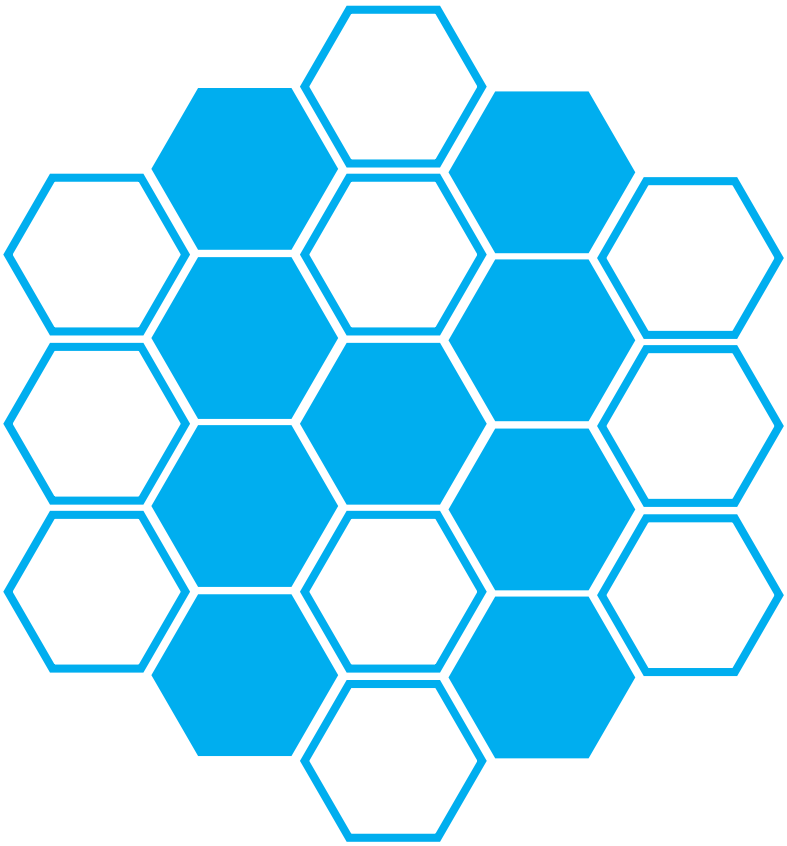
HYDRA2 INSTALLATION MANUAL



HYDRA2

Gigabit Ethernet Networking

CALREC

Putting Sound in the Picture

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INTRODUCTION

The Hydra2 system is designed to provide seamless, scalable audio networking of consoles and audio interfaces. It allows large numbers of audio inputs and outputs that may be physically remote, to be easily shared and controlled.

The term network is used, rather than routing matrix, to reflect the sophisticated nature of the control software that makes the connecting of resources very straightforward, even with ad hoc networks that change regularly. Audio interfaces and consoles may be added and removed without the need for manual intervention – the control software recognizes the changes and rapidly informs all parts of the network so that new resources are made available to console operators just seconds after they are plugged in.

A network's topology may be designed to meet the specific requirements of the broadcast facility, allowing trunks of varying capacity to be created between different parts of the network to reflect anticipated demand. Of course, there's no manual tie-line management required, the control software transparently organizes all routing, including redundant connections.

Controlling the network couldn't be simpler. All on-line resources are made available to all consoles (unless intentionally isolated for security) – no matter where they are physically connected to the network. Input and output ports may be patched at any time, either manually, or en masse, as part of a memory load.

Hydra2 provides 1-to-N routing, meaning that an input may be routed to any number of destinations without restriction. This means the input may be connected to a channel on multiple consoles, and patched directly to one or more output ports on the network.

Hydra2's interconnections are made using either copper or fiber connections. Distances are only limited by the connection type and may run to many kilometers. The capacity of the network is vast, both in terms of the number of input and output ports and the switching capability.

Each connection between Hydra2 units can carry 512 signals in both directions simultaneously at 48kHz. More than enough for any single IO unit. The real power comes in connecting routers together. Should more connection capacity be required, then simply make another connection between routers to double the connection bandwidth in both directions. Of course all connections should be complemented with a secondary redundant connection, just in case!

Audio interfaces are available in a growing range of units. New formats can easily be supported as they arrive. Hydra2 also supports non-audio data, in particular transportation of GPIO.

As with all Calrec products, reliability is our first concern. All Hydra2 hardware and audio interfaces are designed to the highest standards, with particular attention being paid to power generation and distribution, thermal management and physical robustness – the cornerstones of product reliability. In the event of a fault occurring, a redundancy scheme automatically deploys backup hardware to quickly restore operation. All critical components can have their own hot (powered-up and ready to operate) backup and all network interconnections may be duplicated. In fact, where backup infrastructure exists, secondary routes are created at the same time as primary routes, to speed the process of switching over, in the event of a component failure.

Hydra2 is a companion technology to Calrec's Apollo and Artemis consoles. Each of these consoles contains a Hydra2 router which is used to connect to a variety of audio interface units. It also allows general port to port routing, independently of the console. It is a very simple job to connect several consoles together - all that is needed is a copper or fiber connection between each console – as soon as they are connected together, they behave as a network, without the need for any more hardware or software to be installed.

In its simplest form, a Hydra2 network consists of a router module, within a console, connected to some audio interfaces units, as shown in Figure 1.

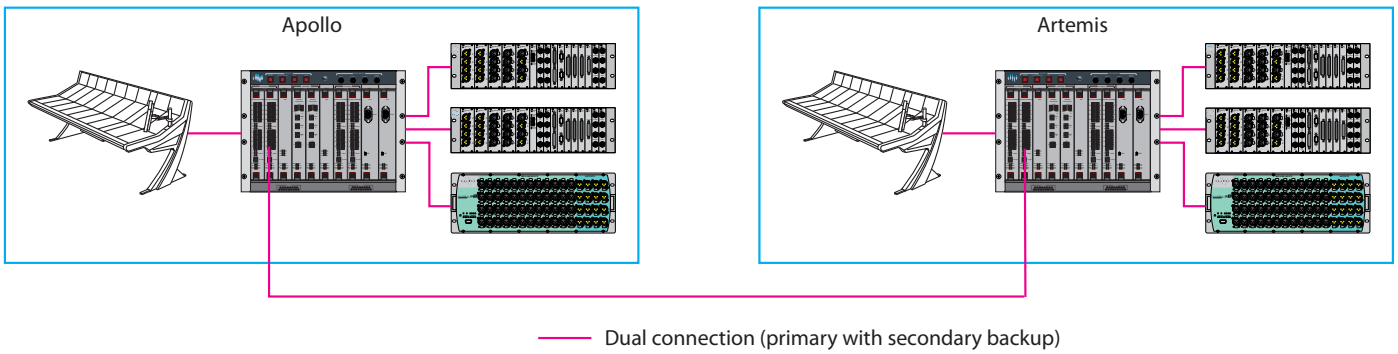
The network allows the convenient placement of resources wherever they are needed with a minimum of infrastructure cost – fiber or copper cabling may be used. A variety of fixed format and modular boxes allow interfacing solutions to be tailored for studio floors, equipment rooms, and control rooms.

The router module is located in the Apollo or Artemis rack, alongside the DSP and control processors. The router has a capacity of 8192 routes and may have up to that many destinations ports connected to it The console DSP card consumes up to 2048 destination ports, making it possible to connect up a further 6144 output ports to the router for general input to output patching.

Audio interface units are connected to the router by copper or fiber connections through mini GBIC connectors located at the front of the router module. Each router module has receptacles for up to 16 connections. If more than 16 audio interfaces are required, then an expansion card may be plugged into the rack, providing connections for up to 16 more.

Each Router, expansion module and cable may have a redundant duplicate that automatically deploys if a problem is detected. A system of heartbeat messages constantly flowing around the network allows faults to be quickly detected. Most audio connections on the network have their backup connection made at the same time, which keeps the fault response time as short as possible. In a simple network, if a cable is disconnected, audio is restored through the backup connection in less than a second. This time may increase for larger networks.

FIGURE 1 - TWO CONSOLE NETWORK



NETWORK CONNECTIONS

Rack connections
Connections from IO boxes should be made to a Hydra2 router. Figure 1 shows a fixed format IO unit connected via two redundant links to an Apollo rack.

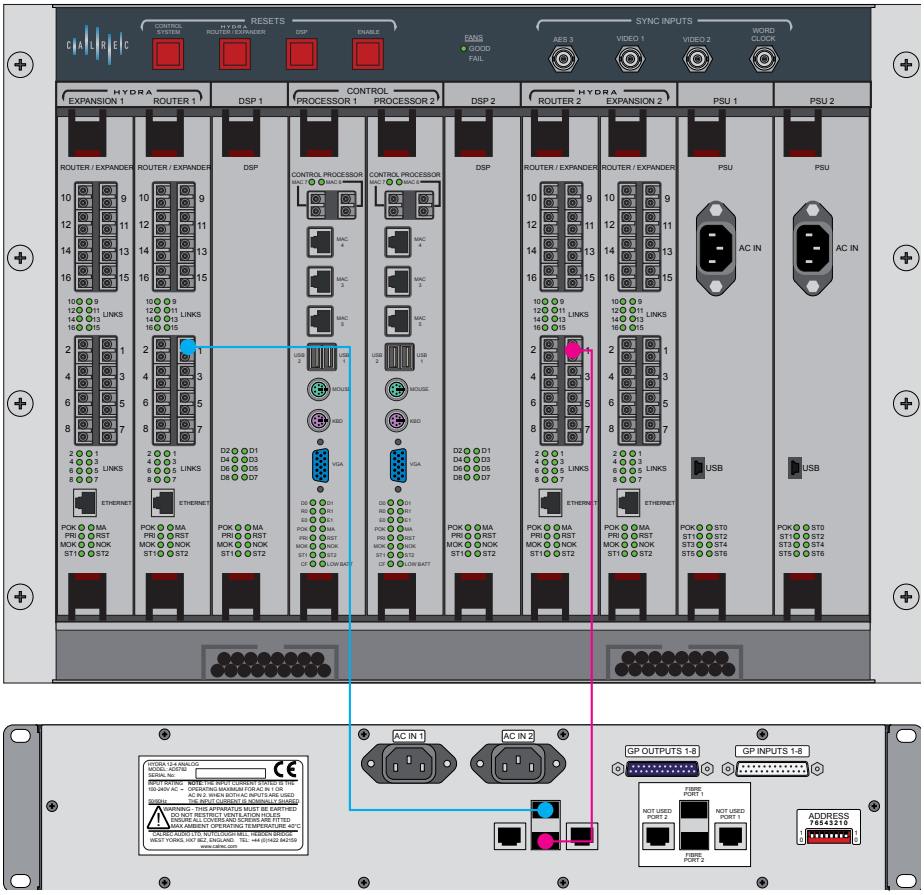
For full connection redundancy, each IO box should be connected to both primary and secondary routers or expander modules.

The primary port on the IO box should be connected to Router 1 and the secondary port to Router 2.

Connection redundancy
Each Hydra2 box has dual SFP ports for full connection redundancy. These ports accept plug-in GBIC modules to allow connections with screened CAT5e/CAT6 copper interfaces and single or multimode fiber interfaces.

For connection information such as maximum distances and the required CAT5e specifications, please refer to the Connection Types section of this document.

FIGURE 1 - CONNECTIONS FROM RACK TO IO BOX



HYDRA2 IO UNIT ADDRESS

Each Hydra IO box in the network must be assigned a unique address.

The address is made up of two parts, the first being a fixed address unique to the system and the second being unique to a single IO unit. Units connected to the same system must have unique unit-specific address components. Units connected to different systems may share the same unit-specific address component as their system address will be different, resulting in an combined unique address.

Assigning addresses

An 8 way DIL switch is provided on the rear of the fixed format units (on the Hydra2 Interface Module circuit board for the Stagebox) for setting the unit specific part of the address using binary notation.

Figure 1 shows the decimal value that each DIL switch represents. To get the full decimal number from a binary number, simply add together every decimal number represented by a DIL switch that is set to a logical 1. Figure 2 shows an example of this process.

If a unit is to be replaced, the address of the new unit must match that of the old unit in order for the system to continue normal operation.

FIGURE 1 - ADDRESS SWITCHES

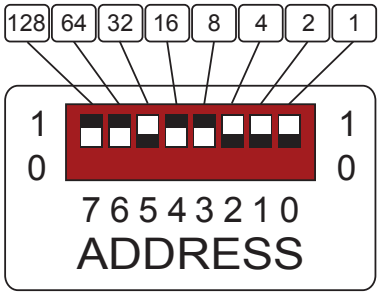
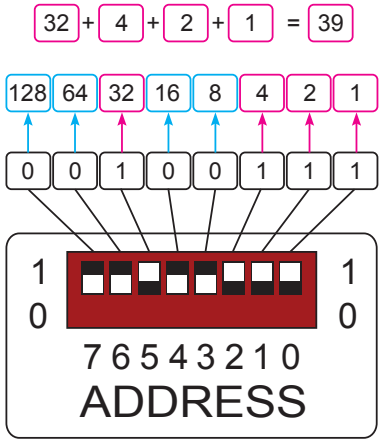


FIGURE 2 - ADDRESS EXAMPLE



HYDRA2
FIXED FORMAT IO OVERVIEW

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FIXED FORMAT OVERVIEW

All Hydra2 inputs and outputs are contained within robust small format boxes providing input and output facilities for use in areas such as:

- Equipment room racks
- Studio wall box
- Studio gantry/lighting grid
- Control room rack
- OB truck
- OB Flight cases
- Remote OB locations

These boxes provide a range of analog and digital interfaces accepting Mic and Line signals, AES, SDI or MADI.

Dual network connections

Each Hydra box has dual SFP ports on the rear for full connection redundancy (highlighted in Figure 1). These ports accept plug-in GBIC modules to allow connections with CAT5e/CAT6 copper interfaces or single or multimode fiber interfaces. For connection distances please refer to the Connection Considerations section of this document. Regardless of the type of connection chosen, full connection redundancy is guaranteed. All external connections to the units are hot pluggable.

Power

Hydra2 units are mains powered and all feature two internal power supply units, providing internal PSU redundancy. AC connections are made using the dual rear IEC connectors for external supply redundancy.

FIGURE 1 - COMMON FRONT PANEL ELEMENTS

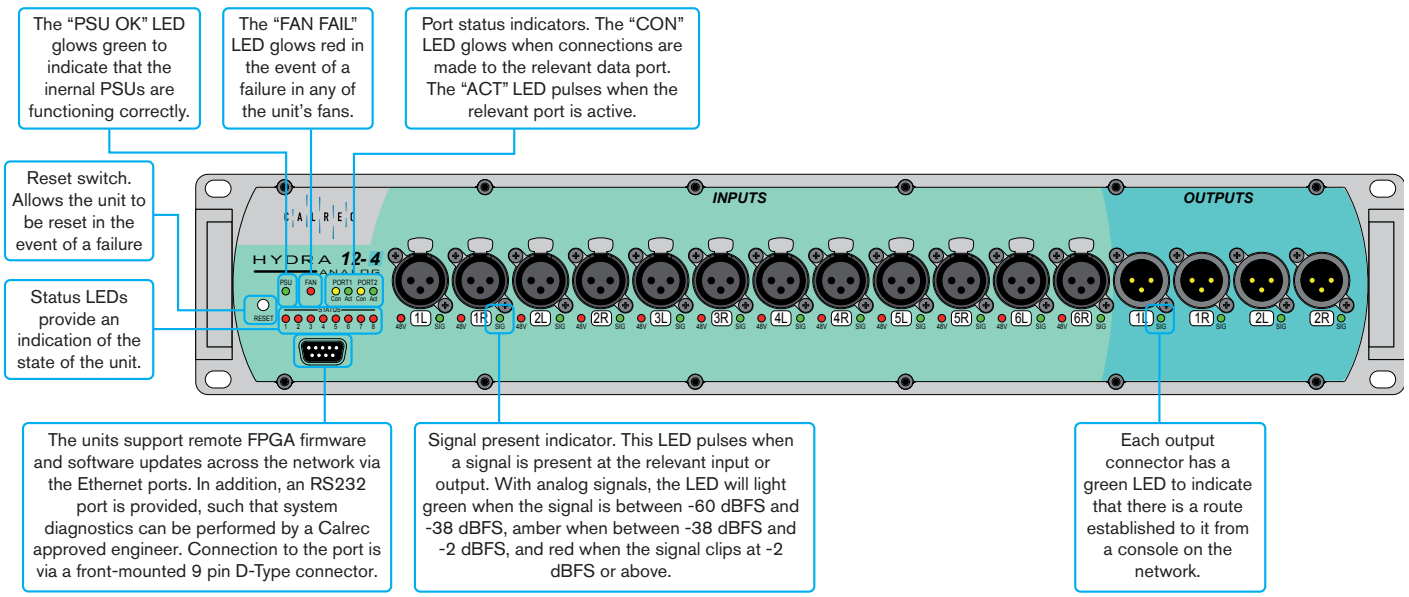
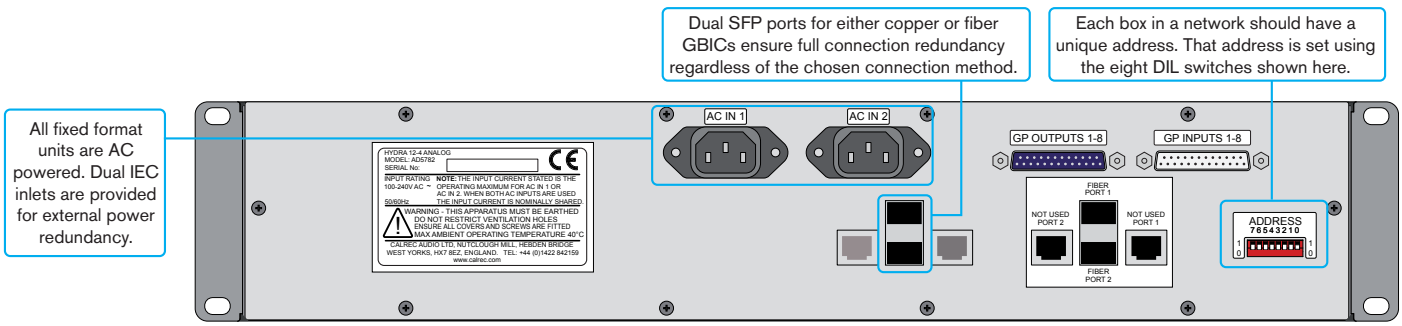


FIGURE 2 - COMMON REAR PANEL ELEMENTS



Common features
Some status LEDs on connectors are common to the front panel of all Hydra2 boxes. Such elements show the status of connections, the presence of signals or allow access to diagnostic information. These elements are shown in Figure 1.

Certain connections are also common to the rear of all Hydra2 boxes. These power and data connections are shown in Figure 2.

GPIO module
All Fixed Format IO units of 2U height or greater may be fitted with an optional GPIO module (SW5739). This provides eight opto-isolated inputs and eight relay outputs on two 25 pin D-Types.

Status LEDs
There are eight status LEDs present on the front panel of every Hydra2 unit which can aid with software level debugging of the units. These are shown in Figure 1. The functions of these LEDs are described in the following paragraphs and summarized in Figure 3.

LED 1: Shared by Hydra2 ports1 & 2 and indicates the state of the network ports on the back of the unit. An active LED indicates that both ports are physically enabled.

