STAGE RACER 2
TECHNICAL MANUAL (FW 3.8.0)

FIBER OPTIC TRANSMISSION with

DECENTRALISED ROUTING, DISTRIBUTION AND PROCESSING capacity.

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1 STAGE RACER 2 SUMMARY

1.1 OVERVIEW

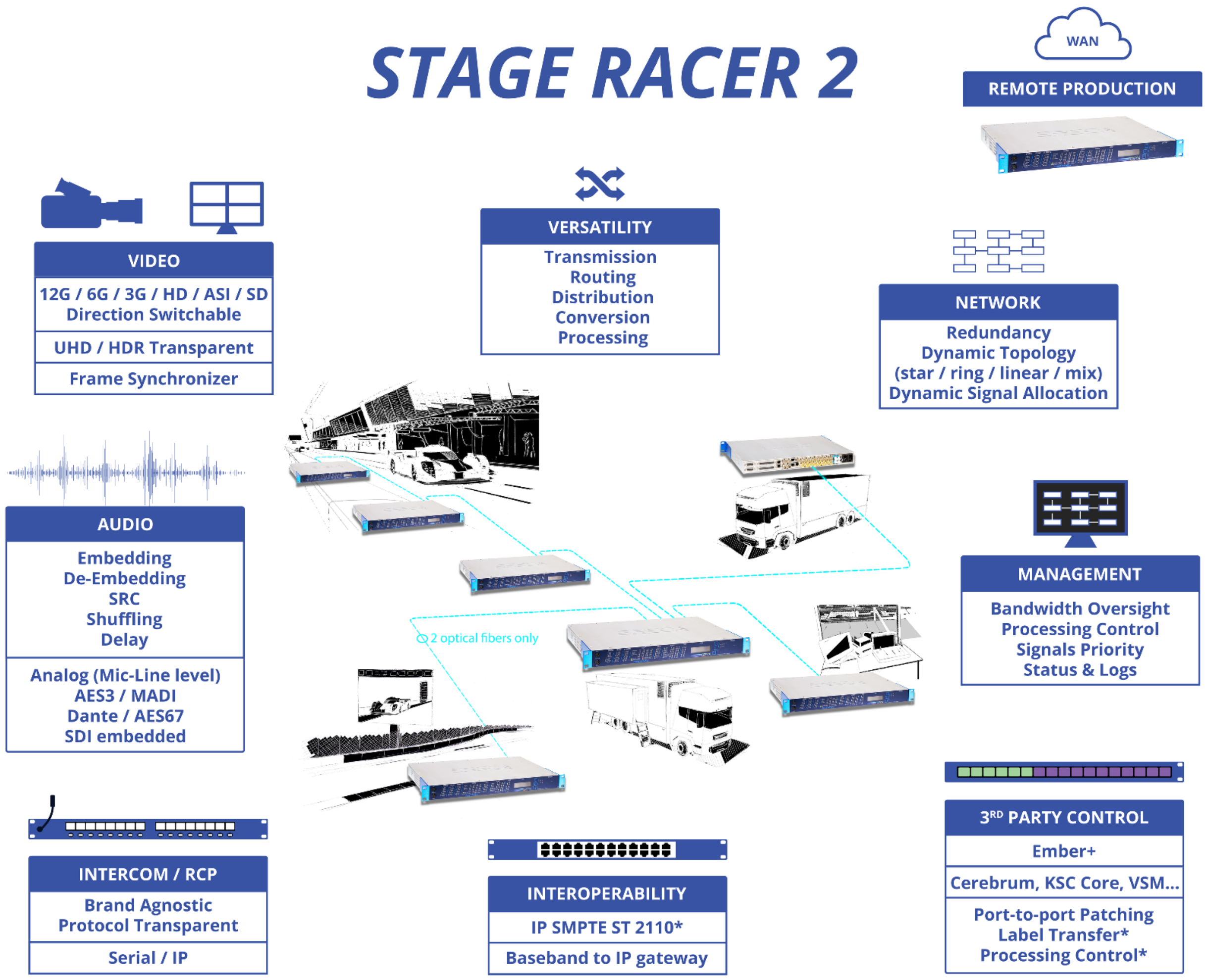
The STAGE RACER 2 is a complete optical fiber transmission solution for every broadcast event, ranging from simple OB interconnect to complex star, ring or linear topology spread over a whole TV compound.
It also supports long distance transmission for remote production capacity allowing content exchange between distant locations.

Stage Racer 2 is designed to accept all kinds of signal on a same device without external adapter. Internally those signals can be associated together / routed / distributed to all other machines of the network.

Stage Racer 2 also offers processing capabilities with Audio Embedding/De-embedding, Audio shuffling, Frame buffering with Audio/Video delay, distributed Multiviewer and Tico-XS compression will come in 2020.

Stage Racer 2 network can be controlled by a built-in intuitive web interface or with automation systems like Cerebrum, KSC Core and VSM.

Stage racer 2 graphical feature summary:



1.2 CONNECTIVITY

The Stage Racer 2 is available in two standard configurations: 24 or 12 SDI channels plus a common set of signals. Each equipment assumes transmission of a comprehensive set of signals as follows:

Stage Racer 2 – 24 SDI version	Stage Racer 2 – 12 SDI version
16 SD to 3G direction switchable channels	8 SD to 3G direction switchable channels
8 SD to 12G direction switchable channels	4 SD to 12G direction switchable channels
1 Distributed Genlock (Composite video / Black burst / Tri-level)	
16 Analog Audio I/O (optional 8ch Mic gain / Phantom 48V module)	
2 Ethernet 10/100/1000Mbs (optional 64ch Dante/AES-67 module on port 1)	
2 Data RS 232/422/485 (optional 6 additional 500Kbps RS422 serial channels)	
8 Contact closures	
4 AES3 bidirectional (Intercom panel compatible)	
1 MADI I/O (AES10) signal (Shared with 2 of the 4 AES connectors)	

Stage racer 2rear Panel: (BNC 13 to 24 are not populated for 12 channels frames).

1.3 TRANSMISSION

Transmission is based on TDM multiplexing for the all signals managed by the system. Each TDM multiplex is transmitted to another machine by **Trunk** ports. Each machine can have up to 4 trunk ports on dual LC/PC socket, meaning that 2 fibers only are needed to connect machines together.

Standard Trunk Allow 10Km fiber optic budget, optionally 40Km trunks can be fitted in the machine. Each trunk data rate is 40Gbs which allow the most rugged interface for harsh environment with potentially dirty fibers and very high outside temperatures.

Regarding transmission principle, most part of the bandwidth is dynamically allocated for high data rate signals (SDI / Ethernet / Raw signals). A small remaining bandwidth is fixed and guaranteed, dedicated to low data rate signals (Genlock / Audio / Serial / GPIO / System management) with a predefined maximum channel capacity per signal type avoiding any congestion for low datarate signals.

As a base rule, each trunk total I/O capacity is:

- 25 HD signals (or similar rate signals like GB Ethernet), or 12x3G or 3x12G or any combination,
- 1 Genlock / Tri-level / Composite,
- 400 Bidirectional Processed Audio channels,
- 50 Bidirectional Serial channels,
- GPIO for 256 frames.

For SDI, routing engine will send the signals at the desired points only, after this point the signal is not carried on the network and its bandwidth is available for another SDI signal. For processed audio, serial and GPIO, all required signals will be allocated a channel and routed elsewhere in the network so each machine can pick it up easily.

For remote production applications, the machine will act as a bridge between the standard and the IP world with future compliance to SMPTE ST2110 standards. Signals managed locally can be sent over IP and vice versa. In this case the “Option” MPO connector will allow 10Gbe connexions for 2110 interface.

1.4 OPTIONS

Numerous hardware options can be fitted in the Stage Racer 2:

- 8 switchable mic/line gain blocks with phantom power injection and gain management,
- Dante module providing 64 I/O channels of Dante / AES67 (shared with Ethernet port 1),
- 6 additional 500Kbs RS422 serial channels,
- 10-16VDC input to connect an external battery used in case of mains power loss,
- Extended range QSFP+ per trunk, for up to 40km transmission.
- Extra wavelength on each fiber stand to allow bidirectional 1490nm CWDM path between each machine for user extra signals like 10G Ethernet or RF over fiber signals.

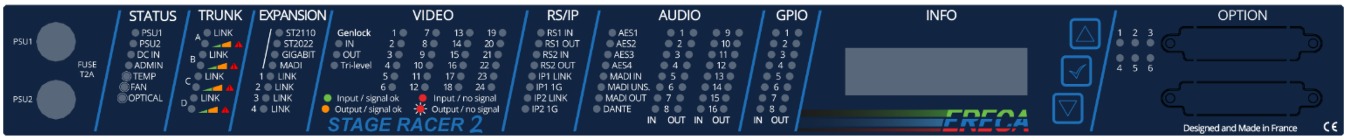
1.5 VISUALISATION

The equipment has multiple front-facing LED for signal presence and alarm display as well an Oled screen for visualisation of IP address, trunk load and optical power received by each trunk.

This on board feature allow quick and easy trouble shooting or and equipment on the field if any signal is missing.

Additionally the small keyboard allow machine reset by a special combination of keys (Press Up and Dn for 5 seconds, then press Check within 5 seconds to initiate reset).

<u>Stage racer 2 Front panel:</u>



1.6 SETUP

Setup is done with embedded interface web. The web interface is accessed via a dedicated admin port available on each machine. Whole machine network can be managed from any single machine of the network.

1.7 POWER

Each equipment has a built-in redundant Mains power supply and can optionally be equipped with a DC input compatible with batteries used for Cameras. Battery energy will be drawn only if both mains sources are down, when mains will reappear battery current draw stops.

<u>Note:</u> The Stage racer 2 cannot charge the external battery from its own power sources.

2 DETAILED DESCRIPTION

2.1 SMALL FORM FACTOR / INTEGRATION

The Stage Racer 2 is a 1RU rack solution ideally designed for space restricted installations. Chassis depth is 330mm excluding connectors.

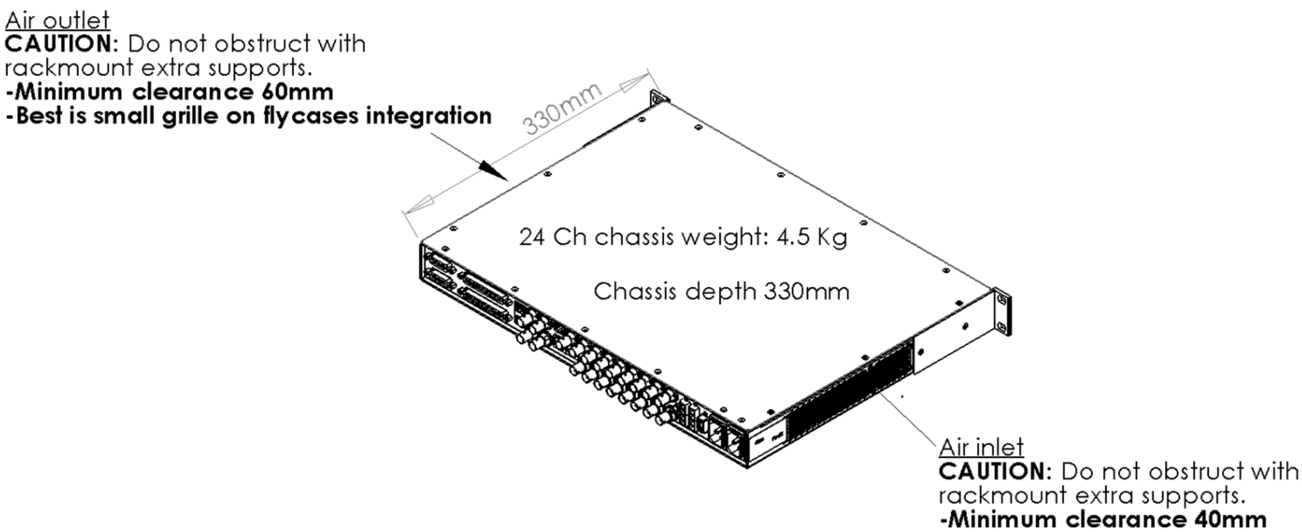
The Stage Racer 2 benefit from a very well-studied thermal conception and can operate from -20°C to +60°C. The internal fans speed is automatically adjusted depending on the internal motherboard temperature. At room temperature, the fans run at minimal speed allowing the Stage Racer 2 to be used in a quiet environment.

For field application a 4 to 5 RU fly case integration offers sufficient room for properly expending all the connections on panel BNC and XLR sockets.

Care should be taken regarding heat accumulation when proceeding to a flight case or any closed container integration. It is important to understand the airflow of the unit and not to obstruct the air inlet and outlet located on the side of the unit (see drawing below).

If space is limited, it is more important to allow more space for the air outlet using a small grille located in regard of the stage racer exhaust grille. Alternatively, a forced air cooling of the flight case would be sufficient as well.

NOTE: Audio / Serial / GPIO connector pinout are the same as the Stage racer 1. Only audio **In** and **Out** connector locations are crossed to ease internal wiring while Mic gain option is fitted.

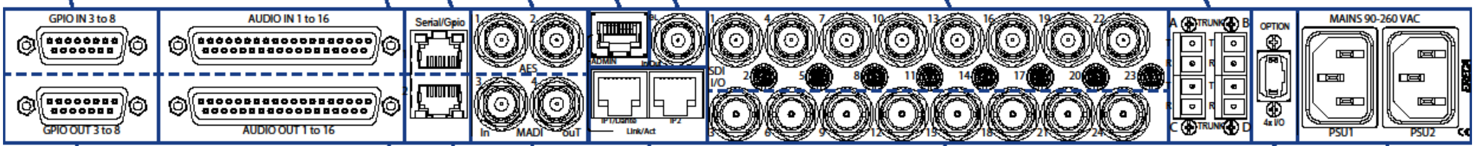


2.2 CONNECTORS LOCATION

The Stage Racer 2 provides signals, optical and power connectors on the rear panel. Optional Serial connectors and optional DC power are fitted on the visualization panel.

- **Rear connectors**

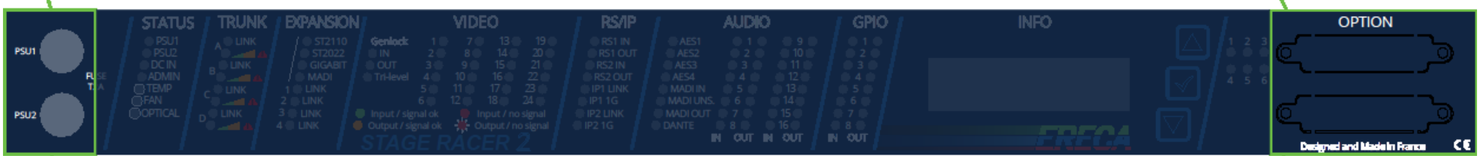
- 1 to 4 fibre trunks A-B-C-D (LC-PC connector)
- 8 to 16 SDI SD/HD/3G (Upper row, BNC / Middle row, mini-BNC)
- 1 Genlock, Composite, PAL, BB, Tri-Level (BNC In or Out)
- 1 Admin port (RJ45)
- 2 AES (n°1-2, BNC)
- 1 RS + 1 GPIO (n°1, RJ45)
- 16 Analog Audio In (D-Sub37 female sockets)
- 6 GPI (n°3-8, D-Sub15 female sockets)



- 6 GPO (n°3-8, D-Sub15 female sockets)
- 16 Analog Audio Out (D-Sub37 female sockets)
- 1 RS + 1 GPIO (n°2, RJ45)
- 2 AES (n°3-4) or 1 MADI In / 1 MADI Out (BNC)
- 2 Giga Ethernet (port 1 supports Dante/AES67) (RJ45)
- 4 to 8 SDI SD/HD/3G/6G/12G (Lower row, BNC)
- 4 10GB Ethernet (4ch fibre MPO connector)
- 2 Redundant PSU built-in 90-260 VAC (IEC/CEE22)

- **Front connectors (For Serial and DC Power options)**

- Optional 6 additional 500Kbps RS422 serial channels (D-Sub25)
- Fuse for PSU1 (2A slow blow 5*20mm fuse)



- Fuse for PSU2 (2A slow blow 5*20mm fuse)
- Optional 10-16VDC input for external battery (D-Sub25 with power inserts)

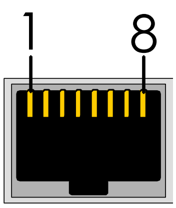
2.3 INTERFACES DESCRIPTION, WIRING, PORTS SETTING

This section includes the pinout for all electrical access and describes protocol audio interfaces such as MADI / SDI embedded Audio / Dante. For SDI, MADI and Ethernet the input configuration process is also described in this section in order to keep concise documentation.

2.3.1 General Purpose IN

For forward product compatibility the GP IN section is split on two kind of connectors.

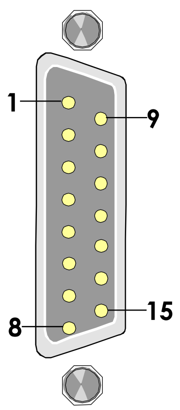
Inputs 1 and 2 are shared with each Serial signal transmission RJ 45 terminal, labeled "Serial/Gpio". These inputs are protected by an opto-coupler but are not floating. A grounding on the input pin triggers the GP-IN.

	**1: GND** **2: GP IN** *3: RX RS 422 – or RX RS 232* *4: TX RS 422 – or TX RS 232* *5: TX RS 422 +* *6: RX RS 422 +* *7: GP OUT* *8: GP OUT*

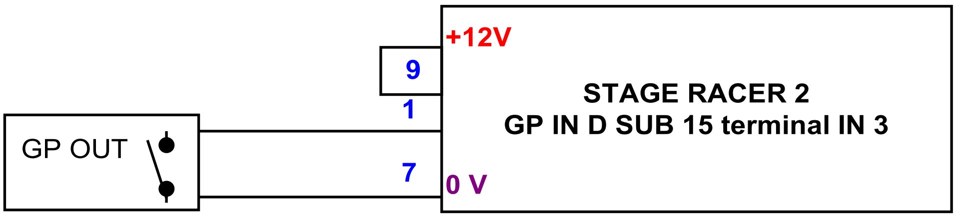
Inputs 3 to 8 are on one D-SUB 15 terminal female socket. Inputs are independent and electrically isolated by opto-couplers. Each input is non-polarized and feature an automatic 5mA current limitation working with an input voltage of 5 to 24 volts. The wiring polarity does not matter in this case.

Ground and power pins are available on the connector to ease interfacing with others machines especially if a dry contact, open connector or ground closure supplies the information.

The 12 volts output of the Stage Racer 2 is protected against external short circuit by an internal 100mA resettable fuse (polyswitch) common to the GPI and GPO sockets.

