ul style="list-style-type: none"> • SDI 1 (Default) • SDI 2 • SDI 3 • SDI 4 • AUX • Option A1* • Option A2* <p>The currently selected input is highlighted.</p> <p>*Available only if an Rx module is fitted to the SFP slot.</p>
Input status	<p>Reports presence of video on each of the inputs.</p> <p>Valid values are:</p> <ul style="list-style-type: none"> • Detected format • Loss • Invalid: Indicates unsupported standard
Output standard	<p>Use this control to select the required output standard for the active channel. Available options are listed on Standards, on page 20.</p> <p>Note: Only allowed standards will be active.</p>
Test pattern	<p>Set a test pattern on the output.</p> <p>Choose from:</p> <ul style="list-style-type: none"> • Off (Default) • Black • Ramp • Bars
Default output	<p>Defines the output in case of input loss.</p> <p>Choose from:</p> <ul style="list-style-type: none"> • Test Pattern (Default) • Freeze • Mute - mutes SDI output
Legalization	<p>The Legalizer ensures that the output video stays within the legal RGB gamut limit, making it suitable for the broadcast signal chain. To achieve this, the legalizer reduces the gain equally on all channels. Anything in the RGB space above the selected value (e.g. 700mV) is scaled down to that value. Anything in the RGB space below 0mV is clipped to 0mV. This is a good compromise between minimizing hue change and raising apparent brightness.</p> <p>Legalizer choices are:</p> <ul style="list-style-type: none"> • Off (Default) • 0 to 700mV • -21 to 721mV • -35 to 735mV • -46 to 746mV

Option	Operation
Luma clipper	<p>The Luma clipper limits the luminance of the signal at the output.</p> <p>Enable Luma clipper when checked</p> <ul style="list-style-type: none"> • White max: The upper limit (hard clip point) of the clipper. Choose between 90% to 109% in 1% steps. Default is 103%. • White knee: Sets a “soft” clip from the knee to the hard white clip point. Choose between 60% to 109% in 1% steps. Default is 100%. • Black knee: Sets a “soft” clip from the knee to the hard black clip point. Choose between -7% to 60% in 1% steps. Default is 0%. • Black min: The lower limit (hard clip point) of the clipper. Choose between -7% to 60% in 1% steps. Default is -1%.
Additional A/V delay	<p>For progressive sources, this control adds additional video delay from 0 to 8 frames in steps of 1 frame. Preset = 0 frame.</p> <p>For interlaced sources, this control adds additional video delay from 0 to 8 fields in steps of 1 field. Preset = 0 field.</p>
HD ARC	<p>Enable HD ARC (Aspect Ratio Control) to apply post scaling to HD output.</p> <ul style="list-style-type: none"> • Size: Adjusts the size of the whole output image while maintaining the aspect ratio. Range is 80% to 120% in steps of 1%. Default is 100%. • Aspect: Adjusts the aspect ratio of the output image. Range is 70% to 150% in steps of 1%. Default is 100%. • Pan: Adjusts the horizontal position of the output image. Range is -50 to +50 pixels in steps of 1 pixel. Default is 0 pixel. • Tilt: Adjusts the vertical position of the output image. Range is -50 to +50 lines in steps of 1 line. Default is 0 line.

Video Processing

Provides controls allowing various types of signal processing to be applied to the signal being converted.



Video Processing Page

The following facilities are available from this page:

Pre-processing

Allows video inconsistencies to be corrected. To be applied before any other color processing.

Process Amplifier (Proc Amp)

Menu Option	Operation
Enable proc amp	Select Enable proc amp to activate Proc Amp functions.
Master gain	Adjusts the contrast and saturation together from -6dB to 6dB in 0.1dB steps. Default is 0.0dB.
Contrast	Adjusts the contrast from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Saturation	Adjusts the color saturation from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Black level	Adjusts the black level from -100mV to +100mV in 0.8mV steps. Default is 0mV.
Gamma	Adjusts the luma gamma from 0.4 to 1.7 in 0.1 steps. Preset is 1.0.
YC offset	Adjusts the horizontal chroma shift, for use when correcting upstream luma-chroma displacement. The adjustment range is -20 to 20 in steps of 2 luma clocks. At the input picture edge, zero chroma is shifted into the active picture area. If the ARC is set to show less than the full width of the input picture, valid input picture chroma is shifted into the output picture area. Default is 0.

Color Correct

Menu Option	Operation
Enable correct	Select Enable pre color correction to activate Color correct functions.
Red lift	Red channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Red gain	Red gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Red gamma	Red gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.

Menu Option	Operation
Green lift	Green channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Green gain	Green gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Green gamma	Green gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Blue lift	Blue channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Blue gain	Blue gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Blue gamma	Blue gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.

Post-processing

To be applied at the end of the processing chain.

Process Amplifier (Proc Amp)

Menu Option	Operation
Enable proc amp	Select Enable proc amp to activate Proc Amp functions.
Master gain	Adjusts the contrast and saturation together from -6dB to 6dB in 0.1dB steps. Default is 0.0dB.
Contrast	Adjusts the contrast from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Saturation	Adjusts the color saturation from -6dB to +6dB in 0.2dB steps. Default is 0dB.
Black level	Adjusts the black level from -100mV to +100mV in 0.8mV steps. Default is 0mV.
Gamma	Adjusts the luma gamma from 0.4 to 1.7 in 0.1 steps. Preset is 1.0.

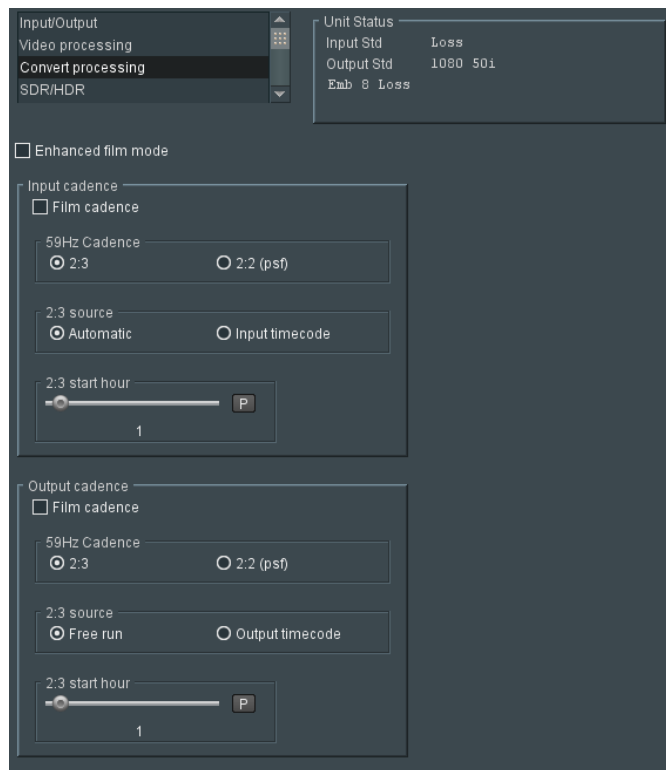
Color Correct

Menu Option	Operation
Enable correct	Select Enable pre color correction to activate Color correct functions.
Red lift	Red channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Red gain	Red gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Red gamma	Red gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Green lift	Green channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Green gain	Green gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Green gamma	Green gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.
Blue lift	Blue channel offset can be adjusted from -200mV to +200mV in steps of 0.8mV. Default is 0mV.
Blue gain	Blue gain can be adjusted from -6dB to +6dB in steps of 0.2dB. Default is 0dB.
Blue gamma	Blue gamma can be adjusted from 0.40 to 1.70 in steps of 0.05. Default is 1.00.

Convert Processing

The Convert Processing page provides a set of solutions to enable optimized conversion of film-originated content. Film-originated content may be transported by standards supporting the original film frame rate, such as 1080 23.98p. Film-originated content may also be packed into interlaced standards using a rule-based method to map source frames to interlaced fields. In this case, the interlaced standard's content is described as having a *film cadence*.

In order to perform high quality conversion of film-originated content, the cadence must be identified and used to adapt the interpolation process. **Film mode** (see [Interlaced Inputs](#), on page 87) also permits the synthesis of film cadence in the output.



Convert Processing Page

The following facilities are available from this page:

Input cadence

The Input Cadence controls allow the user to define any cadence associated with the input video.

Menu Option	Operation
Film Cadence	<p>If the input content is film-originated with a 2:3 cadence, or simulates film-originated content, the Film cadence check box should be enabled. Otherwise, it should be disabled.</p> <p>Note: This feature is not available when converting UHD 59p to UHD 23p, or UHD 60p to UHD 24p.</p> <p>Default = Disabled.</p> <p>Example 1: Input UHD 59p (with embedded 3:2 cadence), Output 1080 23p. Input frame sequence: A, A, B, B, B, C, C, D, D, D ... When cadence is On the output frame sequence will be: A, B, C, D ... When cadence is Off the output will be a linear frame rate conversion.</p>
59Hz Cadence	<p>If the input is film-originated and its frame rate is 59.94Hz, then the cadence should be set as either:</p> <ul style="list-style-type: none"> • 2:3 (default) • 2:2 (psf)
2:3 Source	<p>When set to Automatic (default), the input cadence will be determined by the cadence detection circuit. This feature is useful when the source material contains mixed cadences.</p> <p>When set to Input timecode, the user defines the relationship between timecode and the 2:3 sequence. This feature is useful when the source material contains known continuous 2:3. This setting removes any uncertainty that may be associated by use of the sequence detector (automatic mode).</p>
2:3 Start hour	<p>This control allows the user to define the position of timecode when the 2:3 sequence begins. The assumption is made that the start of the 2:3 sequence is aligned with the start of program, and under normal working practices, that the start of program is coincident with an integer hour value.</p> <p>This control is active only when 2:3 is set to Input timecode and Drop-Frame Timecode is present. For non-Drop Frame Timecode sources this control has no effect.</p> <p>Control is available from 1 hour to 23 hours, in steps of 1 hour.</p> <p>The default is 1 hour.</p>

Output cadence

Allows the insertion of film cadence on the output. Output frame rate must be 50, 59 or 60Hz.

For all other output frame rates, cadence processing is automatically disabled.

Example 1:

Input 1080 23p, Output UHD 59p.

Input frame sequence: A, B, C, D ...

When the **Film cadence** check box is enabled, the output frame sequence will be A, A, B, B, B, C, C, D, D, D ...

When the **Film cadence** check box is disabled, the output will be a linear frame rate conversion.

Example 2:

Input 720 25p, Output UHD 50p

Input frame sequence: A, B, C, D ...

When the **Film cadence** check box is enabled, the output frame sequence will be: A, A, B, B, C, C, D, D ...