LED 2: Used to indicate Heartbeat activity between Hydra2 port 1 and an attached Router. This signal LED flashes approx twice a second to indicate a valid low level IO/Router comms link.

LED 3: Used to indicate Heartbeat activity between Hydra2 port 2 and an attached Router. This signal LED flashes twice a second to indicate a valid low level IO/Router communications link.

LED 4: Spare.

LED 5: Used to indicate a valid control link communications path between Hydra2 port 1 and an attached Router. This LED will be active if control of the IO box is available e.g. Phantom power, Mic gain, SRC.

LED 6: Used to indicate a valid control link communications path between Hydra2 port 2 and an attached Router. This LED will be active if control of the IO box is available e.g. Phantom power, Mic gain, SRC.

LED 7: Used to indicate the source of audio sync and output audio from the Hydra2 network to the box. If active then output audio and audio sync is being sourced from Hydra2 port 1.

LED 8: Used to indicate the source of audio sync and output audio from the Hydra2 network to the box. If active then output audio and audio sync is being sourced from Hydra2 port 2.

Note: LEDs 7 & 8 should never be active (On) simultaneously. They may be inactive (Off) simultaneously e.g. a Hydra system reset or failed connections.

FIGURE 3 - HYDRA2 STATUS LEDS

LED No.	Color	Indication	Status
1	Green	On	Hydra2 ports enabled
		Off	Hydra2 ports disabled/reset
2	Green	Flash	Heartbeat port 1 active
		Steady Off/On	Heartbeat port 1 inactive
3	Green	Flash	Heartbeat port 2 active
		Steady Off/On	Heartbeat port 2 inactive
4	Green	Off	Unused
5	Red	On	Control link port 1 active
		Off	Control link port 1 inactive
6	Red	On	Control link port 2 active
		Off	Control link port 2 inactive
7	Red	On	Output audio/sync source port 1 active
		Off	Output audio/sync source port 1 inactive
8	Red	On	Output audio/sync source port 2 active
		Off	Output audio/sync source port 2 inactive

ANALOG UNIT OVERVIEW

Analog input signals can be at either mic or line level. Input impedance is switched dependant on the gain of the path that the input signal is routed to.

Variants

Boxes with XLR connections are available in three sizes:

- 12 mic/line inputs, 4 line outputs (AD5782)
- 24 mic/line inputs, 8 line outputs (AD5781)
- 48 mic/line inputs, 16 line outputs (AD5780)

XLR versions have front mounted connectors.

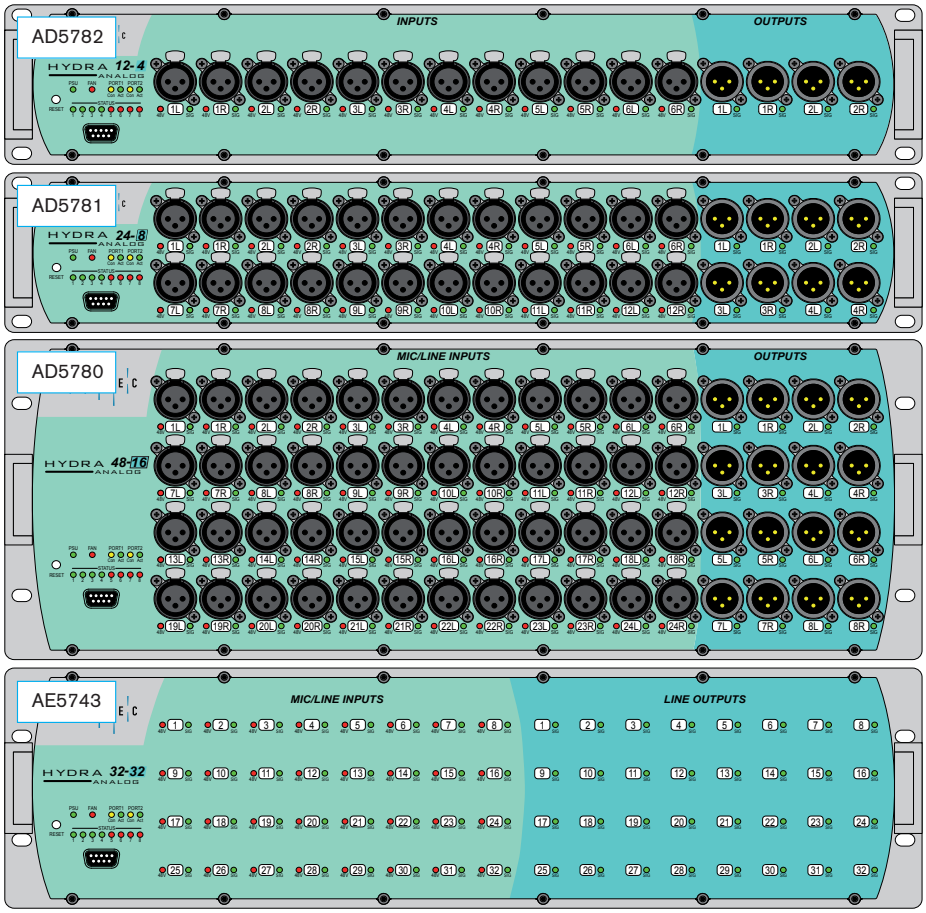
A version with EDAC/ELCO connectors is also available providing 32 mic/line inputs and 32 line outputs (AE5743). The EDAC/ELCO connections are made to the rear of the unit.

These options are shown in Figure 1.

48v Indicators

Each input port has an LED associated with it which will glow when 48v phantom power is present at that port.

FIGURE 1 - ANALOG UNITS



AES3 UNIT OVERVIEW

AES3 signals are sent and received on BNC connectors. Sample rate converters are switchable on all inputs from the surface.

Variants

AES3 boxes are available in two versions:

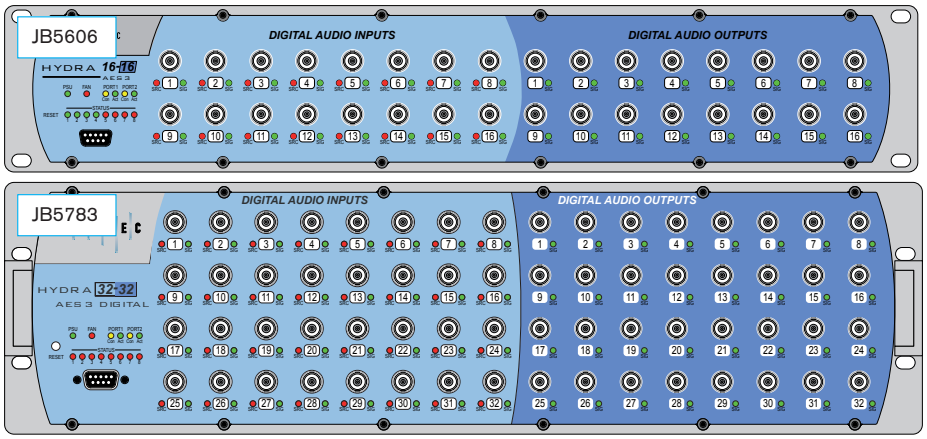
- 16 AES inputs, 16 AES outputs (JB5606)
- 32 AES inputs, 16 AES outputs (JB5783)

These options are shown in Figure 1.

SRC LEDs

LEDs next to each input port indicate whether the sample rate converter for that input is in use.

FIGURE 1 - AES3 UNITS



MADI UNIT OVERVIEW

The Hydra2 MADI unit provides two MADI interfaces in a compact 1U enclosure.

Channel count

Each interface in the MADI unit can operate in either 56 or 64 channel mode. Switches on the front of the unit allow selection for each interface.

Interface medium

The unit can transmit over a coaxial (copper) AND optical (fiber) medium. It can receive over coaxial OR optical medium. Switches on the front panel allow selection of the receiving medium.

Three different versions of the MADI unit are available depending on the fiber interface required.

- Single-mode (SC connectors) (JM5831)
- Multi-mode (SC connectors) (JM5736)
- Multi-mode (ST connectors) (JM5890)

The required connector types must be specified upon purchase.

When using the fiber to interface with external equipment, please refer to Figure 2 to ensure that your equipment can transmit and receive within the range of supported wavelengths.

For detailed information on fiber interfaces and connections, please refer to the 'Fiber Optic Interfaces' section of this document.

FIGURE 1 - MADI UNIT PROVIDING TWO MADI INTERFACES

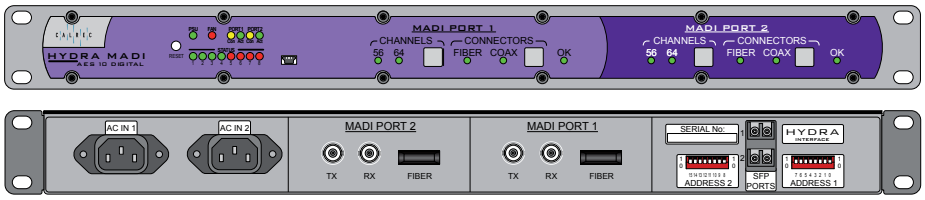


FIGURE 2 - FIBER INTERFACE SPECS

	Single-Mode	Multi-Mode
Fiber Connector Options	SC	SC, ST
TX Wavelength	1260-1360nm	1270-1380nm
RX Wavelength	1260-1360nm	1270-1380nm
Nominal Center Wavelength	1300nm	1310nm

Note:
There is no sample rate conversion available on MADI inputs or outputs. It is therefore vital to ensure that any equipment connected vis MADI is synchronized to the same source as the Apollo system.

HYDRA2
FIXED FORMAT DATASHEETS

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AE5743 – 32 MIC/LINE (EDAC)

The AE5743 is an analog Hydra2 IO box with 32 mic/line inputs and 32 line outputs on EDAC/ELCO connectors.

This unit can be fitted with the SW5739 GPIO module.

Figure 3 highlights the main components of the unit. Figure 2 provides the unit specification.

Figure 7 shows the pin assignments for the rear mounted connectors. Ensure that the correct sex connectors are used by referring to Figure 4.

Connector part numbers are listed in Figure 5. Side views are shown in Figure 6 but additional depth should be allowed for the mating connectors.

FIGURE 2 - SPECIFICATION

Height	3U
Width	19“ (483mm)
Approx Depth (Inc. mating connectors)	12” (300mm)
Approx Weight	11.5lbs (5.2Kg)
Input Power Rating	100-240V AC 1.05-0.51A RMS 50/60Hz
Acoustic Noise	27dB-SPL A-Weighted 1M from source

FIGURE 1 - AE5743 - 32 MIC/LINE INPUTS, 32 LINE OUTPUTS

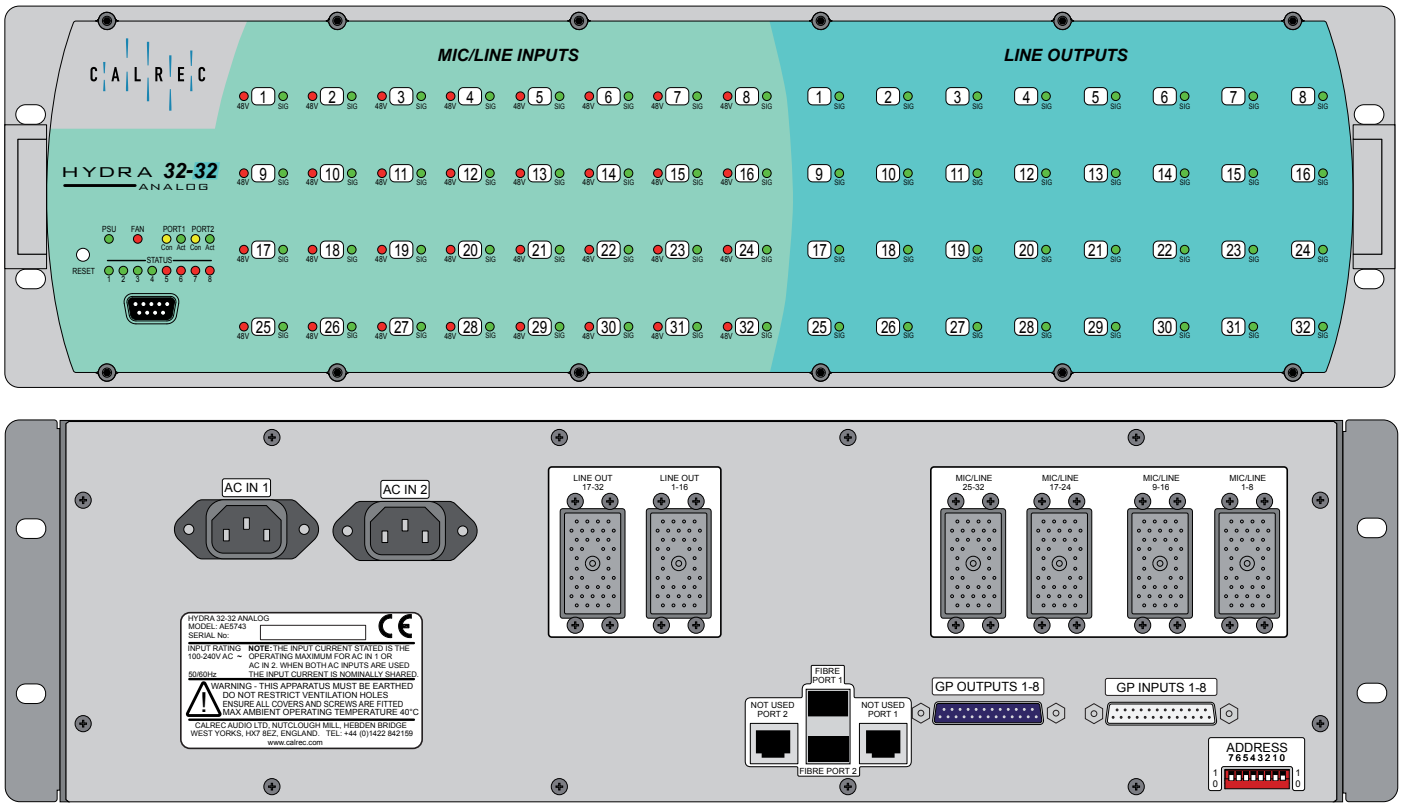


FIGURE 3 - AE5743 - 32 MIC/LINE INPUTS, 32 LINE OUTPUTS

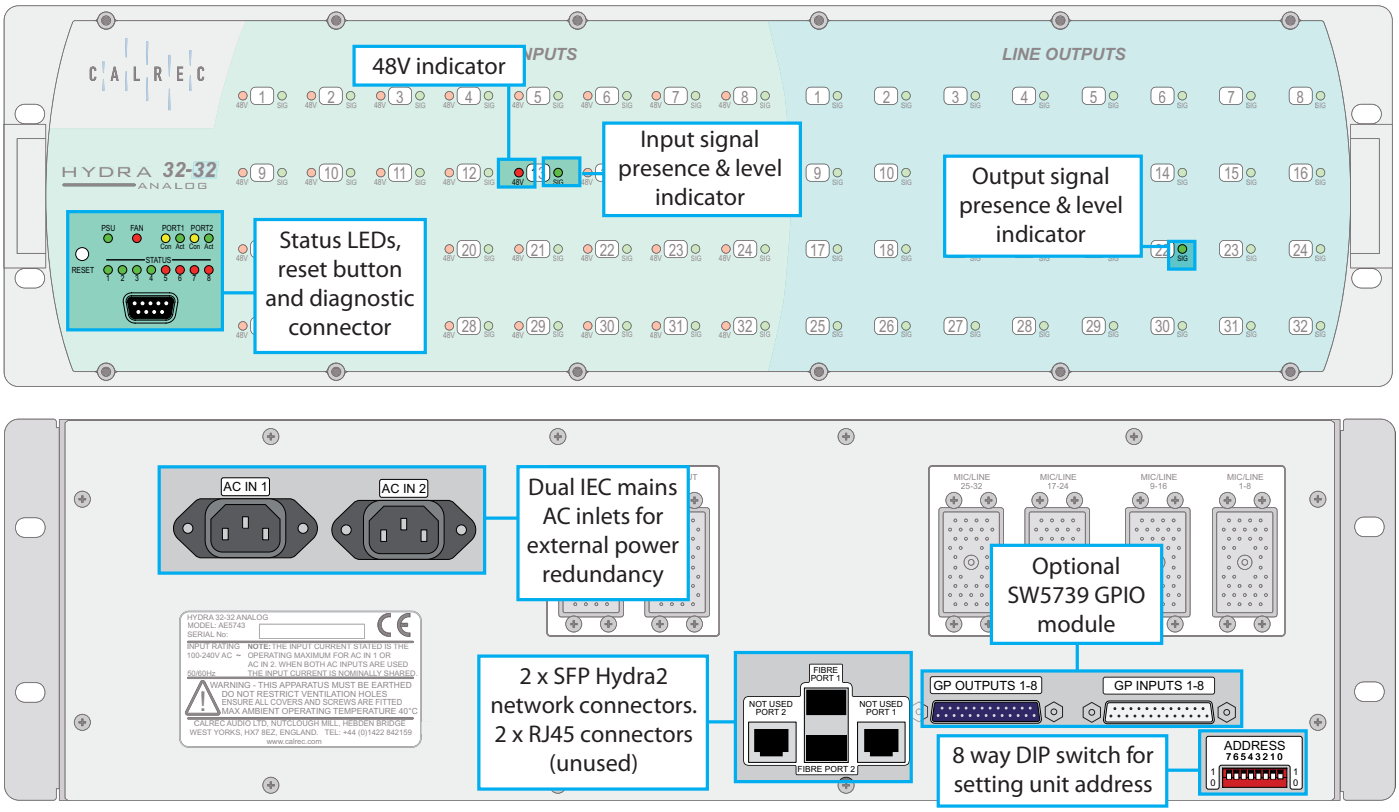


FIGURE 4 - EDAC/ELCO CONNECTOR SEXING

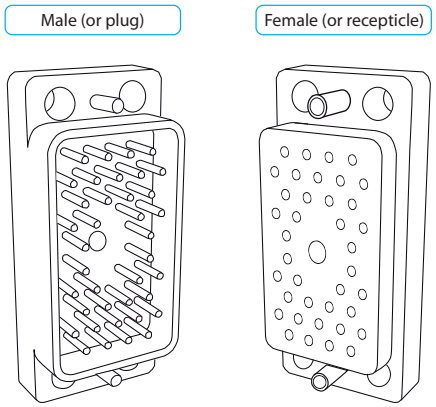


FIGURE 5 - EDAC/ELCO PART NUMBERS

Component	Calrec part	EDAC/ELCO part
38 way socket	400-040	516-038-000-401
38 way metal hood	400-037	516-230-538
Crimp pin	400-024	516-290-590
Solder pin	400-025	516-290-500
Pin extractor tool	-	516-280-200