GP IN N°	SIGNAL	Socket contact	D SUB 15 GP IN	Socket contact	SIGNAL
3	GP IN 3a	1		9	GP IN 3b
4	GP IN 4a	2		10	GP IN 4b
5	GP IN 5a	3		11	GP IN 5b
6	GP IN 6a	4		12	GP IN 6b
7	GP IN 7a	5		13	GP IN 7b
8	GP IN 8a	6		14	GP IN 8b
	GND (0V)	7		15	+ 12V 100 mA
	GND (0V)	8			

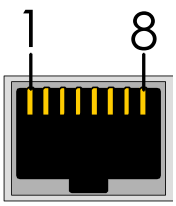
Example: GP IN 3 (with dry contact, ground closure, open collector drive).



2.3.2 General Purpose OUT

For forward product compatibility the GP OUT section is split on two kind of connectors.

Outputs 1 and 2 are shared with each Serial signal transmission RJ 45 terminal, labeled " Serial/Gpio ". These outputs are on floating dry contact relays with 50 Volts AC/DC and 0.25A switching capacity.
The relay is open if the corresponding remote input is not triggered.

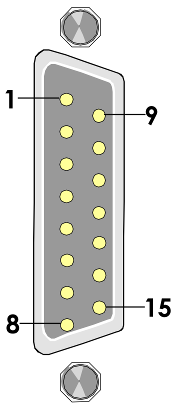


1: GND
2: GP IN
3: RX RS 422 – or RX RS 232
4: TX RS 422 – or TX RS 232
5: TX RS 422 +
6: RX RS 422 +
7: GP OUT
8: GP OUT

Outputs 3 to 8 are on one D-SUB 15 terminal female socket. These outputs are also on floating dry contact relays with 50 Volts AC/DC and 0.25A switching capacity. The relay is also open if the corresponding remote input is not triggered.

Ground and power pins are available on the connector to ease interfacing with others machines especially if the driven machine need a voltage information rather than a contact closure.

The 12 volts output of the Stage Racer 2 is protected against external short circuit by an internal 100mA resettable fuse (polyswitch) common to GPI and GPO sockets.

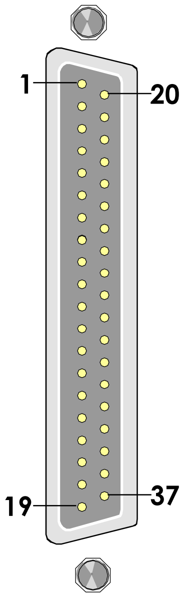
Relay N°	SIGNAL	Socket contact	D SUB 15 GP OUT	Socket contact	SIGNAL
3	GP OUT 3a	1		9	GP OUT 3b
4	GP OUT 4a	2		10	GP OUT 4b
5	GP OUT 5a	3		11	GP OUT 5b
6	GP OUT 6a	4		12	GP OUT 6b
7	GP OUT 7a	5		13	GP OUT 7b
8	GP OUT 8a	6		14	GP OUT 8b
	GND (0V)	7		15	+ 12V 100 mA
	GND (0V)	8			

Each GPI can be affected to one or Multiple GPO by using the GPIO routing grid of the Stage racer 2.

2.3.3 Analog AUDIO

2.3.3.1 Pinout

One D-SUB 37 pin female socket provides the access to the 16 balanced analog AUDIO IN.
One D-SUB 37 pin female socket provides the access to the 16 balanced analog AUDIO OUT.

SIGNAL	Socket contact	D SUB 37 AUDIO In/Out	Socket contact	SIGNAL
AUDIO 1 +	1		20	AUDIO 1 -
AUDIO 2 +	2		21	AUDIO 2 -
AUDIO 3 +	3		22	AUDIO 3 -
AUDIO 4 +	4		23	AUDIO 4 -
AUDIO 5 +	5		24	AUDIO 5 -
GND	6		25	GND
AUDIO 6 +	7		26	AUDIO 6 -
AUDIO 7 +	8		27	AUDIO 7 -
AUDIO 8 +	9		28	AUDIO 8 -
AUDIO 9 +	10		29	AUDIO 9 -
AUDIO 10 +	11		30	AUDIO 10 -
GND	12		31	GND
AUDIO 11 +	13		32	AUDIO 11 -
AUDIO 12 +	14		33	AUDIO 12 -
AUDIO 13 +	15		34	AUDIO 13 -
AUDIO 14 +	16		35	AUDIO 14 -
AUDIO 15 +	17		36	AUDIO 15 -
GND	18			
AUDIO 16 +	19		37	AUDIO 16 -

Note: It is possible to lower output amplitude (Range 0 to -30 dB) of each individual output from the web interface.

2.3.3.2 Audio Mic gain (optional module)

The gain blocks are connected to channels 9 to 16.

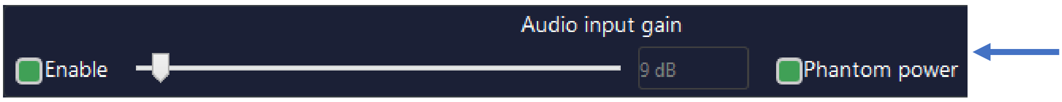
Thru the web server, each input from 9 to 16 can be amplified independently with a gain ranging from 9 to 60 dB (3dB steps) with or without Phantom power supply.

If the gain on a channel is not desired the gain block can be totally bypassed and the input recovers the line input level. See illustration below for setup from the tree view of the stage racer 2 admin.

The phantom power capacity is 10mA for each channel, impedance 6.8Kohms

Caution: Beware of the input phantom power, after switching off the phantom power the 48Volts will still be present for few seconds on the inputs, time needed by the inputs capacitor to discharge thru the internal discharge resistor.

Note: The Mic gain board can be fitted afterwards.



2.3.4 AES / MADI

Digital audio is available on true 75 Ohms BNC sockets.

The total capacity of the Stage Racer 2 is 4 simultaneous bidirectional AES signals. Thru the web server, the AES 3 and 4 can be disabled together to allow for MADI in and out.

Caution: Avoid connecting 50 ohms plugs it will damage the socket central pin causing costly repair especially if this one is on the lower part of the connector side.

2.3.4.1 AES

- **AES RAW transport and routing:**

Each AES port is internally equipped with a 2-4 wire converter connected to transmit a fully bidirectional path to any distant AES port of the Stage Racer 2 network. It appears in the AES audio grid of the network.

This allow to interconnect talkback panels working in a bidirectional manner on one 75 Ohms coax. The ports still can be used without configuration to transport unidirectional signal, no setup needed for channel direction.

Note1: For the internal 2-4 wire converter correct behavior the source/terminal impedance of the machine connected to the AES ports must be 75 Ohms.

Note2: The bidirectional function of the device constraint the design specially to provide an accurate AES activity led display and avoid signal loop if port impedance is not 75 ohms. The internal FPGA seeks for AES3 audio XYZ preamble at 48KHz to light the corresponding AES Led and enable transmission in this direction.

- **AES pick up and insertion:**

In parallel to the raw transport, the AES input signal can be internally decoded and its channels affected to other internal audio resources (Analog/Dante/Madi/AES/SDI Embedded) of the SR2 network. All decoded AES audio transits thru SRC on order to be at Stage racer internal audio frequency. Such AES channels then appears into the Audio grid.

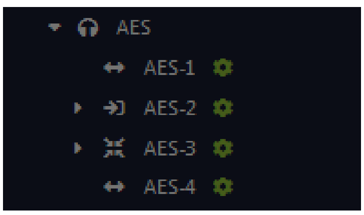
Similarly, an AES output can be created by picking signals of various sources (Analog/Dante/Madi/AES/SDI De-Embedded) available in the SR2 network. In this case AES delivered is synchronous of the SR2 free running internal audio clock.

Format supported /delivered comply to AES 3-2009 standard. Note that the U bits will be not transmitted and the C bits indicate SR2 48 Khz.

- **AES settings:**

For each port set to AES the user need to choose between those 3 modes.

In the example below AES1 and AES 4 are set to raw transport, AES2 to input and AES3 to constructed output.



2.3.4.2 MADI

Stage racer 2 allows 2 principles for MADI transmission described below.

- **MADI RAW transport and routing:**

MADI is transmitted with the packet engine and the stage racer does not takes care of the MADI content. A MADI signals can be distributed to multiple MADI outputs thanks to the MADI routing grid.

For transmission, the MADI clock information is transmitted along the MADI signal. At the receiving side the original clock is precisely regenerated and the MADI data is delivered accordingly to this clock.

The MADI output VCXO capture range is +/- 100 ppm. All AES10-2008 compliant MADI's will be transported whatever the rate / channel numbers.

- **MADI signal pick-up and insertion:**

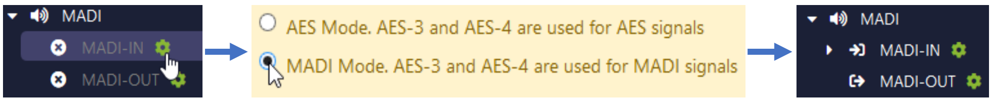
In parallel to the raw transport, the MADI input signal can be internally decoded and its channels affected to other internal audio resources (Analog/Dante/Madi/AES/SDI Embedded) of the stage racer 2 network. All decoded MADI audio transits thru SRC on order to be at Stage racer internal audio frequency.

Similarly, a Madi output can be created by picking signals of various sources (Analog/Dante/Madi/AES/SDI De-Embedded) present in the stage racer 2 network. This job is done from the Audio grid. In this case MADI transits thru and SRC and is synchronous of the genlocked audio audio clock derived from the Genlock supplied by the user. If no genlock is applied, the Genlock is then free run and Madi is not synchronous from the studio masterclock.

Madi input formats supported are 56/64 channels at 48 Khz and comply to AES10-2008.

- **MADI settings:**

When selected through the web server, MADI can be transmitted and port 3 become MADI input and port 4 become MADI output.



For Madi out the user must select between the 2 following modes:

2.3.5 DANTE / AES-67

The Dante / AES-67 board is an optional hardware module provided by Ereca, which provides 64 channels in and out.

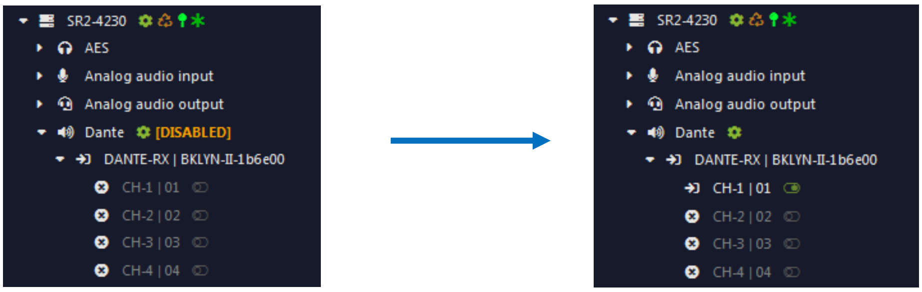
Each individual Dante audio channel can be selected and affected to the stage racer 2 internal audio bus and routed to any stage racer 2 audio output interface (Analog/Dante/Madi/SDI Embedded).

Similarly, Dante output channels can be populated by picking signals of various sources (Analog/Dante/ Madi/SDI De-Embedded) present in the stage racer 2 network. All of those signals appear in the Audio grid of the Stage Racer 2 network after individual enable in the tree-view.

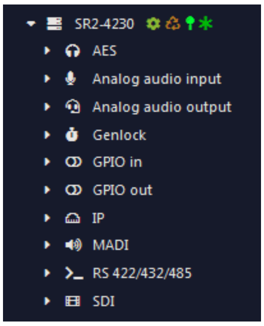
The Dante board embedded in the Stage racer 2 will appear as a slave in the user Dante controller.

Two SRC are used to synchronize DANTE inputs to the Stage racer 2 internal audio frequency and to synchronize Stage racer 2 internal audio to DANTE outputs.

The Dante board is available on port IP-1. It is ''disconnected'' from IP-1 port if no Dante audio channels are enabled, so Dante controller will not see undesired interfaces and no address conflict may happen. This case the Dante board is marked [Disabled]. Both cases are illustrated by the screenshots below:

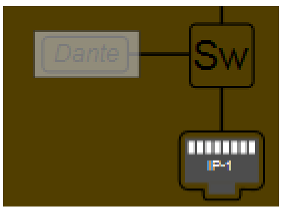


If a unit is <u>not</u> equipped with the Dante board, the Dante source will <u>not</u> appear the tree view of the machine, as shown below:

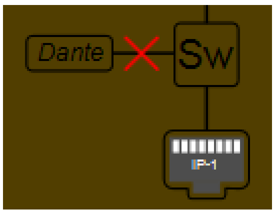


The same information's are available at the Ethernet ports setup page (extract):

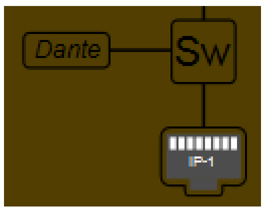
No DANTE board fitted:



DANTE fitted but not used:



DANTE in use:



<u>Note</u> The Dante board can be fitted afterwards.

2.3.6 SDI Embedding / De-Embedding.

Each SDI channel of a stage racer 2 frame is equipped with a 4 groups (16 channels) Embedder / De-Embedder. Depending of the SDI port direction only one is active. For 12G/6G channels by defeult the the first 3G stream is equipped with embedding / de-embedding resources. This logic is working for 48Khz embedded audio rates.

- **SDI port is an Input:**

Up to 4 groups can be de-embedded so up to 16 audios can be selected and affected to the Stage Racer 2 internal audio bus and routed to any stage racer 2 audio output interface (Analog/Dante/Madi/SDI Embedded). An SRC is used to adapt from Embedded audio rate to the Stage racer 2 internal audio frequency.

- **SDI port is an Output:**

Up to 4 groups can be Embedded so up to 16 audios can be sent by picking signals of various sources (Analog/Dante/ Madi/SDI De-Embedded) present in the stage racer 2 network. An SRC is used to adapt the Stage racer 2 internal audio frequency to the SDI signal derived clock locked 48Khz.

Audios 1 to 4 are affected to group 1, audios 5 to 8 are affected to group 2, audios 9 to 12 are affected to group 3 and audios 13 to 16 affected to group 4.

If a group is not embedded onto, the actual embedded audio on this groups is forwarded transparently from the SDI input to the SDI output port(s).

When an audio from the SR2 is affected to a channel of an audio group the remaining audios of this group are erased if not used. (Eg: When embedding audio 6 only, the audios 5,7 and 8 are erased whatever if the originating SDI have audio on group 2 or not).

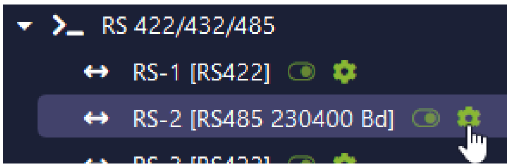
Note1: When Frame buffer is in use on the outputs, Audios contained into the original SDI are disembedded prior to the Frame buffer and re embedded afterwards to offer transparent Frame buffer behavior.

Note2: Regarding previous SR2 firmware's the 3.xx suppress the group notion and present a flat structure of 16 audio, but as explained previously the group consideration is still behind due to the embedding standard. See illustration below:

2.3.7 Serial ports settings

Two multiprotocol RS232/422/485 serial signals are transmitted in standard by the equipment. The maximum supported data rate of each signal is about 500Kbds suitable for Sony 700 protocol.

The setting of the serial protocol is done within the Stage Racer 2 tree view as illustrated in Icon below:

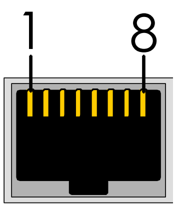


2.3.7.1 RS422/485 pinout

The RJ 45 connector provide 1 differential pair for RS422 transmission and 1 differential pair for RS422 reception.
To build a half-duplex RS485 transmission, just bridge “pin 3 with pin 4” <u>and</u> “pin 5 with pin 6”.

For RS485, setup the corresponding Baud rate within the web server to enable the Stage Racer 2 to manage the output impedance at the right serial byte duration.

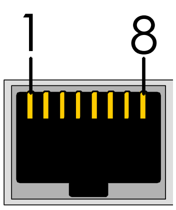
Connect the Shield to pin 1.

	**1: GND (Shield)** *2: GP IN* **3: RX RS 422 – (Stage Racer 2 electrical OUTPUT)** **4: TX RS 422 – (Stage Racer 2 electrical INPUT)** **5: TX RS 422 + (Stage Racer 2 electrical INPUT)** **6: RX RS 422 + (Stage Racer 2 electrical OUTPUT)** *7: GP OUT* *8: GP OUT*

<u>Note:</u> For RS 485 Telex/RTS talkback panels please ask ERECA for wiring tip.

2.3.7.2 RS232

Refer The RS 232 signal ground to pin 1. Leave pins 5 and 6 unconnected.

	**1: GND (Ground ref/Shield)** *2: GP IN* **3: RX RS 232 – (Stage Racer 2 electrical OUTPUT)** **4: TX RS 232 – (Stage Racer 2 electrical INPUT)** *5: Do not connect* *6: Do not connect* *7: GP OUT* *8: GP OUT*

Those serial ports appear in the RS232/422/485 grid and are connectable in a peer 2 peer manner.

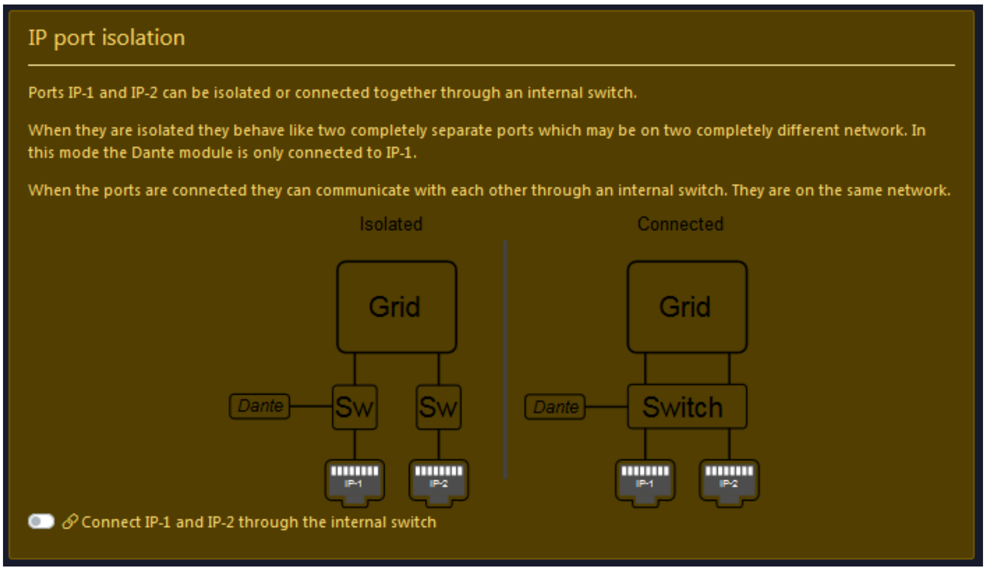
2.3.8 Ethernet ports/ Mode

The Stage Racer 2 offers 2 independent Gigabit Ethernet ports, which can either be isolated or connected together through an internal switch. Setting is done in the web GUI.