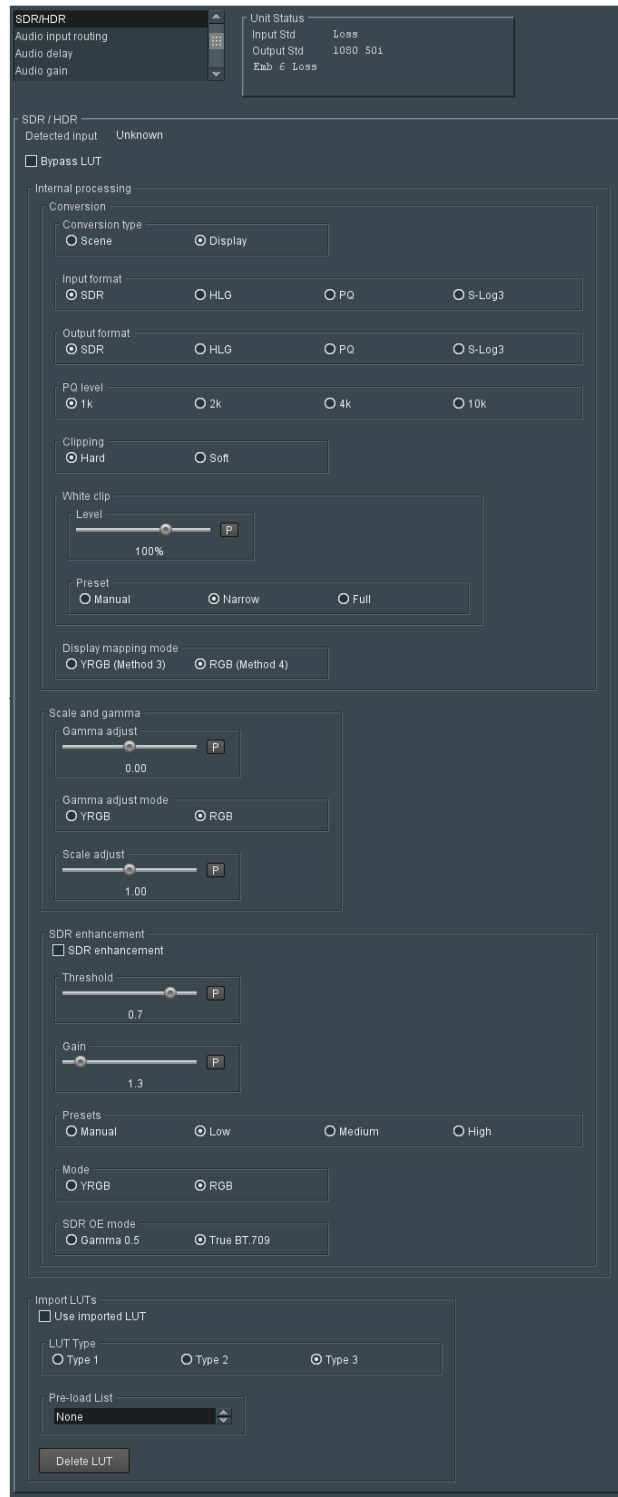
When the **Film cadence** check box is disabled, the output will be a linear frame rate conversion.

Default = **Disabled**

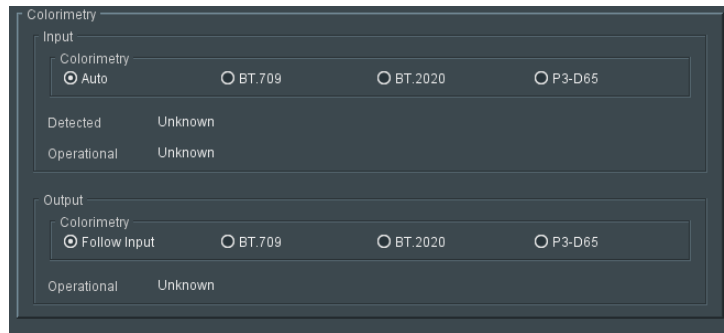
Menu Option	Operation
2:3 Source	<p>If the output is 59Hz (60Hz) and a 2:3 cadence style is selected, this control allows the sequence to be locked to output timecode.</p> <p>When set to Free run (default) the output 2:3 cadence starting point is not defined. The output will have continuous 2:3, but may vary from conversion to conversion.</p> <p>When set to Output timecode, the user defines the point where the 2:3 sequence starts relative to timecode.</p>
59Hz Cadence	<p>If the output is to have a film cadence associated with it and its frame rate is 59.94Hz, then the cadence should be defined as either:</p> <ul style="list-style-type: none"> • 2:3 (default) • 2:2 (psf)
2:3 Start hour	<p>This control allows the user to define the starting position of the 2:3 sequence with respect to timecode. It is active only when 2:3 is set to Output timecode and the Timecode generator is set to Drop-Frame, or, when following input timecode, the source has Drop-Frame Timecode present. When operating with non-Drop Frame Timecode this control has no effect.</p> <p>Control is available from 1 hour to 23 hours, in steps of 1 hour. Default is 1 hour.</p>

SDR/HDR

The SDR/HDR menu allows HDR parameters to be configured.



SDR/HDR Page 1



SDR/HDR Page 2

HDR adjustments are available for some conversions only:

	SDR Out	HLG Out	PQ Out	S-Log3 Out
SDR In				
HLG In	Clip		PQ Level (out)	
PQ In	Clip	PQ Level (in) ³	PQ Level (out) ²	Clip ¹
S-Log3 In	Clip	Clip	PQ Level (out)	



Note

1 A clip is applied for PQ levels (in) beyond 4000cd/m². Inputs graded at 4000cd/m² or less will not be clipped.

2 Where the selected PQ level (out) is less than the incoming PQ level, soft clipping is applied as recommended in BT.2390.

Use the **PQ Level** control to set the grading level of the incoming PQ signal. Setting the PQ level to 10k when the content is graded at 1k will result in a low-brightness output.

Menu Option	Operation
Detected input	<p>Reports the detected SDR/HDR transfer function.</p> <p>Valid values are:</p> <ul style="list-style-type: none"> • SDR-TV • HLG HDR-TV • PQ HDR-TV • Unknown
Bypass LUT	<p>Allows the user to bypass the LUT i.e. no HDR/SDR or color.</p> <ul style="list-style-type: none"> • Disable bypass 3D-LUT (Default) • Enable bypass 3D-LUT <p>See About Look-up Tables (LUTs), on page 76, for more information.</p>
Conversion type	<p>Options are:</p> <ul style="list-style-type: none"> • Display (Default) • Scene
Input format	<p>Select the input gamma function (not automatically detected).</p> <p>Options are:</p> <ul style="list-style-type: none"> • SDR (Default) • HLG • PQ • S-Log3
Output format	<p>Set the output format.</p> <p>Options are:</p> <ul style="list-style-type: none"> • SDR (Default) • HLG • PQ • S-Log3
PQ level	<p>Sets the grading level (Lw) of the input (PQ > HLG) or output (PQ > PQ).</p> <p>Options are:</p> <ul style="list-style-type: none"> • 1k (Default) • 2k • 4k • 10k
Clipping	<p>For some HDR conversions where the maximum supported output level is less than the source level clipping or limiting is applied.</p> <ul style="list-style-type: none"> • Hard (Default): High brightness levels not supported in the selected output format are hard clipped to the maximum supported brightness level • Soft: Brightness levels close to the maximum supported in the selected output format are progressively attenuated to avoid an abrupt cut-off <p>A soft clip is a non-reversible process</p>

Menu Option	Operation
White clip level	<p>Determines the output clip level for those conversions in which the output range is clipped, i.e.</p> <ul style="list-style-type: none"> • HLG > SDR • PQ > SDR/HLG/PQ/SLog3 • SLog3 > SDR/HLG/PQ <p>Note: For all other conversions it has no effect</p> <p>White clip level can be adjusted from 80% to 109% in steps of 1%. Default is 100%.</p>
White clip preset	<p>Manual takes the value from the slider. In narrow (100%) and full (109%) the slider value is ignored.</p> <p>Options are:</p> <ul style="list-style-type: none"> • Manual • Narrow (Default) • Full
Display mapping mode	<p>Choice of display mapping function as defined in BT.2390.</p> <p>Choices are:</p> <ul style="list-style-type: none"> • YRGB (method 3) • RGB (method 4) (Default)
Scale and gamma	<p>Scale and gamma adjustments.</p> <ul style="list-style-type: none"> • Gamma adjust: Adjusts the gamma from -0.20 to +0.20 in 0.01 steps. Default is 0.00. • Gamma adjust mode: Choose between YRGB or RGB. Default is RGB. • Scale adjust: Adjusts the scale from 0.70 to 1.30 in 0.01 steps. Default is 1.00. <p>Note: User is recommended to leave these at preset values</p>
SDR enhancement	<p>Variable enhancement for SDR output (only active when SDR input is selected).</p>
SDR enhance threshold	<p>Specifies threshold at which enhancement starts (No enhancement is applied below this threshold).</p> <p>Adjusts threshold from 0.2 to 0.8 in 0.1 steps. Default is 0.7.</p>
SDR enhance gain	<p>Provides gain for input values above the linear threshold (as set by Threshold control).</p> <p>Adjusts gain from 1.0 to 4.0 in 0.1 steps. Default is 1.5.</p> <p>Note: The gain corresponds to the gain for a unity input.</p>
SDR enhance presets	<p>Options are:</p> <ul style="list-style-type: none"> • Manual • Low (default) (threshold=0.7, gain=4.0) • Medium (threshold=0.6, gain=5.0) • High (threshold=0.5, gain=5.0)
SDR enhance mode	<p>RGB mode applies the enhancement independently to each of the RGB components, whereas YRGB mode calculates it from the luma and then applies it equally to each of the RGB components, thereby preserving hue.</p> <p>Options are:</p> <ul style="list-style-type: none"> • RGB (default) • YRGB

Menu Option	Operation
SDR OE mode	Adjustment to linear section of the gamma function specified in BT.709. Options are: <ul style="list-style-type: none"> • True BT.709 (default) • Gamma 0.5
Use imported LUT	Enable check box if an internal or imported 3D-LUT is to be used. If check box is enabled, but no LUT has been loaded by user, the unity pass-through LUT is used.
Pre-load	Shows all currently imported 3D-LUT files and allows user to select one of them.
Delete LUT	Click to delete the LUT currently selected on the Pre-load List . Select Confirm to delete or Cancel to abandon the deletion.
LUT type	Selects input and output scaling of imported LUTs. Options are: <ul style="list-style-type: none"> • Type 1 • Type 2 • Type 3 (Default)
Colorimetry	Allow the user to specify the colorimetry. See on page 74 for more information.

About Look-up Tables (LUTs)

Look-up Tables (LUTs) are used by the unit when performing color conversions. Custom look-up tables can be imported to use instead of the on-board default LUT, and may be imported in the form of .cube files. For information on the Cube LUT specification, see <https://www.images2.adobe.com/content/dam/acom/en/products/speedgrade/cc/pdfs/cube-lut-specification-1.0.pdf>.

Up to 32 files can be imported, via the web interface only (not supported in RollCall). When imported, these are added to the **Pre-load List** and may be selected for use as needed.

Importing a Custom LUT

Follow these steps to import a custom LUT:

- 1 Open a web browser window, type the unit's IP address (see [page 103](#)) into the address bar, and press RETURN. The browser connects to the unit, and a user interface allowing control of the unit is displayed:



Web Browser Control Interface

The buttons at the top of the screen correspond to the equivalent RollCall control pages, and offer the same functionality. The UI is intuitive and easy to use.

- 2 In the **SDR/HDR** section, click **Choose File**; a Windows Browse dialog is displayed. Select the file to be uploaded, and click **Open**; the Browse dialog is closed, and the filename is displayed next to **Choose File**.
- 3 Click **Import**; the file is imported, and added to the **Pre-load List**. The **Status** is updated to **Done**.
Repeat for each LUT file to be imported.

Colorimetry

Select **Colorimetry** to display the Colorimetry menu. Available functions are:

Menu Option	Operation
Input colorimetry	Input colorimetry setting for HD, 3G and UHD. SD is fixed at BT.601. Colorimetry in use is reported as shown: <ul style="list-style-type: none">• Auto - Sample interleaved: use embedded PID to identify colorimetry. Square Division: selects BT.709.• BT.709• BT.2020• P3-D65
Output colorimetry	Sets the output color standard for HD, 3G and UHD. Colorimetry in use is reported as shown: <ul style="list-style-type: none">• Follow Input: Output colorimetry will be the same as the input colorimetry (as detected or forced).• BT.709• BT.2020• P3-D65

Audio Input Routing

Provides control of audio input routing.



Note

Embedded audio is supported by all models. Analog and AES audio are available only if a UHD with audio option has been purchased.