FIGURE 6 - AE5743 - SIDE VIEWS

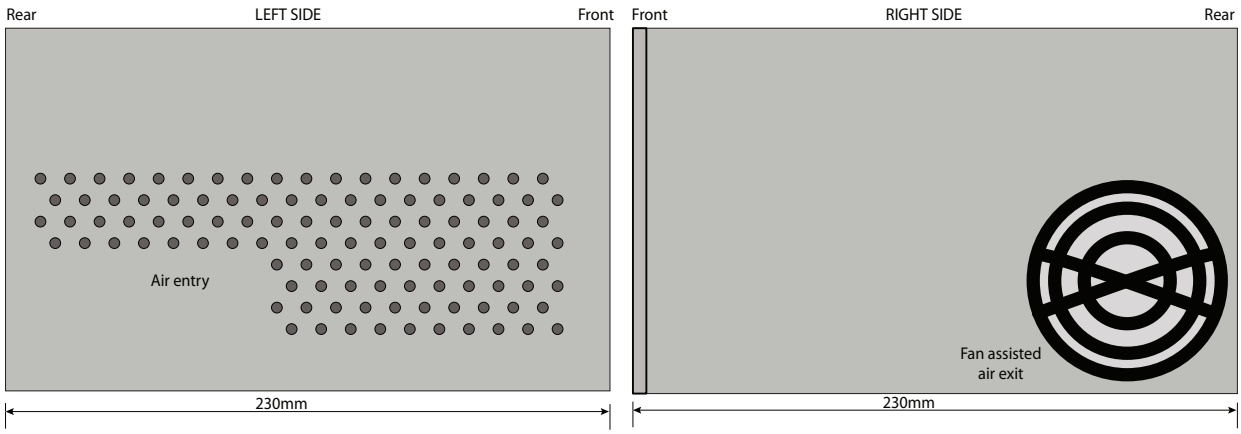


FIGURE 7 - EDAC/ELCO UNIT PINOUT INFORMATION

All connecting cables should be terminated in female (recepticle) type connectors

Pin	Input connectors				Output Connectors	
	Input 1	Input 2	Input 3	Input 4	Output 1	Output 2
A	Ground	Ground	Ground	Ground	Output 1 +	Output 17 +
B	Ground	Ground	Ground	Ground	Output 1 -	Output 17 -
C	Ground	Ground	Ground	Ground	Output 2 +	Output 18 +
D	Ground	Ground	Ground	Ground	Output 2 -	Output 18 -
E	Input 1 +	Input 9 +	Input 17 +	Input 25 +	Output 3 +	Output 19 +
F	Input 1 -	Input 9 -	Input 17 -	Input 25 -	Output 3 -	Output 19 -
J	Input 2 +	Input 10 +	Input 18 +	Input 26 +	Output 4 +	Output 20 +
K	Input 2 -	Input 10 -	Input 18 -	Input 26 -	Output 4 -	Output 20 -
L	Ground	Ground	Ground	Ground	Output 5 +	Output 21 +
M	Ground	Ground	Ground	Ground	Output 5 +	Output 21 +
N	Ground	Ground	Ground	Ground	Output 6 +	Output 22 +
P	Ground	Ground	Ground	Ground	Output 6 -	Output 22 -
R	Input 3 +	Input 11 +	Input 19 +	Input 27 +	Output 7 +	Output 23 +
S	Input 3 -	Input 11 -	Input 19 -	Input 27 -	Output 7 -	Output 23 -
T	Input 4 +	Input 12 +	Input 20 +	Input 28 +	Output 8 +	Output 24 +
U	Input 4 -	Input 12 -	Input 20 -	Input 28 -	Output 8 -	Output 24 -
V	Ground	Ground	Ground	Ground	Ground	Ground
W	Ground	Ground	Ground	Ground	Ground	Ground
X	Ground	Ground	Ground	Ground	Ground	Ground
Y	Ground	Ground	Ground	Ground	Ground	Ground
Z	Input 5 +	Input 13 +	Input 21 +	Input 29 +	Output 9 +	Output 25 +
AA	Input 5 -	Input 13 -	Input 21 -	Input 29 -	Output 9 -	Output 25 -
BB	Input 6 +	Input 14 +	Input 22 +	Input 30 +	Output 10 +	Output 26 +
CC	Input 6 -	Input 14 -	Input 22 -	Input 30 -	Output 10 -	Output 26 -
DD	Ground	Ground	Ground	Ground	Output 11 +	Output 27 +
EE	Ground	Ground	Ground	Ground	Output 11 -	Output 27 -
FF	Ground	Ground	Ground	Ground	Output 12 +	Output 28 +
HH	Ground	Ground	Ground	Ground	Output 12 -	Output 28 -
JJ	Input 7 +	Input 15 +	Input 23 +	Input 31 +	Output 13 +	Output 29 +
KK	Input 7 -	Input 15 -	Input 23 -	Input 31 -	Output 13 +	Output 29 +
MM	Input 8 +	Input 16 +	Input 24 +	Input 32 +	Output 14 +	Output 30 +
NN	Input 8 -	Input 16 -	Input 24 -	Input 32 -	Output 14 -	Output 30 -
PP	Ground	Ground	Ground	Ground	Output 15 +	Output 31 +
RR	Ground	Ground	Ground	Ground	Output 15 -	Output 31 -
SS	Ground	Ground	Ground	Ground	Output 16 +	Output 32 +
TT	Ground	Ground	Ground	Ground	Output 16 -	Output 32 -
H	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground
LL	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground	Chassis Ground

AD5780 – 48 MIC/LINE IN (XLR)

The AD5780 is an analog Hydra2 IO box with 48 mic/line inputs (female XLR) and 16 line outputs (male XLR).

This unit can be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification. Figure 4 provides XLR connector information. Figure 5 shows the side views but additional depth should be allowed for the mating connectors.

FIGURE 1 - AD5780 - 48 MIC/LINE INPUTS, 16 LINE OUTPUTS

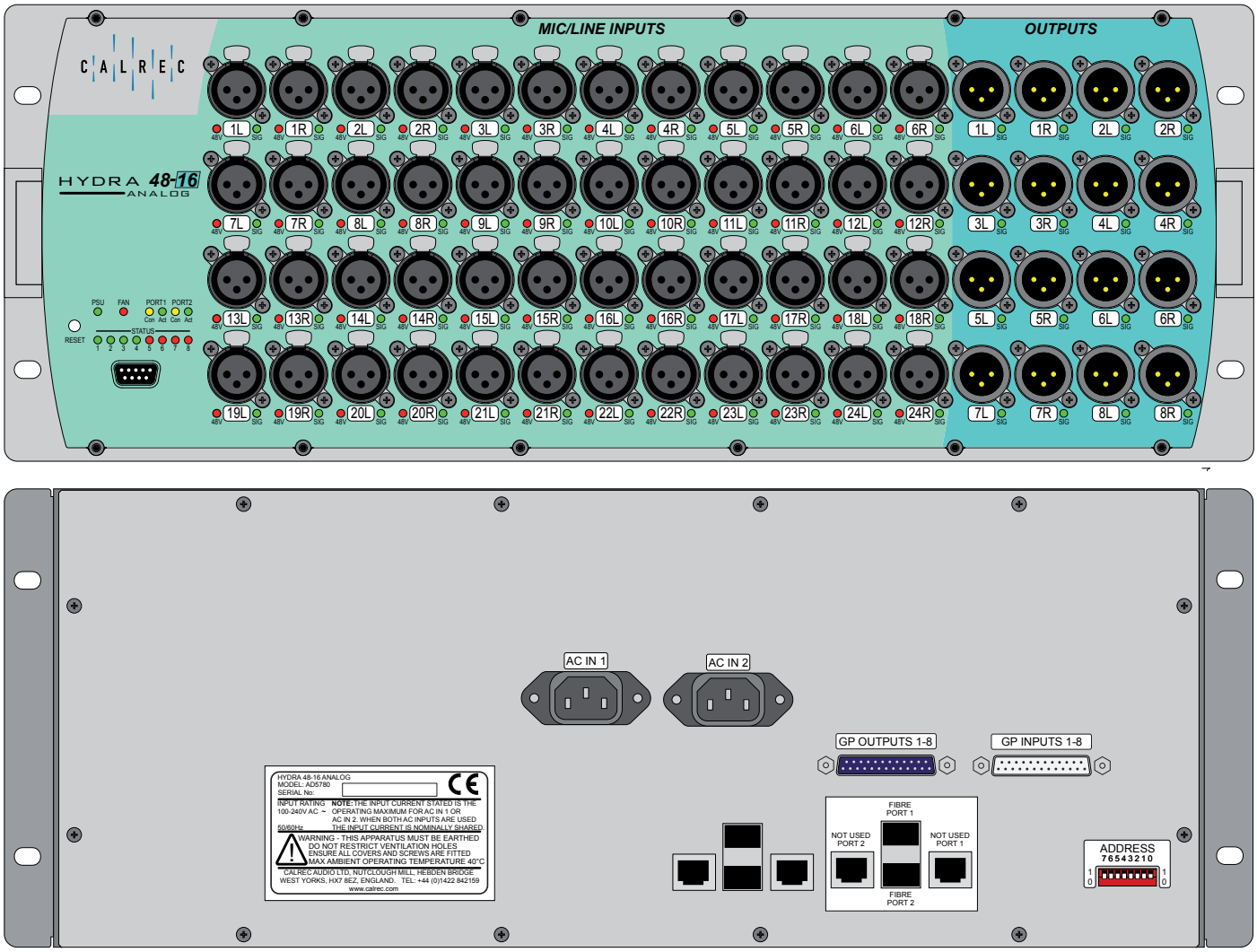


FIGURE 2 - AD5780 - 48 MIC/LINE INPUTS, 16 LINE OUTPUTS

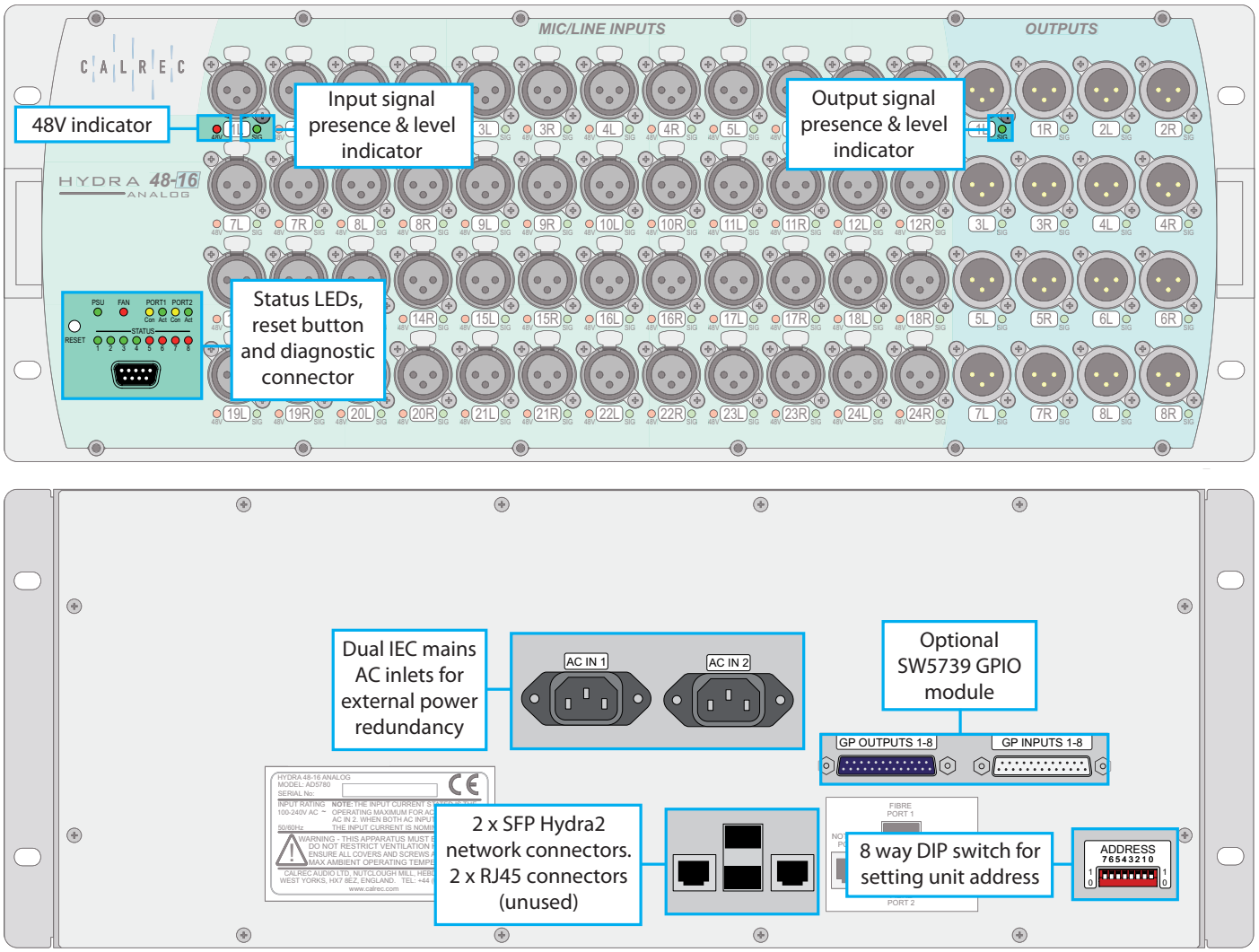
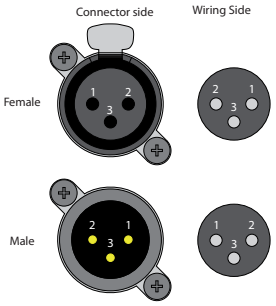


FIGURE 3 - SPECIFICATION

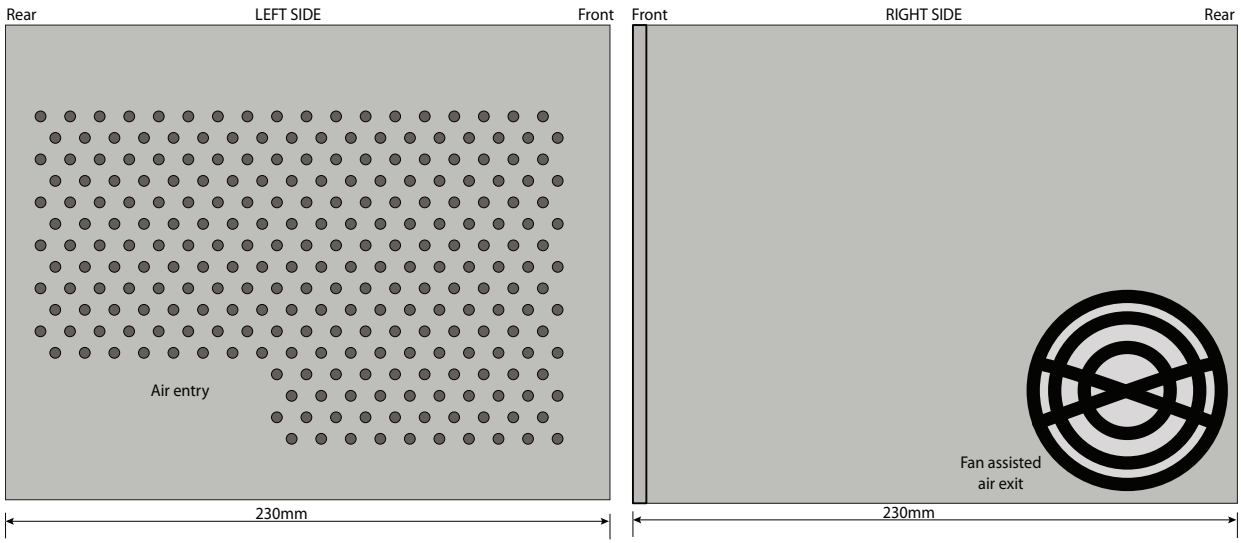
Height	4U
Width	19“ (483mm)
Approx Depth (Inc. mating connectors)	12” (300mm)
Approx Weight	16.1lbs (7.3Kg)
Input Power Rating	100-240V AC 1.05-0.51A RMS 50/60Hz
Acoustic Noise	27dB-SPL A-Weighted 1M from source

FIGURE 4 - XLR CONNECTORS



Function	Pin
Positive	2
Negative	3
Ground	1

FIGURE 5 - AD5780 - SIDE VIEWS



AD5781 – 24 ANALOG MIC/LINE (XLR)

The AD5781 is an analog Hydra2 IO box with 24 mic/line inputs (female XLR) and 8 line outputs (male XLR).

This unit can be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification. Figure 4 provides XLR connector information. Figure 5 shows the front to back dimensions but additional space needs to be allowed for the projecting mating connectors.

FIGURE 1 - AD5781 - 24 MIC/LINE INPUTS, 8 LINE OUTPUTS

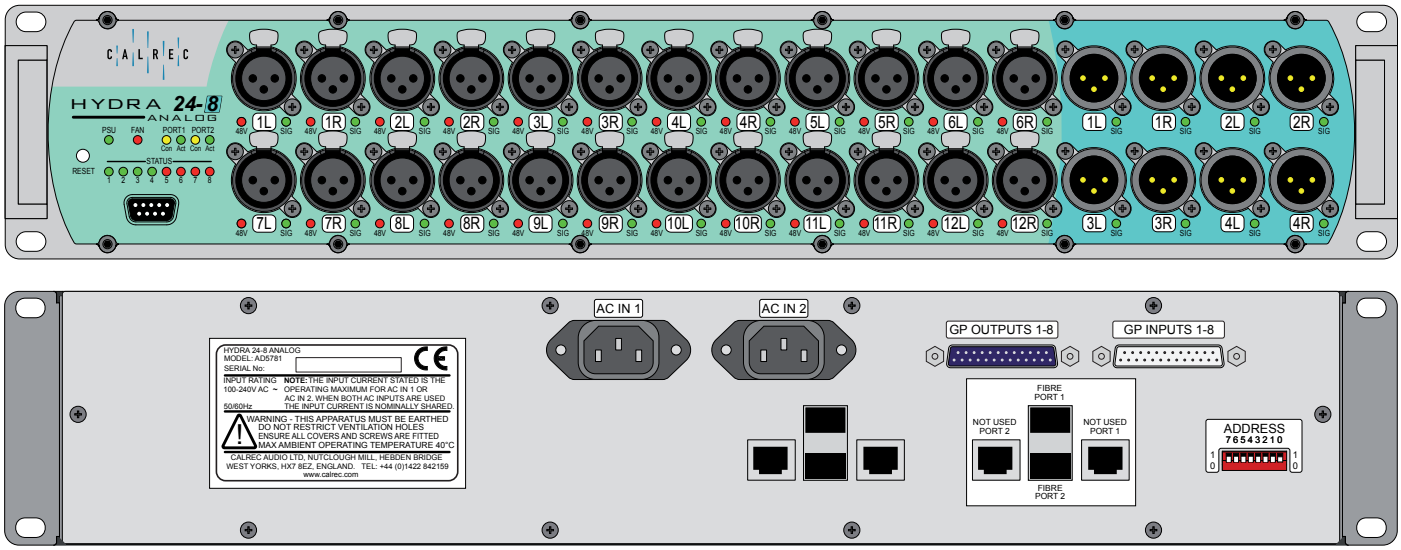


FIGURE 2 - AD5781 - 24 MIC/LINE INPUTS, 8 LINE OUTPUTS

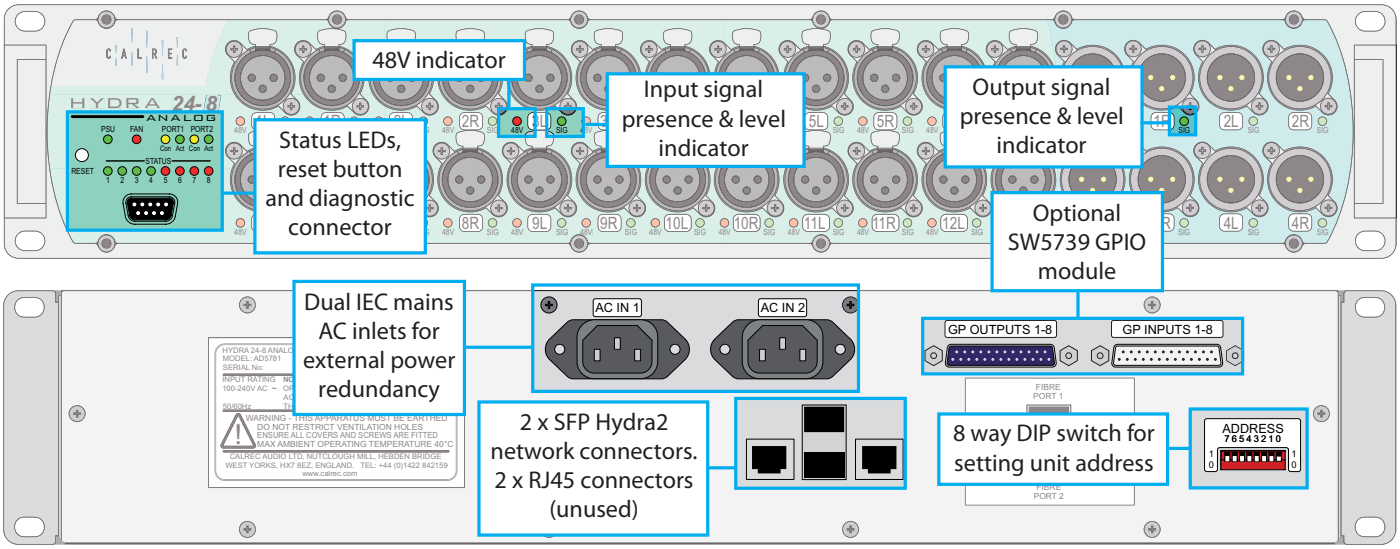
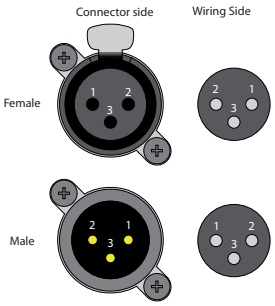