- When they are isolated, they behave like two completely separate ports which enables to create totally independent Peer to Peer connections over the Stage racer 2 network.

- When the ports are connected, they can communicate with each other through an internal switch. Thus, it allows to create a distributed switch along the Stage racer 2 network in a daisy chained manner.

Note: The extremity nodes of the daisy chain can be isolated or connected. If they are isolated the remaining port can be used to create another separate network connection.



Note1: The Dante board is available on port IP-1 only when in Isolated mode and can be reach on IP-1 and IP-2 ports when in Connected mode. The Dante board is available on the IP ports of the corresponding machine whatever is made with the routing of the IP streams over the SR2 network.

Note2: Port speed are 10/100/1000Mbs With autosense and straight/crossed cables support.

2.3.9 Admin port

The Stage Racer 2 is equipped with a dedicated admin port to access the web interface. Port speed is 10/100Mbs Autosense and support straight or crossed cables.

The IP of the machine can be found using the navigation buttons next to the LCD INFO screen.

Firefox browser is recommended for proper Gui usage.

Note: The data volume transferred thru the Admin port is very small and do not need a 1Gbs connexion rate.

2.3.10 Genlock/Composite VIDEO port

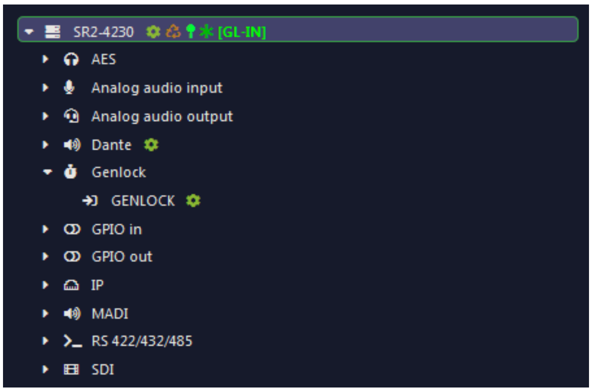
This port supports Composite (PAL, SECAM, NTSC) / Black Burst / Tri-level and is transmitted thru the Stage Racer 2 via the G/L port.

In a Stage Racer 2 network, the G/L port is direction switchable and work as follows: when the Genlock port direction is set to input on a particular unit, the direction of all the other Genlock ports of all units connected to the network will automatically be set to output. Then genlock is distributed to all the machines over the network.

Composite video is carefully processed with Minimal latency and high-quality digitizing with +/-3dB AGC input, 2x over sampling and 10 bits digital filtering and transmission is provided for this signal.

Internally each machine extracts from this signals Video and Audio genlocked clocks for frame buffering purposes. Detailed Genlock setup for frame buffering is detailed in a further section of this document.

When an SR2 frame is set as G/L input this is clearly highlighted into the tree view, with [GL-IN] wordings.



2.3.11 SDI VIDEO ports

Depending on the choice made at the time of order, the Stage Racer 2 can be built with either 12 or 24 video channels. Please note it is not possible to upgrade from 12 to 24ch afterwards.

The 8 BNC of the upper row and 8 mini-BNC of the middle row can accept SD/ASI/HD/3G signals.
The 8 BNC of the lower row can accept SD/HD/3G/6G/12G.

Each video port is direction switchable helping user to avoid congestion at locations with highly unbalanced number of Inputs or Outputs.

Each interface will automatically accept a standard at equal or lower rate than the standard set in the machine.

- **SDI standard**

3G ports comply with SMPTE ST 424, SMPTE ST 292, and SMPTE ST 259 standards. All resolutions/framerates are supported including the most common 1080p50/60, 1080i50/60 and 625i50/480i60.

12G port comply with SMPTE ST 2082-1, ST 2081-1, ST 424, ST 292-1 and ST 259 standards. All resolutions/framerates are supported including the most common 2160p50/60, 1080p50/60, 1080i50/60 and 625i50/480i60.

- **Equalization capacity**

Figures given blow are based on Belden 1694 cable and 800mV 75 Ohms standard source.

3G ports have the following Equalization capacity:

- 140m at 3G rate,
- 260m at HD rate,
- 500m at SD rate.

12G ports have the following Equalization capacity:

- 60m at 12G rate,
- 65m at 6G rate,
- 160m at 3G rate,
- 250m at HD rate,
- 400m at SD rate.

- **12G Transport**

Importent: Uncompressed 12G support in the same direction is currently only possible every two 12G connectors (each contiguous 12G connector must be in a different direction). Using port 3 & 6 or 9 & 15 or 18 & 19 or 21 & 24 both configured as 12G input or 12G input will not work.

In the case of transmitting uncompressed 12G channels, we suggest to set ports 1,2,3 / 7,8,9 / 13,14,15 / 19,20,21 as inputs and ports 4,5,6 / 10,11,12 / 16,17,18 / 22,23,24 as inputs to avoid internal congestion.

This limitation was decided at design time for best price positioning of the product, and the very most existing hardware's can be upgraded with Tico-Xs compression to avoid this limitation and transport 12G streams with only 3Gbs bandwidth consumption and low latency (< 100µs seconds extra delay from Input port to Output port).

Caution: Avoid connecting 50 ohms plugs it will damage the socket central pin causing costly repair especially if this one is on the lower part of the connector side.

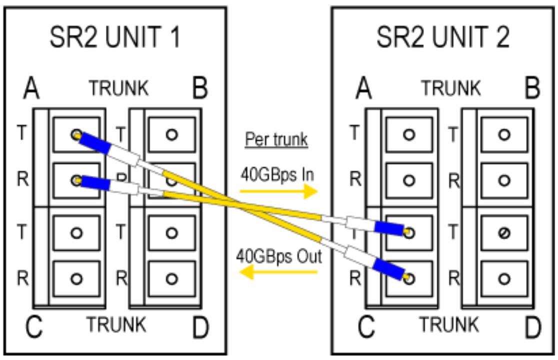
2.3.12 OPTICAL transmission ports

2.3.12.1 Optical connection

The Stage Racer 2 transmission is based on TDM multiplexing for the all signals managed by the system. Each TDM multiplex is transmitted to another machine by "Trunk" ports.

Each unit can have up to 4 trunk ports on dual LC/PC socket for Single Mode fiber (minimum is 1 for a network endpoint).

Trunks are labelled A-B-C-D and can be connected randomly as long as the duplex fiber is connected properly:
(Tx & Rx of the same trunk -> Rx & Tx of another trunk of a different unit).



Each trunk data rate is 40Gbs which allow the most rugged interface for harsh environment with potentially dirty fibers and very high outside temperatures.

Trunks can be combined to offer more bandwidth or redundancy between network nodes.

2.3.12.2 Transmission principle.

Most part of the bandwidth is dynamically allocated for high datarate signals (SDI / Ethernet / Raw Madi), For any signal bandwidth is consumed only between the sources and the destinations programmed for this signal. Elsewhere on the network this amount of bandwidth is free for other signals.

A small remaining bandwidth is fixed and guaranteed, dedicated to low datarate signals (Genlock / Audio / Serial / GPIO / System management) with a predefined maximum channel capacity per signal type.

As a base rule, each trunk total capacity is:

- 25 HD signals (or similar rate signals like GB Ethernet), or 12x3G or 3x12G or any combination,
- 1 Genlock / Trilevel / Composite,
- 400 Bidirectional Audio channels,
- 50 Bidirectional Serial channels,
- 200 Bidirectional GPIO.

You can refer to the section Bandwidth management to see how that translates in the web interface.

2.3.12.3 Trunk types

Internally a Trunk comprises of a QSFP+ mounted and connected inside the machine to the LC/PC sockets on the back of the unit. Different models can cohabitate in the unit depending of customer needs.

There are at least two types of modules available:

<u>STAR2-T4LR:</u> Long Reach (LR) optical module offering a guaranteed optical transmission of up to 10km. This is the most common type of Trunk used in Stage Racer 2.

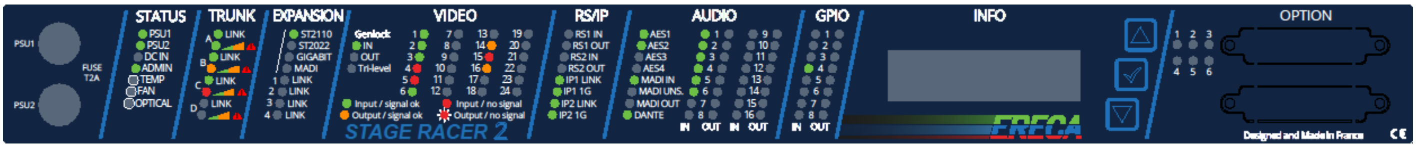
<u>STAR2-T4ER:</u> For much longer distance the Extended Reach (ER) optical module is designed for 40Km transmission.

> CAUTION: The high sensitivity APD receivers of the T4ER may be destroyed by optical power overload, do NOT apply more than -10dBm on the input port (labelled R). A damaged T4ER receiver port is not covered by warranty.
> Similarly, if too much power is applied the receiver may overload and the link will not establish, in this case the optical power reading on the interface may be false as well.
>
> NOTE: The Extended Reach module transmission length it may be affected by fiber chromatic dispersion. Losses in some rare cases of very old fiber.

<u>REMARK:</u> *It is advised to source the QSFP+ at Ereca as factory validates it one by one for compliance with Stage Racer 2 standard. The warranty label will be broken if the user decides to integrate outside QSFP+.*

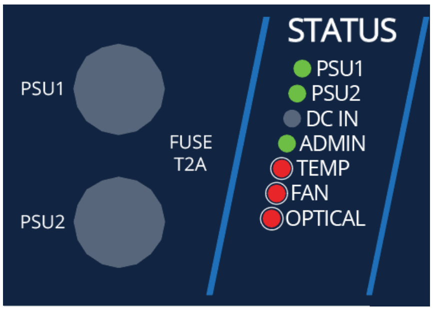
2.4 VISUALISATION

The display face provides a comprehensive LED panel of the STAGE RACER 2.
For ease of trouble shooting one LED is affected per transmitted signal.



The 2 mains PSU fuses are also located on this side of the equipment for ease of replacement. (Model is 250Vac 2Amp time lag 5x20mm fuse).

2.4.1 General Status



Status related to power supply

- **PSU 1:** Green LED, ON when the PSU module 1 is powered.
- **PSU 2:** Green LED, ON when the PSU module 2 is powered.
- **DC IN:** Green LED, ON when the battery is in use (in that case PSU1 and PSU2 are unpowered)

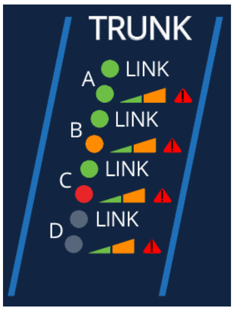
General

- **ADMIN:** GREEN LED, ON when a connection is established on the admin port.

Technical alarms

- **TEMP:** Red LED, ON when the internal temperature is over 70°C
- **FAN:** Red LED, ON when an internal fan is out of service (Open circuit or Stuck)
- **OPTICAL:** Red LED, ON when the power is low on a connected trunk

2.4.2 Trunks



Trunk activity

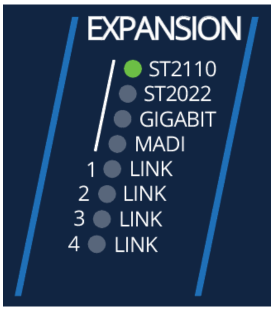
- **LINK:** Green LED, ON when a connection is established with another machine on that particular trunk port (A, B, C or D).

Trunk occupation

- **LED OFF,** when trunk is not used (occupation at 0%)
- **Green LED, ON** when trunk occupation is between 0% to 49%
- **Orange LED, ON** when trunk occupation is between 50 to 100%
- **Red LED, ON** when there is a problem with the trunk

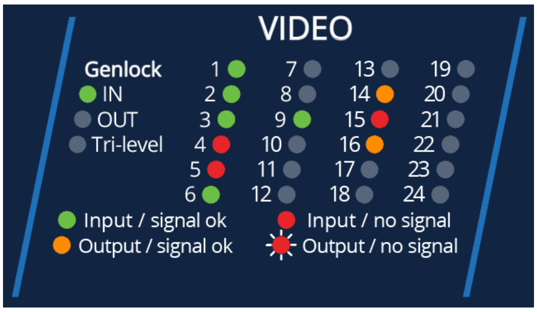
2.4.3 Expansion

The Stage Racer 2 offers 4x10GB Ethernet expansion channels via the MPO connector for future remote production option and future various other applications. As an example of what can be done:



- **ST2110: Green LED, ON** when ST2110 mode is activated in the machine.
- **ST2022: Green LED, ON** when ST2110 mode is activated in the machine.
- **GIGABIT: Green LED, ON** when extra Gbe ports are transmitted.
- **MADI: Green LED, ON** when extra MADI's are transmitted on this machine.
- **Link 1-4: Green LED, ON** to indicate which expansion channel is linked with a peer.

2.4.4 Video Status Leds



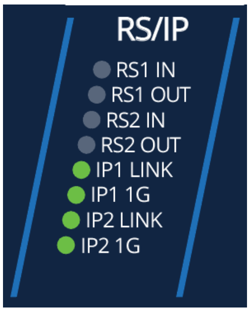
Genlock I/O

- **IN: Green LED, ON** when the unit is Genlock master on the network and a valid Genlock signal is detected on the input.
- **OUT: Green LED, ON** when the unit is Genlock slave on the network and a valid Genlock signal is detected on the output.
- **Tri-Level: Green LED, ON** when a Tri-level signal is detected on the G/L port.

The SDI LED (1 to 24) section indicates the detection of a video signal and its direction.

- **LED OFF**, when the SDI port is disabled via the web interface.
- **Green LED, ON** when the port is configured as Input and a signal is detected conform to its standard.
- **Red LED, ON** when the port is configured as Input, but no signal is received or the signal is not compliant to its configured standard. (for example, the port is configured to receive an SD signal but a 3G signal is actually present)
- **Orange LED, ON** when the port is configured as output and a valid signal is routed to that port
- **Red blinking LED, ON** when an input channel is routed to that output port but no signal is detected

2.4.5 Serial and IP



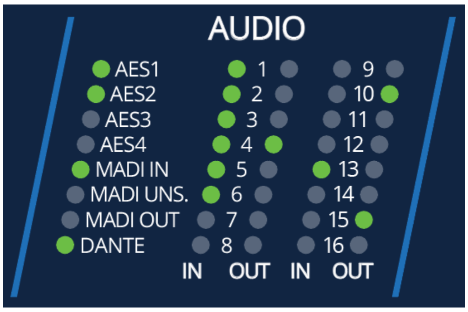
Serial RS

- **RS1 IN, Green LED ON**, when a serial signal is received on the serial port 1
- **RS1 OUT, Green LED ON**, when a serial signal is sent via the serial port 1
- **RS2 IN, Green LED ON**, when a serial signal is received on the serial port 2
- **RS2 OUT, Green LED ON**, when a serial signal is sent via the serial port 2

Ethernet

- **IP1 LINK, Green LED ON,** when an Ethernet link is established on port IP1
- **IP1 1G, Green LED ON,** when the IP link 1 is linked at 1GBps
- **IP2 LINK, Green LED ON,** when an Ethernet link is established on port IP 2
- **IP2 1G, Green LED ON,** when the IP link 2 is linked at 1GBps

2.4.6 AUDIO



This part of the panel displays in details analog audio signals seen by the unit. AES/MADI/DANTE is more summarized but indicates if signal “carrier” is detected. For each single digital channel activity, pls refer to the web interface audio activity panel.

4 bidirectional AES signals.

AES 1-4, Green LED ON, when a 48Khz AES signal is fed on the corresponding port In that case, All Madi Led are Off.

2 bidirectional AES signals + 1 MADI I/O

- **AES 1-2 Green LED ON,** when a 48KHz AES signal is fed on the corresponding port
- **MADI IN, Green LED ON**, when a MADI signal is received on MADI In Port
- **MADI OUT, Green LED ON**, when a MADI signal is sent on MADI Out Port
- **MADI UNS., Red LED ON**, if the internal reclocker is not locked on the input MADI signal.

Dante

- **Dante, Green LED ON**, when the Dante hardware module is properly installed and activated by enabling various channels on it.

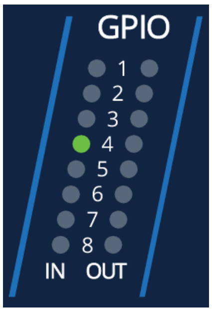
Analog Audio

- **1-16, Green LED ON,** indicates the activity of an analog audio signal received on the input port and/or the output port.

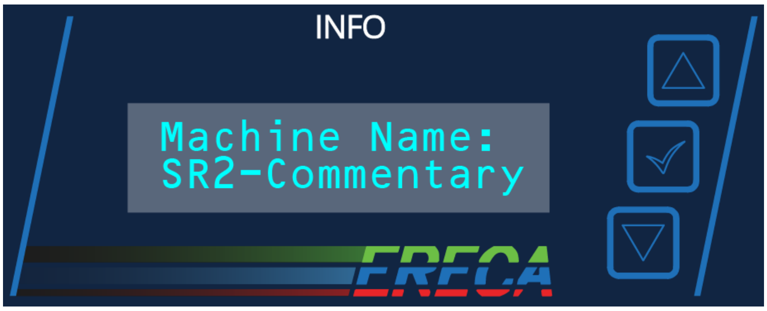
  Note: The trigger level is set to -10dBm approximatively. Audio activity LEDs are refreshed every 500ms displaying if there was a level > -10dBm on the past 500ms period providing a smooth display.

2.4.7 GPIO

- **GPIO 1-8, Green LED ON**, when a GPI or GPO is activated on their respective input and output.



2.4.8 OLED Display & Navigation buttons



- **Screen**

This section provides a list of real time information for control purposes.

The blue buttons on the right allow navigating between the different information listed below and allows performing a factory reset of the unit. (Need firm finger press in their center).