SDR/HDR		Unit Status																Status
Audio input routing		Input Std	Loss															
Audio delay		Output Std	1080 50i															
Audio gain		Emb 8 Loss																
Process pair routing																		
	Pair 1	Pair 2	Pair 3	Pair 4	Pair 5	Pair 6	Pair 7	Pair 8	Pair 9	Pair 10	Pair 11	Pair 12	Pair 13	Pair 14	Pair 15	Pair 16	Status	
Embedded 1	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 2	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 3	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 9	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 11	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 13	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Embedded 15	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	Loss	
Embedded 16	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	Loss	
AES 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
AES 8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Loss	
Analog 1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	PCM	
Analog 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	PCM	
MADI Ch 1 & 2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 3 & 4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 5 & 6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 7 & 8	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 9 & 10	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 11 & 12	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 13 & 14	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 15 & 16	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 17 & 18	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 19 & 20	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 21 & 22	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 23 & 24	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 25 & 26	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 27 & 28	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 29 & 30	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 31 & 32	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 33 & 34	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 35 & 36	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 37 & 38	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 39 & 40	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 41 & 42	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 43 & 44	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 45 & 46	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 47 & 48	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 49 & 50	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 51 & 52	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 53 & 54	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 55 & 56	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 57 & 58	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 59 & 60	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 61 & 62	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	
MADI Ch 63 & 64	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	None	

Audio Input Routing page

Audio Terminology:

- **Source audio** (input pairs or channels) refers to audio associated with the incoming source material, which could be embedded audio, balanced AES (audio option only) or analog audio (audio option only);
- **Process pairs or channels** (sometimes abbreviated to *process pr* in the menus) refer to audio processing channels, to which input audio pairs may be assigned;
- **Output pairs or channels** refer to audio coming from the processing channels which is routed to the unit outputs. Output audio can be embedded, balanced or unbalanced AES (audio option only) or analog (audio option only).

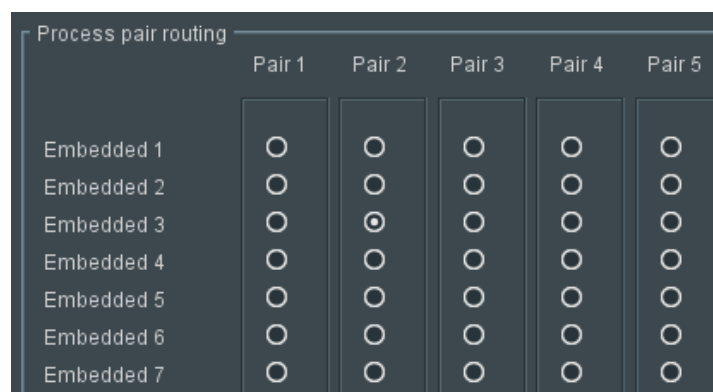
Operation

To select the audio source to be passed to each audio processor, select the process channel from the list of process pairs (1 to 16), and select the source audio to assign to the chosen channel:

Source Audio	Available Choices
Embedded audio	Embedded 1 - 16
AES	AES 1 - 8
Analog	Analog 1 - 2
MADI	MADI Ch 1 & 2 - 63 & 64

For example, to use source audio from SDI Embedded 3 in audio processing channel 2:

- Open the **Audio input routing** page.
- In the **Mapping** section, select the button in the position where the **Process pair 2** column intersects with the **Embedded 3** row:



Audio Routing Selection

Analog Output

The **Analog Output** lists allow output audio pairs to be mapped to outgoing analog pairs. Select an output pair for each analog audio output as required.

Analog Levels

Allows adjustment of analog audio levels.

Analog Level	Operation
Pair 1 Analog ADC headroom	Adjusts the analog audio ADC headroom level for analog audio input Pair 1, from 12 dB to 24 dB in steps of 0.5 dB. Preset is 18 dB.
Pair 2 Analog ADC headroom	Adjusts the analog audio ADC headroom level for analog audio input Pair 2, from 12 dB to 24 dB in steps of 0.5 dB. Preset is 18 dB.
Pair 1 DAC Line-up level	Adjusts the analog audio DAC Line-up level for analog audio output Pair 1, from 12 dB to 24 dB in steps of 0.5 dB. Preset is 18 dB.
Pair 2 DAC Line-up level	Adjusts the analog audio DAC Line-up level for analog audio output Pair 2, from 12 dB to 24 dB in steps of 0.5 dB. Preset is 18 dB.

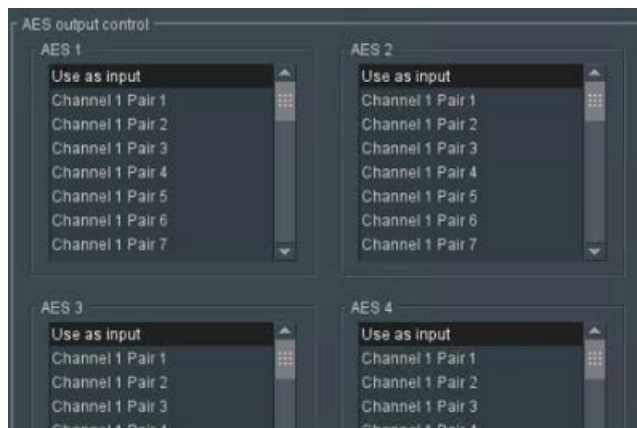
Analog input pair status

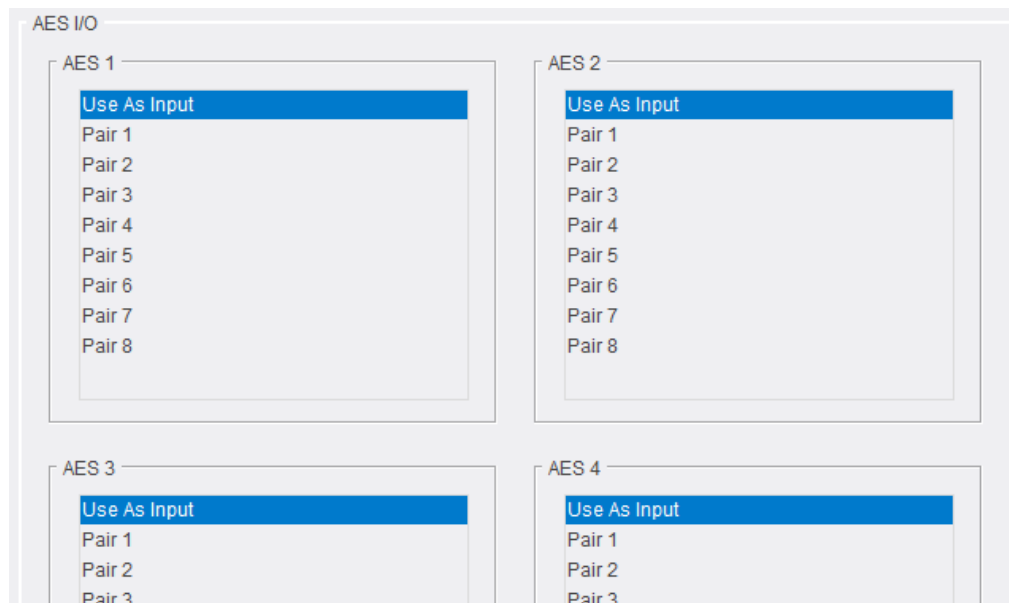
Displays the status of each input. Possible values are:

- **PCM:** audio is PCM.
- **Loss:** no audio detected.
- **Data:** data detected on audio channel.
- **DolbyE:** DolbyE audio detected.

AES I/O

AES audio I/O is available via 8 bi-directional ports, each of which can be configured as either an input or an output.





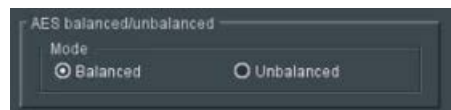
AES I/O Configuration

To configure a port, locate it on the AES x port lists, then select either:

- **Use As Input**, or
- A pair to set as an output.

AES Balanced/Unbalanced

Enables either balanced or unbalanced audio. Select as required.



Audio Delay

The screenshot displays the 'Audio Delay' control interface. At the top left, a menu shows 'SDR/HDR', 'Audio input routing', 'Audio delay' (selected), and 'Audio gain'. To the right, a 'Unit Status' box shows 'Input Std: Loss', 'Output Std: 1080 50i', and 'Tab 3 Loss'. The main area is divided into two columns. The left column, titled 'Audio delay', contains 18 sliders: 'Global delay' (0ms), 'Process channel 1' through 'Process channel 18' (all 0ms). The right column, titled 'Audio delay status', lists 'Audio delay' (0ms), 'Video delay' (0ms), and 'Delay ch 1' through 'Delay ch 32' (all 0ms). Below these are 'Tone frequency' (1000Hz) and 'Dolby E Align' (0 Lines) sliders.

Audio Delay page

Audio Control	Available Choices
Audio Delay	<p>Delay can be adjusted for each of the sixteen audio channels. The adjustment range is -40ms to +500ms in 1ms steps. The default value is 0ms.</p> <p>To adjust delay offset, first select the process channel from the process channel list (Process channel 1 to Process channel 16) then select the required delay offset using the sliders. Alternatively, use the Master control to adjust the delay for all pairs at once: individual pair delay offsets are preserved and limited at the maximum and minimum delay values. With delay set to zero, the audio will be co-timed with the video.</p>
Audio Delay statuses	Shows the total delay per channel in ms.
Tone frequency	<p>Tone frequency can be selected from 100Hz to 10000Hz in steps of 100Hz.</p> <p>Default is 1000Hz.</p>
Dolby E alignment offset	<p>Dolby E alignment offset can be selected from -10 lines to +10 lines in steps of 1 line.</p> <p>Default is 0 lines.</p>
Video delay	Shows the current total video delay through the unit.



Note

1 Global delay is applied to all channels. Individual channel delays are added/subtracted from this delay.

2 Channel delay is added instantaneously and will produce an audible disturbance.

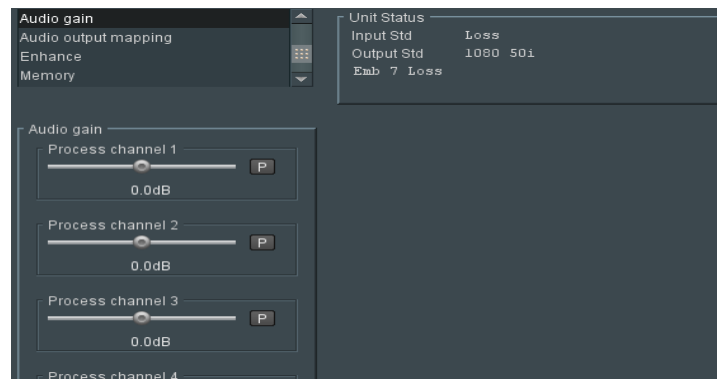
3 Global delay is added or subtracted at the rate of 2ms/s and does not produce an audible disturbance. Allow time for the global delay to settle to the desired value.

4 The maximum audio delay (video processing delay + added audio delay) is limited to 500ms.

Audio Gain

Audio gain can be adjusted from -18dB to +18dB in steps of 0.1dB. Default is 0dB.

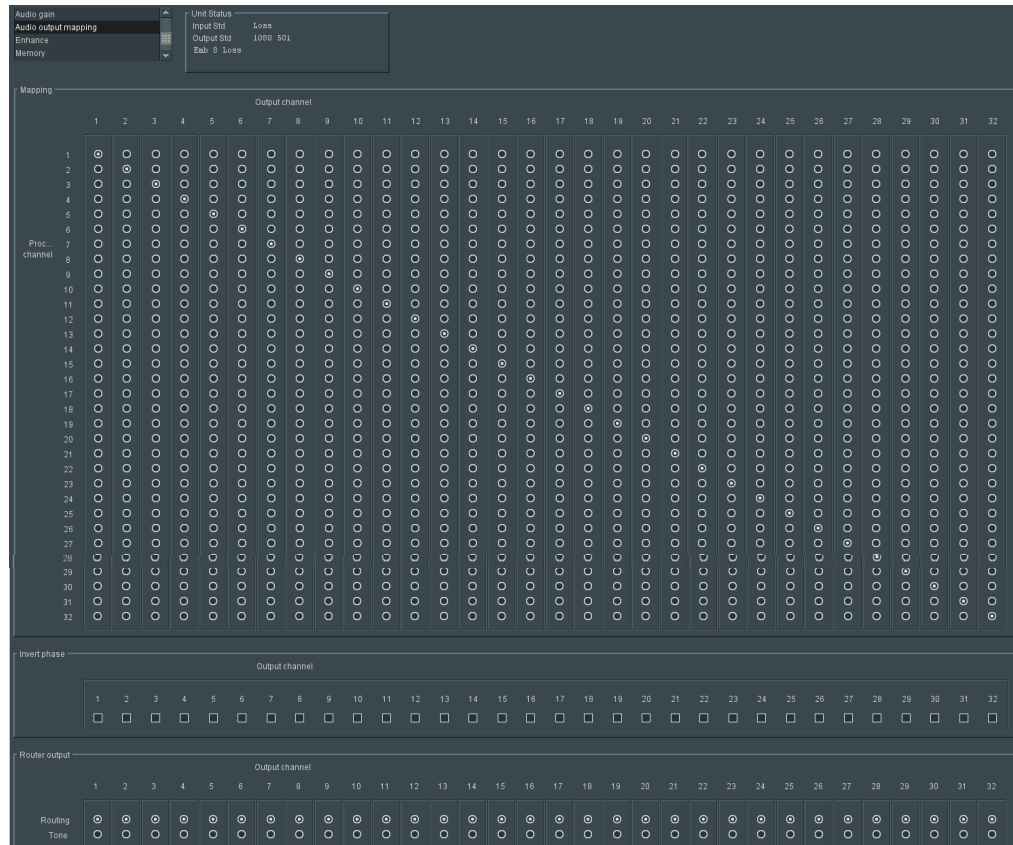
Use the channel sliders to adjust the gain on individual channels. Alternatively, use the **Master** control to adjust the gain for all channels at once.