FIGURE 3 - SPECIFICATION

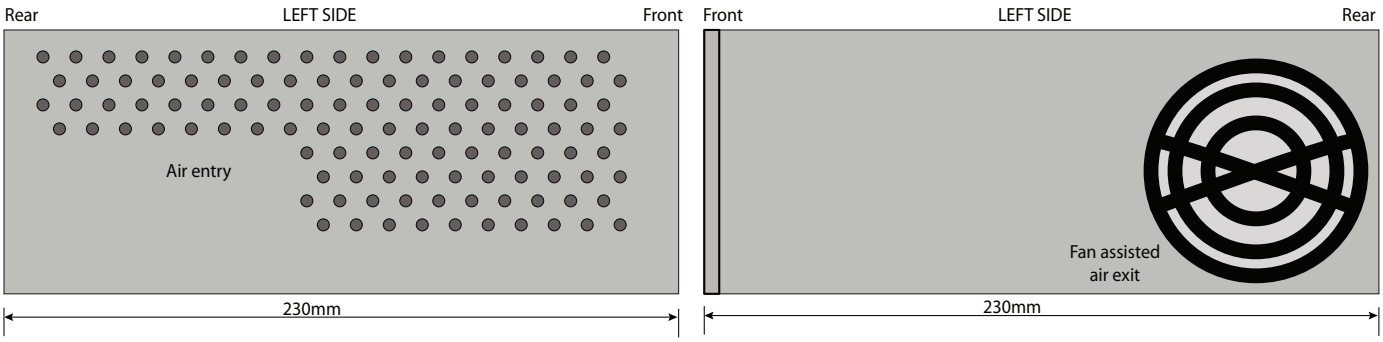
Height	2U
Width	19" (483mm)
Approx Depth (Inc. mating connectors)	12" (300mm)
Approx Weight	12.5lbs (5.7Kg)
Input Power Rating	100-240V AC 0.60-0.31A RMS 50/60Hz
Acoustic Noise	26dB-SPL A-Weighted 1M from source

FIGURE 4 - XLR CONNECTORS



Function	Pin
Positive	2
Negative	3
Ground	1

FIGURE 5 - AD5781 - SIDE VIEWS



AD5782– 12 MIC/LINE (XLR)

The AD5782 is an analog Hydra2 IO box with 12 mic/line inputs (female XLR) and 4 line outputs (male XLR).

This unit can be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification. Figure 4 provides XLR connector information. Figure 5 shows the front to back dimensions but additional space needs to be allowed for the projecting mating connectors.

FIGURE 1 - AD5782 - 12 MIC/LINE INPUTS, 4 LINE OUTPUTS

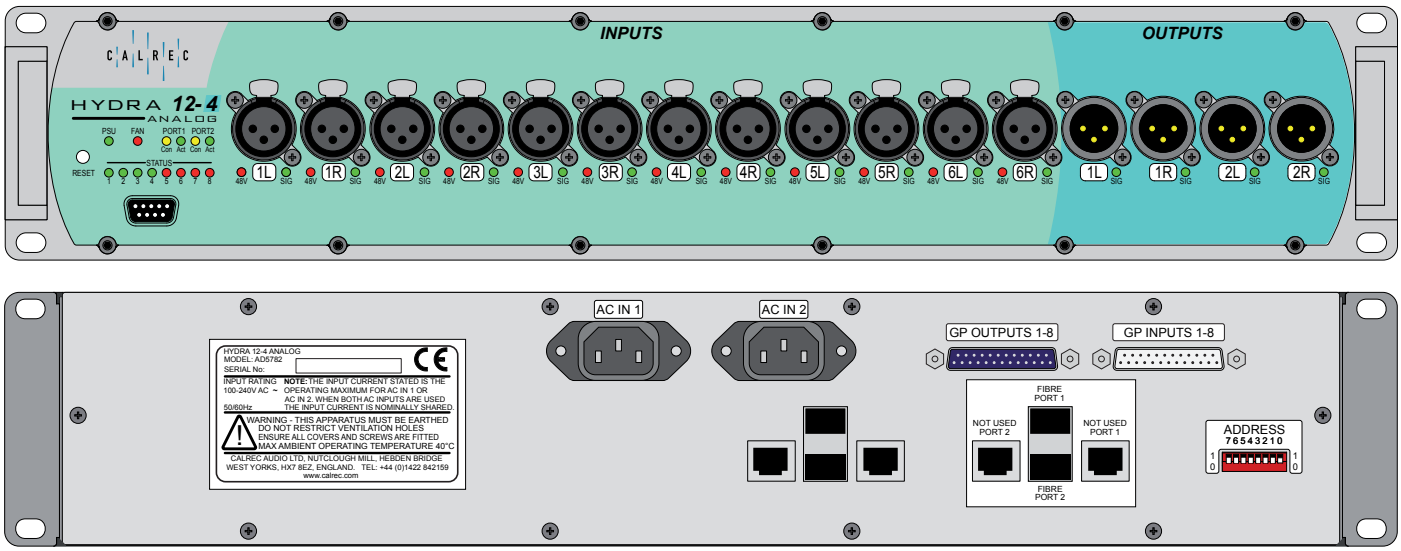


FIGURE 2 - AD5782 - 12 MIC/LINE INPUTS, 4 LINE OUTPUTS

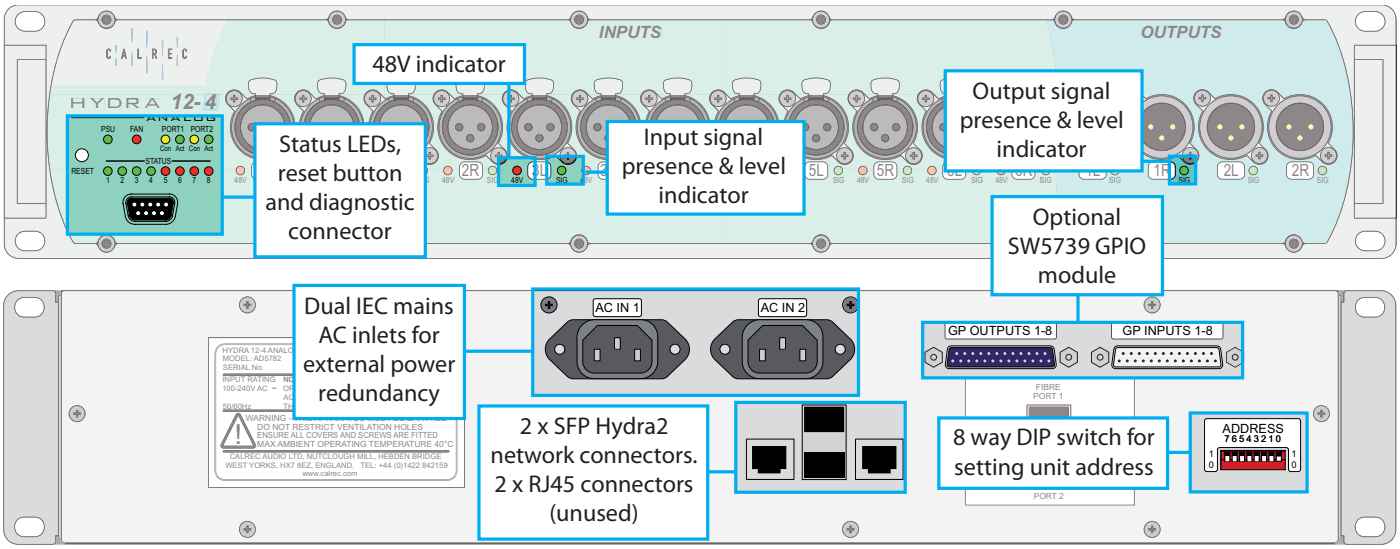
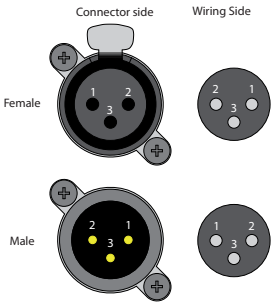


FIGURE 3 - SPECIFICATION

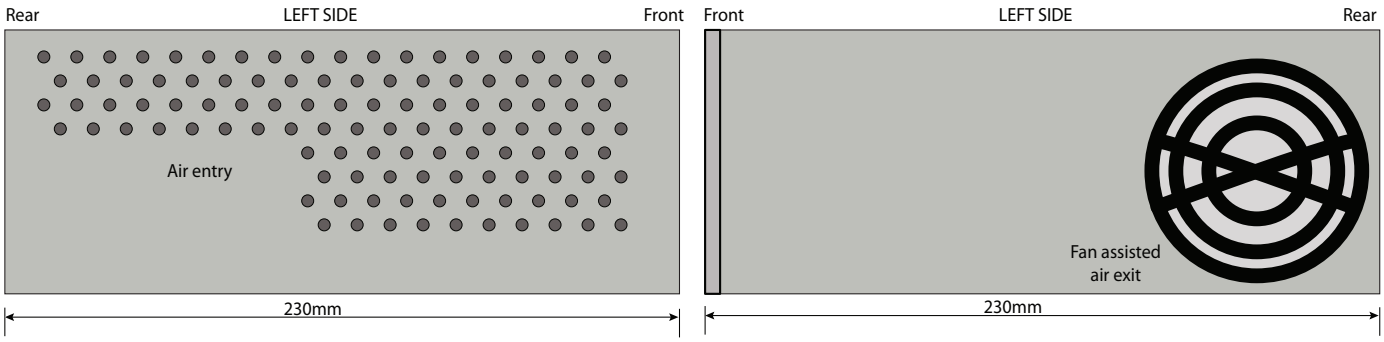
Height	2U
Width	19" (483mm)
Approx Depth (Inc. mating connectors)	12" (300mm)
Approx Weight	11.5lbs (5.2Kg)
Input Power Rating	100-240V AC 0.45-0.25A RMS 50/60Hz
Acoustic Noise	26dB-SPL A-Weighted 1M from source

FIGURE 4 - XLR CONNECTORS



Function	Pin
Positive	2
Negative	3
Ground	1

FIGURE 5 - AD5782 - SIDE VIEWS



JB5606 – 16 AES3 IN/OUT (BNC)

The JB5606 is an AES Hydra2 IO box with 16 AES inputs and 16 AES outputs on BNC connectors.

This unit can be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification. Figure 4 shows the front to back dimensions but additional space needs to be allowed for the projecting mating connectors.

FIGURE 1 - JB5606 - 16 AES3 INPUTS, 16 AES3 OUTPUTS

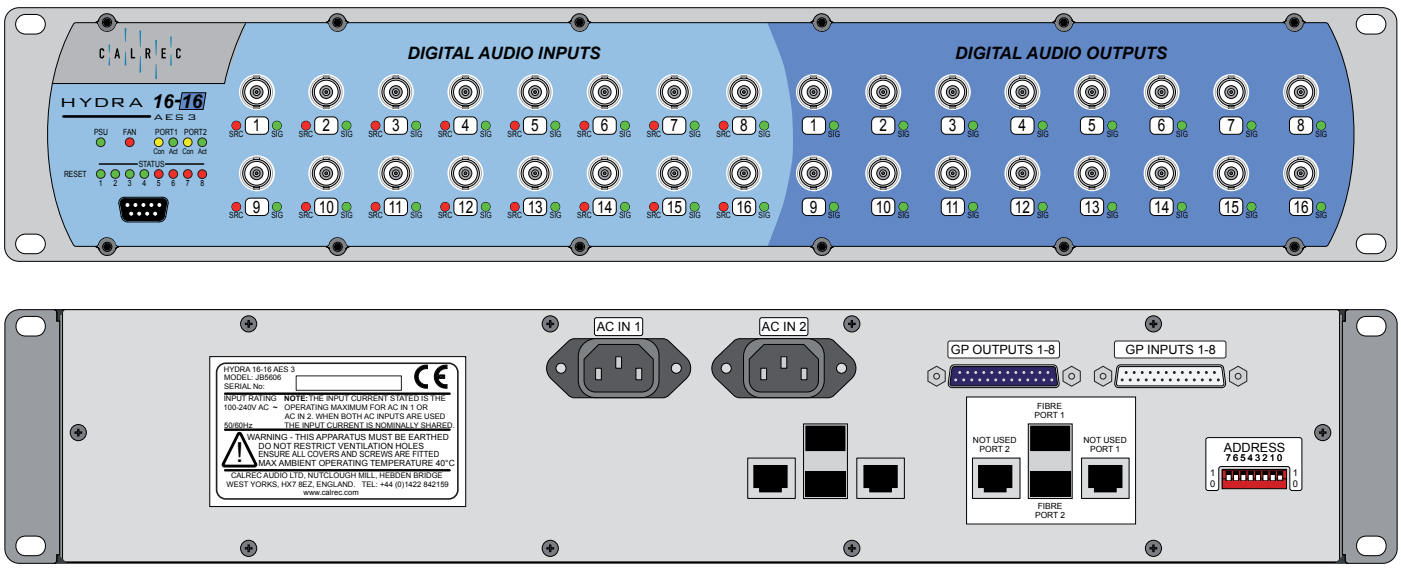


FIGURE 2 - JB5606 - 16 AES INPUTS, 16 AES OUTPUTS

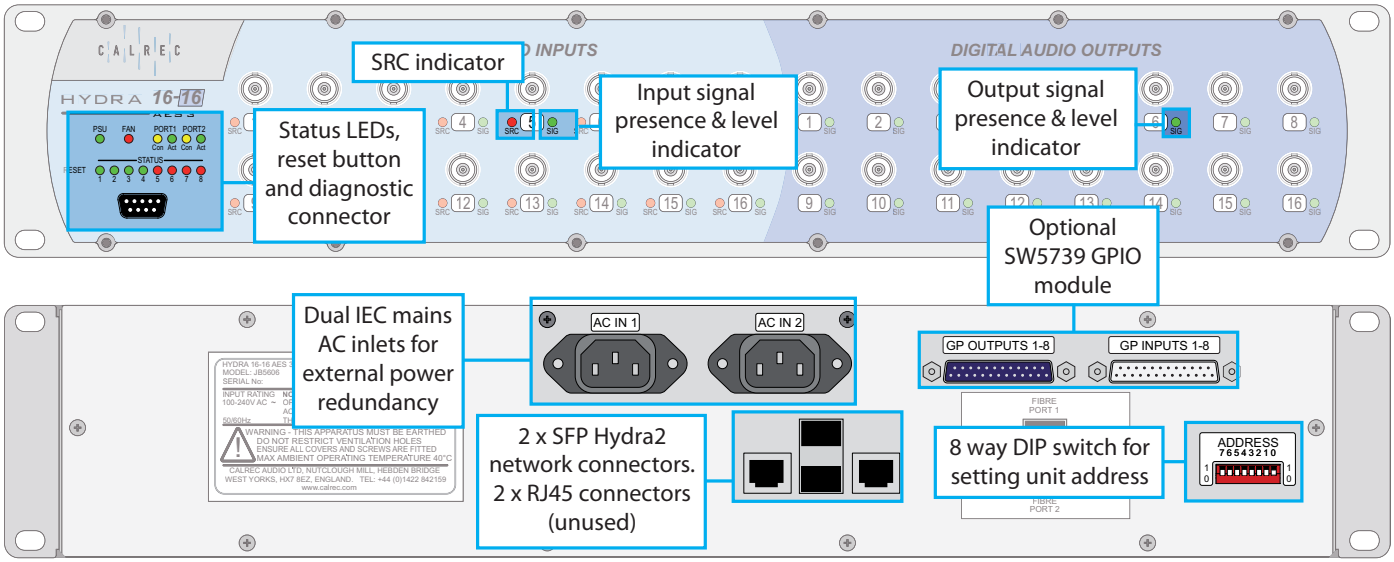
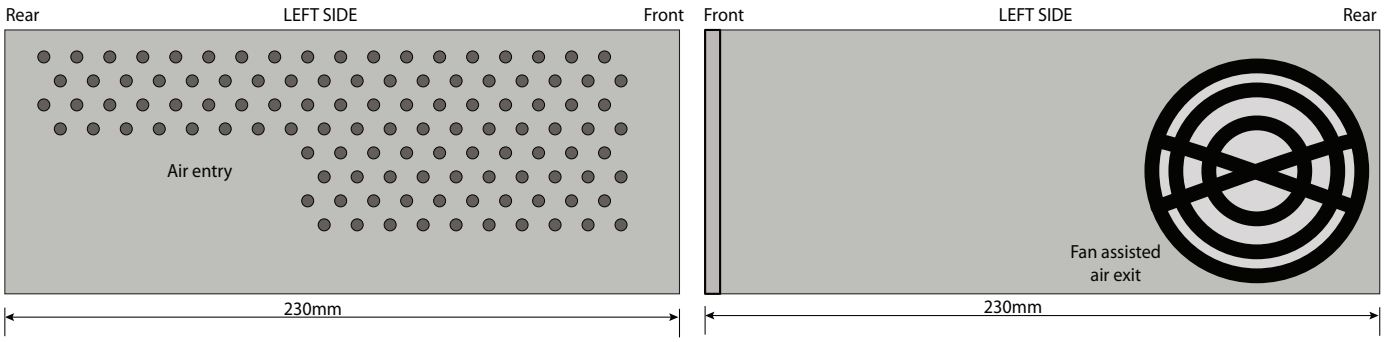


FIGURE 3 - SPECIFICATION

Height	2U
Width	19“ (483mm)
Approx Depth (Inc. mating connectors)	11.8” (300mm)
Approx Weight	8.6lbs (3.9Kg)
Input Power Rating	100-240V AC 0.24-0.13A RMS 50/60Hz
Acoustic Noise	26dB-SPL A-Weighted 1M from source

FIGURE 4 - JB5606 - SIDE VIEWS



JB5783 – 32 AES3 IN/OUT (BNC)

The JB5783 is an AES Hydra2 IO box with 32 AES inputs and 32 AES outputs on BNC connectors.