- **List of messages**

Machine Name: SR2-Commentary	Name of the machine set in the web interface
IP address: 192.168.1.248	IP address of the machine set in the web interface
MAC Address: 507E:EC00:4107	MAC address of the machine
TA Rx 0.2 dBm TB Rx -0.4 dBm	Lowest optical power received on Trunks A & B
TC Rx -6.5 dBm TD Rx -40 dBm	Lowest optical power received on Trunks C & D
Intern Tp 38 Deg Fan Speed 9%	Internal temperature of unit (operating range: -20°C to +60°) Fan speed is automatically adjusted depending on internal temperature
Trunk A load In: 4% Out: 0%	Bandwidth occupation of signals in trunk A In: coming from the distant Node Out: sent to the distant Node
Trunk B load In: 40% Out: 32%	Bandwidth occupation of signals in trunk B In: coming from the distant Node Out: sent to the distant Node
Trunk C load In: 75% Out: 67%	Bandwidth occupation of signals in trunk C In: coming from the distant Node Out: sent to the distant Node
Trunk D load In: 0% Out: 0%	Bandwidth occupation of signals in trunk D In: coming from the distant Node Out: sent to the distant Node

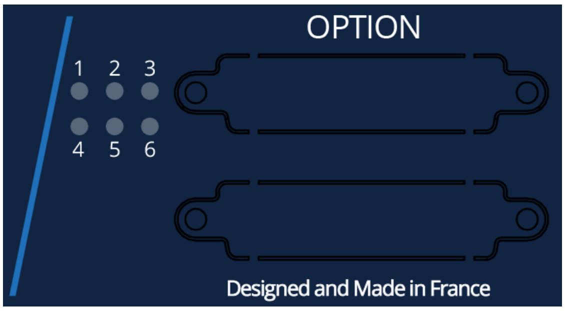
- **Reset from pushbuttons**

The unit can be individually reset to factory default configuration.
It is important to understand all configuration made on this unit will be lost. Therefore, we recommend you to make a backup of the unit via the web interface prior to this operation.

To perform a factory reset:
- Disconnect the unit from the network by temporarily remove the trunks fibers connected to it
- Press and hold the **up** and **down** button for 3s and wait for the message “Press Val…” to appear
- Then the **validate** button on the right side of the screen needs to be pressed within 5s, otherwise, the operation will cancel automatically.
- After the operation is complete, it is recommended to reboot the unit.

2.5 OPTIONAL CONNECTORS

2.5.1 Description



Available hardware options

There are two hardware options available on D-Sub25 connectors:

- **6 additional 500Kbps RS422 channels**

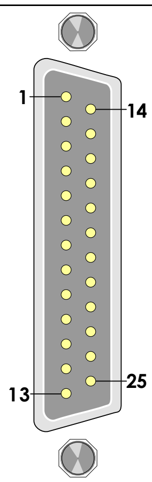
In this case the 6 LED next to the connector will display the IN/OUT activity of each additional serial links.

- **DC input** Provision for D sub socket with power inserts to connect a 10-16 VDC battery to power the Stage Racer 2, used in case of mains power loss.

Caution: The DC input is protected by internal fast acting fuse; any polarity reversal will blow the fuse. Due to the high current involved a resettable protection is not possible.

2.5.2 RS422 option pinout

One D SUB 25 pin female socket provides access to additional RS422 optional channels 3 to 8.

Channel	SIGNAL	Socket contact	D SUB 25 RS422 1to6	Socket contact	SIGNAL
3	IN 3 -	1		14	IN 3 +
3	OUT 3 +	2		15	OUT 3 -
4	IN 4 -	3		16	IN 4 +
4	OUT 4 +	4		17	OUT 4 -
5	IN 5 -	5		18	IN 5 +
5	OUT 5 +	6		19	OUT 5 -
all	GND	7		20	IN 6 -
6	IN 6 +	8		21	OUT 6 +
6	OUT 6 -	9		22	IN 7 -
7	IN 7 +	10		23	OUT 7 +
7	OUT 7 -	11		24	IN 8 -
8	IN 8 +	12		25	OUT 8 +
8	OUT 8 -	13			

It is strongly recommended to connect the shield of the signals transmitted to the GND pin.

Each LED summarize the Input and Output signal activity on the corresponding channel.
Each signal activity is also reported on the web interface.

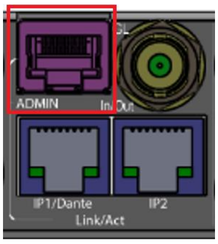
Each differential input is **not** 120Ohms loaded internally for optimum compatibility with transmitted protocols. If impedance matching is needed a small form factor resistor (Eg: SFR16) could be added directly on the D SUB pins, together with the signal wire.

Note 1: For RS 485 Telex/RTS talkback panels please ask ERECA for wiring tip.

Note 2: As the differential inputs are unloaded internally a small crosstalk should happen on the adjacent channel only if it is unused and left floating.

3 MANAGEMENT

3.1 WEB MANAGEMENT INTERFACE



The STAGE RACER 2 whole network can be monitored and configured through a single web interface accessible via any SR2 node of that network.

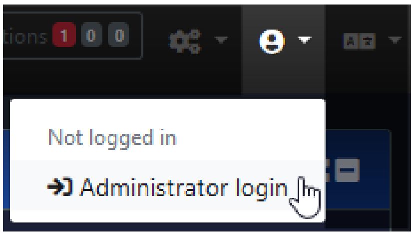
The RJ45 Ethernet ADMIN port of the node provides access to the embedded web server interface.

To locate the IP address of the unit, use the Up/Down button on the front of the unit and navigate to the IP address section and type the IP in your browser (SR2 default IP is : 192.168.1.248). The landing page displays.

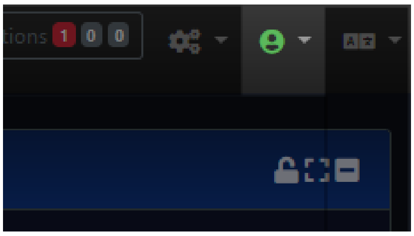
Note: Firefox browser preferred / minimal resolution of 1920x1080.

3.1.1 Admin login / Language selection

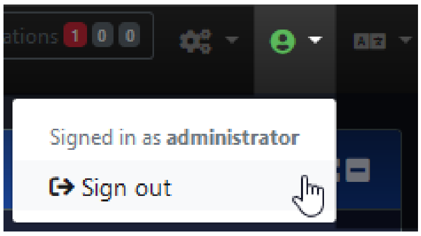
It is necessary to have an **administrator access** to proceed with any changes in the configuration.
To log in as Administrator access the following section (top right of the interface):



1-Click to login. Password: "ereca"

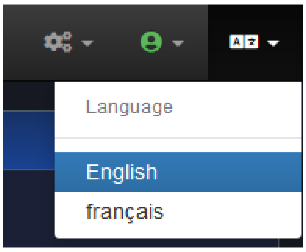


2-Green = Connected as Admin



3-Click again to sign out

Change language
The web interface automatically detects the browser language. However, it is also possible to select a different one.



3.1.2 Web interface Organization

There are three main pages on the web interface accessible from the top navigation bar:

Graph	Provides a live overview of the network topology / usage / condition and allow configuration of all units available in the network and their respective input/outputs ports.
Grid	Allows to route and distribute signals across the network.
Configuration	Allows to modify administrator password and proceed to a firmware update.

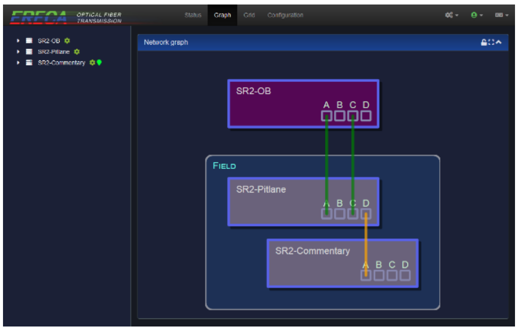
3.2 GRAPH PAGE ESSENTIALS

Graph page is the main dashboard of the SR2 displaying clearly most important technical information and condition of the network.

The page auto-populates in real-time when a new **node** (SR2 frame) or trunk is connected/disconnected. Whole network topology is automatically discovered and displayed. Redundant links between nodes are represented as Green while non-redundant links appear in Orange.

On the **Network graph** subsection, following infos are available:

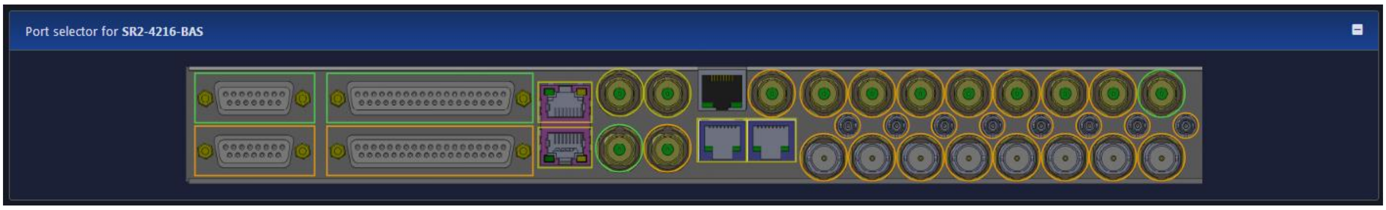
- Network topology and machine interconnexions
- Network connexions bandwidth usage
- Optical power received by each receivers
- Transmissions condition of each trunk
- Node condition (Optical power received, BER of each link, Power supply condition, Internal error).



On the left side a **tree view** displays all nodes found in the network. Unfolding a node gives access to each port for port enabling/disabling, then if port features processing it gives access to processing features.

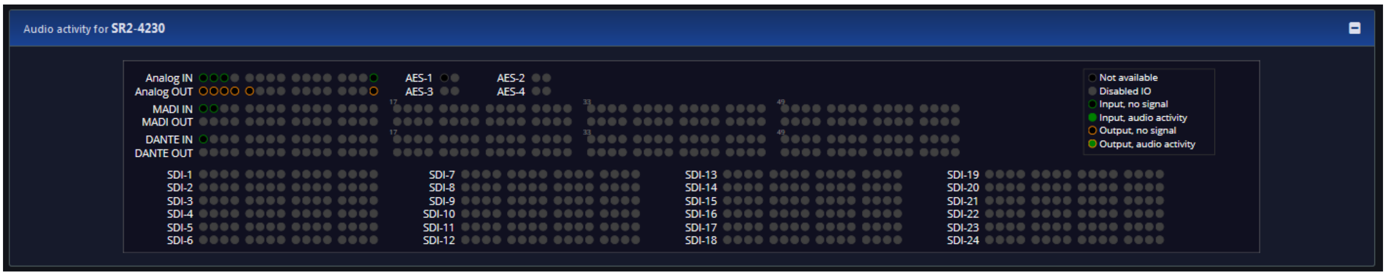
Much more information are also easy to find by simple click of the user on each node, three subsections will display below the graph.

Port selector allow quick access to each machine port by simply clicking on it (= opens it in tree view).



Status displays node front led panel reprint + detailed technical information

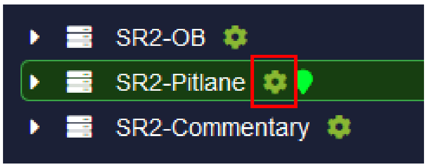
Audio activity displays each audio interface activity for each channel physically available on the product.



Furthermore, clicking on a Link between 2 nodes allow signal route highlight on the whole graph. All those features are explained in detail in the following sections.

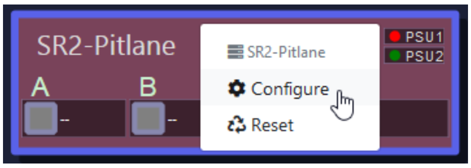
3.2.1 Configure a specific node

This paragraph explains how to configure each node properties. Two ways to enter the property setup are displayed below.



1a-Left column
Click on the green wheel icon next to the unit name

OR



1b-Graph part
Right click on an SR2 node and select Configure

The machine configuration window pops-up allowing to:

- **Name the node** so it can be identified throughout the network.
  Nb: The name is also visible in the front LCD of the unit.
- **Group multiple nodes** together (all units with the same group name will be visually grouped together in the graph with a common background color).
- **Assign a color** for each unit (same color will be reused in the Grid view)
- **Set the Ember+ Id** to be identified by Ember+ clients
- **Set the IP address** netmask, gateway of the Admin port
- **Root machine configuration**: Set the priority level of the node in a network
- **Enable/Disable anonymous telemetry:** for advanced purposes
- **Version**: The version number indicated the firmware loaded in that particular node

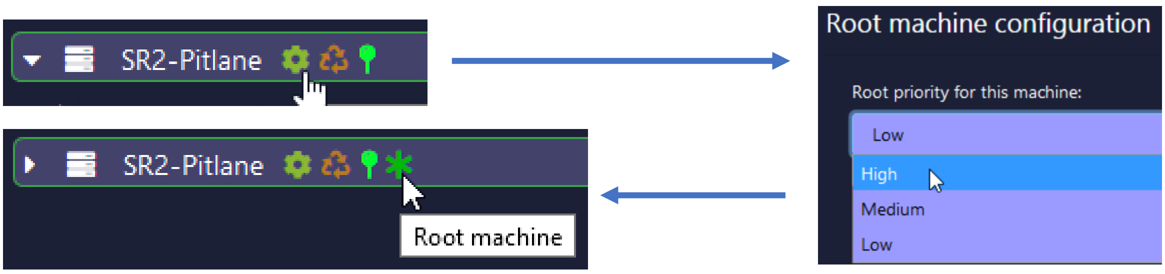
3.2.1.1 Root node setting

The SR2 network is decentralized and automatically discovers its topology, which means that each nodes can be removed or added without requiring any manual configuration.

At any given moment, one node in the network is chosen to be the root node. This node is the grand master sync source for the whole synchronous network. If root node disappear a new one will be elected right away.

For setups with possible parts of the network disconnexion while being on air it is possible to choose whose machine is the root node. Three level of priority are allowed to tune whose next node will become the root node if the highest priority node disappear.

However is it much imporent to set the root node machine at the studio MCR (or equivalent) location.



The green indicator shows the root node.
The backup node are indicated with same icon in grey (one priority level below the root).

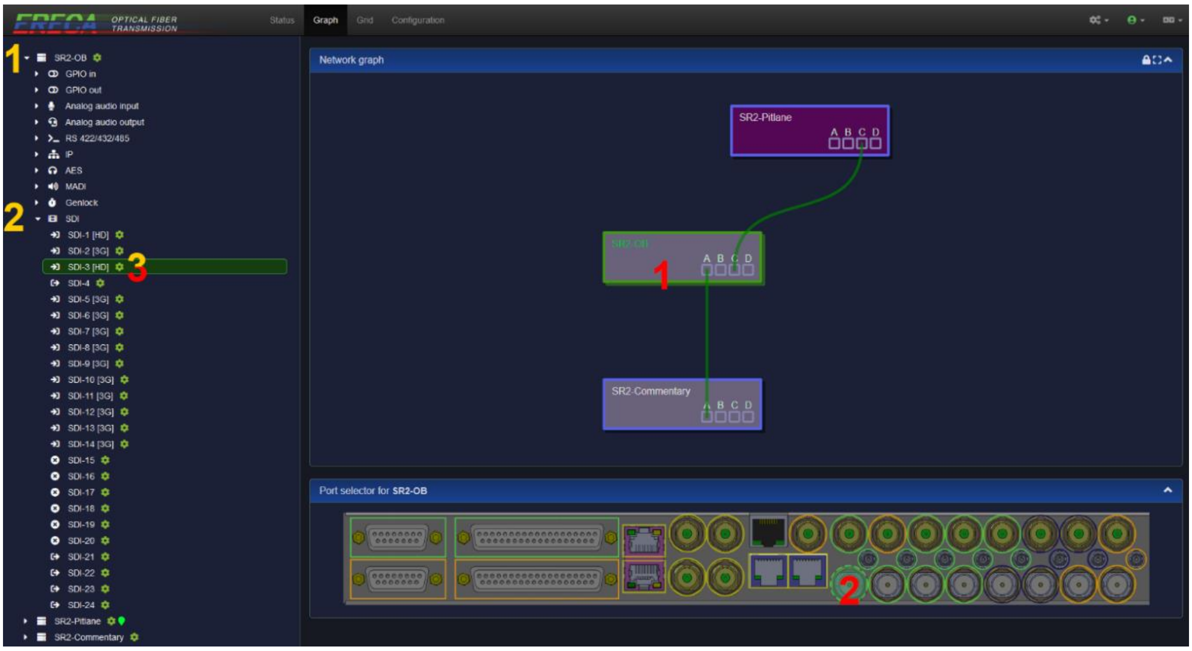
3.2.2 Port Setting

Before any routing attempt, each desired port must be activated properly.
Most of ports can be simply enabled or disabled but SDI ports require more setup as follow:

- Direction of the port have to be set.
- Maximum SDI rate allowed must be set for any inputs.

Every port can be renamed, otherwise the default factory name will be used.
Every port that is not enabled will not appear in the grid view.

There are two methods to configure a port, the **Port selector** or the **Tree view**.



Port selector allow direct access to the desired interface, tree view allow navigating to the desired interface.

3.2.2.1 Port selector

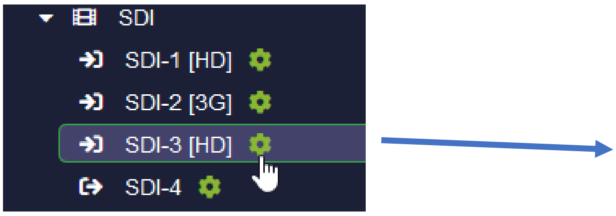
Port selector is helpful to configure a single signal quickly (SDI / Serial / Ethernet / Genlock).

Follow the **1,2,3 "Red"** steps in the previous illustration.

1 - Select one node on the network graph, then the port selector view opens below the graph,

2 - Select one or multiple ports (using Ctrl + Click) in the port selector, it will open the right position in the tree view.

3 - Click the configuration wheel next to one selected port label to open the port configuration windows then set the desired parameters.



Note: In case of multiple ports selection same settings are affected to those ports (Direction / Standard). The name cannot be changed while doing multiple selection.

3.2.2.2 Tree View

The tree view selector allows to navigate amongst all nodes to configure them.

Follow the **1,2,3 "Orange"** steps in the previous illustration.

Any individual port can be accessed by unfolding the desired node / signal type, then selection the configuration wheel of the desired port.

Tip: Selection of multiple ports of the same category is also supported using Shift + Click or Ctrl + Click.

3.2.2.3 Signal type summary

The port configuration option allows user to set a name for each port, the direction, its standard and some other specific options.