Audio Gain page

Audio Output Mapping

Audio output mapping allows routing from each process pair to the output. Facilities to invert audio phase and insert tone or silence are also available here.



Audio Output Mapping page



Note

The **Audio Output Mapping** menu allows any configuration of audio channels to be routed to the output. Illegal combinations will result in the output being forced to silence. If both audio channels of an audio pair have been derived from non-PCM audio channels, there are two possible states, **Non-PCM** or **Forced silence**. To be recognized as valid non-PCM (**N**), both channels must:

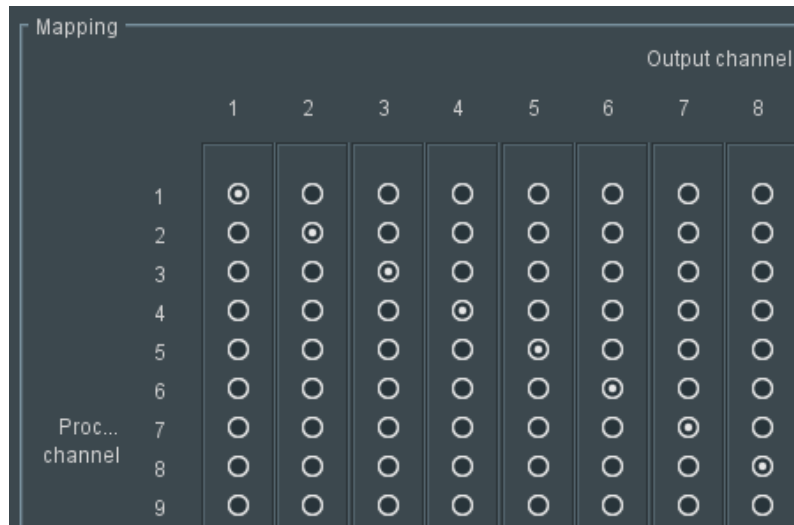
- 1 Have come from the same input pair;
- 2 Have the left and right channels the correct way round;
- 3 Not have the phase inverted.

A failure of any of these conditions will cause the pair to be muted and the status to be reported as Forced silence.

Assigning an output from a processing channel

To use source audio from Input 3 in Output 3:

- Open the **Audio Output Mapping** page.
- In the **Mapping** section, select the button in the position where the **Input Channel 3** column intersects with the **Output Channel 3** row:



Audio Output Mapping Selection

Additional processing options are available:

Invert Phase - Causes the phase of left and right audio channels to be inverted. This is useful when dealing with input audio discrepancies. Enable channel check boxes as required.



Note

Phase invert is available only for PCM audio.

Router Output: Routing - Passes audio to output without performing additional processing.

Router Output: Tone - Inserts a tone into the selected audio channel.

Router Output: Silence - Mutes the selected audio channel.

Enhance

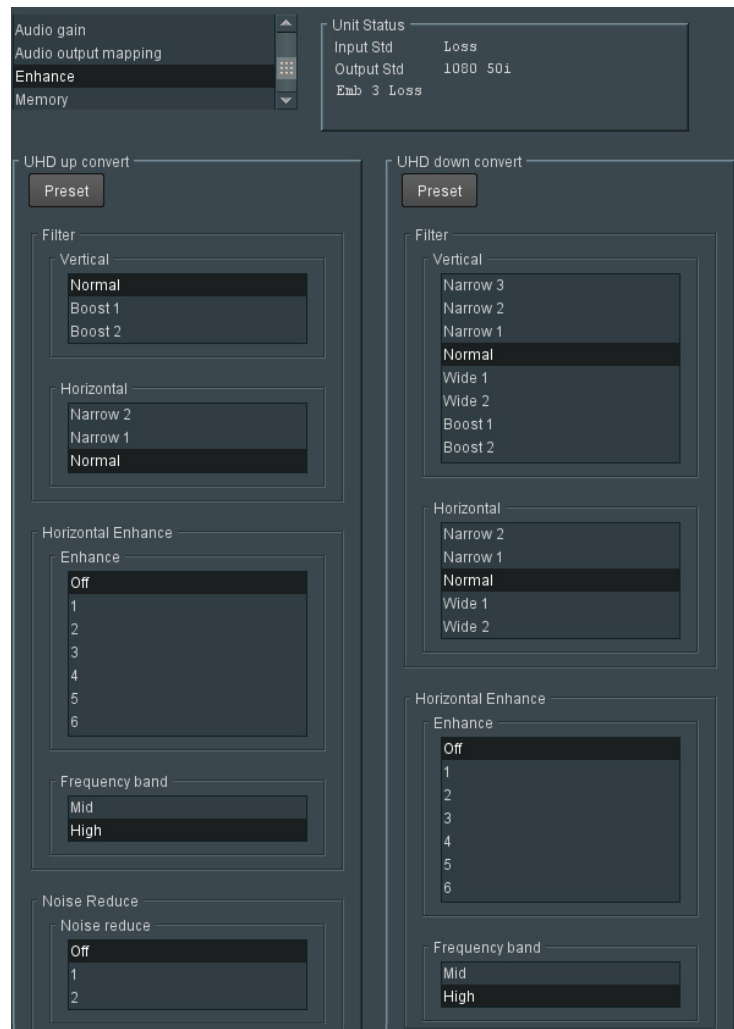
The **Enhance** button provides horizontal and vertical enhancement tools. The main uses of the enhancer functions are to control aliasing in down-conversion, and to add a subjective impression of sharpness in up-conversion. Individual controls are available to make separate adjustments to horizontal and vertical detail, over different frequency bands, in order to achieve the desired subjective effect.

If no enhancement is required, ensure that **Preset** is selected.

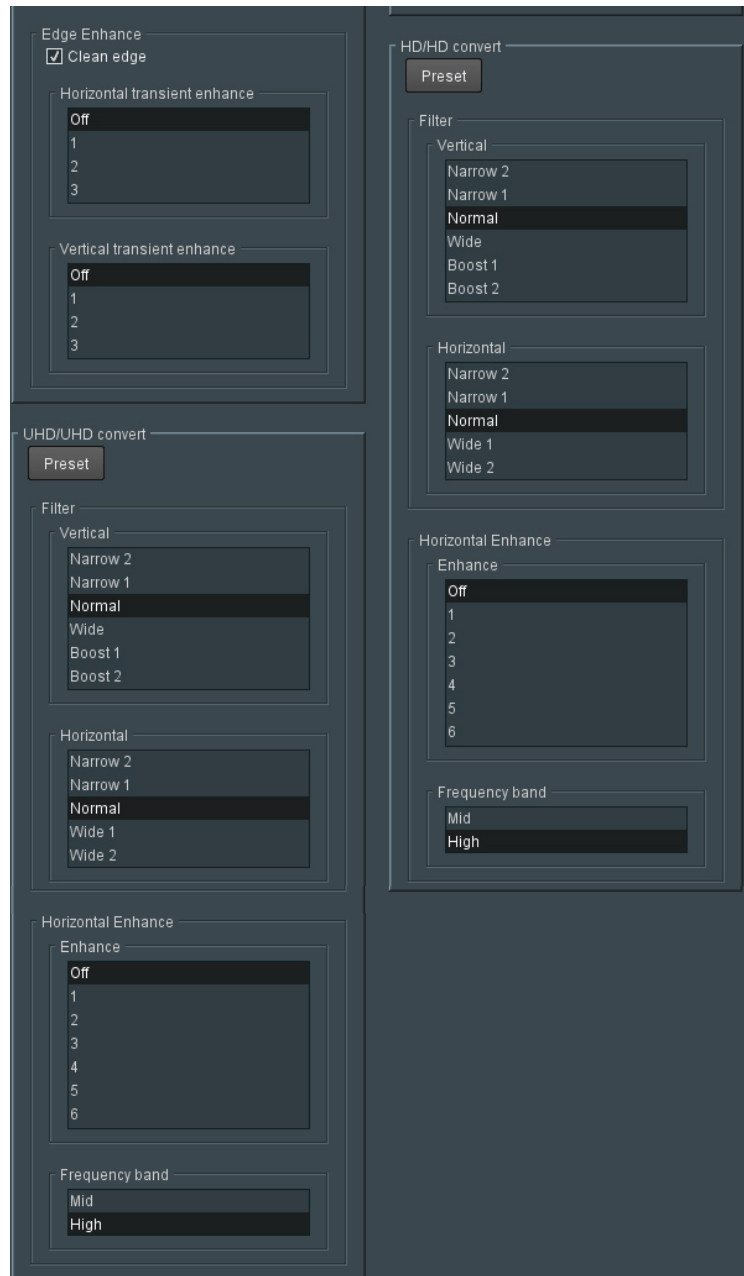


Note

With the web browser interface, Enhancer controls are available from the **Enhance** menu.



Enhance page 1



Enhance page 2

UHD Up Convert



Note

These settings apply only when converting from HD to UHD.

Preset

- **Confirm** to set all enhancers to default preset values.
- **Cancel** to leave enhancers at the current values.

Vertical Filter

- **Normal** (default): Passes all source vertical frequencies without attenuation or boost.
- **Boost 1**: Applies a small amount of boost within the HD frequency band. This can increase the visual sharpness of the up-converted image.
- **Boost 2**: Applies a larger amount of boost beginning at a lower frequency.

Horizontal Filter

- **Narrow 2**: Reduces horizontal bandwidth of HD source prior to up-conversion. May be useful when HD source contains excessive enhancement (ringing), which may be unacceptable in UHD.
- **Narrow 1**: Applies a small reduction in horizontal bandwidth of HD source prior to up-conversion. May be useful when HD source contains some enhancement, which may be unacceptable in UHD.
- **Normal** (default): Passes all source horizontal frequencies without attenuation.

Horizontal Enhance

Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures.

- **Off** (default)
- **1**
- **2**
- **3**
- **4**
- **5**
- **6**

Horizontal Enhance Frequency Band

Selects the frequency band to which the **Horizontal enhance** filter is applied. Boost can be set to operate on either the highest or mid frequencies.

- **Mid**
- **High** (default)

UHD Noise Reduce

Multi-band noise reduction reduces noise visibility in up-converted images, without introducing visual artifacts.

This process will not reduce noise that is already visible in the HD source.

- **Off** (default)
- **1**
- **2**

Clean Edge

Adaptive processing to remove 'ringing' often evident in up-conversion processing. Normally enabled.

- **Disable**
- **Enable** (default)

Horizontal Transient Enhance

Sharp vertical edge detail in the HD source, such as captions and graphics, is identified. The gradient of these transients is increased to occupy the full UHD bandwidth. Adaptive processing ensures that textures are preserved.

- **Off** (default)
- **1**
- **2**
- **3**

Vertical Transient Enhance

Sharp horizontal edge detail in the HD source, such as captions and graphics, is identified. The gradient of these transients is increased to occupy the full UHD bandwidth. Some degradation of fine textures may be evident when using higher settings.