This unit can be fitted with the SW5739 GPIO module.

Figure 1 shows the front and rear views. Figure 2 provides the unit specification. Figure 3 highlights the main components of the unit. Figure 4 shows the front to back dimensions but additional space needs to be allowed for the projecting mating connectors.

FIGURE 2 - SPECIFICATION

Height	3U
Width	19" (483mm)
Approx Depth (Inc. mating connectors)	11.8" (300mm)
Approx Weight	14.3lbs (6.5Kg)
Input Power Rating	100-240V AC 0.38-0.20A RMS 50/60Hz
Acoustic Noise	26dB-SPL A-Weighted 1M from source

FIGURE 1 - JB5783 - 32 AES INPUTS, 32 AES OUTPUTS

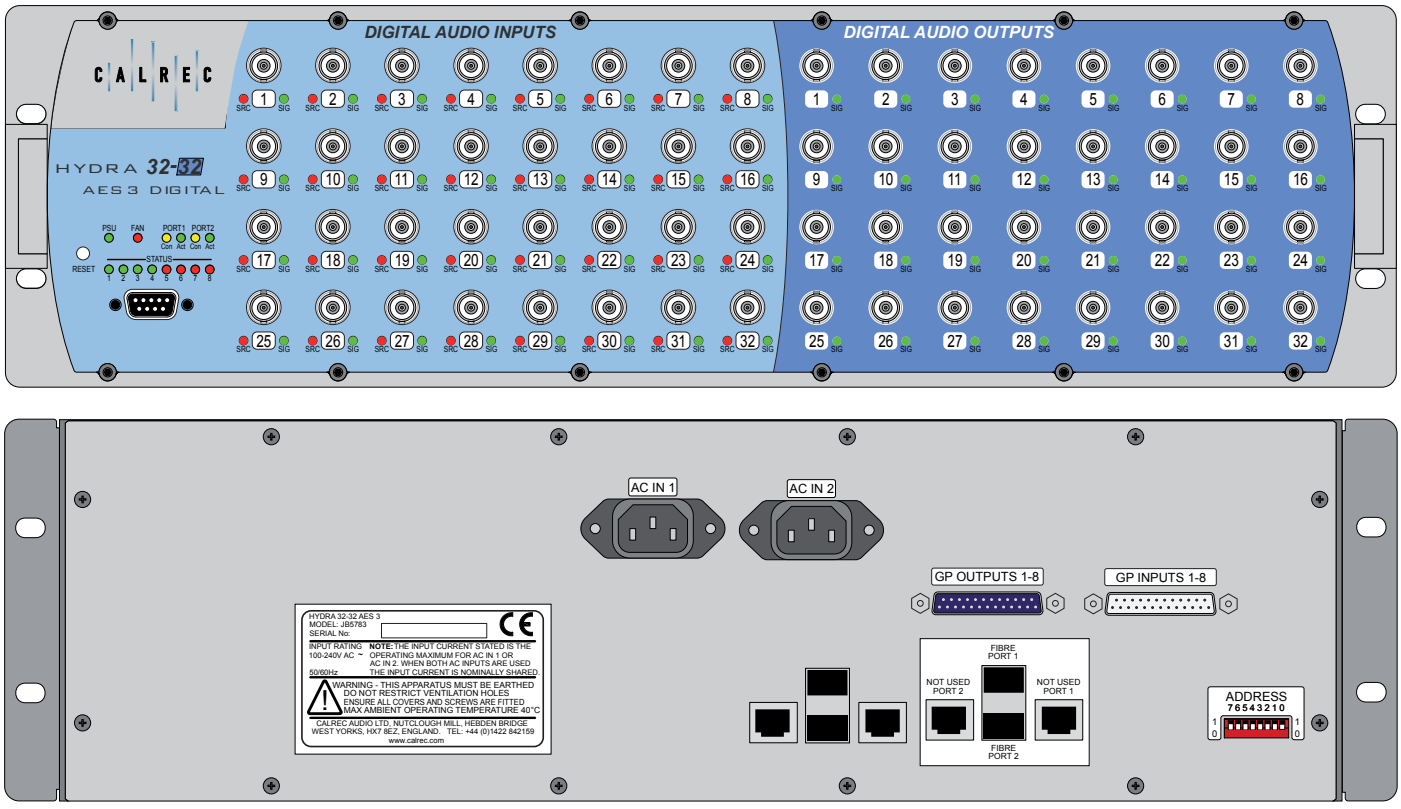


FIGURE 3 - JB5783 - 32 AES3 INPUTS, 32 AES3 OUTPUTS

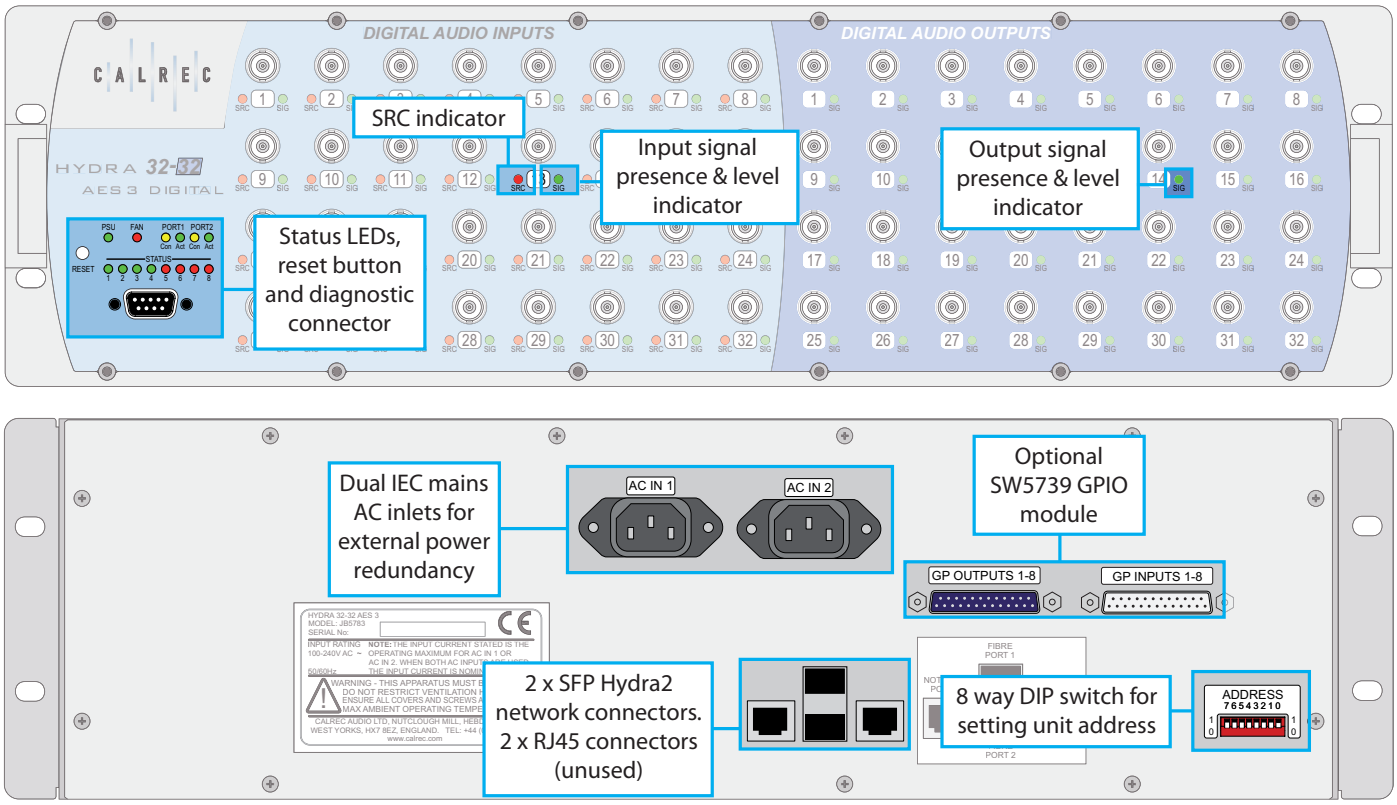
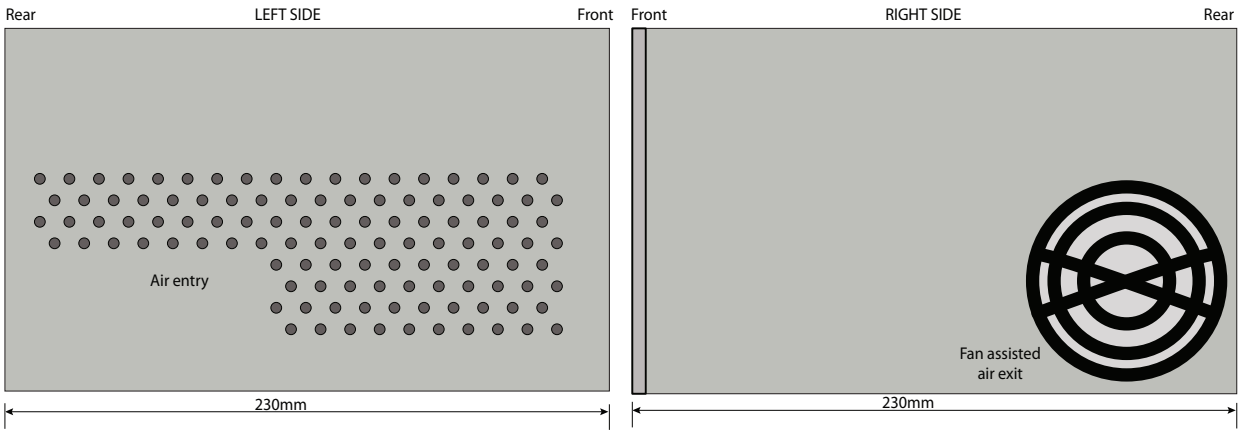


FIGURE 4 - JB5783 - SIDE VIEWS



JM5736 – MADI (MULTI MODE SC)

The JM5736 is a MADI Hydra2 IO box providing two MADI interfaces with both copper and multi mode fiber (SC connectors) connectivity. Each interface can be set with a front panel switch to provide either 56 or 64 channels.

This unit can NOT be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification. Figure 4 shows the front to back dimensions but additional space needs to be allowed for the projecting mating connectors.

This unit uses no forced cooling so it is especially important to ensure air can flow freely to or from all vent holes.

FIGURE 3 - SPECIFICATION

Height	1U
Width	19“ (483mm)
Approx Depth (Inc. mating connectors)	11” (280mm)
Approx Weight	7.5lbs (3.4Kg)
Input Power Rating	100-240V AC 0.20-0.12A RMS 50/60Hz

FIGURE 1 - JM5736 - DUAL MADI INTERFACE

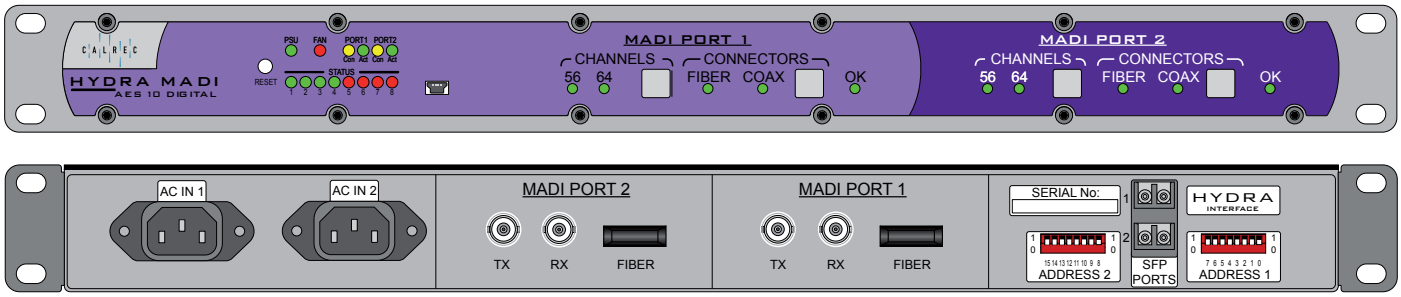


FIGURE 2 - JM5736 - DUAL MADI INTERFACE

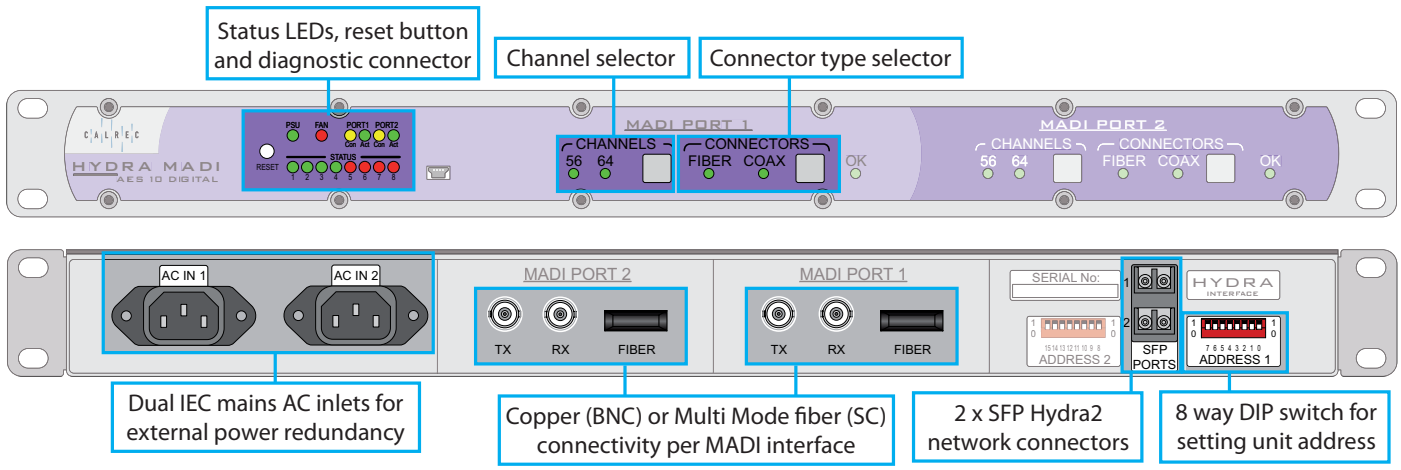
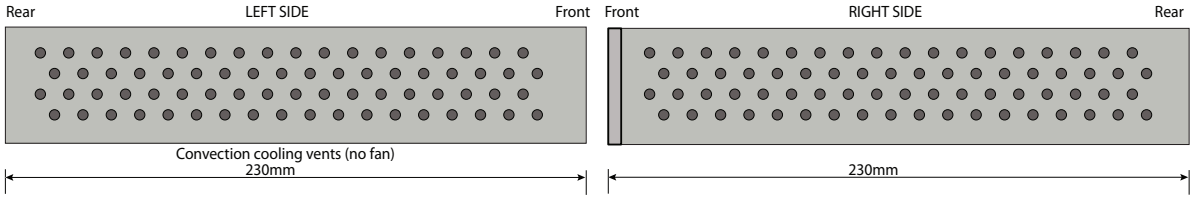


FIGURE 4 - JM5736 - SIDE VIEWS



JM5831 – MADI (SINGLE MODE SC)

The JM5831 is a MADI Hydra2 IO box providing two MADI interfaces with both copper and single mode fiber (SC connectors) connectivity. Each interface can be set with a front panel switch to provide either 56 or 64 channels.

This unit can NOT be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification. The side views are identical to those shown for the JM7536. Additional depth should be allowed for mating connectors.

This unit uses no forced cooling so it is especially important to ensure air can flow freely to or from all vent holes.

FIGURE 3 - SPECIFICATION

Height	1U
Width	19“ (483mm)
Approx Depth (Inc. mating connectors)	11” (280mm)
Approx Weight	7.5lbs (3.4Kg)
Input Power Rating	100-240V AC 0.20-0.12A RMS 50/60Hz

FIGURE 1 - JM5831 - DUAL MADI INTERFACE

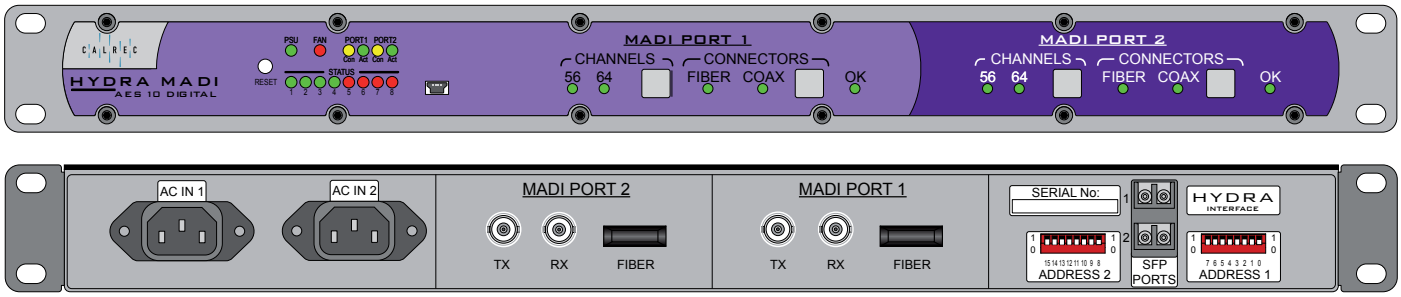
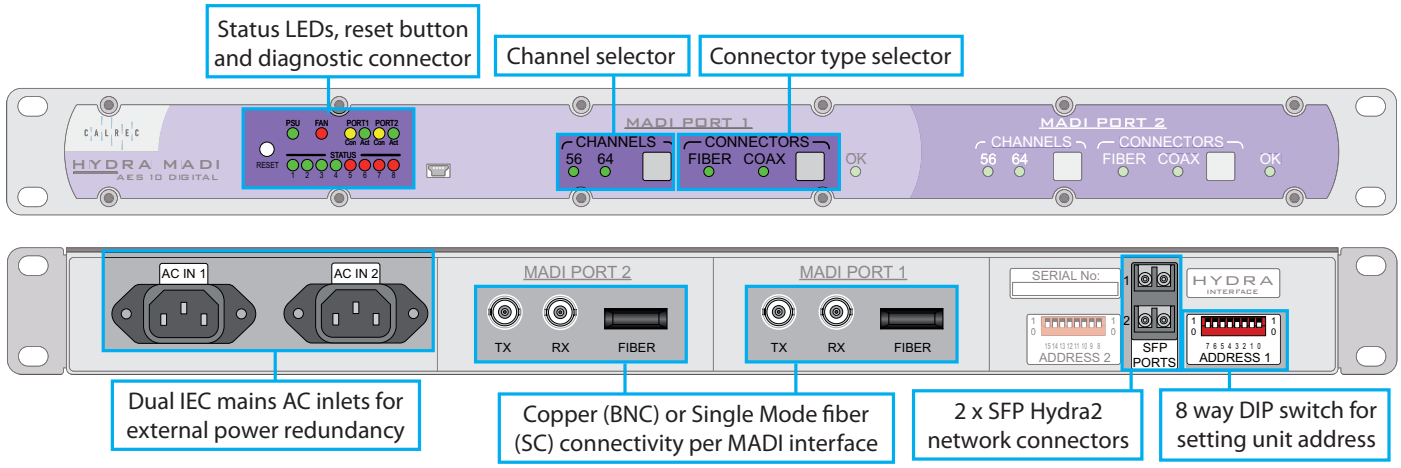


FIGURE 2 - JM5831 - DUAL MADI INTERFACE



JM5890 – MADI (MULTI MODE ST)

The JM5890 is a MADI Hydra2 IO box providing two MADI interfaces with both copper and multi mode fiber (ST connectors) connectivity. Each interface can be set with a front panel switch to provide either 56 or 64 channels.