Here is a summary of all possibilities depending on signal type:

Signal Type	Port Direction	Standards available	Options / Features	Audio Shuffling
GPIO	In & Out			
Analog audio In	In		In 9-16: Mic gain Phantom power 48V	Yes
Analog audio Out	Out		Out 1-16: Attenuator	Yes
Serial	Bidi	RS232 / RS422 / RS485 from 1200bd to 230Kbd		
IP	Bidi	10 Mbs / 100 Mbs / 1GBs / Autosense	Peer to Peer or Chained	
AES	Bidi	AES3 48Khz	Metadata transparent	
	In or Out	AES3 48Khz	C channel fixed	Yes.
MADI In	In	MADI 56-64ch 48 Khz		Yes
MADI Out	Out	MADI 64ch 48 Khz		Yes
Dante	In & Out	64ch of Dante (+ AES67 + Ravenna If allowed by Audinate Brooklyn 2 expansion board firmware).	DHCP, Manual IP, APIPA	Yes
Genlock	In or Out	PAL, NTSC, Composite, Black Burst, Tri-Level (Autosense)	Auto slave configuration	
SDI 3G (top & middle row)	In or Out	SD, ASI, HD, 3G	Framebuffers Audio / Video delay Internal or G/L clock use Routing priorities	Yes
SDI 12G (bottom row)	In or Out	SD, HD, 3G, 6G, 12G	Internal or G/L clock use Routing priorities	Yes

By setting the standard, the bandwidth is allocated in advance. Therefore, a port set up in 3G can accept any signal of lower bandwidth like HD or SD, but not above (e.g. 6G or 12G). The same way a port set to 12G can accept any signal with lower bandwidth. The bandwidth constraint is done on the inputs signal only any output can accept a datarate up to its theoretical maximum.

3.3 GRID PAGE / ROUTING SIGNALS

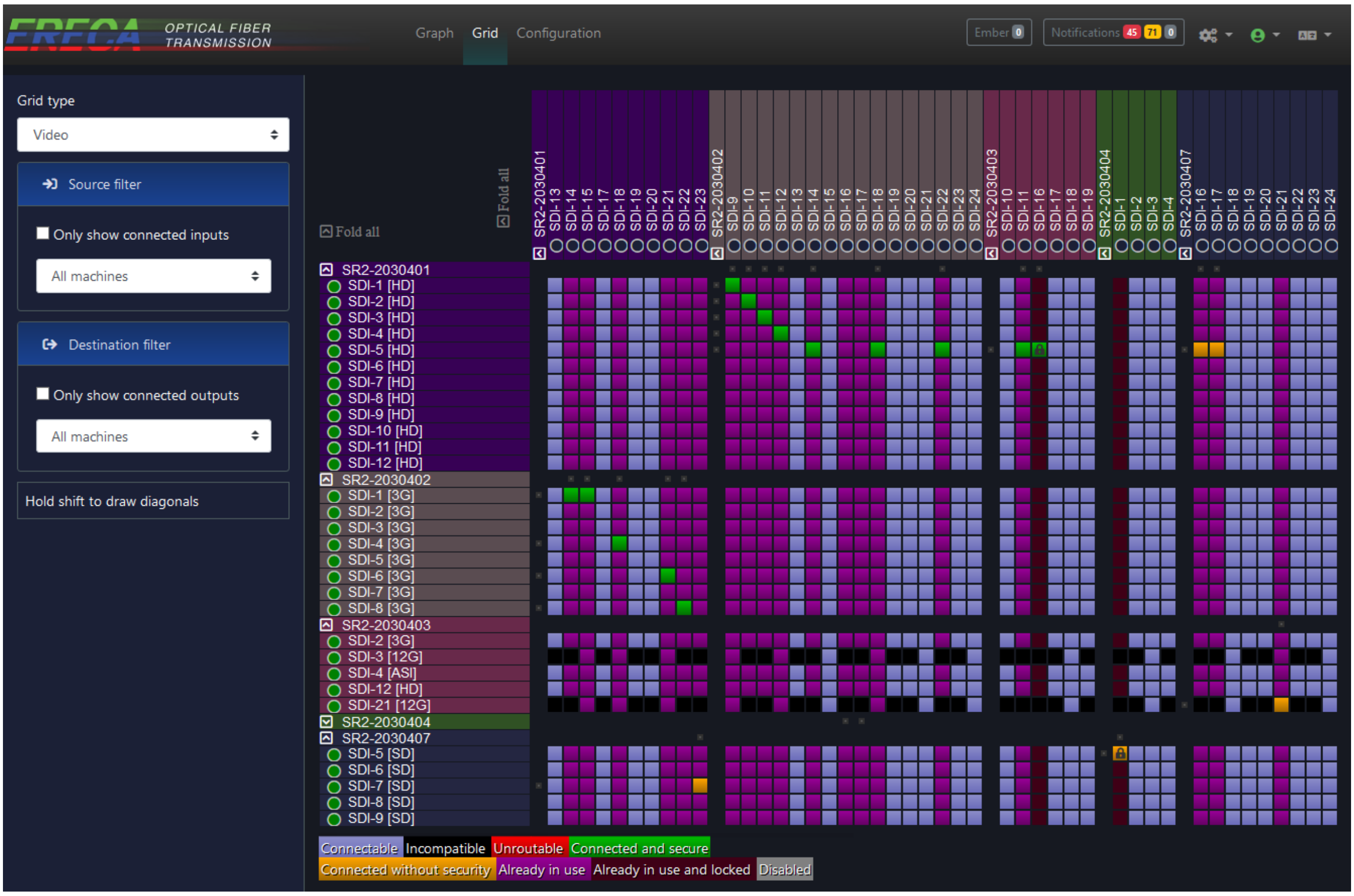
3.3.1 Grid Page Presentation

The **Grid** page allows to route all signals available on the network (peer to peer or distribution). **Grid** is automatically constructed by type of signals dependent of what signals were enabled in the **tree view** of the **graph** page.

The routing crosspoint matrix can be filtered by signal type with the dropdown menu **Grid type** allowing to switch between matrix for the Video, Audio, AES, MADI, GPIO, IP or Serial channels.

User can filter the sources (input) and destinations (output) by node and by type of signal as well, as well as choosing to display only the active crosspoints.

<u>Example below shows Grid page with all video signals of all machines of the network</u>:



In the grid, signals listed vertically correspond to all input signals (sources) available and configured previously, while all signals listed horizontally correspond to output signals (destinations). These ports are grouped per SR2 node for easier filtering.

The port name labelling is formatted in the following manner:
“Physical Port Type-Number” “[Input Signal Type]” I “User Label”. For example: *SDI-3 [12G] UHD Monitor*

The Green / Red dot indicates signal presence on each port. This LED are identical to the ones seen in the front of the unit.

3.3.2 Establish a route between ports

- **Make a route**

The connection between an input and an output is done by a simple click between two ports (in & out).

The route can be established, meaning user can click to establish a new crosspoint.

The route is already in use, which means the output is already fed by an input signal.
To change the latter, simply select another input to establish a new route.

A correctly established route is represented in Green when the path taken by the signals have redundancy by software auto re-routing.

A correctly established route is represented in Orange when the path taken by the signals cannot have redundancy regarding the actual network topology.

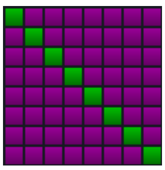
If there is not enough bandwidth available between two machines, then connection is unroutable.
If possible, it is recommended to add another trunk between the units to increase bandwidth (User can check bandwidth occupation by clicking on a trunk on the Graph section).

Any input can be patched to an output as long as the corresponding output is compatible.
For example: A 12G input can only be sent to a 12G output port. As well a 12G input cannot be routed to a 3G output. In this case, the grid cross point is displayed in back and cannot be selected.

A correctly established route is represented in Green with 2 parallel bars highlighted when the path taken by the signals is duplicated by the hardware and have seamless redundancy.

A correctly established route is represented in Orange with 2 parallel bars highlighted when the path of the signal cannot be duplicated by the hardware for redundancy regarding the actual network topology.

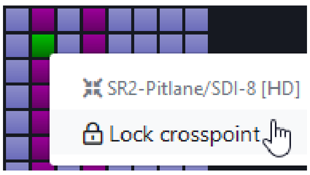
- **Quick diagonal patching**



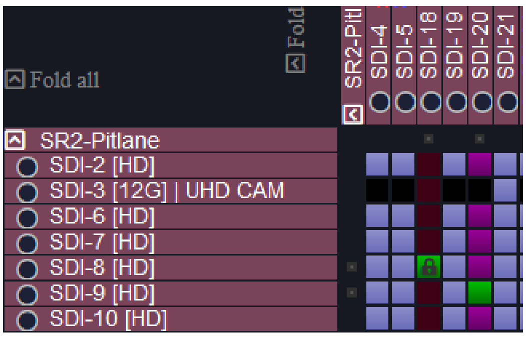
Press shift + click and drag mouse to form multiple crosspoints in diagonal. As soon as mouse button is depressed the routes are executed. This will overwrite any present route.

- **Port protection**

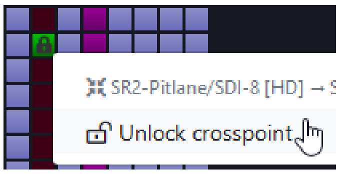
Any output port can be protected of accidental patching from another input source.



1 - Right click on the crosspoint and select Lock.



2 -The whole column is protected



3 - Right click again to unlock.

3.4 PROCESSING

3.4.1 Processing Features list

The following processing features will be detailed in the following subsections.

- Audio shuffling between every source to every destination,
- SDI Embedding / De-Embedding,
- Audio test tone generation,
- Genlock / Video clocking using internal clock,
- Frame Synchronizers + Audio / Video Delay,
- Pattern + label insertion,
- Multiviewers.
- Seamless dual path SDI routing.

3.4.2 Audio Shuffling , Embedding-De-embedding

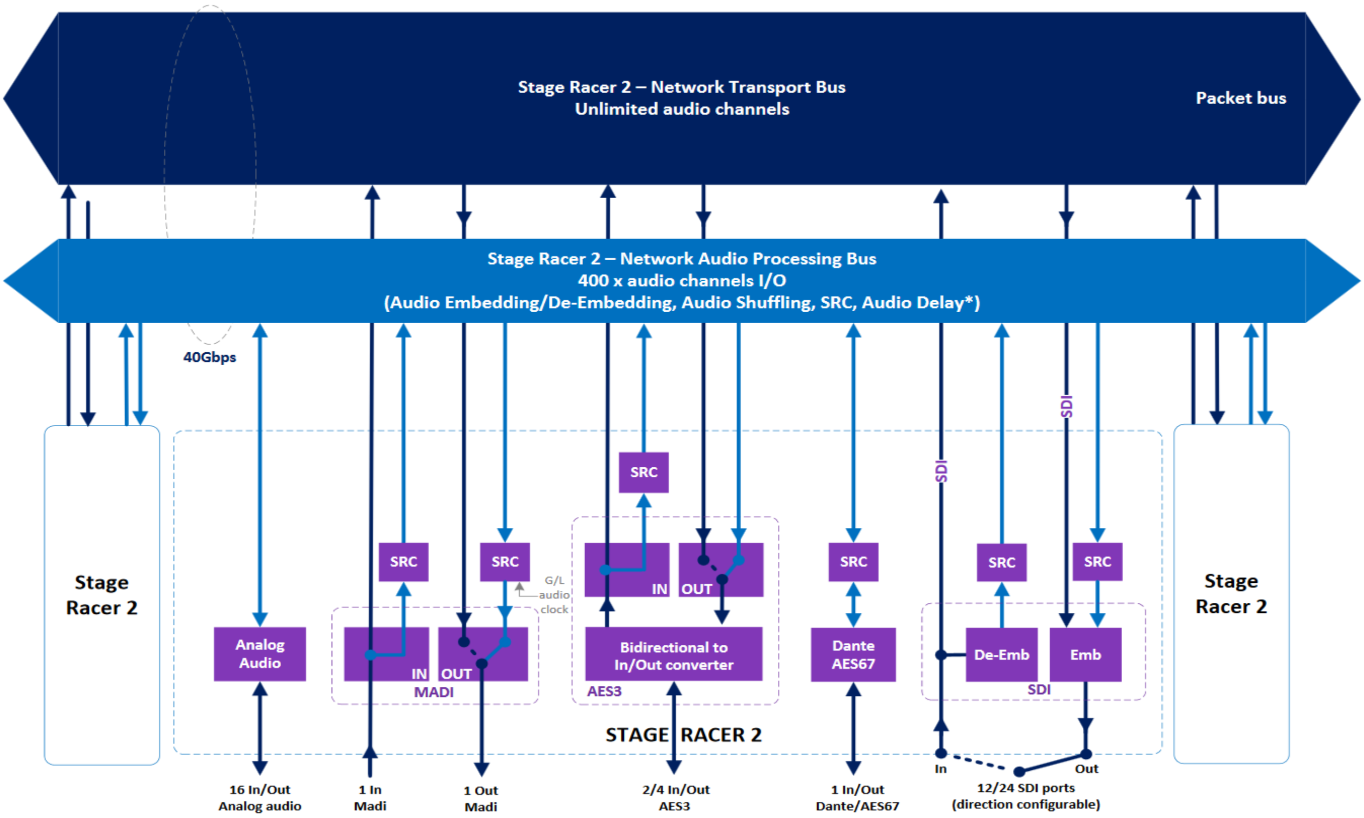
3.4.2.1 Transmission principles

The stage racer 2 allow an unlimited audio transport capability. For the audio channels where the user want to act on (shuffling) have to pass thru the **processed audio** bus. For the audio signals that only have to transit thru the SR2 network, it can be transmitted by the **packet audio bus** without looking into (Madi /Aes). Similarly the SDI embedded audio will go thru the SR2 network if the user do not choose to act on it.

Processed audio: For audio shuffling between Analog / Madi / Dante / AES3 and SDI embedded audio the desired audio signal source is applied to the internal audio bus for transport and then stripped of the audio bus to be affected to the corresponding output. This audio bus is called **processed audio** and have a capacity of 400 sources that are made available in each node of the network. In those cases the digital are locally constructed with fixed channels status indicating 48Khz channels.

Packet audio bus: In parallel the high speed bus used for SDI can be also used to transmit MADI or AES in packet mode, in those cases the metadata / word clock / transport clock remain unchanged by the system.

The illustration below summarize the above:



For user peace of mind SRC (Sample Rate Converters) are adequately placed on audio path to allow asynchronous samples rates of various signals to cope together.

Note that the locally constructed MADI Out audio clock is derived from the Genlock signal supplied to the SR2 network thus easing interfacing with audio mixers.

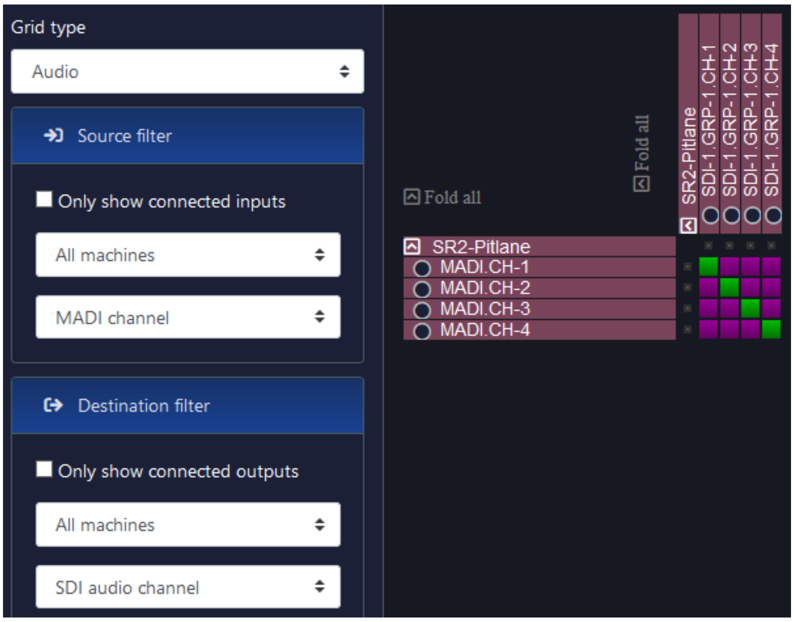
3.4.2.2 Processed audio example

As an example the following illustrations explains how to strip channels from Madi and Embed it into and SDI. Same principles are employed for other kind of audio shuffling.

In steps 1 and 2 each signals are activated in the **Tree view**. In step 3 signals appear in the **Audio Grid**.

1 – Graph, select source node, source signal type, then enable desired input channels to be available in the internal audio bus.

2 – Graph, select destination node, destination signal type, then enable desired output channels to be available in the internal audio bus.



3 – Grid, Audio type, (use Filters), then route signals

3.4.2.3 Audio capacity

The SR2 allows for a maximum of 400 simultaneously processed audio channels in the audio bus, for a whole network. Passed that number, the signal will become “unroutable”.

However the packet audio mode do not have limitations.

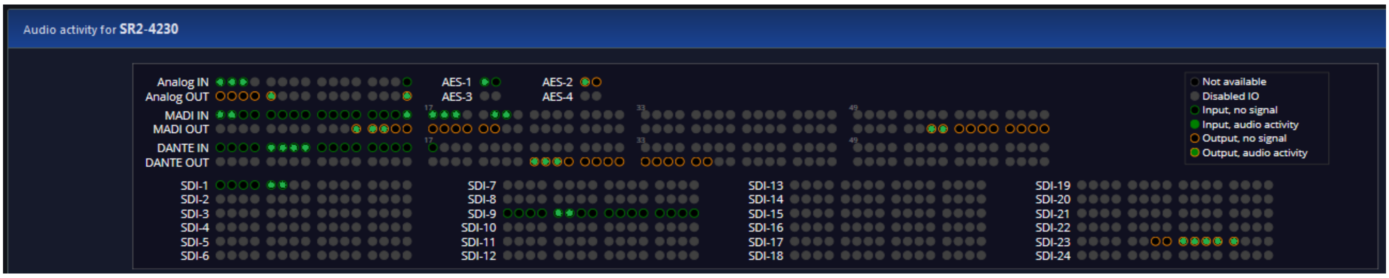
3.4.2.4 Packet audio routing

When a Digital audio signal is set to be transmitted as “Packet” mode, it is found in the corresponding signal grid (AES or MADI).

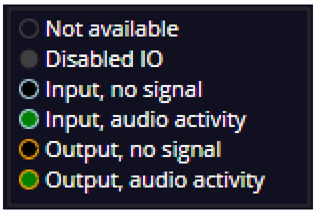
Note that MADI signal can be distributed thru the SR2 network like and SDI signal. It’s not possible for AES as they are made bidirectional by essence in the SR2.