- **Off** (default)
- **1**
- **2**
- **3**

UHD Down Convert



Note

These settings apply only when converting from UHD to HD.

Preset

- **Confirm** to set all enhancers back to default preset values.
- **Cancel** to leave enhancers at the current values.

Vertical Filter

- **Narrow 3**: Reduces vertical bandwidth of the down-conversion process. May be useful when the UHD source contains high levels of mid-frequency content.
- **Narrow 2**: As above, but with less bandwidth reduction.
- **Narrow 1**: As above, but with minimal bandwidth reduction.
- **Normal** (default): Optimized bandwidth setting. Passes all vertical frequencies compatible with the HD output.

- **Wide 1:** Allows some alias frequencies to pass, which may give an apparent increase in picture sharpness.
- **Wide 2:** Allows a wider band of alias frequencies to pass.
- **Boost 1:** Applies a small amount of boost within the HD frequency band. This can increase the visual sharpness of the down-converted image.
- **Boost 2:** Applies a larger amount of boost beginning at a lower frequency.

Horizontal Filter

- **Narrow 2:** Reduces horizontal bandwidth of the down-conversion process. May be useful when the UHD source contains high levels of mid-frequency content.
- **Narrow 1:** As above, but with less bandwidth reduction.
- **Normal (default):** Optimized bandwidth setting. Passes all horizontal frequencies compatible with the HD output.

Horizontal Enhance

Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures.

- **Off (default)**
- **1**
- **2**
- **3**
- **4**
- **5**
- **6**

Horizontal Enhance Frequency Band

Boost can be set to operate on either the highest or mid frequencies.

- **Mid**
- **High (default)**

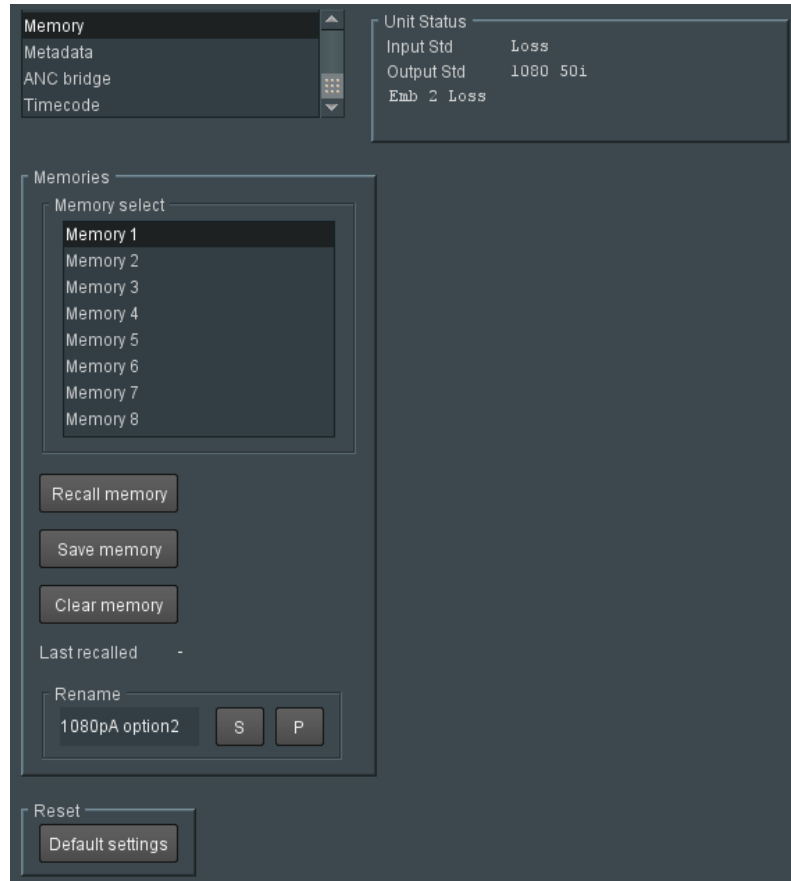
UHD/UHD Convert

Menu Option	Operation
Preset	Click to set all enhancers to default preset values.
Vertical filter	Select as required: <ul style="list-style-type: none"> • Narrow 2: Reduces the vertical bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction. • Normal (default): Optimized bandwidth setting. Passes all vertical frequencies. • Wide: For some down conversion modes, Wide allows extended bandwidth to pass. This may give an apparent increase in picture sharpness. In up conversion modes, this setting is the same as Normal. • Boost 1: Boosts high frequencies with UHD-UHD conversions. • Boost 2: As Boost 1, but giving greater boost or more alias.
Horizontal filter	Select as required: <ul style="list-style-type: none"> • Narrow 2: Reduces the horizontal bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction. • Normal: Optimized bandwidth setting. Passes all horizontal frequencies compatible with the output format. • Wide 1: Will have limited effect in UHD to UHD conversion. • Wide 2: Will have limited effect in UHD to UHD conversion.
Horizontal enhance	Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures. Select a level as required. <ul style="list-style-type: none"> • Off (default) • 1 • 2 • 3 • 4 • 5 • 6
Frequency band	Boost can be set to operate on either the highest or mid frequencies. Select a level as required. <ul style="list-style-type: none"> • Mid • High (default)

HD/HD Convert

Menu Option	Operation
Preset	Click to set all enhancers to default preset values.
Vertical filter	Select as required: <ul style="list-style-type: none"> • Narrow 2: Reduces the vertical bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction. • Normal (default): Optimized bandwidth setting. Passes all vertical frequencies. • Wide: For some down conversion modes, Wide allows extended bandwidth to pass. This may give an apparent increase in picture sharpness. In up conversion modes, this setting is the same as Normal. • Boost 1: Boosts high frequencies with HD-HD conversions. • Boost 2: As Boost 1, but giving greater boost or more alias.
Horizontal filter	Select as required: <ul style="list-style-type: none"> • Narrow 2: Reduces the horizontal bandwidth of the conversion process. • Narrow 1: As above but with less bandwidth reduction. • Normal (default): Optimized bandwidth setting. Passes all horizontal frequencies compatible with the output format. • Wide 1: Will have limited effect in HD to HD conversion. • Wide 2: Will have limited effect in HD to HD conversion.
Horizontal enhance	Applies horizontal frequency boost to make image visually sharper. Adaptive processing prevents an increase in noise level and excessive boost on textures. Select a level as required. <ul style="list-style-type: none"> • Off (default) • 1 • 2 • 3 • 4 • 5 • 6
Frequency band	Boost can be set to operate on either the highest or mid frequencies. Select a level as required. <ul style="list-style-type: none"> • Mid • High (default)

Memory



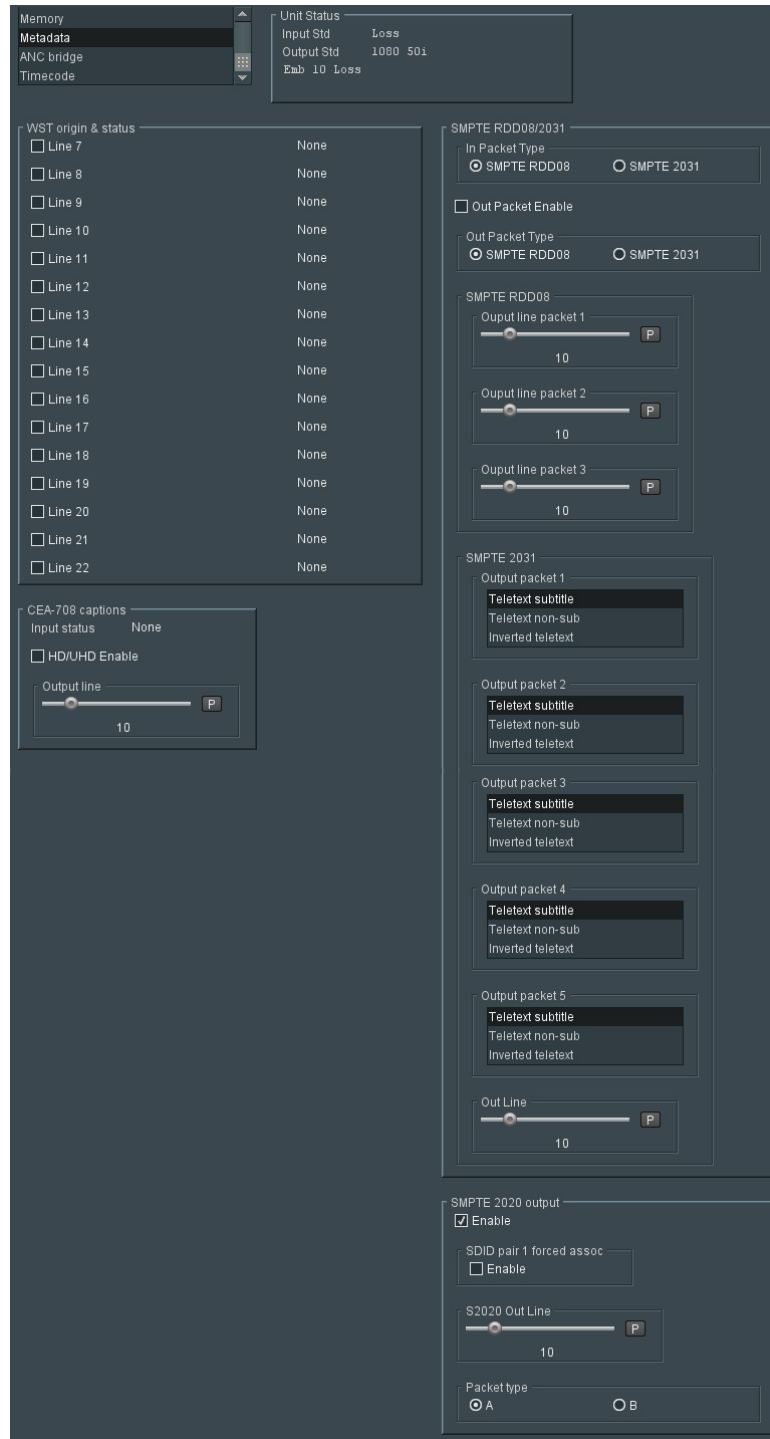
Enhance page 1

The **Memory** button allows the unit to be reset to one of 10 previously saved configurations. Available functions are:

Menu Option	Operation
Memory Select	Selects the required memory to recall, save or clear.
Recall Memory	Press to load the contents of the selected memory.
Save Memory	Press to save current configuration to the selected memory. Please note network settings are NOT saved.
Clear Memory	Press to clear the selected memory.
Last Recalled Memory	Reports the name of the last recalled user memory.

Metadata

The Metadata page provides control of closed caption and teletext information.



Metadata page

The following facilities are available from this page:

WST origin & status

The unit can pass World System RDD-08 teletext for HD or UHD. Teletext output can be enabled or disabled, and the input and output lines to be used specified.

SMPTE RDD08 - Up to 15 lines can be encoded in the OP47 packet. A maximum of three packets are allowed on the output, each with individual line number controls. The number of output OP47 packets is decided by the number of valid WST lines decoded on the input. The first five WST lines are encoded in the first OP47 packet, the next five in the second OP47 packet, and so on.

SMPTE 2031 - Up to 5 SMPTE 2031 packets are allowed to be inserted on the output, with each packet containing data from one SD teletext line. The first five lines selected on the input are encoded in the 2031 packet. All packets will be placed on the line selected by the **Out line** controls.