This unit can NOT be fitted with the SW5739 GPIO module.

Figure 2 highlights the main components of the unit. Figure 3 provides the unit specification.

The side views are identical to those shown for the JM7536. Additional depth should be allowed for mating connectors.

This unit uses no forced cooling so it is especially important to ensure air can flow freely to or from all vent holes.

FIGURE 3 - SPECIFICATION

Height	1U
Width	19“ (483mm)
Approx Depth (Inc. mating connectors)	11” (280mm)
Approx Weight	7.5lbs (3.4Kg)
Input Power Rating	100-240V AC 0.20-0.12A RMS 50/60Hz

FIGURE 1 - JM5890 - DUAL MADI INTERFACE

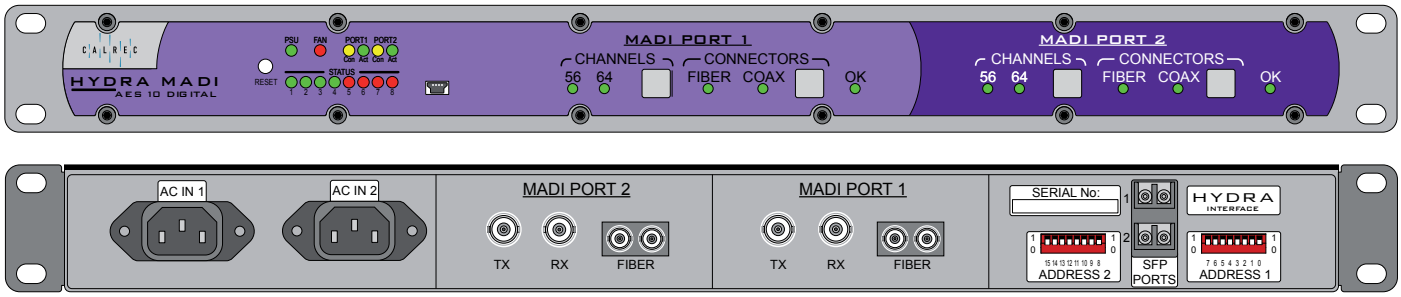
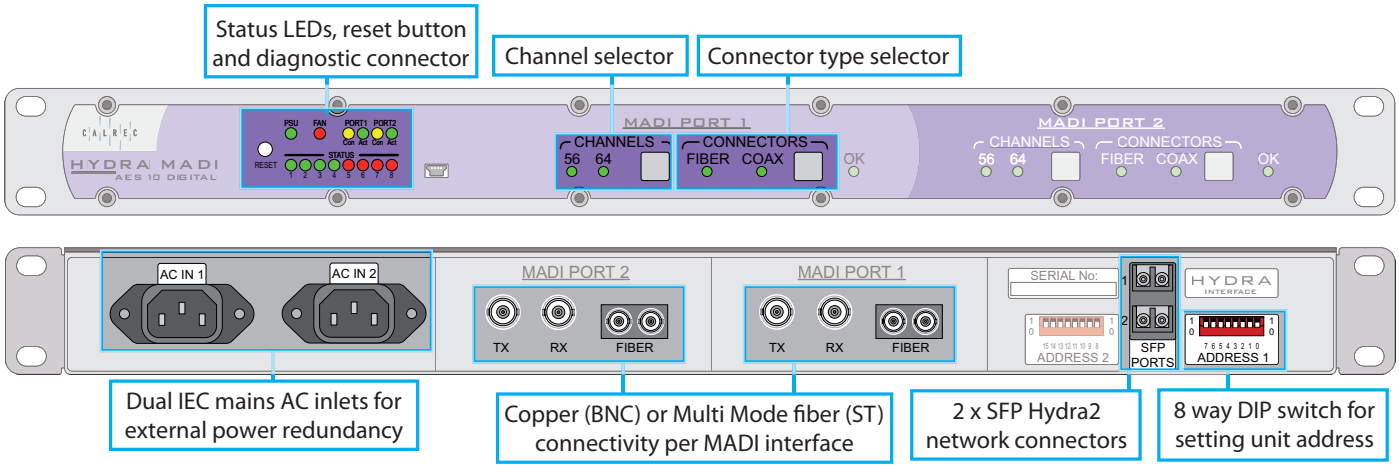


FIGURE 2 - JM5890 - DUAL MADI INTERFACE



SW5739 - GPIO

The SW5739 GPIO Module can be fitted to compatible Hydra2 Fixed Format IO boxes and provides eight relay outputs and eight opto-isolated inputs. These can be controlled from any Calrec console on the Hydra2 network.

For a more detailed description of the functionality of this module, please refer to the 'GPIO' section of the Apollo or Artemis Installation Manual.

GPI pin assignments

The GPI connector on the GPIO card is a 25 pin female D-Type. A 25 pin male D-Type connector on the connecting cable should be wired as shown in Figure 2.

Opto Input Specification

- DC - 5 to 24 volts, positive or negative
- AC - 5 to 24 volts peak, 50 - 60 Hz.

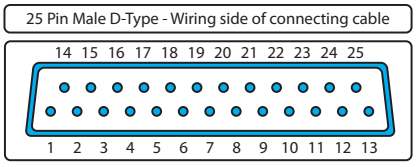
GPO pin assignments

The GPO connector on the GPIO card is a 25 pin male D-Type. A 25 pin female D-Type connector on the connecting cable should be wired as shown in Figure 3.

Relay output specifications

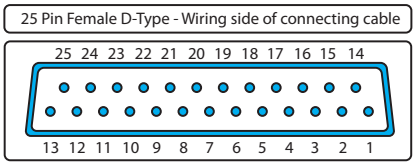
100mA maximum switch current, 30V maximum voltage.

FIGURE 2 - GPI CONNECTING CABLE PIN ASSIGNMENTS



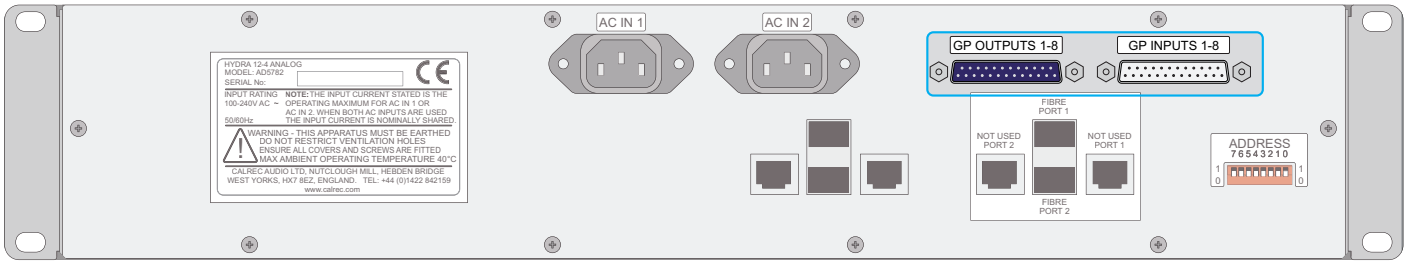
Function		Pin
Opto 1	+	1
	-	14
Opto 2	+	15
	-	3
Opto 3	+	4
	-	17
Opto 4	+	18
	-	6
Opto 5	+	7
	-	20
Opto 6	+	21
	-	9
Opto 7	+	10
	-	23
Opto 8	+	24
	-	12
+5V		2
		5
		8
		11
Ground		16
		19
		22
		25
		13

FIGURE 3 - GPO CONNECTING CABLE PIN ASSIGNMENTS



Function		Pin
Relay 1	Common	1
	Normally Open	14
	Normally Made	2
Relay 2	Common	15
	Normally Open	3
	Normally Made	16
Relay 3	Common	4
	Normally Open	17
	Normally Made	5
Relay 4	Common	18
	Normally Open	6
	Normally Made	19
Relay 5	Common	7
	Normally Open	20
	Normally Made	8
Relay 6	Common	21
	Normally Open	9
	Normally Made	22
Relay 7	Common	10
	Normally Open	23
	Normally Made	11
Relay 8	Common	24
	Normally Open	12
	Normally Made	25
Ground		13

FIGURE 1 - SW5739 - GPIO MODULE



HYDRA2
STAGEBOX OVERVIEW

CALREC

Putting Sound in the Picture

STAGEBOX

The Stagebox is targeted primarily at studio floor and outside broadcast applications. The unit has all audio and control connections located at the front of the unit. Power cables connect at the rear. It is designed to provide a mix of audio interfaces, with a high density of connections, saving rack space and cost.

An example configuration of the Stagebox is shown in Figure 1.

The Stagebox chassis (EE5833) is 3U high and contains 21 slots for modules. Each slot is 4HP (0.8") wide. The center slot is dedicated to the Hydra2 Interface Module leaving 20 slots available for other audio and control interfaces.

Stagebox Power

The chassis is powered and cooled by dual redundant PSU modules (ZN5835), each module contains a power supply and a low noise fan. These modules plug in from the rear of the unit as shown in Figure 2.

In the event of power loss to one of the PSU modules, AWACS warnings will be propagated throughout the system and a warning LED will illuminate on the front of the Hydra2 Interface Module. In this situation, both fans will continue to function and cool the unit. PSU modules may be hot-swapped without interruption to operation.

Mechanical specification

The stagebox basic mechanical data is shown in Figure 3. It is housed in a rack frame, 3 rack units (135mm) high and is normally secured by conventional style rack fixings through the front "ears". To avoid applying excessive stresses to the front panel, the stagebox should also be supported towards the rear using side supports or slides.

The rack is fan cooled and the installation needs to be designed such that air can freely circulate as shown in the diagram Figure 4.

In addition to the 289mm front back depth from the back of the rack ears to the back of the fans, additional depth should be allowed for the rear inserted IEC mains connectors. Space also need to be allowed for the front panel I/O connections and for the cables to them not be forced into tighter bend radii than is recommended by the cable manufacturer.

FIGURE 2 - STAGEBOX REAR

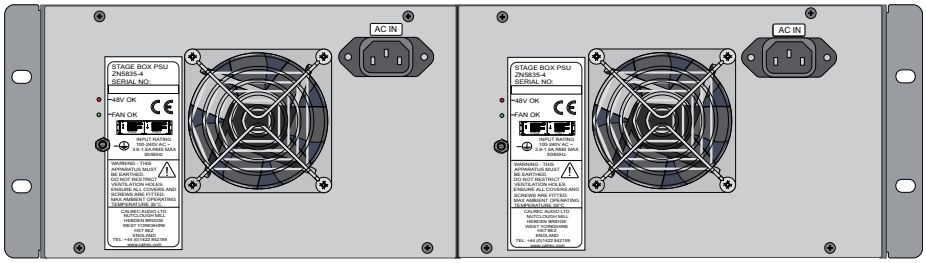


FIGURE 3 - STAGEBOX CHASSIS DATA

Height	3U
Width	19" (483mm)
Approx Depth (Inc. mating connectors)	14.9" (378mm)

FIGURE 1 - STAGEBOX FRONT

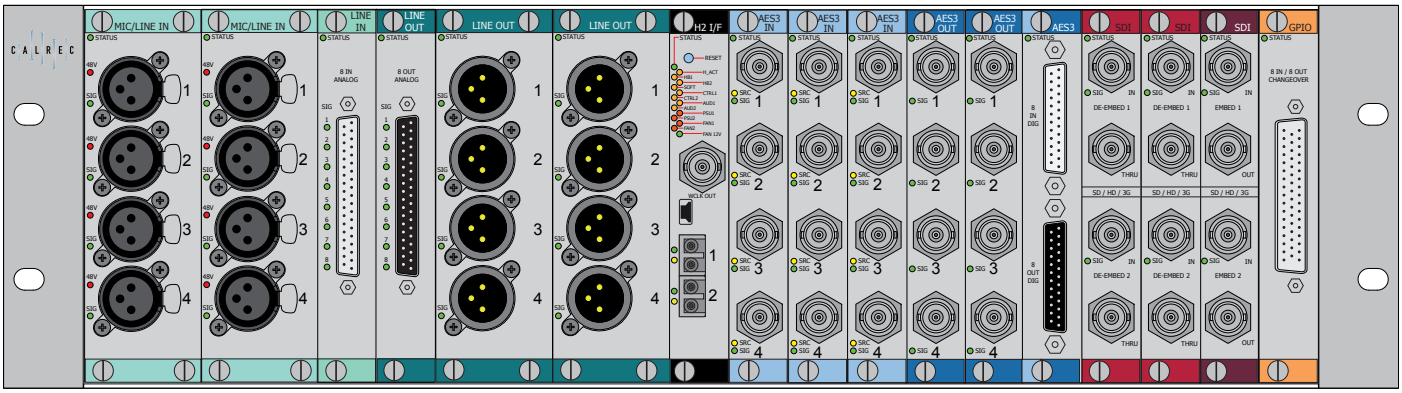
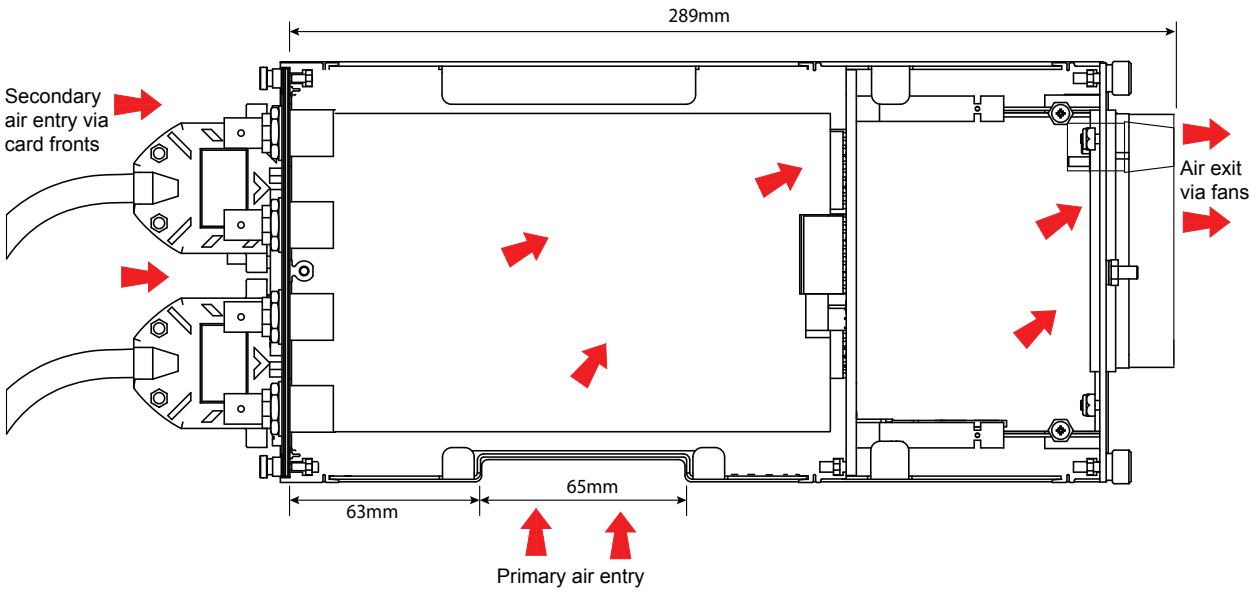


FIGURE 4 - STAGEBOX CROSS SECTION



The Hydra2 Interface Module

This module provides dual SFP sockets for redundant Hydra2 connections to a Hydra2 router over copper or fiber. Each Hydra2 link is limited to 512 bi-directional signals (at 48kHz) and so the configuration of modules in the Stagebox must accommodate for this limit.

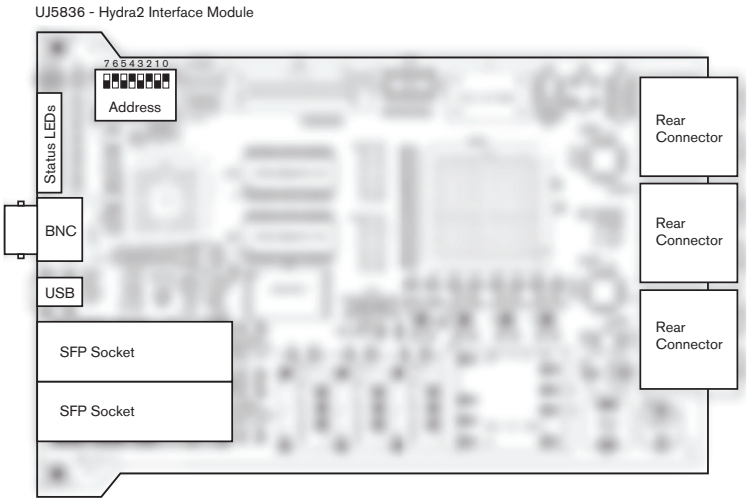
In the rare event of failure of a Hydra2 Interface Module, the module may be hot-swapped with a spare. The Hydra2 network will autodetect the new module and audio will continue to pass as it did prior to the failure.

Note: The new Hydra2 Interface Module must be given the same address as the previous module.

Setting the Stagebox address

Each Stagebox must be given an unique address, as with all Hydra2 IO units. Instead of using the DIL switches on the rear of the unit as with the fixed format units, the Stagebox address switches are located on the Hydra2 Interface Module

FIGURE 5 - ADDRESS SWITCHES ON THE HYDRA2 INTERFACE MODULE



circuit board. The Hydra2 Interface Module must be removed from the stagebox chassis for the address to be set. The location of the address switches on the Hydra2 Interface Module is shown in Figure 3.

The legend on the actual switches should be ignored and reference should be made to the legend on the circuit board. The switch labelled '0' sets the LSB of the address, the switch labelled '7' sets the MSB. When a switch lever is up (away from the board), the relevant bit is set to a logical 1. See the section 'Setting the Hydra2 address' for detailed information on how to set addresses.

STAGEBOX MODULES

Stagebox Modules
Modules currently available for use in the Stagebox are shown in Figure 1.

The following sections of this document provide datasheets for the Stagebox and these modules.