3.4.2.5 Audio Activity indicator panel

All channels made available in the internal audio bus can be visible in a summarized way for each node, simply by going to **Graph** section, clicking the desired node, then scrolling down to bring the **Audio Activity panel**.

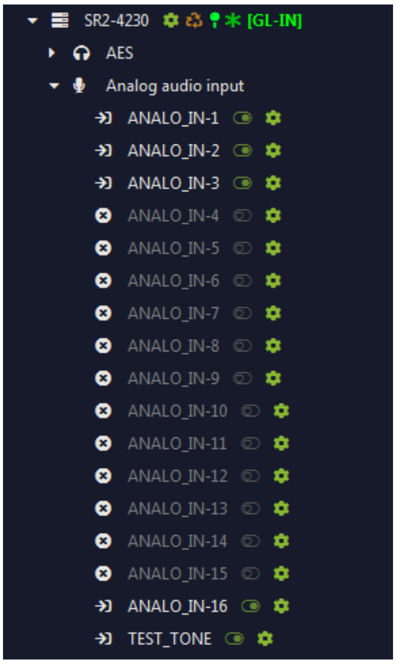


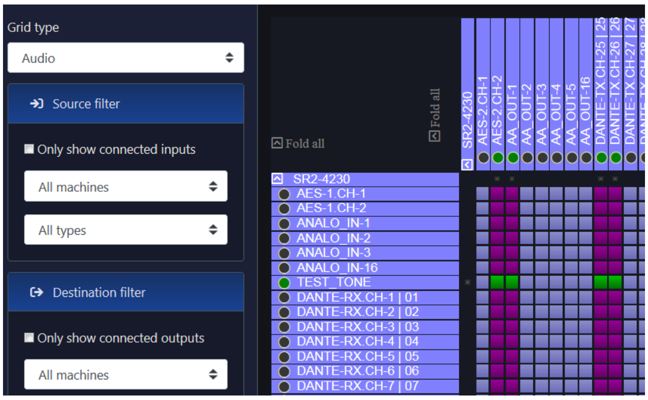
There are 6 audio activity states for each channel:



3.4.3 Test tone generator

For testing purposes a 1Kkz – 18dBm generator is integrated a virtual source into the processed audio grid. It need to be enabled at the bottom of the Analog audio input section, then is appear into the tree view and can be routed everywhere.





3.4.4 Genlock

Reference signal (Trilevel / Black-Burst) can enter the SR2 network by the Genlock (G/L) port. The G/L port is direction switchable. While set as an input, the genlock fed will be automatically send to all other units thru the network.

The genlock signal is also used in each SR2 node to re-create SDI clocks for frame buffer and Audio clock for constructed MADI out.

3.4.4.1 Genlock port setup

Configuration is made in the tree view by setting the desired genlock port to input. All other node genlock ports will automatically switch to output.

3.4.4.2 Genlock clock extraction

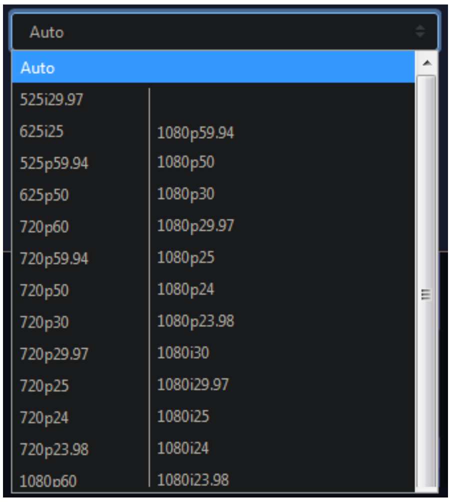
In each frame a genlock clock circuitry re-create SDI clocks locked to the recognized G/L format. While format is recognized (Meaning that the Genlock circuit is Locked and Frame Aligned on the supplied reference) the detected input format is displayed in the Genlock state section. As well the front panels LED displays accordingly.

The Clock and Top of frame signals provided are internally used to drive the frame buffers.

3.4.4.3 Manual setup

By default the circuitry is in automatic mode but can be forced to manually to a specific format if automatic recognition do not work or of a local machine have to work on a similar format with same or integer multiple frame rate.

Tables below illustrates the available formats manageable by the SR2 genlock circuitry:



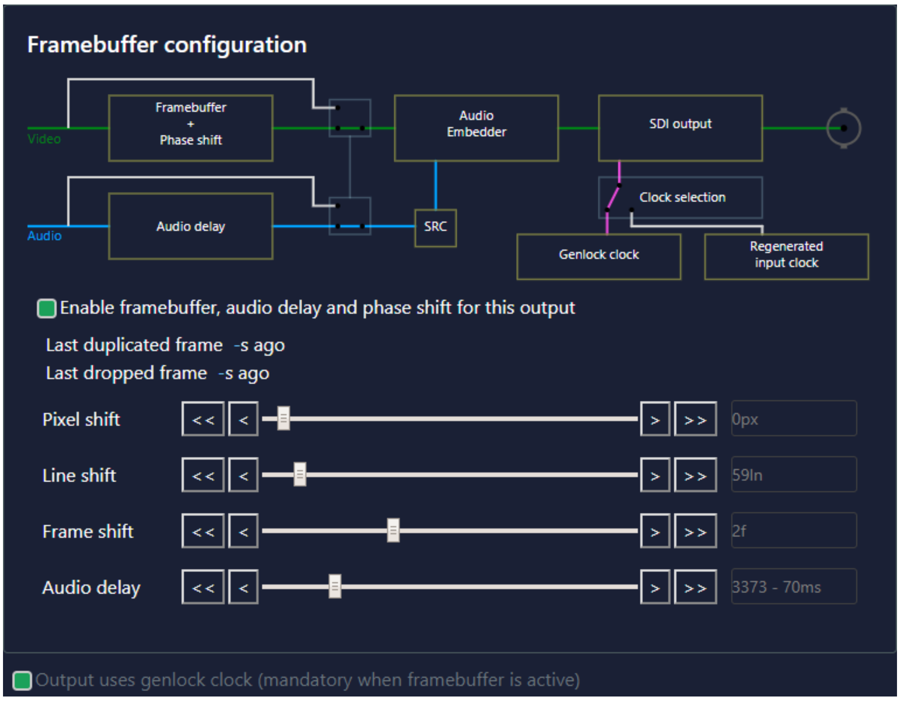
3.4.5 Frame buffers / Synchronizers

Each SR2 node provides 16 independent frame buffers installed on each of 3G SDI ports (reduced to 8 for the SR2-12 Channels units).

Each frame buffer have automatic format recognition and will perform re syncing of unlocked signals by duplicate or dropping frames. In the meantime video phase shift and audio delay is available.

When using frame buffer the Top of frame is aligned to the Supplied/Distributed Genlock reference signal top of Frame. SDI pixel clock is also derived from the Supplied/Distributed Genlock (see previous chapeter).

Schematic below shows signal path available behind every 3G SDI outputs.



To activate frame buffer, just tick the “Enable Framebuffer” button and adjust original phase with the cursors.

The button “Output uses genlock clock” uses the genlocked pixel clock to clock out the SDI signal. This feature enables stable pixel delay between channels (Eg for 4K signals composed for 4*3G channels) providing this UHD source is Genlocked to the system clock. If not 4 frame buffers must be used to achieve the same result. Alternatively it can also help to reduce wander of SDI signals providing they are Genlocked to the system clock.

When frame buffer is activated a pictogram reminds it in the tree view and in the grid.

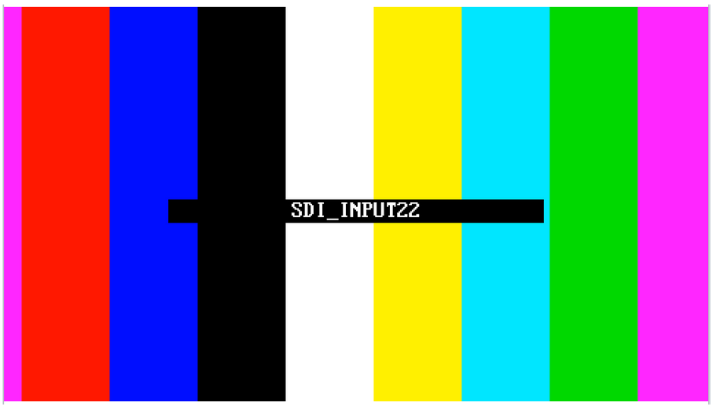
Important remark: due to the very low transmission delay of Stage Racer 2 system (1.5µS per node hop) + 2.5µS I/O delay, frame buffer are not mandatory on the outputs comparatively to systems with much more transmission delay.

3.4.6 Pattern + label insertion

An SDI moving Colorbar is integrated behind each SDI input ports, Colorbar is automatically transmitted if the SDI input signal is not present on the input. Additionally a fixed text is embedded into the Colorbar to identify the signal. The text is automatically composed with the port name declared by the user prefixed by machine name.

Colorbar format is HD in any case and do not follow the SDI rate selected for the input. Colorbar is generated based on SDI pixel clock derived from the Supplied/Distributed Genlock.

See example below:



3.4.7 Multiviewer

A much powerful distributed Multiviewer is now embedded for free into the SR2 firmware.

3.4.7.1 Main specifications

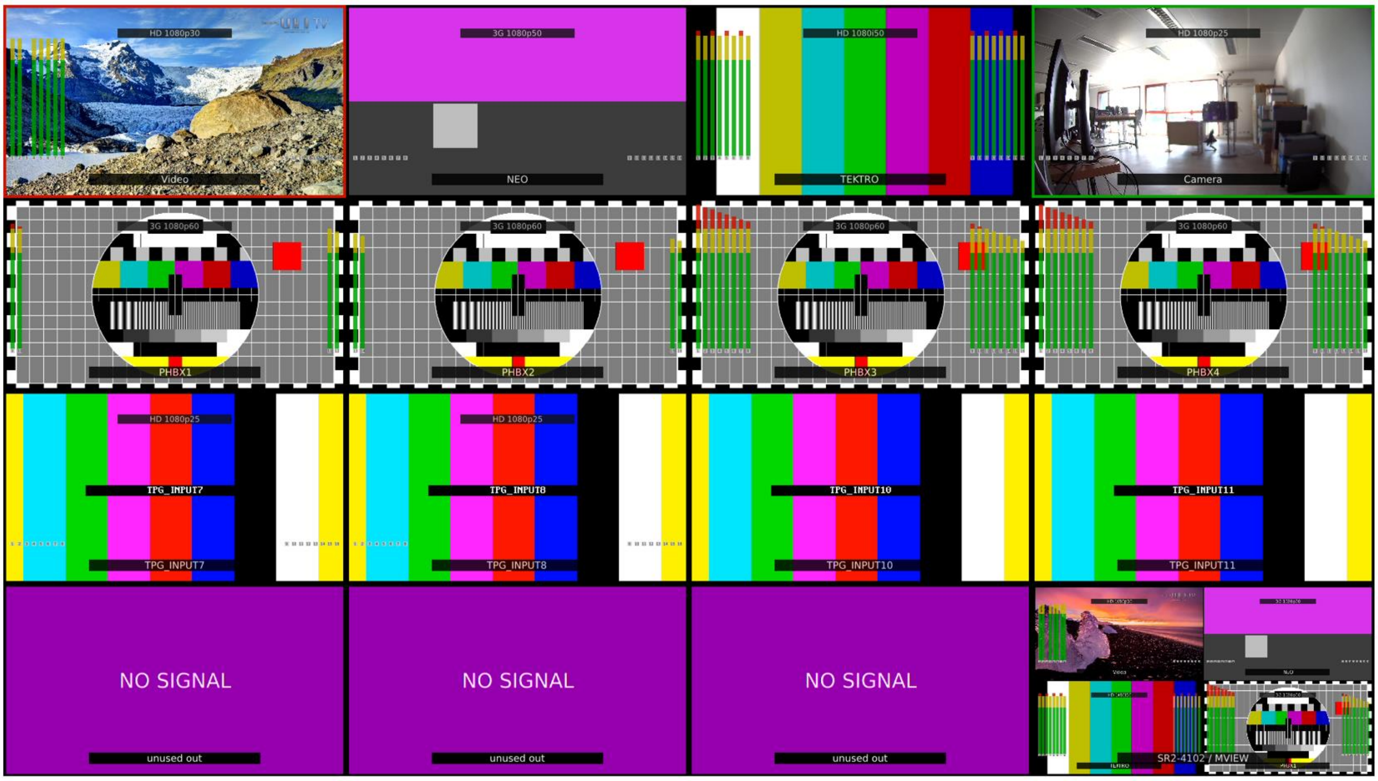
The Multiviewer upgrade offer the following features:

- 1 Multiviewer engine embedded in each network node,
- Alpha blender overlay with
  - -Tally,
  - -UMD,
  - -Audio activity,
  - -Standard indication.
- Up to 16 thumbnails per Multiviewer,
- Multiviewer output routable across the network,
- Recursive Multiviewer (A Multiviewer output can be a thumbnail in another Multiviewer),
- Monitoring of SDI inputs and SDI outputs.

Tally can be driven by GPIO or with TSL IP protocol Version 5.
UMD is driven by TSL IP protocol Version 5 or default to the SDI port name declared in the SR2.

Multiviewer output format is HD. Latency is below 20ms for genlocked signals. Supported inputs formats are HD/3G/ 2SI 6G formats/ 2SI 12G formats. (For 6G and 12G the first quadrant is used to build the thumbnails.

Example below is a screenshot of a 4x4 configuration where, two upper pictures have tally activated, three lower pictures have no signal fed on the corresponding outputs (signalled by a no signal info) and finally the left lower picture is a one coming from another multiviewer.



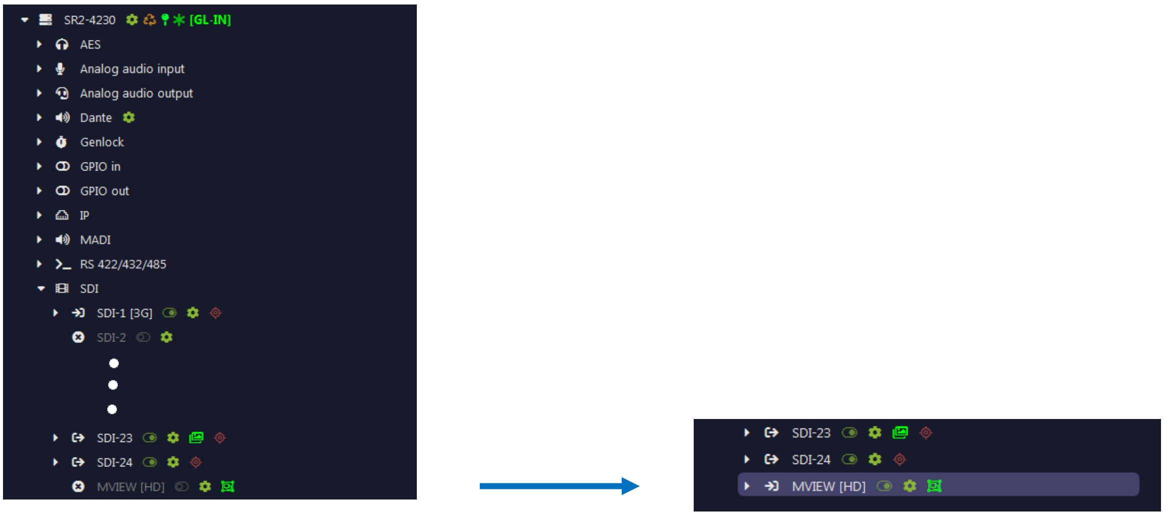
3.4.7.2 Principle of operation

For each SDI that the user wants to integrate in a Multiviewer, a thumbnail is created in the SR2 node where the SDI signal is fed (if monitoring an input) or in the node where the SDI signal is delivered (if monitoring an output). Then the thumbnail is routed within the packet bus to the Multiviewer(s) which needs this thumbnail. If 2 or more Multiviewer(s) need a different thumbnail size for the same SDI, the biggest Thumbnail size is routed across the network and resized into the other Multiviewer(s).

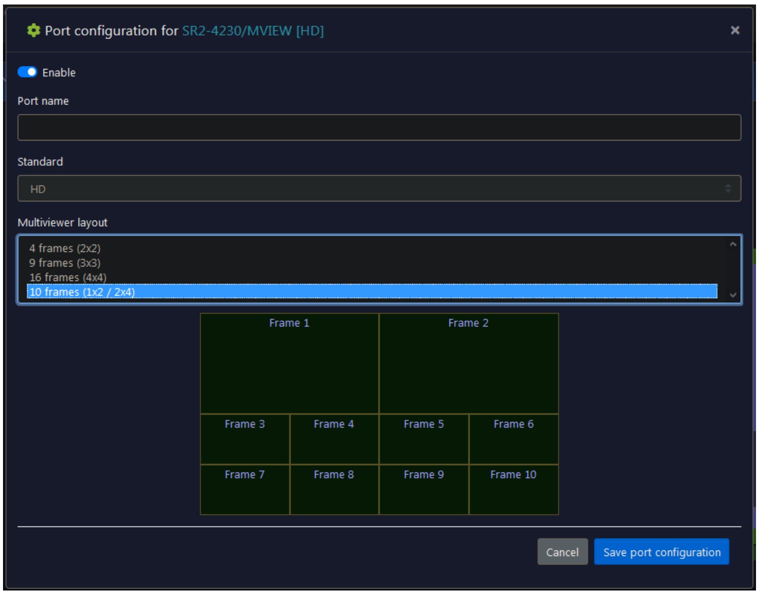
For audio monitoring, the Audio levels are picked up as close as possible of the SDI. If monitoring an input, the audio levels are picked up at the de-embedder just behind the SDI input. If monitoring an Output, the audio levels are picked up with a de-embedder placed just before the SDI Output.

3.4.7.3 Multiviewer setup

First the user need to enable the Multiviewer. Multiviewer engine is available at the bottom of the SDI I/O's into the tree view of the graph page.