Menu Option	Sub-Option	
WST Origin & Status		WST origin line selection. Choose: <ul style="list-style-type: none"> • Off (default) • On for each of Line 7 - Line 22. The line number corresponds to the line number encapsulated within the RDD08 (OP47)/S2031 packet and not the line number on which the packets are present.
SMPTE RDD08/ST2031	In Packet Type	<ul style="list-style-type: none"> • SMPTE RDD08 (default) • SMPTE 2031
	Out Packet Enable	<ul style="list-style-type: none"> • Off (default) • On
	Out Packet Type	<ul style="list-style-type: none"> • SMPTE RDD08 (default) • SMPTE 2031
	RDD08	<p>Out line pkt 1: select line from 8 to 20. Default is line 10. Out line pkt 1 status: reports selected output line number. Out line pkt 2: select line from 8 to 20. Default is line 10. Out line pkt 2 status: reports selected output line number. Out line pkt 3: select line from 8 to 20. Default is line 10. Out line pkt 3 status: reports selected output line number.</p>
	ST2031	<p>Data UID select: for each out packet, 1 to 5, select from:</p> <ul style="list-style-type: none"> • Teletext subtitle • Teletext non-subtitle • Inverted teletext

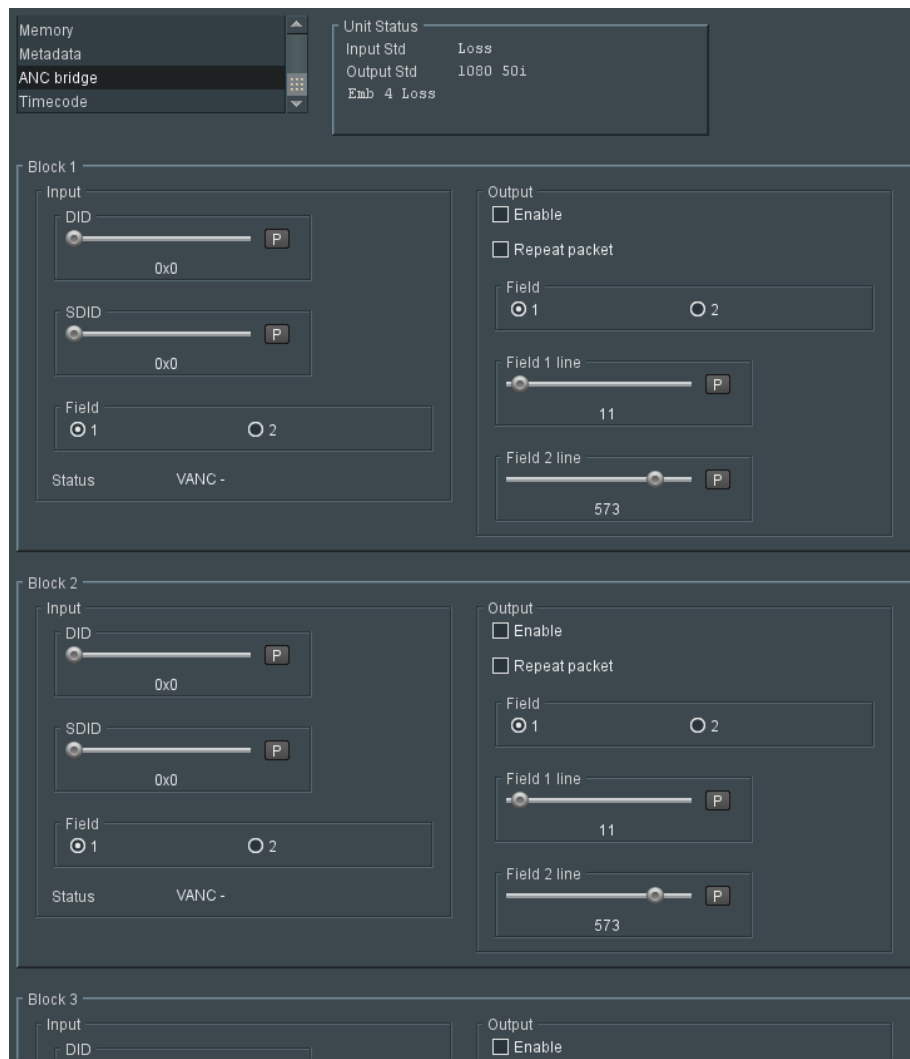
CEA-708 captions

The **CEA-708 captions** controls allow closed captions to be enabled or disabled, and the input and output lines used to be specified.

Menu Option	Operation
Input status	Reports the captions that have been detected.
Output line	Selects the output line on which to insert CEA-708 packets; the range is from line 8 to line 20 in one-line steps. The default is line 10.
Output status	Reports on which output line the captions are being inserted.

ANC Bridge

The ANC Bridge page allows the ANC Bridge to be configured.



ANC Bridge page

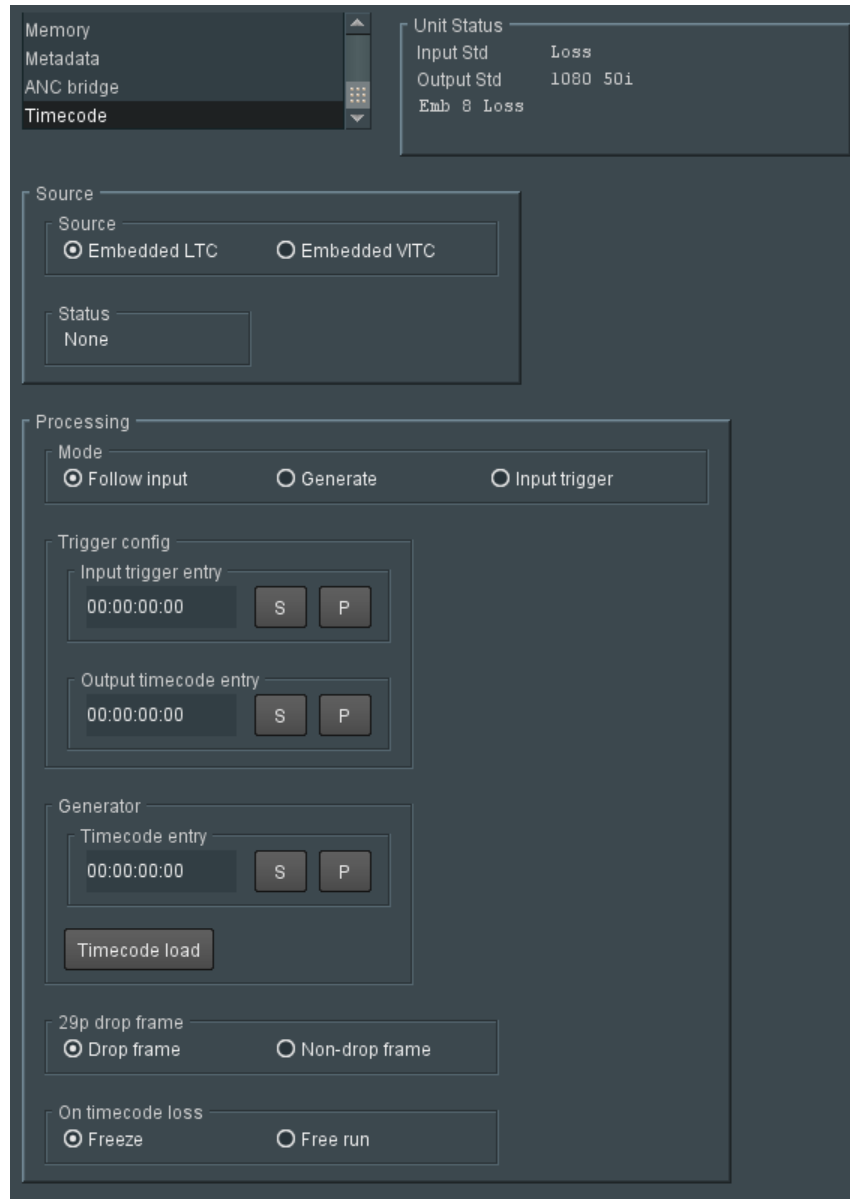
The following facilities are available from this page:

Control	Function
Input (repeated for blocks 1 - 7):	
DID	Selects DID value (range 0 to 0xFF, default = 0).
SDID	Selects SDID value (range 0 to 0xFF, default = 0).
Field	Selects input field for packet detection. Options are: <ul style="list-style-type: none"> • 1 • 2
Status	Displays VANC or HANC and the detected line number.
Output (repeated for blocks 1 - 7):	

Control	Function
Enable	Enables insertion of the selected packet on the output.
Repeat packet	Used to insert packets on every frame when converting from: <ul style="list-style-type: none"> • Interlaced to high frame rate progressive. • Low frame rate progressive to interlaced. • Low frame rate progressive to high frame rate progressive. It is ignored in all other modes.
Field	Selects output field for packet detection. Options are: <ul style="list-style-type: none"> • 1 • 2
Field 1 line	Selects the output line for Field 1. Range is the full Field 1 range for each output standard. Move the slider to select the required output line. Defaults are: <ul style="list-style-type: none"> • [1 to 563] default = 11 (1080i) • [1 to 750] default = 11 (720p) • [1 to 1125] default = 11 (1080pA) • [1 to 563] default = 11 (1080pB) • [1 to 2250] default = 11 (2160p)
Field 2 line	Selects the output line for Field 2. Range is the full Field 2 range for each output standard. Move the slider to select the required output line. Defaults are: <ul style="list-style-type: none"> • [564 to 1125] default = 573 (1080i) • N/A (720p) • N/A (1080pA) • [564 to 1125] default = 573 (1080pB)

Timecode

The Timecode page enables setup and control of the unit's timecode options for VITC (Vertical Interval Timecode) and LTC (Linear Timecode). In the HD domain, both Embedded VITC and Embedded LTC are supported.



Timecode page

When present, timecode can be handed over from the input or internally generated. Where the input frame rate is 29.97 fps, both drop frame and non-drop frame modes are supported. For 29.97fps outputs, timecode can be configured as either drop frame or non-drop frame.

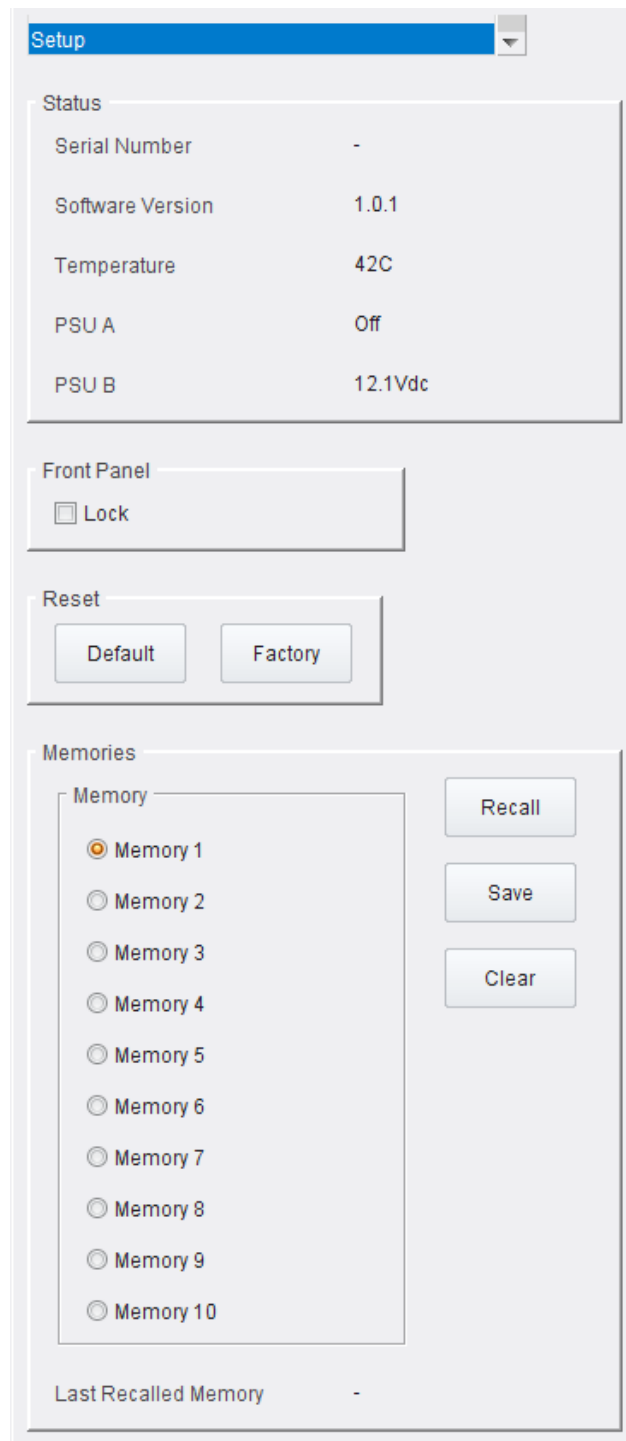
The following facilities are available from this page:

Menu Option	Operation
Source	<ul style="list-style-type: none"> • Embedded LTC (default) • Embedded VITC
Status	Reports the output line containing timecode.
Mode	<ul style="list-style-type: none"> • Follow input (default): When active, only the selected source type of ANC packet is inserted into the output video. So, the action on timecode loss is applicable only to the selected ATC type. • Generate: Allows the user to generate timecode using the value entered in Generator Timecode Entry as a start point. The action taken on selection of the Generate mode depends on the previous timecode handling state: if the mode was Input trigger, the output timecode will jump to the timecode value in Generator Timecode Entry when Generator Timecode Load is selected. If the mode was Follow Input, the output timecode will jump to the timecode value in Generator Timecode Entry as soon as the mode is changed to Generate. • Input trigger: The unit generates the output timecode from a specified input timecode trigger. When Generate mode is selected, both ATC, LTC and ATC VITC are embedded in the output.
Generator Timecode Entry	<p>The value to be used as a start point when generating timecode. Enter as appropriate.</p> <p>Timecode format: HH:MM:SS:FF</p>
Generator Timecode Load	Click to load the value entered in Generator Timecode Entry .
29p Drop Frame	<p>Select:</p> <ul style="list-style-type: none"> • Drop Frame • Non-drop Frame (default)
On Timecode Loss	<ul style="list-style-type: none"> • Freeze (default): freezes output timecode. • Free run: timecode free runs from the current timecode value.