Module Slots
The stagebox chassis has 20 slots available for audio and control modules. These slots are labelled with letters (A, B, C, D, E, G, H, J, K, L, M, N, P, R, S, T, V, W, X, Z) engraved into a metal strip above the module opening. This labelling is used to identify the position of each module in the Apollo and Artemis software.

For modules that take up the width of two slots, the left-most slot will provide the alphabetical reference.

Status LED
All Stagebox modules feature an LED labelled 'status'. This LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

FIGURE 1 - AVAILABLE STAGEBOX MODULES

Module Code	Description	Connector	Width (slots)
AD5840	4 Mic/Line in	XLR	2
AD5838	8 Line in	DB37	1
DA5867	4 Line out	XLR	2
DA5839	8 Line out	DB37	1
JB5860	4 AES3 in	BNC	1
JB5837	4 AES3 out	BNC	1
JD5842	8 AES3 in/out	2 x DB25	1
VO5841	Dual SDI De-embedder	BNC	1
VI5872	Dual SDI Embedder	BNC	1
WY5858	8 GPI / 8 GPO	DB50	1
UJ5836	Hydra2 Interface		1

HYDRA2
STAGEBOX DATASHEETS

CALREC

Putting Sound in the Picture

AD5840 – 4 MIC/LINE IN (XLR)

The AD5840 provides four analog mic/line inputs on female XLR connectors.

The module is two slots wide.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Green signal presence LEDs are available for all inputs. These LEDs illuminate when signal above -60dBFS is present.

The module also features red 48V LEDs for each input which illuminate when phantom power is present.

Wiring information

The wiring information for the input sockets is shown in Figure 2.

FIGURE 1 - AD5840

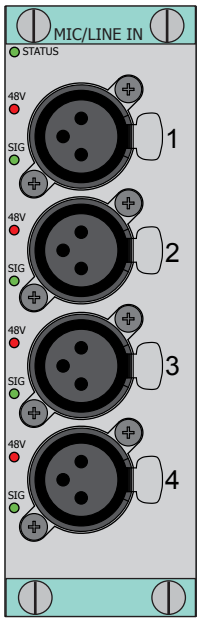
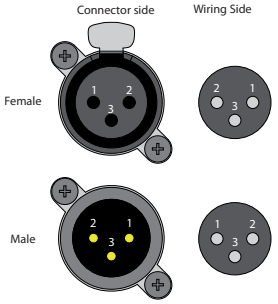


FIGURE 2 - WIRING INFORMATION



Function	Pin
Positive	2
Negative	3
Ground	1

AD5838 – 8 LINE IN (DB37)

The AD5838 provides eight analog line inputs on a DB37F connector.

The module is one slot wide

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Green signal presence LEDs are available for all inputs. These LEDs illuminate when signal above -60dBFS is present.

Wiring information

The wiring information for the input connecting cable is shown in Figure 2.

FIGURE 1 - AD5838

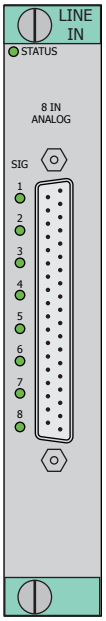
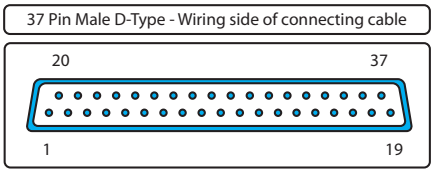


FIGURE 2 - WIRING INFORMATION



Function		Pin
In 1	+	21
	-	3
	Ground	2
In 2	+	23
	-	5
	Ground	4
In 3	+	25
	-	7
	Ground	6
In 4	+	27
	-	9
	Ground	8
In 5	+	29
	-	11
	Ground	10
In 6	+	31
	-	13
	Ground	12
In 7	+	33
	-	15
	Ground	14
In 8	+	35
	-	17
	Ground	16
Ground		18, 20, 36

DA5867 – 4 LINE OUT (XLR)

The DA5867 provides four analog line outputs on male XLR connectors.

The module is two slots wide.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Green signal presence LEDs are available for all outputs and illuminate when signal above -60dBFS is present.

Wiring information

The wiring information for the output sockets is shown in Figure 2.

FIGURE 1 - DA5867

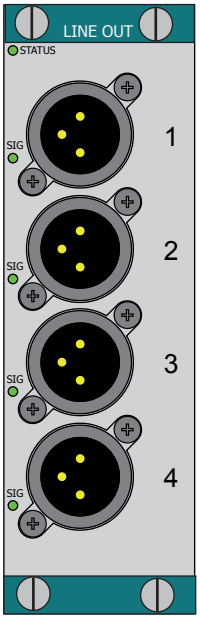
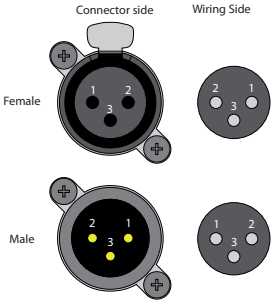


FIGURE 2 - WIRING INFORMATION



Function	Pin
Positive	2
Negative	3
Ground	1

DA5839 – 8 LINE OUT (DB37)

The DA5839 provides eight analog line outputs on a DB37M connector.

The module is one slot wide.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Green signal presence LEDs are available for all outputs. These LEDs illuminate when signal above -60dBFS is present.

Wiring information

The wiring information for the output connecting cable is shown in Figure 2.

FIGURE 1 - DA5839

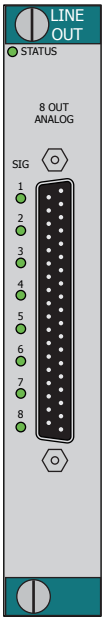
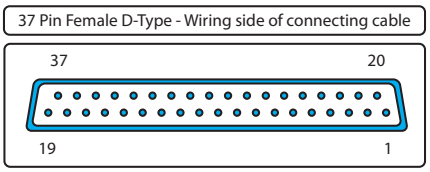


FIGURE 2 - WIRING INFORMATION



Function		Pin
Out 1	+	21
	-	3
	Ground	2
Out 2	+	23
	-	5
	Ground	4
Out 3	+	25
	-	7
	Ground	6
Out 4	+	27
	-	9
	Ground	8
Out 5	+	29
	-	11
	Ground	10
Out 6	+	31
	-	13
	Ground	12
Out 7	+	33
	-	15
	Ground	14
Out 8	+	35
	-	17
	Ground	16
Ground		18, 20, 36

JB5860 – 4 AES3 IN (BNC)

The JB5860 provides four unbalanced AES3 inputs on BNC connectors.

The module is one slot wide.

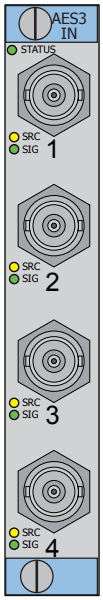
LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

The Yellow LEDs show if the sample rate converter is enabled.

Green signal presence LEDs are available for all inputs. These LEDs illuminate when signal above -60dBFS is present.

FIGURE 1 - JB5860



JB5837 – 4 AES3 OUT (BNC)

The JB5837 provides four unbalanced AES3 outputs on BNC connectors.

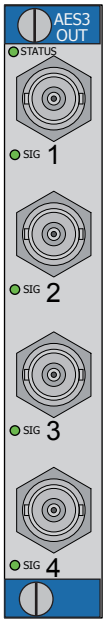
The module is one slot wide.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Green signal presence LEDs are available for all outputs. These LEDs illuminate when signal above -60dBFS is present.

FIGURE 1 - JB5837



JD5842 – 8 AES3 IN/OUT (2 X DB25)

The JD5842 provides eight balanced AES3 inputs and eight AES3 outputs via DB25 connectors.

The module is one slot wide.

LED

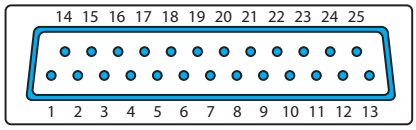
The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Wiring information

The wiring information for the input connecting cable is shown in Figure 2. The output wiring is shown in Figure 3.

FIGURE 2 - INPUT WIRING

25 Pin Male D-Type - Wiring side of connecting cable



Function		Pin
Out 1	+	14
	-	2
	Ground	1
Out 2	+	3
	-	16
	Ground	15
Out 3	+	17
	-	5
	Ground	4
Out 4	+	6
	-	19
	Ground	18
Out 5	+	20
	-	8
	Ground	7
Out 6	+	9
	-	22
	Ground	21
Out 7	+	23
	-	11
	Ground	10
Out 8	+	12
	-	25
	Ground	24
Ground		13

FIGURE 1 - JD5842

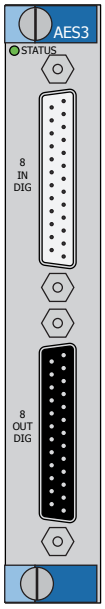
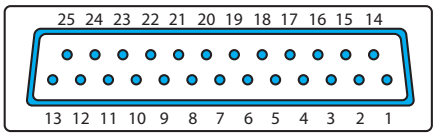


FIGURE 3 - OUTPUT WIRING

25 Pin Female D-Type - Wiring side of connecting cable



Function		Pin
Out 1	+	14
	-	2
	Ground	1
Out 2	+	3
	-	16
	Ground	15
Out 3	+	17
	-	5
	Ground	4
Out 4	+	6
	-	19
	Ground	18
Out 5	+	20
	-	8
	Ground	7
Out 6	+	9
	-	22
	Ground	21
Out 7	+	23
	-	11
	Ground	10
Out 8	+	12
	-	25
	Ground	24
Ground		13

VO5841 - DUAL SDI DE-EMBEDDER

The VO5841 provides two SDI inputs and two Thru outputs on BNC connectors.

The module is one slot wide and features signal presence LEDs for both inputs.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

Green signal presence LEDs are available for all inputs. These LEDs illuminate when an SDI video stream is present.

Thru ports

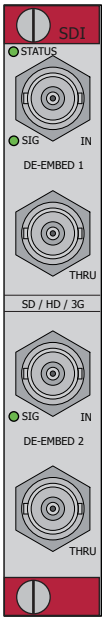
A buffered feed of the input is available on the THRU connector and if not used, especially if cabled to a patch bay, it is good practise to terminate this with a 75 ohm load.

Two alternative versions of the VO5841 can be supplied and it is helpful to discuss with the Calrec appointed project engineer which will be the most appropriate version.

With SD and HD SDI signals up to 1.485 Gbit/s (SMPTE 292M) the two versions offer little practical difference. At the 2.97 Gbit/s rate of 3G SDI signals (SMPTE 424M) timing can become more critical and the alternative merits of the two versions can become significant

VO5841-1 has the buffered thru feed re-clocked and this provides a signal with minimized jitter. This can be important if the maximum cable lengths from the thru port are to be used. Re-clocking inevitably involves additional latency depending on the card activity and for installations where this is undesirable an alternative version is available.

FIGURE 1 - VO5841



The thru feed on VO5841-2 is also buffered but does not get re-clocked so avoids any re-clocking time delay. However, this also means that the jitter on the outgoing signal is dependant on that which is present on the incoming signal and this may reduce the length of cable from the thru' port before the overall jitter becomes unacceptable.

VI5872 – DUAL SDI EMBEDDER

The VI5872 provides two SDI inputs and two SDI outputs on BNC connectors

The module is one slot wide and features signal presence LEDs for both inputs.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

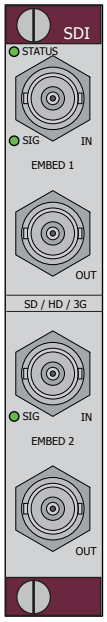
Green signal presence LEDs are available for all inputs. These LEDs illuminate when an SDI video input is present.

SDI formats

The incoming SDI can be either SD or HD and the output will follow the input same format. SDI inputs to the embedder should not normally carry data in their audio streams as it would be over-written by anything routed from the Hydra2 network.

It is good practise to terminate any outputs not being used, especially if cabled to a patchbay.

FIGURE 1 - VI5872



WY5858 – 8 GPI / 8 GPO (DB50)

The WY5858 provides eight GPI and eight GPO connections on a single male DB50 connector. The GPOs are all changover relays.

The module is one slot wide and features signal presence LEDs for both inputs.

LEDs

The Status LED strobes to indicate that the local software is running. The LED illuminates solidly when connection is established to the Hydra2 Interface Module in the same Stagebox chassis.

GPI

The inputs are opto-coupled and have a bridge rectifier on the input making them non-polarity sensitive.

GPO

The outputs are relay changeover contacts.

Current and voltage

GPI input voltage should be between 5 and 24 volts.

No more than 1 amp should be drawn from the 5 V supply

Wiring information

The wiring information for the GPIs is shown in Figure 2. The wiring information for the GPOs is shown in Figure 3.

FIGURE 1 - WY5858

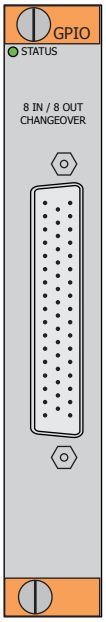
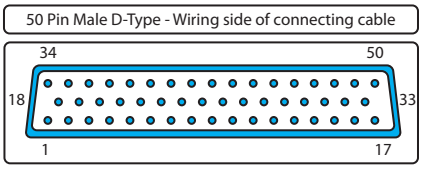


FIGURE 2 - GPI WIRING INFORMATION



Function		Pin
GPI 1	+	1
	-	34
GPI 2	+	18
	-	2
GPI 3	+	35
	-	19
GPI 4	+	3
	-	36
GPI 5	+	20
	-	4
GPI 6	+	37
	-	21
GPI 7	+	5
	-	38
GPI 8	+	22
	-	6
Supply	+5 V	17
Supply	0 V	50

FIGURE 3 - GPO WIRING INFORMATION

Function		Pin
GPO 1	NO	39
	NC	7
	Common	23, 40
GPO 2	NO	24
	NC	41
	Common	8, 25
GPO 3	NO	9
	NC	26
	Common	42, 10
GPO 4	NO	43
	NC	11
	Common	27, 44
GPO 5	NO	28
	NC	45
	Common	12, 29
GPO 6	NO	13
	NC	30
	Common	46, 14
GPO 7	NO	47
	NC	15
	Common	31, 48
GPO 8	NO	32
	NC	49
	Common	16, 33

UJ5836 – HYDRA2 INTERFACE

The UJ5836 contains all processing for the Stagebox and provides the links to a Hydra2 network.

The module is one slot wide and is shown in Figure 1. It features:

- Dual SFP sockets for redundant connections to a Hydra2 network
- A wordclock output
- A reset button to reset the Stagebox
- A mini USB socket for diagnostics
- And 8 way DIL switch to set the address of the Stagebox in which it is installed. This switch uses binary notation. The location of this switch is shown in Figure 2. For details on setting this value, refer to 'The Stagebox' section of this document.

SFP LEDs

The LEDs next to each SFP socket function as follows:

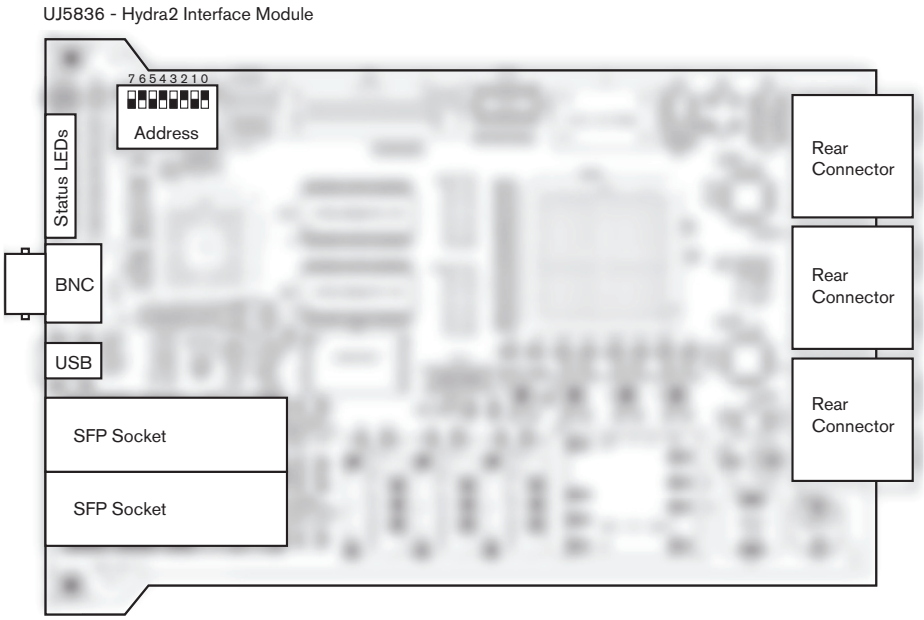
- Yellow: Illuminates steadily when a valid Ethernet carrier is detected
- Green: Strobes when Hydra2 data is present

Status LEDs

- H_ACT - Orange LED. Indicates that firmware has been initialized and is in a state ready to communicate with Hydra2. Not currently implemented.
- HB1 and HB2 - Orange LED. Indicates real traffic is flowing on Hydra2 links 1 & 2 respectively. Sufficient to indicate a heartbeat.
- SOFT - Orange LED. Not currently implemented.
- CTL1 and CTL2 - Orange LEDs. Indicates that Hydra2 control is established on Hydra2 links 1 & 2 respectively.
- AUD1 and AUD2 - Orange LEDs. Indicate which Hydra2 link is being used for audio transfer. Only one of these LEDs will be illuminated at any one time.
- PSU1 and PSU2 - Red failure indicators for the 48V DC supplies.
- FAN1 and FAN2 - Red indicators illuminate when fan 1 or fan 2 stops spinning.
- FAN 12V - Green LED indicates the presence of a 12V supply for the fans.

FIGURE 1 - UJ5836

FIGURE 2 - ADDRESS SWITCHES ON THE HYDRA2 INTERFACE MODULE



HYDRA2
CONNECTION INFORMATION

CALREC

Putting Sound in the Picture

CONNECTION TYPES

External connections in a Hydra2 system are made using SFP GBICs (Small Form-factor Pluggable Giga-Bit Interface Converters).

These converters allow the system design to be agnostic of connector type and connection medium. GBICs can be provided for copper or fiber connections. The two connection mediums are detailed in the following sections.

Copper connections

Copper connections can be made using screened Category 5e or Category 6 cable. The cable MUST be screened in order to comply with EMC requirements. Details are given in the 'Category 5e and6 Cables' section of this document.

Fiber connections

Fiber GBICs convert the Gigabit Ethernet data into light waves using a Laser Diode to transmit into a Fiber Optic Cable and a Photodiode receiver to convert the light waves back into electrical signals. Details are provided in the 'Fiber Optic Interfaces' section of this document.

SDI connections

SDI is a convenient signal format but as with all high data rate connections including Cat5e, care needs to be taken during installation.

The length limits for reliable operation can be dramatically reduced if the internal cable construction is deformed. This can occur when excessive tension is applied, or if cables are bent through too sharp a radius or twisted.

It is also desirable to terminate unused outputs to minimise the risk of crosstalk into other circuits.

CATEGORY 5E AND 6 CABLES

Interconnecting Cat5e cables MUST have an overall foil shield over the 4 twisted pairs, this is often referred to and marked as FTP. Unshielded UTP cable MUST NOT be used. Shielded cable is essential for EMC (Electro Magnetic Compatibility) to comply with the Class B radiated emission limits set in the standard EN55022. Shielded cable also improves the immunity and reliability of the equipment from interference sources.