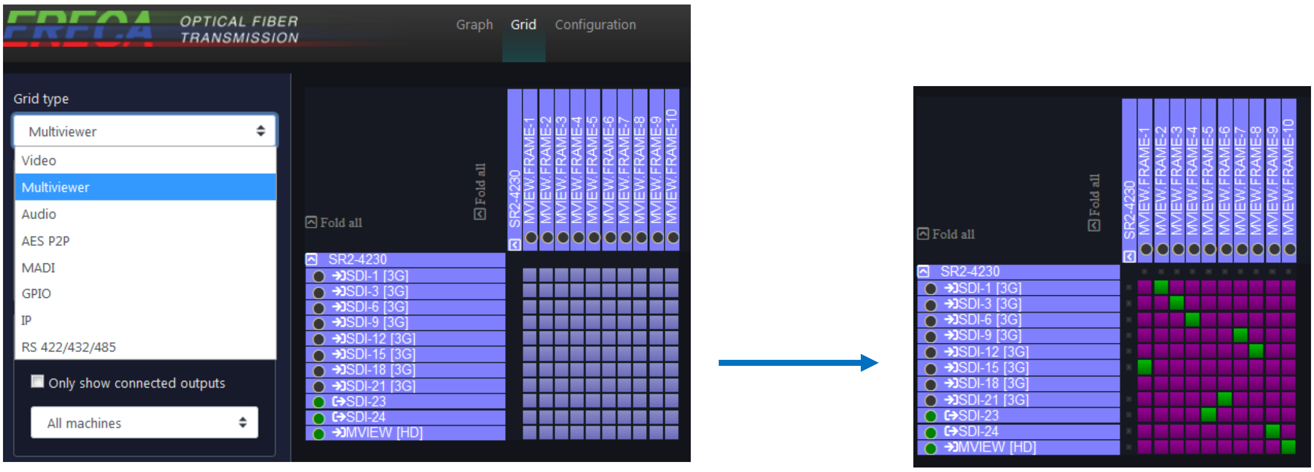
Then a click on the settings wheel gives access to the layout setup and chose the desired layout



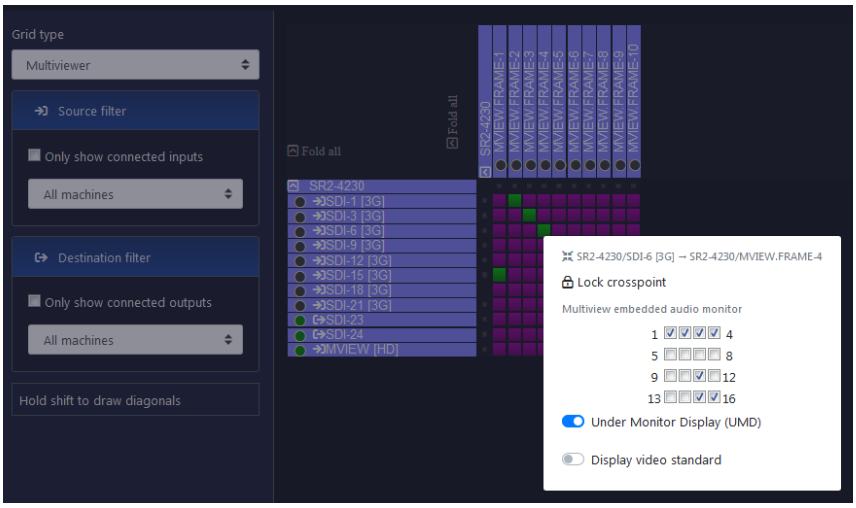
Note: Actually the SR2 work with predefined layouts, this may be more flexible in a future release. But if a special layout is needed pls ask Ereca to add it in the predefined list.

The remaining of the setup is done into the Multiviewer grid which appears among the others routing matrix into the grid page.

The source list (vertical axis) contains all the SDI enabled in the system (Input / Output / Multiviewer output). The destination list contain all the Multiviewer(s) sub-frames composing the chosen layout(s). Making the crosspoints will fill the Multiviewer layout with the desired pictures.



A right click on each crosspoint allow to select the audio channels to be monitored and configure the various items related to this thumbnail.



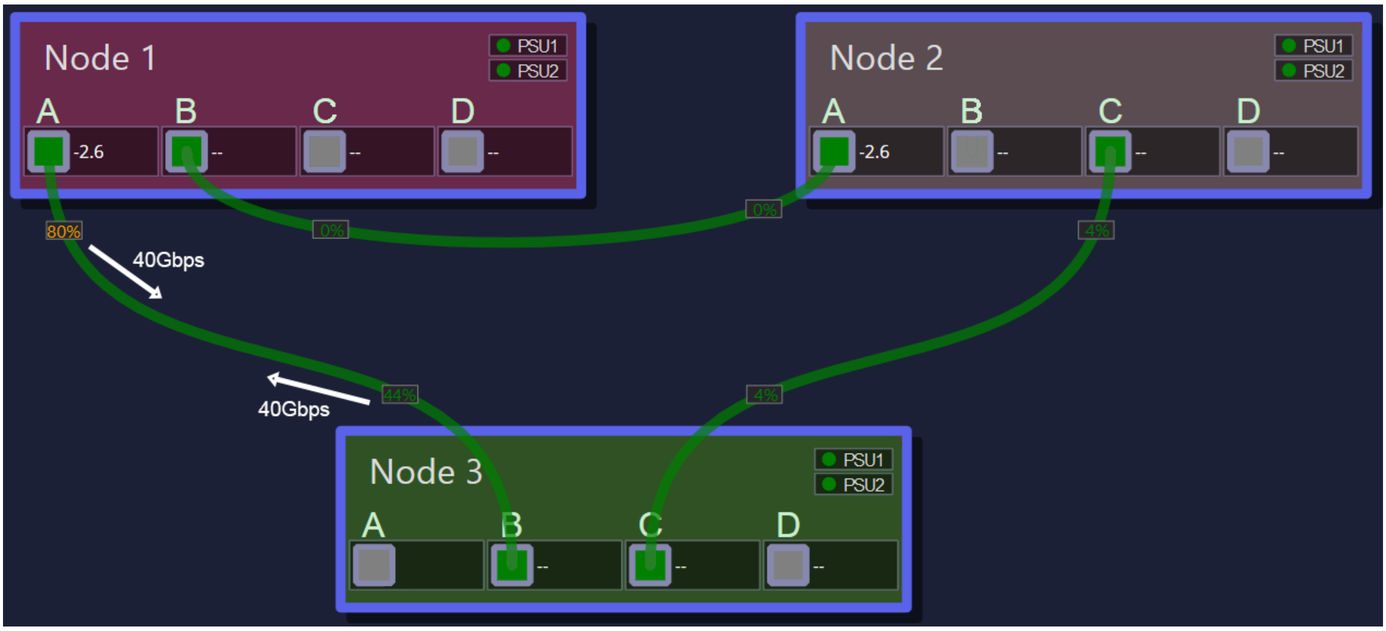
3.5 TRUNKS, BANDWIDTH, REDUNDANCY, PRIORITIES

3.5.1 Bandwidth Management

Each SDI video channel routed/distributed between nodes will occupy a certain amount of bandwidth in the network. The number of signals and their format will influence the amount of bandwidth required.

The Stage Racer 2 system will dynamically allocate these signals in the available fiber trunks whenever there is sufficient bandwidth left. Anyway if a signal reach a node and is not needed afterwards the bandwidth is then allowed for other signals.

The bandwidth occupation is visible in real time in the **Graph view** and displayed in percentage (%) on a trunk link.



Two values per link are displayed as each fiber trunk send (TX) and receive (RX) signals. The total bandwidth per trunk is 40GBps both ways.

Taking the trunk on the left of the image above in consideration:

- From **Node1-TrunkA** to **Node3-TrunkB**, the signals transmitted occupy 80% of the 40GBps of bandwidth available this way.

- From **Node3-TrunkB** to **Node1-TrunkA**, the signals transmitted occupy 44% of the 40Gbps of bandwidth available this other way.

The figure close to the node represents the Transmitted bandwidth occupancy. The value turns orange when it's above 80% occupation and red when it's above 90%.

If more bandwidth is required between these two nodes, the user can create new route between those 2 nodes even by direct connection or thru another node in the network to reach 80, 120 or 160 Gbs bandwidth.

When additional nodes are added, the network topology changes automatically offering different path for the signal to reach its destination.

3.5.2 Redundancy by software re-routing

In the illustrated example above, a ring network topology is formed by having a least one trunk between each 3 Nodes. If one trunk is lost amongst these nodes, its signals would be re-routed automatically to other trunks as long as these trunks still have enough capacity to transmit all signals of the lost trunk.

This is where the trunks colors get important:

Green trunk = redundancy of that trunk is achieved because all signals transiting via that trunk have a redundant path available somewhere in the network (each signal can take a different path in case that trunk is lost).

Figure 1: 2 trunks are connected between Node 3 & 4.
If the trunk from 3-A to 4-B is lost, trunk 3-C to 4-C has enough capacity to accommodate all signals of the lost trunk (or inversely).
In that case its bandwidth occupation would become 7+57=64% from 3-C to 4-C and 5+5=10% from 4-C to 3-C. Thus, trunks appear in green.

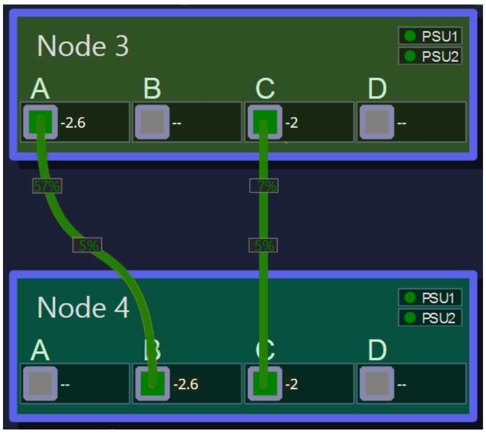


Figure 1 – redunded trunks

Orange trunk = all signals transiting via that trunk cannot be fully redounded.
There could be two reasons for this:

Figure 2: There is only a single fiber going from one node to another, so if this fiber is lost all signals are lost.

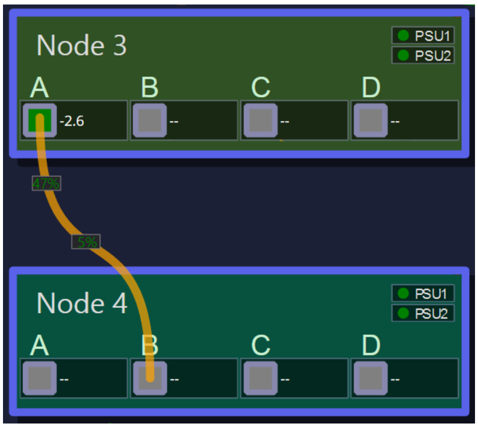


Figure 2 – no redundant trunk

Figure 3: There isn't enough bandwidth available in other trunks for all signals to transit through a single one.
The bandwidth occupation from 3-C to 4-C is also 47%. So, if the trunk from 3-A to 4-B is lost, trunk 3-C to 4-C should reach 47+57=104% capacity. Therefore, some signals won't be transmitted (or inversely).
Thus, trunks appear in orange).

For this reason, **priorities** can be affected to signals in order to re-route it in a clever manner in case of trunk connexions failure.
This scheme apply for High priority to very low priority.
It is described in the following priorities chapter.

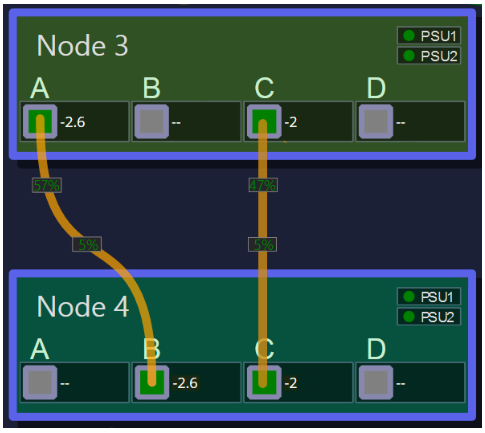


Figure 3 – trunks not fully redunded

In the above cases the software will re-route signals if possible and considering the priority list. This software re-routing takes time and an SDI perturbation occur. For signals which cannot suffer any perturbation, a stream duplication scheme is available. It is described in the next chapter.

3.5.3 Redundancy by stream duplicating.

For signals declared as very high priority, the corresponding streams are duplicated and sent by two different trunk path from their source to their destination.

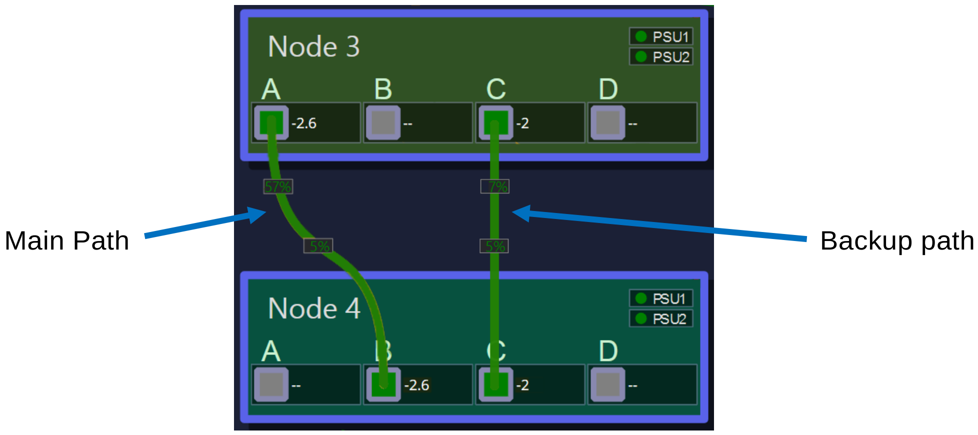
If the main path disappear the destination machine will automatically switch to the backup path. This happen with no noticeable perturbation or image freeze.

The main path is always the one with the lower letter and evaluated in the order A,B,C,D. In the example below, consider an SDI transmitted from Node3 to Node4 with a very high priority on the output located on Node4. In this case the same SDI is sent by trunk A and C from Node3 and enters Node4 by trunk B and C, the Main path is connexion A-B and Backup path is connexion C-C.

Node4 will see the SDI declared as redundant on its trunk B and C, it will take the one from trunk B if available, when it drops it will jump to the one from trunk C within 1microsecond.

If trunk B reappear this SDI will be taken back from trunk B within 1microsecond. Between two trunk switches a minimal wait time of 15 seconds is added to avoid jabbering in case of uncertain trunk connexions.

<u>Important:</u> In this case this SDI consume a full SDI bandwidth on <u>each</u> trunk connexion.



When activated (select very high priority / explained in next chapter) the dual path routing will appear with a double green bar into the Tree view and the Grid view. Example below with SDI24:

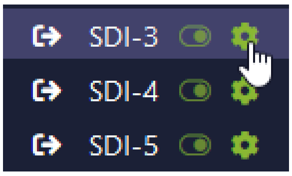
3.5.4 Routing Priorities

3.5.4.1 Priorities for software re-routing

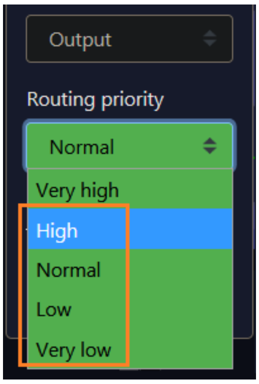
In the case of multiple non-redunded trunks between nodes (marked in orange), we've established that some signals (transiting from the lost trunk) might get lost due to bandwidth overload caused by this unexpected trunk loss.

To prevent a critical situation, the user can decide in advance **which destinations** are more important than others and set individual priorities to them.
Therefore, the higher prioritized destinations have less chances to be discarded as they will occupy first the leftover bandwidth available on other trunks.

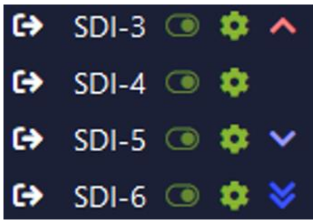
There are four levels of priorities available for this scheme, they are highlighted in orange below. As destinations hold the priority, priority is set on the desired outputs.



Output configuration



Select routing priority



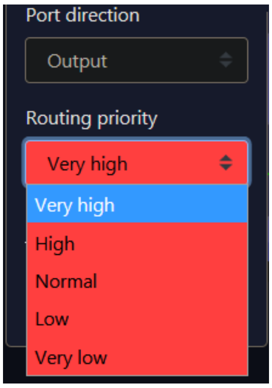
Priority status icons (visible in Tree view & Routing Matrix)

Once, the lost fiber is reconnected the left-over signals will pass through automatically.

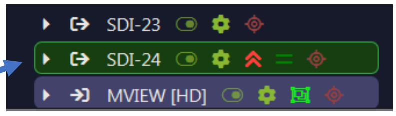
3.5.4.2 Priorities for stream duplication

Same principle apply to tell the system to use a duplicate stream connexion. Just select "Very High" into the priority level.

Output configuration



Select routing priority



Duplicated path status icons (visible in Tree view & Routing Matrix)

3.5.5 Signal Routes Overview per trunks

This feature allow to have an overview of all signals transiting in each trunk by simply accessing the Network Graph and clicking on a Trunk line.

1. It is possible to have an overview of all signals transiting in each trunk simply by accessing the Network Graph and clicking on a trunk.

2. The **Trunk status panel** opens, listing each signal transiting in that trunk in each direction, and the bandwidth occupied by these signals.

3. To highlight all routes taken by a **specific signal**, user can click on the eye  icon.

4. The Network Graph highlights all path/trunks used by that **specific signal**.
(In the illustrated example above, SDI-9 | UHD CAM signal is being sent by Node SR2-1 and received by Node SR2-8 while transiting via 4 different trunks to reach its destination).

3.6 STATUS, ERROR TROUBLESHOOTING

3.6.1 Machine status

From the web admin, an enhanced reprint of the unit display screen allows user to know the detailed condition of this node. To access it just click on the desired node.

3.6.1.1 Status / Signals presence

On the left side general status and the signal presence are displayed as on the visualization screen. Optional parts like extra RS422 and Trunks are masked or grayed if not present in the machine

3.6.1.2 Node condition

On the right side the node technical condition is displayed as follows:

- Main components temperature,
- Main power supplies,
- Fan currents,
- Optical power received on trunks.

Nominally, all values are displayed in Green. If a value starts to be out of tolerance, the value turns to Orange, and if it is totally out of tolerance, it turns Red.

Note on thermal management: with normal airflow, FPGA and Motherboard Temperature are similar. If the airflow is obstructed, the FPGA will become hotter at high operating temperatures. A protective thermal shutdown is operated when FPGA temperature is over 95°C in order to protect silicon with a good safety margin. Power cycle is needed to restart the internal PSU section after the unit self-cooling (The fans will still run after thermal shutdown, providing a quick cool down when fresh air is allowed again to flow thru the unit).

3.6.1.3 Optical power measurement

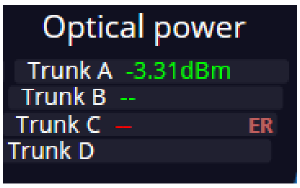
Particular care has been taken to display the optical powers for advanced users. As the Trunks are based on QSFP standard with 4 wavelengths, only the lowest power is displayed at first. Hovering the mouse on the value shows the four optical powers of each QSFP to troubleshoot unequal losses on the fiber.