Status

The **Status** page displays basic information about the module, such as the serial number and software version. Use the functions on the page to restart the unit.





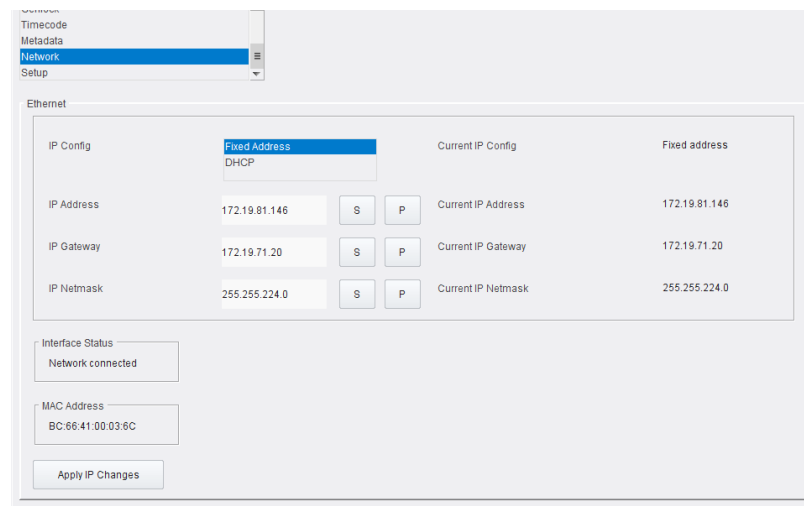
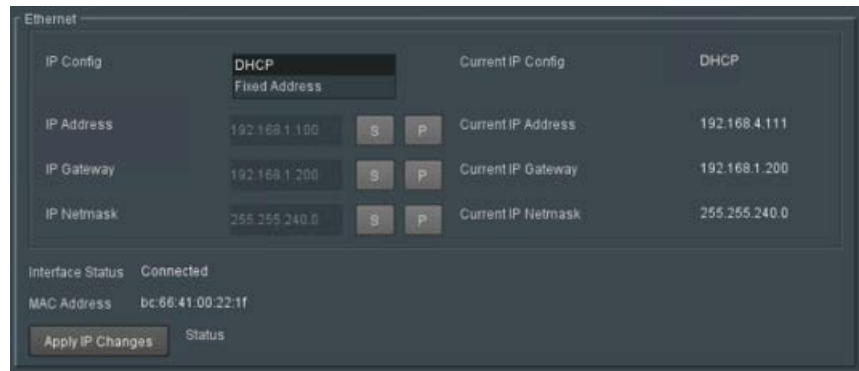
Setup page

The following functions are available:

Control	Function
Status:	
Serial number	Unit serial number.
Serial number	Displays the unique serial number of the unit.
Software version	Currently installed software version number.
PSU A	Displays the voltage currently being output by PSU A.
PSU B	Displays the voltage currently being output by PSU B.
Up time	Shows how long (in days, hours and mins) since the last power cycle.
Temperature	Current unit temperature.
Fan 1...3	Displays the status of the fans.
Last Recalled Memory	Displays the last memory to be recalled.
Restart	Click to restart the unit.

Network

The Network page allows network settings to be configured.



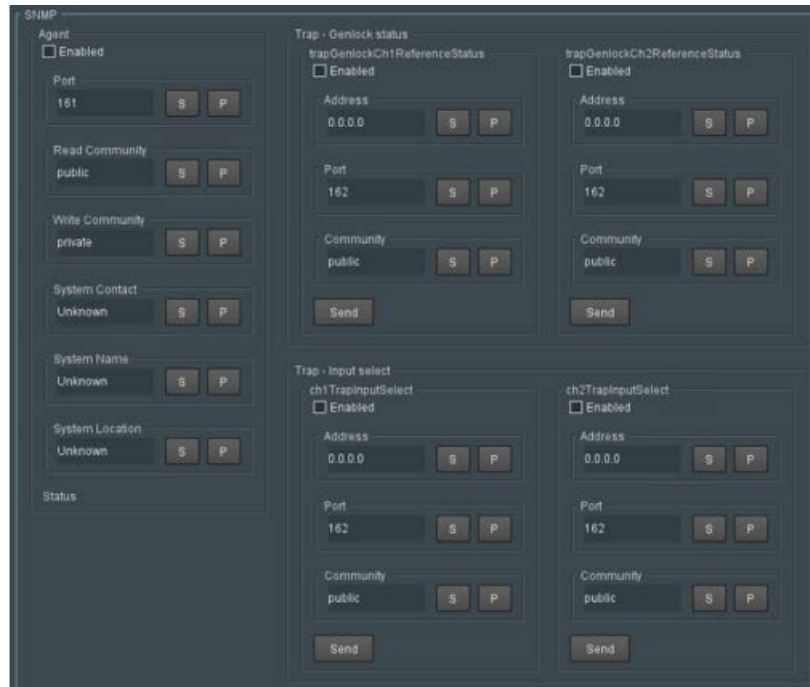
Network page

The following functions are available:

Control	Function
Ethernet:	
IP Config	Select: <ul style="list-style-type: none">• Fixed Address for the unit to use a fixed IP address.• DHCP for the unit to use an IP address assigned by DHCP.
Current IP Config	Displays the current IP status. Possible values are: <ul style="list-style-type: none">• Static• DHCP• OK• FAIL
IP Address	Enter the IP address to be used when Fixed Address is selected.
Current IP Address	Reports the IP address currently assigned to the unit.
IP Gateway	Enter the IP address of the gateway to be used when Fixed Address is selected.
Current IP Gateway	Reports the IP address of the gateway currently used by the unit.
IP Netmask	Enter the IP netmask to be used when Fixed Address is selected.
Current IP Netmask	Reports the IP netmask currently used by the unit.
Interface Status	Reports status of the IP interface.
MAC Address	Reports the MAC address of the UHD unit.
Apply IP Changes	Click to apply changes to IP config.

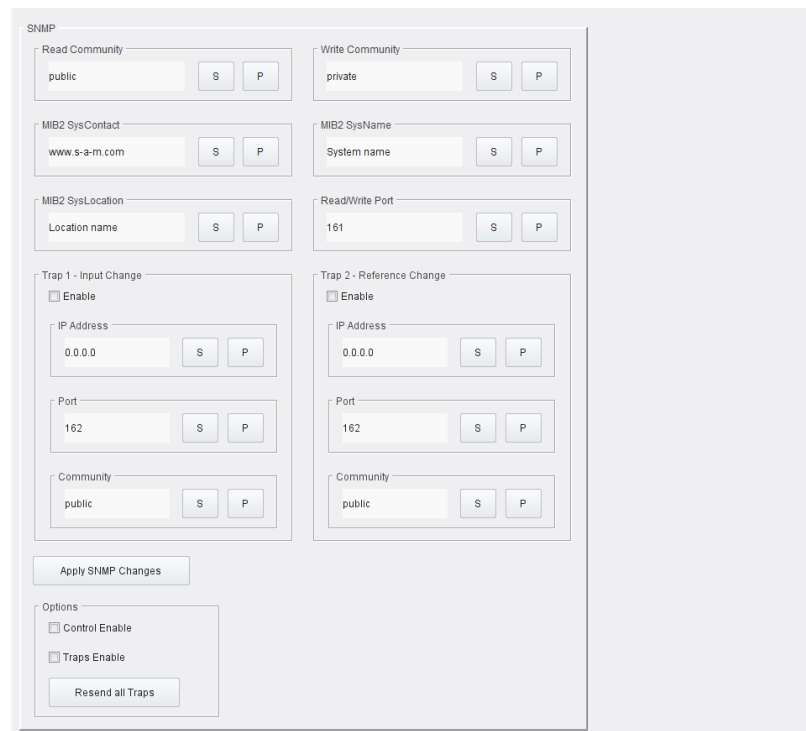
SNMP

The SNMP page allows SNMP settings to be configured.



The image shows a dark-themed web interface for configuring SNMP. It is organized into several sections:

- Agent:** Includes an "Enabled" checkbox, a "Port" field (161), "Read Community" (public), "Write Community" (private), "System Contact" (Unknown), "System Name" (Unknown), and "System Location" (Unknown). Each field has "S" and "P" buttons.
- Trap - Genlock status:** Contains two sub-sections: "trapGenlockCh1ReferenceStatus" and "trapGenlockCh2ReferenceStatus". Each has an "Enabled" checkbox, "Address" (0.0.0.0), "Port" (162), and "Community" (public) fields, with "S" and "P" buttons and a "Send" button.
- Trap - Input select:** Contains two sub-sections: "ch1TrapInputSelect" and "ch2TrapInputSelect". Each has an "Enabled" checkbox, "Address" (0.0.0.0), "Port" (162), and "Community" (public) fields, with "S" and "P" buttons and a "Send" button.



The image shows a light-themed web interface for configuring SNMP. It includes the following sections:

- Read Community:** Field with value "public", "S" and "P" buttons.
- Write Community:** Field with value "private", "S" and "P" buttons.
- MIB2 SysContact:** Field with value "www.s-a-m.com", "S" and "P" buttons.
- MIB2 SysName:** Field with value "System name", "S" and "P" buttons.
- MIB2 SysLocation:** Field with value "Location name", "S" and "P" buttons.
- Read/Write Port:** Field with value "161", "S" and "P" buttons.
- Trap 1 - Input Change:** Includes an "Enable" checkbox, "IP Address" (0.0.0.0), "Port" (162), and "Community" (public) fields, each with "S" and "P" buttons.
- Trap 2 - Reference Change:** Includes an "Enable" checkbox, "IP Address" (0.0.0.0), "Port" (162), and "Community" (public) fields, each with "S" and "P" buttons.
- Buttons:** "Apply SNMP Changes" and "Resend all Traps".
- Options:** "Control Enable" and "Traps Enable" checkboxes.

SNMP page

The following functions are available:

Control	Function
Read-only Community	Enter the read community string. Default is "public".
Write-only Community	Enter the write community string. Default is "private".
System Contact	Enter the name of the person responsible for the managed node.
System Name	Enter the name of the managed node.
System Location	Enter the physical location of the node.
Read/Write Port	Select the UDP read/write port for sending and receiving requests.
Trap Input Select	Reports changes to input. To activate, set IP Address, Port and Community details as required, and click Enable .
Trap Reference Status	Reports changes to the reference. To activate, set IP Address, Port and Community details as required, and click Enable .
Download MIB	Click to download MIB.