Cable manufacturers strongly recommend adhering closely to the installation practises outlined for their cable specification.

Some important issues to consider during installation

Do not exceed the cable manufacturer's specified cable pulling tension and avoid sharp bends in the cable, as it will alter the lay of the pairs within it. Cable manufacturers recommend that cable bend radius should be no less than 4 times the diameter of the cable (post installation). The minimum cable bend radius during installation is 8 times the cable diameter. In practise, this means that where a 25 mm radius would be appropriate within a rack, the conduit leading to it would require minimum bends of 50 mm radius.

Avoid compressing the cables by over-tightening any cable ties (tie-wraps). This problem is most likely to occur in large bundles of cables, where the cables on the outside of the bundle are exposed to more compression than those on the inside. Over-tightening deforms the twisted pairs within the cable, and can affect their performance. The cable ties should only be tight enough to sufficiently support the cable bundle, and not to deform the outer cable sleeve/jacket. One solution can be to use the hook and loop (Velcro) cable ties. When any number of cables are bundled together in long parallel lengths, the capacitive coupling of pairs in different cables in the bundle with the same twist rates can cause cross-talk interference to increase. The best way to avoid this is to minimise the length of long parallel runs, and to install cables as they lie rather than trying to straighten them out into perfectly aligned bundles.

When pulling cables from the reels, be conscious of the occasional tendency of the cable to kink. If the cable kinks, it should be regarded as damaged, and replaced. Do not try to straighten the kink out of the cable.

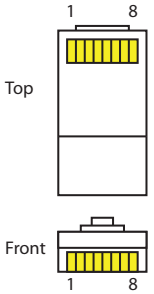
At the point of cable termination, remove only the minimum amount of cable sleeve/jacket. This ensures that the twist rate and lay of the core pairs within the cable are maintained for as much of the transmission path as possible. The twist rate of each pair of cable cores should also be maintained to as close as possible to point of termination within the connector.

These are general rules to follow, and if in doubt, always refer to the cable manufacturer's recommendations.

Cat5e connector information

Should you be required to make up Cat5e cables and are unsure of the connector wiring, please refer to Figure 1 which details the wire colors and contact numbers.

FIGURE 1 - CAT5E CONNECTOR INFO



From		To	
Color	Pins	Pins	Color
O-W	1	1	O-W
O	2	2	O
G-W	3	3	G-W
B	4	4	B
B-W	5	5	B-W
G	6	6	G
Bn-W	7	7	Bn-W
Bn	8	8	Bn

FIBER OPTIC INTERFACES

There are two types of Fiber in common use, Multimode Fiber and Singlemode Fiber, the choice of which to use is based on how far away the IO boxes need to be placed.

Calrec recommends that Singlemode connections be used where possible as these allow for greater distances which may be important for OB stagebox type applications and they are more reliable due to their higher power budget, however there are cost implications which will need consideration.

If the Fiber infrastructure is already in place it may be Multimode and the distances will become important.

What about losses?

See Figure 1. The Optical Power Budget column gives an indication of the maximum loss that is allowable for enough light from the transmitter to reach the receiver for the system to work satisfactorily. The losses occur in 3 areas Fiber Loss, Splice loss and Connector loss. The Maximum Distances column is a guide based on operating at Gigabit Ethernet rates and having a Fiber cable with no splices and a connector at either end. The Splice loss is typically better than 0.3dB/splice and the connector loss is typically better than 0.5dB/connector pair. Fiber losses vary from 3.5dB/km in Multimode down to 0.4dB/km in Singlemode.

The installer should be able to provide certified attenuation figures based on EN 50173.

If the Optical Power Budget less the combined losses of Connectors/Splices and Fiber is a positive number then the system will work.

What is the construction of a fiber cable?

When installing Fiber cable, it is important to use a type which gives enough protection to the fiber for the environment in which it is to be used. The cladding/core of these fibers are made out of glass and are about the thickness of a human hair, so to give the fiber protection, various coatings and layers are added using materials like silicone and Nylon or PVC, and often a layer of Kevlar is added to ruggedize the construction. When fiber cables are to be installed in external environments, additional protection may be necessary. In this case number of individual ruggedized elements are often stranded around a central strength member such as high tensile steel, bound with paper tape and an external sheath applied on top of an aluminium tape moisture barrier.

What problems can arise during installation?

Precautions are necessary during installation to protect against the following:

- Moisture. If moisture gets into the cable sheath and freezes it can cause the fibers to crack.
- Temperature changes causing expansion and contraction stresses.
- Strain especially during the installation process which can cause the fibers to break.
- Abrasion and friction damage when a cable is pulled in.
- Crushing and cracking if a cable is bent beyond its safe bending radius or crushed by heavy objects or over-enthusiastically tie wrapped etc.
- Chemicals which can eat through or dissolve the sheathing.
- Rodents chewing on the cables.

All these factors should be borne in mind during the installation process, many of which are equally valid when installing fiber cabling in internal environments such as in underfloor trunking.

The other important aspect to the use of Fiber Optics is to employ the correct cleaning and maintenance regime to ensure optimum reliability and system performance. These relate to cleanliness of the connector ends of the fiber and the optical transceiver ports, for example the receptacles at the Laser Transmitter and Photodiode Receiver that the fiber connectors plug into.

Why do we need preventive maintenance of fiber optic cables and optics?

Small oil micro-deposits and dirt/dust particles on fiber optic cable optical surfaces cause a loss of light or degraded signal power which may ultimately cause intermittent problems in the optical connection.

Laser power density eventually burns contaminants into the optical surfaces

FIGURE 1 - FIBER CONNECTION DETAILS

Type of Cable	Maximum Distance	Connector	GBIC Type	Optical Power Budget
Copper Cat 5e/6 Ethernet	90m	RJ45	N/A	N/A
Fiber 62.5/125µm Multimode	275m	SC Duplex	SX	7.5dB
Fiber 50/125µm Multimode	550m	SC Duplex	SX	7.5dB
Fiber 8/125µm Singlemode	10km	LC Duplex	LX	8dB
Fiber 8/125µm Singlemode	70km	LC Duplex	LH	23dB

Note.
If connection redundancy is required, two duplex fiber cable runs will be needed per connection.

causing the fiber to produce inaccurate results effectively rendering it unusable.

By extension, contaminated cable connectors may often transfer contaminants and particulates into the “Optical Sub-Assembly" (OSA) barrels of the Optical Module they are inserted into.

It is especially important to watch out for this in Outside Broadcast environments.

Safety precautions during maintenance

General safety precautions are discussed here, but care should be taken to follow any specific optical device guidance as well as the safety precautions outlined for chemicals and tools used.

WARNING

Never look into the end of an optical interface while the device is operational.

Laser radiation can be harmful to the human eye and injury may occur with prolonged exposure.

Cautions

- Do not remove transceiver covers when operating.
- Ensure the unit power is turned off during cleaning.
- Ensure that other power/light sources are disabled during the cleaning of optical interfaces.
- Do not install any unauthorized modifications to the optical devices.

CLEANING FIBER OPTIC INTERFACES

The following tools are used for cleaning:

Compressed air
Clean Dry Air is essential to ensure the aerosol stream is free of dust, water and oil. Use filtered compressed air or canned compressed air, available at any laboratory supplier or camera shop.

Lens paper
A long fiber, low ash content type; having no chemical additives is recommended to minimize particulates and the chance of streaking and/or scratching the optical surfaces.

Lens paper is widely available at any laboratory supplier or camera shop.

Isopropyl alcohol or methanol
Cleaning solutions are available at any laboratory supplier. Isopropyl Alcohol is also available at local pharmacies, or camera shops. Special care should be practiced when using chemicals and it is important to follow the manufacturer's product guidelines.

Inspection microscope
A 200 x (for multimode) or 400 x (for Singlemode) magnification Inspection Scope is necessary tool for inspecting the connector ends of fiber cabling and Optical Sub-Assemblies for cracks and depositsof oil and dirt. These Inspection Scopes are available from various fiber optic suppliers.

Note. Ensure that the device is not operational before examining it through this device.

Cleaning fiber optic cables and connectors
There are multiple ways to clean fiber-optic cables and connectors.

Included below are some helpful tips to properly clean fiber optic cables.

- Do not allow the end of the fiber optic cable to make contact with any surface including fingers.
- Do not excessively bend the fiber cable. Bending the cable may cause internal breaks along the fiber resulting in poor performance or instability.
- Optics and optic coatings are easily chipped and/or scratched. Use of finger cots or powder free surgical gloves while handling fiber optic cables, will help ensure cleanliness.
- Only fresh (dry) spectroscopic grade Isopropyl Alcohol should be used as a cleaning solvent.
- Ensure that the module power is off and that other light sources are disabled.

Cleaning procedure
1. Blow the fiber surface with a stream of Clean Dry Air, this will dislodge larger loose particles.
2. Place 1-3 drops of spectroscopic grade Isopropyl Alcohol in the centre of a lens tissue.
3. Hold the fiber by the connector or cable, place the wet portion of the lens tissue on the optical surface and slowly drag it across.
4. Examine the surface of the fiber end under high intensity light using a direct magnifying inspection microscope or an indirect video inspection tool if available. If streaks or contaminants still remain, repeat the process using a fresh lens tissue.
5. Immediately install a protective cover over the end of the cable to avoid re-contamination or insert the fiber back into the previously cleaned receptacle for immediate use.

Additional notes
Do not tip the can of Clean Dry Air whilst aerosol spraying as liquid may be released contaminating the surface of the fiber.

Do not use lens paper dry as dry lens paper is extremely abrasive.

Do not use Acetone as a cleaning solvent on the fiber optical surfaces.

To ensure the purity of the Isopropyl Alcohol, do not insert the lens tissue, swabs, etc into the liquid, instead, drip the liquid on to the material.

Cleaning optical transceivers
The best way to clean a transceiver port is to remove particles using a stream of Clean Dry Air.

Included below are some helpful tips to properly clean fiber optic modules.

- Always handle optical GBIC modules in an ESD safe manner using the proper safety precautions.
- Ensure that the module power is off and handle the modules with care.
- Always use Clean Dry Air or an approved canned compressed air supply.
- Always hold the can of compressed air upright. Tipping may release liquids into the air stream.
- Do not touch the inner surfaces of the module including the Optical Sub-Assemblies (OSA), or insert any foreign objects into the ports.
- Use of finger cots or powder free surgical gloves are not required but may be used for cleanliness.

Cleaning procedure

1. With the clean dry air, blow the inner barrel of the Transmitter and Receiver Optical Sub-Assemblies (OSA). This will dislodge loose particles.
2. Examine the surface of the OSA lens under high intensity light using the inspection microscope. If contaminants still remain, repeat the process.

Following these guidelines should provide a successful installation and ensure optimum reliability and system performance.

For further information or advice please feel free to contact Calrec.

HYDRA2
OPERATIONAL SPECIFICATION

CALREC

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AUDIO PERFORMANCE SPECIFICATION

The following tables provide the audio performance specification for the Hydra2 and Bluefin2 audio system.

- Figure 1 provides AES3 input specs
- Figure 2 provides AES3 output specs
- Figure 3 provides analog input specs
- Figure 4 provides analog output specs
- Figure 5 provides analog and AES3 performance data
- Figure 6 provides the supported sync inputs

FIGURE 1 - AES3 INPUT SPECS

Formats Supported	AES/EBU (AES3) 24-bit. Also suitable for use with SPDIF (IEC958 type 2) signals
Interface	75 Ohm unbalanced (BNC), 0.3V-1.2V Pk-Pk
Sample Rate Conversion (SRC)	24-Bit switchable on all AES inputs
SRC THD+N	-117dB @ 1kHz, 0.00014%

FIGURE 2 - AES3 OUTPUT SPECS

Formats Supported	AES/EBU (AES3) 24-bit
Interface	110 Ohm transformer balanced, 4V Pk-Pk (nominal) into 110 Ohm load 75 Ohm unbalanced 1V Pk-Pk (nominal) into 75 Ohm load (BNC)
Signal to Noise Ratio	22Hz to 20kHz - Better than -120dB

FIGURE 3 - ANALOG INPUT SPECS

Analog - Digital Conversion	24 Bit
Input	Electronically Balanced
Input Impedance	2k Ohms for Mic Gains 10k Ohms for Line gains
Sensitivity	+18 / -78dB on Mic/Line Inputs
Equivalent Input Noise	-127dB (150 Ohm source)
Distortion	-1dBFS @ 1kHz - Better than 0.003% -20dBFS @ 1kHz - Better than 0.006% -60 dBFS @ 1kHz - Better than 0.3%
Frequency Response	20Hz to 20kHz +/- 0.5dB on Mic/Line Inputs
Input CMR (Common Mode Rejection)	>75dB (Typical 85dB) on Mic/Line inputs
Notes	Analog input for 0dBFS can be pre-set globally to +28, +24, +22, +20, +18 or +15dBU Pre-fader headroom on mic inputs is adjustable globally from +24 to +36dB in 2dB steps For analog inputs/outputs the system can handle analog levels of up to +27 dBu from analog input to analog output at line up. These levels must be attenuated in the system before they are fed to digital outputs.

FIGURE 4 - ANALOG OUTPUT SPECS

Digital - Analog Conversion	24 Bit
Output Balance	Electronically Balanced, 20Hz to 20kHz. Better than -35dB, typically -45dB
Output Impedance	<40 Ohms
Distortion	-1dBFS @ 1kHz - Better than 0.006% -20dBFS @ 1kHz - Better than 0.003% -60 dBFS @ 1kHz - Better than 0.3%
Frequency Response	20Hz to 20kHz +/- 0.25dB
Notes	Analog output for 0dBFS matches input setting into >1kOhms (+24dBu max into 600 Ohms)

FIGURE 5 - AUDIO PERFORMANCE DATA

Digital to Digital (AES3) Distortion	-1dBFS, 20Hz to 10kHz - Better than 0.0001%
Digital to Digital (AES3 with SRC) Distortion	-1dBFS, 20Hz to 10kHz - Better than 0.0002%
Frequency Response (Digital Input to Output)	There is no filtering on digital outputs. A signal routed from digital input to digital output is unchanged.
Frequency Response (Analog Input to Output)	20Hz to 20kHz +/- 0.5dB
Fader Off Isolation	22Hz to 22kHz - Better than -132dB

FIGURE 6 - SYNCHRONIZATION INPUTS

48Hz Synchronization	NTSC/PAL Video Tri-Level Internal Crystal Reference TTL Wordclock (48kHz) AES/EBU (AES3) Digital Input (48kHz)

OPERATIONAL SPECIFICATION

Hydra2 fixed format box specifications are detailed in Figure 1. The Stagebox specifications are shown in Figure 2.

FIGURE 1 - HYDRA2 FIXED FORMAT SPECIFICATIONS

Powering	The 1U, 2U, 3U and 4U Racks have two AC power inlets each powering an internal PSU. Although the racks will operate with one inlet supply we recommend both inlets are powered. This will ensure continued operation should a PSU or AC source fail. The operating AC supply voltage is 100V - 240V +/-10%. The peak inrush current is limited (cold start). Figures are available for all units. This reduces the chance of a nuisance trip or fuse blow from power up. The RMS quiescent current figures are available for all types of I/O rack.
Power Factor	All rack units have less than 75W of input power. The internal power supplies fitted have passive filtering (as opposed to active power factor correction) to reduce the harmonics to within the limits of the standard EN61000-3-2. At the time of writing the standard does not apply to equipment <75W. If the lower limit is ever reduced the units will be compliant and as such are future proof.
Heat Output & Efficiency	The Heat output from the racks depends on the supply voltage and loading. Typically it is 0.55 times the RMS VA (Volts x Amperes) at 230V and 0.7 times the RMS VA at 115V. The heat output figures are available for all types of I/O racks. The low power PSU efficiency again is dependant on supply voltage and loading, generally >70%.
Cooling	The 2U, 3U & 4U racks keep their operating temperature under control with fan assistance. Operation is not dependant on the fan; it is there to extend the operating life of the unit. There is an 80mm low power, low speed and low noise fan mounted in the right side of the racks from front. The fan is speed monitored so if it slows down or stops a warning is given. The air intake is at the left side of the racks viewed from front and the air outtake on the right. At least 50mm (2") clearance must be maintained for these vents. The 1U I/O racks have sufficient surface area to radiate the heat out so no fan is required. Any racks may be mounted in an open bay providing the ambient air temperature is within limits (see below). The racks may also be housed in any air conditioned bay.
Operating Ambient Air Temperature	0°C - 35°C
Relative Humidity	5% – 80% Non-condensing

FIGURE 2 - HYDRA2 STAGEBOX SPECIFICATIONS

Powering	The 3U Stagebox I/O Rack has two pluggable AC-48V DC power modules fitted in the back of the unit. Each power module has four retaining screws, the screws can be released or tightened by hand or with an appropriate sized cross head or straight blade driver. Although the rack will operate with one inlet supply we recommend both inlets are powered. This will ensure continued operation should a PSU or AC source fail. When both power modules have an AC supply the load is shared. The operating AC supply voltage is 100V - 240V +/-10%. The inrush current to each power module is actively limited. At 115V the maximum current is 6.5A and at 230V the maximum current is 13A. This reduces the chance of a nuisance trip or fuse blow from power ups, dips and interruptions. The power requirement (VA) depends on the type and quantity of I/O modules fitted (up to 20 maximum). The highest it can be is 200W. The RMS quiescent current figures for a given input voltage are available for all configurations of I/O rack.
Power Factor	The internal power supplies fitted have active power factor correction to ensure the harmonics are within the limits of the standard EN61000-3-2. A good power factor brings the apparent power down closer to the real power and is more efficient. It also provides a more sinusoidal current flow with a much reduced peak magnitude in the AC distribution cables, this produces much less low frequency noise from the cables that could otherwise couple into sensitive signal paths.
Heat Output & Efficiency	The Heat output from the rack depends on the type and quantity of I/O modules fitted. The highest it can be is 185W. A good rule of thumb for these units is 0.9 x VA (RMS). The PSU efficiency is dependant on loading. The efficiency improves with more I/O modules fitted. Most configurations will be between 75 - 88%.
Cooling	The 3U rack keeps its operating temperature under control with fan assistance. Each of the two power modules has an 80mm fan mounted externally on its rear panel. The speed of the fans is under internal temperature control. Racks equipped with Mic Input and/or AES modules are lower power so the fans will run slow for use in studios etc. Racks equipped with higher density Line In/Out and/or SDI modules are higher power so the fans will run faster as required. This configuration of rack is intended for use where fan noise isn't an issue. The rack has been designed so that if an AC source or a PSU should fail, both fans will continue to run normally so the cooling is maintained. The fans are speed monitored so if one goes too slow or stops a warning is given. The air intake is at the underside of the rack but the design of the rack allows air in from the sides to the same area when mounted against a flat surface. It is essential that the rack is not mounted on anything like carpet or soft furnishings as this will restrict or block the air intake. The air outtake is directly from the fans on the rear of the unit. At least 50mm (2") clearance must be maintained for the side and rear vents. The rack may be mounted in an open bay providing the ambient air temperature is within limits (see below). The rack may also be housed in any air conditioned bay.
Operating Ambient Air Temperature	0°C - 35°C
Relative Humidity	5% – 80% Non-condensing

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