Each figure is displayed in different colors (Green/Orange/Red) if the alarm threshold are reached, summarized by the table below:

QSFP Model	Green	Orange	Red
LR / 10 Km	Over - 8dBm	Between -8dBm and -10dBm	Below -10dBm
ER / 40 Km	Over - 14dBm	Between -14dBm and -16dBm	Below -16dBm

Note1: When optical power received is much too low (< -40 dBm) dashes ("--") are displayed.

Note2: When ER module is fitted in a trunk location, the "ER" pictogram appear in front of corresponding trunks.



3.6.2 Optical transmission Error monitoring

Caution have been taken on the **graph** to inform user of optical network condition.

For each trunk the lowest received power is reported next to the trunk. The color of the square under trunk connexion wire indicate the bit error rate of the corresponding 4 receivers of this trunk.

Figure below explains various colors and meaning:

- Green. No transmission error.
- Orange. BER below 8.33e-12 (Meaning 1 errors every 3 second maximum at 40 Gbs).
- Red. BER over 8.33e-12.
- There is no QSFP installed for that trunk.
- QSFP is not connected to a peer.

3.6.3 Trouble shooting

In case of a SDI signal not routed, following things can be verified:

- Make sure input and output ports are configured in the **Graph -> Tree View**, and SDI source format is really the expected one (not 3G instead of 1.5G for example) -> **Port Setting**.
- Verify the input source is recognized properly with the **Front LED** of the unit or by looking at the **Status windows** (green LED should be lit Solid, if blinking it indicate that the Pixel clock is away from the spec (over +/-50ppm).
- Check if the route is properly established in the **Grid** and that the connection appears in green or orange.
- User can also monitor the output using the **front panel LED** or **Status windows** (orange LED).
- If none of the above works, try another input port
- If none of the above works, try another output port
- You can check the logs for any error or warning (See log section here after)

- If none of the above works: In rare cases, you can check if there is a small red rectangle at the top right of a node in the Network Graph view. If it is the case, click on it and a small pop-up window will appear.

The 4 upper squares represents the SDI process units and the 8 lower the 12G ports. A Non green square indicate something wrong on those components.

For the 4 SDI process: Colors Green, Orange and Red have the same meaning as above (= monitoring transmissions errors between the core FPGA and the SDI process). If Color is Purple, it means that the SDI process firmware was not load properly at machine startup. A power cycle will help.

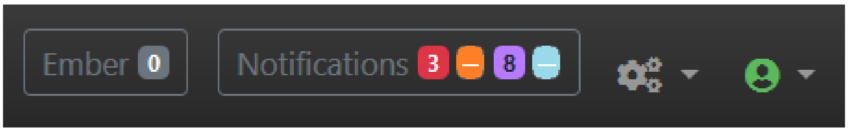
For the 12G ports a red square may happen on early machines indicating that the configuration interface for those chips cannot work well, so the ports may not be functional. A power cycle should help.

3.6.4 Logs

The system is constantly logging multiple information which can be accessible via the notification window.

On top of the Gui, there are 4 counters displayed depending on the kind of information logged.

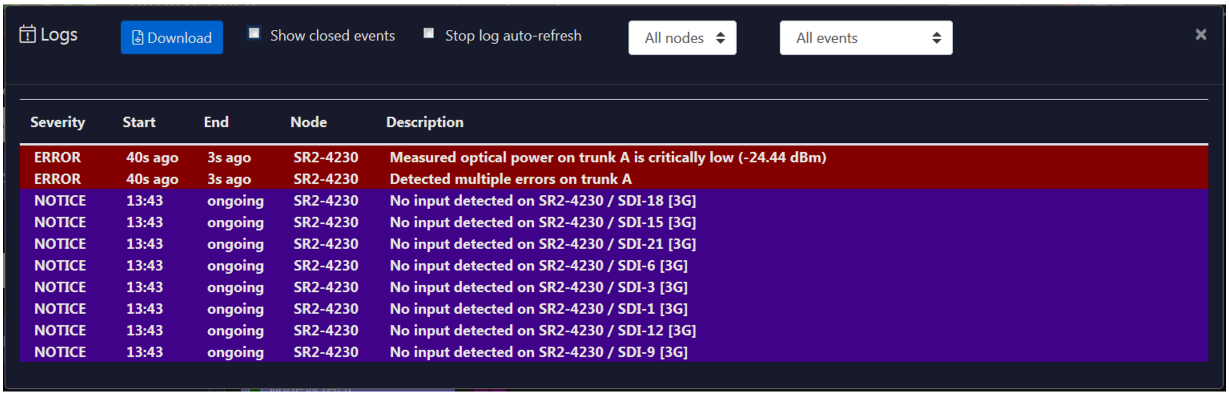
Red corresponds to a critical error (Eg: PSU failure / High errors count on trunk),
Orange corresponds to warnings (Eg: Over-temperature / Single errors count on trunk),
Purple corresponds to information (Eg: No input signal on port SDI xxx),
Blue corresponds to SR2 network information (Eg: New node started / New trunk connexion).



Clicking on the notification button brings a pop-up with additional information on the event and its origin.

Logs can be filtered by Nodes and Event types. The user can display the closed events by ticking the closed events tick box. The auto refresh can be disabled to allow quiet log analysis.

Finally the log can be exported by clicking on download.



Short events are displayed for 1 minute after their End, once the minute is elapsed they enter the “Closed event” list.

Permanent errors have a Start date/time and no End date/time, they are marked ongoing.

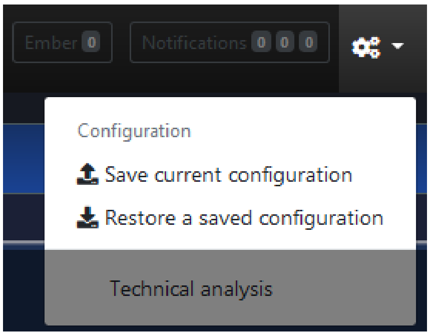
3.7 BACKUP / RESET / FW UPGRADE

3.7.1 Backup/Restore a configuration

It is possible to back the full configuration of the network or of a single unit to restore it later.

- **Save current configuration**

To proceed with a backup, select Save current configuration on the top right navigation bar. You can name the configuration file *.json and save it in the support of your choice.

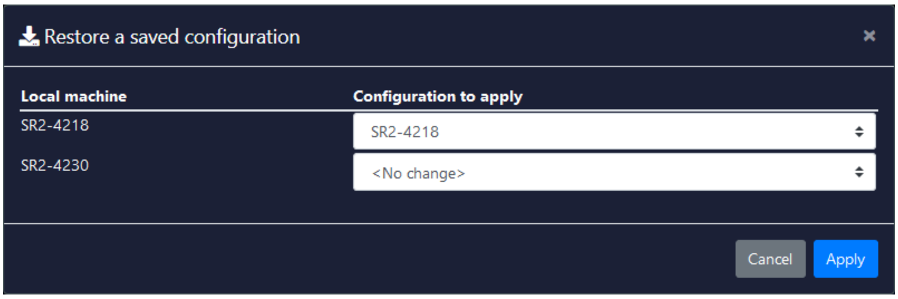


This file contains the entire configuration of the network in its current state.
- Configuration of each machine connected
- Configuration of each ports
- Routing of signals in the network

- **Restore a saved configuration**

To restore the configuration of a network or individual units, click on Restore a saved configuration and select a *.json file previously saved.
You can select individually which node you want to update.
The changes appear immediately to all restored nodes and do not require a reboot.

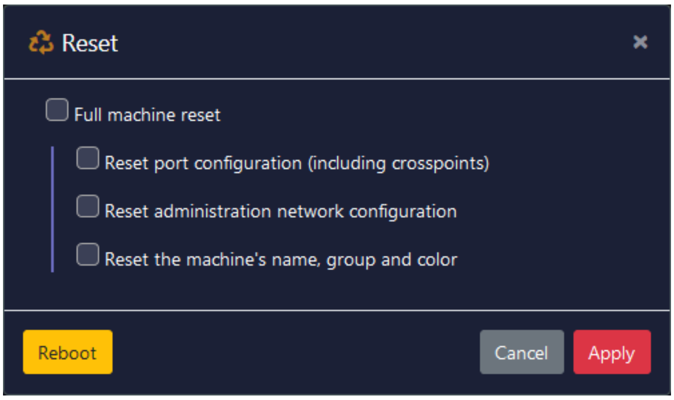
This Save/Restore feature allows a lot of flexibility for the user as a backup contains the full configuration of a network. This allows to use all units of that network on different jobs; apply a different configuration to these units.



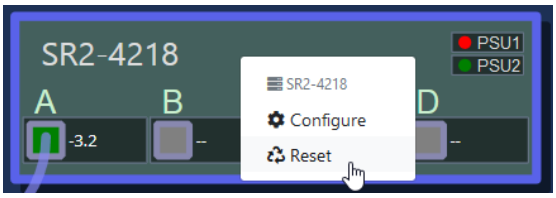
While the new network created will have different configuration, it is possible to restore the configuration of a particular unit or the previous network at any moment. To do so select the configuration to apply for the desired unit and select/keep no change for the others.

3.7.2 Reset Machine Configuration / Reboot

By clicking on the orange reset icon below, it is possible to reset totally or partially the parameters of a node to simply reset it.



Or right click on a node



Selecting Full machine reset the entire machine settings will be reset to default:
Signal names, Admin settings, Machine name…Alternatively a subset of those parameters can be reset individually, select the desired ones in the zone highlighted in green. (This operation needs to be confirmed).

The user can also remotely Reboot a node from this window as well (a confirmation is required).

As a reminder, a full reset can be initiated by the Front panel keyboard (cf. chapter **OLED Display & Navigation buttons**).

3.7.3 Firmware upgrade

Each time ERECA releases a new firmware with new routing / processing functions, any known user may update his machines with this latest firmware if needed.

Update have to be done on each machine and takes less than one minute per machine. The update file is a package containing every info for internal Processor and FPGA's upgrade. The package will be self-extracted by the machine and flashed. At next reboot the machine will start on the new firmware.

Note that if something should go wrong in the update (power loss / corrupted file) the machine will boot on the Firmware that was ran just before the update (Dual boot protection).

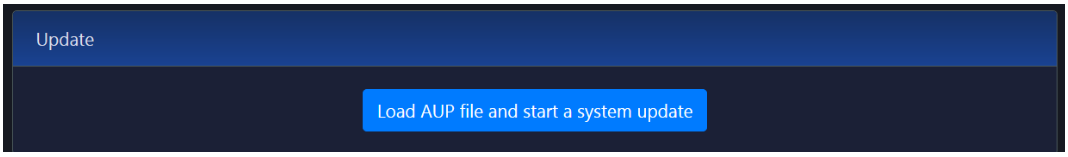
Preparation:

1. It is advised to do a backup of the network configuration (all units connected) before proceeding, as database structure may change with the upgrade due to new features.
2. Disconnect the frame you want to upgrade from the network prior to proceed, simply by removing the fiber trunks connected to it.

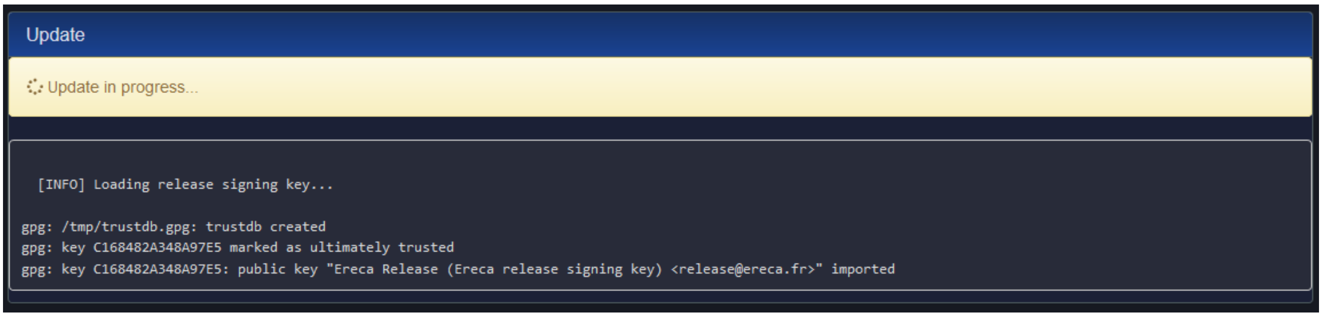
Upgrade process:

The following procedure has to be done for each SR2 frame independently (approx 1min) :

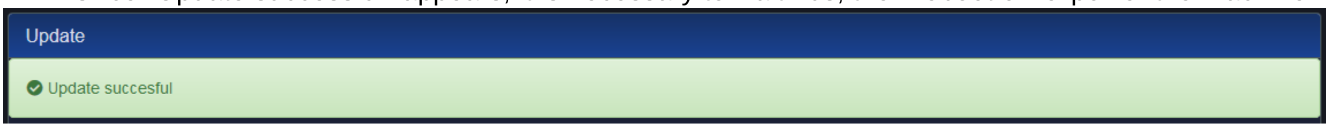
3. Connect to the admin interface of one frame, and log-in as admin.
4. Go to the Configuration page and select the button at the very bottom Load AUP file and start a system update.



5. Choose the directory where you downloaded the file above and click open.
6. The process will start automatically "Uploading package..." / "Update in progress..."



7. Once "Update successful" appears, it is necessary to wait 10s, then reboot or re-power the machine.



Verification and more:

8. Done! The unit should be updated, the new version number is displayed by clicking on the configure icon next to the SR2 box label (left column).
9. Do the same procedure for the other frames (with a reboot or re-power for each of them), then connect them back together.
10. (Optional) In the unlikely event your settings did not get restored, you can upload the previous saved network configuration file.

4 APPENDIX

4.1 TECHNICAL SPECIFICATIONS

4.1.1 Main Hardware

Optical	
Trunk	4 optical fiber trunks per unit providing a total of 160GBps of data traffic In and Out 10Km of single mode fiber / Link power budget 10dB / LC/PC connector (Optionally 40Km range)
SDI Video	
Number, connector:	12 or 24 Channels (Each channel is direction configurable), 75Ω BNC
Standard (Upper row):	SD, ASI, HD, 3G / BNC Connector
Standard (Mid row):	SD, ASI, HD, 3G / HD-BNC Mini Connector
Standard (Lower row):	SD, HD, 3G, 6G, 12G / BNC Connector
Return loss:	Better than -15 dB for 0 to 1,5 GHz / -10 dB for 1,5 to 3 GHz / -6 dB for 6 to 12 GHz
Composite Video / GL	
Number:	1 port, direction configurable / 75Ω BNC connector
Standard:	PAL, NTSC Composite / Black Burst / Tri-level (Auto sense)
Bandwidth:	> 5,8 MHz at +/- 0,2 dB
Differential Gain/Phase:	< 1%, < 1°
Group delay:	< 10 ns
SNR:	> 67 dB (CCIR567)
Analog Audio	
Number, connector:	16 inputs, 16 outputs channels, D-SUB 37 female socket
Impedance:	Input: 10 KΩ differential (non-floating), Output: 20Ω differential (non-floating)
Amplitude:	+4 dBm nominal (saturation at +18 dBm)
Bandwidth:	50 Hz to 15 kHz at +/- 0,5dB (20 Hz to 20 kHz at -3 dB)
Distortion:	0,05% at 1kHz +18 dBm
Signal to noise ratio:	90dB, "A" weighted
Mic preamp option:	Gain from 10 to 60dB (3dB steps) / Phantom power / Preamp Bypass (8 preamp fitted on channels 9 to 16)
Digital audio	
AES ports:	4 bidirectional ports (Intercom panel compatible) / 75 Ω BNC connector / Shared with Madi port BNC
MADI port:	1 input, 1 output / 48 kHz support (SRC) / 75 Ω BNC connector
DANTE-AES67 option:	Dante and AES67 support / 64 channels / 48 kHz support (SRC) / Routed to the gigabit ports
Serial	
Number, connector:	2 bidirectional channels, 1 RJ45 socket per channel
Protocols:	RS485, RS422, RS232
Data rate:	0 to 500 KB/s (Sony compatible)
RS422 option:	6 bidirectional RS422 / 0 to 500 KB/s (Sony compatible) / D-SUB 25 female socket on front side
Ethernet	
Number, connector:	2 independent channels, RJ45 Socket
Protocols:	10, 100 or 1000 Mb/s, Full or Half-duplex (Auto), MDI or MDI-X (Auto)
GPIO	
Number, connector:	8 bidirectional GPIO contacts / 6 on D-SUB 15 female plus 1 GPIO along each RJ45 Serial connector
Output:	Relay (dry contact) 'Common' – 'Normally Open' terminals for each relay
Input:	Floating on the D-SUB, Input pin grounding on RJ45
Powering	
Consumption:	80 Watts per unit maximum (All trunks and all signals used + IP module active)
Mains source:	Dual redundant built in PSU / Voltage range 90 to 260 VAC / 47 to 63 Hz
Low voltage option:	10 to 16 VDC / D-SUB 25 with power inserts (fitted on front side) / protected by internal fast acting fuse
Mechanical	
Size:	1 RU 19" rack, depth 335mm excluding connectors
Weight:	4.5 Kilograms
Cooling:	Internal fan tray with transversal cooling flow / side panels in/out / Passive heatsinks on actives
Operating temp range:	From -20 to + 60°C (Avoiding direct sun exposition)

Signaling / Admin	
Local display:	OLED display for main parameters (IP add / Optical power) / 1 LED per signal / Technical alarms LED
Setup:	Web interface / 3rd party automation protocols (Cerebrum, KSC Core, VSM….)
Connection:	1 dedicated 10/100Mbs ethernet port

4.1.2 Options

STAGE RACER 2 OPTIONAL MODULES (retrofit possible)	
OPTION - Analog Audio Mic preamp / 48V	
Input:	8 Microphone input gain blocks fitted on channels 9 of the 16.
Mic input, Gain:	Gain from 10 to 60dB (3dB steps) / Preamp Bypass, through internal Web Server.
Phantom power:	48 volts switchable, through internal Web Server, Source Impedance 6.8 KΩ.
OPTION - Dante/AES67	
Number, connector:	64 bidirectional channels / 48Khz support (SRC) / Routed to the gigabit port IP1.
Protocols:	Dante/AES67
OPTION – Serial (Channels 3 to 8).	
Number, connector:	6 bidirectional channels, D-SUB 25 female socket on front side.
Protocols:	RS422
Data rate:	0 to 500 Kbps (Sony compatible)
OPTION - Battery powering	
Low voltage option:	10 to 16 VDC / D-SUB 25 with power inserts (fitted on front side) / protected by internal fast acting fuse.