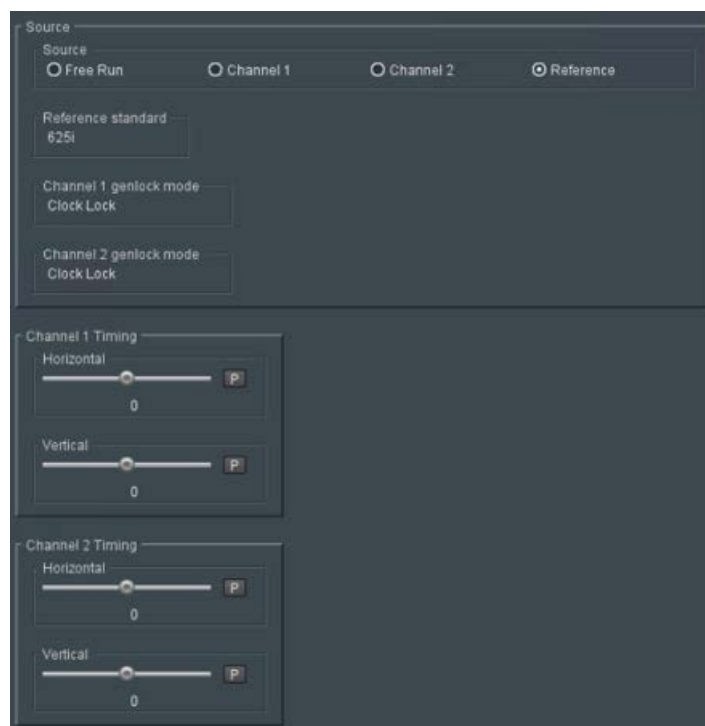
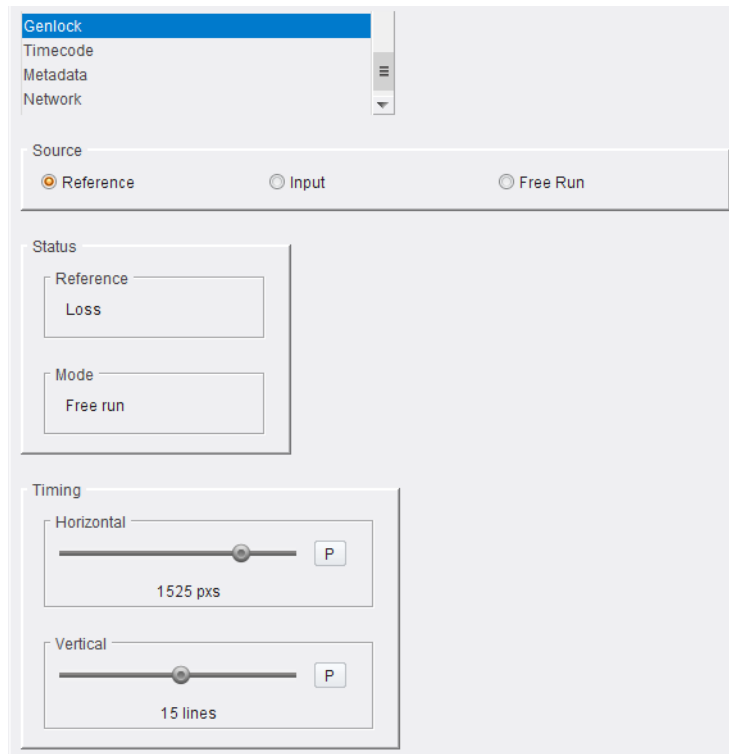


Note

Each SNMP Agent needs to be configured with Read and Write community values. The community provides a very rudimentary level of security. If a GET request is received from an SNMP Manager and the Read community value in the GET message matches the read community value set in the agent, the agent will respond with the value requested. Similarly, when an agent receives a SET command, the Write community value must match. By default most SNMP Agents have a read community value of *Public* and a write community value of *Private*. To prevent unauthorized access to a device, these values should be changed by the user.

Genlock

The Genlock page provides control over system interaction with timing references.



Genlock page

Genlock locks the output video clock to the genlock source (input or reference), regardless of the video standard. If the genlock source and the video output are the same frame rate, for example, 50 Hz or 59.94 Hz, Genlock locks the output to the vertical phase of the genlock source, giving consistent and repeatable delay. If the video output frame rate differs from the genlock source frame rate, the output will 'clock lock' to the genlock source. Clock lock ensures that the output audio 48kHz clock remains locked to the genlock source.

When attempting to pass non-PCM audio (other than Dolby-E), ensure that Genlock is enabled. If using an external reference, it must be clock-locked to the input video.

The following facilities are available from this page:

Menu Option	Operation
Source	<ul style="list-style-type: none"> • Reference (default): locks to the incoming reference. • Channel 1: Locks output to selected input on Channel 1. When input and output frame rates are integer related, selecting Input will force the unit to a fixed processing delay. • Channel 2: Locks output to selected input on Channel 2. When input and output frame rates are integer related, selecting Input will force the unit to a fixed processing delay. • Free run: locks the output video to an internal reference clock.
Status	Shows the status of the currently assigned reference. For example, if genlock is assigned to input, status shows Input followed by the current status of the input. If there is no signal on the assigned reference, status shows Loss .
Channel 1/2 Genlock Mode	Reports: Selected lock mode, Output format, lock status (genlock, Clock Lock, freerun).
Channel 1/2 Vertical timing	Adjusts the vertical timing of output video channel 1 or 2 with respect to the reference signal, from line -1125 to line 1125 in steps of 1 line. Default = 0 lines
Channel 1/2 Horizontal timing	Adjusts the horizontal timing of output video channel 1 or 2 with respect to the reference signal, from pixel -2640 to pixel 2640 in steps of 1 pixel. Default = 0 pixels

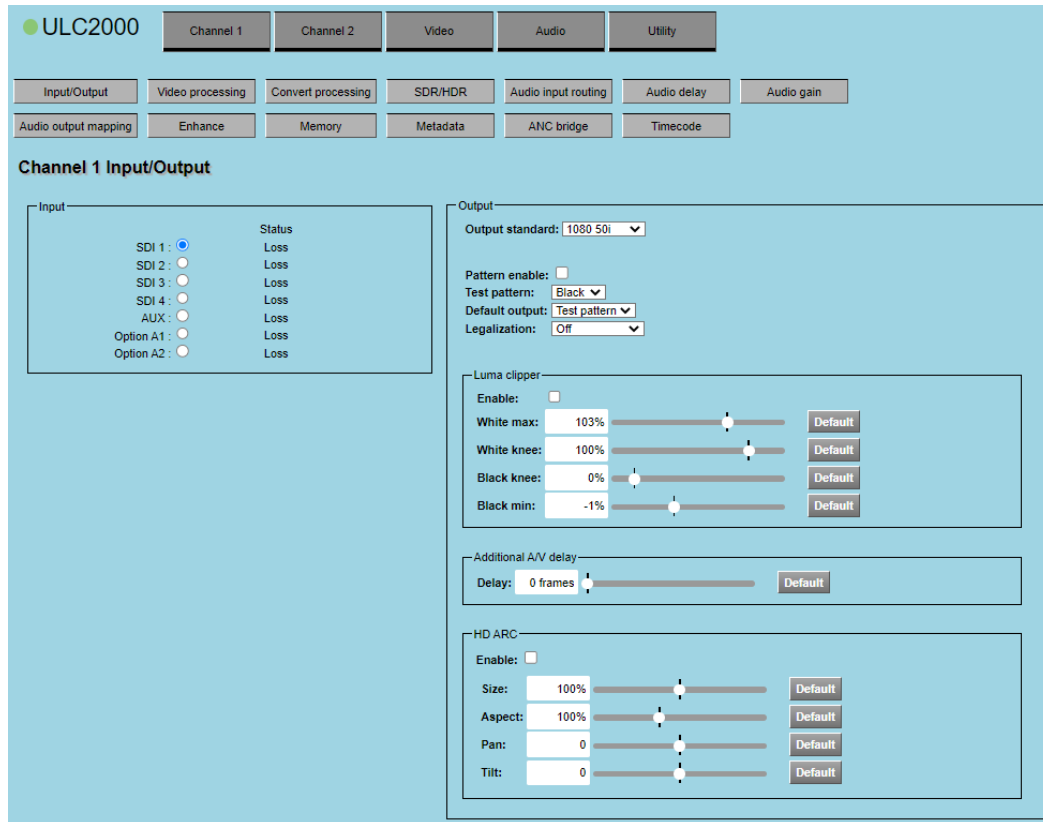


Note

Genlock timing adjustments will take effect only when the Genlock source is set to **Reference**.

Operation Via Web Browser

The KudosPro ULC2000 can be operated from a web browser as well as from the front panel. Simply type the unit's IP address, shown on the bottom of the Home screen, into a browser address bar. This will open a user interface allowing control of the KudosPro ULC2000 unit:



Browser Control Interface - UI Input and Output

The buttons at the top of the screen correspond to the buttons on the front panel, and offer the same functionality. Layout of the controls is a little different to those on the unit - sliders are used to set values for instance, and audio routing and shuffling are set by selecting items in a matrix - but the UI is intuitive and easy to use.

Browser-only Operations

Front Panel soft button

- 1 Open a suitable browser window, type the unit's IP address into the address bar and press RETURN. The browser connects to the unit and the UI is displayed.
- 2 Click **Utility**, then click **Front Panel**; the Front Panel page is displayed:



Browser Control Interface - Front Panel

- 3 Enable check box to lock the front panel controls.



Note

The hard lock button is located on the front panel of the unit.

System Software Upgrade

Currently, upgrading the unit's software can be performed via the browser GUI only. Follow the instructions below to install these updates.

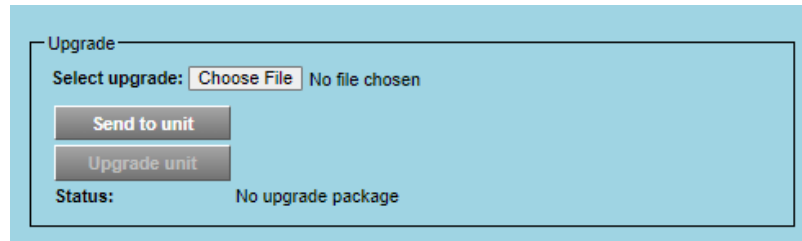


Note

The browser UI utilizes HTML5, and therefore requires the use of a modern browser. The UI has been tested with Chrome, Firefox and Internet Explorer/Edge. Please be aware that, at the time of writing, Internet Explorer does **not** allow the update package to be uploaded to the unit, although the upgrade itself can be performed using IE. Until this has been resolved, we recommend that Firefox or Chrome be used when upgrading units. Some minor cosmetic changes may be noticed in the web UI depending on the web browser.

- 1 Ensure that the upgrade package is readily accessible before beginning the upgrade.
 - 2 The upgrade process will take around 15 minutes. The unit will not be able to be used until the process is complete.
-

- 1 Open a suitable browser window, type the unit's IP address into the address bar and press RETURN. The browser connects to the unit and the UI is displayed.
- 2 Click **Utility**; the Utility page is displayed. Click **Upgrade** button.
- 3 Click **Choose File**; a standard Windows Browse dialog is displayed. Navigate to the upgrade package, select it and click **Open**; the Browse dialog is closed, and the package name is displayed next to **Choose File**.
- 4 Click **Send to Unit**; the software is copied to the unit. When the copy is complete, the user is prompted to start the upgrade; click **Upgrade Unit** to begin.



Browser Control Interface - Software Upgrade

Progress of the upgrade is displayed in the **Status** field; note that the unit will reboot as part of the process.

- 5 When the upgrade is complete, a confirmatory message will be displayed. Successful completion is also confirmed by the **Software Version** field at the top of the Setup page, which should reflect the new software version.

Recovery Mode

If the upgrade fails, because of network failure for instance, the unit will restart in **Recovery** mode. In this case, repeat the upgrade installation procedure described above.



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. Customers with a support contract should call their personalized number, which can be found in their contract, and be ready to provide their contract number and details.

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